GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Canadian Wildfire Exceptional Event Demonstration for Exceedances of the 2024 Annual $PM_{2.5}$ NAAQS at Augusta, GA in 2023

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1. Introduction

The current annual and 24-hour $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) are 9.0 $\mu g/m^3$ and 35 $\mu g/m^3$, respectively. Federal Reference Method (FRM) monitors collect $PM_{2.5}$ samples for 24 hours on filters while Federal Equivalent Method (FEM) monitors measure hourly $PM_{2.5}$ concentrations continuously. An exceedance of the 2024 annual $PM_{2.5}$ NAAQS occurs when the measured 24-hour $PM_{2.5}$ concentration is greater than 9.0 $\mu g/m^3$.

From 2019 through 2023, one FEM monitor collected data at the Augusta site. In addition, in 2022, two collocated FRMs began collecting data. The primary monitor operated on a one in three-day schedule from January 2022 to August 2022, and then on a daily schedule starting August 2022. The collocated FRM monitor collected data on a one in three-day schedule starting September 2022. In addition, the FEM had a NAAQS exclusion starting in January 2022. In 2023, the two collocated FRMs continued to collect data, with a daily schedule for the primary monitor and one in three-day schedule for the collocated monitor, and the FEM monitor continued to collect data with a NAAQS exclusion through 2023. The Augusta-Richmond County, GA-SC MSA is in attainment of the 2012 $PM_{2.5}$ NAAQS.

This exceptional event demonstration shows that the Augusta air monitoring site located in Augusta (Richmond County) in the state of Georgia (AQS ID: 13-245-0091) reported exceedances of the 2024 annual $PM_{2.5}$ NAAQS on 40 different days from 2021-2023 that qualify for exceptional event demonstrations (Table 1), eight of which were due to Canadian wildfires. These exceedances resulted from the transport of wildfire smoke that originated in Canada; therefore, they qualify for removal under the Exceptional Events Rule (EER). Design values (DVs) of the Augusta monitor with and without U.S. Environmental Protection Agency (EPA) concurrence are shown in Table 2. This demonstration will focus on the eight Canadian wildfire events, while separate demonstrations will focus on the three holiday firework events and 29 prescribed fire events. DVs are calculated using 24-hour $PM_{2.5}$ measurements from 2021-2023. For each year, these measurements are first averaged into quarterly values, then to a yearly value. The average of these yearly values is reported as the DV. Inclusion of these events produces a DV of 9.8 $\mu g/m^3$, which is above the new 2024 $PM_{2.5}$ annual NAAQS; however, exclusion reduces the DV at 9.0 $\mu g/m^3$.

On December 20, 2024, the Georgia Environmental Protection Division (EPD) submitted an Initial Notification for these events to the EPA. The request indicated that eight events identified in Table 1 were impacted by smoke from Canadian wildfires and requested review of the events under the case-by-case provision at 40 CFR 50.14(a)(1)(i)(F). The Georgia EPD formally requests that the EPA concur with the exclusion of these events.

Table 1. Exceedances of the 2024 annual $PM_{2.5}$ NAAQS observed by monitors stationed in Augusta, GA at the Augusta site in 2021-2023 that qualify for removal under the Exceptional Events Rule.

#	Date	24-hour $PM_{2.5}$ ($\mu g/m^3$)	Tier	Cause of Exceedance
1	02/04/21	22.1	1	Prescribed fires
2	02/25/21	22.23	1	Prescribed fires
3	02/26/21	21.6	1	Prescribed fires

4	02/27/21	38.58	1	Prescribed fires
5	02/28/21	52.15	1	Prescribed fires
6	03/09/21	30.3	1	Prescribed fires
7	03/10/21	39.66	1	Prescribed fires
8	03/13/21	27.17	1	Prescribed fires
9	04/07/21	29.53	1	Prescribed fires
10	04/08/21	23.18	1	Prescribed fires
11	04/28/21	21.53	1	Prescribed fires
12	07/04/21	42.35	1	Holiday Fireworks
13	07/05/21	39.33	1	Holiday Fireworks
14	07/23/21	22.49	1	Prescribed fires
15	10/15/21	27.18	1	Prescribed fires
16	11/10/21	21.08	1	Prescribed fires
17	12/02/21	25.79	1	Prescribed fires
18	12/04/21	24.89	1	Prescribed fires
19	12/05/21	41.94	1	Prescribed fires
20	12/06/21	23.76	1	Prescribed fires
21	12/16/21	36.35	1	Prescribed fires
22	03/03/22	25.3	1	Prescribed fires
23	12/28/22	23.1	1	Prescribed fires
24	03/01/23	25.6	1	Prescribed fires
25	03/16/23	22.3	1	Prescribed fires
26	04/20/23	21	1	Prescribed fires
27	06/09/23	20.2	1	Canadian Wildfires
28	06/10/23	22.8	1	Canadian Wildfires
29	06/18/23	23.2	1	Canadian Wildfires
30	06/29/23	22.7	1	Canadian Wildfires
31	06/30/23	26.4	1	Canadian Wildfires
32	07/01/23	20.3	1	Canadian Wildfires
33	07/04/23	20.6	1	Holiday Fireworks
34	07/18/23	26.3	1	Canadian Wildfires
35	08/23/23	20.8	1	Canadian Wildfires
36	11/06/23	20.8	1	Prescribed fires
37	11/07/23	22.4	1	Prescribed fires
38	11/09/23	20.8	1	Prescribed fires
39	12/07/23	31.1	1	Prescribed fires
40	12/08/23	31.4	1	Prescribed fires

Table 2. Design values for monitors at the Augusta site for the 2024 annual $PM_{2.5}$ NAAQS.

Monitor Site (AQS ID)	2021-2023 DV without EPA Concurrence (μg/m^3)	2021-2023 DV with EPA Concurrence (μg/m^3)
Augusta (13-245-0091)	9.7	9.0

The EPA has outlined requirements for demonstrations of wildfire events in the 2016 document *Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations* and, pertinent to this demonstration, the 2024 supplementary document *$PM_{2.5}$ Wildland Fire Exceptional Events Tiering Document*. This demonstration will describe how the proposed wildfire events meet the requirements of the EER as described in regulation and the guidance documents, as applicable.

2. Narrative Conceptual Model

The Exceptional Events Rule requires that demonstrations include a narrative conceptual model describing the events. This section describes the 2023 Canadian wildfires that affected public health and impacted air quality monitors in Augusta, GA. Estimates from the National Oceanic and Atmospheric Administration (NOAA) Hybrid Single-Particle Lagrangian Integrated Trajectory model (HYSPLIT) model are used to describe the transportation of wildfire smoke to the area and around the state which ultimately led to enhancements of $PM_{2.5}$ concentrations that exceeded the NAAQS level.

Canadian wildfires during the 2023 wildfire season were well documented and impacted much of the geography of the United States. This season started ahead of the typical Canadian wildfire season, lasting from mid-April to late October (seasons are usually from May – September)[1]. Temperatures and land aridity across Canada were unusually high and resulted in the burning of a record-breaking amount of land area (≥156,000 km^2)[2]. The land area burned during this season far exceeded the average[3] of 21,000 km^2, with the most active burns situated in the eastern province of Quebec in June and July.

Figures in Appendix A are provided to show active Canadian wildfires on the days of the exceedances and for three days beforehand via the Natural Resources Canada Interactive Map[4]. On dates listed in Table 1 (Figures A1-A8), when the exceedances were recorded by the relevant monitor, Canadian wildfires were on-going across the country, the majority of which had each consumed >1000 hectares. These fires were similarly as intense up to three days prior to the recorded exceptional events.

Shown in section 4, these wildfires resulted in the United States being blanketed in smoke and impacted $PM_{2.5}$ surface level concentrations across the country. Pertinent to this demonstration, concentrations were impacted across the southeast of the country, often simultaneously and in conjunction with the arrival of air masses either from Canada or circulated from smoke-laden areas within the United States. Air mass back-trajectories from NOAA's HYSPLIT model indicate that the plumes responsible for the summertime events were emitted from fires in the Canadian provinces of British Columbia, Alberta, Saskatchewan, and Quebec and transported either directly across the Midwest of the United States or circulated from states to the west of Georgia.

This conceptual model describes how emissions from wildfires in Canada and environmental conditions contributed to the events dated in Table 1. Smoke emissions enhanced $PM_{2.5}$

[1] https://doi.org/10.1038/s41467-024-51154-7
[2] https://doi.org/10.1007/s00376-023-3241-0
[3] https://cwfis.cfs.nrcan.gc.ca/ha/nfdb
[4] https://cwfis.cfs.nrcan.gc.ca/interactive-map

concentrations observed by the monitor as they were transported to the Augusta site and caused an exceedance of the annual $PM_{2.5}$ NAAQS. The Georgia EPD requests the EPA's concurrence for the dates listed in Table 1 for exclusion from regulatory decision making, specifically state attainment determinations.

3. Public Notification

As described in 40 CFR 51.930(a), states requesting to exclude data due to exceptional events must take appropriate and reasonable actions to protect public health from exceedances or violations of the NAAQS. These include providing for, at a minimum, prompt public notification whenever concentrations are expected to exceed a NAAQS, public education on actions individuals may take to reduce exposures to unhealthy air quality during events, and implementation of appropriate measures to protect public health from event-caused exceedances or violations of the NAAQS.

With respect to public notification and public education, the Georgia Forestry Commission (GFC) has a public website[5] with an interactive wildfire and burn permit map that contains the current Air Quality Index at all monitors in Georgia with the option to add the following layers: (1) burn restrictions, (2) daily burn permits, (3) $PM_{2.5}$, (4) NOAA Hazard Mapping System (HMS) smoke plumes, (5) wind vectors, and (6) smoke forecast. The public can zoom in to see if smoke may impact their location. The Georgia EPD website[6] has a link to the GFC interactive burn permit map. Also, the Georgia EPD website has a link to EPA's AirNow Fire and Smoke Map[7], EPA's AirNow When Smoke is in the Air[8], EPA's AirNow Prepare for Fire Season[9], and the EPA's Smoke-Ready Toolbox for Wildfires[10]. These websites identify several protective measures that individuals should take to reduce smoke exposure as needed, including limiting outdoor activities, avoiding strenuous outdoor activity and remaining indoors, and considering temporarily relocating or closing all doors and windows during smoke events. In addition, the Georgia EPD Ambient Air Monitoring Program website[11] provides near real-time ambient air concentrations of multiple criteria pollutants (O_3, $PM_{2.5}$, SO_2, NO_2, and CO) across the state.

Outside Georgia EPD and GFC, there was additional notification provided by various news outlets to the public about the potential for elevated air quality impacts from Canadian Wildfires. Some examples include:

- https://www.wsbtv.com/news/local/atlanta/expect-flight-delays-into-atlanta-thanks-canada-wildfire-smoke/RX2WTAWHTBGEVGQAMWFRLYCEJU/ (North Georgia/Metro Atlanta, 6/7/2023)
- https://www.13wmaz.com/article/weather/smoke-from-wildfire-to-central-georgia/93-87f7b552-98fd-4b86-8f99-94140c76d38d (Macon/Central Georgia, 6/7/2023)
- https://www.youtube.com/watch?v=sZkxex_jpQw (Central Georgia, 6/7/2023)

[5] https://georgiafc.firesponse.com/public/
[6] https://epd.georgia.gov/air-protection-branch/open-burning-rules-georgia
[7] https://fire.airnow.gov/
[8] https://www.airnow.gov/wildfires/when-smoke-is-in-the-air/
[9] https://www.airnow.gov/sites/default/files/2020-10/prepare-for-fire-season.pdf
[10] https://www.epa.gov/air-research/smoke-ready-toolbox-wildfires
[11] https://airgeorgia.org/

- https://www.wsbradio.com/weather/wildfire-smoke-drifting-south-canada-into-north-georgia/OKNENTCA6JGGJPYQ76VCO6LF5Q/ (Metro Atlanta/Birmingham, Alabama, 6/7/2023)
- https://www.gpb.org/news/the-picture-show/2023/06/07/photos-extreme-canadian-wildfire-smoke-shrouds-parts-of-us (North and South Carolina, 6/7/2023)
- https://www.atlantanewsfirst.com/2023/06/08/air-quality-georgia-will-smoke-wildfires-reach-us/ (Greater Metro Atlanta, 6/8/2023)
- https://patch.com/georgia/atlanta/code-orange-alert-what-know-air-quality-ga (Atlanta, 6/8/2023)
- https://www.walb.com/2023/06/08/canadian-wildfire-smoke-arrives-south-ga-effects-are-minimal/ (Albany/South Georgia, 6/8/2023)
- https://abcnews.go.com/US/canadian-wildfire-dangers-prompt-proactive-mitigation-government-experts/story?id=100478859 (Predicts plume will migrate to Georgia, 7/1/2023)
- https://www.11alive.com/article/weather/stormtracker/wildfire-smoke-north-georgia/85-b4670fee-4608-4f99-9904-bbdbcf924375 (North Georgia, 7/17/2023)
- https://foxchattanooga.com/weather/stormtrack-9-blog/canadian-wildfire-smoke-impacts-tennessee-georgia-air-quality-once-again (Chattanooga, 7/17/2023)
- https://www.nytimes.com/2023/07/18/us/smoke-wildfires-nc-georgia.html (Georgia, 7/18/2023)
- https://www.fox5atlanta.com/news/code-orange-alert-metro-atlanta-canadian-wildfire-smoke (Georgia, 7/18/2023)
- https://www.atlantanewsfirst.com/2023/07/18/canadian-wildfires-bring-poor-air-quality-north-georgia/ (Metro Atlanta/North Georgia, 7/18/2023)
- https://www.cnn.com/2023/07/17/weather/canada-wildfires-shatter-burning-records/index.html (North Georgia, 7/18/2023)
- https://www.iqair.com/us/newsroom/atlanta-air-quality-alert (Atlanta 7/18/2023)
- https://www.houstonchronicle.com/news/houston-texas/environment/article/houston-pollution-canadian-wildfire-saharan-dust-18206844.php (Atlanta/Georgia, 7/18/2023)
- https://www.wsfa.com/2023/07/18/details-behind-canadian-wildfire-smoke-alabamas-sky/ (Montgomery/Alabama, 7/18/2023)
- https://news.gatech.edu/news/2023/07/19/canadian-wildfire-smoke-affects-atlanta-2 (Atlanta, 7/19/2023)
- https://www.gpb.org/news/2023/07/26/macon-had-georgias-worst-air-quality-last-week-thanks-canadian-wildfires-heat-dome (Macon, 7/26/2023)
- https://www.savannahnow.com/story/weather/2023/10/03/savannah-ga-air-quality-canadian-wildfire-smoke-moves-down-u-s-coast/71045920007/ (Savannah, 10/3/2023)
- https://www.gpb.org/news/2023/10/04/have-you-noticed-haze-in-the-air-heres-why-georgia-dealing-smoke (South/Middle Georgia, 10/4/2023)

4. Clear Causal Relationship and Supporting Analyses

This section addresses the EER requirements at 40 CFR 50.14(c)(3)(iv)(B) by showing that the events affected air quality in such a way that there exists a clear, causal relationship between the specific events and the monitored exceedance, and at 40 CFR 50.14(c)(3)(iv)(C) by providing analyses comparing the claimed event-influenced concentrations to concentrations at the same

monitoring site at other times. The *Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations* and *$PM_{2.5}$ Wildland Fire Exceptional Events Tiering Document* outline the expected components of a clear causal relationship portion of a demonstration. These include a comparison of the event-related concentration to historical concentrations, evidence that the emissions from wildfires were transported to the monitor, and evidence that the prescribed fire emissions affected the monitor. Figures B1-B8 (Appendix B) shows smoke from the NOAA Hazard Mapping System (HMS), plotted via the AirNow Navigator[12]. Active fires and smoke are shown for the day event was registered as well as up to three days beforehand. During the exceptional events, smoke pervaded the air throughout much of the eastern half of the United States, if not the entire country.

The historical data analysis section of this demonstration focuses on 2019-2023 $PM_{2.5}$ FRM data at the Augusta site monitor. Table 3 contains a comparison of exceptional event concentrations to historic 2019-2023 concentrations for the monitor. Generally, the exceptional event concentrations are at least double the 5-year annual average, quarterly average, and monthly average, and in some cases can be nearly three times higher.

Table 3. Comparison of exceptional event concentrations to historic 2019-2023 concentrations at the Augusta site monitor (AQS ID: 13-245-0091).

EE Date	EE Concentration ($\mu g/m^3$)	5-Year Annual Average ($\mu g/m^3$)	5-Year Quarterly Average ($\mu g/m^3$)	5-Year Monthly Average ($\mu g/m^3$)	Ratio EE to 5-Year Annual Average	Ratio EE to 5-Year Quarterly Average	Ratio EE to 5-Year Monthly Average
6/9/2023	20.2	9.6	9.52	10.06	2.1	2.1	2.0
6/10/2023	22.8	9.6	9.52	10.06	2.4	2.4	2.3
6/18/2023	23.2	9.6	9.52	10.06	2.4	2.4	2.3
6/29/2023	22.7	9.6	9.52	10.06	2.4	2.4	2.3
6/30/2023	26.4	9.6	9.52	10.06	2.7	2.8	2.6
7/1/2023	20.3	9.6	9.53	10.18	2.1	2.1	2.0
7/18/2023	26.3	9.6	9.53	10.18	2.7	2.8	2.6
8/23/2023	20.8	9.6	9.53	9.31	2.2	2.2	2.2

Figure 1 plots the 24-hour $PM_{2.5}$ concentrations for 2019-2023. Exceedances caused by wild or prescribed fires are delineated by marker shape. Concentrations generally fall within the Tier 3 range, below 13.19 $\mu g/m^3$, except when smoke from fires is present. All the selected exceptional events days are above the Tier 1 threshold of 19.79 $\mu g/m^3$, making them 1.5 times greater than the highest 98th percentile of data over the last 5 years per the EPA's Tiering Tool.

[12] https://airnowtech.org/navigator/

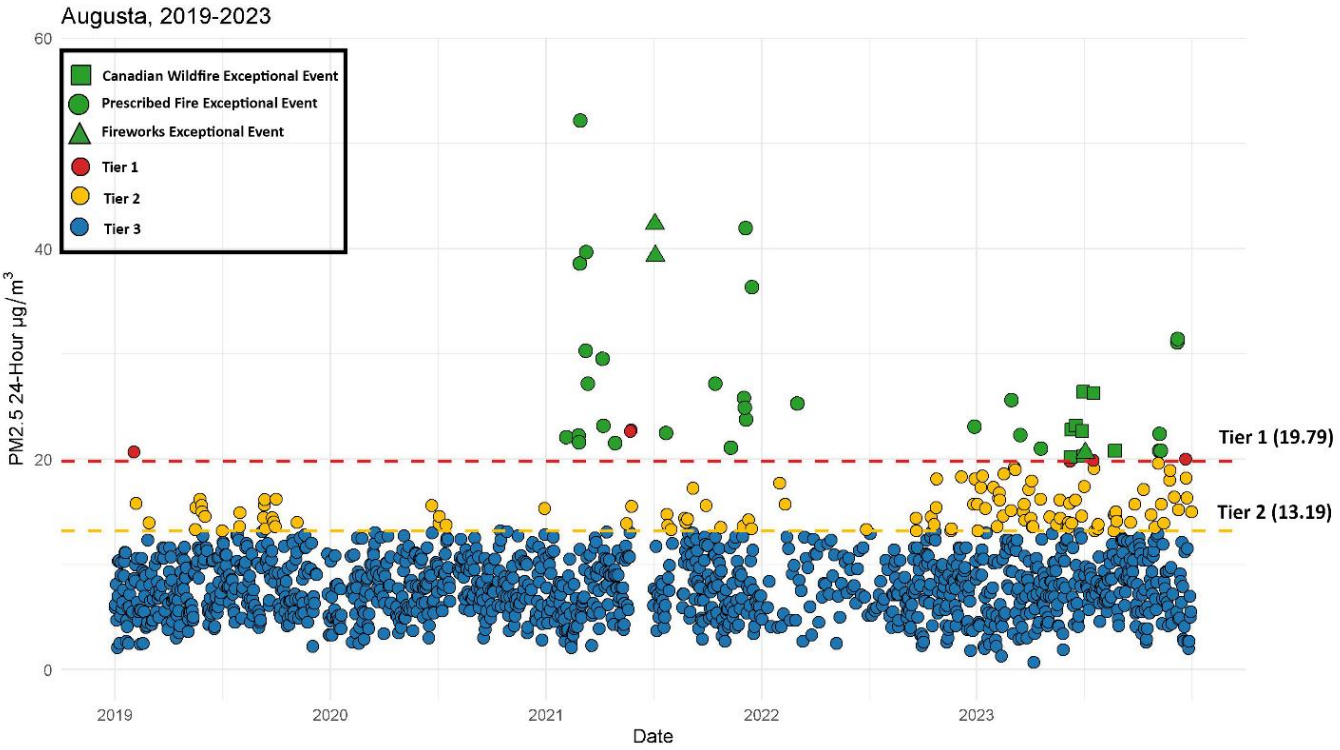

Figure 1. 24-hour $PM_{2.5}$ concentrations for 2019-2023 observed at the Augusta site.

Maps from the AirNow Navigator are provided in Appendix C for each exceedance event in Table 3. The maps include NOAA HMS satellite detected fires, HMS smoke plumes, 24-hour $PM_{2.5}$ concentrations across the United States, and HYSPLIT back-trajectories. These trajectories originate at the Augusta monitor's geographic location and extend 72 hours back in time. Three different starting times were modeled with HYSPLIT for each day: (1) midnight at the start of the exceedance day, (2) noon of the exceedance day, and (3) midnight at the end of the exceedance day. Each trajectory starts at a different elevation above ground level (100 m, 1500 m, and 3000 m). The 1500 m and 3000 m tails are used to estimate the trajectories of smoke transported over a long range. The 100 m tail, nearer to the surface, is used to show local transport. Additionally, these values are chosen to estimate vertical transport near-surface and up to several hundred meters above the planetary boundary layer. Figures in Appendix D are provided to show ground level, daily $PM_{2.5}$ concentrations, and air quality indices (AQIs) in the southeast of the United States. Figures in Appendix E show $PM_{2.5}$ concentration time series for both the event day and the day before.

June 9, 2023

Fires in Canada had been on-going for months at the time the exceedance was measured, and their emissions were likely mixed throughout the air column. From Figure E1, $PM_{2.5}$ concentrations were elevated above the 9.0 µg/m^3 standard throughout the event day and the day prior. Shown in Figure C1, back-trajectories indicate that the smoke plume traveled through Midwest of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in the provinces of British Columbia, Alberta, Saskatchewan, and Quebec. Daily $PM_{2.5}$ concentrations increased to 20.2 µg/m^3. Figure D1 shows that this enhancement

occurred synchronously with elevated concentrations reported by monitors across the southeast, which follows from the large blanket of smoke over this region (Figure B1).

June 10, 2023

Fires in Canada had been on-going for months at the time the exceedance was measured, and their emissions were likely mixed throughout the air column. From Figure E2, $PM_{2.5}$ concentrations were elevated above the 9.0 $\mu g/m^3$ standard throughout the event day and the day prior. Shown in Figure C2, back-trajectories indicate that the smoke plume traveled through Midwest and northeast regions of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in the provinces of British Columbia, Alberta, and Quebec. The back-trajectories converge spatially approximately 12 hours before descending to near-surface level where observed, daily $PM_{2.5}$ concentrations increased to 22.8 $\mu g/m^3$. Figure D2 shows that this enhancement occurred synchronously with elevated concentrations reported by monitors across the southeast, which follows from the large blanket of smoke over this region (Figure B2).

June 18, 2023

Fires in Canada had been on-going for months at the time the exceedance was measured, and their emissions were likely mixed throughout the air column. From Figure E3, $PM_{2.5}$ concentrations were elevated above the 9.0 $\mu g/m^3$ standard throughout the event day and the day prior. Shown in Figure C3, back-trajectories indicate that the smoke plume traveled through Midwest region of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in the provinces of Saskatchewan and Quebec. The back-trajectories converge spatially approximately 6 hours before descending to near-surface level where observed, daily $PM_{2.5}$ concentrations increased to 23.2 $\mu g/m^3$. Figure D3 shows that this enhancement occurred synchronously with elevated concentrations reported by monitors across the southeast, which follows from the large blanket of smoke over this region (Figure B3).

June 29, 2023

Fires in Canada had been on-going for months at the time the exceedance was measured, and their emissions were likely mixed throughout the air column. From Figure E4, $PM_{2.5}$ concentrations were elevated above the 9.0 $\mu g/m^3$ standard throughout the event day and the day prior. Shown in Figure C4, back-trajectories indicate that the smoke plume traveled through the Midwest region of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in the provinces of British Columbia, Alberta, and Quebec. The back-trajectories converge spatially approximately 18 hours before descending to near-surface level where observed, daily $PM_{2.5}$ concentrations increased to 22.7 $\mu g/m^3$. Figure D4 shows that this enhancement occurred synchronously with elevated concentrations reported by monitors across the southeast, which follows from the large blanket of smoke over this region (Figure B4).

June 30, 2023

Fires in Canada had been on-going for months at the time the exceedance was measured, and their emissions were likely mixed throughout the air column. From Figure E5, $PM_{2.5}$ concentrations were elevated above the 9.0 $\mu g/m^3$ standard throughout the event day and the day prior. Shown in Figure C5, back-trajectories indicate that the smoke plume traveled through southwest and Midwest regions of the United States. The trajectories traverse the United States

and originate far from the active fires. Canadian wildfire smoke was circulated from regions in the United States to the west of Georgia. As a result, the plume detected by the monitor is a mixture of emissions from fires in the provinces of British Columbia, Alberta, Saskatchewan, and Quebec. The back-trajectories converge spatially approximately 18 hours before descending to near-surface level where observed, daily $PM_{2.5}$ concentrations increased to 26.4 $\mu g/m^3$. Figure D5 shows that this enhancement occurred synchronously with elevated concentrations reported by monitors across the southeast, which follows from the large blanket of smoke over this region (Figure B5).

July 1, 2023

Fires in Canada had been on-going for months at the time the exceedance was measured, and their emissions were likely mixed throughout the air column. From Figure E6, $PM_{2.5}$ concentrations were elevated above the 9.0 $\mu g/m^3$ standard throughout June 30 and throughout the event day until 11:00 AM ET. Shown in Figure C6, back-trajectories indicate that the smoke plume traveled through the southern and Midwest regions of the United States. The trajectories traverse across the United States and originate far from the active wildfires. Canadian wildfire smoke was likely circulated to Georgia from states to the west. As a result, the plume detected by the monitor is a mixture of emissions from fires in the provinces of British Columbia, Alberta, Saskatchewan, and Quebec. Daily $PM_{2.5}$ concentrations increased to 20.3 $\mu g/m^3$. Figure D6 shows that this enhancement occurred synchronously with elevated concentrations reported by monitors across the southeast, which follows from the large blanket of smoke over this region (Figure B6).

July 18, 2023

Fires in Canada had been on-going for months at the time the exceedance was measured, and their emissions were likely mixed throughout the air column. From Figure E7, $PM_{2.5}$ concentrations were elevated above the 9.0 $\mu g/m^3$ standard throughout the event day and the day prior. Shown in Figure C7, back-trajectories indicate that the smoke plume traveled through northwest and Midwest regions of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in the provinces of British Columbia, Alberta, and Saskatchewan. The back-trajectories converge spatially approximately 12 hours before descending to near-surface level where observed, daily $PM_{2.5}$ concentrations increased to 26.3 $\mu g/m^3$. Figure D7 shows that this enhancement occurred synchronously with elevated concentrations reported by monitors across the southeast, which follows from the large blanket of smoke over this region (Figure B7).

August 23, 2023

Fires in Canada had been on-going for months at the time the exceedance was measured, and their emissions were likely mixed throughout the air column. From Figure E8, $PM_{2.5}$ concentrations were elevated above the 9.0 $\mu g/m^3$ standard throughout the event day and the day prior. Shown in Figure C8, back-trajectories indicate that the smoke plume traveled through southwest and Midwest regions of the United States. Canadian wildfire smoke was likely circulated to Georgia from states to the west. As a result, the plume detected by the monitor is a mixture of emissions from fires in the provinces of British Columbia, Alberta, and Saskatchewan. Daily $PM_{2.5}$ concentrations increased to 20.8 $\mu g/m^3$. Figure D8 shows that this

enhancement occurred synchronously with elevated concentrations reported by monitors across the southeast, which follows from the large blanket of smoke over this region (Figure B8).

The comparisons and analyses, provided here in this demonstration support the Georgia EPD's position that the fire 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 for the dates described in Table 1 and thus satisfies the clear causal relationship criterion.

5. Not reasonably Controllable or Preventable

This section satisfies the EER requirements at 40 CFR 50.14(c)(3)(iv)(A), CFR 50.1(j), 40 CFR 50.14(c)(3)(iv)(D), and 40 CFR 50.14(b)(4): The event was caused by a natural event; an exceptional event is one that is not reasonably controllable or preventable. Stated in section 40 CFR 50.14 (a)(8)(vii), 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.

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

This section satisfies the EER requirement at 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. The definition of wildfire in the EER is: "…any fire started by an unplanned ignition caused by lightning; accidental, human causes actions, or a prescribed fire that has developed into a wildfire. A wildfire that predominately occurs on wildland is a natural event." As stated in sections 2 and 4, the origin and evolution of the wildfires described in this demonstration occurred in Canada.

Based on the documentation provided in sections 2 and 4 of this demonstration, these events qualify as natural events as they spread uncontrolled through remote, natural (i.e., non-agricultural or silvicultural) lands. The National Aeronautics and Space Administration (NASA) noted that many of the Canadian fires were ignited by summer lightning storms and largely burned in deeply wooded areas. The EPA generally considers the emissions of $PM_{2.5}$ from wildfires to meet the regulatory definition of a natural event, defined as one "in which human activity plays little or no direct causal role" (40 CFR 50.1(k)). As the Georgia EPD has shown that the demonstrated exceedances resulted from natural events, they should be considered for treatment as exceptional events.

7. Public Comment Period

The Georgia EPD held a 30-day public comment period starting on December 20, 2024, to receive public input regarding the Exceptional Event Demonstration. Notification of the public comment period was posted on the Georgia EPD website and emailed to interested stakeholders. Public comments received are included in Appendix G of this demonstration, along with the Georgia EPD's responses to these comments in Appendix H.

Appendix A: Active Wildfires in Canada

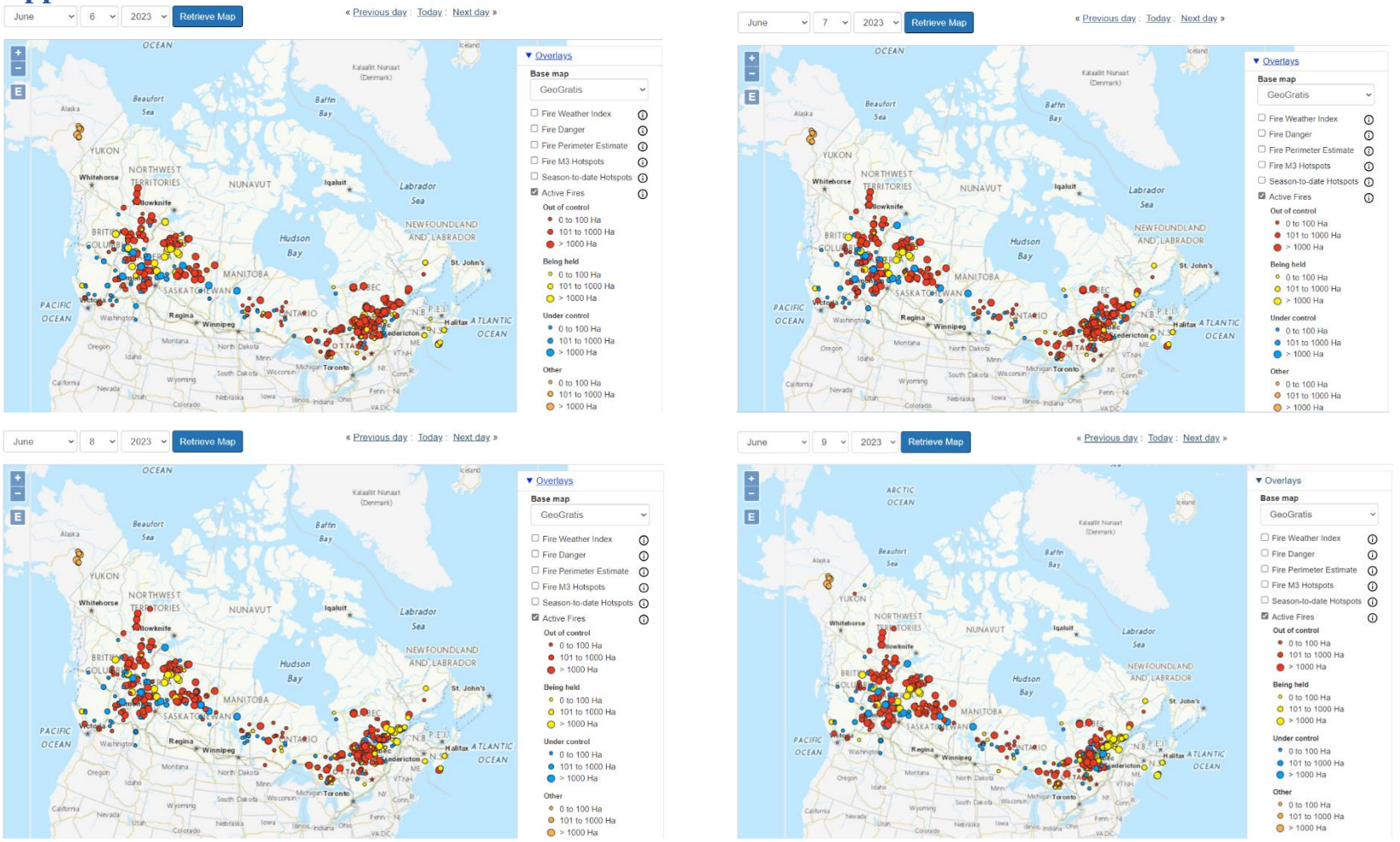

Figure A1. Active wildfires in Canada on June 6-9, 2023.

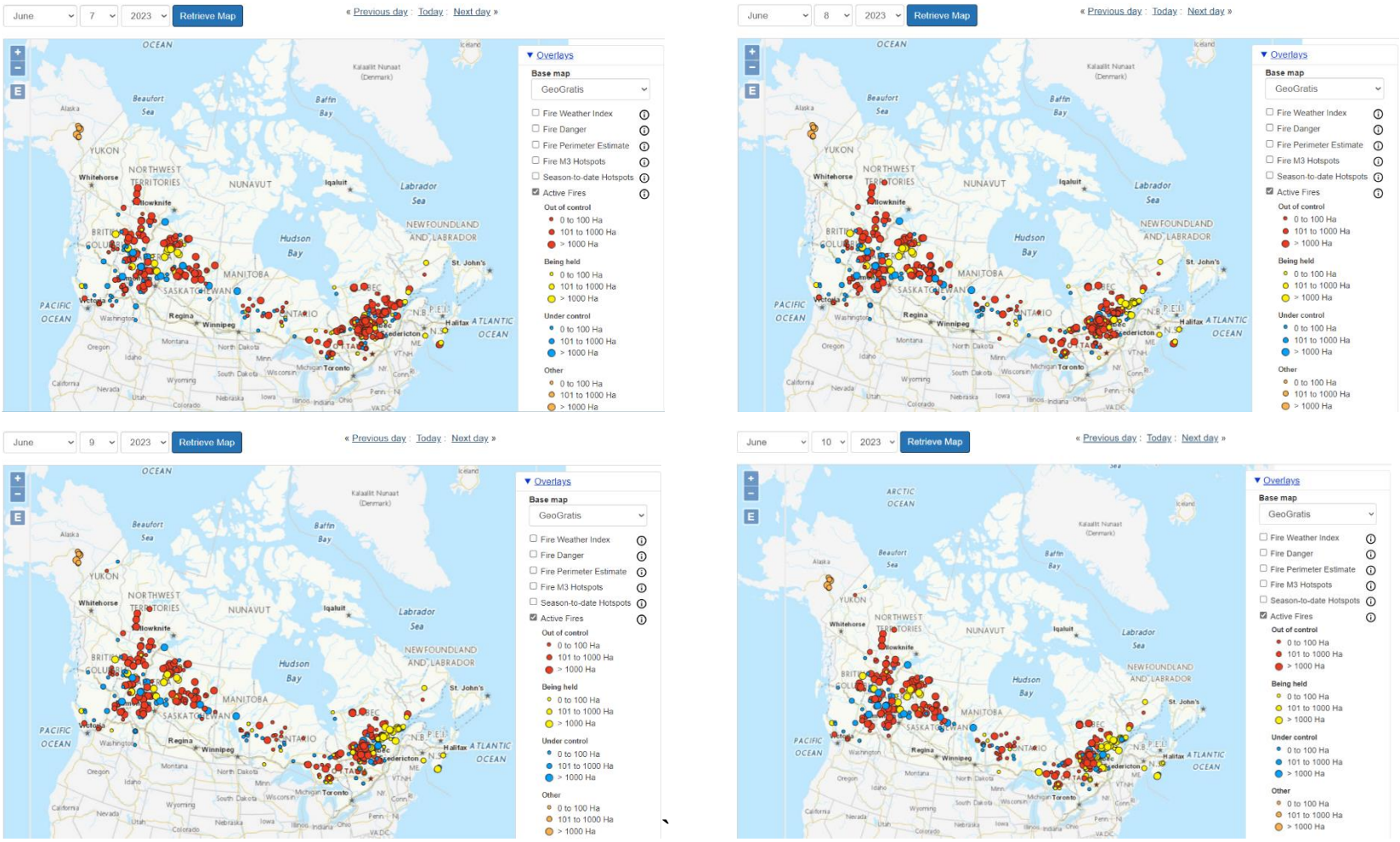

Figure A2. Active wildfires in Canada on June 7-10, 2023.

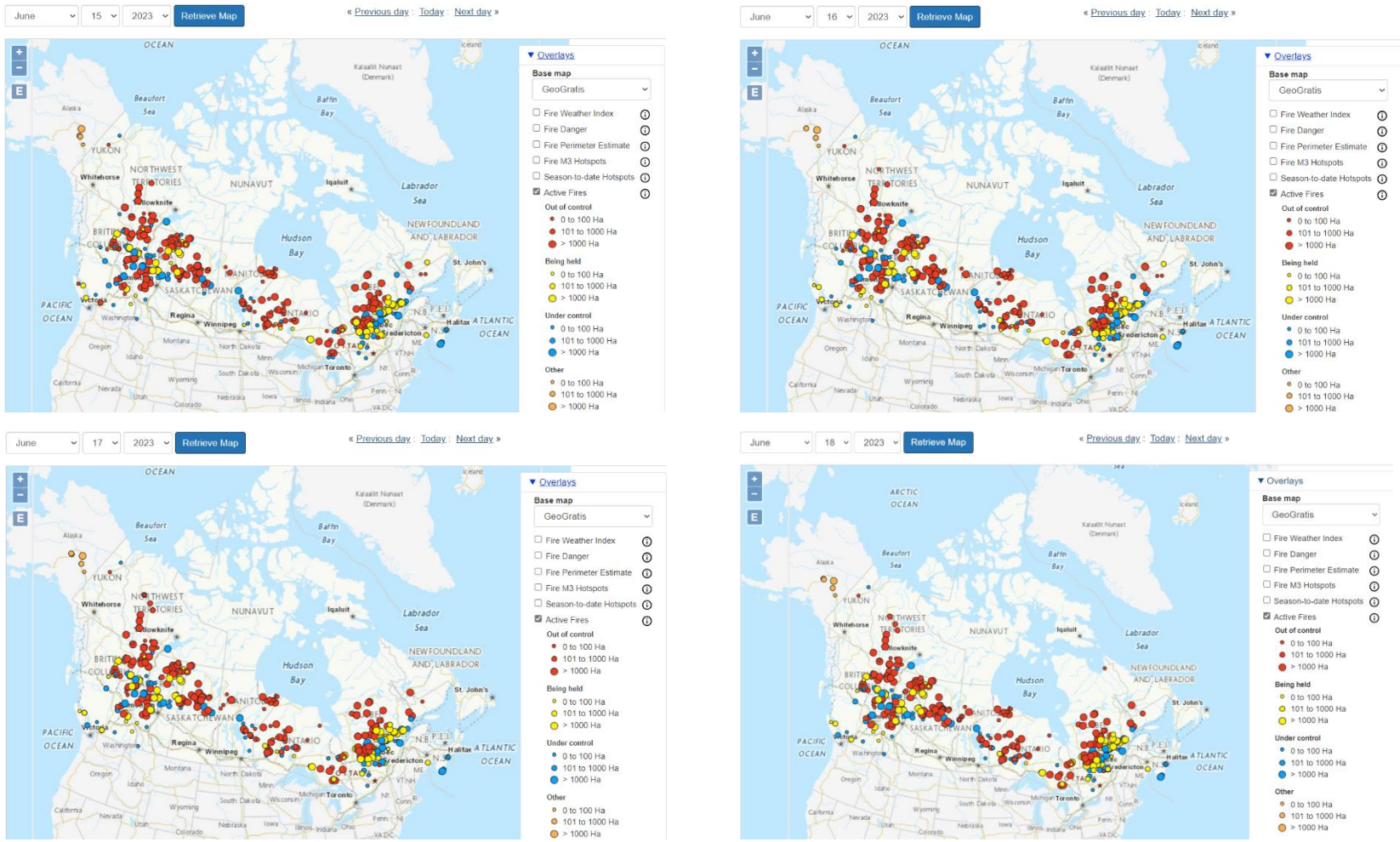

Figure A3. Active wildfires in Canada on June 15-18, 2023.

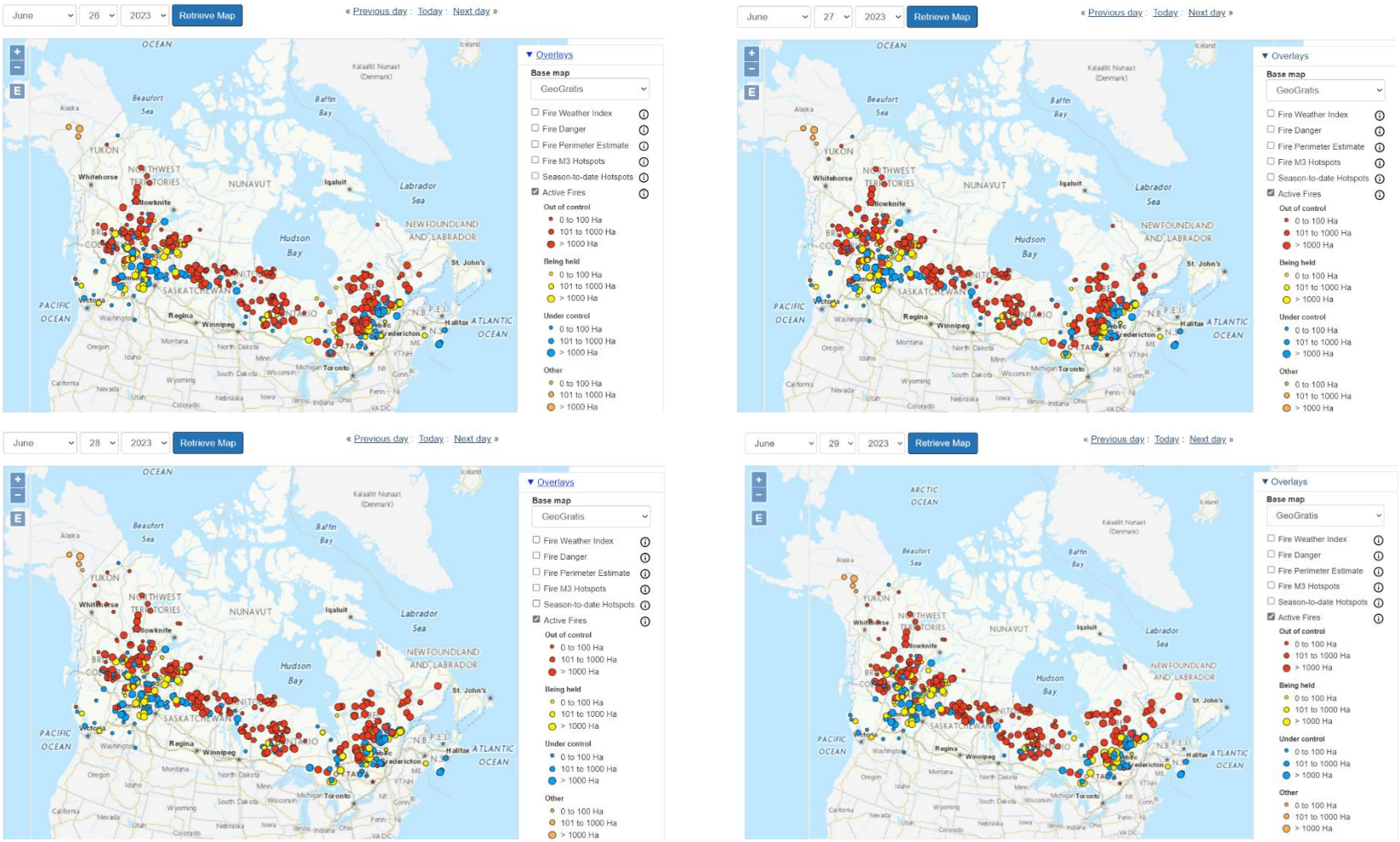

Figure A4. Active wildfires in Canada on June 26-29, 2023.

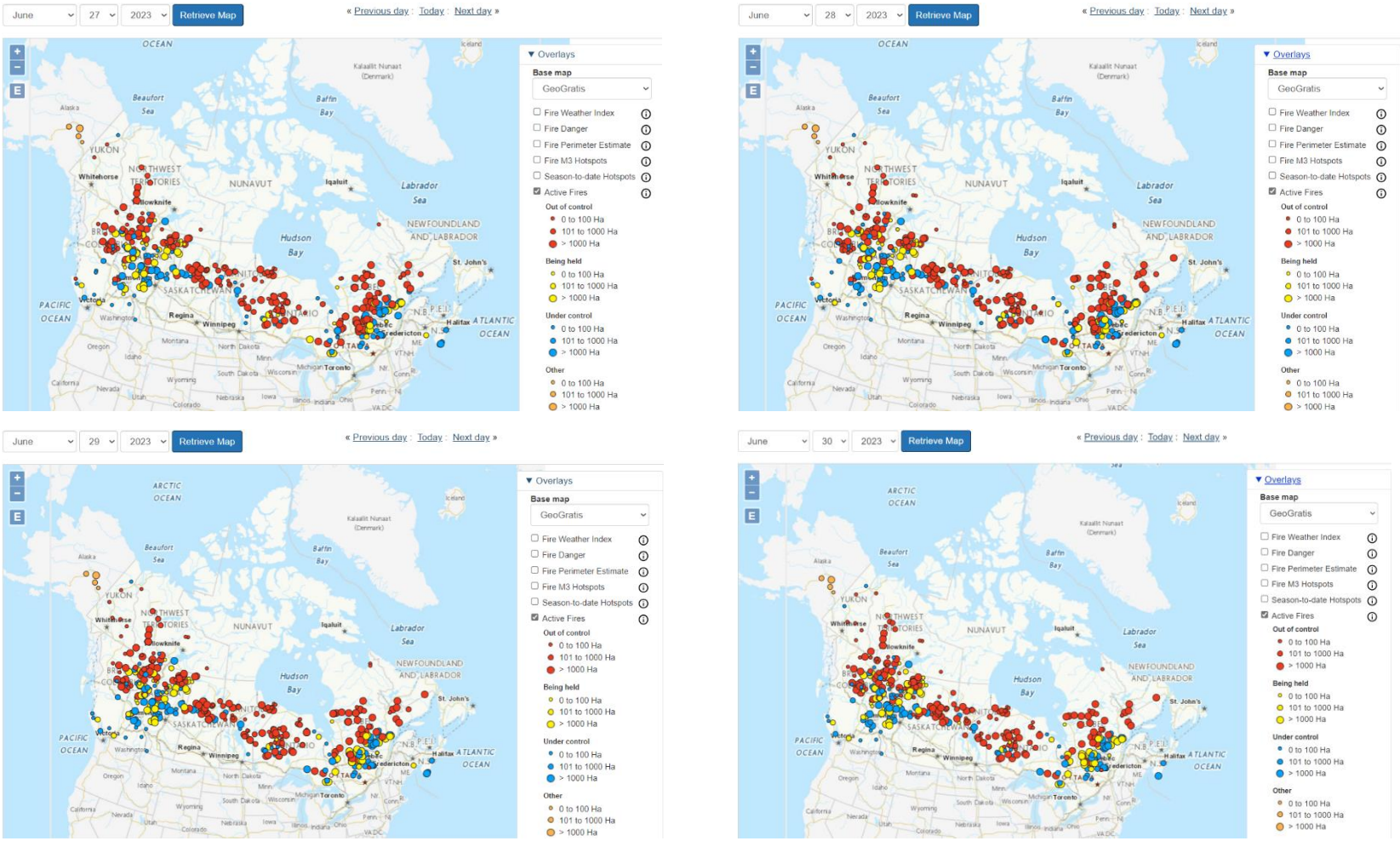

Figure A5. Active wildfires in Canada on June 27-30, 2023.

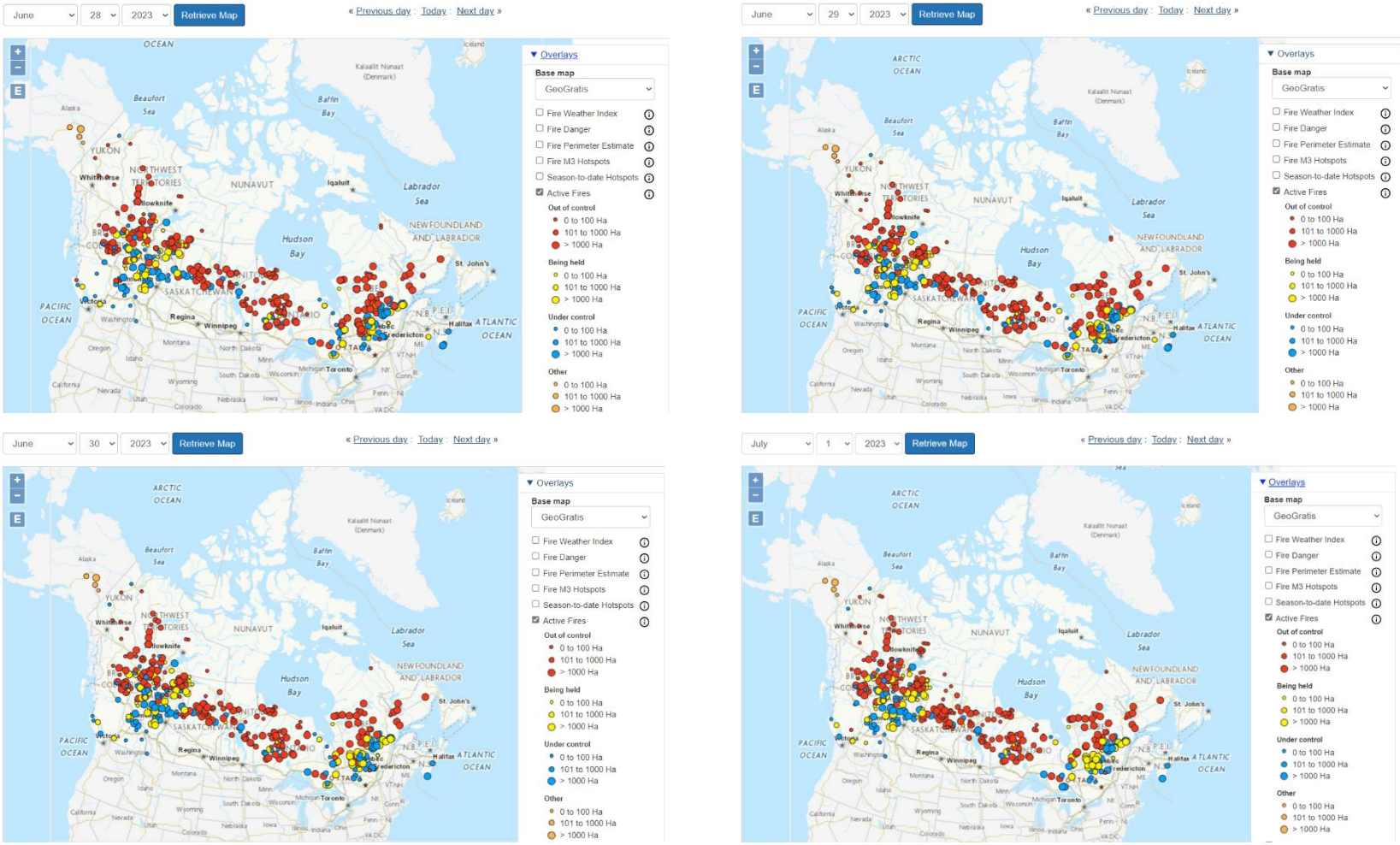

Figure A6. Active wildfires in Canada on June 28 - July 1, 2023.

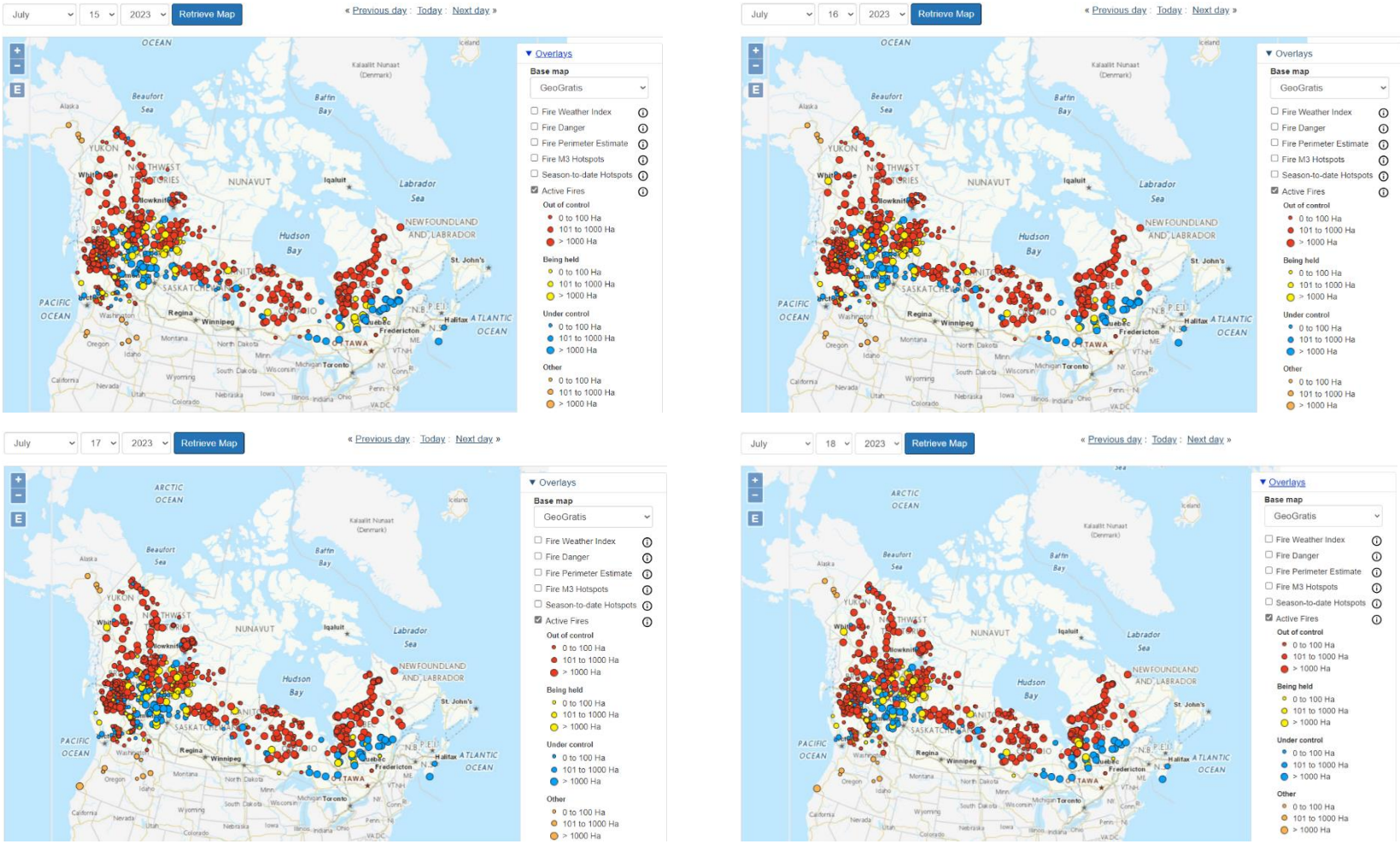

Figure A7. Active wildfires in Canada on July 15-18, 2023.

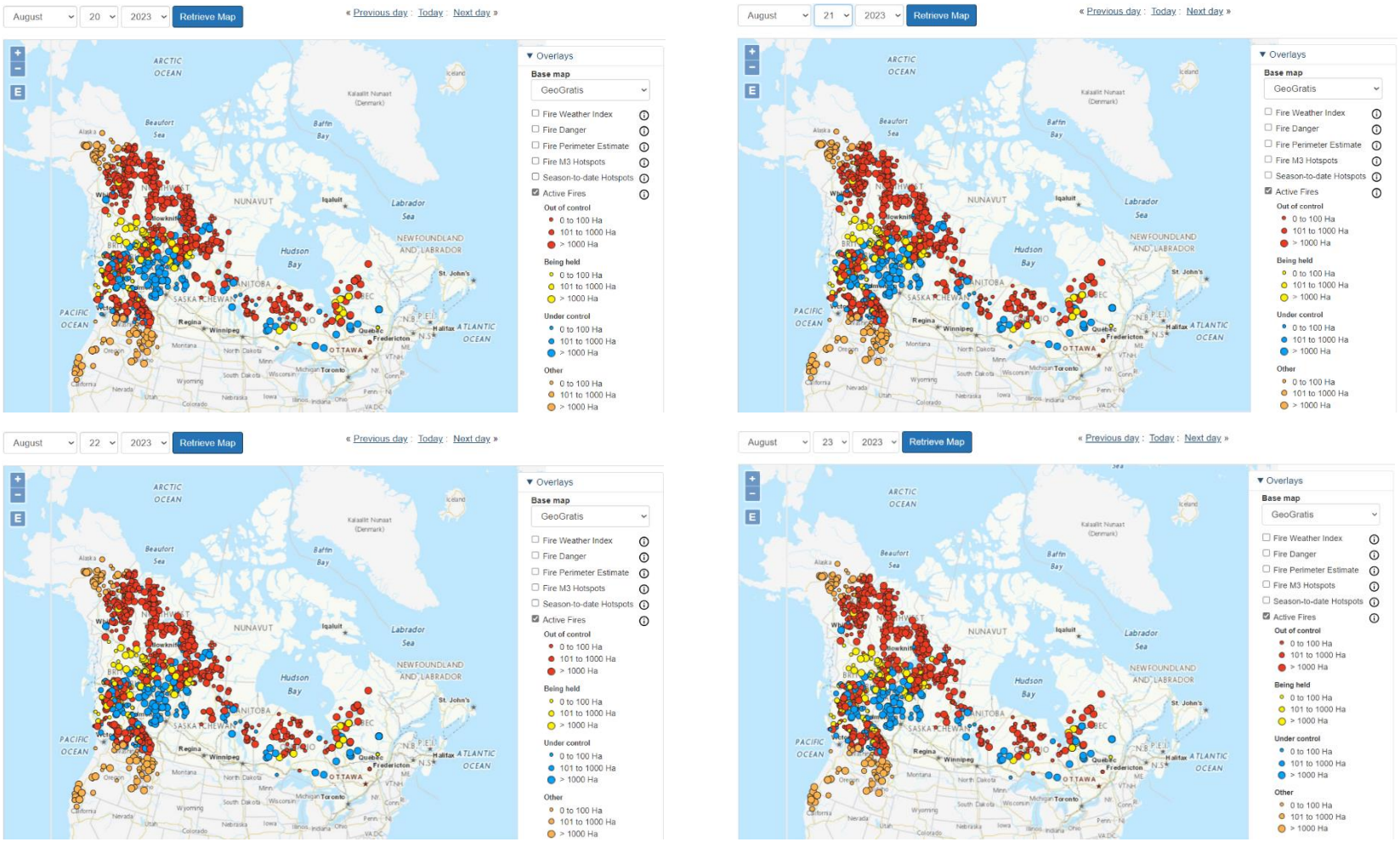

Figure A8. Active wildfires in Canada on August 20-23, 2023.

Appendix B: HMS Smoke and Active Fires

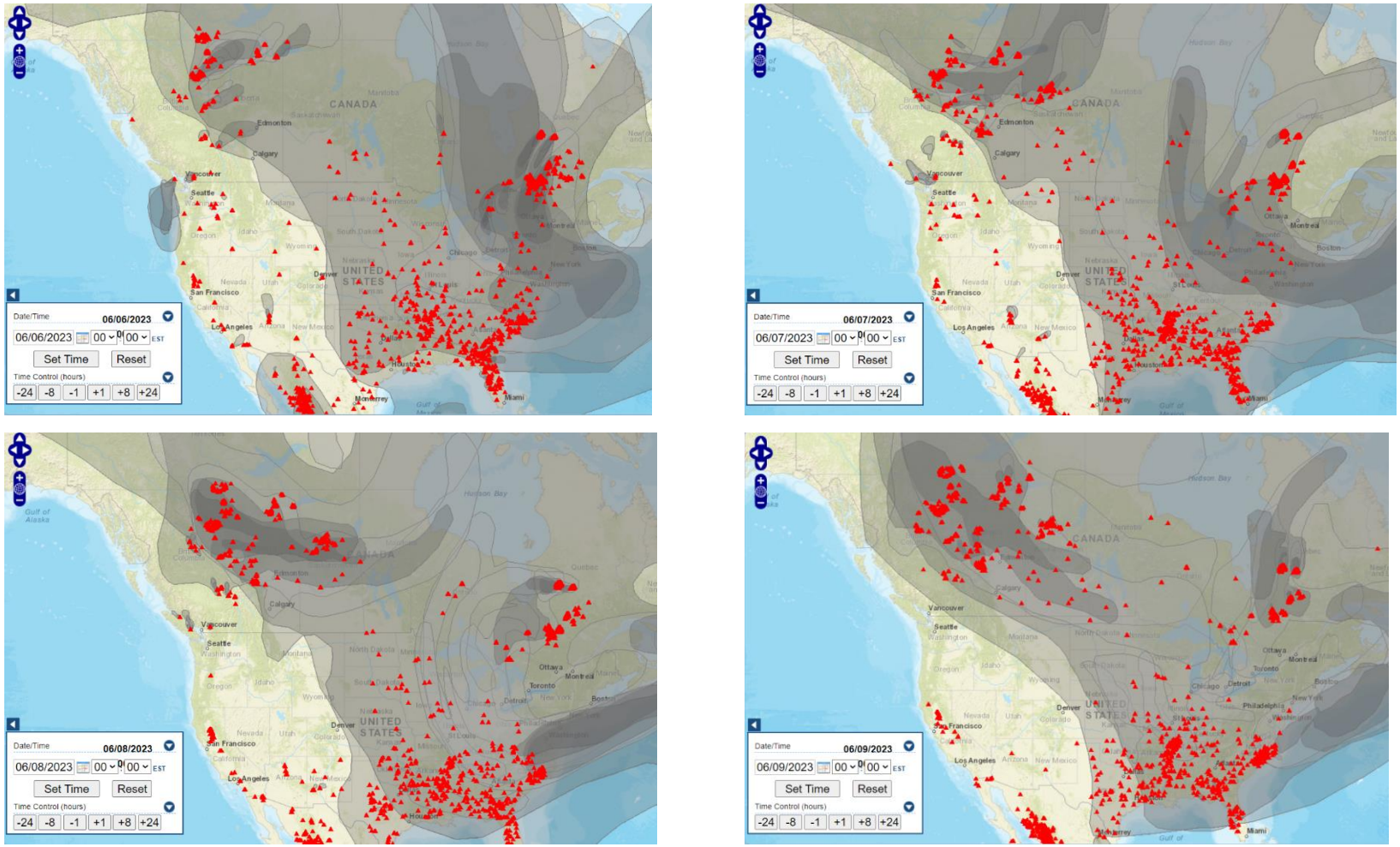

Figure B1. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 6-9, 2023, plotted using the NOAA HMS over North America.

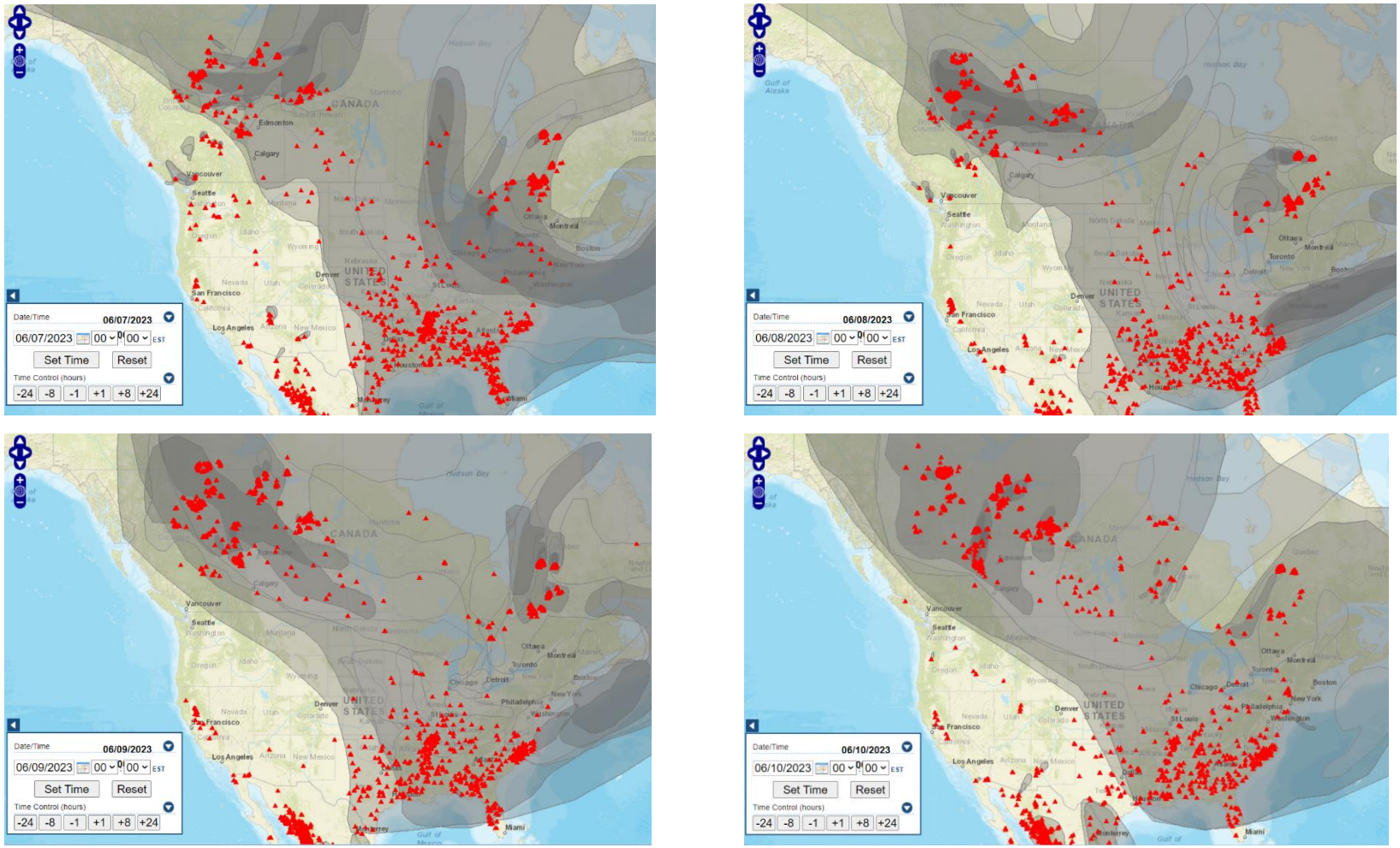

Figure B2. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 7-10, 2023, plotted using the NOAA HMS over North America.

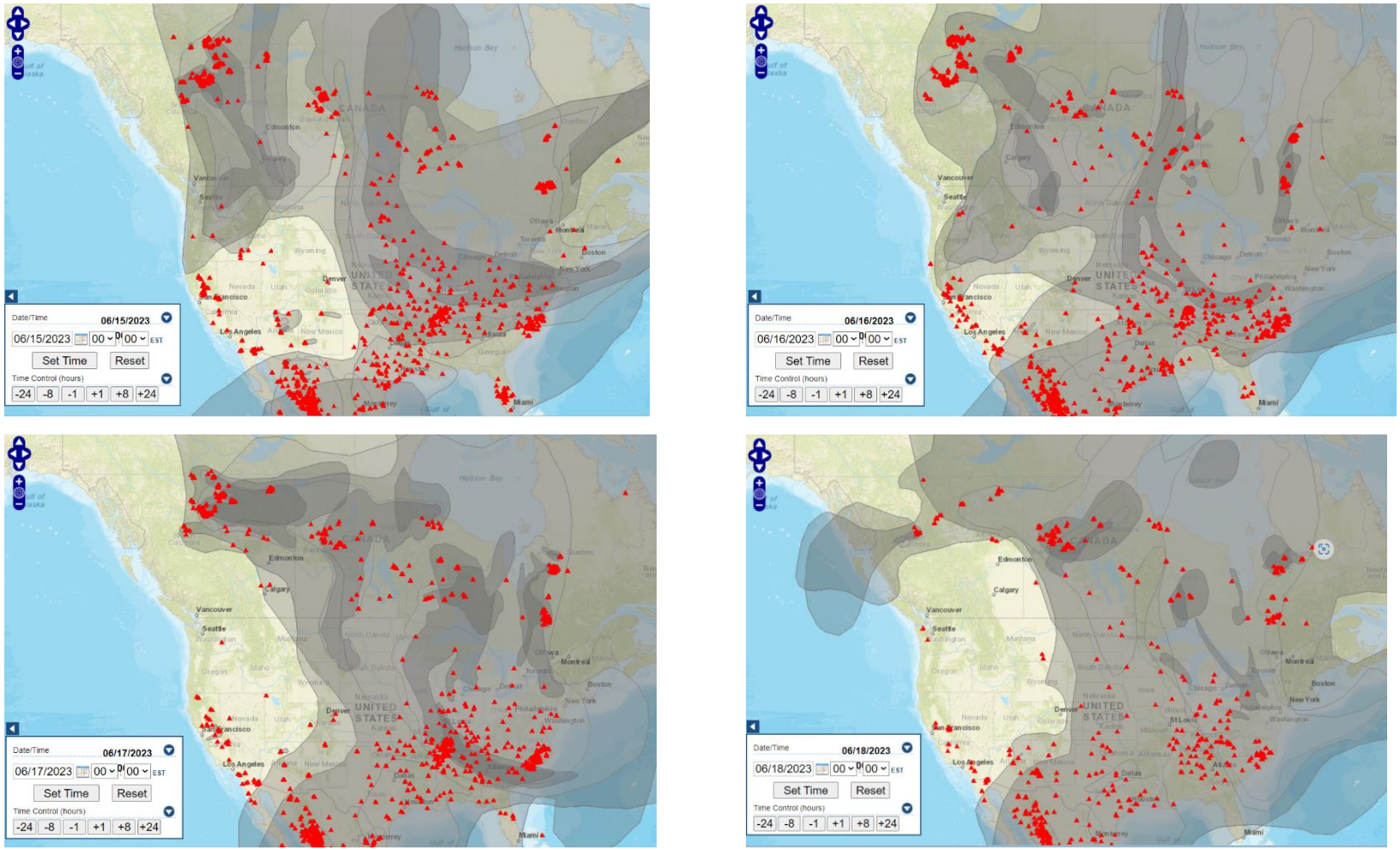

Figure B3. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 15-18, 2023, plotted using the NOAA HMS over North America.

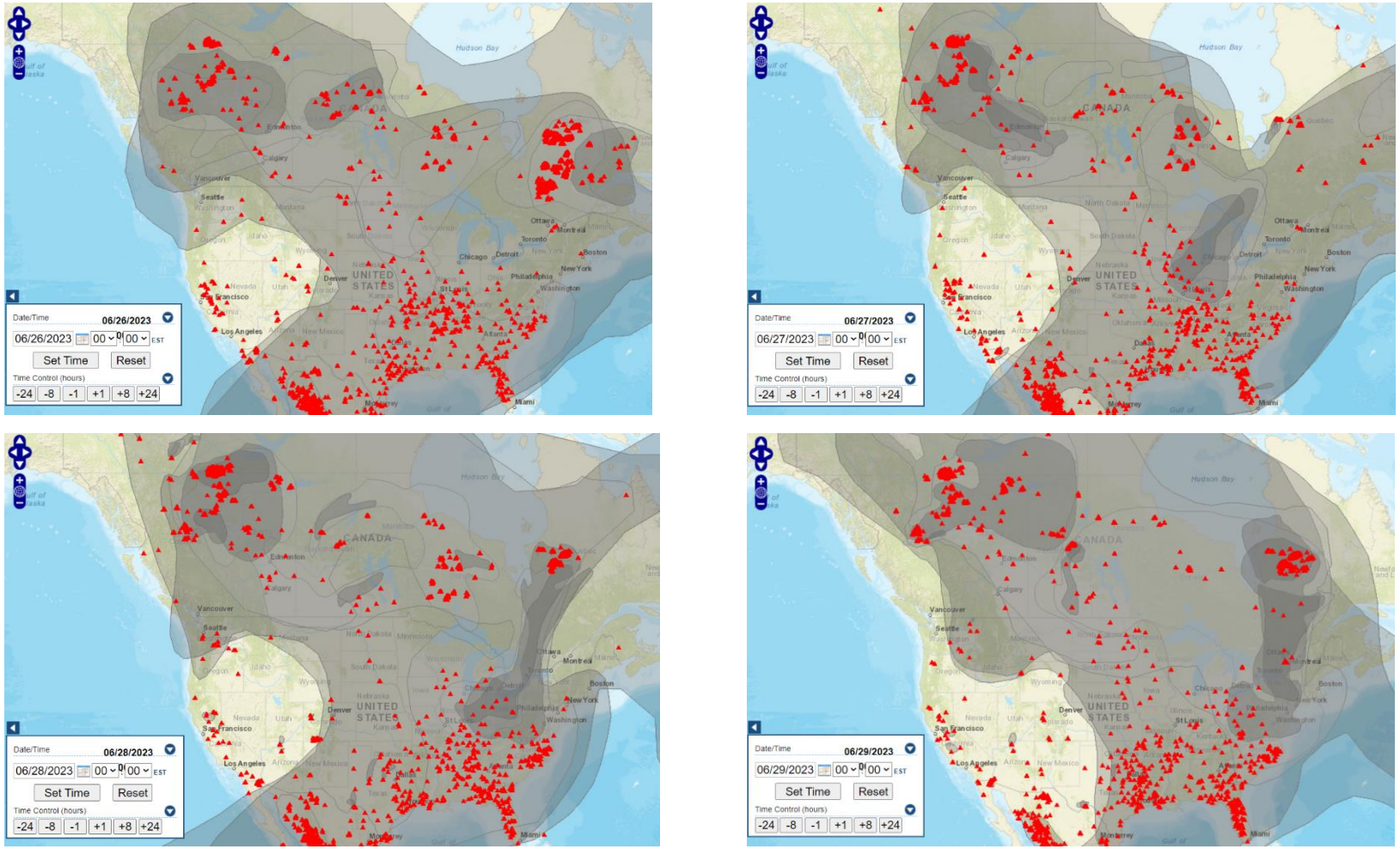

Figure B4. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 26-29, 2023, plotted using the NOAA HMS over North America.

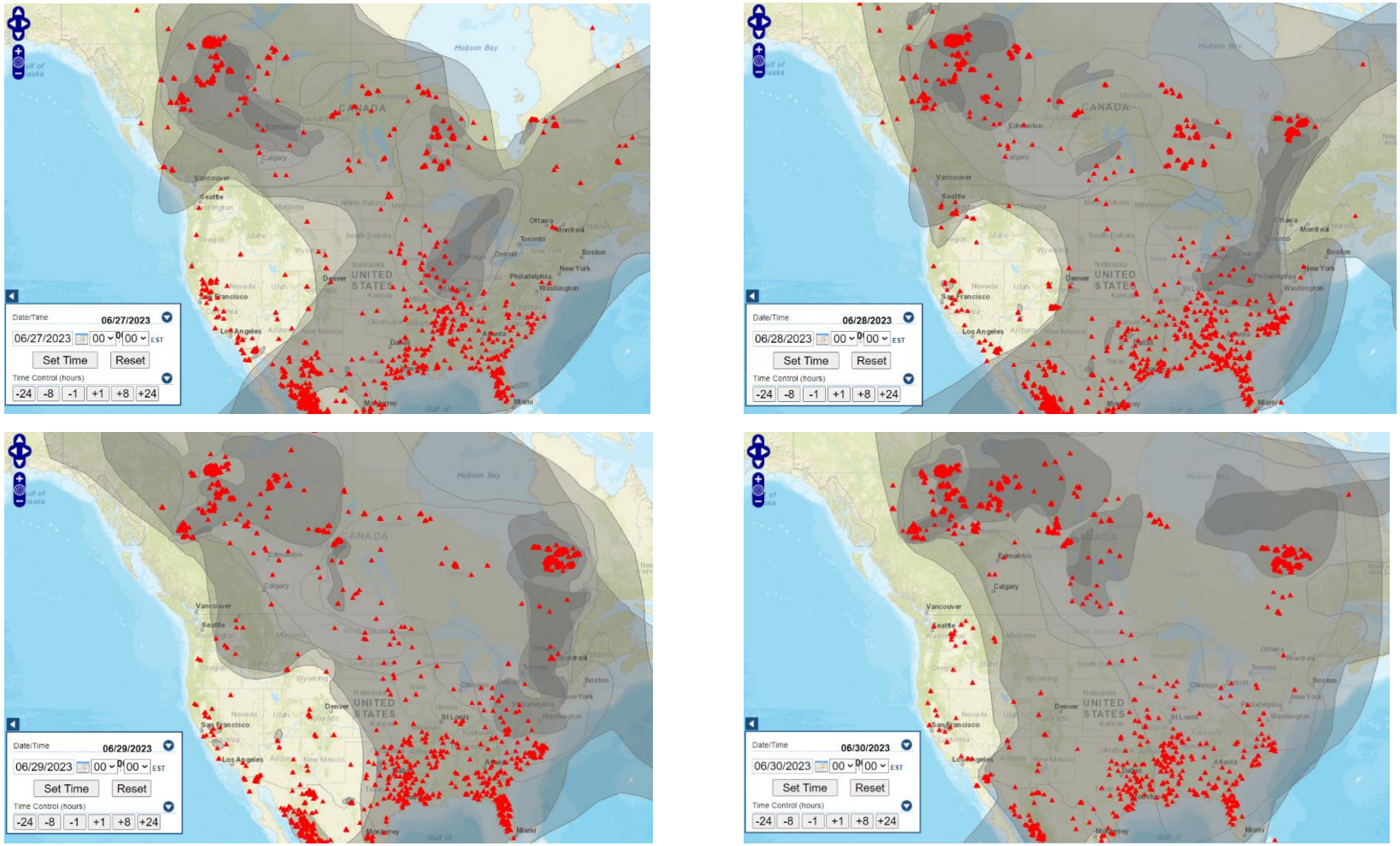

Figure B5. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 27-30, 2023, plotted using the NOAA HMS over North America.

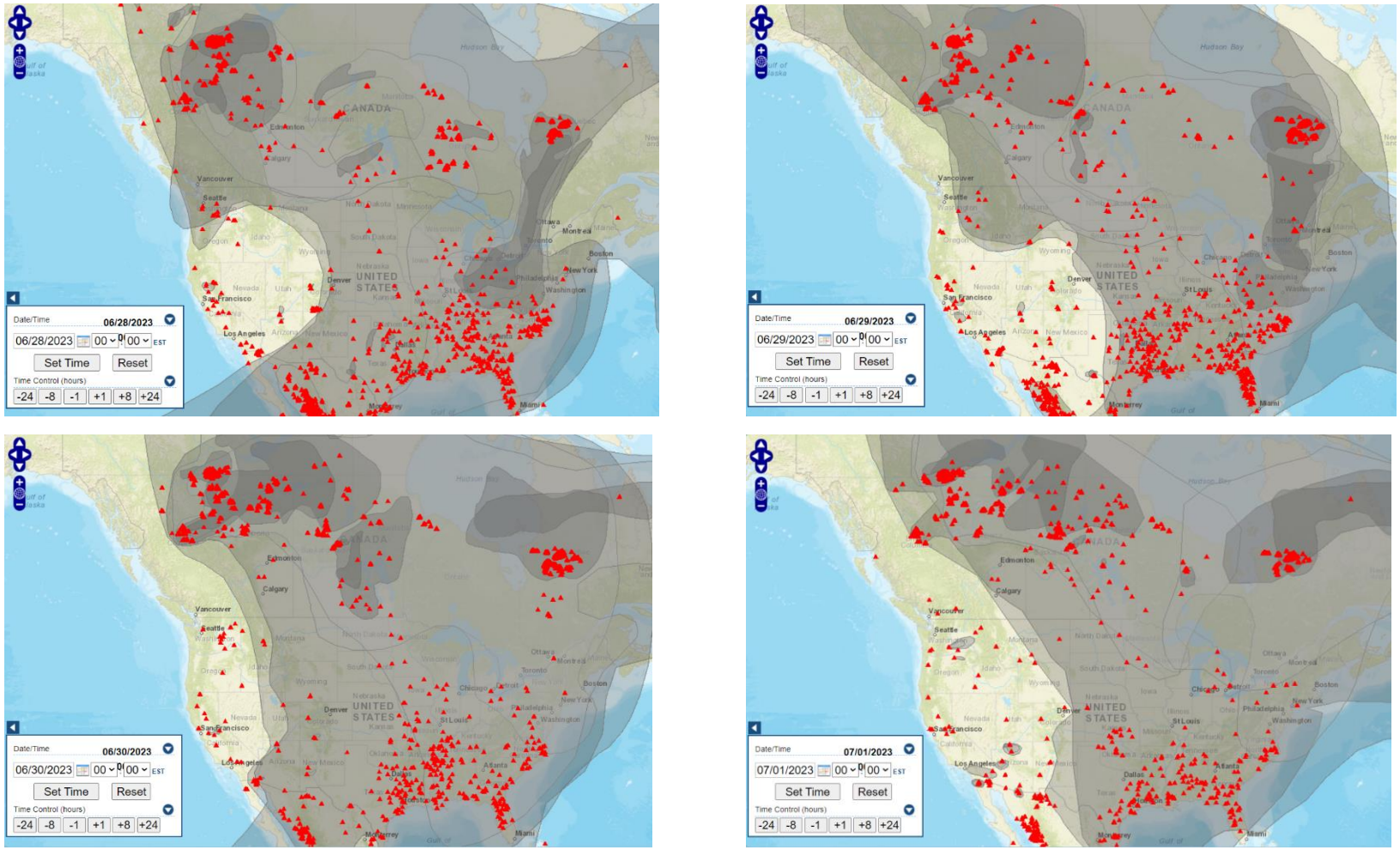

Figure B6. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 28 - July 1, 2023, plotted using the NOAA HMS over North America.

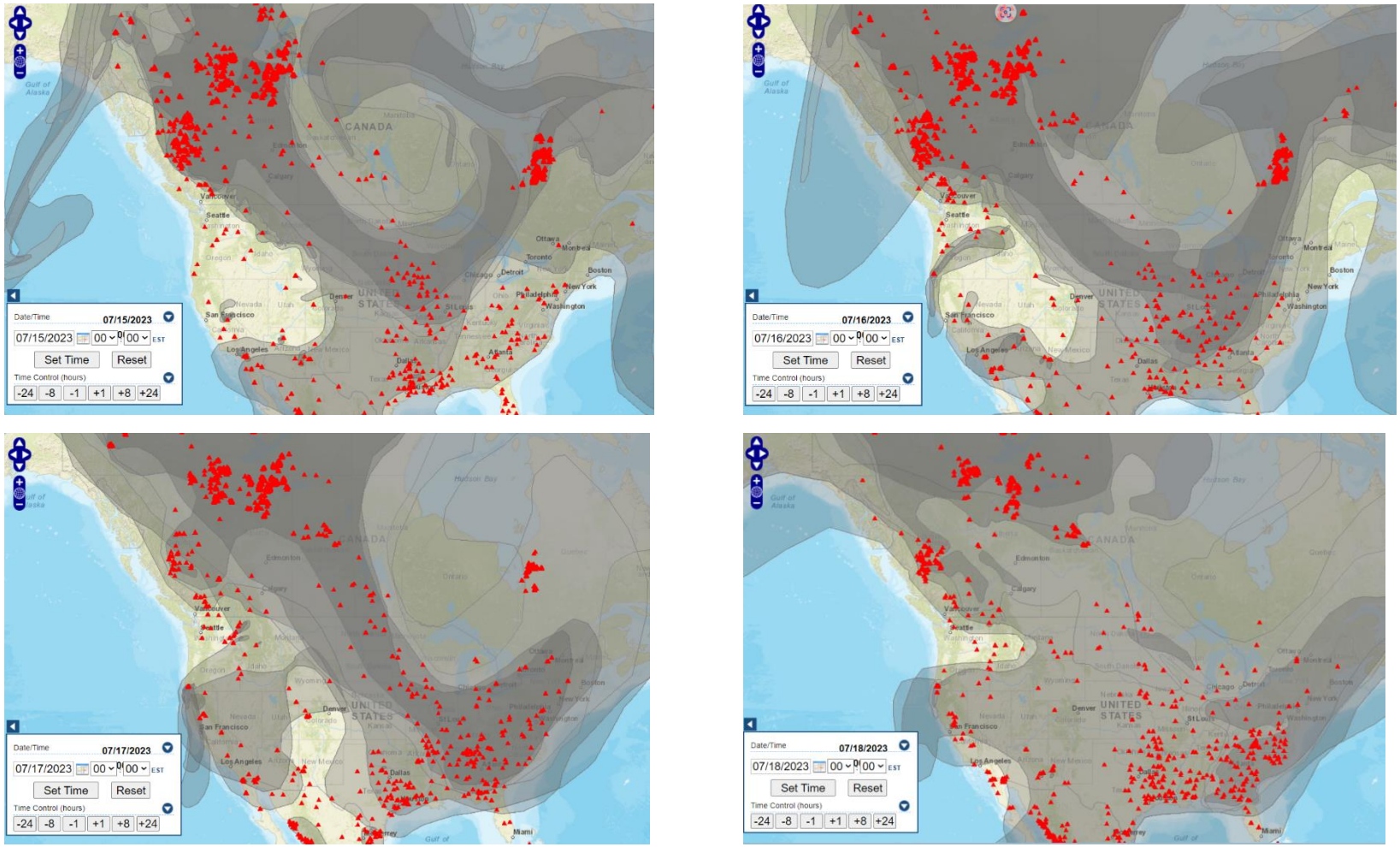

Figure B7. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on July 18, 2023, plotted using the NOAA HMS over North America.

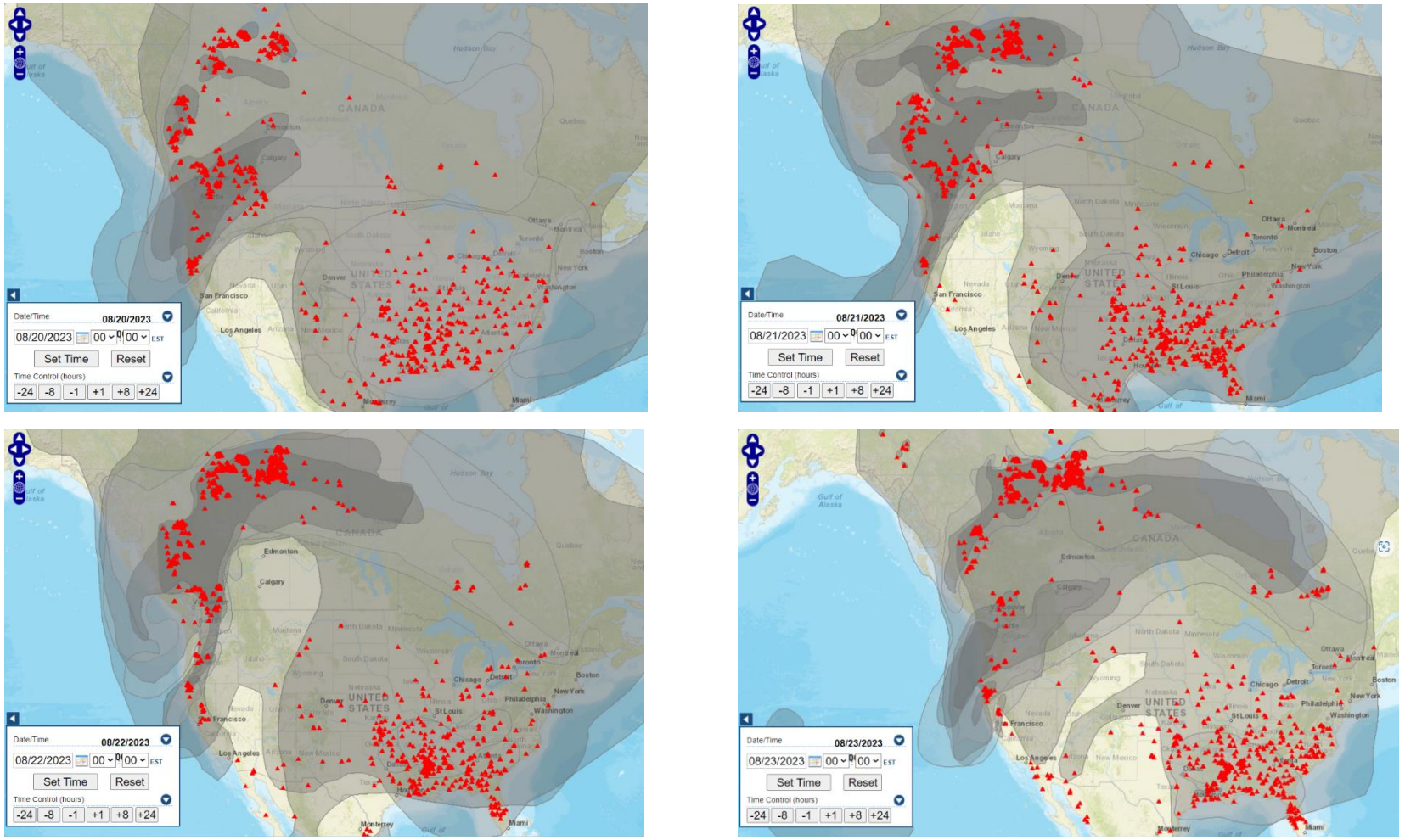

Figure B8. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on August 20-23, 2023, plotted using the NOAA HMS over North America.

Appendix C: HYSPLIT Back-Trajectory Maps

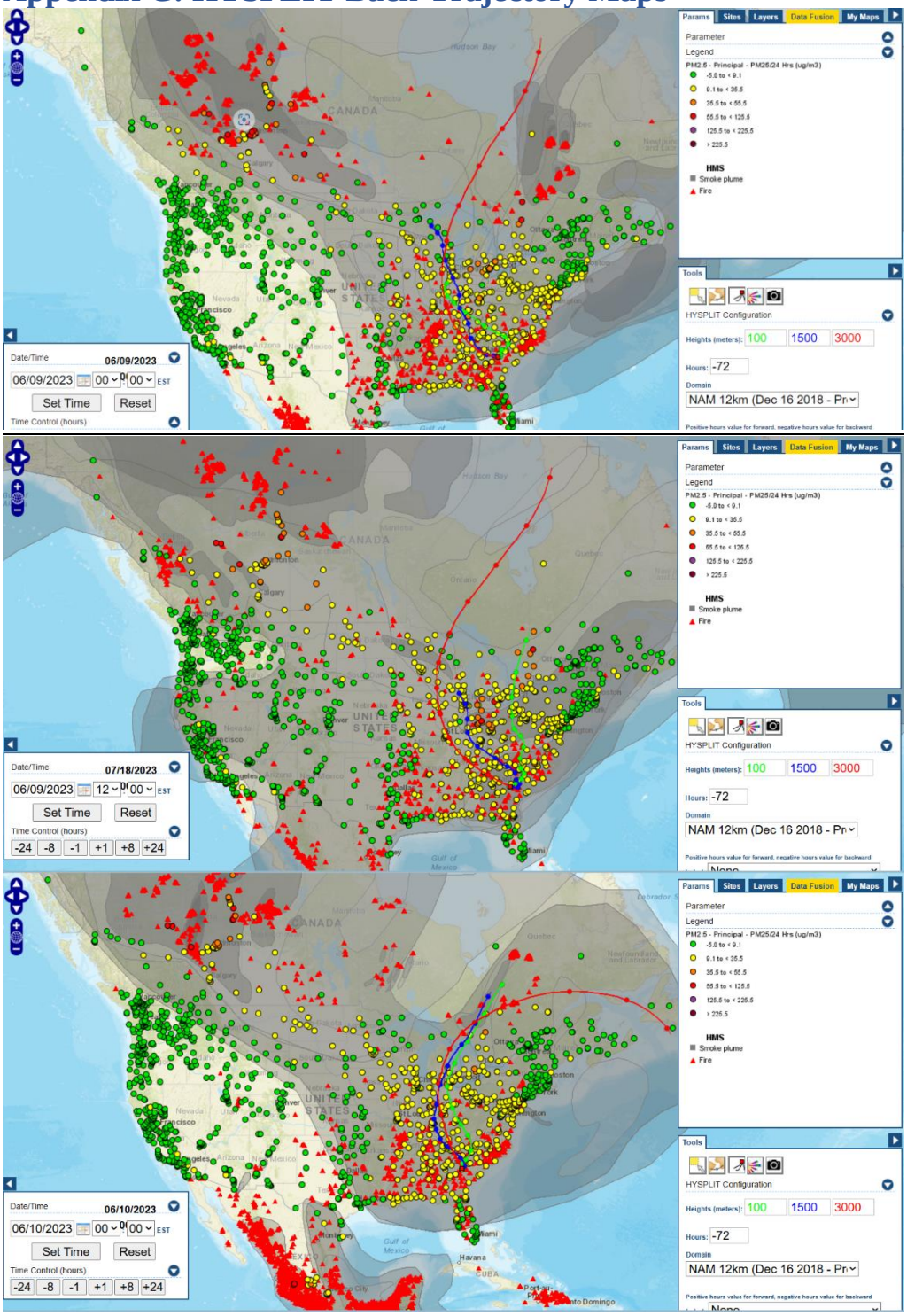

Figure C1. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on June 9, 2023 (top), 12 PM EST on June 9, 2023 (middle), and 0 AM EST on June 10, 2023 (bottom).

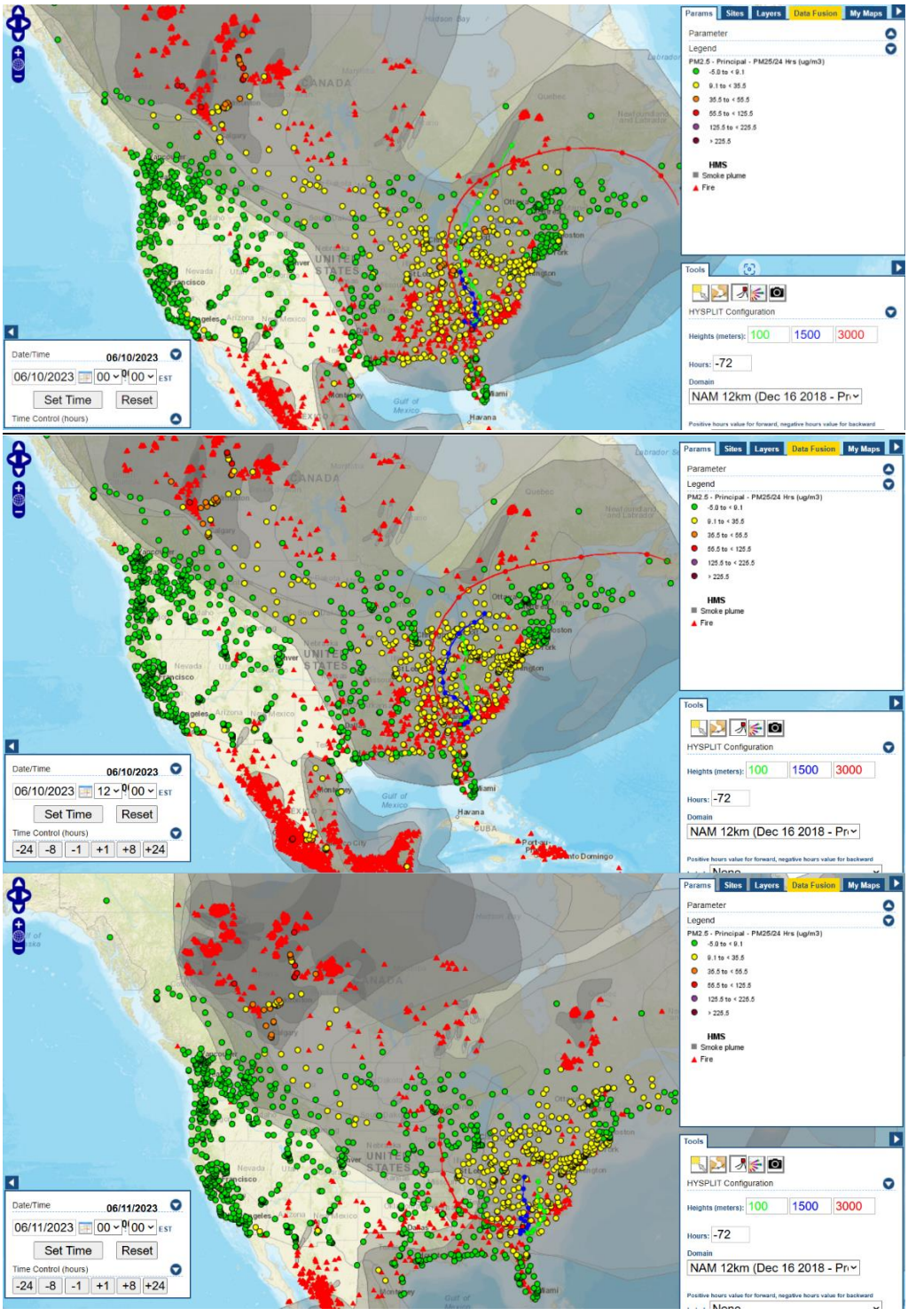

Figure C2. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on June 10, 2023 (top), 12 PM EST on June 10, 2023 (middle), and 0 AM EST on June 11, 2023 (bottom).

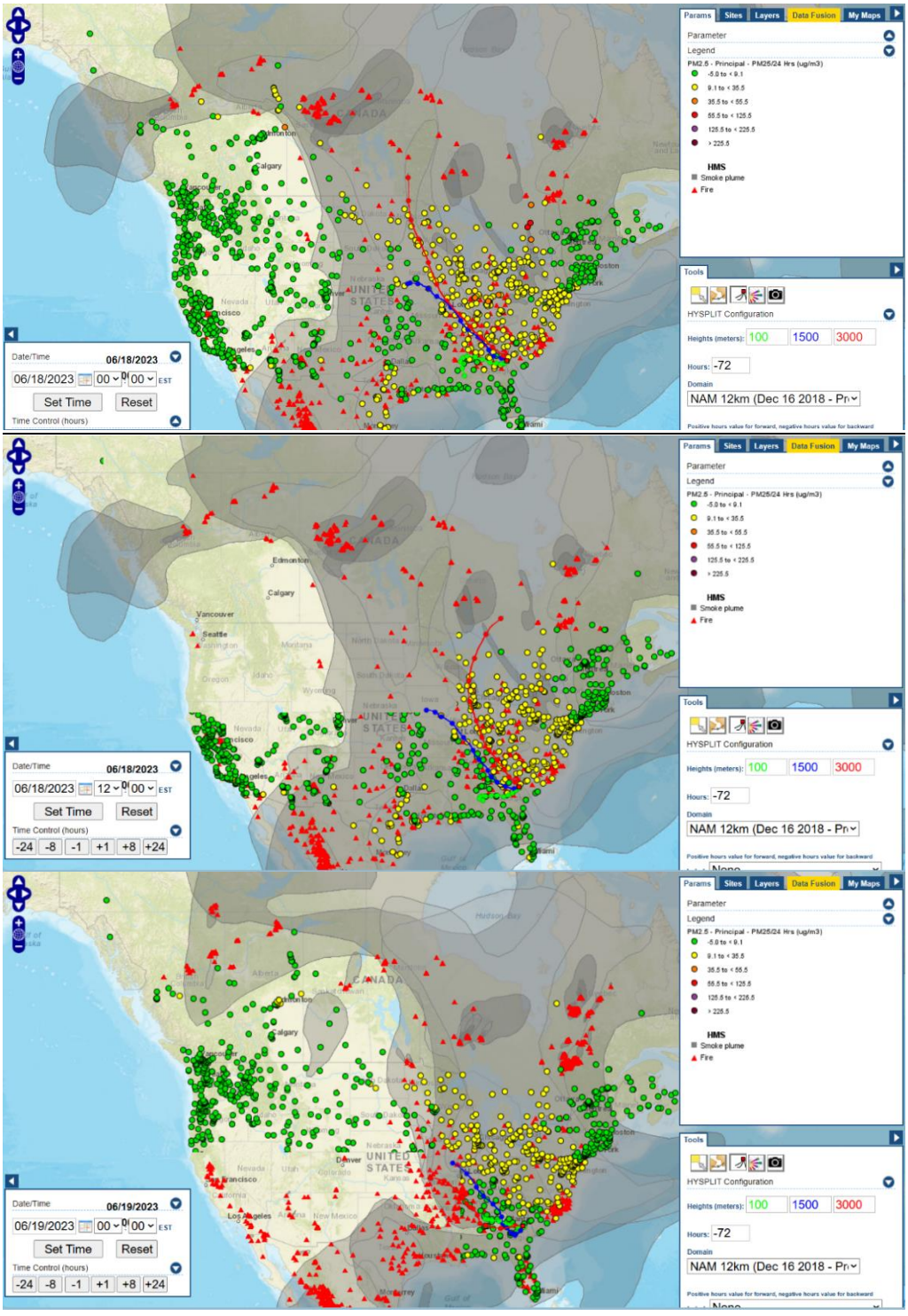

Figure C3. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on June 18, 2023 (top), 12 PM EST on June 18, 2023 (middle), and 0 AM EST on June 19, 2023 (bottom).

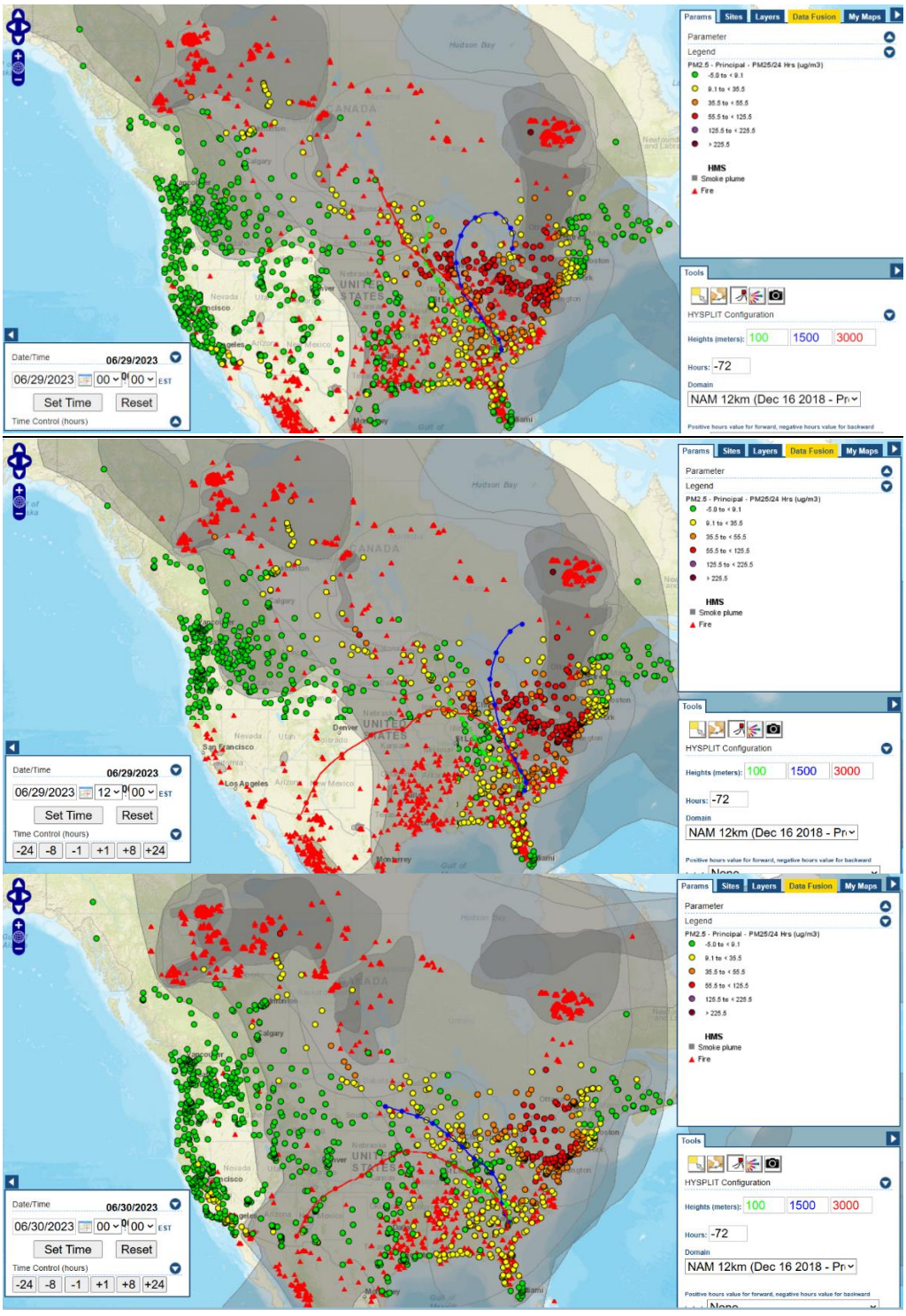

Figure C4. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on June 29, 2023 (top), 12 PM EST on June 29, 2023 (middle), and 0 AM EST on June 30, 2023 (bottom).

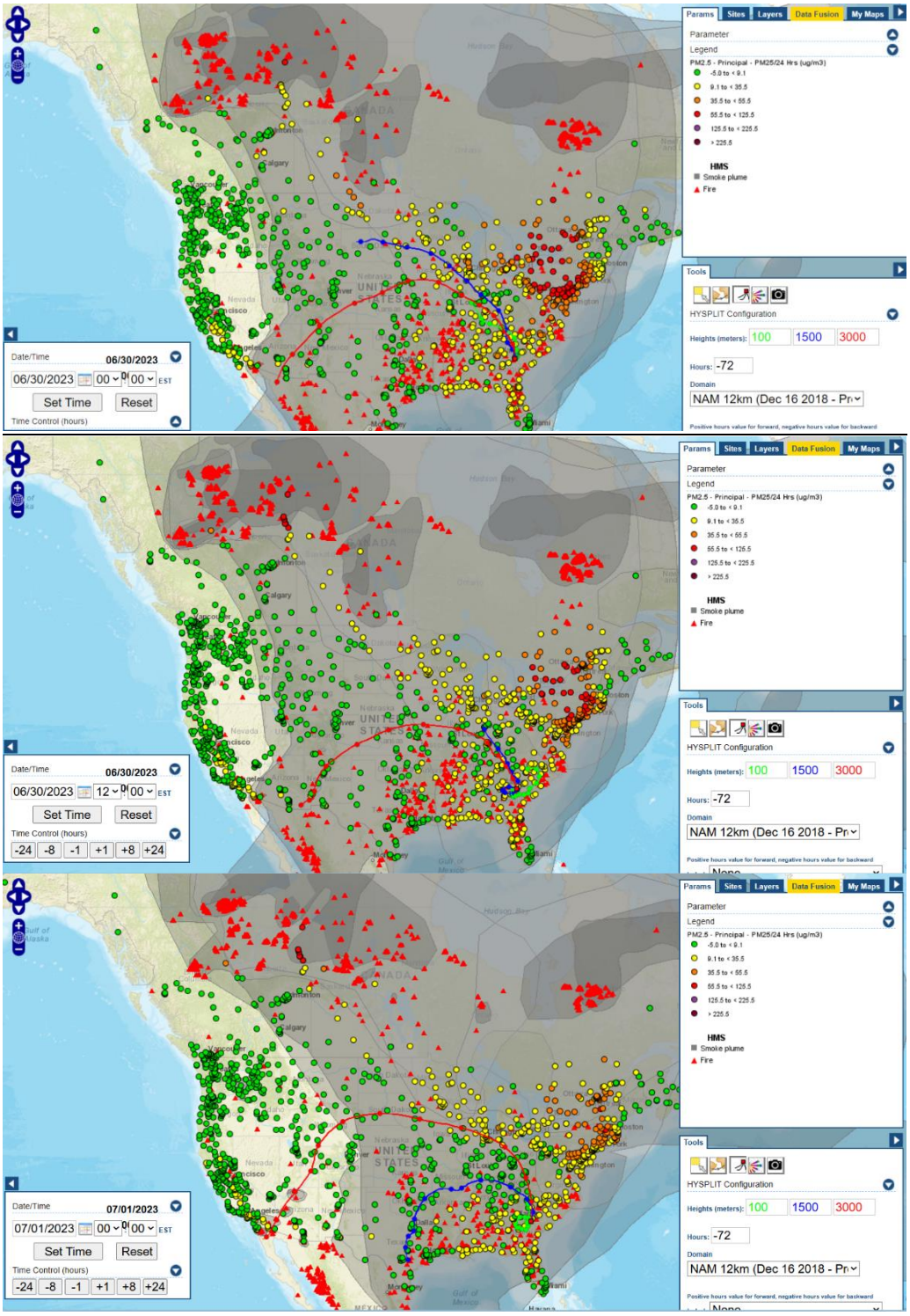

Figure C5. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on June 30, 2023 (top), 12 PM EST on June 30, 2023 (middle), and 0 AM EST on July 1, 2023 (bottom).

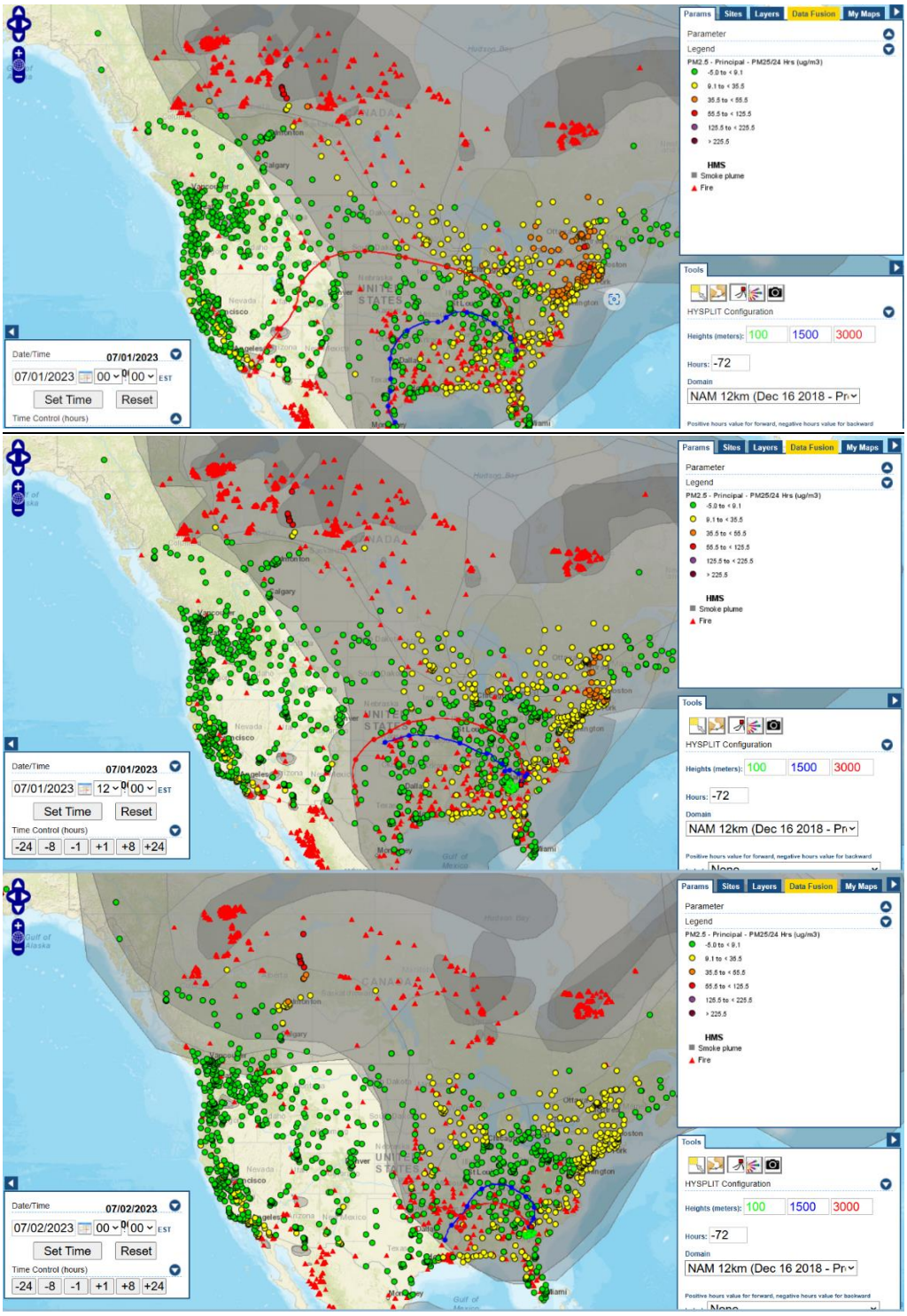

Figure C6. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on July 1, 2023 (top), 12 PM EST on July 1, 2023 (middle), and 0 AM EST on July 2, 2023 (bottom).

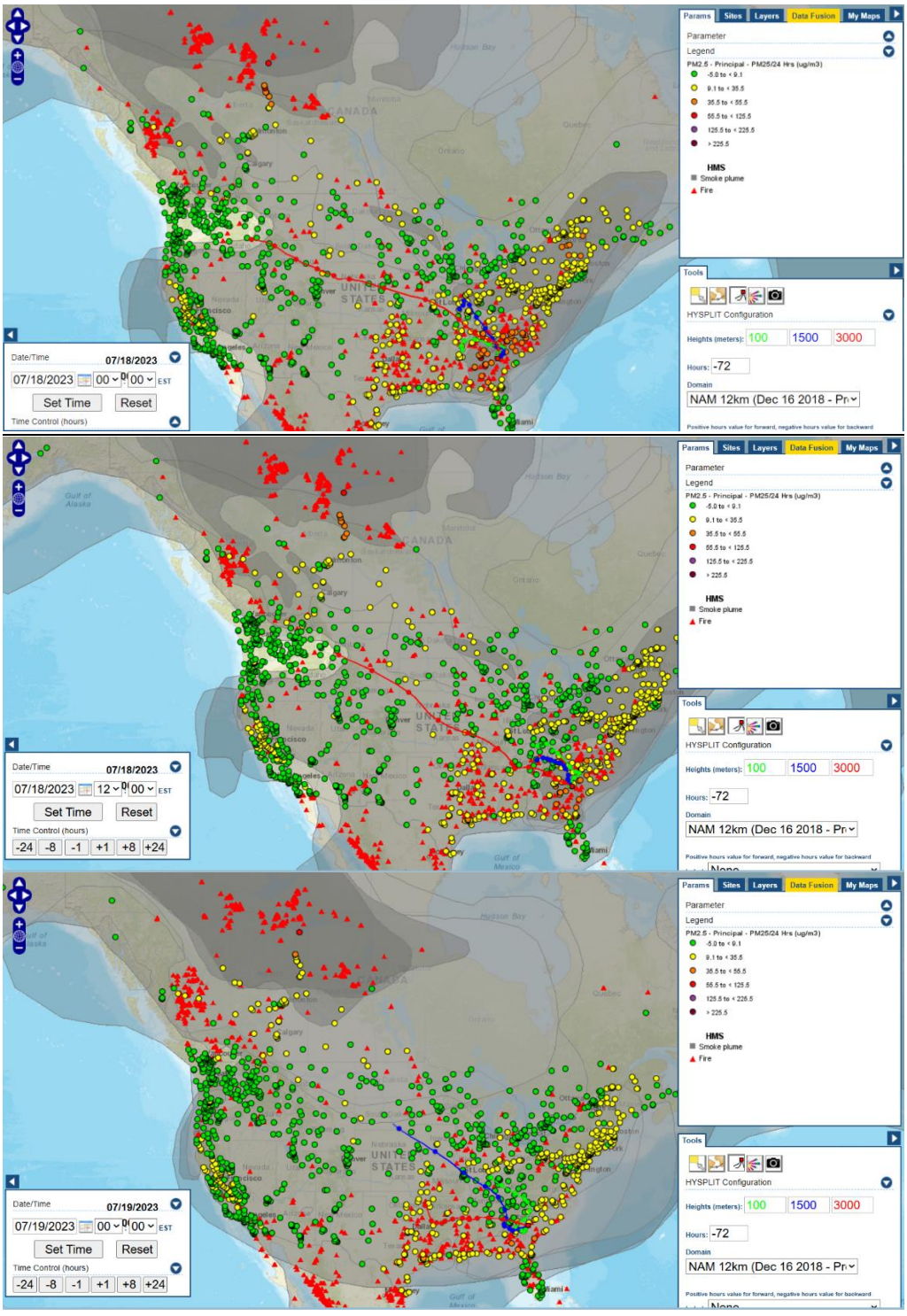

Figure C7. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on July 18, 2023 (top), 12 PM EST on July 18, 2023 (middle), and 0 AM EST on July 19, 2023 (bottom).

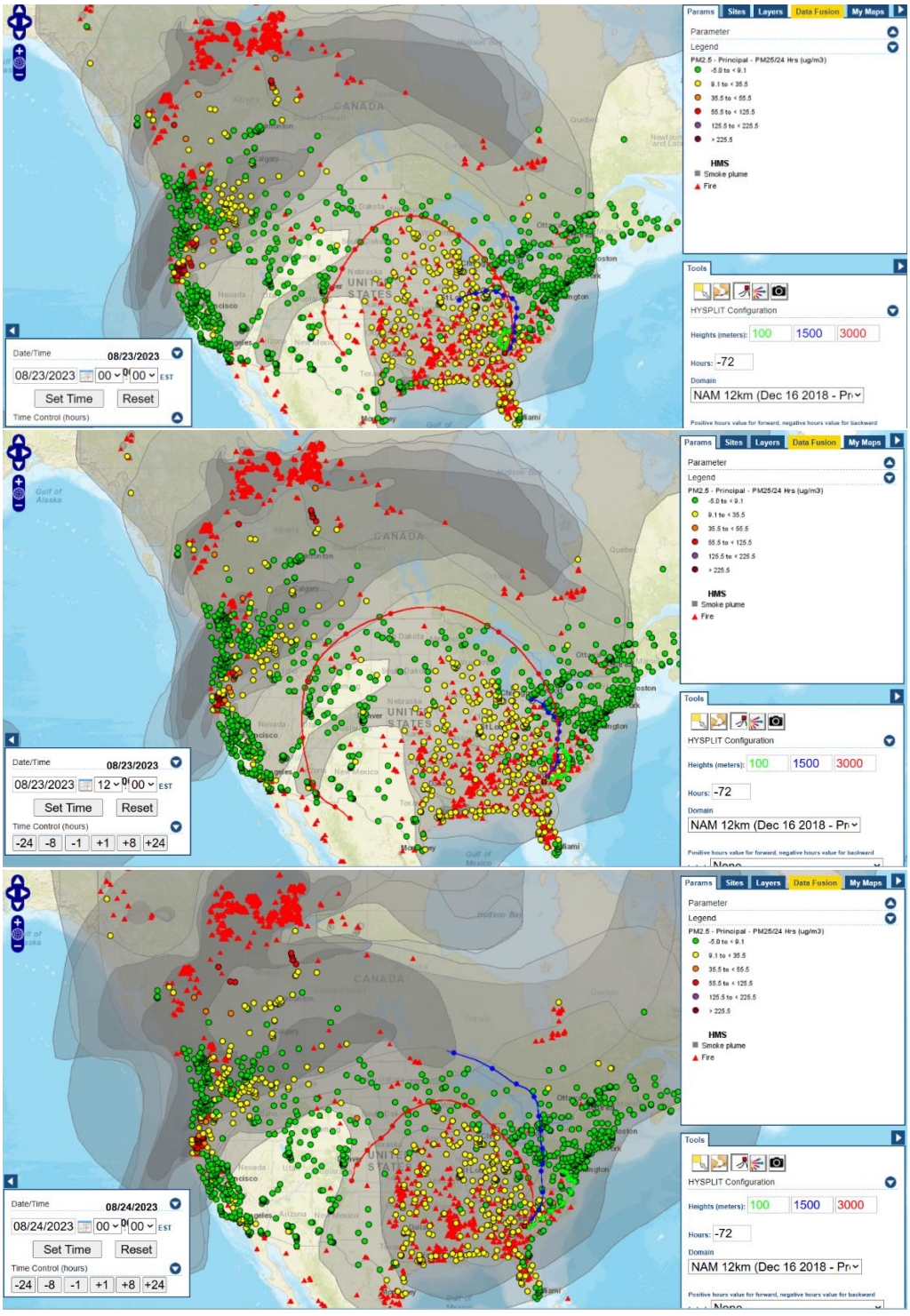

Figure C8. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on August 23, 2023 (top), 12 PM EST on August 23, 2023 (middle), and 0 AM EST on August 24, 2023 (bottom).

Appendix D: $PM_{2.5}$ Surface Concentrations in the Southeast

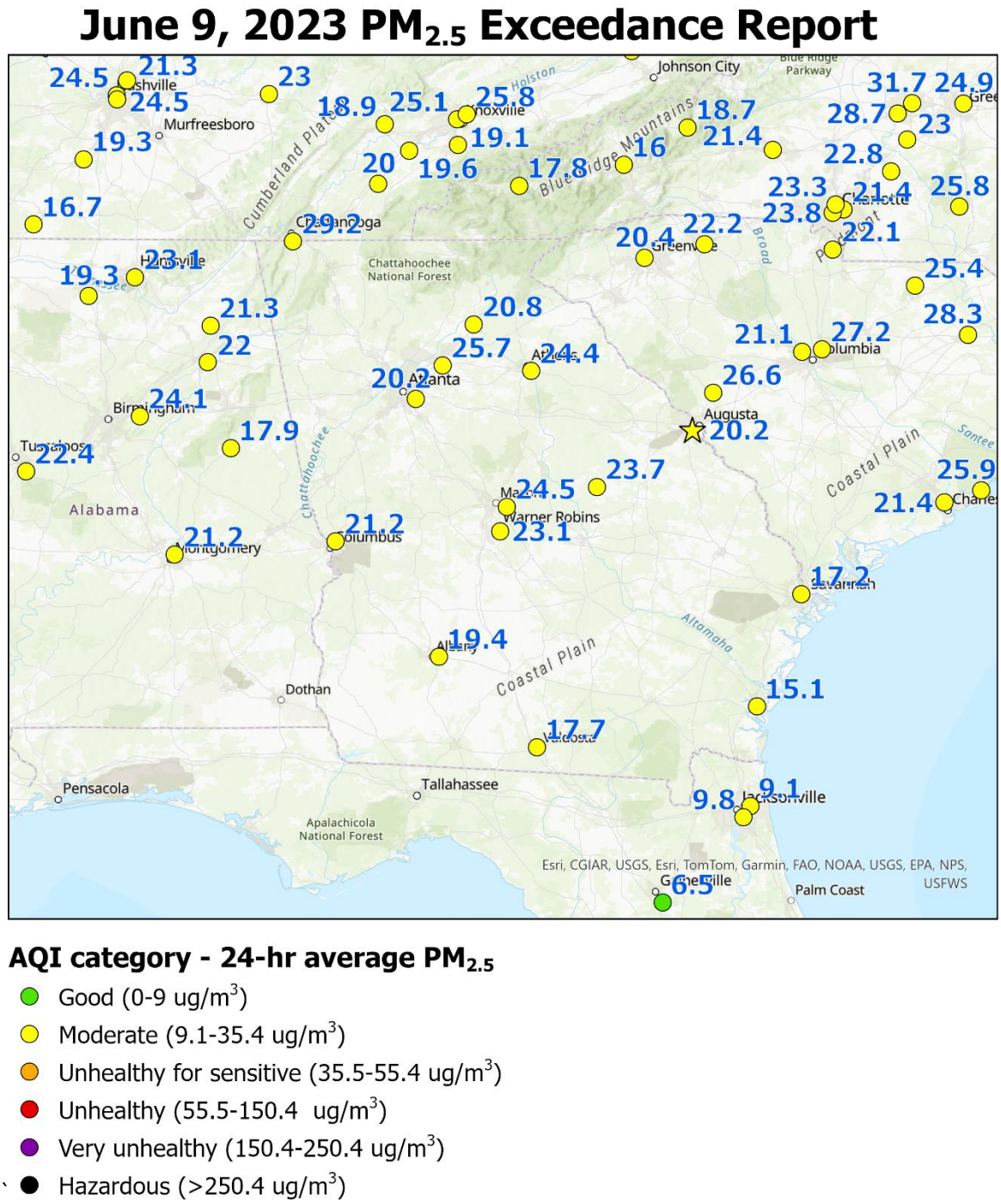

Figure D1. Surface level, daily $PM_{2.5}$ concentrations on June 9, 2023, across the southeast. The Augusta monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual $PM_{2.5}$ NAAQS.

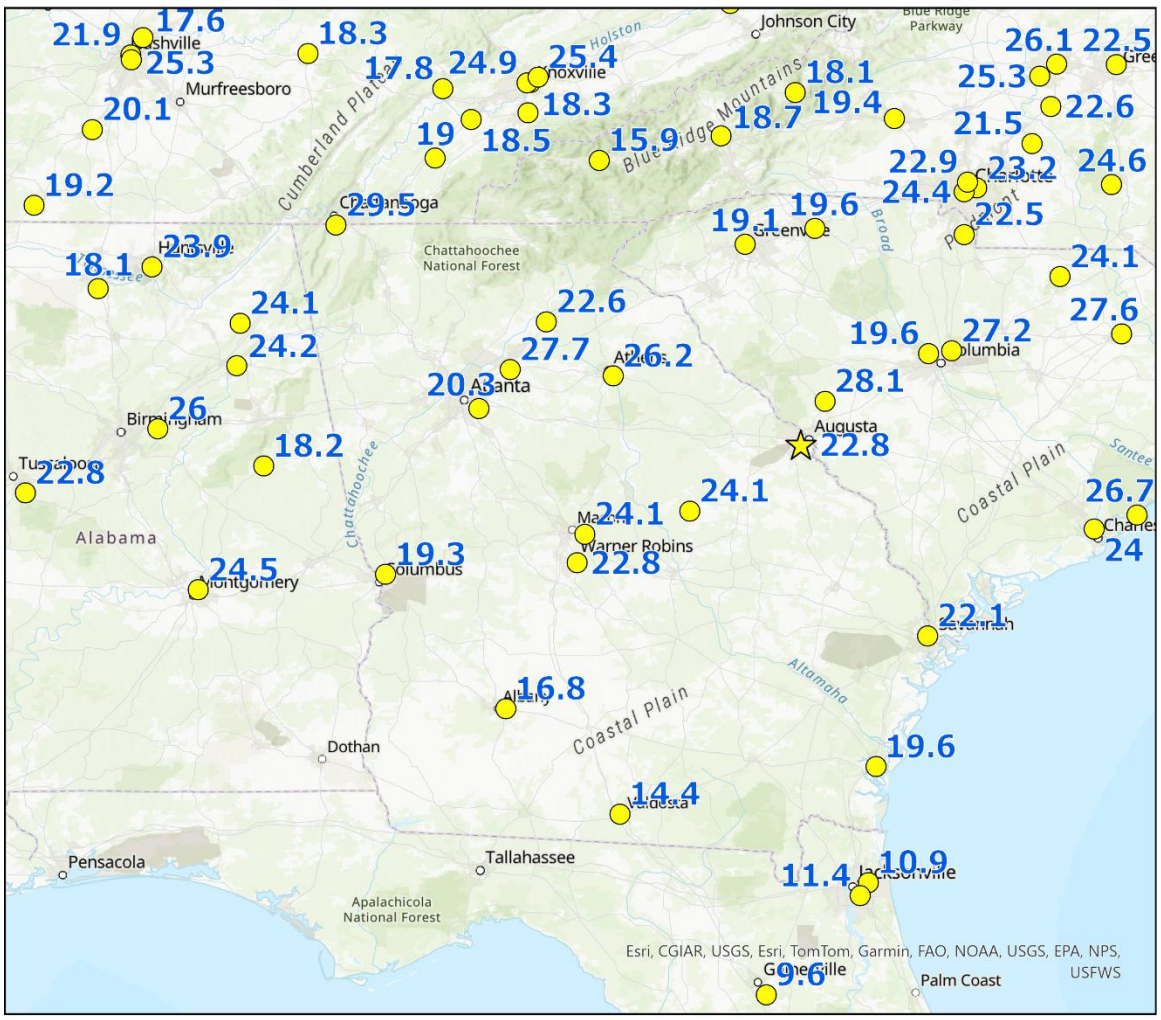

Figure D2. Surface level, daily $PM_{2.5}$ concentrations on June 10, 2023, across the southeast. The Augusta monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual $PM_{2.5}$ NAAQS.

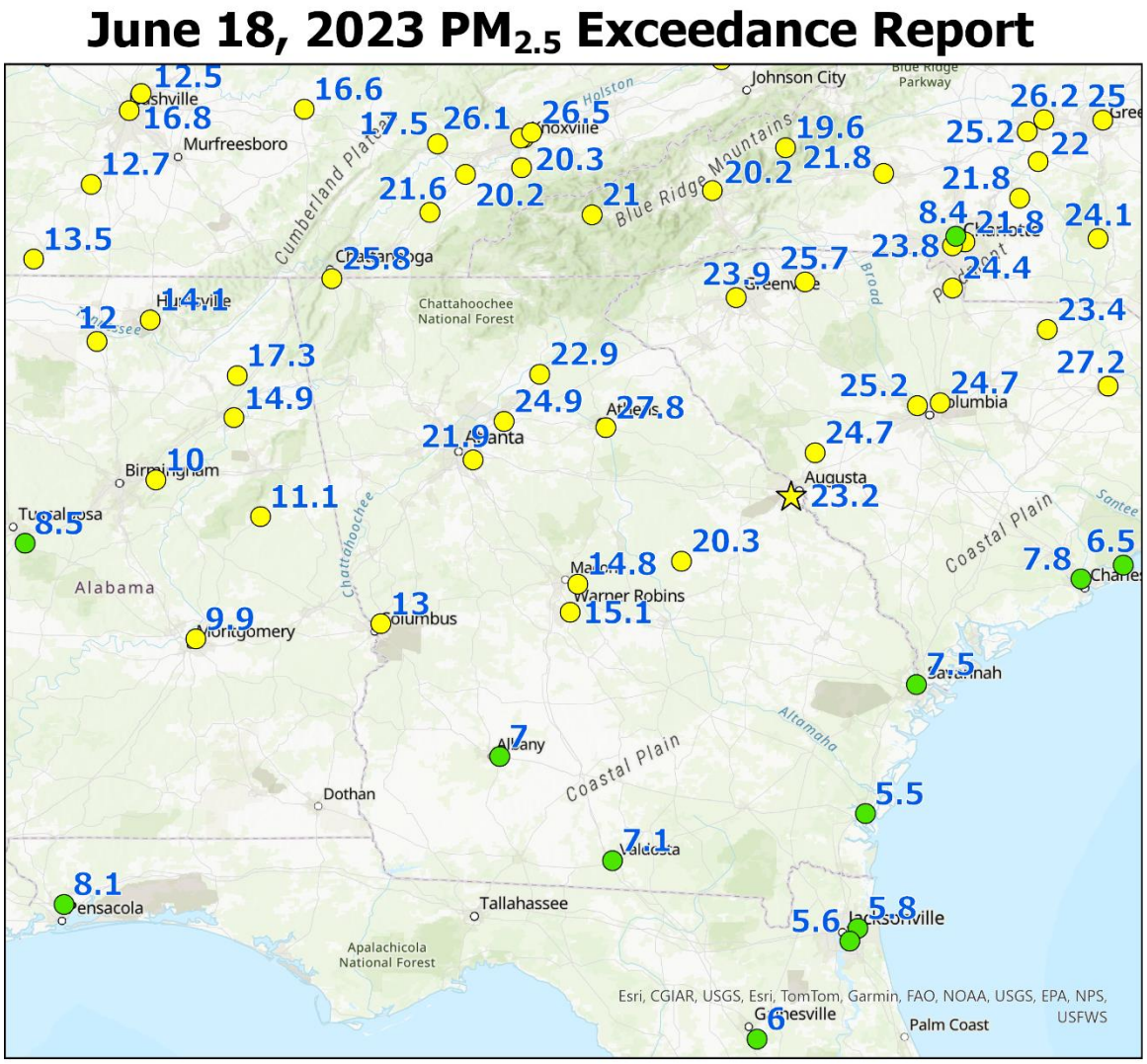

Figure D3. Surface level, daily $PM_{2.5}$ concentrations on June 18, 2023, across the southeast. The Augusta monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual $PM_{2.5}$ NAAQS.

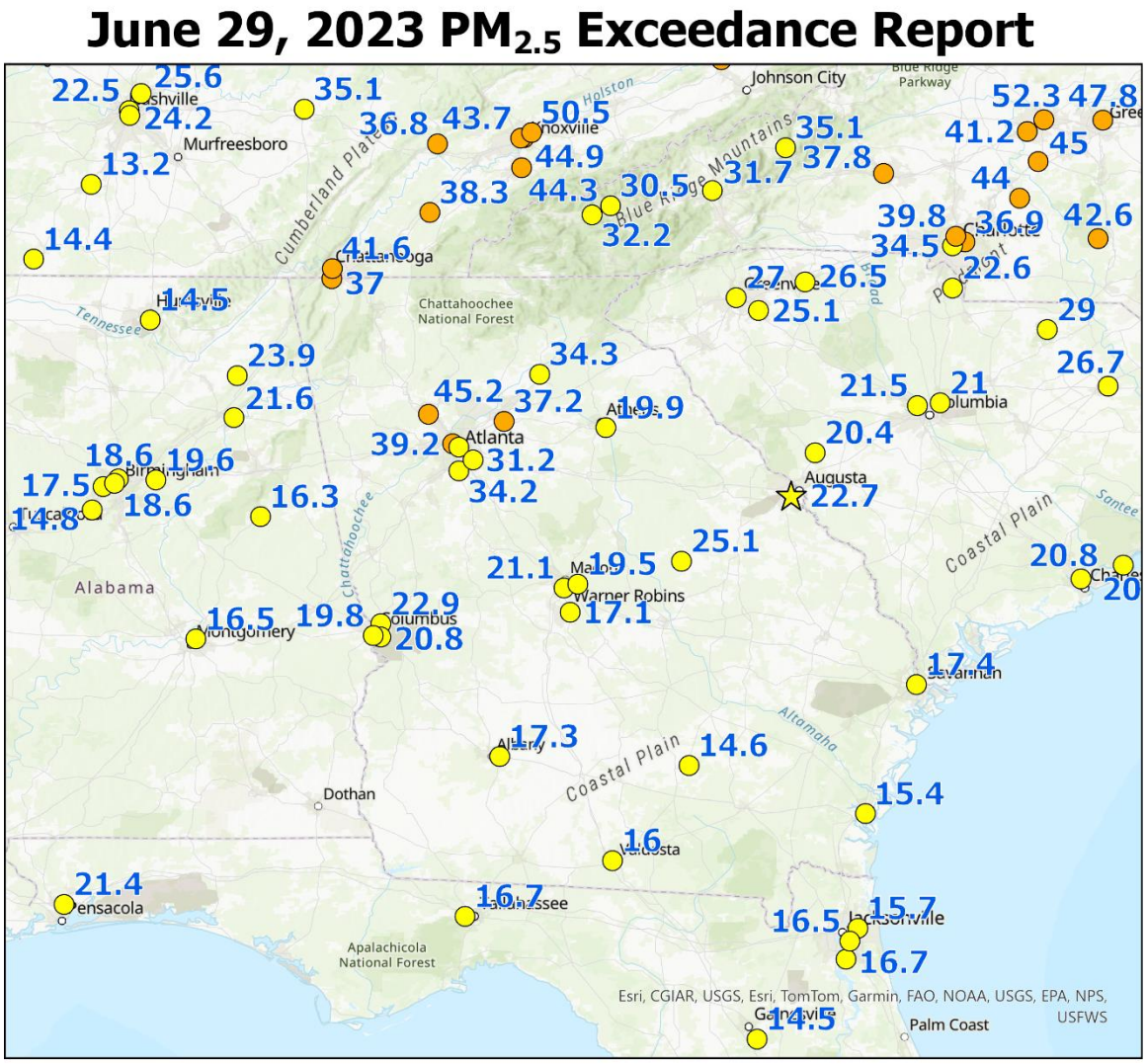

Figure D4. Surface level, daily $PM_{2.5}$ concentrations on June 29, 2023, across the southeast. The Augusta monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual $PM_{2.5}$ NAAQS.

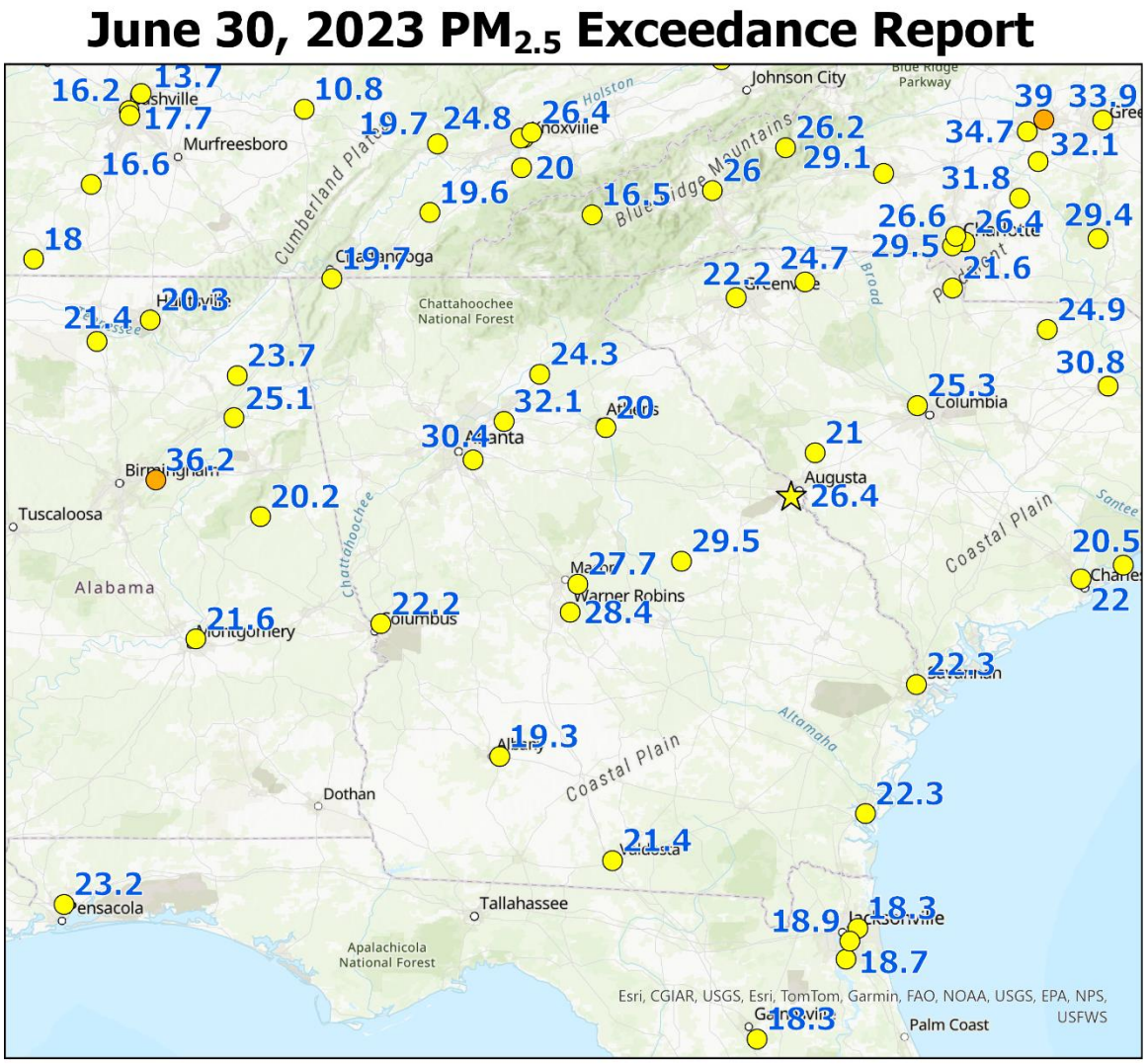

Figure D5. Surface level, daily $PM_{2.5}$ concentrations on June 30, 2023, across the southeast. The Augusta monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual $PM_{2.5}$ NAAQS.

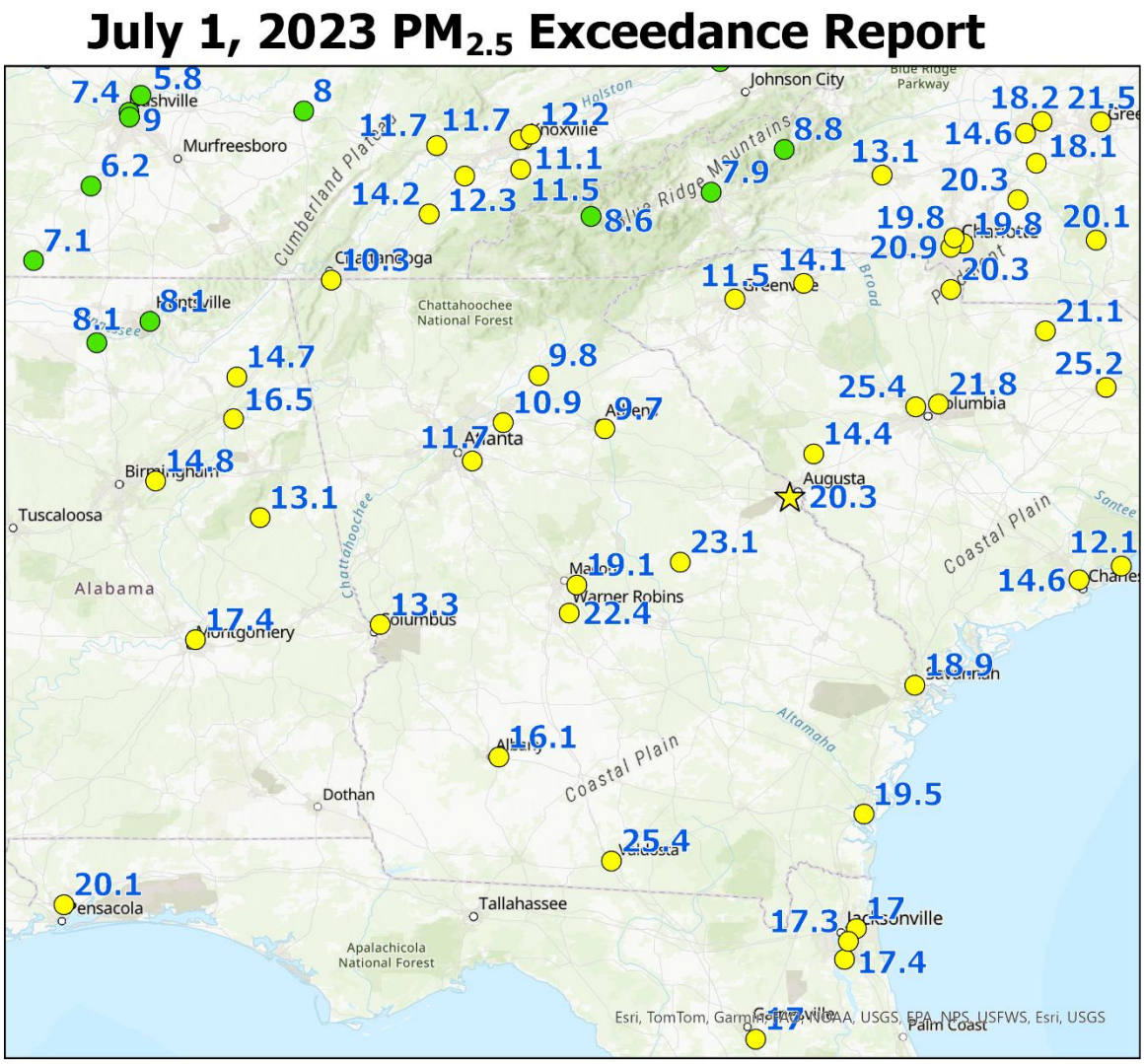

Figure D6. Surface level, daily $PM_{2.5}$ concentrations on July 1, 2023, across the southeast. The Augusta monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual $PM_{2.5}$ NAAQS.

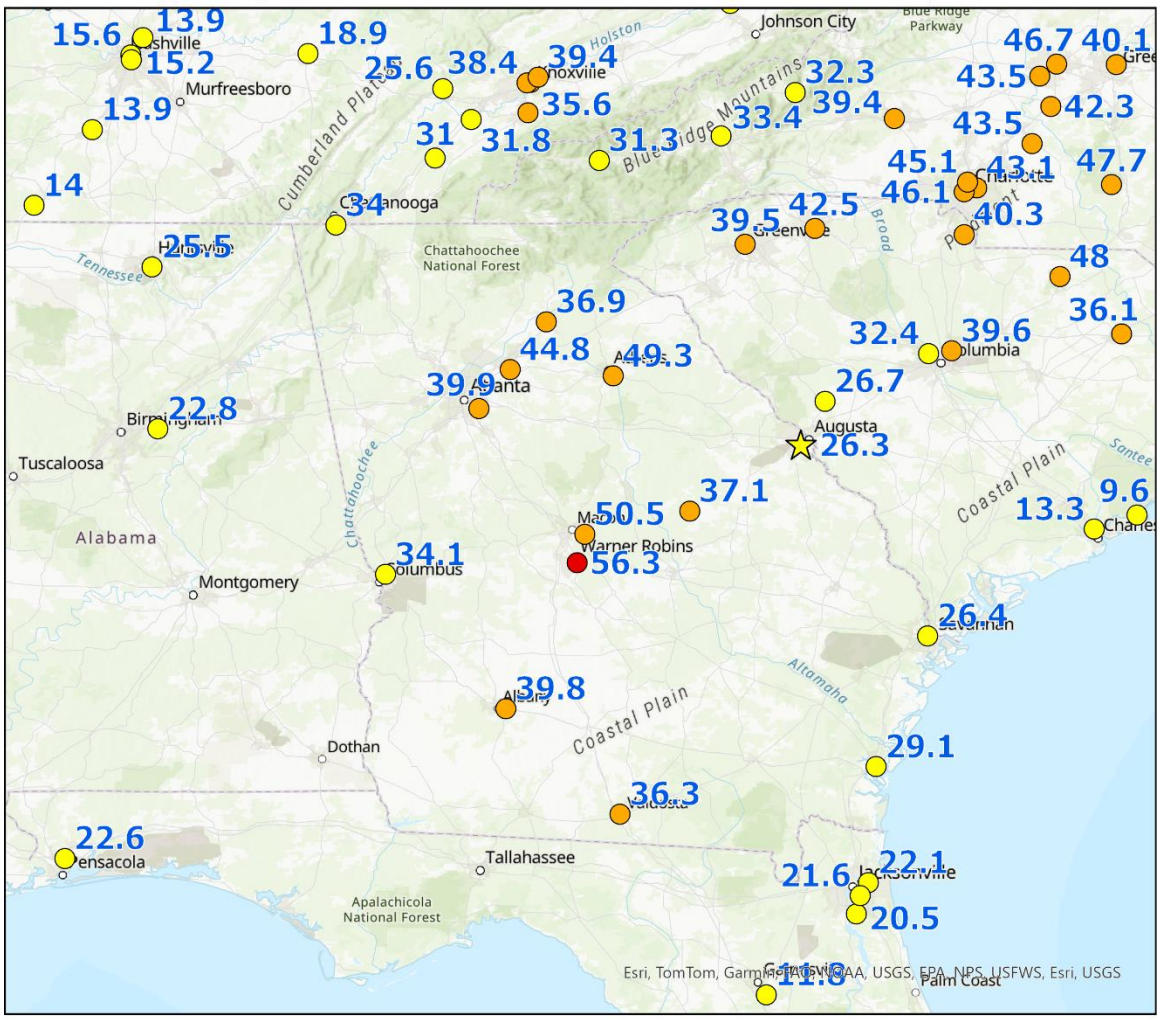

Figure D7. Surface level, daily $PM_{2.5}$ concentrations on July 18, 2023, across the southeast. The Augusta monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual $PM_{2.5}$ NAAQS.

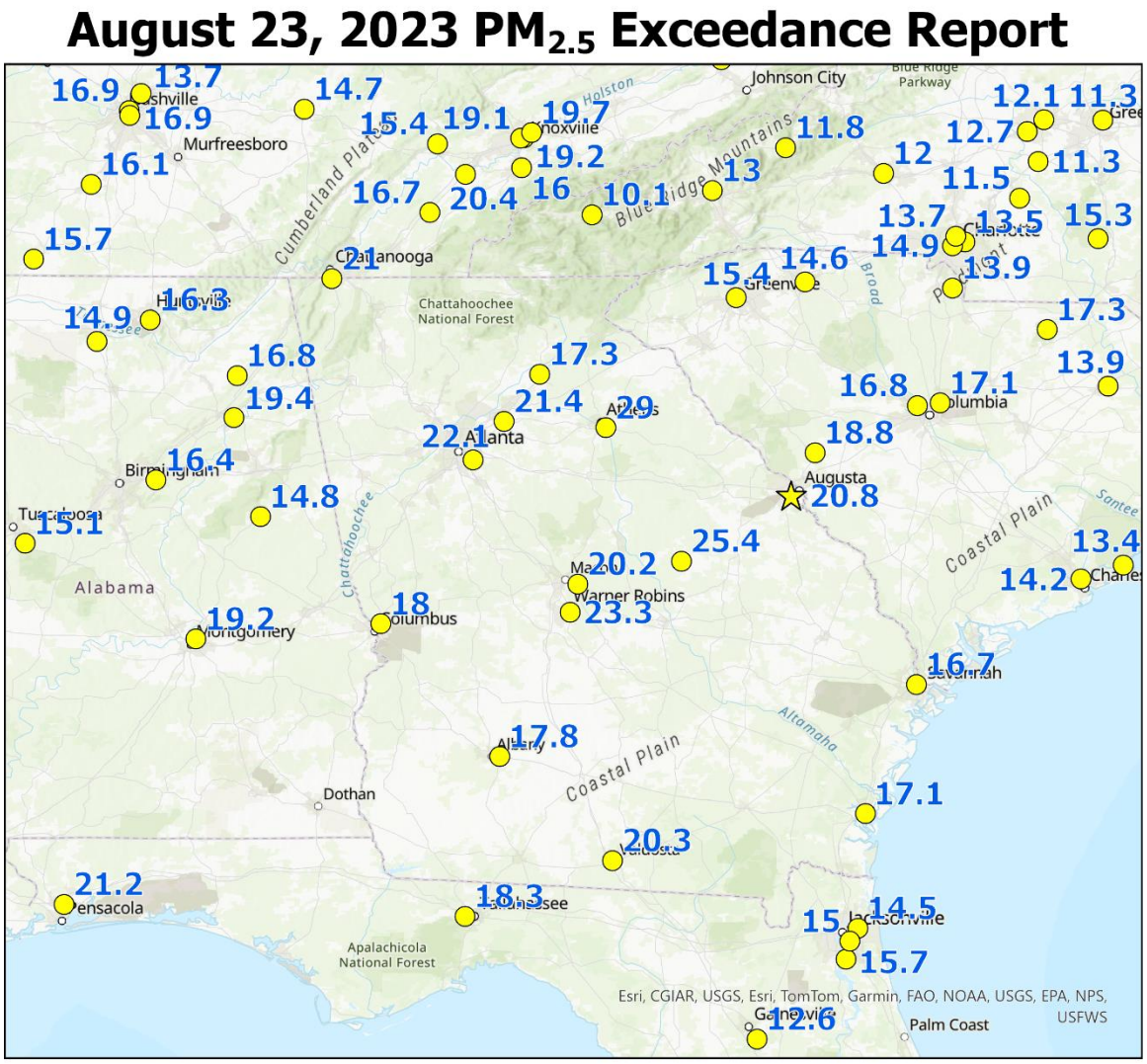

Figure D8. Surface level, daily $PM_{2.5}$ concentrations on August 23, 2023, across the southeast. The Augusta monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual $PM_{2.5}$ NAAQS.

Appendix E: Hourly $PM_{2.5}$ Time Series

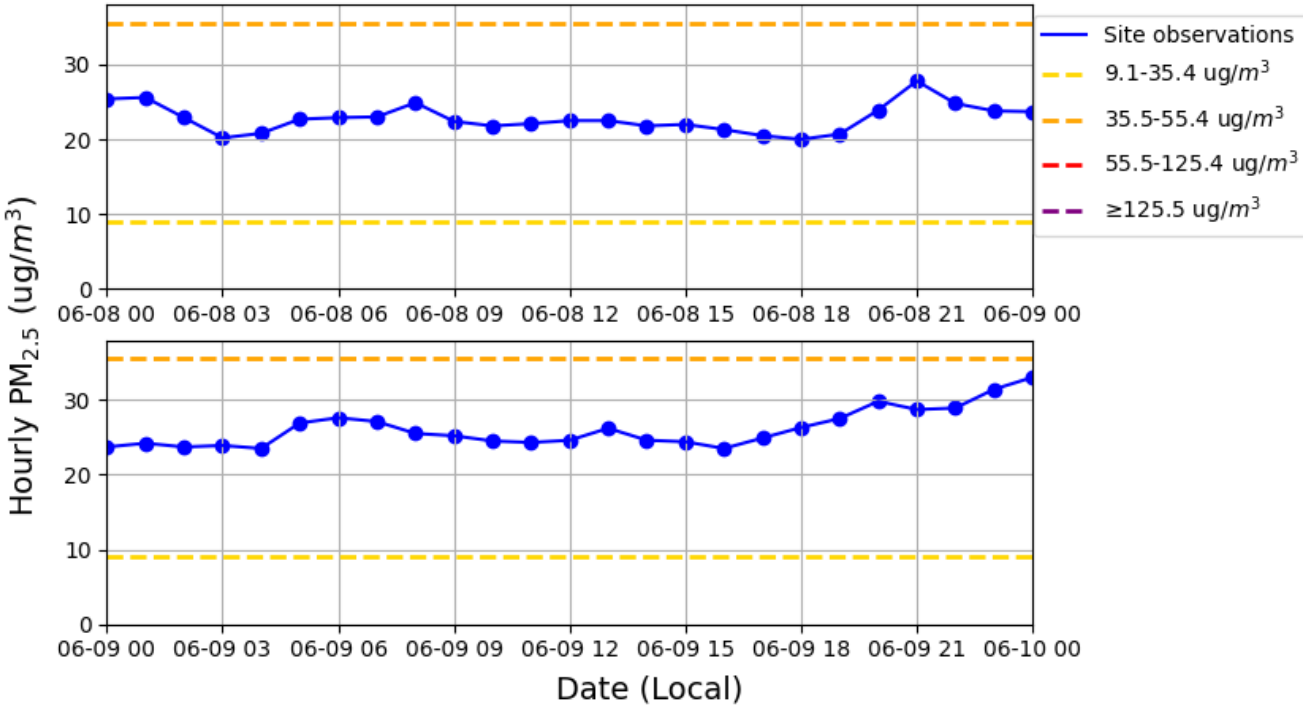

Figure E1. Hourly $PM_{2.5}$ concentrations at the Augusta monitoring site on June 8 and 9, 2023. The solid lines with dots show observations. The dashed lines show AQI breakpoints.

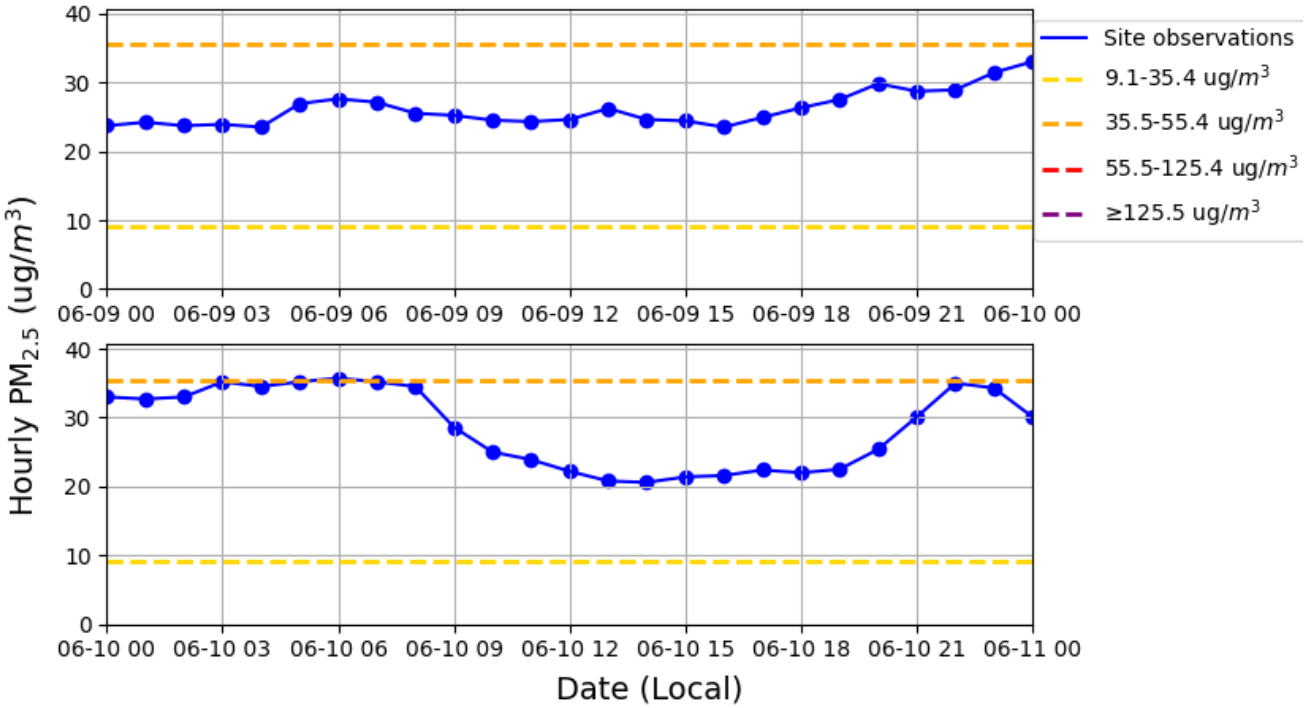

Figure E2. Hourly $PM_{2.5}$ concentrations at the Augusta monitoring site on June 9 and 10, 2023. The solid lines with dots show observations. The dashed lines show AQI breakpoints.

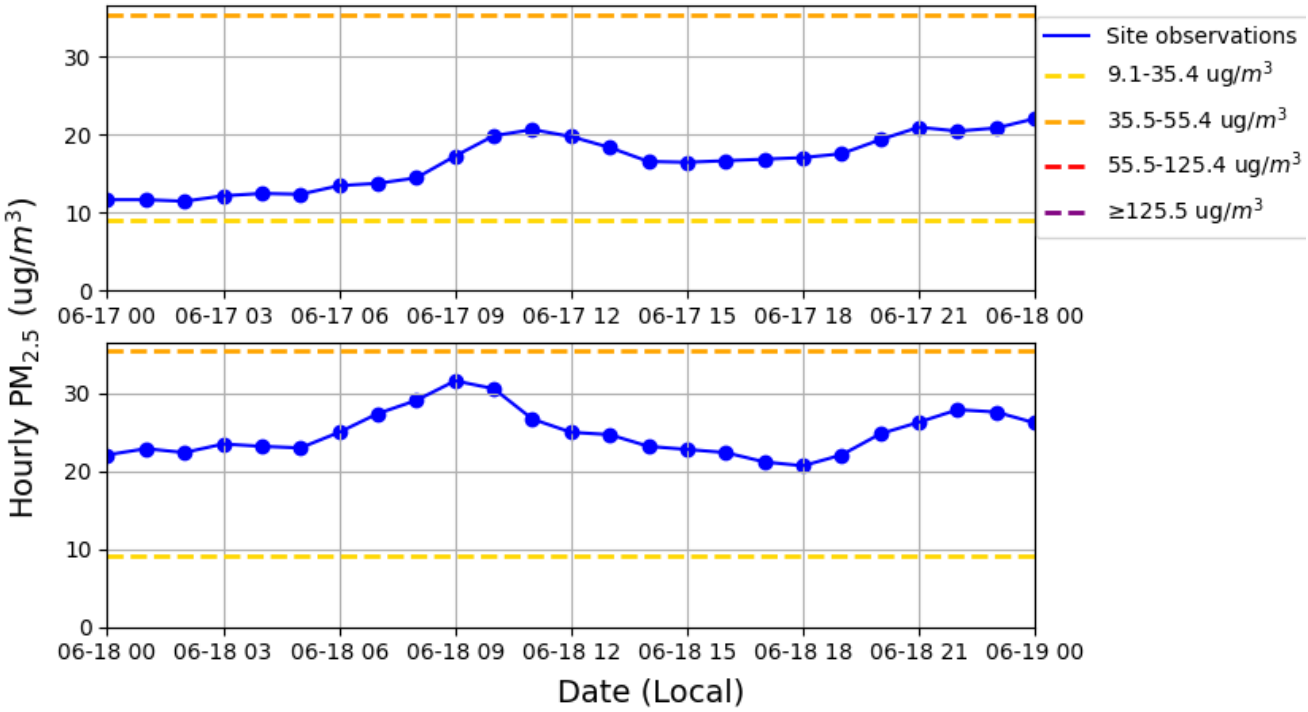

Figure E3. Hourly $PM_{2.5}$ concentrations at the Augusta monitoring site on June 17 and 18, 2023. The solid lines with dots show observations. The dashed lines show AQI breakpoints.

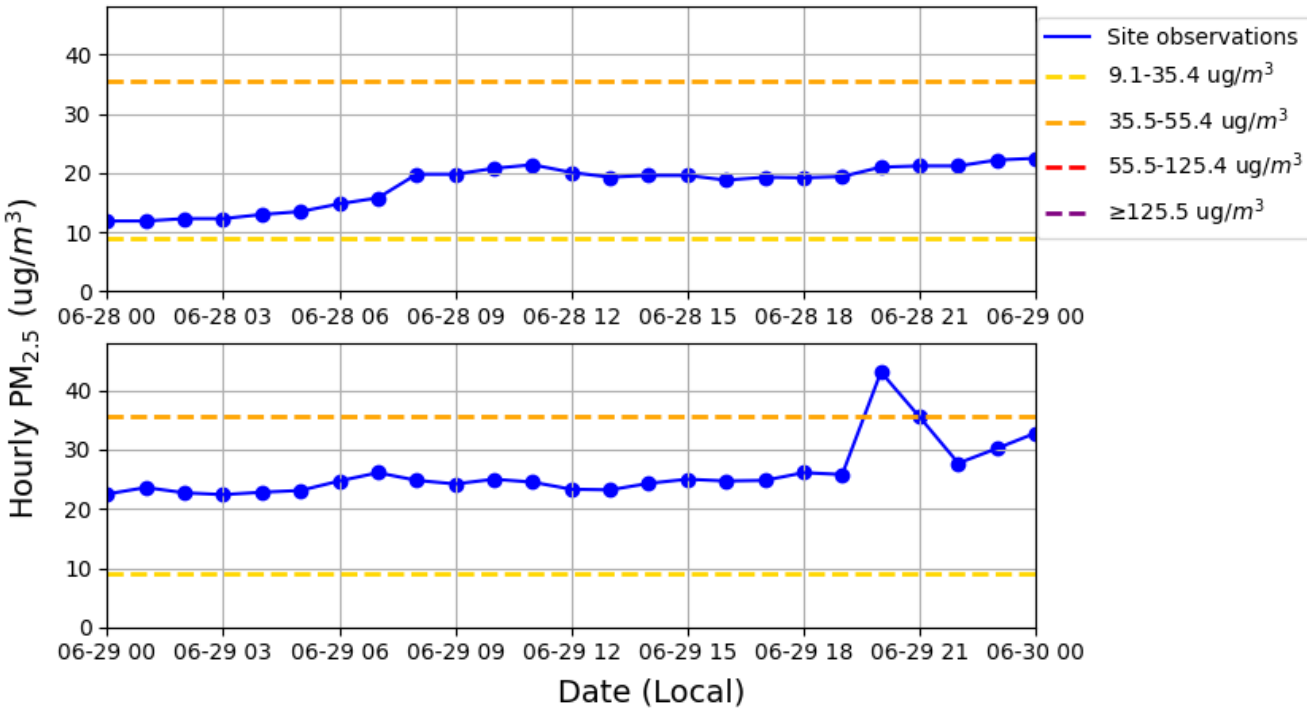

Figure E4. Hourly $PM_{2.5}$ concentrations at the Augusta monitoring site on June 28 and 29, 2023. The solid lines with dots show observations. The dashed lines show AQI breakpoints.

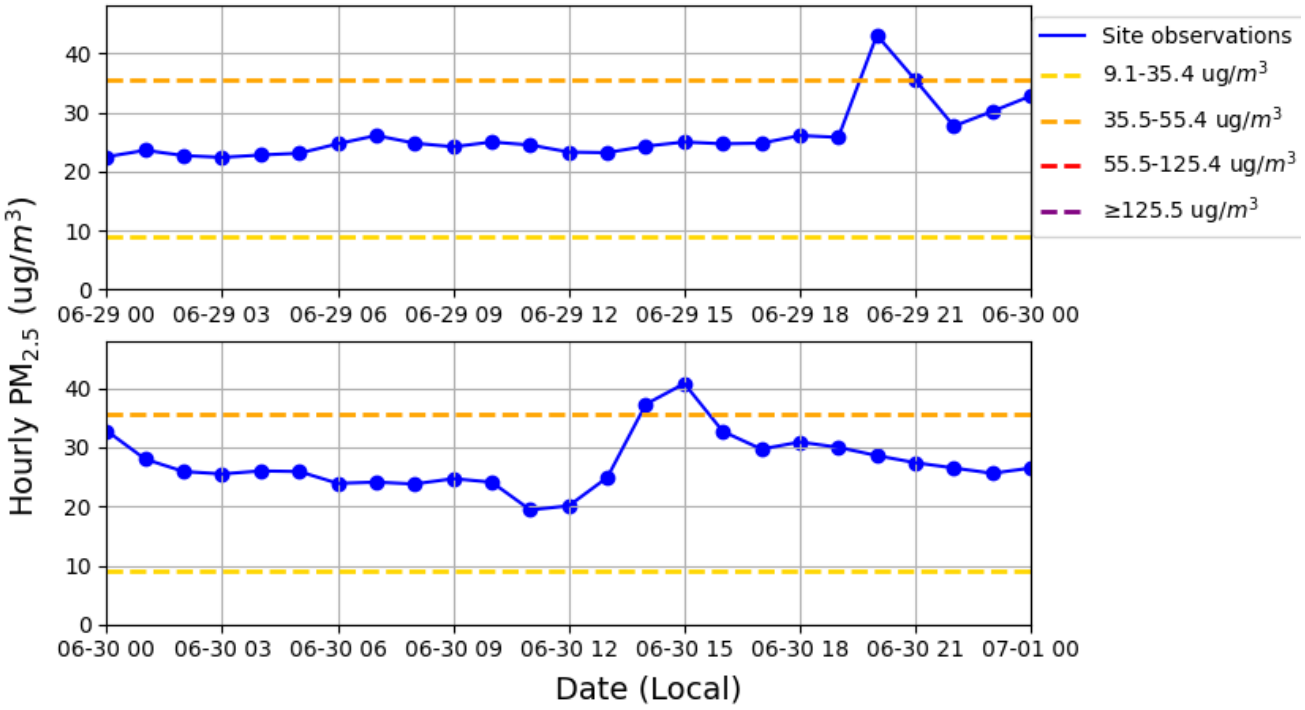

Figure E5. Hourly $PM_{2.5}$ concentrations at the Augusta site on June 29 and 30, 2023. The solid lines with dots show observations. The dashed lines show AQI breakpoints.

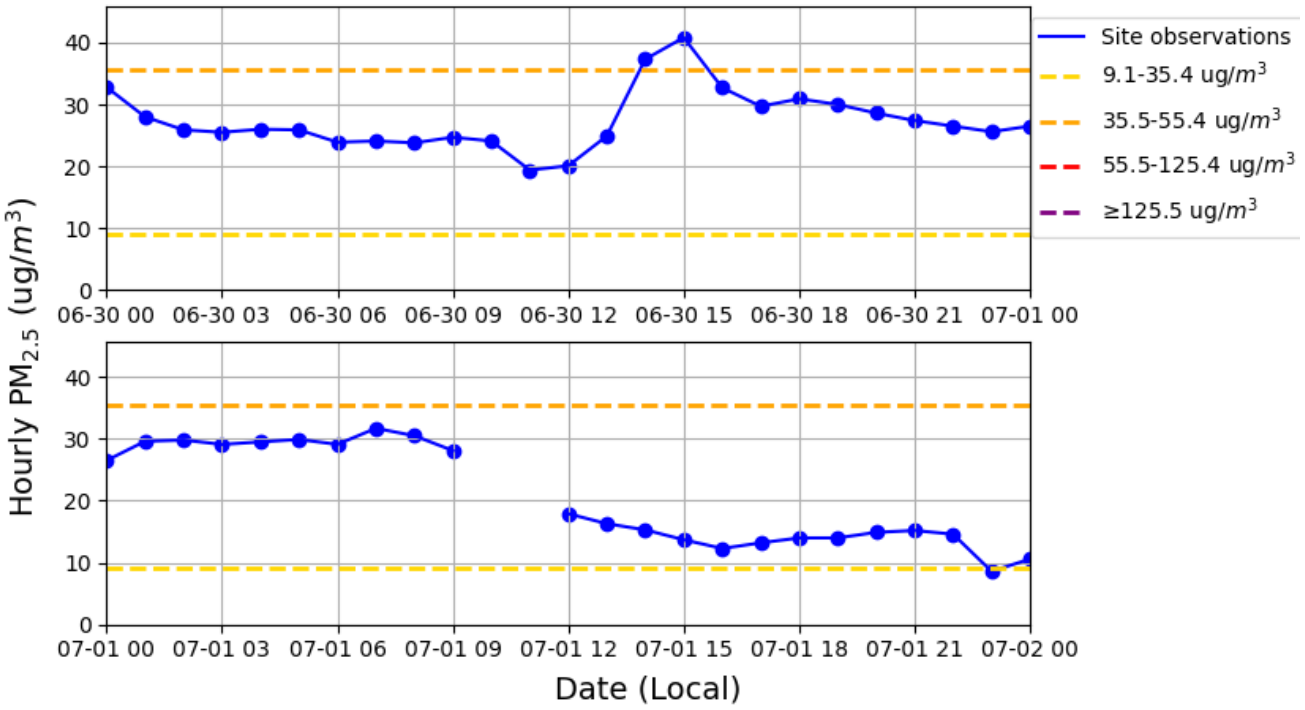

Figure E6. Hourly $PM_{2.5}$ concentrations at the Augusta site on June 30 and July 1, 2023. The solid lines with dots show observations. The dashed lines show AQI breakpoints.

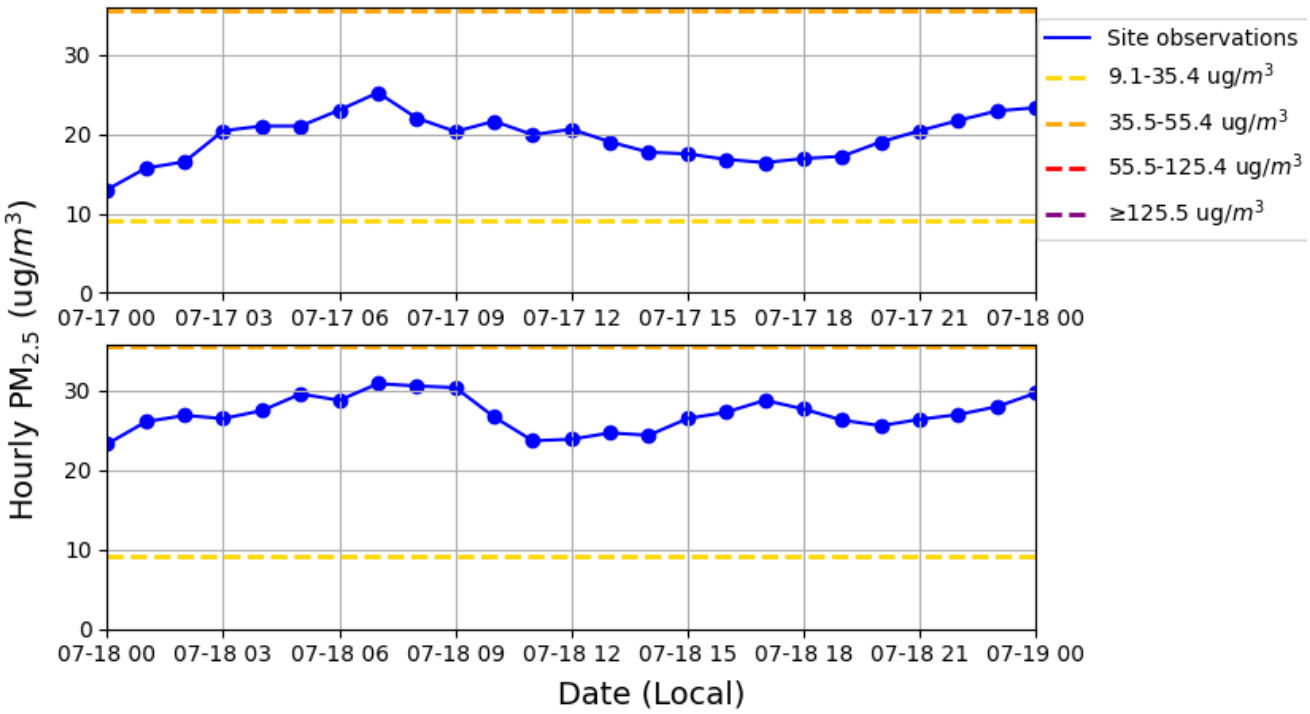

Figure E7. Hourly $PM_{2.5}$ concentrations at the Augusta site on July 17 and 18, 2023. The solid lines with dots show observations. The dashed lines show AQI breakpoints.

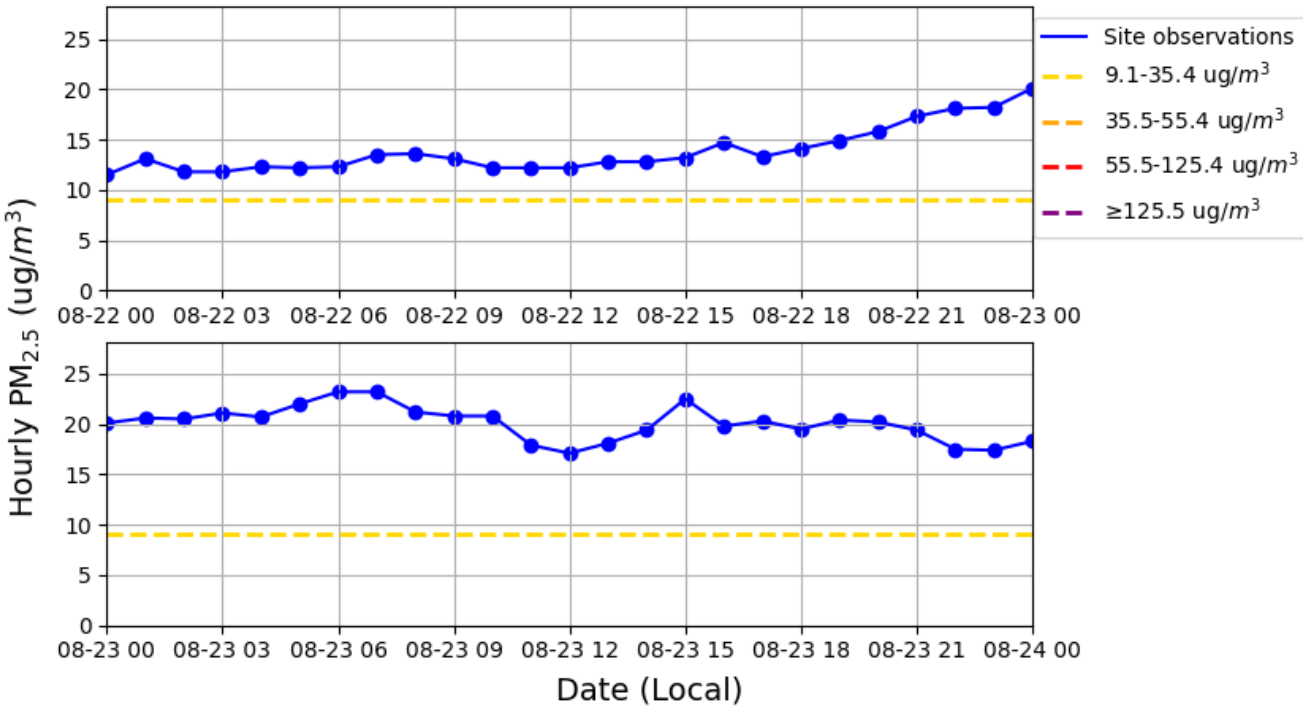

Figure E8. Hourly $PM_{2.5}$ concentrations at the Augusta site on August 22 and 23, 2023. The solid lines with dots show observations. The dashed lines show AQI breakpoints.

Appendix G: Public Comments

Appendix H: Responses to Public Comments