



GEORGIA

DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

Canadian Wildfire Exceptional Event Demonstration for Exceedances of the 2024 Annual PM_{2.5} NAAQS at Rossville, 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 µg/m³ and 35 µg/m³, 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 µg/m³.

From 2019 through June 2020, PM_{2.5} data was collected at the Rossville-Maple St. site (13-295-0002) with both an FRM and an FEM monitor. The FRM monitor collected data on a one in three-day schedule. This location was shut down at the end of June 2020, and then a new site was established in May 2021 at the Rossville-Williams St. location (13-295-0004). The data from these two locations in Rossville (Maple St. and Williams St.) is linked in AQS for attainment purposes. At the Rossville-Williams St. location, one FRM monitor began collecting data in May 2021 on a one in three-day sampling schedule. In addition, starting in April 2021, an FEM monitor began collecting data. These two monitors continued collecting data through 2023. A NAAQS exclusion was requested of U.S. Environmental Protection Agency (EPA) for the FEM monitor starting April 2021. The Chattanooga, TN-GA MSA is in attainment of the 2012 PM_{2.5} NAAQS.

This exceptional event demonstration shows that the air monitoring site located in Rossville (Walker County) in the state of Georgia (AQS ID: 13-295-0004) reported exceedances of the 2024 annual PM_{2.5} NAAQS due to Canadian wildfires on four different days in 2023 that qualify for exceptional event demonstrations (Table 1). These exceedances resulted from the transport of smoke that originated from wildfires burning in Canada; therefore, qualifying for removal under the Exceptional Events Rule (EER). Design values (DVs) of the Rossville-Williams St. monitor with and without EPA concurrence are shown in Table 2. DVs are calculated using 24-hour PM_{2.5} FRM measurements from 2022-2023. The FEM data was excluded due to a requested NAAQS exclusion by Georgia Environmental Protection Division (EPD). Also, the 2021 PM_{2.5} measurements were not included in the design value calculation since the first quarter was missing. 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 9.4 µg/m³, which is above the new 2024 PM_{2.5} annual NAAQS; however, exclusion reduces the DV to 9.0 µg/m³.

On December 20, 2024, Georgia EPD submitted an Initial Notification for these events to the EPA. The request indicated that the 4 events identified in Table 1 were impacted by smoke from wildfires and requested review of the events under the case-by-case provision at 40 CFR 50.14(a)(1)(i)(F). 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 Rossville, GA at the Rossville-William St. site in 2023 that qualify for removal under the Exceptional Events Rule.

#	Date	24-hour concentration (µg/m ³)	Cause of exceedance	Tier
1	06/08/23	20.5	Canadian wildfire	2
2	06/17/23	21.7	Canadian wildfire	2
3	06/29/23	37.0	Canadian wildfire	1
4	07/17/23	43.3	Canadian wildfire	1

Table 2. Design values (DV) for monitor at the Rossville-William St. site for the 2024 annual PM_{2.5} NAAQS.

Monitor Site (AQS ID)	2022-2023 DV without EPA Concurrence (µg/m ³)	2022-2023 DV with EPA Concurrence (µg/m ³)
Rossville-Williams St (13-295-0004)	9.4	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 at the Rossville-William St. site. 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 ($\geq 156,000$ km²)². The land area burned during this season far exceeded the average³ of 21,000 km², 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 Map⁴.

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>

For each of the listed days (Figures A1-A4), 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 either from fires in Quebec or fires in the western provinces (British Columbia, Alberta, and Saskatchewan), and transported across the Midwest of the United States.

This conceptual model describes how emissions from wildfires and environmental conditions contributed to the events dated in Table 1. Smoke emissions enhanced PM_{2.5} concentrations observed by the monitor as they were transported to the Rossville-Williams St. site and caused an exceedance of the annual PM_{2.5} NAAQS. Georgia EPD requests EPA's concurrence on 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 website⁵ 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 website⁶ 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 Map⁷, EPA's AirNow When Smoke is in the Air⁸, EPA's AirNow Prepare for Fire Season⁹, and the EPA's Smoke-Ready Toolbox for Wildfires¹⁰. These websites identify several protective measures that individuals should take to reduce smoke exposure as needed, including limiting

⁵ <https://georgiafc.fireresponse.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>

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 website¹¹ provides near real-time ambient air concentrations of multiple criteria pollutants (O₃, PM_{2.5}, SO₂, NO₂, 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/RX2WTAWHTBGEVQGAMWFRLYCEJU/> (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)
- <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.atlantaneewsfirst.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-bdbcf924375> (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.atlantaneewsfirst.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)

¹¹ <https://airgeorgia.org/>

- <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 evidence that emissions from wildfires were transported to the monitor, evidence that wildfire emissions affected the monitor, and a comparison of the event-related concentration to historical concentrations.

Figures in Appendix B show smoke from the NOAA Hazard Mapping System (HMS), plotted via the AirNow Navigator¹². 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 (Figures B1-B4).

The historical data analysis section of this demonstration focuses on 2019-2023 PM_{2.5} FRM data at the Rossville-William St. 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 twice the 5-year annual average, quarterly average, and monthly average, and in some cases can be up to five times higher.

¹² <https://airnowtech.org/navigator/>

Table 3. Comparison of exceptional event concentrations to historic 2019-2023 concentrations at the Rossville-William St. site monitor (AQS ID: 13-295-0004).

EE Date	EE Concentration ($\mu\text{g}/\text{m}^3$)	5-Year Annual Average ($\mu\text{g}/\text{m}^3$)	5-Year Quarterly Average ($\mu\text{g}/\text{m}^3$)	5-Year Monthly Average ($\mu\text{g}/\text{m}^3$)	Ratio EE to 5-Year Annual Average	Ratio EE to 5-Year Quarterly Average	Ratio EE to 5-Year Monthly Average
06/08/23	20.5	8.5	8.78	9.20	2.4	2.3	2.2
06/17/23	21.7	8.5	8.78	9.20	2.5	2.5	2.4
06/29/23	37.0	8.5	8.78	8.78	4.3	4.2	4.0
07/17/23	43.3	8.5	9.44	10.14	5.1	4.6	4.3

Figure 1 plots the 24-hour $\text{PM}_{2.5}$ concentrations for 2019-2023. Concentrations are generally below the Tier 2 value of $14.9 \mu\text{g}/\text{m}^3$, except when smoke from wildfires is present. Two of the selected exceptional events days in Table 3 are above the Tier 1 threshold of $22.35 \mu\text{g}/\text{m}^3$ (June 29 and July 17), making them 1.5 times greater than the highest 98th percentile of data over the last 5 years per the EPA's Tiering Tool. June 8 and June 17 fall into the Tier 2 category (greater than or equal to a threshold of the minimum annual 98th percentile for 24-hour $\text{PM}_{2.5}$ data over the previous 5-years, but less than 1.5 times this threshold).

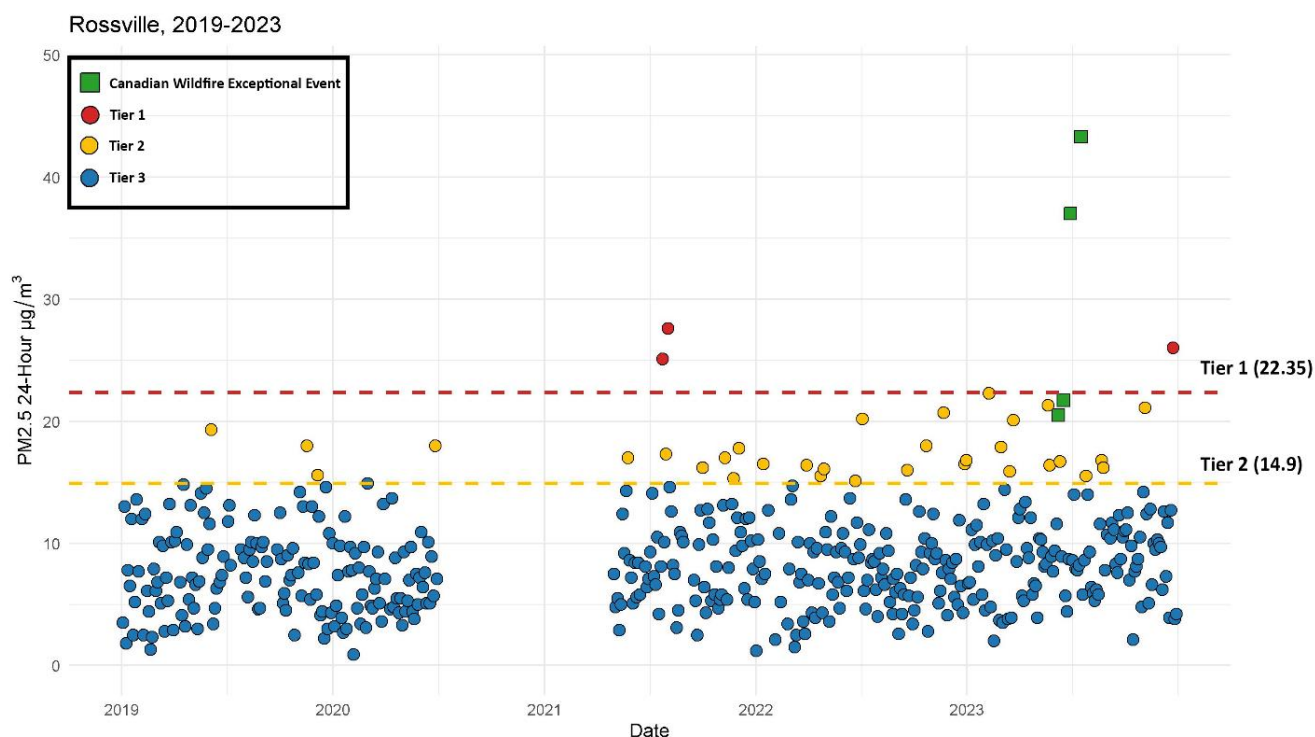


Figure 1. 24-hour $\text{PM}_{2.5}$ concentrations for 2019-2023 observed at the Rossville-William St. site.

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 $\text{PM}_{2.5}$ concentrations across the United States, and HYSPLIT back-trajectories. These trajectories originate at the Rossville-Williams St. 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. AQI tiers adjusted for the 2024 PM_{2.5} NAAQS are plotted as well to show the health impacts from these exceedances.

June 8, 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/m³ standard throughout the event day and the day prior. Shown in Figure C1, back-trajectories indicate that the smoke plume traveled through the Midwest of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in provinces of British Columbia, Alberta, Saskatchewan, Ontario, and Quebec. Daily PM_{2.5} concentrations increased to 20.5 µg/m³. 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 17, 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 µg/m³ standard around 10:00 PM ET on June 16 and remained elevated throughout the event day. Shown in Figure C2, back-trajectories indicate that the smoke plume traveled through the Midwest of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in provinces of British Columbia, Alberta, Saskatchewan, Ontario, 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 21.7 µg/m³. 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 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 E3, PM_{2.5} concentrations were elevated above the 9.0 µg/m³ standard throughout the event day and the day prior. Shown in Figure C3, back-trajectories indicate that the smoke plume traveled through the Midwest of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in provinces of British Columbia, Alberta, Saskatchewan, Ontario, and Quebec. The back-trajectories converge spatially approximately one day before descending to near-surface level where observed, daily PM_{2.5} concentrations increased to 37.0 µg/m³. 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).

July 17, 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 µg/m³ standard around 09:00 PM ET on July 16 and remained elevated throughout the event day. Shown in Figure C4, back-trajectories indicate that the smoke plume traveled through the Midwest of the United States. As a result, the plume detected by the monitor is a mixture of emissions from fires in provinces of British Columbia, Alberta, and Saskatchewan. The back-trajectories all follow similar paths, converging spatially approximately three days before descending to near-surface level where observed, daily PM_{2.5} concentrations increased to 43.3 µg/m³. 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).

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

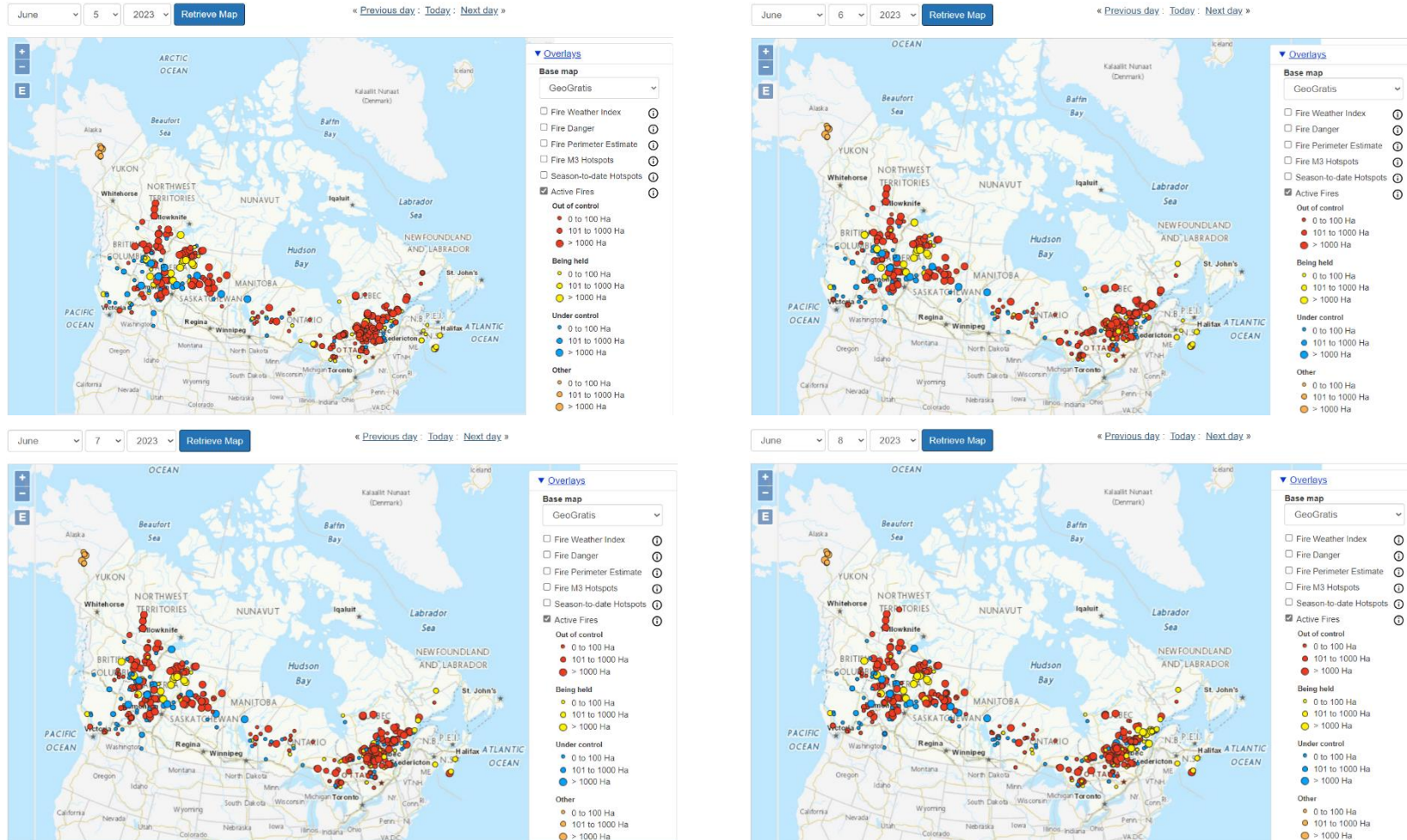


Figure A1. Active wildfires in Canada on June 5-8, 2023.

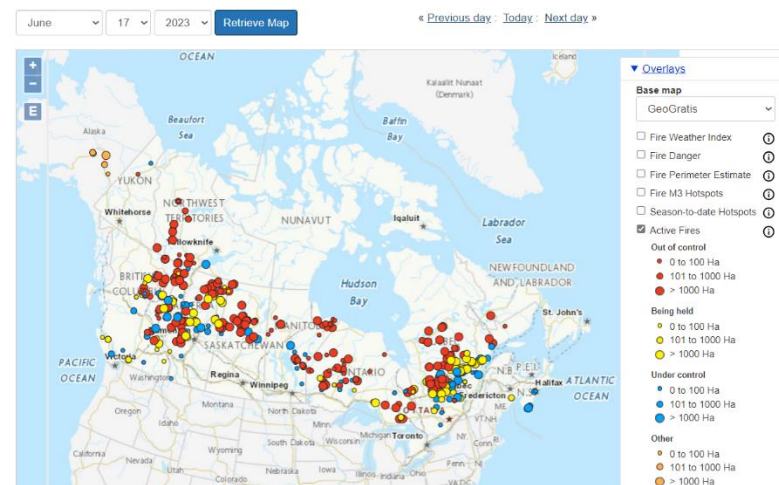
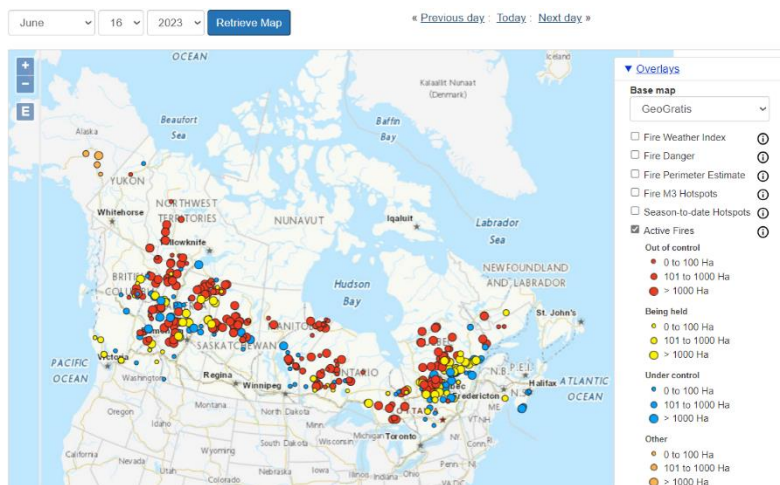
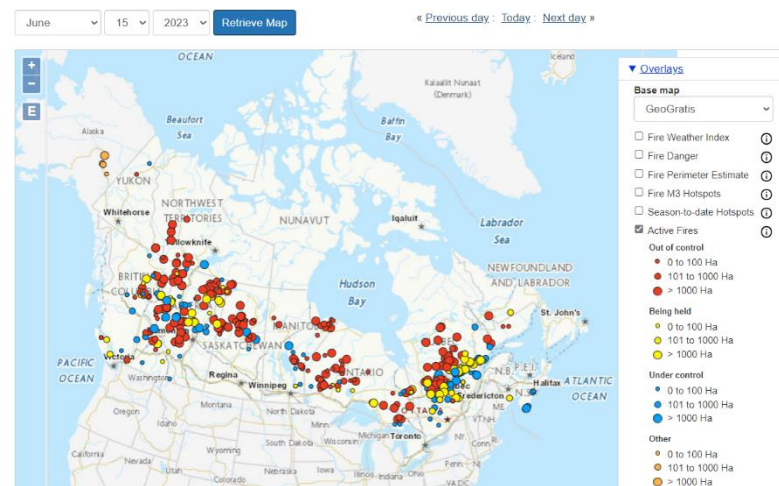
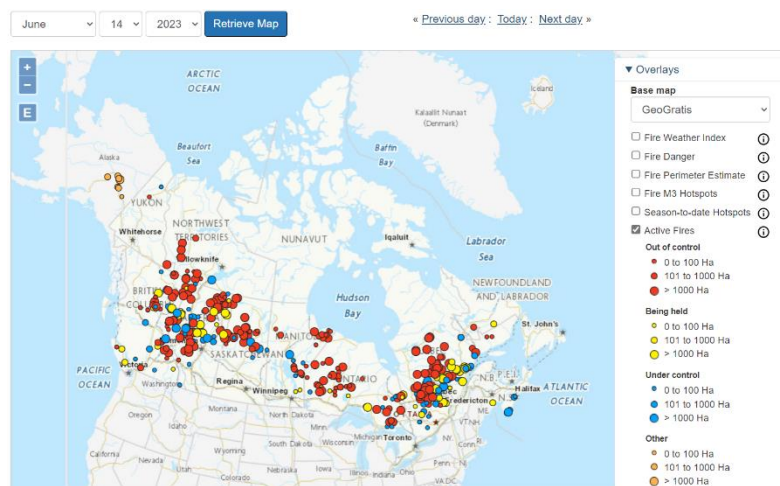


Figure A2. Active wildfires in Canada on June 14-17, 2023.

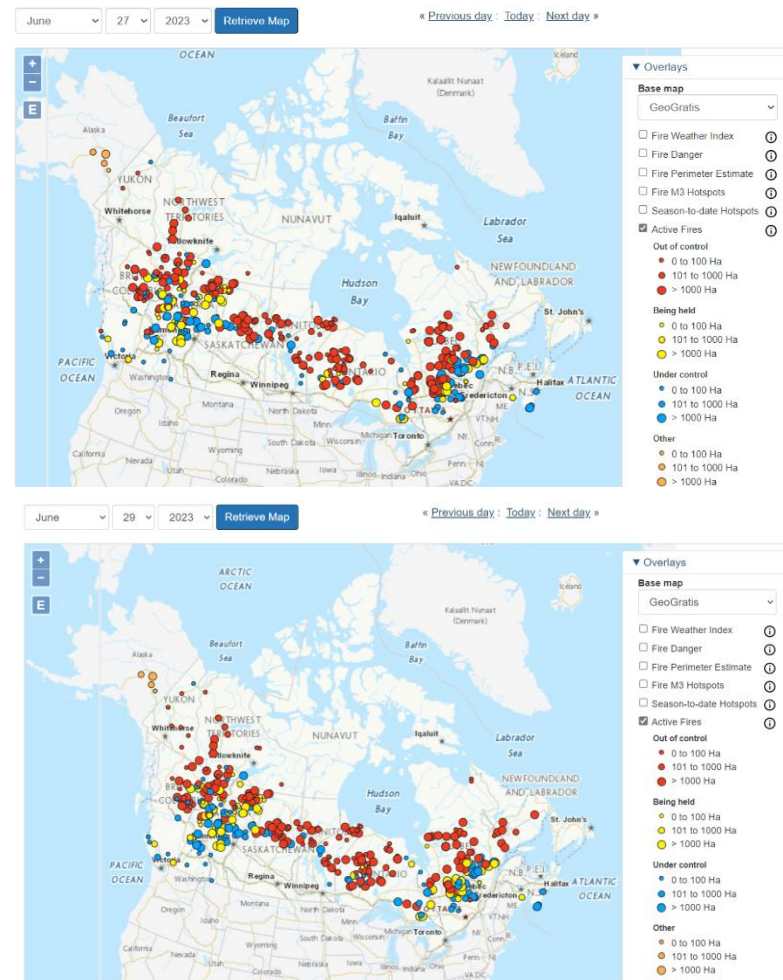
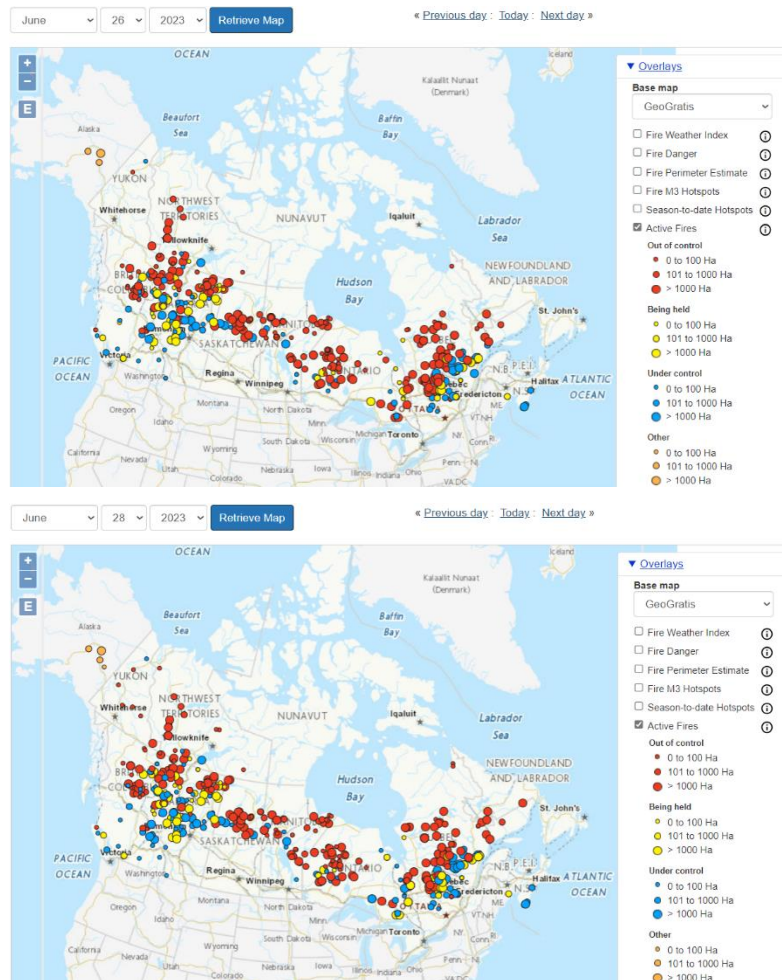


Figure A3. Active wildfires in Canada on June 26-29, 2023.

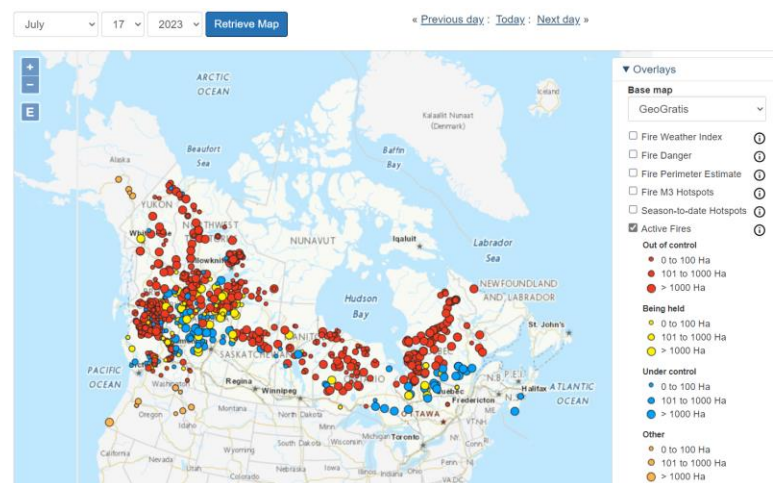
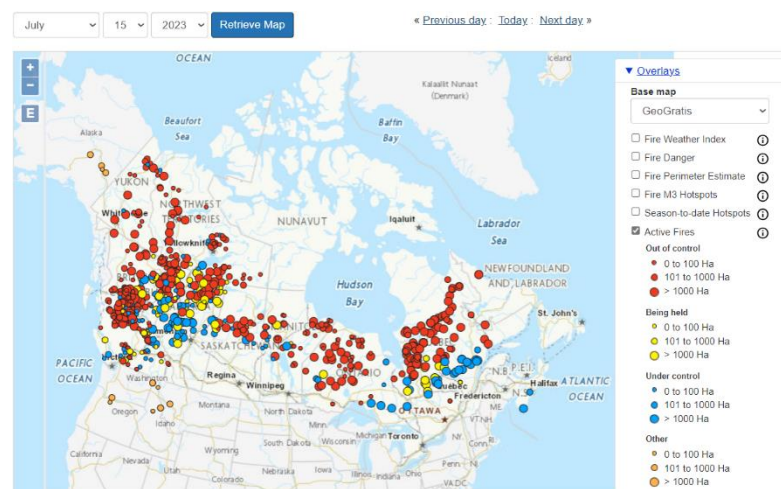
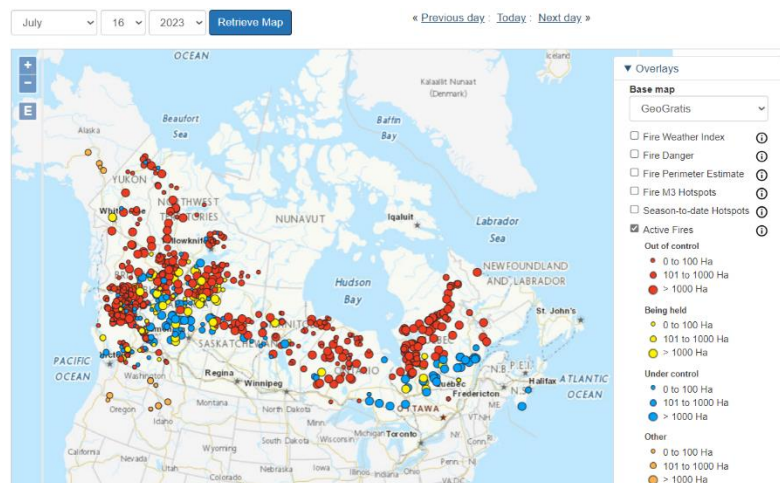
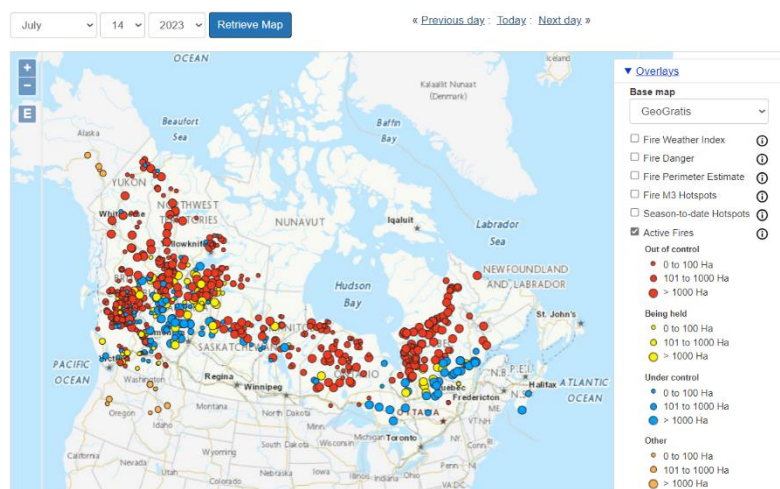


Figure A4. Active wildfires in Canada on July 14-17, 2023.

Appendix B: HMS Smoke and Active Fires

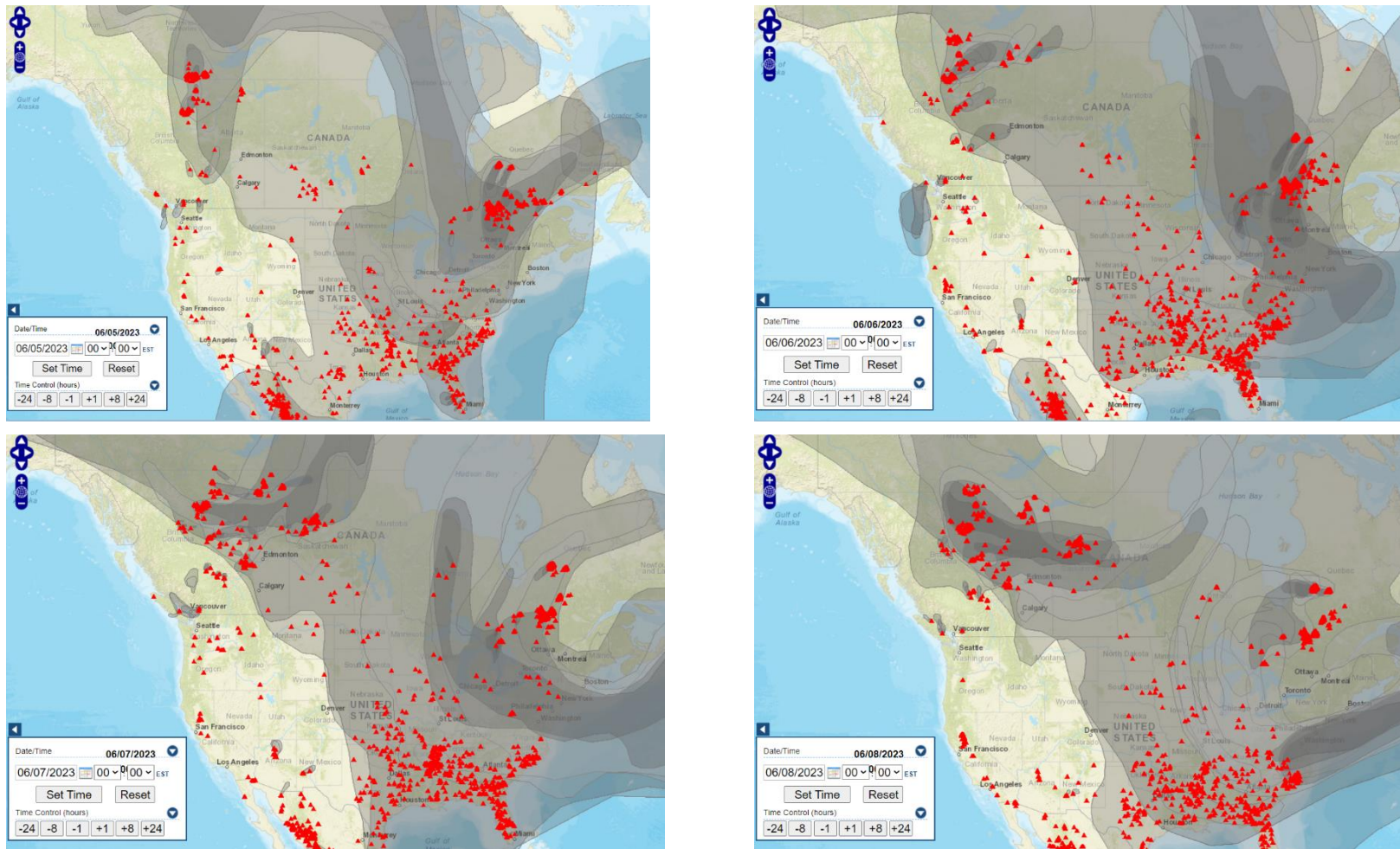


Figure B1. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 5-8, 2023, plotted using the NOAA HMS over North America.

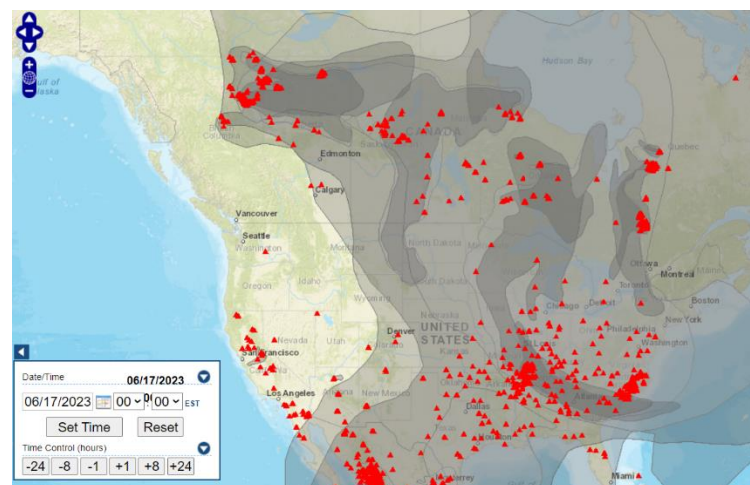
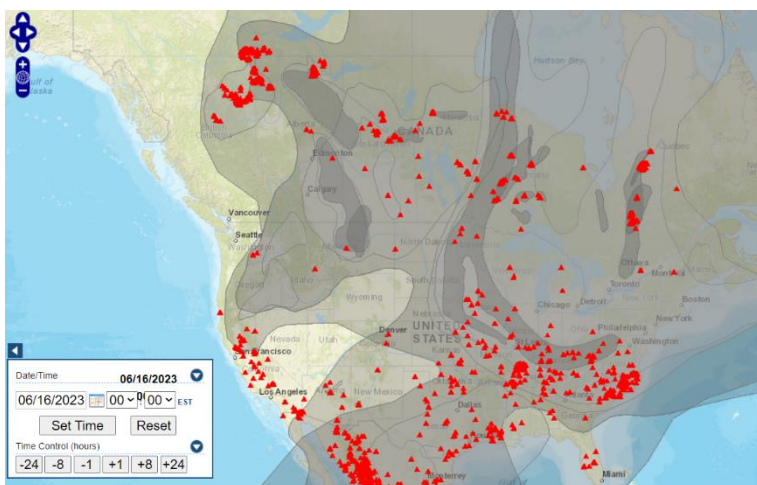
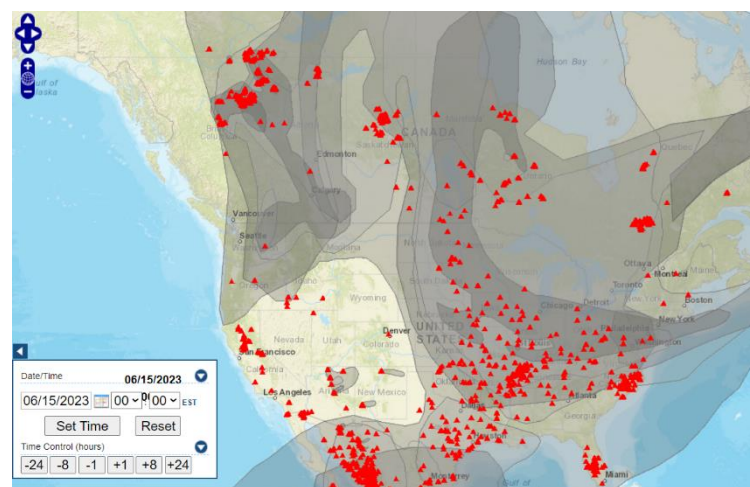
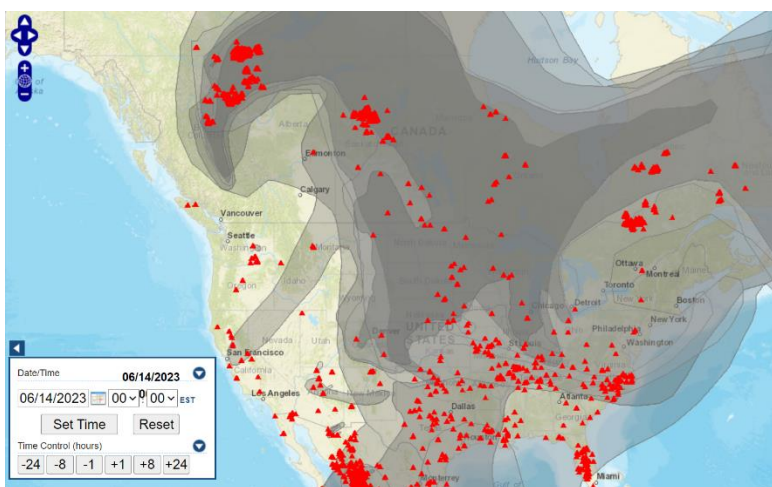


Figure B2. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 14-17, 2023, plotted using the NOAA HMS over North America.

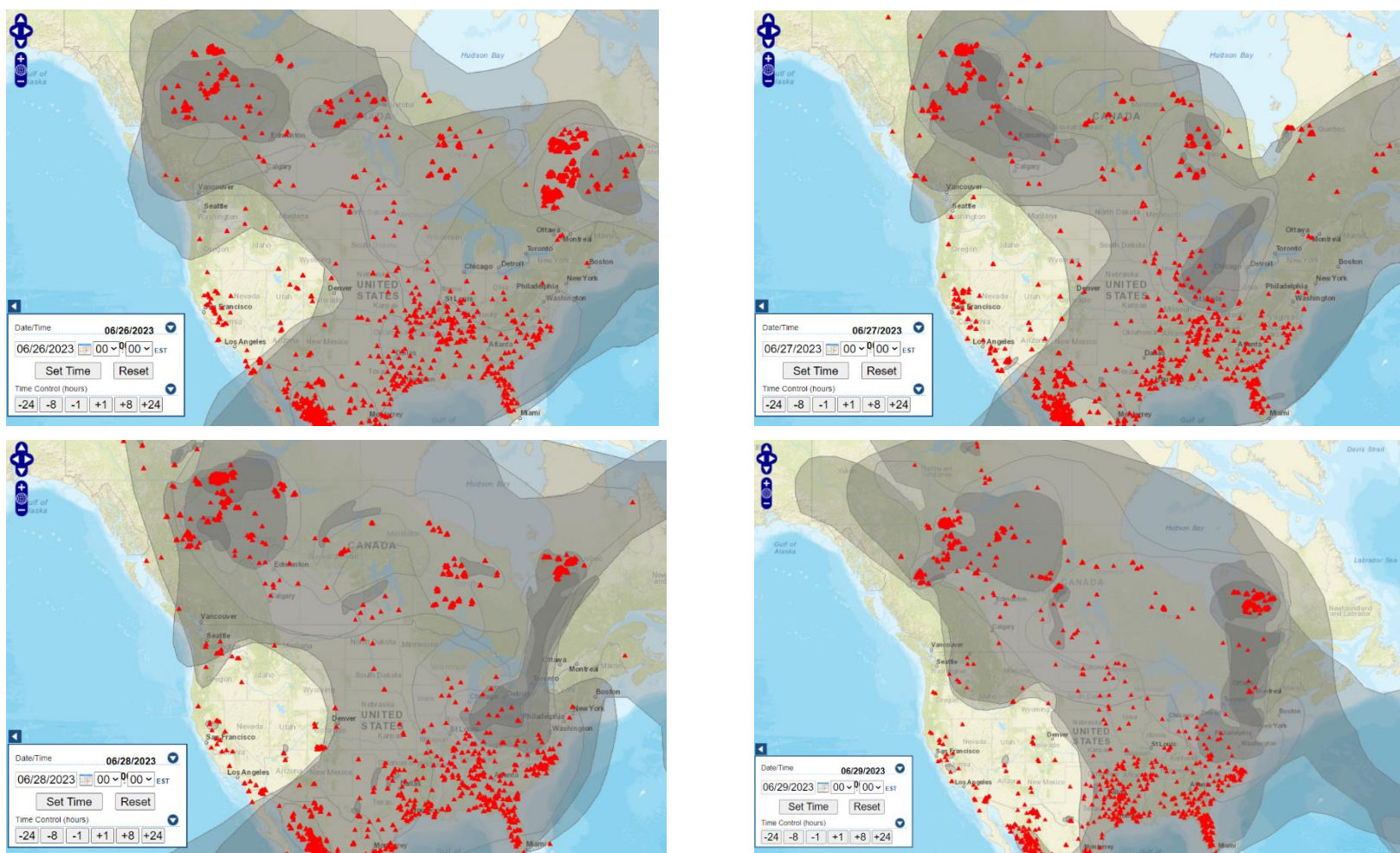


Figure B3. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on June 26-29, 2023, plotted using the NOAA HMS over North America.

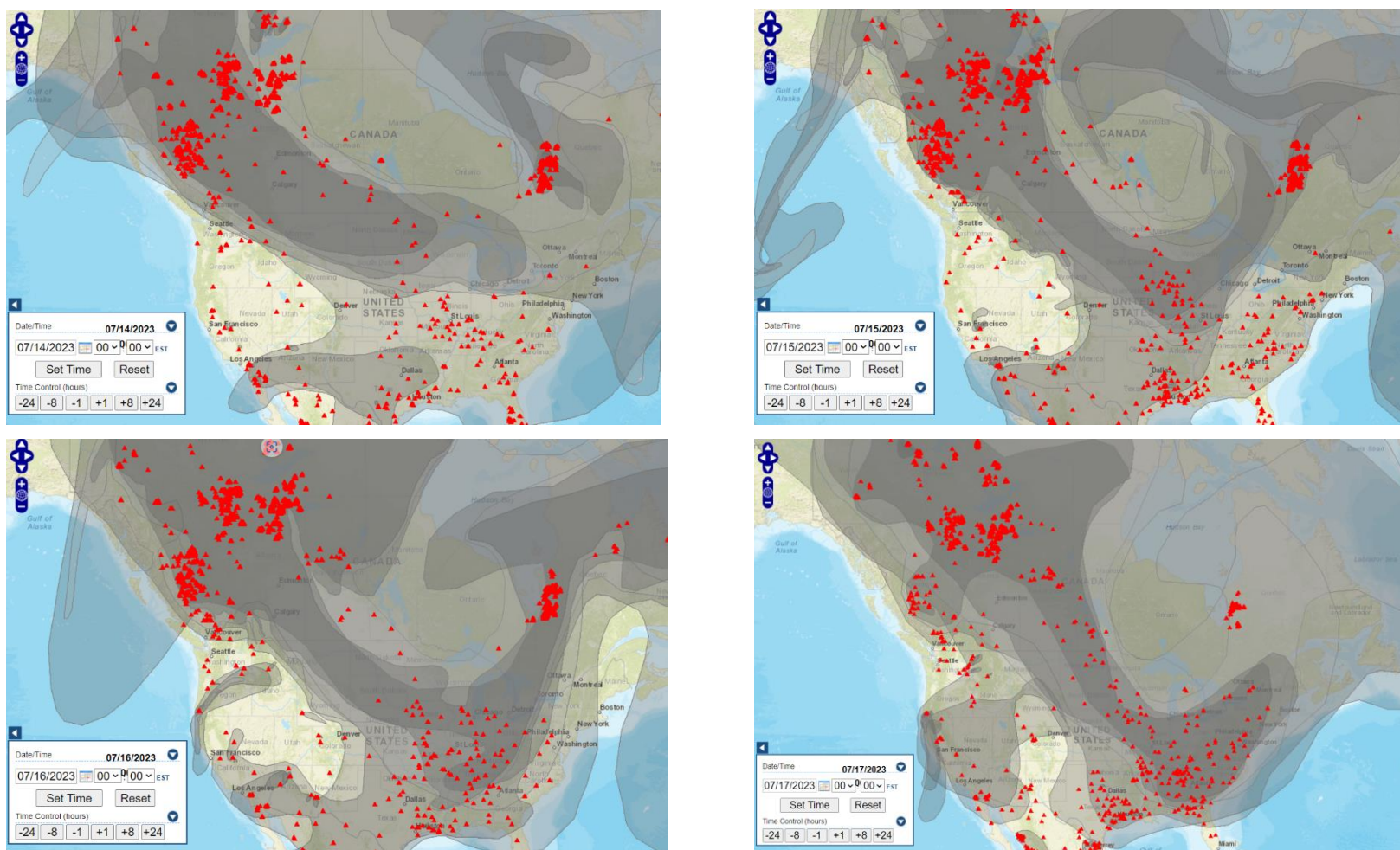


Figure 4. Map from the AirNow Navigator showing active fires (red) and smoke (grey) on July 14-17, 2023, plotted using the NOAA HMS over North America.

Appendix C: HYSPLIT Back-Trajectory Maps

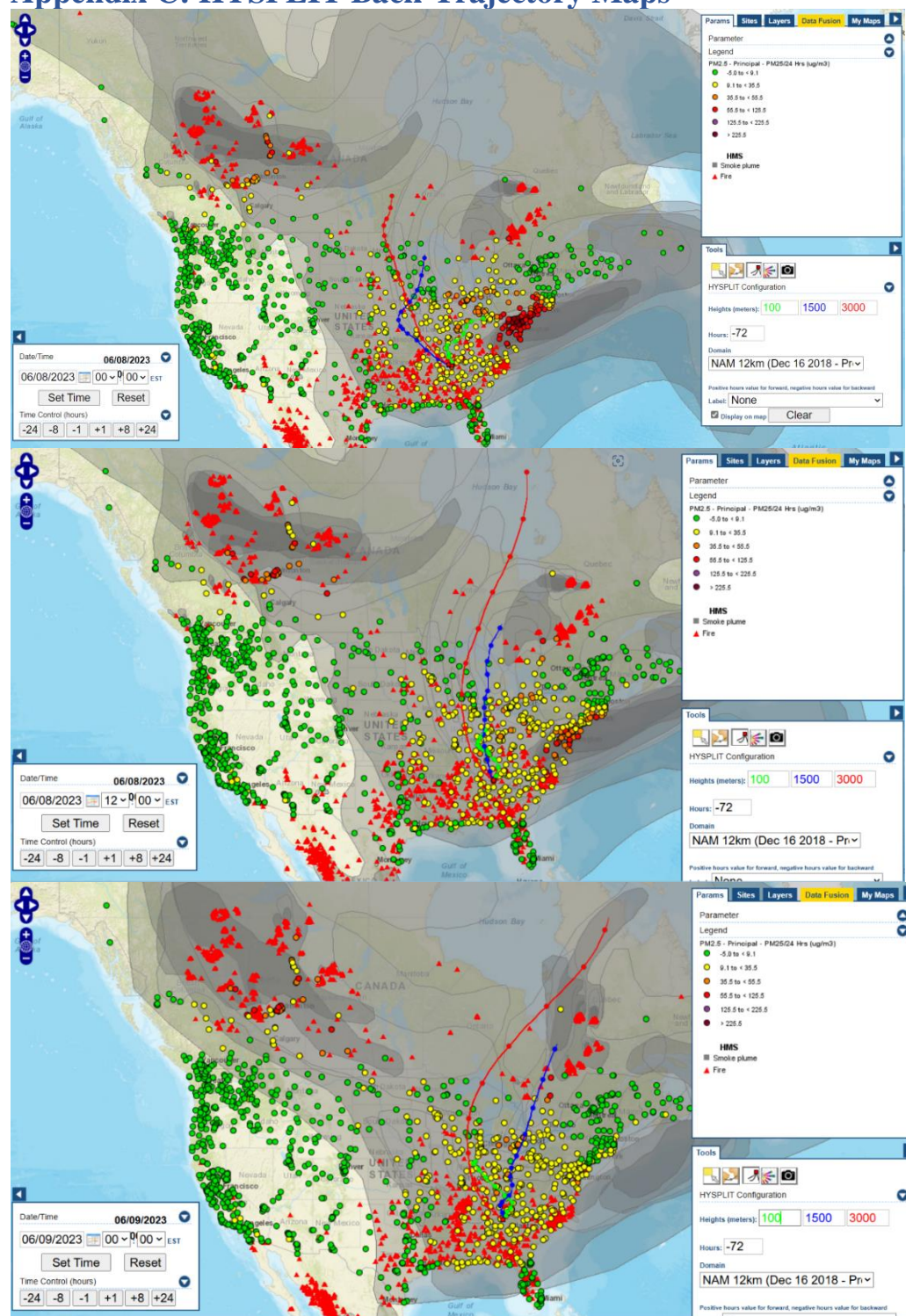


Figure C1. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $\text{PM}_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on June 9, 2023 (top), 12 PM EST on June 9,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

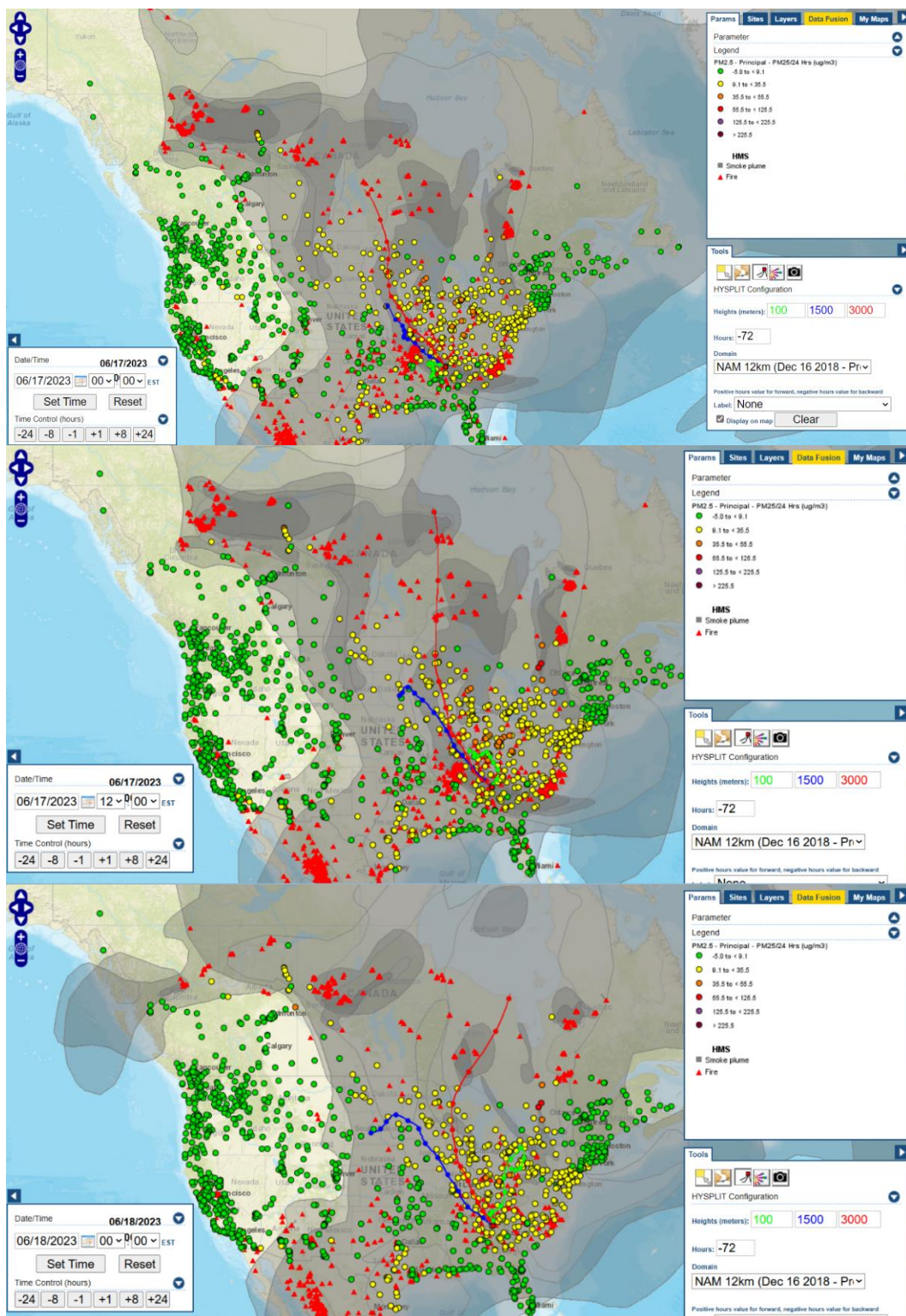


Figure C2. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily PM_{2.5} concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on June 17, 2023 (top), 12 PM EST on June 17, 2023 (middle), and 0 AM EST on June 18, 2023 (bottom).

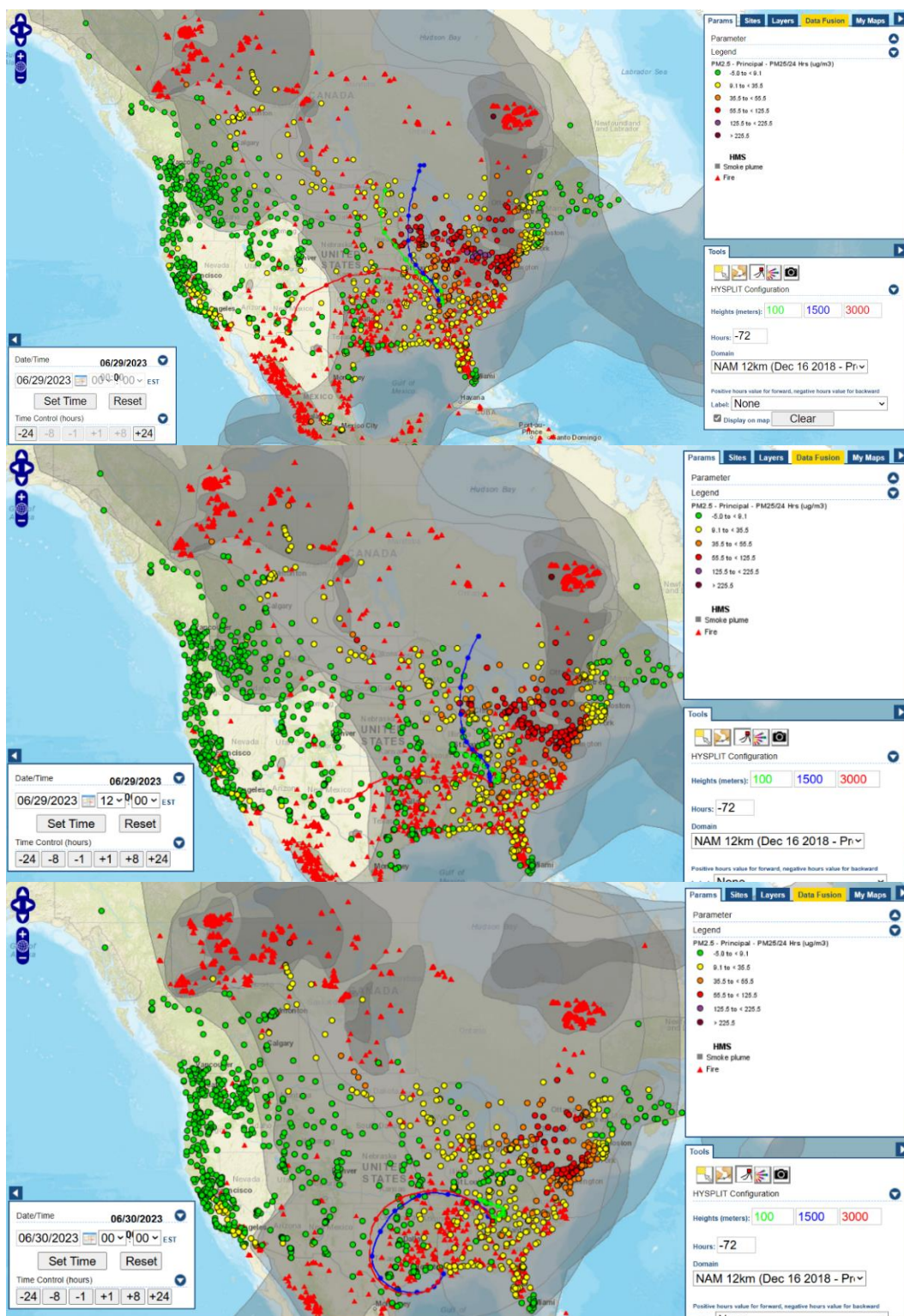


Figure C3. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily $PM_{2.5}$ concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on June 29, 2023 (top), 12 PM EST on June 29, 2023 (middle), and 0 AM EST on June 30, 2023 (bottom).

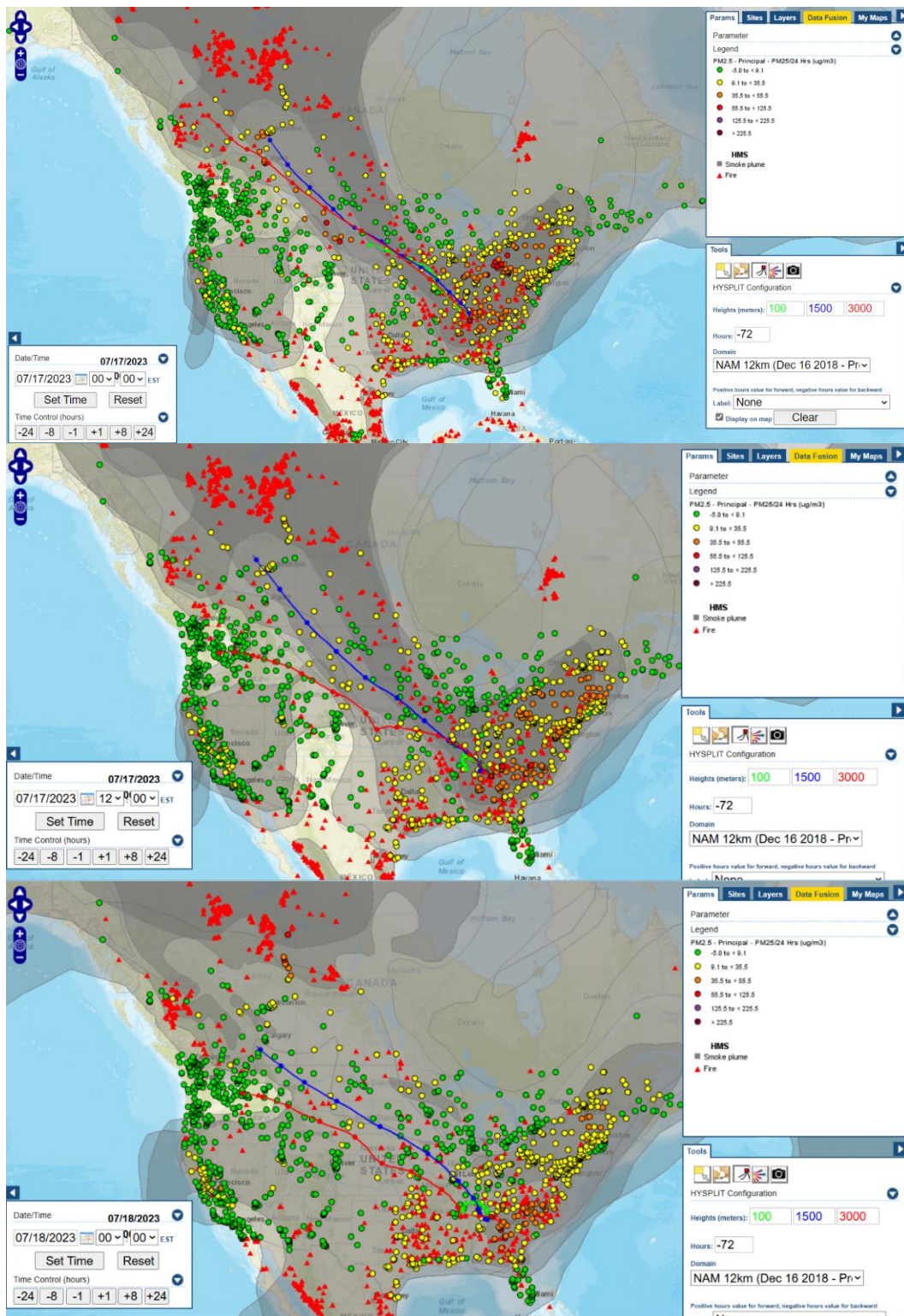
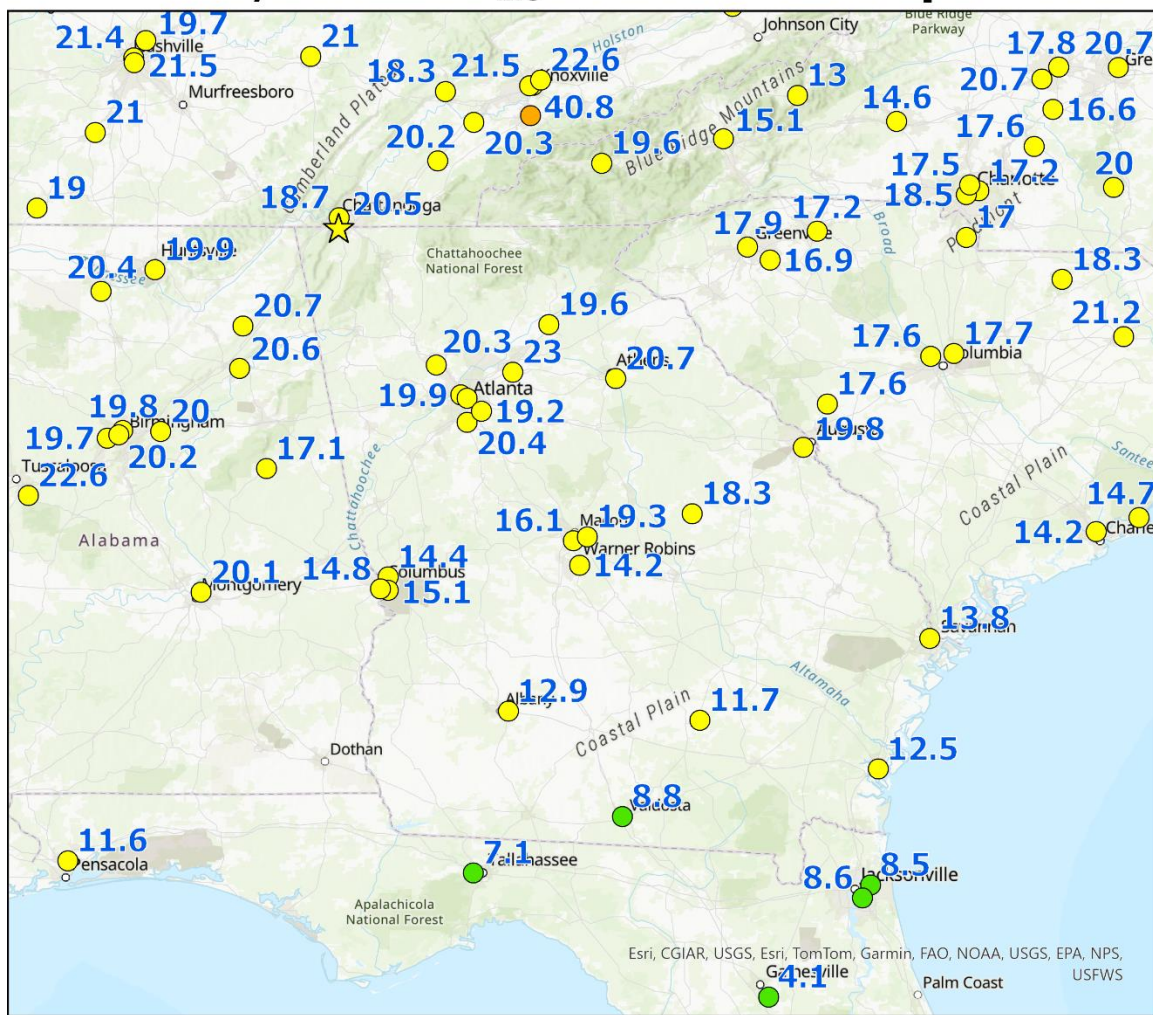


Figure C4. Map of HMS smoke plumes (grey polygons) and fires (red triangles), daily PM_{2.5} concentrations (circles), and HYSPLIT back-trajectories of release heights at 100 m (green lines), 1500 m (blue lines), and 3000 m (red lines) for 0 AM EST on July 17, 2023 (top), 12 PM EST on July 17, 2023 (middle), and 0 AM EST on July 18, 2023 (bottom).

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

June 8, 2023 PM_{2.5} Exceedance Report



AQI category - 24-hr average PM_{2.5}

- Good (0-9 $\mu\text{g}/\text{m}^3$)
- Moderate (9.1-35.4 $\mu\text{g}/\text{m}^3$)
- Unhealthy for sensitive (35.5-55.4 $\mu\text{g}/\text{m}^3$)
- Unhealthy (55.5-150.4 $\mu\text{g}/\text{m}^3$)
- Very unhealthy (150.4-250.4 $\mu\text{g}/\text{m}^3$)
- Hazardous (>250.4 $\mu\text{g}/\text{m}^3$)

Figure D1. Surface level, daily PM_{2.5} concentrations on June 8, 2023, across the southeast. The Rossville-William St. monitoring site is represented by a star. Numerous sites measured concentrations that exceeded the level of annual PM_{2.5} NAAQS.

[illegible]

- Good (0-9 $\mu\text{g}/\text{m}^3$)
- Moderate (9.1-35.4 $\mu\text{g}/\text{m}^3$)
- Unhealthy for sensitive (35.5-55.4 $\mu\text{g}/\text{m}^3$)
- Unhealthy (55.5-150.4 $\mu\text{g}/\text{m}^3$)
- Very unhealthy (150.4-250.4 $\mu\text{g}/\text{m}^3$)
- Hazardous (>250.4 $\mu\text{g}/\text{m}^3$)

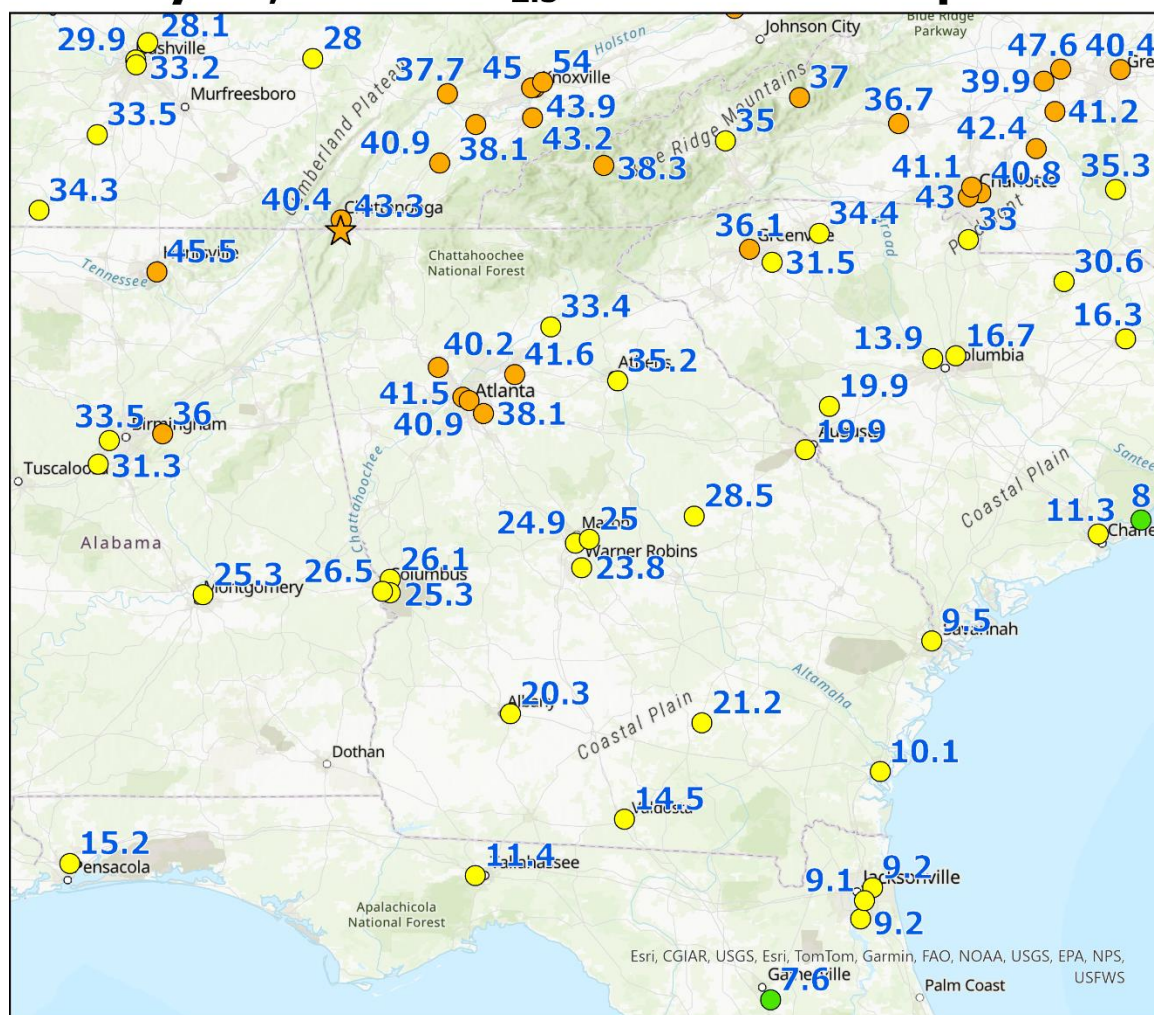
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The map displays the distribution of 100 yellow pine trees across the Southeastern United States. The trees are represented by yellow circles, each labeled with a numerical value. The highest value is 52.3, located near Johnson City, Tennessee, marked with a star. Other high values include 47.8 near Knoxville, Tennessee, and 45 near Chattanooga, Tennessee. The map includes major cities, rivers, and topographical features. The boundaries of several National Forests are shown: Cherokee, Chatahoochee, and Apalachicola. The map also shows the distribution of the trees across the states of Georgia, Alabama, and Tennessee.

- Good (0-9 $\mu\text{g}/\text{m}^3$)
- Moderate (9.1-35.4 $\mu\text{g}/\text{m}^3$)
- Unhealthy for sensitive (35.5-55.4 $\mu\text{g}/\text{m}^3$)
- Unhealthy (55.5-150.4 $\mu\text{g}/\text{m}^3$)
- Very unhealthy (150.4-250.4 $\mu\text{g}/\text{m}^3$)
- Hazardous (>250.4 $\mu\text{g}/\text{m}^3$)

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July 17, 2023 PM_{2.5} Exceedance Report



AQI category - 24-hr average PM_{2.5}

- Good (0-9 ug/m³)
- Moderate (9.1-35.4 ug/m³)
- Unhealthy for sensitive (35.5-55.4 ug/m³)
- Unhealthy (55.5-150.4 ug/m³)
- Very unhealthy (150.4-250.4 ug/m³)
- Hazardous (>250.4 ug/m³)

Figure D4. Surface level, daily PM_{2.5} concentrations on July 17, 2023, across the southeast. The Rossville-William St. 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

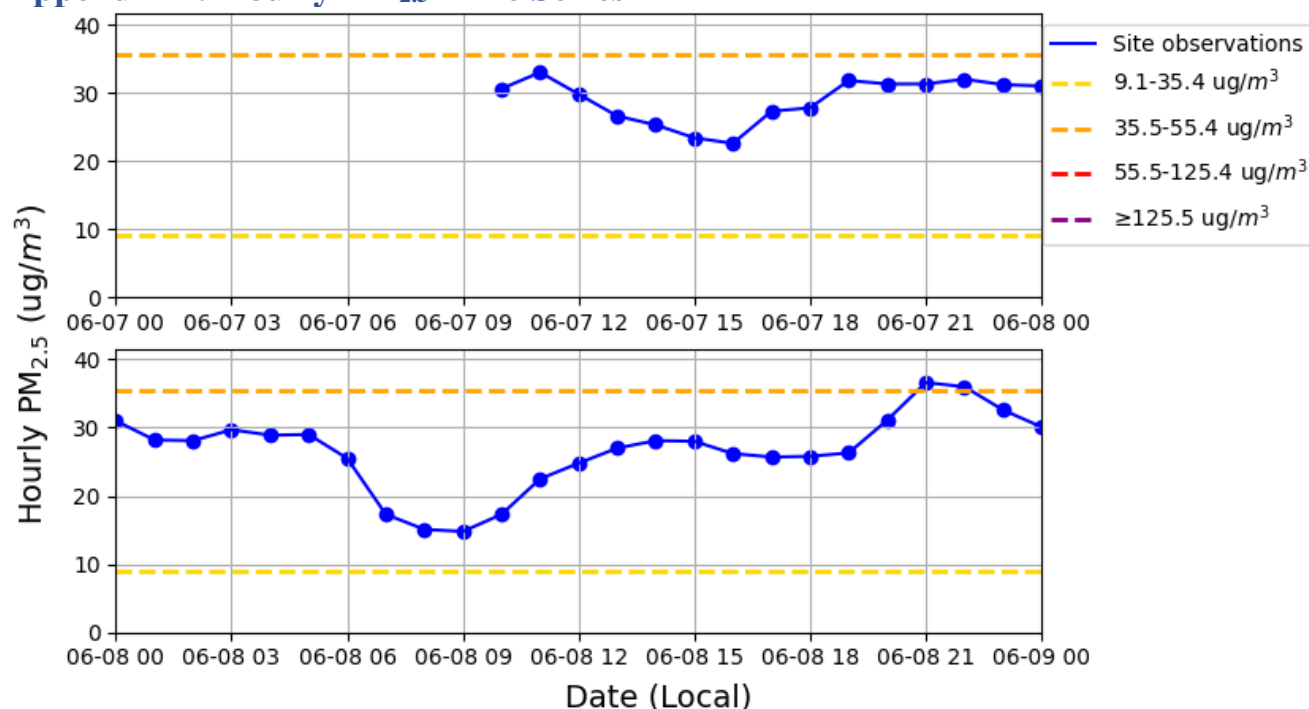


Figure E1. PM_{2.5} concentrations at the Rossville-Williams St. site on June 7 and 8, 2023. The solid blue lines with dots show observations. The dashed lines show AQI breakpoints.

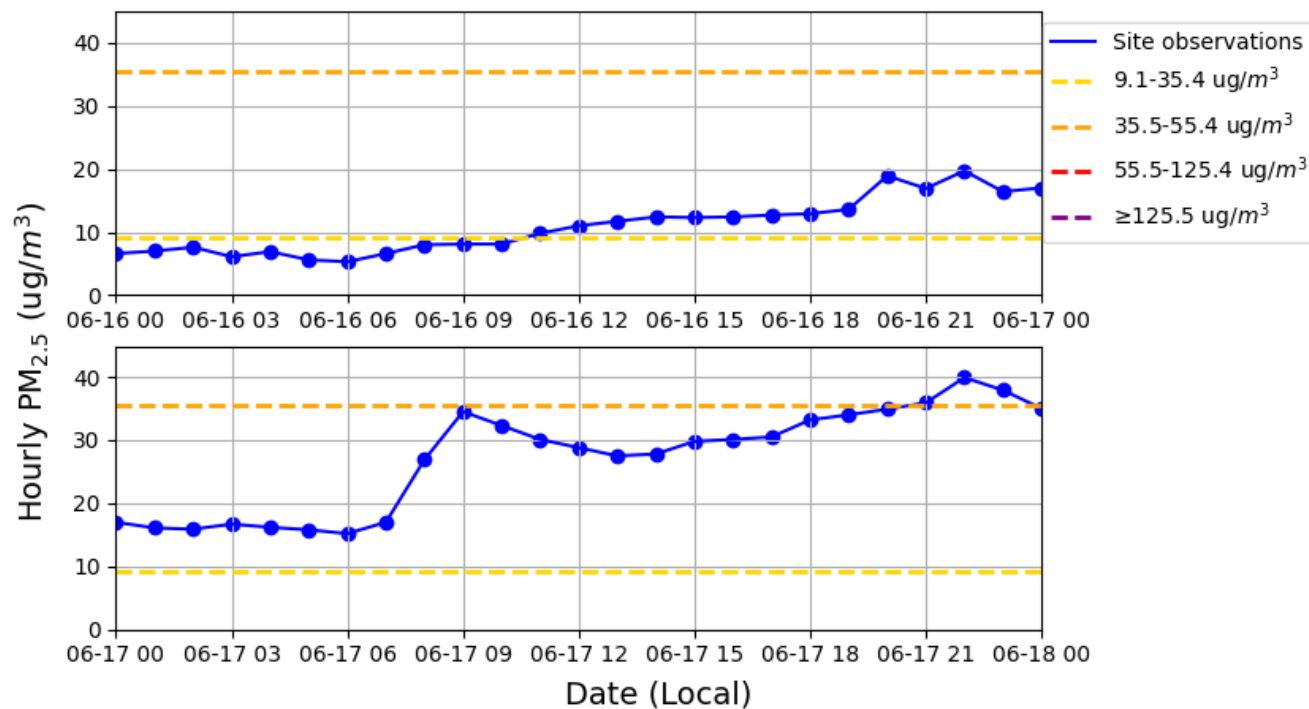


Figure E2. PM_{2.5} concentrations at the Rossville-Williams St. site on June 16 and 17, 2023. The solid blue lines with dots show observations. The dashed lines show AQI breakpoints.

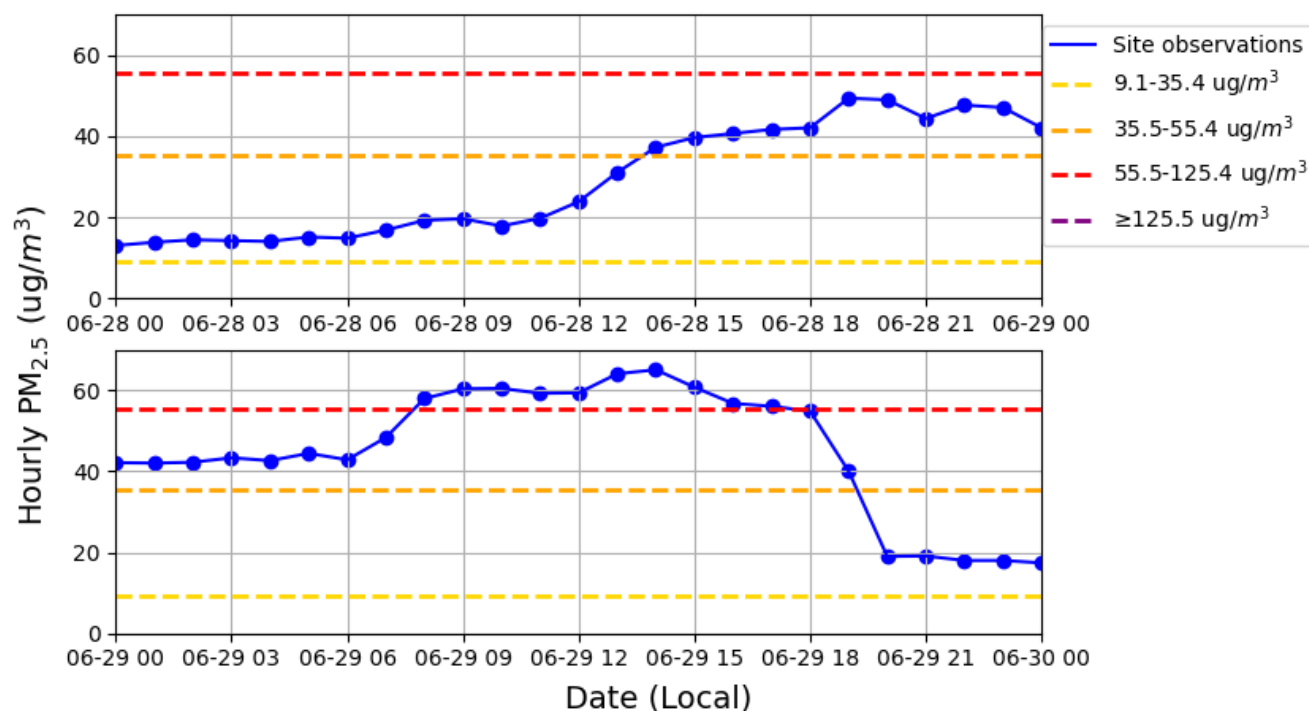


Figure E3. $PM_{2.5}$ concentrations at the Rossville-Williams St. site on June 28 and 29, 2023. The solid blue lines with dots show observations. The dashed lines show AQI breakpoints.

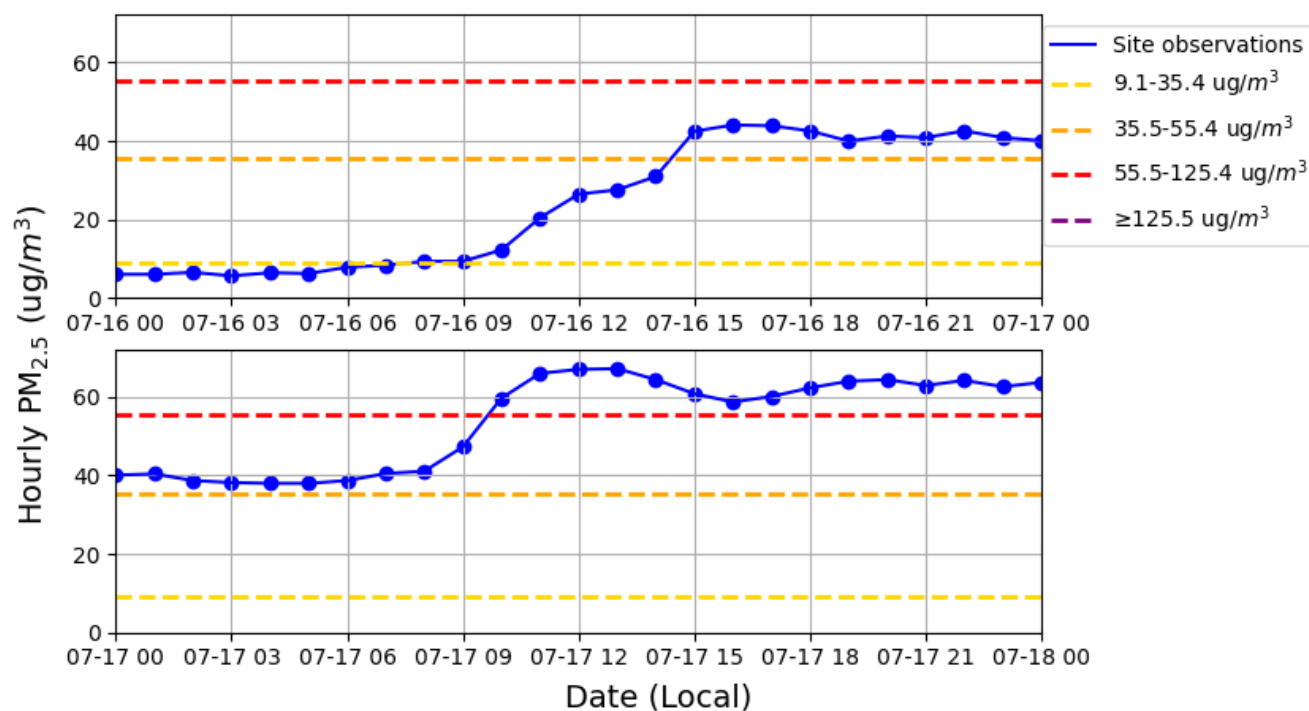


Figure E4. $PM_{2.5}$ concentrations at the Rossville-Williams St. site on July 16 and 17, 2023. The solid blue lines with dots show observations. The dashed lines show AQI breakpoints.

Appendix G: Public Comments

Appendix H: Responses to Public Comments