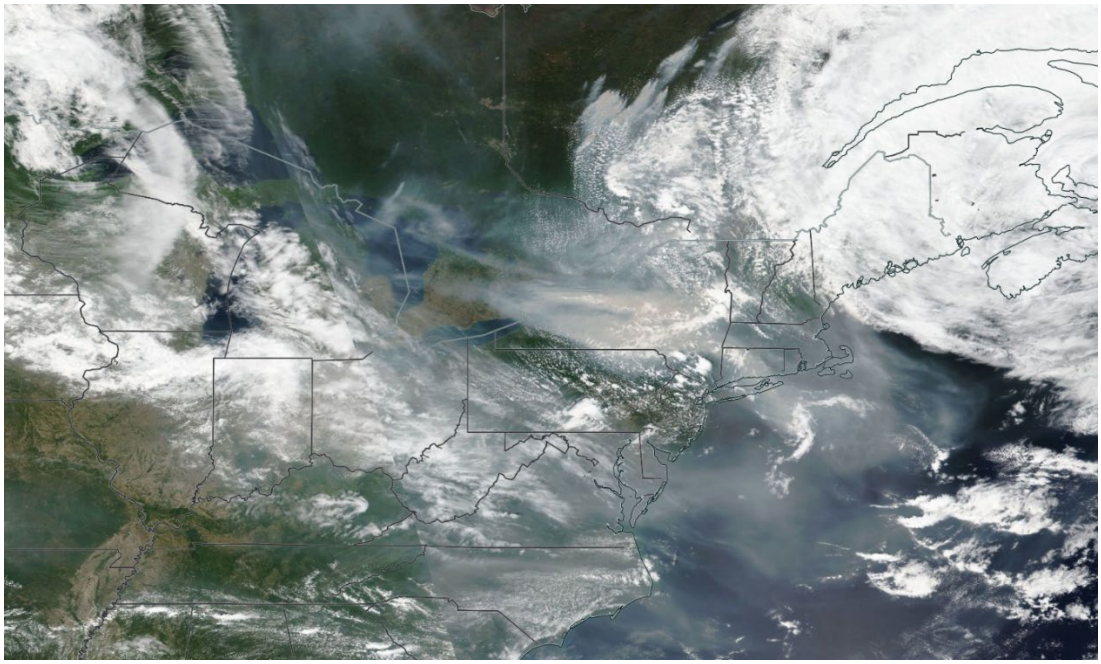
PRE-HEARING DRAFT

Exceptional Events Demonstration to Support Attainment Designation Recommendations for the 2024 Annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) for Mecklenburg and Davidson Counties, North Carolina

(June – July 2023 Canadian Wildfire Smoke Impacts)



Visible satellite imagery showing smoke across the eastern US on June 6th, 2023

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Division of Air Quality

November 20, 2024

Preface: This document contains the State of North Carolina's Exceptional Events Demonstration to support the State's designation recommendations for the 2024 revised primary annual $PM_{2.5}$ National Ambient Air Quality Standard. Two $PM_{2.5}$ monitors in North Carolina have design values (based on certified monitoring data for 2021-2023) that exceed the revised standard of 9.0 µg/m^3. The two monitors are the Remount Road monitor (Air Quality System (AQS) ID# 371190045) located in Mecklenburg County and the Lexington Water Tower monitor (AQS ID# 370570002) located in Davidson County. Specifically, for these two monitors, this document provides technical documentation to support North Carolina's request to U.S. Environmental Protection Agency (EPA) to exclude $PM_{2.5}$ monitoring data for certain days in 2023 strongly influenced by Canadian Wildfire smoke. If approved by EPA, the design value for both monitors would be below the revised standard. This document has been prepared following the EPA Exceptional Events Rule (40 CFR 50.14(c)(3)) for submission of an Exceptional Events Demonstration.

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List of Acronyms

Acronym	Definition
AIR	Ambient Information Reporter [Tool]
AMP	Air Monitoring Program
AQ	Air Quality
AQI	Air Quality Index
AQP	Air Quality Portal

Acronym	Definition
AQS	Air Quality System
CAA	Clean Air Act
CFR	Code of Federal Regulations
CIFFWC	Canadian Interagency Forest Fire Centre
CLT	Charlotte/Douglas International Airport
CWFIS	Canadian Wildland Fire Information System
CONUS	Continental United States
DV	Design Value
EDT	Eastern Daylight Time
EE	Exceptional Events
EPA	[United States] Environmental Protection Agency
EXX	Davidson County Airport
FU	fumée [French], smoke [English]
H5	500 millibar geopotential height
hr	hour
HRRR	High Resolution Rapid Refresh model
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory model
HZ	haze
JQF	Concord Regional Airport
KGSO	Greensboro Airport
km	kilometer
KML	Keyhole Markup Language
m	meter
mb	millibar
METAR	Meteorological Aerodrome Report
NAAPS	Navy Aerosol Analysis and Prediction System
NAAQS	National Ambient Air Quality Standard
NAM	North American Mesoscale model
NC	North Carolina
NCAR	National Center for Atmospheric Research
NCDAQ	North Carolina Division of Air Quality
NCDEQ	North Carolina Department of Environmental Quality
NCEI	National Centers for Environmental Information
NCEP	National Centers for Environmental Protection

Acronym	Definition
NCSCO	North Carolina State Climate Office
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OSPO	Office of Satellite and Product Operations
$PM_{2.5}$	Particulate matter with an aerodynamic diameter ≤2.5 micrometers
RF	'Request Exclusion: Fire - Canadian' AQS flag
SM	statute miles
SPeCS	State Planning Electronic Collaboration System
U.S.	United States
USG	Unhealthy for Sensitive Groups
VA	Virginia
WPC	Weather Prediction Center
z	Zulu time
$\mu g/m^3$	micrograms per cubic meter

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Section I. Introduction

1.1 Overview

A record-breaking wildfire season in Canada and an anomalous synoptic weather pattern resulted in several widespread multi-day smoke intrusions into the United States in 2023. In North Carolina, the most impactful of these smoke intrusion events occurred in June and July, all of which resulted in numerous days of elevated concentrations of particulate matter with an aerodynamic diameter of less than or equal to 2.5 micrometers ($PM_{2.5}$) throughout the state.

In May of 2024, the U.S. Environmental Protection Agency (EPA) revised the primary annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) from 12.0 micrograms per cubic meter ($\mu g/m^3$) to 9.0 $\mu g/m^3$. The following two North Carolina monitors have design values (based on certified monitoring data for 2021-2023) exceeding this revised standard: Remount Road (Air Quality System (AQS) ID# 371190045) located in Mecklenburg County and Lexington Water Tower (AQS ID# 370570002) located in Davidson County. All other monitoring sites in the state are currently meeting the 2024 revised primary annual $PM_{2.5}$ NAAQS.

The North Carolina Department of Environmental Quality (NCDEQ), Division of Air Quality (NCDAQ) prepared this Exceptional Events Demonstration per 40 CFR 50.14(c)(3) to show that many of the elevated $PM_{2.5}$ concentrations that occurred in June and July of 2023 are the result of "*unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that tribal, state, or local air agencies may implement in order to attain and maintain the [NAAQS]*".[1]

The NCDAQ requests that EPA concur with the exclusion from regulatory decisions the specified $PM_{2.5}$ concentrations in **Table 1** below that were influenced by smoke from the 2023 Canadian wildfires. By analyzing meteorological conditions and patterns that occurred during June and July of 2023, NCDAQ has identified four distinct multi-day events (categorized by *Event ID,* below) by which to group the days listed in **Table 1**, which are described in more detail in Section II. Narrative Conceptual Model.

[1] United States Environmental Protection Agency (EPA), *Treatment of Air Quality Monitoring Data Influenced by Exceptional Events,* https://www.epa.gov/air-quality-analysis/treatment-air-quality-monitoring-data-influenced-exceptional-events

***Table 1**: Regulatorily Significant 24-Hour Average PM2.5 Concentrations Requested for Exclusion by NCDAQ*

		Remount (AQS ID# 371190045) (Mecklenburg County)					Lexington (AQS ID# 370570002) (Davidson County)				
Event ID	**Date**	**24-hr $PM_{2.5}$ Average ($\mu g/m^3$)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold ($\mu g/m^3$)****		**24-hr $PM_{2.5}$ Average ($\mu g/m^3$)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold ($\mu g/m^3$)****	
1	6/6/2023	21.7	8.6	151.2 %	Tier 2	16.3	28.6	11.4	150.9 %	Tier 1	25.35
	6/7/2023	26.3	10.0	162.5 %	Tier 1	24.45	29.3	9.2	219.3 %	Tier 1	25.35
	6/8/2023	18.5	8.7	113.6 %	Tier 2	16.3	-	-	-	-	
	6/9/2023	23.7	7.7	208.6 %	Tier 2	16.3	23	8.1	184.0 %	Tier 2	16.9
	6/10/2023	24.3	7.5	224.0 %	Tier 2	16.3	22.5	7.7	192.2 %	Tier 2	16.9
	6/11/2023	-	-	-	-		19.2	9.1	110.4 %	Tier 2	16.9
2	6/17/2023	25.1	8.8	185.9 %	Tier 1	24.45	18.9	8.7	117.9 %	Tier 2	16.9
	6/18/2023	23.7	8.4	181.5 %	Tier 2	16.3	21.9	8.7	153.2 %	Tier 2	16.9
3	6/28/2023	20.2	11.1	82.3 %	Tier 2	16.3	20.5	14.4	42.4 %	Tier 2	16.9
	6/29/2023	37.7	9.0	318.9 %	Tier 1	24.45	45.7	10.7	326.3 %	Tier 1	25.35
	6/30/2023	29.4	9.9	197.0 %	Tier 1	24.45	32	10.8	197.4 %	Tier 1	25.35
	7/1/2023	20.8	7.3	183.4 %	Tier 2	16.3	18	7.6	137.5 %	Tier 2	17.8
4	7/17/2023	43	8.6	401.5 %	Tier 1	24.45	38.6	11.5	236.8 %	Tier 1	26.7
	7/18/2023	46.1	7.9	483.5 %	Tier 1	24.45	42.3	8.3	408.4 %	Tier 1	26.7

** The historical average is defined as the daily average $PM_{2.5}$ concentration over the previous 5-year period (2018-2022) on the given date (i.e., the past 5 June 6ths, the past 5 June 7ths, etc.).*

*** The EPA Tier Level determines the level of evidence required to establish a clear causal relationship in a wildland fire $PM_{2.5}$ exceptional events demonstration and was determined using EPA's Tiering Tool output as displayed in Appendix K: Monitoring Sites' Tiering Graphs. The threshold listed represents the minimum daily average concentration ($\mu g/m^3$) needed to meet the tier level listed for that specific monitor and month.*

1.2 Clean Air Act Requirements

The 2024 revised primary annual $PM_{2.5}$ NAAQS is met when the annual arithmetic mean concentration is less than or equal to 9.0 $\mu g/m^3$ (40 CFR § 50.20(b)). Promulgation of this revised standard started the designation recommendation process and states are required to submit their area recommendations by February 7th, 2025. As part of this process, the state of North Carolina is submitting this Exceptional Events Demonstration to request exclusion of data in **Table 1** from the 2021-2023 design value calculations that will be relied upon by the state in making its recommendation. (The exclusion of this data will also impact EPA's designation process as the events will also be part of the 2022-2024 design values that EPA will use to support its final designations by February 6, 2026.)

1.3 Exceptional Events Rule Requirements

The EPA's *Treatment of Data Influenced by Exceptional Events* (Exceptional Events Rule) lists the requirements that air agencies must meet when requesting EPA to exclude exceptional event-related

ambient air concentration data recorded by regulatory monitors from regulatory determinations. The following table lists the requirements found under 40 CFR § 50.14, the relevant section of this demonstration document, and a summary of the section's contents which satisfy that requirement.

***Table 2**: Summary of the Exceptional Events Rule elements used to demonstrate NCDAQ's findings*

Exceptional Events Rule Element	Regulatory Citation	NCDAQ Demonstration Section	Summary
Narrative conceptual model	40 CFR § 50.14(c)(3)(iv)(A)	II	This section describes the scope of the 2023 Canadian wildfire season, including the anomalous meteorological patterns that contributed to widespread drought and consequent fire activity. Included is a general description of each of the four exceptional events identified by NCDAQ.
Clear causal relationship and historical data analysis	40 CFR § 50.14(c)(3)(iv)(B) 40 CFR § 50.14(c)(3)(iv)(C)	III	This section provides detailed information for each of the identified exceptional events. Both elevated and surface level $PM_{2.5}$ pollution from the Canadian wildfire smoke impacted NC monitors and directly resulted in anomalous concentrations well-above the previous 5-year (2018-2022) daily average concentrations for the event days.
Not reasonably controllable or preventable	40 CFR § 50.14(c)(3)(iv)(D)	IV	The events satisfy this requirement because the wildfires originated outside NCDAQ's jurisdictional boundaries and were predominantly on wildlands.
Natural event or human activity unlikely to recur	40 CFR § 50.14(c)(3)(iv)(E)	V	The events satisfy this requirement because the wildfires were primarily ignited by lightning and were predominantly on wildlands.
Public notification / outreach	40 CFR § 50.14(c)(1)(i)	VI	NCDAQ promptly notified the public via several mediums when Canadian wildfire smoke was forecasted to impact the state. A description of various outreach methods is included for each of the identified exceptional events.

Exceptional Events Rule Element	Regulatory Citation	NCDAQ Demonstration Section	Summary
Initial notification and data flagging	40 CFR § 50.14(c)(2)(i)	VII	NCDAQ engaged in regular communication with EPA Region 4 throughout the initial notification process beginning in July 2024. The data in **Table 1** is currently flagged as "*RF*" in AQS.
Public comments	40 CFR § 50.14(c)(3)(v)(A) 40 CFR § 50.14(c)(3)(v)(B) 40 CFR § 50.14(c)(3)(v)(C)	VIII	The public comment period is being held Nov 20 -Dec 20, 2024. This section lists the public comments received during this period and addresses the comments that refuted or contradicted the findings of this demonstration.

1.4 Canadian Wildfire Impacts on $PM_{2.5}$ Design Values in North Carolina

Exclusion of the data in **Table 1** from the Remount Road and Lexington Water Tower monitoring sites' 2021-2023 $PM_{2.5}$ design values would result in statewide attainment of the 2024 revised primary annual $PM_{2.5}$ NAAQS.

1.5 Action Requested

This report meets all EPA demonstration requirements for exceptional events (see **Table 2**). Pursuant to federal regulations, NCDEQ requests EPA concur that the $PM_{2.5}$ concentrations shown in **Table 1** were caused by exceptional events and should be excluded from regulatory decisions regarding the revised 2024 Annual $PM_{2.5}$ NAAQS and any other applicable regulatory purposes (40 CFR § 50.14(b)). A copy of the AMP 350 report from EPA's AQS system is included in Appendix A: AMP 350 Reports and shows the data included in this demonstration currently has the *Request Exclusion: Fire - Canadian*, or "*RF*", flag applied.

Section II. Narrative Conceptual Model

This section satisfies the following federal requirement:

40 CFR § 50.14(c)(3)(iv)(A): A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s).

The Exceptional Event Rule requires that demonstrations include a narrative conceptual model describing the event. This section will describe the 2023 Canadian wildfires that affected public health and impacted air quality monitors across North Carolina. It will also analyze the anomalous atmospheric circulations that drove the transportation of wildfire smoke into the state.

2.1 Record Setting 2023 Canadian Wildfire Season

The 2023 Canadian wildfire season - the result of intensifying, widespread spring drought across almost all the Canadian provinces - was unprecedented and record-shattering. Prolonged and widespread drought conditions set the stage, while a combination of human and natural (lightning strike) activity initiated more than 7,131 fires that burned 17.2 million hectares of land (see **Figure 1**). This amount doubled the previous record for acres burned, according to the Canadian Interagency Forest Fire Centre.[2]

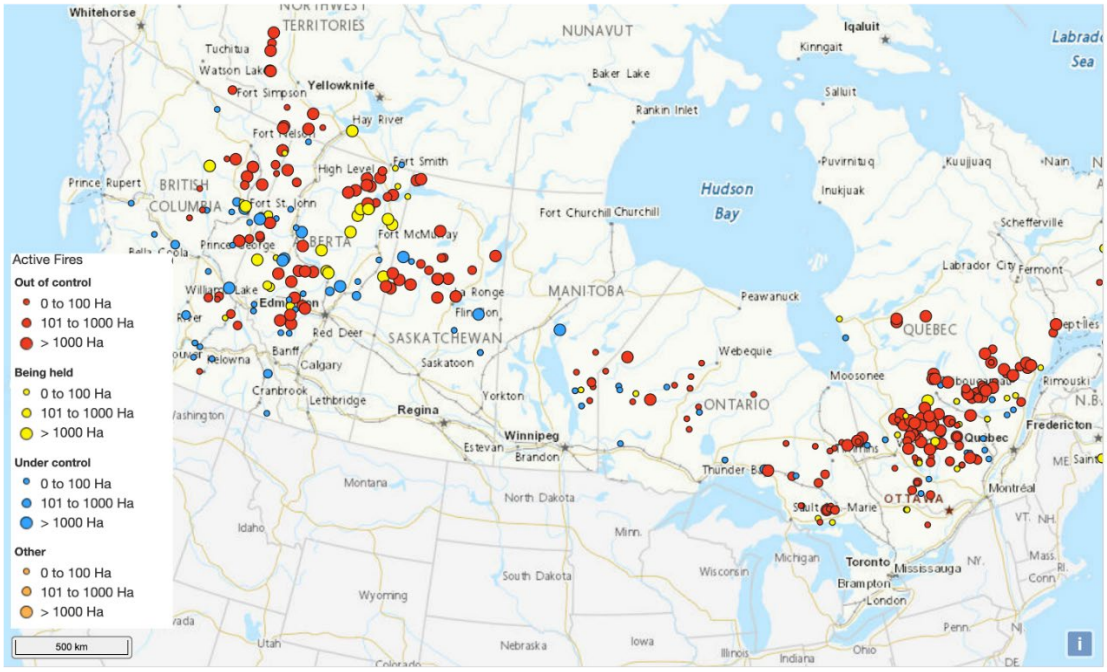


***Figure 1**: Reported active fire locations across Canada, valid on June 6th, 2023. Source: CWFIS Interactive Map*[3]

[2] CIFFWC, *Canada Report - 2023 Fire Season*, https://ciffc.ca/sites/default/files/2024-03/03.07.24_CIFFC_2023CanadaReport%20(1).pdf

[3] Natural Resources Canada, *Interactive Map*, https://cwfis.cfs.nrcan.gc.ca/interactive-map

The historic Canadian wildfire season and resulting intrusion of massive amounts of Canadian wildfire smoke into the contiguous United States (U.S.) was the culmination of several months of anomalous synoptic meteorological conditions across North America. A succession of atmospheric patterns first served as the catalyst for the intensifying drought[4] that resulted in the growing number of wildfires across Canada, then directly led to the large-scale transport of smoke into the eastern U.S.[5]. This resulted in a series of unprecedented air quality events from Maine to Florida, including North Carolina[6], during the months of June and July. Direct impacts from these wildfires to North Carolina's air quality first came in early June, as shown in **Figure 2**.

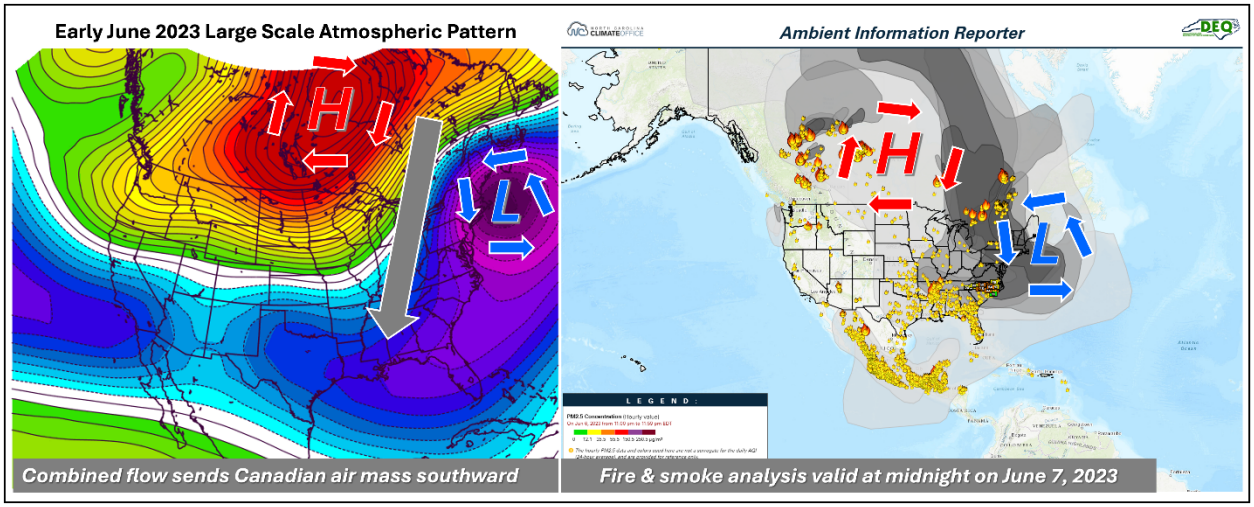


***Figure 2**: Early June 2023 500 millibar (mb) geopotential height anomalies (left) and NOAA OSPO fire and smoke satellite detects with 500 mb circulations overlaid for illustration (right).*

Canadian air masses were ever-present in the eastern U.S. during June 2023. As seen in **Figure 3**, many states recorded well below-normal temperatures for the month[7] due to the anomalous nature of the atmospheric regime that resulted in a persistent fetch of cooler-than-normal, but smokey, Canadian air into the region. This included North Carolina, which recorded its 13th-coldest June[8] in the past 129 years.

[4] Canadian Drought Monitor - June 30th, 2023, https://www.caar.org/wp-content/uploads/2023/08/Page5-main.jpg

[5] https://climate.ncsu.edu/wp-content/uploads/2023/06/500mb_heights_loop_Jun2023.gif

[6] Air Quality Blog – June 13th, 2023, https://airquality.climate.ncsu.edu/2023/06/13/rapid-reaction-smoky-skies-create-unhealthy-air-quality/

[7] National Centers for Environmental Information (NCEI), https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/statewide/mapping/110/tavg/202306/1/rank

[8] Air Quality Blog – July 10th, 2023, https://climate.ncsu.edu/blog/2023/07/smoke-and-storms-fill-the-skies-in-june/

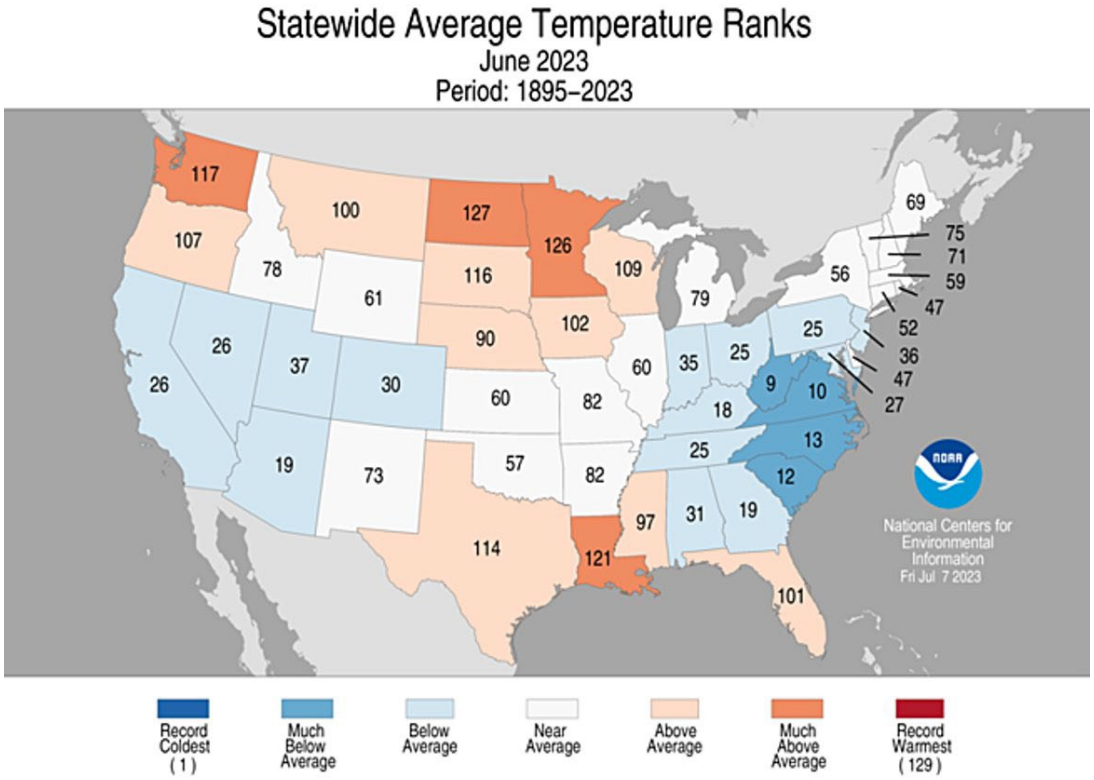


***Figure 3**: June 2023 statewide average temperature rankings show clear evidence of widespread below-normal temperatures due to frequent intrusions of Canadian air masses. Source: NCEI*[7]

2.2 Canadian Wildfire Smoke Significantly Impacts North Carolina Air Quality

Based on our extensive analysis of the impacts of the 2023 Canadian wildfire smoke on North Carolina, we have elected to prepare an exceptional events demonstration package organized into four unique multi-day events that featured atmospherically significant activity that heralded the onset of Canadian wildfire smoke transport into the state and directly impacted both of our $PM_{2.5}$ monitors currently above the new annual $PM_{2.5}$ NAAQS.

2.2.1 Event ID #1 - June 6th through June 11th, 2023

The series of exceptional smoke transport events impacting North Carolina began in early June, starting on June 6th and continuing through June 11th, and featured an anomalously strong 500 mb (H5) high pressure that was anchored over central Canada (anomalous H5 ridging had been persistent for all of May[9] and led to the intensifying drought conditions) and was joined by an equally strong H5 trough of low pressure stationed just off the northeastern U.S. as shown in **Figure 4**, which contains the 500 mb geopotential height anomalies analysis compared to the 1991-2020 climatological normal for June 6th, provided by NCEP/NCAR reanalysis.

[9] https://climate.ncsu.edu/wp-content/uploads/2023/06/500mb_anomaly_May2023.png

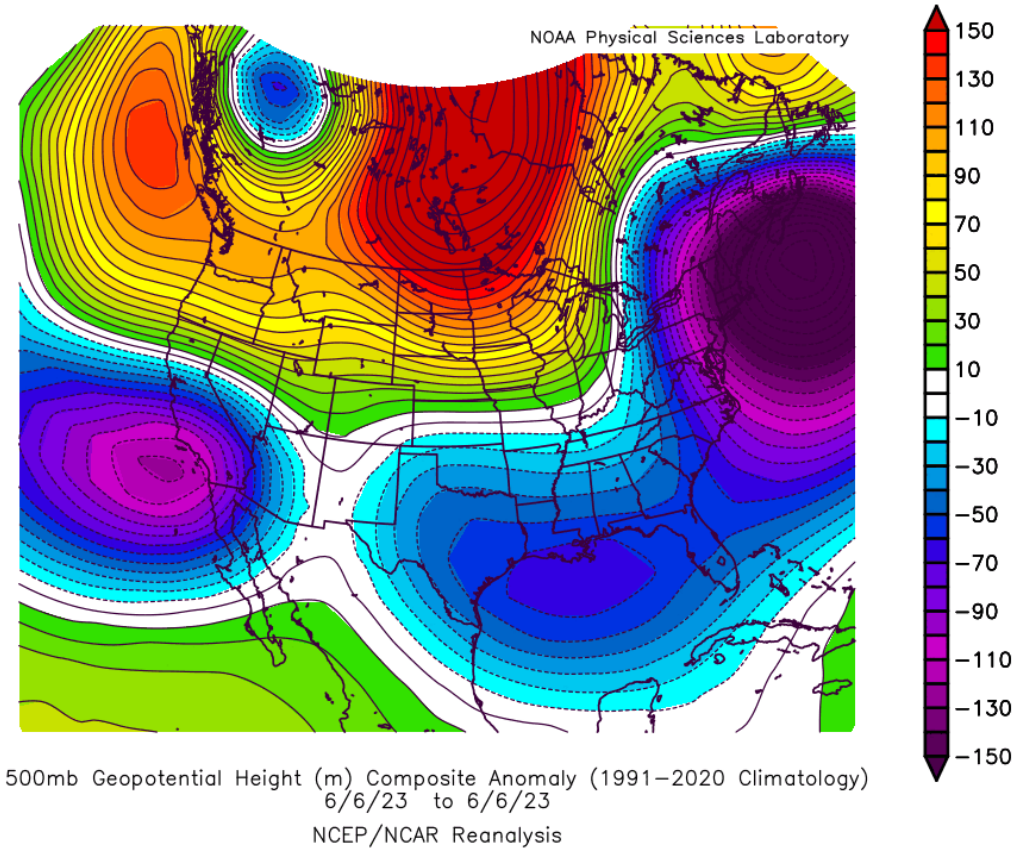


***Figure 4**: 500 mb geopotential height anomalies, valid June 6th, 2023, reveals an anomalous circulation pattern across the northern CONUS and southern Canada.*

The strong upper-level low was coupled to a strong surface low pressure system centered over Maine, with an attendant surface cold front that crossed North Carolina from the north[10], on the morning of June 7th as seen in **Figure 5**. The combined flow pattern around these upper-level circulations resulted in enhanced north-northwesterly[11] winds aloft and significant smoke transport from central and eastern Canada into North Carolina.

[10] NOAA/NWS/Weather Prediction Center, WPC surface analysis valid for 06/07/2023 at 15 UTC, https://www.wpc.ncep.noaa.gov/archives/web_pages/sfc/sfc_archive_maps.php?arcdate=06/07/2023&selmap=2023060715&maptype=namussfc

[11] NOAA/NWS/Storm Prediction Center, Mesoscale Analysis Archive, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=06&STARTDAY=06&STARTTIME=00&INC=48

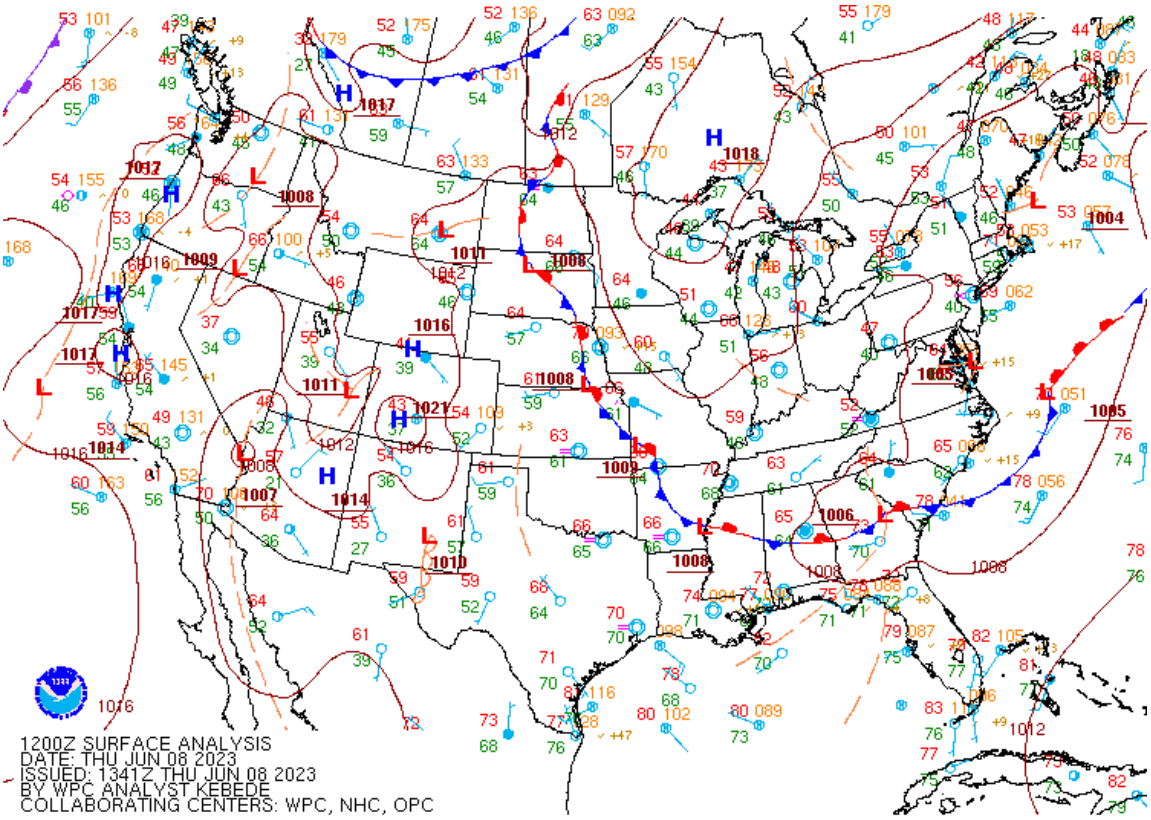


***Figure 5**: WPC surface analysis issued June 8th, 2023 at 8:00 am EDT, showing a cold front that had recently crossed North Carolina.*

Smoke aloft, which can be seen in **Figure 6** showing webcam imagery from Purchase Knob in the North Carolina mountains, mixed to the surface over North Carolina on June 6th. This preceded smoke and elevated $PM_{2.5}$ directly being transported into the state at the surface, which occurred behind the surface cold frontal passage on June 7th. The deposited smoke-laden and elevated $PM_{2.5}$ air mass stagnated over the area through June 11th as surface high pressure built into the region behind the front, resulting in subsidence, light winds and reduced air mass dispersion, trapping the polluted air mass in place.

***Figure 6**: (Left) Webcam image from Purchase Knob, NC on June 6th, 2023 shows significant smoke aloft present. (Right) Webcam image from Purchase Knob, NC on June 10th, 2024 shows a typical view on a clearer day. Source: National Park Service*

2.2.2 Event ID #2 - June 17th through June 18th, 2023

The second event, which occurred between June 17th and June 18th, was essentially a shorter duration repeat of the first event from a meteorological perspective. A strong H5 ridge, centered further north in central Canada, was again joined by a strong H5 low pressure that rotated across New England during the period.

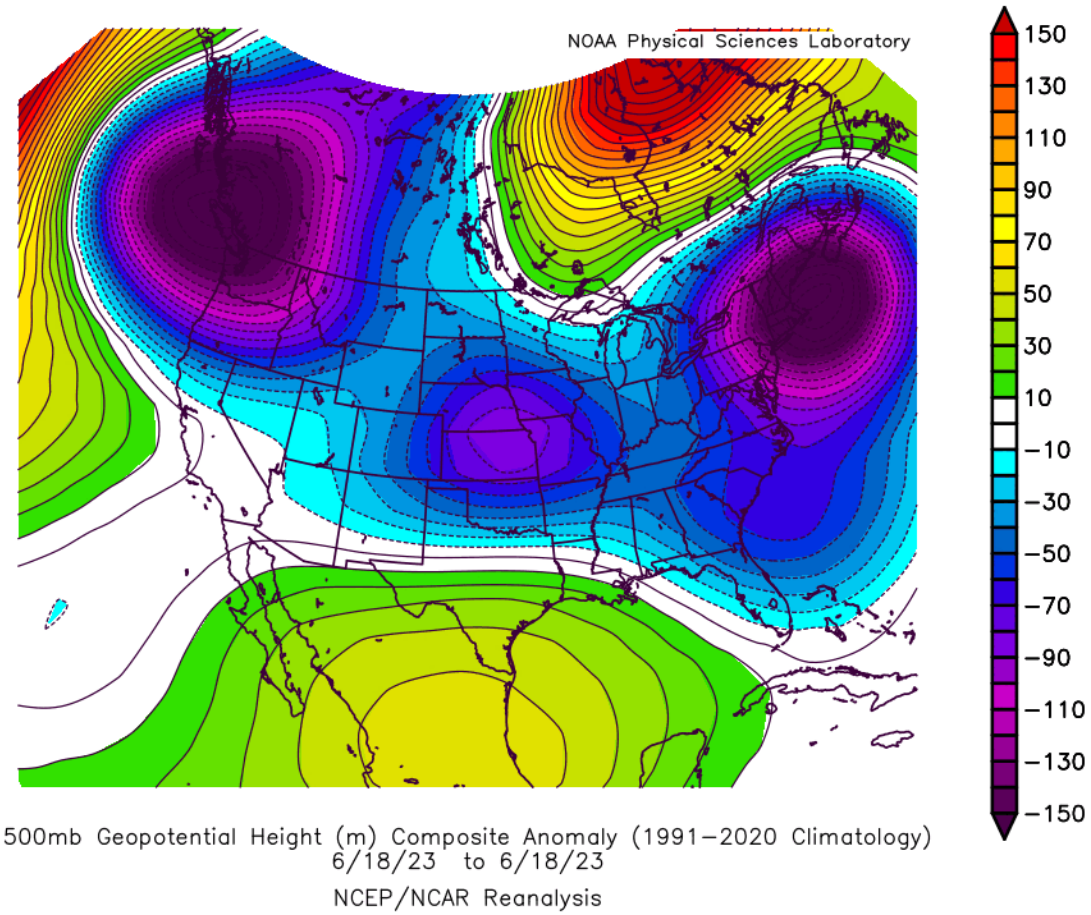


***Figure 7**: 500 mb geopotential height anomalies, valid June 18th, 2023, reveals an anomalous circulation pattern across the northern continental U.S. (CONUS) and southern Canada.*

Also similar to the first episode, this strong upper-level low was coupled to a strong surface low pressure that propelled a surface cold front across North Carolina[12] late on the evening of June 16th. As the base of the upper-level trough of low pressure rotated across the state, mid-level winds became strong out of the north-northwest[13], heralding the onset of smoke transport aloft into the region.

[12] Weather Prediction Center, https://www.wpc.ncep.noaa.gov/archives/sfc/2023/namussfc2023061703.gif
[13] NOAA/NWS/Storm Prediction Center, Mesoscale Analysis Archive, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=06&STARTDAY=16&STARTTIME=00&INC=48

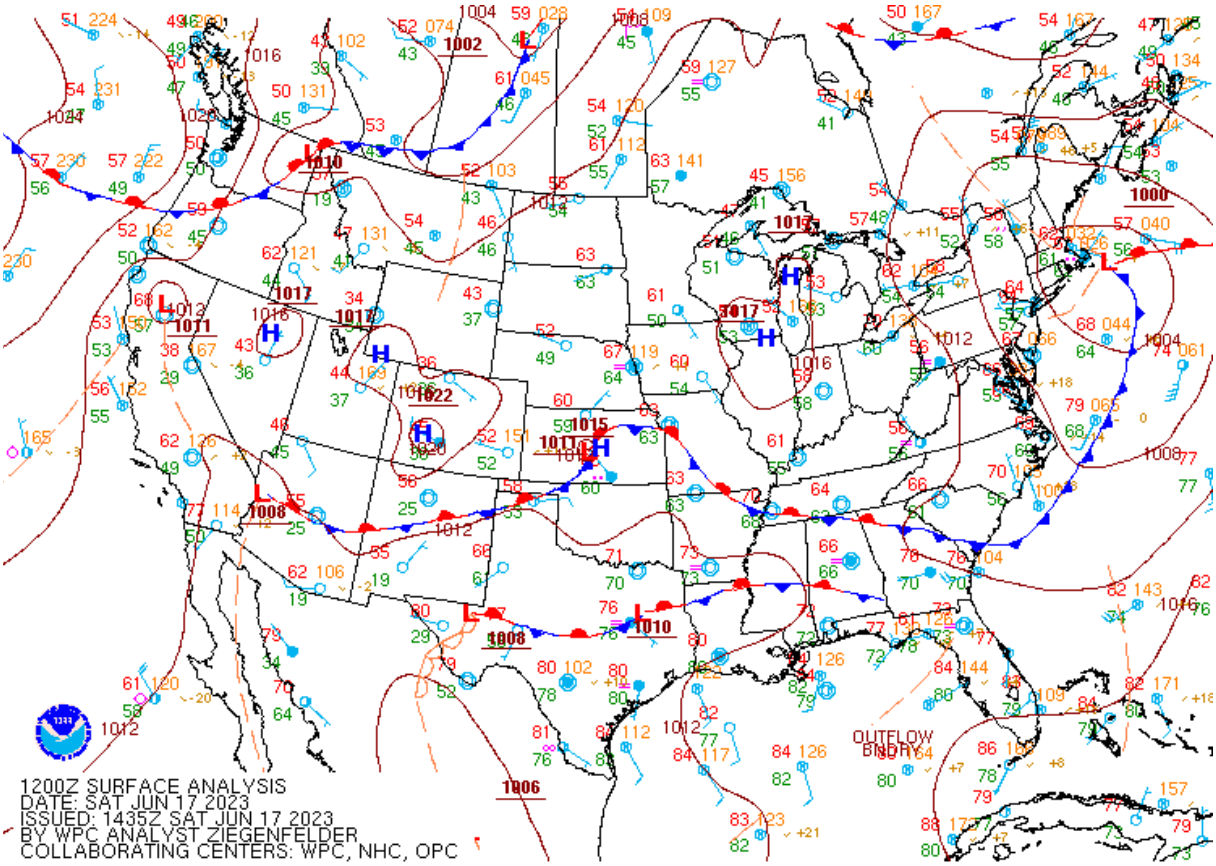


***Figure 8**: WPC surface analysis issued June 17th, 2023 at 8:00 am EDT, showing a cold front that had recently crossed North Carolina.*

Concomitantly, smoke transport mixing downward through the planetary boundary layer along with surface-level smoke and elevated fine particulates advecting into the region from the northwest again resulted in significantly elevated $PM_{2.5}$ levels across the state above typical levels.

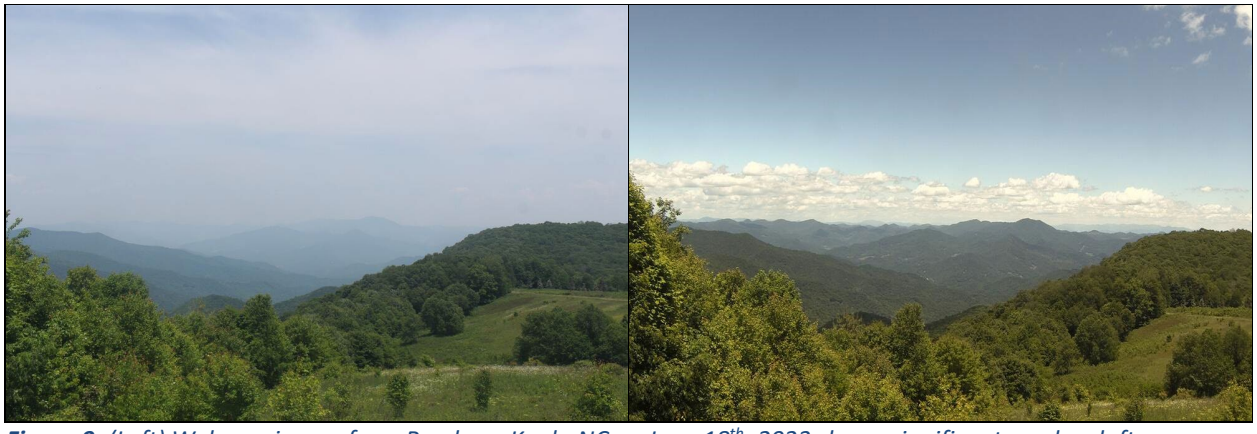


***Figure 9**: (Left) Webcam image from Purchase Knob, NC on June 18th, 2023 shows significant smoke aloft present. (Right) Webcam image from Purchase Knob, NC on June 10th, 2024 shows a typical view on a clearer day. Source: National Park Service*

2.2.3 Event ID #3 - June 28th through July 1st, 2023

The third event, which occurred between June 28th and July 1st, featured another variation of the persistent atmospheric flow regimes discussed in prior events, this time in the form of a Rex blocking pattern.[14] Persistent and recurrent upper-level ridging across Canada continued to exacerbate drought conditions and simultaneously trap Canadian wildfire smoke, while concurrent upper-level low pressure south of the ridge descended across the upper Midwest and then rotated eastward into New England[15] providing the transport mechanism for smoke penetration deep into the eastern and eventually southeastern U.S. during June and July 2023.

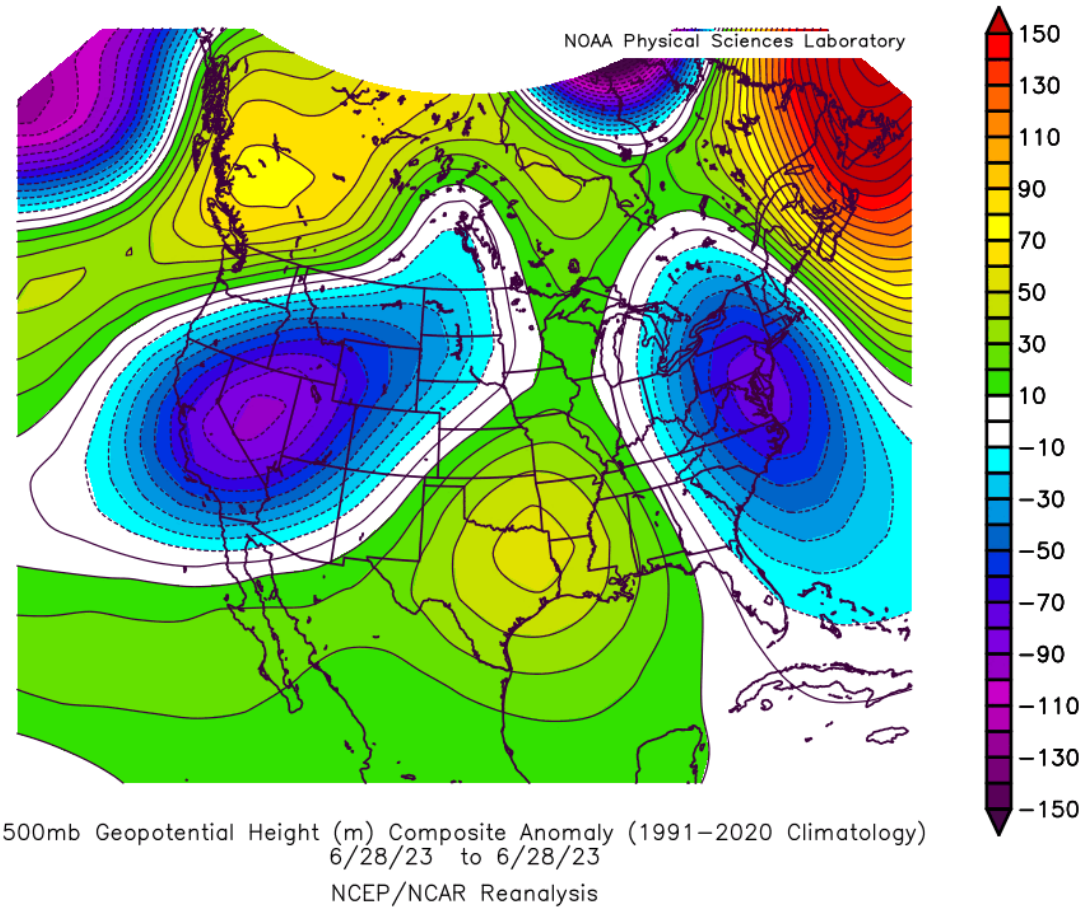


***Figure 10**: 500 mb geopotential height anomalies, valid June 28th, 2023 showing strong Rex block present over the eastern U.S.*

As the upper-level low, and surface low pressure, rotated eastward during the afternoon of June 27th, once again an attendant surface cold front swept across the state.[16] By the evening of June 28th,

[14] The Weather Network, https://www.theweathernetwork.com/en/news/science/explainers/what-is-omega-block-rex-block-upper-level-jet-stream-weather-pattern

[15] NOAA/NWS/Storm Prediction Center, Mesoscale Analysis Archive, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=06&STARTDAY=26&STARTTIME=00&INC=96

[16] Weather Prediction Center, https://www.wpc.ncep.noaa.gov/archives/sfc/2023/namussfc2023062718.gif

hourly fine particulate concentrations were rising above the Code Orange range.[17] On June 29th, 13 out of 21 sites across the state exceeded the daily standard[18], including one site in Forsyth County that recorded a daily average in the Code Red AQI range.

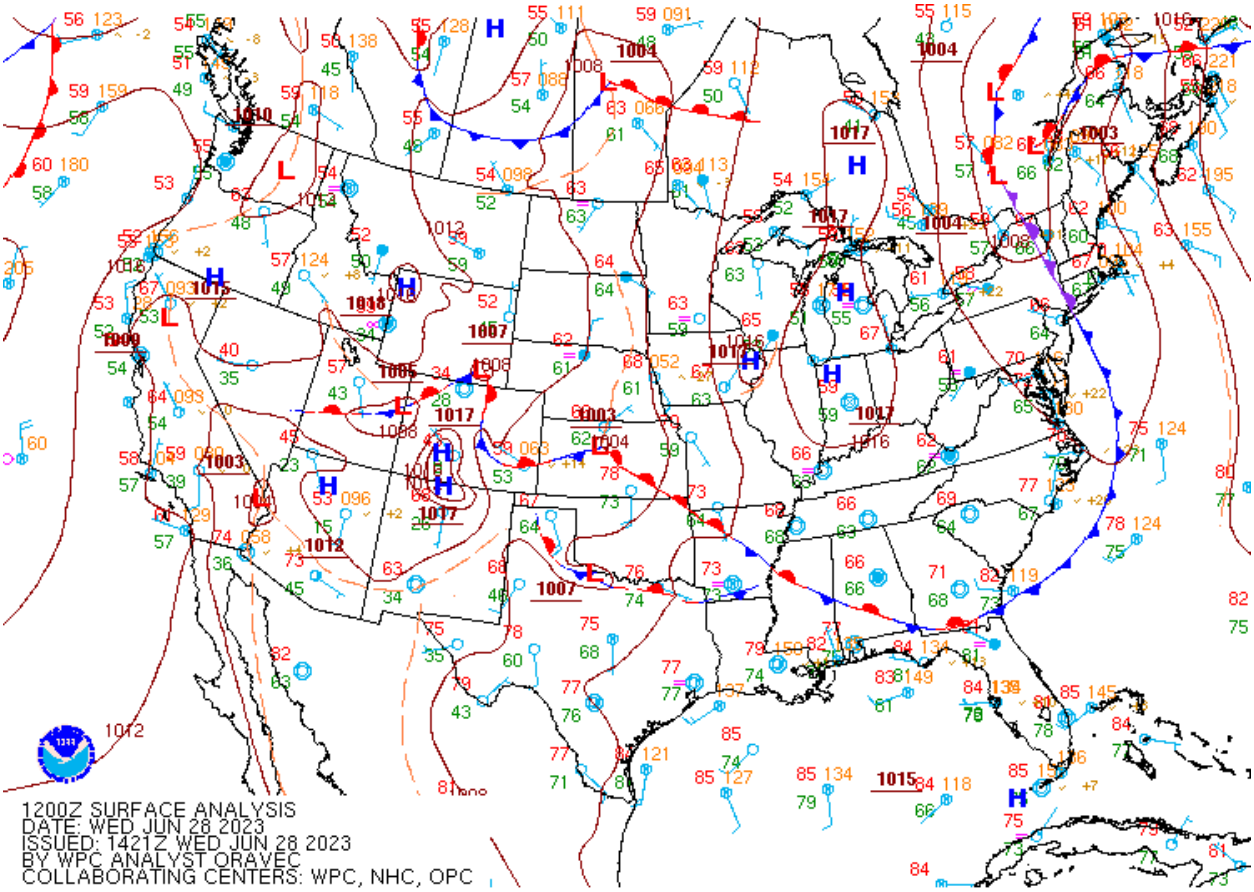


***Figure 11**: WPC surface analysis issued June 28th, 2023 at 8:00 am EDT, showing a cold front that had recently crossed North Carolina.*

Additional exceedances were recorded across the state on June 30th, and the smoke-laden air mass lingered over the state through July 1st as surface high pressure built into the region[19] behind the front, trapping the polluted air mass over the region.

[17] AIR Tool, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=hourly&date_past=2023-06-28&time_past=21&sync_past=0&dataset_past_point1=pm25%7Cinst_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1

[18] AIR Tool, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=daily&date_past=2023-06-29&time_past=10&sync_past=0&dataset_past_point1=pm25|24hr_conc&fires_past=0&smoke_past=0&map_center=37.486,-80.224&map_zoom=8&map_bg=light&states=1&counties=1

[19] Weather Prediction Center, https://www.wpc.ncep.noaa.gov/archives/web_pages/sfc/sfc_archive_maps.php?arcdate=06/30/2023&selmap=2023063000&maptype=namussfc

***Figure 12**: (Left) Webcam image from Purchase Knob, NC on June 29th, 2023 shows significant smoke aloft present. (Right) Webcam image from Purchase Knob, NC on June 10th, 2024 shows a typical view on a clearer day. Source: National Park Service*

2.2.4 Event ID #4 – July 17th through July 18th, 2023

The final event, which occurred between July 17th and July 18th, was the most severe smoke transport event presented in North Carolina's Exceptional Events Demonstration. The atmospheric pattern continued to feature the same anomalous circulations (strong upper-level high and upper-level low pressures) that resulted in decreased westerlies and a blocked jet stream that concurrently led to increased air mass stagnation and smoke transport in the downwind regions of the upper atmospheric pattern. Strong and widespread high pressure both aloft and at the surface remained over most of Canada during the period preceding the event, while a strong upper-level low began to descend southward into the northern Continental U.S. (CONUS) on July 15th and 16th.[20] Smoke wrapped into this upper-level low / trough resulted in a major intrusion of the ongoing Canadian wildfire smoke into the Great Lakes and Ohio Valley region as the core of the cyclonic circulation dug southward.

[20] NOAA/NWS/Storm Prediction Center, Mesoscale Analysis Archive, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=07&STARTDAY=17&STARTTIME=00&INC=-48

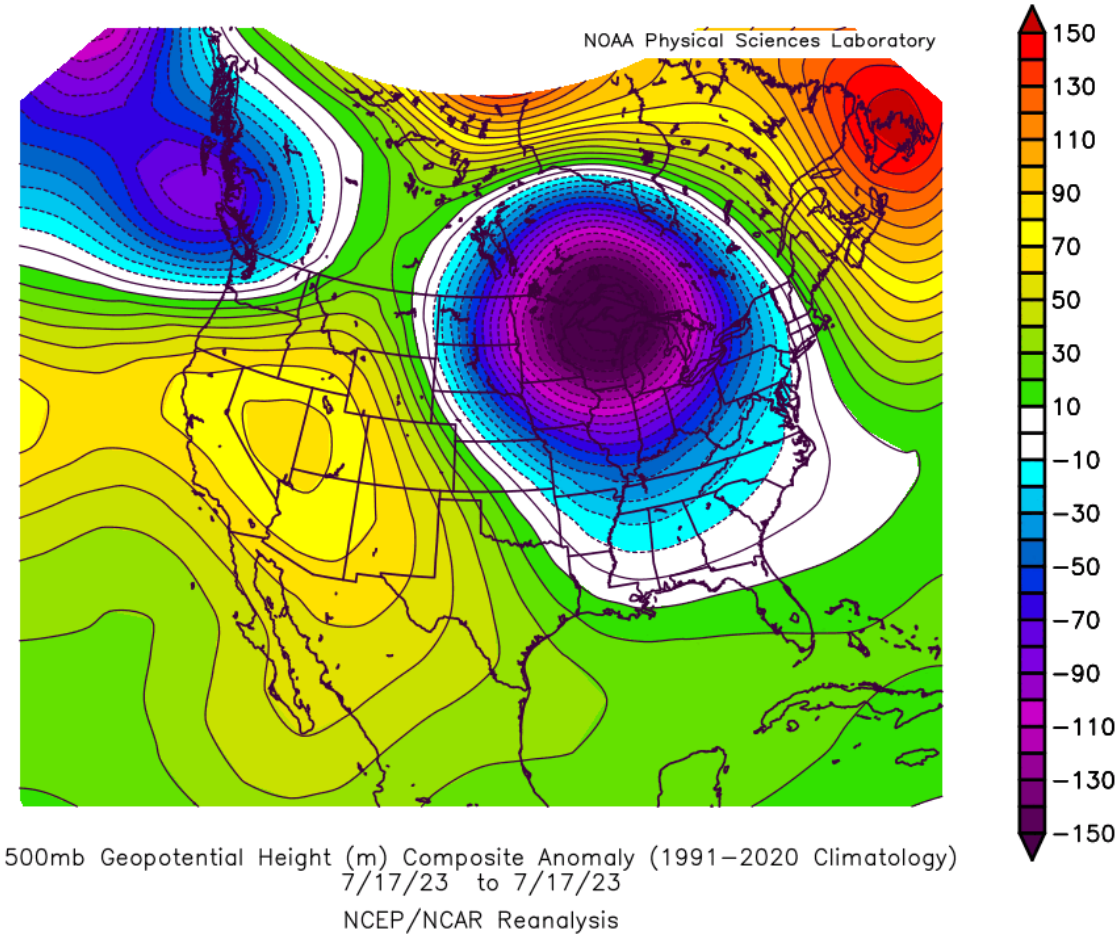


***Figure 13**: 500 mb geopotential height anomalies, valid July 17th, 2023 showing strong upper-level closed low over the Great Lakes region.*

As was the case with the other three other events, as the upper-level low and concurrent surface low pressure rotated eastward on July 16th into July 17th, an attendant surface cold front swept across the state.[21]

[21] Weather Prediction Center, https://www.wpc.ncep.noaa.gov/archives/sfc/2023/namussfc2023071706.gif

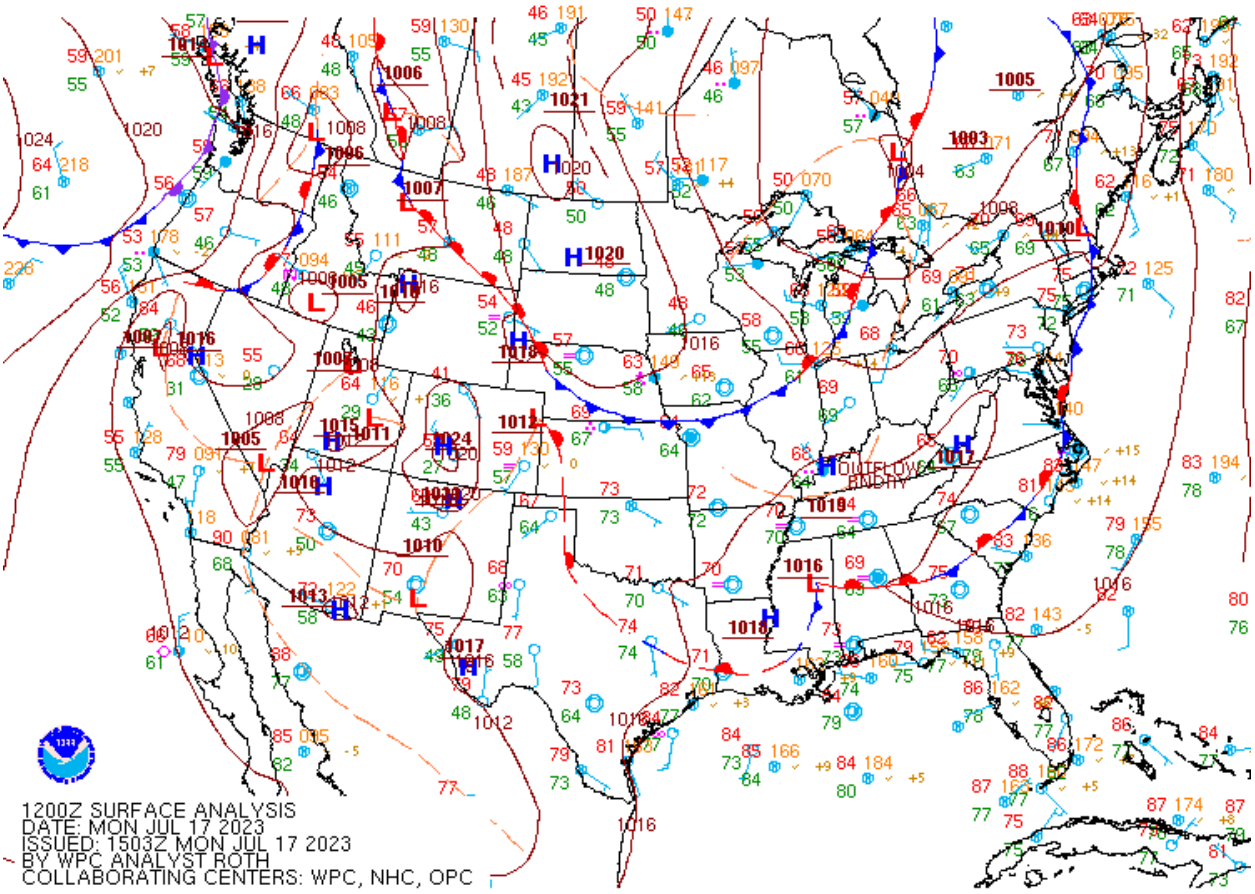


***Figure 14**: WPC surface analysis issued July 17th, 2023 at 8:00 am EDT, showing a cold front crossing North Carolina.*

On July 16th, all but one $PM_{2.5}$ monitoring site across North Carolina measured Code Green 24-hr. daily average concentrations[22], while sites in northwestern Kentucky and all of Indiana observed daily averages above 35.5 µg/m3. On July 17th, 11 out of the 12 sites in the western half of the state recorded daily average concentrations above 35.5 µg/m3[23], a clear indicator of the widespread polluted air mass that had swiftly advected into the state. As the smoke continued to transport from west to east across the state, air quality conditions deteriorated further on July 18th, when 16 out of 21 $PM_{2.5}$ monitoring sites across North Carolina exceeded the daily NAAQS.[24]

[22] AIR Tool, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=daily&date_past=2023-07-16&time_past=13&sync_past=0&dataset_past_point1=pm25|24hr_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1

[23] AIR Tool, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=daily&date_past=2023-07-17&time_past=13&sync_past=0&dataset_past_point1=pm25|24hr_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1

[24] AIR Tool, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=daily&date_past=2023-07-18&time_past=13&sync_past=0&dataset_past_point1=pm25|24hr_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1

***Figure 15**: (Left) Webcam image from Purchase Knob, NC on July 17th, 2023 shows significant smoke aloft present. (Right) Webcam image from Purchase Knob, NC on June 10th, 2024 shows a typical view on a clearer day. Source: National Park Service*

Section III. Clear Causal Relationship

This section satisfies the following federal requirements:

40 CFR § 50.14(c)(3)(iv)(B): A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation.

40 CFR § 50.14(c)(3)(iv)(C): Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the requirement at paragraph (c)(3)(iv)(B) of this section.

The Exceptional Event Rule requires that a clear causal relationship exists between the measured exceedances and the exceptional event to demonstrate that the proposed exceptional event caused a specific air pollution concentration at a particular air quality monitoring location. The analysis provided in this section is consistent with the clear causal relationship examples provided in the Final Rule on the Treatment of Data Influenced by Exceptional Events. Both elevated and surface level $PM_{2.5}$ pollution from the wildfire smoke impacted North Carolina ambient monitors and directly resulted in anomalous concentrations well-above the previous 5-year (2018-2022) daily average concentrations at the $PM_{2.5}$ monitors for the days in our demonstration.

While North Carolina believes that each Tier 2 day should be evaluated within the greater context of the meteorological / air quality events identified and analyzed in this section, in order to satisfy the requirement for Tier 2 days as listed in Section 5.4 of EPA's "$PM_{2.5}$ Wildland Fire Exceptional Events Tiering Document" at least two additional pieces of evidence have been provided -- determined on a day-by-day basis -- for each of the Tier 2 days in this demonstration.[25] These additional pieces of evidence include surface METARs (Meteorological Aerodrome Reports) from both the Charlotte/Douglas International Airport (CLT) and the Concord Regional Airport (JQF), which was the closest airport observing site that included manual (human) obscuration reports (though not at all times). Other observing sites closer to the air quality monitoring locations at Remount and Lexington such as the Charlotte/Douglas International Airport (CLT) or the Davidson County Airport (EXX) did not include these human reports. However, Concord Regional Airport is reasonably close (approximately 20 and 40 miles respectively) and thus representative of conditions at both locations. METARs provide a robust set of hourly surface observations at a location including relevant information for this demonstration such as surface visibility and obscurations (including smoke). Standard, clear surface visibility in METAR reports is 10 statute miles (10SM) and as obscurations reduce visibilities below this, a visibility chart like the one shown below in **Figure 16** is used to determine the visibility by the observer. Any visibility below 7-8 SM indicates a significant obscuration.

[25] EPA, PM2.5 Wildland Fire Exceptional Events Tiering Document, EPA-457/R-24-001, April 2024, https://www.epa.gov/system/files/documents/2024-04/final-pm-fire-tiering-4-30-24.pdf.

3.3 Visibility Chart

As an aid for determining visibility around the station, all stations are required to have a visibility chart. And to be most useful, this chart should be posted near the point from which you observe visibility. This chart should list or otherwise indicate the location of all visibility markers, their distance from the station, and whether they are daytime or nighttime markers. It is also very important that this visibility chart be kept current. An example of the type of visibility chart used is shown in Exhibit 3-1.

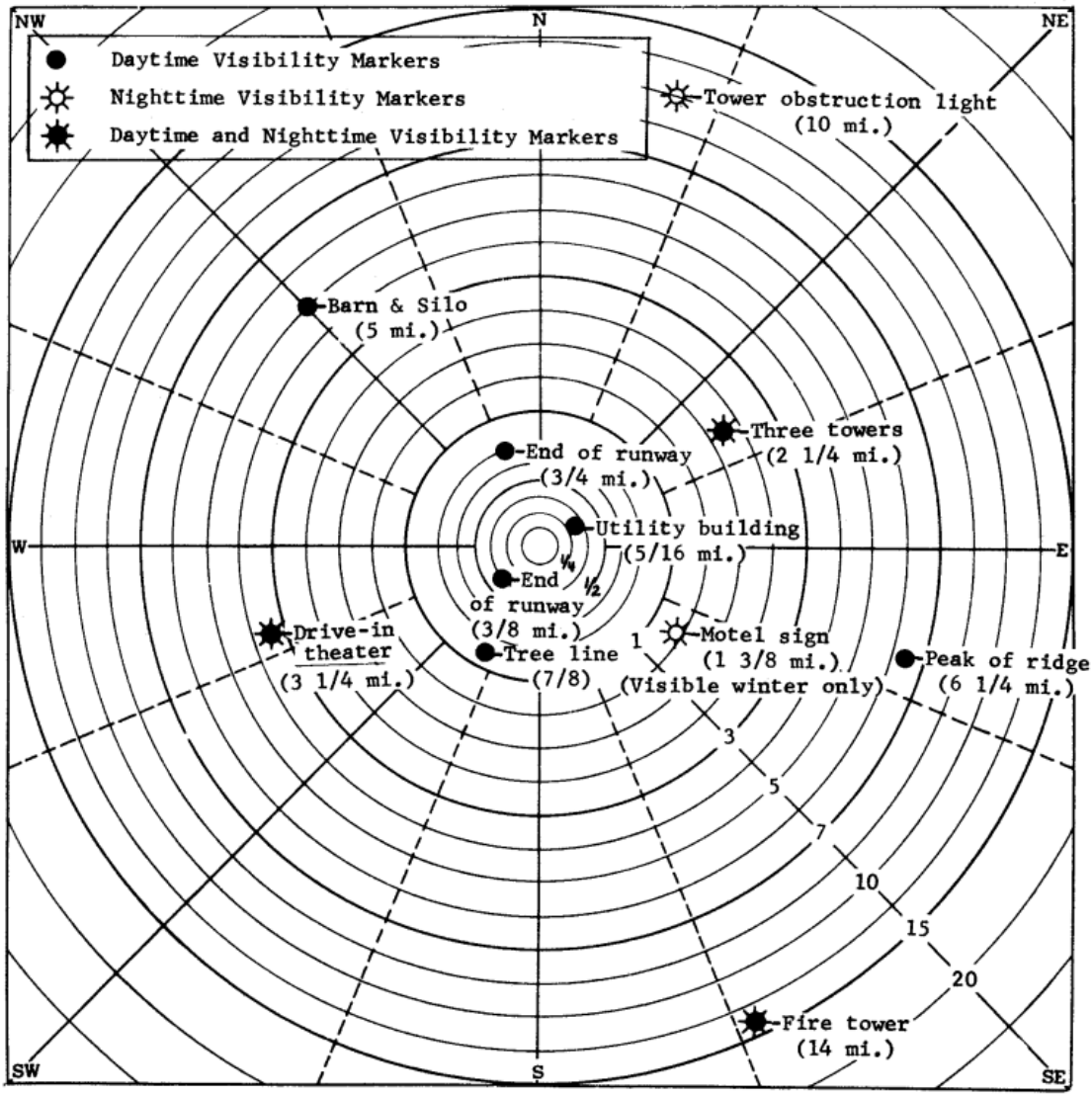


Exhibit 3-1. Visibility Chart

***Figure 16**: Example visibility chart used to determine visibility observations at airports. Typical visibility is 10 statute miles (SM), with lower values indicating increasing obscuration.*[26]

[26] https://www.weather.gov/media/surface/SFCTraining.pdf

Also included as additional Tier 2 evidence on select days are observed upper air radiosonde sounding data in skew-t format from the Greensboro airport (KGSO) and both aerosol model guidance provided by the Naval Research Laboratory Marine Meteorology Division's Navy Aerosol Analysis and Prediction System (NAAPS) Global Aerosol Model and modeled near-smoke concentrations from NOAA's High Resolution Rapid Refresh (HRRR) smoke model.

3.1 Canadian Wildfires Clear Causal Relationship to Elevated $PM_{2.5}$ Observations in NC

As previously discussed, when the anomalous upper-level high pressure[27] built over Canada during April and May 2023, it resulted in record warm and dry conditions across the entire country. By late May 2023, a combination of unseasonably warm temperatures reaching into the 90s (depicted in red numbers in the station observations)[28] and dry weather across Quebec provided ideal conditions for wildfires to develop.[29] When thunderstorms did move through, lightning strikes ignited even more fires. In total, more than 150 wildfires in the province burned almost 400,000 acres just during the first week of June. From early June through mid-July 2023, North Carolina experienced 4 significant intrusions of smoke-laden Canadian air masses that directly resulted in widespread elevated $PM_{2.5}$ observations that otherwise would not have occurred in the absence of these events.

3.1.1 Event ID #1 - June 6th through June 11th, 2023

The first event in early June led to four days of 24-hour $PM_{2.5}$ averages that were classified as Tier 2 level at the Remount monitor and one day that was classified as Tier 1 level. For the Lexington monitor, three days were classified as Tier 2 and two days were classified as Tier 1. This is shown in **Table 3** below.

***Table 3**: Regulatorily Significant 24-Hour Average $PM_{2.5}$ Concentrations Requested for Exclusion for Event #1.*

		Remount (AQS ID# 371190045) (Mecklenburg County)					Lexington (AQS ID# 370570002) (Davidson County)				
Event ID	**Date**	**24-hr $PM_{2.5}$ Average ($\mu g/m^3$)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold ($\mu g/m^3$)****		**24-hr $PM_{2.5}$ Average ($\mu g/m^3$)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold ($\mu g/m^3$)****	
1	6/6/2023	21.7	8.6	151.2 %	Tier 2	16.3	28.6	11.4	150.9 %	Tier 1	25.35
	6/7/2023	26.3	10.0	162.5 %	Tier 1	24.45	29.3	9.2	219.3 %	Tier 1	25.35
	6/8/2023	18.5	8.7	113.6 %	Tier 2	16.3	-	-	-	-	
	6/9/2023	23.7	7.7	208.6 %	Tier 2	16.3	23	8.1	184.0 %	Tier 2	16.9
	6/10/2023	24.3	7.5	224.0 %	Tier 2	16.3	22.5	7.7	192.2 %	Tier 2	16.9
	6/11/2023	-	-	-	-		19.2	9.1	110.4 %	Tier 2	16.9

** The historical average is defined as the daily average $PM_{2.5}$ concentration over the previous 5-year period (2018-2022) on the given date (i.e., the past 5 June 6ths, the past 5 June 7ths, etc.).*

*** The EPA Tier Level determines the level of evidence required to establish a clear causal relationship in a*

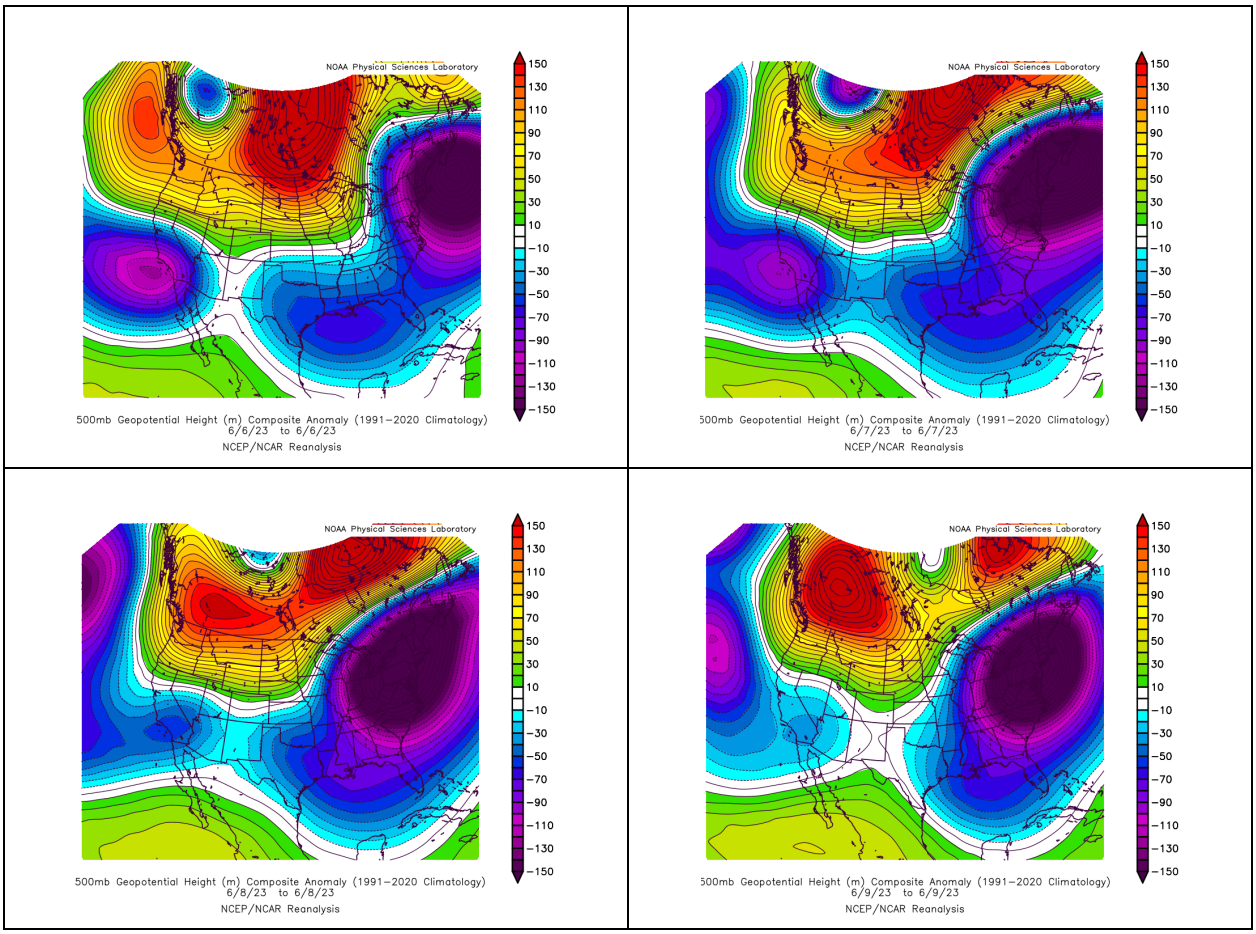
[27] https://climate.ncsu.edu/wp-content/uploads/2023/06/500mb_anomaly_May2023.png

[28] NOAA, https://climate.ncsu.edu/wp-content/uploads/2023/06/sfcmap_QC_2023-05-31_21Z.png

[29] NASA Earth Observatory, https://earthobservatory.nasa.gov/images/151430/fires-burn-across-quebec

wildland fire $PM_{2.5}$ exceptional events demonstration and was determined using EPA's Tiering Tool output as displayed in Appendix K: Monitoring Sites' Tiering Graphs. The threshold listed represents the minimum daily average concentration ($\mu g/m^3$) needed to meet the tier level listed for that specific monitor and month.

This event was driven by a combination of smoke transport aloft and direct transport of a significantly elevated $PM_{2.5}$ air mass at the surface. Aloft, smoke was advected southward from Canada due to strong northerly winds in the mid-levels of the atmosphere along the eastern U.S., which was positioned between an anomalously strong upper-level high pressure (red shading) to the west and upper-level low pressure (purple shading) to the east as shown in **Figure 17**. This upper-level atmospheric pattern was slow to break down, resulting in a persistent fetch of upper-level northerly winds out of eastern Canada that continued to drive smoke into the eastern U.S.



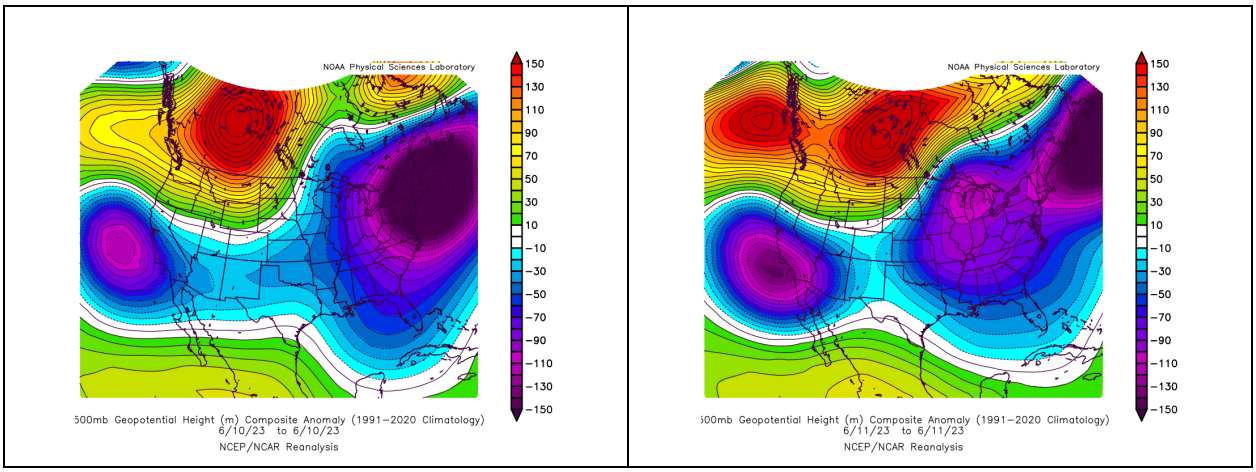


***Figure 17**: 500 mb geopotential height anomalies evolution from June 6th to June 11th, 2023.*

Smoke aloft was visible on satellite imagery over the Ohio Valley and Great Lakes on June 5th, 2023, as seen in **Figure 18**. By June 6th, as the upper-level low continued to provide northwesterly winds aloft, the smoke had blown over North Carolina, as seen in **Figure 19** and **Figure 20**.

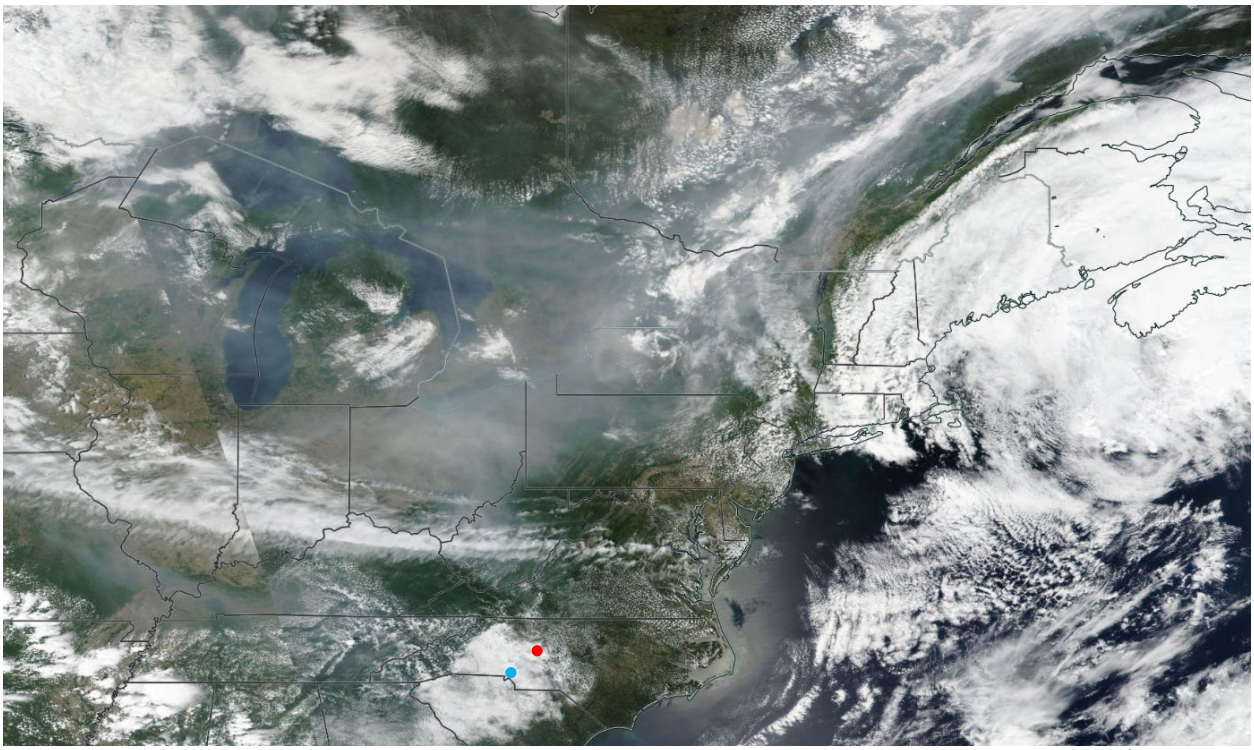


***Figure 18**: Visible satellite imagery showing smoke across the upper Midwest and Great Lakes on June 5th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

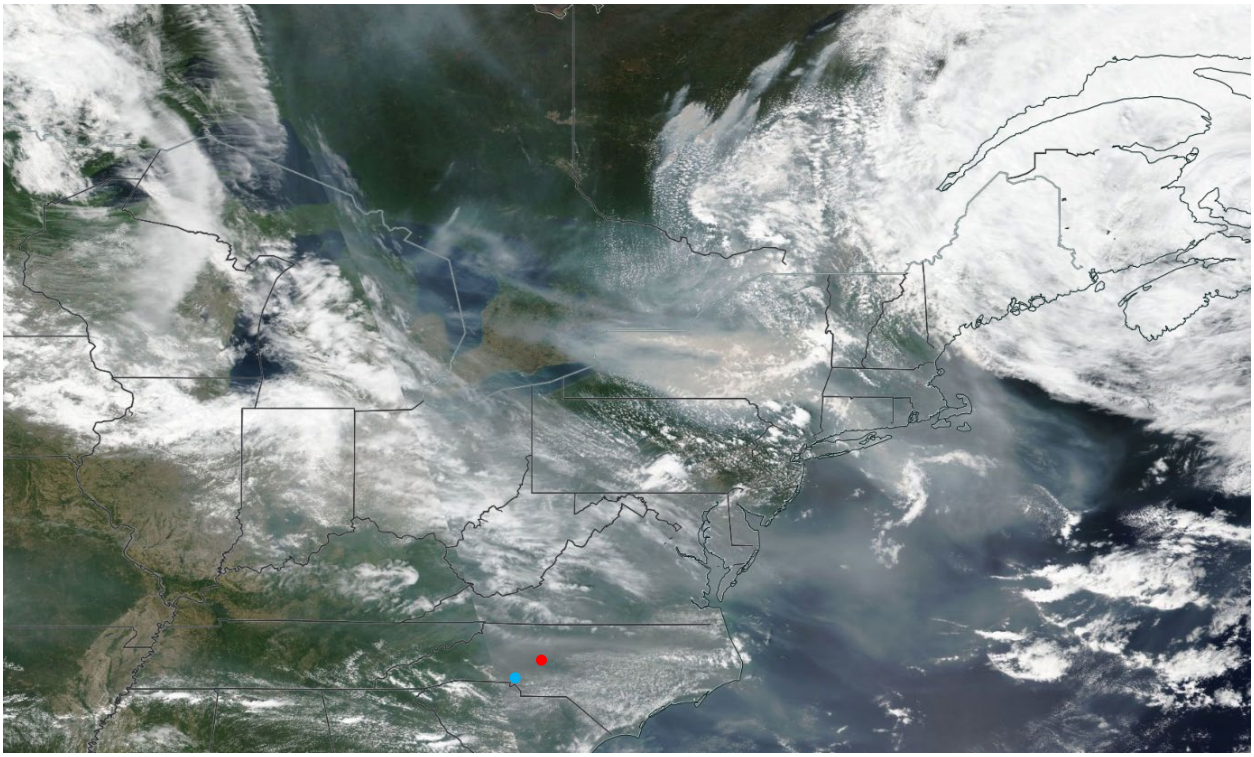


***Figure 19**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 6th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

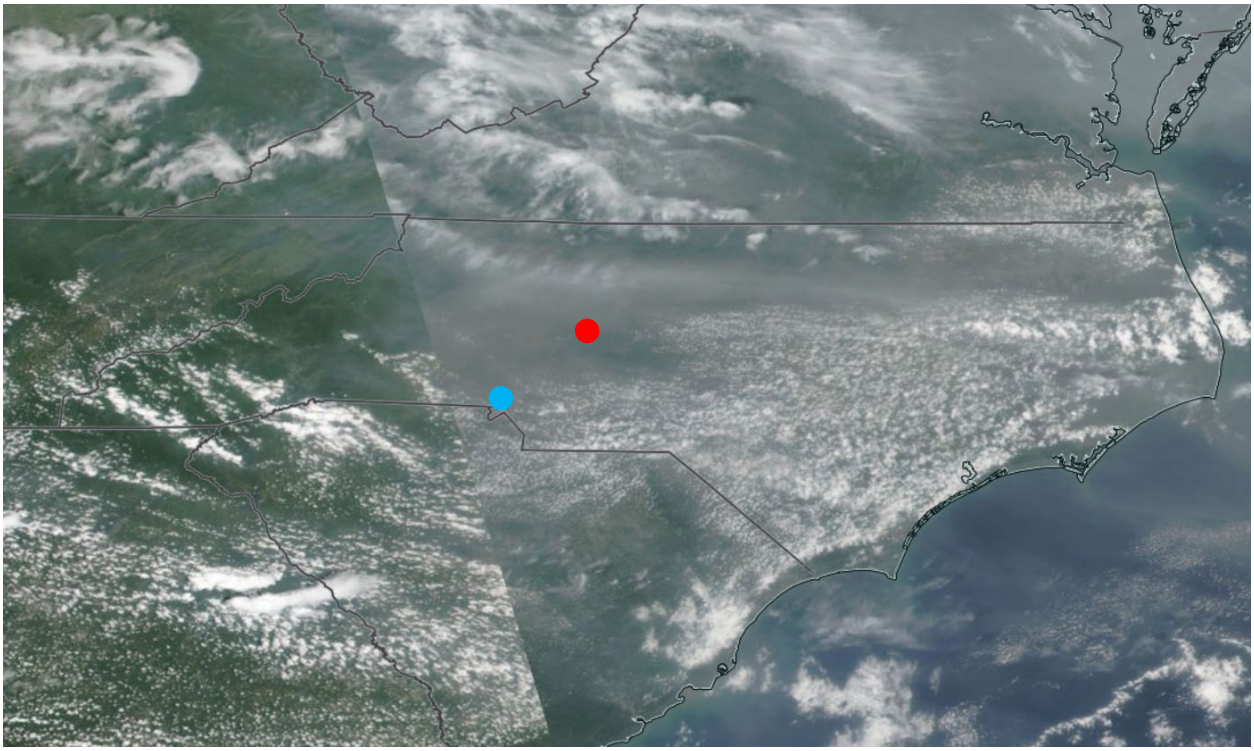


***Figure 20**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 6th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

Signaling the onset of the event, hourly $PM_{2.5}$ values began rising rapidly at both the Remount Road (**Figure 21**) and Lexington Water Tower (**Figure 22**) monitors during the afternoon and evening hours of June 6th. This rise occurred ahead of an approaching surface cold front, a clear indication of vertically downward mixing smoke and elevated fine particulate matter, rather than direct horizontal (surface-level) transport (to this point in time).

Additional Tier 2-level evidence of surface-level smoke on June 6th was evident in hourly METAR reports. Beginning with the 20:50 surface observation (and continuing through midnight) as seen in Appendix B, **Figure 120-B**, surface visibilities lowered to between 5 and 6 statute miles (SM) and smoke (code "FU", an abbreviation of the French word "fumée", which means smoke) was reported. Furthermore, both the HRRR Smoke and NAAPS aerosol models analysis (00 hour initialization) at 8:00 pm on June 6th indicated significant surface smoke greater than 32 µg/m^3 had spread over all of North Carolina as seen in Appendix B, **Figure 121-B** and **Figure 122-B**.

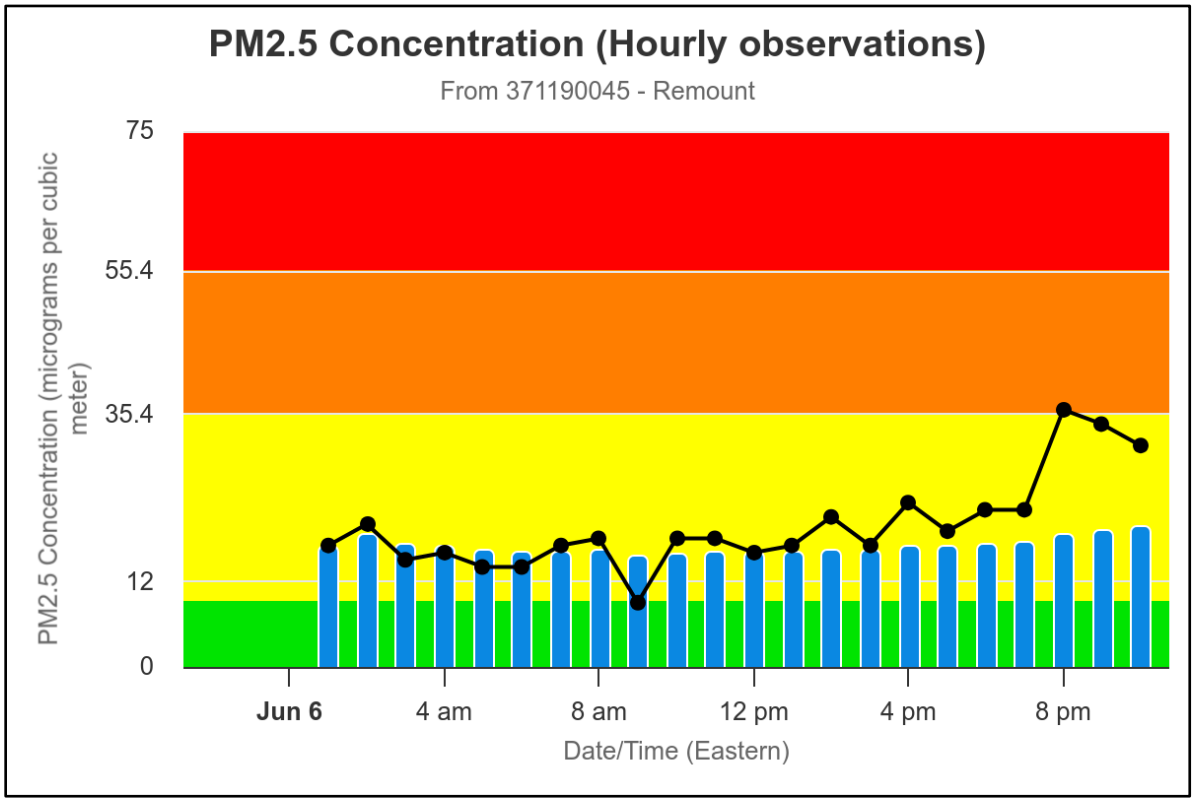


***Figure 21**: Hourly $PM_{2.5}$ observations (black line and dots) valid June 6th, 2023 at the Remount Road monitor. The blue bars represent the rolling daily average of hourly $PM_{2.5}$ observations up to and including the specific hour. The y-axis numerical labels and chart shading are the 24-hour average concentration breakpoints and color categories associated with the Air Quality Index (AQI).*

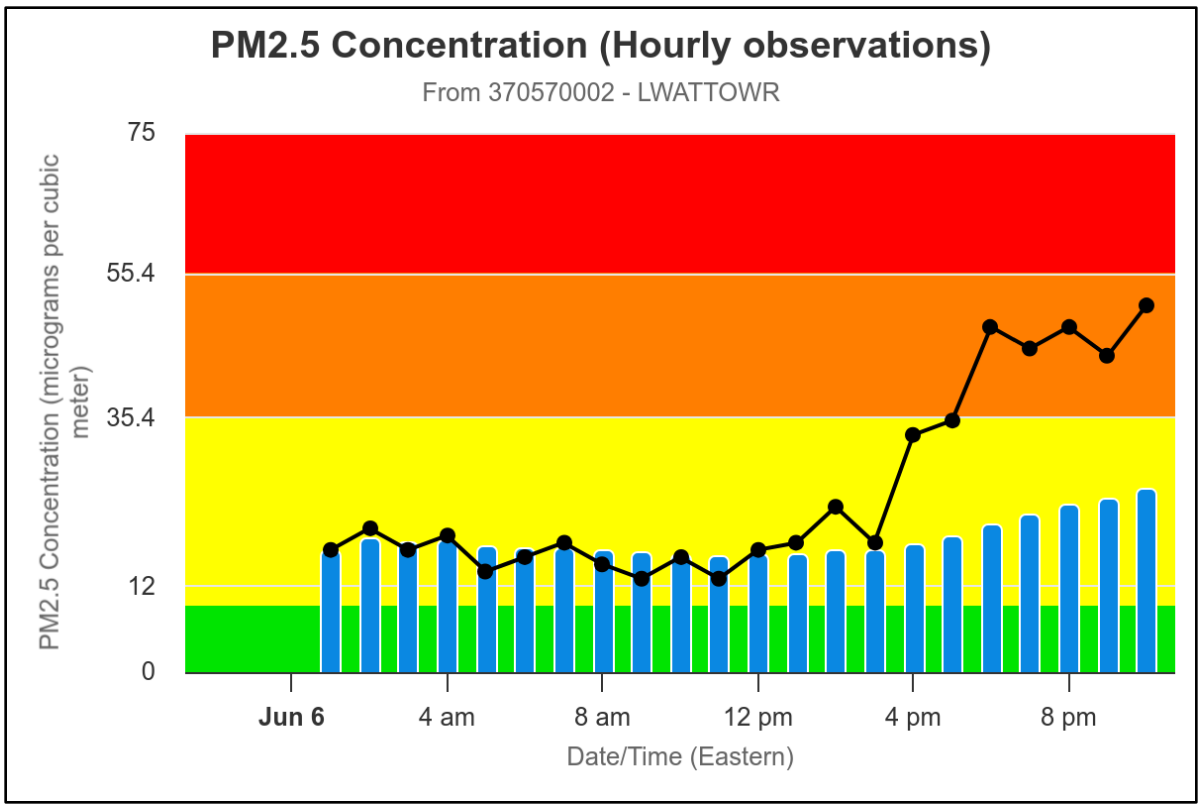


***Figure 22**: Hourly $PM_{2.5}$ observations (black line and dots) valid June 6th, 2023 at the Lexington Water Tower monitor. The blue bars represent the rolling daily average of hourly $PM_{2.5}$ observations up to and including the specific hour. The y-axis numerical labels and chart shading are the 24-hour average concentration breakpoints and color categories associated with the Air Quality Index (AQI).*

At the surface, as seen in **Figure 23** and **Figure 24**, a cold front swept across the state during the morning of June 7th. This resulted in a significantly elevated surface-level air mass of $PM_{2.5}$ moving into the region in tandem with the elevated smoke aloft vertically mixing to the surface during the afternoon hours.

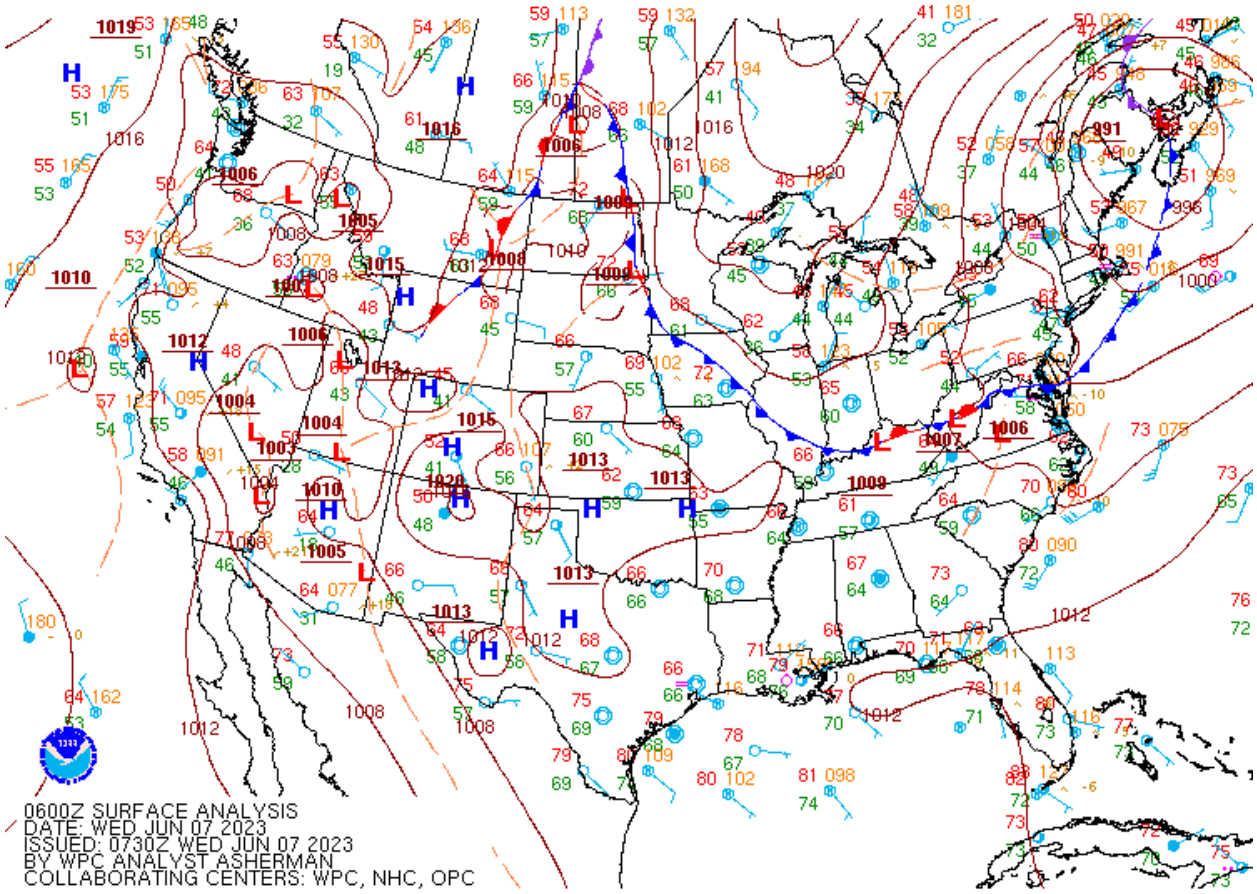


***Figure 23**: WPC surface analysis for June 7th, 2023 at 2:00 am EDT.*

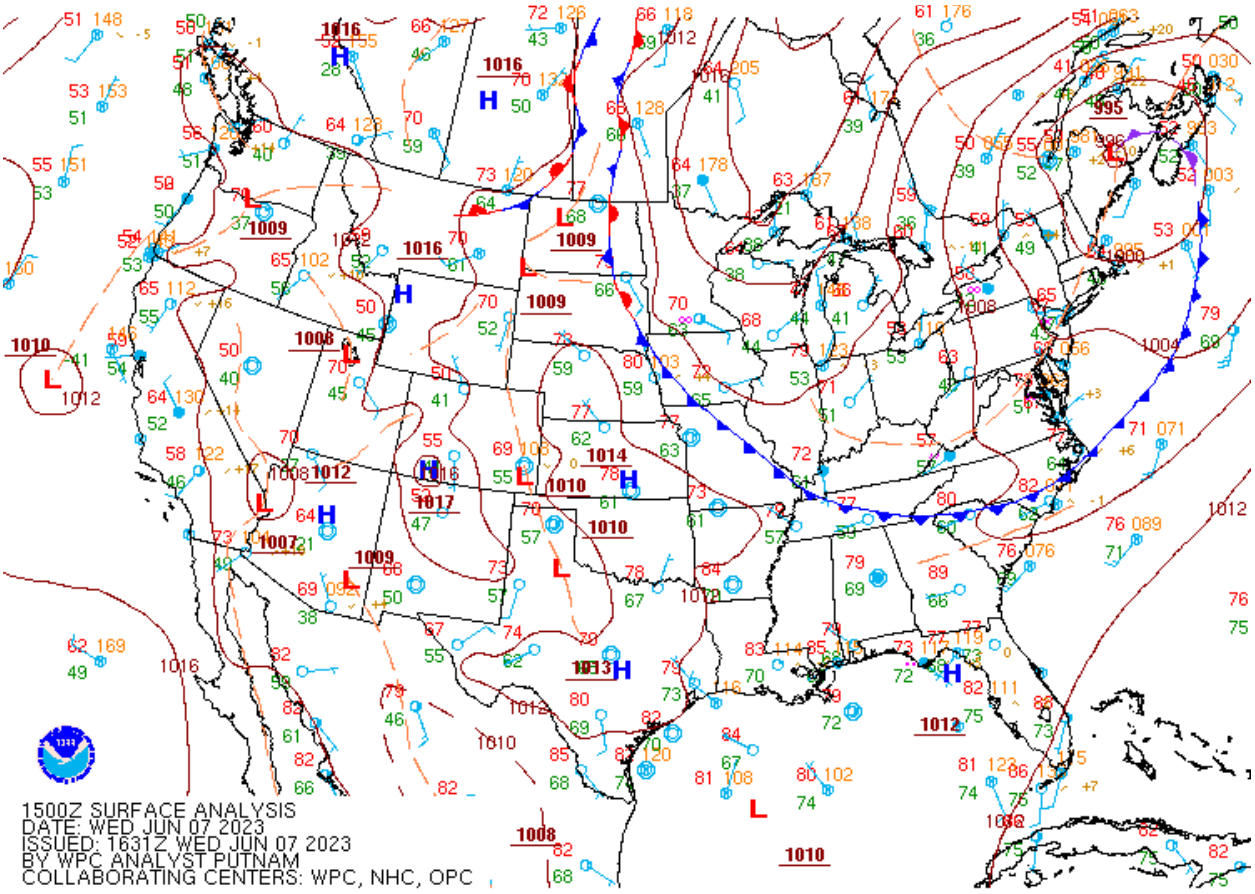


***Figure 24**: WPC surface analysis for June 7th, 2023 at 11:00 am EDT.*

Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model back trajectory analyses (using the North American Mesoscale (NAM) 12km domain via the AirNow-Tech Navigator[30]) show that the smokey air mass seen on visible satellite imagery moved into the state from the northwest. **Figure 25** shows the 24-hour back trajectories, ran from June 7th at both the Remount and Lexington monitors, originated in an air mass containing significantly elevated $PM_{2.5}$ levels on June 6th over northern Kentucky, southern Ohio, and central West Virginia. Resultantly, with continued northwesterly upper-level flow and behind a surface cold frontal passage, elevated $PM_{2.5}$ levels and reduced surface visibilities were observed across the state on June 7th as the polluted air mass moved into the state along the path of the back trajectories, as seen in **Figures 26** through **28**.

[30] AirNow Tech, https://airnowtech.org/index.cfm?page=login

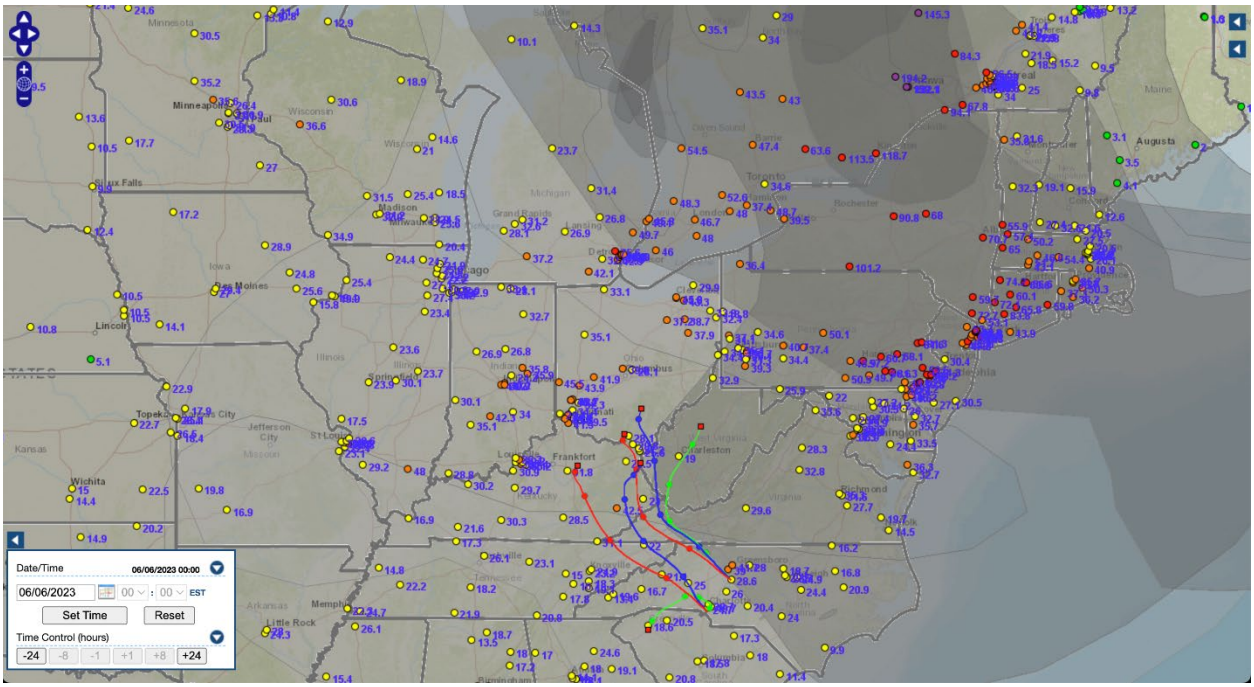


Figure 25**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 6th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 7th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 6th, 2023.

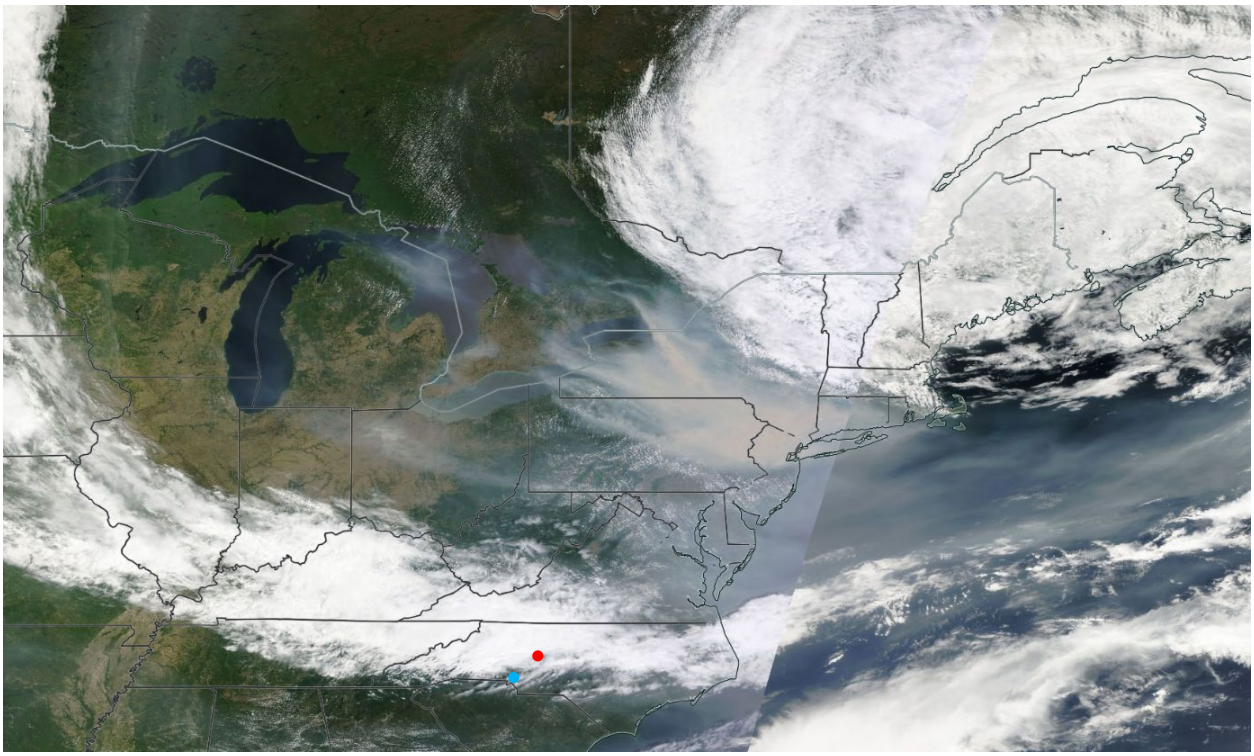


***Figure 26**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 7th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

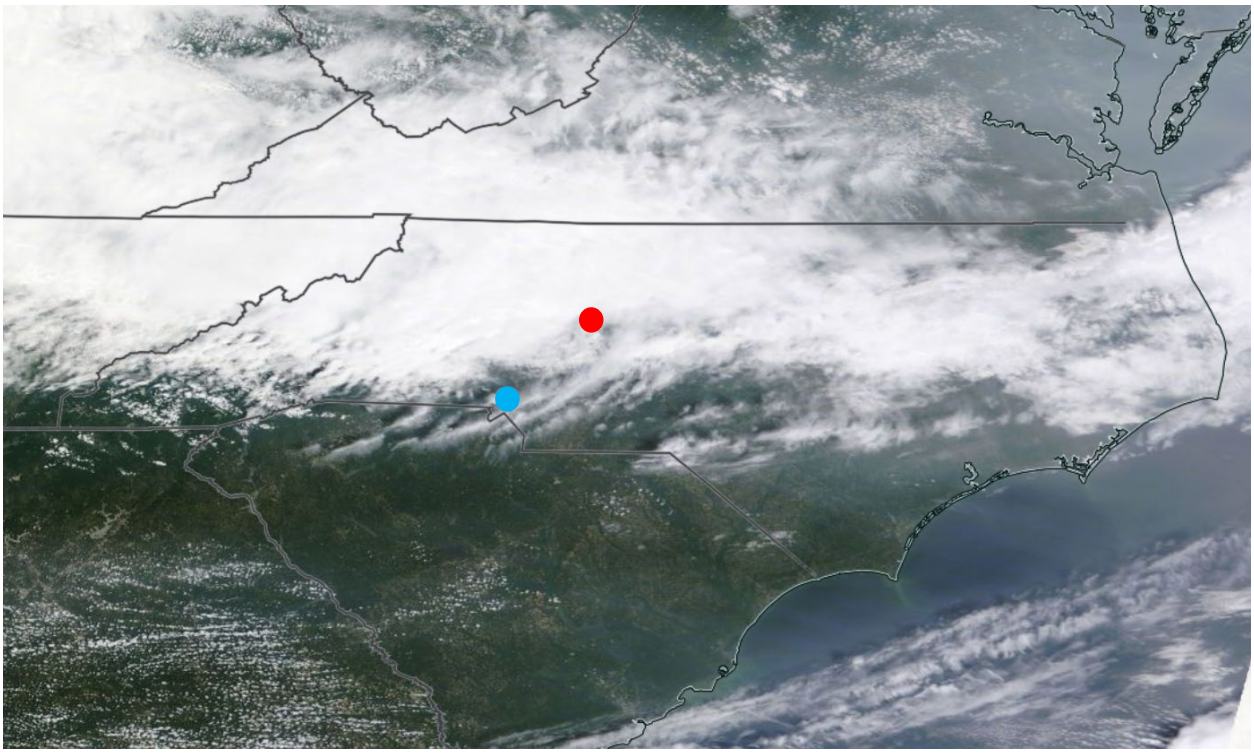


***Figure 27**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 7th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

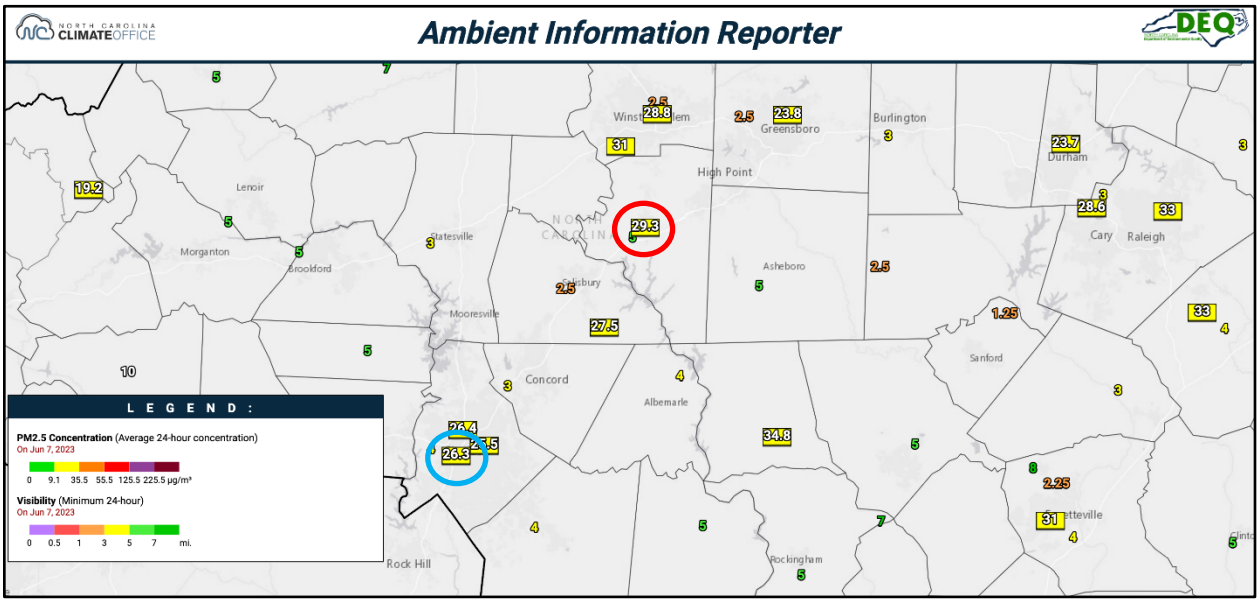


***Figure 28**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 7th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

Once the polluted air mass was deposited into North Carolina, surface high pressure began building into the state from the north and west, as seen in **Figure 29**. This promoted subsidence, light winds, reduced air mass dispersion and stronger nighttime surface temperature inversions, all of which worked to continue holding the polluted air mass in place. Concurrently, the upper-level low

continued to pump a smoke-laden, elevated $PM_{2.5}$ air mass into the state through June 11th as seen in **Figure 30** through **Figure 45.**

Additional Tier 2-level evidence of surface-level smoke and associated impacts on June 8th through June 11th was present in the observed GSO skew-t soundings throughout the period (Appendix C through F, **Figure 123-C** through **Figure 134-F**). A pronounced surface temperature inversion can be seen each morning in the soundings. This occurs when nocturnal surface radiation cools the near-surface temperature more than the air just above, resulting in a very narrow boundary layer of more dense, cold air that sits below the warmer, less dense air just above the surface (circled in red). This acts to trap the polluted surface air mass in place as winds (also seen in the sounding) are typically light to calm under the inversion. Nocturnal surface temperature inversions are expected with strong surface high pressure overhead and as explained previously, these temperature inversions concurrent with strong high pressure overhead traps smoke and fine particulates at the surface. This results in elevated overnight fine particulate levels significantly above what would have occurred without the presence of the deposited smoke-laden air mass. Furthermore, again both the HRRR Smoke and NAAPS aerosol models analysis (00 hr initialization) at 8:00 am on June 8th through June 11th analyzed significant surface smoke over North Carolina due to the lingering surface high pressure and resultant subsidence as seen in Appendix C through F, **Figure 123-C** through **Figure 134-F**.

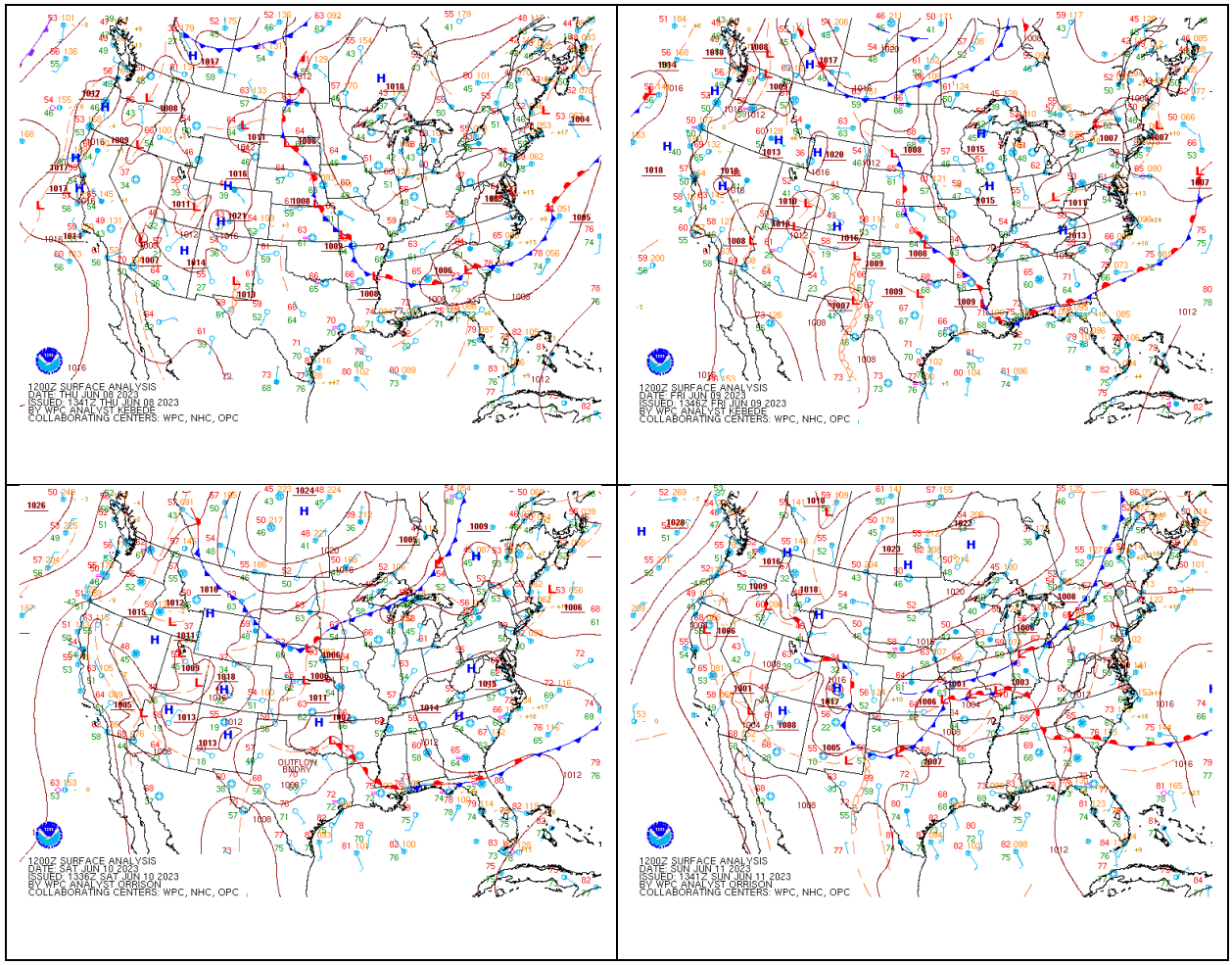


***Figure 29**: WPC 12z (8:00 am EDT) surface analysis evolution from June 8th through June 11th, 2023.*

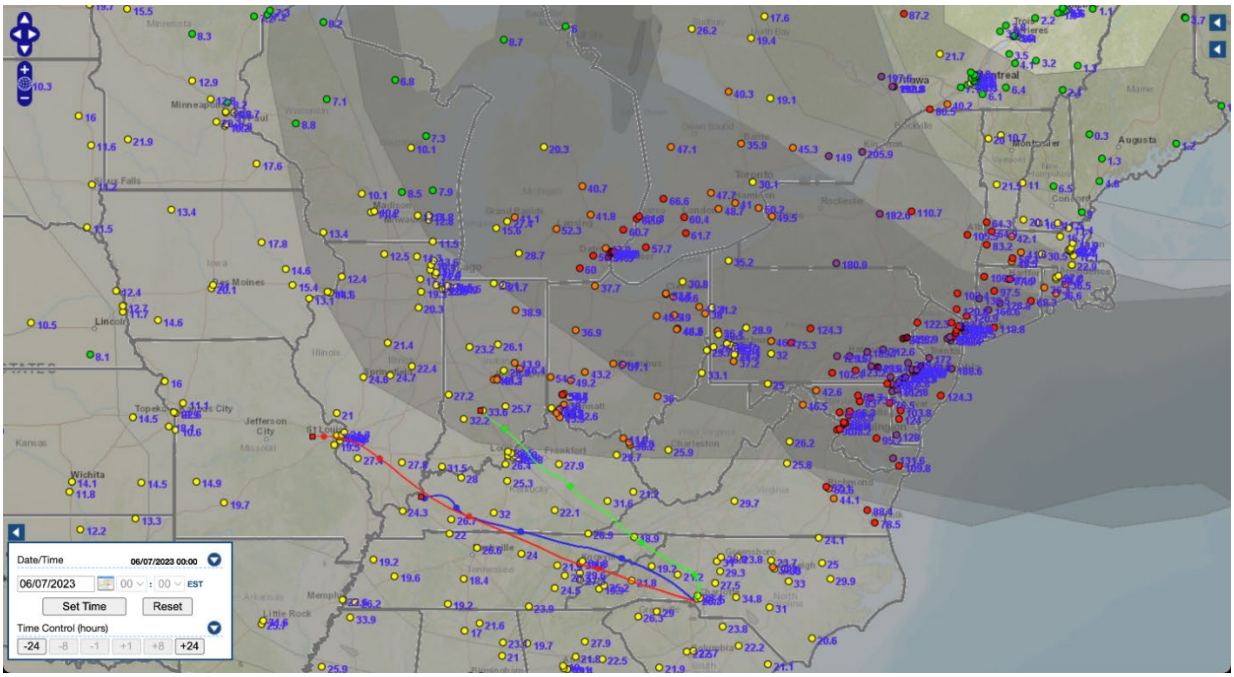


***Figure 30**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 7th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 8th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 7th, 2023**.*

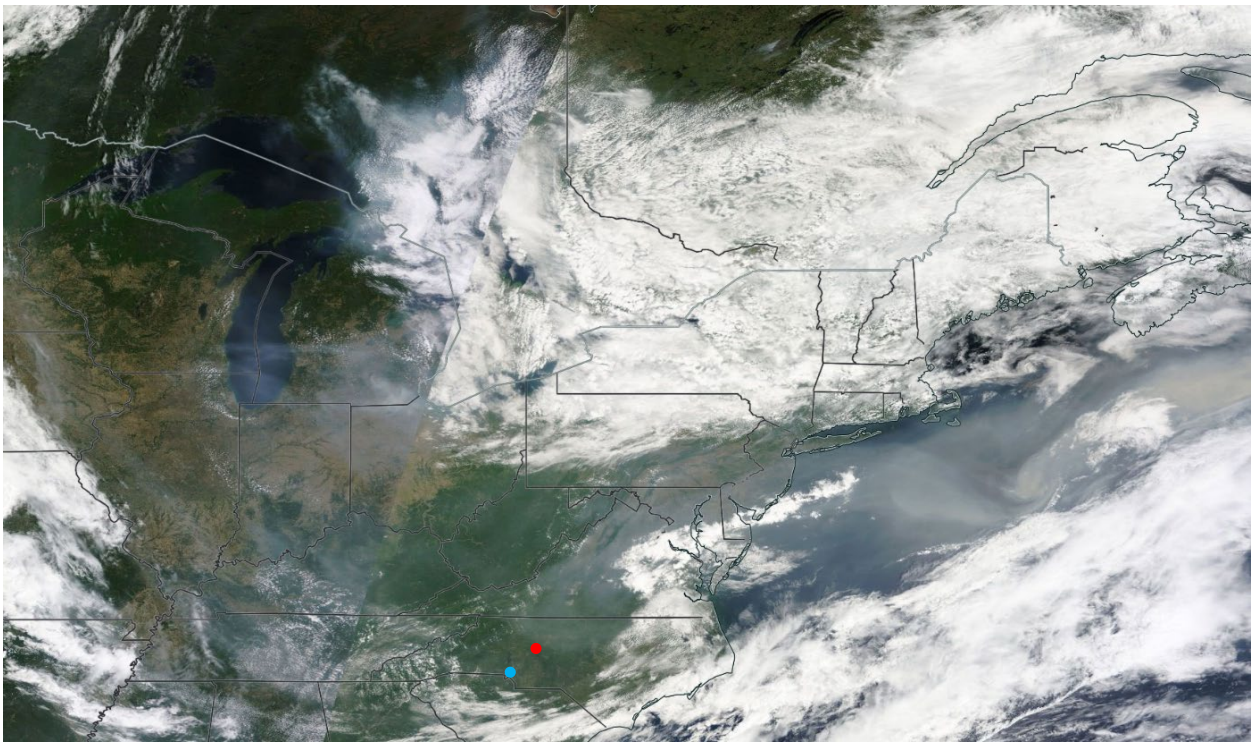


***Figure 31**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 8th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

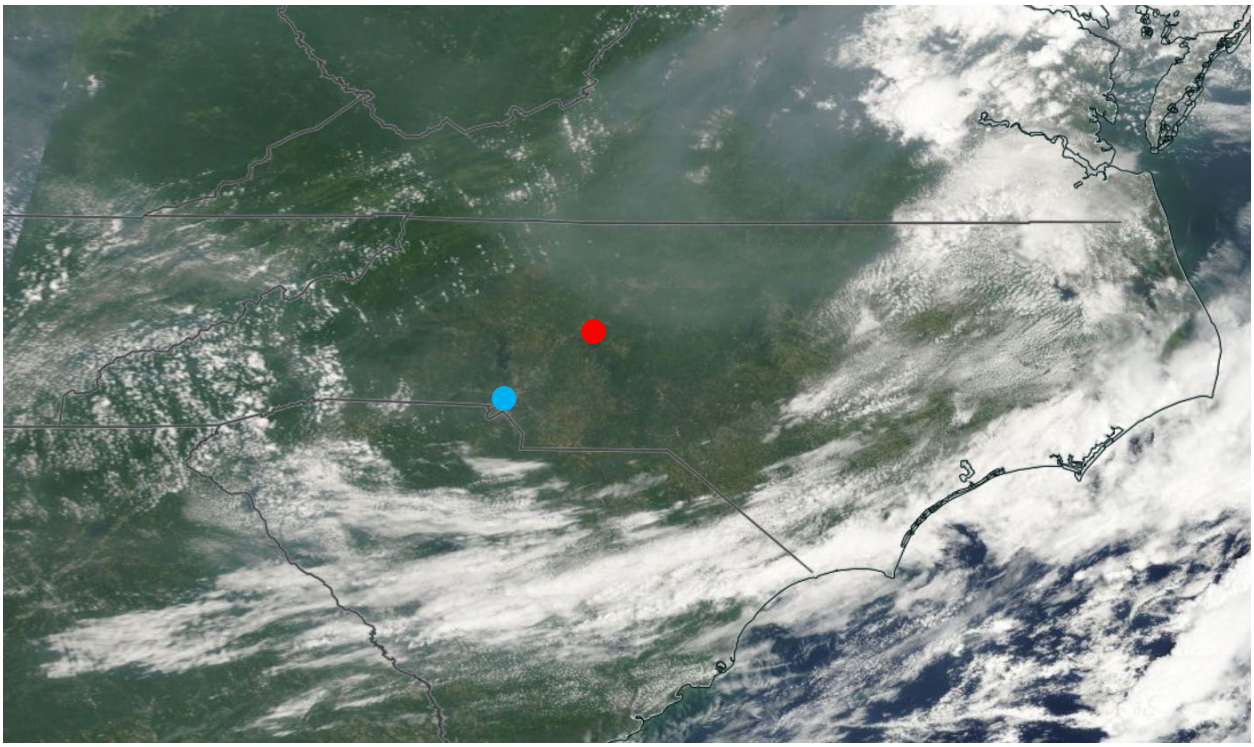


***Figure 32**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 8th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

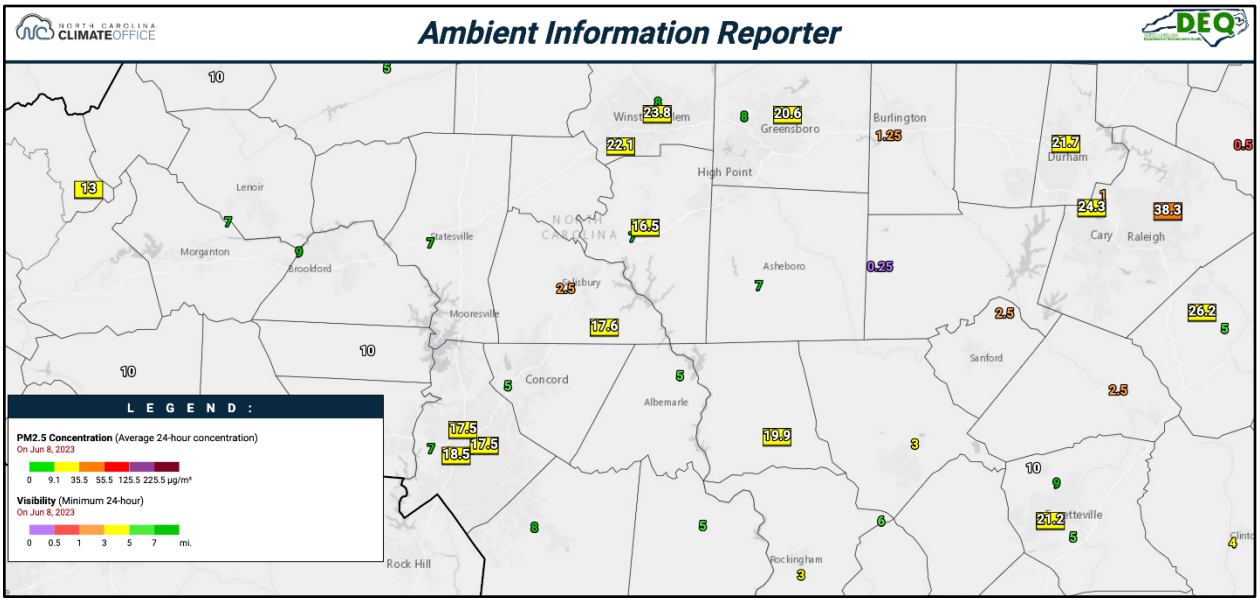


***Figure 33**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 8th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

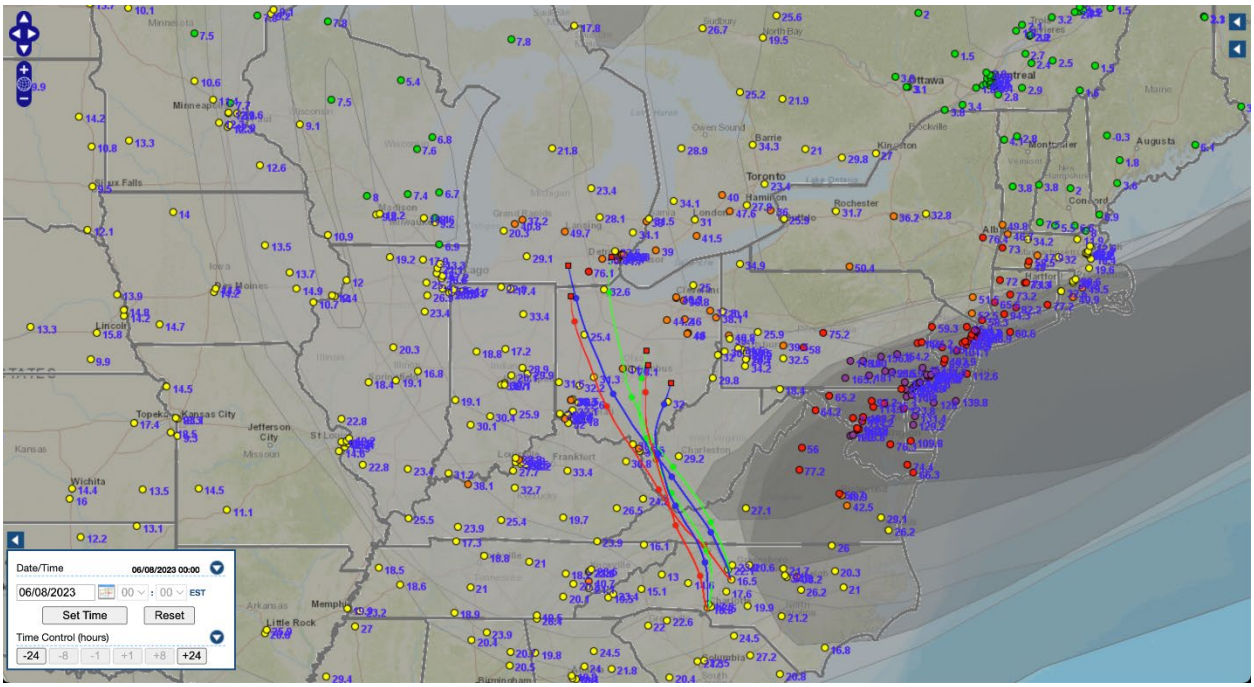


***Figure 34**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 8th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 9th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 8th, 2023**.*

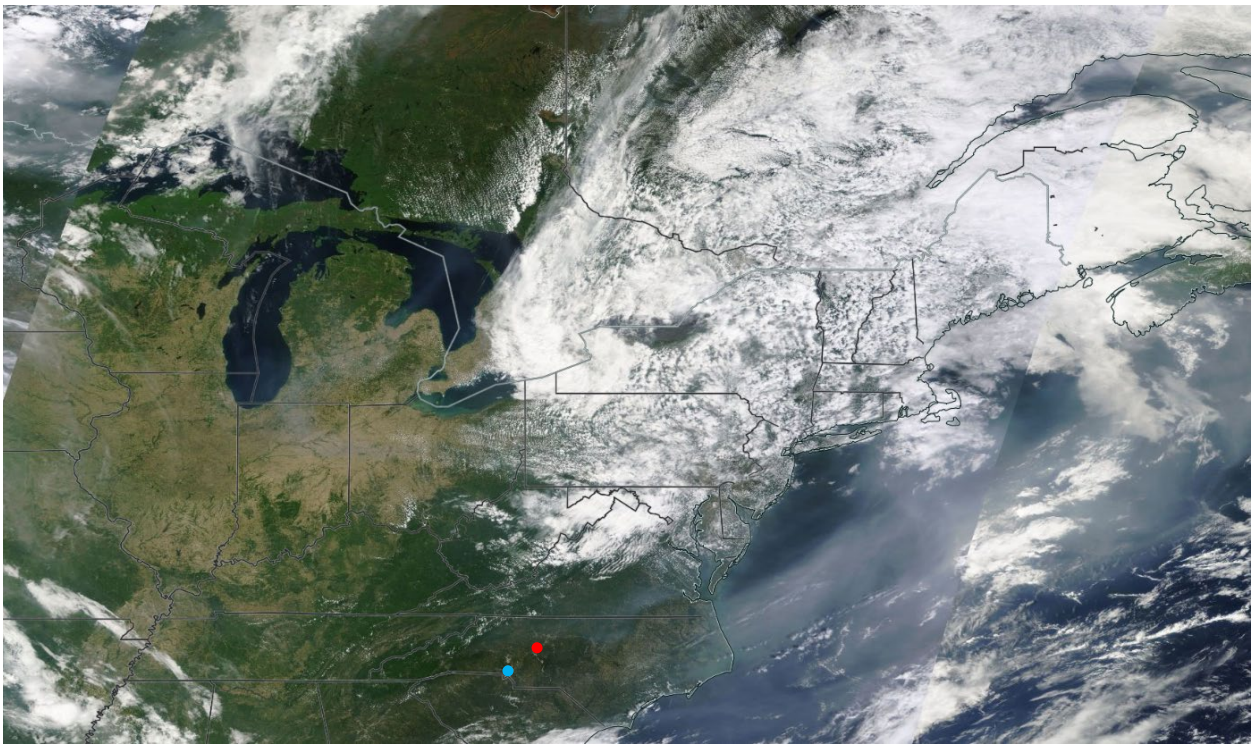


***Figure 35**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 9th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

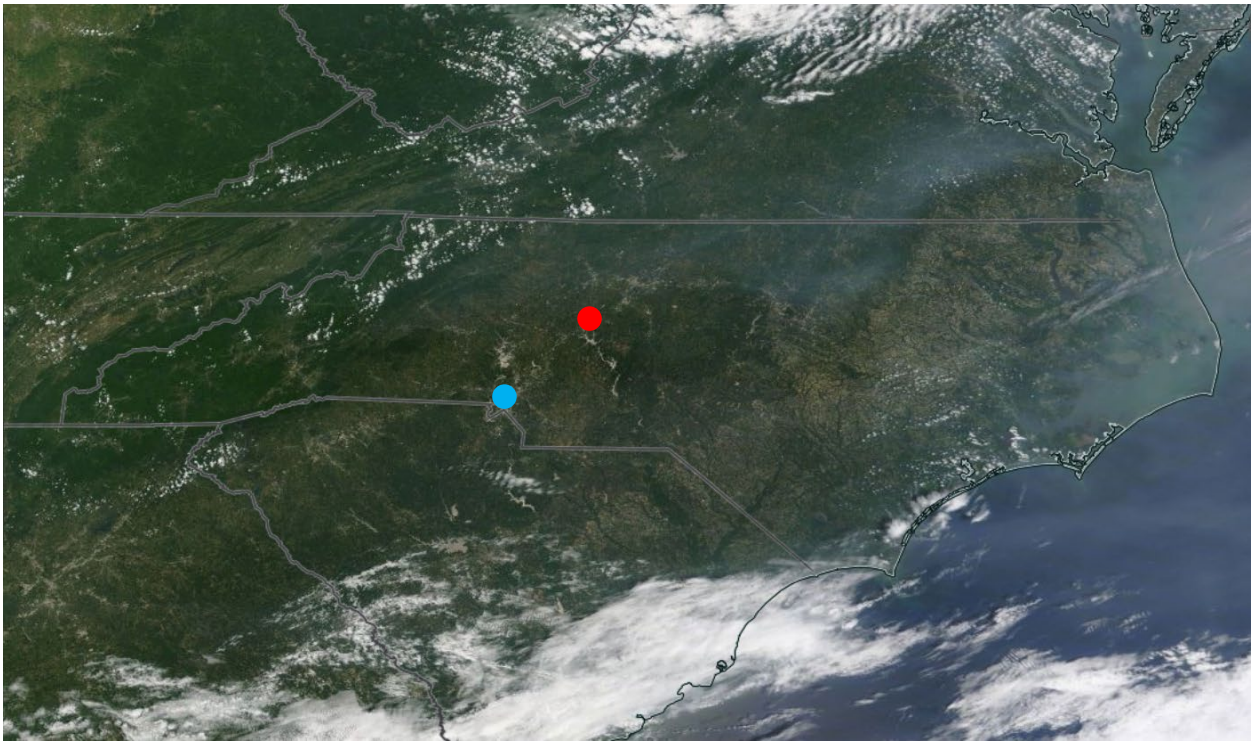


***Figure 36**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 9th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

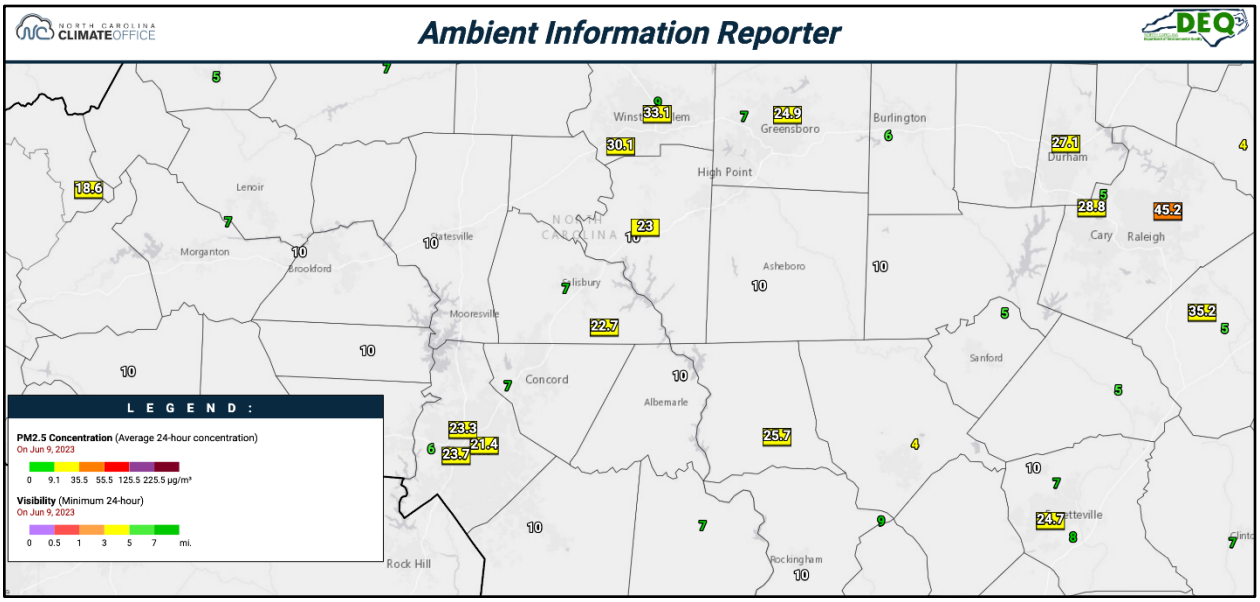


***Figure 37**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 9th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

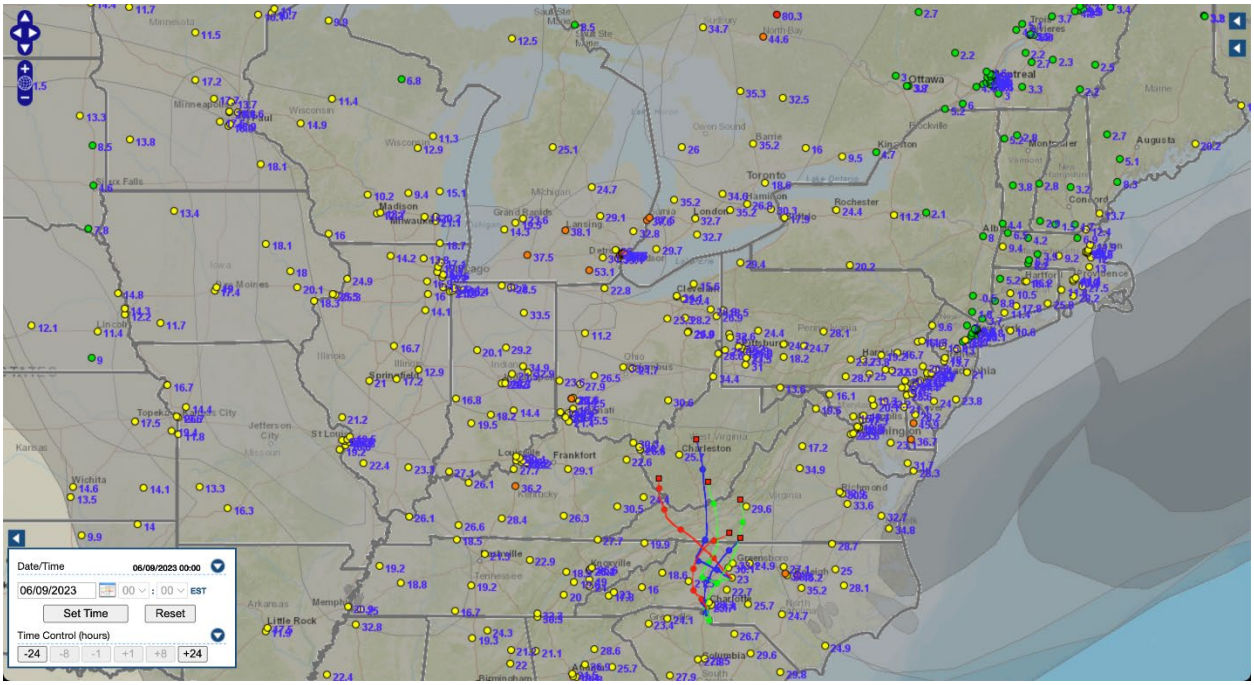


***Figure 38**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 9th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 10th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 9th, 2023**.*

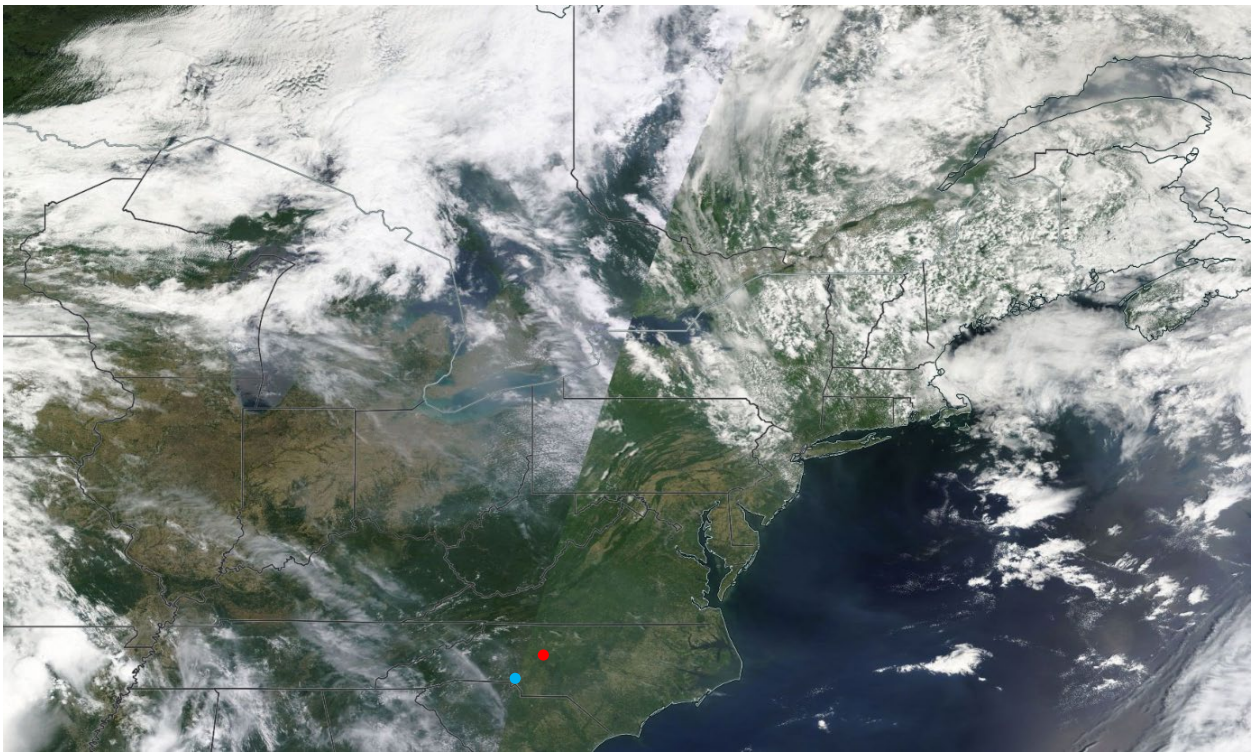


***Figure 39**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 10th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

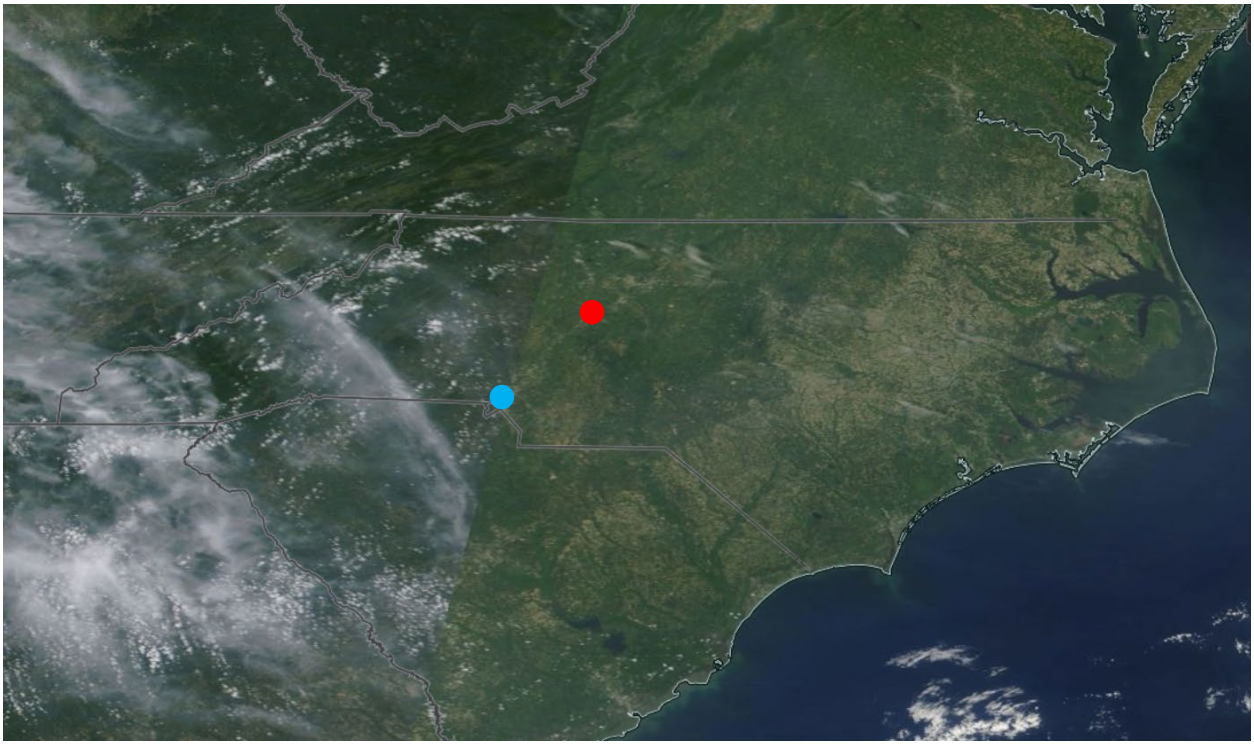


***Figure 40**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 10th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

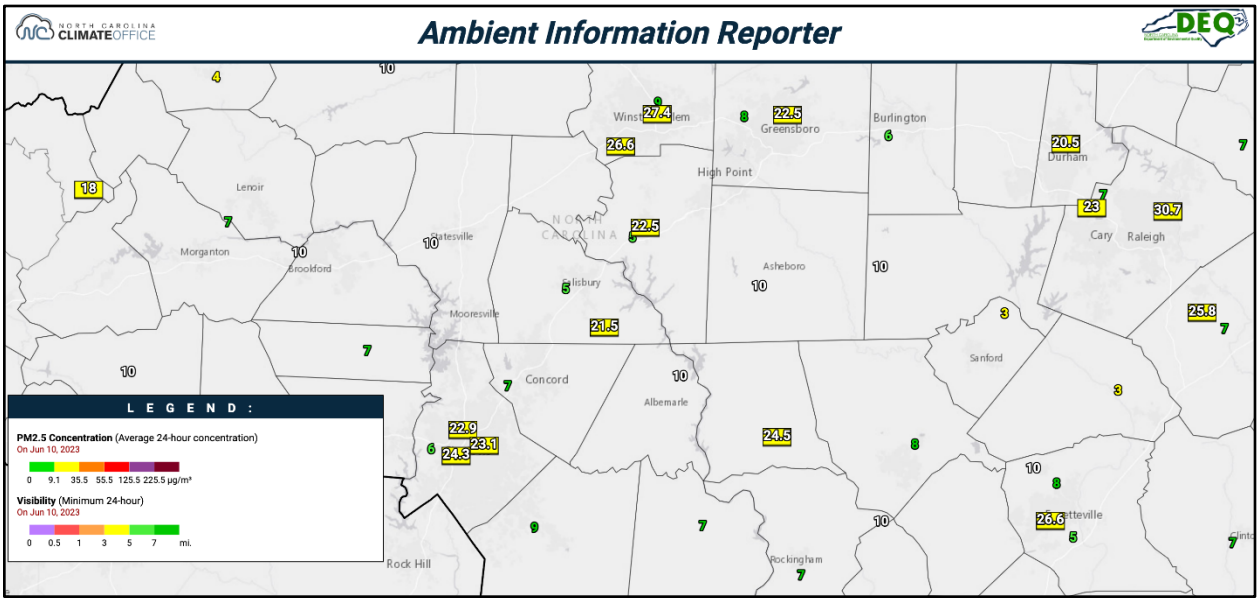


***Figure 41**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 10th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

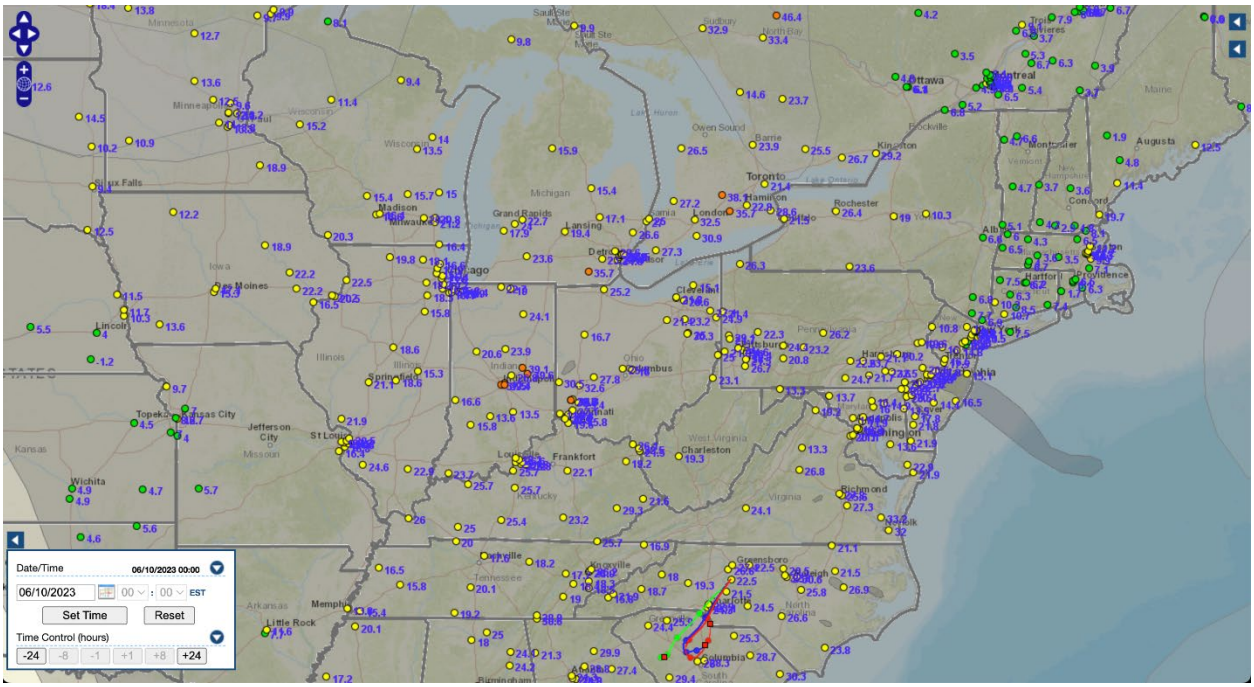


***Figure 42**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 10th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 11th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 10th, 2023**.*

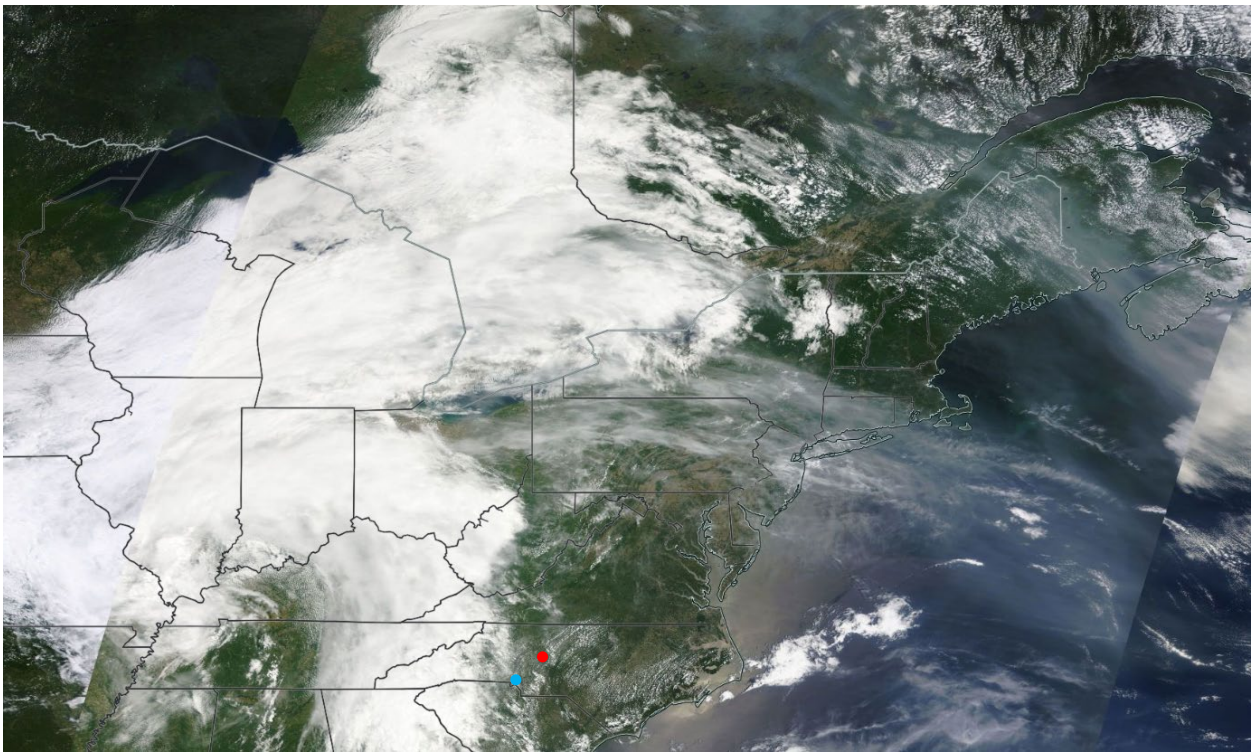


***Figure 43**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 11th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

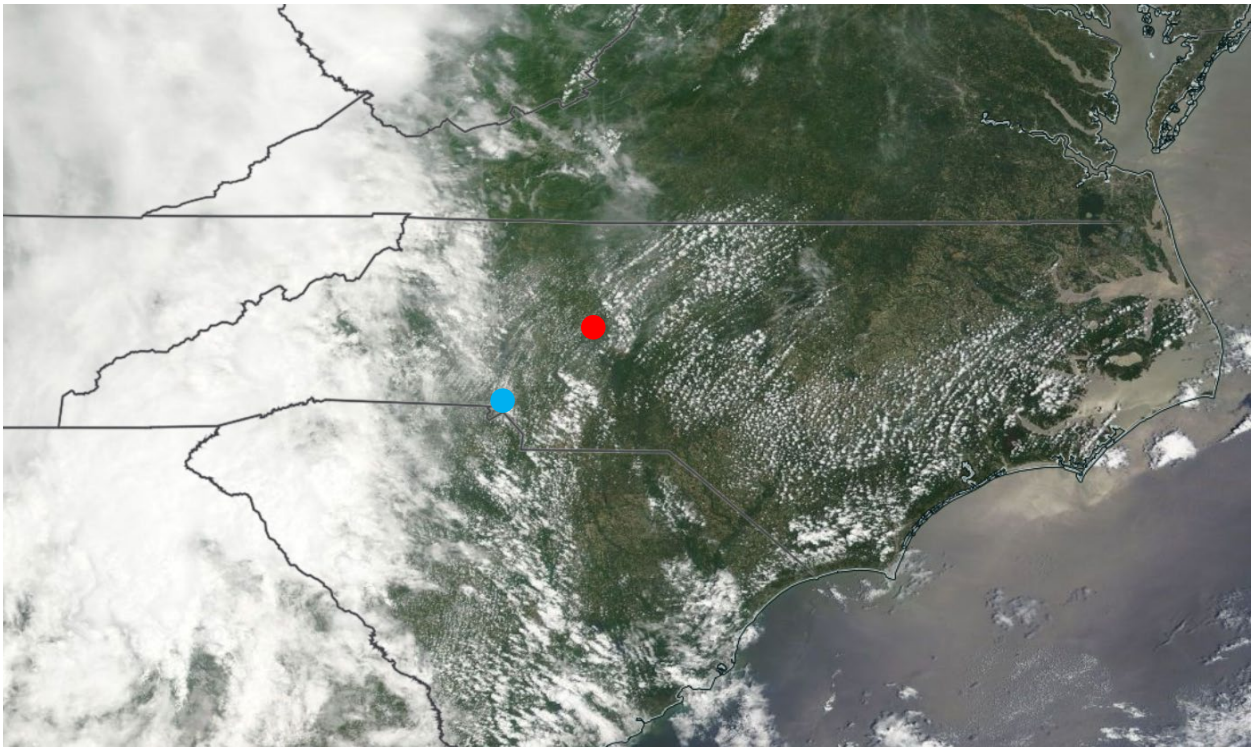


***Figure 44**: Visible satellite imagery showing smoke over the Mid-Atlantic, including NC, on June 11th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

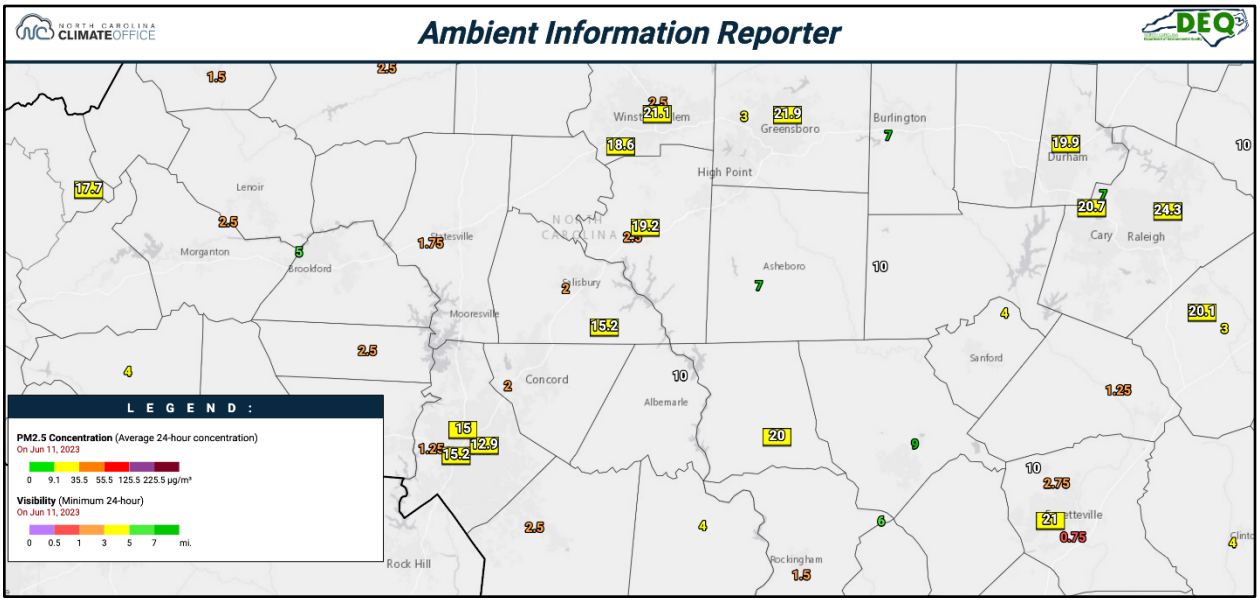


***Figure 45**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 11th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

3.1.2 Event ID #2 - June 17th through June 18th, 2023

The second event occurred in mid-June and led to one day of 24-hour $PM_{2.5}$ averages that were classified as Tier 2 level at the Remount monitor and one day that was classified as Tier 1 level. For

the Lexington monitor, both days were classified as Tier 2. This is shown in **Table 4** below.

***Table 4**: Regulatorily Significant 24-Hour Average $PM_{2.5}$ Concentrations Requested for Exclusion for Event #2.*

		Remount (AQS ID# 371190045) (Mecklenburg County)					Lexington (AQS ID# 370570002) (Davidson County)				
Event ID	**Date**	**24-hr $PM_{2.5}$ Average ($\mu g/m^3$)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold ($\mu g/m^3$)****		**24-hr $PM_{2.5}$ Average ($\mu g/m^3$)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold ($\mu g/m^3$)****	
2	6/17/2023	25.1	8.8	185.9 %	Tier 1	24.45	18.9	8.7	117.9 %	Tier 2	16.9
	6/18/2023	23.7	8.4	181.5 %	Tier 2	16.3	21.9	8.7	153.2 %	Tier 2	16.9

** The historical average is defined as the daily average $PM_{2.5}$ concentration over the previous 5-year period (2018-2022) on the given date (i.e., the past 5 June 6ths, the past 5 June 7ths, etc.).*

*** The EPA Tier Level determines the level of evidence required to establish a clear causal relationship in a wildland fire $PM_{2.5}$ exceptional events demonstration and was determined using EPA's Tiering Tool output as displayed in Appendix K: Monitoring Sites' Tiering Graphs. The threshold listed represents the minimum daily average concentration ($\mu g/m^3$) needed to meet the Tier level listed for that specific monitor and month.*

This second event was the result of another intrusion of Canadian wildfire smoke into North Carolina. The synoptic meteorological pattern associated with this transport event was mechanically equivalent to the first one – a strong upper-level low (**Figure 46**) and attendant surface low pressure system translated eastward into the northeastern U.S., resulting in north-northwesterly upper-level winds. Meanwhile at the surface, a cold front swept across the state and once again resulted in the transport of smoke both aloft and at the surface that led to anomalous $PM_{2.5}$ concentrations across the state, including at the Remount and Lexington monitoring sites.

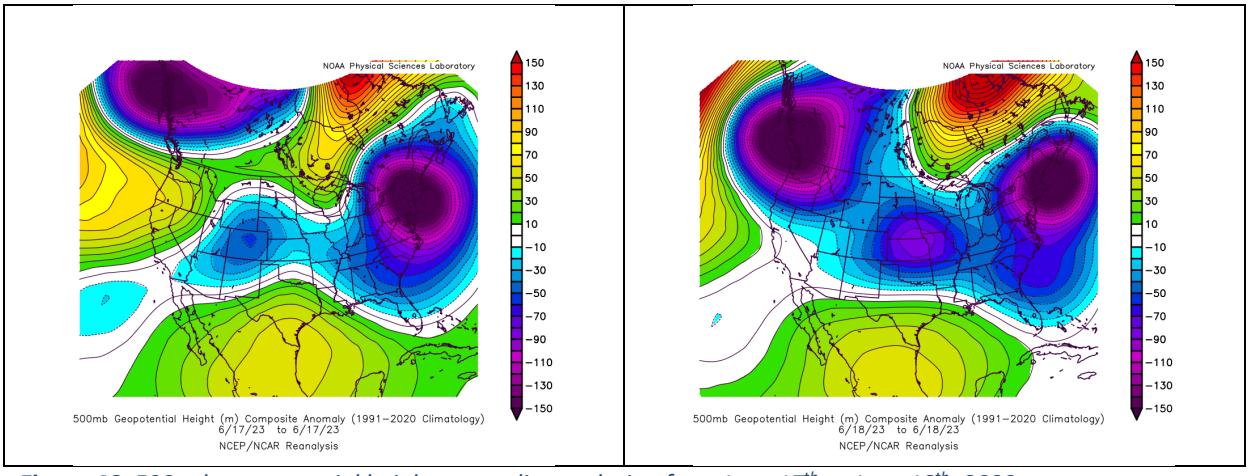


***Figure 46**: 500 mb geopotential height anomalies evolution from June 17th to June 18th, 2023.*

Smoke aloft was visible on satellite imagery over the Ohio Valley on June 15th and 16th, 2023 as seen in **Figure 47** and **Figure 48**. By June 17th, as the upper-level low rotated eastward, 500 mb winds over

the eastern U.S. backed to northwesterly[31], providing a path for the smoke to be blown southeastward.

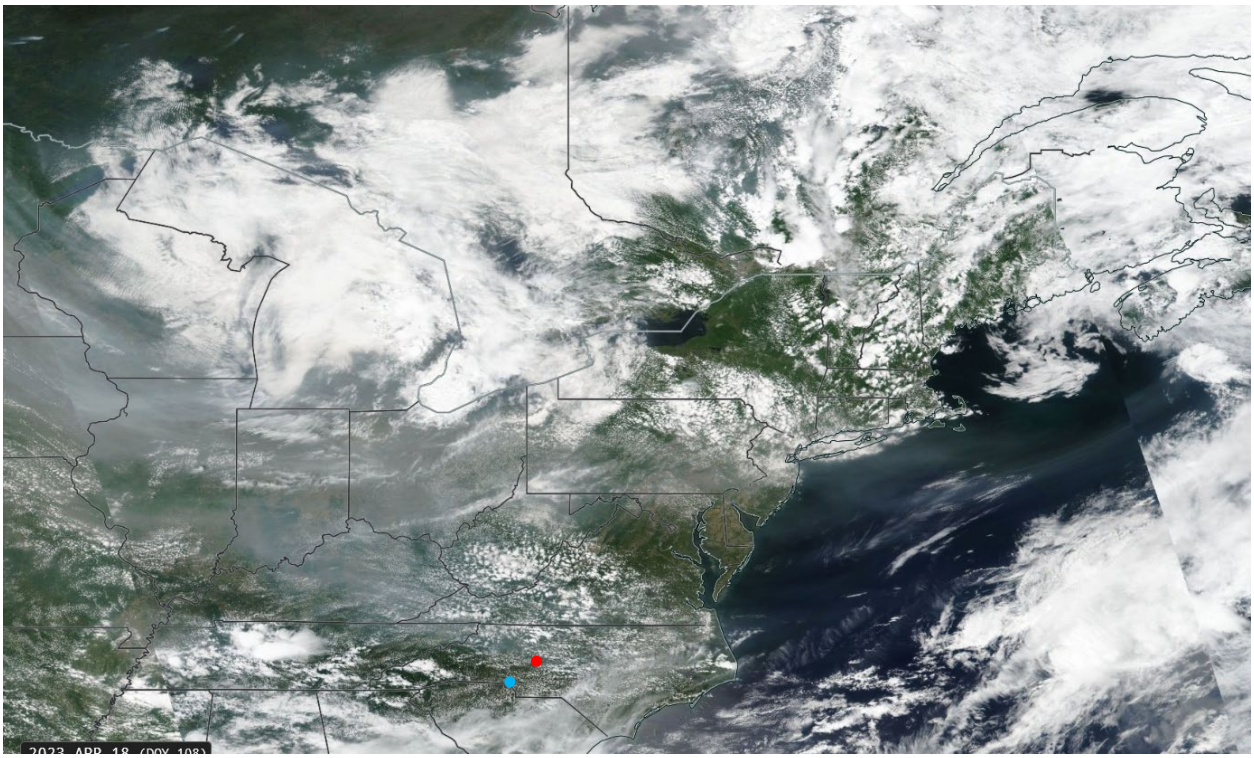


***Figure 47**: Visible satellite imagery showing smoke across the Ohio Valley on June 15th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

[31] NOAA/NWS/Storm Prediction Center, Mesoscale Analysis Archive, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=06&STARTDAY=16&STARTTIME=00&INC=48

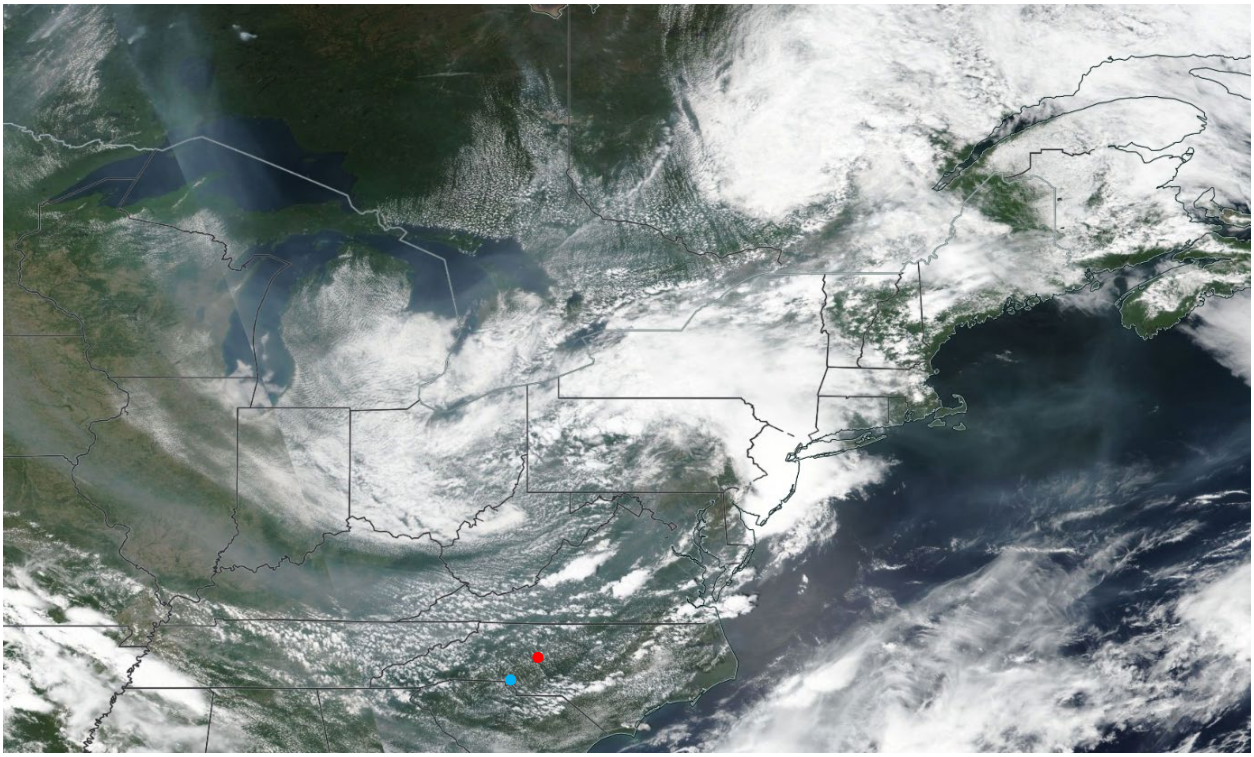


***Figure 48**: Visible satellite imagery showing smoke over the lower Ohio Valley on June 16th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

HYSPLIT back trajectories again reveal that the smokey air mass seen on visible satellite imagery in the preceding days moved into the state from the north and northwest. In **Figure 49**, the 24-hour back trajectories, ran from June 17th at both the Remount and Lexington monitors, originated in an air mass containing significantly elevated $PM_{2.5}$ levels on June 16th over much of the Upper Midwest and Ohio Valley. Once again, the polluted air mass aloft moved into the state along the path of the back trajectories but this time with significant surface-level transport heralding the onset of the event.

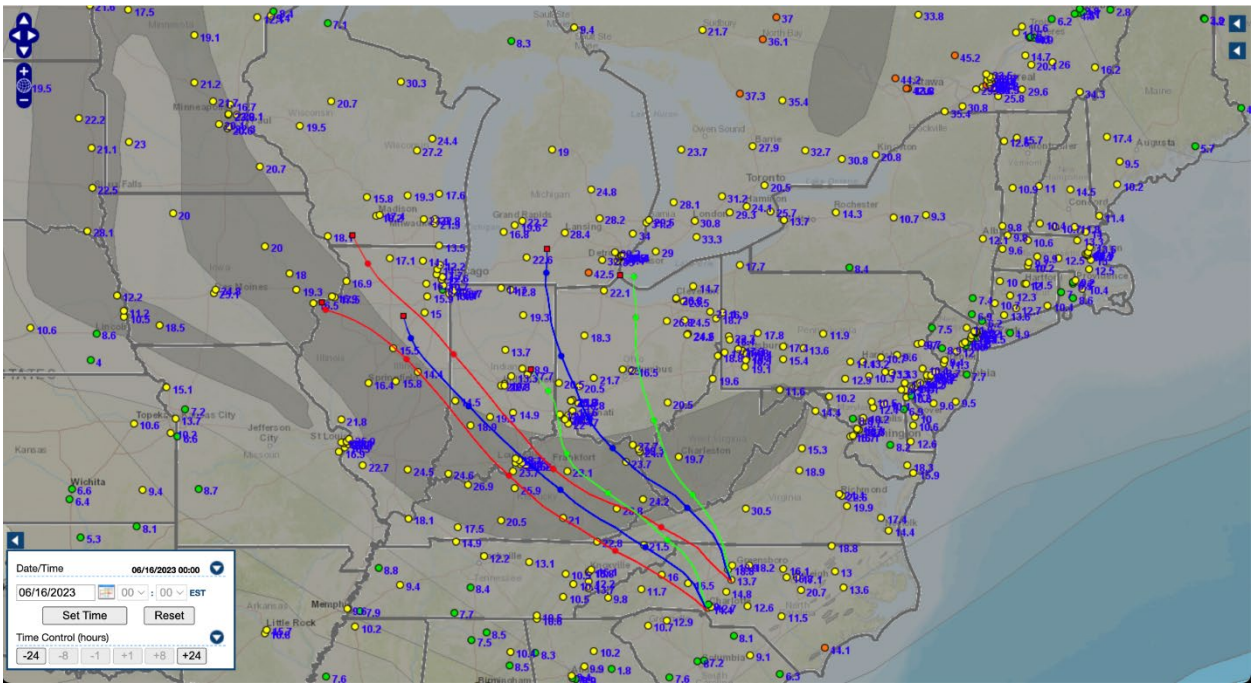


***Figure 49**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 16th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 17th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 16th, 2023**.*

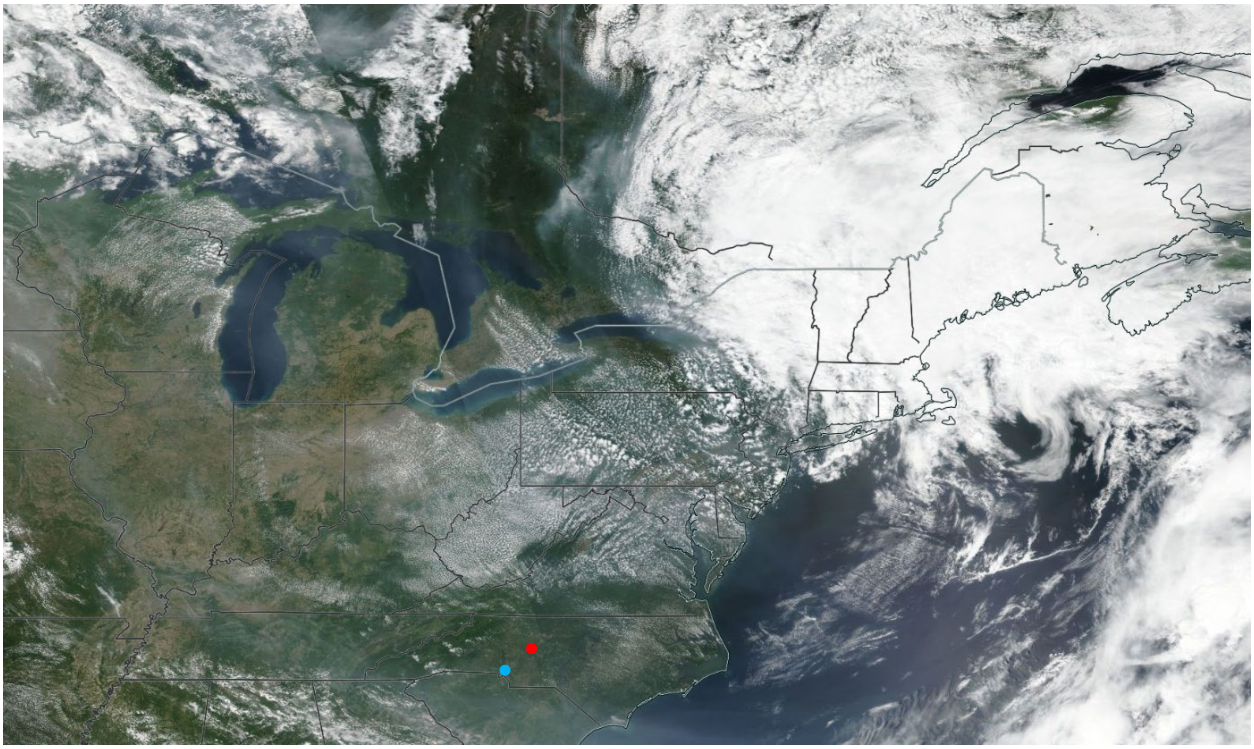


***Figure 50**: Visible satellite imagery showing smoke over the southeastern U.S. on June 17th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

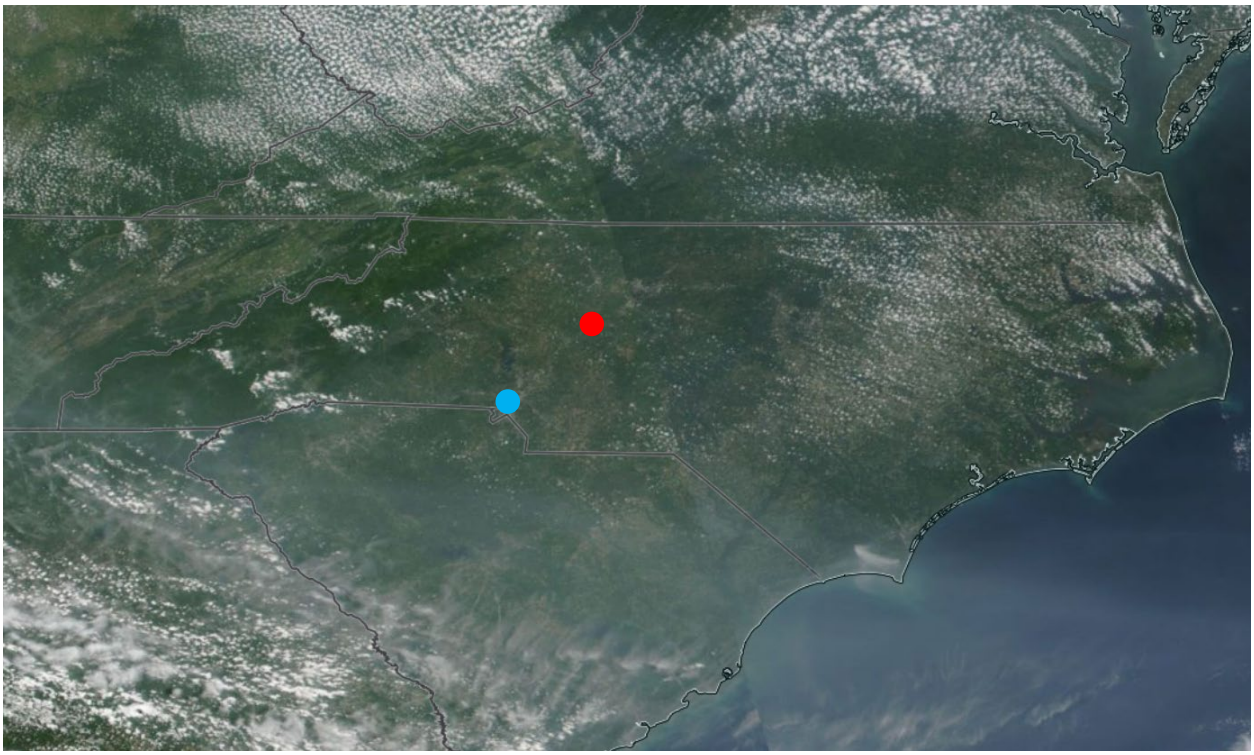


***Figure 51**: Visible satellite imagery showing smoke over the southeastern U.S., including NC, on June 17th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

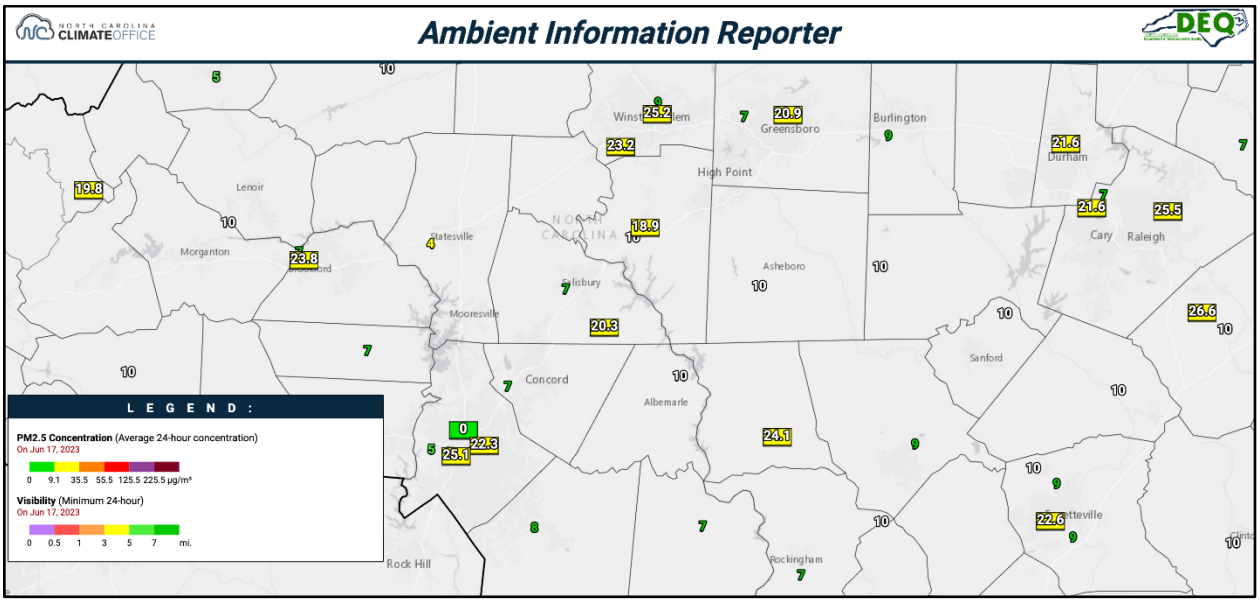


***Figure 52**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 17th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

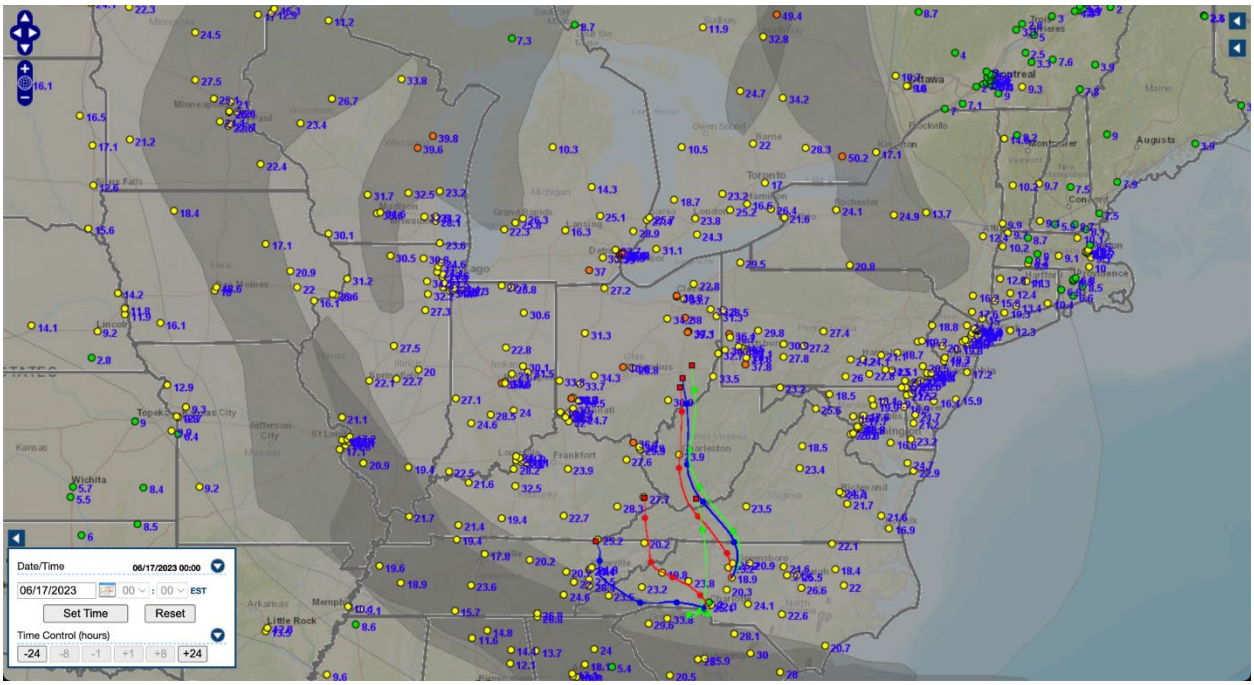


***Figure 53**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 17th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 18th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 17th, 2023**.*

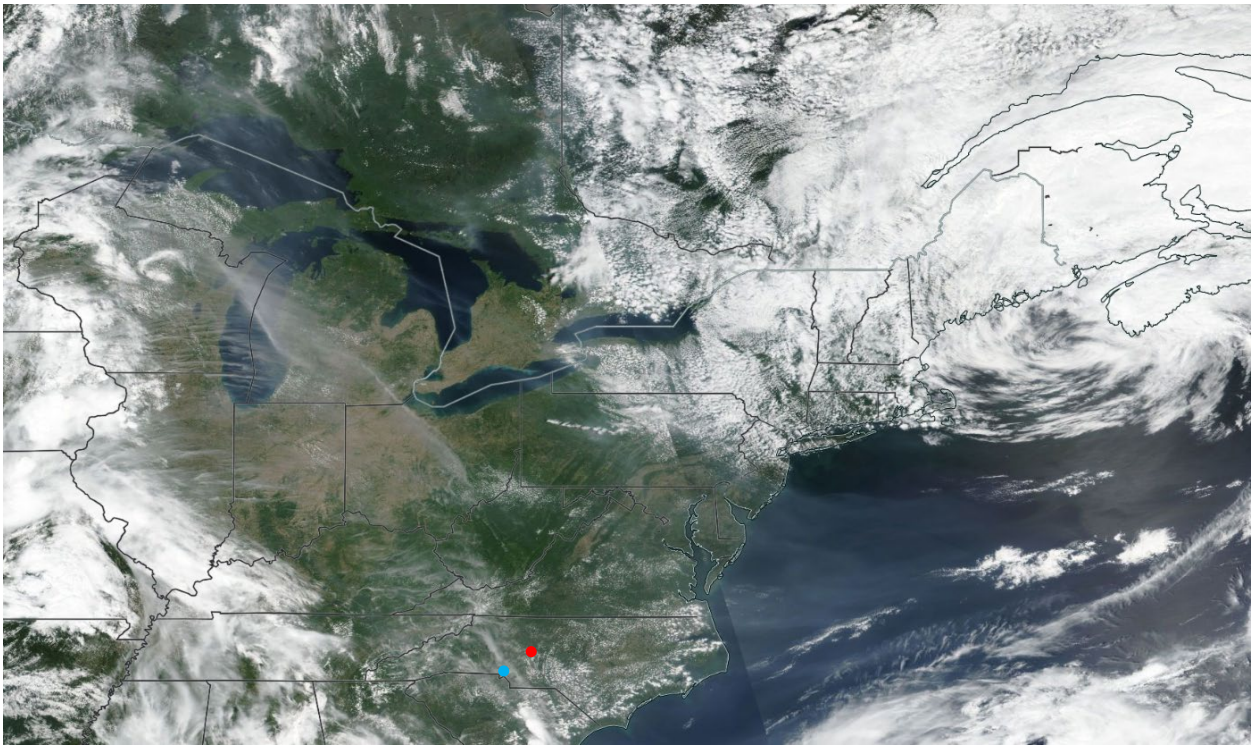


***Figure 54**: Visible satellite imagery showing patchy smoke over much of the eastern U.S. on June 18th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

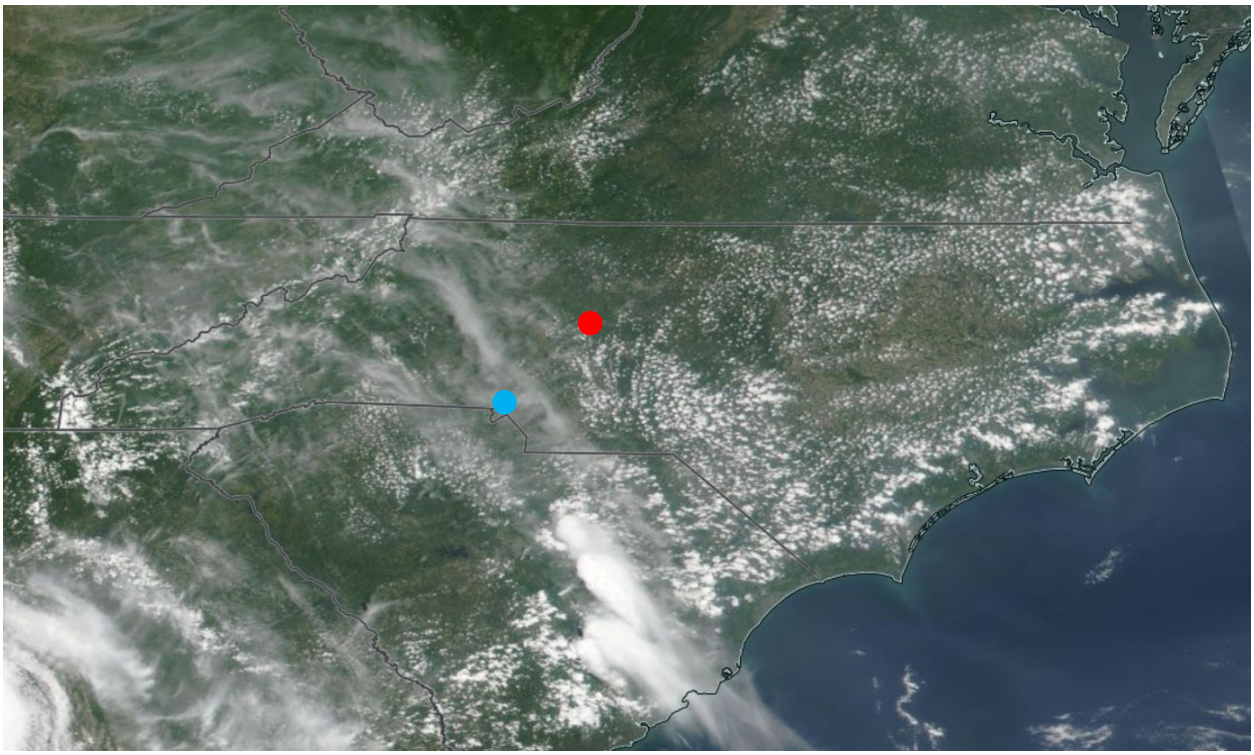


***Figure 55**: Visible satellite imagery showing patchy smoke over the southeastern U.S., including NC, on June 18th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

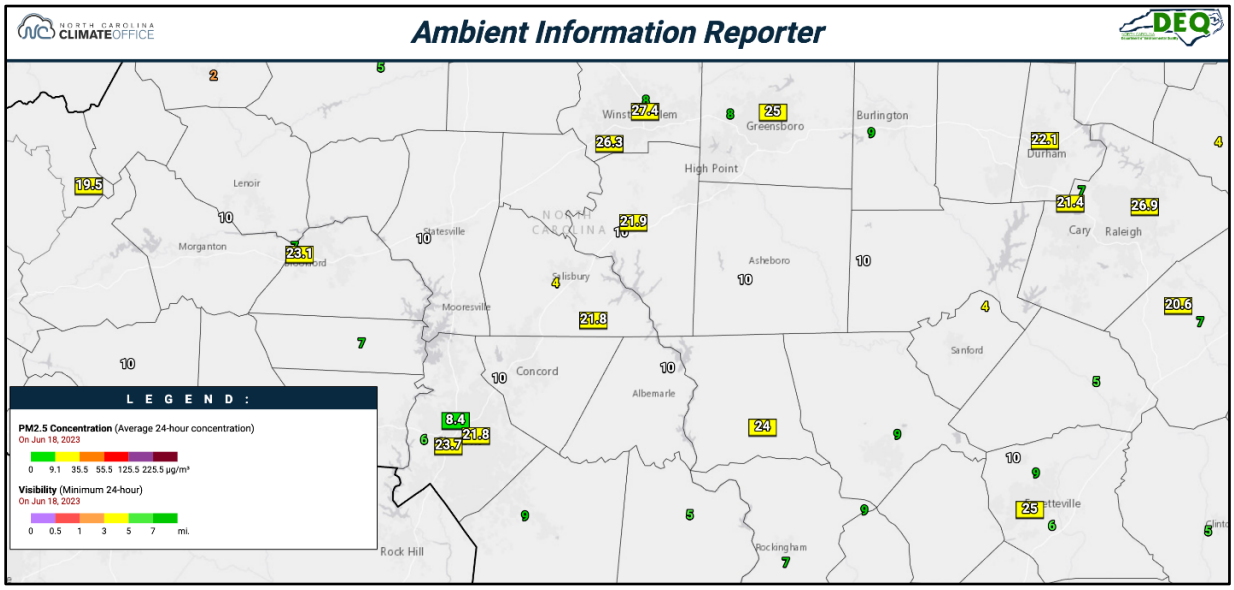


***Figure 56**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 18th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

In this event, the onset of significantly elevated $PM_{2.5}$ measurements at North Carolina monitoring sites directly coincided with the passage of a surface cold front across the state, which occurred during the evening of June 16th. Hourly $PM_{2.5}$ concentrations at both the Remount and Lexington

monitors began rising after 6:00 pm EDT on June 16th, as seen in **Figure 57** and **Figure 58.**

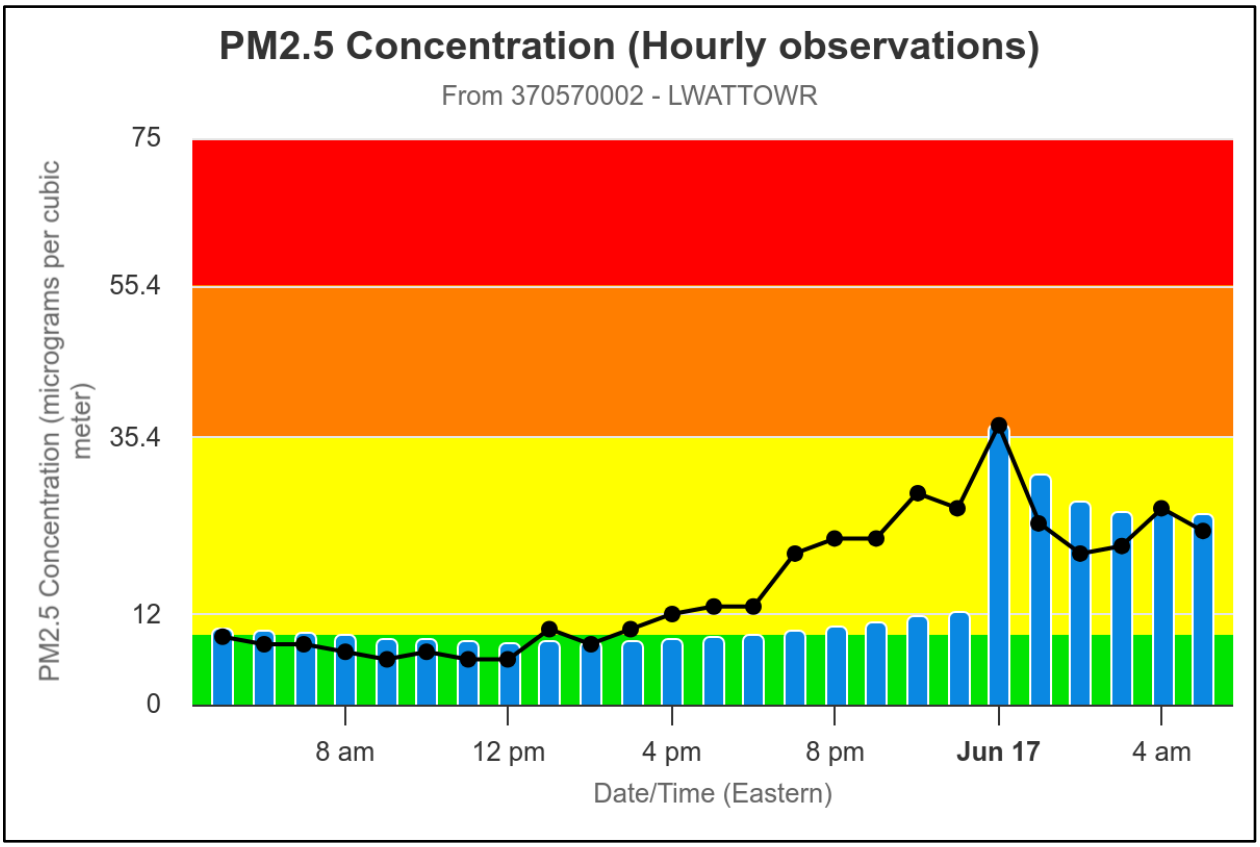


***Figure 57**: Hourly $PM_{2.5}$ observations (black line and dots) valid June 16th into June 17th, 2023 at the Lexington Water Tower monitor. The blue bars represent the rolling daily average of hourly $PM_{2.5}$ observations up to and including the specific hour. The y-axis numerical labels and chart shading are the 24-hour average concentration breakpoints and color categories associated with the Air Quality Index (AQI).*

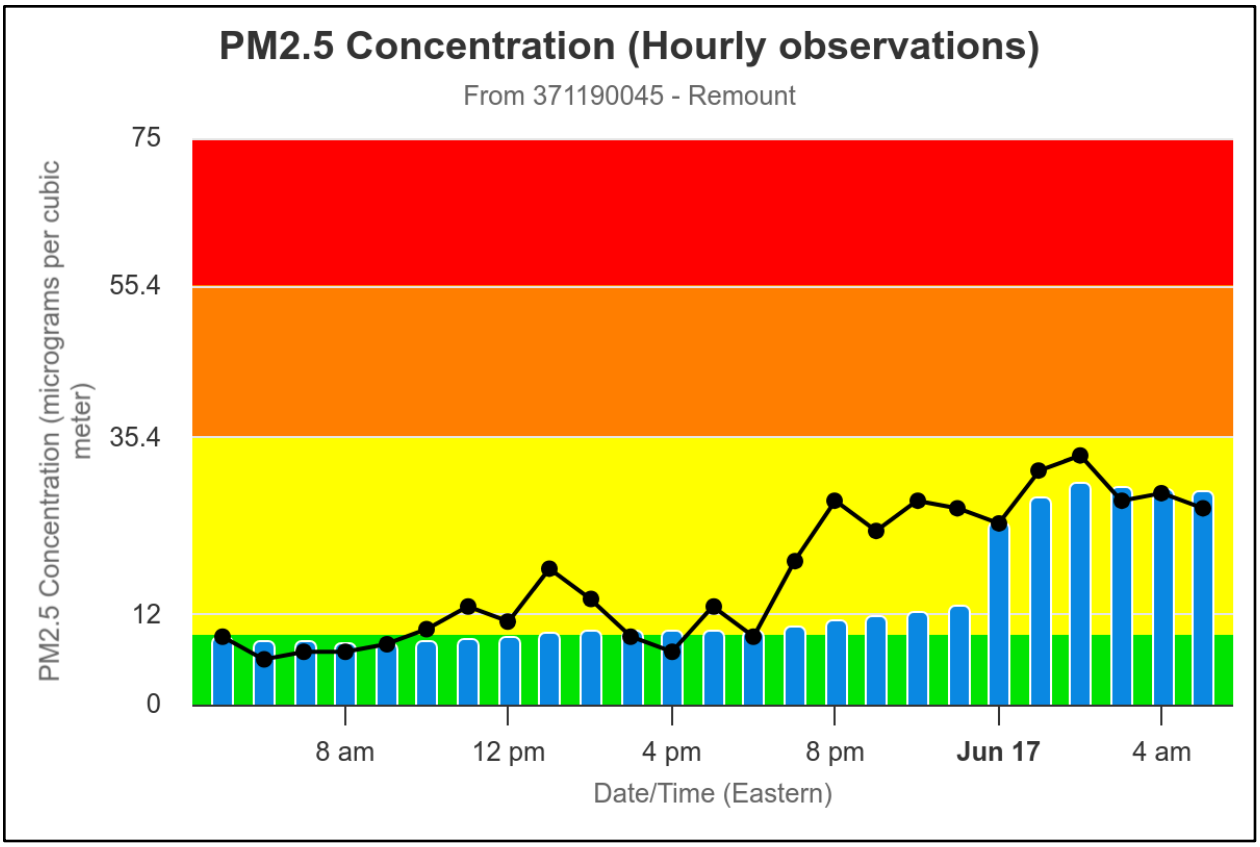


***Figure 58**: Hourly $PM_{2.5}$ observations (black line and dots) valid June 16th into June 17th, 2023 at the Remount Road monitor. The blue bars represent the rolling daily average of hourly $PM_{2.5}$ observations up to and including the specific hour. The y-axis numerical labels and chart shading are the 24-hour average concentration breakpoints and color categories associated with the Air Quality Index (AQI).*

Ahead of the surface cold front, analyzed by WPC at 5:00 pm EDT on June 16th to be located near the northwestern NC / southwestern VA border (**Figure 59**), $PM_{2.5}$ concentrations across the western NC Piedmont were in the 13 to 18 µg/m^3 range (**Figure 60**).

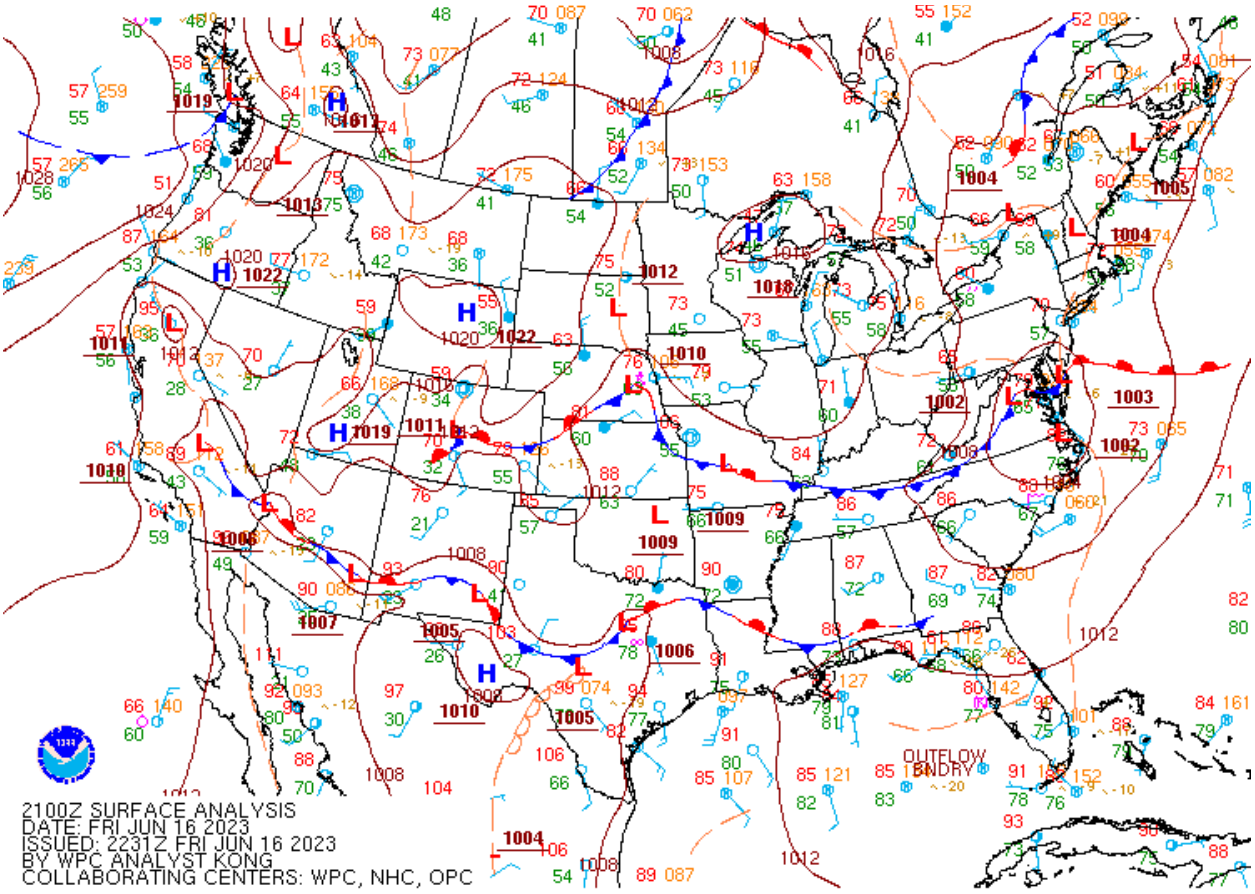


***Figure 59**: WPC surface analysis for June 16th, 2023 at 5:00 pm EDT.*

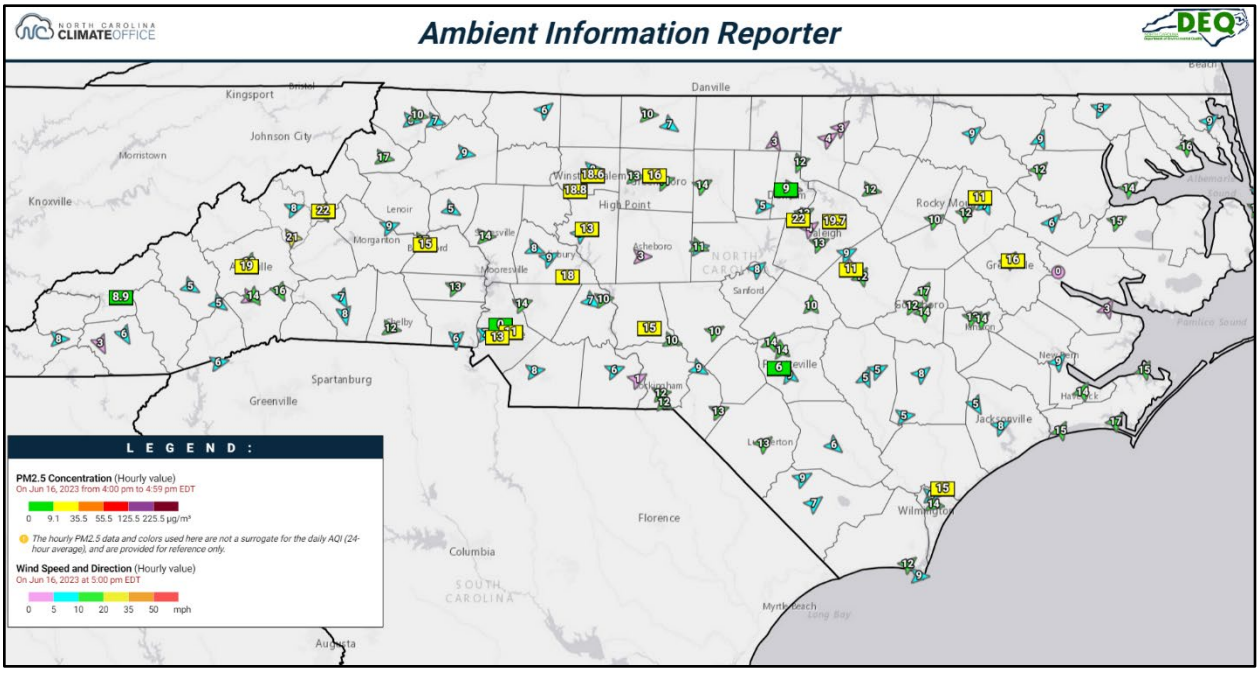


***Figure 60**: Hourly $PM_{2.5}$ concentrations, wind speed and direction observations at 5:00 pm EDT on June 16th, 2023.*

Immediately after the front had crossed the state during the late evening of June 16th, as seen in **Figure 61** showing the WPC 11:00 pm EDT analysis, hourly $PM_{2.5}$ concentrations across the western NC Piedmont rapidly rose into the 26 to 37 µg/m^3 range. This leaves little doubt that the onset of the second event was clearly and directly caused by the advection of a polluted air mass into the region behind the surface frontal passage.

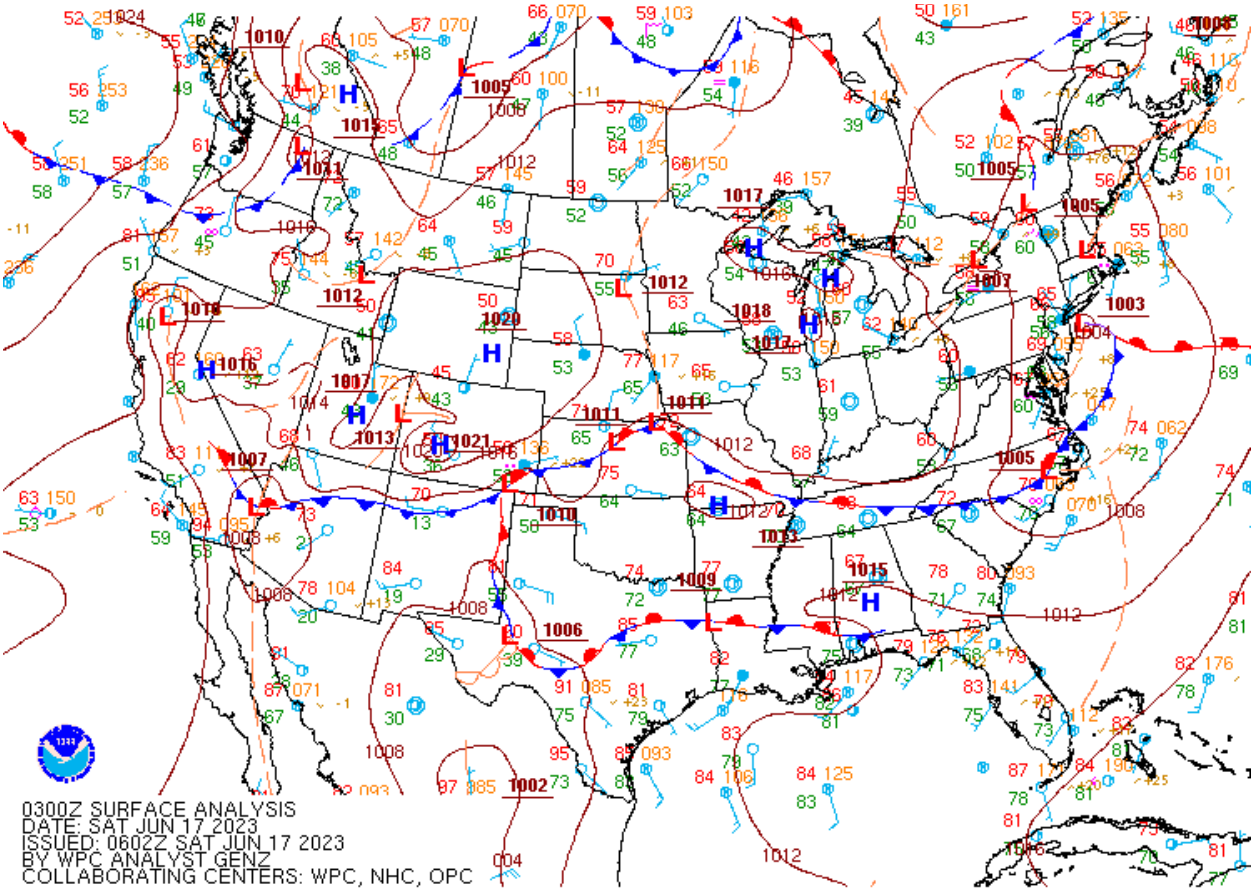


***Figure 61**: WPC surface analysis for June 16th, 2023 at 11:00 pm EDT (June 17th - 0003Z).*

Additional Tier 2-level evidence of surface-level smoke and associated impacts on June 17th through June 18th were directly reported this time in the Charlotte/Douglas International Airport (CLT) METARs as seen in appendix G and H, **Figure 136-G** and **Figure 139-H**. Numerous hours on both days contained sky condition reports of "HZ CLR" with visibility less than 7 statute miles, with dewpoints significantly lower than temperature (thus eliminating the possibility of fog). This was a clear indication of surface haze, and with the proof already provided earlier, it is clear this was from smoke. To further support this, we have also included the National Weather Service - Greenville Spartanburg's aviation forecast discussion from the evening of June 17th, where they explicitly mention that Canadian wildfire smoke has circulated into the forecast area, as seen in Appendix G, **Figure 135-G**. Finally, both the HRRR Smoke and the NAAPS aerosol models analysis (00 hr initialization) at 8:00 am on June 17th through June 18th analyzed surface smoke over North Carolina as seen in Appendix G and H: **Figure 137-G, Figure 138-G, Figure 140-H** and **Figure 141-H**.

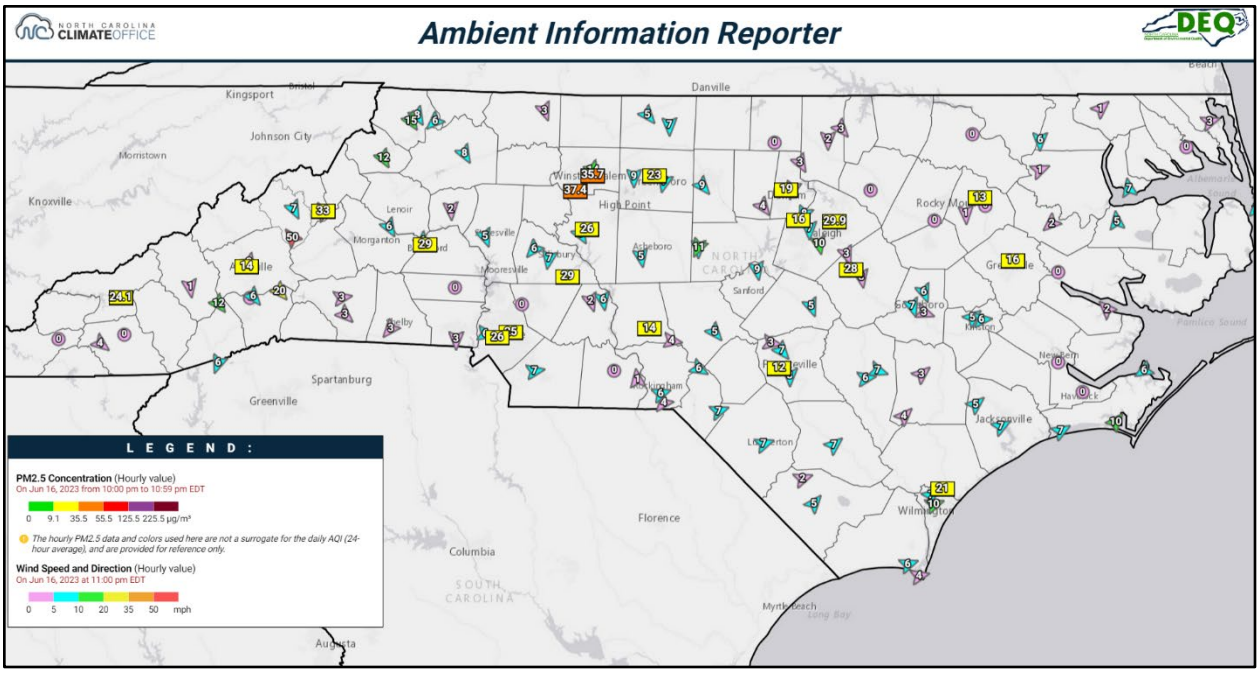


***Figure 62**: Hourly $PM_{2.5}$ concentrations, wind speed and direction observations at 11:00 pm EDT on June 16th, 2023.*

3.1.3 Event ID #3 - June 28th through July 1st, 2023

The third event occurred at the end of June and into the beginning of July and led to two days of 24-hour $PM_{2.5}$ averages that were classified as Tier 2 level at both the Remount and Lexington monitors and two days that were classified as Tier 1 level at each monitor. This is shown in **Table 5** below.

***Table 5**: Regulatorily Significant 24-Hour Average $PM_{2.5}$ Concentrations Requested for Exclusion for Event #3.*

		Remount (AQS ID# 371190045) (Mecklenburg County)					Lexington (AQS ID# 370570002) (Davidson County)				
Event ID	**Date**	**24-hr $PM_{2.5}$ Average (µg/m³)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold (µg/m³)****		**24-hr $PM_{2.5}$ Average (µg/m³)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold (µg/m³)****	
3	6/28/2023	20.2	11.1	82.3 %	Tier 2	16.3	20.5	14.4	42.4 %	Tier 2	16.9
	6/29/2023	37.7	9.0	318.9 %	Tier 1	24.45	45.7	10.7	326.3 %	Tier 1	25.35
	6/30/2023	29.4	9.9	197.0 %	Tier 1	24.45	32	10.8	197.4 %	Tier 1	25.35
	7/1/2023	20.8	7.3	183.4 %	Tier 2	16.3	18	7.6	137.5 %	Tier 2	17.8

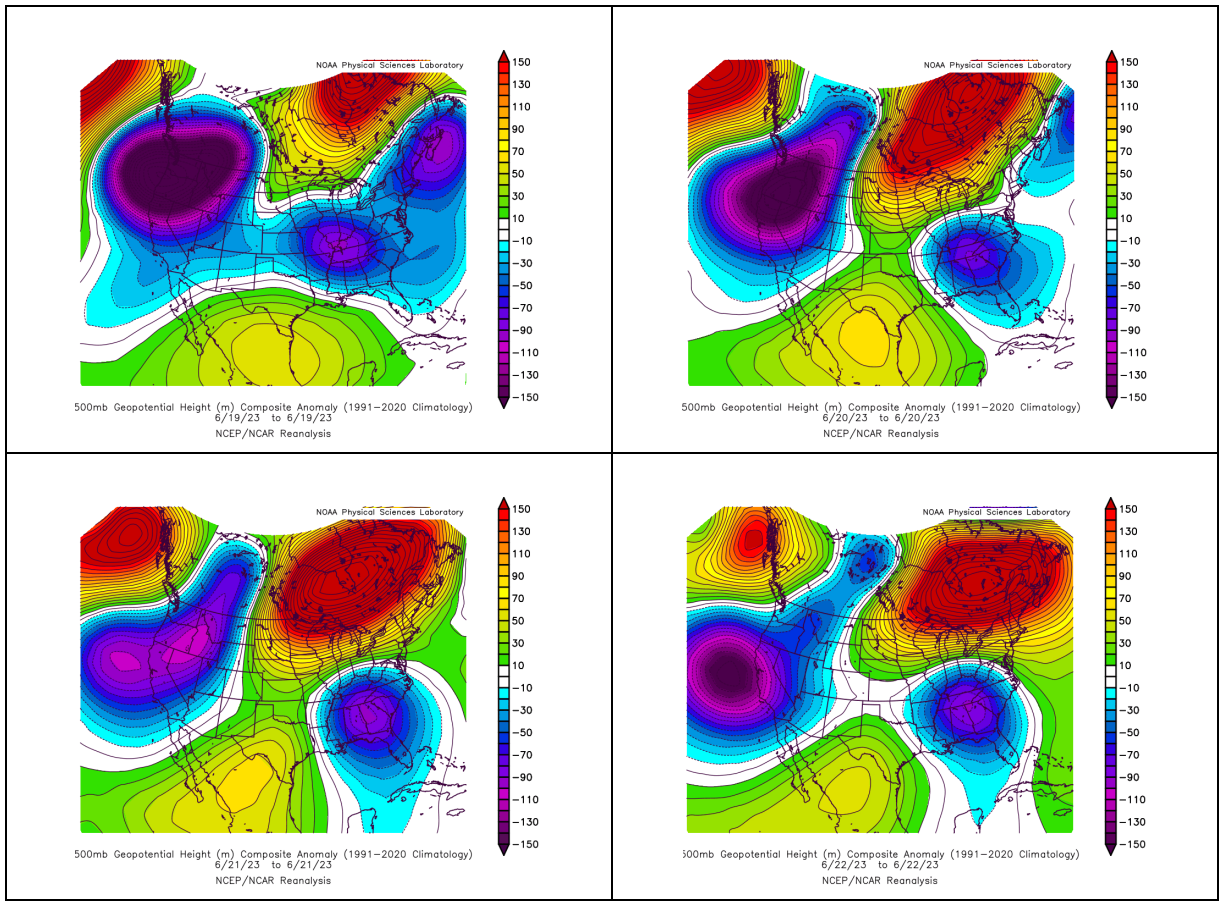
** The historical average is defined as the daily average $PM_{2.5}$ concentration over the previous 5-year period (2018-2022) on the given date (i.e., the past 5 June 6ths, the past 5 June 7ths, etc.).*

*** The EPA Tier Level determines the level of evidence required to establish a clear causal relationship in a wildland fire $PM_{2.5}$ exceptional events demonstration and was determined using EPA's Tiering Tool output as displayed in Appendix K: Monitoring Sites' Tiering Graphs. The threshold listed represents the minimum daily average concentration (µg/m³) needed to meet the Tier level listed for that specific monitor and month.*

This event was the result of another significant intrusion of Canadian wildfire smoke into North

Carolina which was driven by the anomalous atmospheric regime that dominated June and July 2023 across the eastern U.S. Preceding the onset of smoke transport into the state that started late in June, the period from June 19th through June 26th saw a strong Rex Block (strong high pressure located next to strong low pressure that creates a blocking pattern that can trap air masses, resulting in air mass stagnation) develop over southeastern Canada and the eastern U.S.

Strong, blocking high pressure exacerbated drought and wildfire conditions across Canada, while a trapped upper-level low underneath the upper-level high pressure held station over the eastern U.S., as seen in **Figure 63**. The anomalous blocking pattern allowed an intense area of smoke from the numerous ongoing wildfires to become trapped and continue to aggregate under the upper-level high over southeastern Canada through June 26th (**Figure 64**). The 7-day period from June 16th through June 26th set the stage for the transport of intense smoke and fine particulate matter into the eastern U.S., including North Carolina, at the end of June.



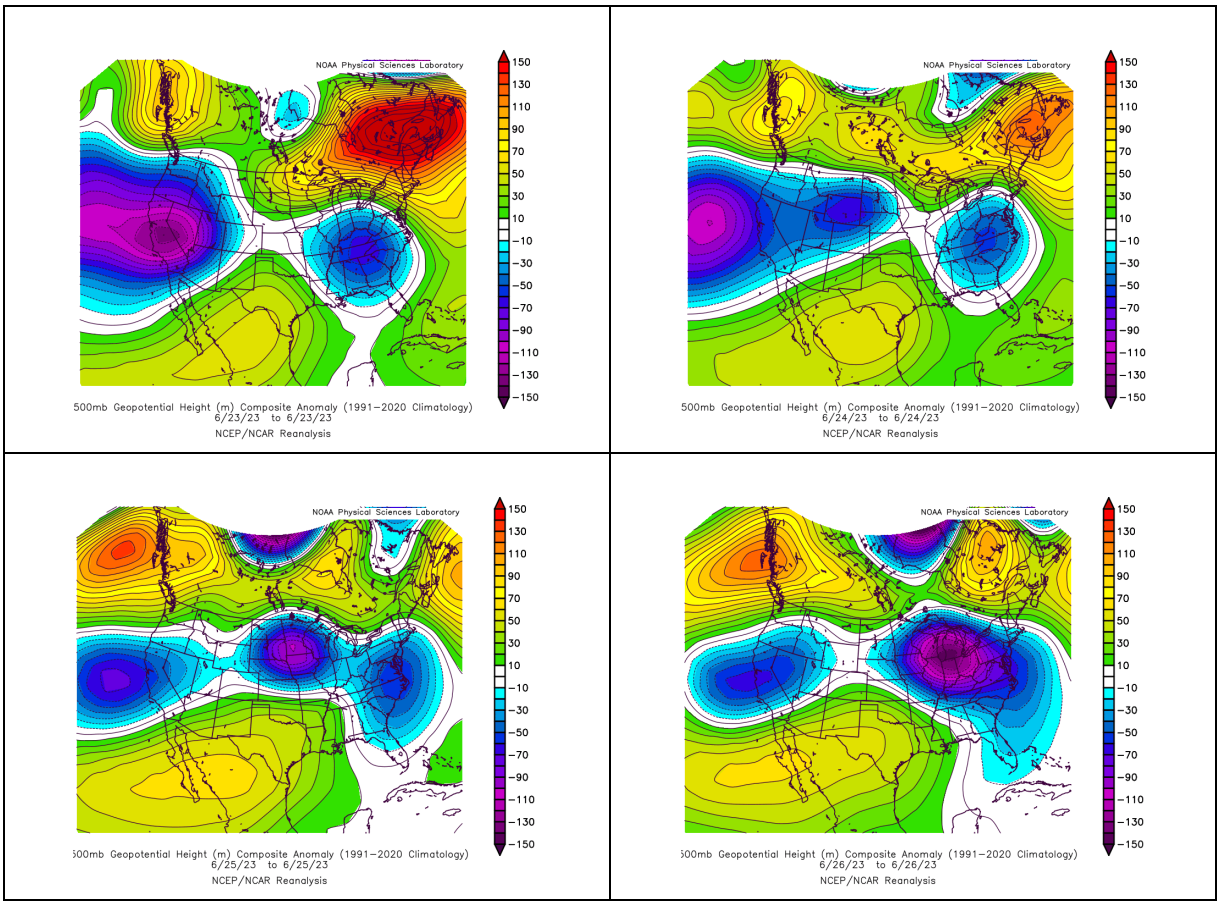


***Figure 63**: 500 mb geopotential height anomalies evolution from June 19th to June 26th, 2023.*

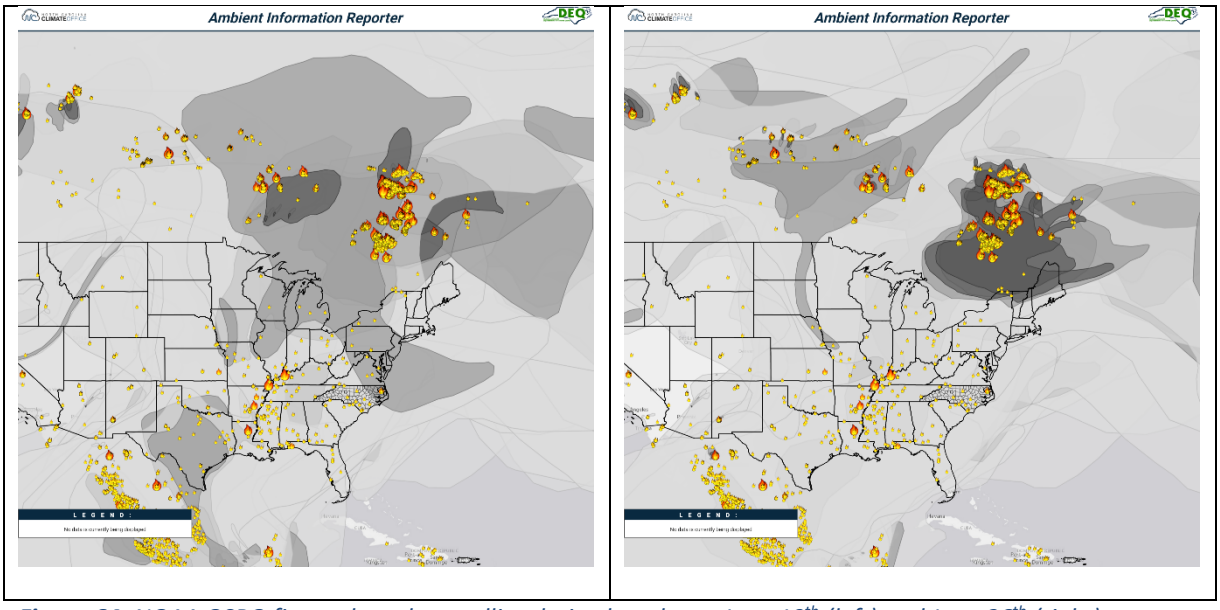


***Figure 64**: NOAA OSPO fire and smoke satellite-derived analyses. June 19th (left) and June 26th (right).*

Between June 26th and June 28th, a newly formed upper-level low initially over the Great Lakes rotated into the Mid-Atlantic, and once again pulled an attendant surface low and cold front

eastward with it. The surface front crossed the state during the morning into the early afternoon of June 27th, as seen in **Figure 65** and **Figure 66**. Behind the front, a large swath of smoke can be seen in visible satellite imagery over the Great Lakes on June 27th in **Figure 67.**

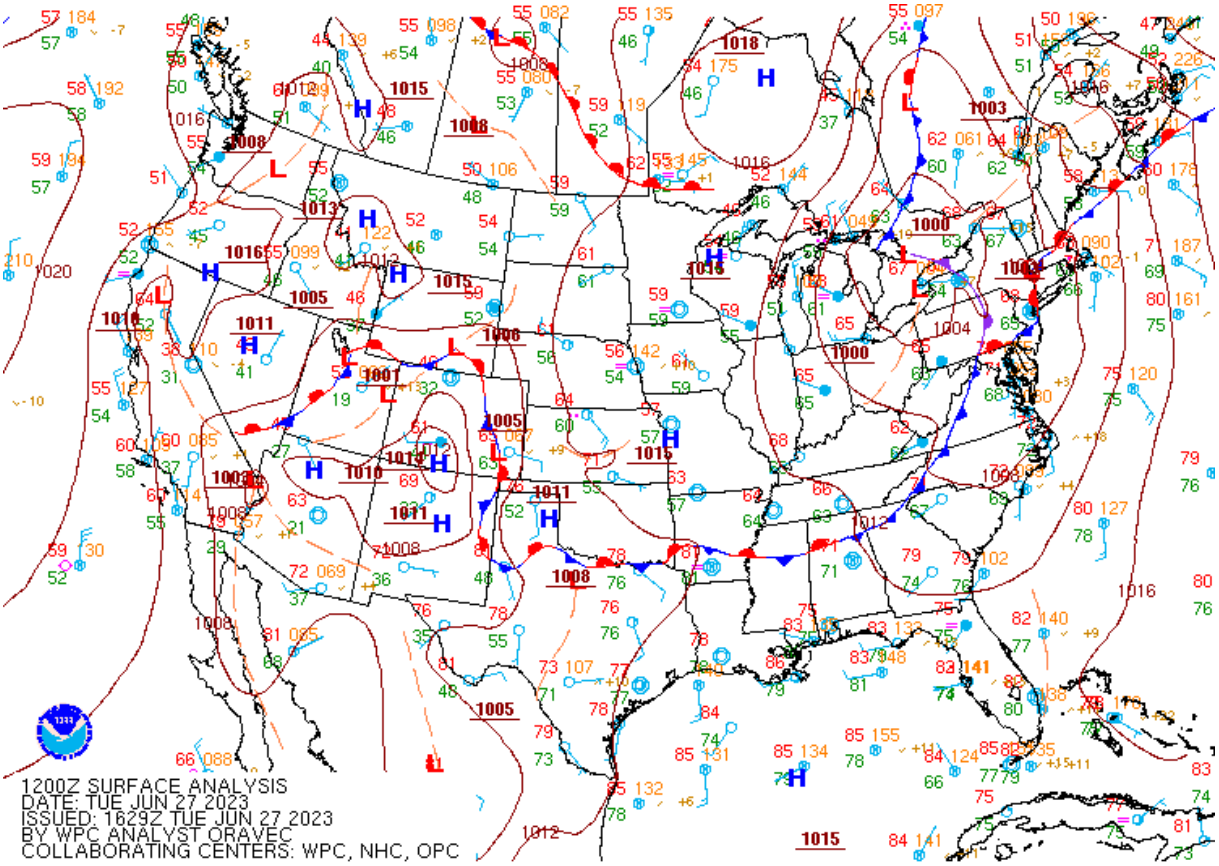


***Figure 65**: WPC surface analysis for June 27th, 2023 at 8:00 am EDT.*

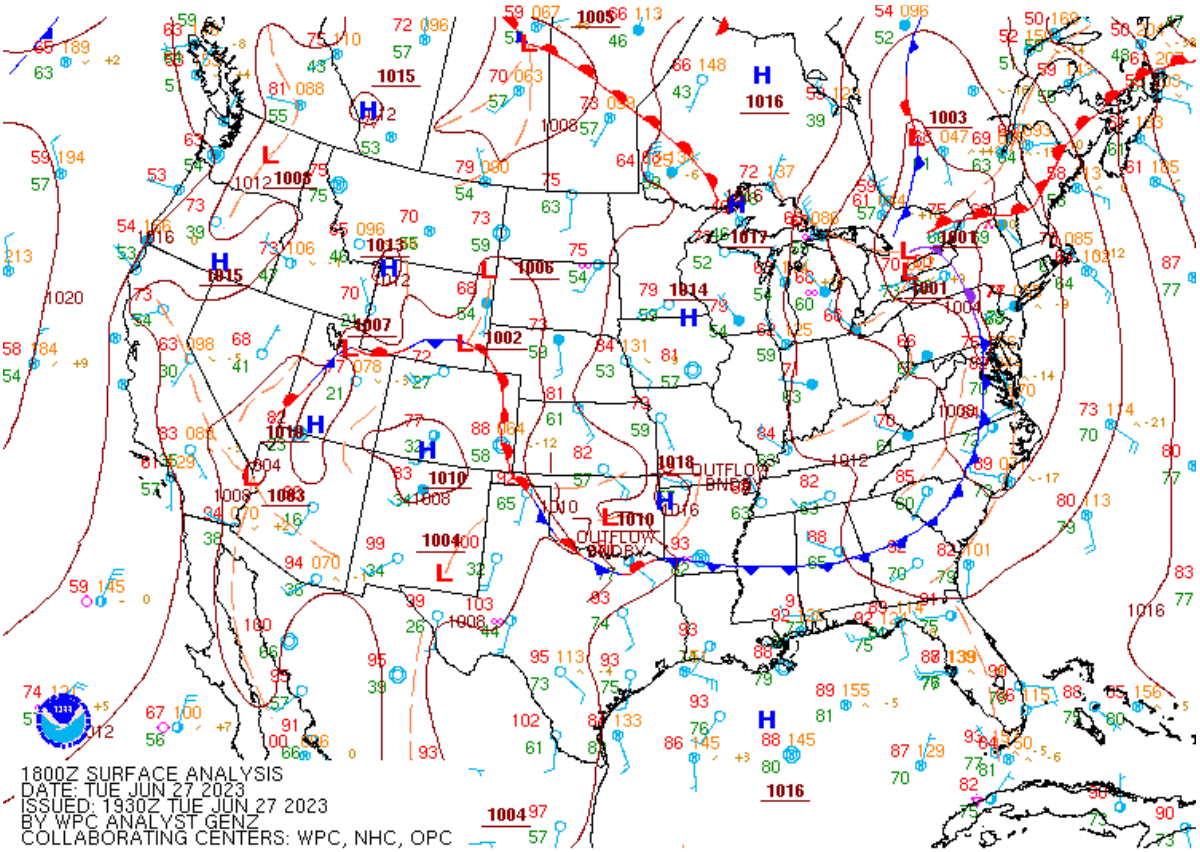


***Figure 66**: WPC surface analysis for June 27th, 2023 at 2:00 pm EDT.*

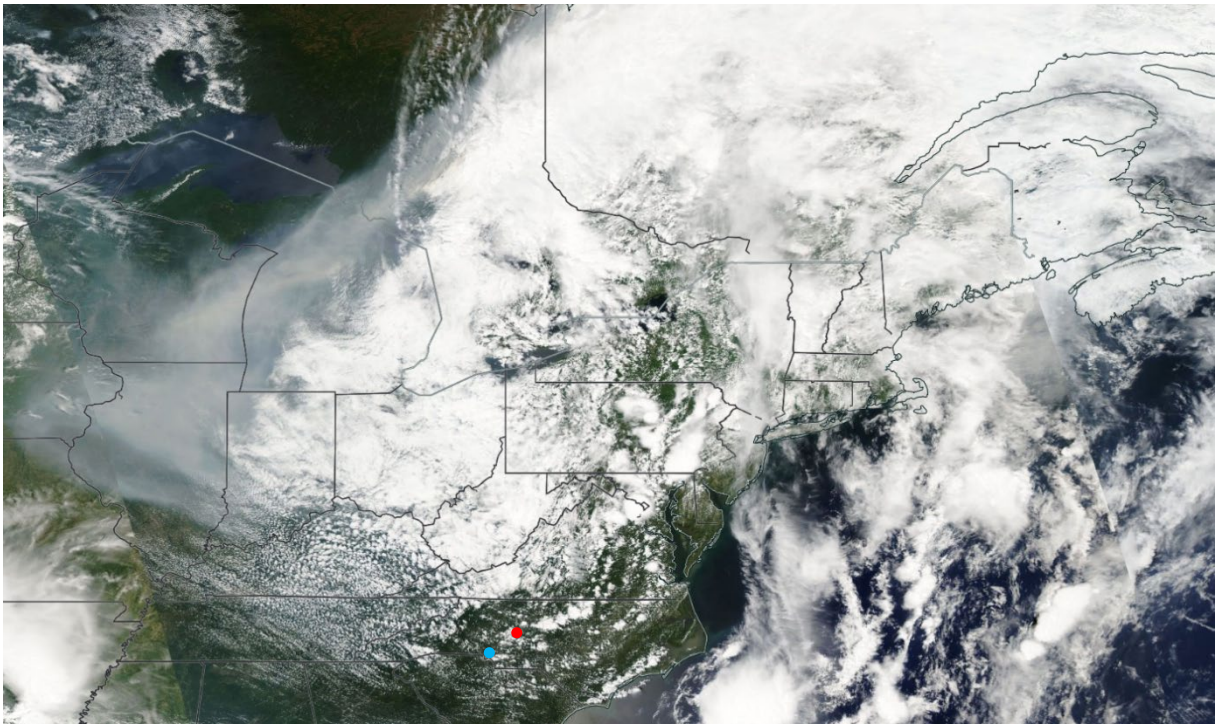


***Figure 67**: Visible satellite imagery reveals heavy smoke across Wisconsin, Michigan and Illinois while clouds mask additional smoke further east on June 27th, 2023. The red and blue circles show the approximate locations*

of the Lexington and Remount monitors, respectively.

By June 28th, the upper-level low had rotated into the Mid-Atlantic. Meanwhile, the upper-level high had begun to shift eastward in Canada (**Figure 69)**, which allowed the heavily smoke-laden air mass to drain southward in the upper-level trough over the eastern U.S.

Additional Tier 2 analysis - it is important to note, as evidenced in **Figure 68** below, that the later part of June 28th was strongly impacted by smoke as hourly $PM_{2.5}$ concentrations had elevated above 55 µg/m_3 in western NC and were rising into the 30 to 40 µg/m_3 range at 11:00 pm EDT across the western Piedmont. Hourly observations would surpass 50 µg/m_3 on the midnight, June 29th observation at monitors in Guilford and Forsyth Counties. Additionally, airport visibilities had lowered into the 4 to 7-mile range, another clear indicator that thicker smoke was being advected into the state. As seen in Appendix I, **Figure 142-I** the Concord Regional Airport's visibility had lowered to 7 SM beginning with the 19:50 observation and remained at this lowered visibility through midnight, which coincided with the rising PM2.5 concentrations as the heavier smoke advected into the region. Lastly, once again both the HRRR Smoke and NAAPs guidance analyzed heavy smoke over the region from 8:00 am on June 28th, as seen in Appendix I, **Figure 143-I** through **Figure 144-I**. Collectively, it is logical to deduce that the daily average $PM_{2.5}$ concentrations recorded at both the Remount and Lexington monitors on June 28th would have been significantly lower but for the significant amount of smoke that moved into the state during the evening.

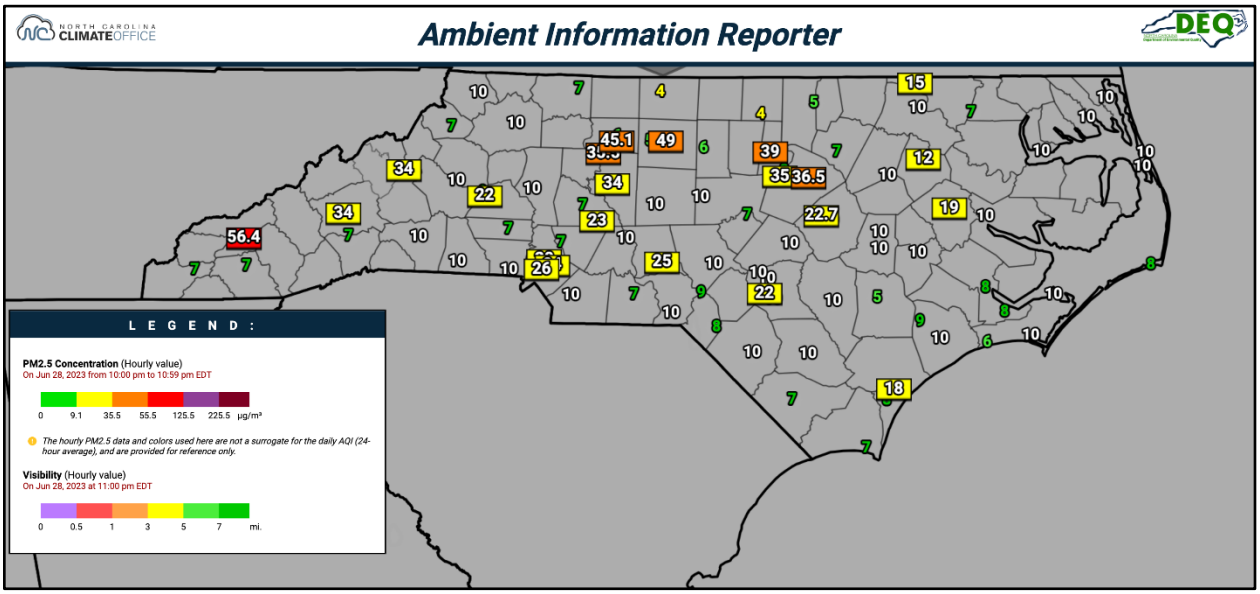


***Figure 68**: Hourly $PM_{2.5}$ and airport visibility observations on June 28th, 2023 at 11:00 pm EDT.*

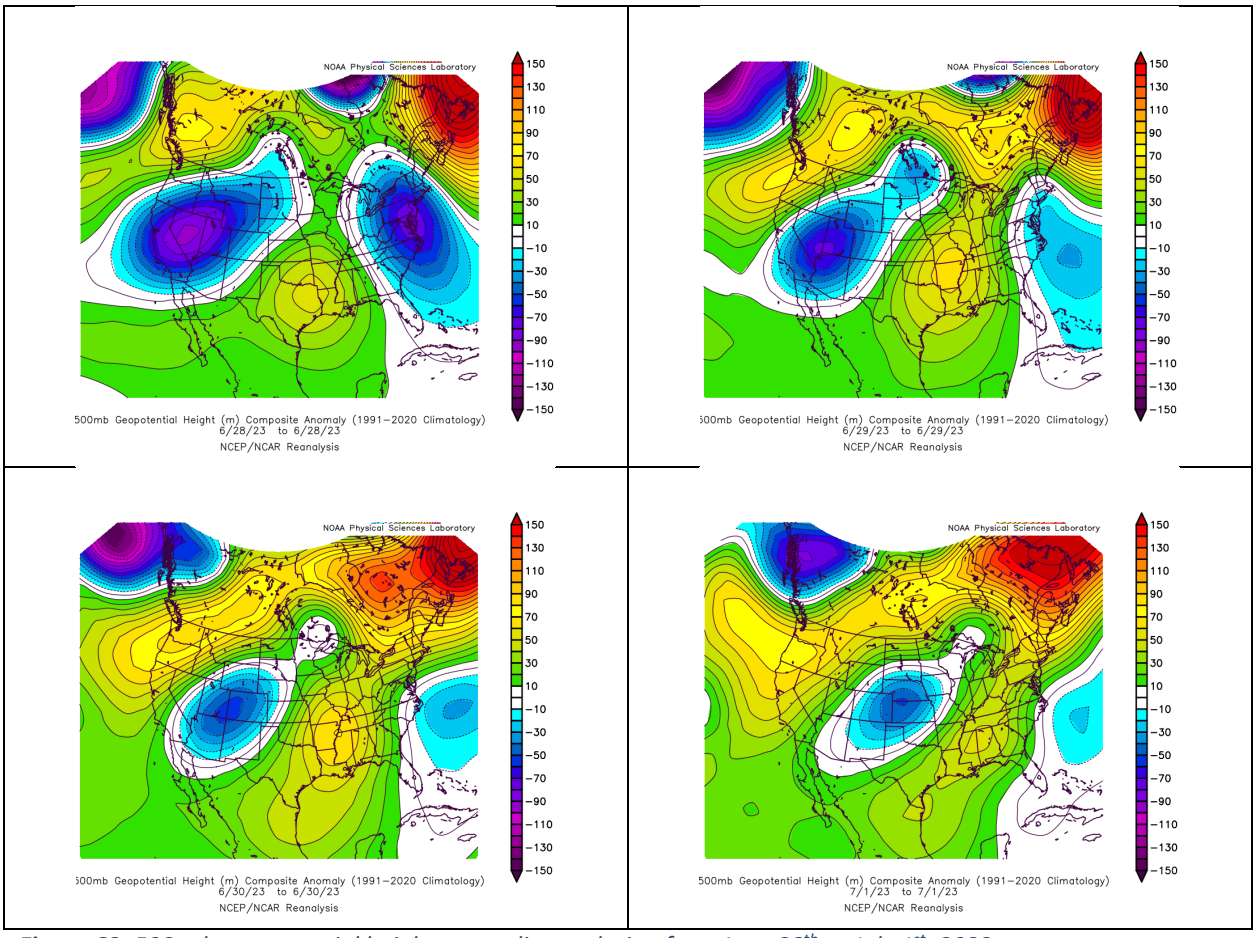


***Figure 69**: 500 mb geopotential height anomalies evolution from June 28th to July 1st, 2023.*

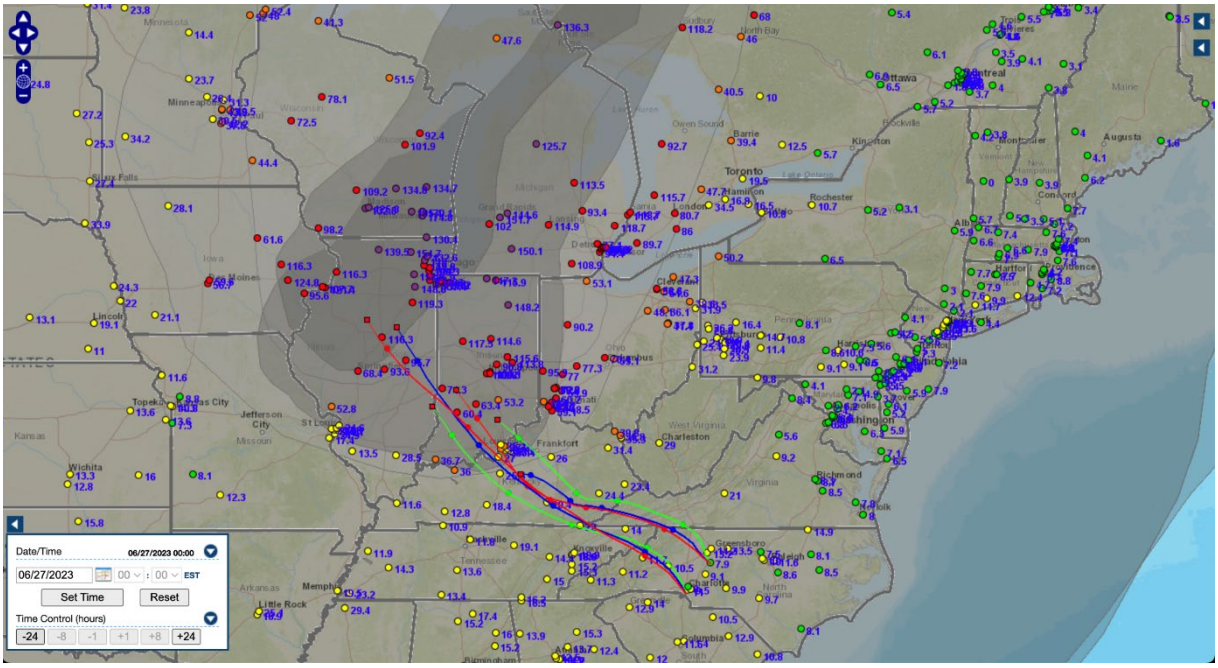


***Figure 70**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 27th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending*

*on **June 28th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 27th, 2023**.*

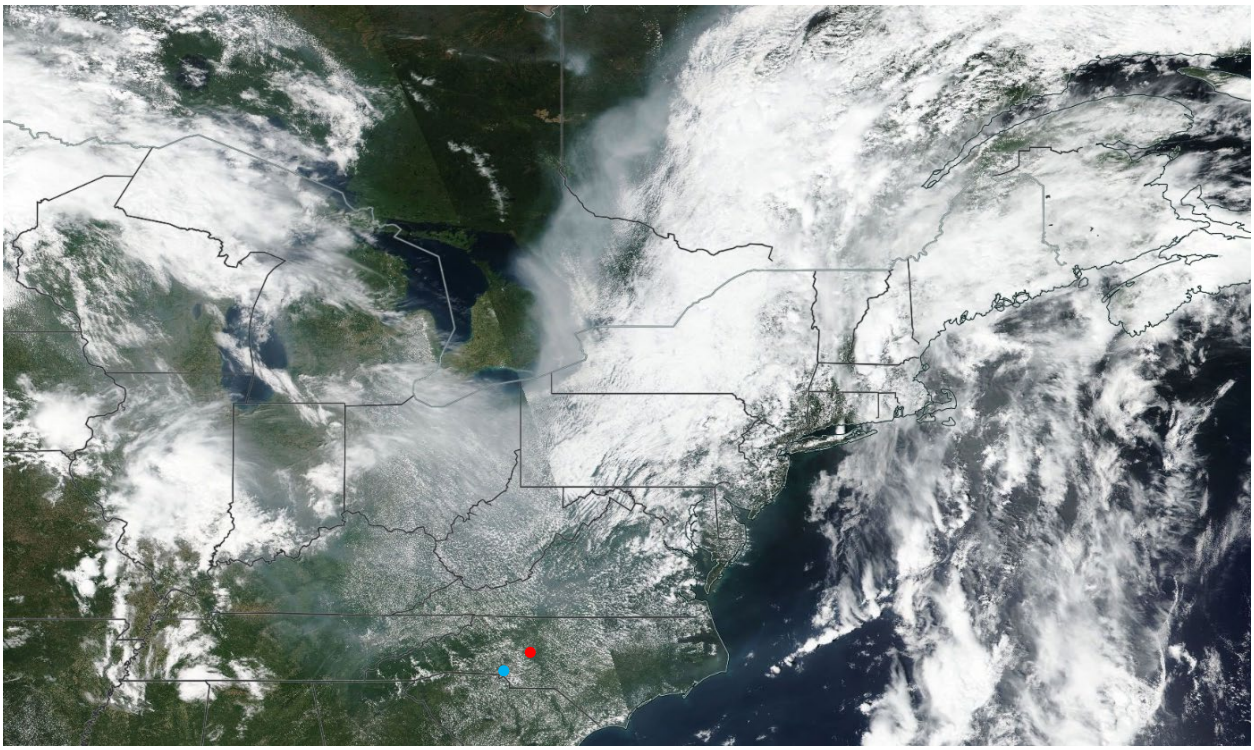


***Figure 71**: Visible satellite imagery reveals heavy smoke across the Ohio Valley, Mid-Atlantic and upper southeastern U.S., including North Carolina, on June 28th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

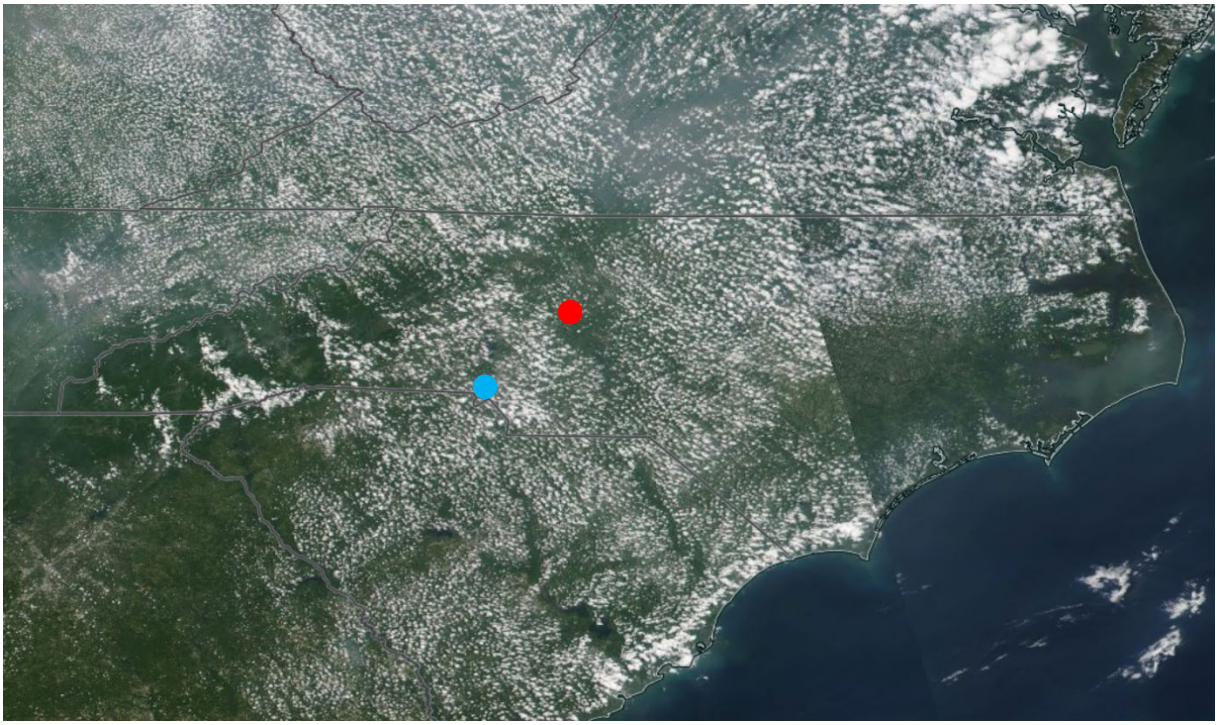


***Figure 72**: Visible satellite imagery reveals heavy smoke across the Ohio Valley, Mid-Atlantic and upper*

southeastern U.S., including North Carolina, on June 28th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.

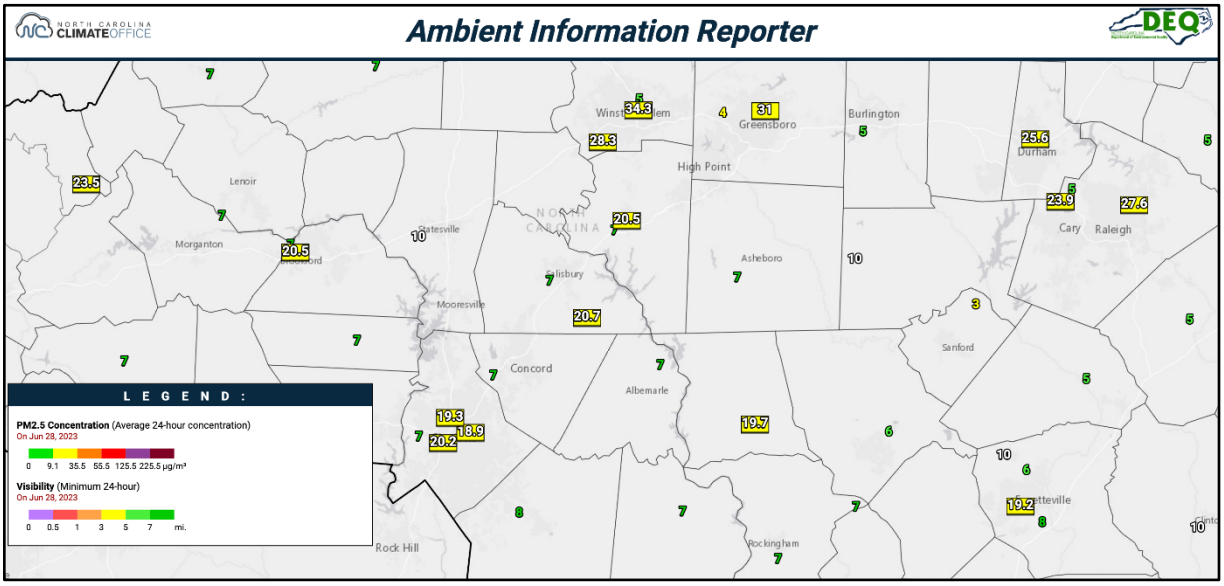


***Figure 73**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 28th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

By June 29th, a plume of the heaviest smoke laden air was being directly transported into North Carolina from the source of the heaviest fire and smoke activity over southeastern Canada, as seen in **Figure 74**. This analysis of a direct fetch of smoke from the origin source in Canada in concurrence with the onset of widespread exceedances at most North Carolina $PM_{2.5}$ monitoring sites provides evidence of the clear causal relationship that existed during the third event in North Carolina in late June into early July as seen in the remainder of our analyses in **Figure 75** through **Figure 87**.

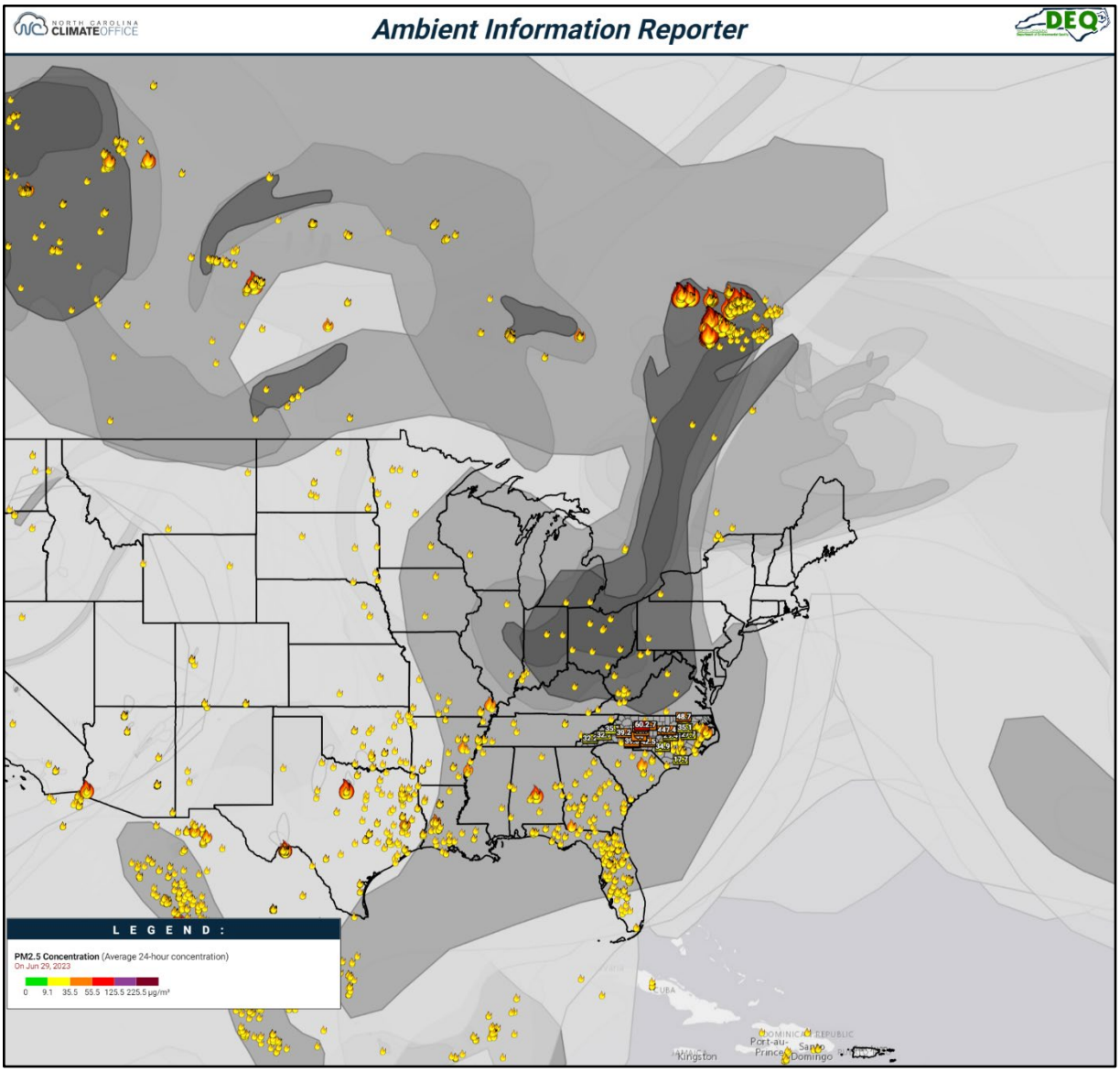


***Figure 74**: 24-hr. avg. $PM_{2.5}$ concentrations and NOAA OSPO fire and smoke satellite-derived analyses on June 29th.*

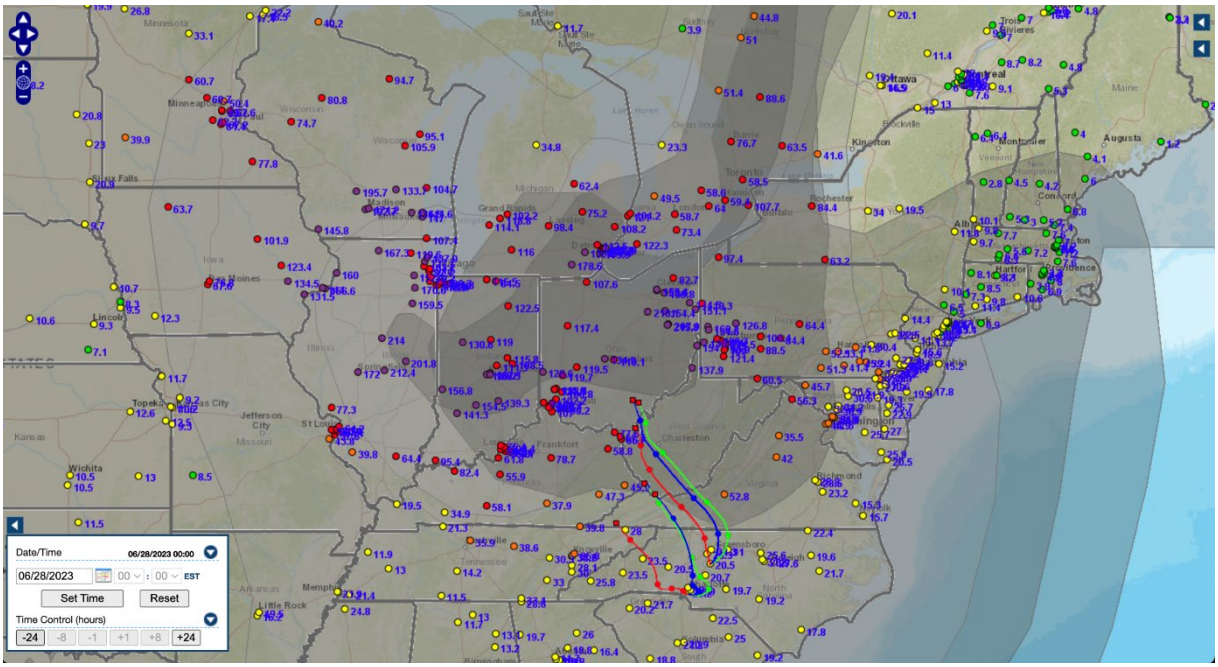


***Figure 75**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 28th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 29th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 28th, 2023**.*

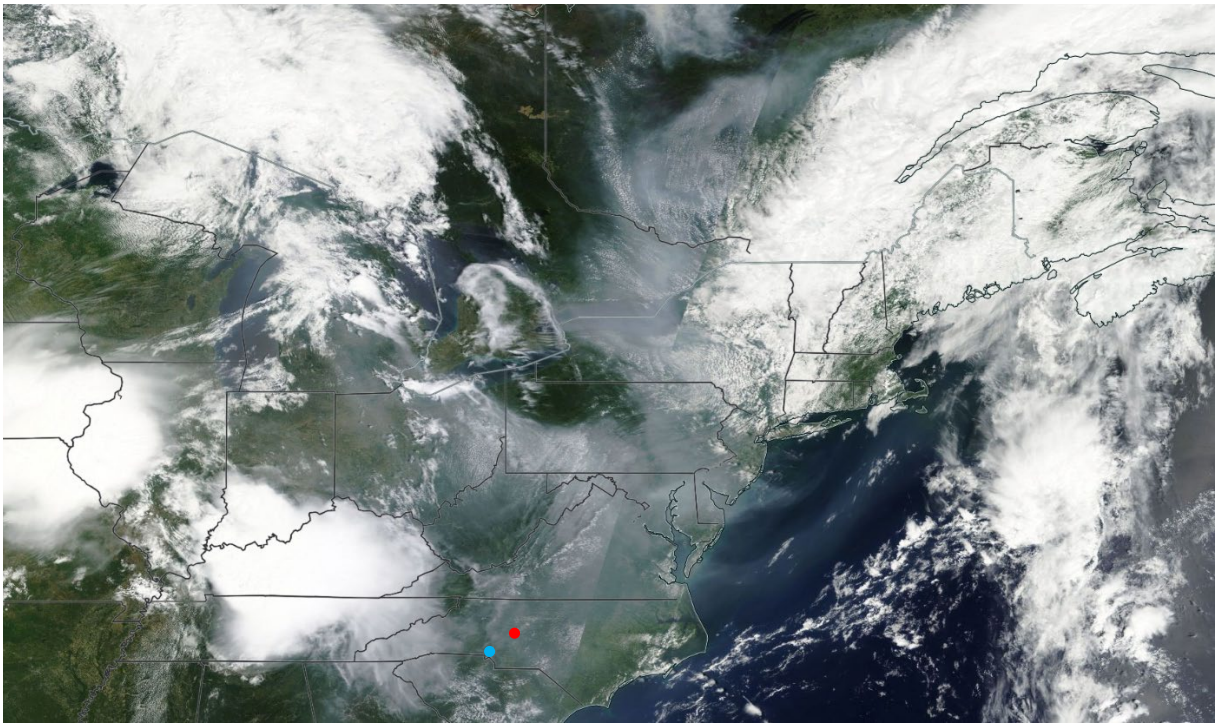


***Figure 76**: Visible satellite imagery reveals heavy smoke across the Ohio Valley, Mid-Atlantic and upper southeastern U.S., including North Carolina, on June 29th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

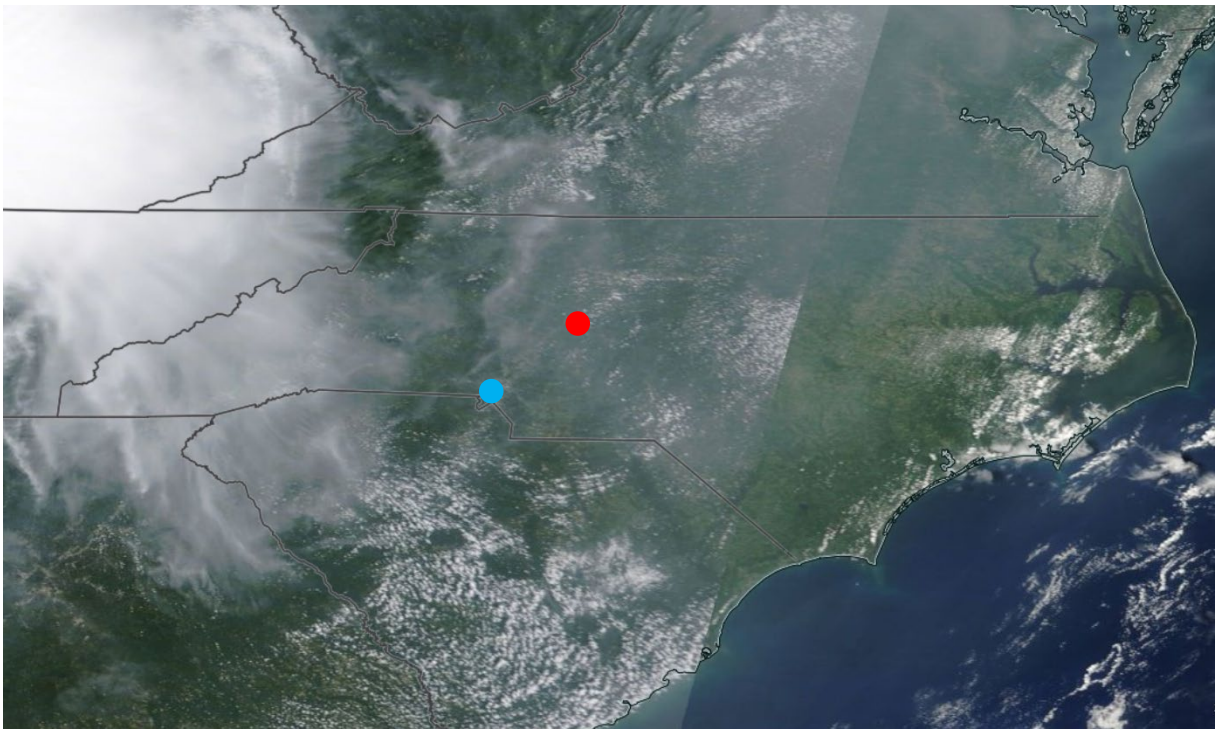


***Figure 77**: Visible satellite imagery reveals heavy smoke across the Ohio Valley, Mid-Atlantic and upper southeastern U.S., including North Carolina, on June 29th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

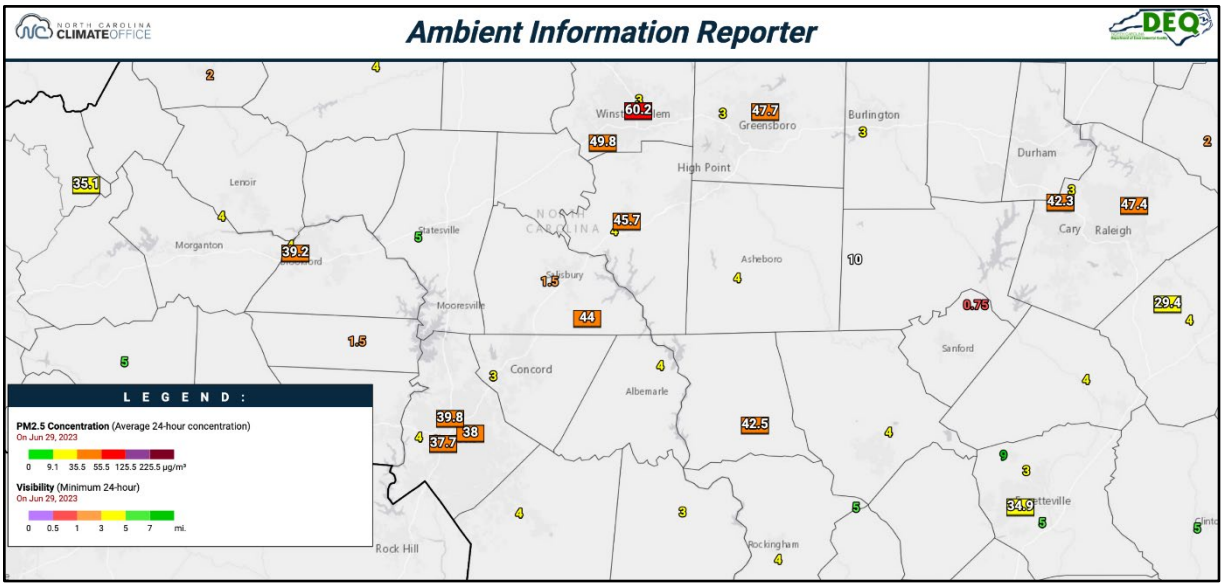


***Figure 78**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 29th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

Once the polluted air mass was deposited into the state, high pressure built into the region behind the surface cold front as seen in the daily WPC surface analysis evolution shown in **Figure 79.** With reduced dispersion, lighter winds and strong overnight temperature inversions, this acted to trap the elevated $PM_{2.5}$ air mass over the region through July 1st.

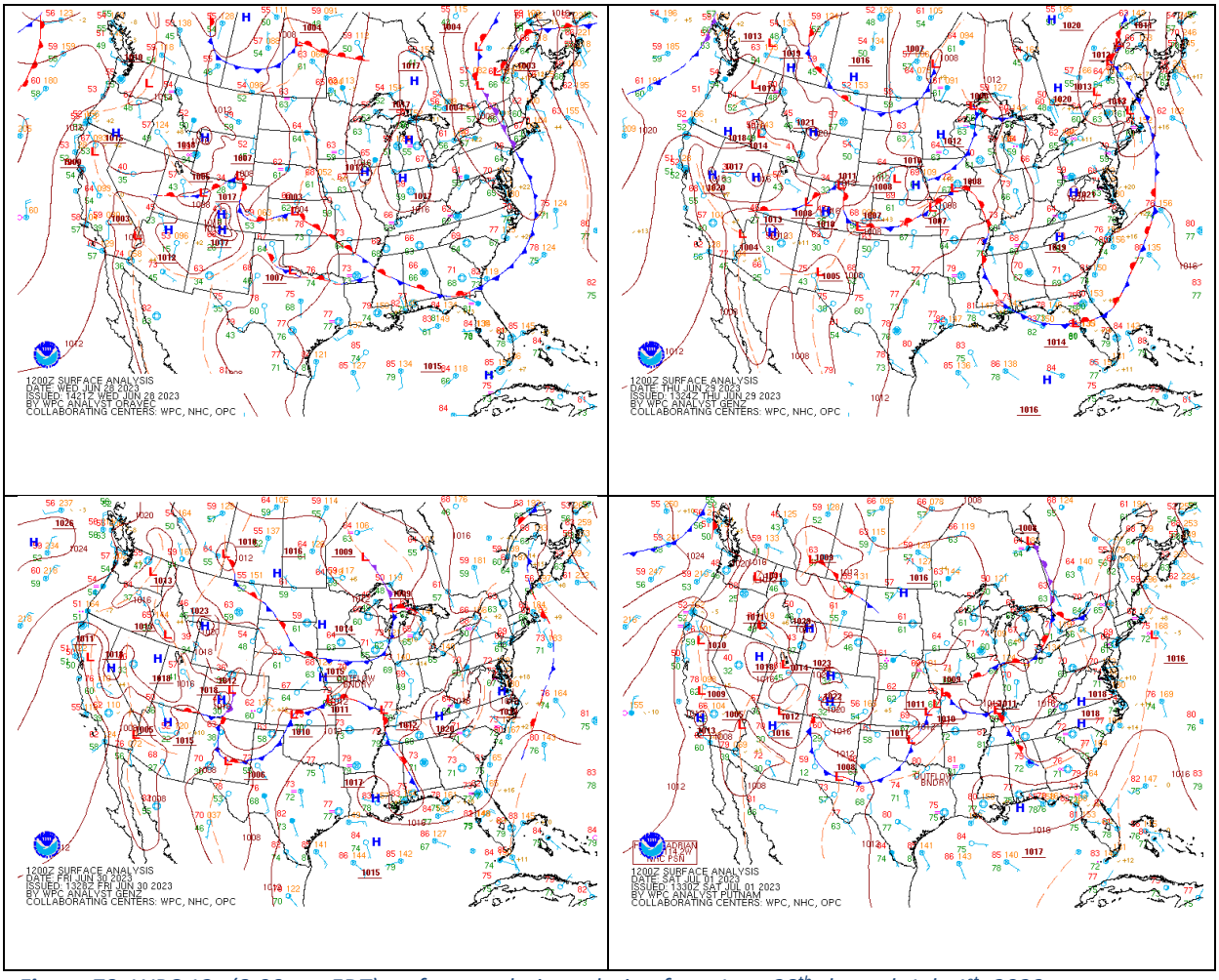


***Figure 79**: WPC 12z (8:00 am EDT) surface analysis evolution from June 28th through July 1st, 2023.*

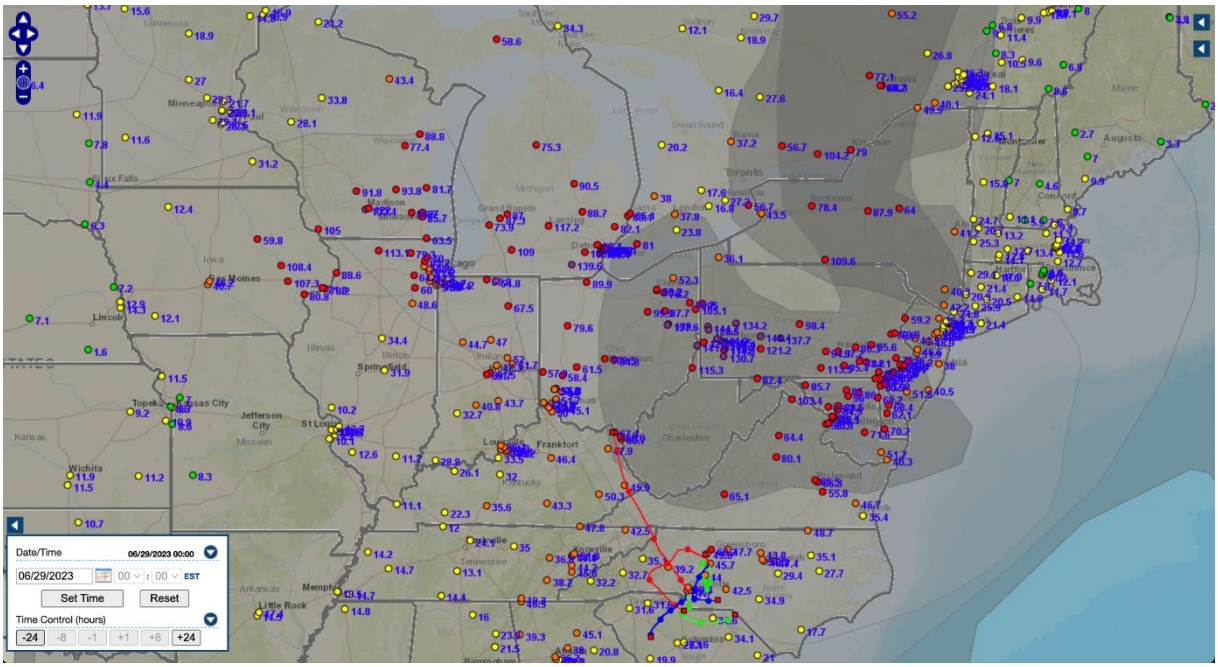


***Figure 80**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 29th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **June 30th, 2023**. Red squares indicate air parcel location along back trajectory path on **June 29th, 2023**.*

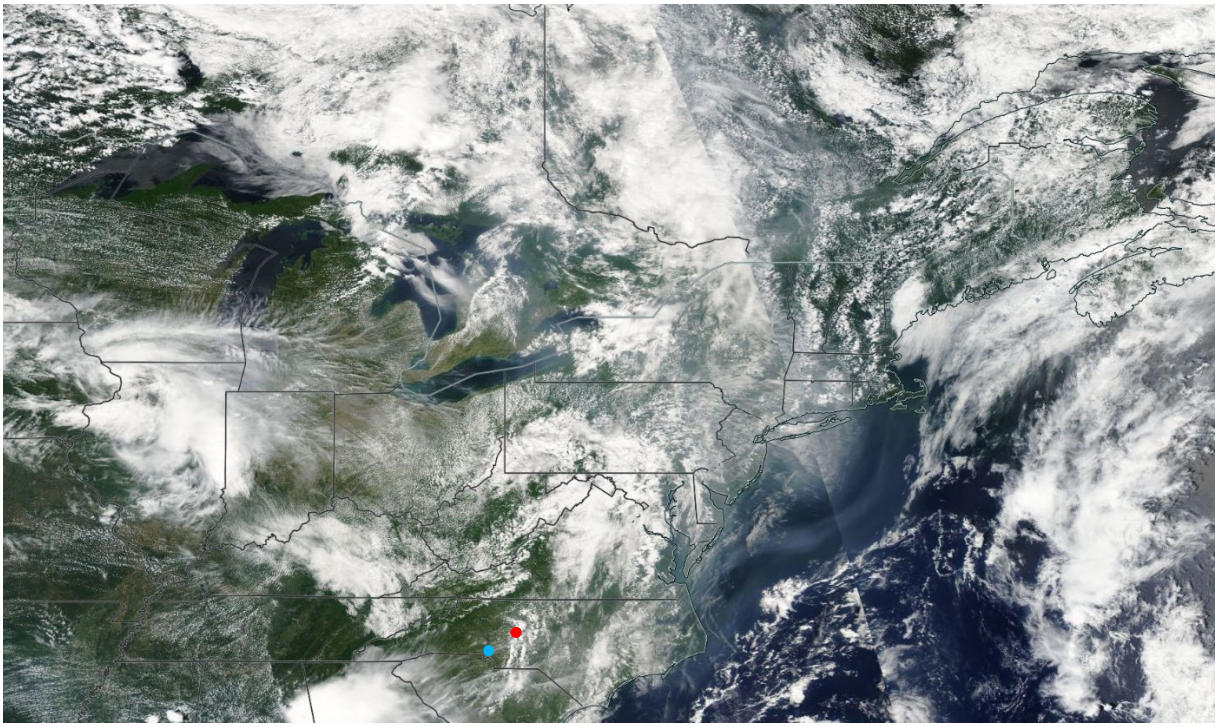


***Figure 81**: Visible satellite imagery reveals heavy smoke across the Ohio Valley, Mid-Atlantic and upper southeastern U.S., including North Carolina, on June 30th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

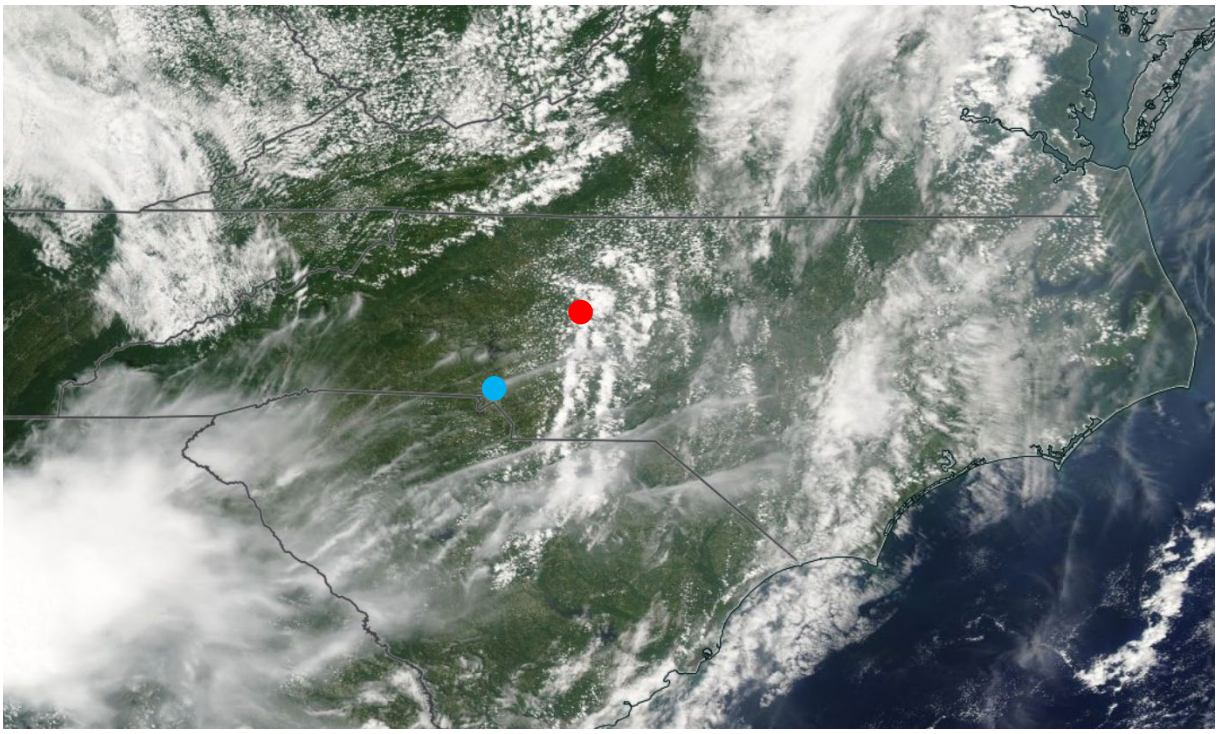


***Figure 82**: Visible satellite imagery reveals heavy smoke across the Ohio Valley, Mid-Atlantic and upper southeastern U.S., including North Carolina, on June 30th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

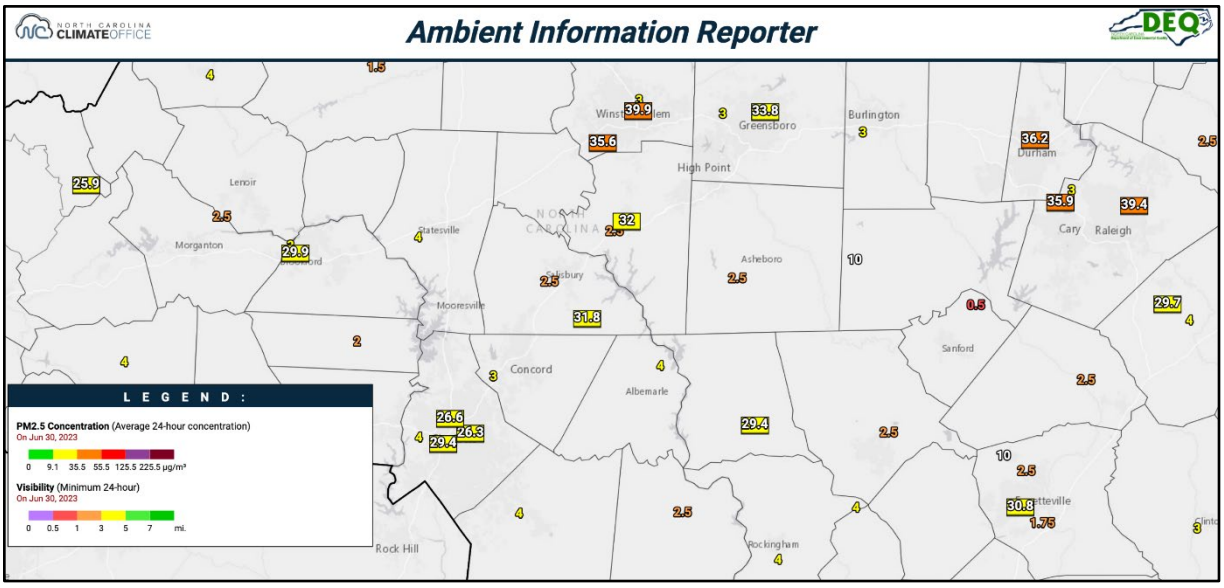


***Figure 83**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on June 30th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

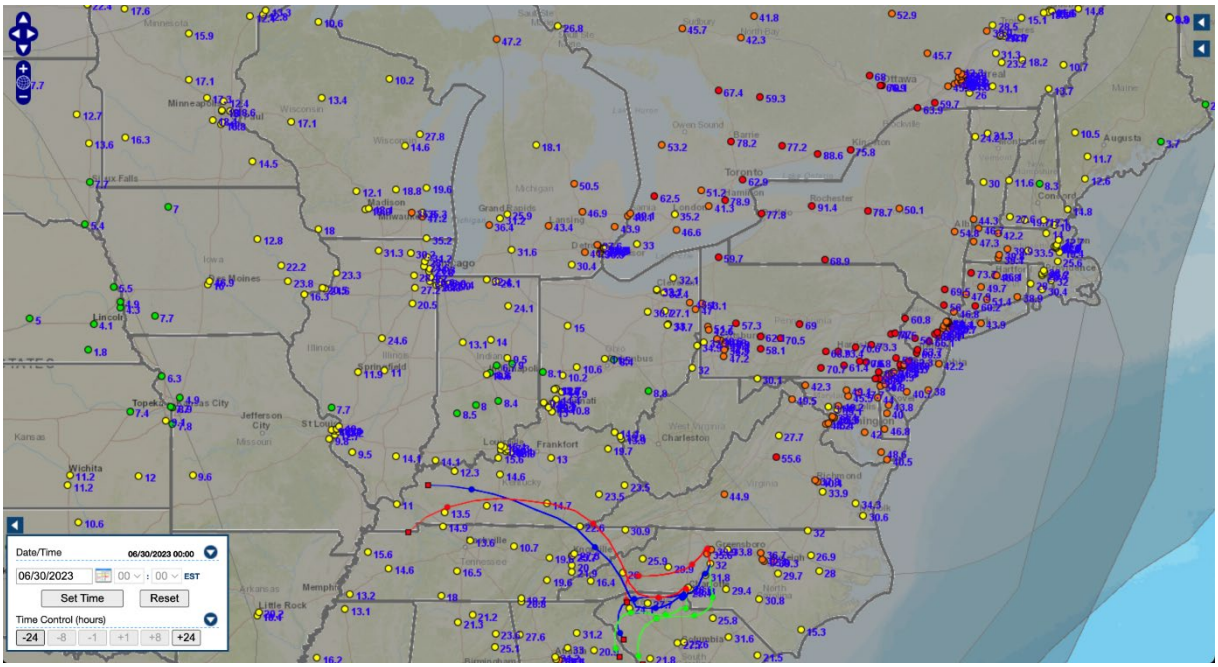


***Figure 84**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **June 30th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **July 1st, 2023**. Red squares indicate air parcel location along back trajectory path on **June 30th, 2023**.*

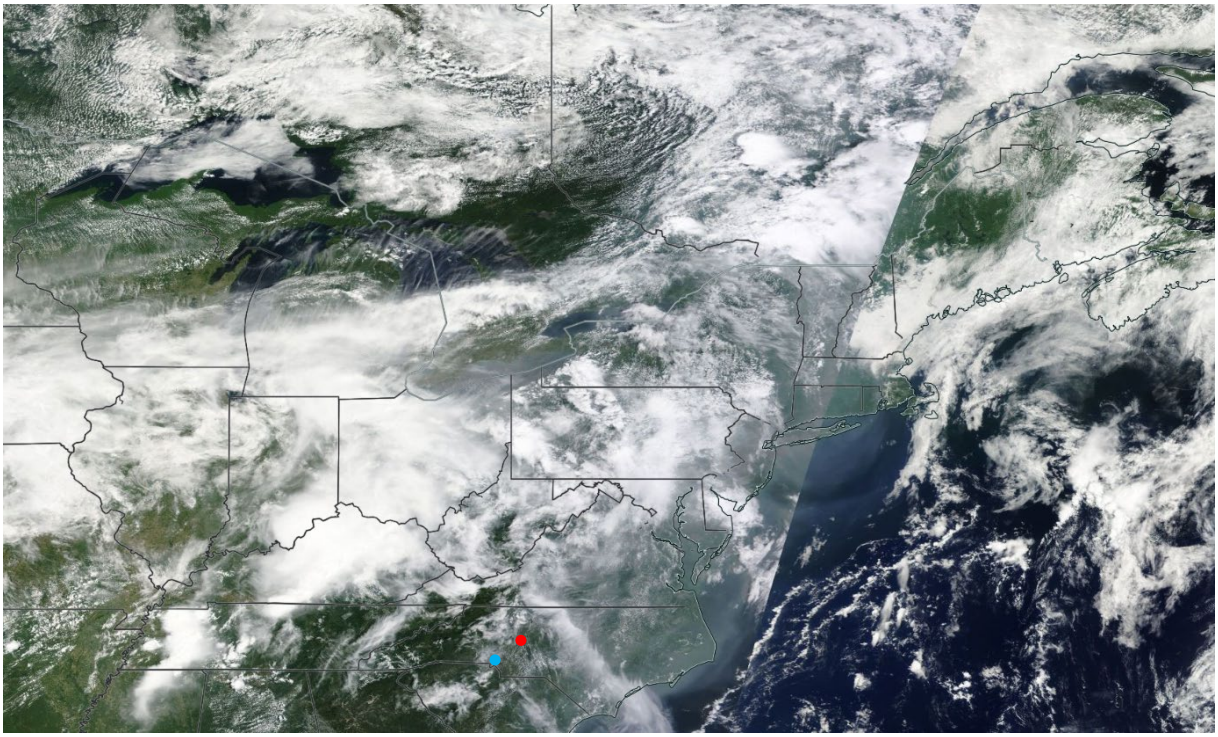


***Figure 85**: Visible satellite imagery reveals heavy smoke across the Ohio Valley, Mid-Atlantic and upper southeastern U.S., including North Carolina, on July 1st, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

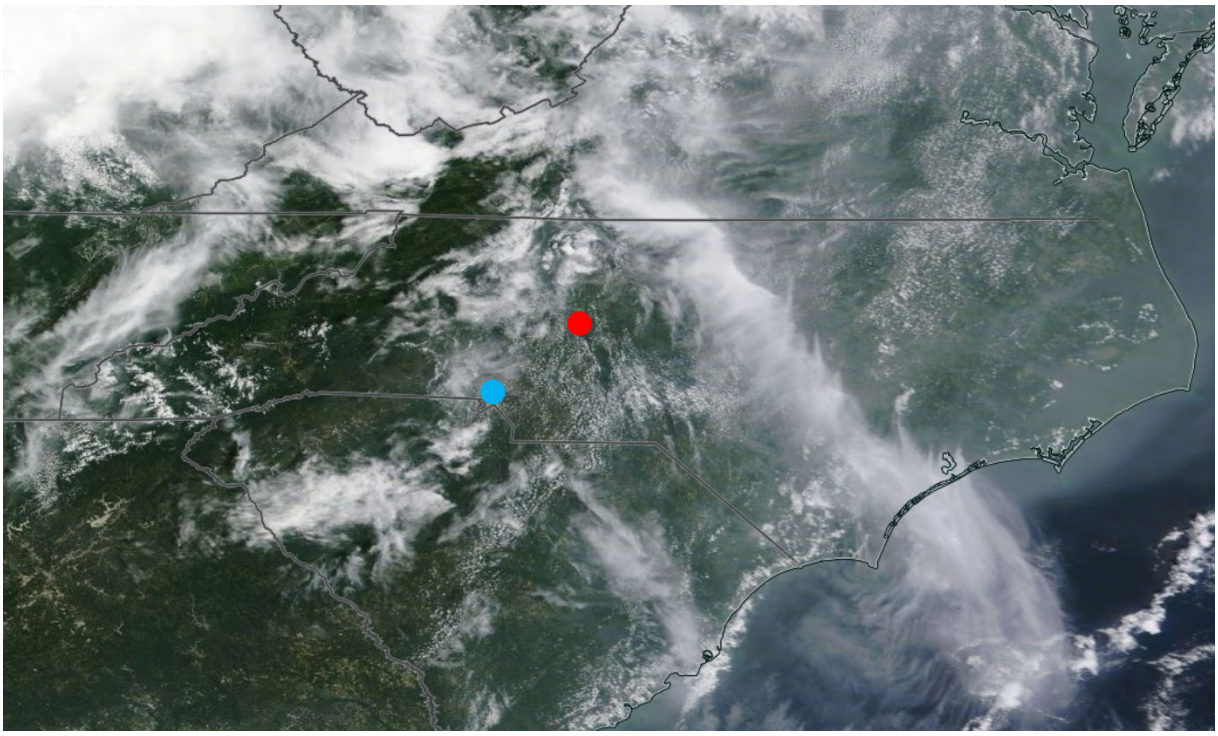


***Figure 86**: Visible satellite imagery reveals heavy smoke across the Ohio Valley, Mid-Atlantic and upper southeastern U.S., including North Carolina, on July 1st, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

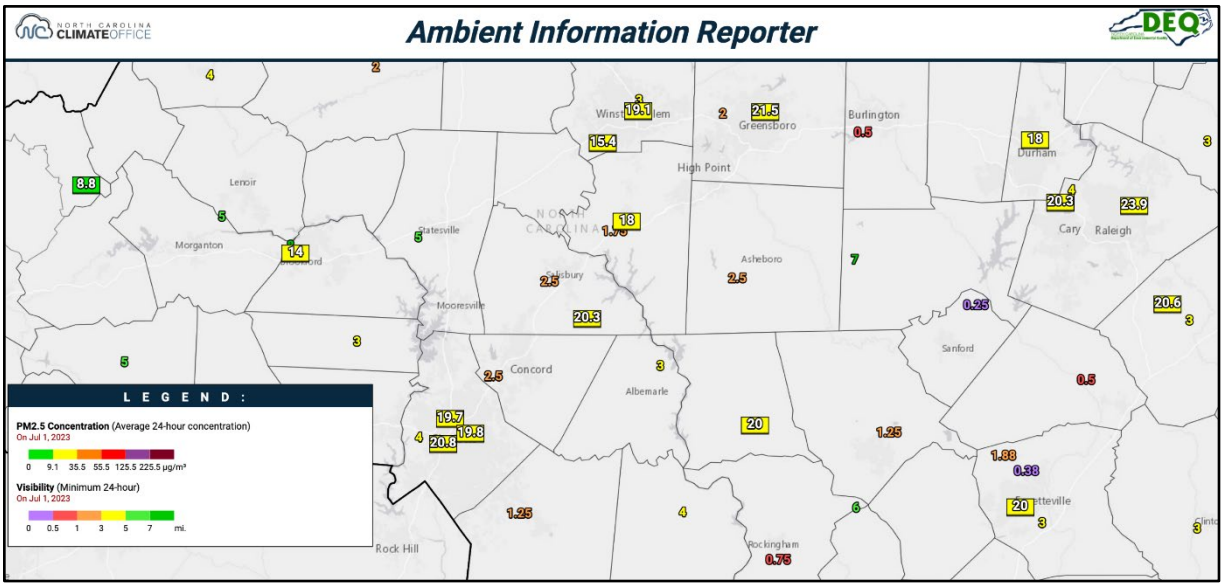


***Figure 87**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on July 1st, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

Additional Tier 2-level evidence of surface-level smoke and associated impacts on July 1st once again presented itself in the hourly METAR observations from the Concord Regional Airport (JQF) as seen in Appendix J, **Figure 145-J**. Numerous hours contained sky condition reports of "FUHZ" (smoke / haze) with visibility less than 7 statute miles, with dewpoints significantly lower than temperature (thus

eliminating the possibility of fog). Additionally, both the HRRR Smoke and the NAAPS aerosol model analysis (00 hr initialization) at 8:00 am on July 1st analyzed surface smoke over North Carolina as seen in Appendix J, **Figure 146-J** through **Figure 147-J**.

3.1.4 Event ID #4 - July 17th through July 18th, 2023

The fourth and final event included in North Carolina's 2023 exceptional event package, which occurred in mid-July, led to two days of 24-hour $PM_{2.5}$ averages that were classified as Tier 1 level at both the Remount and Lexington monitors. This is shown in **Table 6** below.

***Table 6**: Regulatorily Significant 24-Hour Average $PM_{2.5}$ Concentrations Requested for Exclusion for Event #4.*

		Remount (AQS ID# 371190045) (Mecklenburg County)					Lexington (AQS ID# 370570002) (Davidson County)				
Event ID	**Date**	**24-hr $PM_{2.5}$ Average ($\mu g/m^3$)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold ($\mu g/m^3$)****		**24-hr $PM_{2.5}$ Average ($\mu g/m^3$)**	**Historical Average* (2018-2022 Avg. Daily Conc.)**	**% Increase from Historical Average**	**EPA Tier Level / Threshold ($\mu g/m^3$)****	
4	7/17/2023	43	8.6	401.5 %	Tier 1	24.45	38.6	11.5	236.8 %	Tier 1	26.7
	7/18/2023	46.1	7.9	483.5 %	Tier 1	24.45	42.3	8.3	408.4 %	Tier 1	26.7

** The historical average is defined as the daily average $PM_{2.5}$ concentration over the previous 5-year period (2018-2022) on the given date (i.e., the past 5 June 6ths, the past 5 June 7ths, etc.).*

*** The EPA Tier Level determines the level of evidence required to establish a clear causal relationship in a wildland fire $PM_{2.5}$ exceptional events demonstration and was determined using EPA's Tiering Tool output as displayed in Appendix K: Monitoring Sites' Tiering Graphs. The threshold listed represents the minimum daily average concentration ($\mu g/m^3$) needed to meet the Tier level listed for that specific monitor and month.*

This event again featured widespread exceedances of the daily $PM_{2.5}$ NAAQS. 16 out of 21 monitors in North Carolina's $PM_{2.5}$ ambient monitoring network measured daily concentrations above 35.5 $\mu g/m^3$ on July 18th. However, unlike the other three events, much of the smoke transported into North Carolina in mid-July 2023 was primarily sourced from northwestern Canada rather than eastern Canada.

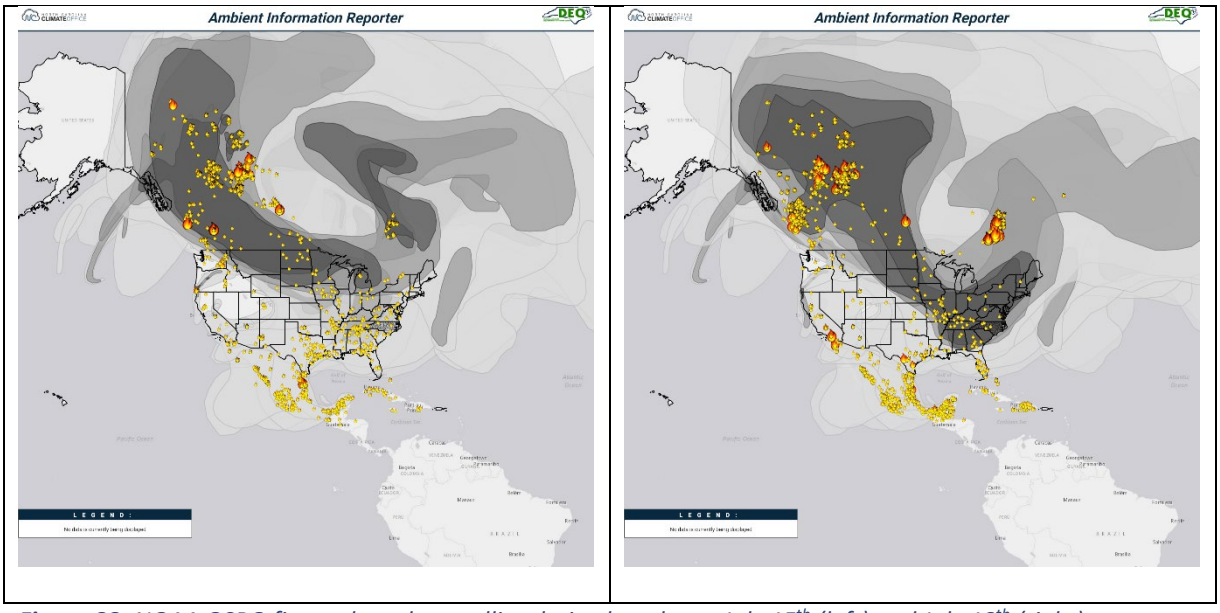
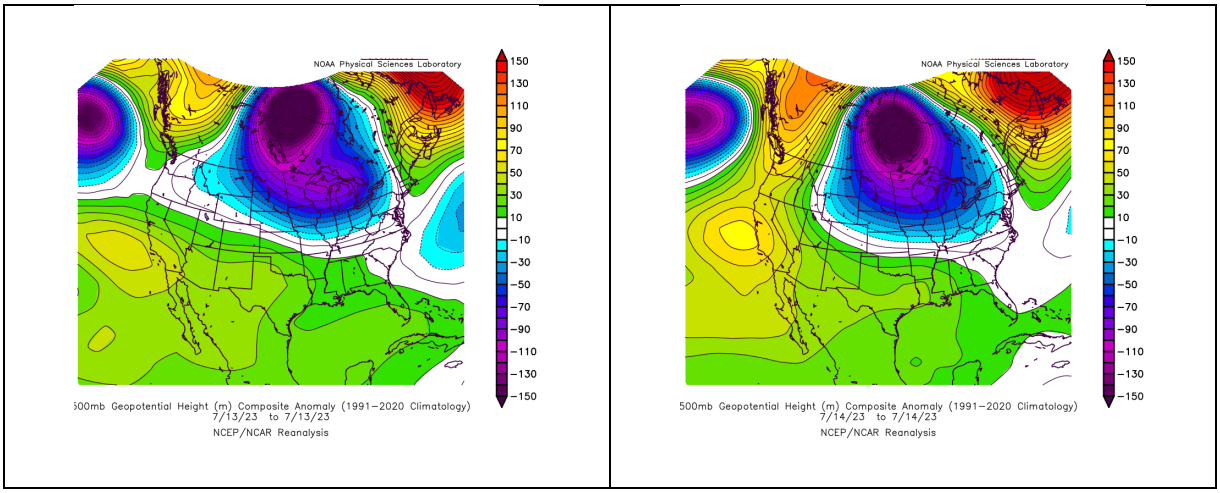


***Figure 88**: NOAA OSPO fire and smoke satellite-derived analyses. July 15th (left) and July 18th (right).*

By mid-July 2023, NC DAQ forecasters were experiencing meteorological déjà vu as yet again a variation of a familiar atmospheric pattern recurred with a strong upper-level high over southeastern Canada and a digging upper-level low gradually shifting southward into the Great Lakes (seen in **Figure 89**). This strong upper-level low resulted in another deep trough digging into the eastern U.S., with northwesterly flow aloft delivering one last major blast of Canadian wildfire smoke-laden air into the state.



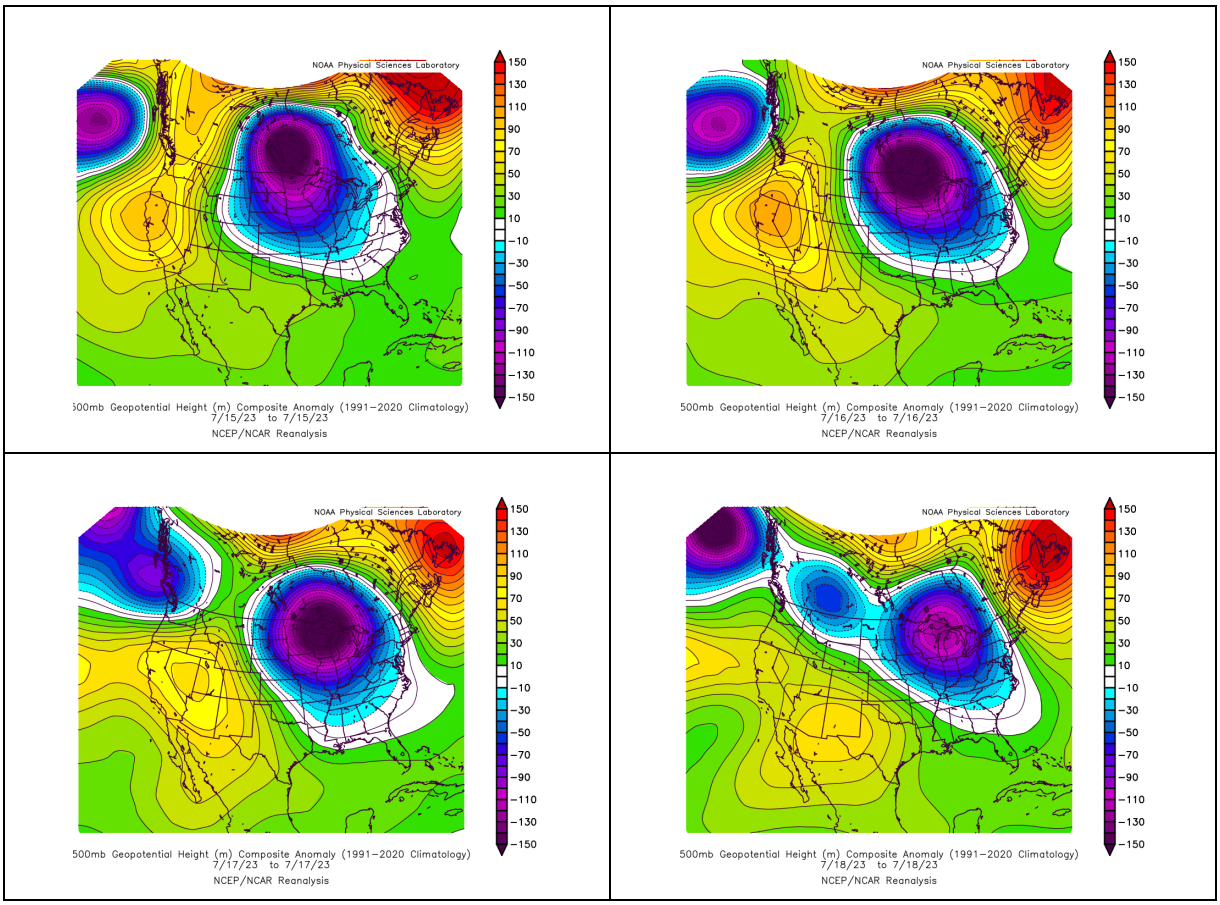


***Figure 89**: 500 mb geopotential height anomalies evolution from July 13th to July 18th, 2023.*

In a variation from the other events from a synoptic setup, the surface cold front that crossed the region during mid-July 2023 was tied to a weakening surface low pressure trough out ahead of the stacked, closed upper-level low / surface low system over the Upper Midwest on July 16th. The front was quasi-stationary on July 16th before slowly crossing the state during the late evening hours. The evolution of the frontal passage across North Carolina during the evening of July 16th into the early morning hours of July 17th is shown in **Figure 90** through **Figure 92** below.

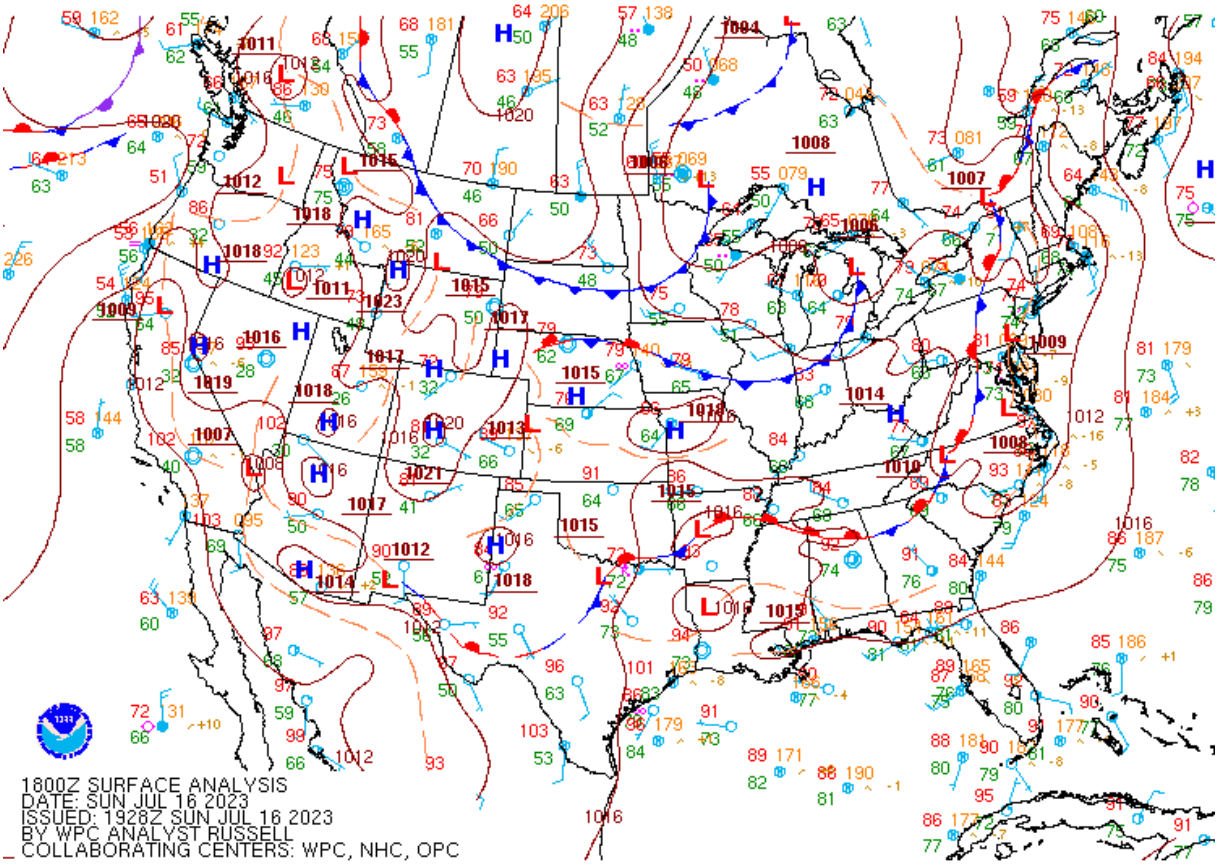


***Figure 90**: WPC surface analysis for July 16th, 2023 at 2:00 pm EDT.*

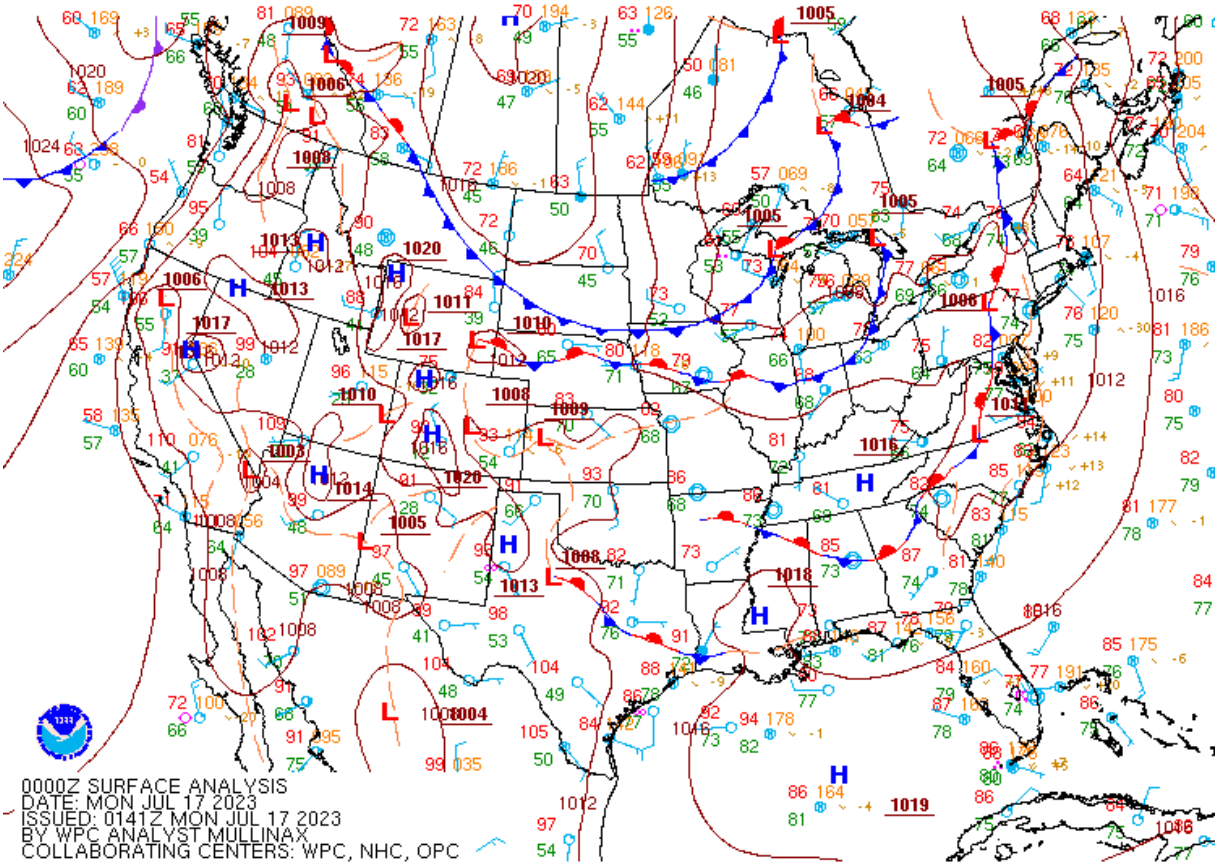


***Figure 91**: WPC surface analysis for July 16th, 2023 at 8:00 pm EDT (July 17th - 0000Z).*

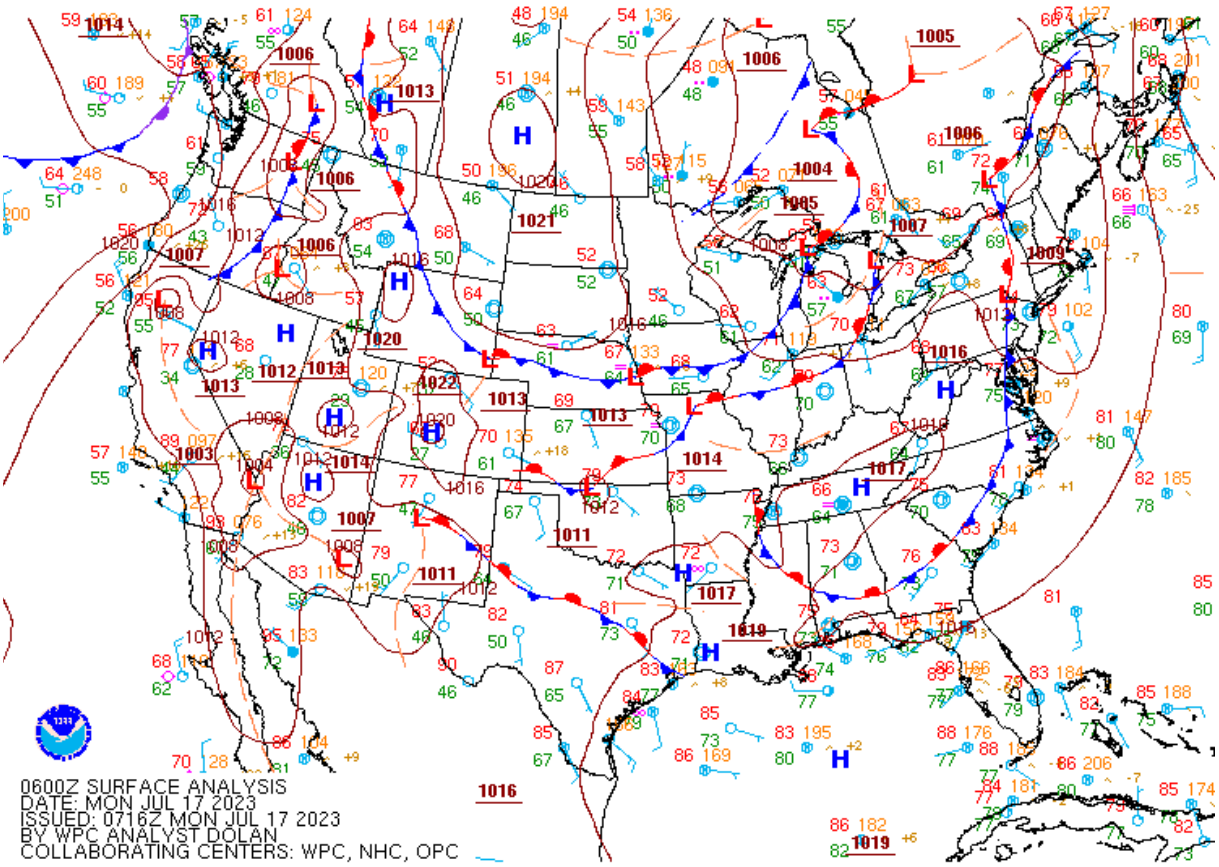


***Figure 92**: WPC surface analysis for July 17th, 2023 at 2:00 am EDT.*

Ahead of the surface front, heavy smoke could be seen on visible satellite imagery during the afternoon hours of July 16th across the Ohio and Tennessee Valleys **(Figure 93**). However, despite the correlation between the cold frontal passage / smoke location in this event, it appears that the primary driver of elevated smoke transport to the surface was downward mixing of smoke aloft.

Evidenced in the hourly observations on July 17th, seen in **Figure 94** and **Figure 95**, a significant spike in surface $PM_{2.5}$ concentrations was measured as the height of the planetary boundary layer increased with morning heating. Between 9:00 am and noon, fine particulate levels elevated rapidly at both sites, a clear indication of elevated smoke aloft mixing to the surface. $PM_{2.5}$ values continued to gradually increase on July 17th, eventually reaching the Code Red range for hourly concentrations at both the Remount and Lexington $PM_{2.5}$ monitors. Once the smoke-laden air mass was deposited into the state, hourly concentrations remain elevated for much of July 17th through July 18th, as evidenced in **Figure 96** through **Figure 103**.

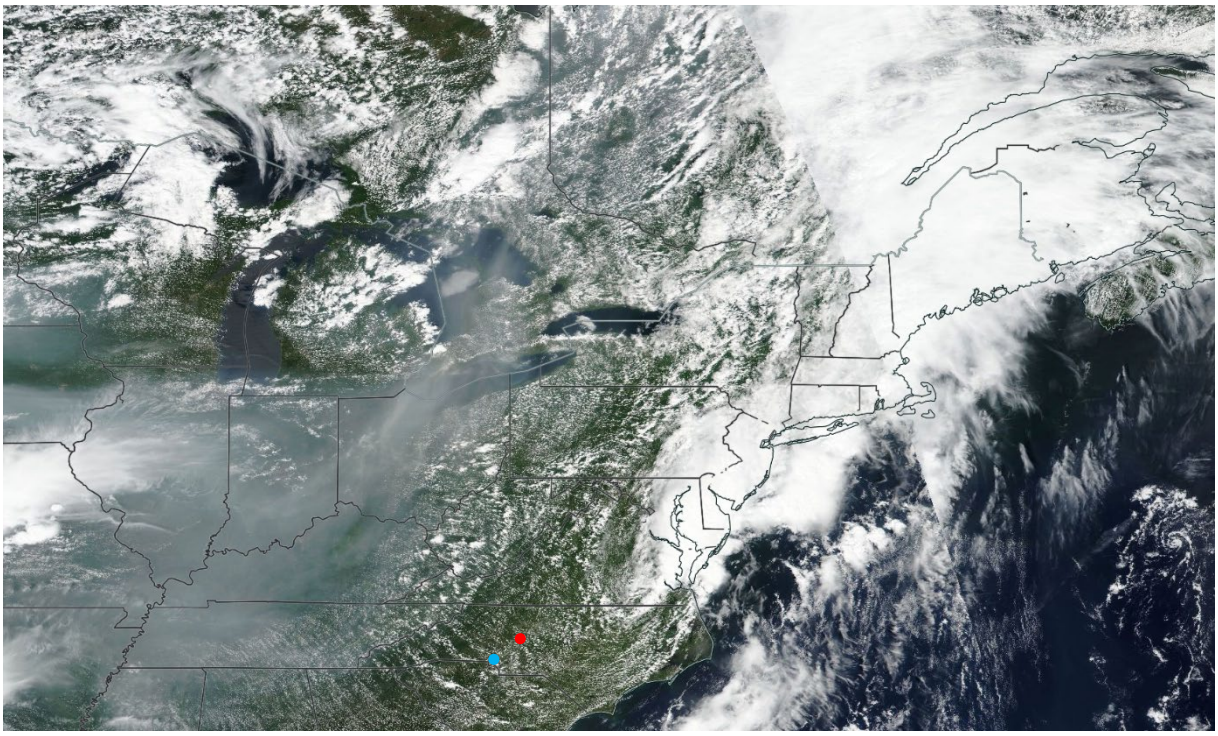


***Figure 93**: Visible satellite imagery reveals heavy smoke across the Ohio and Tennessee Valleys on July 16th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

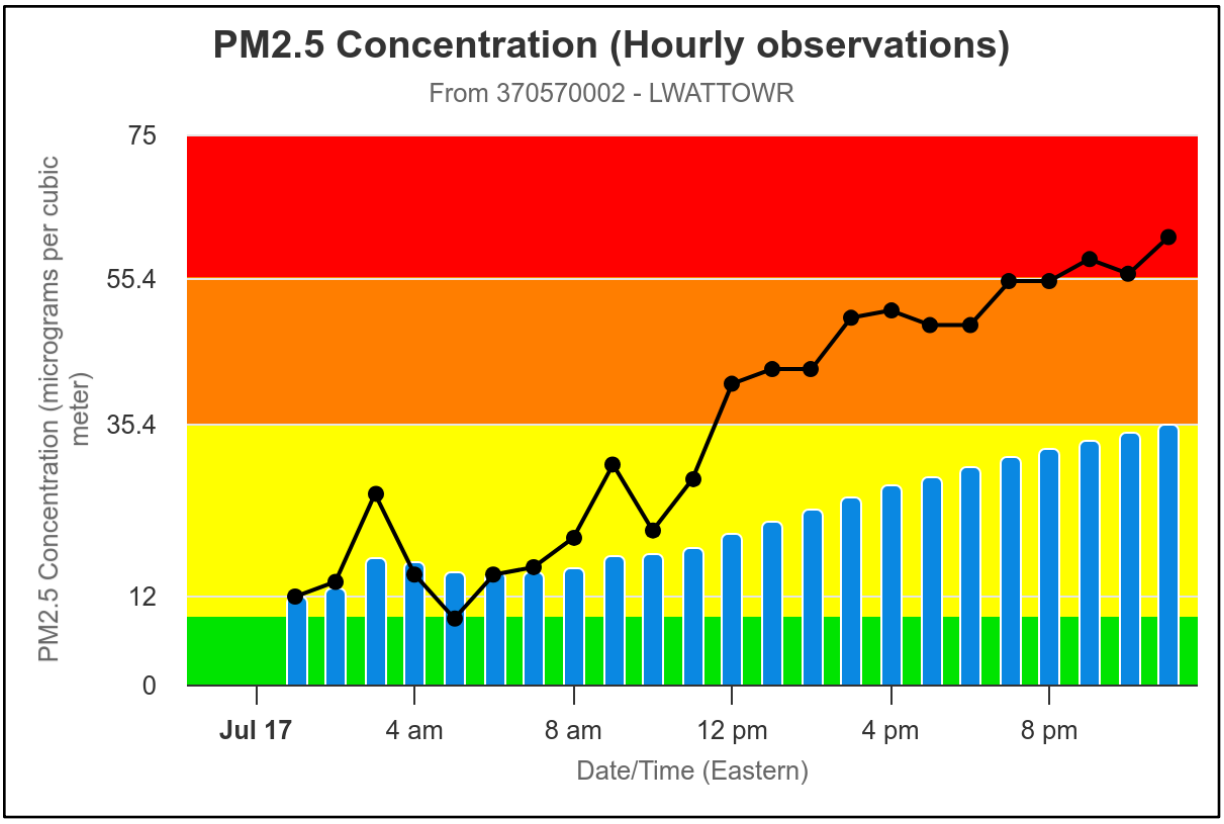


***Figure 94**: Hourly $PM_{2.5}$ observations (black line and dots) valid July 17th, 2023 at the Lexington Water Tower*

monitor. The blue bars represent the rolling daily average of hourly $PM_{2.5}$ observations up to and including the specific hour. The y-axis numerical labels and chart shading are the 24-hour average concentration breakpoints and color categories associated with the Air Quality Index (AQI).

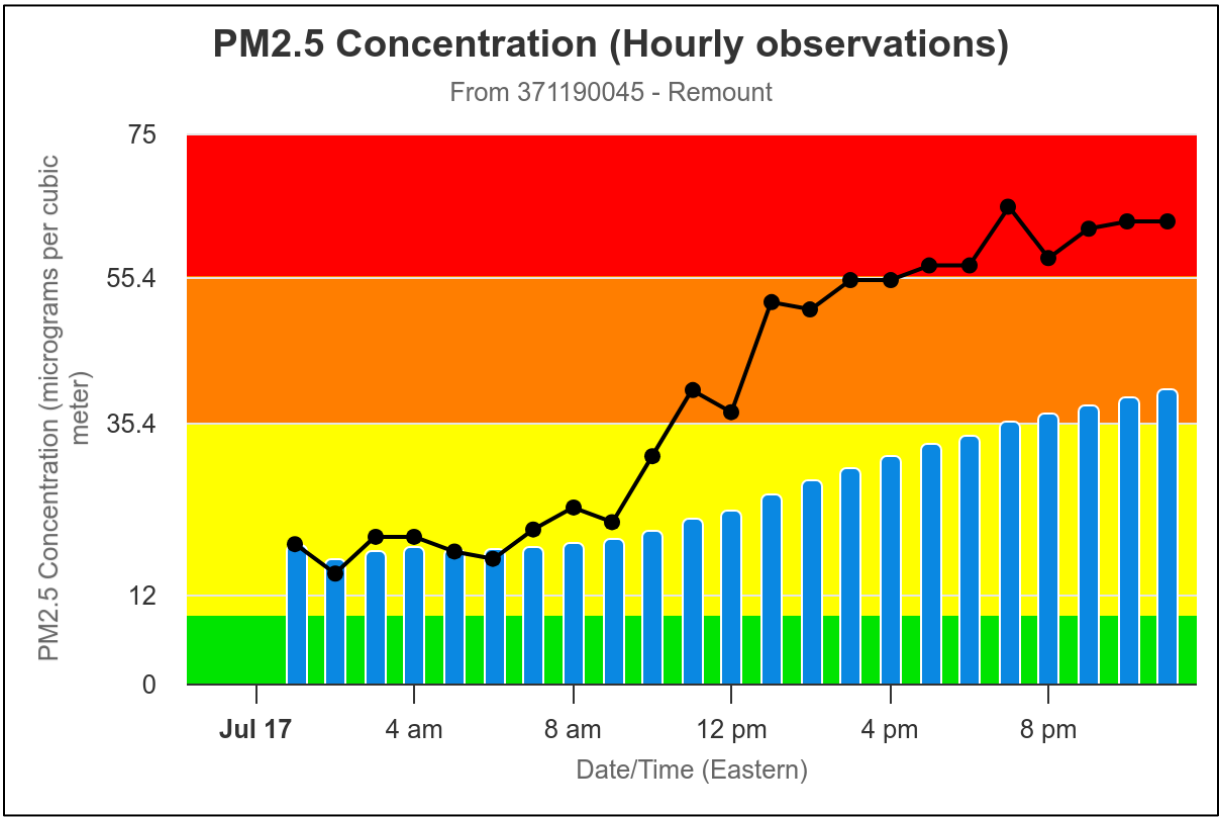


***Figure 95**: Hourly $PM_{2.5}$ observations (black line and dots) valid July 17th, 2023 at the Remount Road monitor. The blue bars represent the rolling daily average of hourly $PM_{2.5}$ observations up to and including the specific hour. The y-axis numerical labels and chart shading are the 24-hour average concentration breakpoints and color categories associated with the Air Quality Index (AQI).*

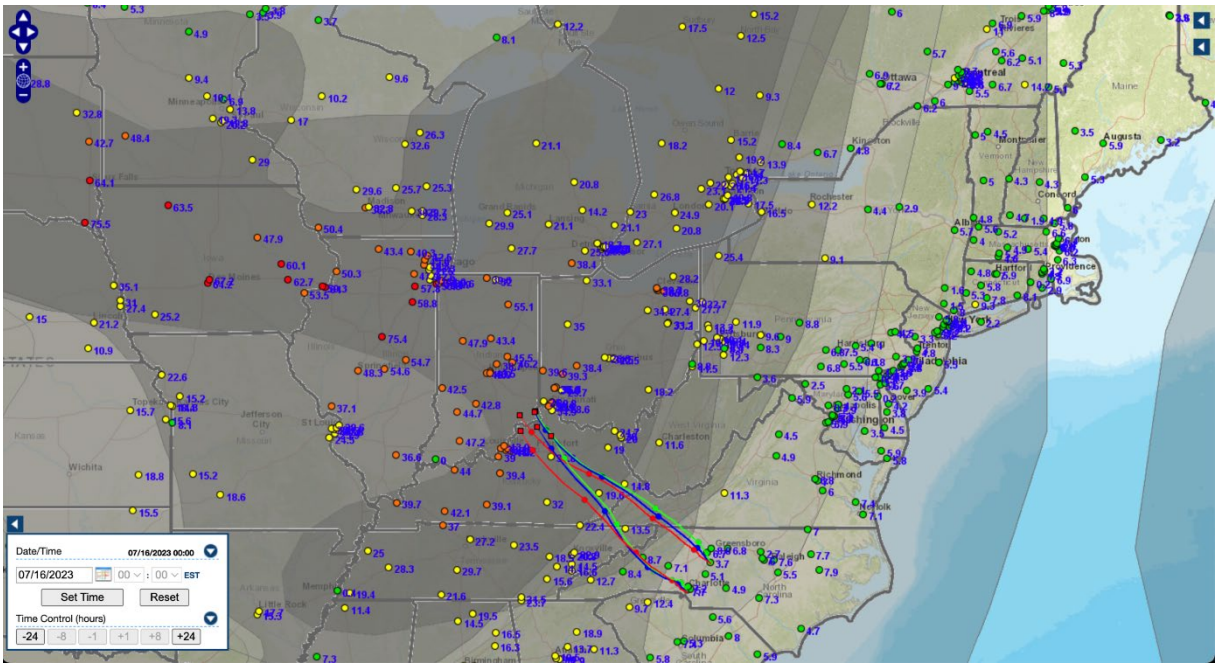


***Figure 96**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **July 16th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **July 17th, 2023**. Red squares indicate air parcel location along back trajectory path on **July 16th, 2023**.*

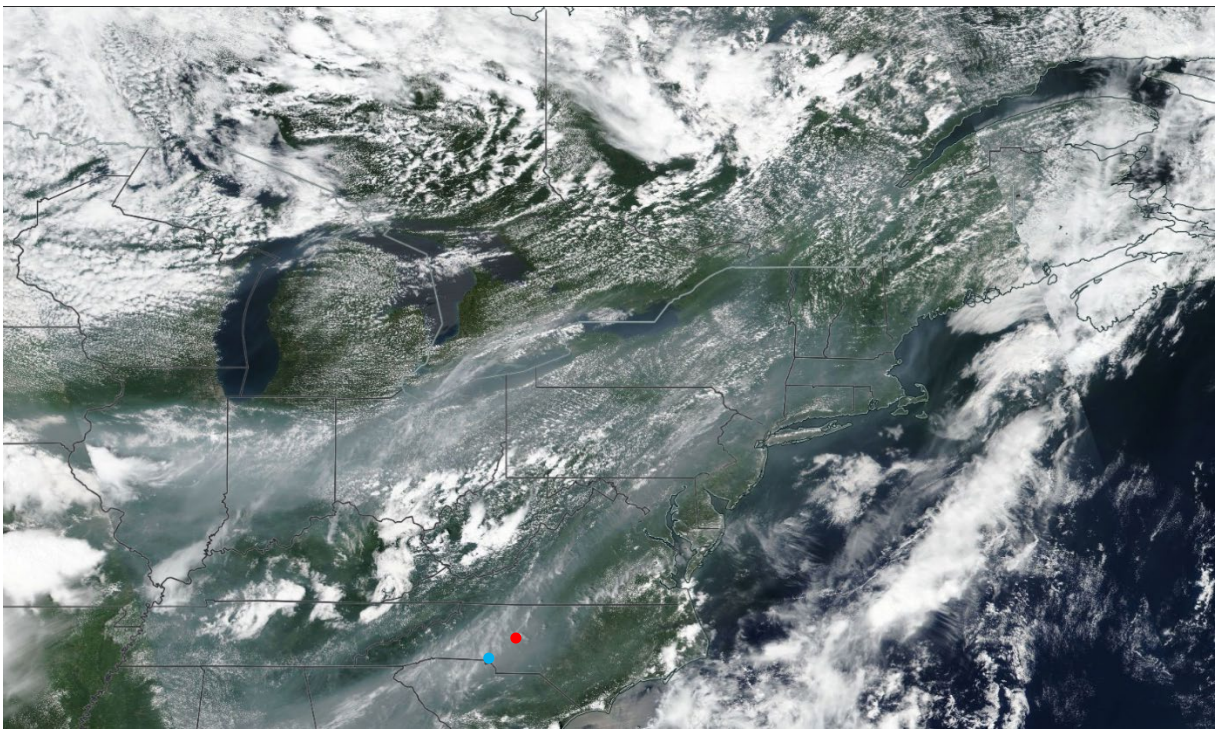


***Figure 97**: Visible satellite imagery reveals heavy smoke across the eastern U.S., including North Carolina, on July 17th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

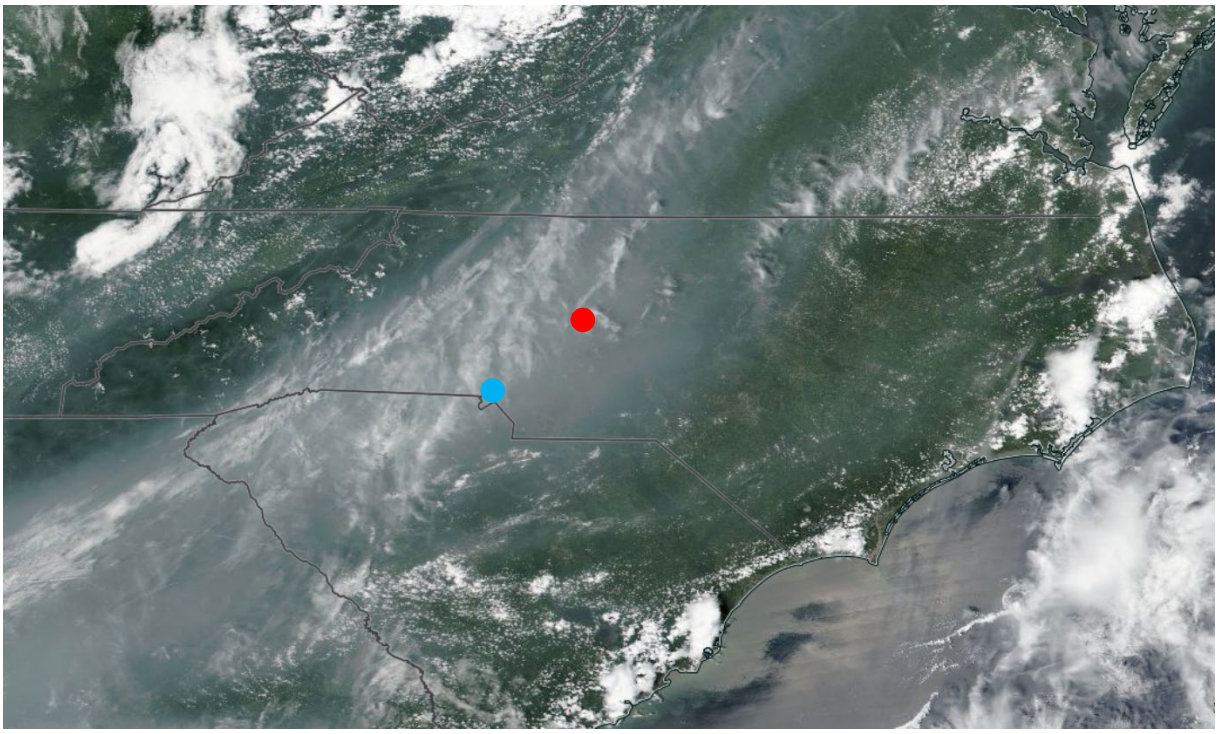


***Figure 98**: Visible satellite imagery reveals heavy smoke across the southeastern U.S., including North Carolina, on July 17th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

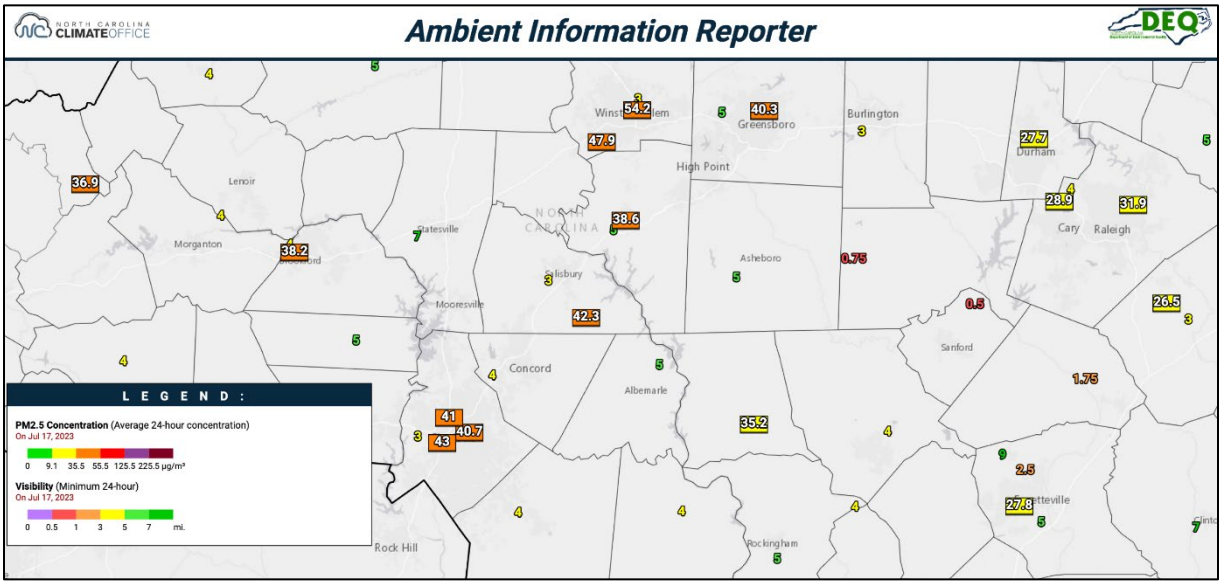


***Figure 99**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on July 17th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

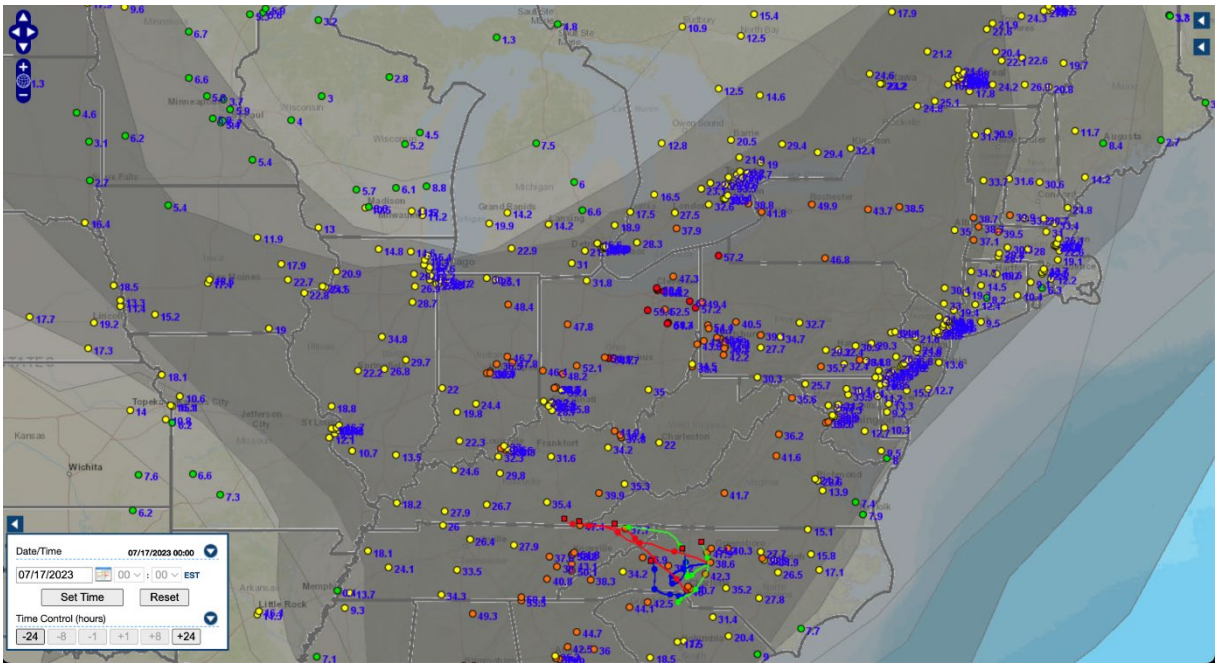


***Figure 100**: 24-hr. avg. $PM_{2.5}$ concentrations valid on **July 17th, 2023**, NOAA OSPO satellite-derived smoke analysis and 24-hr. backward trajectories at 100 m (green line), 750 m (blue line) and 1500 m (red line) ending on **July 18th, 2023**. Red squares indicate air parcel location along back trajectory path on **July 17th, 2023**.*

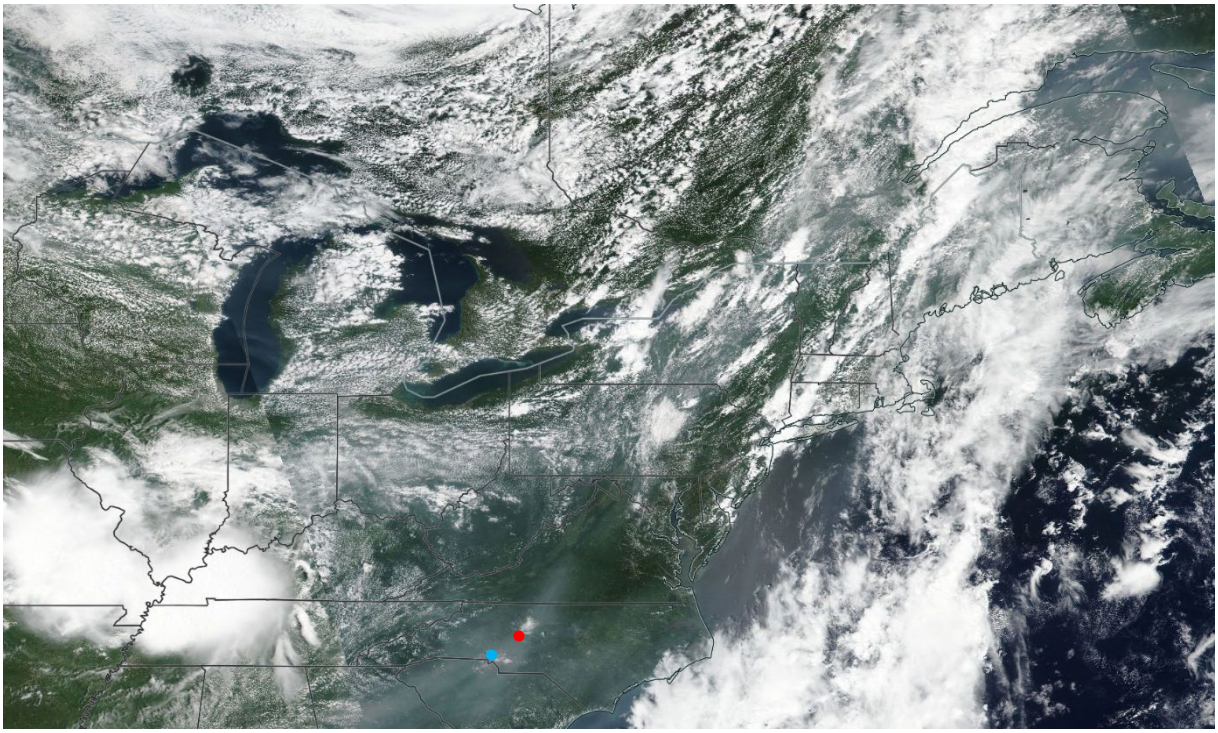


***Figure 101**: Visible satellite imagery reveals heavy smoke across the eastern U.S., including North Carolina, on July 18th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

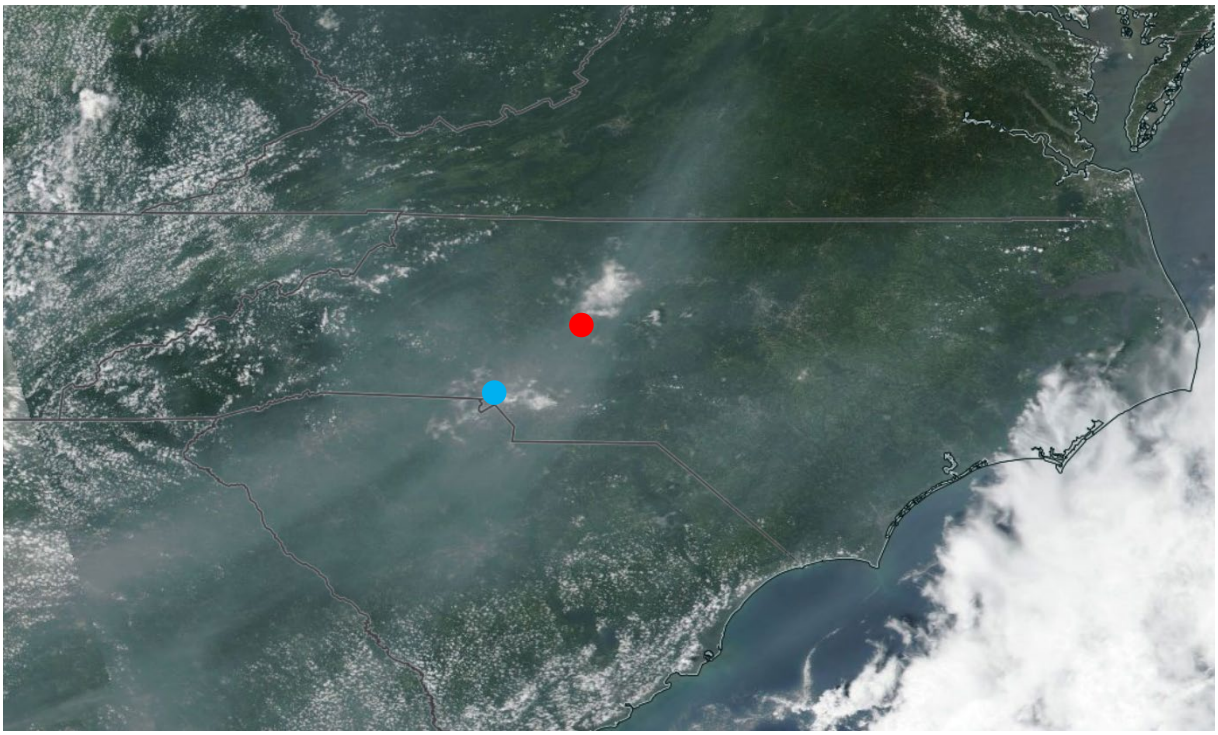


***Figure 102**: Visible satellite imagery reveals heavy smoke across the southeastern U.S., including North Carolina, on July 18th, 2023. The red and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

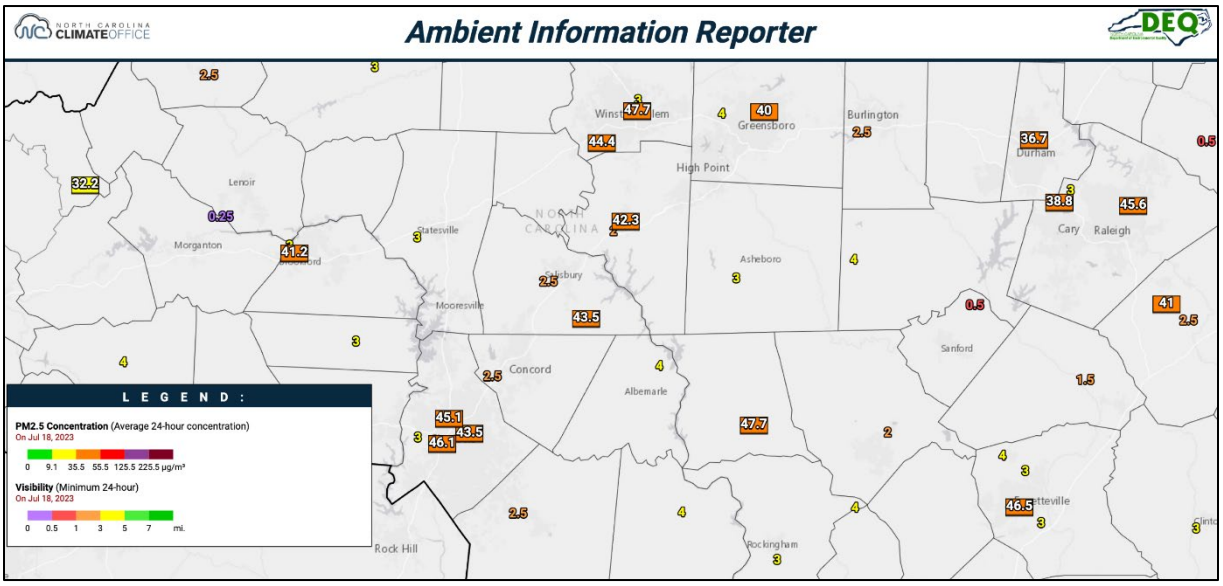


***Figure 103**: 24-hr. avg. $PM_{2.5}$ concentrations and minimum 24-hr. visibility from airport observing sites on July 18th, 2023. Minimum visibility can be used as a proxy for additional air quality monitors and when values fall below the standard 10 statue mile range, it is an indicator of an obscuration (such as smoke, dust, haze, etc.).*

3.2 Event-Influenced $PM_{2.5}$ Concentrations Analysis

As we demonstrated in Section II. Narrative Conceptual Model, the dominant atmospheric regime in June and July 2023 resulted in unusually strong and recurrent transport of Canadian air masses into

North Carolina. It is only logical to conclude that a clear causal relationship exists between those air masses -- originating from a region experiencing an unprecedented, record-shattering wildfire season -- and concurrent $PM_{2.5}$ exceedances of the daily NAAQS observed from Minnesota to Maine to Florida, including North Carolina's ambient monitoring network, that were well-above climatological normal measurements.

As seen below in **Figure 104** and **Figure 105**, both the Lexington Water Tower (Lexington) and Remount Road (Remount) $PM_{2.5}$ monitors measured concentrations on each day that are part of one of the four events in our exceptional event demonstration that were well-above the climatological normal value. Here, we define the climatological normal value as the daily average $PM_{2.5}$ concentration over the previous 5-year period (2018-2022) on the given date (i.e., the past 5 June 6ths, the past 5 June 7ths, etc.).

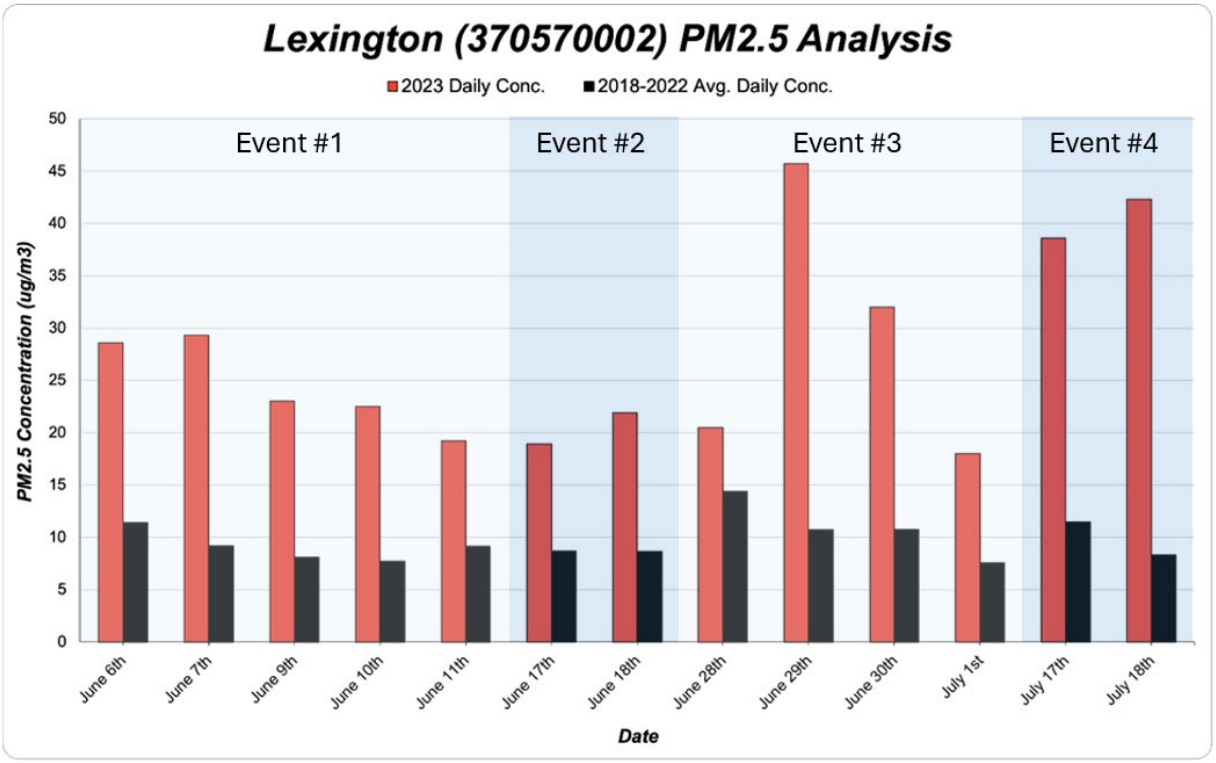


***Figure 104**: Comparison of 2023 Canadian wildfire-influenced event day measurements to historical normal at the Lexington Water Tower monitor.*

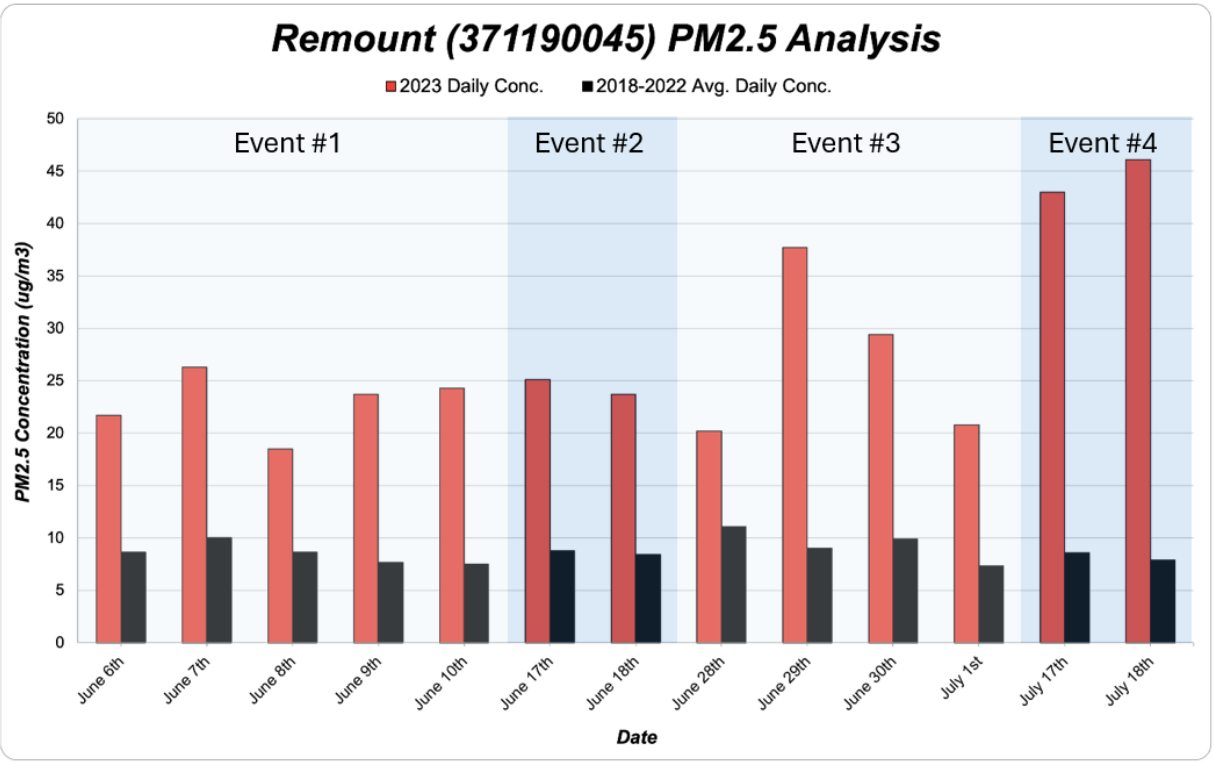


***Figure 105**: Comparison of 2023 Canadian wildfire-influenced event day measurements to historical normal at the Remount Road monitor.*

Continuing to focus on the daily climatological normal, as seen in **Table 7** and **Table 8** below, the percent increases on almost all of our proposed exceptional event days at both sites were over 100%, except for June 28th when smoke began to move into the region during the late evening. Additionally, all days in our demonstration were either Tier 1 or Tier 2 level days using the EPA's tiering tool as seen in Appendix K: Monitoring Sites' Tiering Graphs**.**

***Table 7**: $PM_{2.5}$ daily analysis of Canadian wildfire-influenced events at Remount Road monitor.*

Remount (371190045)							
Event ID	**Date**	**2023 Daily Conc. (µg/m³)**	**2018-2022 Avg. Daily Conc. (Climatological Normal)**	**Percent Increase from Climatological Normal**	**EPA Tier Level / Threshold (µg/m³)**		**AQS Data Flag(s)**
1	June 6th	21.7	8.6	151.2 %	Tier 2	16.3	RF
	June 7th	26.3	10.0	162.5 %	Tier 1	24.45	RF
	June 8th	18.5	8.7	113.6 %	Tier 2	16.3	RF
	June 9th	23.7	7.7	208.6 %	Tier 2	16.3	RF
	June 10th	24.3	7.5	224.0 %	Tier 2	16.3	RF
2	June 17th	25.1	8.8	185.9 %	Tier 1	24.45	4, RF, 2, 6
	June 18th	23.7	8.4	181.5 %	Tier 2	16.3	RF
3	June 28th	20.2	11.1	82.3 %	Tier 2	16.3	RF
	June 29th	37.7	9.0	318.9 %	Tier 1	24.45	4, RF, 2, 6
	June 30th	29.4	9.9	197.0 %	Tier 1	24.45	RF
	July 1st	20.8	7.3	183.4 %	Tier 2	16.3	RF

Remount (371190045)							
Event ID	Date	2023 Daily Conc. (µg/m³)	2018-2022 Avg. Daily Conc. (Climatological Normal)	Percent Increase from Climatological Normal	EPA Tier Level / Threshold (µg/m³)		AQS Data Flag(s)
4	July 17th	43	8.6	401.5 %	Tier 1	24.45	RF
	July 18th	46.1	7.9	483.5 %	Tier 1	24.45	RF

***Table 8**: $PM_{2.5}$ daily analysis of Canadian wildfire-influenced events at Lexington Water Tower monitor.*

Lexington (370570002)							
Event ID	Date	2023 Daily Conc.	2018-2022 Avg. Daily Conc. (Climatological Normal)	Percent Increase from Climatological Normal	EPA Tier Level / Threshold (µg/m³)		AQS Data Flag(s)
1	June 6th	28.6	11.4	150.9 %	Tier 1	25.35	RF
	June 7th	29.3	9.2	219.3 %	Tier 1	25.35	RF
	June 9th	23	8.1	184.0 %	Tier 2	16.9	RF
	June 10th	22.5	7.7	192.2 %	Tier 2	16.9	RF
	June 11th	19.2	9.1	110.4 %	Tier 2	16.9	2, 4, 6, RF
2	June 17th	18.9	8.7	117.9 %	Tier 2	16.9	2, 4, 6, RF
	June 18th	21.9	8.7	153.2 %	Tier 2	16.9	RF
3	June 28th	20.5	14.4	42.4 %	Tier 2	16.9	RF
	June 29th	45.7	10.7	326.3 %	Tier 1	25.35	2, 4, 6, RF
	June 30th	32	10.8	197.4 %	Tier 1	25.35	RF
	July 1st	18	7.6	137.5 %	Tier 2	17.8	RF
4	July 17th	38.6	11.5	236.8 %	Tier 1	26.7	2, 4, 6, RF
	July 18th	42.3	8.3	408.4 %	Tier 1	26.7	RF

This data provides evidence of a clear causal relationship between the atypical concentrations recorded at both Remount Road and Lexington Water Tower during the four events we have identified -- that significantly contributed to the 2021-2023 design values exceeding the new NAAQS -- and the Canadian wildfire smoke-laden air masses that concomitantly advected into the region during June and July 2023.

Section IV. Not Reasonably Controllable or Preventable

This section satisfies the following federal requirement:

40 CFR § 50.14(c)(3)(iv)(D): A demonstration that the event was both not reasonably controllable and not reasonably preventable.

40 CFR § 50.14 (a)(8)(vii) provides that "*the Administrator shall not require a State to provide case-specific justification to support the not reasonably controllable or preventable criterion for emissions-generating activity that occurs outside of the State's jurisdictional boundaries within which the concentration at issue was monitored.*" This was the case with the 2023 Canadian wildfires. No federal or North Carolina policy or regulatory action could have prevented the fires or the resulting smoke to cross international borders and enter the United States or North Carolina.

Further, 40 CFR § 50.14(b)(4) states that "*the Administrator will determine every wildfire occurring predominantly on wildland to have met the requirements identified in paragraph (c)(3)(iv)(D) of this section regarding the not reasonably controllable or preventable criterion.*" In the next section, Section V. Human Activity Unlikely to Recur at a Particular Location or Natural Event, NCDAQ asserts that the Canadian wildfires did occur predominantly on wildland.

Therefore, it is NCDAQ's conclusion that emissions from these wildfires were not reasonably controllable or preventable and they meet this criterion for treatment as an exceptional event.

Section V. Human Activity Unlikely to Recur at a Particular Location or Natural Event

This section satisfies the following federal requirement:

40 CFR § 50.14(c)(3)(iv)(E): A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event.

40 CFR § 50.1(n) defines a wildfire as "*any fire started by an unplanned ignition caused by lightning; volcanoes; other acts of nature; unauthorized activity; or accidental, human-caused actions, or a prescribed fire that has developed into a wildfire.* ***A wildfire that predominantly occurs on wildland is a natural event***."

40 CFR § 50.1(o) defines wildland as "*an area in which human activity and development are essentially non-existent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.*"

As detailed earlier in Section II. Narrative Conceptual Model, anomalous drought and heat set the stage in Canada for a prolific wildfire season by enhancing the flammability of fuel such as trees, underbrush, and grass. Lightning strikes from thunderstorm activity ignited that dry fuel, accounting for 59% of the wildfire ignitions during the 2023 season.[32] In terms of total area burned, lightning-caused wildfires accounted for 93% of the total acreage burned across Canada.[30]

Many of these wildfires burned in remote areas within Canada's enormous boreal forest on rugged terrain. This is supported by **Figure 106** which shows the active fires burning in Canada in early June overlayed with OpenStreetMap data via Natural Resources Canada. The green space, as denoted by the OpenStreetMap legend, is predominantly forest; Canada is the third-most forested country in the world and its boreal zone is the largest remaining intact forest on Earth.[33] Much of these areas can be considered wildland where little human activity and development exist.

"People around the world probably don't really comprehend just the scale of the forested area that we have," said Richard Carr, a physical scientist and fire research analyst with the Canadian Forest Service in Edmonton, "You can get into the northern parts of the provinces and the territories and there's places where you could drive for several hours without running across a town — just huge expanses of forest with not many people there. So trying to put a fire out in that takes a lot of time to get people and equipment into those areas, if it's even necessary." [31]

[32] Jain, P., Barber, Q.E., Taylor, S.W. *et al.* Drivers and Impacts of the Record-Breaking 2023 Wildfire Season in Canada. *Nat Commun* **15**, 6764 (2024). https://doi.org/10.1038/s41467-024-51154-7

[33] https://www.usatoday.com/story/news/nation/2024/07/20/canada-wildfires-smoke-united-states-michigan-climate-change/74479512007/

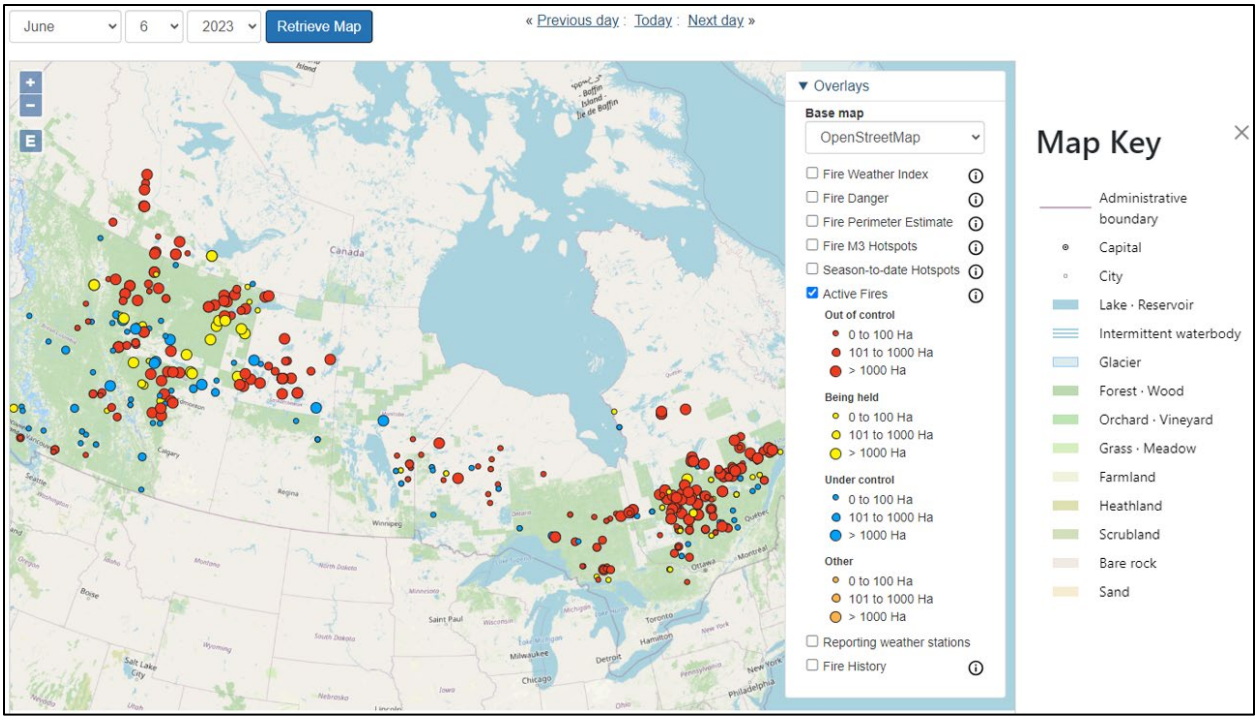


***Figure 106**: Active wildfires in early June 2023 via [Natural Resources Canada](#)[34] overlayed with land type data from OpenStreetMap.*

The 2023 Canadian wildfires qualify as a "natural event" because they were unplanned, mostly lightning-ignited fires predominantly on wildland, and for this reason NCDAQ has concluded that emissions from these wildfires meet this criterion for treatment as an exceptional event.

[34] CWFIS Interactive Map, https://cwfis.cfs.nrcan.gc.ca/interactive-map?zoom=1&center=248390.2717805435%2C570523.4527135696&month=6&day=6&year=2023#iMap

Section VI. Public Notification / Outreach

This section satisfies the following federal requirement:

40 CFR § 50.14(c)(1)(i): In accordance with the mitigation requirement at 40 CFR § 51.930(a)(1), all States and, where applicable, their political subdivisions must notify the public promptly whenever an event occurs or is reasonably anticipated to occur which may result in the exceedance of an applicable air quality standard.

The Exceptional Event Rule requires that the demonstration show that the public was notified promptly whenever an event occurs or is reasonably anticipated to occur which may result in the exceedance of an applicable air quality standard. This section documents the public outreach that was conducted before and during the 2023 Canadian wildfire smoke events that impacted air quality in North Carolina.

6.1 Overview

NCDAQ utilizes several mediums to relay air quality information to the public. This includes the Air Quality Portal (AQP)[35] and the Ambient Information Reporter Tool (AIR Tool)[36], two websites that were built from a collaborative effort between NCDAQ and the State Climate Office of North Carolina (NCSCO). The AQP is a comprehensive air quality information hub for North Carolina. The website provides the public with access to current, forecast, and historical air quality and weather information. In addition to this data, the website also provides educational resources and an air quality blog[37], which covers a wide range of air quality topics including analysis of specific air quality events that impacted the state such as the Canadian wildfire smoke episodes.

Current, forecast, and historical air quality data is available within the AQP through the AIR Tool. NCDAQ's team of meteorologists issue daily fine particulate and ground-level ozone air quality forecasts out four days (including the current day) for 91 of the state's 100 counties. The Forsyth County Office of Environmental Assistance and Protection issues a single regional forecast[38] for the nine counties in the Triad region. These forecasts are available within the AIR Tool and are also sent to and displayed on the EPA's AirNow mapping tool. Keyhole Markup Language (KML) files are also made available through the AQP for consumers to display air quality forecasts on their own platforms. Air quality alerts are also provided to the National Weather Service where they are disseminated through various channels to partners and the public.

NCDAQ operates social media accounts through which air quality information is shared to the public. It is also an active participant in the AirNow EnviroFlash notification system, which allows air quality forecasts and alerts to be sent through e-mail to subscribers. The Division also shares air quality information through media interviews and press releases.

[35] Air Quality Portal, https://airquality.climate.ncsu.edu/
[36] Ambient Information Reporter, https://airquality.climate.ncsu.edu/air/
[37] Air Quality Blog, https://airquality.climate.ncsu.edu/blog/
[38] Triad Air Quality Forecast, https://forsyth.cc/EAP/dailyforecast.aspx

Providing air quality information through several mediums allows it to be disseminated to a broader audience and for it to be consumed quicker, enabling more time for the public to make health-based decisions. This is especially important for events that are occurring, or will occur, that may exceed an applicable air quality standard.

For the multi-day events presented in this Exceptional Events Demonstration, NCDAQ utilized these tools and channels to bring awareness to the public regarding the wildfire smoke and associated poor air quality and health-risks.

6.1.1 Event ID #1 - June 6th through June 11th, 2023

The first event, spanning from June 6th to June 11th, included extensive efforts by NCDAQ to notify the public about poor air quality due to Canadian wildfire smoke. Examples of these efforts are provided in **Table 9**, which includes links to NCDAQ's forecasts, social media outreach and if applicable, press releases and media interviews.

Table 9*: For each day within Event #1, links are provided for the NCDAQ morning forecast as well as the previous afternoon forecast. Links to social media posts, press releases, and media interviews are also listed.*

Exceptional Event		Public Outreach				
ID	**Date**	**AQ Forecast (prev. afternoon)**	**AQ Forecast (morning)**	**Social Media**	**Press Release**	**Media Interview**
1	*6/6/2023*	Link	Link	Link	Link	-
	6/7/2023	Link	Link	Link	Link	Link Link Link
	6/8/2023	Link	Link	Link	Link	-
	6/9/2023	Link	Link	Link	-	-
	6/10/2023	Link	Link	Link	-	-
	6/11/2023	Link	Link	Link	-	-

NCDAQ began to notify the public on June 3rd about the potential for additional areas of wildfire smoke from Canadian wildfires to reach the state and impact air quality, three days prior to the first day in Event #1. The AQP afternoon forecast discussion on June 3rd [39] noted that *"Northerly upper level winds are likely to send additional areas of smoke from Canadian wildfires southward towards the region early next week"* and the initial forecast for June 6th reflected that concern with elevated 24-hour average fine particulates in the Code Yellow category. Subsequent forecast discussions leading up to June 6th included increasingly stronger verbiage around the wildfire smoke and impacts to air quality as confidence grew. On June 4th, [40] Code Orange levels for 24-hour average fine particulates were introduced into the forecast for June 7th across the northern half of the state, further underscoring that the wildfire smoke posed concerning health risks to the public. NCDAQ

[39] NCDAQ Forecast Discussion – June 3rd, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-06-03&time=pm
[40] NCDAQ Forecast Discussion – June 4th, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-06-04&time=pm

issued its first air quality alert[41] on June 6th for Code Orange air quality (**Figure 107**) for most of the state due to forecast elevated fine particulate matter from wildfire smoke.

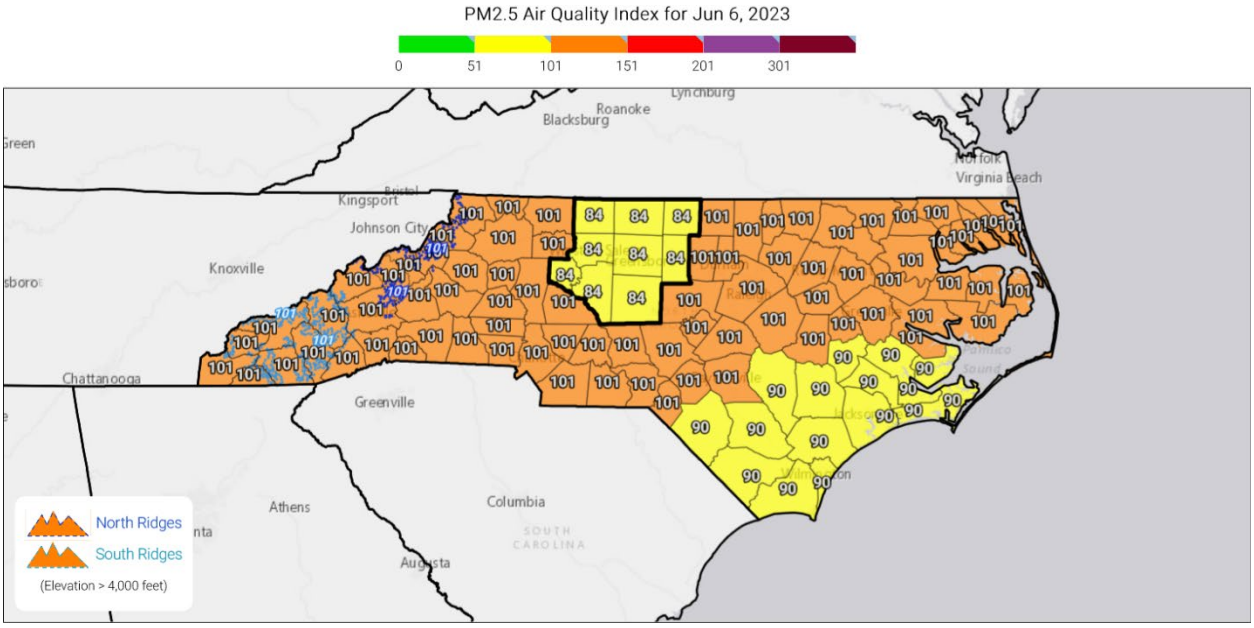


***Figure 107**: Code Orange air quality levels were forecast (as seen in the AQP) across much of the state on June 6th, prompting NCDAQ to issue its first Code Orange alert for Event #1.*

A Code Red air quality alert was issued for June 7th across much of the Piedmont and Code Orange was issued for the rest of the state, as seen in **Figure 110**. Code Orange alerts were issued daily for at least some portion of the state through June 9th due to elevated fine particulate matter.

To further put NCDAQ's public outreach efforts into perspective, web traffic to the AQP and associated webpages (**Figure 108** and **Figure 109**) substantially surpassed previous records. Over 160,000 pageviews occurred between June 5th and June 12th, with the majority of those happening between June 6th and June 8th (**Figure 108**). On June 7th, NCDAQ forecast discussions received over 5,000 views. This magnitude of viewership for NCDAQ's air quality forecasts was unprecedented.

[41] NCDAQ Forecast Discussion – June 6th, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-06-06&time=pm

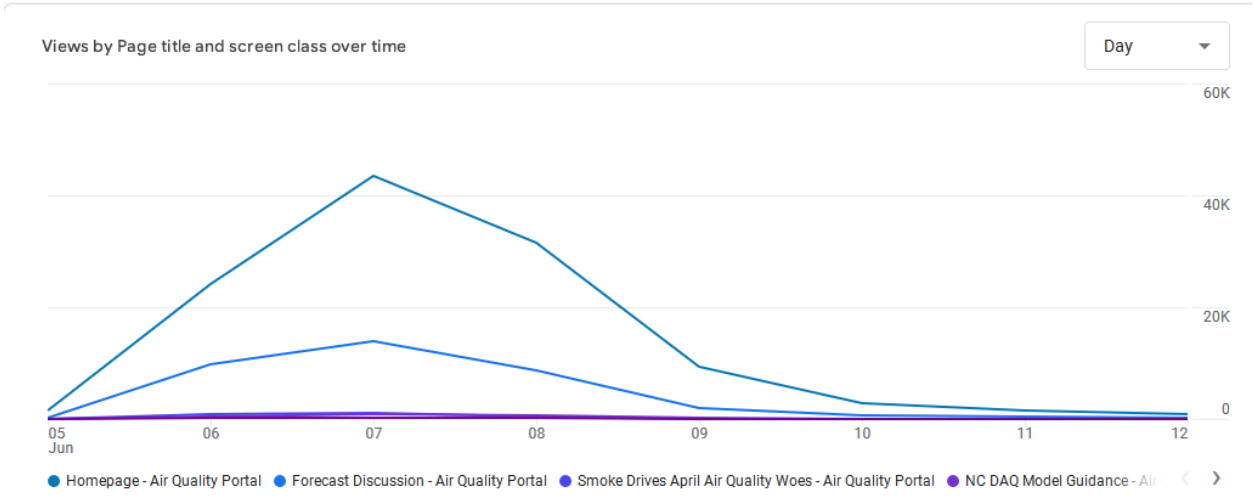


***Figure 108**: Daily pageviews for the AQP and associated webpages from June 5th to June 12th (Google Analytics).*

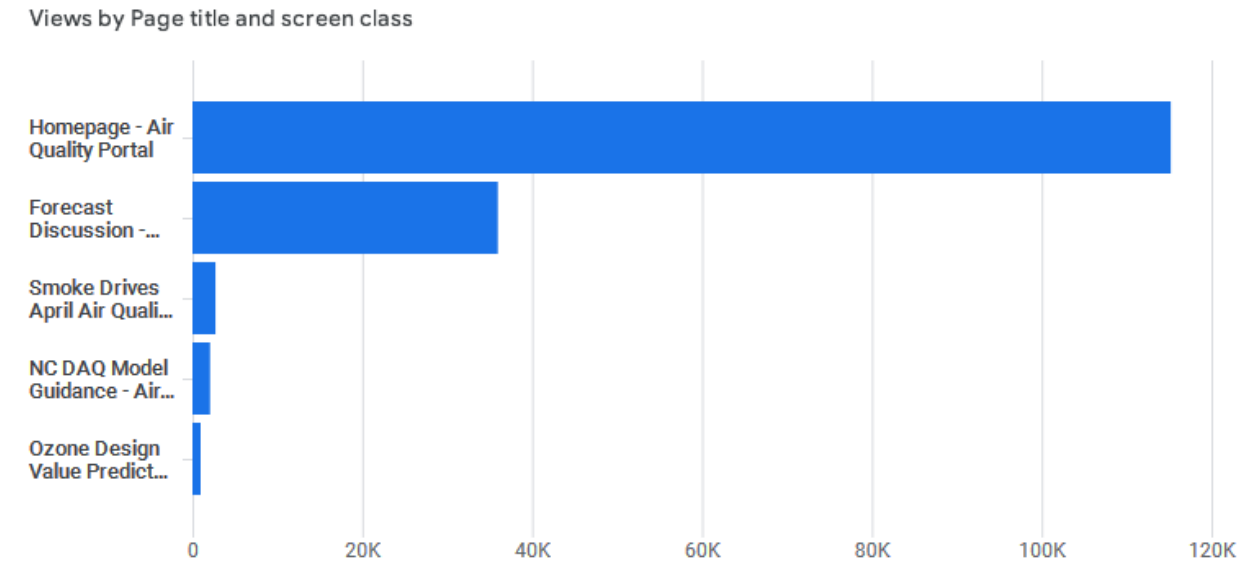
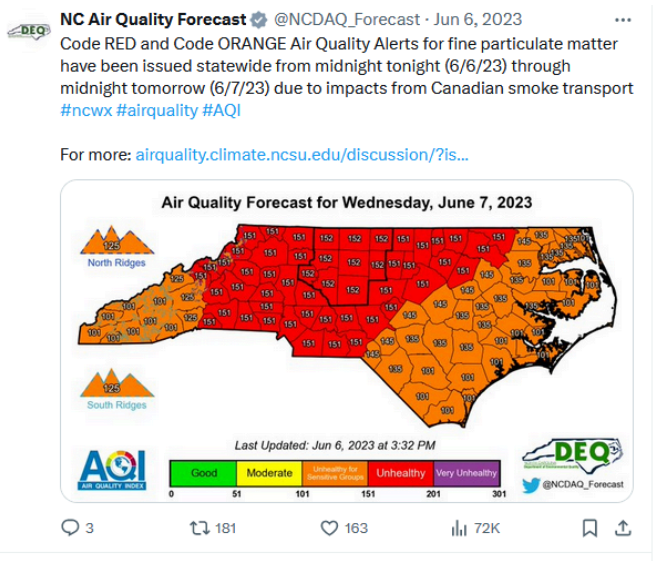


***Figure 109**: Individual AQP webpages and their total pageviews from June 5th to June 12th (Google Analytics).*

In addition to issuing forecasts in the AQP, NCDAQ was also active on social media. Every forecast issued was automatically posted to the NCDAQ X/Twitter account (**Figure 110**) and content was also posted on the Facebook account (**Figure 111**). Both platforms allowed followers to engage with and share the forecast information. This provided a great opportunity for staff at NCDAQ to answer any questions the public had regarding the forecast and to bring additional awareness on the concerning air quality and its impacts.



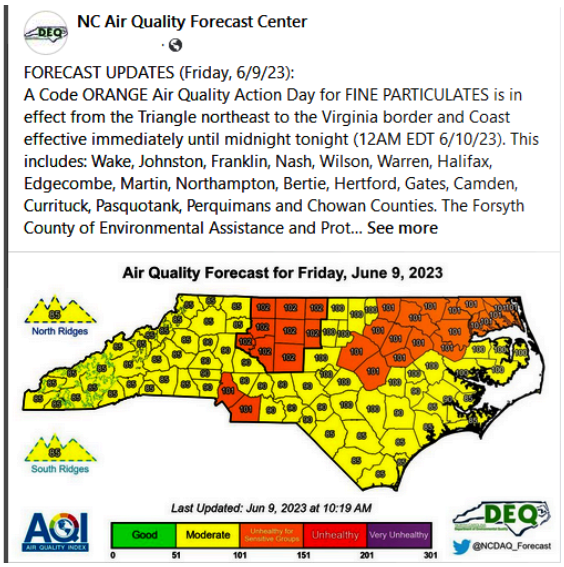


***Figure 110 (Left)**: NCDAQ June 7th forecast published on X/Twitter with over 72,000 impressions.*
***Figure 111 (Right):** NCDAQ June 9th forecast published on Facebook. NCDAQ utilized social media to bring more awareness to impacts of wildfire smoke on air quality across the state.*

Several press releases were issued by the NCDEQ between June 6th and June 8th, including one shown in **Figure 112**, and links to them are provided in **Table 9**. These gave additional notice to the public regarding the degraded air quality caused by the wildfire smoke and included detailed information on the impacts and ways for the public to take action to protect themselves. Spanish-translated versions were also made available to reach a larger audience.

***Figure 112**: Press releases were made available to the public to further draw attention to degraded air quality due to wildfire smoke.*

Staff within NCDAQ also participated in interviews with several television and newspaper outlets across the state. Soundbites and quotes from the staff were used within news coverage allowing NCDAQ to bring further awareness on the dangers that the wildfire smoke presented to the public's health.

6.1.2 Event ID #2 - June 17th through June 18th, 2023

The second event, spanning from June 17th to June 18th, was shorter than the first event. However, air quality was again degraded due to an intrusion of Canadian wildfire smoke and NCDAQ notified the public through several mediums. Examples of public outreach during this event are provided in **Table 10**, which includes links to NCDAQ's forecasts and social media posts.

***Table 10**: For each day within Event #2, links are provided for the NCDAQ morning forecast as well as the previous afternoon forecast. Links to social media posts, press releases, and media interviews are also listed.*

Exceptional Event		Public Outreach				
ID	**Date**	**AQ Forecast (prev. afternoon)**	**AQ Forecast (morning)**	**Social Media**	**Press Release**	**Media Interview**
2	*6/17/2023*	Link	Link	Link	-	-
	6/18/2023	Link	Link	Link	-	-

NCDAQ began to notify the public about the potential for wildfire smoke to impact air quality on June 14th, 3 days before the first day in Event #2. The AQP forecast discussion on June 14th [42]noted that "*Friday into Saturday, familiar north-northwesterly flow around familiar upper level low pressure to the north will likely drive renewed areas of smoke -- although not to the levels previously experienced last week -- into the region during this period. It appears likely that ozone and particle pollution levels will likely respond during the late week, and have slowly increased predicted values during this period.*"

Subsequent forecast discussions in the days leading up to and during the event also continued to mention elevated fine particulate matter due to Canadian wildfire smoke intrusions and the daily average fine particulate forecast was for at least Code Yellow conditions statewide for both days.

[42] NCDAQ Forecast Discussion – June 14th, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-06-14&time=pm

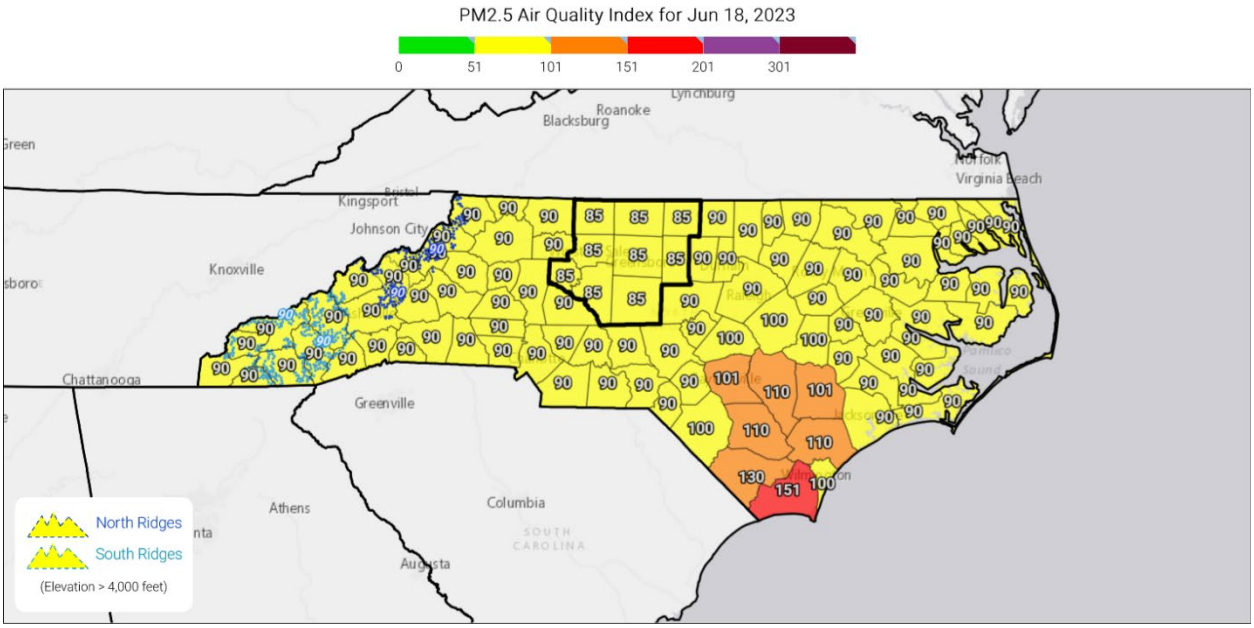


***Figure 113**: Upper Code Yellow air quality levels were forecast (as seen in the AQP on June 17th) across much of the state for the next day, June 18th due to an intrusion of Canadian wildfire smoke from the north and west. Code Orange and Red levels were forecast across the far southeastern portion of the state due to smoke from a localized wildfire.*

These forecasts were also posted to social media (X/Twitter) each day which provided another avenue for consumption by the public, bringing further awareness on the upcoming degraded air quality.

6.1.3 Event ID #3 - June 28th through July 1st, 2023

The third event lasted four days, spanning from June 28th to July 1st. Before and during the event, NCDAQ provided information to the public regarding the Canadian wildfire smoke and impacts to the air quality across the state. Examples of this public outreach are provided in **Table 11**, which includes links to NCDAQ's forecasts, social media outreach, and if applicable, press releases and media interviews.

***Table 11**: For each day within Event #3, links are provided for the NCDAQ morning forecast as well as the previous afternoon forecast Links to social media posts, press releases, and media interviews are also listed.*

Exceptional Event		Public Outreach				
ID	**Date**	**AQ Forecast (prev. afternoon)**	**AQ Forecast (morning)**	**Social Media**	**Press Release**	**Media Interview**
3	*6/28/2023*	Link	Link	Link	Link	-
	6/29/2023	Link	Link	Link	-	Link
	6/30/2023	Link	Link	Link	-	-
	7/1/2023	Link	Link	Link	-	-

Similar to the previous two events, NCDAQ first started discussing for the potential of degraded air quality due to Canadian wildfire smoke three days before the first day of Event #3. The forecast

discussion[43] from June 25th noted "*By Wednesday, current consensus of most smoke guidance is for another round of smoke-laden air to advect into the region.*" Based on this, the forecast for June 28th was for elevated daily average fine particulate matter in the Code Yellow range. NCDAQ continued to discuss and forecast the potential for wildfire smoke to impact the air quality across the state in the days leading up to the event. On June 27th, Code Orange for daily average fine particulate matter was introduced into the forecast[44] across much of the state for June 28th and June 29th. As a result, Code Orange alerts were issued for June 28th across a large section of the state.

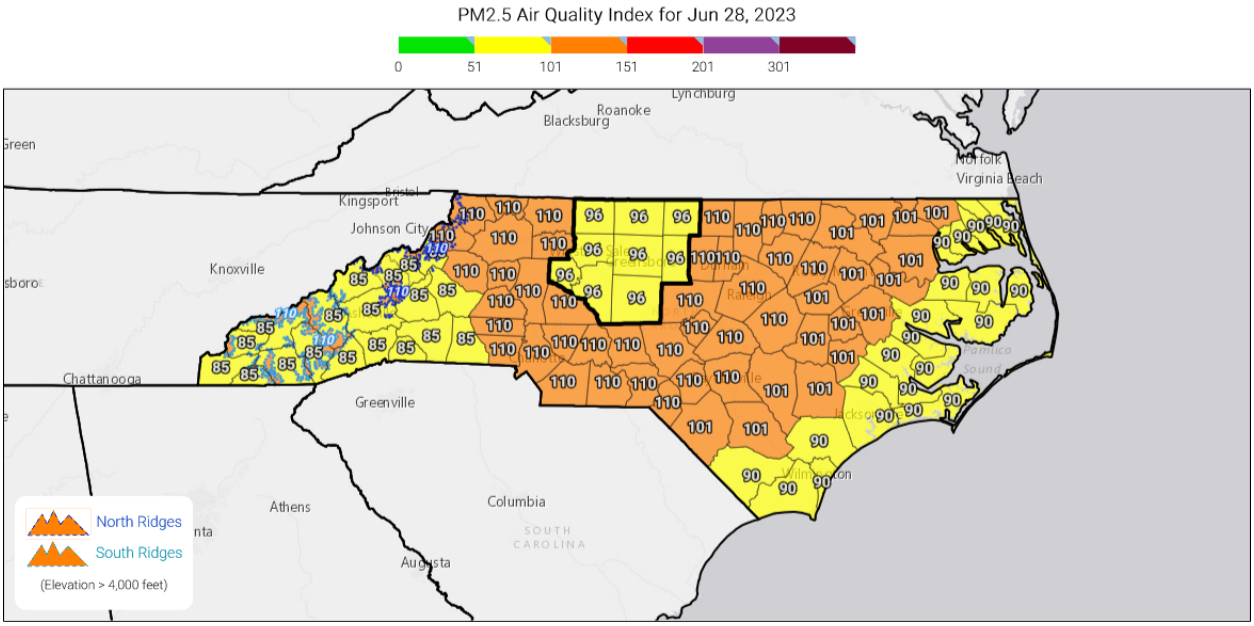


***Figure 114**: On June 27th, Code Orange daily average fine particulate levels were forecast for the next day (June 28th) due to Canadian wildfire smoke, prompting NCDAQ to issue Code Orange alerts.*

After analyzing observations, trends, and model data on the morning of June 29th, NCDAQ issued a Code Orange alert for fine particulates through midnight across the western two-thirds of the state. The forecast would be later upgraded to Code Red for the Triad region. With a stagnant airmass expected to remain in place, as noted in the forecast discussion, Code Orange alerts were issued again for June 30th across much of the interior. Daily average fine particulate levels were forecast to remain elevated for the days after, but gradually decreasing due to anticipated stormier weather and a wind shift. This continued to be the message in future forecasts towards the end of Event #3 and after, which informed the public on when better air quality would return. Between June 27th and July 2nd, the AQP and related webpages were viewed around 46,000 times, with the greatest viewership on June 29th.

To further bring awareness to the poor air quality impacting the state, NCDAQ posted forecasts on its social media channels (**Figure 115** and **Figure 116**), which included X/Twitter and Facebook. This allowed for the forecasts to be shared with a broader audience and enable the staff to communicate

[43] NCDAQ Forecast Discussion – June 25th, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-06-25&time=pm
[44] NCDAQ Forecast Discussion – June 27th, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-06-27&time=pm

with the pubic more directly and answer any questions.

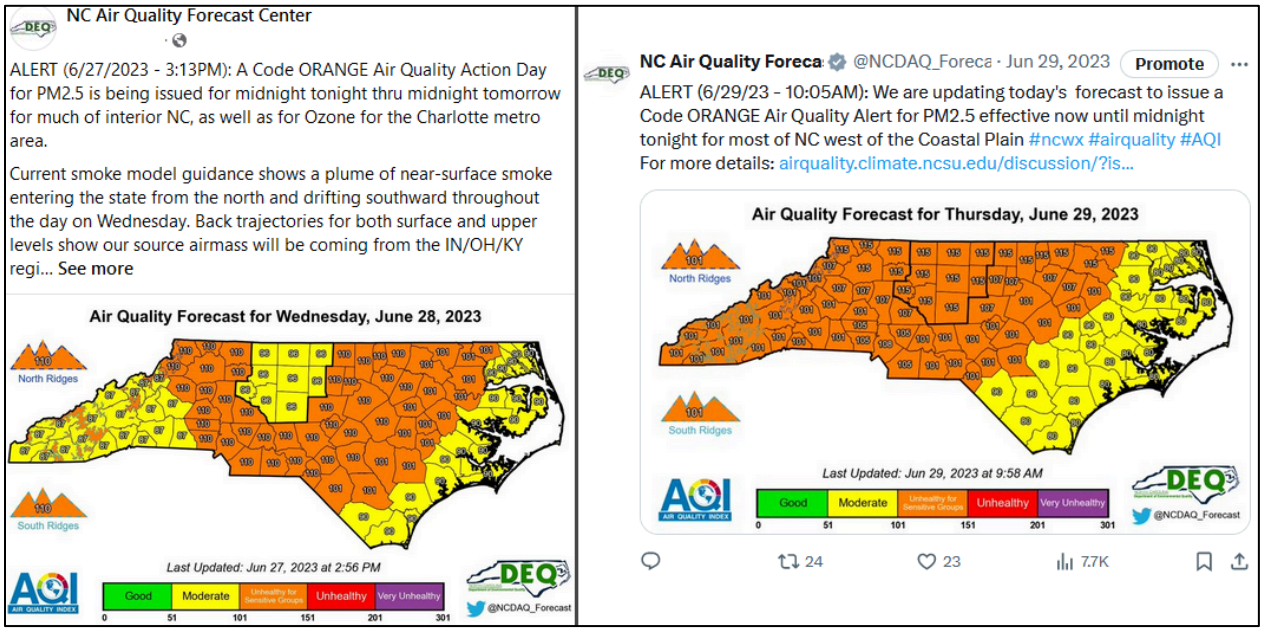


Figure 115 (Left): *NCDAQ alerted the public on Facebook that Code Orange alerts were being issued for June 28th.*

Figure 116 (Right)*: NCDAQ alerted the public on X/Twitter that the forecast for June 29th was being upgraded and Code Orange alerts were being issued.*

A press release (**Figure 117**) was also issued by the Department on June 28th detailing the unhealthy air quality that was probable across the state during the week. Links were provided to assist the public in learning more about the dangers of wildfire smoke and how they could take action to mitigate health impacts. Also included was a reminder about the prohibition of open burning during Code Orange Action days to lessen additional emission contributions. Staff at NCDAQ also spoke to local media across the state and were included in news articles.

Figure 117*: A press release was made available to the public on June 28th to further create awareness around the probable unhealthy air quality during the week.*

6.1.4 Event ID #4 – July 17th through July 18th, 2023

The fourth event, spanning from July 17th to July 18th, included extensive efforts of public outreach by NCDAQ regarding poor air quality due to Canadian wildfire smoke. Examples of these efforts are provided in **Table 12**, which includes links to NCDAQ's forecasts, social media outreach, and if applicable, press releases and media interviews.

***Table 12**: For each day within Event #4, links are provided for the NCDAQ morning forecast as well as the previous afternoon forecast. Links to social media posts, press releases, and media interviews are also listed.*

Exceptional Event		Public Outreach				
ID	**Date**	**AQ Forecast (prev. afternoon)**	**AQ Forecast (morning)**	**Social Media**	**Press Release**	**Media Interview**
4	*7/17/2023*	Link	Link	Link	Link	-
	7/18/2023	Link	Link	Link	-	Link

On July 14th, three days before the first day in Event #4, the NCDAQ forecast discussion[45] included concerns of potential wildfire smoke arriving by July 17th, noting *"smoke and meteorological guidance hints at the potential for more Canadian wildfire smoke intrusion into the mid-Atlantic region"*. The next day, concerns continued to grow that wildfire smoke was going to degrade air quality on July 17th so NCDAQ introduced Code Orange daily average fine particulate levels into the forecast[46] for the western third of the state. Most of this area was lowered to Code Yellow on July 16th, but at an Air Quality Index of 100, it was very close to the threshold of Code Orange (101). However, the Triad region's forecast[47] did remain at Code Orange. With smoke around and a favorable meteorological setup for a strong overnight inversion on July 18th, Code Orange was forecast for the western two-thirds of the state in the July 17th forecast product. Code Orange alerts for daily fine particulate matter were issued for this day. Between July 16th and July 19th, the AQP and related webpages were viewed around 25,000 times.

[45] NCDAQ Forecast Discussion – July 14th, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-07-14&time=pm
[46] NCDAQ Forecast Discussion – July 15th, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-07-15&time=pm
[47] NCDAQ Forecast Discussion – July 16th, 2023, https://airquality.climate.ncsu.edu/discussion/?view=past&date=2023-07-16&time=pm

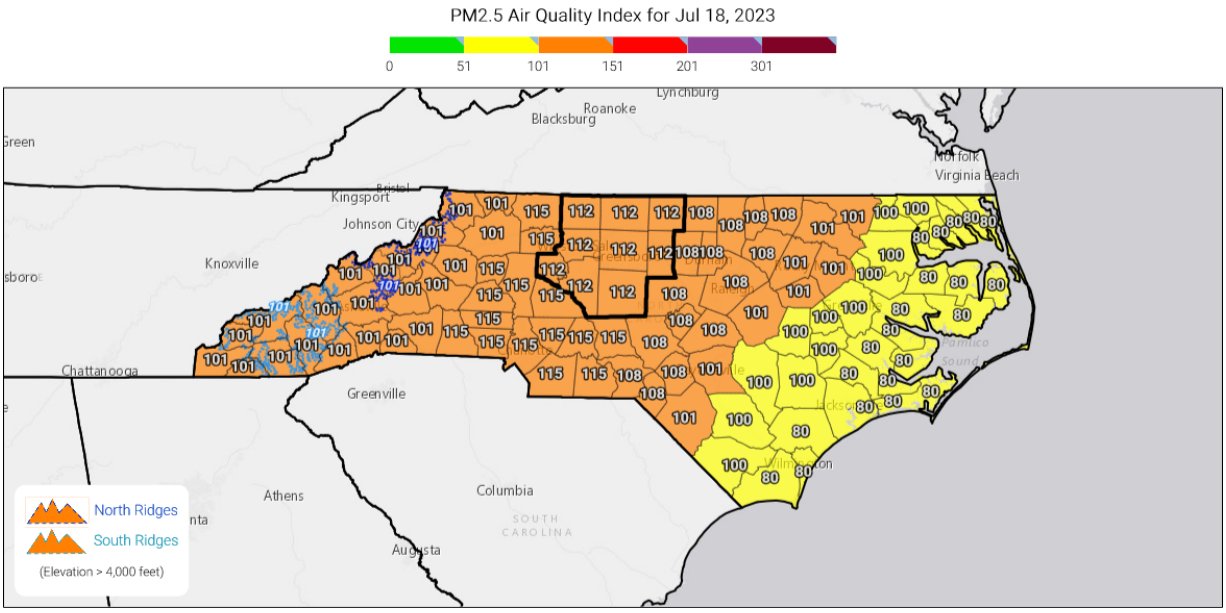


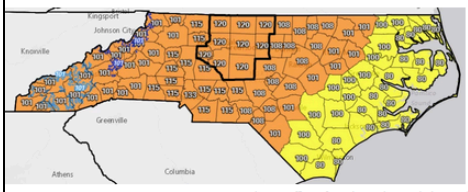
***Figure 118**: On July 17th, Code Orange daily average fine particulate levels were forecast for the next day (July 18th) due to Canadian wildfire smoke, prompting NCDAQ to issue Code Orange alerts.*

NCDAQ communicated these forecasts on social media through its X/Twitter and Facebook accounts and engaged with the public when they had questions. The Department also posted a press release about the unhealthy air quality which included links to resources for the public to stay safe. The staff also participated in interviews with local media (**Figure 119**), describing the forecast and educating the public on Code Orange Air Quality Action Days.

North Carolina's air quality keeps changing. Here's why.

WUNC | By Sophie Mallinson

Published July 18, 2023 at 6:27 PM EDT



State Climate Office Of North Carolina And The North Carolina Division Of Air Quality

A map of North Carolina counties, with Central and Western regions colored orange to indicate an air quality on July 18 that was unhealthy for some groups.

From moderate Code Yellow to hazardous Code Maroon alerts, the State Climate Office of North Carolina and state Division of Air Quality issue daily forecasts to tell residents when to limit time outdoors.

Shawn Taylor, a spokesperson for the NC Division of Air Quality, said smoke from the ongoing Canadian wildfires is worsening North Carolina's air quality by increasing the amount of fine particulate matter. That matter is made up of harmful microscopic particles smaller than the width of human hair.

According to Taylor, children, older adults and people with heart and lung conditions are more vulnerable to health concerns caused by such particles. That's why a Code Orange alert was issued Tuesday for most of North Carolina, cautioning those sensitive groups.

"Because the particles are so small, they can penetrate really deep in your lungs," Taylor said. "They can even get into your bloodstream, and that can be associated with a range of symptoms from an elevated heart rate, difficulty breathing, and other symptoms just associated with smoke: a burning sensation in your eyes or a runny nose."

To predict air quality, Taylor said meteorologists look to the Canadian wildfires for things like smoke generation and firefighting efforts, but an accurate local weather forecast can be crucial.

***Figure 119**: NCDAQ staff frequently participated in media interviews, such as this one with WUNC[48] on July 18th, before and during unhealthy air quality events caused by Canadian wildfire smoke. These provided another opportunity of public outreach to increase awareness around the smoke and impacts to air quality.*

[48] Mallinson, S. (2023, July 18). *North Carolina's air quality keeps changing. Here's why.* WUNC North Carolina Public Radio. Retrieved August 23, 2024, from https://www.wunc.org/environment/2023-07-18/north-carolinas-air-quality-keeps-changing-heres-why

Section VII. Initial Notification and Data Flagging

This section satisfies the following federal requirement:

40 CFR § 50.14(c)(2)(i): A State shall notify the Administrator of its intent to request exclusion of one or more measured exceedances of an applicable national ambient air quality standard as being due to an exceptional event by creating an initial event description and flagging the associated data that have been submitted to the AQS database and by engaging in the Initial Notification of Potential Exceptional Event process as follows:

> (A) The State and the appropriate EPA Regional office shall engage in regular communications to identify those data that have been potentially influenced by an exceptional event, to determine whether the identified data may affect a regulatory determination and to discuss whether the State should develop and submit an exceptional events demonstration according to the requirements in this section.

NCDAQ initiated communication with EPA Region 4 exceptional event staff via email on July 9th, 2024. The first virtual meeting with EPA staff was held on July 15th, 2024 during which the state of North Carolina's current status, analyses, and strategy for requesting data exclusion were shared and discussed. Communication via email and virtual meetings between these groups continued as needed throughout this initial process until a draft version of NCDAQ's initial notification letter was deemed sufficient by EPA Region 4 via email on September 6th, 2024.

On September 11th, 2024, NCDAQ submitted a letter to EPA Region 4 titled "*Initial Notification of Potential Exceptional Event Submission for the Revised Primary Annual $PM_{2.5}$ NAAQS,*" which is provided in Appendix L: Initial Notification Letter. This initial notification letter contains the specific dates and data listed in **Table 1** as well as a brief description of the anomalous conditions in Canada and large-scale weather patterns that caused each of the smoke intrusion events. The initial notification letter was submitted by email and online via the State Planning Electronic Collaboration System (SPeCS).

EPA Region 4 staff responded to the initial notification via email on November 1st, 2024 confirming that the initial notification meets the requirements of 40 CFR § 50.14(c)(2)(i) and it is appropriate for NCDAQ to submit a full demonstration.

All data listed in **Table 1** which NCDAQ is requesting be excluded from regulatory decisions has been flagged in the AQS system with the *Request Exclusion: Fire – Canadian* ("*RF*") flag.

Section VIII. Public Comments

This section satisfies the following federal requirements:

40 CFR § 50.14(c)(3)(v)(A): Document that the State followed the public comment process and that the comment period was open for a minimum of 30 days, which could be concurrent with the beginning of the Administrator's initial review period of the associated demonstration provided the State can meet all requirements in this paragraph

40 CFR § 50.14(c)(3)(v)(B): Submit the public comments it received along with its demonstration to the Administrator.

40 CFR § 50.14(c)(3)(v)(C): Address in the submission to the Administrator those comments disputing or contradicting factual evidence provided in the demonstration.

8.1 Public Comment Period

NCDAQ will post notice of this exceptional events demonstration on November 20, 2024 on NCDAQ's website for a comment period of 30 days.

8.2 Public Comments Received

Comments received from the public will be listed in this section at the conclusion of the public comment period.

8.3 Resolution of Public Comments

In this section, NCDAQ will address the public comments that dispute or contradict the information provided in this demonstration.

Appendix A: AMP 350 Reports

Air Quality System Raw Data Reports (AMP 350) that show the data that NCDAQ is requesting to be excluded from regulatory decisions has been flagged with *Request Exclusion: Fire - Canadian*, or "*RF*".

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

User ID: JPOPE

RAW DATA REPORT

Report Request ID: 2232968 Report Code: AMP350 Oct. 17, 2024

GEOGRAPHIC SELECTIONS

Tribal Code	State	County	Site	Parameter	POC	City	AQCR	UAR	CBSA	CSA	EPA Region
	37	119	0045								
	37	057	0002								

PROTOCOL SELECTIONS

Parameter Classification	Parameter	Method	Duration
CRITERIA	88101		

SELECTED OPTIONS

Option Type	Option Value
INCLUDE NULLS	YES
DAILY STATISTICS	MAXIMUM
UNITS	STANDARD
RAW DATA EVENTS	INCLUDE EVENTS
MERGE PDF FILES	YES
AGENCY ROLE	PQAO

SORT ORDER

Order	Column
1	STATE_CODE
2	COUNTY_CODE
3	SITE_ID
4	PARAMETER_CODE
5	POC

DATE CRITERIA

Start Date	End Date
2023 06 06	2023 06 11

APPLICABLE STANDARDS

Standard Description
PM25 Annual 2024

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 1
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (145) R & P Model 2025 PM-2.5 Sequential
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: 2023

DURATION: 24 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 2

MONTH

Day	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11						18.3 rf						
12												
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28												
29												
30												
31												
NO.:	0	0	0	0	0	1	0	0	0	0	0	0
MAX:						18.3						
MEAN:						18.30						

ANNUAL OBSERVATIONS: 1 ANNUAL MEAN: 18.30 ANNUAL MAX: 18.3

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 3
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2.4

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (170) Met One BAM-1020 Mass Monitor w/VS
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: JUNE 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1																									0	
2																									0	
3																									0	
4																									0	
5																									0	
6	20.0rf	17.0rf	19.0rf	14.0rf	16.0rf	18.0rf	15.0rf	13.0rf	16.0rf	13.0rf	17.0rf	18.0rf	23.0rf	18.0rf	33.0rf	35.0rf	48.0rf	45.0rf	48.0rf	44.0rf	51.0rf	48.0rf	50.0rf	48.0rf	24	51.0
7	47.0rf	48.0rf	42.0rf	43.0rf	51.0rf	48.0rf	45.0rf	47.0rf	46.0rf	45.0rf	36.0rf	26.0rf	22.0rf	15.0rf	14.0rf	10.0rf	9.0rf	16.0rf	20.0rf	11.0rf	17.0rf	13.0rf	17.0rf	16.0rf	24	51.0
8	13.0IF	21.0IF	14.0IF	12.0IF	13.0IF	9.0IF	14.0IF	15.0IF	15.0IF	14.0IF	AV	16.0IF	19.0IF	17.0IF	16.0IF	14.0IF	13.0IF	13.0IF	24.0IF	21.0IF	24.0IF	25.0IF	21.0IF	18.0IF	23	25.0
9	21.0rf	20.0rf	19.0rf	24.0rf	19.0rf	19.0rf	21.0rf	18.0rf	21.0rf	21.0rf	23.0rf	21.0rf	14.0rf	21.0rf	22.0rf	32.0rf	25.0rf	21.0rf	26.0rf	24.0rf	27.0rf	34.0rf	28.0rf	32.0rf	24	34.0
10	31.0rf	28.0rf	34.0rf	27.0rf	31.0rf	30.0rf	27.0rf	28.0rf	23.0rf	22.0rf	22.0rf	18.0rf	13.0rf	20.0rf	16.0rf	19.0rf	18.0rf	14.0rf	15.0rf	19.0rf	19.0rf	25.0rf	23.0rf	20.0rf	24	34.0
11	32.0rf	32.0rf	23.0rf	30.0rf	29.0rf	29.0rf	32.0rf	27.0rf	26.0rf	20.0rf	16.0rf	8.0rf	15.0rf	18.0rf	23.0rf	25.0rf	14.0rf	20.0rf	12.0rf	9.0rf	8.0rf	5.0rf	5.0rf	5.0rf	24	32.0
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31																									0	
NO.:	6	6	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6	6	6	6	6	6	6		
MAX:	47.0	48.0	42.0	43.0	51.0	48.0	45.0	47.0	46.0	45.0	36.0	26.0	23.0	21.0	33.0	35.0	48.0	45.0	48.0	44.0	51.0	48.0	50.0	48.0		
AVG:	27.33	27.67	25.17	25.00	26.50	25.50	25.67	24.67	24.50	22.50	22.80	17.83	17.67	18.17	20.67	22.50	21.17	21.50	24.17	21.33	24.33	25.00	24.00	23.17		

MONTHLY OBSERVATIONS: 143 MONTHLY MEAN: 23.29 MONTHLY MAX: 51.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-119-0045 POC: 3
COUNTY: (119) Mecklenburg
CITY: (12000) Charlotte
SITE ADDRESS: 1030 Remount Road
SITE COMMENTS:
MONITOR COMMENTS:

STATE: (37) North Carolina
AQCR: (167) METROPOLITAN CHARLOTTE
URBANIZED AREA: (1510) CHARLOTTE, NC
LAND USE: INDUSTRIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.213171
LONGITUDE: -80.874084
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 194
PROBE HEIGHT: 2

SUPPORT AGENCY: (0669) Mecklenburg County Air Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (209) Met One BAM-1022 Mass Monitor w/ V
PQAO: (0669) Mecklenburg County Air Quality

REPORT FOR: JUNE 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1																									0	
2																									0	
3																									0	
4																									0	
5																									0	
6	20.0rf	15.0rf	16.0rf	14.0rf	14.0rf	17.0rf	18.0rf	9.0rf	18.0rf	18.0rf	16.0rf	17.0rf	21.0rf	17.0rf	23.0rf	19.0rf	22.0rf	22.0rf	36.0rf	34.0rf	31.0rf	33.0rf	39.0rf	34.0rf	24	39.0
7	39.0rf	37.0rf	40.0rf	40.0rf	36.0rf	38.0rf	36.0rf	36.0rf	38.0rf	28.0rf	28.0rf	26.0rf	29.0rf	24.0rf	24.0rf	20.0rf	10.0rf	11.0rf	15.0rf	14.0rf	16.0rf	17.0rf	15.0rf	15.0rf	24	40.0
8	13.0rf	14.0rf	11.0rf	13.0rf	11.0rf	12.0rf	10.0rf	11.0rf	12.0rf	21.0rf	26.0rf	24.0rf	24.0rf	16.0rf	23.0rf	21.0rf	25.0rf	18.0rf	16.0rf	22.0rf	21.0rf	27.0rf	28.0rf	25.0rf	24	28.0
9	23.0rf	24.0rf	21.0rf	24.0rf	23.0rf	26.0rf	21.0rf	25.0rf	22.0rf	25.0rf	22.0rf	19.0rf	20.0rf	17.0rf	20.0rf	19.0rf	24.0rf	24.0rf	25.0rf	28.0rf	30.0rf	30.0rf	29.0rf	29.0rf	24	30.0
10	33.0rf	31.0rf	33.0rf	33.0rf	31.0rf	27.0rf	31.0rf	27.0rf	25.0rf	24.0rf	19.0rf	17.0rf	20.0rf	19.0rf	18.0rf	17.0rf	19.0rf	16.0rf	18.0rf	19.0rf	22.0rf	26.0rf	33.0rf	27.0rf	24	33.0
11	22.0IF	26.0IF	24.0IF	25.0IF	25.0IF	22.0IF	22.0IF	27.0IF	18.0IF	18.0IF	18.0IF	14.0IF	16.0IF	26.0IF	3.0IF	5.0IF	3.0IF	5.0IF	11.0IF	6.0IF	6.0IF	11.0IF	7.0IF	7.0IF	24	27.0
12																									0	
13																									0	
14																									0	
15																									0	
16																									0	
17																									0	
18																									0	
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24																									0	
25																									0	
26																									0	
27																									0	
28																									0	
29																									0	
30																									0	
31																									0	
NO.:	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
MAX:	39.0	37.0	40.0	40.0	36.0	38.0	36.0	36.0	38.0	28.0	28.0	26.0	29.0	26.0	24.0	21.0	25.0	24.0	36.0	34.0	31.0	33.0	39.0	34.0		
AVG:	25.00	24.50	24.17	24.83	23.33	23.67	23.00	22.50	22.17	22.33	21.50	19.50	21.67	19.83	18.50	16.83	17.17	16.00	20.17	20.50	21.00	24.00	25.17	22.83		

MONTHLY OBSERVATIONS: 144 MONTHLY MEAN: 21.67 MONTHLY MAX: 40.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

QUALIFIER CODES:

Qualifier Code	Qualifier Description	Qualifier Type
AV	Power Failure.	NULL
IF	Fire - Canadian.	INFORM
rf	Fire - Canadian.	REQEXC

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional concurrence are shown in lower case.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

User ID: JPOPE

RAW DATA REPORT

Report Request ID: 2232976 Report Code: AMP350 Oct. 17, 2024

GEOGRAPHIC SELECTIONS

Tribal Code	State	County	Site	Parameter	POC	City	AQCR	UAR	CBSA	CSA	EPA Region
	37	119	0045								
	37	057	0002								

PROTOCOL SELECTIONS

Parameter Classification	Parameter	Method	Duration
CRITERIA	88101		

SELECTED OPTIONS

Option Type	Option Value
INCLUDE NULLS	YES
DAILY STATISTICS	MAXIMUM
UNITS	STANDARD
RAW DATA EVENTS	INCLUDE EVENTS
MERGE PDF FILES	YES
AGENCY ROLE	PQAO

SORT ORDER

Order	Column
1	STATE_CODE
2	COUNTY_CODE
3	SITE_ID
4	PARAMETER_CODE
5	POC

DATE CRITERIA

Start Date	End Date
2023 06 17	2023 06 18

APPLICABLE STANDARDS

Standard Description
PM25 Annual 2024

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 1
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (145) R & P Model 2025 PM-2.5 Sequential
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: 2023

DURATION: 24 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 2

MONTH

Day	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1												
2												
3												
4												
5												
6												
7												
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9												
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16												
17						19.1 rf						
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22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
NO.:	0	0	0	0	0	1	0	0	0	0	0	0
MAX:						19.1						
MEAN:						19.10						

ANNUAL OBSERVATIONS: 1 ANNUAL MEAN: 19.10 ANNUAL MAX: 19.1

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 3
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2.4

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (170) Met One BAM-1020 Mass Monitor w/VS
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: JUNE 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1																									0	
2																									0	
3																									0	
4																									0	
5																									0	
6																									0	
7																									0	
8																									0	
9																									0	
10																									0	
11																									0	
12																									0	
13																									0	
14																									0	
15																									0	
16																									0	
17	20.0rf	21.0rf	26.0rf	23.0rf	19.0rf	16.0rf	21.0rf	19.0rf	21.0rf	14.0rf	17.0rf	16.0rf	16.0rf	18.0rf	19.0rf	16.0rf	14.0rf	15.0rf	17.0rf	17.0rf	17.0rf	21.0rf	27.0rf	25.0rf	24	27.0
18	23.0rf	28.0rf	24.0rf	23.0rf	23.0rf	19.0rf	21.0rf	24.0rf	22.0rf	18.0rf	19.0rf	19.0rf	18.0rf	16.0rf	19.0rf	25.0rf	19.0rf	20.0rf	18.0rf	23.0rf	24.0rf	28.0rf	28.0rf	26.0rf	24	28.0
19																									0	
20																									0	
21																									0	
22																									0	
23																									0	
24																									0	
25																									0	
26																									0	
27																									0	
28																									0	
29																									0	
30																									0	
31																									0	
NO.:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
MAX:	23.0	28.0	26.0	23.0	23.0	19.0	21.0	24.0	22.0	18.0	19.0	19.0	18.0	18.0	19.0	25.0	19.0	20.0	18.0	23.0	24.0	28.0	28.0	26.0		
AVG:	21.50	24.50	25.00	23.00	21.00	17.50	21.00	21.50	21.50	16.00	18.00	17.50	17.00	17.00	19.00	20.50	16.50	17.50	17.50	20.00	20.50	24.50	27.50	25.50		

MONTHLY OBSERVATIONS: 48 MONTHLY MEAN: 20.46 MONTHLY MAX: 28.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

(88101) PM2.5 - Local Conditions

SITE ID: 37-119-0045 POC: 1
COUNTY: (119) Mecklenburg
CITY: (12000) Charlotte
SITE ADDRESS: 1030 Remount Road
SITE COMMENTS:
MONITOR COMMENTS:

STATE: (37) North Carolina
AQCR: (167) METROPOLITAN CHARLOTTE
URBANIZED AREA: (1510) CHARLOTTE, NC
LAND USE: INDUSTRIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.213171
LONGITUDE: -80.874084
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 194
PROBE HEIGHT: 2

SUPPORT AGENCY: (0669) Mecklenburg County Air Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (145) R & P Model 2025 PM-2.5 Sequential
PQAO: (0669) Mecklenburg County Air Quality

REPORT FOR: 2023

DURATION: 24 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 2

MONTH

Day	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17						22.9 rf						
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
NO.:	0	0	0	0	0	1	0	0	0	0	0	0
MAX:						22.9						
MEAN:						22.90						

ANNUAL OBSERVATIONS: 1 ANNUAL MEAN: 22.90 ANNUAL MAX: 22.9

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-119-0045 POC: 3
COUNTY: (119) Mecklenburg
CITY: (12000) Charlotte
SITE ADDRESS: 1030 Remount Road
SITE COMMENTS:
MONITOR COMMENTS:

STATE: (37) North Carolina
AQCR: (167) METROPOLITAN CHARLOTTE
URBANIZED AREA: (1510) CHARLOTTE, NC
LAND USE: INDUSTRIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.213171
LONGITUDE: -80.874084
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 194
PROBE HEIGHT: 2

SUPPORT AGENCY: (0669) Mecklenburg County Air Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (209) Met One BAM-1022 Mass Monitor w/ V
PQAO: (0669) Mecklenburg County Air Quality

REPORT FOR: JUNE 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1																									0	
2																									0	
3																									0	
4																									0	
5																									0	
6																									0	
7																									0	
8																									0	
9																									0	
10																									0	
11																									0	
12																									0	
13																									0	
14																									0	
15																									0	
16																									0	
17	33.0rf	27.0rf	28.0rf	26.0rf	27.0rf	26.0rf	26.0rf	31.0rf	23.0rf	19.0rf	20.0rf	20.0rf	19.0rf	21.0rf	23.0rf	25.0rf	23.0rf	22.0rf	20.0rf	23.0rf	24.0rf	34.0rf	31.0rf	33.0rf	24	34.0
18	31.0rf	23.0rf	25.0rf	26.0rf	23.0rf	20.0rf	20.0rf	21.0rf	26.0rf	19.0rf	20.0rf	18.0rf	23.0rf	21.0rf	24.0rf	28.0rf	28.0rf	21.0rf	27.0rf	28.0rf	29.0rf	25.0rf	23.0rf	21.0rf	24	31.0
19																									0	
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25																									0	
26																									0	
27																									0	
28																									0	
29																									0	
30																									0	
31																									0	
NO.:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
MAX:	33.0	27.0	28.0	26.0	27.0	26.0	26.0	31.0	26.0	19.0	20.0	20.0	23.0	21.0	24.0	28.0	28.0	22.0	27.0	28.0	29.0	34.0	31.0	33.0		
AVG:	32.00	25.00	26.50	26.00	25.00	23.00	23.00	26.00	24.50	19.00	20.00	19.00	21.00	21.00	23.50	26.50	25.50	21.50	23.50	25.50	26.50	29.50	27.00	27.00		

MONTHLY OBSERVATIONS: 48 MONTHLY MEAN: 24.46 MONTHLY MAX: 34.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

QUALIFIER CODES:

Qualifier Code	Qualifier Description	Qualifier Type
rf	Fire - Canadian.	REQEXC

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional concurrence are shown in lower case.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

User ID: JPOPE

RAW DATA REPORT

Report Request ID: 2232978 Report Code: AMP350 Oct. 17, 2024

GEOGRAPHIC SELECTIONS

Tribal Code	State	County	Site	Parameter	POC	City	AQCR	UAR	CBSA	CSA	EPA Region
	37	119	0045								
	37	057	0002								

PROTOCOL SELECTIONS

Parameter Classification	Parameter	Method	Duration
CRITERIA	88101		

SELECTED OPTIONS

Option Type	Option Value
INCLUDE NULLS	YES
DAILY STATISTICS	MAXIMUM
UNITS	STANDARD
RAW DATA EVENTS	INCLUDE EVENTS
MERGE PDF FILES	YES
AGENCY ROLE	PQAO

SORT ORDER

Order	Column
1	STATE_CODE
2	COUNTY_CODE
3	SITE_ID
4	PARAMETER_CODE
5	POC

DATE CRITERIA

Start Date	End Date
2023 06 28	2023 07 01

APPLICABLE STANDARDS

Standard Description
PM25 Annual 2024

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 1
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (145) R & P Model 2025 PM-2.5 Sequential
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: 2023

DURATION: 24 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 2

Day	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1												
2												
3												
4												
5												
6												
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10												
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18												
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22												
23												
24												
25												
26												
27												
28												
29						45.0 rf						
30												
31												
NO.:	0	0	0	0	0	1	0	0	0	0	0	0
MAX:						45.0						
MEAN:						45.00						

ANNUAL OBSERVATIONS: 1 ANNUAL MEAN: 45.00 ANNUAL MAX: 45.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 3
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2.4

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (170) Met One BAM-1020 Mass Monitor w/VS
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: JUNE 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1																									0	
2																									0	
3																									0	
4																									0	
5																									0	
6																									0	
7																									0	
8																									0	
9																									0	
10																									0	
11																									0	
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25																									0	
26																									0	
27																									0	
28	14.0rf	15.0rf	14.0rf	13.0rf	11.0rf	14.0rf	16.0rf	23.0rf	18.0rf	26.0rf	21.0rf	18.0rf	25.0rf	22.0rf	20.0rf	25.0rf	19.0rf	20.0rf	19.0rf	26.0rf	25.0rf	34.0rf	28.0rf	28.0rf	24	34.0
29	30.0rf	33.0rf	27.0rf	36.0rf	43.0rf	56.0rf	58.0rf	60.0rf	58.0rf	51.0rf	41.0rf	52.0rf	51.0rf	53.0rf	46.0rf	48.0rf	42.0rf	40.0rf	46.0rf	44.0rf	44.0rf	42.0rf	48.0rf	48.0rf	24	60.0
30	43.0rf	44.0rf	41.0rf	44.0rf	42.0rf	43.0rf	42.0rf	44.0rf	45.0rf	42.0rf	45.0rf	35.0rf	28.0rf	34.0rf	24.0rf	30.0rf	26.0rf	21.0rf	24.0rf	16.0rf	18.0rf	14.0rf	14.0rf	11.0rf	24	45.0
31																									0	
NO.:	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
MAX:	43.0	44.0	41.0	44.0	43.0	56.0	58.0	60.0	58.0	51.0	45.0	52.0	51.0	53.0	46.0	48.0	42.0	40.0	46.0	44.0	44.0	42.0	48.0	48.0		
AVG:	29.00	30.67	27.33	31.00	32.00	37.67	38.67	42.33	40.33	39.67	35.67	35.00	34.67	36.33	30.00	34.33	29.00	27.00	29.67	28.67	29.00	30.00	30.00	29.00		

MONTHLY OBSERVATIONS: 72 MONTHLY MEAN: 32.79 MONTHLY MAX: 60.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 3
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2.4

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (170) Met One BAM-1020 Mass Monitor w/VS
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: JULY 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1	8.0rf	16.0rf	15.0rf	14.0rf	19.0rf	19.0rf	27.0rf	33.0rf	30.0rf	27.0rf	29.0rf	19.0rf	25.0rf	16.0rf	21.0rf	16.0rf	16.0rf	19.0rf	15.0rf	10.0rf	8.0rf	9.0rf	13.0rf	10.0rf	24	33.0
2																									0	
3																									0	
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30																									0	
31																									0	
NO.:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
MAX:	8.0	16.0	15.0	14.0	19.0	19.0	27.0	33.0	30.0	27.0	29.0	19.0	25.0	16.0	21.0	16.0	16.0	19.0	15.0	10.0	8.0	9.0	13.0	10.0		
AVG:	8.00	16.00	15.00	14.00	19.00	19.00	27.00	33.00	30.00	27.00	29.00	19.00	25.00	16.00	21.00	16.00	16.00	19.00	15.00	10.00	8.00	9.00	13.00	10.00		

MONTHLY OBSERVATIONS: 24 MONTHLY MEAN: 18.08 MONTHLY MAX: 33.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

(88101) PM2.5 - Local Conditions

SITE ID: 37-119-0045 POC: 1
COUNTY: (119) Mecklenburg
CITY: (12000) Charlotte
SITE ADDRESS: 1030 Remount Road
SITE COMMENTS:
MONITOR COMMENTS:

STATE: (37) North Carolina
AQCR: (167) METROPOLITAN CHARLOTTE
URBANIZED AREA: (1510) CHARLOTTE, NC
LAND USE: INDUSTRIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.213171
LONGITUDE: -80.874084
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 194
PROBE HEIGHT: 2

SUPPORT AGENCY: (0669) Mecklenburg County Air Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (145) R & P Model 2025 PM-2.5 Sequential
PQAO: (0669) Mecklenburg County Air Quality

REPORT FOR: 2023

DURATION: 24 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 2

MONTH

Day	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1												
2												
3												
4												
5												
6												
7												
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29						34.5 rf						
30												
31												
NO.:	0	0	0	0	0	1	0	0	0	0	0	0
MAX:						34.5						
MEAN:						34.50						

ANNUAL OBSERVATIONS: 1 ANNUAL MEAN: 34.50 ANNUAL MAX: 34.5

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

(88101) PM2.5 - Local Conditions

SITE ID: 37-119-0045 POC: 3
COUNTY: (119) Mecklenburg
CITY: (12000) Charlotte
SITE ADDRESS: 1030 Remount Road
SITE COMMENTS:
MONITOR COMMENTS:

STATE: (37) North Carolina
AQCR: (167) METROPOLITAN CHARLOTTE
URBANIZED AREA: (1510) CHARLOTTE, NC
LAND USE: INDUSTRIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.213171
LONGITUDE: -80.874084
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 194
PROBE HEIGHT: 2

SUPPORT AGENCY: (0669) Mecklenburg County Air Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (209) Met One BAM-1022 Mass Monitor w/ V
PQAO: (0669) Mecklenburg County Air Quality

REPORT FOR: JUNE 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1																									0	
2																									0	
3																									0	
4																									0	
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28	16.0rf	20.0rf	22.0rf	23.0rf	19.0rf	16.0rf	20.0rf	21.0rf	22.0rf	24.0rf	23.0rf	21.0rf	16.0rf	20.0rf	17.0rf	15.0rf	20.0rf	17.0rf	18.0rf	20.0rf	15.0rf	26.0rf	27.0rf	27.0rf	24	27.0
29	22.0rf	24.0rf	28.0rf	27.0rf	28.0rf	27.0rf	40.0rf	51.0rf	60.0rf	60.0rf	52.0rf	49.0rf	36.0rf	37.0rf	43.0rf	34.0rf	32.0rf	32.0rf	31.0rf	32.0rf	36.0rf	43.0rf	40.0rf	41.0rf	24	60.0
30	42.0rf	43.0rf	40.0rf	40.0rf	39.0rf	38.0rf	38.0rf	37.0rf	34.0rf	29.0rf	34.0rf	30.0rf	27.0rf	22.0rf	13.0rf	11.0rf	12.0rf	AN	AN	21.0rf	20.0rf	26.0rf	28.0rf	24.0rf	22	43.0
31																									0	
NO.:	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	3	3	3		
MAX:	42.0	43.0	40.0	40.0	39.0	38.0	40.0	51.0	60.0	60.0	52.0	49.0	36.0	37.0	43.0	34.0	32.0	32.0	31.0	32.0	36.0	43.0	40.0	41.0		
AVG:	26.67	29.00	30.00	30.00	28.67	27.00	32.67	36.33	38.67	37.67	36.33	33.33	26.33	26.33	24.33	20.00	21.33	24.50	24.50	24.33	23.67	31.67	31.67	30.67		

MONTHLY OBSERVATIONS: 70 MONTHLY MEAN: 29.11 MONTHLY MAX: 60.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-119-0045 POC: 3
COUNTY: (119) Mecklenburg
CITY: (12000) Charlotte
SITE ADDRESS: 1030 Remount Road
SITE COMMENTS:
MONITOR COMMENTS:

STATE: (37) North Carolina
AQCR: (167) METROPOLITAN CHARLOTTE
URBANIZED AREA: (1510) CHARLOTTE, NC
LAND USE: INDUSTRIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.213171
LONGITUDE: -80.874084
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 194
PROBE HEIGHT: 2

SUPPORT AGENCY: (0669) Mecklenburg County Air Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (209) Met One BAM-1022 Mass Monitor w/ V
PQAO: (0669) Mecklenburg County Air Quality

REPORT FOR: JULY 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1	20.0rf	22.0rf	28.0rf	27.0rf	27.0rf	30.0rf	26.0rf	28.0rf	AV	AV	AV	22.0rf	18.0rf	18.0rf	24.0rf	24.0rf	23.0rf	17.0rf	11.0rf	7.0rf	11.0rf	19.0rf	18.0rf	18.0rf	21	30.0
2																									0	
3																									0	
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NO.:	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1		
MAX:	20.0	22.0	28.0	27.0	27.0	30.0	26.0	28.0				22.0	18.0	18.0	24.0	24.0	23.0	17.0	11.0	7.0	11.0	19.0	18.0	18.0		
AVG:	20.00	22.00	28.00	27.00	27.00	30.00	26.00	28.00				22.00	18.00	18.00	24.00	24.00	23.00	17.00	11.00	7.00	11.00	19.00	18.00	18.00		

MONTHLY OBSERVATIONS: 21 MONTHLY MEAN: 20.86 MONTHLY MAX: 30.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

QUALIFIER CODES:

Qualifier Code	Qualifier Description	Qualifier Type
AN	Machine Malfunction.	NULL
AV	Power Failure.	NULL
rf	Fire - Canadian.	REQEXC

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional concurrence are shown in lower case.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

User ID: JPOPE

RAW DATA REPORT

Report Request ID: 2232981 Report Code: AMP350 Oct. 17, 2024

GEOGRAPHIC SELECTIONS

Tribal Code	State	County	Site	Parameter	POC	City	AQCR	UAR	CBSA	CSA	EPA Region
	37	119	0045								
	37	057	0002								

PROTOCOL SELECTIONS

Parameter Classification	Parameter	Method	Duration
CRITERIA	88101		

SELECTED OPTIONS

Option Type	Option Value
INCLUDE NULLS	YES
DAILY STATISTICS	MAXIMUM
UNITS	STANDARD
RAW DATA EVENTS	INCLUDE EVENTS
MERGE PDF FILES	YES
AGENCY ROLE	PQAO

SORT ORDER

Order	Column
1	STATE_CODE
2	COUNTY_CODE
3	SITE_ID
4	PARAMETER_CODE
5	POC

DATE CRITERIA

Start Date	End Date
2023 07 17	2023 07 18

APPLICABLE STANDARDS

Standard Description
PM25 Annual 2024

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 1
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (145) R & P Model 2025 PM-2.5 Sequential
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: 2023

DURATION: 24 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 2

MONTH

Day	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1												
2												
3												
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5												
6												
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31												
NO.:	0	0	0	0	0	0	1	0	0	0	0	0
MAX:							41.2					
MEAN:							41.20					

ANNUAL OBSERVATIONS: 1 ANNUAL MEAN: 41.20 ANNUAL MAX: 41.2

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-057-0002 POC: 3
COUNTY: (057) Davidson
CITY: (38060) Lexington
SITE ADDRESS: 938 S.SALISBURY ST
SITE COMMENTS: SITE LOCATED AT WATER TOWER AT CORNER HWY 8 & MAIN ST.
MONITOR COMMENTS: ID2=409

STATE: (37) North Carolina
AQCR: (136) NORTHERN PIEDMONT
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: COMMERCIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.8145
LONGITUDE: -80.2627
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 241
PROBE HEIGHT: 2.4

SUPPORT AGENCY: (0776) North Carolina Dept Of Environmental Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (170) Met One BAM-1020 Mass Monitor w/VS
PQAO: (0776) North Carolina Dept Of Environmental Quality

REPORT FOR: JULY 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1																									0	
2																									0	
3																									0	
4																									0	
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17	14.0rf	26.0rf	15.0rf	9.0rf	15.0rf	16.0rf	20.0rf	30.0rf	21.0rf	28.0rf	41.0rf	43.0rf	43.0rf	50.0rf	51.0rf	49.0rf	49.0rf	55.0rf	55.0rf	58.0rf	56.0rf	61.0rf	65.0rf	58.0rf	24	65.0
18	60.0rf	60.0rf	57.0rf	55.0rf	58.0rf	56.0rf	58.0rf	52.0rf	57.0rf	43.0rf	25.0rf	16.0rf	26.0rf	26.0rf	24.0rf	34.0rf	32.0rf	42.0rf	36.0rf	39.0rf	39.0rf	39.0rf	39.0rf	43.0rf	24	60.0
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NO.:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
MAX:	60.0	60.0	57.0	55.0	58.0	56.0	58.0	52.0	57.0	43.0	41.0	43.0	43.0	50.0	51.0	49.0	49.0	55.0	55.0	58.0	56.0	61.0	65.0	58.0		
AVG:	37.00	43.00	36.00	32.00	36.50	36.00	39.00	41.00	39.00	35.50	33.00	29.50	34.50	38.00	37.50	41.50	40.50	48.50	45.50	48.50	47.50	50.00	52.00	50.50		

MONTHLY OBSERVATIONS: 48 MONTHLY MEAN: 40.50 MONTHLY MAX: 65.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Oct. 17, 2024

(88101) PM2.5 - Local Conditions

SITE ID: 37-119-0045 POC: 3
COUNTY: (119) Mecklenburg
CITY: (12000) Charlotte
SITE ADDRESS: 1030 Remount Road
SITE COMMENTS:
MONITOR COMMENTS:

STATE: (37) North Carolina
AQCR: (167) METROPOLITAN CHARLOTTE
URBANIZED AREA: (1510) CHARLOTTE, NC
LAND USE: INDUSTRIAL
LOCATION SETTING: URBAN AND CENTER CITY

CAS NUMBER:
LATITUDE: 35.213171
LONGITUDE: -80.874084
UTM ZONE:
UTM NORTHING:
UTM EASTING:
ELEVATION-MSL: 194
PROBE HEIGHT: 2

SUPPORT AGENCY: (0669) Mecklenburg County Air Quality
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (209) Met One BAM-1022 Mass Monitor w/ V
PQAO: (0669) Mecklenburg County Air Quality

REPORT FOR: JULY 2023

DURATION: 1 HOUR
UNITS: Micrograms/cubic meter (LC)
MIN DETECTABLE: 5

DAY	HOUR 0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1																									0	
2																									0	
3																									0	
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17	15.0rf	20.0rf	20.0rf	18.0rf	17.0rf	21.0rf	24.0rf	22.0rf	31.0rf	40.0rf	37.0rf	52.0rf	51.0rf	55.0rf	55.0rf	57.0rf	57.0rf	65.0rf	58.0rf	62.0rf	63.0rf	63.0rf	64.0rf	65.0rf	24	65.0
18	68.0rf	66.0rf	64.0rf	64.0rf	61.0rf	57.0rf	57.0rf	50.0rf	47.0rf	46.0rf	46.0rf	44.0rf	47.0rf	42.0rf	38.0rf	28.0rf	34.0rf	29.0rf	32.0rf	40.0rf	33.0rf	35.0rf	37.0rf	42.0rf	24	68.0
19																									0	
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31																									0	
NO.:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
MAX:	68.0	66.0	64.0	64.0	61.0	57.0	57.0	50.0	47.0	46.0	46.0	52.0	51.0	55.0	55.0	57.0	57.0	65.0	58.0	62.0	63.0	63.0	64.0	65.0		
AVG:	41.50	43.00	42.00	41.00	39.00	39.00	40.50	36.00	39.00	43.00	41.50	48.00	49.00	48.50	46.50	42.50	45.50	47.00	45.00	51.00	48.00	49.00	50.50	53.50		

MONTHLY OBSERVATIONS: 48 MONTHLY MEAN: 44.56 MONTHLY MAX: 68.0

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has reviewed the value and does not concur with the qualifier.

QUALIFIER CODES:

Qualifier Code	Qualifier Description	Qualifier Type
rf	Fire - Canadian.	REQEXC

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional concurrence are shown in lower case.

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Appendix B: Additional Tier 2 Evidence for 6/6/2023

station	valid	metar
JQF	2023-06-06 00:50	KJQF 060050Z 00000KT 10SM BKN042 21/18 A2995
JQF	2023-06-06 01:50	KJQF 060150Z 00000KT 10SM CLR 20/17 A2996
JQF	2023-06-06 02:50	KJQF 060250Z 00000KT 10SM CLR 18/17 A2997
JQF	2023-06-06 04:20	KJQF 060420Z AUTO 00000KT 7SM CLR 17/16 A2997 RMK AO2
JQF	2023-06-06 04:40	KJQF 060440Z AUTO 00000KT 7SM CLR 17/16 A2997 RMK AO2
JQF	2023-06-06 05:00	KJQF 060500Z AUTO 00000KT 7SM CLR 17/16 A2997 RMK AO2
JQF	2023-06-06 05:20	KJQF 060520Z AUTO 00000KT 7SM SCT037 17/16 A2997 RMK AO2
JQF	2023-06-06 05:40	KJQF 060540Z AUTO 00000KT 7SM SCT037 17/16 A2997 RMK AO2
JQF	2023-06-06 06:00	KJQF 060600Z AUTO 00000KT 5SM BR CLR 17/16 A2996 RMK AO2 LTG DSNT W
JQF	2023-06-06 06:20	KJQF 060620Z AUTO 00000KT 2 1/2SM BR CLR 16/15 A2996 RMK AO2
JQF	2023-06-06 06:40	KJQF 060640Z AUTO 00000KT 4SM BR CLR 16/16 A2996 RMK AO2
JQF	2023-06-06 07:00	KJQF 060700Z AUTO 00000KT 2 1/2SM BR SCT030 16/15 A2996 RMK AO2 VIS 1V5
JQF	2023-06-06 07:20	KJQF 060720Z AUTO 00000KT 5SM BR SCT030 16/15 A2996 RMK AO2 LTG DSNT SW
JQF	2023-06-06 07:40	KJQF 060740Z AUTO 00000KT 3SM BR BKN030 16/16 A2995 RMK AO2
JQF	2023-06-06 08:00	KJQF 060800Z AUTO 00000KT 5SM BR OVC030 17/16 A2995 RMK AO2 LTG DSNT S
JQF	2023-06-06 08:20	KJQF 060820Z AUTO 00000KT 5SM BR OVC030 17/17 A2995 RMK AO2 LTG DSNT SW
JQF	2023-06-06 08:40	KJQF 060840Z AUTO 00000KT 7SM BKN029 OVC035 17/17 A2994 RMK AO2
JQF	2023-06-06 09:00	KJQF 060900Z AUTO 00000KT 4SM BR SCT027 BKN037 17/16 A2994 RMK AO2
JQF	2023-06-06 09:20	KJQF 060920Z AUTO 00000KT 5SM BR BKN027 17/16 A2994 RMK AO2
JQF	2023-06-06 09:40	KJQF 060940Z AUTO 00000KT 2SM BR SCT027 BKN037 16/16 A2994 RMK AO2
JQF	2023-06-06 10:00	KJQF 061000Z AUTO 00000KT 5SM BR SCT039 16/16 A2994 RMK AO2
JQF	2023-06-06 10:20	KJQF 061020Z AUTO 00000KT 5SM BR BKN026 BKN039 16/16 A2994 RMK AO2
JQF	2023-06-06 10:40	KJQF 061040Z AUTO 00000KT 5SM BR SCT026 OVC039 17/16 A2994 RMK AO2
JQF	2023-06-06 10:50	KJQF 061050Z 00000KT 4SM BR BKN024 OVC037 17/17 A2994
JQF	2023-06-06 11:00	KJQF 061100Z AUTO 00000KT 5SM BR BKN026 BKN033 OVC039 17/16 A2994 RMK AO2
JQF	2023-06-06 11:50	KJQF 061150Z 00000KT 7SM OVC028 19/18 A2994
JQF	2023-06-06 12:50	KJQF 061250Z 00000KT 7SM OVC023 21/19 A2994
JQF	2023-06-06 13:50	KJQF 061350Z 28004KT 10SM CLR 23/18 A2993
JQF	2023-06-06 14:50	KJQF 061450Z 31006KT 10SM SCT022 24/18 A2993
JQF	2023-06-06 15:50	KJQF 061550Z 29005KT 10SM SCT022 26/19 A2992
JQF	2023-06-06 16:50	KJQF 061650Z 28003KT 10SM FEW022 27/17 A2991
JQF	2023-06-06 17:50	KJQF 061750Z 32008KT 10SM SCT041 27/15 A2989
JQF	2023-06-06 18:50	KJQF 061850Z 32008KT 10SM SCT041 28/15 A2988
JQF	2023-06-06 19:50	KJQF 061950Z 35008G15KT 10SM CLR 28/11 A2986
JQF	2023-06-06 20:50	KJQF 062050Z 01010G15KT **6SM FU** BR CLR 28/07 A2984
JQF	2023-06-06 21:50	KJQF 062150Z 02006G12KT **5SM FU** BR CLR 28/09 A2983
JQF	2023-06-06 22:50	KJQF 062250Z 36004G12KT **5SM FU** BR CLR 27/09 A2982
JQF	2023-06-06 23:50	KJQF 062350Z 05004KT **5SM FU** BR CLR 26/11 A2983

***Figure 120-B**: Hourly METAR reports from Concord Regional Airport (KJQF) on June 6th, 2023. "FU" is abbreviation for smoke.*

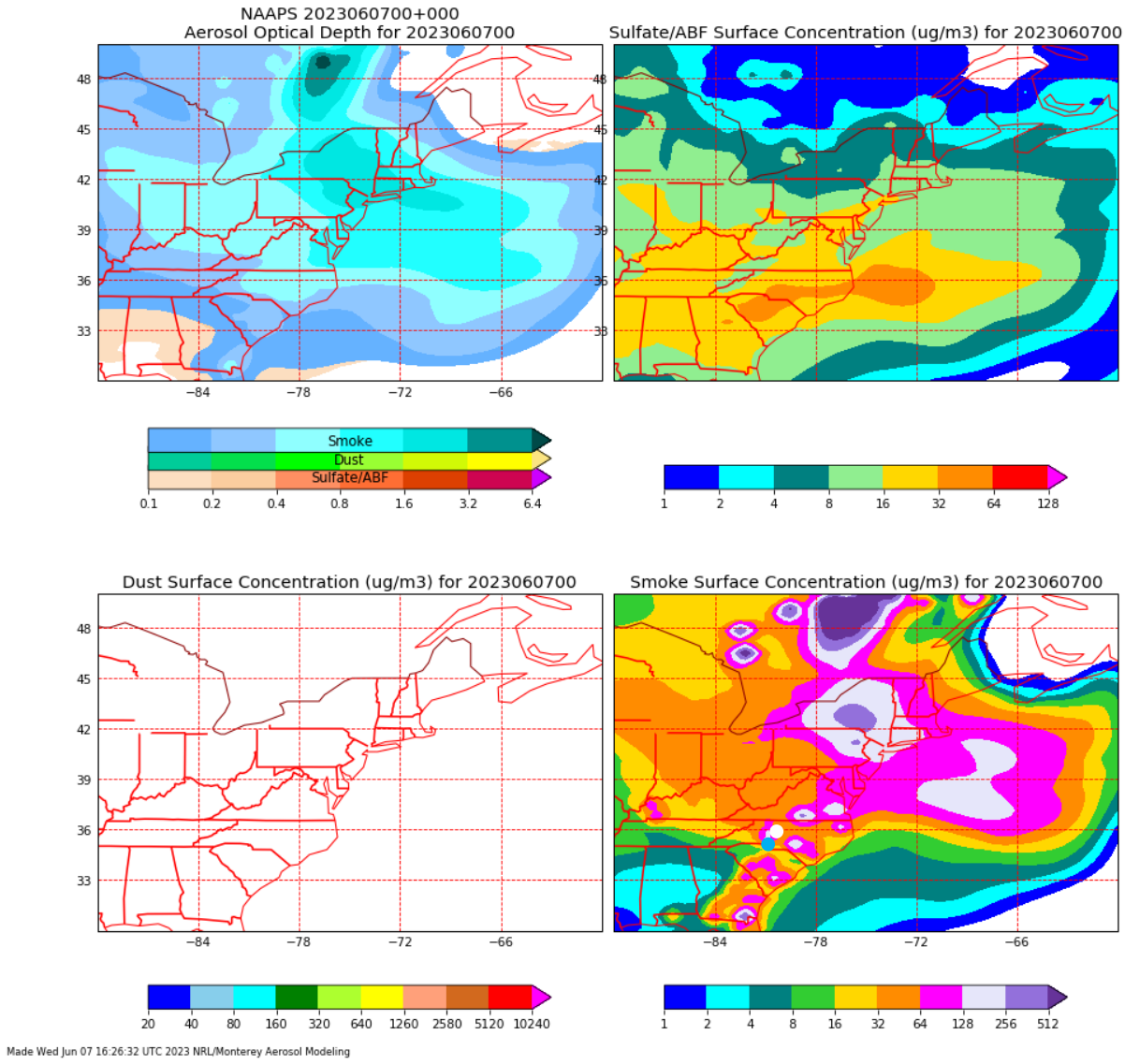

***Figure 121-B**: NAAPs Global Aerosol Model initialization / analysis at 8:00 pm on June 6th, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

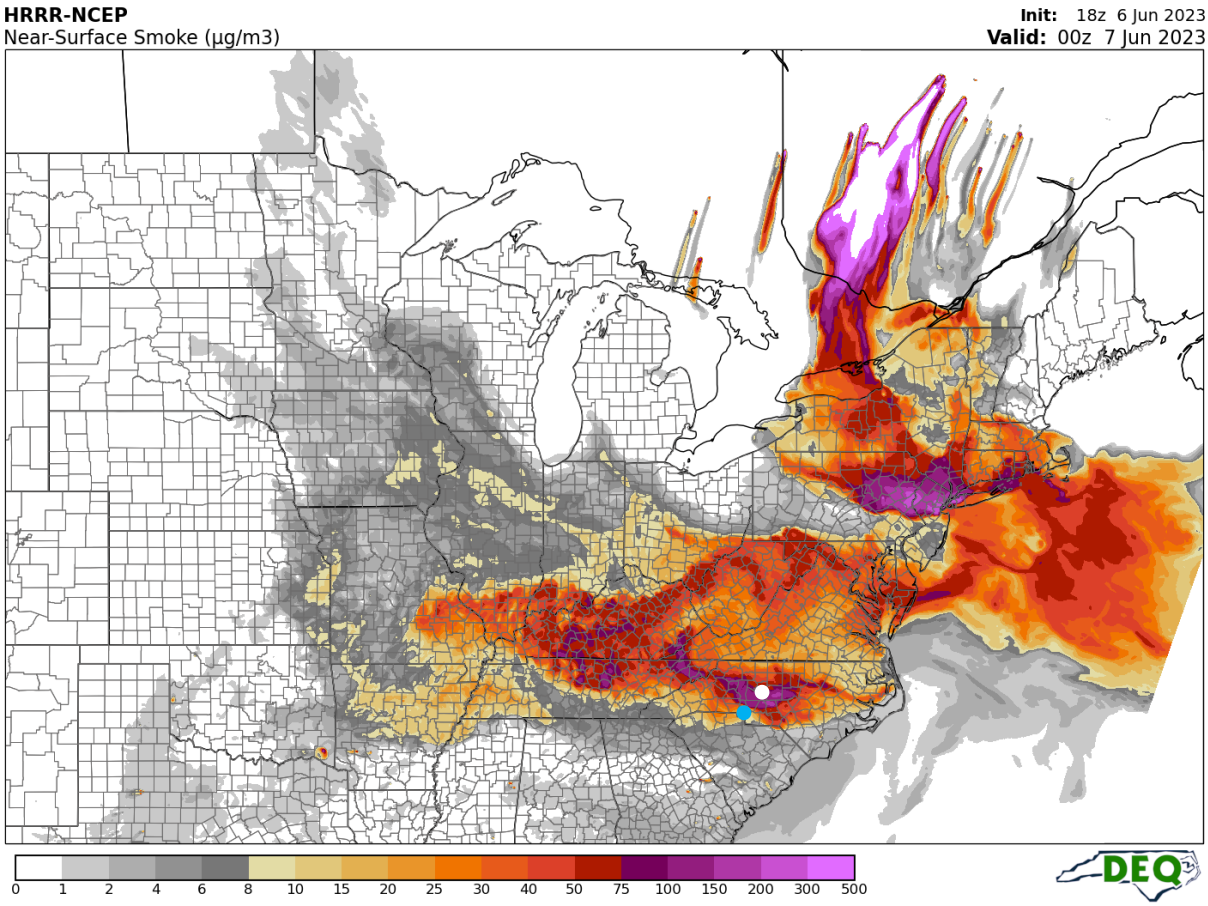

***Figure 122-B**: HRRR-NCEP Smoke model output, initialized at 2:00 pm June 6th, showing near-surface smoke at 8:00 pm on June 6th. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix C: Additional Tier 2 Evidence for 6/8/2023

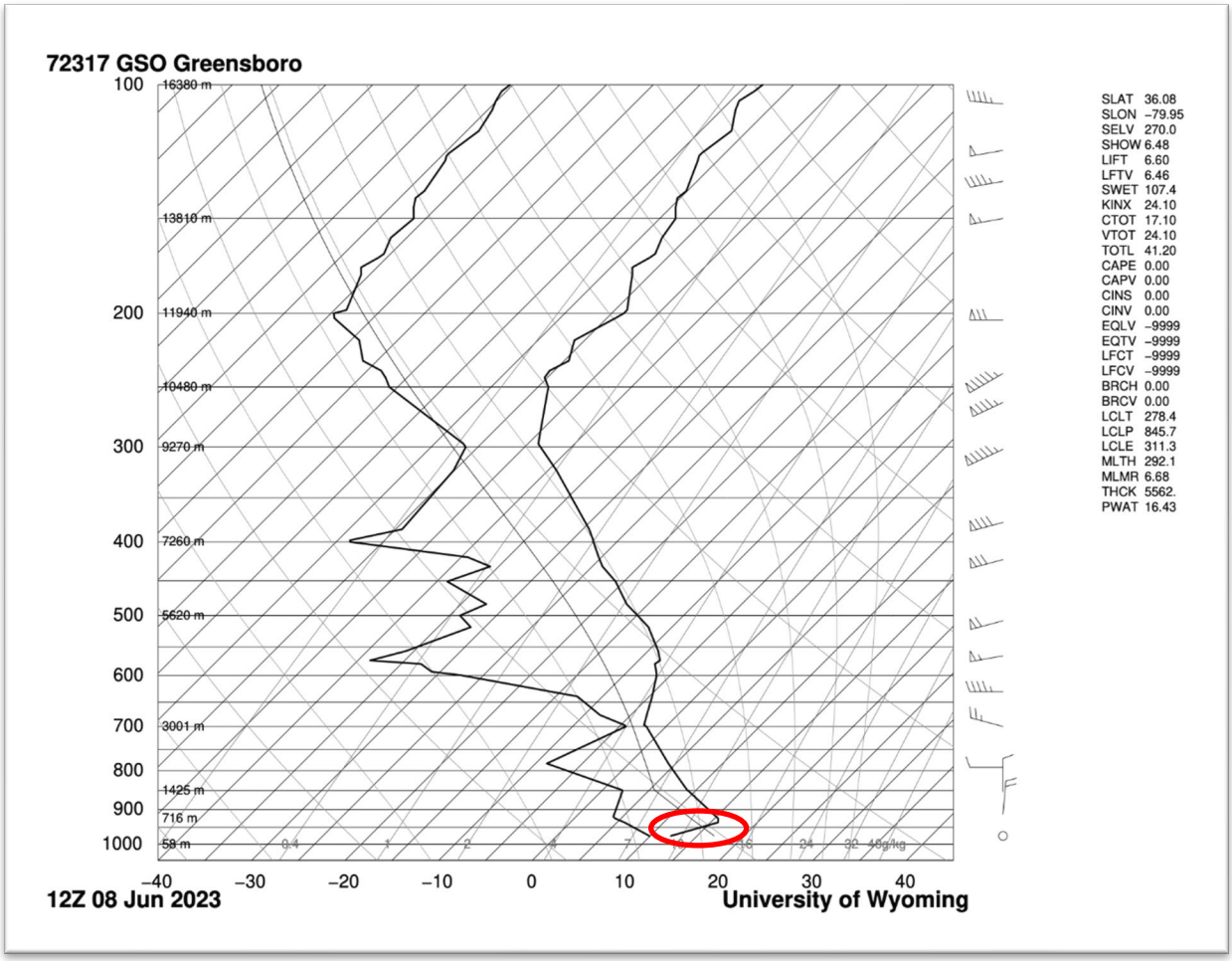

***Figure 123-C**: KGSO 8:00 am, June 8th, 2023 observed radiosonde sounding. Strong surface temperature inversion circled in red.*

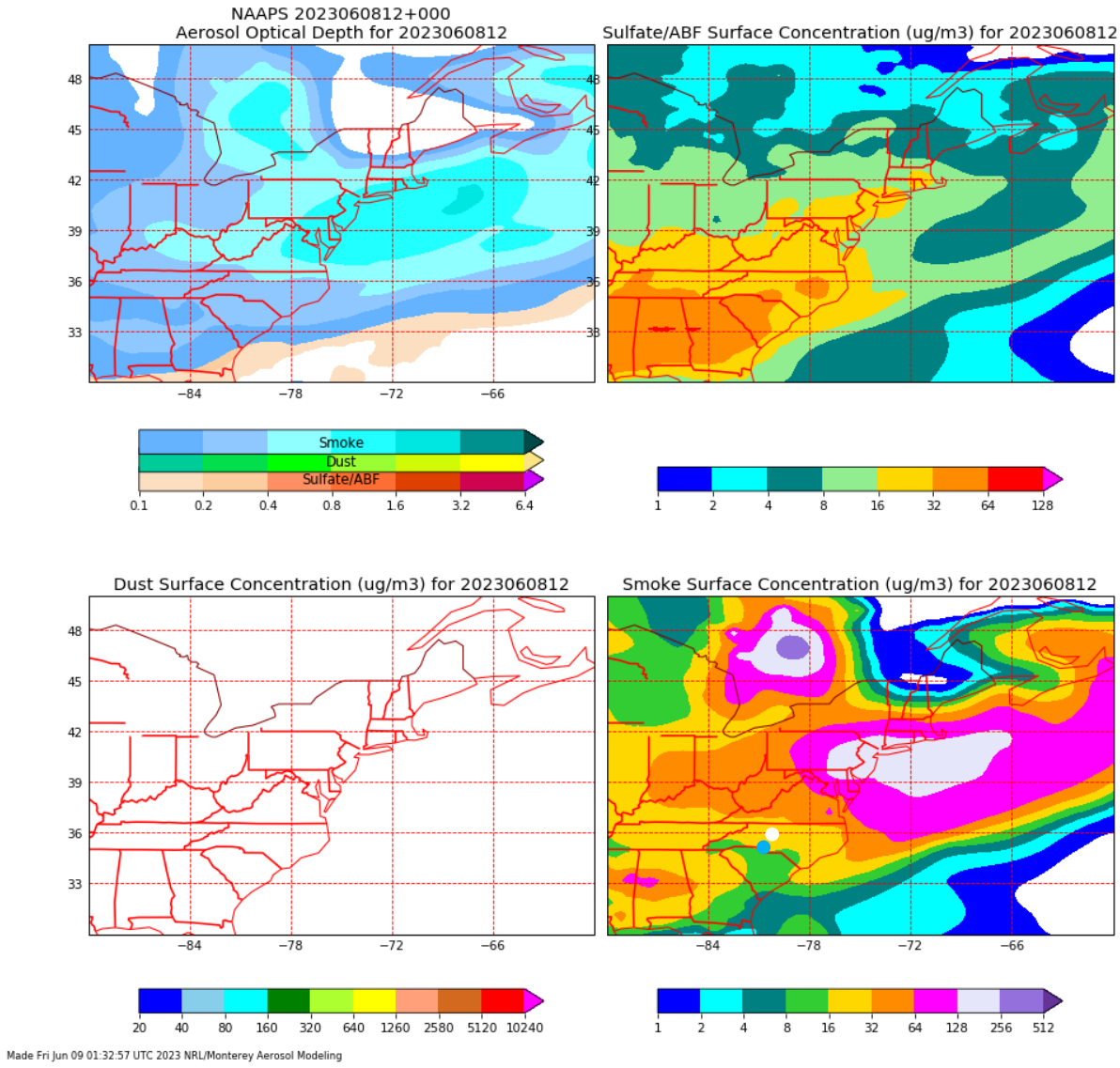

***Figure 124-C**: NAAPs Global Aerosol Model initialization / analysis at 8:00 am on June 8th, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

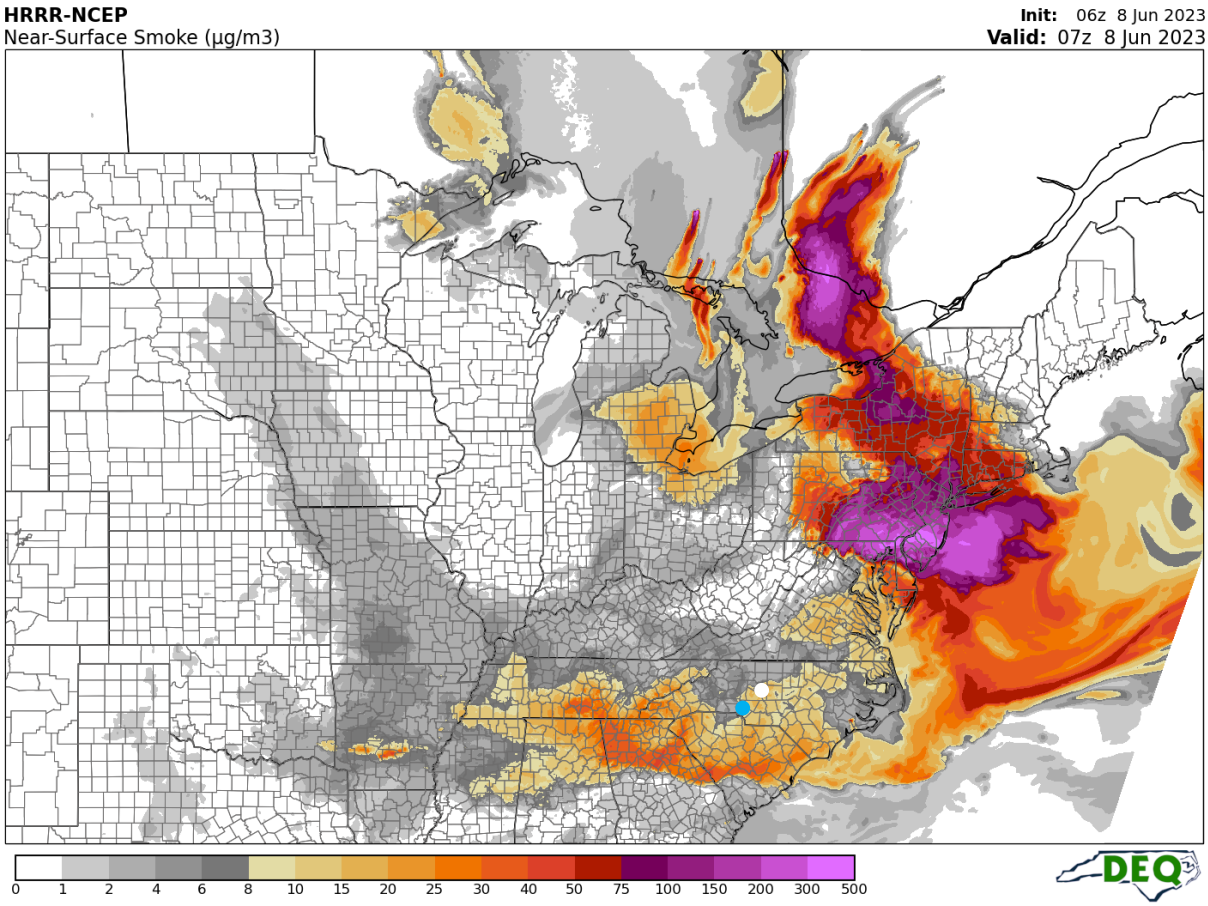

***Figure 125-C**: HRRR-NCEP Smoke model output, initialized at 2:00 am June 8th, showing near-surface smoke at 3:00 am on June 8th. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix D: Additional Tier 2 Evidence for 6/9/2023

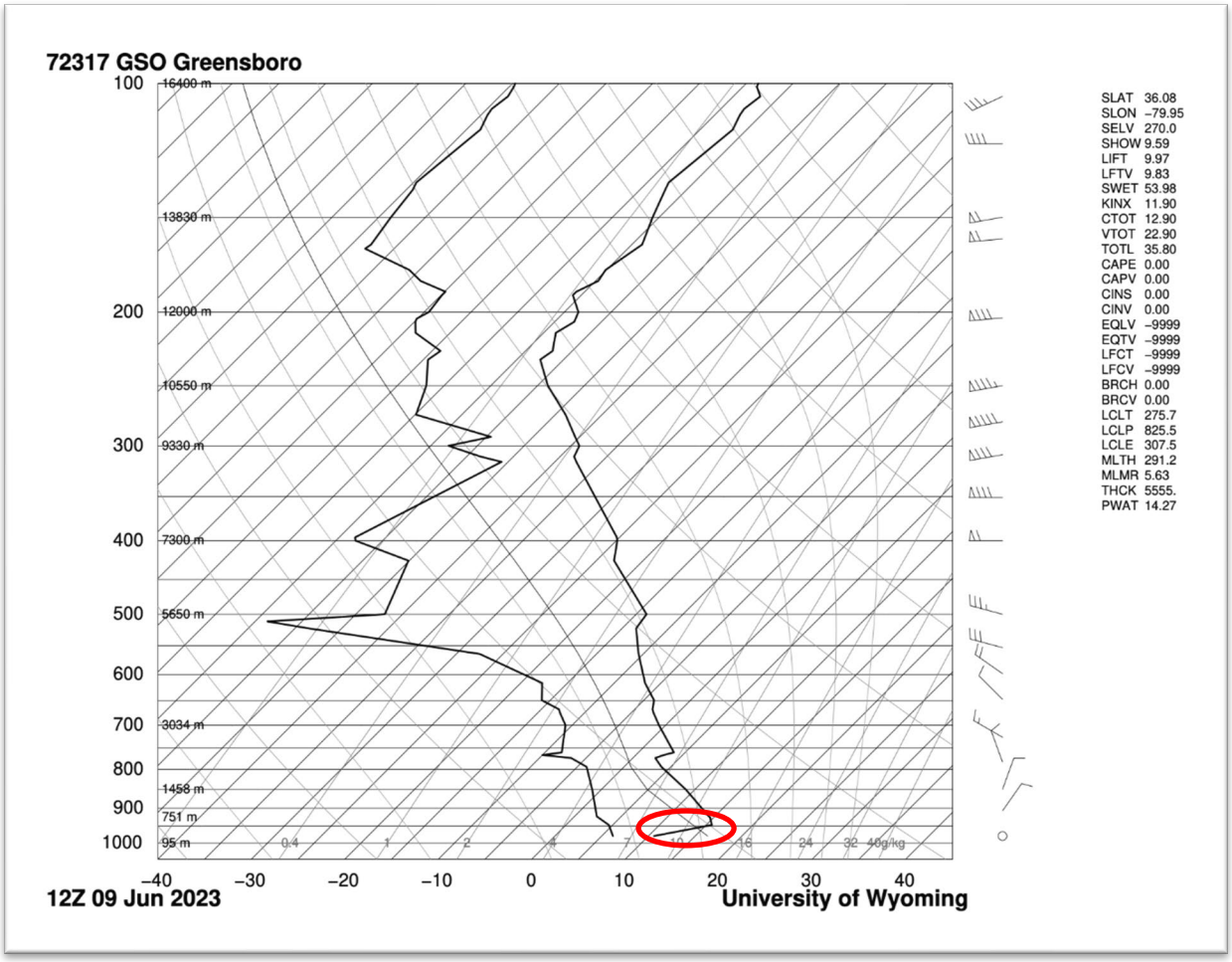

***Figure 126-D**: KGSO 8:00 am, June 9th, 2023 observed radiosonde sounding. Strong surface temperature inversion circled in red.*

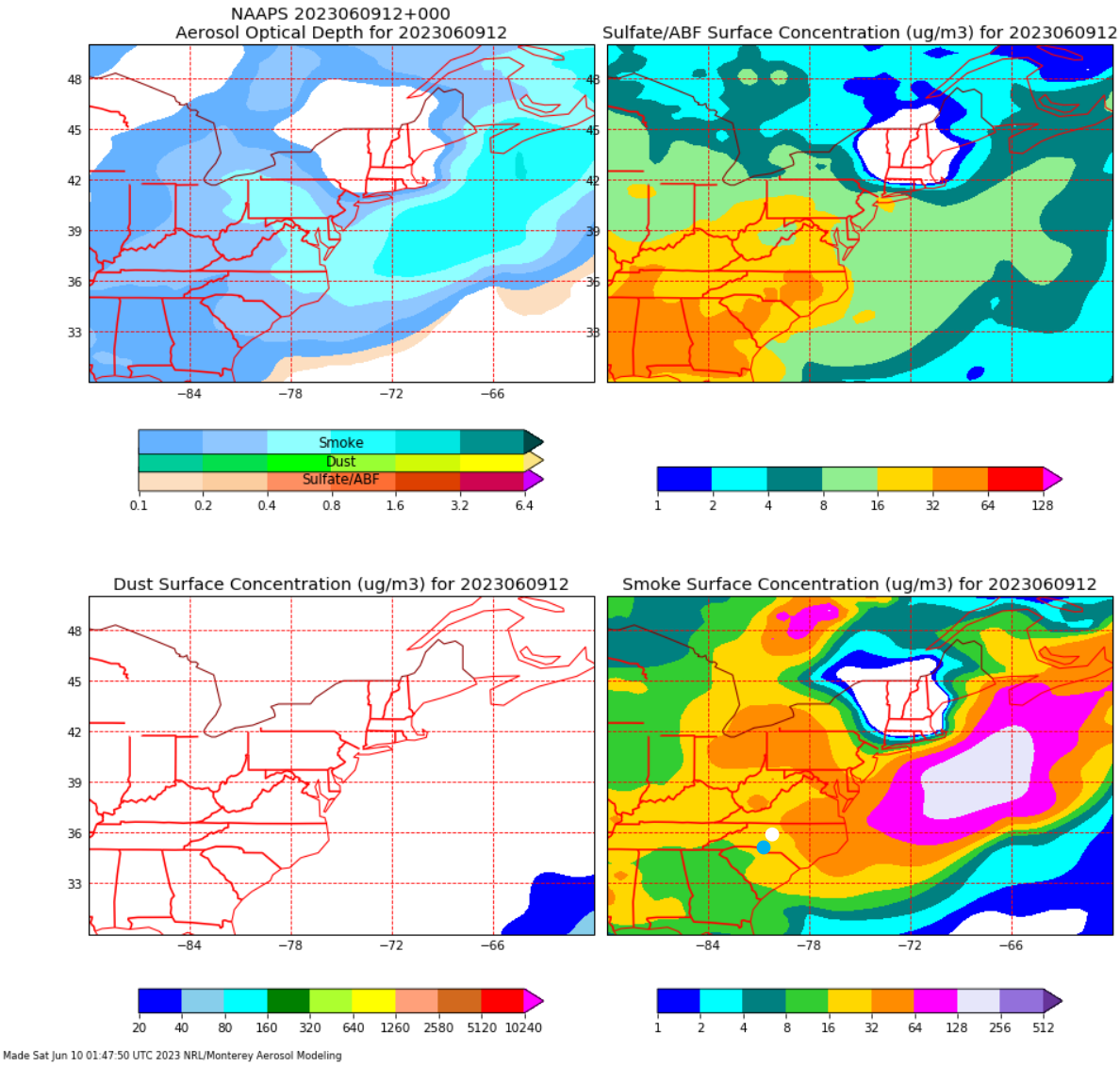

***Figure 127-D**: NAAPs Global Aerosol Model initialization / analysis at 8:00 am on June 9th, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

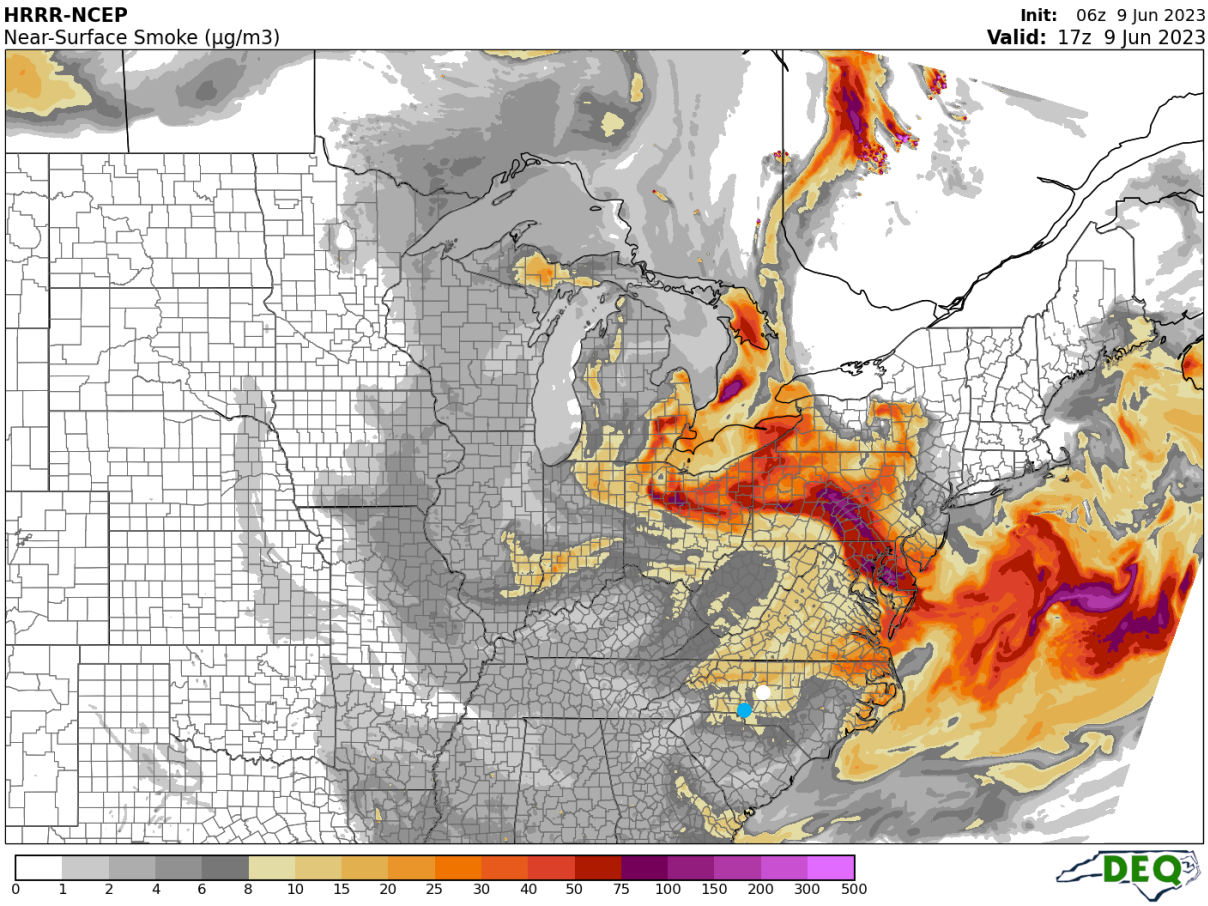

***Figure 128-D**: HRRR-NCEP Smoke model output, initialized at 2:00 am June 9th, showing near-surface smoke at 1:00 pm on June 9th. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix E: Additional Tier 2 Evidence for 6/10/2023

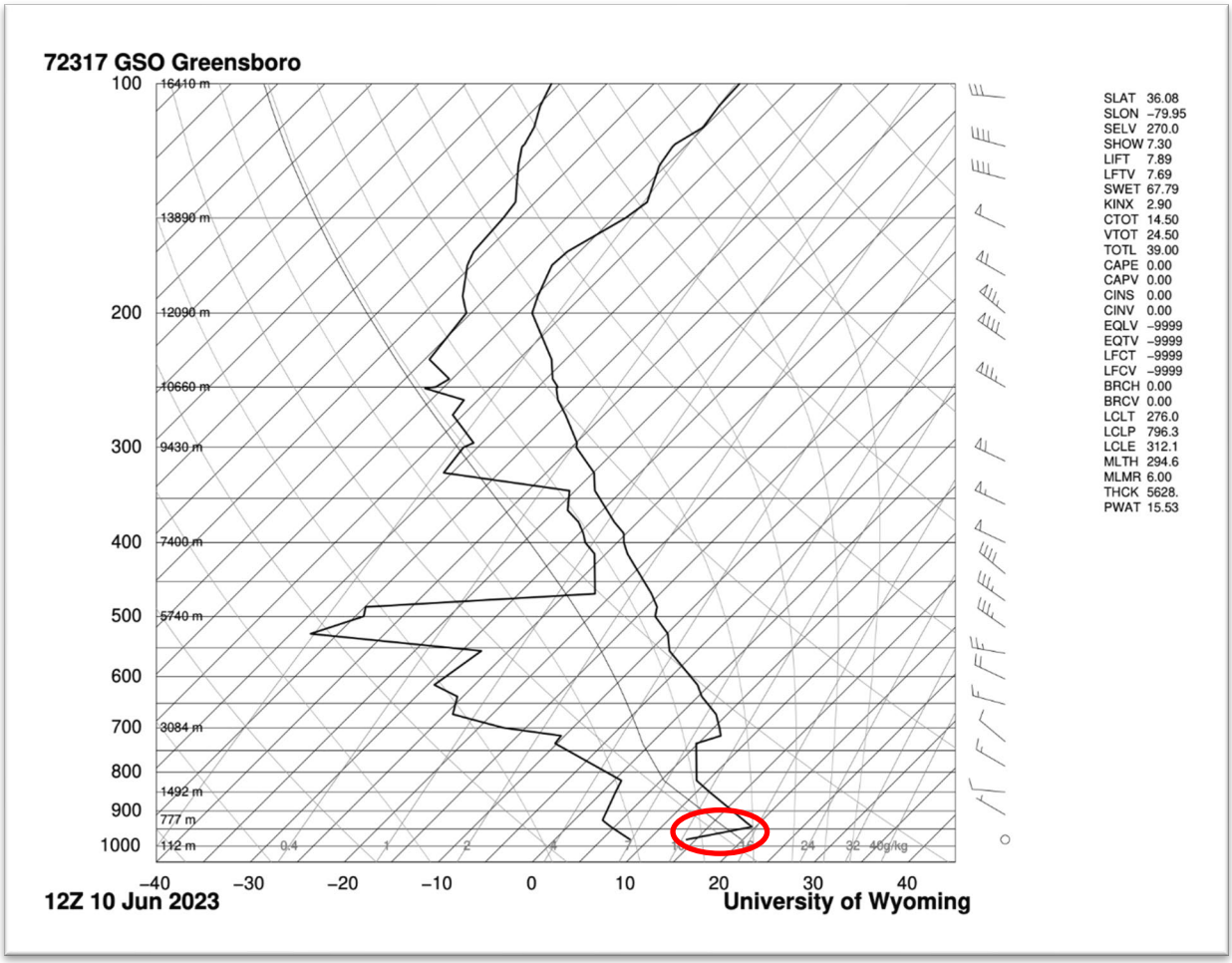

***Figure 129-E**: KGSO 8:00 am, June 10th, 2023 observed radiosonde sounding. Strong surface temperature inversion circled in red.*

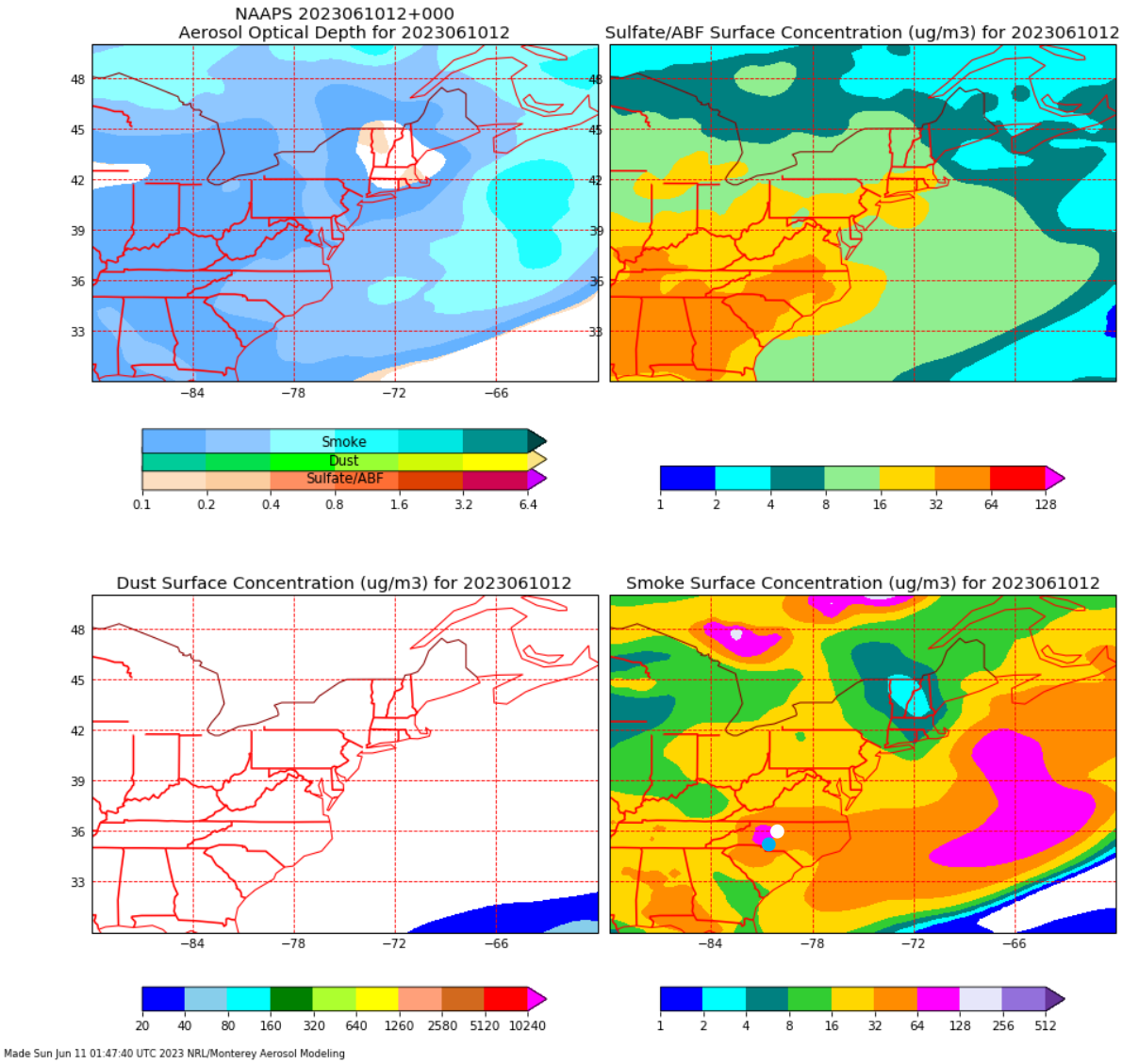

***Figure 130-E**: NAAPs Global Aerosol Model initialization / analysis at 8:00 am on June 10th, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

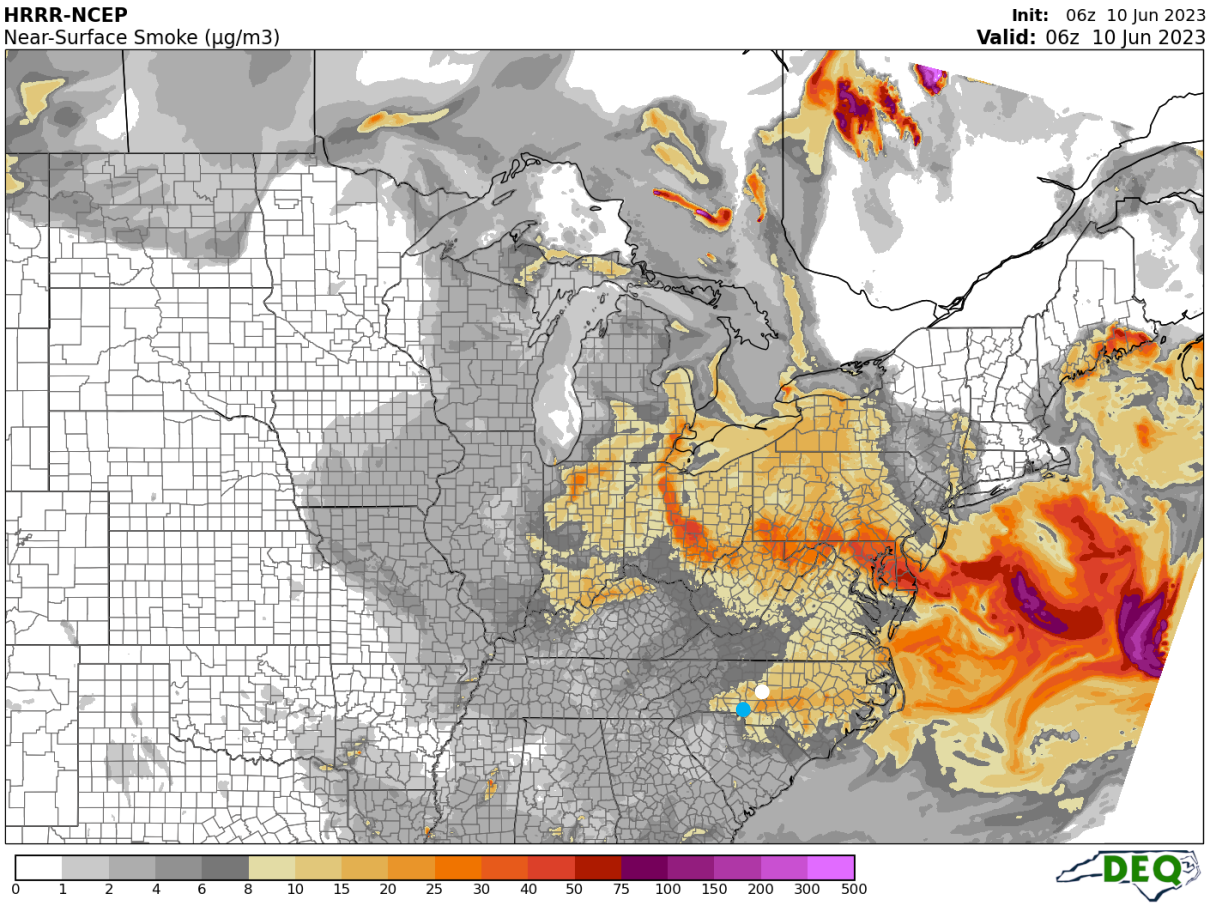

***Figure 131-E**: HRRR-NCEP Smoke model output, initialized at 2:00 am June 10th, showing near-surface smoke at 2:00 am on June 10th. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix F: Additional Tier 2 Evidence for 6/11/2023

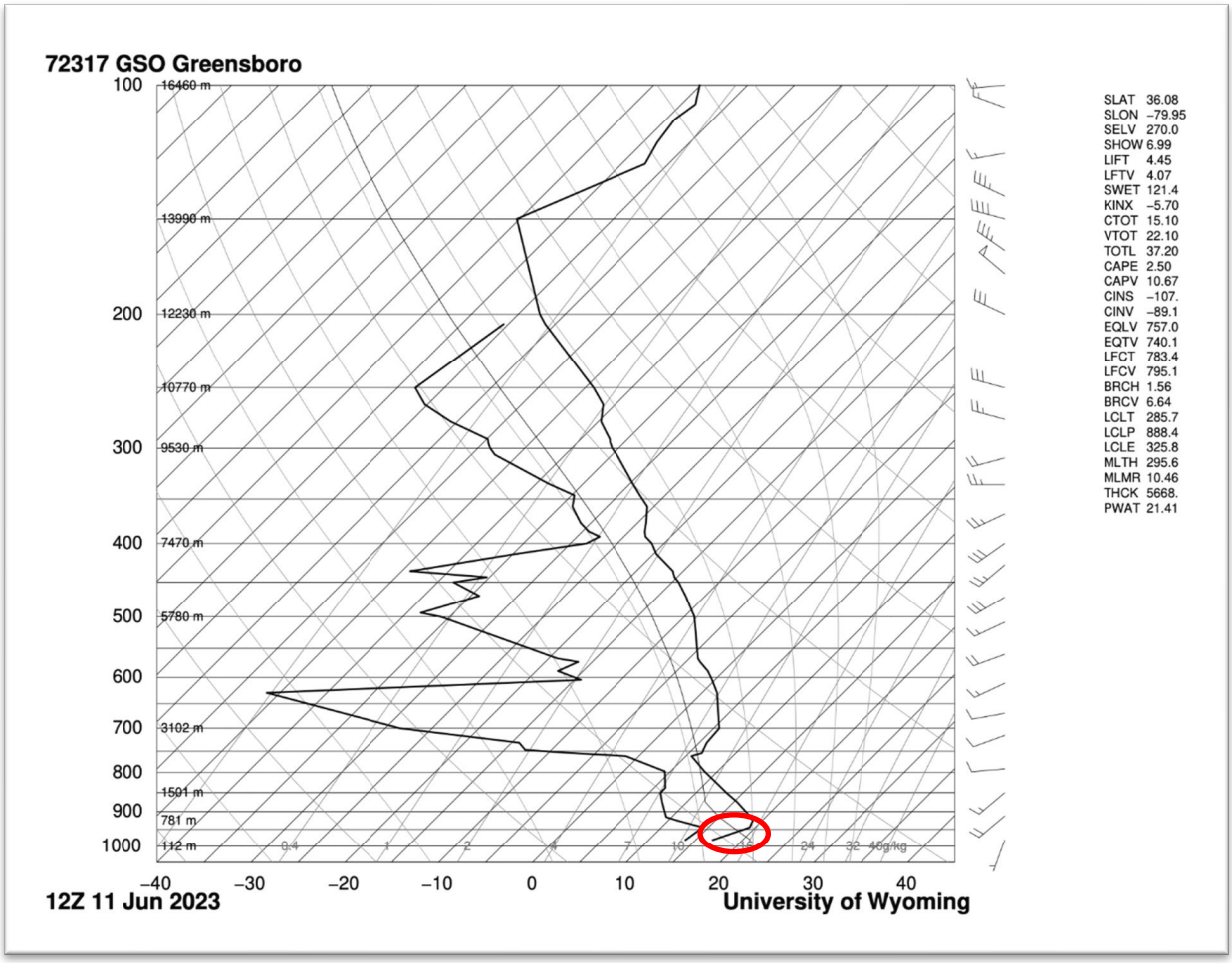

***Figure 132-F**: KGSO 8:00 am, June 11th, 2023 observed radiosonde sounding. Strong surface temperature inversion circled in red.*

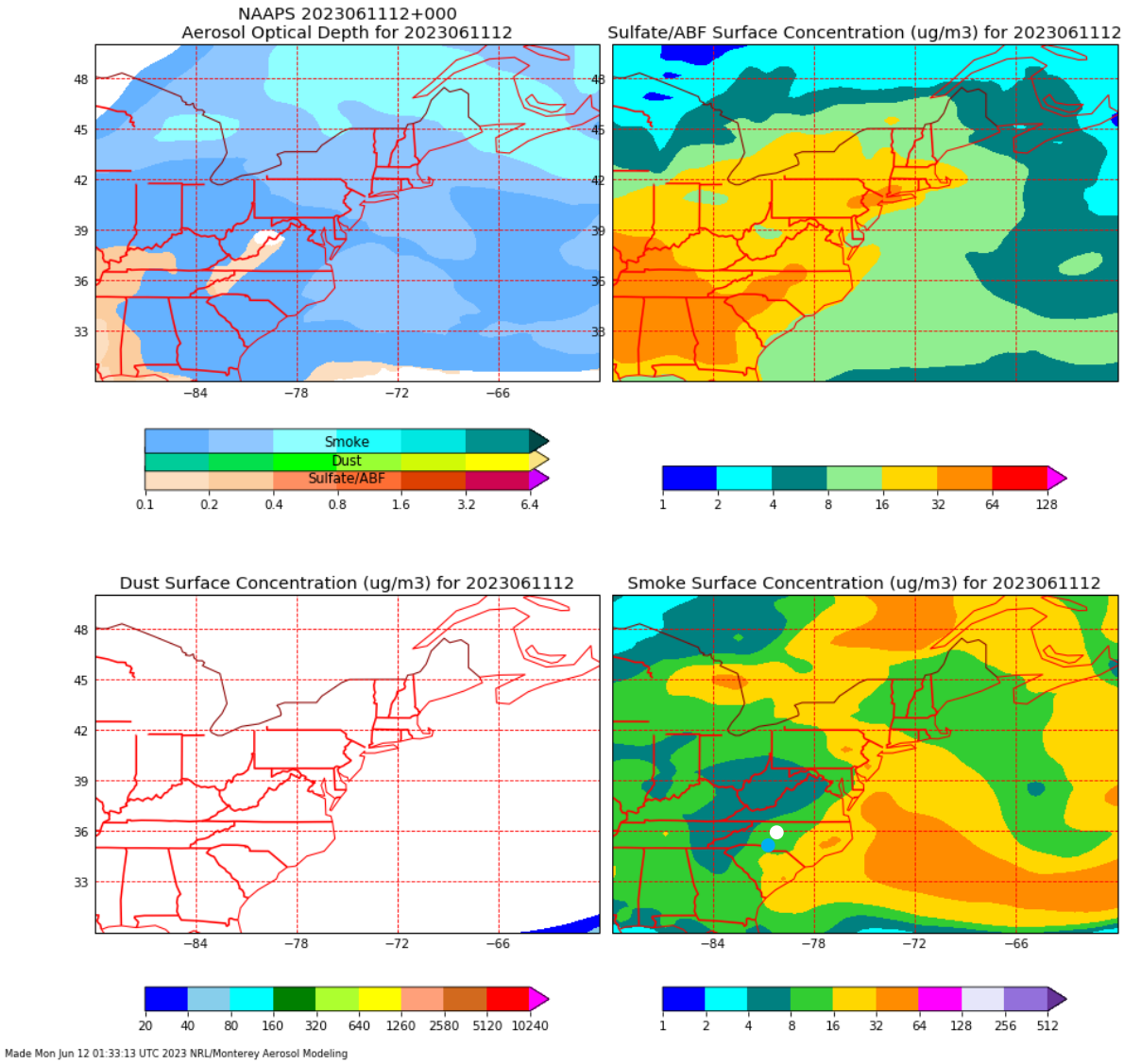

***Figure 133-F**: NAAPs Global Aerosol Model initialization / analysis at 8:00 am on June 11th, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

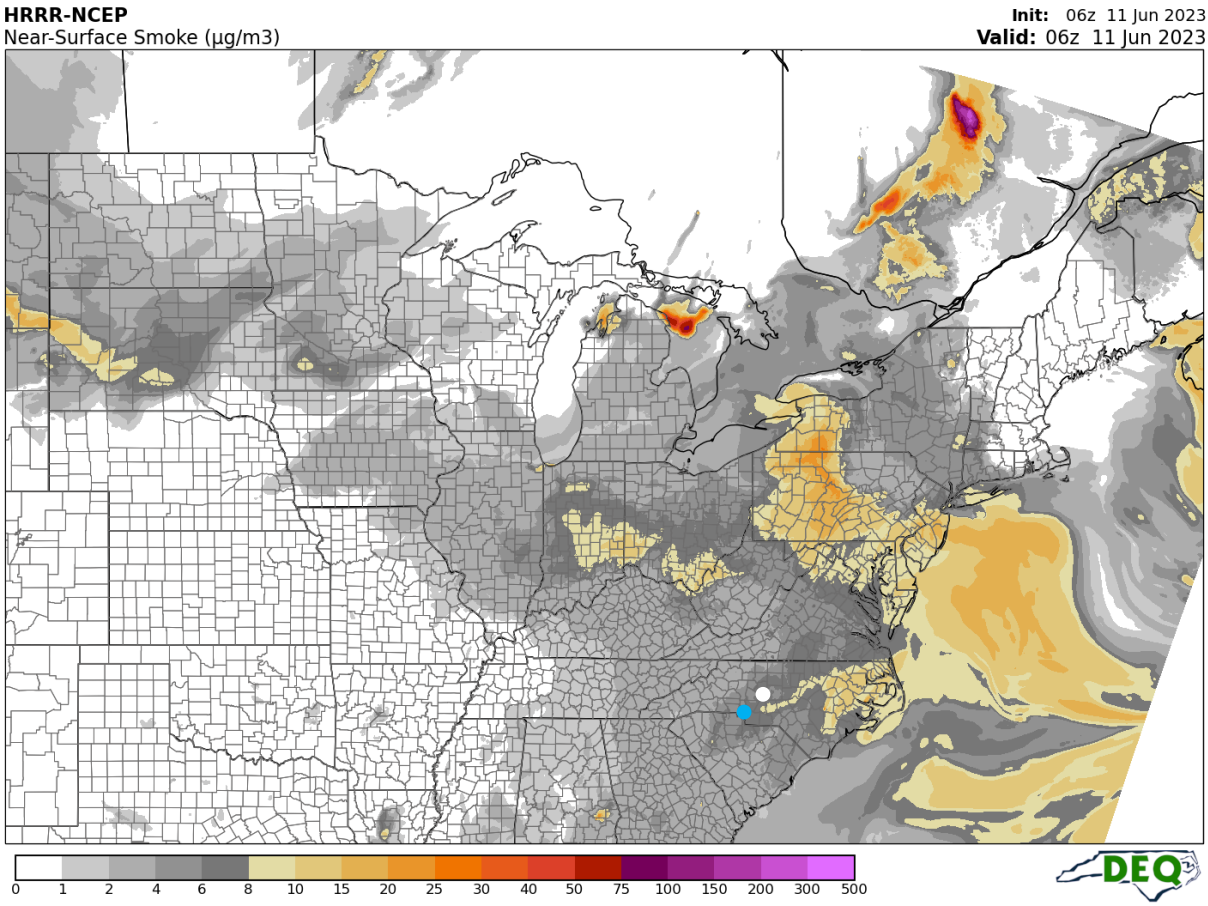

***Figure 134-F**: HRRR-NCEP Smoke model output, initialized at 2:00 am June 11th, showing near-surface smoke at 2:00 am on June 11th. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix G: Additional Tier 2 Evidence for 6/17/2023

"AVIATION /20Z SATURDAY THROUGH THURSDAY/... At KCLT and elsewhere: ***Smoke from Canadian wildfires is once again circulating into the Terminal Forecast Area****, and has resulted in some brief reduction to MVFR visby in a few areas so far today. This trend could continue/resume, especially overnight into early Sunday, but this is far from certain, and have opted for a VFR/convection- free forecast in light of a dry low level air mass."*

Figure 135-G*: NWS GSP Aviation Forecast Discussion on June 17th, 2023.*

station	valid	metar
CLT	2023-06-17 00:52	KCLT 170052Z 24004KT 8SM FEW250 27/15 A2974 RMK AO2 SLP074 T02670150
CLT	2023-06-17 01:52	KCLT 170152Z 21005KT 8SM CLR 26/15 A2977 RMK AO2 SLP085 T02560150
CLT	2023-06-17 02:52	KCLT 170252Z 28005KT 8SM FEW075 24/16 A2980 RMK AO2 SLP097 T02390161 53028
CLT	2023-06-17 03:52	KCLT 170352Z 01006KT 8SM FEW075 23/16 A2982 RMK AO2 SLP103 T02280161
CLT	2023-06-17 04:52	KCLT 170452Z 01008KT **6SM HZ** CLR 23/13 A2983 RMK AO2 SLP104 T02330133 403220194
CLT	2023-06-17 05:52	KCLT 170552Z 03006KT **6SM HZ** CLR 22/12 A2983 RMK AO2 SLP106 T02170117 10289 20217 51008
CLT	2023-06-17 06:52	KCLT 170652Z 03004KT 7SM CLR 21/11 A2985 RMK AO2 SLP111 T02060111
CLT	2023-06-17 07:52	KCLT 170752Z 01006KT 7SM CLR 19/11 A2985 RMK AO2 SLP114 T01890106
CLT	2023-06-17 08:52	KCLT 170852Z 24003KT 7SM CLR 18/12 A2986 RMK AO2 SLP115 T01830117 51009
CLT	2023-06-17 09:52	KCLT 170952Z 28003KT **6SM HZ** CLR 17/12 A2987 RMK AO2 SLP121 T01720122
CLT	2023-06-17 10:52	KCLT 171052Z 00000KT **5SM HZ** CLR 17/13 A2990 RMK AO2 SLP129 T01720128
CLT	2023-06-17 11:52	KCLT 171152Z 36004KT **5SM HZ** CLR 19/13 A2991 RMK AO2 SLP134 T01940133 10217 20161 53018
CLT	2023-06-17 12:52	KCLT 171252Z 02005KT **6SM HZ** CLR 22/13 A2992 RMK AO2 SLP139 T02170133
CLT	2023-06-17 13:52	KCLT 171352Z 03007KT 7SM CLR 23/13 A2992 RMK AO2 SLP138 T02330128
CLT	2023-06-17 14:52	KCLT 171452Z 34007KT 8SM CLR 25/13 A2992 RMK AO2 SLP137 T02500128 50003
CLT	2023-06-17 15:52	KCLT 171552Z VRB03KT 8SM CLR 27/13 A2992 RMK AO2 SLP136 T02670128
CLT	2023-06-17 16:52	KCLT 171652Z 00000KT 8SM CLR 26/12 A2990 RMK AO2 SLP132 T02560122
CLT	2023-06-17 17:52	KCLT 171752Z 28006KT 8SM FEW050 27/13 A2989 RMK AO2 SLP128 T02720128 10278 20194 58009
CLT	2023-06-17 18:52	KCLT 171852Z 16005KT 8SM FEW050 27/13 A2988 RMK AO2 SLP123 T02720128
CLT	2023-06-17 19:52	KCLT 171952Z 23005KT 7SM FEW055 29/13 A2987 RMK AO2 SLP121 T02890133
CLT	2023-06-17 20:52	KCLT 172052Z VRB04KT 7SM FEW060 29/13 A2985 RMK AO2 SLP115 T02940128 58013
CLT	2023-06-17 21:52	KCLT 172152Z 31004KT 7SM CLR 29/13 A2984 RMK AO2 SLP111 T02940128
CLT	2023-06-17 22:52	KCLT 172252Z 25003KT 7SM CLR 28/14 A2984 RMK AO2 SLP111 T02830139
CLT	2023-06-17 23:52	KCLT 172352Z 24004KT 7SM CLR 27/14 A2984 RMK AO2 SLP112 T02720139 10294 20272 55003

Figure 136-G*: Hourly METAR reports from Charlotte/Douglas International Airport (KCLT) on June 17th, 2023. "HZ" is abbreviation for haze.*

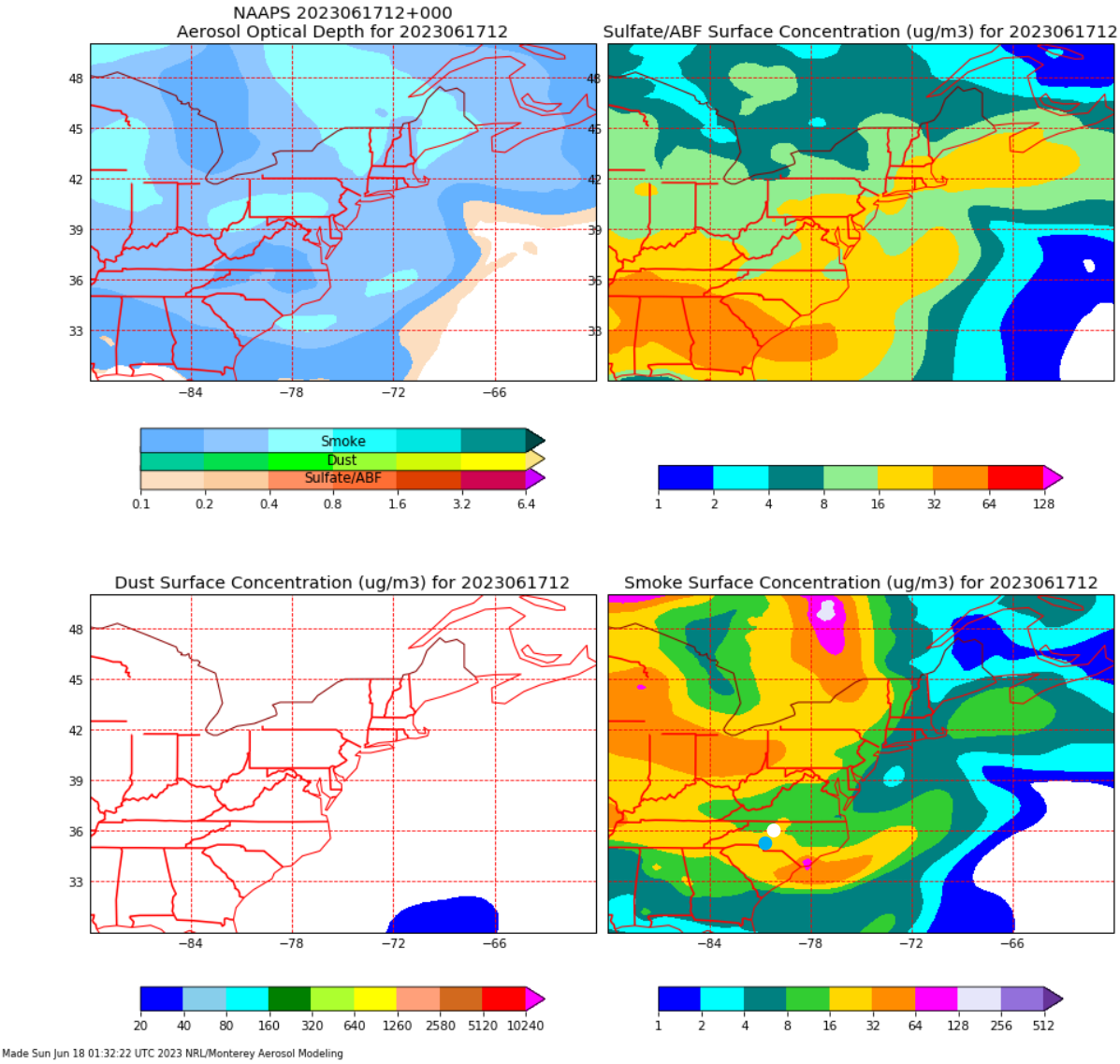

***Figure 137-G**: NAAPs Global Aerosol Model initialization / analysis at 8:00 am on June 17th, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

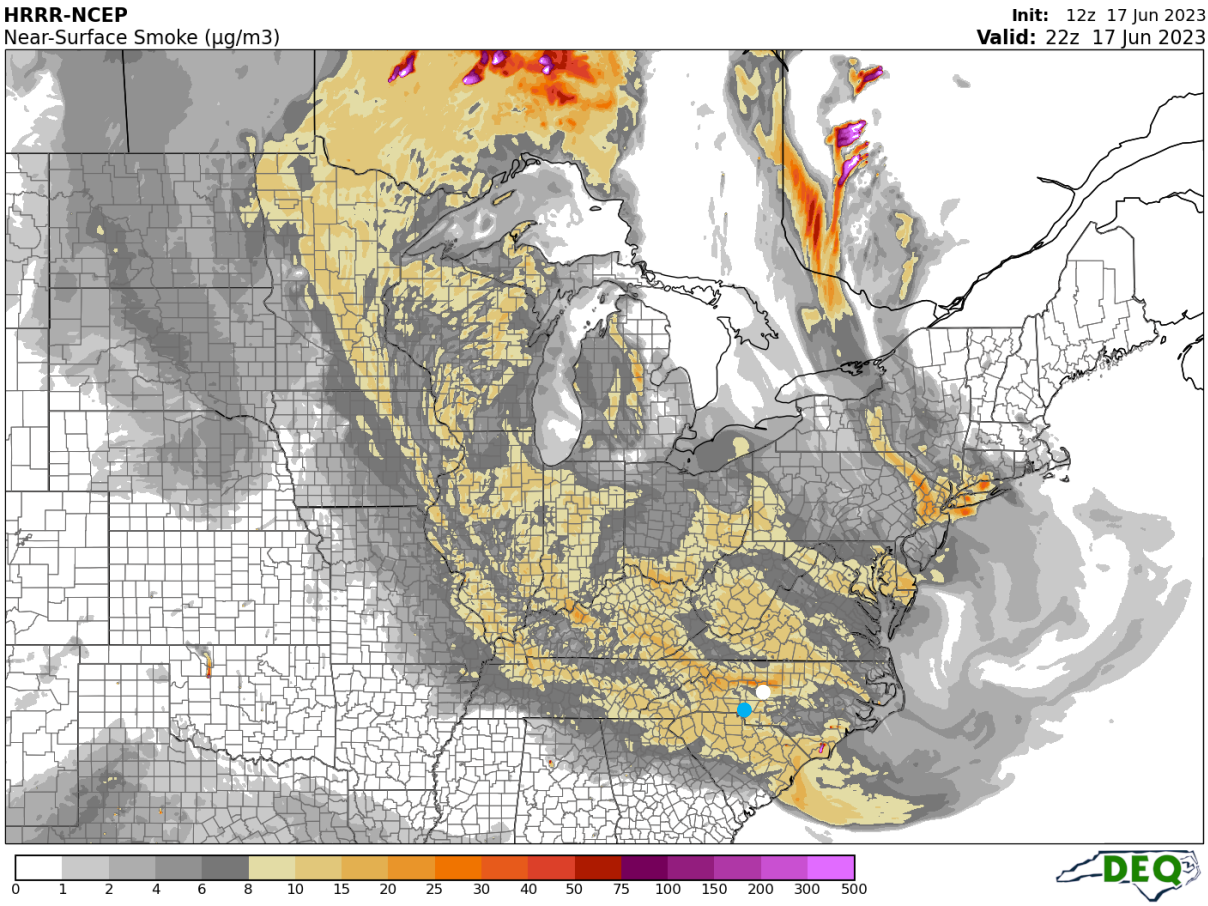

***Figure 138-G**: HRRR-NCEP Smoke model output, initialized at 8:00 am June 17th, showing near-surface smoke at 6:00 pm on June 17th. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix H: Additional Tier 2 Evidence for 6/18/2023

station	valid	metar
CLT	2023-06-18 00:52	KCLT 180052Z 21003KT 7SM FEW055 26/14 A2986 RMK AO2 SLP119 T02610144
CLT	2023-06-18 01:52	KCLT 180152Z 00000KT 7SM CLR 24/16 A2989 RMK AO2 SLP127 T02390156
CLT	2023-06-18 02:52	KCLT 180252Z 14003KT 7SM FEW075 25/15 A2991 RMK AO2 SLP133 T02500150 51022
CLT	2023-06-18 03:52	KCLT 180352Z 12003KT 7SM FEW070 23/15 A2991 RMK AO2 SLP134 T02330150
CLT	2023-06-18 04:52	KCLT 180452Z 00000KT 7SM FEW070 23/14 A2991 RMK AO2 SLP135 T02280144 402940161
CLT	2023-06-18 05:52	KCLT 180552Z 03008KT 8SM CLR 22/13 A2991 RMK AO2 SLP133 T02170133 10272 20200 58001
CLT	2023-06-18 06:52	KCLT 180652Z 04008KT 8SM CLR 22/12 A2990 RMK AO2 SLP131 T02170117
CLT	2023-06-18 07:52	KCLT 180752Z 03005KT 8SM CLR 21/12 A2990 RMK AO2 SLP130 T02060117
CLT	2023-06-18 08:52	KCLT 180852Z 34003KT 8SM CLR 19/12 A2991 RMK AO2 SLP133 T01890122 55000
CLT	2023-06-18 09:52	KCLT 180952Z 04005KT 8SM SCT060 19/12 A2992 RMK AO2 SLP138 T01890117
CLT	2023-06-18 10:52	KCLT 181052Z 07006KT 7SM FEW060 20/12 A2992 RMK AO2 SLP136 T02000117
CLT	2023-06-18 11:52	KCLT 181152Z 35005KT **6SM HZ** CLR 19/13 A2994 RMK AO2 SLP143 T01940133 10222 20183 53010
CLT	2023-06-18 12:52	KCLT 181252Z 36005KT 7SM FEW055 FEW250 22/13 A2996 RMK AO2 SLP151 T02170133
CLT	2023-06-18 13:52	KCLT 181352Z 04006KT 7SM FEW060 FEW250 24/13 A2996 RMK AO2 SLP153 T02390133
CLT	2023-06-18 14:52	KCLT 181452Z 08006KT 7SM FEW060 FEW250 26/13 A2995 RMK AO2 SLP147 T02560133 50004
CLT	2023-06-18 15:52	KCLT 181552Z 04004KT 8SM FEW065 SCT250 28/14 A2995 RMK AO2 SLP146 T02780139
CLT	2023-06-18 16:52	KCLT 181652Z 15004KT 8SM SCT250 28/13 A2994 RMK AO2 SLP143 T02830133
CLT	2023-06-18 17:52	KCLT 181752Z VRB05KT 8SM SCT060 SCT075 BKN250 29/13 A2992 RMK AO2 SLP138 T02940133 10300 20194 58009
CLT	2023-06-18 18:52	KCLT 181852Z 21009KT 8SM FEW060 BKN250 30/14 A2990 RMK AO2 SLP130 T03000144
CLT	2023-06-18 19:52	KCLT 181952Z VRB04KT 8SM FEW060 BKN250 30/15 A2989 RMK AO2 SLP125 T03000150
CLT	2023-06-18 20:52	KCLT 182052Z VRB04KT 7SM SCT060 BKN250 31/15 A2987 RMK AO2 SLP120 T03110150 56017
CLT	2023-06-18 21:52	KCLT 182152Z 28004KT **6SM HZ** SCT065 SCT200 BKN250 31/16 A2986 RMK AO2 SLP117 T03110161
CLT	2023-06-18 22:52	KCLT 182252Z 27004KT 7SM FEW060 FEW200 BKN250 31/16 A2985 RMK AO2 SLP114 T03060161
CLT	2023-06-18 23:52	KCLT 182352Z 36004KT 7SM FEW060 BKN250 28/16 A2986 RMK AO2 SLP119 T02830161 10317 20283 55003

***Figure 139-H**: Hourly METAR reports from Charlotte/Douglas International Airport (KCLT) on June 18th, 2023. "HZ" is abbreviation for haze.*

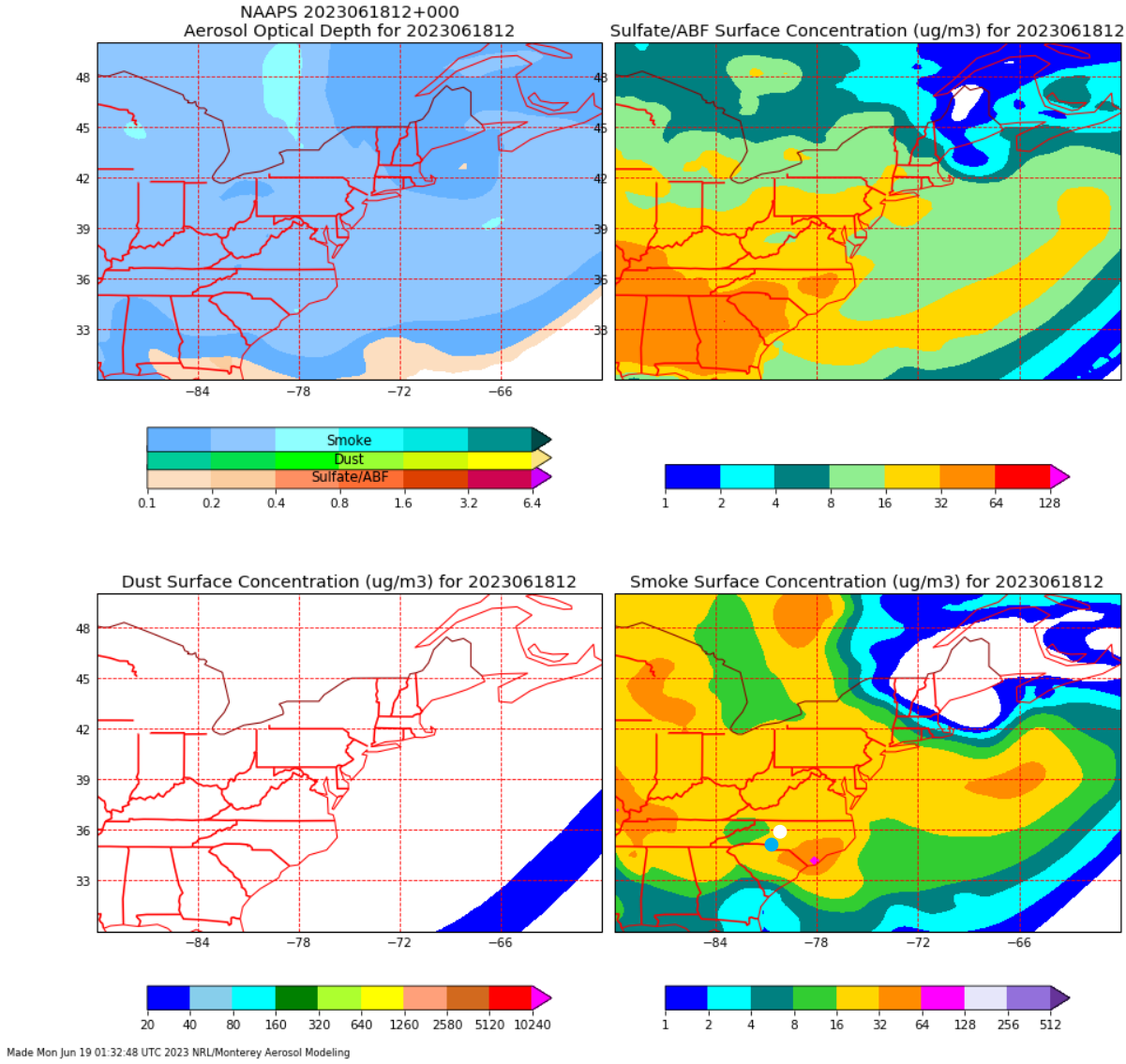

***Figure 140-H**: NAAPs Global Aerosol Model initialization / analysis at 8:00 am on June 18th, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

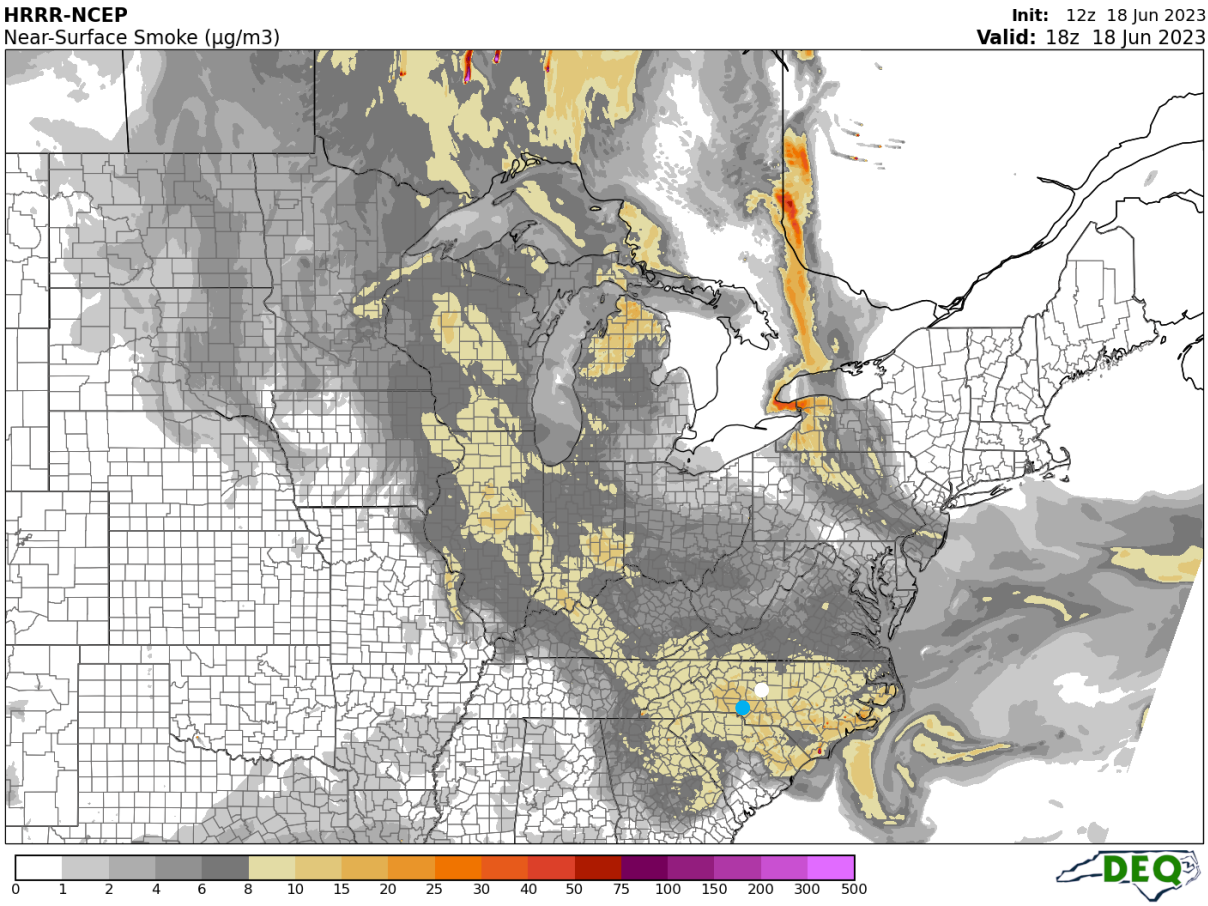

***Figure 141-H**: HRRR-NCEP Smoke model output, initialized at 8:00 am June 18th, showing near-surface smoke at 2:00 pm on June 18th. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix I: Additional Tier 2 Evidence for 6/28/2023

station	valid	metar
JQF	2023-06-28 00:50	KJQF 280050Z 00000KT 10SM CLR 26/17 A2985
JQF	2023-06-28 01:50	KJQF 280150Z 00000KT 10SM CLR 23/18 A2988
JQF	2023-06-28 02:50	KJQF 280250Z 00000KT 10SM CLR 23/18 A2990
JQF	2023-06-28 04:20	KJQF 280420Z AUTO 32005KT 10SM BKN110 23/17 A2993 RMK AO2
JQF	2023-06-28 04:40	KJQF 280440Z AUTO 32005KT 10SM BKN100 23/17 A2993 RMK AO2
JQF	2023-06-28 05:00	KJQF 280500Z AUTO 31005KT 10SM BKN100 22/17 A2993 RMK AO2
JQF	2023-06-28 05:20	KJQF 280520Z AUTO 31004KT 10SM BKN110 22/17 A2993 RMK AO2
JQF	2023-06-28 05:40	KJQF 280540Z AUTO 32005KT 10SM BKN110 22/17 A2993 RMK AO2
JQF	2023-06-28 06:00	KJQF 280600Z AUTO 33004KT 10SM SCT100 22/17 A2993 RMK AO2
JQF	2023-06-28 06:20	KJQF 280620Z AUTO 00000KT 10SM CLR 21/17 A2993 RMK AO2
JQF	2023-06-28 06:40	KJQF 280640Z AUTO 00000KT 10SM SCT075 20/17 A2993 RMK AO2
JQF	2023-06-28 07:00	KJQF 280700Z AUTO 00000KT 10SM CLR 20/17 A2993 RMK AO2
JQF	2023-06-28 07:20	KJQF 280720Z AUTO 00000KT 10SM CLR 19/17 A2993 RMK AO2
JQF	2023-06-28 07:40	KJQF 280740Z AUTO 00000KT 10SM CLR 20/17 A2992 RMK AO2
JQF	2023-06-28 08:00	KJQF 280800Z AUTO 00000KT 10SM CLR 19/16 A2992 RMK AO2
JQF	2023-06-28 08:20	KJQF 280820Z AUTO 00000KT 10SM CLR 19/17 A2992 RMK AO2
JQF	2023-06-28 08:40	KJQF 280840Z AUTO 00000KT 10SM CLR 18/17 A2992 RMK AO2
JQF	2023-06-28 09:00	KJQF 280900Z AUTO 00000KT 10SM CLR 18/17 A2992 RMK AO2
JQF	2023-06-28 09:20	KJQF 280920Z AUTO 00000KT 10SM CLR 18/16 A2993 RMK AO2
JQF	2023-06-28 09:40	KJQF 280940Z AUTO 00000KT 10SM CLR 18/16 A2993 RMK AO2
JQF	2023-06-28 10:00	KJQF 281000Z AUTO 00000KT 10SM CLR 17/16 A2994 RMK AO2
JQF	2023-06-28 10:20	KJQF 281020Z AUTO 00000KT 10SM CLR 18/16 A2994 RMK AO2
JQF	2023-06-28 10:40	KJQF 281040Z AUTO 00000KT 7SM CLR 18/16 A2995 RMK AO2
JQF	2023-06-28 10:50	KJQF 281050Z 00000KT 10SM CLR 18/17 A2996
JQF	2023-06-28 11:00	KJQF 281100Z AUTO 00000KT 10SM CLR 17/17 A2996 RMK AO2
JQF	2023-06-28 11:50	KJQF 281150Z 00000KT 10SM CLR 22/17 A2998
JQF	2023-06-28 12:50	KJQF 281250Z 02004KT 10SM CLR 24/17 A3000
JQF	2023-06-28 13:50	KJQF 281350Z 03004KT 10SM CLR 26/18 A3001
JQF	2023-06-28 14:50	KJQF 281450Z 00000KT 10SM CLR 27/16 A3001
JQF	2023-06-28 15:50	KJQF 281550Z 01006KT 10SM CLR 28/17 A3001
JQF	2023-06-28 16:50	KJQF 281650Z 00000KT 10SM CLR 29/17 A3001
JQF	2023-06-28 17:50	KJQF 281750Z 32008KT 10SM CLR 29/17 A2999
JQF	2023-06-28 18:50	KJQF 281850Z 27005KT 10SM CLR 30/17 A2998
JQF	2023-06-28 19:50	KJQF 281950Z 35004KT **7SM** CLR 30/17 A2998
JQF	2023-06-28 20:50	KJQF 282050Z 35004KT **7SM** CLR 31/15 A2995
JQF	2023-06-28 21:50	KJQF 282150Z 36005KT **7SM** SCT060 31/17 A2996
JQF	2023-06-28 22:50	KJQF 282250Z 01003KT **7SM** CLR 29/18 A2995
JQF	2023-06-28 23:50	KJQF 282350Z 05003KT **7SM** CLR 29/18 A2997

***Figure 142-I**: Hourly METAR reports from Concord Regional Airport (KJQF) on June 28th, 2023.*

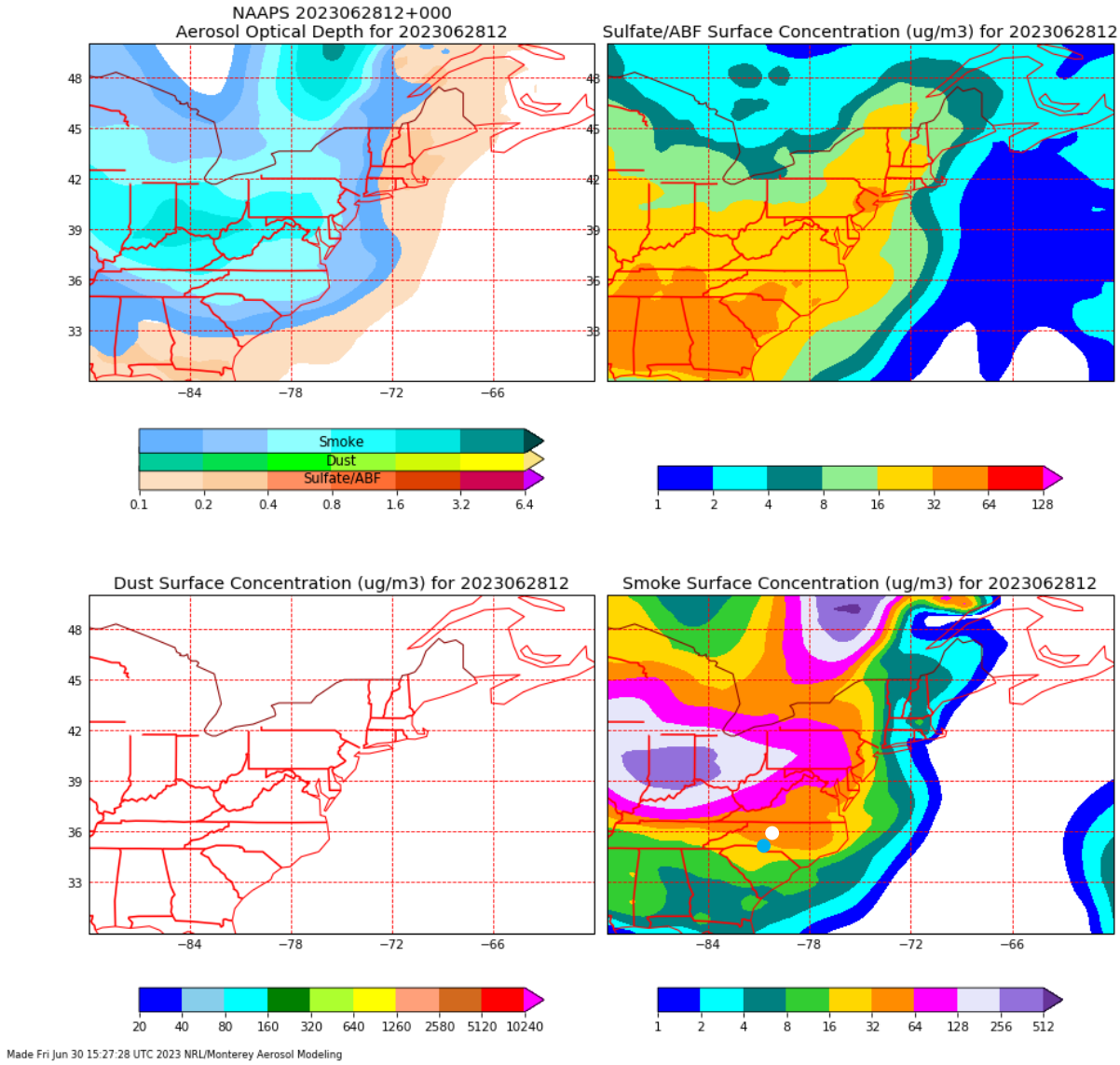

***Figure 143-I**: NAAPs Global Aerosol Model initialization / analysis at 8:00 am on June 28th, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

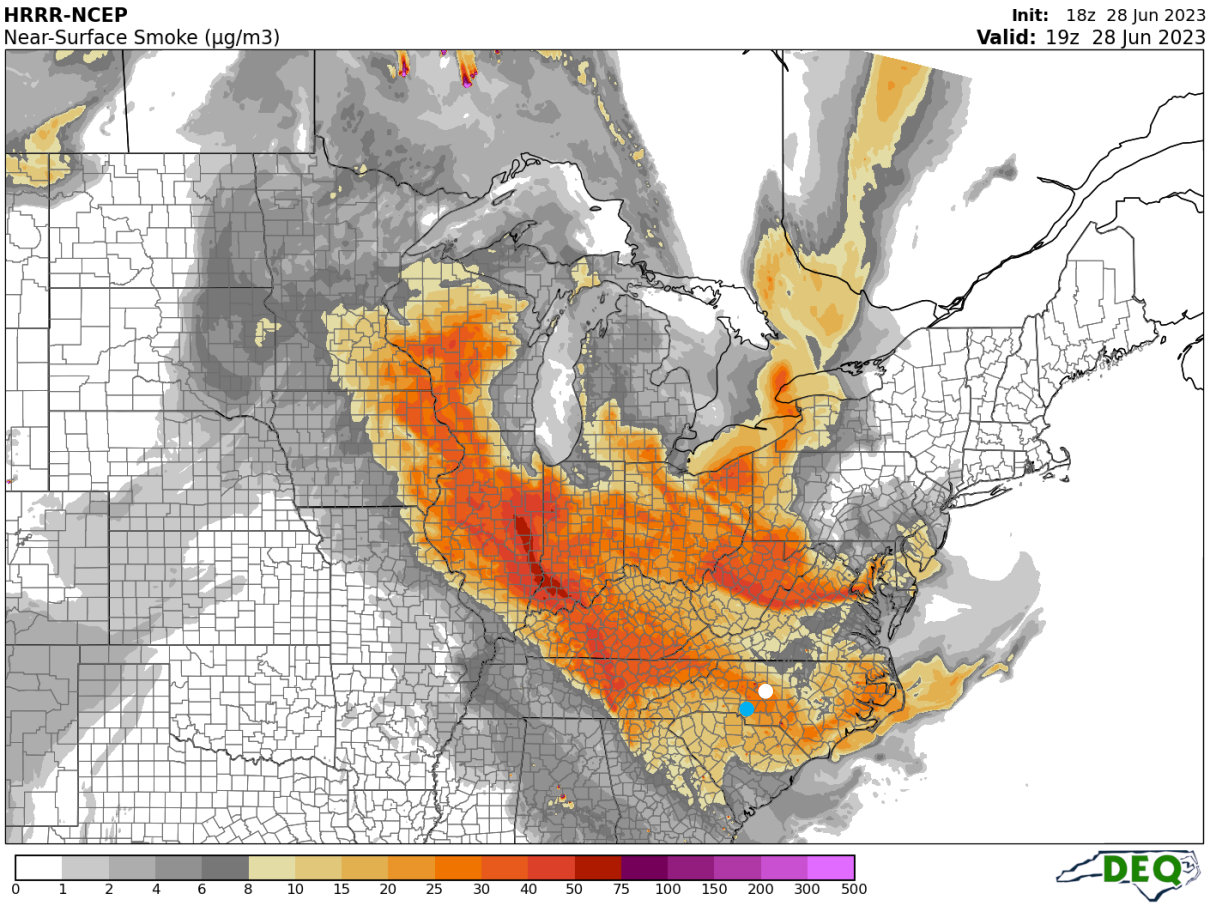

***Figure 144-I**: HRRR-NCEP Smoke model output, initialized at 2:00 pm June 28th, showing near-surface smoke at 3:00 pm on June 28th. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix J: Additional Tier 2 Evidence for 7/1/2023

station	valid	metar
JQF	2023-07-01 00:50	KJQF 010050Z 00000KT 10SM CLR 26/19 A3002
JQF	2023-07-01 01:50	KJQF 010150Z 00000KT 10SM CLR 26/22 A3003
JQF	2023-07-01 02:50	KJQF 010250Z 00000KT 10SM CLR 26/22 A3005
JQF	2023-07-01 04:20	KJQF 010420Z AUTO 00000KT 10SM CLR 24/22 A3006 RMK AO2
JQF	2023-07-01 04:40	KJQF 010440Z AUTO 12004KT 10SM CLR 24/21 A3005 RMK AO2
JQF	2023-07-01 05:00	KJQF 010500Z AUTO 00000KT 10SM CLR 23/21 A3005 RMK AO2
JQF	2023-07-01 05:20	KJQF 010520Z AUTO 00000KT 10SM CLR 23/21 A3005 RMK AO2
JQF	2023-07-01 05:40	KJQF 010540Z AUTO 00000KT 10SM CLR 23/21 A3005 RMK AO2
JQF	2023-07-01 05:55	KJQF 010555Z AUTO 00000KT 7SM CLR 23/21 A3005 RMK AO2
JQF	2023-07-01 06:20	KJQF 010620Z AUTO 00000KT 7SM CLR 22/21 A3004 RMK AO2
JQF	2023-07-01 06:40	KJQF 010640Z AUTO 00000KT 7SM CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 07:00	KJQF 010700Z AUTO 13003KT 7SM CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 07:20	KJQF 010720Z AUTO 00000KT 7SM CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 07:40	KJQF 010740Z AUTO 00000KT 7SM CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 08:00	KJQF 010800Z AUTO 00000KT 5SM BR CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 08:20	KJQF 010820Z AUTO 00000KT 5SM BR CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 08:40	KJQF 010840Z AUTO 00000KT 5SM BR CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 09:00	KJQF 010900Z AUTO 00000KT 4SM BR CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 09:20	KJQF 010920Z AUTO 00000KT 4SM BR CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 09:40	KJQF 010940Z AUTO 00000KT 4SM BR CLR 22/21 A3003 RMK AO2
JQF	2023-07-01 10:00	KJQF 011000Z AUTO 00000KT 3SM BR CLR 21/21 A3003 RMK AO2
JQF	2023-07-01 10:20	KJQF 011020Z AUTO 00000KT 3SM BR CLR 21/21 A3004 RMK AO2
JQF	2023-07-01 10:40	KJQF 011040Z AUTO 00000KT 2 1/2SM BR CLR 21/20 A3005 RMK AO2
JQF	2023-07-01 10:55	KJQF 011055Z 00000KT **7SM FUHZ** CLR 22/21 A3004
JQF	2023-07-01 11:00	KJQF 011100Z AUTO 00000KT 2 1/2SM BR CLR 21/21 A3004 RMK AO2
JQF	2023-07-01 11:50	KJQF 011150Z 00000KT **7SM FUHZ** CLR 23/22 A3007
JQF	2023-07-01 12:50	KJQF 011250Z 00000KT **6SM HZ** CLR 24/22 A3007
JQF	2023-07-01 13:59	KJQF 011359Z 00000KT **6SM HZ** CLR 28/22 A3009
JQF	2023-07-01 14:50	KJQF 011450Z 00000KT 7SM CLR 29/22 A3008
JQF	2023-07-01 15:59	KJQF 011559Z 00000KT 7SM CLR 31/22 A3007
JQF	2023-07-01 16:50	KJQF 011650Z 18005KT 8SM BKN032 31/22 A3007
JQF	2023-07-01 17:50	KJQF 011750Z 17004KT 8SM BKN045 31/22 A3006
JQF	2023-07-01 18:50	KJQF 011850Z 00000KT 7SM SCT044 BKN050 32/22 A3004
JQF	2023-07-01 19:50	KJQF 011950Z 19007KT 7SM SCT044 33/22 A3001
JQF	2023-07-01 20:50	KJQF 012050Z 22007KT 7SM SCT046 33/22 A2999
JQF	2023-07-01 21:50	KJQF 012150Z 22005KT 7SM SCT046 32/21 A2997
JQF	2023-07-01 22:50	KJQF 012250Z 29005KT 7SM BKN046 31/22 A3000
JQF	2023-07-01 23:50	KJQF 012350Z 00000KT 10SM CLR 24/22 A2999

***Figure 145-J**: Hourly METAR reports from Concord Regional Airport (KJQF) on July 1st, 2023."FU" is abbreviation for smoke. "HZ" is abbreviation for haze.*

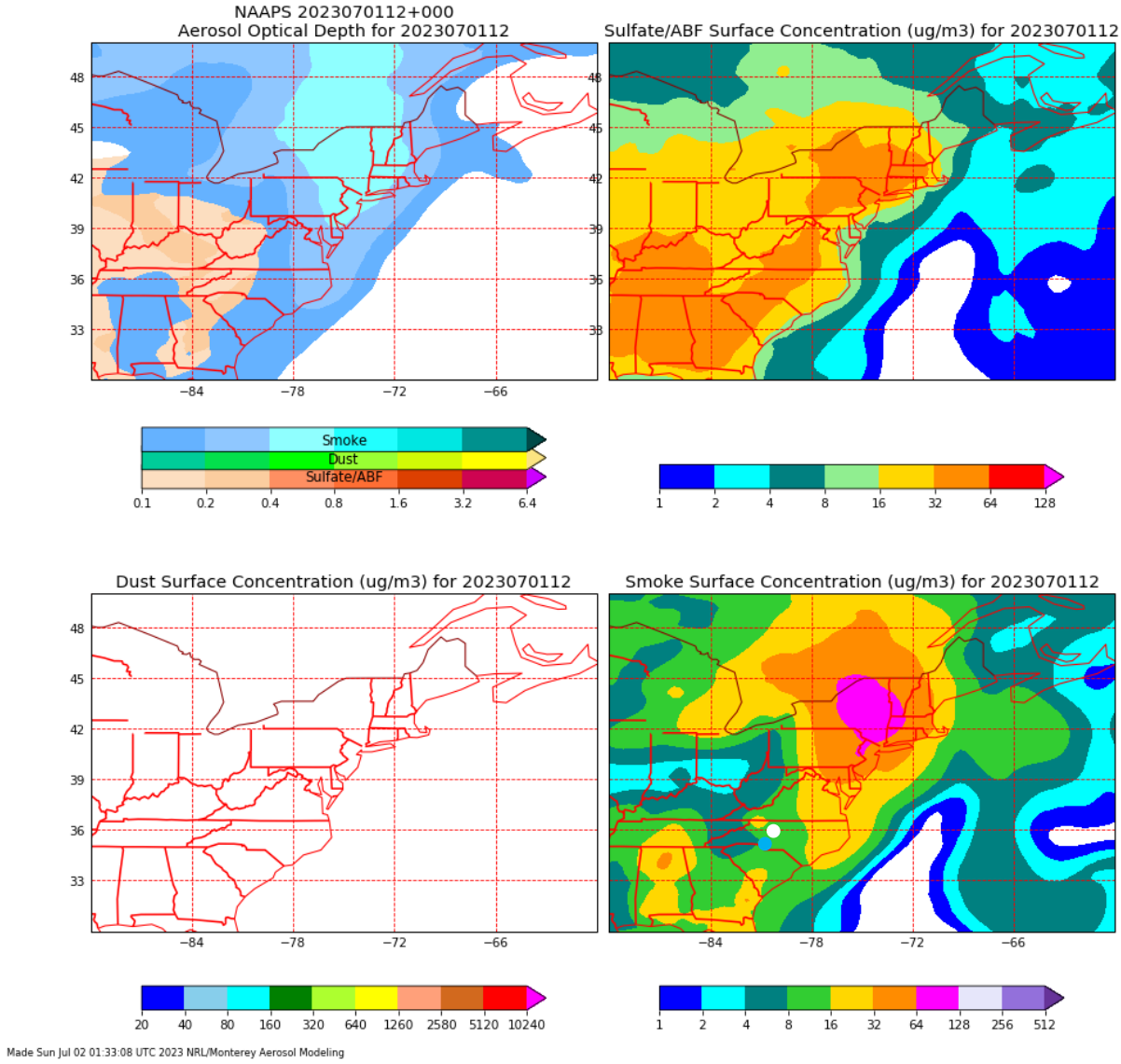

***Figure 146-J**: NAAPs Global Aerosol Model initialization / analysis at 8:00 am on July 1st, 2023. The white and blue circles on the bottom right plot show the approximate locations of the Lexington and Remount monitors, respectively.*

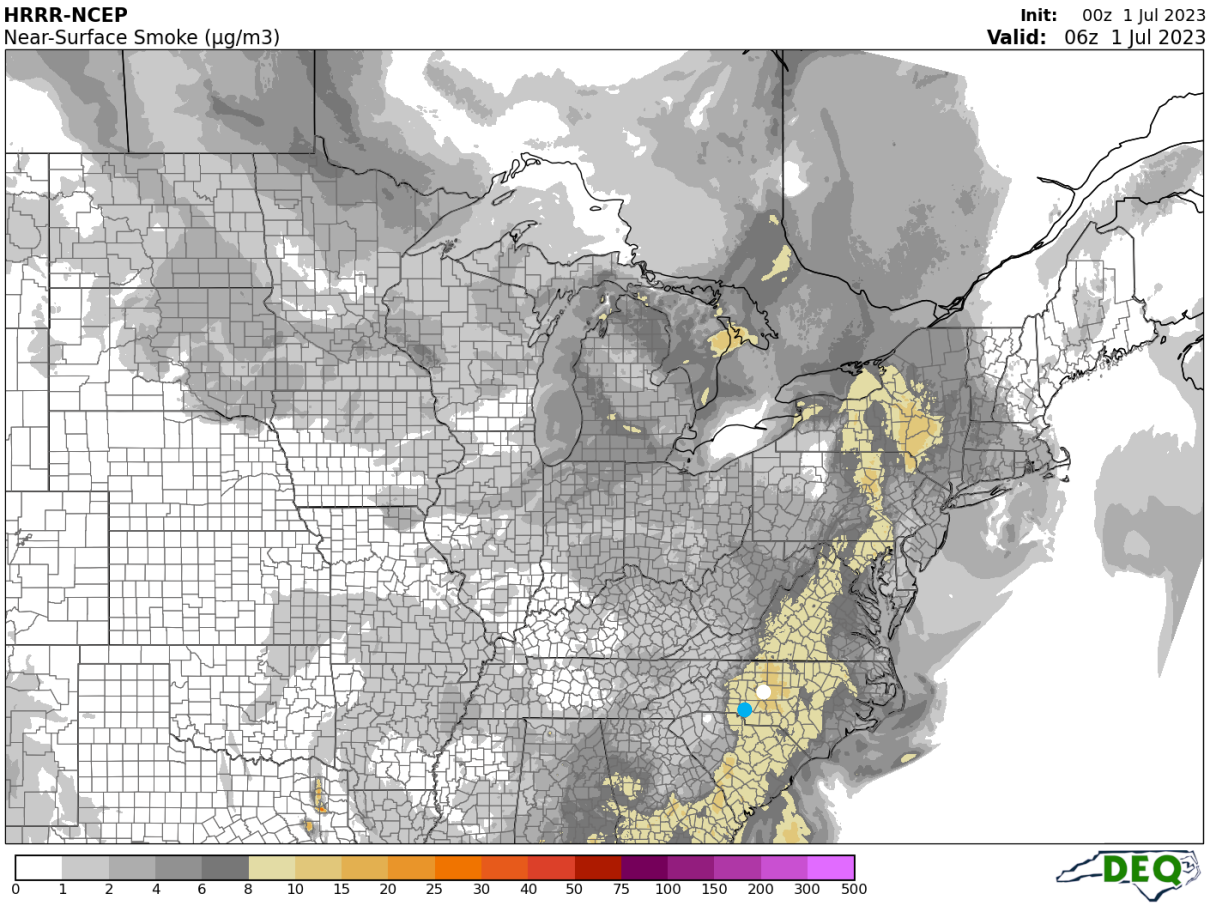

***Figure 147-J**: HRRR-NCEP Smoke model output, initialized at 8:00 pm June 30th, showing near-surface smoke at 2:00 am on July 1st. The white and blue circles show the approximate locations of the Lexington and Remount monitors, respectively.*

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Appendix K: Monitoring Sites' Tiering Graphs

All graphs courtesy of EPA's $PM_{2.5}$ Tiering Tool for Exceptional Events Analysis.[49]

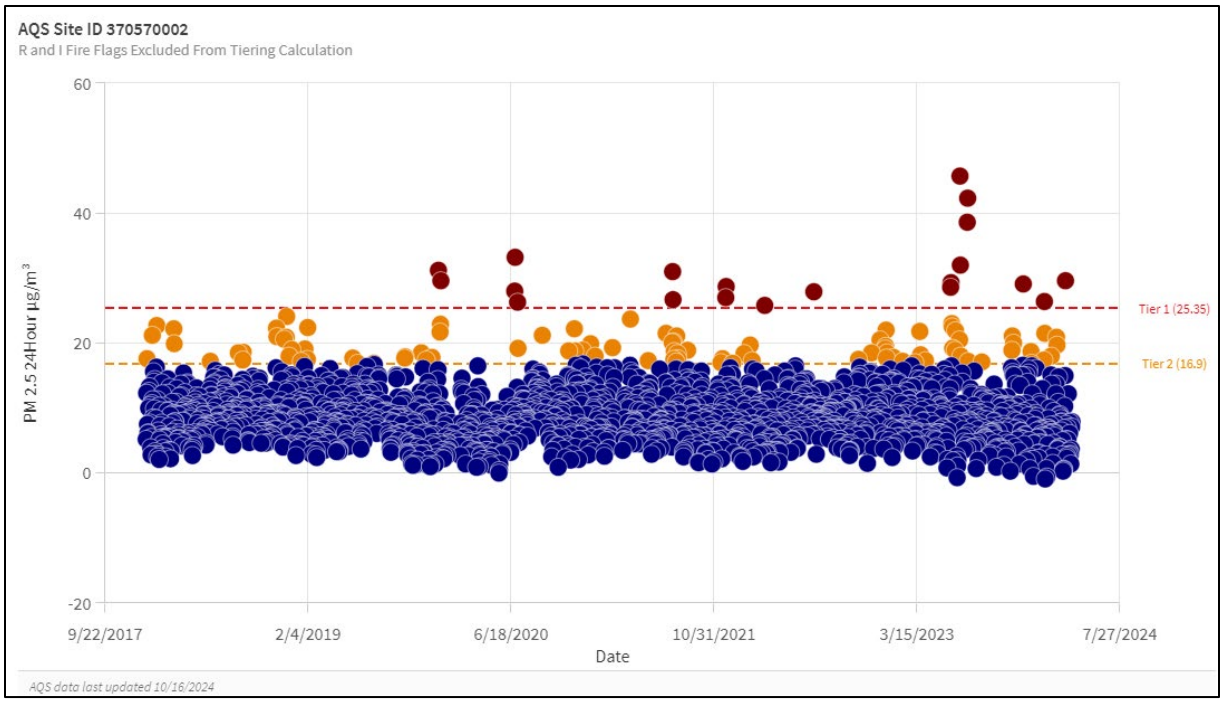

***Figure 148-K**: Tiering Graph for the Lexington Monitor for June Exceptional Events. Daily average $PM_{2.5}$ values equal to or greater than 25.35 µg/m³ are considered Tier 1. Values less than 25.35 µg/m³ but equal to or greater than 16.9 µg/m³ are considered Tier 2. Values less than 16.9 µg/m³ are considered Tier 3.*

[49] EPA, *PM2.5 Tiering Tool – for Exceptional Events Analysis*, https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis

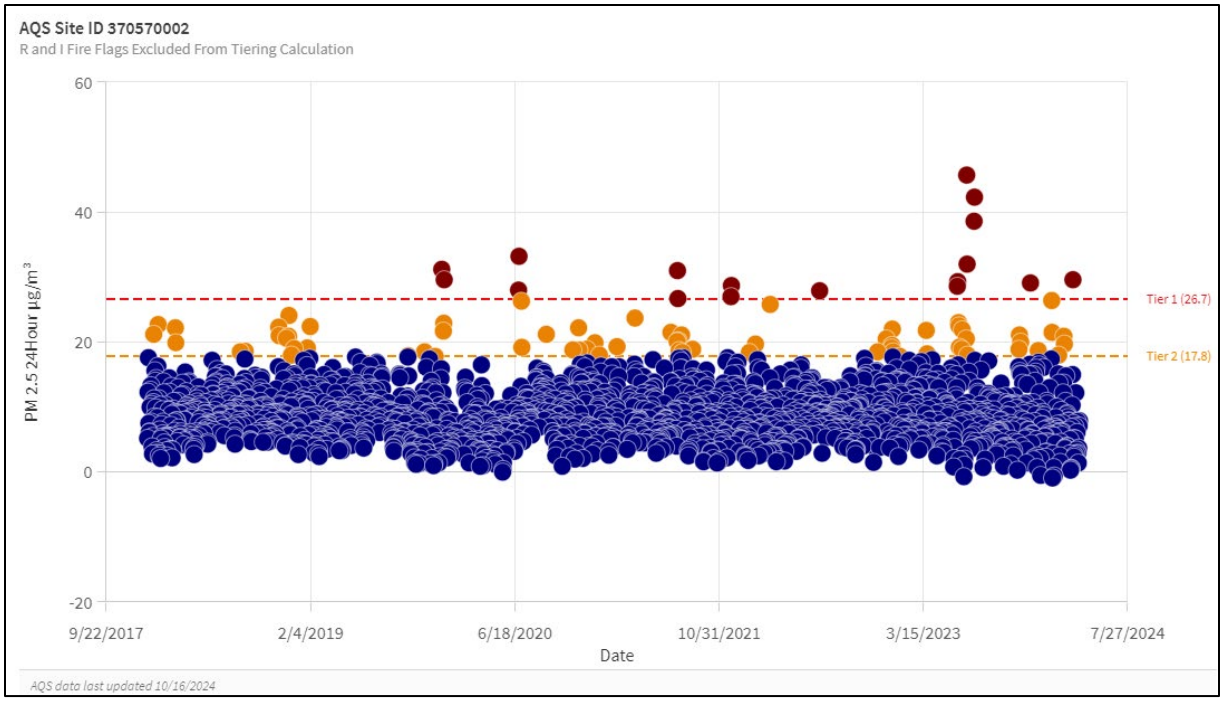

***Figure 149-K**: Tiering Graph for the Lexington Monitor for July Exceptional Events. Daily average $PM_{2.5}$ values equal to or greater than 26.7 µg/m³ are considered Tier 1. Values less than 26.7 µg/m³ but equal to or greater than 17.8 µg/m³ are considered Tier 2. Values less than 17.8 µg/m³ are considered Tier 3.*

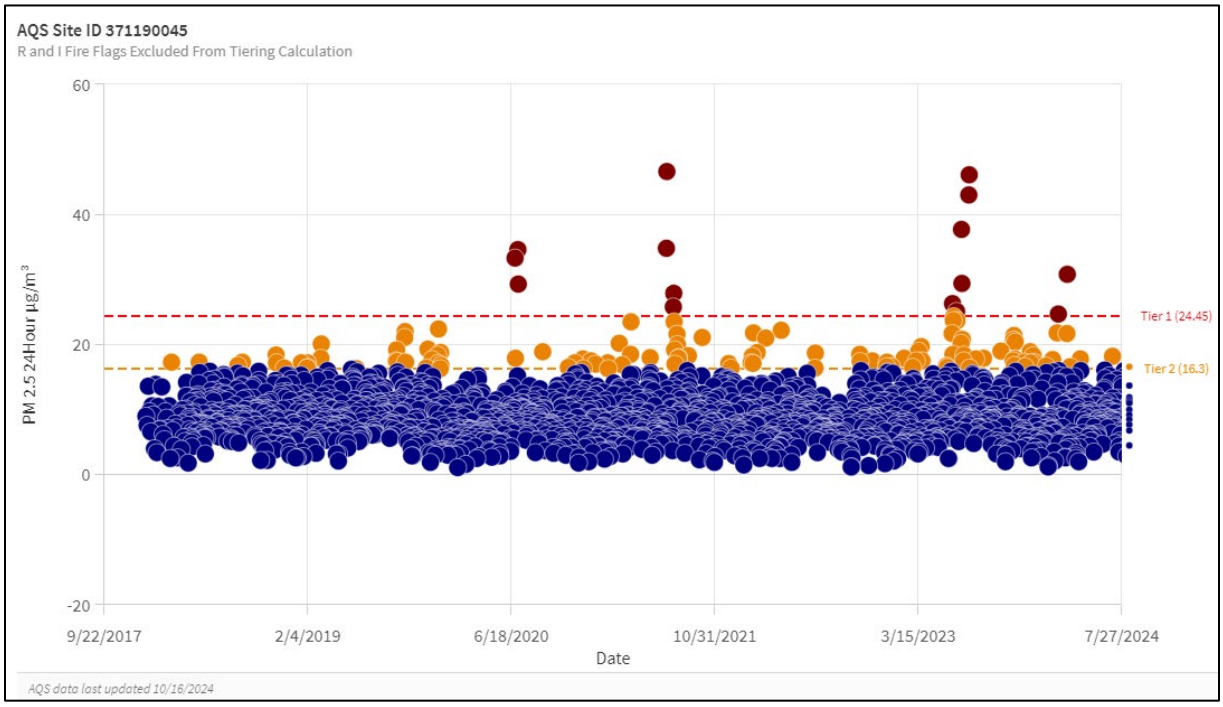

***Figure 150-K**: Tiering Graph for the Remount Monitor for June Exceptional Events. Daily average $PM_{2.5}$ values equal to or greater than 24.45 µg/m³ are considered Tier 1. Values less than 24.25 µg/m³ but equal to or greater than 16.3 µg/m³ are considered Tier 2. Values less than 16.3 µg/m³ are considered Tier 3.*

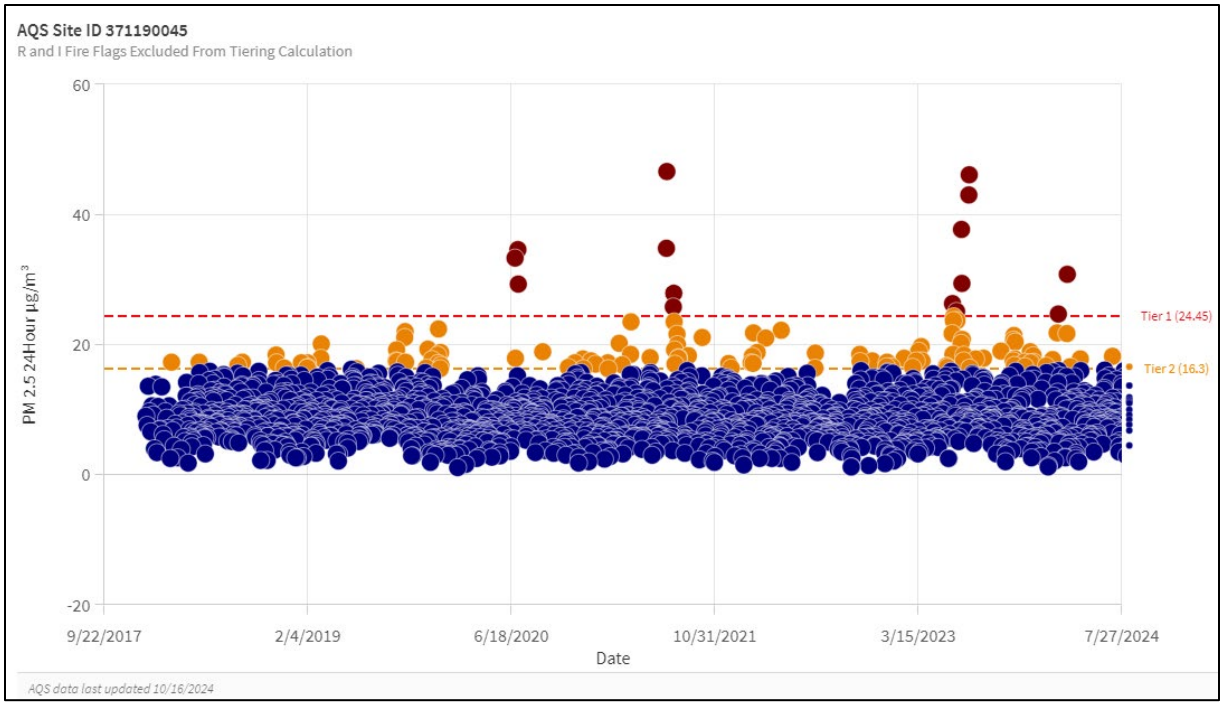

***Figure 151-K**: Tiering Graph for the Remount Monitor for July Exceptional Events. Daily average $PM_{2.5}$ values equal to or greater than 24.25 µg/m³ are considered Tier 1. Values less than 24.25 µg/m³ but equal to or greater than 16.3 µg/m³ are considered Tier 2. Values less than 16.3 µg/m³ are considered Tier 3.*

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Appendix L: Initial Notification Letter

From:	Palmer, Darren
To:	Strait, Randy P
Cc:	Abraczinskas, Michael; Hartsfield, Taylor; Diaz, Denisse; Benjamin, Lynorae; Freund, Weston (he/him/his); Spann, Jane; Gillam, Rick; Jarvis, Simone (she/her/hers); Lusky, Katy; Rhodes, Leslie; Manning, Tammy; Kreuser, Sara I; McLamb, Bradley N; Root, Jordan D; Butler, Patrick; Pope, Jeremy B
Subject:	[External] RE: Initial Notification of Potential Exceptional Event Submission for the Revised Primary Annual PM2.5 NAAQS
Date:	Friday, November 1, 2024 12:14:52 PM
Attachments:	image001.png

Randy, this email is to confirm that we have received your Initial Notification and that it meets the Initial Notification requirements of 40 CFR 50.14(c)(2)(i). We believe it is appropriate for your agency to submit a full demonstration for these event days.

It was really good to talk to y'all yesterday to discuss our comments about your draft exceptional event demonstration. We appreciate your and your staff's time and we both thought the call was very helpful. Rick will follow up in a separate email on the one or two remaining items we left hanging. Let us know if you have any add'l questions or concerns.

Hope everyone has a great weekend!

Darren Palmer
Acting Supervisor
USEPA - Region 4 | Air & Radiation Division | Air Data & Analysis Section
(404) 562-9052 | https://epa.gov/region4

From: Strait, Randy P <randy.strait@deq.nc.gov>
Sent: Wednesday, September 11, 2024 5:22 PM
To: Gettle, Jeaneanne <Gettle.Jeaneanne@epa.gov>
Cc: michael.abraczinskas@deq.nc.gov; taylor.hartsfield@deq.nc.gov; Diaz, Denisse <Diaz.Denisse@epa.gov>; Benjamin, Lynorae <benjamin.lynorae@epa.gov>; Freund, Weston (he/him/his) <Freund.Weston@epa.gov>; Spann, Jane <Spann.Jane@epa.gov>; Palmer, Darren <Palmer.Darren@epa.gov>; Gillam, Rick <Gillam.Rick@epa.gov>; Jarvis, Simone (she/her/hers) <Jarvis.Simone@epa.gov>; Adams, Evan (he/him/his) <adams.evan@epa.gov>; Lusky, Katy <Lusky.Kathleen@epa.gov>; Leslie Rhodes <leslie.rhodes@mecklenburgcountync.gov>; Manning, Tammy <tammy.manning@deq.nc.gov>; Kreuser, Sara I <Sara.Kreuser@deq.nc.gov>; McLamb, Bradley N <bradley.mclamb@deq.nc.gov>; Root, Jordan D <jordan.root@deq.nc.gov>; Butler, Patrick <patrick.butler@deq.nc.gov>; Pope, Jeremy B <Jeremy.Pope@deq.nc.gov>
Subject: Initial Notification of Potential Exceptional Event Submission for the Revised Primary Annual PM2.5 NAAQS

Dear Ms. Gettle,

On behalf of Director Michael Abraczinskas, please find attached North Carolina's "Initial Notification of Potential Exceptional Event Submission for the Revised Primary Annual PM2.5 NAAQS." We have submitted the attached file to EPA's State Planning Electronic Collaboration System (SPeCS).

We appreciate the help we received from your staff in preparing this submittal. Please let us know if you have any questions.

Thank you,
Randy

Randy Strait
Chief, Planning Section, Division of Air Quality
North Carolina Department of Environmental Quality
Office: (919) 707-8721 | Cell: (919) 724-8080
randy.strait@deq.nc.gov — **New address**

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
MICHAEL ABRACZINSKAS
Director

NORTH CAROLINA
Environmental Quality

September 11, 2024

Jeaneanne Gettle, Acting Regional Administrator
USEPA Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-8960

Subject: Initial Notification of Potential Exceptional Event Submission for the Revised Primary Annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS)

Dear Ms. Gettle:

In accordance with section (40 CFR 50.14(c)(2)) of the Exceptional Events (EE) rule, I am pleased to submit for the United States Environmental Protection Agency's (EPA) review and comment North Carolina's "Initial Notification of Potential Exceptional Event" demonstration. On behalf of North Carolina's Governor, the North Carolina Department of Environmental Quality (DEQ), Division of Air Quality (DAQ) intends to submit the EE demonstration in support of its designation recommendations for the revised primary annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) due to EPA by February 7, 2025.

Based on certified monitoring data for 2021-2023, the DAQ has concluded that Canadian wildfire smoke-laden air masses during the summer of 2023 caused two $PM_{2.5}$ monitors in North Carolina to measure design values slightly above the revised standard. These two monitors: Remount Road (371190045), located in Mecklenburg County and Lexington Water Tower (370570002), located in Davidson County, are depicted as yellow rectangles with a rounded Design Value of 9.2 micrograms per cubic meter ($\mu g/m^3$) in Figure 1. Note that the Canadian wildfire smoke contributed to elevated design values for many other monitors in North Carolina; however, the design values are below the revised NAAQS and therefore not eligible for inclusion in an EE demonstration at this time.

The attachment to this letter documents four multiple-day events in June and July of 2023 the DAQ intends to include in its EE demonstration because of the significant impact of Canadian wildfire smoke on the design values for the two monitors. The documentation in the attachment has been prepared following the EE rule and consultation with EPA staff. Please advise me if we need to provide additional documentation regarding this "Initial Notification of Potential Exceptional Event" demonstration.

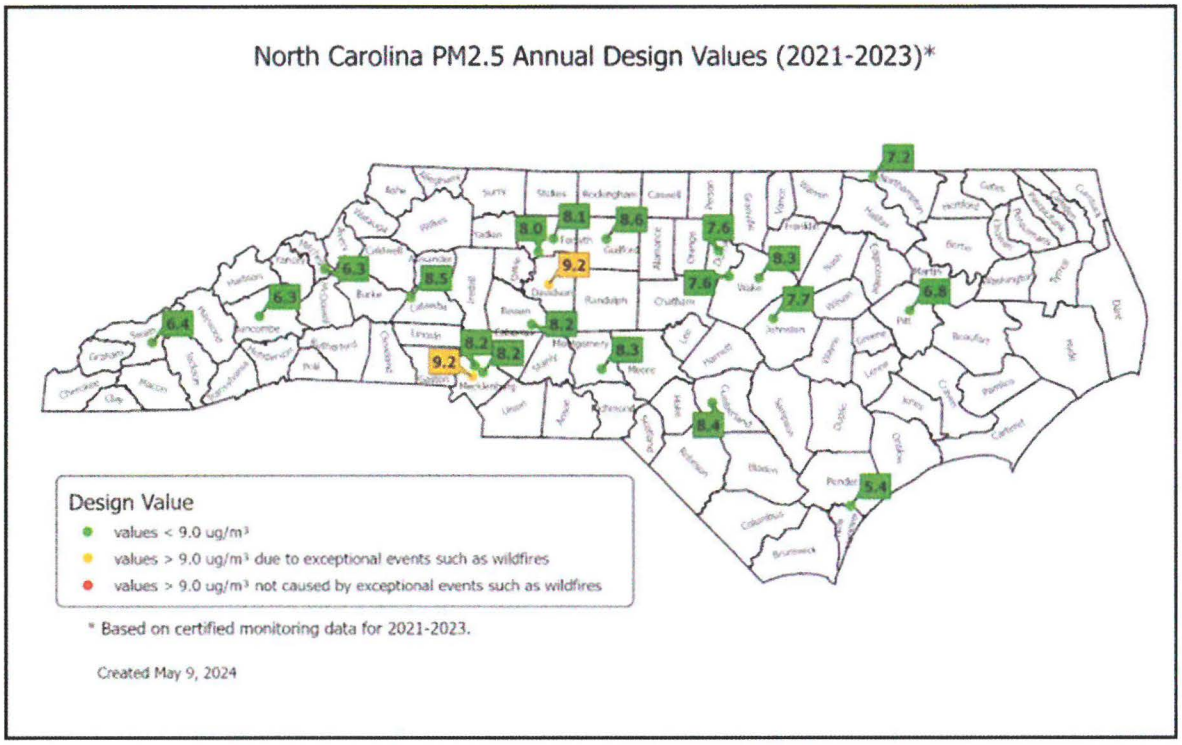

Figure 1. Map of North Carolina $PM_{2.5}$ Monitors and 2021-2023 Design Values ($\mu g/m^3$)

If you should have any questions, please contact Randy Strait of my staff at (919) 707-8721 or randy.strait@deq.nc.gov.

Sincerely,

Michael A. Abraczinskas, Director
Division of Air Quality, NCDEQ

MAA/rps
Attachment

cc: Denisse Diaz, USEPA
Lynorae Benjamin, USEPA
Jane Spann, USEPA
Weston Freund, USEPA
Evan Adams, USEPA
Simone Jarvis, USEPA
Katy Lusky, USEPA
Darren Palmer, USEPA
Rick Gillam, USEPA
Taylor Hartsfield, DAQ
Randy Strait, DAQ
Tammy Manning, DAQ
Bradley McLamb, DAQ
Sara Kreuser, DAQ
Patrick Butler, DAQ
Jeremy Pope, DAQ
Leslie Rhodes, Mecklenburg County Air Quality Agency

Attachment

North Carolina Exceptional Events Demonstration Initial Notification

Overview

This attachment provides a brief overview of atmospheric patterns that transported Canadian wildfire smoke to the U.S. and North Carolina in the summer of 2023, identifies four multiple-day events the DAQ proposes to include in North Carolina's Exceptional Events (EE) demonstration, and provides a succinct summary of how Canadian wildfire smoke significantly elevated $PM_{2.5}$ concentrations above the revised annual $PM_{2.5}$ NAAQS at two monitors in North Carolina. Without the influence of Canadian wildfire smoke, the DAQ believes the design values for the two monitors would be below the standard.

2023 Canadian Wildfire Fire Smoke Impacts on the U.S. and North Carolina

The 2023 Canadian wildfire season - the result of intensifying, widespread spring drought across almost all the Canadian provinces - was unprecedented and record-shattering. A total of 7,131 fires burned 42.5 million acres (17.2 million hectares) of land, doubling the previous record for acres burned, according to the Canadian Interagency Forest Fire Centre.[1] The resulting intrusion of massive amounts of Canadian wildfire smoke into the contiguous United States was the culmination of several months of anomalous synoptic meteorological conditions across North America. A succession of atmospheric patterns first served as the catalyst for the intensifying drought that resulted in the growing number of wildfires across Canada and then directly led to the large-scale transport of smoke into the eastern U.S.[2,3] This resulted in numerous exceptional air quality events from Maine to Florida, including North Carolina, during the months of June and July.[4]

Canadian air masses were frequent in the eastern U.S. during June 2023. Many states recorded well below-normal temperatures for the month, due to the anomalous nature of the atmospheric regime that resulted in a persistent fetch of cooler-than-normal, but smoky, Canadian air into the region.[5] This included North Carolina, which recorded its 13th-coldest June in the past 129 years.[6]

Despite experiencing numerous rounds of Canadian wildfire smoke-laden air masses during the summer of 2023, only two $PM_{2.5}$ monitors in North Carolina were driven (slightly) above the new annual $PM_{2.5}$ NAAQS set by the EPA on May 6, 2024. These two monitors: Remount Road (371190045), located in Mecklenburg County and Lexington Water Tower (370570002), located in Davidson County.

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[1] Canadian Interagency Forest Fire Centre, 2023 Fire Season, https://ciffc.ca/sites/default/files/2024-03/03.07.24_CIFFC_2023CanadaReport (1).pdf.
[2] Canadian Drought Monitor, Conditions as of June 30, 2023, https://www.caar.org/wp-content/uploads/2023/08/Page5-main.jpg.
[3] North Carolina State Climate Office, 500 mb Heights (dm) / Temperature Humidity (%), June 6-12, 2023, 500mb_heights_loop_Jun2023.gif (1024×1024) (ncsu.edu).
[4] North Carolina Air Quality Portal, Rapid Reaction: Smoky Skies Create Unhealthy Air Quality, June 13, 2023 | Air Quality Blog, https://airquality.climate.ncsu.edu/2023/06/13/rapid-reaction-smoky-skies-create-unhealthy-air-quality/.
[5] National Centers for Environmental Information, https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/statewide/mapping/110/tavg/202306/1/rank.
[6] North Carolina State Climate Office, Smoke and Storms Fill the Skies in June, July 10, 2023 | Climate Blog, Climate Summary, https://climate.ncsu.edu/blog/2023/07/smoke-and-storms-fill-the-skies-in-june/.

Days Proposed for Inclusion in the EE Demonstration

Based on the North Carolina Division of Air Quality's (DAQ) extensive analysis of the impacts of the 2023 Canadian wildfire smoke on the state, we propose to submit an EE demonstration for the Remount Road and Lexington Water Tower $PM_{2.5}$ monitors. Table 1 presents data for four unique multiple-day events that feature atmospherically significant activity that heralded the onset of Canadian wildfire smoke transport into the state and directly impacted both monitors to the extent that the design values for the monitors exceeded the revised annual $PM_{2.5}$ NAAQS. The data for each event in Table 1 are organized by color-coordinated, alternating, row colors (light/dark tan) for each event. In the columns, we begin with EE IDs (1-4). Next, each date contained in an event is in the second column, followed by additional data for each date including: a hyperlink to our daily air quality forecast from the afternoon prior to the event (column 3), a hyperlink to the next morning's updated discussion (column 4), a hyperlink to a Twitter post for each day's forecast (column 5), and a hyperlink to the daily 24-hr. $PM_{2.5}$ statewide observations in our Ambient Information Reporter tool (column 6). The next section of columns contains monitor-specific data starting with the Remount Road monitor: 24-hr. $PM_{2.5}$ average (column 7), the 5-year (2018-2022) date-specific average (this is the climatological daily average concentration over the previous 5-year period on the given date, i.e., the past 5 June 6ths, the past 5 June 7ths, etc.) (column 8), EPA tier level (column 9) and the Air Quality System (AQS) data flags (column 10). The same type of data is then presented for the Lexington Water Tower monitor in columns 11-14.

Event 1 (June 6 – June 11, 2023)

The series of exceptional smoke transport events impacting North Carolina began in early June, starting on June 6th and continuing through June 11th, and featured an anomalously strong 500mb (H5) ridge that was anchored over central Canada (anomalous H5 ridging had been persistent for all of May and led to intensifying drought conditions) and was joined by equally strong H5 low pressure stationed just off the northeastern U.S.[7] This strong upper-level low was coupled to a strong surface low pressure system centered over Maine, with an attendant surface cold front that crossed the state from the north on the morning of June 7th.[8] The combined flow pattern around these upper-level circulations resulted in enhanced north-northwesterly winds aloft and significant smoke transport from central and eastern Canada into North Carolina.[9] Smoke aloft mixed to the surface initially on June 6th, before smoke was directly transported into the state at the surface behind the frontal passage from an area of elevated $PM_{2.5}$ to the north and northwest beginning on June 7th. The polluted air mass stagnated over the area through June 11th as surface high pressure built into the region behind the front. This resulted in subsidence, light winds, and reduced air mass dispersion which trapped the polluted air mass in place.

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[7] North Carolina State Climate Office, 500mb_anomaly_May2023.png (900×512) (ncsu.edu).
[8] National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Weather Prediction Center, WPC surface analysis valid for 06/07/2023 at 15 UTC, https://www.wpc.ncep.noaa.gov/archives/web_pages/sfc/sfc_archive_maps.php?arcdate=06/07/2023&selmap=2023060715&maptype=namussfc.
[9] NOAA, NWS, Storm Prediction Center, Mesoscale Analysis Archive, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=06&STARTDAY=06&STARTTIME=00&INC=48.

Table 1. Summary of Canadian Wildfire Events Proposed for Inclusion in the Exceptional Events Demonstration

Exceptional Event		DAQ Statewide Data				Remount (371190045) Current 21-23 DV: 9.24 Adjusted 21-23 DV: 9.01				Lexington (370570002) Current 21-23 DV: 9.15 Adjusted 21-23 DV: 8.92			
ID	Date	AQ Forecast (prev. afternoon)	AQ Forecast (morning)	Outreach (X, formerly Twitter)	Observ-ations	24-hr. $PM_{2.5}$ Avg.	5-Year (2018-2022) Daily Average	Tier Level	Data Flag(s)*	24-hr. $PM_{2.5}$ Avg.	5-Year (2018-2022) Daily Average	Tier Level	Data Flag(s)*
1	6/6/2023	Link	Link	Link	Link	21.7	8.6	Tier 2	RF	28.6	11.4	Tier 1	RF
	6/7/2023	Link	Link	Link	Link	26.3	10.0	Tier 1	RF	29.3	9.2	Tier 1	RF
	6/8/2023	Link	Link	Link	Link	18.5	8.7	Tier 2	RF	-	-	-	-
	6/9/2023	Link	Link	Link	Link	23.7	7.7	Tier 1	RF	23	8.1	Tier 2	RF
	6/10/2023	Link	Link	Link	Link	24.3	7.5	Tier 1	RF	22.5	7.7	Tier 2	RF
	6/11/2023	Link	Link	Link	Link	-	-	-	-	19.2	9.1	Tier 2	2, 4, 6, RF
2	6/17/2023	Link	Link	Link	Link	25.1	8.8	Tier 1	4, RF, 2, 6	18.9	8.7	Tier 2	2, 4, 6, RF
	6/18/2023	Link	Link	Link	Link	23.7	8.4	Tier 1	RF	21.9	8.7	Tier 2	RF
3	6/28/2023	Link	Link	Link	Link	20.2	11.1	Tier 2	RF	20.5	14.4	Tier 2	RF
	6/29/2023	Link	Link	Link	Link	37.7	9.0	Tier 1	4, RF, 2, 6	45.7	10.7	Tier 1	2, 4, 6, RF
	6/30/2023	Link	Link	Link	Link	29.4	9.9	Tier 1	RF	32	10.8	Tier 1	RF
	7/1/2023	Link	Link	Link	Link	20.8	7.3	Tier 2	RF	18	7.6	Tier 2	RF
4	7/17/2023	Link	Link	Link	Link	43	8.6	Tier 1	RF	38.6	11.5	Tier 1	2, 4, 6, RF
	7/18/2023	Link	Link	Link	Link	46.1	7.9	Tier 1	RF	42.3	8.3	Tier 1	RF

* Note that in AQS, the DAQ will change the flag for each day from Informational Canadian Wildfire (IF) to Request Exclusion Canadian wildfire (RF) prior to submitting North Carolinas Exceptional Events Demonstration to EPA.

Event 2 (June 17 – 18, 2023)

The second event, which occurred between June 17th and June 18th, was essentially a shorter duration repeat of the first event from a meteorological perspective. A strong H5 ridge, centered further north in central Canada, was again joined by strong H5 low pressure that rotated across New England during the period. Also similar to the first episode, this strong upper-level low was coupled to a strong surface low pressure system that propelled a surface cold front across North Carolina late on the evening of June 16th.[10] As the base of the upper-level trough of low pressure rotated across the state, mid-level winds became strong out of the north-northwest, heralding the onset of smoke transport aloft into the region.[11] Concomitantly, smoke transport mixing downward through the planetary boundary layer along with surface-level smoke and elevated fine particulates advecting into the region from the northwest resulted in $PM_{2.5}$ levels across the state again elevating significantly above background levels.

Event 3 (June 28 – July 1, 2023)

The third event, which occurred between June 28th and July 1st, featured another variation of the persistent atmospheric flow regimes discussed in prior events, this time in the form of a Rex blocking pattern.[12] Persistent and recurrent upper-level ridging across Canada continued to exacerbate drought conditions and simultaneously trap Canadian wildfire smoke. Concurrent upper-level low pressure south of the ridge descended across the upper Midwest and then rotated eastward into New England providing the transport mechanism for smoke penetration deep into the eastern and eventually southeastern U.S. during June and July 2023.[13] As the upper-level low, and surface low pressure, rotated eastward during the afternoon of June 27th, once again an attendant surface cold front swept across the state.[14] By the evening of June 28th, hourly fine particulate concentrations were rising above the Code Orange range.[15] On June 29th, 13 out of 21 sites across the state exceeded the daily standard, including one site in Forsyth County that recorded a daily average in the Code Red AQI range.[16] Additional exceedances were recorded across the state on

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[10] NOAA, NWS, Weather Prediction Center, National Centers for Environmental Prediction, 0300Z Surface Analysis, June 17, 2023, https://www.wpc.ncep.noaa.gov/archives/sfc/2023/namussfc2023061703.gif.
[11] NOAA, NWS, Storm Prediction Center, Mesoscale Analysis Archive, June 16-18, 2023, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=06&STARTDAY=16&STARTTIME=00&INC=48.
[12] The Weather Network, How Omega blocks and Rex blocks can affect Canada's Weather, https://www.theweathernetwork.com/en/news/science/explainers/what-is-omega-block-rex-block-upper-level-jet-stream-weather-pattern.
[13] NOAA, NWS, Weather Prediction Center, Mesoscale Analysis Archive, June 26-30, 2023, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=06&STARTDAY=26&STARTTIME=00&INC=96.
[14] NOAA, NWS, Weather Prediction Center, National Centers for Environmental Prediction, 1800Z Surface Analysis, June 27, 2023, https://www.wpc.ncep.noaa.gov/archives/sfc/2023/namussfc2023062718.gif.
[15] North Carolina Ambient Information Reporter, PM2.5 (Hourly) concentrations on Wednesday, June 28, 2023 at 9:00 pm, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=hourly&date_past=2023-06-28&time_past=21&sync_past=0&dataset_past_point1=pm25%7Cinst_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1.
[16] North Carolina Ambient Information Reporter, PM2.5 (Avg. 24-hr. concentration) on Thursday, June 29, 2023, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=daily&date_past=2023-06-29&time_past=21&sync_past=0&dataset_past_point1=pm25%7C24hr_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1.

June 30th, and the smoke-laden air mass lingered over the state through July 1st as surface high pressure built into the region behind the front, trapping the polluted air mass over the region.[17]

Event 4 (July 17 – 18, 2023)

The fourth event, which occurred between July 17th and July 18th, was the most severe smoke transport event for North Carolina in 2023. The atmospheric pattern continued to feature the same anomalous circulations (strong upper-level ridge of high pressure and strong upper-level low). Strong and widespread ridging remained over most of Canada during the period preceding the event, while a strong upper-level low began to descend southward into the northern continental U.S. (CONUS) on July 15th and 16th.[18] Smoke wrapped into this upper-level low / trough resulted in a major intrusion of the ongoing Canadian wildfire smoke into the Great Lakes and Ohio Valley region as the core of the cyclonic circulation dug southward. On July 16th, all but one $PM_{2.5}$ monitoring site across North Carolina measured Code Green 24-hr. daily average concentrations, while sites in northwestern Kentucky and all of Indiana observed daily averages above 35.5 $\mu g/m^3$.[19] On July 17th, 11 out of the 12 sites in the western half of the state recorded daily average concentrations above 35.5 $\mu g/m^3$, a clear indicator of the widespread polluted air mass that had swiftly advected into the state.[20] As the smoke continued to transport from west to east across the state, conditions deteriorated further on July 18th, when 16 out of 21 $PM_{2.5}$ monitoring sites across North Carolina exceeded the 24-hour daily NAAQS.[21]

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[17] NOAA, NWS, Weather Prediction Center, WPC surface analysis valid for 06/30/2023 at 00 UTC, https://www.wpc.ncep.noaa.gov/archives/web_pages/sfc/sfc_archive_maps.php?arcdate=06/30/2023&selmap=2023063000&maptype=namussfc.

[18] NOAA, NWS, Storm Prediction Center, Mesoscale Analysis Archive, July 15-17, 2023, https://www.spc.noaa.gov/exper/ma_archive/action5.php?BASICPARAM=500mb.gif&STARTYEAR=2023&STARTMONTH=07&STARTDAY=17&STARTTIME=00&INC=-48.

[19] North Carolina Ambient Information Reporter, PM2.5 (Avg. 24-hr. concentration) on Sunday, July 16, 2023, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=daily&date_past=2023-07-16&time_past=13&sync_past=0&dataset_past_point1=pm25%7C24hr_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1.

[20] North Carolina Ambient Information Reporter, PM2.5 (Avg. 24-hr. concentration) on Monday, July 17, 2023, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=daily&date_past=2023-07-17&time_past=13&sync_past=0&dataset_past_point1=pm25%7C24hr_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1.

[21] North Carolina Ambient Information Reporter, PM2.5 (Avg. 24-hr. concentration) on Tuesday, July 18, 2023, https://airquality.climate.ncsu.edu/air/?tab=past&aggtype_past=daily&date_past=2023-07-18&time_past=13&sync_past=0&dataset_past_point1=pm25%7C24hr_conc&fires_past=0&smoke_past=0&map_center=35.6,-80.3&map_zoom=8&map_bg=light&states=1&counties=1.