GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

2025 Five-Year Network Assessment

Air Protection Branch

Ambient Monitoring Program

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Executive Summary

The Ambient Monitoring Program of the Air Protection Branch of the Environmental Protection Division (GA AAMP) has monitored air quality in the State of Georgia for over forty-five years. The list of compounds monitored has grown to more than 200 pollutants using several types of samplers at sites statewide. This report is GA AAMP’s Five-Year Assessment of those samplers and their networks, and is prepared in part to fulfill the requirements specified in the federal monitoring regulations (40CFR58). The first assessment was due July 1, 2010. This Network Assessment document is prepared and submitted along with the *2025 Ambient Air Monitoring Plan* to fulfill these requirements.

All monitoring networks operated by the GA AAMP were evaluated to determine if they meet the monitoring objectives as defined by the regulations. Considerations were given to: Number of Parameters Monitored; Trends Impacts; Measured Concentrations; Deviation form NAAQS; Monitor-to-Monitor Correlations; Air Quality Index; Population Requirements, Changes, Sensitive populations; Health Effects; Area Served; Emission Inventory with modeling of emissions data; Exceedance Probability; Meteorological data; and the PAMS network.

Each pollutant that GA AAMP monitors is discussed with summary of the pollutant, monitoring technique, analysis method, and quality assurance schedule. Each network is also discussed in detail. Each monitoring station is outlined with a metropolitan statistical area (MSA) map (if applicable), spatial scale map, aerial photo, site address, site established date, latitude/longitude, elevation, site photos, all parameters monitored at that station, monitoring objective of each sampler, sampling schedule of each sampler, probe inlet height of each sampler, spatial scale of each sampler, the date that each monitor began sampling, and future recommendations for that monitoring station. A list of the current inventory is included.

GA AAMP meets or exceeds current ambient air monitoring requirements. There are adequate ambient air monitoring stations in populated areas, including where sensitive groups reside. Monitoring needs continue to evolve. This may require the consolidation of sites for one of more pollutants if GA AAMP determines additional monitoring is required for another pollutant.

Georgia AAMP’s Ambient Air Monitoring Networks

GA AAMP’s budget is made up of a combination of three sources: state funds, federal funds, and fee funds. Since the last Five-Year Assessment there has been some fluctuation in the number of ambient air monitoring samplers across the state. A continuous $PM_{2.5}$ FEM monitor was added at the Brunswick (13-127-0006) site. A second continuous $PM_{2.5}$ FEM monitor was added at the Athens (13-059-0002) site for quality assurance purposes. More continuous $PM_{2.5}$ FEM monitors were added in 2023 with the EPA American Rescue Plan funds at the Macon-Allied (13-021-0007), Columbus-Baker (13-215-0012), Forest Park (13-063-0091), Kennesaw (13-067-0003), and General Coffee (13-069-0002) sites. Several $PM_{2.5}$ FRM samplers were set up including at the Savannah L&A (13-051-1002) site and two at the Augusta (13-245-0091) site. The Columbus-Cusseta (13-215-0011) site was moved and renamed as Columbus-Baker (13-215-0012). The Rossville-Maple St. (13-295-0002) site was moved and renamed Rossville-Williams St. (13-295-0004). In addition, one PM_{10} continuous TEOM was shut down at the Augusta (13-245-0091) site and replaced with a continuous $PM_{2.5}$/ PM_{10} T640X FEM monitor. The following sites have been shut down and therefore have been removed from analyses: Rome-Kraftsman (13-115-0006), Columbus-Health Department (13-215-0001), and Columbus-Allied (13-215-0009).

Although the Five-Year Network Assessment covers data collected from 2019-2023, there were many changes to the network made in 2024 and early 2025 that will not be reflected in the analyses of this report. Three ozone monitoring sites were shut down: Evans (13-073-0001), Summerville (13-055-0001), Leslie (13-261-1001). In addition, five $PM_{2.5}$ continuous FEM monitors [Kennesaw (13-067-0003), Macon-Forestry (13-021-0012), Columbus-Airport (13-215-0008), Forest Park (13-063-0091), Sandersville (13-303-0001)] were shut down. One $PM_{2.5}$ continuous non-FEM monitor [NR-285 (13-089-0003)], meteorological equipment [Evans (13-073-0001)], two $PM_{2.5}$ FRM samplers [Kennesaw (13-067-0003) and the collocated sampler at Macon-Allied (13-021-0007)], and the Columbus-Crime Lab (13-215-1003) meteorological site were shut down.

Two lead sites were shut down in 2020 and 2021 at Columbus-Cusseta (13-215-0011) and Columbus-Allied (13-215-0009) sites. A new lead site is in the process of being set up in Fulton County named Empire Blvd (13-121-0057). A collocated $PM_{2.5}$ FEM monitor was placed at the General Coffee (13-069-0002) site. After the shutdown of the $PM_{2.5}$ FEM monitors at select sites, the monitors were replaced with $PM_{2.5}$ FRM monitors including at the Sandersville (13-303-0001) and Forest Park (13-063-0091) sites, and one was reopened at the Gwinnett Tech (13-135-0002) site and Gainesville (13-139-0003). A ceilometer was installed to measure mixing layer height at the South Dekalb (13-089-0002) site. A complete list of the monitors that have been shut down since the last publication of the Five-Year Assessment can be found in Appendix D of this document.

The objectives of Georgia AAMP's Networks are:

- Provide air pollution data to the general public in a timely manner. Meteorologists provide daily Air Quality Index (AQI) forecasts, and health advisories when warranted, to the public through the news media as well as the GA AAMP's website. On this website (https://airgeorgia.org/), hourly air quality measurements from all continuous monitoring samplers are electronically transmitted and posted, including ozone and $PM_{2.5}$ data. In addition, summary data from the non-continuous samplers is also posted on the GA AAMP website.

- Support compliance with ambient air quality standards and emissions strategy development. Data from GA AAMP's criteria pollutant monitors are used for comparing an area's air pollution levels against the National Ambient Air Quality Standards (NAAQS) to determine attainment status classification. In addition, the data are utilized for the development of attainment and maintenance plans, evaluation of the regional air quality models used in developing emission strategies, and the tracking of trends in air pollution abatement control measures aimed at improving air quality. In monitoring locations near major air pollution sources, source-oriented monitoring data provide insight into how well industrial sources are controlling their pollutant emissions.

- Support for air pollution research studies. GA AAMP's ambient air monitoring data have been used to supplement data collected by researchers working on health effects assessments and atmospheric processes, and for monitoring methods development work.

To fulfill the objectives of the Five-Year Network Assessment, several analyses were performed according to EPA guidance. Eight of these produced quantifiable results which were used to determine the relative importance of each monitor within the GA AAMP Ambient Air Monitoring Network. These assessments include: trends and longevity of parameters monitored, measured concentrations, deviation of criteria pollutants at each site from NAAQS, number of parameters monitored, monitor-to-monitor correlations, change in population, area served by particular networks, and number of days with an Air Quality Index (AQI) > 100. Monitors were scored within each of these assessments to determine their relative importance. A weighted average of the eight scores was calculated for each monitor and a total rank assigned. The top ranking sites are considered the most important sites within the monitoring network while the lowest ranking sites are considered least important and most likely to be recommended for elimination or consolidation with another site. The highest-ranking sites are the South DeKalb and Dawsonville sites and are considered the most important sites in the monitoring network according to the assessments performed. The lowest ranking sites are the Summerville and NR-GA Tech sites, according to these assessments. Several factors, such as available personnel and budgetary concerns, would play a large part in adding or shifting monitors around the state of Georgia. The GA AAMP will make every effort to place monitors where needed, especially as mandated by the federal regulations.

It is important to note that due to the timeliness of drafting this Five-Year Network Assessment, GA AAMP performed these extensive evaluations on data collected from 2019 through 2023. However, there were some network changes that occurred in 2024 and early 2025. Those changes are reflected in Table 2.

Acronyms and Glossary

AADT	Annual Average Daily Traffic
Aerosols	A gaseous suspension of fine solid or liquid particles
AM	Annual Mean
Anthropogenic	Resulting from human activity
APB	Air Protection Branch
AQCR	Air Quality Control Region
AQS	Air Quality System
ARITH MEAN	Arithmetic Mean
ARM	Approved Regional Method
BAM	Beta Attenuation Monitor
CAA	Clean Air Act
CBSA	Core Based Statistical Area
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CSA	Combined Statistical Area
CV	Coefficient of Variation
DNPH	Dinitrophenylhydrazine
EPA	United States Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method- the official measurement technique for a given pollutant
GA AAMP	Georgia Ambient Air Monitoring Program
GA EPD	Georgia Environmental Protection Division
GEO MEAN	Geometric Mean
HAP	Hazardous Air Pollutant
HPLC	High Performance Liquid Chromatography
LOD	Limit of Detection
$\mu g/m^3$	Micrograms per cubic meter
m/s	Meter per second
MSA	Metropolitan Statistical Area, as defined by the US Census Bureau
NAAQS	National Ambient Air Quality Standard
NATTS	National Air Toxics Trends Station
NCore	National Core Multipollutant Monitoring Network
NDV	Normalized Design Value
NMHC	Non-Methane Hydrocarbons
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NO_y	Reactive oxides of Nitrogen
NWS	National Weather Service
O_3	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
PAMS	Photochemical Assessment Monitoring Station
Pb	Lead
$PM_{2.5}$	Particles with an aerodynamic diameter of 2.5 microns or less
PM_{10}	Particles with an aerodynamic diameter of 10 microns or less

$PM_{10-2.5}$	Particles with an aerodynamic diameter between 2.5 and 10 microns
ppb	Parts per Billion
ppm	Parts per Million
Precursor	A substance from which another substance is formed
PUF	Polyurethane Foam
QTR	Calendar Quarter
Rawinsonde	A source of meteorological data for the upper atmosphere
SLAMS	State and Local Air Monitoring Stations
SO_2	Sulfur Dioxide
SPMS	Special Purpose Monitoring Stations
STN	Speciation Trends Network
TBD	To Be Determined
TEOM	Tapered Element Oscillating Microbalance
TNMOC	Total Non-Methane Organic Compounds
TRS	Total Reduced Sulfur
UV	Ultraviolet
VOC	Volatile Organic Compound
W/m^2	Watts per square meter
ZPS	Zero/Precision/Span

Agency Contacts

Access to More Information about the Ambient Air Monitoring Network

While this report includes a great deal of information about the Ambient Air Monitoring Network, much more information is readily available, including summaries of the pollutant data from the monitors around the state, on the GA AAMP's website (https://airgeorgia.org/).

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1.0 Introduction

The Five-Year Network Assessment is written as part of the requirements for the Environmental Protection Agency's (EPA) amended ambient air monitoring regulations established on October 17, 2006. It will show Georgia Environmental Protection Division Ambient Air Monitoring Program's (GA AAMP) assessment to meet EPA's regulations for monitoring air quality in the state of Georgia. The purposes of the Five-Year Network Assessment include:

- ensuring that Georgia's Ambient Air Monitoring Program meets the monitoring objectives defined Appendix D of 40CFR58
- evaluation of the network's existing sites efficiency in meeting objectives and relative costs
- determining if new sites are needed or if existing sites are no longer needed and can be terminated
- determine whether discontinuing ambient air monitors would adversely impact data users and health studies
- determine if new technologies are appropriate for the network
- determine whether the existing and proposed sites support air quality characterization in areas with high populations of susceptible individuals (such as children and sensitive population areas)
- determine whether changes need to be made to the $PM_{2.5}$ population-oriented network
- develop recommendations for network improvements.

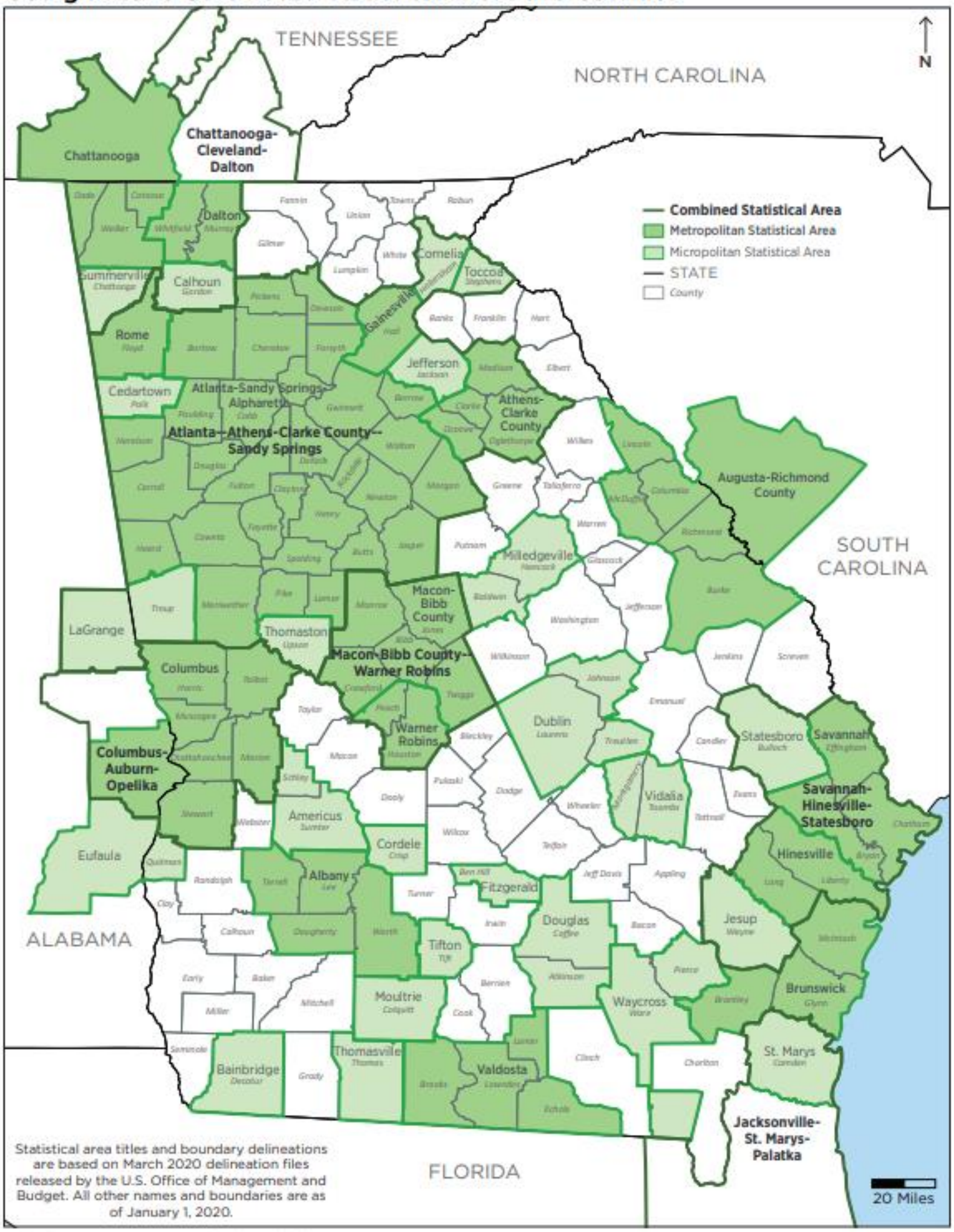
This document will provide a comprehensive look at Georgia's ambient air monitoring network. Multiple assessments were performed on Georgia's network including: Trends Impacts; Measured Concentrations; Deviation from the NAAQS; Number of Parameters Monitored; Monitor-to-Monitor Correlations; Air Quality Index Assessment; Population Requirements, Changes, Sensitive Populations; Health Assessment; Area Served; Modeling Criteria Pollutants; Emission Inventory Assessment with Modeling of Emissions Data; Meteorological Assessment; PAMS Network Assessment; and Exceedance Probability Assessment. The Five-Year Network Assessment will outline the established sites across the state of Georgia, as well as the proposal to maintain and discontinue sites in the state's ambient air quality surveillance system.

As early as 1957, the state of Georgia has monitored air pollutants. Prior to the Clean Air Act of 1970, the state health department conducted air monitoring in Georgia. In the early 1970's, the GA AAMP took over the responsibility of ambient air monitoring to better identify and control air pollutants in Georgia. During the 2019 through 2023 time period, the GA AAMP relies on a sampling network of 36 stations, including the EPA CASTNET site, to:

- determine whether air quality standards are being met
- track air quality improvements
- measure the impact of industrial expansion
- provide air pollution information to the public
- assist in enforcement actions

Within this document, the GA AAMP has included the metropolitan statistical area (MSA) represented by each site, which was derived from the following map (Figure 1). The U.S. Census Bureau defines an MSA as a geographic entity containing a core urban area of 50,000 or more population and consists of one or more counties containing the core urban area, as well as adjacent counties that have a high degree of social and economic integration with the urban core (http://www.census.gov).

Georgia: 2020 Core Based Statistical Areas and Counties



U.S. Census Bureau, Population Division

Figure 1: Map of Statistical Areas in Georgia

Section 2.0 outlines the standards applied to criteria pollutant concentrations established by the EPA and the state of Georgia to protect human health (primary standards) and plants, animals and property (secondary standards). Section 3.0 describes the monitoring objectives and spatial scales. Section 4.0 gives a description of the networks. Section 5.0 provides a list of site evaluations performed on the monitoring stations. The remaining sections detail each assessment. Appendix A includes the comprehensive list of sites with their detailed information. Appendix B includes an inventory of the current ambient monitoring equipment. Appendix C describes the pollutants, analysis methods, and quality assurance schedules. Appendix D gives a list of monitors that have been shut down, the date the monitors were shut down, and the last Annual Plan that included those monitors. Appendix E displays 2021-2023 wind roses and pollution roses from across the state (historical climatological wind roses are also available upon request). Appendix F includes the full memorandum of agreements (MOAs) documentation, where applicable in the state.

1.1 Mandate

This document is produced in response to duties mandated to ambient air monitoring agencies in 40CFR58.10:

> ***40 CFR PART 58.10: Annual monitoring network plan and periodic network assessment.***
>
> *(d) The state, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby states and tribes or health effects studies. The state, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator. The assessments are due every five years beginning July 1, 2010.*

1.2 Procedures for Making Changes to the Monitoring Network

In some circumstances, monitors must be shut down or moved. While the Ambient Monitoring Program of GA AAMP makes every effort to maintain continued operation of all required monitors, it operates as a guest or leaseholder at all monitoring sites. The GA AAMP does not hold ownership rights to the land at any of its ambient air monitoring sites. If the GA AAMP loses its lease or is otherwise forced to leave a given site, the monitors at that site may be moved to a nearby location or discontinued [40CFR58.14(c)(6)].

1.3 Memorandum of Agreement

The GA AAMP has memorandum of agreements with the Chattanooga-Hamilton County Air Pollution Control Bureau and the South Carolina Department of Health and Environmental Control for air monitoring activities in MSAs that cross state lines.

As stated in the Memorandum of Agreement dated December 28, 2017, "The purpose of the Memorandum of Agreement (MOA) is to establish the Chattanooga-Hamilton County-Walker County Metropolitan Statistical Area (MSA) Criteria Pollutant Air Quality Monitoring Agreement between CHCAPCB [Chattanooga-Hamilton County Air Pollution Control Bureau] and GAEPDAPB [Georgia Environmental Protection Division Air Protection Branch] (collectively referred to as the "affected agencies") to collectively meet United States Environmental Protection Agency (EPA) minimum monitoring requirements for particles of an aerodynamic diameter of 10 micrometers and less (PM10), particles of an aerodynamic diameter of 2.5 micrometers and less (PM2.5), and ozone; as well as other criteria pollutant air quality monitoring deemed necessary to meet the needs of the MSA as determined reasonable by all parties. This MOA will establish the terms and conditions of this collective agreement to provide adequate criteria pollutant monitoring for the Chattanooga–Hamilton County-Walker Co, GA MSA as required by 40CFR58 Appendix D, Section 2, (e) (March 28, 2016)." For full MOA documentation, see Appendix F of this document.

The Memorandum of Agreement dated January 2017 states, "The purpose of the Memorandum of Agreement (MOA) is to renew the Augusta-Richmond County Metropolitan Statistical Area (MSA) Criteria Pollutant Air Quality Monitoring Agreement between SCDHEC [South Carolina Department of Health and Environmental Control] and GA EPD (collectively referred to as the "affected agencies") to collectively meet United States Environmental Protection Agency (EPA) minimum monitoring requirements for particles of an aerodynamic diameter of 10 micrometers and less (PM10), particles of an aerodynamic diameter of 2.5 micrometers and less (PM2.5), and ozone; as well as other criteria pollutant air quality monitoring deemed necessary to meet the needs of the MSA as determined reasonable by all parties. This MOA will establish the terms and conditions of this collective agreement to provide adequate criteria pollutant monitoring for the Augusta–Richmond County MSA as required by 40CFR58 Appendix D, Section 2, (e)." For full MOA documentation, see Appendix F of this document. South Carolina DHEC is now known as the South Carolina Department of Environmental Services (DES). Both agencies have agreed that the MOA is still valid with this name change.

For the Columbus, GA-AL MSA, both the Alabama Department of Environmental Management and the GA AAMP have agreed to fully cover EPA's regulations for monitoring their respective state.

1.4 Request for Waiver/Discontinuance

Renewal of Solar and TUVR Radiation at Conyers Site:
The GA AAMP is requesting a waiver to continue monitoring the solar radiation and total ultraviolet radiation at the Conyers site (13-247-0001) for the South DeKalb (13-089-0002) PAMS site. The South DeKalb monitoring site does not fit the necessary guidelines for measurement of solar radiation, due to the topography of the site location. Solar radiation measurements from the

total global solar radiation sensor must be made from a location that is free from any obstruction which may cause a shadowing effect. In addition, the pyranometer must be located away from highly reflective surfaces, which may cause enhanced optical scattering and overestimate the incoming total solar radiation. The required total ultraviolet radiation and solar radiation measurements are collected at the Conyers monitoring site, which meets necessary criteria.

Lead Monitoring Waiver Request:
Per 40 CFR Part 58, Appendix E, Section 10, GA AAMP is requesting a waiver for the location of the monitors at the Empire Blvd site (13-121-0057). The GA AAMP will have collocated lead monitors at this site. Due to logistics of the microscale site, the monitors are less than 15 meters from the nearest road (Empire Blvd) and located near trees. GA AAMP and EPA are in agreement that the road has minimal impact on the air monitors and representative of the microscale. Empire Blvd has less than approximately 2,780 annual average daily traffic count. In addition, the monitors cannot reasonably be located in another area to minimize safety concerns and have the least amount of unobstructed wind flow in the vicinity.

Gwinnett Tech Site Waiver Request:
GA AAMP is requesting a waiver to continue monitoring at the Gwinnett Tech site (13-135-0002) location. GA AAMP has attempted to find a location with proper distance from roads, and open fetch for ambient air data collection. GA AAMP has researched several areas near the existing site, including several schools, suggested by EPA. At each location, the open spaces seem to be used for playgrounds and sporting events. Any of the areas that are not in open spaces are either too close to busy highways and roads, buildings, trees and do not allow for at least 270 degrees of continuous air flow. GA AAMP cannot locate the site on top of the school for safety reasons for the site operators/field auditors, as well as the ambient air monitoring includes the use of a site shelter. Thus far, GA AAMP has been unable to locate a suitable location to establish an ambient air monitoring site that will accommodate the footprint needed with the site shelter.

1.5 Air Quality Index (AQI)

The Air Quality Index (AQI) is a method of reporting daily air quality that converts concentration levels of pollution to a simple color-coded number scale of 0-500. Colored categories on the AQI scale are related to potential health effects from exposure to measured concentrations of a major pollutant. Certain monitoring stations in the GA AAMP’s SLAMS network provide data used in daily AQI reporting.

Figure 2 shows how the monitored concentrations correspond to the AQI values, descriptors and health advisories. AQI reporting is required for all urban areas with a population exceeding 350,000, which in Georgia include the Atlanta-Sandy Springs-Roswell MSA; the Augusta-Richmond County, GA-SC MSA; the Savannah MSA; and the Chattanooga TN-GA MSA. The GA AAMP provides daily AQI reporting to the general public in Georgia through the Ambient Monitoring Program website (https://airgeorgia.org/). The Chattanooga, Tennessee-Georgia MSA AQI reporting is covered by the GA AAMP and the Chattanooga-Hamilton County Air Pollution Control Bureau per the MOA, as discussed above. The Augusta-Richmond County, GA-SC MSA AQI is covered by the GA AAMP and the South Carolina Department of Environmental Services per the MOA.

Maximum Pollutant Concentration							AQI Value	Descriptor	EPA Health Advisory
$PM_{2.5}$	PM_{10}	SO_2	O_3	O_3	CO	NO_2			
(24hr) µg/m^3	(24hr) µg/m^3	(1hr)* ppb	(8hr)^ ppm	(1hr) ppm	(8hr) ppm	(1hr) ppb			
0.0– 9.0	0– 54	0– 35	0.000– 0.054	None	0.0– 4.4	0– 53	0 to 50	**Good (green)**	Air quality is considered satisfactory, and air pollution poses little or no risk.
9.1– 35.4	55– 154	36– 75	0.055– 0.070	None	4.5– 9.4	54-100	51 to 100	**Moderate (yellow)**	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to the condition of the air may experience respiratory symptoms.
35.5– 55.4	155 – 254	76 – 185	0.071 – 0.085	0.125 – 0.164	9.5– 12.4	101- 360	101 to 150	**Unhealthy for Sensitive Groups**	Members of sensitive groups (people with lung or heart disease) are at greater risk from exposure to particle pollution. Those with lung disease are at risk from exposure to ozone. The general public is not likely to be affected in this range.
55.5– 150.4	255– 354	186– 304*	0.086– 0.105	0.165– 0.204	12.5– 15.4	361- 649	151 to 200	**Unhealthy (red)**	Everyone may begin to experience health effects in this range. Members of sensitive groups may experience more serious health effects.
150.5– 250.4	355– 424	305– 604*	0.106– 0.200	0.205– 0.404	15.5– 30.4	650- 1249	201 to 300	**Very Unhealthy (purple)**	AQI values in this range trigger a health alert. Everyone may experience more serious health effects. When the AQI is in this range because of ozone, most people should restrict their outdoor exertion to morning or late evening hours to avoid high ozone exposures.
250.5– 350.4	425– 504	605– 804*	0.201- (^)	0.405 – 0.504	30.5– 40.4	1250- 1649	301 to 400	**Hazardous (maroon)**	AQI values over 300 trigger health warnings of emergency conditions. The entire population is more likely to be affected.
350.5– 500.4	505– 604	805– 1004*	None^	0.505– 0.604	40.5– 50.4	1650- 2049	401 to 500		

*Values of 200 or greater are calculated with 24-hr SO_2 concentrations; ^Values of 301 or greater are calculated with 1-hr O_3 concentrations

Figure 2: Detailed AQI Values by Pollutant

1.6 QAPP and QMP

As part of the requirements for EPA (40CFR58 Appendix A), the GA AAMP has submitted the appropriate Quality Assurance Project Plans (QAPP) and Quality Monitoring Plans (QMP). The following table shows the current status of submittals and approvals of these documents.

Table 1: List of Georgia AAMP's QAPPs

QAPP Title	Submittal	Approval
Quality Assurance Project Plan of the Georgia Ambient Air Quality Monitoring Project for $PM_{2.5}$	10/1/2024 (Annual)	4/7/2023 (5-year approval)
Quality Assurance Project Plan of the Georgia Ambient Air Quality Monitoring Project for the Criteria Air Pollutants and National Core Multi-Pollutant Station	11/12/2024 (Annual)	5/19/2023 (5-year approval)
Quality Assurance Project Plan of the Georgia Ambient Air Quality Monitoring Project for the Photochemical Assessment Monitoring Stations State of Georgia	Annual to be submitted 6/2/2025	12/4/2023 (5-year approval)
Quality Assurance Project Plan of the Georgia Ambient Air Quality Monitoring Project for the Near Road Monitoring Network	7/23/2024 (Annual)	1/25/2023 (5-year approval)
Quality Assurance Project Plan for the Georgia National Air Toxics Trends Project	5/14/2024 (Annual)	11/22/2022 (5-year approval)
Quality Assurance Project Plan for the Georgia Ambient Air Monitoring Program for Lead	2/7/2024	6/14/2024 (5-year approval)
Quality Assurance Project Plan for the Georgia Ambient Air Monitoring Program for Special Projects	3/27/2024	
Quality Management Plan for the Air Protection Branch	6/27/2023	

1.7 Public Notice and Comment Procedures

Future changes to the monitoring network listed in the Annual Ambient Air Monitoring Plan are subject to a required public notice and comment process each year before EPA approval is sought for the changes. Any public comments submitted in response to the document's notice and comment process will be submitted to EPA along with the final document. Persons wishing to comment on proposed changes and documentation are required to submit their comments, in writing, to the GA AAMP at the following address:

Air Protection Branch
Attn: Annual Ambient Air Monitoring Plan Comments
4244 International Parkway, Suite 120
Atlanta, Georgia 30354

In addition, public comments can be submitted in writing to Jaime Gore, Program Manager of the Ambient Monitoring Program, at Jaime.Gore@dnr.ga.gov or to Air-General.Comments@dnr.ga.gov.

The deadline for submitting comments to the GA AAMP is no later than 30 days after the date on which the document is published on https://airgeorgia.org/. Should the comment period end on a weekend or holiday, comments will be accepted up until the next working day. The GA AAMP, in soliciting comments for the final draft before submittal to EPA as required by 40CFR58.10(a)(1), will address, as appropriate, any comments received before the deadline.

The GA AAMP's responses to comments and any other relevant information will be included in the final document published on https://airgeorgia.org/.

1.8 New Technologies

At a few sites across the state, GA AAMP is planning to add new monitoring equipment in which new technologies will be put to use. The GA AAMP has begun installing and using the Thermo 49iQ ozone analyzers, and plans to install Thermo 43iQ SO_2 analyzers, and Thermo 48iQTL CO analyzers. The GA AAMP has incorporated new Agilaire 8872 data loggers throughout the network at the continuous sites. GA AAMP is installing the new 2025i model for integrated $PM_{2.5}$ monitoring. In addition, the TEOM 1405-F replaced the TEOM 1400AB model at the Near-road-GA Tech site. GA AAMP installed an ATEC 2200-22P to replace the ATEC VOC sampler at the NATTS site. For more information about technology used in the GA AAMP network, refer to Appendix C.

1.9 Use of Data

GA AAMP collects ambient air monitoring data covering both criteria and non-criteria pollutants. This data is used by several different groups and has many uses from public health studies to making regulatory decisions. The data is used to provide air pollution information to the public, including the Air Quality Index (discussed above in Section 1.5 and in Section 13.0), the GA AAMP website (https://airgeorgia.org/) with hourly readings of continuous data, and finally producing a forecast of the air quality which is reported in AirNow and various news reports to the public. The data is used to assist in enforcement actions with permitting and compliance, and to determine the extent of allowable industrial expansion. State modelers as well as private consultants use the air monitoring data to help make these determinations. The ambient air monitoring data has been used by non-governmental planning groups, such as the Georgia Commute Options, and intergovernmental groups, such as Atlanta Regional Commission, to make recommended improvements for cities across the state. The ambient air monitoring data is used to determine whether National Ambient Air Quality Standards as defined by EPA are being met, and if the state of Georgia has areas of nonattainment according to these standards.

GA AAMP routinely has requests of the ambient air monitoring data from other states, various universities, research institutes, public health and federal agencies such as the Centers for Disease Control. The data is used to determine the improvement or declination of air quality, and how the air quality is related to human and environmental health. In addition, the data has been used in international studies to compare with major cities around the world.

Annually, the GA AAMP provides an Ambient Air Surveillance report that summarizes and analyzes the previous year's ambient air data, including a risk assessment, for the general public. In addition, GA AAMP produces an Ambient Air Monitoring Plan on an annual basis. The Ambient Air Monitoring Plan details the location and site specific data for each monitor in GA AAMP's ambient monitoring network, as well as GA AAMP's plans for changes to the network. This document is made available for public review and comment regarding placement of ambient air monitors and collection of ambient air data. Both the Ambient Air Surveillance Report and Ambient Air Monitoring Plan are also found on the website listed above.

1.10 Georgia AAMP Budget

GA AAMP's budget is made up of a combination of three sources: state funds, federal funds, and fee funds. In recent years, GA AAMP has had budget and personnel constraints, and since the last publication of the Five-Year Network Assessment there has been some fluctuation in the number of ambient air monitoring samplers across the state. A complete list of the monitors that have been shut down since the last publication of the Five-Year Network Assessment can be found in Appendix D of this document.

1.11 Inventory of Ambient Monitoring Equipment

As part of the requirements for the *Ambient Air Monitoring Plan*, the GA AAMP has included a list and evaluation of the current ambient monitoring equipment. See attached Appendix B of this document for the inventory listing.

1.12 List of Sites

The following table gives a complete list of the current air monitoring network and the parameters that are sampled at each site. It is important to note that due to the timeliness of drafting this Five-Year Network Assessment, GA AAMP performed these extensive evaluations on data collected from 2019 through 2023. However, there were some network changes that occurred in 2024 and early 2025. Those changes are reflected in Table 2. Sites or monitors that have been shut down since 2023 are shown in red.

Table 2: 2025 Georgia Ambient Air Monitoring Network

SITE ID	SITE NAME	COUNTY	O_3	CO	$PM_{2.5}$ FRM	$PM_{2.5}$ Cont.	$PM_{2.5}$ Spec.	PM Coarse	Pb	NO/ NOx	NO_2	NOy	SO_2	PM_{10}	PM_{10} Cont.	PAMS VOC	VOC	SVOC	Carb-onyls	Meteo-rology	Black Carbon	Metals
Rome MSA																						
131150003	Rome	Floyd				S	X															
Brunswick MSA																						
131270006	Brunswick	Glynn	S		S	S														NR		
Valdosta MSA																						
131850003	Valdosta	Lowndes			S	S																
Warner Robins MSA																						
131530001	Warner Robins	Houston			S	S																
Dalton MSA																						
132130003	Fort Mountain	Murray	S																	NR		
Albany MSA																						
130950007	Albany	Dougherty			S	S																
Gainesville MSA																						
131390003	Gainesville	Hall			S	S																
Athens-Clarke County MSA																						
130590002	Athens	Clarke	S			S																
Macon-Bibb County, MSA																						
130210007	Macon-Allied	Bibb			S	S	X															
130210012	Macon-Forestry	Bibb	S		S	S							S							NR		
Columbus Georgia- Alabama MSA																						
132150008	Columbus-Airport	Muscogee	S		S	S																
132150012	Columbus-Baker	Muscogee			S	S	X															
132151003	Columbus-Crime Lab	Muscogee																		NR		
Savannah MSA																						
130510021	Savannah-E. President	Chatham	S										S							NR		
130511002	Savannah- L&A	Chatham			S	S							S							NR		
Augusta-Richmond County, Georgia-South Carolina MSA																						
130730001	Evans	Columbia	S																	NR		
132450091	Augusta	Richmond	S		S	S	X						S		S					NR		

Table 3: 2025 Georgia Ambient Air Monitoring Network (continued)

SITE ID	SITE NAME	COUNTY	O_3	CO	$PM_{2.5}$ FRM	$PM_{2.5}$ Cont.	$PM_{2.5}$ Spec.	PM Coarse	Pb	NO/ NOx	NO_2	NOy	SO_2	PM_{10}	PM_{10} Cont.	PAMS VOC	VOC	SVOC	Carb-onyls	Meteo-rology	Black Carbon	Metals
Atlanta-Sandy Springs-Alpharetta MSA																						
130630091	Forest Park	Clayton			S	S																
130670003	Kennesaw	Cobb	S		S	S																
130850001	Dawsonville	Dawson	S																	NR		
130890002	South DeKalb	DeKalb	S/P/C	S/P/C	S/C	S/C	T/C	S		S/P	S/P	S/P/ C	C		C	P	N	N	P/N	P/C		N
130890003	NR-285	DeKalb				S				R	R						R				R	
130970004	Douglasville	Douglas	S																	NR		
131210039	Fire Station #8	Fulton			S									S								
131210055	United Ave.	Fulton	S			S							S							NR		
131210056	NR-GA Tech	Fulton		R	R	R				R	R									R	R	
131210057	Empire Blvd	Fulton							S													
131350002	Gwinnett Tech	Gwinnett	S		S	S																
131510002	McDonough	Henry	S			S																
132319991	EPA CASTNET	Pike	A																			
132470001	Conyers	Rockdale	S																	NR/P		
Chattanooga Tennessee-Georgia MSA																						
132950004	Rossville-Williams St.	Walker			S	S	X															
Not in an MSA																						
130550001	Summerville	Chattooga	S																			
130690002	General Coffee	Coffee			S	S	X															
132611001	Leslie	Sumter	S																			
133030001	Sandersville	Washington			S	S																

Monitoring Types: S=SLAMS; P=PAMS; C=NCore; X=Supplemental Speciation; T=STN; N=NATTS; R=Near-road; NR=Non-Regulatory; G=General Information; A=CASTNET

Red text signifies a shutdown site or monitor after analyses in report have been conducted

2.0 Standards

Ambient air quality statuses for the six criteria pollutants are determined by measuring pollutants concentrations in ambient air and comparing the measured concentrations to corresponding standards. The six criteria pollutants are sulfur dioxide, particulate matter ($PM_{2.5}$ and PM_{10}), carbon monoxide, ozone, nitrogen dioxide, and lead. The EPA defines the ambient air as that portion of the atmosphere, external to buildings, to which the general public has access.

The National Ambient Air Quality Standards (NAAQS) are divided into primary and secondary standards[1]. Primary standards are those established to protect public health. Secondary standards are those established to protect the public welfare from adverse pollution effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, climate, property, transportation, economy, personal comfort and well-being. The scientific criteria upon which the standards are based are reviewed periodically by the EPA, which may reestablish or change the standards according to its findings. Note that there are hundreds of compounds that are generally considered pollutants when found in ambient air but whose health and welfare effects are not well enough understood for ambient standards to be defined.

A pollutant measurement that is greater than the ambient air quality standard for a specific averaging time is called an exceedance. An exceedance does not always imply that a violation of the standard took place. For each pollutant, there are specific rules for a given time period before a pattern of exceedances is considered a violation of the NAAQS. If a violation occurs, it may result in regulatory actions to further clean up the air in the area where the violation occurred. This distinction is made to allow for certain limited exceedances of the standard that may occur, for example, during an unusual weather pattern, reserving regulatory action for cases where the exceedances are too large or too frequent.

3.0 Monitoring Objectives and Spatial Scale

Federal regulations indicate that a minimum of four monitoring objectives should be met in establishing an ambient air monitoring network. The network is to have stations that monitor: (1) the highest pollutant concentrations; (2) the representative concentrations in areas of high population density; (3) the impact of major pollution emissions sources; and (4) the general background concentration levels. The physical siting of the air monitoring station must achieve a spatial scale of representativeness that is consistent with the monitoring objective. The spatial scale results from the physical location of the site with respect to the pollutant sources and categories. It estimates the size of the area surrounding the monitoring site that experiences uniform pollutant concentrations.

The categories of spatial scale are:
<u>Micro Scale:</u> An area of uniform pollutant concentrations ranging from several meters up to 100 meters.
<u>Middle Scale:</u> Uniform pollutant concentrations in an area of about 100 meters to 0.5 kilometer.
<u>Neighborhood Scale:</u> An area with dimensions in the 0.5 to 4.0 kilometer range.
<u>Urban Scale:</u> Citywide pollutant conditions with dimensions ranging from 4 to 50 kilometers.

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[1] For a list of the most current standards, please refer to EPA's website https://www.epa.gov/criteria-air-pollutants/naaqs-table.

Regional Scale: An entire rural area of the same general geography (this area ranges from tens to hundreds of kilometers).

Monitoring objectives and associated spatial scales are taken from Appendix D of 40CFR58, Table D-1, and summarized in **Error! Reference source not found.** below.

Table 4: Monitoring Objective and Spatial Scale

Monitoring Objective	Appropriate Spatial Scale
Highest concentration or source impact	Micro, Middle, Neighborhood, or (less frequently) Urban
Population oriented	Neighborhood or Urban
General/background, regional transport, welfare related impacts	Urban or Regional

4.0 Description of Networks

4.1 NCore

The State of Georgia is required to have one National Core (NCore) Multipollutant Monitoring station, and the GA AAMP complies with this requirement at the South DeKalb site (13-089-0002) in DeKalb County. The NCore site monitoring equipment includes: $PM_{2.5}$ FRM, $PM_{2.5}$ continuous, $PM_{2.5}$ speciation, ozone (collecting data year-round), trace level carbon monoxide (CO), trace level sulfur dioxide (SO_2), trace level nitrogen oxide (NO), total reactive nitrogen (NOy), wind direction, wind speed, temperature, and relative humidity. The site has operated since January 1, 2011, and site establishment and details were included in the GA AAMP's *2011 Ambient Air Monitoring Plan, Appendix C, Ambient Air Monitoring Plan for National Core (NCore) Multipollutant Monitoring Station*. NCore monitoring network sites have the following monitoring objectives:

- Timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms
- Support development of emission strategies through air quality model evaluation and other observational methods
- Accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors
- Support long-term health assessments that contribute to ongoing reviews of the National Ambient Air Quality Standards (NAAQS)
- Compliance through establishing nonattainment/attainment areas by comparison with the NAAQS
- Support multiple disciplines of scientific research, including: public health, atmospheric and ecological

4.2 Sulfur Dioxide

EPA lowered the sulfur dioxide (SO_2) NAAQS standard to a 1-hour primary standard of 75 ppb, added new SO_2 ambient monitoring requirements in 2010 (75FR119, 06/22/10) and retained the standard in 2019 (84FR9866, 3/18/19). The rule combines air quality modeling and monitoring. The rule requires refined dispersion modeling to determine if areas with sources that have the potential to cause or contribute to a violation of the new SO_2 standard can comply with the standard.

The monitoring regulations require monitors to be placed in Core Based Statistical Areas (CBSAs), based on a population weighted emissions index (PWEI) for the area. The rule requires three monitors in CBSAs with index values of 1,000,000 or more; two monitors in CBSAs with index values less than 1,000,000 but greater than 100,000; and one monitor in CBSAs with index values greater than 5,000. Based on these requirements, the GA AAMP is required to have one monitor in the Atlanta-Sandy Springs-Alpharetta MSA. Currently, GA AAMP monitors SO_2 at the United Avenue (13-121-0055) and South DeKalb (13-089-0002) sites in the Atlanta-Sandy Springs-Alpharetta MSA, the Augusta (13-245-0091) site in the Augusta-Richmond County, GA- SC MSA, the Savannah-L&A (13-051-1002) and Savannah-E. President Street (13-051-0021) sites in the Savannah MSA, and the Macon-Forestry (13-021-0012) site in the Macon-Bibb County, MSA.

As an NCore site, the South DeKalb site (13-089-0002) also began monitoring trace level sulfur dioxide as of October 1, 2010. The GA AAMP collects and reports 5-minute maximum data with all the SO_2 monitors in the state.

GA EPD is currently evaluating the siting location of the SO_2 monitor at the Augusta site (13-245-0091) and nearby area. Modeling is being conducted by the Planning and Support Program to determine the best location for the monitor. The GA AAMP has also deployed SO_2 sensors to compare with the modeling results when complete.

4.3 Nitrogen Dioxide

On May 18, 2018, EPA retained the 2010 nitrogen dioxide (NO_2) National Ambient Air Quality Standard (NAAQS) (Federal Register, Vol. 83, No. 75, 04/18/18). EPA's last revision of the NAAQS was January 22, 2010. Near-road NO_2 monitors were to be set up in CBSAs with 500,000 or more population (additional monitor with CBSA population above 2,500,000), average traffic counts of 250,000 vehicles or greater, and represent a microscale (no more than 50 meters from the edge of the nearest traffic lane) (Federal Register, Vol. 75, No. 26, 02/09/10). The GA AAMP meets this requirement with two monitors in the Atlanta-Sandy Springs-Alpharetta MSA. The first near-road NO_2 monitor was set up at the near-road site on the Georgia Institute of Technology campus (NR-GA Tech, 13-121-0056) on June 15, 2014. NO_2/NO/NOx, CO, $PM_{2.5}$, black carbon, wind speed and wind direction are monitored at this site. For details regarding the establishment of the first near-road site in the Atlanta-Sandy Springs-Alpharetta MSA, refer to Appendix E of the *2014 Ambient Air Monitoring Plan* at https://airgeorgia.org/networkplans.html. The second near-road monitoring site was set up in the Atlanta-Sandy Springs-Alpharetta MSA on January 1, 2015, at the established monitoring site near interstate 285 (NR-285, 13-089-0003). At the NR-285 site, NO_2/NO/NOx, volatile organic compounds, non-regulatory continuous $PM_{2.5}$, and black carbon are monitored for the near-road network. For details regarding the establishment of the second near-road site, refer to the GA AAMP's Addendum to the *2015 Ambient Air Monitoring Plan* at https://airgeorgia.org/networkplans.html.

In addition to the near-road NO_2 requirements, the GA AAMP is required to operate at least one area-wide NO_2 monitor in the Atlanta-Sandy Springs-Alpharetta MSA. These monitors should be placed in CBSAs with a population of 1,000,000 or more, and are expected to have the highest concentrations representing a neighborhood or larger spatial scale (40CFR58, Appendix D, Section 4.3.3). The South DeKalb site (13-089-0002) is the GA AAMP's PAMS site (discussed below), and collects area-wide NO_2 data for the Atlanta-Sandy Springs-Alpharetta MSA. The South DeKalb site has historically collected the highest concentrations representing urban spatial scale, is located within an urban area, and operates year round. Therefore, the South DeKalb NO_2 monitor satisfies the area-wide requirement.

4.4 Carbon Monoxide

EPA's last revision to the monitoring requirements for the carbon monoxide (CO) monitoring network was in 2011. EPA requires that a CO monitor be collocated with an NO_2 near-road monitor in urban areas with populations of one million or more. EPA specified that in areas with 2.5 million or more, the CO monitors should be operational by January 1, 2015 (Federal Register: Vol. 76, No. 169, Page 54293, 08/31/11). For this monitoring requirement, the State of Georgia is required to have one CO monitor located in the Atlanta-Sandy Springs-Alpharetta MSA, collocated with an NO_2 near-road monitor. The GA AAMP meets this monitoring requirement with a CO monitor that began monitoring at the NR-GA Tech site (13-121-0056) on June 15, 2014. In addition, the South DeKalb site (13-089-0002) is the GA AAMP's NCore site and collects CO data as part of that network (discussed above).

4.5 $PM_{2.5}$ Speciation Trends Network (STN)

The Speciation Trends Network (STN) (40CFR58, Appendix D, Section 4.7.4) characterizes the make-up of the $PM_{2.5}$ samples collected. With this speciation information, air quality modeling can be improved to help implement the NAAQS standards; health studies can be interpreted by knowing the constituents of the $PM_{2.5}$ sample, and the understanding of the constituents in regional haze is also improved. There are 52 Speciation Trends sites across the United States. The GA AAMP meets this requirement with the South DeKalb site (13-089-0002). The South DeKalb Speciation Trends site began monitoring on October 1, 2000, and samples are collected every three days. Additionally, there are six more $PM_{2.5}$ speciation monitors that the GA AAMP has chosen to operate. These sites are located in Rome (13-115-0003) (started 3/1/02), Macon-Allied (13-021-0007) (started 3/1/02), Columbus-Baker (13-215-0012) (started 5/1/02), Augusta (13-245-0091) (started 3/2/02), Rossville-Williams St. (13-295-0004) (started 3/23/05), and General Coffee (13-069-0002) (started 3/1/02). These are in place to provide supplemental speciation data in the overall chemical speciation network and take samples every 6 days.

4.6 Photochemical Assessment Monitoring Stations (PAMS)

On October 26, 2015, EPA made revisions to the ozone standard, and with those changes, also revised the regulations for the supporting PAMS stations (Federal Register, Vol.80, No. 206, page

65467). EPA required that PAMS measurements be collected at NCore sites only. The GA AAMP meets this requirement with the South DeKalb (13-089-0002) site, which is the GA AAMP's NCore site. Therefore, for the PAMS requirements, the GA AAMP will continue hourly collection of speciated volatile organic compounds in June, July, and August; three 8- hour samples of carbonyls collected every third day during June, July and August; hourly ozone, NO, NO_2, NO_Y, temperature, wind direction, wind speed, barometric pressure, relative humidity, precipitation, and sigma theta at the South DeKalb site. As discussed in Section 1.4, solar radiation and ultraviolet radiation are monitored at the Conyers (13-247-0001) site due to siting conditions.

The South DeKalb site is located in DeKalb County to provide neighborhood scale measurements in the area that the chemicals which form ozone have the greatest impact. The data measurements generated at the South DeKalb site are used principally for development and evaluation of imminent and future control strategies, corroboration of NOx and VOCs emission inventories, verification of photochemical grid model performance, characterization of ozone and toxics air pollutant exposures, development of pollutant trends (particularly toxic air pollutants and annual ambient speciated VOCs trends to compare with trends in annual VOC emission estimates), and determination of attainment with NAAQS for O_3, $PM_{2.5}$, PM_{10}, CO, SO_2, and NO_2. On January 8, 2020 (85 FR 834, page 834), EPA delayed the start of the revised PAMS monitoring network to June 1, 2021. GA AAMP fully implemented the program by June 1, 2021, and began sampling the hourly VOCs from June through August, the 8-hour carbonyls three times a day every third day from June through August, and hourly direct NO_2.

4.7 National Air Toxics Trends Station (NATTS)

The National Air Toxics Trends Stations (NATTS) program is a nationwide monitoring project for the assessment of national trends and variations of several selected air toxics pollutants. The NATTS network was established to produce data that is consistent and of standardized quality to be able to perform comparisons of air toxics data nationwide. There are 25 NATTS locations nationwide, with both urban sites to address the range of population exposure in urban areas, and rural sites to characterize population exposure in non-urban areas, establish background concentrations, and better assess environmental impacts of emissions of air toxic pollutants. The GA AAMP meets the requirement with the location of the NATTS station at the South DeKalb site (13-089-0002). As part of the NATTS network, the GA AAMP samples metals with a PM_{10} sampler, semi-volatile organic compounds, volatile organic compounds, and carbonyls. Samples are collected from midnight to midnight for a 24-hour sample, every 6 days. Also at the South DeKalb site, GA AAMP began sampling ethylene oxide as of January 2020.

4.8 Ozone

Ozone monitoring has been in place in the Atlanta area since the 1970's. Currently the Atlanta-Sandy Springs-Alpharetta MSA ozone network includes nine monitors located in nine counties. Across Georgia, there are 16 ozone monitors in the network, which exceeds the EPA requirement (40CR58, Appendix D, Section 4.1). The standard is an 8-hour averaging time, fourth maximum value, averaged over three years. On October 1, 2015, EPA lowered the ozone standard to 0.070 ppm. For this 2015 standard, with the 2019-2021 data, the Atlanta area met the ozone standard.

In October 2022, the Atlanta area was designated as attainment for the 2015 ozone NAAQS (Federal Register, Vol. 87, No. 194, page 60897, dated October 7, 2022).
As part of the Clean Air Status and Trends Network (CASTNET), EPA established a monitoring site in Pike County, Georgia in 1988. The CASTNET site is part of a national air quality monitoring network put in place to assess long-term trends in atmospheric deposition and ecological effects of air pollutants. The CASTNET site is one of 99 regional sites across rural areas of the United States and Canada measuring nitrogen, sulfur, and ozone concentrations, and deposition of sulfur and nitrogen. Like the South DeKalb ozone monitor, the CASTNET ozone monitor also collects data year-round (https://www.epa.gov/castnet). With the exception of the South DeKalb and CASTNET sites, ozone in Georgia, unlike other pollutants previously discussed, is monitored March through October, complying with federal monitoring regulations (in 40CFR Part 58).

4.9 Particulate Matter

Particulate pollution may be categorized by size since there are different health impacts associated with the different sizes of particulate matter. GA AAMP currently monitors for three sizes of particles: PM_{10} (up to 10 microns in diameter), $PM_{2.5}$ (up to 2.5 microns in diameter) and PM_{coarse} (PM_{10} minus $PM_{2.5}$). To give size relation, approximately ten PM_{10} particles can fit on a cross section of a human hair, and approximately thirty $PM_{2.5}$ particles would fit on a cross section of a hair. These particles and droplets are invisible to the naked eye, and composition and sources can vary greatly by region. There are three monitoring stations with PM_{10} monitors, one station with a PM_{coarse} monitor, and 24 stations with continuous and/or integrated $PM_{2.5}$ monitors, which exceeds the number of samplers required according to 40CFR58, Appendix D, Section 4.7.

For an area to be in attainment of the annual ambient air $PM_{2.5}$ standard, the three-year average of the annual average concentrations has to be less than or equal to 9.0 $\mu g/m^3$. In addition, the 24-hour primary and secondary standard requires that the three-year average of the 98th percentile of the 24-hour concentrations be less than or equal to 35 $\mu g/m^3$. Currently all areas of Georgia are designated unclassifiable/attainment for the 2012 annual $PM_{2.5}$ standard because the national standards are being met. For PM_{10}, the 24-hour data is compared to 150 $\mu g/m^3$. The standard allows one exceedance per year, averaged over a 3-year period, and all three samplers collected data well below the standard. Currently, there is no standard for PM_{coarse}.

4.10 Lead (Pb)

GA AAMP has monitored lead in different areas of Georgia and at different times throughout the years since the inception of GA EPD in the 1970’s. EPA’s last revision to the requirements for measuring lead in the ambient air was in 2010. The emission threshold for placing lead monitors near industrial facilities was lowered from 1.0 tons per year (tpy) to 0.5 tpy (Federal Register: Vol. 75, No. 247, Page 81126, 12/27/10). With the EPA Toxic Release Inventory in 2018, Georgia had no sources of lead that were emitting 0.5 tpy. In addition, as of December 2020, all areas of Georgia are meeting the lead NAAQS, which is a rolling three-month average for three years, not to exceed 0.15 $\mu g/m^3$ (Federal Register: Vol. 73, No. 219, Page 66964, 11/12/08). Therefore, GA AAMP shut down the lead samplers as of March 31, 2021.

In the past two years, EPA conducted preliminary monitoring near a potential lead source in Fulton County within the Atlanta-Sandy Springs-Alpharetta MSA. EPA then requested GA AAMP to monitor near this potential source. GA AAMP identified a location to monitor near the source and submitted the required site information and documentation to EPA for approval. EPA approved the location, and GA AAMP began sampling at the site on May 30, 2025. The site is called Empire Blvd with an AQS site code 13-121-0057. The initial documentation for setting up the site can be found in the GA AAMP's *Second Addendum to 2023 Ambient Air Monitoring Plan*.

4.11 Sensitive Population Comparison Maps

To meet the requirements set forth by EPA, GA AAMP needs to consider its ability to support air quality characterization for areas with high populations of susceptible individuals. GA AAMP operates air quality monitoring stations across the state, including evaluating air quality in vulnerable areas, such as populations of children under 5 and adults over 65. Detailed maps for Georgia, as well as the largest MSAs in Georgia, were created using ArcGIS Pro and the U.S. Census Bureau's demographic statistics. The maps illustrate the location of GA AAMP's ambient air monitors in relation to sensitive age groups, minority populations, and poverty indicators. From the results of this assessment, it appears that there is sufficient coverage of ambient air monitors in areas with sensitive populations across the state of Georgia. It is important to note that these analyses function as screening tools. They rely on nationally available datasets and may not fully reflect the complexities of local environmental risks or community demographics. Please refer to Section 12, Population Assessment, for more discussion and detailed maps.

5.0 Site Evaluations

The GA AAMP performs site evaluations throughout the year on an annual basis for each site. The following table details when the most recent site evaluations were performed and a summary of the comments that the evaluator made about each site.

Table 5: Site Evaluations

SITE ID	COMMON NAME	COUNTY	SITE EVALUATION DATE	COMMENTS	ACTION TAKEN
Rome MSA					
131150003	Rome	Floyd	12/18/2024	Samplers meet siting criteria.	No action required.
Brunswick MSA					
131270006	Brunswick	Glynn	12/4/2024	Samplers meet siting criteria.	No action required.
Valdosta MS					
131850003	Valdosta	Lowndes	12/3/2024	Samplers meet siting criteria.	No action required
Warner Robins MSA					
131530001	Warner Robins	Houston	1/15/2025	Samplers meet siting criteria.	No action required.
Dalton MSA					
132130003	Fort Mountain	Murray	12/4/2024	Samplers meet siting criteria.	No action required
Albany MSA					
130950007	Albany	Dougherty	6/10/2024	Samplers meet siting criteria.	No action required.
Gainesville MSA					
131390003	Gainesville	Hall	2/29/2024	Samplers meet siting criteria.	No action required.
Athens-Clark County MSA					
130590002	Athens	Clarke	6/12/2024	On 6/12/2024, samplers meet siting criteria. With EPA visit on 2/28/2025, was found to have siting deviation with tree drip line distance.	On 5/6/2025 GA AAMP cut trees next to shelter. Data qualified with “SX” code from 2/28/2025 to 5/5/2025
Macon-Bibb County, MSA					
130210007	Macon-Allied	Bibb	8/15/2024	Samplers meet siting criteria.	No action required.
130210012	Macon-Forestry	Bibb	10/22/2024	Samplers meet siting criteria.	Shelter replaced February 2024.

SITE ID	COMMON NAME	COUNTY	SITE EVALUATION DATE	COMMENTS	ACTION TAKEN
Columbus MSA					
132150008	Columbus-Airport	Muscogee	8/27/2024	Samplers meet siting criteria.	No action required.
132150012	Columbus-Baker	Muscogee	2/5/2025	Samplers meet siting criteria.	No action required.
Savannah MSA					
130510021	Savannah - E. President	Chatham	5/2/2024	Samplers meet siting criteria.	No action required.
130511002	Savannah – L&A	Chatham	4/10/2024	Samplers did not meet siting criteria. Trees too close to site.	Tree has been cut several times, but still not meeting criteria. Qualify data with “SX” code from 4/10/2024 until resolve.
Augusta MSA					
132450091	Augusta	Richmond	9/10/2024	Samplers meet siting criteria.	No action required.
Atlanta-Sandy Springs-Alpharetta MSA					
130630091	Forest Park	Clayton	2/18/2025	Samplers meet siting criteria.	No action required.
130670003	Kennesaw	Cobb	6/13/2024	Samplers meet siting criteria.	No action required.
130850001	Dawsonville	Dawson	10/29/2024	Samplers meet siting criteria.	No action required.

SITE ID	COMMON NAME	COUNTY	SITE EVALUATION DATE	COMMENTS	ACTION TAKEN
130890002	South DeKalb	DeKalb	10/2/2024	Samplers meet siting criteria.	No action required.
130890003	NR-285	DeKalb	3/4/2025	Samplers meet siting criteria.	No action required.
130970004	Douglasville	Douglas	2/26/2024	Samplers meet siting criteria.	No action required.
131210039	Fire Station #8	Fulton	6/6/2024	Samplers meet siting criteria.	No action required.
131210055	United Ave.	Fulton	8/6/2024	On 8/6/2024, samplers meet siting criteria. With EPA visit on 2/27/2025, was found to have a siting deviation with tree drip line distance.	On 3/2/2025, site operators trimmed branches. Qualify hourly SO_2 data “SX” from 2/27/2025 to 3/2/2025.
131210056	NR-GA Tech	Fulton	4/10/2024	On 4/10/2024, samplers meet siting criteria. With EPA site visit on 2/27/2025, was found to have siting deviation with tree drip line distance.	Tree is waiting to be cut. Need GA DOT permission. Qualify data “SX” from 2/27/2025 until completed
131210057	Empire Blvd	Fulton	In process	Site was established 5/30/2025.	Not applicable.
131350002	Gwinnett Tech	Gwinnett	7/30/2024	Samplers meet siting criteria. Interpolated distance of the O_3 inlet from Table E-1 should be at least 180 meters from Hwy 316. The inlet is 162 meters from the highway. Based upon the required distance criteria from Table E-1 of CFR 40, Part 58, Appendix E. Requesting a waiver for the monitoring scale.	Requesting a waiver for the monitoring scale.
131510002	McDonough	Henry	4/9/2025	Samplers meet siting criteria.	No action required.
132470001	Conyers	Rockdale	7/25/2024	Samplers meet siting criteria.	No action required.
Chattanooga Tennessee-Georgia MSA					
132950004	Rossville-Williams St.	Walker	6/6/2024	Samplers meet siting criteria.	No action required.
Not in an MSA					
130690002	General Coffee	Coffee	9/5/2024	Samplers meet siting criteria.	No action required.
133030001	Sandersville	Washington	6/25/2024	Samplers meet siting criteria.	No action required.

Introduction to Assessment Sections

To fulfill the objectives of the Five-Year Assessment, multiple analyses were performed on different aspects involving ambient air monitoring. These analyses include: comparison of the number of parameters monitored at each site; trends and longevity of parameters monitored; measured concentrations of criteria pollutants with values above NAAQS; deviation of criteria pollutants at each site from NAAQS; comparing monitor-to-monitor correlations using concentrations of different monitors; area served by particular networks; emission inventory; population statistics including change in population, population served, and sensitive subpopulations (children and sensitive population areas). In addition, other resources were explored to ensure that GA AAMP is meeting the above listed objectives. The Air Quality Index (AQI), including health related statistics, comprehensive meteorological data, and the PAMS network were explored.

Each assessment that produced quantifiable results for the sites examined in that assessment was ranked with an appropriate ranking method. One of two ranking methods was used with each of the quantifiable assessments. The proportionality ranking method was used when the weight of each ranking seemed to lend itself to be compared to a proportion of the highest and lowest ranking. The formula used for the proportionality ranking was (Value-Min)/(Max-Min). The binning ranking method was used when each site's ranking had a certain limit with which that the site could be compared. For example, the binning method was used such that if the absolute value of the design value was equal to the NAAQS=1, within 85% NAAQS=0.5, less than 85% NAAQS=0.

For these assessments, the data was used through the end of 2023, and the sites were used as they were set up through 2023. With assessments in which the data is not as complete when compared to the other sites in that assessment, notations have been made. In addition, there may have been some changes with the sites since 2023. Due to the timeliness of the document, the site set up and data was evaluated and discussed as it was set up by the end of 2023.

6.0 Trends Impact Assessment

The Trends Impact Assessment focuses on site monitors with a long, unbroken history. When examining trends, it takes several years to establish a good base. The longer a site has been running continuously, the better suited that site will be for a trends impact study, simply due to a greater duration for observing patterns. Often, sites will change the means of sampling and analysis methodology, making them poor contenders for a trends study. Trends are determined by plotting annual averages by site for a specific parameter on a graph. A line graph provides the best visual assessment, allowing trends to be determined by following a monitor's averages from year to year, and comparing the result to neighboring sites and across the state. This assessment does not compare parameters to the national ambient air quality standards (NAAQS), but compares the annual averages for each parameter assessed.

The Trends Impact Assessment evaluated each of GA AAMP's ambient air monitoring sites for overall duration. In addition, ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, PM_{10} (integrated and continuous), $PM_{2.5}$ (integrated, continuous, and speciation mass), lead, and National Air Toxics Trends Station (NATTS) benzene, arsenic, and formaldehyde were examined for their trends in data and the length of time each monitor has been sampling data. The first table displays all the ambient air monitoring sites in Georgia as of 2023, as well as their start date and proportionality ranking. The proportionality ranking considered the longest running site as having the most value and was ranked the highest. All of the other sites were given a ranking compared to the longevity, or number of years since established, of the longest running site. Following the list of all the sites, each of the above listed criteria parameters is graphed and displayed in a table for longevity analysis.

As of 2023, there were 35 ambient air monitoring sites in 28 counties across Georgia, including the EPA's CASTNET site. There are several sites in Georgia with a long running history. Of the 35 sites, almost half have collected data since the 1980's. The longest continuous running site is the Savannah-L&A site, which was established in 1972. Although the site located in Rossville has been running since 1967, it moved from Maple St. to Williams St. in March 2021. With this type of analysis, the Rossville location would rank the highest. The lowest ranking sites would be the sites that were most recently established. This would be the NR-GA Tech site, which began sampling in 2014.

Table 6.0: Georgia Monitoring History

Sites Arranged by Start Date				
Rank	**Site Location**	**County**	**Start Date**	**Proportionality Ranking**
1	Rossville-Williams St.[1]	Walker	1967	1.00
2	Savannah-L&A	Chatham	1972	0.89
3	Fire Station #8	Fulton	1973	0.87
4	Macon-Allied	Bibb	1974	0.85
4	South DeKalb	DeKalb	1974	0.85
4	Rome	Floyd	1974	0.85
4	Sandersville	Washington	1974	0.85
8	Augusta	Richmond	1976	0.81
9	Forest Park	Clayton	1978	0.77
9	Conyers	Rockdale	1978	0.77
11	Columbus-Crime Lab	Muscogee	1980	0.72
12	Leslie	Sumter	1981	0.70
13	Columbus-Airport	Muscogee	1982	0.68
14	Dawsonville	Dawson	1985	0.62
15	NR-285	DeKalb	1986	0.60
16	Brunswick	Glynn	1987	0.57
17	Summerville	McDuffie	1990	0.51
18	Albany	Dougherty	1991	0.49
18	Columbus-Baker[2]	Muscogee	1991	0.49
18	United Ave.	Fulton	1991	0.49
21	Savannah-E. President St.	Chatham	1995	0.40
21	Gwinnett Tech	Gwinnett	1995	0.40
23	Macon-Forestry	Bibb	1997	0.36
23	Douglasville	Douglas	1997	0.36
25	Kennesaw	Cobb	1999	0.32
25	Gainesville	Hall	1999	0.32
25	Fort Mountain	Murray	1999	0.32
25	McDonough	Henry	1999	0.32
25	Valdosta	Lowndes	1999	0.32
25	General Coffee	Coffee	1999	0.32
31	Warner Robins	Houston	2000	0.30
32	Athens	Clarke	2002	0.26
33	Evans	Columbia	2005	0.19
34	CASTNET	Pike	2011	0.06
35	NR-GA Tech	Fulton	2014	0.00

[1] Rossville-Williams St. (13-295-0004) site was moved from Rossville-Maple St. location on 3/1/2021, historical data can be found with AQS ID 13-295-0002

[2] Columbus-Baker (13-215-0012) site was moved from Columbus-Cusseta location on 3/1/2021, historical data can be found with AQS ID 13-215-0011

6.1 Ozone

The following table examines the longevity of GA AAMP's ozone monitors. The annual averages for all of these ozone monitors are plotted below the table to display the trend in ozone data across the entire network. The analysis includes all of the ozone monitors that were sampling data as of 2023.

Table 6.1: Ozone Monitoring History

Ozone			
Rank	**Site Location**	**County**	**Start Date**
1	South DeKalb	DeKalb	1974
2	Conyers	Rockdale	1978
3	Columbus-Airport	Muscogee	1983
4	Dawsonville	Dawson	1987
5	Leslie	Sumter	1988
6	Augusta	Richmond	1989
7	United Ave.	Fulton	1991
8	Brunswick	Glynn	1995
8	Savannah-E. President St.	Chatham	1995
8	Gwinnett Tech	Gwinnett	1995
11	Macon-Forestry	Bibb	1997
11	Douglasville	Douglas	1997
11	Kennesaw	Cobb	1997
14	McDonough	Henry	1999
14	Fort Mountain	Murray	1999
14	Athens	Clarke	1999
17	Summerville	Chattooga	2000
18	Evans	Columbia	2002
19	CASTNET	Pike	2011

The longest running ozone site is the South DeKalb site, due primarily to its urban location. The South DeKalb site was established in 1974, making it the most important site in conducting a trends analysis. The Conyers site follows closely after with its starting date of 1978. Four sites were established in the 1980's with the vast majority installed in the 1990's. According to the Trends Impact assessment, the most recently established Georgia site, Evans, is most susceptible to termination. The CASTNET site is part of the EPA network, and started reporting data in 2011. These sites have a shorter history and are therefore less useful when trying to determine trends.

Figure 6.1 displays the annual average 1-hour ozone concentrations for all active sites as of 2023. Again, this is not a comparison to the NAAQS. Trends in ozone levels seem to be fairly consistent among all of the established sites in Georgia. During the late 1970's and early 1980's, the few sites that were monitoring showed some minor fluctuation, but trends can be observed forming in the late 1980's and early 1990's as more sites are added. Levels fell in 1987 and continued to do so until 1989, rising again until 1991. This rise and fall pattern continued over the years until 1996. With eleven sites and five more added during the decade, the latter half of the 1990's showed a major cohesive increase in O_3 levels. In 2000, levels show a rapid decline that does not even out until 2005 when a slow increasing trend begins. Overall, ozone has risen and fallen at a steady rate. Upon observation, annual averages have stayed below 0.070 ppm and began to level off and drop again in 2007. After a sharp decline until 2009 average concentrations rose again until in 2011 and have been in decline. From 2011 to 2019, hourly ozone levels remained below 0.060 ppm, with minor increases and decreases. In 2020, there was a sharp decrease in ozone levels, likely due to quarantine measures taken for the COVID-19 pandemic. Since 2020, annual averages have climbed back to approximately where they were in the decade prior. The highest readings tend to be around the metro Atlanta area, and the lowest levels have consistently been in the coastal cities (e.g. the Savannah and Brunswick sites).

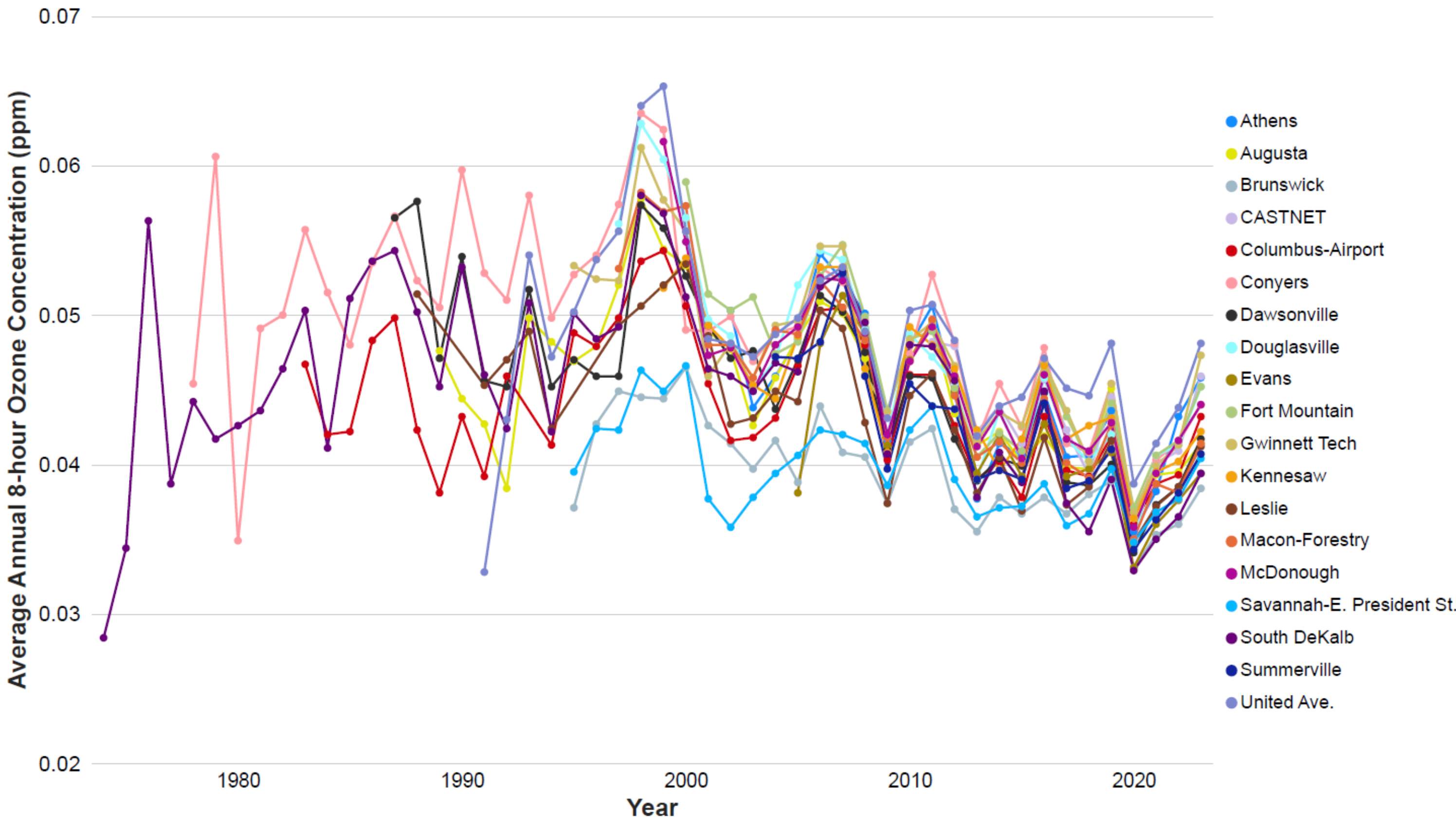


Figure 6.1: Ozone Trend in Data

6.2 Carbon Monoxide

In the following table, the longevity of GA AAMP's carbon monoxide monitors are examined. The annual averages for all these carbon monoxide monitors are plotted below the table to display the trend in carbon monoxide data in the current network.

Table 6.2: Carbon Monoxide Monitoring History

Carbon Monoxide				
Rank	Site Location	City Name	County	Start Date
1	South DeKalb	Decatur	DeKalb	2003[1]
2	NR-GA Tech	Atlanta	Fulton	2014

[1] South DeKalb CO Monitor was not operational in 2009

Figure 6.2 shows the annual average 1-hour CO concentration for all active sites as of 2023. The South DeKalb site was added in 2003 and the NR-GA Tech site in 2014. The South DeKalb site shows a steady trend in the most recent years, with annual average remaining below 0.35 ppm. However, the NR-GA Tech site began on an increasing trend with a rapid decline from 2016 to 2017. Recently, the average annual concentrations show a steady trend.

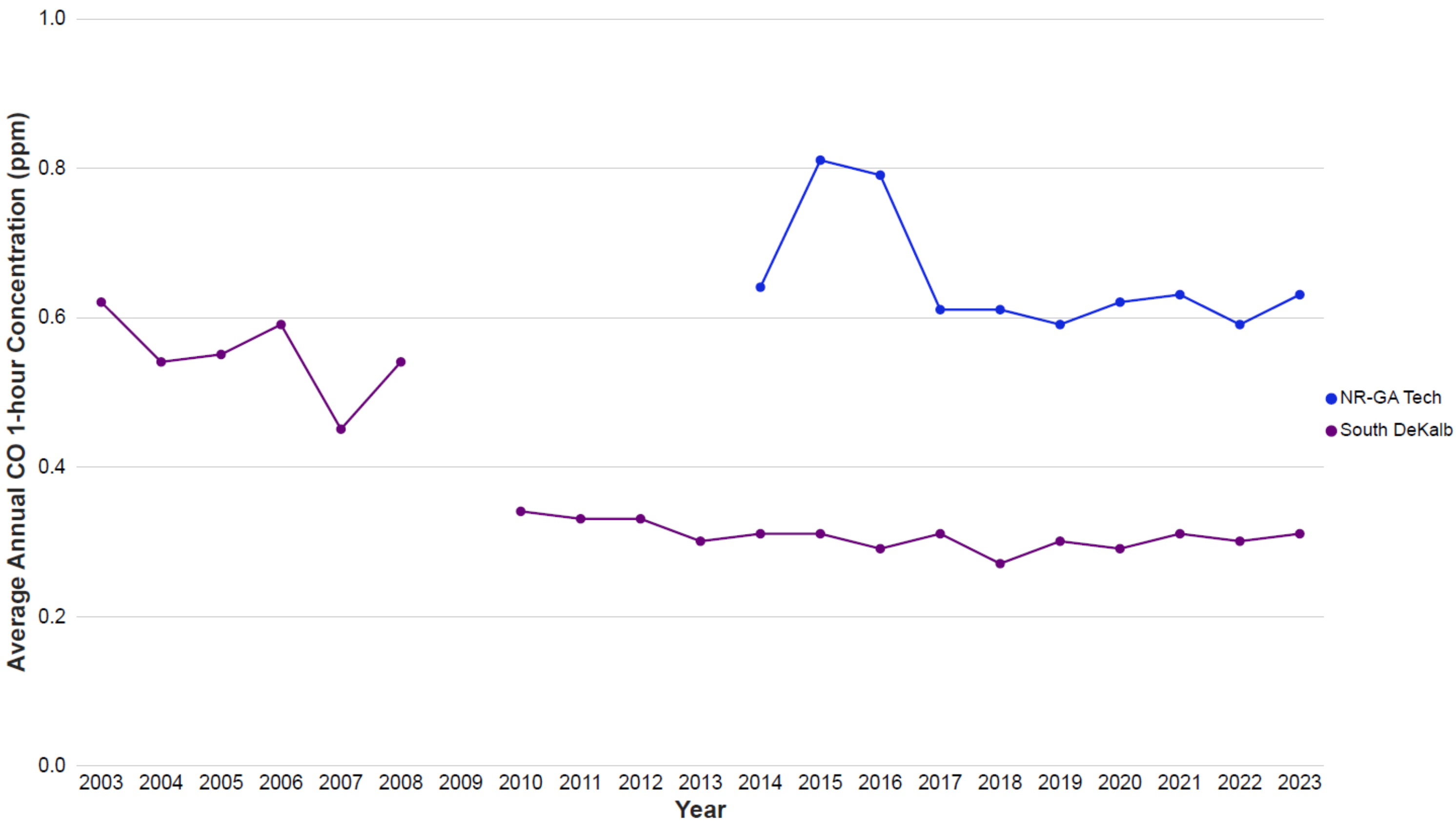


Figure 6.2: Carbon Monoxide Trend in Data

6.3 Sulfur Dioxide

The following table examines the longevity of GA AAMP's sulfur dioxide monitors. The annual averages for all sulfur dioxide monitors are plotted below the table to display the trend in sulfur dioxide data across the entire network. The analysis includes the sulfur dioxide monitors that were sampling data as of 2023.

Table 6.3: Sulfur Dioxide Monitoring History

Sulfur Dioxide			
Rank	**Site Location**	**County**	**Start Date**
1	Rome[1]	Floyd	1975
2	United Ave.	Fulton	1991
3	Savannah-E. President St.	Chatham	1995
4	Macon-Forestry	Bibb	1997
5	Savannah-L&A	Chatham	1998
6	South DeKalb	DeKalb	2010
7	Augusta	Richmond	2013

[1] SO_2 monitor was operated at the Rome site (13-115-0003) site until 01/11/2017, when it was moved to the Rome-Kraftsman site (13-115-0006). The monitor was then shut down on 12/31/2020.

Figure 6.3 shows the annual average SO_2 concentrations for all active sites as of 2018. The site in the Rome area (Rome-Coosa) was established in 1975 and was the longest surviving SO_2 site in Georgia. In December of 2016, SO_2 monitoring was moved from the Rome-Coosa location to the Rome-Kraftsman location due to the Data Requirements Rule (DRR, see Section 4.2 for more details). The Rome-Kraftsman site was then shutdown in 2020. As of 2023, United Ave. is now the longest running SO_2 site, running since 1991. There was a consistent downward trend in the data until 2018, since then the annual averages have remained steady.

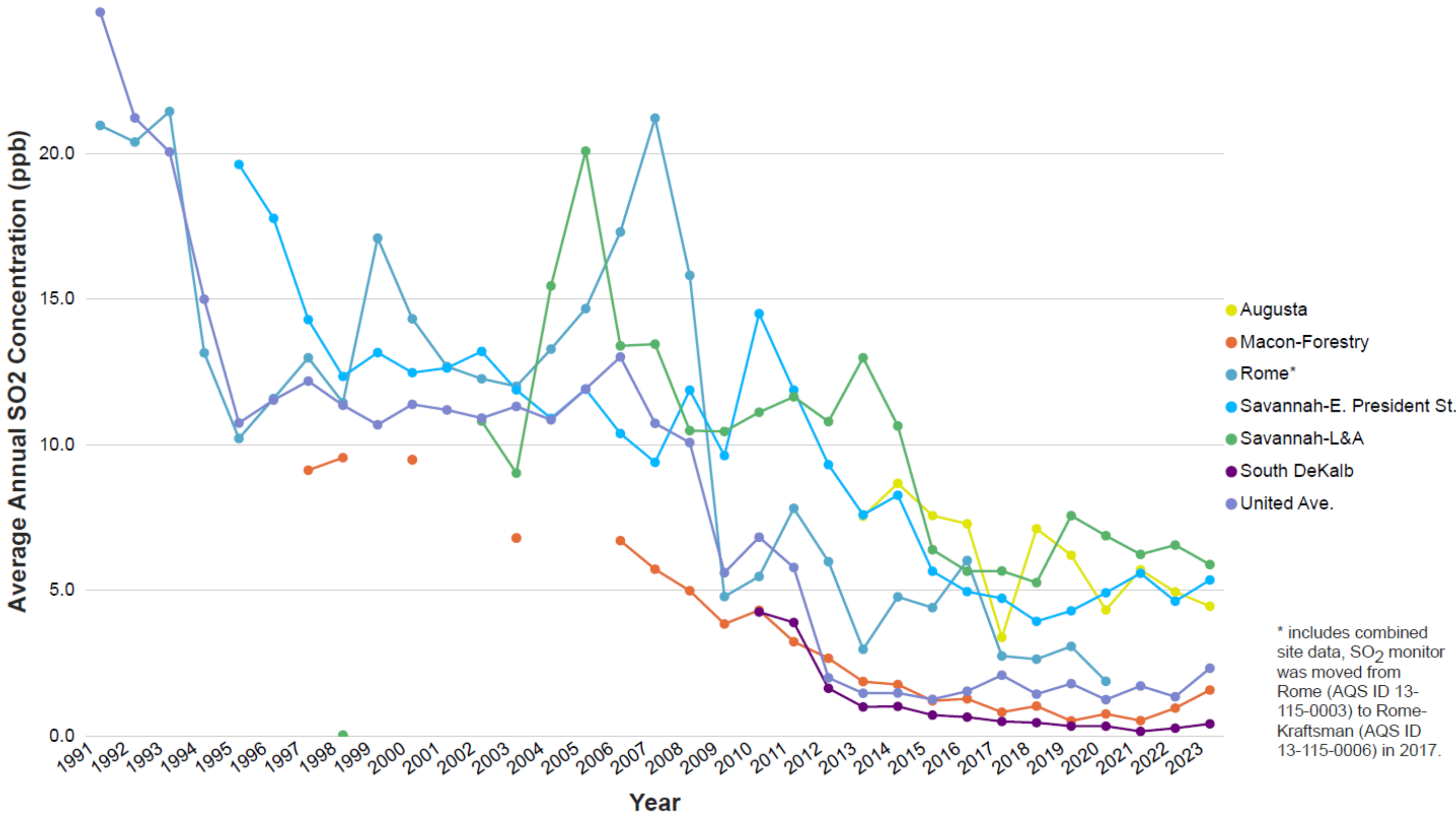


Figure 6.3: Sulfur Dioxide Trend in Data

6.4 Nitrogen Dioxide

The following table examines the longevity of GA AAMP's nitrogen dioxide monitors. The annual averages for nitrogen dioxide monitors are plotted below the table to display the trend in nitrogen dioxide data across the entire network. The analysis includes all the nitrogen dioxide monitors that were sampling data as of 2023. The South DeKalb site's NO_2 monitor was established in 1982, while the NR-GA Tech and NR-285 sites were added as part of the Near-road network in 2014 and 2015, respectively.

Table 6.4: Nitrogen Dioxide Monitoring History

Nitrogen Dioxide			
Rank	**Site Location**	**County**	**Start Date**
1	South DeKalb	DeKalb	1982
2	NR-GA Tech	Fulton	2014
3	NR-285	DeKalb	2015

Figure 6.4 shows the annual average 1-hour NO_2 concentrations for all sites active as of 2023. The NR-GA Tech and NR-285 sites show higher averages of NO_2, possibly due to the sites being located near heavily traveled interstates, while the South DeKalb site has been on a decreasing trend since it was established in 1982.

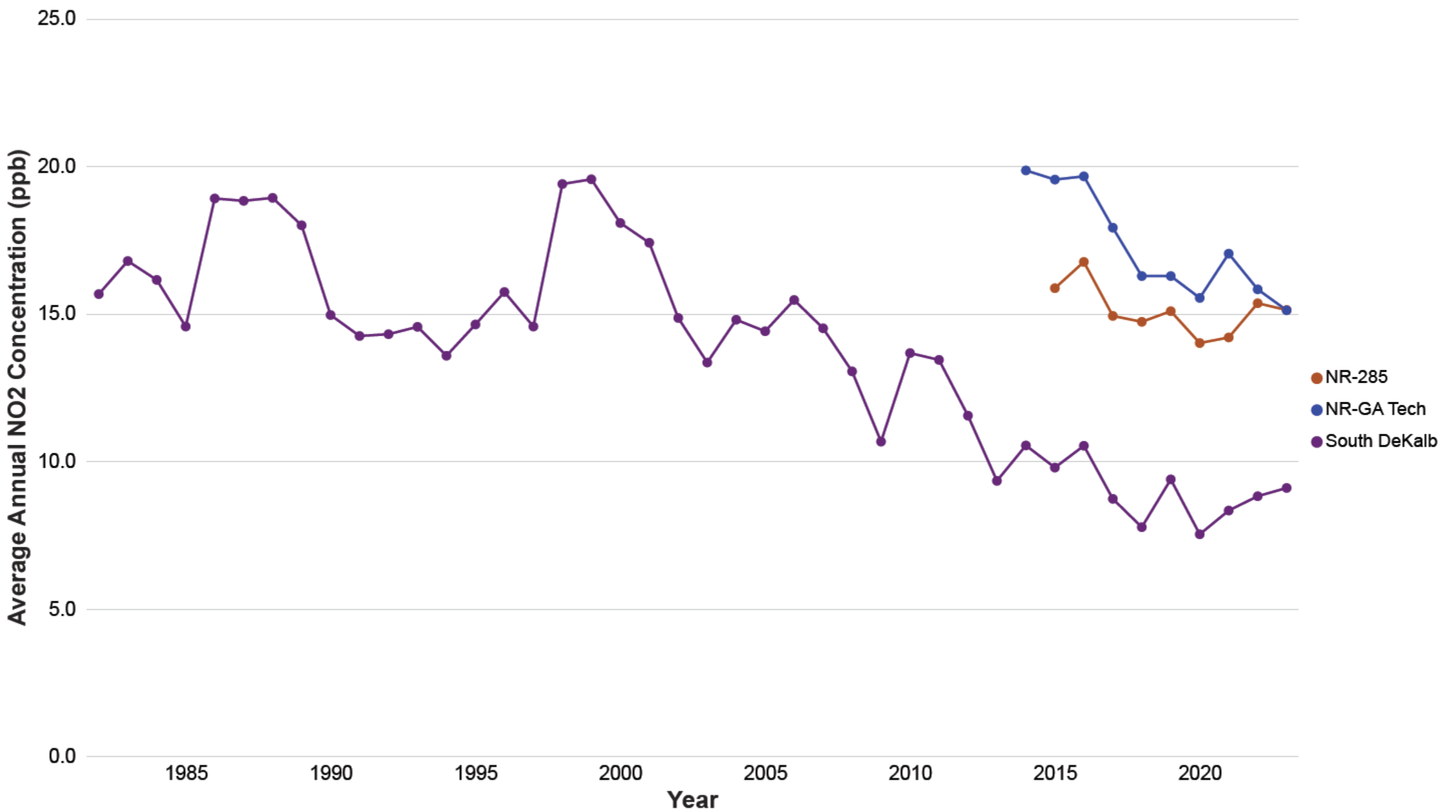


Figure 6.4: Nitrogen Dioxide Trend in Data

6.5 PM_{10}

Table 6.6 shows the start date of GA AAMP's PM_{10} (integrated and continuous) monitors. Integrated samples are collected every 6 days. Continuous samples are collected hourly. The Fire Station #8 site began operation in late 1987 and ran until 2006. Then it was shut down until it restarted in 2013.

Table 6.5: PM_{10} Monitoring History (Integrated and Continuous)

Particulate Matter$_{10}$ Integrated and Continuous			
Rank	**Site Location**	**County**	**Start Date**
1	Fire Station #8	Fulton	1987[1]
2	Augusta	Richmond	1996
3	South DeKalb	DeKalb	2011

[1] Fire Station #8 PM_{10} monitor was shut down from 09/26/2006 to 01/03/2013

The annual average concentrations of the PM_{10} integrated (24-hour) and continuous (1-hour) monitors that were sampling as of 2023 are plotted in Figure 6.5. Some variation in concentrations at the Augusta site is apparent from 1997 until 2007 when concentrations begin a steady decline. The PM_{10} sampler at the Augusta site was changed from an integrated sampler to a continuous sampler in October of 2017. In 2020, Augusta showed a significant downward spike, and an upward trend since. The South DeKalb site has a shorter record, but concentrations appear to have remained steady. The Fire Station #8 site's concentration has declined significantly since it began operation in late 1987; there is a lapse in the data from 2006 until 2013, but concentrations have remained stable thereafter.

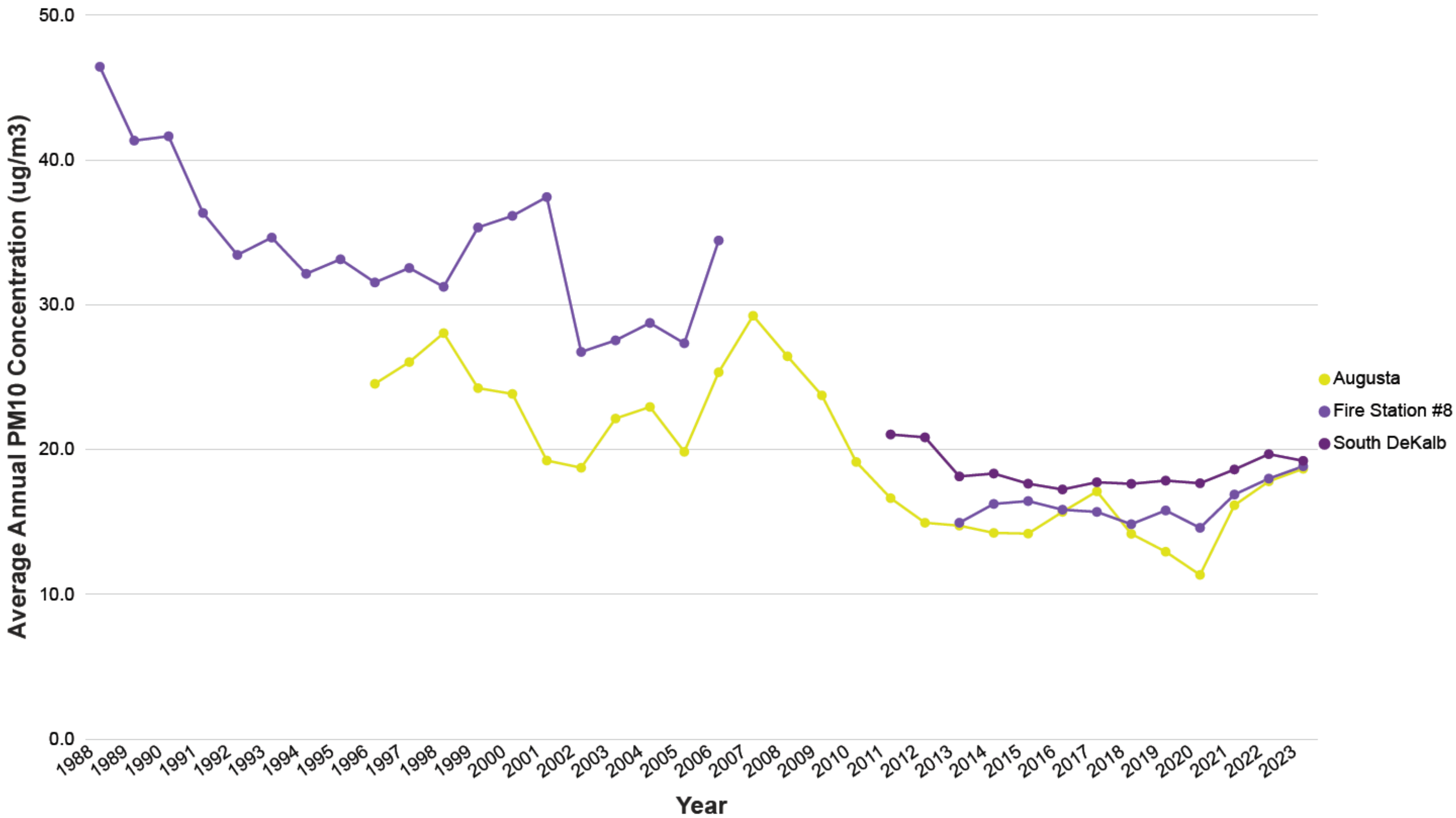


Figure 6.5: PM_{10} Trend in Data

6.6 $PM_{2.5}$ (Federal Reference Method)

The following table examines the longevity of Georgia AAMP's $PM_{2.5}$ FRM (Federal Reference Method) monitors. The annual averages for all these $PM_{2.5}$ monitors are plotted below the table to display the trend in $PM_{2.5}$ data across the entire network. The analysis includes all the $PM_{2.5}$ FRM monitors that were sampling data as of 2023, except as noted in Table 6.6. The Savannah-L&A site started monitoring $PM_{2.5}$ FRM in March 2023, and the Gainesville site resumed monitoring in March 2023. Please note that the NR-GA Tech site is only compared to the $PM_{2.5}$ 24-hour standard, and not compared to the $PM_{2.5}$ annual standard.

Table 6.6: $PM_{2.5}$ FRM Monitor History

Particulate Matter$_{2.5}$ Federal Reference Method			
Rank	**Site Location**	**County**	**Start Date**
1	Macon-Allied	Bibb	1999
1	Macon-Forestry	Bibb	1999
1	Forest Park	Clayton	1999
1	Kennesaw	Cobb	1999
1	South DeKalb	DeKalb	1999
1	Albany	Dougherty	1999
1	Fire Station #8	Fulton	1999

Particulate Matter2.5 Federal Reference Method			
1	Brunswick	Glynn	1999
1	Gainesville	Hall	1999[1]
1	Columbus-Baker[2]	Muscogee	1999
1	Augusta	Richmond	1999[3]
1	Sandersville[4]	Washington	1999
13	Rossville-Williams St.[5]	Walker	2000
13	Gwinnett Tech[6]	Gwinnett	2000
13	Warner Robins	Houston	2000
13	Valdosta	Lowndes	2000
17	Columbus-Airport	Muscogee	2003
18	Athens[7]	Clarke	2005
19	NR-GA Tech	Fulton	2015
20	General Coffee	Coffee	2016
21	Savannah-L&A	Chatham	2023

[1] Gainesville FRM was shut down from 11/01/2018-03/23/2023
[2] Columbus-Baker (13-215-0012) site was moved from Columbus-Cusseta location on 3/1/2021, historical data can be found with AQS ID 13-215-0011
[3] Augusta FRM was shut down from 11/16/2018-12/31/2021
[4] Sandersville FRM was shut down on 08/15/2019
[5] Rossville-Williams St. (13-295-0004) site was moved from Rossville-Maple St. location on 3/1/2021, historical data can be found with AQS ID 13-295-0002
[6] Gwinnett Tech FRM was shut down on 11/1/2018
[7] Athens FRM was shut down on 04/03/2019

The $PM_{2.5}$ FRM monitors are used for attainment purposes and use a method of collection that is approved by EPA. As of 2023, there were a total of 18 $PM_{2.5}$ FRM monitors. Over an almost twenty-five year stretch, the yearly averages of the FRM 24-hour data follow a fairly distinguishable trend (Figure 6.6). The majority of the samplers started with higher averages (between 18 $\mu g/m^3$ and 22 $\mu g/m^3$) in 1999 and decreased until 2002. From 2003 to 2006, averages fluctuate but stay within the 11 $\mu g/m^3$ to 19 $\mu g/m^3$ range. There was an increase in 2010, followed by a consistent decrease in concentrations until 2018. Since 2018, concentrations have stayed constant, with a slight increase in 2023. Albany had the highest average (9.26 $\mu g/m^3$) in 2023.

In March 2021, both the Columbus-Cusseta site and the Rossville-Maple St. sites moved to new locations – Columbus-Baker and Rossville-Williams St., respectively. The historical data from the previous sites were combined with the current sites for the purpose of this figure.

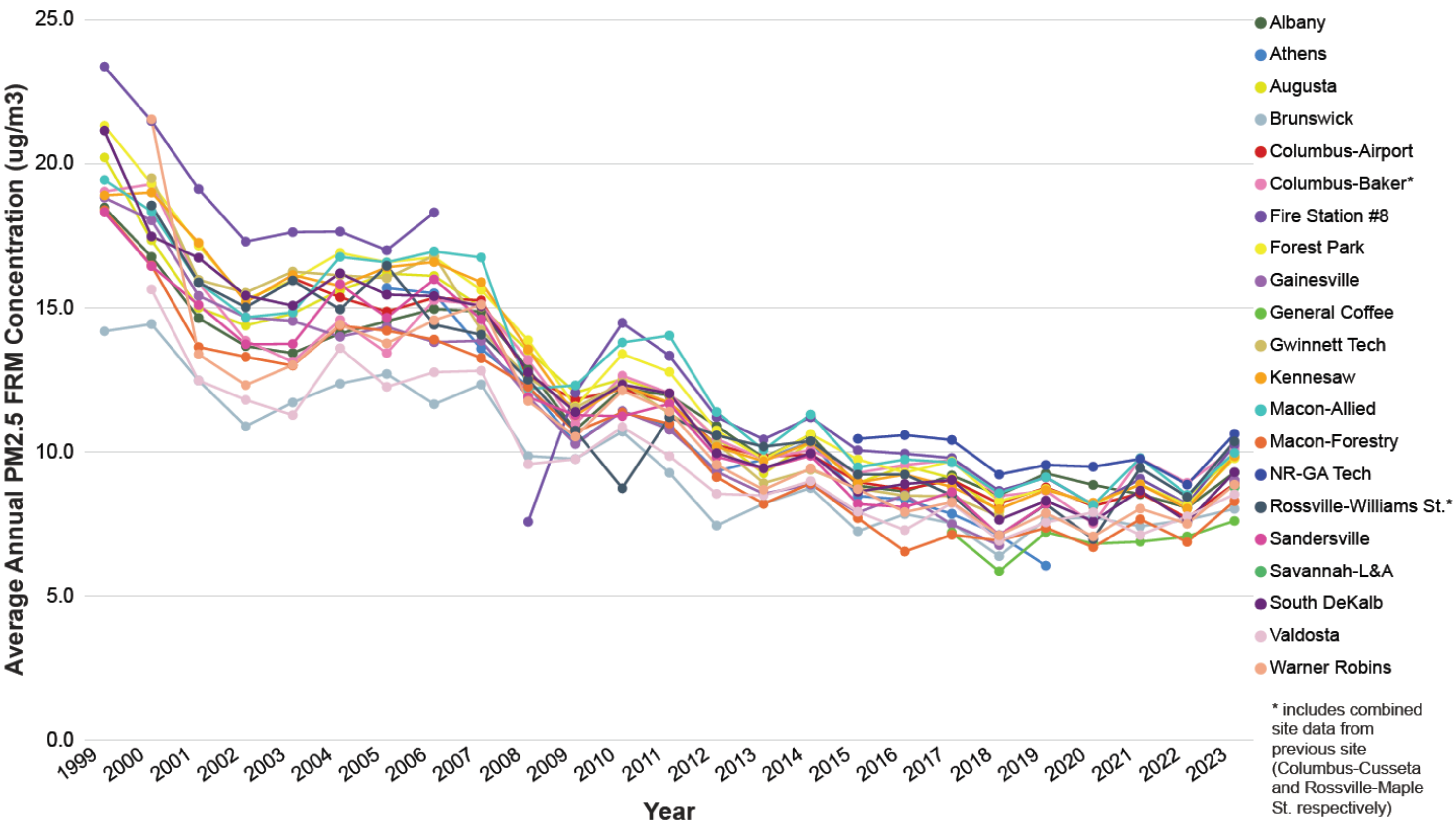


Figure 6.6: $PM_{2.5}$ FRM Trend in Data

6.7 $PM_{2.5}$ (Continuous)

In the following table, the duration of GA AAMP's $PM_{2.5}$ (Continuous) monitors are examined. The annual averages for all these $PM_{2.5}$ monitors are plotted below the table to display the trend in $PM_{2.5}$ data across the entire network. The analysis includes all the $PM_{2.5}$ continuous monitors that were sampling data as of 2023. Please note that the NR-GA Tech site is only compared to the $PM_{2.5}$ 24-hour standard, and not compared to the annual standard.

Table 6.7: $PM_{2.5}$ Continuous Monitor History

Particulate Matter$_{2.5}$ Continuous			
Rank	**Site Location**	**County**	**Start Date**
1	South DeKalb	DeKalb	2002
2	Macon-Forestry	Bibb	2003
2	Columbus-Airport	Muscogee	2003
2	Savannah-L&A	Chatham	2003
2	Augusta	Richmond	2003
2	Gwinnett Tech	Gwinnett	2003
2	McDonough	Henry	2003
8	Athens	Clarke	2004

Particulate Matter$_{2.5}$ Continuous			
9	United Ave.	Fulton	2005
10	Rossville-Williams St.	Walker	2007
11	Albany	Dougherty	2008
11	Gainesville	Hall	2008
11	Warner Robins	Houston	2008
11	Valdosta	Lowndes	2008
15	Rome	Floyd	2009
16	NR-GA Tech	Fulton	2016
17	Sandersville	Washington	2019
18	Brunswick	Glynn	2021
19	Columbus-Baker	Muscogee	2023
19	General Coffee	Coffee	2023
19	Kennesaw	Cobb	2023
19	Macon-Allied	Bibb	2023
19	NR-285	DeKalb	2023

Continuous samples provide almost instant data, allowing someone to judge the air quality the very day of its collection instead of waiting weeks for FRM data. There are two types of continuous $PM_{2.5}$ samplers: one type that is not equivalent to the federal method (non-FEM) and one type that is equivalent to the federal method (FEM). These monitors can be used for attainment purposes along with the FRMs. The non-FEM samplers are used for general informational purposes about the air quality in an area and for air quality forecasting.

Until 2017, GA AAMP had two sites that monitored continuous $PM_{2.5}$ data with FEMs: the South DeKalb and Albany sites. The South DeKalb site began sampling with the FEM as of 2011, while the Albany FEM started in 2013. Between 2019 and 2023, seven additional sites began monitoring continuous $PM_{2.5}$ with FEMs. As of December 2023, the following sites have FEM monitors: Macon-Forestry, Savannah-L&A, Athens, South DeKalb, Gwinnett Tech, General Coffee, Brunswick, Gainesville, Warner Robins, Valdosta, Rossville-Williams St., and Sandersville. The remaining sites in the network contain either non-FEM continuous monitors, or FEM monitors with NAAQS exclusions, and the data is not used for attainment purposes. For the purpose of this assessment, all continuous $PM_{2.5}$ data collected by GA AAMP – including both NAAQS-comparable and NAAQS-excluded data – are included below (Figure 6.7).

In general, the continuous $PM_{2.5}$ 1-hour data (Figure 6.7) resembles the $PM_{2.5}$ FRM 24-hour data (Figure 6.6). There is a general increase in concentrations from 2002 to 2006, and then a general decrease through to 2009. There have been a few outliers from the bulk of data, however overall the concentrations declined in 2013. Concentrations have remained relatively steady since 2017, with McDonough having the most consistently low concentrations from 2019 to 2023.

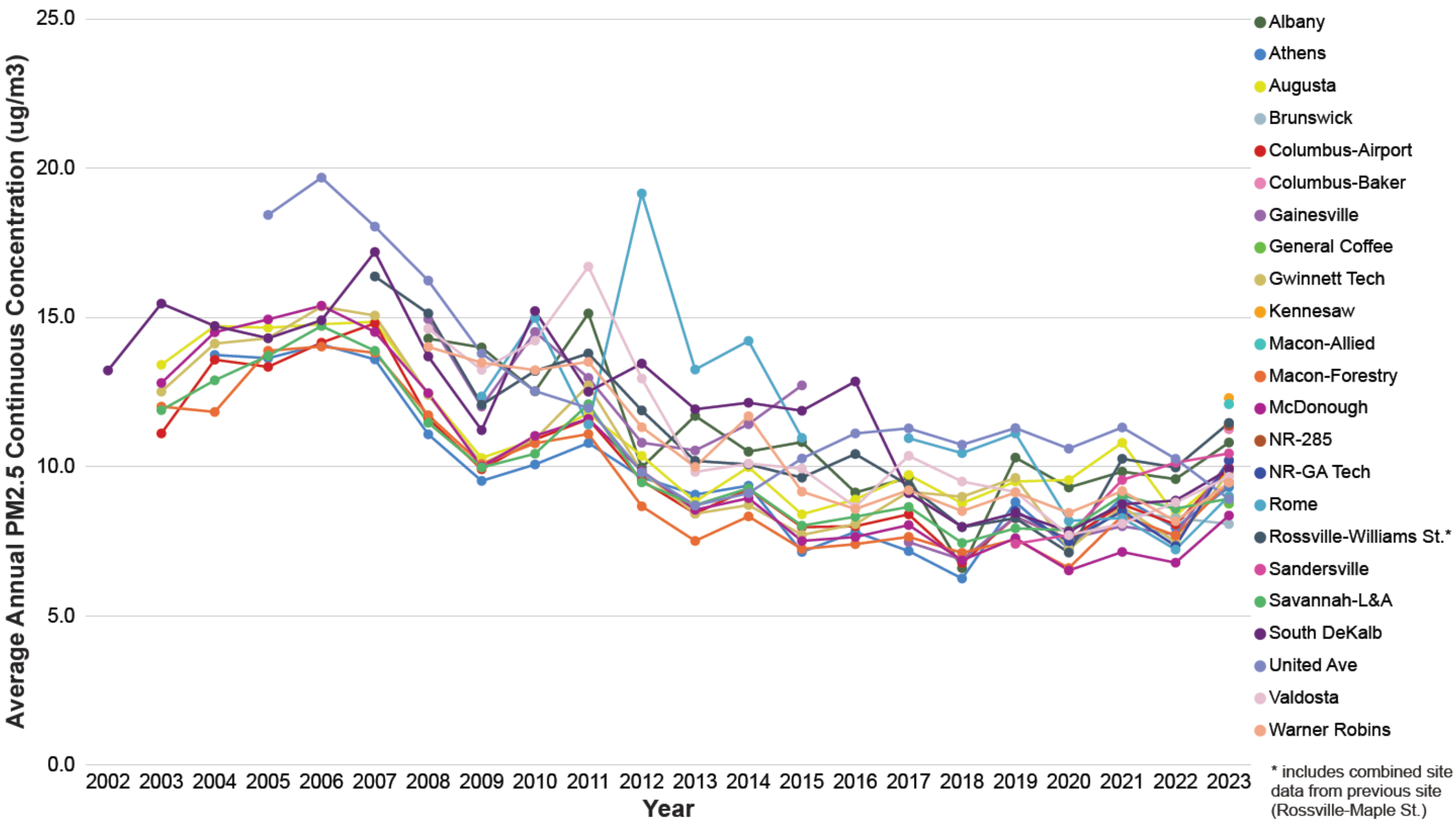


Figure 6.7: $PM_{2.5}$ Continuous Trend in Data

6.8 $PM_{2.5}$ (Speciation)

The following table examines the duration of GA AAMP's $PM_{2.5}$ (Speciation) monitors. The annual averages of the mass readings for all of these $PM_{2.5}$ Speciation monitors are plotted below the table to display the trend in $PM_{2.5}$ data across the entire network. The analysis includes all of the Speciation $PM_{2.5}$ monitors that were sampling data as of 2023.

Table 6.8: $PM_{2.5}$ Speciation Monitor History

Particulate Matter$_{2.5}$ Speciation			
Rank	**Site Location**	**County**	**Start Date**
1	South DeKalb	DeKalb	2001
2	Macon-Allied	Bibb	2002
2	Columbus-Baker[1]	Muscogee	2002
2	Augusta	Richmond	2002
2	General Coffee	Coffee	2002
6	Rossville-Williams St.[2]	Walker	2005
7	Rome	Floyd	2009

[1] Columbus-Baker (13-215-0012) site was moved from Columbus-Cusseta location on 3/1/2021, historical data can be found with AQS ID 13-215-0011
[2] Rossville-Williams St. (13-295-0004) site was moved from Rossville-Maple St. location on 3/1/2021, historical data can be found with AQS ID 13-295-0002

The South DeKalb site was established before the other speciation monitors, making it the most valuable site for observing trends. After the South DeKalb site was established in 2001, the rest of the sites were established the following year with the exception of the Rossville-Williams St. and Rome sites which were added in 2005 and 2009, respectively. Figure 6.8 shows that average annual $PM_{2.5}$ speciation sulfate concentrations as a representation of the $PM_{2.5}$ speciation data. There is an overall decreasing trend in the data from 2001 to 2018, and a steady, consistent trend from 2018 to 2023. For the purposes of the trends impact analysis, the Rome site is the least valuable because it has the shortest monitoring history, beginning in 2009.

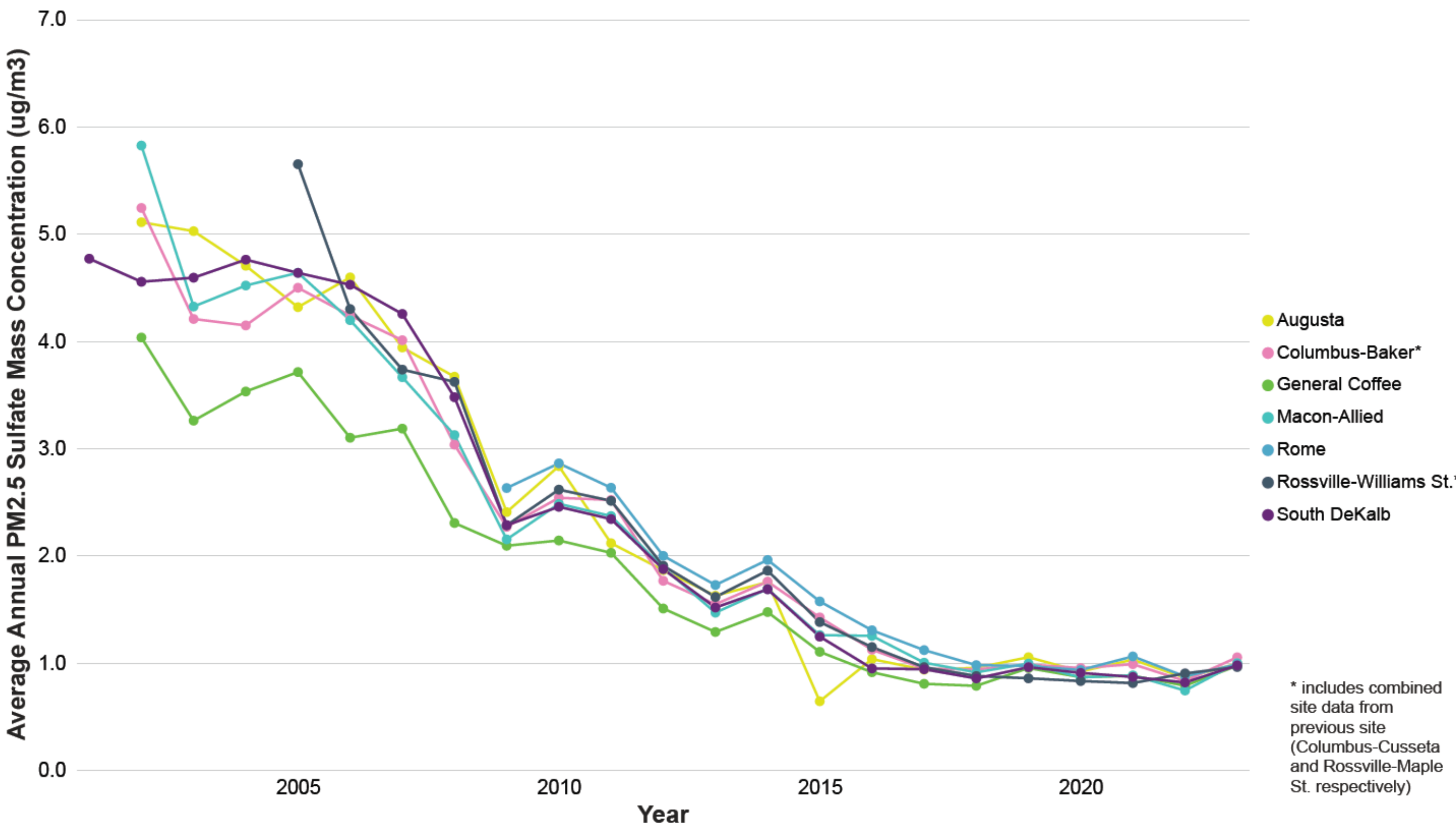


Figure 6.8: $PM_{2.5}$ Speciation Sulfate Trend in Data

6.9 Lead

The following table examines the longevity of GA AAMP's lead monitors. The annual averages for these lead monitors are plotted below the table to display the trend in lead data. The analysis includes the lead monitors that were sampling data as of 2023.

Table 6.9: Lead Monitor History

Lead			
Rank	**Site Location**	**County**	**Start Date**
1	Columbus-Cussetta[1]	Muscogee	1991
2	Columbus-Allied[2]	Muscogee	2012

[1] Columbus-Cussetta Lead monitor shut down on 07/26/2020
[2] Columbus-Allied Lead monitor shut down on 03/31/2021

The longest running lead site was the Columbus-Cusseta site in Muscogee County, which began collecting data in 1991. Figure 6.9 shows that the annual lead concentrations at the Columbus-Cusseta site began high and showed a more fluctuating pattern during the 1990s. From 2003 to 2007, the laboratory detection levels changed and Columbus-Cussetta concentrations were reported at that laboratory detection limit of 0.10 µg/m^3. Then in 2009, the laboratory analysis method and detection limit changed, causing the concentrations to drop significantly. As of 2017, there were minimal concentrations of lead detected at both sites, consistently measuring below 0.04 µg/m^3. Due to the low average lead concentrations, meeting the lead NAAQS standards, and the nearby facility shutting down, GA AAMP shut down the lead samplers as of March 31, 2021.

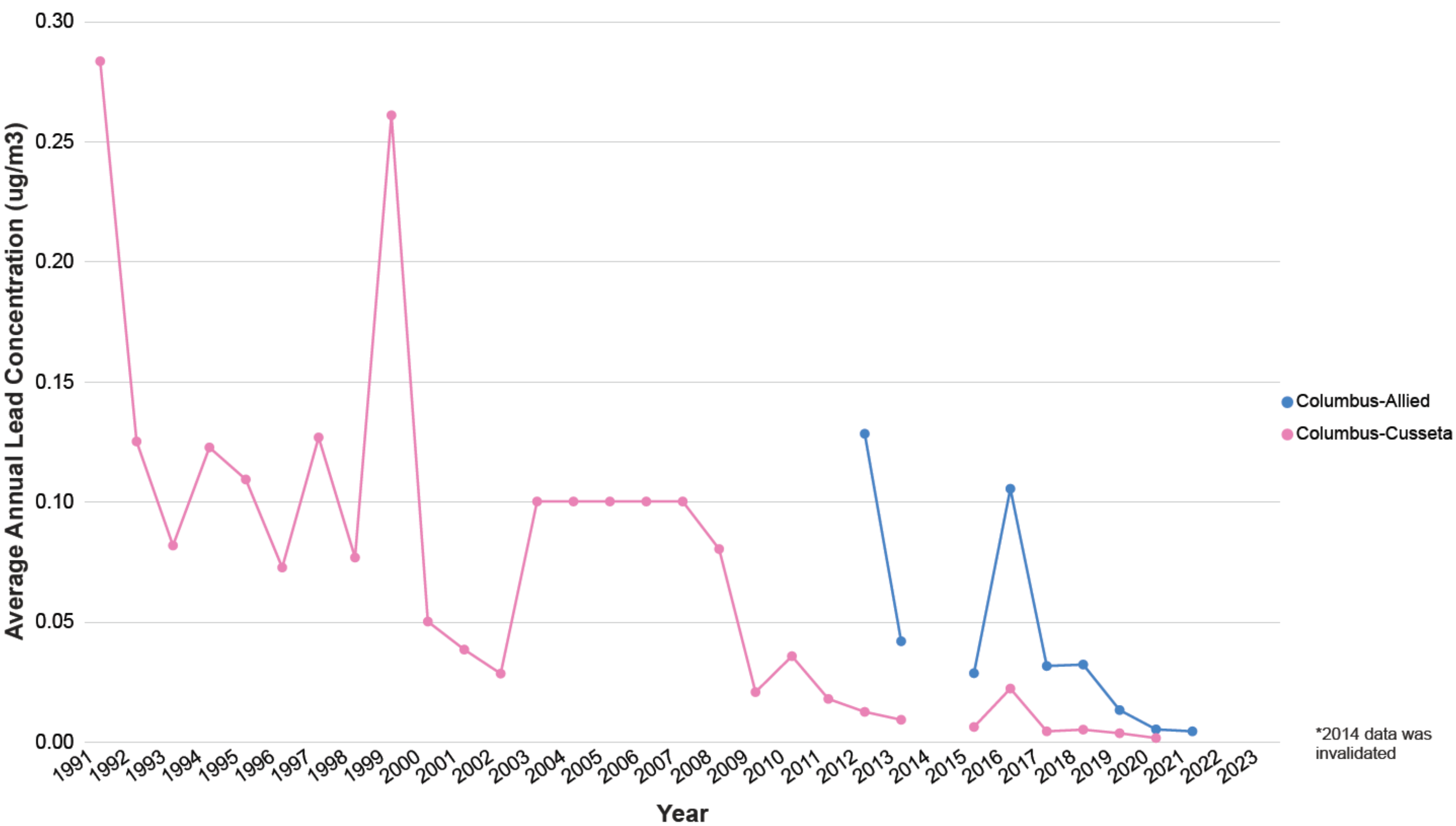


Figure 6.9: Lead Trend in Data

6.10 NATTS

The National Air Toxics Trends Station (NATTS) network was established in 2003 and is intended for long-term operation for the purpose of discerning national trends. The NATTS Network consists of 25 sites nationwide with one site located in Georgia. The South DeKalb site was chosen for the NATTS network due to its metro Atlanta location, making it a well-populated area and a prime location for observing the effects of air toxics on the public. Similar to Georgia's Air Toxics Network, the same air toxic compounds are monitored, as well as black carbon, and carbonyls.

All of these air toxic pollutants can have negative effects on human health, ranging from causing headaches, nausea, dizziness, cancer, birth defects, problems breathing, and other serious illnesses. These effects can vary depending on frequency of exposure, length of exposure, health of the person that is exposed, along with the toxicity of the compound. These air pollutants also affect the environment. Wildlife experiences symptoms similar to those in humans. Pollutants accumulate in the food chain. Many air pollutants can also be absorbed into waterways and have toxic effects on aquatic wildlife. Some of the substances tend to have only one critical effect, while others may have several. Some of the effects may occur after a short exposure and others appear after long-term exposure or many years after being exposed. Exposure is not only through direct inhalation of the pollutant, but also through the consumption of organisms, such as fish, that have absorbed the pollutant.

To compare the South DeKalb site to the other Air Toxics sites, one compound of each of three groups were chosen to represent that category. The volatile organic compound representative is benzene, the semi-volatile organic compound is naphthalene, and the metal is arsenic. The following graphs compare the compounds at the NATTS network site, South DeKalb, with other Georgia sites that have monitored Air Toxics. Since 2019, South DeKalb and NR-285 are the sites monitoring VOCs, and South DeKalb is the site monitoring arsenic and naphthalene.

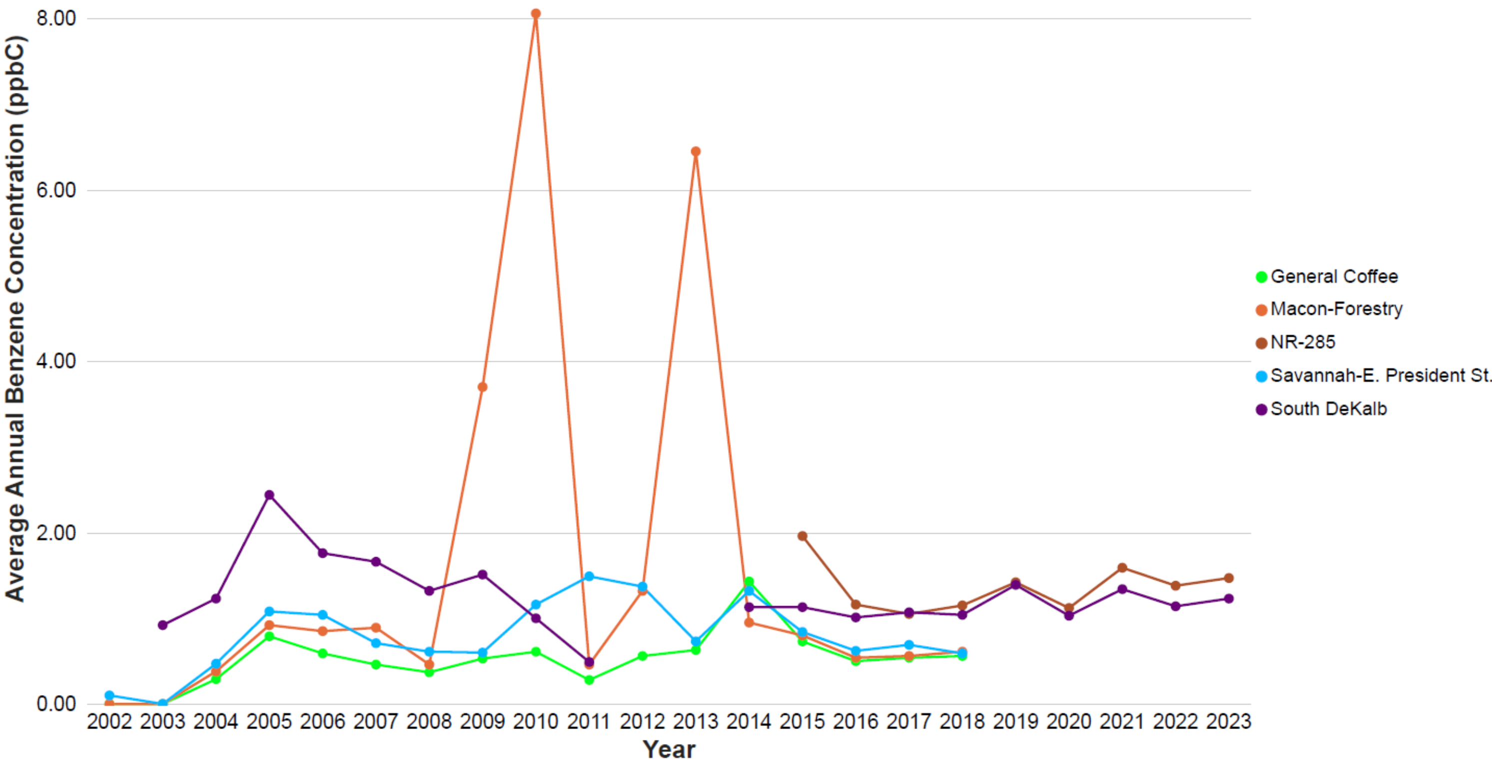


Figure 6.10: Comparison of Benzene Trend in Data

The annual benzene concentrations have remained below 2.0 ppbC for the past ten years. Macon-Forestry had relatively high values in 2009, 2010, and 2013, but had a rapid decrease in 2014, and the low values remained. Annual concentrations at all other sites seem to follow the same trend, which shows concentrations below 2.0 ppbC through 2023.

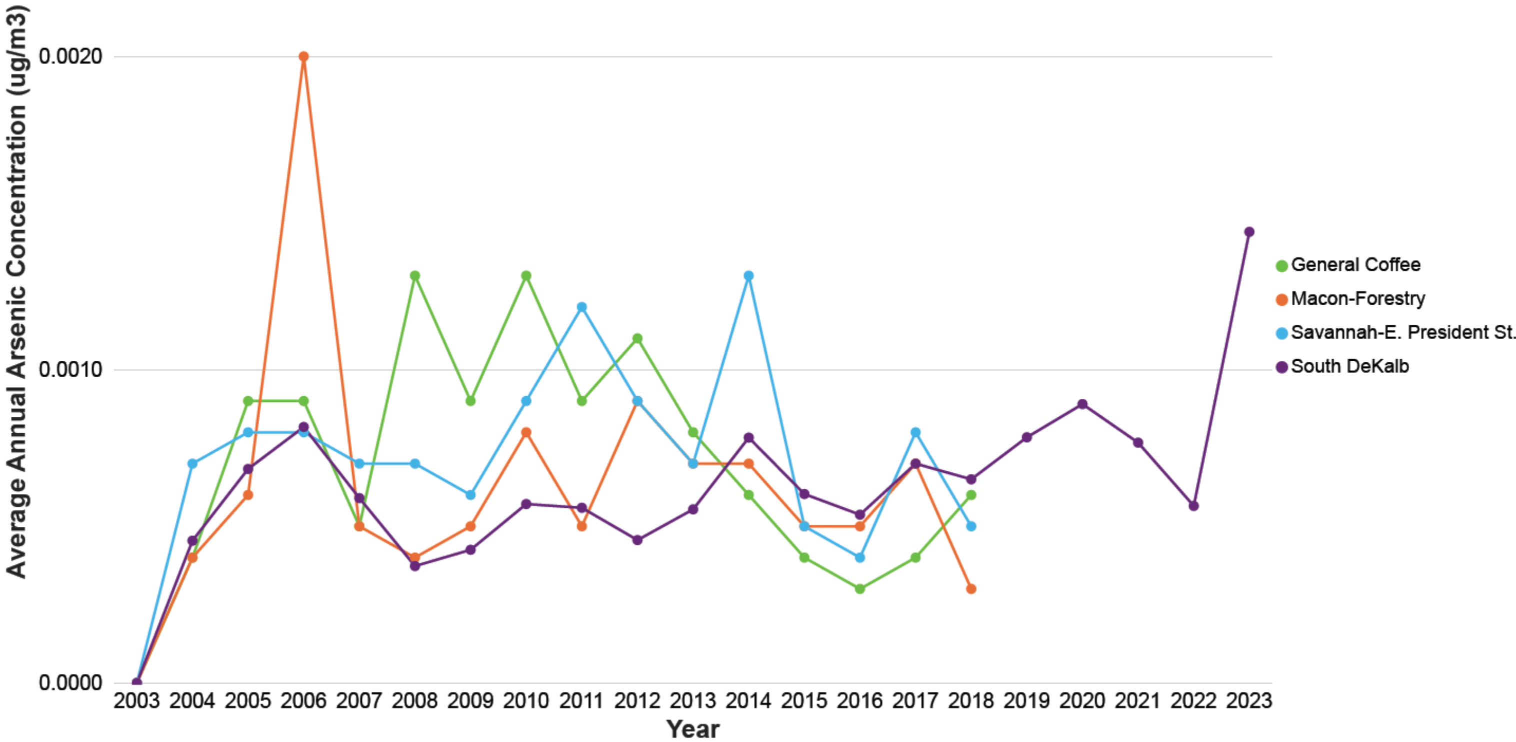


Figure 6.11 Comparison of Arsenic Trend in Data

Average annual arsenic concentrations have remained below 0.0015 µg/m^3 since 2003, with the exception of the Macon-Forestry site in 2006 (0.002 µg/m^3), which to date, has been the highest. Average annual concentrations between 2019 and 2022 remained below 0.0008 µg/m^3, although an increase at South DeKalb was measured in 2023 (0.0014 µg/m^3).

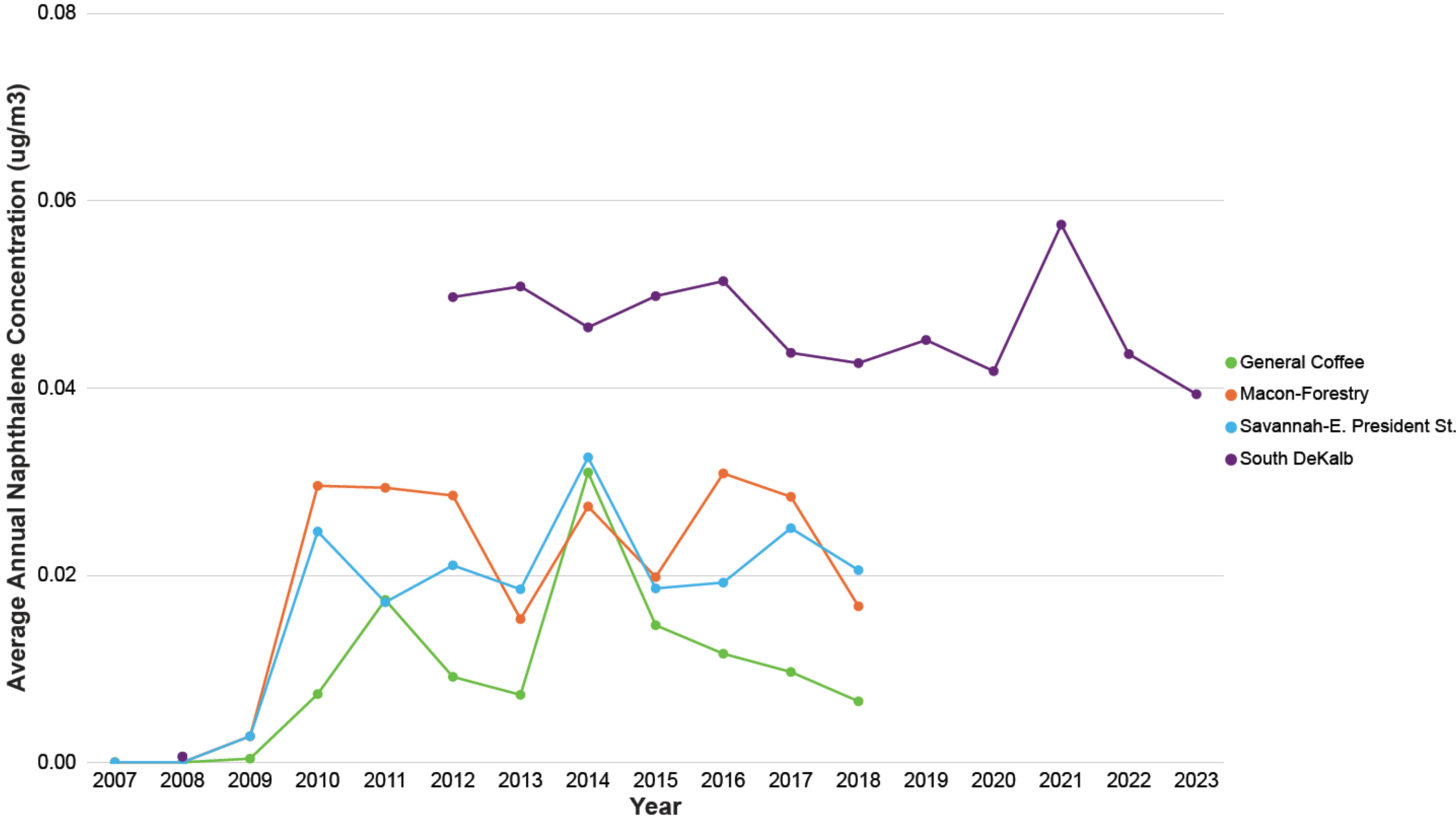


Figure 6.12 Comparison of Naphthalene Trend in Data

Average annual naphthalene concentrations remained close to 0 µg/m^3 from 2007 to 2008, when the South DeKalb site started collecting naphthalene data. At the end of 2009, the laboratory analysis method changed, and more data was detected. The South DeKalb site has consistently had much greater concentrations of naphthalene detected compared to the other Air Toxics sites. Naphthalene concentrations have remained below 0.06 µg/m^3 at South DeKalb through 2023, including the spike in 2021 (0.057 µg/m^3). At the other sites, there was a slight increase in 2014, but concentrations declined the following year. In 2018, concentrations remained lower for all sites, with the General Coffee site showing the lowest concentration at 0.0065 µg/m^3.

6.13 Concluding Points

For the Trends Assessment, all of Georgia's ambient air monitoring sites across the state were ranked according to how long each site has been collecting data. As of 2023, there were 35 sites in 28 counties across the state, including the EPA's CASTNET site. There are several sites in Georgia with a long running history. Of the 35 sites, almost half the sites have collected data since the 1970's and 80's. The longest continuous running site is the Savannah-L&A site, which was established in 1972. Although the site in Rossville has been running since 1967, it moved from Maple St. to Rossville-Williams St. in March 2021. With the Trends Assessment, this site would rank the highest. The lowest ranking sites would be the sites that were most recently established. This would include the NR-GA Tech site, which began sampling ambient air data in 2014.

In addition to the overall duration of each site, each of the criteria pollutants were evaluated for longevity and trends in the data. Even though the South DeKalb site is not the longest running site in

Georgia's network, it is consistently one of the longest running sites for almost all of the criteria pollutants. The South DeKalb site was established in 1974, and as of 2023 collects data for ozone, sulfur dioxide (SO_2), carbon monoxide (CO), $PM_{2.5}$ (FRM, continuous, and speciation), PM_{10}, PM_{coarse}, nitrogen dioxide (NO_2), and also collects data as part of the NATTS, PAMS, and NCore networks.

As noted within the discussion above, the lead emissions in the Columbus, GA-AL MSA continued to decrease due to the source no longer operating, and the lead monitors were shut down by March 2021. In addition, the $PM_{2.5}$ network has been evolving with further evaluation of the continuous FEM method, and going forward the GA AAMP will be evaluating both the FEM and FRM $PM_{2.5}$ methods and networks.

7.0 Measured Concentrations

With the Measured Concentrations analysis, the $PM_{2.5}$ and Ozone sites were examined. These sites were chosen since the concentrations at these sites can cause the design values to be above the National Ambient Air Quality Standards, or NAAQS. With this type of analysis, the sites with the highest average concentrations are considered the most important and ranked highest, and the sites with the lowest concentrations are considered the least important and ranked lowest. This aids to identify sites from a regulatory perspective based on maximum concentrations. The sites that measure the higher concentrations are more important for assessing compliance with the NAAQS and population exposure.

The NAAQS for $PM_{2.5}$ and ozone are calculated differently. $PM_{2.5}$ has both a 24-hour standard and an annual standard. The NAAQS for $PM_{2.5}$ 24-hour standard is three-year average of the 98th percentile, and the NAAQS for the $PM_{2.5}$ Annual standard is the three-year average of the annual means. Please note that the NR-GA Tech site is only compared to the $PM_{2.5}$ 24-hour standard and not the $PM_{2.5}$ annual standard; therefore, it is not included in Table 7.2 or Figure 7.2 below. The NAAQS for ozone is the three-year average of the 4th daily maximum value of the 8-hour averages. For this analysis, to give a more comprehensive look at the data, five-year averages from 2019 to 2023 of the $PM_{2.5}$ 98th percentile, $PM_{2.5}$ annual means, and ozone 4th maximum values were used. The sites with the highest average concentrations were given the highest-ranking score for that parameter. All three parameter scores were then totaled for each site. Sites with the highest total score were considered most important for this analysis.

Table 7.1: $PM_{2.5}$ 24-Hour Site Rankings Measured Concentrations

Measured Concentrations $PM_{2.5}$ 98th Percentile 2019-2023			
Site ID	Site Name	Average ($\mu g/m^3$)	Proportion Ranking
132150012	Columbus-Baker	23.7	1.00
133030001	Sandersville	23.4	0.96
132450091	Augusta	23.4	0.95
132950004	Rossville-Williams St.	22.2	0.76
130950007	Albany	21.7	0.68
131350002	Gwinnett Tech	21.4	0.63
130590002	Athens	21.3	0.62
133153001	Warner Robins	21.1	0.58
131210056	NR-GA Tech	20.9	0.56
131210039	Fire Station #8	20.6	0.50
130670003	Kennesaw	20.1	0.43
130210012	Macon-Forestry	20.1	0.43
132150008	Columbus-Airport	19.9	0.40
130511002	Savannah-L&A	19.9	0.39
130630091	Forest Park	19.8	0.38
130890002	South DeKalb	19.4	0.31
130210007	Macon-Allied	19.3	0.29

Measured Concentrations $PM_{2.5}$ 98th Percentile 2019-2023			
Site ID	Site Name	Average ($\mu g/m^3$)	Proportion Ranking
131850003	Valdosta	18.9	0.23
131390003	Gainesville	18.5	0.17
132170006	Brunswick	17.9	0.07
130690002	General Coffee	17.5	0.00

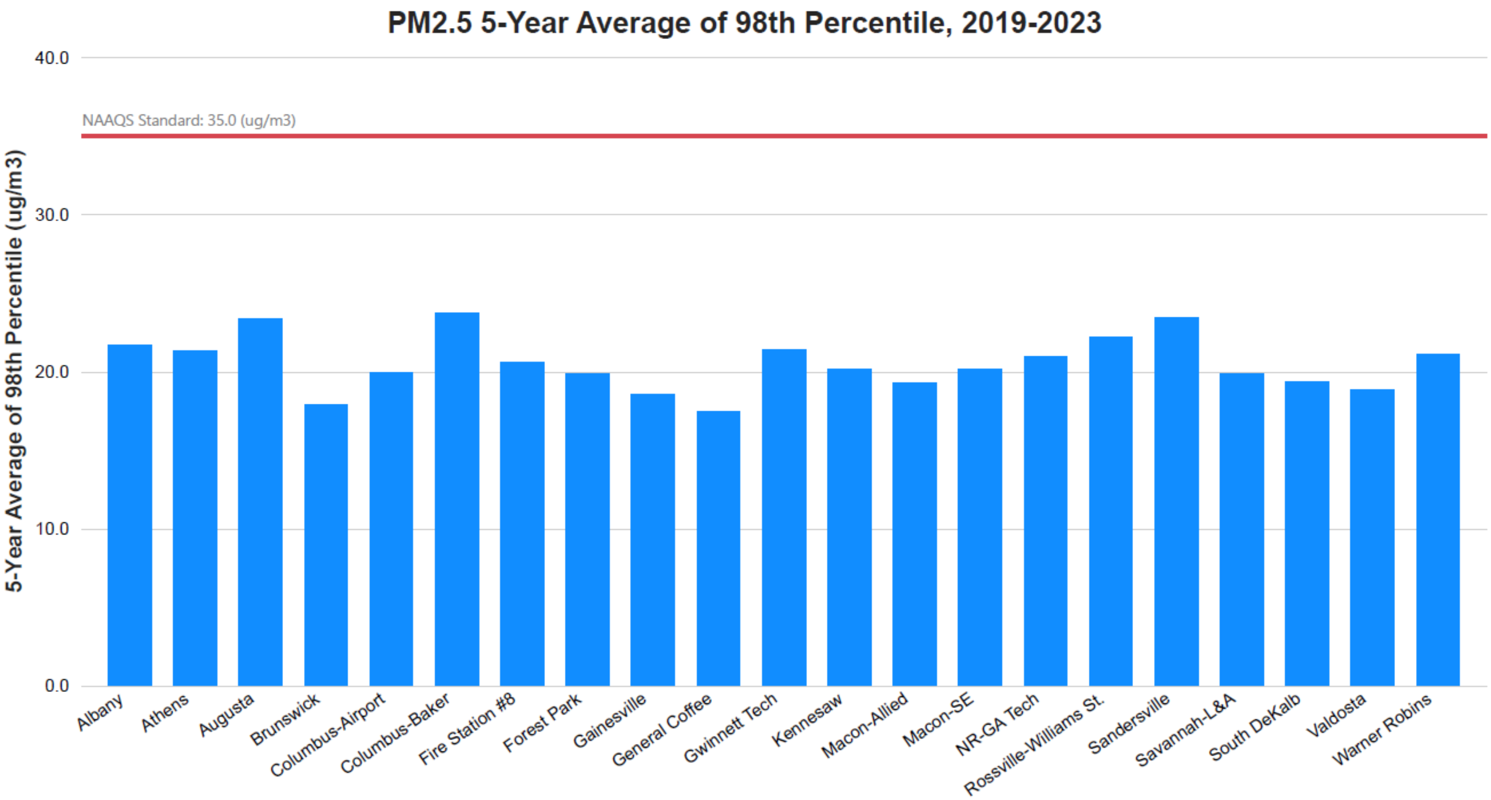


Figure 7.1: $PM_{2.5}$ 24-hr 5 year 98th Percentile Average

For the 5-year averages of $PM_{2.5}$ 24-hour design values, the Columbus-Baker, Sandersville, and Augusta sites would rank the highest. The $PM_{2.5}$ values in these areas can be affected by prescribed fires and agricultural burns that take place nearby. The Brunswick and General Coffee sites would rank the lowest for the $PM_{2.5}$ 24-hour values of 5-year averages.

Table 7.2: $PM_{2.5}$ Annual 5 Year Averages

$PM_{2.5}$ Annual Mean 2019-2023 Average of 5 Yr. Averages			
Site ID	Site Name	Average ($\mu g/m^3$)	Proportion Ranking
132450091	Augusta	9.6	1.00
132150012	Columbus-Baker	9.2	0.84
130210007	Macon-Allied	9.1	0.79
133030001	Sandersville	9.1	0.78

PM2.5 Annual Mean 2019-2023 Average of 5 Yr. Averages			
Site ID	**Site Name**	**Average ($\mu g/m^3$)**	**Proportion Ranking**
132950004	Rossville-Williams St.	9.0	0.77
130950007	Albany	9.0	0.75
131210039	Fire Station #8	8.9	0.72
131530001	Warner Robins	8.6	0.58
130890002	South DeKalb	8.5	0.55
132150008	Columbus-Airport	8.5	0.54
131350002	Gwinnett Tech	8.5	0.54
130590002	Athens	8.4	0.51
130511002	Savannah-L&A	8.4	0.50
131850003	Valdosta	8.2	0.43
131390003	Gainesville	8.0	0.36
130210012	Macon-Forestry	7.9	0.29
131270006	Brunswick	7.8	0.26
130690002	General Coffee	7.2	0.00

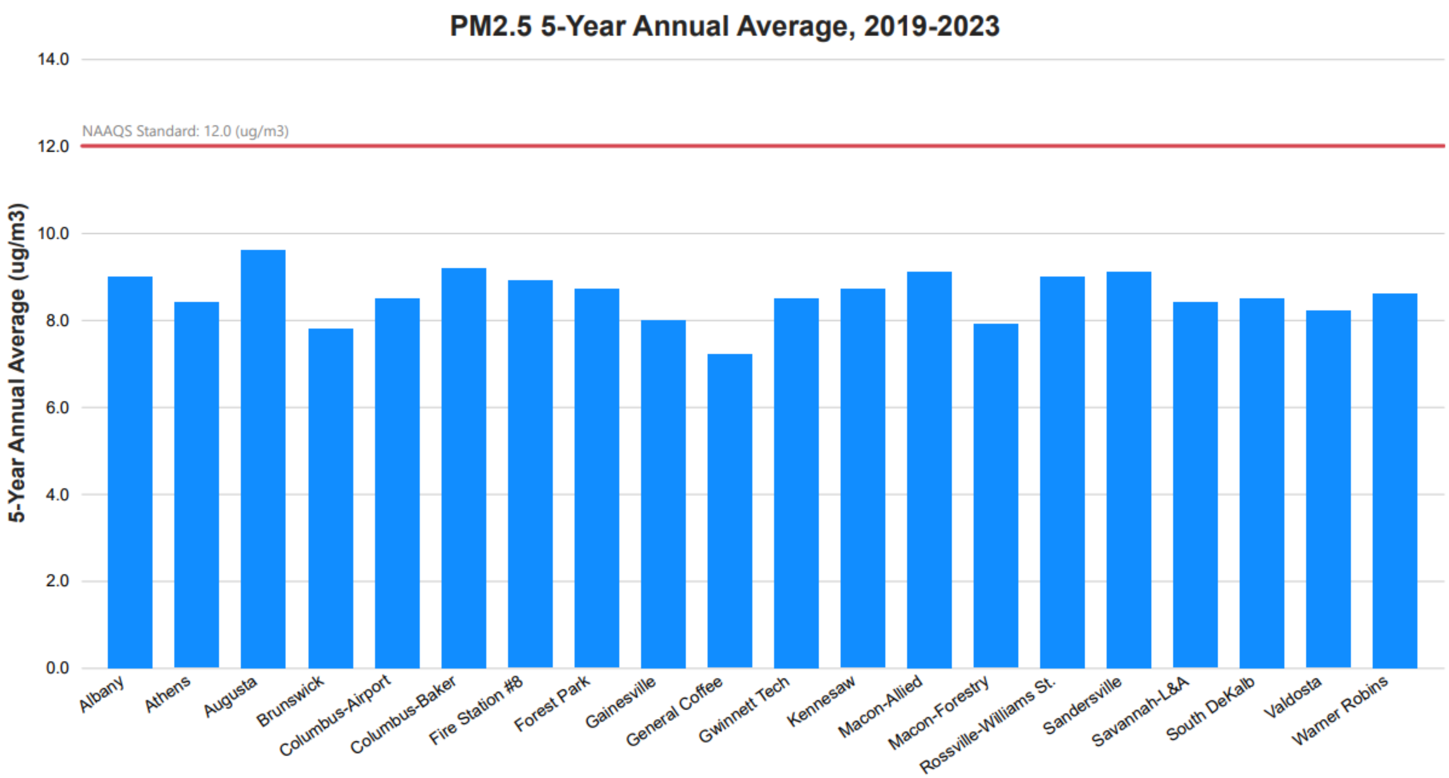


Figure 7.2: PM2.5 Annual Measured Concentrations

For the $PM_{2.5}$ annual design values 5-year averages, the Augusta, Columbus-Baker, and Macon-Allied sites would rank the highest, and the Macon-Forestry, Brunswick and General Coffee sites would rank the lowest.

Table 7.3: Ozone Sites Ranked, Measured Concentrations

Five Year Average 2019-2023 of 4th Max Ozone			
Site ID	Site Name	Average (ppb)	Proportion Ranking
131210055	United Ave.	0.070	1.00
131510002	McDonough	0.068	0.88
131350002	Gwinnett Tech	0.067	0.82
130890002	South DeKalb	0.067	0.82
130970004	Douglasville	0.067	0.79
132470001	Conyers	0.066	0.76
132130003	Fort Mountain	0.065	0.63
132319991	CASTNET	0.064	0.56
130670003	Kennesaw	0.063	0.50
130590002	Athens	0.062	0.44
132450091	Augusta	0.062	0.43
130210012	Macon-Forestry	0.062	0.41
130850001	Dawsonville	0.061	0.40
132611001	Leslie	0.060	0.26
132150008	Columbus-Airport	0.060	0.26
130550001	Summerville	0.058	0.18
130510021	Savannah-E. Pres. St.	0.058	0.16
130730001	Evans	0.057	0.06
131270006	Brunswick	0.056	0.00

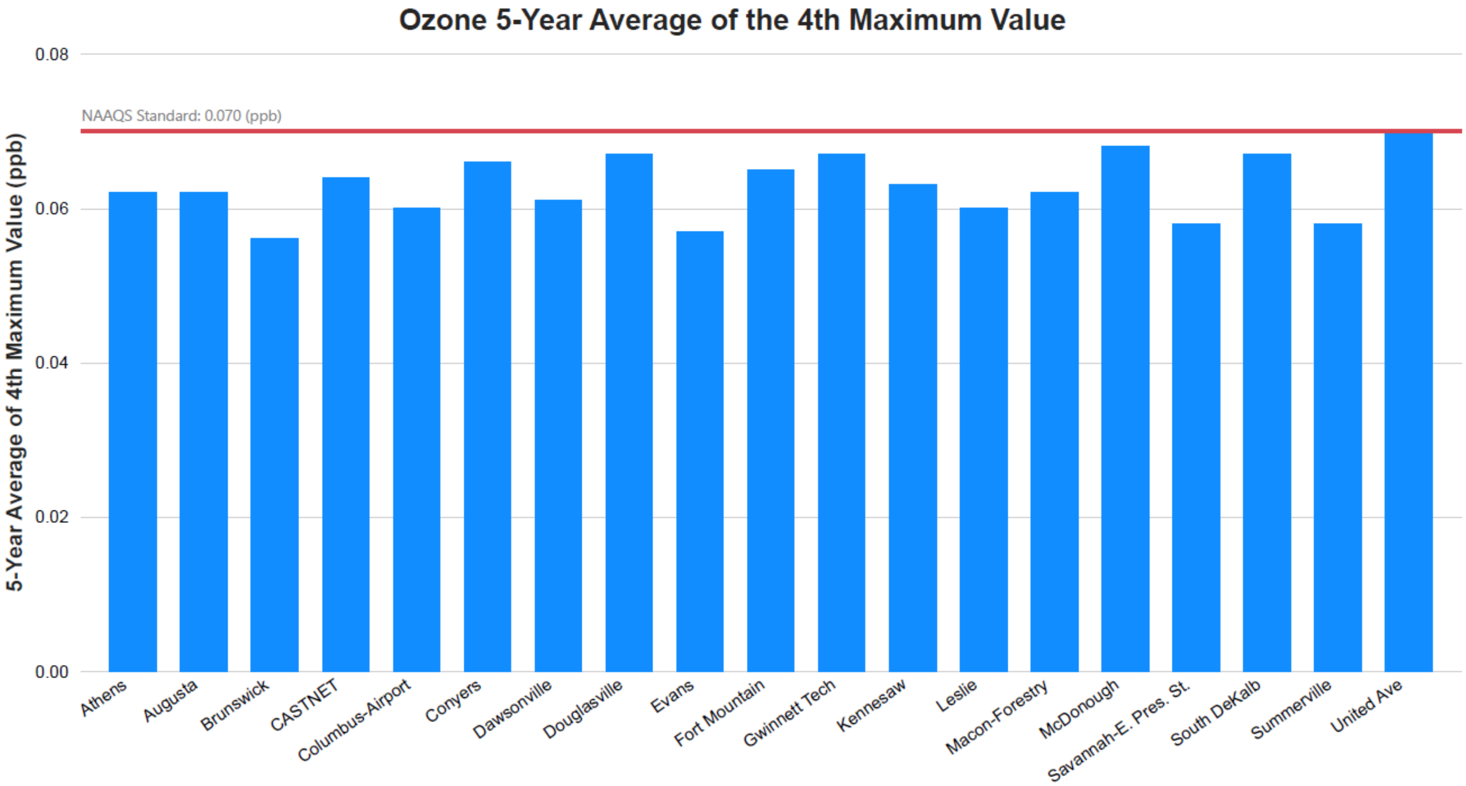


Figure 7.3: Ozone Measured Concentrations

With the ozone design values, the Savannah-E. Pres. St., Evans, and Brunswick sites would rank the least important. The United Ave, McDonough, and Gwinnett Tech sites show the highest design values across the timeframe and would rank the highest with this type of assessment.

7.1 Concluding Points

With the Measured Concentrations Assessment, monitors that measure the highest concentrations are ranked higher than monitors with lower concentrations. Those sites with the lowest concentrations could be recommended for elimination or consolidation. For this assessment, the $PM_{2.5}$ and ozone monitor concentrations were examined. For $PM_{2.5}$, there is both a 24-hour and an annual standard; therefore, both standards were included in the assessment. For the $PM_{2.5}$ 24-hour standard, the 98th percentile was used, and for the Annual standard, the annual average was used to compare sites. For the ozone concentrations, the 4th max was used for comparisons. In all three cases, the 2019 to 2023 data was used from AQS.

Table 7.4 gives the total score for each site. The Augusta site received the highest overall score while the Savannah-E. Pres. St., Evans, and General Coffee sites ranked the lowest. With this assessment, the three sites, Savannah-E. Pres. St., Evans, and General Coffee, could be recommended to be shut down or consolidated.

Table 7.4: Sum of $PM_{2.5}$ 24 Hour, $PM_{2.5}$ Annual, and Ozone Ranking Scores for Each Site

Site ID	Site Name	$PM_{2.5}$ 24 Hour Score	$PM_{2.5}$ Annual Score	Ozone Score	Total Ranking Score
132450091	Augusta	0.95	0.99	0.43	2.37
131350002	Gwinnett Tech	0.63	0.53	0.82	1.98
132150012	Columbus-Baker	1.00	0.83		1.83
133030001	Sandersville	0396	0.77		1.73
130890002	South DeKalb	0.31	0.54	0.82	1.67
130670003	Kennesaw	0.43	0.63	0.50	1.56
130590002	Athens	0.62	0.50	0.44	1.56
132950004	Rossville-Williams St.	0.76	0.77		1.53
130950007	Albany	0.68	0.75		1.43
131210039	Fire Station #8	0.50	0.71		1.21
132150008	Columbus-Airport	0.40	0.54	0.26	1.20
131530001	Warner Robins	0.58	0.57		1.15
130210012	Macon-Forestry	0.43	0.28	0.41	1.12
130210007	Macon-Allied	0.29	0.78		1.07
130630091	Forest Park	0.38	0.63		1.01
131210055	United Ave.			1.00	1.00
131510002	McDonough			0.88	0.88
130511002	Savannah-L&A	0.39	0.49		0.88
130970004	Douglasville			0.79	0.79
132470001	Conyers			0.76	0.76
131850003	Valdosta	0.23	0.43		0.66
132130003	Fort Mountain			0.63	0.63
132319991	CASTNET			0.56	0.56
131210056	NR-GA Tech	0.56			0.56
131390003	Gainesville	0.17	0.36		0.53
130850001	Dawsonville			0.40	0.40
131270006	Brunswick	0.07	0.25	0.00	0.32
132611001	Leslie			0.26	0.26
130550001	Summerville			0.18	0.18
130510021	Savannah-E. Pres. St.			0.16	0.16
130730001	Evans			0.06	0.06
130690002	General Coffee	0.00	0.00		0.00

8.0 Deviation from the NAAQS

Another type of analysis that can be performed to determine a site's importance is the Deviation from the National Ambient Air Quality Standards (NAAQS) analysis. These standards pertain to the criteria pollutants (carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide). Therefore, the following tables and graphs reflect these specific parameters and their specific calculations to compare to the NAAQS. With this type of analysis, all of the sites are ranked according to a binning method for each of the criteria pollutants. This method examined the percentage of each site's concentrations compared to each standard. If the absolute value of the pollutant's average was equal to the standard, it was given a rank of 1. If absolute value of the pollutant's average was ≥85% of the standard, it was given a 0.5. If the pollutant's average was <85% of the standard, it was ranked as a 0. The sites with the least amount of deviation from the NAAQS rank the highest in this type of analysis and are considered more valuable for the network in determining attainment of the standard. These results are shown in the table for each pollutant's averages. The actual design values have been included in the tables and graphs to show the comparison to the NAAQS as well.

For the ozone, $PM_{2.5}$, and SO_2 calculations, 3-year averages were examined from 2019-2021 through 2021-2023 averages. In the ozone, $PM_{2.5}$, and SO_2 graphs, the values are shown as a value of how far the design values deviate from the NAAQS; therefore, the 'zero' would actually represent the standard. For the PM_{10}, lead, CO, and NO_2 graphs, the past five years (2019 to 2023) are compared to the actual standard as indicated. Due to the timing of this document and available data to perform analyses by the deadline, the data was used through 2023 and NAAQS standards as of 2023 were used. Additionally, for the $PM_{2.5}$ annual standard change from 12.0 $\mu g/m^3$ to 9.0 $\mu g/m^3$ in May 2024, the 2021-2023 $PM_{2.5}$ annual design value is compared to the new 2024 standard of 9.0 $\mu g/m^3$.

Please note that the NR-GA Tech site is only compared to the $PM_{2.5}$ 24-hour standard and not the $PM_{2.5}$ annual standard; therefore, it is not included in $PM_{2.5}$ annual standard tables and figures below.

8.1 Ozone

The following table displays the three-year design values for ozone from the 2019-2021 period to the 2021-2023 period. Also displayed in the table is the rank of each monitor. These rankings were determined with a binning method as described above. For the ozone standard, the 85% threshold in the table below is 0.060 ppm. Each three-year design value was ranked, and then each of these rankings was added across the years for a total ranking per site.

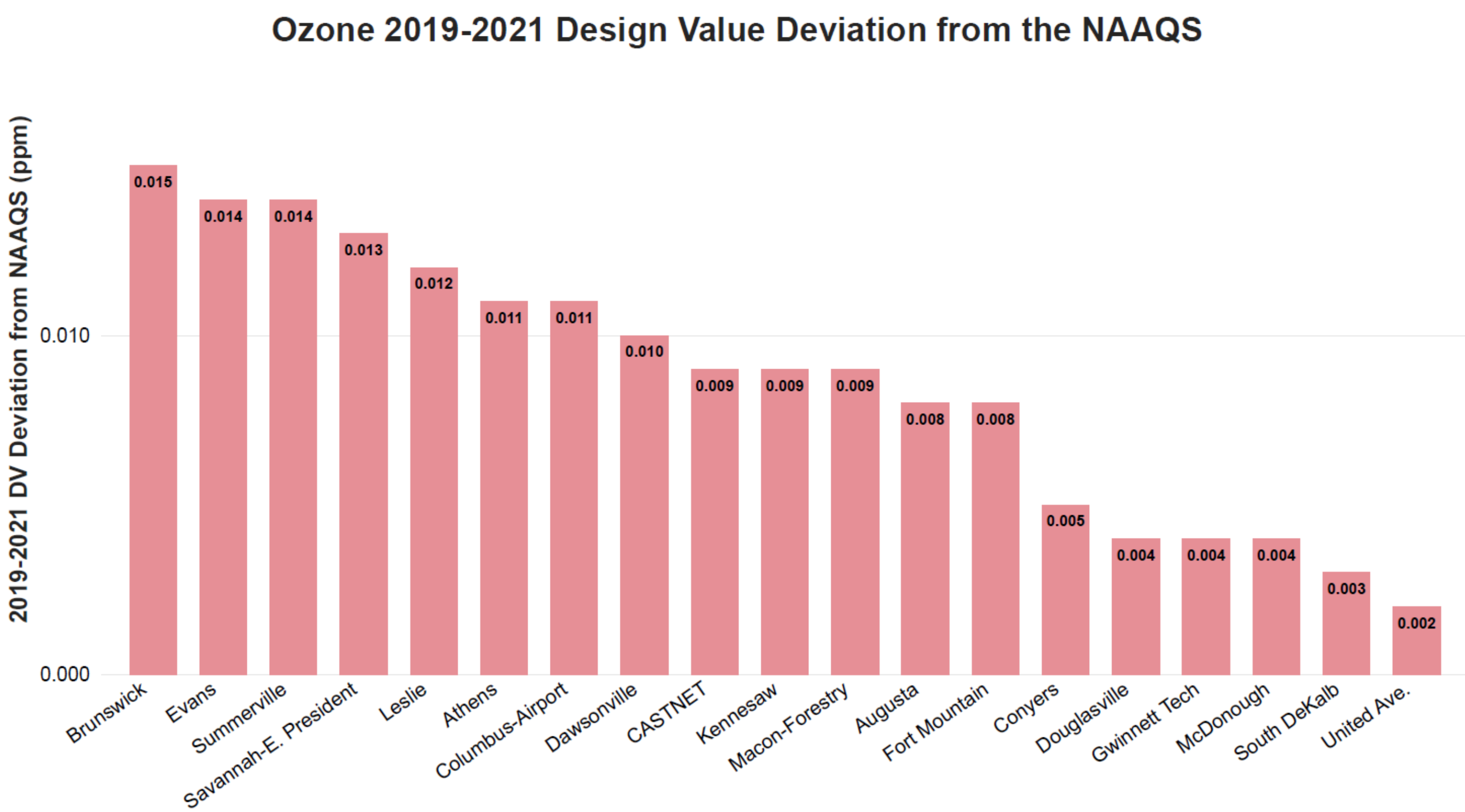
Table 8.1: Ozone Design Values and Ranking

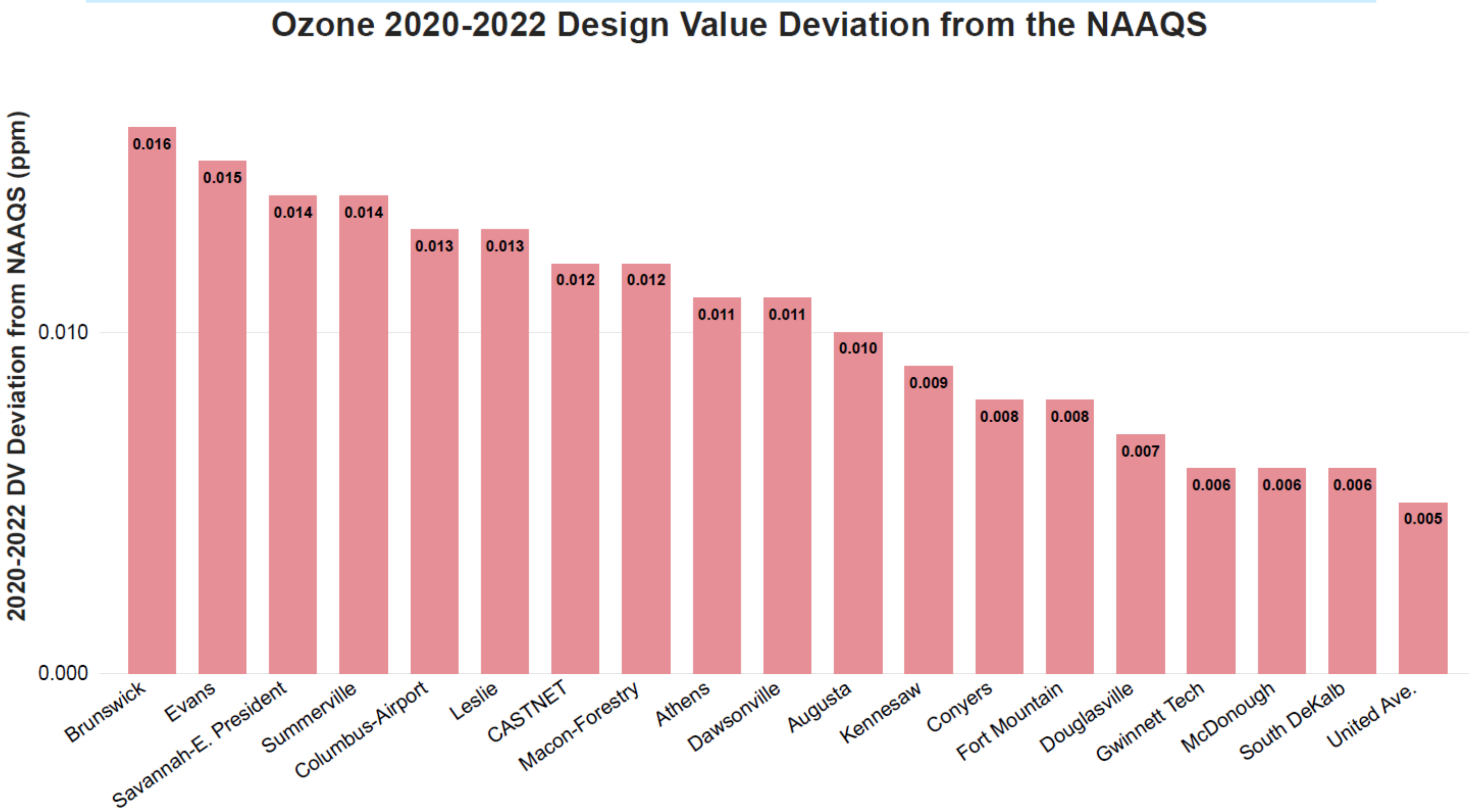
Ozone Sites	2019-2021 (ppm)	Absolute Value from NAAQS	Rank	2020-2022 (ppm)	Absolute Value from NAAQS	Rank	2021-2023 (ppm)	Absolute Value from NAAQS	Rank	Total Ranking
United Ave.	0.068	0.002	**0.5**	0.065	0.005	**0.5**	0.070	0	**1.0**	**2.0**
Conyers	0.065	0.005	**0.5**	0.062	0.008	**0.5**	0.066	0.004	**0.5**	**1.5**
Augusta	0.062	0.008	**0.5**	0.060	0.010	**0.5**	0.062	0.008	**0.5**	**1.5**
Fort Mountain	0.062	0.008	**0.5**	0.062	0.008	**0.5**	0.066	0.004	**0.5**	**1.5**
Gwinnett Tech	0.066	0.004	**0.5**	0.064	0.006	**0.5**	0.067	0.003	**0.5**	**1.5**
Douglasville	0.066	0.004	**0.5**	0.063	0.007	**0.5**	0.068	0.002	**0.5**	**1.5**

Ozone Sites	2019-2021 (ppm)	Absolute Value from NAAQS	Rank	2020-2022 (ppm)	Absolute Value from NAAQS	Rank	2021-2023 (ppm)	Absolute Value from NAAQS	Rank	Total Ranking
South DeKalb	0.067	0.003	**0.5**	0.064	0.006	**0.5**	0.067	0.003	**0.5**	**1.5**
Kennesaw	0.061	0.009	**0.5**	0.061	0.009	**0.5**	0.063	0.007	**0.5**	**1.5**
McDonough	0.066	0.004	**0.5**	0.064	0.006	**0.5**	0.069	0.001	**0.5**	**1.5**
CASTNET	0.061	0.009	**0.5**	0.058	0.012	**0.0**	0.065	0.005	**0.5**	**1.0**
Dawsonville	0.060	0.010	**0.5**	0.059	0.011	**0.0**	0.062	0.008	**0.5**	**1.0**
Macon-Forestry	0.061	0.009	**0.5**	0.058	0.012	**0.0**	0.062	0.008	**0.5**	**1.0**
Leslie	0.058	0.012	**0.0**	0.057	0.013	**0.0**	0.060	0.010	**0.5**	**0.5**
Columbus-Airport	0.059	0.011	**0.0**	0.057	0.013	**0.0**	0.060	0.010	**0.5**	**0.5**
Athens	0.059	0.011	**0.0**	0.059	0.011	**0.0**	0.063	0.007	**0.5**	**0.5**
Summerville	0.056	0.014	**0.0**	0.056	0.014	**0.0**	0.060	0.010	**0.5**	**0.5**
Brunswick	0.055	0.015	**0.0**	0.054	0.016	**0.0**	0.056	0.014	**0.0**	**0.0**
Evans	0.056	0.014	**0.0**	0.055	0.015	**0.0**	0.057	0.013	**0.0**	**0.0**
Savannah-E. Pres. St.	0.057	0.013	**0.0**	0.056	0.014	**0.0**	0.059	0.011	**0.0**	**0.0**

As explained above, for this assessment, the sites with the highest ranking would be considered most important for comparing to the standard. The highest ranking site was the United Ave. site, with a ranking of 2.0. The lowest ranking ozone sites were the Brunswick, Evans, and Savannah-E. Pres. St. sites, with a ranking of 0.0. The remaining sites had rankings of 0.5 to 1.5, indicating that these sites had design values that were above 85% of the NAAQS (0.060 ppm), or above the NAAQS for each three-year average used in the assessment.

The following graphs show how each ozone monitor deviates from the standard of 0.070 ppm. To aide in displaying this data graphically, the standard of 0.070 ppm is shown in the following graphs as ‘0’. Then, the extent of each site’s deviation from the NAAQS is shown as the distance from 0. If the site’s monitor was 0.070 ppm, then it would be displayed in the graph as 0. The sites that were closest to the standard of 0.070 ppm are considered most important. The sites are shown in order of importance. The absolute value from the standard determined its importance and not whether it was above or below the standard. For regulatory purposes, the sites with the highest values would be of concern to determine whether those areas are in attainment of the standard. However, for this type of analysis shown here, sites with values closest to the standard are considered more valuable for NAAQS evaluation.


Ozone 2019-2021 Design Value Deviation from the NAAQS
2019-2021 DV Deviation from NAAQS (ppm)
0.010
0.000
0.015
0.014
0.014
0.013
0.012
0.011
0.011
0.010
0.009
0.009
0.009
0.008
0.008
0.005
0.004
0.004
0.004
0.003
0.002
Brunswick
Evans
Summerville
Savannah-E. President
Leslie
Athens
Columbus-Airport
Dawsonville
CASTNET
Kennesaw
Macon-Forestry
Augusta
Fort Mountain
Conyers
Douglasville
Gwinnett Tech
McDonough
South DeKalb
United Ave.



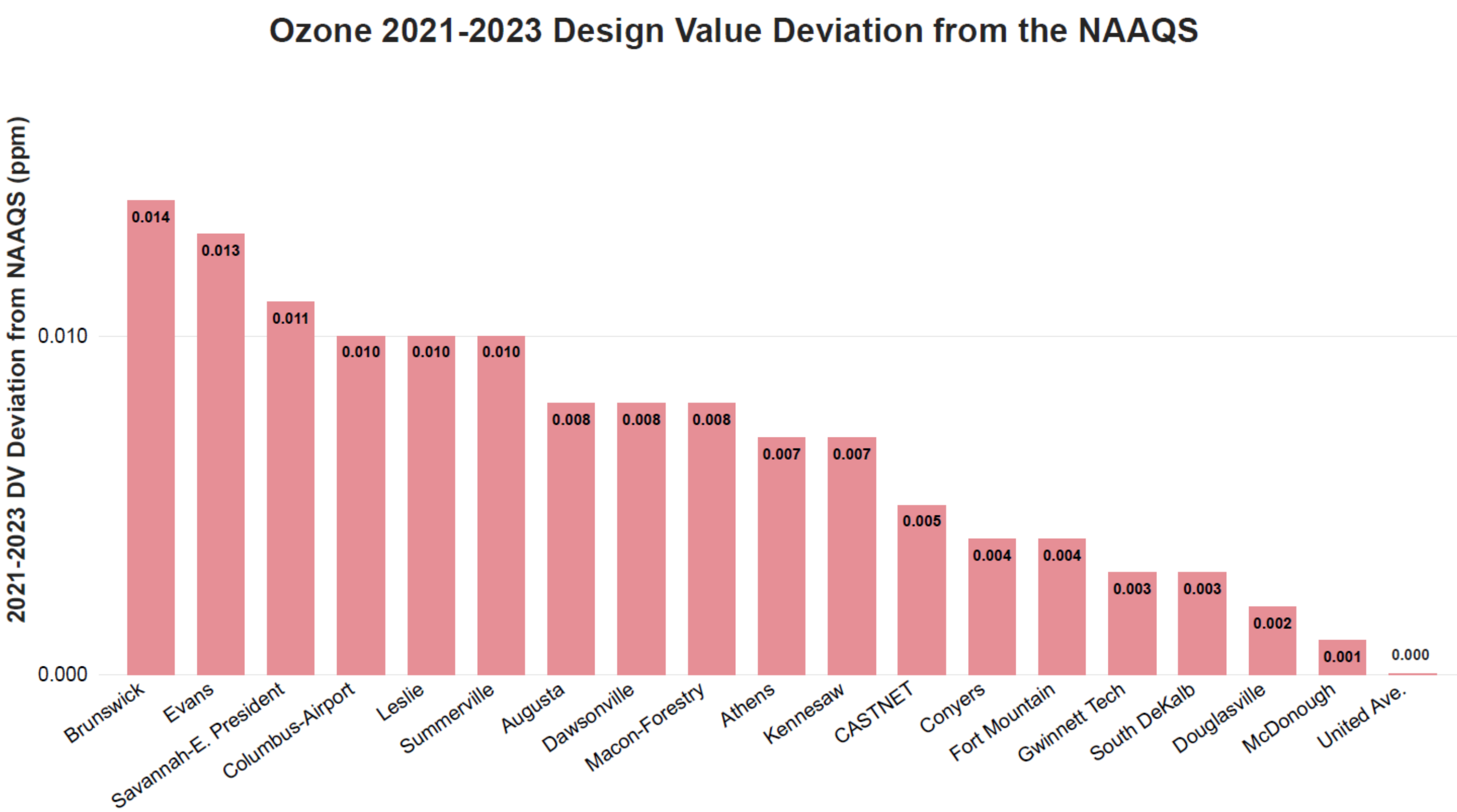


Figure 8.1: Ozone Deviation from the NAAQS (Absolute Value)

For the ozone monitoring sites, the locations with design values closest to the NAAQS for the last three years have consistently been the United Ave, South DeKalb, and McDonough sites. The Brunswick and Evans sites are consistently the least important ozone sites with this type of analysis, having the largest deviation from the NAAQS.

The following map reflects the deviation from the 2021-2023 ozone NAAQS with normalized values. The lighter colors have less deviation from the NAAQS that correlate with the above graph. For instance, the United Ave. ozone monitor has a 0 ranking in the graph, and a white circle on the map. The darker colors have the most deviation from the NAAQS, and an example is the Brunswick ozone monitor with a larger deviation from the NAAQS and a darker color purple on the map.

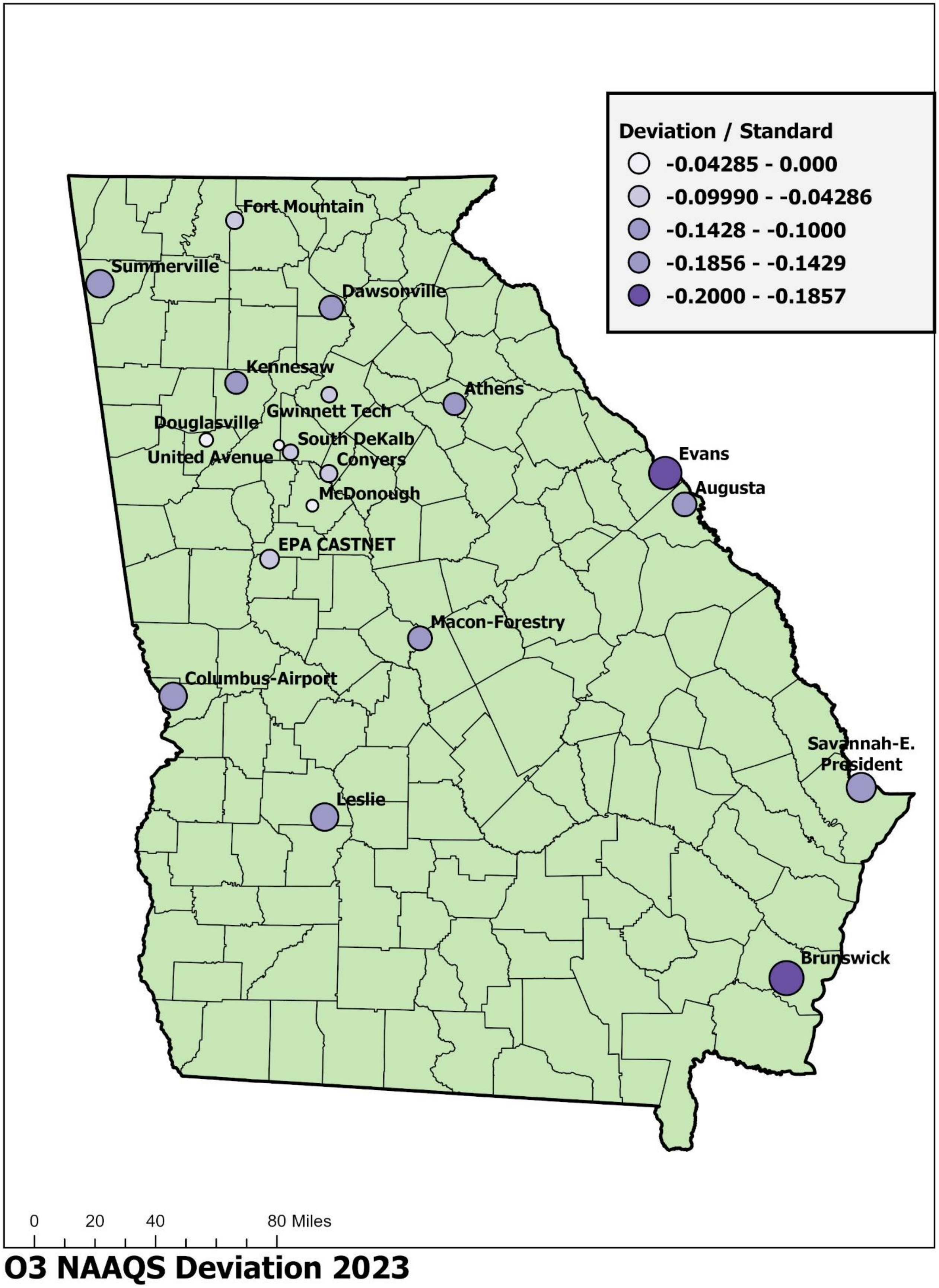


Figure 8.2: Ozone Deviation from the NAAQS 2023

8.2 $PM_{2.5}$ 24-Hour

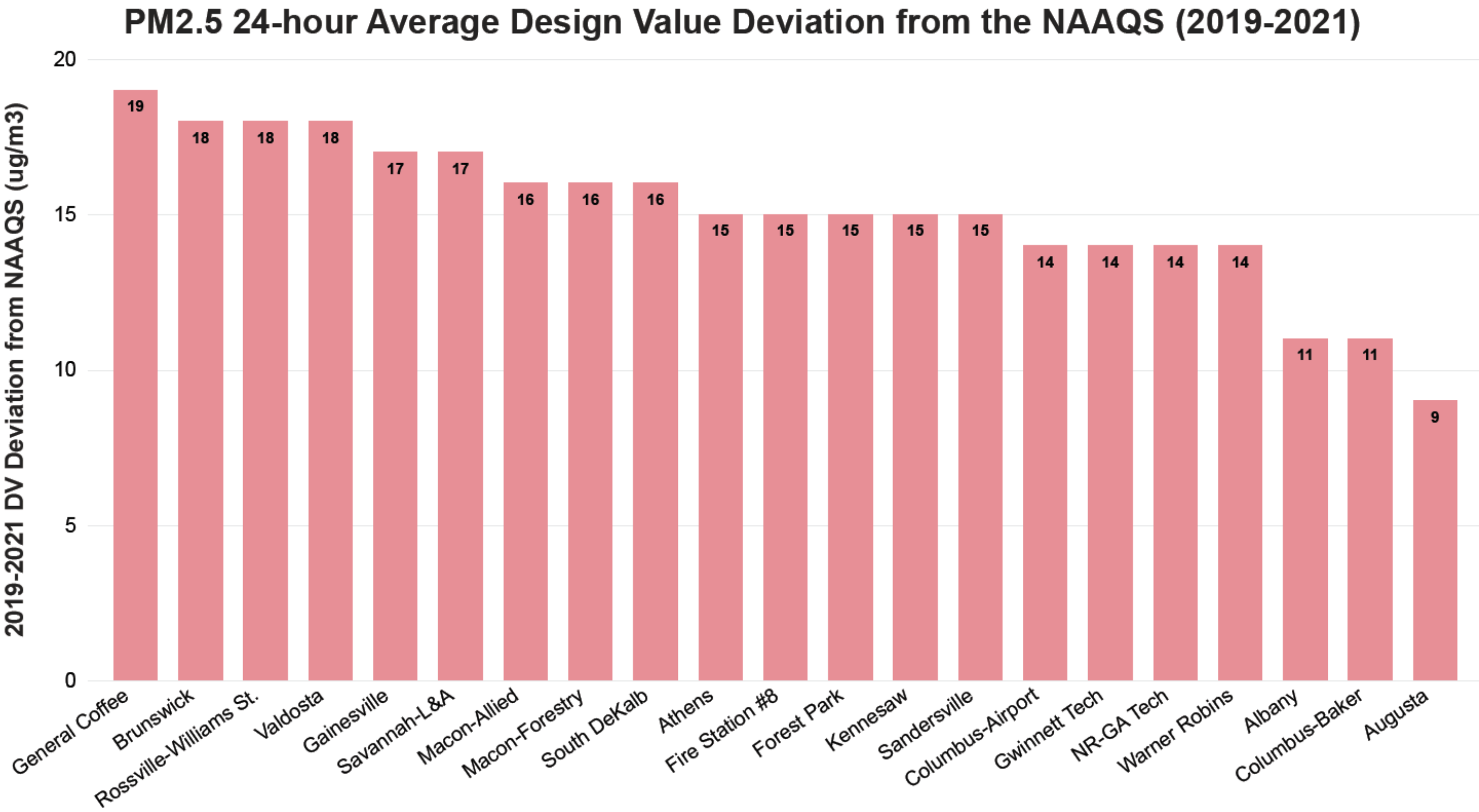
The following table displays the 24-hour $PM_{2.5}$ three-year design values in micrograms per cubic meter (µg/m^3) from the 2019-2021 period to the 2021-2023 period. The National Ambient Air Quality Standard for 24-hour $PM_{2.5}$ is 35 µg/m^3. The ranking for each monitor is also displayed in the table. These rankings were determined with a binning method as described above. Each three-year design value was ranked, and then each of these rankings was added across the years for a total ranking per site.

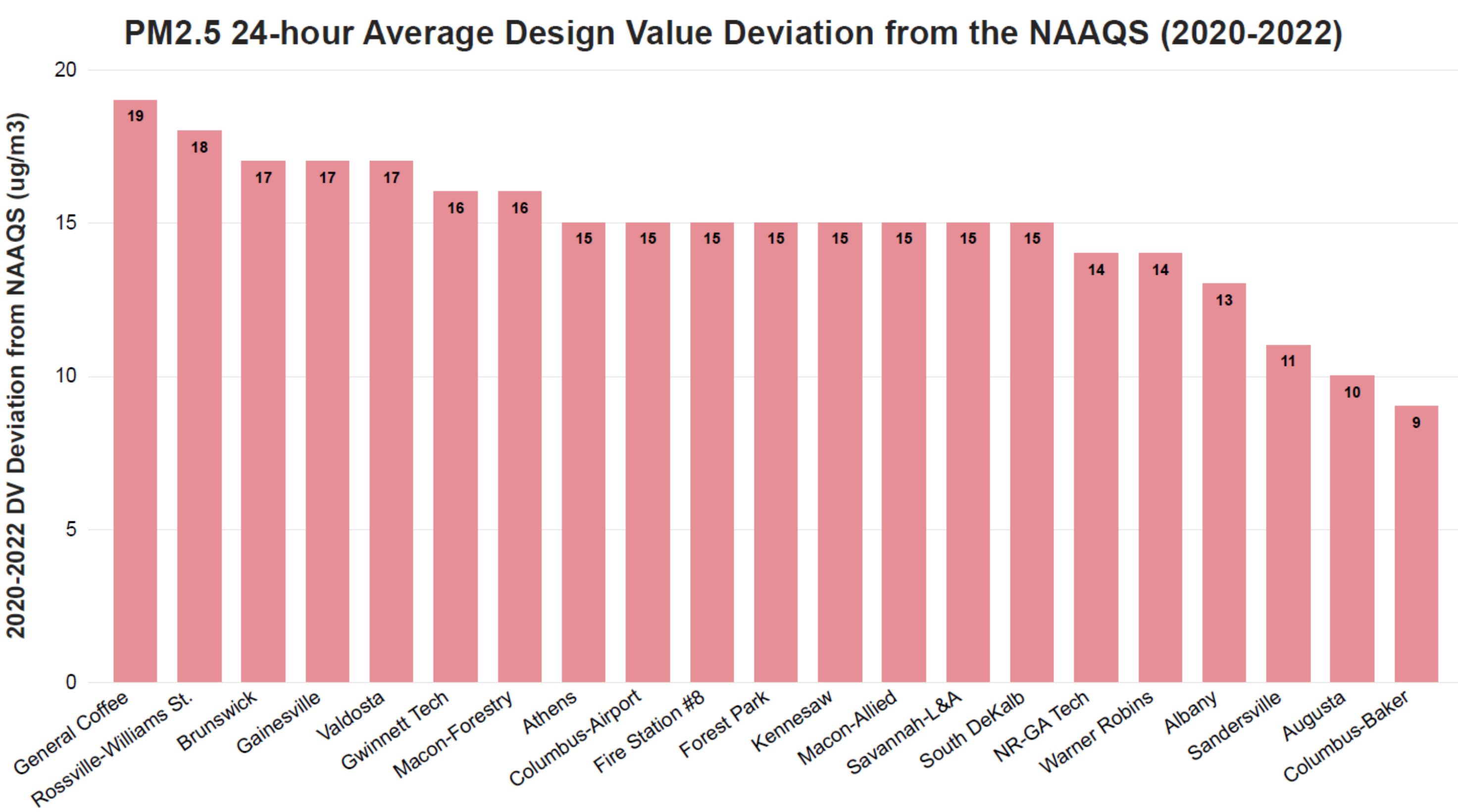
Table 8.2: $PM_{2.5}$ 24-Hour Design Values and Ranking

$PM_{2.5}$ 24-Hour	2019-2021	Absolute Value from NAAQS	Rank	2020-2022	Absolute Value from NAAQS	Rank	2021-2023	Absolute Value from NAAQS	Rank	Total Ranking
Macon-Allied	19	16	**0**	20	15	**0**	21	14	**0**	**0.0**
Macon-Forestry	19	16	**0**	19	16	**0**	22	13	**0**	**0.0**
Savannah-L&A	18	17	**0**	20	15	**0**	22	13	**0**	**0.0**
Athens	20	15	**0**	20	15	**0**	23	12	**0**	**0.0**
Forest Park	20	15	**0**	20	15	**0**	19	16	**0**	**0.0**
Kennesaw	20	15	**0**	20	15	**0**	20	15	**0**	**0.0**
General Coffee	16	19	**0**	16	19	**0**	18	17	**0**	**0.0**
South DeKalb	19	16	**0**	20	15	**0**	21	14	**0**	**0.0**
Albany	24	11	**0**	22	13	**0**	22	13	**0**	**0.0**
Fire Station #8	20	15	**0**	20	15	**0**	20	15	**0**	**0.0**
NR-GA Tech	21	14	**0**	21	14	**0**	20	15	**0**	**0.0**
Brunswick	17	18	**0**	18	17	**0**	19	16	**0**	**0.0**
Gwinnett Tech	21	14	**0**	19	16	**0**	22	13	**0**	**0.0**
Gainesville	18	17	**0**	18	17	**0**	20	15	**0**	**0.0**
Warner Robins	21	14	**0**	21	14	**0**	22	13	**0**	**0.0**
Valdosta	17	18	**0**	18	17	**0**	20	15	**0**	**0.0**
Columbus-Airport	21	14	**0**	20	15	**0**	20	15	**0**	**0.0**
Columbus-Baker	24	11	**0**	26	9	**0**	27	8	**0**	**0.0**
Augusta	26	9	**0**	25	10	**0**	25	10	**0**	**0.0**
Rossville-Williams St.	17	18	**0**	17	18	**0**	18	17	**0**	**0.0**
Sandersville	20	15	**0**	24	11	**0**	27	8	**0**	**0.0**

With the 24-hour $PM_{2.5}$ data, all the sites have a ranking of 0 with 24-hour design values below 85% of the NAAQS (29.75 µg/m^3).

The following graphs show the data in the same way that the ozone data was displayed. The standard is shown as '0', and how far the absolute value of each site's concentration deviates from that standard is shown as the extent from 0. For the 24-hour $PM_{2.5}$ data, the standard is 35 µg/m^3. Therefore, the graphs depict the information in the above table and show the difference of the average compared to the standard of 35 µg/m^3.


PM2.5 24-hour Average Design Value Deviation from the NAAQS (2019-2021)
2019-2021 DV Deviation from NAAQS (ug/m3)
General Coffee 19
Brunswick 18
Rossville-Williams St. 18
Valdosta 18
Gainesville 17
Savannah-L&A 17
Macon-Allied 16
Macon-Forestry 16
South DeKalb 16
Athens 15
Fire Station #8 15
Forest Park 15
Kennesaw 15
Sandersville 15
Columbus-Airport 14
Gwinnett Tech 14
NR-GA Tech 14
Warner Robins 14
Albany 11
Columbus-Baker 11
Augusta 9


PM2.5 24-hour Average Design Value Deviation from the NAAQS (2020-2022)
2020-2022 DV Deviation from NAAQS (ug/m3)
General Coffee 19
Rossville-Williams St. 18
Brunswick 17
Gainesville 17
Valdosta 17
Gwinnett Tech 16
Macon-Forestry 16
Athens 15
Columbus-Airport 15
Fire Station #8 15
Forest Park 15
Kennesaw 15
Macon-Allied 15
Savannah-L&A 15
South DeKalb 15
NR-GA Tech 14
Warner Robins 14
Albany 13
Sandersville 11
Augusta 10
Columbus-Baker 9

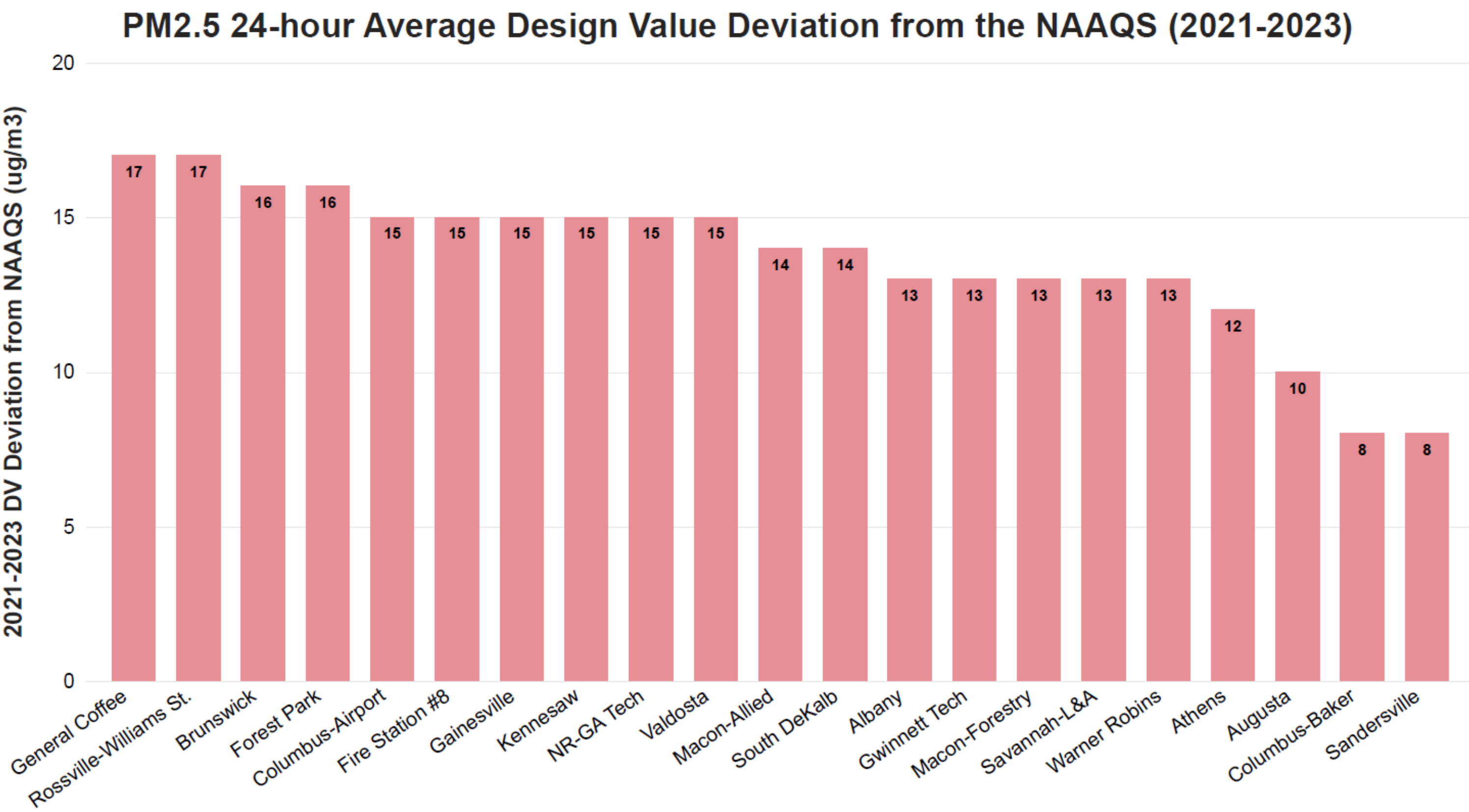


Figure 8.3: PM$_{2.5}$ 24-Hour Deviation from the NAAQS (Absolute Value)

The following map reflects the deviation from the 2021-2023 24-hour PM$_{2.5}$ NAAQS with normalized values. The lighter colors have less deviation from the NAAQS that correlate with the above graph. For instance, the Sandersville PM$_{2.5}$ monitor has a 0 ranking, and a white circle on the map. The darker colors have the most deviation from the NAAQS, and an example is the General Coffee PM$_{2.5}$ monitor with a larger deviation from the NAAQS and a darker color purple on the map.

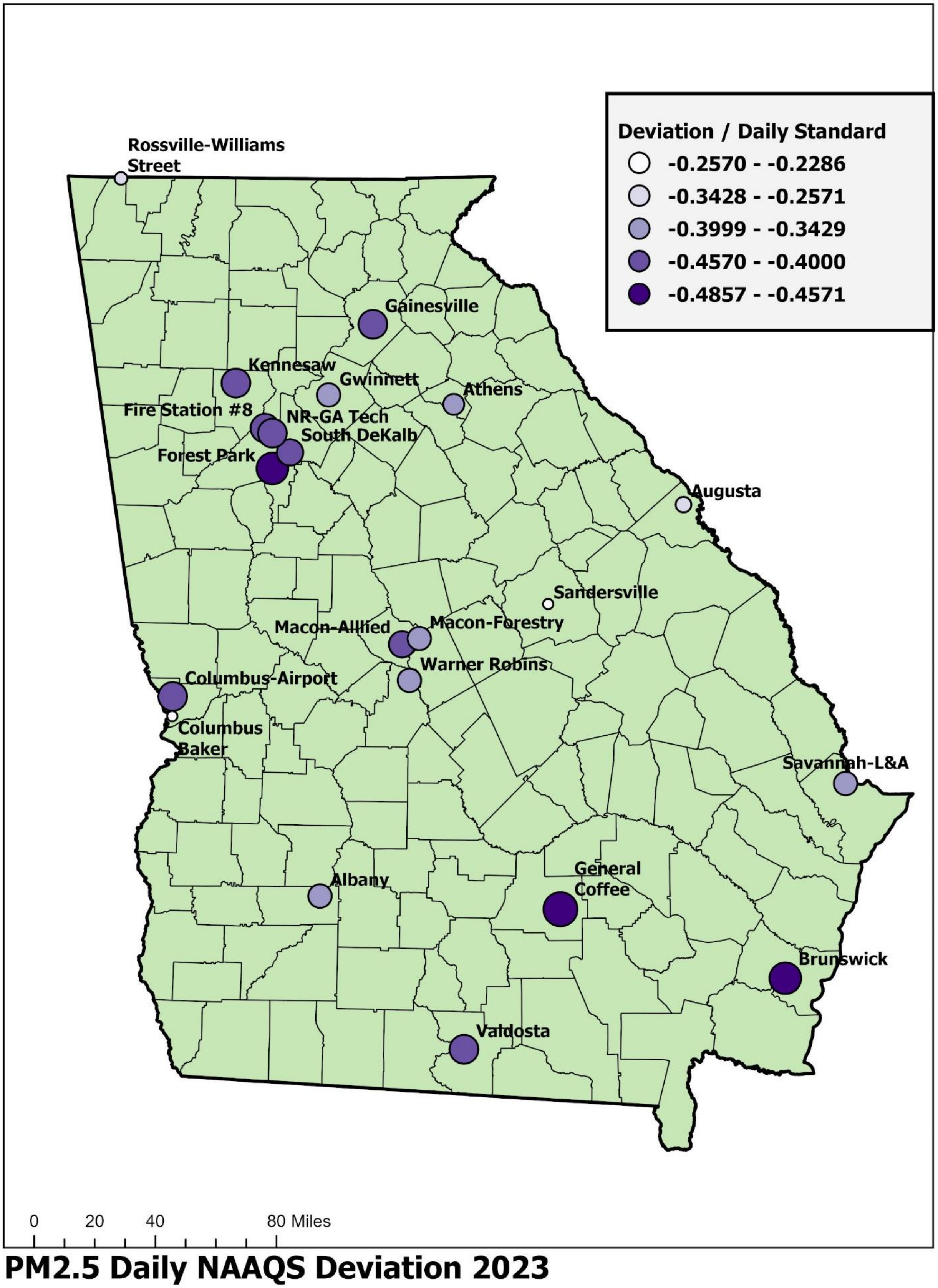


Figure 8.4: PM$_{2.5}$ 24-Hour Deviation from NAAQS 2023

8.3 $PM_{2.5}$ Annual

The following table displays the three-year design values for annual $PM_{2.5}$ from the 2019-2021 period to the 2021-2023 period. Also shown in the table are the rankings for each monitor in Georgia AAMP's $PM_{2.5}$ network. These rankings were determined with a binning method as described above. Each three-year design value was ranked, and then each of these rankings were added across the years for a total ranking per site. Please note that the NR-GA Tech site is not compared to the annual $PM_{2.5}$ standard; therefore, it is not included in Table 8.3 or the following graphs below.

For the 2019-2021 and 2020-2022 design values, the $PM_{2.5}$ annual standard used was 12.0 µg/m^3. A range of 11.5-12.5 µg/m^3 was ranked with a 1.0, to represent the importance of monitors with values close to the standard. The ±85% threshold of 10.2 up to 11.5 was ranked 0.5, and 12.6 to 13.8 µg/m^3 would be ranked 0.5. Values 15% above and 15% below the standard are given the same rank. Values outside of 10.2 µg/m^3 and 13.8 µg/m^3 would have a rank of 0.0.

For the 2021-2023 design value, the $PM_{2.5}$ annual standard used was 9.0 µg/m^3 to reflect the lowering of the NAAQS standard. A range of 8.5-9.5 µg/m^3 was ranked with a 1.0, to represent the importance of monitors with values close to the standard. The ±85% threshold of 7.65 up to 8.5 was ranked 0.5, and 9.6 to 10.35 µg/m^3 would be ranked 0.5. Values 15% above and 15% below the standard are given the same rank. Values outside of 7.65 µg/m^3 and 10.35 µg/m^3 would have a rank of 0.0.

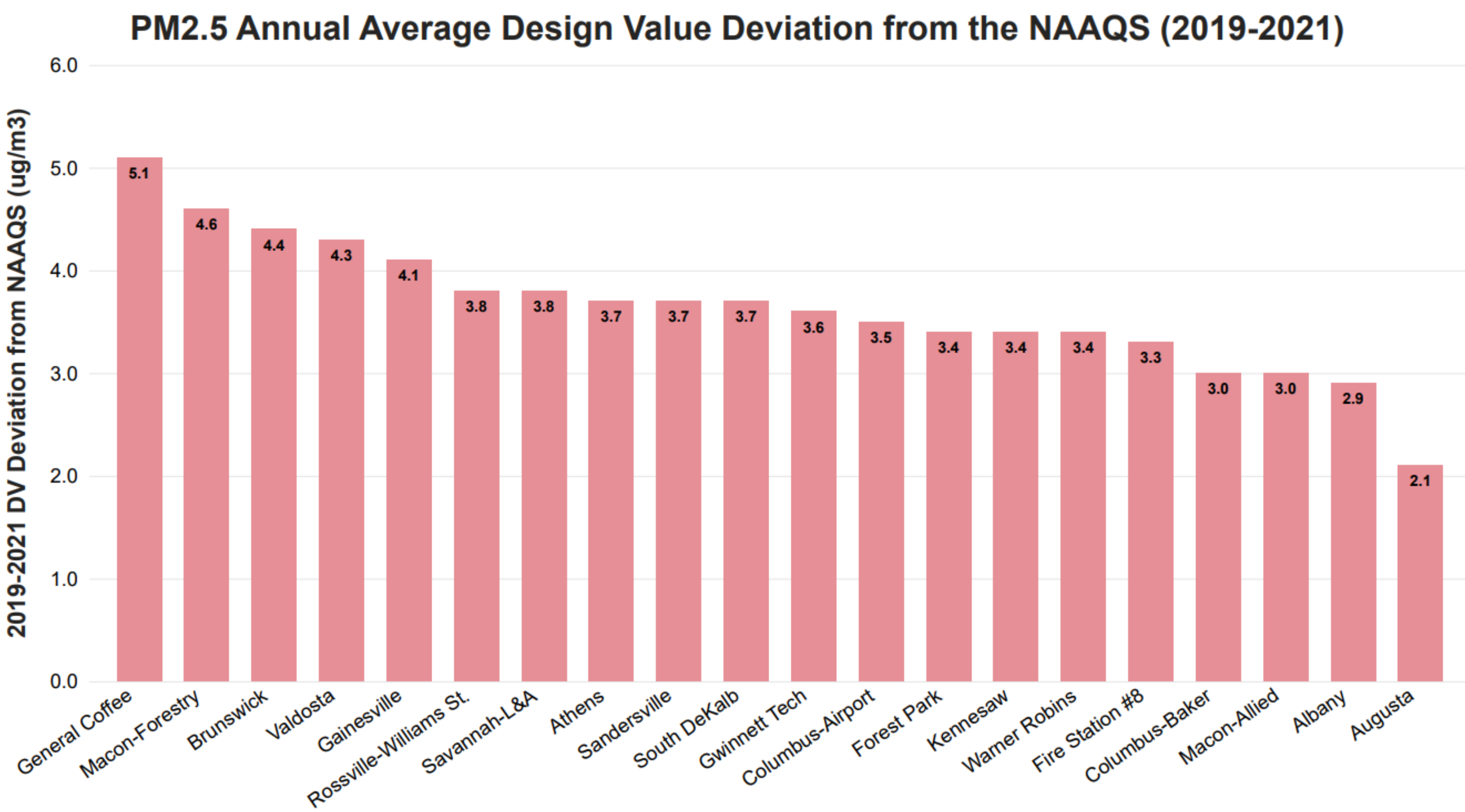
Table 8.3: $PM_{2.5}$ Annual Design Values and Ranking

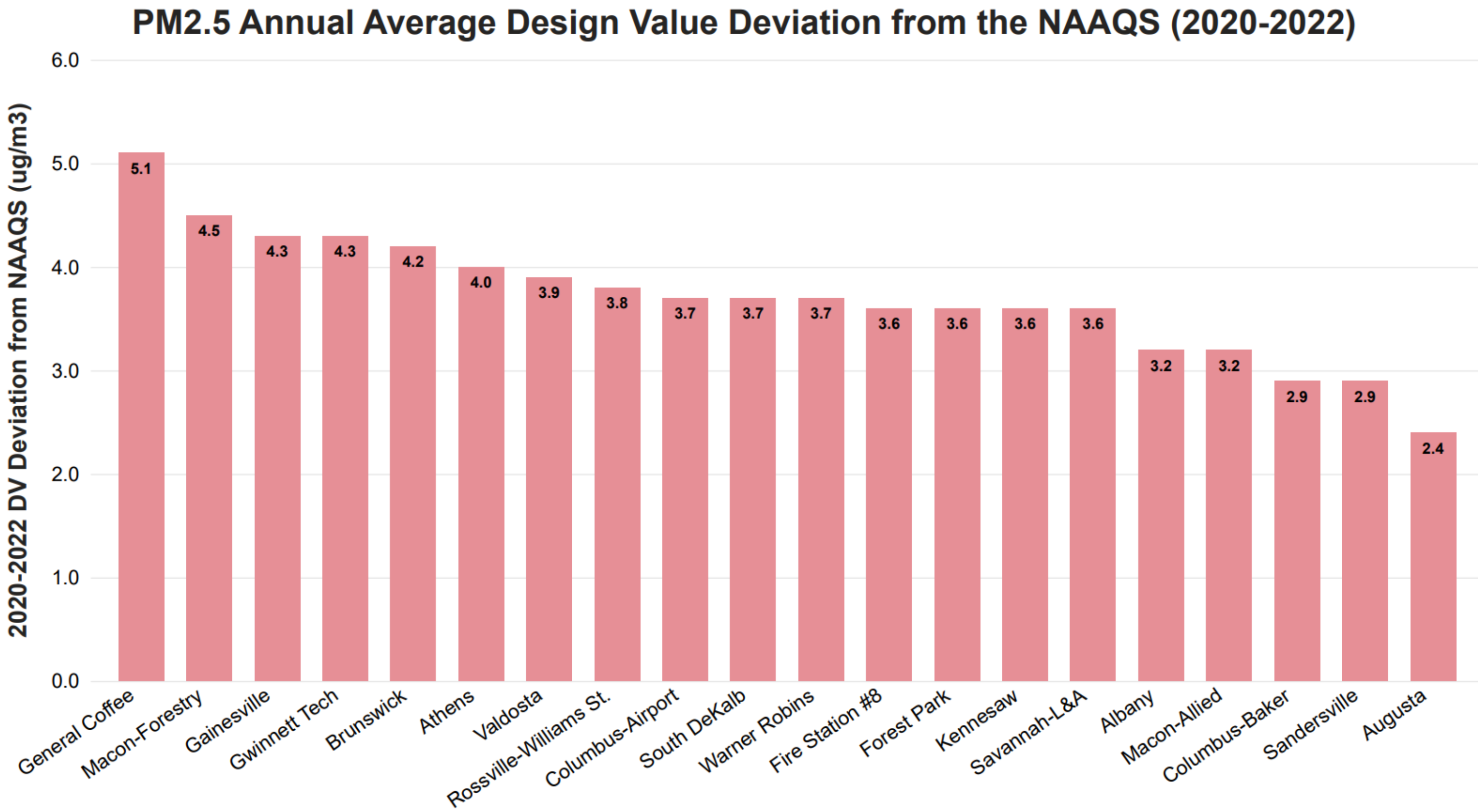
$PM_{2.5}$ Annual	2019-2021 (µg/m^3)	Absolute Value from NAAQS	Rank	2020-2022 (µg/m^3)	Absolute Value from NAAQS	Rank	2021-2023 (µg/m^3)	Absolute Value from NAAQS*	Rank	Total Ranking
Macon-Allied	9.0	3.0	**0.0**	8.8	3.2	**0.0**	9.4	0.4	**1.0**	**1.0**
Macon-Forestry	7.4	4.6	**0.0**	7.5	4.5	**0.0**	8.4	0.6	**0.5**	**0.5**
Savannah-L&A	8.2	3.8	**0.0**	8.4	3.6	**0.0**	8.7	0.3	**1.0**	**1.0**
Athens	8.3	3.7	**0.0**	8.0	4.0	**0.0**	8.7	0.3	**1.0**	**1.0**
Forest Park	8.6	3.4	**0.0**	8.4	3.6	**0.0**	8.9	0.1	**1.0**	**1.0**
Kennesaw	8.6	3.4	**0.0**	8.4	3.6	**0.0**	8.9	0.1	**1.0**	**1.0**
General Coffee	6.9	5.1	**0.0**	6.9	5.1	**0.0**	7.3	1.7	**0.0**	**0.0**
South DeKalb	8.3	3.7	**0.0**	8.3	3.7	**0.0**	8.7	0.3	**1.0**	**1.0**
Albany	9.1	2.9	**0.0**	8.8	3.2	**0.0**	9.0	0	**1.0**	**1.0**
Fire Station #8	8.7	3.3	**0.0**	8.4	3.6	**0.0**	9.1	0.1	**1.0**	**1.0**
Brunswick	7.6	4.4	**0.0**	7.8	4.2	**0.0**	7.9	1.1	**0.5**	**0.5**
Gwinnett Tech	8.4	3.6	**0.0**	7.7	4.3	**0.0**	8.5	0.5	**1.0**	**1.0**
Gainesville	7.9	4.1	**0.0**	7.7	4.3	**0.0**	8.2	0.8	**0.5**	**0.5**
Warner Robins	8.6	3.4	**0.0**	8.3	3.7	**0.0**	8.7	0.3	**1.0**	**1.0**
Valdosta	7.7	4.3	**0.0**	8.1	3.9	**0.0**	8.6	0.4	**1.0**	**1.0**
Columbus-Airport	8.5	3.5	**0.0**	8.3	3.7	**0.0**	8.5	0.5	**1.0**	**1.0**
Columbus-Baker	9.0	3.0	**0.0**	9.1	2.9	**0.0**	10.0	1.0	**0.5**	**0.5**
Augusta	9.9	2.1	**0.0**	9.6	2.4	**0.0**	9.7	0.7	**0.5**	**0.5**
Rossville-Williams St.	8.2	3.8	**0.0**	8.2	3.8	**0.0**	9.3	0.3	**1.0**	**1.0**
Sandersville	8.3	3.7	**0.0**	9.1	2.9	**0.0**	10.0	1.0	**0.5**	**0.5**

***NAAQS annual $PM_{2.5}$ standard of 9.0 µg/m^3 used for the 2021-2023 deviation calculation**

For the 2019-2021 and 2020-2022 design values, all of three-year averages were below 85% of the NAAQS $PM_{2.5}$ annual standard, which is 10.2 µg/m^3, giving a ranking of 0.0 for that three-year average. For the new standard, several sites had a design value in 2021-2023 at or above the standard, with Columbus-Baker, Augusta, and the Sandersville sites having three-year averages of above the 9.5 µg/m^3 threshold.

The following graphs display the difference between the three-year averages and the $PM_{2.5}$ annual standard. Therefore, the '0' represents the $PM_{2.5}$ annual standard of 12.0 µg/m^3 for the 2019-2021 and 2020-2022 periods, and 9.0 µg/m^3 for the 2021-2023 period.





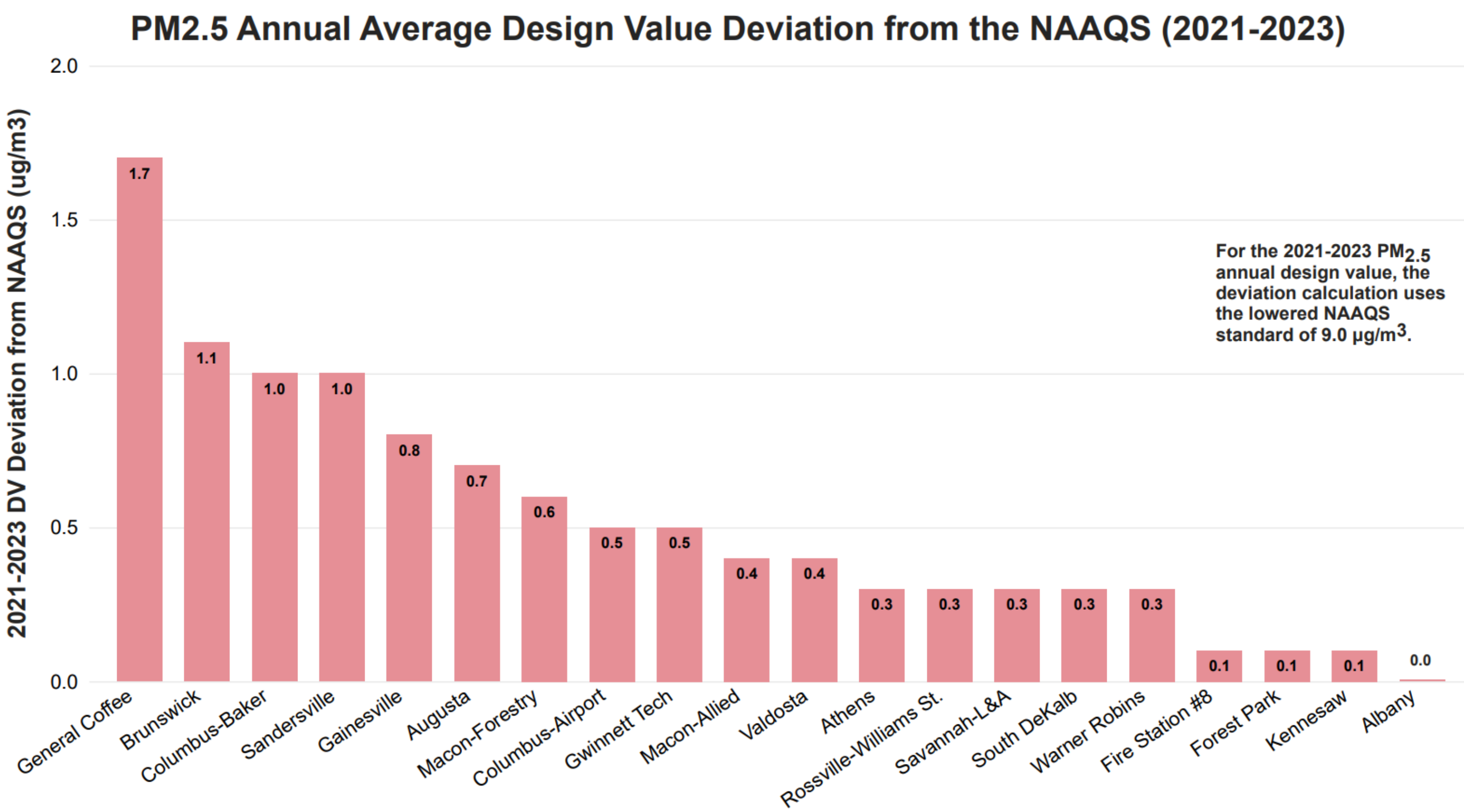


Figure 8.5: $PM_{2.5}$ Annual Deviation from the NAAQS (Absolute Value)

The following map reflects the deviation from the 2021-2023 annual $PM_{2.5}$ NAAQS with normalized values. With this standard, there were sites that were above the NAAQS, therefore they are represented with shades of orange. The darker orange color represents higher 2021-2023 annual $PM_{2.5}$ values above the NAAQS, and the lighter orange represents lower 2021-2023 annual $PM_{2.5}$ values above the NAAQS that correlate with the above graph. The purple shades represent a negative deviation, and the darker the purple indicates more deviation from the 2021-2023 annual $PM_{2.5}$ NAAQS. For instance, the Sandersville $PM_{2.5}$ monitor has a darker orange, and one of the higher 2021-2023 annual $PM_{2.5}$ values, while the darker purple at the General Coffee site represents one of the lower 2021-2023 annual $PM_{2.5}$ values.

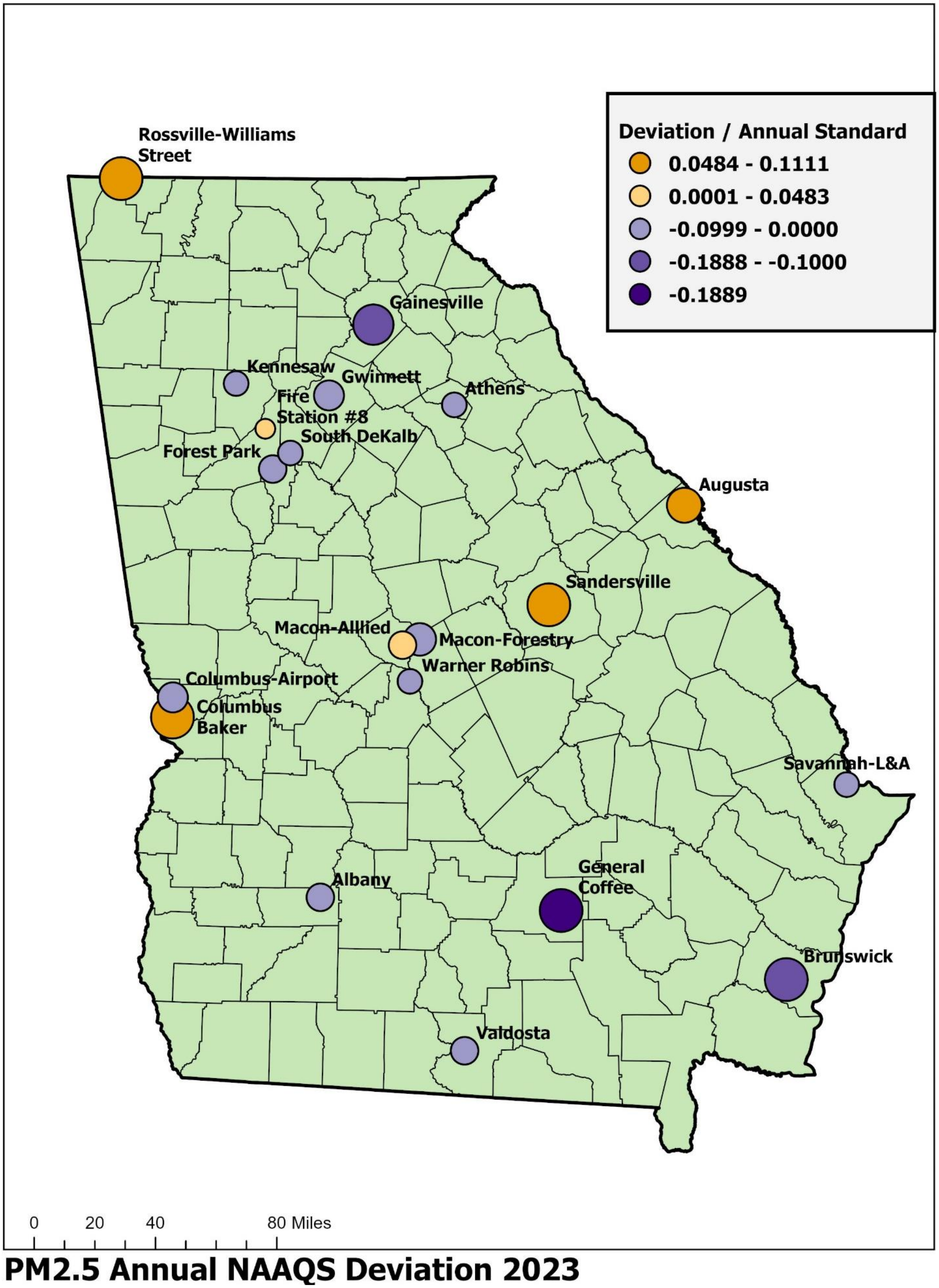


Figure 8.6: PM2.5 Deviation from the Annual NAAQS 2023

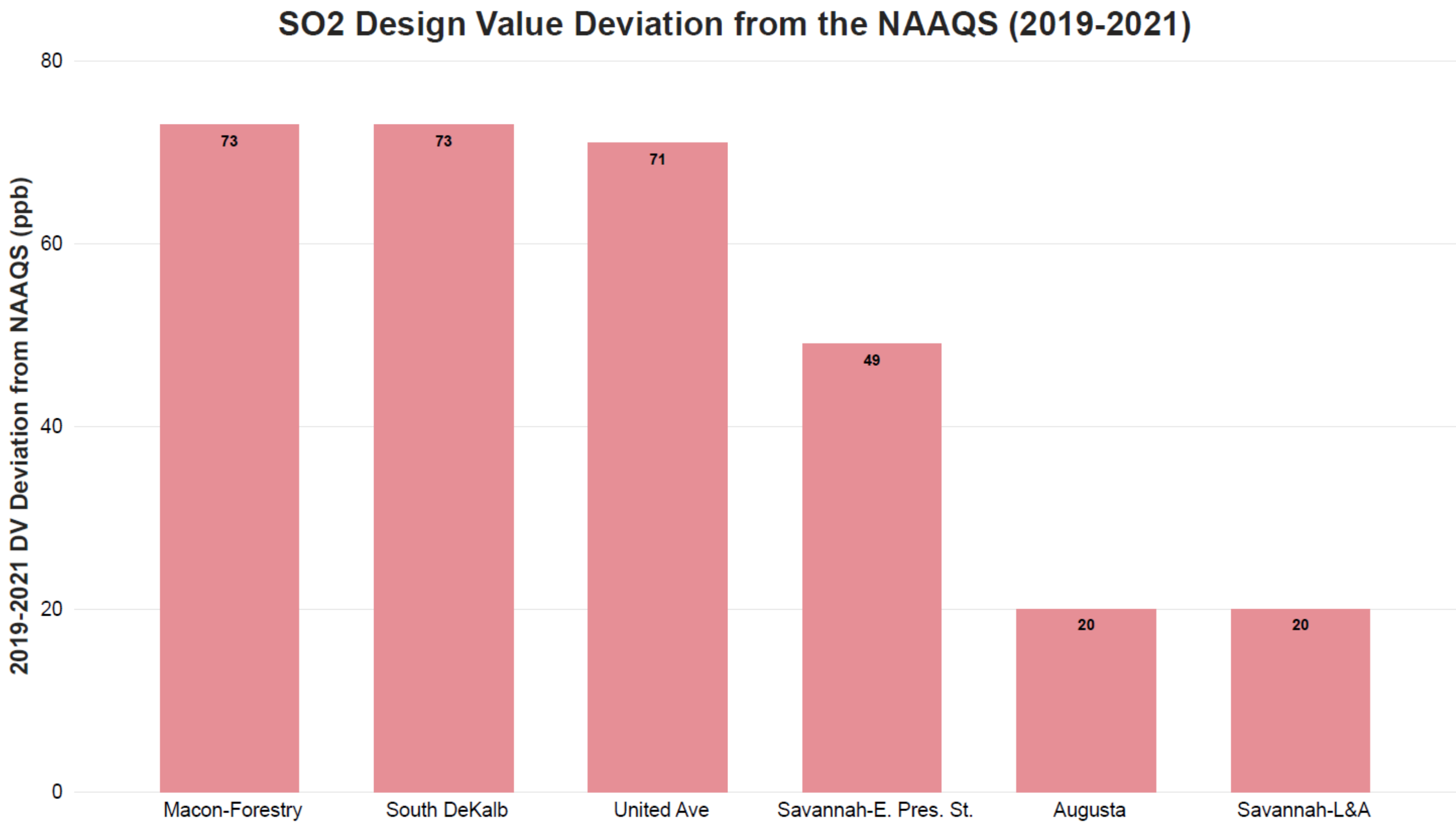
8.4 Sulfur Dioxide

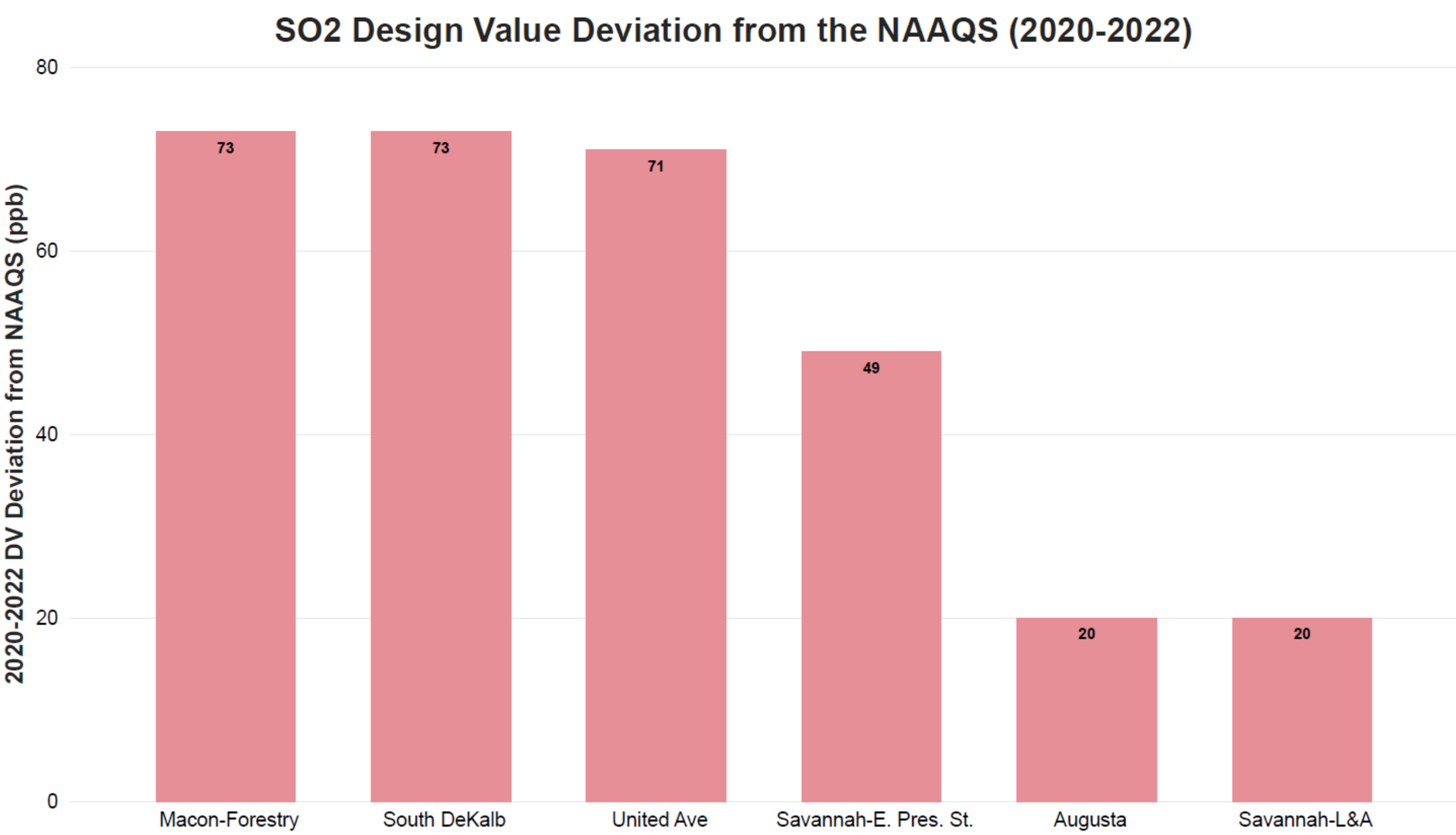
The sulfur dioxide (SO_2) National Ambient Air Quality standard compares the 99th percentile of 1-hour daily maximum concentrations, averaged for three years, compared to 75 ppb. The following table and graphs show these three-year averages from the 2019-2021 period to the 2021-2023 period compared to 75 ppb. As of 2023, there were six SO_2 samplers collecting data in Georgia.

Table 8.4: Sulfur Dioxide Values and Ranking

SO_2 99% of daily 1-hr maxes, 75 ppb	**Deviation from the NAAQS**									
Site	**2019-2021**	**Absolute Value from NAAQS**	**Rank**	**2020-2022**	**Absolute Value from NAAQS**	**Rank**	**2021-2023**	**Absolute Value from NAAQS**	**Rank**	**Total Ranking**
Macon-Forestry	2	73	**0.0**	3	72	**0.0**	3	72	**0.0**	**0.0**
Savannah-E. Pres.	26	49	**0.0**	28	47	**0.0**	31	44	**0.0**	**0.0**
Savannah-L&A	55	20	**0.0**	55	20	**0.0**	48	27	**0.0**	**0.0**
South DeKalb	2	73	**0.0**	2	73	**0.0**	2	73	**0.0**	**0.0**
United Ave.	4	71	**0.0**	4	71	**0.0**	4	71	**0.0**	**0.0**
Augusta	55	20	**0.0**	56	19	**0.0**	52	23	**0.0**	**0.0**

For sulfur dioxide, 85% of the NAAQS is 63.75 ppb. The sulfur dioxide sites in this analysis all had a ranking of 0.0. The site with the highest three-year average of SO_2 was the Augusta site's 2020-2022 value of 56 ppb, which is about 75% of the standard. All the sites have the lowest ranking of 0.0 with this type of analysis. The following graphs display the amount of deviation from the standard of 75 ppb, with the absolute value of the 99th percentile of the 1-hour daily maximum concentrations, averaged for three years, as shown in the above table. Again, the '0' in these graphs represent the 75 ppb standard. All the concentrations are well below the standard.


SO2 Design Value Deviation from the NAAQS (2019-2021)
2019-2021 DV Deviation from NAAQS (ppb)
80
60
40
20
0
73
73
71
49
20
20
Macon-Forestry
South DeKalb
United Ave
Savannah-E. Pres. St.
Augusta
Savannah-L&A


SO2 Design Value Deviation from the NAAQS (2020-2022)
2020-2022 DV Deviation from NAAQS (ppb)
80
60
40
20
0
73
73
71
49
20
20
Macon-Forestry
South DeKalb
United Ave
Savannah-E. Pres. St.
Augusta
Savannah-L&A

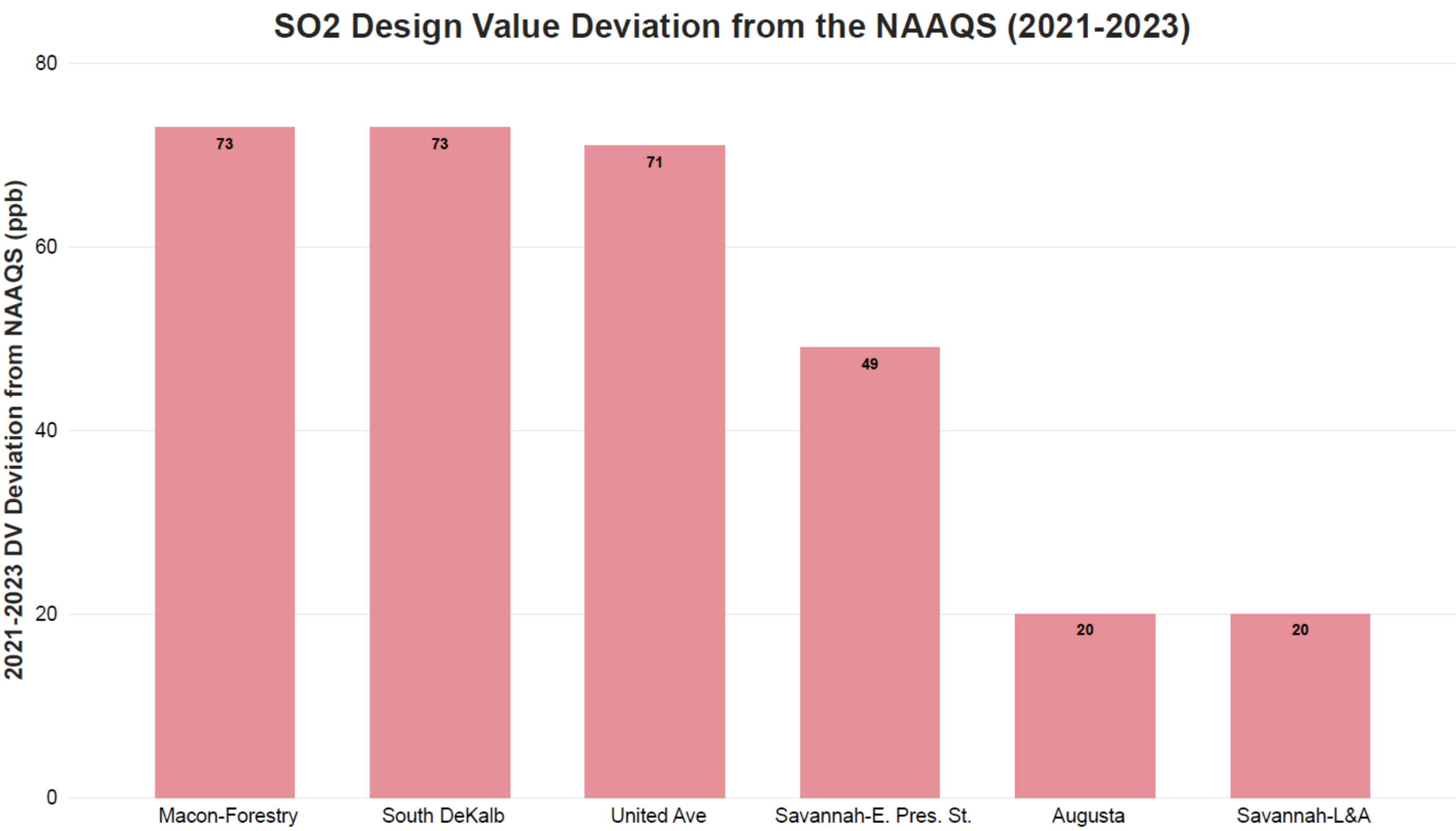


Figure 8.7: Sulfur Dioxide Deviation from the NAAQS (Absolute Value)

The following map reflects the deviation from the 2021-2023 SO_2 NAAQS with normalized values. The lighter colors have less deviation from the NAAQS that correlate with the above graph. For instance, the Augusta and Savannah-L&A SO_2 monitor have a 0 ranking, and a white circles on the map. The darker colors have the most deviation from the NAAQS, and an example is the Macon-Forestry SO_2 monitor with a larger deviation from the NAAQS and a darker color purple on the map.

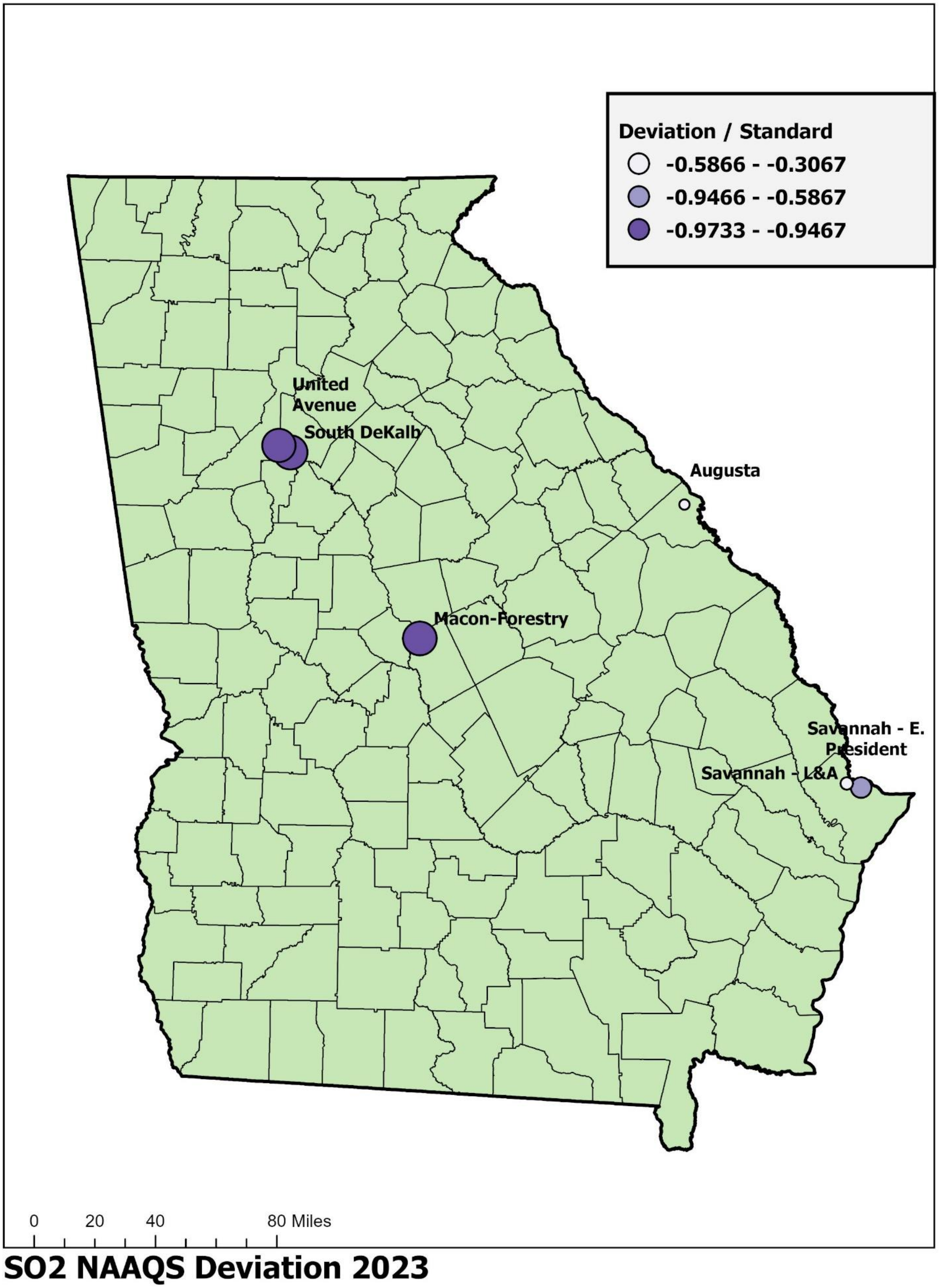


Figure 8.8. SO_2 **Deviation from the NAAQS 2023**

8.5 Lead

For the criteria lead, the NAAQS is 0.15 µg/m^3 maximum, for a rolling three-month average, for a three-year period. GA AAMP had two sites that collected criteria lead data, although both were shutdown by March 31, 2021. Both samplers were located in Muscogee County, at the Allied and Cusseta Elementary sites in Columbus. The following table displays the maximum quarterly averages for both sites from 2019 until their shutdown (7/26/2020 for Columbus-Cusseta and 3/31/2021 for Columbus-Allied). The ranking system for lead is similar to the system used for the $PM_{2.5}$ annual standard (above). For a standard of 0.15 µg/m^3, a range of 0.14 to 0.16 µg/m^3 was ranked with a 1.0. The approximately ±85% threshold of 0.13 µg/m^3 up to 0.14 µg/m^3 was ranked 0.5, and 0.160 to 0.17 µg/m^3 would be ranked 0.5. Values less than 0.13 µg/m^3 and greater than 0.17 µg/m^3 would have a rank of 0.0.

Table 8.5: Lead Values and Ranking

Lead 1st Max, 3-month rolling avg, 0.15 µg/m^3										
Site	**2019**	**Absolute Value from NAAQS**	**Rank**	**2020**	**Absolute Value from NAAQS**	**Rank**	**2021**	**Absolute Value from NAAQS**	**Rank**	**Total Ranking**
Columbus-Allied[1]	0.02	0.13	**0.0**	0.01	0.14	**0.0**	0.01	0.14	**0.0**	**0.0**
Columbus-Cusseta[2]	0.01	0.14	**0.0**	0.00	0.15	**0.0**	-	-	-	**0.0**

[1]Columbus-Allied lead site was shut down on 3/31/2021
[2]Columbus-Cusseta lead site was shut down on 7/26/2020

All sites had a ranking of 0.0 with the binning method since all of the concentrations were outside the approximately ±85% threshold of the standard of 0.15 µg/m^3 (less 0.13 µg/m^3 and greater than 0.17 µg/m^3). The following graph displays the three-month rolling averages of the two lead sites in Columbus. The averages are compared to the standard, shown with a red line, and the actual values are shown instead of absolute values. Due to low lead concentrations well below the standard, these sites were shut down.

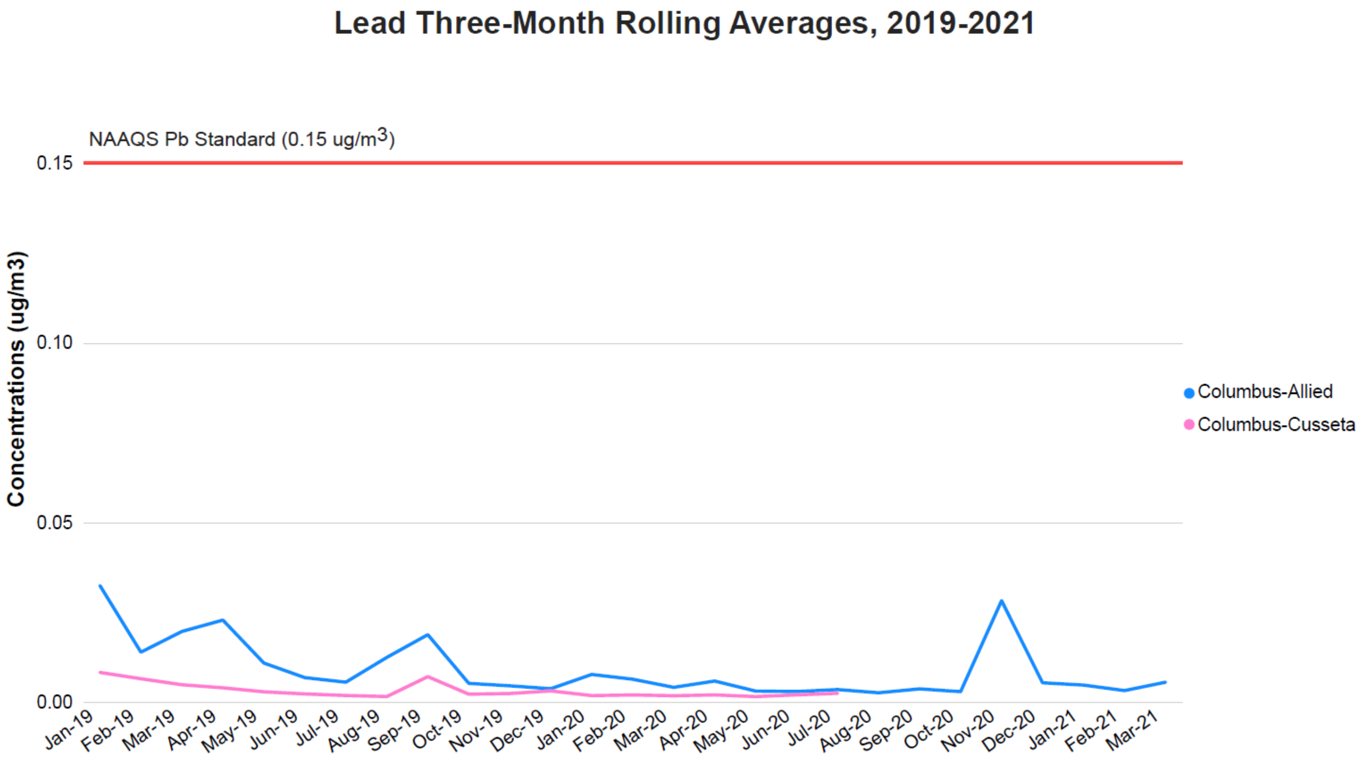


Figure 8.9: Lead Deviation from the NAAQS

The following map reflects the deviation from the 2019-2021 lead NAAQS with normalized values. The lighter colors have less deviation from the NAAQS that correlate with the above graph. In this case, the Columbus-Allied lead monitor is closest to the NAAQS, and a white circle on the map. The darker colors have the most deviation from the NAAQS, and in this case, the Columbus-Allied lead monitor has the larger deviation from the NAAQS and a purple color on the map.

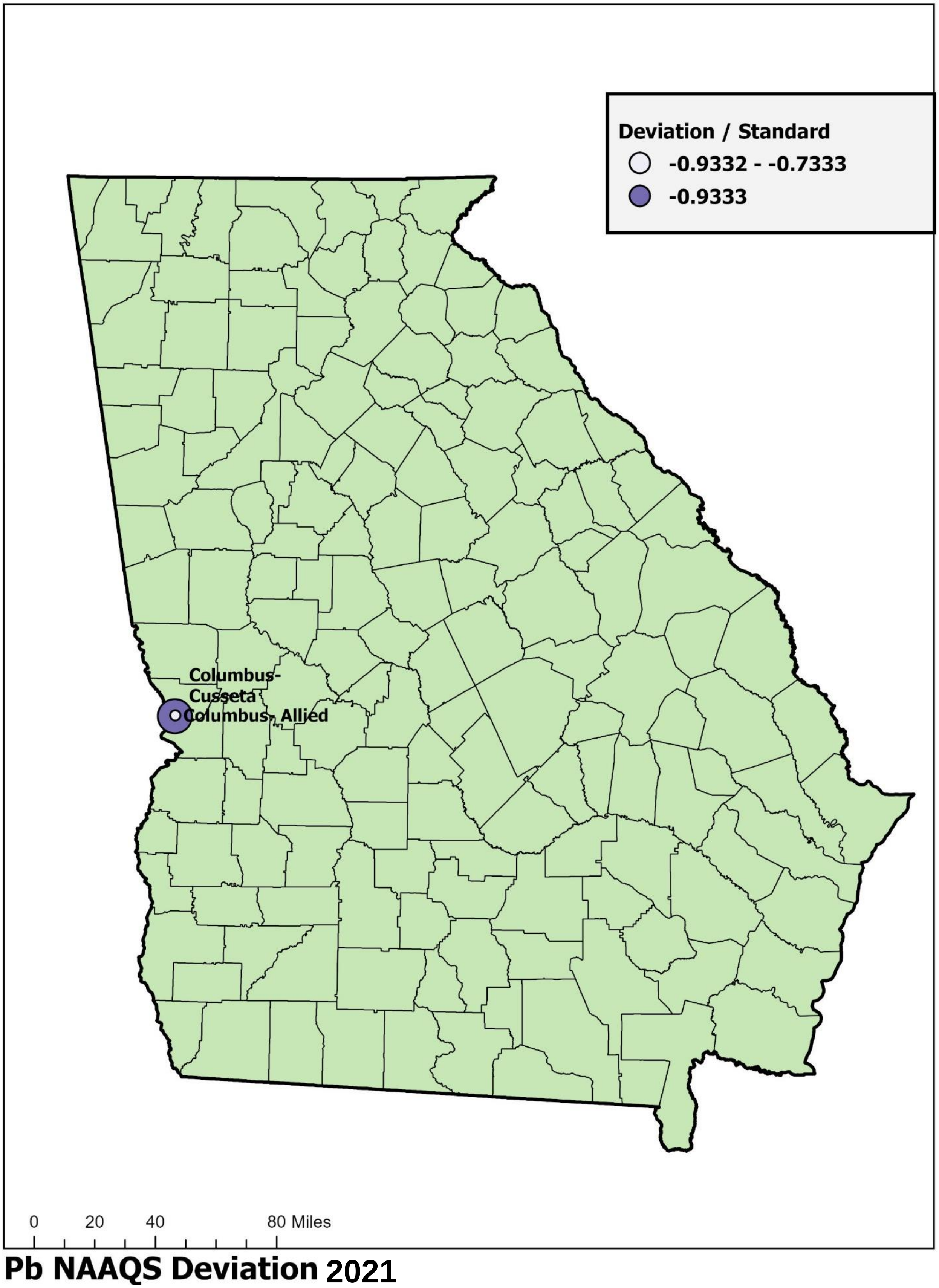


Figure 8.9. Lead Deviation from the NAAQS 2021

8.6 PM_{10}

For PM_{10}, the NAAQS compares the highest 24-hour concentration to 150 µg/m^3. The standard of 150 µg/m^3 is not to be exceeded more than once per year on average over three years. For a comprehensive look at the data, five years of the highest maximum concentrations were examined. As of 2023, GA AAMP operates three PM_{10} monitors, located at the South DeKalb, Fire Station #8, and Augusta sites. The same evaluation and ranking technique was used on the PM_{10} data, as was used with the ozone and $PM_{2.5}$ data explained above. For a standard of 150 µg/m^3, a range of 145 to 154.9 µg/m^3 was ranked with a 1.0. The ±85% threshold of 127.5 µg/m^3 up to 144.9 µg/m^3 was ranked 0.5, and 155 to 172.5 µg/m^3 would be ranked 0.5. Values outside of 127.4 µg/m^3 and 172.6 µg/m^3 would have a rank of 0.0. All the PM_{10} sites have a rank of 0.

Table 8.6: PM_{10} Values and Ranking

PM_{10} 1st Max, 150 µg/m^3	**Deviation from the NAAQS**															
Site	**2019**	**Absolute Value from NAAQS**	**Rank**	**2020**	**Absolute Value from NAAQS**	**Rank**	**2021**	**Absolute Value from NAAQS**	**Rank**	**2022**	**Absolute Value from NAAQS**	**Rank**	**2023**	**Absolute Value from NAAQS**	**Rank**	**Total Rank**
South DeKalb	42	108	**0.0**	79	71	**0.0**	44	106	**0.0**	49	101	**0.0**	67	83	**0.0**	**0.0**
Fire Station #8	30	120	**0.0**	51	99	**0.0**	44	106	**0.0**	53	97	**0.0**	55	95	**0.0**	**0.0**
Augusta	29	121	**0.0**	73	77	**0.0**	61	89	**0.0**	47	103	**0.0**	47	103	**0.0**	**0.0**

The following graph displays the first maximum PM_{10} data shown in the table above for the three sites from 2019 to 2023. Since all the data is significantly below or above the standard, this data is not shown as an absolute value, but the actual value as it compares to the standard (shown with red line). On average, all three sites have yearly maximum concentrations at least 70 µg/m^3 below the standard.

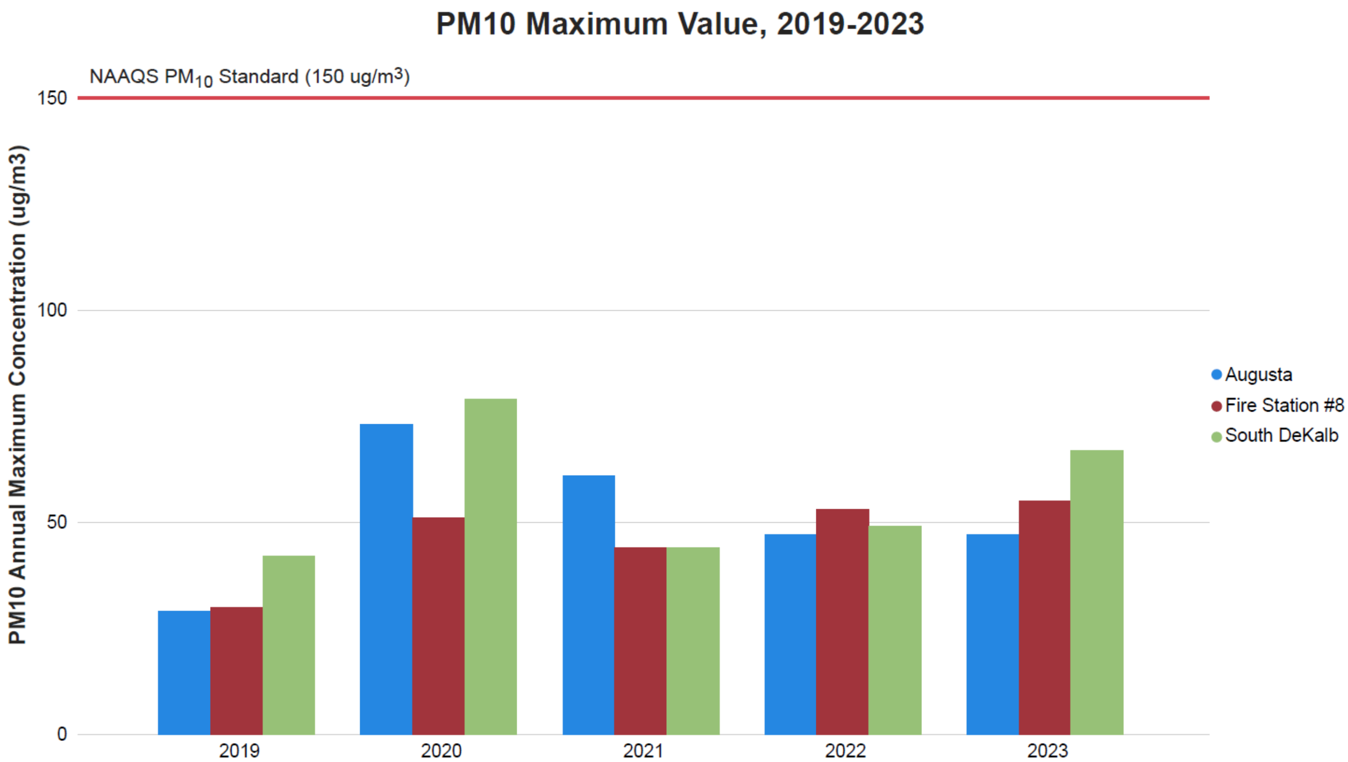


Figure 8.10: PM_{10} Deviation from the NAAQS

The following map reflects the deviation from the 2021-2023 PM_{10} NAAQS with normalized values. The lighter colors have less deviation from the NAAQS that correlate with the above graph. For instance, the South DeKalb PM_{10} monitor has a 0 ranking, and a white circle on the map. The darker colors have the most deviation from the NAAQS, and an example is the Augusta PM_{10} monitor with a larger deviation from the NAAQS and a darker color purple on the map.

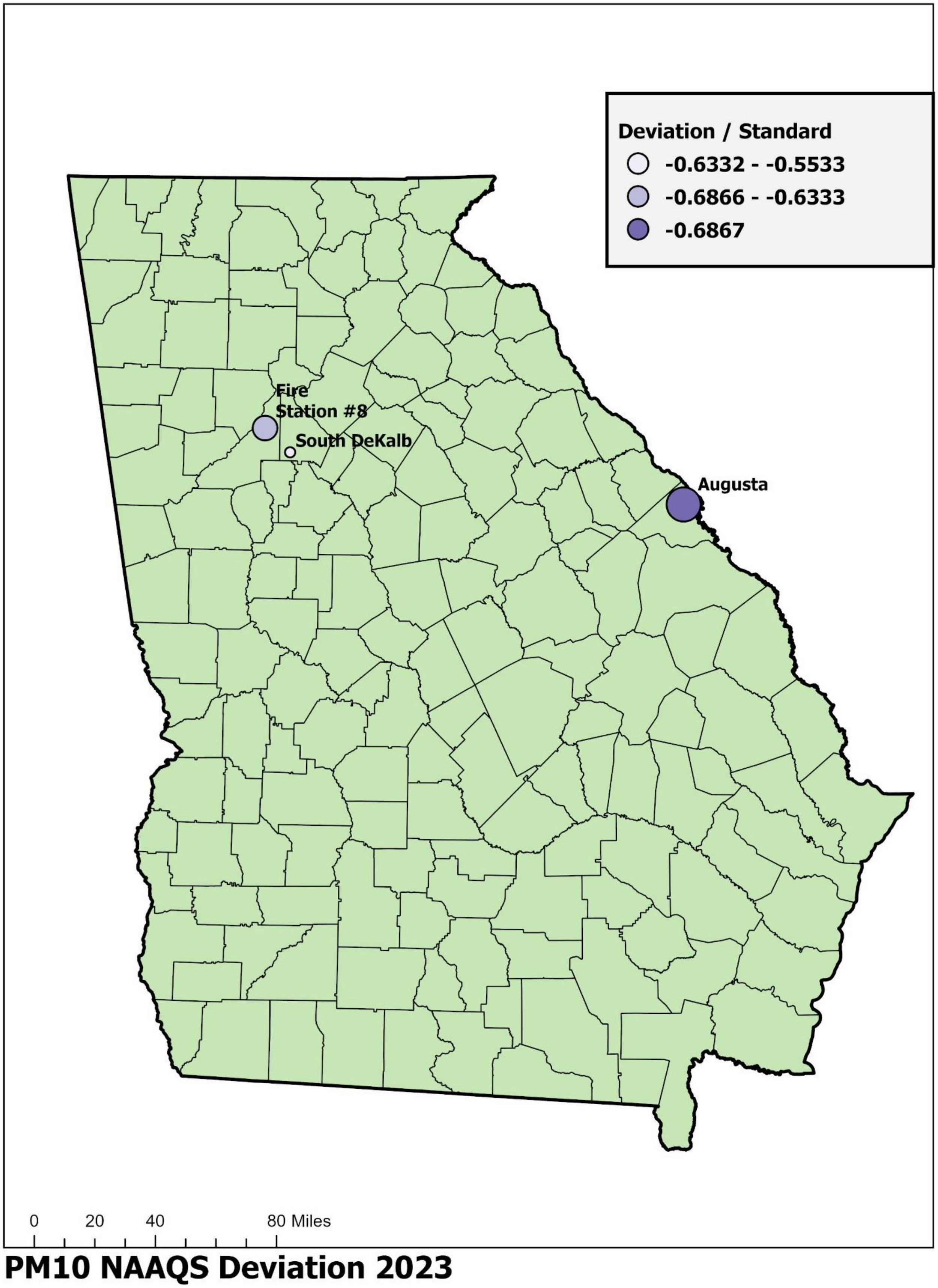


Figure 8.11. PM_{10} Deviation from the NAAQS 2023

8.7 Nitrogen Dioxide

With the nitrogen dioxide (NO_2) samplers, there are two forms of the standard. One design value is calculated as a three-year average of the 98th percentile of daily one-hour maximums. The three-year average of the 1-hour standard is 100 ppb. The other design value is an annual average that is compared to 53 ppb. All three sites that were collecting data in 2023 had both design values well below these standards. The following tables and graphs display these values. Since all the data is significantly below the standard, the data in the graphs are not shown as an absolute value, but the actual value as it compares to the standard (shown with red line).

Table 8.7: Nitrogen Dioxide 1-Hr Design Values and Ranking

NO_2 98th Percentile of daily 1-hr maxes, 100 ppb	Deviation from the NAAQS									
Site	**2019-2021**	**Absolute Value from NAAQS**	**Rank**	**2020-2022**	**Absolute Value from NAAQS**	**Rank**	**2021-2023**	**Absolute Value from NAAQS**	**Rank**	**Total Ranking**
South DeKalb	45.3	54.7	**0**	51.6	48.4	**0**	43.7	56.3	**0**	**0**
NR-285	49.9	50.1	**0**	51.1	48.9	**0**	48.1	51.9	**0**	**0**
NR-GA Tech	45.7	54.3	**0**	44.0	56.0	**0**	45.0	55.0	**0**	**0**

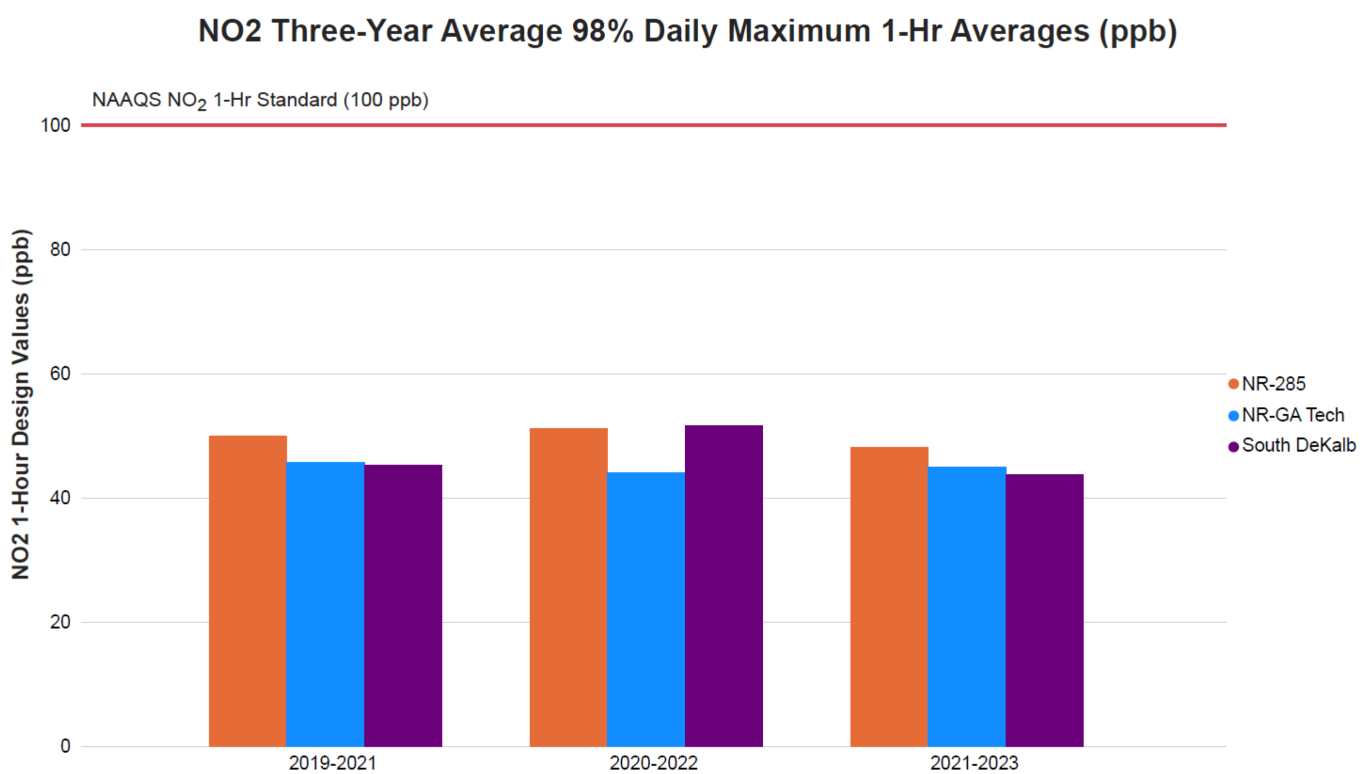


Figure 8.12: Nitrogen Dioxide Deviation from the NAAQS for 1-Hour Standard

The following map reflects the deviation from the 2021-2023 NO_2 1-hour NAAQS with normalized values. All of the values are very close in range. The lighter colors have slightly less deviation from the NAAQS that correlate with the above graph. For instance, the NR-285 NO_2 monitor has a white circle on the map. The darker colors have the slightly more deviation from the NAAQS, and an example is the South DeKalb NO_2 monitor with a slightly larger deviation from the NAAQS and a darker color purple on the map.

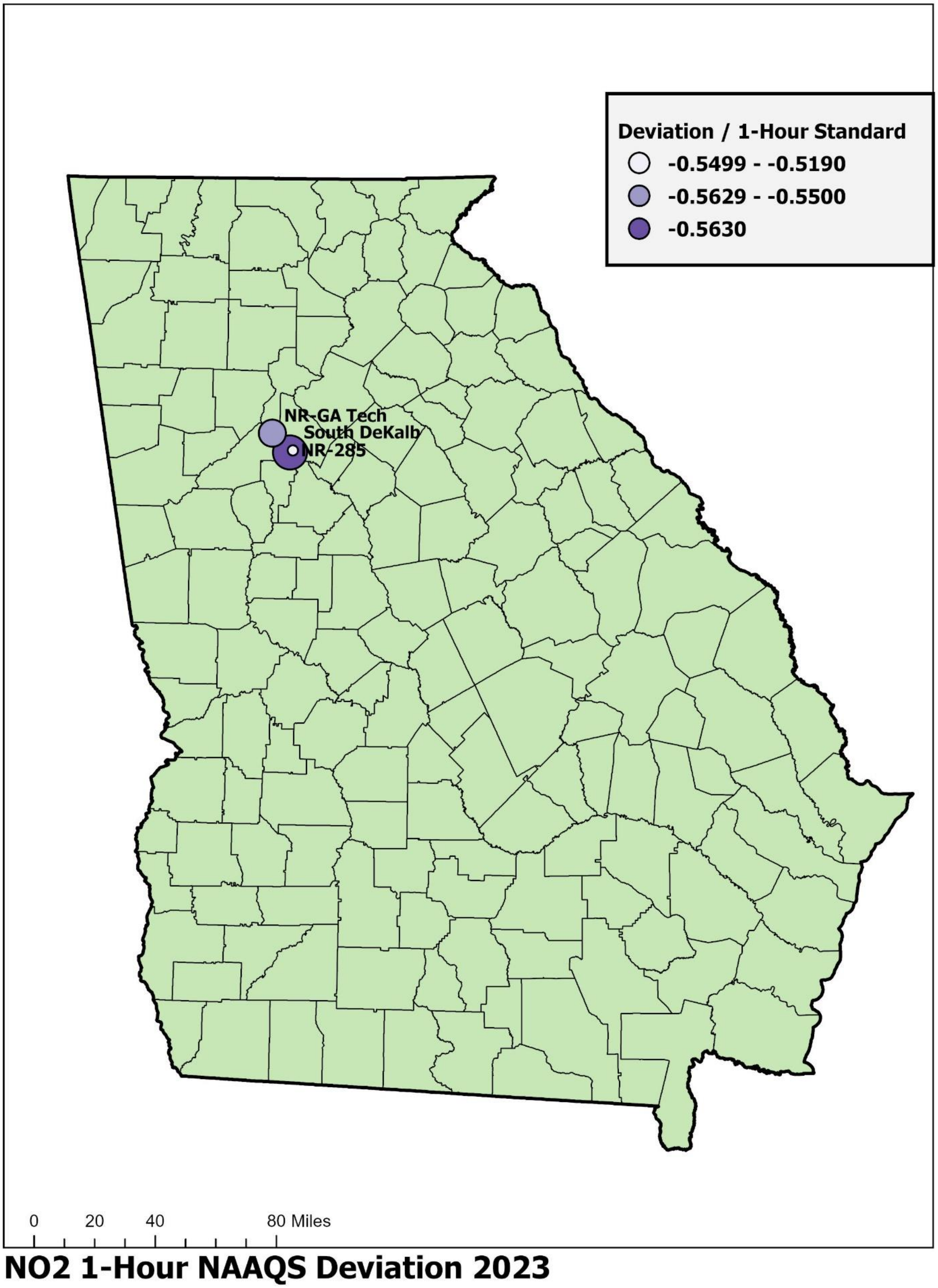


Figure 8.13: NO_2 Deviation from the 1-Hour NAAQS 2023

The nitrogen dioxide sites would rank equally in this analysis. With the binning method, all sites would rank '0', with concentrations less than 85% of the standard of 53 ppb. The following table and graph display the annual averages and how those values compare to the standard, which is shown with a red line. Since all the data is significantly below the standard, this data is not shown as an absolute value, but the actual value as it compares to the standard (shown with red line).

Table 8.8: Nitrogen Dioxide Annual Design Values and Ranking

NO_2 Annual, 53 ppb	Deviation from the NAAQS										
Site	2019	Rank	2020	Rank	2021	Rank	2022	Rank	2023	Rank	Total Ranking
South DeKalb	9.39	**0**	7.52	**0**	8.16	**0**	8.83	**0**	9.11	**0**	**0**
NR-285	15.04	**0**	13.97	**0**	14.15	**0**	15.28	**0**	15.07	**0**	**0**
NR-GA Tech	16.23	**0**	15.51	**0**	17.00	**0**	15.78	**0**	15.16	**0**	**0**

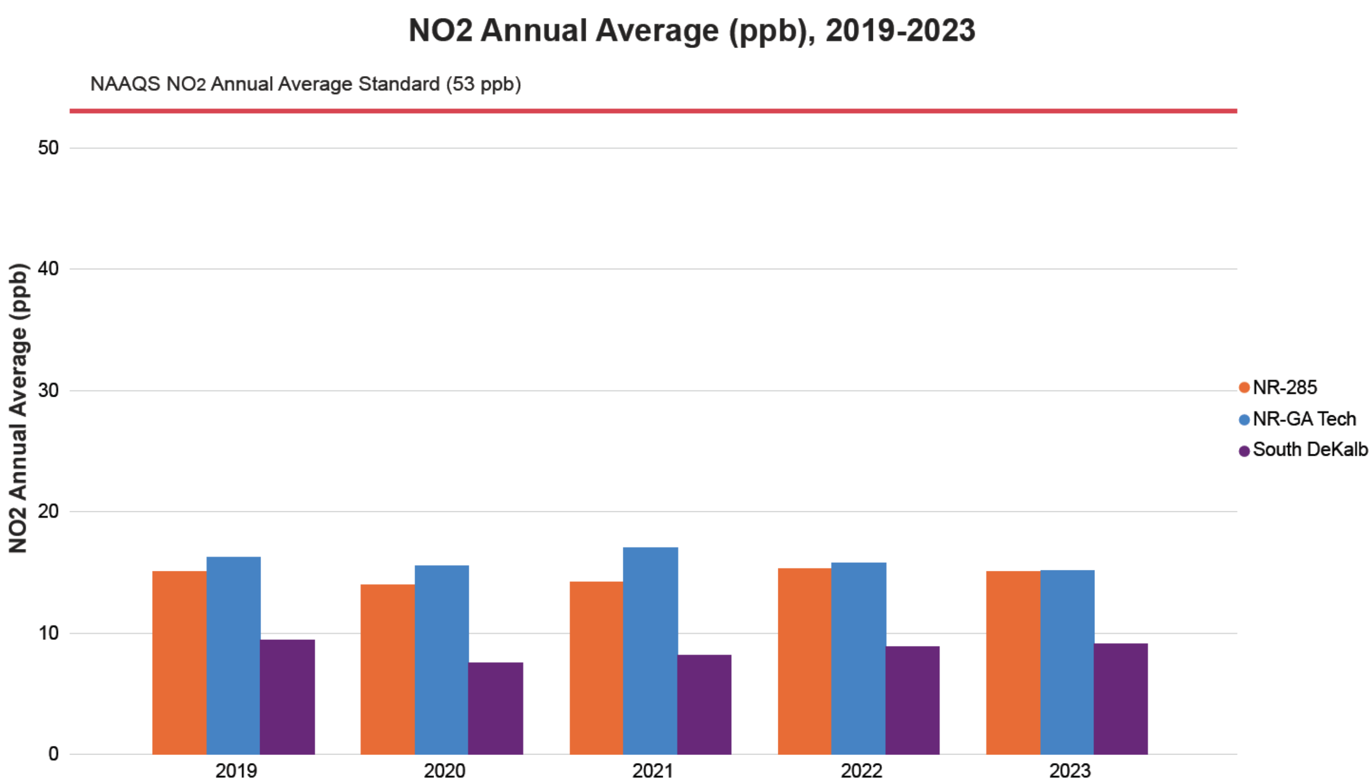


Figure 8.14: Nitrogen Dioxide Deviation from the NAAQS for Annual Standard

The following map reflects the deviation from the 2021-2023 NO_2 annual NAAQS with normalized values. The lighter colors have less deviation from the NAAQS that correlate with the above graph. For instance, the NR-285 NO_2 monitor has a the lowest ranking, and a white circle on the map. The darker colors have the most deviation from the NAAQS, and an example is the South DeKalb NO_2 monitor with a larger deviation from the NAAQS and a darker color purple on the map.

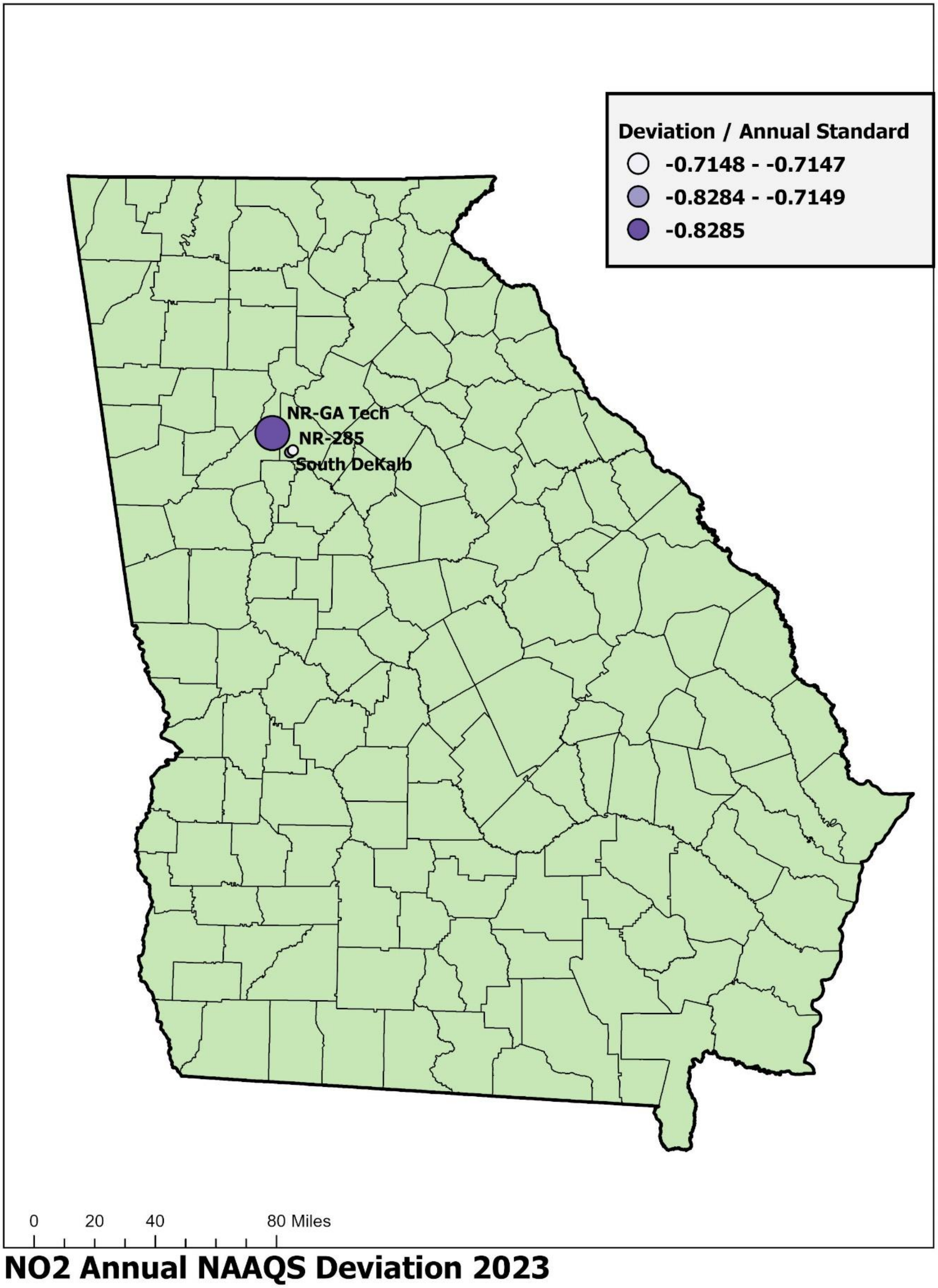


Figure 8.15: NO_2 Deviation from the Annual NAAQS 2023

8.8 Carbon Monoxide

For the carbon monoxide (CO) data analysis, both sites that were sampling carbon monoxide data through 2023 were examined. The two sites collecting carbon monoxide data are the South DeKalb site and the NR-GA Tech site. The carbon monoxide data collected for several years has been consistently below the standard. The following tables display the first maximum values for the 1-hour and 8-hour samples for 2019 through 2023. Eighty-five percent of the 1-hr standard is 29.75 ppm, and 85% of the 8-hour standard is 7.65 ppm. Since all the data is significantly below the standard, this data is not shown as an absolute value in the following graphs, but the actual value as it compares to the standard (shown with red line in graph below).

With the binning method, both sites would rank ‘0’ since they have concentrations less than 85% of the standard of 35 ppm for the 1-hour standard. Both the South DeKalb and NR-GA Tech sites have averages significantly lower than the standards. The following table and graph display the highest 1-hour averages and how those values compare to the standard, which is shown with a red line. Since all the data is significantly below the standard, this data is not shown as an absolute value, but the actual value as it compares to the standard (shown with red line).

Table 8.9: Carbon Monoxide 1-Hour Values and Rankings

CO 1-hour, 35 ppm	Deviation from the NAAQS										
Site	**2019**	**Rank**	**2020**	**Rank**	**2021**	**Rank**	**2022**	**Rank**	**2023**	**Rank**	**Total Ranking**
South DeKalb	1.50	**0**	1.65	**0**	1.65	**0**	1.54	**0**	1.30	**0**	**0**
NR-GA Tech	2.3	**0**	2.5	**0**	2.1	**0**	2.0	**0**	2.0	**0**	**0**

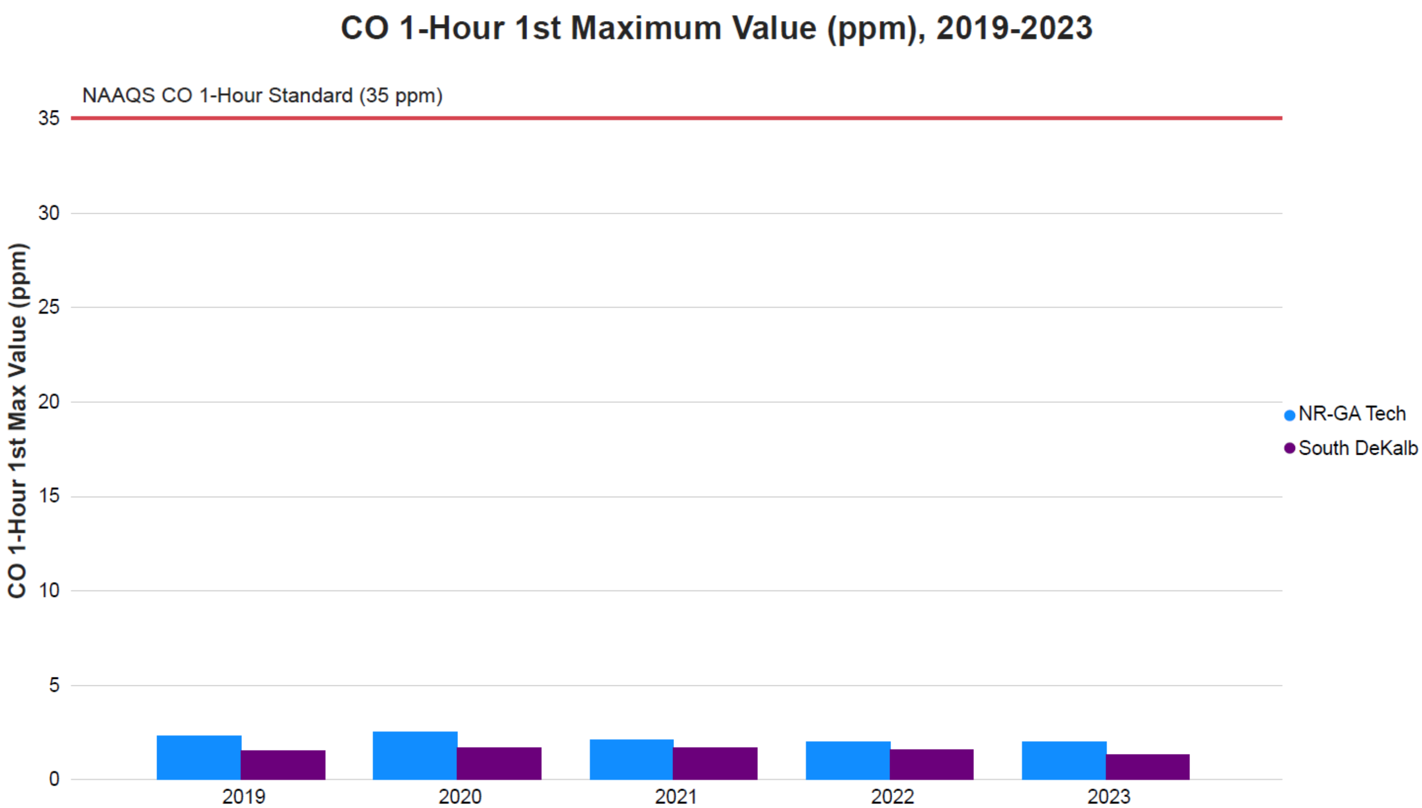


Figure 8.16: Carbon Monoxide Deviation from the 1-Hour NAAQS

The following map reflects the deviation from the 2021-2023 CO 1-hour NAAQS with normalized values. The lighter colors have less deviation from the NAAQS that correlate with the above graph. For instance, the NR-GA Tech CO monitor has a 0 ranking, and a lighter colored circle on the map. The darker color of the South DeKalb CO monitor represents the most deviation from the NAAQS.

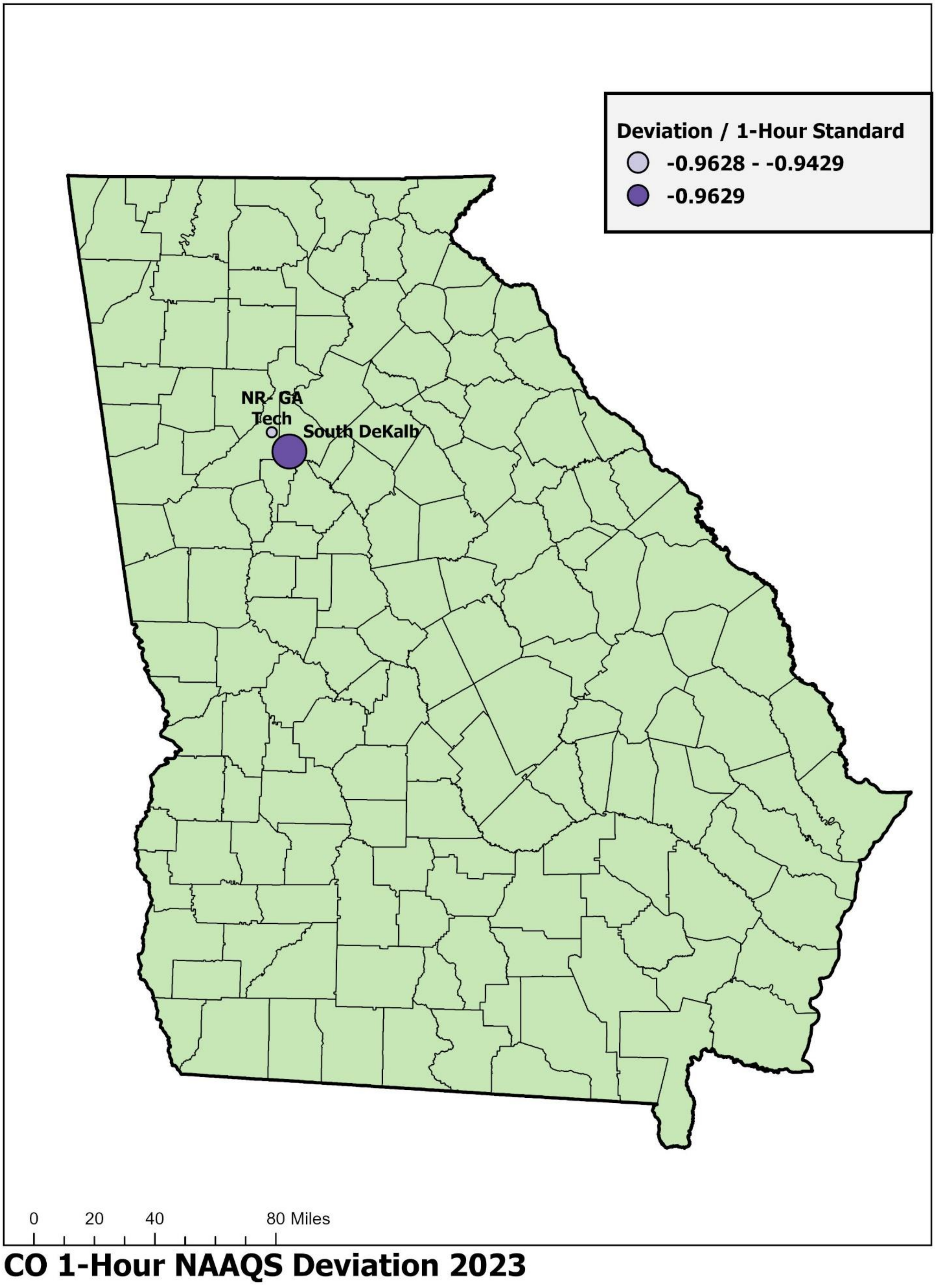


Figure 8.17: CO Deviation from the 1- Hour NAAQS 2023

With the binning method, both the South DeKalb and NR-GA Tech sites would rank ‘0’ since they have concentrations less than 85% of the standard of 9 ppm for the 8-hour. The following table and graph display the highest 8-hour averages and how those values compare to the standard, which is shown with a red line. Since all the data is significantly below the standard, this data is not shown as an absolute value, but the actual value as it compares to the standard (shown with red line).

Table 8.9: Carbon Monoxide 8-Hour Values and Rankings

CO 8-hour, 9 ppm	Deviation from the NAAQS										
Site	**2019**	**Rank**	**2020**	**Rank**	**2021**	**Rank**	**2022**	**Rank**	**2023**	**Rank**	**Total Ranking**
South DeKalb	1.3	**0**	1.5	**0**	1.3	**0**	1.1	**0**	1.2	**0**	**0**
NR-GA Tech	2.0	**0**	1.9	**0**	1.8	**0**	1.6	**0**	1.6	**0**	**0**

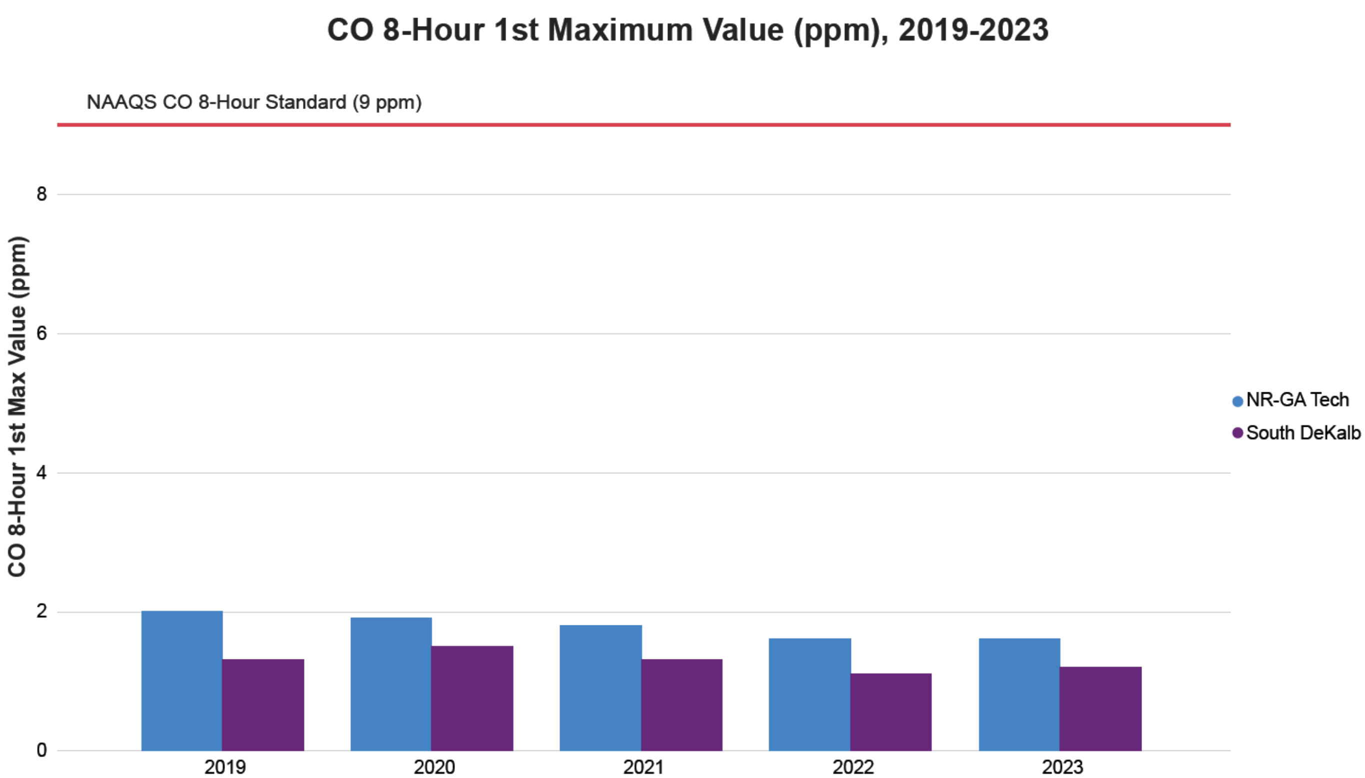


Figure 8.18: Carbon Monoxide Deviation from the 8-Hour NAAQS

The following map reflects the deviation from the 2021-2023 CO 8-hour NAAQS with normalized values. The lighter colors have less deviation from the NAAQS that correlate with the above graph. For instance, the NR-GA Tech CO monitor has a 0 ranking, and a lighter color on the map. The darker color purple of the South DeKalb CO monitor has the most deviation from the NAAQS.

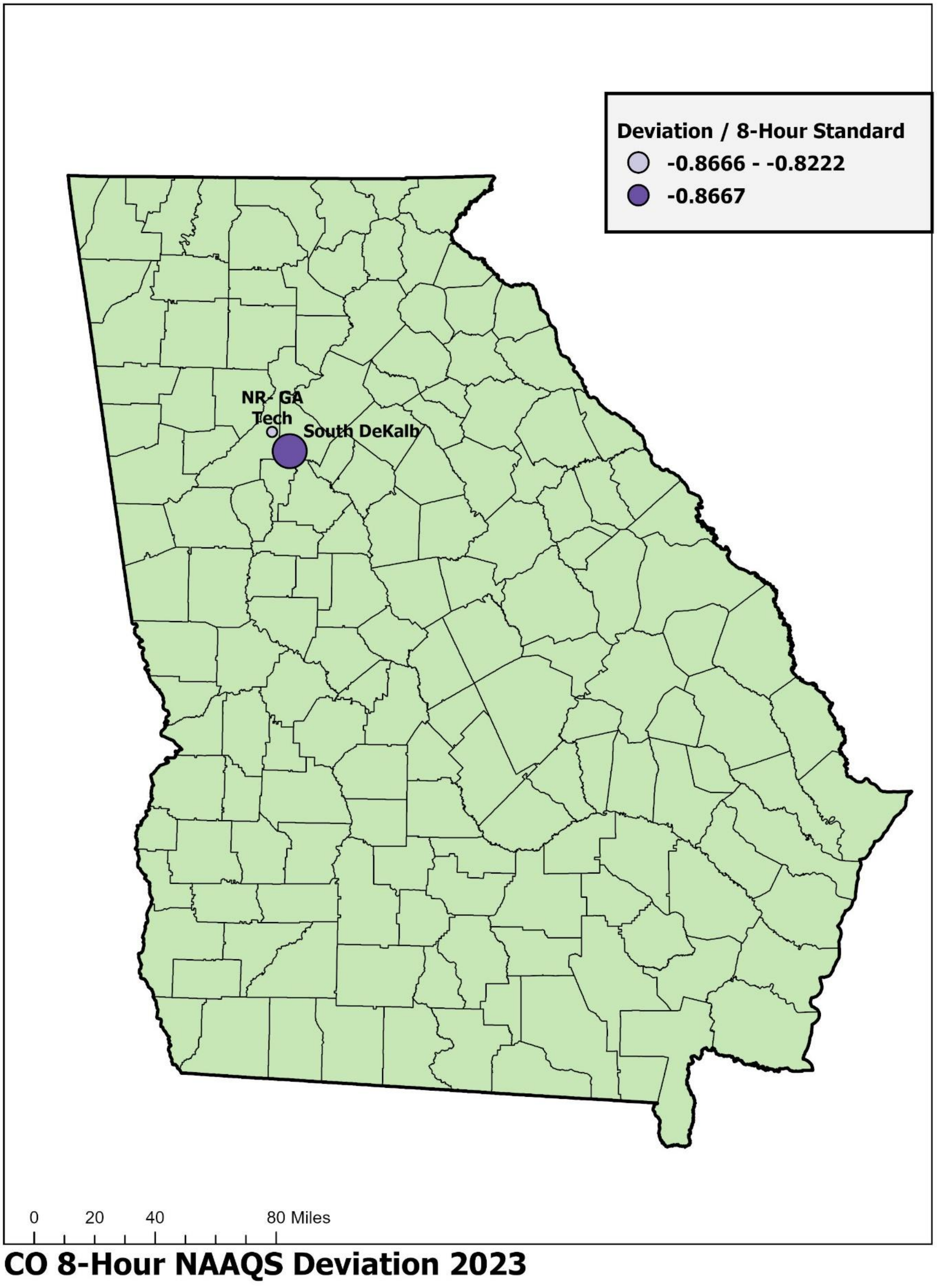


Figure 8.19: CO Deviation from the 8- Hour NAAQS 2023

8.9 Concluding Points

With the Deviation from the NAAQS assessment, the pollutants that have averages at the NAAQS levels have the highest rankings. Therefore, the sites that monitor ozone and $PM_{2.5}$ show the most value. Although sites that monitor SO_2, PM_{10}, lead, CO and NO_2 are required by EPA, these sites would have less value when comparing to the NAAQS. Therefore, those sites with concentrations far below the NAAQS for several years could be recommended for elimination. Table 8.9 sums the ranks of each pollutant monitored for each site. The South DeKalb and Gwinnett Tech sites have the highest total rank (2.5) while there are 6 sites with the lowest rank (0.0). Please note that the NR-GA Tech site does not have a ranking for $PM_{2.5}$ Annual as this site is not compared to the $PM_{2.5}$ annual standard. According to this analysis, there are many sites that could be recommended for elimination as they have had concentrations consistently below the NAAQS for several years (2019-2023).

Table 8.9: Summary Table Showing Total Rank for Each Site

	$PM_{2.5}$ Annual	$PM_{2.5}$ 24-Hour	Ozone	SO_2	Lead	PM_{10}	NO_2 1-hour	NO_2 Annual	CO 1-hour	CO 8-hour	Total Rank
South DeKalb	**1.0**	**0.0**	**1.5**	**0.0**		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.5**
Gwinnett Tech	**1.0**	**0.0**	**1.5**								**2.5**
Augusta	**0.5**	**0.0**	**1.5**	**0.0**		**0.0**					**2.0**
CASTNET			**1.0**								**1.0**
Savannah-E Pres St			**0.0**	**0.0**							**0.0**
Athens	**1.0**	**0.0**	**0.5**								**1.5**
Columbus-Airport	**1.0**	**0.0**	**0.5**								**1.5**
Kennesaw	**1.0**	**0.0**	**1.5**								**1.5**
Macon-Forestry	**0.5**	**0.0**	**1.0**	**0.0**							**1.5**
Forest Park	**1.0**	**0.0**									**1.0**
Albany	**1.0**	**0.0**									**1.0**
Douglasville			**1.5**								**1.5**
United Ave			**2.0**	**0.0**							**2.0**
McDonough			**1.5**								**1.5**
Conyers			**1.5**								**1.5**
Macon-Allied	**1.0**	**0.0**									**1.0**
Savannah-L&A	**1.0**	**0.0**		**0.0**							**1.0**
Summerville			**0.5**								**0.5**
Fire Station #8	**1.0**	**0.0**				**0.0**					**1.0**
Valdosta	**1.0**	**0.0**									**1.0**
Columbus-Cusseta					**0.0**						**0.0**
Sandersville	**0.5**	**0.0**									**0.5**
Evans			**0.0**								**0.0**

	$PM_{2.5}$ Annual	$PM_{2.5}$ 24-Hour	Ozone	SO_2	Lead	PM_{10}	NO_2 1-hour	NO_2 Annual	CO 1-hour	CO 8-hour	Total Rank
Dawsonville			1.0								1.0
Fort Mountain			1.5								1.5
Gainesville	0.5	0.0									0.5
Leslie			0.5								0.5
Brunswick	0.5	0.0	0.0								0.5
Warner Robins	1.0	0.0									1.0
Rossville-Williams St.	1.0	0.0									1.0
Columbus-Allied					0.0						0.0
General Coffee	0.0	0.0									0.0
NR-GA Tech		0.0					0.0	0.0	0.0	0.0	0.0
NR-285							0.0	0.0			0.0
Columbus-Baker	0.5	0.0									0.5

9.0 Number of Parameters Monitored

For the Number of Parameters Monitored Assessment type, the sites with more parameters are considered more valuable and rank higher than sites with fewer parameters. The term parameter refers to sampler in this assessment. The number of parameters measured at each site were explored and displayed a few different ways to analyze the sites. First, the percent of GA AAMP's network with the same number of parameters is shown. Then the number of sites with the same number of parameters is examined. Finally, each site is listed with the number of parameters monitored at that site. Following the graphs is a table showing the rankings of each site. The sites were ranked with a proportionate ranking, with the site with the most parameters ranking the highest. A limitation to this assessment method is that it does not "weight" the parameters, and some pollutant measurements may be more useful than others. Also, samplers such as VOC monitors, which give an array of specimens, were viewed as one parameter in this analysis. All collocated monitors were counted as an individual parameter, separate from the primary monitor.

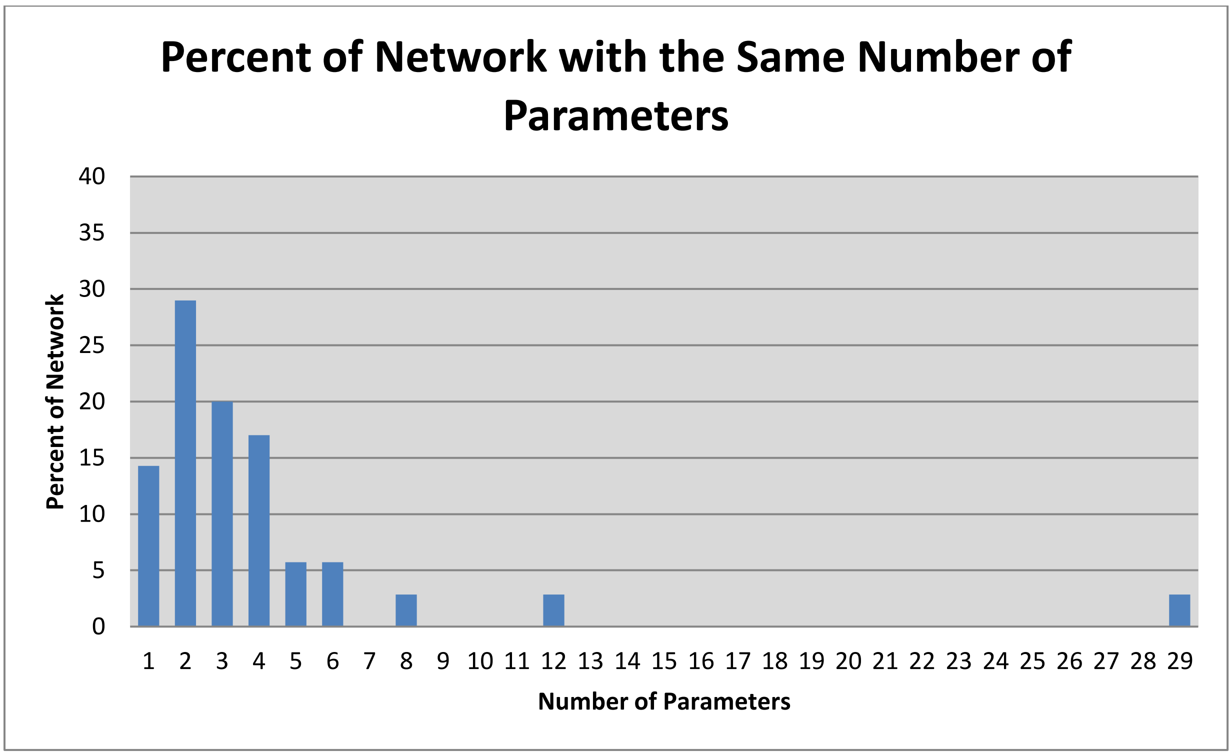


Figure 9.1: Percent of Network with Same Number of Parameters

From a percentage standpoint, most of Georgia's ambient air monitoring network monitors for less than three parameters. Fourteen percent of the ambient air monitoring sites monitor for one parameter. Two parameters are measured by twenty-nine percent of the monitoring network's sites. Twenty percent of the network's sites measure three parameters. To create more efficiency within the ambient air monitoring network, with this assessment, it would be recommended to combine sites or eliminate sites that monitor only one parameter. Sites that monitor for several parameters are more valuable for air quality analyses, creating models, and evaluating emissions. In addition, sites with several parameters are more cost-efficient.

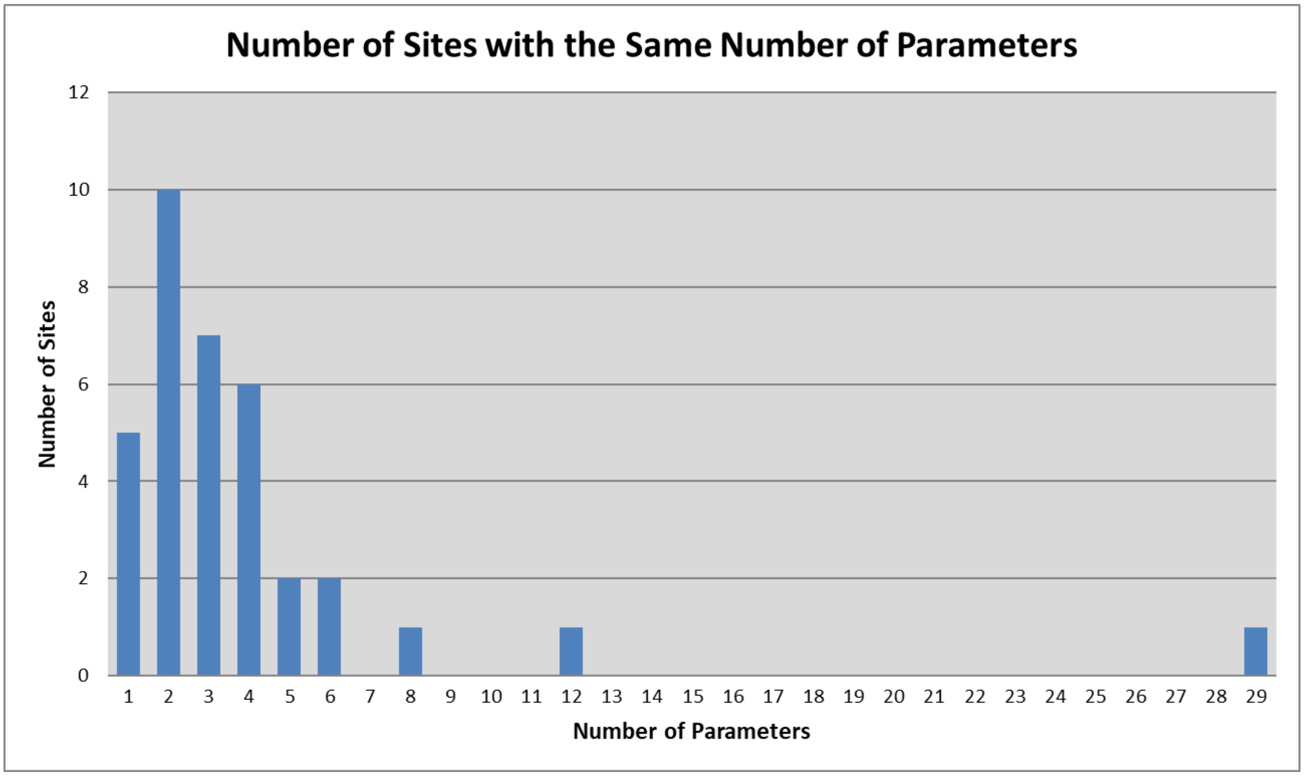


Figure 9.2: Number of Sites with the Same Number of Parameters

The above graph has the same information as shown in Figure 9.1, but is displayed differently. This display gives a different perspective, showing the actual number of sites and how many parameters are measured at each site is shown, as opposed to the percentage of the network. There are five sites that monitor only one parameter. There are ten sites that monitor two parameters. Seven sites monitor three parameters. There is one site that measures twenty-nine parameters. The following graph shows each site and how many parameters are measured at that site.

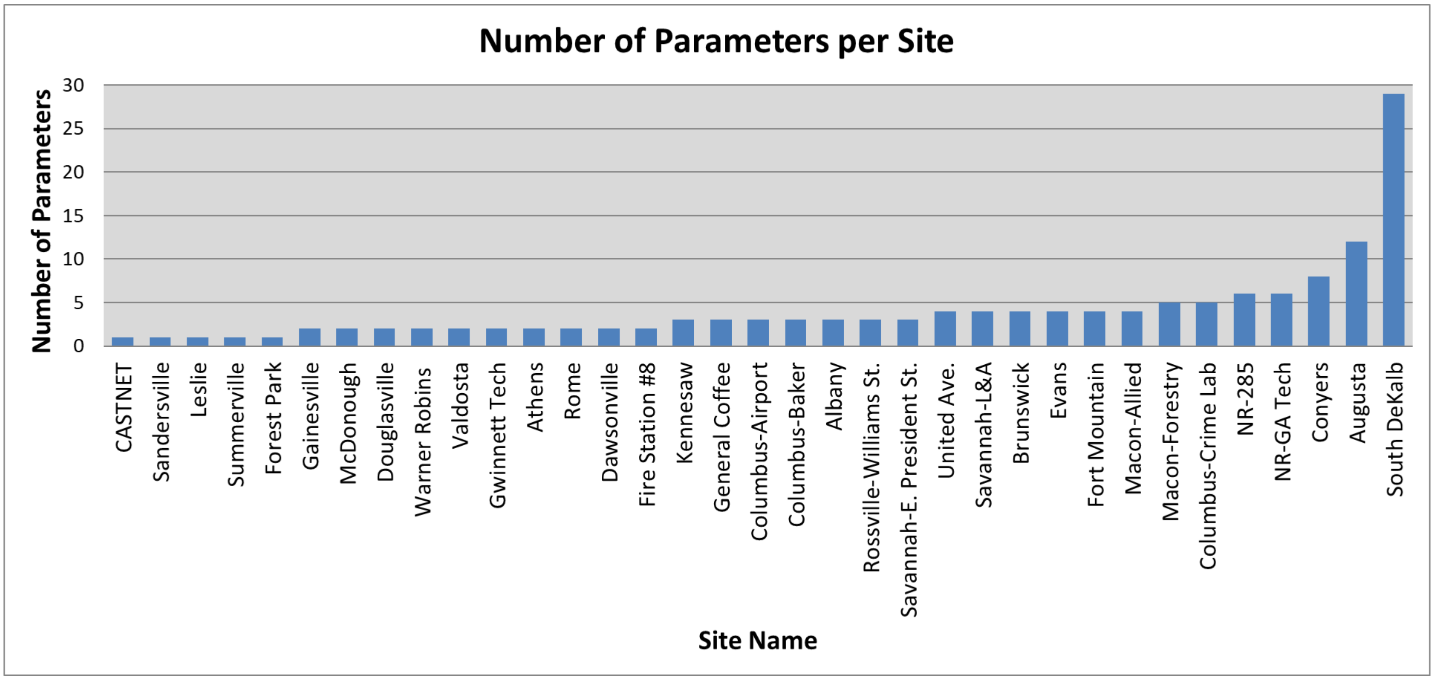


Figure 9.3: Number of Parameters per Site

Figure 9.3 is a view of the actual number of parameters monitored at each air monitoring site in the entire state of Georgia. The top-ranking sites are the South DeKalb, Augusta, and Conyers. The South DeKalb site monitors 29 parameters. The Augusta and Conyers sites measure 12 and 8 parameters respectively. In addition, the number of parameters monitored at the NR-GA Tech, NR-285 Lab, Columbus-Crime Lab, and Macon-Forestry sites range from 5 to 6 parameters. The other 28 sites monitor four or less parameters. The above information is shown in the following table with the appropriate ranking.

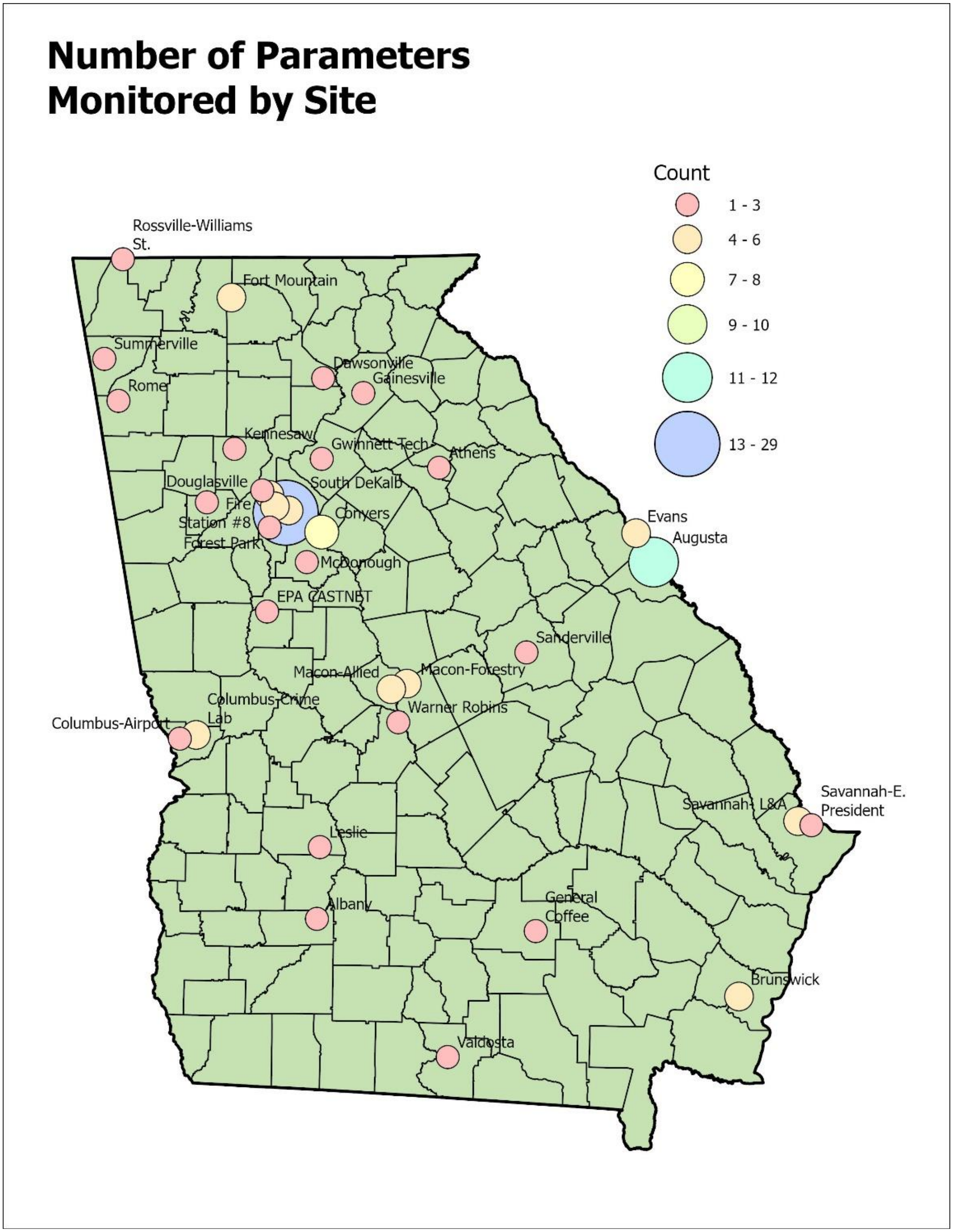


Figure 9.4: Number of Parameters Monitored by Site Map in 2019-2023

Figure 9.4 is a map created on ArcGIS that depicts where each site is located and the number of parameters monitored. The size and color of the dot corresponds to the number of parameters monitored at each site. This information displays the same information in the following table, but in map format to show where they are located.

Table 9.1: Number of Parameters Monitored per Site and Rankings

	Number of Parameters	Proportionate Ranking
South DeKalb	29	1.00
Augusta	12	0.39
Conyers	8	0.25
NR-GA Tech	6	0.18
NR-285	6	0.18
Columbus-Crime Lab	5	0.14
Macon-Forestry	5	0.14
Macon-Allied	4	0.11
Fort Mountain	4	0.11
Evans	4	0.11
Brunswick	4	0.11
Savannah-L&A	4	0.11
United Ave.	4	0.11
Savannah-E.President St.	3	0.07
Rossville-Williams St.	3	0.07
Albany	3	0.07
Columbus-Baker	3	0.07
Columbus-Airport	3	0.07
General Coffee	3	0.07
Kennesaw	3	0.07
Fire Station #8	2	0.04
Dawsonville	2	0.04
Rome	2	0.04
Athens	2	0.04
Gwinnett Tech	2	0.04
Valdosta	2	0.04
Warner Robins	2	0.04
Douglasville	2	0.04
McDonough	2	0.04
Gainesville	2	0.04
Forest Park	1	0.00
Summerville	1	0.00

	Number of Parameters	Proportionate Ranking
Leslie	1	0.00
Sandersville	1	0.00
CASTNET	1	0.00

9.1 Concluding Points

With the Number of Parameters Monitored assessment, each site was examined and ranked according to how many parameters were monitored at that site as shown in Table 9.1. A large portion of sites across the state of Georgia monitor fewer than five parameters per site. One reason to perform the Number of Parameters Monitored type of assessment is to consider which sites are more cost-effective. The sites that would be most cost-effective would be the sites with the highest number of parameters monitored. These sites would include the South DeKalb, Augusta, Conyers, NR-GA Tech, and NR-285 sites. In addition, sites with more parameters monitored can aid in analyzing the data for sources, modeling of the data, and emission inventory. The sites with the smallest number of parameters monitored would have the lowest ranking. This list of sites would include the five sites that monitor only one parameter. This could be an opportunity to add more parameters to those sites or combine sites to increase the data set at one site. In addition, this could be an opportunity to eliminate single parameter sites to improve cost effectiveness. There were several sites shut down between the years 2019-2023 that were not included in this analysis since the evaluation was performed on current monitoring sites. Savannah-Mercer was shut down effective 6/30/2019, Columbus-Cusseta was shut down 7/30/2020, and Rome-Kraftsman and Columbus-Health Department sites were both shut down on 12/31/2020. Also, not included in the evaluation was Empire Blvd site which is intended to be established as a new lead monitoring site in Fulton County in 2025; therefore, it is not within the scope of this dataset.

10.0 Monitor-to- Monitor Correlations

The Monitor-to-Monitor Correlations assessment type compares concentrations of one type of monitor to concentrations of another monitor of the same type. In this analysis, $PM_{2.5}$ and ozone were used for the comparisons, and these values were obtained by EPA's NetAssess tool (EPA, 2024g). Samplers were compared within each Metropolitan Statistical Areas (MSA) that had more than one $PM_{2.5}$ or ozone monitor. The Pearson correlation coefficient (r^2) was used to determine the correlation between each monitoring pair. The Environmental Protection Agency has determined that an r^2 >0.75 suggests redundancy. The site pairs were ranked according to their r^2 values, with sites that had a higher correlation (r^2) being considered redundant.

10.1 $PM_{2.5}$

The relationship between paired sites within their respective MSA was analyzed with regression correlations. Only integrated $PM_{2.5}$ sites which are used for comparison to NAAQS were included in this analysis. These sites collect data on daily, 3-day, and 6-day schedules; therefore, the use of a weekly average was used for comparison.

A weekly average was calculated for each sampler from the years 2019 through 2023 and was used to calculate the average weekly $PM_{2.5}$ concentration for all years for each site. The r^2 between each paired site was then calculated and a rank assigned according to the r^2 value. Site pairs with an r^2 value >0.75 were given a 0, sites pairs with an r^2 value of 0.45 to 0.74 were given a 0.5, and site pairs with an r^2 value <0.44 were ranked with a 1. The distances between sites were calculated in Excel using latitude and longitude coordinates.

Tables 10.1 through 10.3 show site pairs for each MSA, the distance between the sites, the r^2 value and the rank. Figures 10.1, 10.3, and 10.5 show the $PM_{2.5}$ correlation matrix for each MSA. Figures 10.2 and 10.4 plot the r^2 and distance between for each site pair for each MSA (with greater than two sites).

Table 10.1 displays the Atlanta MSA. The Forest Park/Fire Station #8 and NR-GA Tech/Fire Station #8 pairs show the highest correlation (r^2=0.95) and was given a rank of 0. This indicates that this pair of monitors collects similar data and one could be eliminated, according to this assessment. Figure 10.1 gives a visual representation of the r^2 values in Table 10.1. Figure 10.2 plots the r^2 versus distance between each site pair. The red line indicates the 0.75 r^2 value.

Table 10.1: Atlanta MSA $PM_{2.5}$ Correlations and Rankings

Atlanta Metropolitan Statistical Area ($PM_{2.5}$)						
Site ID	**Common Name**	**Site ID**	**Common Name**	**Distance (miles)**	**R-Squared**	**Rank**
130630091	Forest Park	130670003	Kennesaw	30	0.92	0
130630091	Forest Park	130890002	South DeKalb	8	0.92	0
130630091	Forest Park	131210039	Fire Station #8	14	0.95	0
130630091	Forest Park	131210056	NR-GA Tech	12	0.94	0
130630091	Forest Park	131350002	Gwinnett Tech	30	0.86	0
130670003	Kennesaw	130890002	South DeKalb	29	0.84	0
130670003	Kennesaw	131210039	Fire Station #8	17	0.94	0
130670003	Kennesaw	131210056	NR-GA Tech	21	0.93	0
130670003	Kennesaw	131350002	Gwinnett Tech	31	0.85	0
130890002	South DeKalb	131210039	Fire Station #8	11	0.92	0
130890002	South DeKalb	131210056	NR-GA Tech	9	0.92	0
130890002	South DeKalb	131350002	Gwinnett Tech	23	0.88	0
131210039	Fire Station #8	131210056	NR-GA Tech	3	0.95	0
131210039	Fire Station #8	131350002	Gwinnett Tech	24	0.88	0
131210056	NR-GA Tech	131350002	Gwinnett Tech	22	0.89	0

	South DeKalb	*Fire Station #8*	*Gwinnett Tech*	*NR-GA Tech*	*Forest Park*	*Kennesaw*
South DeKalb	1.00					
Fire Station #8	0.92	1.00				
Gwinnett Tech	0.88	0.88	1.00			
NR-GA Tech	0.92	0.95	0.89	1.00		
Forest Park	0.92	0.95	0.86	0.94	1.00	
Kennesaw	0.84	0.94	0.85	0.93	0.92	1.00

Figure 10.1 Correlation Matrix of Atlanta MSA $PM_{2.5}$

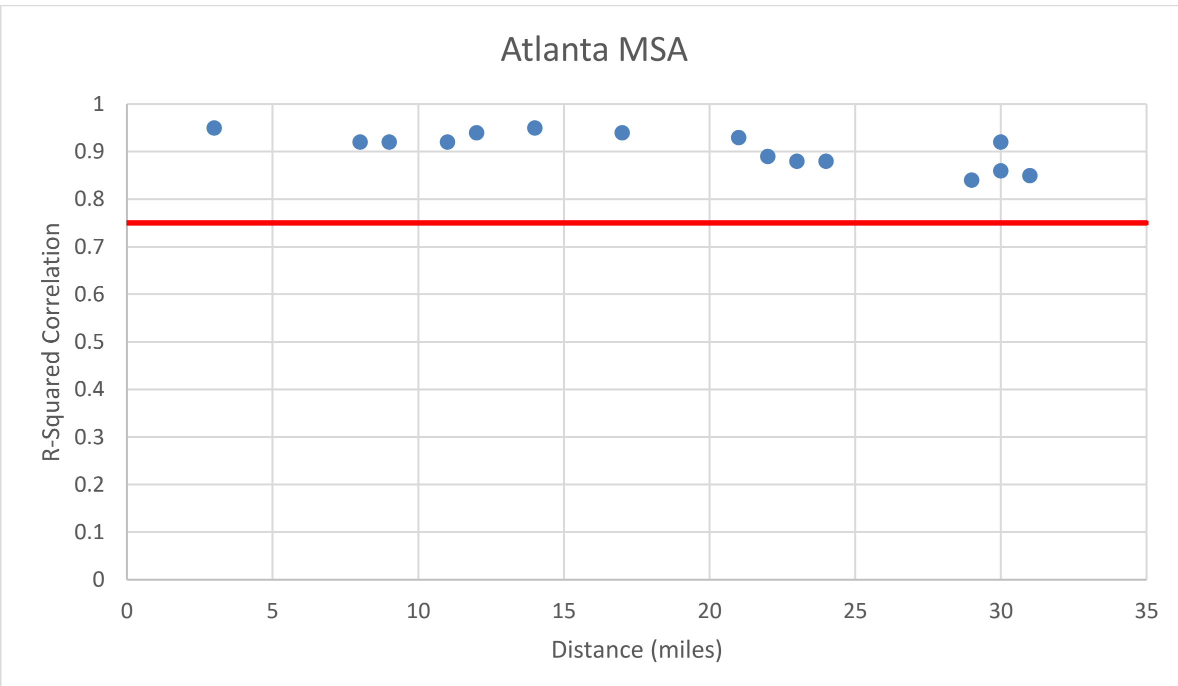


Figure 10.2: Atlanta MSA $PM_{2.5}$ Correlations

In Table 10.2, the r^2 values for and distances between the $PM_{2.5}$ monitoring pairs in the Columbus MSA are shown. All monitoring pairs have an r^2 of 0.88 or more, indicating high correlation between sites in this MSA. Figure 10.3 gives a visual representation of the r^2 values from Table 10.2. Figure 10.4 plots the r^2 versus the distances between each monitoring pair. The red line indicates the 0.75 r^2 value.

Table 10.2: Columbus MSA $PM_{2.5}$ Correlations and Rankings

Columbus Metropolitan Statistical Area $PM_{2.5}$						
Site ID	**Common Name**	**Site ID**	**Common Name**	**Distance (miles)**	**R-Squared**	**Rank**
011130003	Alabama	132150008	Columbus-Airport	7	0.90	0
011130003	Alabama	132150012	Columbus-Baker	3	0.91	0
132150008	Columbus-Airport	132150012	Columbus-Baker	6	0.88	0

	Columbus-Airport	*Columbus-Baker*	*Alabama*
Columbus-Airport	1.00		
Columbus-Baker	0.88	1.00	
Alabama	0.90	0.91	1.00

Figure 10.3: Columbus MSA $PM_{2.5}$ Correlation Matrix

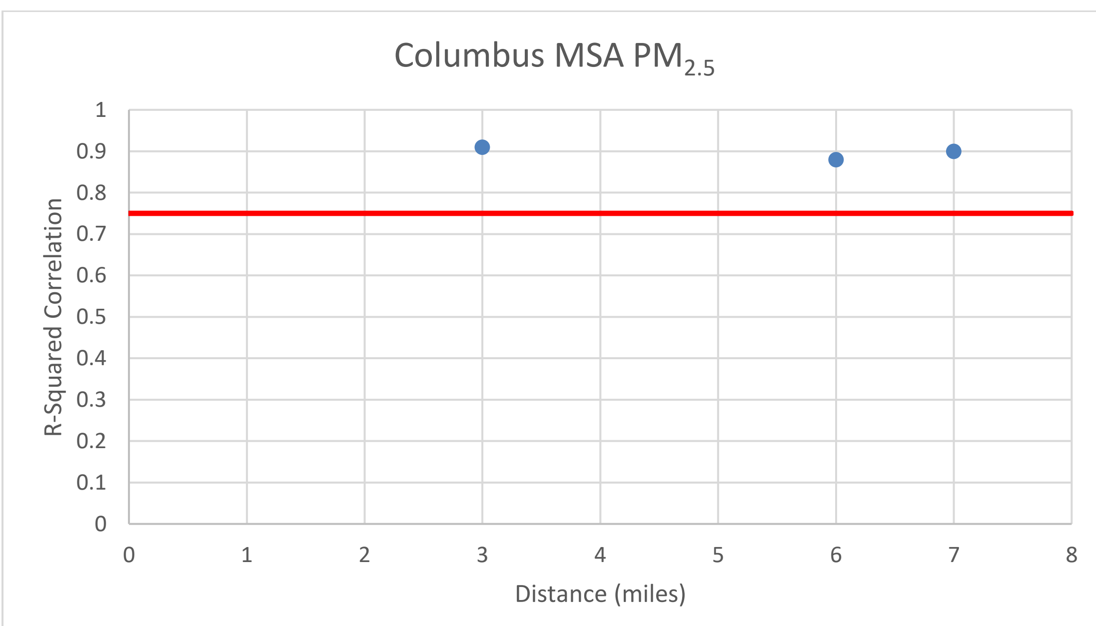


Figure 10.4: Columbus MSA $PM_{2.5}$ Correlations

Table 10.3 shows the r^2 values for the $PM_{2.5}$ samplers in the Macon MSA. The r^2 between these two monitors is 0.89 with a rank of 0. Figure 10.5 displays the correlation matrix for Macon-Forestry and Macon-Allied.

Table 10.3: Macon MSA $PM_{2.5}$ Correlations and Rankings

Macon Metropolitan Statistical Area $PM_{2.5}$						
Site ID	**Common Name**	**Site ID**	**Common Name**	**Distance (miles)**	**R-Squared**	**Rank**
130210012	Macon-Forestry	130210007	Macon-Allied	6	0.89	0

	Macon-Allied	*Macon-Forestry*
Macon-Allied	1.00	
Macon-Forestry	0.89	1.00

Figure 10.5: Macon MSA $PM_{2.5}$ Correlation Matrix

Monitors with similar data (an r^2 value of 0.75 or above) may be considered redundant. There are some sites in the Atlanta and Macon MSAs with high r^2 values meaning those sites are collecting data that is closely related. Therefore, based on this single analysis there may be justification to eliminate monitors in the $PM_{2.5}$ network based on the monitor-to-monitor correlation.

10.2 Ozone

Correlations between paired ozone sites were calculated using hourly data from 2019 through 2023. The average hourly ozone concentrations were calculated for each year for each site, and then an average of all years was calculated for each site. Sites were paired within each MSA, r^2 values were calculated for each pair, and a rank assigned according to the r^2 value.

Tables 10.4 through 10.6 show site pairs for each MSA, the distance between the sites, the r^2 value and the rank. Figures 10.6, 10.8, and 10.9 show the ozone correlation matrix for each MSA. Figure 10.7 and Figure 10.10 plot the r^2 and distance between for each site pair for the Atlanta MSA and Augusta MSA (the only MSAs with more than two ozone sites).

Table 10.4 displays the Atlanta MSA. Ozone site pairs with an r^2 >0.94 were given a rank of 0, r^2 between 0.88 and 0.94 were given a rank of 0.5 and an r^2 <0.88 was given a rank of 1. The South DeKalb/United Ave. pair show the highest correlations (r^2=0.98) and was given a rank of 0. This indicates that this pair of monitors collects similar data and one could be eliminated, according to this assessment. Figure 10.7 and Figure 10.10 give visual representations of the data from Table 10.4 and Table 10.6, respectively. The red line indicates the 0.75 r^2 value.

Table 10.4: Atlanta Ozone Correlations and Rankings

Atlanta Metropolitan Statistical Area (O_3)						
Site ID	Common Name	Site ID	Common Name	Distance (miles)	R-Squared	Rank
130670003	Kennesaw	130850001	Dawsonville	40	0.78	1
130670003	Kennesaw	130890002	South DeKalb	29	0.85	1
130670003	Kennesaw	130970004	Douglasville	21	0.89	0.5
130670003	Kennesaw	131210055	United Ave	25	0.88	0.5
130670003	Kennesaw	131350002	Gwinnett Tech	31	0.83	1
130670003	Kennesaw	131510002	McDonough	47	0.79	1
130670003	Kennesaw	132319991	CASTNET	59	0.79	1
130670003	Kennesaw	132470001	Conyers	43	0.78	1
130850001	Dawsonville	130890002	South DeKalb	49	0.75	1
130850001	Dawsonville	130970004	Douglasville	60	0.79	1
130850001	Dawsonville	131210055	United Ave	48	0.73	1
130850001	Dawsonville	131350002	Gwinnett Tech	29	0.81	1
130850001	Dawsonville	131510002	McDonough	65	0.72	1
130850001	Dawsonville	132319991	CASTNET	85	0.76	1
130850001	Dawsonville	132470001	Conyers	54	0.73	1
130890002	South DeKalb	130970004	Douglasville	28	0.81	1
130890002	South DeKalb	131210055	United Ave	4	0.98	0
130890002	South DeKalb	131350002	Gwinnett Tech	23	0.93	0.5
130890002	South DeKalb	131510002	McDonough	19	0.91	0.5
130890002	South DeKalb	132319991	CASTNET	35	0.84	1
130890002	South DeKalb	132470001	Conyers	14	0.93	0.5
130970004	Douglasville	131210055	United Ave	24	0.83	1
130970004	Douglasville	131350002	Gwinnett Tech	43	0.81	1
130970004	Douglasville	131510002	McDonough	41	0.77	1
130970004	Douglasville	132319991	CASTNET	44	0.85	1
130970004	Douglasville	132470001	Conyers	42	0.76	1
131210055	United Ave	131350002	Gwinnett Tech	24	0.92	0.5
131210055	United Ave	131510002	McDonough	23	0.90	0.5
131210055	United Ave	132319991	CASTNET	37	0.82	1
131210055	United Ave	132470001	Conyers	19	0.89	0.5
131350002	Gwinnett Tech	131510002	McDonough	37	0.84	1
131350002	Gwinnett Tech	132319991	CASTNET	57	0.79	1

Site ID	Common Name	Site ID	Common Name	Distance (miles)	R-Squared	Rank
131350002	Gwinnett Tech	132470001	Conyers	26	0.88	0.5
131510002	McDonough	132319991	CASTNET	22	0.88	0.5
131510002	McDonough	132470001	Conyers	12	0.94	0.5
132319991	CASTNET	132470001	Conyers	34	0.83	1

	Kennesaw	*Dawsonville*	*South DeKalb*	*Douglasville*	*United Ave*	*Gwinnett Tech*	*CASTNET*	*McDonough*	*Conyers*
Kennesaw	1.00								
Dawsonville	0.78	1.00							
South DeKalb	0.85	0.75	1.00						
Douglasville	0.89	0.79	0.81	1.00					
United Ave	0.88	0.73	0.98	0.83	1.00				
Gwinnett Tech	0.83	0.81	0.93	0.81	0.92	1.00			
CASTNET	0.79	0.76	0.84	0.85	0.82	0.79	1.00		
McDonough	0.79	0.72	0.91	0.77	0.90	0.84	0.88	1.00	
Conyers	0.78	0.73	0.93	0.76	0.89	0.88	0.83	0.94	1.00

Figure 10.6: Atlanta MSA Ozone Correlation Matrix

The following graph plots the r^2 versus distance for the Atlanta MSA monitor pairs. The red line indicates the 0.75 r^2 value.

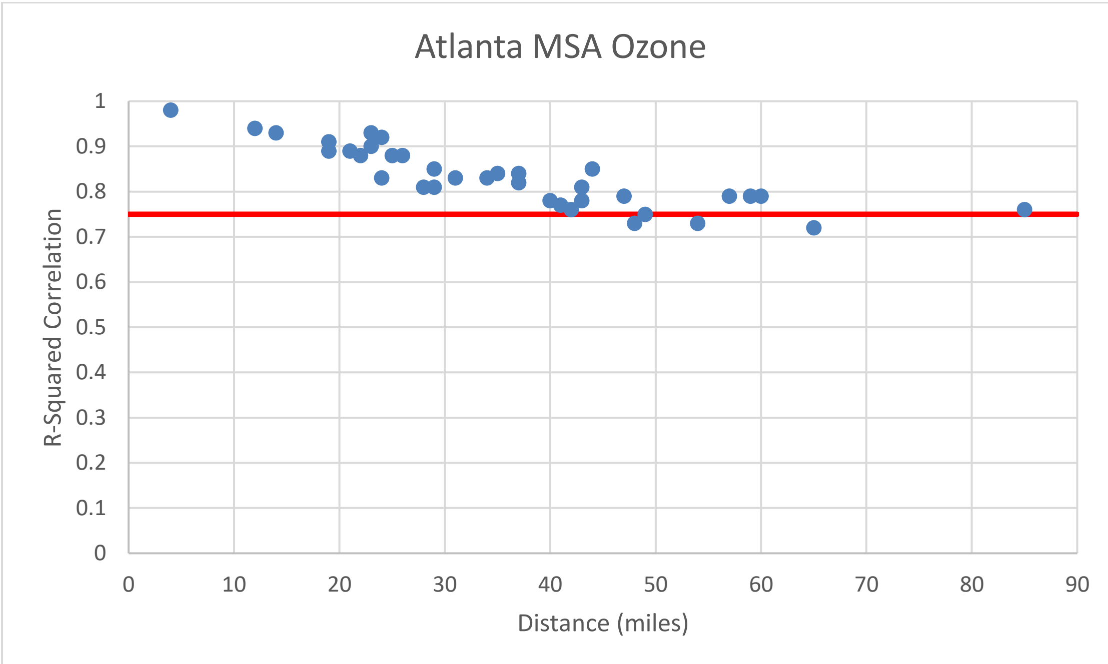


Figure 10.7: Atlanta MSA Ozone Correlations

In Table 10.5, the r^2 value for the ozone samplers in the Columbus MSA is shown. There is a high correlation between the Columbus-Airport site and the Alabama site (0.95) indicating that both samplers collect very similar data and one of these monitors could be eliminated according to this assessment.

Table 10.5: Columbus MSA Ozone Correlations and Rankings

Columbus Metropolitan Statistical Area (O_3)						
Site ID	**Common Name**	**Site ID**	**Common Name**	**Distance (miles)**	**R-Squared**	**Rank**
132150008	Columbus-Airport	11130003	Alabama	7	0.95	0

	Columbus-Airport	*Alabama*
Columbus-Airport	1.00	
Alabama	0.95	1.00

Figure 10.8: Columbus MSA Ozone Correlation Matrix

Table 10.6 shows the r^2 value for the ozone samplers in the Augusta MSA. There is a high correlation between the Evans/South Carolina-Trenton (0.96) and Augusta/South Carolina-Jackson pairs (0.95) indicating that these samplers collect very similar and data and one of these monitors could be eliminated according to this assessment.

Table 10.6: Augusta Ozone Correlations and Rankings

Augusta Metropolitan Statistical Area (O_3)						
Site ID	**Common Name**	**Site ID**	**Common Name**	**Distance (miles)**	**R-Squared**	**Rank**
130730001	Evans	132450091	Augusta	12	0.92	0.5
130730001	Evans	450030003	South Carolina - Jackson	25	0.91	0.5
130730001	Evans	450370001	South Carolina -Trenton	19	0.96	0
132450091	Augusta	450030003	South Carolina - Jackson	15	0.95	0
132450091	Augusta	450370001	South Carolina -Trenton	23	0.92	0.5
450030003	South Carolina - Jackson	450370001	South Carolina -Trenton	27	0.91	0.5

	Evans	Augusta	South Carolina - Jackson	South Carolina - Trenton
Evans	1.00			
Augusta	0.92	1.00		
South Carolina - Jackson	0.91	0.95	1.00	
South Carolina - Trenton	0.96	0.92	0.91	1.00

Figure 10.9: Augusta MSA Ozone Correlation Matrix

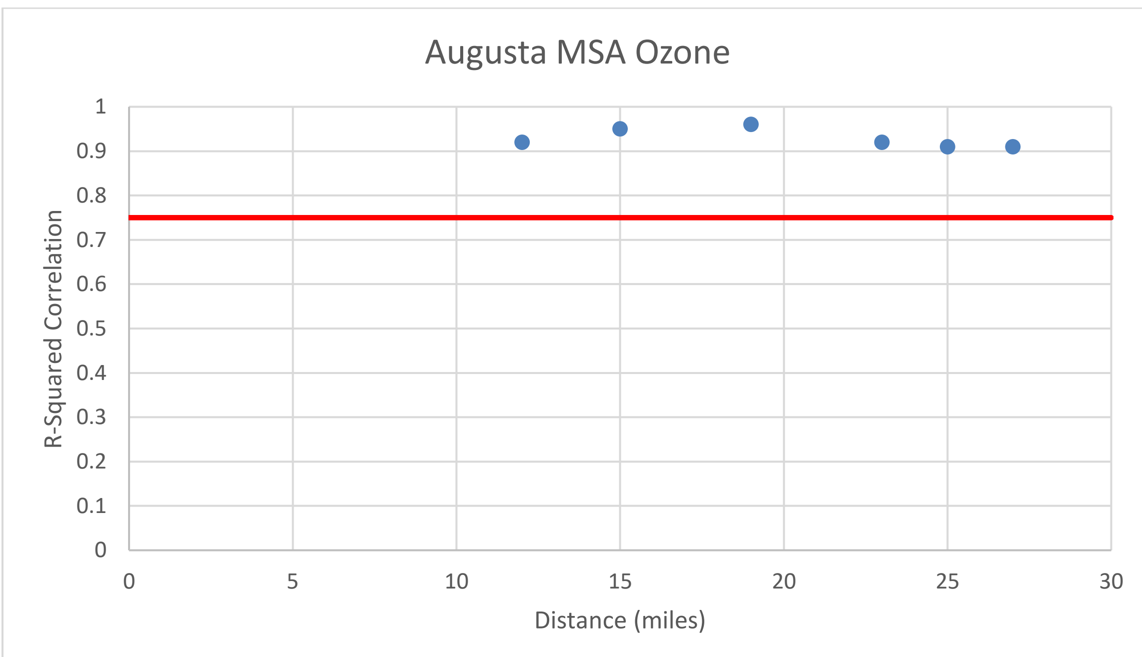


Figure 10.10: Augusta MSA Ozone Correlations

For the purpose of this report, the Environmental Protection Agency has placed the standard of 0.75 as the range at which an r-squared value suggests redundancy between the two sites being correlated. With this assessment, several of the sites with ozone monitors have higher r-square values (>0.75), meaning that sites are collecting data that is closely related. Therefore, based on this single analysis there may be justification to eliminate monitors in the ozone network based on the higher correlations.

10.3 Concluding Points

For the Monitor-to-Monitor Correlation assessment, all of the sites within each MSA that had at least two $PM_{2.5}$ or two ozone samplers were paired and a correlation coefficient (r^2) was calculated. Each site was ranked according to the r^2 value within each MSA. If a pair of sites has an r^2 value above 0.75, the data being collected may be redundant. Conversely, a pair of sites with a low r^2 value would suggest that the concentrations being monitored are unique and would have more value for spatial coverage including assessment of local emissions or transport. Table 10.7 shows the sum of the $PM_{2.5}$ and Ozone ranks for each site. Dawsonville had the highest overall rank while NR-GA Tech, Fire Station #8, Columbus-Airport, Columbus-Baker, Forest Park, Macon-Forestry, and Macon-Allied had the lowest ranks, indicating that they are more highly correlated to nearby sites.

Table 10.7: Total of Ozone and $PM_{2.5}$ Ranks for Each Site

Site ID	Common Name	$PM_{2.5}$ Rank	Ozone Rank	Total Rank
130850001	Dawsonville		8	8
130970004	Douglasville		7.5	7.5
130890002	South DeKalb	0	5.5	5.5
132319991	CASTNET		7.5	7.5
130670003	Kennesaw	0	7	7
131350002	Gwinnett Tech	0	6.5	6.5
131510002	McDonough		6	6
132470001	Conyers		6	6
131210055	United Ave.		5	5
130730001	Evans		1.5	1.5
132450091	Augusta		1.5	1.5
131210056	NR-GA Tech	0		0
131210039	Fire Station #8	0		0
132150008	Columbus-Airport	0	0	0
132150012	Columbus-Baker	0		0
130630091	Forest Park	0		0
130210012	Macon-Forestry	0		0
130210007	Macon-Allied	0		0

11.0 Area Served Assessment

Overview

The maps and tables provided show the coverage and importance of ozone and $PM_{2.5}$ monitoring sites in Georgia's Ambient Air Monitoring Program (AAMP). Using the Thiessen polygons technique, GA AAMP determined and ranked the area of coverage for each monitoring site. This analysis supports the thesis that Georgia's ambient air networks for ozone and $PM_{2.5}$ adequately cover the population and provide robust air quality coverage in line with scientific and EPA standards.

Thiessen polygons, also known as Voronoi diagrams, partition a plane into regions based on the distance to specific points. In the context of ambient air monitoring, each point represents a monitoring site. The polygon for each site includes all locations closer to that site than to any other. This method is particularly useful for determining the area of coverage for each monitoring site (EPA Network Assessment Guidance). The use of Thiessen polygons to determine area coverage helps to provide an understanding of each monitoring site's area of representation around the sites. Sites with larger coverage areas, especially in rural regions, are crucial for capturing regional air quality trends. Urban sites, while covering smaller areas, are essential for detailed monitoring in densely populated regions (EPA Network Assessment Guidance).

The maps were created using ArcGIS Pro. To accurately calculate the polygons for monitors whose coverage areas extend beyond the state line, the nearest out-of-state monitors were included. However, these out-of-state monitors were excluded from the ranking process.

For this analysis, the ozone and $PM_{2.5}$ networks were examined. Each site was ranked according to the surrounding area served by the monitor, which is shown in square miles. Sites that cover a larger area are ranked higher than sites that cover a smaller area. A proportionality ranking was used for each network. Within each section, a table displays the site identification number, 2023 population served by the monitor (the most recent complete year of verified data when completing the assessment), area in square miles served by each monitor, latitude, longitude, and rank. Since the areas covered are overlapping state boundaries, the assessment includes all the sites in Georgia, as well as the sites surrounding the state. The red dots indicate the location of each monitor and the polygon drawn in white indicates the area served by that monitor.

Ranking

The ranking in the tables provides a quantitative measure of each site's importance based on the area served. The rank was determined by square mileage covered using the formula: Ranking=Value−MinMax−Min\text{Ranking}= \frac{\text{Value} - \text{Min}}{\text{Max} - \text{Min}}Ranking=Max−MinValue−Min (Table 11.1 and Table 11.2). The ranking system based on area coverage helps identify key sites that are critical for maintaining comprehensive air quality monitoring. This analysis can guide future network design and resource allocation to ensure effective monitoring of air quality across Georgia.

11.1 Ozone Area Served

The ozone network coverage map and table show the spatial distribution and area coverage of ozone monitoring sites in Georgia. The red dots represent Georgia AAMP ozone monitors (including EPA's CASTNET site), while the blue dots represent ozone monitors from neighboring states. Figure 11.1 and Table 11.1 illustrate the ozone network coverage and the corresponding area served by each monitor.

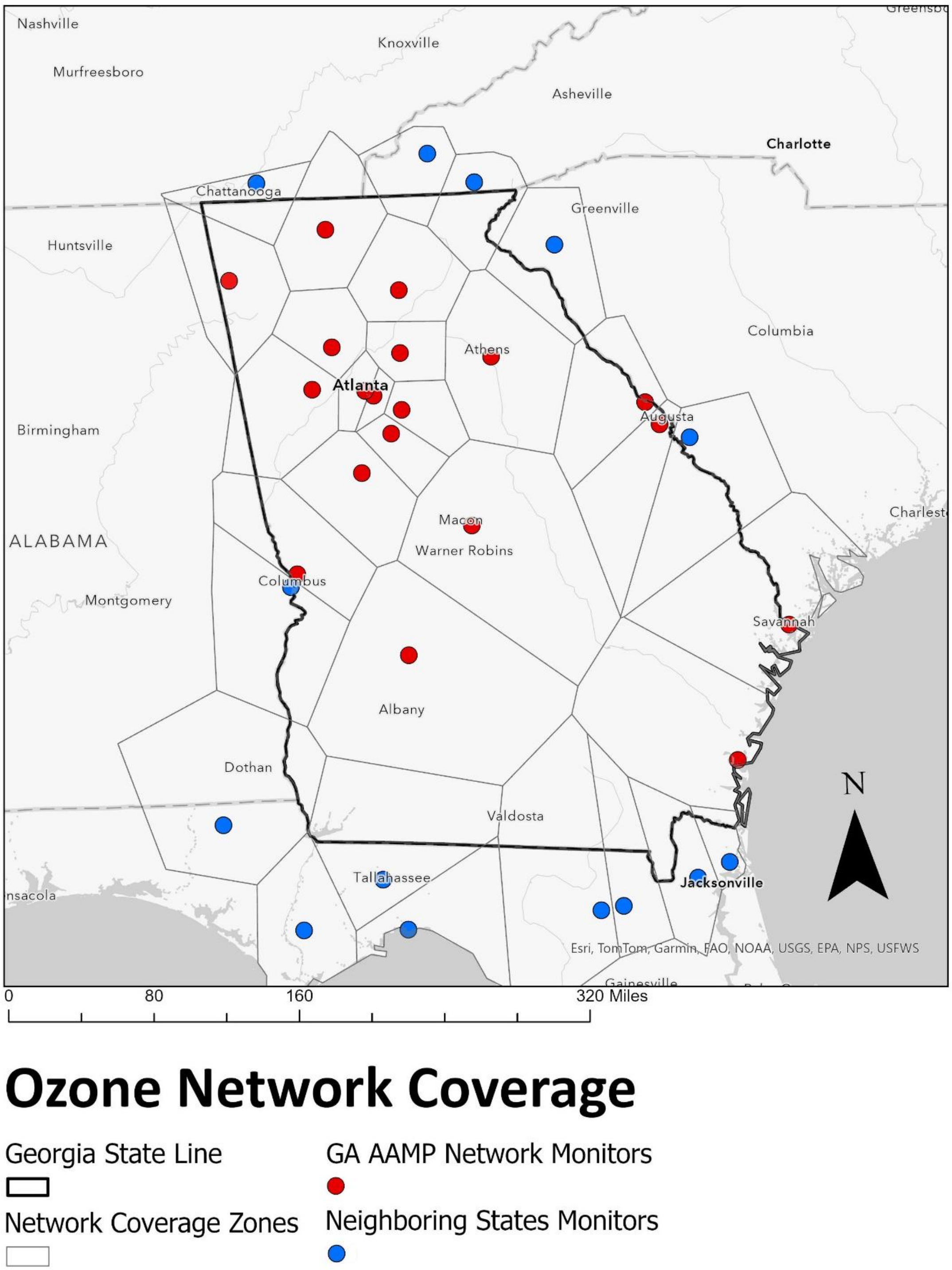


Figure 11.1. Ozone Network Coverage 2023

Along Georgia's borders, the maps indicate that some of Georgia's ozone monitors cover areas in surrounding states and some of the other state's ozone monitors cover areas in Georgia. In the following table, the sites from other states are shown along with Georgia's ozone sites for informative purposes. Georgia's sites are highlighted in pink and ranked accordingly. The sites are listed in order of rank.

Rank	State	Site ID	Local Site Name	2023 Total Population	Square Miles Covered	Latitude	Longitude
	Alabama	11130003	Phenix City - South Girard School	332062		32.43703	-84.99965
	Florida	120590004	Bonifay	395414		30.84861	-85.60389
	Florida	120230002	Lake City - Veteran's Domicile	341394		30.17806	-82.61917
	Florida	120730012	Tallahassee Community College	504745		30.43972	-84.34639
	Florida	120779991	Sumatra	46357		30.11030	-84.99030
	Florida	121290001	St. Marks Wildlife Refuge	62973		30.09250	-84.16111
	Florida	120030002	Olustee	52956		30.20111	-82.44111
	Florida	120310106	Cisco Drive	540294		30.37822	-81.84090
	Florida	120310077	Sheffield	307710		30.47773	-81.58734
1	Georgia	132611001	Leslie	442602	8,125.94	31.95429	-84.08101
0.8441	Georgia	130210012	Macon-Forestry	652116	6,893.47	32.80526	-83.54349
0.6291	Georgia	131270006	Brunswick	294514	5,194.22	31.16980	-81.49503
0.6047	Georgia	130510021	Savannah-E. President	811489	5,001.32	32.06848	-81.04942
0.4185	Georgia	130590002	Athens	434664	3,528.73	33.91814	-83.34439
0.2886	Georgia	132150008	Columbus-Airport	326957	2,501.90	32.52127	-84.94463
0.2846	Georgia	130970004	Douglasville	690201	2,470.27	33.74124	-84.77643
0.2715	Georgia	130550001	Summerville	239257	2,367.08	34.47453	-85.40885
0.2601	Georgia	132130003	Fort Mountain	270444	2,276.87	34.78522	-84.62642
0.2632	Georgia	130730001	Evans	227710	2,301.55	33.58204	-82.13125
0.2421	Georgia	132319991	EPA CASTNET	289980	2,134.48	33.17870	-84.40520
0.2403	Georgia	132450091	Augusta	310582	2,120.18	33.43390	-82.02240
0.2067	Georgia	130850001	Dawsonville	502373	1,855.07	34.37623	-84.05951
0.1259	Georgia	130670003	Kennesaw	1189941	1,215.70	34.01544	-84.60742
0.0851	Georgia	131350002	Gwinnett Tech	1561430	893.65	33.96320	-84.06910
0.0789	Georgia	132470001	Conyers	350960	844.65	33.58855	-84.06961
0.0647	Georgia	131510002	McDonough	309833	731.85	33.43395	-84.16181
0.0246	Georgia	131210055	United Avenue	1172372	415.26	33.72074	-84.35732
0.00	Georgia	130890002	South DeKalb	566104	220.67	33.68780	-84.29050
	North Carolina	371139991	Coweeta	107216		35.06080	-83.43060
	North Carolina	370750001	Joanna Bald	77597		35.25780	-83.79550
	South Carolina	450030003	Jackson Middle School	174053		33.34223	-81.78873
	South Carolina	450070006	Garrison Arena	417754		34.63596	-82.81067
	Tennessee	470654003	1A Ozone	556032		35.10264	-85.16219

Table 11.1: List of Ozone Monitors with Area Served in Square Miles

Key Observations:

- **Largest Coverage Areas**: Sites with the largest coverage areas are typically rural sites, such as Leslie (Site ID: 132611001), Macon-Forestry (Site ID: 130210012), and Brunswick (Site ID: 131270006). These sites serve extensive areas, highlighting their importance in providing regional air quality data (Table 11.1).

- **Urban Sites**: Sites located within or near urban centers, like Atlanta, have smaller coverage areas due to the higher density of monitors. These sites are crucial for capturing urban air quality variations (Table 11.1).

11.2 $PM_{2.5}$ Area Served

The $PM_{2.5}$ network coverage map and table display the spatial distribution and area coverage of $PM_{2.5}$ monitoring sites in Georgia. Similar to the ozone network, the red dots indicate Georgia AAMP monitors, and the blue dots denote monitors from neighboring states. Figure 11.2 and Table 11.2 illustrate the $PM_{2.5}$ network coverage and the corresponding area served by each monitor.

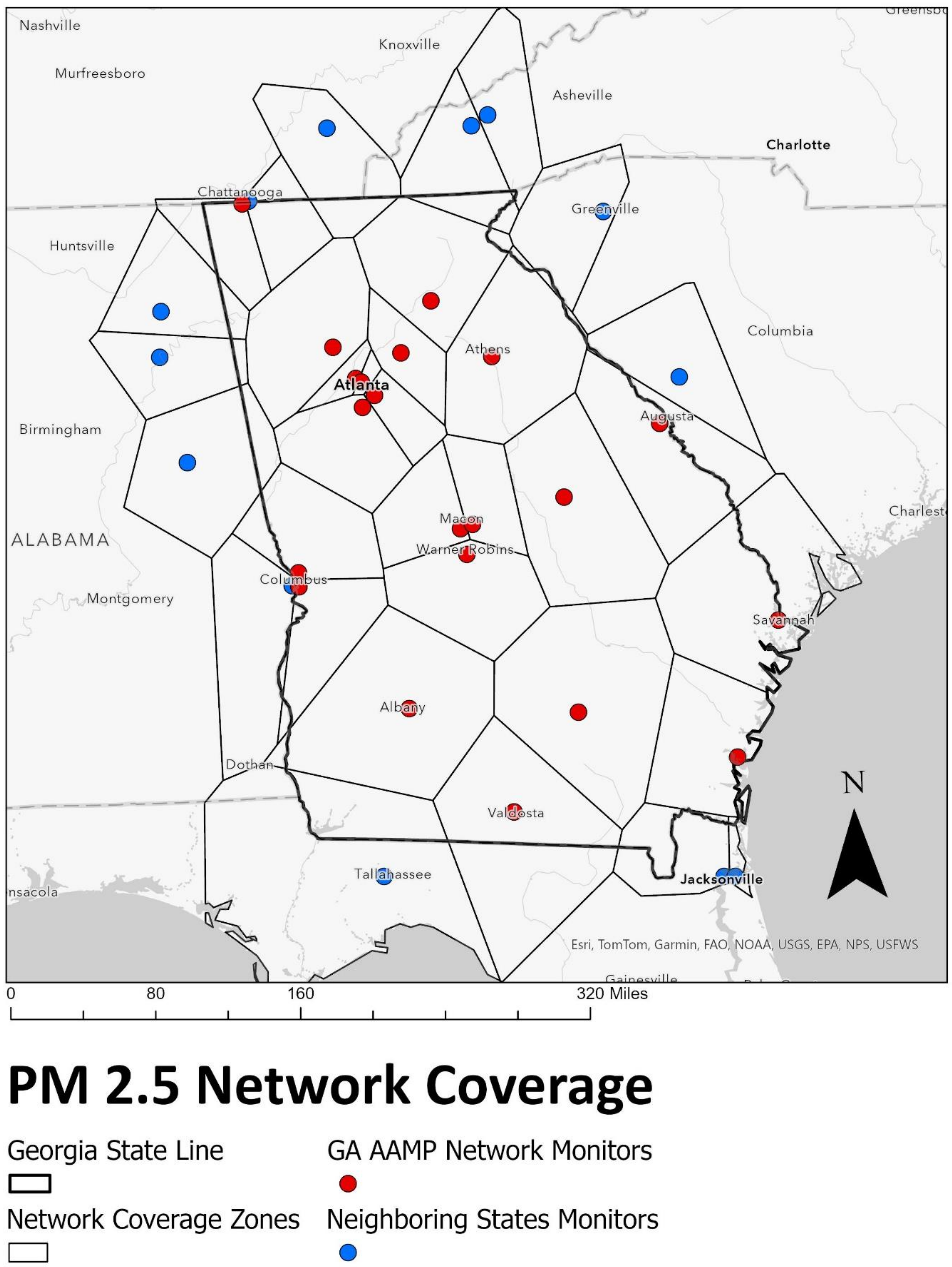


Figure 11.2: $PM_{2.5}$ Area Served with Monitors Sampling in 2023, All of Georgia

The following table shows the same statistics as shown with the ozone network. Along Georgia's borders, the maps indicate that some of Georgia's $PM_{2.5}$ monitors cover areas in surrounding states and some of the other states' $PM_{2.5}$ monitors cover areas in Georgia. In the following table, the sites from other states are shown along with Georgia's $PM_{2.5}$ monitors for informative purposes. Georgia's $PM_{2.5}$ sites are highlighted in pink and ranked accordingly. The sites are listed in order of rank.

Rank	State	Site ID	Local Site Name	2023 Total Population	Square Miles Covered	Latitude	Longitude
	Alabama	010550010	Gadsden C. Collage	212330		33.98821	-85.99256
	Alabama	010491003	Crossville	207290		34.28857	-85.96986
	Alabama	011130003	Phenix City	357908		32.43703	-84.99965
	Alabama	010270001	Ashland	208822		33.28493	-85.80361
	Florida	120310099	Sunny Acres	247475		30.35472	-81.54778
	Florida	120310032	Kooker Park	433271		30.35634	-81.63540
	Florida	120730012	Tallahassee Community College	786071		30.43972	-84.34639
1	Georgia	130690002	General Coffee	258651	6,181.97	31.51310	-82.74997
0.9832	Georgia	131850003	Valdosta	306706	6,080.16	30.84860	-83.29330
0.9466	Georgia	130950007	Albany	332188	5,858.44	31.57760	-84.09980
0.8635	Georgia	130511002	Savannah-L&A	836006	5,354.22	32.09078	-81.13022
0.7398	Georgia	133030001	Sandersville	156055	4,604.56	32.96736	-82.80687
0.6486	Georgia	132450091	Augusta	546486	4,051.77	33.43390	-82.02240
0.6124	Georgia	130590002	Athens	444251	3,832.11	33.91814	-83.34439
0.4943	Georgia	130670003	Kennesaw	1544235	3,116.52	34.01544	-84.60742
0.4757	Georgia	131270006	Brunswick	193200	3,003.68	31.16980	-81.49503
0.4658	Georgia	131390003	Gainesville	586696	2,943.40	34.29930	-83.81340
0.4384	Georgia	131530001	Warner Robins	275230	2,777.23	32.60560	-83.59780
0.3773	Georgia	132150008	Columbus-Airport	307160	2,406.76	32.52127	-84.94463
0.3267	Georgia	130630091	Forest Park	1001321	2,100.42	33.61084	-84.39072
0.3032	Georgia	132150012	Columbus - Baker	107493	1,957.70	32.42740	-84.94570
0.2362	Georgia	130210007	Macon-Alllied	221865	1,551.83	32.77746	-83.64100
0.2038	Georgia	132950004	Rossville-Williams St.	158947	1,355.52	34.97840	-85.29430
0.1986	Georgia	130210012	Macon-Forestry	107074	1,323.59	32.80526	-83.54349
0.1695	Georgia	131350002	Gwinnett Tech	1633653	1,147.45	33.96320	-84.06910
0.1075	Georgia	130890002	South DeKalb	818872	771.70	33.68780	-84.29050
0.0367	Georgia	131210039	Fire Station #8	662741	342.42	33.80224	-84.43562
0.00	Georgia	131210056	NR-GA Tech	573521	119.38	33.77840	-84.39140
	North Carolina	371730007	Old High School	149658		35.49871	-83.31024
	North Carolina	371730002	Bryson City	111516		35.43477	-83.44213
	South Carolina	450450015	Greenville ESC	738305		34.84390	-82.41458
	South Carolina	450370001	Trenton	200351		33.73996	-81.85364
	Tennessee	470650031	East Ridge City Hall	443229		34.99438	-85.24293
	Tennessee	471071002	Athens $PM_{2.5}$ monitor	248440		35.45012	-84.59620

Table 11.2: List of $PM_{2.5}$ Monitors and Area Served

Key Observations:

- **Largest Coverage Areas**: For $PM_{2.5}$, the General Coffee site (Site ID: 130690002) and Valdosta site (Site ID: 131850003) have the largest coverage areas, emphasizing their role in monitoring regional $PM_{2.5}$ levels (Table 11.2).
- **Urban Sites**: Urban sites such as those in Atlanta cover smaller areas due to the dense network of monitors, ensuring detailed air quality data for populated areas (Table 11.2).

This analysis is crucial for several reasons:

- **Resource Allocation**: By identifying the sites with the largest coverage areas, the analysis helps prioritize which sites need more resources and attention. Sites covering larger areas are essential for providing accurate regional air quality data (EPA Network Assessment Guidance).
- **Network Design**: Understanding the coverage of each site allows for better network design. It ensures that all areas, especially those with higher pollution risks, are adequately monitored.
- **Public Health**: Accurate air quality data is vital for public health. This analysis helps ensure that data collected represents the air quality across different regions, aiding in better health advisories.

This analysis was included in the 2025 Network Assessment to provide a comprehensive overview of the current monitoring network and to identify any gaps or areas for improvement. By including out-of-state monitors, the analysis offers a more accurate representation of coverage areas, especially near state borders (EPA Network Assessment Guidance).

12.0 Population Assessment

As part of the Five-Year Network Assessment, several aspects concerning the levels of population across the state need to be addressed. There are network requirements that should be met according to Appendix D of part 58 of the Federal Register published October 17, 2006. For O_3, $PM_{2.5}$, and PM_{10} networks, each metropolitan statistical area (MSA) above a certain population, and each monitor above a certain percentage of the National Ambient Air Quality Standards (NAAQS), should have a certain number of that type of monitor in each MSA. Another aspect to consider is change in population. The changes in population over time and shifts in population within an area need to be assessed to ensure that GA AAMP is meeting population-oriented requirements for monitoring ambient air. In addition, it is GA AAMP's responsibility to evaluate if proposed or existing sites support air quality characterization in areas with high populations of susceptible individuals.

The following three-part table (Table 12.1) is taken from the Federal Register and shows the requirements for monitoring ozone, PM_{10}, and $PM_{2.5}$ according to population and comparison to the NAAQS.

Table 12.1: Tables D-2, D-4, and D-5 of Appendix D to Part 58

Table D–2 of Appendix D to Part 58 **— SLAMS Minimum O_3 Monitoring Requirements**

MSA population[1,2]	Most recent 3-year design value concentrations ≥85% of any O_3 NAAQS[3]	Most recent 3-year design value concentrations <85% of any O_3 NAAQS[3,4]
>10 million	4	2
4–10 million	3	1
350,000–<4 million	2	1
50,000–<350,000[5]	1	0

[1]Minimum monitoring requirements apply to the Metropolitan statistical area (MSA).
[2]Population based on latest available census figures.
[3]The ozone (O_3) National Ambient Air Quality Standards (NAAQS) levels and forms are defined in 40 CFR part 50.
[4]These minimum monitoring requirements apply in the absence of a design value.
[5]Metropolitan statistical areas (MSA) must contain an urbanized area of 50,000 or more population.

Table D–4 of Appendix D to Part 58 — PM_{10} Minimum Monitoring Requirements (Approximate Number of Stations Per MSA)[1]

Population category	High concentration[2]	Medium concentration[3]	Low concentration[4,5]
>1,000,000	6–10	4–8	2–4
500,000–1,000,000	4–8	2–4	1–2
250,000–500,000	3–4	1–2	0–1
100,000–250,000	1–2	0–1	0

[1]Selection of urban areas and actual numbers of stations per area will be jointly determined by EPA and the State agency.
[2]High concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding the PM_{10} NAAQS by 20 percent or more.
[3]Medium concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding 80 percent of the PM_{10} NAAQS.
[4]Low concentration areas are those for which ambient PM_{10} data show ambient concentrations less than 80 percent of the PM_{10} NAAQS.
[5]These minimum monitoring requirements apply in the absence of a design value.

Table D–5 of Appendix D to Part 58 — $PM_{2.5}$ Minimum Monitoring Requirements

MSA population[1,2]	Most recent 3-year design value ≥85% of any $PM_{2.5}$ NAAQS[3]	Most recent 3-year design value <85% of any $PM_{2.5}$ NAAQS[3,4]
>1,000,000	3	2
500,000–1,000,000	2	1
50,000–<500,000[5]	1	0

[1]Minimum monitoring requirements apply to the Metropolitan statistical area (MSA).
[2]Population based on latest available census figures.
[3]The $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) levels and forms are defined in 40 CFR part 50.
[4]These minimum monitoring requirements apply in the absence of a design value.
[5]Metropolitan statistical areas (MSA) must contain an urbanized area of 50,000 or more population.

Table 12.2 below displays the requirements for O_3, $PM_{2.5}$, and PM_{10} and how they pertain to the state of Georgia. Each MSA in Georgia is outlined as are the locations where GA AAMP has monitors that are not in an MSA. These areas are micropolitan statistical areas. Population is based on the most current 2020 census, estimated population for 2023 and 2024 (from the US Census Bureau, https://www.census.gov/data/tables/time-series/demo/popest/2020s-total-metro-and-micro-statistical-areas.html). 2020-2022 and 2021-2023 design values for the O_3, $PM_{2.5}$, and PM_{10} monitors across the GA AAMP network were calculated from data extracted from EPA's Air Quality System (AQS). The number of required ambient air monitors per MSA is labeled 'Required Monitors Per Area'. The column labeled 'Actual Monitors Per Area' shows the actual number of monitors GA AAMP has in place, as well as neighboring states that share that MSA. The percentage of the NAAQS that was used to compare to the actual design value is shown for each pollutant in each pollutant heading. Since $PM_{2.5}$ has a daily standard and an annual standard, both are shown in the table.

In Table 12.2, one can see that GA AAMP meets or exceeds the requirements for the number of ozone, $PM_{2.5}$, and PM_{10} monitors. Georgia shares three MSAs with neighboring states: Chattanooga TN-GA MSA, Columbus GA-AL MSA, and Augusta-Richmond County, GA-SC MSA. These states also collect O_3 and $PM_{2.5}$ data within these MSAs. The monitor with the highest concentrations in each MSA is used to compare to the NAAQS regardless of which state the monitor is located. GA AAMP does not currently have an O_3 monitor in the Chattanooga TN-GA MSA; however, Georgia has an agreement with Chattanooga-Hamilton County Air Pollution Control Bureau to use the data from their O_3 monitors. According to 40CFR58, Appendix D, GA AAMP would be required to have four $PM_{2.5}$ monitors for the daily standard and 16 for the annual standard for its population by area and the percentage of $PM_{2.5}$ concentrations compared to the NAAQS[1]. GA AAMP currently has 35 $PM_{2.5}$ monitors, including two in Tennessee, in the Chattanooga TN-GA MSA, one in South Carolina in the Augusta-Richmond County, GA-SC MSA, and one in Alabama in the Columbus GA-AL MSA. According to 40CFR58, Appendix D, GA AAMP would be required to have 12 O_3 monitors for its population by area and the percentage of O_3 concentrations compared to the NAAQS. Currently, the network consists of 21 O_3 monitors, including two that are covered by Tennessee in the Chattanooga TN-GA MSA, one in Alabama in the Columbus, GA-AL MSA, and two in South Carolina in the Augusta-Richmond County, GA-AL MSA. In addition, three PM_{10} monitors would be required and GA AAMP's network which currently has three monitors.

[1] $PM_{2.5}$ design values may change when EPA approves the $PM_{2.5}$ exceptional event demonstration submitted by GA AAMP.

Table 12.2: Network Requirements for PM2.5, Ozone, and PM10 and Population Change (from Appendix D, Part 58)

	Population (2020 Census)	Population (2023 Estimated Census)	Population (2024 Estimated Census)	PM2.5 Table D-5 24-hr DV 2022	2023	35 ug/m3; 85% = 29.75 ug/m3 Required Monitors per Area	Actual Monitors per Area	Reason Number of Monitors Required	PM2.5 Table D-5 Annual DV 2022	2023	9 ug/m3; 85% = 7.65 ug/m3 Required Monitors per Area	Actual Monitors per Area	Reason Number of Required Monitors
Rome MSA	98,583	100,407	101,390	*	*	0	*	50,000-500,000 pop, but <85%	*	*	0	*	50,000-500,000 pop, but <85%
Brunswick MSA	113,520	116,178	117,135	18	19	0	2+	50,000-500,000 pop, but <85%	7.8	7.9	1	2+	50,000-500,000 pop, but >85%
Valdosta MSA	148,353	151,266	152,588	18	20	0	2+	50,000-500,000 pop, but <85%	8.1	8.6	1	2+	50,000-500,000 pop, but >85%
Warner Robins MSA	192,400	200,762	204,110	21	22	0	2+	50,000-500,000 pop, but <85%	8.3	8.7	1	2+	50,000-500,000 pop, but >85%
Albany MSA	148,253	145,538	145,451	22	22	0	1	50,000-500,000 pop, but <85%	8.8	9.0	1	1	50,000-500,000 pop, but >85%
Gainesville MSA	203,409	218,248	221,745	18	20	0	2+	50,000-500,000 pop, but <85%	7.7	8.2	1	2+	50,000-500,000 pop, but >85%
Athens-Clark County MSA	215,715	222,637	223,689	20	23	0	1	50,000-500,000 pop, but <85%	8.0	8.8	1	1	50,000-500,000 pop, but >85%
Macon MSA	233,609	236,333	237,617			0	3	50,000-500,000 pop, but <85%			1	3	50,000-500,000 pop, but >85%
Macon - Allied				20	21				8.8	9.4			
Macon - Forestry				19	22				7.5	8.4		+	
Columbus GA-AL MSA	329,195	323,936	324,343			0	2GA,1AL**	50,000-500,000 pop, but <85%			1	2GA,1AL**	50,000-500,000 pop, but >85%
Columbus - Airport				20	20				8.3	8.5			
Columbus - Baker				26	27				9.1	10.0			
Alabama (01-113-0003)				24	25				9.1	9.5			
Savannah MSA	405,312	426,182	431,589	20	21	0	2+	50,000-500,000 pop, but <85%	8.5	8.8	1	2+	50,000-500,000 pop, but >85%
Augusta GA-SC MSA	612,228	630,968	636,760			1	1GA,1SC**	500,000-1,000,000 pop,but<85%			2	1GA,1SC**	500,000-1,000,000 pop, but >85%
Augusta				25	25				9.6	9.7			
South Carolina (45-037-0001)				17	18				7.5	8.1			
Atlanta MSA	6,121,086	6,336,015	6,411,149			2	8	>1,000,000 pop, but <85%			3	8	>1,000,000 pop, but >85%
Forest Park				20	19				8.4	8.9			
Kennesaw				20	20				8.4	8.9			
South DeKalb				20	21		+		8.3	8.7		+	
Fire Station#8				20	20				8.4	9.1			
United Avenue				*	*				*	*			
NR-GA Tech				21	20				*	*			
Gwinnett Tech				19	22				7.7	8.6			
McDonough				*	*				*	*			
Chattanooga TN-GA MSA Rossville-Williams St. **Regional Transport site**	564,632	582,452	588,050			1	2GA,2TN**	500,000-1,000,000 pop,but <85%			2	2GA,2TN**	500,000-1,000,000 pop, and >85%
Rossville				22	26		+		8.8	10.0		+	
Tennessee (47-065-0031)				21	21				8.3	8.3			
Tennessee (47-065-4002)				19	22				7.7	8.4			
Not in an MSA													
General Coffee (Douglas Micro) **Background site**	51,370	51,815	52,286	16	18	++	2+		6.9	7.3	++	2+	
Sandersville (Washington Co)	19,957	19,891	19,834	24	27	++	2+		9.1	10.0	++	2+	
				Totals		4	31	**Totals**			16	31	
			Totals with Other States			4	35	**Totals with Other States**			16	35	

***TEOM and/or no design value, **Part of MSA covered by another state, +Multiple regulatory monitors at this site, ++Area below 50,000 population requirement**

	Population (2020 Census)	Population (2023 Estimated Census)	Population (2024 Estimated Census)	O3		0.070 ppm			
				Table D-2		85%=	0.0595 ppm		
				4th Max Average, 3yrs					
				2022	2023	Monitor Above Threshold	Required Monitors per Area	Actual Monitors per Area	Reason Number of Required Monitors
Brunswick MSA	113,520	116,178	117,135	0.054	0.056	0	0	1	50,000-350,000 pop, but <85%
Dalton MSA	142,806	145,219	146,386	0.062	0.066	1	1	1	50,000-350,000 pop, and >85%
Athens-Clark County MSA	215,715	222,637	223,689	0.059	0.063	1	1	1	50,000-350,000 pop, and >85%
Macon MSA	233,609	236,333	237,617	0.058	0.062	1	1	1	50,000-350,000 pop, and >85%
Columbus GA-AL MSA	329,195	323,936	324,343				1	1GA,1AL**	50,000-350,000 pop, and >85%
Columbus-Airport				0.057	0.060	1			
Alabama (01-113-0003)				0.057	0.061	1			
Savannah MSA	405,312	426,182	431,589	0.056	0.059	1	1	1	350,000-<4 mil pop, but <85%
Augusta GA-SC MSA	612,228	630,968	636,760				2	2GA, 2SC**	350,000-<4 mil pop, and >85%
Augusta				0.060	0.062	1			
Evans[+]				0.055	0.057	0			
South Carolina (45-003-0003)				0.058	0.062	1			
South Carolina (45-037-0001)				0.058	0.059	0			
Atlanta MSA	6,121,086	6,336,015	6,411,149				3	9	4 mil-10 mil pop, and >85%
Kennesaw				0.061	0.063	1			
Dawsonville				0.059	0.062	1			
South DeKalb				0.064	0.067	1			
Douglasville				0.063	0.068	1			
United Ave				0.065	0.070	1			
Gwinnett Tech				0.064	0.067	1			
McDonough				0.064	0.069	1			
CASTNET				0.058	0.065	1			
Conyers				0.062	0.066	1			
Chattanooga TN-GA MSA	564,632	582,452	588,050				2	2 TN**	350,000-<4 mil pop, and >85%
Tennessee (47-065-1011)				0.061	0.064	1			
Tennessee (47-065-4003)				0.063	0.065	1			
Not in an MSA									
Summerville[+]	4,395	4,410	4,421	0.056	0.060	1	*	1	
Leslie (Americus Micro)[+]	34,060	33,476	33,475	0.057	0.060	1	*	1	
						Totals	12	19	
				Totals with Other States			12	24	

[+]**Shut down as of December 2024** *** Area below 50,000 population requirement, **Part of MSA covered by another state**

	Population (2020 Census)	Population (2023 Estimated Census)	Population (2024 Estimated Census)	PM10 Table D-4 1st Max, 3 yrs ($\mu g/m^3$) 2022	2023	Monitor Above Threshold	150 $\mu g/m^3$ 80%=120; 120%=180 $\mu g/m^3$ Required Monitors per Area	Actual Monitors per Area	Reason Number of Monitors Required
Rome MSA	98,583	100,407	101,390	NA	NA	0	**0**	**0**	pop below 100,000
Brunswick-St. Simons MSA	113,520	116,178	117,135	NA	NA	**0**	**0**	**0**	100,000-250,000, but <80%
Valdosta MSA	148,353	151,266	152,588	NA	NA	**0**	**0**	**0**	100,000-250,000, but <80%
Warner Robins MSA	192,400	200,762	204,110	NA	NA	**0**	**0**	**0**	100,000-250,000, but <80%
Albany MSA	148,253	145,538	145,451	NA	NA	**0**	**0**	**0**	100,000-250,000, but <80%
Gainesville MSA	203,409	218,248	221,745	NA	NA	**0**	**0**	**0**	100,000-250,000, but <80%
Athens-Clark County MSA	215,715	222,637	223,689	NA	NA	**0**	**0**	**0**	100,000-250,000, but <80%
Macon MSA	233,609	236,333	237,617			**0**	**0**	**0**	100,000-250,000, but <80%
Macon - Allied				NA	NA	**0**			
Macon - Forestry				NA	NA	**0**			
Columbus GA-AL MSA	329,195	323,936	324,343				**0**	**0**	250,000-500,000 pop, but <80%
Columbus - Airport				NA	NA	**0**			
Columbus - Baker				NA	NA	**0**			
Alabama (01-113-0003)				NA	NA	**0**			
Savannah MSA	405,312	426,182	431,589	NA	NA	**0**	**0**	**0**	50,000-500,000 pop, but <80%
Augusta GA-SC MSA	612,228	630,968	636,760			**0**	**1**	**1GA**	500,000-1,000,000 pop,but<80%
Augusta				73	61				
South Carolina (45-037-0001)				NA	NA				
Atlanta-Sandy Springs-Roswell MSA	6,121,086	6,336,015	6,411,149				**2**	**2**	>1,000,000 pop, but <80%
Forest Park				NA	NA	**0**			
Kennesaw				NA	NA	**0**			
South DeKalb				79	67				
Fire Station#8				52	55				
NR-GA Tech				NA	NA	**0**			
Gwinnett Tech				NA	NA	**0**			
Chattanooga TN-GA MSA	564,632	582,452	588,050			**0**	**0**	**0**	500,000-1,000,000 pop,but <80%
Rossville				NA	NA	**0**			
Tennessee (47-065-0031)				NA	NA	**0**			
Tennessee (47-065-4002)				NA	NA	**0**			
Not in an MSA									
General Coffee (Douglas Micro)	51,370	51,815	52,286	NA	NA	**0**	**0**	**0**	pop below 100,000
Sandersville (Washington Co)	19,957	19,891	19,834	NA	NA	**0**	**0**	**0**	pop below 100,000
				Totals			**3**	**3**	
				Totals with Other States			**3**	**3**	

In Table 12.3, percent population change in census tracts from 2020 to 2023 and ranks based on population change are shown. Sites were ranked proportionately and sites in census tracts with the highest percent change in population were given the highest rank.

Table 12.3 Air Monitoring Sites Ranked by Percent Change in Population from 2020 to 2023

Site ID	Site Name	Population (2020 Census)	Population (ACS 2023)	Raw Change in Population	Percent Change in Population	Rank
130510021	Savannah-E President	1062	1956	894	84.18	1.00
131270006	Brunswick	3759	5811	2052	54.59	0.71
131210055	United Avenue	3297	3926	629	19.08	0.37
132151003	Columbus-Crime Lab	6412	7311	899	14.02	0.32
131510002	McDonough	3937	4421	484	12.29	0.31
130890003	NR-285	2150	2380	230	10.70	0.29
130890002	South DeKalb	5024	5547	523	10.41	0.29
130590002	Athens	4896	5387	491	10.03	0.28
131530001	Warner Robins	3067	3347	280	9.13	0.27
130730001	Evans	12287	13107	820	6.67	0.25
130850001	Dawsonville	4582	4851	269	5.87	0.24
131210039	Fire Station #8	4976	5220	244	4.90	0.23
132130003	Fort Mountain	4313	4495	182	4.22	0.23
132470001	Conyers	3716	3832	116	3.12	0.22
132611001	Leslie	2124	2188	64	3.01	0.22
131850003	Valdosta	1929	1984	55	2.85	0.21
130550001	Summerville	2560	2591	31	1.21	0.20
131210056	NR-GA Tech	7401	7396	-5	-0.07	0.19
130630091	Forest Park	4465	4451	-14	-0.31	0.18
133030001	Sandersville	4748	4697	-51	-1.07	0.18
132450091	Augusta	3331	3288	-43	-1.29	0.17
130970004	Douglasville	6589	6499	-90	-1.37	0.17
130690002	General Coffee	3113	3066	-47	-1.51	0.17
132319991	Pike CASTNET	3781	3720	-61	-1.61	0.17
130670003	Kennesaw	3393	3262	-131	-3.86	0.15
130210012	Macon-Forestry	1830	3720	-77	-4.21	0.15
130210007	Macon-Allied	1830	1753	-77	-4.21	0.15
131150003	Rome	6818	6499	-319	-4.68	0.14
132950004	Rossville-Williams St.	5289	4986	-303	-5.73	0.13
130950007	Albany	2415	2246	-169	-7.00	0.12
132150008	Columbus-Airport	5033	4674	-359	-7.13	0.12
130511002	Savannah-L&A	2181	2008	-173	-7.93	0.11
132150012	Columbus-Baker	2330	2109	-221	-9.49	0.09
131350002	Gwinnett Tech	4124	3616	-508	-12.32	0.07
131390003	Gainesville	4481	3616	-865	-19.30	0.00

Table 12.3 shows that approximately half the census tracts with air quality monitors in Georgia experienced population growth from the 2020 census to the estimated 2023 population. The census tract with the Savannah-E President saw the biggest increase, with 84.18%. Therefore, ranking the highest according to this assessment.

The population during the official 2020 census, the 2023 estimate, and the percent change in population for all metropolitan and micropolitan statistical areas in Georgia are shown in Table 12.4.

Table 12.4: Population Change in Micropolitan Statistical Areas and Metropolitan Statistical Areas

Statistical Area	Population (2020 Census)	Population (ACS 2023)	Growth Rate	% Population Change	Rank by % Population Change
Jefferson	70493	80666	0.046	14.43	1.00
Bainbridge	26595	29118	0.031	9.49	0.81
Warner Robins	182819	195171	0.022	6.76	0.70
Thomaston	26329	27856	0.019	5.80	0.66
Savannah	390211	412089	0.018	5.61	0.66
Statesboro	88390	92112	0.014	4.21	0.60
Cornelia	45204	46948	0.013	3.86	0.59
Kingsland	53960	56036	0.013	3.85	0.59
Hinesville	81275	84338	0.012	3.77	0.58
Thomasville	69238	71752	0.012	3.63	0.58
Atlanta-Sandy Springs-Roswell	5961455	6177193	0.012	3.62	0.58
Tifton	48510	50237	0.012	3.56	0.58
Athens-Clarke County	210784	218164	0.012	3.50	0.57
Toccoa	25934	26842	0.012	3.50	0.57
Gainesville	201162	208139	0.011	3.47	0.57
Dublin	57121	58811	0.010	2.96	0.55
Augusta-Richmond County-SC	408335	419565	0.009	2.75	0.54
Cedartown	42251	43365	0.009	2.64	0.54
Columbus-AL	261705	267278	0.007	2.13	0.52
Macon-Bibb County	229565	234040	0.006	1.95	0.51
Jesup	29959	30519	0.006	1.87	0.51
Valdosta	146462	149139	0.006	1.83	0.51
Waycross	55081	55954	0.005	1.59	0.50
Fitzgerald	16889	17138	0.005	1.47	0.49
Rome	97805	98985	0.004	1.21	0.48
Calhoun	57756	58336	0.003	1.00	0.48
Moultrie	45510	45907	0.003	0.87	0.47
Summerville	24826	24975	0.002	0.60	0.46
Chattanooga, TN-GA	152762	153001	0.001	0.16	0.44
Douglas	51381	51422	0.000	0.08	0.44

Dalton	143911	143400	-0.001	-0.36	0.42
LaGrange-AL	70095	69821	-0.001	-0.39	0.42
Albany	147431	146768	-0.002	-0.45	0.42
Vidalia	36016	35618	-0.004	-1.11	0.39
Milledgeville	45072	43669	-0.010	-3.11	0.31
Brunswick-St. Simons	118149	114345	-0.011	-3.22	0.31
Americus	34929	33713	-0.012	-3.48	0.30
Eufaula, AL-GA	2290	2092	-0.030	-8.65	0.10
Cordele	22509	19995	-0.039	-11.17	0.00

Table 12.4 shows that most of Georgia's MSAs experienced population growth from the 2020 census to the estimated 2023 population. The Jefferson Micropolitan Statistical Area saw the biggest increase, with 14.43%; therefore, ranking the highest according to this assessment. The next biggest areas to have an increase in population were the Bainbridge and Warner Robins areas with 9.49% and 6.76% increases, respectively. Nine of the twenty-three MSA/CBSAs sites experienced a decline in population.

12.1 Population Change

In order to assess population change, the 2020 census and the American Community Survey 5-year estimated population for 2023 were compared. Figure 12.1 shows the 2023 total estimated population for each census tract. According to the United States Census Bureau, "census tracts are small, relatively permanent statistical subdivisions of a county or equivalent entity that are updated by local participants prior to each decennial census as part of the Census Bureau's Participant Statistical Areas Program. Census tracts generally have a population size between 1,200 and 8,000 people, with an optimum size of 4,000 people" (www.census.gov). The ambient air monitoring stations are shown with blue circles. The darker the color purple, the higher the estimated population for that census tract. Completely white census tracts denote missing census data.

Figures 12.1 and 12.2 show population density at the tract and MSA level respectively. Density is calculated by dividing the total population by the size of the area in US square miles. Figure 12.3 shows the 3-year compound annual growth rate for all Georgia counties (between 2020 and 2023). Growth rate is calculate using the formula:

$$\text{CAGR} = \left(\frac{V_{\text{final}}}{V_{\text{begin}}}\right)^{1/t} - 1$$

Vfinal represents the 2023 population, **Vbegin** represents the total 2020 population, and **t** represents time. In this assessment, the 3-year period between 2020 and 2023 is calculated.

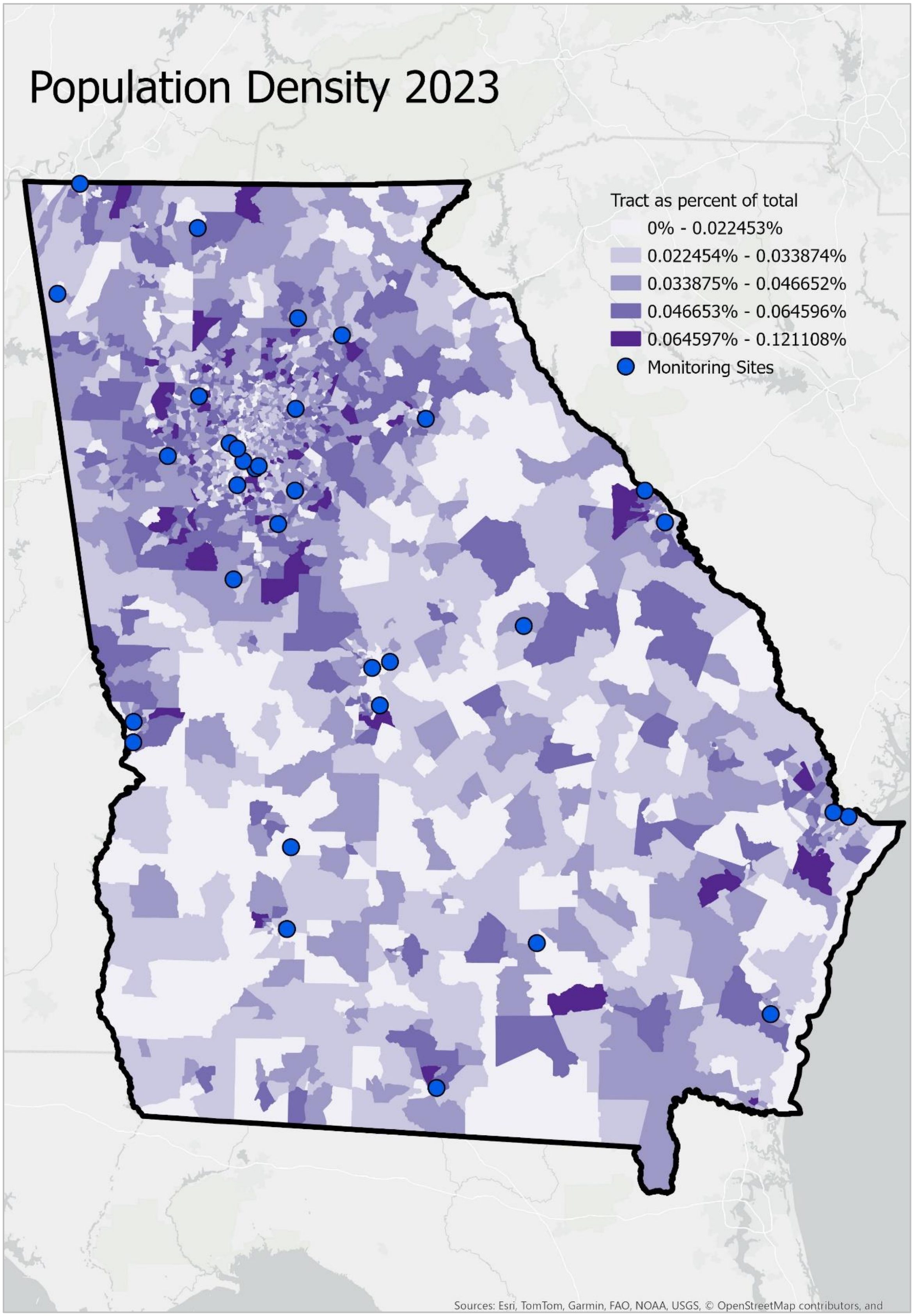


Figure 12.1: 2023 Georgia Total Estimated Population by Census Tract

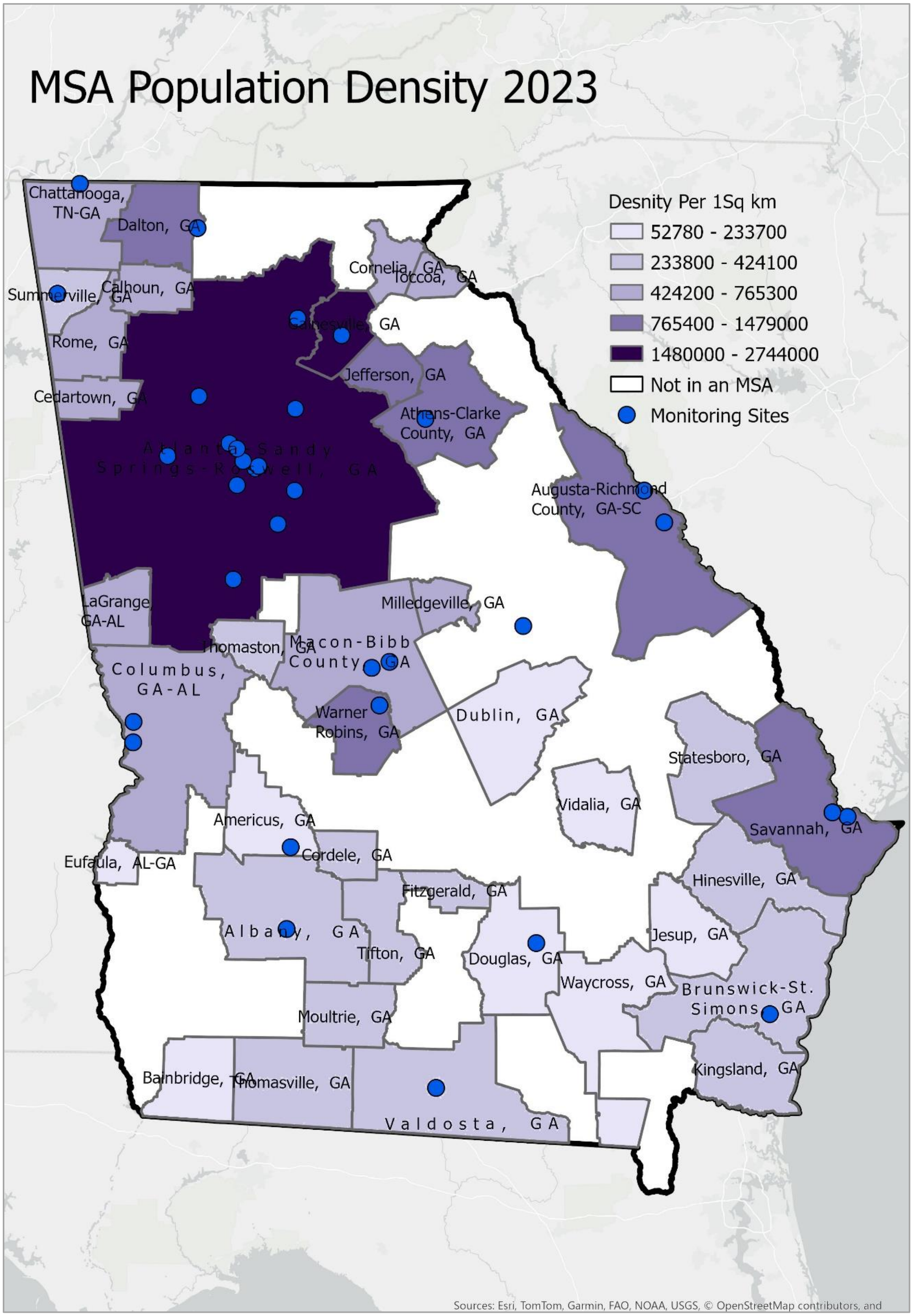


Figure 12.2: Population Densities for Georgia MSAs

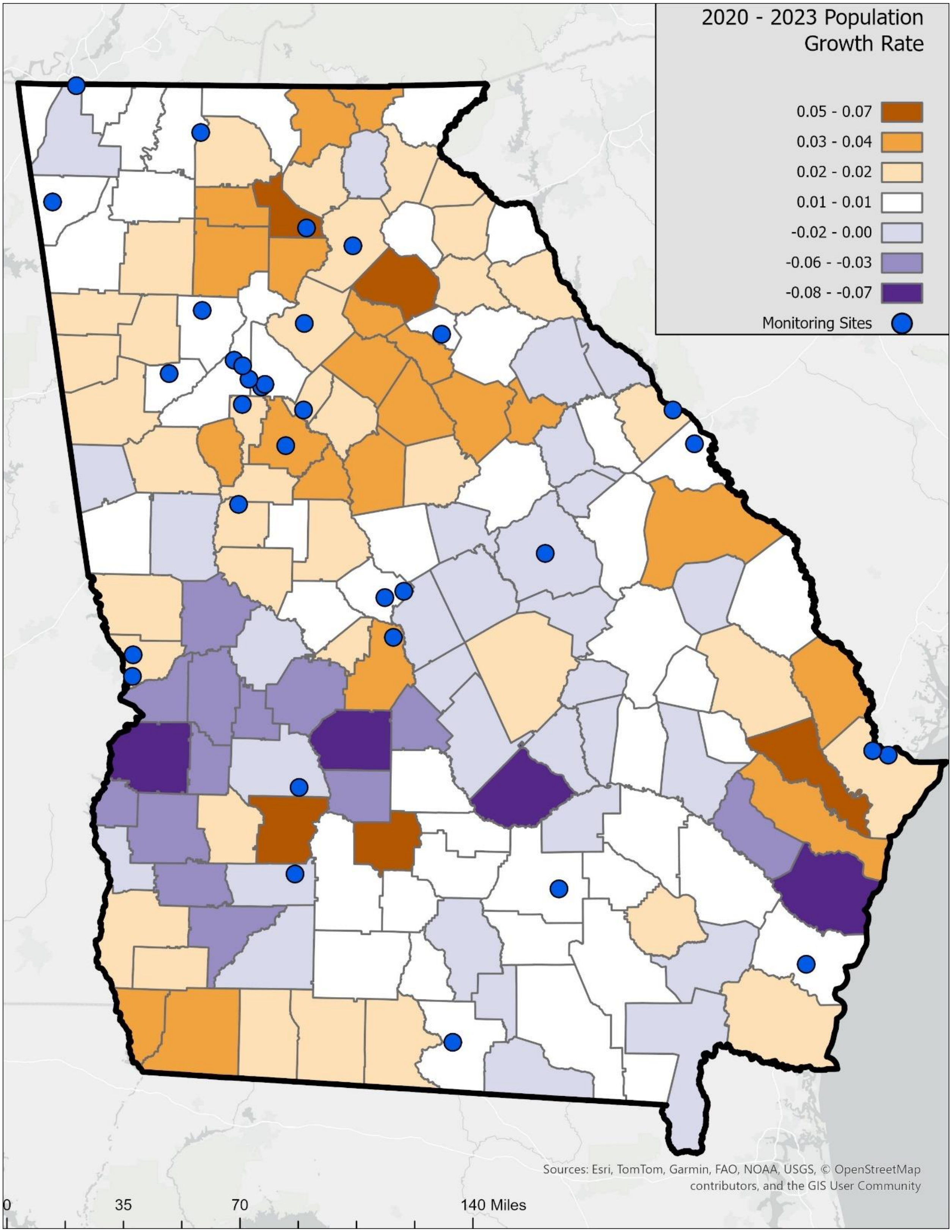


Figure 12.3: Georgia Population Growth Rate by County from 2020 to 2023

In Figure 12.3, purple colors represent a negative percent change in population, while the darker orange represent a positive percent change in population. White represents nearly no population change. The total population of Georgia increased about 2.9% with a 3-year growth rate of 0.96% from 2020 to 2023, with a total estimated population of 10,822,5905 in 2023. Overall changes in population were calculated for each county using the 2020 census data and the American Community Survey 5-year estimated population for 2023. Bryan County had the highest overall increase in population (+21.82%) with a 3-year growth rate of 0.07% and Telfair County had the greatest overall decrease in population (-23.29%) and a 3-year growth rate of -0.84% between 2020 and 2023.

Figures 12.4 through 12.7 show a closer view of the population growth rate from 2020 to 2023 for each of five major MSAs in Georgia (Atlanta-Sandy Springs-Roswell, Augusta-Richmond County, GA-SC, Columbus, GA-AL, Macon-Bibb County, and Savannah) by census tract.

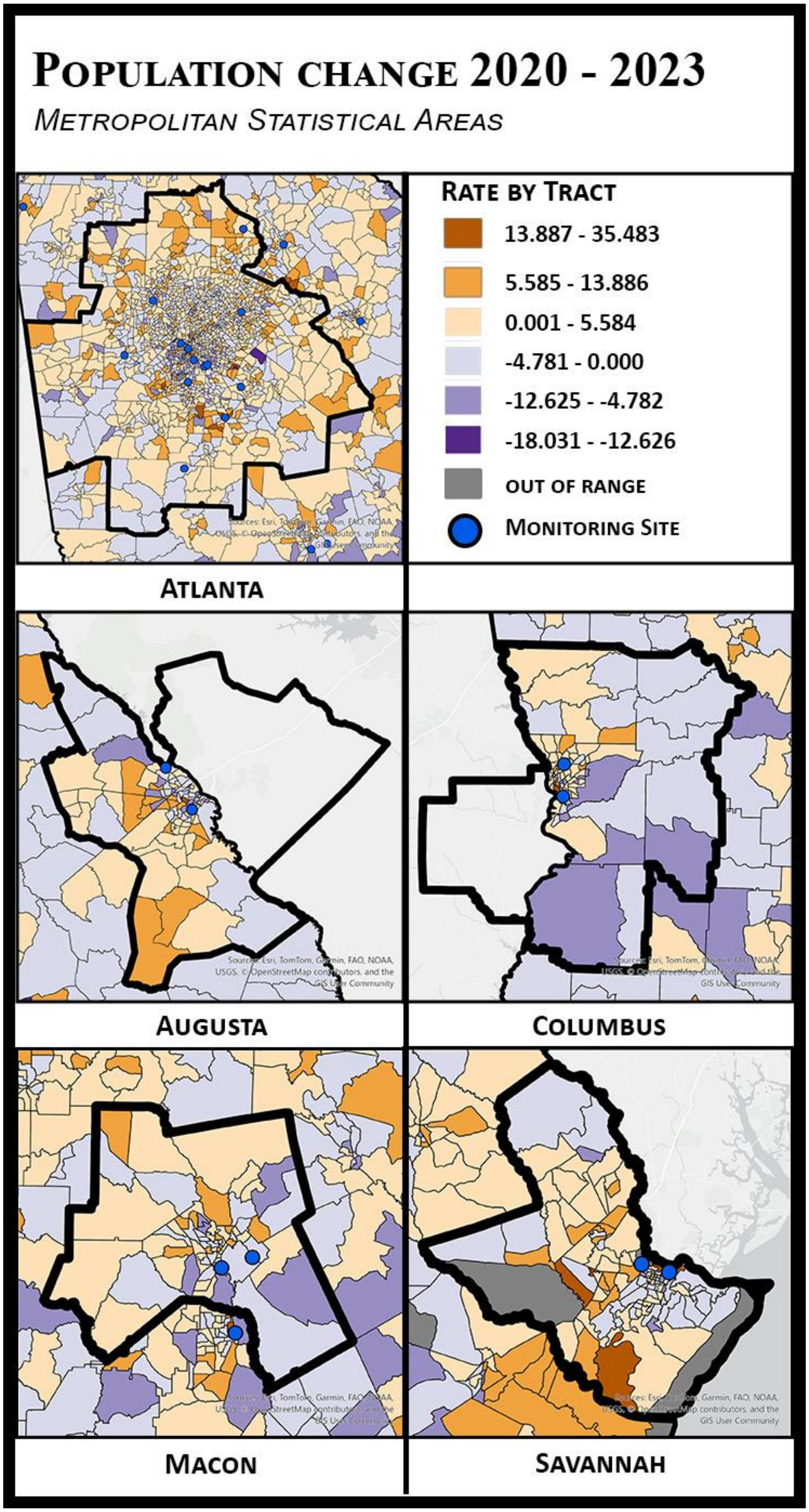


Figure 12.4: Atlanta-Sandy Springs-Roswell, Augusta-Richmond County, Columbus GA-Al, Macon- Bibb-County, and Savannah MSA's Percent Population Change by Census Tract from 2020 to 2023

12.2 Sensitive Populations

To meet the requirements set forth by EPA, GA AAMP needs to consider its ability to support air quality characterization for areas with high populations of susceptible individuals. GA AAMP operates air quality monitoring stations across the state, including evaluating air quality in vulnerable areas, such as populations of children under 5 and adults over 65. Detailed maps for Georgia, as well as the largest MSAs in Georgia, can be found below. These maps were created using ArcGIS Pro and the U.S. Census Bureau's demographic statistics. The maps illustrate the location of GA AAMP's ambient air monitors in relation to sensitive age groups. From the results of this assessment, it appears that there is sufficient coverage of ambient air monitors in areas with sensitive populations across the state of Georgia. It is important to note that these analyses function as screening tools. They rely on nationally available datasets and may not fully reflect the complexities of local environmental risks or community demographics.

Figure 12.5 and Figure 12.6 show the 2023 estimated population demographics for age for each census tract. Georgia's ambient air monitors are indicated on each map by blue circles. Figure 12.5 shows the percentile of the population under the age of five and over the age of 65 for each census tract in Georgia.

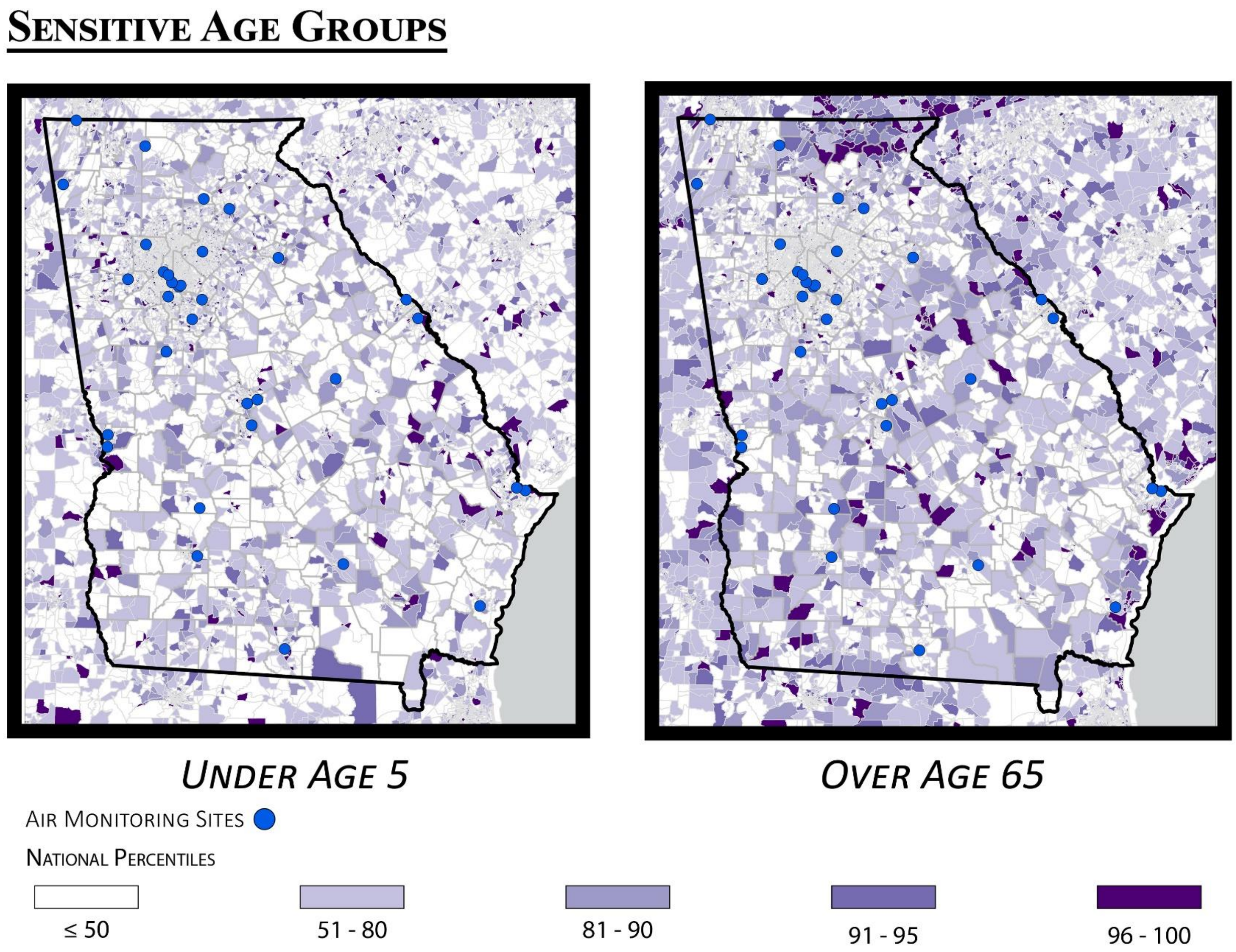


Figure 12.5: Tract percentile for Georgia's Population Under 5 Years of Age and Persons over 65 Years of Age

Figure 12.6 below shows how well each age group is represented by ambient air monitors in Georgia's largest MSAs (Atlanta-Sandy Springs-Roswell, Augusta-Richmond County, GA-SC, Columbus, GA-AL, Macon-Bibb County, and Savannah).

Figure 12.6: Percent of the Population in the Atlanta-Sandy Springs-Roswell, Augusta-Richmond County, GA-SC, Columbus, GA-AL, Macon-Bibb County, and Savannah MSAs under 5 Years (to the left) and over 65 Years (to the right)

For the larger MSAs, the majority of air montioring sites seem to be within 81st -90th and 91st -95th percentiles, with a few air monitoring sites in the the 96th-100th percentile tract for populations under 5 years old and over 65 years old.

12.2.3.1 Asthma Prevalence

To examine one aspect of air quality with regards to different groups of the population, the following tables were taken from a Centers for Disease Control (CDC) study involving asthma prevalence (https://www.cdc.gov/asthma/brfss/2023/brfssdata.htm). The tables show the self-reported current levels and lifetime levels of asthma.

The first two tables show the self-reported current levels and lifetime levels of asthma along with five categories of ethnicity. The tables show the ethnicity and prevalence of asthma with each ethnicity in the study.

Table 12.5: Adult Self-Reported Current Asthma Prevalence Rate (Percent) and Prevalence (Number) by Race/Ethnicity and State or Territory: BRFSS 2021

State	Race/Ethnicity	Sample Size	Prevalence (Percent)	Standard Error	95% CI[d] (Percent)	Weighted Number	95% CI[d] (Weighted Number)
GA	White NH	4,993	15	0.78	(13.5–16.5)	653,586	(583,285–723,887)
GA	Black NH	2,009	15.2	1.34	(12.6–17.8)	377,241	(307,026–447,457)
GA	Other NH	476	12.5	2.06	(8.4–16.5)	65,984	(43,384–88,585)
GA	Hispanic	461	11.7	2.04	(7.6–15.7)	84,704	(53,780–115,628)

*CI denotes confidence interval
https://www.cdc.gov/asthma/brfss/2021/default.htm

Table 12.5: Adult Self-Reported Lifetime Asthma Prevalence Rate (Percent) and Prevalence (Number) by Race/Ethnicity and State or Territory: BRFSS 2021

State	Race/Ethnicity	Sample Size	Prevalence (percent)	Standard Error (percent)	95% CI* (percent)	Prevalence (number)	95% CI* (number)
GA	White NH	5,005	9.5	0.64	(8.3–10.8)	416,008	(359,615–472,402)
GA	Black NH	2,015	10.8	1.11	(8.6–13.0)	269,710	(212,736–326,683)
GA	Other NH	479	7.1	1.53	(4.1–10.1)	37,756	(21,262–54,249)
GA	Hispanic	464	4.3	1.22	(1.9–6.7)	31,401	(13,626–49,176)
GA	White NH	5,005	9.5	0.64	(8.3–10.8)	416,008	(359,615–472,402)

*CI denotes confidence interval
https://www.cdc.gov/asthma/brfss/2021/default.htm

With this study, White Non-Hispanic, Black Non-Hispanic, Other Non-Hispanic, Multiracial Non-Hispanic, and Hispanic groups were examined for percent prevalence of asthma. In both the current and lifetime rates of prevalence, the Black Non-Hispanic group had the highest percentage rate of asthma (15.2% and 10.8%, respectively).

The next two tables show the age group and prevalence of asthma in each age group category from 18 to 65+ years of age.

Table 12.6: Adult Self-Reported Current Asthma Prevalence Rate (Percent) and Prevalence (Number) by Age and State or Territory: BRFSS 2021

State	Age Group	Sample Size	Prevalence (percent)	Standard Error (percent)	95% CI* (percent)	Prevalence (number)	95% CI* (number)
GA	18–24	416	11.5	2.08	(7.4–15.6)	120,939	(75,359–166,518)
GA	25–34	751	12.2	1.6	(9.0–15.3)	174,818	(126,717–222,918)
GA	35–44	941	9.2	1.17	(6.9–11.5)	127,061	(94,457–159,666)
GA	45–54	1,135	8	1.09	(5.9–10.1)	99,936	(72,484–127,389)
GA	55–64	1,452	8.5	0.91	(6.7–10.3)	113,173	(88,915–137,431)
GA	65+	3,199	7.2	0.62	(6.0–8.5)	117,042	(97,024–137,061)

*CI denotes confidence interval
https://www.cdc.gov/asthma/brfss/2021/default.htm

Table 12.7: Adult Self-Reported Lifetime Asthma Prevalence Rate (Percent) and Prevalence (Number) by Age and State or Territory: BRFSS 2021

State	Age Group	Sample Size	Prevalence (percent)	Standard Error (percent)	95% CI* (percent)	Prevalence (number)	95% CI* (number)
GA	18–24	419	21.2	2.68	(16.0–26.5)	225,402	(162,251–288,552)
GA	25–34	765	20.3	1.88	(16.6–24.0)	298,035	(238,091–357,980)
GA	35–44	946	13.6	1.41	(10.8–16.4)	188,417	(148,282–228,552)
GA	45–54	1,138	11.7	1.24	(9.2–14.1)	145,639	(113,969–177,309)
GA	55–64	1,462	11.2	1.02	(9.2–13.2)	149,235	(121,821–176,648)
GA	65+	3,210	11.1	0.79	(9.6–12.7)	181,433	(155,151–207,715)

*CI denotes confidence interval
https://www.cdc.gov/asthma/brfss/2021/default.htm

For the asthma prevalence rate in Georgia, the age group of 18-24 years had the highest rate for both the current and lifetime asthma prevalence rate at 11.5% (unchanged from 2017 and shows a 4.3% increase in lifetime prevalence in 2021 at 21.2%).

The next two tables show the level of income and prevalence of asthma at each level of income in the study.

Table 12.8: Adult Self-Reported Current Asthma Prevalence Rate (Percent) and Prevalence (Number) by Income and State or Territory: BRFSS 2021

State	Income	Sample Size	Prevalence (percent)	Standard Error (percent)	95% CI* (percent)	Prevalence (number)	95% CI* (number)
GA	< $15,000	467	10.5	1.77	(7.0–14.0)	49,142	(32,700–65,583)
GA	$15,000–<$25,000	792	11.6	1.9	(7.9–15.4)	86,720	(56,972–116,468)
GA	$25,000–<$50,000	1,696	10.2	1.13	(8.0–12.4)	173,560	(134,486–212,634)
GA	$50,000–<$75,000	1,043	9.2	1.46	(6.4–12.1)	98,976	(66,721–131,231)
GA	>=$75,000	2,045	8.1	0.96	(6.2–10.0)	179,305	(135,626–222,984)

*CI denotes confidence interval
https://www.cdc.gov/asthma/brfss/2021/default.htm

Table 12.9: Adult Self-Reported Lifetime Asthma Prevalence Rate (Percent) and Prevalence (Number) by Income and State or Territory: BRFSS 2021

State	Income	Sample Size	Prevalence (percent)	Standard Error (percent)	95% CI* (percent)	Prevalence (number)	95% CI* (number)
GA	< $15,000	470	16.1	2.28	(11.6–20.6)	75,524	(53,693–97,355)
GA	$15,000–<$25,000	796	17.6	2.19	(13.3–21.9)	133,010	(97,218–168,802)
GA	$25,000–<$50,000	1,705	16.1	1.49	(13.2–19.1)	276,541	(221,509–331,573)
GA	$50,000–<$75,000	1,050	14	1.61	(10.8–17.2)	151,364	(114,833–187,895)
GA	>=$75,000	2,053	12.2	1.13	(10.0–14.4)	273,055	(220,767–325,342)

*CI denotes confidence interval
https://www.cdc.gov/asthma/brfss/2021/default.htm

In this study, income levels of <$15,000 through ≥$75,000 were examined. In the current and lifetime asthma prevalence rates, the second lowest income (<$15,000->$25,000) have the highest rates of asthma prevalence. With current asthma prevalence rates, the prevalence was 11.6%, and with the lifetime rates, the prevalence was 17.6%

13.0 AQI Assessment

National Ambient Air Quality Standards (NAAQS)

The NAAQS are established for each pollutant for which air quality criteria have been issued. The EPA is to set standards where "the attainment and maintenance are requisite to protect public health" with "an adequate margin of safety." In 1971, the EPA established standards for six "criteria" pollutants as required by the Clean Air Act. The standards have changed over time to keep up with improvements in scientific knowledge and as this document is written are shown in the following table. There have been proposed changes, and for the most up to date standards refer to EPA's website (https://www.epa.gov/criteria-air-pollutants/naaqs-table).

Table 13.1: National Ambient Air Quality Standards

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [81 FR 71906, Oct 18, 2016]		primary and secondary	Rolling 3-month average	0.15 μg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide [77 FR 20218, Apr 3, 2012] [75 FR 6474, Feb 9, 2010]		primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	Annual	53 ppb (2)	Annual Mean
Ozone [80 FR 65292 Oct 26, 2015]		primary and secondary	8-hour	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution[89 FR 16202, March 6, 2024]	$PM_{2.5}$	primary	Annual	9 μg/m^3	annual mean, averaged over 3 years
		secondary	Annual	15 μg/m^3	annual mean, averaged over 3 years
		primary and secondary	24-hour	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [84 FR 9866, March 18, 2019] [77 FR 20218, Apr 3, 2012]		primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
(2) The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.
(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.
(4) The previous SO_s standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designation nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP under the previous SO_2 standards (40 CFE 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.
https://www.epa.gov/criteria-air-pollutants/naaqs-table

As shown in Table 13.1, there are two categories for ambient air quality standards, primary and secondary. Primary standards are intended to protect the most sensitive individuals in a population. These "sensitive" individuals include children, the elderly, and people with chronic illnesses. The secondary standards are designed to protect public welfare or the quality of life. This includes visibility protection, limiting economic damage, damage to wildlife, the climate, or man-made material. The varied averaging times are to address the health impacts of each pollutant. Short-term averages are to protect against acute effects. Long-term averages are to protect against chronic effects.

The Georgia ambient air monitoring network provides information on the measured concentrations of criteria and non-criteria pollutants at pre-selected locations. The 2023 Georgia Air Sampling Network collected data at 35 locations in 28 counties, including all sites monitored during segmented sections of the year and the EPA CASTNET site. Monitoring occurs year-round, although some pollutants have various required monitoring periods. Ozone, with the exception of the South DeKalb site, is sampled from March through October, and the continuous (hourly) Photochemical Assessment Monitoring Stations (PAMS) volatile organic compounds are sampled from June through August. Please note that not all pollutants are monitored at all sites. All official monitoring performed in support of the National Ambient Air Quality Standards (NAAQS) must use EPA-defined reference methods described in 40 CFR, Appendix L, or equivalent methods designated in accordance with Part 53 of that chapter. All data collected in the network undergoes an extensive quality assurance review and is then submitted to the Air Quality System (AQS) database that is maintained by the EPA.

Air Quality Index (AQI)

The Air Quality Index (AQI) is a national air standard rating system developed by the U.S. Environmental Protection Agency. The AQI is used throughout Georgia to provide the public, on a daily basis, with an analysis of air pollution levels and possible related health risks. Generally, an index scale of 0 to 500 is used to assess the quality of air, and these numbers are synchronized with a corresponding descriptor word such as: Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, and Hazardous.

To protect public health the EPA has set an AQI value of 100 to correspond to the NAAQS for the following pollutants: Ozone (O_3), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Particulate Matter 10 (PM_{10}), Particulate Matter 2.5 ($PM_{2.5}$), and Nitrogen Dioxide (NO_2). The AQI for a reporting region equates to the highest rating recorded for any pollutant within that region. For example, if EPA reports an AQI level of 90 for ozone for a given metropolitan area, residents of the area would know that the ozone level for the region is at the high end of the moderate range. Those residents would also know that ozone is the pollutant with the highest AQI reading for that hour, and that all other measured pollutants are therefore in the good or moderate range. On days when two or more pollutants have AQI values greater than 100, the pollutant with the highest index level is reported, but information on any other pollutants above 100 may also be reported. Therefore, the larger the AQI value, the greater level of air pollution present, and the greater expectation of potential health concerns. Table 13.2 below shows how the recorded concentrations correspond to the AQI index values, descriptors and health advisories.

GA AAMP determines the index number on a daily basis for each of the pollutants and reports the number to AirNow (https://airnow.gov/). The highest of the figures and corresponding pollutant are reported for each major metropolitan area in Georgia.

Table 13.2: Detailed AQI Values by Pollutant

Maximum Pollutant Concentration									
$PM_{2.5}$	PM_{10}	SO_2	O_3	O_3	CO	NO_2			
(24hr) µg/m^3	(24hr) µg/m^3	(1hr)* ppb	(8hr)^ ppm	(1hr) ppm	(8hr) ppm	(1hr) ppb	**AQI Value**	**Descriptor**	**EPA Health Advisory**
0.0–9.0	0– 54	0– 35	0.000–0.054	None	0.0–4.4	0– 53	0 to 50	**Good (green)**	Air quality is considered satisfactory, and air pollution poses little or no risk.
9.1–35.4	55–154	36–75	0.055–0.070	None	4.5–9.4	54-100	51 to 100	**Moderate (yellow)**	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to the condition of the air may experience respiratory symptoms.
35.5–55.4	155 – 254	76 – 185	0.071 – 0.085	0.125 – 0.164	9.5–12.4	101-360	101 to 150	**Unhealthy for Sensitive Groups**	Members of sensitive groups (people with lung or heart disease) are at greater risk from exposure to particle pollution. Those with lung disease are at risk from exposure to ozone. The general public is not likely to be affected in this range.
55.5–125.4	255–354	186–304*	0.086–0.105	0.165–0.204	12.5–15.4	361-649	151 to 200	**Unhealthy (red)**	Everyone may begin to experience health effects in this range. Members of sensitive groups may experience more serious health effects.
125.5–225.4	355–424	305–604*	0.106–0.200	0.205–0.404	15.5–30.4	650-1249	201 to 300	**Very Unhealthy (purple)**	AQI values in this range trigger a health alert. Everyone may experience more serious health effects. When the AQI is in this range because of ozone, most people should restrict their outdoor exertion to morning or late evening hours to avoid high ozone exposures.
225.5+	425–504	605–804*	0.201-(^)	0.405 – 0.504	30.5–40.4	1250-1649	301 to 400	**Hazardous (maroon)**	AQI values over 300 trigger health warnings of emergency conditions. The entire population is more likely to be affected.
	505–604	805–1004*	None^	0.505–0.604	40.5–50.4	1650-2049	401 to 500		

It is important to note that the AQI value is designed for short-term use only. The value corresponding with each day provides the public with an indicator. People with asthma, lung disease, heart disease, and other susceptible populations can use the daily AQI to stay informed of the current conditions. This can certainly provide a jogger with the information needed to determine whether it is safe to exercise outside or not. However, this system only addresses air pollution in terms of acute health effects over time periods of 24 hours or less and does not provide an indication of chronic pollution exposure over months or years. As the AQI index is a valuable tool for public use, it cannot be used to determine whether a site is in attainment or not. Real-time data that support the Air Quality Index require continuous samplers. Continuous samplers produce hourly averaged data that is available fifteen minutes after the end of each hour. The immediate availability of this data allows the public to make informed decisions regarding their outdoor physical activities. At this time, the GA AAMP uses a few continuous $PM_{2.5}$ samplers that are not set up as being fully equivalent to the reference method. This means that data from these continuous $PM_{2.5}$ samplers cannot be used for determining if an area is in attainment of the NAAQS; only data from the reference method may be used. As a result, sites that may have a high number of days above the AQI value of 100 may not necessarily be in nonattainment, though oftentimes a correlation is observed.

Index reporting is required for all urban areas with a population exceeding 350,000, which in Georgia include the Atlanta-Sandy Springs-Roswell MSA, the Augusta-Richmond County Georgia-South Carolina MSA, the Savannah MSA, and the Chattanooga Tennessee-Georgia MSA. As an added service to the public, the GA AAMP reports the highest AQI values and corresponding pollutants for each major metropolitan area in Georgia.

In Figure 13.1, the number of days each MSA in the state of Georgia had AQI values above 100 are shown. The data was extracted from AQS using all available historical data. This figure applies current AQI standards to all years, so historical data may show more exceedances than in the past because current AQI thresholds are lower. The Atlanta-Sandy Springs-Roswell MSA consistently has the highest number of days above 100. There has been a seemingly cyclical pattern, with an overall downward trend.

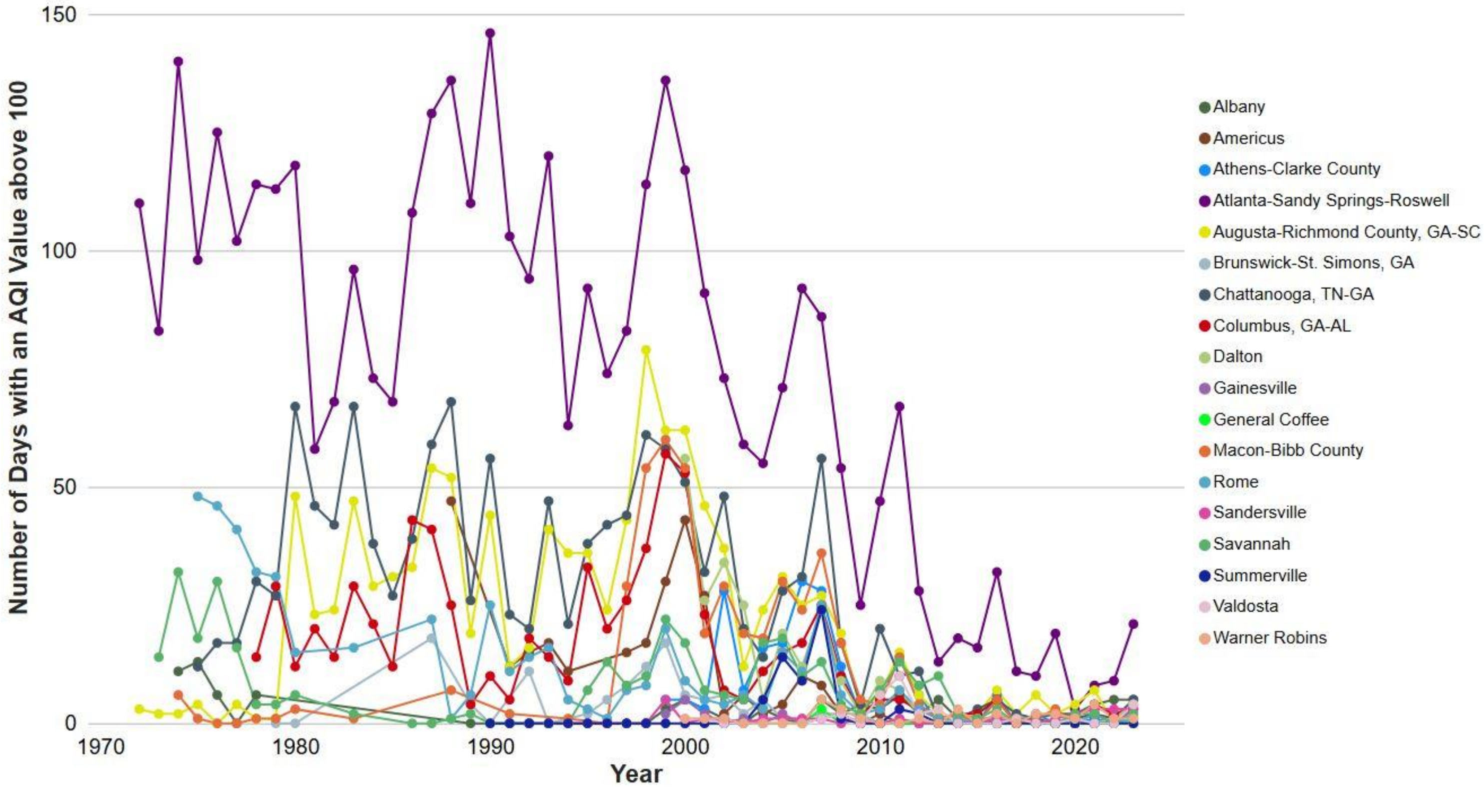
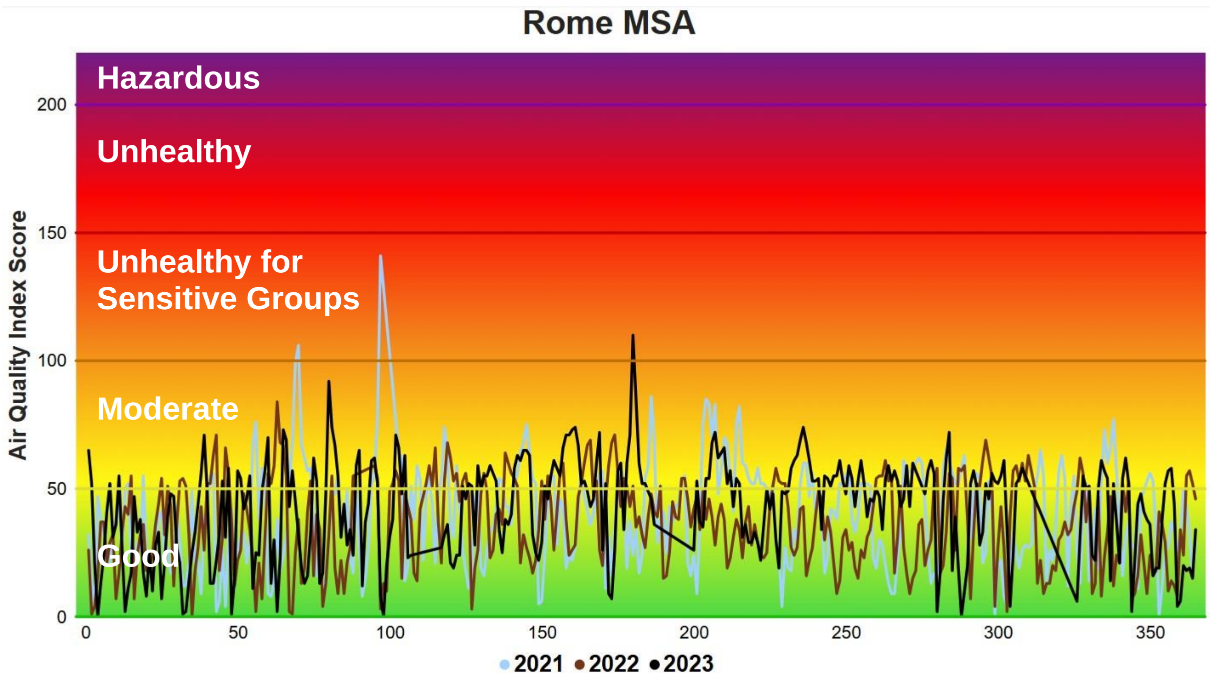
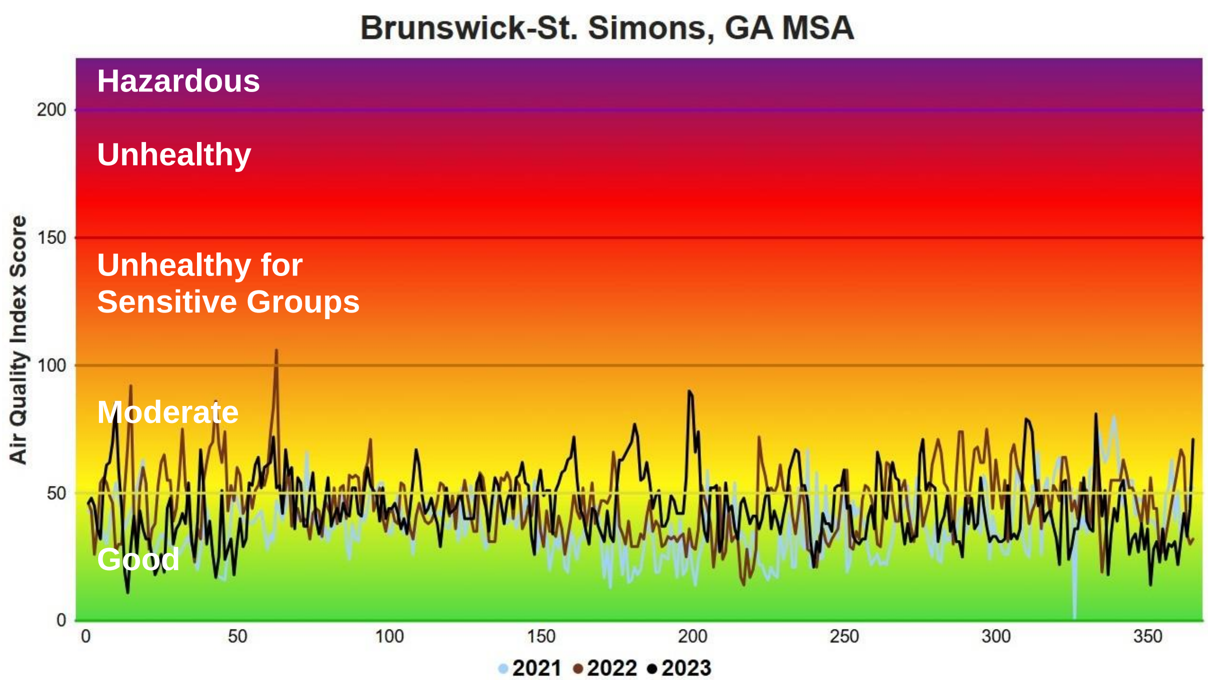
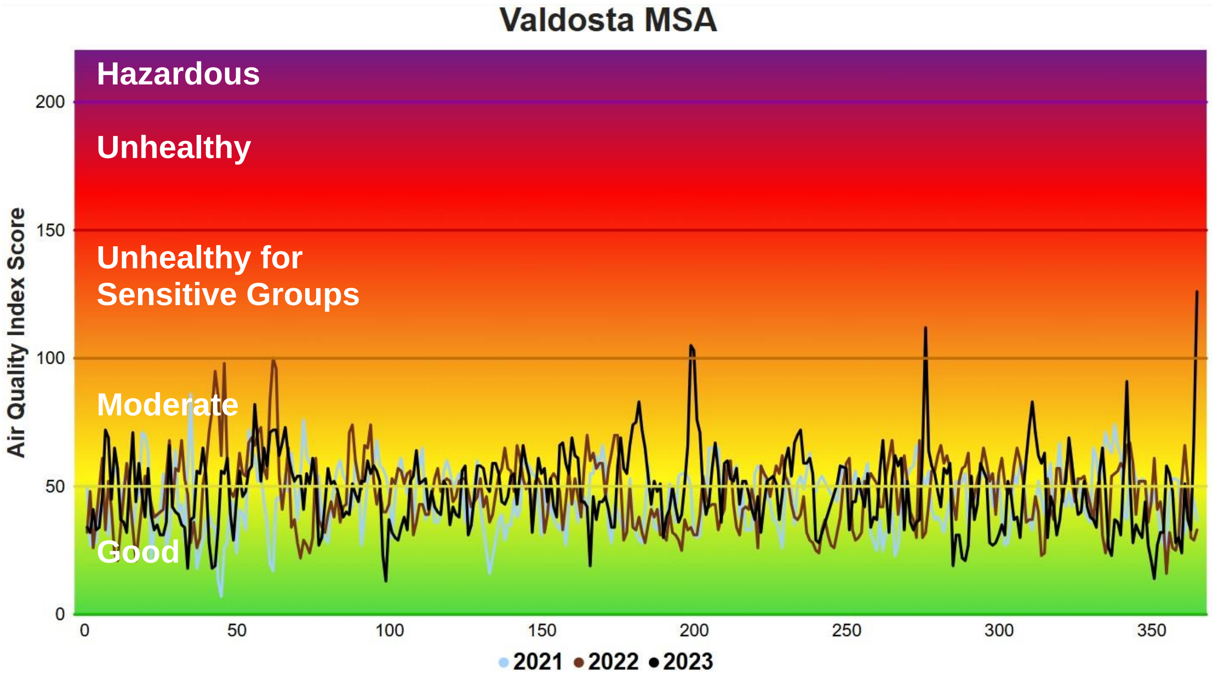


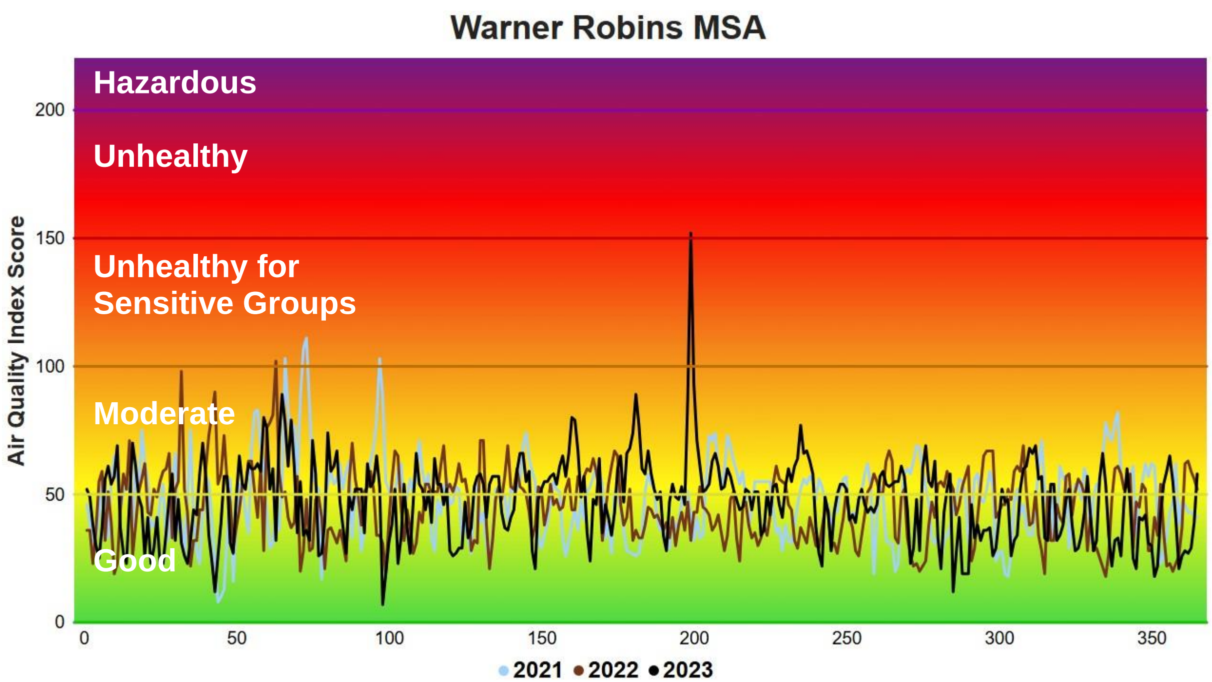
Figure 13.1: Number of Days with an AQI value above 100 across Georgia from 1972 to 2023

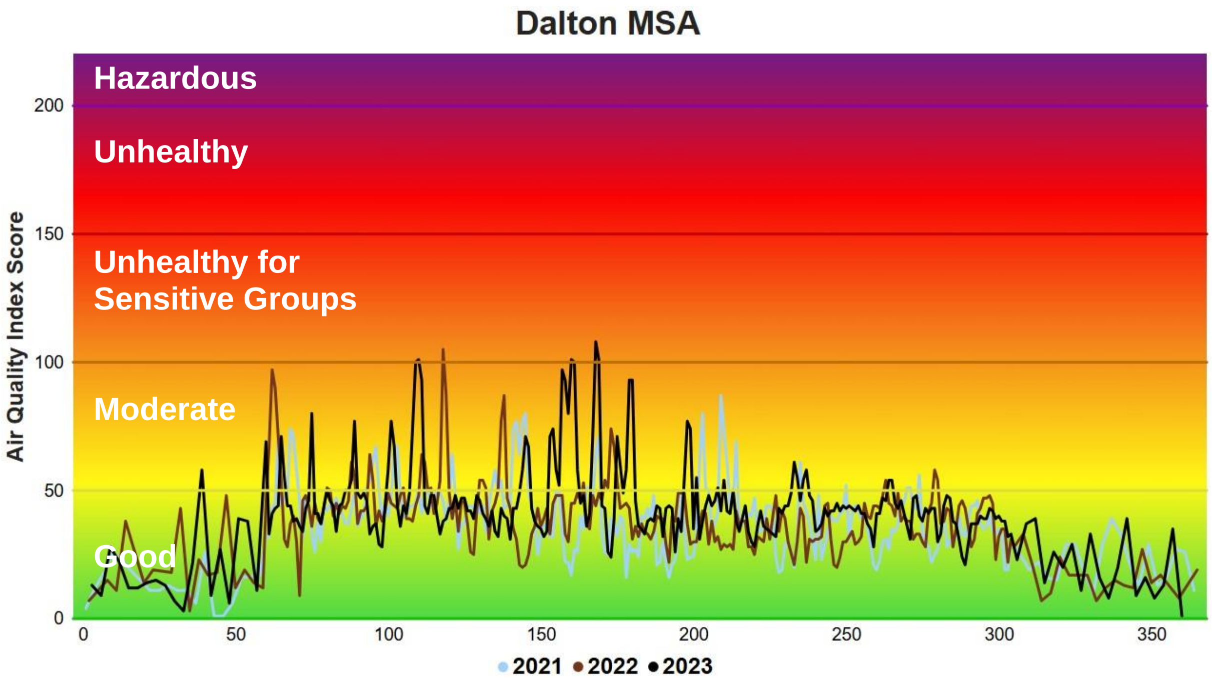
The following charts additionally show the trends of the AQI in each of the Metropolitan Statistical Areas (MSAs) from 2021 through 2023. The darkest years line is the most recent year, 2023. Not all, but many MSAs experienced a spike in July of 2023. Many of these are due to the Canadian Wildfires that took place at that time. Additionally, only one MSA shows even semblance of a trend – the Atlanta-Sandy Springs-Roswell MSA, which hints at seasonal variation in the AQI. This seasonal variation would be consistent with the higher ozone values which occur in the MSA during the summer months.


Rome MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
250
300
350
2021
2022
2023


Brunswick-St. Simons, GA MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
250
300
350
2021
2022
2023


Valdosta MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
0
50
100
150
200
250
300
350
2021
2022
2023


Warner Robins MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
0
50
100
150
200
250
300
350
2021
2022
2023


Dalton MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
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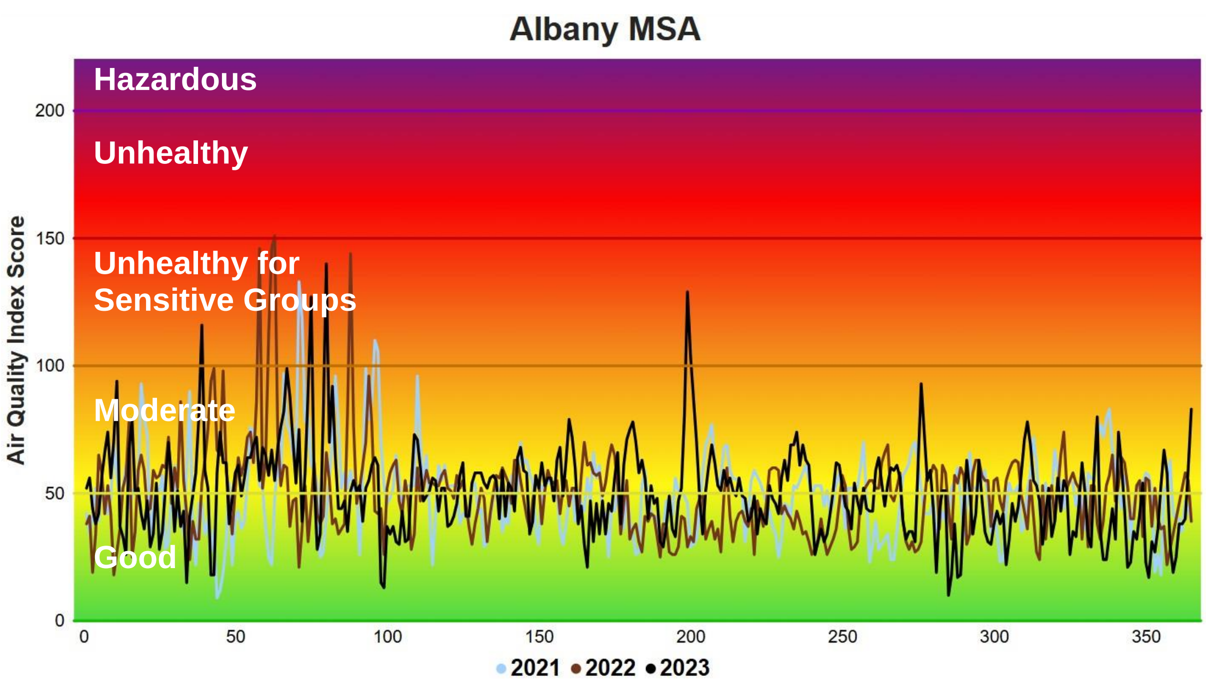
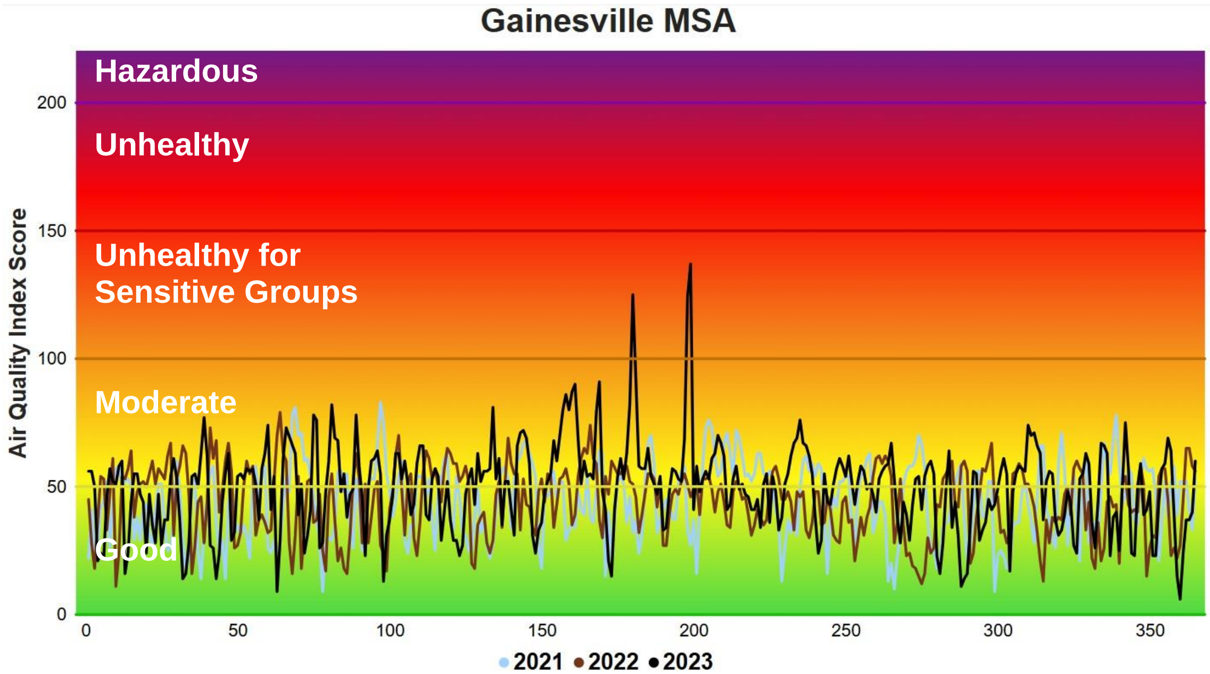
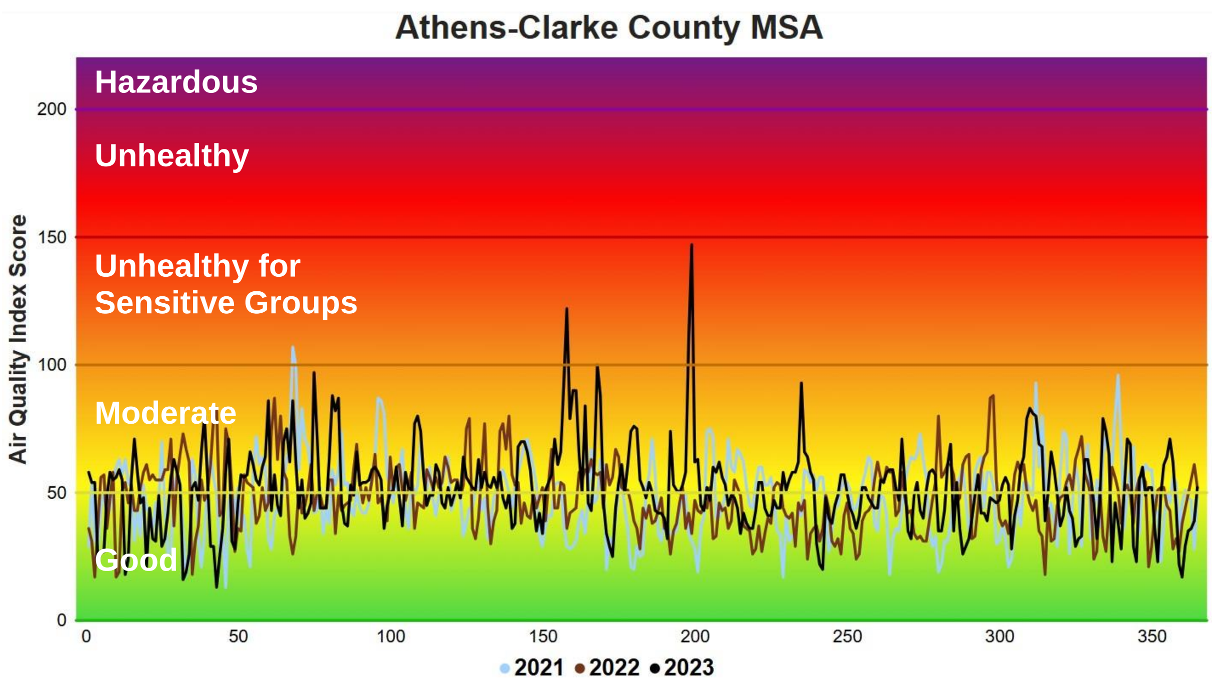
50
100
150
200
0
50
100
150
200
250
300
350
2021
2022
2023


Albany MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
0
50
100
150
200
250
300
350
2021
2022
2023


Gainesville MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
0
50
100
150
200
250
300
350
2021
2022
2023


Athens-Clarke County MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
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50
100
150
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0
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100
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200
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300
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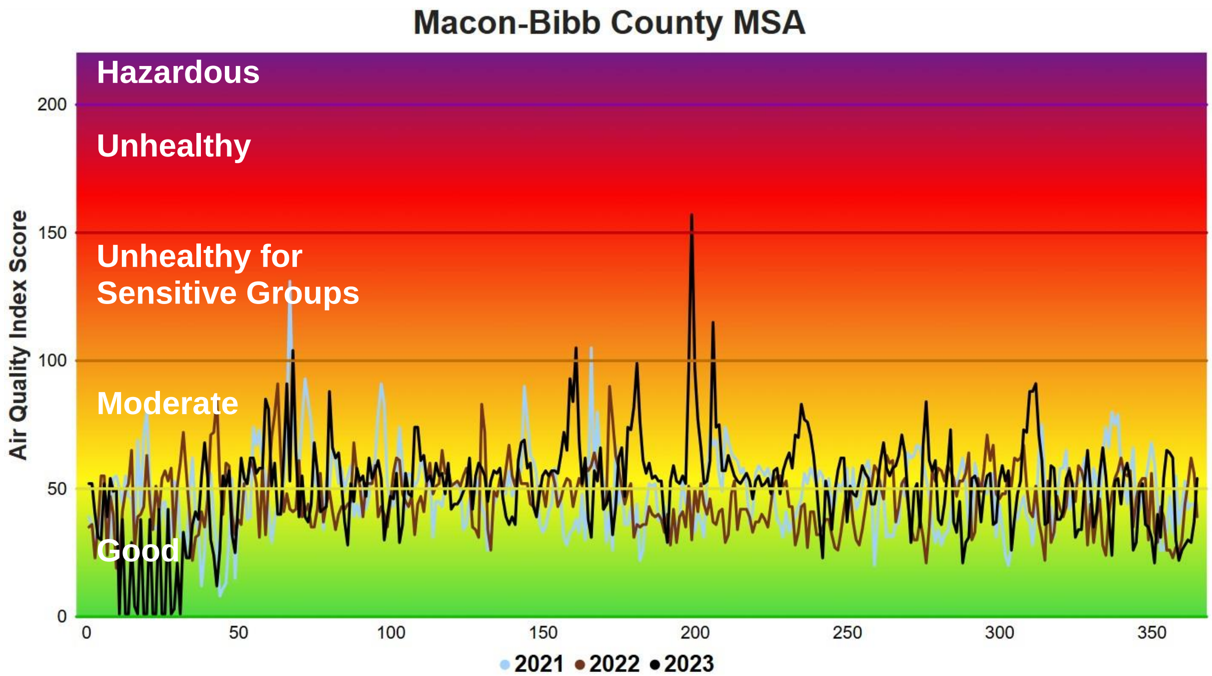
2021
2022
2023



Macon-Bibb County MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
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100
150
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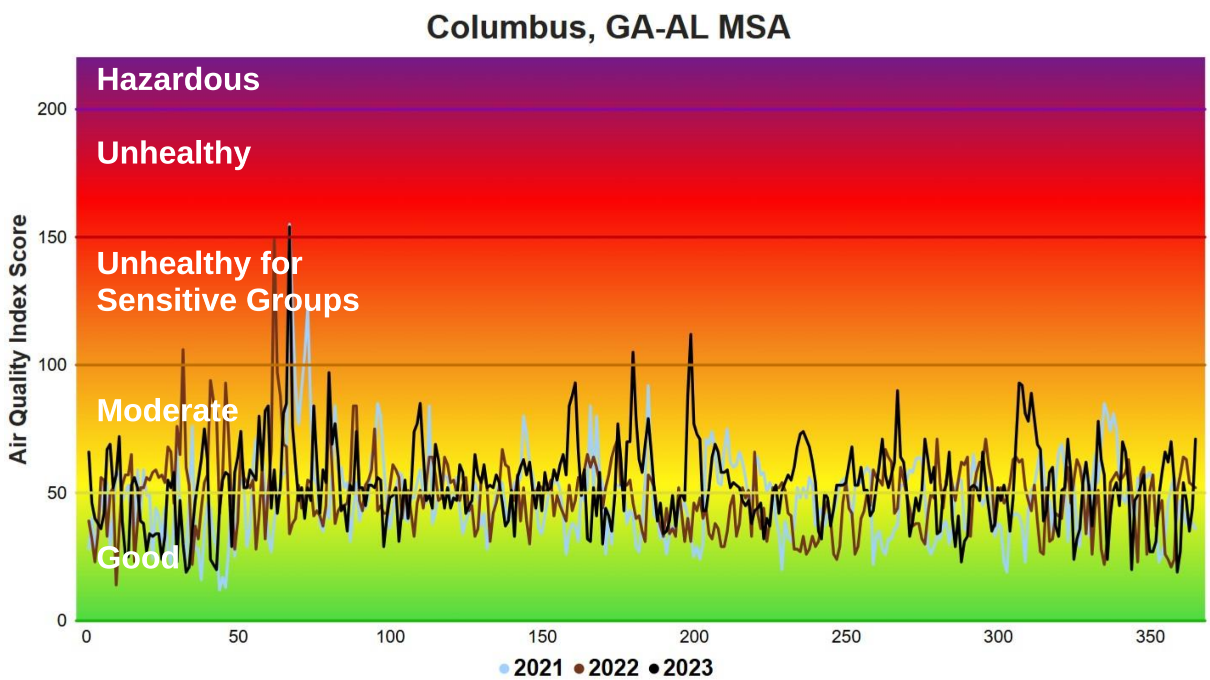
50
100
150
200
250
300
350
2021
2022
2023



Columbus, GA-AL MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
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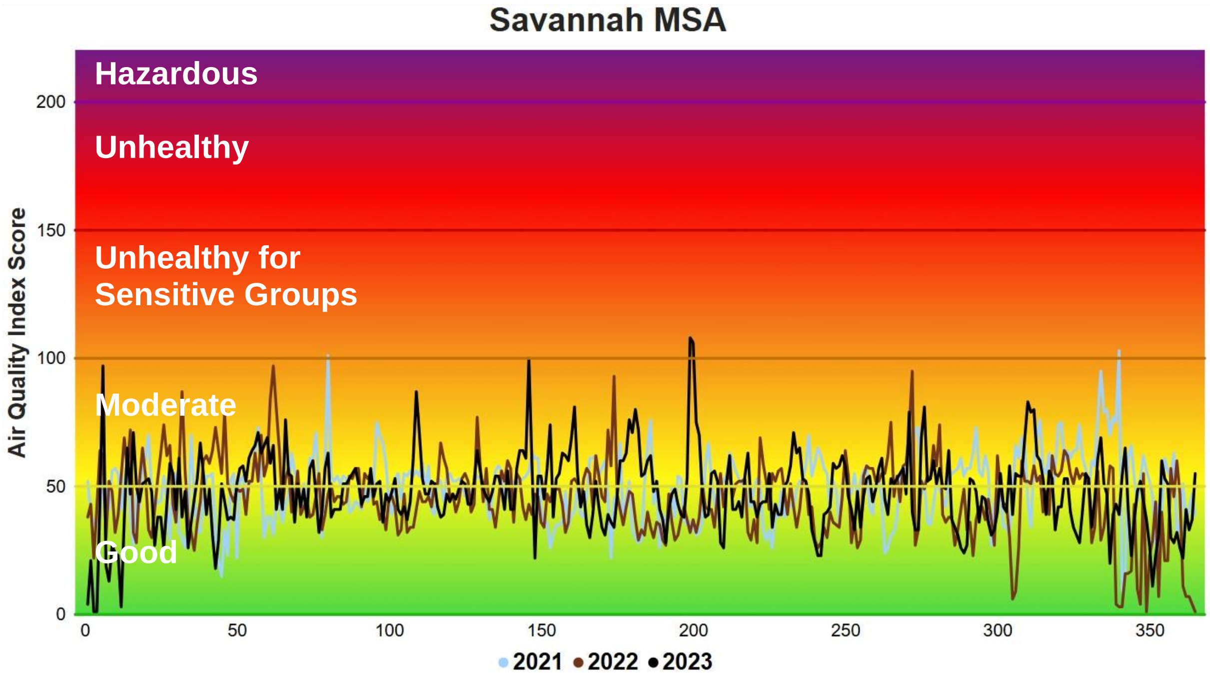
100
150
200
0
50
100
150
200
250
300
350
2021
2022
2023


Savannah MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
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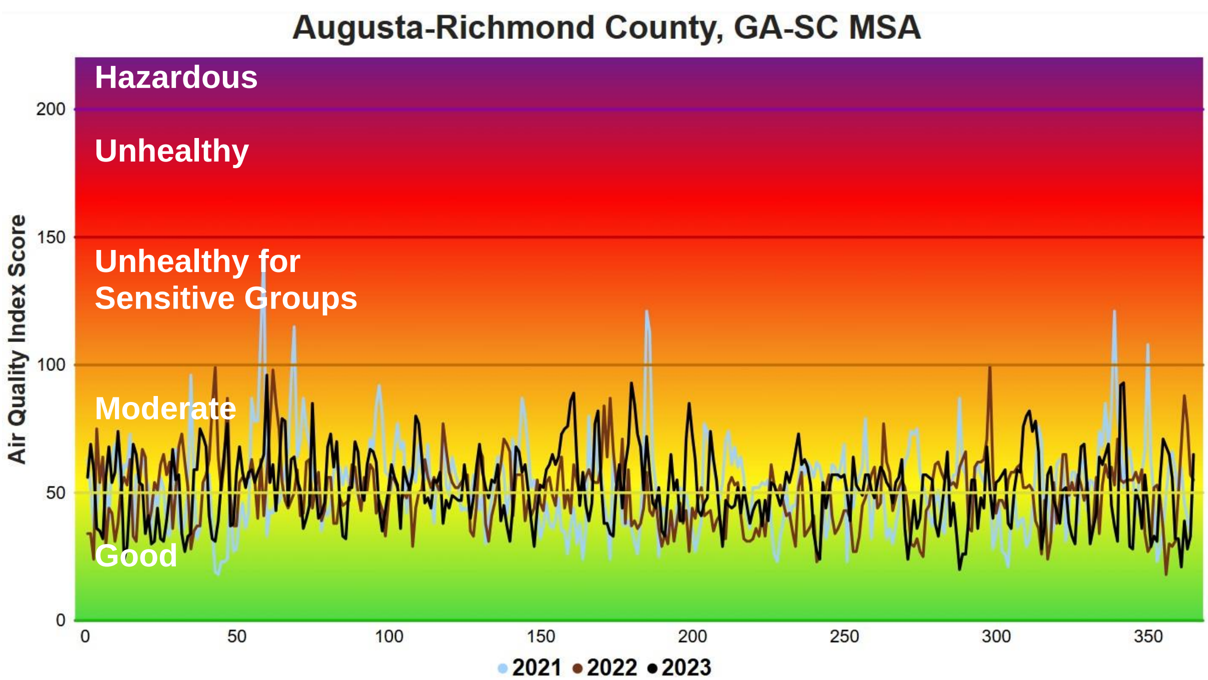
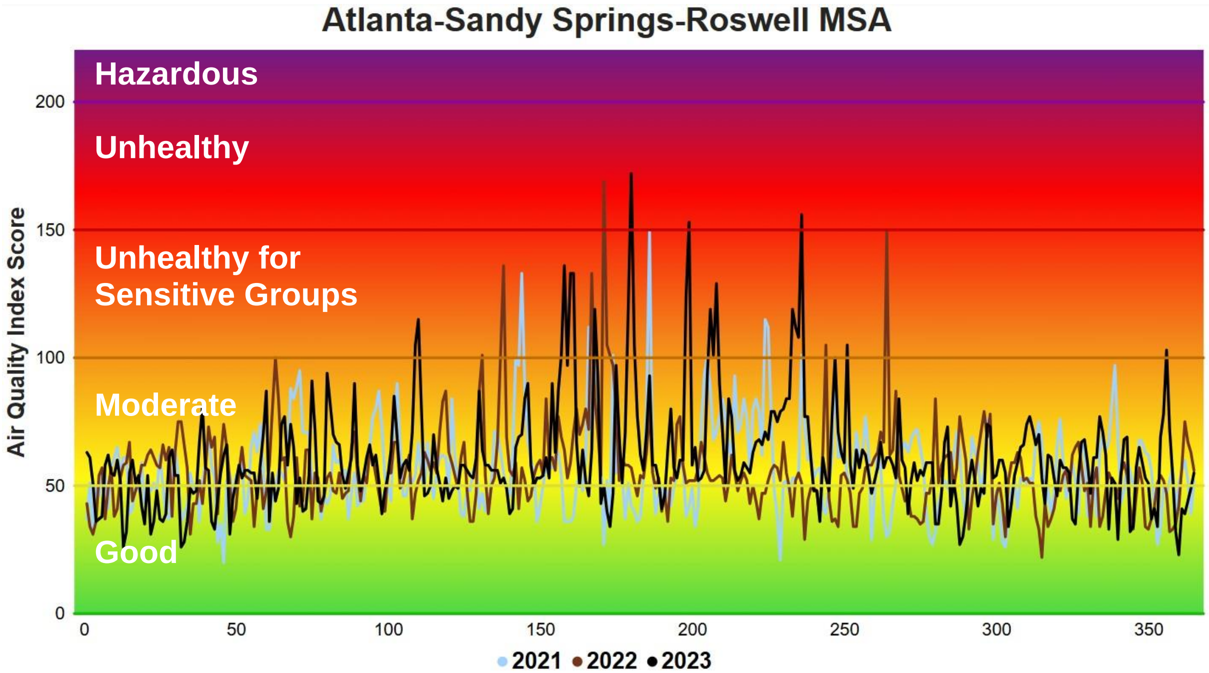
100
150
200
0
50
100
150
200
250
300
350
2021
2022
2023


Augusta-Richmond County, GA-SC MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
0
50
100
150
200
250
300
350
2021
2022
2023


Atlanta-Sandy Springs-Roswell MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
0
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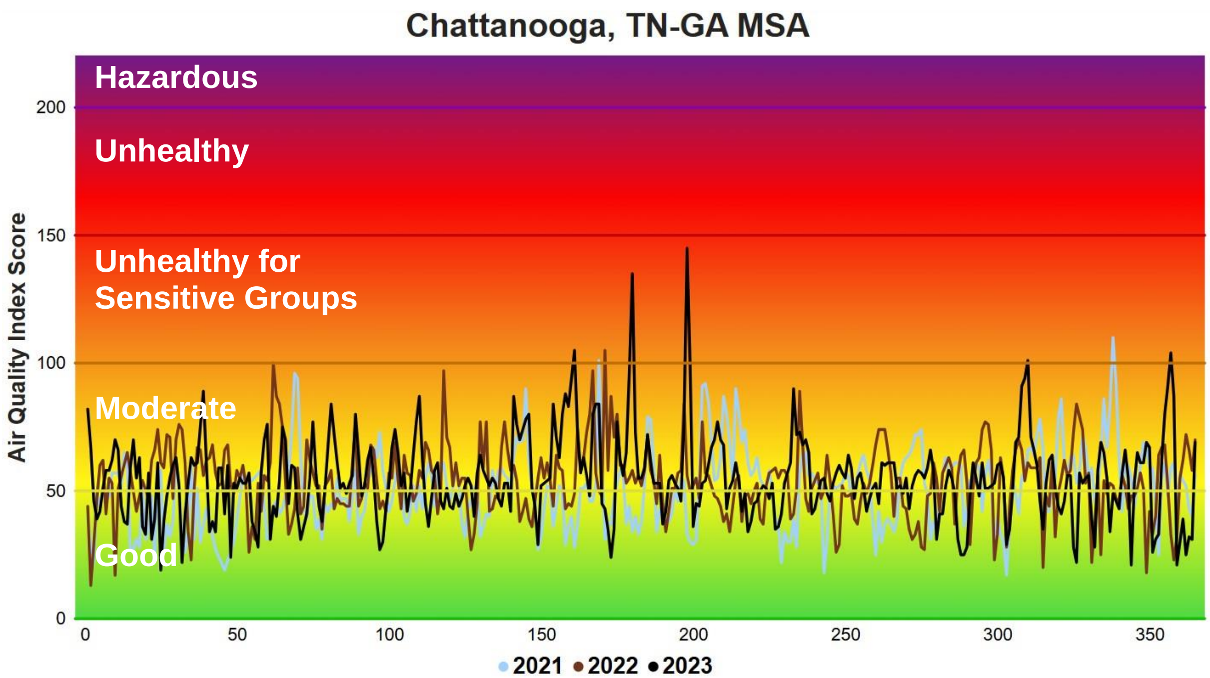
100
150
200
250
300
350
2021 2022 2023


Chattanooga, TN-GA MSA
Hazardous
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
Air Quality Index Score
0
50
100
150
200
0
50
100
150
200
250
300
350
2021 2022 2023

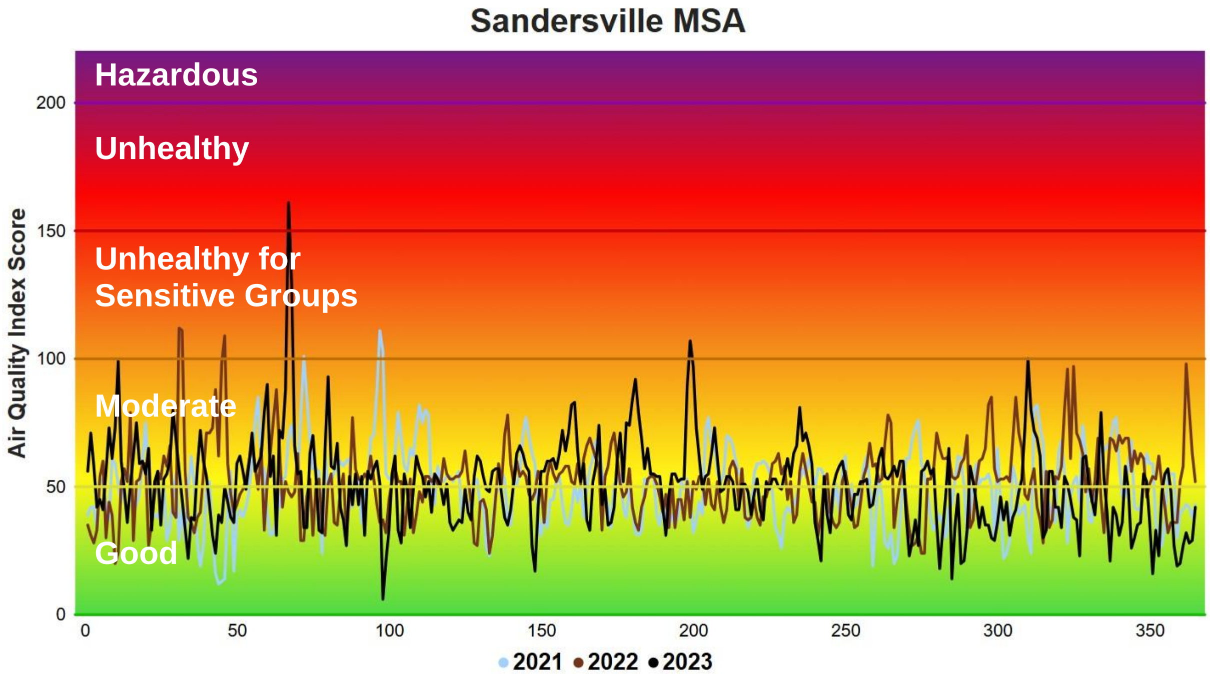


Figure 13.2: Color Charted MSA AQI Trend Lines from 2021-2023

The following table outlines each metropolitan statistical area (MSA) as defined by the U.S. Census Bureau, in which GA AAMP currently has ambient air monitors. The table was taken from EPA's guide, 'Designing a Network Assessment for an Ambient Air Monitoring Program' (U.S. EPA 2010). The column entitled 'Status of NAAQS and Major Risk Issues' addresses whether a site is in Attainment or Nonattainment for each of the criteria pollutants listed above. If an area was previously a nonattainment area and then meets the standards and additional redesignation requirements in the CAA [Section 107(d)(3)(E)], the area is labeled as 'Maintenance'. The classification 'Attainment/Unclassifiable' is defined as meeting the standard or expected to be meeting the standard despite a lack of monitoring data. With the drafting of this document in January 2025, the most current designations of the standards were used in the assessment. The next column, 'Extent of NAAQS Violations', cites the location of a violation within the MSA. Violations are identified by county, and in some cases, a partial section of a county. It should be noted that there can be exceedances of the NAAQS within an MSA, and AQI values over 100, but not have a violation of the NAAQS due to how the NAAQS are calculated.

In Table 13.3, 'Days above 100 on the AQI' was calculated using data pulled from EPA's Air Quality System (AQS) for the years 2021 through 2023. A three-year average is a better representation of air quality since year to year weather systems can be variable, affecting the air quality. The AQS AQI index provides the daily maximum for each MSA. The number of days for each year were totaled, and then the average was taken for all three years. With the Columbus GA-AL, Augusta-Richmond County, and Chattanooga TN-GA MSAs, it should be noted that each MSA is included in its entirety, including sites in the respective adjoining states.

The final category, 'Contributions to Downwind Violations' examines the act of air pollution from an area relocating to another area based on wind patterns. An attempt was made to determine an impact on areas of nonattainment using wind roses found in Appendix E to study the direction of the wind in a given quarter or year. Though wind roses were examined, in some cases evidence was inconclusive, and the potential of downwind violations in neighboring areas are shown in the following table.

Table 13.3: Criteria Pollutants Current Status of the NAAQS and the 2021-2023 Average AQI
(as of January 2025)
(P) indicates the status applies to only part of that county

Rome MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	N/A	N/A
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	1.00	Potentially Chattanooga Tennessee-Georgia and Dalton MSAs
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Brunswick-St. Simons MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	0.00	N/A
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	0.33	Potentially South Carolina
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Valdosta MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	N/A	N/A
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	1.33	Potentially Brunswick-St. Simons and Albany MSAs
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Warner Robins MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	N/A	N/A
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	2.00	Potentially Macon and Atlanta-Sandy Springs-Roswell MSAs
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Dalton MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	1.67	Potentially Chattanooga Tennessee-Georgia and Rome MSAs
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	N/A	N/A
$PM_{2.5}$-Annual	Attainment	N/A		N/A
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Albany MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	N/A	N/A
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	4.33	Potentially Valdosta, Columbus and Warner Robins MSAs
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Gainesville MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	N/A	N/A
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	1.00	Potentially Atlanta-Sandy Springs-Roswell and Athens-Clarke County MSAs
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Athens-Clarke County MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	0.33	Potentially South Carolina
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	1.00	Potentially South Carolina
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Macon MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	1.00	Potentially Sandersville and Warner Robins MSA
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	0.00	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	1.00	Potentially Sandersville and Warner Robins MSA
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Columbus Georgia-Alabama MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	0.33	Potentially Phenix City, AL, Atlanta-Sandy Springs-Roswell MSAs
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	2.67	Potentially Phenix City, AL, Atlanta-Sandy Springs-Roswell and Warner Robins MSAs
$PM_{2.5}$-Annual	Attainment	N/A		N/A
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

Savannah MSA

<table>
<tr><th>Pollutant</th><th>Status of NAAQS and Major Risk Issues</th><th>Extent of NAAQS Violations</th><th>Days Above 100 on the AQI</th><th>Contributions to Downwind Violations</th></tr>
<tr><td>Ozone</td><td>Attainment</td><td>N/A</td><td>0.67</td><td>Potentially South Carolina and Brunswick-St. Simons MSA</td></tr>
<tr><td>CO</td><td>Attainment</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>SO_2</td><td>Attainment</td><td>N/A</td><td>0.00</td><td>N/A</td></tr>
<tr><td>NO_2</td><td>Attainment</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>$PM_{2.5}$-24-Hour</td><td>Attainment/Unclassifiable</td><td>N/A</td><td rowspan="2">0.67</td><td>Potentially South Carolina and Brunswick-St. Simons MSA</td></tr>
<tr><td>$PM_{2.5}$-Annual</td><td>Attainment</td><td>N/A</td><td>N/A</td></tr>
<tr><td>PM_{10}</td><td>Attainment</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Pb</td><td>Attainment</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>

Augusta-Richmond County Georgia-South Carolina MSA

<table>
<tr><th>Pollutant</th><th>Status of NAAQS and Major Risk Issues</th><th>Extent of NAAQS Violations</th><th>Days Above 100 on the AQI</th><th>Contributions to Downwind Violations</th></tr>
<tr><td>Ozone</td><td>Attainment</td><td>N/A</td><td>0.00</td><td>N/A</td></tr>
<tr><td>CO</td><td>Attainment</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>SO_2</td><td>Attainment</td><td>N/A</td><td>0.00</td><td>N/A</td></tr>
<tr><td>NO_2</td><td>Attainment</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>$PM_{2.5}$-24-Hour</td><td>Attainment/Unclassifiable</td><td>N/A</td><td rowspan="2">2.33</td><td rowspan="2">Potentially Athens-Clarke County and Savannah MSAs</td></tr>
<tr><td>$PM_{2.5}$-Annual</td><td>Attainment</td><td>N/A</td></tr>
<tr><td>PM_{10}</td><td>Attainment</td><td>N/A</td><td>0.00</td><td>N/A</td></tr>
<tr><td>Pb</td><td>Attainment</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>

Atlanta-Sandy Spring-Roswell MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	12.00	Potentially Gainesville, Macon, Athens-Clarke County MSAs
CO	Attainment	N/A	0.00	N/A
SO_2	Attainment	N/A	0.00	N/A
NO_2	Attainment	N/A	0.00	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	2.33	Potentially Gainesville, Macon, Athens-Clarke County MSAs
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	0.00	N/A
Pb	Attainment	N/A	N/A	N/A

Chattanooga Tennessee-Georgia MSA

Pollutant	Status of NAAQS and Major Risk Issues	Extent of NAAQS Violations	Days Above 100 on the AQI	Contributions to Downwind Violations
Ozone	Attainment	N/A	1.00	Potentially Rome and Dalton MSAs and Tennessee
CO	Attainment	N/A	N/A	N/A
SO_2	Attainment	N/A	N/A	N/A
NO_2	Attainment	N/A	N/A	N/A
$PM_{2.5}$-24-Hour	Attainment/Unclassifiable	N/A	1.67	Potentially Rome and Dalton MSAs and Tennessee
$PM_{2.5}$-Annual	Attainment	N/A		
PM_{10}	Attainment	N/A	N/A	N/A
Pb	Attainment	N/A	N/A	N/A

For the ozone and $PM_{2.5}$ standards, Georgia has had areas of attainment/unclassifiable areas redesignated to attainment. Redesignated areas are areas that were formerly nonattainment but which have achieved the specific standard and have been redesignated to attainment by EPA. These areas have EPA-approved plans for maintaining attainment with the standard. For maps of these previous designations, refer to EPA's website: https://www.epa.gov/green-book.

For an area to be in attainment of the annual ambient air $PM_{2.5}$ standard, the three-year average of the annual average concentrations has to be less than or equal to 9.0 $\mu g/m^3$ starting with the 2022-2024 design values. In addition, the 24-hour primary and secondary standard requires that the three-year average of the 98th percentile of the 24-hour concentrations be less than or equal to 35 $\mu g/m^3$ (Federal Register Vol. 89, No. 45, page 16202, March 6, 2024). GA AAMP has recommended all areas within Georgia be designated attainment/unclassifiable for the 2024 annual $PM_{2.5}$ standard.

For an area to be in attainment of the ozone standard, the annual fourth-highest daily maximum 8-hour concentration, averaged over three years has to be less than or equal to 0.070 ppm (Federal Register Vol. 80, No. 206, page 65292, October 26, 2015). There has been a gradual reduction in the number of days exceeding the ozone standards, and since the 2019-2021 data, the Atlanta area has attained the 2015 ozone standard of 0.070 ppm (Federal Register, Vol. 87, No. 199, page 62733-62736).

In summary, $PM_{2.5}$ and ozone are important pollutants affecting the air quality of the state of Georgia. These pollutants are the primary cause of AQI values above 100 in Georgia. Since 1972, there has been a noticeable decrease in the number of ozone exceedances; and as of the 2019-2021 data, Georgia was in attainment for both $PM_{2.5}$ and ozone standards at that time.

The following table shows the number of days where the AQI was over 100 between 2021 and 2023. The sites were ranked with a proportionate ranking, with the site with the most days with AQI over 100 ranking the highest. Typically, the daily AQI is based on the full metropolitan statistical area (MSA); however, for the purposes of determining the rank of each site's AQI, Table 13.4 is based on each individual site, not MSA.

Table 13.4: Ranking of Sites with AQI over 100 from 2021-2023

Site Name	2021	2022	2023	Average # Days with AQI > 100 (2021-2023)	Rank	Proportionality
United Ave.	4	3	12	6.33	1	1.00
Albany	4	5	5	4.67	2	0.74
McDonough	1	3	7	3.67	3	0.58
South DeKalb	2	2	7	3.67	3	0.58
Douglasville	2	1	6	3.00	5	0.47
Gwinnett Tech	2	0	7	3.00	5	0.47
Sandersville	3	3	3	3.00	5	0.47
Augusta	7	0	0	2.33	8	0.37
Columbus-Airport	2	1	3	2.00	9	0.32
Macon-Forestry	2	0	4	2.00	9	0.32
Warner Robins	4	1	1	2.00	9	0.32
CASTNET	0	0	5	1.67	12	0.26
Fort Mountain	0	1	4	1.67	12	0.26
Rossville-Williams St.	1	0	4	1.67	12	0.26
Athens	1	0	3	1.33	15	0.21
Conyers	0	0	4	1.33	15	0.21
Kennesaw	0	1	3	1.33	15	0.21
Valdosta	0	0	4	1.33	15	0.21
Columbus-Baker	1	1	1	1.00	19	0.16
Dawsonville	0	1	2	1.00	19	0.16
Gainesville	0	0	3	1.00	19	0.16
NR-285	0	0	3	1.00	19	0.16
NR-GA Tech	0	0	3	1.00	19	0.16
Rome	2	0	1	1.00	19	0.16
Savannah-L&A	2	0	1	1.00	19	0.16
Fire Station #8	0	0	2	0.67	26	0.11
Brunswick	0	1	0	0.33	27	0.05
General Coffee	0	0	1	0.33	27	0.05
Macon-Allied	0	0	1	0.33	27	0.05
Savannah-E. Pres.	0	0	1	0.33	27	0.05
Evans	0	0	0	0.00	31	0.00
Forest Park	0	0	0	0.00	31	0.00
Leslie	0	0	0	0.00	31	0.00
Summerville	0	0	0	0.00	31	0.00

14.0 Health Assessment

Exposure to air pollution can cause a wide variety of health effects. Each pollutant, or group of pollutants, can have differing effects, depending on the length of exposure, route of exposure, and health of the person exposed. The following section briefly explains the health impacts of each pollutant.

Carbon Monoxide

Once carbon monoxide (CO) is inhaled, it enters the blood stream where it binds chemically to hemoglobin. Hemoglobin is the component of blood that is responsible for carrying oxygen to the cells (California Air Resources Board, 2024). When CO binds to hemoglobin, it reduces the ability of hemoglobin to do its job, and in turn reduces the amount of oxygen delivered throughout the body. The percentage of hemoglobin affected by CO depends on the amount of air inhaled, the concentration of CO in air, and the length of exposure. The level of CO usually found in ambient air primarily affects people with cardiovascular disease. Negative health effects of CO include weakening the contractions of the heart, in turn reducing blood flow to various parts of the body. In a healthy person, this effect significantly reduces the ability to perform physical activities. In persons with chronic heart disease, this effect can threaten the overall quality of life, because their systems may be unable to compensate for the decrease in oxygen (EPA, 2024a). CO pollution is also likely to cause such individuals to experience chest pain during activity. Adverse effects have also been observed in individuals with heart conditions who are exposed to CO pollution in heavy freeway traffic for one or more hours. In addition, fetuses, young infants, pregnant women, elderly people, and individuals with anemia or emphysema are likely to be more susceptible to the effects of CO. For these individuals, the effects are more pronounced when exposure takes place at high altitude locations, where oxygen concentration is lower. CO can also affect mental functions, visual acuity, and the alertness of healthy individuals, even at relatively low concentrations.

Nitrogen Dioxide

Exposure to high levels of nitrogen dioxide (NO_2) for short durations (less than three hours) can lead to respiratory problems. Asthma sufferers, in particular, are sensitive to NO_2. This sensitivity was expressed in a study that examined changes in airway responsiveness of exercising asthmatics during exposure to relatively low levels of NO_2 (EPA, 2024b). Other studies also indicate a relationship between indoor NO_2 exposures and increased respiratory illness rates in young children, but definitive results are still lacking. In addition, many animal analyses suggest that NO_2 impairs respiratory defense mechanisms and increases susceptibility to infection. Several other observations also show that chronic exposure to relatively low NO_2 pollution levels may cause structural changes in the lungs of animals. These studies suggest that chronic exposure to NO_2 could lead to adverse health effects in humans, but specific levels and durations likely to cause such effects have not yet been determined.

Sulfur Dioxide

Exposure to sulfur dioxide (SO_2) can cause impairment of respiratory function, aggravation of existing respiratory disease (especially bronchitis), and a decrease in the ability of the lungs to clear foreign particles. It can also increase mortality, especially if elevated levels of particulate matter (PM) are present (EPA, 2024c). Individuals with hyperactive airways, cardiovascular disease, and asthma are most sensitive to the effects of SO_2. In addition, elderly people and children are also likely to be sensitive to SO_2. The effects of short-term peak exposures to SO_2

have been evaluated in controlled human exposure studies. These studies show that SO_2 generally increases airway resistance in the lungs and can cause significant constriction of air passages in sensitive asthmatics. These impacts have been observed in subjects engaged in moderate to heavy exercise while exposed to relatively high peak concentrations. These changes in lung function are accompanied by perceptible symptoms such as wheezing, shortness of breath, and coughing in these sensitive groups (American Lung Association, 2023). The presence of particle pollution appears to aggravate the impact of SO_2 pollution. Several studies of chronic effects have found that people living in areas with high particulate matter and SO_2 levels have a higher incidence of respiratory illnesses and symptoms than people living in areas without such a combination of pollutants.

Ozone

Ozone and other photochemical oxidants such as peroxyacetyl nitrate (PAN) and aldehydes are associated with adverse health effects in humans. Peroxyacetyl nitrate and aldehydes cause irritation that is characteristic of photochemical pollution. Ozone has a greater impact on the respiratory system, where it irritates the mucous membranes of the nose, throat, and airways; ninety percent of the ozone inhaled into the lungs is never exhaled. Symptoms associated with exposure include cough, chest pain, and throat irritation (EPA, 2024d). Ozone can also increase susceptibility to respiratory infections. In addition, ozone impairs normal functioning of the lungs and reduces the ability to perform physical exercise. Recent studies suggest that even at lower ozone concentrations some healthy individuals engaged in moderate exercise for 6 to 8 hours may experience symptoms. All of these effects are more severe in individuals with sensitive respiratory systems, and studies show that moderate levels may impair the ability of individuals with asthma or respiratory disease to engage in normal daily activities. The potential chronic effects of repeated exposure to ozone are of even greater concern. Laboratory studies show that people exposed over a six-to-eight-hour period to relatively low ozone levels develop lung inflammation. Animal studies suggest that if exposures are repeated over a long period (e.g. months, years, lifetime), inflammation of this type may lead to permanent scarring of lung tissue, loss of lung function, and reduced lung elasticity.

Lead

Exposure to lead occurs mainly through inhalation and ingestion of lead in food, water, soil, or dust. It accumulates in the blood, bones, and soft tissues. Lead can adversely affect the kidneys, liver, nervous system, and other organs. Excessive exposure to lead may cause neurological impairments, such as seizures, mental retardation, and behavioral disorders. Even at low doses, lead exposure is associated with damage to the nervous systems of fetuses and young children, resulting in learning deficits and lowered IQ (EPA, 2024e). Recent studies also show that lead may be a factor in high blood pressure and subsequent heart disease. Lead can also be deposited on the leaves of plants, presenting a hazard to grazing animals. Lead deposition in soil puts children at particular risk exposure since they commonly put hands, toys, and other items in their mouths, which may come in contact with the lead contained in dust and dirt.

Particulate Matter (PM_{10} and $PM_{2.5}$)

Marked increases in daily mortality have been statistically associated with very high 24-hour concentrations of PM_{10}, with some increased risk of mortality at lower concentrations. Small increases in mortality appear to exist at even lower levels. Risks to sensitive individuals increase with consecutive, multi-day exposures to elevated PM_{10} concentrations. The research also indicates that aggravation of bronchitis occurs with elevated 24-hour PM_{10} levels, and small decreases in lung function take place when children are exposed to lower 24-hour peak PM_{10} levels. Lung function impairment lasts for 2-3 weeks following exposure to PM_{10}.

$PM_{2.5}$ can penetrate the sensitive regions of the respiratory tract, which make it a health concern. Recently published community health studies indicate that significant respiratory and cardiovascular-related problems are associated with exposure to fine particle levels below the existing particulate matter standards. In addition, fine particles are likely to cause the most serious health effects, which include premature death, hospital admissions from respiratory causes, and increased respiratory problems. Long-term exposure to particulate matter may increase the rate of developing respiratory/cardiovascular illnesses, Parkinson's disease, Alzheimer's disease, and other dementias, and even reduce the life span of an individual. Some data also suggests that fine particles can pass through lung tissues and enter the bloodstream (American Lung Association, 2024). Therefore, children, the elderly, and individuals with cardiovascular disease or lung diseases such as emphysema and asthma are especially vulnerable.

PAMS

The Photochemical Assessment Monitoring Stations (PAMS) monitor some of the pollutants discussed above: ozone, oxides of nitrogen, as well as volatile organic compounds (VOCs), selected carbonyl compounds, and meteorological parameters.

Carbonyl and VOCs define a large group of substances that can act as precursors to ozone formation. Depending on the amount inhaled, exposure to these compounds can cause irritation to the eyes, ears, nose, and throat, dizziness, and damage to the lungs. Some examples of potential health effects are discussed in the following paragraph. Formaldehyde is a health concern because of its respiratory irritancy and potential as a carcinogen. It may cause irritation of the eye, nose, throat, and skin, and has the potential under certain exposure scenarios to cause cancers of the nose and throat (ATSDR, 2008). Acetaldehyde, an intermediate product of plant respiration and a product of incomplete combustion, is ubiquitous in the environment. Acetaldehyde, like formaldehyde, is also a concern as an upper respiratory irritant, and because of its potential to cause nasal tumors in animal studies (U.S. EPA, 1992; U.S. EPA, 2000). With large amounts of exposure, benzene can cause problems in the blood, including anemia, excessive bleeding, blood cancers, miscarriage, and harm to the immune system, and may result in death (ATSDR, 2024a). Tetrachloroethene acts as a central nervous system depressant. Long periods of exposure in animals cause changes in brain chemistry resulting in mood changes, memory, and attention, but it is unknown if this applies to humans as well (ATSDR, 2019a). Trichloroethylene can cause nervous system effects, abnormal heartbeat, coma, and possibly death. If exposed for long periods of time, trichloroethylene may cause damage to kidney and liver (ATSDR, 2019b). At very low concentrations, acrolein is an upper respiratory irritant, and at very high concentrations, it may produce more serious damage to the lining of the upper respiratory tract and lungs, and in more extreme cases can lead to a pulmonary edema (ATSDR, 2024b; U.S. EPA, 2003).

Air Toxics

Air Toxics include VOCs and carbonyls discussed above, as well as semi-volatile organic compounds and metals. Air toxic pollutants can have negative effects on human health, ranging from causing headaches, nausea, dizziness, cancer, birth defects, problems breathing, damage to lungs and nasal cavities, and other serious illnesses. These effects can vary depending on frequency, length of time, and health of the person that is exposed, along with the toxicity of the compound. These air pollutants also affect the environment. Wildlife experience symptoms similar to those in humans. Pollutants accumulate in the food chain. Many air pollutants can also be absorbed into waterways and have toxic effects on aquatic wildlife. Some of the substances tend to have only one critical effect, while others may have several. Some of the effects may occur after a short exposure and others appear after long-term exposure or many years after being exposed. Exposure is not only through direct inhalation of the pollutant, but also through the consumption of organisms such as fish that have absorbed the pollutant.

Health Effects

The following information was taken from EPA's AirCompare website. It can be used as a guide that outlines the health concerns or each group of sensitive populations that can be affected when the Air Quality Index is Code Orange or Code Red. The table also shows which pollutant, or pollutants, affect each health concern or sensitive population. It is used as an illustration, with the understanding that some individuals can be more sensitive than others.

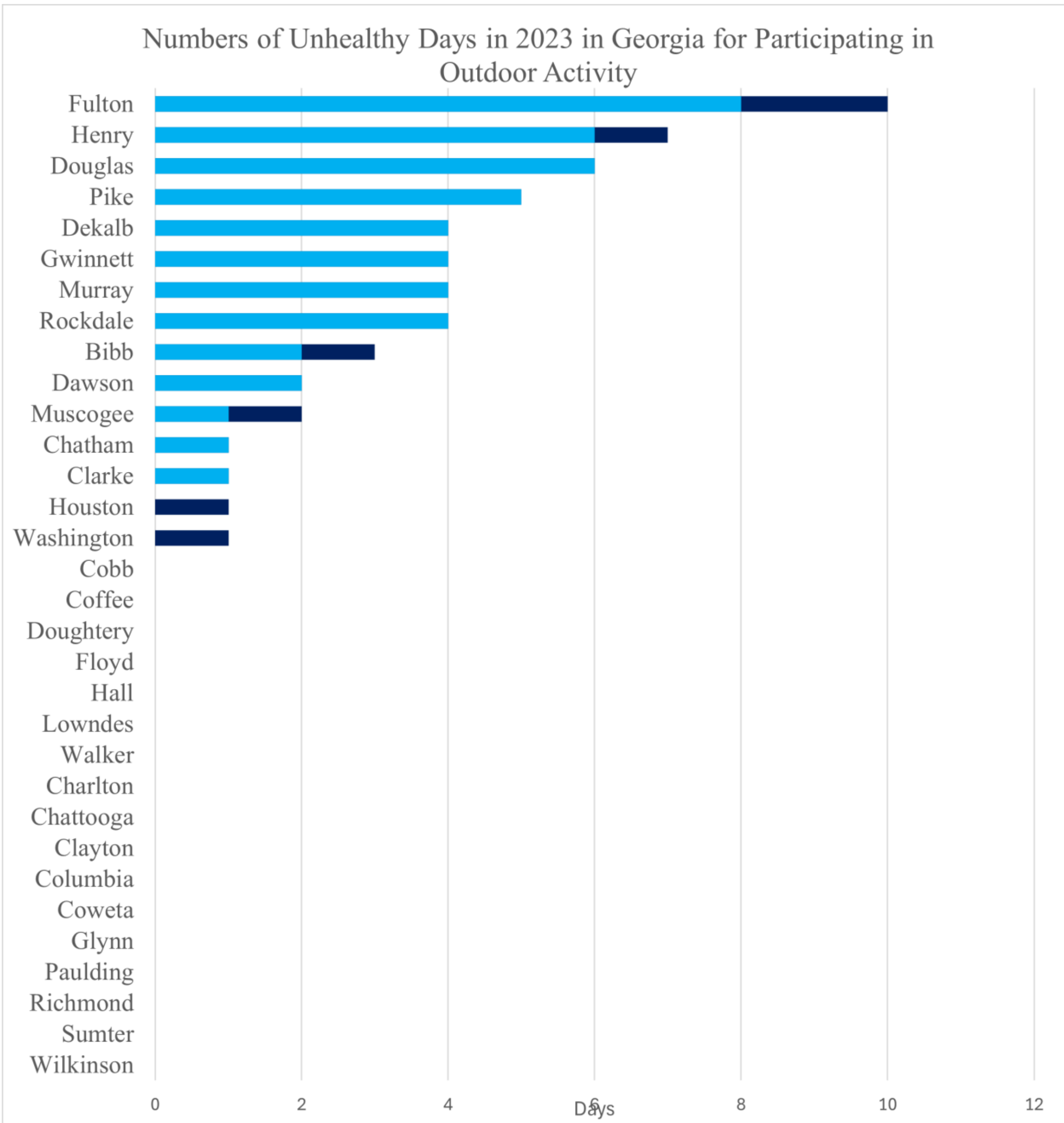
Health Concern	Pollutant and AQI Category				
	Ozone	Particle Pollution	Sulfur Dioxide	Carbon Monoxide	Any Pollutant
	Code Orange	Code Orange	Code Orange	Code Orange	Code Red
Asthma or other Lung Disease	X	X	X		X
Heart Disease		X		X	X
Children (with no specific health concern)	X	X			X
Older Adults (with no specific health concern)	X	X			X
Active Outdoors (with no specific health concern)	X		X		X
General Population (with no specific health concern)					X

Figure 14.1: Health Concerned Affected by Pollutant

Figure 14.1 summarizes the health concerns that are affected by higher pollution levels of ozone, particulate matter, sulfur dioxide, and carbon monoxide. The table shows which pollutants that can cause concern when the Air Quality Index (AQI) levels are 101-150, or Code Orange, and 151-200, or Code Red. The AQI is used as a way to measure air quality, which is reported in values from 0 to 500. The higher the AQI value, the greater the level of air pollution, which would lead to greater health concerns. When AQI values are between 101 and 150 (Code Orange), members of sensitive groups may experience health effects of specific pollutants. These sensitive groups are generally children and older adults, although the general population can also be affected if active outdoors. The general population that would not be exercising outdoors is not likely to be affected when the AQI is in this range. However, the general population, along with the sensitive and exercising groups, are more likely to be affected when the AQI values are above 150.

The following figures were also derived from EPA's Air Quality System website (EPA, 2024f). Each county that collects ambient air monitoring data across the state of Georgia is shown. In 2023, the number of unhealthy days for the general population did not exceed 150. As shown in Figure 14.1, any of the criteria pollutants would affect the general population if the AQI value were above 150, or Code Red.

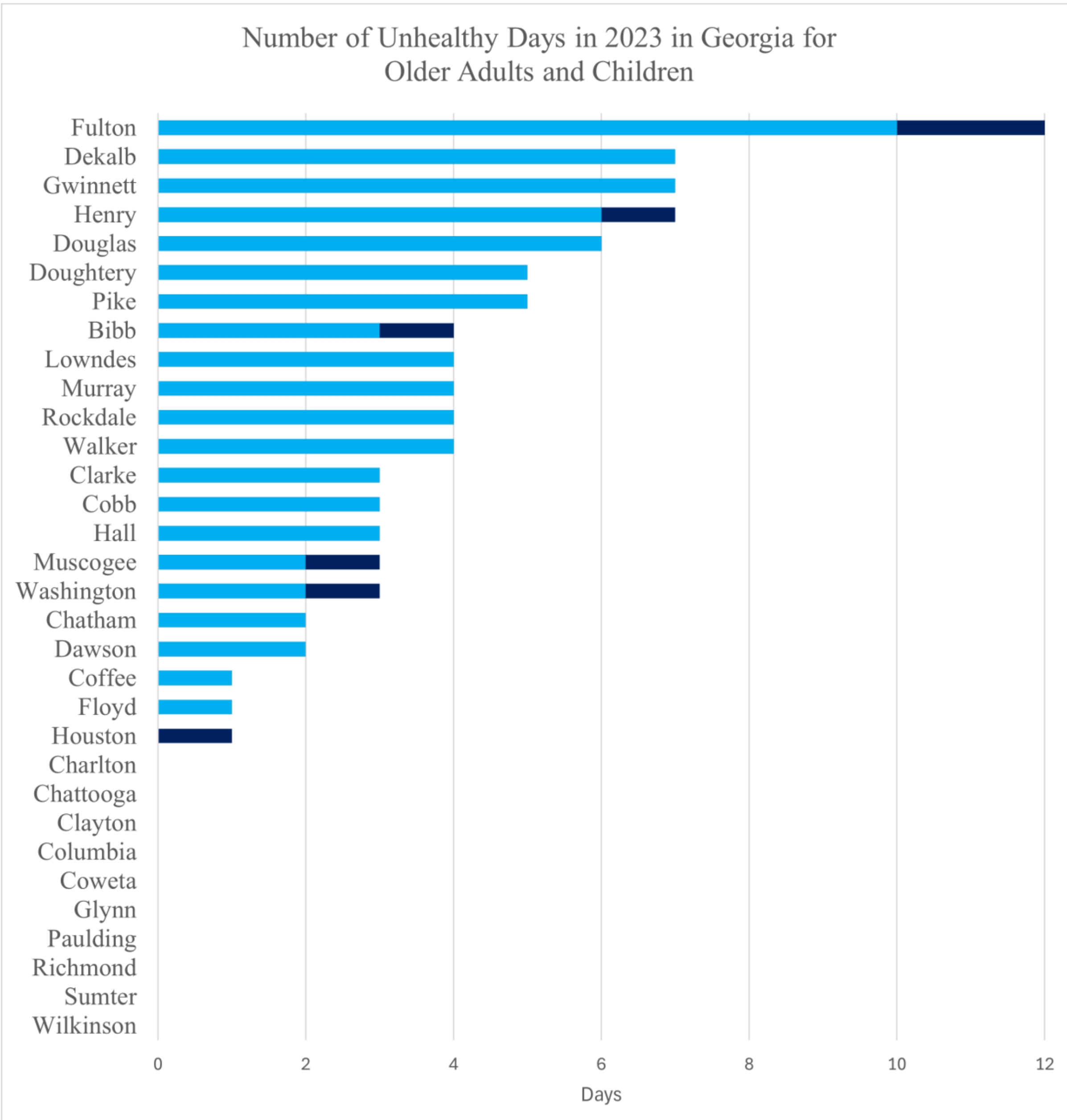
Figure 14.2 shows the number of unhealthy days in Georgia in 2023 for the population who participates in outdoor activity. An AQI value between 101 and 150 (represented with light blue) affects this population, with ozone and sulfur dioxide being the primary pollutants that contribute to unhealthy days, and an AQI value between 151-200 (represented with dark blue) affects this population with all parameters (Figure 14.1). Fifteen counties had at least one unhealthy day, with Fulton County reporting the highest number (10 days altogether). It is important to note, in 2023 there were Canadian wildfires that potentially affected the air quality in Georgia worse than most years.



Source: [Download Files | AirData | US EPA]

Figure 14.2: Number of Unhealthy Days in 2023 for Active Outdoors

In the following figure, the number of unhealthy days in Georgia in 2023 for older adults and children is shown. An AQI value between 101 and 150 (represented with light blue) affects this population, with ozone and particle pollution being the primary contributors to health concerns, and an AQI value between 151-200 (represented with dark blue) affects this population for all parameters (Figure 14.1). There were twenty-two counties that had at least one unhealthy day in 2023. Fulton County showed the highest number of unhealthy days (12 days altogether). It is important to note, in 2023 there were Canadian wildfires that potentially affected the air quality in Georgia worse than most years.



Source: [Download Files | AirData | US EPA]

Figure 14.3: Number of Unhealthy Days in 2023 for Older Adults and Children

The following figure shows the monthly averages for the highest four counties for the past five years in each county according to unhealthy for sensitive groups (shown in orange) and unhealthy air (shown in red) by month. Each bar shows the total number of unhealthy days for that month averaged over the past five years. If a bar contains more than one color, the proportion of orange and red days shows the make up of the total number of unhealthy days for that month. The monthly average breakdown shows the most effect on older adults and children would be during the summer months for Fulton, Henry, DeKalb, and Douglas Counties.

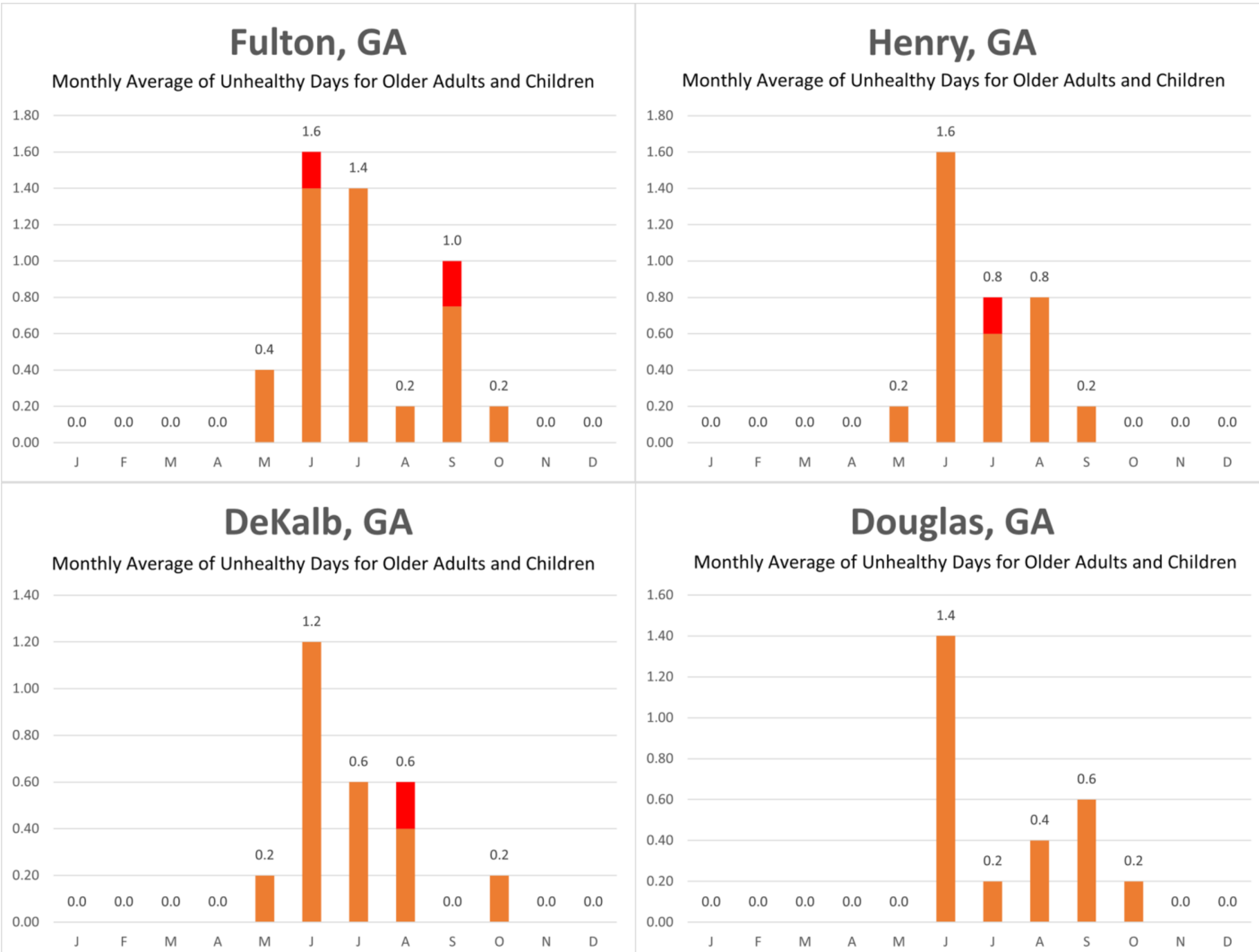
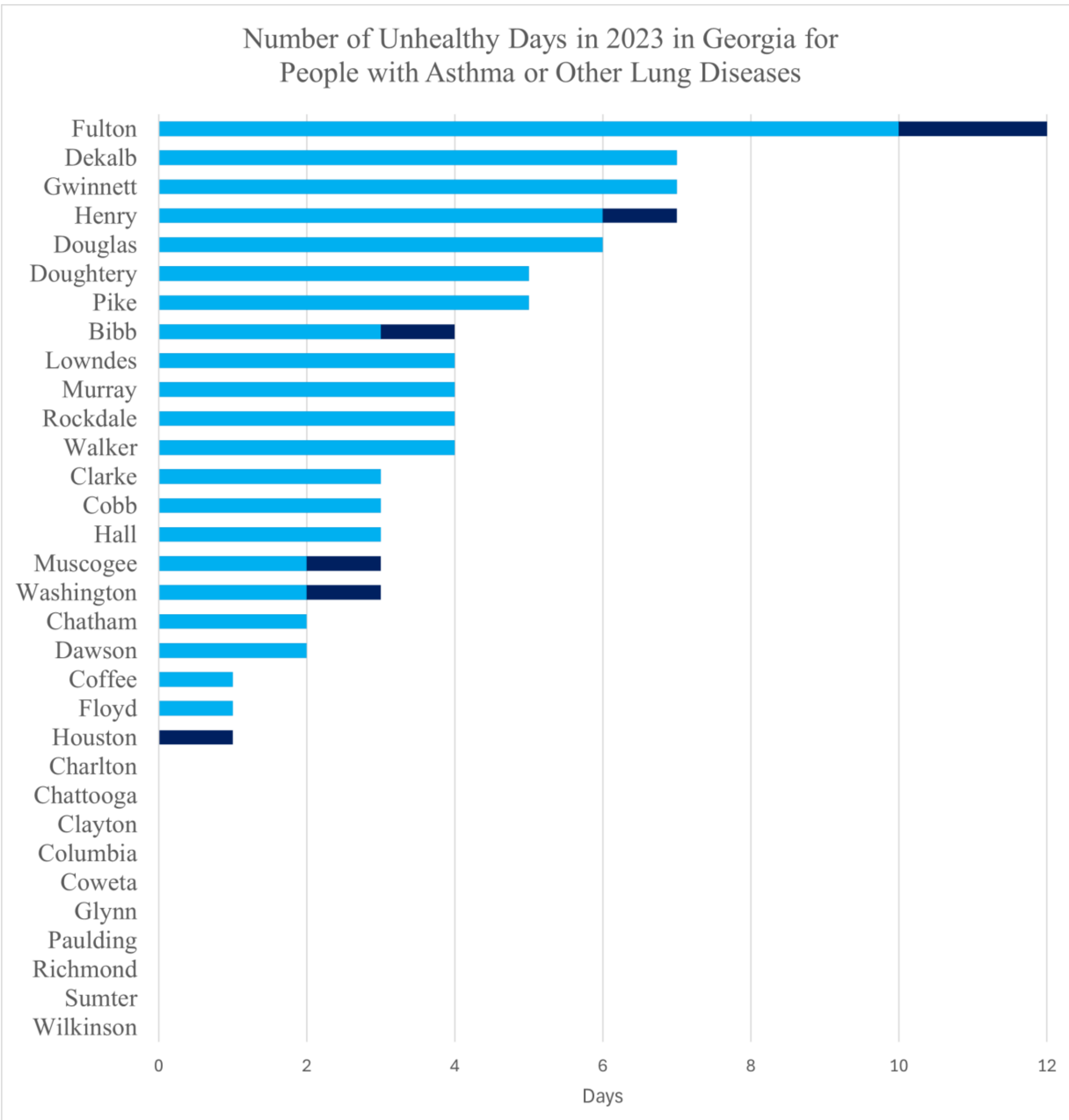


Figure 14.4: Monthly Averages for Top Four Counties with Unhealthy Days for Older Adults and Children, 2019-2023

The following figure shows the number of unhealthy days in 2023 in Georgia for people who suffer from asthma and other lung diseases. People who suffer from asthma and other lung diseases can be affected by ozone, particle pollution, and sulfur dioxide, with the AQI value between 101 and 150 (represented with light blue), and from all parameters at an AQI between 151-200 (represented with dark blue) (Figure 14.1). Twenty-two counties had at least one unhealthy day for asthma and other lung disease sufferers. The maximum number of unhealthy days occurred in Fulton County (12 days altogether). It is important to note, in 2023 there were Canadian wildfires that potentially affected the air quality in Georgia worse than most years. In general, individuals who suffer from asthma and other lung diseases are one of the most sensitive groups, along with older adults and children.



Source: [Download Files | AirData | US EPA]

Figure 14.5: Number of Unhealthy Days in 2023 for People with Asthma and Other Lung Disease

The following figure shows the top four counties with the highest number of unhealthy days for people with asthma or other lung diseases (Fulton, Henry, DeKalb, and Douglas Counties). These graphs break down the average number of days in each county according to unhealthy for sensitive groups (shown in orange), unhealthy air (shown in red), and very unhealthy air (shown in purple) by month. This is a monthly average for the past five years, and each bar shows the proportion of orange, red, and purple days for that month. The highest five-year average was 1.6 days in Fulton and Henry Counties, both occurring in June. The other five-year averages ranged from 0.0 to 1.4 days per month.

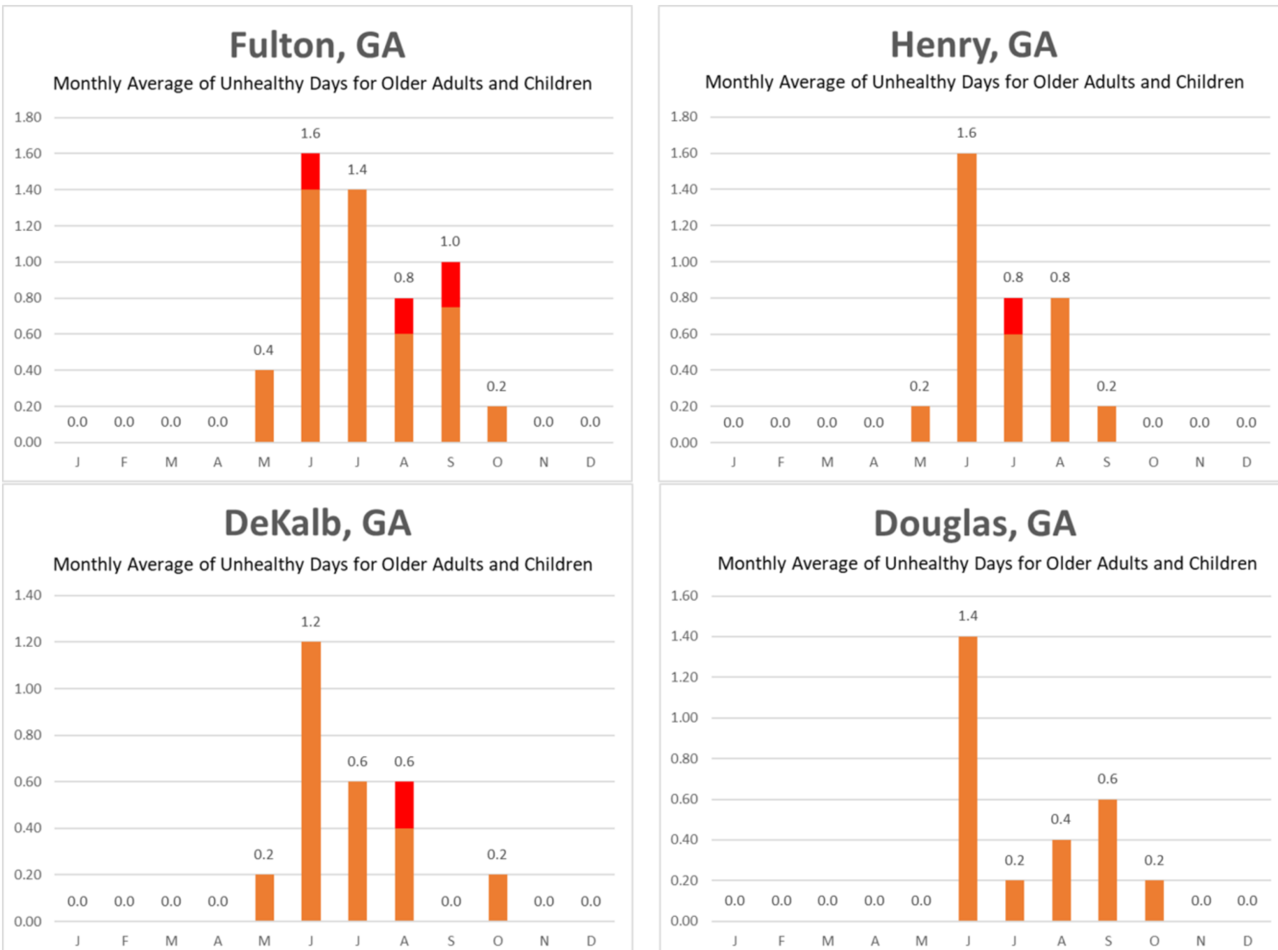


Figure 14.6: Monthly Averages for Top Four Counties with Unhealthy Days for People with Asthma and Other Lung Disease, 2019-2023

The Georgia Department of Public Health reports from the Centers for Disease Control and Prevention (CDC) that in 2021, 9.7% of Georgia's children, age 0 to 17 years currently have asthma (https://www.cdc.gov/asthma/brfss/2021/child/tableC1.html). In addition, about 14.3% of children in Georgia had been told at some point that they had asthma (https://www.cdc.gov/asthma/brfss/2021/child/tableL1.html). In 2022, the adult asthma prevalence rate in Georgia was 9.6%, which totals to about 802,783 people (https://www.cdc.gov/asthma-data/about/most-recent-asthma-data.html). In addition, based on data from 2021, about 14.6% of adults in Georgia were told at some point in their lives that they had asthma corresponding to the sample size of 8,155 people (https://www.cdc.gov/asthma/brfss/2021/tableL1.html). Children and older adults are more likely to be hospitalized with asthma.

The following tables give estimated prevalence of asthma according to adult age groups for Georgia in 2021 for current (https://www.cdc.gov/asthma/brfss/2021/tableC3.html) and lifetime (https://www.cdc.gov/asthma/brfss/2021/tableL3.html) asthma prevalence (Tables 14.1 and 14.2, respectively).

Age Group	Sample Size	Prevalence (percent)	Standard Error	95% CI* (percent)	Prevalence (number)	95% CI* (number)
18–24	416	11.5	2.08	(7.4–15.6)	120,939	(75,359–166,518)
25–34	751	12.2	1.6	(9.0–15.3)	174,818	(126,717–222,918)
35–44	941	9.2	1.17	(6.9–11.5)	127,061	(94,457–159,666)
45–54	1,135	8	1.09	(5.9–10.1)	99,936	(72,484–127,389)
55–64	1,452	8.5	0.91	(6.7–10.3)	113,173	(88,915–137,431)
65+	3,199	7.2	0.62	(6.0–8.5)	117,042	(97,024–137,061)

* CI denotes confidence interval

Source: https://www.cdc.gov/asthma/brfss/2021/tableC3.html

Table 14.1: Adult Self-Reported Current Asthma Prevalence Rate (Percent) and Prevalence (Number) by Age: BRFSS 2021

The age group with the highest current asthma prevalence in Georgia was 25-34 with 12.2% prevalence.

Age Group	Sample Size	Prevalence (percent)	Standard Error	95% CI* (percent)	Prevalence (number)	95% CI* (number)
18-24	419	21.2	2.68	(16.0–26.5)	225,402	(162,251–288,552)
25-34	765	20.3	1.88	(16.6–24.0)	298,035	(238,091–357,980)
35-44	946	13.6	1.41	(10.8–16.4)	188,417	(148,282–228,552)
45-54	1,138	11.7	1.24	(9.2–14.1)	145,639	(113,969–177,309)
55-64	1,462	11.2	1.02	(9.2–13.2)	149,235	(121,821–176,648)
65+	3,210	11.1	0.79	(9.6–12.7)	181,433	(155,151–207,715)

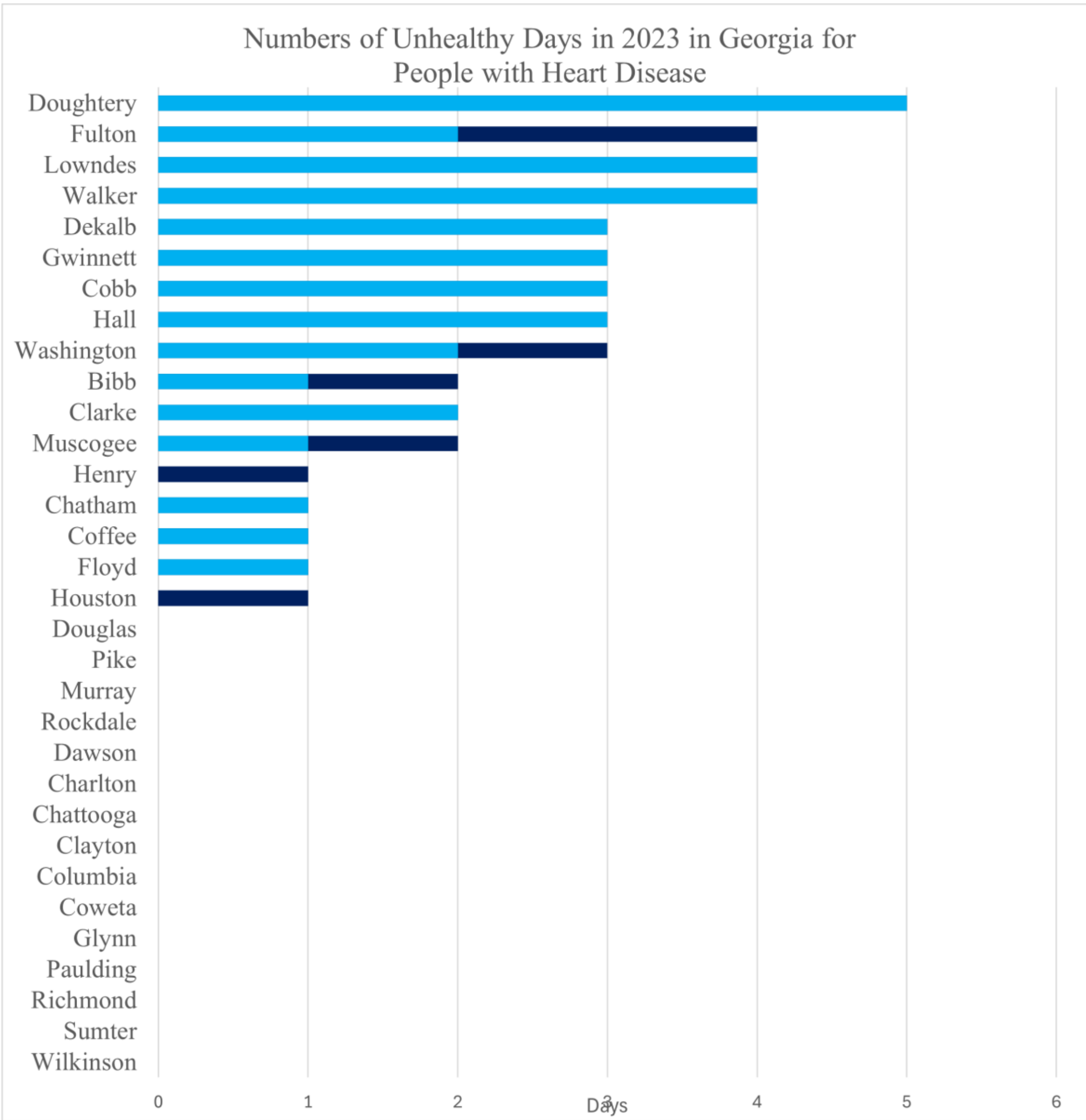
* CI denotes confidence interval

Source: https://www.cdc.gov/asthma/brfss/2021/tableL3.html

Table 14.2: Adult Self-Reported Lifetime Asthma Prevalence Rate (Percent) and Prevalence (Number) by Age: BRFSS 2021

For lifetime asthma prevalence in Georgia, the age group with the highest asthma prevalence was also 18-24 with prevalence of 21.2%.

Figure 14.7 shows the number of unhealthy days in 2023 in Georgia for people who suffer from heart disease. For this group, particle pollution and carbon monoxide are the pollutants of concern. In general, the AQI value would be between 101 and 150 (represented with light blue) for this group to be affected, or for a value of 151-200 (represented with dark blue) of any pollutant parameters (Figure 14.1). However, more sensitive individuals could be affected with lower AQI values. There were seventeen counties that experienced unhealthy days for people with heart disease, with Dougherty County having the maximum days (5 days). It is important to note, in 2023 there were Canadian wildfires that potentially affected the air quality in Georgia worse than most years.



Source: [Download Files | AirData | US EPA]

Figure 14.7: Number of Unhealthy Days in 2023 for People with Heart Disease

The following figure shows the top five counties with the highest number of unhealthy days (data taken from AQS) for people with heart disease (Dougherty, DeKalb, Gwinnett, Hall, and Washington Counties). These graphs break down the average number of days in each county according to unhealthy for sensitive groups (shown in orange), unhealthy air (shown in red), and very unhealthy air (shown in purple) by month. The highest five-year average occurred in March (2.0 days) in Doughtry County. The other five-year averages range from 0.0 to 0.6 days per month to potentially affect people with heart disease.

Figure 14.8: Monthly Averages of Top Five Counties with Unhealthy Days for People with Heart Disease, 2019-2023

Several counties across the state had at least one day in 2023 with unhealthy levels of ambient air that could contribute to asthma or other lung disease, heart disease, or that could affect children or older adults. The number of days went up to 12 for the year for some counties. It is important to note, in 2023 there were Canadian wildfires that potentially affected the air quality in Georgia worse than most years. The ability to collect this information for the public and provide the data for sensitive populations is valuable to the citizens of Georgia and exhibits the importance of having these ambient air monitors. As part of the monitoring objectives for Georgia AAMP, this information is provided to the public, as well as to researchers for health effects studies.

15.0 Exceedance Probability Assessment

As part of the 5-year assessment, GA AAMP examines different aspects of whether or not new monitors are needed in certain areas, or if monitors are placed in close proximity and redundant and not needed in certain areas. One aspect to consider is the probability that an area could have exceedances of the standards set by EPA, and whether or not GA AAMP has monitors in place to detect those exceedances. Lake Michigan Air Directors Consortium (LADCO) in Region 5 created an online tool, NetAssess (https://ladco.shinyapps.io/NetAssessApp/) which was updated for the 2025 Five-Year Assessment and available at https://rconnect-public.epa.gov/NetAssess2025/ to assess the probability of exceedances with a spatial distribution of the highest daily values. Ozone and $PM_{2.5}$ are examined below, as Georgia has had exceedances of these two pollutants and has had areas that are nonattainment of these two pollutants in the past. The methods used to create this tool are summarized below from http://ladco.github.io/NetAssessApp/tools.html#exprob, with the years of data updated:

"The surface probability maps were created by using EPA/CDC downscaler data. Downscaler data are daily estimates of ground level ozone and $PM_{2.5}$ for every census tract in the continental US. These are statistical estimates from "fusing" photochemical modeling data and ambient monitoring data using Bayesian space-time methods. For more details on how the data were generated, see the meta data document on the EPA website. Daily downscaler estimates for 8-hour maximum ozone and 24-hour mean $PM_{2.5}$ for the years [2019-2021] were obtained from the EPA website. Years [2019-2021] were obtained from the CDC's Environmental Public Health Tracking Program.

An extreme value distribution was fit for each census tract centroid in the continental United States. That is, for each census tract, yearly maxima were obtained, and a distribution of those maxima was estimated. In the simplest case, an extreme value distribution would be fit using just one maximum value for each year. For example, daily precipitation values from a rain gauge over 100 years would provide about 36,500 daily values. The maximum precipitation level for each year over a span of 100 years would give 100 values (each a maximum for a year), and an extreme value distribution could be estimated using those 100 values. That distribution could be used to find the probability of an extreme flood event.

A generalized extreme value distribution, using just the maximum value for each year, has the following distribution function:

$$F(x) = exp\left\{-\left[1+\xi\left(\frac{x^{(r)}-\mu}{\sigma}\right)\right]^{\frac{-1}{\xi}}\right\}$$

where μ is the location parameter, σ is the scale parameter, and ξ is the shape parameter.
However, downscaler data for the entire country was only available for [limited number of years], which would not be enough data to estimate a probability distribution. For that reason, the top r values per year were used. For 8-hour maximum ozone, the top 4 values per year were used to characterize the extreme values for each census tract (r=4), and for 24-hour mean $PM_{2.5}$ the top 7 values were used (r=7). Specifically, a joint probability distribution function for the r largest yearly values was estimated:

$$F\left(x^{(1)},\ldots,x^{(r)}\right) = exp\left\{-\left[1+\xi\left(\frac{x^{(r)}-\mu}{\sigma}\right)\right]^{\frac{-1}{\xi}}\right\} \times \prod_{k=1}^{r}\sigma^{-1}\left[1+\xi\left(\frac{x^{(k)}-\mu}{\sigma}\right)\right]^{-\frac{1}{\xi}-1}$$

where

$-\infty < \mu < \infty$ and $-\infty < \xi < \infty$; $x^{(r)} \le z^{\cdots(r-1)} \le \cdots \le z^{(1)}$; and $x^{(k)} : 1+\xi\left(x^{(k)}-\mu\right)/\sigma > 0$ for $k = 1,\ldots,r$

(see Coles 2001, 66–72).

These distributions were then used to find the probability of an extreme value above a certain threshold for each census tract. If the threshold was 70 ppb for 8-hour maximum ozone, then the probability for each census tract is

$$P(X > 70ppb) = 1 - F\left(x^{(1)},\ldots,x^{(4)}\right).$$

Again, this is the probability that there would be at least one day in a year with an 8-hour maximum ozone value above 70 ppb (not the probability that the fourth highest value would be above the threshold).”

15.1 Ozone

The following figure shows areas with the probability of ozone concentrations exceeding a threshold of 70 ppb, based on the spatial distribution of historical highest daily values. The darker blue color represents the lowest probability of ozone concentrations exceeding the threshold. Red circles represent ozone monitoring sites. According to the figure below, there is 0% probability of an exceedance.

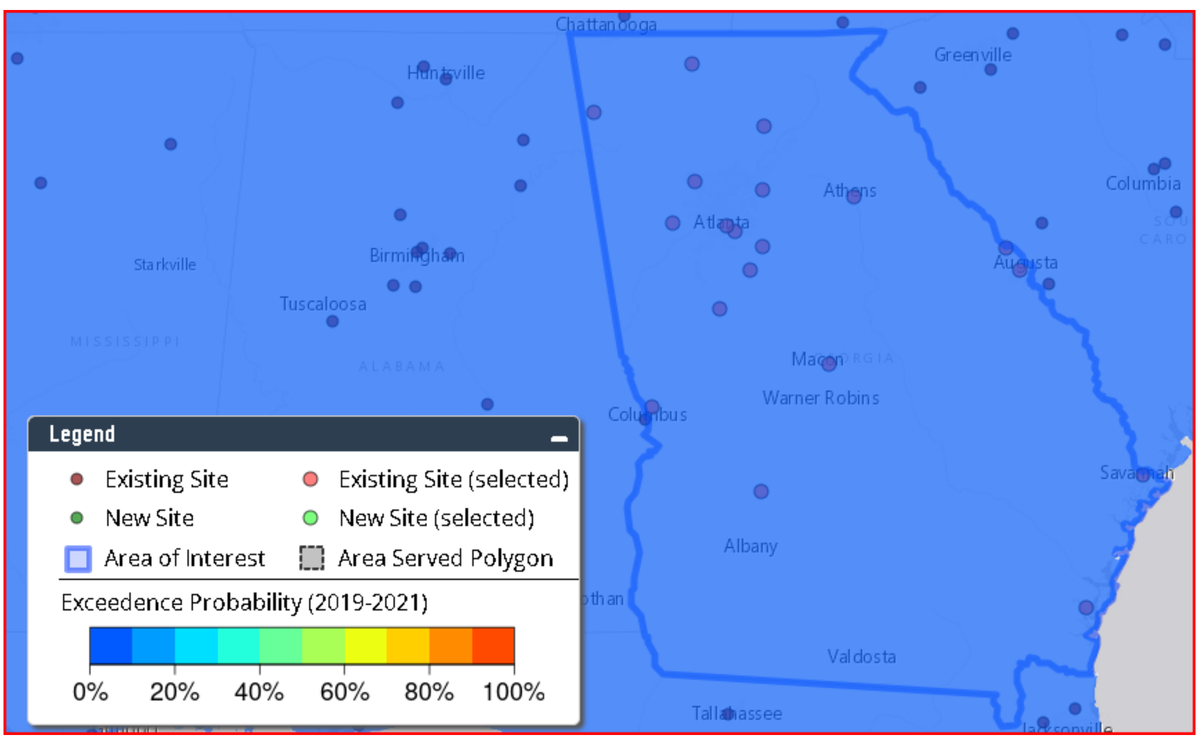


Figure 15.1: Ozone Probability of Exceedance at 70 ppb for Georgia

15.2 $PM_{2.5}$

Figure 15.2 illustrates the probability of exceeding the $PM_{2.5}$ threshold of 35 µg/m^3 across Georgia (outlined with darker blue) using data from 2019 to 2021. The analysis reveals that urban centers, particularly the Atlanta-Sandy Springs-Roswell MSA, exhibit the highest probability of exceeding the $PM_{2.5}$ level of 35 µg/m^3, as indicated by the dark orange zones. It is reasonable to assume elevated levels of $PM_{2.5}$ can be attributed to high population density, transportation emissions, and local sources concentrated in these regions. Other MSAs such as Augusta-Richmond County, GA-SC and Columbus, GA-AL also show elevated exceedance probabilities, though to a slightly lesser extent than within the Atlanta-Sandy Springs-Roswell MSA, reflecting the influence of local sources. Moderately affected areas, including Albany and the surroundings of Macon and Warner Robins, display yellow and green hues, suggesting that these regions face periodic air quality issues influenced by local sources.

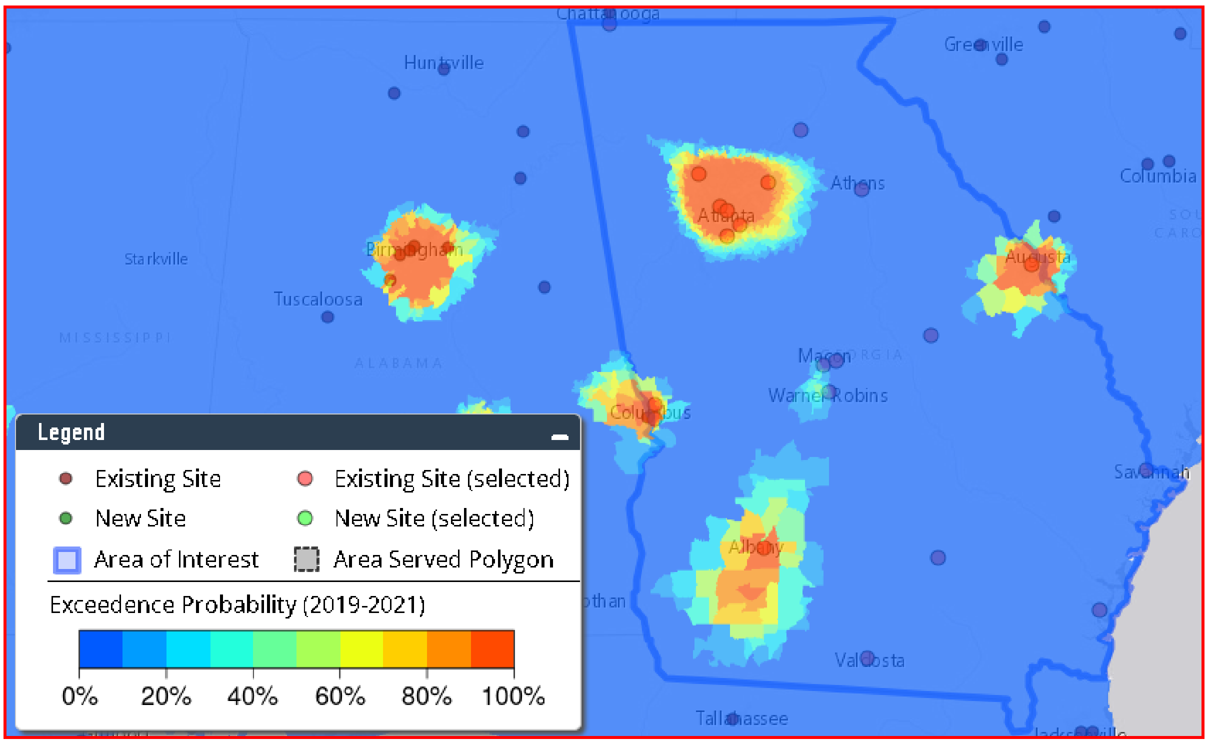


Figure 15.2: $PM_{2.5}$ Probability of Exceedance for Georgia

16.0 Emissions Assessment

In order to determine if GA AAMP's current ambient air monitoring network is located in areas to collect maximum emissions data, an emissions assessment was performed. Data from EPA's Emissions Inventory System (EIS) Gateway website, https://www.epa.gov/air-emissions-inventories/emissions-inventory-system-eis-gateway, was used to determine the location of each facility in Georgia that emits one of five pollutants (NOx, PM_{10}, $PM_{2.5}$, SO_2, and VOCs) using the 2020 (National Emissions Inventory) NEI report. The 2020 NEI report was chosen due to the amount of facility data being more expansive than other report options on the EIS Gateway. Facilities were grouped by source type and mapped in ArcGIS. A threshold depending on the pollutant's annual emissions was selected to separate major emissions source types from minor ones. Source types that emitted greater than the threshold chosen were displayed on the map, while source types that emitted less were grouped together and represented with a smaller point on the map. Mapped are 2032 photochemical modeling with 2032 emissions projected from 2018[1],and 2022 and 2032 typical anthropogenic emissions of CO, PM_{10}, SO_2, $PM_{2.5}$, VOCs, and NO_x. These pollutants were compared for each county in Georgia along with the difference and percent change between 2022 and 2032. This data was provided by the EPA's Emissions Modeling Platform (EMP) 2022v1 Data Retrieval Tool [2]. The emissions data from EPA's tool was filtered by Georgia and EI Sector to only include anthropogenic sectors.

The Georgia EPD Data and Modeling Unit (DMU) developed model direct concentration maps from air quality modeling outputs that were developed for EPA's modeling for the "Final Regulatory Impact Analysis [RIA]for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter".[3] Air quality models use emission inventory data and meteorological data to estimate ambient air concentrations. For the purpose of regulatory modeling, air quality models are typically run for a "base year" and a "future year". For the EPA RIA modeling project, 2018 was the "base year" and 2032 was the "future year". The base year meteorology was used for both the base year and future year air quality modeling. For the 2032 RIA modeling project, EPA used its own modeling platform.[4]

For the 2032 photochemical modeling, once the annual emission inventories were developed for 2032 projected from 2018, EPA ran the Sparse Matrix Operator Kernel Emissions (SMOKE) model (version 4.8.1) to generate hourly, gridded, speciated emission data for the air quality model.[5] The Weather Research and Forecasting (WRF) model (version 3.8) was used to generate meteorological fields for the air quality model.[6] The 2032 projection inventories were prepared for all sectors except for biogenic emission and fire emissions, which were held constant in the future.

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[1] https://gaftp.epa.gov/Air/emismod/2018/v2/

[2] https://awsedap.epa.gov/public/single/?appid=a2771e5d-51cf-4af8-a237-b521f789b8eb&sheet=5d3fdda7-14bc-4284-a9bb-cfd856b9348d&opt=ctxmenu,currsel

[3] Final Regulatory Impact Analysis for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter: https://www.epa.gov/system/files/documents/2024-02/naaqs_pm_reconsideration_ria_final.pdf

[4] 2018v2 Emissions Modeling Platform Technical Support Document | US EPA https://www.epa.gov/air-emissions-modeling/2018v2-emissions-modeling-platform-technical-support-document

[5] 2018v2 Emissions Modeling Platform Technical Support Document | US EPA https://www.epa.gov/air-emissions-modeling/2018v2-emissions-modeling-platform-technical-support-document

[6] Final Regulatory Impact Analysis for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter

EPA conducted air quality modeling for the base year (2018) and the future year (2032) with the Community Multiscale Air Quality (CMAQ) model version 5.3.2. Figure 16.1 shows the 12-km modeling domain which covers the entire continental U.S. CMAQ produces hourly pollutant concentrations by accounting for pollutant influx from the domain boundaries, advection, diffusion, chemical reactions, emissions, and deposition. The base year modeling results were evaluated against observed ambient concentrations and showed acceptable model performance. The Georgia EPD DMU used the EPA 2018 and 2032 emission inventories and CMAQ modeling results to produce data to create GIS maps and emission charts for this report.

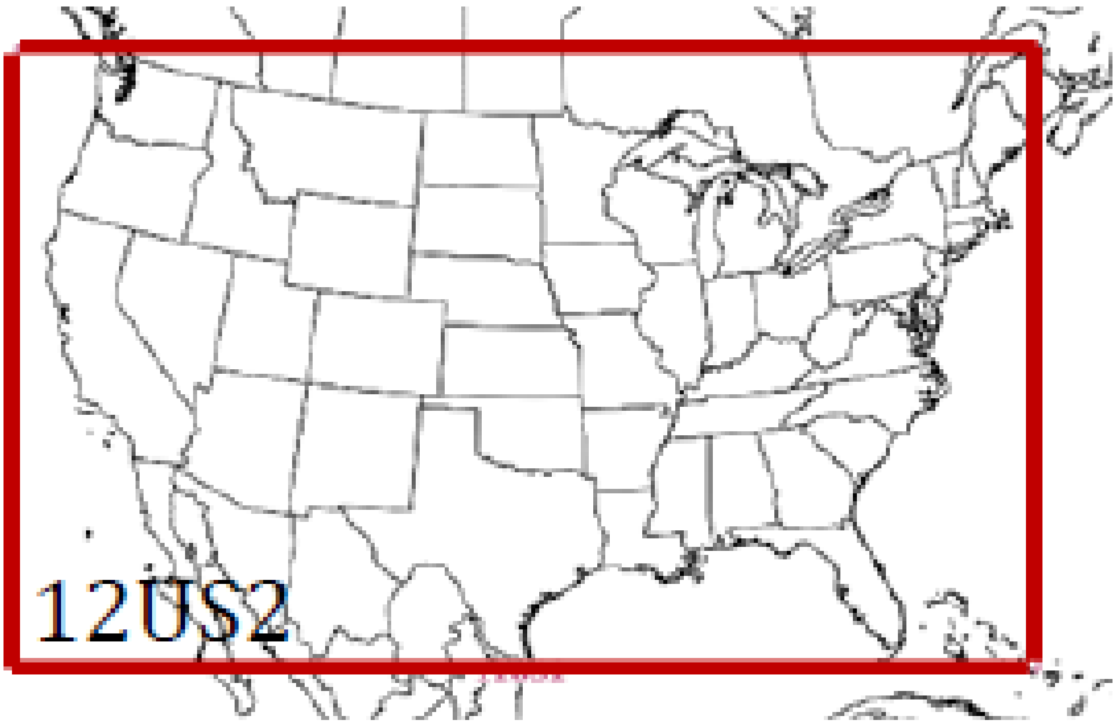


Figure 16.1: 12-km (red box) modeling domain

The Georgia EPD Emission and Control Strategies Unit (ECSU) created emission trend charts with data extracted from EMP 2022v1 Data Retrieval Tool. Emission inventories typically contain annual emissions with units of tons-per-year (TPY). EPA's NEI emission inventory consists of air pollutants and their precursors emitted from several source sectors. ECSU re-classified EPA's source sector emission summaries into seven (7) source categories: Electric Generation Units (EGU), non-EGU, non-point, Nonroad, Onroad, Marine-Airport-Rail (MAR), and Fire. EGU point sources are fossil fuel power plants. Non-EGU point sources refer to point sources (e.g., oil & gas and manufacturing facilities) that are not EGUs. The Nonroad sources are nonroad mobile equipment. Onroad sources consist of mobile gasoline and diesel vehicles that drive on roads. Emissions from both Nonroad and Onroad sources were calculated using the Motor Vehicle Emissions Simulator (MOVES) model (EPA, 2015). The MAR sources consist of Category 1-3 commercial marine vessels, airports, and rail locomotives. The fire sources cover emissions from fires related to agricultural, wildfires, and prescribed burning activities. The non-point sources consist of all other emissions from small point sources (e.g. < 25 TPY NOx) that are not covered by the previous six categories and other non-point sources (e.g., non-point area fugitive dust and non-point oil and gas sources).

16.1 Sulfur Dioxide

The following map shows the location of the source types that emit sulfur dioxide (SO_2) in Georgia per the 2020 NEI. The source types displayed include those that as a whole produce over 200 tons/year of SO_2. These source types include airports, chemical plants, electricity generation via combustion, pulp and paper plants, and other industrial sources.

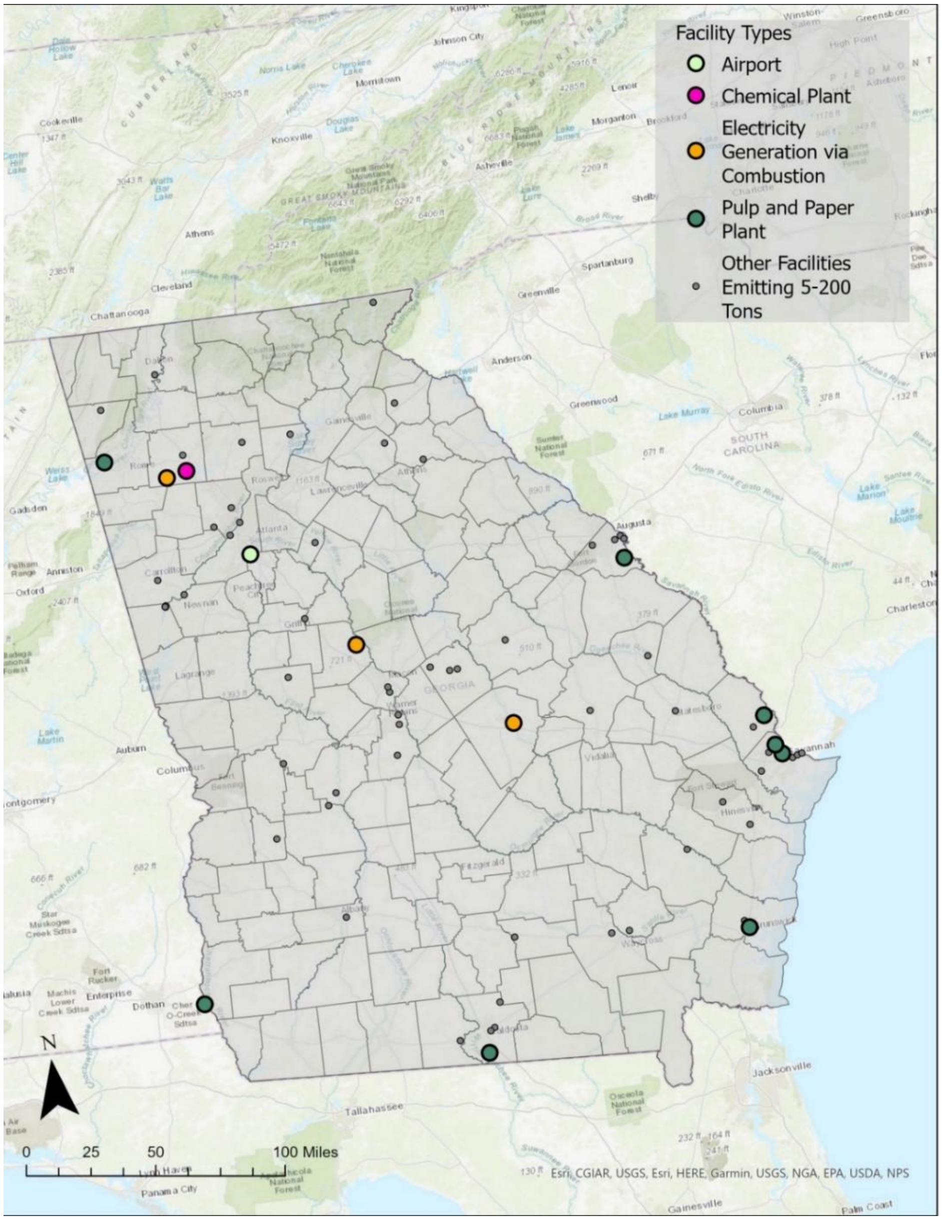


Figure 16.2: SO_2 Emitting Facilities in Georgia

In the following figure, the total modeled anthropogenic sulfur dioxide typical emissions are shown for 2022 and 2032. Emissions are shown in tons per year (TPY) at the county level, and the counties with the highest levels are shown in dark red. In addition, the difference between 2022 and 2032 emissions is shown using the formula 2032 emissions – 2022 emissions. The percent change in emissions between 2022 and 2032 is shown using the formula (2032/2022-1) X 100.

2022 and 2032 GA Annual Total Anthropogenic SO_2

Difference = 2032-2022 and % Changes = (2032/2022 -1) * 100

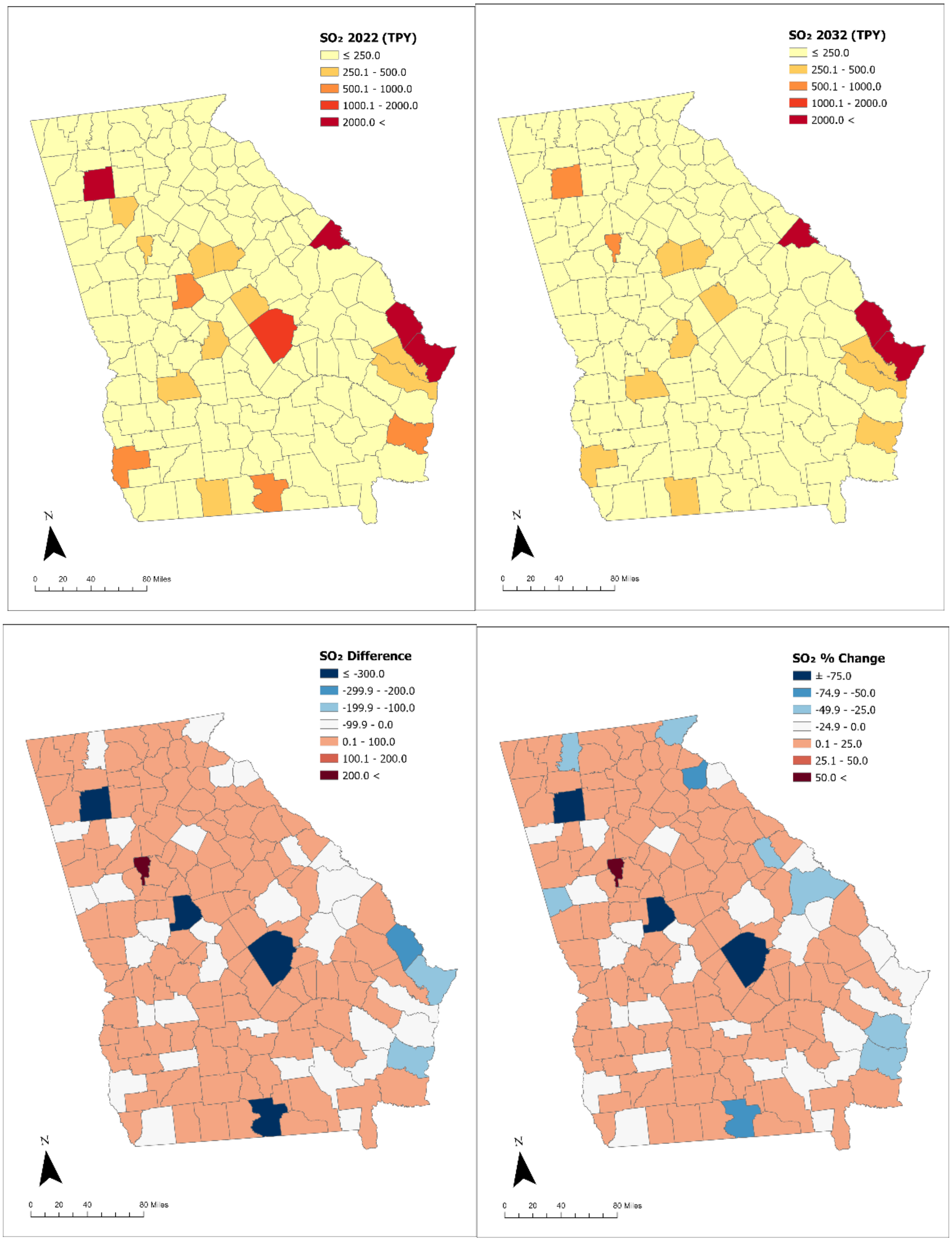


Figure 16.3: Sulfur Dioxide 2022 and 2032 Typical Emissions

The areas with the highest levels of emissions seem to be in the Rome MSA, Savannah MSA, and Augusta-Richmond County, Georgia-South Carolina MSA. With the modeled 2022 data, the counties with the highest levels were Chatham, Effingham, Richmond, and Bartow (dark red). In the modeled 2032 data, there was overall a decrease in the predicted emissions, with the exception of Clayton County.

The following model output shows projected annual average concentrations of sulfur dioxide based on 2032 emissions data. The concentrations are shown in parts per billion, and the hotter colors represent higher levels of concentration (orange and red). These models take into account meteorological conditions based on 2018 data. The current locations of GA AAMP's ambient air monitors are shown with white triangles.

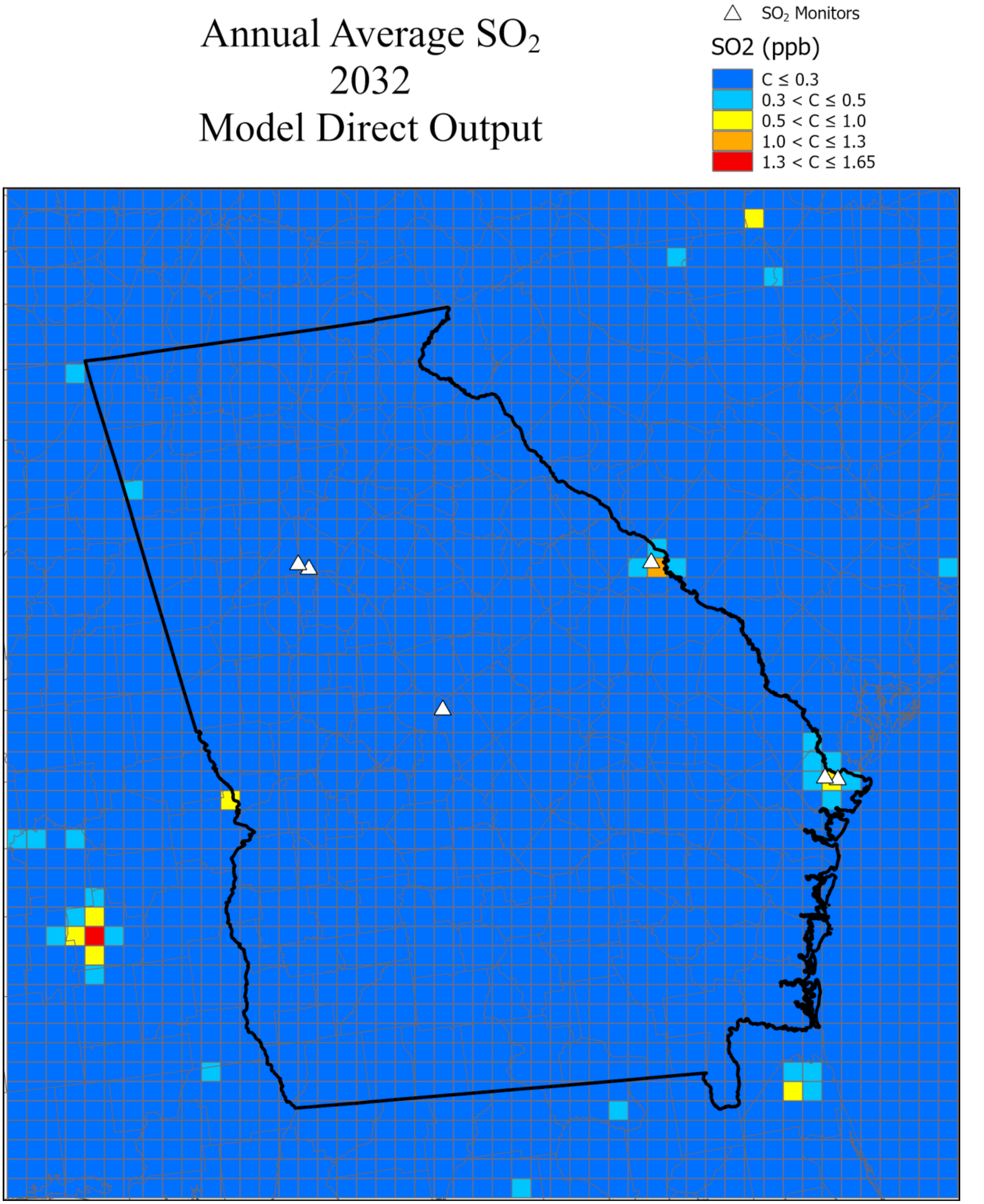


Figure 16.4: Sulfur Dioxide, Modeled 2032, Annual Average

With the above model, the annual average concentrations of sulfur dioxide emissions for 2032 are predicted to be very low statewide, with the highest areas in the Augusta-Richmond County, GA-SC MSA, and secondary high values in the Savannah MSA and Columbus, GA-AL MSA. GA AAMP has strategically placed SO_2 monitors in areas with the highest predicted 2032 SO_2 emissions (with two of those areas being Augusta-Richmond County, GA-SC MSA and the Savannah MSA). According to this model, the Atlanta-Sandy Springs-Roswell MSA and Macon-Bibb County MSA show very low annual averages predicted (less than 0.3 ppb). It should be noted that the values represented on this map are especially low values, with the highest category (red) ranging from 1.3 to 1.65 ppb. The Emission Assessment is one part of overall analysis. Decisions will be made about changing the placement of these monitors or adding monitors to the network based on several factors and the overall assessment.

16.2 PM_{10}

The following map shows the location of the source types that emit PM_{10} in Georgia per the 2020 NEI. The source types displayed include those that as a whole produce over 200 tons/year of PM_{10} emissions. These source types include brick, structural clay or clay ceramics plants, electricity generation via combustion, mineral processing plants, plywood and engineered wood products, cement manufacturing plants, pulp and paper plants, and other industrial sources.

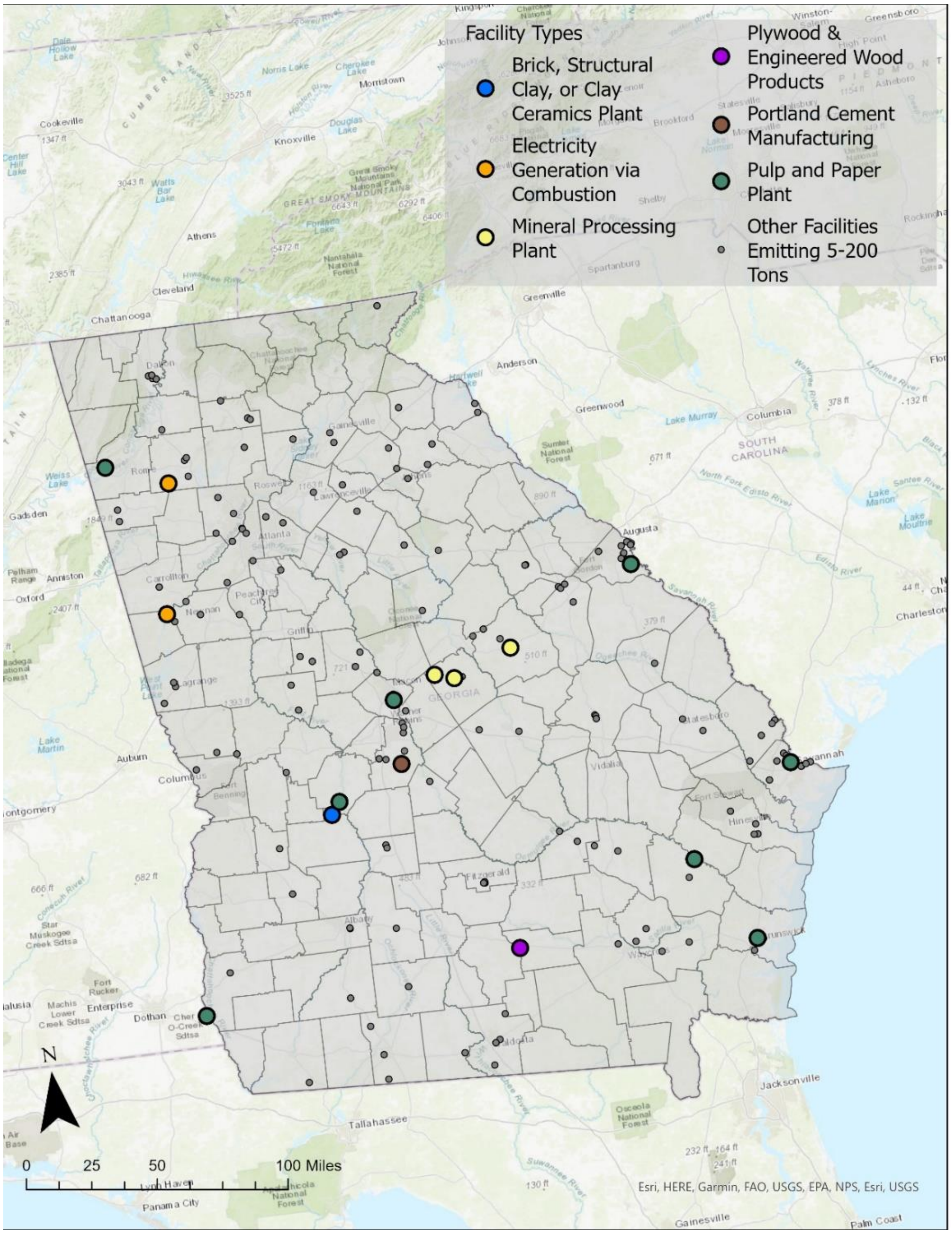


Figure 16.5: PM_{10} Emitting Facilities in Georgia

The following figure shows the total primary anthropogenic PM_{10} typical emissions for 2022 and 2032. Emissions are shown in tons per year (TPY) at the county level; the counties with the highest levels are shown in dark red. In addition, a difference between 2022 and 2032 emissions is shown using the formula 2032 emissions - 2022 emissions. The percent change in emissions from 2022 -2032 is shown using the formula (2032/2022-1) X 100.

2022 and 2032 GA Annual Total Anthropogenic PM_{10}

Difference = 2032-2022 and % Changes = (2032/2022 -1) * 100

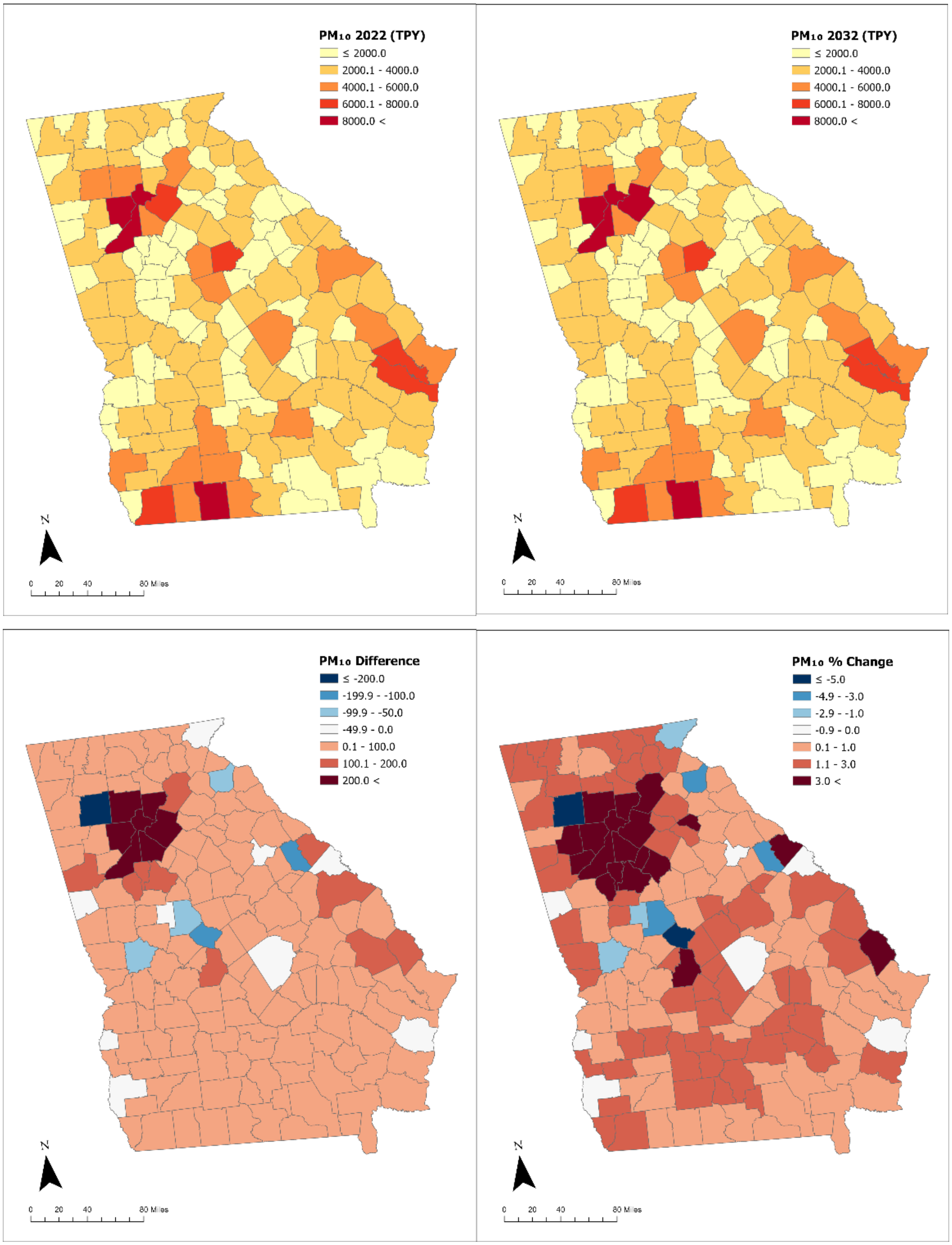


Figure 16.6: PM_{10} 2022 and 2032 Typical Emissions

According to the 2022 and 2032 typical anthropogenic primary PM_{10} emissions maps shown above, the areas with the highest PM_{10} emissions are primarily around the Atlanta-Sandy Springs- Roswell MSA, Putnam County, Thomas County, and the Savannah MSA. These areas are shown in dark red in the top two maps and represent greater than 8,000 TPY of emissions. There does not appear to be much projected change in the PM_{10} emissions levels from 2022 to 2032. The percent change represented in the map ranges from -5% to 3%.

The following model outputs show projected average annual concentrations of PM_{10} based on 2032 emissions data. The concentrations are shown in micrograms per cubic meter ($\mu g/m^3$), areas in red have higher concentrations and dark blue the lowest. These models take into account meteorological conditions based on 2018 data. The current locations of GA AAMP's ambient air monitors are shown with white triangles.

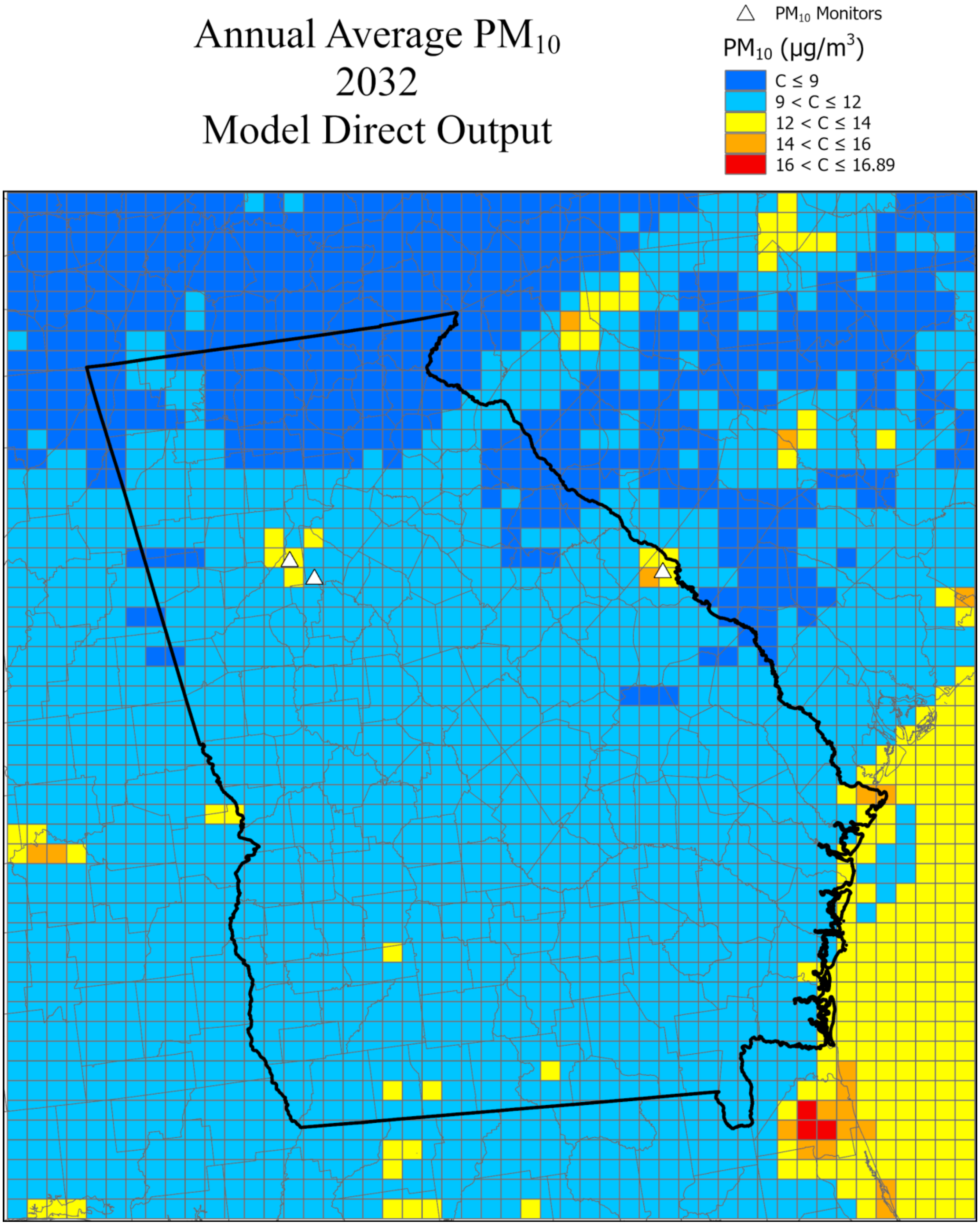


Figure 16.7: PM_{10}, Modeled 2032, Annual Average

According to the modeled 2032 annual average, the areas with the highest PM_{10} emissions are primarily in the Augusta-Richmond Country, GA-SC MSA and the Savannah MSA, with secondary high values in the Atlanta-Sandy Springs-Roswell MSA. The NAAQS for PM_{10} comparison is 150 $\mu g/m^3$, so it should be noted that these are very low values reflected in the map. GA AAMP has PM_{10} monitors located in the Atlanta-Sandy Springs-Roswell MSA and Augusta-Richmond County, GA-SC MSA which are located in MSAs with higher populations, according to the Federal Register (40CFR58). The Emission Assessment is one part of the overall analysis. Decisions can be made about changing the placement of these monitors or adding monitors to the network based on several factors and the overall assessment.

16.3 $PM_{2.5}$

The following map shows the location of the source types that as a whole emit over 100 tons/year of $PM_{2.5}$ in Georgia per the 2020 NEI. The source types displayed include brick, structural clay, or clay ceramics plants, electricity generation via combustion, fertilizer plants, mineral processing plants, mineral wood plants, plywood and engineered wood products, cement manufacturing plants, pulp and paper plants, sugar mills, wood pellet plants, and other industrial sources.

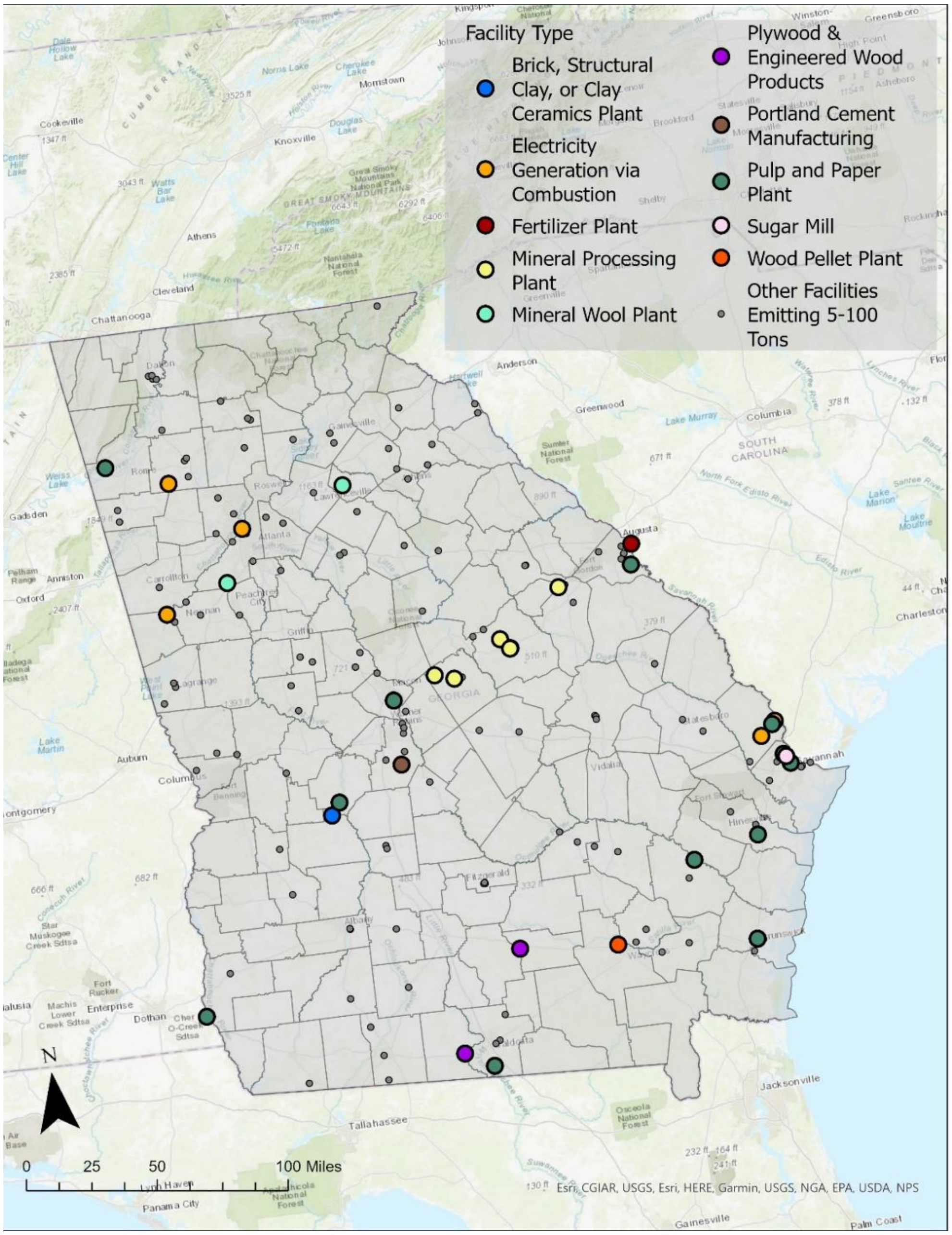


Figure 16.8: $PM_{2.5}$ Emitting Facilities in Georgia

In the following figure, the total anthropogenic $PM_{2.5}$ typical emissions are shown for 2022 and 2032. Emissions are shown in tons per year (TPY) at the county level, and the counties with the highest levels are shown in dark red. In addition, a difference between 2022 and 2032 emissions is shown using the formula 2032 emissions - 2022 emissions. A percent change in emissions is shown using the formula (2032/2022-1) X 100.

2022 and 2032 GA Annual Total Anthropogenic $PM_{2.5}$

Difference = 2032-2022 and % Changes = (2032/2022 -1) * 100

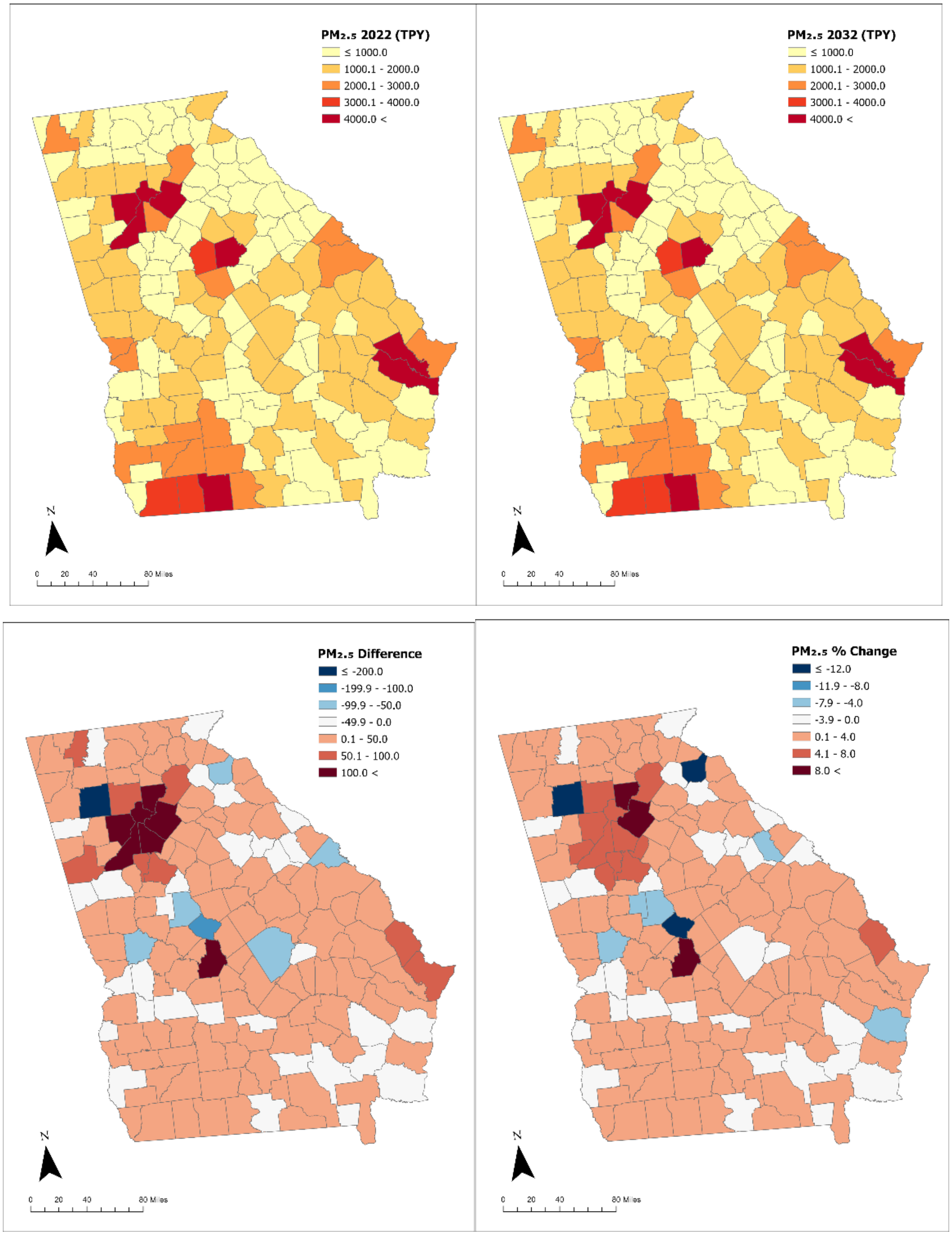


Figure 16.9: $PM_{2.5}$ 2022 and 2032 Typical Emissions

According to the 2022 typical anthropogenic primary $PM_{2.5}$ emissions maps shown above, the areas with the highest typical anthropogenic $PM_{2.5}$ emissions are primarily around the Atlanta-Sandy Springs-Roswell MSA, Putnam County, Thomas County, and Savannah MSA (all are shown in dark red). These areas are shown in dark red in the top two maps and represent greater than 4,000 TPY of emissions. There does not appear to be much projected change in the $PM_{2.5}$ emissions levels from 2022 to 2032.

The following model outputs show projected concentrations of the $PM_{2.5}$ annual average based on 2032 emissions data. The concentrations are shown in micrograms per cubic meter (µg/m^3), areas with higher concentrations are shown in red. These models take into account meteorological conditions based on 2018 data. The current locations of GA AAMP's ambient air monitors are shown with white triangles.

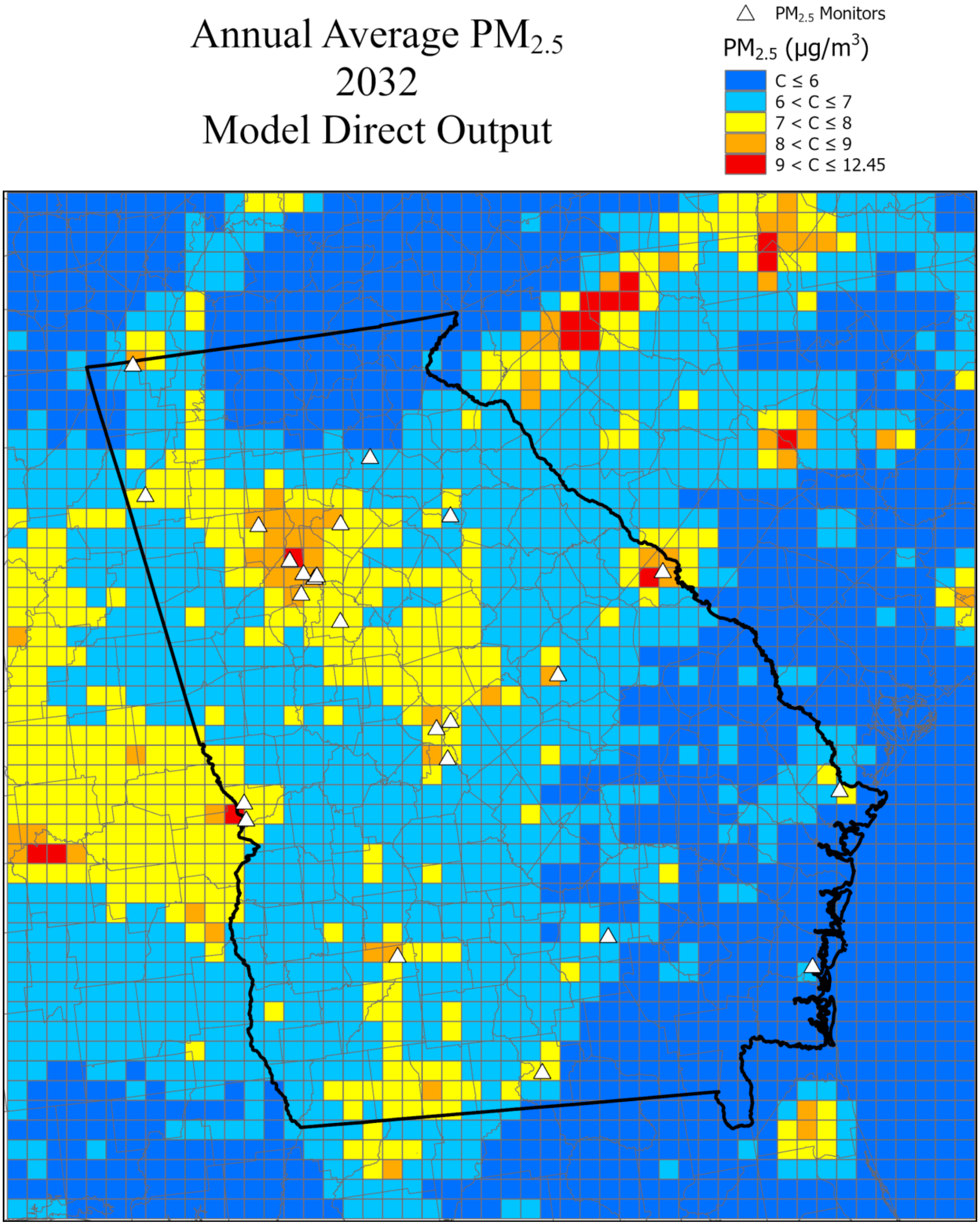


Figure 16.10: $PM_{2.5}$, Modeled 2032, Annual Average

According to the modeled 2032 annual average with 24-hour daily averages, the areas with the highest $PM_{2.5}$ emissions are primarily in the Augusta-Richmond County, GA-SC MSA and the Atlanta-Sandy

Springs-Roswell MSA, with secondary high values in the Warner Robins MSA, Macon-Bibb County, MSA and Washington County. As stated above with the PM_{10} Emission Assessment, GA AAMP currently meets the monitoring requirements for $PM_{2.5}$. The Emission Assessment is one part of the overall analysis. Decisions can be made about changing the placement of these monitors or adding monitors to the network based on several factors and the overall assessment.

16.4 Carbon Monoxide

The following map shows the location of the source types that emit over 500 tons/year of CO in Georgia per the 2020 NEI. The source types displayed include airports, brick, structural clay, or clay ceramics plants, chemical plants, electricity generation via combustion, fabricated metal products plants, fertilizer plants, mineral wood plants, plywood and engineered wood products plants, cement manufacturing plants, pulp and paper plants, and other industrial sources.

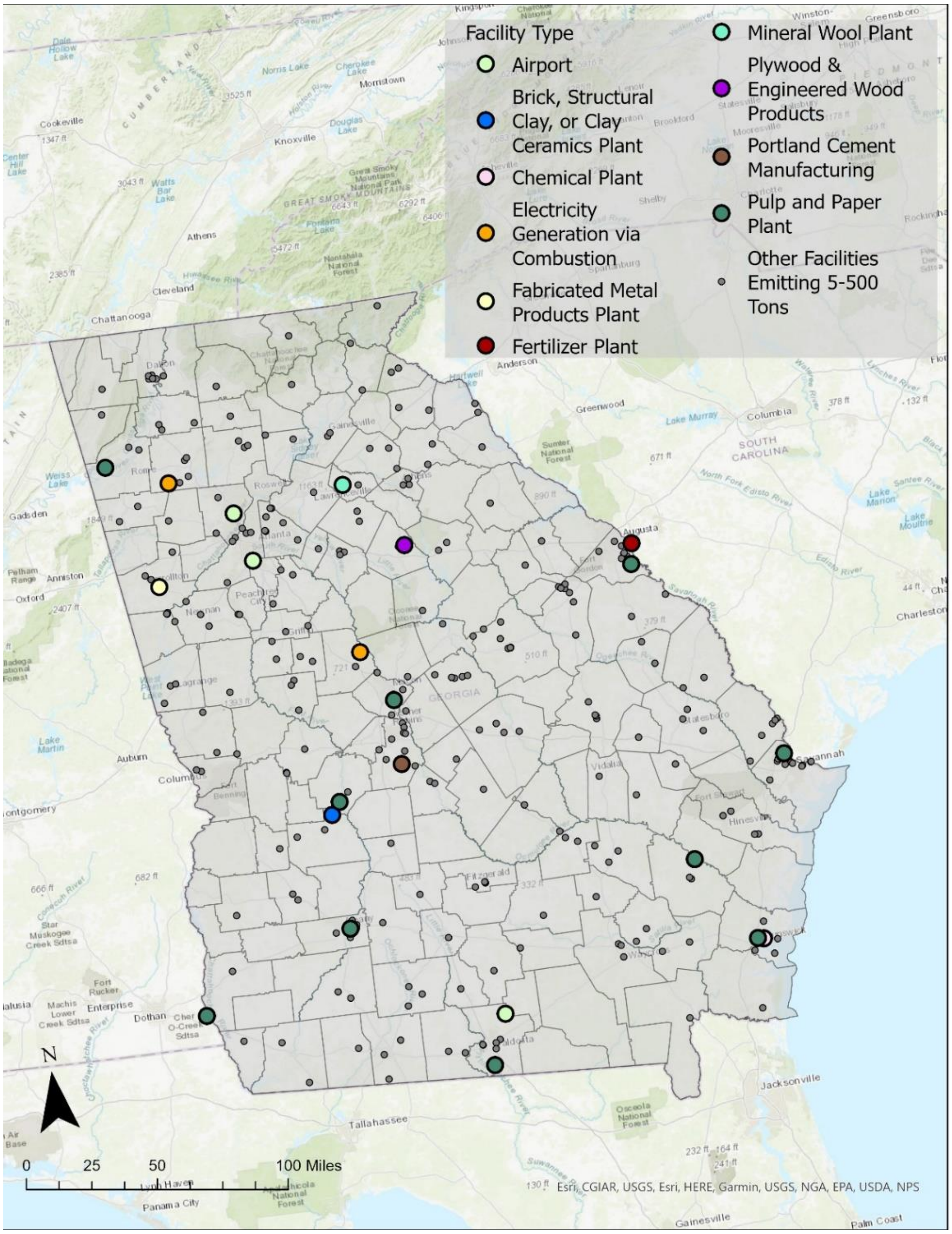


Figure 16.11: CO Emitting Facilities in Georgia

In the following maps, the total anthropogenic carbon monoxide typical emissions are shown for 2022 and 2032. Emissions are shown in tons per year (TPY) at the county level, and the counties with the highest levels are shown in dark red. In addition, a difference between 2022 and 2032 emissions is shown using the formula 2032 emissions - 2022 emissions. A percent change in emissions is shown using the formula (2032/2022-1) X 100.

2022 and 2032 GA Annual Total Anthropogenic CO

Difference = 2032 -2022 and % Changes = (2032/2022 -1) * 100

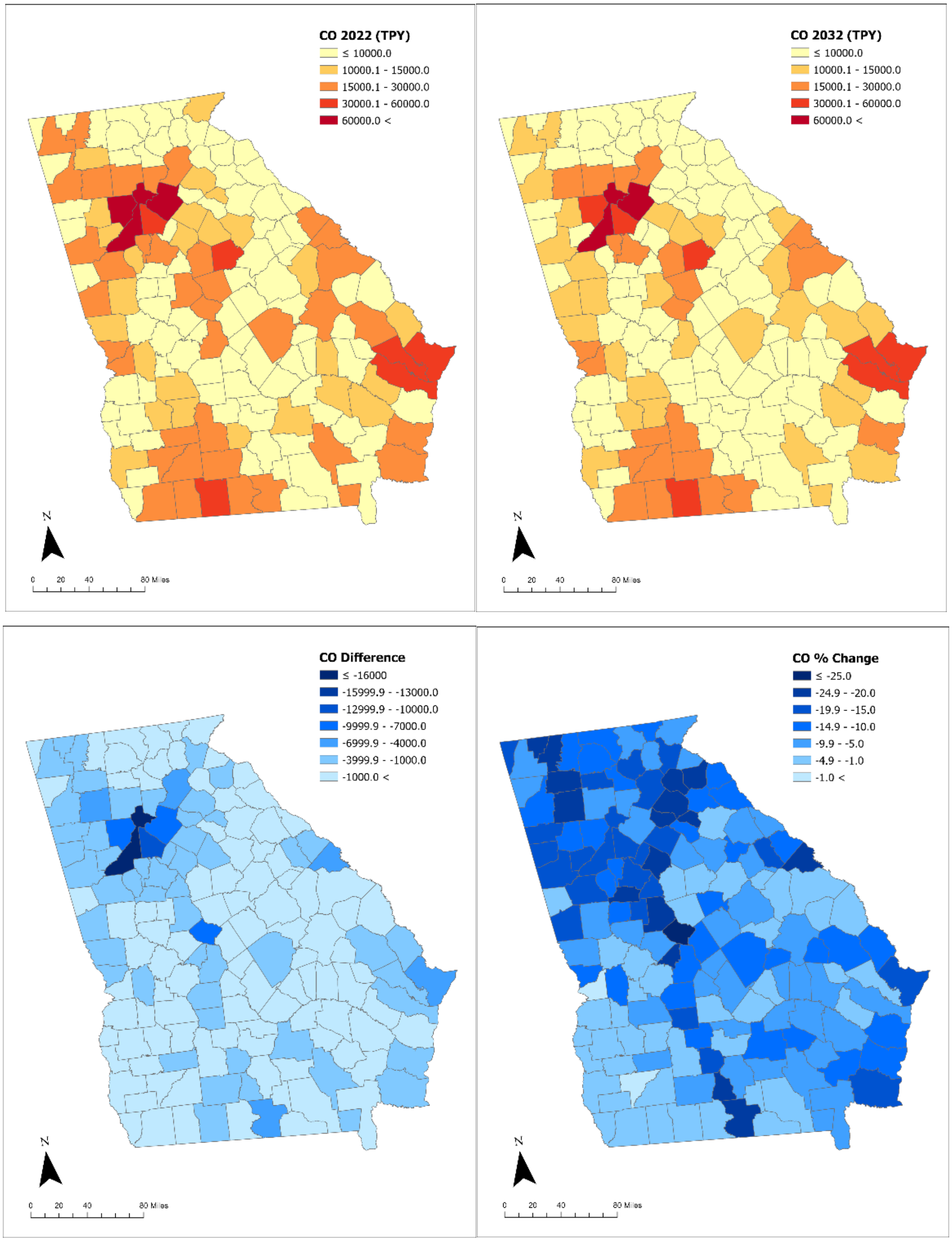


Figure 16.12: CO 2022 and 2032 Typical Emissions

For the CO emissions in Georgia, the Atlanta-Sandy Springs-Roswell (shown in dark red) has the highest level of emissions for 2022. In 2032, the predicted CO emissions for most parts of the Atlanta-Sandy Springs-Roswell remain consistent with the exception of Cobb County, which is predicted to decrease.

In the following model outputs, projected annual average concentrations of CO based on 2032 emissions data are shown. The concentrations are shown in parts per million, higher concentration levels are shown in red. These models take into account meteorological conditions based on 2018 data. The current locations of GA AAMP's ambient air monitors are shown with white triangles.

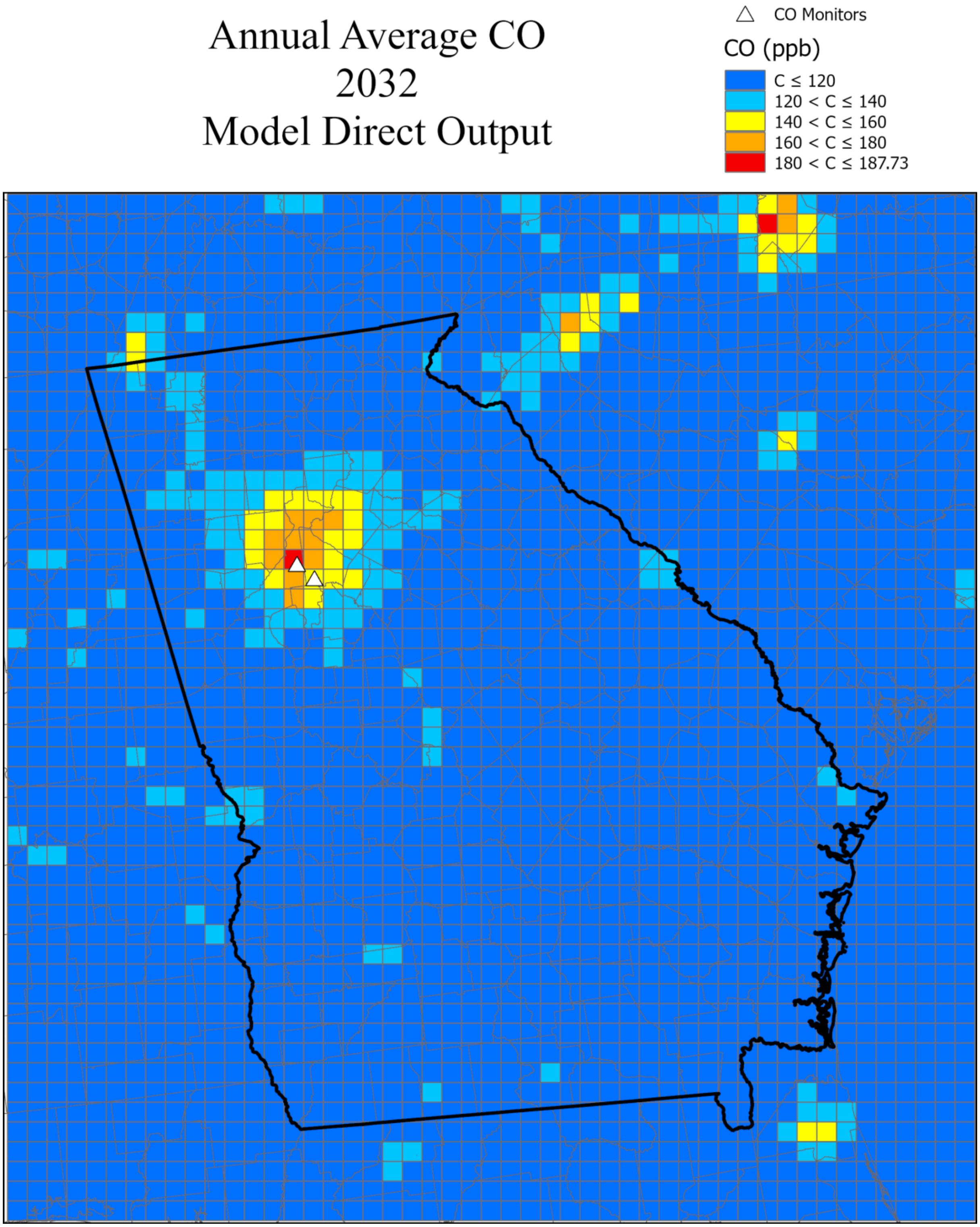


Figure 16.13: CO, Modeled 2032, Annual Average

With the above map, the annual average concentrations of carbon monoxide are predicted. For the annual averages, the Atlanta-Sandy Springs-Roswell MSA has the highest level of emissions. GA AAMP has CO monitors located in the Atlanta-Sandy Springs-Roswell MSA, with higher population and areas of high vehicle traffic, according to the Federal Register (40CFR58).

16.5 Ozone

The following model outputs show predicted concentrations of ozone at the fourth highest daily 8-hour maximum based on 2032 emissions data. The concentrations are shown in parts per billion, higher concentration levels are shown in red. These models take into account meteorological conditions based on 2018 data. The current locations of GA AAMP's ambient air monitors are shown with white triangles.

It should be noted that ozone is a secondary pollutant, and not directly emitted from sources; therefore, models were not conducted of emissions data for ozone. NOx and VOCs are major contributors to the formation of ozone, and this emission information was modeled, with the results discussed in the sections below.

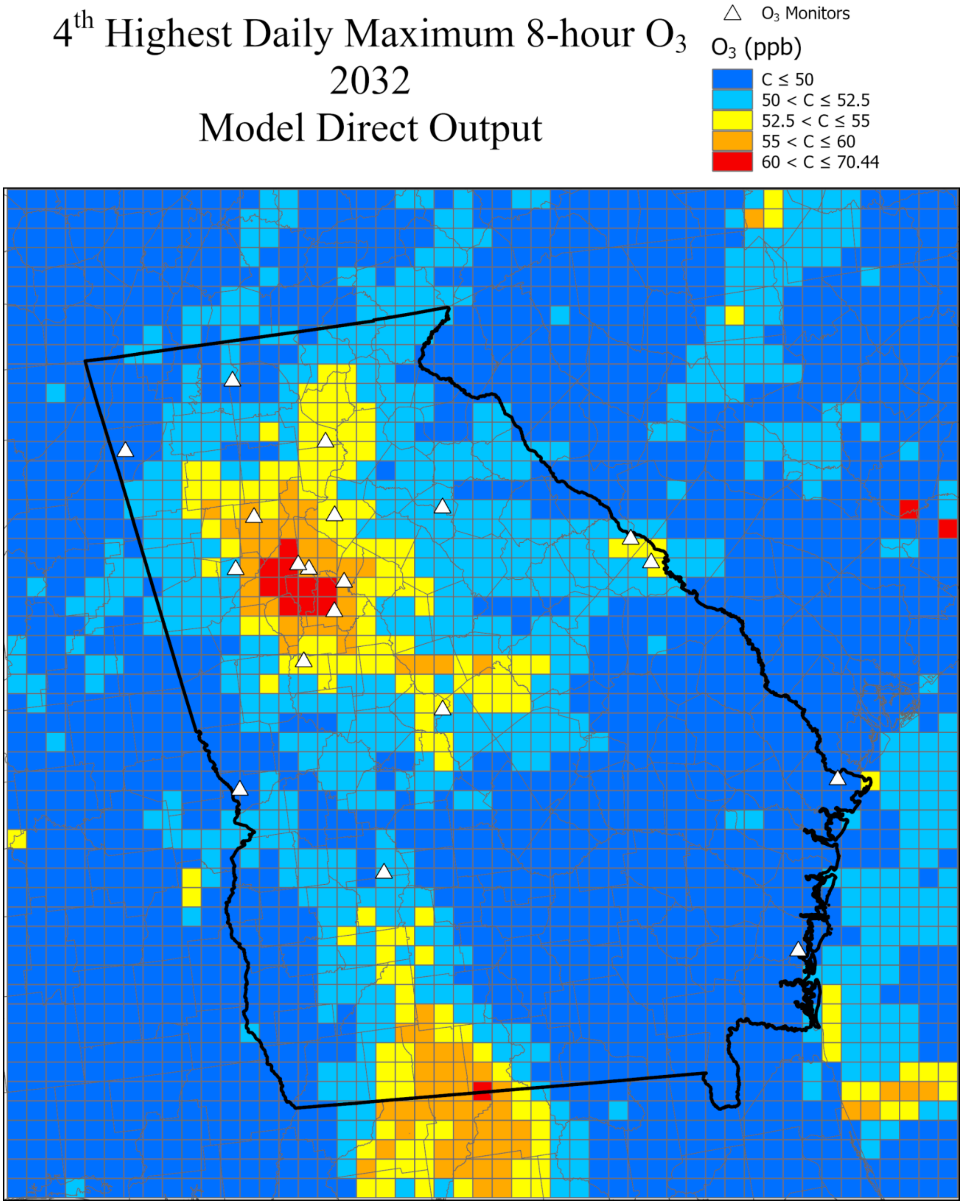


Figure 16.14: Ozone, Modeled 2032, 4th Highest Daily Maximum

It appears that GA AAMP has ozone monitors in the area of the state where the highest levels of 4th highest daily maximum of the 8-hour O_3 values are predicted to be in 2032, the Atlanta-Sandy Springs-

Roswell MSA. Secondary high values appear to lie within the Macon-Bibb County, MSA and Valdosta MSA, though there are no ozone monitors located in the Valdosta MSA. Several ozone monitors are located in areas with lower predicted ozone values (shown in blue areas) and may not be needed, according to this assessment. There are two monitors (United Avenue and South DeKalb sites) in the core of the Atlanta-Sandy Springs-Roswell MSA that appear to be overlapping. One of these monitors may not be needed since these two monitors are so close in proximity. The Emission Assessment is one part of the overall analysis. Decisions can be made about changing the placement of these monitors or adding monitors to the network based on several factors and the overall assessment.

On October 1, 2015, EPA changed the 8-hour primary and secondary ozone standards, designed to protect public health, to 70 parts per billion (ppb) (80FR65292). At this time, even with the strengthening of the standard, no adjustments have been needed to fulfill the network requirements in 40 CFR 58 Appendix D.

16.6 NO_X

The following map shows the location of the source types that emit over 500 tons/year of oxides of nitrogen in Georgia per the 2020 NEI. The source types displayed include airports, brick, structural clay, or clay ceramics plants, compressor stations, electricity generation via combustion, fertilizer plants, cement manufacturing plants, pulp and paper plants, and other industrial facilities.

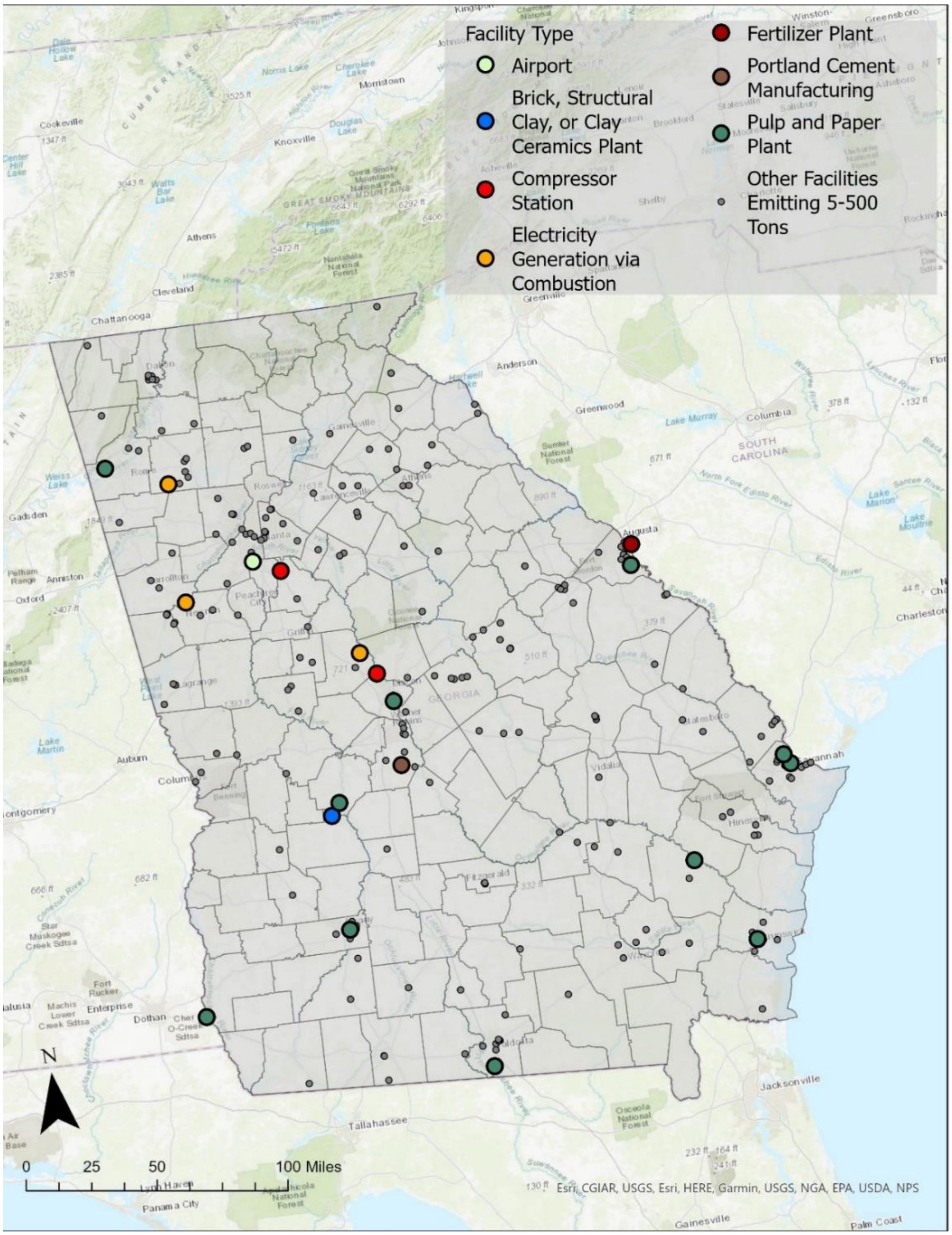


Figure 16.15: NO_X Emitting Facilities in Georgia

In the following maps, the total anthropogenic oxides of nitrogen typical emissions are shown for 2022 and 2032. Emissions are shown in tons per year (TPY) at the county level, and the counties with the highest levels are shown in dark red. In addition, a difference between 2022 and 2032 emissions is shown using the formula 2032 emissions - 2022 emissions. A percent change in emissions is shown using the formula (2032/2022-1) X 100.

2022 and 2032 GA Annual Total Anthropogenic NO_X

Difference = 2032-2022 and % Changes = (2032/2022 -1) *100

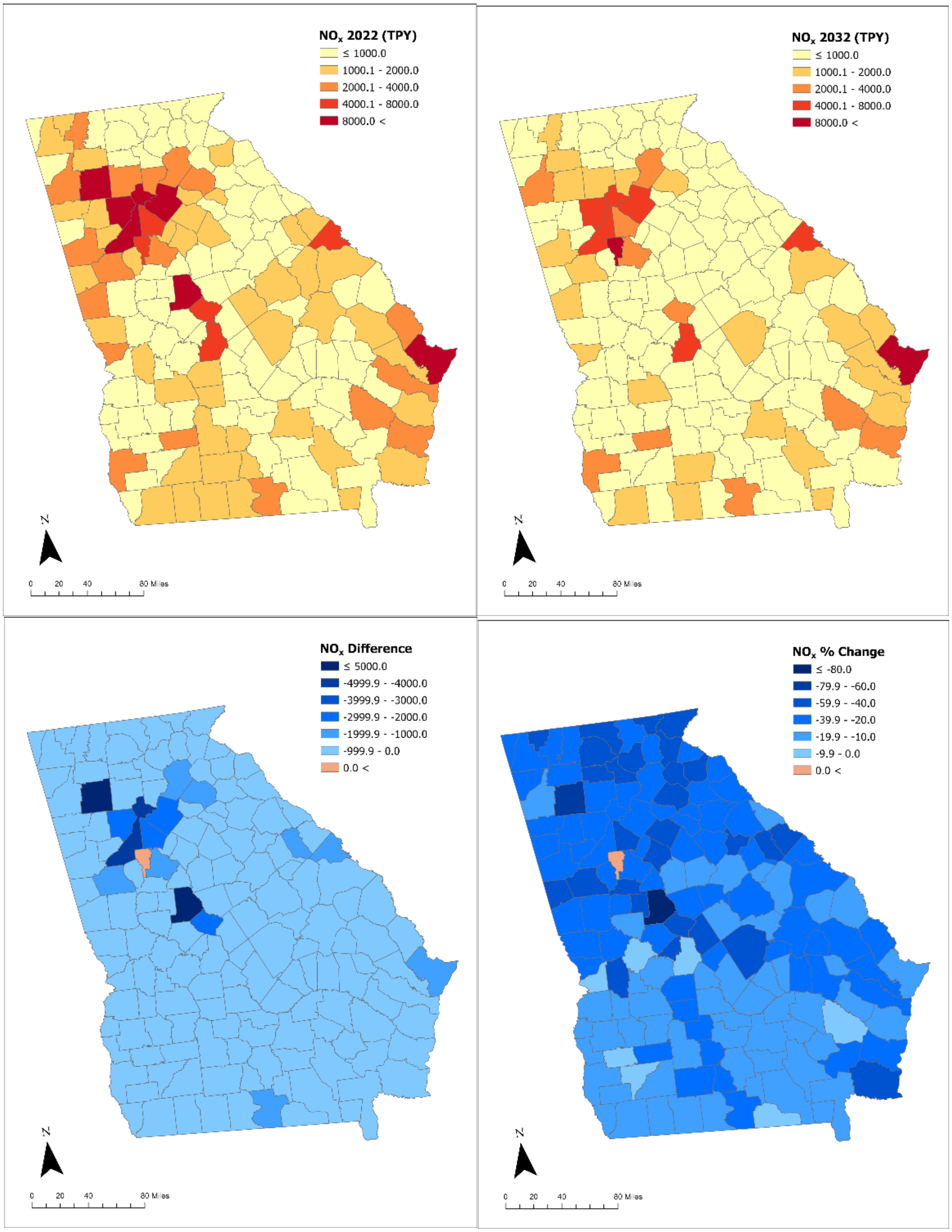


Figure 16.16: NO_X 2022 and 2032 Typical Emissions

The NO_X emissions models show that part of the Atlanta-Sandy Springs-Roswell MSA, part of the Savannah MSA, and part of the Macon MSA, have over 8,000 TPY of typical predicted emissions in 2022 (shown in dark red). In 2032, the predicted NOx emissions levels in most of these areas have significant decreases or remained the same, with the exception of Clayton County in the Atlanta-Sandy Springs-Roswell MSA.

The following model outputs show projected annual average concentrations of nitrogen dioxide based on 2032 emissions data. The concentrations are shown in parts per billion, and the hotter colors (red and orange) represent higher levels of concentration. These models take into account meteorological conditions based on 2018 data. The current locations of GA AAMP's ambient air monitors are shown with white triangles.

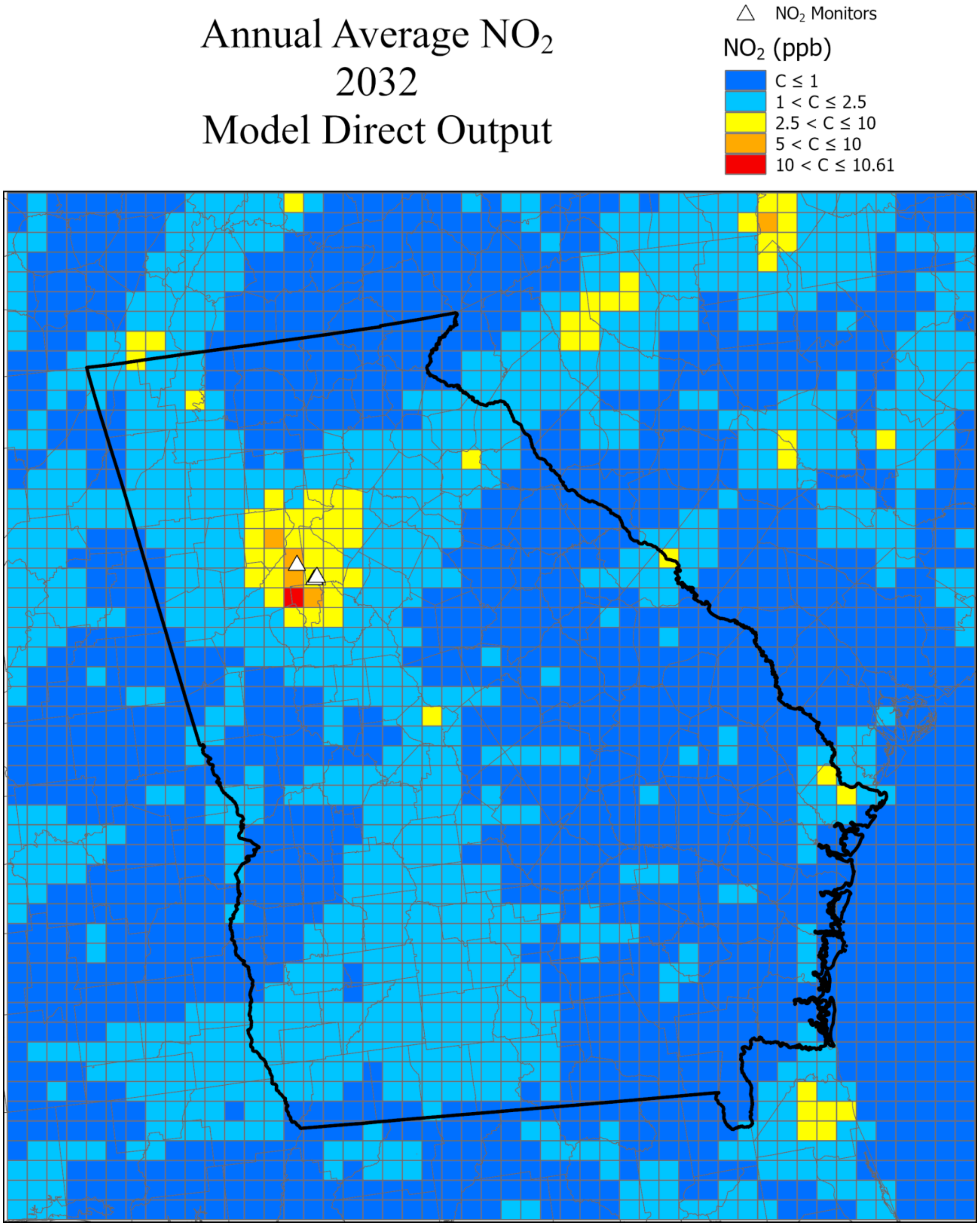


Figure 16.17: NO_2, Modeled 2032, Annual Average

In the above map, the areas with the highest annual average of NO_2 are predicted. The Atlanta-Sandy Springs-Roswell MSA has the highest predicted level, which is less than 10.61 ppb. The Atlanta-

Sandy Springs-Roswell MSA has a monitor that is part of the PAMS network, and two monitors that are part of the Near-road network with areas of higher population and high vehicle traffic, according to the Federal Register (40CFR58).

16.7 Volatile Organic Compounds

In the following map, the source types that emit over 300 tons/year of volatile organic compounds (VOCs) in Georgia are shown per the 2020 NEI. The source types displayed include airports, chemical plants, food products processing plants, lumber and sawmills, plywood and engineered wood products, pulp and paper plants, wood pellet plants, and other industrial facilities.

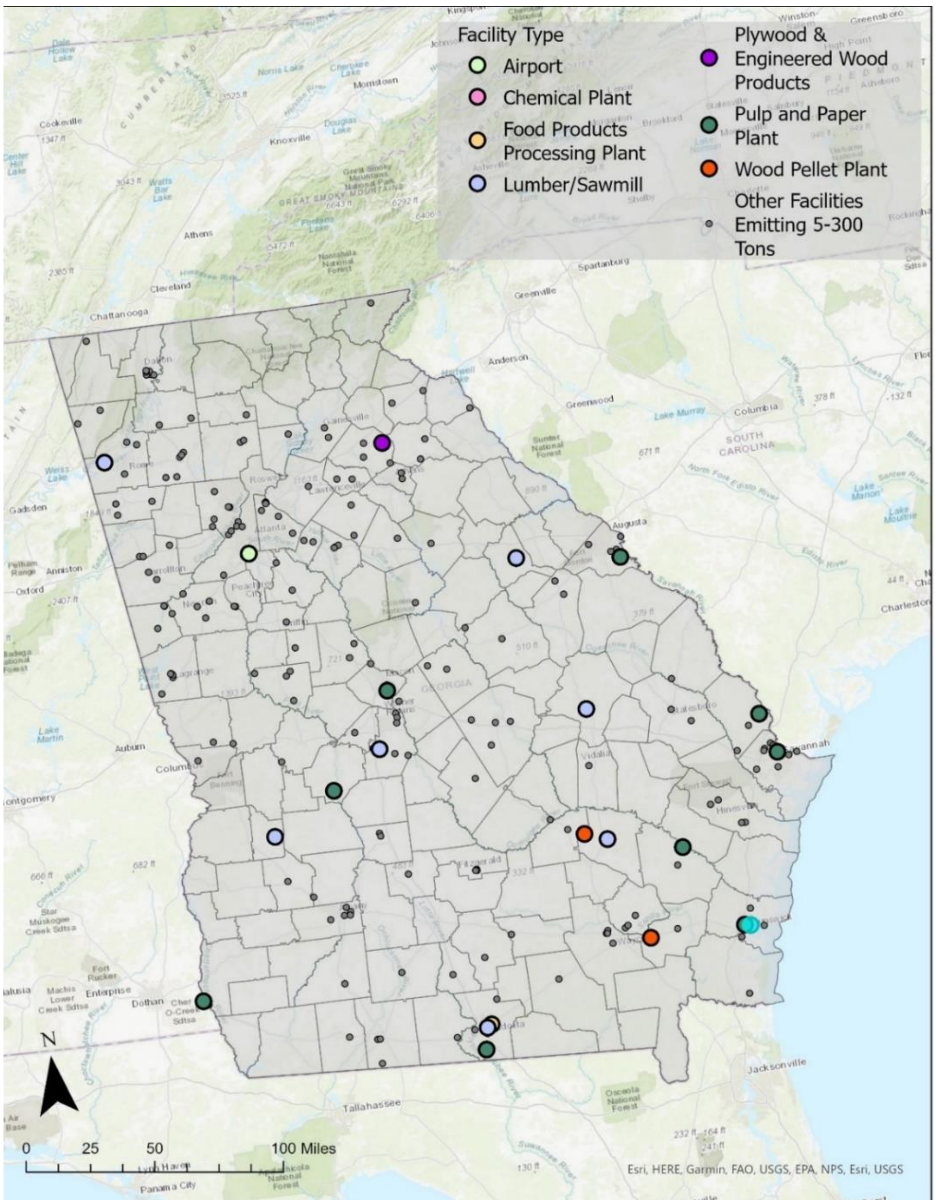


Figure 16.18: VOCs Emitting Facilities in Georgia

The following maps show the total anthropogenic VOCs for typical emissions for 2022 and 2032. Emissions are shown in tons per year (TPY) at the county level, and the counties with the highest levels are shown in dark red. In addition, a difference between 2022 and 2032 emissions is shown using the formula 2032emissions - 2022 emissions. A percent change in emissions is shown using the formula (2032/2022-1) X 100.

2022 and 2032 GA Annual Total Anthropogenic VOC

Difference = 2032-2022 and % Changes = (2032/2022 -1) * 100

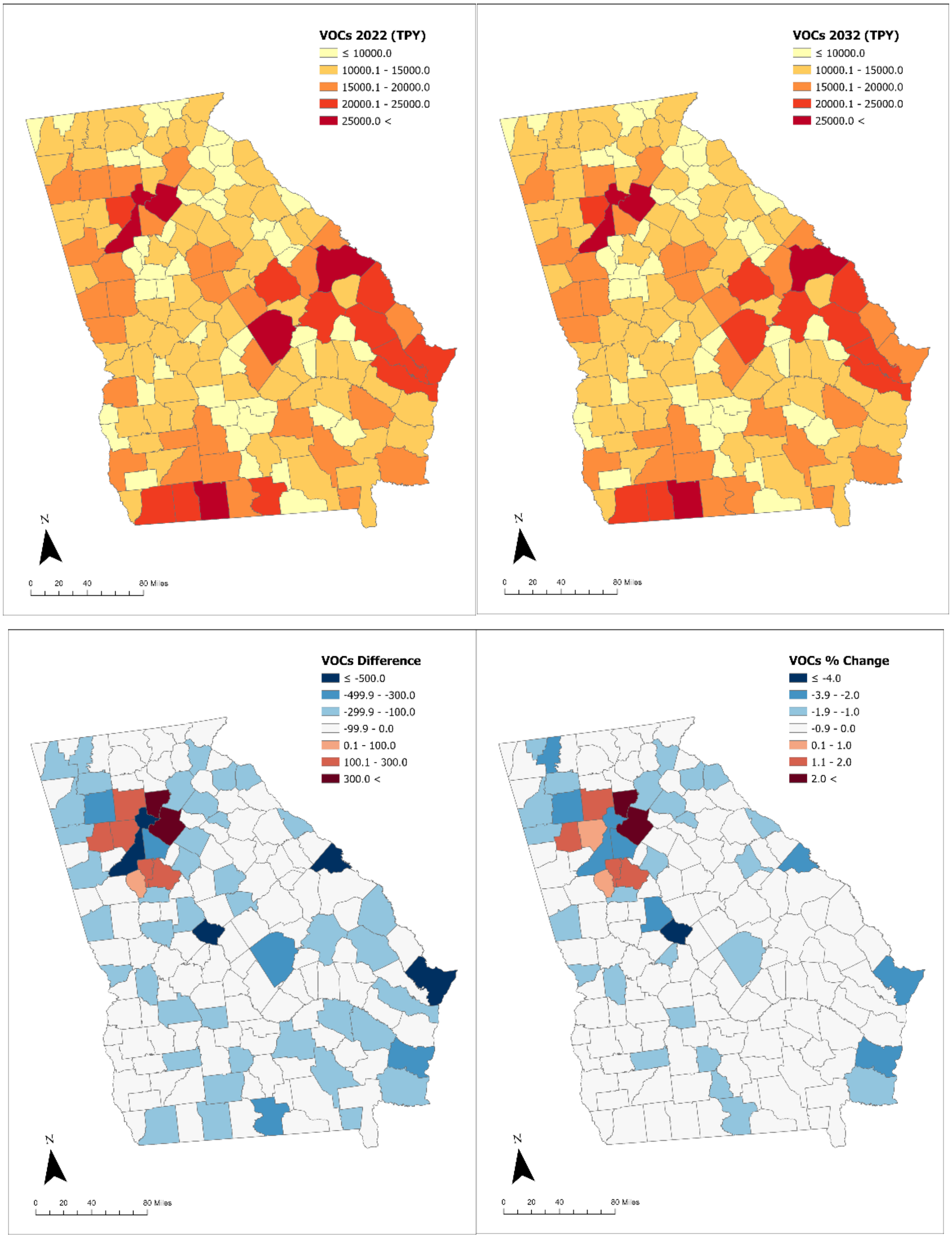


Figure 16.19: VOCs 2022 and 2032 Typical Emissions

According to the 2022 anthropogenic primary VOCs emissions map shown above, the areas with the highest typical anthropogenic VOCs emissions are parts of the Atlanta-Sandy Springs-Roswell MSA, Augusta- Richmond County, Georgia-South Carolina MSA, Laurens County, and Thomas County. The total emissions per county are >25,000 TPY, shown in dark red. According to the 2032 anthropogenic primary VOCs emissions map, the amount of emissions are predicted to remain consistent across the state, with the exception of Laurens County. It should be noted that biogenic (natural) sources in Georgia are more important in regards to VOCs emissions than anthropogenic (man-made) sources.

The two following model outputs show predicted 2032 concentrations of the annual average formaldehyde (as a proxy for VOCs) and the average formaldehyde (as a proxy for VOCs) during ozone season (March 1-Ocotber 31) based on 2032 emissions data. The hotter colors (red and orange) represent higher levels of formaldehyde. These models take into account meteorological conditions based on 2018 data. The current locations of GA AAMP's ambient air monitors are shown with white triangles.

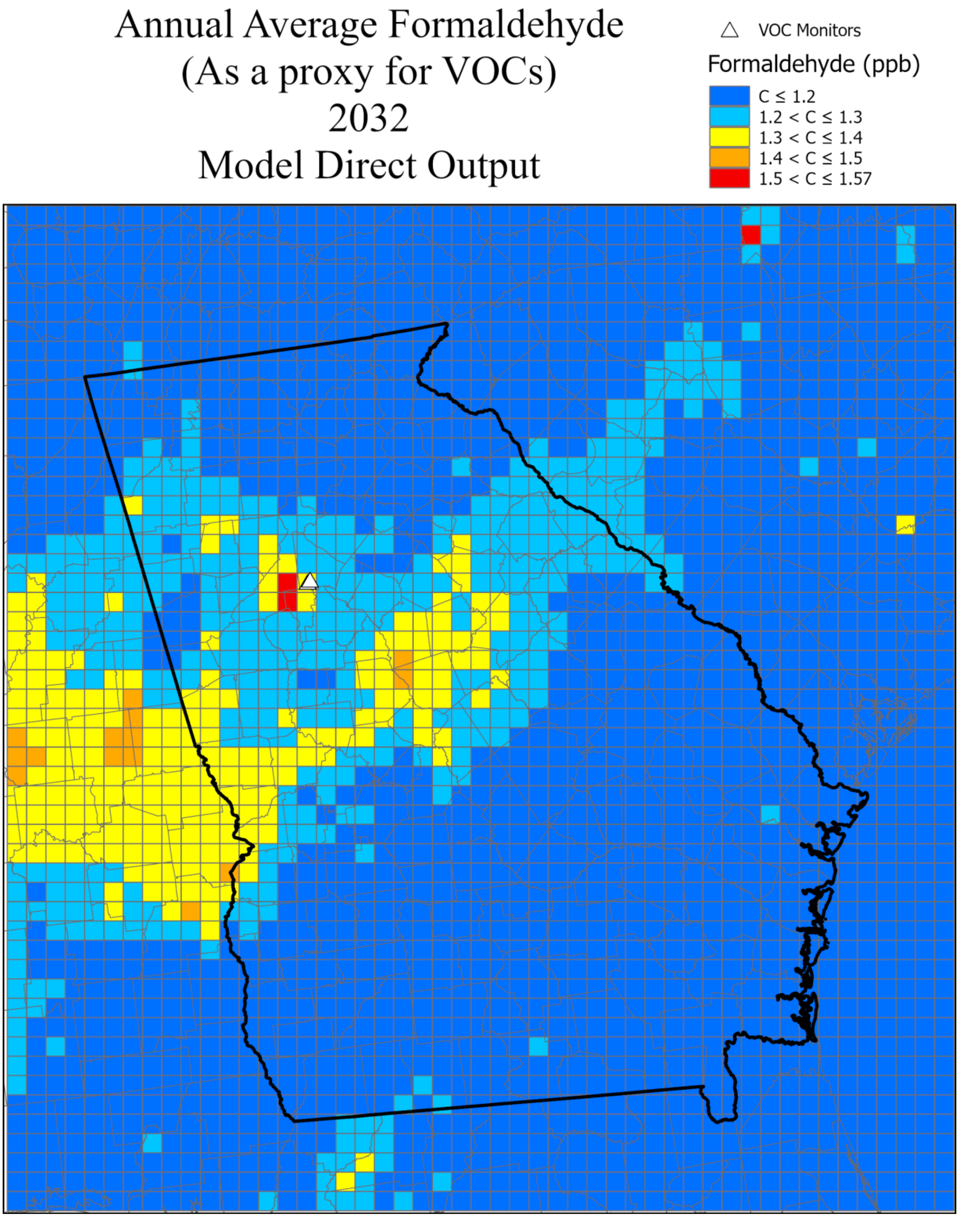


Figure 16.20: Formaldehyde, Modeled 2032, Annual Average

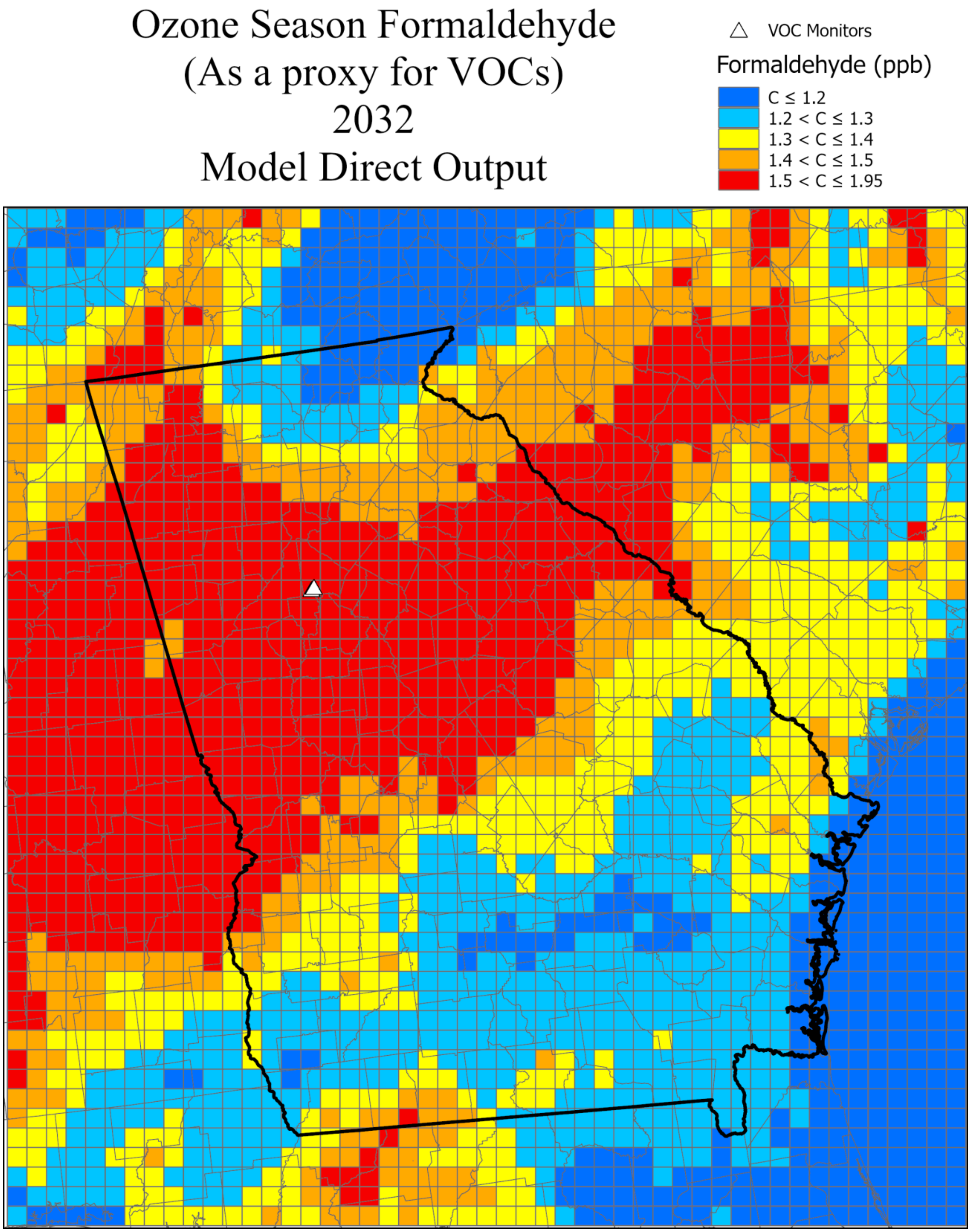


Figure 16.21: Formaldehyde, Modeled 2032, Ozone Season Average

In the above map (Figure 16.20), the predicted 2032 annual average formaldehyde concentrations (shown in blue) are really low, with the exception of the center of the Atlanta-Sandy Springs-Roswell MSA. For the ozone season map (Figure 16.21), almost the entire state has greater than 1.2 ppb predicted formaldehyde concentrations (shown in light blue), and approximately a third of the state has levels up to 1.95 ppb of predicted formaldehyde concentrations (shown in red) for the 2032 ozone season average. It appears that, due to the higher levels of formaldehyde shown during ozone season average, GA AAMP may need to add VOCs samplers to sufficiently monitor VOCs concentrations. The Emissions Assessment is one of many assessments being considered to determine if monitors need to be added, removed, or moved within Georgia.

In summary, based on the above modeling results, most of the pollutants have very low predicted values for 2032. The GA AAMP may consider discontinuing the SO_2 monitor in the Macon MSA and the $PM_{2.5}$ monitors where the predicted emissions are very low (especially along the coast). The GA AAMP may consider adding VOCs monitors across the northwestern half of the state. However, there are many factors that are considered when placing, discontinuing, or moving monitors, such as population, sources, traffic, etc. The Emission Assessment is one part of the overall analysis. Decisions can be made about changing the placement of these monitors or adding monitors to the network based on several factors and the overall assessment.

16.8 Emissions Trends

The following graphs display the trends in the emissions data described above. Each graph shows one pollutant and the type of emissions contributing to that pollutant. These pollutants include VOCs, SO_2, PM_{10}, $PM_{2.5}$, NOx, ammonia (NH_3), and CO. The emission types are Non-Point Sources, Electric Generating Units (EGUs), Non-Electric Generating Units (non-EGUs), Nonroad Sources, Onroad Sources, Marine-Airport-Railroad (MAR), and Fires.

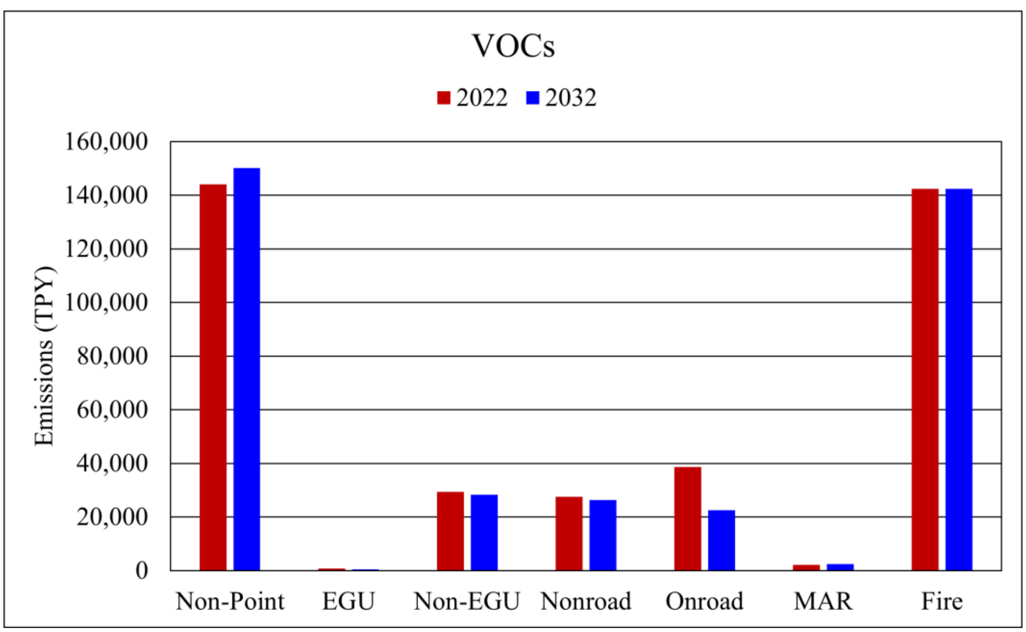


Figure 16.22: VOCs Emissions Trends in Georgia, 2022-2032

The largest sources of VOCs emissions in 2022 were Non-Point Sources and Fire Sources. In 2022, the Fire emissions were at approximately 140,000 TPY. The Non-Point and Fire emissions levels seem to remain from 2022 to 2032.

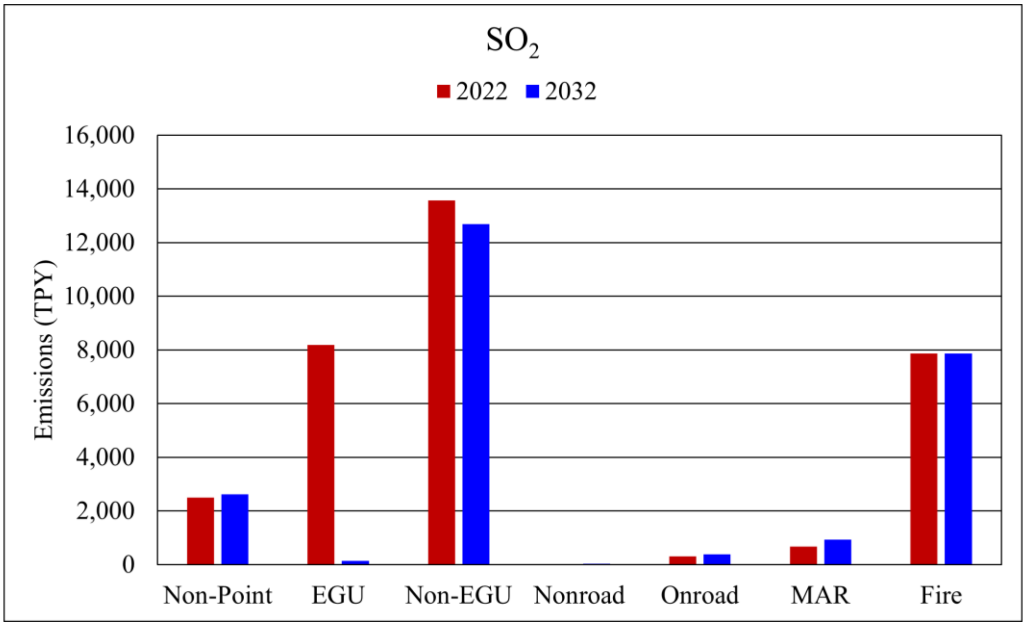


Figure 16.23: SO_2 Emissions Trends in Georgia, 2022-2032

SO_2 emissions in 2022 are almost entirely attributed to EGUs and Non-EGUs. From 2022 to 2032, EGUs are expected to decrease from 8,000 to about 140 TPY. The other contributors remain at approximately the same level from 2022 to 2032.

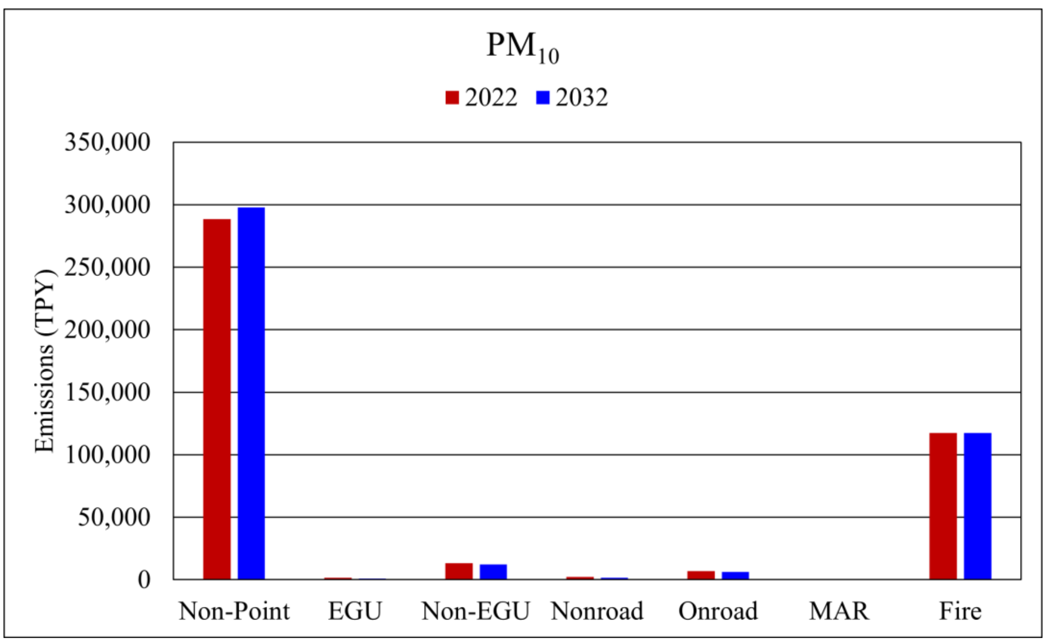


Figure 16.24: PM_{10} Emissions Trends in Georgia, 2022-2032

For the PM_{10} emissions, Non-Point Sources are the highest contributing sources. Levels of emissions are expected to remain about the same level from 2022 to 2032.

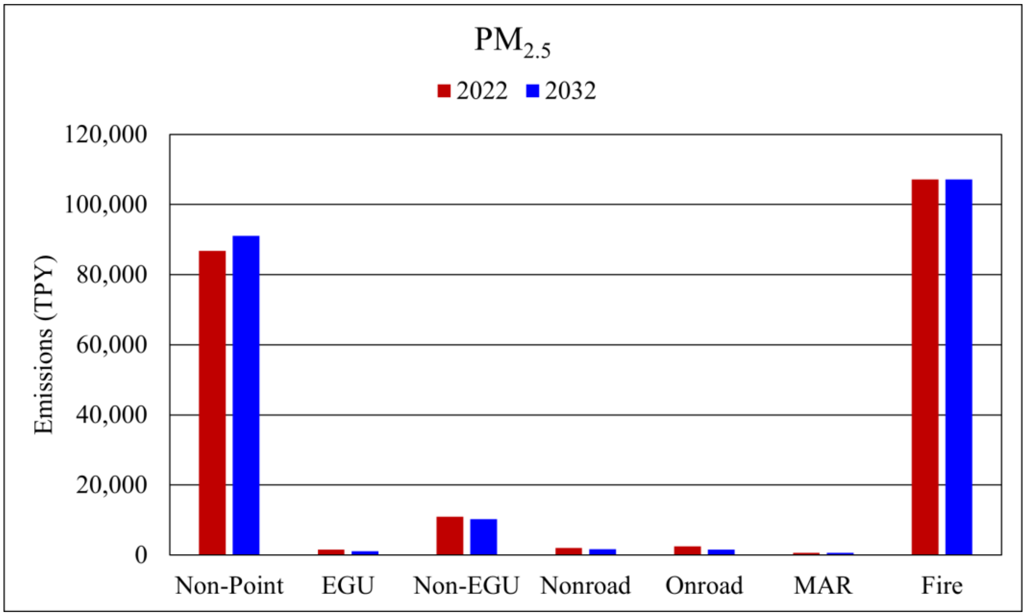


Figure 16.25: $PM_{2.5}$ Emissions Trends in Georgia, 2022-2032

The majority of the $PM_{2.5}$ emissions are from Non-Point Sources and Fires. Both sources are significantly higher than the other sources, with emission levels at about 85,000 and 110,000 TPY, respectively. $PM_{2.5}$ emission levels from all source types are expected to remain about the same from 2022 to 2032.

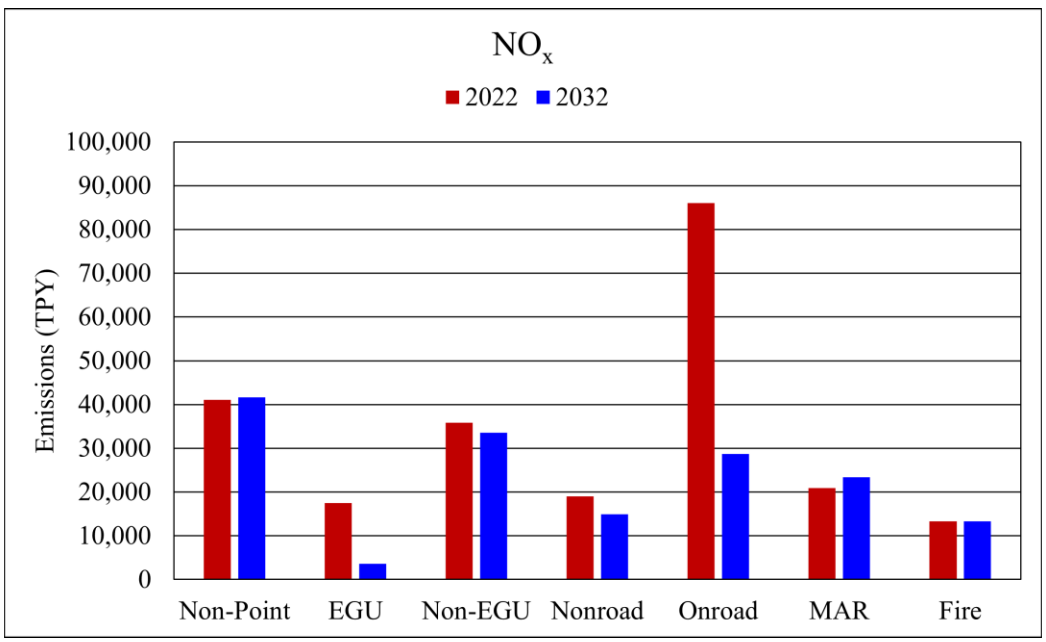


Figure 16.26: NOx Emissions Trends in Georgia, 2022-2032

Onroad emissions are the largest contributors to NO_X pollution in Georgia in 2022. There is an expected dramatic decrease of almost two-thirds, from about 85,000 to 30,000 TPY, from 2022 to 2032.

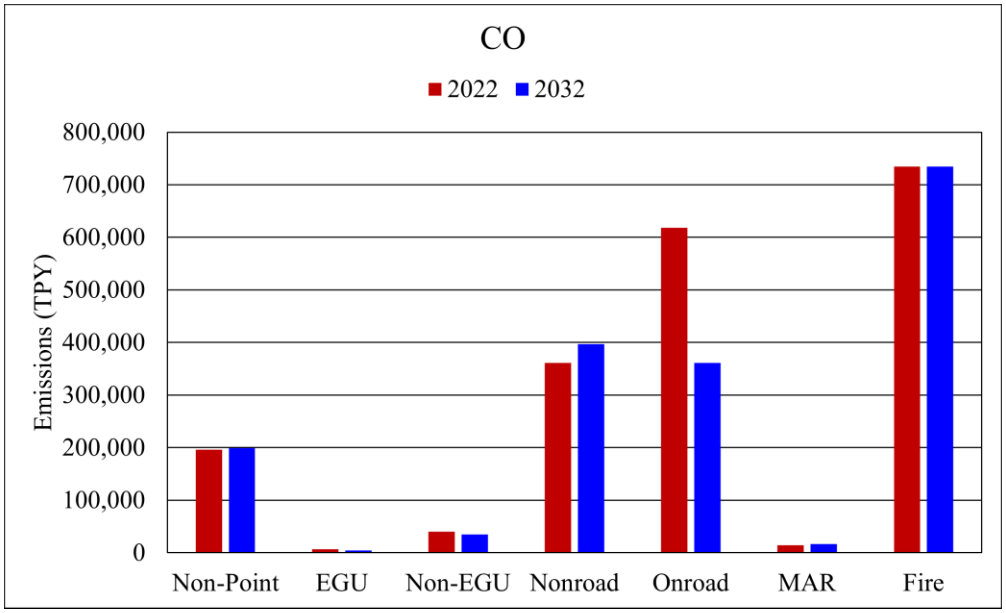


Figure 16.27: CO Emissions Trends in Georgia, 2022-2032

As can be seen in the above graph, the largest levels of CO emission in Georgia are from Fire emissions, with about 730,000 TPY, and Onroad emissions with about 610,000 TPY in 2022. However, those Onroad emission levels are expected to show a decrease of about half that level by 2032 and drop to about 360,000 TPY.

17.0 Meteorological Assessment

17.1 State Climatology and Meteorological Summary for 2019 through 2023

The climate of central Georgia, which includes the metropolitan areas of Atlanta, Columbus, and Macon, involves summers of warm, humid weather, and variable temperatures during the winter months. The average date of first freeze is in mid-November. The average date of the last freeze in the spring is mid to late March. Average amounts of rainfall reach between 45 and 50 inches, with September and October averaging as the driest months and the wettest being March. The climate across Northern Georgia is largely a function of terrain. Most of the northern half of the state is made up of rolling hills with elevation ranging from 400 feet to between 800 and 1100 feet. The northeast region of the state occupied by the Appalachian Mountains is termed the "Northeast Georgia Mountains" and has a climate similar to the rest of North Georgia.

Meteorological Monitoring

The climate across North and Central Georgia varies based on a variety of factors, the most prominent of which is terrain. The Gulf of Mexico and the Atlantic Ocean are the two nearby maritime bodies that exert an important influence on the South Georgia climate, acting as major sources of moisture support. The Meteorology Unit monitors a wide array of weather conditions at sites spanning from the mountains of North Georgia to the south coast in Brunswick. All 14 meteorological monitoring locations shown in Figure 17.1 measure wind speed and wind direction, as they are crucial parameters during poor air quality events (See Appendix B for details). Other parameters that are monitored include:

- Ambient Temperature – Surface temperature measured at 7 stations
- Relative Humidity – Surface relative humidity measured alongside surface temperature
- Barometric Pressure – Station pressure measured at 5 sites, from the coast to Columbus and the Metro Atlanta area
- Solar Radiation – Measured for the PAMS network, monitoring total solar radiation (entire spectrum) as well as ultraviolet radiation at Conyers site
- Precipitation – Hourly rainfall totals measured at 4 sites along the fall line and the Metro Atlanta area

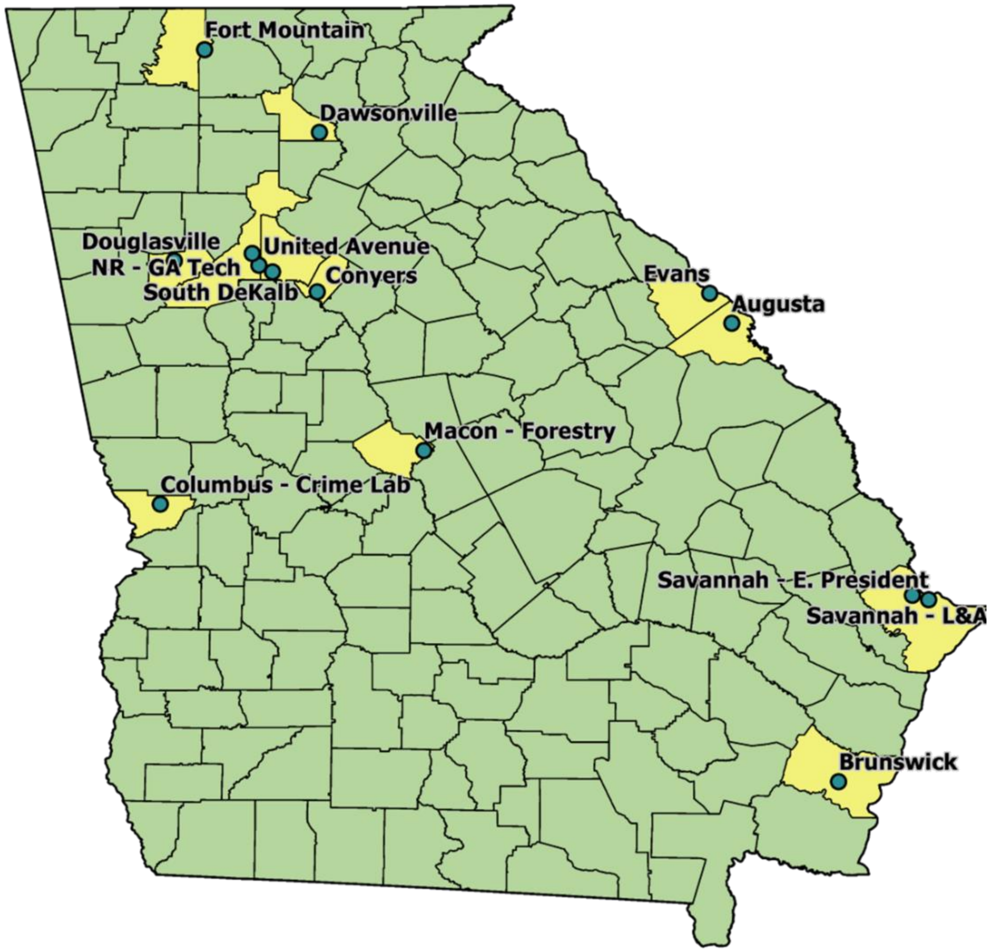


Figure 17.1: Meteorological Monitoring Stations in Georgia

Figure 17.2: Sample meteorological instrumentation at EPD sites
a) ceilometer, b) sonic anemometer, c) Temperature probe and relative humidity monitor, d) tipping bucket

17.1.1 2019

<u>**Meteorological Summary – 2019**</u>

2019 Severe Weather

- Valentine's Day tornado outbreak—4 EF-0 rated tornadoes reported.
- An EF-1 rated tornado was reported on Feb 24th in Moreland, GA.

- March experienced the biggest severe weather outbreak of the year on the 3rd as a strong low-pressure system swept through the area. Half-dollar sized hail and 14 tornadoes were reported with this system. The strongest tornado in Georgia was an EF-2/EF-3 rating in the cities of Ellerslie and Talbotton.
- More severe weather in April produced numerous tornadoes and flooding across north and central Georgia mid-month.
- By September, the outer bands of Hurricane Dorian impacted coastal Georgia, bringing peak wind gusts to several EPD sites: 42.51 mph at Savannah L&A, 41.6 mph at Savannah East President, and 41.3 mph in Brunswick. Gusts were even higher at some barrier islands.
- Numerous high temperature records were set in September and October during a stretch of abnormally hot and dry conditions. This led to the onset of a flash drought across the region.
- Overall, 2019 was the warmest year on record for Atlanta and Macon.
- No snowfall was recorded throughout 2019 at the Atlanta, Macon, Columbus, or Athens climate sites.

2019 Drought Conditions for Georgia

- The year started with drought-free conditions for the first two months before abnormally dry (D0) and moderate (D1) drought conditions were introduced into the state in March.
- By April 9th, 79% of the state experienced drought conditions (D0 or worse) and 14% was under D1 conditions. Drought conditions fluctuated geographically but remained prevalent through June.
- Drought conditions improved significantly in November and December due to abundant rain and less heating. By the end of the year, the entire state was drought free except for the southwest corner with a small area under D0 conditions.

Figure 17.3: Rainfall across the state in April and a flooded road in Troup County (images from NWS Peachtree City

- In August, a slight increase in abnormally dry and moderate drought conditions across the state was observed, which set the stage for a major flash drought event. A flash drought is an event during which an area experiences degradation by two or more drought categories in a four-week period, based on the U.S. Drought Monitor.

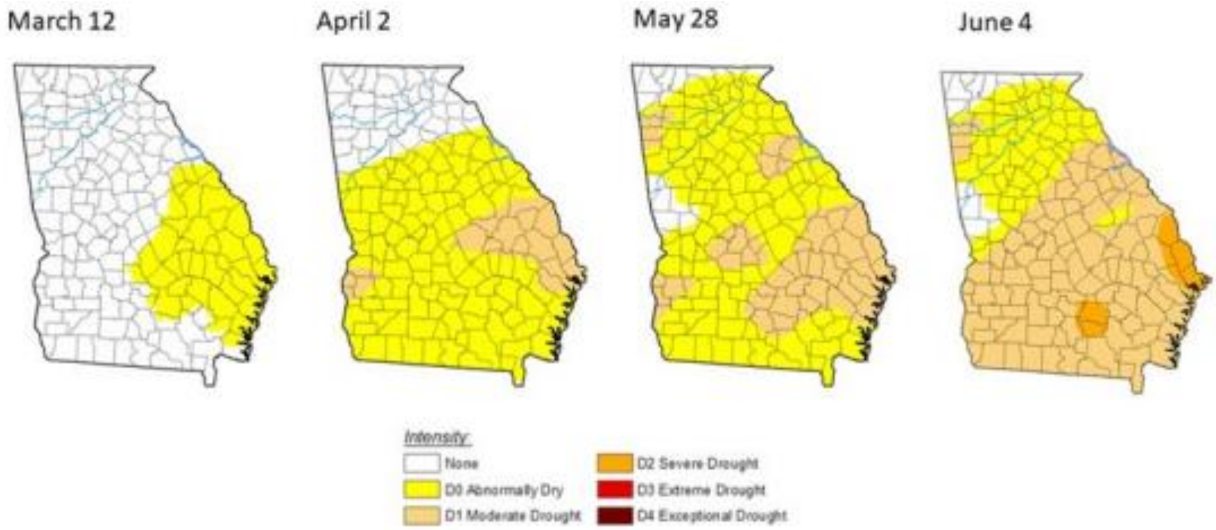


Figure 17.4: U.S. Drought Monitor in 2019

- A rapid deterioration in drought conditions across the state was observed in September and October due to intense daytime heating, lack of rainfall, and sudden increase in evapotranspiration.

2019 Agricultural Impacts

- A wet winter continued in the beginning of the year. Premature fruit blooms were seen in some species. Many cattle producers throughout the state were feeding hay because of the poor grazing conditions caused by the rain. Growers noted lower grades in cotton and soybeans left to rot in fields due to the excess rainfall.
- In March, livestock producers throughout the state were feeding hay where grazing conditions were still poor. Late frosts negatively impacted some peach and blueberry crops causing minimal losses. There were reports in southwest Georgia of cotton fields which were never harvested due to the wet winter.
- Dry conditions became a concern in May and early June. Corn started to show some wilting. Planting stopped on non-irrigated acres in some counties. The weather conditions helped the small grain harvest, but other crops like corn suffered.
- Corn rust and increasing activity of aphids were reported in July.
- The flash drought from the end of August to early November caused significant damage and loss. Cattle experienced stress and were being sold or fed hay. In some counties, nearly all peanut and cotton harvesting stopped due to the dry conditions. Ponds dried up and pastures and hayfields were dry and unproductive. The weather conditions prevented planting of winter grazing crops and delayed the application of fertilizer and pre-emergent herbicides to fall forages. Many pine and oak trees died.
- Despite the adverse weather conditions in 2019, corn for grain production increased 12% from 2018. Cotton production was up 36% from the 2018 crop which was significantly damaged by Hurricane Michael. Peanut production was down 4%. Soybeans gave the lowest production since 1963, mainly due to low planted acreage. Tobacco production in 2019 was the lowest since 1932 for the same reason.

2019 Air Quality Forecasting Statistics for Atlanta, Macon, and Columbus

- Statistics are based on team daily predicted and final daily observed continuous ozone (daily peak 8-hour average) and preliminary and final PM (daily 24-hour average) data. Observed data were retrieved from the EPA AirNow Tech database (www.airnowtech.org). Note: the following analyses include only days on which there are records for both observed and predicted values in the $PM_{2.5}$ season (January 1 – December 31), and 214 days in the ozone season (April 1 – October 31).

Table 17.1 Observed Air Quality in 2019

		Observed # of Days in AQI Category			
Metro Area and Pollutant	Total # of days in record	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Atlanta Ozone	214	119	77	17	1
Macon Ozone	209*	179	29	1	0
Atlanta $PM_{2.5}$	361**	197	164	0	0
Columbus $PM_{2.5}$	365	268	97	0	0

Note: Total number of days in record based on AirNow data for observed measurements. * In Macon in 2019, AirNow does not have any observed ozone data for 5/9, 5/13, 5/14, 5/15, and 7/31. ** In Atlanta in 2019, AirNow does not have any observed PM2.5 data for 5/9, 5/13, 5/14, and 5/15.

Table 17.2 Predicted Air Quality in 2019

	Hits	Misses	False Alarms	Bias	Gross Error	Correlation (-1 to +1)	% Accurate 2 categories	% Accurate 5 categories
Atlanta Ozone	6	12	6	0.7 ppbv	5.7 ppbv	0.84	92	76
Macon Ozone	0	1	0	1.9 ppbv	5.7 ppbv	0.77	99.5	89
Atlanta $PM_{2.5}$	0	0	0	-0.4 $\mu g/m^3$	2.6 $\mu g/m^3$	0.71	100	78
Columbus $PM_{2.5}$	0	0	0	-0.6 $\mu g/m^3$	2.6 $\mu g/m^3$	0.66	100	81

Notes: Hits are the number of days on which an observed exceedance of the daily NAAQS was correctly predicted. Misses are the number of days on which an observed exceedance of the daily NAAQS was not predicted. False Alarms are the number of days on which an exceedance of the daily NAAQS was predicted but was not later observed. Bias is the average tendency to over-predict (positive bias) or under-predict (negative bias) the observed pollutant concentration. Gross Error is the average absolute error of the predictions relative to the observations. Correlation is a measure of the ability to predict the relative change in observed concentrations. Higher positive correlation implies that the predictions are accurately anticipating changes in the observed concentrations. % Accurate 2 categories are the percentage of days when the forecast prediction correctly matched the observation for the "no smog alert" / "smog alert" condition (i.e. 2 categories). % Accurate 5 categories are the percentage of days when the forecast prediction correctly matched the observation for five categories of the Air Quality Index (Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy).

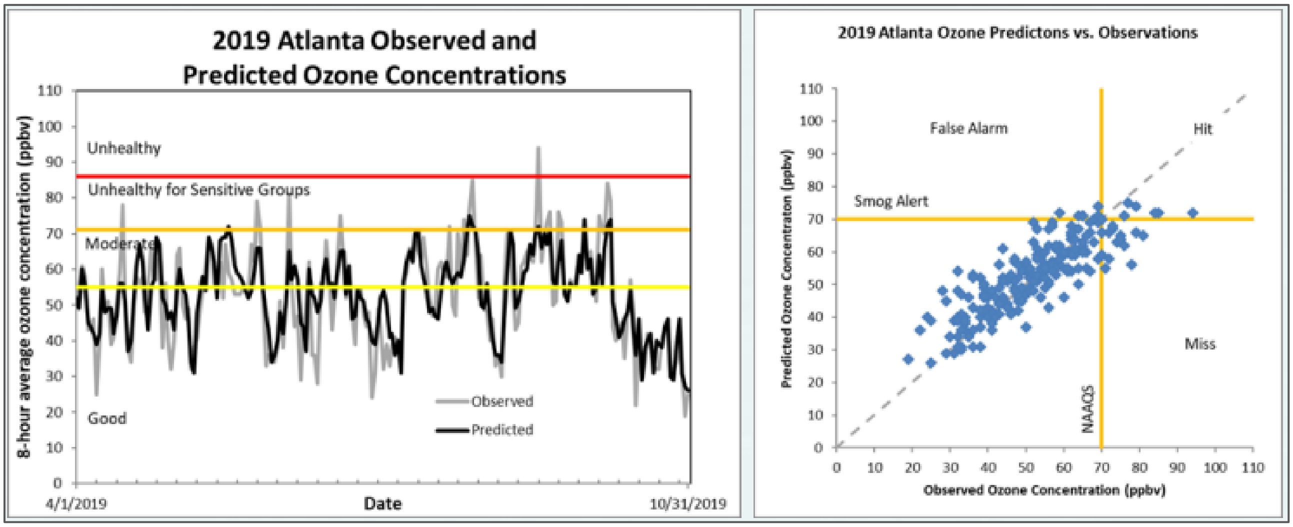


Figure 17.5 Atlanta Observed and Predicted Air Quality, 2019

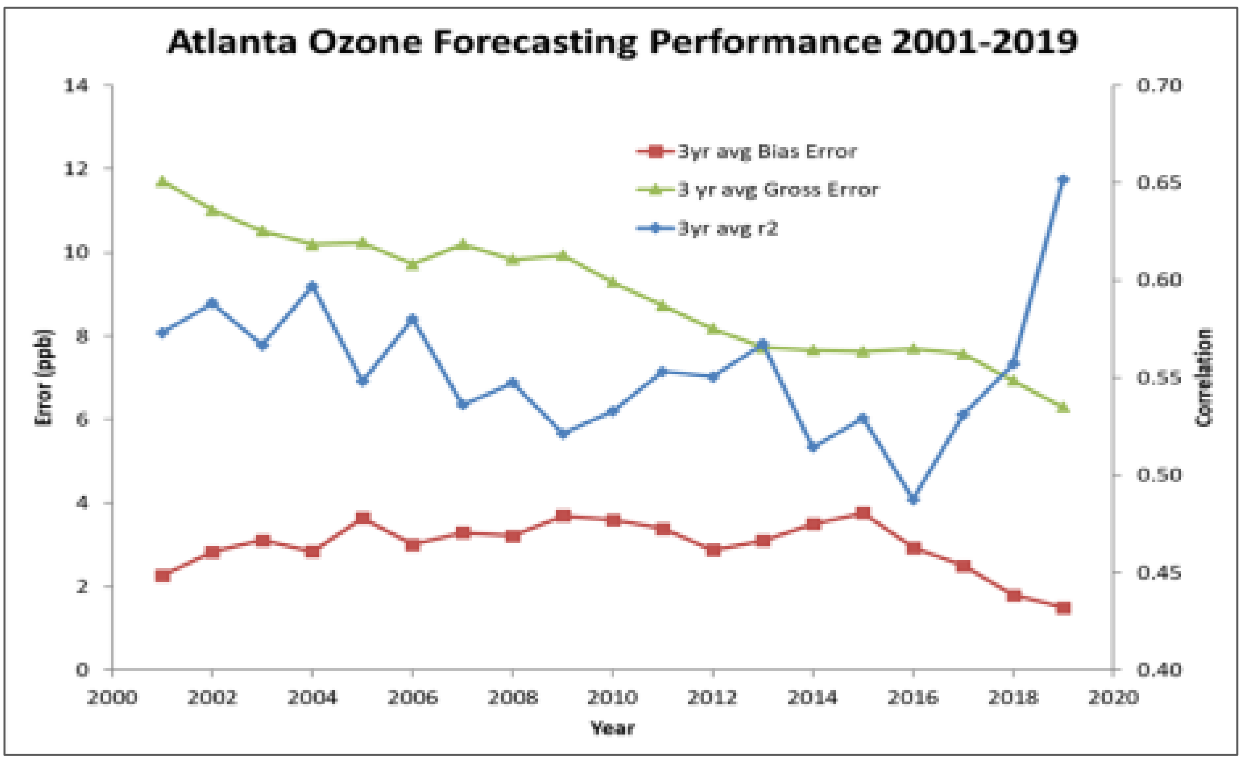


Figure 17.6: Atlanta Ozone Forecasting Performance, 2001-2019

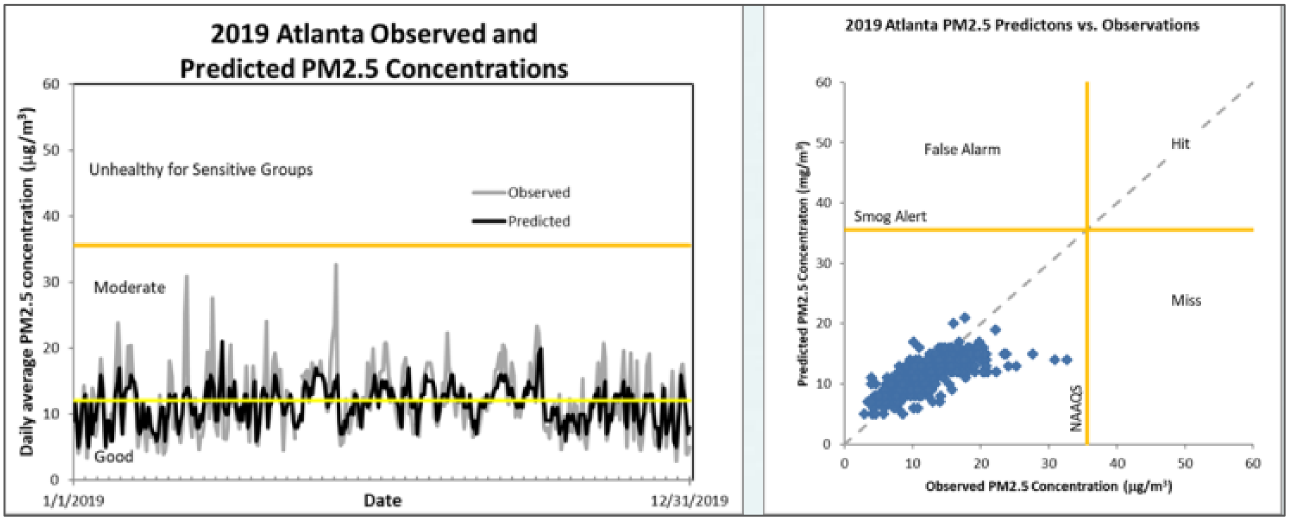


Figure 17.7: Atlanta Observed and Predicted Ozone, 2019

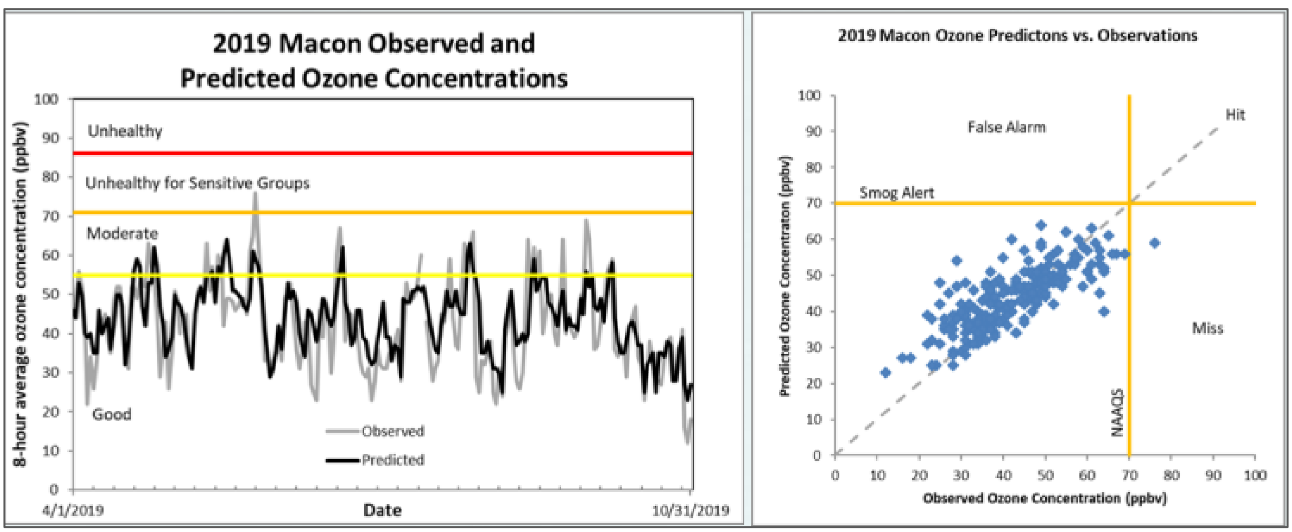


Figure 17.8: Macon Observed and Predicted Ozone, 2019

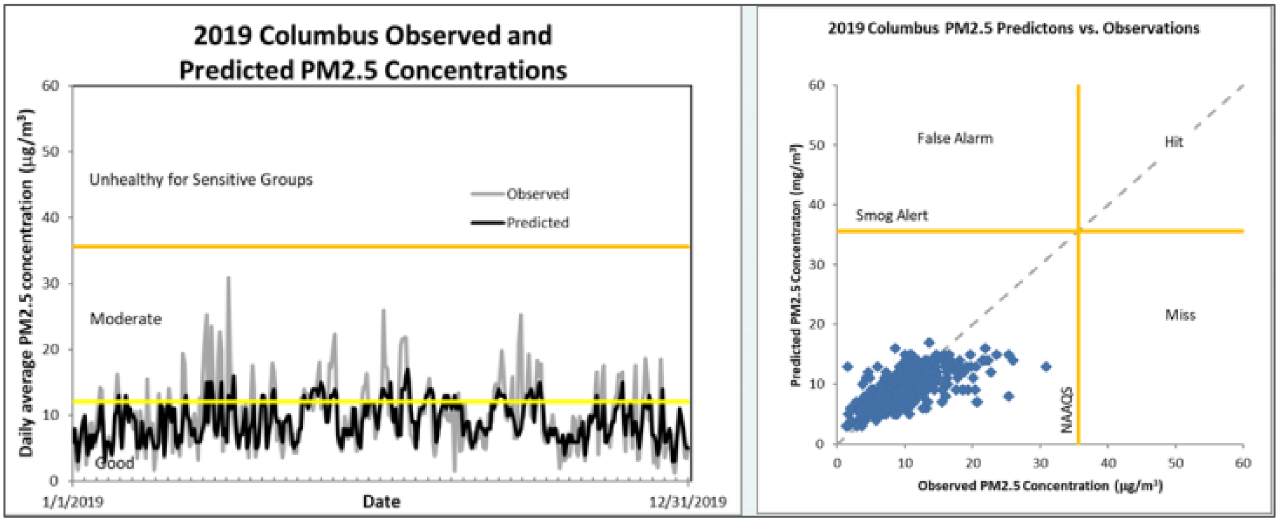


Figure 17.9: Columbus Observed and Predicted $PM_{2.5}$, 2019

17.1.2 2020

<u>Meteorological Summary – 2020</u>

2020 Severe Weather

- Weather conditions for 2020 consisted of above normal rainfall and warmer than average temperatures for north and central Georgia.
- Severe storms on the 11th and 14th of January led to five confirmed tornadoes across eastern Paulding/western Cobb, Fannin, Upson, Pike and Spalding counties.
- Heavy rainfall from severe storms in February caused several climate sites to break their all-time records for daily rainfall on February 6th.
- A fast-moving system on February 8th dropped 6 to 7 inches of snow over the north Georgia mountains.
- A strong storm system led to an outbreak of severe weather on Easter across the South, spawning 21 confirmed tornadoes across north and central Georgia from April 12th through 13th, including two EF-3 tornadoes.

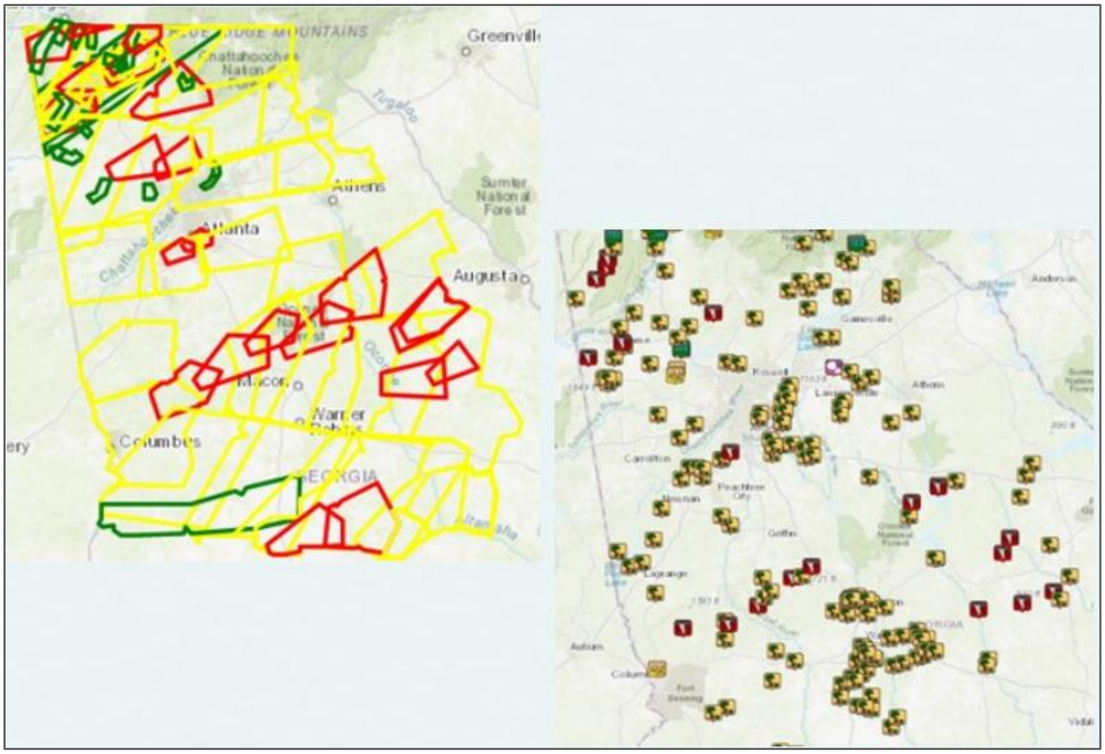


Figure 17.10: Warnings issued on April 12-13th

Note: 2020 (left) and local storm reports issued from the event (right) across north and central Georgia (Source: National Weather Service)

- Remnants of Hurricane Sally moved across portions of north and central Georgia on September 16th and 17th. Atlanta, Athens, Columbus, and Macon all broke daily precipitation records.

Figure 17.11: Hurricane Sally Total Rainfall across portions of north and central Georgia
(Source: National Weather Service)

- Athens, Atlanta, and Macon all experienced top 10 warmest years on record.
- Athens, Atlanta, Columbus, and Macon all experienced top 10 wettest years on record.

2020 Drought Conditions for Georgia

- Above normal precipitation and several tropical systems kept Georgia nearly drought free for the entire year.
- At the beginning of August, high temperatures and localized precipitation left 55% of the state abnormally dry with less than 3% designated as D1 (moderate drought). The drought conditions were improved by rainfall from several tropical systems including Hurricane Isaias, Hurricane Laura, and Hurricane Marco. Storms were at either Tropical Storm or Tropical Depression stage when their outer rainbands propagated into Georgia.

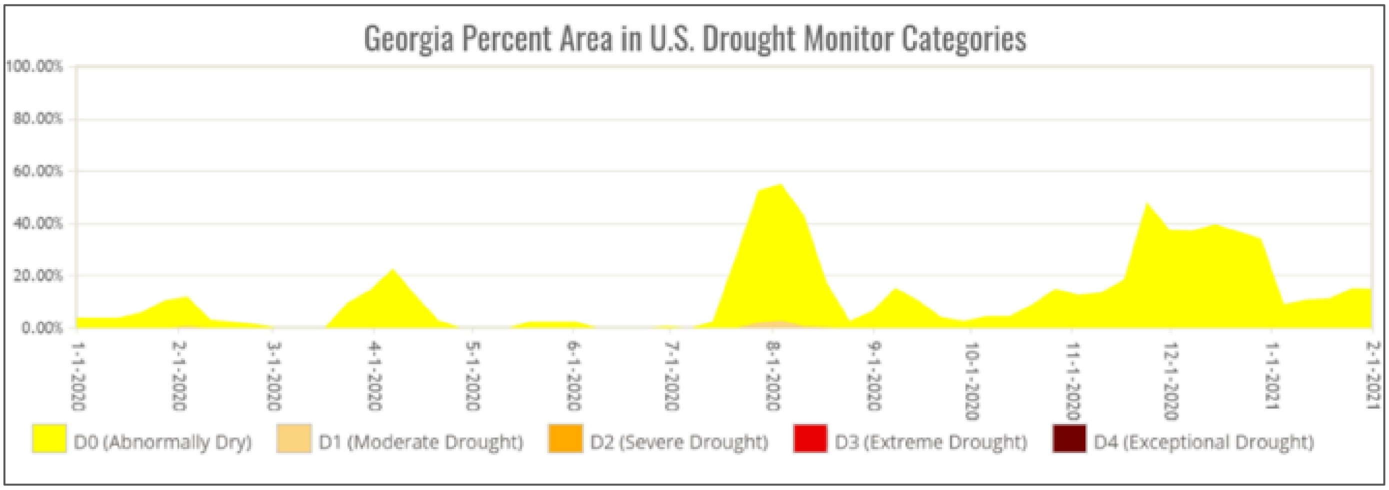


Figure 17.12: Georgia Annual Percent Area Drought Categories

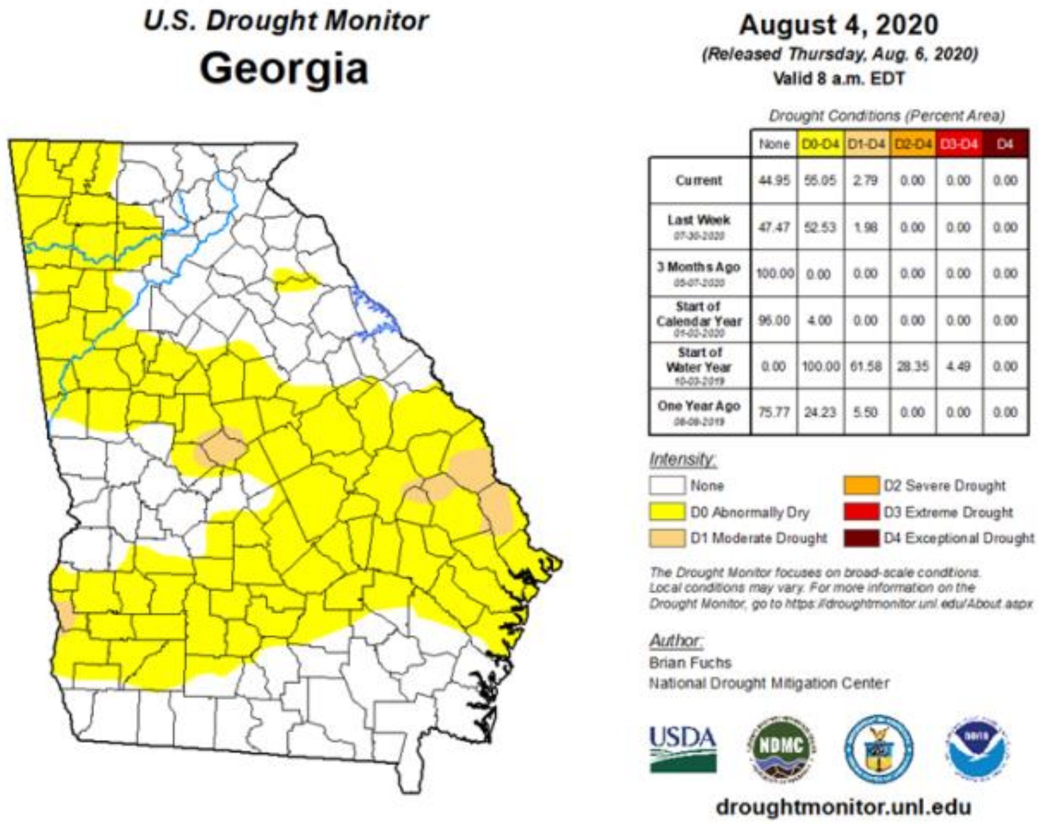


Figure 17.13: Drought Conditions in Georgia

Agricultural Impacts

- In January and February, short supplies of hay due to the flash drought in the previous year and limited grazing potential due to saturated grounds brought difficulties to the farmers. The Spring onion crop struggled with disease because wet conditions prevented application of fungicide. Conditions improved in March.
- Multiple fruit crops were damaged when freezing conditions occurred in north Georgia in April. Multiple heavy rain episodes limited fieldwork in some counties in May and June. High temperatures and lack of rainfall in late July and early August put some stress on the crops. Conditions improved in September.
- Hurricane Zeta reduced the time farmers were able to spend in fields near the end of October. High winds and heavy rain caused some trees to fall. Farmers in the northern part of the state noted multiple freezes in November. In December, above normal rainfall in certain areas affected planting/harvesting activities. Freezing temperatures and heavy rain caused pasture conditions to be sloppy.
- Corn for grain production was 70.2 million bushels, an increase of 25 percent from 2019. Cotton production was 2.18 million bales, down 20 percent from 2019 due primarily to a reduction in planted acreage. Peanut production, at 3.28 billion pounds, was up 19 percent from 2019 due to an increase in planted acreage. Soybean production, at 3.90 million bushels, was up 56 percent from 2019. Tobacco harvested acres was at the lowest level since 1918 with production totaled 19.3 million pounds.

Characteristics of the 2020 Air Quality Seasons and Forecasting in Atlanta, Macon, and Columbus, Georgia

- Statistics are based on team daily predicted and final daily observed continuous ozone (daily peak 8-hour average) and preliminary and final PM (daily 24-hour average) data. Observed data were retrieved from the EPA AirNow Tech database (www.airnowtech.org) on 4/12/2021. Note: the following analyses include only days on which there are records for both observed and predicted values. In 2020, there were 366 possible days in the PM2.5 season (January 1 – December 31), and 214 days in the ozone season (April 1 – October 31).

Table 17.3: Observed Air Quality in 2020

		Observed # of Days in AQI Category			
Metro Area and Pollutant	Total # of days in record	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Atlanta Ozone	214	180	33	1	0
Macon Ozone	211*	208	3	0	0
Atlanta $PM_{2.5}$	366	253	111	2	0
Columbus $PM_{2.5}$	366	297	68	1	0

Notes: Total number of days in record based on AirNow data for observed measurements. *In Macon in 2020, AirNow does not have any observed ozone data for 9/17, 10/5, and 10/20.

Table 17.4: Predicted Air Quality in 2020

	Hits	Misses	False Alarms	Bias	Gross Error	Correlation (-1 to +1)	% Accurate 2 categories	% Accurate 5 categories
Atlanta Ozone	0	1	6	2.1 ppbv	5.7 ppbv	0.78	99.5	83
Macon Ozone	0	0	0	3.3 ppbv	6.2 ppbv	0.75	100	97
Atlanta $PM_{2.5}$	0	2	0	-0.6 μg/m^3	2.6 μg/m^3	0.59	99.2	78
Columbus $PM_{2.5}$	0	1	0	-0.6 μg/m^3	2.5 μg/m^3	0.56	99.5	84

Notes: Hits are the number of days on which an observed exceedance of the daily NAAQS was correctly predicted. Misses are the number of days on which an observed exceedance of the daily NAAQS was not predicted. False Alarms are the number of days on which an exceedance of the daily NAAQS was predicted but was not later observed. Bias is the average tendency to over-predict (positive bias) or under-predict (negative bias) the observed pollutant concentration. Gross Error is the average absolute error of the predictions relative to the observations. Correlation is a measure of the ability to predict the relative change in observed concentrations. Higher positive correlation implies that the predictions are accurately anticipating changes in the observed concentrations. % Accurate 2 categories are the percentage of days when the forecast prediction correctly matched the observation for the "no smog alert" / "smog alert" condition (i.e. 2 categories). % Accurate 5 categories are the percentage of days when the forecast prediction correctly matched the observation for five categories of the Air Quality Index (Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy).

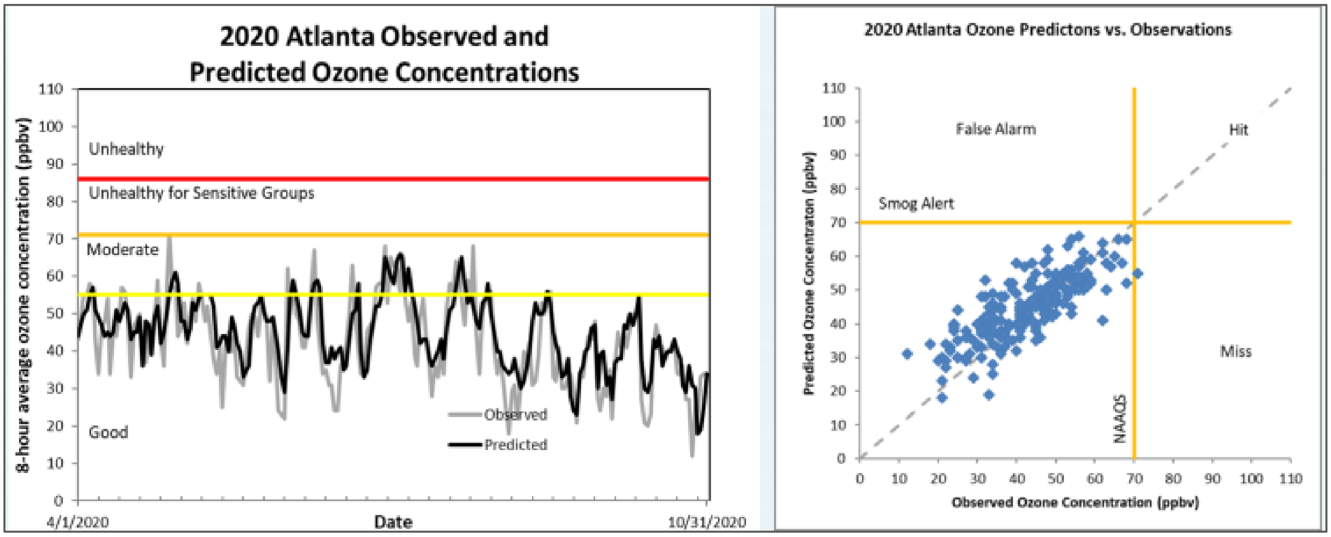


Figure 17.14: Atlanta Observed and Predicted Ozone, 2020

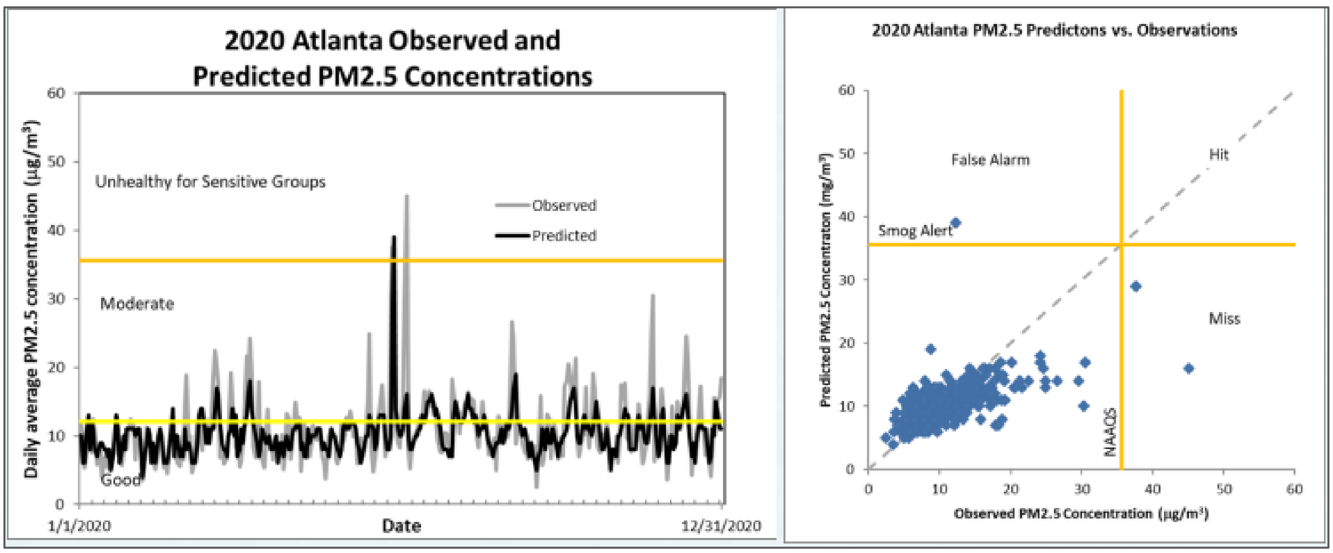


Figure 17.15: Atlanta Observed and Predicted $PM_{2.5}$, 2020

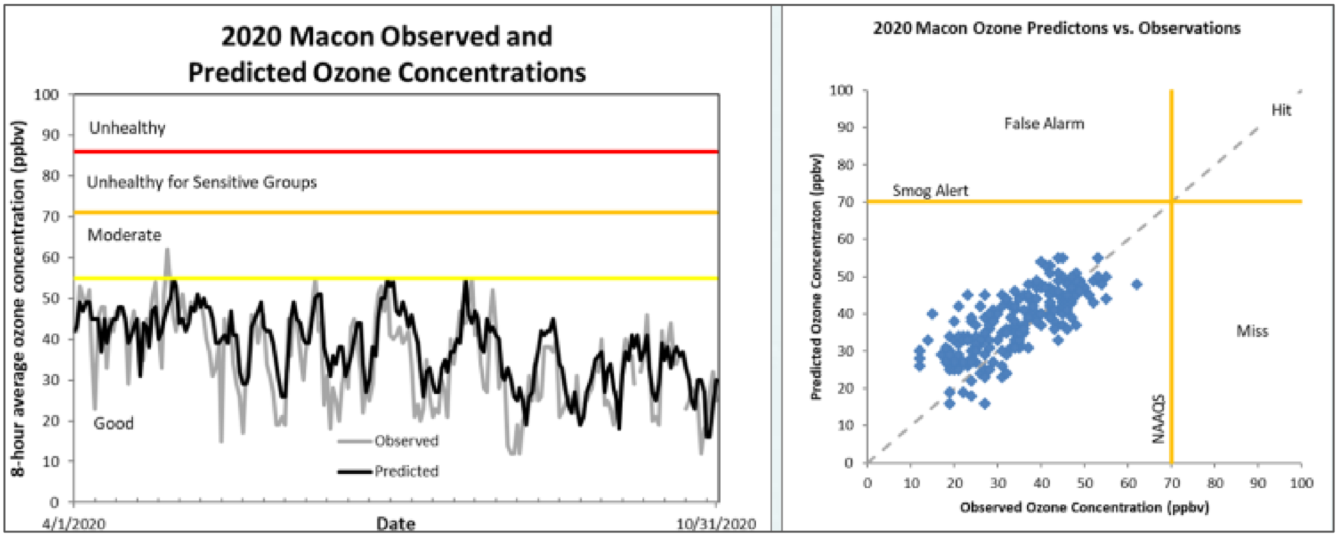


Figure 17.16: Macon Observed and Predicted Ozone, 2020

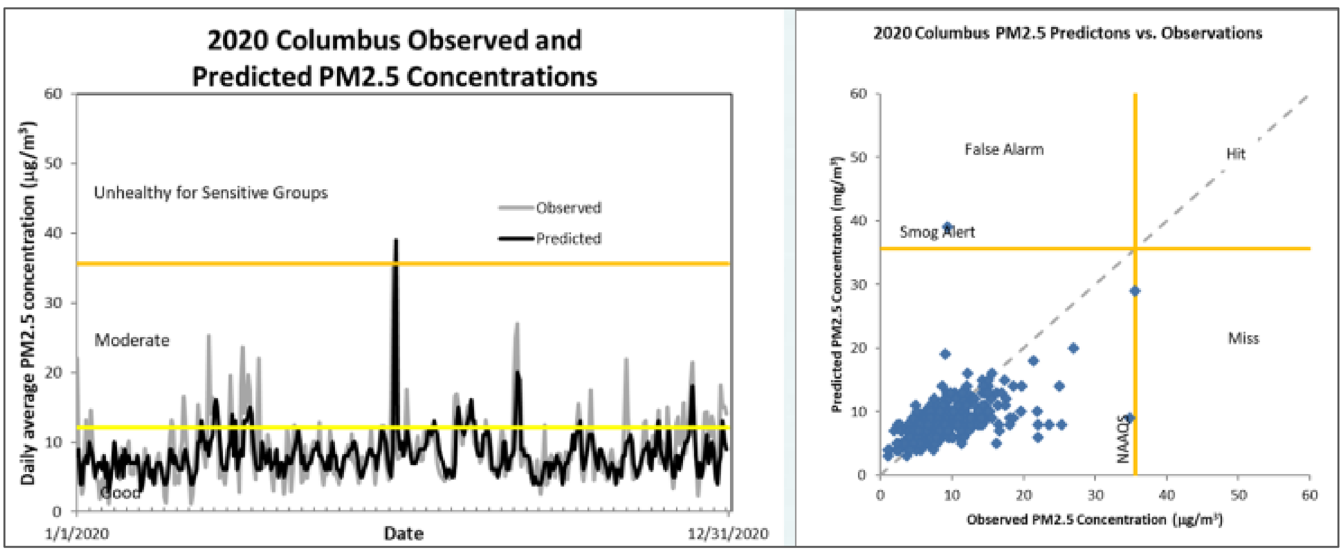


Figure 17.17: Columbus Observed and Predicted $PM_{2.5}$, 2020

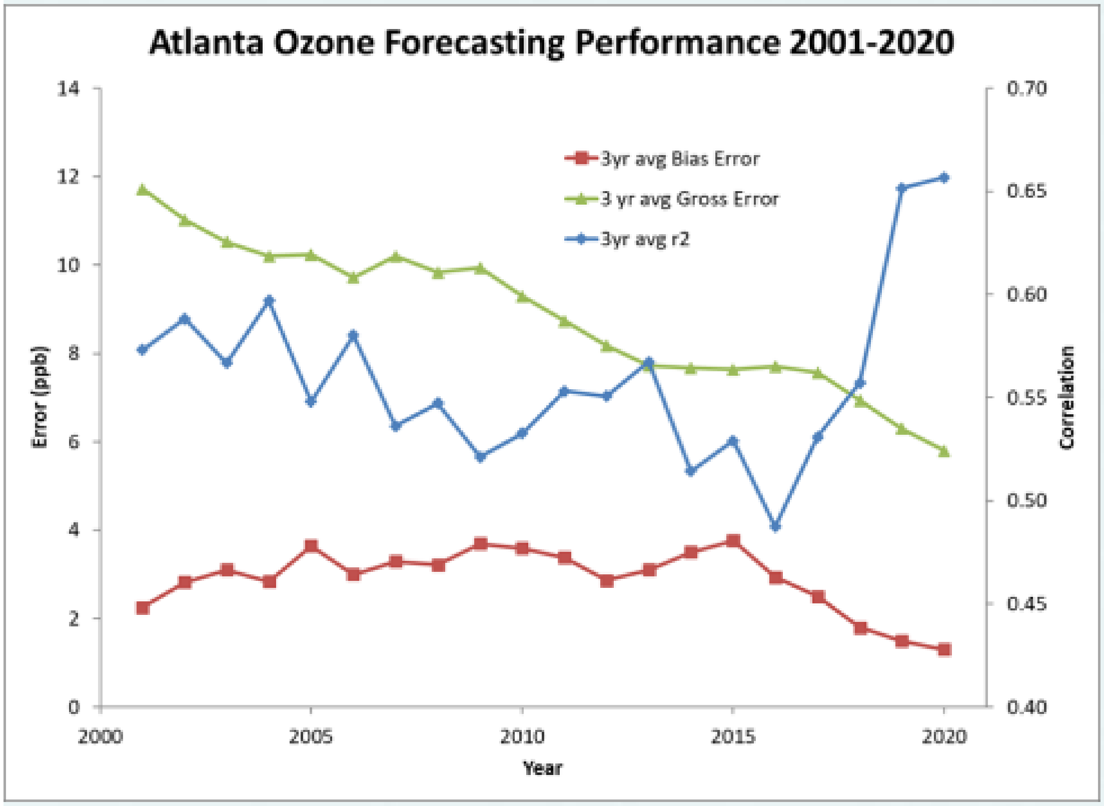


Figure 17.18: Atlanta ozone forecasting performance 2001-2020

- By all measures, air quality forecasting continues to trend towards greater accuracy. Figure 17.18 shows the 3-year running average of the mean normalized bias (MNB), mean normalized error (MNE), and correlation coefficient (r^2) for ozone forecasting in Atlanta since 2001 (note: 1999 was the first year the team began forecasting next day peak 8-hour ozone concentrations, so 2001 is the first year that a 3-yr average is available). The trends show that the team continues to become more accurate in its forecasts: the gross error (a measure of how much the team tends to err in its estimate of the next day's peak ozone concentration without regard to whether that estimate overpredicts or underpredicts the observed value) has almost been cut in half and continues to decline. Bias (a measure of how much the team tends to err in its estimate of the next day's peak ozone concentration accounting for the overprediction or underprediction of the observed value) is also at an all-time low. Meanwhile, correlation (a measure of the skill in predicting the relative change in observed concentrations) has increased over the last several years and now stands at an all-time high.

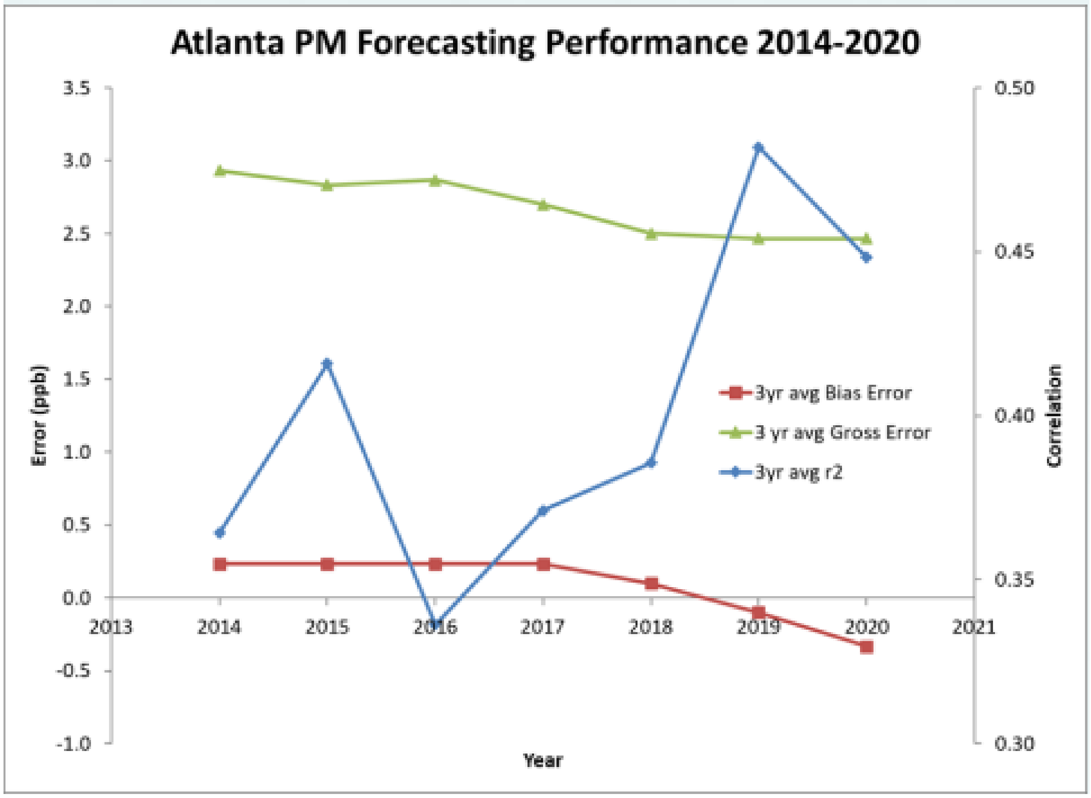


Figure 17.19: Atlanta particulate matter forecasting performance 2014-2020

- Similar, though not as pronounced, trends towards improved accuracy are also noted for PM: recent gross error is lower to flat relative to previous years, and correlation is increased. Curiously, bias error has trended to negative meaning the forecasting team tends to underpredict observed PM concentrations, whereas in earlier years, the team tended to overpredict PM concentrations.
- Despite the general forecasting accuracy, the team continues to experience difficulty predicting exceedances. In 2020, there were only 4 exceedance events (one ozone NAAQS exceedance and two PM NAAQS exceedances in Atlanta, and a single PM NAAQS exceedance in Columbus), and none of them were correctly predicted. Though the cause of the events are often readily explained after the fact, the information that explains them is not usually available prior to the event – especially in the case of PM exceedances caused by prescribed burning. The team and the models they rely on have the ability to anticipate when and where burning may occur, but this is based more on intuition and experience than real data. Until better information is available about when and where prescribed burns are going to occur prior to their ignition, air quality forecasting may have reached a plateau in terms of accuracy.

17.1.3 2021

<u>Meteorological Summary – 2021</u>

2021 Severe Weather

- Weather conditions for 2021 consisted of above normal rainfall and both above and below average temperatures across the state.
- On February 6th, a winter storm produced over 3 inches of snow in the higher elevations of the North Georgia mountains.
- Severe thunderstorms on the 26th of March resulted in an EF-4 tornado in Coweta County and two EF-1 tornados in Bartow County. This was the first EF-4 tornado in Georgia since 2011.
- On May 3rd, severe thunderstorms resulted in three EF-1 tornados in Douglas, Fulton, and Madison counties. On May 4th, two EF-0 tornados were reported in Walton and Oglethorpe counties. Areas of North Georgia experienced localized flooding on both the 3rd and 4th of May.
- Tropical storm Fred brought widespread heavy rainfall and localized flooding, which led to Athens and Atlanta breaking daily rainfall records on August 17th. Severe thunderstorms from tropical storm Fred also spawned seven EF-0 and EF-1 tornados across Georgia.
- Athens, Atlanta, Columbus, and Macon all recorded above average temperatures.
- In Macon, below average temperatures tied with the previous record set in 1989 on the 8th of May, and below average temperatures also set a record low in September.
- In October, Columbus experienced above average rainfall which broke the previous record set in 1891.

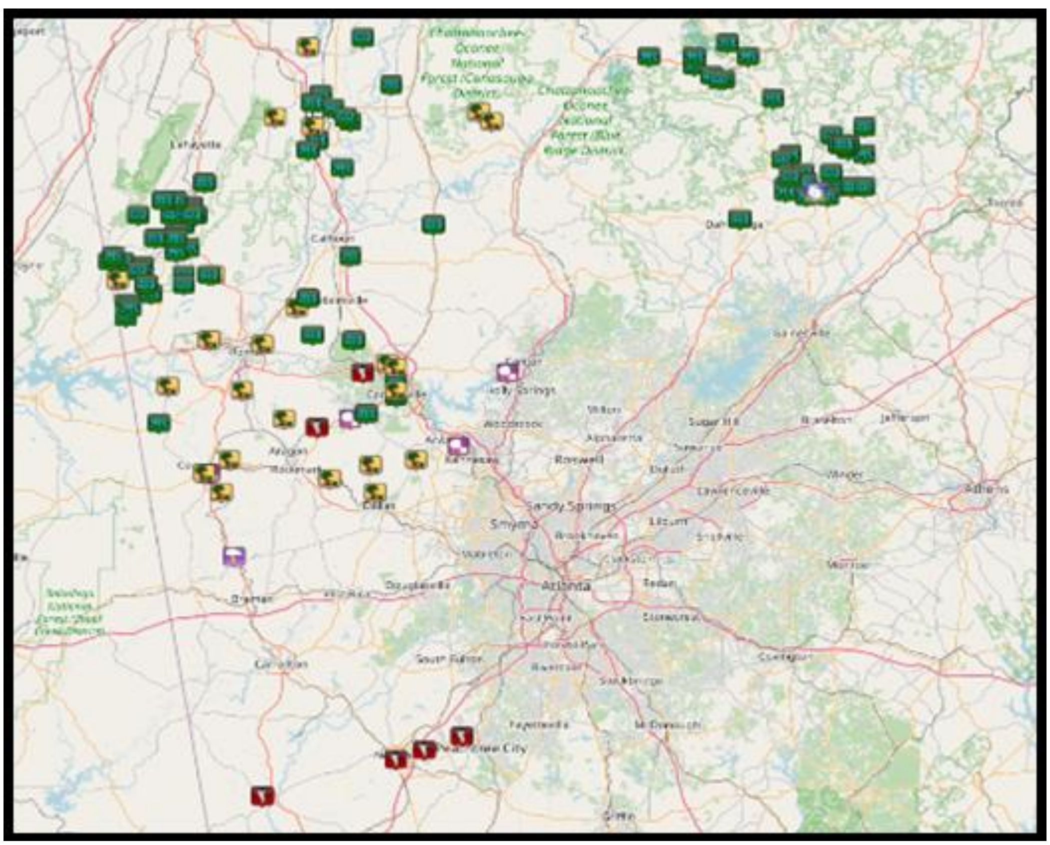


Figure 17.20: Local Storm Reports March 25th-26th

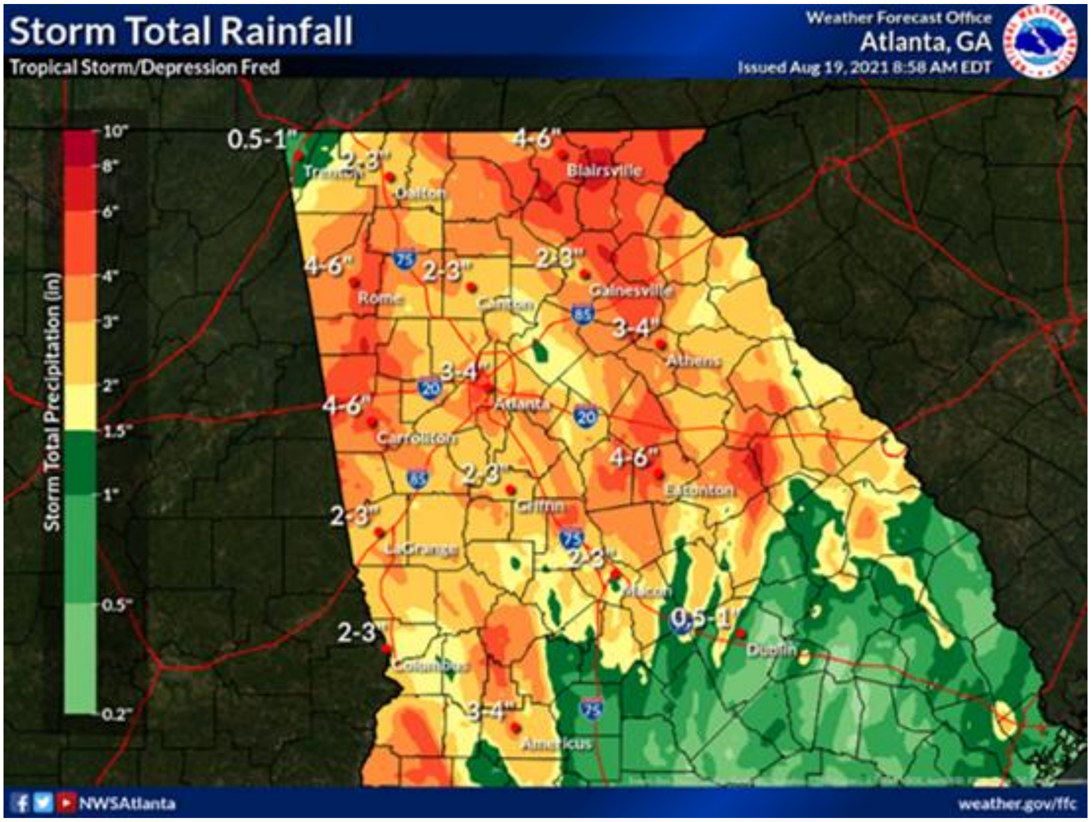


Figure 17.21: Storm Total Rainfall from Tropical Storm Fred
(Source: National Weather Service)

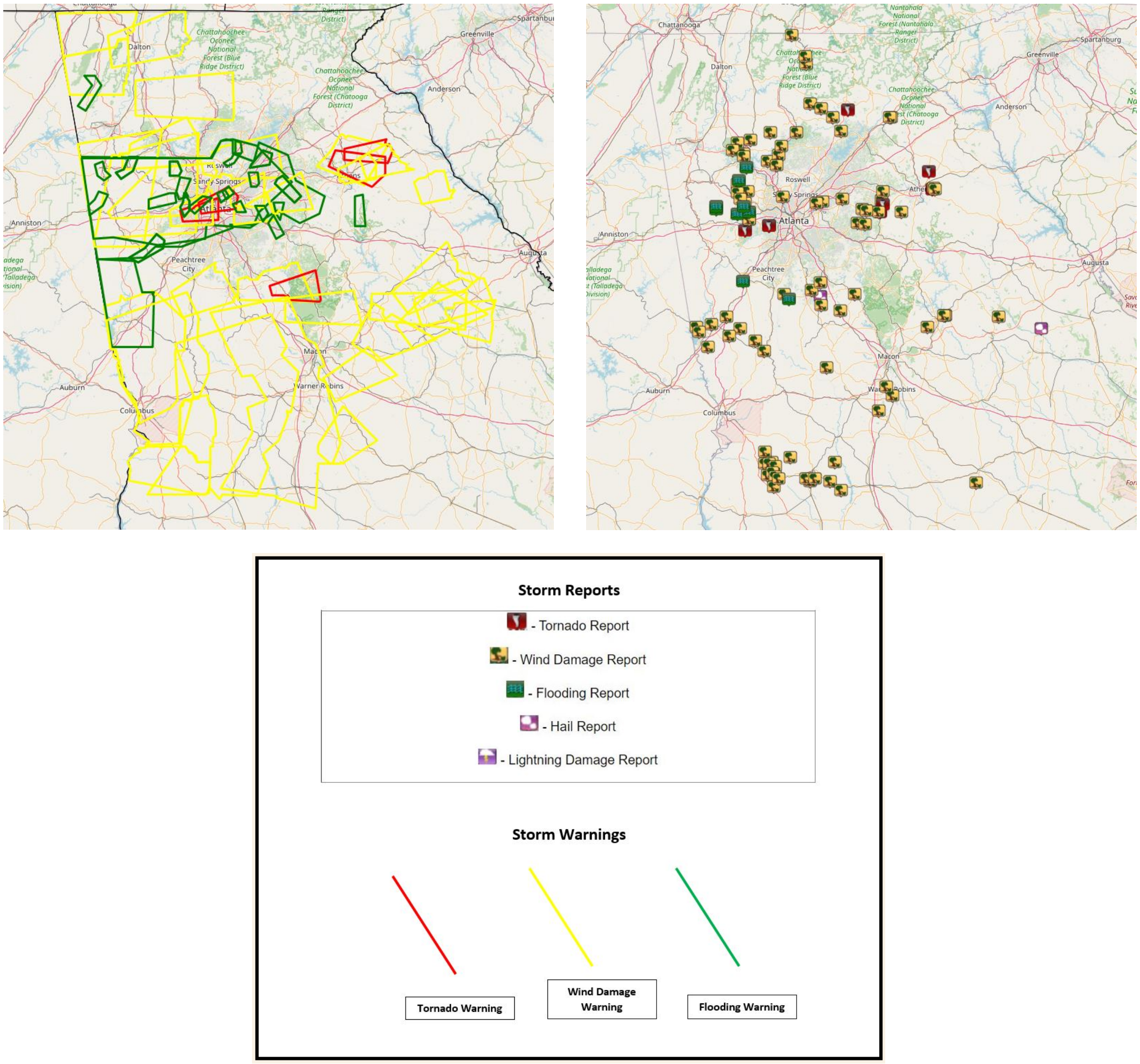


Figure 17.22: Severe Storm May 3rd-4th
Storm Warnings Issued May (top left), Local Storm Reports (top right), Legend (bottom)
(Source: National Weather Service)

Characteristics of the 2021 Air Quality Seasons and Forecasting in Atlanta, Macon, and Columbus, Georgia

- During the 2021 calendar year, the forecast team issued a total of 1134 air quality forecasts: 214 ozone forecasts (April 1 – October 31) and 365 PM forecasts (January 1 – December 31) for Atlanta; 213 ozone forecasts for Macon, and 342 PM forecasts for Columbus. The tables and figures below describe the forecasting performance (i.e., relative accuracy of the forecasts compared to observed pollutant concentrations). Forecasting performance in 2021 was consistent with previous years.

Table 17.5: Observed Air Quality, 2021

		Observed # of Days in AQI Category			
Metro Area and Pollutant	Total # of days in record	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Atlanta Ozone	214	148	60	6	0
Macon Ozone	213	191	21	1	0
Atlanta $PM_{2.5}$	365	225	137	3	0
Columbus $PM_{2.5}$	342	273	66	3	0

Note: The total number of days in record is based on AirNow data for observed measurements.

Table 17.6: Predicted Air Quality, 2021

	Hits	Misses	False Alarms	Bias	Gross Error	Correlation (-1 to +1)	% Accurate 2 categories	% Accurate 5 categories
Atlanta Ozone	1	5	6	1.3 ppbv	6.6 ppbv	0.78	99	78
Macon Ozone	0	1	0	2.7 ppbv	6.0 ppbv	0.79	99.5	91
Atlanta $PM_{2.5}$	0	3	0	-0.8 µg/m^3	2.8 µg/m^3	0.69	99.2	79
Columbus $PM_{2.5}$	0	3	0	-0.7 µg/m^3	2.6 µg/m^3	0.70	99.1	88

Notes: Hits are the number of days on which an observed exceedance of the daily NAAQS was correctly predicted. Misses are the number of days on which an observed exceedance of the daily NAAQS was not predicted. False Alarms are the number of days on which an exceedance of the daily NAAQS was predicted but was not later observed. Bias is the average tendency to over-predict (positive bias) or under-predict (negative bias) the observed pollutant concentration. Gross Error is the average absolute error of the predictions relative to the observations. Correlation is a measure of the ability to predict the relative change in observed concentrations. Higher positive correlation implies that the predictions are accurately anticipating changes in the observed concentrations. % Accurate 2 categories are the percentage of days when the forecast prediction correctly matched the observation for the "no smog alert" / "smog alert" condition (i.e. 2 categories). % Accurate 5 categories are the percentage of days when the forecast prediction correctly matched the observation for five categories of the Air Quality Index (Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy).

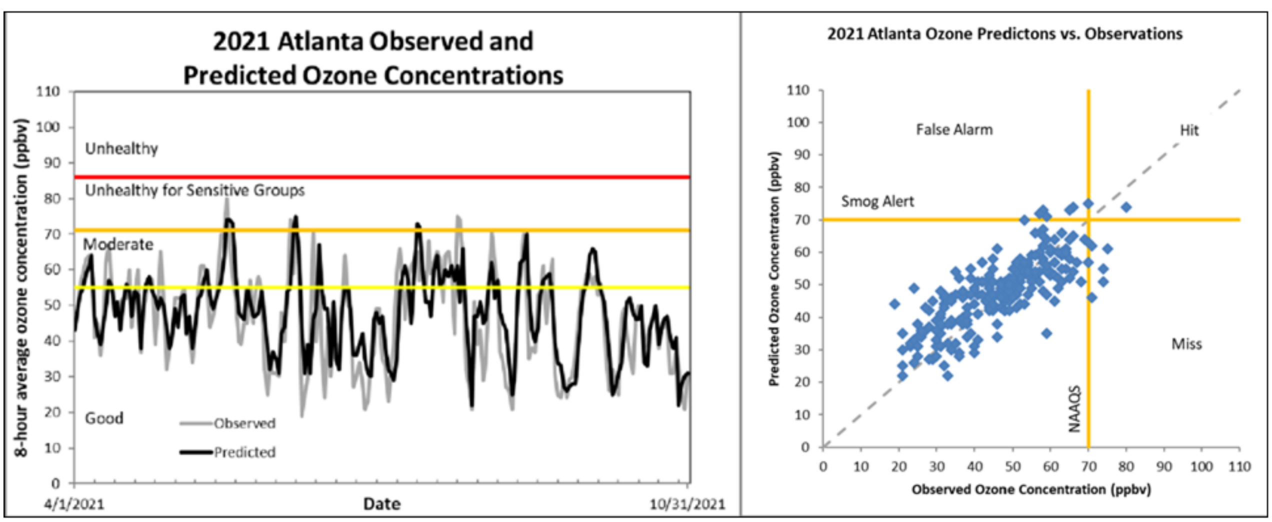


Figure 17.23: Atlanta observed and predicted ozone, 2021

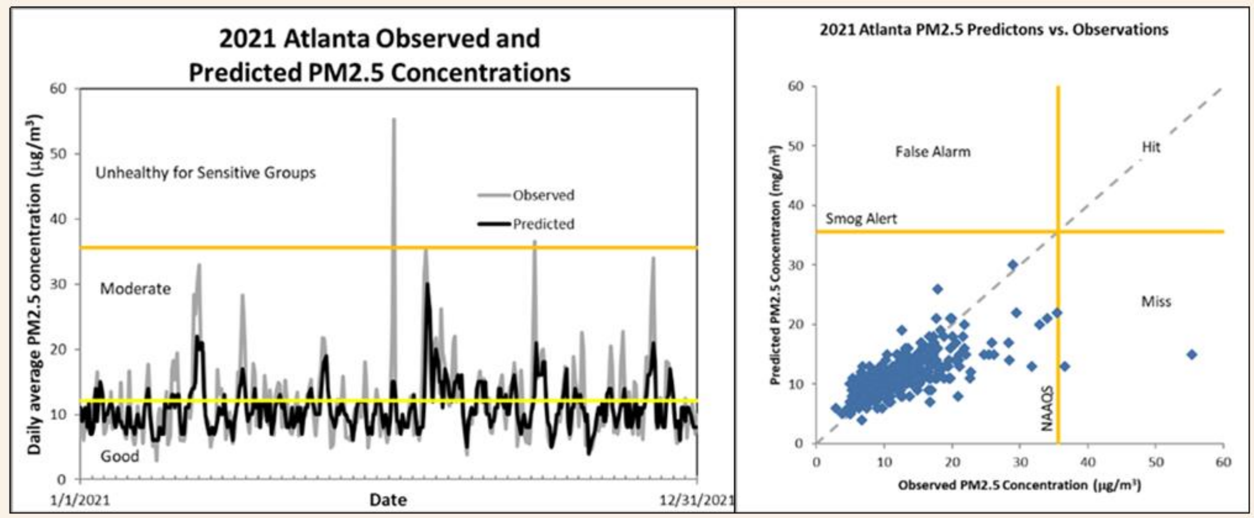


Figure 17.24: Atlanta observed and predicted $PM_{2.5}$, 2021

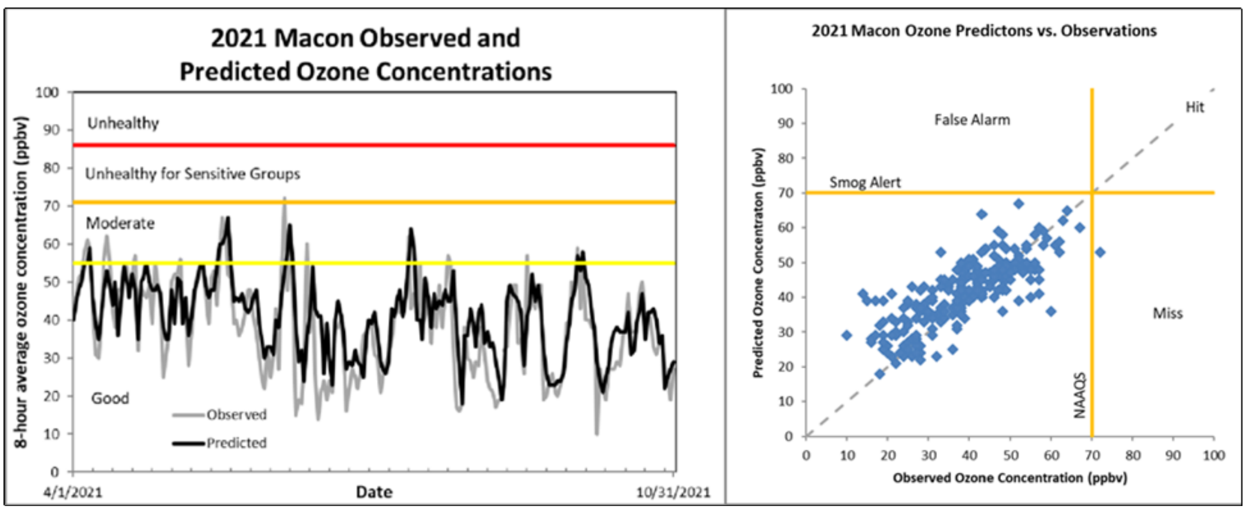


Figure 17.25: Macon observed and predicted ozone, 2021

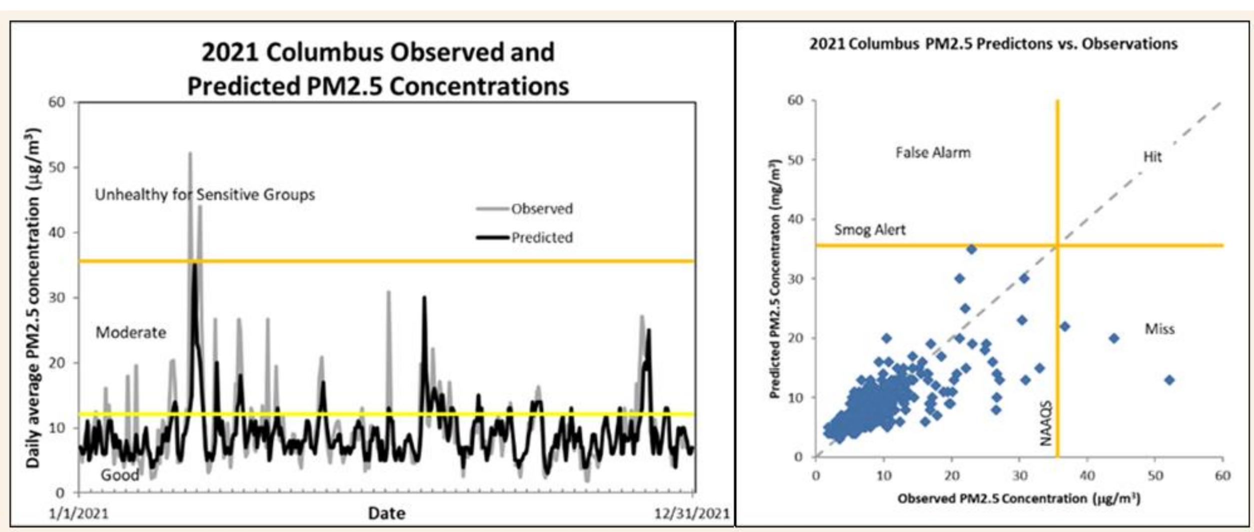
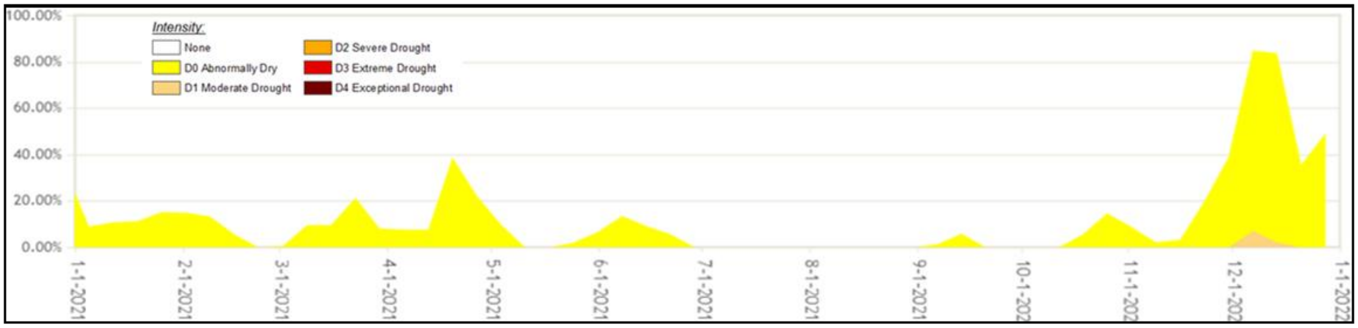


Figure 17.26: Columbus observed and predicted $PM_{2.5}$, 2021

2021 Drought Conditions for Georgia

- Near normal temperatures and above normal precipitation kept Georgia drought free for almost the entire year. Moderate drought conditions (D1) appeared on December 7th but quickly dissipated. It was the first time for D1 development in Georgia since August 25th, 2020.



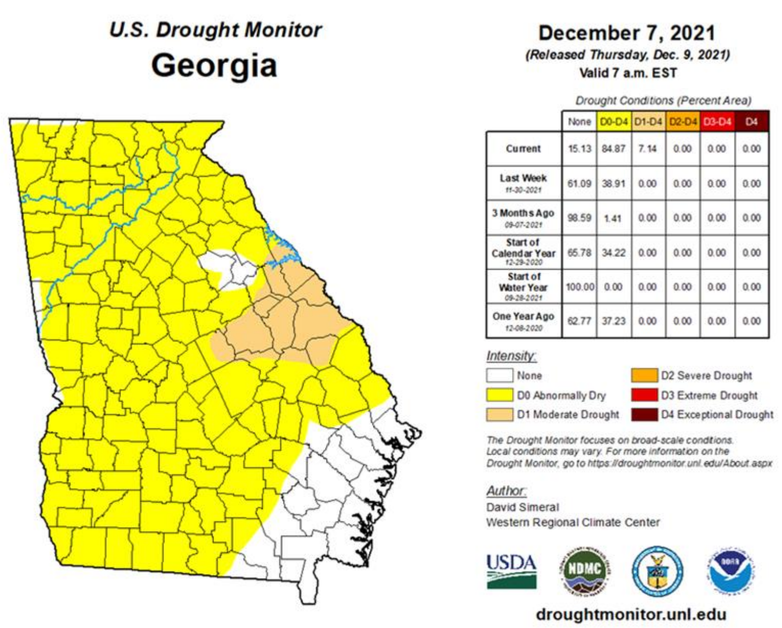


Figure 17.27: Georgia's Drought Monitor
(Source: droughtmonitor.unl.edu)

Agricultural Impacts

- A late season frost in early April caused damage to crop. Planting and herbicide application were limited.
- At the end of April, a late freeze event caused damage to crop in northern and central Georgia, while heavy rainfall and hail caused damage in the south. Blueberries, vineyards, and peaches were reported to suffer the most from the late freeze event.
- Tropical Storm Elsa brought heavy rain in July, which prevented some growers from applying fungicides, slowed peach harvest, prevented farmers from hay cutting, and led disease pressure in vegetables.

- In October, heavy rain stalled harvest for many crops. Cotton quality was negatively affected by the wet conditions throughout the fall.
- In the year 2021, corn for grain production totaled 81.0 million bushels, an increase of 15% from 2020. Cotton production totaled 2.25 million bales, up 3% from 2020. Peanut production totaled 3.34 billion pounds, up 1% from 2020. Soybean production totaled 6.21 million bushels, up 59% from 2020. Tobacco production totaled 14.4 million pounds, a decrease of 26% from 2020.

17.1.4 2022
Meteorological Summary – 2022

2022 Severe Weather

- Weather conditions for 2022 consisted of below normal rainfall and above average temperatures for the state.
- A winter storm during the middle of January brought snowfall to areas of north Georgia, including Atlanta, which had not seen snow since 2018 (Figure 17.28).
- Spring thunderstorm activity on the 12th, 16th, and 19th of March led to gusty winds, downed trees, and hail in the storms that became severe.
- On April 5th, an EF-3 tornado was reported in Houston County with the peak winds estimated to be 160 mph, causing one injury. An EF-4 tornado was reported in Bryan County on April 5th with the estimated peak wind speed of 185 mph, causing one fatality and 12 injuries. This was the second EF-4 tornado reported in a decade and the 11th in Georgia since 1950 (Figure 17.29).

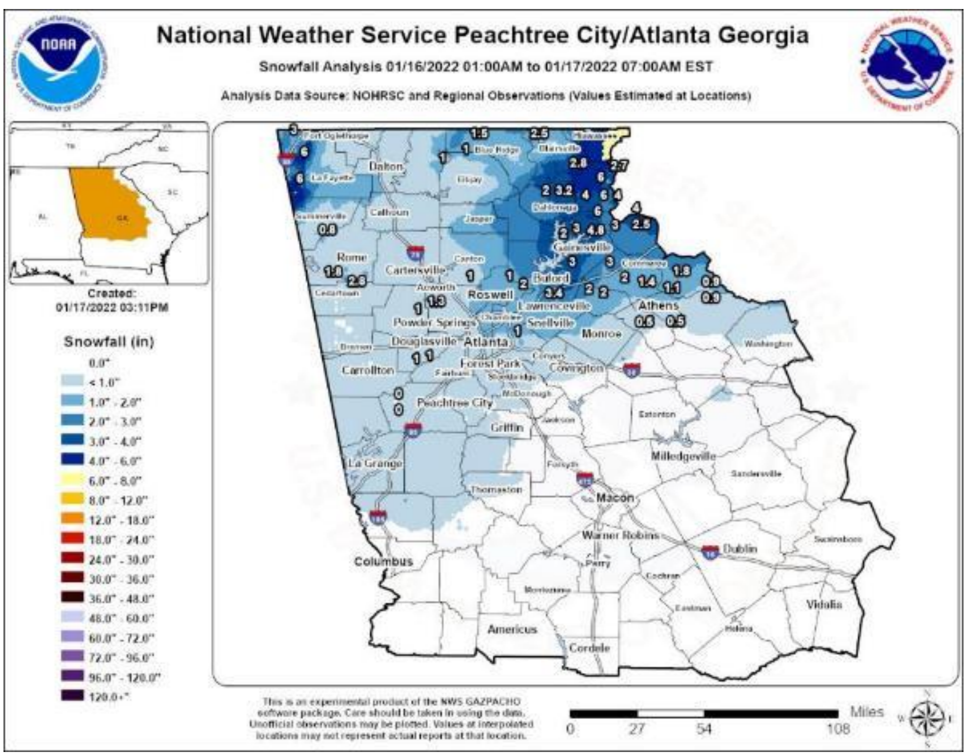


Figure 17.28: Snowfall Analysis from January 16th - January 17th

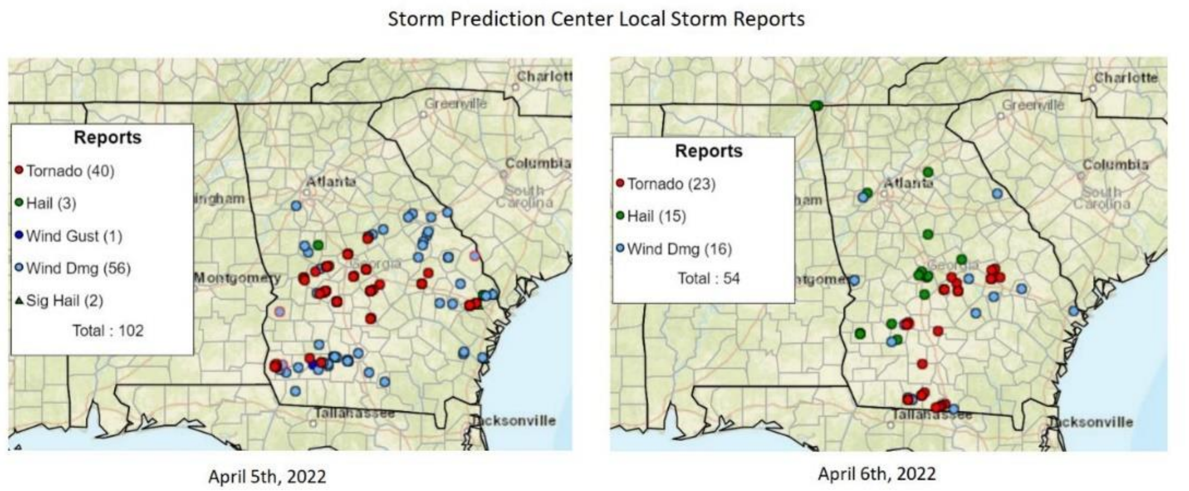


Figure 17.29: Storm Reports April Severe Weather

- The month of June was hot and dry for Georgia, with many daily maximum temperature records set (Table 17.7).
- Tropical Storm Colin formed along the South Carolina coast on July 2nd, not impacting Georgia with any significant weather.
- A period of record-breaking warmth at the beginning of November led to several record high temperatures set across the state.
- Atlanta experienced the 7th warmest year on record at 64.6°F, which tied with 2015 and 2021.

Table 17.7: Daily Maximum Temperature Record in June

Daily Maximum Temperature Record Set in June

Date	Location	Record	Previous Record Including Ties (Year)
6/15	Atlanta	99 °F	96 °F (1943)
	Athens	99 °F	99 °F (1918)
	Macon	104 °F	100 °F (2010)
6/16	Athens	100 °F	100 °F (1911)
	Macon	100 °F	99 °F (1920)
6/17	Macon	101 °F	101 °F (2016)
6/22	Atlanta	98 °F	98 °F (1964)
	Athens	102 °F	102 °F (1925)
	Macon	105 °F	101 °F (1925)
6/23	Macon	104 °F	101 °F (1944)
6/24	Macon	104 °F	101 °F (1944)

https://www.weather.gov/wrh/climate?wfo=ffc

Characteristics of the 2022 Air Quality Seasons and Forecasting in Atlanta, Macon, and Columbus, Georgia

- Statistics are based on team daily predicted and daily observed continuous ozone (daily peak 8-hour average, AIRS parameter code 44201) and PM (daily 24-hour average, AIRS parameter code 88101 and 88502) data. Observed data for 2022 was last retrieved from the EPA AirNow Tech database (www.airnowtech.org) on 1/6/2023 and may include both preliminary and final data. Note: the following analyses include only days on which there are records for both observed and predicted values. Also note: the Columbus GA-AL MSA includes observed PM2.5 data from the ADEM monitor in Phenix City, AL.
- During the 2022 calendar year, the forecast team issued a total of 1153 air quality forecasts: 214 ozone forecasts (April 1 – October 31) and 365 PM 2.5 forecasts (January 1 – December 31) for Atlanta; 211 ozone forecasts for Macon, and 363 PM 2.5 forecasts for Columbus. The tables and figures below describe the forecasting performance (i.e., relative accuracy of the forecasts compared to observed pollutant concentrations). Forecasting performance in 2022 was consistent with previous years.

Table 17.8: Observed Air Quality, 2022

		Observed # of days in AQI category			
Metro Area and Pollutant	Total # of days in record	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Atlanta Ozone	214	156	49	8	1
Macon Ozone	211	202	9	0	0
Atlanta $PM_{2.5}$	365	242	123	0	0
Columbus $PM_{2.5}$	363	285	78	0	0

* In Macon in 2022, AirNow does not have any observed ozone data for 5/14, 9/6, and 9/28. In Columbus/Phenix City, observed data are not available on 1/1 and 1/5.

Note: The total number of days in record is based on AirNow data for observed measurements.

Table 17.9: Predicted Air Quality, 2022

	Hits	Misses	False Alarms	Bias	Gross Error	Correlation (-1 to +1)	% Accurate 2 categories	% Accurate 5 categories
Atlanta Ozone	2	7	1	2.6 ppbv	6.6 ppbv	0.73	96	78
Macon Ozone	0	0	0	3.4 ppbv	6.1 ppbv	0.73	100	96
Atlanta $PM_{2.5}$	0	0	0	-0.3 $\mu g/m^3$	2.5 $\mu g/m^3$	0.63	100	75
Columbus $PM_{2.5}$	0	0	0	-0.6 $\mu g/m^3$	2.5 $\mu g/m^3$	0.67	100	82

Notes: Hits are the number of days on which an observed exceedance of the daily NAAQS was correctly predicted. Misses are the number of days on which an observed exceedance of the daily NAAQS was not predicted. False Alarms are the number of days on which an exceedance of the daily NAAQS was predicted, but was not later observed. Bias is the average tendency to over-predict (positive bias) or under-predict (negative bias) the observed pollutant concentration. Gross Error is the average absolute error of the predictions relative to the observations. Correlation is a measure of the ability to predict the relative change in observed concentrations. Higher positive correlation implies that the predictions are accurately anticipating changes in the observed concentrations. % Accurate 2 categories is the percentage of days when the forecast prediction correctly matched the observation for the "no smog alert" / "smog alert" condition (i.e. 2 categories). % Accurate 5 categories is the percentage of days when the forecast prediction correctly matched the observation for five categories of the Air Quality Index (Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy).

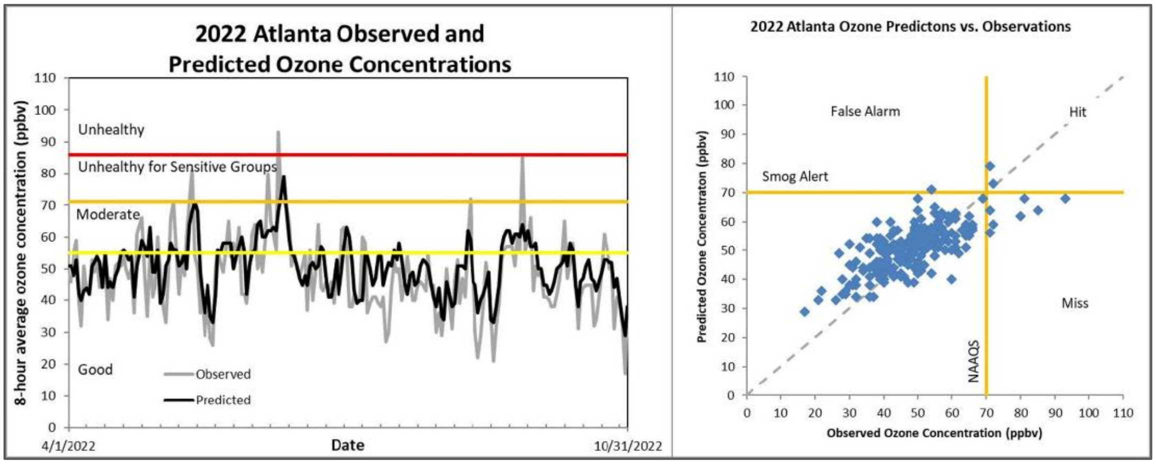


Figure 17.30: Atlanta observed and predicted ozone, 2022

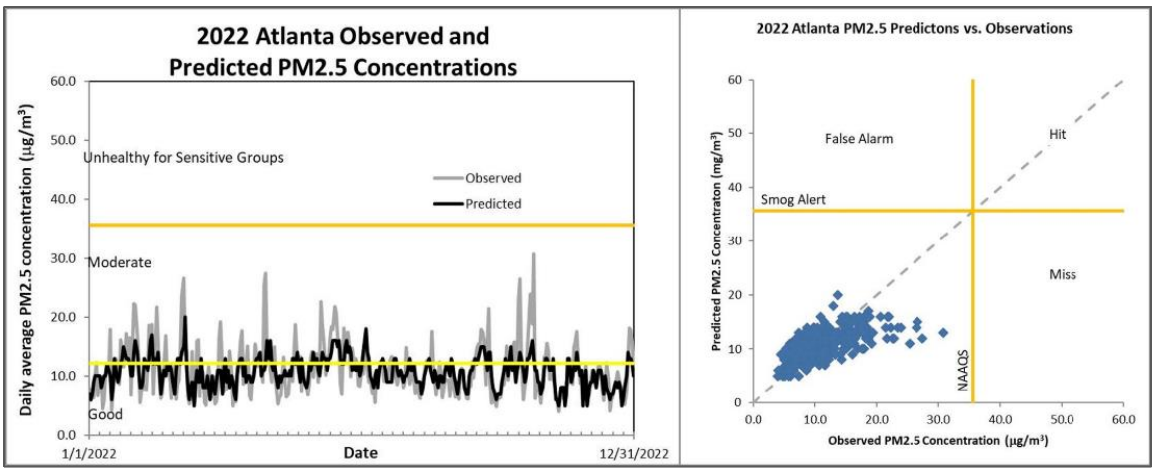


Figure 17.31: Atlanta observed and predicted $PM_{2.5}$, 2022

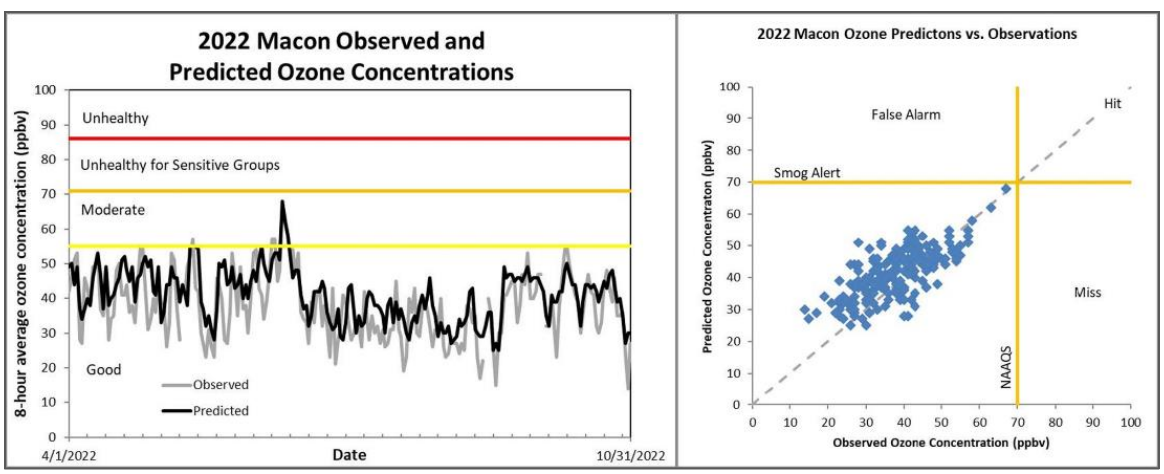


Figure 17.32: Macon observed and predicted ozone, 2022

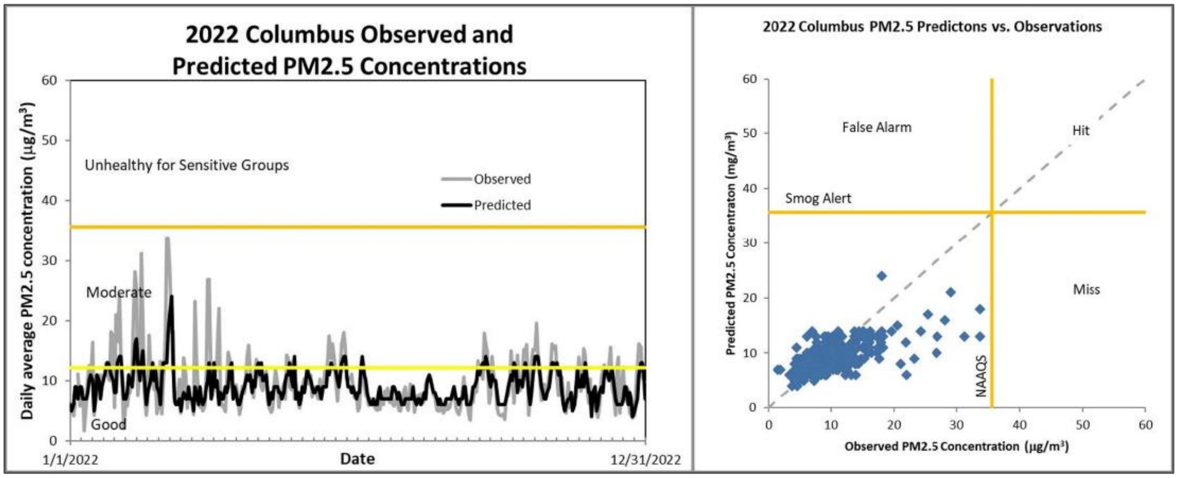


Figure 17.33: Columbus observed and predicted $PM_{2.5}$, 2022

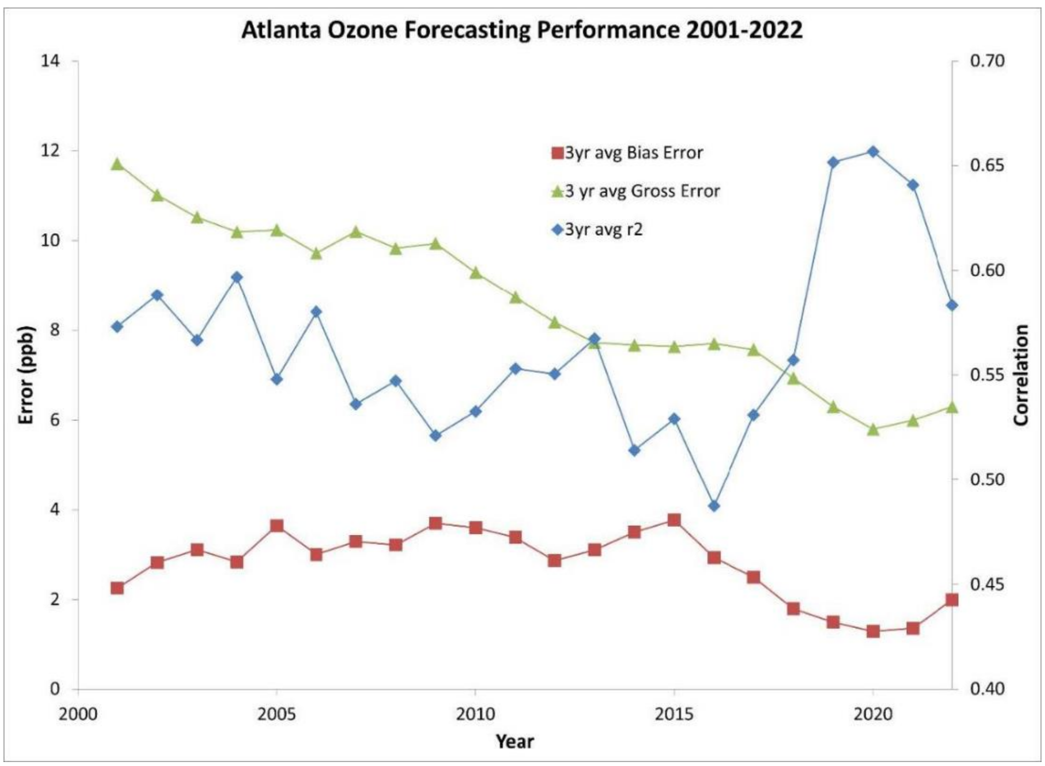


Figure 17.34: Atlanta Ozone Forecasting Performance 2001-2022

Forecasting Performance Notes:

- By all measures, the long-term trend in air quality forecasting accuracy has leveled off, and over the last few years may be trending slightly worse as ozone levels have become lower.
- The figure above (17.34) shows the 3-year running average of the mean normalized bias (MNB), mean normalized error (MNE), and correlation coefficient (r^2) for ozone forecasting in Atlanta since 2001 (note: 1999 was the first year the team began forecasting next day peak 8-hour ozone concentrations, so 2001 is the first year that a 3-yr average is available).
- The trends show that the team became more accurate in its forecasts until ~2020: the gross error (a measure of how much the team tends to error in its estimate of the next day's peak

ozone concentration without regard to whether that estimate overpredicts or underpredicts the observed value) was almost cut in half.

- Bias (a measure of how much the team tends to err in its estimate of the next day's peak ozone concentration accounting for the overprediction or underprediction of the observed value) also decreased slightly, especially during the last quarter of that 20-year period.
- Meanwhile, correlation (a measure of the skill in predicting the relative change in observed concentrations) also increased.
- Since 2020, however, these long-term trends have leveled off and may be reversing.

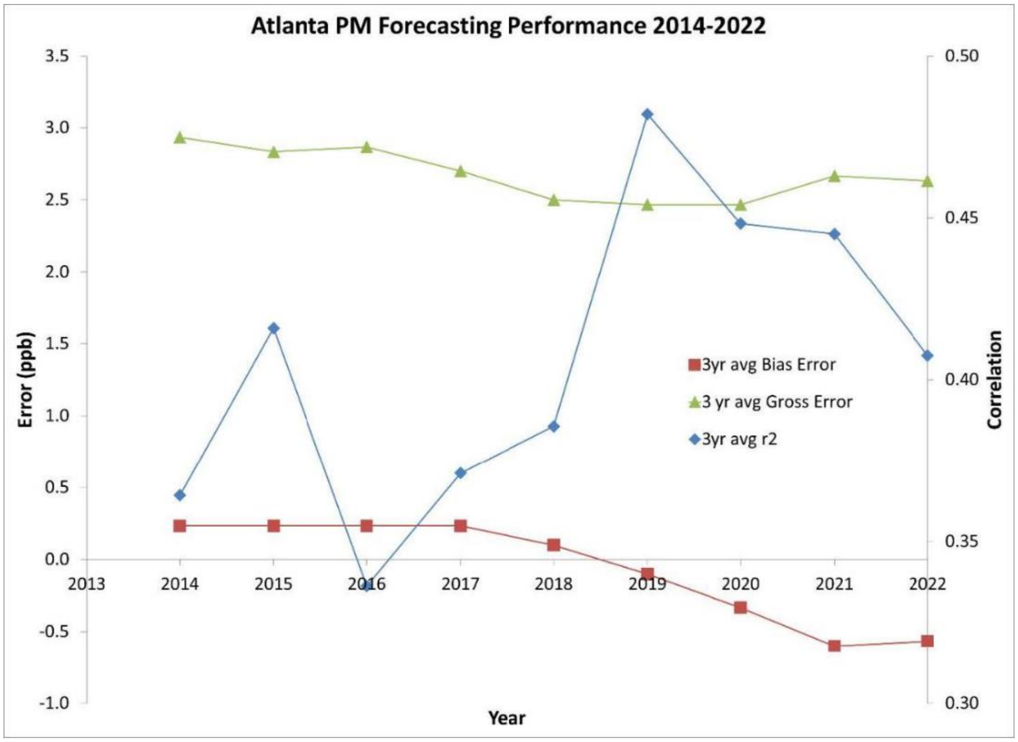


Figure 17.35: Atlanta Particulate Matter Forecasting Performance 2014-2022

- Discerning clear trends for PM are not as obvious: recent gross error is higher than in the last few years but remains lower than during the early years of PM forecasting.
- Likewise, correlation is lower than it has been in recent years, but higher than the early years of PM forecasting.
- Meanwhile, bias error continued its recent negative history meaning the forecasting team is, on average, underpredicting observed PM concentrations, whereas in earlier years, the team tended to overpredict PM concentrations.
- These nuanced trends notwithstanding, air quality forecasting performance is generally consistent from year to year.

2022 Drought Conditions in Georgia

- In 2022, much more of the state experienced periods of drought conditions than in 2021 (Figure 17.36 top graph).
- There was an especially significant flash drought from mid-October through November due to enhanced subsidence and evapotranspiration as Hurricane Ian passed by. A strong high-

pressure system and intense daytime heating exacerbated the dryness. The figure on the bottom shows the fall flash drought progression.

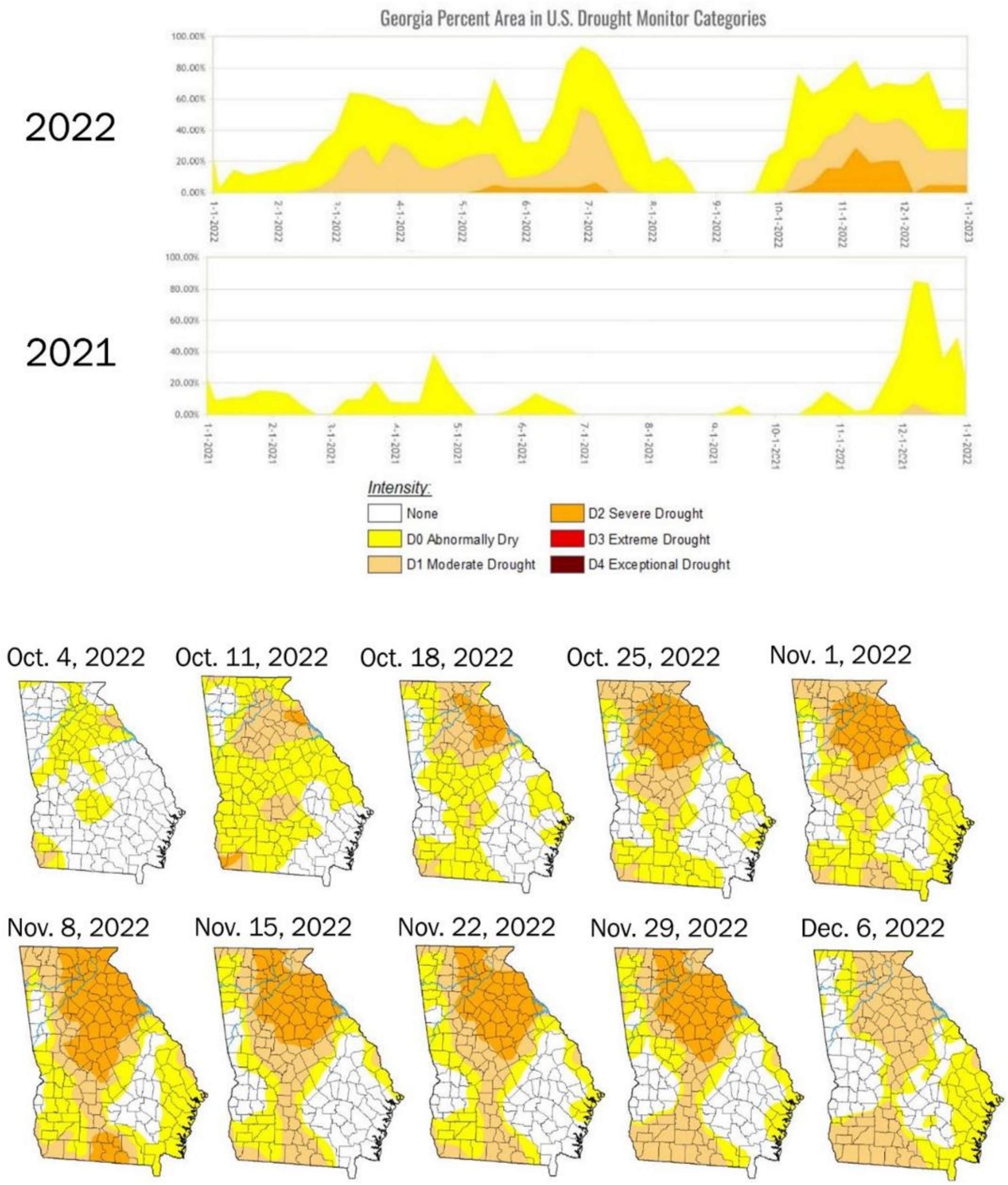


Figure 17.36: 2022 Drought Conditions Comparison for Georgia

- The U.S. Drought Monitor Comparison Slider map can be found at: https://droughtmonitor.unl.edu/Maps/ComparisonSlider.aspx. By selecting the Area Type, Area, and the dates in both the Left and Right drop-down menus, the map will display drought information from the selected area and dates. The swipe tool can be used to compare drought conditions from two dates.

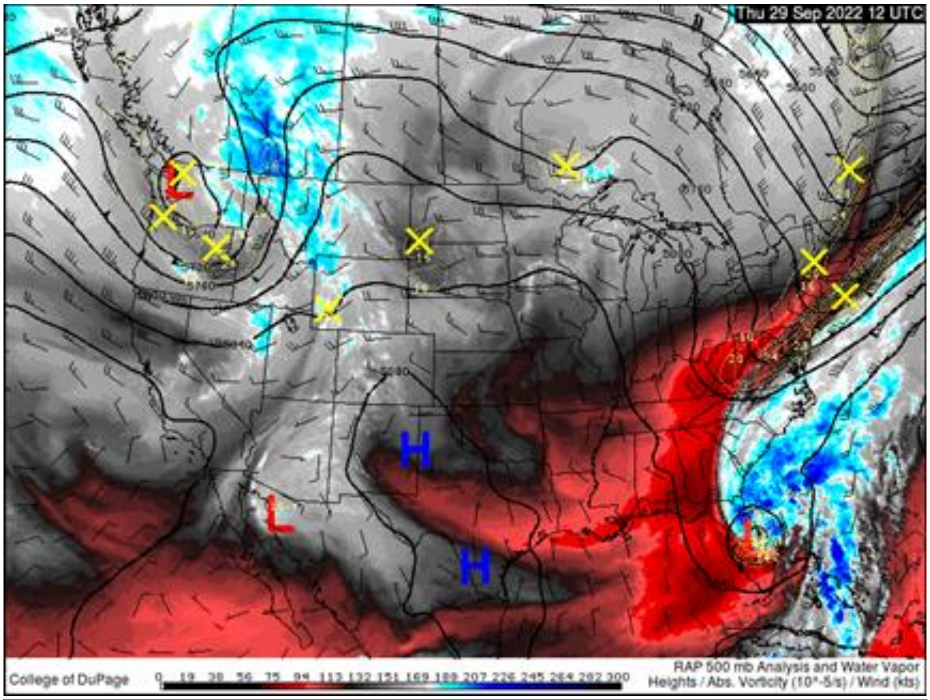


Figure 17.37: Hurricane Ian water vapor concentration at 500mb Fall 2022

<u>Agricultural Impacts</u>

The 2022 fall flash drought caused agricultural impacts including:

- Brown pastures and fields.
- Farmers feeding cattle hay early.
- The Broad River's water levels between Wilkes and Elbert County went down to only 6 inches when it is usually between 2.5 to 3 feet deep.
- Pond levels decreased at least 10 feet in Jackson County.
- Farmers had trouble keeping trout in stocked ponds alive.

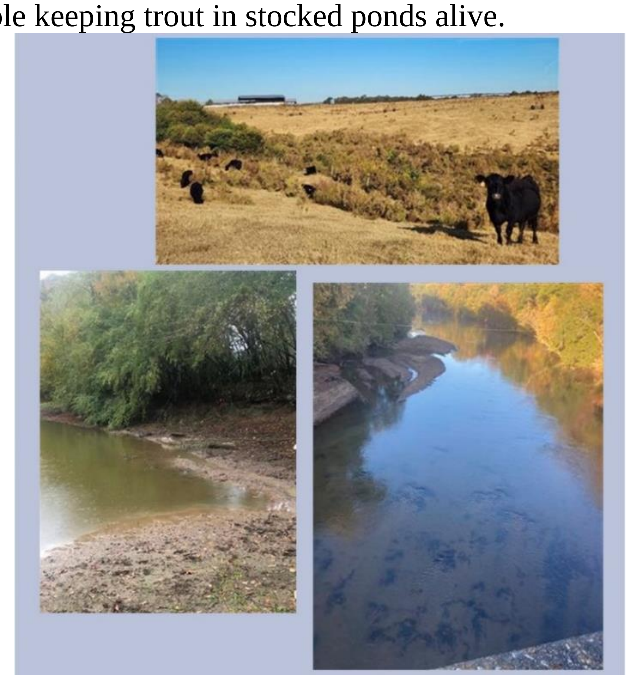


Figure 17.38: Agricultural Impacts from Fall Drought

17.1.5 2023

Meteorological Summary – 2023

- Weather conditions for 2023 consisted of above normal rainfall and above normal temperatures for the state.
- Numerous tornados occurred across North and Central Georgia during the month of January as a strong storm system moved through the state (Figure 17.39).
- Four tornadoes touched down in Central Georgia from March 25th to 27th, as part of a severe storm system that traveled from Texas to the southeast coast (Figure 17.40).
- Hurricane Idalia made landfall along the Florida Big Bend on the morning of August 30th as a Category 3 storm. The rainbands along the eastside of the hurricane impacted all of SE Georgia through the day (Figure 17.41).

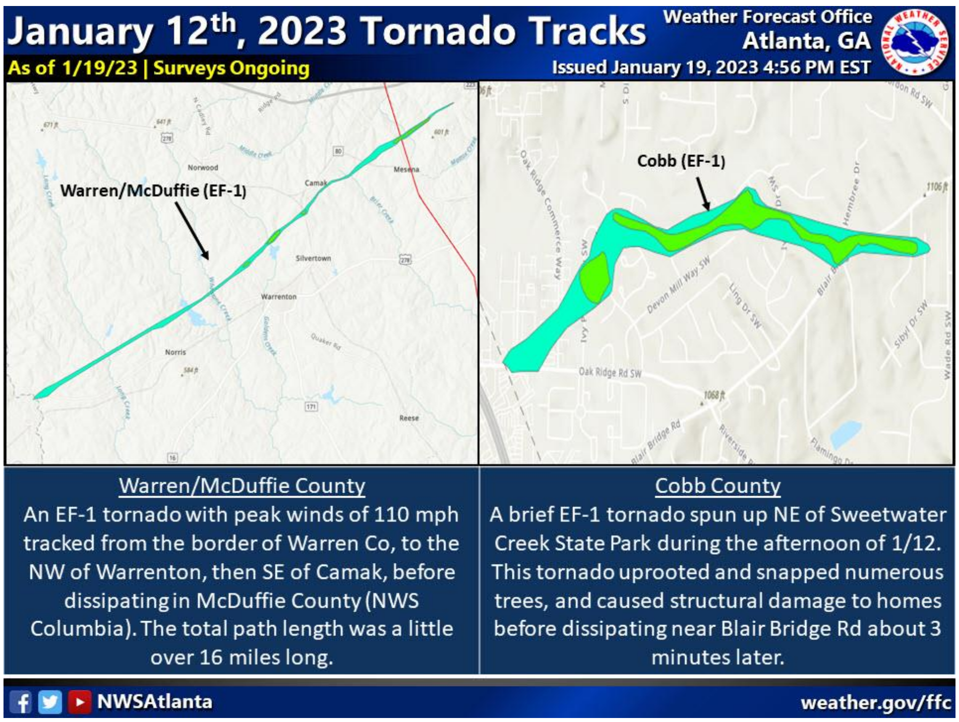


Figure 17.39: Tornado Tracks on January 12th, 2023

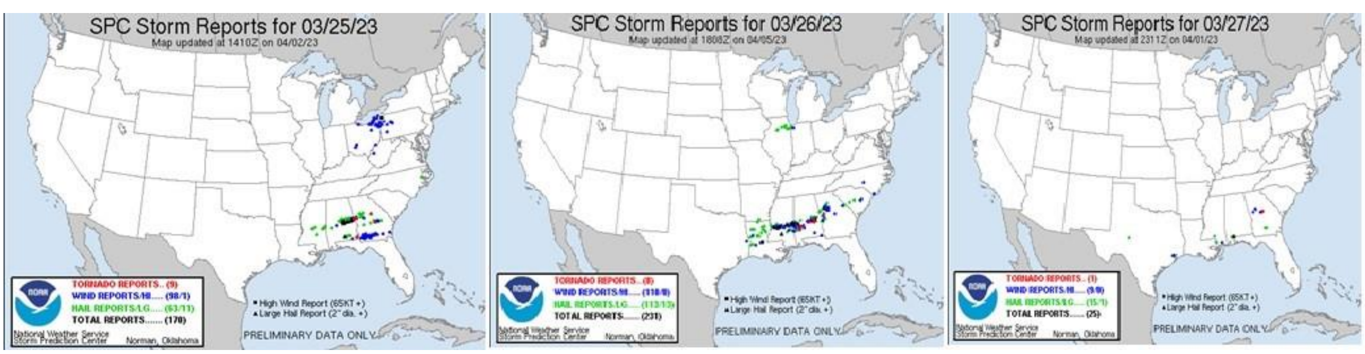


Figure 17.40: Severe Storm System Tornado Reports March 25th-27th, 2023

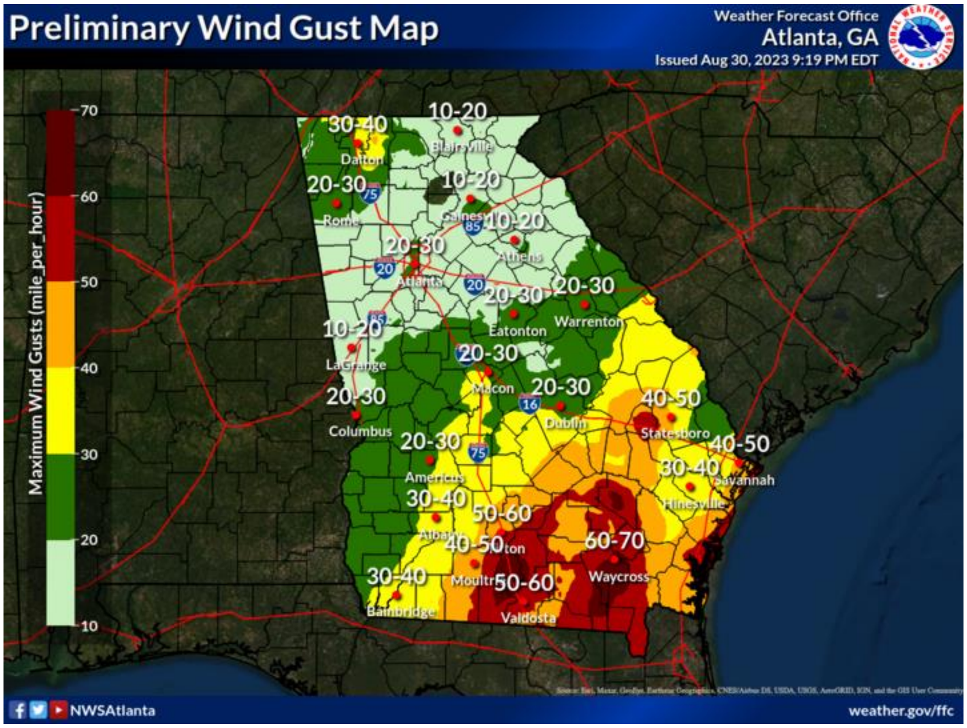


Figure 17.41: Hurricane Idalia Wind Gusts in Georgia

2023 Drought Conditions in Georgia

- In 2023, less of Georgia's land area was affected by dry conditions or drought than in 2022. However, the drought reached a much higher severity in 2023 than in 2022 (Figure 17.42).
- The year began with the entire southern half of the state experiencing drought conditions. These conditions improved through January and retreated to the southern two corners of the state in February and March.
- In October 2023, Northwest Georgia reached Extreme Drought (D3), and in November 2023 Northwest Georgia reached Exceptional Drought (D4) (Figure 17.42).
- Before 2023, the last time any part of the state reached D3 was October 2019, and the last time any part of the state reached D4 was December 2016.
- The D3 and D4 conditions in 2023 occurred during a fall rapid onset drought, Georgia's second rapid onset drought in two years.
- As a result of this drought, a few small wildfires broke out in Northwest Georgia and caused $PM_{2.5}$ exceedances on the 22nd and 23rd of December.

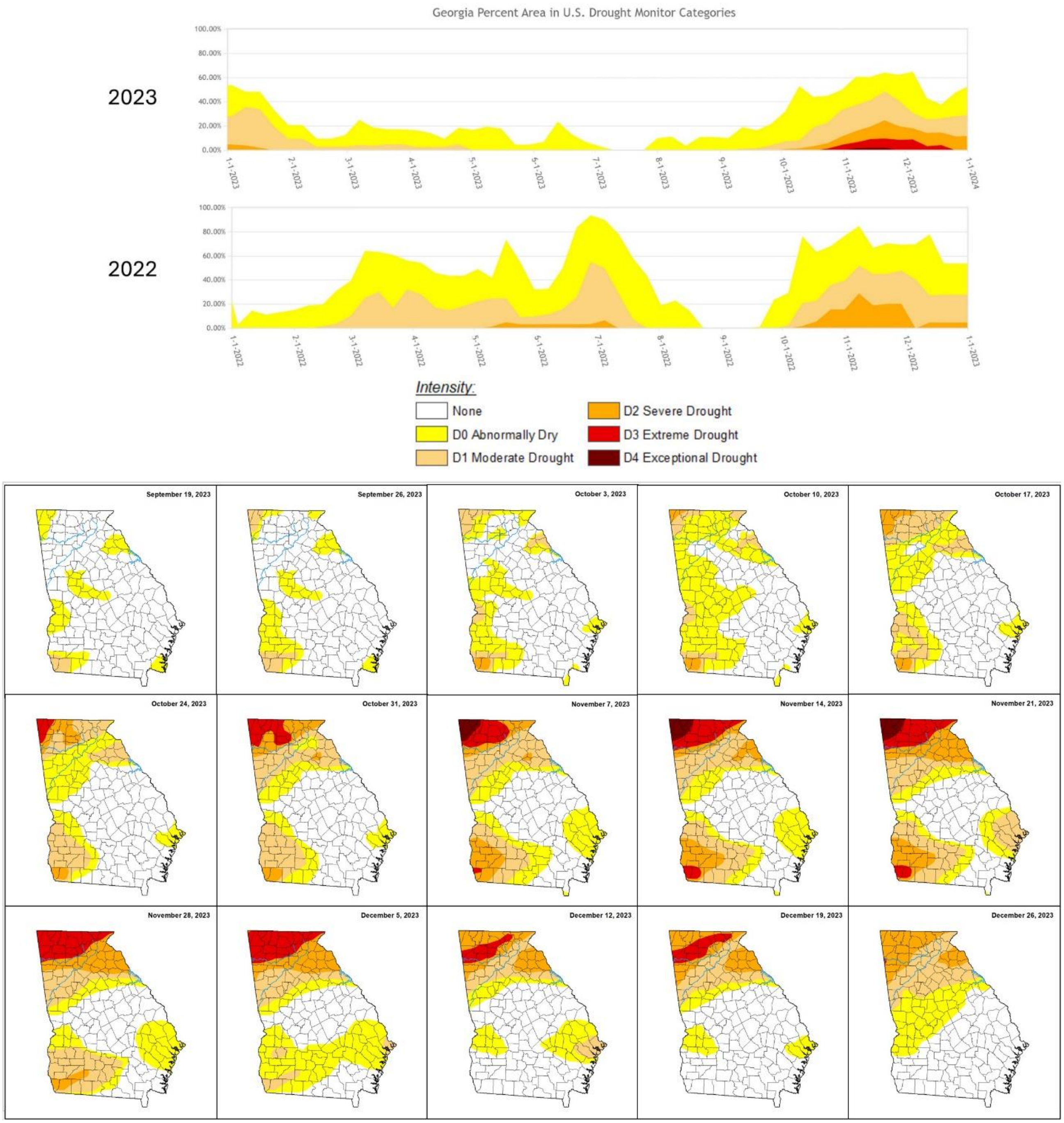


Figure 17.42: U.S. Drought Monitor Georgia 2023
Percent of Georgia Area in U.S. Drought Monitor Categories (top figure); color coded legend (middle figure); Fall 2023 Rapid onset Drought Progression (bottom figure)
Image credit: USDM produced by the National Drought Mitigation Center, NOAA, and USDA

Agricultural Impacts 2023

- The 2023 fall flash drought caused agricultural impacts including:
  - Dry, brown pastures and fields (Figure 17.43).
  - Dry or low ponds and creeks (Figure 17.43 and 17.44).

- Pastures for forage unable to grow.
- Farmers feeding cattle hay early (Figure 17.45).
- Farmers having to buy up to 5 times the normal amount of hay and supplemental feeding required.
- Farmers forced to sell cattle.
- Planting of fall crops was delayed due to hard ground and fear of crop failure.
- Crops that were planted failed or seeds were eaten by birds.

Figure 17.43: Dry Field, Wilkes County Condition Monitoring Observer Report 11-8-23

Figure 17.44: Dry Creek, Gordon County Condition Monitoring Observer Report 11-2-23

Figure 17.45: Feeding Cattle Hay Early, Franklin County Condition Monitoring Observer Report 11-6-23

Characteristics of the 2023 Air Quality Seasons and Forecasting in Atlanta, Macon, and Columbus Georgia

Statistics are based on team daily predicted and daily observed continuous ozone (daily peak 8-hour average, AIRS parameter code 44201) and PM (daily 24-hour average, AIRS parameter code 88101 and 88502) data. Observed data were last retrieved from the EPA AirNow Tech database (www.airnowtech.org) on 3/11/2024 and may include both preliminary and final data. Note: the following analyses include only days on which there are records for both observed and predicted values. In 2023, there were 365 possible days in the PM2.5 season (January 1 – December 31), and 214 days in the ozone season (April 1 – October 31). Also note: the Columbus CBSA includes observed PM2.5 data from the ADEM monitor in Phenix City, AL (only through February 28, 2023; no data from this site is available after that date).

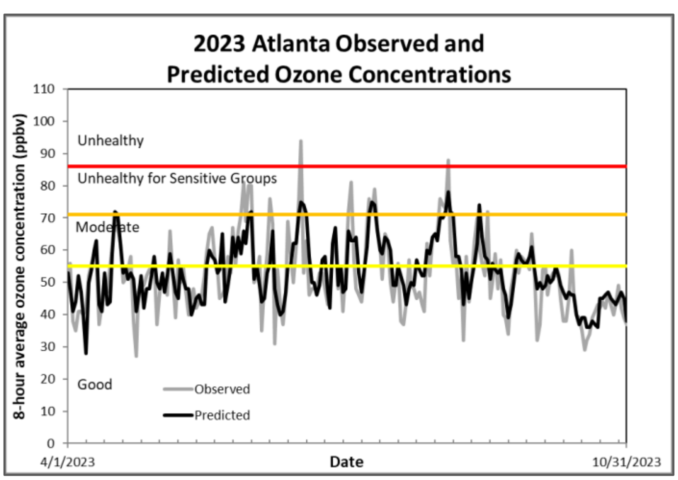
Table 17.10: Observed Air Quality, 2023

Metro Area and Pollutant	Total # of days in record	Observed # of days in AQI category			
		Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Atlanta Ozone	214	135	61	16	2
Macon Ozone	214	202	9	3	0
Atlanta PM2.5	365	203	157	4	1
Columbus PM2.5	365	257	106	1	1

Table 17.11: Predicted Air Quality, 2023

	Hits	Misses	False Alarms	Bias	Gross Error	Correlation (-1 to +1)	% Accurate 2 categories	% Accurate 5 categories
Atlanta Ozone	10	8	6	0.6 ppbv	5.5 ppbv	0.79	93	75
Macon Ozone	0	3	0	2.3 ppbv	5.4 ppbv	0.68	99	92
Atlanta PM2.5	1	4	0	-1.6 µg/m^3	3.6 µg/m^3	0.67	99	72
Columbus PM2.5	0	2	0	-0.2 µg/m^3	3.2 µg/m^3	0.60	99	78

Notes: Hits are the # of days on which an observed exceedance of the daily NAAQS was correctly predicted. Misses are the # of days on which an observed exceedance of the daily NAAQS was not predicted. False Alarms are the # of days on which an exceedance of the daily NAAQS was predicted, but was not later observed. Bias is the average tendency to over-predict (positive bias) or under-predict (negative bias) the observed pollutant concentration. Gross Error is the average absolute error of the predictions relative to the observations. Correlation is a measure of the ability to predict the relative change in observed concentrations. Higher positive correlation implies that the predictions are accurately anticipating changes in the observed concentrations. % Accurate 2 categories is the percentage of days when the forecast prediction correctly matched the observation for the "no smog alert" / "smog alert" condition (i.e. 2 categories) % Accurate 5 categories is the percentage of days when the forecast prediction correctly matched the observation for five categories of the Air Quality Index (Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy).



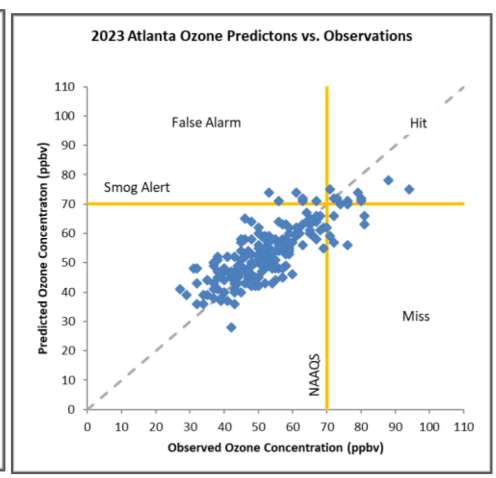


Figure 17.46: Atlanta Ozone Observed and Predicted, 2023

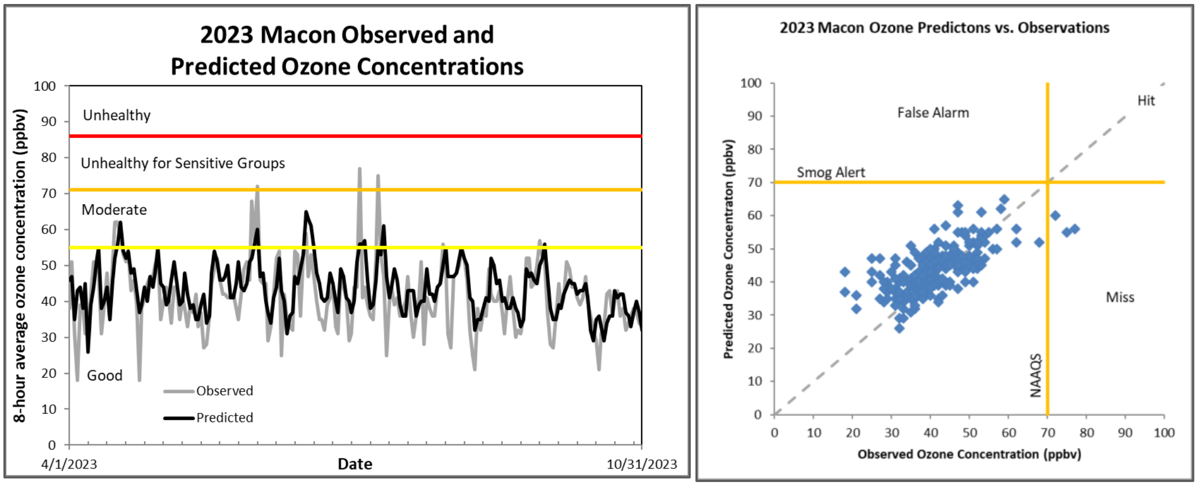


Figure 17.47: Macon Ozone Observed and Predicted, 2023

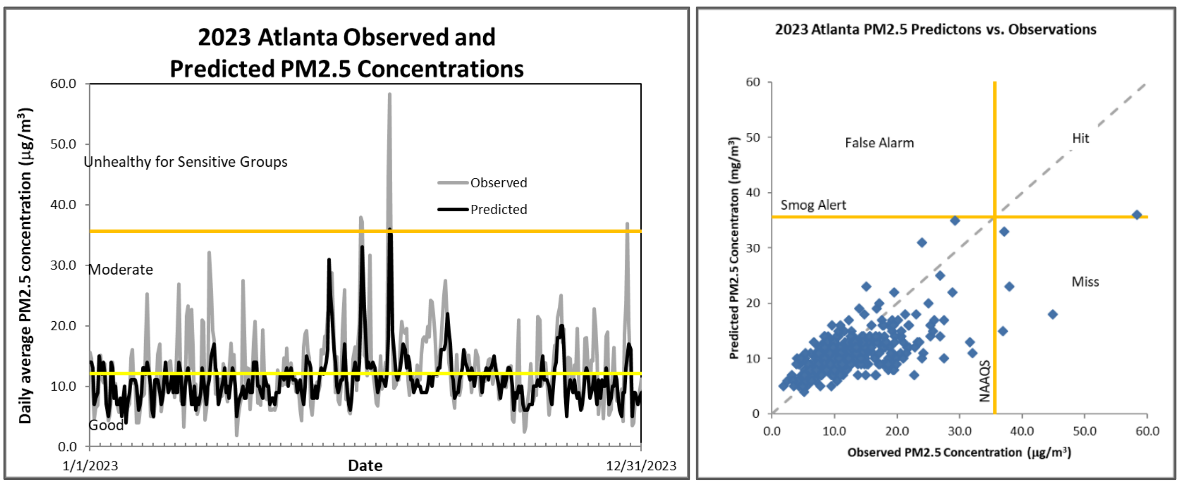


Figure 17.48: Atlanta Particulate Matter Observed and Predicted, 2023

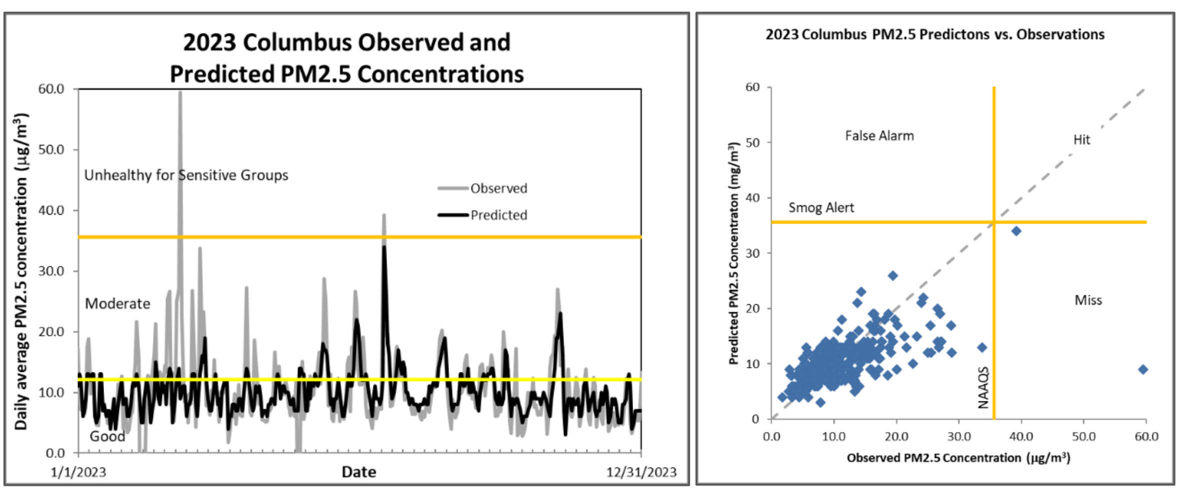


Figure 17.49: Columbus Particulate Matter Observed and Predicted, 2023

By all measures, the long-term trend in air quality forecasting accuracy has leveled off, and over the last few years may be trending slightly worse – especially for forecasting of $PM_{2.5}$ concentrations. Figure 17.50 shows the 3-year running average of the mean normalized bias (MNB), mean normalized error (MNE), and correlation coefficient (r^2) for ozone forecasting in Atlanta since 2001 (note: 1999 was the first year the team began forecasting next day peak 8-hour ozone concentrations, so 2001 is the first year that a 3-yr average is available). The trends show that the team became more accurate in its forecasts until ~2020: the gross error (a measure of how much the team tends to err in its estimate of the next day's peak ozone concentration without regard to whether that estimate overpredicts or underpredicts the observed value) was almost cut in half. Bias (a measure of how much the team tends to err in its estimate of the next day's peak ozone concentration accounting for the overprediction or underprediction of the observed value) also decreased slightly, especially during the last quarter of that 20-year period. Meanwhile, correlation (a measure of the skill in predicting the relative change in observed concentrations) also increased. Since 2020, however, these long-term trends have mostly leveled off.

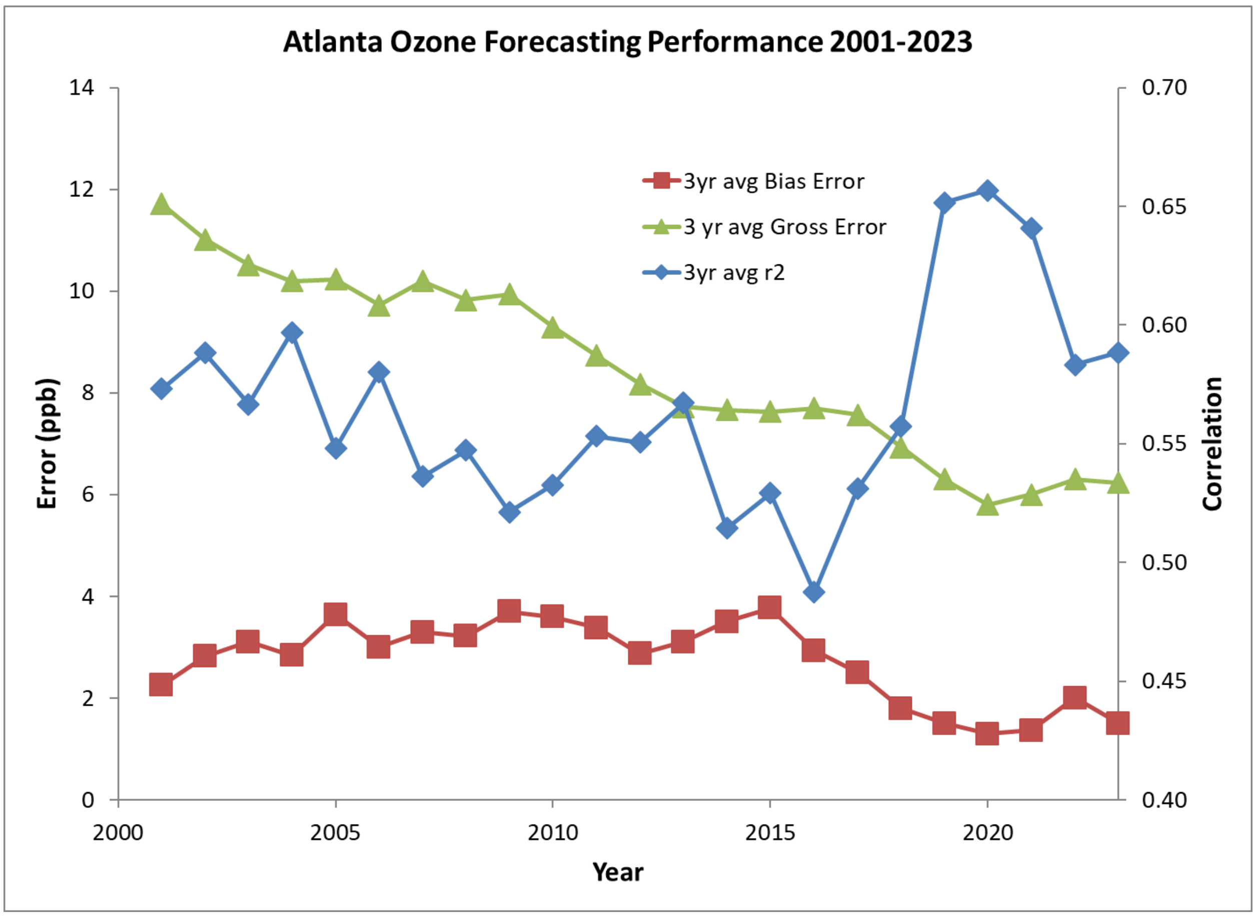


Figure 17.50: Atlanta ozone forecasting performance 2001-2023

For PM, a recent trend in increasing gross error and increasing negative bias suggests that PM forecasting performance is getting worse. Interestingly, the bias error clearly transitioned from forecasters routinely overpredicting PM concentrations prior to 2019 to forecasters now routinely underpredicting PM concentrations. This shift in the latter half of the 10-year period was accompanied by higher overall gross errors too – not just a shift in bias. As forecasting operations have largely remained consistent over the last decade, it is not evident at this time what the cause is for the shift in bias from positve prior to 2019 to negative since 2019. Anecdotally, however, forest fire activity, both of the prescribed burning and wildfire activity, and their impacts on Georgia's air quality, would seem to be more frequent and consequential since 2019. If the forecasters have not been able to account for increased smoke from fire, which it appears that they may not have been able to do, this could explain the recent trend to underpredict PM concentrations. That is forecasters may not be accounting for increased burning activity beginning in 2019 – both wild and prescribed. This requires more investigation, and if warranted, the development of new approaches for forecasting when, where, how, and by how much fires may affect Georgia's air. These nuanced trends notwithstanding, air quality forecasting performance is generally consistent from year to year.

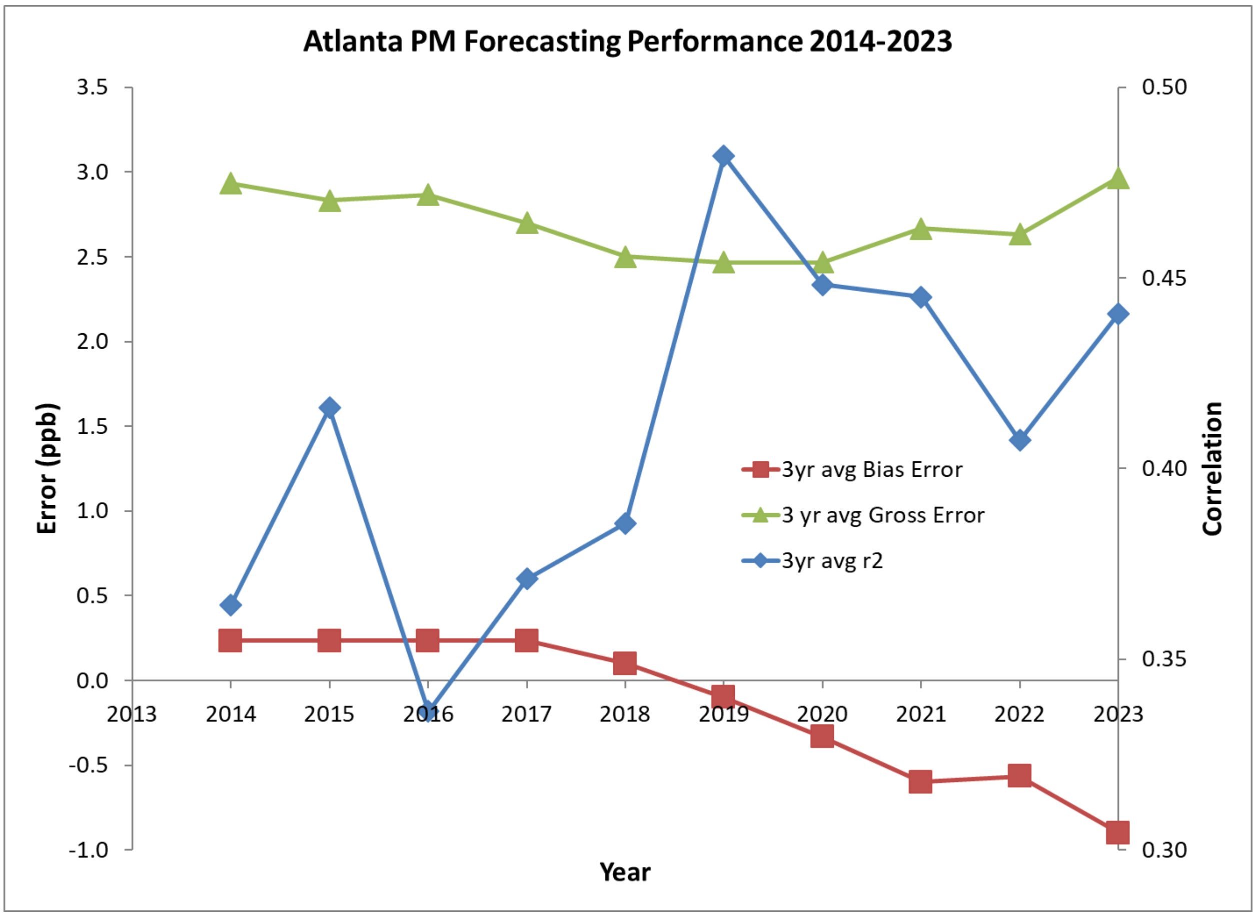


Figure 17.51: Atlanta PM forecasting performance 2014-2023

18.0 Photochemical Assessment Monitoring Stations (PAMS) Assessment

18.1 General Information

Ozone is the most prevalent photochemical oxidant and an important contributor to photochemical pollutants. The understanding of the chemical processes in ozone formation and the specific understanding of the atmospheric mixture in nonattainment areas nationwide are essential. To better understand the chemical processes and develop a strategy for solving those problems, EPA revised the ambient air quality surveillance regulations. In February 1993, Title 40, Part 58 of the Code of Federal Regulations (40 CFR Part 58) was developed to include provisions for enhanced monitoring of ozone, oxides of nitrogen, volatile organic compounds (VOCs), select carbonyl compounds, and the monitoring of meteorological parameters. These parameters would be monitored at Photochemical Assessment Monitoring Stations (PAMS). Stated in Title 40, Part 58 of the Code of Federal Regulation (40 CFR Part 58), the increased monitoring of ozone and its precursor concentrations allows for the characterization of precursor emissions within the area, transport of ozone and its precursors, and the photochemical processes leading to nonattainment. By expanding on the study of ozone formation, PAMS monitoring sites serve as a means to study trends and spatial and diurnal variability.

PAMS measurements are performed to support the regulatory, analytical, and public health purposes of the program. By performing these measurements, GA AAMP can better serve two major goals. First, by studying local atmospheric chemistry, it improves the ability to control the formation of secondary pollutants like ozone and particulate matter. Second, GA AAMP is monitoring the concentration of pollutants (aside from the defined criteria air pollutants) expected to be harmful to human health, but do not have standards. By making such data available, scientists who study human health as it relates to air quality can study how these pollutants may affect human health. When this understanding is further refined, their data can serve to guide policymakers toward making decisions that protect public health.

According to EPA, PAMS monitoring was to be implemented in cities that were classified as serious, severe, or extreme for ozone nonattainment. The classifications were based on the number of exceedances of the ozone standard, and the severity of those exceedances. Nineteen areas nationwide were required to implement a PAMS network. In the Atlanta metropolitan area, a network of four sites was established beginning in 1993 (Yorkville (13-223-0003), South DeKalb (13-089-0002), Tucker (13-089-3001), and Conyers (13-247-0001)). The monitoring sites were selected depending on the pollutants monitored in relation to the prevailing winds in the area. Until the end of 2006, this was the setup of the PAMS network. At the end of 2006, the Tucker site was shut down. In 2013 the continuous gas chromatograph at Conyers was shut down, and in 2015, the 6-day PAMS canister and $NO/NO_2/NO_x$ monitors were shut down. Then in 2017 the Yorkville site was shut down. At this point, Conyers is only used to measure solar radiation and total ultraviolet radiation, and South DeKalb is the only PAMS site in the GA AAMP network.

Also, according to EPA, PAMS monitoring is to be implemented at sites that are part of the NCore network. For GA AAMP, the South DeKalb site serves as the NCore site; therefore, the GA AAMP is meeting this requirement by monitoring for PAMS pollutants at this site.

South DeKalb is expected to measure the highest precursor concentrations of NOx and VOCs in the Atlanta area. The South DeKalb site monitors the magnitude and type of precursor emissions and are located immediately downwind of the area of maximum precursor emissions receiving the predominant morning downwind wind. This site is located in DeKalb County in order to provide neighborhood scale measurements in the area that the precursors have the greatest impact. The data measurements generated at South DeKalb site are used principally for development and evaluation of imminent and future control strategies, corroboration of NO_x and VOC emission inventories, verification of photochemical grid model performance, characterization of ozone and toxics air pollutant exposures, development of pollutant trends (particularly toxic air pollutants and annual ambient speciated VOC trends) to compare with trends in annual VOC emission estimates, and determination of attainment with NAAQS for O_3, $PM_{2.5}$, CO, and NO_2.

The current PAMS site is shown in Figure 18.1.

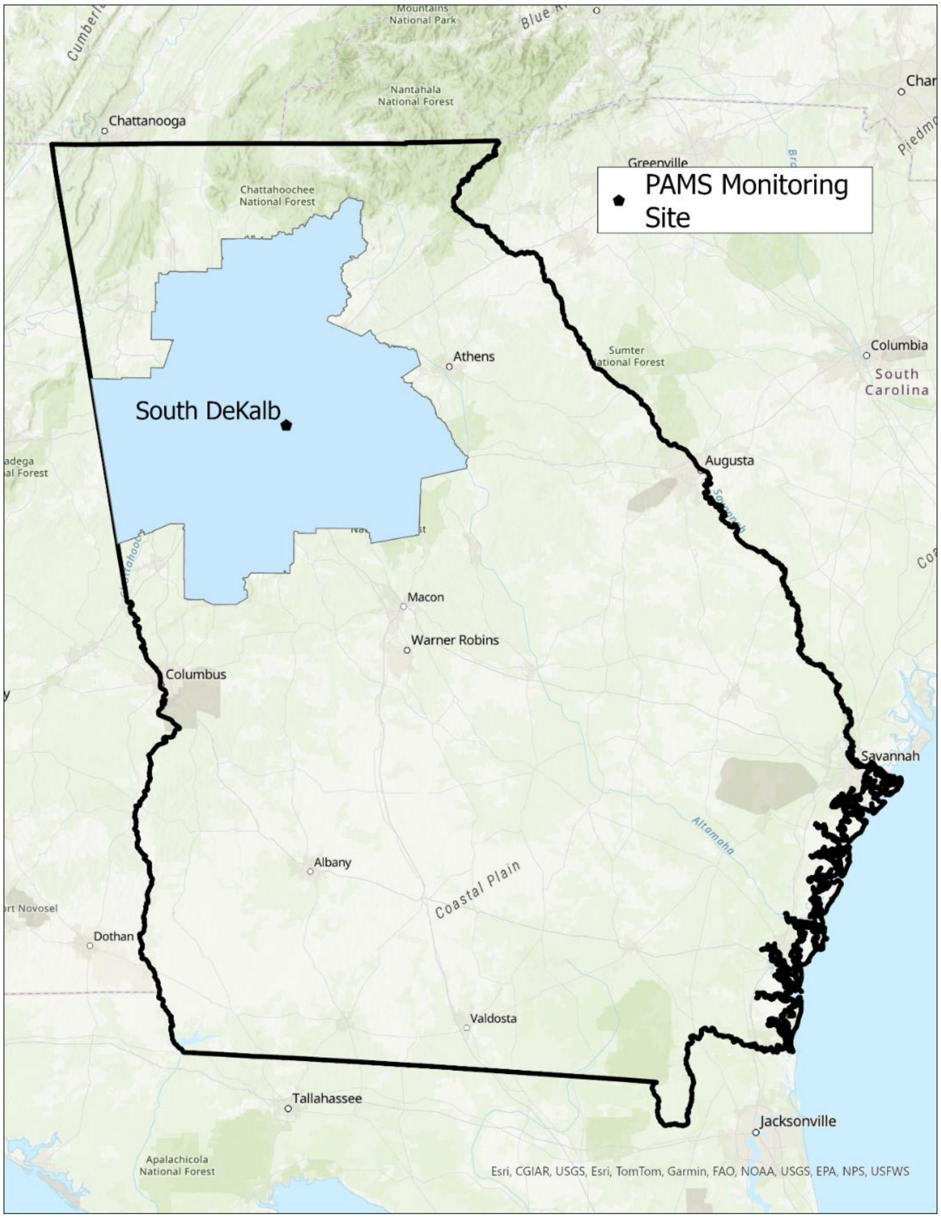


Figure 18.1: Georgia PAMS Monitoring Site, Atlanta-Sandy Springs-Roswell MSA Shown as Solid Color

Using the EPA's 'Designing a Network Assessment for an Ambient Air Monitoring Program' document as guidance, the following PAMS assessment was performed to: 1) address whether ozone exceedances are NO_x or VOCs limited; 2) show how the PAMS data relates to State Implementation

Plans (SIPs); 3) identify target emission pollutants in the SIPs; 4) identify pollutants targeted for emission reduction; 5) identify PAMS data used to assess progress in control programs; 6) assess air pollution being transported into PAMS areas; 7) assess if PAMS station is still properly sited; 8) assess if the PAMS network still meets the network design requirements; 9) discuss how the requirements for upper air measurements are being met.

18.1.1 Ozone

Ground level ozone formation occurs through a complex series of photochemical reactions that take place in the presence of strong sunlight. Since the reactions must take place in the presence of sunlight, ozone concentrations have a strong diurnal pattern (occurring daily and in daylight hours). Figure 18.2 shows this typical diurnal pattern of ozone concentration throughout the day.

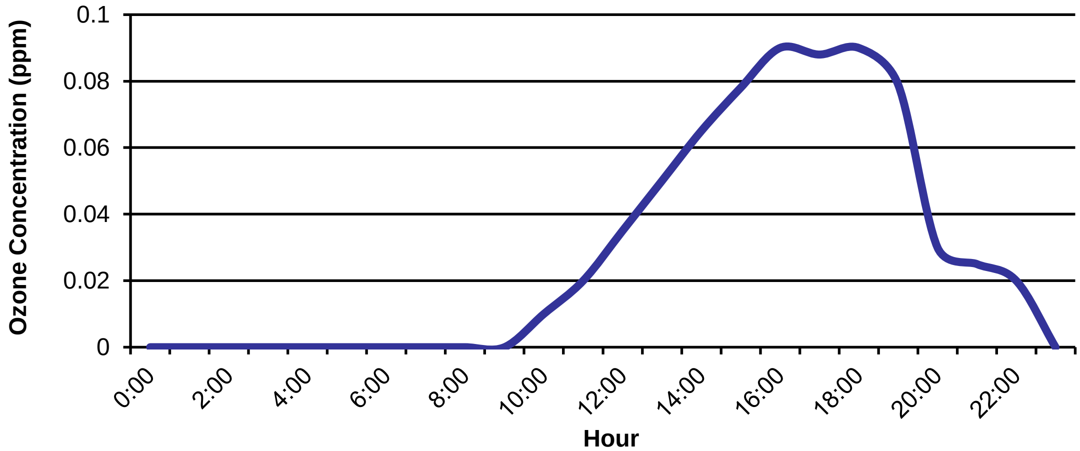


Figure 18.2: Typical Urban 1-hour Ozone Diurnal Pattern

For these photochemical reactions to take place, certain components, or precursors, must be available. The precursors to ozone are oxides of nitrogen (NO_x) and photochemically reactive volatile organic compounds (VOCs) (Figure 18.3). Common sources of NO_x include combustion processes from vehicles and industrial processes. Examples of the reactive VOCs that contribute to ozone formation are hydrocarbons found in automobile exhaust (benzene, propane, toluene), vapors from cleaning solvents (toluene), and biogenic emissions from plants (isoprene).

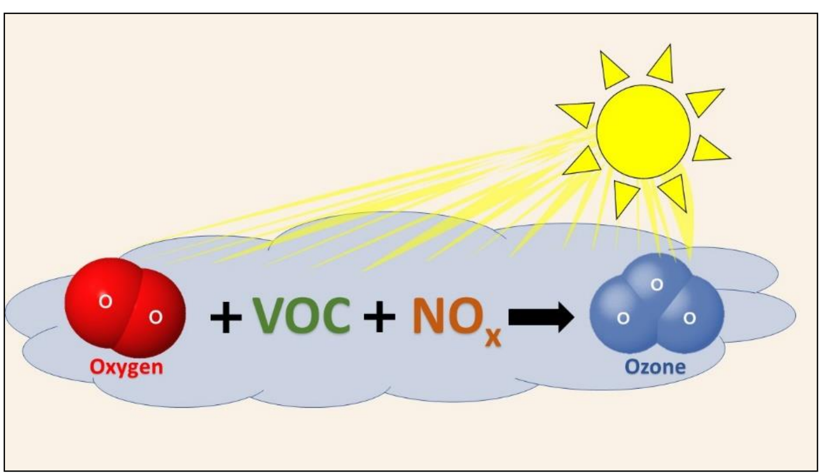


Figure 18.3: Ozone Formation Process

18.1.2 Volatile Organic Compounds

Sources of volatile organic compounds (VOCs) in Georgia are shown in Figure 18.4 followed by a spatial view of VOC emissions across the state in Figure 18.5. In Georgia, biogenic emissions are the most common source of volatile organic compounds. These figures are taken from the latest emissions report from EPA (https://storymaps.arcgis.com/stories/d7d730f974c6474190b142a49ae8d3bd), based on 2020 data.

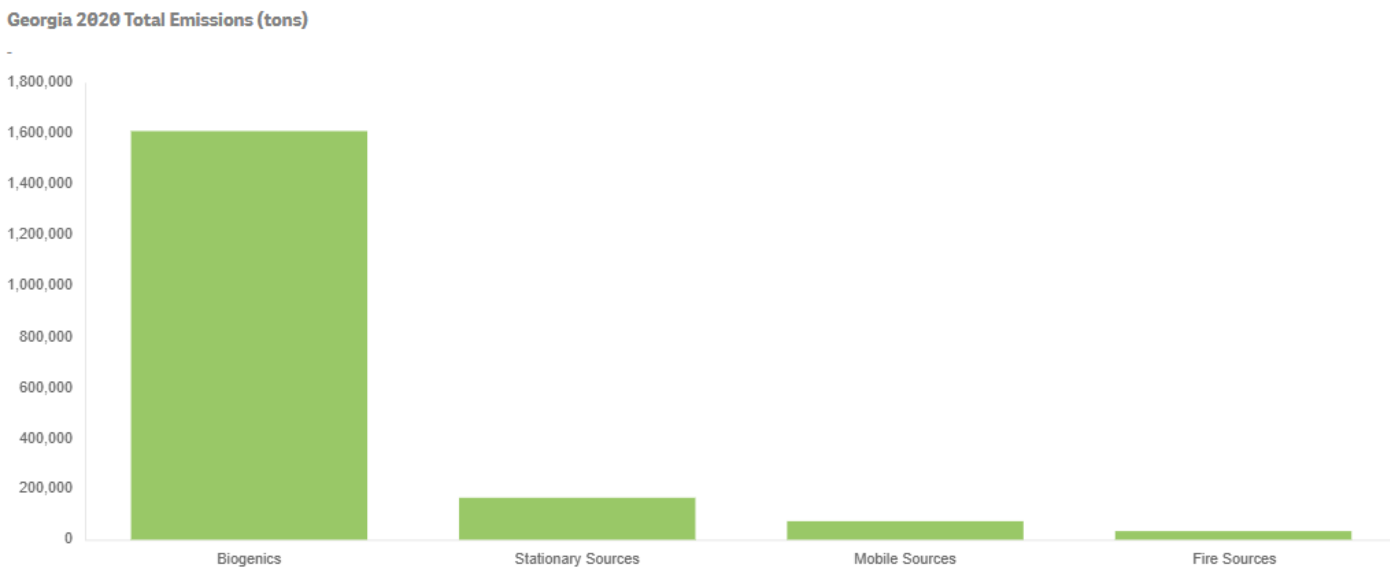


Figure 18.4: Common Sources of VOCs in Georgia in 2020

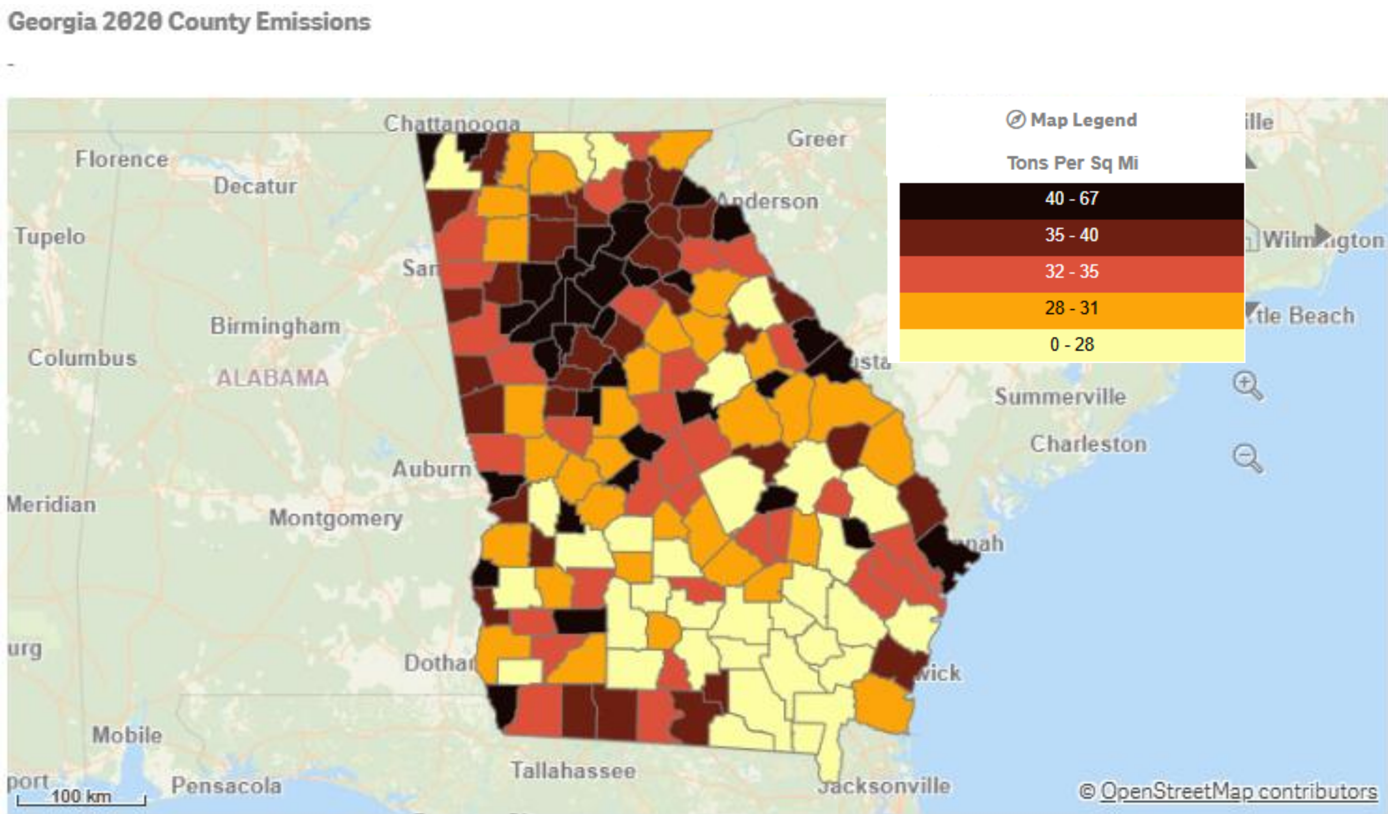


Figure 18.5: Spatial View of VOCs Emissions in Georgia

Figure 18.6 shows the seasonal occurrence of isoprene, the tracer for VOCs emissions from vegetation. Isoprene is a 5-carbon organic compound naturally released on a seasonal basis in large quantities by conifer trees native to Georgia. Evidence of isoprene's natural seasonal origin is shown in this figure, where the ambient concentration is essentially non-existent from November to May.

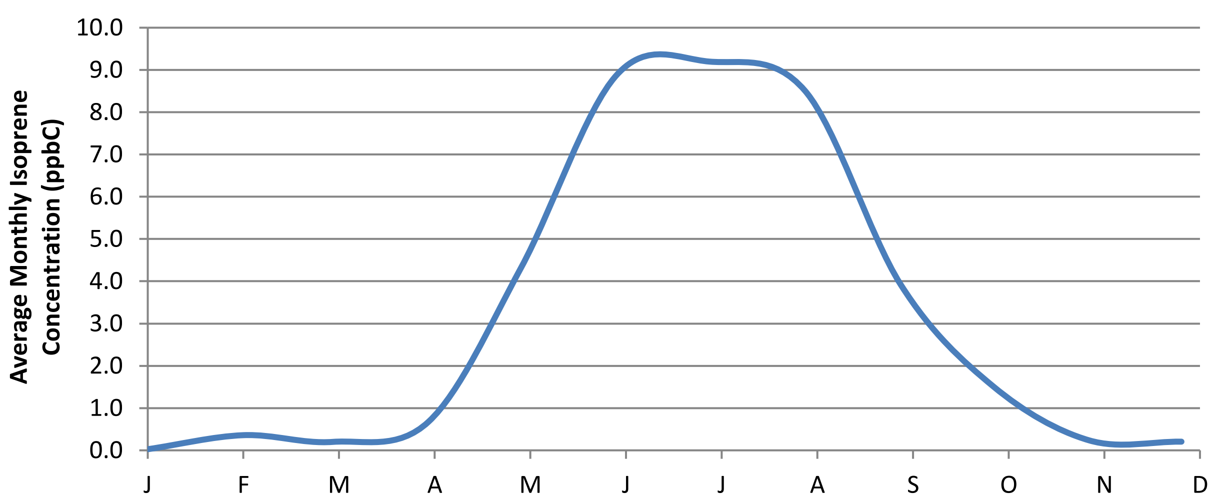


Figure 18.6: Average Yearly Profile of Isoprene

The anthropogenic VOCs compounds detected at all sites with the highest ozone formation potential are toluene, m/p xylene, propylene, ethylene, and isopentane. The sources for these five compounds are varied. All five compounds are emitted by mobile sources, with ethylene being an important tracer for vehicle emissions. Toluene (generally the most abundant species in urban air), m/p xylene, and isopentane are also emitted by solvent use and refinery activities. Toluene reaches the air from a variety of sources such as combustion of fossil fuels and evaporative emissions. This hydrocarbon is in motor vehicle fuel and is also used as a common solvent in many products such as paint. It has a substituted benzene ring possessing modest atmospheric reactivity. Figure 18.7 compares the seasonal occurrence of toluene.

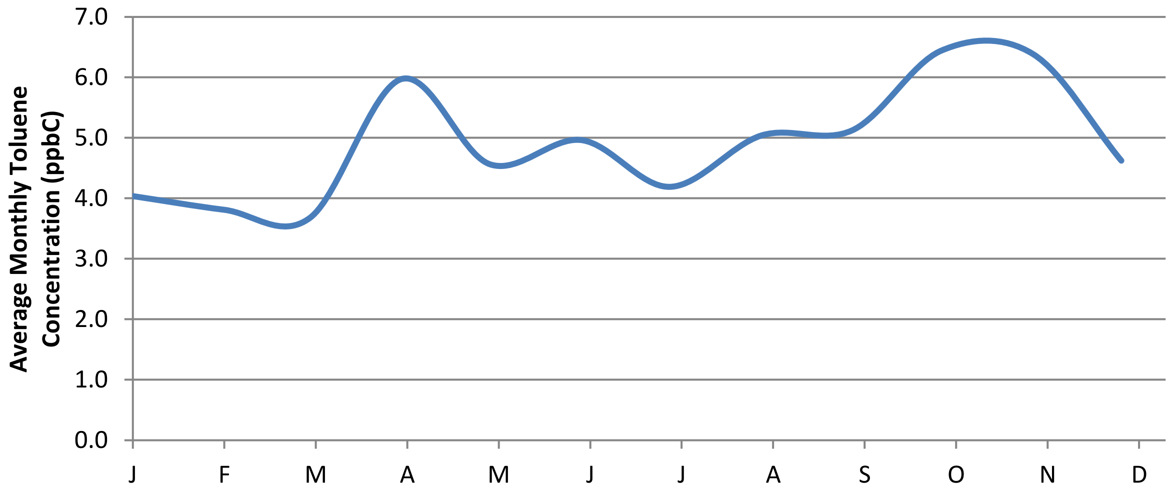


Figure 18.7: Toluene Average Annual Occurrence

As shown in Figure 18.7, the atmospheric levels of toluene are relatively constant throughout the year, suggesting a steady level of emissions year-round. Over the past eleven years, an occasional spike in concentration has occurred without evidence of a pattern.

As stated previously, ozone is formed when its precursors come together in the presence of strong sunlight. The reaction only occurs when both precursors are present, and the reaction itself consumes the precursors as it produces ozone. The amount of ozone produced, assuming sufficient sunlight, is controlled by what is known as the “limiting reactant.” Ozone production can only occur until the process has consumed all of any one of the required ingredients. As an example, natural background hydrocarbon levels are quite low in Los Angeles. Therefore, hydrocarbons are typically the reactant that limits how much ozone can be produced there. The control measures that involved reducing hydrocarbon emissions proved most effective in reducing smog in the Los Angeles area.

At the start of air quality control implementation in Georgia, the assumption was that Georgia was also hydrocarbon limited. However, the initial control measures seemed ineffective in actually reducing ozone levels. In time, researchers discovered that native vegetation naturally emits large quantities of hydrocarbons. Isoprene, the tracer for VOCs emissions from vegetation, is by far the largest contributor to ozone formation at all monitoring sites. Isoprene is a 5 carbon organic compound naturally released in large quantities by conifer trees. These trees are very abundant in the Southeastern United States, contributing a significant portion to the overall carbon loading of the atmosphere in this region. Isoprene’s chemical structure makes it a highly reactive substance with a short atmospheric lifetime and large ozone forming potential. The solution to ozone control in Georgia, then, would have to focus on a different limiting reactant. Since there will always be strong sunshine in the summer, and there will always be oxygen, the only effective way left to control ozone production is to reduce emissions of oxides of nitrogen.

18.1.3 Oxides of Nitrogen

Oxides of nitrogen exist in various forms in the atmosphere (Table 18.1). The most common is nitric oxide (NO), but other forms such as nitrogen dioxide (NO_2), nitric acid (HNO_3) and dinitrogen pentoxide (N_2O_5) are also present. The bulk of these compounds in the atmosphere are produced from high temperature combustion and lightning. Nitrogen is a very stable molecule and is essentially inert unless subjected to extreme conditions. The oxides of nitrogen are less stable, however, and are key participants in atmospheric chemistry, converting back and forth between numerous states under different conditions. Many of these reactions involve the conversion of oxygen atoms between their atomic (O_2) and ozone (O_3) forms. As such, oxides of nitrogen are studied as precursors of (and alternately by-products of) ozone formation. With the many forms of oxides of nitrogen in the atmosphere, they are sometimes referred to using the generic terms NO_x or NO_y. Nitric acid (HNO_3) is the most oxidized form of nitrogen in the atmosphere. This species is water-soluble and is removed from the atmosphere in the form of acidic raindrops.

NO is changed to NO_2 in very rapid atmospheric reactions. During daylight hours, ultraviolet (UV) radiation from the sun breaks apart NO_2 into NO and free oxygen (O). The free oxygen atom (O) will attach itself to molecular oxygen (O_2) creating an ozone (O_3) molecule. This is the origin of the majority of ground level ozone. With the UV radiation breaking apart the NO_2 and N_2O_5, daytime levels are low. Then the concentrations rise rapidly overnight with the lack of UV radiation. When the sun rises again in the morning, the compounds are converted back to NO and ozone. Figure 18.8 is a representation of the typical diurnal pattern of NO_2.

Table 18.1: Common Oxides of Nitrogen Species and Terms

ABBREVIATION	FULL NAME	CREATION PROCESSES	ELIMINATION PROCESSES
NO	Nitrous Oxide	Result of ozone photochemistry High-temperature combustion	Reacts with ozone to form NO_2 and oxygen
NO_2	Nitrogen Dioxide	High-temperature combustion Reaction of NO and ozone	Reacts with oxygen in strong sun to form ozone plus NO “washes out” in rain
HNO_3	Nitric Acid	$NO_2 + H_2O$	“washes out” in rain
PAN	Peroxyacetyl Nitrate	Oxidation of hydrocarbons in sunlight	Slow devolution to NO_2
NO_x	Name for NO + NO_2		
NO_y	Name for all atmospheric oxides of nitrogen- mostly NO, NO_2, HNO_3, N_2O_5, and PAN		

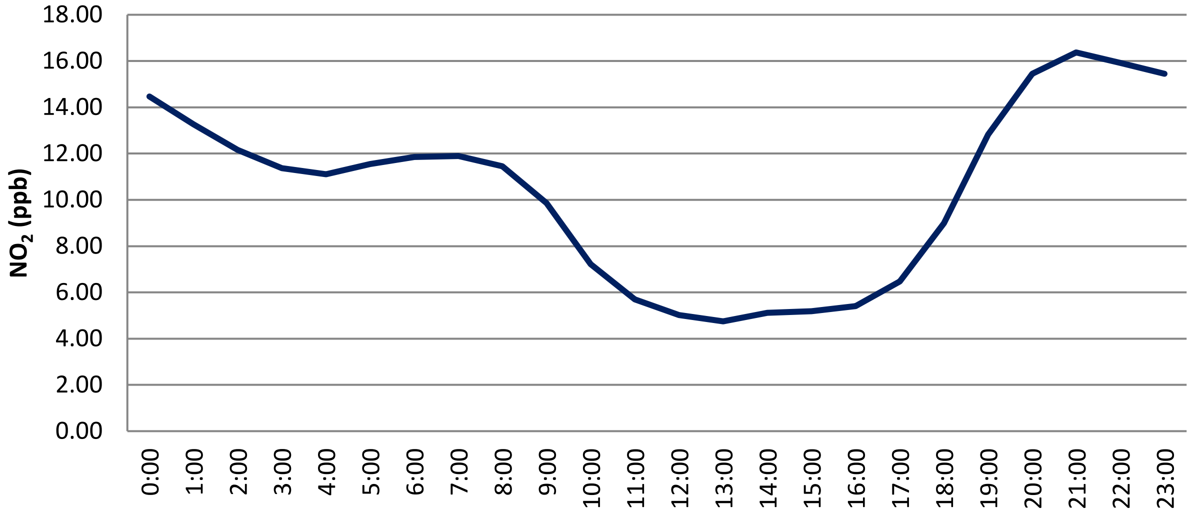


Figure 18.8: Typical Diurnal Pattern of Nitrogen Dioxide

Nitrogen dioxide (NO_2) is one of the important oxides of nitrogen. It is a light brown gas, and can be an important component of urban haze, depending upon local sources. Nitrogen oxides usually enter the air as the result of high-temperature combustion processes, such as those occurring in automobiles and industries (Figure 18.9). Home heaters, gas stoves, and non-road equipment also produce substantial amounts of NO_2. NO_2 is formed from the oxidation of nitric oxide (NO), which has a pungent odor at high concentrations and a bleach smell at lower concentrations. NO_2 is a precursor to ozone formation and can be oxidized to form nitric acid (HNO_3), one of the compounds that contribute to acid rain. Nitrate particles and NO_2 can block the transmission of light, reducing visibility.

Figure 18.10 shows a spatial view of the varying concentrations of nitrogen oxides by county in Georgia during 2020. Figures 18.9 and 18.10 are taken from the latest emissions report from EPA, based on 2020 data. Mobile sources are the biggest contributor to NO_x in Georgia.

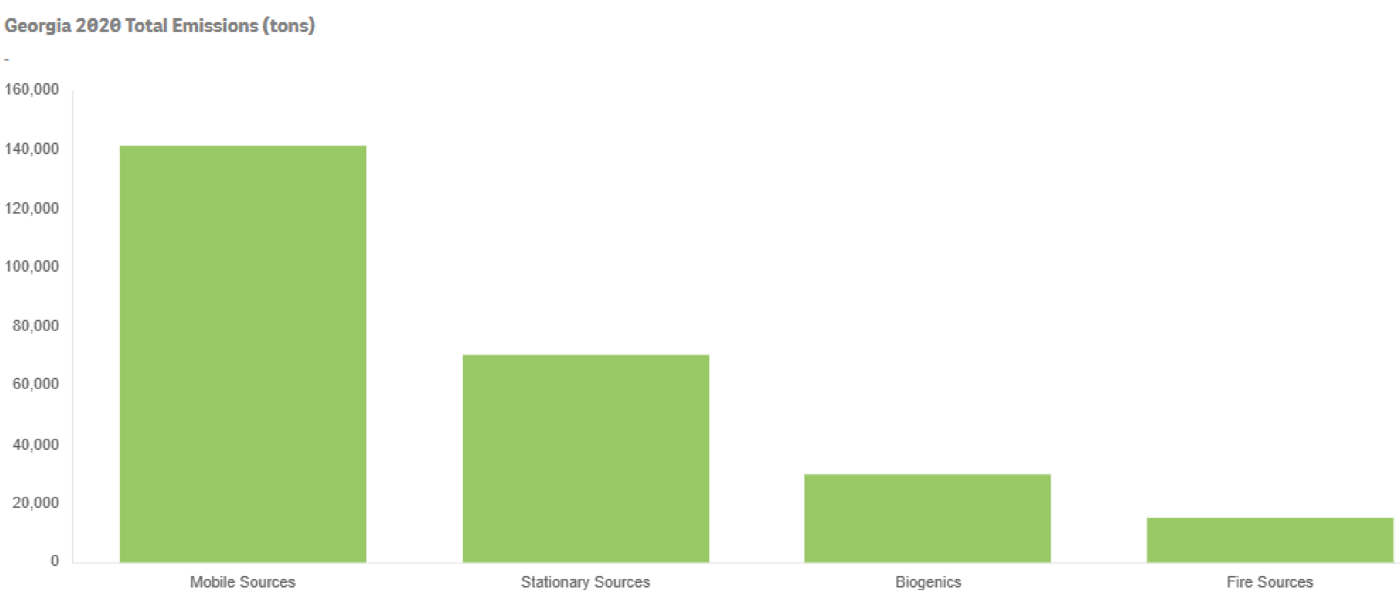


Figure 18.9: Common Sources of Nitrogen Oxides in Georgia in 2020

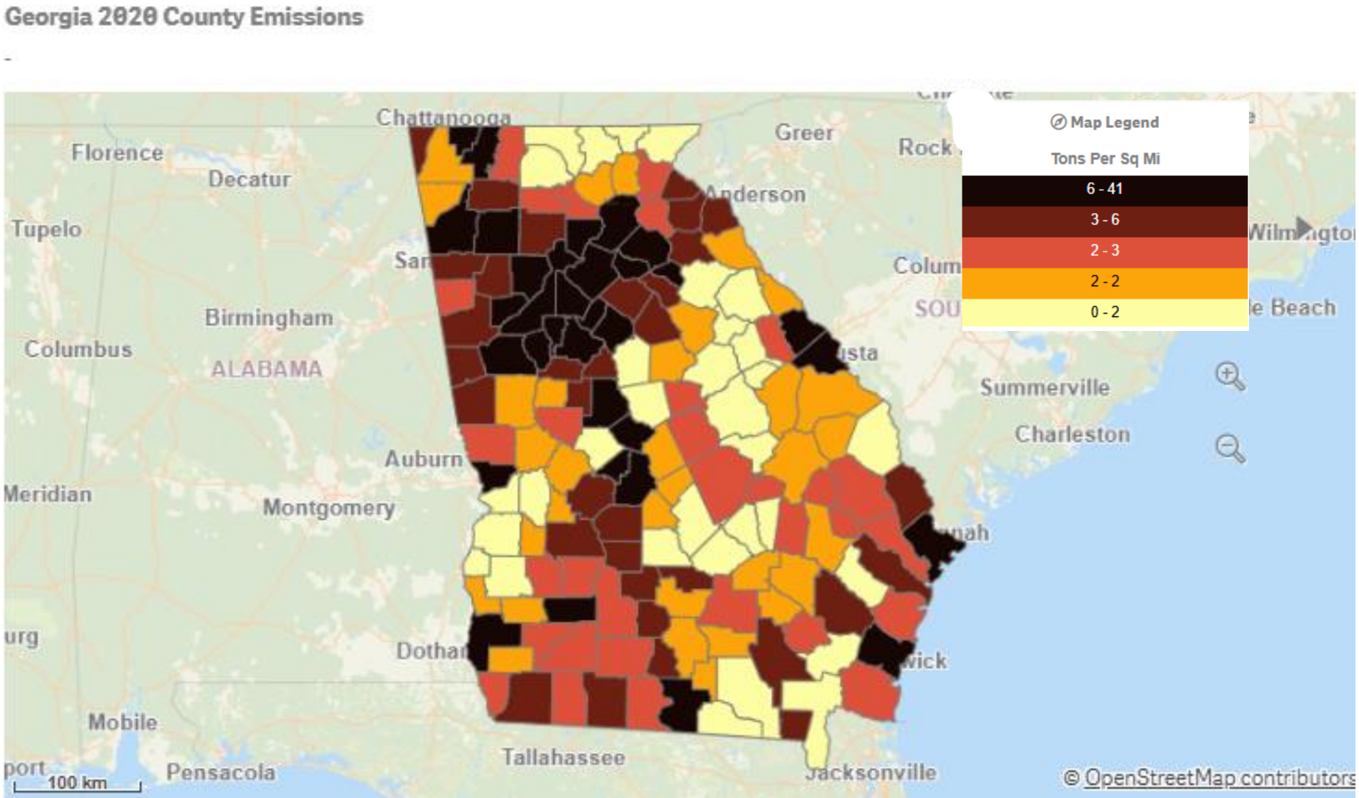


Figure 18.10: Spatial View of Nitrogen Oxides Emissions in Georgia

Efforts are being taken to reduce the emissions of harmful nitrogen oxides. School bus retrofitting, truck stop electrification, and locomotive conversions are three alternative methods that are being used to reduce emissions. School bus retrofitting focuses on older school buses that are being fitted with an emission control device to reduce emitted NO_x. A specific type of retrofit known as selective catalytic reduction (SCR) reduces output by converting nitrogen oxides to molecular nitrogen and oxygen-rich exhaust streams. SCR systems are enhanced by using a low sulfur fuel. The amount of sulfur in diesel was reduced by 90 percent, creating low sulfur fuel (https://www.epa.gov/diesel-fuel-standards/diesel-fuel-standards-and-rulemakings). As sulfur tends to hamper exhaust-control devices, the introduction of low sulfur fuel has allowed retrofitting to be an effective means of reducing emissions.

Truck stop electrification (TRE) reduces idling by diesel powered commercial trucks. Truck drivers are typically required to rest 8 hours for every 10 hours of travel time. During this resting period, diesel engines are idled as a means to power their air conditioning and heating systems. TRE eliminates this diesel dependence by providing an electrical system that charges battery-powered appliances including air conditioning, heating, and other electronic devices. In addition, cool or warm air is pumped into the trucks via a hose hookup at the truck stops as another method of cutting down on idling and emissions. All of this reduces oxides of nitrogen that would be produced by unnecessary idling.

Locomotive conversions reduce emissions by replacing old single diesel engines used by switch locomotives with smaller, more efficient modular diesel engines. Switch locomotives, or switchers, assemble and disassemble trains at rail yards. When they are not in action, they idle on the rails until another train comes along. The new engines, known as "genset" and eventually Tier 4 engines, utilize two or more smaller engines that can combine to equal the strength of the older engines to pull the maximum load. They can function individually, or with less horsepower, to handle less demanding loads, while cutting down on the fuel needed to perform the task. These lower-emitting off-road diesel engines also feature an automatic engine start/stop technology to reduce idling when not in use.

18.2 State Implementation Plan

The following excerpt is the *Final Submittal for Georgia's Redesignation Request and Maintenance Plan for the Atlanta Ozone Nonattainment Area for the 2018 8-Hour Ozone NAAQS*:

1.0 Introduction

This document contains technical support for the Georgia Environmental Protection Division's (EPD's) request to redesignate Bartow, Clayton, Cobb, DeKalb, Fulton, Gwinnett, and Henry counties (Atlanta Area) to attainment for the 2015 8-hour ozone National Ambient Air Quality Standard (NAAQS) pursuant to Sections 107(d)(3)(D) and (E) of the Clean Air Act (CAA), as amended. This redesignation request was prepared in accordance with U.S. EPA guidance memos issued on September 4, 1992 and October 28, 1992 from John Calcagni[1], and EPA's 2015 Ozone Implementation Guidance[2].

1.1 Atlanta Area Nonattainment Designation

On October 1, 2015, EPA promulgated the 8-hour ozone standard of 0.070 ppm. On June 4, 2018, EPA published a final rule in the Federal Register designating 7-counties surrounding the City of Atlanta as marginal nonattainment for the 2015 8-hour ozone National Ambient Air Quality Standard (83 FR 25776). The 7-county area includes the counties of Bartow, Clayton, Cobb, DeKalb, Fulton, Gwinnett, and Henry (Atlanta Nonattainment Area).

According to EPA's 2015 Ozone Implementation Guidance, the attainment deadline for marginal areas was August 3, 2021. The CAA allows a three-year period from the effective date of designation for a 'Marginal' nonattainment area to attain the NAAQS. In this case, the last designations were effective on August 3, 2018 (83 FR 25776).

On February 11, 2021, EPD submitted 2020 ozone ambient air quality data to EPA. EPA concurred with the certification on February 23, 2021. With an attainment deadline of August 3, 2021, marginal areas were required to attain the National Ambient Air Quality Standard (NAAQS) by the end of the 2020 ozone season (October 31, 2020). EPD has determined that the Atlanta Area has attained the 8-hour ozone NAAQS of 0.070 ppm based on ambient air quality data from 2018-2020 and is requesting redesignation to attainment. This request is based on ambient air quality data from 2018-2020. The Atlanta Area will continue to be in marginal nonattainment until this request to be redesignated to attainment, along with an applicable Section 175A Maintenance Plan, is approved by EPA.

[1] "Procedures for Processing Requests to Redesignate Areas to Attainment", September 4, 1992, and "State Implementation Plan (SIP) Requirements Submitted in Response to Clean Air Act (Act) Deadlines", October 28, 1992, John Calcagni, Director, Air Quality Management Division, USEPA.

[2] "Implementation of the 2015 National Ambient Air Quality Standards for Ozone: State Implementation Plan

Requirements; Final Rule"; 83 FR 62998-63036.

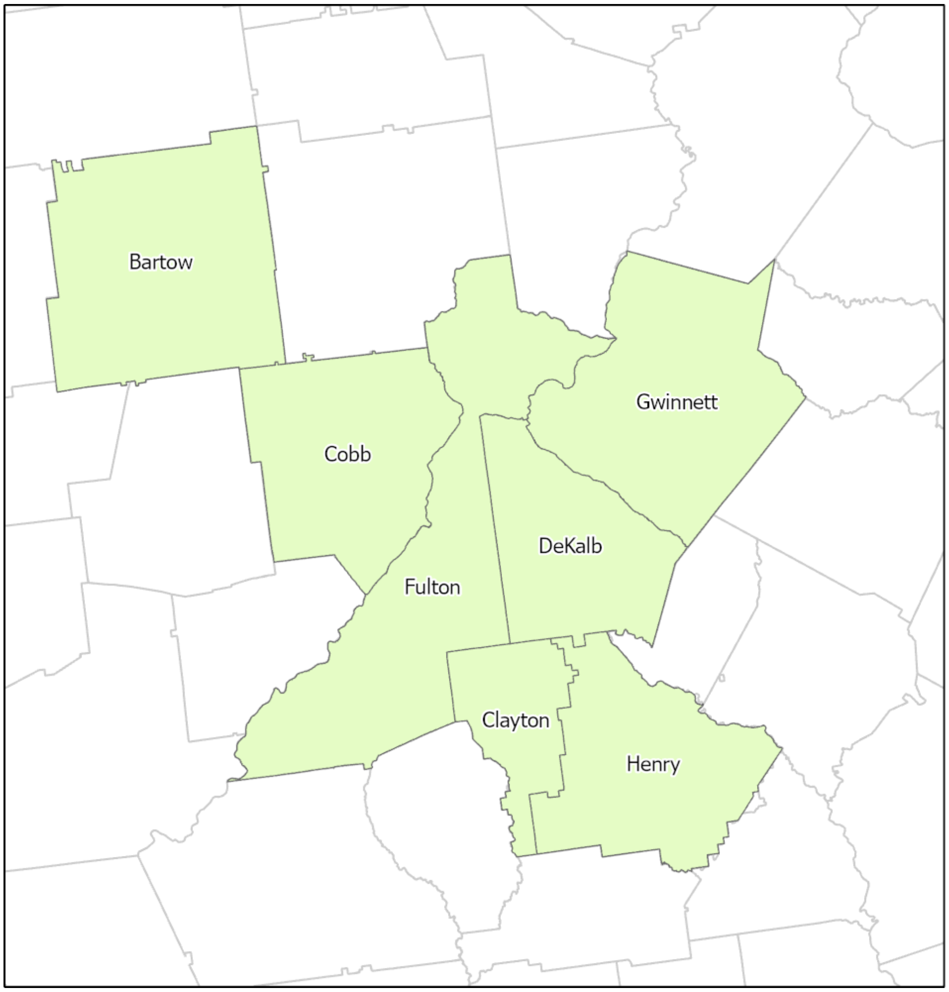


Figure 1-1. 2015 Ozone NAAQS Nonattainment Area in Georgia

1.2 Redesignation Request

This document contains Georgia's request that the metro Atlanta nonattainment area be redesignated to attainment with respect to the 2015 8-hour ozone NAAQS. Section 107(d) of the CAA states that an area can be redesignated to attainment if the following conditions are met:

1. *The EPA has determined that the NAAQS has been attained.*
2. *The applicable implementation plan has been fully approved by EPA under Section 110(k) of the CAA.*
3. *The EPA has determined that the improvement in air quality is due to permanent and enforceable reductions in emissions.*
4. *The state has met all applicable requirements for the area under Title 1 (Part A, Section 110 and Part D) of the CAA.*
5. *The EPA has fully approved a maintenance plan, including a contingency plan, for the area as required by CAA Section 175A.*

The supporting documentation to show that items 1 through 4 have been met is contained in Section 2 of this document. EPA's approval of the maintenance plan detailed in Section 3.0 of this document will satisfy item 5.

1.3 Maintenance Plan

The maintenance plan (see item 5 under Section 1.2 above) has two required components under Section 175A of the CAA:

- *A demonstration of maintenance of the standard for at least ten years after redesignation; and*
- *Contingency provisions for prompt correction of any future violations.*

Per EPA guidance[3], the metro Atlanta 8-hour ozone maintenance plan also includes the following elements:

- *An attainment year emissions inventory (to support the maintenance demonstration);*
- *A commitment to continued operation of ambient monitoring equipment in the area; and*
- *Verification of continued attainment.*

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[3] *"Procedures for Processing Requests to Redesignate Areas to Attainment", September 4, 1992, John Calcagni, Director, Air Quality Management Division, OAQPS, USEPA.*

2.0 Redesignation Request

As noted in Section 1.2 of this document, Section 107(d) of the CAA states that an area can be redesignated to attainment if the following conditions are met:

1. *The EPA has determined that the NAAQS has been attained.*
2. *The applicable implementation plan has been fully approved by EPA under Section 110(k) of the CAA.*
3. *The EPA has determined that the improvement in air quality is due to permanent and enforceable reductions in emissions.*
4. *The state has met all applicable requirements for the area under Title 1 (Part A, Section 110 and Part D) of the CAA.*
5. *The EPA has fully approved a maintenance plan, including a contingency plan, for the area under Section 175A of the CAA.*

This section of the document includes supporting documentation for items 1 through 4 above.

2.1 Attainment of the 8-Hour Ozone NAAQS

A monitoring site is in attainment of the 8-hour ozone standard when the average of the annual fourth-highest daily maximum concentration over three consecutive years measured at the monitor does not exceed 0.070 ppm. This 3-year average is termed the "design value" for the monitor. The data must be complete and quality-assured, consistent with 40 CFR Part 58 requirements and other relevant EPA guidance. Therefore, for a single site to meet the standard, the design value calculated from the previous three calendar years must be less than or equal to the standard. For a nonattainment area to achieve attainment, all monitoring sites in the nonattainment area must be in attainment.

EPD maintains eight ozone monitoring sites in the Atlanta Core-Based Statistical Area (Atlanta CBSA). The design values for the Atlanta CBSA monitors, based on data from 2018 through 2020, range from 0.062 ppm to 0.070 ppm, which demonstrates attainment of the standard. The monitoring network and ambient ozone data are presented below.

2.1.1 Monitoring Network

Ozone is monitored using EPA-approved reference or equivalent methods. These analyzers continuously measure the concentration of ozone in the ambient air using the ultraviolet photometric method. EPD operates seven of nine ozone monitors located in the Atlanta CBSA from March 1st through October 31st. The eighth monitor is a National Core Monitoring Network (NCore) ozone monitor (South DeKalb, 13-089-0002) that EPD operates year-round. The ninth monitor is part of the Clean Air Status and Trends Network (CASTNET, 13-231- 9991) that EPA operates year-round. All the ozone monitors in the Atlanta CBSA are operated according to the requirements of 40 CFR Part 58. During the monitoring season analyzers are subjected to multiple calibration checks, and on an annual basis EPD's Quality Assurance Unit audits these samplers.

EPD began monitoring ozone at the South DeKalb site (13-089-0002) in 1974. Since that time, the EPD ozone-monitoring network has grown to eight ozone monitors operating within the Atlanta CBSA. All eight ozone monitors are part of the State and Local Ambient Monitoring Stations (SLAMS) network. Also, the South DeKalb (13-089-0002) ozone monitor is designated a

Photochemical Assessment Monitoring Stations (PAMS) site.

In addition, as part of the Clean Air Status and Trends Network (CASTNET), EPA established a monitoring site in Georgia in 1988. The CASTNET site is part of a national air quality monitoring network put in place to assess long-term trends in atmospheric deposition and ecological effects of air pollutants. The CASTNET site is one of 85 regional sites across rural areas of the United States and Canada measuring nitrogen, sulfur, and ozone concentrations, and deposition of sulfur and nitrogen. Like the South DeKalb ozone monitor, the CASTNET ozone monitor also collects data year-round. As of 2011, the CASTNET ozone monitor met the Code of Federal Regulations (40 CFR) quality assurance and completeness criteria. Therefore, data collected by this monitor in 2011 and beyond can be used for comparison to the NAAQS. Table 2-1 lists the metro Atlanta ozone monitors shown in Figure 2-1 and their respective start dates.

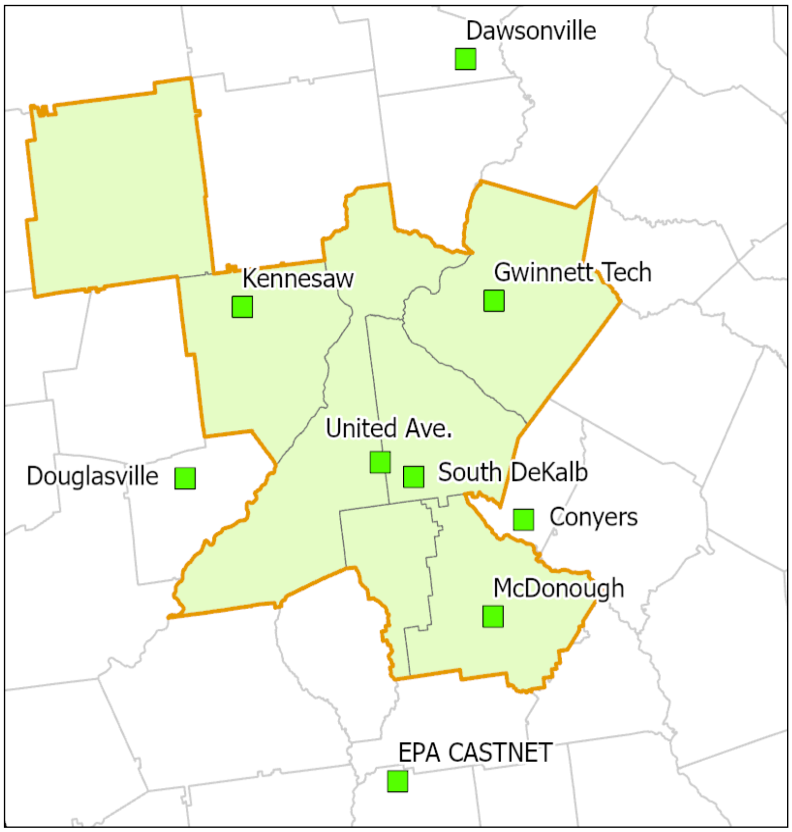


Figure 2-1. Locations of Ozone Monitors in the Atlanta Area

Table 2-1. Metro Atlanta Data Collection Sites

Site Name – Address	AQS Site ID	Start Date
Kennesaw – Georgia National Guard, 1901 McCollum Parkway	13-067-0003	Sept. 1, 1999
South DeKalb – 2390-B Wildcat Road	13-089-0002	Jan. 1, 1974
Douglasville – Douglas County Water Authority, 7725 W. Strickland St.	13-097-0004	Aug. 15, 1997
Gwinnett Tech – 5150 Sugarloaf Pkwy, Lawrenceville	13-135-0002	March 17, 1995
McDonough – Blessings Thrift Store, 86 Work Camp Road	13-151-0002	June 7, 1999
Conyers – Monastery, 2625 GA Highway 212	13-247-0001	July 26, 1978
United Ave. – 945 East United Ave.	13-121-0055	Oct. 1, 1991
Dawsonville – Georgia Forestry Commission, 4500 Georgia Highway 53 East	13-085-0001	January 1, 1985
CASTNET – GA Agricultural Experiment Station, Pike County	13-231-9991	Jan. 1, 2011+

+As of 2011, the CASTNET ozone monitor met the Code of Federal Regulations (40 CFR) quality assurance and completeness criteria. Therefore, as of 2011, data collected by this monitor can be used for comparison to the NAAQS.

2.1.2 Ambient Ozone Data

Table 2-2 shows the 8-hour ozone concentrations and the associated 3-year design value average that demonstrate attainment of the standard in the Atlanta Area. The 2018–2020 3-year design values range from 0.061 ppm to 0.070 ppm, all of which meet the standard of 0.070 ppm.

Table 2-2. 2018, 2019, and 2020 4th High Maximum Values and 2018-2020 8-Hour Ozone Design Values for Counties in the Atlanta Area

County	Monitor Location (AQS Site ID)	2018 4th max (ppb)	2019 4th max (ppb)	2020 4th max (ppb)	2018-2020 Design Value (ppb)
Cobb	Kennesaw (13-067-0003)	65	67	56	62
Dawson	Dawsonville (13-085-0001)	65	62	57	61
DeKalb	South DeKalb (13-089-0002)	67	73	61	67
Douglas	Douglasville (13-097-0004)	64	72	56	64
Fulton	United Avenue (13-121-0055)	72	75	63	70
Gwinnett	Gwinnett (13-135-0002)	65	68	66	66
Henry	McDonough (13-151-0002)	69	75	58	67
Pike	CASTNET (13-231-9991)	65	68	54	62
Rockdale	Conyers (13-247-0001)	69	72	60	67

2.1.3 Determination of Attainment by Applicable Attainment Date

With an attainment deadline of August 3, 2021, marginal areas were required to attain the National Ambient Air Quality Standard (NAAQS) by the end of the 2020 ozone season (October 31, 2020). EPD's ozone data for 2018 through 2020 was certified and quality assured by EPD's Ambient Monitoring Program and the 2020 data was certified on February 11, 2021 showing that the Atlanta area attained the 2015 ozone standard before the August 3, 2021 attainment deadline. EPA concurred with the certification on February 23, 2021. Item 1 in Section 2.0 of this document has been met.

2.2 Requirements Under Section 110(k)

Section 110(k) of the CAA addresses EPA's responsibilities and requirements for acting on state implementation plan submittals including completeness criteria, completeness findings, effect of findings of incompleteness, deadlines for action by EPA, full and partial approvals and disapprovals, conditional approvals, calls for plan revisions, and corrections. A September 4, 1992 memo from John Calcagni of EPA[4] states the following:

"The SIP for the area must be fully approved under section 110(k) and must satisfy all requirements that apply to the area. It should be noted that approval action on SIP elements and the redesignation request may occur simultaneously."

EPA accepted and concurred that EPD's ozone data for 2018 through 2020 was certified and quality assured. This data demonstrated that the Atlanta Area had attained the 2015 8-Hour Ozone NAAQS. When EPA designates the Atlanta Area in the Federal Register, the Atlanta

[4] *"Procedures for Processing Requests to Redesignate Areas to Attainment", September 4, 1992, John Calcagni, Director, Air Quality Management Division, USEPA.*

nonattainment area will have attained the 2015 8-hour ozone NAAQS. Item 2 in Section 2.0 of this document has been met.

2.3 Permanent and Enforceable Reductions in Emissions

In order for the nonattainment area to be redesignated to attainment, the State must demonstrate (and EPA must concur) that the improvement of ambient ozone concentrations during the years 2018-2020 is due to permanent and enforceable reductions in emissions. This subsection contains EPD's demonstration that the improved air quality is due to permanent and enforceable emissions reductions.

Table 2-3 and Figure 2-2 show the measured annual fourth highest daily maximum 8-hour ozone concentration at each of the monitors in the Atlanta Area. Table 2-4 and Figure 2-3 show design values at each of the monitors in the Atlanta Area. The continuing drop in ozone concentrations and the implementation of federally enforceable control measures lend strong evidence that the improvements in air quality are a result of reductions in emissions and not a meteorological *influenced phenomenon.*

Figure 2-4 shows the average temperature and precipitation during May-September in Atlanta, Georgia from 1930-2020. The 2018-2020 average temperature and precipitation fluctuates around the average meteorological conditions, with 2018, 2019, and 2020 being hotter than the 1930-2020 average temperature and 2018 and 2020 wetter than the 1930-2020 average precipitation. Figure 2-5 compares the 2020 temperature and precipitation and shows the departure from the mean of 1930-2019. Figure 2-6 compares the ratio of 2020 temperature and precipitation to the mean from 1930-2019. In 2020, four of eight ozone season months were above the monthly average temperature and six of eight months were above the monthly average precipitation. Similar results are shown in Figure 2-7 which ranks temperature and precipitation across the continental U.S. Based on this information, it was concluded that the 2018-2020 period for the Atlanta Area was not unusually cool or wet and that meteorologyis not responsible for the decreasing ozone trends.

Table 2-3. 4th Highest Ozone Concentration (ppb) – Atlanta Area Monitors

Ozone Monitor Name (AIRS ID)	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***
Kennesaw (13-067-0003)	*76*	*79*	*79*	*75*	*67*	*63**	*66*	*70*	*65*	*65*	*67*	*56*
Dawsonville (13-085-0001)	*67*	*73*	*66*	*63*	*63*	*66*	*63*	*67*	*65*	*65*	*62*	*57*
South DeKalb (13-089-0002)	*77*	*75*	*80*	*85*	*62*	*70*	*71*	*74*	*68*	*67*	*73*	*61*
Douglasville (13-097-0004)	*72*	*74*	*78*	*73*	*63*	*65*	*70*	*71*	*66*	*64*	*72*	*56*
United Avenue (13-121-0055)	*77*	*80*	*84*	*87*	*69*	*73*	*77*	*75*	*74*	*72*	*75*	*63*
Gwinnett (13-135-0002)	*73*	*72*	*82*	*80*	*69*	*68*	*71*	*78*	*65*	*65*	*68*	*66*
McDonough (13-151-0002)	*74*	*78*	*82*	*88*	*70*	*75*	*70*	*78*	*67*	*69*	*75*	*58*
CASTNET (13-231-9991)			*75*	*77*	*64*	*66*	*68*	*71*	*62*	*65*	*68*	*54*
Conyers (13-247-0001)	*70*	*76*	*81*	*81*	*71*	*79*	*68*	*76*	*65*	*69*	*72*	*60*
AVERAGE	***73***	***76***	***79***	***79***	***66***	***69***	***69***	***73***	***66***	***67***	***70***	***59***

**The Kennesaw monitor did not meet the annual data completeness requirements of 75% in 2014.*

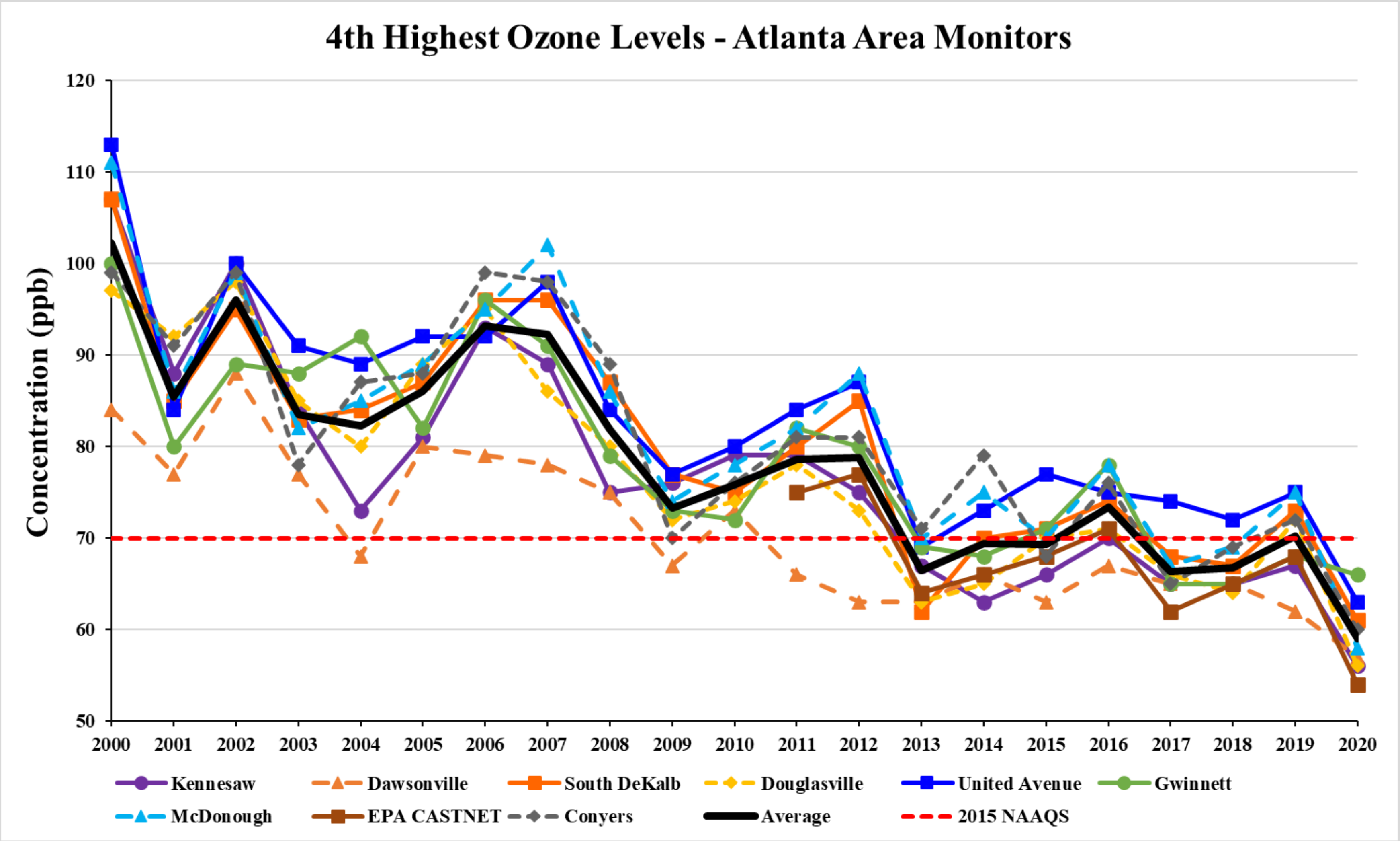


Figure 2-2. Annual 4th High Daily Maximum 8-Hour Ozone Concentrations for 2000 to 2020 for Atlanta Area Ozone Monitors.

Table 2-4. Ozone Design Value Concentrations (ppb) – Atlanta Area Monitors

Ozone Monitor Name (AIRS ID)	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Kennesaw (13-067-0003)	80	76	78	77	73	68*	65*	66*	67	66	65	62
Dawsonville (13-085-0001)	73	71	68	67	64	64	64	65	65	65	64	61
South DeKalb (13-089-0002)	86	79	77	80	75	72	67	71	71	69	69	67
Douglasville (13-097-0004)	79	75	74	75	71	67	66	68	69	67	67	64
United Avenue (13-121-0055)	86	80	80	83	80	76	73	75	75	73	73	70
Gwinnett (13-135-0002)	81	74	75	78	77	72	69	72	71	69	66	66
McDonough (13-151-0002)	87	79	78	82	80	77	71	74	71	71	70	67
CASTNET (13-231-9991)					72	69	66	68	67	66	65	62
Conyers (13-247-0001)	85	78	75	79	77	77	72	74	69	70	68	67
AVERAGE	**82**	**77**	**76**	**78**	**74**	**71**	**68**	**70**	**69**	**68**	**67**	**65**

**The Kennesaw monitor did not meet the annual data completeness requirements of 75% in 2014; therefore, 2014, 2015, and 2016 design values are not valid.*

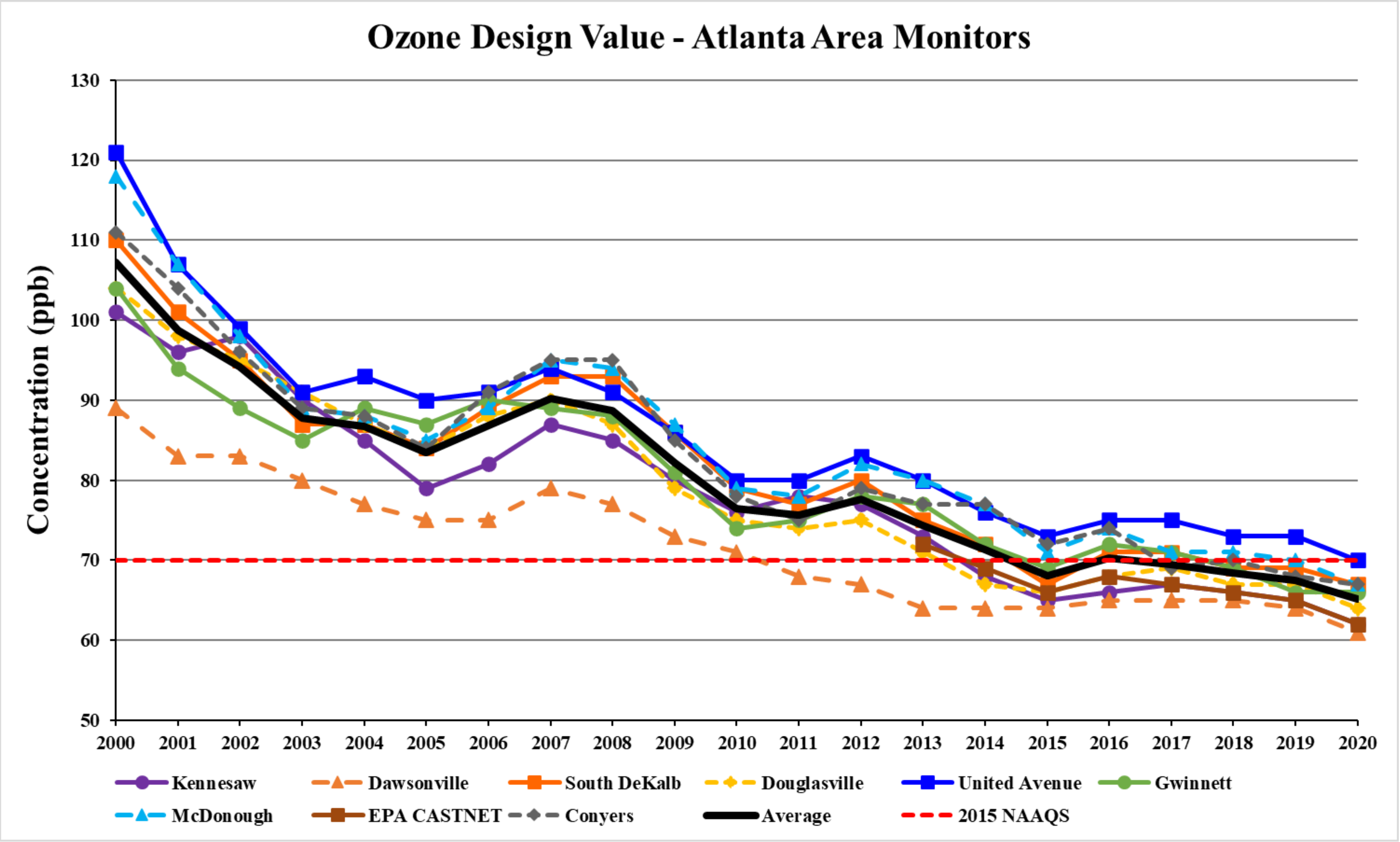
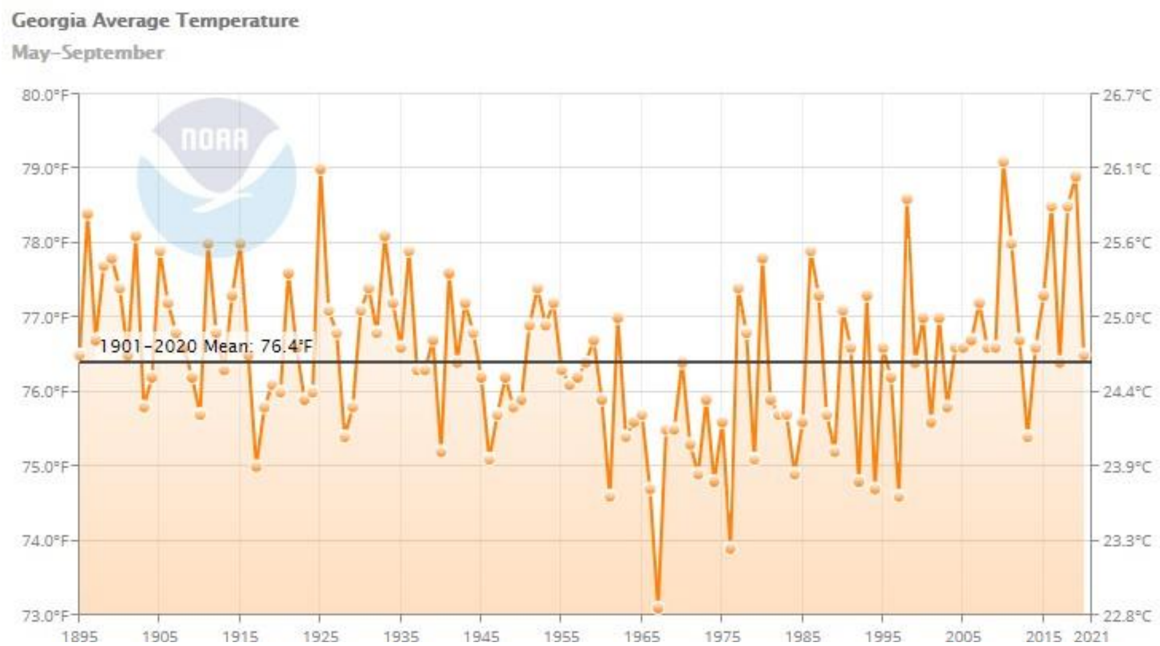
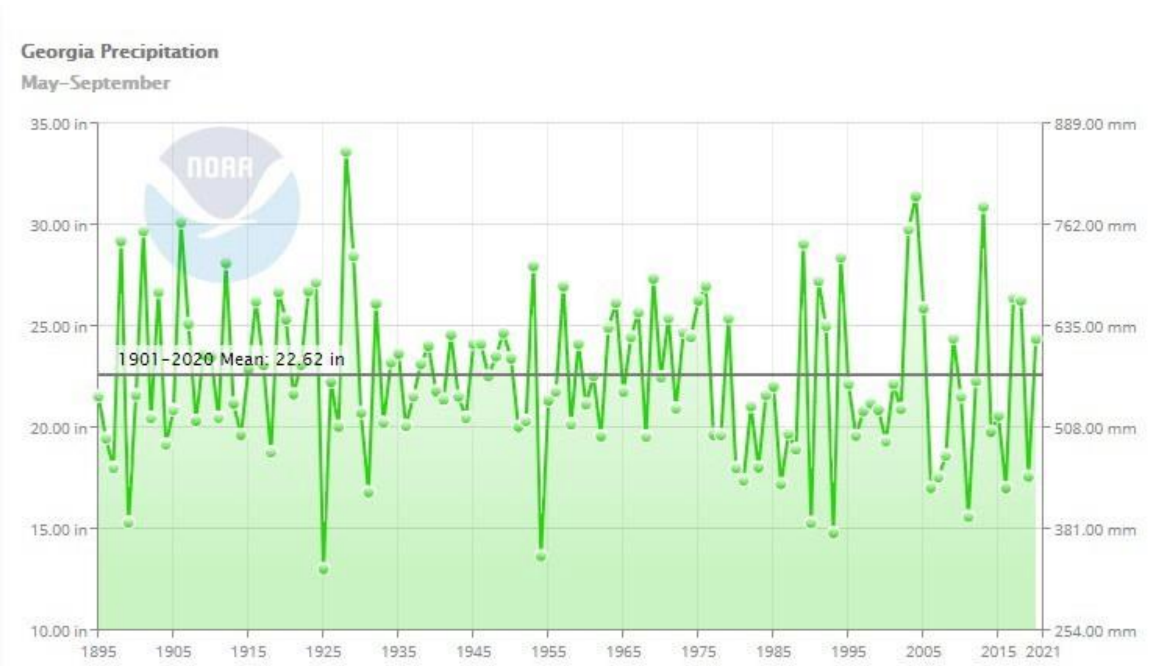


Figure 2-3. Ozone Design Values for 2000 to 2020 for Atlanta Area ozone monitors.





**Obtained from NOAA website (http://www.ncdc.noaa.gov/cag).*

Figure 2-4. Trend of Average Temperatures (top) and Precipitation (bottom) during May-September in Atlanta, Georgia

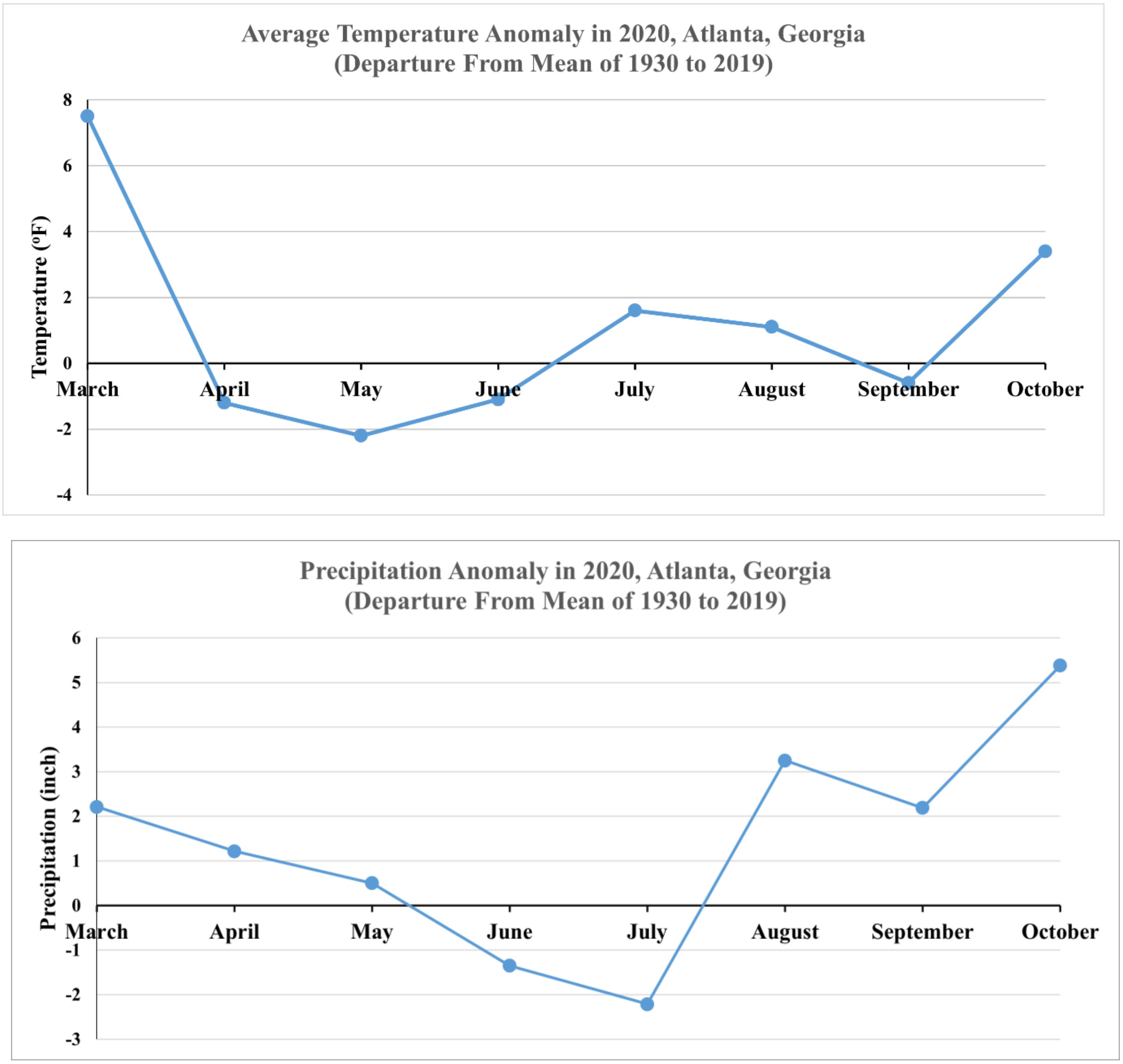
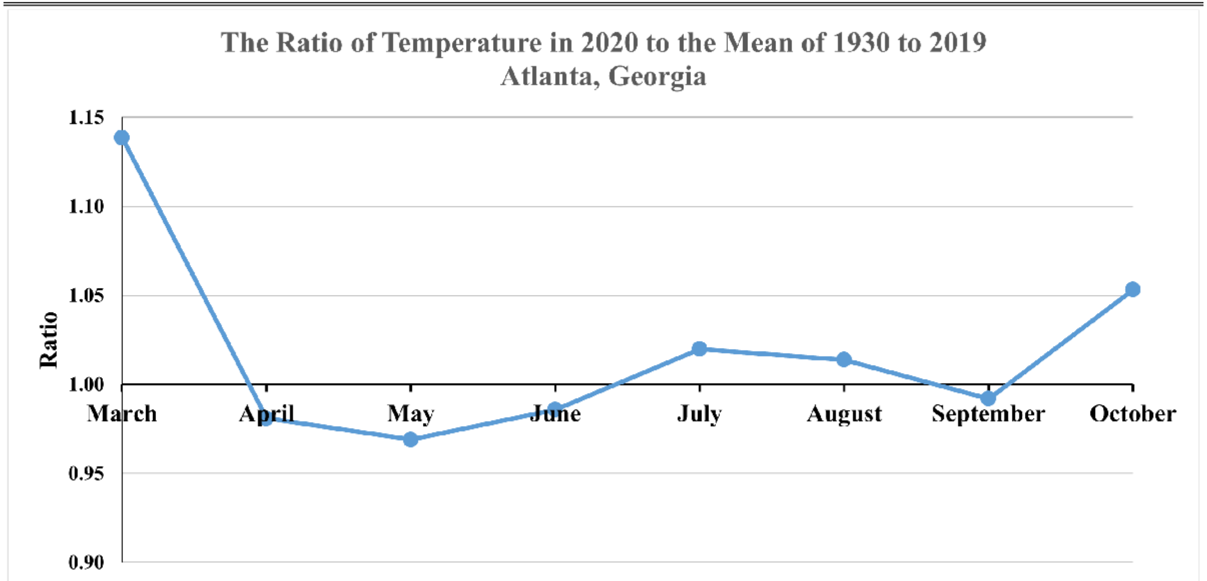


Figure 2-5. Trend of Temperature Anomaly in 2020 (top) and Precipitation (bottom) (Departure of the Mean of 1930 to 2019) in Atlanta, Georgia



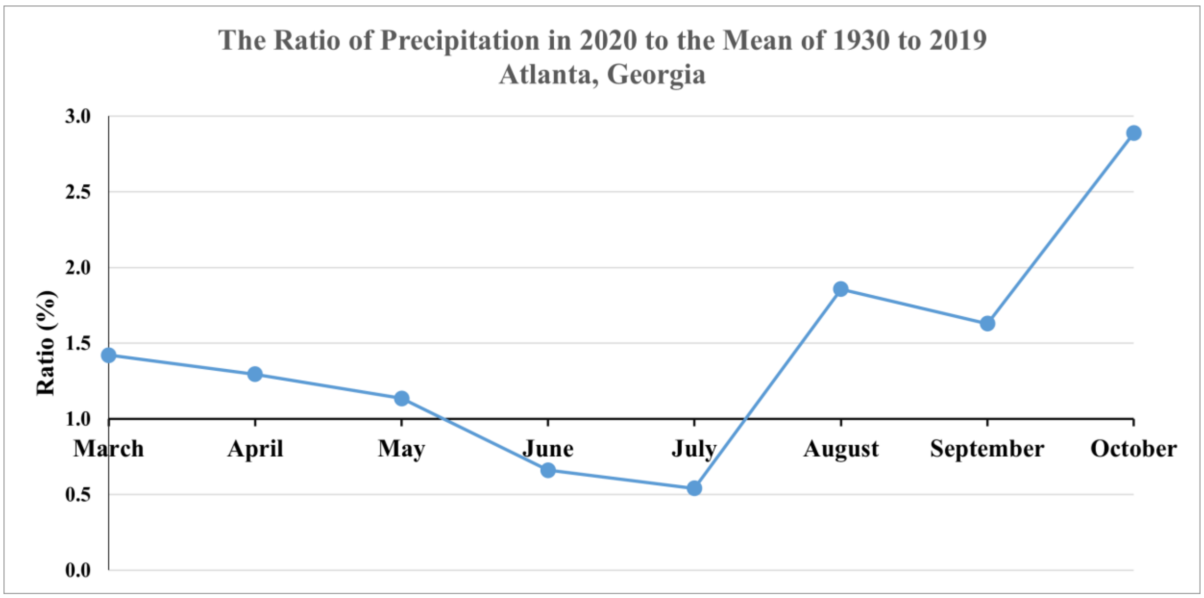
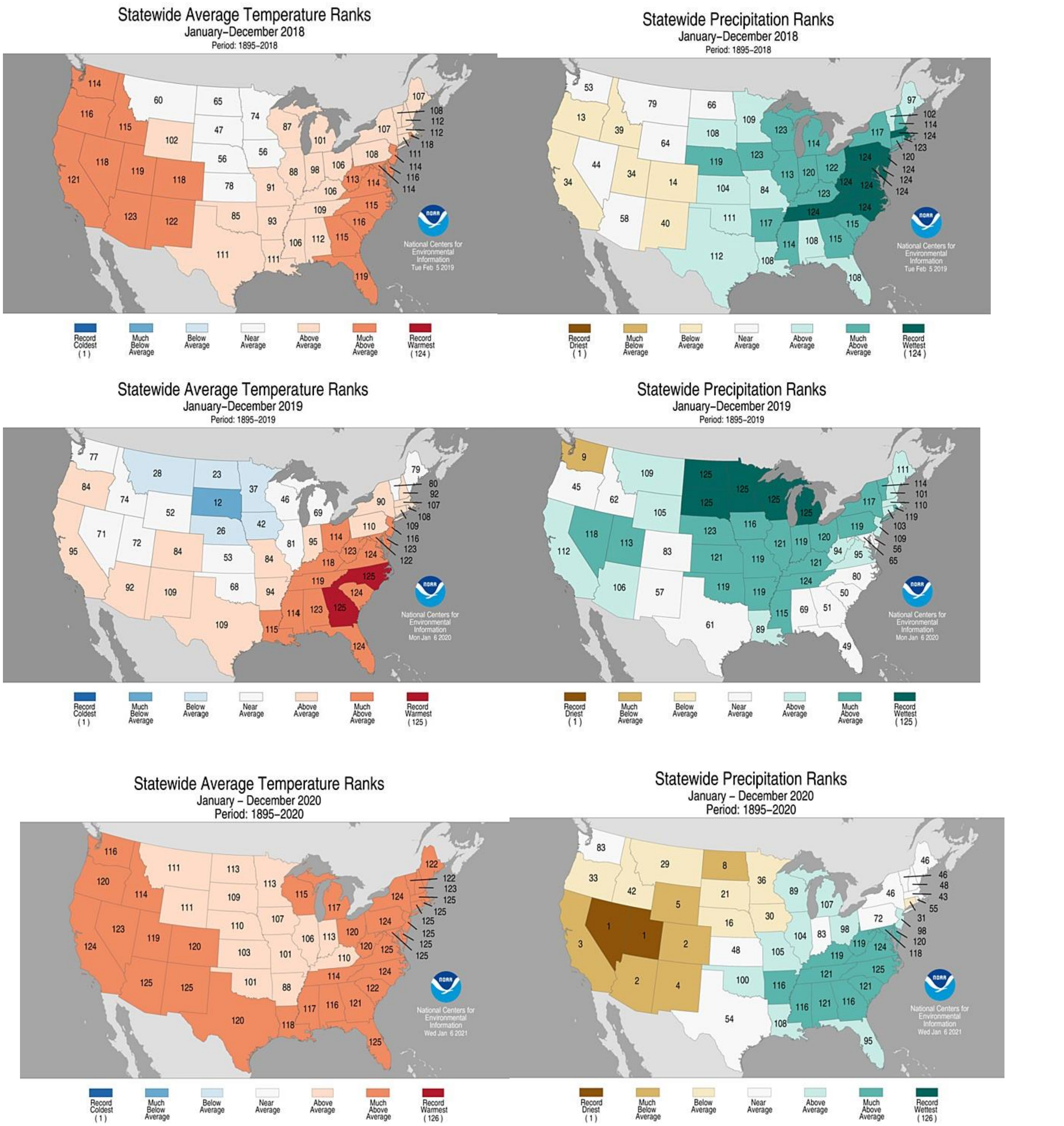


Figure 2-6. Trend of Ratio of Temperature in 2020 to the Mean of 1930 to 2019 (top) and Precipitation (bottom) in Atlanta, Georgia



**Obtained from NOAA website (http://www.ncdc.noaa.gov/temp-and-precip/us-maps/)*

Figure 2-7. Statewide Ranks of Average Temperature (left) and Precipitation (right) during 2018 (top), 2019 (middle), and 2020 (bottom)

In order to evaluate the impact of COVID-19 on vehicle traffic in 2020, a comparison was made between Atlanta area traffic in the three years composing the attaining 2018-2020 design value for the 2015 ozone NAAQS. EPD acquired traffic count data at 15-minute intervals from the Georgia Department of Transportation (GDOT) for all traffic counter sites in the state of Georgia from 2018-2020. Each vehicle passing a sensor was counted as one vehicle. This pool of data was filtered for the 7-county nonattainment area as well as for all traffic counter sites where data was available in each month of 2018, 2019, and 2020 to ensure an apples-to- apples comparison. Within this group of sites, the data was further filtered to guarantee all sites covered the same periods across years (e.g., if a site had invalidated data on October 22, 2018, then October 22, 2019 and October 22, 2020 were also excluded). A total of 58 qualified sites covering 6 of the 7 counties in the nonattainment area were used in the comparison (Figure 2-8). The shaded area in Figure 2-8 represents the 7-county Atlanta nonattainment area for the 2015 ozone NAAQS. Once all the data filters were applied, the remaining data were grouped into 36 monthly files and all the counts were summed for each month. Detailed data is available in Appendix A-1.

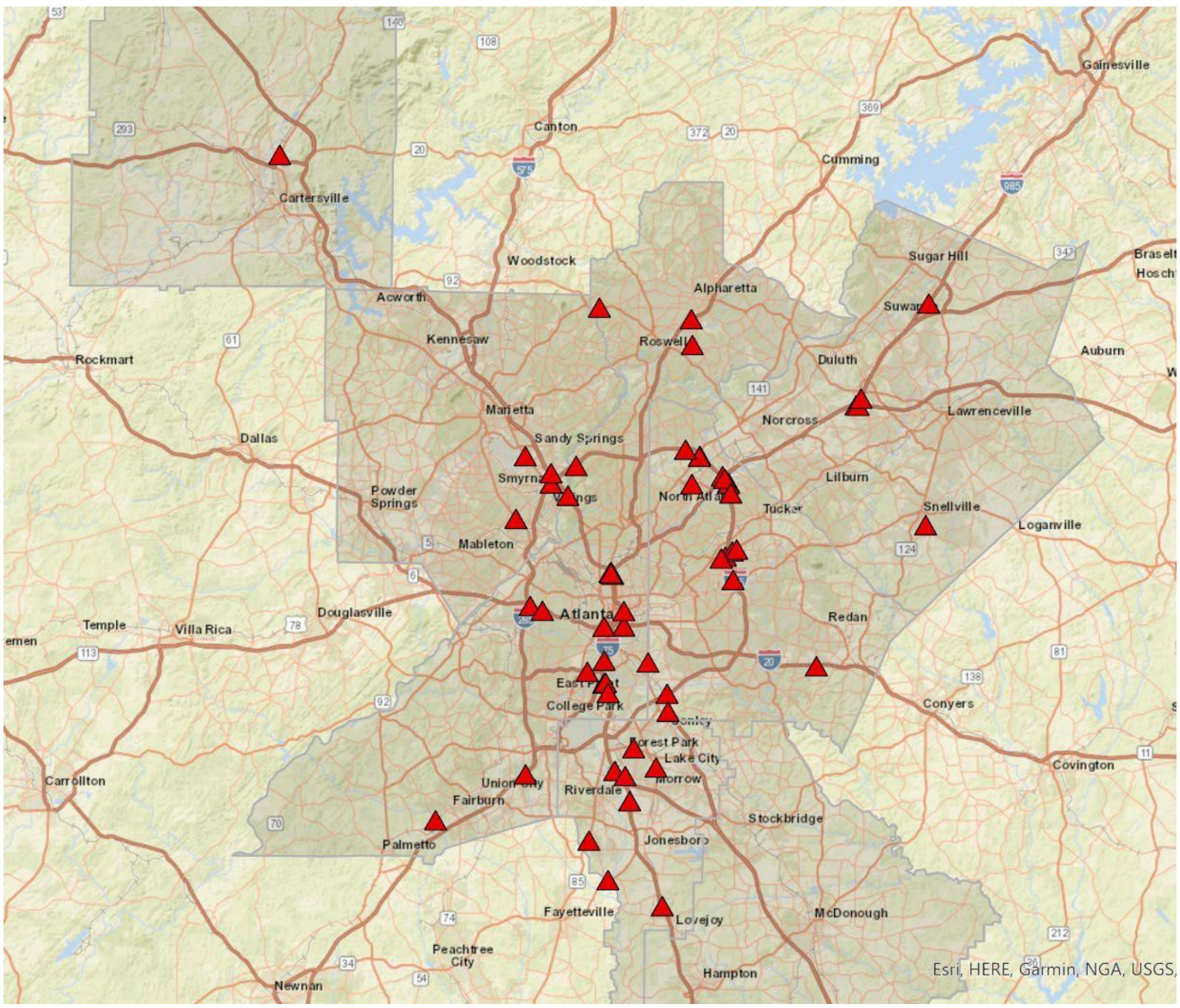


Figure 2-8. Map of Traffic Counter Sites Used in the Comparison Study

The 36 monthly traffic count sums were split by year and the results are shown in Figure 2-9. Figure 2-10 shows the total traffic count differences between 2020 and the average of 2018 and 2019 expressed as a percentage. During January, the 2020 counts were 10.6% higher than 2018 counts and 5.7% higher than the average of 2018 and 2019 counts. With the shutdown starting in mid-March and continuing through April 2020, traffic counts fell relative to 2018 and 2019 (with a maximum drop of 40%). A partial reopening in May 2020, led to increased traffic counts; although still lower than 2018 and 2019 traffic counts (25% lower). Further relaxing of restrictions going into the summer of 2020 (June to September) resulted in traffic counts that were 9-13% lower than the previous two years. The remaining months of the year saw only a 7-9% lower count compared to pre-pandemic years.

Before the pandemic began, the January 2019 counts were 9.3% higher than the January 2018 counts, and the January 2020 counts were 10.6% higher than the January 2018 counts. These variations are very similar to the 9-13% variation in traffic counts during the most crucial months in the ozone season (June-September). The most significant traffic count deviations were seen from March to May 2020; however, Atlanta ozone monitors typically measure fewer exceedances of the ozone standard in these months.

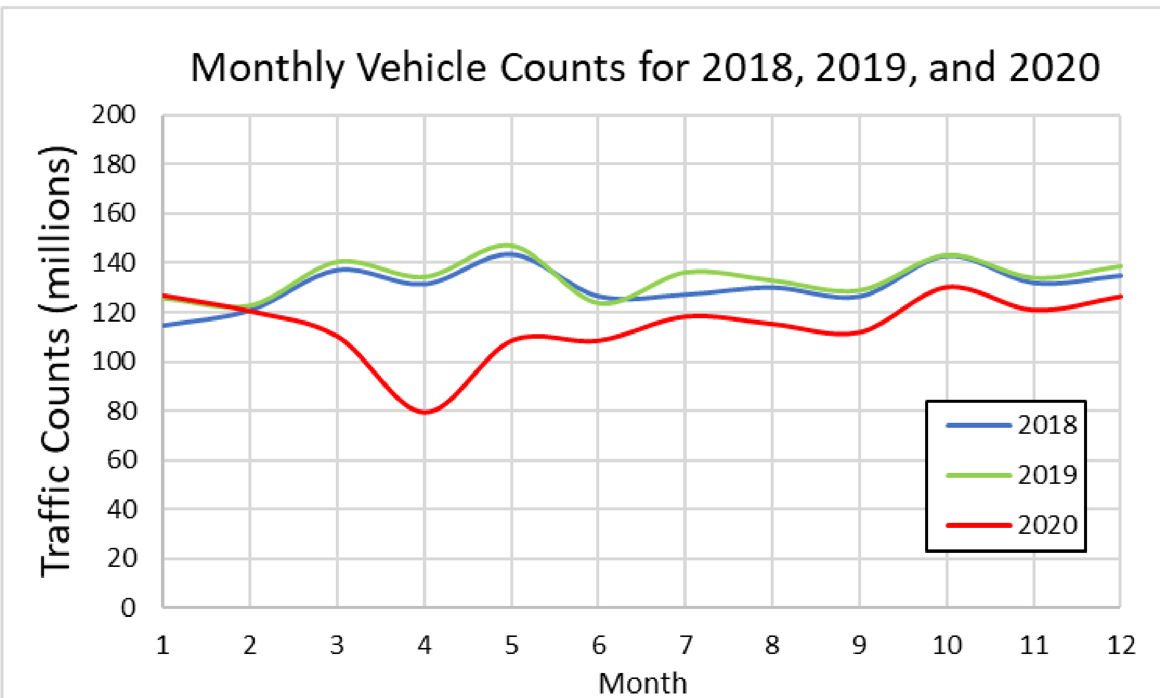


Figure 2-9. Comparison of Traffic Count Totals by Monthly Totals

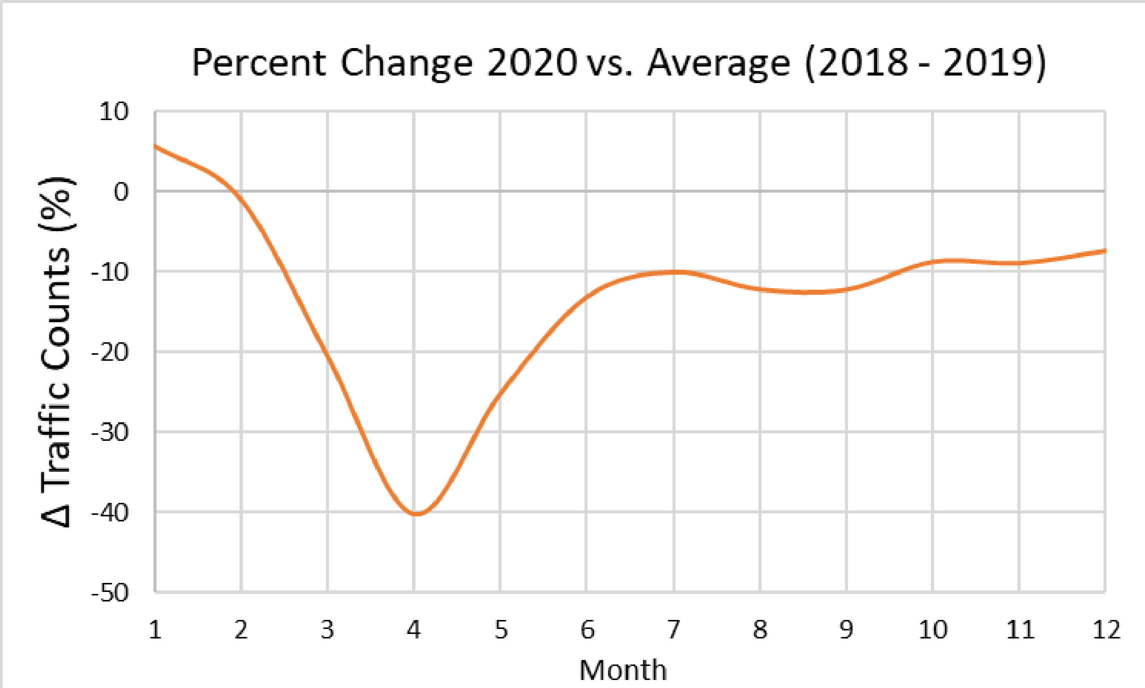


Figure 2-10. Percent (%) Difference of Traffic Counts Between 2020 and Average of 2018 and 2019

Although the NOx and VOC emissions in 2020 were lower due to COVID-19, there is sufficient evidence that the emissions will not return to 2019 levels after the pandemic is over. Studies indicate that many employees may be permanently working from home or will continue to telework more frequently than they did prior to the pandemic.[5] In addition, airport emissions will not return to 2019 levels for several years as businesses are replacing in-person business trips with less costly virtual options.[6] Also, much of the power plant emissions decrease in 2020 was not related to COVID-19, but rather due to a significant increase in the use of renewable power generation.[7] Finally, on-road mobile emissions continue to drop year after year due to vehicle fleet turnover where older dirty vehicles are replaced with new clean vehicles. As a result, we expect future NOx and VOC emissions to remain well below 2019 levels for the foreseeable future.

To add further support, the 2021 preliminary 4th highest 8-hour ozone value at the United Avenue monitor (historically the highest monitor in the Atlanta Area) is 66 ppb and the preliminary 2019-2021 ozone design value for the Atlanta Area is 68 ppb. The 2021 ozone data will be certified by the EPD Ambient Monitoring Program by May 1, 2022. A continued decrease in ozone design values is being observed despite preliminary traffic and congestion

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[5] *https://gacommuteoptions.com/home/return-to-office/covid-19-commute-impact-report/*
[6] *https://aci.aero/news/2021/03/25/the-impact-of-covid-19-on-the-airport-business-and-the-path-to-recovery/*
[7] *https://ieefa.org/ieefa-u-s-georgia-solarhydro-electricity-output-tops-in-state-coal-generation-during-first- half-of-2020/*

data from GDOT, TomTom International BV (TomTom), and FHWA indicating increased VMT from 2020 to 2021, but still below 2019 pre-pandemic levels. Table 2-5 contains the average traffic volumes in Atlanta (third week of September) on key traffic corridors in 2019, 2020, and 2021 (snapshot from GDOT[8]).

Table 2-5. Average Traffic Volumes in Atlanta (third week of September) on Key Traffic Corridors in 2019, 2020, and 2021.

Location	*2019*	*2020*	*2021*	*Change (2020 – 2021)*	*Change (2019 – 2021)*
I-75 SB-Delk Road	*138,002*	*128,083*	*132,466*	*+3.4%*	*– 4.2%*
I-85 SB – Beaver Ruin	*150,227*	*144,317*	*144,271*	*0%*	*-4.1%*
GA 400 SB- Pitts Road	*92,470*	*73,806*	*81,103*	*9.9%*	*-14%*
I-285 WB at Cham-Dunwdy	*102,878*	*92,179*	*94,577*	*2.6%*	*-8.8%*
I-20 WB at Columbia Dr	*94,577*	*41,456*	*44,523*	*7.4%*	*-0.2%*
I-20 EB at MLK Jr. Dr	*83,224*	*72,915*	*79,677*	*9.3%*	*-4.5%*
I-75 NB at I-675	*91,852*	*89,180*	*92,812*	*4%*	*-1%*

Figure 2-11 uses TomTom traffic data[9] to illustrate the daily and weekly difference in congestion between 2021 and 2019. Daily and weekly differences are based on weighted averages derived from hourly data. In the top graphic, blue indicates less congestion in 2021, red indicates more congestion in 2021, and the size of the circle represents the magnitude of the difference. Congestion is measured as the additional time required to reach a destination compared to an uncongested traffic pattern (e.g., 50% congestion means a 1-hour trip takes 1.5 hours). The magnitude of the weekday congestion reduction decreases from January (weeks 1-4) through March (weeks 9-12). The rest of the year, the reduction in weekday congestion remains relatively steady with the exception of the holidays (Memorial Day, Independence Day, Labor Day, and Thanksgiving) where the reductions remained large and weekends where traffic congestion was often greater in 2021 compared to 2019. The lower graphic represents the relative difference (e.g., 0.2 = 20%) between 2021 congestion and 2019 congestion as a weekly average. Average weekly congestion reduction decreases over time but continues to show all weeks in 2021 thru early December (the latest data available) are less congested than 2019.

Figure 2-12 uses TomTom traffic data[9] to show the changes in working day travel patterns in 2019-2021. In January and February, 2019 and 2020 (both pre-pandemic) have similar traffic while 2021 is much lower (post-pandemic). In March, 2020 (start of the pandemic) and 2021 (post-pandemic) both have less traffic than 2019 (pre-pandemic). In April-December, 2019 (pre-pandemic) has the most traffic, 2020 (post-pandemic) has the least traffic, and 2021 (post- pandemic with recovery) is between 2019 and 2020.

[8] https://atlantaregional.org/whats-next-atl/articles/how-traffic-patterns-in-atl-have-changed-during-pandemic/
[9] https://www.tomtom.com/en_gb/traffic-index/atlanta-traffic/

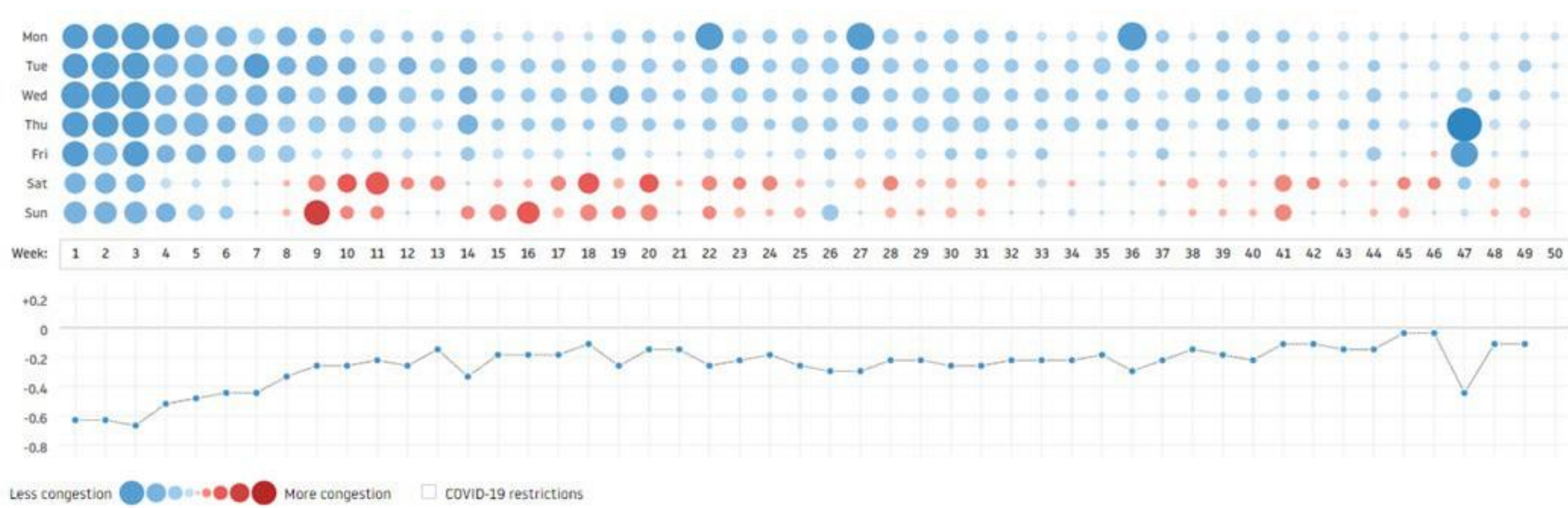

Figure 2-11. Daily and weekly congestion levels in Atlanta (2021 compared to 2019) based on TomTom traffic data.

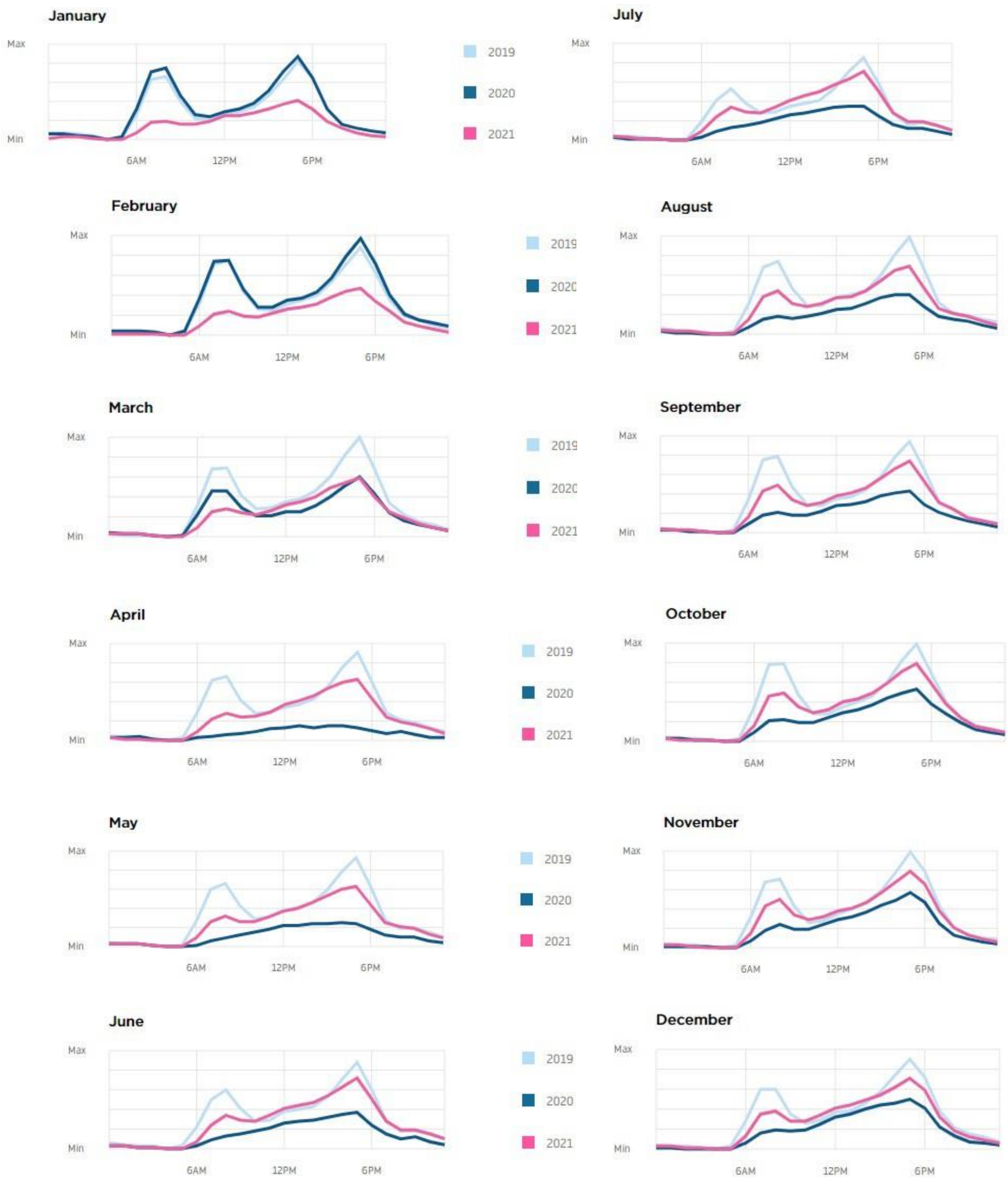

Figure 2-12. Changes in Working Day Travel Patterns in 2019-2021.

Figure 2-13 contains 2019, 2020, and 2021 FHWA VMT data (2019 normalized to match sites used for 2020 and 2021) for Georgia urban roads.[10] *The vast majority of urban VMT in Georgia comes from the Atlanta area. This plot shows that after the start of the pandemic, 2021 VMT is higher than 2020 VMT, but lower than 2019 (pre-pandemic) VMT.*

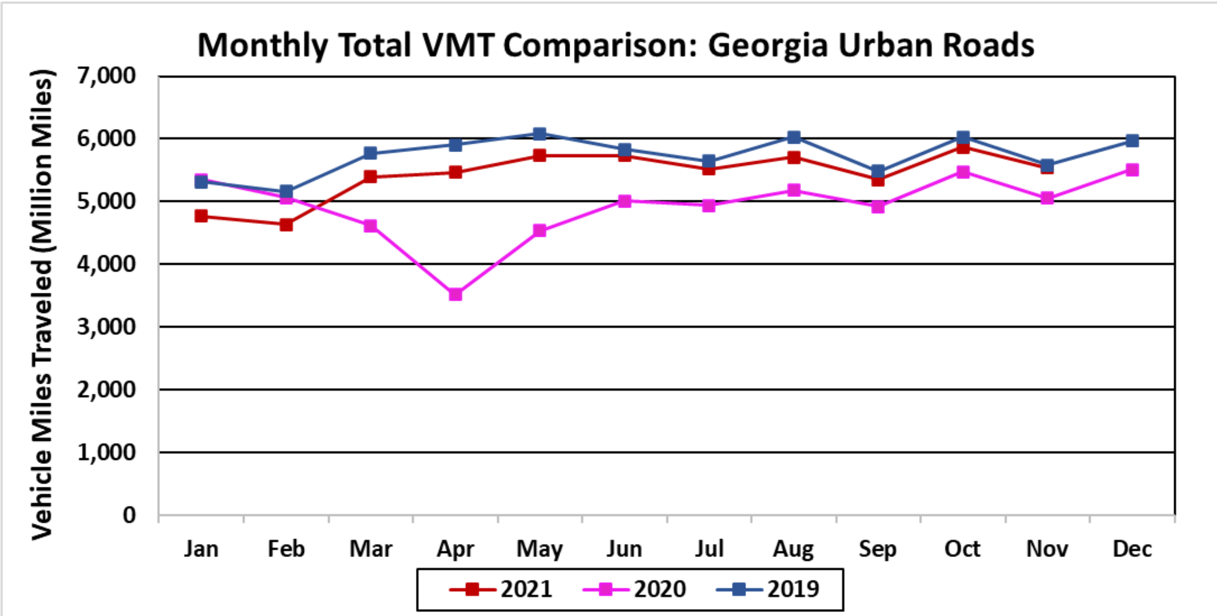

Figure 2-13. FHWA Georgia Urban Road VMT in 2019, 2020, and 2021

[10] *https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm*

2.3.1 State Control Measures - Georgia

The metro Atlanta region was previously designated nonattainment for the 1979 1-hour, 1997 8-hour, and 2008 8-hour ozone NAAQS. Control of anthropogenic NO_x and VOC emissions is generally considered the most important component of an ozone control strategy. However, the metro Atlanta nonattainment area has shown a greater sensitivity to NO_x controls rather than VOC controls due to the large biogenic component of VOC emissions in Georgia. Anthropogenic NO_x emissions are primarily from combustion devices. Therefore, control measures have focused on the control of NO_x emissions from combustion devices.

NO_x emission limitations and standard provisions in Georgia Rule 391-3-1-.02(2) are established for various external and internal combustion devices and include numerical emission standards and work practice requirements. State measures that target the reductions of NO_x emissions include the following:

- *Georgia Rule (yy) – Emissions of Nitrogen Oxides*
- *Georgia Rule (jjj) – NO_x from EGUs*
- *Georgia Rule (lll) – NO_x from Fuel Burning Equipment*
- *Georgia Rule (nnn) – NO_x from Large Stationary Gas Turbines*
- *Georgia Rule (rrr) – NO_x from Small Fuel Burning Equipment*
- *Vehicle Emissions Inspection and Maintenance (I/M) Program*

2.3.1.1 Georgia Rule (yy)

Georgia Rule (yy) is a case-by-case RACT determination for major sources of NO_x emissions that applies to sources with the potential to emit more than 25 tons of NO_x per year in the following 13 counties: Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale; and to those sources that have the potential to emit more than 100 tons of NO_x per year in these seven counties: Barrow, Bartow, Carroll, Hall, Newton, Spalding, and Walton. This rule has changed over the years based on the major source threshold for NO_x. This rule was adopted as a state rule on June 8, 2008 and adopted into the Georgia SIP on September 28, 2012 (77 FR 59554). As part of the federally approved SIP, this rule is permanent and federally enforceable.

Georgia Rule (yy) continues to be in effect for affected sources in all counties in the Atlanta Area, and some counties outside the Atlanta Area.

2.3.1.2 Georgia Rule (jjj)

NO_x emissions from coal-fired external combustion devices that generate steam for electricity generation are regulated under Georgia Rule 391-3-1-.02(2)(jjj). This rule was adopted into the Georgia SIP on July 10, 2001 (66 FR 35906). As part of the federally approved SIP, this rule is permanent and federally enforceable. As required by the SIP adopted in 2001 (66 FR 35906), Georgia Rule (jjj) established a more stringent NO_x emission standard from May 1 – September 30 (starting in 2003) averaged across affected sources in the affected counties. Plant Bowen is the only remaining coal-fired EGU in the Atlanta Area (see Figure 2-14). In order to comply with Rule (jjj), Plant Bowen incorporated a 0.07 lb/MMBtu permit limit from

May 1 – September 30 into its Title V permit. Plant Bowen has been operating at or below 0.07 lb/MMBtu each year from May 1 – September 30 since 2003 in order to comply with Georgia Rule (jjj).

Figure 2-14. Location of the Coal-fired EGU Facility (Plant Bowen) in the Atlanta Area

2.3.1.3 Georgia Rule (lll)

Fuel burning equipment that is installed or modified after May 1, 1999, is regulated under Georgia Rule 391-3-1-.02(2)(lll) for NO_x emissions. This rule was adopted into the Georgia SIP on July 10, 2001 (66 FR 35906). As part of the federally approved SIP, this rule is permanent and federally enforceable. This rule applies to fuel-burning equipment with maximum design heat input capacities ≥ 10 MMBtu/hr and ≤ 250 MMBtu/hr in 45 counties, including all of the counties in the Atlanta Area and counties in the surrounding area. Georgia Rule (lll) established a compliance date for this standard beginning May 1, 2000, and it affects all fuel burning equipment installed from that date forward. This rule affects future possible emissions for new or modified sources by requiring the operation of equipment during the control season to meet emission limits based on the use of natural gas. The continued implementation of this rule will support the maintenance of the ozone NAAQS for the Atlanta Area.

2.3.1.4 Georgia Rule (nnn)

Stationary gas turbines greater than 25 MW are regulated under Georgia Rule 391-3-1-.02(2)(nnn) for NO_x emissions. This rule was adopted into the Georgia SIP on July 10, 2001 (66 FR 35906). As part of the federally approved SIP, this rule is permanent and federally enforceable. Georgia Rule (nnn) establishes ozone-season NO_x emissions limits for large stationary gas turbines located in 45 counties, all of the counties in the Atlanta Area and counties in the surrounding area. Plant McDonough-Atkinson in Cobb County (in the Atlanta Area) is the only electric generation unit (EGU) subject to Georgia Rule (nnn), which requires combustion turbines permitted on or after April 1, 2000, to emit no more than 6 ppm NO_x at 15% oxygen during the period May 1 through September 30 of each year.

2.3.1.5 Georgia Rule (rrr)

Georgia Rule (rrr) is a Reasonably Available Control Technology (RACT) rule for small fuel- burning equipment that requires an annual tune-up and the burning of natural gas, LPG, or propane during ozone season to reduce nitrogen oxides emissions. This rule was adopted into the Georgia SIP on September 28, 2012 (77 FR 59554) and remains in effect. As part of the federally approved SIP, this rule is permanent and federally enforceable.

The deadline for full compliance with Georgia Rule (rrr) was May 15, 2005, in the following 13 counties: Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale; and March 1, 2009, in the additional 7 counties: Barrow, Bartow, Carroll, Hall, Newton, Spalding, and Walton. This continues to be in effect in the 2015 Atlanta nonattainment area.

2.3.1.6 Vehicle Emissions Inspection and Maintenance (I/M) Program

Georgia's Clean Air Force (GCAF) was created in 1996 as a result of the CAA and the support of the Georgia General Assembly to reduce VOC and NOx emissions from passenger vehicles. GCAF is administered by EPD and serves as the state's Enhanced Vehicle Emission Inspection and Maintenance (I/M) Program for the following 13 counties: Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale. Clayton, Cobb, DeKalb, Fulton, Gwinnett, and Henry are part of the 7-county Atlanta Nonattainment Area. This rule was adopted into the Georgia SIP on April 17, 2009 (74 FR 17783) and remains in effect. As part of the federally approved SIP, this rule is permanent and federally enforceable.

2.3.2 Federal Control Measures

Federal control measures related to the reduction of VOCs and NO_x emissions are discussed below. All the emission reductions discussed below are federally enforceable.

<u>VOCs</u>

Federal measures that target reduction of VOCs from stationary point sources include New Source Performance Standards (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAPs), and Reasonably Available Control Technology (RACT). The State of Georgia has been *delegated the authority to administer these measures.*

NOx

Federal measures that targeted reduction of NO_x emissions are as follows:

- *Clean Air Interstate Rule (CAIR) and Cross-State Air Pollution Rule (CSAPR), which replaced CAIR;*
- *Tier 2 Vehicle Standards;*
- *Tier 3 Vehicle Standards;*
- *Heavy-duty Gasoline and Diesel Highway Vehicles Standards & Ultra Low-Sulfur Diesel Rule;*
- *Medium- and Heavy-duty Vehicle Fuel Consumption and GHG Standards;*
- *Large Nonroad Diesel Engines Rule & Ultra Low-Sulfur Diesel Rule;*
- *Non-Road Large Spark Ignition Engines and Recreational Engines Standard;*
- *Greenhouse Gas Emissions and Fuel Economy Standards;*
- *Boiler and Reciprocating Internal Combustion Engine (RICE) NESHAP;*
- *Mercury and Air Toxics Standards (MATS); and*
- *New Source Performance Standards (NSPS).*

Table 2-6 shows the maximum ozone design values and ozone design values averaged across all Atlanta Area monitors combined with the control measures applied to the area during those years. The ozone design values averaged across all Atlanta Area monitors are included to demonstrate the overall impact of emission controls across the entire Atlanta Area. To see ozone design values at specific monitors, please see Table 2-4. Additional federal control measures will take effect after the attainment year so that the Atlanta Area will continue to maintain the standard.

Table 2-6. Ozone Design Values at Atlanta Area Monitors Combined with the Control Measures Applied during those Years.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Maximum Ozone Design Value (ppb)	80	80	83	80	77	73	75	75	73	73	70
Average Ozone Design Value (ppb)	77	76	78	74	71	68	70	69	68	67	65
Clean Air Interstate Rule and Cross-State Air Pollution Rule											
Tier 2 Vehicle Standards[a]											
Tier 3 Vehicle Standards											
Heavy-Duty Gasoline and Diesel Highway Vehicle Standards & Ultra Low-Sulfur Diesel Rule											
Medium- and Heavy-Duty Vehicle Fuel Consumption and GHG Standards											
Large Nonroad Diesel Engines Rule & Ultra Low-Sulfur Diesel Rule											
Nonroad Large Spark-Ignition Engines and Recreational Engines Standard											
Greenhouse Gas Emissions and Fuel Economy Standards											
Boiler and Reciprocating Internal Combustion Engine (RICE) National Emissions Standards for Hazardous Air Pollutants (NESHAP)											
Utility Mercury Air Toxics Standards (MATS) and New Source Performance Standards (NSPS)											

[a] All passenger vehicle manufacturers had to comply with Tier 2 vehicle standards by 2009. More stringent Tier 3 vehicle standards took effect in 2017.

2.3.2.1 Clean Air Interstate Rule and Cross-State Air Pollution Rule

On May 12, 2005, the U.S. EPA promulgated the "Rule To Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule)" referred to as CAIR. This rule established the requirement for States to adopt rules limiting the emissions of NO_x and sulfur dioxide (SO_2) and a model rule for the states to use in developing their rules. The purpose of CAIR was to reduce interstate transport of precursors of fine particulate matter and ozone.

CAIR applied to fossil-fuel-fired electric generation units (EGUs), including certain cogeneration units, with nameplate capacities of greater than 25 megawatts electric (MWe). This rule set annual state caps for NO_x and SO_2 in two phases, with the Phase I caps starting in 2009 and 2010, respectively. Phase II caps for NO_x and SO_2 were to become effective in 2015.

As part of CAIR, EPA determined that Georgia contributed significantly to downwind $PM_{2.5}$ nonattainment areas and/or interfered with maintenance of the $PM_{2.5}$ NAAQS (70 FR 25246- 25250). Accordingly, Georgia's state CAIR rule [Georgia rule 391-3-1-.02(12) and Georgia rule 391-3-1-.02(13)] were adopted that mirror the provisions of the federal CAIR.

On July 11, 2008, the U.S. District Court of Appeals in the District of Columbia vacated CAIR and remanded it to EPA. A rehearing of the Court's decision was requested and granted. On December 23, 2008, the court remanded CAIR to EPA without vacatur (i.e., the rule was still in place). EPA was directed to correct the deficiencies in CAIR that were identified in the court's decision.

To replace CAIR, EPA promulgated the Cross-State Air Pollution Rule (CSAPR) on August 8, 2011 (76 FR 48208). CSAPR imposes restrictions on emissions of NO_x and SO_2 from states identified as having significant impacts on ozone and/or $PM_{2.5}$ NAAQS attainment, or as interfering with maintenance of these same standards in downwind states. The requirements of CSAPR were to become effective in 2012 and 2014. However, on December 30, 2011, the U.S. Court of Appeals for the D.C Circuit Court issued a ruling to stay CSAPR pending judicial review. The timing of CSAPR's implementation has been affected by a number of court actions. On December 30, 2011, CSAPR was stayed prior to implementation. On April 29, 2014, the U.S. Supreme Court issued an opinion reversing an August 21, 2012 D.C. Circuit decision that had vacated CSAPR. Following the remand of the case to the D.C. Circuit, EPA requested that the court lift the CSAPR stay and delay the CSAPR compliance deadlines by three years. On October 23, 2014, the D.C. Circuit granted EPA's request. Accordingly, CSAPR Phase 1 implementation began in 2015 and Phase 2 began in 2017.

On March 15, 2021, EPA finalized the Revised Cross-State Air Pollution Rule Update for the 2008 ozone National Ambient Air Quality Standards (NAAQS). Starting in the 2021 ozone season, the rule will require additional emissions reductions of nitrogen oxides (NO_X) from power plants in 12 states. Georgia wasn't one of those states but is still part of the Group 1 trading program for ozone season NOx and part of the Group 2 trading program for SO_2. Georgia is covered by CSAPR for both fine particles (SO_2 and annual NO_x) and ozone season NO_x.

2.3.2.2 Tier 2 Vehicle Standards

Federal Tier 2 vehicle standards have reduced NO_x emissions from passenger vehicles. The standards require all passenger vehicles in a manufacturer's fleet, including light-duty trucks and sport utility vehicles (SUVs), to meet an average standard of 0.07 grams of NO_x per mile. Implementation began in 2004 and was completely phased in by 2007. The Tier 2 standards also cover passenger vehicles over 8,500-pounds-gross-vehicle-weight rating (the larger pickup trucks and SUVs) beginning in 2005, with full compliance in 2009. The new standards required vehicles to be 77% to 95% cleaner than those on the road prior to implementation of Tier 2. The Tier 2 rule also reduced the sulfur content of gasoline to 30 parts per million (ppm) starting in January 2006. Sulfur occurs naturally in gasoline but interferes with the operation of catalytic converters on vehicles, resulting in higher emissions. Lower-sulfur gasoline is necessary to achieve the Tier 2 vehicle emission standards. With fleet turnover it took several years for Tier 2 to be fully implemented; therefore, Tier 2 emission reductions contributed to the Atlanta Area attaining the 2015 8-hour ozone NAAQS. Once Tier 3 (described below) is in effect, it will provide additional controls for maintenance.

2.3.2.3 Tier 3 Vehicle Standards

The Tier 3 program sets new vehicle emissions standards and lowers the sulfur content of gasoline in order to reduce air pollution from passenger cars and trucks, with implementation beginning in 2017 and phasing in through 2025. Tailpipe and evaporative emissions will be reduced for passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles. The Tier 3 vehicle standards for light-duty vehicles, light-duty trucks, and medium-duty passenger vehicles will be 0.03 grams of NO_x per mile as measured on the Federal Test Procedure (FTP), and 0.05 grams of NO_x per mile as measured on the Supplemental Federal Test Procedure (SFTP). The Tier 3 vehicle standards for heavy-duty pick-ups and vans will be 0.178 grams of NO_x per mile for Class 2b vehicles and 0.630 grams of NO_x per mile for Class 3 vehicles, as measured on the FTP. The Tier 3 gasoline sulfur standard requires federal gasoline to meet an annual average standard of 10 parts per million (ppm) of sulfur by January 1, 2017. The Tier 3 tailpipe standards for light-duty vehicles will reduce the fleet average standards for the sum of non-methane organic gases (NMOG) and nitrogen oxides (NO_x), NMOG+NO_x, by approximately 80% from the current fleet average standards, and will reduce the per-vehicle particulate matter (PM) standards by 70%. The Tier 3 program for heavy-duty vehicles will reduce the fleet average standards for NMOG+NO_x and PM by approximately 60% from the current fleet average standards. The Tier 3 program is also reducing the evaporative VOCs by approximately 50% from the current standards, and these standards apply to all light-duty and onroad gasoline-powered heavy-duty vehicles.

2.3.2.4 Heavy-Duty Gasoline and Diesel Highway Vehicle Standards & Ultra Low-Sulfur Diesel Rule

EPA standards designed to reduce NO_x and VOC emissions from heavy-duty gasoline and diesel highway vehicles (14,001 pounds or more) took effect in 2004. A second phase of standards and testing procedures, which began in 2007, reduced particulate matter from heavy-duty highway engines. The standards also reduced highway diesel fuel sulfur content *to 15 ppm to prevent damage to the catalytic converters. The total program achieves a 90% reduction in particulate matter (PM) emissions and a 95% reduction in NO_x emissions, compared to older engines using diesel with higher sulfur content. SO_2 emissions will also be reduced due to the lower fuel sulfur content. With fleet turnover it took several years for this rule to be fully implemented; therefore, emission reductions from this rule contributed to the Atlanta Area attaining the 2015 8-hour ozone NAAQS.*

2.3.2.5 Medium- and Heavy-Duty Vehicle Fuel Consumption and GHG Standards

In September 2011, the EPA and the National Highway Traffic Safety Administration (NHTSA) adopted joint rules to reduce greenhouse gas (GHG) emissions and increase fuel efficiency from combination tractors (semi-trucks), heavy-duty pickup trucks and vans, and vocational vehicles. The agencies' complementary standards, which form the Heavy-Duty National Program, cover model years 2014 – 2018. The standards for combination tractors will reduce CO_2 emissions and fuel consumption by 9% to 23% over the 2010 baselines. The standards for heavy-duty pickup trucks and vans will reduce CO_2 emissions by 17% for diesel vehicles and 12% for gasoline vehicles, on average per vehicle over the 2010 baselines, and will reduce fuel consumption by 15% for diesel vehicles and 10% for gasoline vehicles, on average per vehicle compared to a common baseline. The standards for vocational vehicles will reduce CO_2 emissions and fuel consumption by 6% to 9% over the 2010 baselines. The decreased fuel consumption due to the Heavy-Duty National Program will result in decreased NO_x emissions from vehicles as the fleet turns over.

2.3.2.6 Large Nonroad Diesel Engines Rule & Ultra Low-Sulfur Diesel Rule

In May 2004, the EPA promulgated new rules for large nonroad diesel engines, such as those used in construction, agricultural, and industrial equipment, to be phased in between 2014 and 2015. The nonroad diesel rules reduced the allowable sulfur in nonroad diesel fuel by over 99%. Prior to 2006, nonroad diesel fuel averaged about 3,400 ppm sulfur. The rule limited nonroad diesel sulfur content to 500 ppm in 2006 and 15 ppm in 2010. The combined engine and fuel rules reduced NO_x and PM emissions from large nonroad diesel engines by over 90%, compared to older engines using diesel with higher sulfur content. SO_2 emissions were also reduced due to the lower fuel sulfur content.

2.3.2.7 Nonroad Large Spark-Ignition Engines and Recreational Engine Standard

This standard regulates nitrogen oxides (NO_x), hydrocarbons (HC), and carbon monoxide (CO) for groups of previously unregulated nonroad engines. The standard applies to all new engines sold in the United States and imported after these standards began and applies to large spark-ignition engines (forklifts and airport ground service equipment), recreational vehicles (off-highway motorcycles and all-terrain-vehicles), and recreational marine diesel engines. The regulation varies based upon the type of engine or vehicle.

The large spark-ignition engines contribute to ozone formation and ambient CO and PM levels in urban areas. Tier 1 of this standard was implemented in 2004 and Tier 2 started in 2007.

Like the large spark-ignition engines, recreational vehicles contribute to ozone formation and ambient CO and PM levels. For the model year 2006 off-highway motorcycles and all-terrain-vehicles, the new exhaust emissions standard was phased-in by 50%, and for model years 2007 and later at 100%. Recreational marine diesel engines over 37 kilowatts are used in yachts, cruisers, and other types of pleasure craft. Recreational marine engines contribute to ozone formation and PM levels, especially in marinas. Depending on the size of the engine, the standard began phasing in during 2006.

The final rule was published in the Federal Register (67 FR 68241) and became effective January 7, 2003. Now that the rule is fully implemented, we have a reduction of the nonroad spark-ignition engines and recreational engines emissions, with estimates of overall 72% reduction in HC, 80% reduction in NO_x*, and 56% reduction in CO emissions which are documented in the rule text. These controls helped reduce ambient concentrations of ozone, CO, and fine PM.*

2.3.2.8 Greenhouse Gas Emissions and Fuel Economy Standards

The National Program for greenhouse gas emissions (GHG) and fuel economy standards was developed by the EPA along with the National Highway Traffic Safety Administration (NHTSA) and affects light-duty cars and trucks in model years 2012 – 2016 for phase 1, and model years 2017 – 2025 for phase 2. Additionally, the Tier 3 program for vehicle emission standards and gasoline sulfur content will be implemented during the same period as the second phase of the GHG standards for light-duty vehicles, beginning in model year 2017. The final GHG and fuel economy standards were estimated to give an average industry fleet- wide level of 163 grams of carbon dioxide (CO_2*) per mile in model year 2025, equivalent to 54.5 miles per gallon if attained entirely through fuel economy improvements. This program will reduce the precursors of ambient ozone from light duty vehicles in MOVES slightly by improving fuel economy thus reducing the amount of VOC emissions slightly from less refueling emissions, thus slightly reducing the amount of VOC emissions released.*

The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule was issued on March 20, 2020 by EPA as an update to Phase 2. The new standard sets tough but feasible fuel economy and carbon dioxide standards that increase 1.5% in stringency each year from model years 2021 through 2026. These standards apply to both passenger cars and light trucks. On December 30, 2021, EPA revised[11] the GHG emissions standards for light-duty vehicles to be more stringent than the SAFE rule standards in each model year from 2023 through 2026.

[11] *86 FR 74434, effective February 28, 2022.*

2.3.2.9 Boiler and Reciprocating Internal Combustion Engine (RICE) National Emissions Standards for Hazardous Air Pollutants (NESHAP)

The NESHAP for industrial, commercial, and institutional boilers (40 CFR Part 63 Subpart DDDDD) and the NESHAP for reciprocating internal combustion engines (40 CFR Part 63 Subpart ZZZZ) are projected to reduce VOC emissions.

The NESHAP for industrial, commercial, and institutional boilers and process heaters applies to boiler and process heaters located at major sources of hazardous air pollutants (HAP) that burn natural gas, fuel oil, coal, biomass, refinery gas, or other gas. The compliance deadline for existing boilers was January 31, 2016. The NESHAP includes work practice standards such as regular boiler tune-ups and a one-time energy assessment, emission limitations for pollutants including filterable particulate matter (PM), hydrochloric acid (HCl), Mercury, and carbon monoxide (CO), and operating limitations for control devices. The emission limits and operating limits only apply to larger boilers of at least 10 million BTU/hr that burn fuels other than natural gas, refinery gas, or other gas 1 fuels (gaseous fuel containing no more than 10 µg/m^3 mercury).

The NESHAP for reciprocating internal combustion engines (RICE) applies to existing, new, or reconstructed stationary RICE located at major or area sources of HAP, excluding stationary RICE being tested at a stationary RICE test cell/stand. The compliance date for existing stationary RICE, excluding existing non-emergency stationary compression ignition (CI) RICE, with > 500 brake HP located at a major source of HAP emissions was June 15, 2007. The compliance date for existing non-emergency stationary CI RICE with > 500 brake HP located at a major source of HAP, existing stationary CI RICE with ≤ 500 brake HP located at a major source of HAP, or existing stationary CI RICE located at an area source of HAP was May 3, 2013. The compliance date for existing stationary spark ignition (SI) RICE with ≤ 500 brake HP located at a major source of HAP emissions, or an existing stationary SI RICE located at an area source of HAP emissions was October 19, 2013. The NESHAP includes work practice standards such as engine maintenance, fuel requirements, regular performance testing, operating limitations, and emission limitations for pollutants including formaldehyde and CO.

2.3.2.10 Mercury and Air Toxics Standards (MATS) and New Source Performance Standards (NSPS)

EPA published the final rules for the MATS for new and existing coal- and oil-fired electric generation units (EGU) and the NSPS for fossil-fuel-fired electric utility, industrial- commercial-institutional, and small industrial-commercial-institutional steam generating units on February 16, 2012 (77 FR 9304). The purpose of the MATS is to reduce mercury and other toxic air pollutant emissions from coal- and oil-fired EGUs with a capacity of 25 megawatts or more that generate electricity for sale and distribution through the national electric grid to the public. The NSPS has revised emission standards for NO_x, SO_2, and particulate matter (PM) that apply to new coal- and oil-fired power plants.

The compliance date for existing sources subject to MATS was April 16, 2015, although all coal-fired EGUs in Georgia sought and received a one-year compliance extension. The MATS *rule has resulted in further reductions of both NO_x and SO_2 emissions in addition to the reduction in mercury and other air toxic emissions.*

The control measures listed in Section 2.3.1 and 2.3.2 of this document demonstrate that Item 3 in Section 2.0 has been met.

2.4 Title 1 Part A, Section 110 and Part D Requirements of the Clean Air Act

Title 1 Part A, Section 110 of the CAA contains the requirements for state implementation plans (SIPs). The purpose of a SIP is to provide for the implementation, maintenance, and enforcement of the National Ambient Air Quality Standards (NAAQS). Title 1 Part D, of CAA (Sections 171 to 179) contains general requirements for areas that have been designated nonattainment. As stated in Section 1.1 of this maintenance plan, the Atlanta Area was designated as nonattainment for the 2015 8-hour ozone standard on June 4, 2018, effective August 3, 2018.

With an attainment deadline of August 3, 2021, marginal areas were required to attain the National Ambient Air Quality Standard (NAAQS) by the end of the 2020 ozone season. EPD's ozone data for 2018 through 2020 was certified and quality assured by EPD's Ambient Monitoring Program. The 2020 data was certified on February 11, 2021 showing that the Atlanta Area attained the 2015 ozone standard before the August 3, 2021 attainment deadline. When EPA determines that the Atlanta Area has attained the NAAQS, the area will no longer be subject to the nonattainment provisions of Section 110 and Part D. All other Section 110 and Part D Clean Air Act requirements pertaining to the Atlanta Area have previously been approved or are currently subject to approval by EPA or will be suspended upon submittal of this plan.

The requirements that have previously been submitted by the state include ozone monitoring, emissions inventory, and emission statement requirements. EPD submitted its current annual monitoring network plan to EPA on June 25, 2021. The current monitors are operated consistent with 40 CFR Part 58 and any changes will only be made if they are consistent with 40 CFR Part 58. On July 1, 2020, EPD submitted to EPA, the base year emissions inventory (2014) and emissions statements SIP in order to fulfill the requirements of Part D, Sections 182(a)(1) and 182(a)(3)(B) of the CAA.

The state has met all applicable requirements for the Atlanta Area under Section 110 of the CAA and Sections 171 through 179 of the CAA (Part D). Therefore, Item 4 in Section 2.0 of this document has been met.

3.0 Maintenance Plan

Any state seeking redesignation of an area to attainment must submit documentation to EPA that the area will continue to attain the standard in the form of a maintenance plan. Title 1 Part D, Section 175A of the CAA defines maintenance plan requirements. Requirements include a quantitative demonstration of maintenance of the standard (ozone, in this case) and contingency provisions for prompt implementation of corrective measures if attainment is not maintained. Per guidance from EPA[12], this maintenance plan also includes a method to verify continued attainment of the 2015 8-hour ozone standard to support the maintenance demonstration. This plan also includes a plan to use the ambient monitoring network for verification of continued attainment or for triggering contingency provisions, if required.

3.1 Maintenance Demonstration

Part D Section 175A of the CAA requires any state requesting a redesignation to submit a revision to its SIP demonstrating maintenance of the applicable standard for a minimum of 10 years after the redesignation date. Section 107(d)(3)(D) allows EPA up to 18 months from receipt of a complete submittal to process a redesignation request. Therefore, EPD is providing a demonstration of maintenance through the year 2033.

There are two generally accepted methodologies for demonstrating maintenance. Under the first method, an emissions inventory is compiled for one of the three years which are used to show clean (i.e., attaining) ambient data (see Section 2.1). This is called the attainment year inventory. Emissions are projected for the final year of the maintenance period (called the maintenance inventory) and for intermediate years. If the projected emission levels in each of the intermediate and maintenance years are less than the emission level for the attainment year, then maintenance of the standard is demonstrated. Under the second maintenance demonstration method, air quality modeling is used to project ambient pollutant concentrations and annual design values for the final year and intermediate years. If all of the modeled rolling 3-year averages of the annual design values are below the standard, maintenance is demonstrated.

EPD selected the method of comparing attainment year emissions to projected emissions for this maintenance plan. This approach has been used in the previous maintenance plans submitted by EPD and approved by EPA. The following sections discuss the attainment year inventory, the projected inventories for the maintenance year and intermediate years, and a demonstration that the Atlanta Area will continue to attain the standard.

Provision 175A(b) of the Clean Air Act requires that "8 years after redesignation of any area as an attainment area under section 107(d), the State shall submit to the Administrator an additional revision of the applicable State implementation plan for maintaining the national

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[12] "Procedures for Processing Requests to Redesignate Areas to Attainment", September 4, 1992, John Calcagni, Director, Air Quality Management Division, OAQPS, USEPA

primary ambient air quality standard for 10 years after the expiration of the 10-year period referred to in subsection (a)." EPD intends to address this provision in the future.

3.1.1 Attainment and Maintenance Year Emissions Inventories

EPD prepared 2018 and 2033 summer day emissions inventories of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) for the following 7 counties in the Atlanta Area: Bartow, Clayton, Cobb, DeKalb, Fulton, Gwinnett, and Henry.

The 2018 emissions developed by EPD to meet the Air Emissions Reporting Requirements (AERR) are used when available. Sources without 2018 emission estimates are estimated using different approaches that vary by source category as documented below. Then, the base year 2018 emissions are projected to 2033 using different methods for each source category, including:

- *EGU point sources*
- *Non-EGU point source*
- *Area sources*
- *Fires – Agricultural burning and land clearing*
- *Fires – Wildfire and prescribed burning*
- *Nonroad mobile sources – NONROAD model category*
- *Nonroad mobile sources – Marine, aircraft and railroad*
- *Onroad mobile sources*

The summer day emission calculations are performed creating emissions fractions of the typical summer ozone day and annual value broken down by county and sector in the 2016 Emissions Modeling Platform version 1. These spreadsheets can be found in Appendix A-3.

All the detailed calculations by source categories can be found in the Appendices A-2 through A-11, as well as emission summary by counties, SCC, and facilities (Appendix A-12). Emissions in Tables 3-2, 3-3, 3-4, 3-5, 3-7, 3-8, 3-10, 3-12, 4-3 and 4-4 are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table. The actual values in the intermediate calculations have more digits than displayed. The exact emission numbers used to generate the total emissions can be found in Excel files located in the appropriate Appendix.

3.1.1.1 Point Sources

Point sources in the 2018 emission inventory include stationary sources whose actual emissions equal or exceed 250 tons per year of VOC or 2,500 tons per year of NO_x in the following 7 counties: Bartow, Clayton, Cobb, DeKalb, Fulton, Gwinnett, and Henry counties. Emissions from point sources have been calculated for EGU and non-EGU sources. The 2017 emissions inventory (most recent triennial NEI year) includes all stationary sources whose actual emissions equal or exceed 100 tons per year of VOC or 100 tons per year of NO_x. Therefore, 2017 point source emissions for the smaller point sources that were not included in the 2018 inventory were added to provide a comprehensive 2018 point emissions inventory.

<u>EGU Point Sources:</u>

2018 NO_x and VOC emissions from two power plants in the Atlanta Area (Plant Bowen and Plant McDonough/Atkinson) were submitted by Georgia Power during the 2018 EPD emission data collection process[13].

The 2033 emissions from Plant Bowen (coal-fired with SCR) and Plant McDonough/Atkinson (gas-fired NGCC with SCR) are projected from their 2018 emissions using growth factors based on fuel consumption for the Southeastern region in the Annual Energy Outlook 2018[14]. The growth factors vary by fuel types (Table 3-1) and are applied to 2018 process-level emissions by Source Classification Code (SCC). Detailed information can be found in Appendix A-2. No control factors are applied since no additional controls are expected for Plant Bowen and Plant McDonough/Atkinson during the period from 2018 to 2033.

Table 3-1. Growth Factors by SCC s for EGU Sources

SCC	Fuel Type	2033/2018
20100101	Distillate Fuel Oil	0.3811
10100501	Distillate Fuel Oil	0.3811
20100201	Natural Gas	1.0816
10100604	Natural Gas	1.0816
10100602	Natural Gas	1.0816
10100212	Coal	0.9449

The summer day NO_x emissions from EGU point sources are calculated by summing the hourly CEMS NO_x emission measurements during the 20 weekdays in July 2018 and then dividing by 20 days. The summer day VOC emissions are calculated by multiplying the annual VOC emissions with fractions of average heat input during July weekdays to annual total heat input.

$$emis_{summer-day} = emis_{annual} \times \frac{\sum_j HeatInput_j/20}{\sum_i HeatInput_i}$$

Where i refers to every day during 2018 and j refers to every day during July weekdays listed in Table 3-1. Specifically, the above data are downloaded from the EPA Air Markets Program Data (AMPD) website[15]. Detailed calculations can be found in Appendix A-2.

Summer day emissions during 2018 and 2033 were summarized by each EGU facility (Table 3-2).

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[13] https://epd.georgia.gov/forms-permits/air-protection-branch-forms-permits/air-emissions/submit-emissions- inventory
[14] Energy Information Administration, Department of Energy, "Annual Energy Outlook, 2018".
[15] http://ampd.epa.gov/ampd/

Table 3-2. Summer Day Emissions by EGU Facilities in 2018 and 2033 (tons/day)

Facility Name	***Facility ID***	***Summer Day Emissions (TPD)***			
		2018		***2033***	
		NO_x	***VOC***	***NO_x***	***VOC***
Ga Power Company – Plant Bowen	*1500011*	*19.95*	*0.60*	*18.85*	*0.56*
Ga Power Company – Plant McDonough/Atkinson	*6700003*	*1.25*	*0.37*	*1.36*	*0.40*
Total*		***21.20***	***0.97***	***20.20***	***0.96***

**Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

Non-EGU Point Sources:

2018 NO_x and VOC emissions from non-EGU point sources were submitted by facilities during the 2018 EPD emission data collection process[16]. The 2033 emissions from non-EGU point sources were not grown from the 2018 emissions based on the following guidance from the EPA[17]:

"Since 2006 (EPA, 2006a), the EPA has been assuming that emissions growth does not track with economic growth for many stationary sources (both point and nonpoint). This "no-growth" assumption is based on an examination of historical emissions and economic data. Emissions (as of 2005) had declined for several years and those reductions could not be directly attributed to specific control programs despite increasing economic-based growth factors for many metrics over the same time period. While the EPA continues to work toward improving the projection approach in its own work, we are still using this no-growth assumption for many emissions sectors."

In addition, EPD checked the growth and control data in the 2016 Emissions Modeling Platform version 1[18] and found that no growth or control factors were applied for non-EGU point sources in the Atlanta Area. EPD is also not aware of other significant controls that will be applied to these non-EGU point sources during the period from 2018 to 2033. Therefore, the 2033 emissions are kept the same as 2018 emissions for these non-EGU point sources.

The summer day emissions from non-EGU point sources are calculated by applying the emissions fractions from the SMOKE monthly and weekly temporal profiles to the annual non-EGU point source emissions. The SMOKE monthly temporal profiles include weighting factors by month, and the weekly profiles include weighting factors by day of week. These

[16]https://epd.georgia.gov/forms-permits/air-protection-branch-forms-permits/air-emissions/submit-emissions- inventory
[17] U.S. EPA, 2015. Technical Support Document: Preparation of Emissions Inventories for the Version 6.2, 2011 Emissions Modeling Platform, Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division.
[18] https://gaftp.epa.gov/Air/emismod/2016/v2/2016emissions/

profiles vary with SCCs. More detailed information can be found in the SMOKE manual[19]. Specifically, emissions during July are first calculated following the equation:

$$emis_{July} = emis_{annual} \times \frac{wf_{July}}{\sum_{i=1}^{12} wf_i}$$

where wf_{July} refers to weighting factor for July and wf_i refers to weighting factor for each month. Then the summer day emissions are calculated following the equation:

$$emis_{summer-day} = emis_{July} \times \frac{\sum_{j=1}^{5} n_j wf_j}{\sum_{i=1}^{7} n_i wf_i} \div 20$$

where i refers to everyday in a week, j refers to every weekday, wf_i or wf_j refers to the weighting factors for a specific day, and n_i or n_j refers to the number of days for a specific day during July. Since the 2016 temporal profiles were not available at the time this project began, temporal profiles were downloaded from the EPA 2011 modeling Platform ftp site[20]. Detailed calculation and a list of non-EGU point sources in the Atlanta ozone nonattainment area and facility-specific VOC and NO_x summer day emissions for 2018 and 2033 can be found in Appendices A-3 and A-4.

2018 and 2033 summer day emissions of NO_x and VOC from EGU and non-EGU facilities are shown in Table 3-3.

Table 3-3. Summer Day Point Source Emissions in 2018 and 2033 (tons/day)

Source	***Summer Day Emissions (TPD)***			
	2018		***2033***	
	NO_x	***VOC***	***NO_x***	***VOC***
EGU Point Sources	*21.20*	*0.97*	*20.20*	*0.96*
Non-EGU Point Sources	*6.82*	*7.10*	*6.82*	*7.10*
Total*	***28.02***	***8.07***	***27.02***	***8.06***

**Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

[19] *https://www.cmascenter.org/smoke/*
[20] *https://gaftp.epa.gov/air/emismod/2011/v2platform/ancillary_data/*

3.1.1.2 Nonpoint Sources

<u>Area Sources:</u>

Since 2018 is not an NEI year, area source 2018 emissions are estimated as the interpolation between 2016 and 2023 emissions in the 2016 Emissions Modeling Platform v1. These 2016 and 2023 emissions have been carefully reviewed by EPD and are considered the best available emission estimates for area sources in Georgia.

2033 emissions from area sources were estimated by multiplying 2018 emissions by growth factors calculated using 2016, 2023, and 2028 emissions in EPA's 2016 modeling platform. The 2023 and 2028 emissions were developed by EPA using growth factors based on surrogate data varying by source sectors (e.g., AEO growth rates for energy sectors) and control factors due to new regulations or amendments to regulations (NESHAP-RICE, NSPS-RICE, Boiler MACT, etc.). After EPD reviewed the methodology and data in the 2016 Emissions Modeling Platform v1, EPD concluded that the 2023 and 2028 emissions could reasonably reflect the area source emission trends in Georgia. Therefore, these emissions are used to develop the growth factors used to project 2033 emissions.

The 2018 and 2033 emissions were calculated as follows:

$$E_{2033} = (E_{2028} - E_{2023}) \times 2 + E_{2023}$$

$$E_{2018} = (E_{2016} + E_{2020})/2$$

These growth factors vary with SCC, county, and pollutants.

Summer day emissions for area sources were calculated using the average summer weekday ozone season for NOx and VOC estimates by county and sector in the 2016 modeling platform v.1. Appendix A-5 contains SCC-specific VOC and NO_X summer day emissions for 2018 and 2033, and Appendix A-3 contains the average ozone summer day emissions used for nonpoint sources.

<u>Fires - Agricultural Burning and Land Clearing:</u>

2018 emissions from agricultural burning and land clearing were developed using detailed 2018 burning records collected from Georgia Forestry Commission (GFC). The emission factors for agricultural burning are provided by the EPA Office of Air Quality Planning and Standards (OAQPS) during the development of 2011 agricultural burning emissions for the 2011 NEI. The emissions for land clearing are estimated using the same method used in SEMAP 2007[21] and the 2011 NEI fire inventory. Emissions in future year 2033 were assumed to be the same as base year 2018.

Summer day emissions from agricultural burning and land clearing are calculated using emissions during July. Daily emissions are obtained by using monthly totals and applying the same formula used to calculate summer day emissions as described for non-EGU sources. Detailed information can be found in Appendix A-6.

21 AMEC, 2012. Development of the 2007 Base Year and Typical Year Fire Emission Inventory for the Southeastern States Air Resource Managers, Inc. (Final Report)

<u>Fires - Wildfire and Prescribed Burning:</u>

2018 emissions from wildfires and prescribed burning were developed using detailed 2018 burning records collected from the GFC, United States Forest Service, United States Fish & Wildlife Service, and military bases. The detailed burning records showed burned area per day. The emissions are estimated using the same method used in SEMAP 2007[22] and the 2011 NEI fire inventory. The fuel consumption and emission factors used in this method are considered to be the best available for fires in the southeast. These emission estimates have been submitted to EPA to meet the AERR and have been included as part of the 2014 NEI and 2017 NEI. Emissions in future year 2033 were assumed to be the same as base year 2018.

The summer day emissions from wildfires and prescribed burning are calculated by summing the daily emissions from fires that occurred during the 20 July weekdays as mentioned above and then dividing the total emissions during July weekdays by 20 days. Appendix A-7 contains VOC and NO_x summer day emissions summary by fire types and county in Atlanta ozone nonattainment area for 2018.

The 2018 and 2033 summer day emissions of NO_x and VOC from nonpoint sources are shown in Table 3-4.

Table 3-4. Summer Day Nonpoint Source Emissions in 2018 and 2033 (tons/day)

Source	Summer Day Emissions (TPD)			
	2018		2033	
	NO_x	VOC	NO_x	VOC
Area Sources	2.69	23.35	2.69	25.94
Fire – Ag & Land Clearing	0.00	0.01	0.00	0.01
Fire – Wild & Prescribed	0.00	0.00	0.00	0.00
Total	**2.70**	**23.36**	**2.70**	**25.95**

**Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

3.1.1.3 Nonroad Mobile Sources

<u>NONROAD Model Category:</u>

NONROAD model within MOVES calculates emissions from a diverse collection of nonroad equipment such as logging, agricultural, construction, industrial, residential and commercial lawn and garden equipment, as well as nonroad vehicles. This model does not calculate

[22] AMEC, 2012. Development of the 2007 Base Year and Typical Year Fire Emission Inventory for the Southeastern States Air Resource Managers, Inc. (Final Report)

emissions from marine, aircraft, and locomotives which are separately estimated as documented below.

2018 and 2033 emissions from NONROAD model category were calculated using the NONROAD portion of MOVES3 model released on November 16, 2020, which reflects all of EPA's final nonroad standards to date. Defaults in MOVES3 were used with 2018 meteorological data based on observations at Hartsfield-Jackson Atlanta International Airport (HJAIA). Default fuel properties with MOVES3 have been updated for the Atlanta area so they were used. Emissions were calculated by county, SCC, day, and hour. Summer day emissions were calculated by running MOVES for a typical July weekday. Detailed MOVES run specification files, output database, SQL query codes for analysis and SCC-specific VOC and NO_x *emissions by county are provided in Appendix A-8.*

Marine, Aircraft, and Locomotives:

Emissions from locomotives in 2018 were grown from 2017 emissions obtained from the 2017 NEI version 2[23] because locomotive fuel consumption changed very little from 2017 to 2018 according to the Bureau of Transportation. For detailed historical fuel use, refer to the Fuel Use Data Summary in Appendix A-9. Emissions from Georgia yard locomotives were obtained from the 2017 NEI[24].

Emissions from locomotives in 2033 are projected from 2018 emissions using growth and control factors. Growth factors for Class I and Class II/III line haul and diesel switchyard operations were calculated based on freight rail sector fuel consumption forecasts from the Annual Energy Outlook (AEO), 2019. Growth factors for passenger and commuter rail were developed from national forecasts of passenger rail diesel consumption. Control factors were based on EPA's locomotive engine Regulatory Impact Analyses[25] (RIA) and associated emission factor guidance from EPA[26]. Diesel locomotive engines are subject to revised Federal Tier 0, Tier 1, and Tier 2 standards, as well as new Tier 3 and 4 standards. Refer to Appendix A-9 for detailed growth factor calculations, AEO 2019 table data, and control factor calculations. Appendix A-9 also contains a list of specific aircraft and locomotives sources in the Atlanta Area and SCC-specific VOC and NO_x *emissions for 2018 and 2033 and the associated growth or control factors.*

Annual and summer day emissions from aircrafts at HJAIA in 2018 and 2033 were provided by Crawford, Murphy & Tilly. Appendix A-10 contains HJAIA emissions and the documentation of the methods used to calculate 2018 and 2033 emissions.

[23] *U.S. EPA, 2020. Technical Support Document: Preparation of Emissions Inventories for 2016v1 North American Emissions Modeling Platform, Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division. https://gaftp.epa.gov/Air/emismod/2016/v2/2016emissions/*
[24] *Downloaded from EPA 2016 modeling Platform ftp site, https://gaftp.epa.gov/Air/emismod/2016/v1/*
[25] *U.S. EPA, 2008. "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder," Office of Transportation and Air Quality, EPA-420-R-08-001. March 2008.*
[26] *U.S. EPA, 2009. "Emission Factors for Locomotives," Office of Transportation and Air Quality, EPA-420- F09-025. April 2009.*

Other aircraft emissions for 2018 were projected from the 2017 NEI version 2 and then were projected for 2033 using growth factors. Growth factors for all aircraft engine and airport- related SCCs, except for HJAIA, were based on landing and take-off operation (LTO) projections available from the Federal Aviation Administration's Terminal Area Forecasts (TAF)[27]. Growth factors were calculated for itinerant air carrier, itinerant air taxi and commuter, and local Georgia operations as Atlanta Area averages (excluding HJAIA operations). Growth rates for military aircraft were held constant at 2017 levels. No control factors have been applied to aircraft for criteria pollutant forecasts.

There were negligible emissions from commercial marine vessels in the Atlanta Area.

Summer day emissions for aircrafts, except HJAIA, and locomotives were calculated using the SMOKE temporal profiles as described for non-EGU point sources.

The 2018 and 2033 summer day emissions of NO_x and VOC from nonroad mobile sources are shown in Table 3-5.

Table 3-5. Summer Day Nonroad Mobile Source Emissions in 2018 and 2033 (tons/day)

Source	***Summer Day Emissions (TPD)***			
	2018		***2033***	
	NO_x	***VOC***	***NO_x***	***VOC***
NONROAD	*26.46*	*32.16*	*16.20*	*35.38*
Railroad	*4.43*	*2.17*	*1.92*	*0.20*
Aircraft	*18.33*	*3.56*	*28.50*	*5.50*
Marine	*0.00*	*0.00*	*0.00*	*0.00*
Total	***49.22***	***37.89***	***46.63***	***41.08***

**Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

[27] *FAA, 2020. Federal Aviation Administration, "Terminal Area Forecasts, 2017-2040," available from http://aspm.faa.gov/main/taf.asp.*

3.1.1.4 Onroad Mobile Sources

2018 and 2033 emissions from onroad mobile sources were developed by Atlanta Regional Commission using MOVES3. MOVES3 was run separately for two groups of nonattainment counties in Atlanta in inventory mode due to differences in I/M control programs and summer fuel blends (volatility levels) due to a federal rule. These two groups are the following six counties – Clayton, Cobb, DeKalb, Fulton, Gwinnett, and Henry; and one other county – Bartow. The 6-county group has an I/M program and summer fuel blend with Reid Vapor Pressure (RVP, measure of volatility) limit of 8.8 psi for 2018. Bartow county does not have an I/M program and has a summer fuel blend with RVP limit of 10.0 psi. All 7 counties in the Atlanta Area would have the same fuel blend by 2033. Running MOVES3 separately for the two unique groups of counties helps address impacts from different inputs by county and is consistent with modeling for future transportation conformity demonstrations. Further details regarding this approach are provided in the document "Ozone 2015 Maintenance Plan Modeling Assumptions" in Appendix A-11.

Best available local data were used for MOVES3 inputs such as vehicle population, vehicle miles traveled (VMT) by source type, road type distribution, average speed distributions, starts per day, hourly VMT fractions, age distributions, I/M inputs and fuel properties, as well as average July 2018 daily meteorological inputs. National defaults were applied to populations and age distributions for long haul combination trucks. Please refer to the document "Ozone 2015 Maintenance Plan Modeling Assumptions" provided by the Atlanta Regional Commission in Appendix A-11 for more detailed information.

The 2018 and 2033 summer day emissions of NO_x and VOC from onroad mobile sources are shown in Table 3-6.

Table 3-6. Summer Day Onroad Mobile Source Emissions in 2018 and 2033 (tons/day)

Source	***Summer Day Emissions (TPD)***			
	2018		***2033***	
	NO_x	***VOC***	***NO_x***	***VOC***
*Onroad Mobile Sources**	*99.99*	*54.00*	*36.43*	*21.73*

**Includes 0.03 tons/day NOx and 0.05 tons/day VOC emissions in addition to the original summer day emission estimates to account for Senior I/M exemption for on-road sources.*

3.1.1.5 Summary of 2018 and 2033 Emissions Inventories

The total 2018 and 2033 NO_x and VOC emissions for the Atlanta Area are presented for each source sector in Table 3-7. In 2018, the majority of NO_x and VOC emissions are from onroad and nonroad mobile sources. In 2033, the majority of NO_x emissions are from nonroad and onroad mobile sources and the majority of VOC emissions are from nonroad mobile sources and nonpoint sources.

Table 3-7. Summary of 2018 and 2033 Summer Day Emissions Inventory (tons/day)

Source	**Summer Day Emissions (TPD)**			
	2018		**2033**	
	NO_x	**VOC**	**NO_x**	**VOC**
Point - EGU	*21.20*	*0.97*	*20.20*	*0.96*
Point - non-EGU	*6.82*	*7.10*	*6.82*	*7.10*
Nonpoint	*2.70*	*23.36*	*2.70*	*25.95*
Onroad	*99.99*	*54.00*	*36.43*	*21.73*
*Nonroad**	*49.22*	*37.89*	*46.63*	*41.08*
Fires	*0.00*	*0.00*	*0.00*	*0.00*
Total*	***179.92***	***123.32***	***112.77***	***96.81***

**Including Aircraft and Locomotive.*
***Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

3.1.2 Intermediate Year Emissions Projections

As discussed previously, EPD is providing a demonstration of maintenance through the year 2033 (maintenance year). Emissions projections to support maintenance have been prepared through 2033. In addition, emissions have been calculated by interpolation for the years 2021, 2024, 2027, and 2030. Emissions levels for 2027 were calculated by linear interpolation between 2018 and 2033, emissions levels for 2024 were calculated by linear interpolation between 2018 and 2027, emission levels for 2021 were calculated by linear interpolation between 2018 and 2024, and emission levels for 2030 were calculated by linear interpolation of 2027 and 2033. Emissions for these additional years provide additional reference points for periodic assessment of maintenance of the standard. The intermediate year emission inventories are presented in the following subsections.

3.1.2.1 Point Sources

Intermediate year emission projections for EGU and non-EGU point sources are shown in Table 3-8.

Table 3-8. Projected Point Source Emissions (tons/summer day)

Pollutant	2018 (attainment)	2021	2024	2027	2030	2033 (maintenance)
EGU						
NO_x	21.2	21.0	20.8	20.6	20.4	20.2
VOC	0.97	0.97	0.97	0.96	0.96	0.96
Non-EGU						
NO_x	6.82	6.82	6.82	6.82	6.82	6.82
VOC	7.1	7.1	7.1	7.1	7.1	7.1
Total Point*						
NO_x	**28.02**	**27.82**	**27.62**	**27.42**	**27.22**	**27.02**
VOC	**8.07**	**8.07**	**8.07**	**8.06**	**8.06**	**8.06**

**Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

3.1.2.2 Nonpoint Sources

Intermediate year emission projections for nonpoint sources are shown in Table 3-9.

Table 3-9. Projected Nonpoint Source Emissions (tons/summer day)

Pollutant	2018 (attainment)	2021	2024	2027	2030	2033 (maintenance)
Nonpoint (excluding fire)						
NO_x	2.69	2.69	2.69	2.69	2.69	2.69
VOC	23.35	23.87	24.39	24.90	25.42	25.94
Fire						
NO_x	0.00	0.00	0.00	0.00	0.00	0.00
VOC	0.01	0.01	0.01	0.01	0.01	0.01
Total Nonpoint*						
NO_x	**2.70**	2.70	2.70	2.70	2.70	**2.70**
VOC	**23.36**	23.88	24.40	24.91	25.43	**25.95**

**Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

3.1.2.3 Nonroad mobile sources

Intermediate year emission projections for nonroad mobile sources are shown in Table 3-10.

Table 3-10. Projected Nonroad Mobile Source Emissions (tons/summer day)

Pollutant	***2018 (attainment)***	***2021***	***2024***	***2027***	***2030***	***2033 (maintenance)***
NONROAD						
NO_x	*26.46*	*24.41*	*22.36*	*20.31*	*18.25*	*16.20*
VOC	*32.16*	*32.81*	*33.45*	*34.10*	*34.74*	*35.38*
Aircraft						
NO_x	*18.33*	*20.36*	*22.40*	*24.43*	*26.47*	*28.50*
VOC	*3.56*	*3.95*	*4.34*	*4.72*	*5.11*	*5.50*
Locomotive						
NO_x	*4.43*	*3.93*	*3.43*	*2.92*	*2.42*	*1.92*
VOC	*2.17*	*1.78*	*1.38*	*0.99*	*0.59*	*0.20*
Marine						
NO_x	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
VOC	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Nonroad						
NO_x	***49.22***	***48.70***	***48.18***	***47.67***	***47.15***	***46.63***
VOC	***37.89***	***38.53***	***39.17***	***39.80***	***40.44***	***41.08***

**Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

3.1.2.4 Onroad mobile sources

Intermediate year emission projections for onroad mobile sources are shown in Table 3-11.

Table 3-11. Projected Onroad Mobile Source Emissions (tons/summer day)

Pollutant	***2018 (attainment)***	***2021***	***2024***	***2027***	***2030***	***2033 (maintenance)***
NO_x	***99.99***	*87.27*	*74.56*	*61.85*	*49.14*	***36.43***
VOC	***54.00***	*47.55*	*41.09*	*34.64*	*28.18*	***21.73***

3.1.2.5 Emissions Projections Summary and Demonstration of Maintenance of Attainment

The consolidated emissions projections and intermediate years for all source categories are presented in Table 3-12. Emissions of NO_x and VOC drop significantly from 2018 to 2033. Overall, emissions of NO_x are projected to decline by 37.3 percent and emissions of VOC are projected to decline by 21.5 percent over the course of the maintenance period.

Table 3-12. Projected Emissions – Total of All Sectors (tons/summer day)

Pollutant	***2018 (attainment)***	***2021***	***2024***	***2027***	***2030***	***2033 (maintenance)***
Total Point						
NO_x	*28.02*	*27.82*	*27.62*	*27.42*	*27.22*	*27.02*
VOC	*8.07*	*8.07*	*8.07*	*8.06*	*8.06*	*8.06*
Total Nonpoint						
NO_x	*2.70*	*2.70*	*2.70*	*2.70*	*2.70*	*2.70*
VOC	*23.36*	*23.88*	*24.40*	*24.91*	*25.43*	*25.95*
Onroad						
NO_x	*99.99*	*87.27*	*74.56*	*61.85*	*49.14*	*36.43*
VOC	*54.00*	*47.55*	*41.09*	*34.64*	*28.18*	*21.73*
Total Nonroad						
NO_x	*49.22*	*48.70*	*48.18*	*47.67*	*47.15*	*46.63*
VOC	*37.89*	*38.53*	*39.17*	*39.80*	*40.44*	*41.08*
Total of All*						
NO_x	***179.92***	***166.49***	***153.06***	***139.63***	***126.20***	***112.77***
VOC	***123.32***	***118.03***	***112.73***	***107.41***	***102.11***	***96.82***

**Emissions are generally reported to two decimal places (rounded) and that the summation of the values in the tables may not appear to exactly match the value in the "Total" row due to rounding to the number of significant digits reported in the table.*

3.1.2.6 Emissions Decreases

The degree of improvement (reduction) in 2033 emissions compared to the attainment year (2018) emissions can be used to determine the amount of emissions that can be allocated as safety margin for the area's motor vehicle emissions budget. The decrease in emissions of NO_x and VOC from 2018 to 2033 is shown in Table 3-13. Only a portion of the NO_x (and VOC) margin will be allotted to the Motor Vehicle Emissions Budget (see Section 4).

Table 3-13. Emissions Decreases (tons)

Pollutant	*Emissions Decrease* 2018 to 2033 (tons)*
NO_x **	67.16
VOC **	26.50

** Decrease in Emissions = (2018 emissions level) – (2033 emissions level)*
*** These quantities do not reflect allotment to Motor Vehicle Emissions Budget*

3.1.3 Verification of ContinuedAttainment

Verification of continued attainment is accomplished through operation of the ambient ozone monitoring network and the periodic updates of the area's emissions inventory. EPD will continue operation of an appropriate air quality monitoring network in accordance with 40 CFR Part 58, Ambient Air Quality Surveillance and associated appendices.

The Consolidated Emissions Reporting Rule (CERR) was promulgated by EPA on June 10, 2002. The CERR was replaced by the Air Emissions Reporting Requirements (AERR) rule on December 17, 2008. The most recent triennial inventory for Georgia was compiled for 2017. The larger point sources of air pollution will continue to submit emissions data on an annual basis as required by the AERR. Emissions from the rest of the point sources, the nonpoint source portion, and the onroad and nonroad mobile sources continue to be quantified on a three-year cycle.

The inventory will be updated and maintained on a three-year cycle. As required by the AERR, future comprehensive emissions inventories will be compiled for 2020, 2023, 2026, 2029, 2032, and 2035.

3.2 Contingency Provisions for Maintenance

Section 175A(d) of the CAA requires that the maintenance plan include provisions for contingency measures that would promptly be implemented to correct a violation of the standard, should this occur, after redesignation of an area to attainment. The measures may include rules or other measures that are not yet effective that EPD agrees to adopt and implement, as expeditiously as practicable, when required by this plan. The minimum requirement for contingency provisions is the implementation of all measures that were *contained in the SIP for the area (i.e., the nonattainment plan) before the redesignation. In addition, EPA guidance (John Calcagni memo dated September 4, 1992) specifies the following pertaining to contingency provisions in the maintenance plan:*

- *identification of additional measures that would be considered for implementation should a violation occur;*
- *identification of triggers for the implementation of additional contingency measures; and*
- *a schedule and procedure for adoption and implementation of additional measures (with time limit).*

3.2.1 Contingency Plan

Section 175A(d) of the CAA requires that the maintenance plan include provisions for contingency measures that would promptly be implemented by the state to correct any violation of the 8-hour ozone NAAQS after redesignation of an area as an attainment area. A list of potential contingency measures that could be considered for future implementation in such an event should also be included in the maintenance plan.

EPD has developed a contingency plan for the Atlanta 2015 8-hour ozone nonattainment area. Contingency measures are intended to provide further emission reductions if violations of the 8-hour ozone NAAQS occur after redesignation to attainment. Consistent with this plan, EPD agrees to adopt and implement, as expeditiously as practicable, the necessary corrective actions for attainment of the standard. The contingency measures as described below would be adopted and implemented within 24 months of a contingency trigger.

EPD will use actual ambient monitoring and emissions inventory data as the indicators to determine whether contingency measures would be implemented. In accordance with 40 CFR Part 58, ambient ozone monitoring data that indicates an exceedance of the ozone NAAQS level will begin the process to implement these contingency measures according to the protocols identified below. The contingency plan provides for corrective responses should the 8-hour ozone NAAQS be violated, or if emissions in the Atlanta maintenance area increase significantly above current levels.

3.2.1.1 Tier I

A Tier I trigger will apply where no actual violation of the 2015 8-hour ozone standard has occurred, but where the state finds monitored ozone levels indicating that an actual ozone NAAQS violation may be imminent. A pattern will be deemed to exist when there are two consecutive ozone seasons in which the 4th highest values are 0.071 ppm or greater at a single monitor within the Atlanta Area. The trigger date will be 60 days from the date that the state observes a 4th highest value of 0.071 ppm or greater at a monitor for which the previous season had a 4th highest value of 0.071 ppm or greater.

If a Tier I trigger is activated, EPD will develop a plan identifying additional voluntary measures that can be implemented. Possible voluntary measures could include the following *types of measures or any other measure deemed appropriate and effective at the time the selection is made:*

- *Additional Clean Air Force campaign strategies*
- *Additional GDOT marketing campaigns*
- *Implementation of diesel retrofit programs, including incentives for performing retrofits for fleet vehicle operations*
- *Alternative fuel programs for fleet vehicle operations*
- *Gas can and lawnmower replacement programs*
- *Voluntary engine idling reduction programs.*

If the 4th highest exceedance occurs early in the season, EPD will work with entities identified in the plan to determine if the measures can be implemented during the current season, otherwise, EPD will implement the plan for the following ozone season.

By May 1 of the year following the ozone season in which the Tier I trigger has been activated, EPD will complete sufficient analyses to begin adoption of necessary rules for ensuring attainment and maintenance of the 2015 8-hour ozone NAAQS. The rules would become state effective by the following year.

3.2.1.2 Tier II

A Tier II trigger is activated when any quality assured ozone design value is equal to or greater than 0.071 ppm at a monitor in the Atlanta Area. The trigger date will be 60 days from the date that the state observes a 4th highest value that, when averaged with the two previous ozone seasons' fourth highest values, would result in a three-year average equal to or greater than

0.71 ppm. Alternately, a Tier II trigger is activated if the periodic emission inventory updates (based on the triennial AERR) reveal excessive or unanticipated growth greater than 10% in NO_x or VOC emissions over the attainment or intermediate emissions inventories for the Atlanta Area.

In the case that a Tier II trigger is activated, EPD will conduct a comprehensive analysis, based on quality-assured ambient data that will examine:

- *the severity of the trigger condition,*
- *the meteorological conditions (in the case of an ambient concentration trigger) associated with the trigger condition,*
- *potential contributing local emissions sources,*
- *potential contributing emissions resulting from regional or long-range transport,*
- *the geographic applicability of possible contingency measures,*
- *emission trends, including implementation timelines of potential control measures,*
- *timelines of "on-the-books" (adopted) measures that are not yet fully implemented, and*
- *current and recently identified control technologies.*

All monitored ozone data will be verified through EPD's Ambient Monitoring Program quality assurance and certification process. This process will include an analysis of available *data regarding the air quality, meteorology, transport, and related activities in the area to determine the possible cause of the violation.*

EPD commits to implement within 24 months of a Tier II trigger, or as expeditiously as practicable, whichever is earlier, at least one of the control measures listed in the paragraph below or other contingency measures that may be determined to be more appropriate based on the analyses performed.

If the analysis required above determines emissions from the local area are contributing to the trigger condition, EPD will evaluate those measures as specified in Section 172 of the CAA for control options as well as other available measures. If a new measure/control is already promulgated and scheduled to be implemented at the federal or state level, and that measure/control is determined to be adequate, additional local controls may be unnecessary. Under Section 175A(d), the minimum requirement for contingency measures is the implementation of all measures that were contained in the SIP before the redesignation. Currently all such measures are in effect for the Atlanta Area; however, an evaluation of those measures, such as RACT, can be performed to determine if those measures are adequate or up-to-date. In addition to those identified above, contingency measure(s) will be selected from the following types of measures or from any other measure deemed appropriate and effective at the time the selection is made:

- *Reasonably Available Control Measures (RACM) for sources of VOC and* NO_x*.*
- *Reasonably Available Control Technology (RACT) for point sources of VOC and* NO_x*, specifically the adoption of new and revised RACT rules based on Groups II, III, and IV CTGs.*
- *Other measures deemed appropriate at the time as a result of advances in control technologies.*
- *Additional* NO_x *reduction measures yet to be identified.*

Any resulting contingency measure(s) will be based upon cost effectiveness, emission reduction potential, economic and social considerations, ease and timing of implementation, and other appropriate factors.

Adoption of additional control measures is subject to necessary administrative and legal processes. EPD will solicit input from interested and affected persons (stakeholders) in the area prior to selecting appropriate contingency measures. No contingency measure will be implemented without providing the opportunity for full public participation. This process will include publication of notices, an opportunity for public hearing, and other measures required by Georgia law.

3.2.2 Tracking Program for Ongoing Maintenance

EPD will continue operation of an appropriate air quality monitoring network in accordance with 40 CFR Part 58, Ambient Air Quality Surveillance and associated appendices. EPD will continue to update its emissions inventory at least once every three years. In addition to the emissions inventory for 2018, the emissions inventory base year, and the last year of the maintenance plan, 2033, the interim years of 2021, 2024, 2027, and 2030 were selected to show a trend analysis for maintenance of the 2015 8-hour ozone NAAQS. Tracking the *progress of the maintenance plan also includes performing reviews of the updated emissions inventories for the area using the latest emissions factors, models, and methodologies. For these periodic inventories, EPD will review the assumptions made for projected growth of activity levels.*

4.0 Motor Vehicle Emissions Budget

The transportation conformity rule (40 CFR 93.100 – 40 CFR 93.129) ensures that projects and plans funded by the Federal Highway Administration and the Federal Transit Administration conform to air quality SIPs and maintenance plans. In the case of a NAAQS maintenance plan, the rule requires a motor vehicle emissions budget (MVEB) to be established for the last year of the plan's maintenance period. The rule, at 40 CFR 93.124(a), describes a motor vehicle emissions budget as "...the implementation plan's estimate of future [motor vehicle] emissions." Such budgets establish caps on motor vehicle emissions; projected emissions from transportation plans and programs must be equal to or less than these caps for a positive conformity determination to be made. Transportation conformity determinations are required for federally-funded highway and transit projects that are classified as nonexempt before they are funded and approved for transportation plans and transportation improvement programs.

4.1 Pollutants

For this maintenance plan, MVEBs will be set for NO_x and VOC emissions. 40 CFR Parts 93.119(f)(1) through (10) identify the ozone precursor pollutants which must be analyzed for transportation conformity purposes. These parts of the rule are listed below:

§119(f)(1) - VOC in ozone areas; and

§119(f)(2) - NO_x in ozone areas, unless the EPA Administrator determines that additional reductions in NO_x would not contribute to attainment.

4.2 Methodology

In preparation of this Atlanta Area Ozone Maintenance Plan, EPD worked closely with the Georgia Department of Transportation (GDOT) and the Atlanta Regional Commission (ARC) to develop the estimates of mobile source emissions for the Atlanta Area. ARC is the metropolitan planning organization (MPO) for Metro Atlanta Area. Mobile source inventories for 2018 and 2033 were developed using the latest available planning assumptions, the most recent travel demand model, EPA's latest MOtor Vehicle Emission Simulator (MOVES3) model, and vehicle population and age distributions developed from registration data obtained from R.L. Polk, a division of IHS. The methodology used to calculate the highway mobile source emissions on which the 2018 and 2033 MVEBs are based is discussed below.

MOVES3 was run in "inventory mode" producing raw emissions in g/hr but aggregated to "per day" time frame with mass units converted to "tons" for this maintenance plan ("tons/day"). In this mode, emissions are estimated by multiplying activity (e.g., VMT, vehicles, and starts) by emission factors (mass pollutant per mile for VMT, per vehicle for vehicle population, and per start for starts which involve parked vehicles being turned on and driven). See Appendix A-11 for more details on the development of the travel demand model and the determination of emissions.

The MOVES3 motor vehicle emissions model was used to calculate 2018 and 2033 emission factors with all currently known 2018 and 2033 onroad mobile source control rules in place. The emission rates reflect all federal controls, such as the Federal Motor Vehicle Control Program including Tier 1, Tier 2 tailpipe standards, the National Low Emission Vehicle program, and Tier 3 emission standards. These Tier 3 standards phase in beginning in 2017 for cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty trucks. Tier 3 fuel standards require lower sulfur gasoline phase in beginning in 2017. The model also incorporates heavy-duty engine and vehicle greenhouse gas (GHG) regulations that phase in during model years 2014-2018, as well as the second phase of light-duty vehicle GHG regulations that phase in for model years 2017-2025.

The ARC travel demand model is developed and maintained by the Atlanta Regional Commission in cooperation with GDOT. Inputs to the model are socioeconomic data and the highway network that consists of roadway segments (links) and intersections (nodes). Outputs include vehicle activity, number of trips, vehicle population, and other data. The use of a county-specific travel demand model for transportation conformity calculations is consistent with the transportation conformity rule at 40 CFR 93.122(b) and (d), which requires a network-based travel model emissions estimation methodology as the use of such procedures has been the previous practice of the ARC.

Section 93.105(b) of the Transportation Conformity Rule and Sections 106(g) and 106(h) of Georgia's transportation conformity SIP require interagency consultation for SIP development. Accordingly, a detailed listing of the procedures and planning assumptions used for the regional emissions analysis supporting development of the MVEB was presented to the ARC interagency consultation committee for review on March 23, 2021. The assumptions used to develop metro Atlanta's conforming Long Range Transportation Plan and Transportation Improvement Program were also used to develop the network and emissions for this maintenance plan MVEBs.

4.3 Motor Vehicle Emissions Budgets and Safety Margins

The projected 2033 on-road motor vehicle emissions for NO_x and VOC are 36.43 and 21.73 tons per day, respectively. As presented in Section 3.1.2.2, the overall surplus or overall emissions reduction from 2018 for all sectors is 67.16 tons per day for NO_x and 26.50 tons per day for VOCs. A portion of these emission reductions will be used as a safety margin for the 2033 MVEBs. The safety margin allotted for the MVEB is based on determining a worst- case daily emissions projection. The worst-case scenario increased VMT by ~35%, increased vehicle population by ~30%, and increased vehicle starts by ~25%. Also, the average age of vehicles was increased by 2 years. Safety margins do not apply to the 2018 MVEBs (only applies to 2033 MVEBs).

The worst-case 2033 daily motor vehicle emissions projection for NO_x is 48 percent above the projected 2033 on-road emissions. In a worst-case scenario, the needed safety margin allotment for the 2033 MVEB would be 17.57 tons per day resulting in an overall MVEB of 54 tons per day. This leaves a remaining overall safety margin of 49.59 tons per day for NOx. The worst-case 2033 daily motor vehicle emissions projection for VOC is 61 percent above the projected 2033 on-road emissions. In a worst-case scenario, the needed safety margin *allotment for the 2033 MVEB would be 13.27 tons per day resulting in an overall MVEB of 35 tons per day. This leaves a remaining overall safety margin of 13.23 tons per day for VOCs.*

The 2018 and projected 2033 on-road emissions, MVEBs, and safety margins (listed as "N/A" for 2018) are presented in Tables 4-1 and 4-2. The additional emission allotted for the safety margin is also added to the overall inventory as presented in Tables 4-3 and 4-4.

Table 4-1. 2018 Motor Vehicle Emissions, Safety Margins, and Emissions Budgets

Pollutant	***2018 On-Road Emissions (tons per day)***	***Safety Margin Allotted to MVEB (tons per day)***	***MVEB (tons per day)***
NO_x	*99.99*	*N/A*	*99.99*
VOC	*54.00*	*N/A*	*54.00*

Table 4-2. 2033 Motor Vehicle Emissions, Safety Margins, and Emissions Budgets

Pollutant	***2033 Projected On-Road Emissions (tons per day)***	***Amount Above 2033 Projection Allotted to MVEB***	***Safety Margin (tons per day)***	***Portion of Safety Margin Allotted to MVEB (tons per day)***	***Remaining Safety Margin (tons per day)***	***MVEB with Safety Margin Portion included (tons per day)***
NO_x	*36.43*	*48%*	*67.16*	*17.57*	*49.59*	*54*
VOC	*21.73*	*61%*	*26.50*	*13.27*	*13.23*	*35*

Table 4-3. Summary of Projected NO_x Emissions – Total of All Sectors (tons/summer day)

Source	***2018 (attainment)***	***2021***	***2024***	***2027***	***2030***	***2033 (maintenance)***
Point - total	*28.02*	*27.82*	*27.62*	*27.42*	*27.22*	*27.02*
Area - total	*2.70*	*2.70*	*2.70*	*2.70*	*2.70*	*2.70*
Non-road - total	*49.22*	*48.70*	*48.18*	*47.67*	*47.15*	*46.63*
Onroad	*99.99*	*87.27*	*74.56*	*61.85*	*49.14*	*36.43*
Onroad Safety Margin						*17.57*
Total	***179.92***	*166.49*	*153.06*	*139.63*	*126.20*	***130.34***

Table 4-4. Summary of Projected VOC Emissions – Total of All Sectors (tons/summer day)

Source	***2018 (attainment)***	***2021***	***2024***	***2027***	***2030***	***2033 (maintenance)***
Point - total	*8.06*	*8.06*	*8.06*	*8.06*	*8.06*	*8.06*
Area - total	*23.36*	*23.88*	*24.40*	*24.91*	*25.43*	*25.95*
Non-road - total	*37.89*	*38.53*	*39.17*	*39.80*	*40.44*	*41.08*
Onroad	*54.00*	*47.55*	*41.09*	*34.64*	*28.18*	*21.73*
Onroad Safety Margin						*13.27*
Total	***123.32***	*118.02*	*112.72*	*107.42*	*102.12*	***110.08***

Conclusion

Section 107(d) of the CAA states that an area can be redesignated to attainment if the following conditions are met:

1. *The EPA has determined that the NAAQS has been attained.*
2. *The applicable implementation plan has been fully approved by EPA under Section 110(k) of the CAA.*
3. *The EPA has determined that the improvement in air quality is due to permanent and enforceable reductions in emissions.*
4. *The state has met all applicable requirements for the area under Title 1 (Part A, Section 110 and Part D) of the CAA.*
5. *The EPA has fully approved a maintenance plan, including a contingency plan, for the area as required under Section 175A of the CAA.*

The supporting documentation to show that the above conditions have been met for the Atlanta Area is contained in this document. EPD's ozone data for 2018 through 2020 was certified and quality assured by EPD's Ambient Monitoring Program. The 2020 data was certified on February 11, 2021 showing that the Atlanta Area attained the 2015 ozone standard before the August 3, 2021 attainment deadline. The maintenance demonstration in this document shows that, based on the comparison of projected emissions to attainment year emissions, emissions are expected to stay at or below 2018 levels through the year 2033. This document also contains provisions for contingency measures should emissions levels or ambient concentrations rise unexpectedly. EPA's concurrence that the improvement in the metro Atlanta Area's air quality is due to permanent and enforceable reductions in emissions and EPA's approval of this document will satisfy Items 1 through 5 above. Therefore, EPD requests that the Atlanta Area be redesignated to attainment with respect to the 2015 8-hour ozone NAAQS as expeditiously as possible.

18.3 Assessment of Progress with Emission Control Programs

To address the PAMS data used to assess progress in the emission control programs, trends analyses were performed. Figure 18.14 shows the average annual 1-hour NO_x and ozone concentrations, and the summer (June-August) 1-hour averages for the VOCs concentrations at the South DeKalb site. PAMS VOCs data was not collected between 2018-2020. The graph also indicates when the Multi-Pollutant Rule was implemented. With the implementation of this rule, both ozone and NO_x concentrations show a consistent decrease in concentrations. The VOCs are not directly controlled by the Multi-Pollutant Rule, and do not show a consistent pattern, but have had an overall decrease since 1995.

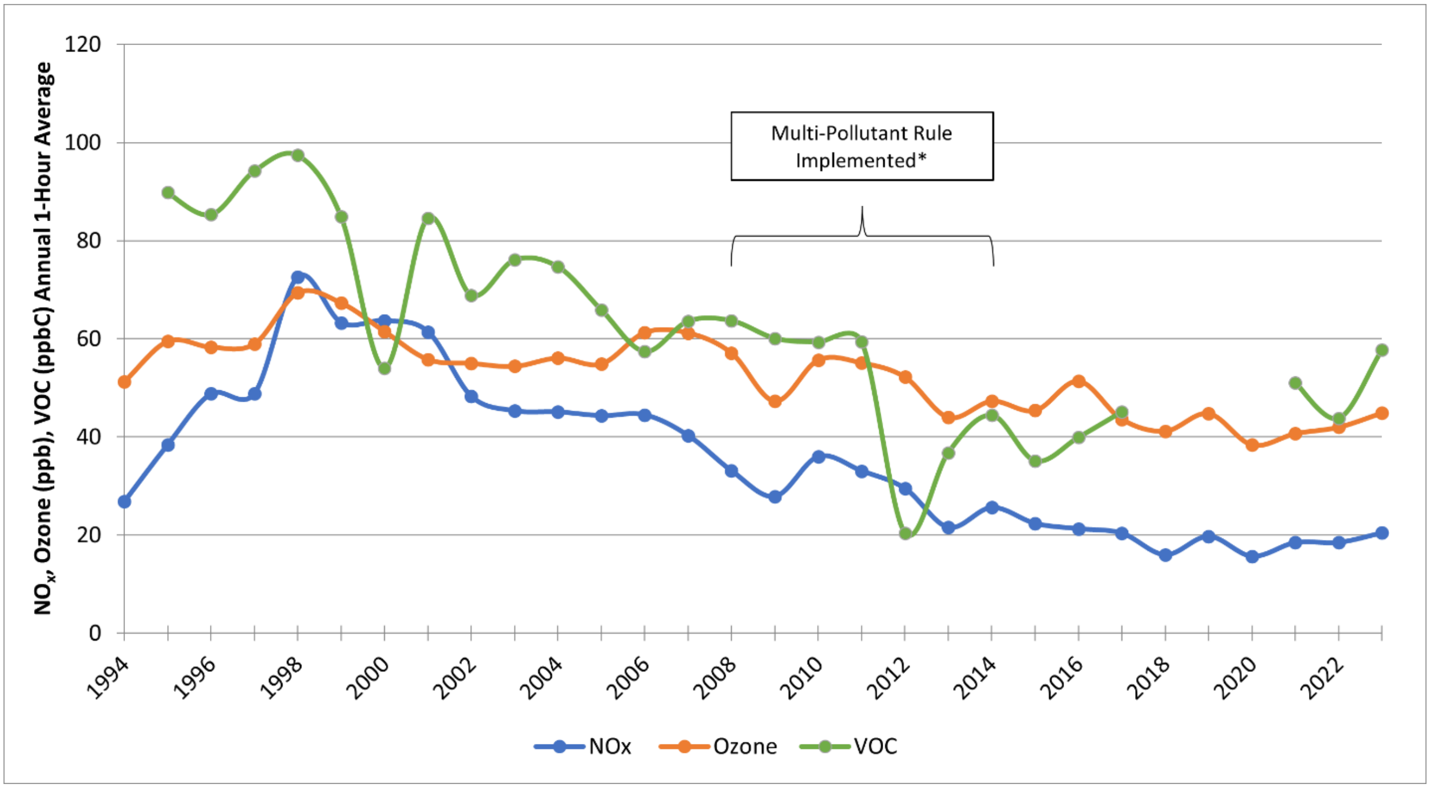


Figure 18.14: Average Annual 1-Hour NO_X and Ozone, and Summer Hourly Average VOC Concentrations for South DeKalb, 1994 - 2023

Figure 18.15 shows Georgia's annual average NO_2 concentrations from 2000 to 2023. Annual average concentrations are well below the standard of 53 ppb and show a slight decreasing trend.

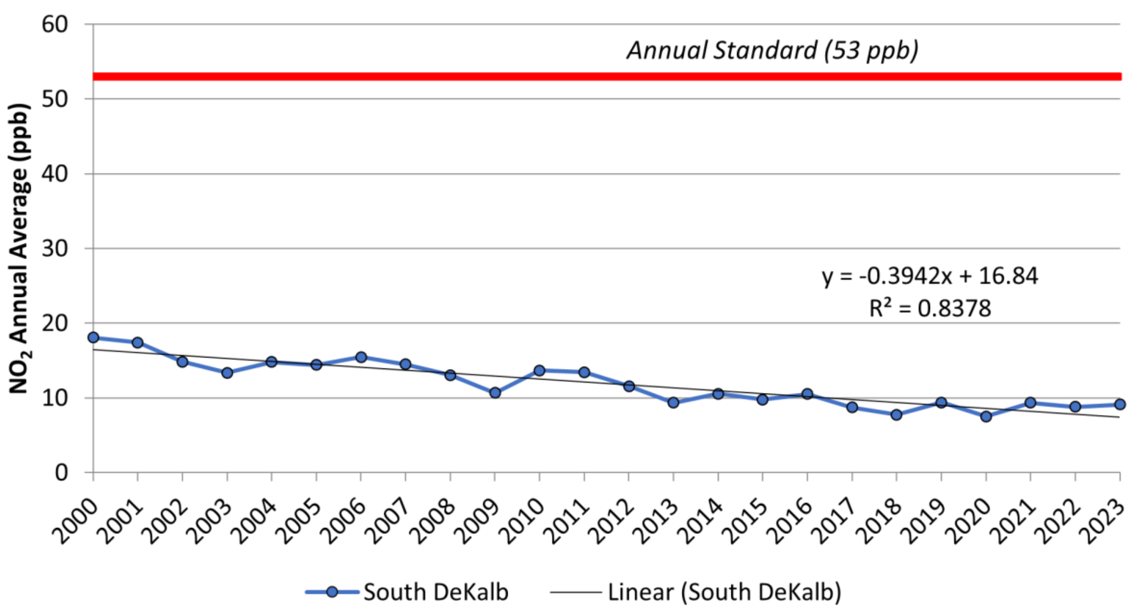


Figure 18.15 Nitrogen Dioxide Annual Averages Compared to the Annual Standard

Figure 18.16 displays the three-year averages of the 98^{th}% of annual daily maximum 1-hour averages (1-hour design values), as available from 2000 to 2023. The 1-hour design values are well below the 100 ppb standard and have consistently dropped since the 2000-2002 averages.

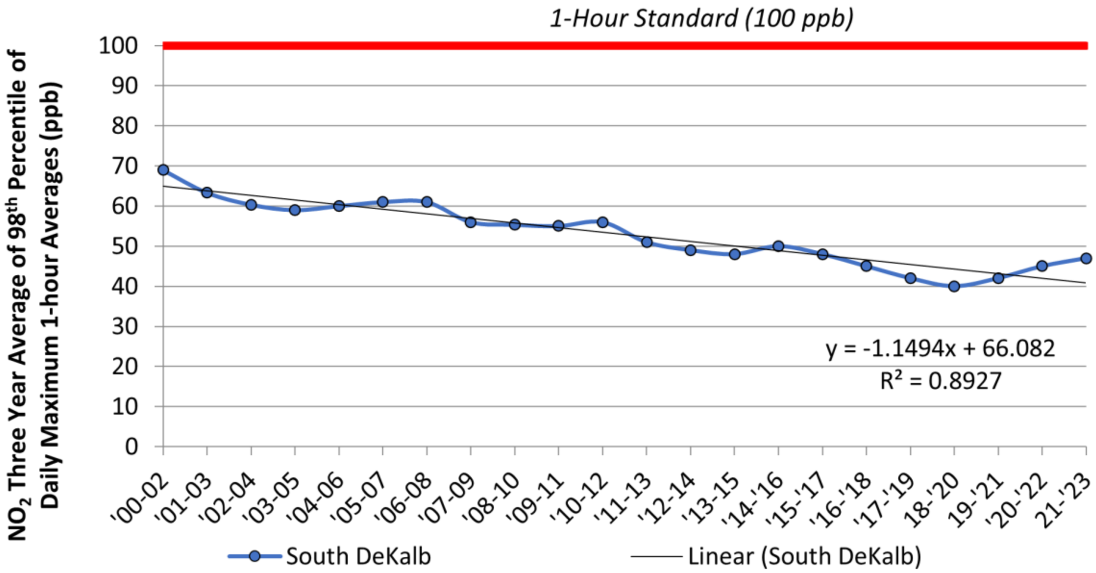


Figure 18.16: Nitrogen Dioxide 1-hour Design Values Compared to the 1-hour Standard

18.4 Assessing the Siting of Georgia's PAMS Stations

The South DeKalb site monitors the magnitude and type of precursor emissions and is located immediately downwind of the area of maximum precursor emissions receiving the predominant morning downwind wind. This site is located in DeKalb County in order to provide neighborhood scale measurements in the area that the precursors have the greatest impact. The wind roses for 2020 through 2023 (Appendix E) continue to show the predominant wind direction to be coming from WNW, which is the direction of downtown Atlanta. As shown in the Trends Assessment (Section 6.0) and Deviation from the NAAQS Assessment (Section 8.0), the South DeKalb site has lower concentrations of CO and NO_2 when compared to the other sites (NR-GA Tech and NR-285): however, the other sites are located in close proximity to monitor near-road emissions. In addition, the South DeKalb PAMS site has been collocated with the NCore network requirements since 2011.

18.5 Upper Air Measurements

For upper air measurement, GA EPD uses a SODAR PA5-LR system in conjunction with balloon rawinsonde data collected from NWS at Peachtree City. This upper air system proves especially useful for monitoring low-level winds during smoke transport events.

19.0 Site Suitability Analysis

As part of the Five-Year Network Assessment, it is important for GA AAMP to assess the locations of existing monitors and ensure that any future additions are in suitable locations for ambient air monitoring. For this assessment, a comprehensive site suitability analysis was conducted to identify optimal locations for monitoring $PM_{2.5}$ and ozone across the state of Georgia. The following modeling approach utilized demographic and environmental data from 2023 to evaluate sensitive populations and exposure across a spatial framework. The sites in the maps are shown with the monitoring network as it was set up in 2023. Since that time, GA AAMP has shut down the ozone monitors at the Leslie (13-261-1001), Evans (13-073-0001), and Summerville (13-055-0001) sites. The model considered factors such as total population, sensitive age groups, low-income populations, unemployment, air pollution levels, and the proportion of people of color. Suitability scoring was performed at both the state and metropolitan statistical area (MSA) levels to assess the current and potential locations to ensure effective, representative monitor placement.

19.1 Methodology

A hexagonal tessellation with 20-mile-wide cells was generated to cover the entire state. Population data were summarized within each hex, and separate rasters were created for the following variables: total population, population under age 5, population over age 65, unemployment rate, percent low-income, percent people of color, and average $PM_{2.5}$ and ozone concentrations (as of 2023). Weights were applied evenly to each variable. A composite suitability score was calculated for each hex by multiplying the values by their weights and summing the results. This produced a continuous raster surface representing $PM_{2.5}$ and ozone monitoring suitability statewide.

The "Locate Regions" tool in ArcGIS Pro was used to identify clusters of hexes with the highest average suitability values. Hex size and shape were preserved in this analysis. The statewide model identified 30 potential regions, which is the maximum number of locations the model is capable of calculating. Ten locations were calculated for the five major MSAs in Georgia: Atlanta-Sandy Springs-Roswell, Augusta Richmond County GA-SC, Columbus GA-AL, Macon-Bibb County and the Savannah MSA. Each model uses a composite suitability score to determine a location ranking, from 1 to 30 at the state level and 1 to 10 for each MSA level map. A location assigned with the rank of 1 (shown on the map in dark purple) had the highest composite suitability scores. It should be noted that although sites represented in darker purple are those which the model deemed most suitable, all locations displayed are considered to have an elevated suitability for monitor placement.

19.2 $PM_{2.5}$ Site Suitability Analysis

19.2.1 Statewide Model

Figure 19.1 shows the $PM_{2.5}$ site suitability model applied to the entire state of Georgia. The ArcGIS Pro suitability modeling tool allows for calculating up to 30 locations. The statewide model identified the Atlanta-Sandy Springs-Roswell MSA as having the highest composite suitability scores across Georgia. This is consistent with the demographic and pollution profile of the Atlanta-Sandy Springs-Rowell MSA: it holds the largest total population, some of the highest concentrations across all sensitive population groups, and $PM_{2.5}$ concentration. Additionally, elevated suitability is identified in the other four major MSAs (Augusta-Richmond County, GA-SC, Columbus GA-AL, Macon-Bibb County, and Savannah MSAs). Current GA AAMP $PM_{2.5}$ monitors are indicated by blue dots.

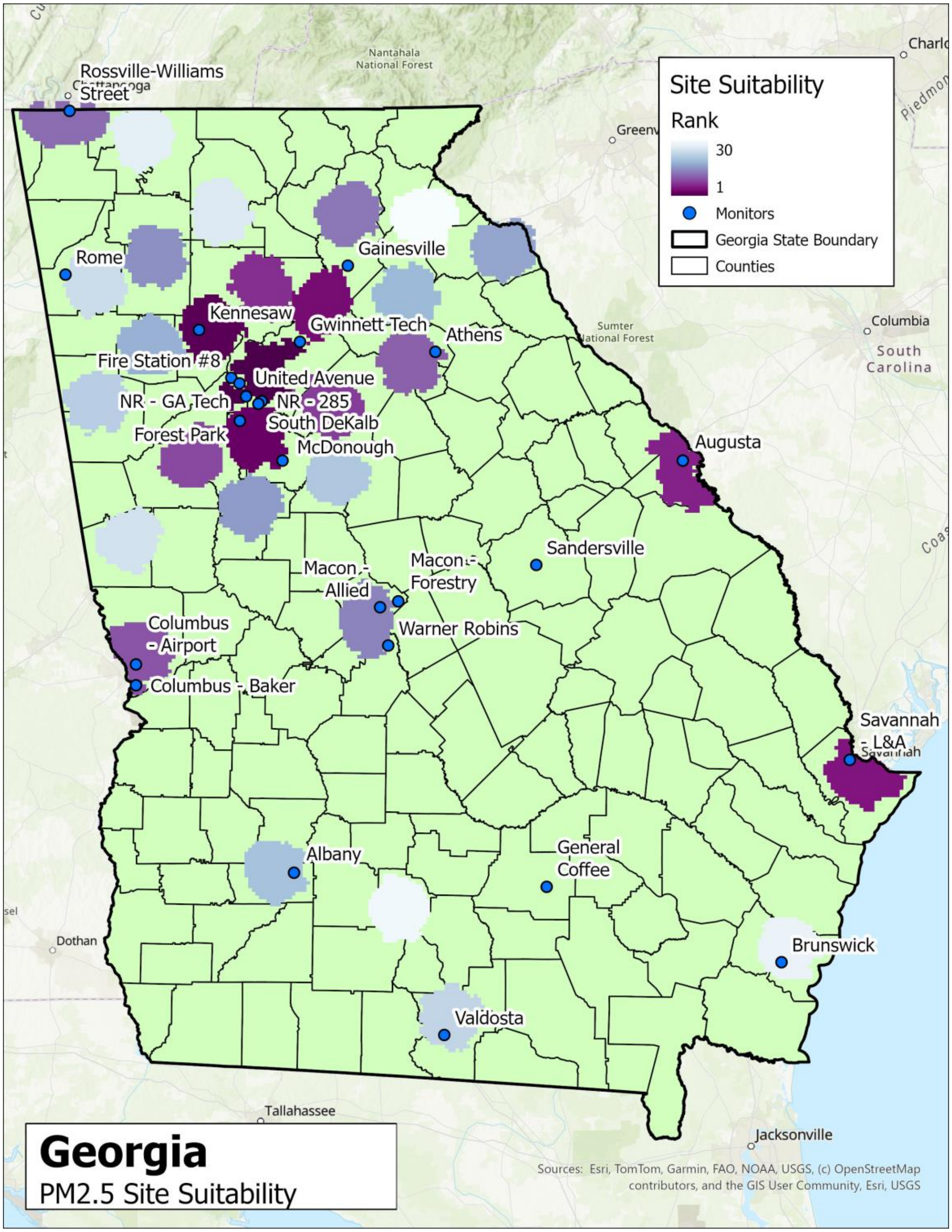


Figure 19.1: Statewide – $PM_{2.5}$ Potential Locations

19.2.2 Metropolitan Statistical Area Models

The site suitability model was also applied independently within each of the five major MSAs where GA AAMP monitors $PM_{2.5}$: Atlanta-Sandy Springs-Roswell, Augusta-Richmond County GA-SC, Columbus GA-AL, Macon-Bibb County, and Savannah (Figures 19.2-19.6). This was done to ensure that the model was more representative of the specific demographic and environmental conditions present in each MSA.

Figure 19.2 displays potential $PM_{2.5}$ monitoring locations across the Atlanta-Sandy Springs-Roswell MSA. Suitability scores are categorized by value ranges, with 1 representing sites that rank the highest among the desired demographic and environmental variables, shown in dark purple. Lighter colors represent sites that rank lower, although it should be noted that any site identified in this model could potentially be a suitable site location. Current GA AAMP $PM_{2.5}$ monitors are indicated by blue dots, and several sites are located in areas with the highest suitability ranking. This map demonstrates how the Atlanta-Sandy Springs-Roswell MSA continues to be a critical area for air quality surveillance.

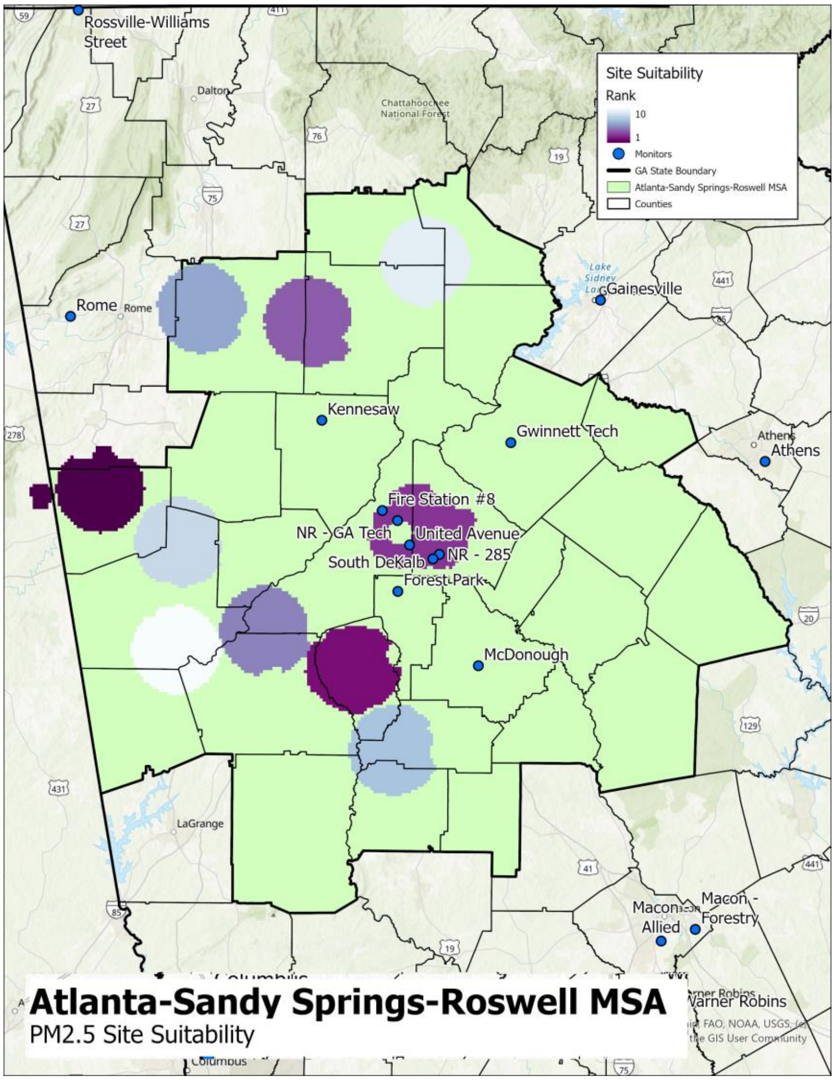


Figure 19.2: Atlanta-Sandy Springs-Roswell MSA – $PM_{2.5}$ Potential Locations

Figure displays potential monitoring sites across the Augusta-Richmond County, GA-SC MSA based on local suitability scores. Existing GA AAMP monitors are displayed as blue dots. This MSA-level analysis ensures locally prioritized coverage, in addition to the statewide model. The Augusta-Richmond County, GA-SC MSA shows the highest suitability near the current site location. Only census tracts within Georgia were included in the analysis, excluding neighboring South Carolina areas.

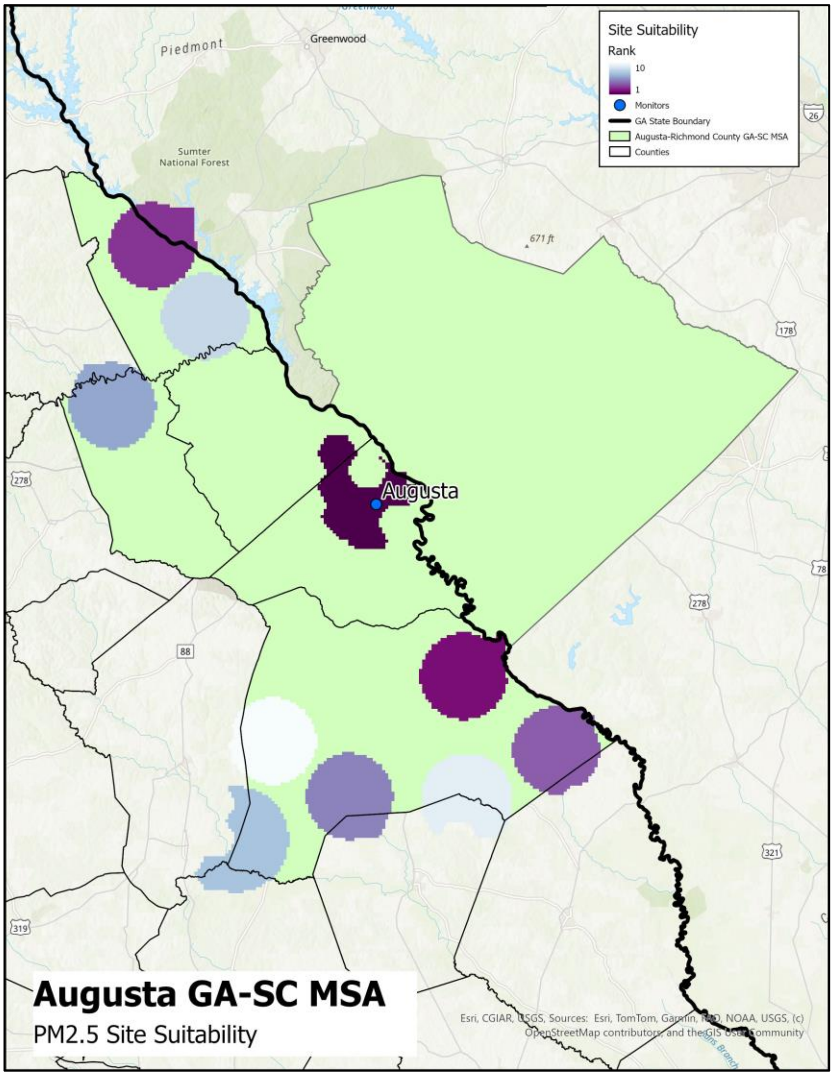


Figure 19.3: Augusta-Richmond County, GA-SC MSA – $PM_{2.5}$ Potential Locations

Suitability scores within the Columbus GA-AL MSA were used to identify high-priority zones for $PM_{2.5}$ monitoring, as visualized in Figure 19.3. The map highlights potential hexes and current monitoring locations. In the Columbus GA-AL MSA assessment, the Alabama tracts were excluded from the analysis. The current sites are located in and around the areas with the highest suitability ranking.

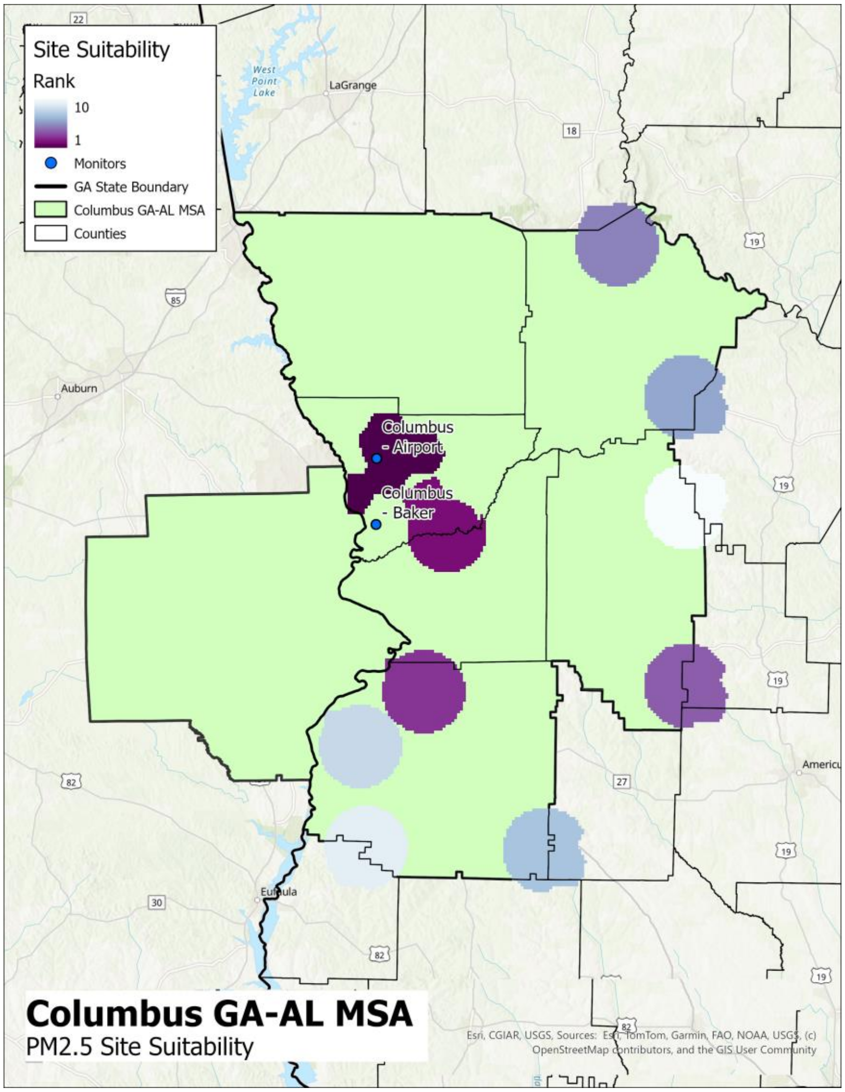


Figure 19.3: Columbus GA-AL MSA – $PM_{2.5}$ Potential Locations

Figure 19.5 identifies potential $PM_{2.5}$ monitoring locations in the Macon-Bibb County MSA, using demographic and pollution exposure data. Two existing monitors are shown with blue dots. Suitability scores in this MSA cluster around the central urban area and southern portions of the region. Two existing monitors are supplemented by new potential zones that extend coverage into nearby tracts.

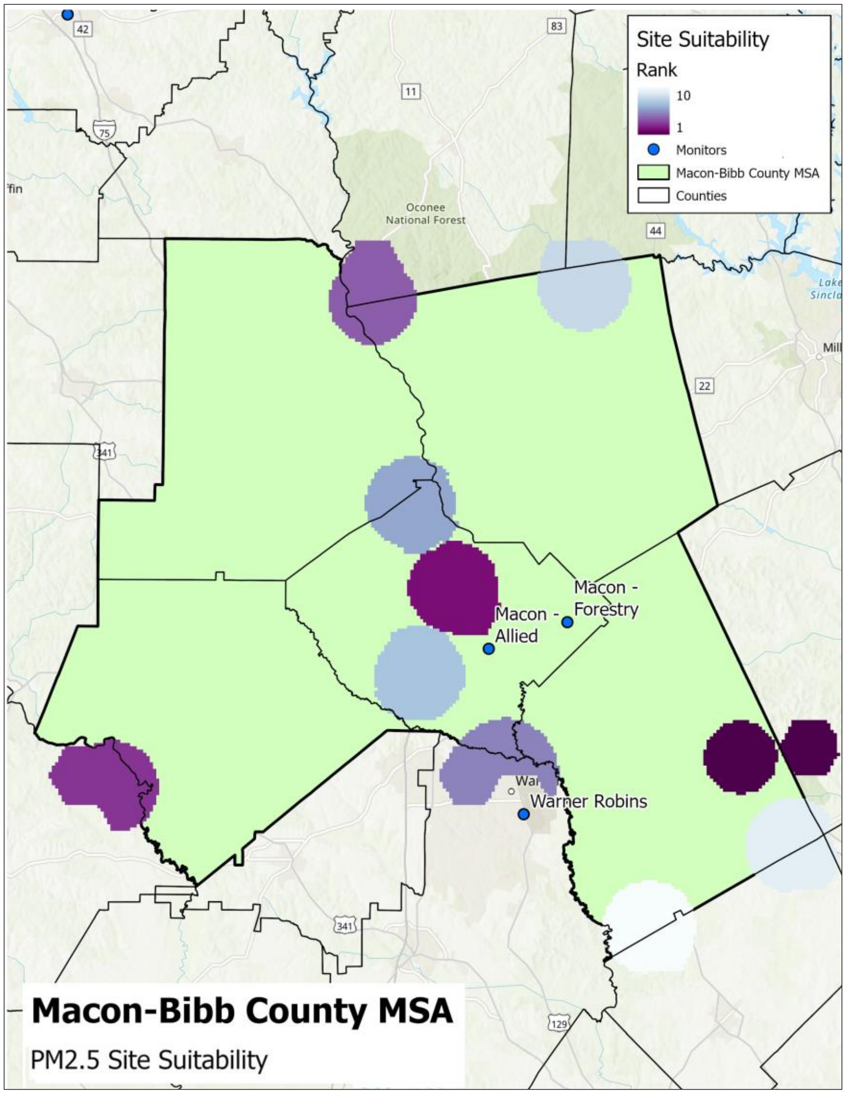


Figure 19.5: Macon-Bibb County MSA – $PM_{2.5}$ Potential Locations

In the Savannah MSA (Figure 19.4), potential locations for $PM_{2.5}$ monitoring were selected based on a localized suitability model. The Savannah MSA features elevated suitability near the city and extending westward. Potential sites are strategically placed to ensure coastal and inland population centers are covered. The current site is located in the highest suitability ranking area.

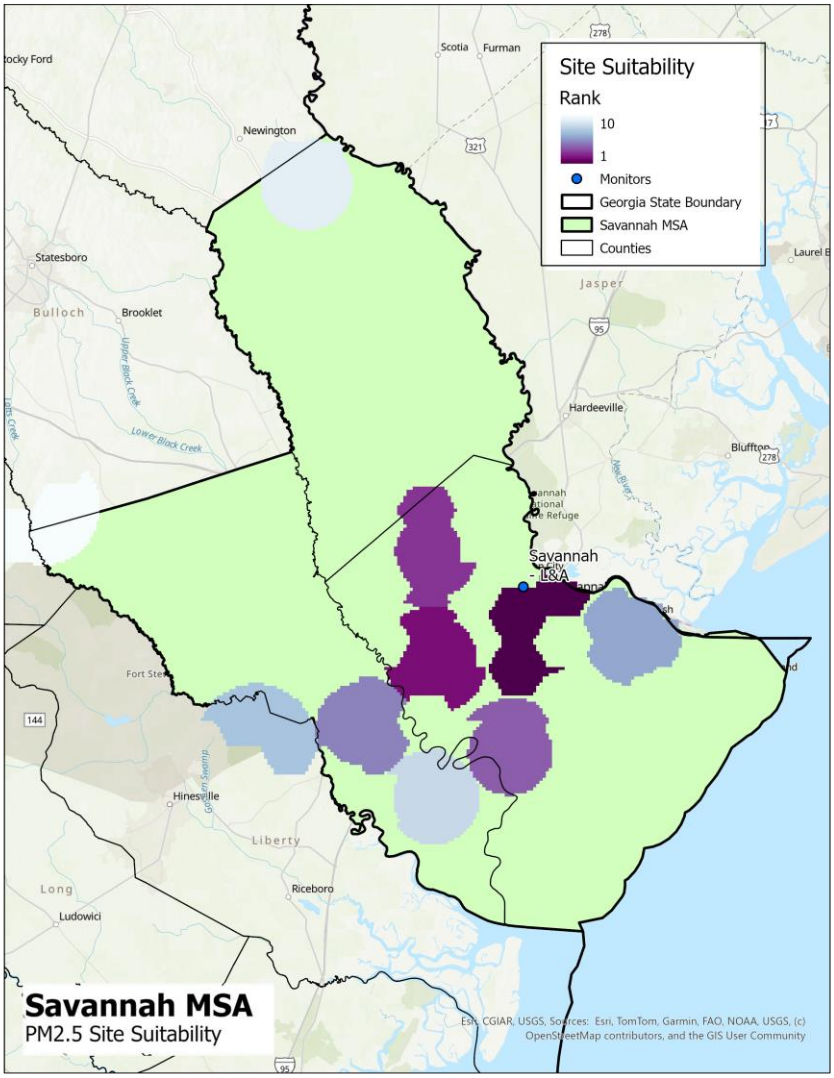


Figure 19.4: Savannah MSA – $PM_{2.5}$ Potential Locations

19.3 Ozone Site Suitability Analysis

19.3.1 Statewide Model for Ozone

Figure 19.7 shows the site suitability model applied to the entire state of Georgia as of 2023. Please note that the ozone monitors at the Leslie (13-261-1001), Evans (13-073-0001), and Summerville (13-055-0001) sites have been shut down since that time. The ArcGIS Pro suitability modeling tool allows for calculating up to 30 locations. The model identified a cluster of locations across the Atlanta-Sandy Springs-Roswell MSA which rank highly for site suitability. The highest ranking cluster contains three ambient air monitoring locations with the highest composite suitability scores for all locations in the state. This is consistent with the demographic and pollution profile of the Atlanta-Sandy Springs-Rowell MSA: it holds the largest total population and some of the highest concentrations of ozone. Additionally elevated suitability is identified in the Augusta-Richmond County GA-SC, Columbus GA-AL, Macon-Bibb County and Savannah MSAs.

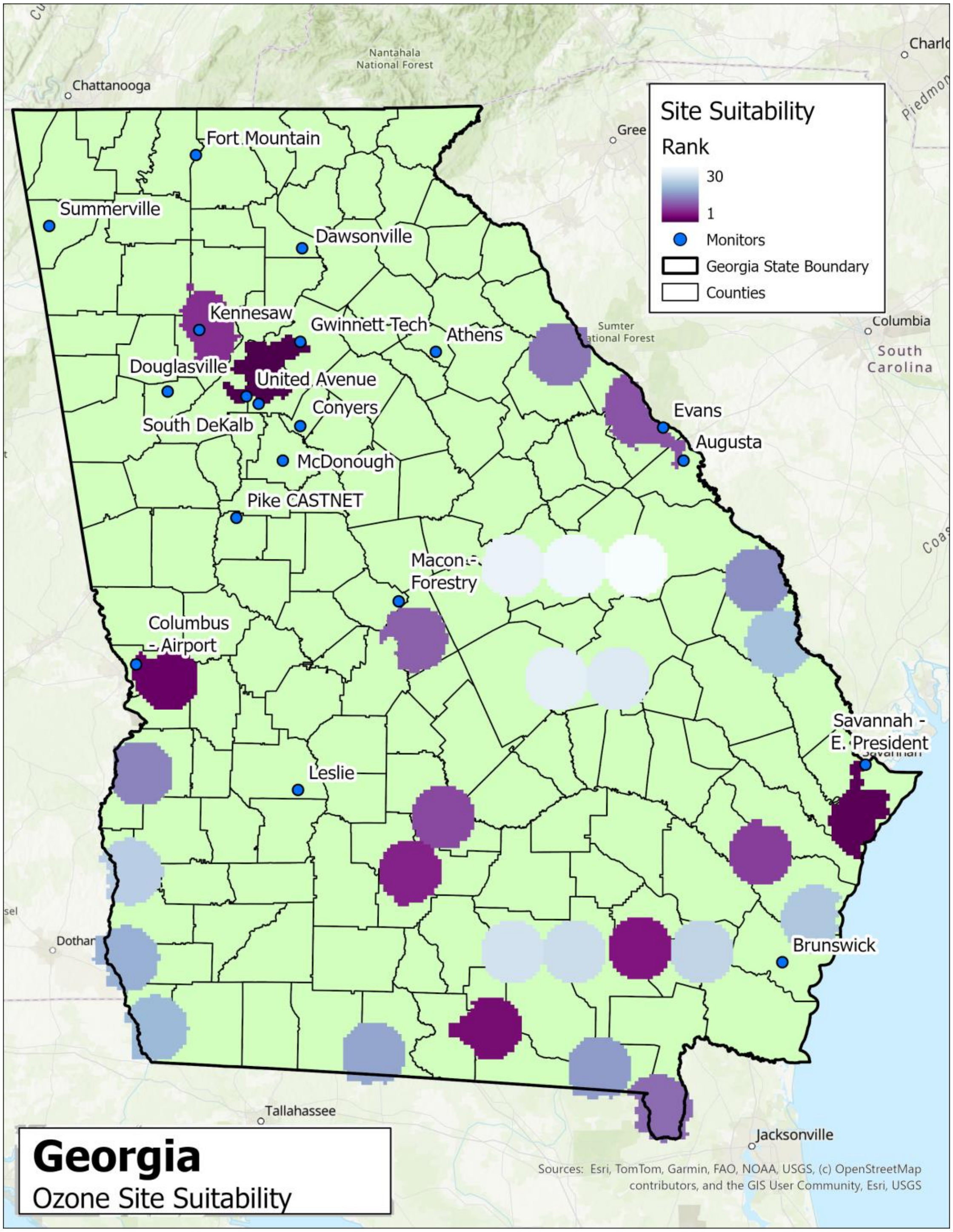


Figure 19.7: Statewide – Ozone Potential Locations

*Please note that the Leslie, Evans, and Summerville ozone monitors have been shut down after 2023, when this assessment was conducted.

19.3.2 Metropolitan Statistical Area Models

The site suitability model was also applied independently within each of the five major MSAs that monitor ozone within Georgia: Atlanta-Sandy Springs-Roswell, Augusta-Richmond County GA-SC, Columbus GA-AL, Macon-Bibb County, and Savannah (Figures 19.8-19.12). This was done to ensure that the model was more representative of the specific demographic and environmental conditions present in each MSA. This strategy ensures adequate monitoring coverage in areas with sensitive populations.

The next map (Figure 19.8) displays potential ozone monitoring locations across the Atlanta-Sandy Springs-Roswell MSA. Suitability scores are categorized by value ranges, with 1 representing sites that rank the highest among the desired demographic and environmental variables, shown in dark purple. Lighter colors represent sites that rank lower. It should, however, be noted that all locations displayed are considered well suited for monitoring ozone. GA AAMP ozone monitors as of 2023 are indicated by blue dots. Please note that since that time, GA AAMP has shut down the ozone monitors at the Leslie (13-261-1001), Evans (13-073-0001), and Summerville (13-055-0001) sites. Potential sites are well-distributed across the urban core and suburban areas, with several sites in the areas with the highest suitability ranking. This map demonstrates how the Atlanta-Sandy Springs-Roswell MSA continues to be a critical area for air quality surveillance.

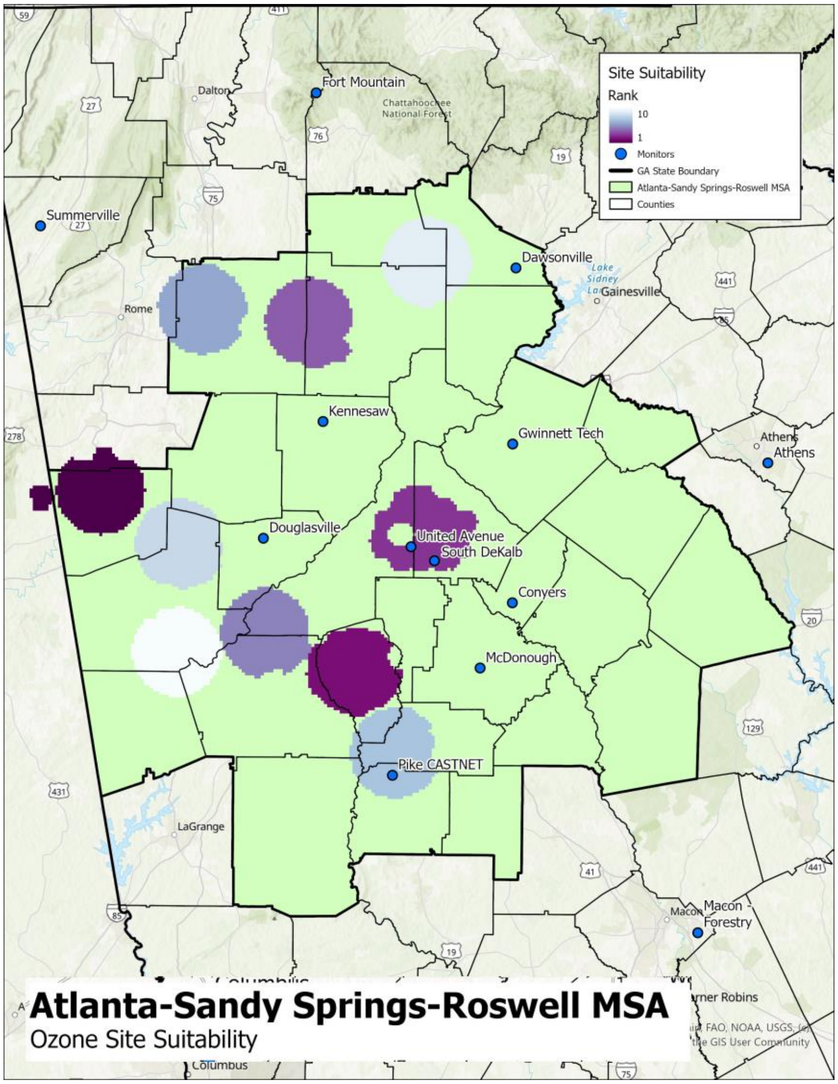


Figure 19.8: Atlanta-Sandy Springs-Roswell MSA – Ozone Potential Locations

*Please note that the Summerville ozone monitor has been shut down after 2023, when this assessment was conducted.

The potential monitoring sites displayed in Figure 19.9 were selected across the Augusta-Richmond County, GA-SC MSA based on local suitability scores. Existing GA AAMP monitors are displayed as blue dots. This MSA-level analysis ensures locally prioritized coverage in addition to the statewide model. The Augusta-Richmond County, GA-SC MSA's Augusta ozone monitor is currently centered inside the highest-scoring region for the MSA. Only census tracts within Georgia were included in the analysis, excluding neighboring South Carolina areas.

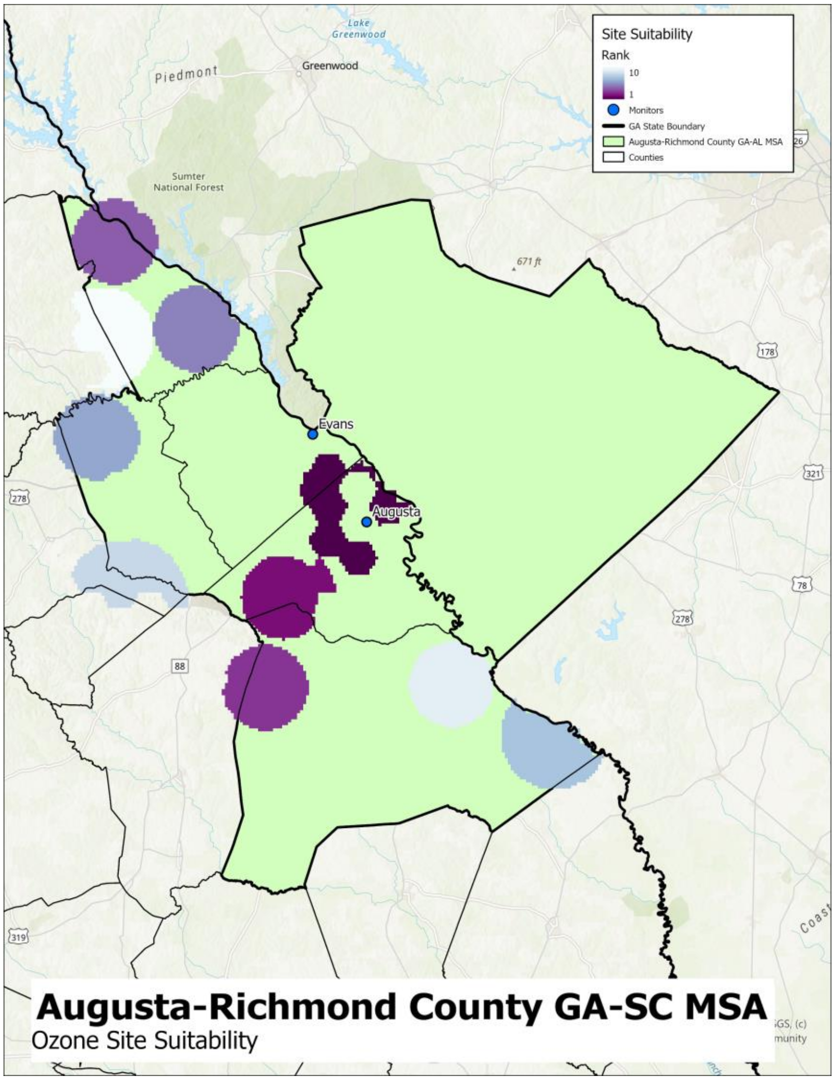


Figure 19.9: Augusta-Richmond County, GA-SC MSA – Ozone Potential Locations
*Please note that the Evans ozone monitor has been shut down after 2023, when this assessment was conducted.

Suitability scores within the Columbus GA-AL MSA were used to identify high-priority zones for ozone monitoring (Figure 19.10). The map highlights potential hexes and current monitoring locations. The Alabama tracts are excluded from the analysis. The potential sites are positioned to enhance coverage in key urban and suburban zones. The Columbus-Airport site is currently located in the area with the highest scoring location as identified by the model.

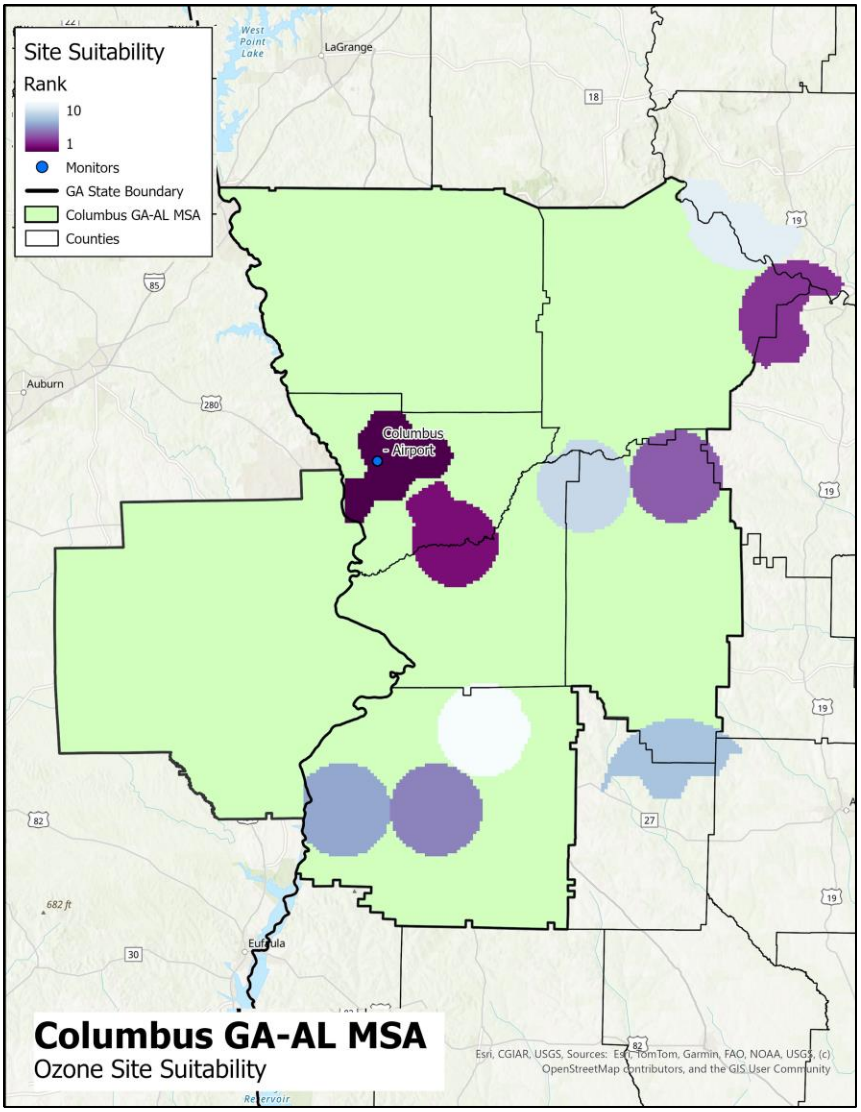


Figure 19.10: Columbus GA-AL MSA – Ozone Potential Locations

Figure 19.11 identifies potential ozone monitoring locations in the Macon-Bibb County MSA, using demographic and pollution exposure data. The existing monitor is shown with a blue dot. Suitability scores in this MSA cluster around the central urban area and southern portions of the region. The existing monitor is supplemented by new potential zones that extend coverage into nearby high ranking tracts. This selection strategy improves monitoring reach into surrounding populations.

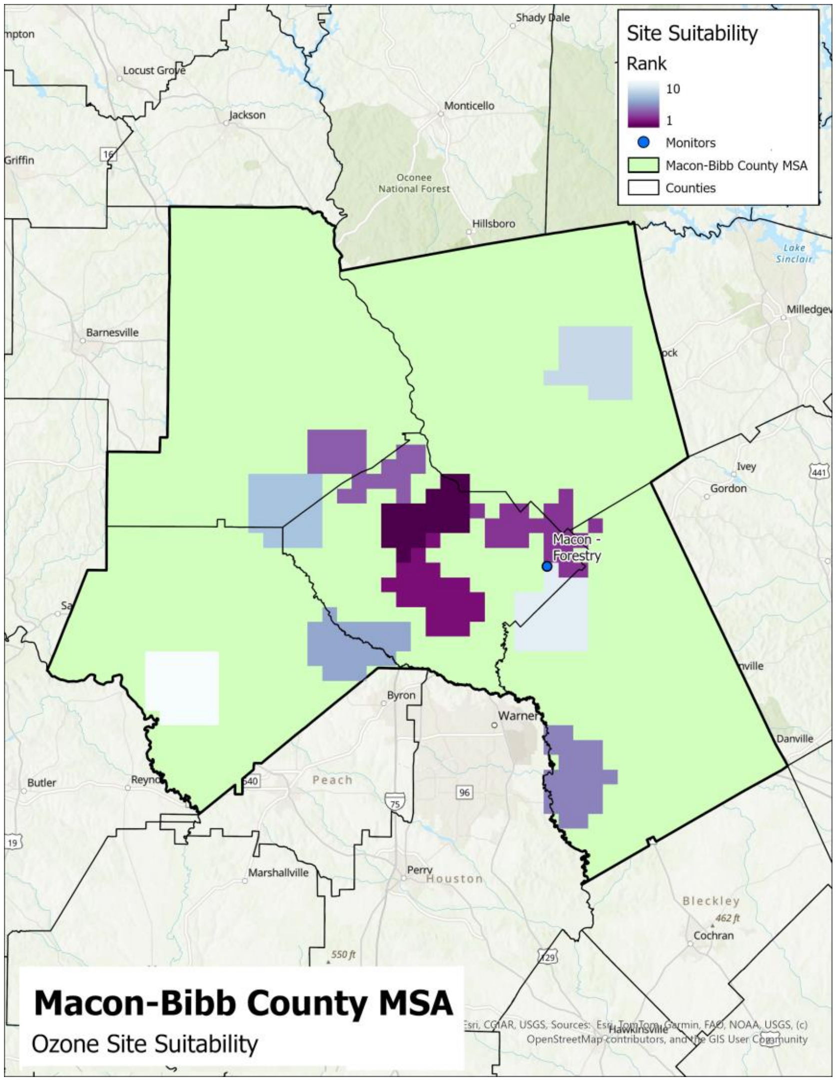


Figure 19.11: Macon-Bibb County MSA – Ozone Potential Locations

Figure 19.12 shows the Savannah MSA and potential locations for ozone monitoring. Locations were selected based on a localized suitability model. The Savannah MSA features elevated suitability near the current location and extending westward. Potential locations are strategically placed to ensure coastal and inland population centers are covered. Savannah's current ozone monitor is located in area of highest suitability ranking.

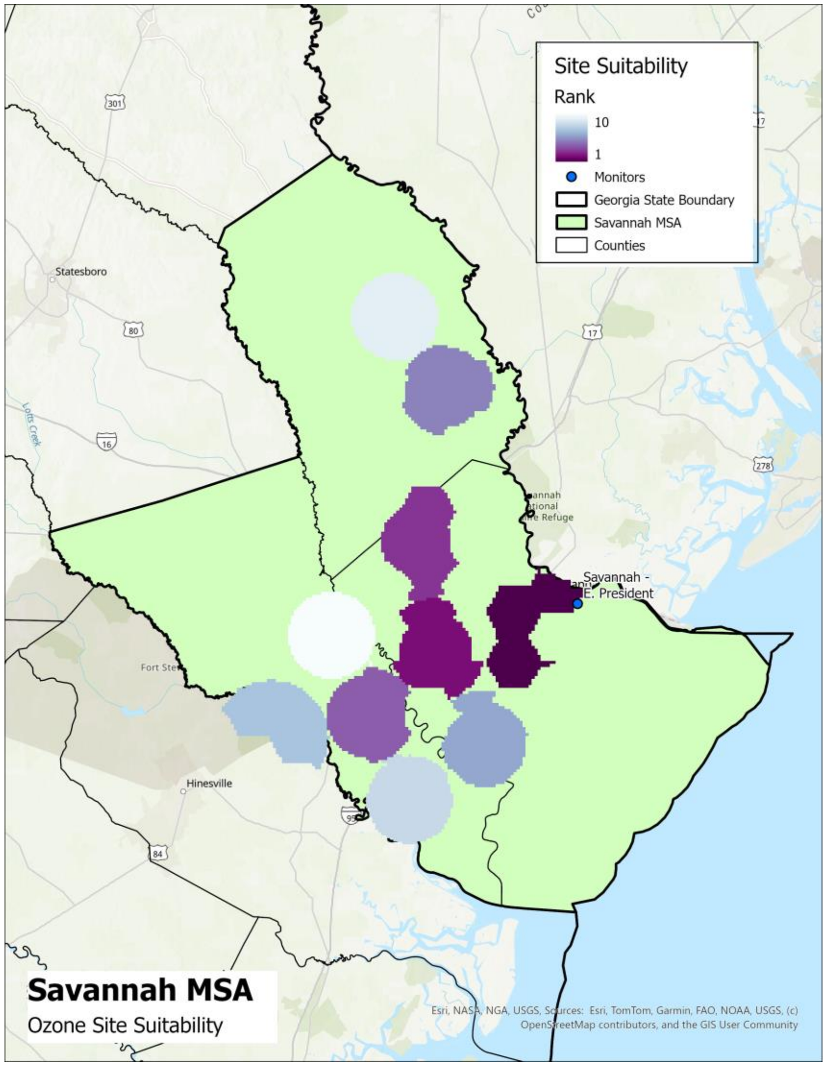


Figure 19.12: Savannah MSA – Ozone Suitability and Potential Locations

19.4 Conclusion

The statewide composite suitability model includes total population, $PM_{2.5}$ and ozone exposure, and other equally weighted demographic factors. Suitability scores are categorized by value and displayed using a hexagonal grid. The results of this analysis provide a data-driven, spatially balanced framework for potentially expanding GA AAMP's $PM_{2.5}$ and ozone monitoring networks. By applying both statewide and MSA models, this approach ensures that monitors are sited in areas with the greatest potential impact while maintaining coverage across all major urban areas. The methodology and outputs can be used to guide potential future investment, planning, and regulatory reporting.

20.0 Conclusion

As part of the requirements for the Environmental Protection Agency's (EPA) amended ambient air monitoring regulations established on October 17, 2006, GA AAMP has performed a Five-Year Assessment. The assessment addresses GA AAMP's efforts to meet EPA's regulations for monitoring air quality in the state of Georgia. The purposes of the Five-Year Network Assessment include: 1) ensuring that Georgia's Ambient Air Monitoring Program meets the monitoring objectives defined in Appendix D of 40CFR58, 2) evaluating the network's existing sites' efficiency in meeting objectives and relative costs, 3) determining if new sites are needed or if existing sites are no longer needed and can be terminated, 4) determining whether discontinuing ambient air monitors would adversely impact data users and health studies, 5) determining if new technologies are appropriate for the network, 6) determining whether the existing and proposed sites support air quality characterization in areas with high populations of susceptible individuals, 7) determining whether changes need to be made to the $PM_{2.5}$ population-oriented network, and 8) developing recommendations for network improvements.

This document provides a comprehensive look at Georgia's ambient air monitoring network. To fulfill the purposes of the Five-Year Assessment listed above, several different analyses were performed on different aspects involving Georgia's ambient air monitoring networks. These assessments included: Trends Impacts; Measured Concentrations; Deviation from the NAAQS; Number of Parameters Monitored; Monitor-to-Monitor Correlations; Population Requirements, Changes, Sensitive populations; Air Quality Index Assessment; Health Assessment; Area Served; Emission Inventory Assessment with modeling of emissions data; Meteorological Assessment; Exceedance Probability; and PAMS network Assessment. The Five-Year Network Assessment outlines the established sites across the state of Georgia, as well as the proposal to maintain and discontinue sites in the state's ambient air quality surveillance system. In addition, Appendix A serves as a directory of existing sites with detailed site information, aerial photo, spatial scale map for each site, list of parameters monitored at each site, monitoring objectives, sampling schedules, probe inlet height, spatial scale, start date of each monitor, and recommendations for that site. Each Metropolitan Statistical Area (MSA) is mapped with existing sites shown within each MSA, as well. Appendix B is a list of Georgia's current ambient air monitoring inventory. Appendix C discusses the ambient air monitoring equipment that GA AAMP uses. Appendix D lists ambient air monitors that have closed, when they closed, and when they were last shown in an *Ambient Air Monitoring Plan*. Appendix E shows wind roses, as well as $PM_{2.5}$ and ozone pollutions wind roses, across the state for 2021 through 2023, where applicable. Appendix F includes the memorandum of agreements (MOAs) with surrounding states.

Each assessment that produced quantifiable results for the sites examined was ranked with one of two ranking methods. The proportionality ranking method was used when the weight of each ranking could be compared to a proportion of the highest and lowest ranking. The formula used for the proportionality ranking was (Value-Min)/(Max-Min). The binning ranking method was used when each site's ranking had a certain limit with which that the site could be compared. For example, with the Deviation from the NAAQS assessment, the binning method was used such that if the absolute value of the pollutant's average was ≥NAAQS=1, ≥85% NAAQS=0.5, <85% NAAQS=0.

If an assessment did not produce quantifiable results, discussion was included that outlined where sites were needed and where sites were not needed according to that assessment. These assessments included parts of the Population Assessment where ambient air monitoring in areas of sensitive populations were examined. Also, the Emissions Inventory Assessment, Health Assessment, Meteorological Summary, PAMS Assessment, and Exceedance Probability Assessment did not have quantifiable results to be calculated and tallied with the other assessments. Each of these sections included the areas where monitors needed to be moved to have sufficient coverage, and areas where monitors could possibly be unnecessary or redundant and removed according to that assessment.

Table 20.1 was developed for assessments that produced quantifiable results. Both the ranking methods and the following table were adapted from Kevin Cavendar's (EPA/OAQPS/AQAD) example presented at the 2009 National Ambient Air Monitoring Conference. These quantifiable assessments included Trends Impacts, Measured Concentrations, Deviation from the NAAQS, Number of Parameters Monitored, Monitor-to-Monitor Correlations, Population Change, Area Served, and Number of Days with an AQI > 100. Depending on the assessment, there may be a different number of sites examined. The focus was on the criteria pollutants, and in some assessments, $PM_{2.5}$ and ozone specifically. $PM_{2.5}$ and ozone have been a focus for GA AAMP due to areas of Georgia being in nonattainment for these two pollutants. Table 20.1 shows a summary of the ranks of each monitor for each assessment with quantifiable results. The site ranks and individual values for each assessment are shown within their respective sections. The total score was calculated for each monitor by adding the quantifiable scores for all the assessments in which that monitoring site was included. If the site was not involved in a particular assessment, there is a blank space in that column. A weighted average was used to determine total rank to prevent bias. The weighted averages were calculated by dividing the total rank of each site by the number of assessments in which the site was included. Sites with the highest weighted averages were given the highest ranks.

It should be noted that due to the timeliness of drafting this Five-Year Assessment document, GA AAMP performed extensive evaluation on data collected from 2019 through 2023.

Table 20.1: Combined Ranking Table of the 2023 GA AAMP Network

AQS ID	Site	Trends	Measured Concentrations	Deviation from the NAAQS	Number of Parameters Monitored	Monitor-to-Monitor Correlations	Population Change	Area Served	# Days with AQI > 100	Total Score	Weighted Average	Total Rank
130890002	South DeKalb	0.85	1.67	2.5	1.00	5.5	0.29	0.108	0.58	12.496	1.562	1
131350002	Gwinnett Tech	0.40	1.98	2.5	0.04	6.5	0.07	0.255	0.47	12.218	1.527	2
130670003	Kennesaw*	0.32	1.56	1.5	0.07	7.0	0.15	0.620	0.21	11.431	1.429	3
130970004	Douglasville	0.36	0.79	1.5	0.04	7.5	0.17	0.285	0.47	11.118	1.390	4
130850001	Dawsonville	0.62	0.40	1.0	0.04	8.0	0.24	0.207	0.16	10.665	1.333	5
131210055	United Ave.	0.49	1.00	2.0	0.11	5.0	0.37	0.025	1.00	9.995	1.249	6
132319991	CASTNET	0.06	0.56	1.0	0.00	7.5	0.17	0.242	0.26	9.795	1.224	7
132470001	Conyers	0.77	0.76	1.5	0.25	6.0	0.22	0.079	0.21	9.789	1.224	8
131510002	McDonough	0.32	0.88	1.5	0.04	6.0	0.31	0.065	0.58	9.694	1.212	9
132450091	Augusta	0.81	2.37	2.0	0.39	1.5	0.17	0.889	0.37	8.497	1.062	10
130590002	Athens	0.26	1.56	1.5	0.04		0.28	1.031	0.21	4.881	0.697	11
130950007	Albany	0.49	1.43	1.0	0.07		0.12	0.947	0.74	4.793	0.685	12
133030001	Sandersville	0.85	1.73	0.5	0.00		0.18	0.740	0.47	4.473	0.639	13
132950002	Rossville Williams St.	1.00	1.53	1.0	0.07		0.13	0.204	0.26	4.197	0.600	14
130210012	Macon-Forestry	0.36	1.12	1.5	0.11	0.0	0.15	1.043	0.32	4.598	0.575	15
130511002	Savannah-L&A	0.89	0.88	1.0	0.11		0.11	0.863	0.16	4.011	0.573	16
132150008	Columbus-Airport	0.68	1.20	1.5	0.04	0.0	0.12	0.666	0.32	4.522	0.565	17
131530001	Warner Robins	0.30	1.15	1.0	0.04		0.27	0.438	0.32	3.514	0.502	18
131850003	Valdosta	0.32	0.66	1.0	0.04		0.21	0.983	0.21	3.424	0.489	19
131270006	Brunswick	0.57	0.32	0.5	0.11		0.71	1.105	0.05	3.367	0.481	20
132130003	Fort Mountain	0.32	0.63	1.5	0.11		0.23	0.260	0.26	3.313	0.473	21
130210007	Macon-Allied	0.85	1.07	1.0	0.14	0.0	0.15	0.236	0.05	3.499	0.437	22
131210039	Fire Station #8	0.87	1.21	1.0	0.04	0.0	0.23	0.037	0.11	3.492	0.436	23
132150011	Columbus-Baker	0.49	1.83	0.5	0.07	0.0	0.09	0.303	0.16	3.441	0.430	24
132151003	Columbus-Crime Lab**	0.72		0.5	0.14		0.32			1.680	0.420	25
130630091	Forest Park	0.77	1.01	1.0	0.00	0.0	0.18	0.327	0.00	3.287	0.411	26
132611001	Leslie**	0.70	0.26	0.5	0.00		0.22	1.000	0.00	2.680	0.383	27
130510021	Savannah-E. Pres. St.	0.40	0.16	0.0	0.07		1.00	0.605	0.05	2.287	0.327	28
130730001	Evans**	0.19	0.06	0.0	0.11	1.5	0.25	0.263	0.00	2.373	0.297	29
131390003	Gainesville	0.32	0.53	0.5	0.04		0.00	0.466	0.16	2.014	0.288	30
130890003	NR-285	0.60		0.0	0.18		0.29		0.16	1.228	0.246	31
131150003	Rome	0.85		0.0	0.04		0.14		0.16	1.188	0.238	32
130550001	Summerville**	0.51	0.18	0.5	0.00		0.20	0.272	0.00	1.662	0.237	33
130690002	General Coffee	0.32	0.00	0.0	0.07		0.17	1.000	0.05	1.613	0.230	34
131210056	NR-GA Tech	0.00	0.56	0.0	0.18	0.0	0.19	0.000	0.16	1.088	0.136	35

***Sites that had monitors shut down in 2024 or early 2025, **Sites shut down in 2024 or early 2025**

There were 35 ambient air monitoring sites across the state of Georgia as of 2023. Although ranks were assigned to each monitor in the table above, these are used only as guidelines; various regulations need to be considered regarding elimination of a particular site. This table is limited in that it does not show where new sites are needed; however, gaps in monitoring areas are discussed within each non-quantifiable assessment. Although the Summerville, Leslie, and Evans sites are shown in Table 20.1 above, GA AAMP has since shut these sites down as of December 2024.

Throughout this assessment, emphasis was given to sites that monitor criteria pollutants and, in some assessments, $PM_{2.5}$ and ozone specifically. The quantifiable assessments focused on sites that contain these monitors. The Measured Concentrations (Section 7.0) and Monitor-to-Monitor Correlations (Section 10.0) only assessed sites with ozone and $PM_{2.5}$ monitors. When all the criteria pollutants were examined, as with Deviation from the NAAQS (Section 8.0), the sites that monitor ozone and $PM_{2.5}$ show higher values and were ultimately ranked higher. In addition, the Area Served Assessment (Section 11.0) only assessed the sites that monitor ozone and $PM_{2.5}$.

Sites that monitor only a few parameters typically have lower rankings. As can be seen in the above table, the Summerville site is ranked one of the lowest of all the ambient monitoring sites. The Summerville site monitored only ozone as addressed by the Number of Parameters Monitored Assessment (Section 9.0). (Please note that the Summerville site was shut down December 2024, after these assessments were performed). Other factors that contribute to a monitoring site having a lower ranking include sites that do not monitor criteria pollutants, and in particular ozone or $PM_{2.5}$, or sites that represent a smaller monitoring area around that monitor (Section 11.0). For example, the NR-GA Tech site does not collect ozone, and it is one of the lowest ranking sites. The lowest ranking sites would be candidates for removal or consolidation with other nearby sites. Combining sites within the same MSA may eliminate redundancy and ensure that regulations are met. For example, there are currently four sites within the Columbus, GA-AL MSA (since the Columbus-Crime Lab site was shut down in 2025), and these sites may be good candidates for consolidation with the other sites within the Columbus, GA-AL MSA.

For the Area Served Assessment (Section 11.0), the ozone and $PM_{2.5}$ networks were examined. For the ozone network, there are sections of southeast GA where the polygons representing an area are very large, covering thousands of square miles. According to this assessment, ozone monitors may be needed in southeast GA to sufficiently represent this part of the state. The addition of an ozone monitor at the site in the Valdosta MSA or at the General Coffee site in Coffee County may be helpful to cover the southeastern portion of the state.

MSAs that have multiple sites monitoring the same parameter within that MSA could have sites combined to have a sufficient number to cover the requirements. According to the population requirements (Section 12.0) for ozone and $PM_{2.5}$, several MSAs have more than the required number of monitors. In particular, the Atlanta-Sandy Springs-Roswell MSA, the Columbus GA-AL MSA, and the Macon MSA have multiples of the same type of monitor and more monitors than are required for the population and design values (Table 12.2). For the Atlanta-Sandy Springs-Roswell MSA, there are eight $PM_{2.5}$ monitors, while only three would be required, and there are nine ozone monitors, while only three would be required. Also, for the Columbus, GA-AL MSA, there are three $PM_{2.5}$ monitors, while only one would be required, according to the population and $PM_{2.5}$ design value. Sites within these MSAs could be consolidated to eliminate redundancy.

As of 2023, there were thirteen ambient air monitoring sites within the Atlanta-Sandy Springs-Roswell MSA. As discussed above, according to the population and design value requirements (Table 12.2), three ozone, three $PM_{2.5}$, and at least three PM_{10} monitors are required. Currently, there are nine ozone samplers, eight $PM_{2.5}$ samplers and three PM_{10} samplers, far exceeding these requirements. As shown in the Monitor-to-Monitor Correlations Section (Section 11.0), the $PM_{2.5}$ and ozone monitors within Atlanta-Sandy Springs-Roswell MSA show that this data is highly correlated. The $PM_{2.5}$ r^2 values range from 0.84 to 0.95, all above the EPA's suggested limit of 0.75 indicating redundancy. The ozone values range from 0.72 to 0.98, with 32 out of 36 values above the 0.75 threshold, indicating redundancy for several ozone monitors within the MSA. To increase efficiency within the networks, sites collecting $PM_{2.5}$ and ozone data in close proximity within this MSA could be consolidated.

With the Emissions Assessment (Section 16.0), some areas of the state had models that showed lower predicted emissions where there are currently monitors for that particular pollutant. For example, SO_2 predicted concentrations are very low across the state, with the highest prediction of 1.65 ppb, and the SO_2 NAAQS is 75 ppb. Further, there are two SO_2 monitors in the Atlanta-Sandy Springs-Roswell MSA, while the predicted values of SO_2 are below 0.3 ppb (with 75 ppb being the NAAQS). In addition, there are two PM_{10} samplers in the Atlanta-Sandy Springs-Roswell MSA, while the predicted values of PM_{10} are below 12-14 µg/m^3 (with 150 µg/m^3 being the NAAQS). The GA AAMP may consider whether or not these monitors are still beneficial for the network, while still meeting federal requirements. Also, as seen in the Emissions Assessment, there were some areas shown that could possibly benefit from having monitors added. The area across the mid-region of the state could potentially benefit from having VOCs monitors, as this area is predicted to have higher VOCs emissions. As of the publication of this document, the GA AAMP has VOC monitors located in the Atlanta-Sandy Springs-Roswell MSA; therefore, according to the Emissions Assessment, additional VOCs monitors may be useful for collecting and characterizing potential emissions data in other areas of the state.

The highest-ranking site is the South DeKalb site. A combination of the quantifiable assessments lead to the South DeKalb site being ranked the highest. The South DeKalb site monitors the most pollutants (including almost all of the criteria pollutants, as well as PAMS, NATTS, and NCore pollutants) (Section 9.0) and has been established since 1974 (Section 6.0). It is located within the Atlanta-Sandy Springs-Roswell MSA, which consistently measures the highest number of days above 100 for the AQI (Section 13.0), and it is one of the areas with more population growth (Section 12.0). The South DeKalb site had concentrations of criteria pollutants that ranked higher in the Deviation from the NAAQS Assessment (Section 8.0) for having concentrations close to the NAAQS.

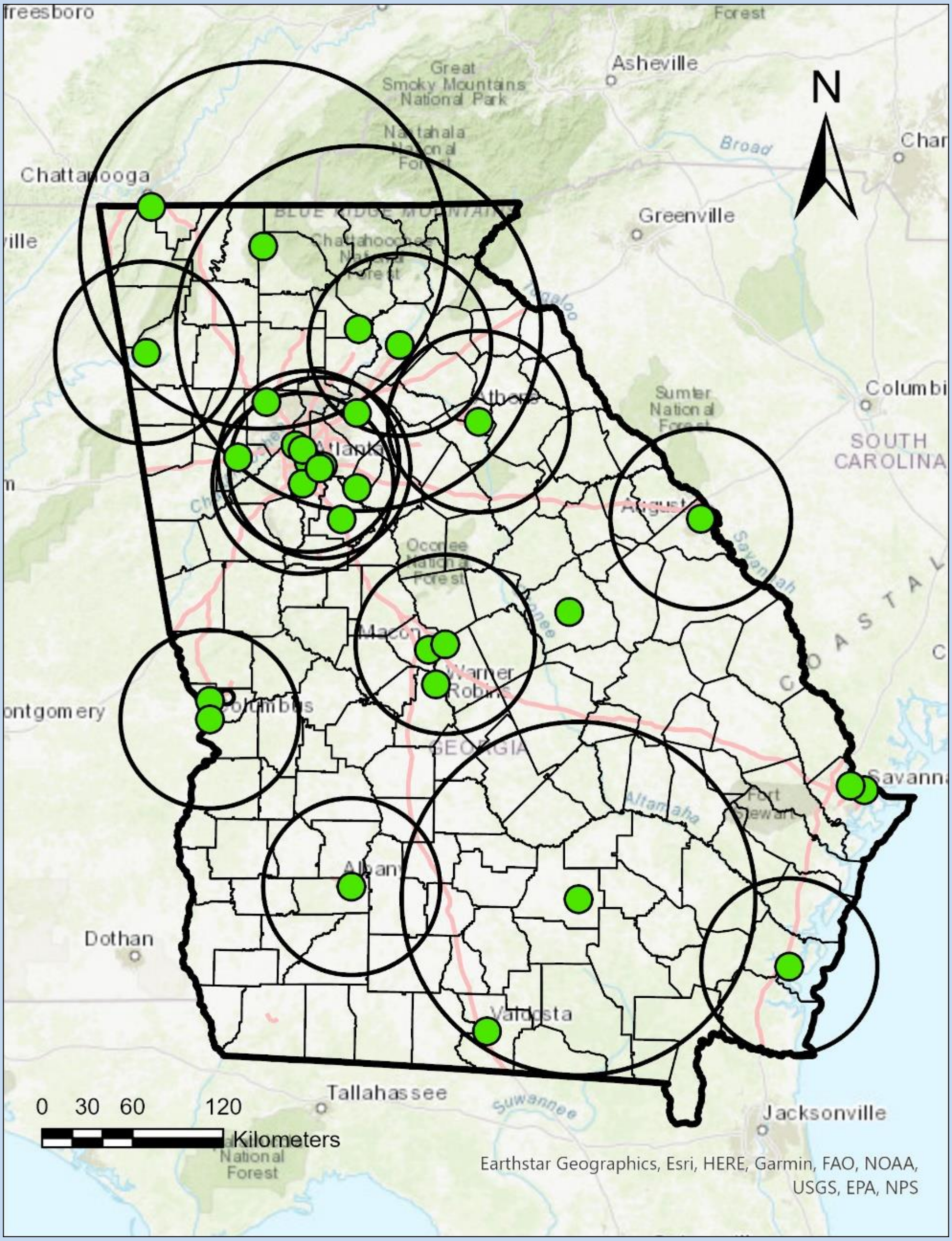
Since GA AAMP conducted the previous edition of the 5-Year Assessment in 2020, several changes have been made to the ambient monitoring networks, as stated earlier. A few sites have been consolidated within the same MSA, sites have been added, and sites have been shut down. Efforts have been made to eliminate redundancies where possible, and sites have been added to ensure federal regulations are met. Appendix A of this document contains a full, detailed list of GA AAMP's current sites, and Appendix D lists monitors that have been shut down.

While GA AAMP has made an effort to review the ambient air monitoring network across the state, these findings and their resulting discussions form the basis for further considerations and planning. Several factors, such as available personnel and budgetary concerns, will play a large part in adding or shifting monitors around the state of Georgia. GA AAMP will make every effort to place monitors where needed, especially as mandated by the federal regulations. As changes are made to the regulations, GA AAMP may need to shift or consolidate monitoring locations in order to accommodate those particular changes and have sufficient coverage.

Appendix A: Individual Site Information Grouped by Metropolitan Statistical Area (Smallest to Largest)

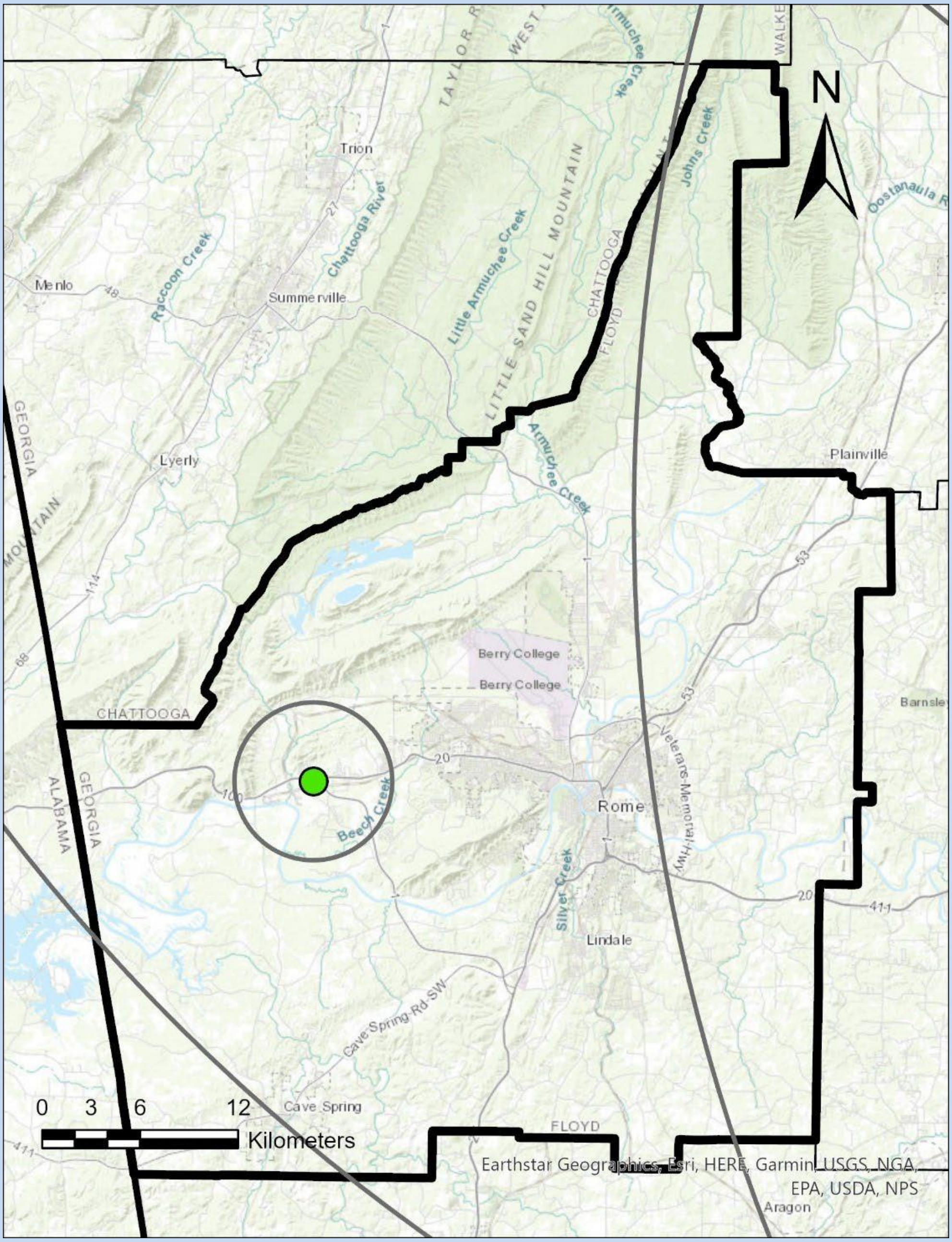
Georgia Department of Natural Resources Environmental Protection Division

Spatial Scales of GA AAMP's Ambient Air Monitors



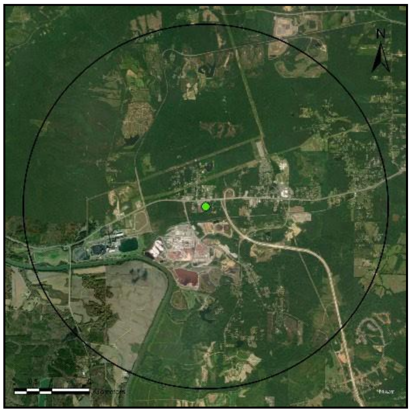
Radius of Circles on Map Micro
Scale: up to 100m Middle
Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

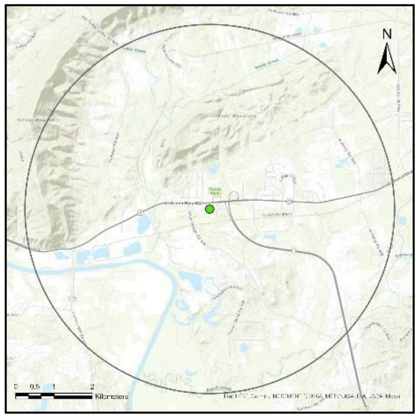
Rome MSA

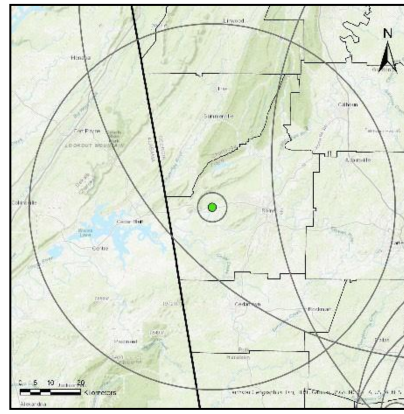


<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Rome







AQS ID: 131150003

Address: 5041 Alabama Hwy, Rome, Floyd County, Georgia 30165

Site Established: 1/1/74

Latitude/Longitude: N34.2605/W-85.3232

Elevation: 186 meters

Area Represented: Rome MSA

Site History: Established as SO_2 site

North

South

East

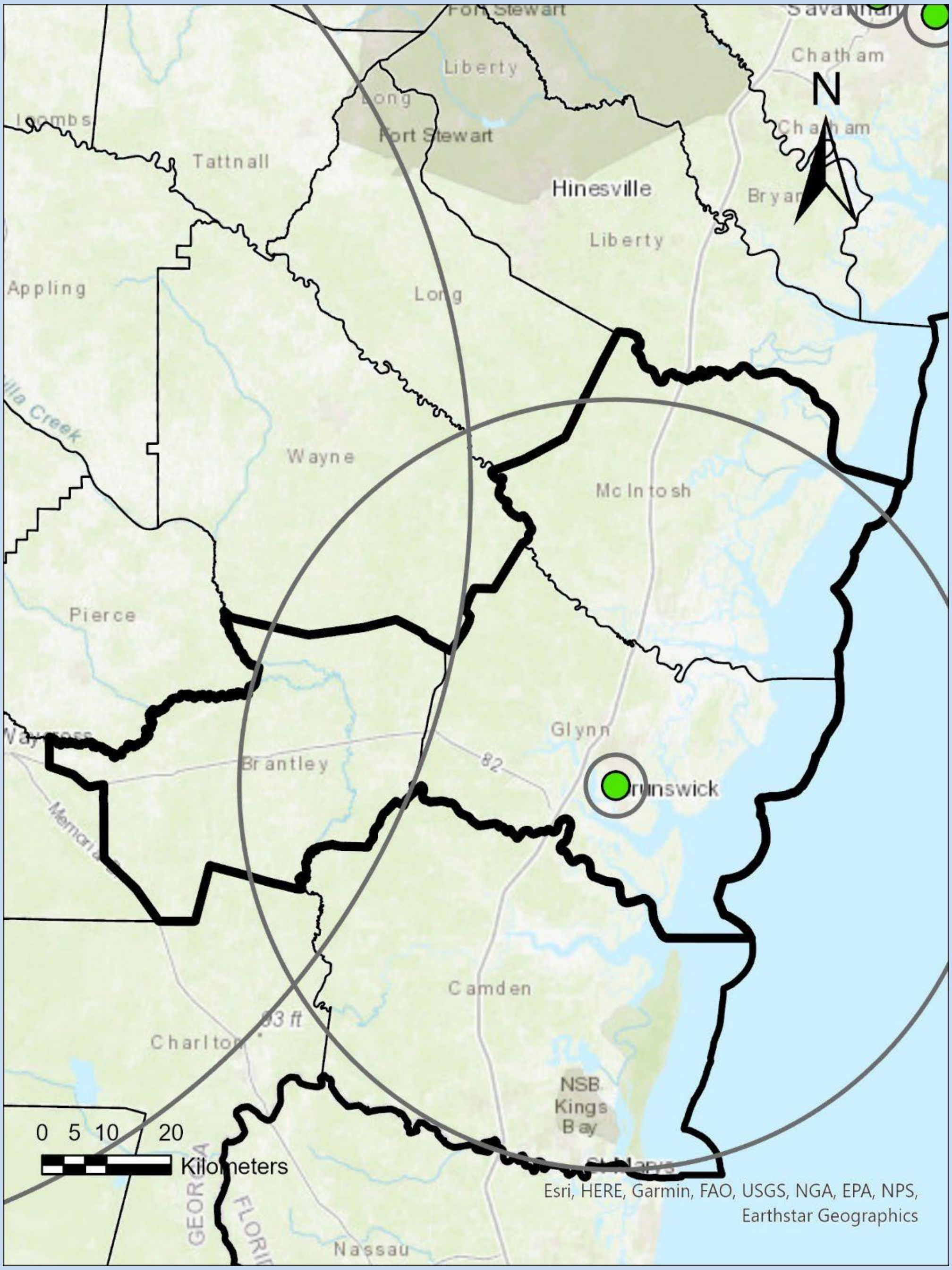
West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$ Speciation	Population Exposure	Every 6 days	2.5 m	Neighborhood	3/1/02
$PM_{2.5}$ Continuous	Population Exposure	Continuous	3.5 m	Urban	3/24/09*

*Sampler inactive from 1/1/15 until reopened 2/15/17

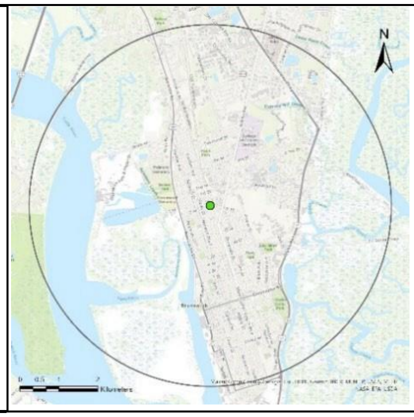
GA AAMP's plans for this site: Continue monitoring; Spatial scale was changed from neighborhood to urban for the continuous $PM_{2.5}$ monitor

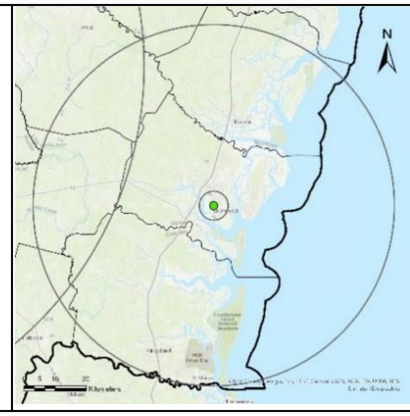
Brunswick MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Brunswick





AQS ID: 131270006

Address: Glynn Learning Center, 2900 Albany Street, Brunswick, Glynn County, Georgia 31520

Established: 1/1/87

Latitude/Longitude: N31.169611/W-81.495194

Elevation: 19.4 meters

Area Represented: Brunswick MSA

Site History: Established as SO_2 site

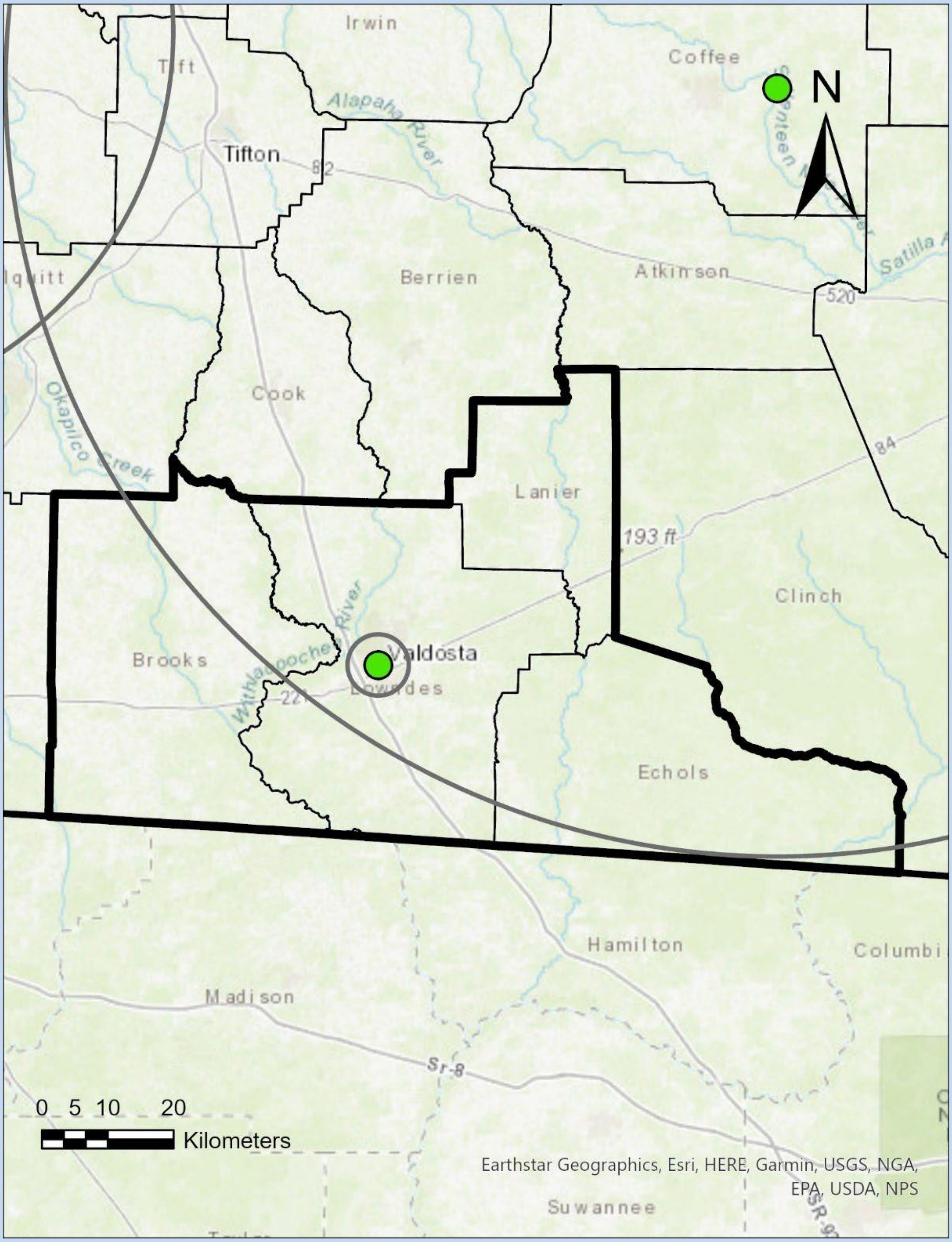
North South East West




Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Every 3 days	4.6 m	Urban	8/31/95
$PM_{2.5}$	Population Exposure	Continuous	4.8 m	Urban	10/21/21
O_3	Population Exposure	Continuous (Mar-Oct)	4.6 m	Neighborhood	3/1/95
Wind Speed	General/ Background	Continuous	9 m	Neighborhood	1/1/04
Wind Direction	General/ Background	Continuous	9 m	Neighborhood	1/1/04

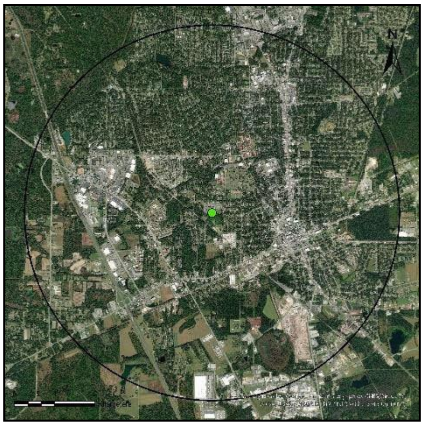
GA AAMP's plans for this site: Continue monitoring; running FEM continuous $PM_{2.5}$ T640 since October 21, 2021; GA AAMP moved to a new shelter in June 2023; Spatial scale was changed from neighborhood to urban for the $PM_{2.5}$ monitors

Valdosta MSA



Radius of Circles on Map
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Valdosta



AQS ID: 131850003

Address: 821 W Gordon Street, Lowndes County, Georgia 31602

Site Established: 12/17/99

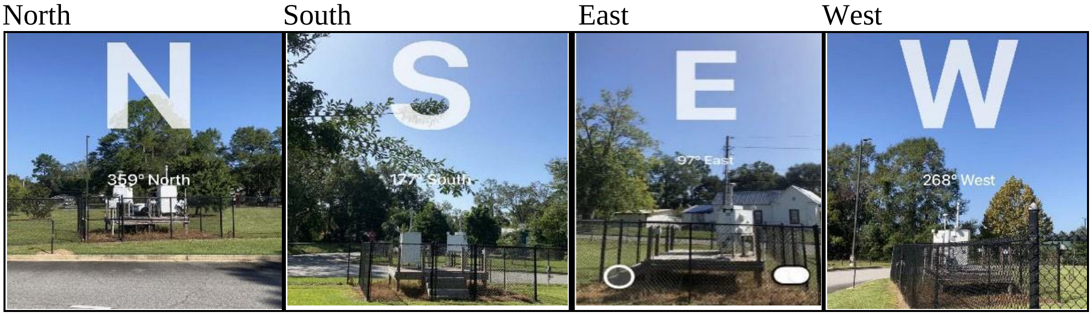
Latitude/Longitude: N30.836577/W-83.294719

Elevation: 55.0 meters

Area Represented: Valdosta MSA

History: Established as $PM_{2.5}$ site

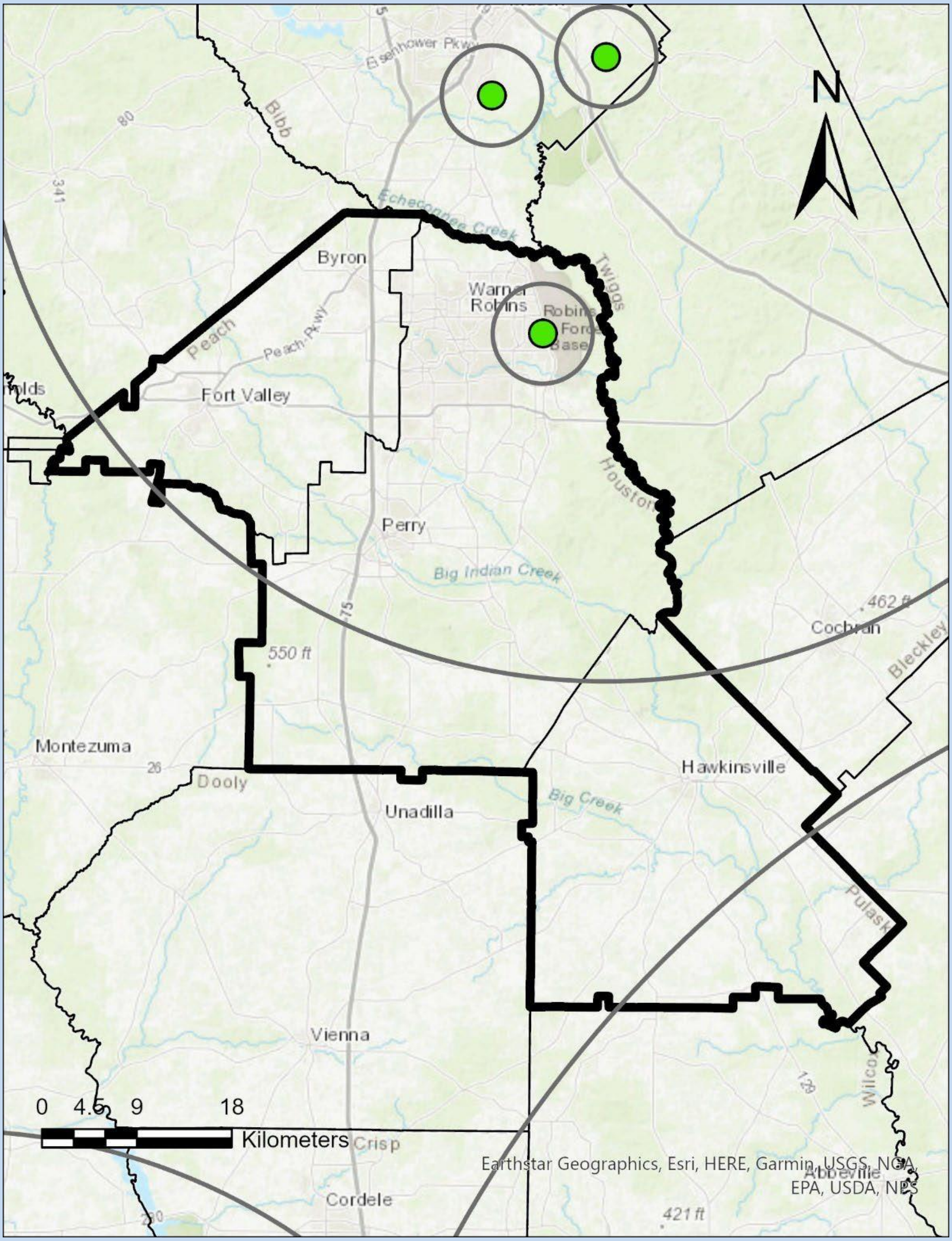
North South East West



Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Daily	2.8 m	Neighborhood	1/1/00
$PM_{2.5}$	Population Exposure	Continuous	3.2 m	Neighborhood	1/1/08

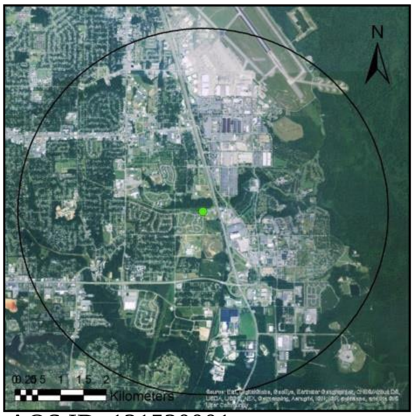
GA AAMP's plans for this site: Continue monitoring; running continuous $PM_{2.5}$ monitor as FEM as of October 22, 2020; Changed the $PM_{2.5}$ FRM sampling schedule to every day as of January 1, 2025; with the August 2023-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

Warner Robins MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Warner Robins



AQS ID: 131530001

Address: Warner Robins Air Force Base, Memorial Park, 800 South 1st Street, Warner Robins, Houston County, Georgia 31088

Site Established: 6/15/00

Latitude/Longitude: N32.6056/W-83.5978

Elevation: 86.25 meters

Area Represented: Warner Robins MSA

Site History: Established as $PM_{2.5}$ site

North

South

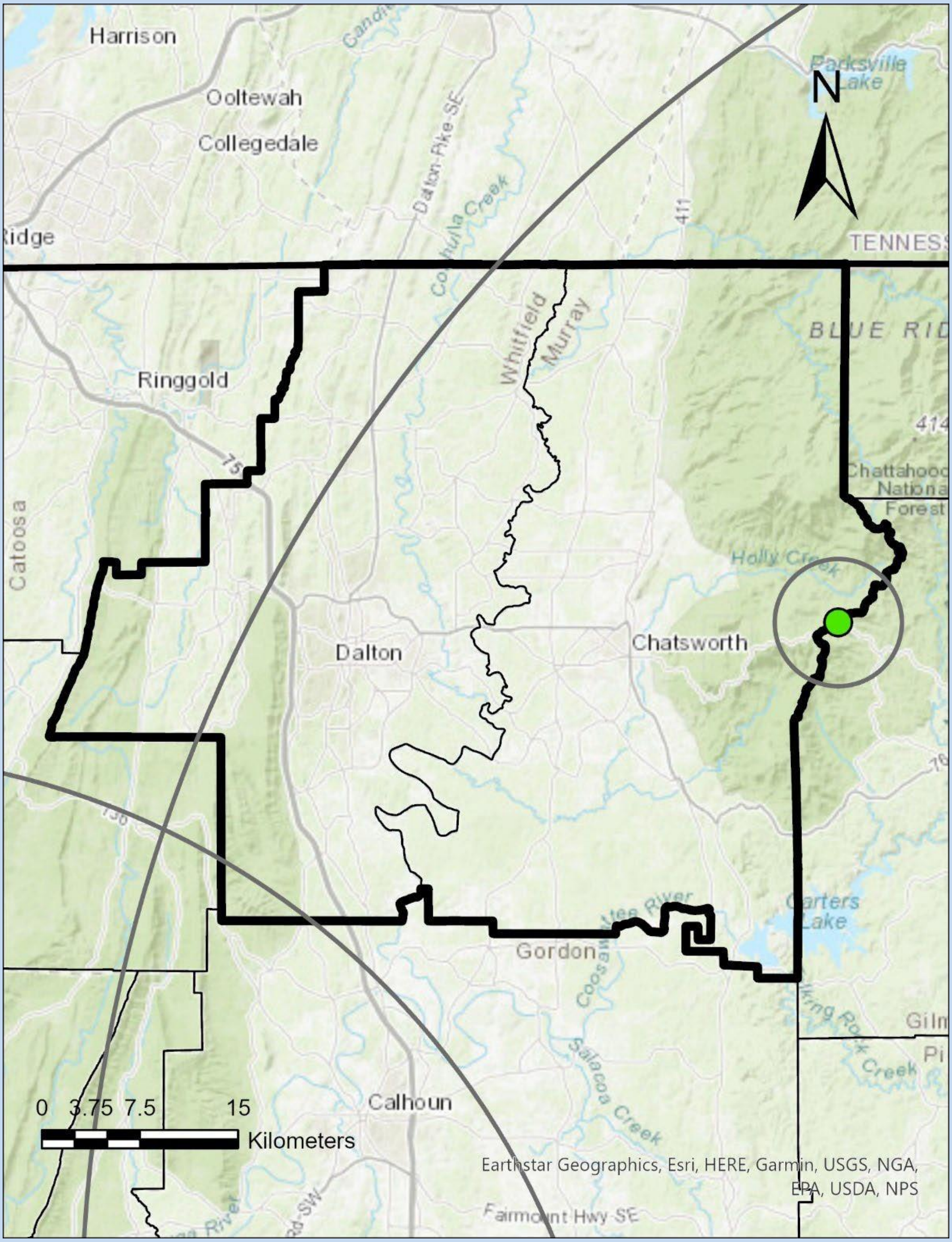
East

West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Daily	2.4 m	Neighborhood	7/5/00
$PM_{2.5}$	Population Exposure	Continuous	2.2 m	Neighborhood	1/1/08

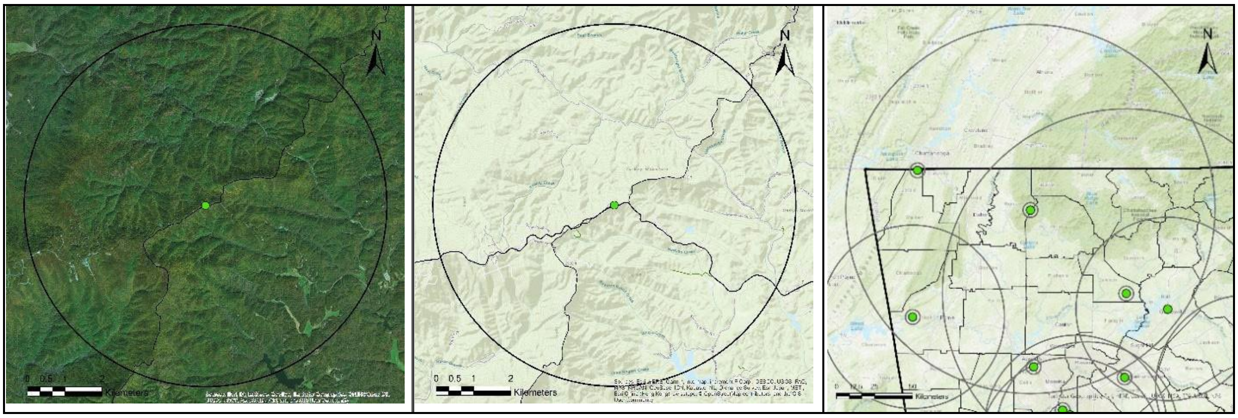
<u>GA AAMP's plans for this site:</u> Continue monitoring; running continuous $PM_{2.5}$ monitor as FEM as of March 7, 2018; on January 7, 2025 the sampling schedule on the FRM increased from sampling every 3 days to daily

Dalton MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Fort Mountain



AQS ID: 132130003

Address: Fort Mountain, State Highway 52, Cohutta Overlook, Chatsworth, Murray County, Georgia 30705

Site Established: 3/23/99

Latitude/Longitude: N34.7851/W-84.6265

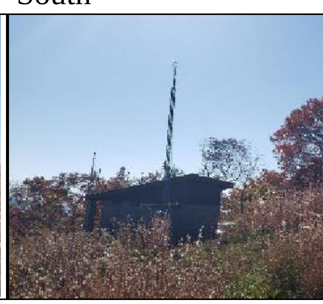
Elevation: 794 meters

Area Represented: Dalton MSA

Site History: Established as O_3 site

North

South



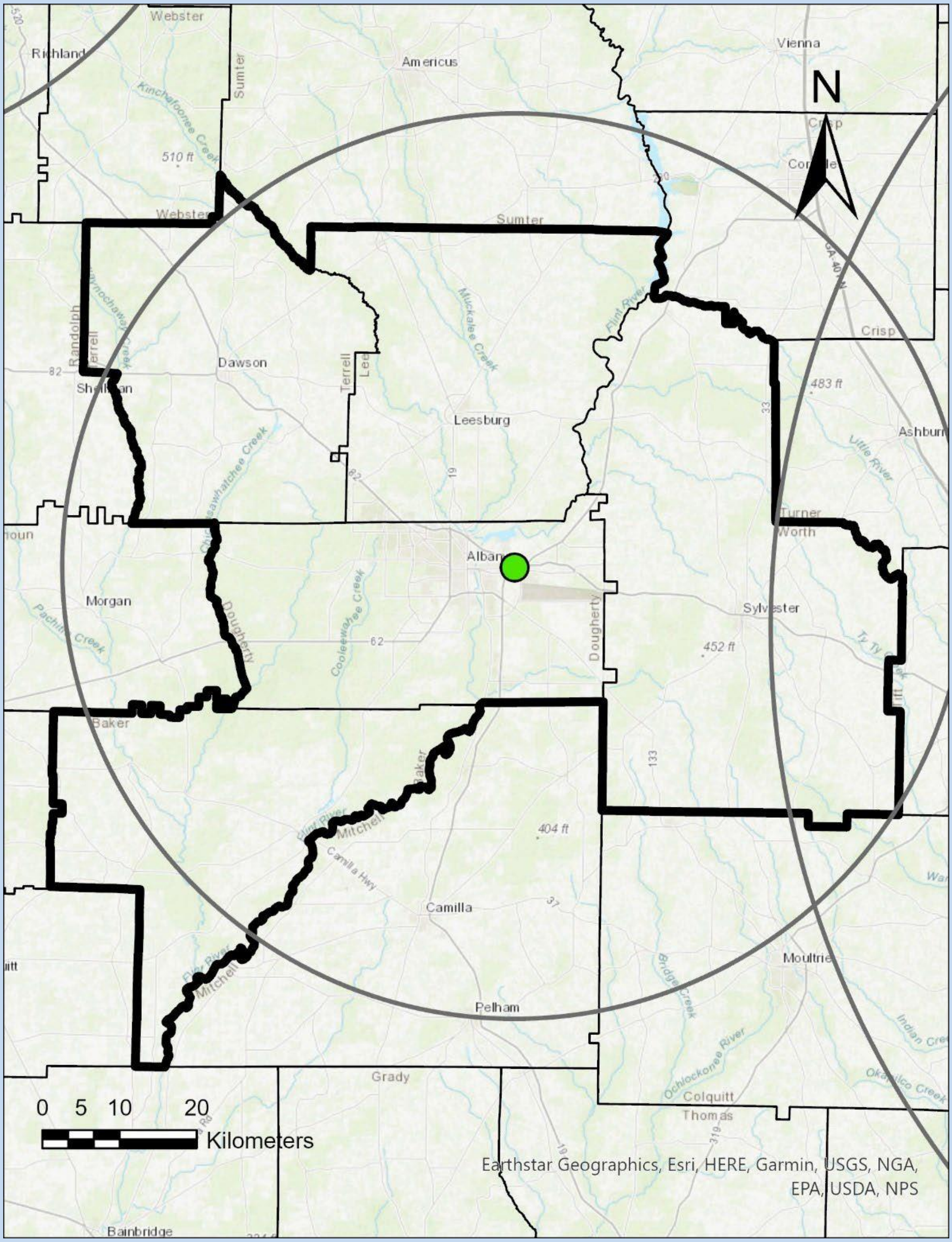
East

West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	5 m	Regional	3/1/00
Wind Speed	General/ Background	Continuous	10 m	Neighborhood	2/7/02
Wind Direction	General/ Background	Continuous	10 m	Neighborhood	2/7/02
Outdoor Temperature	General/ Background	Continuous	2 m	Neighborhood	2/7/02
Relative Humidity	General/ Background	Continuous	2 m	Neighborhood	2/7/02

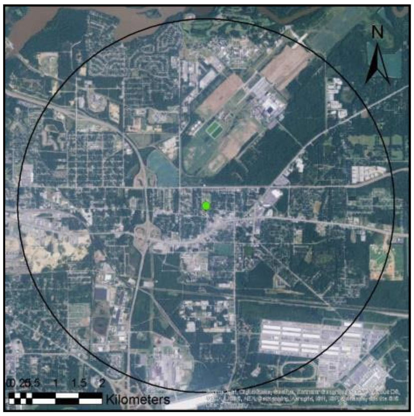
GA AAMP's plans for this site: Continue monitoring

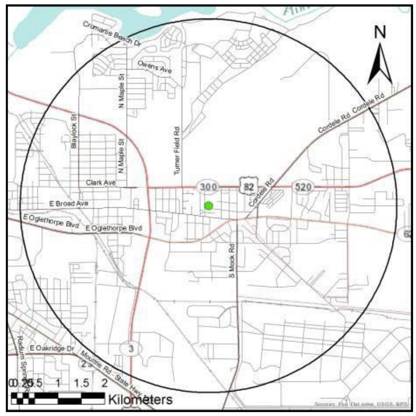
Albany MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Albany





AQS ID: 130950007

Address: Turner Elementary School, 2001 Leonard Avenue, Albany, Dougherty County, Georgia 31705

Site Established: 7/31/91

Latitude/Longitude: N31.57757/W-84.10087

Elevation: 62 meters

Area Represented: Albany MSA Site

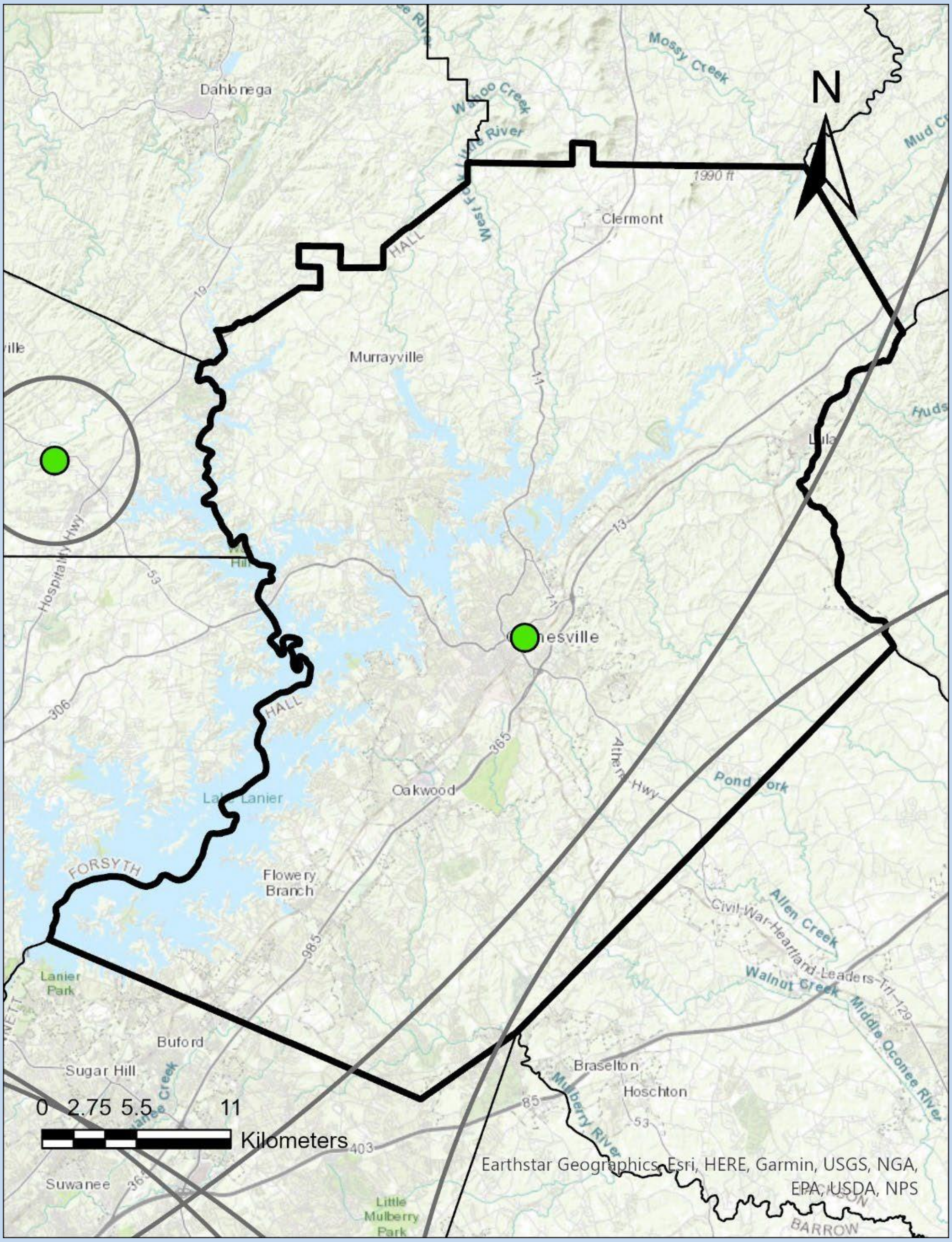
History: Established as TSP site

North South East West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Daily	2.1 m	Urban	2/2/99
$PM_{2.5}$	Quality Assurance	Every 3 days	2.1 m	Urban	1/10/13
$PM_{2.5}$	Population Exposure	Continuous	2.2 m	Urban	5/11/08

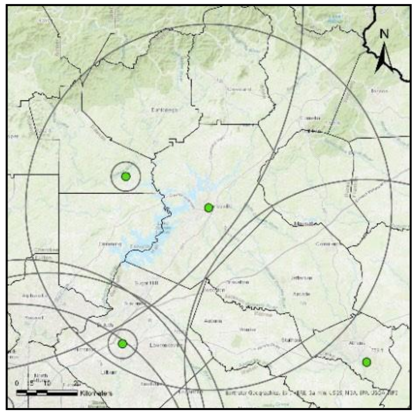
GA AAMP's plans for this site: Continue monitoring; running continuous $PM_{2.5}$ monitor as FEM as of January 10, 2013; from January 1, 2022 to July 31, 2023 there was a NAAQS exclusion for testing the data network alignment; from August 1, 2023 through August 1, 2025, the continuous $PM_{2.5}$ monitor continues to be non-NAAQS with a NAAQS exclusion; GA AAMP relocated the sampling station to ground level as of March 2024; with the August 2023-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

Gainesville MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Gainesville



AQS ID: 131390003

Address: Fair Street School, 695 Fair Street, Gainesville, GA 30501

Site Established: 1/1/97

Latitude/Longitude: N34.2993/W-83.8134

Elevation: 353 meters

Area Represented: Gainesville MSA

Site History: Established as $PM_{2.5}$ site

North

South

East

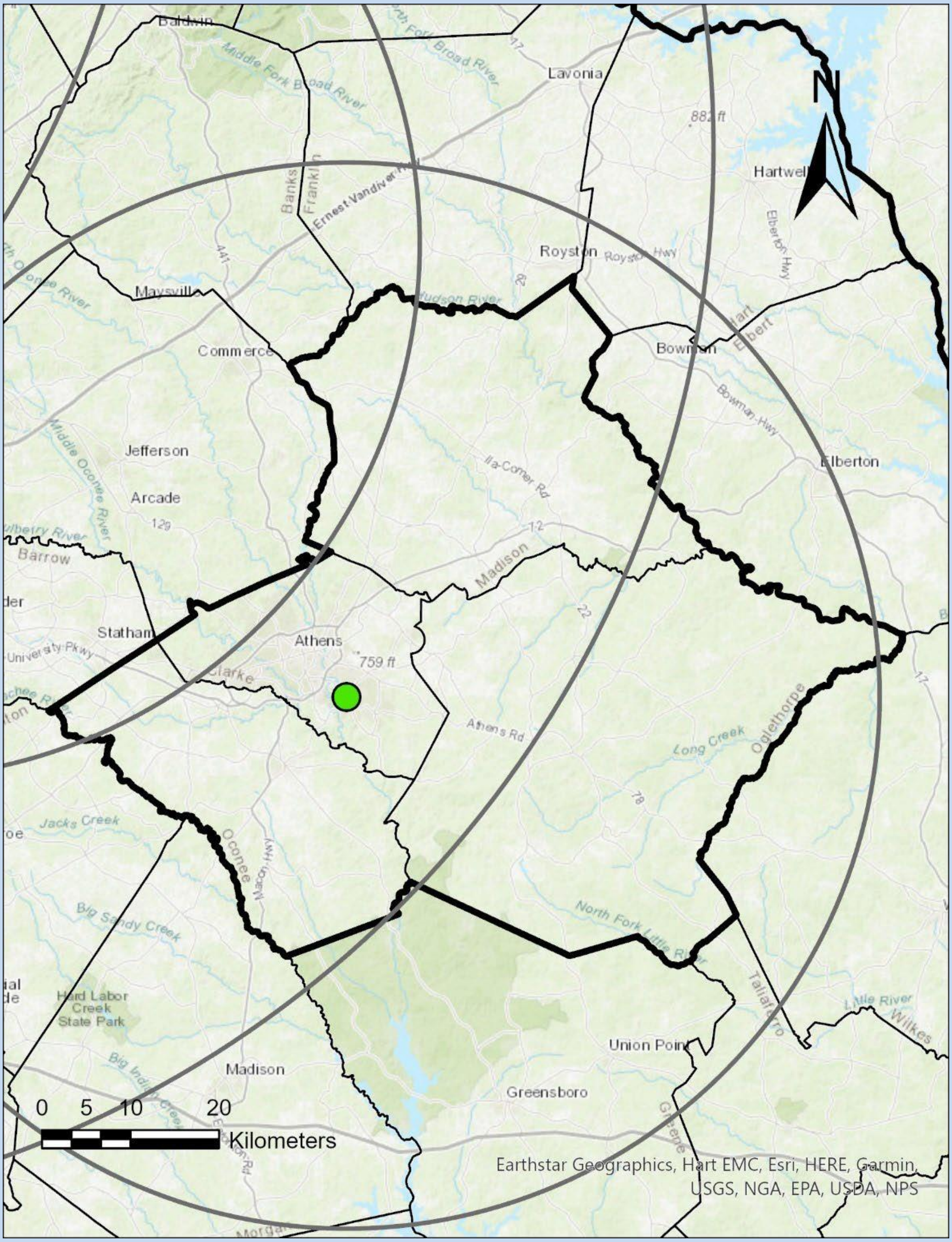
West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Daily	2.9 m	Urban	2/14/99*
$PM_{2.5}$	Population Exposure	Continuous	2.9 m	Urban	1/1/08

*Sampler inactive from 11/1/18 until reopened 3/24/23

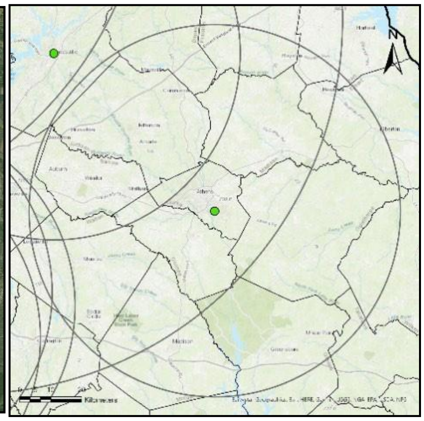
<u>GA AAMP's plans for this site:</u> Continue monitoring; running continuous monitor as FEM as of October 3, 2017; FRM monitor was inactive from November 1, 2018 to March 24, 2023 when daily sampling was reinstated to ensure redundancy in the Gainesville MSA and avoid completeness issues; Spatial scale was changed from neighborhood to urban for the $PM_{2.5}$ monitors: a NAAQS exclusion has been approved for the continuous $PM_{2.5}$ FEM monitor from January 1, 2021 to July 31, 2025 for testing network data alignment; with the August 2023-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

Athens-Clarke County MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Athens

AQS ID: 130590002

Address: 2350 Barnett Shoals Road, Athens, Clarke County, Georgia 30605

Site Established: 3/1/02

Latitude/Longitude: N33.9180/W-83.3445

Elevation: 220 meters

Area Represented: Athens-Clarke County MSA

Site History: Established as O_3 and PM site

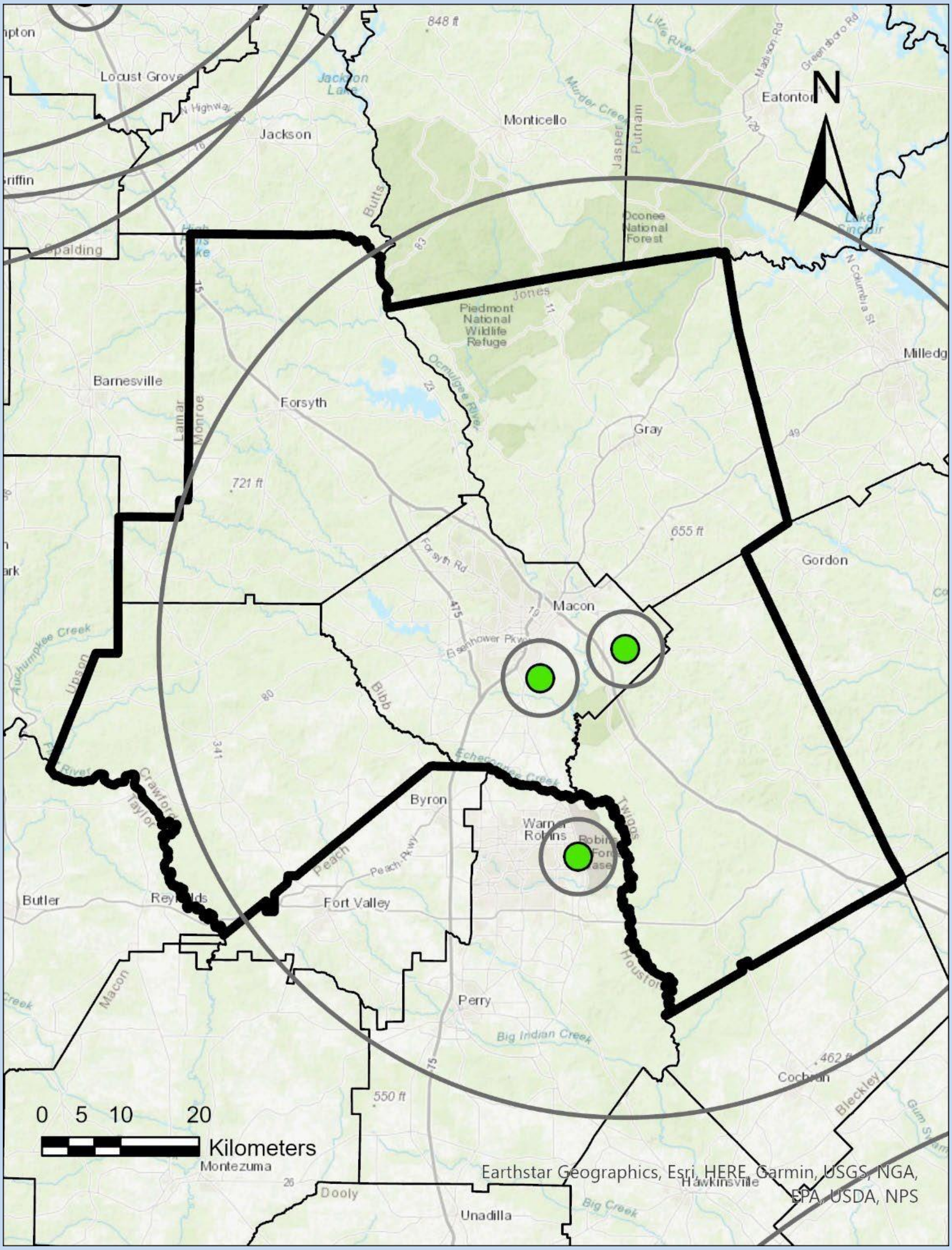
North South East West




Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	4.6 m	Urban	5/1/02
$PM_{2.5}$	Population Exposure	Continuous	4.6 m	Urban	8/1/04
$PM_{2.5}$	Quality Assurance	Continuous	4.6 m	Urban	2/15/19

GA AAMP's plans for this site: Continue monitoring; running continuous $PM_{2.5}$ monitor as FEM as of April 1, 2018; on February 15, 2019, GA AAMP added a second FEM Teledyne T640 Continuous $PM_{2.5}$ sampler to satisfy collocation requirements

Macon-Bibb County, MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Macon-Allied

AQS ID: 130210007

Address: 300 Allied Industrial Blvd., Macon, Bibb County, Georgia 31206

Site Established: 1/1/74

Latitude/Longitude: N32.7773/W-83.6411

Elevation: 106 meters

Area Represented: Macon-Bibb County MSA

Site History: Established as TSP site

North

South

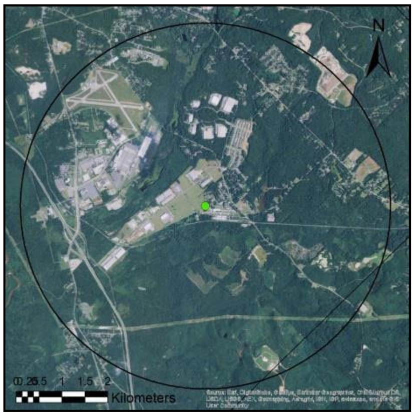
East

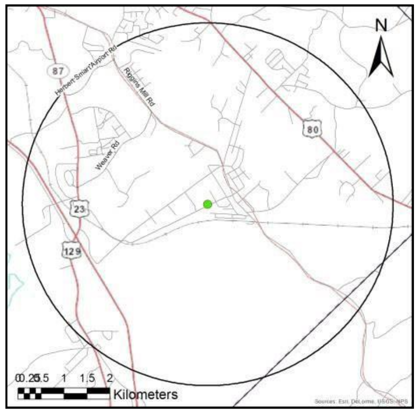
West

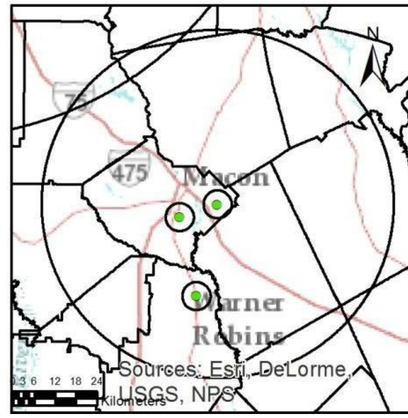
Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$ Speciation (SASS/URG)	Population Exposure	Every 6 days	1.9 m/2.1 m	Neighborhood	3/1/02
$PM_{2.5}$	Population Exposure	Daily	2.2 m	Neighborhood	2/2/99
$PM_{2.5}$	Population Exposure	Continuous	2.5 m	Neighborhood	6/5/23

GA AAMP's plans for this site: Continue monitoring; GA AAMP installed a continuous $PM_{2.5}$ non-NAAQS sampler with the EPA American Rescue Plan funds on June 5, 2023 and the monitor will be non-NAAQS for two years; the collocated $PM_{2.5}$ sampler was shut down as of December 30, 2024; the FRM sampling schedule changed from every 3 days to daily on January 7, 2025; at the request of Teledyne, as of January 2, 2025, the GA AAMP is doing an experimental (non-regulatory) data collection with a $PM_{2.5}$ Teledyne T640 monitor for upgrades to the data alignment feature; with the August 2023-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

Macon-Forestry







AQS ID: 130210012

Address: Georgia Forestry Commission, 5645 Riggins Mill Road, Dry Branch, Bibb County, Georgia 31020

Site Established: 5/7/97

Latitude/Longitude: N32.8051/W-83.5436

Elevation: 120 meters

Area Represented: Macon-Bibb County MSA

Site History: Established as O_3 and SO_2 site

North

South

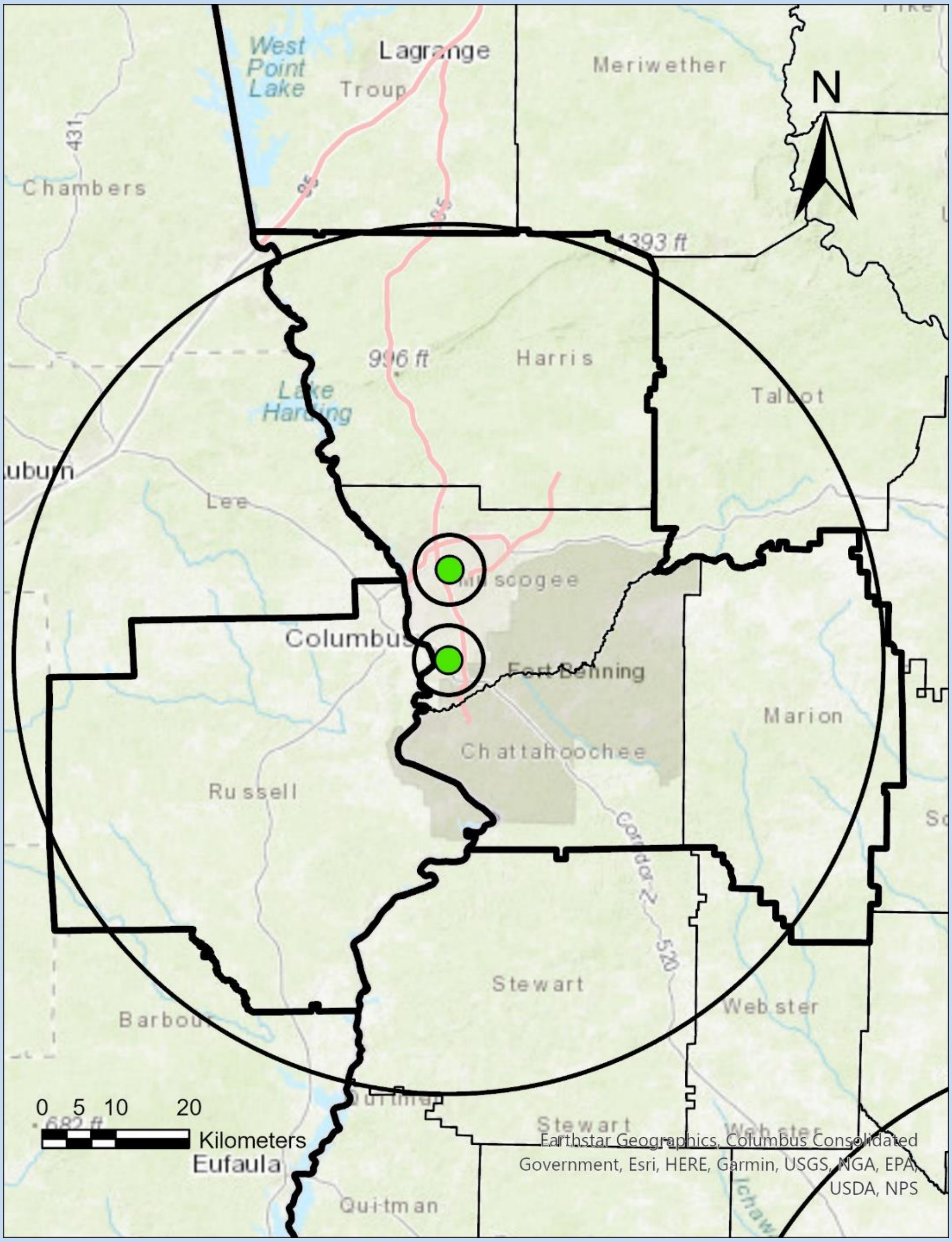
East

West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Every 3 days	4.5 m	Urban	2/1/99
Wind Direction	General/ Background	Continuous	9 m	Neighborhood	1/1/04
Wind Speed	General/ Background	Continuous	9 m	Neighborhood	1/1/04
O_3	Population Exposure	Continuous (Mar-Oct)	4.3 m	Neighborhood	5/7/97
SO_2	Population Exposure	Continuous	4.3 m	Urban	5/7/97
SO_2 5-Minute Maximum	Population Exposure	Continuous	4.3 m	Neighborhood	8/1/10

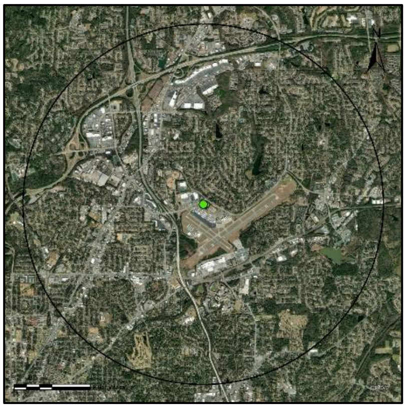
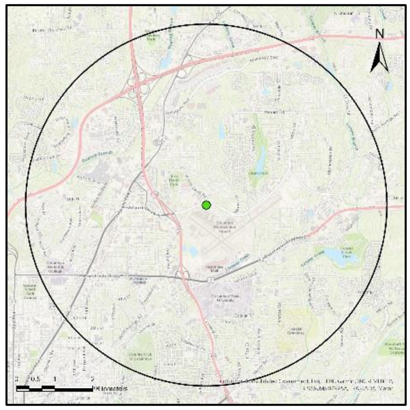
GA AAMP's plans for this site: Continue monitoring; running continuous $PM_{2.5}$ monitor as FEM as of October 1, 2017; a new shelter was installed February 2024; Spatial scale for $PM_{2.5}$ monitors was changed from neighborhood to urban; $PM_{2.5}$ continuous FEM monitor was shut down September 30, 2024

Columbus Georgia-Alabama MSA



Radius of Circles on Map
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Columbus-Airport

AQS ID: 132150008

Address: Columbus Airport, 3100 Airport Thruway Drive, Columbus, Muscogee County, Georgia 31909

Site Established: 7/1/82

Latitude/Longitude: N32.5211/W-84.9447

Elevation: 445 meters

Area Represented: Columbus Georgia-Alabama MSA

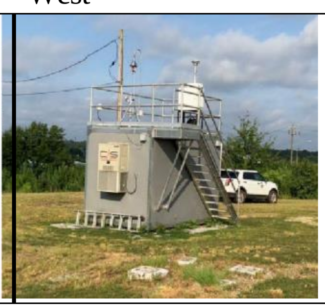
Site History: Established as O_3 site

North

South

East

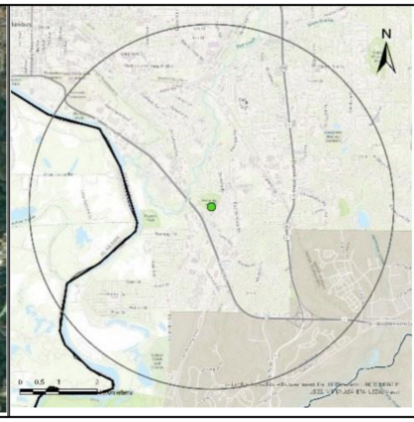
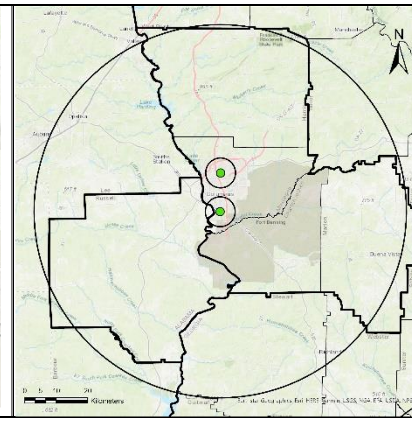
West



Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	4m	Neighborhood	7/1/82
$PM_{2.5}$	Population Exposure	Every 3 days	4.7 m	Neighborhood	6/2/03

GA AAMP's plans for this site: Continue monitoring; GA AAMP installed a continuous FEM $PM_{2.5}$ T640 sampler to replace the continuous non-FEM $PM_{2.5}$ TEOM on November 23, 2021; beginning with January 1, 2022 to July 31, 2023, there was a NAAQS exclusion on the $PM_{2.5}$ FEM monitor for testing data network alignment; another NAAQS exclusion was approved from August 1, 2023 to September 30, 2024; the continuous $PM_{2.5}$ FEM monitor was shut down on September 30, 2024; as of November 2, 2024 the $PM_{2.5}$ FRM sampling schedule changed from daily to every 3 days

Columbus-Baker

AQS ID: 132150012

Address: Baker Middle School, 1215 Benning Dr, Columbus, Muscogee County, Georgia 31903

Site Established: 3/1/21

Latitude/Longitude: N32.4274/W-84.9457

Elevation: 85 meters

Area Represented: Columbus Georgia-Alabama MSA

Site History: Established as $PM_{2.5}$ site

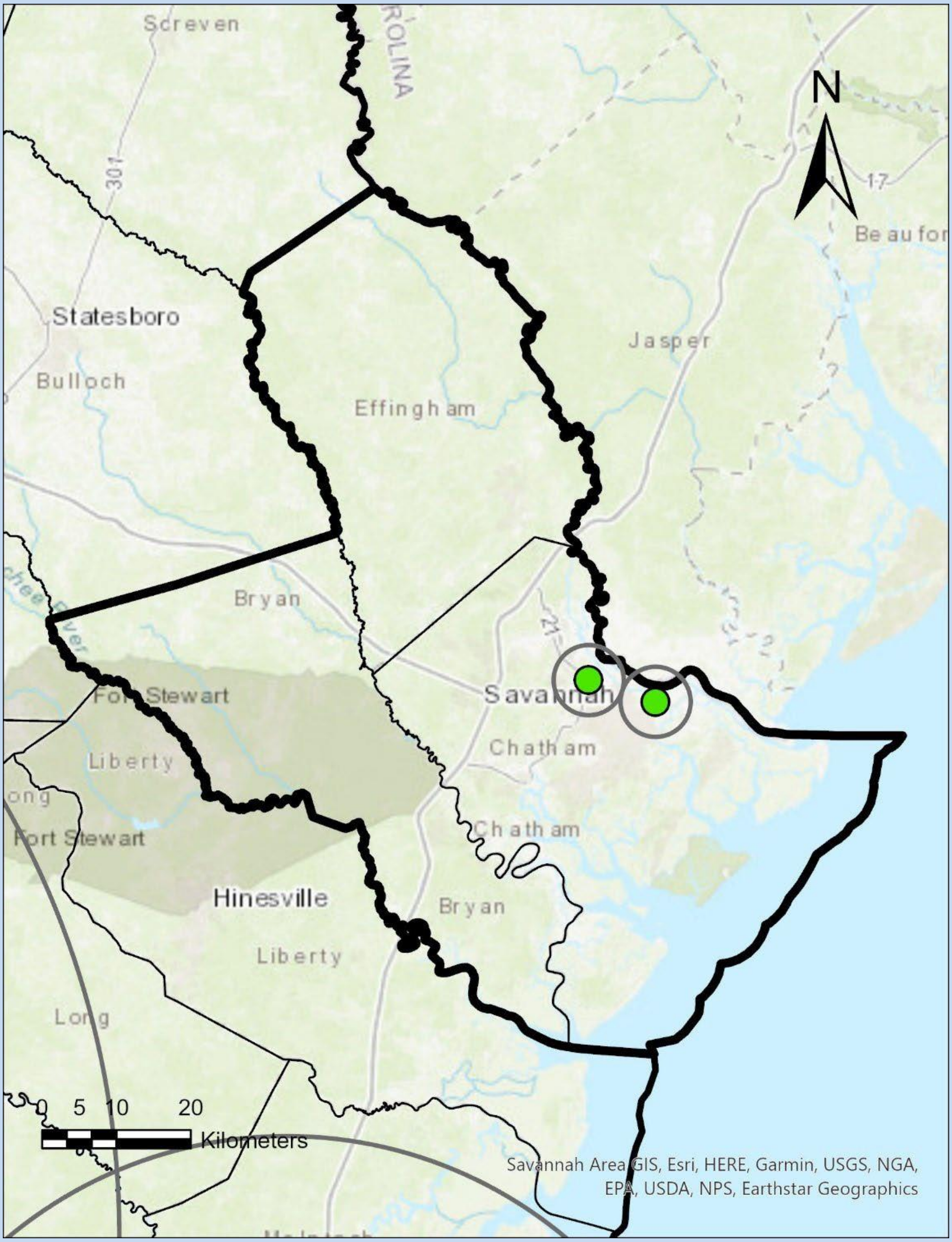
North South East West




Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Daily	2.8 m	Urban	3/1/21
$PM_{2.5}$ Speciation (SASS/URG)	Population Exposure	Every 6 days	1.8 m/ 2.7 m	Neighborhood	3/1/21
$PM_{2.5}$	Population Exposure	Continuous	3 m	Urban	6/6/23

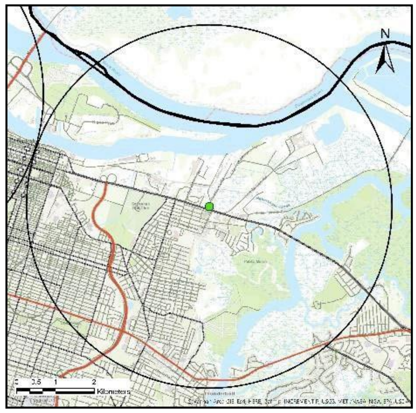
<u>GA AAMP's plans for this site:</u> Continue monitoring; site moved from Columbus-Cusseta location and historical data can be found with AQS ID 13-215-0011; GA AAMP installed a continuous $PM_{2.5}$ non-NAAQS sampler with the EPA American Rescue Plan funds on June 6, 2023 and the monitor will be non-NAAQS for two years; spatial scale was changed from neighborhood to urban for the $PM_{2.5}$ monitors; the $PM_{2.5}$ FRM sampler was updated to a daily sampling schedule as of January 7, 2025; with the August 2023-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

Savannah MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Savannah- E. President

AQS ID: 130510021

Address: American Red Cross, 2500 E. President Street, Bd-A, Savannah, Chatham County, Georgia 31404

Site Established: 2/1/95

Latitude/Longitude: N32.0683/W-81.0496

Elevation: 10.4 meters

Area Represented: Savannah MSA

Site History: Established as SO_2 and H_2S site

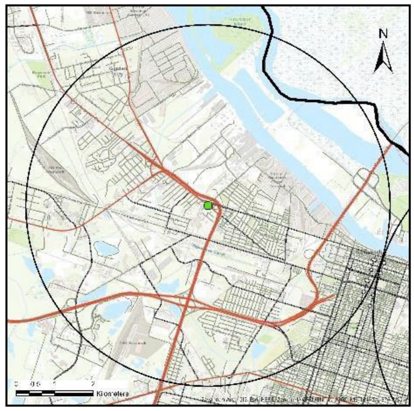
North South East West




Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	3.9 m	Neighborhood	4/19/95
SO_2	Source Oriented	Continuous	3.9 m	Neighborhood	3/29/95
SO_2 5-Minute Maximum	Population Exposure	Continuous	3.9 m	Neighborhood	8/1/10
Wind Direction	General/ Background	Continuous	8.6 m	Neighborhood	1/1/04
Wind Speed	General/ Background	Continuous	8.6 m	Neighborhood	1/1//04

GA AAMP's plans for this site: Continue monitoring

Savannah- L&A



AQS ID: 130511002

Address: Pumping Station at Intersection of West Lathrop and Augusta Avenue, Savannah, Chatham County, Georgia 31415

Site Established: 1/1/72

Latitude/Longitude: N32.0906/W-81.1304

Elevation: 6.11 meters

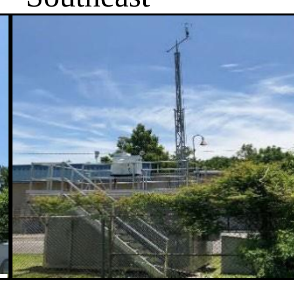
Area Represented: Savannah MSA

Site History: Established as TSP site

North

South

Southeast

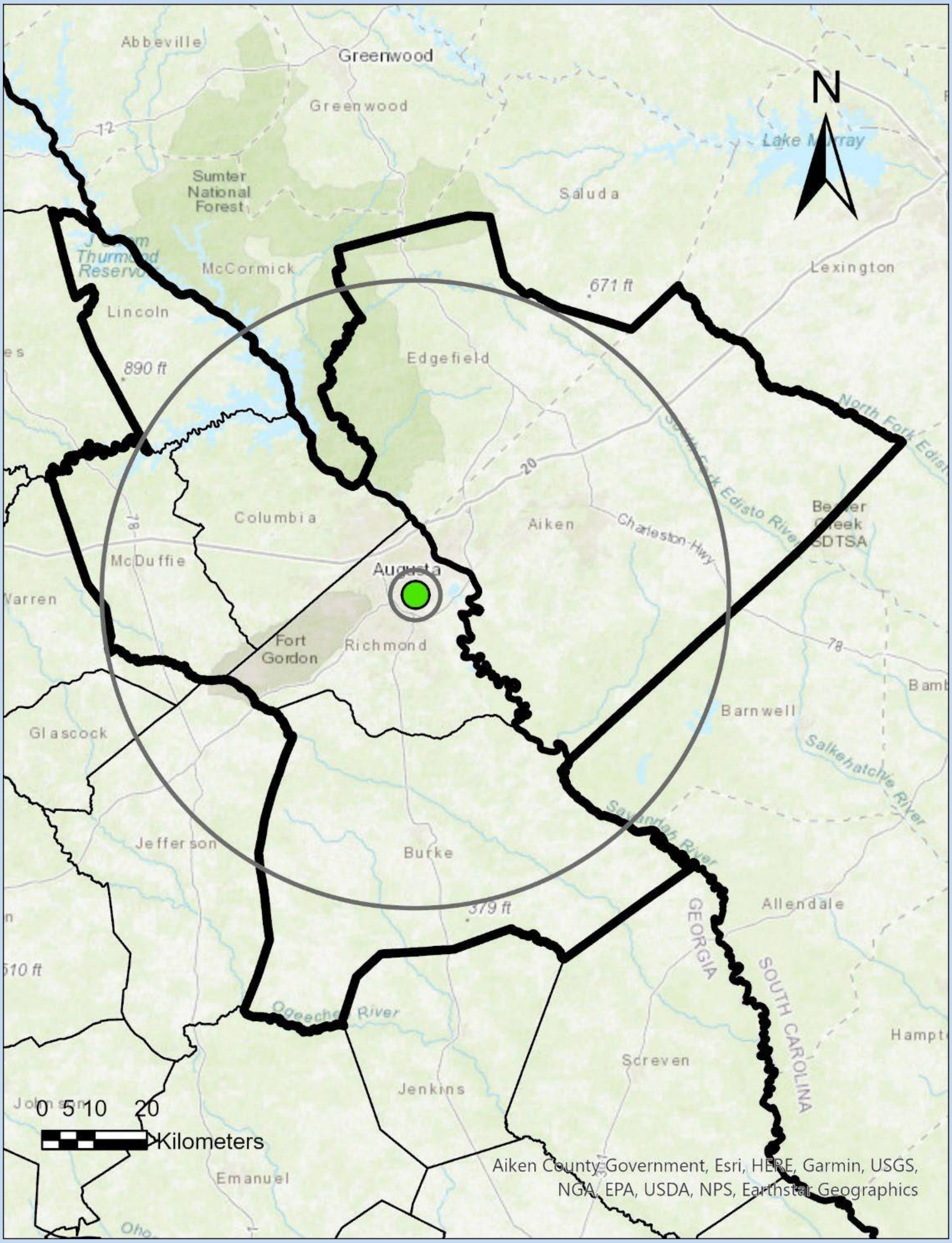


West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
SO_2	Population Exposure	Continuous	4.3 m	Neighborhood	1/1/98
SO_2 5-Minute Maximum	Population Exposure	Continuous	4.3 m	Neighborhood	8/1/10
Wind Direction	General/ Background	Continuous	9.8 m	Neighborhood	1/1/79
Wind Speed	General/ Background	Continuous	9.8 m	Neighborhood	1/1/79
$PM_{2.5}$	Population Exposure	Daily	4.7 m	Neighborhood	3/13/23
$PM_{2.5}$	Population Exposure	Continuous	4.3 m	Neighborhood	10/1/03

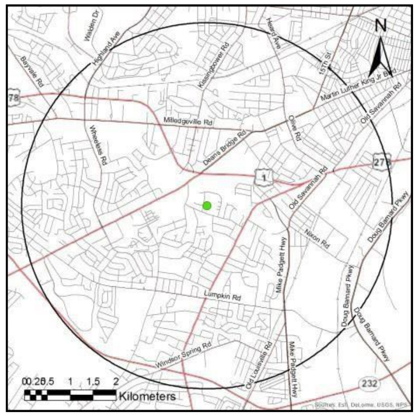
<u>GA AAMP's plans for this site:</u> Continue monitoring; running continuous $PM_{2.5}$ sampler as FEM as of November 7, 2017 to ensure redundancy in the Savannah MSA and avoid data completeness issues

Augusta-Richmond County, Georgia-South Carolina MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Augusta



AQS ID: 132450091

Address: Bungalow Road Elementary School, 2216 Bungalow Rd, Augusta, Richmond County, Georgia 30906

Site Established: 1/1/76

Latitude/Longitude: N33.4339/W-82.0224

Elevation: 48.77 meters

Area Represented: Augusta-Richmond County, Georgia-South Carolina MSA

Site History: Established as TSP site

North

South

East

West

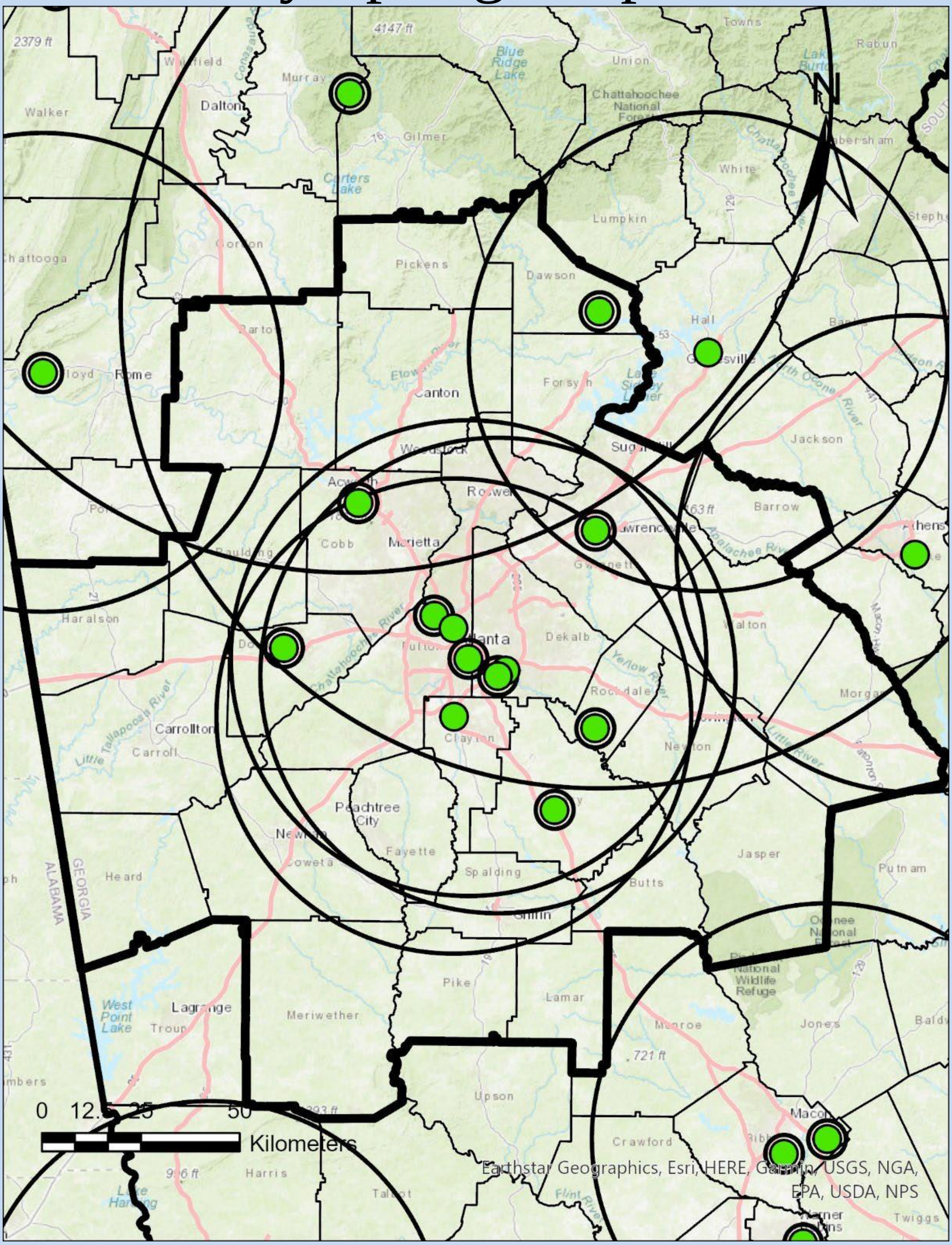
Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	4.5 m	Neighborhood	4/27/89
PM_{10}	Population Exposure	Continuous	4.6 m	Urban	7/13/21
$PM_{2.5}$ Speciation (SASS/URG)	Population Exposure	Every 6 days	2.4 m/2.7 m	Neighborhood	3/2/02
$PM_{2.5}$	Population Exposure	Continuous	4.6 m	Urban	10/1/03
$PM_{2.5}$	Population Exposure	Daily	2.6 m	Urban	1/1/22
$PM_{2.5}$	Quality Assurance	Every 3 days	2.6 m	Urban	9/20/22
SO_2	Population Exposure	Continuous	4.5 m	Neighborhood	1/14/13

Augusta (continued)

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
SO_2 5-Minute Maximum	Population Exposure	Continuous	4.5 m	Neighborhood	1/14/13
Wind Speed	General/ Background	Continuous	9.3 m	Neighborhood	10/2/03
Wind Direction	General/ Background	Continuous	9.3 m	Neighborhood	10/2/03
Outside Temperature	General/ Background	Continuous	2 m	Neighborhood	10/2/03
Relative Humidity	General/ Background	Continuous	2 m	Neighborhood	10/2/03
Rain/Melt Precipitation	General/ Background	Continuous	4 m	Neighborhood	10/2/03
Barometric Pressure	General/ Background	Continuous	1.7 m	Neighborhood	10/2/03

GA AAMP's plans for this site: GA AAMP's plans for this site: Continue monitoring; running continuous $PM_{2.5}$ monitor as FEM as of October 1, 2017; beginning with August 1, 2023 data, continuous $PM_{2.5}$ monitor is non-NAAQS for two years; GA AAMP replaced the continuous PM_{10} TEOM and continuous $PM_{2.5}$ T640 with continuous T640X, which reads $PM_{2.5}$, PM_{10}, and PMcoarse on July 13, 2021; the $PM_{2.5}$ speciation sampling was temporarily suspended from March 23, 2021 until June 9, 2021; the integrated $PM_{2.5}$ FRM monitor was shut down from 2018-2021, and reopened January 1, 2022 to meet collocation requirements; spatial scale was changed from neighborhood to urban for the $PM_{2.5}$ and PM_{10} monitors, excluding the $PM_{2.5}$ speciation monitor; GA EPD is currently evaluating the siting location of the SO_2 monitor and nearby area; modeling is being conducted by the Planning and Support Program to determine the best location for the monitor; the $PM_{2.5}$ FEM monitor had a NAAQS exclusion starting in January 2022 through 2023; with the August 2023-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

Atlanta-Sandy Springs-Alpharetta MSA



Radius of Circles on Map

Micro Scale: up to 100m

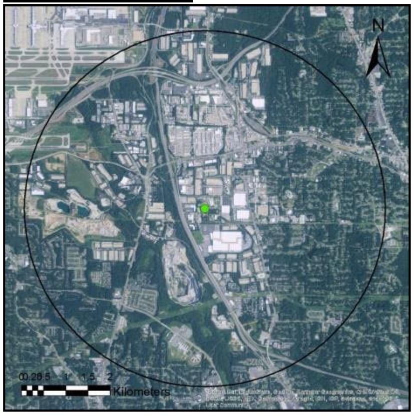
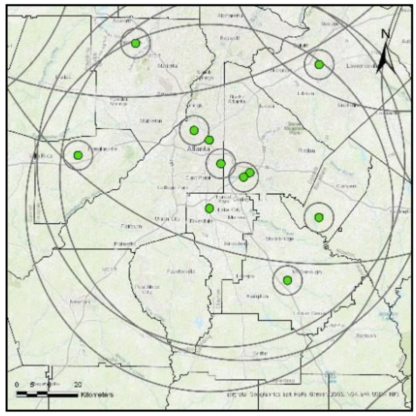
Middle Scale: up to 0.5km

Neighborhood Scale: up to 4.0km

Urban Scale: up to 50km

Regional Scale: up to 100s of km (100km shown)

Forest Park

AQS ID: 130630091

Address: 25 Kennedy Drive, Forest Park, Clayton County, Georgia

30297 Site Established: 1/1/78

Latitude/Longitude: N33.6107/W-84.3908

Elevation: 288 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as TSP site

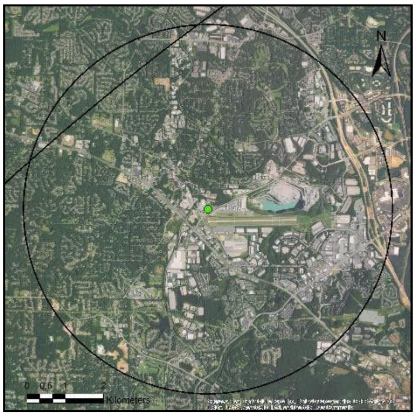
North South East West

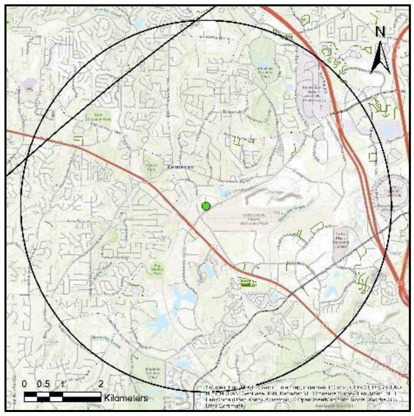



Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Every 3 Days	2.7 m	Urban	1/9/99

GA AAMP's plans for this site: Continue monitoring; GA AAMP replaced the FRM $PM_{2.5}$ with a continuous FEM $PM_{2.5}$ T640 sampler on February 20, 2024, and used EPA American Rescue Plan funds for this new sampler; Spatial scale was changed from neighborhood to urban for the $PM_{2.5}$ monitor; the FRM $PM_{2.5}$ monitor replaced the continuous FEM $PM_{2.5}$ on July 22, 2024

Kennesaw





AQS ID: 130670003

Address: Georgia National Guard, 1901 McCollum Parkway, Kennesaw, Cobb County, Georgia, 30144

Site Established: 2/7/99

Latitude/Longitude: N34.0153/W-84.6075

Elevation: 317 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as $PM_{2.5}$ site

North

South

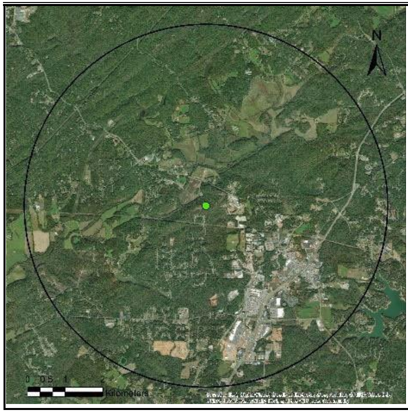
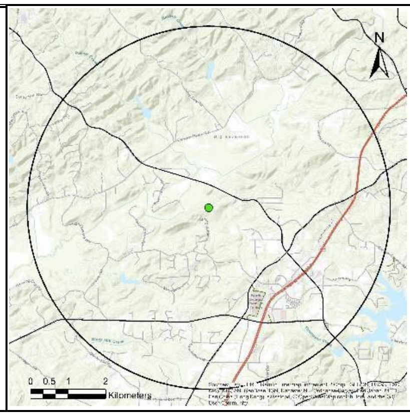
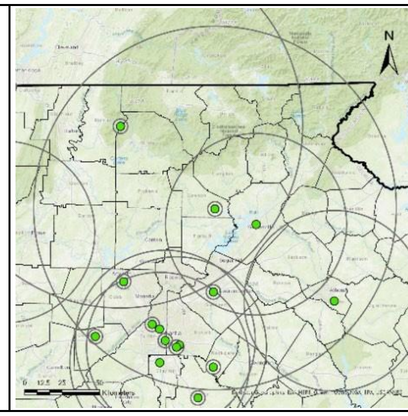
East

West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	4.2 m	Neighborhood	9/1/99

<u>GA AAMP's plans for this site:</u> Continue monitoring; GA AAMP installed a continuous $PM_{2.5}$ non-NAAQS T640 sampler with the EPA American Rescue Plan funds on October 25, 2023, and the monitor was installed with a NAAQS exclusion; the $PM_{2.5}$ FEM monitor was shut down on January 2, 2025; the $PM_{2.5}$ FRM monitor was shut down on March 19, 2025

Dawsonville

AQS ID: 130850001

Address: Georgia Forestry Commission, 4500 Georgia Highway 53 East, Dawsonville, Dawson County, Georgia 30534

Site Established: 1/1/85

Latitude/Longitude: N34.3761/W-84.0596

Elevation: 372 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as O_3 site

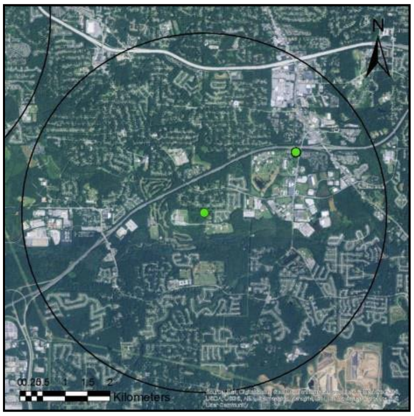
North South East West

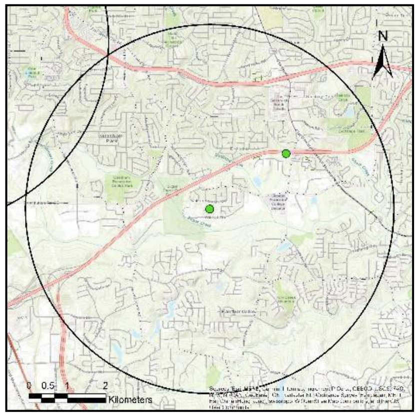


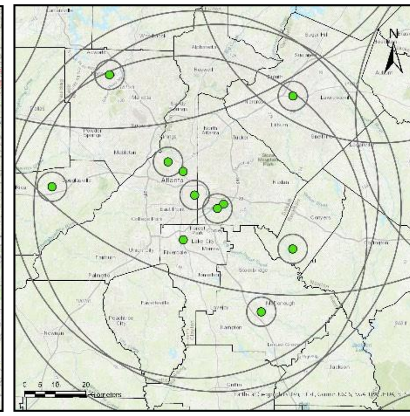

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	4 m	Neighborhood	1/1/85
Wind Speed	General/ Background	Continuous	10 m	Regional	1/1/05
Wind Direction	General/ Background	Continuous	10 m	Regional	1/1/05

GA AAMP's plans for this site: Continue monitoring

South DeKalb







AQS ID: 130890002

Address: 2300-C Wildcat Road, Decatur, DeKalb County, Georgia 30034

Site Established: 1/1/74

Latitude/Longitude: N33.6877/W-84.2905

Elevation: 308 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as O_3 site

North

South

East

West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Daily	2.4 m	Urban	1/22/99
$PM_{2.5}$	Quality Assurance	Every 3 days	2.4 m	Urban	12/20/08
$PM_{2.5}$	Population Exposure	Continuous	4 m	Urban	5/1/03
$PM_{2.5}$ Speciation (SASS/URG))	Population Exposure	Every 3 days	2.4 m	Neighborhood	10/1/00
SO_2	Population Exposure	Continuous	3.8 m	Neighborhood	10/1/10
SO_2 5-Minute Maximum	Population Exposure	Continuous	3.8 m	Neighborhood	10/1/10
O_3	Population Exposure	Continuous	4 m	Neighborhood/ Urban	1/1/74
CO	Population Exposure	Continuous	4 m	Neighborhood	5/19/03

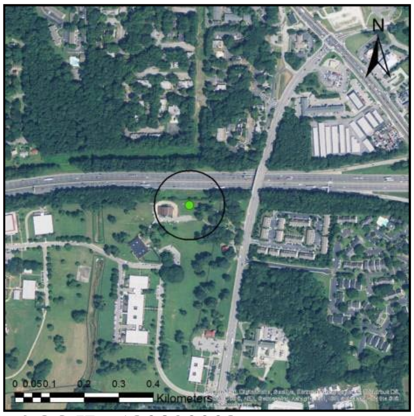
South DeKalb (continued)

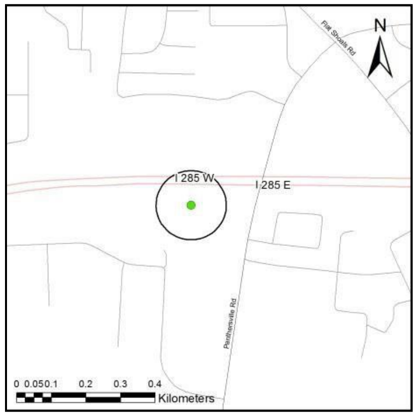
Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
NOy	Population Exposure	Continuous	9.5 m	Neighborhood/ Urban	1/1/98
NO	Population Exposure	Continuous	4 m	Neighborhood/ Urban	4/1/94
NOx	Population Exposure	Continuous	4 m	Neighborhood/ Urban	4/1/94
NO_2	Population Exposure	Continuous	4 m	Neighborhood/ Urban	7/21/78
Carbonyls (PAMS)	Max Precursor Emissions	Three 8-hour samples every third day in summer	3.8 m	Neighborhood	6/1/93
Carbonyls (NATTS)	Population Exposure	Every 6 days	3.8 m	Neighborhood	6/1/93
Carbonyls (NATTS)	Quality Assurance	1/month	3.8 m	Neighborhood	1/1/06
PM_{10} Select Metals (NATTS)	Population Exposure	Every 6 days	2 m	Neighborhood	1/1/00
PM_{10} Select Metals (NATTS)	Quality Assurance	1/month	2 m	Neighborhood	1/1/05
PM_{10} Continuous	Population Exposure	Continuous	4 m	Urban	1/1/11
PM_{coarse} Continuous	Population Exposure	Continuous	4 m	Urban	1/1/11
VOCs (PAMS)	Max Precursor Emissions	Continuous in Summer (June-August)	3.8 m	Neighborhood	6/1/93
VOCs (NATTS)	Population Exposure	Every 6 days	3.8 m	Neighborhood	6/1/93
VOCs (NATTS)	Quality Assurance	1/month	3.8 m	Neighborhood	1/1/05
Semi-VOCs (NATTS)	Population Exposure	Every 6 days	2.5 m	Neighborhood	4/30/07
Semi-VOCs (NATTS)	Quality Assurance	1/month	2.5 m	Neighborhood	4/30/07
Outdoor Temperature	General/ Background	Continuous	2 m	Neighborhood	6/1/93
Rain/Melt Precipitation	General/ Background	Continuous	3.2 m	Neighborhood	1/1/97

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
Barometric Pressure	General/ Background	Continuous	2 m	Neighborhood	6/1/93
Wind Direction	General/ Background	Continuous	10 m	Neighborhood	6/1/93
Wind Speed	General/ Background	Continuous	10 m	Neighborhood	6/1/93
Sigma Theta	General/ Background	Continuous	10 m	Neighborhood	1/1/02
Relative Humidity	General/ Background	Continuous	2 m	Neighborhood	6/1/93
Mixing Layer Height	General/ Background	Continuous	4.2	Neighborhood	12/5/24

GA AAMP's plans for this site: Continue monitoring. NCore site (refer to GA AAMP's *2011 Ambient Air Monitoring Plan, Appendix C, Ambient Air Monitoring Plan for National Core (NCore) Multipollutant Monitoring Station* for full description and approval). Solar radiation and ultraviolet radiation for South DeKalb PAMS are currently monitored at the Conyers site due to equipment specifications (see Section 1.4 for waiver request). GA AAMP replaced both the primary and collocated NATTS high-volume PM_{10} metals samplers with low-volume PM_{10} metals samplers as of April 1, 2022. GA AAMP installed a Markes-Agilent 7890B Gas Chromatograph to fulfill the PAMS requirement for measuring hourly VOCs by June 1, 2021. GA AAMP also installed a direct NO_2 monitor in June 2021 to fulfill PAMS requirements; Spatial scale was changed from neighborhood to urban for all $PM_{2.5}$ and PM_{10} monitors, except the $PM_{2.5}$ speciation monitors; GA AAMP installed a ceilometer on December 5, 2024

NR-285





AQS ID: 130890003

Address: 3073 Panthersville Road, Decatur, DeKalb County, Georgia 30034

Site Established: 7/1/86

Latitude/Longitude: N33.6985/W-84.2727

Elevation: 238 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as lead site

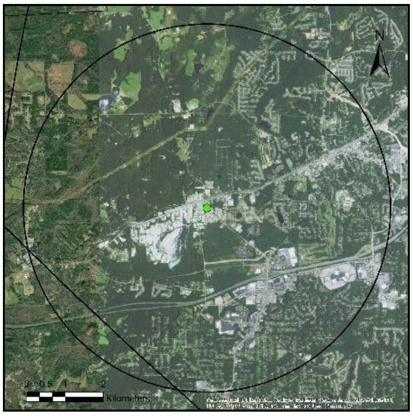
North South East West

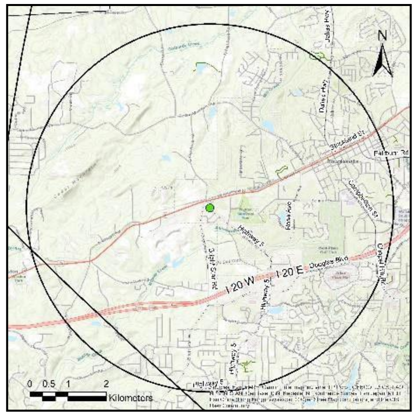



Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
NO_2	Source Oriented	Continuous	4.5 m	Micro	1/1/15
NO	Source Oriented	Continuous	4.5 m	Micro	1/1/15
NOx	Source Oriented	Continuous	4.5 m	Micro	1/1/15
VOCs	Source Oriented	Every 12 days	3.9 m	Micro	3/31/15
Black Carbon	Source Oriented	Continuous	3.9 m	Micro	9/1/15

GA AAMP's plans for this site: Continue monitoring; Near-road site as of January 1, 2015 (see *Addendum to 2015 Ambient Monitoring Plan* for full description); black carbon instrument was replaced with a Met One sampler on January 1, 2022 and was shut down from January 31, 2022 until March 17, 2023 and restarted collecting data as of April 18, 2023; the continuous $PM_{2.5}$ monitor is a non-FEM, non-NAAQS TEOM 1405-F; the non-FEM continuous $PM_{2.5}$ TEOM sampler was shut down July 2, 2024

Douglasville





AQS ID: 130970004

Address: Douglas County Water Authority, 7725 W. Strickland St., Douglasville, Douglas County, Georgia 30134

Site Established: 8/15/97

Latitude/Longitude: N33.7411/W-84.7765

Elevation: 373 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as O_3 site

North

South

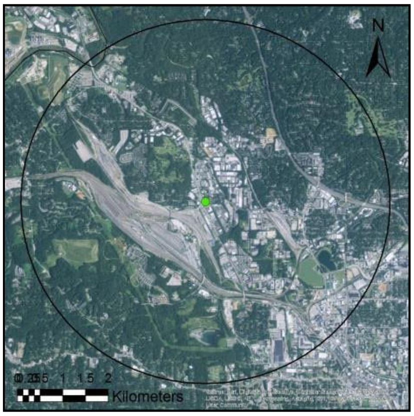
East

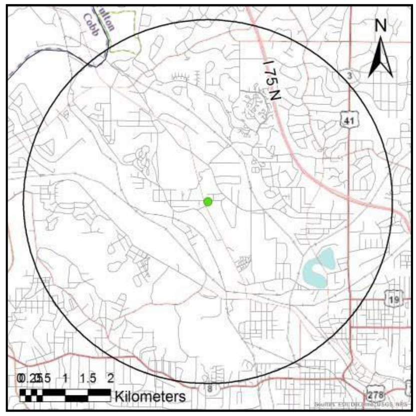
West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	4 m	Neighborhood	8/15/97
Wind Direction	General/ Background	Continuous	10 m	Neighborhood	8/15/97
Wind Speed	General/ Background	Continuous	10 m	Neighborhood	8/15/97

GA AAMP's plans for this site: Continue monitoring

Fire Station #8





AQS ID: 131210039

Address: Fire Station #8, 1711 Marietta Blvd., Atlanta, Fulton County, Georgia 30318

Site Established: 1/1/73

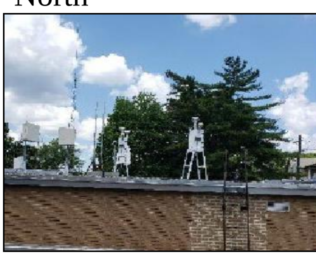
Latitude/Longitude: N33.8021/W-84.4357

Elevation: 265 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as TSP site

North



South

East

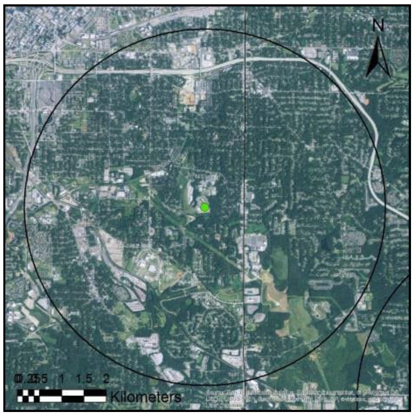
West

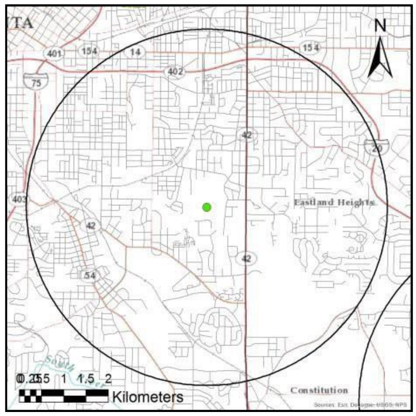
Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Every 3 days	10.1 m	Neighborhood	1/21/99*
PM_{10}	Population Exposure	Every 6 days	10 m	Neighborhood	1/1/86**
PM_{10}	Population Exposure/Quality Assurance	Every 12 days	10 m	Neighborhood	2/1/86***

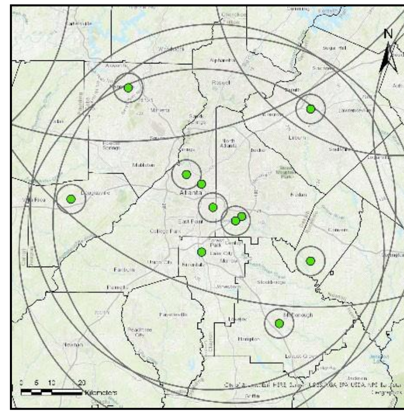
* Sampler inactive from 9/30/06 to 12/1/08, **Sampler inactive from 9/26/06 to 1/3/13, ***Sampler inactive from 10/12/87 to 1/1/06 and from 9/26/06 to 6/1/17

GA AAMP's plans for this site: Continue monitoring

United Avenue







AQS ID: 131210055

Address: 945 United Avenue, Atlanta, Fulton County, Georgia

30316 Site Established: 10/1/91

Latitude/Longitude: N33.7206/W-84.3574

Elevation: 288 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as O_3 and SO_2 site

North

South

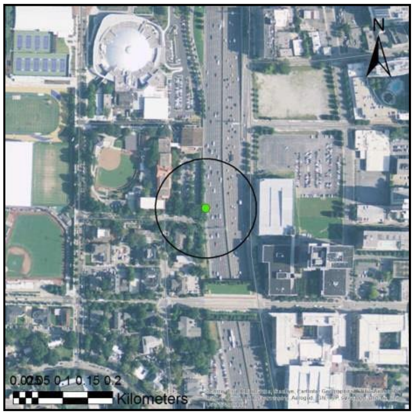
East

West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
SO_2	Population Exposure	Continuous	4 m	Neighborhood	10/1/91
SO_2 5-Minute Maximum	Population Exposure	Continuous	4 m	Neighborhood	8/1/10
O_3	Maximum Concentration	Continuous (Mar-Oct)	4 m	Neighborhood	10/1/91
$PM_{2.5}$	Population Exposure	Continuous	4.8 m	Urban	7/1/05
Wind Direction	General/ Background	Continuous	10 m	Neighborhood	1/1/04
Wind Speed	General/ Background	Continuous	10 m	Neighborhood	1/1/04

<u>GA AAMP's plans for this site:</u> Continue monitoring; Spatial scale was changed from neighborhood to urban for continuous $PM_{2.5}$ monitor

NR-GA Tech



AQS ID: 131210056

Address: Georgia Institute of Technology, 6th Street and I-75, Atlanta, Fulton County, Georgia, 30313

Site Established: 6/15/14

Latitude/Longitude: N33.7784/W-84.3914

Elevation: 286 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as near-road site

North South East West

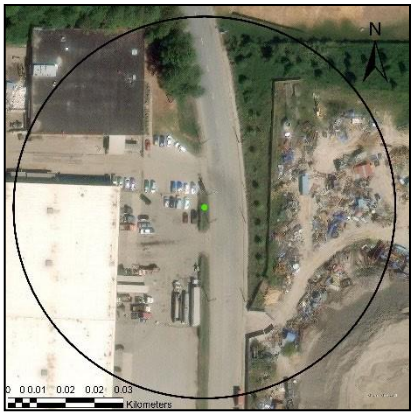
Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
NO_2	Source Oriented	Continuous	3.8 m	Micro	6/15/14
NO	Source Oriented	Continuous	3.8 m	Micro	6/15/14
NOx	Source Oriented	Continuous	3.8 m	Micro	6/15/14
CO	Source Oriented	Continuous	3.8 m	Micro	6/15/14
$PM_{2.5}$	Source Oriented	Every 3 days	5 m	Micro	1/1/15
$PM_{2.5}$	Source Oriented	Continuous	4.8 m	Micro	3/1/18
Black Carbon	Source Oriented	Continuous	4.0 m	Micro	7/9/15

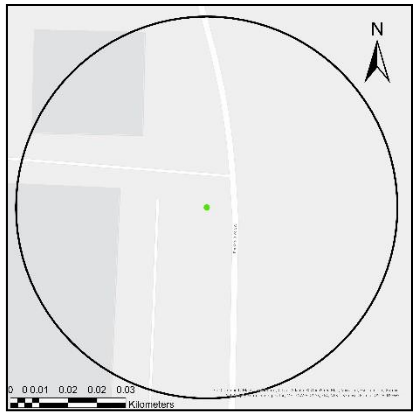
NR-GA Tech (continued)

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
Wind Direction	Source Oriented	Continuous	5.5 m	Micro	8/20/14
Wind Speed	Source Oriented	Continuous	5.5 m	Micro	8/20/14

GA AAMP's plans for this site: Continue monitoring; see Appendix E of *2014 Ambient Air Monitoring Plan* for near- road site establishment and details; GA AAMP replaced the $PM_{2.5}$ continuous nephelometer with a $PM_{2.5}$ non-FEM continuous TEOM sampler on April 20, 2023; replaced the black carbon with a Met One sampler on May 10, 2023; Refer to the *Addendum to 2024 Ambient Air Monitoring Plan* for discussion of GA AAMP's request for the reclassification of the $PM_{2.5}$ FRM monitor to a non-regulatory, non-NAAQS monitor for the purpose of comparison to the annual $PM_{2.5}$ NAAQS

Empire Blvd





AQS ID: 131210057
Address: 3325 Empire Blvd SW, Atlanta, GA 30354
Established: 5/30/2025
Latitude/Longitude: N33.664476, W-84.391869
Elevation: 280 meters
Area Represented: Atlanta-Sandy Springs-Alpharetta
Site History: Established as Lead site

North

South

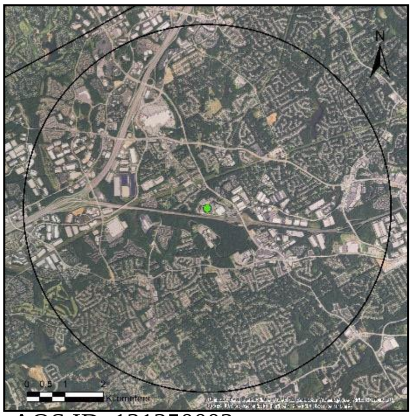
East

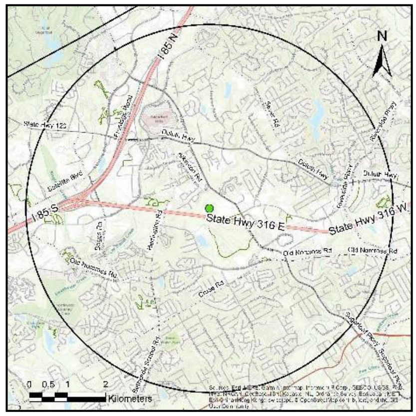
West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
Lead	Source Oriented	Every 6 days	2.13 m	Micro	5/30/2025
Lead	Quality Assurance	Every 12 days	2.13 m	Micro	5/30/2025

GA AAMP's plans for this site: Continue monitoring

Gwinnett Tech





AQS ID: 131350002

Address: Gwinnett Tech, 5150 Sugarloaf Parkway, Lawrenceville, Gwinnett County, Georgia 30043

Established: 3/17/95

Latitude/Longitude: N33.9632/W-84.0691

Elevation: 294 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as O_3 site

North

South

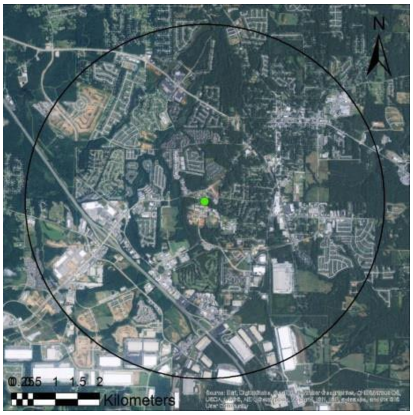
East

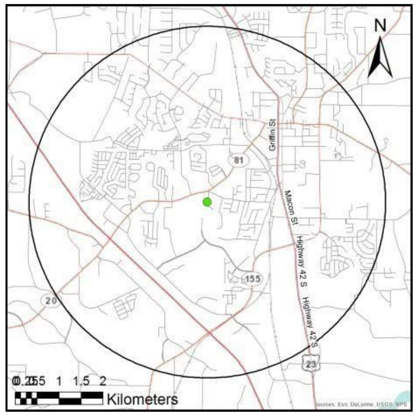
West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Population Exposure	Continuous (Mar-Oct)	3.4 m	Neighborhood	5/17/95
$PM_{2.5}$	Population Exposure	Continuous	4.4 m	Neighborhood	9/1/03
$PM_{2.5}$	Population Exposure	Daily	4.5 m	Neighborhood	9/30/24

GA AAMP's plans for this site: Continue monitoring; running continuous $PM_{2.5}$ sampler as FEM as of October 26, 2017; due to increased traffic counts, a waiver has been requested for the ozone monitoring as no feasible sites to relocate the ozone monitor; on September 30, 2024 an FRM $PM_{2.5}$ sampler was deployed and started on a daily sampling schedule; with the October 2024-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

McDonough





AQS ID: 131510002

Address: 86 Work Camp Rd, McDonough, Henry County, Georgia 30253 Site Established: 6/7/99

Latitude/Longitude: N33.4338/W-84.1619

Elevation: 261.35 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

Site History: Established as O_3 site

North

South

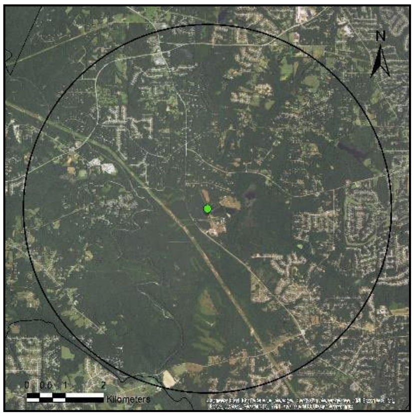
East

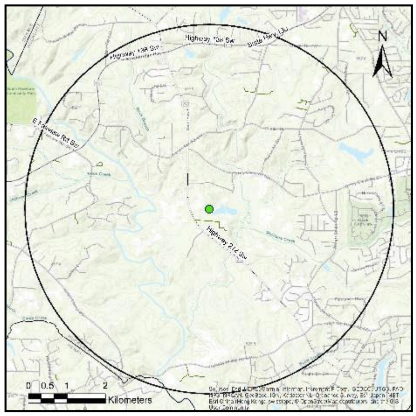
West

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Maximum Concentration	Continuous (Mar-Oct)	4 m	Neighborhood	6/7/99
$PM_{2.5}$	Population Exposure	Continuous	4.2 m	Neighborhood	9/1/03

GA AAMP's plans for this site: Continue monitoring

Conyers





AQS ID: 132470001

Address: 2625 Georgia Highway 212, Conyers, Rockdale County, Georgia 30094

Established: 7/26/78

Latitude/Longitude: N33.5884/W-84.0697

Elevation: 219 meters

Area Represented: Atlanta-Sandy Springs-Alpharetta MSA

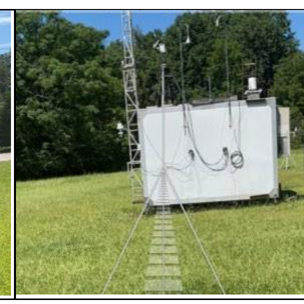
Site History: Established as O_3 site

North

South

East

West



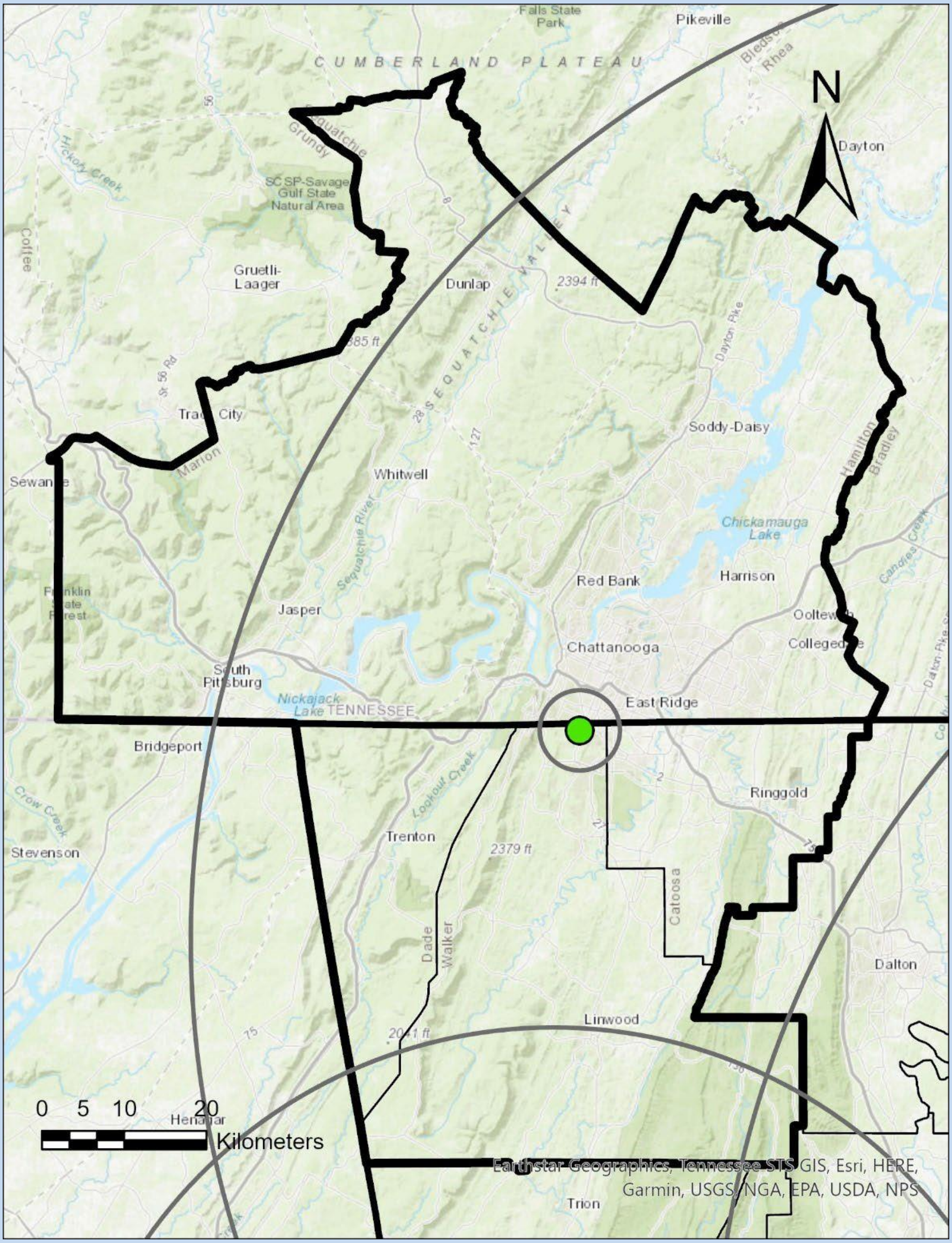
Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
O_3	Maximum Concentration	Continuous (Mar-Oct)	4.2 m	Neighborhood	7/26/78
Relative Humidity	General/ Background	Continuous	2.3 m	Neighborhood	6/1/94
Barometric Pressure	General/ Background	Continuous	2.2 m	Neighborhood	6/1/94
Ultraviolet Radiation	General/ Background	Continuous	2.2 m	Neighborhood	1/1/97
Outdoor Temperature	General/ Background	Continuous	2.3 m	Neighborhood	6/1/94
Solar Radiation	General/ Background	Continuous	2.2 m	Neighborhood	6/1/94

Conyers (continued)

Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
Wind Direction	General/ Background	Continuous	10 m	Neighborhood	6/1/94
Wind Speed	General/ Background	Continuous	10 m	Neighborhood	6/1/94
Rain/Melt Precipitation	General/ Background	Continuous	3.8 m	Neighborhood	7/1/03

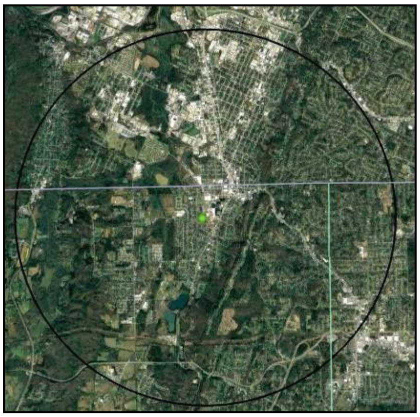
GA AAMP's plans for this site: Continue monitoring; ultraviolet radiation and solar radiation monitored at Conyers are also used to fulfill meteorological requirements for South DeKalb PAMS (see Section 1.4 for waiver request)

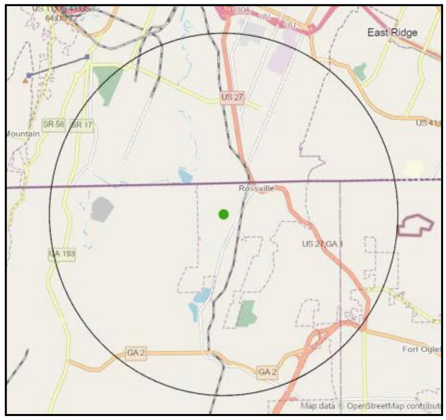
Chattanooga Tennessee-Georgia MSA



<u>Radius of Circles on Map</u>
Micro Scale: up to 100m
Middle Scale: up to 0.5km
Neighborhood Scale: up to 4.0km
Urban Scale: up to 50km
Regional Scale: up to 100s of km (100km shown)

Rossville-Williams St.





AQS ID: 132950004

Address: 301 Williams St., Rossville, Walker County, Georgia, 30741

Site Established: 3/1/21

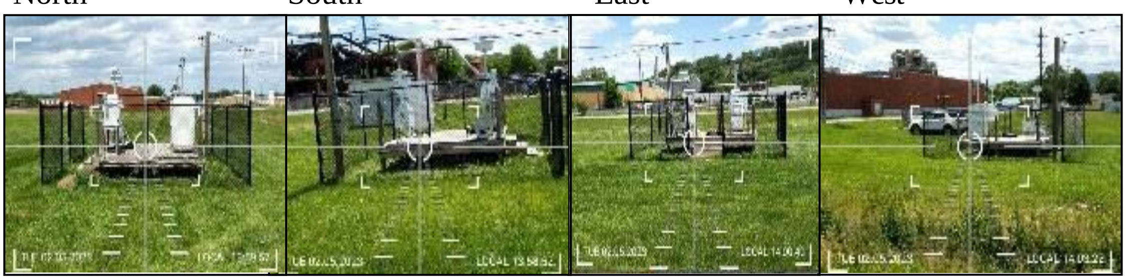
Latitude/Longitude: N34.9784/W-85.2943

Elevation: 200 meters

Area Represented: Chattanooga Tennessee-Georgia MSA

Site History: Established as $PM_{2.5}$ site

North South East West



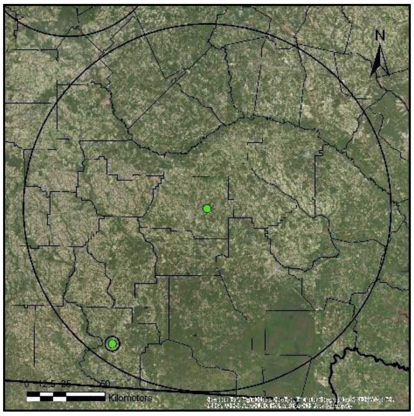
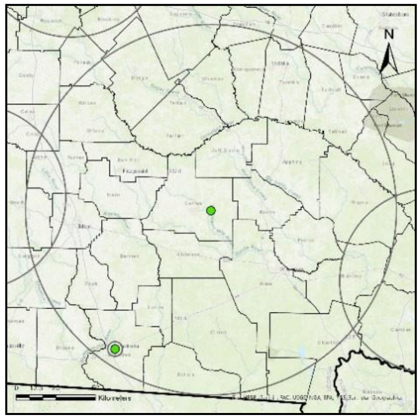
Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Continuous	2.5 m	Neighborhood	3/1/21
$PM_{2.5}$	Population Exposure/ Regional Transport	Daily	2.7 m	Neighborhood	3/1/21
$PM_{2.5}$ Speciation	Population Exposure	Every 6 days	2.5 m	Neighborhood	4/28/21

<u>GA AAMP's plans for this site:</u> Continue monitoring; site moved from Maple St. location and historical data can be found with AQS ID 13-295-0002; the speciation sampling was temporarily suspended from July 1, 2020 until April 28, 2021; The spatial scale was changed from regional to neighborhood in 2024, but remains the 'regional transport site'; $PM_{2.5}$ FRM sampling schedule changed from every 3 day to daily on January 1, 2025; with the August 2023-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

Sites Not in an MSA

(Listed in AQS ID Order)

General Coffee

AQS ID: 130690002

Address: 46 John Coffee Road, Nicholls, Coffee County, Georgia 31554

Site Established: 1/1/99

Latitude/Longitude: N31.5129/W-82.7501

Elevation: 49 meters

Area Represented: Not in an MSA, Douglas Micropolitan Statistical Area

Site History: Established as Air Toxics site

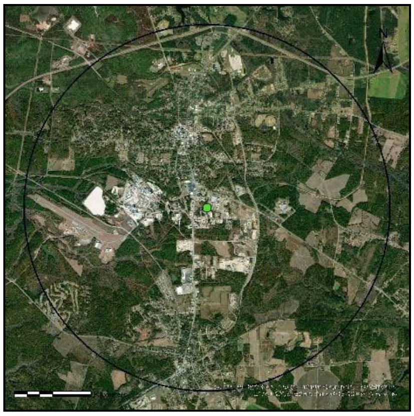
North South East West




Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$ Speciation (SASS/URG)	General Background	Every 6 days	2.7 m/2.9 m	Regional	3/1/02
$PM_{2.5}$	General Background	Every 3 days	2.9 m	Regional	2/1/17
$PM_{2.5}$	Population Exposure	Continuous	3.2 m	Regional	9/8/23
$PM_{2.5}$	Quality Assurance	Continuous	3.2 m	Regional	10/17/24

GA AAMP's plans for this site: Continue monitoring; GA AAMP installed a continuous $PM_{2.5}$ FEM T640 sampler with the EPA American Rescue Plan funds on September 8, 2023; as of October 17, 2023, the FRM $PM_{2.5}$ sampler was changed from a 1 in 3 day sampling schedule to a daily sampling schedule; the deck at General Coffee was rebuilt in April 2023; a collocated $PM_{2.5}$ FEM monitor for quality assurance started October 17, 2024; as of October 30, 2024 the $PM_{2.5}$ FRM sampling schedule changed from daily to every 3 days

Sandersville



AQS ID: 133030001

Address: 420 Riddleville Road, Sandersville, Washington County, Georgia 31082

Site Established: 1/1/74

Latitude/Longitude: N32.968060/W-82.805903

Elevation: 140 meters

Area Represented: Not in an MSA, Washington County

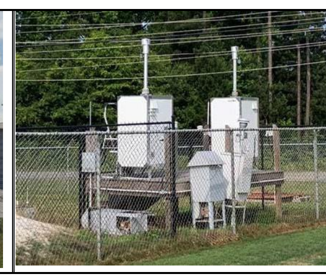
Site History: Established as TSP site

North

South

East

West



Parameter	Monitoring Objective	Sampling Schedule	Probe Inlet Height	Spatial Scale	Begin Date
$PM_{2.5}$	Population Exposure	Daily	3.1 m	Neighborhood	1/30/99
$PM_{2.5}$	Population Exposure	Continuous	3.0 m	Neighborhood	1/30/19

GA AAMP's plans for this site: Continue monitoring; on August 14, 2019, GA AAMP replaced the FRM with an FEM Teledyne T640 Continuous $PM_{2.5}$ sampler; GA AAMP added another FEM sampler to ensure redundancy in the area and avoid data completeness issues; the $PM_{2.5}$ FRM sampler did not collect data from August 15, 2019 to July 18, 2024; on July 18, 2024 GA AAMP redeployed the FRM $PM_{2.5}$ monitor sampling on a daily schedule; on July 18, 2024 the collocated FEM $PM_{2.5}$ monitor was removed from the site with the July 2024-January 2025 data outside the additive vs. multiplicative bias polygon and the bias higher than 5%, GA AAMP is requesting that the continuous $PM_{2.5}$ FEM T640 sampler be a non-NAAQS special purpose monitor, with exclusion from the annual $PM_{2.5}$ NAAQS until at least August 2027

Appendix B: Inventory of Ambient Monitoring Equipment

Georgia Department of Natural Resources
Environmental Protection Division

SITE NAME	EQUIPMENT NAME	EQUIPMENT DESCRIPTION	AGE
Rome MSA			
Rome	Agilaire 8872	Datalogger	>1
	Met One SASS	$PM_{2.5}$ Speciation Sampler	>9
	URG 3000N	$PM_{2.5}$ Speciation Sampler	>13
	TEOM 1400AB	Continuous $PM_{2.5}$ Sampler	>9
Brunswick MSA			
Brunswick	Agilaire 8872	Datalogger	>1
	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>12
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>3
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>3
	Aluma T-135	Meteorological Crank Tower	>14
	Environics 7000	Zero Air Supply	>9
Valdosta MSA			
Valdosta	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>9
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>3
	ESC DAS 8832	Datalogger	>8
Warner Robins MSA			
Warner Robins	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>8
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>6
	ESC DAS 8832	Datalogger	>10
Dalton MSA			
Fort Mountain	Agilaire 8872	Datalogger	>1
	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	new
	RM Young Temp/RH Probe 41382VC	Ambient Temperature & Relative Humidity	>3
	Aluma FOT-10	Meteorological Fold Over Tower	>14
Gainesville MSA			
Gainesville	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>2
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>6
	ESC DAS 8832	Datalogger	>10
Albany MSA			
Albany	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>8
	Thermo Partisol-Plus 2025	Collocated Integrated $PM_{2.5}$ Sampler	>8
	ESC DAS 8832	Datalogger	>10
	Teledyne T640	Continuous PM Sampler	>4
Athens-Clarke County MSA			
Athens	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	Teledyne T640	Continuous PM Sampler	>5
	Teledyne T640	Collocated Continuous PM Sampler	>4
	Agilaire 8872	Datalogger	>1
	Environics 7000	Zero Air Supply	>8
Macon-Bibb County, MSA			
Macon-Allied	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>8
	Thermo Partisol-Plus 2025	Collocated Integrated $PM_{2.5}$ Sampler	>8
	Met One SASS	$PM_{2.5}$ Speciation Sampler	>13

SITE NAME	EQUIPMENT NAME	EQUIPMENT DESCRIPTION	AGE
Macon-Allied cont'd	URG 3000N	$PM_{2.5}$ Speciation Sampler	>13
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>1
	ESC DAS 8832	Datalogger	>10
Macon-Forestry	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>8
	Sulfur Dioxide Cylinder	Gas Cylinder	>10
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>1
	Aluma T-135	Meteorological Crank Tower	>14
	Agilaire 8872	Datalogger	>1
	Thermo 49i series	O_3 Analyzer	>13
	Thermo 49iPS series	O_3 Calibrator	>12
	Thermo 43i	SO_2 Analyzer	>12
	Thermo 146i	Multi-Gas Calibrator	>13
Columbus Georgia-Alabama MSA			
Columbus - Airport	Thermo 49iQ series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	Thermo 43i	SO_2 Analyzer	>12
	Thermo 146i	Multi-Gas Calibrator	>13
	Thermo Partisol-Plus 2025i	Integrated $PM_{2.5}$ Sampler	>8
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>5
	Sabio 1001	Zero Air Supply	>1
	Agilaire 8872	Datalogger	>1
Columbus - Baker	Thermo Partisol-Plus 2025i	Integrated $PM_{2.5}$ Sampler	>1
	Met One SASS	$PM_{2.5}$ Speciation Sampler	>10
	URG 3000N	$PM_{2.5}$ Speciation Sampler	>8
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>1
	ESC DAS 8832	Datalogger	>10
Savannah MSA			
Savannah - E President	Agilaire 8872	Datalogger	>1
	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	Thermo 43i	SO_2 Analyzer	>12
	Thermo 146i	Multi-Gas Calibrator	>12
	Sabio 1001	Zero Air Supply	>4
	Graseby PUF Sampler GSP1*	Semi-VOCs (PAH) Sampler	>12
	Andersen Hi-VL 2000 HBL*	Metals Sampler	>12
	Sulfur Dioxide Cylinder	Gas Cylinder	>12
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>3
	Aluma T-135	Meteorological Crank Tower	>14
	RM Young Temp/RH Probe 41382VC	Ambient Temperature & Relative Humidity	>1
	RM Young Barometric Pressure Sensor 61302	Barometric Pressure Sensor	>1

SITE NAME	EQUIPMENT NAME	EQUIPMENT DESCRIPTION	AGE
Savannah - L&A	Agilaire 8872	Datalogger	>1
	Thermo 43i	SO_2 Analyzer	>12
	Thermo 146i	Multi-Gas Calibrator	>12
	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>2
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>5
	Sulfur Dioxide Cylinder	Gas Cylinder	>12
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>4
	Aluma T-135	Meteorological Crank Tower	>14
	Environics 7000	Zero Air Supply	>8
Augusta-Richmond County, Georgia-South Carolina MSA			
Augusta	Sabio 1001	Zero Air Supply	>8
	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	Thermo 43i-TLE	SO_2 Analyzer	>12
	Thermo 146i	Multi-Gas Calibrator	>12
	Teledyne T640x	Continuous PM Sampler	>4
	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>3
	Thermo Partisol-Plus 2025	Collocated Integrated $PM_{2.5}$ Sampler	>3
	Met One SASS	$PM_{2.5}$ Speciation Sampler	>9
	URG 3000N	$PM_{2.5}$ Speciation Sampler	>9
	Sulfur Dioxide Cylinder	Gas Cylinder	>12
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>8
	Aluma T-135	Meteorological Crank Tower	>14
	Agilaire 8872	Datalogger	>1
	Novalynx 260-2501 Tipping Bucket	Precipitation Sensor	>1
	RM Young Temp/RH Probe 41382VC	Ambient Temperature & Relative Humidity	>2
	PM Young Barometric Pressure Sensor 61302	Barometric Pressure Sensor	>3
Atlanta-Sandy Springs-Alpharetta MSA			
Forest Park	Thermo Partisol-Plus 2025i	Integrated $PM_{2.5}$ Sampler	new
Kennesaw	Agilaire 8872	Datalogger	>1
	Thermo 49i series	O_3 Analyzer	>11
	Thermo 49 iQPS	O_3 Calibrator	>5
Dawsonville	Thermo 49i series	O_3 Analyzer	>10
	Thermo 49iPS series	O_3 Calibrator	>10
	Agiliare 8872	Datalogger	new
	Environics 7000	Zero Air Supply	>10
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>5
	Aluma FOT-10	Meteorological Fold Over Tower	>14

SITE NAME	EQUIPMENT NAME	EQUIPMENT DESCRIPTION	AGE
South DeKalb	Agilaire 8872	Datalogger	>3
	Thermo 49i series	O_3 Analyzer	>7
	Thermo 49iQPS	O_3 Calibrator	>5
	Environics 6103	Multi-Gas Calibrator	>8
	Environics 6103	Multi-Gas Calibrator	>7
	Thermo 42iY	NOy Analyzer	>13
	Teledyne N500 CAPS	NO, NO2, NOx	>3
	Thermo 48i-TLE	CO Analyzer	>8
	Thermo 43i-TLE	SO_2 Analyzer	>8
	Thermo Partisol-Plus 2025i	Integrated $PM_{2.5}$ Sampler	>8
	Thermo Partisol-Plus 2025i	Collocated Integrated $PM_{2.5}$ Sampler	>8
	Teledyne T640X	Continuous PM Sampler	>6
	Tisch TE-Wilbur Filter Based (2)	Integrated $PM_{2.5}$ Metals Sampler	>1
	Met One SASS	$PM_{2.5}$ Speciation Sampler	>8
	URG 3000N	$PM_{2.5}$ Speciation Sampler	>12
	Environics 7000 (2)	Zero Air Supply	>7
	ATEC 8000	Carbonyls Sampler	>8
	ATEC 8000/ATEC 2200-1C	Collocated Carbonyls Sampler	>8
	Tisch Environmental PUF	Semi-VOCs (PAH) Sampler	>11
	Tisch Environmental PUF	Collocated Semi-VOCs (PAH) Sampler	>11
	Grasby Environmental PUF	Semi-VOCs (PAH) Sampler	>13
	Grasby Environmental PUF	Collocated Semi-VOCs (PAH) Sampler	>13
	ATEC 2200/ATEC 2200-22P	VOCs Sampler	>12
	ATEC 2200	Collocated VOCs Sampler	>12
	Sierra-Andersen/Graseby High-Vol	PM_{10} Metals	>12
	Sierra/Andersen/Graseby High-Vol	Collocated PM_{10} Metals	>12
	Met-One Low-Vol	PM_{10} Metals	>4
	Met-One Low-Vol	Collocated PM_{10} Metals	>4
	Markes Unity XR Thermal Desorber	Gas Chromatograph	>4
	Agilent 7890B	Gas Chromatograph	>4
	Markes CIA Advantage	VOC Analyzer	>4
	Markes Kori XR	VOC Desorber	>4
	Merlin Microscience System	Gas Dilution System	>4
	Parker Zero Air Generator 75-83NA	Zero Air Generator	>4
	Werther PC1-24-3	Oil-free Air Compressor	>4
	AirGas Hydrogen Cylinder (13)	Gas Cylinder	>4
	AirGas Helium Cylinder (6)	Gas Cylinder	>4
	NexAir Helium Cylinder	Gas Cylinder	>4
	AirGas Compressed Air (4)	Gas Cylinder	>4
	Parker TOC Generator	Zero Air Generator	>4
	Peak Scientific Hydrogen Generator	Hydrogen Generator	>4
	AirGas Nitrogen Cylinder (1)	Gas Cylinder	>4
	Carbon Monoxide Cylinder	Gas Cylinder	<12
	Nitrogen Oxide Cylinder	Gas Cylinder	<12
	Sulfur Dioxide Cylinder	Gas Cylinder	<12
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>8
	Aluma T-135	Meteorological Crank Tower	>14
	RM Young Temp/RH Probe 41382VC	Ambient Temperature & Relative Humidity	>2
	Novalynx 260-2501 Tipping Bucket	Precipitation Sensor	>8
	RM Young Barometric Pressure Sensor 61302	Barometric Pressure Sensor	>1
	Vaisala Inc. CL51 Ceilometer	Cloud Height and mixing layer height Detection	>1

SITE NAME	EQUIPMENT NAME	EQUIPMENT DESCRIPTION	AGE
NR-285	Agilaire 8872	Datalogger	>3
	Thermo 42i	NOx Analyzer	>8
	Xonteck 910	VOC Sampler	>8
	Environics 6103	Multi-gas Calibrator	>8
	Nitrogen Oxide Cylinder	Gas Cylinder	>12
	Met One Instrument BC-1060	Black Carbon Sampler	>3
Douglasville	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>5
	Aluma T-135	Meteorological Crank Tower	>14
	Environics 7000	Zero Air Supply	>8
	Agilaire 8872	Datalogger	>1
Fire Station #8	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>8
	Tisch TE-Wilbur Filter Based	Integrated PM_{10} Sampler	>6
	Tisch TE-Wilbur Filter Based	Collocated Integrated PM_{10} Sampler	>6
United Avenue	Thermo 146i	Multi-gas Calibrator	>7
	Agilaire 8872	Datalogger	>3
	Thermo 49i series	O_3 Analyzer	>10
	Thermo 49iPS series	O_3 Calibrator	>10
	Thermo 43i	SO_2 Analyzer	>9
	TEOM 1400AB	Continuous $PM_{2.5}$ Sampler	>12
	Sulfur Dioxide Cylinder	Gas Cylinder	>12
	Environics 7000	Zero Air Supply	>8
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>8
	Aluma T-135	Meteorological Crank Tower	>14
NR-GA Tech	Agilaire 8872	Datalogger	>1
	Thermo 42i	NO_2 Analyzer	>8
	Thermo 48i-TLE	CO Analyzer	>12
	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>8
	TEOM 1405-F	Continuous $PM_{2.5}$ Sampler	>2
	Carbon Monoxide Cylinder	Gas Cylinder	>12
	Nitrogen Oxide Cylinder	Gas Cylinder	>12
	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	new
	Aluma T-135	Meteorological Crank Tower	>10
	Environics 7000	Zero Air Supply	>8
	Environics 6103	Multi-gas Calibrator	>8
	Met One Instruments BC-1060	Black Carbon Sampler	>3
Empire Blvd	Graseby Hi-Vol	Lead Sampler	>10
	Graseby Hi-Vol	Collocated Lead Sampler	>10
Gwinnett Tech	Agilaire 8872	Datalogger	>1
	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	Environics 7000	Zero Air Supply	>7
	Thermo Partisol-Plus 2025i	Integrated $PM_{2.5}$ Sampler	new
	Teledyne T640	Continuous PM Sampler	>6
McDonough	Agilaire 8872	Datalogger	>1
	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iPS series	O_3 Calibrator	>12
	Environics 7000	Zero Air Supply	>8
	TEOM 1400AB	Continuous $PM_{2.5}$ Sampler	>12
Conyers	Agilaire 8872	Datalogger	>3
	Thermo 49i series	O_3 Analyzer	>12
	Thermo 49iQPS	O_3 Calibrator	>5
	Environics 7000	Zero Air Supply	>8

SITE NAME	EQUIPMENT NAME	EQUIPMENT DESCRIPTION	AGE
Conyers cont'd	RM Young Ultrasonic Anemometer 81000	Wind Speed and Wind Direction	>5
	Aluma T-135	Meteorological Crank Tower	>14
	Aluma T-135	Meteorological Crank Tower	>14
	Eppley Lab Standard Precision Pyronometer 38380F3	Solar Radiation Instrument	>3
	Eppley Lab TUVR 38020	Ultraviolet Radiometer	>3
	Novalynx 260-2501 Tipping Bucket	Precipitation Sensor	>8
	RM Young Temp/RH Probe 41382VC	Ambient Temperature & Relative Humidity	>7
	RM Young Barometric Pressure Sensor 61302	Barometric Pressure Sensor	>8
Chattanooga Tennessee-Georgia MSA			
Rossville-Williams St.	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>9
	Met One SASS	$PM_{2.5}$ Speciation Sampler	>9
	URG 3000N	$PM_{2.5}$ Speciation Sampler	>9
	ESC DAS 8832	Datalogger	>10
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>5
Sites Not in an MSA			
General Coffee	Met One SASS	$PM_{2.5}$ Speciation Sampler	>8
	URG 3000N	$PM_{2.5}$ Speciation Sampler	>12
	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	>13
	Teledyne T640	Continuous $PM_{2.5}$ Sampler	>1
	Teledyne T640	Collocated Continuous $PM_{2.5}$ Sampler	new
	ESC DAS 8832	Datalogger	>8
Sandersville	Teledyne T640	Continuous PM Sampler	>6
	Thermo Partisol-Plus 2025	Integrated $PM_{2.5}$ Sampler	new
	ESC DAS 8832	Datalogger	>8
Georgia AAMP			
	BGI/MesaLabs DeltaCal (4)	Flow, Temperature & Pressure Standard	>9
	BGI/MesaLabs TetraCal (3)	Flow, Temperature & Pressure Standard	>9
	BIOS DC-Lite DCL-H	Flow Standard	>9
	BIOS Definer 220 High Flow	High flow volumetric standardized gas	>9
	BIOS Definer 220 Low Flow	Low flow volumetric standardized gas	>9
	Chinook Engineering Streamline Pro (3)	Flow Transfer Standard	>9
	Graseby GMW	PUF Orifice	>9
	Linde UltraPure Gas Standard	PAMS - EPA UltraPure Gas Standard	>9
	Sensidyne Gilibrator Flow Cell (6)	Flow Standard	>9
	Sensidyne Gilibrator Flow Cell Base (2)	Flow Standard	>9
	Tisch Environmental TE-5040A	PUF Orifice	>9
	Vaisala HM40/HM46 (3)	Temperature & Relative Humidity Probe	>9
	Vaisala HMI41/HMP46 (3)	Temperature & Relative Humidity Probe	>9
	Thermo 49i-PS (2)	O_3 Standard	>12
	Thermo 49-PS (2)	O_3 Standard	>13
	Thermo 146i (2)	Multi-Gas Calibrator	>13
	Airgas EPA Protocol Gas Standard (5)	EPA Protocol NO/NOx/CO/SO_2 Gas Standard	>9
	Bosch GLM 80 (2)	Laser Distance/Angle Measurer	>9
	NexAir EPA Protocol Gas Standard (5)	EPA Protocol NO/CO/SO_2 Gas Standard	>9
	Linde/Nexair	EPA Protocol PAMS Gas Standard	<1
	Linde/Nexair	EPA UltraPure Gas Standard	>4
	Thermo 49iQps (2)	O_3 Standard	<1

SITE NAME	EQUIPMENT NAME	EQUIPMENT DESCRIPTION	AGE
Meteorology Unit Workshop	RM Young Ultrasonic Anemometer 810000 (15)	Wind Speed and Wind Direction	various
	RM Young Meteorological Translator 26800	Datalogger	>4
	Eppley Lab Standard Precision Pyronometer 38380F3 (7)	Solar Radiation Instrument	various
	Eppley Lab TUVR (5)	Ultraviolet Radiometer	various
	Novalynx 260-2501 Tipping Bucket (6)	Precipitation Sensor	various
	RM Young Temp/RH Probe 41382VC/ 41382VC (23)	Ambient Temperature & Relative Humidity	various
	RM Young Barometric Pressure Sensor 61302 (19)	Barometric Pressure	various
	Aluma FOT-10 (1)	Fold-Over Tower	various
	Aluma T-135 (5)	Meteorological Crank Tower	various
Workshop	Met One SASS (9)	$PM_{2.5}$ Speciation Sampler	>11
	URG 3000N (4)	$PM_{2.5}$ Speciation Sampler	>8
	Thermo 43i-TLE (4)	SO_2 Analyzer	various
	Thermo 146i (9)	Multi-Gas Calibrator	various
	Thermo 42i (5)	NO, NO_2, NOx Analyzer	various
	Environics 6103 (10)	Multi-Gas Calibrator	>8
	Thermo 48i-TLE (5)	CO Analyzer	various
	Thermo 42iY	NOy Analyzer	>11
	Thermo 42iY	NOy Analyzer	>1
	Thermo 43i (3)	SO_2 Analyzer	various
	Sabio 1001 (14)	Zero Air Supply	>8
	Teledyne T701H (2)	Zero Air Supply	various
	Environics 7000 (5)	Zero Air Supply	>7
	Teledyne T640 (8)	Continuous PM Sampler	>6
	Teledyne T640X	Continuous PM Sampler	>6
	Met One E-SEQ-FRM (3)	Integrated PM Sampler	various
	Thermo 49i-PS (6)	O_3 Calibrator	various
	Thermo 49i (10)	O_3 Analyzer	various
	Thermo 49C-PS (4)	O_3 Calibrator	various
	Thermo 49C (2)	O_3 Analyzer	various
	Thermo Partisol-Plus 2025 (17)	Integrated $PM_{2.5}$ Sampler	various
	TEOM 1400AB (6)	Continuous $PM_{2.5}$ Sampler	>11
	Agilaire 8872 (7)	Datalogger	various
	ATEC 2200-1P (9)	VOCs Sampler	>11
	ATEC 2200-1C (2)	VOCs Sampler	>11
	ATEC 8000 (5)	Carbonyls Sampler	various
	Thermo 49i QPS (5)	Primary O_3 Standard	>6
	Thermo 49i-PS, Thermo 49i	O_3 Bench Calibrator and Sampler	>11
	Thermo 146iQ (2)	Multi-Gas Calibrator	>5
	Xonteck 911 (2)	Canister Sampler	>8
	Tisch Wilbur	PM_{10} Sampler	>6
	Alicat Scientific FP-25 (23)	Flow, Temperature & Pressure Standard	various
	Alicat Whisper	Flow, Temperature & Pressure Standard	various
	BGI/MesaLabs TetraCal (26)	Flow, Temperature & Pressure Standard	various
	BGI/MesaLabs DeltaCal (23)	Flow, Temperature & Pressure Standard	various
	Tisch Environmental TE-5028A VRC (8)	Variable High Volume Orifice	various
	Tisch Environmental TE-5040A (4)	PUF Orifice	various
	Sensidyne Gilibrator Sets (13)	Flow Standard	various

SITE NAME	EQUIPMENT NAME	EQUIPMENT DESCRIPTION	AGE
Workshop cont'd	Carbon Monoxide Cylinder(4)	Gas Cylinder	>12
	Nitrogen Oxide Cylinder (12)	Gas Cylinder	>12
	Sulfur Dioxide Cylinder (6)	Gas Cylinder	>12
	ESC DAS 8832 (29)	Datalogger	>9
	Carbon Dioxide Cylinder	Gas Cylinder	<12
	RM Young Ultrasonic Anemometer 810000	Wind Speed and Wind Direction	>6
	Aluma T-135 (4)	Meteorological Crank Tower	>6
	Environics 7000 (2)	Zero Air Supply	>8
	AVOCS* (2)	VOC Sampler	>13
	Chinook Engineering Streamline Pro (3)	Flow Transfer Standard	>3
	Thermo Partisol-Plus 2025i (9)	Integrated $PM_{2.5}$ Sampler	>1
	ATEC 1000*	Carbonyls Sampler	>12
	Entech CS1200E Passive Sampler	Ethylene oxide	>4
	Helium (5)	Gas Cylinder	>12
	Mesa Labs Flexcal High Flow (2)	High Flow	>9
	Mesa Labs Flexcal Low Flow (2)	Low Flow	>9
	Marathon Zero Air Generator	Zero Air Gas Generator	various
	Parker TOC Generator	Zero Air Generator	various
	PAMS Air Compressor	Air Compressor	various
	Met One Instrument BC-1060	Black Carbon Sampler	new
	Teledyne T200UP (2)	NO_x Analyzer	new
	Environics 9100	Zero Air Supply	new
	Shelter One BAM enclosure (2)	Enclosure	new
	Shelter One T640 enclosure (2)	Enclosure	new
	MetOne EBAM	Continuous $PM_{2.5}$ Sampler	new
	TISH PUF orifices (12)	Flow Standard	new
	TISH Hi-Vol orifices (11)	Flow Standard	new
	TISH ProCal	Flow Standard	new
	AirGas Ultra High Pure Air Cylinder (8)	Gas Cylinder	new
	AirGas Nitrogen (7)	Gas Cylinder	>4
	Thermo 49iQ series	O_3 Analyzer	new
	Teledyne 701 (3)	Zero Air Supply	new

NOTE:
Age = age in years
*** = Not currently in use**

Appendix C:
Pollutant Description, Analysis Method, and Quality Assurance Schedule

Georgia Department of Natural Resources
Environmental Protection Division

Pollutant Description, Analysis Method, and Quality Assurance Schedule

All monitors have known precision, accuracy, interferences, and operational parameters. The monitors as well as all measurement devices are carefully calibrated at predetermined frequencies, varying from daily to quarterly. Calibration standards are traceable to National Institute of Standards and Technology (NIST) master standards.

Monitoring and analysis are performed according to a set of standard operating procedures (SOP). Field personnel visit sampling sites, replace sample media, and check the operation and calibration of monitors per the SOP.

Specialized data-collection and storage equipment is used at most sites to collect the data. A computerized telemetry system aids in assembly of the data for submission to the U.S. EPA. This enhances data validity, minimizes travel costs, and allows data to be available by computer at GA AAMP's main office immediately. Numerous manual and automated checks are performed to ensure that only valid data are reported to EPA.

Quality assurance activities are carried out to determine the quality of the collected ambient data, improve the quality of the data, and evaluate how well the entire monitoring system operates. The goal of quality assurance activities is to produce high quality monitoring data.

1.0 Particulate Matter

Particulate matter is defined as any airborne material, except uncombined water (liquid, mist, steam, etc.) that exists in a finely divided form as liquid or solid at standard temperature (25°C) and pressure (760mmHg) and has an aerodynamic diameter of less than 100 micrometers. Three sizes of particulate matter are monitored: PM_{10}, $PM_{2.5}$, and PMcoarse (10-2.5). PM_{10} is particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (µm). $PM_{2.5}$ are solid particles and liquid droplets found in the air that are less than 2.5 micrometers (µm) or micronsin diameter. Individually, these particles and droplets are invisible to the naked eye. Collectively, however, they can appear as clouds or a fog-like haze. $PM_{2.5}$ is also referred to as "fine" particles. $PM_{10\text{-}2.5}$ is called PMcoarse. The PMcoarse fraction has a diameter between 2.5 and 10 micrometers (µm) or microns. In comparison, a human hair is 70-100 µm in diameter.

Particulates are emitted by many human activities, such as fuel combustion, motor vehicle operation, industrial processes, grass mowing, agricultural tilling, and open burning. Natural sources include windblown dust, forest fires, volcanic eruptions, and pollen. Particulates emitted directly from a source may be either fine (less than 2.5 µm) or larger (2.5-60 µm), but particles formed in the atmosphere will usually be fine. Typically, fine particles are formed by condensation of materials produced during combustion or atmospheric reactions in which gaseous pollutants are chemically converted to particles.

Particulate matter can cause health problems affecting the breathing system, including aggravation of existing lung and heart disease, limitation of lung clearance, changes in form and structure of organs, and development of cancer. Individuals most sensitive to the effects of particulate matter include those with chronic obstructive lung or heart disease, those suffering from the flu, asthmatics, the elderly, children, and mouth breathers.

Health effects from inhaled particles are influenced by the depth of penetration of the particles into the respiratory system, the amount of particles deposited in the respiratory system, and the chemical composition of the deposited particles. The risks of adverse health effects are greater when particles enter the tracheobronchial and alveolar portions of the respiratory system. Healthy respiratory systems can trap particles larger than 10 µm more efficiently before they move deeply into the system, and can more effectively remove the particles that are not trapped before they can lodge deeply in lung tissue.

Particulate matter also can interfere with plant photosynthesis by forming a film on leaves that reduces exposure to sunlight. Particles also can cause soiling and degradation of property, which can be costly to clean and maintain. Suspended particles can absorb and scatter light, causing reduction of visibility. This is a national concern, especially in areas such as national parks, historic sites, and scenic attractions.

a. Particulate Matter (PM_{10}) Integrated

GA AAMP conducts PM_{10} monitoring on an integrated basis at one site in Georgia. GA AAMP uses an EPA-approved method. The Tisch – TE Wilbur Filter Based PM_{10} Air Sampler functions to collect airborne particulate matter ≤ 10 µm (PM_{10}) on a pre-weighted 47mm diameter filter over a 24-hour period, midnight to midnight. The sampler normally samples every 6 days and exposed filter are subsequently collected and sent to Pace Analytical Services, LLC for gravimetric analysis and measurement of PM_{10} concentration. The system monitors and records all system sensors such as flow, temperatures and barometric pressure, as well as the system pressure, filter temperature variation, and flow total which provides the operator or laboratory technician additional information on the sample if warnings or alarms occurred during the sample run. These monitors are used to determine attainment of the PM_{10} standard. These analyzers are subjected to quarterly checks and are audited by GA AAMP's Quality Assurance Unit on a semi-annual basis, within a five to seven month window.

b. Particulate Matter (PM_{10}) Continuous

GA AAMP conducts PM_{10} monitoring on a continuous basis at two sites in Georgia. GA AAMP uses an EPA-approved equivalent method, the Teledyne T640/640x, which is a real-time, continuous PM mass monitor that uses scattered light spectrometry for measurement. The T640 measures $PM_{2.5}$, and the T640x Option measures $PM_{2.5}$, PM_{10}, and $PM_{10\text{-}2.5}$. The sampling head draws in the ambient air with different size particles, which are dried with the Aerosol Sample Conditioner (ASC) and moved into the optical particle sensor where scattered light intensity is measured to determine particle size diameter. The inlet used for the T640x option samples at 16.67 liters per minute (LPM) to mechanically size-cut the aerosol intake for sampling particles at 10 microns and under. The particles move separately into the T-aperture through an optically differentiated measurement volume that is homogeneously illuminated with polychromatic light. This Model T640 with 640x option PM_{10} monitor is configurable as a PM_{10} FEM (EQPM-0516-239), and the data is used to determine attainment of the PM_{10} NAAQS. This analyzer is subjected to monthly flow checks and is audited by GA AAMP's Quality Assurance Unit on a semi-annual basis.

c. Fine Particulate Matter ($PM_{2.5}$) Integrated

At sites where GA AAMP collects $PM_{2.5}$ samples on an integrated basis, the samples are measured using very similar techniques utilized for measuring PM_{10}. The official federal reference method (FRM) requires that samples are collected on Teflon™ filters with a $PM_{2.5}$ sampler for 24 hours. A specialized particle size sorting device is used to filter the air, collecting only particles 2.5 microns in size and smaller. The filters are weighed in a laboratory before and after the sampling period. The change in the filter weight corresponds to the mass weight of $PM_{2.5}$ particles collected. That mass weight, divided by the total volume of air sampled, corresponds to the mass concentration of the particles in the air for that 24-hour period. This data is collected using the FRM, and the data is appropriate to use for making attainment determinations relative to the $PM_{2.5}$ NAAQS. Currently, GA AAMP uses the Thermo Scientific Partisol 2025 (RFPS-0498-118 or EQPM-0202-145) and Thermo Scientific Partisol 2025i (RFPS-0498-118). The sampling frequency for integrated $PM_{2.5}$ sampling varies by site, based on EPA rules, and is listed with each individual site's information in Appendix A of this document and in Table 1 below. On a semi-annual basis, GA AAMP's Quality Assurance Unit audits these $PM_{2.5}$ samplers.

d. Fine Particulate Matter ($PM_{2.5}$) Continuous

GA AAMP monitors for $PM_{2.5}$ on a continuous basis with two different methods. One method is the Teledyne T640/640x, which is an optical aerosol spectrometer that converts optical measurements to mass measurements by determining sampled particle size via scattered light using 90° white- light scattering with polychromatic LED. The inlet used for the T640/640x samples at 5.0 liters per minute (LPM). The Aerosol Sample Conditioner (ASC) removes the volatile components (mainly water) of the aerosol to avoid false particle size. The internal vacuum pump is controlled by a pulse-width modulation (PWM) feedback control for consistently accurate flow to the sensor. The external vacuum pump is controlled by an ambient and pressure compensated mass flow controller in combination with a pneumatic valve for consistently accurate flow. The Teledyne T640/640x is officially designated as an U.S. EPA Federal Equivalent Method (FEM) (EQPM-0516-236 and EQPM-0516-238) (81 FR 45285), and used for making attainment decisions relative to the $PM_{2.5}$ NAAQS. GA AAMP continues to evaluate the continuous $PM_{2.5}$ Teledyne T640/640x monitors at locations where they are collocated with the $PM_{2.5}$ FRMs (filter based) monitors. At this time, GA AAMP has continuous $PM_{2.5}$ Teledyne T640/640x monitors that are not comparable to the NAAQS. These monitors are labeled as special purpose monitors (SPM). Please see Table 5 of this Appendix for more information.

Another $PM_{2.5}$ continuous collection method utilized by GA AAMP is the Thermo Scientific tapered element oscillating microbalance (TEOM) Series 1400/1400a/1405-F monitors. These monitors use an inline $PM_{2.5}$ cyclone for particle size selection and an inline Sample Equilibration System (SES), which uses a diffusion drying technique to minimize water vapor interference with the particle mass measurement. The instrument oscillates the sample filter on a microbalance continuously while particles are collected from ambient air. By measuring the change in the oscillation frequency, the change in filter mass can be determined. The sampling method for the TEOM type of continuous $PM_{2.5}$ monitor was approved as Federal Equivalent Method (FEM) in Notices of the Federal Register/Vol.74; page 28696 dated June 17, 2009 when used with a "Filter Dynamics Measurement System (FDMS)". The FDMS component estimates and adjusts for the volatile component of the mass. Currently, the TEOMs in the ambient air monitoring network are not configured to sample as FEMs. Therefore, data collected from the TEOM samplers cannot be used for making attainment decisions relative to the NAAQS.

Both types of continuous $PM_{2.5}$ samplers are used to support development of air quality models and forecasts, including the AQI, and to provide the public with information about pollutant concentrations in real time. All three types of analyzers are subject to monthly flow checks and are audited by GA AAMP's Quality Assurance Unit on a semi-annual basis.

e. Fine Particulate Matter ($PM_{2.5}$) Speciation

Particle speciation measurements require the use of a wide variety of analytical techniques, but all generally use filter media to collect the particles to be analyzed. Laboratory techniques currently in use are gravimetric (micro weighing); X-ray fluorescence and particle-induced X-ray emission for trace elements; ion chromatography for anions and selected cations; controlled combustion for carbon; and gas chromatography/mass spectroscopy (GC/MS) for semi-volatile organic particles. Samples are collected for 24 hours and shipped to an EPA-appointed laboratory for analysis. The sampling frequency varies by site and is detailed in Table 1. GA AAMP's Quality Assurance Unit subjects these samplers to audits on a semi-annual basis.

f. Coarse Particulate Matter ($PM_{10-2.5}$)

As part of the NCore requirements (discussed in Section 4.1 of the Introduction), the South DeKalb site (13-089-0002) began $PM_{10-2.5}$ sampling as of January 1, 2011. The Teledyne T640x $PM_{10-2.5}$ is the current system used to measure coarse particulate matter. The Teledyne T640/640x is a real-time, continuous PM mass monitor that uses scattered light spectrometry for measurement. The T640x Option measures $PM_{2.5}$, PM_{10}, and $PM_{10-2.5}$. The sampling head draws in the ambient air with different size particles, which are dried with the Aerosol Sample Conditioner (ASC) and moved into the optical particle sensor where scattered light intensity is measured to determine particle size diameter. The particles move separately into the T-aperture through an optically differentiated measurement volume that is homogeneously illuminated with polychromatic light. GA AAMP uses the 16.7 LPM Model T640 with 640x option $PM_{10-2.5}$ monitor: EQPM-0516-240. This analyzer is subjected to monthly flow checks and is audited by GA AAMP's Quality Assurance Unit on a semi-annual basis.

The sampling frequency of the integrated (FRM), continuous (Teledyne, TEOM), and speciated $PM_{2.5}$ samplers is detailed in Table 5, and Appendix A. The $PM_{2.5}$ samplers highlighted in yellow are the $PM_{2.5}$ samplers that are used for comparison to the NAAQS for attainment purposes.

Table 5. $PM_{2.5}$ Sampling Frequency

Site ID	Site Name	County	Integrated	Continuous	Speciation
Rome MSA					
131150003	Rome	Floyd		$PM_{2.5}$	6 Day
Brunswick MSA					
131270006	Brunswick	Glynn	$PM_{2.5}$ (3 Day)	FEM $PM_{2.5}$	
Valdosta MSA					
131850003	Valdosta	Lowndes	$PM_{2.5}$ (Daily)	SPM $PM_{2.5}$	
Warner Robins MSA					
131530001	Warner Robins	Houston	$PM_{2.5}$ (Daily)	FEM $PM_{2.5}$	
Albany MSA					
130950007	Albany	Dougherty	2 $PM_{2.5}$ (Daily, 3 Day)	SPM $PM_{2.5}$	
Gainesville MSA					
131390003	Gainesville	Hall	$PM_{2.5}$ (Daily)	SPM $PM_{2.5}$	
Athens-Clarke County MSA					
130590002	Athens	Clarke		2 FEM $PM_{2.5}$	
Macon-Bibb County, MSA					
130210007	Macon-Allied	Bibb	$PM_{2.5}$ (Daily)	SPM $PM_{2.5}$	6 Day
130210012	Macon-Forestry	Bibb	$PM_{2.5}$ (3 Day)		
Columbus, Georgia- Alabama MSA					
132150008	Columbus-Airport	Muscogee	$PM_{2.5}$ (3 Day)		
132150012	Columbus-Baker	Muscogee	$PM_{2.5}$ (Daily)	SPM $PM_{2.5}$	6 Day
Savannah MSA					
130511002	Savannah-L&A	Chatham	$PM_{2.5}$ (Daily)	FEM $PM_{2.5}$	
Augusta, Georgia-South Carolina MSA					
132450091	Augusta	Richmond	2 $PM_{2.5}$ (Daily, 3 Day)	SPM $PM_{2.5}$	6 Day
Atlanta-Sandy Springs-Alpharetta MSA					
130630091	Forest Park	Clayton	$PM_{2.5}$ (3 Day)		
130890002	South DeKalb	DeKalb	2 $PM_{2.5}$ (Daily, 3 Day)	FEM $PM_{2.5}$	3 Day
131210039	Fire Station #8	Fulton	$PM_{2.5}$ (3 Day)		
131210055	United Ave.	Fulton		$PM_{2.5}$	
131210056	NR-Georgia Tech	Fulton	$PM_{2.5}$ (3 Day)	$PM_{2.5}$	
131350002	Gwinnett Tech	Gwinnett	$PM_{2.5}$ (Daily)	SPM $PM_{2.5}$	
131510002	McDonough	Henry		$PM_{2.5}$	
Chattanooga, Tennessee-Georgia MSA					
132950004	Rossville-Williams St.	Walker	$PM_{2.5}$ (Daily)	SPM $PM_{2.5}$	6 Day
Not in an MSA					
130690002	General Coffee	Coffee	$PM_{2.5}$ (Daily)	2 FEM $PM_{2.5}$	6 Day
133030001	Sandersville	Washington	$PM_{2.5}$ (Daily)	SPM $PM_{2.5}$	

Highlighted samplers used for comparison to NAAQS. See Appendix A for updates to this network over the next 18 months.

2.0 Carbon Monoxide (CO)

Carbon monoxide (CO) is a colorless and poisonous gas produced by incomplete burning of fossil fuels used in vehicles, space heating, and industrial processes. Boilers and other fuel burning heating systems are also significant sources.

Breathing elevated levels of carbon monoxide affects the oxygen-carrying capacity of the blood. Hemoglobin in the blood binds with CO more readily than with oxygen, starving the body of vital oxygen. Individuals with lung and heart diseases or anemia are particularly sensitive to CO health effects. Low concentrations affect mental function, vision, and alertness. High concentrations can cause fatigue, reduced work capacity and may adversely affect fetal development. Chronic exposure to CO at concentrations as low as 70 parts per million (ppm) (80 mg/m^3) can cause cardiac damage. Other health effects associated with exposure to CO include central nervous system effects and pulmonary function difficulties. Ambient CO apparently does not adversely affect vegetation or materials.

Carbon monoxide (CO) is monitored using EPA-approved reference or equivalent methods. These analyzers are self-contained and capable of measuring ambient CO on a continuous, real-time basis using the non-dispersive infrared analysis and gas filter correlation techniques. CO is monitored using specialized analyzers based on the principle that CO absorbs infrared radiation. The sample is drawn through the sample bulkhead and the optical bench. Radiation from an infrared source is chopped and then passed through a gas filter alternating between CO and nitrogen (N_2). The radiation then passes through a narrow bandpass interference filter and enters the optical bench where absorption by the sample gas occurs. The infrared radiation then exits the optical bench and falls on an infrared detector. The N_2 side of the filter wheel produces a measure beam which can be absorbed by the CO in the cell. The chopped detector signal is modulated by the alternation between the two gas filters with amplitude related to the concentration of CO in the sample cell. Thus, the gas filter correlation system responds specifically to CO. The sampler is equipped with a microprocessor that enables digital measurement of CO, automatic compensation for changes in temperature and pressure, and internal diagnostics. These analyzers are subjected to biweekly zero, precision, and span (ZPS) checks, quarterly multipoint calibrations, and are audited by GA AAMP's Quality Assurance Unit on a semi-annual basis.

3.0 Ozone (O_3)

Ozone (O_3) is a clear gas that forms in the troposphere (lower atmosphere) by chemical reactions involving hydrocarbons (also called volatile organic compounds) and oxides of nitrogen in the presence of sunlight. Even low concentrations of tropospheric ozone, also called ground level ozone are harmful to people, animals, vegetation and materials.

Ozone is the major component of a complex mixture of compounds known as photochemical oxidants. Ozone is not usually emitted directly into the atmosphere, but is formed by a series of complex reactions involving hydrocarbons, nitrogen oxides, and strong sunlight. Ozone concentrations are generally higher during the daytime, when temperatures are moderate or hot, and during seasons when conditions are dry and the sunlight is more intense.

Ozone is a pulmonary irritant, affecting the respiratory mucous membranes, as well as other lung tissues and respiratory functions. Ozone has been shown to impair normal function of the lung causing shallow, rapid breathing and a decrease in pulmonary function. Other symptoms of exposure include chest tightness, coughing and wheezing. People with asthma, bronchitis, or emphysema may experience breathing difficulty when exposed to short-term concentrations at higher levels of ozone. Continued or repeated long-term exposure may result in permanent lung structure damage.

Ozone damages vegetation by injuring leaves. Ozone also accelerates material aging, cracking rubber, fading dyes and eroding paint.

Georgia's ozone analyzers continuously measure the concentration of ozone in ambient air using the ultraviolet (UV) photometric method and are EPA-approved for regulatory air monitoring programs. The degree to which the UV light is absorbed is directly related to the ozone concentration. The ambient air is drawn into the sample bulkhead and is split into two gas streams. One gas stream flows through an ozone scrubber to become the reference gas. The reference gas then flows to the reference solenoid valve. The sample gas flows directly to the sample solenoid valve. The solenoid valves alternate the reference and sample gas streams between the two cells every 10 seconds. When cell A contains reference gas, cell B contains sample gas and vice versa. The UV light intensities of each cell are measured by detectors A and B. When the solenoid valves switch the reference and sample gas streams to opposite cells, the light intensities are ignored for several seconds to allow the cells to be flushed. The sampler calculates the ozone concentration for each cell and outputs the average concentration to both the front panel display and the analog or digital output. Data gained from the monitors is used to determine compliance with the NAAQS for ozone.

As required by Table D-3 of 40 CFR Part 58, Appendix D (4.1)(c)(3)(i), GA AAMP operates ozone monitors each year from March 1st through October 31st, with the exception of the NCore (National Core Monitoring Network) ozone monitor. The NCore ozone monitor, located at the South DeKalb site (13-089-0002), samples year round, as required by 40 CFR Part 58. During the monitoring season, analyzers are subjected to biweekly ZPS checks and quarterly multipoint calibrations. GA AAMP's Quality Assurance Unit audits these samplers on an annual basis.

EPA established a Clean Air Status and Trends Network (CASTNET) monitoring site in Georgia in 1988. The CASTNET site (13-231-9991) is part of a national air quality monitoring network put in place to assess long-term trends in atmospheric deposition and ecological effects of air pollutants. The CASTNET site is one of 89 regional sites across rural areas of the United States and Canada measuring nitrogen, sulfur, and ozone concentrations, and deposition of sulfur and nitrogen. Like the South DeKalb ozone monitor, the CASTNET ozone monitor also collects data year-round. Since 2011, the CASTNET ozone monitor has met requirements for quality assurance and completeness criteria and can be used for comparison to the NAAQS [40 CFR 58, (1.1)(b)].

4.0 Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) is a colorless, corrosive, harmful gas with a pungent odor. Sulfur oxides contribute to the formation of acid rain and the formation of particles that reduce visibility. The main sources of SO_2 are combustion of fossil fuels containing sulfur compounds and the manufacture of sulfuric acid. Other sources include refining of petroleum and smelting of ores that contain sulfur.

The most obvious health effect of sulfur dioxide is irritation and inflammation of body tissues brought in contact with the gas. Sulfur dioxide can increase the severity of existing respiratory diseases such as asthma, bronchitis, and emphysema. Sulfuric acid and fine particulate sulfates, which are formed from sulfur dioxide, also may cause significant health problems. Sulfur dioxide causes injury to many plants. A bleached appearance between the veins and margins on leaves indicates damage from SO_2 exposure. Commercially important plants sensitive to SO_2 include cotton, cucumber, alfalfa, sweet potatoes, tulips, apple trees, and several species of pine trees.

Sulfur dioxide is measured in the ambient air using EPA-approved reference method instruments as defined in 40 CFR Part 53. Georgia's sulfur dioxide network consists of continuous instruments using a pulsed ultraviolet (UV) fluorescence technique. This monitoring technique is based on measuring the emitted fluorescence of SO_2 produced by its absorption of UV radiation. Pulsating UV light is focused through a narrow bandpass filter allowing only light wavelengths of 1,900 to 2,300 angstrom units (Å) to pass into the fluorescence chamber. SO_2 absorbs light in this region without any quenching by air or most other molecules found in polluted air. The SO_2 molecules are excited by UV light and emit a characteristic decay radiation. A second filter allows only this decay radiation to reach a photomultiplier tube. Electronic signal processing transforms the light energy impinging on the photomultiplier tube into a voltage which is directly proportional to the concentration of SO_2 in the sample stream being analyzed. The sampler outputs the SO_2 concentration to the front panel display and analog or digital output. These analyzers are subjected to biweekly ZPS checks, quarterly multipoint calibrations, and are audited by GA AAMP's Quality Assurance Unit on an annual basis.

5.0 Nitrogen Oxides (NOx)

Several gaseous oxides of nitrogen (NO_x) are normally found in the atmosphere, including nitrous oxide (N_2O), nitric oxide (NO) and nitrogen dioxide (NO_2). Nitrous oxide is a stable gas with anesthetic characteristics and typical ambient concentrations well below the threshold concentration for a biological effect. Nitric oxide is a colorless gas with ambient concentrations generally low enough to have no significant biological effect. Nitrogen dioxide is reddish-brown but is not usually visible at typical ambient concentrations.

The most significant nitrogen oxide emissions result from the burning of fossil fuels such as coal, oil, and gasoline, due to the oxidation of atmospheric nitrogen and nitrogen compounds in the fuel. The primary combustion product is NO, which immediately reacts with oxygen in the atmosphere to form NO_2.

At high concentrations, nitrogen dioxide has significant health effects as a pulmonary irritant, especially upon asthmatics and children. At concentrations more typical in Georgia, though, NO_2 is primarily of concern because of its role in the formation of ground-level ozone. In warm, sunny conditions, it reacts with hydrocarbons in the atmosphere to form ozone. Ironically, the same reaction can run in reverse in the absence of sunlight, though, meaning that urban areas with higher NO_2 emissions and daytime ozone problems will often have virtually zero ozone present at night. Yet the next morning, the store of unreacted NO_2 that builds up in these areas overnight can cause rapid ozone formation once the sun rises. Therefore, urban areas often have summertime ozone concentrations with dramatic afternoon peaks contrasting against periods overnight where no ozone is present. Areas without significant local NO_2 sources, like rural areas and national parks, tend to have ozone present around the clock, but in moderate concentrations that are steadier throughout a twenty-four hour period.

Some types of vegetation are very sensitive to NO_2, including oats, alfalfa, tobacco, peas, and carrots. Chronic exposure causes chlorosis (yellowing), and acute exposure usually causes irregularly shaped lesions on the leaves.

Nitric oxide and nitrogen dioxide do not directly damage materials. However, NO_2 can react with moisture in the air to produce nitric acid, which corrodes metal surfaces and contributes to acid rain. High concentrations of NO_2 may reduce visibility.

Oxides of nitrogen, particularly NO_2, are monitored using specialized analyzers that continuously measure the concentration of oxides of nitrogen in ambient air using the ozone-phase chemiluminescent method. GA AAMP operates a Thermo Environmental Model 42i Chemiluminescence NO-NO_2-NO_x Analyzer (EPA Automated Equivalent Method RFNA-1289-074). Nitric oxide (NO) and ozone (O_3) react to produce a characteristic luminescence with intensity linearly proportional to the NO concentration. Infrared light emission results when electronically excited NO_2 molecules decay to lower energy states. NO_2 must first be convertedto NO before it can be measured using the chemiluminescent reaction. NO_2 is converted to NO by a molybdenum NO_2-to-NO converter heated to about 325°C. The ambient air sample is drawn into the sample bulkhead. The sample flows through a particulate filter, a capillary, then to the mode solenoid valve. The solenoid valve routes the sample either straight to the reaction chamber (NO mode) or through the NO_2-to-NO converter and then to the reaction chamber (NO_x mode). Dry air enters the dry air bulkhead through a flow sensor, and then through a silent discharge ozonator. The ozonator generates the necessary ozone concentration needed for the chemiluminescent reaction. The ozone reacts with the NO in the ambient air to produce electronically excited NO_2 molecules. A photomultiplier tube housed in a thermoelectric cooler detects the NO_2 luminescence. The NO and NO_2 concentrations calculated in the NO and NO_x modes are storedin memory, and the difference between the concentrations are used to calculate the NO_2 concentration. The sampler outputs NO, NO_2, and NO_x concentrations on the front panel display and the analog or digital outputs. There are two major instrument designs. While they are closely related, they do not monitor the same species. NO_x analyzers measure NO, NO_2, and NO_x. NO_y analyzers measure NO and NO_y, but cannot measure NO_2. The NO_y analyzers are also specialized for measuring trace-level concentrations; as such, they cannot measure higher concentrations. Because of these tradeoffs, it is necessary to operate a network of both instrument types to get a complete picture of local conditions. Of the oxides of nitrogen, only NO_2 is regulated under the NAAQS. Therefore, only the NO_x type analyzers produce data directly relevant to the standard. These analyzers are subjected to biweekly ZPS checks, quarterly multipoint calibrations, and are audited by GA AAMP's Quality Assurance Unit on an annual basis.

At the South DeKalb PAMS site (13-089-0002), the GA AAMP utilizes the Teledyne Advanced Pollution Instrumentation Model N500 Nitrogen Dioxide Analyzer for collection of direct NO/NO_2/NO_x measurements (Federal Equivalent Method EQNA-0320-256). The Model N500 collects direct measurements of NO/NO_2/NO_x with cavity attenuated phase shift spectroscopy (CAPS). The N500 CAPS monitor operates as an optical absorption spectrometer. The CAPS method uses light from a blue Ultraviolet (UV) light emitting diode (LED) centered at 405 nm, a measurement cell with high reflectivity mirrors located at either end to provide an extensive optical path length, and a vacuum photodiode detector. The sampler outputs NO, NO_2, and NO_X

concentrations on the front panel display and the analog or digital outputs directly to the AirVision database. These analyzers are subjected to biweekly ZPS checks, quarterly multipoint calibrations, and are audited by GA AAMP's Quality Assurance Unit on an annual basis.

6.0 Lead (Pb)

Lead (Pb) is a toxic heavy metal element occurring in the atmosphere as a constituent of small particles. The major source of atmospheric lead used to be the combustion of gasoline containing the additive tetraethyl lead as an antiknock agent. The use as a gasoline additive has been banned in all applications except aviation gasoline. This ban has dramatically decreased concentrations of lead in the ambient air. Significant remaining sources include coal combustion and sandblasting of highway structures and water tanks. Lead is also used in some batteries, paints, insecticides, and newspaper inks.

Lead persists and accumulates in the environment and the human body. It may be inhaled, ingested, and eventually absorbed into the bloodstream and distributed to all body tissues. Exposure to low concentrations interferes with blood production and specific enzyme systems. It is believed to cause kidney and nerve cell damage, and severe lead poisoning is known to cause brain damage in children.

Since lead is a particulate, the measurement for ambient air lead concentrations is performed using a manual method, unlike measurements for the gaseous pollutants discussed earlier (ozone, SO_2, NO_2 and CO). Samples are collected on 8" x 10" pre-weighed fiberglass filters with a high volume total suspended (TSP) sampler for 24 hours, collecting particles with diameters of 100 microns or less. High volumes of ambient air in the flow range of 40-60 cubic feet per minute are sampled at a constant rate during the sampling period. This produces a uniform distribution of particles deposited on the sample filter downstream of the sampler inlet. Samples collected with the TSP high-volume sampler can be used to determine the average ambient TSP concentration over a sampling period followed by subsequent analysis to determine the identity and quantity of inorganic metals present in the TSP. The filter sample is shipped to a laboratory for analysis using inductively coupled plasma mass spectroscopy (commonly known as ICP-MS). Data gained from the criteria lead samplers is used to determine compliance with the National Ambient Air Quality Standards for lead. On a semi-annual basis, GA AAMP's Quality Assurance Unit audits these samplers.

In addition to the criteria lead network sites, lead is monitored as a trace metal in the National Air Toxics Trends Station (NATTS), and with the $PM_{2.5}$ speciation samplers. The NATTS lead is sampled using a PM_{10} sampler, and particles are sampled up to 10 microns in size. With the $PM_{2.5}$ speciation sampler, samples are collected that include particles up to 2.5 microns in size. These sampling techniques collect 24-hour samples on pre-weighed filters, have samples sent to a laboratory for analysis, and are analyzed using inductively coupled plasma mass spectroscopy (commonly known as ICP-MS). On a semi-annual basis, GA AAMP's Quality Assurance Unit audits these samplers.

7.0 Metals

A sub-group of the National Air Toxics Trends data includes the metals group, which encompass compounds such as cadmium, mercury, chromium and lead. These pollutants, also known as Hazardous Air Pollutants (HAPs), are those pollutants that are known or suspected to cause cancer or other serious health effects, such as damage to the immune system, reproductive effects or birth defects, developmental or neurological problems, or adverse environmental effects. These effects can vary depending on how often one is exposed, how long one is exposed, the person's health that is exposed, and the toxicity of the compound. Some of the substances tend to have only one critical effect, while others may have several. The lifetime, transportation, and make-up of these pollutants are affected by weather (rain and wind) and landscape (mountains and valleys). They can be transported far away from the original source, or be caught in rain and brought down to waterways or land.

In addition to exposure from breathing air toxics, some toxic air pollutants such as mercury can deposit onto soils or surface waters, where plants take them up, are ingested by animals, and are eventually magnified up through the food chain. Through this process, known as bioaccumulation, larger animals build up concentrations of these pollutants in their tissues that may be thousands of times higher than that found in the most polluted water or soil. Like humans, animals may experience health problems if exposed to sufficient quantities of air toxics over time. Humans who eat animals that have accumulated large concentrations of these pollutants are at the very top of this bioaccumulative food chain and as such are at particular risk for experiencing health effects.

The PM_{10} sampler used for sampling toxic metal particles less than or equal to 10 microns in diameter as part of the NATTS network is a Met One low-volume single channel timed sampler. GA AAMP is in the process of replacing the Met One PM_{10} samplers with Tisch-Wilbur PM_{10} samplers. Collecting 16.7 liters per minute, with a total collection of 24.05 m^3, the sampler uses a 47 mm diameter Teflon™ filter to trap particulate matter. The samplers run once every six days following a pre-established schedule that corresponds to a nationwide sampling schedule. On the sixth day the sampler runs midnight to midnight and takes a 24-hour composite sample. The sample is analyzed using inductively coupled plasma mass spectrometry (ICP/MS). With ICP/MS, an argon gas is used to atomize and ionize the elements in a sample. The resulting ions are used to identify the isotopes of the elements and a mass spectrum is used to identify the element proportional to a specific peak formed from an isotope. The NATTS PM_{10} metals samplers are subjected to quarterly checks and audited by GA AAMP's Quality Assurance Unit on a semi-annual basis.

8.0 Volatile Organic Compounds (VOCs)

All volatile organic compounds (VOCs) contain carbon, the basic chemical element found in living beings. Carbon-containing chemicals are called organic. Volatile chemicals escape into the air easily and react with NO_2 in sunlight to form ground level ozone. Some VOCs are also hazardous air pollutants, which can cause serious health effects. VOCs are released from burning fuel (gasoline, oil, coal, natural gas, etc.), solvents, paints, glues, and other products used at work or at home. Cars are a significant source of VOCs. VOCs include chemicals such as benzene, toluene, methylene chloride and methyl chloroform. Some VOCs are naturally occurring. VOCs such as pinenes and terpenes emitted from pine trees are a significant source of VOCs in the southeastern United States.

VOCs are collected and analyzed with three different types of samplers. Two types of collection method use a passivated inert stainless steel canister: ATEC 2200 and Xonteck 910. The canister is evacuated to a near-perfect vacuum and attached to a sampler with a pump controlled by a timer. The canister is filled to greater than 5 psig. These samplers collect a sample for a representative 24-

hour period, and the samples are analyzed using a gas chromatograph with mass spectroscopy detection (GC/MS), using EPA compendium method TO15, by the GA EPD laboratory. The South DeKalb site uses the ATEC 2200 to collect VOCs as part of the National Air Toxics Trends Station. These VOCs samplers are subjected to quarterly checks and are audited by GA AAMP's Quality Assurance Unit twice per year.

The third type of sampler used for VOCs collection and analysis is with the Photochemical Assessment Monitoring Station (PAMS) network in which VOCs are collected and analyzed on-site with a gas chromatograph/flame ionization detector (GC/FID). The South DeKalb site is the GA AAMP's PAMS site. During June, July, and August, the PAMS VOCs samples are collected continuously on an hourly basis. The VOCs sampler in the PAMS network is subjected to checks and audited during the PAMS season (June, July and August).

9.0 Carbonyls

Carbonyl compounds are a subset of VOCs, and define a large group of substances, which include acetaldehyde and formaldehyde. These compounds can act as precursors to ozone formation. They can be formed from the breakdown of certain organic pollutants in outdoor air, from forest fires and wildfires, as well as from vehicle exhaust.

The carbonyls are sampled with two types of methods. One type is an absorbent cartridge filled with dinitrophenylhydrazine (DNPH)-coated silica that is attached to a pump to allow approximately 180 liters of air to be sampled. The cartridge is then analyzed using high performance liquid chromatography (HPLC). For the PAMS site, during June, July, and August, three 8-hour samples are taken every third day. A 24-hour integrated carbonyls sample is also taken every 6 days throughout the year at the South DeKalb NATTS site. The other method used for collecting carbonyls is the canister sampler that is used for sampling volatile organic compounds. Acrolein is a carbonyl compound that is collected using this canister method, described above, and analyzed with the GC/MS method. The PAMS and NATTS carbonyls samplers are subjected to quarterly checks and audited by GA AAMP's Quality Assurance Unit every six months.

10.0 Semi-Volatile Organic Compounds

Polycyclic aromatic hydrocarbons (PAHs), also called semi-volatile organic compounds are chemical compounds that consist of fused, six-carbon aromatic rings. They are formed by incomplete combustion of carbon-containing fuels such as wood, coal, diesel fuels, fat or tobacco. PAHs can occur in air attached to dust particles, and some can evaporate into the air from soil or surface waters. PAHs can stick tightly to particles and seep through soil to contaminate groundwater. They do not dissolve easily in water and can stick to solid particles and settle to the bottoms of lakes and rivers. Many PAHs are known or suspected carcinogens. The PUF (polyurethane foam) sampler used for sampling semi-volatile organic compounds, as part of the NATTS network, is a timed sampler. The sampler is calibrated to collect 198 to 242 liters (L) of air per minute. A multi-layer cartridge is prepared which collects both the particulate fraction and the volatile fraction of this group of compounds. The plug, filter and absorbent are extracted at the GA EPD laboratory and analyzed using gas chromatography with an electron capture detector (ECD). The semi-VOCs samplers are subjected to quarterly checks and audited by GA AAMP's Quality Assurance Unit annually.

11.0 Black Carbon

Black carbon is a particulate aerosol formed from the incomplete combustion of fossil fuels, biomass, and biofuels. Diesel engines are a large contributor of black carbon. Sampling for black carbon provides an estimate of the anthropogenic portion of carbon sources in ambient air pollution. For continuous sampling of black carbon, GA AAMP is using the Met One Instruments BC-1060 at the NR-285 (13-089-0003) and NR-Georgia Tech (13-121-0056) sites. Operating continuously at 2 LPM, these instruments have dual-wavelength illumination (370 nm and 880 nm) and use quartz tape to perform an optical analysis to determine the concentration of carbon particles passing through an air stream. Concentrations are determined by measuring the change in optical transmission as black carbon containing particulate matter accumulates onto a filter and then converting this transmission data into black carbon concentration. These parameters are subjected to quarterly checks and audited by GA AAMP's Quality Assurance Unit every six months.

12.0 Meteorological Parameters

GA AAMP has fourteen meteorological stations across the state. Surface meteorological measurements, including wind speed and wind direction, are measured at each location. In addition, as part of the Photochemical Assessment Monitoring Site (PAMS) in the metropolitan Atlanta area, a complete suite of meteorological instrumentation is used to characterize meteorological conditions. The PAMS station measures hourly-averaged vector wind speed and vector-averaged wind direction at the 10-meter level, and hourly-averaged surface temperature, relative humidity and barometric pressure at the 2-meter level. Several sites include instruments to record total hourly precipitation, global solar radiation, and total ultraviolet radiation. In addition, the standard deviation of the wind direction is computed at the NCore site (South DeKalb). These parameters are audited by the GA AAMP's Quality Assurance Unit on an annual basis. For upper air measurement, GA AAMP uses a Vaisala BL-VIEW Ceilometer in conjunction with balloon rawinsonde data collected from NWS at Peachtree City. This upper air system is useful for monitoring the mixing height and low-level winds during smoke transport events.

Appendix D: List of Closed Ambient Monitors (in order of shut down date)

Georgia Department of Natural Resources
Environmental Protection Division

Site ID	Site Name	Sampler	Date Shut Down	Last Published in Annual Plan
131210039	Fire Station#8	PM_{10}	9/26/06	N/A
130893001	Tucker	Ozone	10/31/06	N/A
130090001	Milledgeville-Airport	SO_2	12/31/06	2009
130893001	Tucker	PAMS VOCs, NO/NOx/NOy/NO_2	1/7/07	N/A
131110091	McCaysville	SO_2	10/2/07	2007
131210001	Fulton Co Health Dept	PM_{10}	9/1/08	2008
130970003	Douglasville-Beulah Pump Station	PM_{10}	9/1/08	2008
132550002	Griffin-Spalding County	PM_{10}	9/1/08	2008
132151003	Columbus-Crime Lab	Ozone	10/31/08	2008
130090001	Milledgeville-Airport	Air Toxics	10/31/08	2011
131150004	Rome-Co. Health Dept	Air Toxics	10/31/08	2011
131210020	Utoy Creek	Air Toxics	10/31/08	2011
131273001	Brunswick-Brunswick Coll	Air Toxics/Carbonyls	10/31/08	2011
131390003	Gainesville	Air Toxics	10/31/08	2011
131530001	Warner Robins	Air Toxics	10/31/08	2011
131850003	Valdosta	Air Toxics	10/31/08	2011
132155000	Columbus-Columbus State	Air Toxics	10/31/08	2011
132450092	Augusta-Clara Jenkins	Air Toxics	10/31/08	2011
130550001	Summerville-Fish Hatchery	Acid Rain	10/31/08	2011
130850001	Dawsonville	Acid Rain	10/31/08	2011
131890001	McDuffie-Fish Hatchery	Acid Rain	10/31/08	2011
132410002	Hiawassee-Lake Burton	Acid Rain	10/31/08	2011
132970001	Social Circle-Fish Hatchery	Continuous $PM_{2.5}$	10/31/08	2011
131130001	Fayetteville-GA DOT	Ozone, Wind Speed, Wind Direction	10/31/08	2013
131270006	Brunswick	Total Reduced Sulfur	10/31/08	2013
131210048	Georgia Tech	$PM_{2.5}$	12/1/08	2008
131150005	Rome	$PM_{2.5}$ FRM, PM_{10}, $PM_{2.5}$ Speciation	Consolidated with 131150003 3/09	2008
131210048	Georgia Tech	SO_2, NO, NO_2, NOx	4/30/09	2011
130150003	Cartersville	Wind Speed, Wind Dir	12/31/11	2011
130730001	Evans	NO_y	7/28/2008	2012
130210013	Macon-Lake Tobesofkee	NO_y, O_3	10/31/2008	2012
131270006	Brunswick	SO_2	12/31/12	2012
132150008	Columbus -Airport	SO_2	12/31/12	2012
130510017	Savannah-Market St.	$PM_{2.5}$ FRM	12/31/12	2012
132450005	Augusta-Medical College	$PM_{2.5}$ FRM	12/31/12	2012
131210032	Atlanta-E. Rivers School	$PM_{2.5}$ FRM, PM_{10}	12/31/12	2012
130892001	Doraville Health Center	$PM_{2.5}$ FRM	12/31/12	2012
130670004	Powder Springs-Macland Aquatic Ctr.	$PM_{2.5}$ FRM	12/31/12	2012
130210007	Allied	PM_{10}	12/31/12	2012
130510014	Savannah-Shuman Middle	PM_{10}	12/31/12	2012
130550001	Summerville-Fish Hatchery	PM_{10}	12/31/12	2012
130892001	Doraville Health Center	PM_{10}	12/31/12	2012
130950007	Albany	PM_{10}	12/31/12	2012
131150003	Rome	PM_{10}	12/31/12	2012
131210048	Georgia Tech	PM_{10}	12/31/12	2012
131270004	Brunswick-Arco Pump Station	PM_{10}	12/31/12	2012

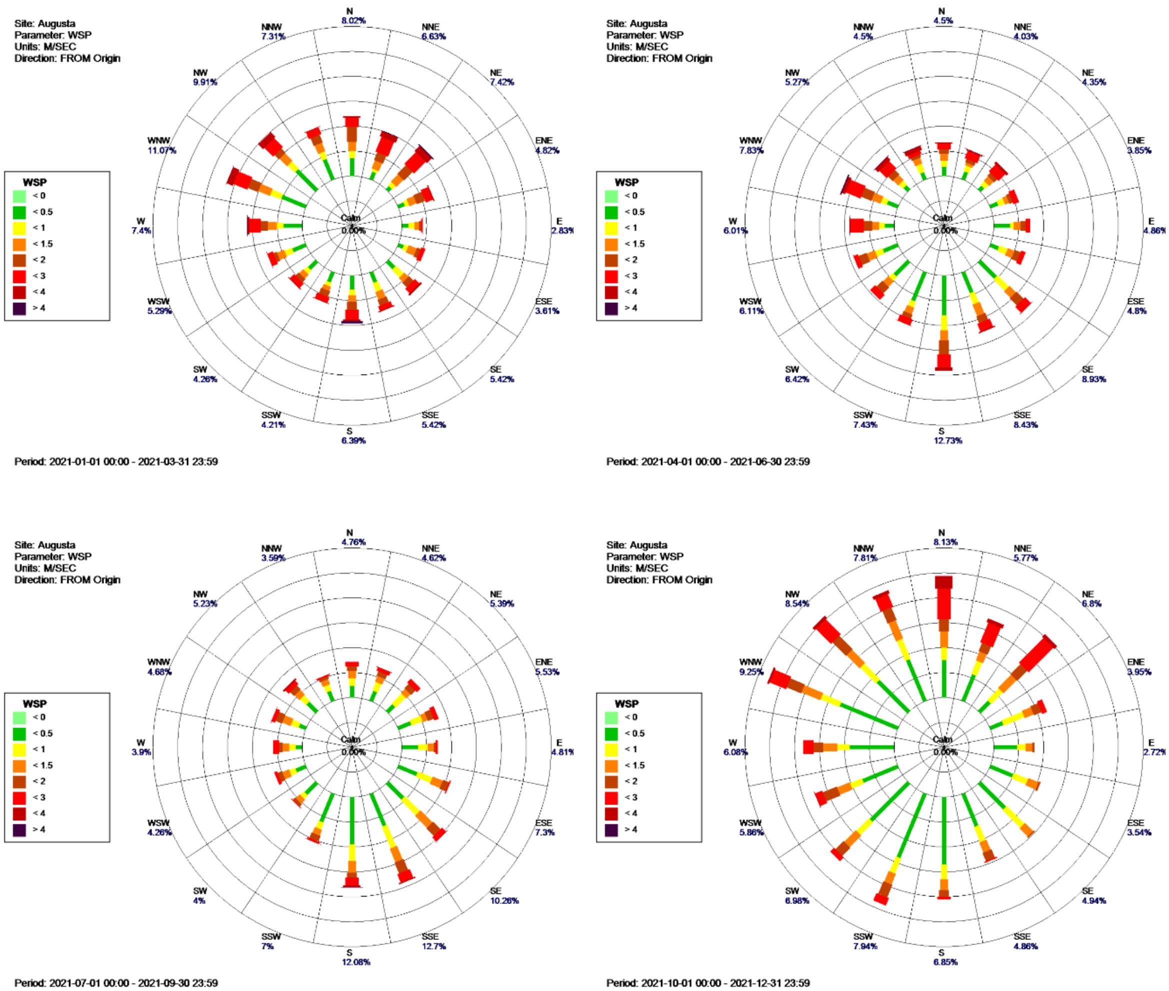
132150011	Columbus-Cusseta Road	PM_{10}	12/31/12	2012
133030001	Sandersville	PM_{10}	12/31/12	2012
130893001	Tucker-Idlewood Road	Wind Speed, Wind Direction, Temp, RH, Solar Radiation, UV Radiation, BP, Precip	5/31/13	2013
130890002	South DeKalb	Hexavalent chromium	7/15/13	2013
132470001	Conyers	Continuous Gas Chromatograph	8/31/13	2013
130150003	Cartersville	Lead	2/22/14	2013
131210099	Roswell Road	CO	3/5/14	2013
130590002	Athens	$PM_{2.5}$ Speciation	1/24/15	2014
132230003	Yorkville	Continuous Gas Chromatograph	8/31/15	2015
132230003	Yorkville	6-Day PAMs, $NO/NO_2/NOx$, CO	12/31/15	2015
130850001	Dawsonville	Air Toxics/Carbonyls	12/31/15	2015
132470001	Conyers	6-Day PAMs, $NO/NO_2/NOx$	12/31/15	2015
130890003	NR-285	Lead	6/30/16	2016
130890002	South DeKalb	Black carbon	12/31/16	2016
133190001	Gordon	$PM_{2.5}$ FRM	12/31/16	2016
132230003	Yorkville	O_3	12/31/16	2016
132230003	Yorkville	$PM_{2.5}$ FRM, Continuous $PM_{2.5}$, VOCs, Semi-VOCs, Carbonyls, Metals, Wind Speed, Wind Direction, Temp, RH, Solar Radiation, UV Radiation, BP, Precip	1/31/17	2016
131150003	Rome-Coosa	SO_2	12/31/16	2017
132450091	Augusta	Integrated PM_{10}	3/31/18	2017
130770002	Newnan	O_3, $PM_{2.5}$, Wind Direction, Wind Speed	11/15/17	2018
132150010	Columbus-Joy Rd	Lead	6/30/18	2018
132450091	Augusta	$PM_{2.5}$ FRM	10/31/18 (reopened 1/1/2022)	2018 (reinstated in 2022)
131390003	Gainesville	$PM_{2.5}$ FRM	10/31/18	2018 (reinstated in 2023)
131350002	Gwinnett Tech	$PM_{2.5}$ FRM	10/31/18	2018
130210012	Macon-Forestry	Air Toxics	12/31/18	2018
130510021	Savannah-E. President's Street	Air Toxics	12/31/18	2018
130690002	General Coffee	Air Toxics	12/31/18	2018
130590002	Athens	$PM_{2.5}$ FRM	3/31/19	2018
130510091	Savannah-Mercer	$PM_{2.5}$ FRM	6/30/19	2019
133030001	Sandersville	$PM_{2.5}$ FRM	8/15/19	2019
131150006	Rome-Kraftsman	SO_2, Wind Speed, Wind Direction	12/31/2020	2020
132150009	Columbus-Allied	Lead	3/31/2021	2020
132150011	Columbus-Cusseta	$PM_{2.5}$ FRM, Lead	7/30/2020	2020
132150001	Columbus-Health Department	$PM_{2.5}$ FRM	12/31/2020	2020
132950002	Rossville-Maple St.	$PM_{2.5}$ FRM, $PM_{2.5}$ Continuous, $PM_{2.5}$ Speciation	7/30/2020	2020
132450091	Augusta	PM_{10} TEOM	7/13/2021	2021

130630091	Forest Park	$PM_{2.5}$ FRM	2/18/2024	2023
130890003	NR-285	$PM_{2.5}$ non-FEM continuous	7/2/2024	2024
133030001	Sandersville	$PM_{2.5}$ Continuous	7/18/2024	2024
130630091	Forest Park	$PM_{2.5}$ Continuous	7/22/2024	2024
130730001	Evans	Wind Speed, Wind Direction	09/27/2024	2024
132150008	Columbus-Airport	$PM_{2.5}$ Continuous	9/30/2024	2024
130210012	Macon-Forestry	$PM_{2.5}$ Continuous	9/30/2024	2024
130730001	Evans	Outside Temperature, Relative Humidity	12/20/2024	2024
130730001	Evans	O_3	12/31/2024	2024
130550001	Summerville	O_3	12/31/2024	2024
132611001	Leslie	O_3	12/31/2024	2024
130670003	Kennesaw	$PM_{2.5}$ Continuous	1/2/2025	2024
130670003	Kennesaw	$PM_{2.5}$ FRM	3/19/2025	2024
132151003	Columbus-Crime Lab	Outside Temperature, Relative Humidity, Wind Speed, Wind Direction	4/14/2025	2024

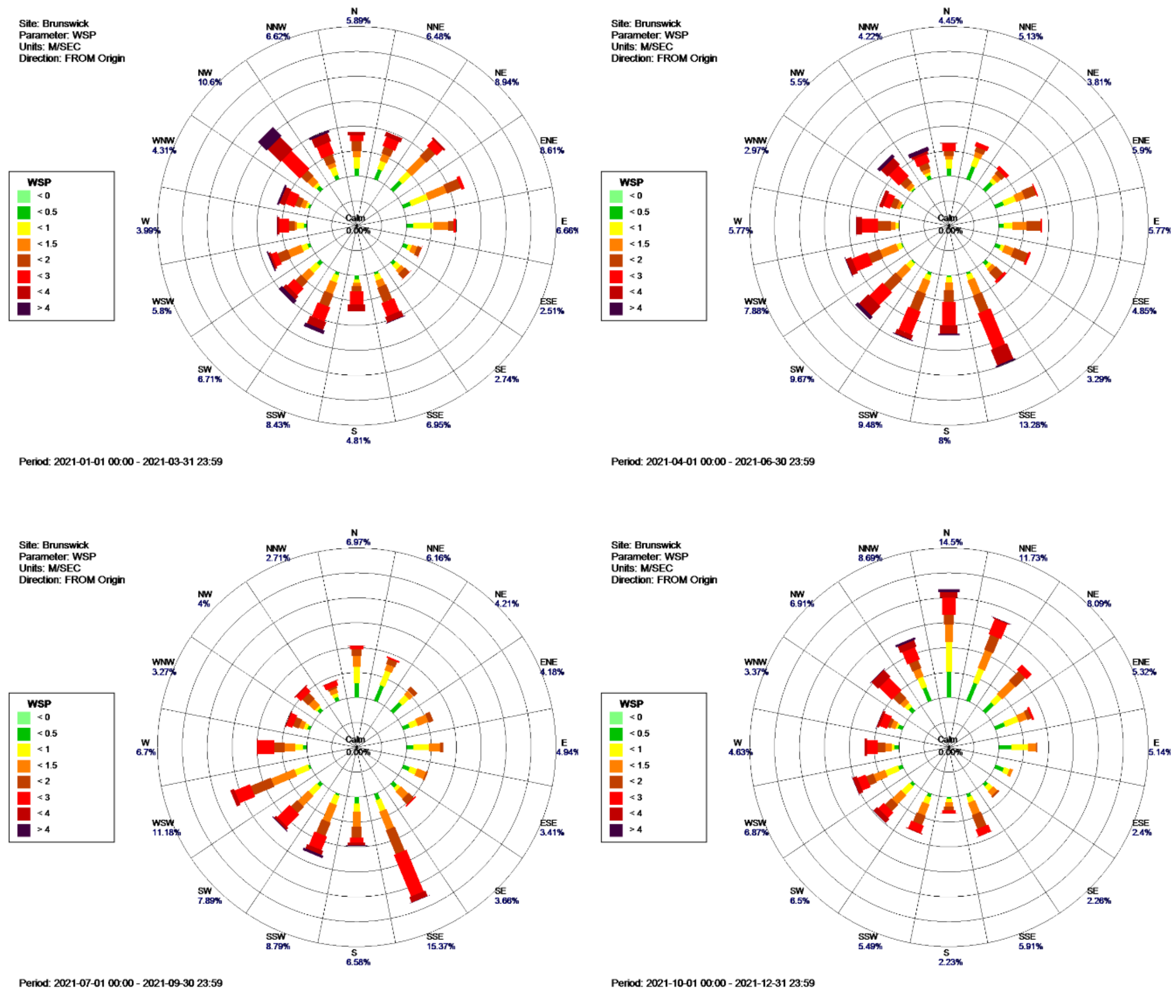
Appendix E:
Wind and Pollution Roses

Georgia Department of Natural Resources
Environmental Protection Division

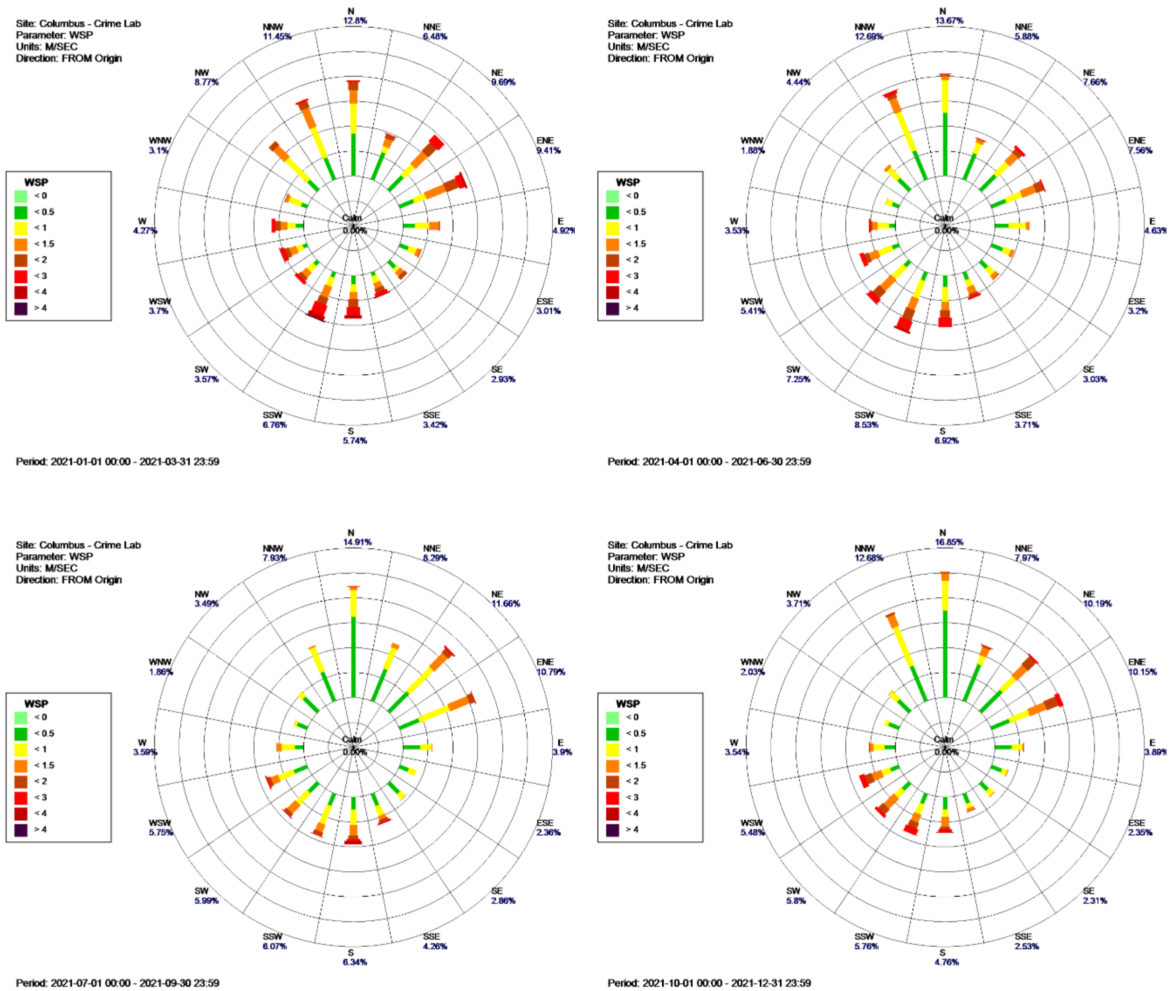
Note: In a few instances, the equipment had malfunctioned and the data was not available.



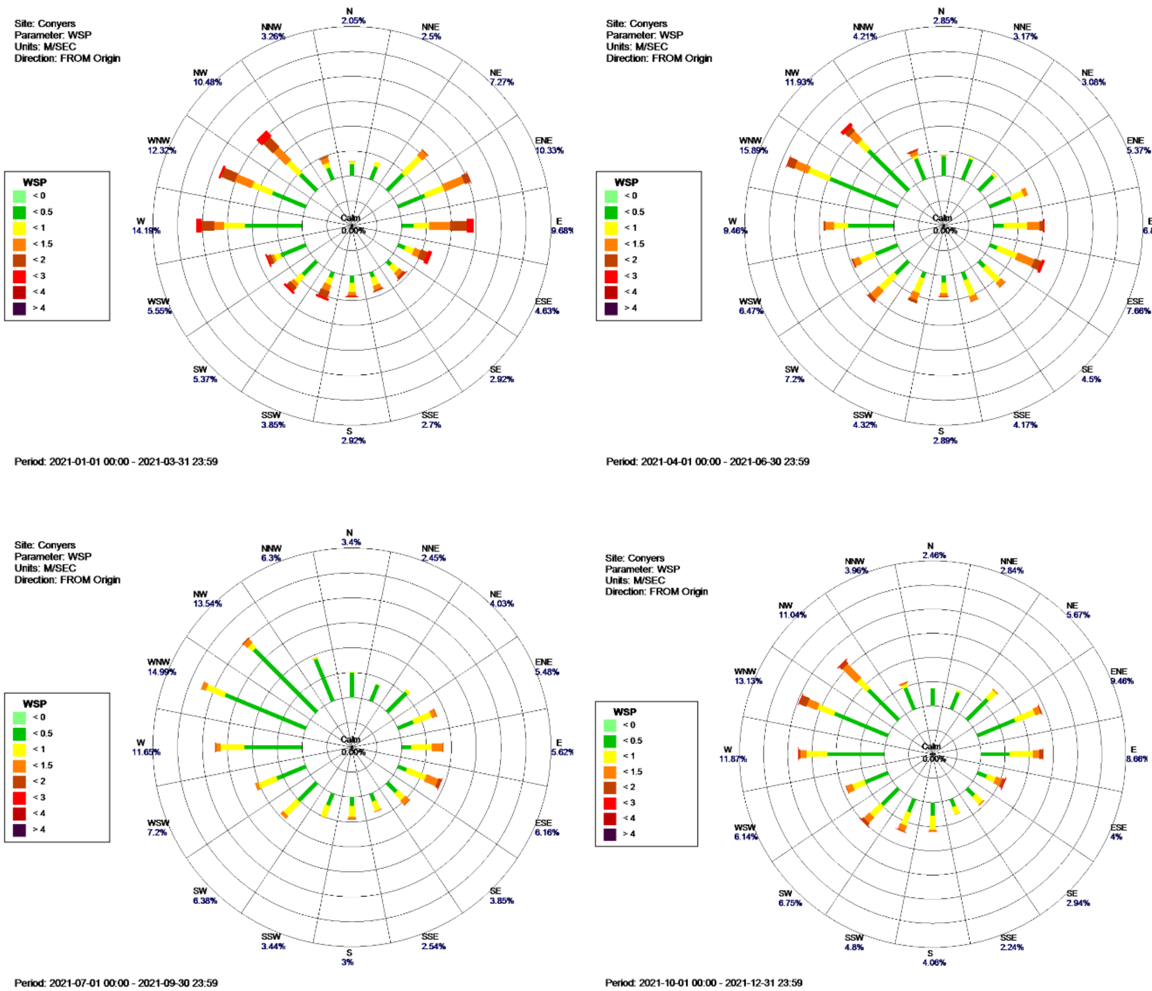
Augusta, 2021 Quarterly Winds



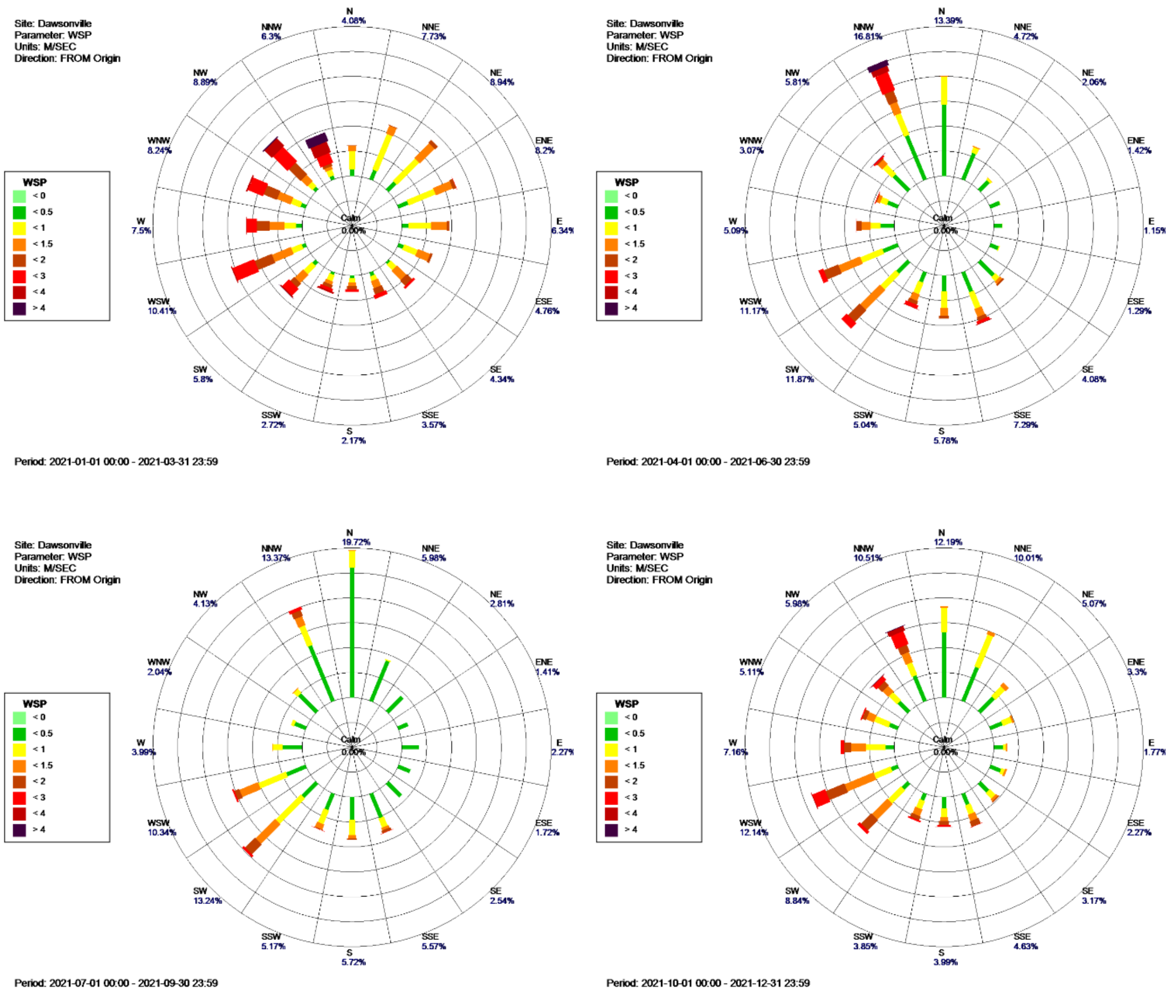
Brunswick, 2021 Quarterly Winds



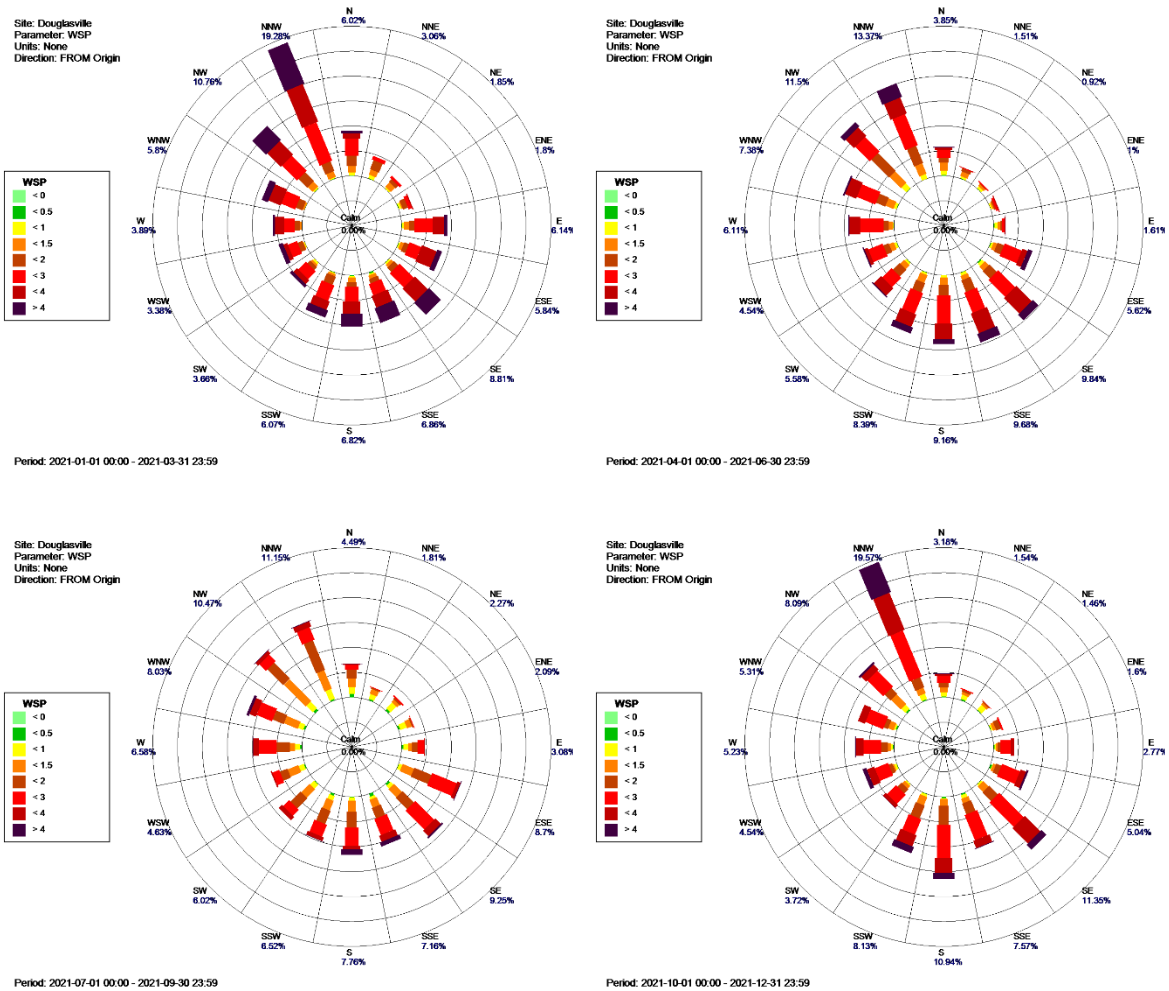
Columbus-Crime Lab, 2021 Quarterly Winds



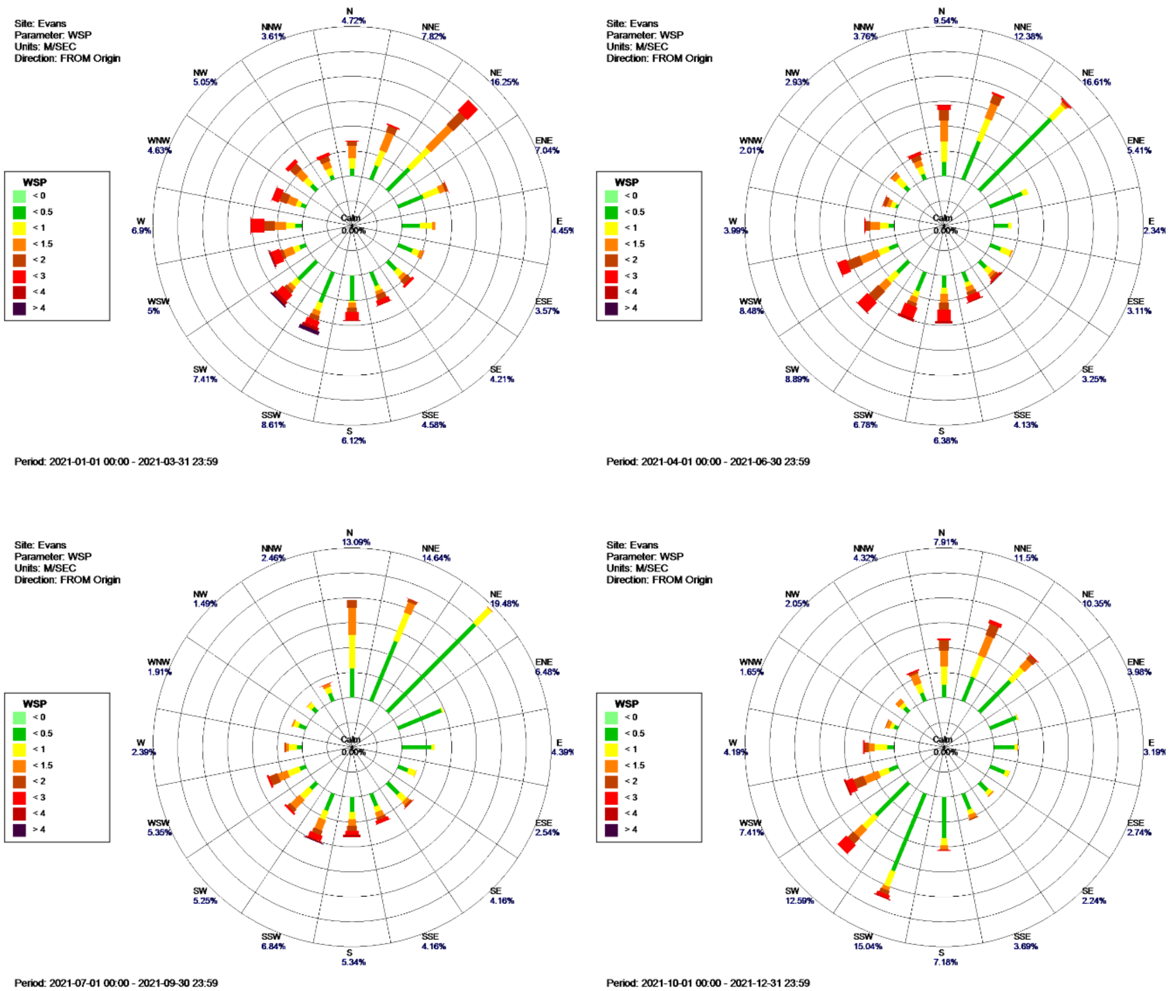
Conyers, 2021 Quarterly Winds



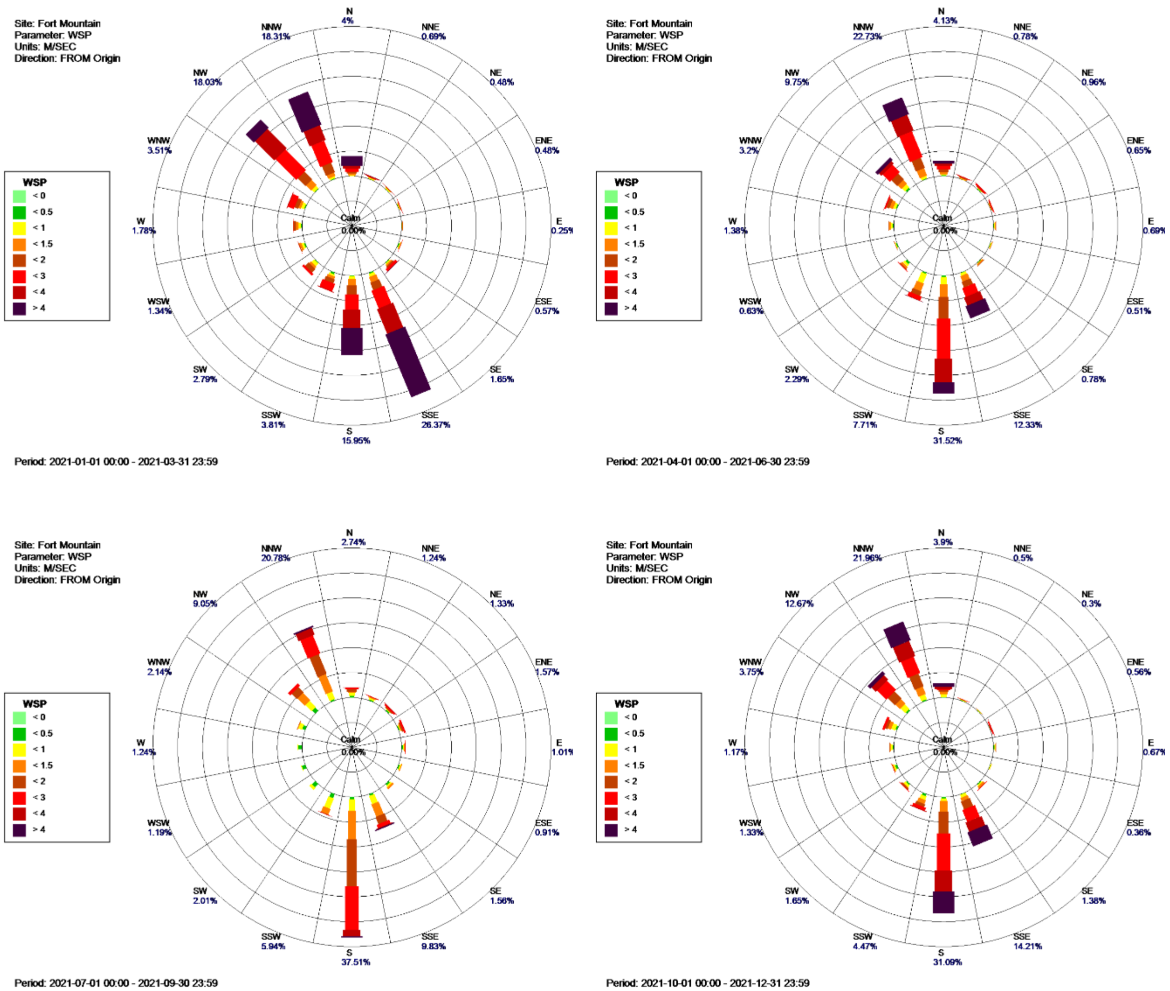
Dawsonville, 2021 Quarterly Winds



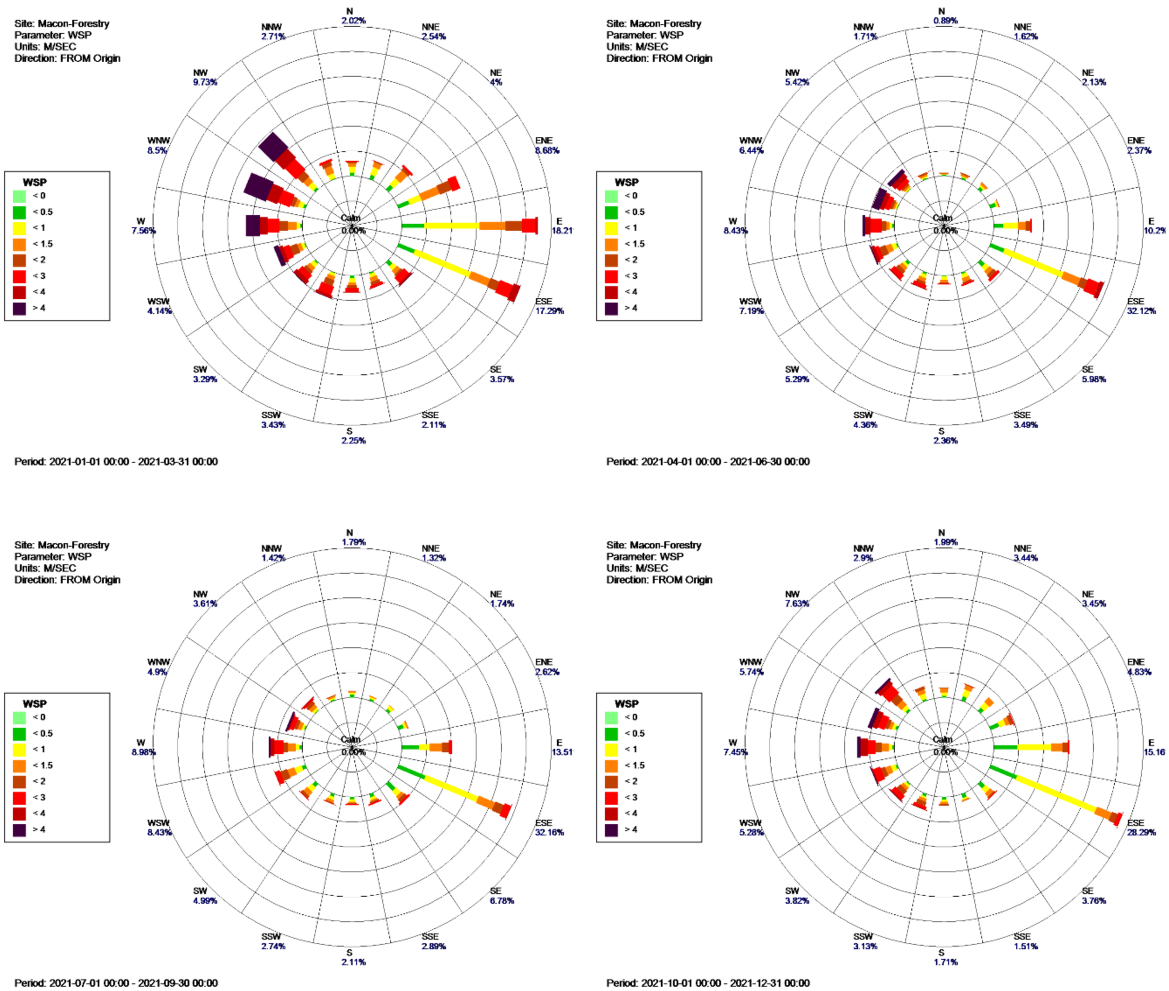
Douglasville, 2021 Quarterly Winds



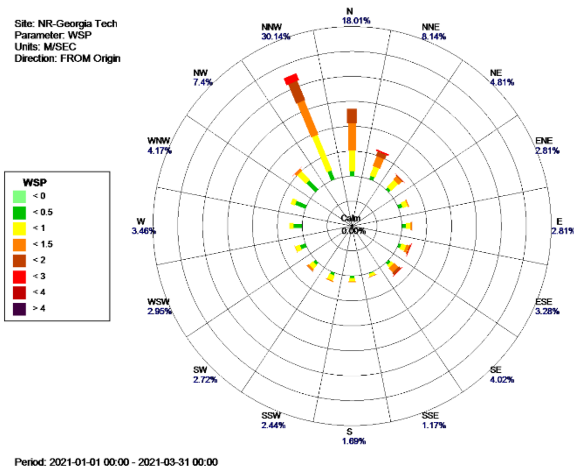
Evans, 2021 Quarterly Winds

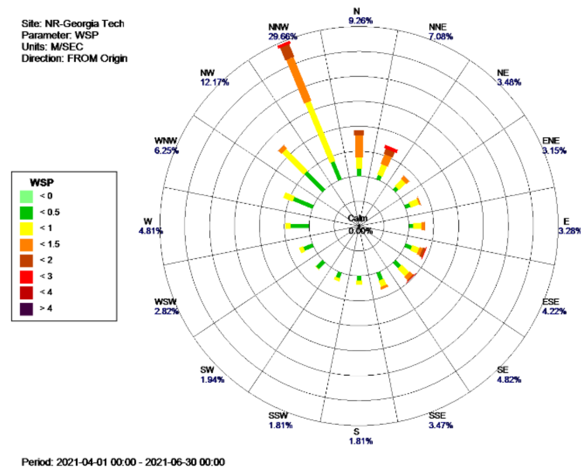


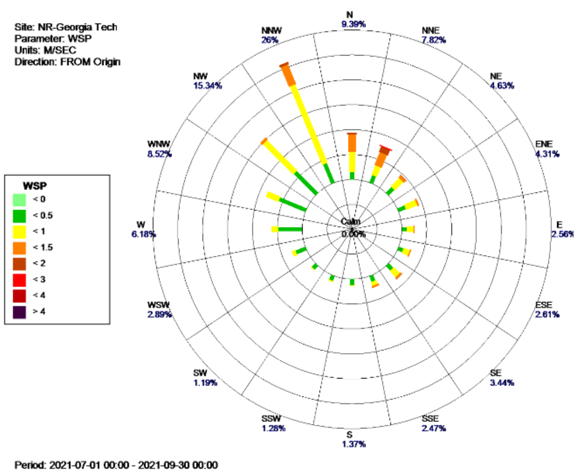
Fort Mountain, 2021 Quarterly Winds

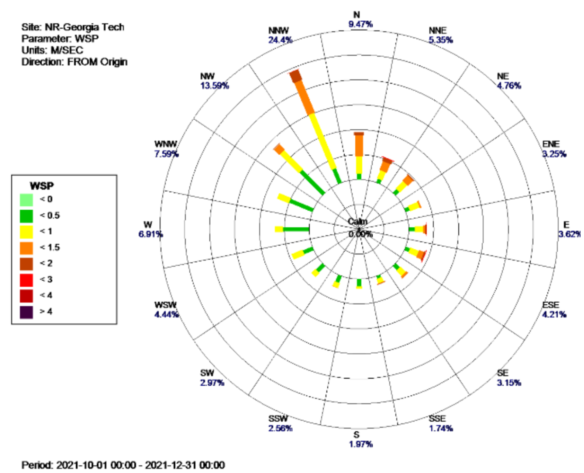


Macon-Forestry, 2021 Quarterly Winds

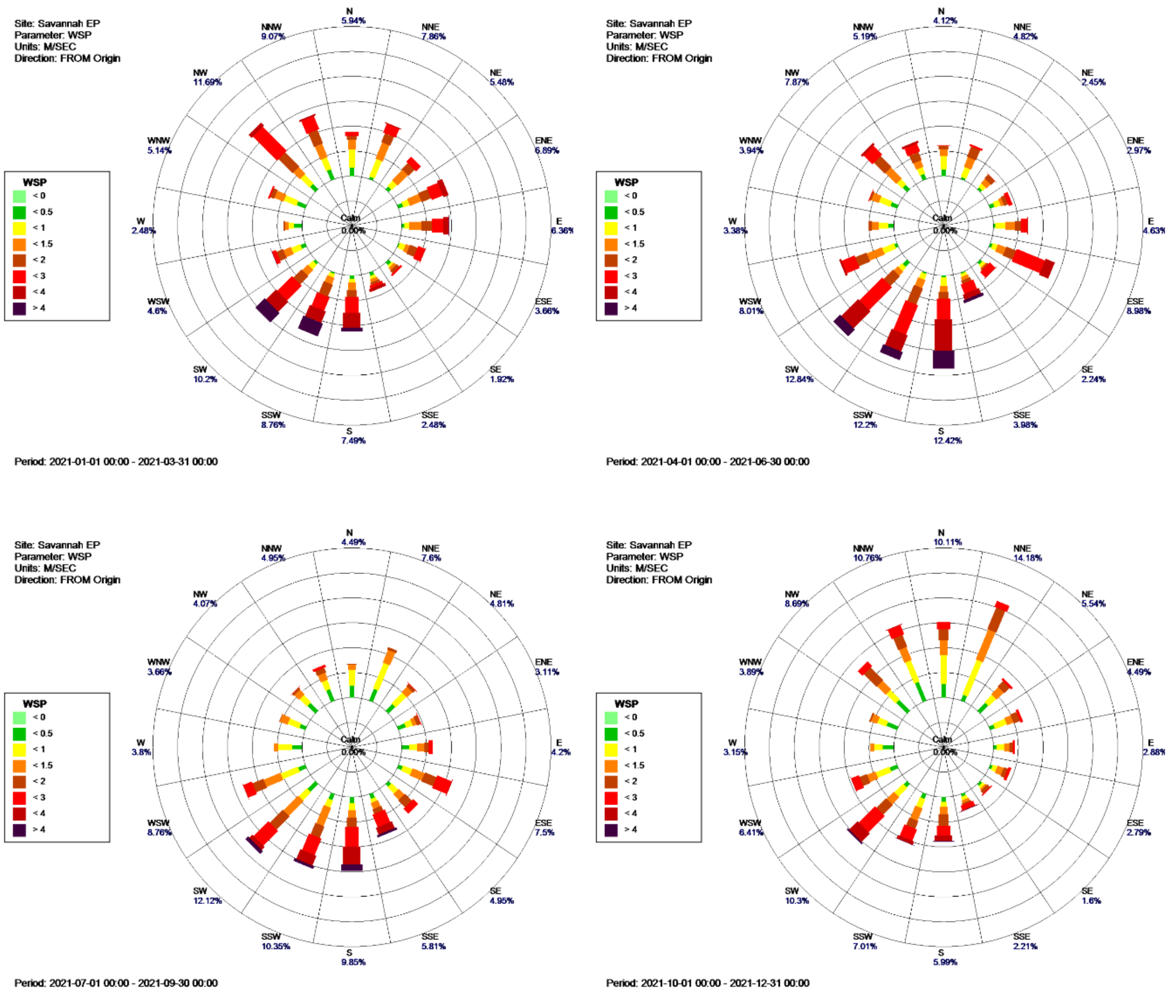




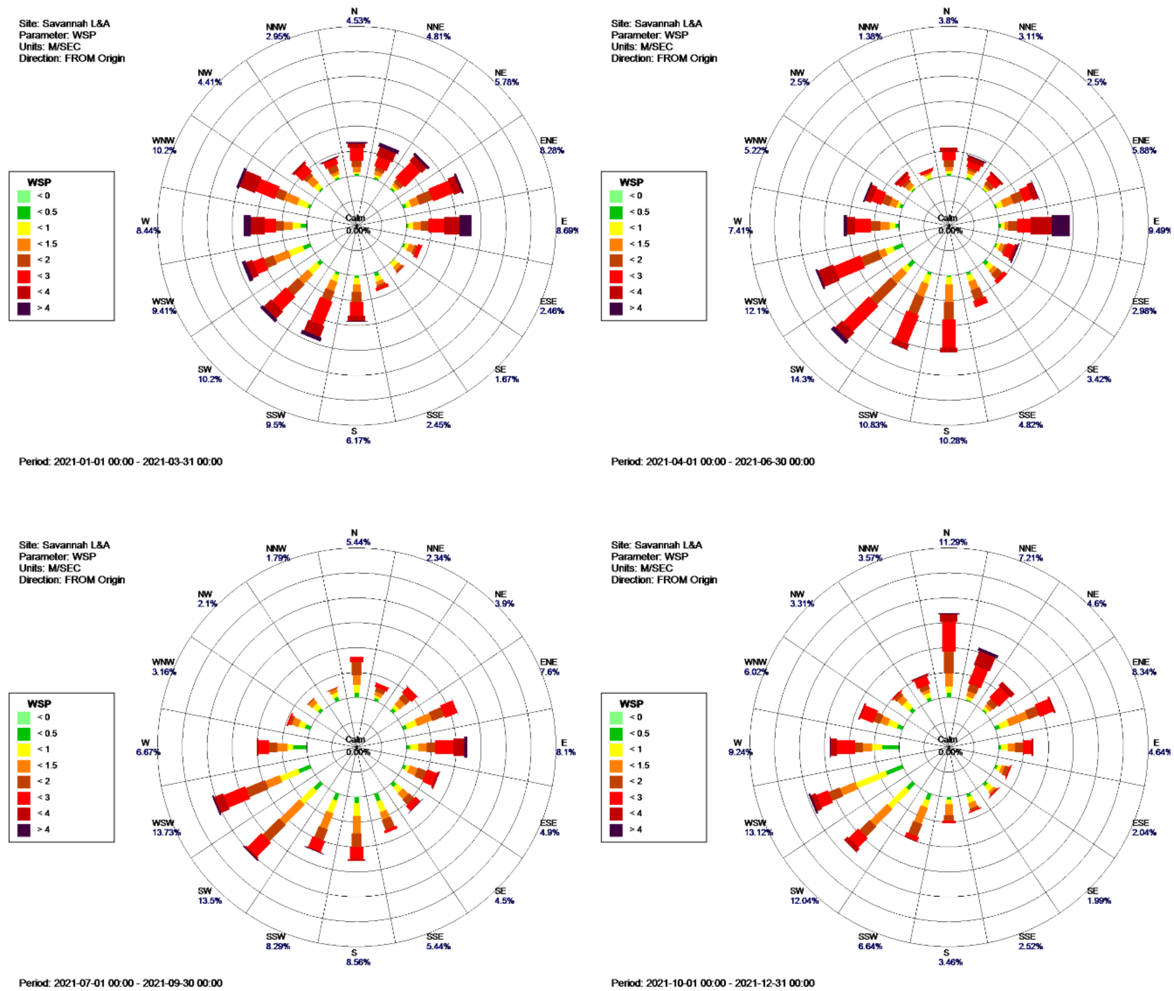




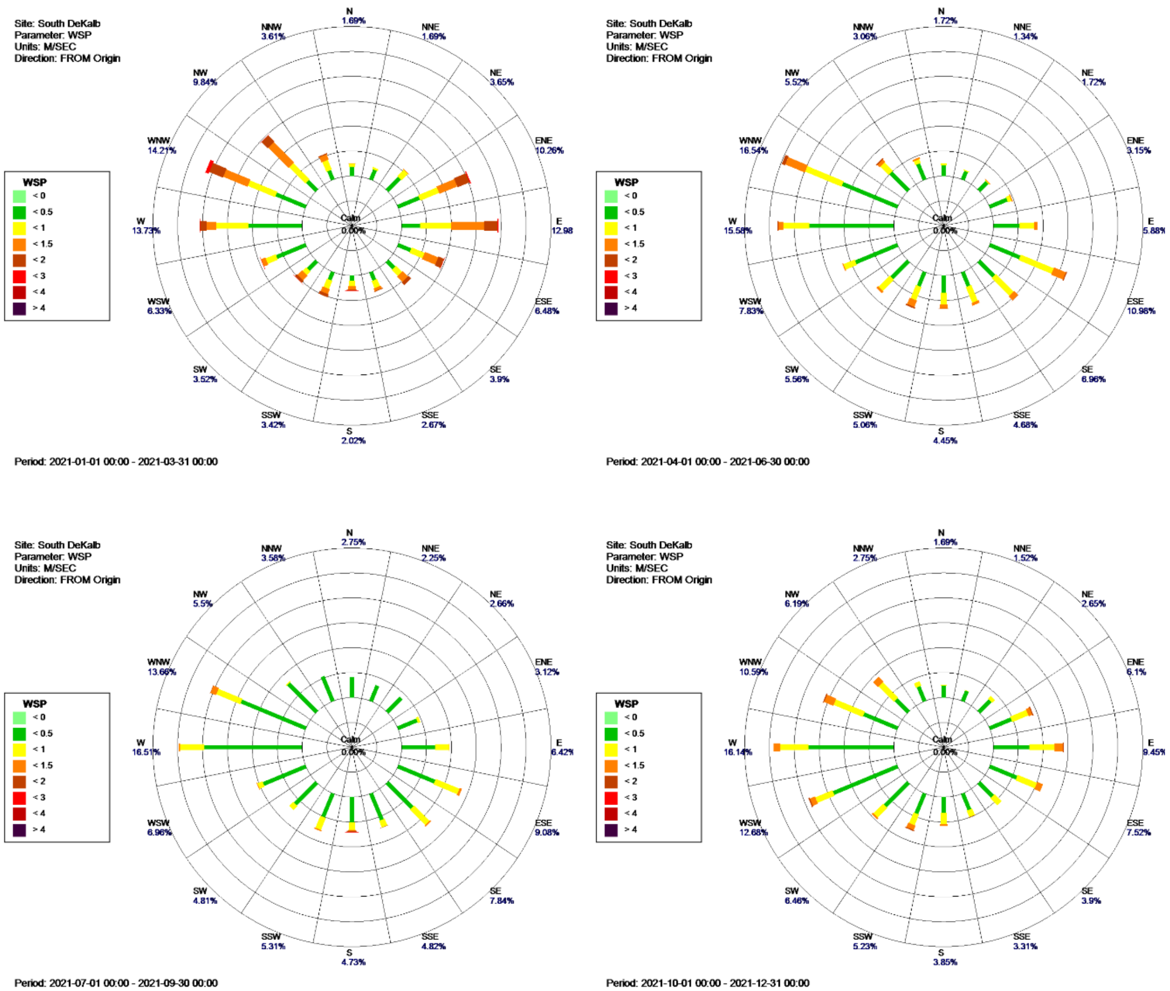
NR-GA Tech, 2021 Quarterly Winds



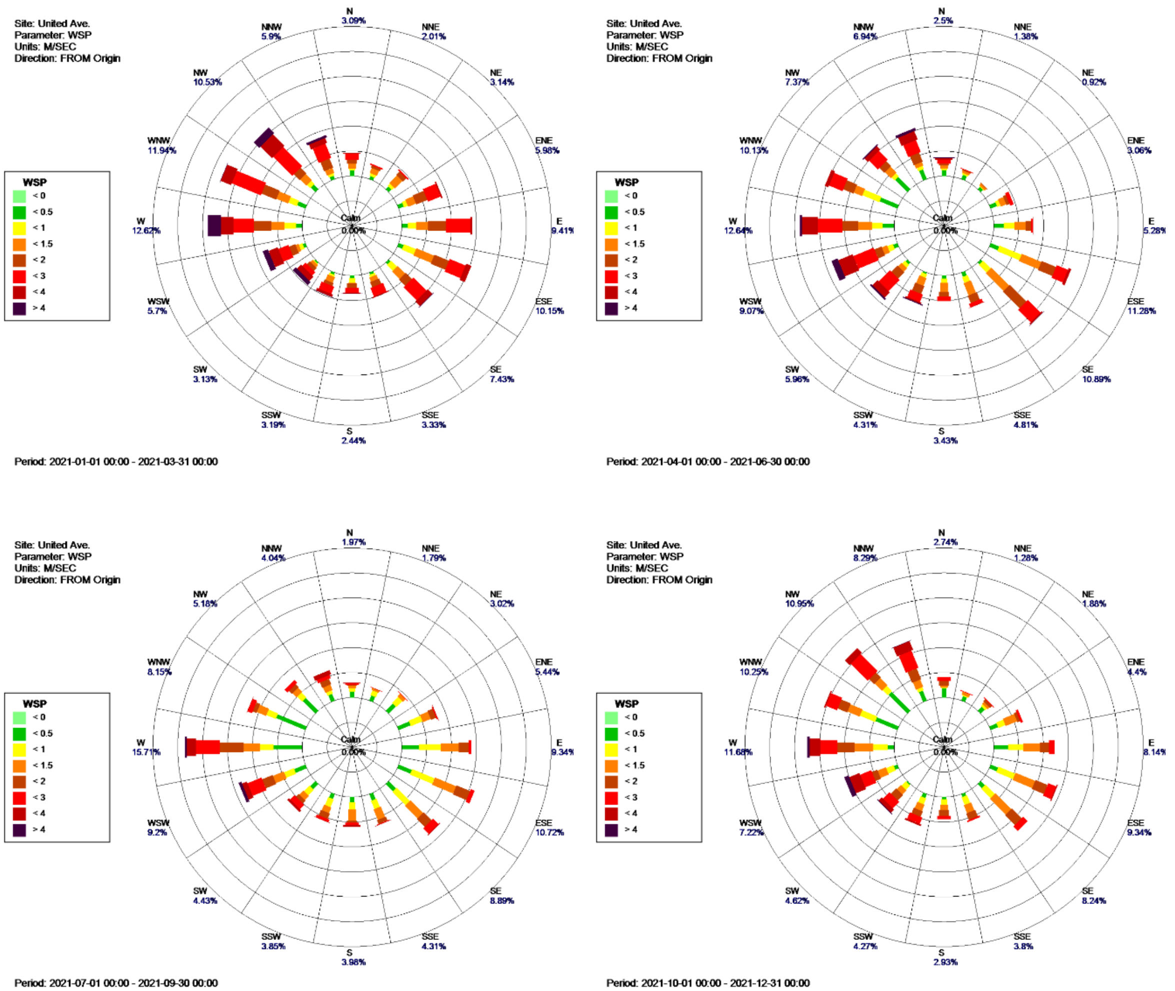
Savannah- E President, 2021 Quarterly Winds



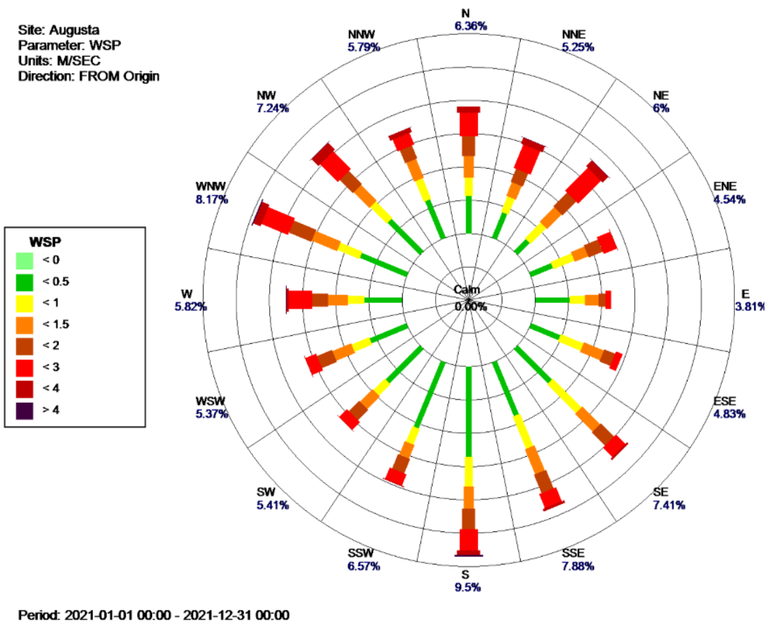
Savannah- L&A, 2021 Quarterly Winds



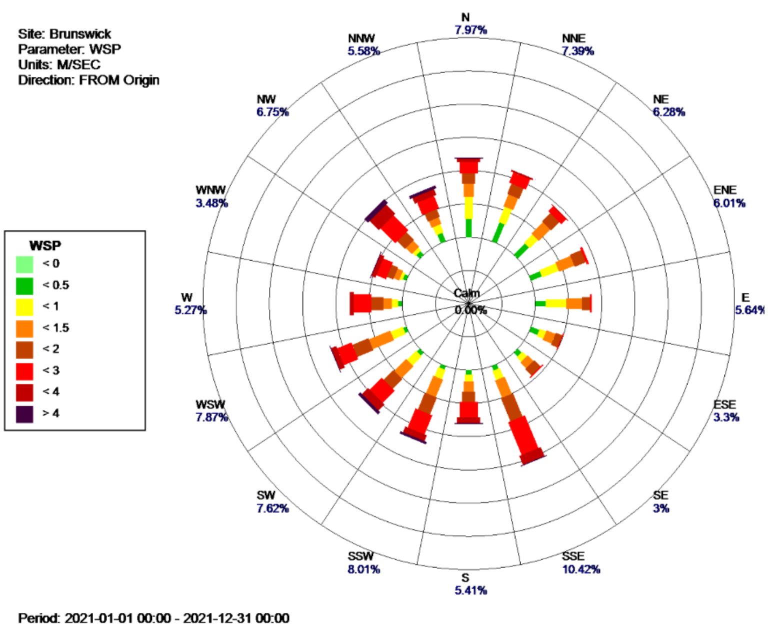
South DeKalb, 2021 Quarterly Winds



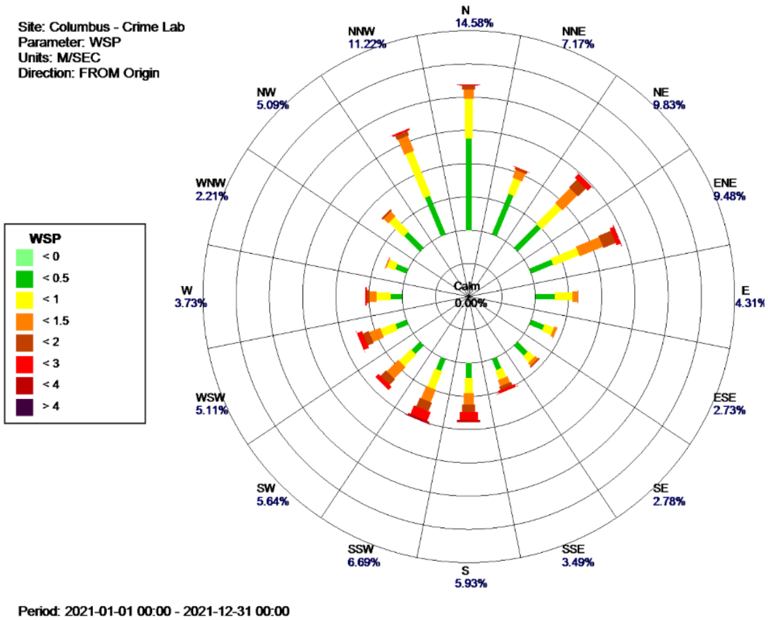
United Ave, 2021 Quarterly Winds



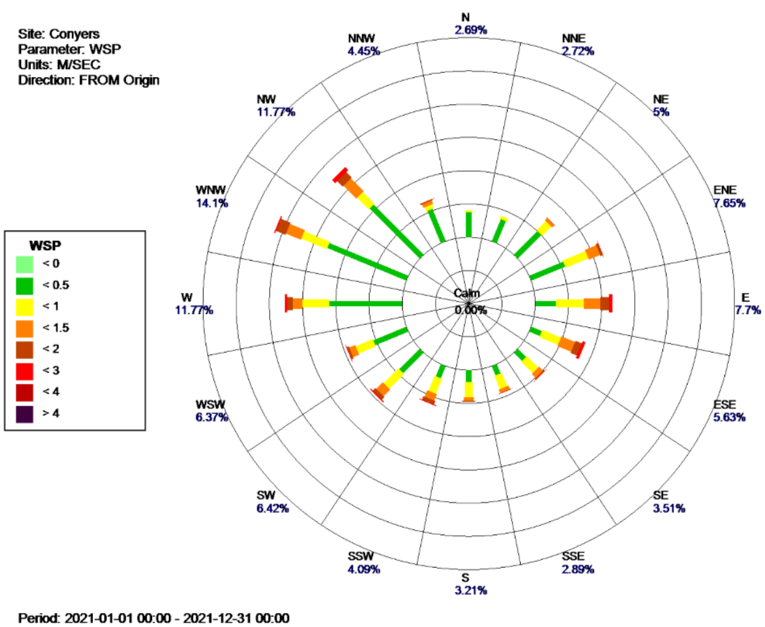
Augusta, 2021 Annual Winds



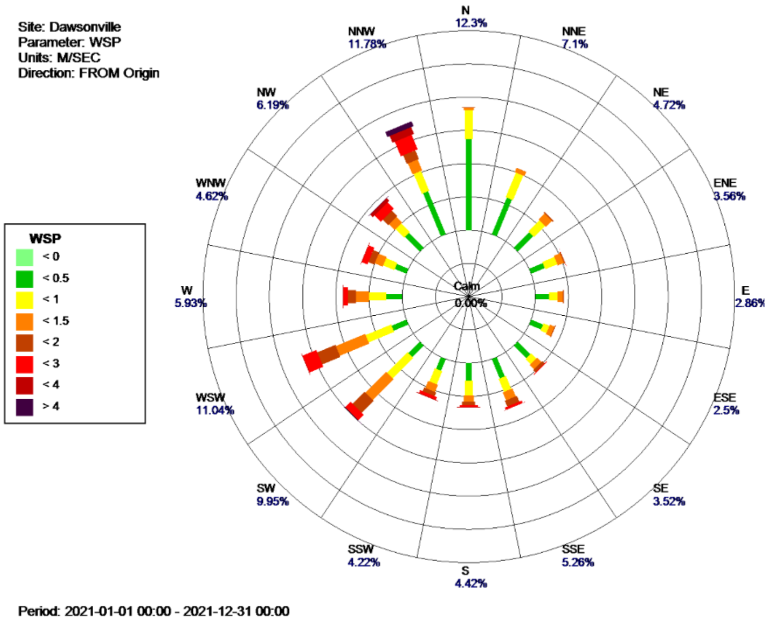
Brunswick, 2021 Annual Winds



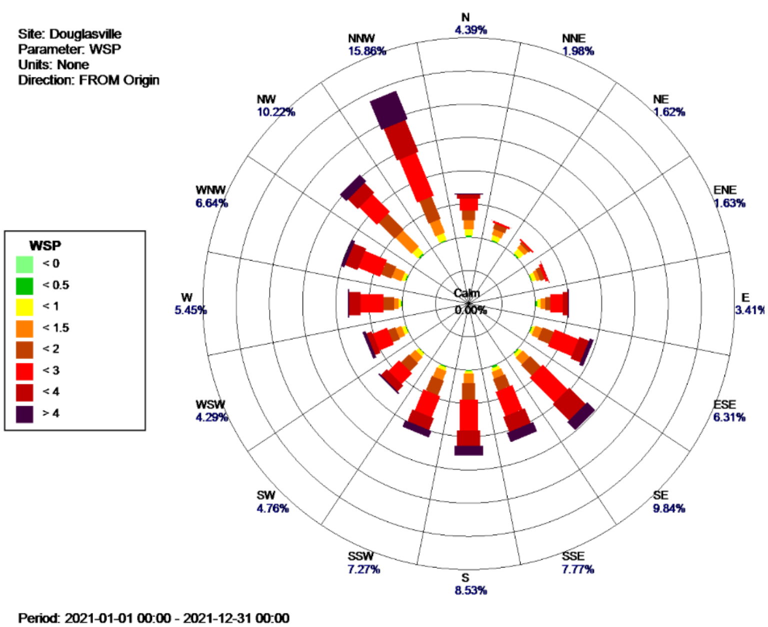
Columbus-Crime Lab, 2021 Annual Winds



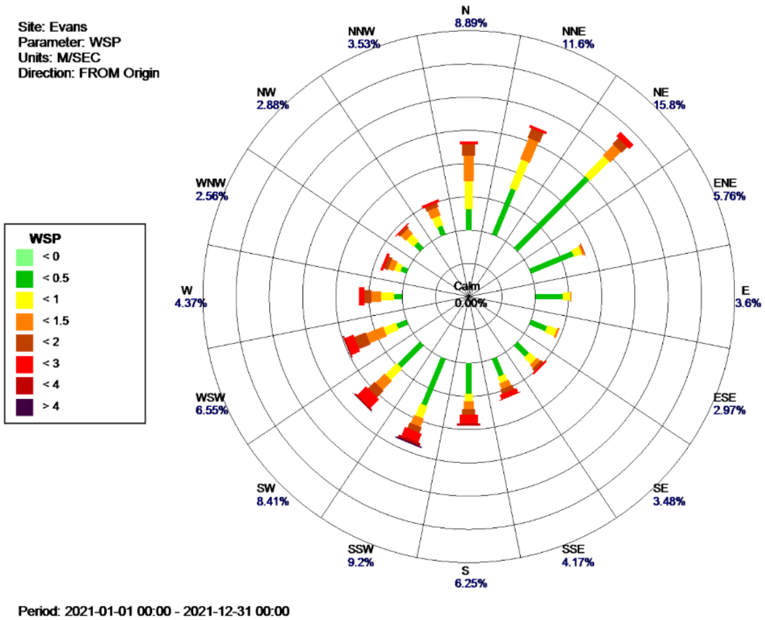
Conyers, 2021 Annual Winds



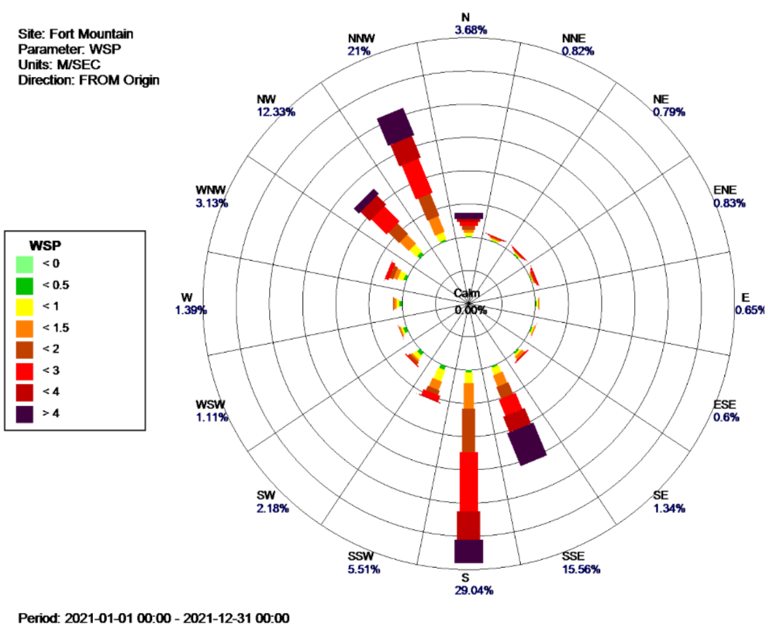
Dawsonville, 2021 Annual Winds



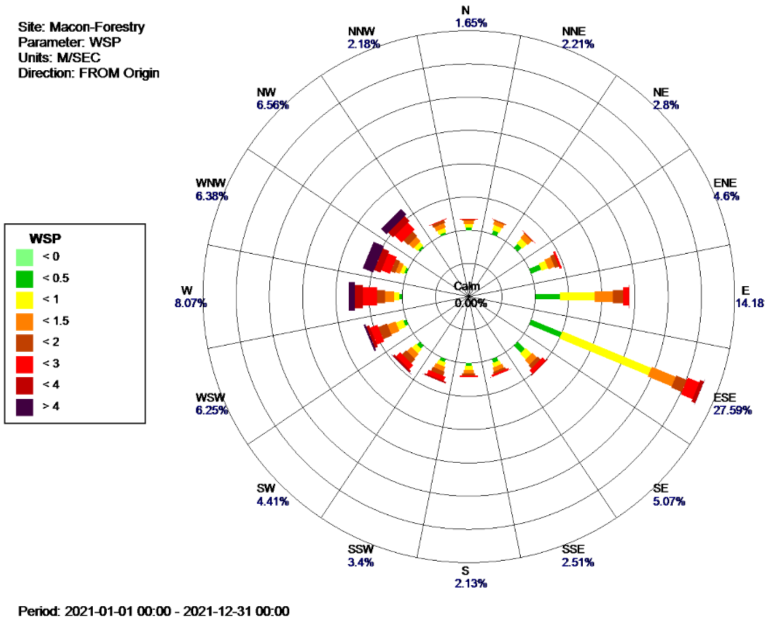
Douglasville, 2021 Annual Winds



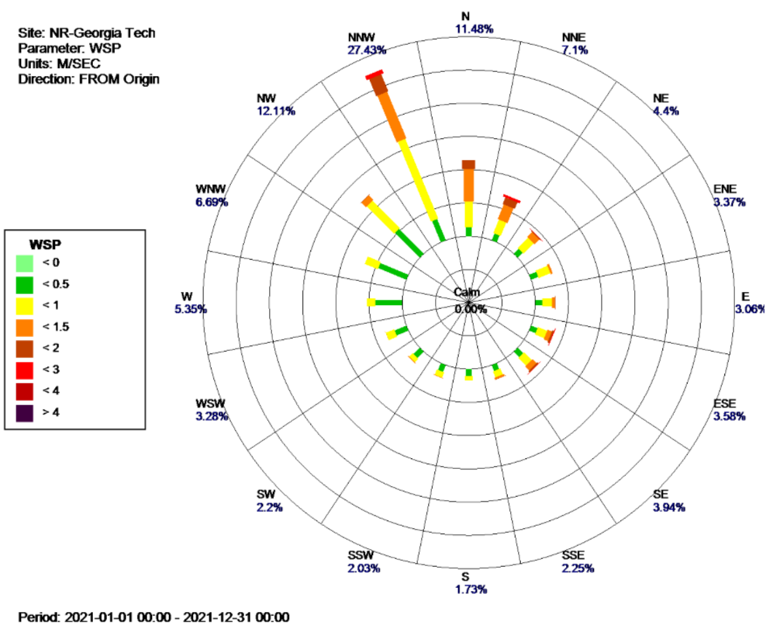
Evans, 2021 Annual Winds



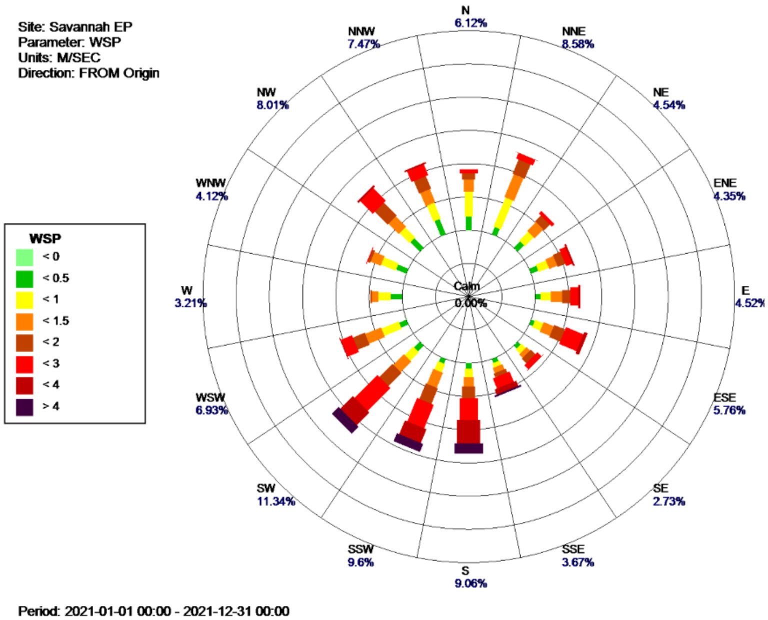
Fort Mountain, 2021 Annual Winds



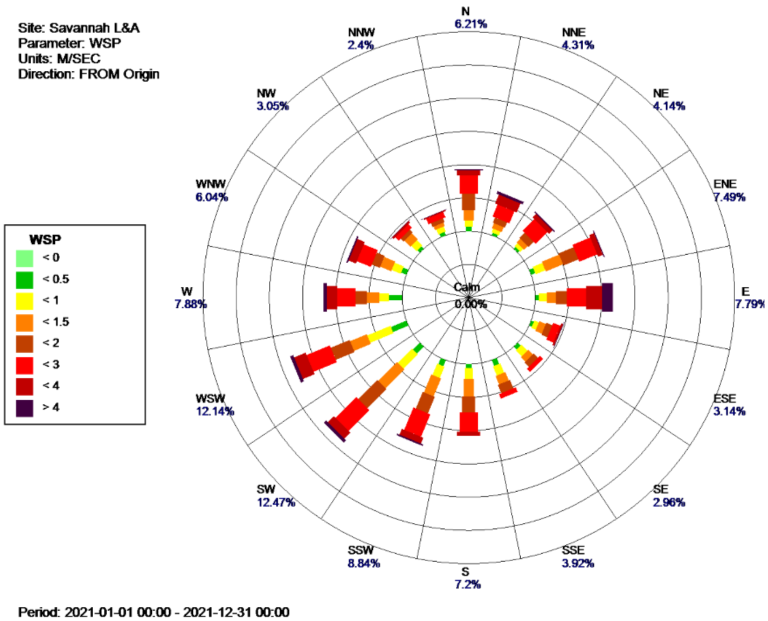
Macon-Forestry, 2021 Annual Winds



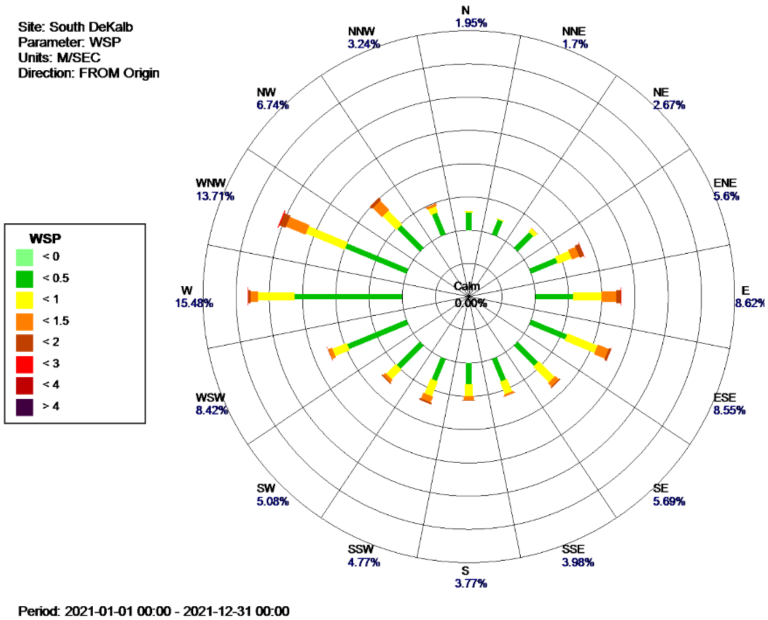
NR-GA Tech, 2021 Annual Winds



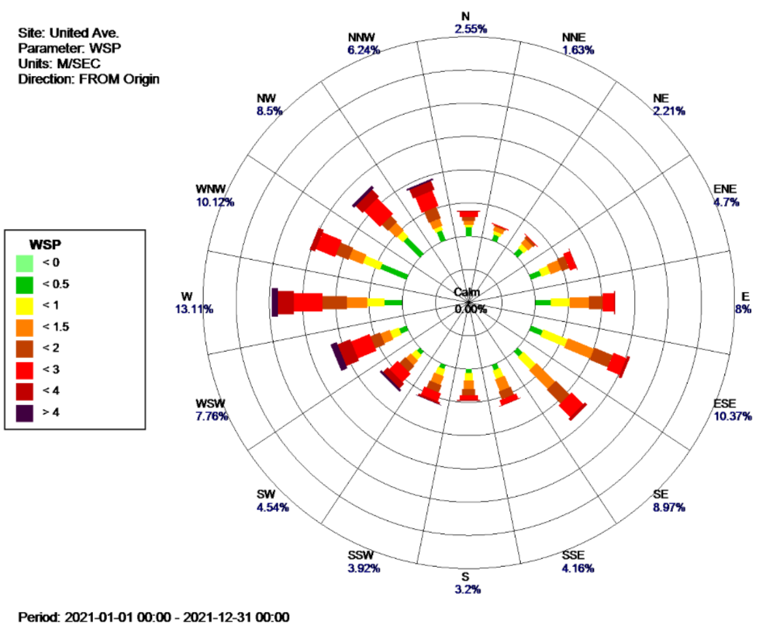
Savannah- E President, 2021 Annual Winds



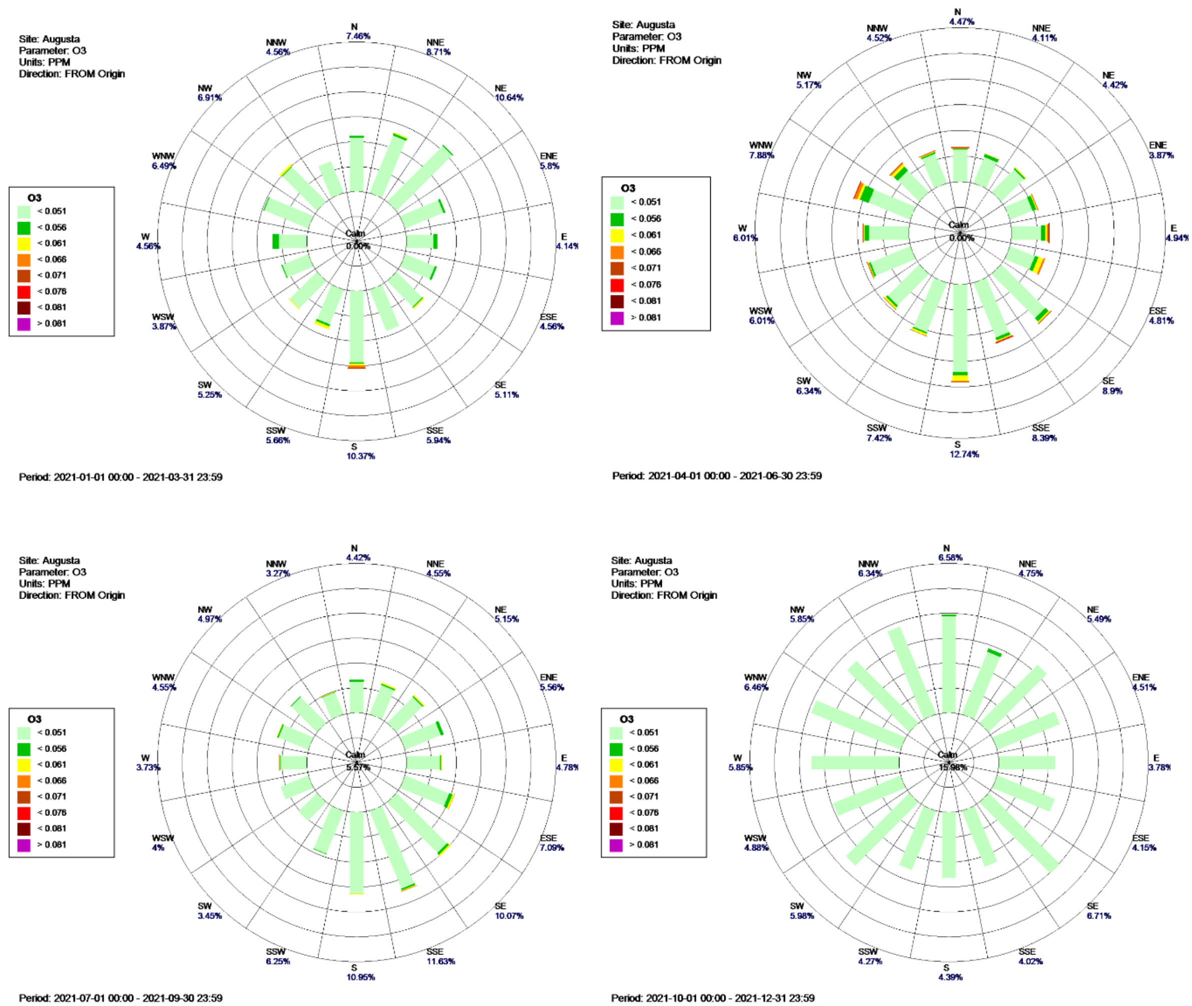
Savannah- L&A, 2021 Annual Winds



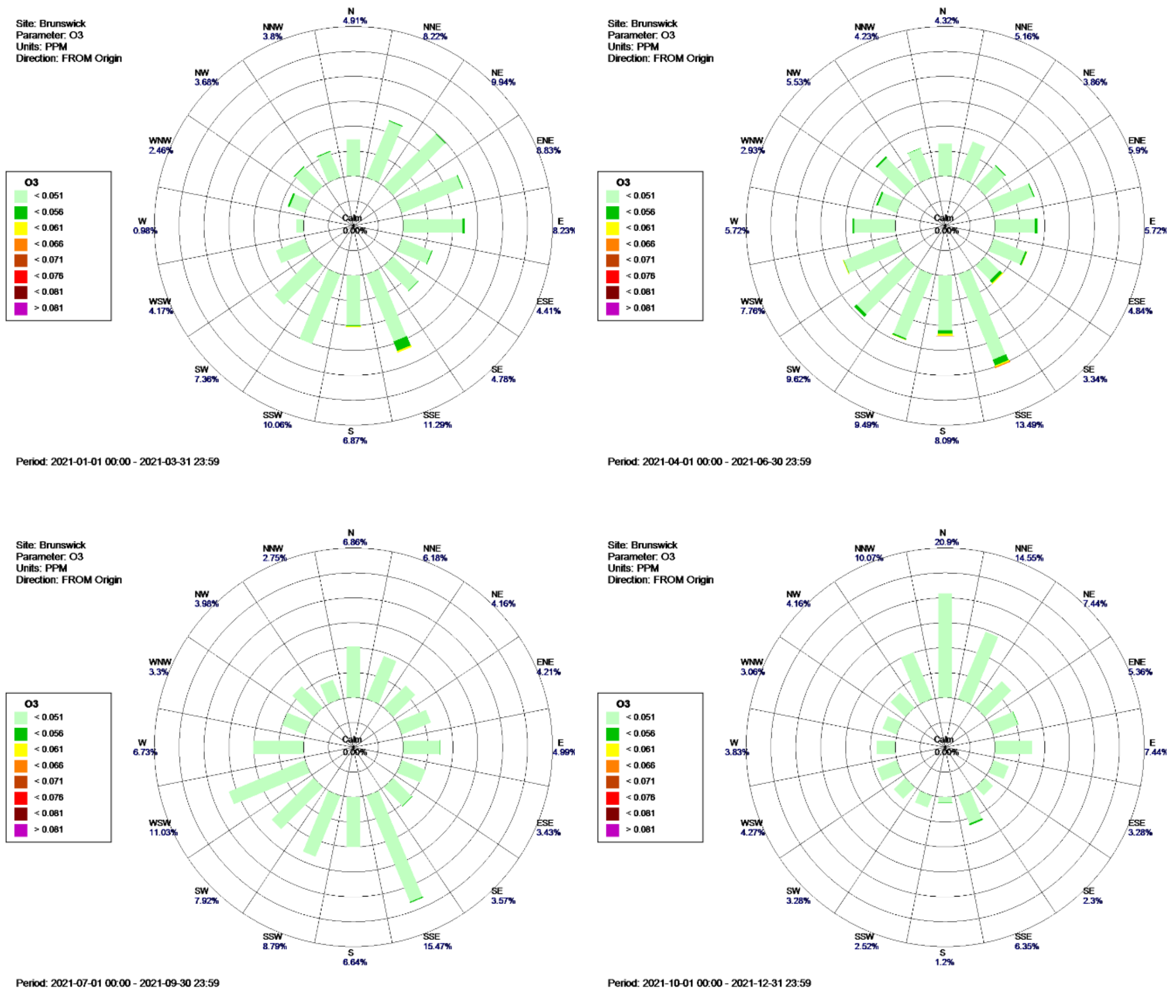
South DeKalb, 2021 Annual Winds



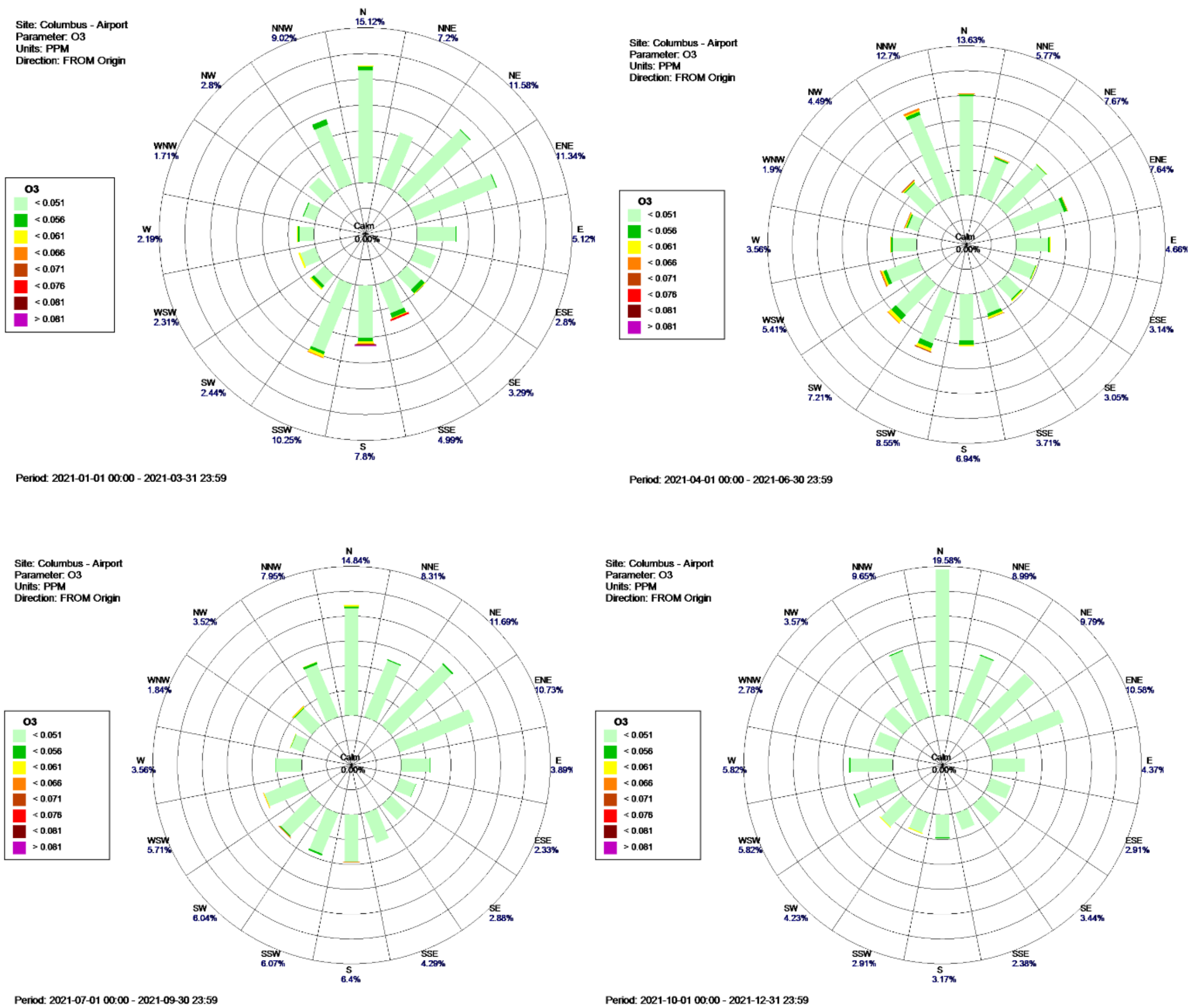
United Ave, 2021 Annual Winds



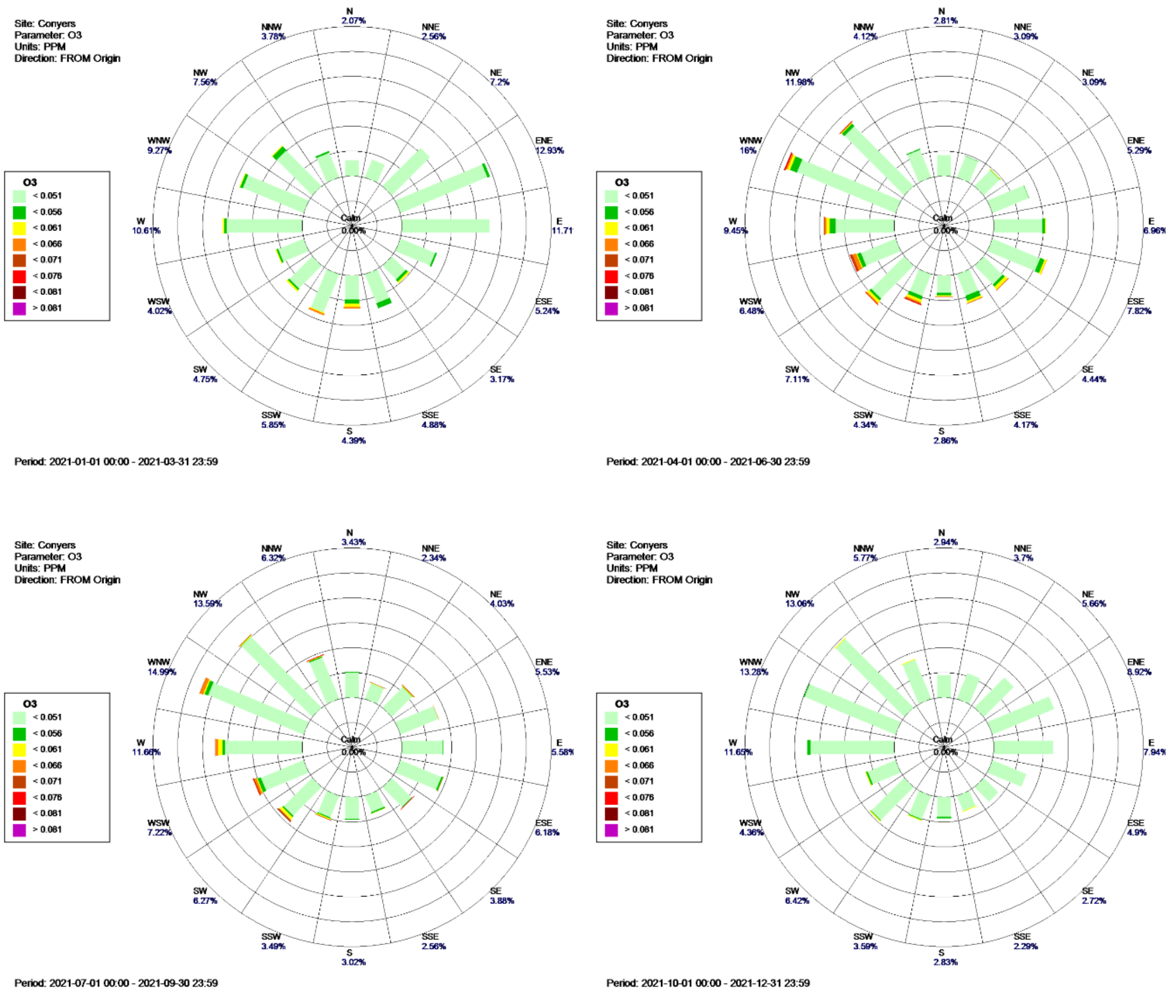
Augusta, 2021 Quarterly Ozone



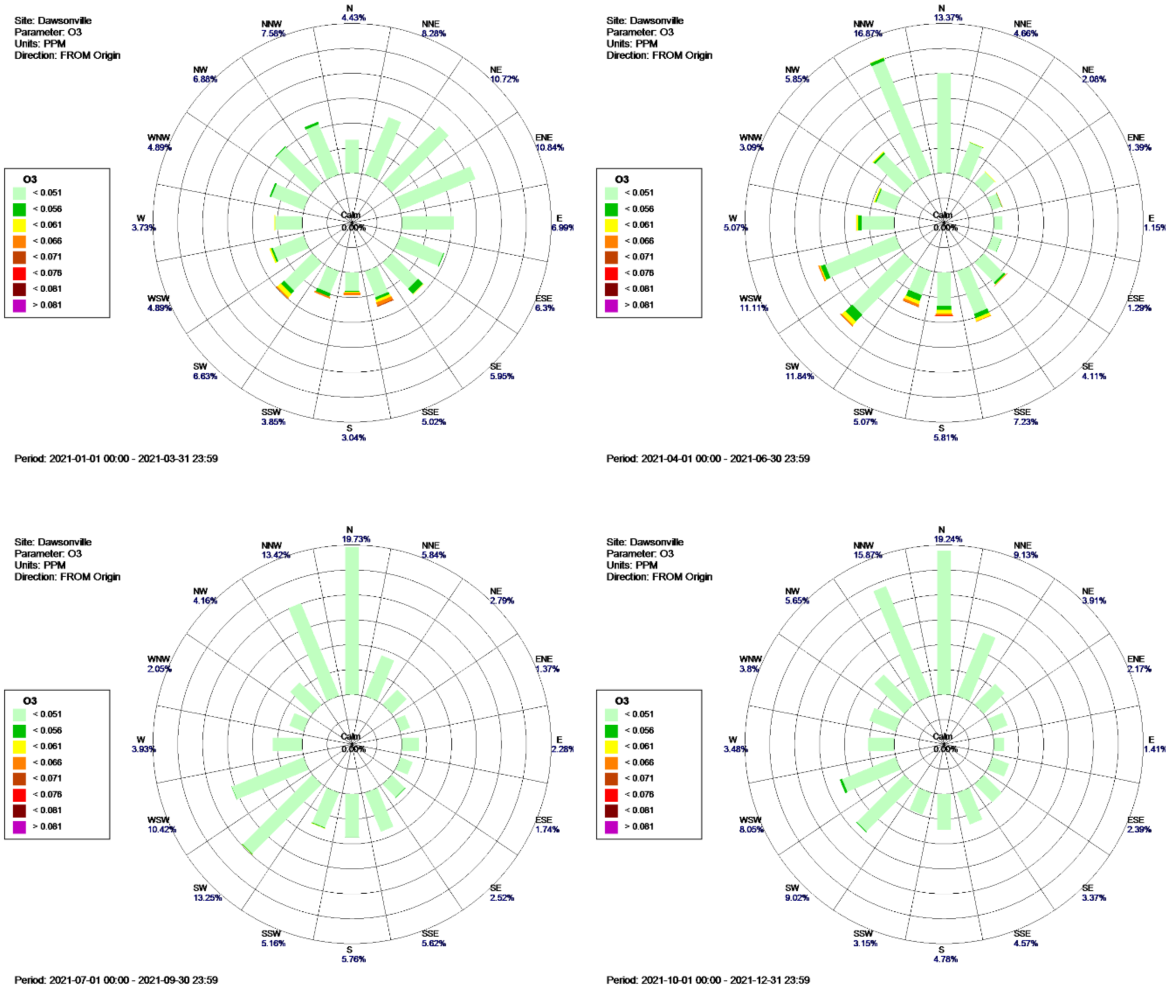
Brunswick, 2021 Quarterly Ozone



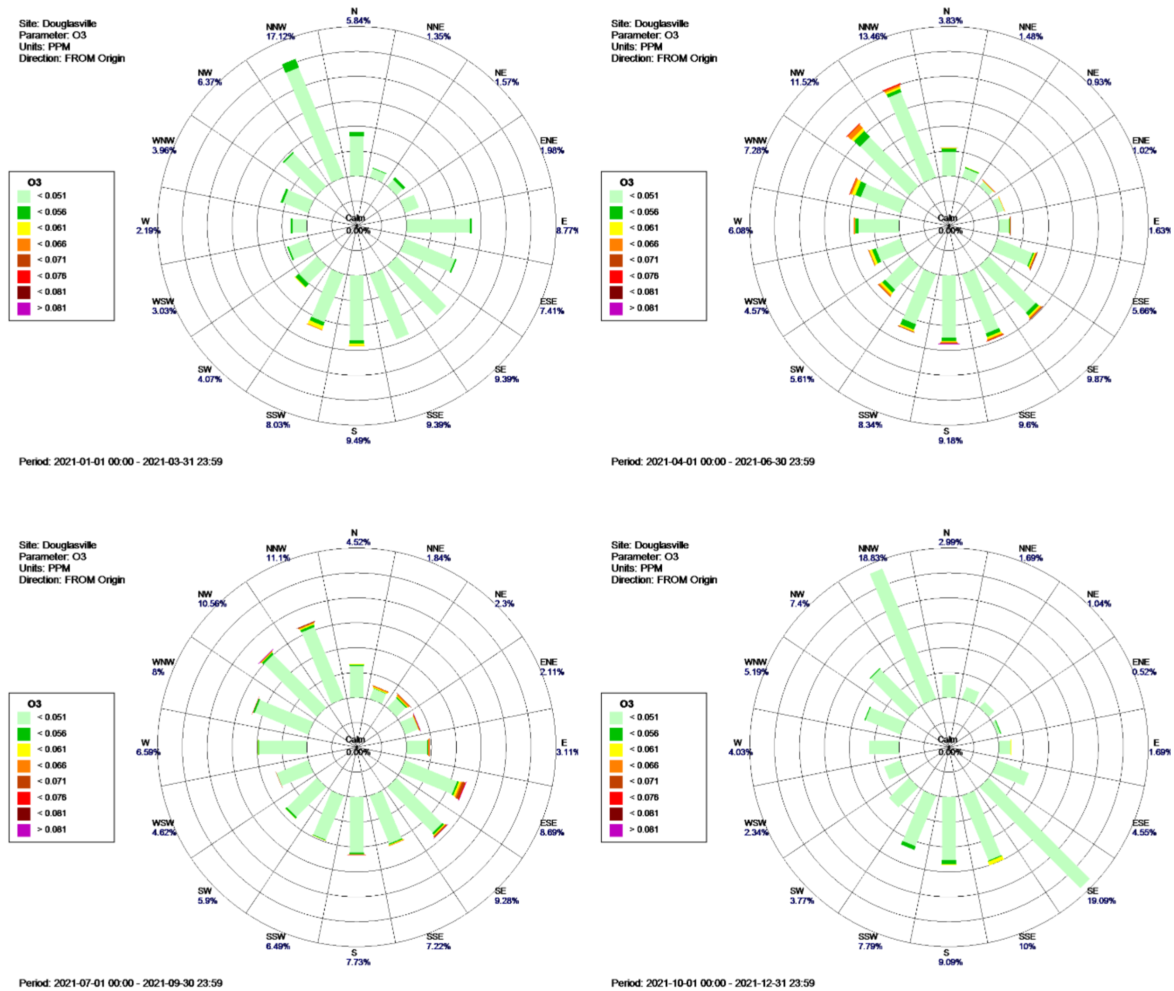
Columbus-Airport, 2021 Quarterly Ozone



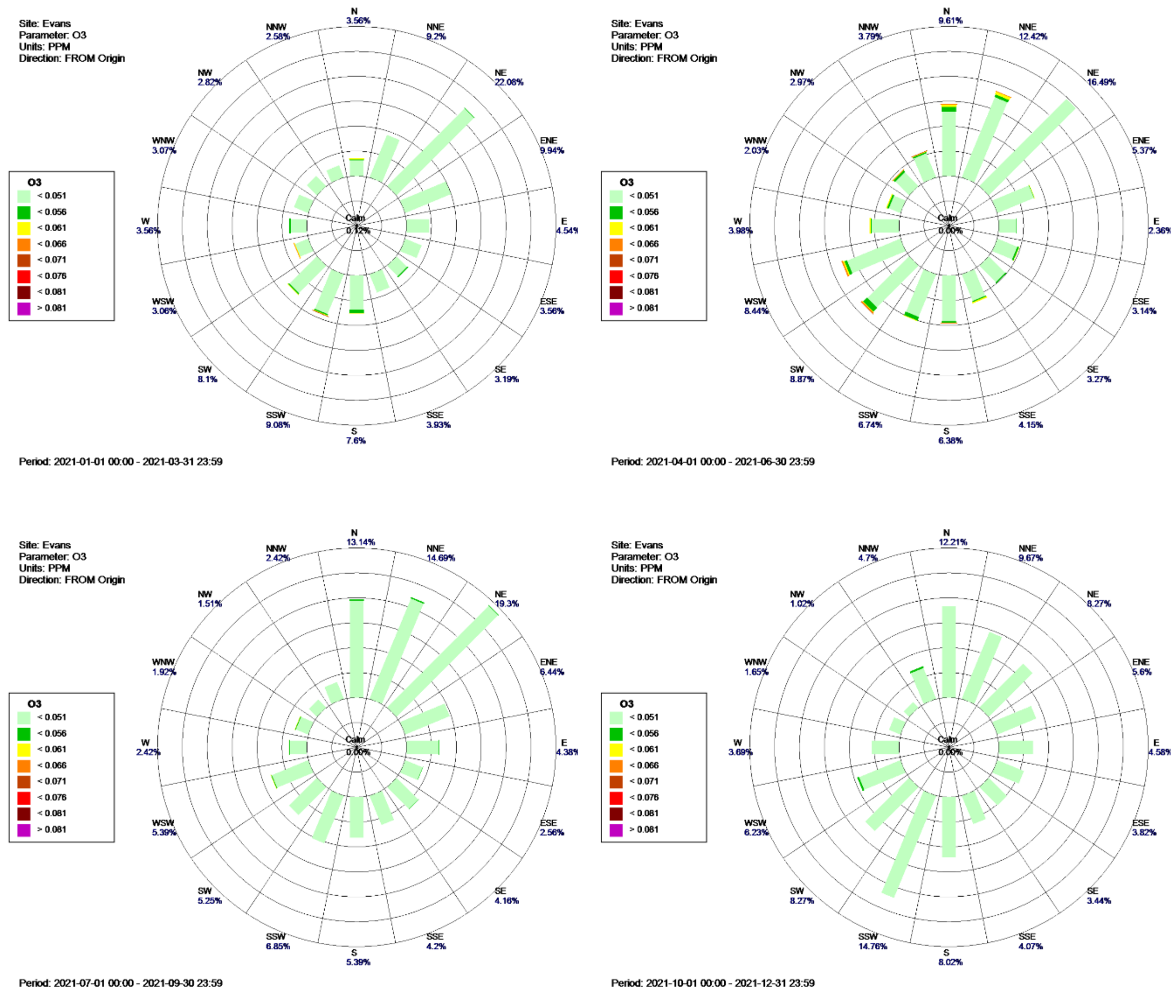
Conyers, 2021 Quarterly Ozone



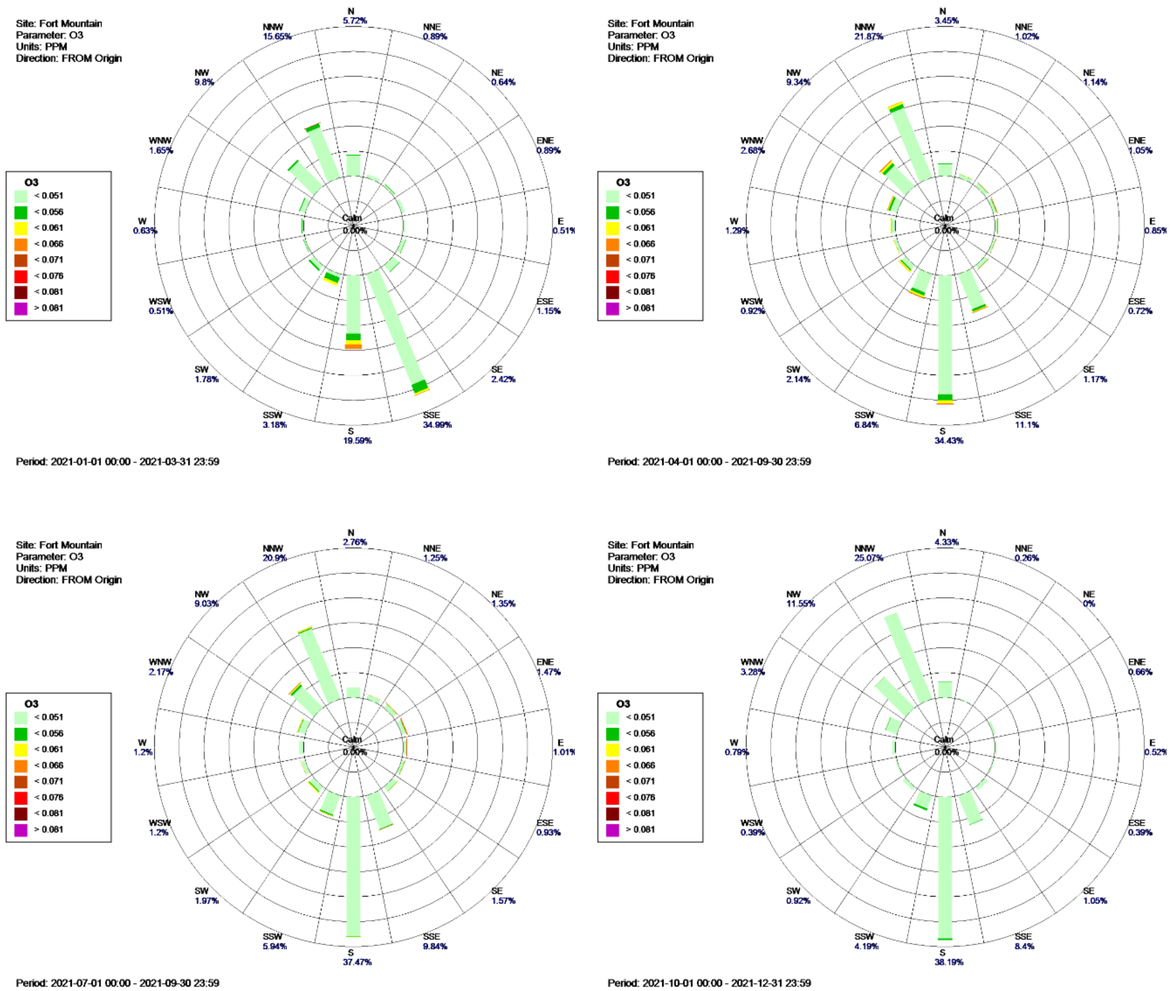
Dawsonville, 2021 Quarterly Ozone



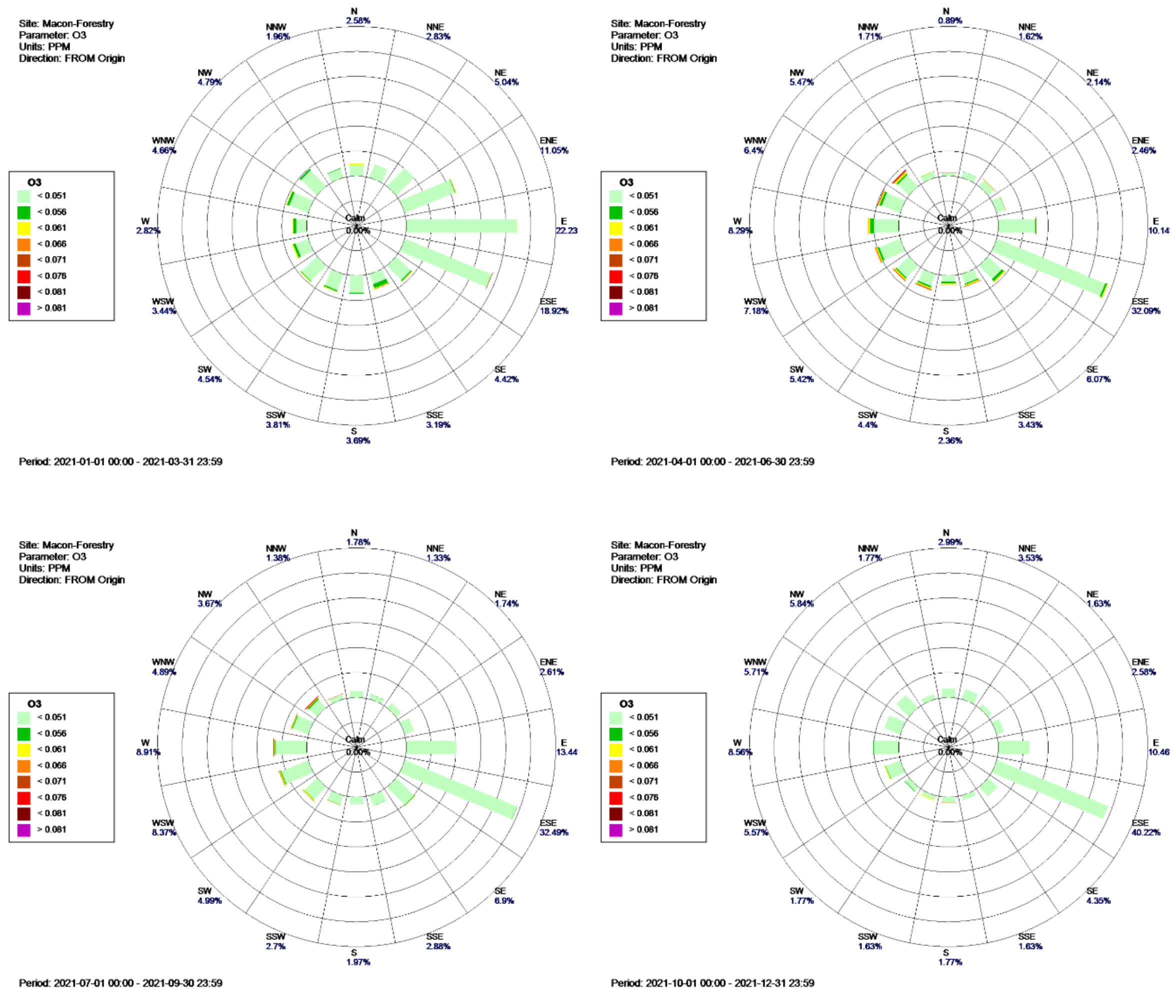
Douglasville, 2021 Quarterly Ozone



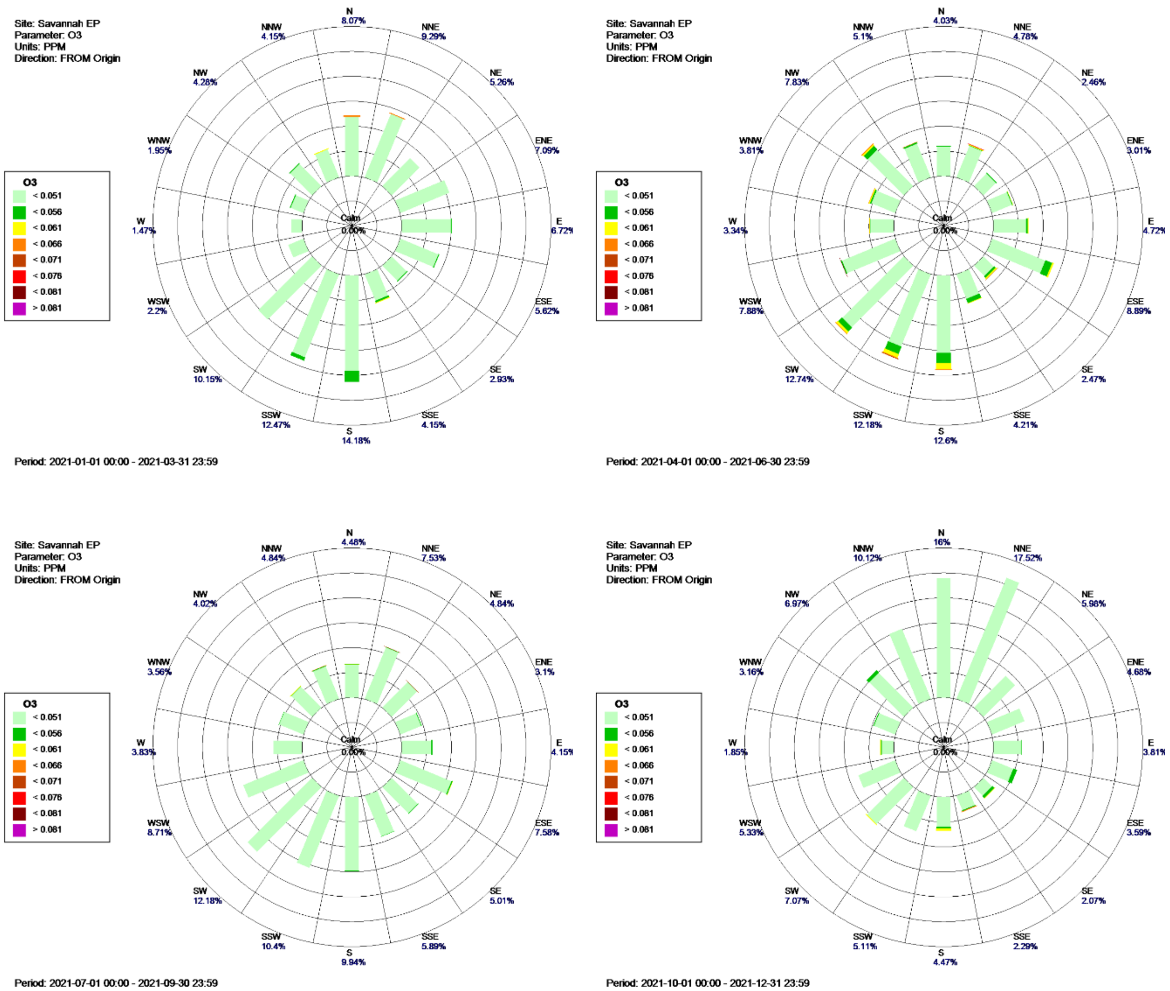
Evans, 2021 Quarterly Ozone



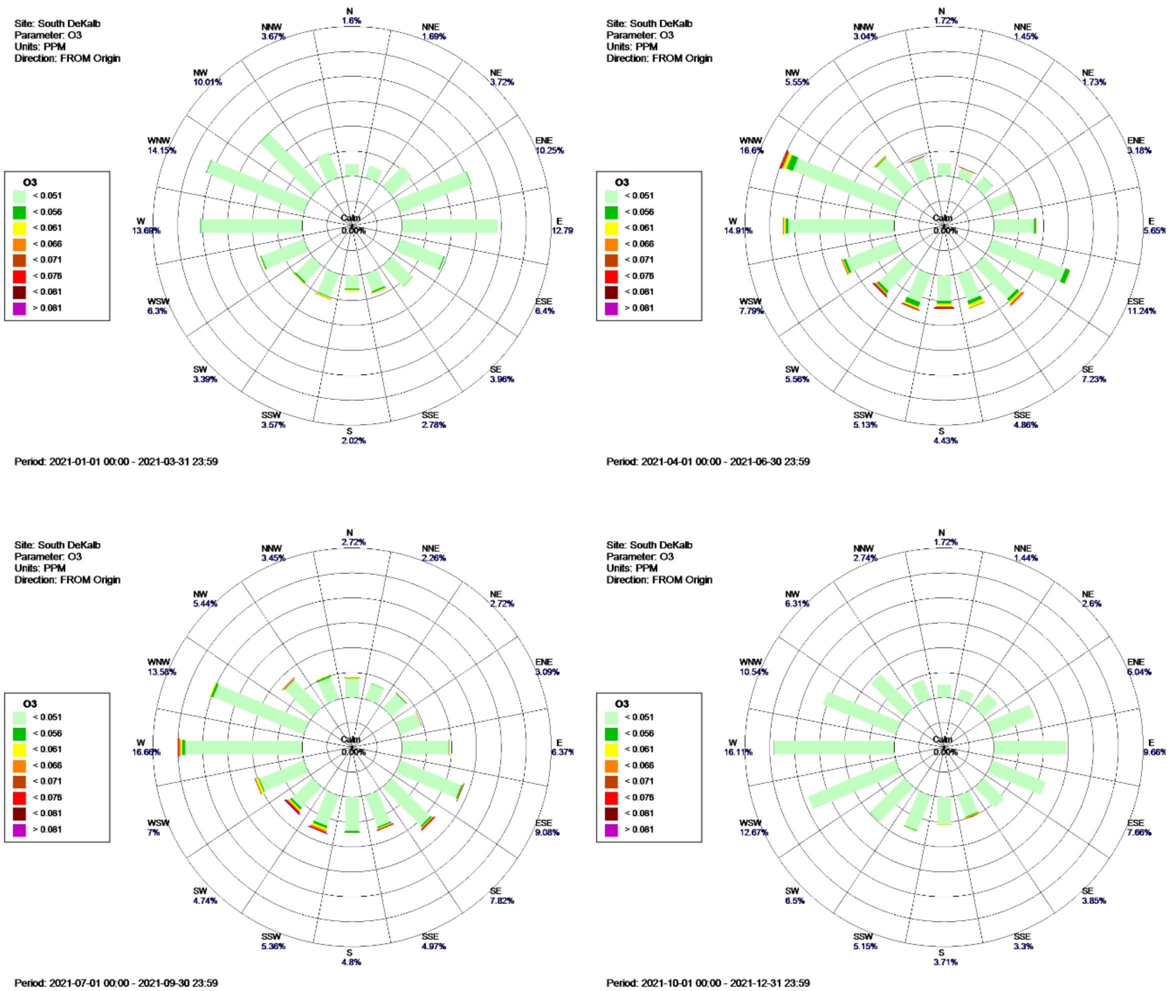
Fort Mountain, 2021 Quarterly Ozone



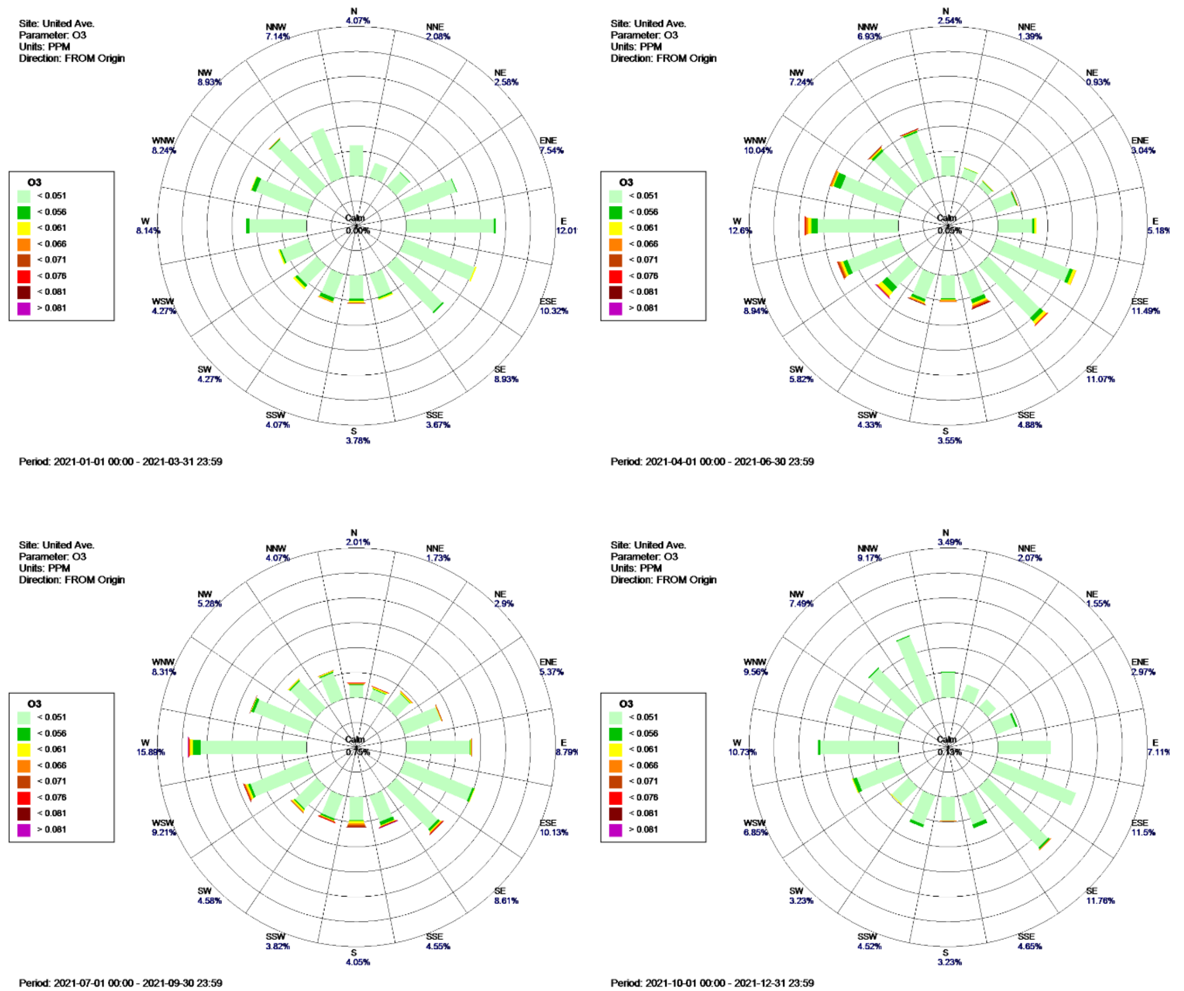
Macon-Forestry, 2021 Quarterly Ozone



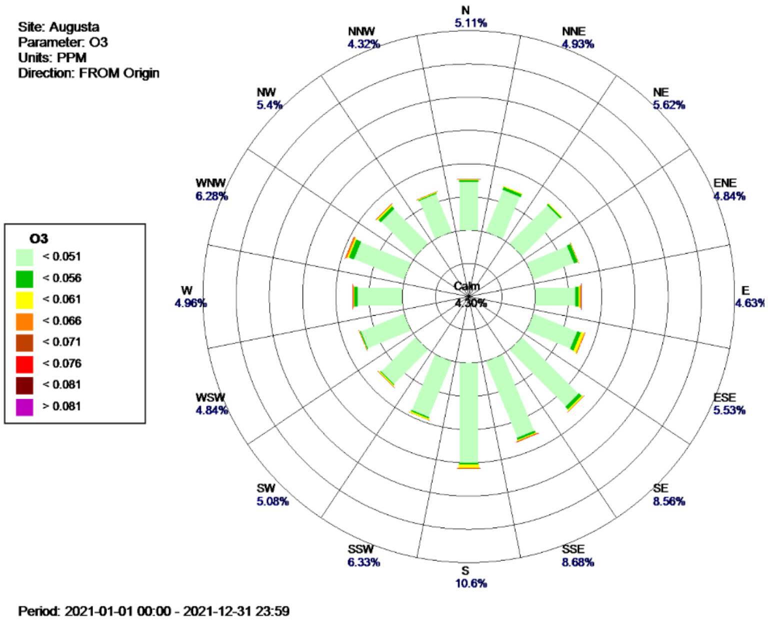
Savannah-E President, 2021 Quarterly Ozone



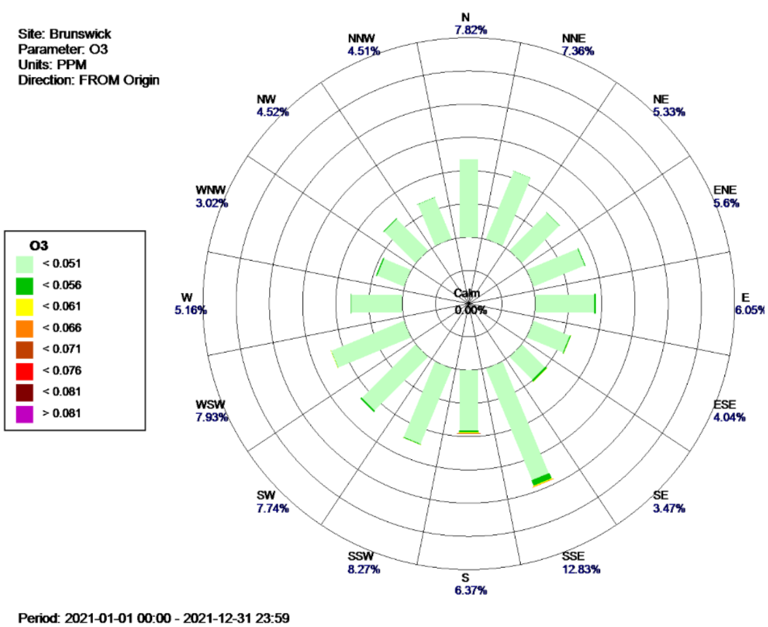
South DeKalb, 2021 Quarterly Ozone



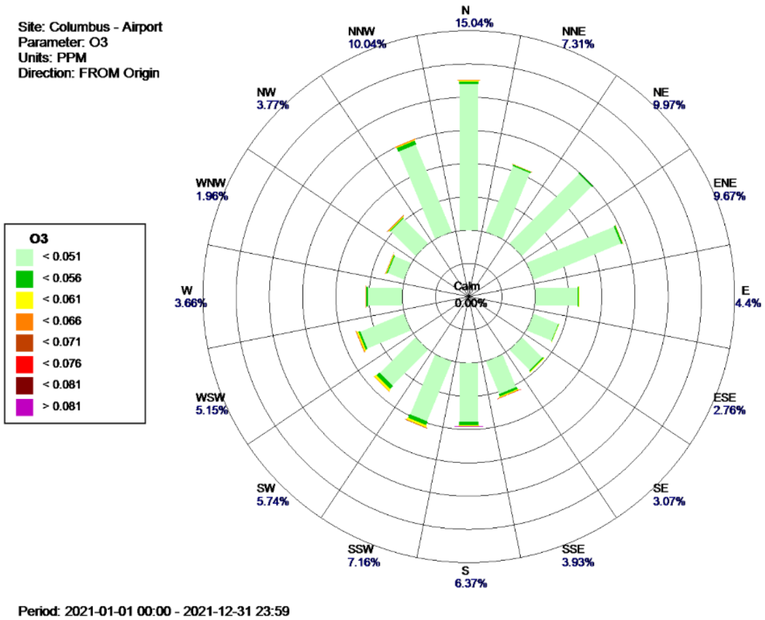
United Ave, 2021 Quarterly Ozone



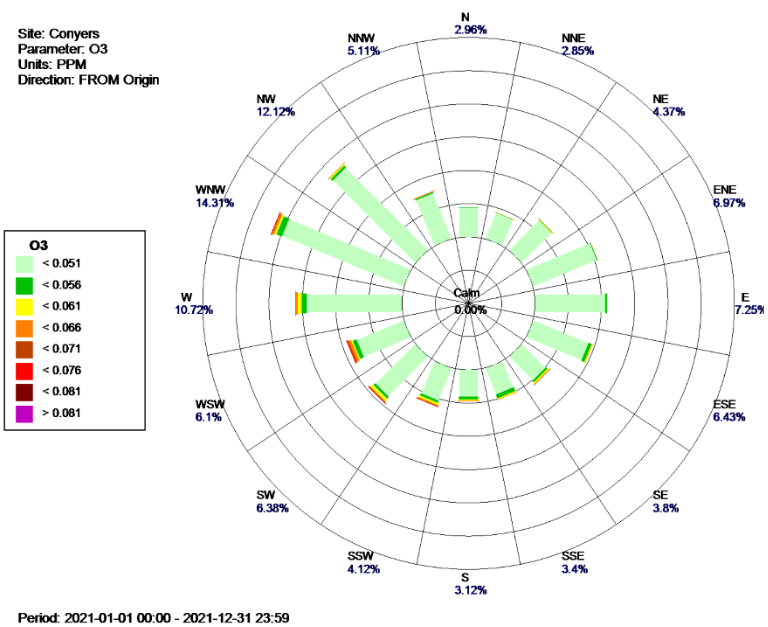
Augusta, 2021 Annual Ozone



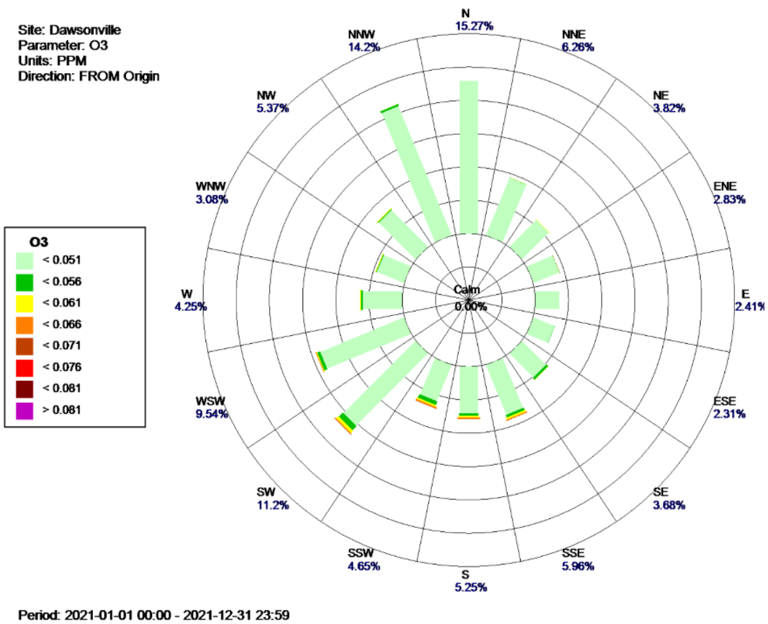
Brunswick, 2021 Annual Ozone



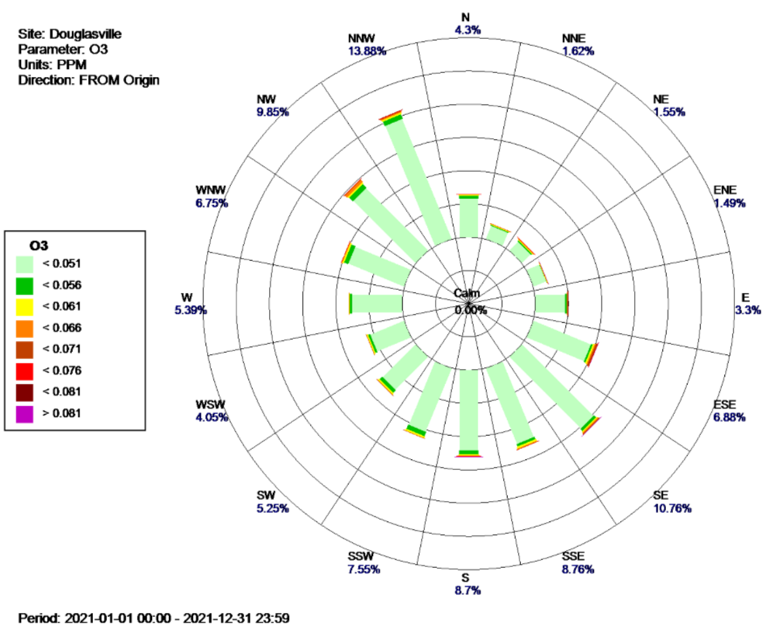
Columbus-Airport, 2021 Annual Ozone



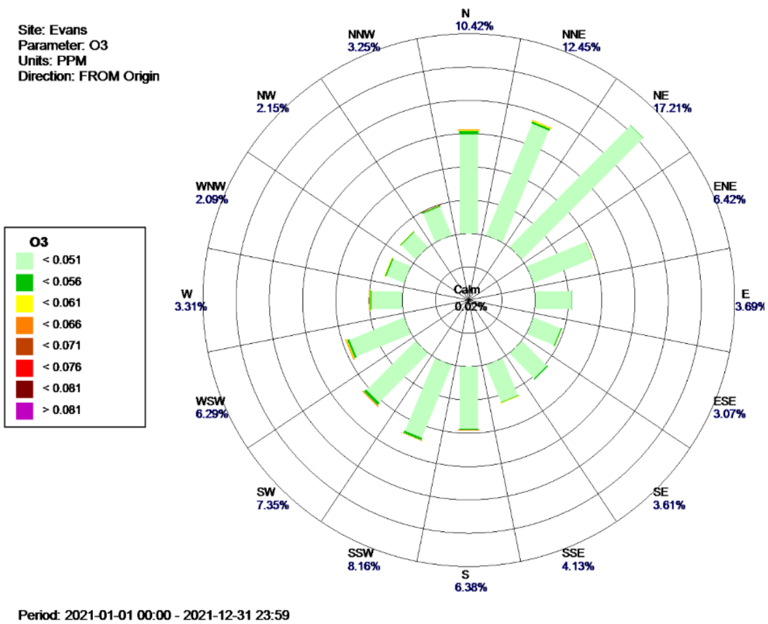
Conyers, 2021 Annual Ozone



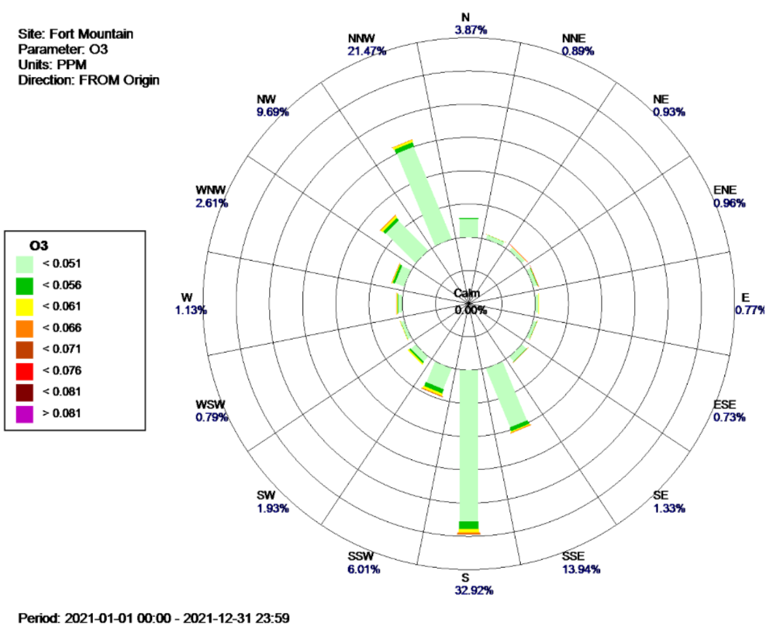
Dawsonville, 2021 Annual Ozone



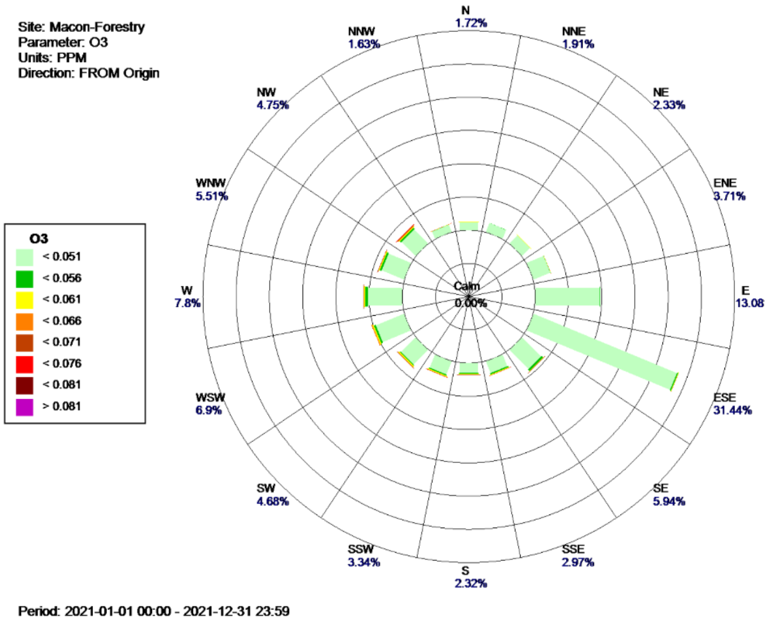
Douglasville, 2021 Annual Ozone



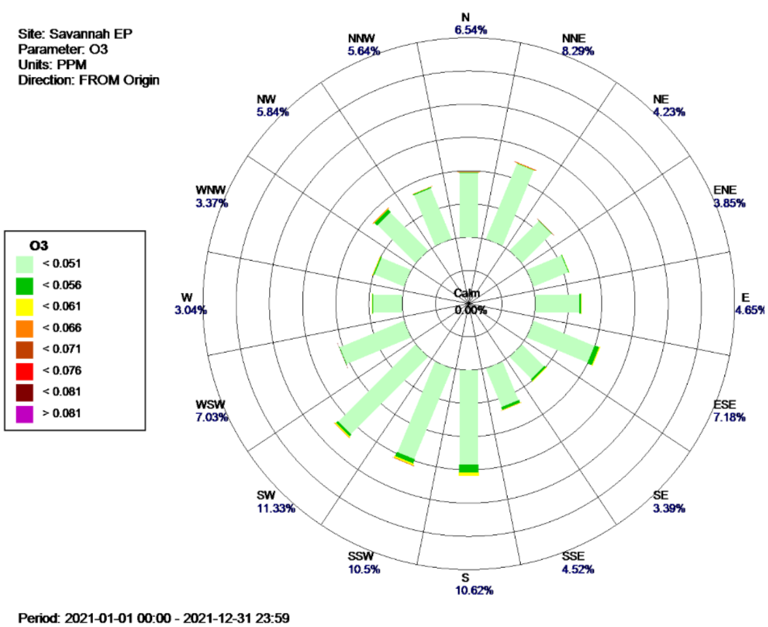
Evans, 2021 Annual Ozone



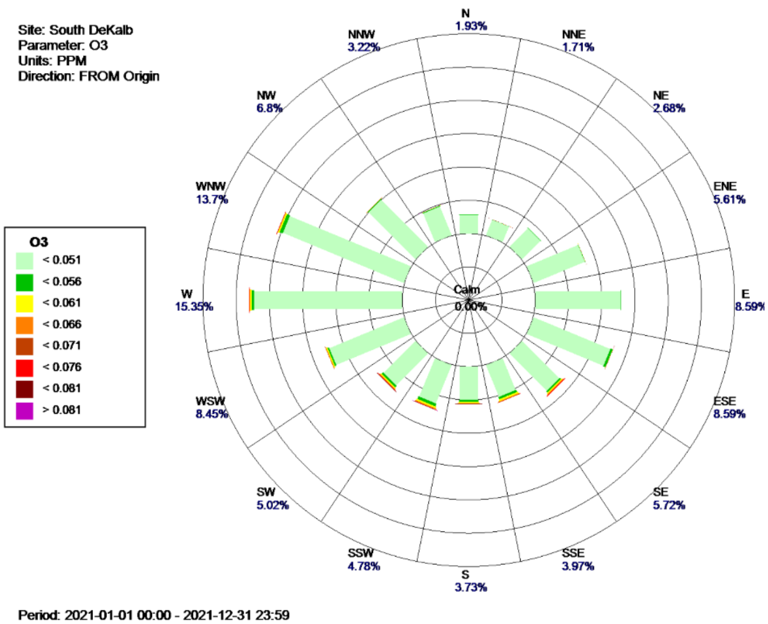
Fort Mountain, 2021 Annual Ozone



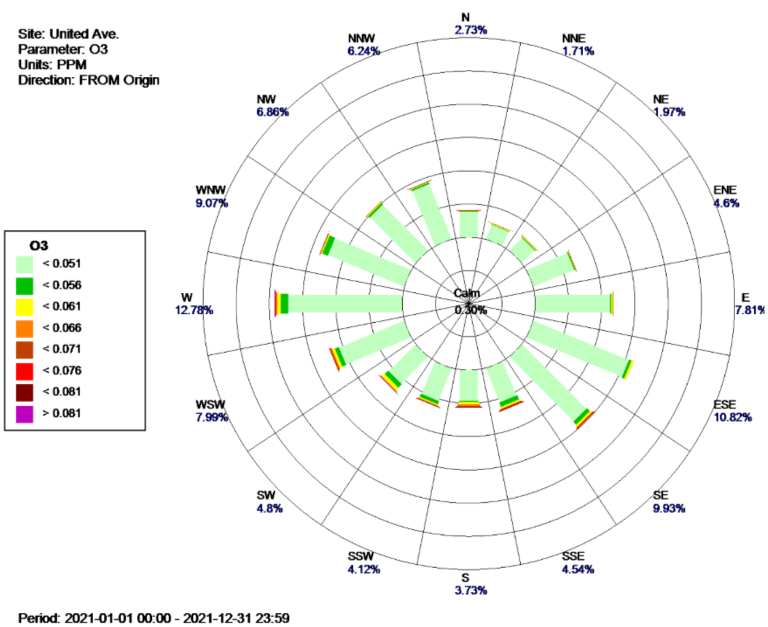
Macon-Forestry, 2021 Annual Ozone



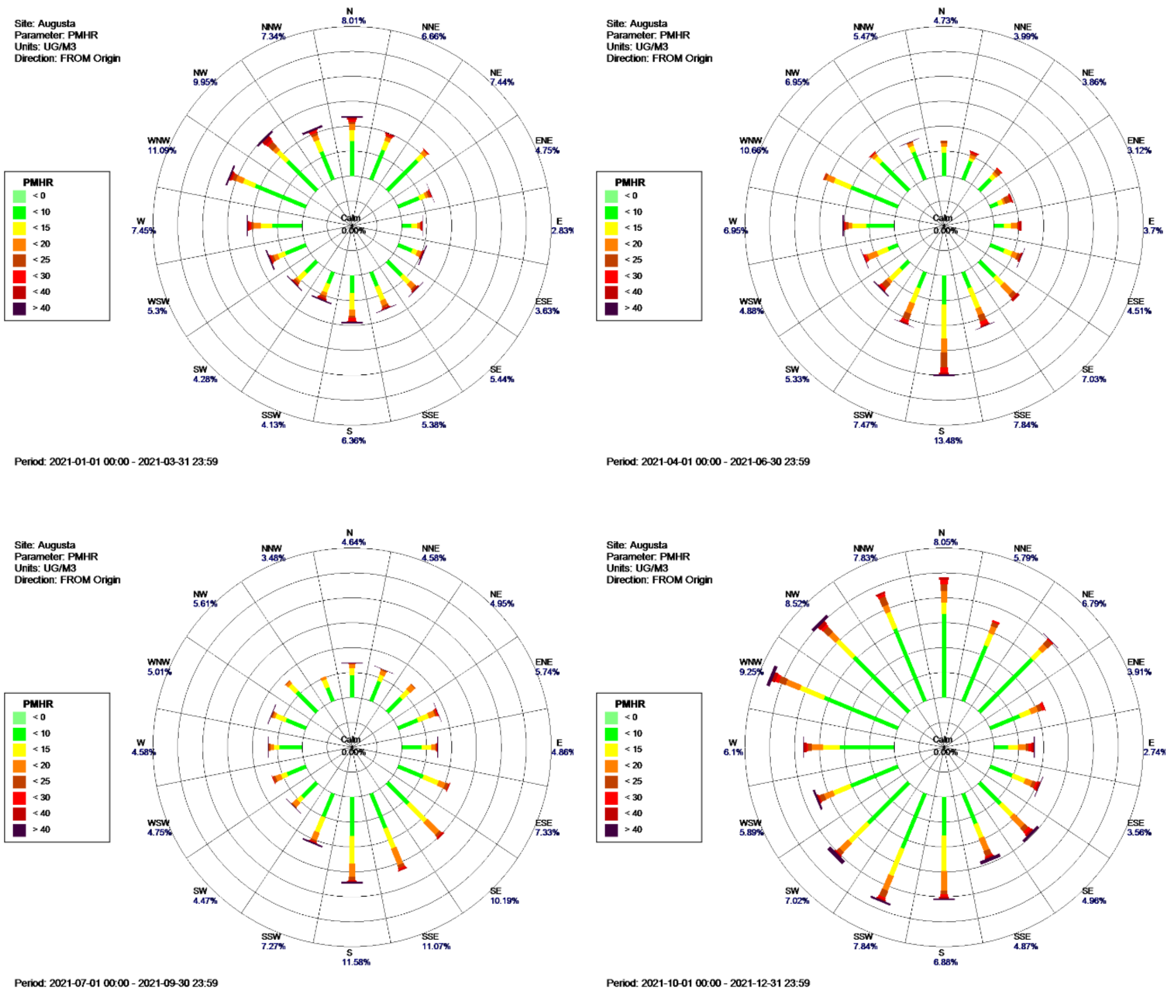
Savannah- E President, 2021 Annual Ozone



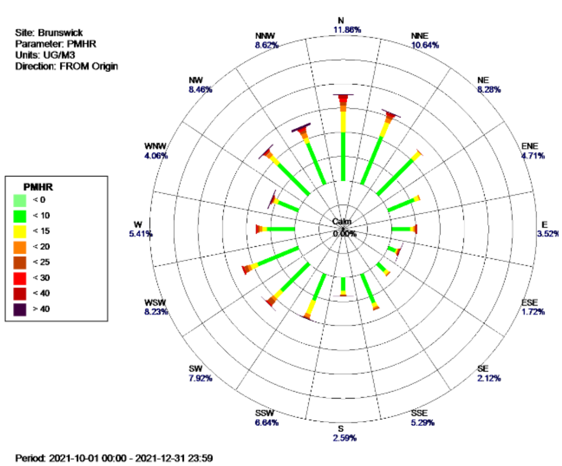
South DeKalb, 2021 Annual Ozone



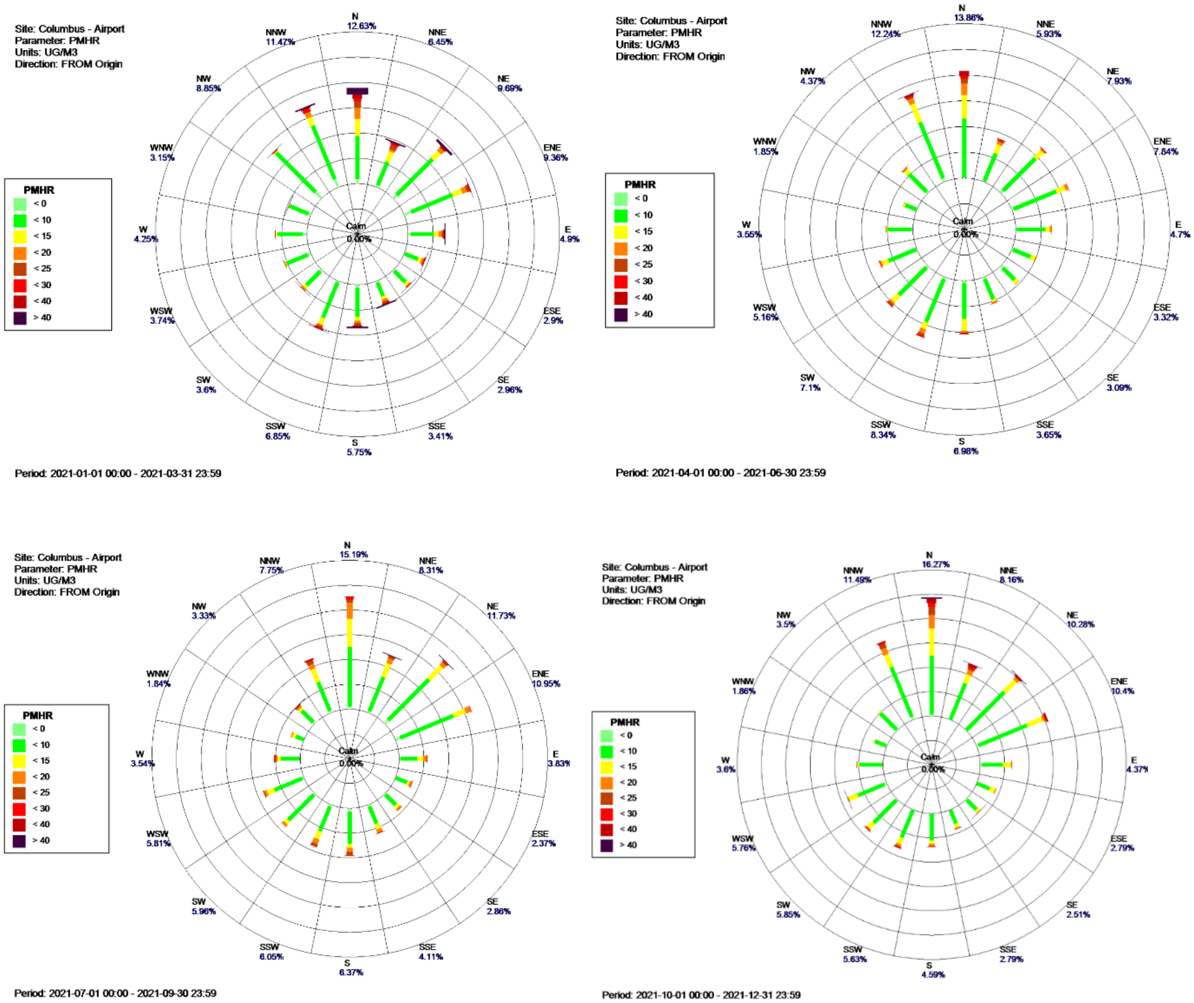
United Ave, 2021 Annual Ozone



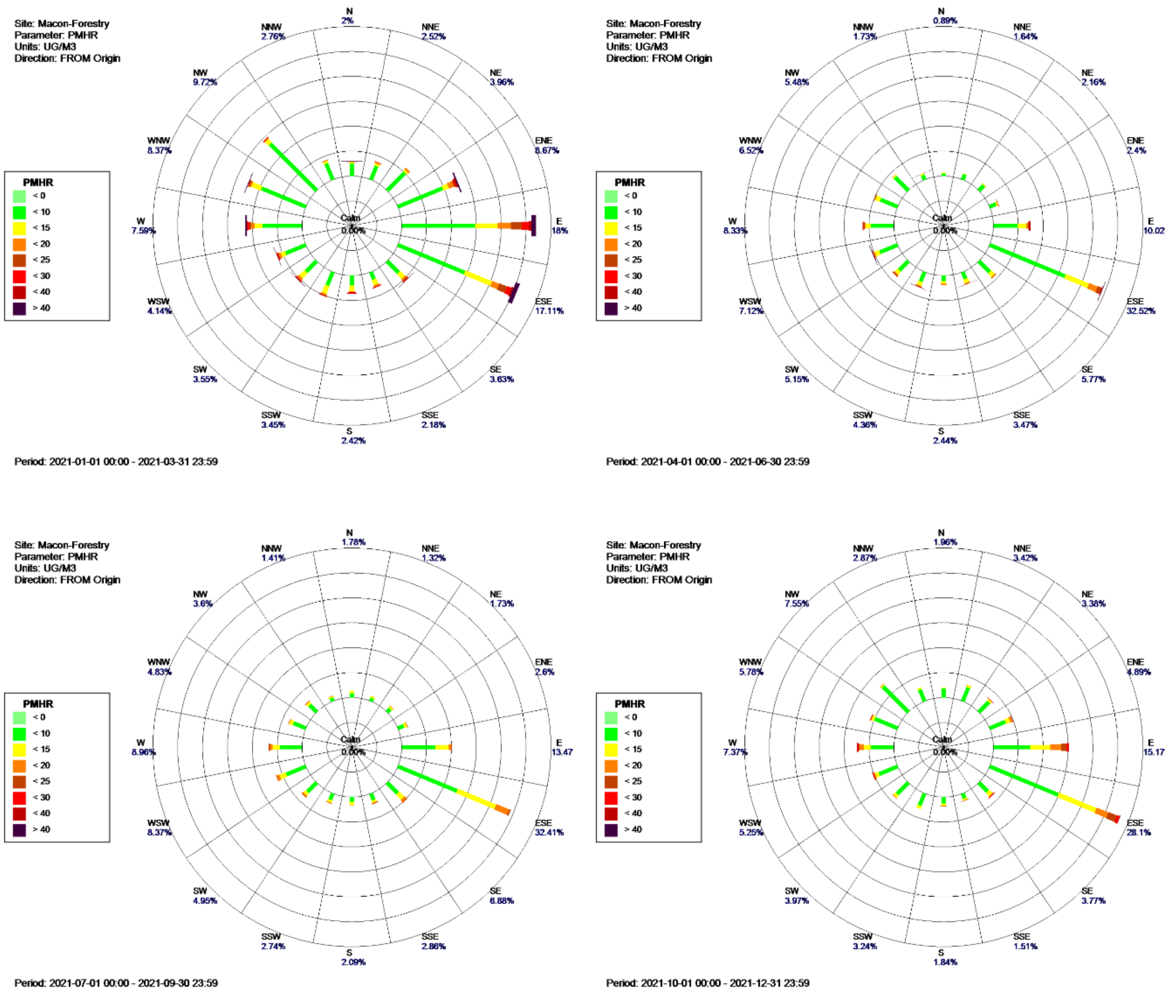
Augusta, 2021 Quarterly $PM_{2.5}$



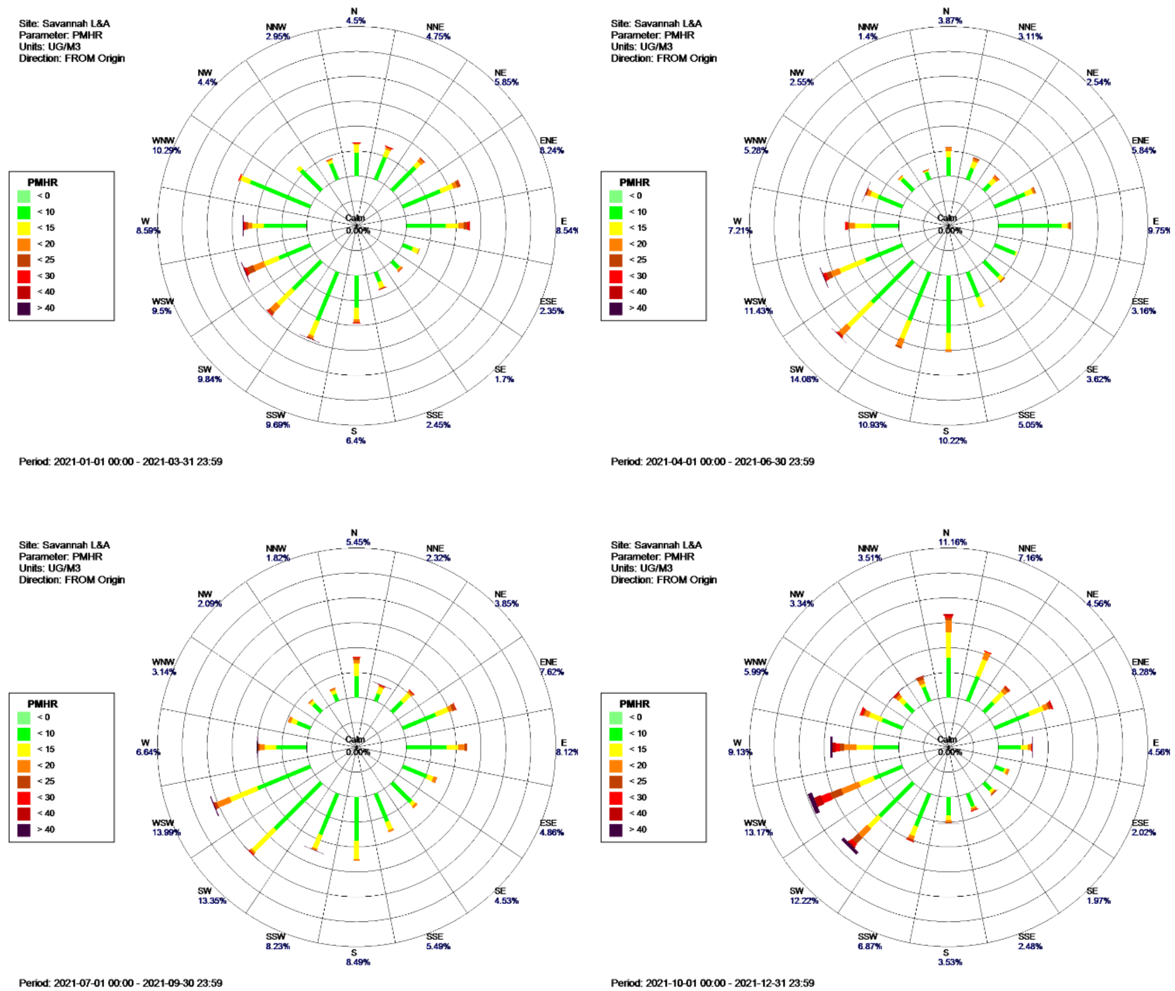
Brunswick, 2021 Quarterly $PM_{2.5}$ (Monitor established October 2021)



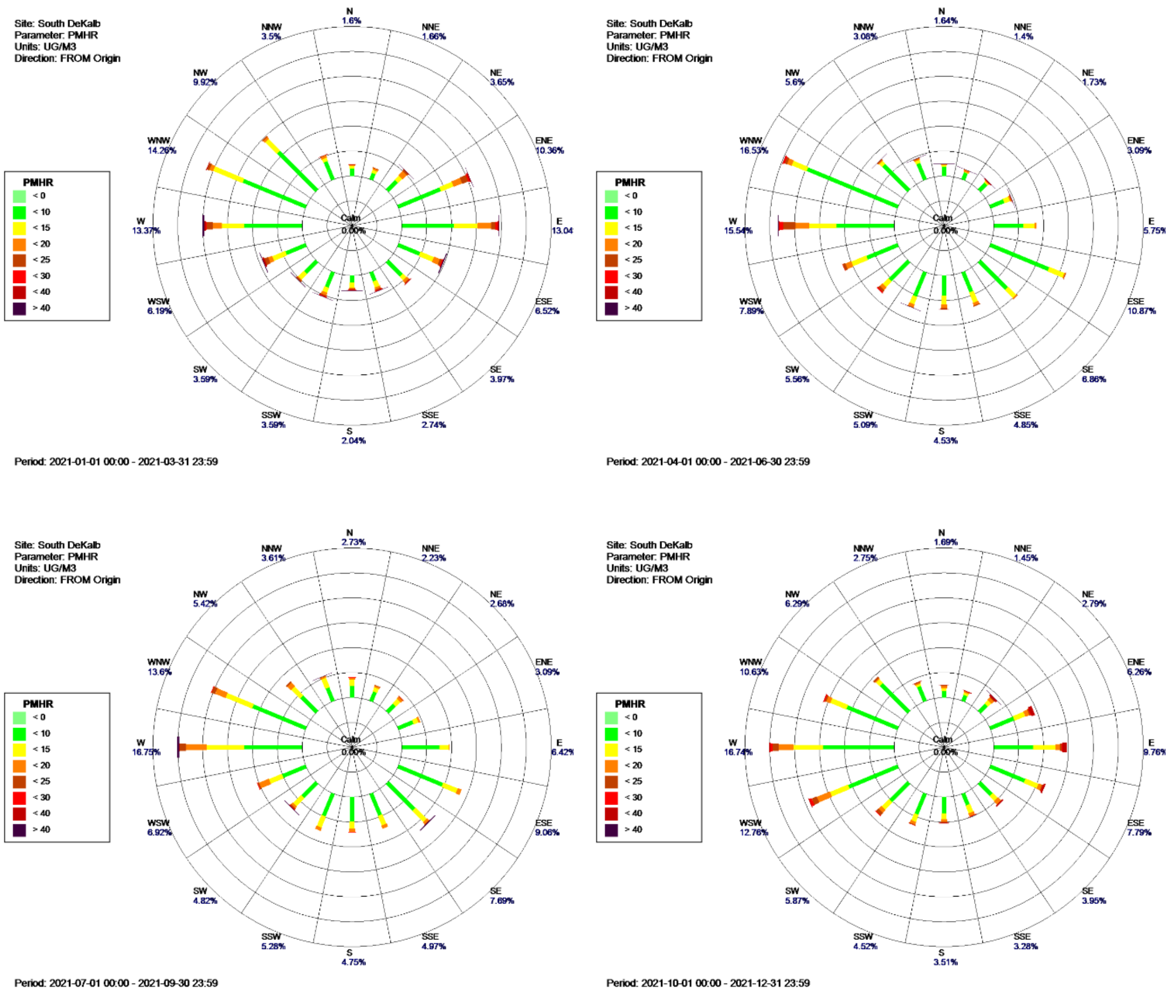
Columbus-Airport, 2021 Quarterly $PM_{2.5}$



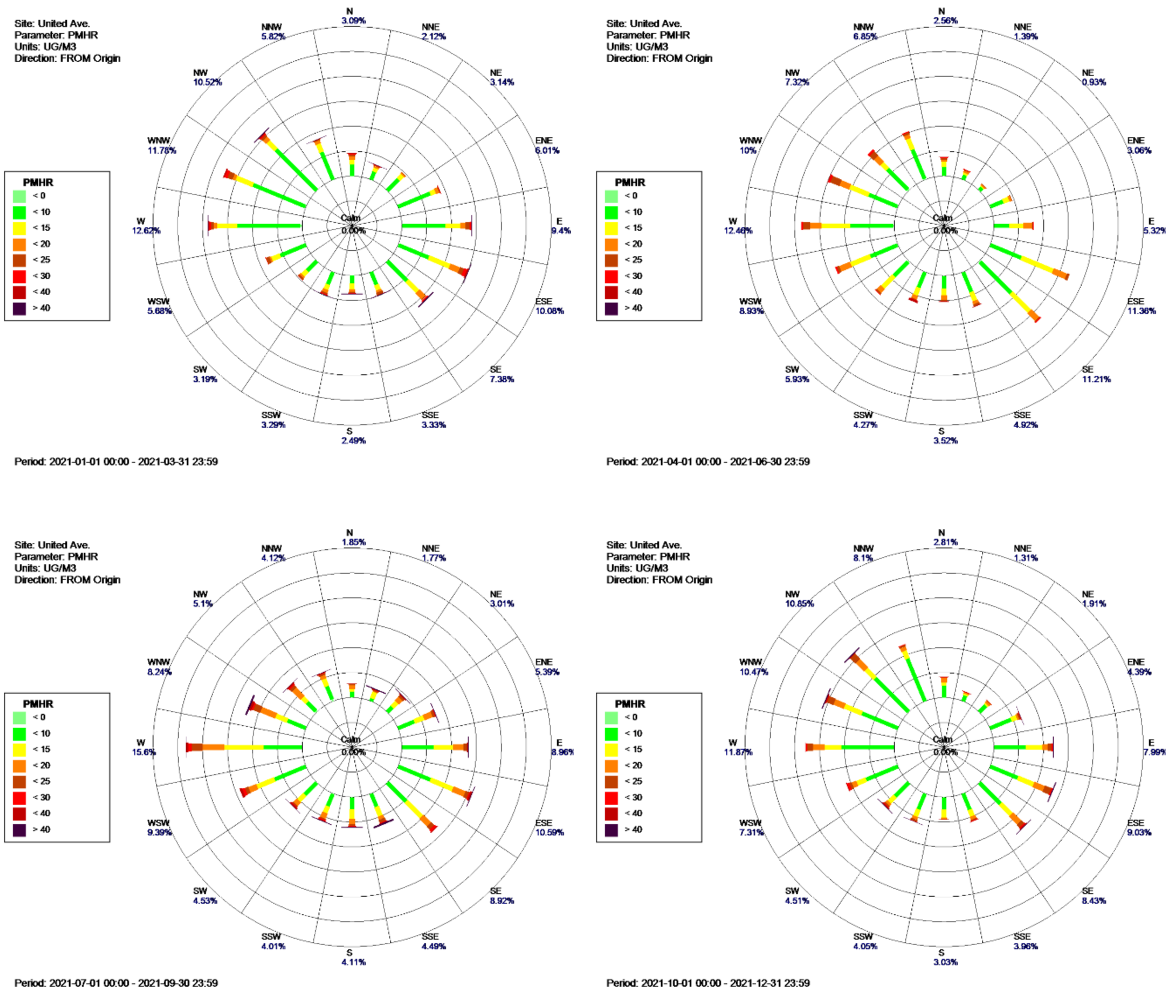
Macon-Forestry, 2021 Quarterly $PM_{2.5}$



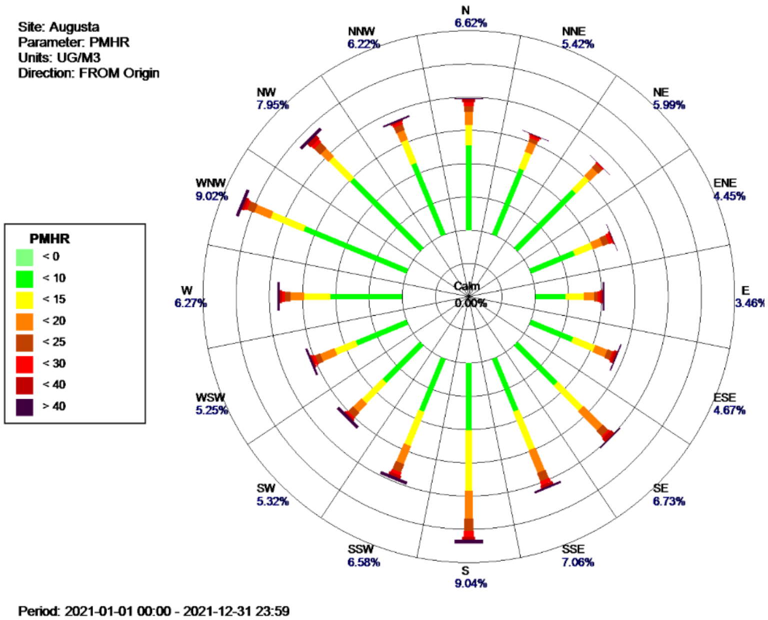
Savannah-L&A, 2021 Quarterly $PM_{2.5}$



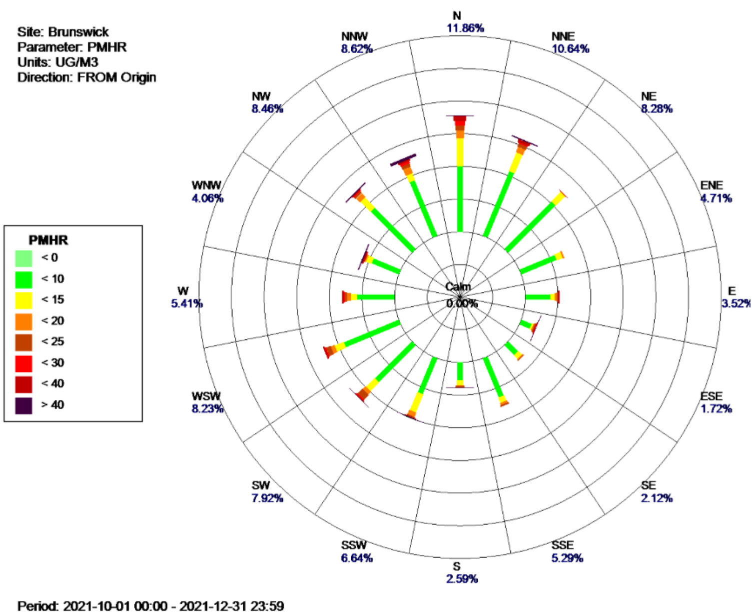
South DeKalb, 2021 Quarterly $PM_{2.5}$



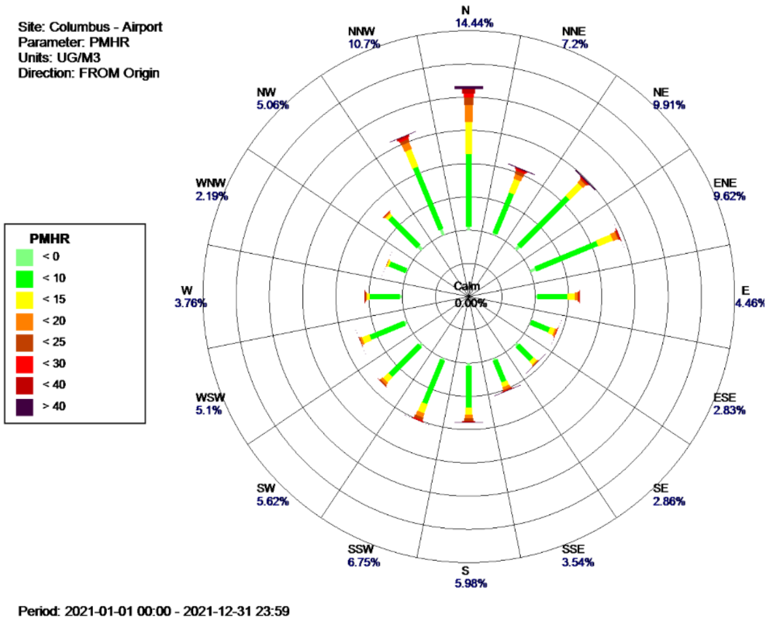
United Ave, 2021 Quarterly $PM_{2.5}$



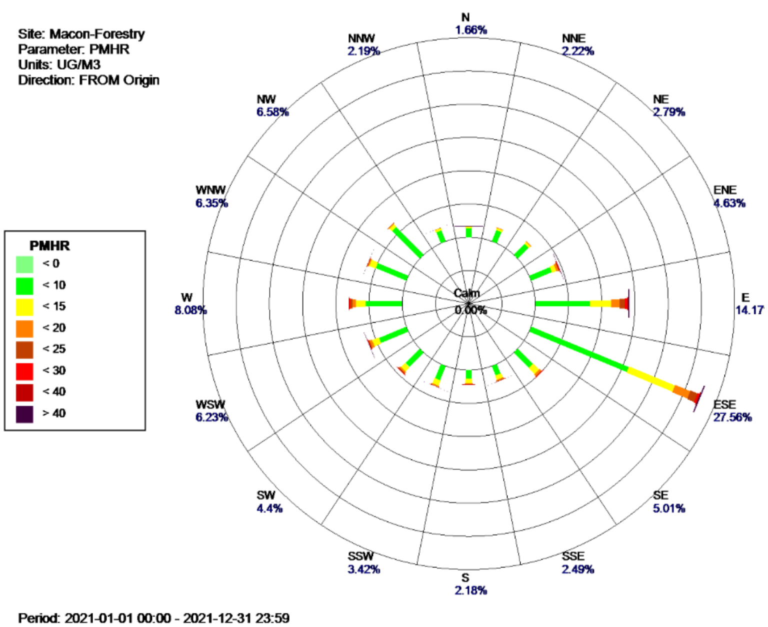
Augusta, 2021 Annual $PM_{2.5}$



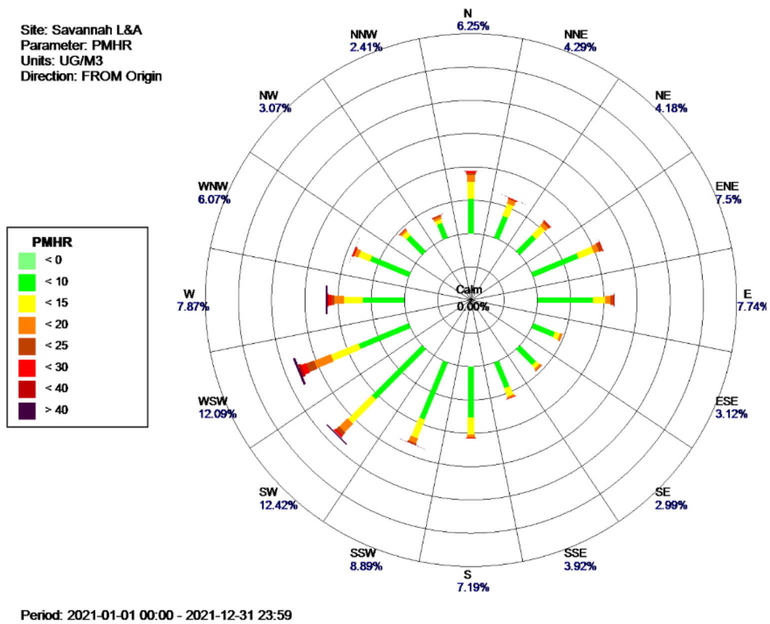
Brunswick, 2021 Annual $PM_{2.5}$



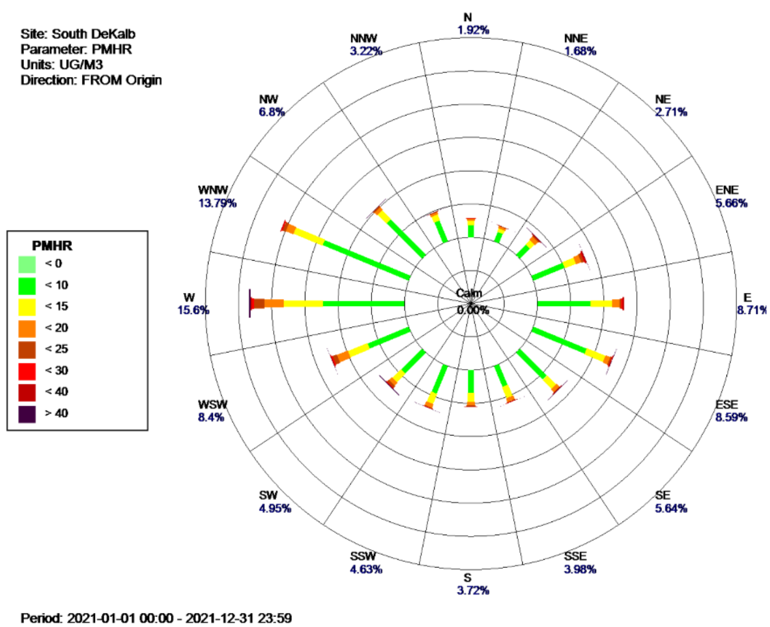
Columbus-Airport, 2021 Annual $PM_{2.5}$



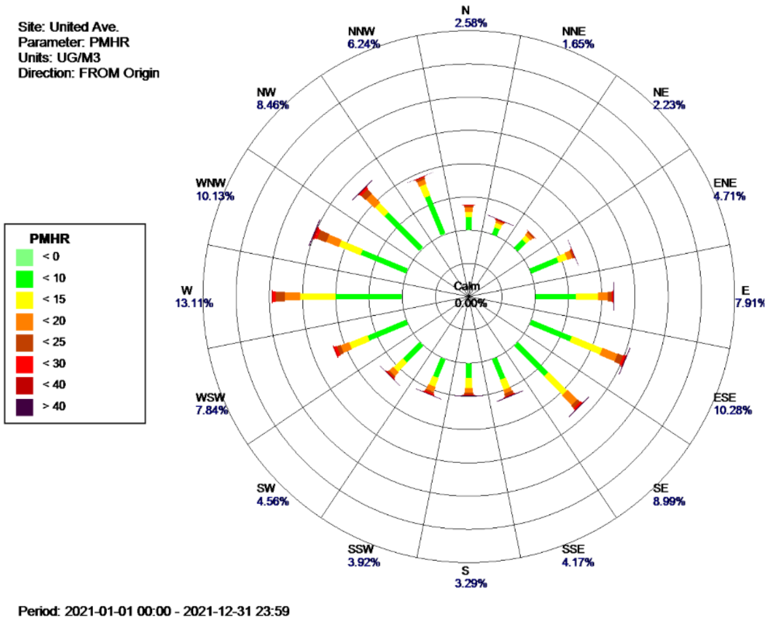
Macon-Forestry, 2021 Annual $PM_{2.5}$



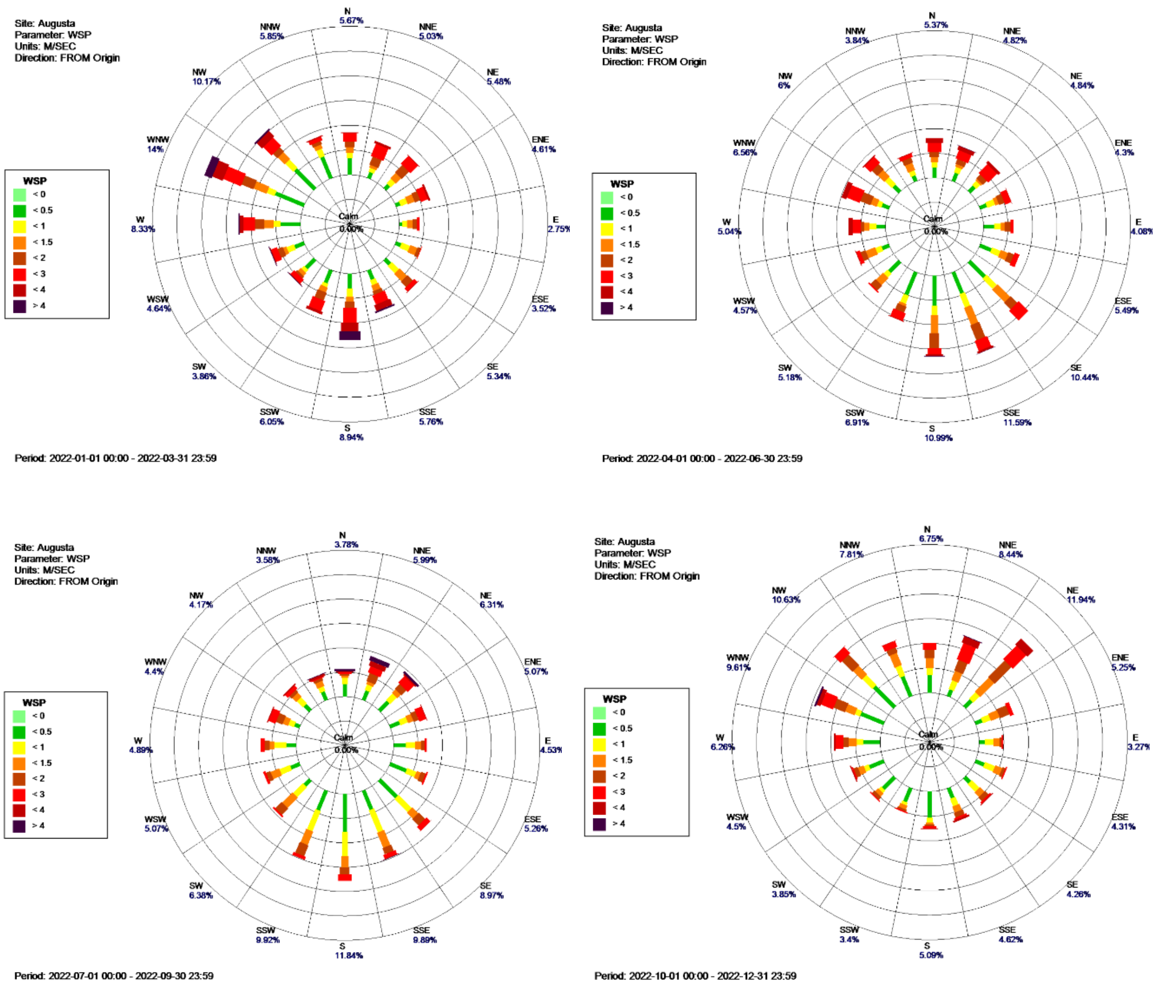
Savannah-L&A, 2021 Annual $PM_{2.5}$



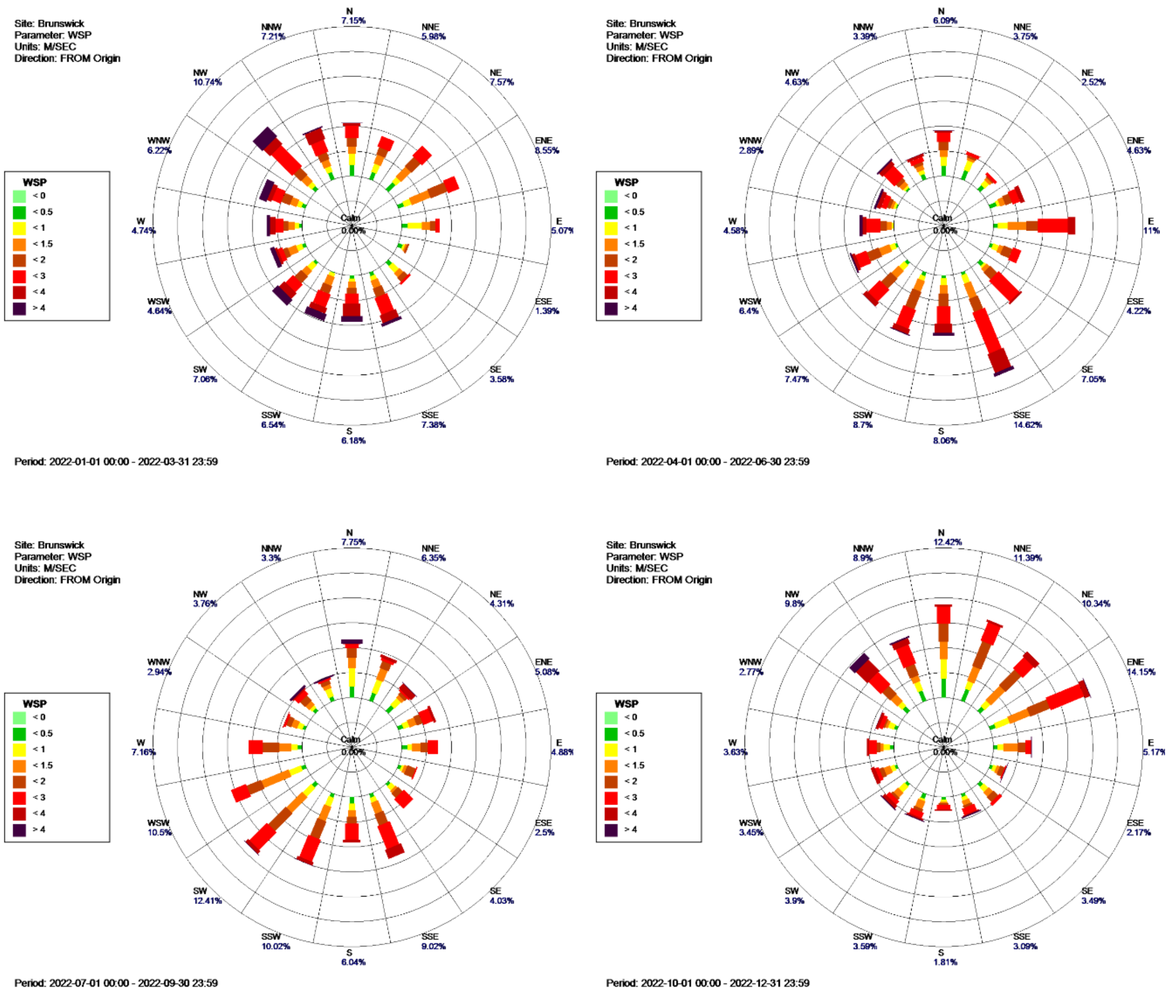
South DeKalb, 2021 Annual $PM_{2.5}$



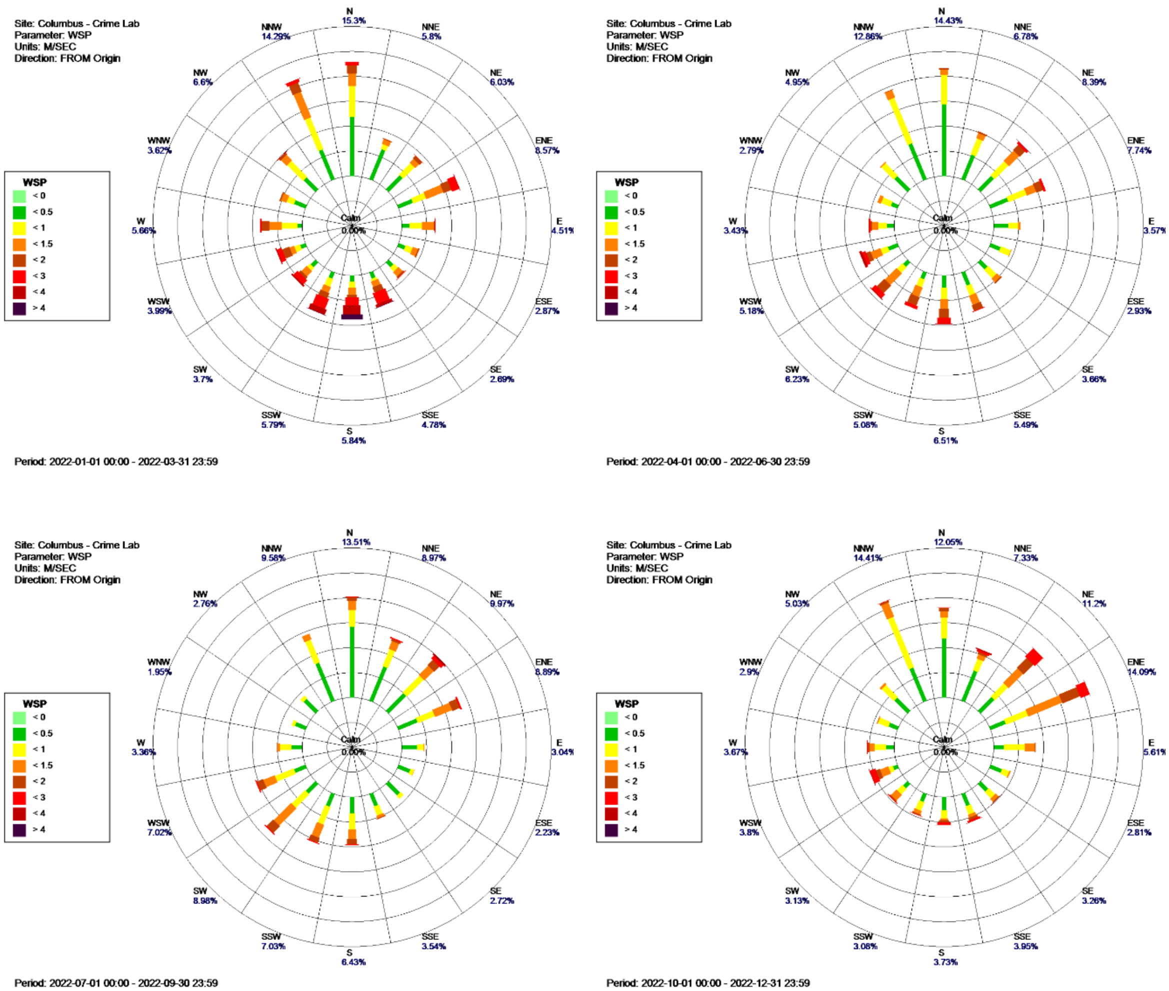
United Ave, 2021 Annual $PM_{2.5}$



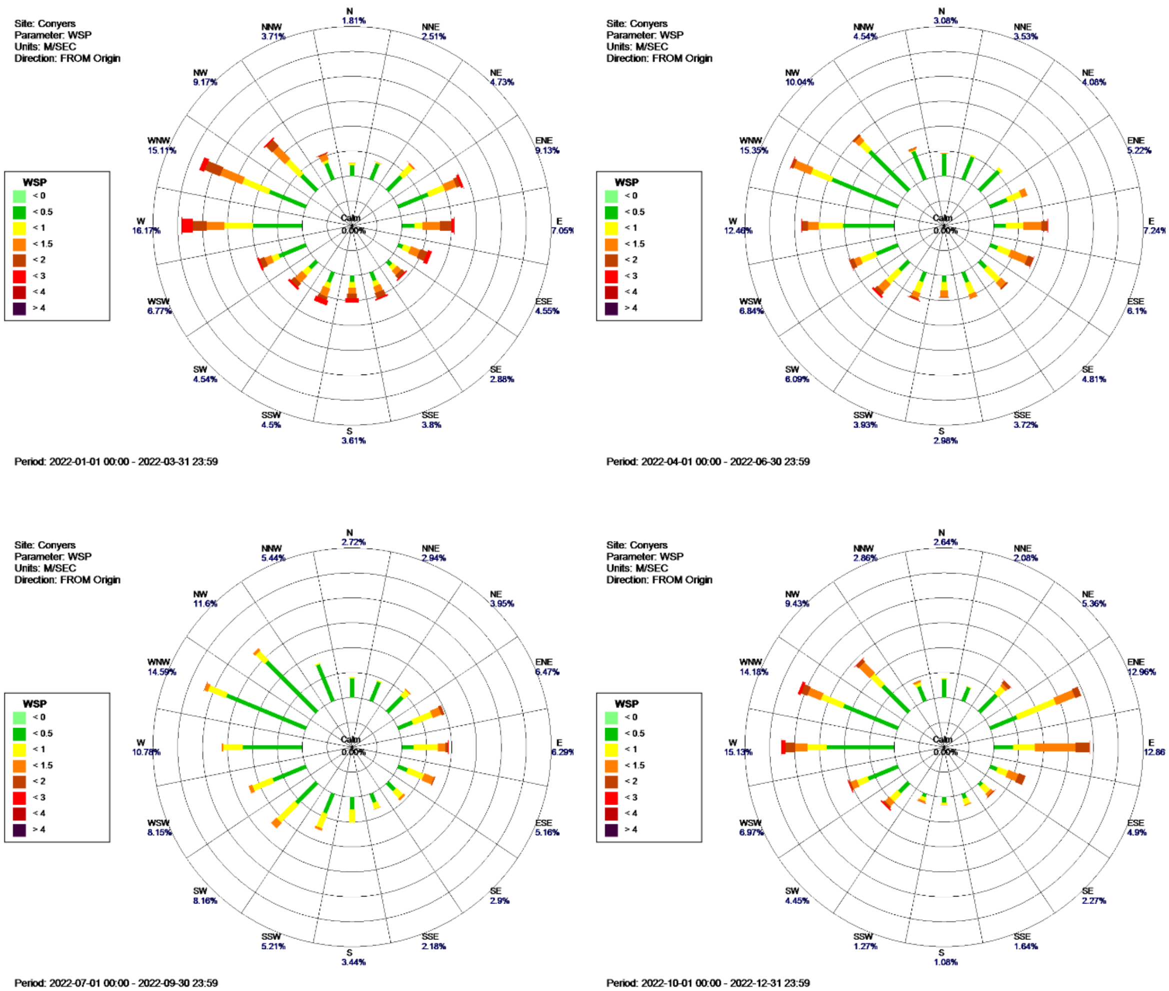
Augusta, 2022 Quarterly Winds



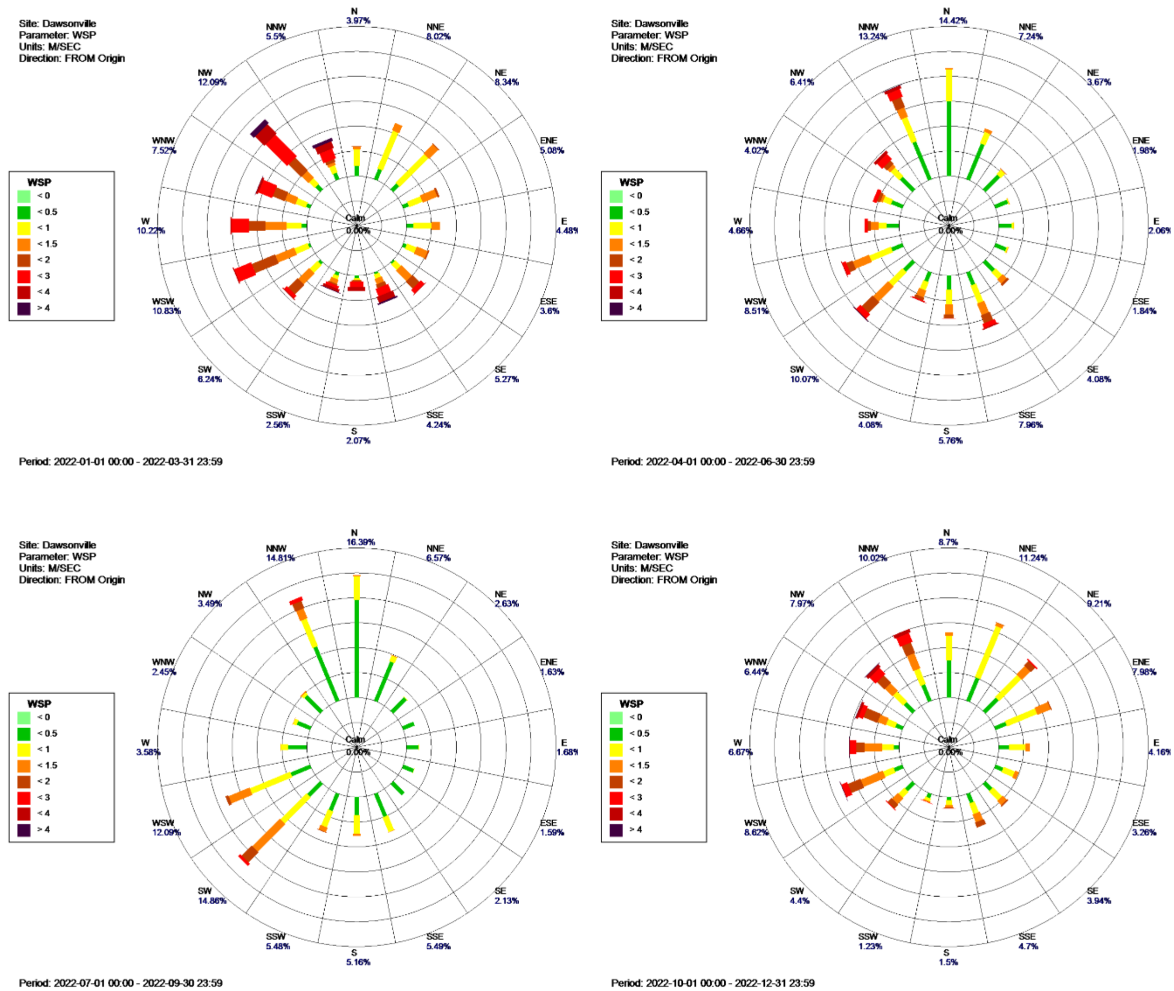
Brunswick, 2022 Quarterly Winds



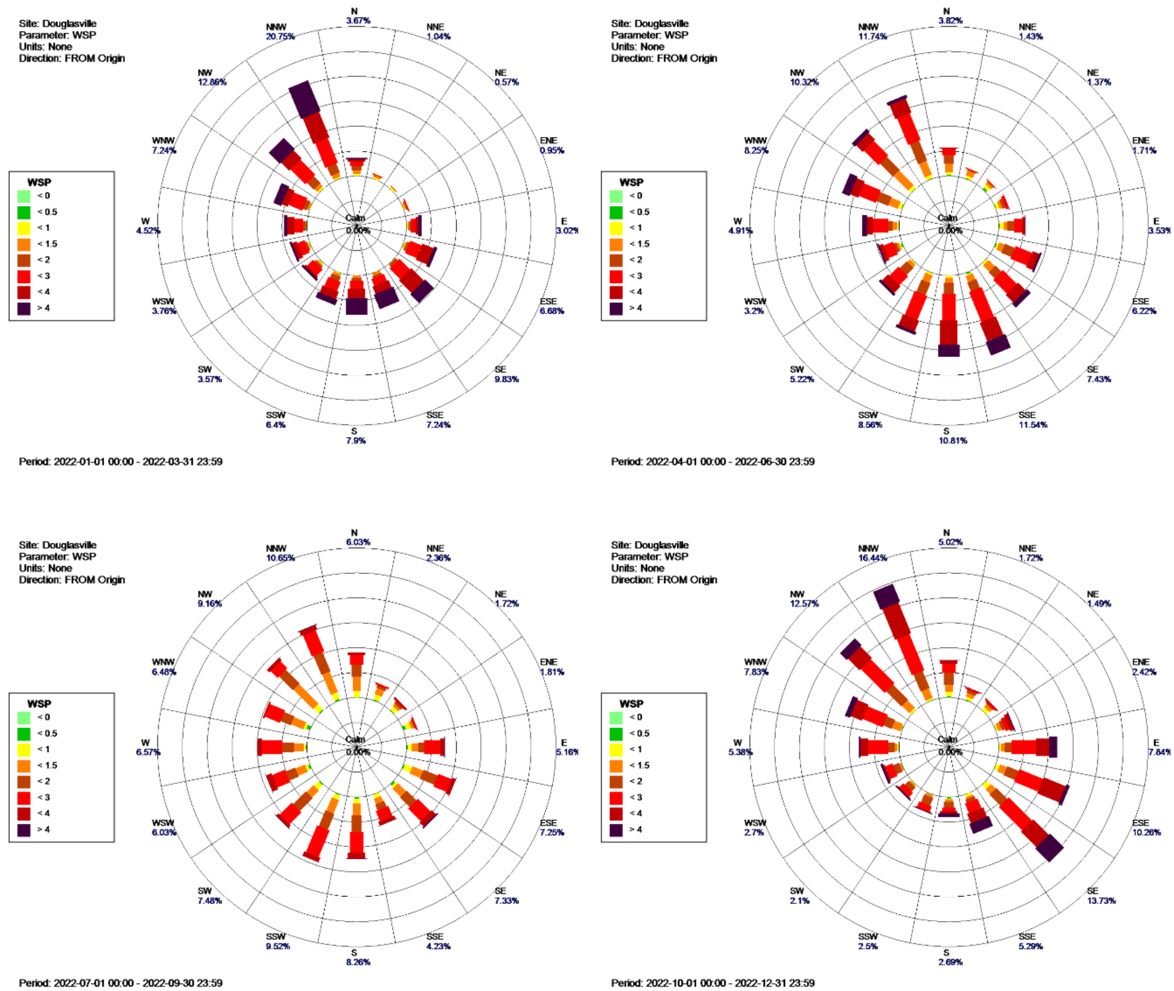
Columbus-Crime Lab, 2022 Quarterly Winds



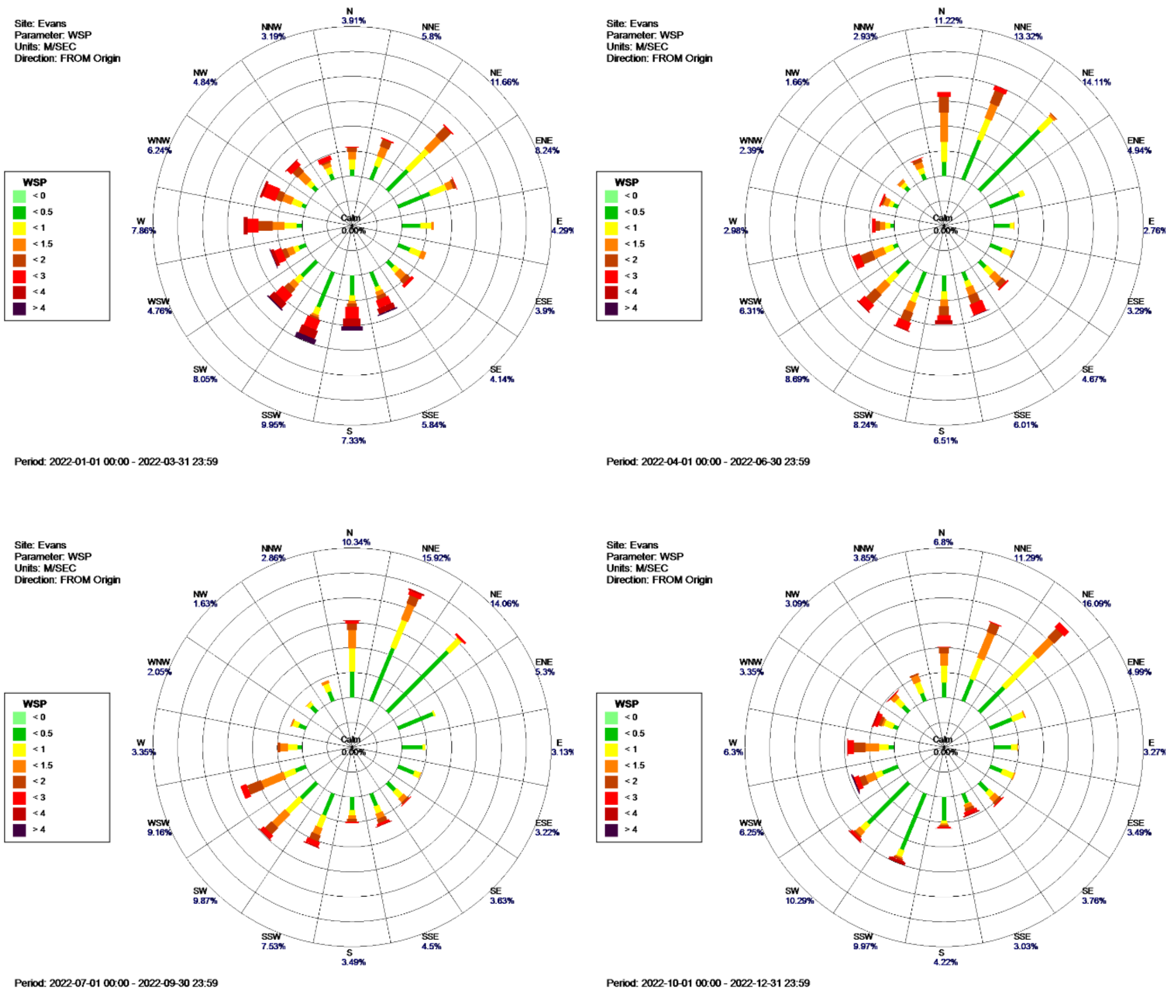
Conyers, 2022 Quarterly Winds



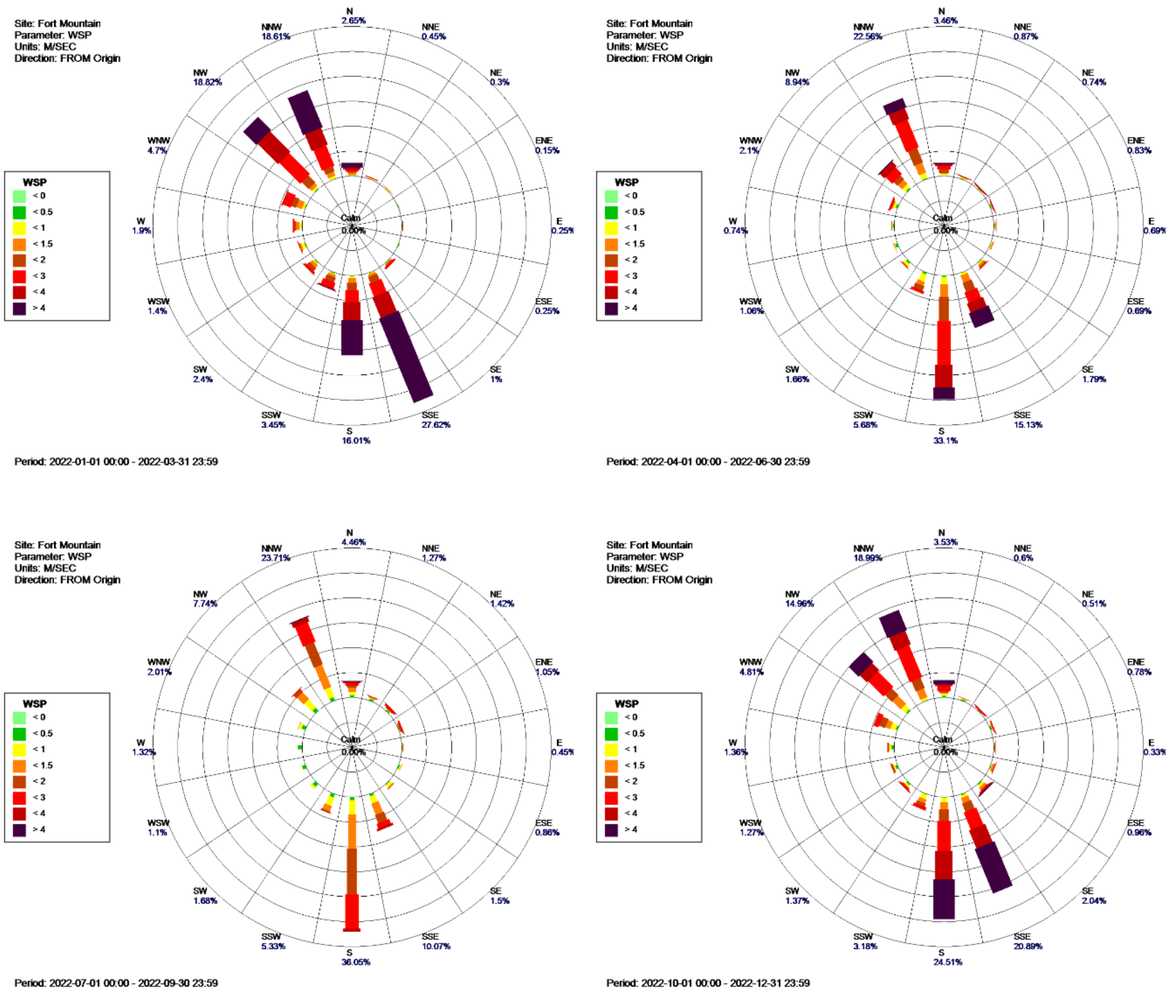
Dawsonville, 2022 Quarterly Winds



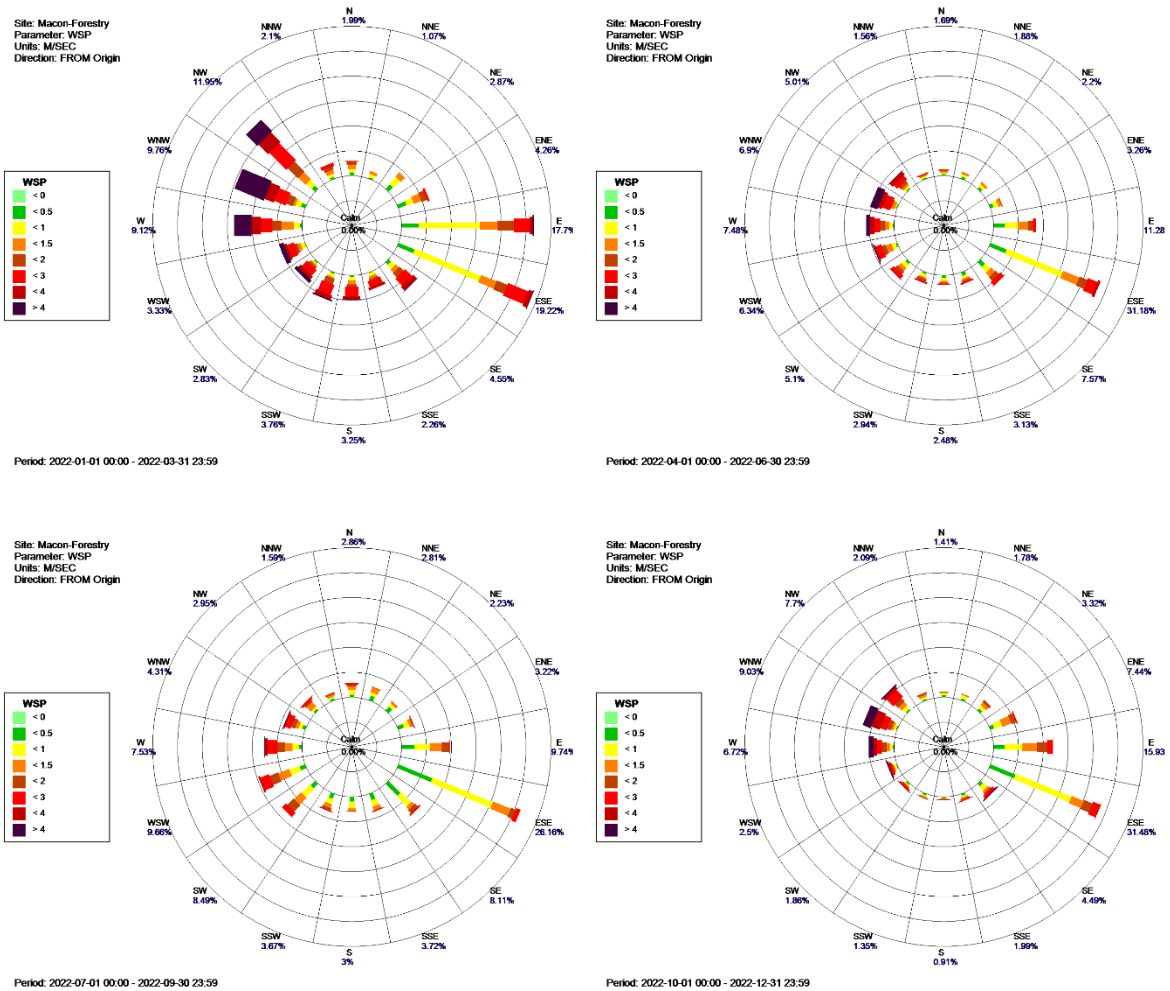
Douglasville, 2022 Quarterly Winds



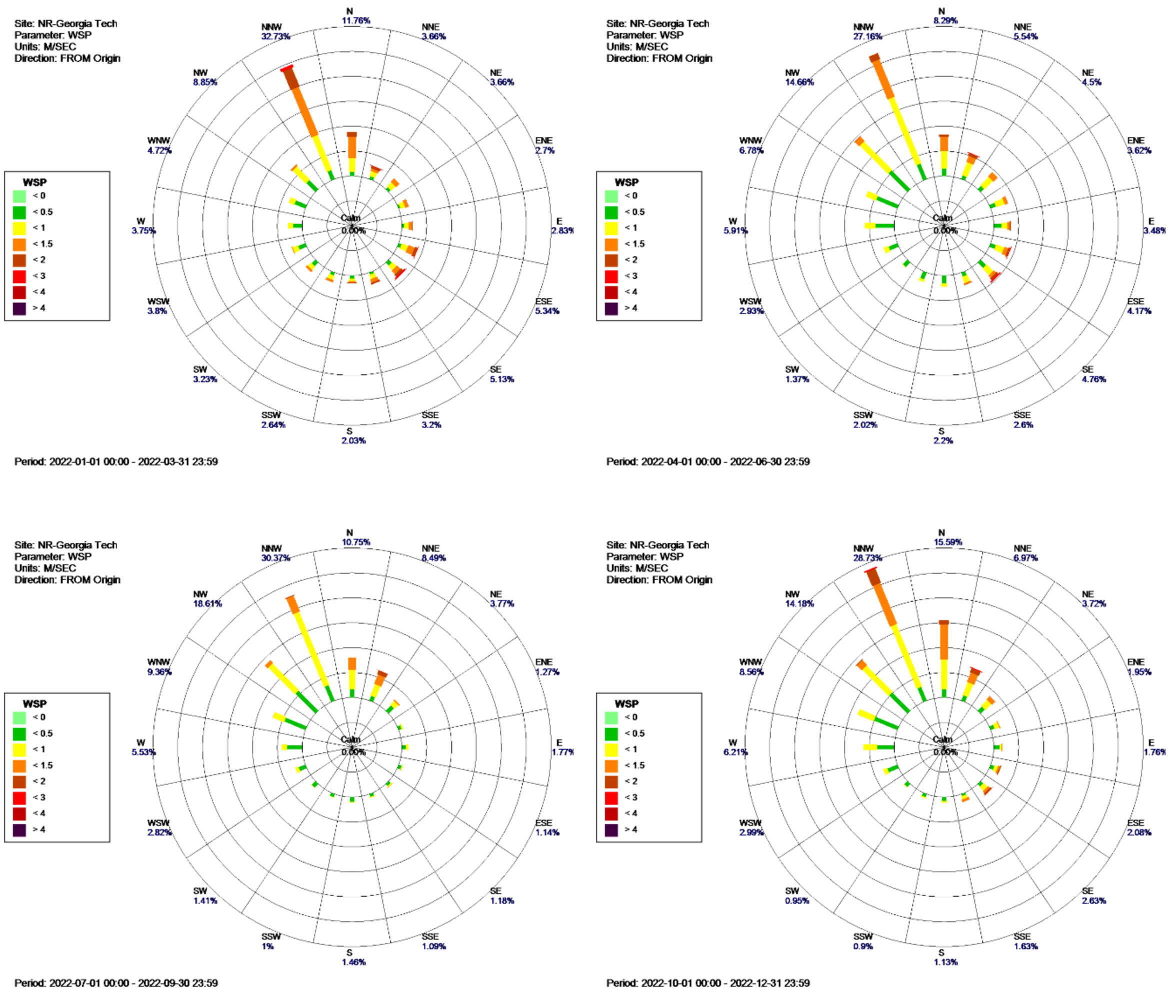
Evans, 2022 Quarterly Winds



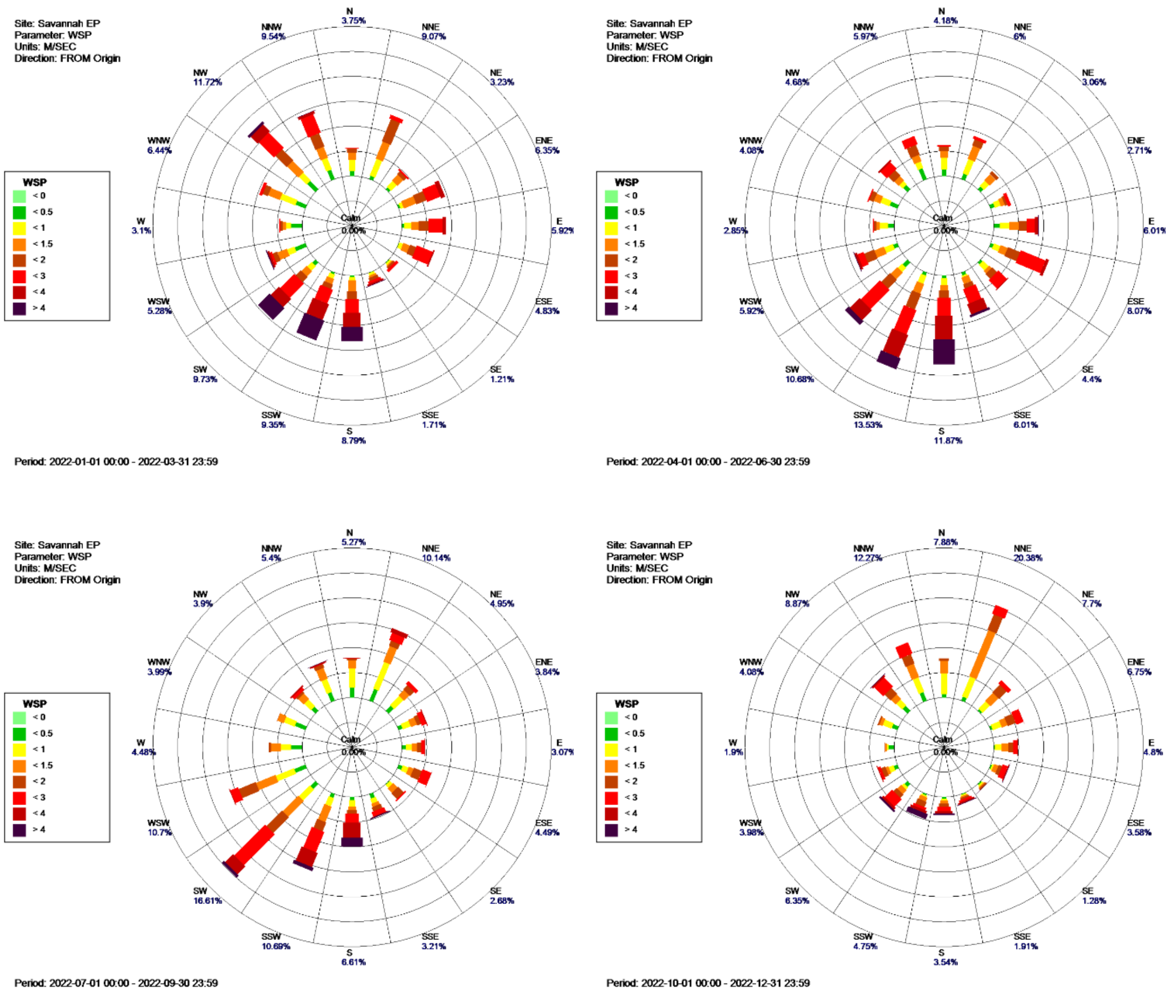
Fort Mountain, 2022 Quarterly Winds



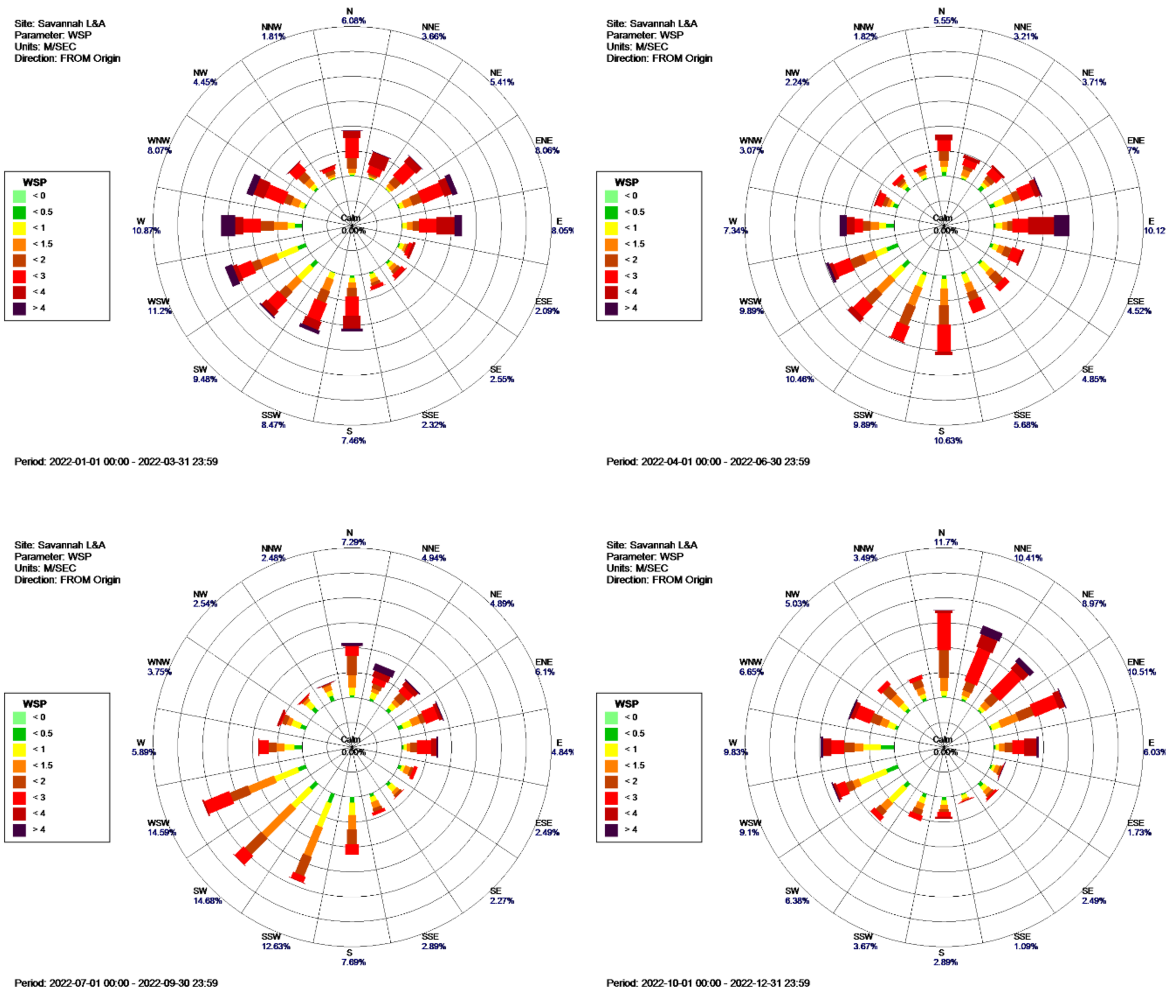
Macon-Forestry, 2022 Quarterly Winds



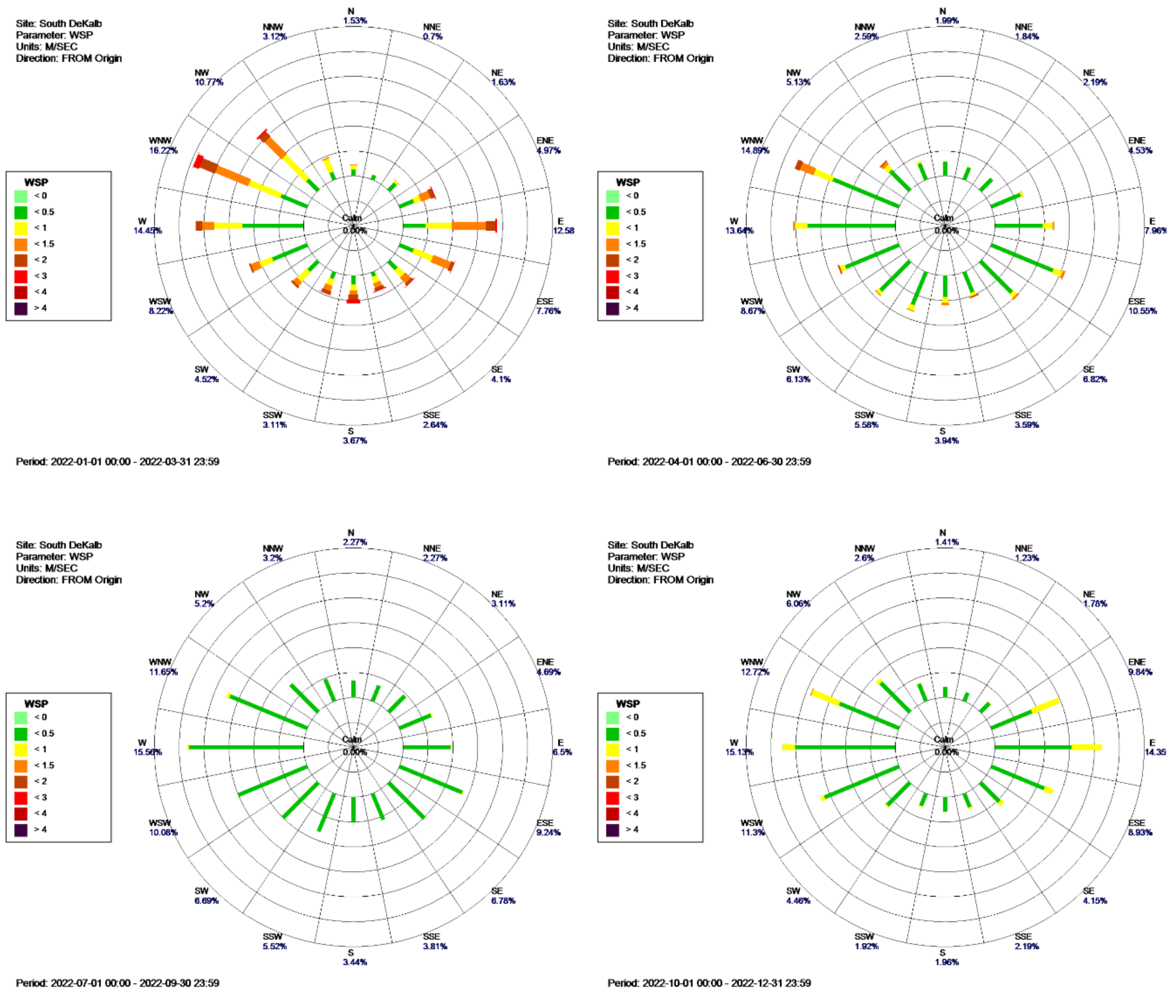
NR-GA Tech, 2022 Quarterly Winds



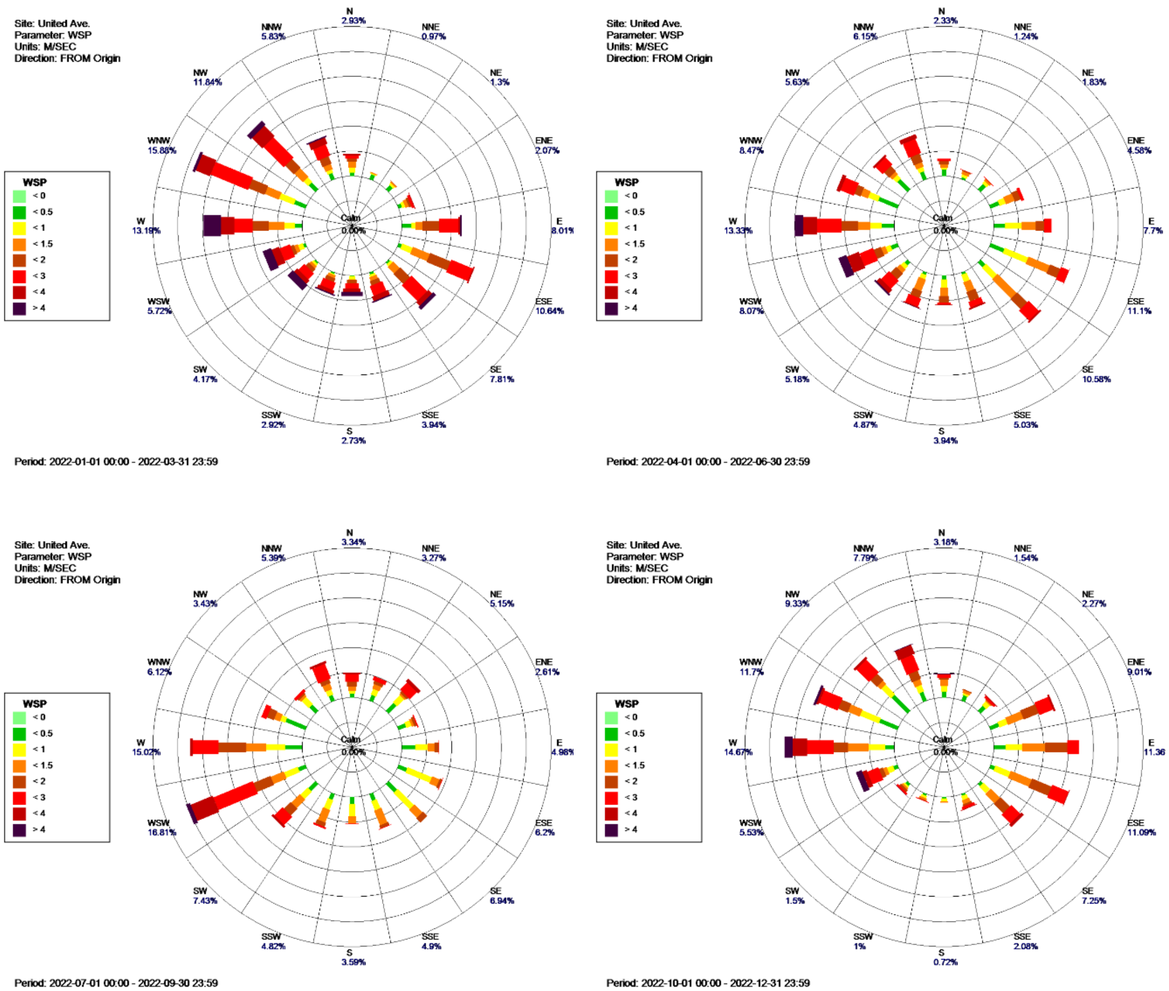
Savannah- E President, 2022 Quarterly Winds



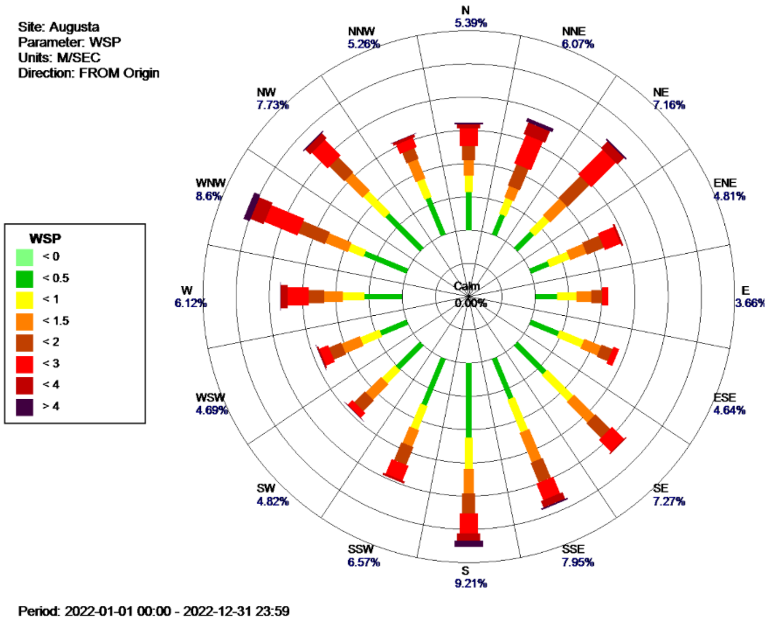
Savannah- L&A, 2022 Quarterly Winds



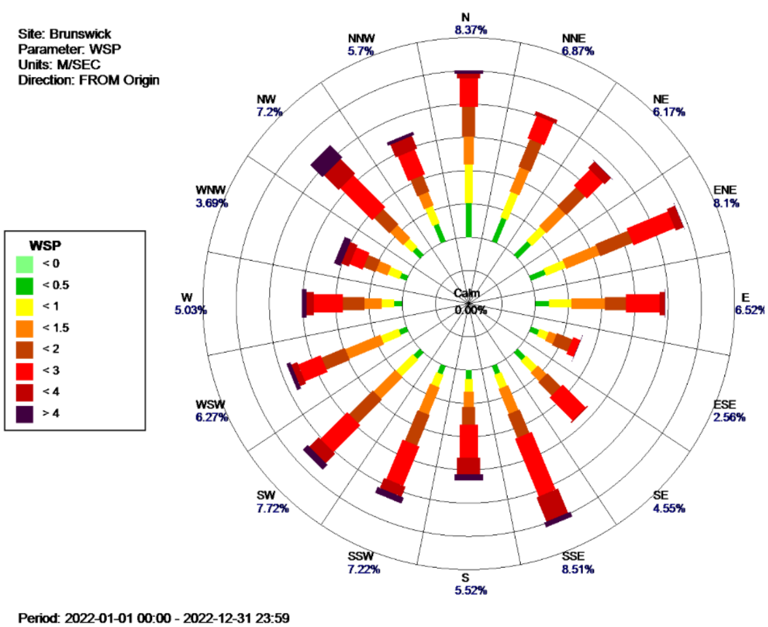
South DeKalb, 2022 Quarterly Winds



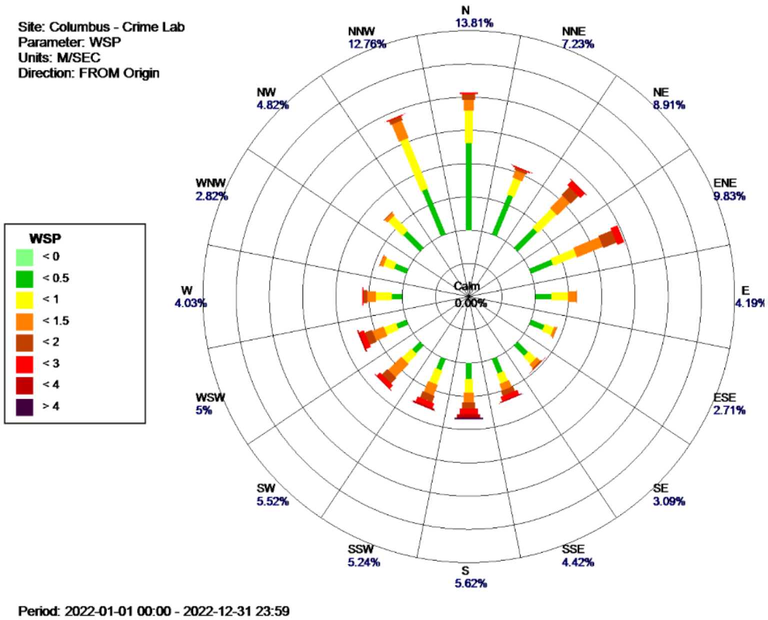
United Ave, 2022 Quarterly Winds



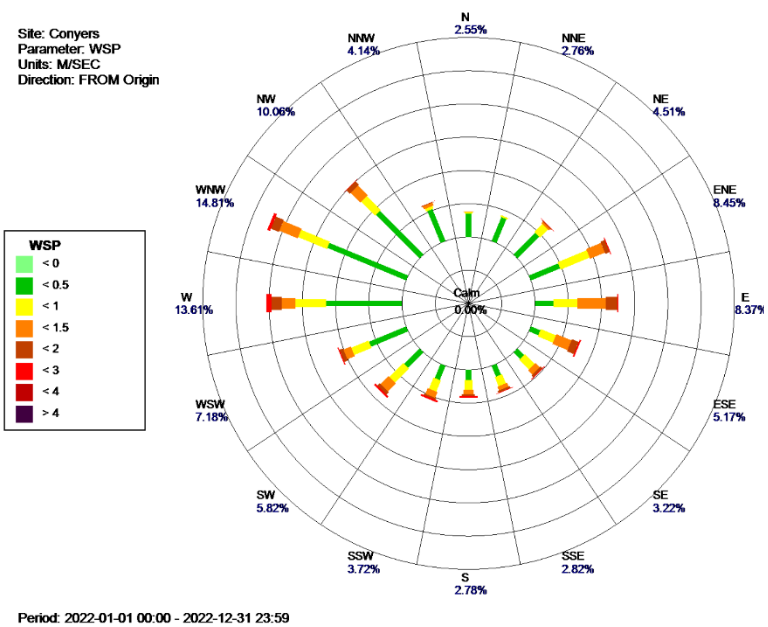
Augusta, 2022 Annual Winds



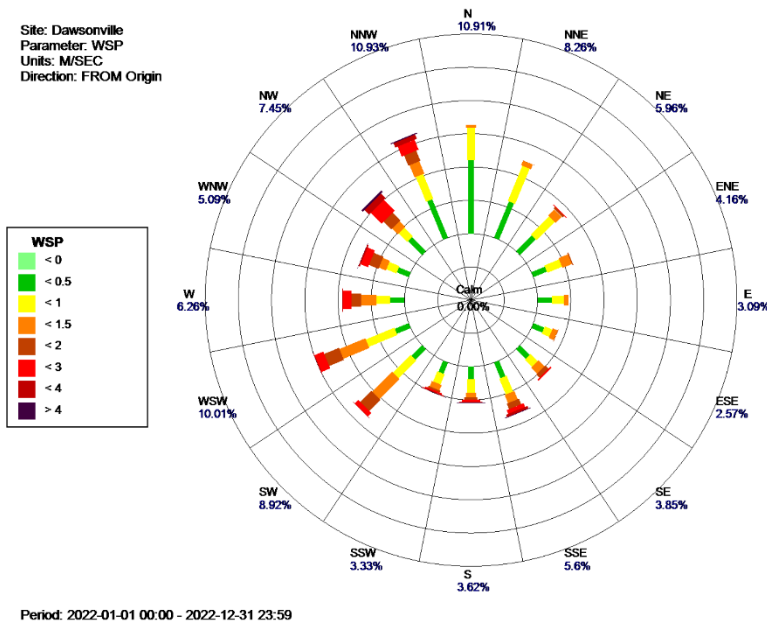
Brunswick, 2022 Annual Winds



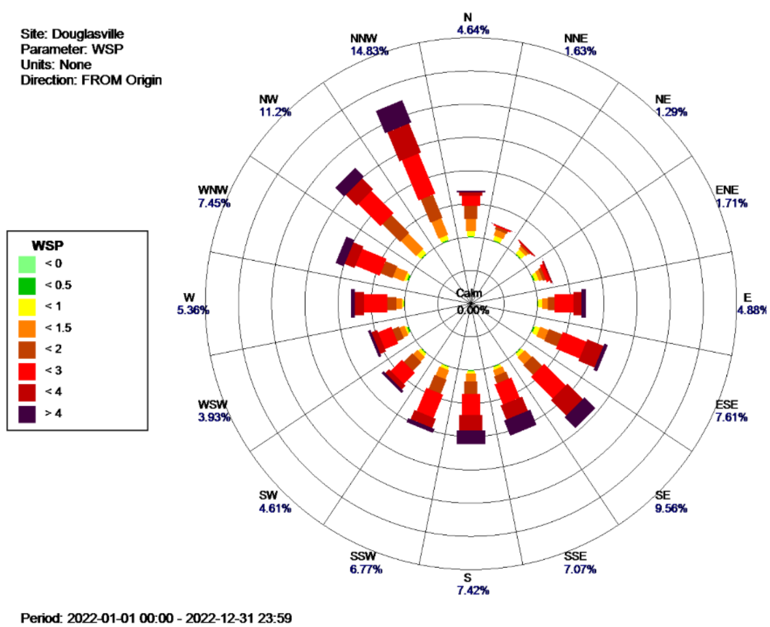
Columbus-Crime Lab, 2022 Annual Winds



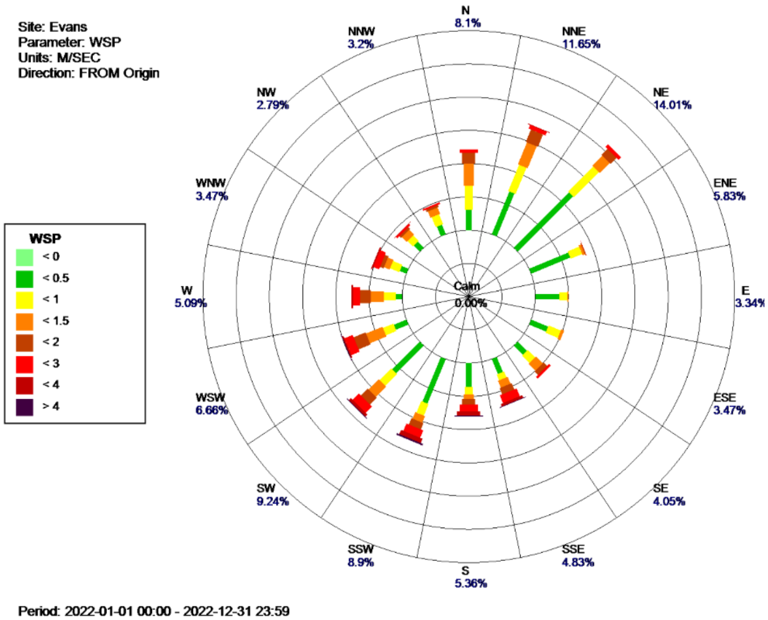
Conyers, 2022 Annual Winds



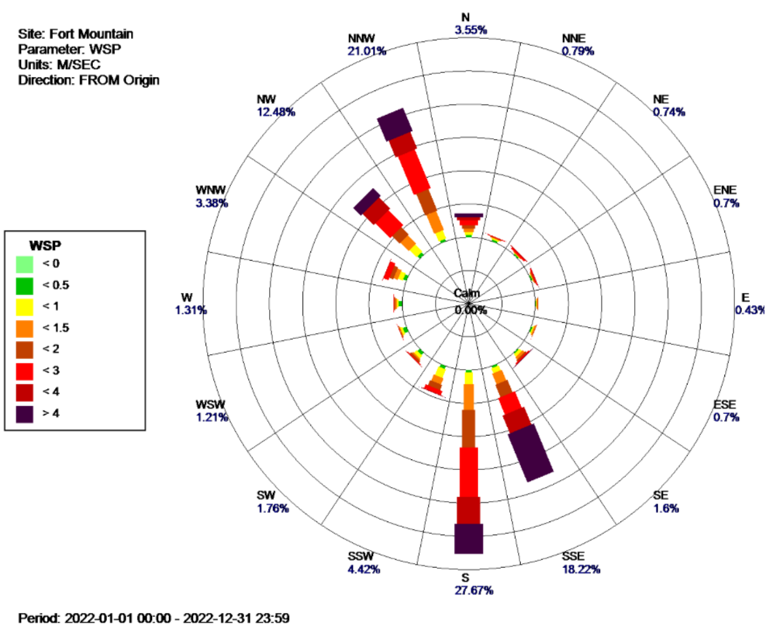
Dawsonville, 2022 Annual Winds



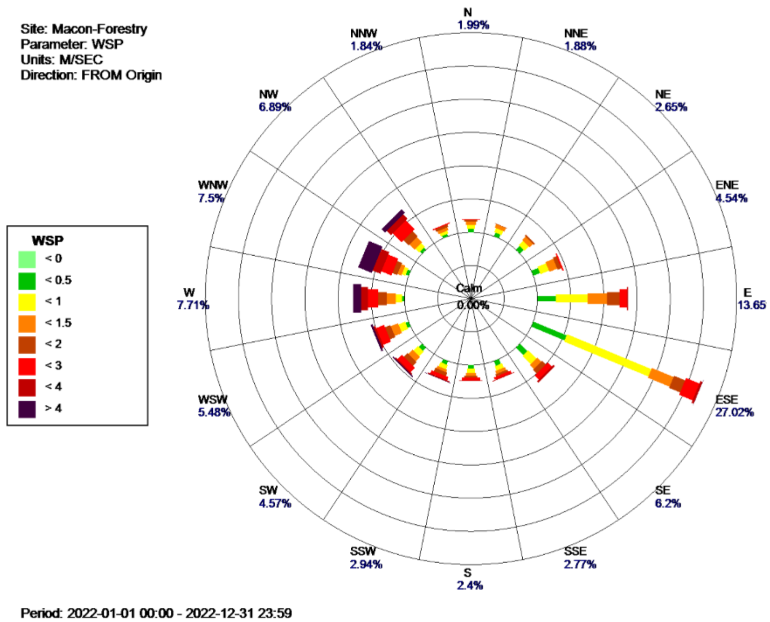
Douglasville, 2022 Annual Winds



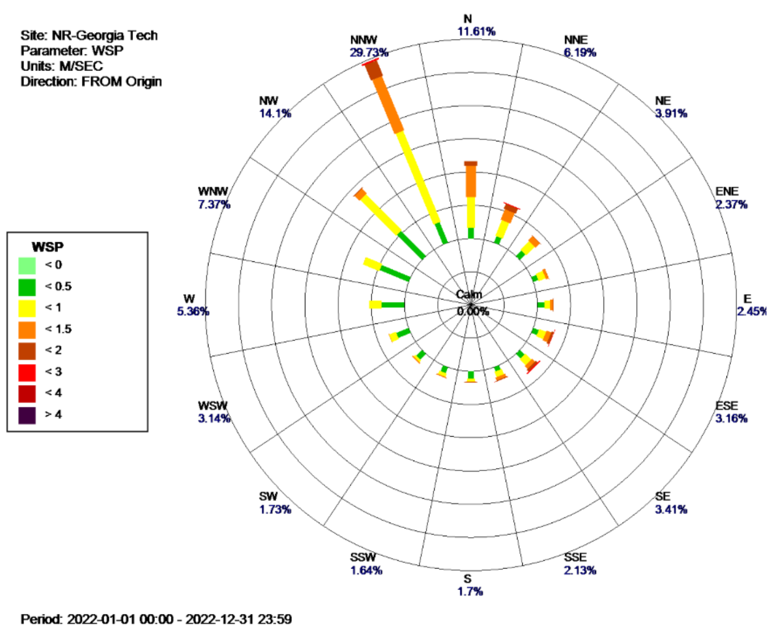
Evans, 2022 Annual Winds



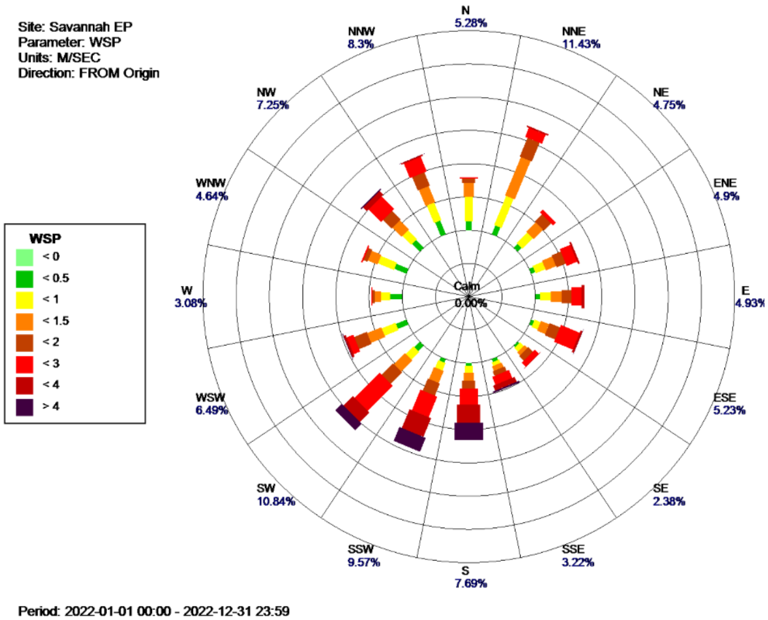
Fort Mountain, 2022 Annual Winds



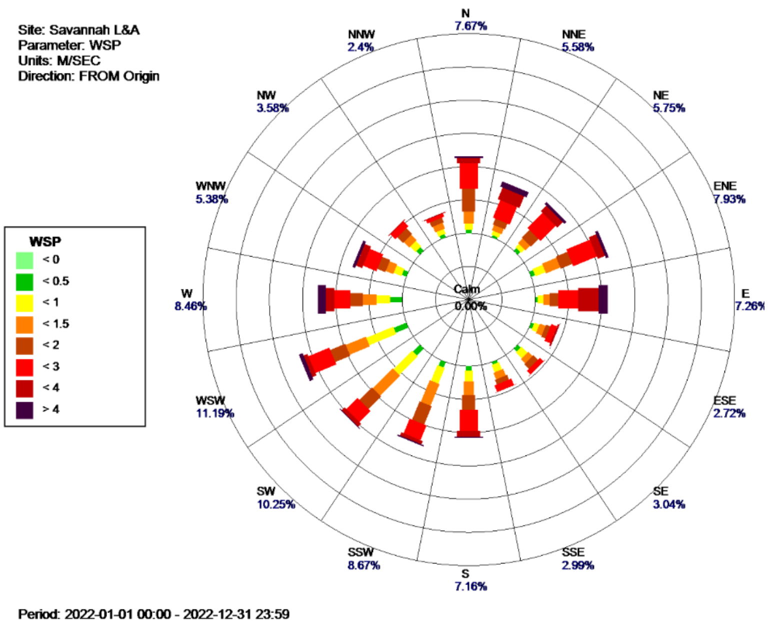
Macon-Forestry, 2022 Annual Winds



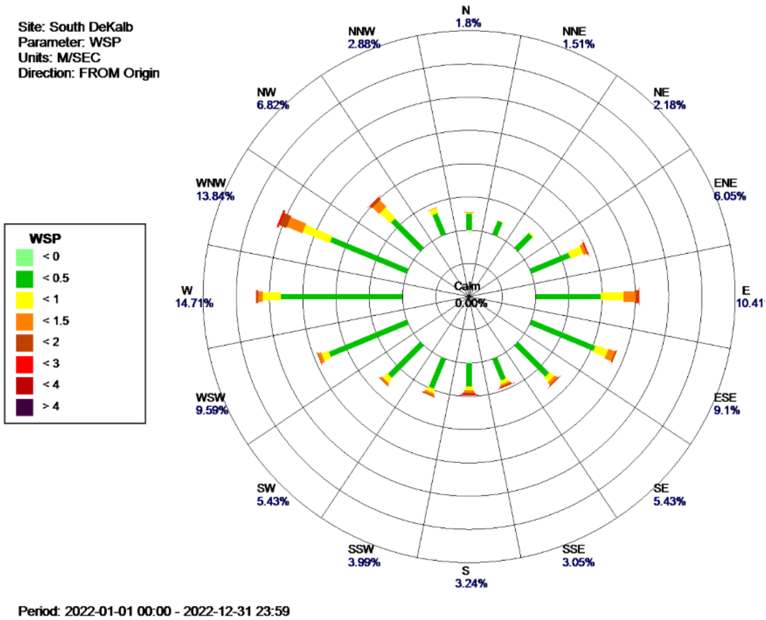
NR-GA Tech, 2022 Annual Winds



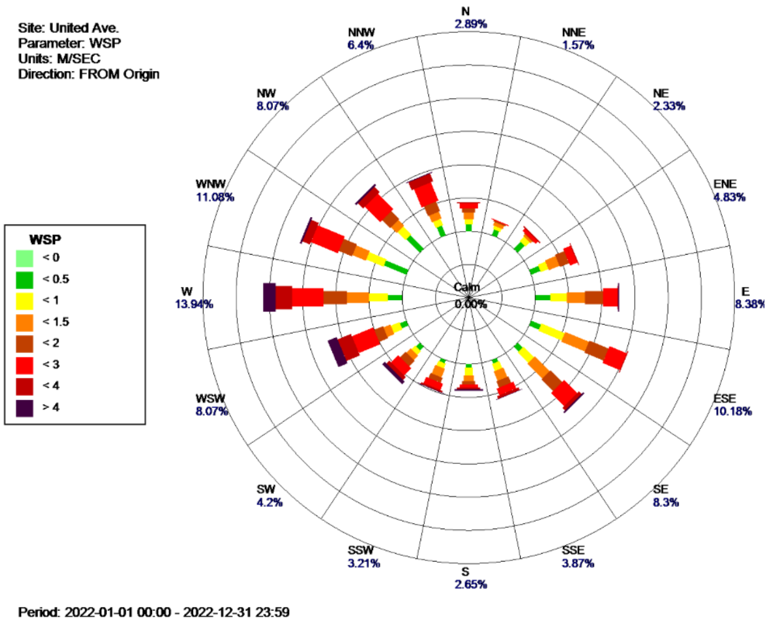
Savannah- E President, 2022 Annual Winds



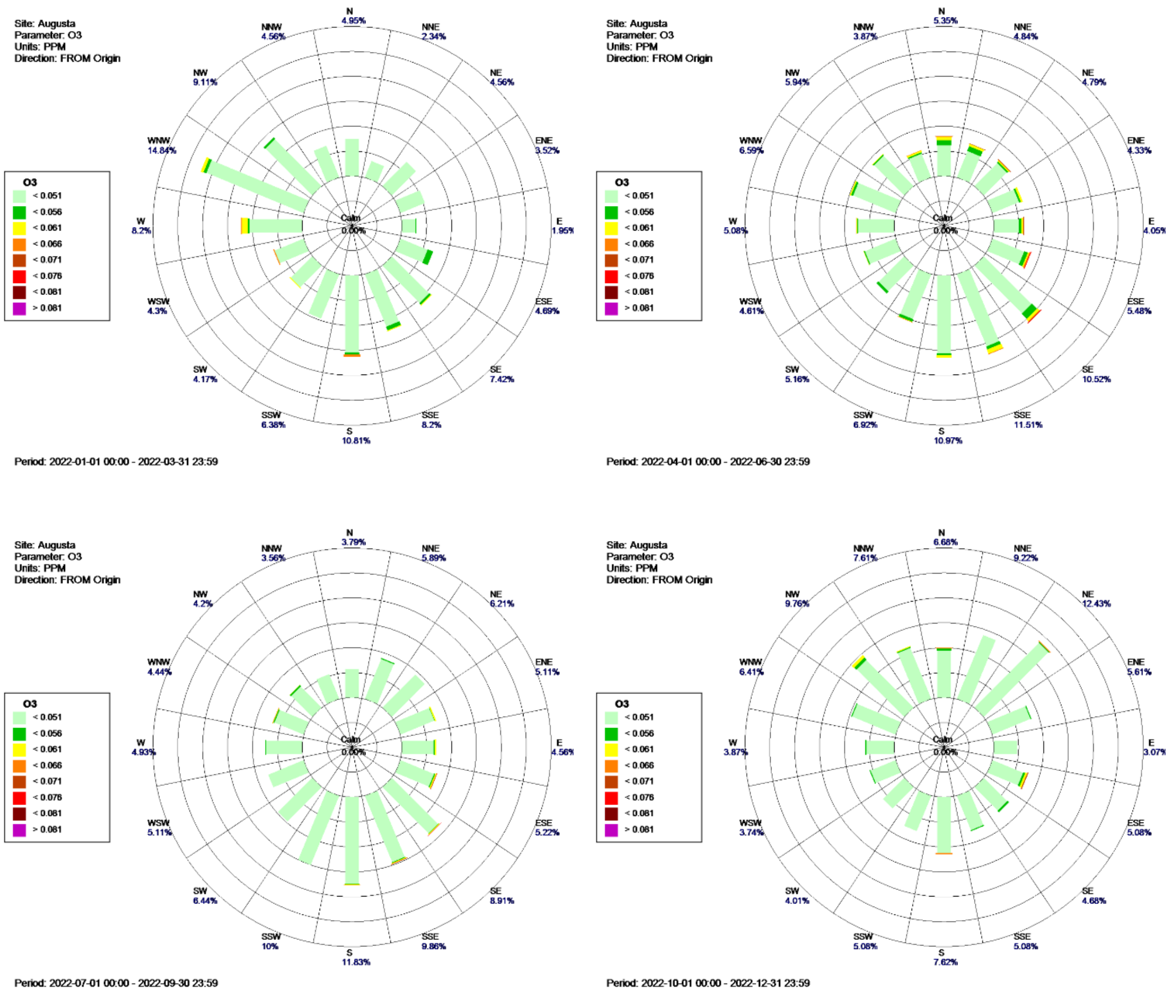
Savannah- L&A, 2022 Annual Winds



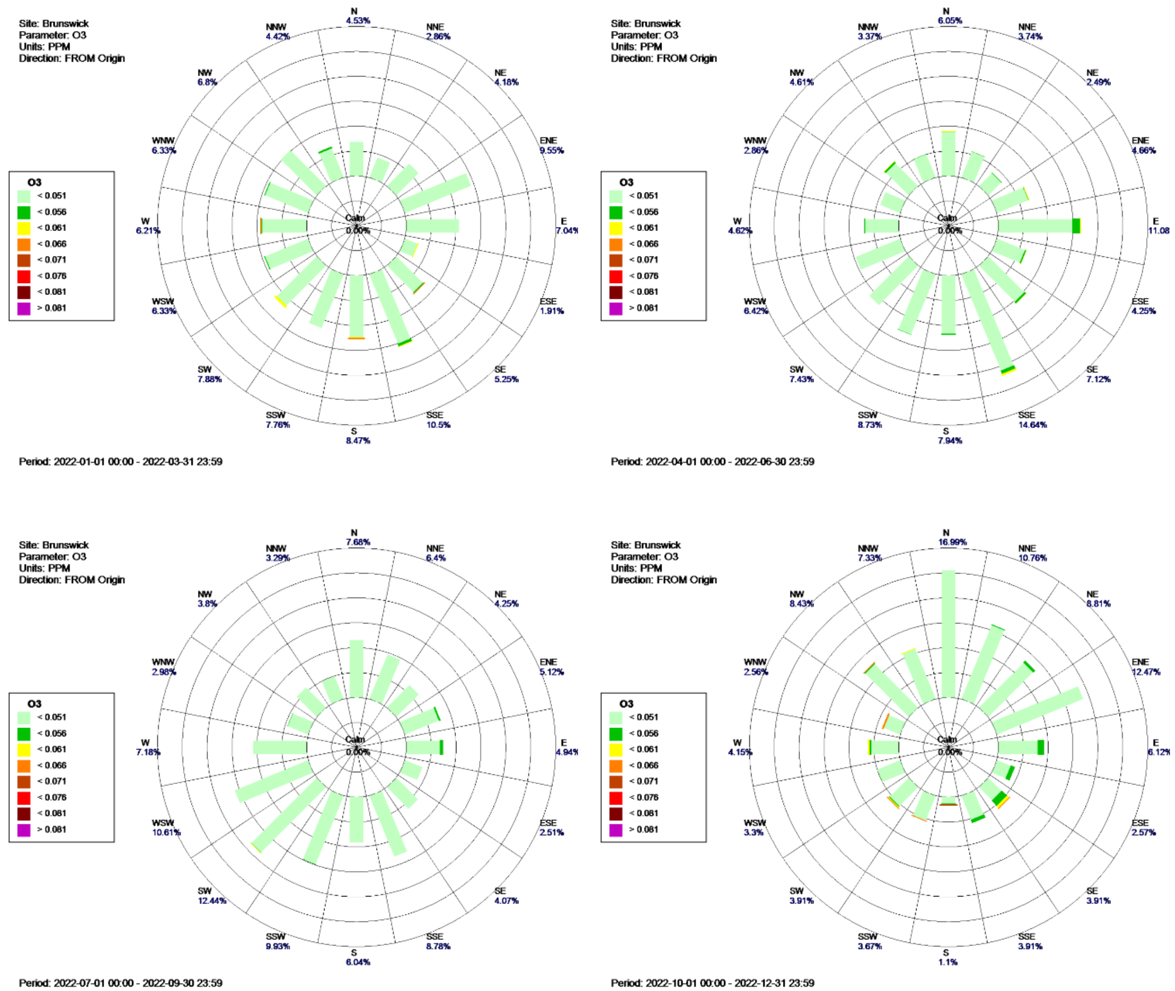
South DeKalb, 2022 Annual Winds



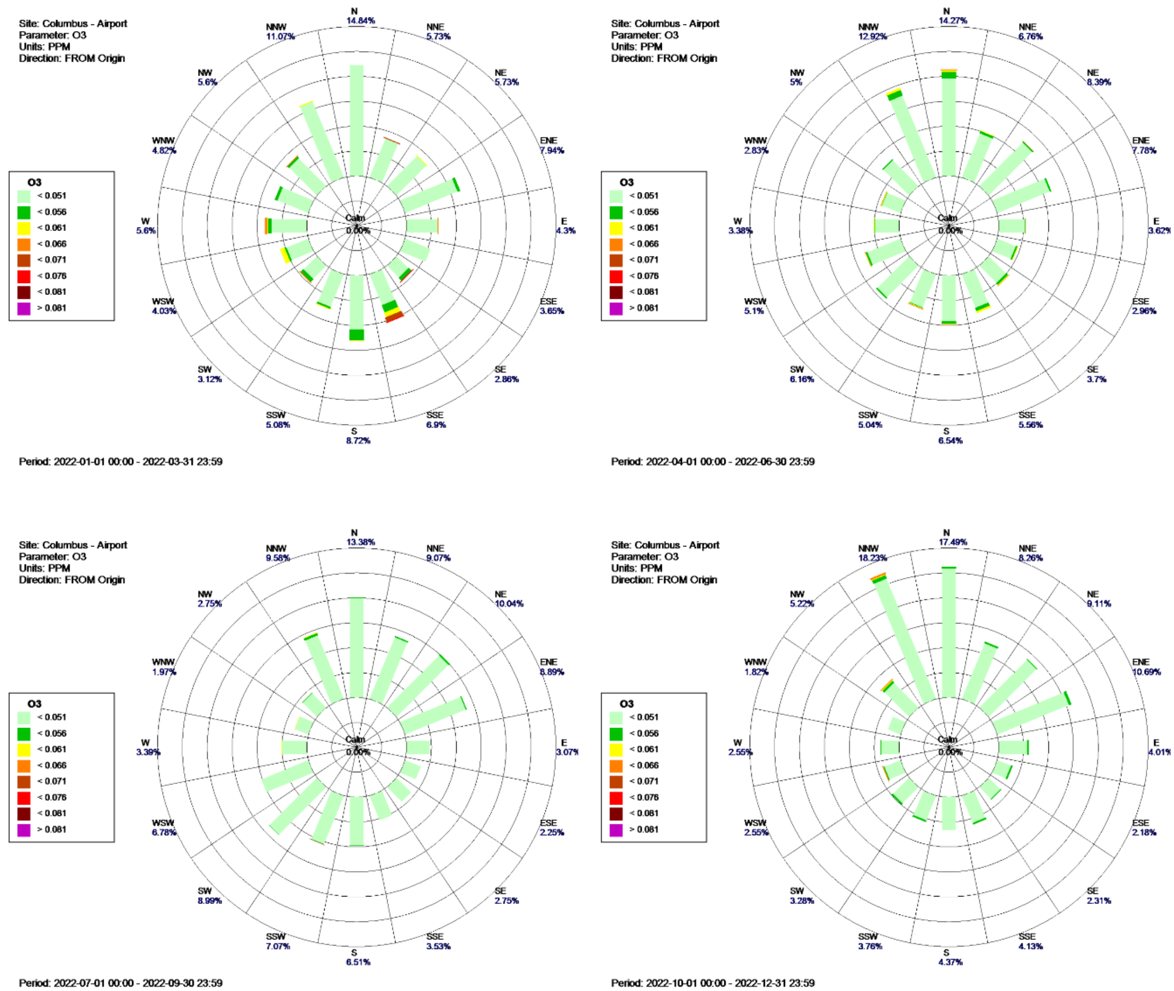
United Ave, 2022 Annual Winds



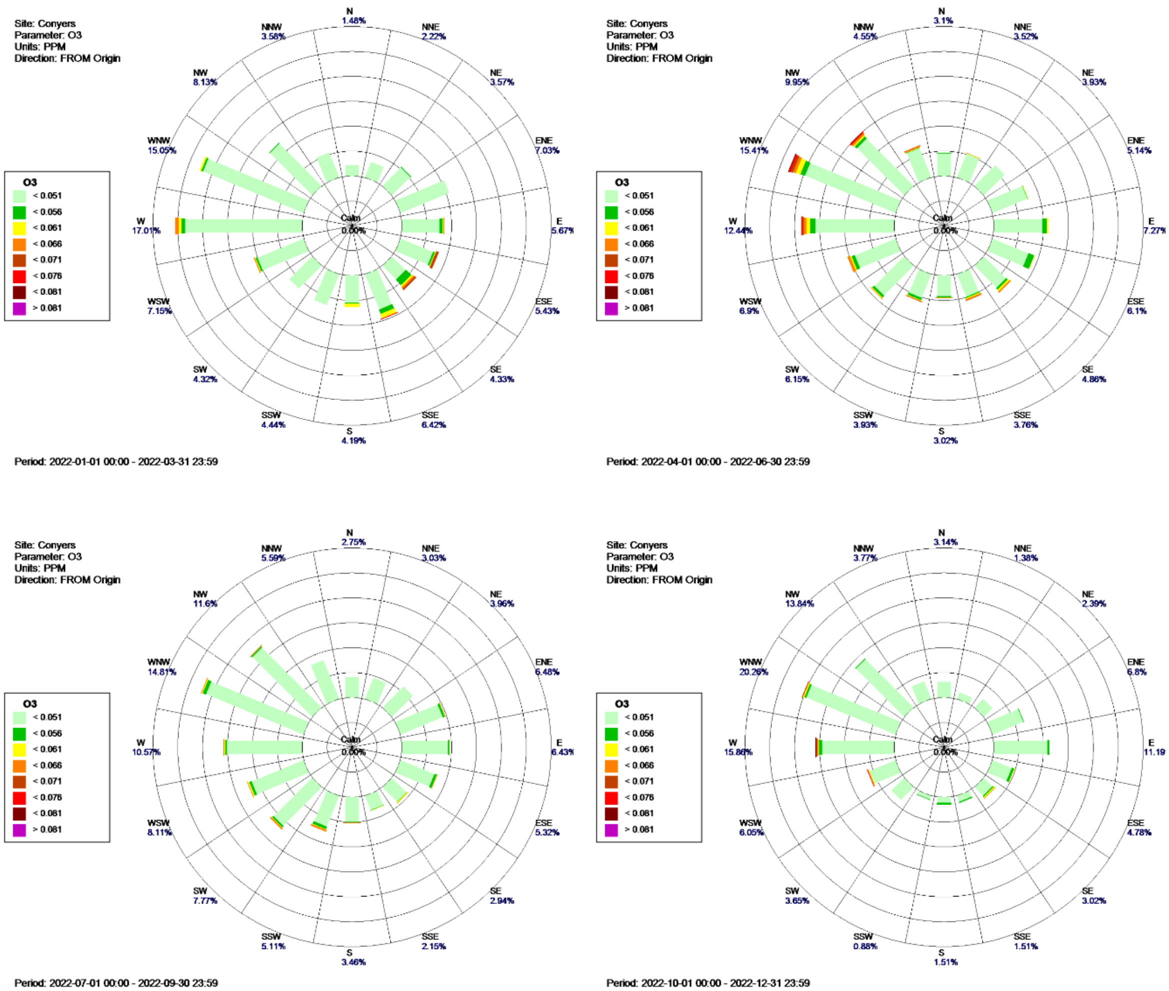
Augusta, 2022 Quarterly Ozone



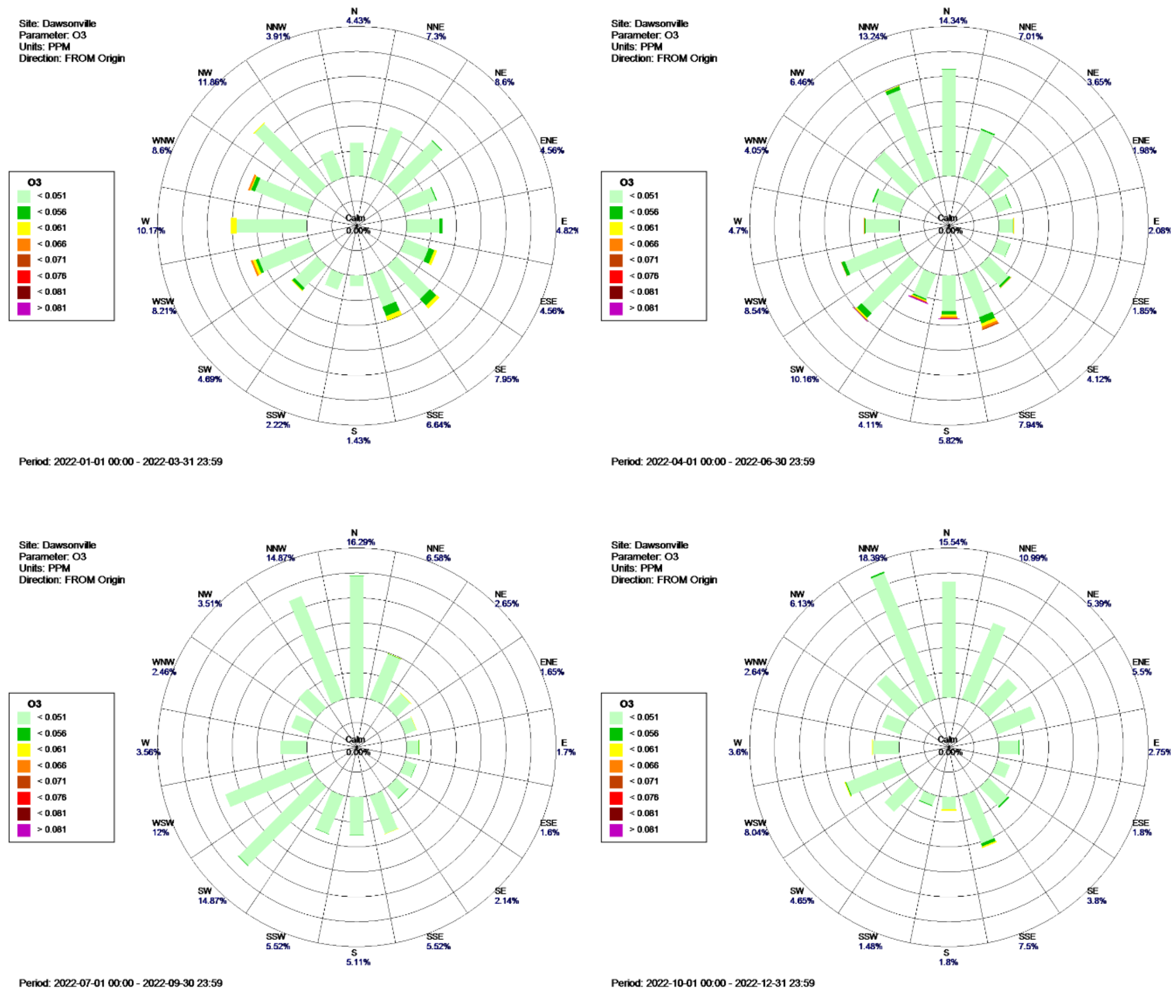
Brunswick, 2022 Quarterly Ozone



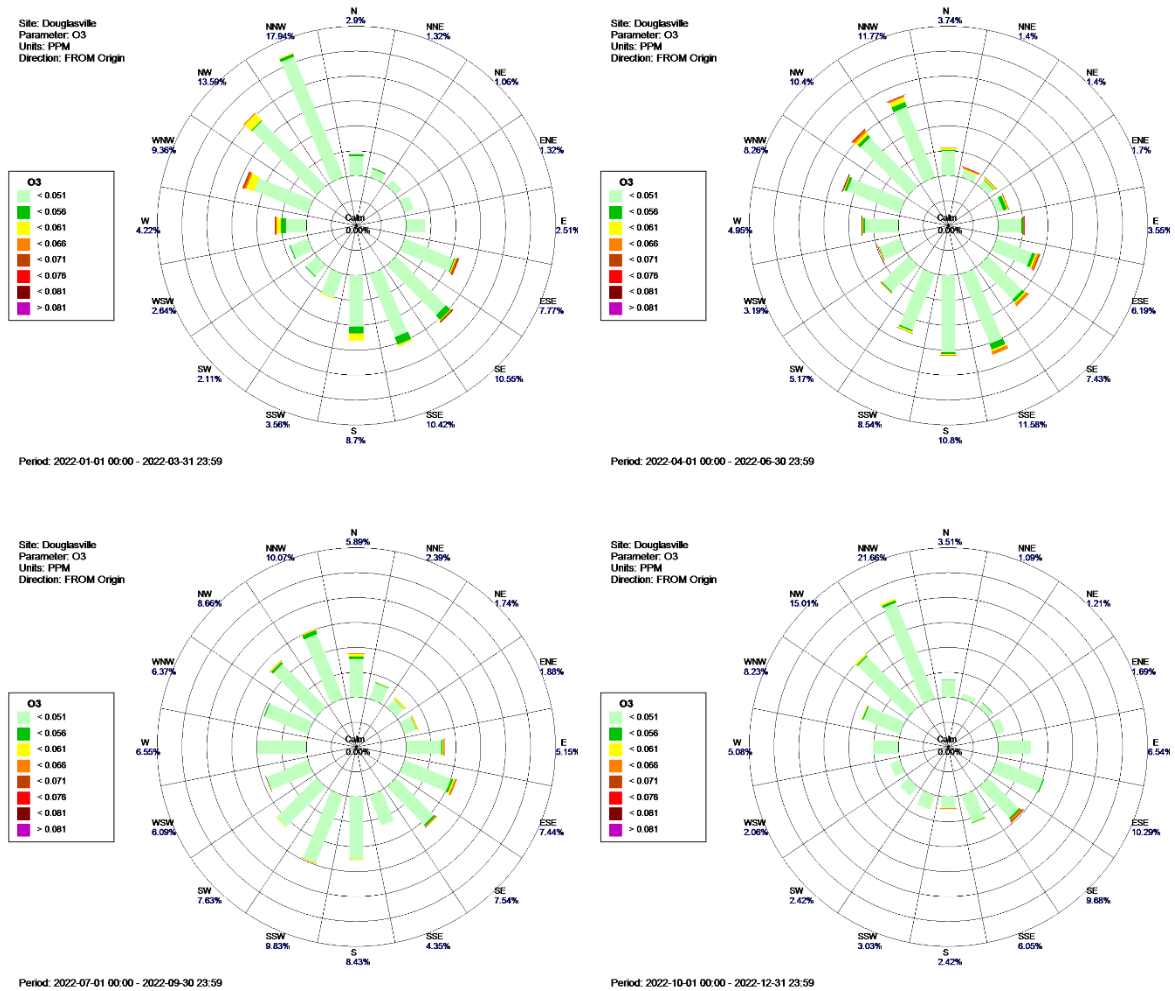
Columbus-Airport, 2022 Quarterly Ozone



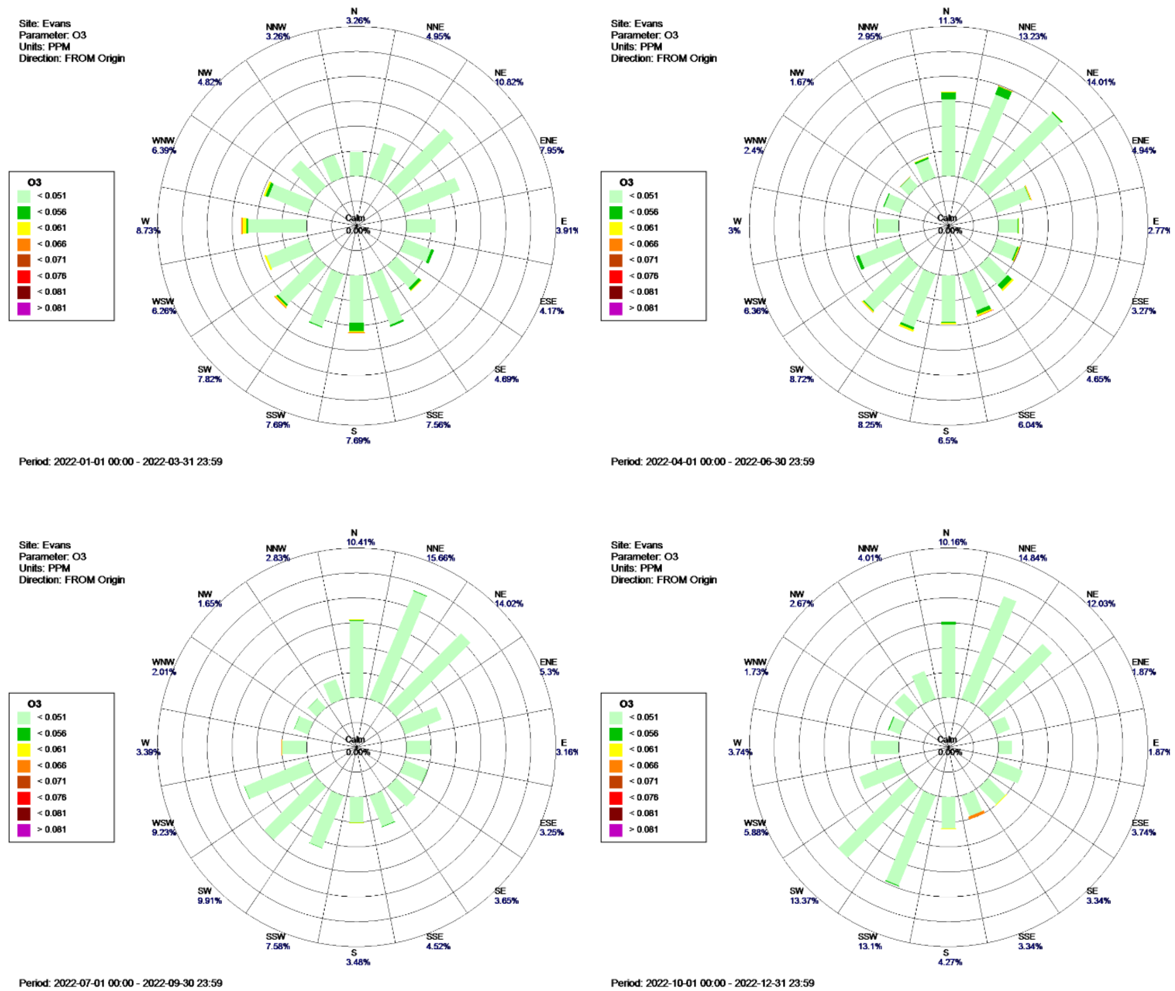
Conyers, 2022 Quarterly Ozone



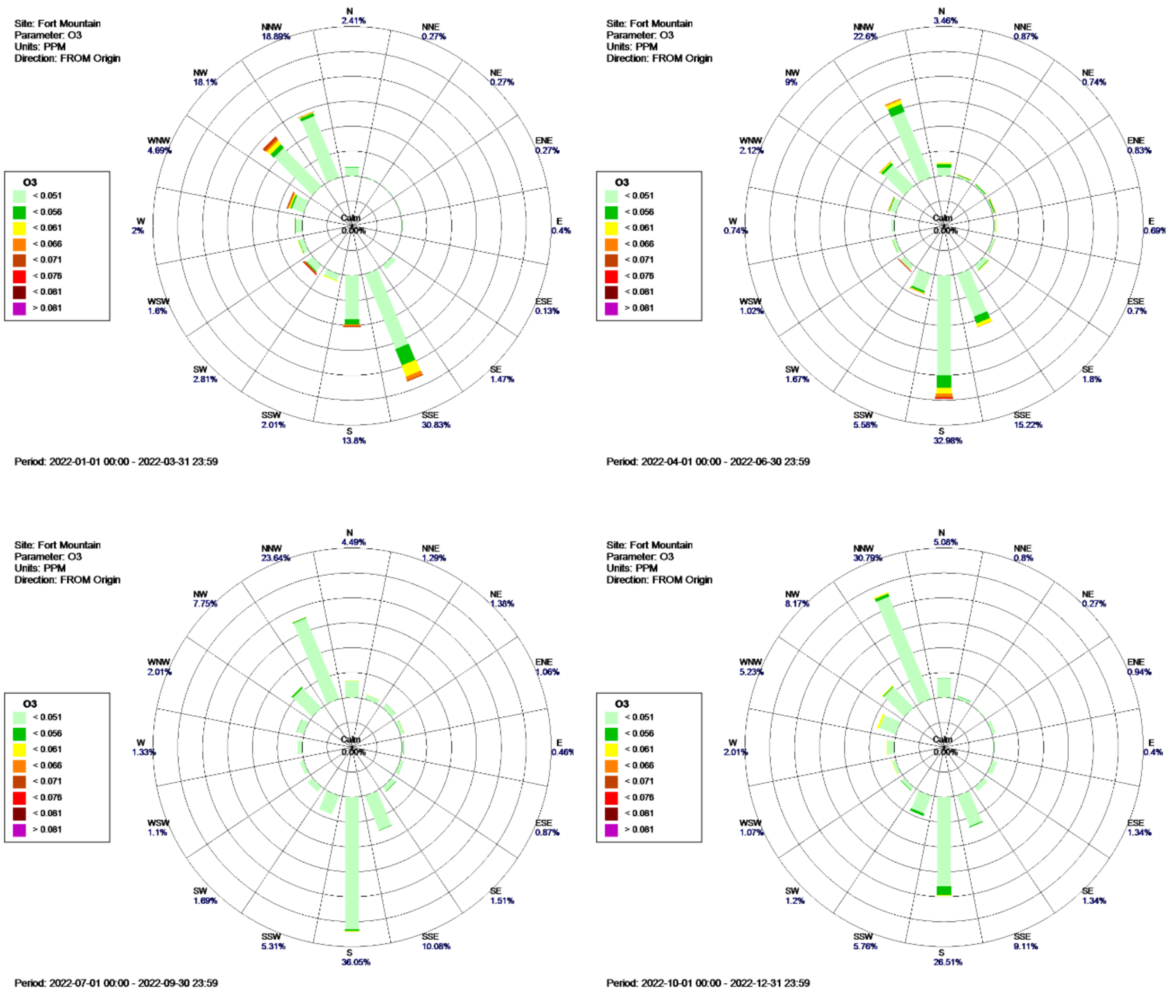
Dawsonville, 2022 Quarterly Ozone



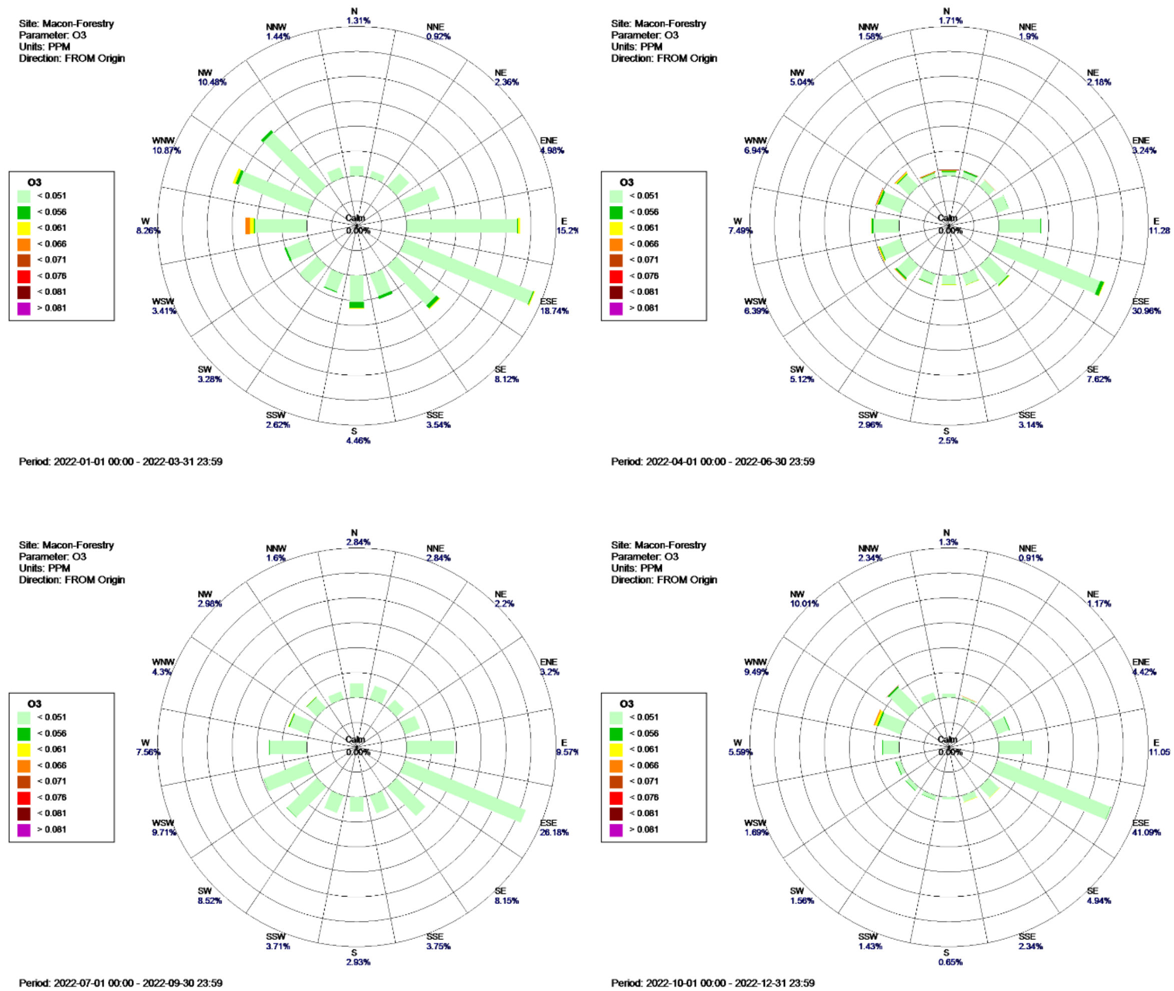
Douglasville, 2022 Quarterly Ozone



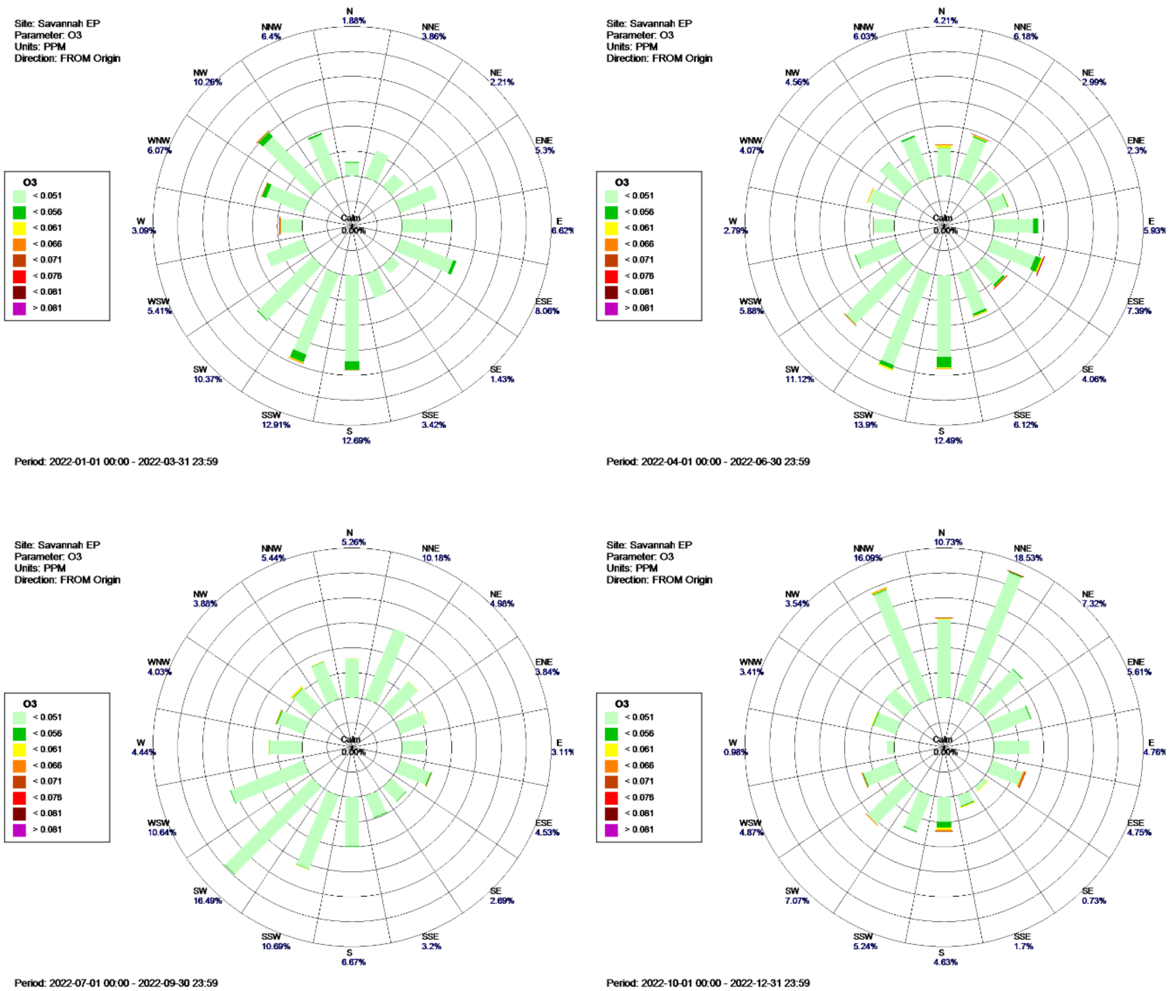
Evans, 2022 Quarterly Ozone



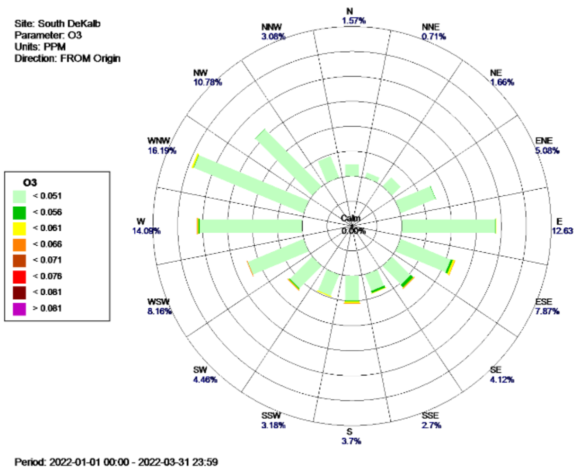
Fort Mountain, 2022 Quarterly Ozone

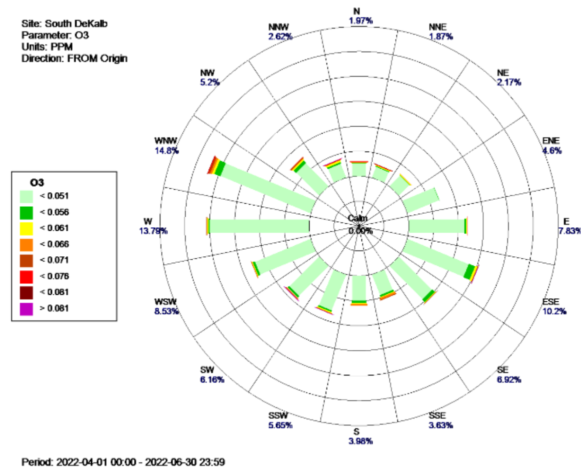


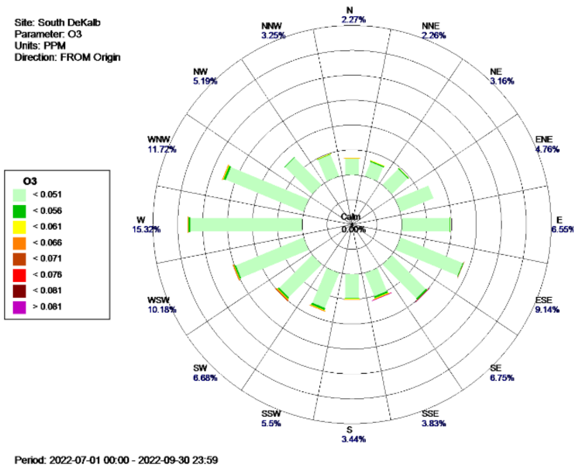
Macon-Forestry, 2022 Quarterly Ozone

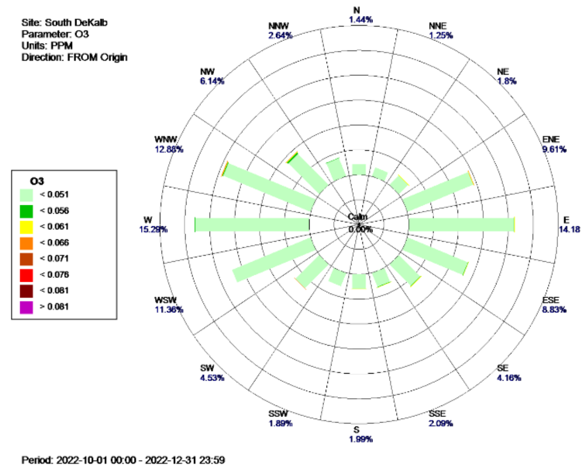


Savannah-E President, 2022 Quarterly Ozone

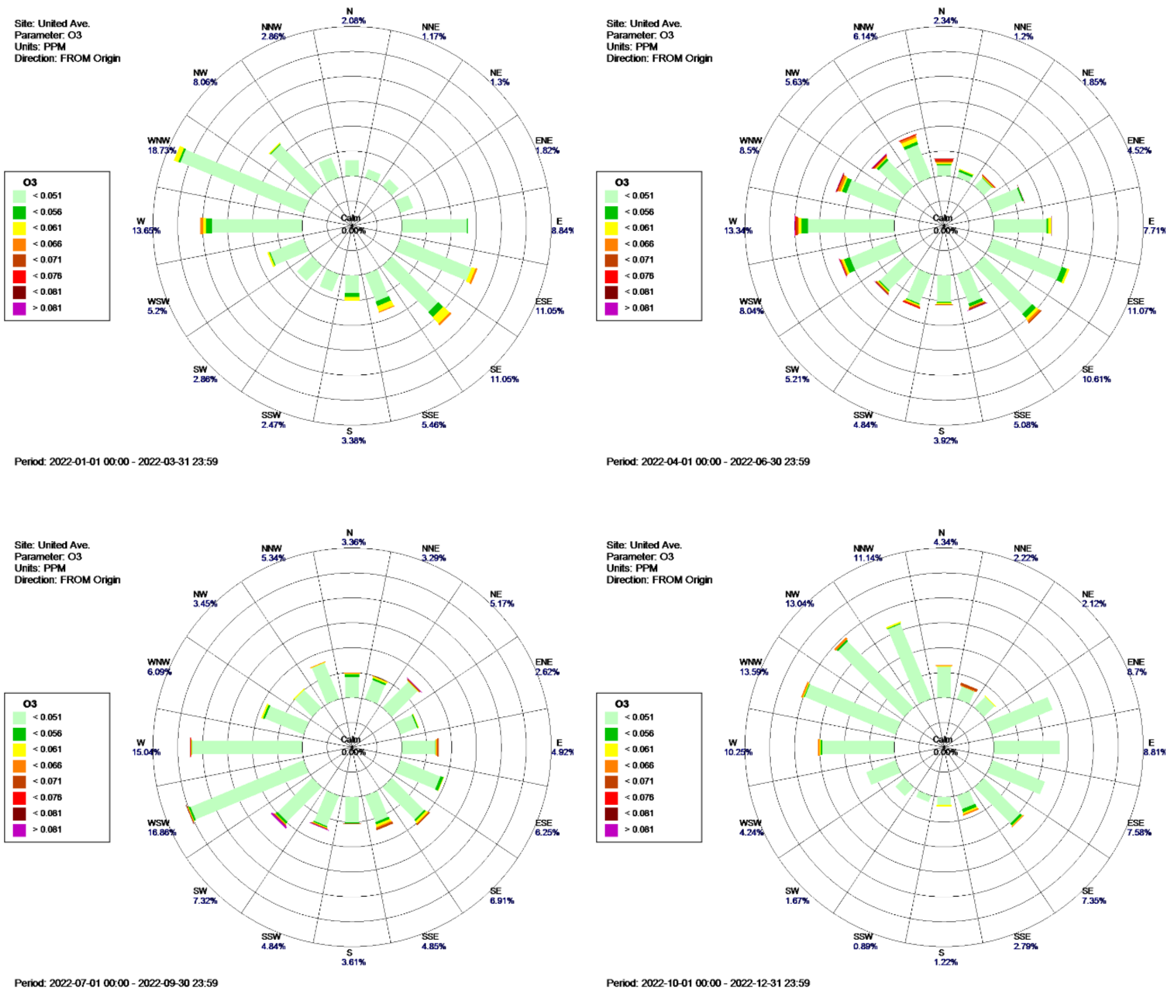




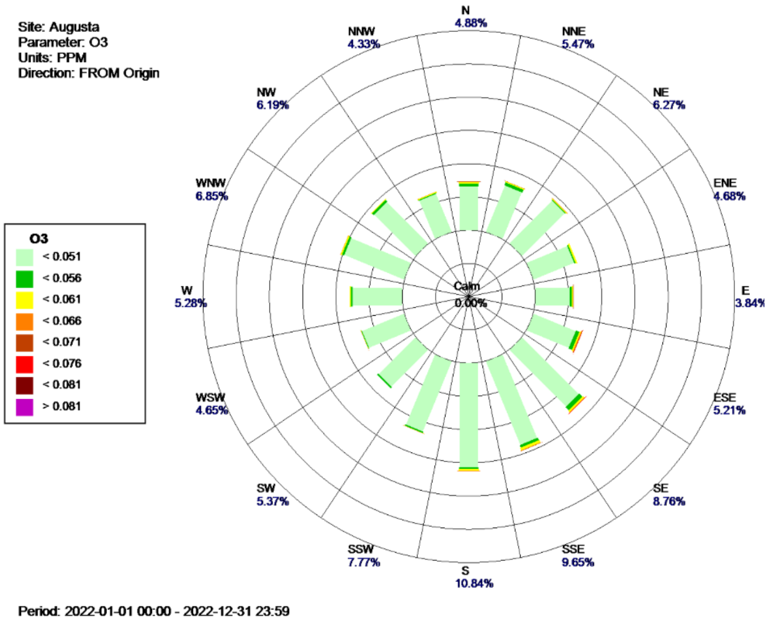




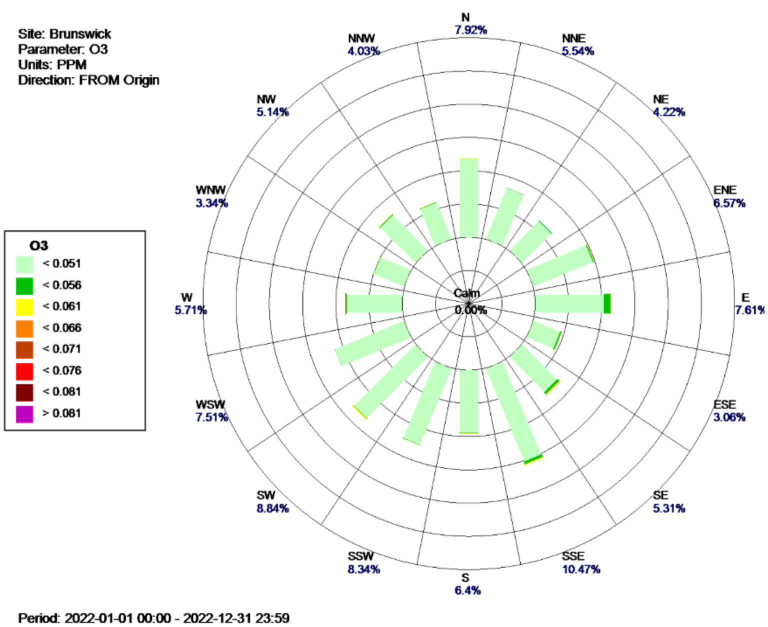
South DeKalb 2022 Quarterly Ozone



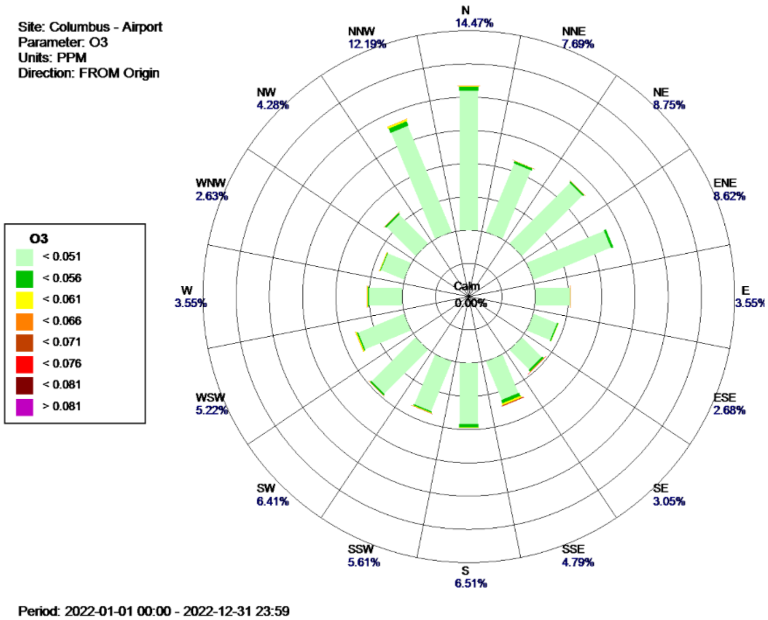
United Ave, 2022 Quarterly Ozone



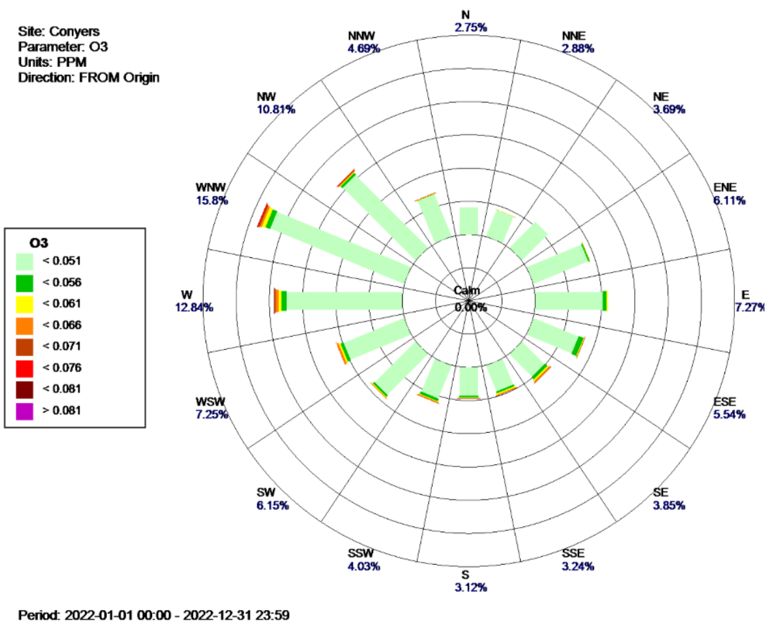
Augusta, 2022 Annual Ozone



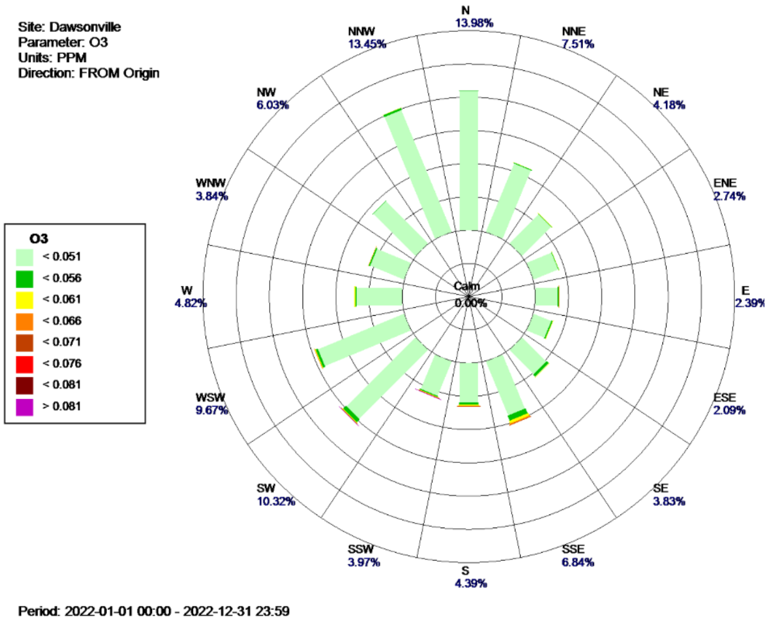
Brunswick, 2022 Annual Ozone



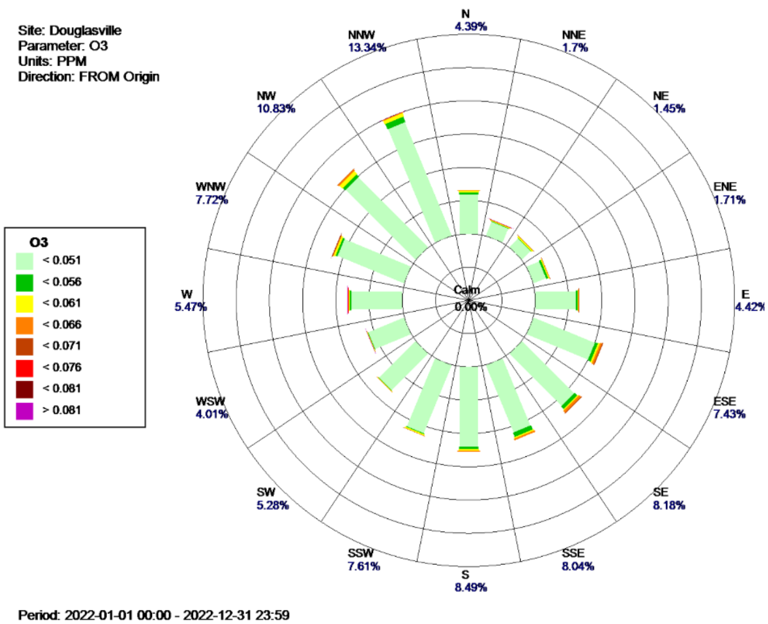
Columbus-Airport, 2022 Annual Ozone



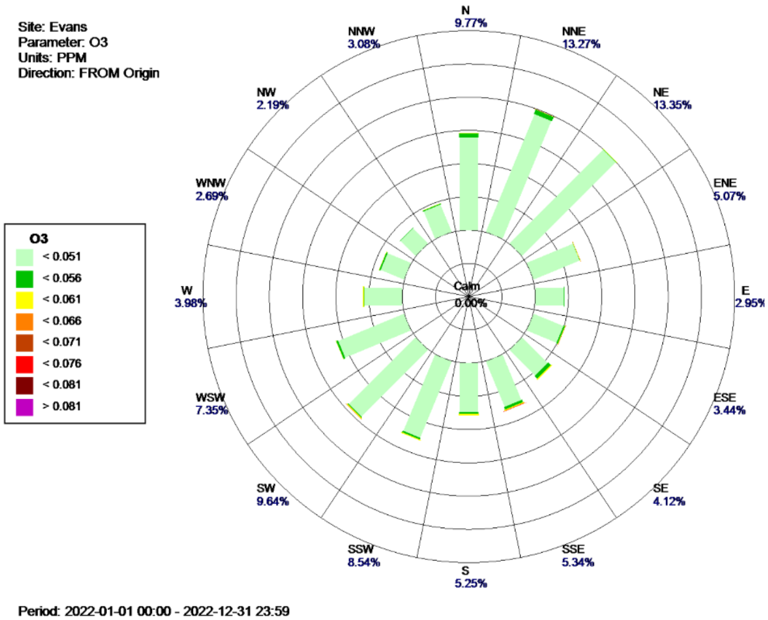
Conyers, 2022 Annual Ozone



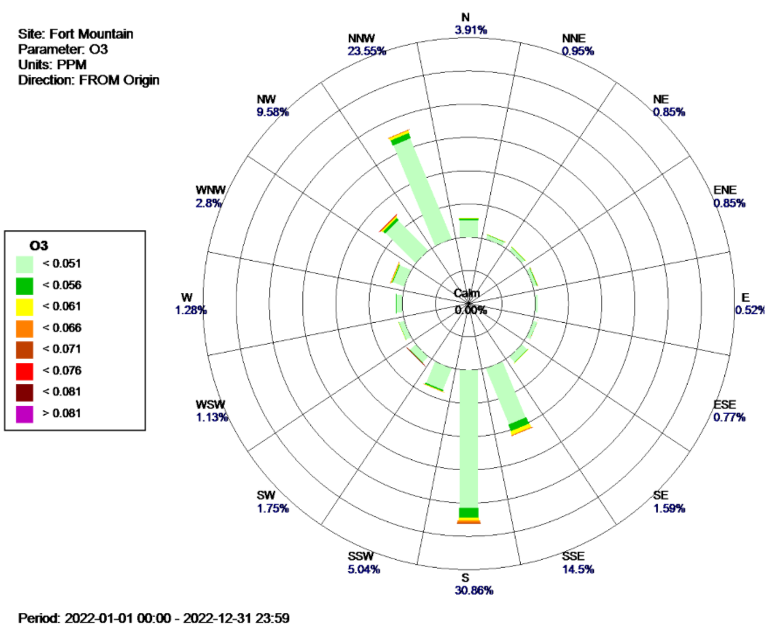
Dawsonville, 2022 Annual Ozone



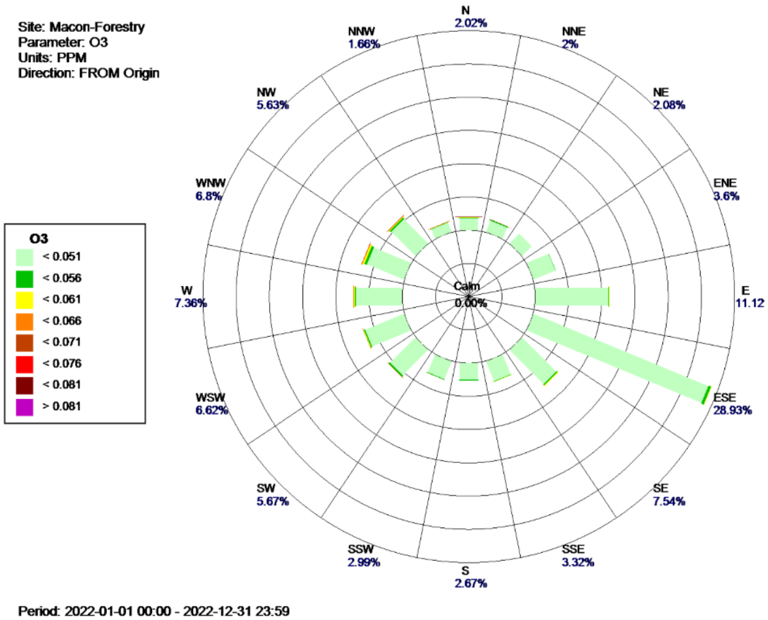
Douglasville, 2022 Annual Ozone



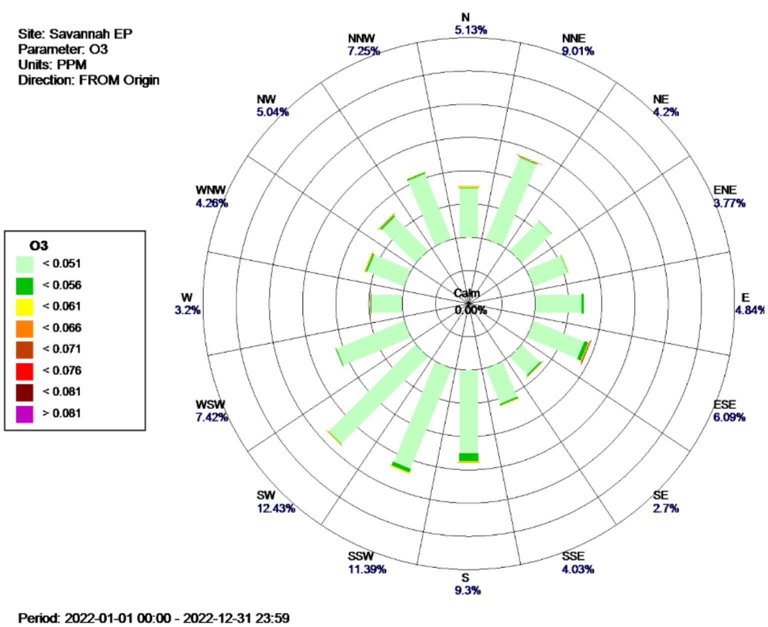
Evans, 2022 Annual Ozone



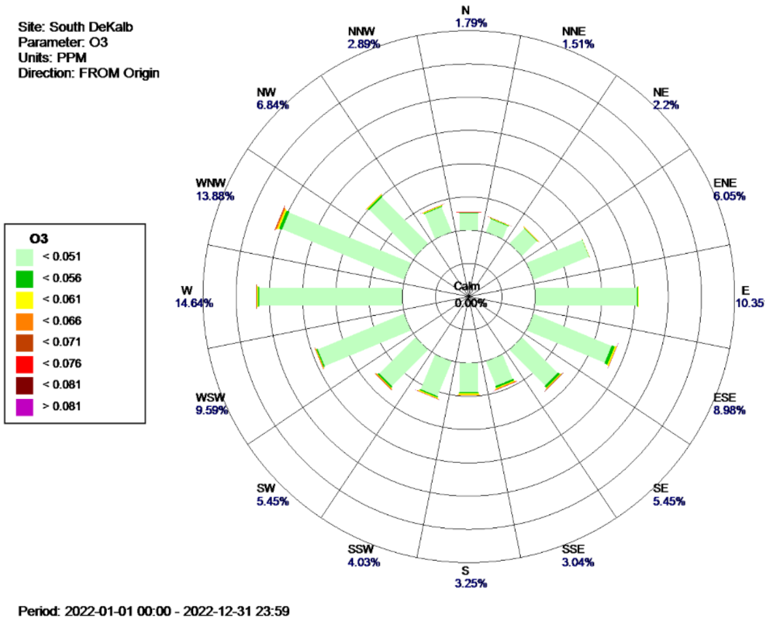
Fort Mountain, 2022 Annual Ozone



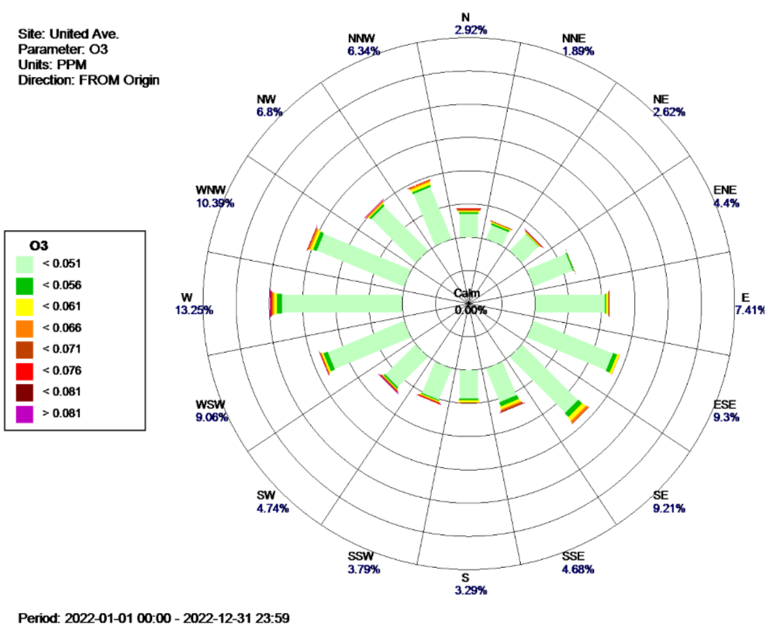
Macon-Forestry, 2022 Annual Ozone



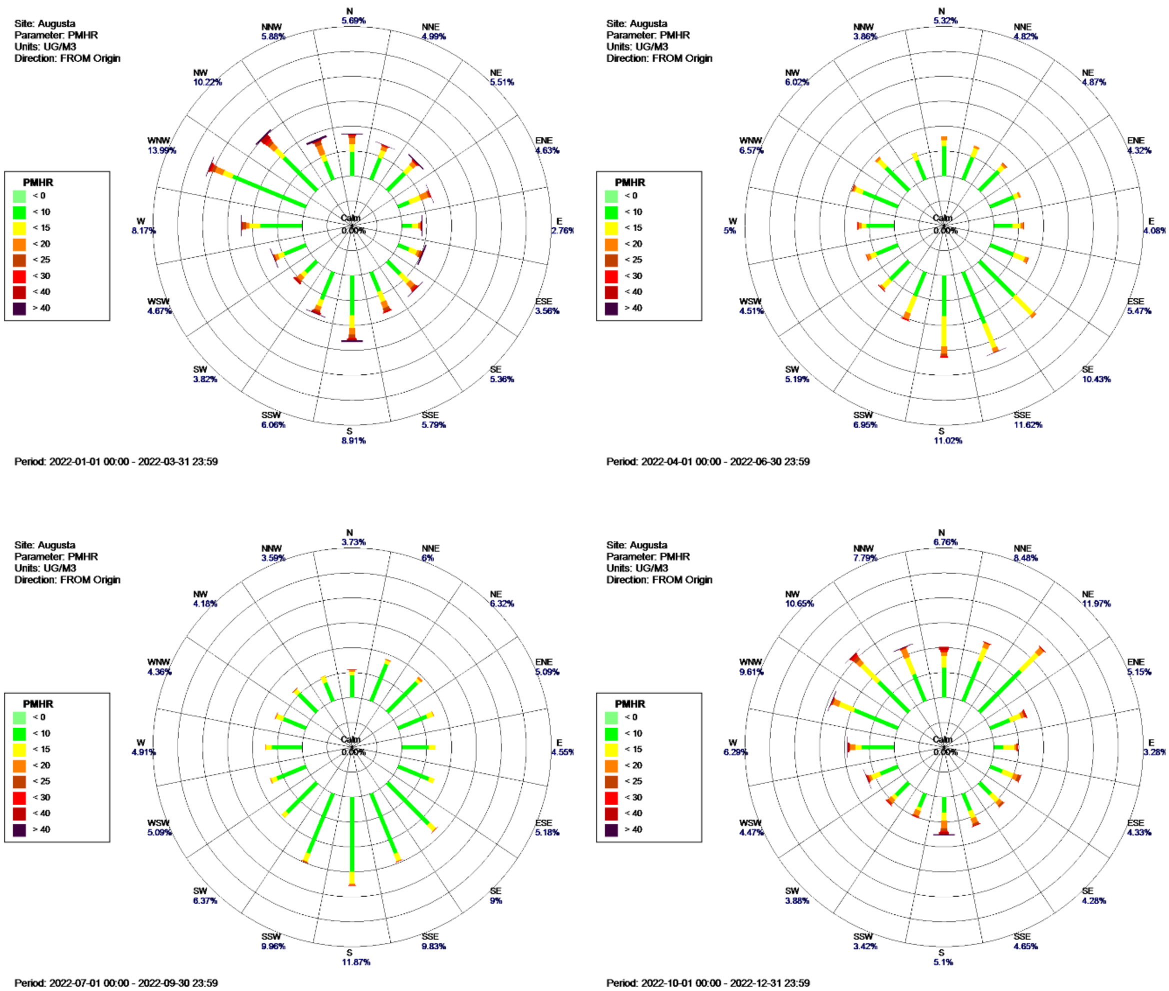
Savannah-E President, 2022 Annual Ozone



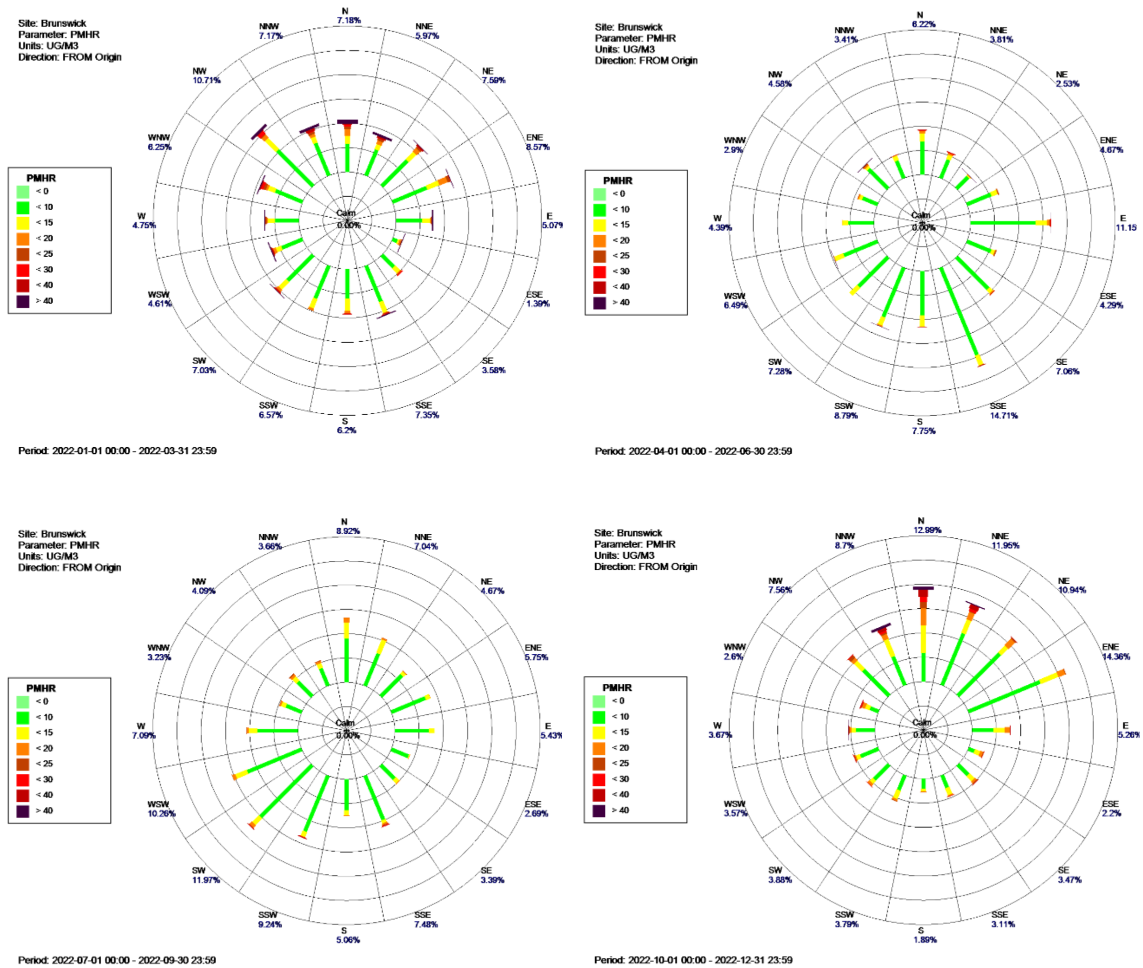
South DeKalb, 2022 Annual Ozone



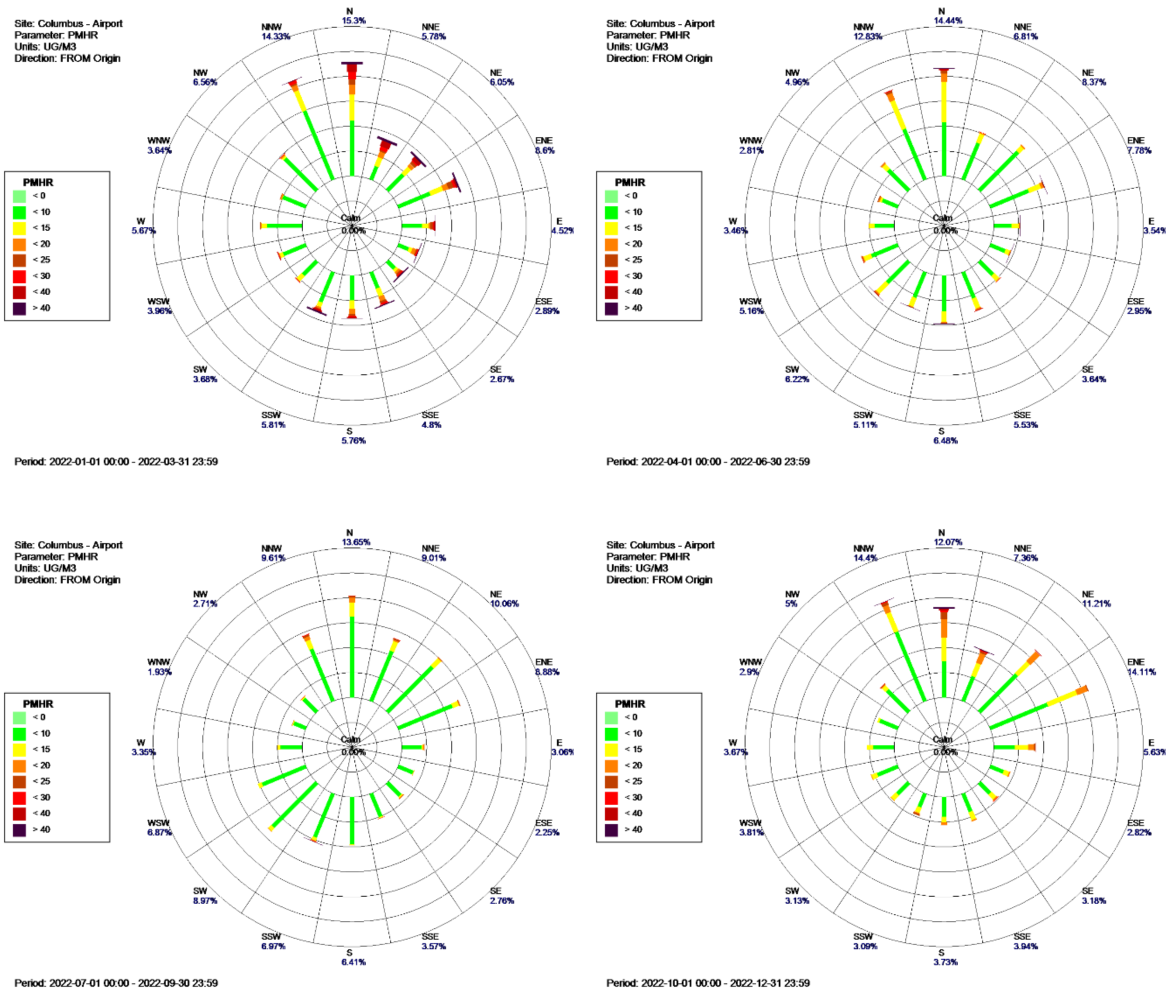
United Ave, 2022 Annual Ozone



Augusta, 2022 Quarterly $PM_{2.5}$

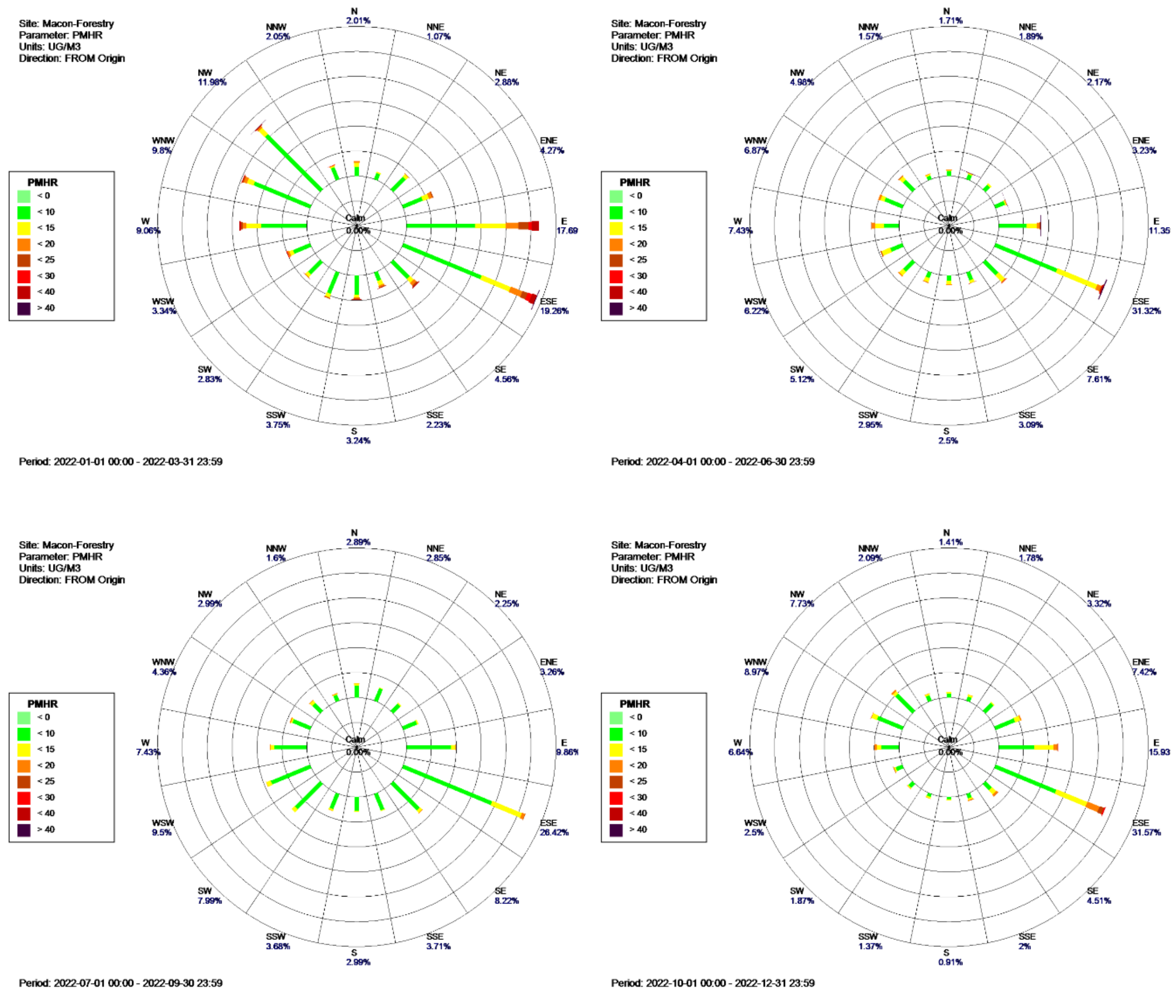


Brunswick, 2022 Quarterly $PM_{2.5}$

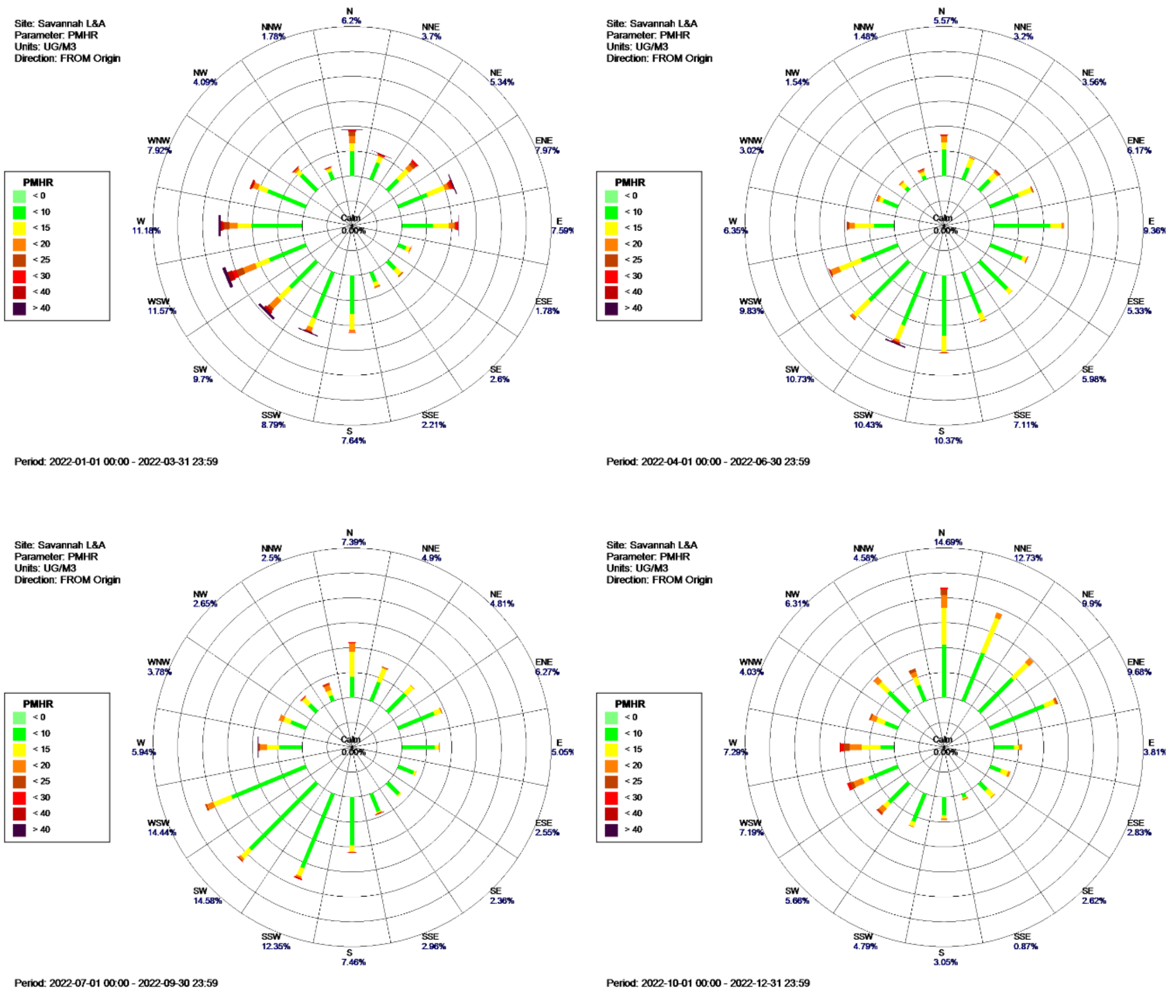


Columbus-Airport, 2022 Quarterly $PM_{2.5}$

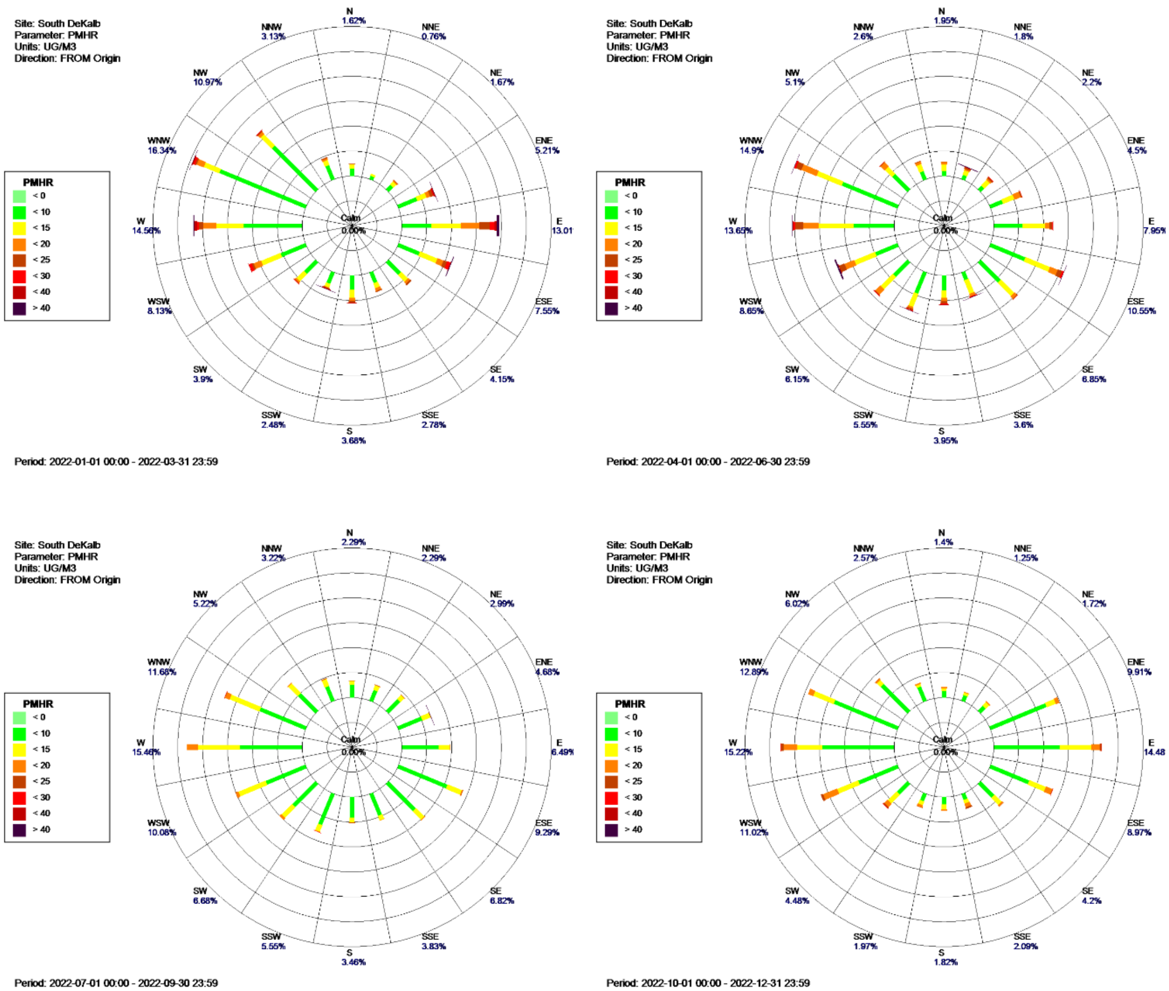
Columbus-Baker: Insufficient Data



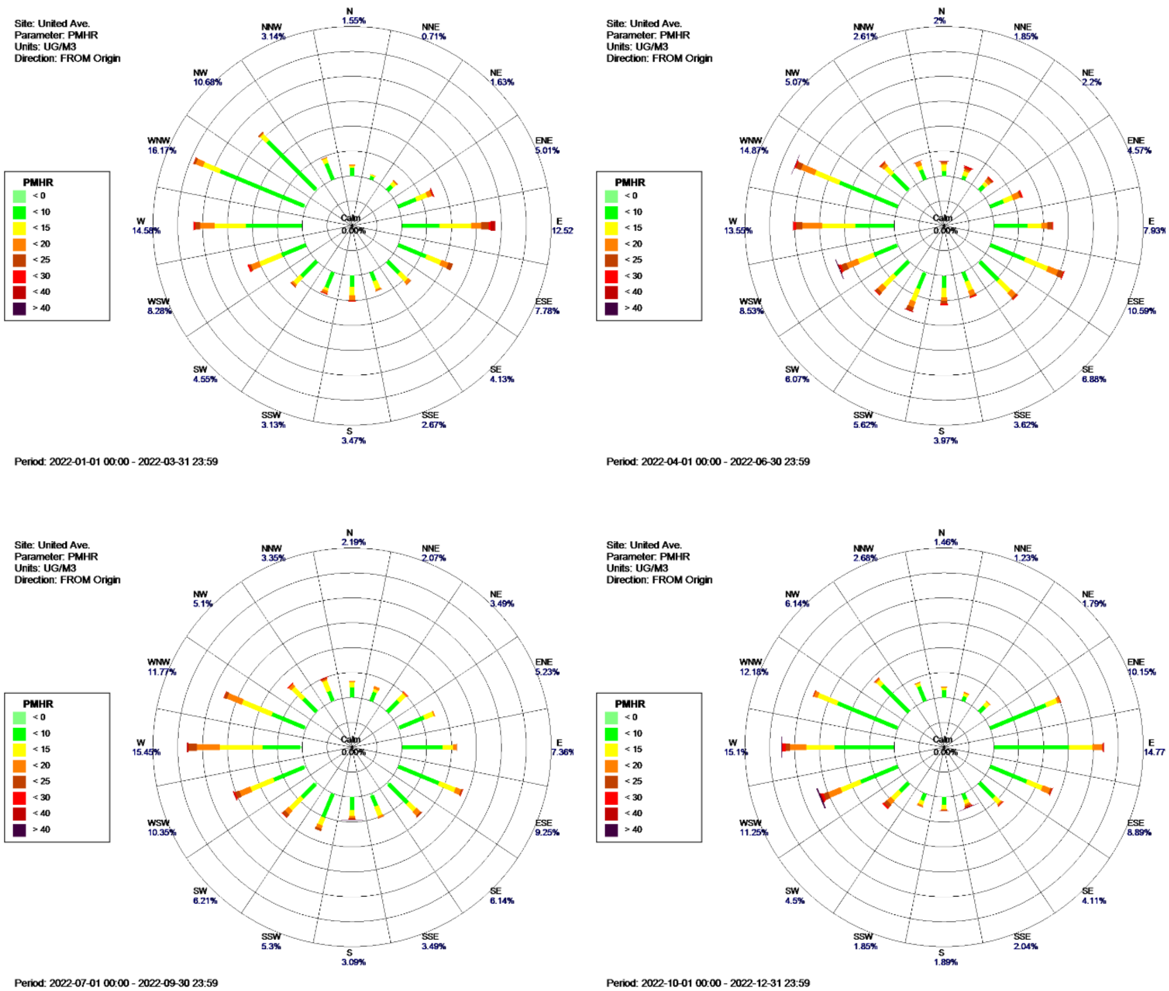
Macon-Forestry, 2022 Quarterly $PM_{2.5}$



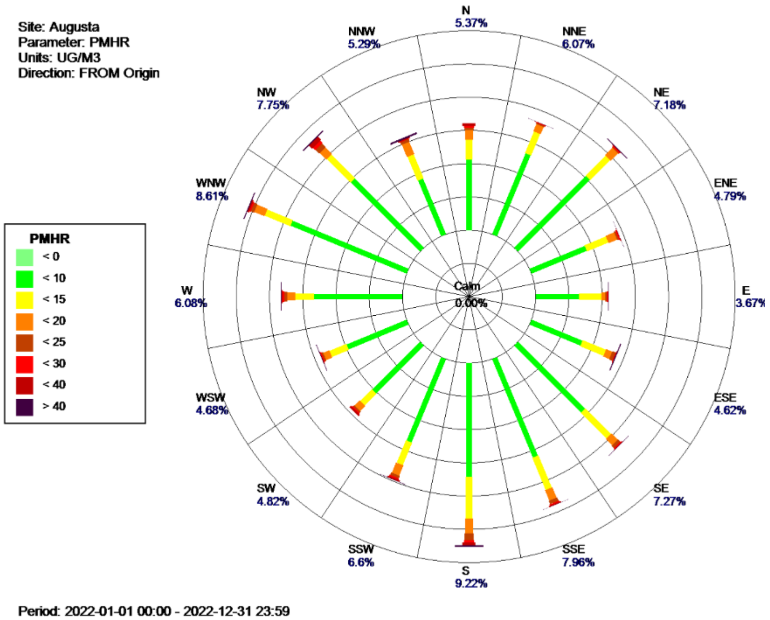
Savannah-L&A, 2022 Quarterly $PM_{2.5}$



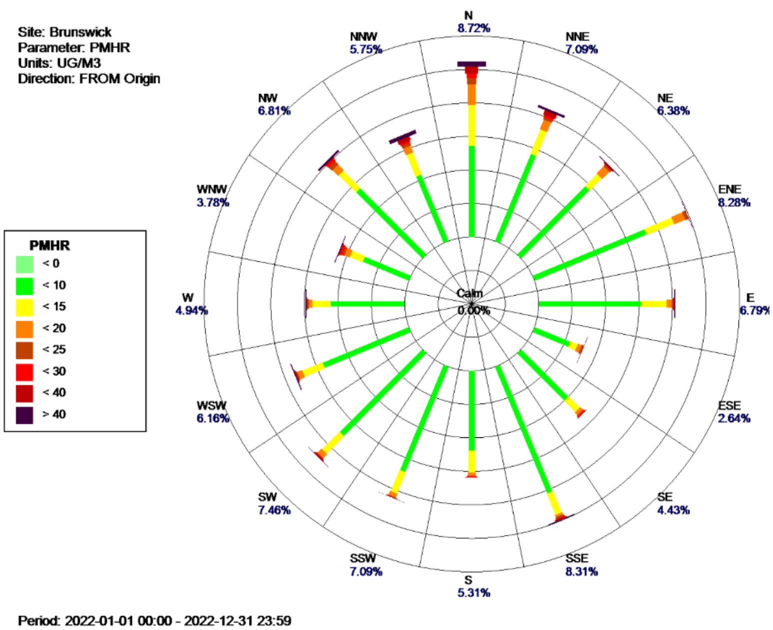
South DeKalb, 2022 Quarterly $PM_{2.5}$



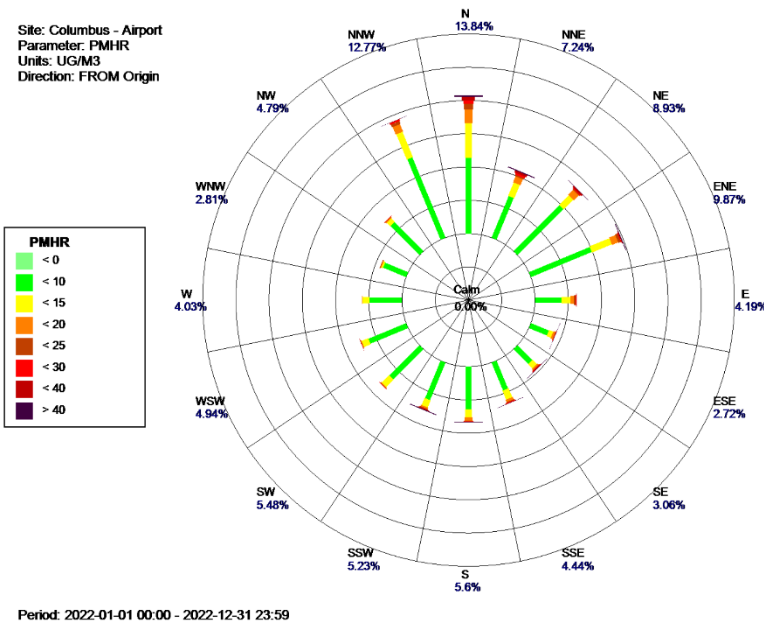
United Ave, 2022 Quarterly $PM_{2.5}$



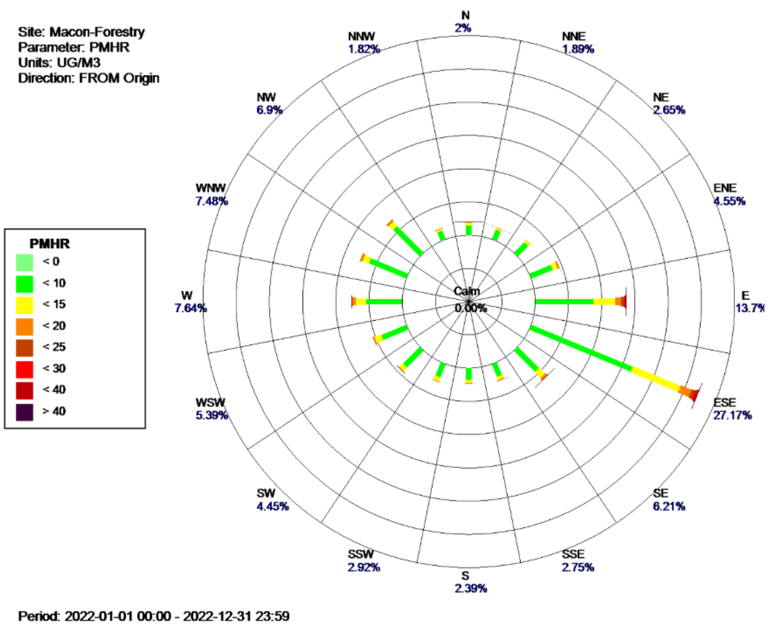
Augusta, 2022 Annual $PM_{2.5}$



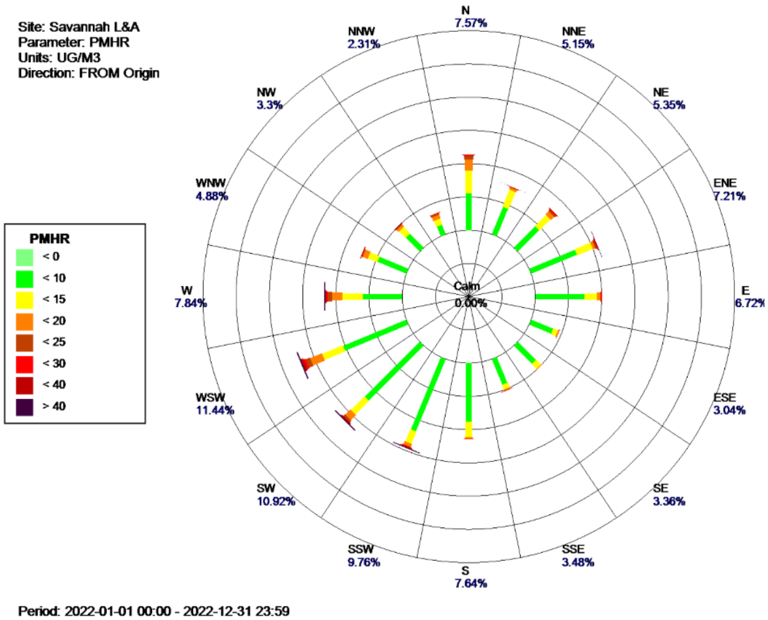
Brunswick, 2022 Annual $PM_{2.5}$



Columbus-Airport, 2022 Annual $PM_{2.5}$



Macon-Forestry, 2022 Annual $PM_{2.5}$



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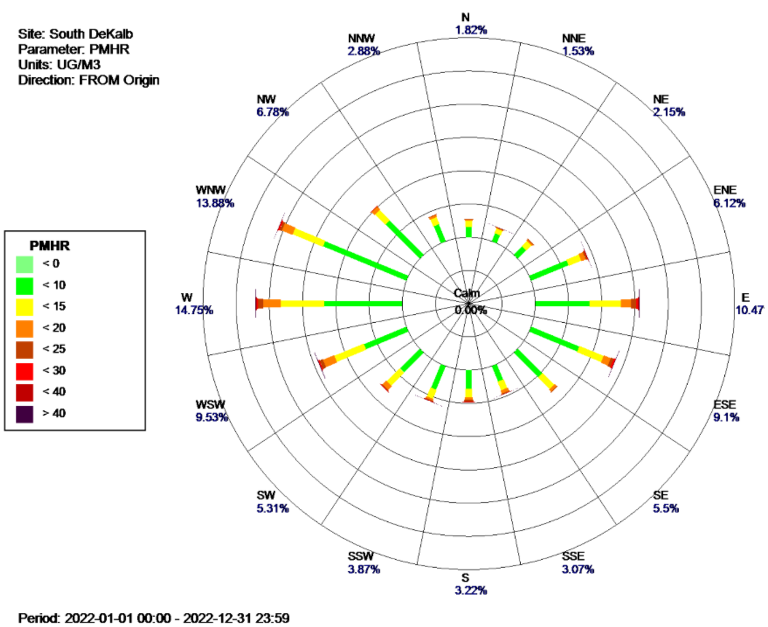
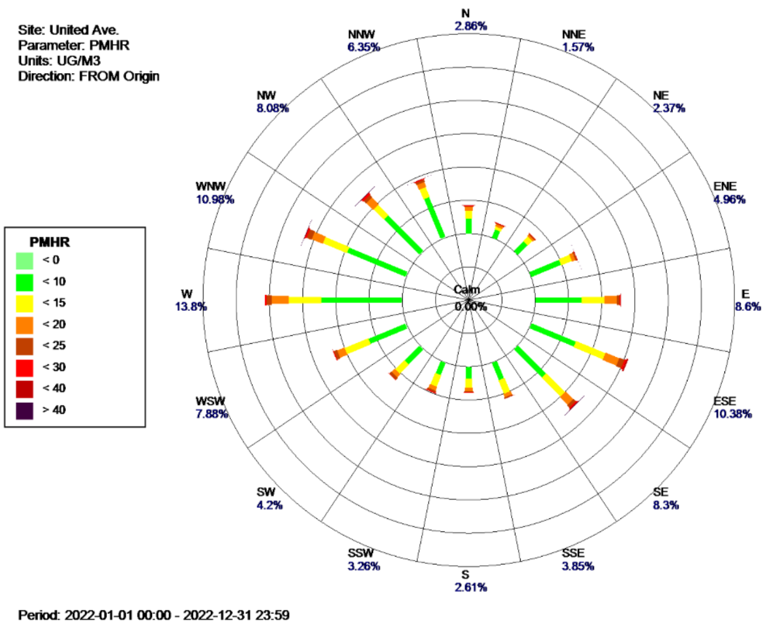
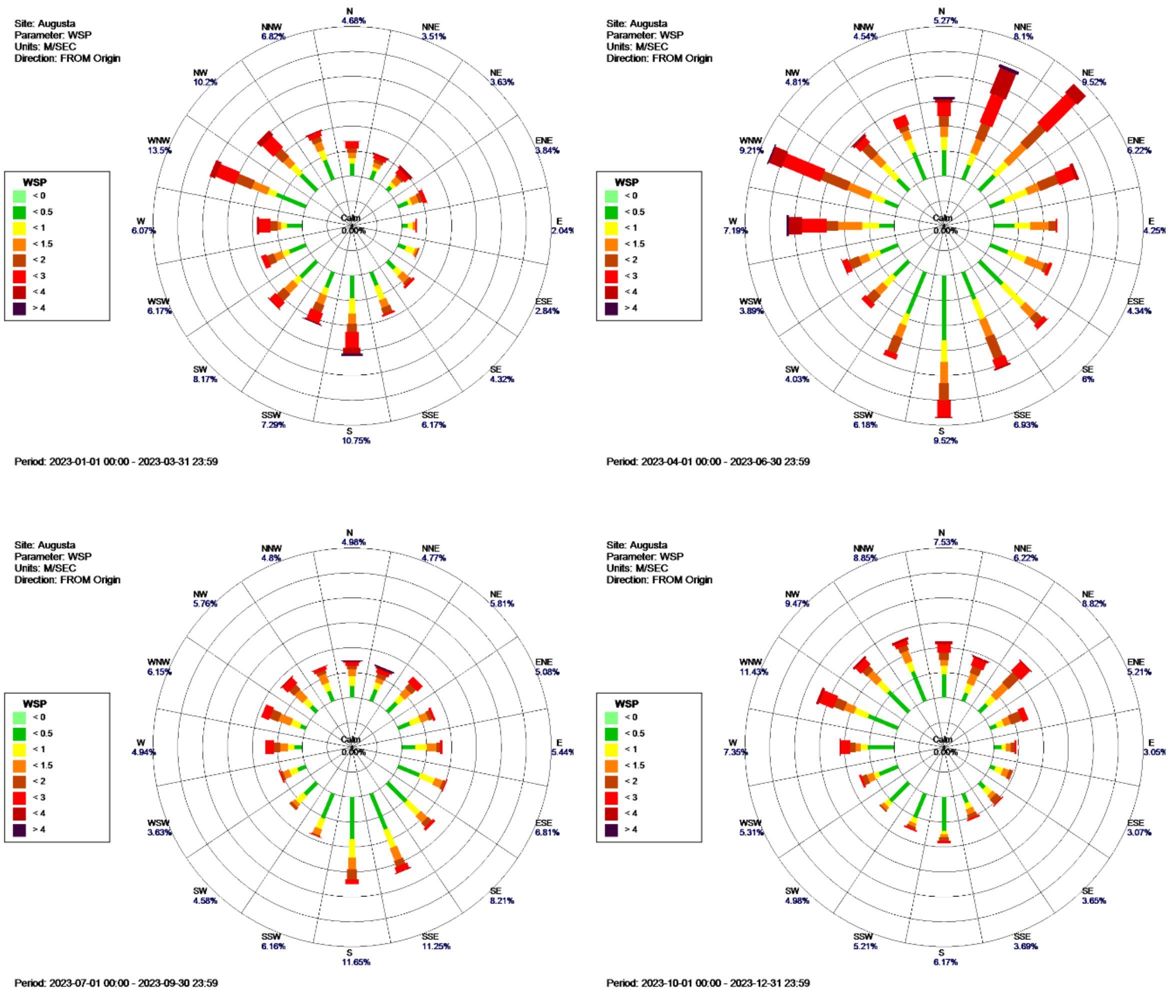


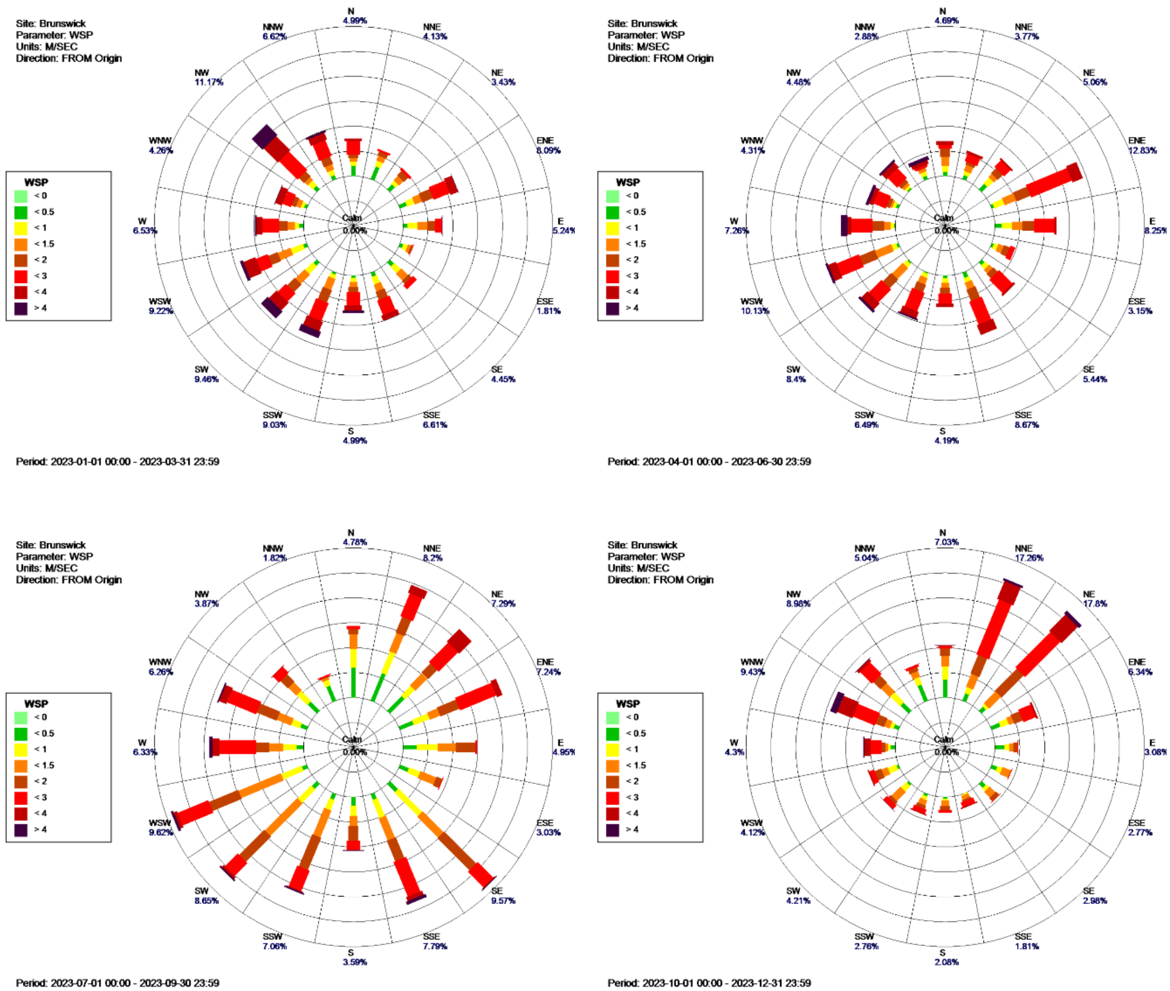
South DeKalb, 2022 Annual $PM_{2.5}$



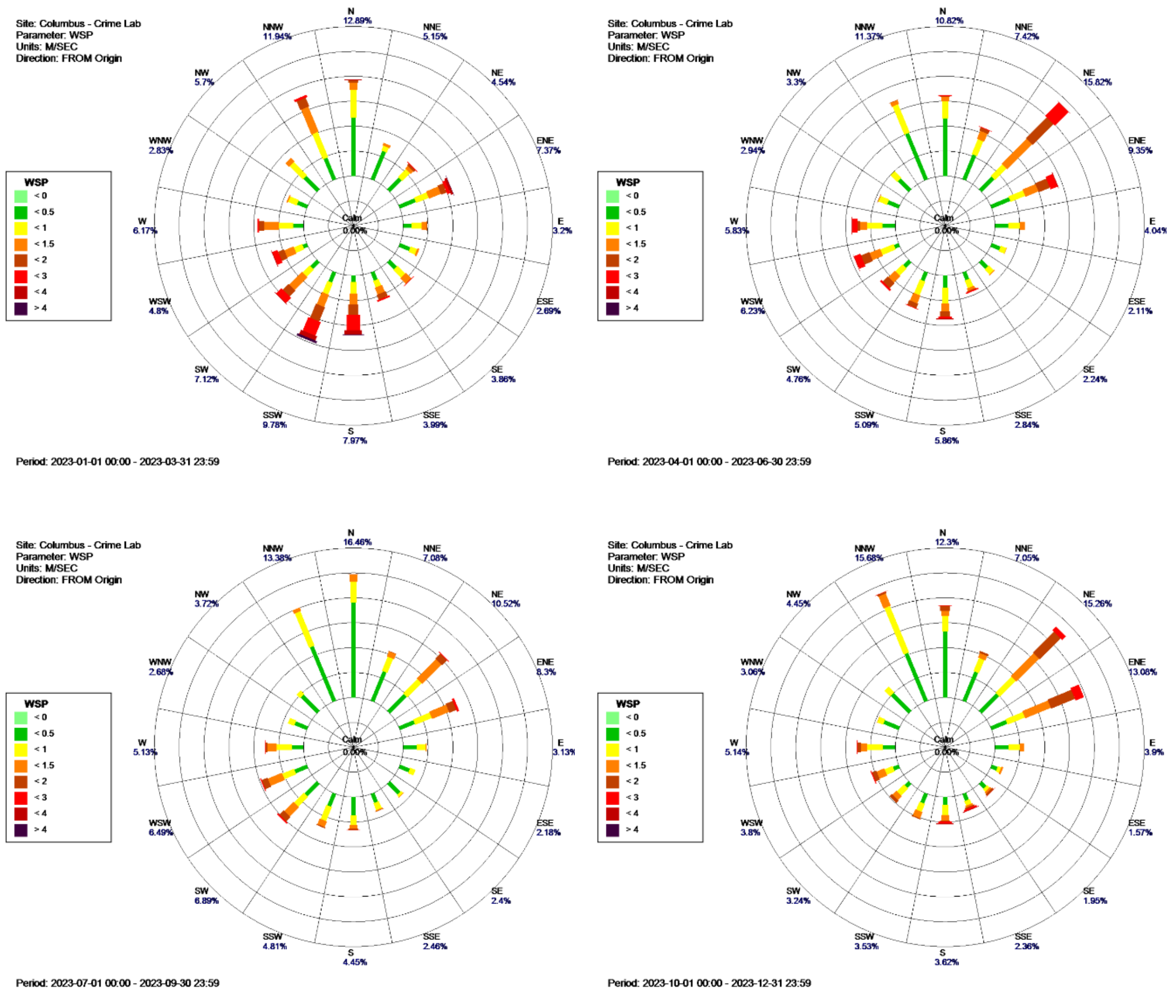
United Ave, 2022 Annual $PM_{2.5}$



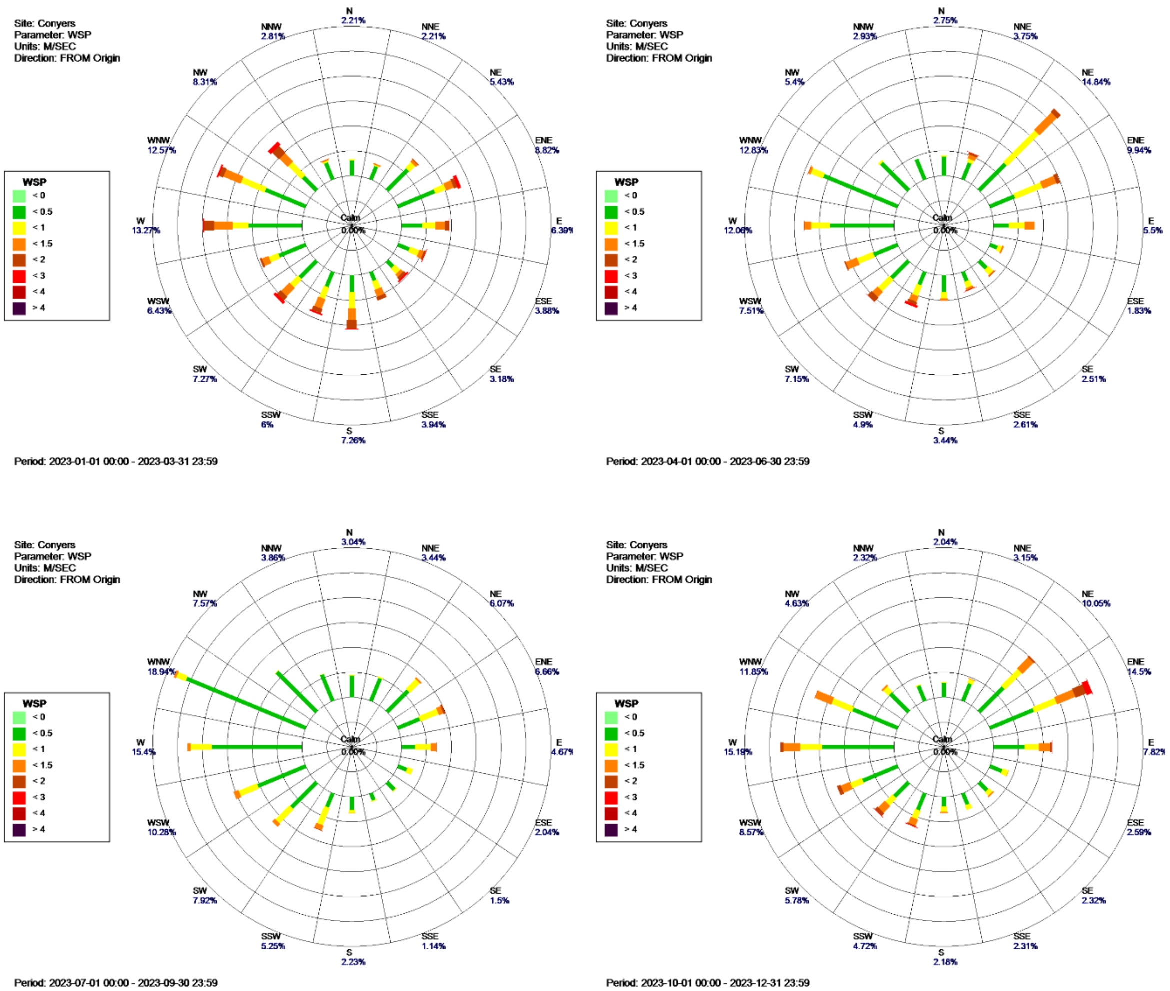
Augusta, 2023 Quarterly Winds



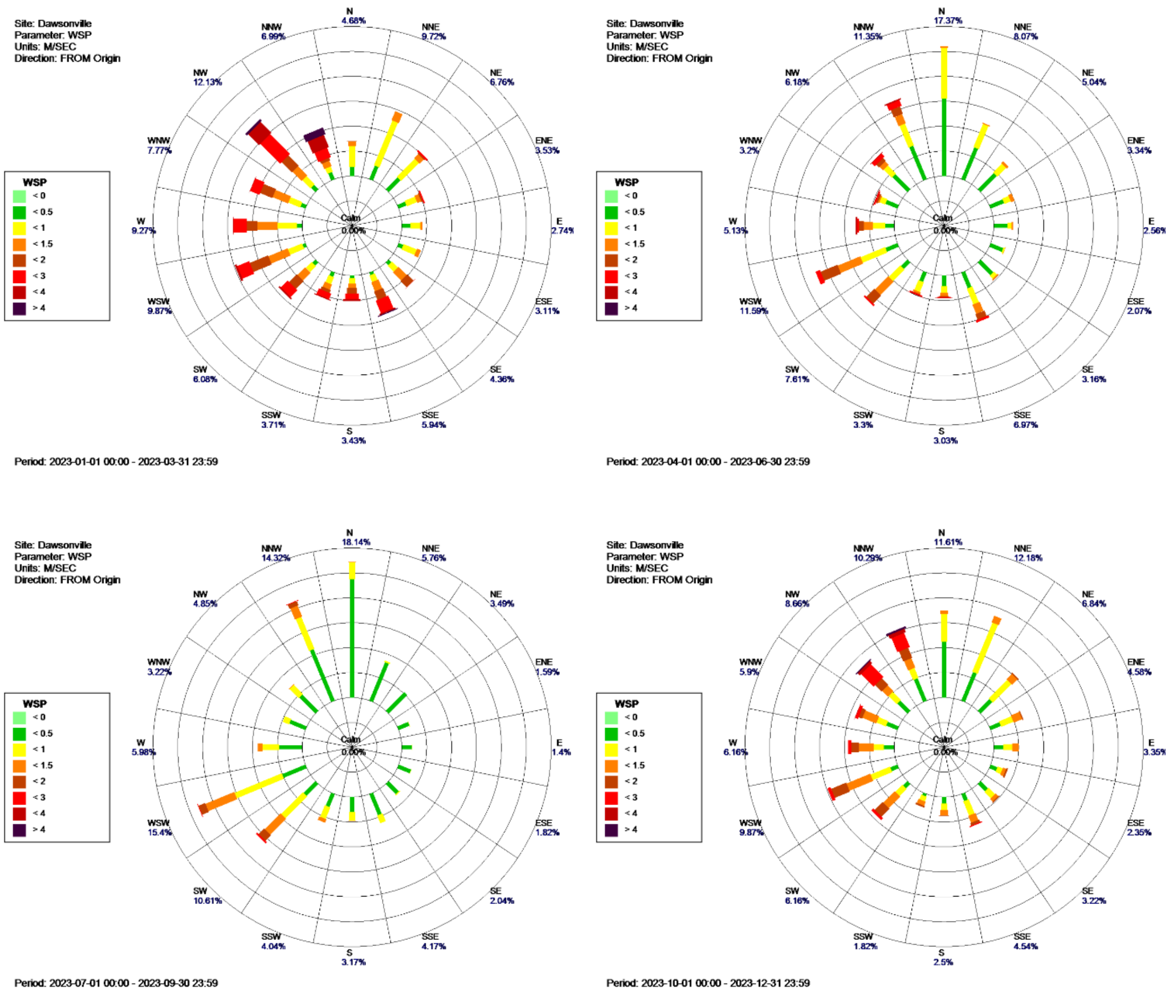
Brunswick, 2023 Quarterly Winds



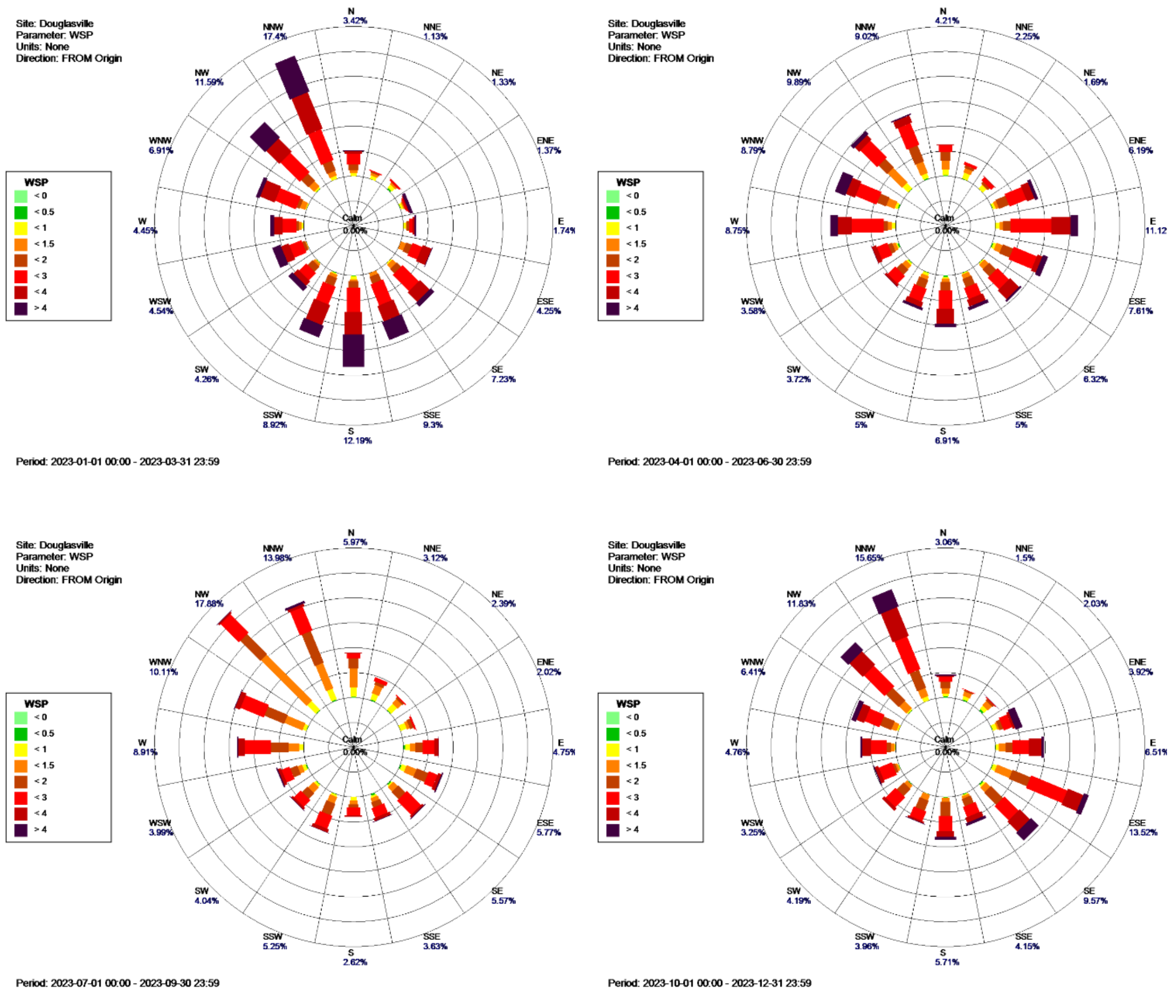
Columbus-Crime Lab, 2023 Quarterly Winds



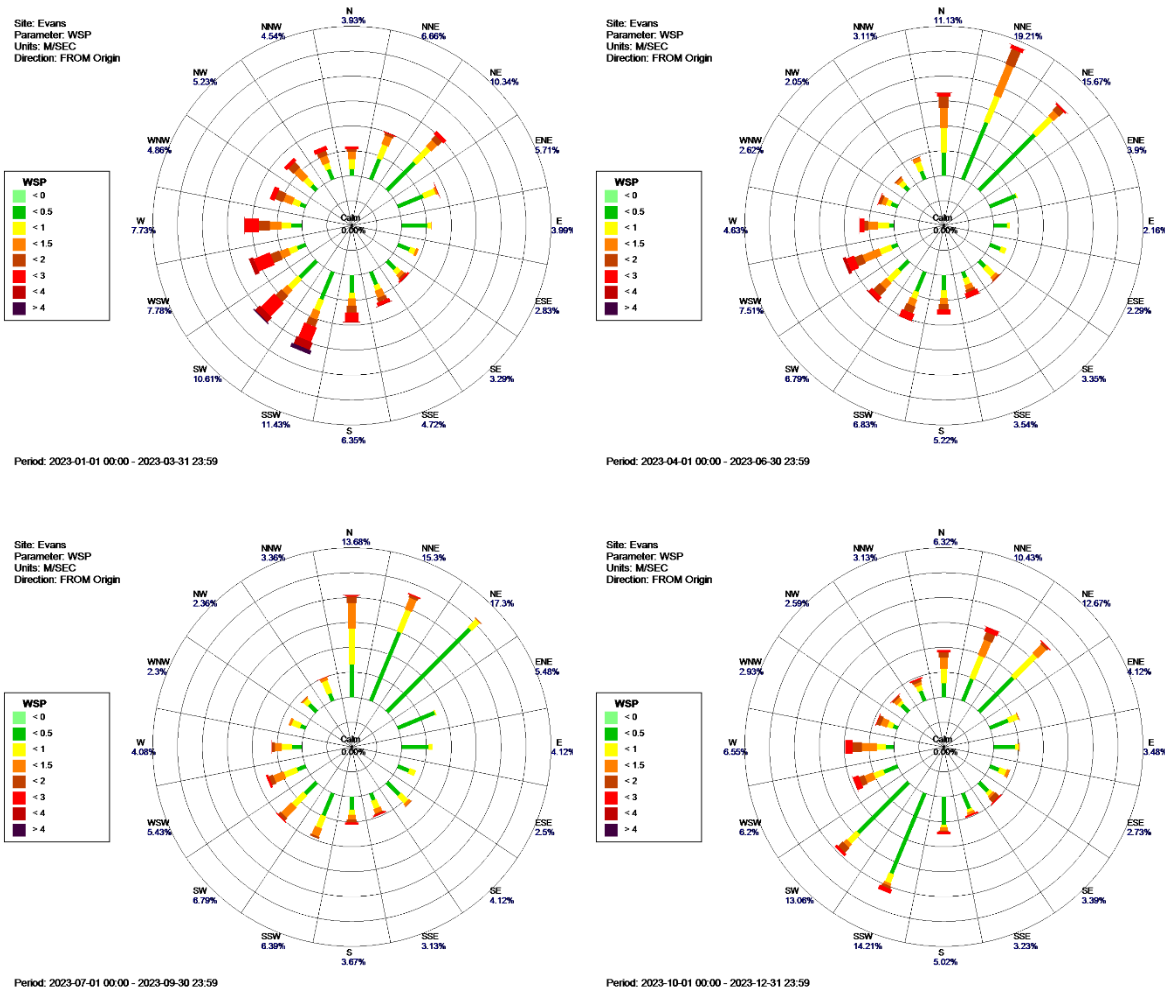
Conyers, 2023 Quarterly Winds



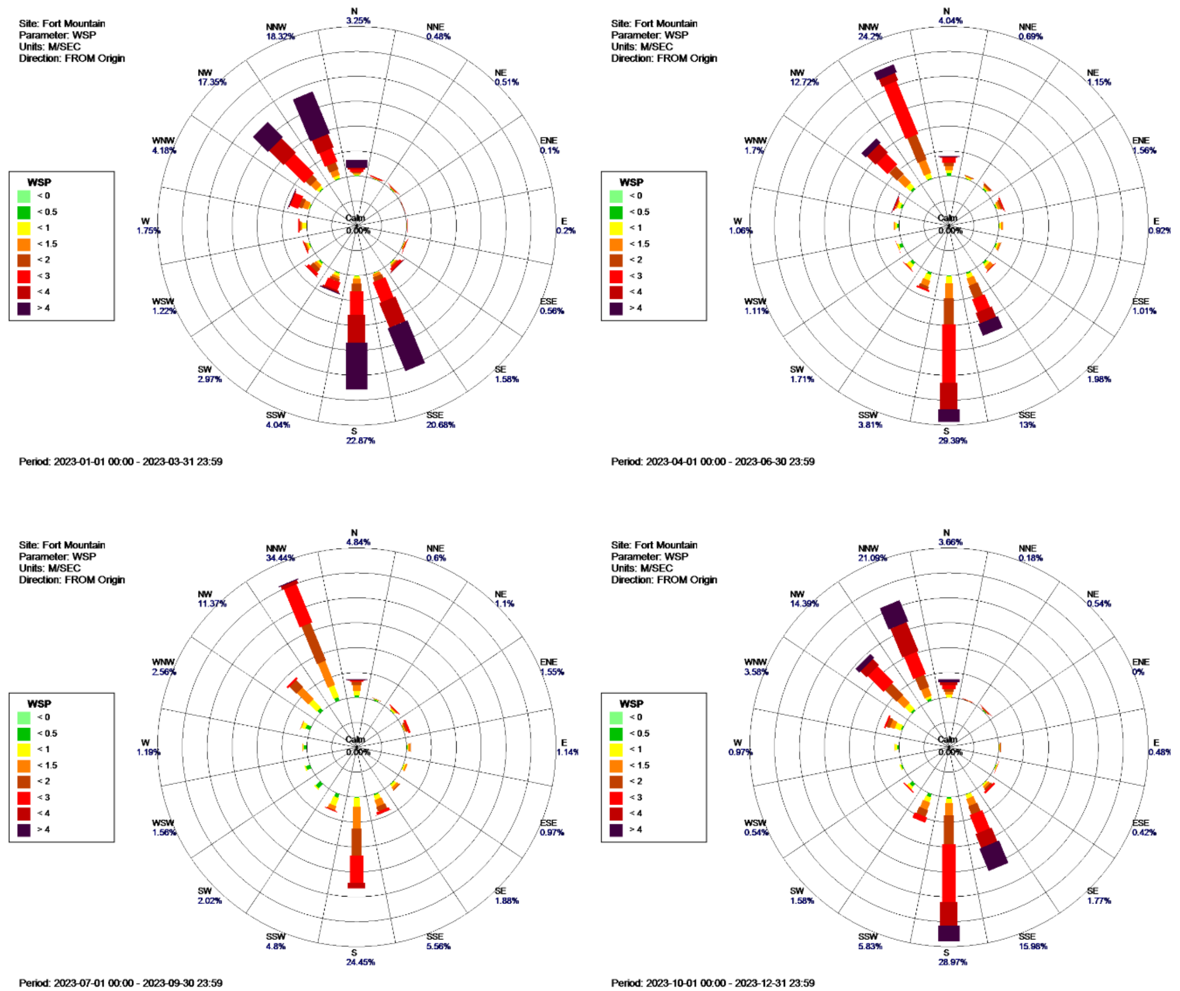
Dawsonville, 2023 Quarterly Winds



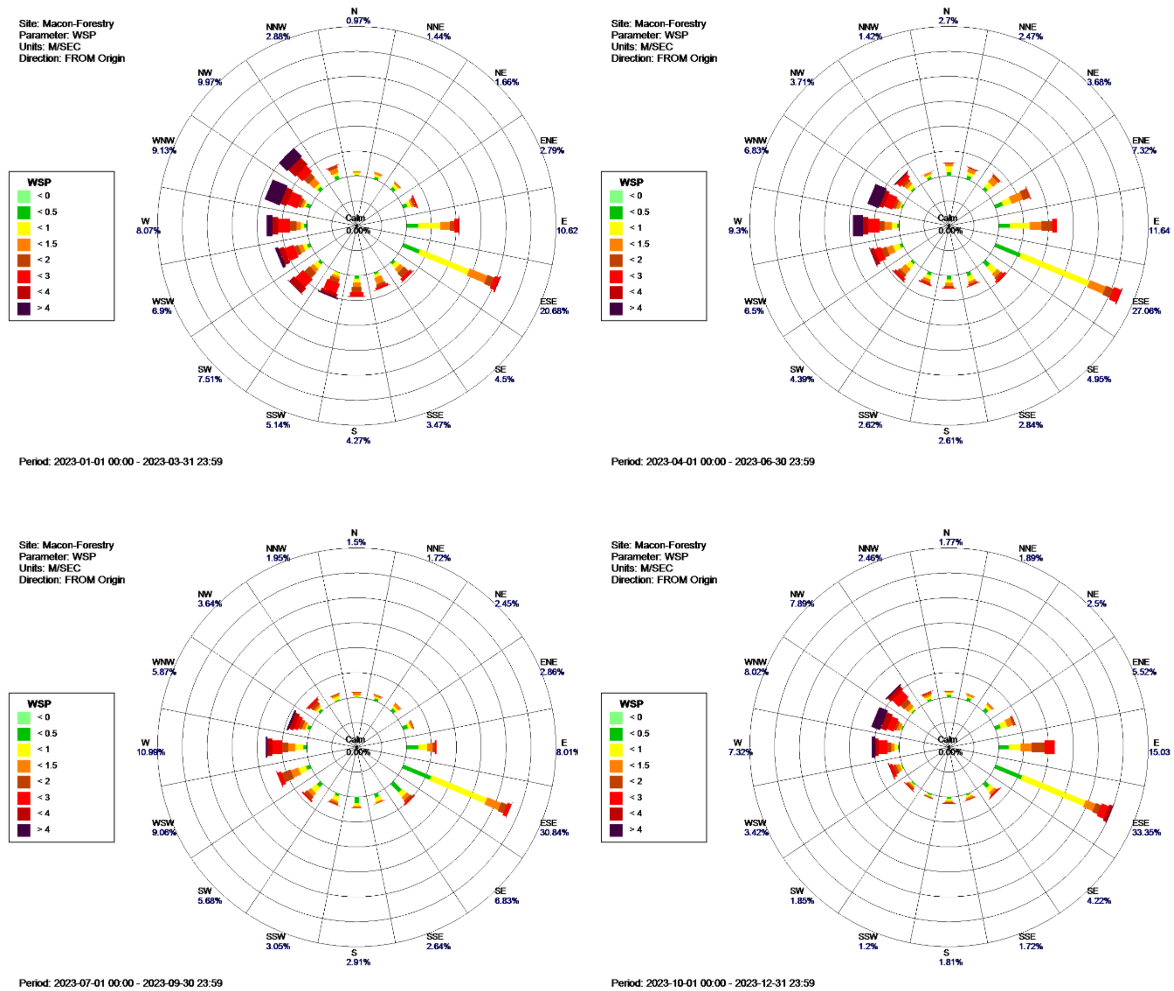
Douglasville, 2023 Quarterly Winds



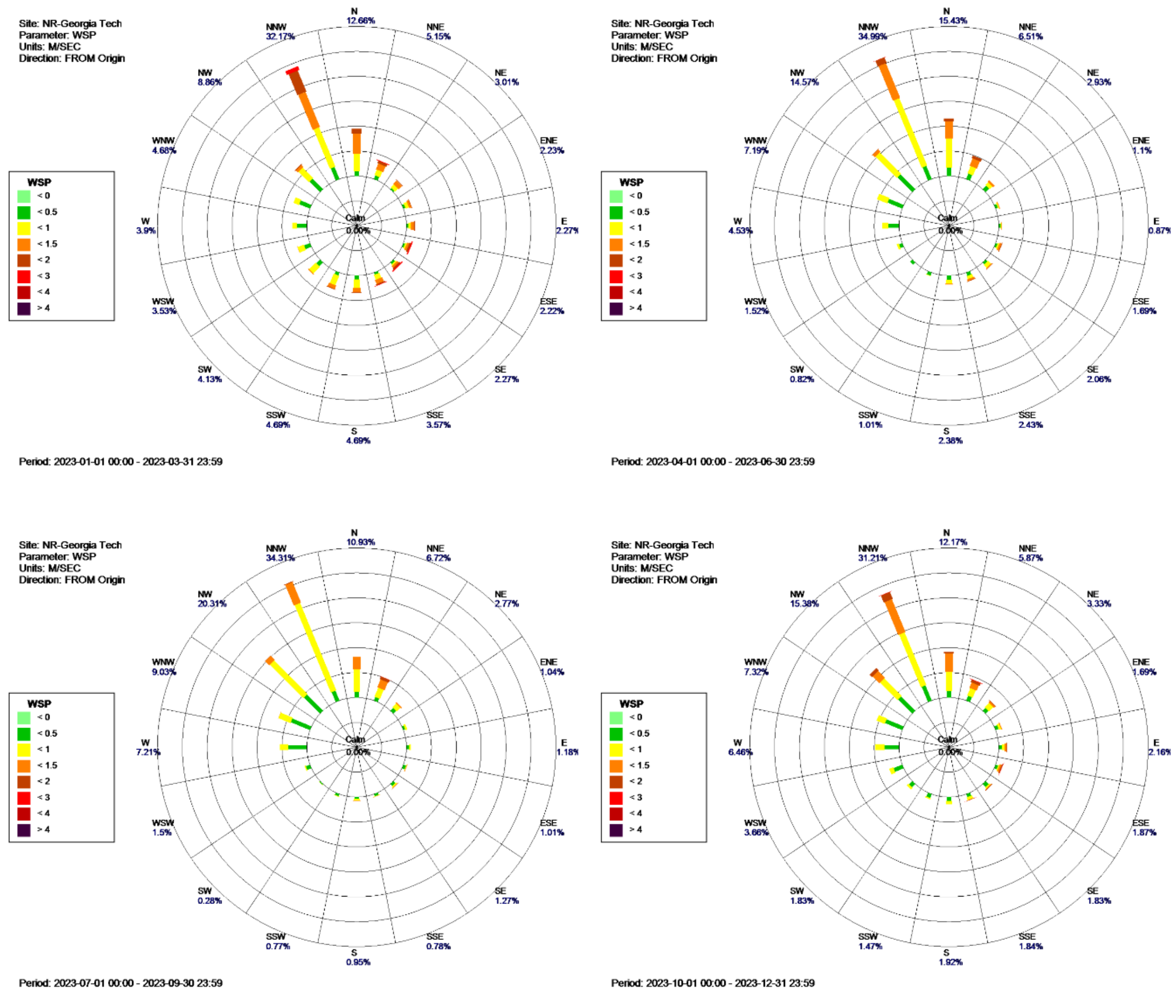
Evans, 2023 Quarterly Winds



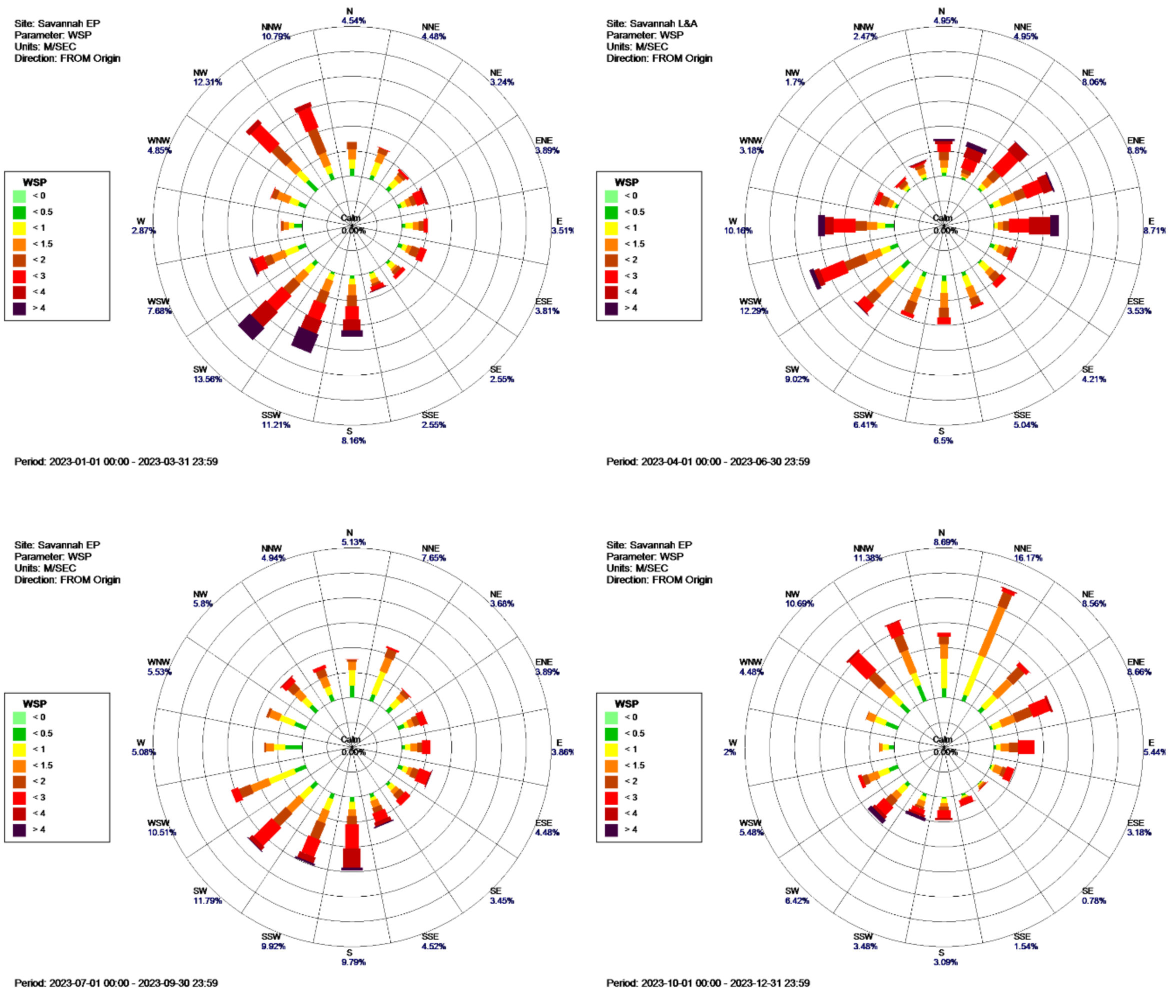
Fort Mountain, 2023 Quarterly Winds



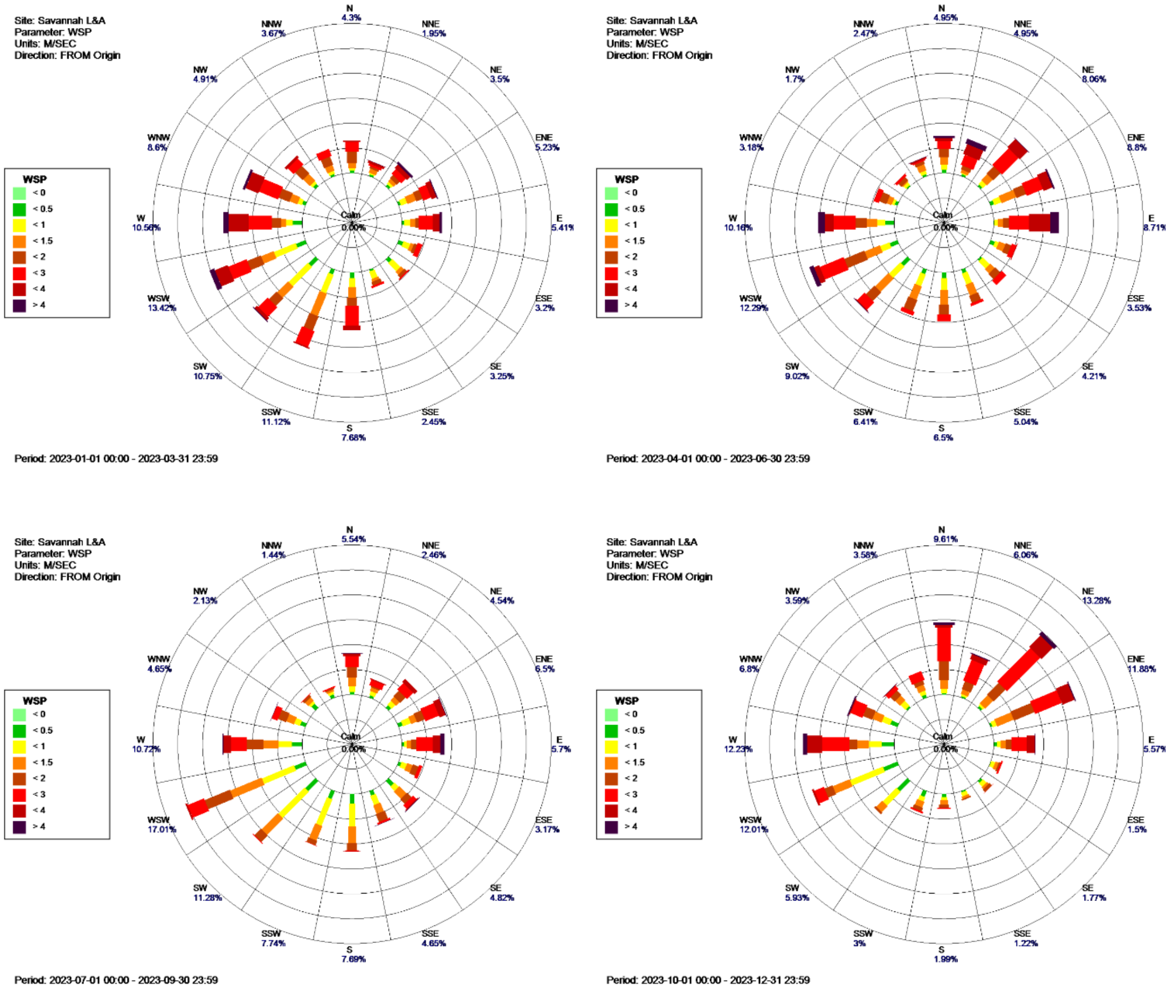
Macon-Forestry, 2023 Quarterly Winds



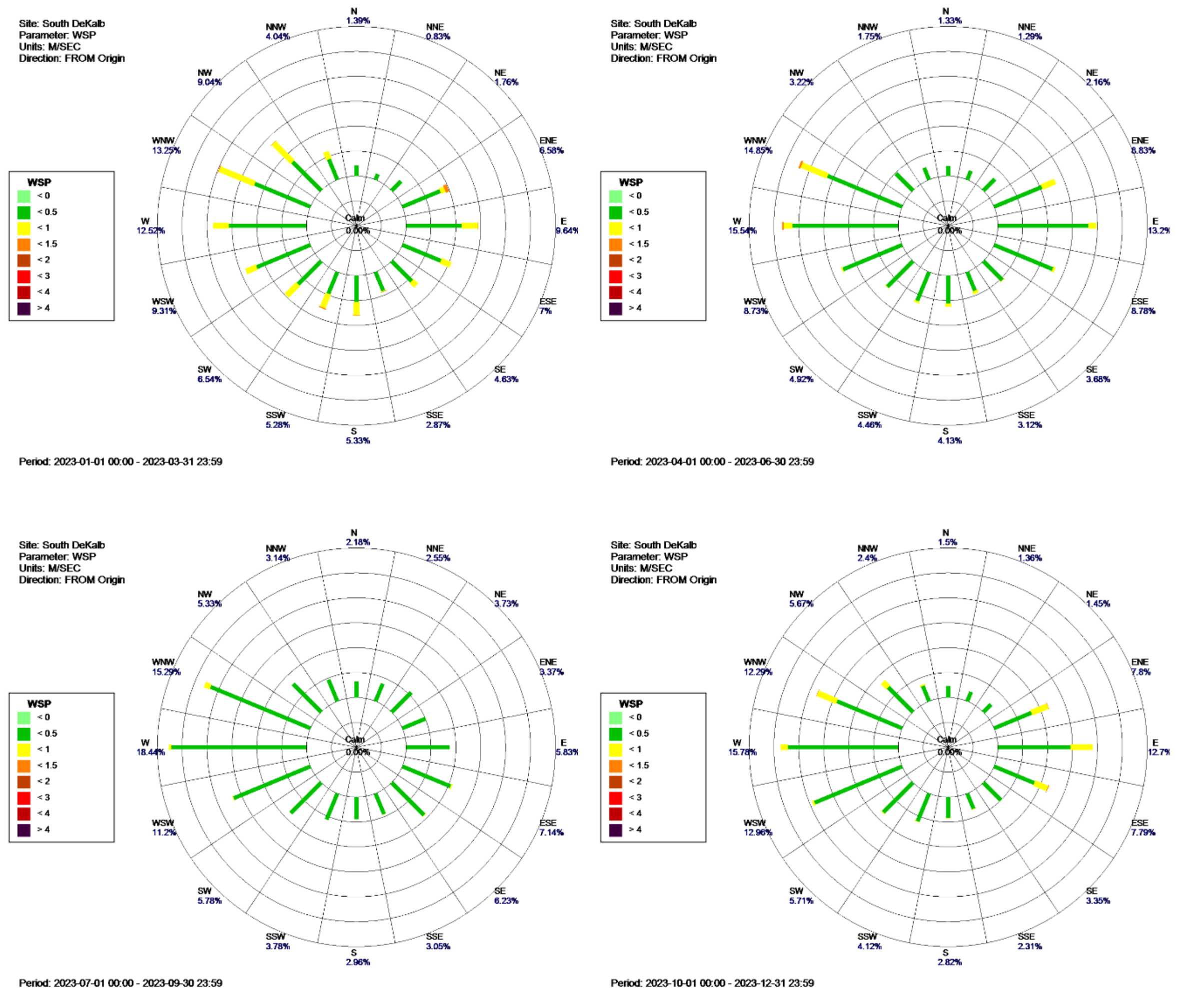
NR-GA Tech, 2023 Quarterly Winds



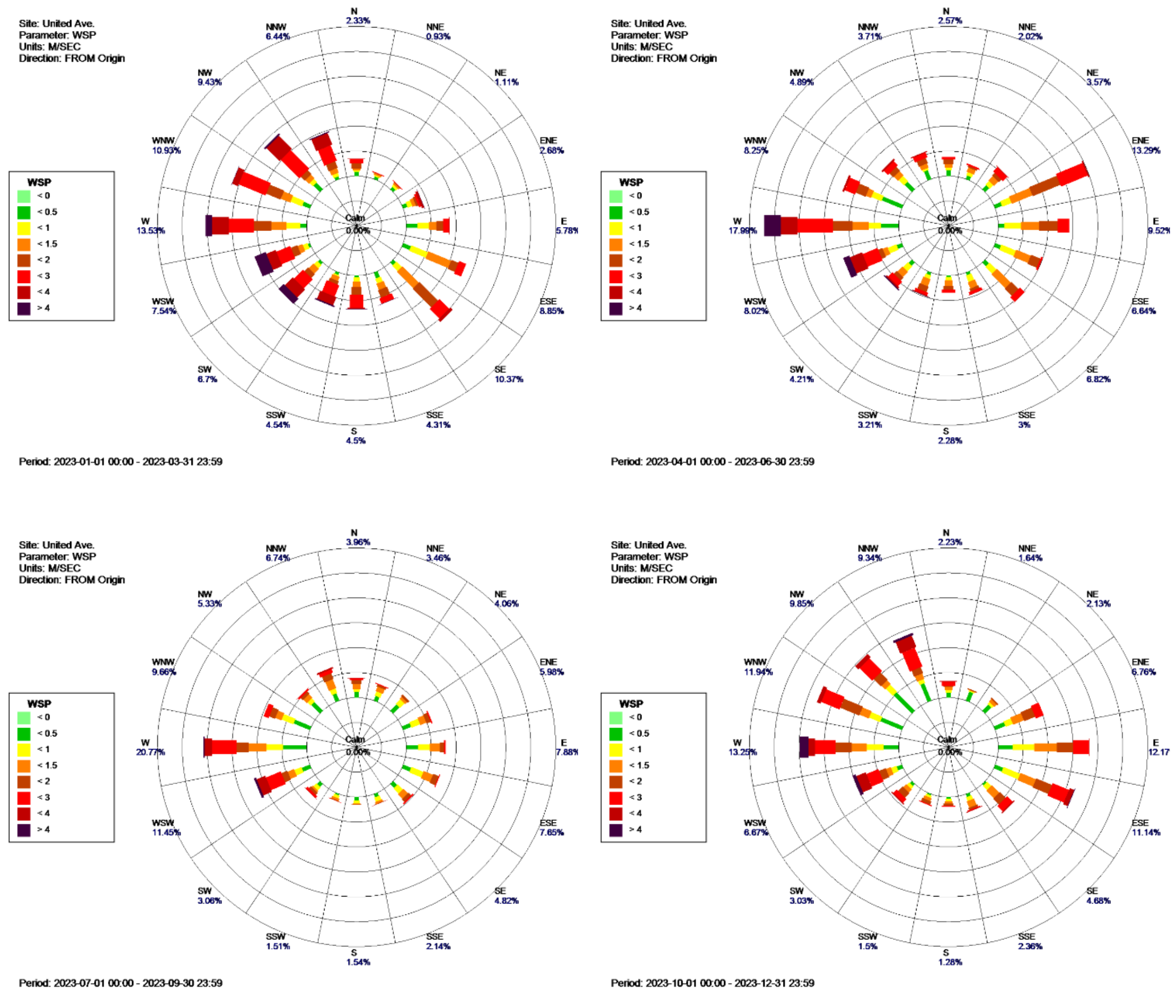
Savannah- E President, 2023 Quarterly Winds



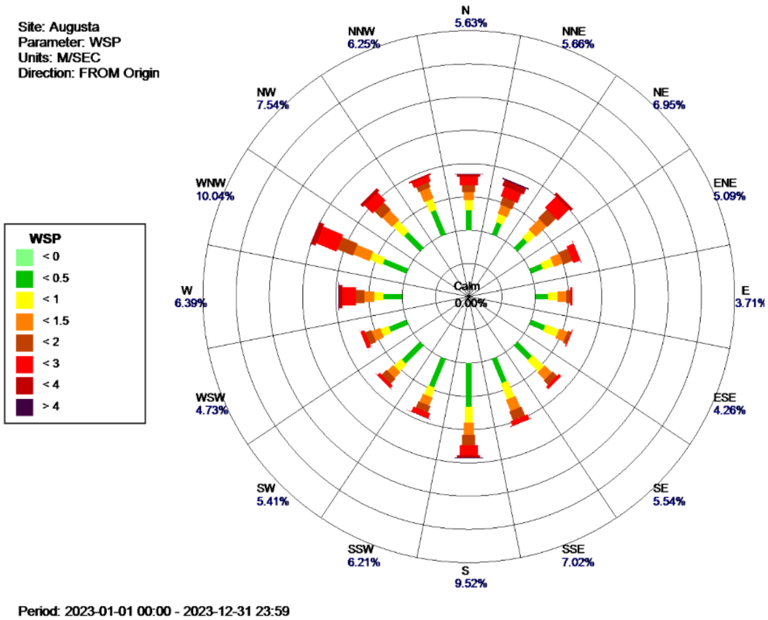
Savannah- L&A, 2023 Quarterly Winds



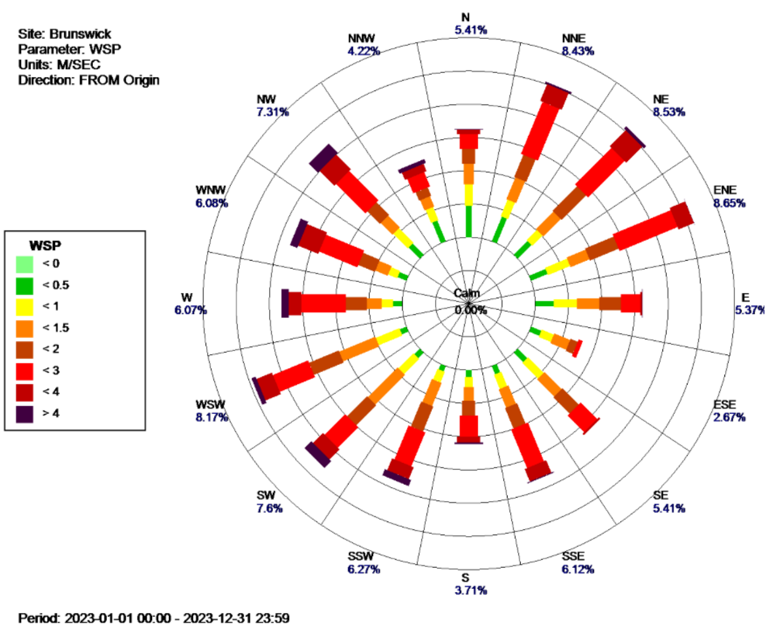
South DeKalb, 2023 Quarterly Winds



United Ave, 2023 Quarterly Winds



Augusta, 2023 Annual Winds



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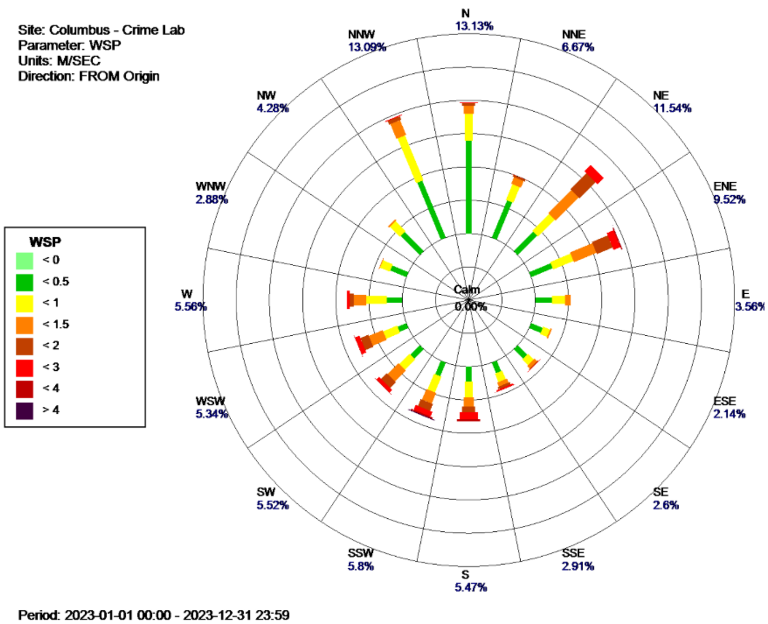

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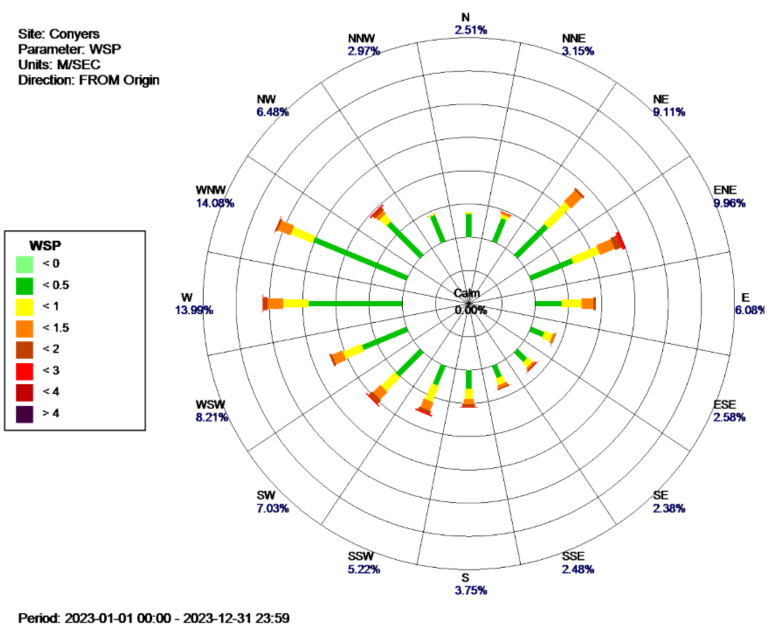

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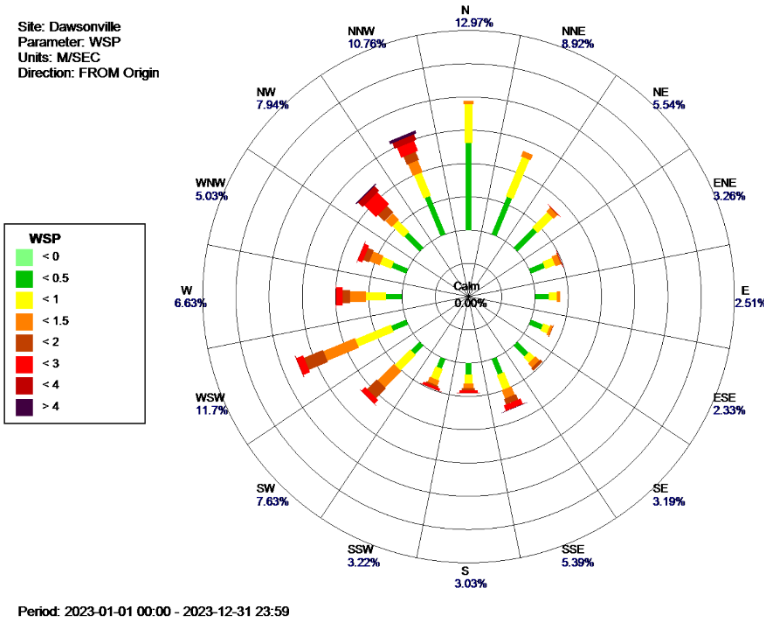

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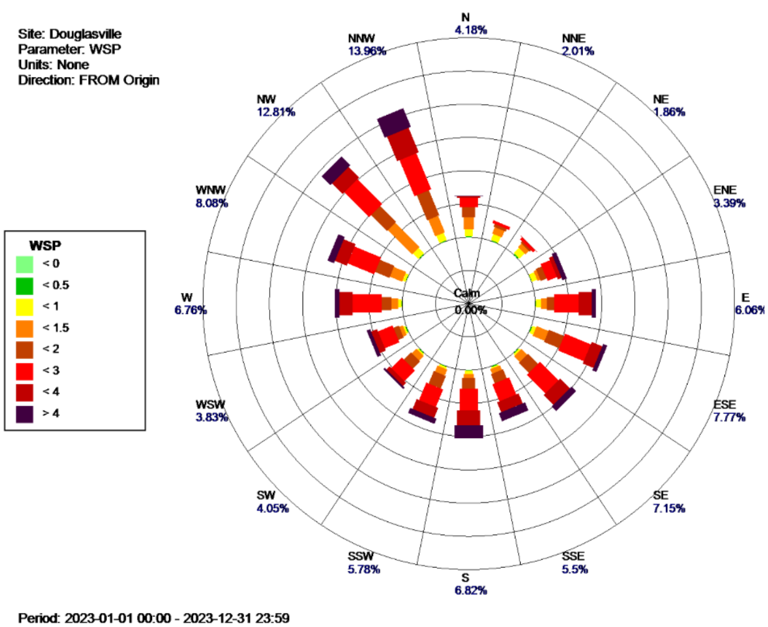

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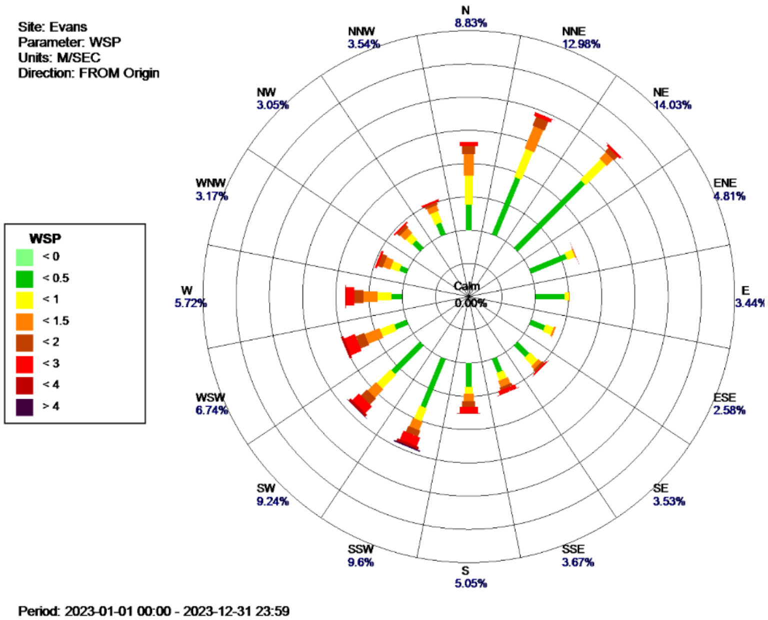

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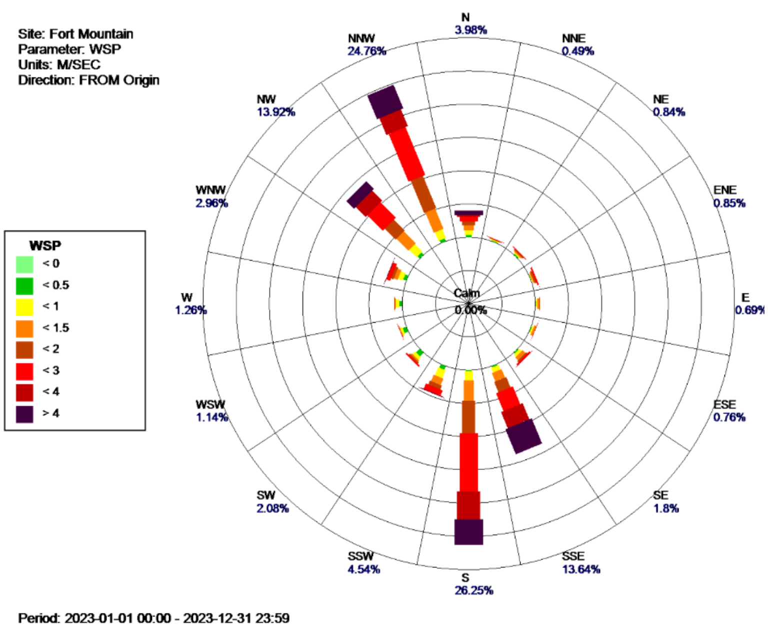

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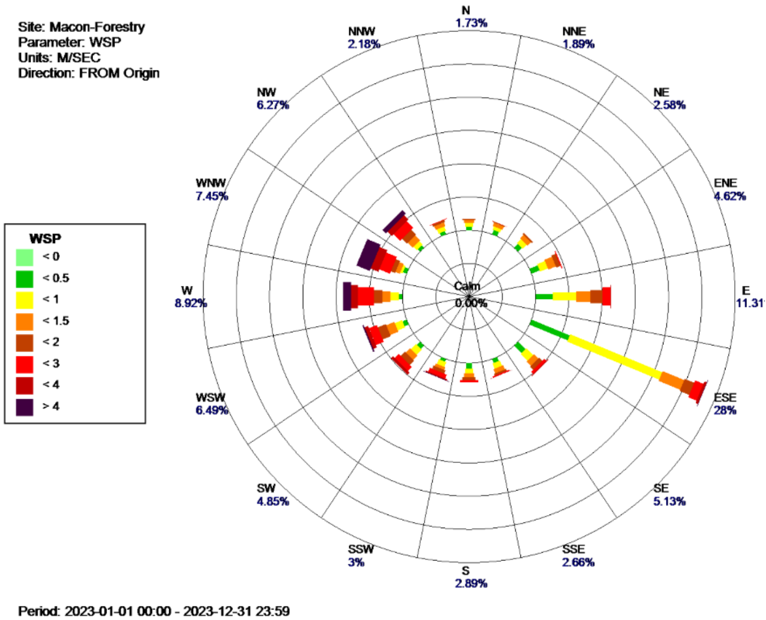

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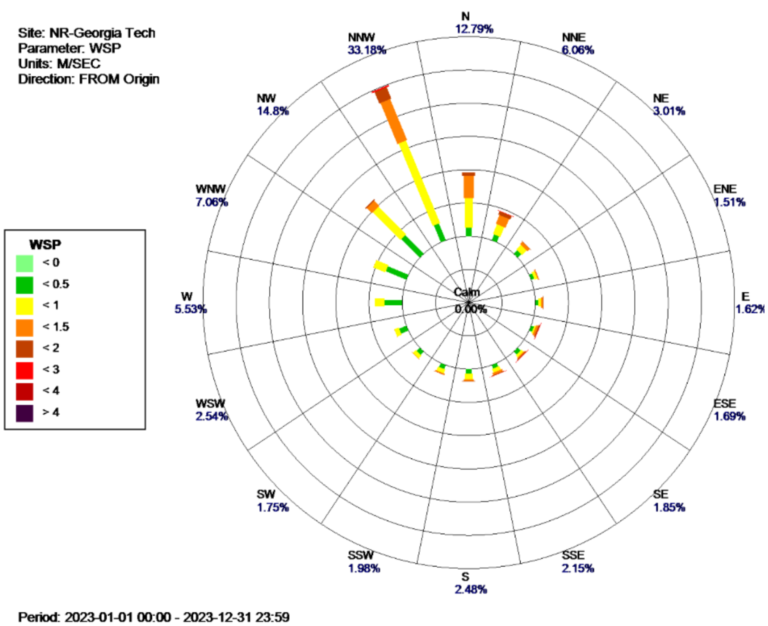

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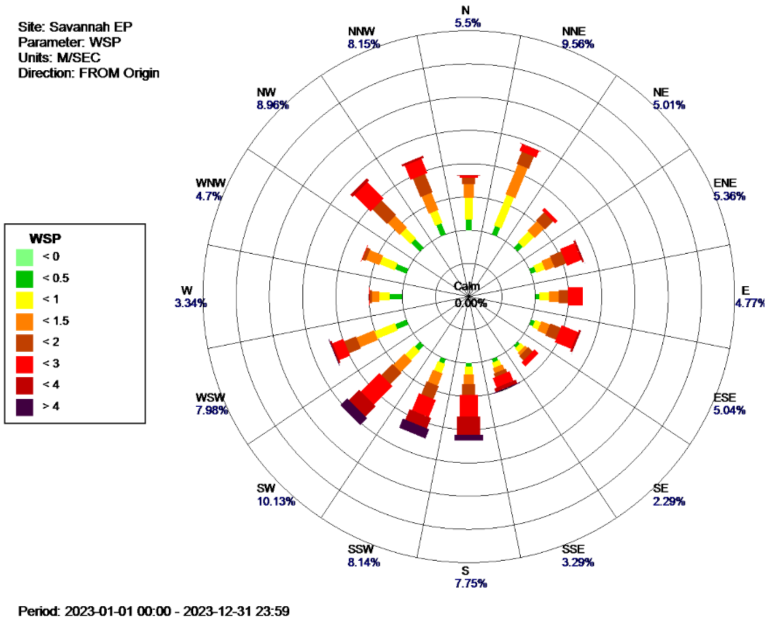
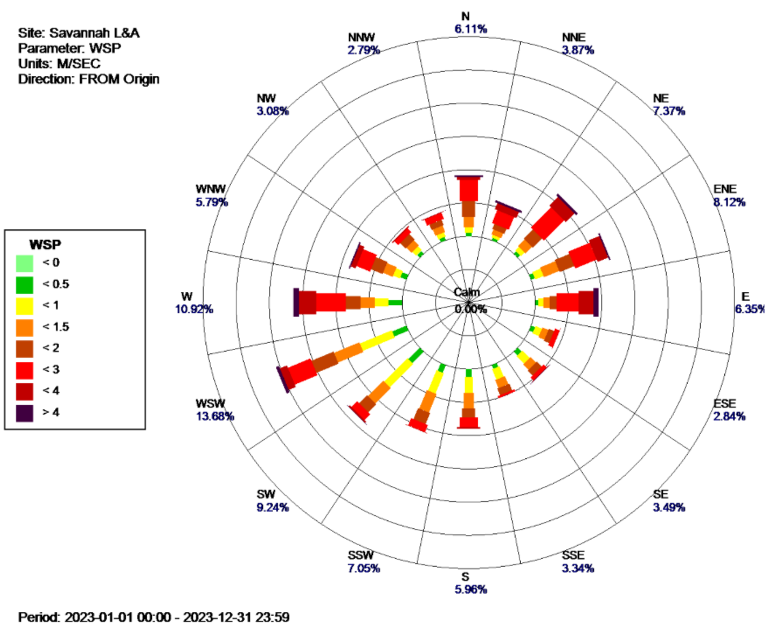


Savannah- E President, 2023 Annual Winds



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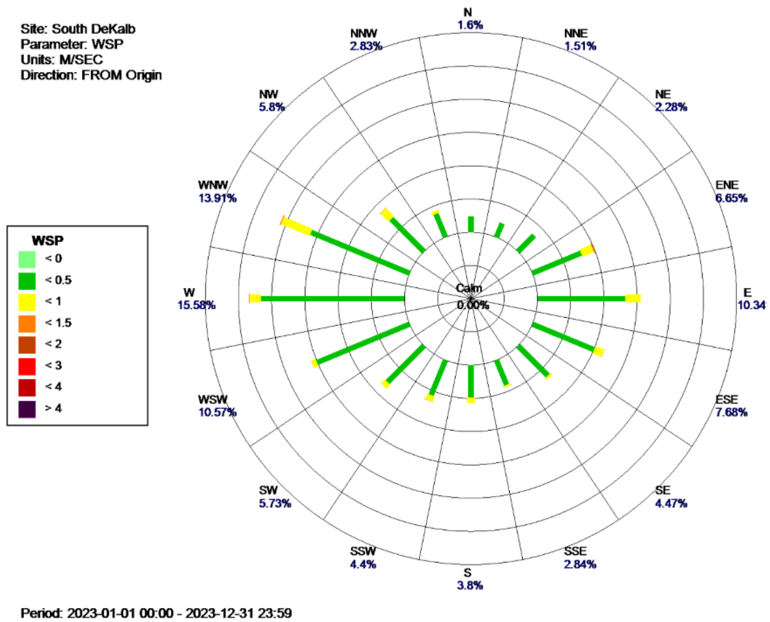

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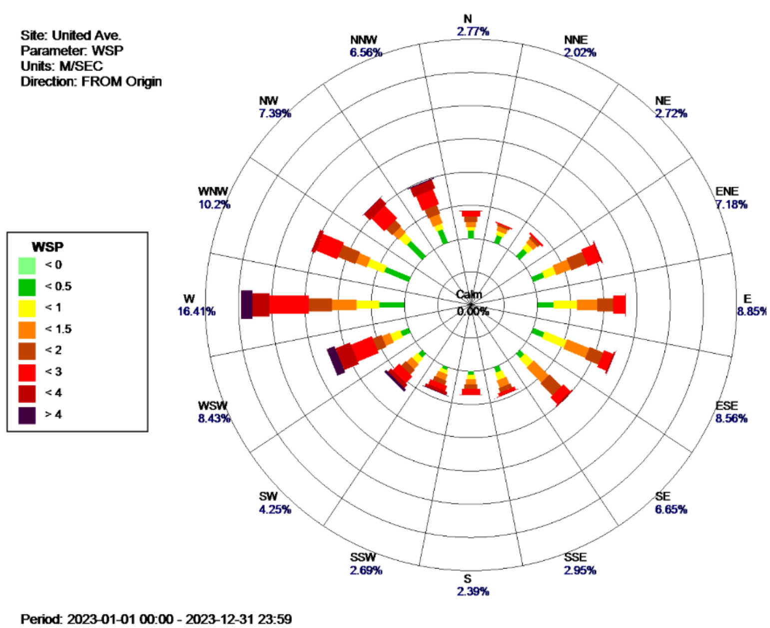

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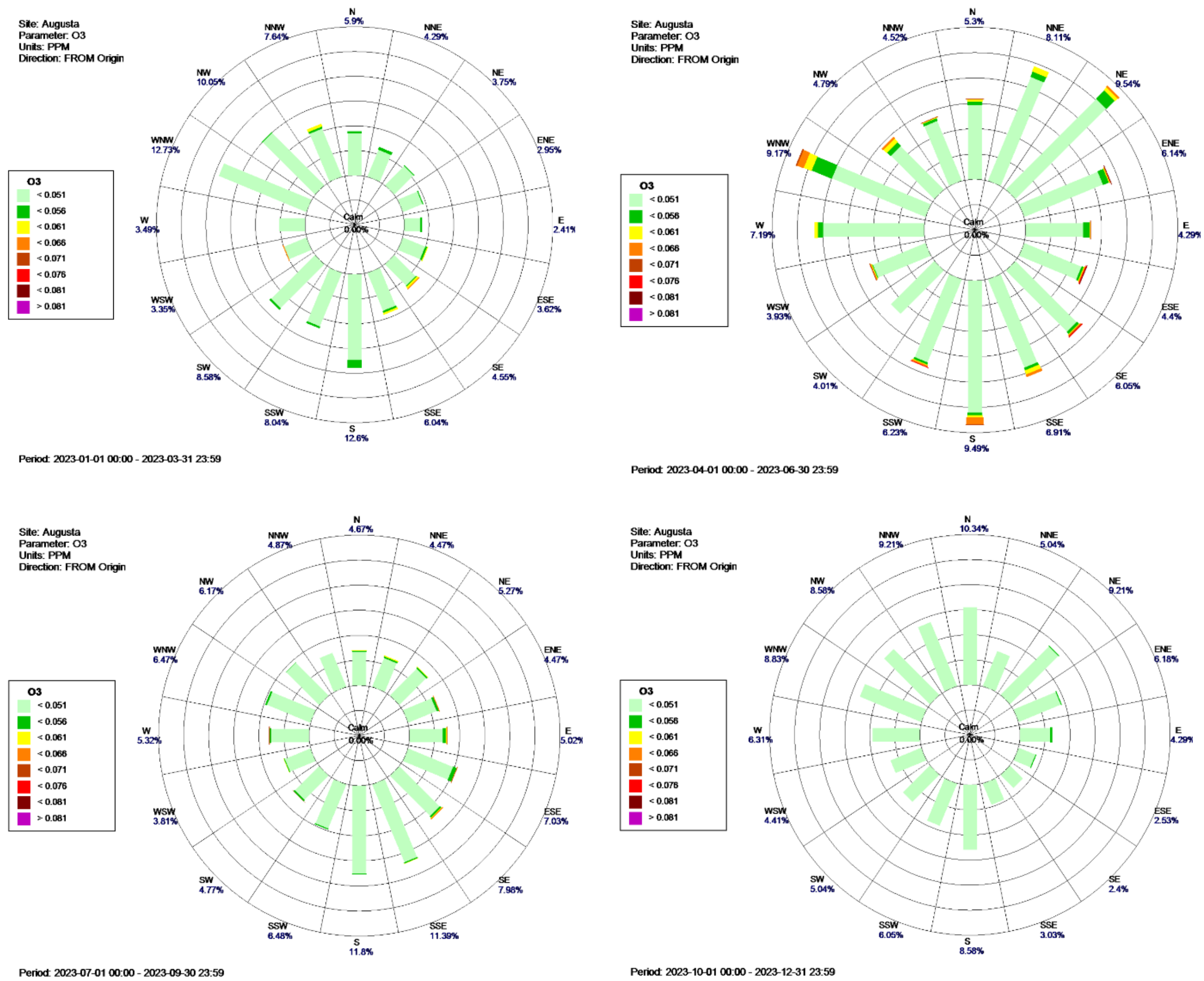

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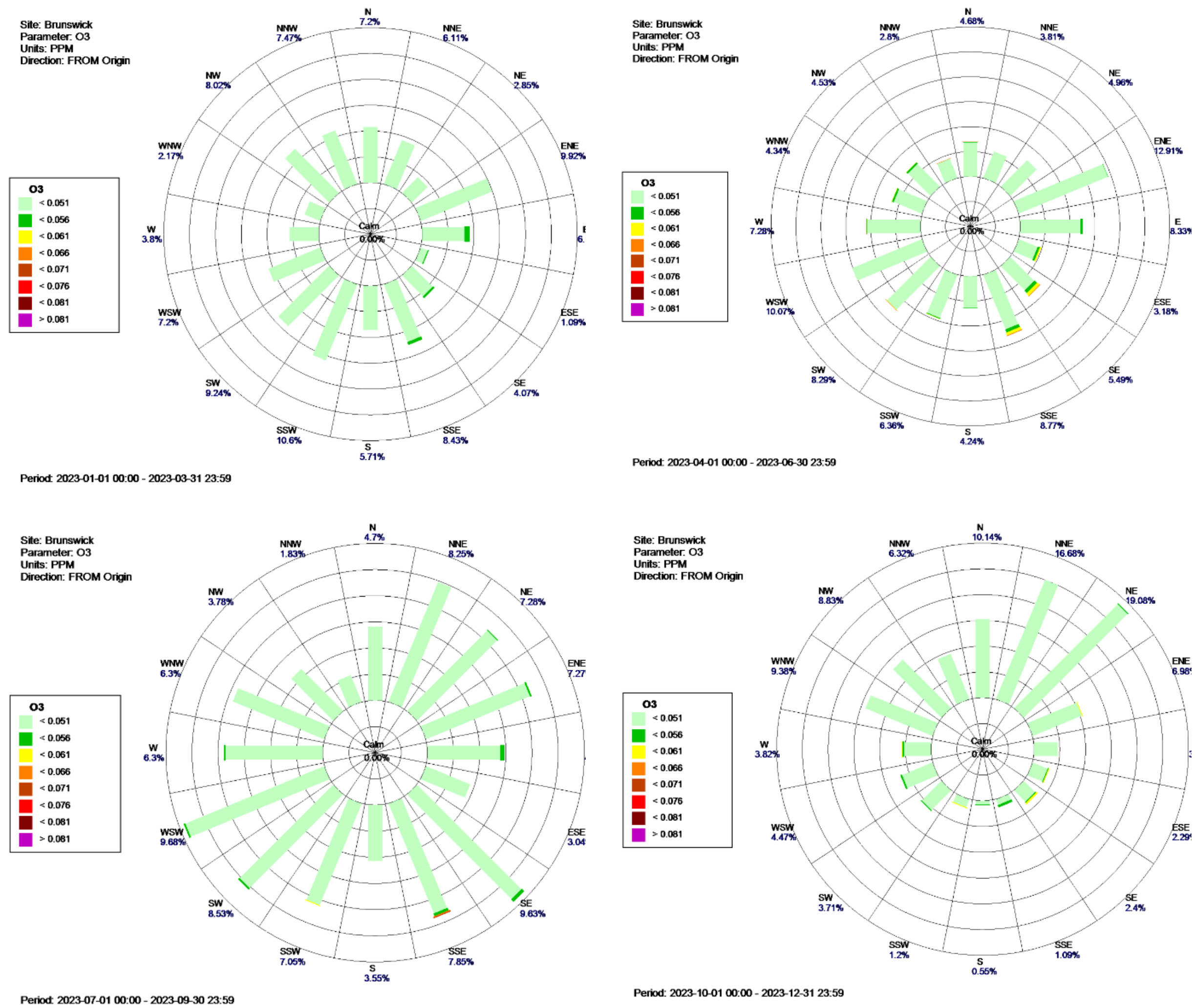
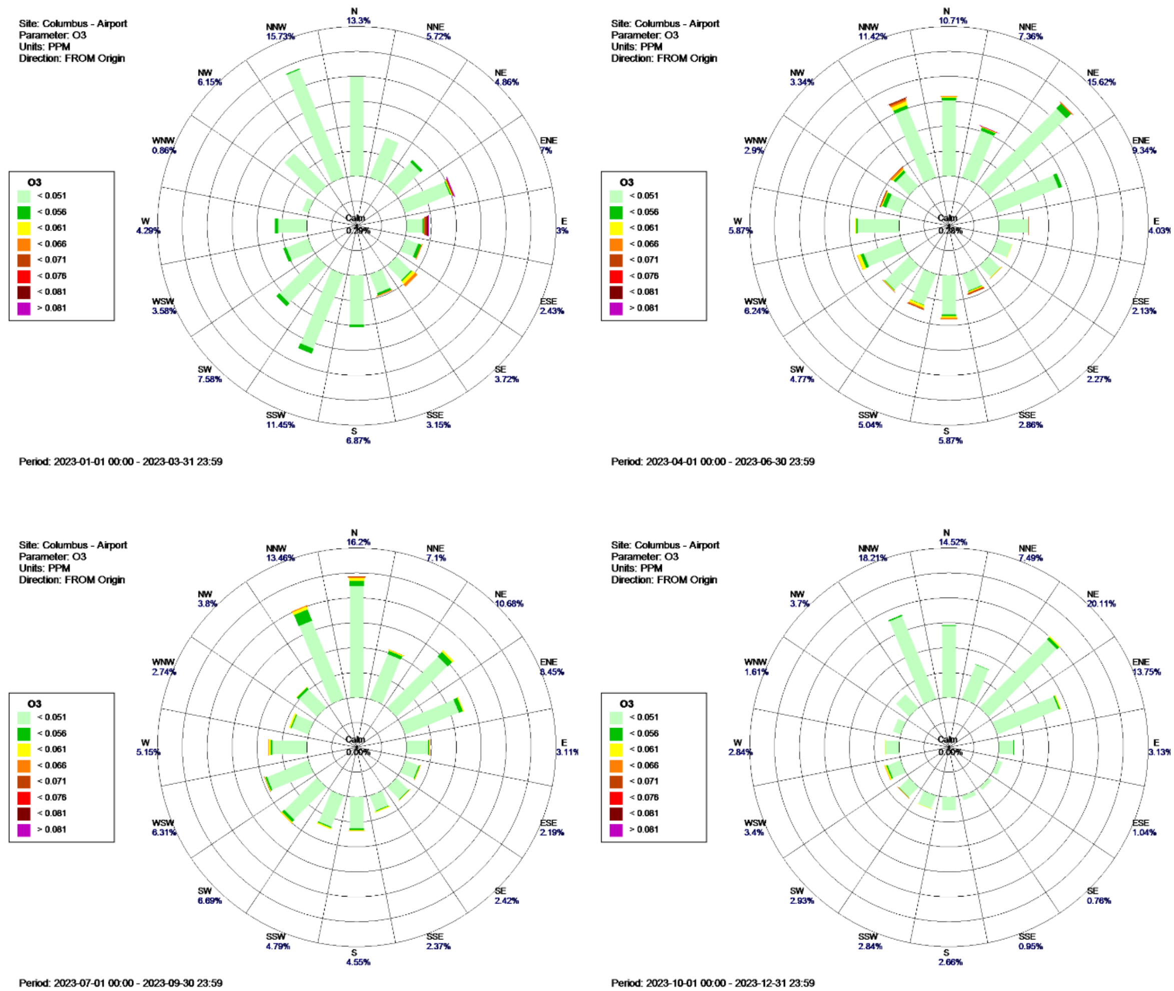
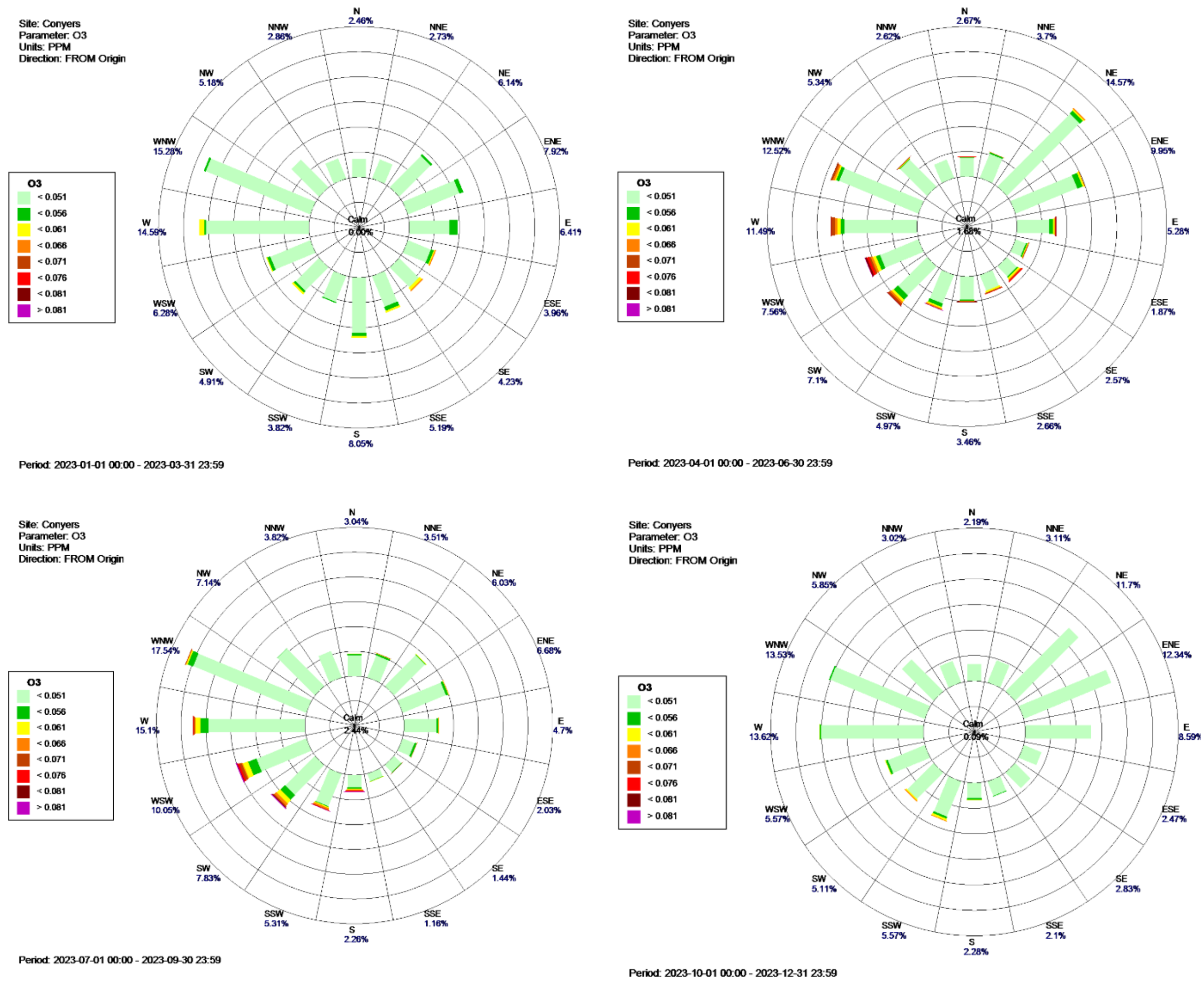


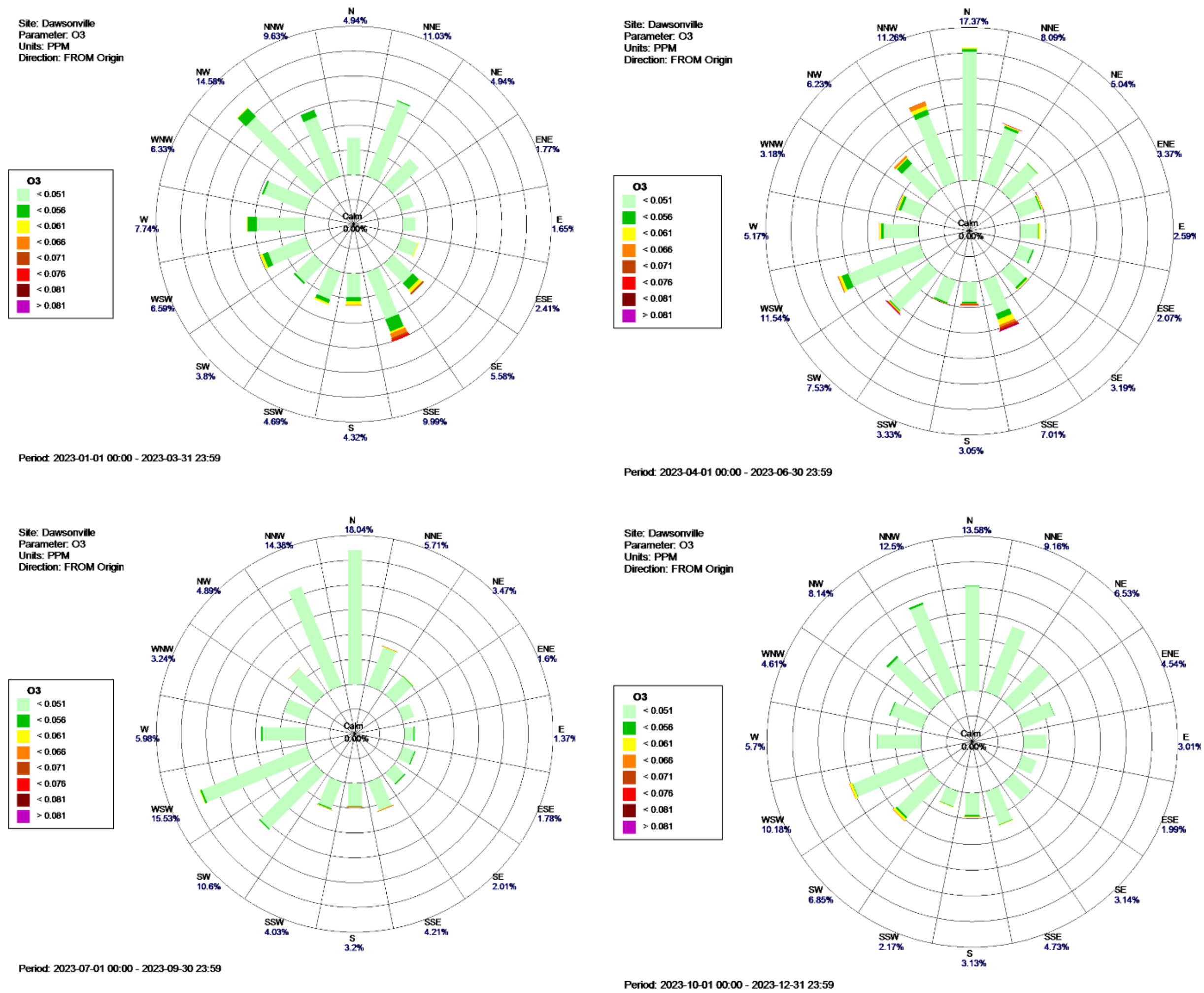
Brunswick, 2023 Quarterly Ozone



Columbus-Airport, 2023 Quarterly Ozone



Conyers, 2023 Quarterly Ozone



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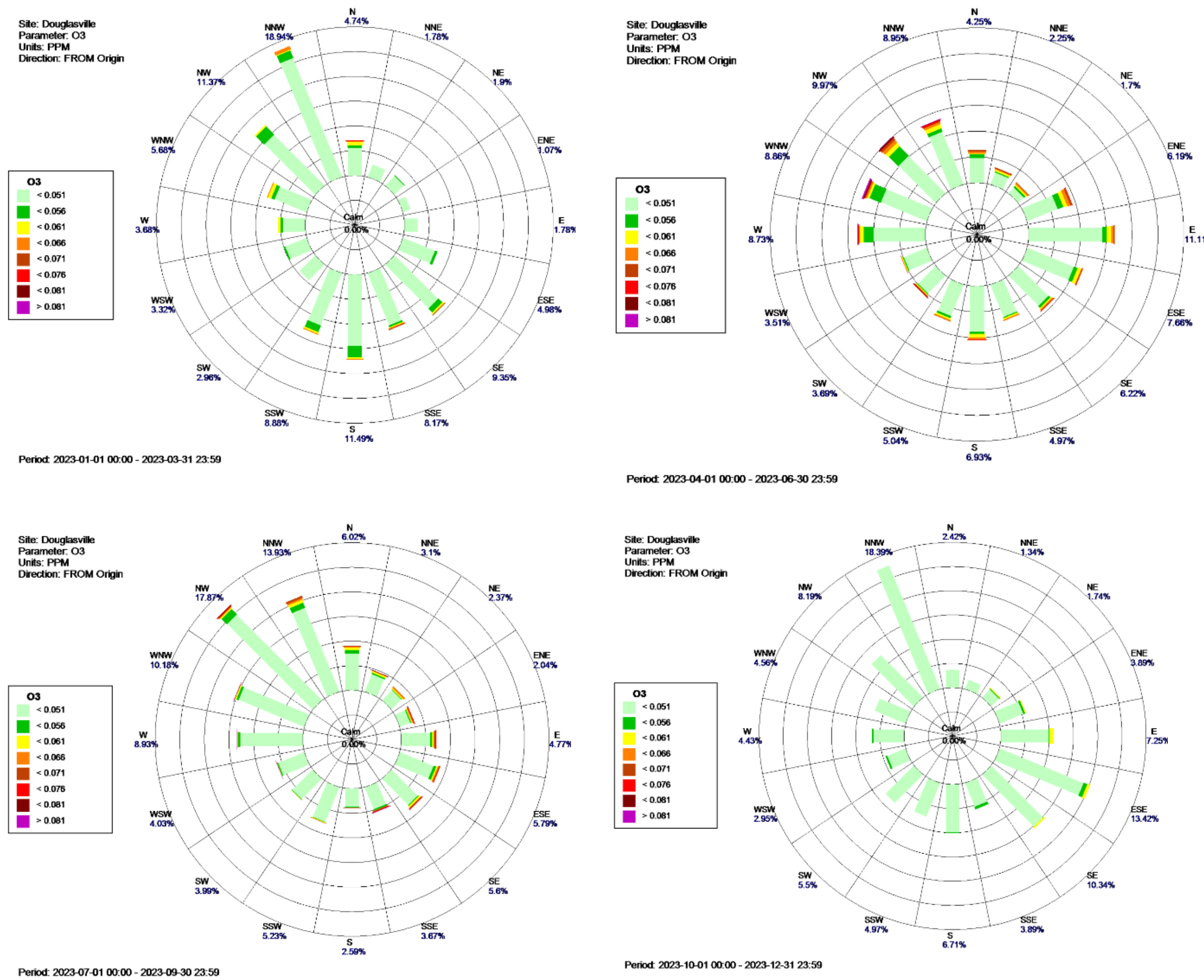
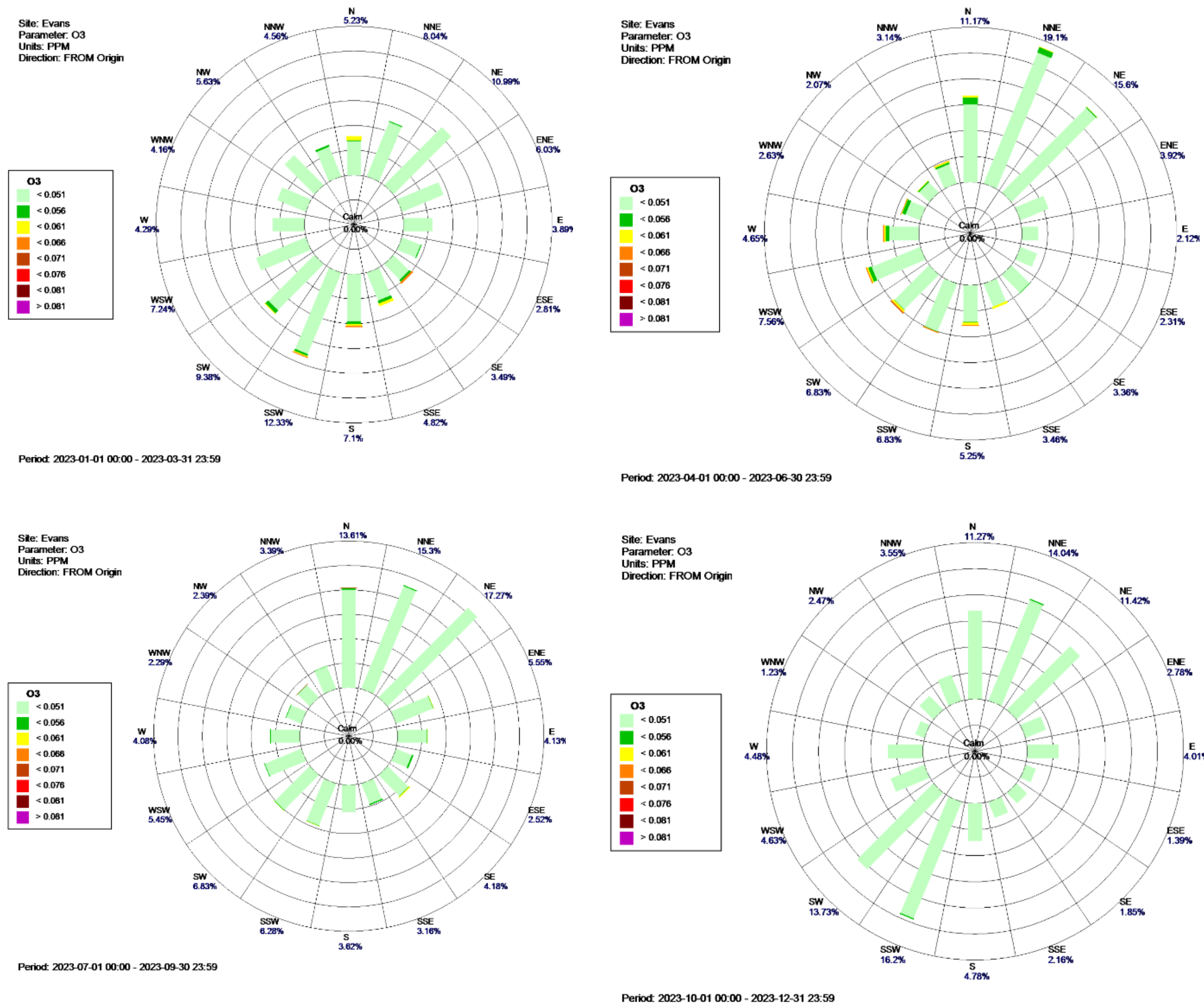
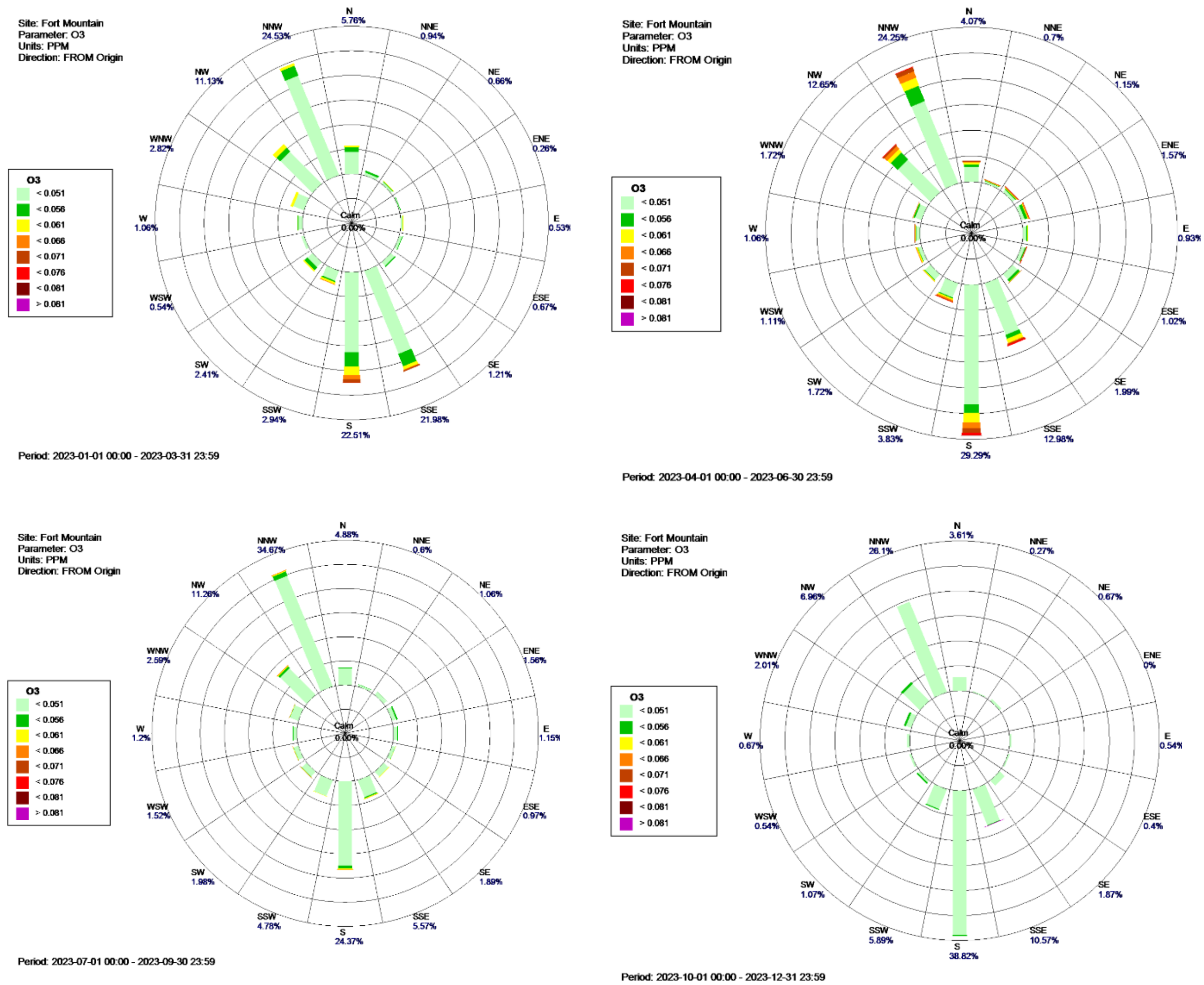


Douglasville, 2023 Quarterly Ozone



Evans, 2023 Quarterly Ozone



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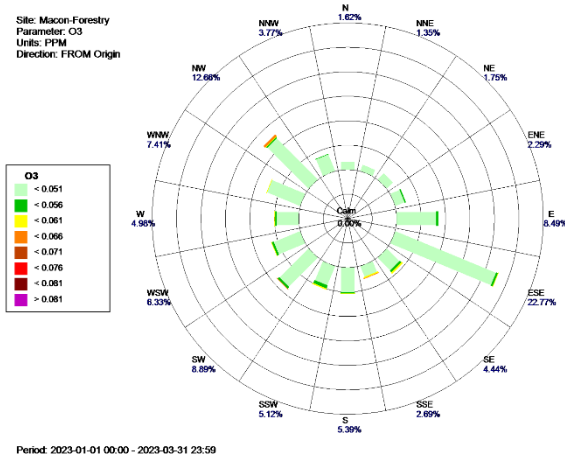

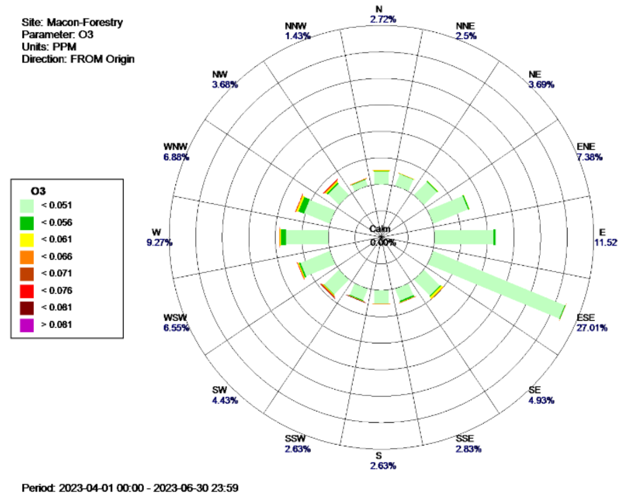

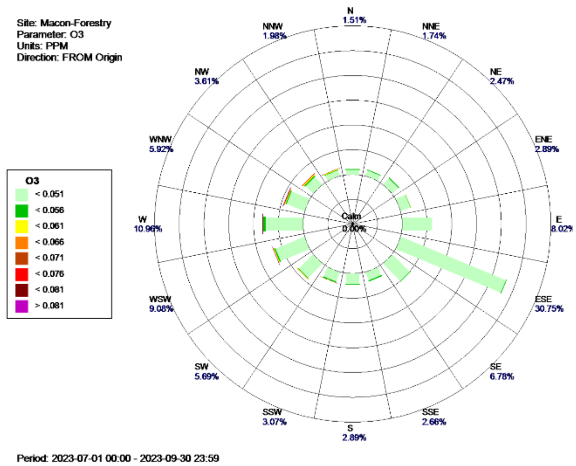

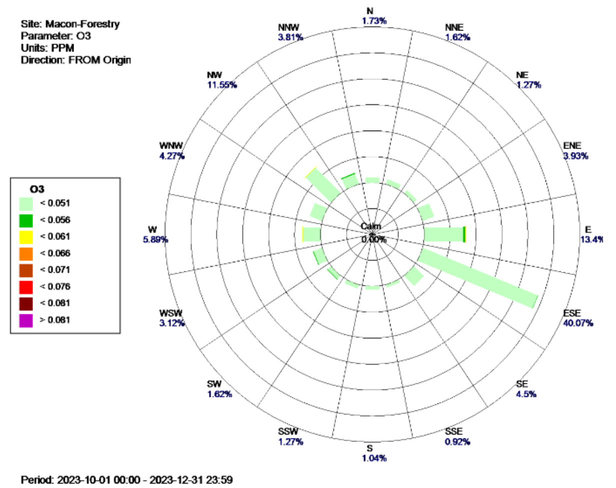

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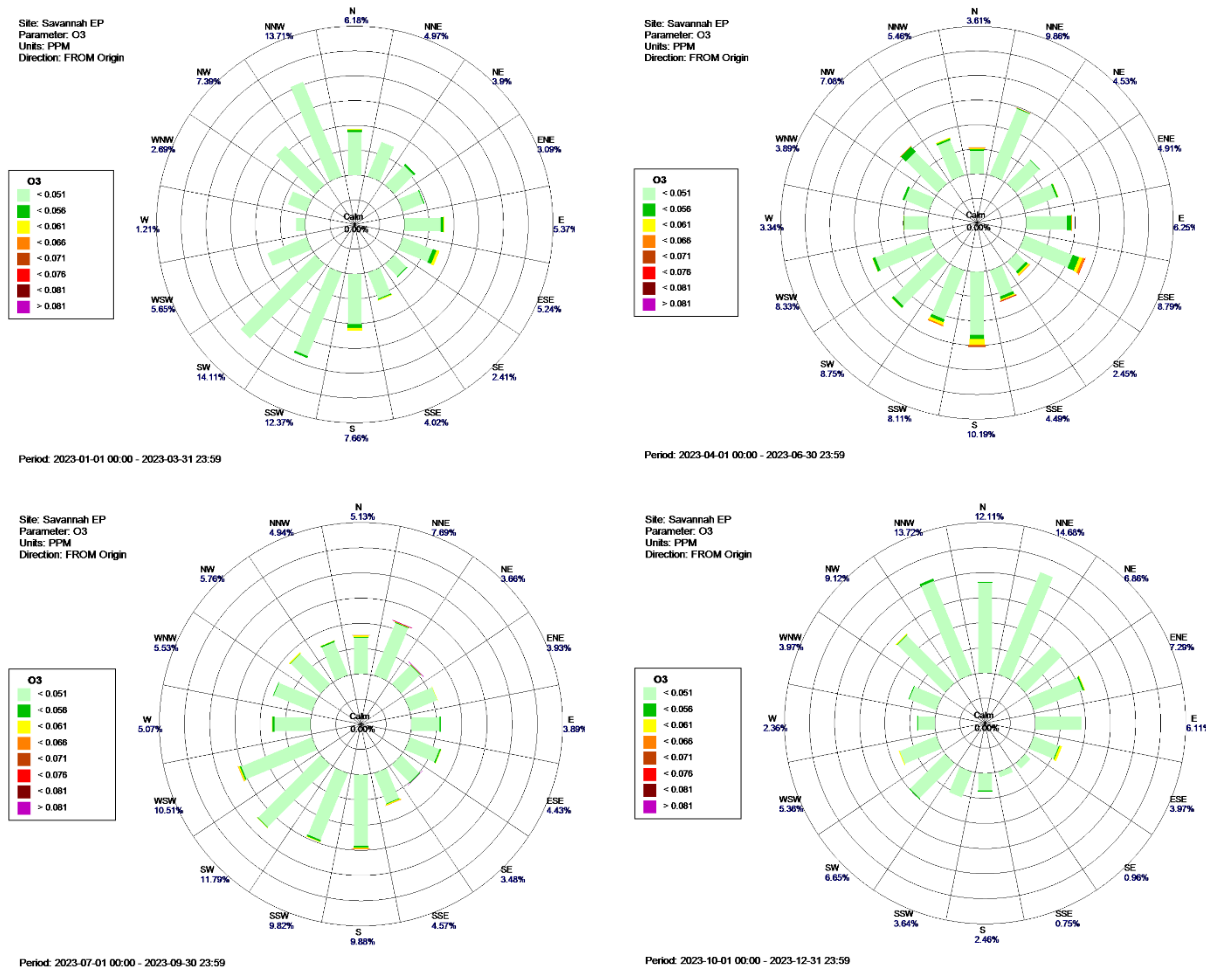
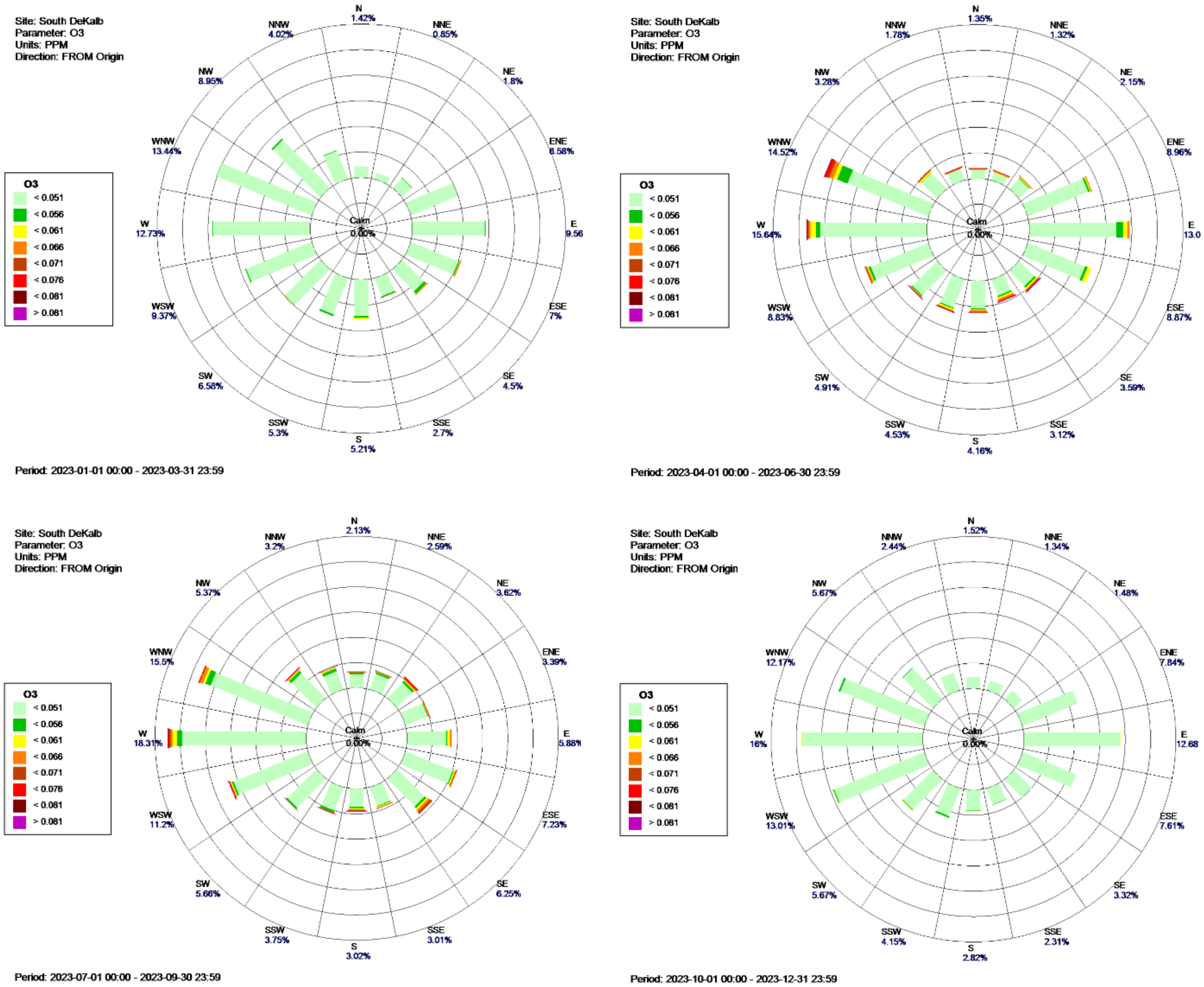


Savannah- E President, 2023 Quarterly Ozone



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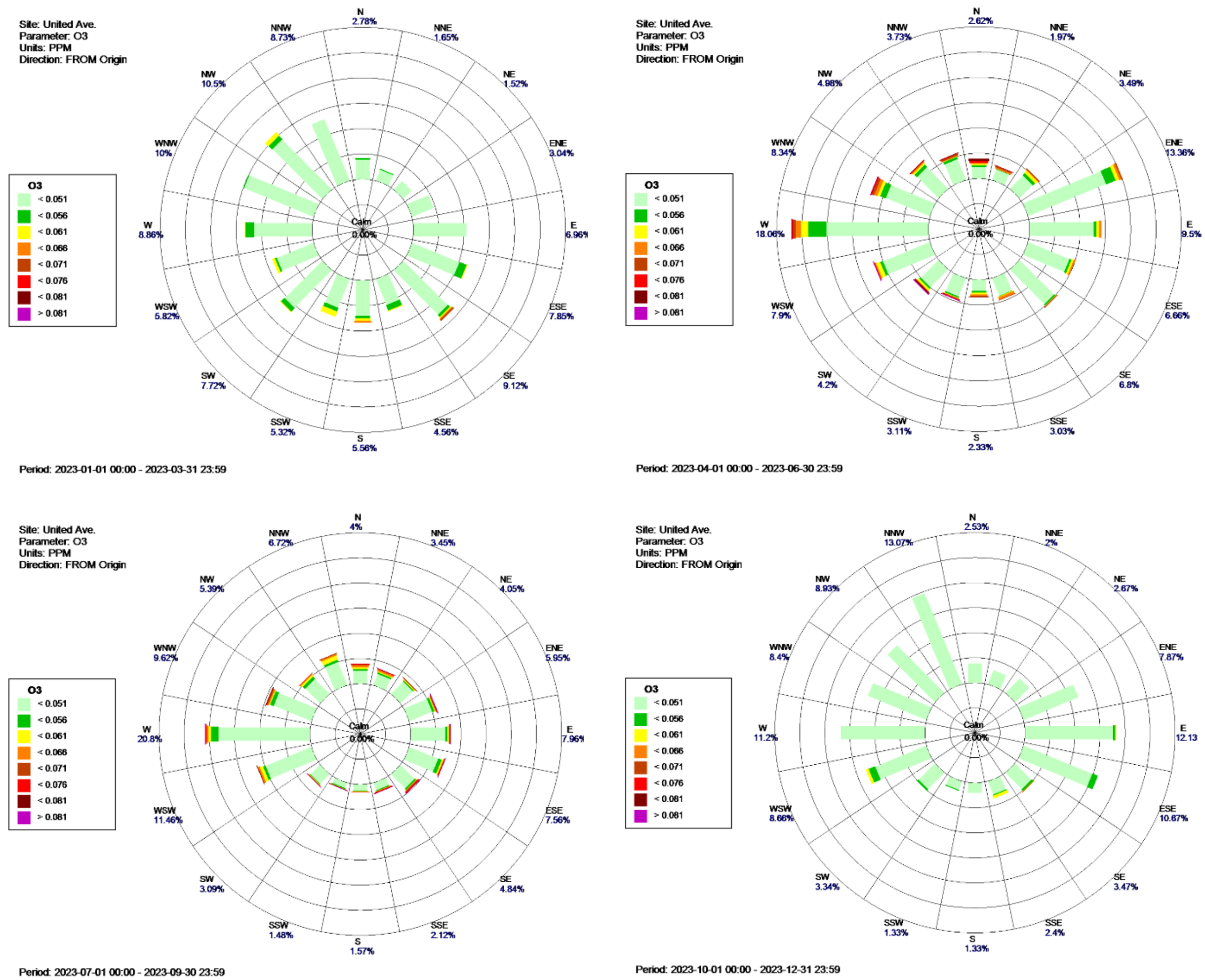
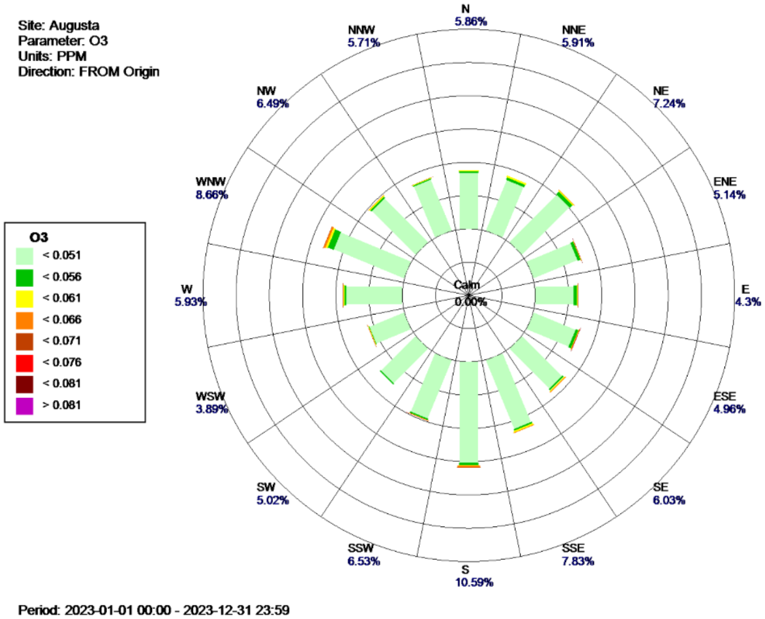


United Ave, 2023 Quarterly Ozone



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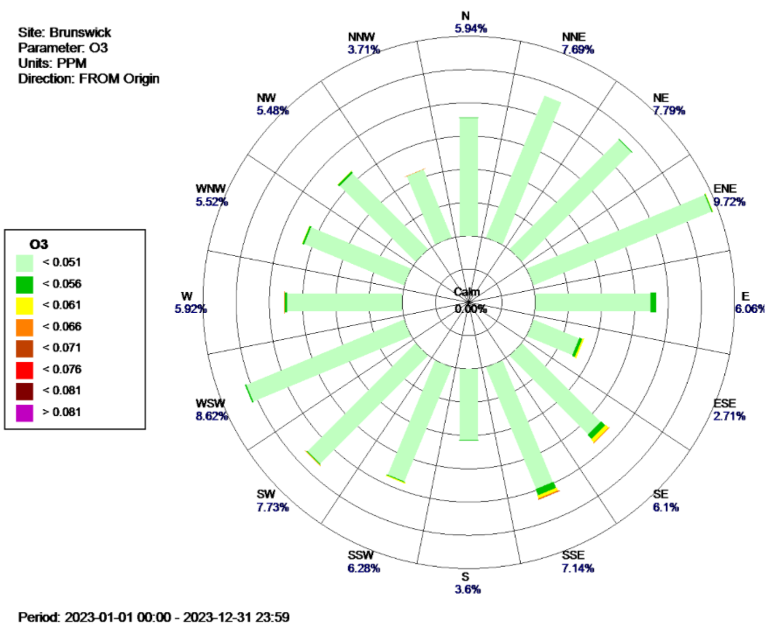

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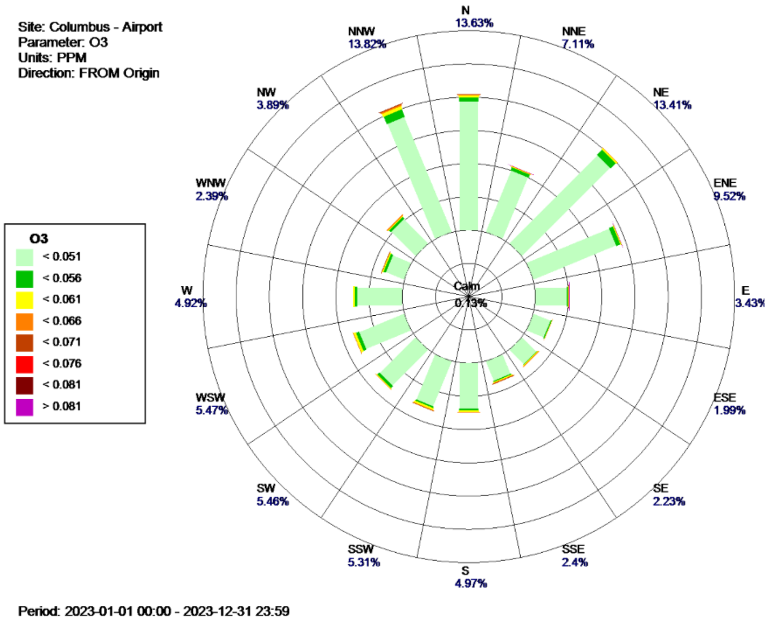

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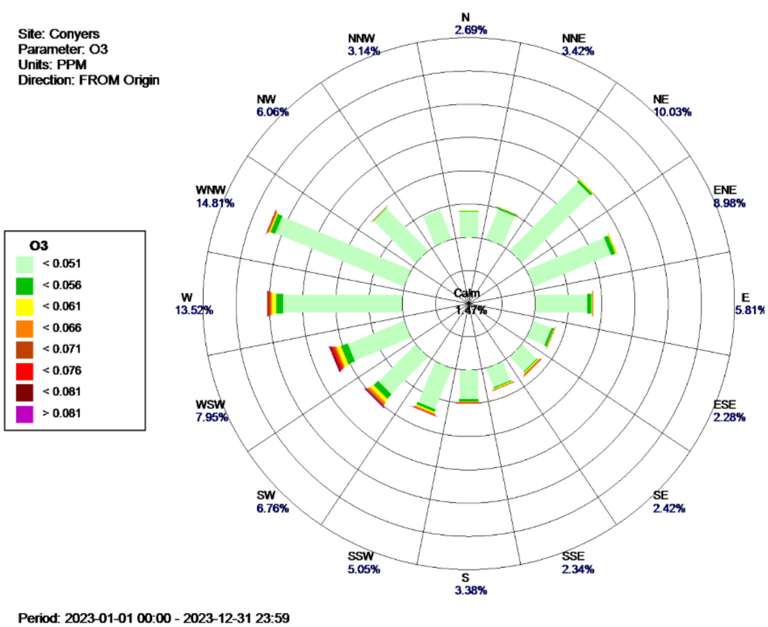

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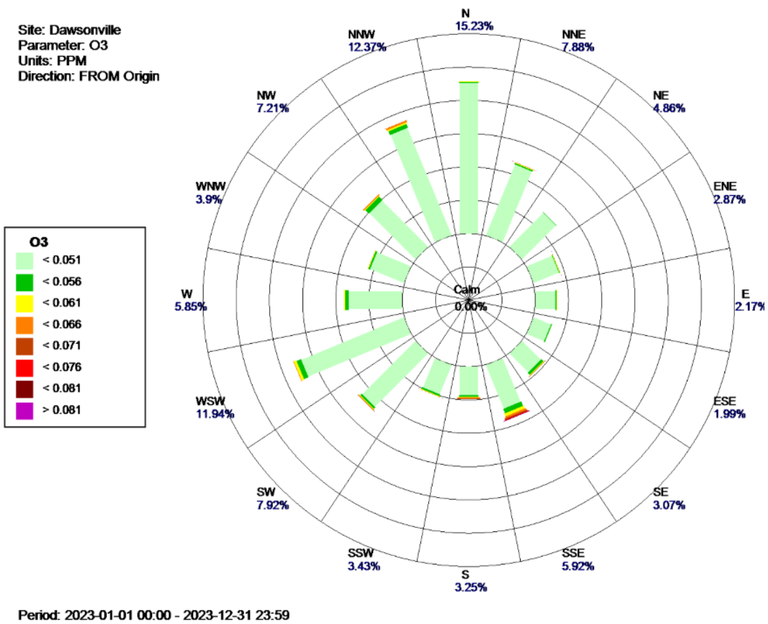

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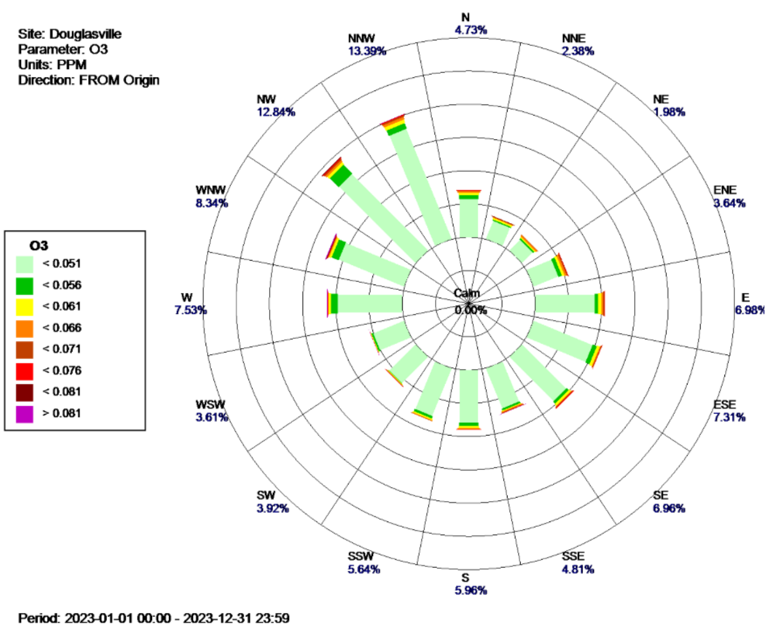

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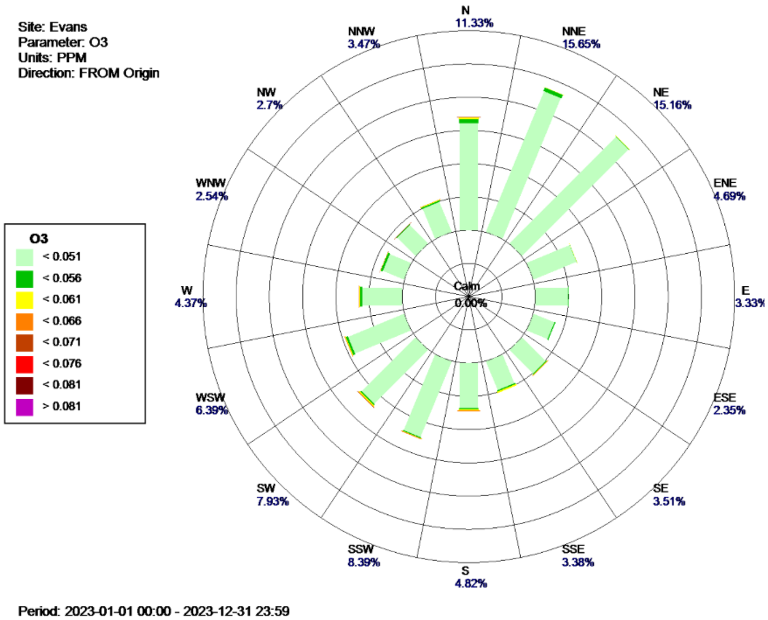

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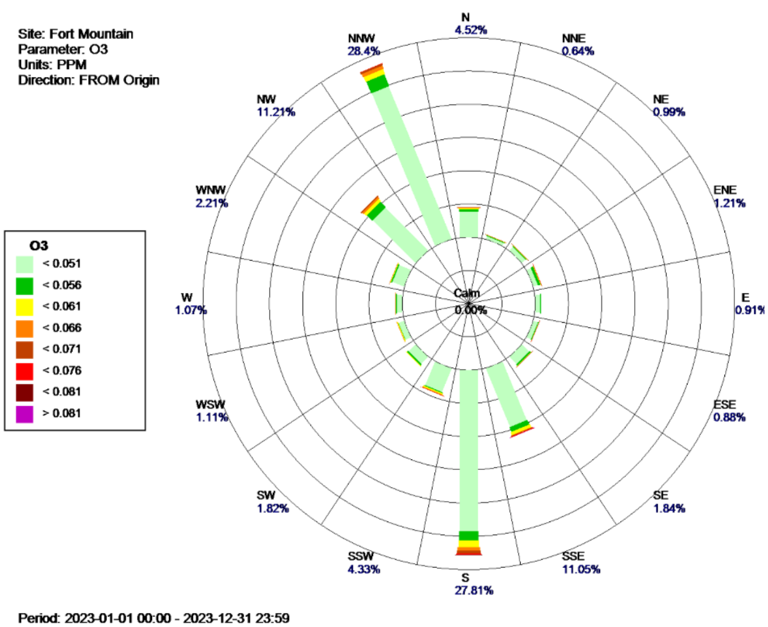

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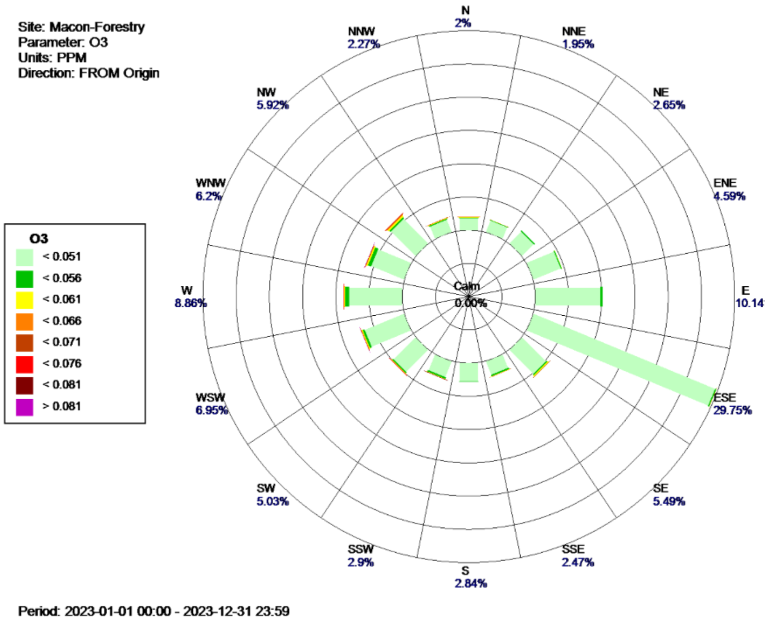

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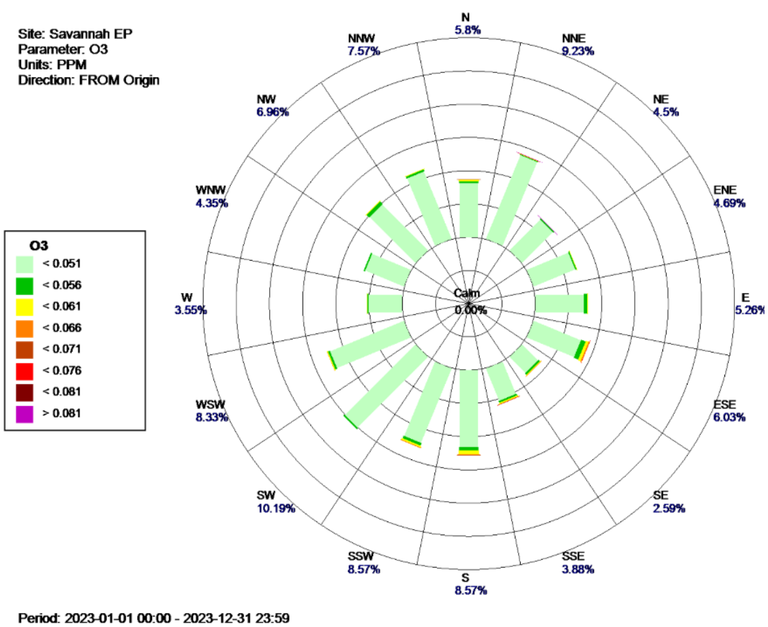
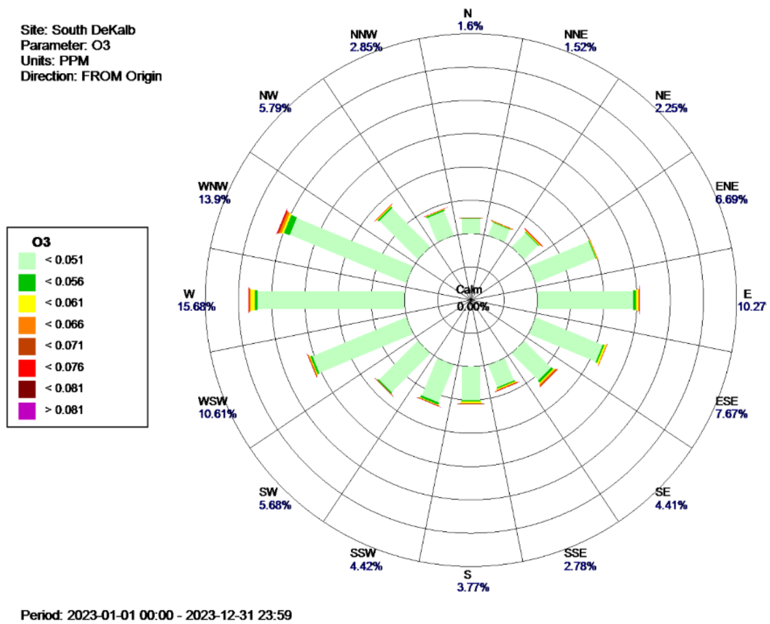


Savannah-E President, 2023 Annual Ozone



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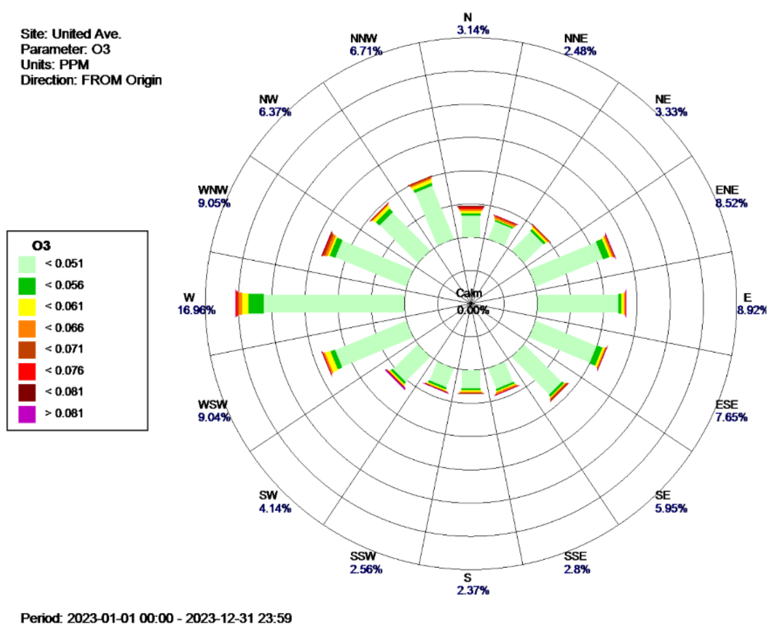

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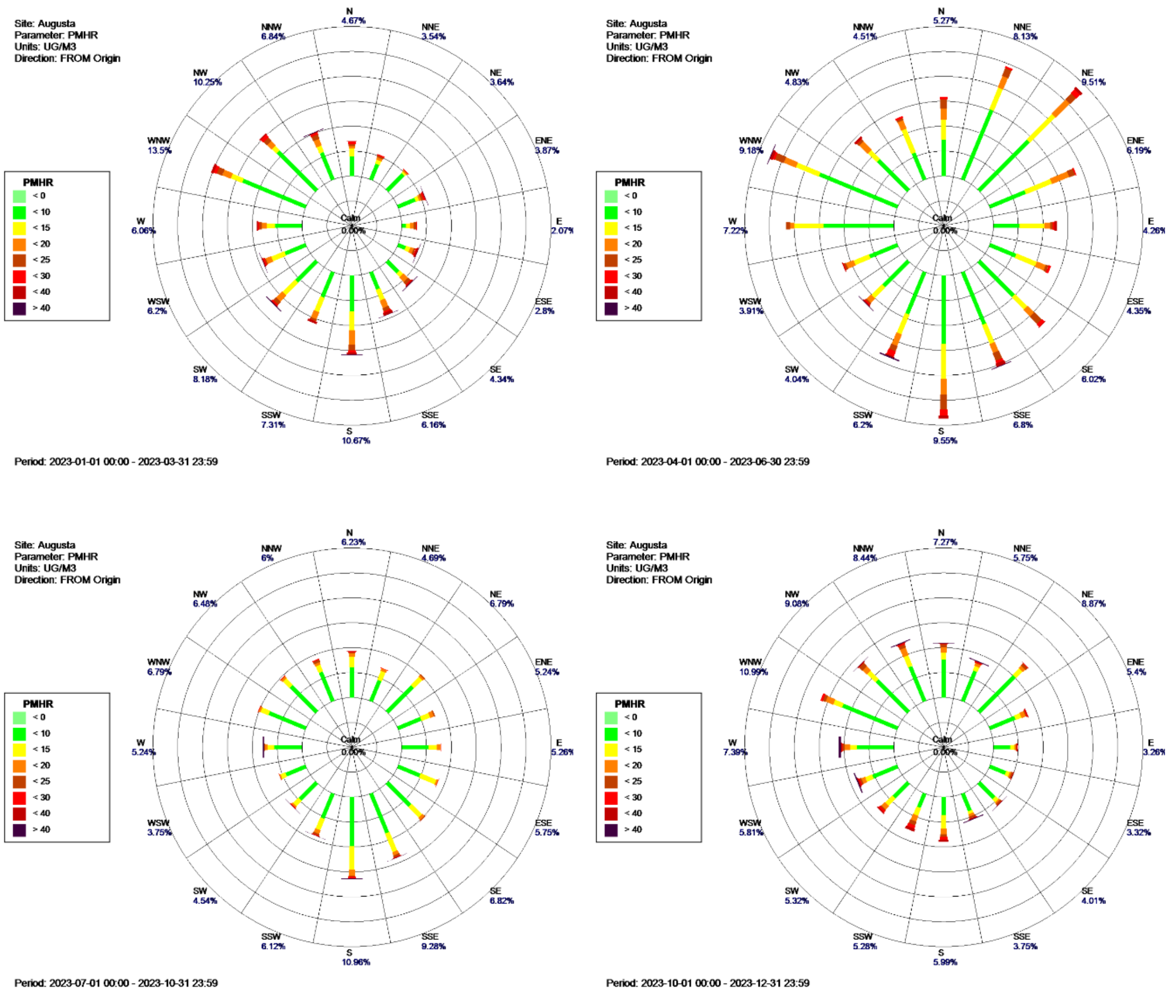
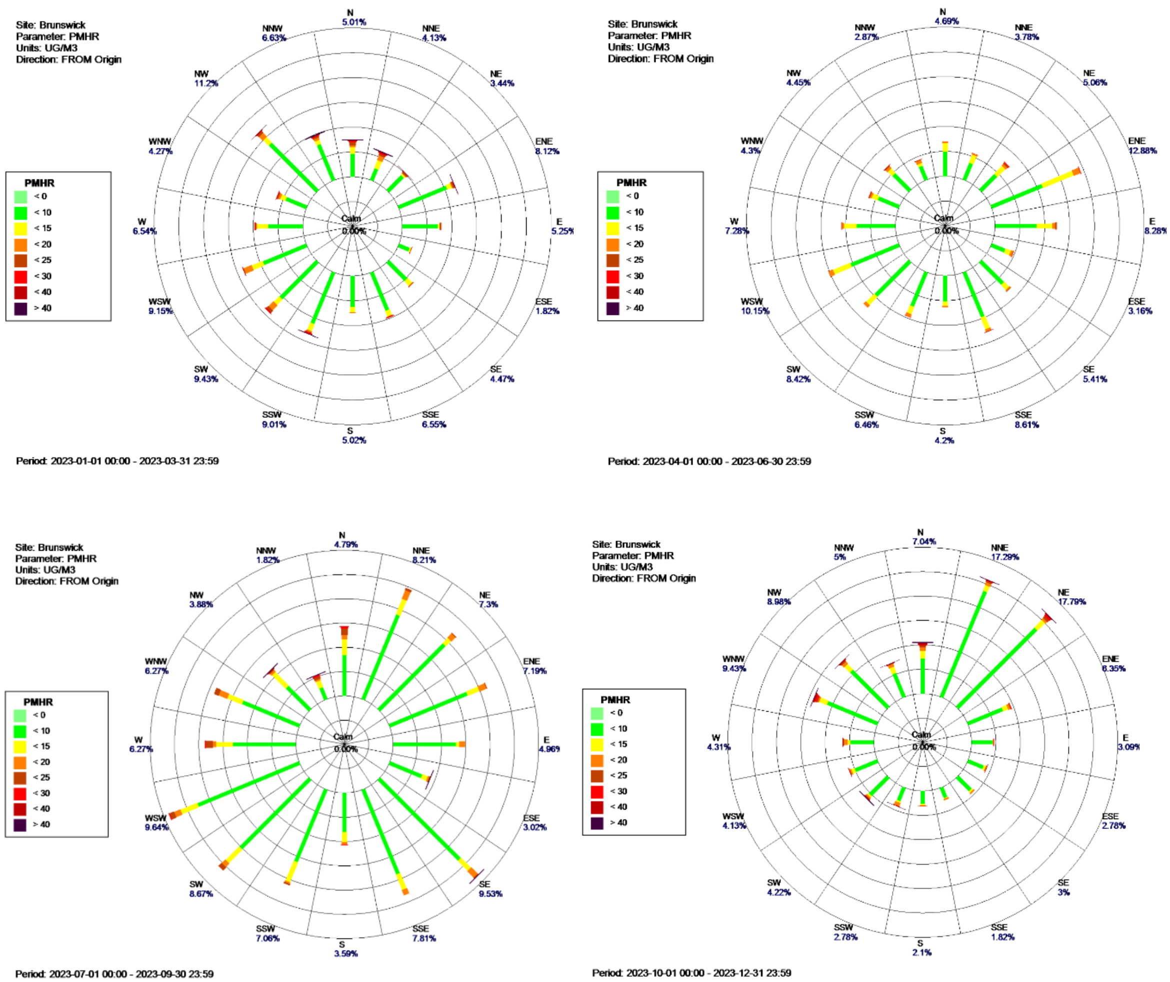
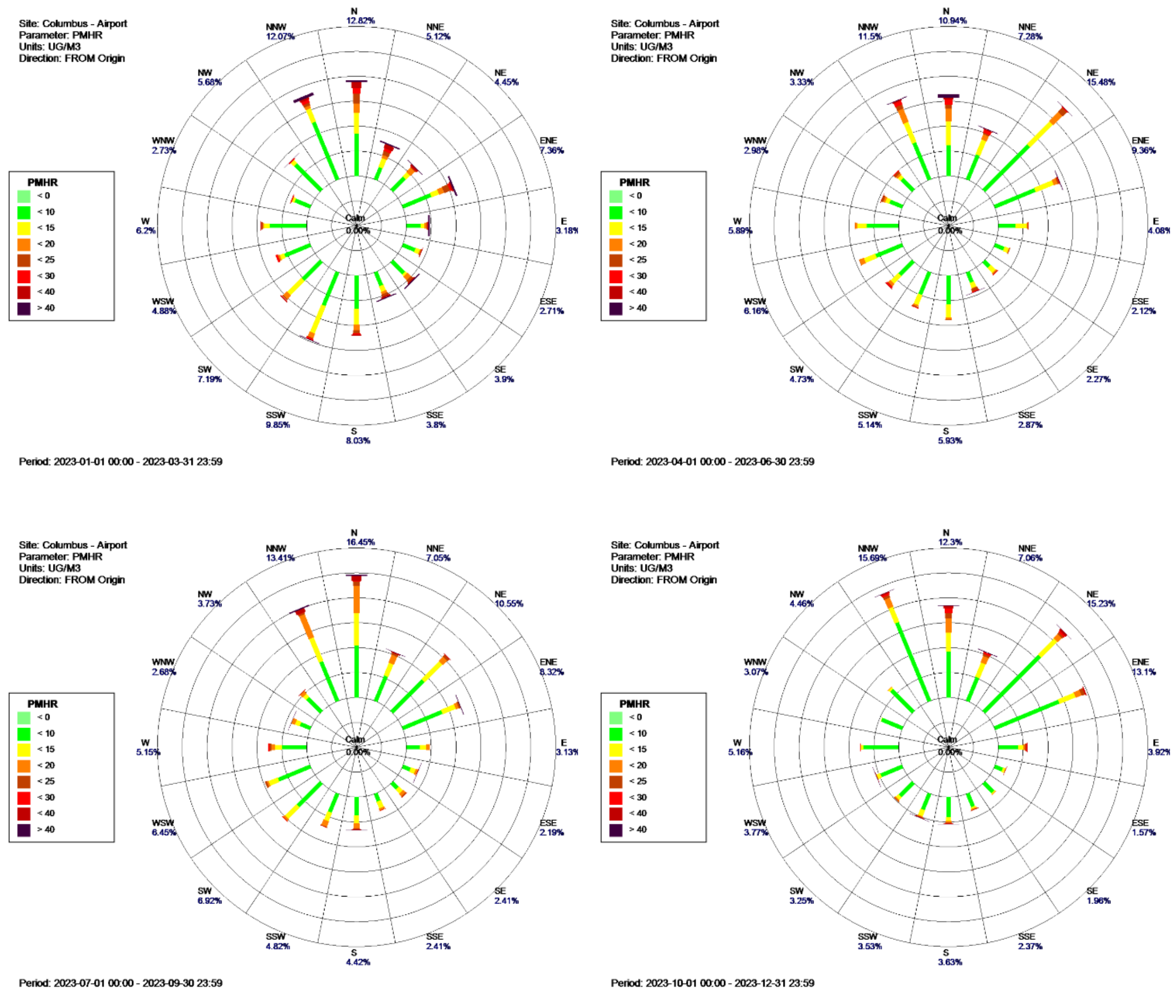


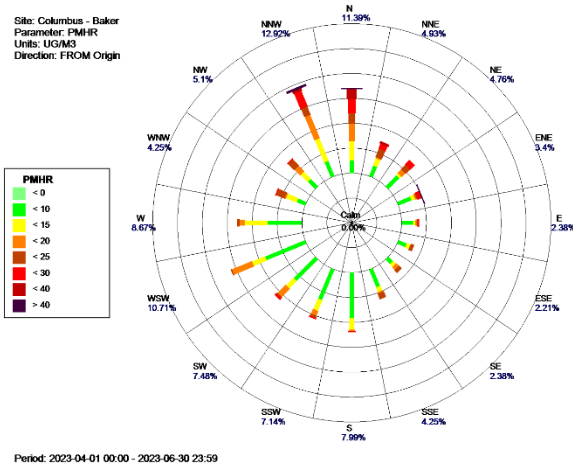
Augusta, 2023 Quarterly $PM_{2.5}$

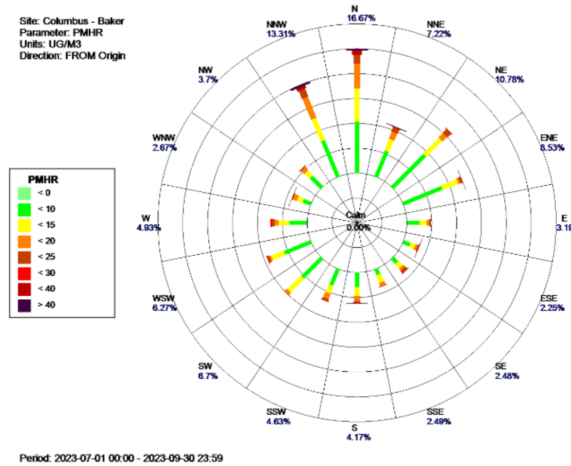


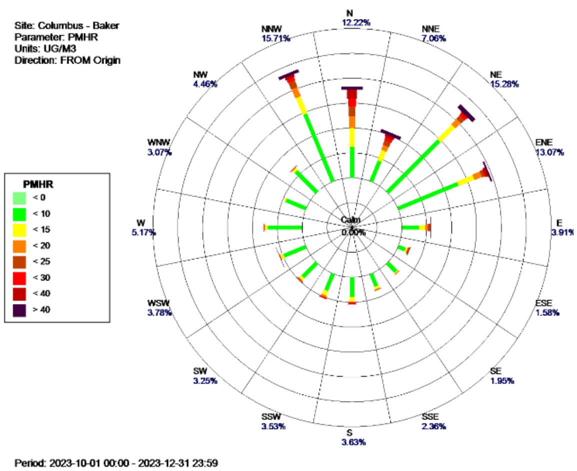
Brunswick, 2023 Quarterly $PM_{2.5}$



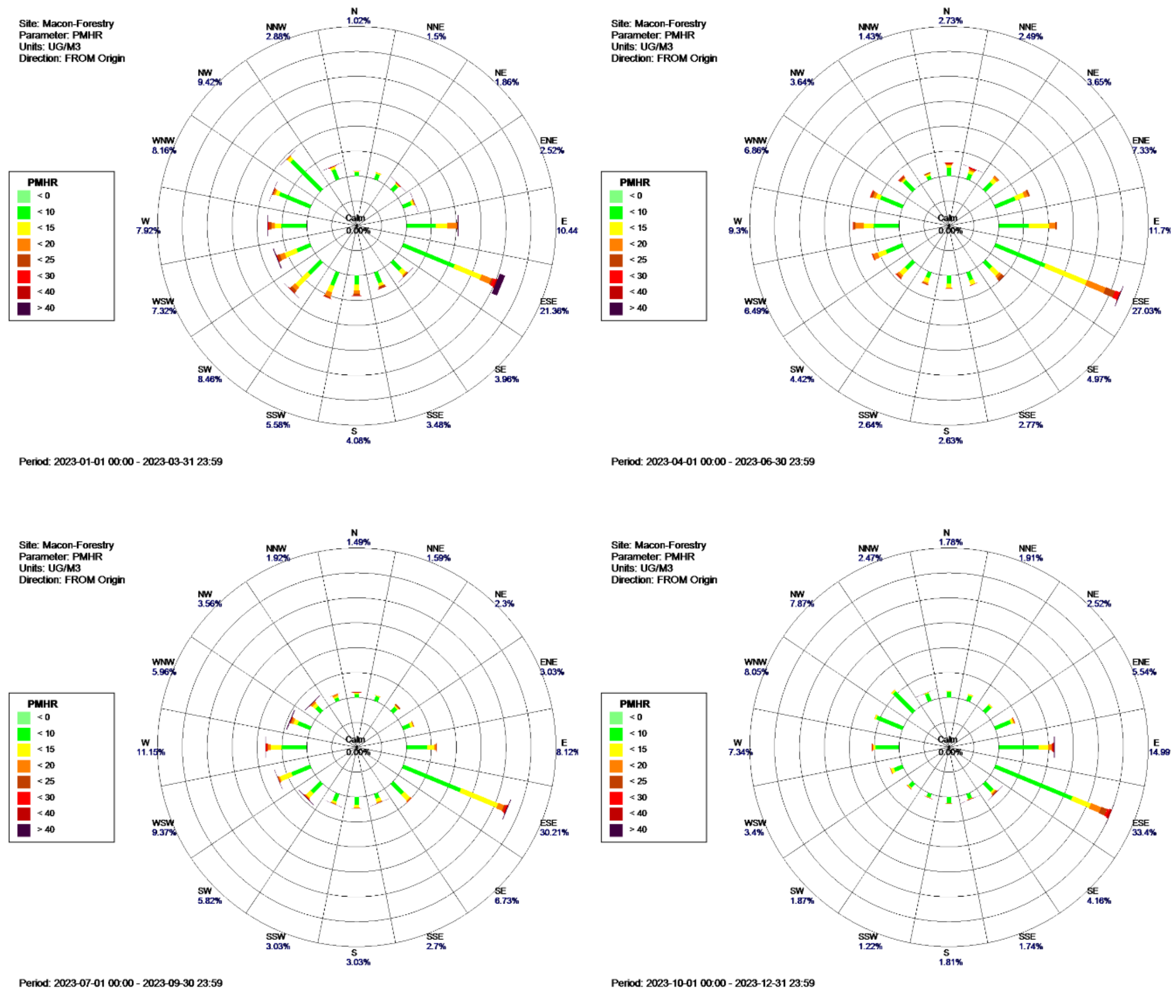
Columbus-Airport, 2023 Quarterly $PM_{2.5}$



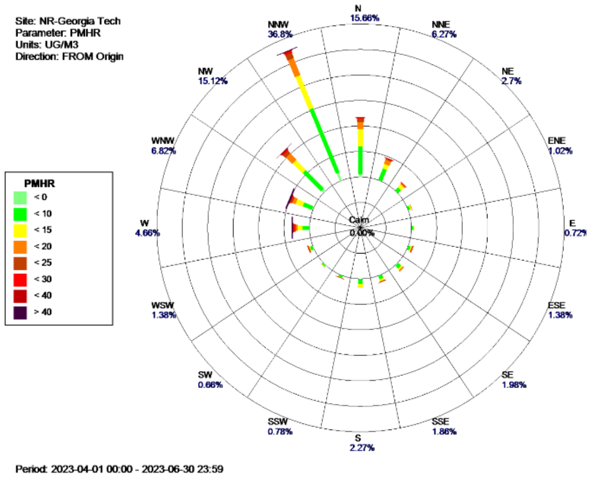


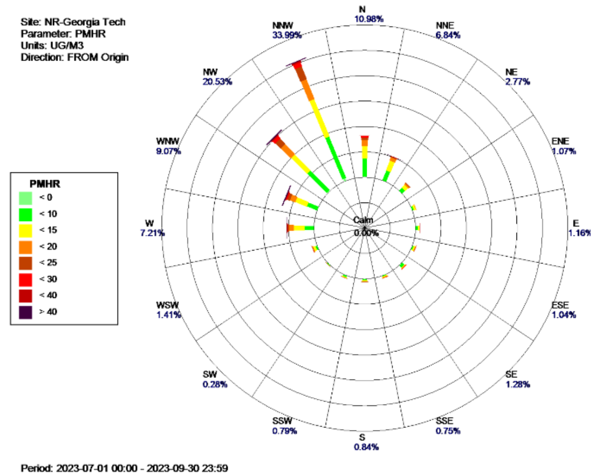


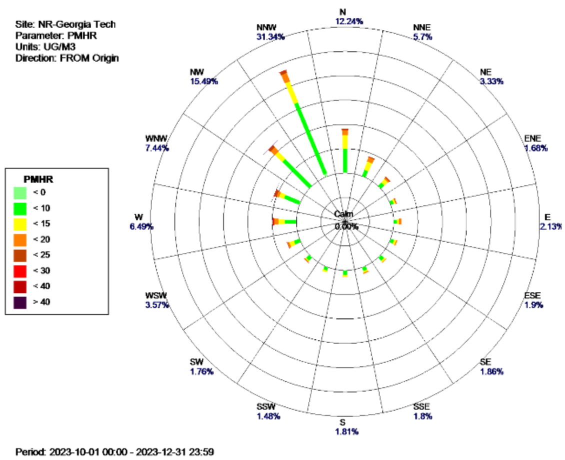
Columbus-Baker, 2023 Quarterly $PM_{2.5}$ (FEM monitor established June 2023)



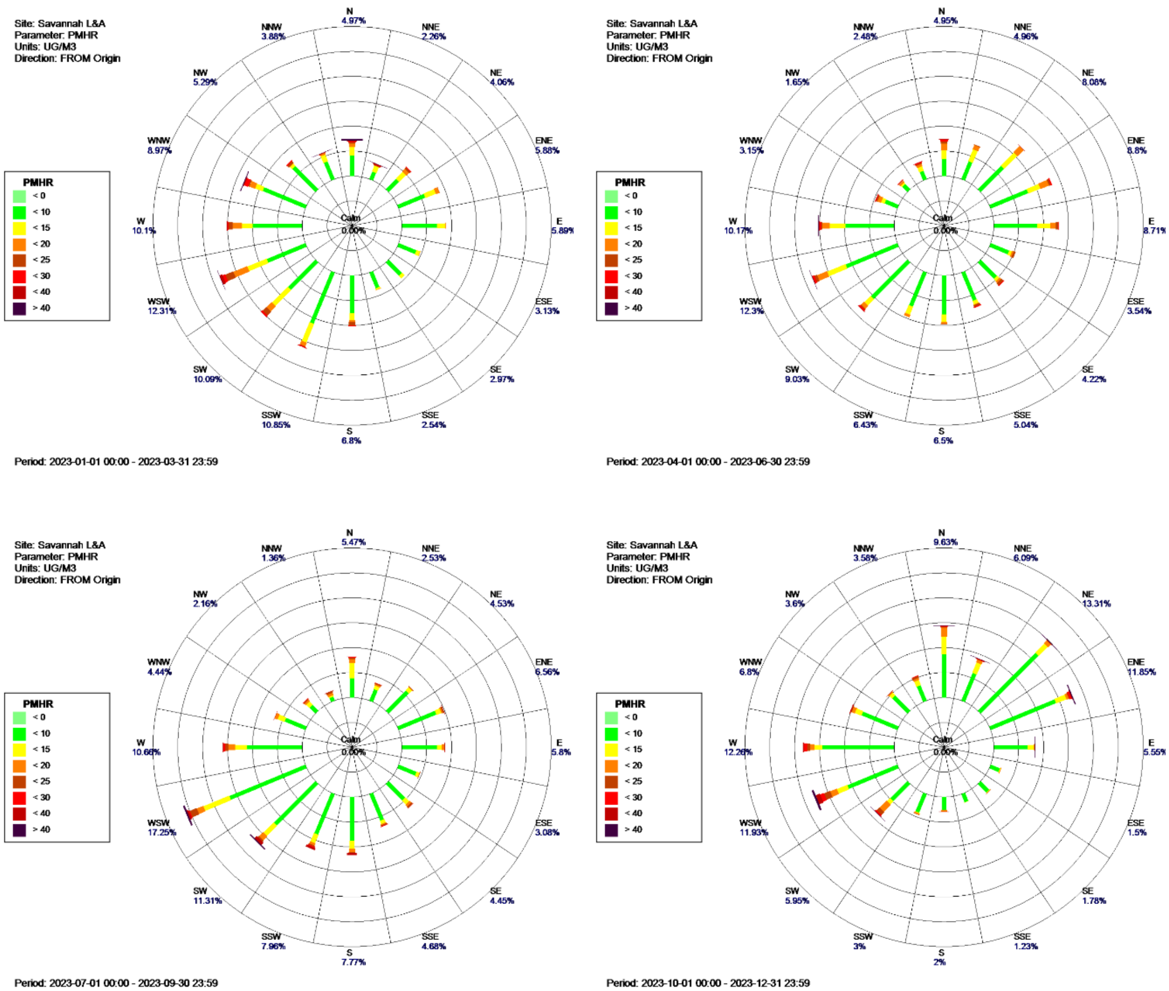
Macon-Forestry, 2023 Quarterly $PM_{2.5}$



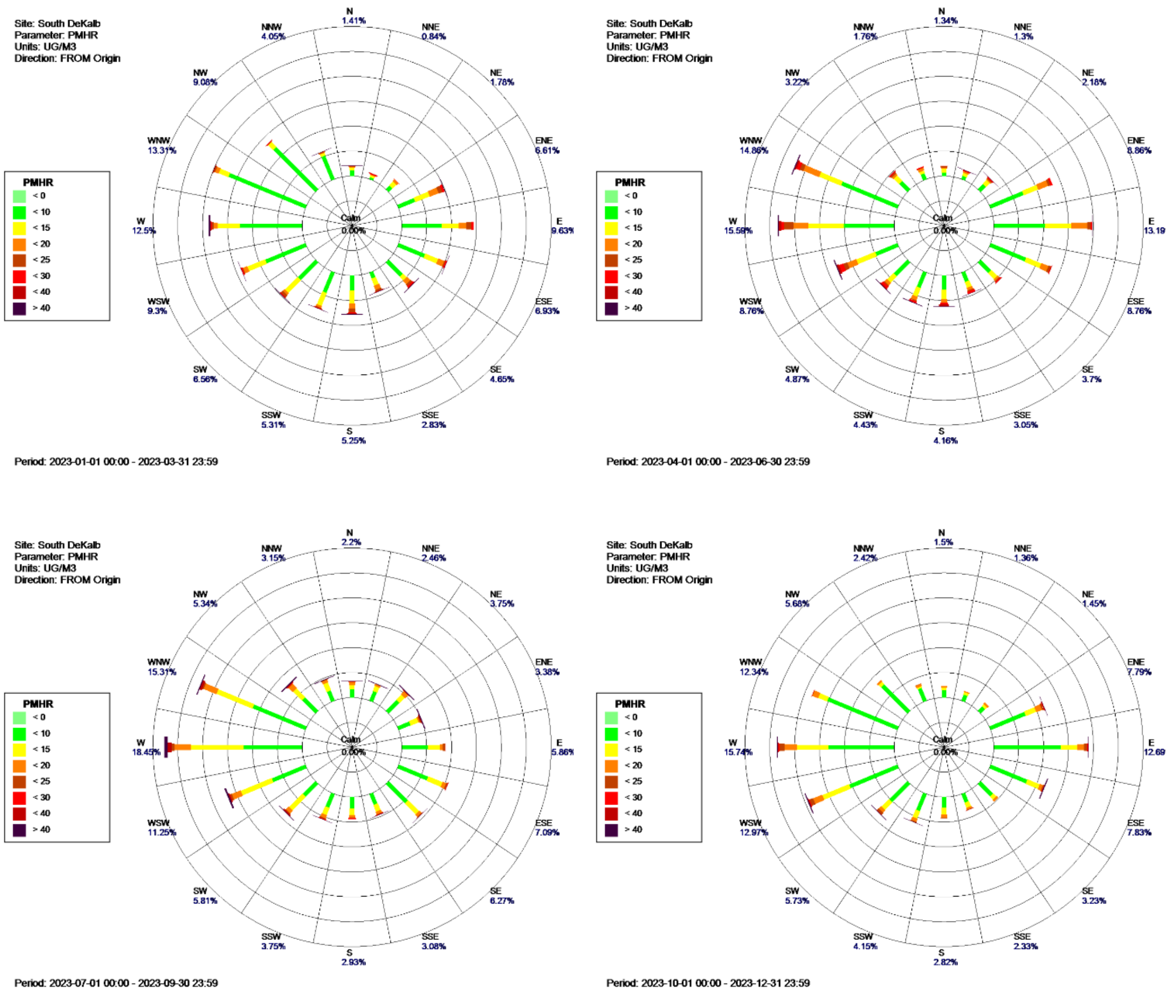




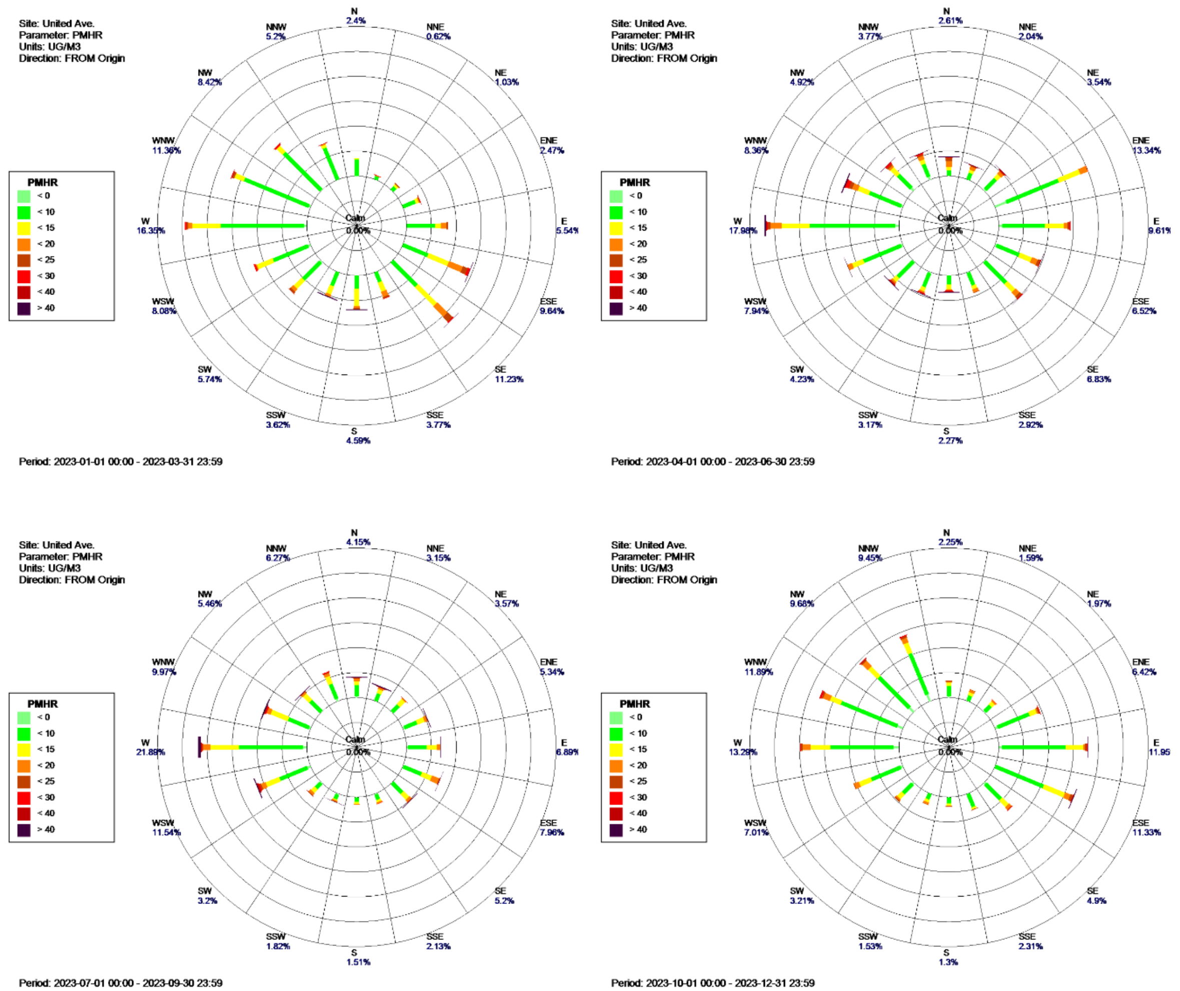
NR-GA Tech, 2023 Quarterly $PM_{2.5}$



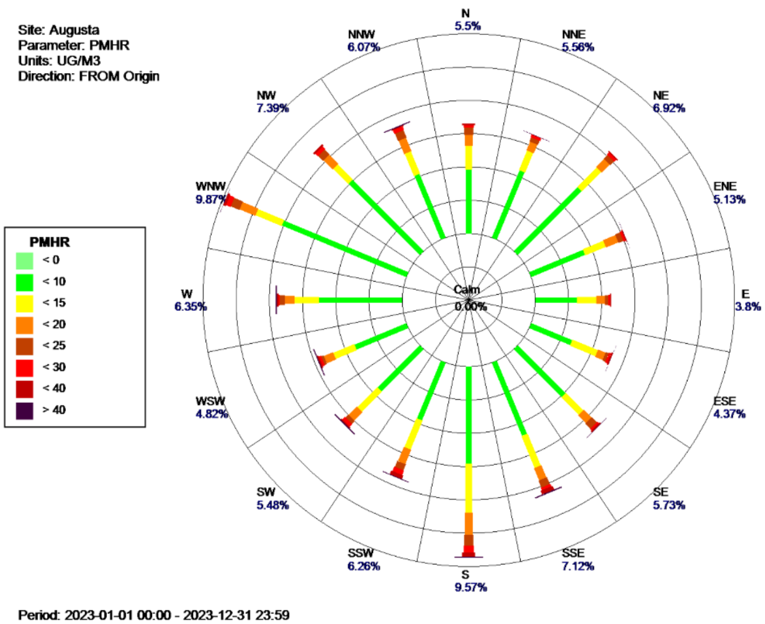
Savannah-L&A, 2023 Quarterly $PM_{2.5}$



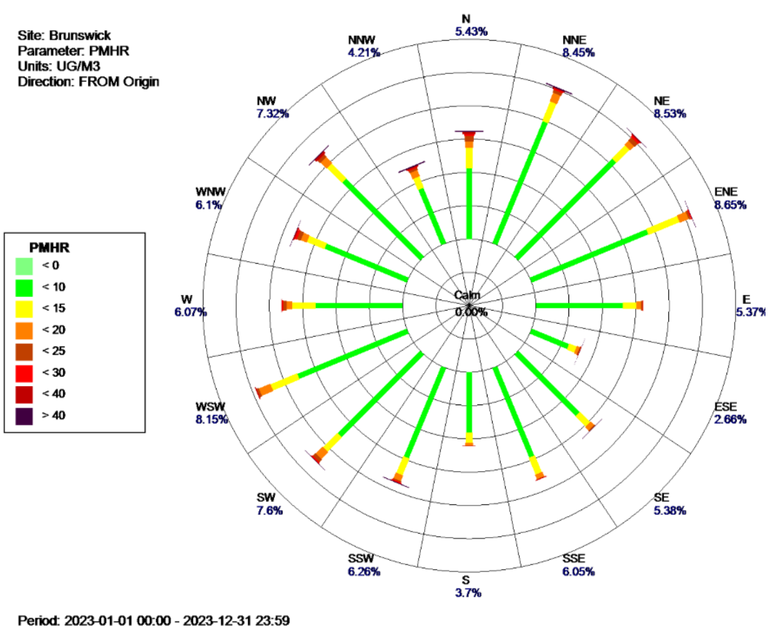
South DeKalb, 2023 Quarterly $PM_{2.5}$



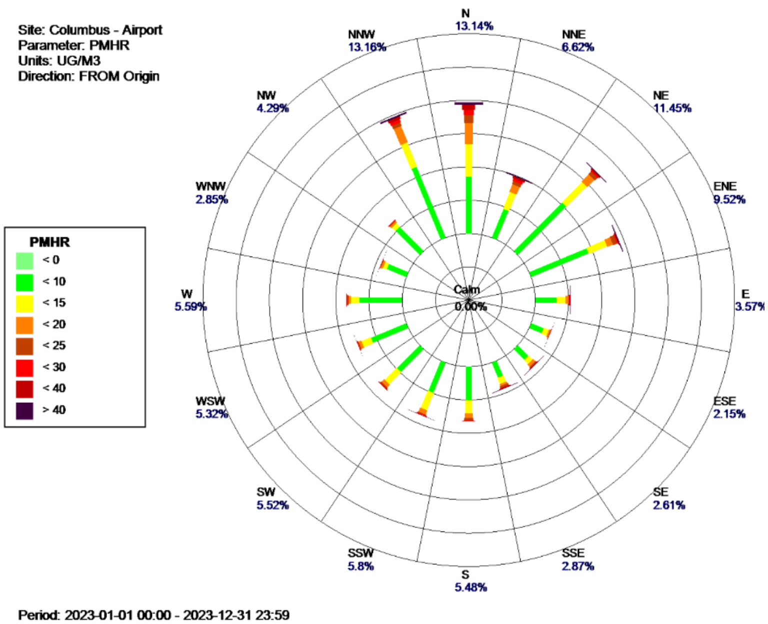
United Ave, 2023 Quarterly $PM_{2.5}$



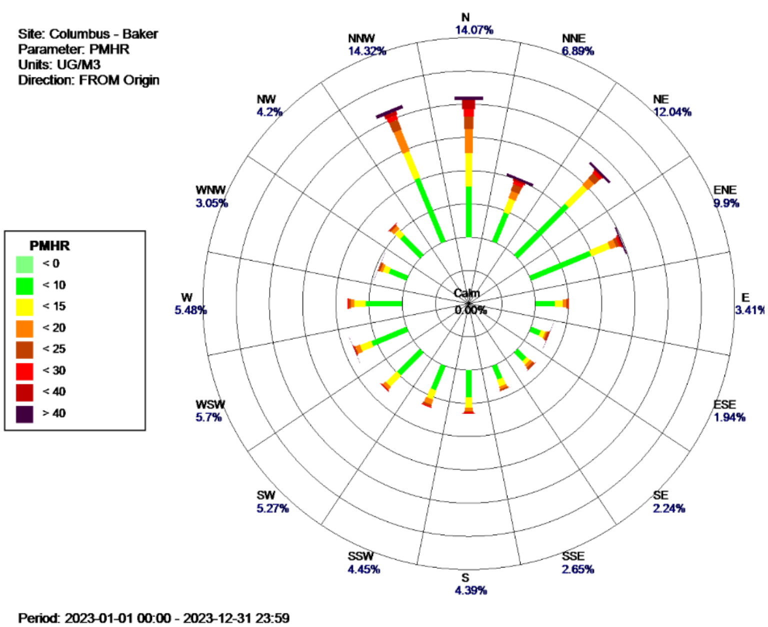
Augusta, 2023 Annual $PM_{2.5}$



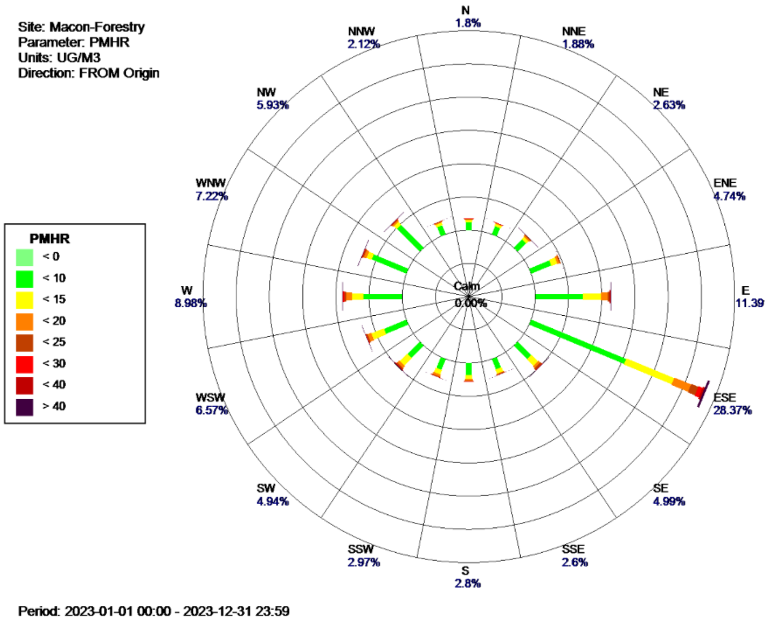
Brunswick, 2023 Annual $PM_{2.5}$



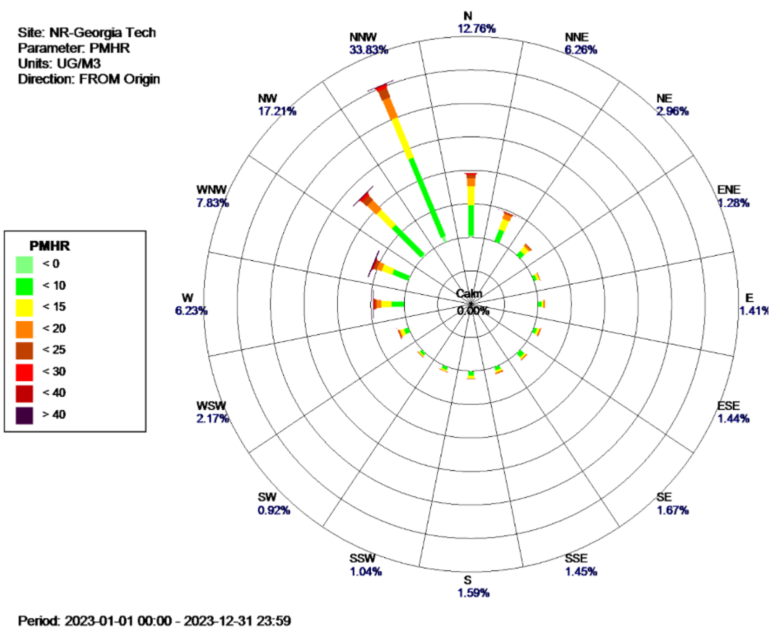
Columbus-Airport, 2023 Annual $PM_{2.5}$



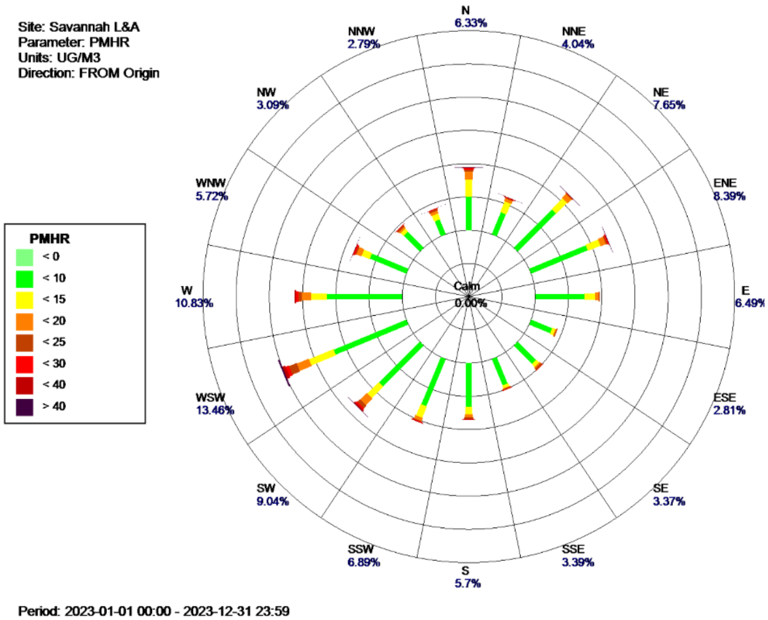
Columbus-Baker, 2023 Annual $PM_{2.5}$ (June 2023-December 2023)



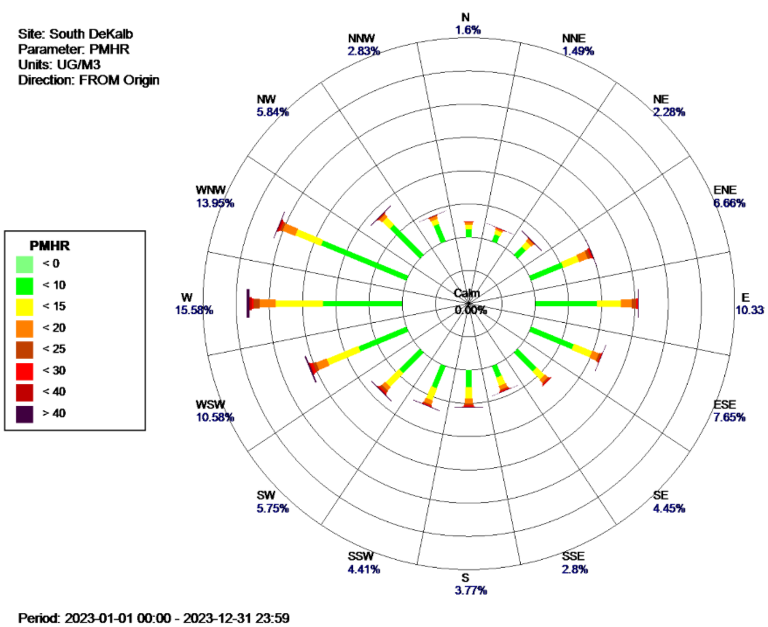
Macon-Forestry, 2023 Annual $PM_{2.5}$



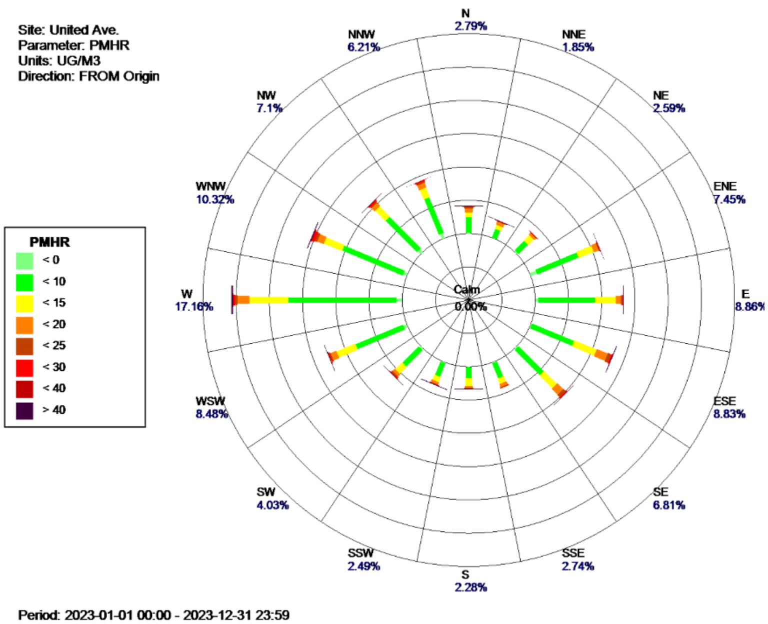
NR-GA Tech 2023 Annual $PM_{2.5}$



Savannah-L&A, 2023 Annual $PM_{2.5}$



South DeKalb, 2023 Annual $PM_{2.5}$



United Ave, 2023 Annual $PM_{2.5}$

Appendix F:
Memorandum of Agreement

Georgia Department of Natural Resources
Environmental Protection Division

MEMORANDUM OF AGREEMENT

ON AIR QUALITY MONITORING FOR CRITERIA POLLUTANTS FOR

THE CHATTANOOGA-WALKER COUNTY

METROPOLITAN STATISTICAL AREA MSA

December 28, 2017

Participating Agencies:

Georgia
Georgia Department of Natural Resources (GA DNR)
Environmental Protection Division GA EPD APB

Tennessee
Chattanooga-Hamilton County Air Pollution Control Bureau (CHCAPCB)

I. PURPOSE/OBJECTIVES/GOALS

The purpose of the Memorandum of Agreement (MOA) is to establish the Chattanooga-Hamilton County-Walker County Metropolitan Statistical Area (MSA) Criteria Pollutant Air Quality Monitoring Agreement between CHCAPCB and GAEPDAPB (collectively referred to as the "affected agencies") to collectively meet United States Environmental Protection Agency (EPA) minimum monitoring requirements for particles of an aerodynamic diameter of 10 micrometers and less (PM10), particles of an aerodynamic diameter of 2.5 micrometers and less (PM2.5), and ozone; as well as other criteria pollutant air quality monitoring deemed necessary to meet the needs of the MSA as determined reasonable by all parties. This MOA will establish the terms and conditions of this collective agreement to provide adequate criteria pollutant monitoring for the Chattanooga –Hamilton County-Walker Co, GA MSA as required by 40 CFR 58 Appendix D, Section 2, (e) (March 28, 2016)[1].

II. BACKGROUND

The Chattanooga-Hamilton Co-Walker Co, GA MSA consists of the following counties: Dade, Walker, Catoosa, Hamilton, Marion, and Sequatchie. GA EPD APB has jurisdiction over Dade, Walker, and Catoosa Counties in Georgia and CHCAPCB has jurisdiction over Hamilton County, Tennessee. The State of Tennessee has jurisdiction over Marion and Sequatchie Counties in Tennessee, but does not have any permanent air monitoring sites in those counties. The CHCAPCB and GA EPD APB are required by the Clean Air Act to measure for certain criteria pollutants in the ambient air in the Chattanooga-Hamilton County-Walker Co, GA Metropolitan Statistical Area (MSA). The United States Environmental Protection Agency (EPA) has established minimum monitoring requirements based on the size of the MSA and the quality of the air in the

MSA for particles of an aerodynamic diameter of 10 micrometers and less (PM10), particles of an aerodynamic diameter of 2.5 micrometers and less (PM2.5), and ozone.

40 CFR 58 Appendix D, Section 2, (e)[1] states (in part):

"...The EPA recognizes that there may be situations where the EPA Regional Administrator and the affected State or local agencies may need to augment or to divide the overall MSA/CSA monitoring responsibilities and requirements among these various agencies to achieve an effective network design. Full monitoring requirements apply separately to each affected State or local agency in the absence of an agreement between the affected agencies and the EPA Regional Administrator."[1]

Currently each air pollution control agency (affected agency) conducts monitoring in its respective jurisdiction and coordinates its monitoring with the other air pollution control agencies within the MSA.

I. ROLES AND RESPONSIBILITIES

The parties agree to the following terms and conditions:

- CHCAPCB and GA EPD APB (the "affected agencies") commit to conducting appropriate monitoring in their respective jurisdictions of the MSA; as needed, to collectively meet EPA minimum monitoring requirements for the entire MSA for PM10, PM2.5, and ozone, as well as other criteria air pollutant monitoring deemed necessary to meet the needs of the MSA as determined reasonable by all affected agencies. The minimum air quality monitoring requirement (for PM10, PM2.5, and ozone described in 40 CFR 58) for the MSA shall apply to the MSA in its entirety and shall not apply to any sole affected agency within the MSA unless agreed upon by all affected agencies.

- The affected agencies commit to coordinating monitoring "...responsibilities and requirements...to achieve an effective network design..."[1] regarding criteria air pollutant monitoring conducted in the MSA and commit to communicate unexpected or unplanned changes in monitoring activities within their jurisdictions to the other affected agencies of this MOA. As conditions warrant, the affected agencies may conduct telephone conference calls, meetings, or other communications to discuss monitoring activities for the MSA. Each affected agency shall inform the other affected agencies via telephone or e-mail of any monitoring changes occurring in its jurisdiction of the MSA at its earliest convenience after learning of the need for the change or making the changes. Such unforeseen changes may include evictions from monitoring sites, destruction of monitoring sites due to natural disasters, or similar occurrences that result in a loss of more than 25% data in a quarter or a permanent change in the monitoring network. At least once a year in the second quarter of the year or before June 15th, each agency shall make available to the other agencies who are a party to this agreement, a copy of its proposed monitoring plan for the MSA for the next year. The CHCAPCB will submit the network review that is submitted to the State of Tennessee for inclusion in the State's monitoring plan.

- Each party reserves the right to revoke or terminate this MOA at any time and for any reason by giving thirty (30) days written notice prior to the date of termination.

III. LIMITATIONS

A. All commitments made in this MOA are subject to the availability of appropriated funds and each party's budget priorities. Nothing in this MOA, in and of itself, obligates CHCAPCB or GA EPD APB to expend appropriations or to enter into any contract, assistance agreement, interagency agreement or other financial obligation.

B. This MOA is neither a fiscal nor a funds obligation document. Any endeavor involving reimburse or contribution of funds between parties to this MOA will be handled in accordance with applicable laws, regulations, and procedures, and will be subject to separate subsidiary agreements that will be effected in writing by representatives of the parties.

C. Except as provided in Section III, this MOA does not create any right or benefit, substantive or procedural, enforceable by law or equity against CHCAPCB or GA EPD APB, their officers or employees, or any other person. This MOA does not direct or apply to any person outside CHAPCD or GAEPD APB.

V. PROPRIETARY INFORMATION AND INTELLECTUAL PROPERTY

No proprietary information or intellectual property is anticipated to arise out of this MOA.

VI. POINTS OF CONTACT

The following individuals are designated points of contact for the MOA:

GA EPD APB

DeAnna G. Oser
GAEPD APB Ambient Monitoring Program
4244 International Parkway, Suite 120
Atlanta, GA 30354

DeAnna.Oser@dnr.ga.gov
Voice: (404) 363-7004
FAX: (404) 363-7100

CHCAPCB

Robert Colby
CHCAPCB
6125 Preservation Dr
Chattanooga, Tn 37416

bcolby@chattanooga.gov
Voice: (423) 643-5999
FAX: (423) 643-5972

VII. MODIFICATION/DURATION/TERMINATION

This MOA will be effective when signed by all parties. This MOA may be amended at any time by the mutual written consent of the parties. The parties will review this MOA at least once every 10 years to determine whether it should be revised, renewed, or cancelled. This MOA may be revoked or terminated by an affected agency at any time and for any reason by giving thirty (30) days written notice prior to the date of termination.

VIII. REFERENCE

1 – United States Environmental Protection Agency, Title 40 Code of Federal Regulations, Part 58, Appendix D, "Network Design Criteria for Ambient Air Quality Monitoring", Section 2 (e), "General Monitoring Requirements".

IX. APPROVALS

Georgia Department of Natural Resources, Environmental Protection Division
Air Protection Branch (GA EPD APB)

BY:

TITLE: DIRECTOR

DATE: 1/24/18

Chattanooga-Hamilton County Air Pollution Bureau (CHCAPCB)

BY:

TITLE: Director

DATE: January 3, 2018

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BUREAU OF AIR QUALITY

DHEC MOA#: 2017-429

MEMORANDUM OF AGREEMENT ON AIR QUALITY MONITORING FOR CRITERIA POLLUTANTS FOR THE AUGUSTA - RICHMOND COUNTY METROPOLITAN STATISTICAL AREA (MSA)

January 2017

Participating Agencies:

Georgia
Georgia Department of Natural Resources
Environmental Protection Division
Air Protection Branch (GA EPD)

South Carolina
Department of Health and Environmental Control (SCDHEC)
Bureau of Air Quality

I. PURPOSE/OBJECTIVES/GOALS

The purpose of this Memorandum of Agreement (MOA) is to renew the Augusta - Richmond County Metropolitan Statistical Area (MSA) Criteria Pollutant Air Quality Monitoring Agreement between SCDHEC and GA EPD (collectively referred to as the "affected agencies") to collectively meet United States Environmental Protection Agency (EPA) minimum monitoring requirements for particles of an aerodynamic diameter of 10 micrometers and less (PM10), particles of an aerodynamic diameter of 2.5 micrometers and less (PM2.5), and ozone; as well as any other criteria pollutant air quality monitoring deemed necessary to meet the needs of the MSA as determined reasonable by all parties. This MOA will establish the terms and conditions of this collective agreement to provide adequate criteria pollutant monitoring for the Augusta - Richmond County MSA as required by 40 CFR 58 Appendix D, Section 2(e).

II. BACKGROUND

The Augusta - Richmond County MSA consists of the following counties: Burke, Columbia, McDuffie, Lincoln, Richmond, Aiken and Edgefield. GA EPD has jurisdiction over Burke, Columbia, McDuffie, Lincoln, and Richmond Counties in Georgia and SCDHEC has jurisdiction over Aiken and Edgefield Counties, South Carolina. The SCDHEC and GA EPD are required by the Clean Air Act to measure for certain criteria pollutants in the ambient air in the Augusta - Richmond County Metropolitan Statistical Area (MSA). The EPA has established minimum monitoring requirements based on the size of the MSA and the quality of the air in the MSA for PM10, PM2.5, and ozone.

40 CFR 58 Appendix D, Section 2(e) states (in part):

> "…The EPA recognizes that there may be situations where the EPA Regional Administrator and the affected State or local agencies may need to augment or to divide the overall MSA/CSA monitoring responsibilities and requirements among these various agencies to achieve an effective network design. Full monitoring requirements apply separately to each affected State or local agency in the absence of an agreement between the affected agencies and the EPA Regional Administrator."

Currently each air pollution control agency (affected agency) conducts monitoring in its respective jurisdiction and coordinates its monitoring with the other air pollution control agency within the MSA.

III. ROLES AND RESPONSIBILITIES

The parties agree to the following terms and conditions:

- SCDHEC, and GA EPD (the "affected agencies") commit to conducting appropriate monitoring in their respective jurisdictions of the MSA; as needed, to collectively meet EPA minimum monitoring requirements for the entire MSA for PM10, PM2.5, and ozone, as well as any other criteria air pollutant monitoring deemed necessary to meet the needs of the MSA as determined reasonable by all affected agencies. The minimum air quality monitoring requirements (for PM10, PM2.5, and ozone described in 40 CFR 58) for the MSA shall apply to the MSA in its entirety and shall not apply to any sole affected agency within the MSA unless agreed upon by all affected agencies.

- The affected agencies commit to coordinating monitoring "responsibilities and requirements…to achieve an effective network design" regarding criteria air pollutant monitoring conducted in the MSA and commit to communicate unexpected or unplanned changes in monitoring activities within their jurisdictions to the other affected agency. As conditions warrant, the affected agencies may conduct telephone conference calls, meetings, or other communications to discuss monitoring activities for the MSA. Each affected agency shall inform the other affected agency via telephone or e-mail of any monitoring changes occurring in its jurisdiction of the MSA at its earliest convenience after learning of the need for the change or making the changes. Such unforeseen changes may include evictions from monitoring sites, destruction of monitoring sites due to natural disasters, or similar occurrences that result in an extended (greater than 1 quarter) or permanent change in the monitoring network. At least once a year in the second quarter of the year or before June 15th, each affected agency shall make available to the other affected agency, a copy of its proposed monitoring plan for its jurisdiction within the MSA for the next year.

- Each party reserves the right to revoke or terminate this MOA at any time and for any reason by giving thirty (30) days written notice prior to the date of termination.

IV. LIMITATIONS

A. All commitments made in this MOA are subject to the availability of appropriated funds and each party's budget priorities. Nothing in this MOA, in and of itself, obligates SCDHEC or GA EPD to expend appropriations or to enter into any contract, assistance agreement, interagency agreement or other financial obligation.

B. This MOA is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement or contribution of funds between parties to this MOA will be handled in accordance with applicable laws, regulations, and procedures, and will be subject to separate subsidiary agreements that will be effected in writing by representatives of the parties.

C. Except as provided in Section III, this MOA does not create any right or benefit, substantive or procedural, enforceable by law or equity against SCDHEC or GA EPD, their officers or employees, or any other person. This MOA does not direct or apply to any person outside SCDHEC or GA EPD.

V. PROPRIETARY INFORMATION AND INTELLECTUAL PROPERTY

No proprietary information or intellectual property is anticipated to arise out of this MOA.

VI. POINTS OF CONTACT

The following individuals are designated points of contact for the MOA:

GA EPD: DeAnna Oser
GA EPD Ambient Monitoring Program
4244 International Parkway, Suite 120
Atlanta, GA 30354

DeAnna.Oser@dnr.ga.gov
Voice: (404) 363-7004
FAX: (404) 363-7100

SCDHEC: Micheal Mattocks
SCDHEC Bureau of Environmental Services
8231 Parklane Road
Columbia, SC 29223

mattocm@dhec.sc.gov
Voice: (803) 896-0902
FAX: (803) 896-0980

In the event that a point of contact needs to be changed, notification may be made via email to the other parties.

VII. MODIFICATION/DURATION/TERMINATION

This MOA will be effective when signed by all parties. This MOA may be amended at any time by the mutual written consent of the parties. The parties will review this MOA at least once every 10 years to determine whether it should be revised, renewed, or cancelled. This MOA may be revoked or terminated by an affected agency at any time and for any reason by giving thirty (30) days written notice prior to the date of termination.

VIII. REFERENCE

United States Environmental Protection Agency, Title 40 Code of Federal Regulations, Part 58, Appendix D, "Network Design Criteria for Ambient Air Quality Monitoring", Section 2 (e), "General Monitoring Requirements."

IX. APPROVALS

Georgia Department of Natural Resources, Environmental Protection Division (GA EPD)

BY: ____________________

TITLE: Director

DATE: 2/21/17

South Carolina Department of Health and Environmental Control (SCDHEC) Bureau of Air Quality

BY: ____________________

TITLE: Bureau Chief

DATE: 03/01/17

THIS AGREEMENT IS NOT OFFICIAL AND BINDING UNTIL SIGNED BY THE DHEC CONTRACTS MANAGER.

____

Francine Miller
DHEC Contracts Manager
DATE: 3-6-17

5

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