Environmental Protection Agency

Ohio's

Exceptional Events Demonstration for 2023 PM$_{2.5}$ Episodes in the Canton–Massillon, OH Metropolitan Statistical Area

Prepared by:

The Ohio Environmental Protection Agency

Division of Air Pollution Control

November 2024

1. Introduction

1.1. Overview

On February 7, 2024, the United States Environmental Protection Agency (U.S. EPA) promulgated a revised National Ambient Air Quality Standard (NAAQS) for fine particulate matter (PM$_{2.5}$), with an effective date of May 6, 2024 (89 FR 16202). The level of the new annual PM$_{2.5}$ NAAQS was set to 9.0 μg/m^3. In advance of the February 7, 2025 deadline for nonattainment area designation recommendations, U.S. EPA asked state and local air agencies to submit demonstrations to exclude days impacted by exceptional events from consideration in the designations process.

In the Canton–Massillon, OH Metropolitan Statistical Area (MSA), consisting of Stark County and Carroll County in Ohio, air quality was impacted from June to August 2023 by smoke entering the region from wildfires in Canada. Wildfires across Canada during this period produced smoke plumes that impacted surface air quality throughout the Great Lakes region. The smoke from these wildfires produced PM$_{2.5}$ pollution episodes across the region that had significant health and regulatory implications. One of the regulatory impacts of the wildfire smoke was the effect on air quality design values in the Great Lakes region.

Table 1 shows the seven days in 2023 affected by regulatorily significant wildfire smoke-driven PM$_{2.5}$ episodes that, if excluded from the three-year (2021-2023) PM$_{2.5}$ design value calculation, would result in a design value for the Canton Fire St8 (39-151-0017) monitoring site in the Canton–Massillon, OH MSA that does not violate the 2024 PM$_{2.5}$ NAAQS. All seven days are PM$_{2.5}$ Tier 1 category days according to the online U.S. EPA PM$_{2.5}$ Tiering Tool, and the daily mean PM$_{2.5}$ concentrations rank as the 1st, 2nd, 3rd, 4th, 5th, 7th, and 8th highest observed concentration days at this monitor in the 2019-2023 period. These seven days in 2023 were affected by five distinct regulatorily significant wildfire smoke-driven PM$_{2.5}$ episodes in the Canton–Massillon, OH MSA lasting from June 6-8, June 17, June 27-30, July 16-17, and August 2-3, respectively. Figure 1 was generated by the online U.S. EPA PM$_{2.5}$ Tiering Tool for the Canton Fire St8 monitoring site in Stark County within the Canton–Massillon, OH MSA. This figure identifies June 8, June 17, June 29, July 16, July 17, August 2, and August 3, 2023 as Tier 1 category days.

Table 1. Data requested for exclusion at the Canton Fire St8 (39-151-0017) monitoring site due to regulatorily significant wildfire smoke-driven PM$_{2.5}$ episodes.

Date of Event	U.S. EPA PM$_{2.5}$ Tier	24-Hour Average PM$_{2.5}$ Concentration (µg/m³)	5-Year Percentile	5-Year Rank
June 8, 2023	Tier 1	30.1	99.52	4
June 17, 2023	Tier 1	28.3	98.88	8
June 29, 2023	Tier 1	110.5	100.00	1
July 16, 2023	Tier 1	33.2	99.68	3
July 17, 2023	Tier 1	48.0	99.84	2
August 2, 2023	Tier 1	29.5	99.36	5
August 3, 2023	Tier 1	28.6	99.04	7

Figure 1. Time series plot of PM$_{2.5}$ daily combined site data for the Canton Fire St8 (39-151-0017) monitoring site in the Canton–Massillon, OH MSA from 2018-2024, with the data points requested for exclusion labeled. The tier thresholds (25.50 µg/m³ for Tier 1 in June/August and 25.35 µg/m³ for Tier 1 in July), shown below for June/August, are based on 2019-2023, the most recent 5-year period of certified data at the time of publication of this document[1].
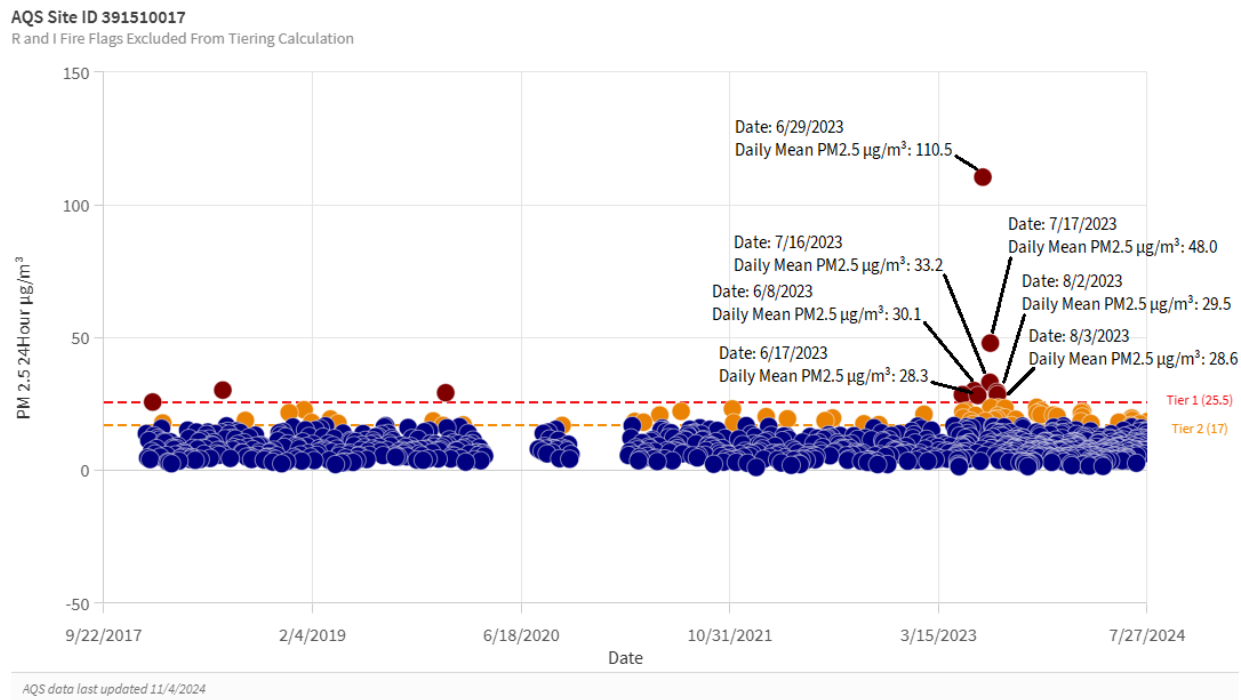
The Ohio Environmental Protection Agency (Ohio EPA) requests that U.S. EPA exclude the PM$_{2.5}$ data from these seven dates in 2023 (June 8, June 17, June 29, July 16, July 17, August 2, and August 3) from regulatory determinations, including calculations of annual PM$_{2.5}$ design values, due to the influence of Canadian wildfire smoke on the monitored concentrations at the Canton Fire St8 (39-151-0017) monitoring site during those days. When the 24-hour average PM$_{2.5}$ concentrations measured at the Canton Fire St8 monitoring site on these seven dates are included, the valid 2021-2023 annual PM$_{2.5}$ design value is 9.5 µg/m³, above the 2024 revised annual PM$_{2.5}$ NAAQS value of 9.0 µg/m³. Although the Canton Fire St8 monitoring site does not meet the PM$_{2.5}$ data completeness criteria for the first quarter of calendar year 2021, the calculated design value is deemed valid because the test design value calculated by applying the data substitution test described in 40 CFR Part 50, Appendix N, Paragraph

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[1] This figure was created on November 18, 2024, from the online U.S. EPA PM$_{2.5}$ Tiering Tool available at https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis
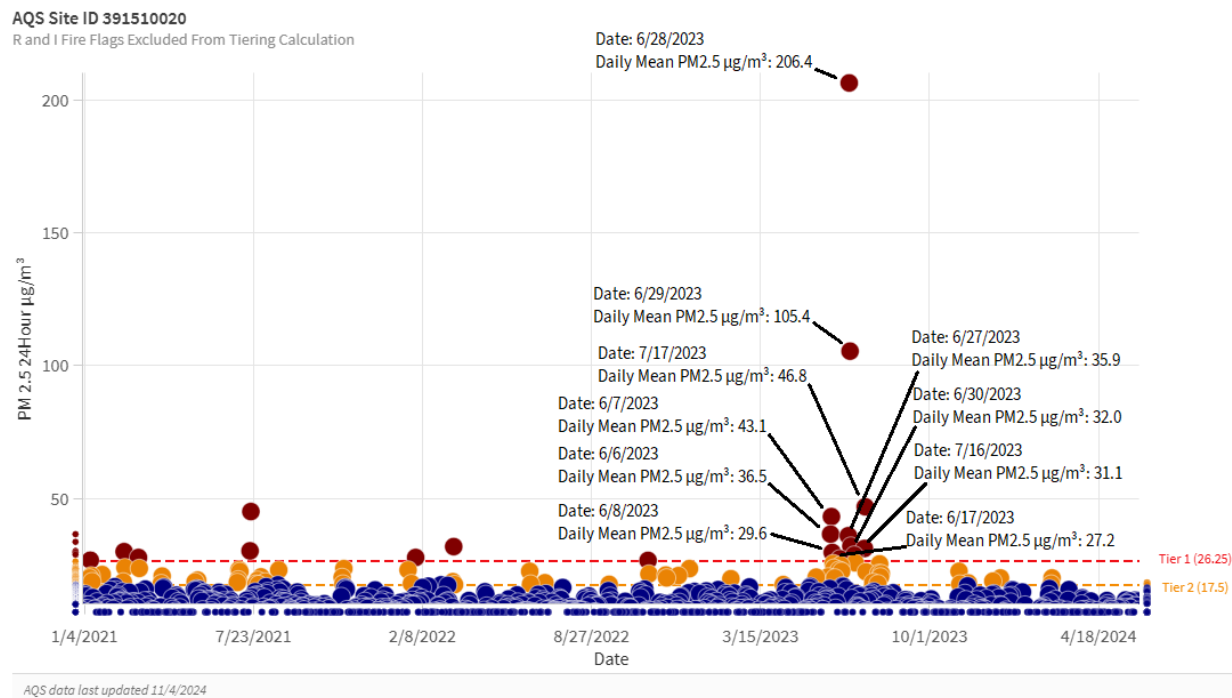
4.1(c)(i) is greater than the level of the standard. However, if these seven 24-hour average $PM_{2.5}$ concentrations were excluded, the Canton Fire St8 monitoring site in the Canton–Massillon, OH MSA would have a 2021-2023 annual $PM_{2.5}$ design value of 9.0 μg/m³, although this design value would be deemed invalid and thus ineligible for comparison against the annual $PM_{2.5}$ NAAQS, as the data substitution test would not be allowed, since not all quarters met the threshold of at least 50% data completeness. Excluding the observed $PM_{2.5}$ data from these seven dates has regulatory significance because it helps reduce the 2021-2023 annual $PM_{2.5}$ design value for the Canton Fire St8 monitoring site in the Canton–Massillon, OH MSA to a value that is at or below the 2024 revised annual $PM_{2.5}$ NAAQS value of 9.0 μg/m³ and will help preclude the Canton–Massillon, OH MSA from being designated a nonattainment area for the 2024 revised annual $PM_{2.5}$ NAAQS.

The Canton (39-151-0020) $PM_{2.5}$ monitoring site also operates within Stark County in the Canton–Massillon, OH MSA. The Canton monitoring site, located just 2.4 km (1.5 mi) northeast of the Canton Fire St8 monitoring site, also measured ambient $PM_{2.5}$ concentrations that were impacted by the multiple Canadian wildfire smoke episodes affecting the Canton–Massillon, OH MSA in the summer of 2023. Table 2 shows the ten days in 2023 affected by regulatorily significant wildfire smoke-driven $PM_{2.5}$ episodes that, if excluded from the three-year (2021-2023) $PM_{2.5}$ design value calculation, would result in a design value for the Canton (39-151-0020) monitoring site in the Canton–Massillon, OH MSA that attains the 2024 $PM_{2.5}$ NAAQS. All ten days are $PM_{2.5}$ Tier 1 category days according to the online U.S. EPA $PM_{2.5}$ Tiering Tool, and the daily mean $PM_{2.5}$ concentrations rank as the 1st, 2nd, 3rd, 5th, 6th, 8th, 10th, 12th, 15th, and 21st highest observed concentration days at this monitor in the 2019-2023 period. These ten days in 2023 were affected by four distinct regulatorily significant wildfire smoke-driven $PM_{2.5}$ episodes in the Canton–Massillon, OH MSA lasting from June 6-8, June 17, June 27-30, and July 16-17, respectively. Figure 2 was generated by the online U.S. EPA $PM_{2.5}$ Tiering Tool for the Canton monitoring site in Stark County within the Canton–Massillon, OH MSA. This figure identifies these ten days in 2023 (June 6, June 7, June 8, June 17, June 27, June 28, June 29, June 30, July 16, and July 17) as Tier 1 category days.

Table 2. Data requested for exclusion at the Canton (39-151-0020) monitoring site due to regulatorily significant wildfire smoke-driven PM$_{2.5}$ episodes.

Date of Event	U.S. EPA PM$_{2.5}$ Tier	24-Hour Average PM$_{2.5}$ Concentration (µg/m^3)	5-Year Percentile	5-Year Rank
June 6, 2023	Tier 1	36.5	99.66	6
June 7, 2023	Tier 1	43.1	99.78	5
June 8, 2023	Tier 1	29.6	99.16	15
June 17, 2023	Tier 1	27.2	98.88	21
June 27, 2023	Tier 1	35.9	99.61	8
June 28, 2023	Tier 1	206.4	100.00	1
June 29, 2023	Tier 1	105.4	99.94	2
June 30, 2023	Tier 1	32.0	99.50	10
July 16, 2023	Tier 1	31.1	99.39	12
July 17, 2023	Tier 1	46.8	99.89	3

Figure 2. Time series plot of PM$_{2.5}$ daily combined site data for the Canton (39-151-0020) monitoring site in the Canton–Massillon, OH MSA from 2021-2024, with the data points requested for exclusion labeled. The tier thresholds, which are the same for the months of June and July, are based on 2019-2023, the most recent 5-year period of certified data at the time of publication of this document[2].

AQS Site ID 391510020
R and I Fire Flags Excluded From Tiering Calculation

Date: 6/28/2023
Daily Mean PM2.5 µg/m³: 206.4

Date: 6/29/2023
Daily Mean PM2.5 µg/m³: 105.4

Date: 6/27/2023
Daily Mean PM2.5 µg/m³: 35.9

Date: 7/17/2023
Daily Mean PM2.5 µg/m³: 46.8

Date: 6/7/2023
Daily Mean PM2.5 µg/m³: 43.1

Date: 6/30/2023
Daily Mean PM2.5 µg/m³: 32.0

Date: 6/6/2023
Daily Mean PM2.5 µg/m³: 36.5

Date: 7/16/2023
Daily Mean PM2.5 µg/m³: 31.1

Date: 6/8/2023
Daily Mean PM2.5 µg/m³: 29.6

Date: 6/17/2023
Daily Mean PM2.5 µg/m³: 27.2

Tier 1 (26.25)
Tier 2 (17.5)

AQS data last updated 11/4/2024

The Ohio Environmental Protection Agency (Ohio EPA) requests that U.S. EPA exclude these ten dates in 2023 (June 6, June 7, June 8, June 17, June 27, June 28, June 29, June 30, July 16, and July 17) from regulatory determinations, including calculations of annual PM$_{2.5}$ design values, due to the influence of Canadian wildfire smoke on the monitored concentrations at the Canton (39-151-0020) monitoring site during those days. When the 24-hour average PM$_{2.5}$ concentrations measured at the Canton monitoring site on these ten dates are included, the valid 2021-2023 annual PM$_{2.5}$ design value is 9.2 µg/m³, above the 2024 revised annual PM$_{2.5}$ NAAQS value of 9.0 µg/m³. However, if these ten 24-hour average PM$_{2.5}$ concentrations were excluded, the Canton monitoring site in the Canton–Massillon, OH MSA would have a valid 2021-2023 annual PM$_{2.5}$ design value of 8.7 µg/m³, representing attainment of the 2024 revised annual PM$_{2.5}$ NAAQS. Excluding the observed PM$_{2.5}$ data from these ten dates affected by

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[2] This figure was created on November 18, 2024, from the online U.S. EPA PM$_{2.5}$ Tiering Tool available at https://www.epa.gov/air-quality-analysis/pm25-tiering-tool-exceptional-events-analysis

regulatorily significant wildfire smoke-driven PM$_{2.5}$ episodes helps reduce the 2021-2023 annual PM$_{2.5}$ design value for the Canton monitoring site in the Canton–Massillon, OH MSA to a value that is at or below the 2024 revised annual PM$_{2.5}$ NAAQS value of 9.0 µg/m^3 and will help preclude the Canton–Massillon, OH MSA from being designated a nonattainment area for the 2024 revised annual PM$_{2.5}$ NAAQS.

1.2. Exceptional Events Rule Requirements

U.S. EPA's Treatment of Data Influenced by Exceptional Events ("Exceptional Events Rule", 81 FR 68216) provides the requirements that air agencies must meet when requesting U.S. EPA to exclude exceptional event-related concentrations from regulatory determinations. All of the required elements under 40 CFR 50.14(c)(1)(i), 40 CFR 50.14(c)(3)(iv)(A–E), and 40 CFR 50.14(c)(3)(v)(A-C) are included in this demonstration.

- 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) is presented in Section 2 of this document.
- 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, including analyses comparing the event-influenced concentrations to concentrations at the same monitoring site at other times, is presented in Section 3 of this document.
- A demonstration that the event was both not reasonably controllable and not reasonably preventable is presented in Section 4 of this document.
- A demonstration that the event was a human activity that is unlikely to recur at a location or was a natural event is presented in Section 5 of this document.
- A demonstration that the public was promptly notified of the occurrence of the event(s) that may result in the exceedance of an applicable air quality standard is presented in Section 6 of this document.
- A demonstration that Ohio followed the public comment process for the submission of this document, including a copy of all public comments received and Ohio's responses to those comments received, is presented in Section 7 of this document.

2. Narrative Conceptual Model

The narrative conceptual models for the five distinct wildfire smoke-driven PM$_{2.5}$ episodes impacting the Canton–Massillon, OH MSA in the summer of 2023 (June 6-8, June 17, June 27-30, July 16-17, and August 2-3) are presented in this section. Narrative conceptual models are presented separately for each episode.

2.1. June 6-8, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode
2.1.1. Episode Description

Air quality in the Canton–Massillon, OH MSA was impacted from June 6-8, 2023 by wildfire smoke entering the region from Quebec, Canada. Smoke plumes impacted the Canton–Massillon, OH MSA during multiple episodes in the summer of 2023, including the June 6-8 episode. Figure 3 and Figure 4 show the daily average PM$_{2.5}$ concentrations for the years 2019-2023 at the Canton and Canton Fire St8 monitoring sites, respectively, in the Canton–Massillon, OH MSA. These figures illustrate the severity of the wildfire smoke-driven PM$_{2.5}$ episodes in the summer of 2023 relative to other periods of the year and compared to the same period in the past five years. Data collected during the June 6-8, 2023 wildfire smoke-driven PM$_{2.5}$ episode are labeled in each figure.

Figure 3. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton (39-151-0020) monitoring site in the Canton–Massillon, OH MSA, with data from the June 6-8, 2023 episode labeled.
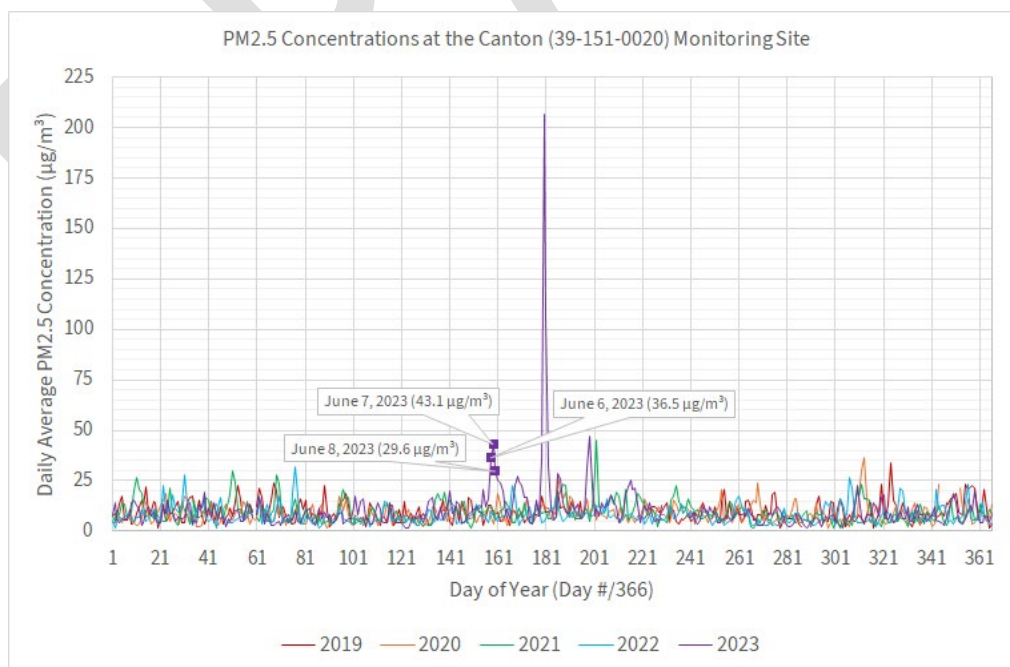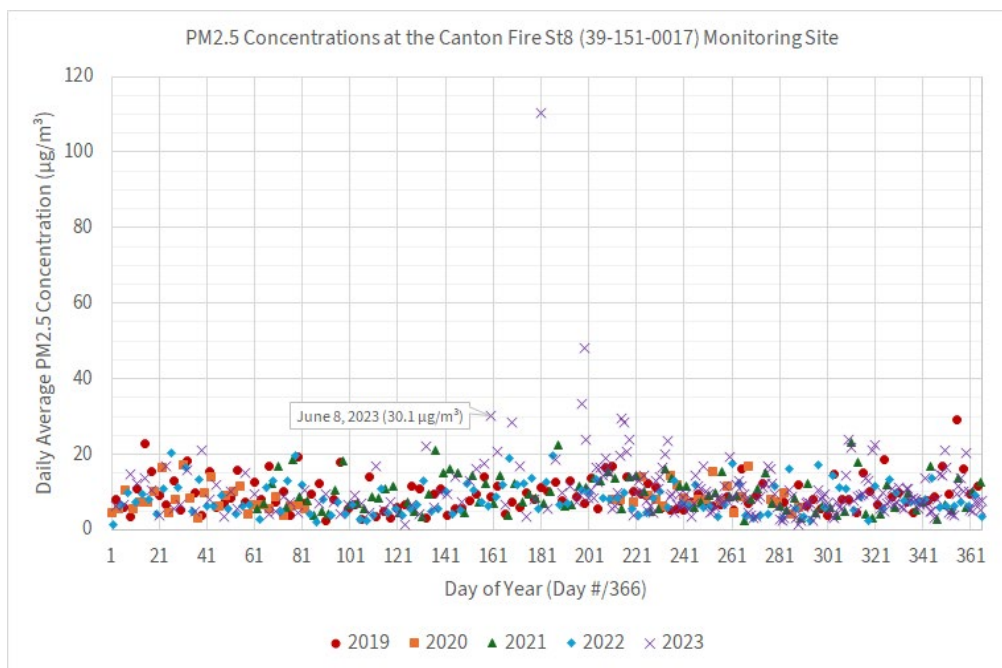
Figure 4. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton Fire St8 (39-151-0017) monitoring site in the Canton–Massillon, OH MSA, with data from the June 6-8, 2023 episode labeled.

2.1.2. Meteorology

From June 2 to June 9, 2023, two distinct weather patterns connected the upper Midwest with Canada and brought wildfire smoke into the Great Lakes Basin. Early in the episode (June 2-4), a cold front moved across southern Canada and the trailing high-pressure system brought with it smoke from wildfires burning in southeastern Quebec south into the Great Lakes region. Starting on June 5, an area of low-pressure formed along the southeastern coast of Canada near Maine, and an area of high-pressure formed over Hudson Bay in Canada. These features remained in place until June 7 and were the primary physical drivers of the smoke transport into the Great Lakes Basin that impacted air quality in the Canton–Massillon, OH MSA on June 6-8, 2023.

Figure 5 shows Hazard Mapping System (HMS) smoke maps, daily average PM$_{2.5}$ concentrations, satellite imagery, and surface weather maps for June 4-6, 2023, while Figure 6 shows the same for June 7-9, 2023. These figures show an area of high pressure with clear skies connecting Hudson Bay to the Great Lakes. The strong low-pressure system off to the east produced cyclonic (counterclockwise) flow, which created a northerly wind transport corridor along its western edge. Combined with the stationary front along the Ohio River

Valley, the synoptic conditions were ideal for smoke transport and buildup in northeastern Ohio. The western edge of the low-pressure system created northerly flow and a descending air mass with accompanying high pressure. This flow pattern brought smoke south from the wildfires burning near the southern end of James Bay in Quebec and carried it to the surface in the Great Lakes Basin. The stationary front along the southern edge of the Great Lakes region caused the air mass to stall, allowing the smoke to build up, resulting in high concentrations of $PM_{2.5}$ at the surface.

Figure 5. Daily average PM$_{2.5}$ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the NOAA-20 satellite imagery of cloud cover, and the surface weather map (right) during June 4-6, 2023.

HMS Smoke + Surface 24-Hour Average PM$_{2.5}$	Satellite Imagery	Surface Weather Map, 0700 EST
June 4, 2023		
June 5, 2023		
June 6, 2023		
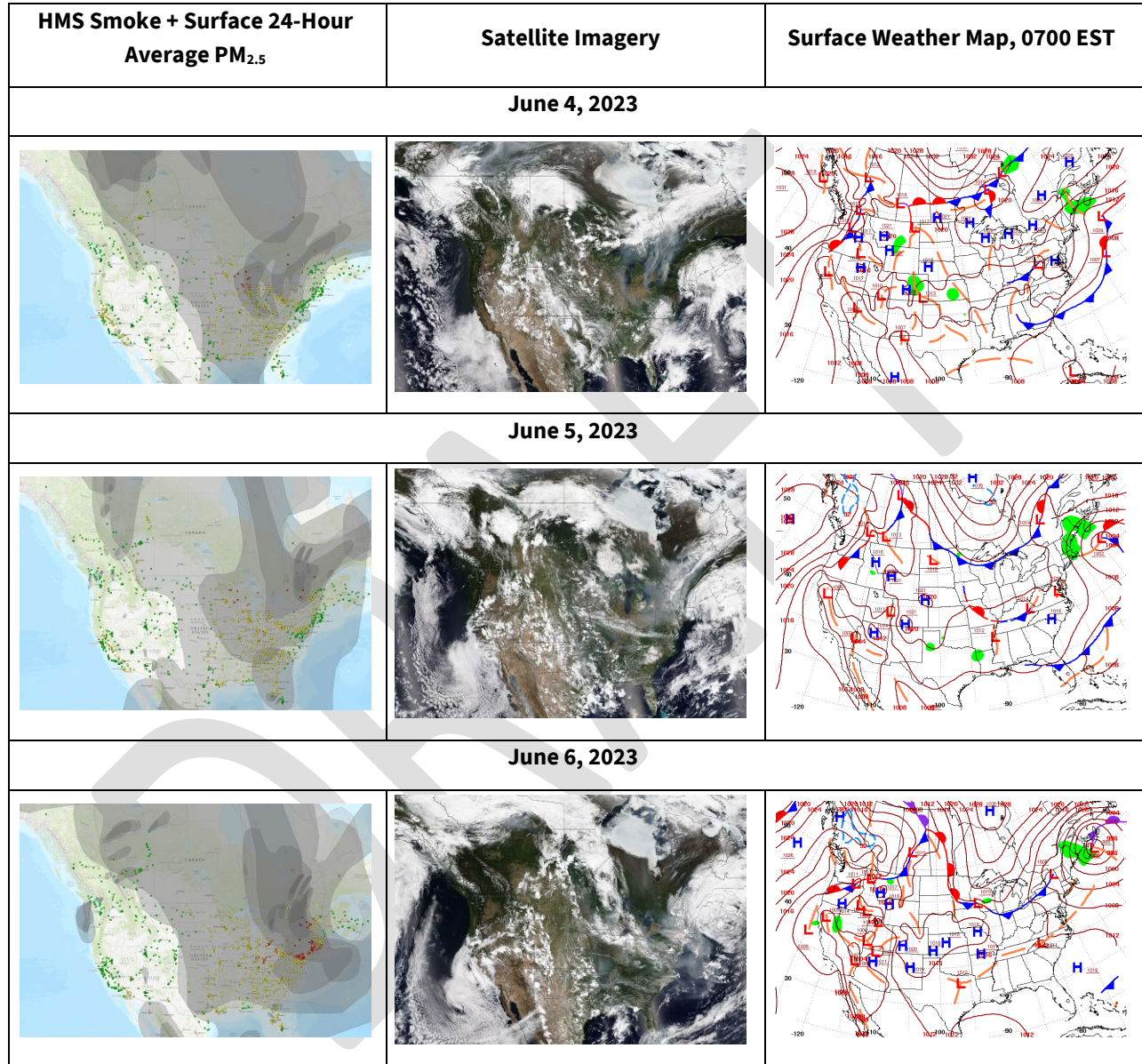
Figure 6. Daily average PM$_{2.5}$ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the NOAA-20 satellite imagery of cloud cover, and the surface weather map (right) during June 7-9, 2023.

HMS Smoke + Surface 24-Hour Average PM$_{2.5}$	Satellite Imagery	Surface Weather Map, 0700 EST
June 7, 2023		
June 8, 2023		
June 9, 2023		
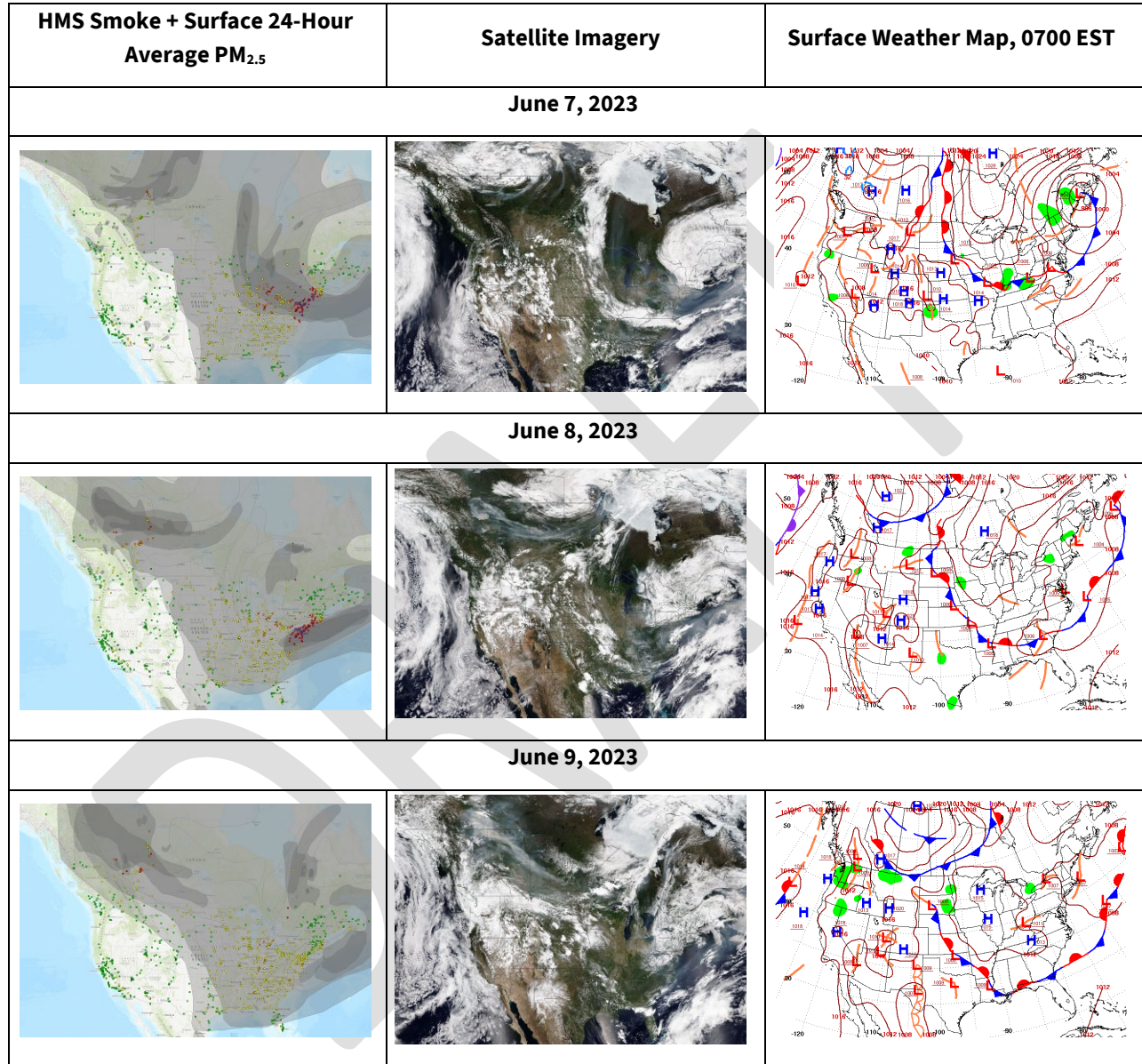
2.1.3. Canadian Wildfires

Starting on May 27, 2023, the Canadian Wildland Fire Information System (CWFIS)[3] began to report extreme fire danger conditions from the southwest border of Ontario northeast across Quebec to the Gulf of St. Lawrence. The area of Quebec centered around the southern end of James Bay remained almost continuously under high to extreme fire danger through most of the month. On June 2, the Quebec provincial fire-management authority, Société de Protection des Forets Contre le Feu (SOPFEU[4]), reported to the Canadian Interagency Forest Fire Center (CIFFC) a fire preparedness level 5 for the province, which is the highest alert level in Canada for mobilizing resources to fight wildfires and protect life and structures[5]. The province remained at a level 5 alert continuously until it was lowered to level 4 on July 17. On June 4, the Aviation, Forest Fire, and Emergency Services division of the Ontario Ministry of Natural Resources and Forestry (OMNRF-AFFES) [6], reported to CIFFC a fire preparedness level 4 for the province[7], which remained until being lowered to level 3 on July 11.

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[3] https://cwfis.cfs.nrcan.gc.ca/home

[4] https://sopfeu.qc.ca/

[5] https://ciffc.net/situation/2023-06-02

[6] https://www.ontario.ca/page/forest-fire-management

[7] https://ciffc.net/situation/2023-06-04

Figure 7 is a CWFIS map showing the active fires and fire hotspots in eastern Ontario and Quebec on June 4, 2023. On June 4 there were 150 active fires burning 382,578 acres across Quebec, while there were 40 active fires burning 45,189 acres across Ontario[8]. The smoke plumes arising from the wildfires and recent hotspots east of Val-d'Or, as well as west of Pembroke, were located in the source regions intersected by the June 6, 2023 HYSPLIT 48-hour back and forward trajectory plots shown in Figure 34 in Section 3 of this document.

Figure 7. Map from CWFIS of active fires in Quebec on June 4, 2023.

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[8] https://ciffc.net/situation/2023-06-04
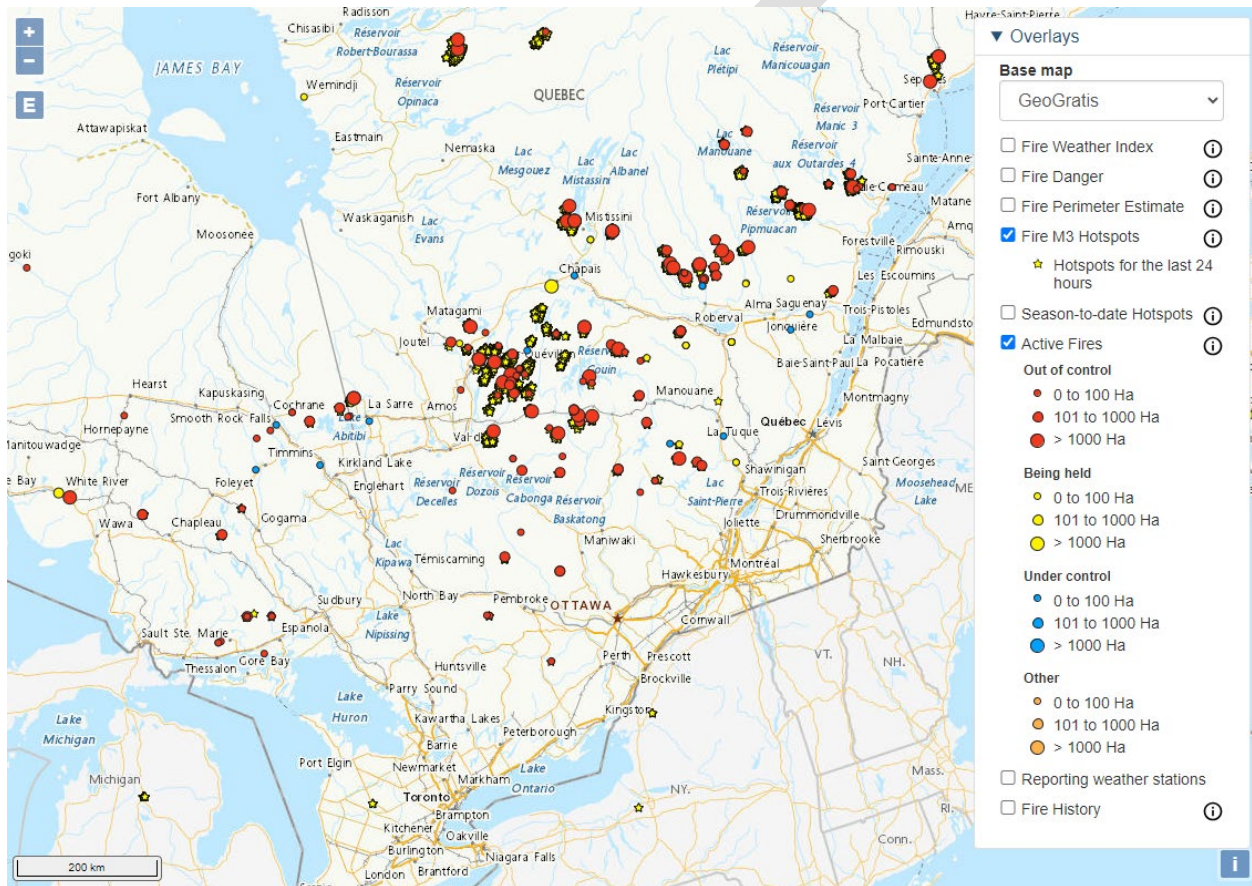
Figure 8 is a CWFIS map showing the active fires and fire hotspots in Quebec on June 5, 2023. On June 5 there were 154 active fires burning 384,401 acres in the province[9]. The smoke plumes arising from the wildfires and recent hotspots east of Wemindji were located in the source region intersected by the June 7, 2023 HYSPLIT 48-hour back and forward trajectory plots shown in Figure 36 in Section 3 of this document.

Figure 8. Map from CWFIS of active fires in Quebec on June 5, 2023.
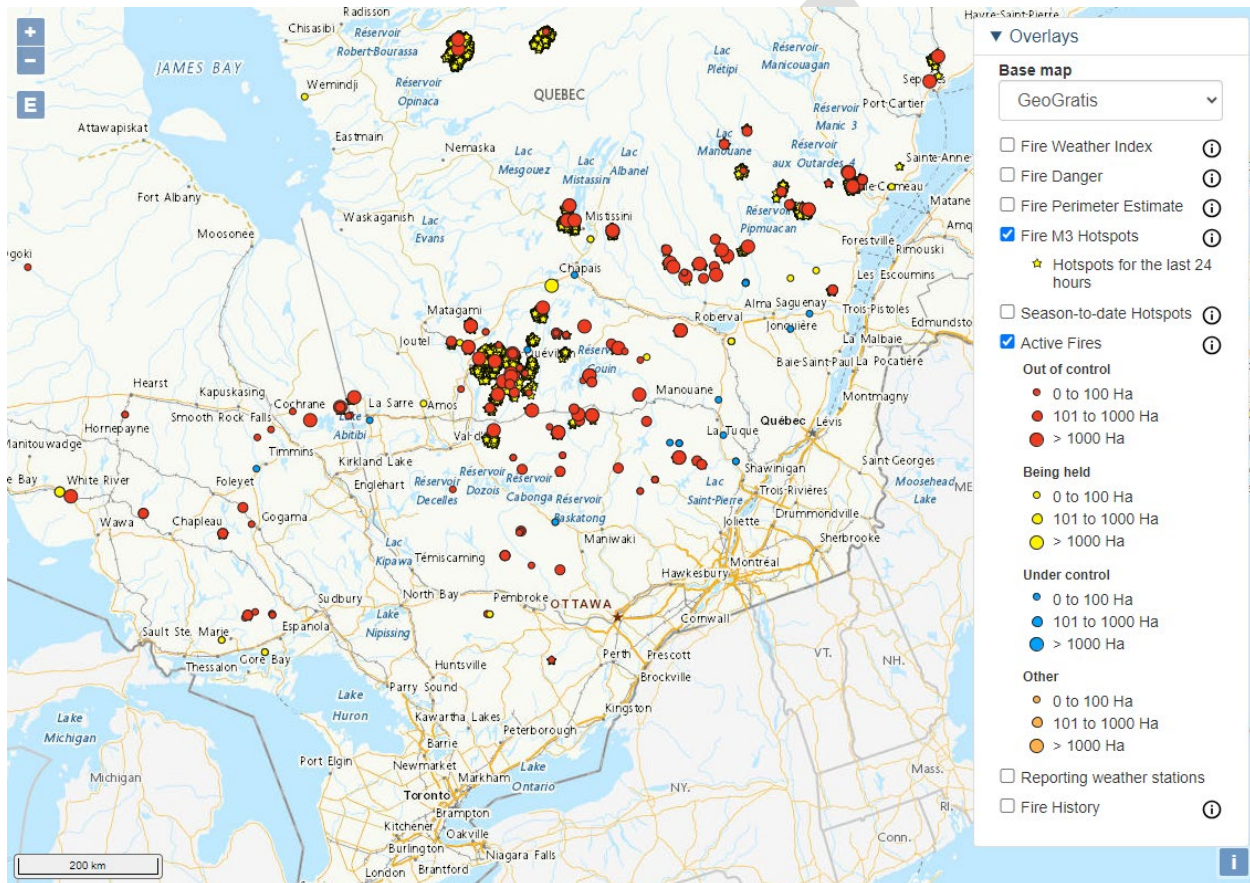
Figure 9 is a CWFIS map showing the active fires and fire hotspots in Quebec on June 6, 2023. On June 6 there were 154 active fires burning 651,405 acres in the province[10]. The smoke plumes arising from the fires and recent hotspots east of Wemindji were located in the source region intersected by the June 8, 2023 HYSPLIT 48-hour back and forward trajectory plots shown in Figure 38 in Section 3 of this document.

Figure 9. Map from CWFIS of active fires in Quebec on June 6, 2023.
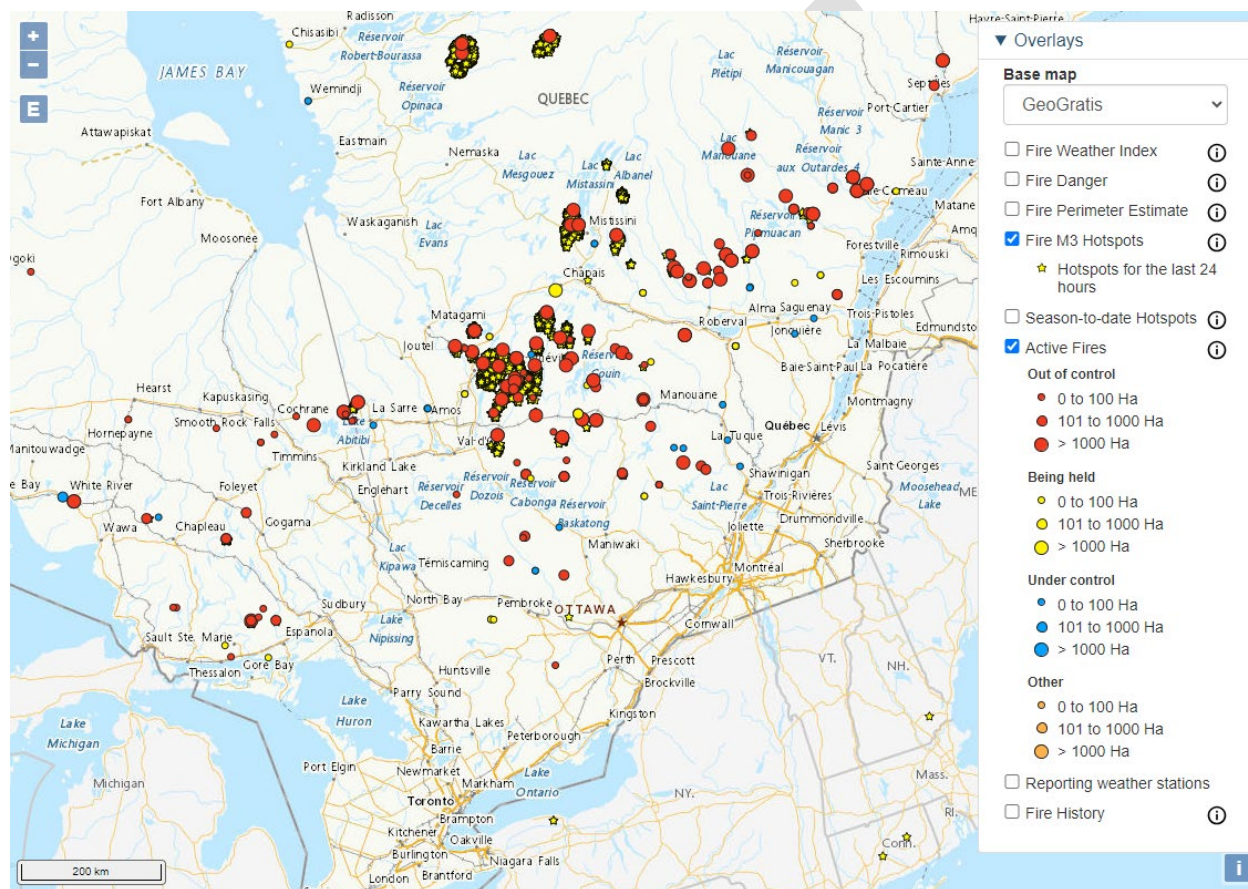
2.1.4. Media Coverage

News media across the country reported on the wildfire smoke in the Great Lakes region during the summer of 2023. The coverage of the smoke, particularly by media outlets that typically only report on extreme weather and air quality events, indicated the historic nature of the Canadian wildfire smoke impacts in the Great Lakes region, including the Canton–

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[10] https://ciffc.net/situation/2023-06-06

Massillon, OH MSA. While the list of news stories in Table 3 is not exhaustive, it illustrates the severe nature of the June 6-8, 2023 $PM_{2.5}$ pollution episode in the Great Lakes region and northeastern Ohio in particular, and serves as further evidence that the June 6-8, 2023 episode was not local in nature but driven by transported wildfire smoke from Canada that blanketed the region.

Table 3. News media reporting of the June 6-8, 2023 Canadian wildfire smoke in the Great Lakes region.

Date	Source	Headline
June 6, 2023	The Canton Repository	Canton, Stark County under Air Quality Advisory as smoke from wildfires blows through[11]
June 6, 2023	NPR	How Canadian wildfires are worsening U.S. air quality and what you can do to cope[12]
June 7, 2023	Cleveland.com	Will smoke from Canadian wildfires get worse in Northeast Ohio before it gets better?[13]
June 7, 2023	Associated Press	Air pollution cloaks eastern US for a second day. Here's why there is so much smoke[14]
June 8, 2023	The Akron Beacon Journal	Poor air quality in Greater Akron: Hospitals share protection tips, Kent State stays indoors[15]
June 8, 2023	CBS News	When will the wildfire smoke clear? Here's what meteorologists say.[16]

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[11] https://www.cantonrep.com/story/news/2023/06/06/canton-weather-canadian-wildfire-smoke-causes-air-quality-advisory/70293436007

[12] https://www.npr.org/2023/06/06/1180508544/heres-how-canadian-wildfires-are-worsening-air-quality-across-the-u-s

[13] https://www.cleveland.com/news/2023/06/will-smoke-from-canadian-wildfires-get-worse-in-northeast-ohio-before-it-gets-better.html

[14] https://apnews.com/article/canada-wildfires-air-quality-8af805b127ba4d4f5933463cf8fdc746

[15] https://www.beaconjournal.com/story/news/2023/06/08/air-quality-index-akron-ohio-how-to-protect-yourself/70302829007

[16] https://www.cbsnews.com/news/canada-wildfire-smoke-how-much-longer-air-quality-improve-forecast

2.2. June 17, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

2.2.1. Episode Description

Air quality in the Canton–Massillon, OH MSA was impacted on June 17, 2023 by wildfire smoke entering the region from Quebec, Canada. Smoke plumes impacted the Canton–Massillon, OH MSA during multiple episodes in the summer of 2023, including the June 17 episode. Figure 10 and Figure 11 show the daily average PM$_{2.5}$ concentrations for the years 2019-2023 at the Canton and Canton Fire St8 monitoring sites, respectively, in the Canton–Massillon, OH MSA. These figures illustrate the severity of the wildfire smoke-driven PM$_{2.5}$ episodes in the summer of 2023 relative to other periods of the year and compared to the same period in the past five years. Data collected during the June 17, 2023 wildfire smoke-driven PM$_{2.5}$ episode are labeled in each figure.

Figure 10. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton (39-151-0020) monitoring site in the Canton–Massillon, OH MSA, with data from the June 17, 2023 episode labeled.
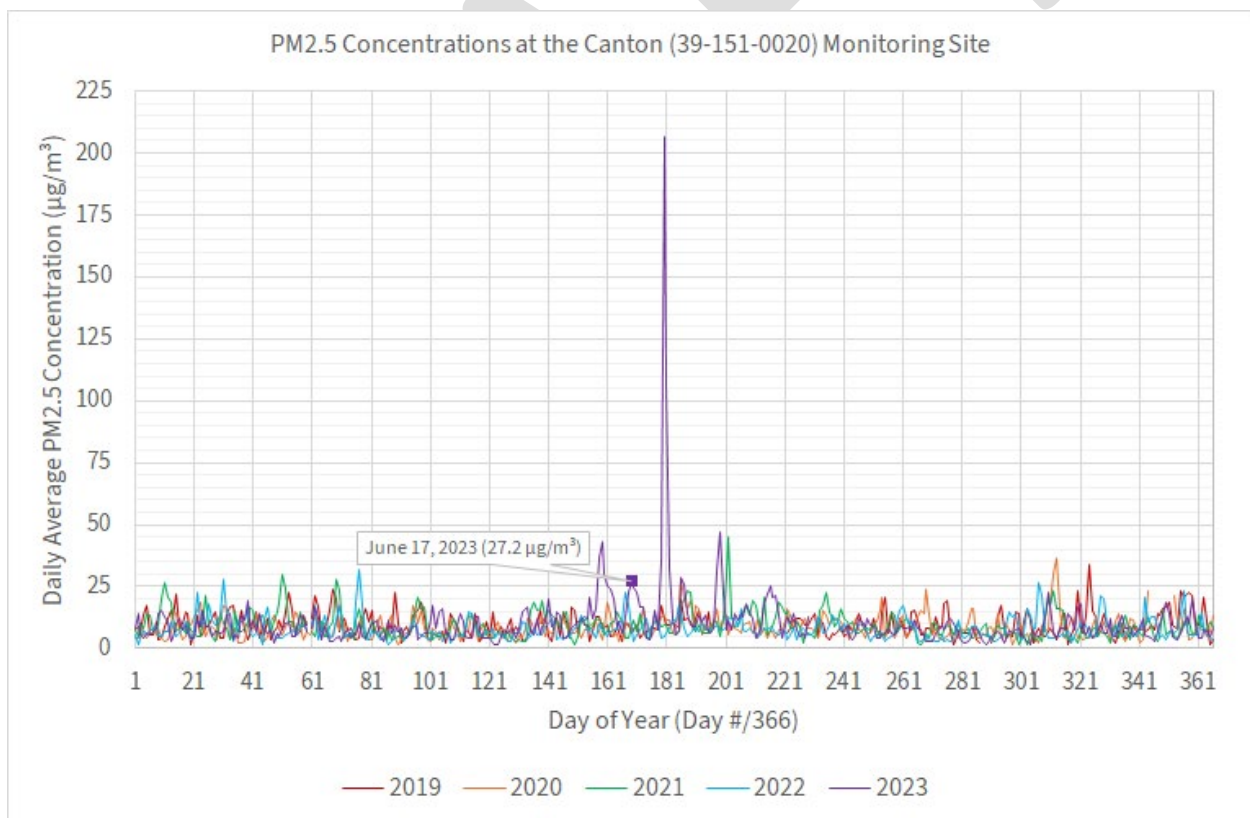
Figure 11. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton Fire St8 (39-151-0017) monitoring site in the Canton–Massillon, OH MSA, with data from the June 17, 2023 episode labeled.
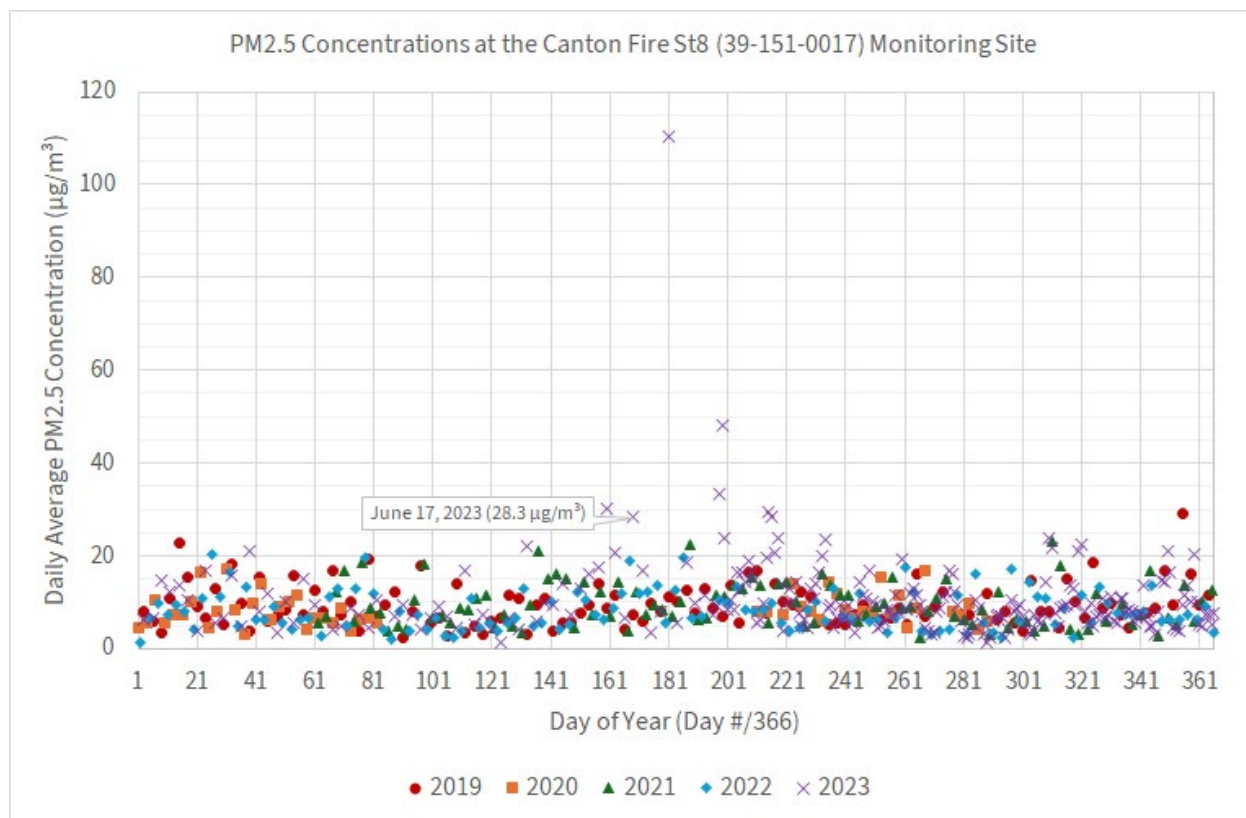
2.2.2. Meteorology

From June 12 through June 17, 2023, distinct airmass transport patterns connected the Midwest with Quebec and brought smoke into the Great Lakes Basin, including the Canton–Massillon, OH MSA. Figure 12 shows Hazard Mapping System (HMS) smoke maps, daily average PM$_{2.5}$ concentrations, satellite imagery, and surface weather maps for June 12-14, 2023, while Figure 13 shows the same for June 15-17, 2023. During June 12-15, a cyclonic (e.g., counterclockwise) circulation around a large low-pressure system centered on the Great Lakes carried smoke into the Upper Midwest from wildfires occurring in the source regions east of James Bay in Quebec, Canada. Smoke from these wildfires was transported along the trailing edge of the low-pressure system as it moved east through the Great Lakes region.

Figure 12. Daily average PM₂.₅ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the NOAA-20 satellite imagery of cloud cover, and the surface weather map (right) during June 12-14, 2023.
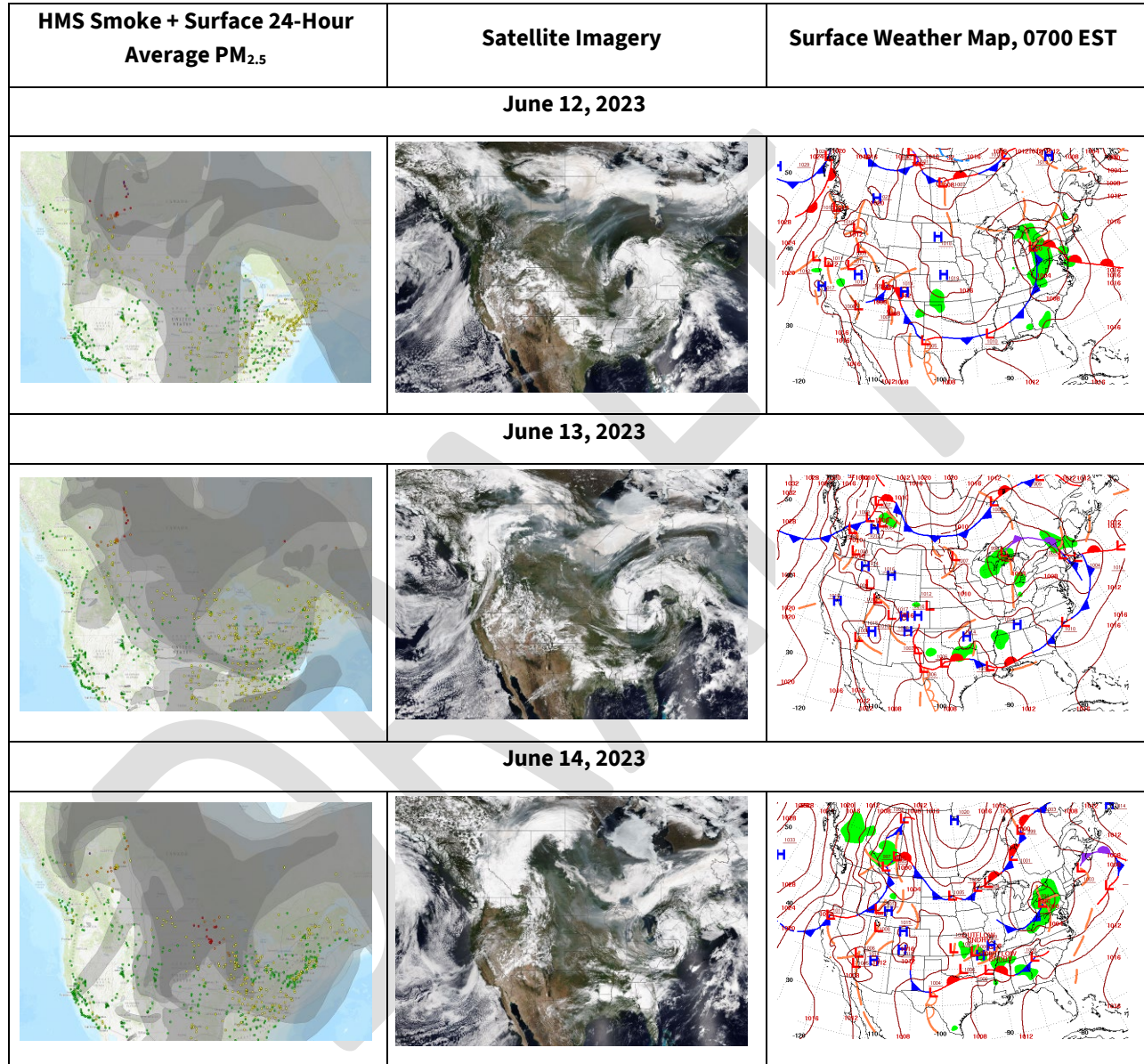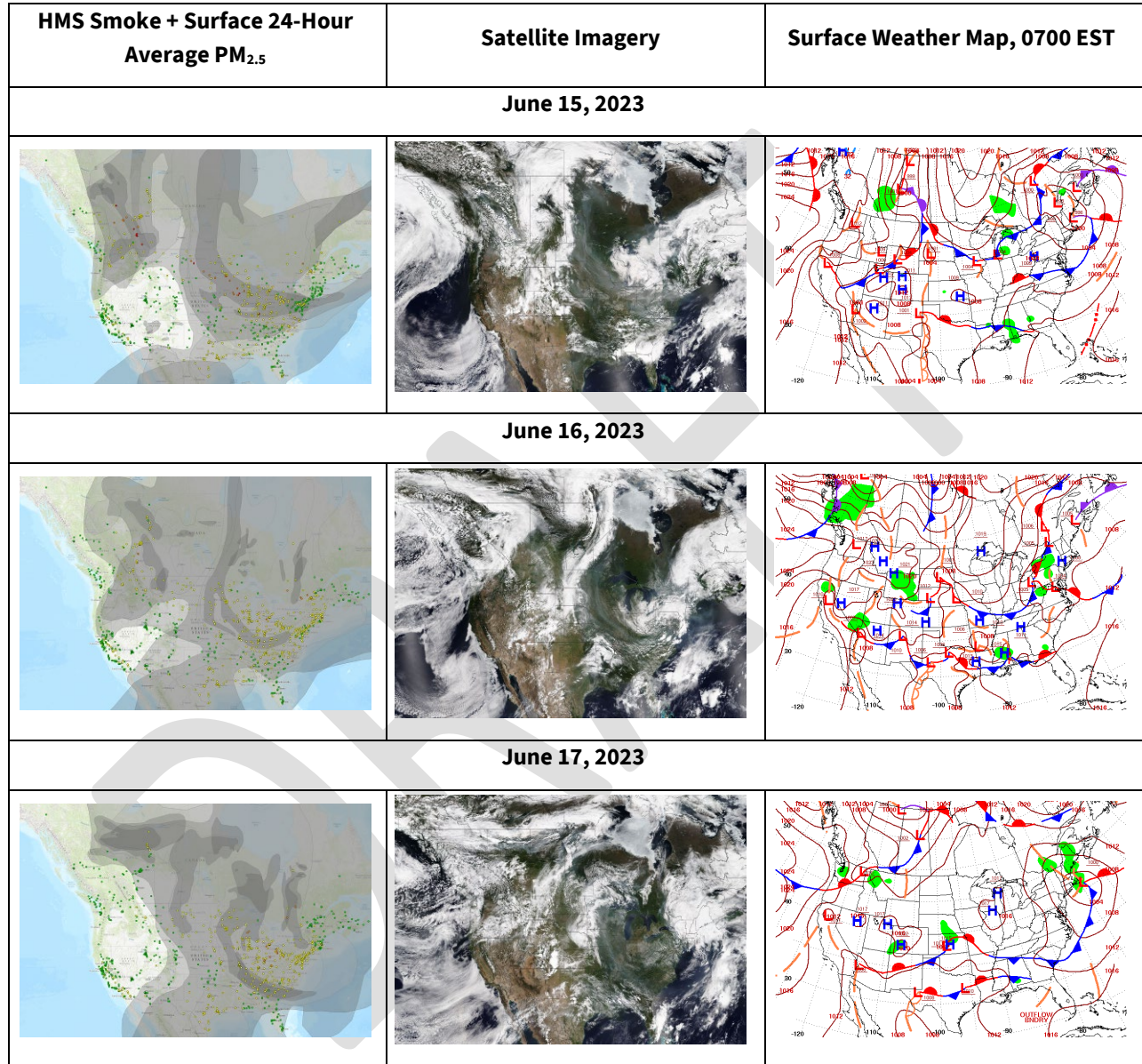
HMS Smoke + Surface 24-Hour Average PM₂.₅	Satellite Imagery	Surface Weather Map, 0700 EST
June 12, 2023		
June 13, 2023		
June 14, 2023		

Figure 13. Daily average PM$_{2.5}$ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the NOAA-20 satellite imagery of cloud cover, and the surface weather map (right) during June 15-17, 2023.

HMS Smoke + Surface 24-Hour Average PM$_{2.5}$	Satellite Imagery	Surface Weather Map, 0700 EST
June 15, 2023		
June 16, 2023		
June 17, 2023		

The strong low-pressure system that formed over the Great Lakes quickly developed into a cut-off low, causing the system to pass very slowly across the Great Lakes region. The northerly wind transport corridor created by the cyclonic flow from the strong low-pressure system, along with the slow-moving nature of the system as a cut-off low, allowed smoke

from wildfires burning west of Chisasibi in Quebec to continually transport into the Great Lakes region and steadily build up at the surface across the region.

Starting on June 15, 2023, the low-pressure system weakened and moved towards eastern Canada, while a weak high-pressure system began to form over western Ontario and the western Great Lakes region. This weak high-pressure system slowly moved through the Great Lakes region from June 15-17, which pushed the trapped smoke from the Canadian wildfires eastward over Ohio and caused high PM$_{2.5}$ concentrations at the surface on June 17. By the evening of June 18, the weak high-pressure system had pushed eastward across the Ohio Valley, clearing the wildfire smoke from the region.

2.2.3. Canadian Wildfires

Quebec continued to be in state of fire preparedness level 5 for the province in mid-June 2023. Figure 14 is a CWFIS map showing the active fires and fire hotspots in Quebec on June 15, 2023. On June 15 there were 107 active fires burning 1,965,810 acres in the province[17]. The smoke plumes arising from the wildfires and hotspots east of Wemindji were located in the source region intersected by the June 17, 2023 HYSPLIT 48-hour back and forward trajectory plots shown in Figure 40 in Section 3 of this document.

Figure 14. Map from CWFIS of active fires in Quebec on June 15, 2023.

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[17] https://ciffc.net/situation/2023-06-15
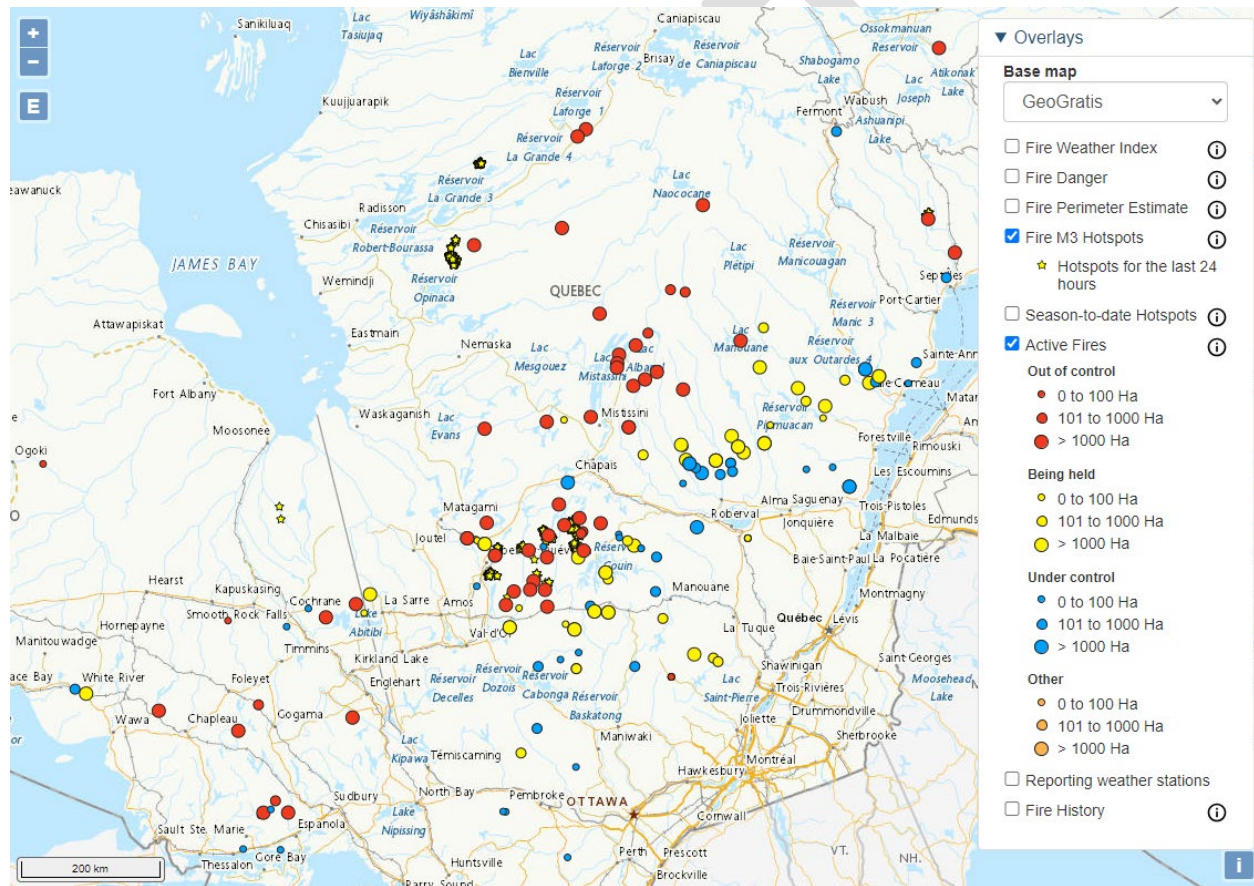
2.2.4. Media Coverage

Similar to the media and messaging coverage shown for the June 6-8, 2023 wildfire smoke-driven $PM_{2.5}$ episode, Table 4 illustrates the severe nature of the June 17, 2023 $PM_{2.5}$ pollution episode in the Great Lakes region and northeastern Ohio in particular, and serves as further evidence that the June 17, 2023 episode was not local in nature but driven by transported wildfire smoke from Canada that blanketed the region.

Table 4. News media reporting of the June 17, 2023 Canadian wildfire smoke episode in the Great Lakes region.

Date	Source	Headline
June 15, 2023	CNN	New round of smoke from Canada fires prompts air quality alerts across the Upper Midwest[18]
June 16, 2023	The Journal-News	Air quality alert in effect this weekend in Butler, Warren counties[19]
June 16, 2023	The Washington Post	Where the Canadian wildfire smoke is now and where it's headed[20]
June 16, 2023	The Hill	Wildfire smoke makes weekend comeback as Canadian fires rage[21]
June 17, 2023	Yahoo News	Mother Nature to turn up the heat across parts of Northeast, Midwest[22]
June 18, 2023	Zenger	Canadian wildfire smoke blankets Midwest, settles in major US cities[23]

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[18] https://www.cnn.com/2023/06/15/weather/canada-wildfires-air-quality-upper-midwest/index.html

[19] https://www.journal-news.com/news/air-quality-alert-in-effect-this-weekend-in-butler-warren-counties/EHUPZ3TT5RDFPAURA4S3F4YW4A

[20] https://www.washingtonpost.com/weather/2023/06/16/canada-wildfires-smoke-forecast-weekend-united-states

[21] https://thehill.com/policy/energy-environment/4053676-wildfire-smoke-makes-weekend-comeback-as-canadian-fires-rage

[22] https://www.yahoo.com/news/turning-heat-across-parts-northeast-161200345.html

[23] https://www.zenger.news/2023/06/18/canadian-wildfire-smoke-blankets-midwest-settles-in-major-us-cities

2.3. June 27-30, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

2.3.1. Episode Description

Air quality in the Canton–Massillon, OH MSA was impacted from June 27-30, 2023 by wildfire smoke entering the region from Quebec, Canada. Smoke plumes impacted the Canton–Massillon, OH MSA during multiple episodes in the summer of 2023, including the June 27-30 episode. Figure 15 and Figure 16 show the daily average PM$_{2.5}$ concentrations for the years 2019-2023 at the Canton and Canton Fire St8 monitoring sites, respectively, in the Canton–Massillon, OH MSA. These figures illustrate the severity of the wildfire smoke-driven PM$_{2.5}$ episodes in the summer of 2023 relative to other periods of the year and compared to the same period in the past five years. Data collected during the June 27-30, 2023 wildfire smoke-driven PM$_{2.5}$ episode are labeled in each figure.

Figure 15. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton (39-151-0020) monitoring site in the Canton–Massillon, OH MSA, with data from the June 27-30, 2023 episode labeled.
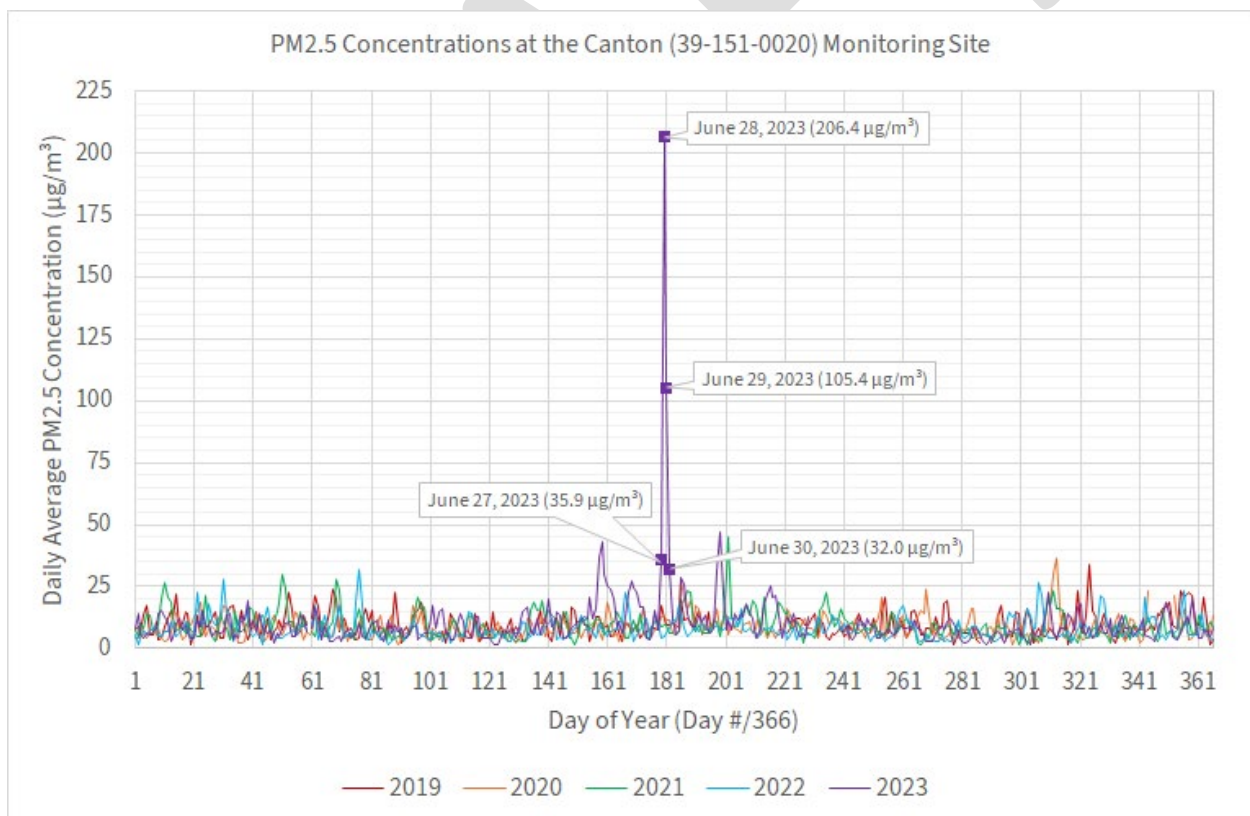
Figure 16. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton Fire St8 (39-151-0017) monitoring site in the Canton–Massillon, OH MSA, with data from the June 27-30, 2023 episode labeled.
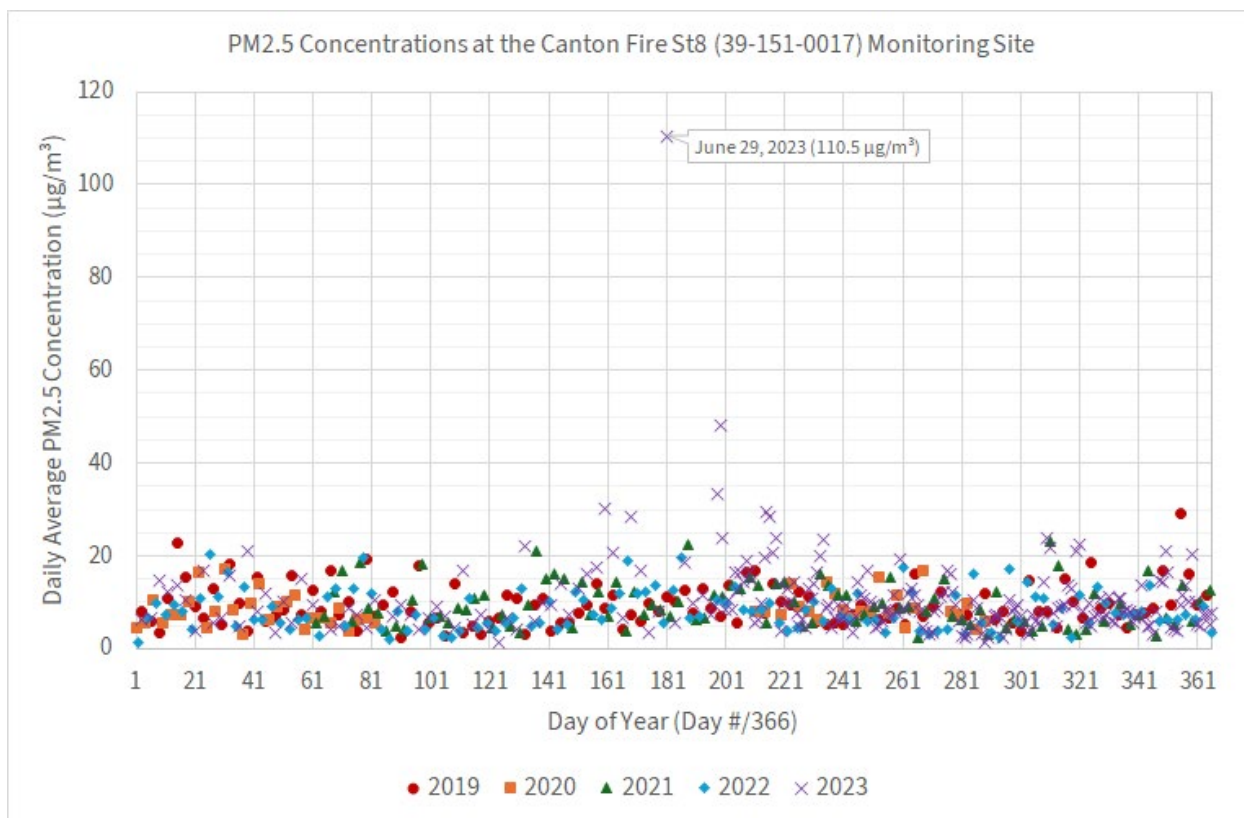
2.3.2. Meteorology

From June 25 through June 30, 2023, distinct airmass transport patterns connected the upper Midwest with Canada and brought smoke into the Great Lakes Basin, including the Canton–Massillon, OH MSA. Figure 17 shows Hazard Mapping System (HMS) smoke maps, daily average PM$_{2.5}$ concentrations, satellite imagery, and surface weather maps for June 25-27, 2023, while Figure 18 shows the same for June 28-30, 2023. During June 25-27, a cyclonic (e.g., counterclockwise) circulation around a large low-pressure system centered on the Great Lakes carried smoke into the upper Midwest from source regions in Ontario and Quebec, Canada. Thick smoke from the Canadian wildfires was transported along the trailing edge of the low-pressure system as it moved east through the Great Lakes Basin. Stable air featured during this period with a consistent northerly to northwesterly wind of 7-15 m/s (16-34 mph).

Figure 17. Daily average PM$_{2.5}$ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the Suomi NPP satellite imagery of cloud cover, and the surface weather map (right) during June 25-27, 2023.
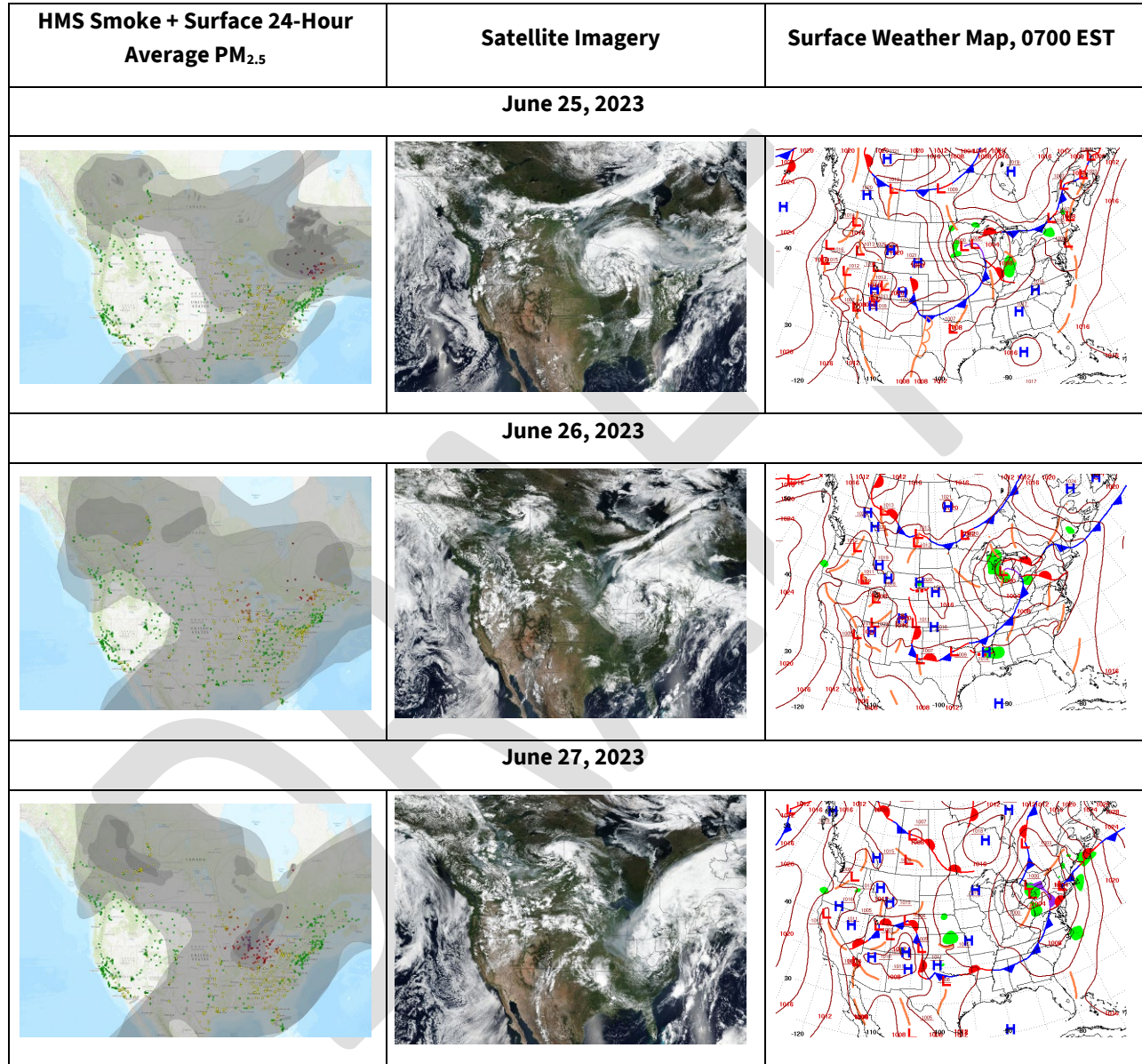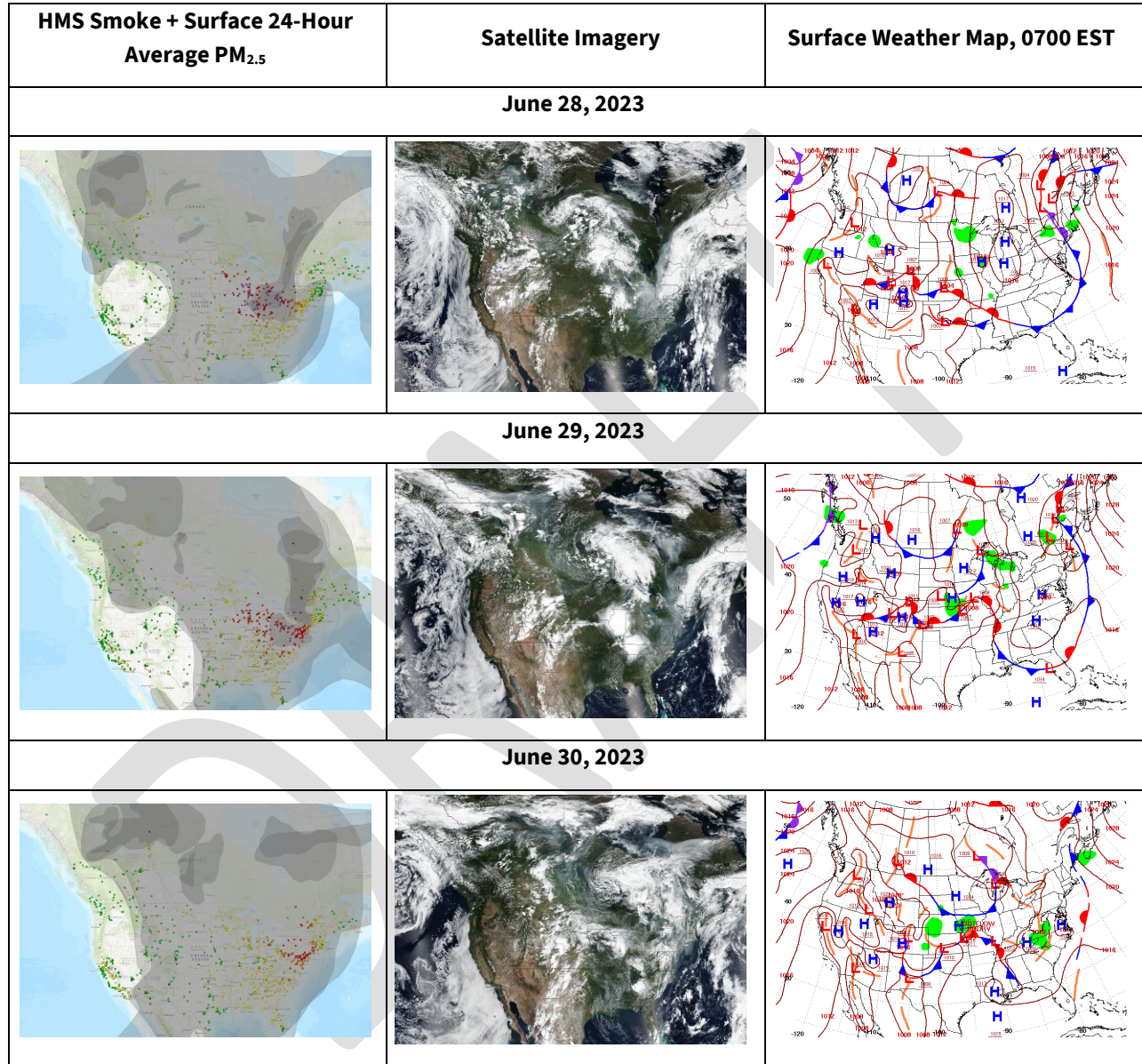
HMS Smoke + Surface 24-Hour Average PM$_{2.5}$	Satellite Imagery	Surface Weather Map, 0700 EST
June 25, 2023		
June 26, 2023		
June 27, 2023		

Figure 18. Daily average PM$_{2.5}$ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the Suomi NPP satellite imagery of cloud cover, and the surface weather map (right) during June 28-30, 2023.

HMS Smoke + Surface 24-Hour Average PM$_{2.5}$	Satellite Imagery	Surface Weather Map, 0700 EST
June 28, 2023		
June 29, 2023		
June 30, 2023		

An omega block formed in the upper air during June 25-27, which featured two strong low-pressure systems sitting over the Pacific Northwest and the northern Great Lakes blocked by a ridge of high pressure over the Great Plains, similar to the weather formations leading up to the June 17, 2023 wildfire smoke-driven PM$_{2.5}$ episode. This blocking feature allowed smoke

from Canada to transport into the Great Lakes region and build up at the surface across the region.

Starting on June 28, 2023, the low-pressure system aloft weakened and moved towards eastern Canada. As a result, a long, weak ridge of high-pressure centered in the Midwest covered most of the eastern U.S. This weak high-pressure system that persisted until the evening of June 29 produced a dry, stagnant air mass in the Great Lakes region that trapped the smoke from the Canadian fires over the region and caused high surface $PM_{2.5}$ conditions at the surface. On June 28, a large low-pressure system formed east of Lake Winnipeg in Manitoba, Canada. At the same time, two well-established meso-scale convective systems that formed in Nebraska and Kansas moved into Illinois on the morning of June 29. Between these two features, a smoke transport corridor formed across the central Great Lakes Basin that brought smoke from Quebec, Canada along with a smoke-enriched airmass from the central Canadian provinces into the region. This corridor persisted until June 30 when the smoke started to clear out of the region to the east.

2.3.3. Canadian Wildfires

Quebec continued to be in state of fire preparedness level 5 for the province in mid-June 2023. Figure 19 is a CWFIS map showing the active fires and fire hotspots in Quebec on June 25, 2023. On June 25 there were 79 active fires burning 3,003,034 acres in the province[24]. The smoke plumes arising from the wildfires and recent hotspots northeast of Matagami were located in the source region intersected by the June 27, 2023 HYSPLIT 48-hour back and forward trajectory plots shown in Figure 42 in Section 3 of this document.
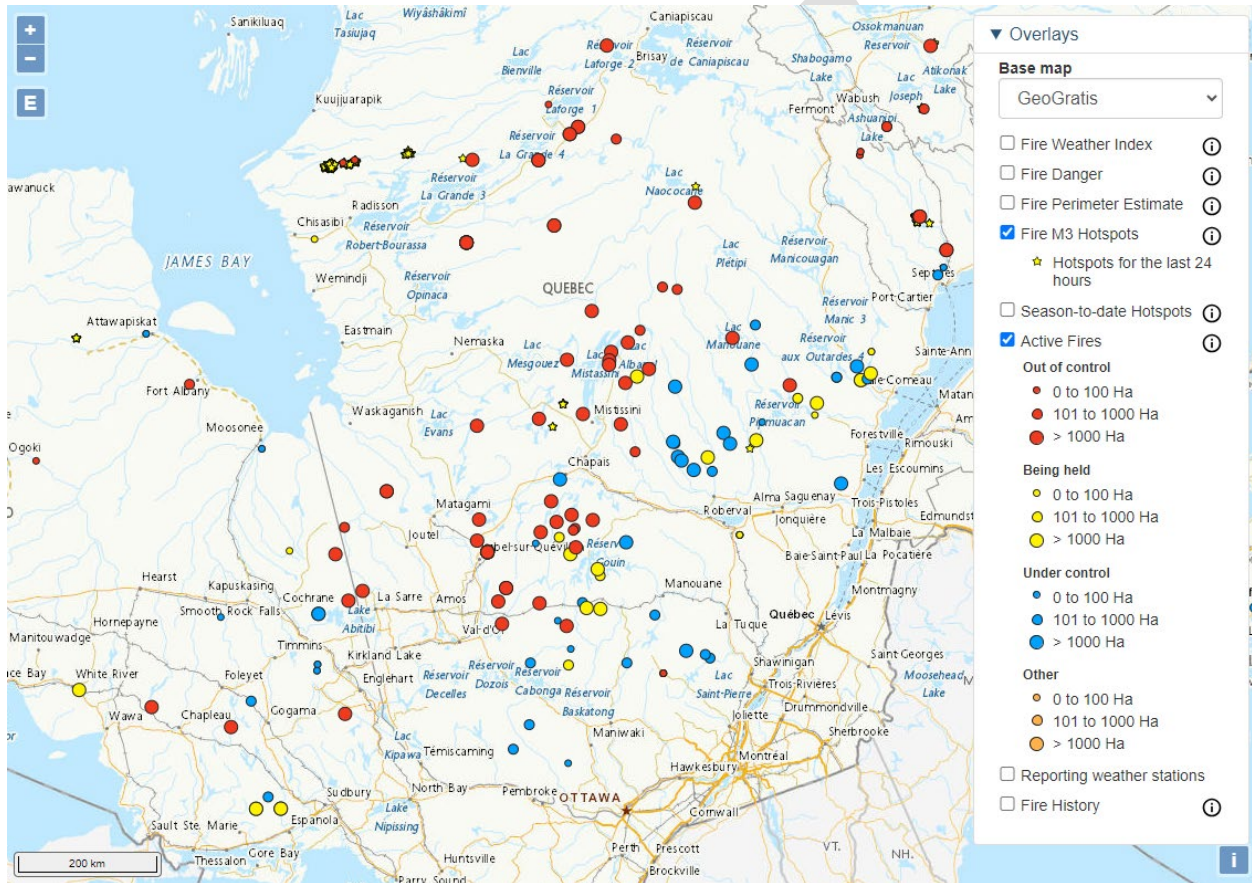
Figure 19. Map from CWFIS of active fires in Quebec on June 25, 2023.

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[24] https://ciffc.net/situation/2023-06-25
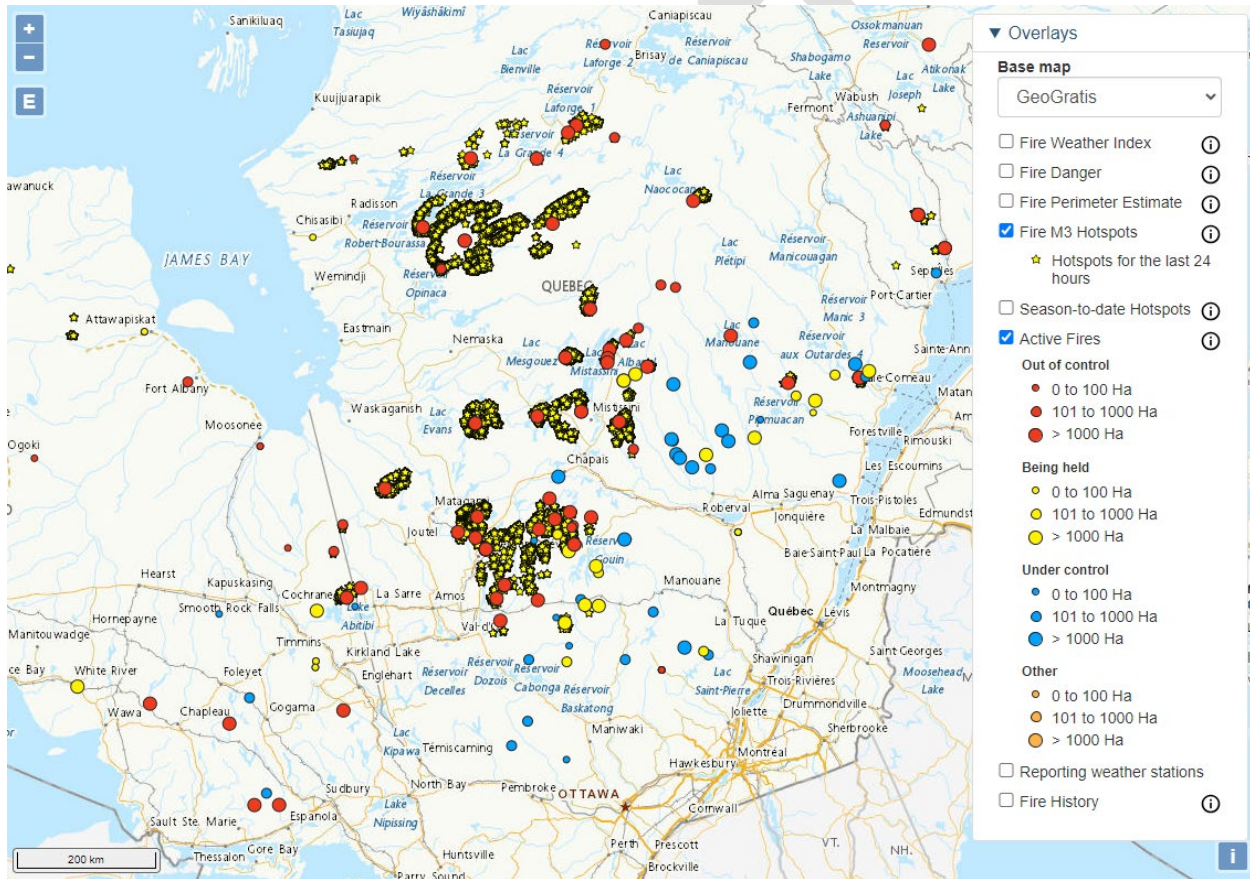
Figure 20 is a CWFIS map showing the active fires and fire hotspots in Quebec on June 26, 2023. On June 26 there were 81 active fires burning 3,013,848 acres in the province[25]. The smoke plumes arising from the wildfires and recent hotspots northeast of Matagami were located in the source region intersected by the June 28, 2023 HYSPLIT 48-hour back and forward trajectory plots shown in Figure 44 in Section 3 of this document.

Figure 20. Map from CWFIS of active fires in Quebec on June 26, 2023.

[25] https://ciffc.net/situation/2023-06-26
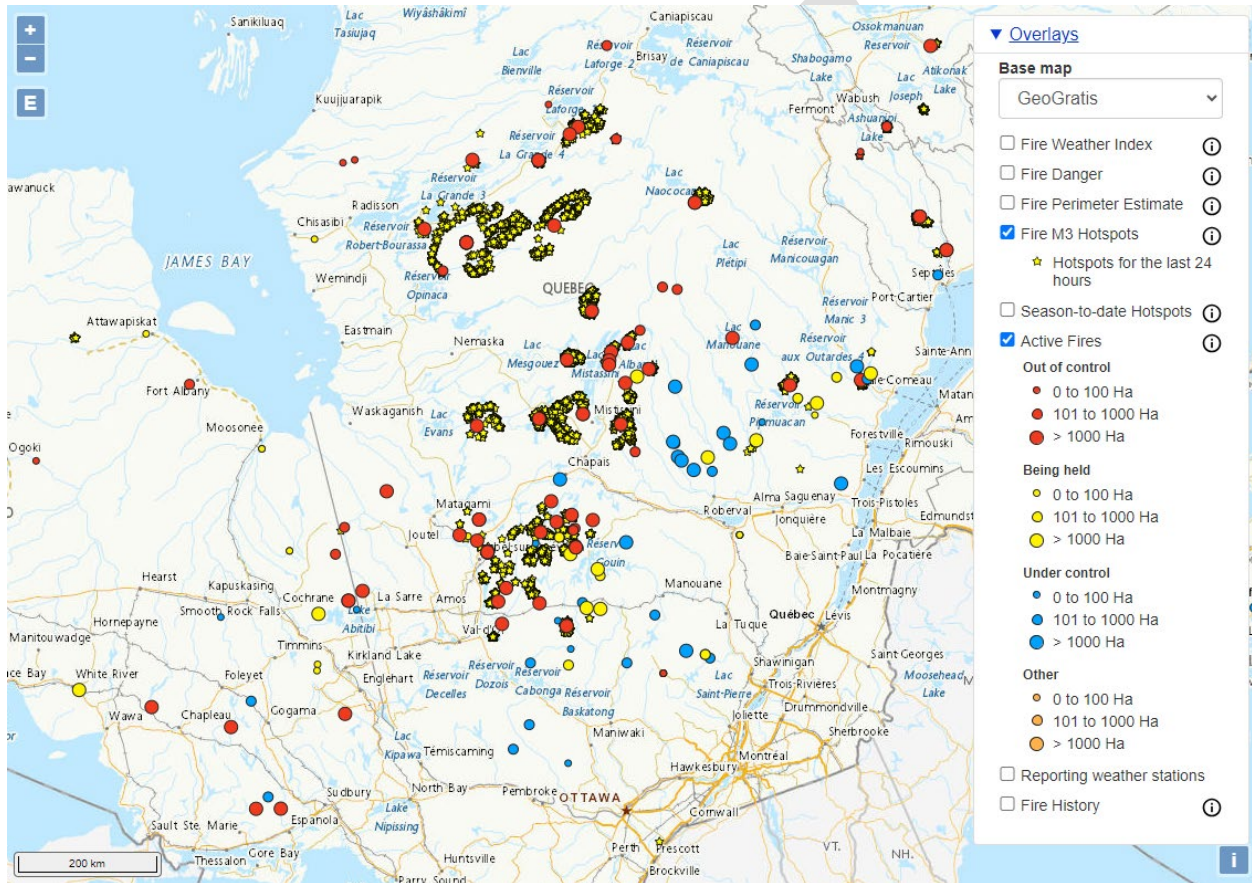
Figure 21 is a CWFIS map showing the active fires and fire hotspots in Quebec on June 27, 2023. On June 27 there were 80 active fires burning 3,200,677 acres in the province[26]. The smoke plumes arising from the wildfires and recent hotspots northeast of Chisasibi were located in the source region intersected by the June 29, 2023 HYSPLIT 48-hour back and forward trajectory plots shown in Figure 46 in Section 3 of this document.

Figure 21. Map from CWFIS of active fires in Quebec on June 27, 2023.

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[26] https://ciffc.net/situation/2023-06-27

Figure 22 is a CWFIS map showing the active fires and fire hotspots in Quebec on June 28, 2023. On June 28 there were 76 active fires burning 3,425,162 acres in the province[27]. However, the smoke plumes arising from the wildfires in Quebec had already reached the Canton area and begun to affect local air quality by June 28, and the stalled airmass containing this wildfire smoke was situated over northeastern Ohio through midday June 30.

Figure 22. Map from CWFIS of active fires in Quebec on June 28, 2023.
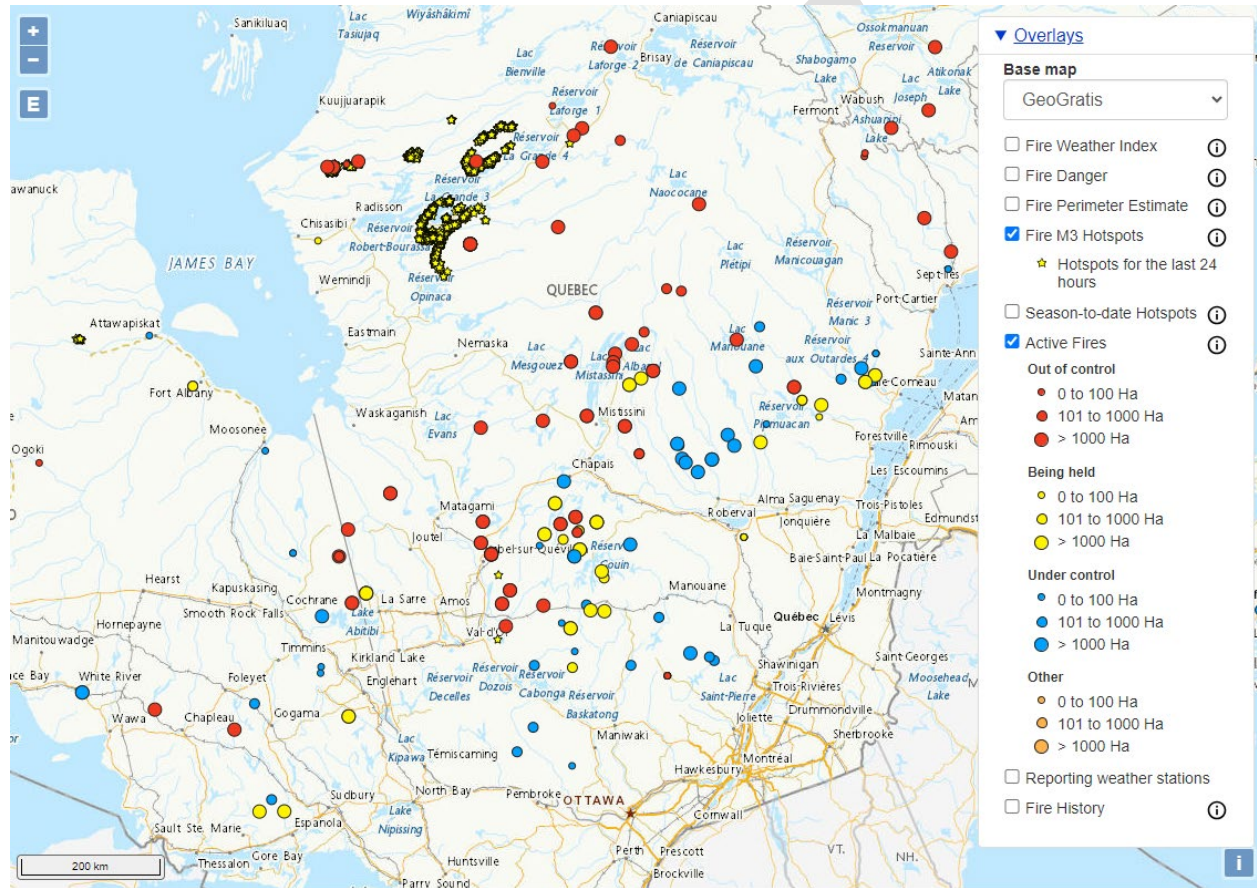
2.3.4. Media Coverage

Similar to the media and messaging coverage shown for the earlier wildfire smoke-driven PM$_{2.5}$ episodes, Table 5 illustrates the severe nature of the June 27-30, 2023 PM$_{2.5}$ pollution episode in the Great Lakes region and northeastern Ohio in particular, and serves as further

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[27] https://ciffc.net/situation/2023-06-28

evidence that the June 27-30, 2023 episode was not local in nature but driven by transported wildfire smoke from Canada that blanketed the region.

Table 5. News media reporting of the June 27-30, 2023 Canadian wildfire smoke episode in the Great Lakes region.

Date	Source	Headline
June 27, 2023	Axios	Smoke from historic Canadian wildfires again triggers air alerts across U.S.[28]
June 28, 2023	Ideastream Public Media	When will the wildfire smoke clear in Northeast Ohio?[29]
June 28, 2023	The Canton Repository	Canton, Northeast Ohio remain under Air Quality Advisory from wildfires in Canada[30]
June 29, 2023	The New York Times	Smoke from Canada fires stretches from Midwest to East Coast[31]
June 29, 2023	Cleveland.com	Air quality remains poor in Cleveland area as Canadian wildfire smoke lingers[32]
June 30, 2023	CNN	Smoke from Canadian wildfires is still wafting south. Conditions for some are expected to improve soon[33]
June 30, 2023	WHBC	Canton–Massillon Air Quality Index sets record[34]

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[28] https://www.axios.com/2023/06/27/smoke-unprecedented-canadian-wildfires-chokes-upper-midwest

[29] https://www.ideastream.org/health/2023-06-28/state-of-cuyahoga-county-address-postponed-due-to-unhealthy-air-quality

[30] https://www.cantonrep.com/story/news/local/stark-county/2023/06/28/unhealthy-air-quality-in-canton-ohio-made-by-canadian-wildfires/70365554007

[31] https://www.nytimes.com/live/2023/06/29/nyregion/canada-wildfires-air-quality-smoke

[32] https://www.cleveland.com/metro/2023/06/air-quality-remains-poor-in-cleveland-area-as-canadian-wildfire-smoke-lingers.html

[33] https://www.cnn.com/2023/06/30/weather/canada-wildfire-smoke-great-lakes-friday/index.html

[34] https://www.whbc.com/canton-massillon-air-quality-index-sets-record

2.4. July 16-17, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

2.4.1. Episode Description

Air quality in the Canton–Massillon, OH MSA was impacted from July 16-17, 2023 by wildfire smoke entering the region from northern Alberta, Canada. Smoke plumes impacted the Canton–Massillon, OH MSA during multiple episodes in the summer of 2023, including the July 16-17 episode. Figure 23 and Figure 24 show the daily average PM$_{2.5}$ concentrations for the years 2019-2023 at the Canton and Canton Fire St8 monitoring sites, respectively, in the Canton–Massillon, OH MSA. These figures illustrate the severity of the wildfire smoke-driven PM$_{2.5}$ episodes in the summer of 2023 relative to other periods of the year and compared to the same period in the past five years. Data collected during the July 16-17, 2023 wildfire smoke-driven PM$_{2.5}$ episode are labeled in each figure.

Figure 23. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton (39-151-0020) monitoring site in the Canton–Massillon, OH MSA, with data from the July 16-17, 2023 episode labeled.
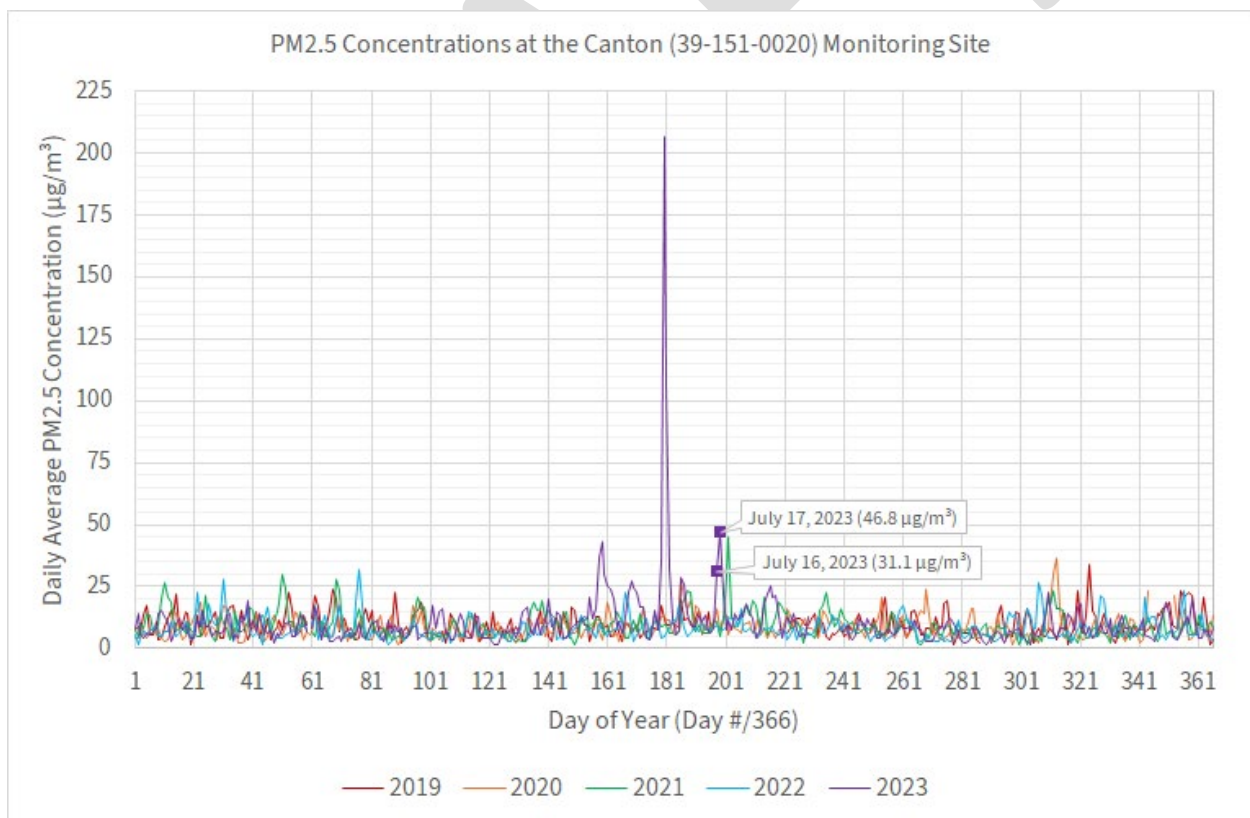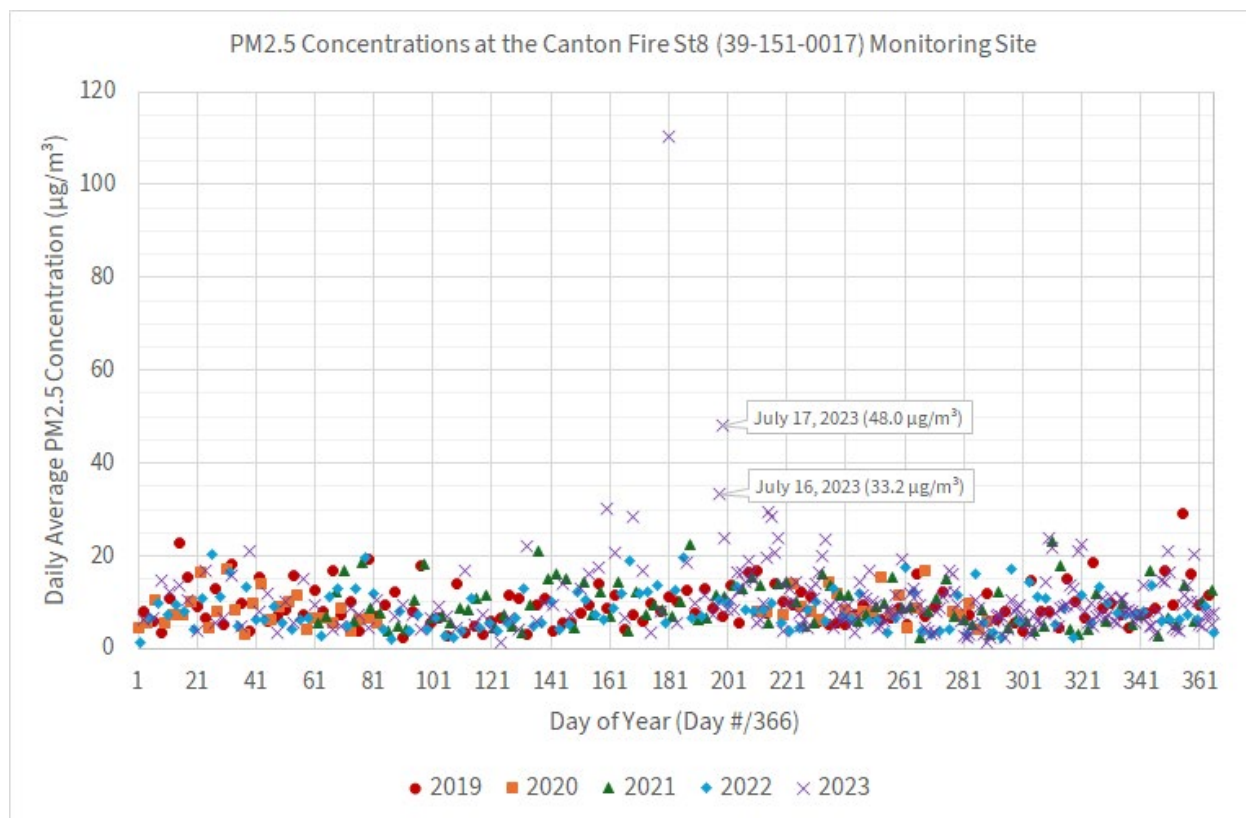
Figure 24. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton Fire St8 (39-151-0017) monitoring site in the Canton–Massillon, OH MSA, with data from the July 16-17, 2023 episode labeled.

2.4.2. Meteorology

From July 13-18, 2023, distinct airmass transport patterns connected the Midwest with western Canada and brought smoke into the Ohio Valley, including the Canton–Massillon, OH MSA. Figure 25 shows Hazard Mapping System (HMS) smoke maps, daily average PM$_{2.5}$ concentrations, satellite imagery, and surface weather maps for July 13-15, 2023, while Figure 26 shows the same for July 16-18, 2023. During July, a cyclonic (e.g., counterclockwise) circulation around a large low-pressure system centered on northern Manitoba carried smoke into the Midwest from source regions in northern Alberta, Canada. Thick smoke from the Canadian wildfires was transported along the trailing edge of the low-pressure system as it moved southeast through Ontario and Quebec.

Figure 25. Daily average PM$_{2.5}$ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the NOAA-20 satellite imagery of cloud cover, and the surface weather map (right) during July 13-15, 2023.
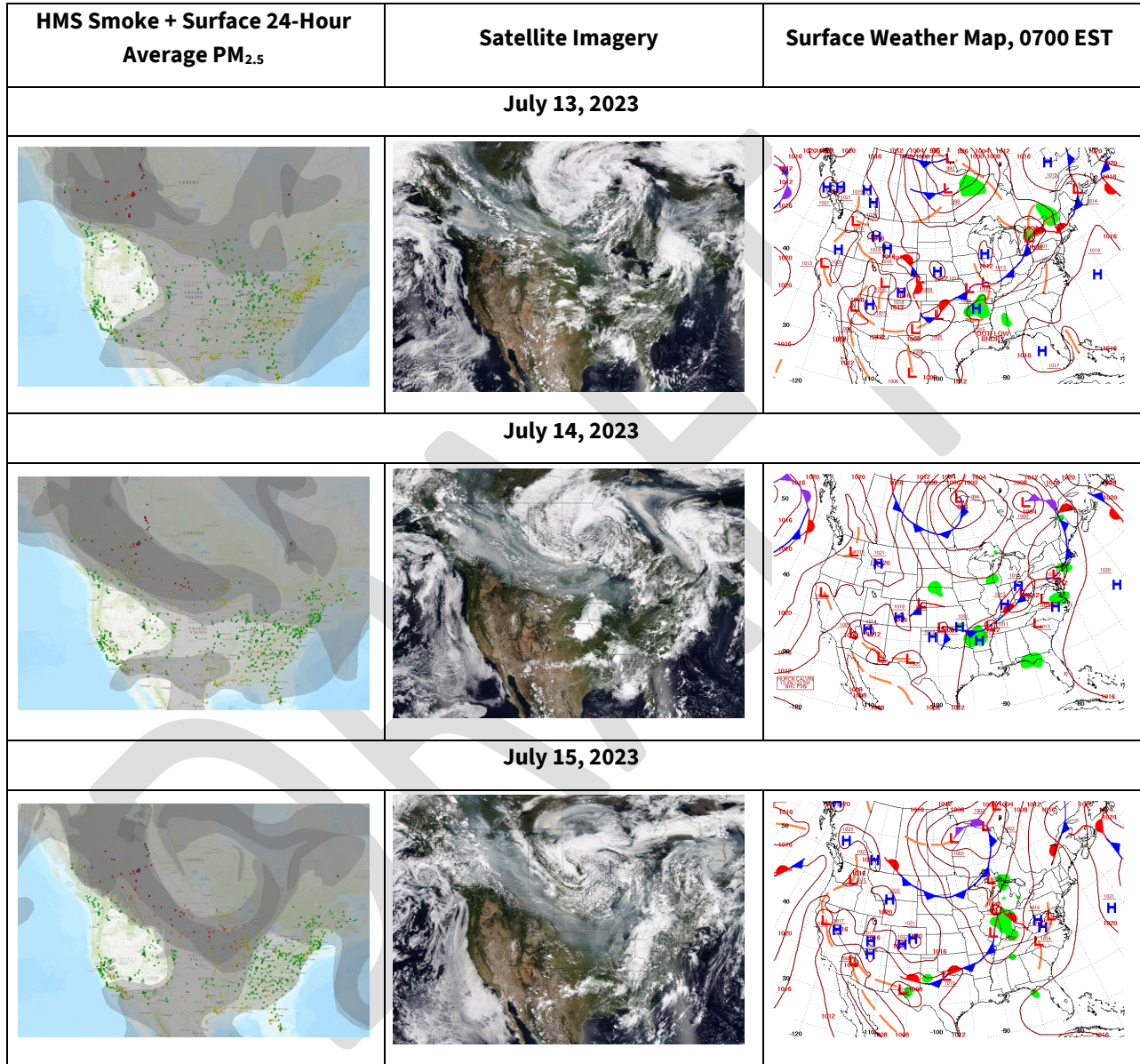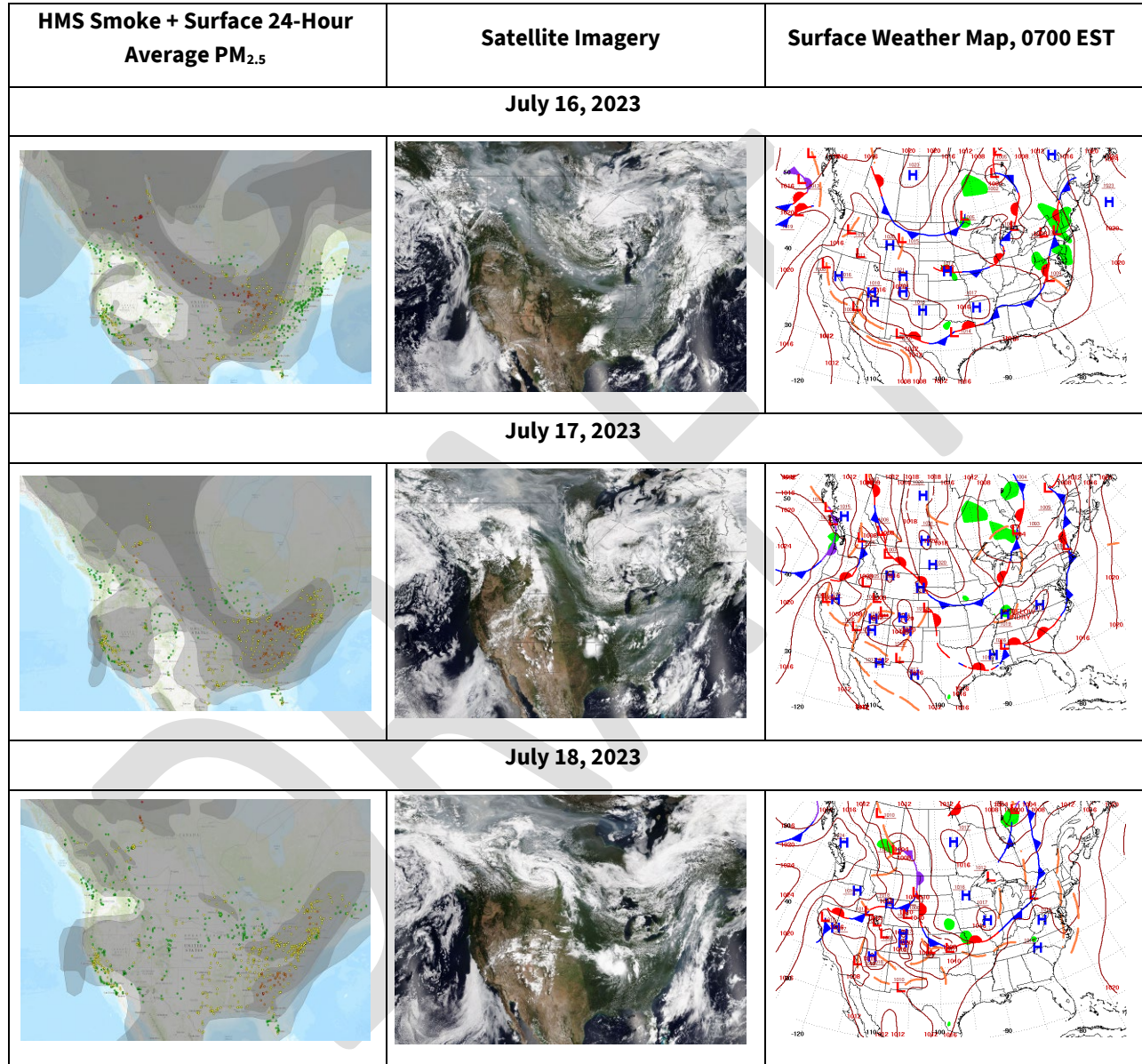
HMS Smoke + Surface 24-Hour Average PM$_{2.5}$	Satellite Imagery	Surface Weather Map, 0700 EST
July 13, 2023		
July 14, 2023		
July 15, 2023		

Figure 26. Daily average PM₂.₅ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the NOAA-20 satellite imagery of cloud cover, and the surface weather map (right) during July 16-18, 2023.

HMS Smoke + Surface 24-Hour Average PM₂.₅	Satellite Imagery	Surface Weather Map, 0700 EST
July 16, 2023		
July 17, 2023		
July 18, 2023		

An omega block formed in the upper air during July 13-15, which featured two strong low-pressure systems off the coast of British Columbia and over northern Manitoba, blocked by a ridge of high pressure stretching from the Northwest Territories, through British Columbia and Alberta, down to northern Wyoming. This blocking feature, though weakened, remained

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through July 17, allowing wildfire smoke from northern Alberta to be transported into the Midwest and the Ohio Valley and build up at the surface across the region.

Starting on July 15, 2023, the low-pressure system over Manitoba weakened and moved towards the Great Lakes. As a result, the ridge of high-pressure slowly pushed the trapped wildfire smoke eastward towards the Ohio Valley. This weak high-pressure system stalled on July 16-17 behind a stationary front over the Ohio Valley that trapped the Canadian wildfire smoke over the region, causing high $PM_{2.5}$ concentrations at the surface. By July 18, the omega block had dissipated, and a cold front extending from a low-pressure system over James Bay pushed through the northern Ohio Valley, clearing most of the wildfire smoke from the region.

2.4.3. Canadian Wildfires

On June 1, 2023, the Alberta provincial fire management authority, Alberta Wildfire[35], reported to CIFFC a fire preparedness level 5 for the province, which is the highest alert level in Canada for mobilizing resources to fight wildfires and protect life and structures[36]. The province remained at a level 5 alert continuously until it was lowered to level 4 on June 20, at which it remained until it was again lowered to level 3 on July 29. Starting on July 5, 2023, CWFIS began to report very high and extreme fire danger conditions across most of Mackenzie County and Wood Buffalo National Park in northern Alberta. The area above the 57th parallel in northern Alberta remained almost continuously under high to extreme fire danger through most of the month. On July 2, 2023, the Saskatchewan provincial fire management authority, the Saskatchewan Public Safety Agency[37], reported to CIFFC a fire preparedness level 3 for the province[38]. Saskatchewan remained at a fire preparedness level 3 until it was lowered to level 2 on August 4, 2023. On July 10, 2023, the British Columbia provincial fire management authority, the British Columbia Wildfire Service[39], reported to CIFFC a fire preparedness level 5 for the province[40]. British Columbia remained at a fire prepared level 5 until it was lowered to level 4 on September 5, 2023.

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[35] https://www.alberta.ca/alberta-wildfire

[36] https://ciffc.net/situation/2023-06-01

[37] https://www.saskpublicsafety.ca

[38] https://ciffc.net/situation/2023-07-02

[39] https://www2.gov.bc.ca/gov/content/safety/wildfire-status

[40] https://ciffc.net/situation/2023-07-10
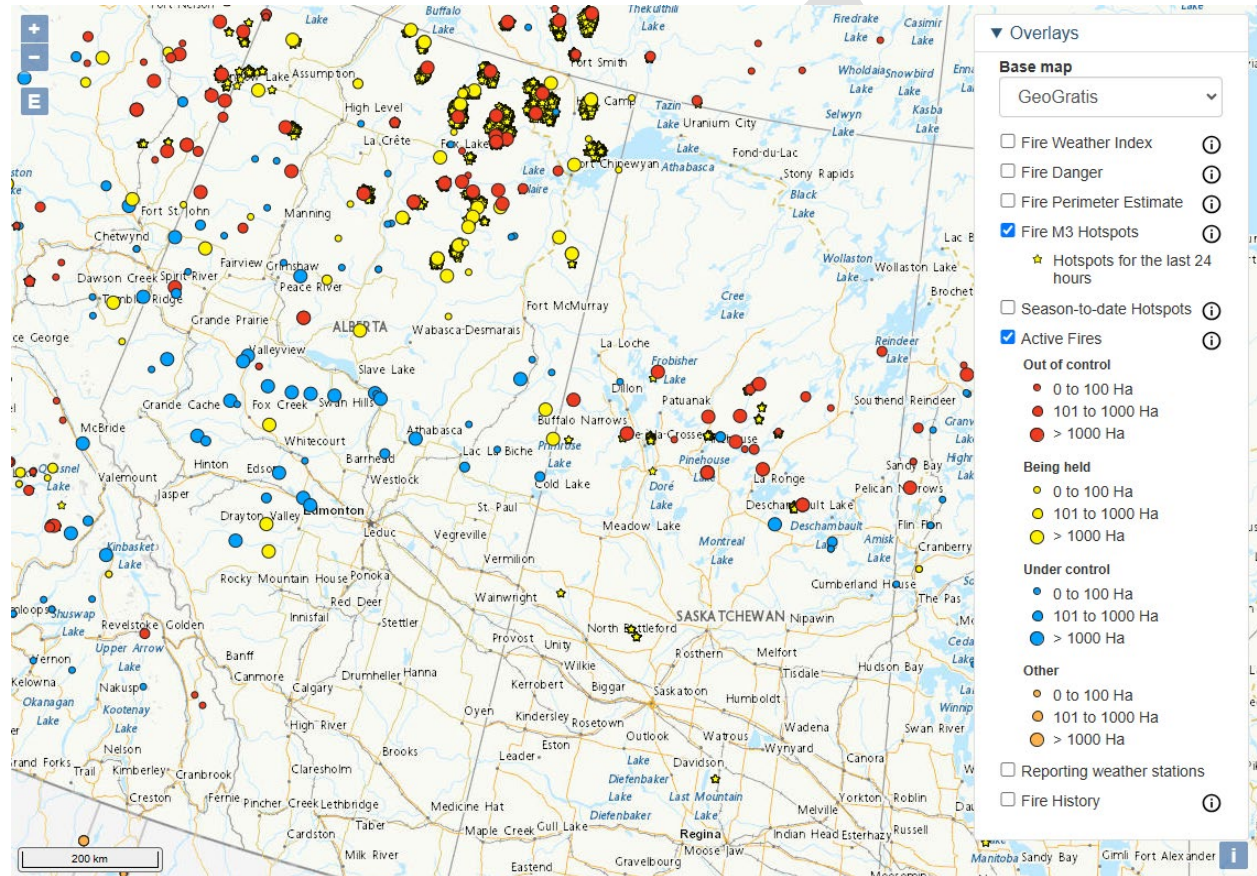
Figure 27 is a CWFIS map showing the active fires and fire hotspots in Alberta n July 13, 2023. On July 13 there were 120 active fires burning 3,819,839 acres in Alberta[41]. The smoke plumes arising from the wildfires and recent hotspots northeast of High Level, Alberta were located in the source regions intersected by the July 16, 2023 HYSPLIT 72-hour back and forward trajectory plots shown in Figure 50 in Section 3 of this document.

Figure 27. Map from CWFIS of active fires in Alberta and Saskatchewan on July 13, 2023.

[41] https://ciffc.net/situation/2023-07-13

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Figure 28 is a CWFIS map showing the active fires and fire hotspots in Alberta and British Columbia on July 14, 2023. On July 14 there were 119 active fires burning 3,935,763 acres in Alberta, while there were 296 active fires burning 2,227,668 acres across British Columbia[42]. The smoke plumes arising from the wildfires and recent hotspots west of High Level, Alberta and northwest of Prince George, British Columbia were located in the source regions intersected by the July 17, 2023 HYSPLIT 72-hour back and forward trajectory plots shown in Figure 52 in Section 3 of this document.

Figure 28. Map from CWFIS of active fires in Alberta and British Columbia on July 14, 2023.
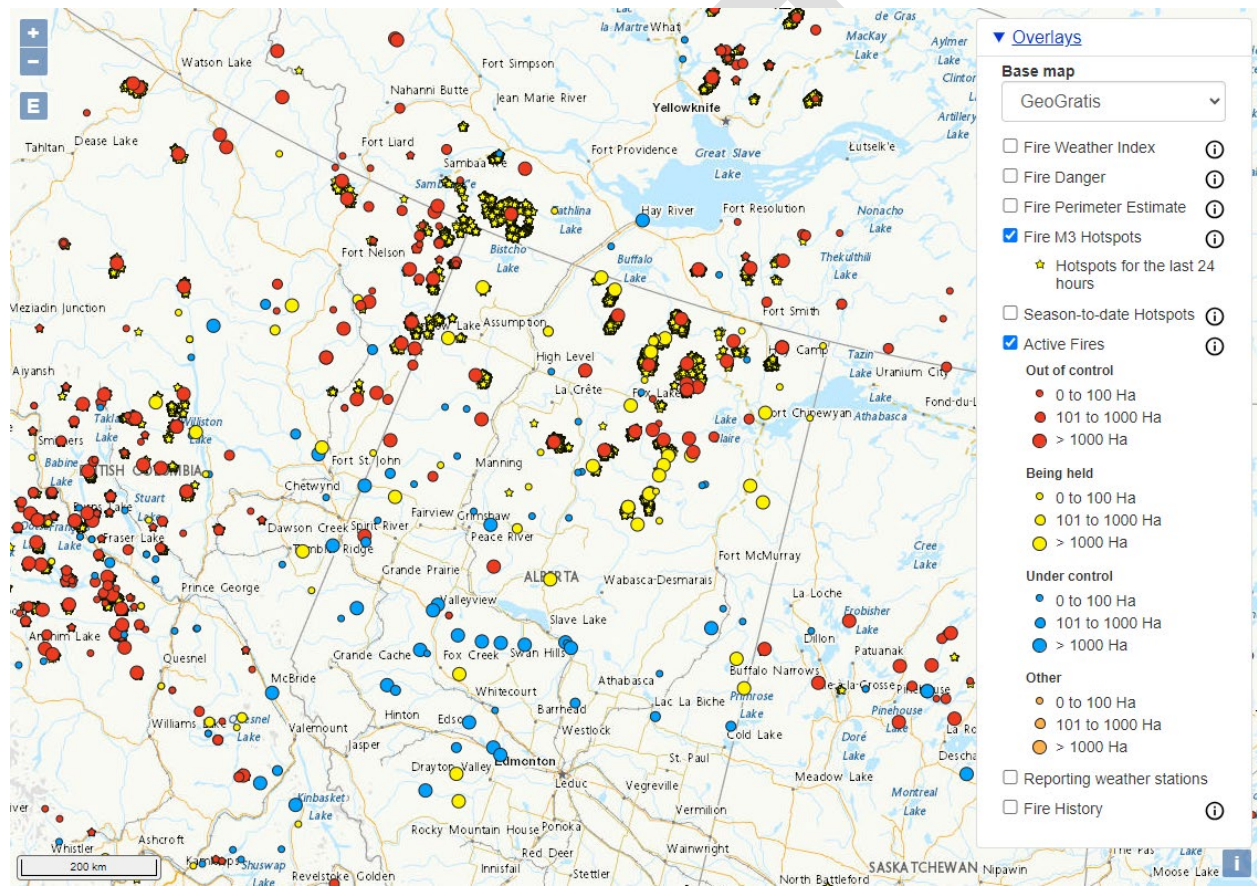
2.4.4. Media Coverage

Similar to the media and messaging coverage shown for the earlier wildfire smoke-driven PM$_{2.5}$ episodes, Table 6 illustrates the severe nature of the July 16-17, 2023 PM$_{2.5}$ pollution

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[42] https://ciffc.net/situation/2023-07-14

episode in the Great Lakes region and northeastern Ohio in particular, and serves as further evidence that the July 16-17, 2023 episode was not local in nature but driven by transported wildfire smoke from Canada that blanketed the region.

Table 6. News media reporting of the July 16-17, 2023 Canadian wildfire smoke episode in the Great Lakes region.

Date	Source	Headline
July 14, 2023	CNN	A new outbreak of Canadian wildfires is sending a plume of unhealthy smoke into the US yet again[43]
July 15, 2023	Spectrum News 1 Ohio	Wildfire smoke takes aim at Ohio Valley again this weekend[44]
July 16, 2023	WTRF	Wildfire smoke returns to the Ohio Valley Monday[45]
July 16, 2023	USA Today	Canada wildfire smoke targets air quality in Midwest, Great Lakes. What to know this week.[46]
July 17, 2023	The Canton Repository	Canadian wildfires prompt new air quality alert in Stark County; relief coming[47]
July 17, 2023	The New York Times	Smoke pollution from Canadian wildfires blankets U.S. cities, again[48]
July 18, 2023	The Washington Post	Wildfire smoke is easing in Eastern U.S. but more is building in Canada[49]

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[43] https://www.cnn.com/2023/07/14/us/canada-wildfire-smoke-us-air-quality/index.html

[44] https://spectrumnews1.com/oh/columbus/weather/2023/07/15/wildfire-smoke-to-return-to-the-region-this-weekend

[45] https://www.wtrf.com/weather/wildfire-smoke-returns-to-the-ohio-valley-monday

[46] https://www.usatoday.com/story/news/nation/2023/07/16/canadian-wildfire-smoke-air-quality/70417933007

[47] https://www.cantonrep.com/story/news/local/2023/07/17/cantons-alliance-massillon-air-quality-listed-as-unhealthy-due-to-canada-wildfires/70419720007

[48] https://www.nytimes.com/2023/07/17/us/wildfire-smoke-canada-ny-air-quality.html

[49] https://www.washingtonpost.com/weather/2023/07/18/smoke-forecast-unhealthy-air-quality-ease-eastern-us

2.5. August 2-3, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

2.5.1. Episode Description

Air quality in the Canton–Massillon, OH MSA was impacted from August 2-3, 2023 by wildfire smoke entering the region from the area near Lake Athabasca in northwestern Saskatchewan, Canada. Smoke plumes impacted the Canton–Massillon, OH MSA during multiple episodes in the summer of 2023, including the August 2-3 episode. Figure 29 shows the daily average PM$_{2.5}$ concentrations for the years 2019-2023 at the Canton Fire St8 monitoring sites in the Canton–Massillon, OH MSA. This figure illustrates the severity of the wildfire smoke-driven PM$_{2.5}$ episodes in the summer of 2023 relative to other periods of the year and compared to the same period in the past five years. Data collected during the August 2-3, 2023 wildfire smoke-driven PM$_{2.5}$ episode are labeled in the figure.

Figure 29. 2019-2023 daily average PM$_{2.5}$ concentrations at the Canton Fire St8 (39-151-0017) monitoring site in the Canton–Massillon, OH MSA, with data from the August 2-3, 2023 episode labeled.
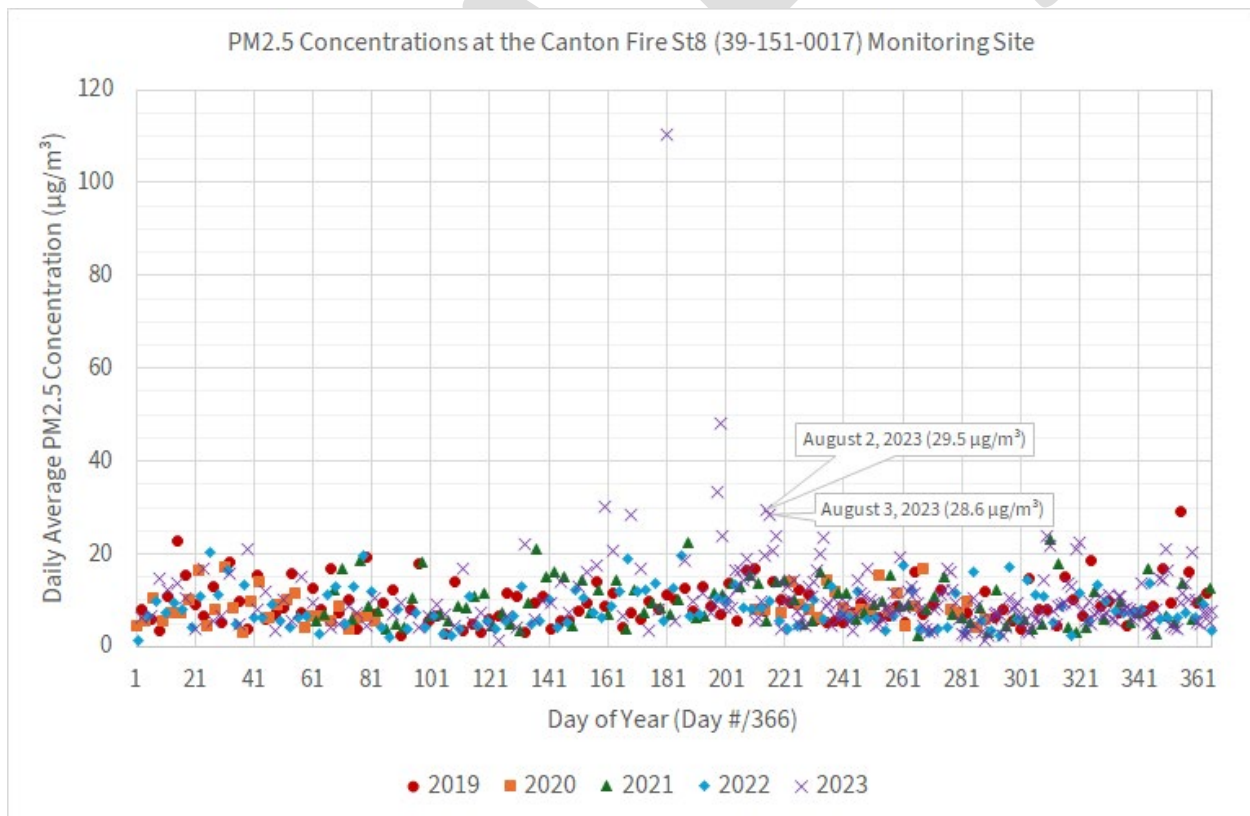
2.5.2. Meteorology

From July 28 to August 4, 2023, distinct airmass transport patterns connected the Midwest with western Canada and brought wildfire smoke into the Great Lakes region, including the Canton–Massillon, OH MSA. Figure 30 shows Hazard Mapping System (HMS) smoke maps, daily average $PM_{2.5}$ concentrations, satellite imagery, and surface weather maps for July 30 – August 1, 2023, while Figure 31 shows the same for August 2-4, 2023. On July 28, a large high-pressure system over Alberta, picking up wildfire smoke from northern Alberta. Over July 28-30, as the high-pressure system carrying wildfire smoke slowly moved southeast, a large low-pressure system with cyclonic circulation formed over James Bay, creating a wind transport corridor between the two systems for wildfire smoke to travel from northern Alberta down toward the Great Lakes. By August 1, the wildfire smoke following this wind transport corridor had covered the Great Lakes region and slowly moved eastward through August 4, when a cold front from a separate low-pressure system that formed east of James Bay pushed the wildfire smoke out from the Great Lakes region.

Figure 30. Daily average PM₂.₅ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the NOAA-20 satellite imagery of cloud cover, and the surface weather map (right) during July 30 – August 1, 2023.
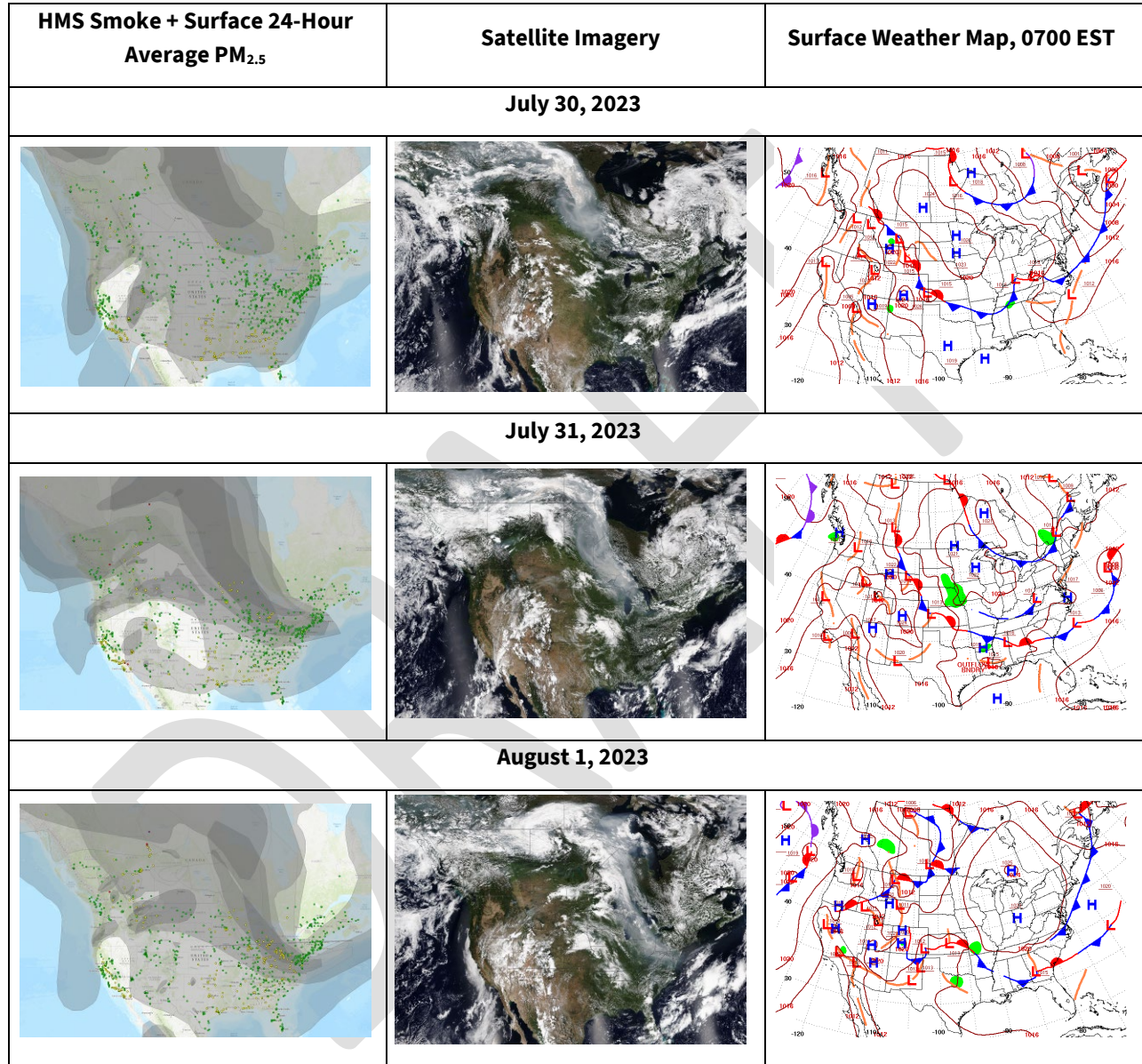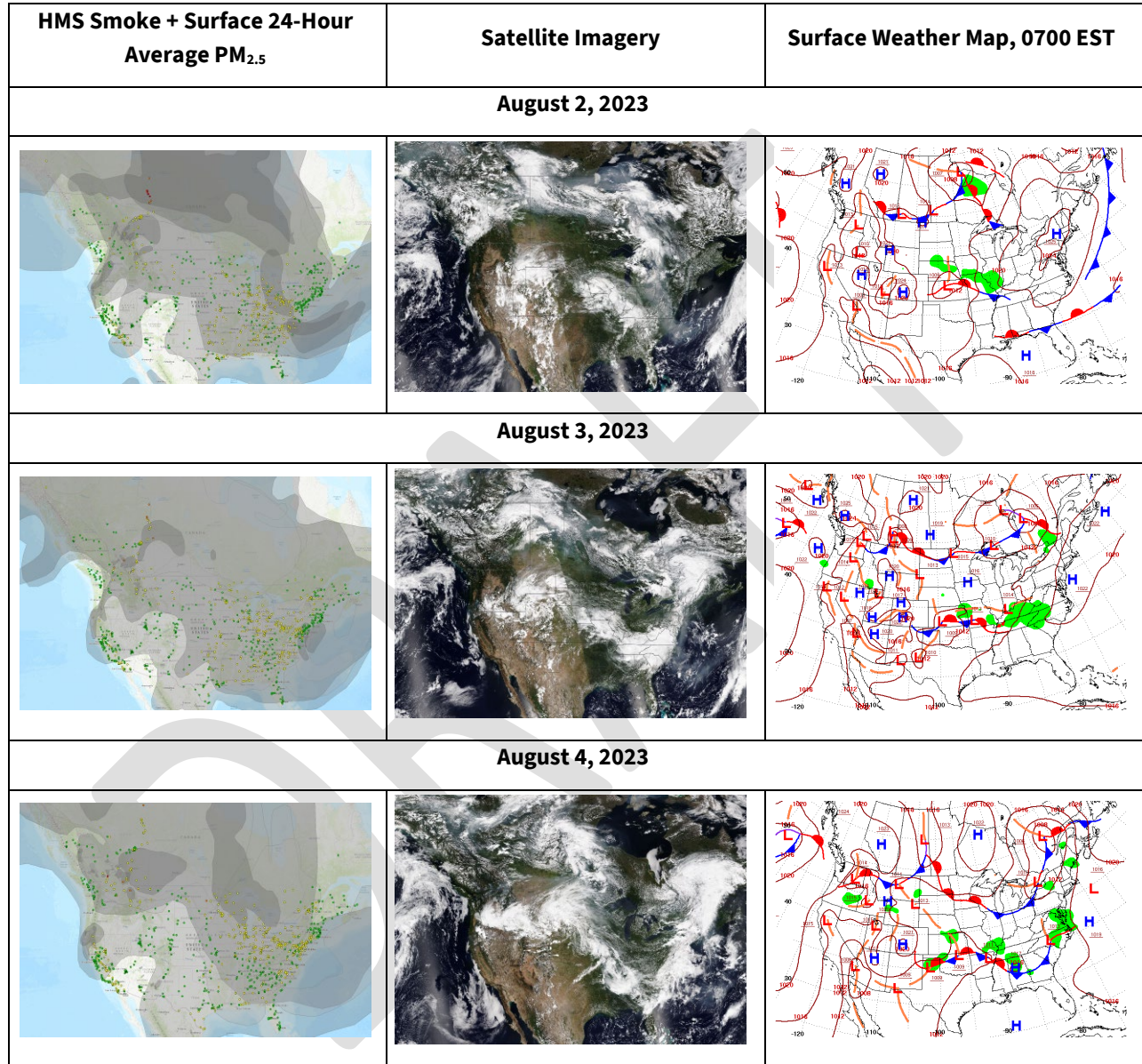
| HMS Smoke + Surface 24-Hour Average PM₂.₅	Satellite Imagery	Surface Weather Map, 0700 EST
July 30, 2023		
July 31, 2023		
August 1, 2023		

Figure 31. Daily average PM₂.₅ concentrations overlapped with NOAA's Hazard Mapping System (HMS) smoke layers (left), daily snapshot of the NOAA-20 satellite imagery of cloud cover, and the surface weather map (right) during August 2-4, 2023.

HMS Smoke + Surface 24-Hour Average PM₂.₅	Satellite Imagery	Surface Weather Map, 0700 EST
August 2, 2023		
August 3, 2023		
August 4, 2023		

2.5.3. Canadian Wildfires

Throughout July 2023, the Saskatchewan Public Safety Agency reported to CIFFC a fire preparedness level of 3 or higher for the province[50]. From July 27 to August 4, 2023, the Manitoba provincial fire management authority, the Manitoba Wildfire Service[51], reported to CIFFC a fire preparedness level 3 for the province. From July 28-30, 2023, CWFIS reported high, very high, and extreme fire danger conditions across most of northern Saskatchewan. Very high and extreme fire danger conditions were also reported during this period for northeastern Alberta and the southeastern portion of the Northwest Territories, while high fire danger conditions were reported in portions of central Manitoba.

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[50] https://ciffc.net/situation/2023-07-31

[51] https://www.gov.mb.ca/nrnd/wildfire_program/index.html

Figure 32 is a CWFIS map showing the active fires and fire hotspots in Manitoba, Saskatchewan, northern Alberta, and the southeastern portion of the Northwest Territories on July 30, 2023. On July 30 there were 12 active fires burning 353,118 acres in Saskatchewan, 9 active fires burning 103,754 acres in Manitoba, 123 active fires burning 4,376,185 acres in Alberta, and 24 active fires burning 292,480 acres in the Northwest Territories[52]. The smoke plumes arising from the wildfires and recent hotspots north of Wollaston Lake in Saskatchewan and southeast of Thompson, Manitoba were located in the source regions intersected by the August 2, 2023 HYSPLIT 72-hour back and forward trajectory plots shown in Figure 54 in Section 3 of this document.

Figure 32. Map from CWFIS of active fires in Manitoba, Saskatchewan, northern Alberta, and the southeastern portion of the Northwest Territories on July 30, 2023.

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[52] https://ciffc.net/situation/2023-07-30
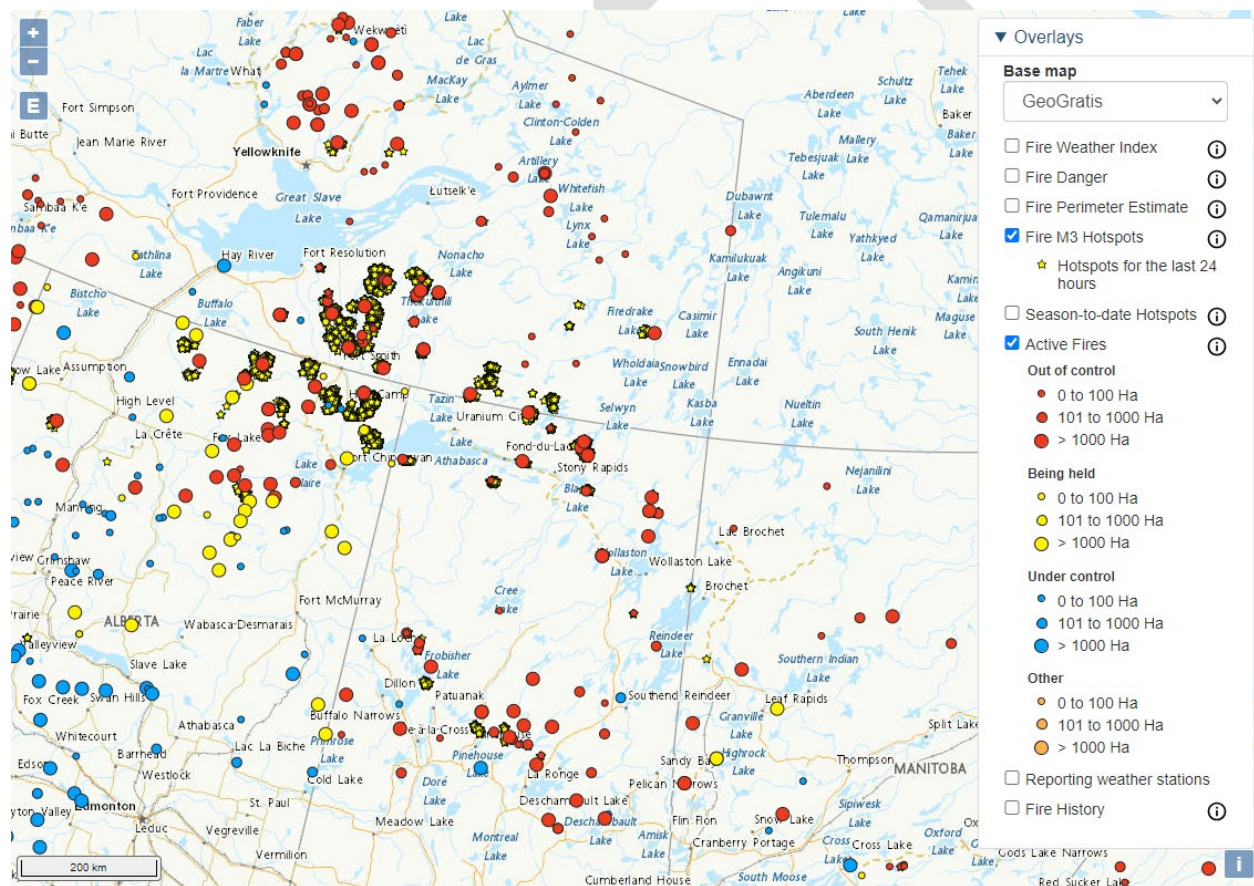
Figure 33 is a CWFIS map showing the active fires and fire hotspots in Manitoba, Saskatchewan, northern Alberta, and the southeastern portion of the Northwest Territories on July 31, 2023. On July 31 there were 12 active fires burning 353,118 acres in Saskatchewan, 9 active fires burning 103,754 acres in Manitoba, 125 active fires burning 4,416,544 acres in Alberta, and 24 active fires burning 292,478 acres in the Northwest Territories[53]. The smoke plumes arising from the wildfires and recent hotspots # were located in the source regions intersected by the August 3, 2023 HYSPLIT 72-hour back trajectory plot shown in Figure 56 in Section 3 of this document.

Figure 33. Map from CWFIS of active fires in Manitoba, Saskatchewan, northern Alberta, and the southeastern portion of the Northwest Territories on July 31, 2023.

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[53] https://ciffc.net/situation/2023-07-30
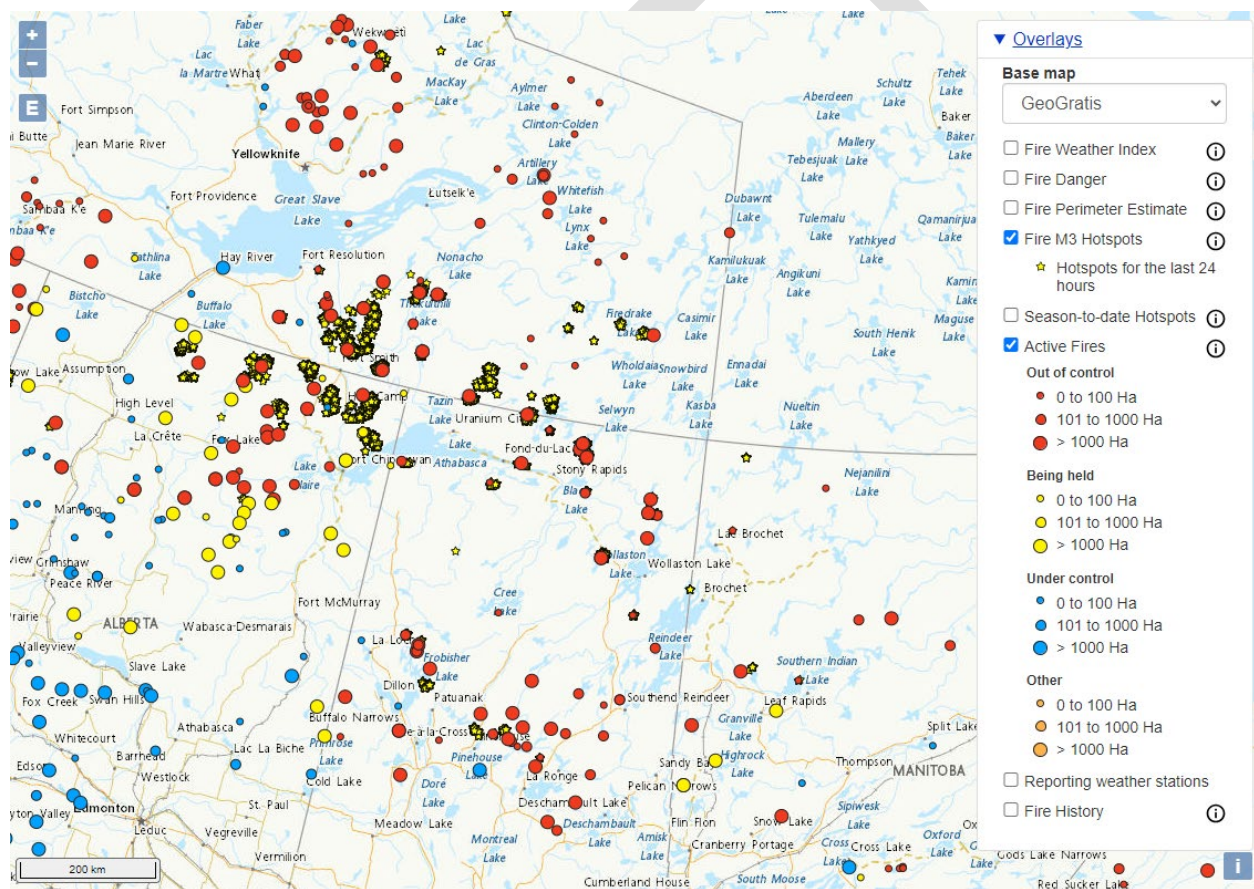
2.5.4. Media Coverage

Similar to the media and messaging coverage shown for the earlier wildfire smoke-driven $PM_{2.5}$ episodes, Table 7 illustrates the severe nature of the August 2-3, 2023 $PM_{2.5}$ pollution episode in the Great Lakes region and northeastern Ohio in particular, and serves as further evidence that the August 2-3, 2023 episode was not local in nature but driven by transported wildfire smoke from Canada that blanketed the region.

Table 7. News media reporting of the August 2-3, 2023 Canadian wildfire smoke in the Great Lakes region.

Date	Source	Headline
August 1, 2023	WLWT	Smoke and haze events could be the new future for Cincinnati[54]
August 1, 2023	WOIO	Northeast Ohio weather: Cooler-than-normal tonight; haze lingers through tomorrow[55]
August 1, 2023	AccuWeather	Wildfire smoke is back in the Midwest, Northeast. Here's what you need to know[56]
August 2, 2023	MLive.com	Satellite imagery shows wildfire smoke drifting through the Great Lakes[57]
August 2, 2023	The Akron Beacon Journal	No alert issued in Summit County for moderate air quality caused by Canadian, US wildfires[58]
August 2, 2023	WTTE	Columbus Weather: Wildfire smoke around Wednesday, but so is sunshine[59]

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[54] https://www.wlwt.com/article/smoke-haze-events-cincinnati-new-future-normal/44699991

[55] https://www.cleveland19.com/2023/08/01/northeast-ohio-weather-hazy-sun-today-due-canada-wildfire-smoke

[56] https://www.accuweather.com/en/health-wellness/wildfire-smoke-is-back-in-the-midwest-northeast-heres-what-you-need-to-know/1566180

[57] https://www.mlive.com/weather/2023/08/satellite-imagery-shows-wildfire-smoke-drifting-through-the-great-lakes.html

[58] https://www.beaconjournal.com/story/news/2023/08/02/akron-ohio-aqi-moderate-air-quality-caused-by-canadian-us-wildfires/70512049007

[59] https://myfox28columbus.com/newsletter-daily/columbus-weather-central-ohio-wx-sarah-converse-forecast-wildfire-smoke-around-wednesday-but-so-is-sunshine

3. Clear Causal Relationship

While the regional wildfire smoke episodes spanned multiple days in the summer of 2023, the Canton–Massillon, OH MSA experienced some of the worst smoke impacts during the June 6-8, June 17, June 27-30, July 16-17, and August 2-3 episodes. The impacts of these wildfire smoke episodes on the Canton–Massillon, OH MSA are clearly seen in satellite imagery, remote sensing products, and surface $PM_{2.5}$ monitors. The figures in this section that are used to establish the clear and causal relationship between the Canadian wildfires and the $PM_{2.5}$ pollution episodes in the Canton–Massillon, OH MSA show data from AirNowTech.org and include the following information:

- Hazard Mapping System (HMS) smoke layers and fire locations for all wildfire smoke-driven $PM_{2.5}$ episodes
- Air Quality System (AQS) 24-hour average $PM_{2.5}$ surface concentrations for all wildfire smoke-driven $PM_{2.5}$ episodes
- HYSPLIT 48-hour back trajectories released at 50, 250, and 1000 meters for $PM_{2.5}$ episodes driven by smoke from wildfires in Quebec and eastern Ontario (June 6-8, June 17, and June 27-30, 2023)
- HYSPLIT 48-hour forward trajectories corresponding to back trajectories for $PM_{2.5}$ episodes driven by smoke from wildfires in Quebec and eastern Ontario (June 6-8, June 17, and June 27-30, 2023)
- HYSPLIT 72-hour back trajectories released at 250, 1000, and 1500 meters (for July 16-17, 2023) and 500, 1500, and 2000 meters (for August 2-3, 2023) for $PM_{2.5}$ episodes driven by longer range, slower transport of higher altitude smoke from wildfires in central and western Canada
- HYSPLIT 72-hour forward trajectories corresponding to back trajectories for $PM_{2.5}$ episodes driven by longer range, slower transport of higher altitude smoke from wildfires in central and Western Canada (July 16-17 and August 2-3, 2023)

NASA Worldview[60] data are also used in this section, and include the following information:

- Aerosol optical depth (AOD) from the MODIS combined Terra and Aqua Multi-Angle Implementation of Atmospheric Correction (MAIAC) Land Aerosol Optical Depth level 2

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[60] https://worldview.earthdata.nasa.gov

product, with black denoting no data and darker, redder color signifying greater AOD values (left plots)

- Moderate Resolution Imaging Spectroradiometer (MODIS) Terra/Aqua corrected reflectance (true color) and NOAA-20 Visible Infrared Imaging Radiometer Suite (VIIRS) Fire and Thermal Anomalies (day and night, 375m) layer showing active fire detections and thermal anomalies (right plots)

The clear causal relationship between the 2023 Canadian wildfires and $PM_{2.5}$ concentrations in the Canton–Massillon, OH MSA for the wildfire smoke-driven $PM_{2.5}$ episodes from June 6-8, June 17, June 27-30, July 16-17, and August 2-3 are presented in this section. Clear causal relationship descriptions are presented separately for each episode.

3.1. June 6-8, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

3.1.1. June 6, 2023

The HYSPLIT 48-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 6, 2023. Figure 34 shows the HYSPLIT 48-hour back trajectory plot for June 6, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 6, as well as the HYSPLIT 48-hour forward trajectory plot for June 4, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 4. The wildfire and smoke locations 60 km (37 mi) west of Pembroke, Ontario coincide with the endpoint (at 1005 meters above ground level, AGL) of the 50-meter release height back trajectory from Canton and the Canton area is the endpoint (at 32 meters AGL) of the 1000-meter release height forward trajectory from those wildfires. The wildfire and smoke locations 65 km (40 mi) east of Val-d'Or, Quebec coincide with the endpoint (at 2034 meters AGL) of the 250-meter release height back trajectory from Canton and Canton is the endpoint (at 229 meters AGL) of the 2000-meter release height forward trajectory from those wildfires. The coincidence of the 48-hour back and forward trajectories between the wildfire locations and the Canton area serves as clear evidence that the smoke from the wildfires in Ontario and Quebec caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 6, 2023. The accompanying AOD and imagery maps for June 6 presented in Figure 35 provide further evidence that dense smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on June 6, 2023, and that this wildfire smoke was the cause of the high concentrations of PM$_{2.5}$ at the monitoring sites.

Figure 34. HYSPLIT 48-hour back trajectory plot from June 6, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 6, 2023 (top), and HYSPLIT 48-hour forward trajectory plot from June 4, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 4, 2023 (bottom).
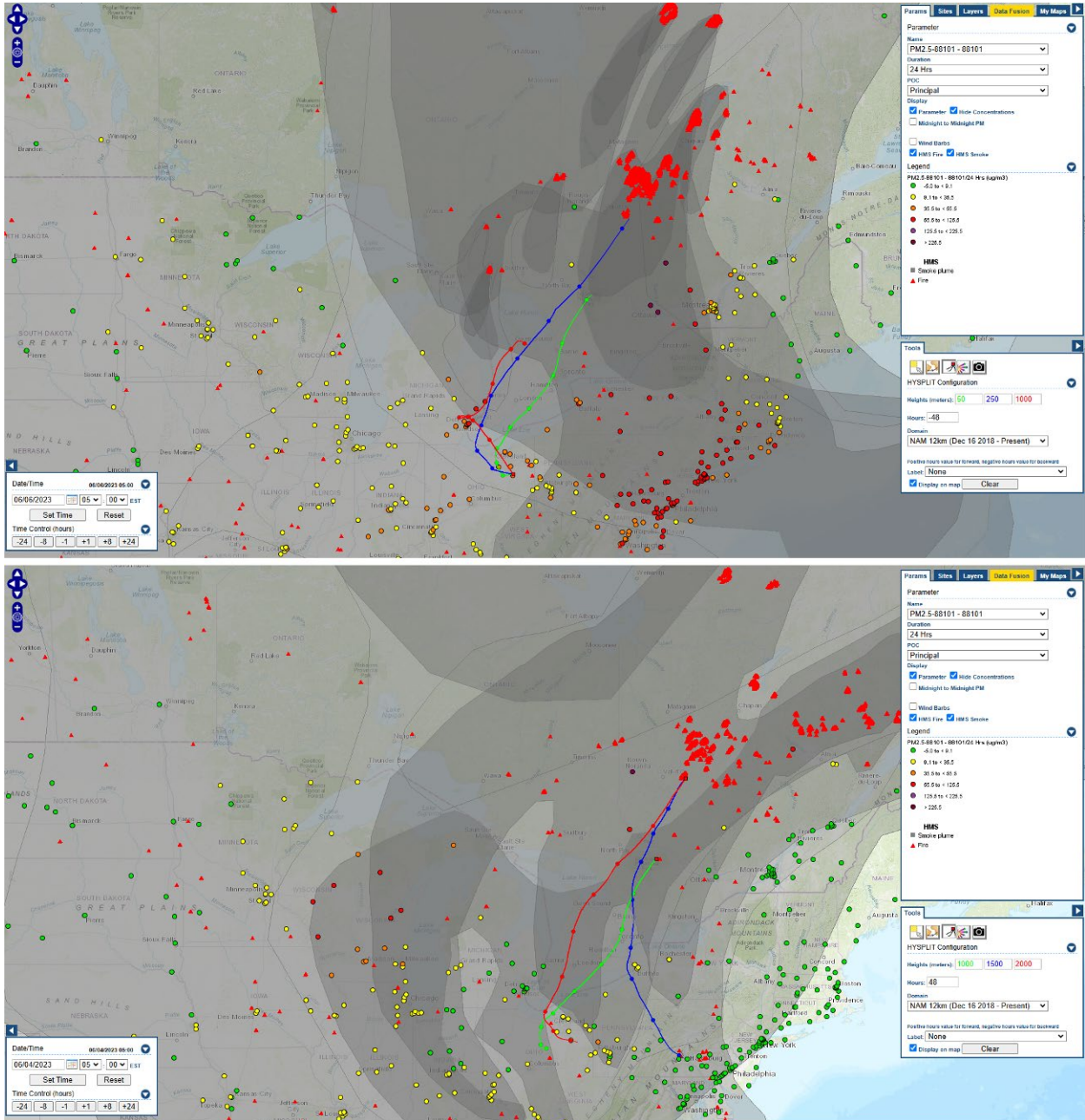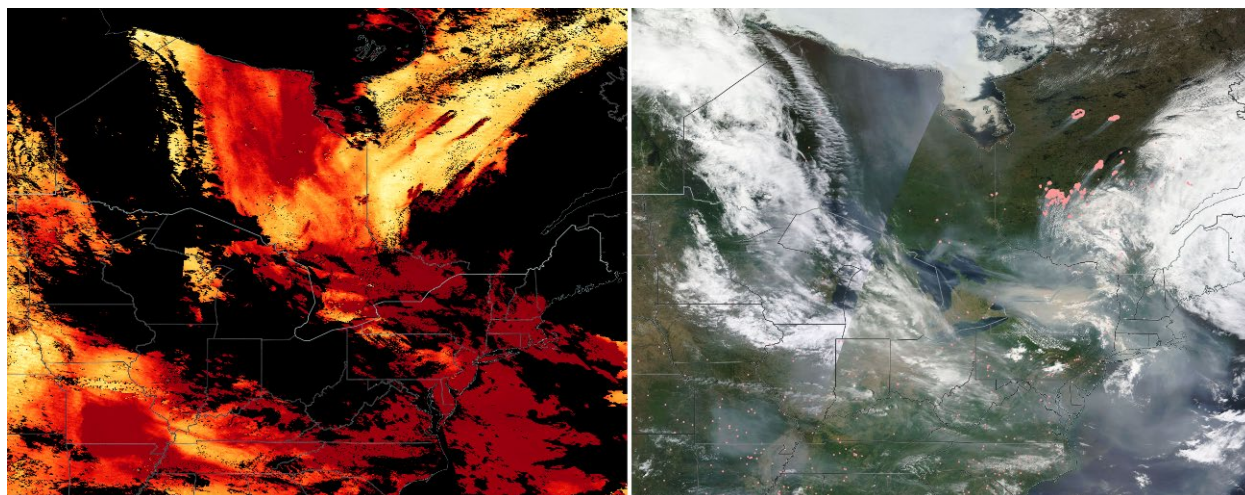
Figure 35. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for June 6, 2023.

3.1.2. June 7, 2023

The HYSPLIT 48-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 7, 2023. Figure 36 shows the HYSPLIT 48-hour back trajectory plot for June 7, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 7, as well as the HYSPLIT 48-hour forward trajectory plot for June 5, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 5. The wildfire and smoke locations 225 km (140 mi) east of Wemindji, Quebec coincide with the point (at 512 meters AGL) at 15:00 Eastern Standard Time (EST) on June 5 of the 250-meter release height back trajectory from Canton and the 500-meter release height forward trajectory from those wildfires at 15:00 EST on June 5 reaches Canton (at 259 meters AGL) at 02:00 EST on June 7. The wildfire and smoke locations 225 km (140 mi) east of Wemindji, Quebec coincide with the point (at 1709 meters AGL) at 15:00 EST on June 5 of the 1000-meter release height back trajectory from Canton and the 2000-meter release height forward trajectory from those wildfires at 15:00 EST on June 5 reaches Canton (at 994 meters AGL) at 02:00 EST on June 7. The coincidence of the 48-hour back and forward trajectories between the wildfire locations and the Canton area serves as clear evidence that the smoke from the wildfires in Quebec caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 7, 2023. The accompanying AOD and imagery maps for June 7 presented in Figure 37 provide further evidence that dense

smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on June 7, 2023, and that this wildfire smoke was the cause of the high concentrations of PM$_{2.5}$ at the monitoring sites.

Figure 36. HYSPLIT 48-hour back trajectory plot from June 7, 2023, with fire locations, monitored surface PM$_{2.5}$ c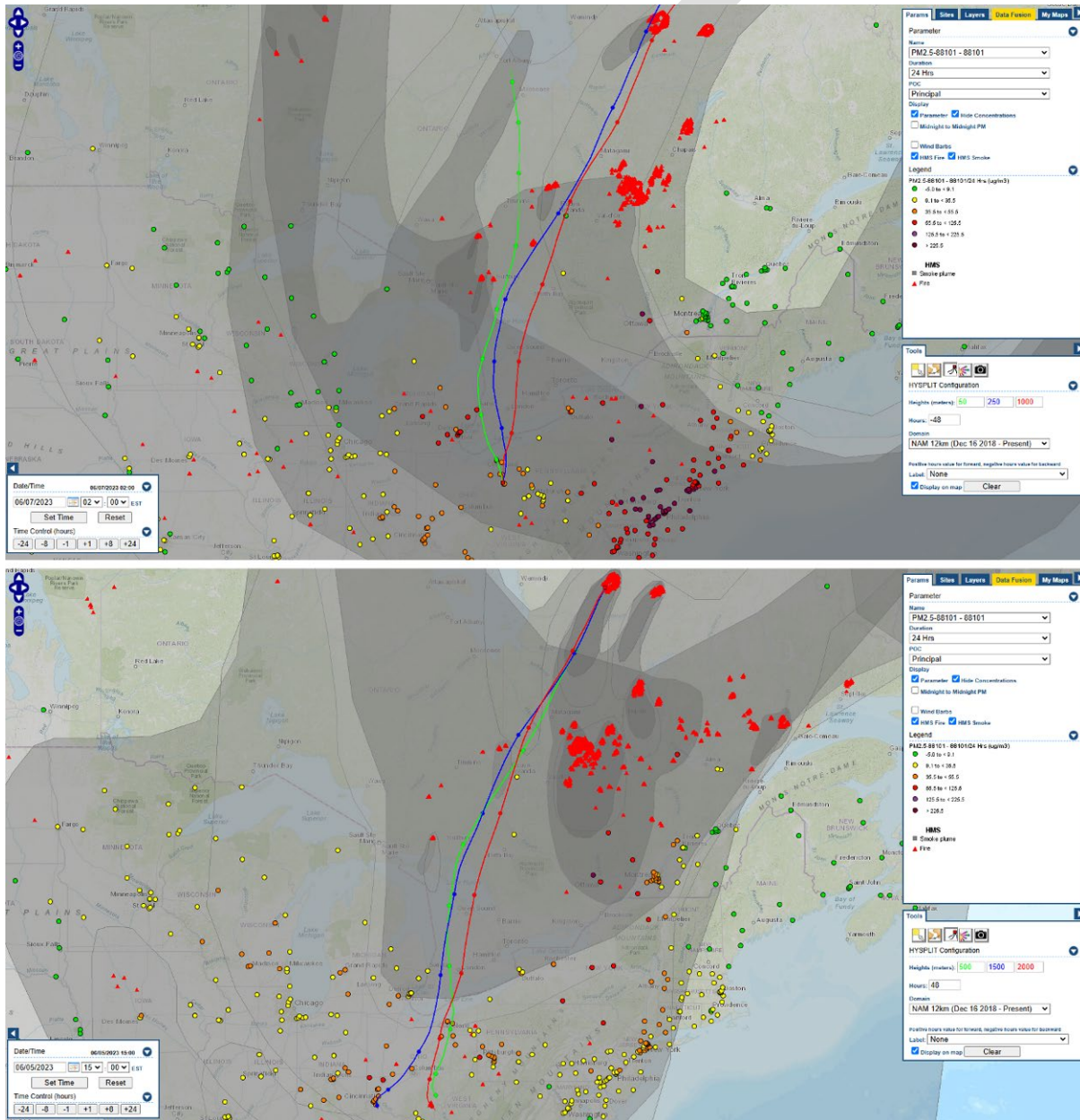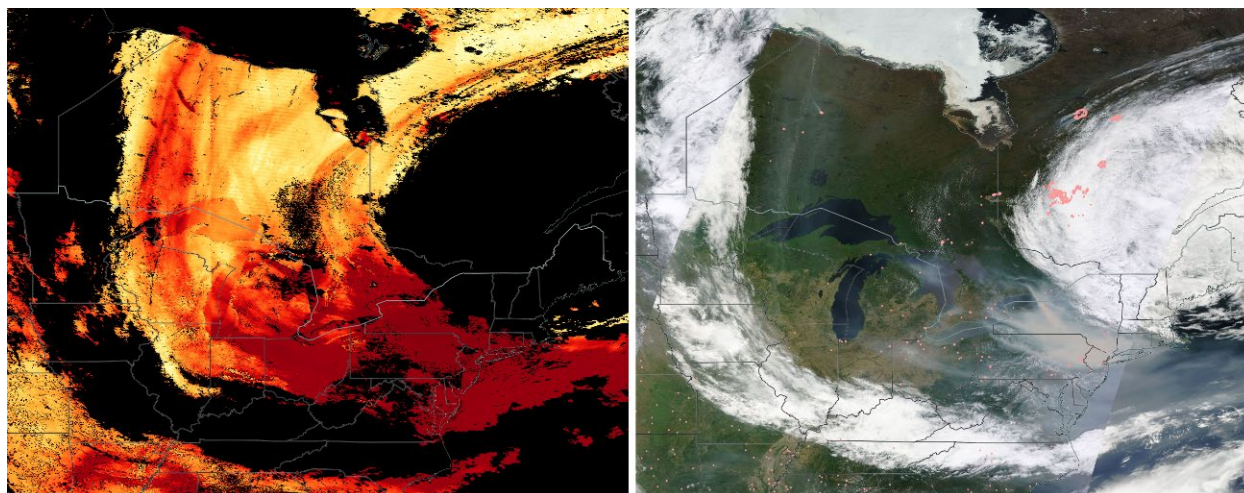oncentrations, and HMS smoke polygons for June 7, 2023 (top), and HYSPLIT 48-hour forward trajectory plot from June 5, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 5, 2023 (bottom).

Figure 37. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for June 7, 2023.

3.1.3. June 8, 2023

The HYSPLIT 48-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 8, 2023. Figure 38 shows the HYSPLIT 48-hour back trajectory plot for June 8, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 8, as well as the HYSPLIT 48-hour forward trajectory plot for June 6, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 6. The wildfire and smoke locations 225 km (140 mi) east of Wemindji, Quebec coincide with the point (at 1029 meters AGL) at 16:00 EST on June 6 of the 250-meter release height back trajectory from Canton and the 1000-meter release height forward trajectory from those wildfires at 16:00 EST on June 6 reaches Canton (at 339 meters AGL) at 03:00 EST on June 8. The wildfire and smoke locations 225 km (140 mi) east of Wemindji, Quebec coincide with the point (at 1878 meters AGL) at 16:00 EST on June 6 of the 1000-meter release height back trajectory from Canton and the 2000-meter release height forward trajectory from those wildfires at 16:00 EST on June 6 reaches Canton (at 743 meters AGL) at 03:00 EST on June 8. The coincidence of the 48-hour back and forward trajectories between the wildfire locations and the Canton area serves as clear evidence that the smoke from the wildfires in Quebec caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 8, 2023. The accompanying AOD and imagery maps for June 8 presented in Figure 39 provide further evidence that dense smoke from the Canadian

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wildfires was present in the Canton–Massillon, OH MSA on June 8, 2023, and that this wildfire smoke was the cause of the high concentrations of PM$_{2.5}$ at the monitoring sites.

Figure 38. HYSPLIT 48-hour back trajectory plot from June 8, 2023, with fire locations, monitored surface PM$_{2.5}$ c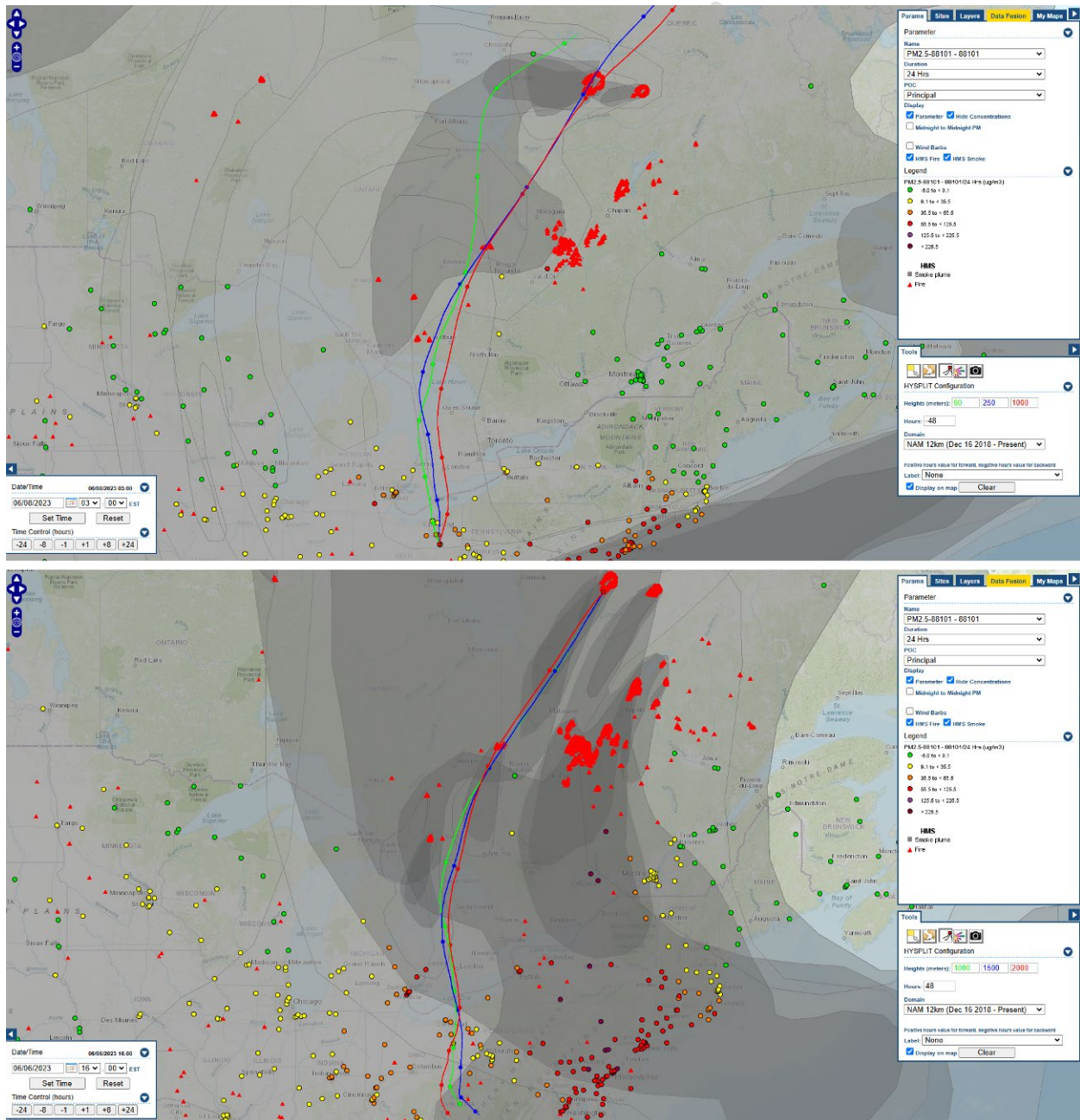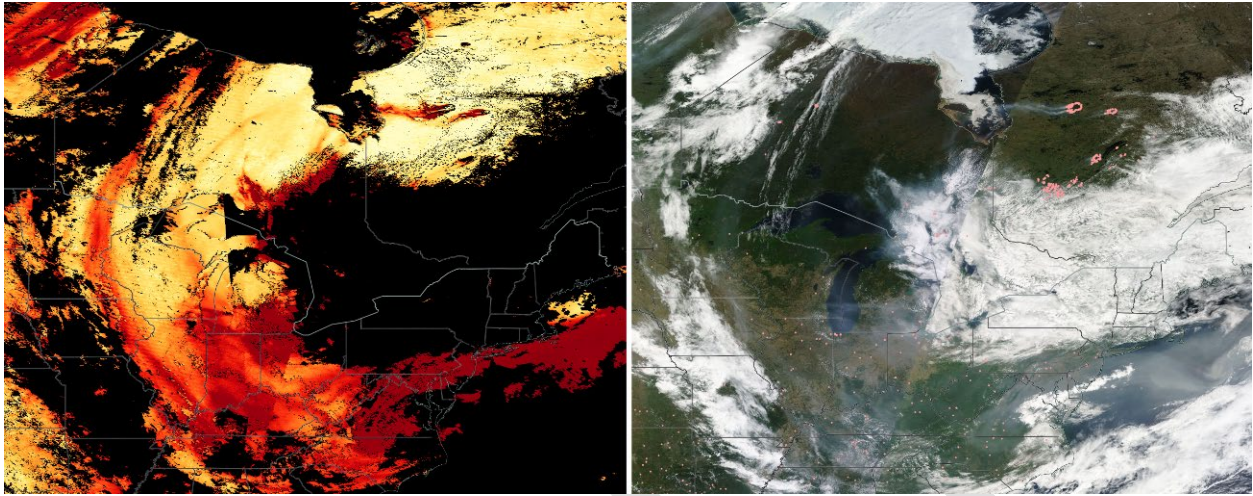oncentrations, and HMS smoke polygons for June 8, 2023 (top), and HYSPLIT 48-hour forward trajectory plot from June 6, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 6, 2023 (bottom).

Figure 39. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for June 8, 2023.

3.2. June 17, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

3.2.1. June 17, 2023

The HYSPLIT 48-hour back trajectory plot shows the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 17, 2023. Figure 40 shows the HYSPLIT 48-hour back trajectory plot for June 17, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 17, as well as the HYSPLIT 48-hour forward trajectory plot for June 15, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 15. The wildfire and smoke locations 200 km (124 mi) east of Wemindji, Quebec coincide with the point (at 757 meters AGL) at 13:00 EST on June 15 of the 1000-meter release height back trajectory from Canton and the 750-meter release height forward trajectory from those wildfires at 13:00 EST on June 15 reaches Canton (at 987 meters AGL) at 06:00 EST on June 17. The coincidence of the 48-hour back and forward trajectories between the wildfire locations and the Canton area serves as clear evidence that the smoke from the wildfires in Quebec caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 17, 2023.The accompanying AOD and imagery maps for June 17 presented in Figure 41 provide further evidence that dense smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on June 17, 2023, and that this wildfire smoke was the cause of the high concentrations of PM$_{2.5}$ at the monitoring sites.

Figure 40. HYSPLIT 48-hour back trajectory plot from June 17, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 17, 2023 (top), and HYSPLIT 48-hour forward trajectory plot from June 15, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 15, 2023 (bottom).
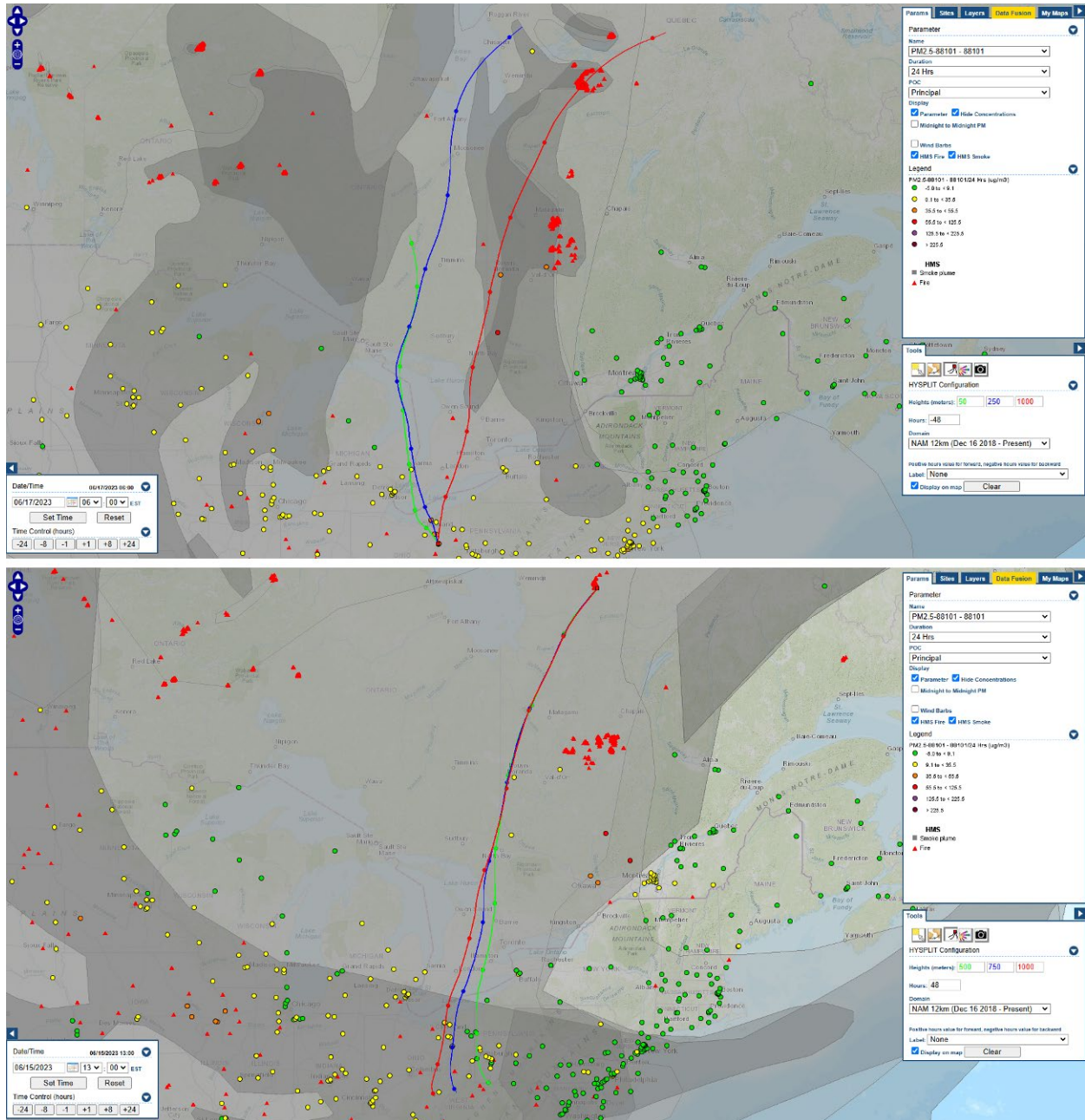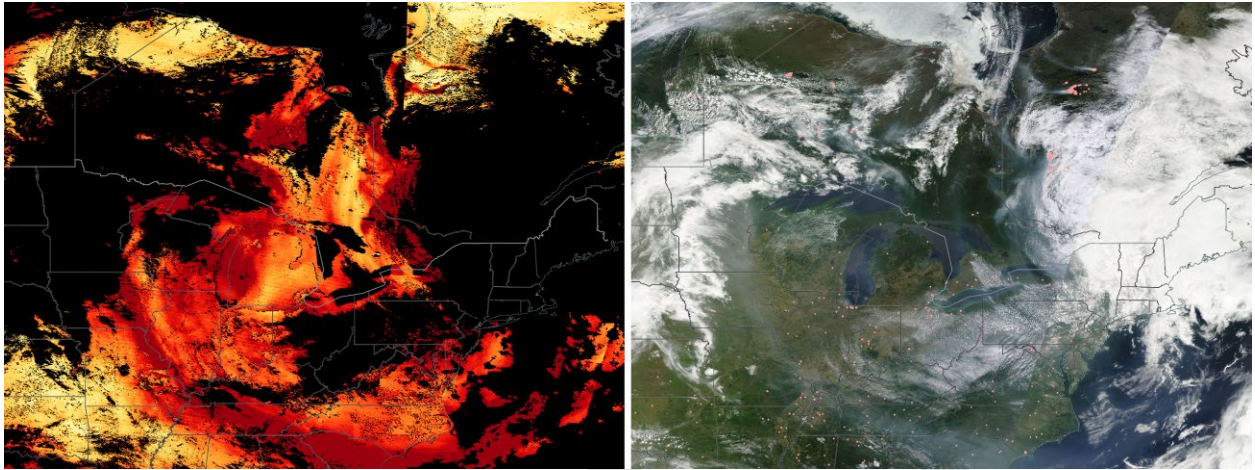
Figure 41. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for June 17, 2023.

3.3. June 27-30, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

3.3.1. June 27, 2023

The HYSPLIT 48-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 27, 2023. Figure 42 shows the HYSPLIT 48-hour back trajectory plot for June 27, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 27, as well as the HYSPLIT 48-hour forward trajectory plot for June 25, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 25. The wildfire and smoke locations 125 km (78 mi) northeast of Matagami, Quebec coincide with the endpoint (at 211 meters AGL) of the 1000-meter release height back trajectory from Canton and Canton is the endpoint (at 1011 meters AGL) of the 250-meter release height forward trajectory from those wildfires. The coincidence of the 48-hour back and forward trajectories between the wildfire locations and the Canton area serves as clear evidence that the smoke from the wildfires in Quebec caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 27, 2023. The accompanying AOD and imagery maps for June 27 presented in Figure 43, which show smoke from Wisconsin to Indiana with heavy cloud cover above the smoke obscuring Ohio, provide further evidence that dense smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on June 27, 2023, and that this smoke was the cause of the high concentrations of PM$_{2.5}$ at the monitoring sites.

Figure 42. HYSPLIT 48-hour back trajectory plot from June 27, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 27, 2023 (top), and HYSPLIT 48-hour forward trajectory plot from June 25, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 25, 2023 (bottom).
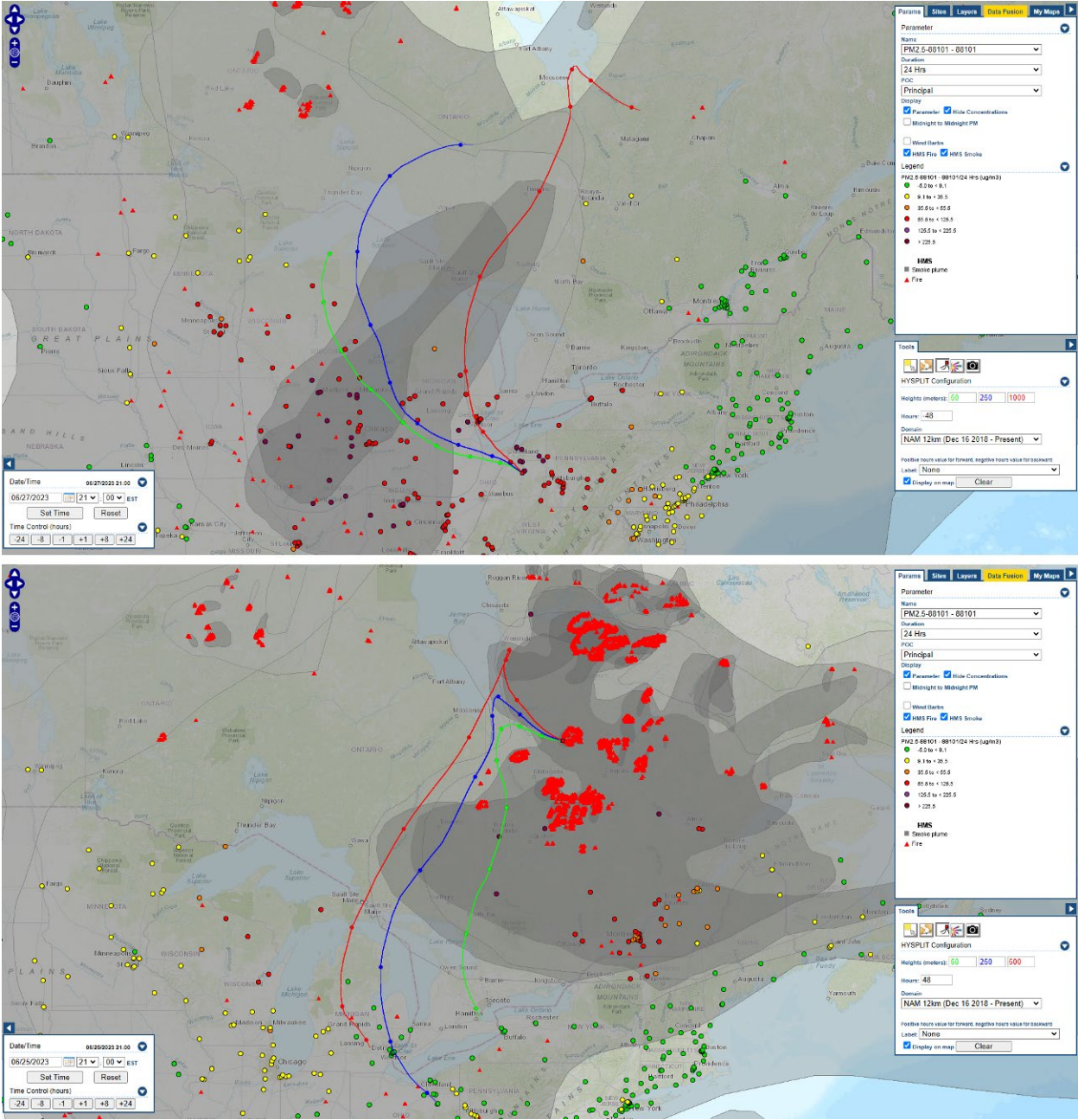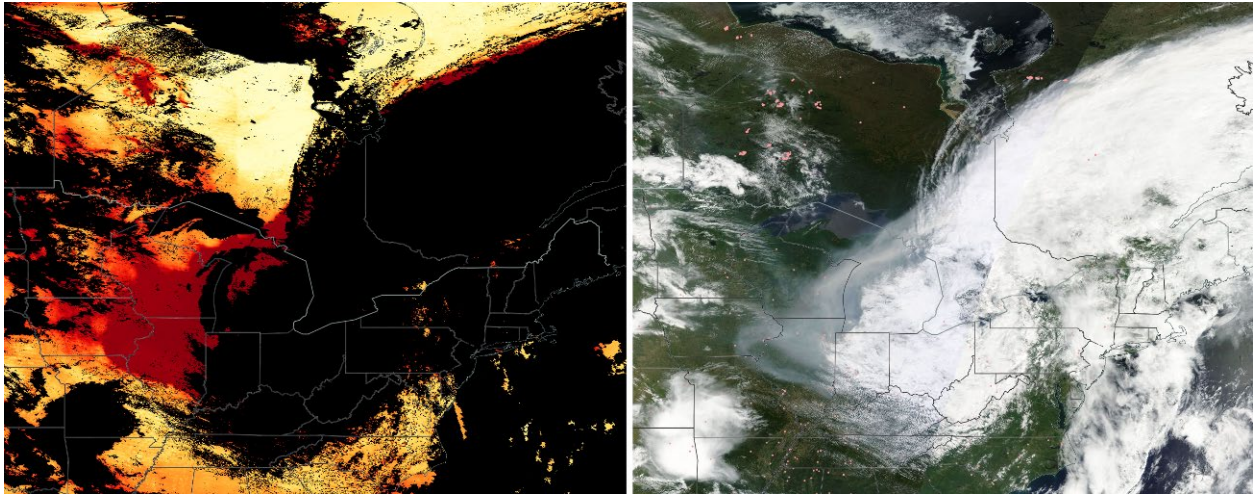
Figure 43. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for June 27, 2023.

3.3.2. June 28, 2023

The HYSPLIT 48-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 28, 2023. Figure 44 shows the HYSPLIT 48-hour back trajectory plot for June 28, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 28, as well as the HYSPLIT 48-hour forward trajectory plot for June 26, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 26. The wildfire and smoke locations 135 km (84 mi) northeast of Matagami, Quebec coincide with the endpoint (at 1239 meters AGL) of the 1000-meter release height back trajectory from Canton and Canton is the endpoint (at 1095 meters AGL) of the 1250-meter release height forward trajectory from those wildfires. The coincidence of the 48-hour back and forward trajectories between the wildfire locations and the Canton area serves as clear evidence that the smoke from the wildfires in Quebec caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 28, 2023. The accompanying AOD and imagery maps for June 28 presented in Figure 45, although slightly obscured by moderate cloud cover, show high AOD values as well as visible haze and smoke over northern Ohio, providing further evidence that dense smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on June 28, 2023, and that this smoke was the cause of the high concentrations of PM$_{2.5}$ at the monitoring sites.

Figure 44. HYSPLIT 48-hour back trajectory plot from June 28, 2023, with fire locations, monitored surface PM₂.₅ concentrations, and HMS smoke polygons for June 28, 2023 (top), and HYSPLIT 48-hour forward trajectory plot from June 26, 2023, with fire locations, monitored surface PM₂.₅ concentrations, and HMS smoke polygons for June 26, 2023 (bottom).
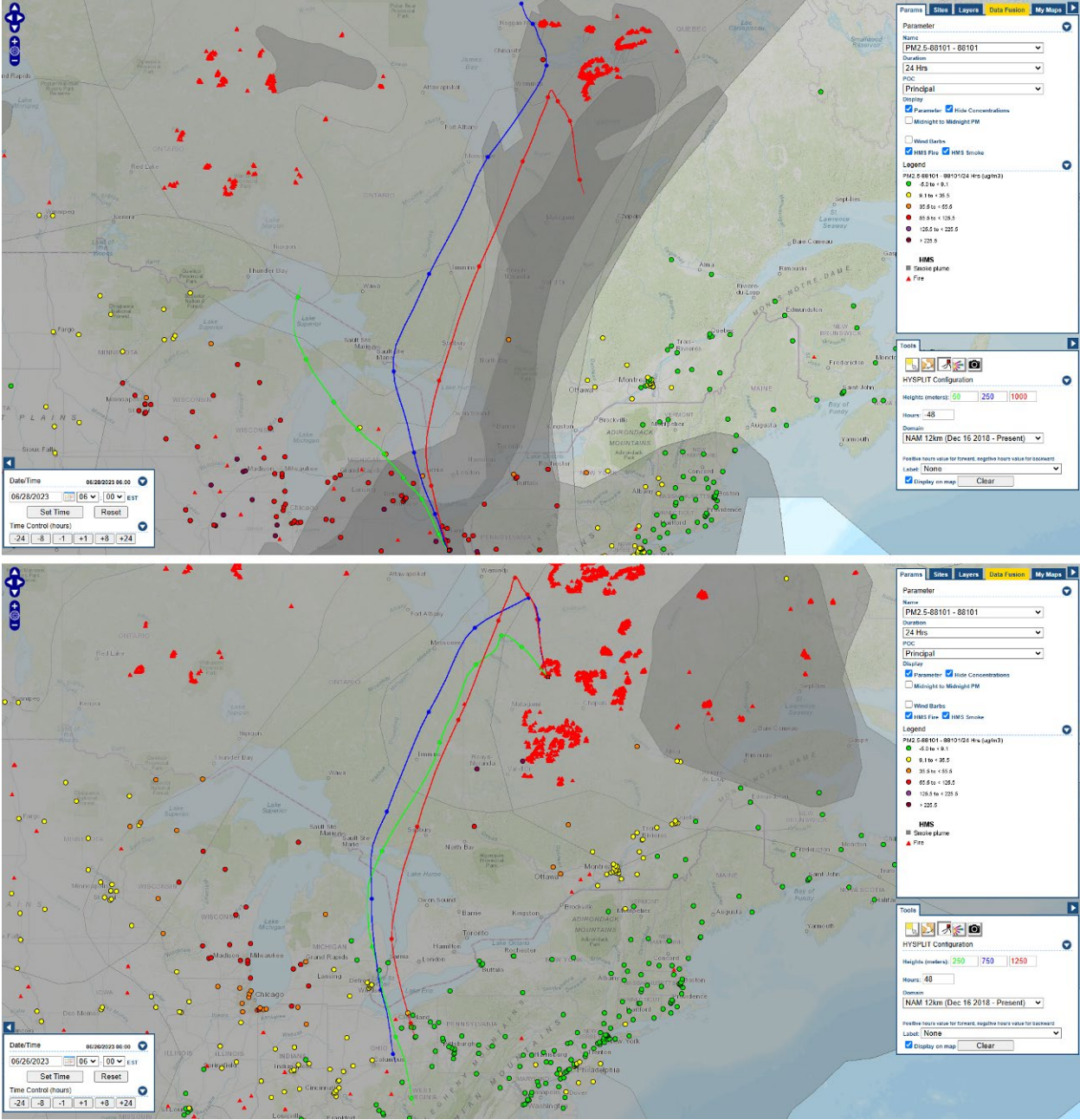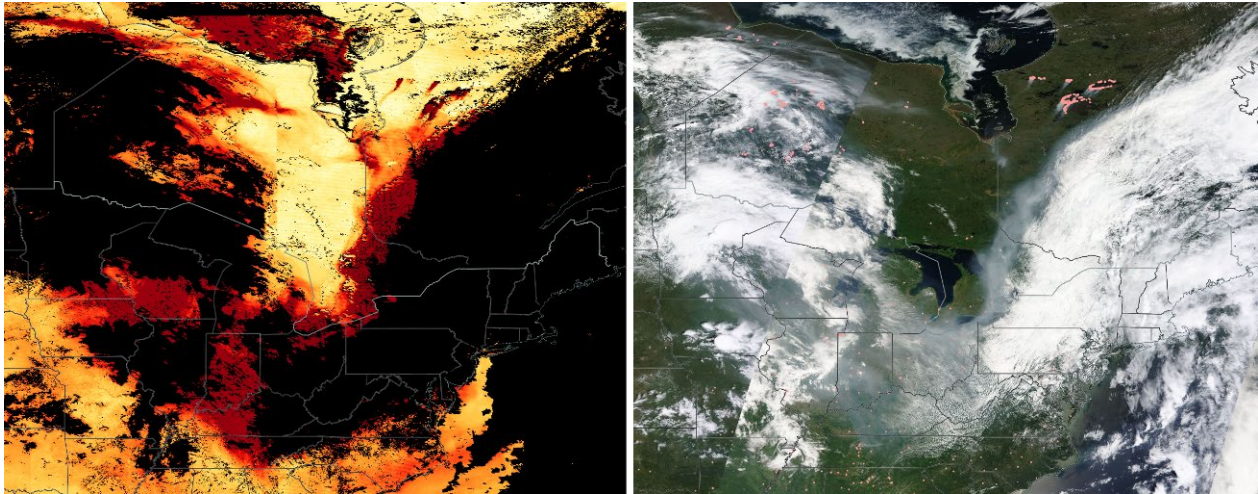
Figure 45. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for June 28, 2023.

3.3.3. June 29, 2023

The HYSPLIT 48-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 29, 2023. Figure 46 shows the HYSPLIT 48-hour back trajectory plot for June 29, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 29, as well as the HYSPLIT 48-hour forward trajectory plot for June 27, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 27. The wildfire and smoke locations 110 km (68 mi) northeast of Chisasibi, Quebec coincide with the endpoint (at 1002 meters AGL) of the 250-meter release height back trajectory from Canton and the Canton area is the endpoint (at 237 meters AGL) of the 1000-meter release height forward trajectory from those wildfires. The coincidence of the 48-hour back and forward trajectories between the wildfire locations and the Canton area serves as clear evidence that the smoke from the wildfires in Quebec caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 29, 2023. The accompanying AOD and imagery maps for June 29 presented in Figure 47, which show high AOD values as well as visible haze and smoke over most of Ohio, provide further evidence that dense smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on June 29, 2023, and that this smoke was the cause of the high concentrations of PM$_{2.5}$ at the monitoring sites.

Figure 46. HYSPLIT 48-hour back trajectory plot from June 29, 2023, with fire locations, monitored surface PM₂.₅ concentrations, and HMS smoke polygons for June 29, 2023 (top), and HYSPLIT 48-hour forward trajectory plot from June 27, 2023, with fire locations, monitored surface PM₂.₅ concentrations, and HMS smoke polygons for June 27, 2023 (bottom).
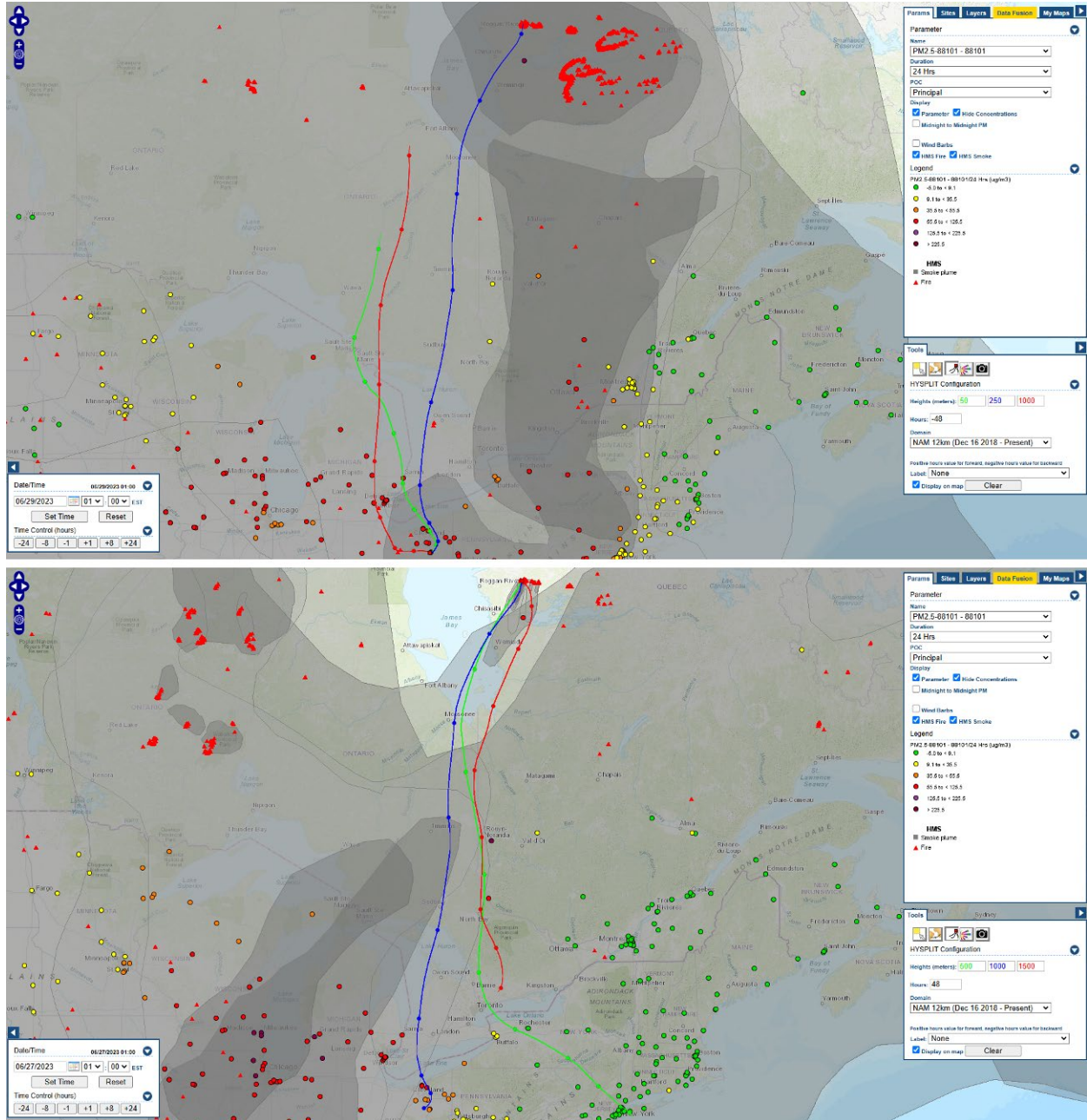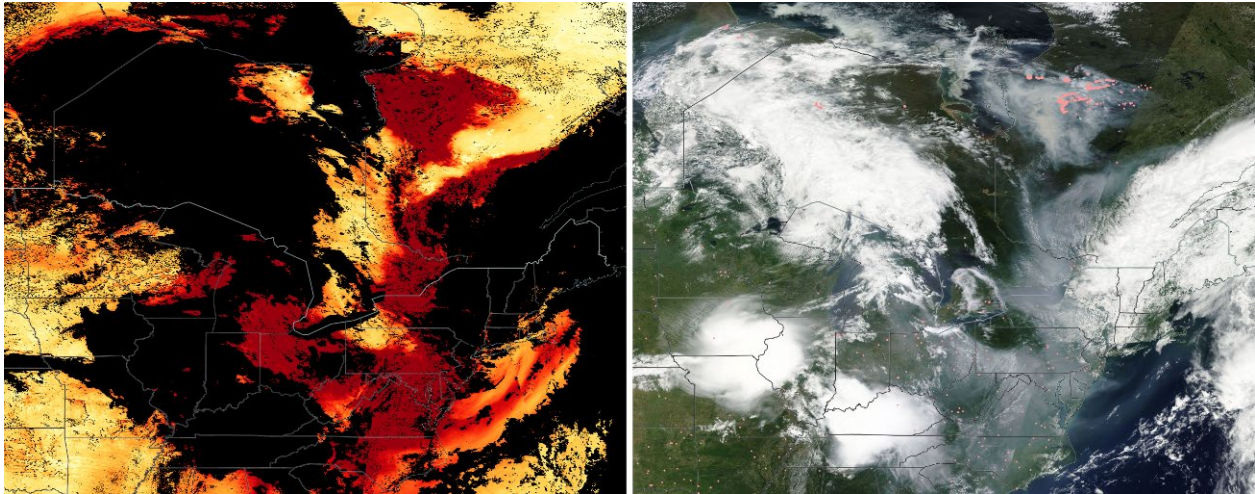
Figure 47. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for June 29, 2023.

3.3.4. June 30, 2023

The HYSPLIT 48-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 30, 2023. Figure 48 shows the HYSPLIT 48-hour back trajectory plot for June 30, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 30, as well as the HYSPLIT 48-hour forward trajectory plot for June 28, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for June 28. As previously shown, wildfire smoke was already present in the Canton area on June 28, when a stalled air mass over most of Ohio caused the wildfire smoke in northeastern Ohio to slowly circulate south toward the Ohio River and return to northern Ohio. The 50-meter release height back trajectory from Canton originated near Medina about 50 km (31 mi) northwest of Canton at a height of 90 meters AGL, and the 100-meter release height forward trajectory from the location near Medina affected by wildfire smoke ended near Canton at a height of 73 meters AGL. The 250-meter release height back trajectory from Canton originated near Loudonville about 70 km (43 mi) southwest of Canton at a height of 367 meters AGL, and the 350-meter release height forward trajectory from the location near Loudonville affected by wildfire smoke ended near Canton at a height of 249 meters AGL. Additionally, the 50-meter release height forward trajectory from Canton ended near Washington, PA at a height of 33 m AGL on June 30, just 125 km (75 mi) southeast of the wildfire smoke affecting Canton on June 28, illustrating the extremely

slow-moving nature of the air mass over northern Ohio containing the wildfire smoke. The coincidence of the 48-hour back and forward trajectories between the locations in Ohio known to be affected by wildfire smoke on June 28 and the Canton area serves as clear evidence that the smoke from these wildfires caused the high $PM_{2.5}$ concentrations in the Canton–Massillon, OH MSA on June 30, 2023. The accompanying AOD and imagery maps for June 30 presented in Figure 49, although partially obscured by cloud cover over most of Ohio, show high AOD values as well as visible haze and smoke over portions of northern Ohio, providing further evidence that dense smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on June 30, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the monitoring sites.

Figure 48. HYSPLIT 48-hour back trajectory plot from June 30, 2023, with fire locations, monitored surface PM₂.₅ concentrations, and HMS smoke polygons for June 30, 2023 (top), and HYSPLIT 48-hour forward trajectory plot from June 28, 2023, with fire locations, monitored surface PM₂.₅ concentrations, and HMS smoke polygons for June 28, 2023 (bottom).
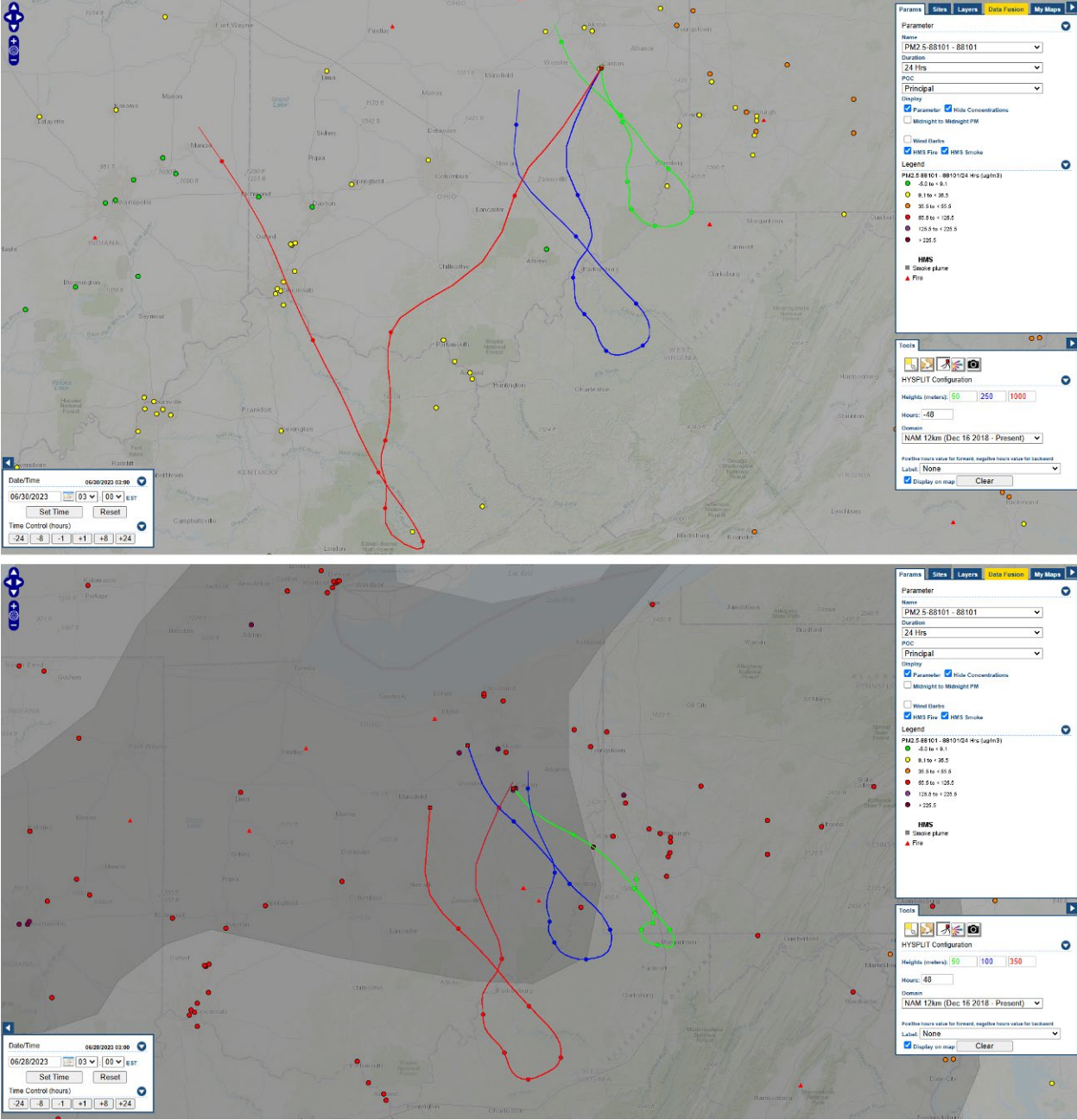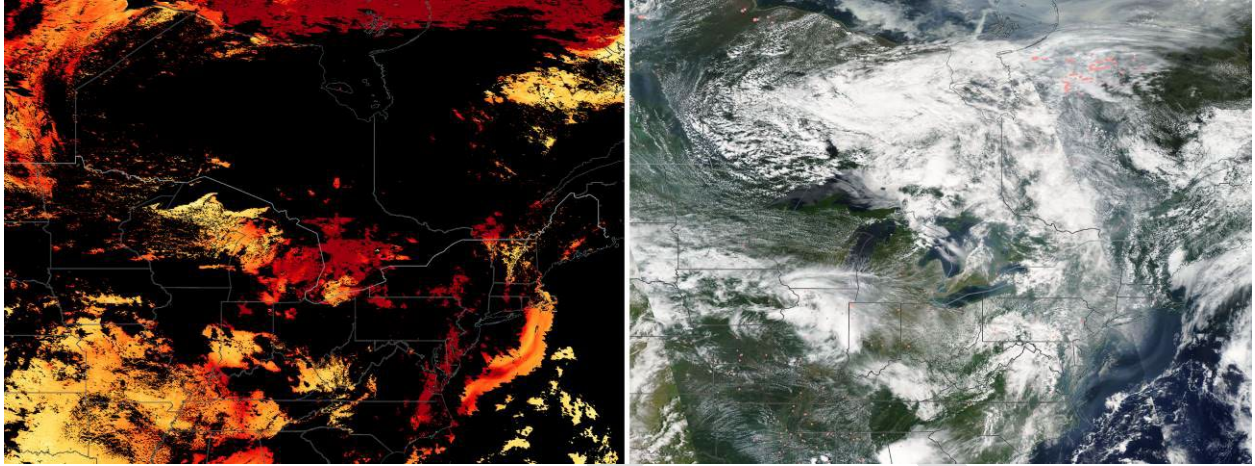
Figure 49. MAIAC AOD imagery (left) and Aqua satellite true color imagery (right) for June 30, 2023.

3.4. July 16-17, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

The nature of this wildfire smoke-driven PM$_{2.5}$ episode involved longer range transport of wildfire smoke from western Canada to the Canton area, so 72-hour HYSPLIT trajectories were analyzed, as opposed to the 48-hour HYSPLIT trajectories analyzed for the previously discussed wildfire smoke-driven PM$_{2.5}$ episodes. Additionally, the transport of this wildfire smoke across North America occurred at higher altitudes, so the release heights of the HYSPLIT 72-hour back trajectories were set at 250, 1000, and 1500 meters, as opposed to the release heights of 50, 250, and 1000 meters used in the previously discussed analyses.

3.4.1. July 16, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on July 16, 2023. Figure 50 shows the HYSPLIT 72-hour back trajectory plot for July 16, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 16, as well as the HYSPLIT 72-hour forward trajectory plot for July 13, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 13. The wildfire smoke-impacted locations 100 km (62 mi) northwest of Regina, Saskatchewan coincide with the endpoint (at 940 meters AGL) of the 1000-meter release height back trajectory from Canton and the Canton area is the endpoint (at 749 meters AGL) of the 1000-meter release height forward trajectory from those locations. The wildfire and smoke locations 75 km (47 mi) northeast of High Level, Alberta coincide with the endpoint (at 2453 meters AGL) of the 1500-meter release height back trajectory from Canton and the Canton area is the endpoint (at 1256 meters AGL) of the 2500-meter release height forward trajectory from those wildfires. The coincidence of the 72-hour back and forward trajectories between the wildfire and smoke locations and the Canton area serves as clear evidence that the smoke from the wildfires in northern Alberta caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on July 16, 2023. The accompanying AOD and imagery maps for July 16 presented in Figure 51, which show high AOD values and visible haze and smoke stretching from the wildfires in northern Alberta, across the Upper Midwest, and blanketing the Ohio River Valley, provide further evidence that smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on July 16, 2023, and that this wildfire smoke was the cause of the high concentrations of PM$_{2.5}$ at the monitoring sites.

Figure 50. HYSPLIT 72-hour back trajectory plot from July 16, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 16, 2023 (top), and HYSPLIT 72-hour forward trajectory plot from July 13, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 13, 2023 (bottom).
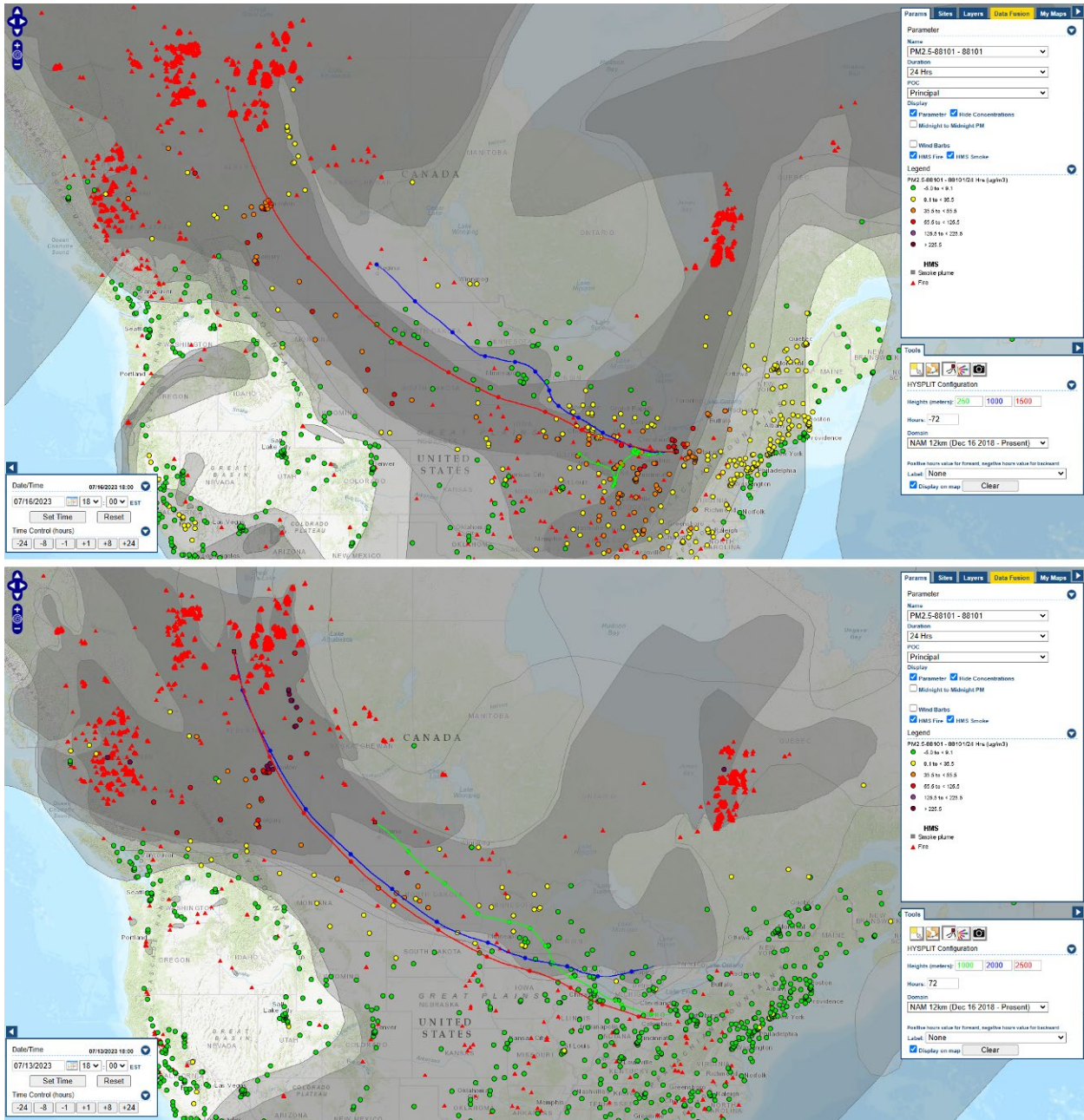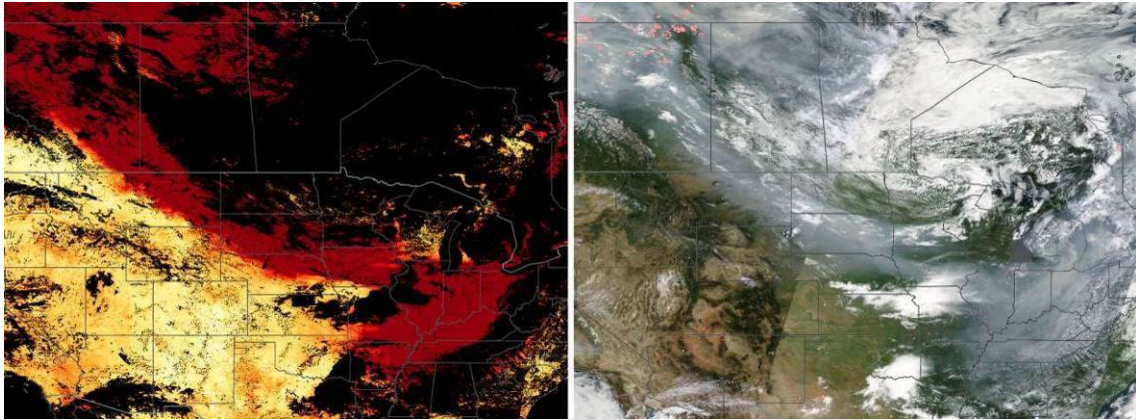
Figure 51. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for July 16, 2023.

3.4.2. July 17, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface $PM_{2.5}$ concentrations in the Canton–Massillon, OH MSA on July 17, 2023. Figure 52 shows the HYSPLIT 72-hour back trajectory plot for July 17, overlaid on a map of fire locations, monitored 24-hour average surface $PM_{2.5}$ concentrations, and HMS smoke polygons for July 17, as well as the HYSPLIT 72-hour forward trajectory plot for July 14, overlaid on a map of fire locations, monitored 24-hour average surface $PM_{2.5}$ concentrations, and HMS smoke polygons for July 14. The wildfire and smoke locations 155 km (96 mi) west of High Level, Alberta coincide with the endpoint (at 3350 meters AGL) of the 1000-meter release height back trajectory from Canton and the Canton area is the endpoint (at 1108 meters AGL) of the 3250-meter release height forward trajectory from those wildfires. The wildfire and smoke locations 150 km (93 mi) northwest of Prince George, British Columbia coincide with the endpoint (at 3801 meters AGL) of the 1500-meter release height back trajectory from Canton and the Canton area is the endpoint (at 1553 meters AGL) of the 3750-meter release height forward trajectory from those wildfires. The coincidence of the 72-hour back and forward trajectories between the wildfire locations and the Canton area serves as clear evidence that the smoke from the wildfires in northern Alberta and British Columbia caused the high $PM_{2.5}$ concentrations in the Canton–Massillon, OH MSA on July 17, 2023. The accompanying AOD and imagery maps for July 17 presented in Figure 53, which show high AOD values and visible haze and smoke over northeastern Ohio, further support that smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on July 17, 2023, and that this wildfire smoke caused the high concentrations of $PM_{2.5}$ at the monitoring sites.

Figure 52. HYSPLIT 72-hour back trajectory plot from July 17, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 17, 2023 (top), and HYSPLIT 72-hour forward trajectory plot from July 14, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 14, 2023 (bottom).
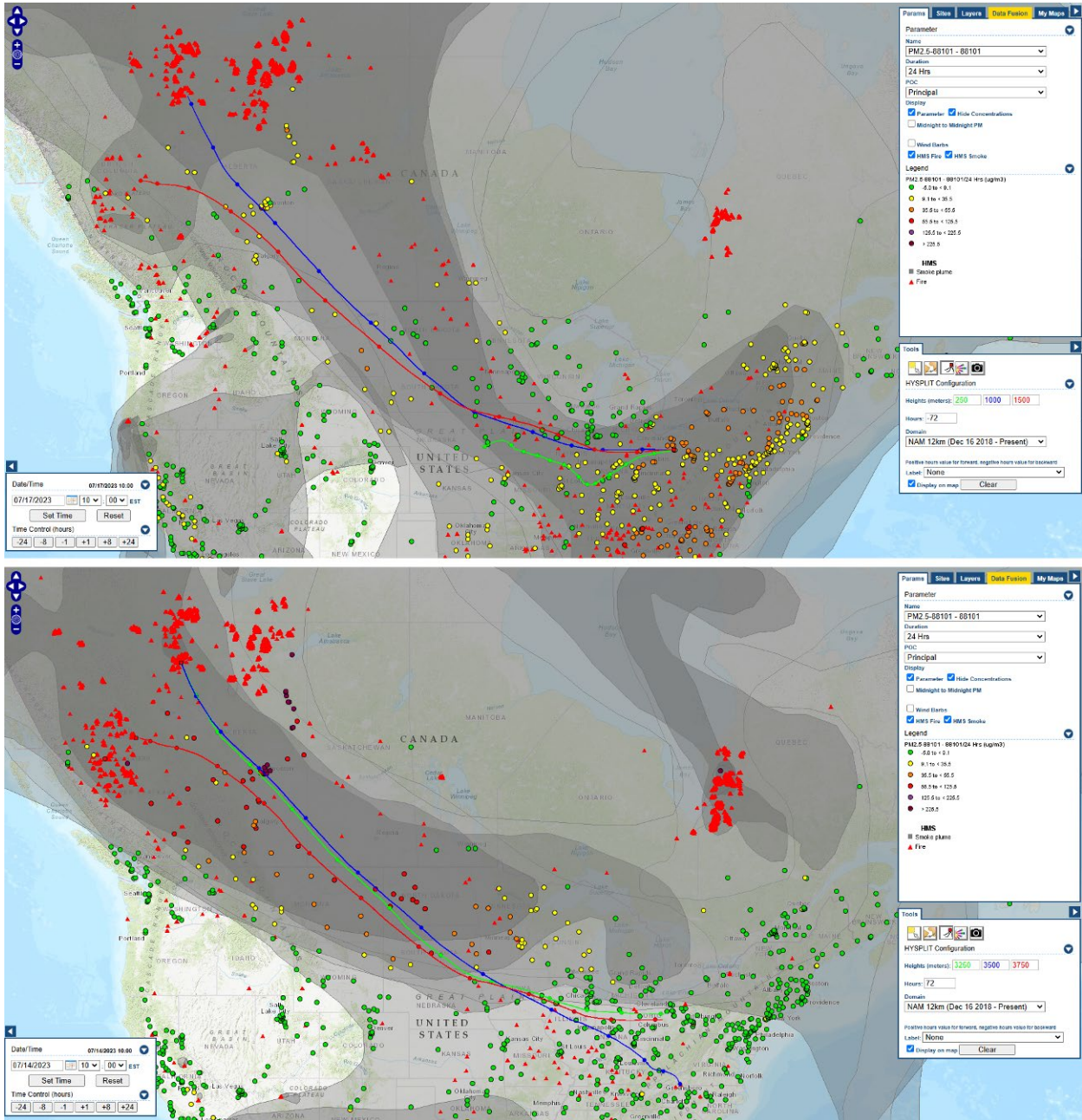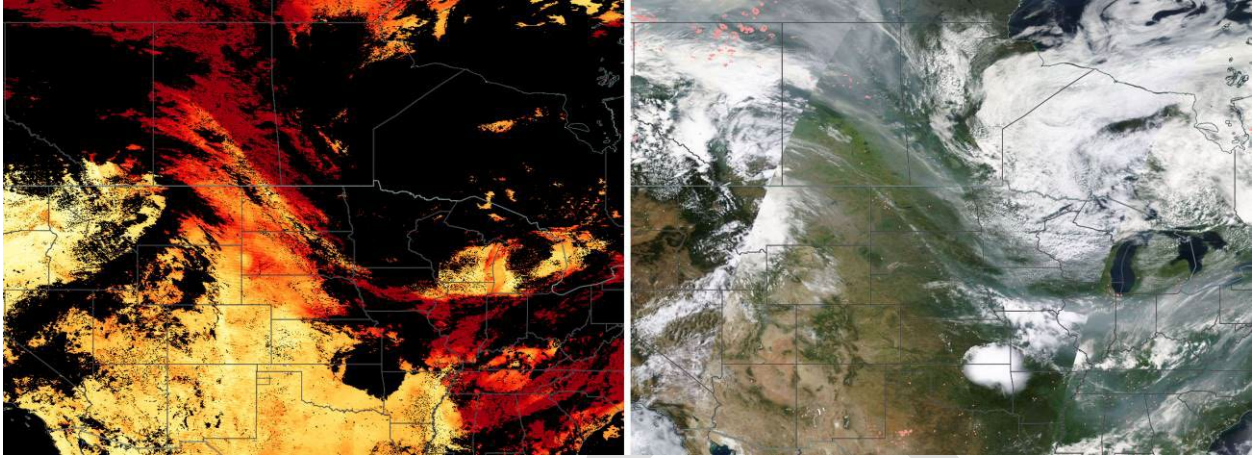
Figure 53. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for July 17, 2023.

3.5. August 2-3, 2023 Wildfire Smoke-Driven PM$_{2.5}$ Episode

The nature of this wildfire smoke-driven PM$_{2.5}$ episode involved longer range and significantly slower transport of wildfire smoke from central Canada to the Canton area, so 72-hour HYSPLIT trajectories were analyzed. Additionally, the transport of this wildfire smoke occurred at significantly higher altitudes, so the release heights of the HYSPLIT 72-hour back trajectories were set at 500, 1500, and 2000 meters.

3.5.1. August 2, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on August 2, 2023. Figure 54 shows the HYSPLIT 72-hour back trajectory plot for August 2, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for August 2, as well as the HYSPLIT 72-hour forward trajectory plot for July 30, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 30. The wildfire smoke location 35 km (22 mi) northeast of Lac Brochet, Manitoba, blanketed by wildfire smoke due to being just 120-220 km (75-137 mi) downwind of multiple large wildfire complexes burning in northeastern Saskatchewan, coincide with the endpoint (at 2374 meters AGL) of the 2000-meter release height back trajectory from Canton and the Canton area is the endpoint (at 2139 meters AGL) of the 2500-meter release height forward trajectory from that wildfire smoke location. The wildfire and smoke locations 155 km (96 mi) southeast of Thompson, Manitoba coincide with the endpoint (at 2019 meters AGL) of the 1500-meter release height back trajectory from Canton and the Canton area is the endpoint (at 1743 meters AGL) of the 2000-meter release height forward trajectory from those wildfire and smoke locations. Both wildfire locations were also being affected on July 30 by the smoke plumes from wildfires burning farther west near Lake Athabasca. The coincidence of the 72-hour back and forward trajectories between the wildfire and smoke locations and the Canton area serves as clear evidence that the smoke from the wildfires in northern Saskatchewan and Manitoba caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on August 2, 2023. The accompanying AOD and imagery maps for August 2 presented in Figure 55, which show high AOD values and visible haze and smoke across Ohio, provide further evidence that smoke from the Canadian wildfires was present in the Canton–Massillon, OH

MSA on August 2, 2023, and that this wildfire smoke was the cause of the high concentrations of PM$_{2.5}$ at the Canton Fire St8 monitoring site.

Figure 54. HYSPLIT 72-hour back trajectory plot from August 2, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for August 2, 2023 (top), and HYSPLIT 72-hour forward trajectory plot from July 30, 2023, with fire locations, monitored surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 30, 2023 (bottom).
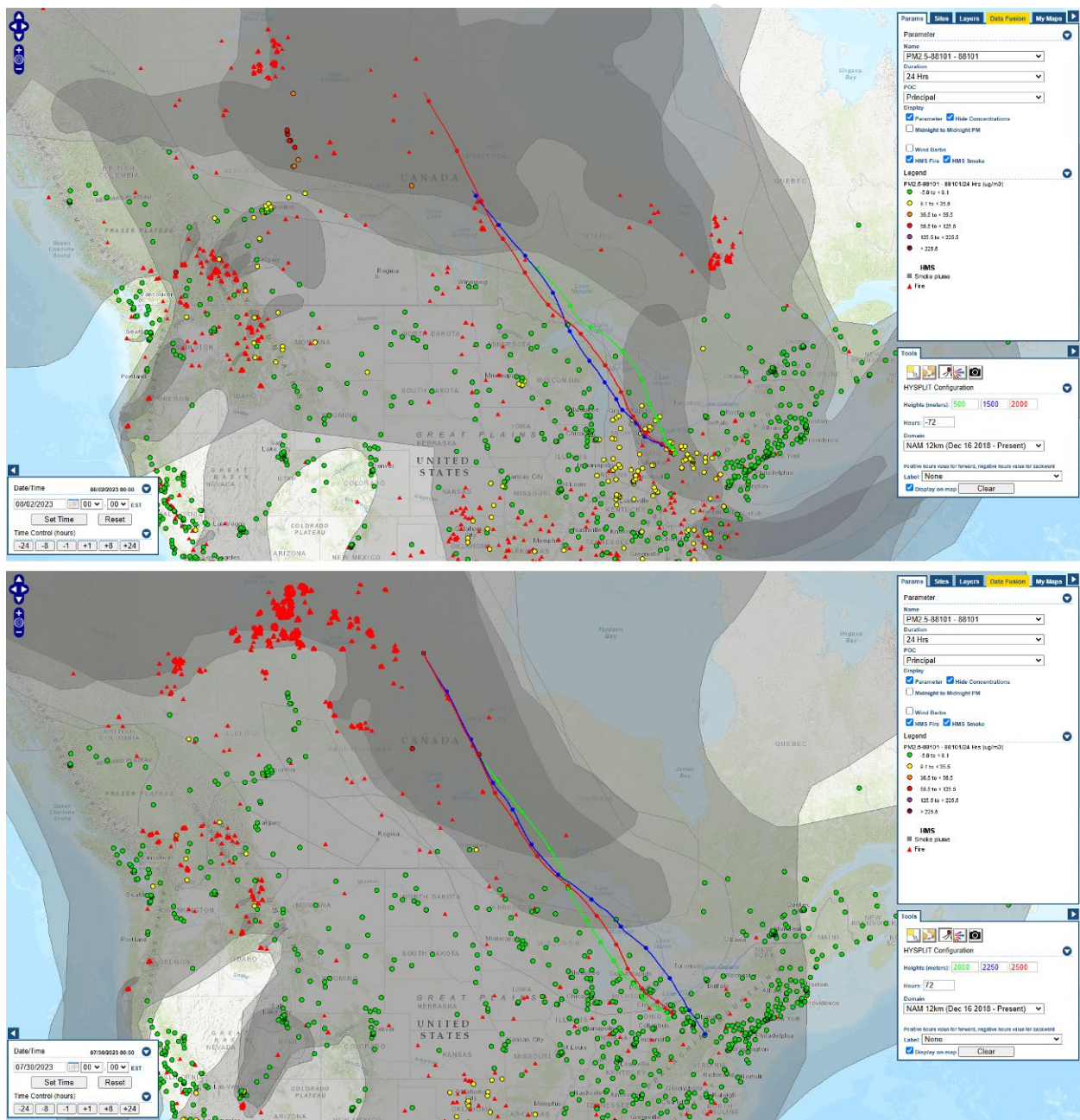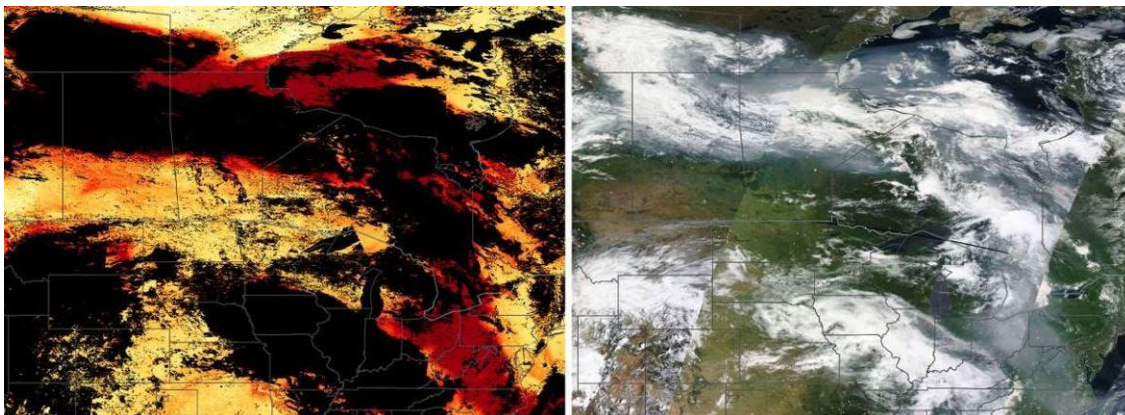
Figure 55. MAIAC AOD imagery (left) and Terra satellite true color imagery (right) for August 2, 2023.

3.5.2. August 3, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the smoke plumes that caused the high surface PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on August 3, 2023. Figure 56 shows the HYSPLIT 72-hour back trajectory plot for August 3, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for August 3, as well as the HYSPLIT 72-hour forward trajectory plot for July 31, overlaid on a map of fire locations, monitored 24-hour average surface PM$_{2.5}$ concentrations, and HMS smoke polygons for July 31. The wildfire smoke location 55 km (34 mi) north of Houghton, MI coincides with the endpoint (at 2932 meters AGL) of the 1500-meter release height back trajectory from Canton and the Canton area is the endpoint (at 1380 meters AGL) of the 3000-meter release height forward trajectory from that wildfire smoke location. The wildfires and smoke locations in the southern portion of Poplar/Nanowin Rivers Park Reserve, Manitoba coincide with the endpoint (at 4257 meters AGL) of the 2000-meter release height back trajectory from Canton and the Canton area is the endpoint (at 2115 meters AGL) of the 4250-meter release height forward trajectory from those wildfires. Both wildfire and smoke locations were being affected on July 31 by the smoke plumes from wildfires burning farther northwest near Lake Athabasca. The coincidence of the 72-hour back and forward trajectories between the wildfire and smoke locations and the Canton area serves as clear evidence that the smoke from the wildfires in Manitoba and near Lake Athabasca caused the high PM$_{2.5}$ concentrations in the Canton–Massillon, OH MSA on August 3, 2023. The accompanying AOD and imagery maps for August 3 presented in Figure 57, which show high AOD values and visible haze and smoke over northern Ohio, further

support that smoke from the Canadian wildfires was present in the Canton–Massillon, OH MSA on August 3, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the Canton Fire St8 monitoring site.

Figure 56. HYSPLIT 72-hour back trajectory plot from August 3, 2023, with fire locations, monitored surface $PM_{2.5}$ concentrations, and HMS smoke polygons for August 3, 2023 (top), and HYSPLIT 72-hour forward trajectory plot from July 31, 2023, with fire locations, monitored surface $PM_{2.5}$ concentrations, and HMS smoke polygons for July 31, 2023 (bottom).
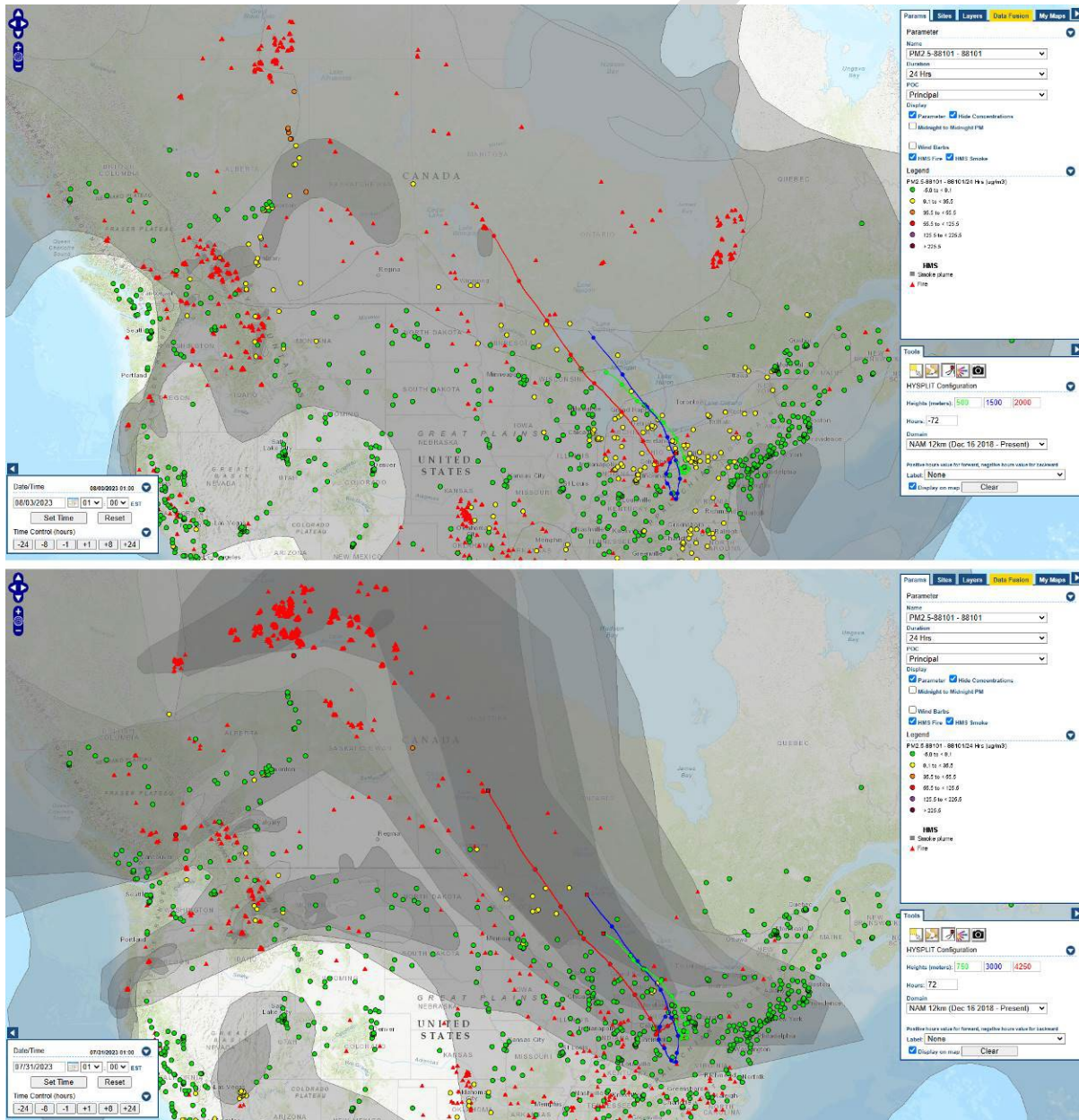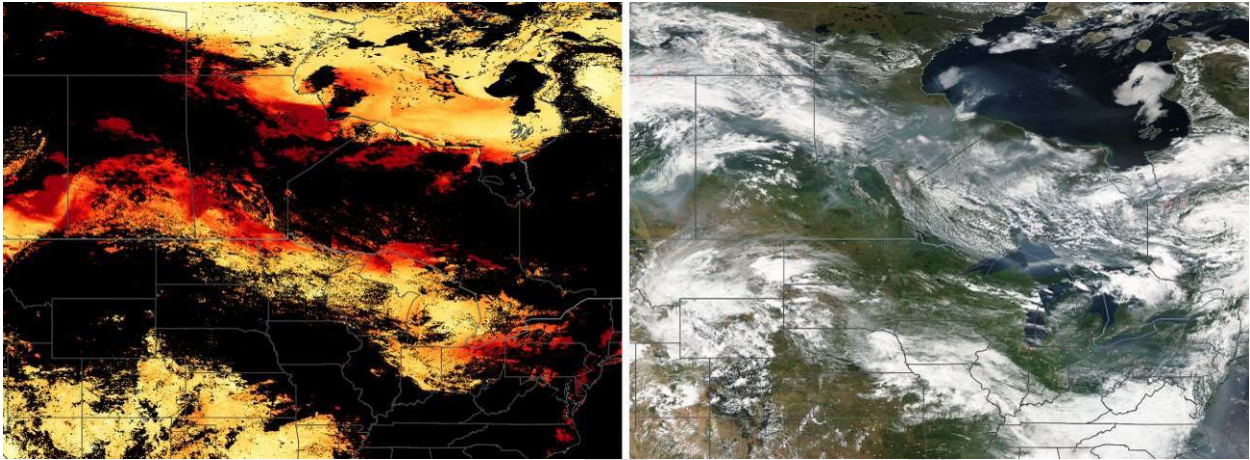
Figure 57. MAIAC AOD imagery (left) and Aqua satellite true color imagery (right) for August 3, 2023.

4. Not Reasonably Controllable and Not Reasonably Preventable

40 CFR 50.14 (c)(3)(iv)(D) requires a demonstration that the event was both not reasonably controllable and not reasonably preventable. For wildfires, it is presumed according to 40 CFR 50.14(b)(4) that wildfires on wildland will satisfy both factors unless there is evidence that demonstrates otherwise. 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". 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". Figure 58 shows satellite imagery of the wildland areas east of Val-d'Or, Quebec and west of Pembroke, Ontario on which wildfires produced smoke resulting in the $PM_{2.5}$ episodes in the Canton–Massillon, OH MSA on June 6, 2023. Figure 59 shows satellite imagery of the wildland areas east of Wemindji, Quebec, northeast of Matagami, Quebec, and northeast of Chisasibi, Quebec on which wildfires produced smoke resulting in the $PM_{2.5}$ episodes in the Canton–Massillon, OH MSA on June 7, June 8, June 17, June 27, June 28, June 29, and June 30, 2023. Figure 60 shows satellite imagery of the wildland areas northeast of High Level, Alberta, west of High Level, Alberta, and northwest of Prince George, British Columbia on which wildfires produced smoke resulting in the $PM_{2.5}$ episodes in the Canton–Massillon, OH MSA on July 16-17, 2023. Figure 61 shows satellite imagery of the wildland areas southeast of Thompson, Manitoba and east of Grand Rapids, Manitoba on which wildfires produced smoke resulting in the $PM_{2.5}$ episodes in the Canton–Massillon, OH MSA on August 2-3, 2023. Figure 62 shows satellite imagery of the wildland areas in northeastern Saskatchewan west of Wollaston Lake, north of Wollaston Lake, and north of Black Lake on which several large wildfire complexes produced smoke resulting in the $PM_{2.5}$ episodes in the Canton–Massillon, OH MSA on August 2-3, 2023. The satellite imagery shown in Figures 58-62 represent overhead views from an altitude of 100 km (155 mi), such that the outer diameter of each circle representing a wildfire location is about 1.6 km (1.0 mi) at the surface.

Figure 58. Satellite imagery of the wildland areas east of Val-d'Or, Quebec (left) and west of Pembroke, Ontario (right), with circles marking the locations of wildfires resulting in PM$_{2.5}$ episodes in the Canton–Massillon, MSA.

Figure 59. Satellite imagery of the wildland areas east of Wemindji, Quebec (left), northeast of Matagami, Quebec (middle), and northeast of Chisasibi, Quebec (right), with circles marking the locations of wildfires resulting in PM$_{2.5}$ episodes in the Canton–Massillon, MSA.

Figure 60. Satellite imagery of the wildland areas northeast of High Level, Alberta (left), west of High Level, Alberta (middle) and northwest of Prince George, British Columbia (right), with circles marking the locations of wildfires resulting in PM$_{2.5}$ episodes in the Canton–Massillon, MSA.

Figure 61. Satellite imagery of the wildland areas southeast of Thompson, Manitoba (left) and east of Grand Rapids, Manitoba (right), with circles marking the locations of wildfires resulting in PM$_{2.5}$ episodes in the Canton–Massillon, MSA.

Figure 62. Satellite imagery of the wildland areas in northeastern Saskatchewan west of Wollaston Lake (left), north of Wollaston Lake (middle), and north of Black Lake (right), with circles marking the locations of wildfires resulting in PM$_{2.5}$ episodes in the Canton–Massillon, MSA.
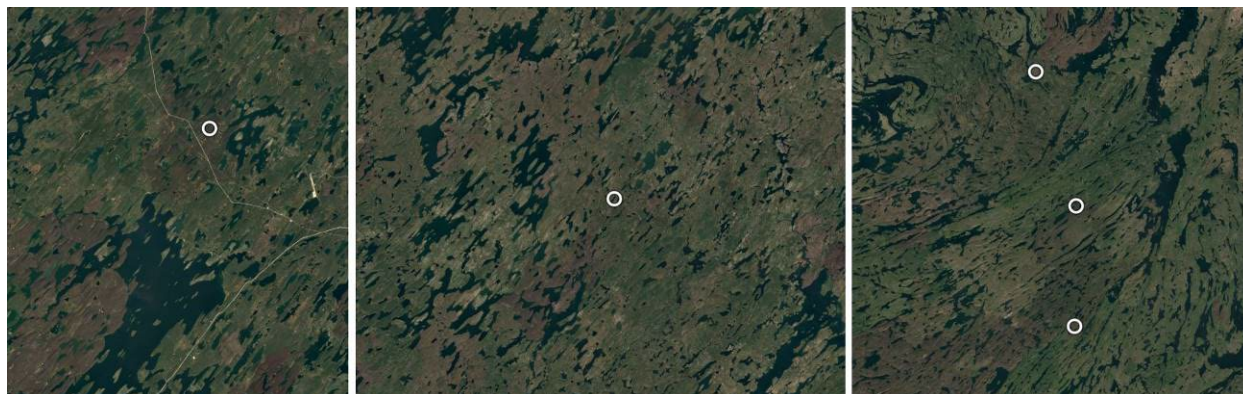

Extensive wildfire activity occurred on wildlands across Canada during the late spring and summer of 2023. The Canadian government estimates that on average 67% of the area burned in Canada from wildfires is due to lightning-caused fires[61]. CIFCC[62] reported that on June 1, 2023, "a major lightning strike hit Quebec, igniting 182 forest fires in a single day". On July 5, Alberta Wildfire informed CIFFC that increased fire behavior was to be expected over the next week or so, along with continued increased risks of fire hazard conditions[63]. On July 8, Alberta Wildfire reported to CIFCC that an additional 7 new wildfires of natural causes had started across the province the previous day, with increased fire activity in northern Alberta leading to challenges in controlling new fire starts[64]. As shown in Figure 63, the naturally occurring wildfires, likely started by lightning strikes, grew rapidly across northern Alberta over the first two weeks of July, with the large increase in burned forested areas resulting in the smoke plumes that ultimately resulted in the July 16-17 PM$_{2.5}$ episode in the Canton–Massillon, OH MSA. These wildfires continued to burn, with new wildfires started by lightning strikes occurring across northern Alberta and northern Saskatchewan over the next two

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[61] https://natural-resources.canada.ca/our-natural-resources/forests/wildland-fires-insects-disturbances/forest-fires/fire-behaviour/13145

[62] https://ciffc.ca/sites/default/files/2024-03/03.07.24_CIFFC_2023CanadaReport%20%281%29.pdf

[63] https:// ciffc.net/situation/2023-07-05

[64] https://ciffc.net/situation/2023-07-08

weeks, resulting in the smoke plumes that affected the Canton–Massillon, OH MSA on August 2-3, 2023.

Figure 63. Map from CWFIS showing active fires and estimated wildfire burned perimeter areas in northern Alberta on July 1 (top) and July 14 (bottom), 2023.
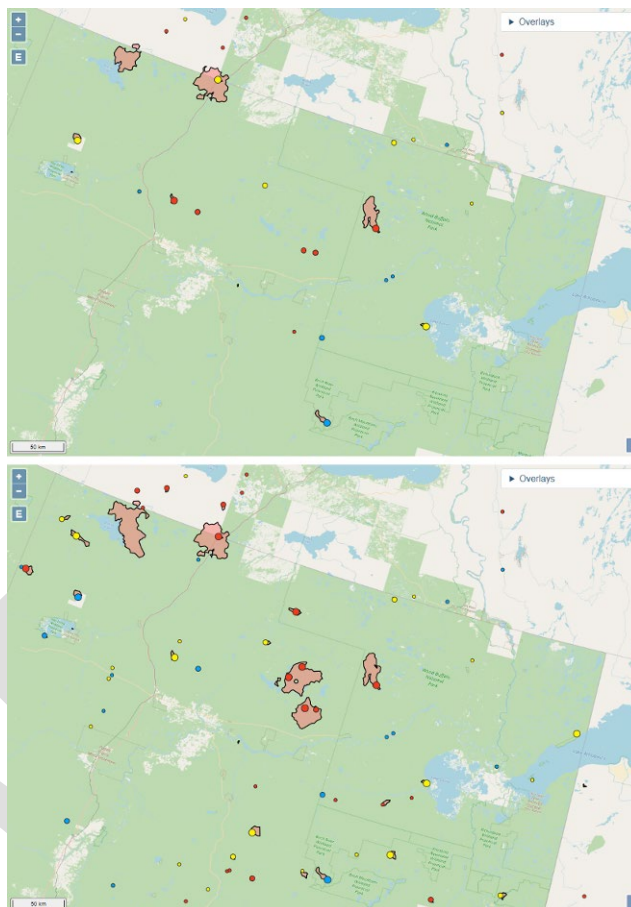
As the June, July, and August 2023 fires in Canada were reported to have been started by natural causes, namely unplanned ignitions caused by lightning strikes, they are considered wildfires as defined in 40 CFR 50.1(n). Since these wildfires occurred predominantly on wildlands, they meet the not reasonably controllable and not reasonably preventable criterion in the Exceptional Events Rule. The wildfires burning in June, July, and August 2023 could not have been prevented and could not have been controlled by state or federal natural resources managers in the U.S. The excessive wildfire smoke emissions in 2023 that contributed to monitored violations of the 2024 revised annual $PM_{2.5}$ NAAQS in the Canton–Massillon, OH MSA on June 6-8, June 17, June 27-30, July 16-17, and August 2-3, were caused by the wildfires and not the result of emissions from anthropogenic sources.

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

40 CFR 50.14(c)(3)(iv)(E) requires 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(k) defines a natural event as "an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role", and further states that for purposes of this definition, "anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions". Additionally, 40 CFR 50.1(n) states that a "wildfire that predominantly occurs on wildland is a natural event". As described in this document, the origin and evolution of the June, July, and August 2023 wildfires occurred predominantly across Canadian wildlands in Quebec, Alberta, Saskatchewan, and the Northwest Territories.

Based on the documentation provided in this demonstration, the June, July, and August 2023 events qualify as wildfires because lightning most likely caused the unplanned wildfire events. As the wildfire events that are subject of this demonstration occurred on wildlands and were caused by lightning, they were natural and should be considered for treatment as exceptional events.

6. Public Notification

Ohio EPA maintains a public alert system as well as publicly available information via the Ohio EPA website[65] to keep residents informed of potential wildfire smoke impacts. As required by 40 CFR Part 58, Appendix D, Ohio EPA and partner public health and air pollution control agencies in the state install, operate, and maintain a network of instruments to measure ambient air quality at monitoring sites across the state. Figures 64, 65, and 66 show the locations of active $PM_{2.5}$ monitoring sites in the state of Ohio, in the Canton–Massillon, OH MSA, and in the city of Canton, respectively.

Figure 64. Map of active $PM_{2.5}$ monitoring sites in the state of Ohio.

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[65] https://epa.ohio.gov
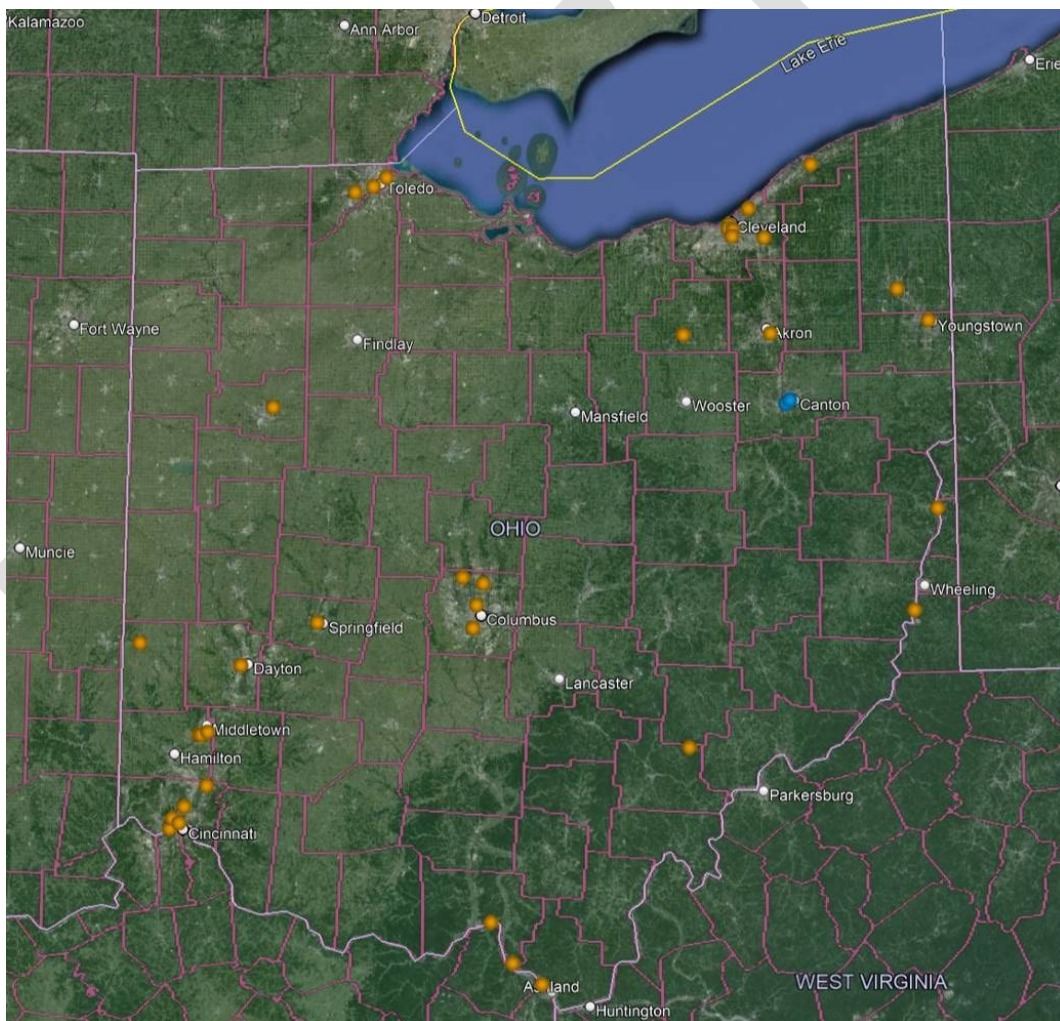
Figure 65. Map of active PM$_{2.5}$ monitoring sites in the Canton–Massillon, OH MSA.
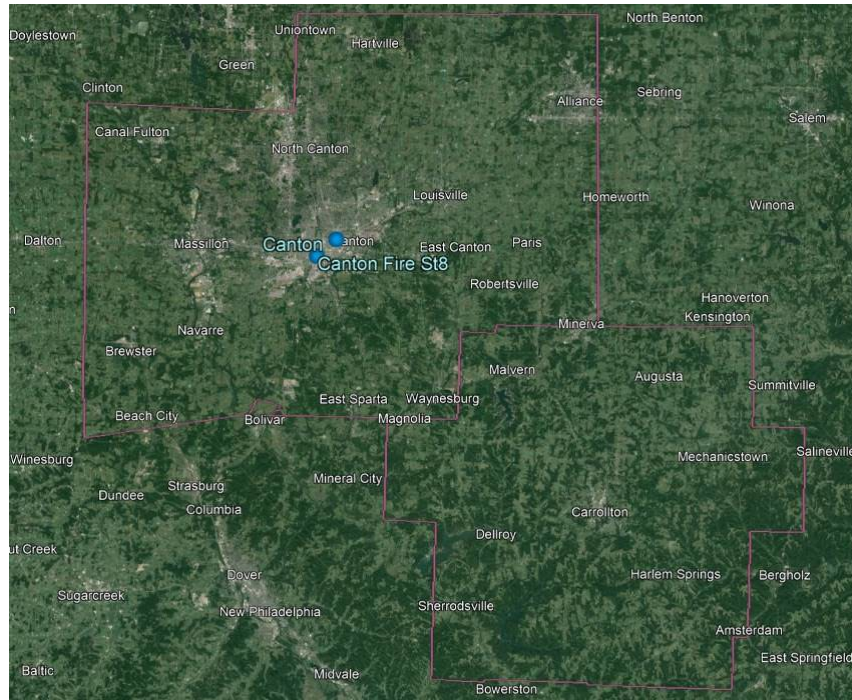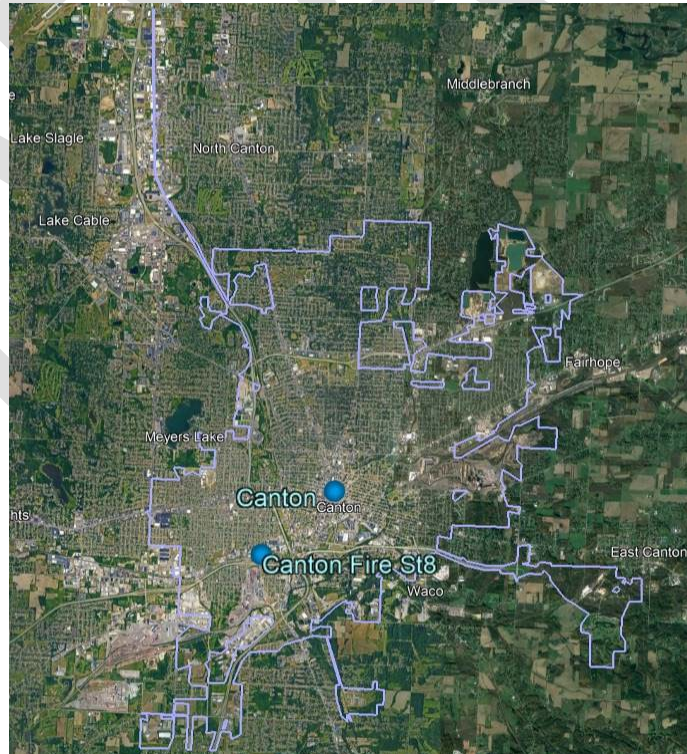

Figure 66. Map of active PM$_{2.5}$ monitoring sites in the city of Canton, OH.

The Canton and Canton Fire St8 monitoring sites in the Canton–Massillon, OH MSA were each operational and collected ambient $PM_{2.5}$ measurements throughout 2023, including during the June 6-8, June 17, June 27-30, July 16-17, and August 2-3 wildfire smoke-driven $PM_{2.5}$ episodes. Ohio EPA reported these data in real time to U.S. EPA for inclusion in the AirNow system, which triggers EnviroFlash notifications upon the Air Quality Index reaching the "Unhealthy for Sensitive Groups" category for those registered to receive such notifications. The ambient $PM_{2.5}$ data from the Canton and Canton Fire St8 monitoring sites were also publicly accessible through the Ohio EPA Division of Air Pollution Control website[66].

Data collected from the network of monitoring sites are used by Ohio EPA and partner agencies, such as public health departments, local air pollution control agencies, and metropolitan planning organizations, to notify the public when air pollution may reach levels that are potentially harmful to public health. Table 8 lists the public notices issued by Ohio EPA and other agencies in northeastern Ohio regarding the wildfire smoke-driven $PM_{2.5}$ episode from June 6-8, 2023. Similarly, Tables 9, 10, and 11 list the public notices and statements issued by Ohio EPA and other agencies in northeastern Ohio regarding the 2023 wildfire smoke-driven $PM_{2.5}$ episodes from June 27-30 for public notices issued on June 27-28, June 27-30 for public notices issued on June 29-30, and July 16-17. It should be noted that no public notices for the Canton area were issued regarding the June 17 $PM_{2.5}$ episode and only one public notice was issued for northeastern Ohio just after the August 2-3 $PM_{2.5}$ episode[67], as the concentrations on June 17 and August 2-3 in the Canton–Massillon, OH MSA, although elevated due to wildfire smoke from Canada, were not as clearly predictable or as pronounced as other wildfire smoke-driven $PM_{2.5}$ episodes.

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[66] https://epa.ohio.gov/divisions-and-offices/air-pollution-control/reports-and-data/airohio-air-monitoring-data

[67] https://x.com/noaca_mpo/status/1687171268292775936

Table 8. Public notices issued regarding the wildfire smoke-driven PM$_{2.5}$ episode impacting the Canton–Massillon, OH MSA from June 6-8, 2023.

Date Issued	Date(s) Covered	Issued By	Counties Covered	Type of Notice
June 6, 2023	June 6, 2023	Canton City Public Health	Stark	Air Quality Advisory[68]
June 6, 2023	June 7, 2023	NOACA	Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	Air Quality Advisory[69]
June 7, 2023	June 7, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory[70]
June 7, 2023	June 7, 2023 & June 8, 2023	Canton City Public Health	Stark	Air Quality Advisory[71]
June 7, 2023	June 8, 2023	NOACA	Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	Air Quality Advisory[72]
June 8, 2023	June 8, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory[73]

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[68] https://www.cantonohio.gov/DocumentCenter/View/5755/662023-Air-Quality-Advisory-PM-PDF

[69] https://myemail-api.constantcontact.com/Air-Quality-Advisory-June-7--2023.html?soid=1105576147256&aid=4FGMtYARt7Q

[70] https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory

[71] https://www.cantonohio.gov/DocumentCenter/View/5756/672023-Air-Quality-Alert---PM25-PDF

[72] https://myemail-api.constantcontact.com/Air-Quality-Advisory-June-8--2023.html?soid=1105576147256&aid=5QFYKyGaKXk

[73] https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory-june-8

Table 9. Public notices issued on June 27 and June 28 regarding the wildfire smoke-driven PM$_{2.5}$ episode impacting the Canton–Massillon, OH MSA from June 27-30, 2023.

Date Issued	Date(s) Covered	Issued By	Counties Covered	Type of Notice
June 27, 2023	June 27, 2023 & June 28, 2023	Canton City Public Health	Stark	Air Quality Alert[74]
June 27, 2023	June 28, 2023	NOACA	Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	Air Quality Advisory[75]
June 28, 2023	June 28, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory[76]
June 28, 2023	June 28, 2023 & June 29, 2023	Eastgate Regional COG	Mahoning, Trumbull	Air Quality Advisory[77]
June 28, 2023	June 29, 2023	NOACA	Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	Air Quality Advisory[78]

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[74] https://www.cantonohio.gov/DocumentCenter/View/5758/6272023-Air-Quality-Alert-PM25-PDF

[75] https://myemail.constantcontact.com/Air-Quality-Advisory-June-28--2023.html?soid=1105576147256&aid=j3tENpRGT94

[76] https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory-june-28

[77] https://eastgatecog.org/news/2023/06/28/Wednesday-and-Thursday-June-28--29th-are-Air-Quality-Advisory-Days

[78] https://myemail-api.constantcontact.com/Air-Quality-Advisory-June-29--2023.html?soid=1105576147256&aid=1yfle3EBprg

Table 10. Public notices issued on June 29 and June 30 regarding the wildfire smoke-driven PM$_{2.5}$ episode impacting the Canton–Massillon, OH MSA from June 27-30, 2023.

Date Issued	Date(s) Covered	Issued By	Counties Covered	Type of Notice
June 29, 2023	June 29, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory[79]
June 29, 2023	June 29, 2023	Canton City Public Health	Stark	Air Quality Alert[80]
June 29, 2023	June 30, 2023	NOACA	Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	Air Quality Advisory[81]
June 30, 2023	June 30, 2023	Eastgate Regional COG	Mahoning, Trumbull	Air Quality Advisory[82]

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[79] https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory-june-29

[80] https://www.cantonohio.gov/DocumentCenter/View/5759/6292023-Air-Quality-Alert-PM25-PDF

[81] https://myemail-api.constantcontact.com/Air-Quality-Advisory-June-30--2023.html?soid=1105576147256&aid=plkiOuq7GgY

[82] https://eastgatecog.org/news/2023/06/30/Friday-June-30th-Is-an-Air-Quality-Advisory-Day

Table 11. Public notices issued regarding the wildfire smoke-driven PM$_{2.5}$ episode impacting the Canton–Massillon, OH MSA from July 16-17, 2023.

Date Issued	Date(s) Covered	Issued By	Counties Covered	Type of Notice
July 15, 2023	July 16, 2023	NOACA	Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	Air Quality Advisory[83]
July 16, 2023	July 17, 2023	NOACA	Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	Air Quality Advisory[84]
July 17, 2023	July 17, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory[85]
July 17, 2023	July 17, 2023	Eastgate Regional COG	Mahoning, Trumbull	Air Quality Advisory[86]
July 17, 2023	July 17, 2023 & July 18, 2023	Canton City Public Health	Stark	Air Quality Alert[87]

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[83] https://x.com/noaca_mpo/status/1680376709940387841

[84] https://x.com/noaca_mpo/status/1680729150225514502

[85] https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory-july-17

[86] https://eastgatecog.org/news/2023/07/17/Monday-July-17-Declared-Air-Quality-Advisory-Day

[87] https://www.cantonohio.gov/DocumentCenter/View/5761/7172023-Air-Quality-Alert-PM25-PDF

7. Public Participation

In accordance with the requirements of 40 CFR 50.14(c)(2)(i), on September 10, 2024, Ohio formally notified U.S. EPA of its intent to request the exclusion of data due to exceptional events. A copy of the initial notification form submitted to U.S. EPA regarding exceptional events in the Canton–Massillon, OH MSA is included as Appendix A. Ohio published solicitation for public comment concerning the draft Exceptional Events Demonstration for 2023 PM$_{2.5}$ Episodes in the Canton–Massillon, OH Metropolitan Statistical Area on November 25, 2024. The public comment period closed on December 27, 2024. Appendix B includes a copy of the public notice, a copy of the public comments received, and a copy of Ohio's responses to the public comments received.

8. Summary

This exceptional events demonstration shows that wildfires in Canada adversely affected ambient $PM_{2.5}$ concentrations measured by monitoring sites in the Canton–Massillon, OH MSA from June 6-8, June 17, June 27-30, July 16-17, and August 2-3, 2023. The ambient $PM_{2.5}$ concentrations measured at the Canton Fire St8 (39-151-0017) monitoring site on June 8, June 17, June 29, July 16, July 17, August 2, and August 3, 2023 have been shown to have contributed to a monitored violation of the 2024 revised annual $PM_{2.5}$ NAAQS, and it has been demonstrated that the exclusion of the ambient $PM_{2.5}$ concentrations measured at the Canton monitoring site on these dates would result in a 2021-2023 annual $PM_{2.5}$ design value (albeit invalid due to data incompleteness) that is at or below the 2024 revised annual $PM_{2.5}$ NAAQS value of 9.0 µg/m^3, proving regulatory significance. Ohio EPA therefore requests the exclusion of the ambient $PM_{2.5}$ concentrations measured at the Canton Fire St8 monitoring site on June 8, June 17, June 29, July 16, July 17, August 2, and August 3, 2023 from regulatory determinations, including calculations of annual $PM_{2.5}$ design values.

Similarly, the ambient $PM_{2.5}$ concentrations measured at the Canton (39-151-0020) monitoring site on June 6, June 7, June 8, June 17, June 27, June 28, June 29, June 30, July 16, and July 17, 2023 have been shown to have been impacted by the same regulatorily significant wildfire smoke-driven $PM_{2.5}$ episodes. It has also been demonstrated that the exclusion of the ambient $PM_{2.5}$ concentrations measured at the Canton monitoring site on these dates would result in a 2021-2023 annual $PM_{2.5}$ design value that is at or below the 2024 revised annual $PM_{2.5}$ NAAQS value of 9.0 µg/m^3. Ohio EPA therefore requests the exclusion of the ambient $PM_{2.5}$ concentrations measured at the Canton monitoring site on June 6, June 7, June 8, June 17, June 27, June 28, June 29, June 30, July 16, and July 17, 2023 from regulatory determinations, including calculations of annual $PM_{2.5}$ design values.

This exceptional events demonstration includes all the required elements of wildfire smoke-driven $PM_{2.5}$ exceptional events demonstrations as described in the Exceptional Events Rule. These included elements meet all applicable requirements of the Exceptional Events Rule and clearly demonstrate that wildfire smoke from Canada had unprecedented impacts on ambient $PM_{2.5}$ concentrations in the Canton–Massillon, OH MSA from June 6-8, June 17, June 27-30, July 16-17, and August 2-3, 2023.