EXCEPTIONAL EVENT DEMONSTRATION

2023 Late June Quebec Wildfires and Their Impacts on Fine Particulate Matter Concentrations in Southeast Wisconsin

DRAFT FOR PUBLIC REVIEW

Prepared by the Wisconsin Department of Natural Resources

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Acronyms

AGL	Above Ground Level
AOD	Aerosol Optical Depth
AQS	Air Quality System
CBSA	Core-Based Statistical Area
CDT	Central Daylight Time
CIFFC	Canadian Interagency Forest Fire Centre
CWFIS	Canadian Wildland Fire Information System
DNR	Wisconsin Department of Natural Resources
DV	Design Value
EE	Exceptional event
EPA	U.S. Environmental Protection Agency
FEDS	Fire Events Data Suite
HMS	Hazard Mapping System
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
MAIAC	Multi-Angle Implementation of Atmospheric Correction
MKE16	Milwaukee 16th Street Health Center $PM_{2.5}$ Monitor
MODIS	Moderate Resolution Imaging Spectroradiometer
NAAQS	National Ambient Air Quality Standard
NASA	National Aeronautics and Space Administration
NAM	North American Mesoscale Forecast System
NOAA	National Oceanic and Atmospheric Administration
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers
SLTs	State, Local, and Tribal Agencies
T640(x)	Teledyne instruments used to collect hourly concentrations for $PM_{2.5}$ data monitoring
VIIRS	Visible Infrared Imaging Radiometer Suite
WCA	Waukesha Cleveland Avenue $PM_{2.5}$ Monitor
WI	Wisconsin
Z	Zulu

Introduction

In the 2023 wildfire season around 15 million hectares of Canadian land was burned, more than doubling Canada's previous annual record from 1989 and more than six-times its annual average of 2.5 million hectares. In Eastern Canada, more land was burned in southern Quebec from June 1 through June 25, 2023, than in the previous 20-years combined (Figure 1). [1]

Significant growth of multiple Quebec wildfires in late June in concert with favorable meteorological conditions led to a prolonged surface-smoke event across the Great Lakes region from June 26–30, 2023 (Figures 2 and 3). During this event, fine particulate matter ($PM_{2.5}$) concentrations measured by Wisconsin's regulatory air quality monitoring network registered the highest hourly and daily average $PM_{2.5}$ concentrations in the state's recorded history.

Pursuant to the U.S. Environmental Protection Agency's (EPA) Exceptional Events (EE) Rule, state, local and tribal agencies (SLTs) may request that the EPA exclude data impacted by EEs from the data sets used to make regulatory determinations (e.g., the data set used to calculate a design value (DV)) in instances where the exclusion of the data has regulatory significance.[2] With the promulgation of a revised annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) on February 7, 2024, SLTs have until February 7, 2025, to make area designation recommendations using 2023 DVs and submit relevant EE demonstrations.

Table 1 shows the current 2023 annual $PM_{2.5}$ DVs for the Milwaukee 16th Street Health Center (MKE16) and the Waukesha Cleveland Avenue (WCA) monitors, the dates of the late June Quebec wildfire smoke event and the 2023 annual $PM_{2.5}$ DVs after exclusion of data from June 26-30 at each monitor. The exclusion of these data results in DVs at or below the promulgated revised annual $PM_{2.5}$ NAAQS of 9.0 µg/m^3.

Given the impending regulatory determinations to be made by EPA regarding the primary annual $PM_{2.5}$ NAAQS in conjunction with the regulatory significance the late June Quebec wildfire smoke event had on the MKE16 and WCA monitors, the Wisconsin Department of Natural resources (DNR) formally submits the following EE Demonstration.

Table 1. Monitors impacted by the late June Quebec wildfire smoke event with regulatory significance, dates requested for exclusion from the DV calculation, and 2021-2023 Annual DVs before and after exclusion.

Site	Air Quality System (AQS) ID	Dates for Exclusion	2021-23 $PM_{2.5}$ Annual DV – Before Exclusion	2021-23 $PM_{2.5}$ Annual DV – After Exclusion
Milwaukee 16th St.	**55-079-0010**	**6/26/2023 6/27/2023 6/28/2023 6/29/2023 6/30/2023**	**9.2 µg/m^3**	**8.8 µg/m^3**
Waukesha Cleveland Ave.	**55-133-0027**		**9.1 µg/m^3**	**8.7 µg/m^3**

[1] https://natural-resources.canada.ca/simply-science/canadas-record-breaking-wildfires-2023-fiery-wake-call/25303

[2] "Final Revisions to the Exceptional Events Rule", 81 F.R. 68216 (finalized October 3, 2016).

Figure 1. Growth in 12-hour-increments of a wildfire near the La Grande Reservoir 3 in southern Quebec from June 1 – July 23, 2023. As of September 19, 2023, this fire was the largest Canadian fire within NASA's Fire Events Data Suite (FEDS) database at over 1.2 million hectares. Curtesy of NASA https://earthobservatory.nasa.gov/images/151985/tracking-canadas-extreme-2023-fire-season

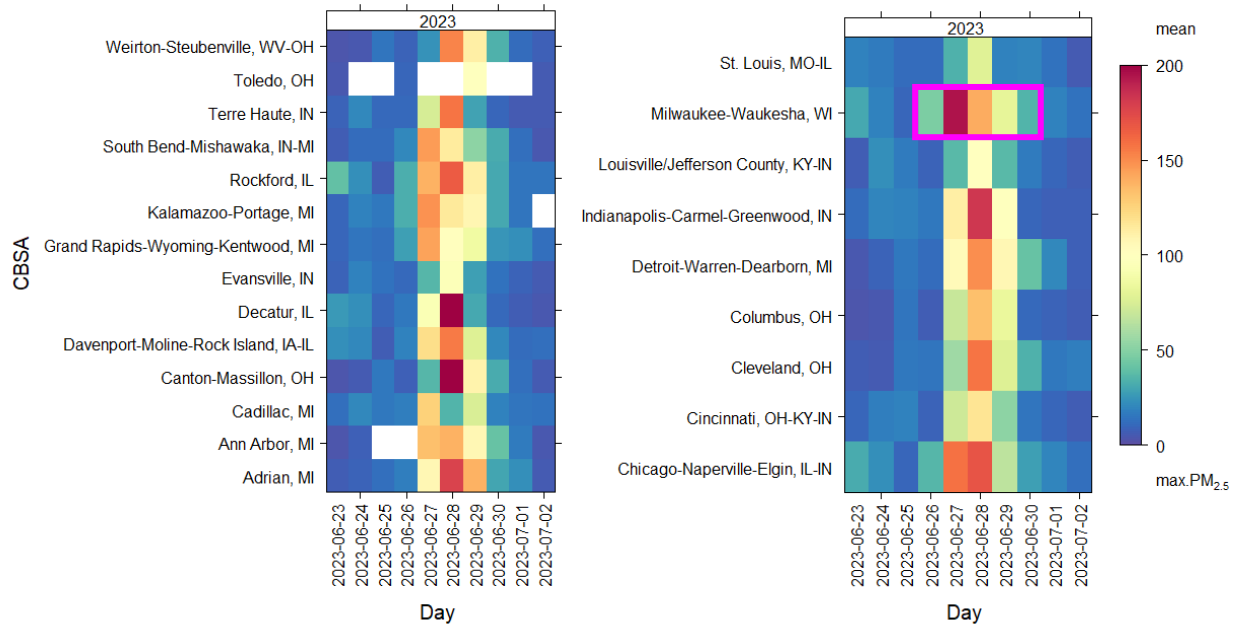

Figure 2. Maximum daily average $PM_{2.5}$ concentration by Core-Based Statistical Area (CBSA) across the Great Lakes region from June 23 – July 2, 2023. The late June Quebec wildfire smoke event for the Milwaukee-Waukesha CBSA is outlined in magenta.

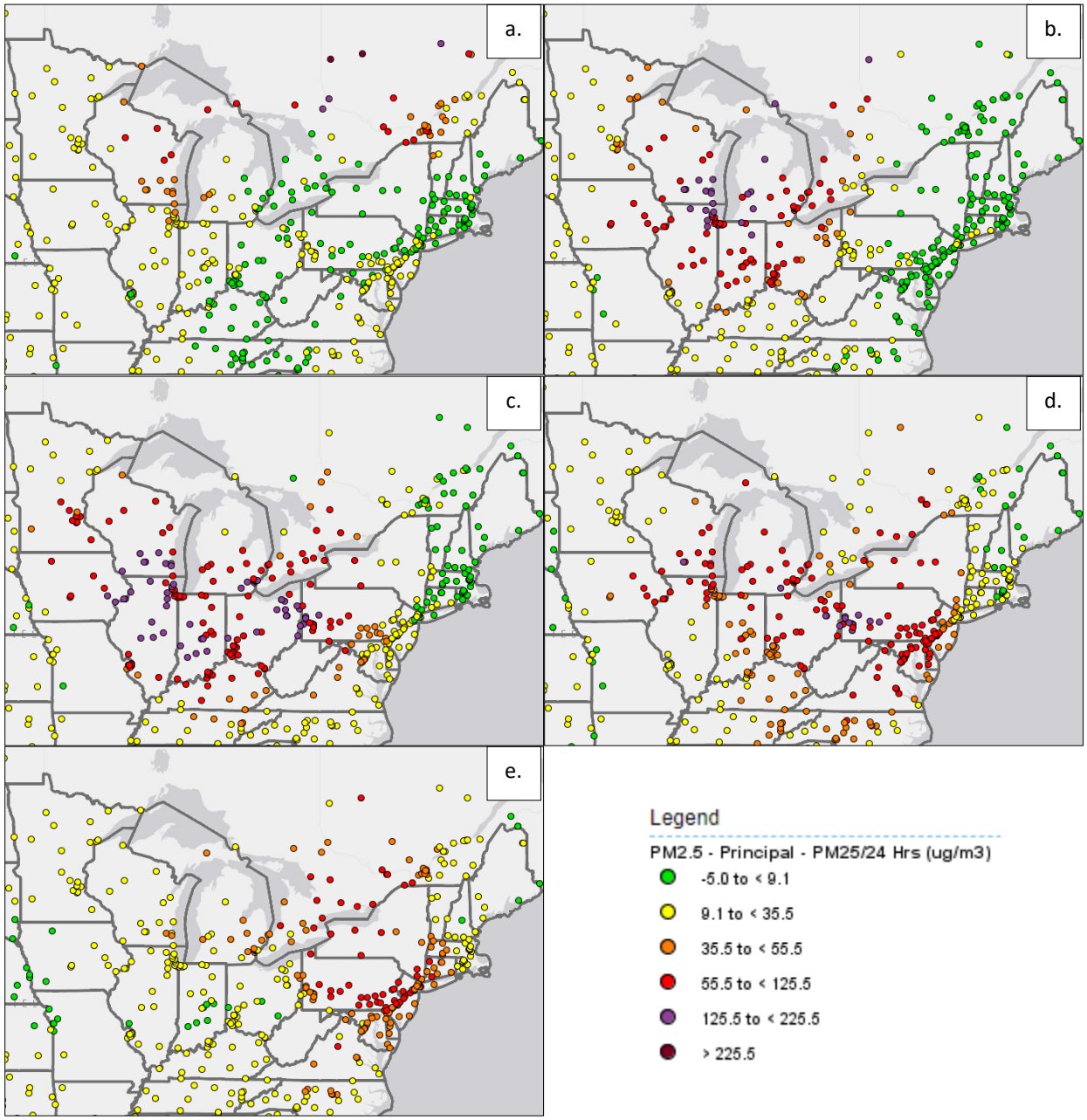

Figure 3. Observed $PM_{2.5}$ AQI (colored circles; Green=Good AQI, Yellow=Moderate AQI, Orange=Unhealthy for Sensitive Groups AQI, Red=Unhealthy AQI, Purple=Very Unhealthy AQI, and Maroon=Hazardous AQI) and corresponding daily average $PM_{2.5}$ concentration bins (lower right) for (a) June 26, 2023, (b) June 27, 2023, (c) June 28, 2023, (d) June 29, 2023, and (e) June 30, 2023.

Narrative Conceptual Model

On June 19, 2023, multiple wildfire complexes were well established across southern Quebec province. Over a one-week period, favorable meteorological conditions led to significant growth of these wildfires (Figure 4), producing an extensive area of dense smoke across southern Quebec, visible within the column via satellite imagery and confirmed to have sustained surface impacts via in-situ daily average $PM_{2.5}$ concentrations in the Very Unhealthy to Hazardous AQI range (Figure 5). With wildfire smoke impacts well established in the column across southern Quebec on June 25, meteorological features then become the catalyst for Wisconsin's June 26-30 wildfire smoke event, outlined in four phases below.

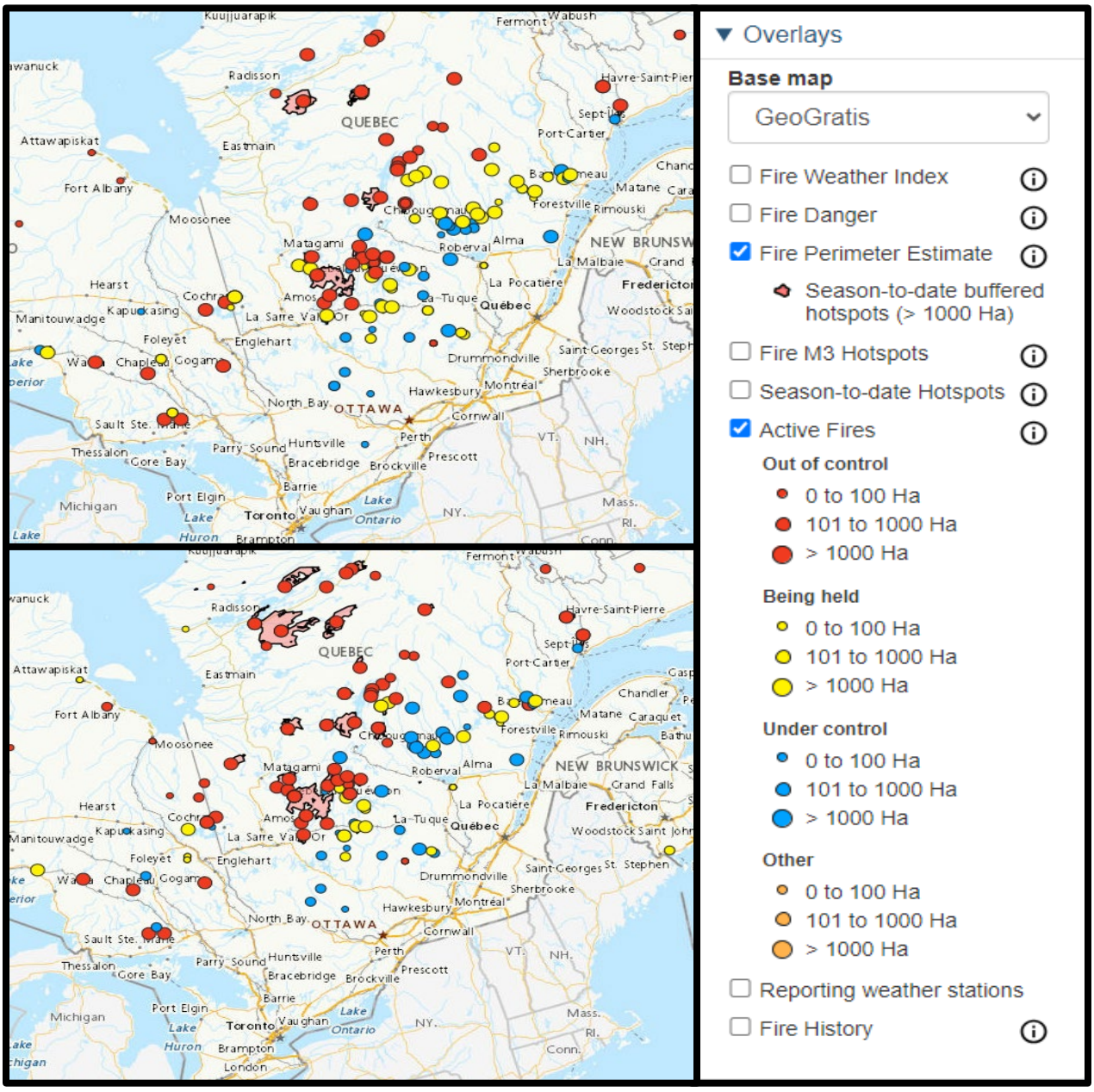

Figure 4. Active fires with fire perimeter estimate across southern Quebec on June 19 (top) and June 25 (bottom), 2023, curtesy of the Canadian Wildland Fire Information System (CWFIS).

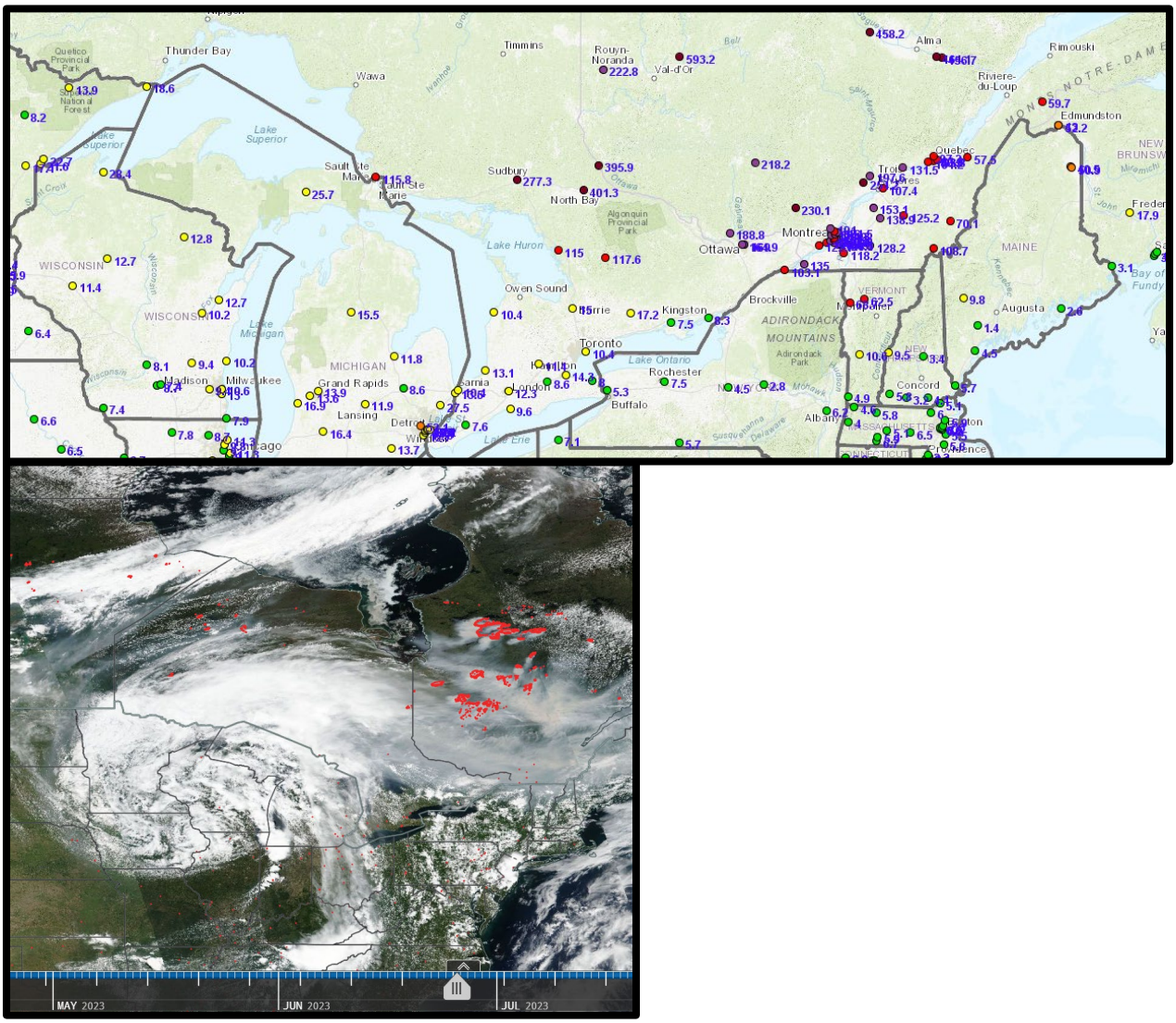

Figure 5. Daily average concentrations of surface $PM_{2.5}$ for June 25, 2023 (top) and corrected reflectance true-color imagery from the Suomi National Polar-orbiting Partnership satellite with thermal anomalies from the Terra and Aqua polar-orbiting satellites (bottom) valid for June 25, 2023. Surface $PM_{2.5}$ observations were obtained through EPA's AirNow-Tech database and satellite products were obtained through NASA's Worldview database.

Phase 1: Smoke Transport and Initial Impacts

An occluded surface low-pressure system slowly moved east across the Great Lakes region from June 25-27 (seen at bottom of Figure 5 via its signature comma-shaped cloud formation and circled in red in Figures 6 and 8). This synoptic surface feature and its cyclonic (counterclockwise) flow was responsible for the transport of low-level smoke from southern Quebec into Wisconsin on June 25-27, indicated by the black arrows in Figure 6. This led to the influx in $PM_{2.5}$ concentrations observed at the MKE16 and WCA monitors on June 26 as the smoke spilled over the northwest periphery of the low. True-color satellite imagery clearly showed this smoke plume blanketing southeast Wisconsin along the western side of the exiting surface low on June 27 (Figure 7).

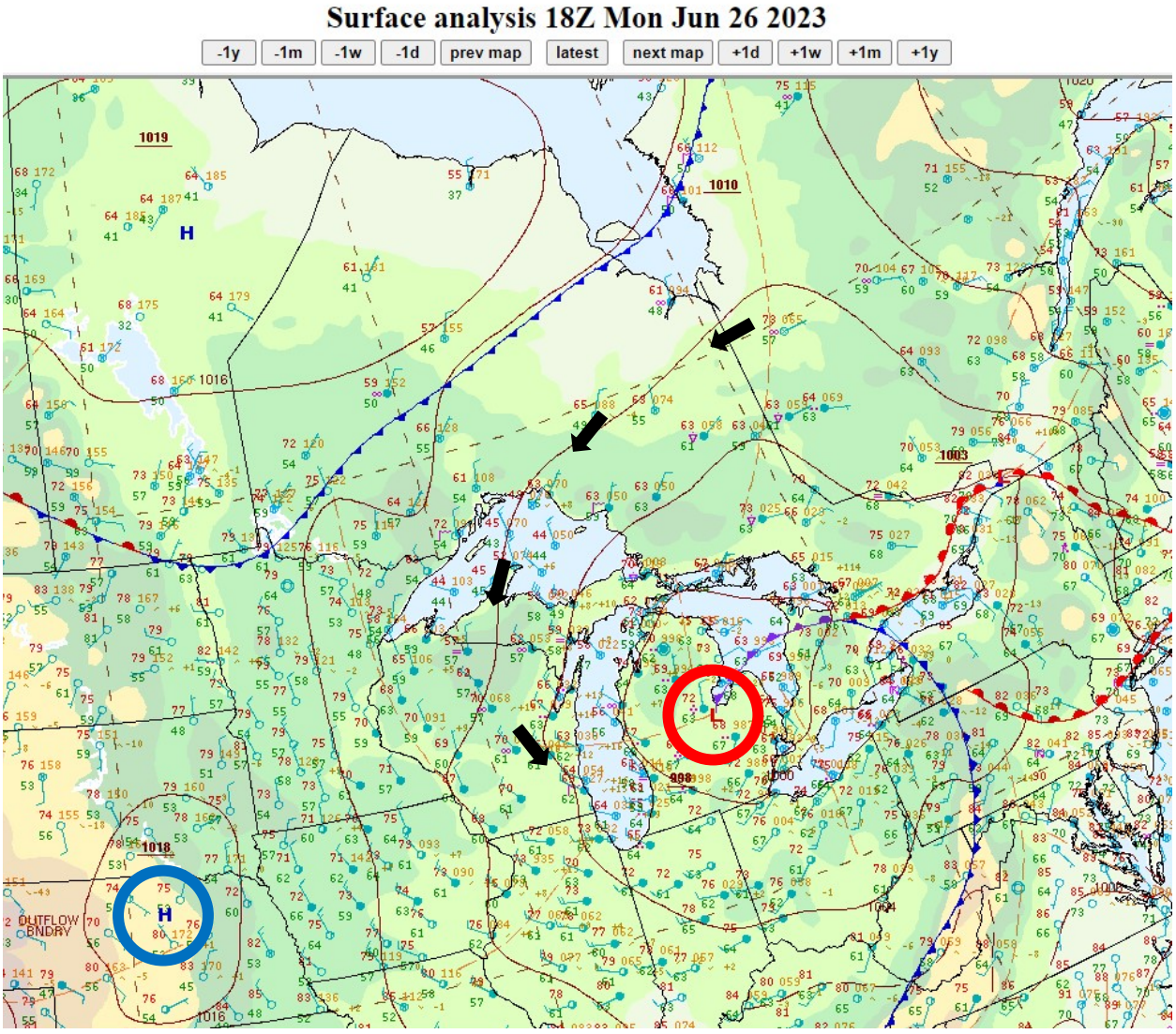

Figure 6. Surface weather map valid for 18Z on June 26, 2023. Cyclonic flow (black arrows) around the low-pressure center (red circle) resulted in the transport of smoke from Quebec into Wisconsin.

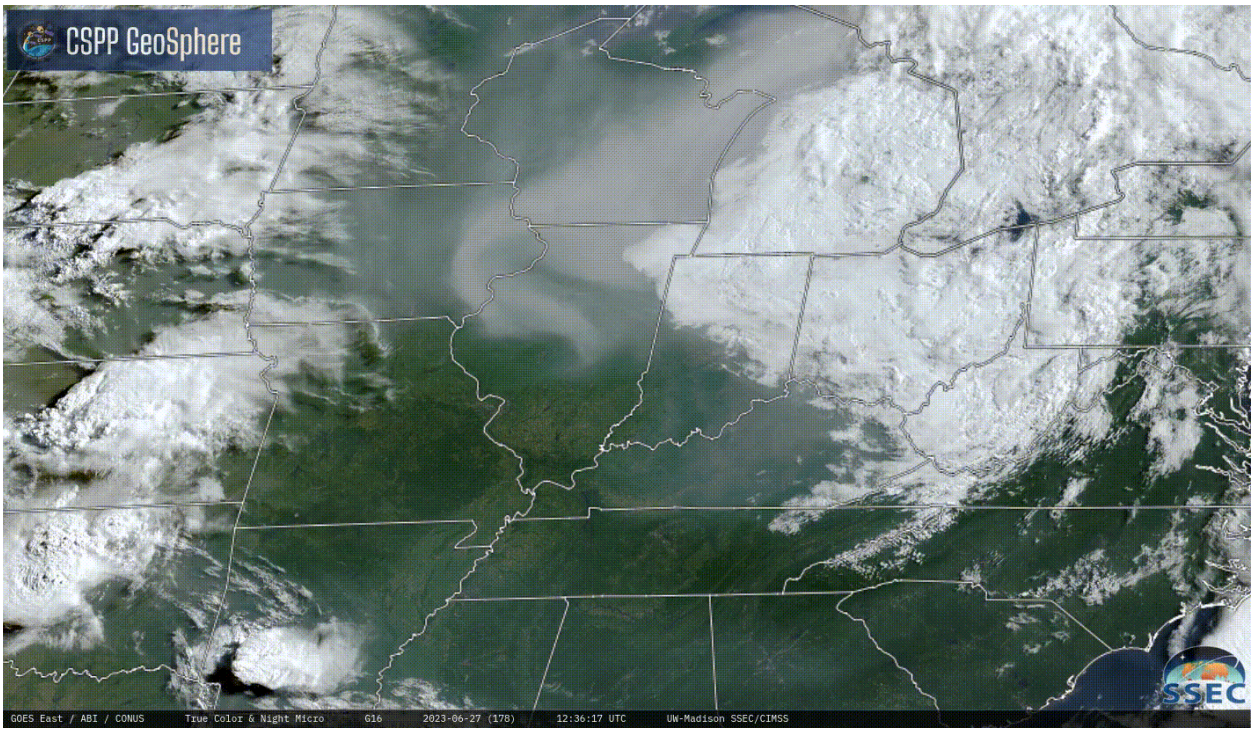

Figure 7. True-Color 15-minute imagery from the Geostationary Operational Environmental Satellites- from 1236Z – 2121Z on June 27, 2023. Imagery curtesy of UW-Madison SSEC/CIMS. https://cimss.ssec.wisc.edu/satellite-blog/archives/53108

Phase 2: Stagnation and Smoke Inundation

A broad area of high-pressure shifted east from the Plains into the upper-Mississippi River valley behind the departing low on June 26-27 before traveling over the Great Lakes region on June 28 (circled in blue in Figures 6, 8, & 9a). This synoptic feature impacted the event twofold. First, general descent within the broad high-pressure region promoted increases in measured $PM_{2.5}$ concentrations as any elevated smoke within the lower to mid-levels of the atmosphere was being steadily forced towards the surface. Second, the low-level clockwise flow near the high-pressure center was relatively weak. Both classic high-pressure system behaviors led to Unhealthy to Very Unhealthy AQI $PM_{2.5}$ concentrations from southern Kentucky to northern Wisconsin and central Iowa to central Pennsylvania (Figure 3c). The MKE16 and WCA monitors observed event maximum daily average $PM_{2.5}$ concentrations on June 27 with a slight reduction in concentrations on June 28.

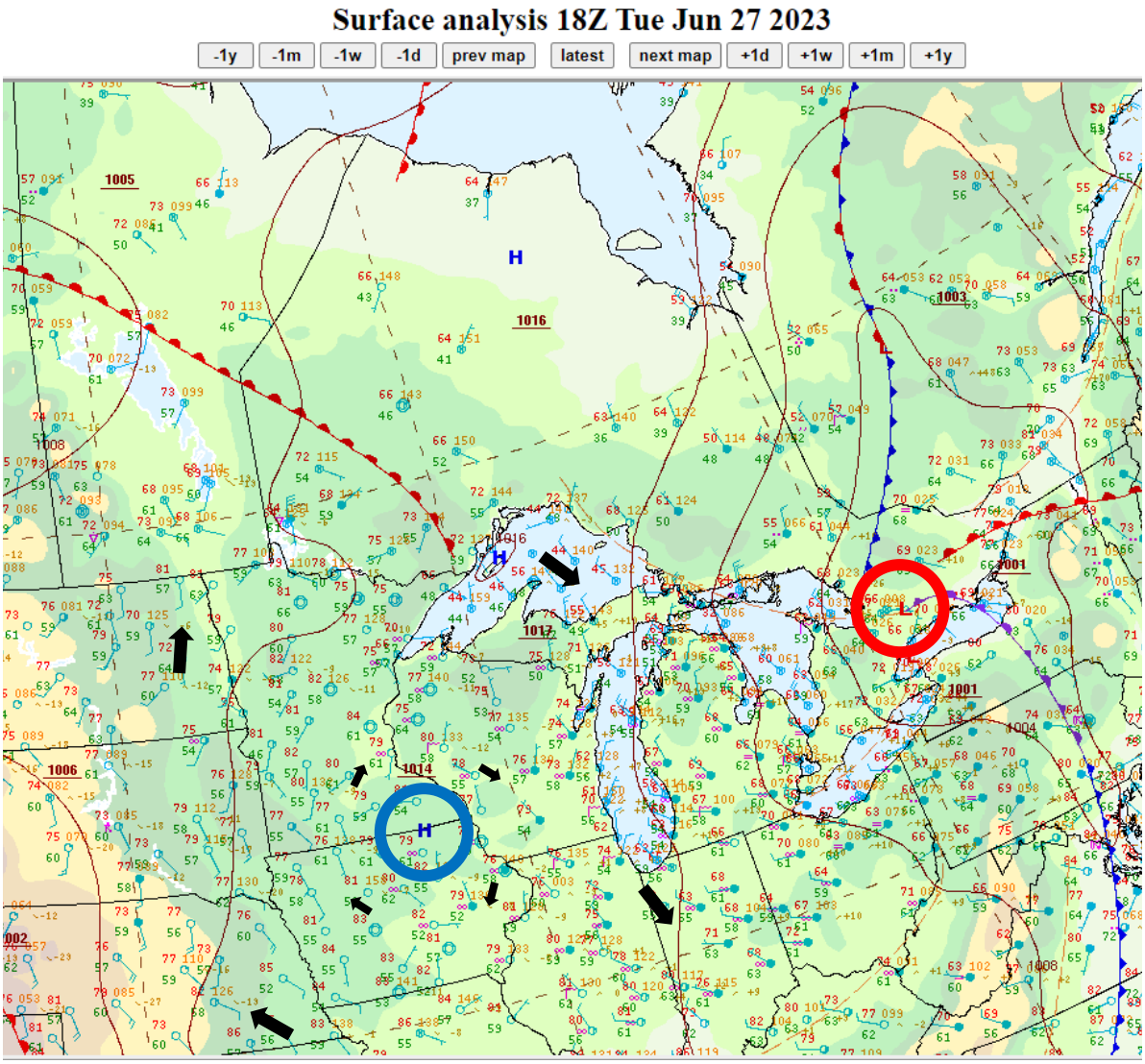

Figure 8. Surface weather map valid for 18Z on June 27, 2023. Weak anticyclonic flow (black arrows) around the high-pressure center (blue circle) resulted in stagnant conditions across Wisconsin.

Phase 3: Stagnation Weakens as Recirculation Begins

The high-pressure area continued east on June 28 and arrived over the mid-Atlantic region by June 29 (circled in blue in Figures 9a and 9b). Concurrently, a low-pressure area was developing west of Wisconsin by June 28 (highlighted by two areas of low-pressure circled in red in Figure 9a). The area of low-pressure acted in unison with the high-pressure area to tighten the pressure-gradient, which engendered south to southeasterly return flow over southeastern Wisconsin during this period (indicated by black arrows in Figures 9a and 9b). This flow pattern provided minimal relief as considerable surface smoke impacts had inundated Iowa, Illinois, Indiana, and Ohio on June 27-28. Although daily average $PM_{2.5}$ concentrations at MKE16 and WCA decreased again on June 29, concentrations remained well above normal at roughly three-times higher than their respective Tier-1 thresholds.

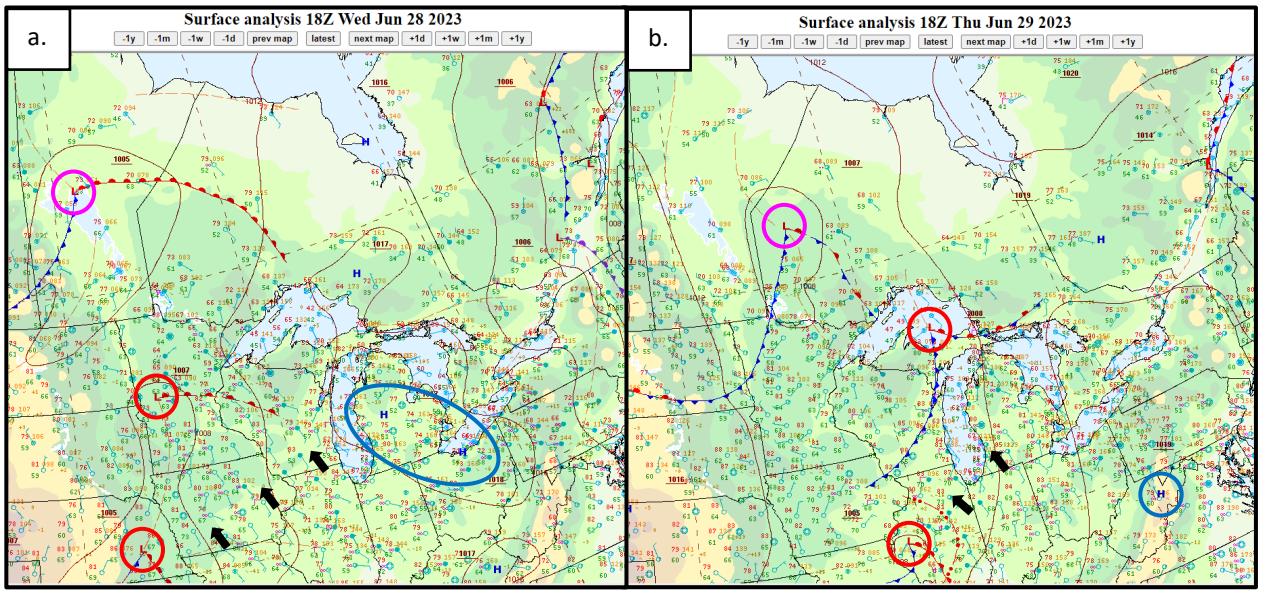

Figure 9. (a) Surface weather map valid for 18Z on June 28, 2023. (b) Surface weather map valid for 18Z on June 29, 2023. Forcing from low-pressure (red circles) and high-pressure (blue circle) resulted in southerly/southeasterly return flow (black arrows) into Wisconsin.

Phase 4: Recirculation Ends and Clearing Begins

On June 29, severe thunderstorms associated with a convective system (circled in red at bottom-center of Figure 9b) moved east across the Iowa/Missouri border, through Illinois and into Indiana. The confluence between a stalled cold front (associated with weak low-pressure over Lake Superior) and the outflow boundary of these storms (all plotted in Figure 9b) sustained elevated $PM_{2.5}$ concentrations across southeast Wisconsin through the evening of June 29 and into the early morning of June 30. It was not until a cold front associated with synoptic low-pressure (circled in magenta in Figures 9a, 9b, and 10) merged with the remnants of the weak low over Lake Superior (circled in red in Figure 10) and pushed clean air into the Milwaukee/Waukesha area around 8 a.m. CDT on June 30 (indicated by blue arrows in Figure 10) that $PM_{2.5}$ concentrations began to steadily decrease.

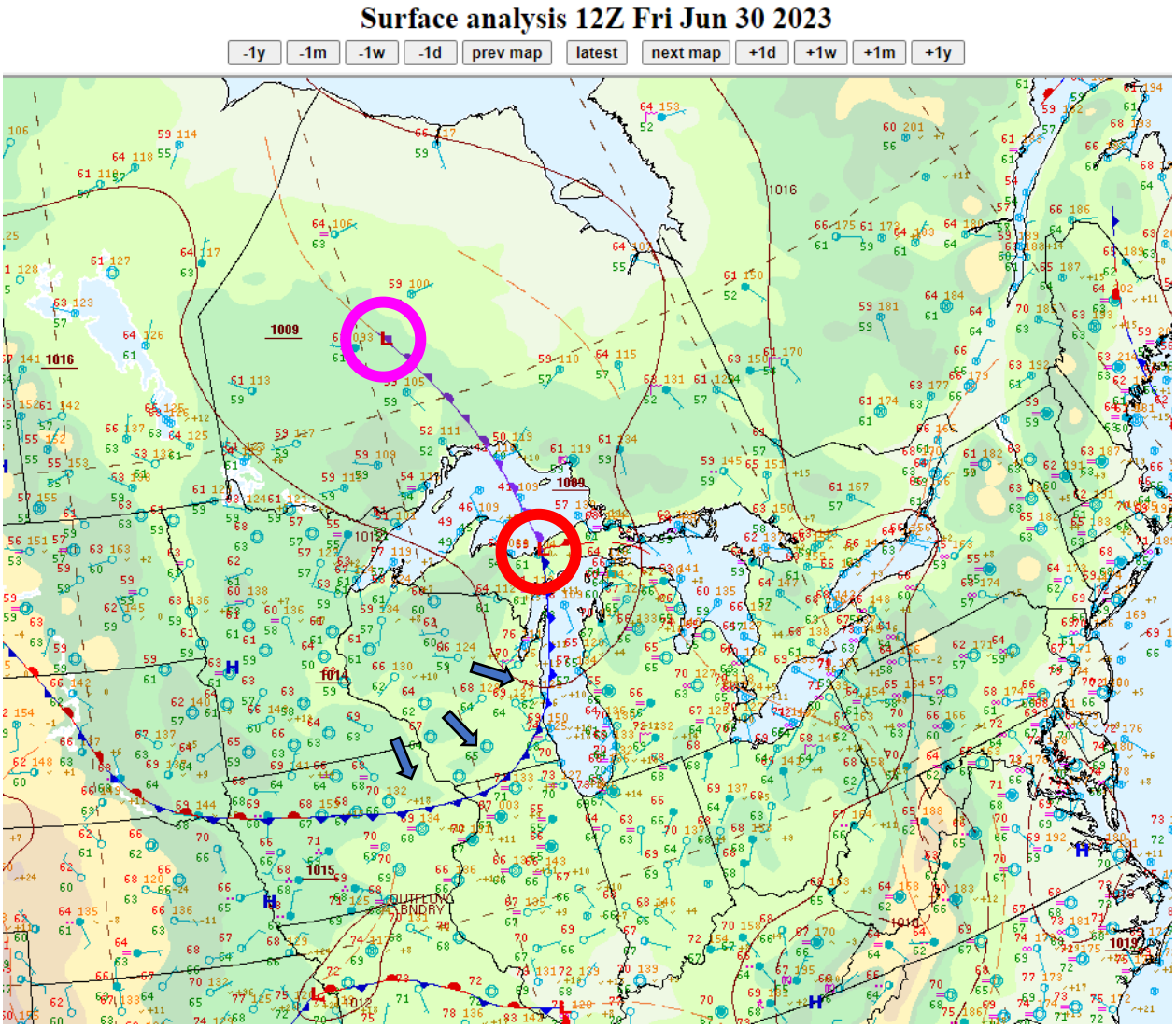

Figure 10. Surface weather map valid for 12Z on June 30, 2023. A cold front associated with a weak synoptic low (magenta circle) in Ontario ultimately brought a clean airmass into southeastern Wisconsin (blue arrows).

Tier 1 Clear Causal Relationship Analyses

This section addresses the EE Rule requirements at 40 CFR 50.14(c)(3)(iv)(B) by showing that the event affected air quality in such a way that there exists a clear, causal relationship between the specific event and the monitored exceedances, and at 40 CFR 50.14(c)(3)(iv)(C) by providing analyses comparing the event-influenced concentrations to concentrations at the same monitoring sites at other times. The $PM_{2.5}$ Wildland Fire Exceptional Events Tiering Document[3] and Wildfire Ozone Guidance[4] outline the expected components of a clear causal relationship portion of a demonstration. These include a comparison of the event-related concentrations to historical concentrations, evidence that the emissions from the wildfire were transported to the monitor and evidence that the wildfire emissions affected the monitor.

Key Factor and Tier Analysis (Comparison to Historical Concentrations)

The historical data analysis section of this demonstration focuses on 2019–2023 $PM_{2.5}$ data from the MKE16 and WCA monitoring sites. Continuous data collected via Teledyne T640(x) monitors throughout this five-year period was reported hourly, then averaged into daily values following the methodology defined by $PM_{2.5}$ NAAQS and outlined in the 40 CFR Appendix-N-to-Part-50 3.0(c). Figures 11 and 12 display the daily average $PM_{2.5}$ concentrations for the MKE16 and WCA monitors, with each colored line depicting an individual year. The late June Canadian wildfire event affected both sites, causing daily average $PM_{2.5}$ concentrations to reach over 160 µg/m^3, approximately 20 times higher than the 2019–2023 average. Implementing guidance from EPA's $PM_{2.5}$ Wildland Fire Exceptional Events Tiering Document, issued April 2024, tiering thresholds were determined by calculating 98th percentile values over various subsets of the five-year dataset (Table 2). These calculations produced tiering thresholds of 19.2 µg/m^3 and 17.4 µg/m^3 for MKE16 and WCA, respectively. Multiplying these thresholds by 1.5 yielded Tier 1 cutoff values of 28.8 µg/m^3 and 26.1 µg/m^3 for MKE16 and WCA, respectively, resulting in Tier 1 status for June 26-30, 2023, at both monitors (Table 3).

[3] https://www.epa.gov/system/files/documents/2024-04/final-pm-fire-tiering-4-30-24.pdf
[4] https://www.epa.gov/system/files/documents/2023-12/guidance-on-the-preparation-of-ee-wf-ozone.pdf

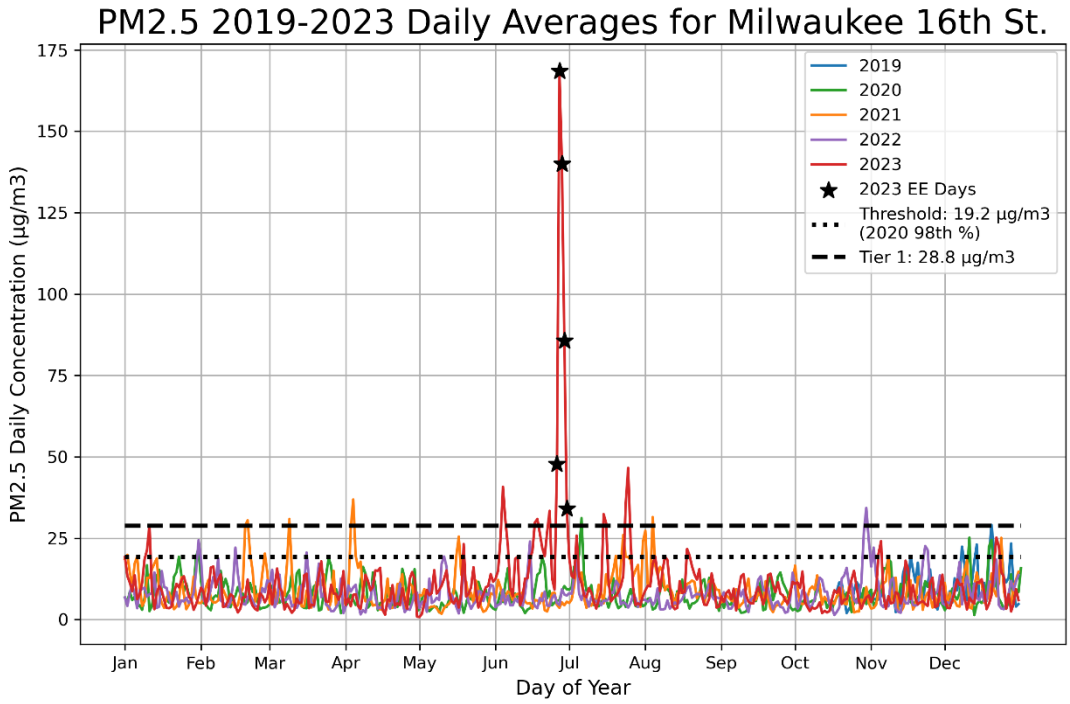

Figure 11. Time series of daily average $PM_{2.5}$ concentrations (µg/m³) spanning 2019–2023 at the MKE16 monitor. Each year is shown as an individual line, with 2023 (red) including the five event days from June 26 through June 30, 2023 (black stars). Tiering threshold (dotted) and Tier 1 cutoff (dashed) values are included to show that all five days meet Tier 1 requirements.

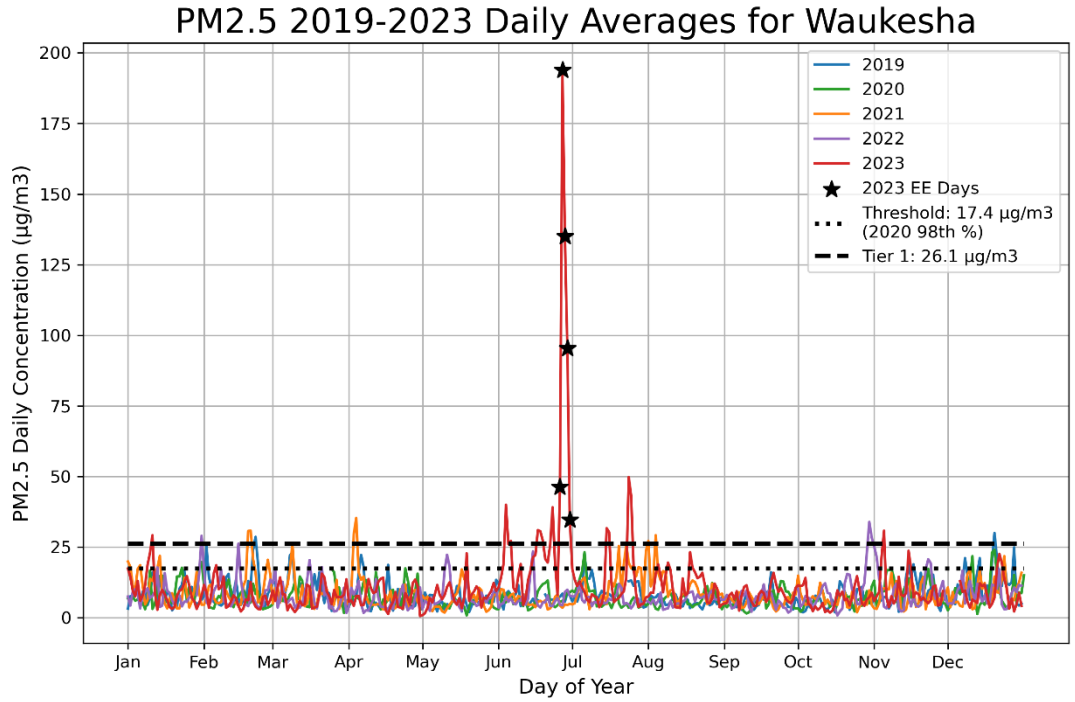

Figure 12. Time series of daily average $PM_{2.5}$ concentrations (µg/m³) spanning 2019–2023 at the WCA monitor. Each year is shown as an individual line, with 2023 (red) including the five event days from June 26 through June 30, 2023 (black stars). Tiering threshold (dotted) and Tier 1 cutoff (dashed) values are included to show that all five days meet Tier 1 requirements.

Table 2. 98th percentiles calculated across various subsets originating from daily average $PM_{2.5}$ concentrations (µg/m³) spanning 2019–2023. Monthly subsets include all data points from the specified month over the last five years. For example, the June subset includes all June datapoints from 2019-2023. Yearly subsets include all datapoints from that year. Percentile calculations use the methodology defined in the $PM_{2.5}$ NAAQS. Rows highlighted in yellow indicate values that DNR considered when assessing the tier of each event day, per EPA's tiering guidance. Of these values, the lowest (bolded in red) was used as the tiering threshold for each respective monitor.

Statistic Period	Milwaukee 16th Street	Waukesha
98th percentile daily averages of month-specific subsets spanning 2019-2023 (µg/m³)		
January	21.4	19.9
February	20.3	26.2
March	17.9	20.4
April	17.8	18.7
May	19.4	16.7
June	47.8	46.2
July	31.2	30.3
August	19.7	18.9
September	14	12.8
October	16.6	15.2
November	21.4	21.5
December	24.5	23.1
98th percentile daily averages of year-specific subsets spanning 2019-2023 (µg/m³)		
2019	23.1	22.1
2020	**19.2**	**17.4**
2021	25.5	25.4
2022	21.4	21.5
2023	33.4	34.7

Table 3. Detailed list of each event day at each monitor of interest, including the daily average $PM_{2.5}$ concentration (µg/m³), Tier 1 cutoff value (µg/m³) and resulting tier.

Date	Milwaukee 16th Street			Waukesha		
	Daily Concentration (µg/m³)	Tier 1 Cutoff (µg/m³)	Tier	Daily Concentration (µg/m³)	Tier 1 Cutoff (µg/m³)	Tier
6/26/2023	47.8	28.8	1	46.3	26.1	1
6/27/2023	168.6		1	193.9		1
6/28/2023	140.1		1	135.1		1
6/29/2023	85.9		1	95.4		1
6/30/2023	34.3		1	34.7		1

HYSPLIT Trajectories and Smoke Impact Narrative

To show the initial transport, stagnation and recirculation of smoke from the Quebec fires to the impacted monitors, the DNR utilized forward and backward trajectories from the National Oceanic and Atmospheric Administration's (NOAA) Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. Meteorological data from the 12-kilometer North American Mesoscale Forecast System (NAM) was employed, with forward and backward trajectories initialized at 100 meters, 250 meters and 500 meters above ground level (AGL). Contours indicating the presence of smoke in the column are shown with the trajectories (excluding Figure 14), courtesy of NOAA's Hazard Mapping System (HMS) Fire and Smoke Product. In addition to the HYSPLIT trajectories, a composite of satellite data from NASA Worldview comprised of the following is included:

- Moderate Resolution Imaging Spectroradiometer (MODIS) Terra corrected reflectance (true color)
- Aerosol optical depth (AOD) from the MODIS combined Terra and Aqua Multi-Angle Implementation of Atmospheric Correction (MAIAC) Land Aerosol Optical Depth level 2 product
- The Visible Infrared Imaging Radiometer Suite (VIIRS) Fire and Thermal Anomalies (day and night, 375 m) layer showing active fire detections and thermal anomalies.

As active fires burned across Quebec from June 19 through June 25 (shown in Figure 4), smoke was transported towards the Great Lakes region. The HYSPLIT forward trajectories in Figures 14 and 15a show the path of transport between June 23 and June 26. Initialized over what would be Eastern Canada's largest wildfire of 2023 (Figures 14 and 15a), flow from this fire passes over other active fire complexes in southern Quebec on June 24 and June 25 before turning west and entering the United States. Wisconsin began seeing impacts from this event on June 26, 2023, as a low-pressure system moved through the Great Lakes region. Cyclonic (counterclockwise) flow around the surface low pressure created a corridor of northerly/easterly winds between the Quebec fires and Wisconsin, allowing a significant amount of smoke to be transported into the state. Figure 15b shows a 72-hour HYSPLIT back trajectory plot with parcel paths located directly above activate fires roughly two days before significant impacts began in Wisconsin. By the afternoon of June 27, the DNR observed smoke across Wisconsin (Figure 13b) with hourly $PM_{2.5}$ averages reaching over 200 $\mu g/m^3$ at MKE16 and over 300 $\mu g/m^3$ at WCA. The HYSPLIT trajectories in Figures 14, 16a and 16b show persistent flow from the north-northeast as the surface low pressure system continued tracking east-northeast and surface high-pressure approached from the west. High-pressure settled into the region by June 28, resulting in stagnant conditions that trapped smoke near the surface. The lack of wind is evident in Figures 14, 17a and 17b, as the HYSPLIT trajectories for June 28 span a notably smaller distance compared to the previous day, especially near the surface. Wind speeds increased slightly by June 29, initiating the period of return flow discussed above in Phase 3. Though increased wind speeds would normally assist with mixing a stagnated airmass, this return flow recirculated dense surface smoke from Illinois and Indiana back into southern Wisconsin (Figures 14, 18a and 18b). On June 30, a cold front associated with the low-pressure system outlined in Phase 4 transported significantly cleaner air from the west-northwest to southeast Wisconsin (Figures 19a and 19b). The front cleared the Milwaukee-Waukesha CBSA by late morning, with hourly average $PM_{2.5}$ concentrations at the MKE16 and WCA monitors dipping below 35 $\mu g/m^3$ by 8 a.m. CDT on June 30. Overall, this event not only set new records for highest hourly and daily

average $PM_{2.5}$ concentrations measured in Wisconsin but produced the longest duration of continuous impacts on record. MKE16 observed 92 consecutive hours of $PM_{2.5}$ concentrations over 35 µg/m^3.

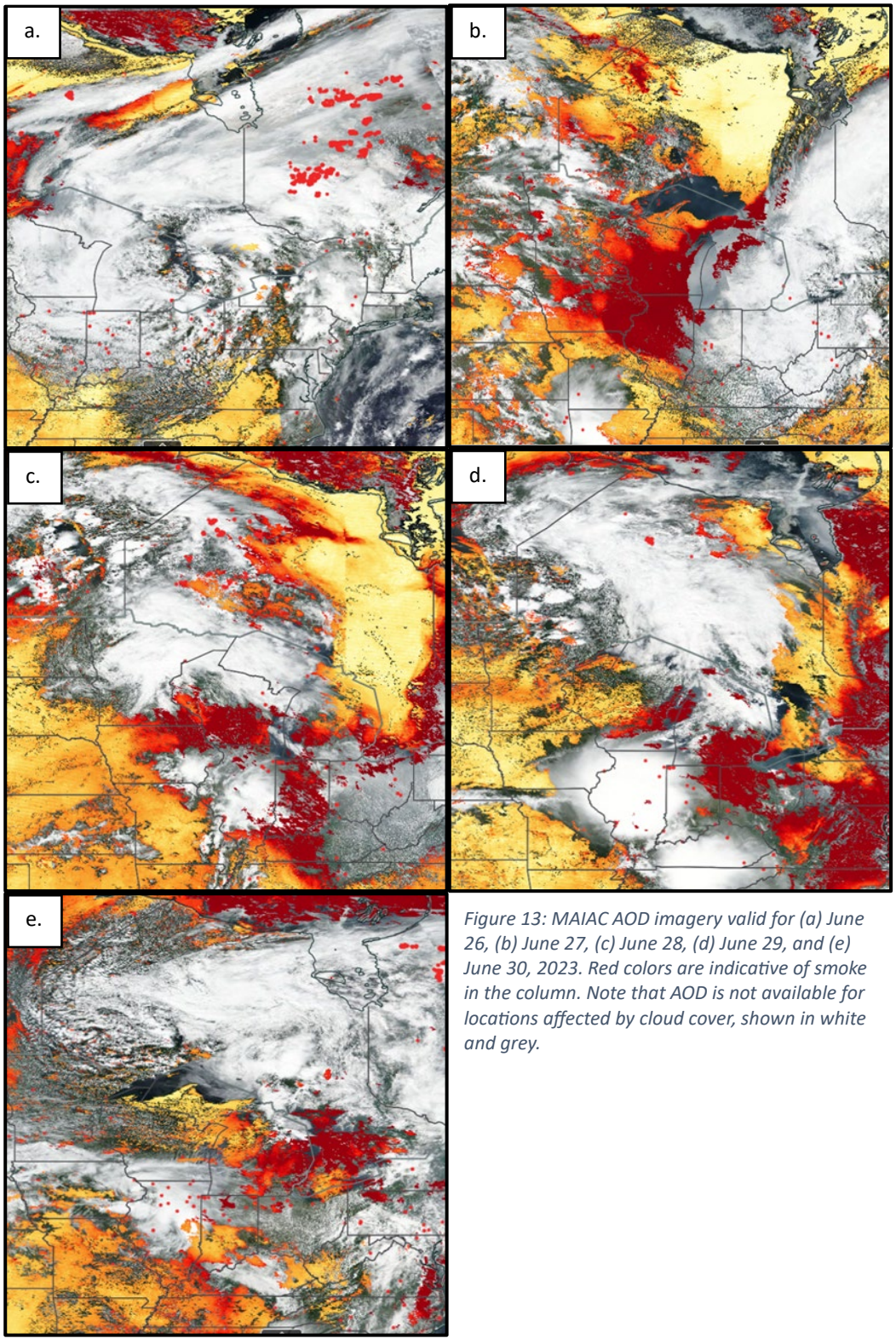

Figure 13: MAIAC AOD imagery valid for (a) June 26, (b) June 27, (c) June 28, (d) June 29, and (e) June 30, 2023. Red colors are indicative of smoke in the column. Note that AOD is not available for locations affected by cloud cover, shown in white and grey.

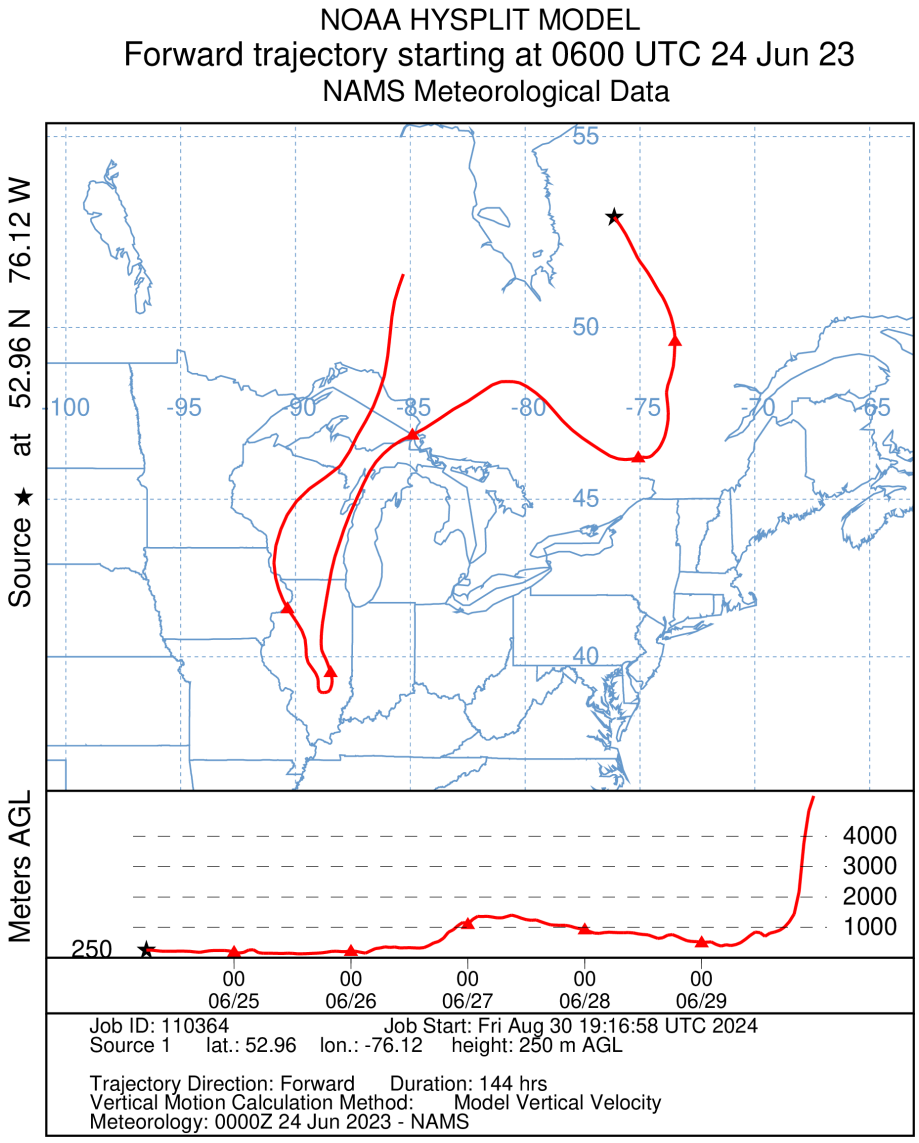

Figure 14. HYSPLIT forward trajectory initialized at 06Z on June 24, 2023. The DNR initiated the trajectory from 250 m AGL and ran forward 144-hours. Triangles along the trajectory indicate 24-hour intervals beginning 00Z on June 25 and ending 00Z on June 29, 2023. The time series under the map denotes the parcel height in meters AGL throughout the trajectory path.

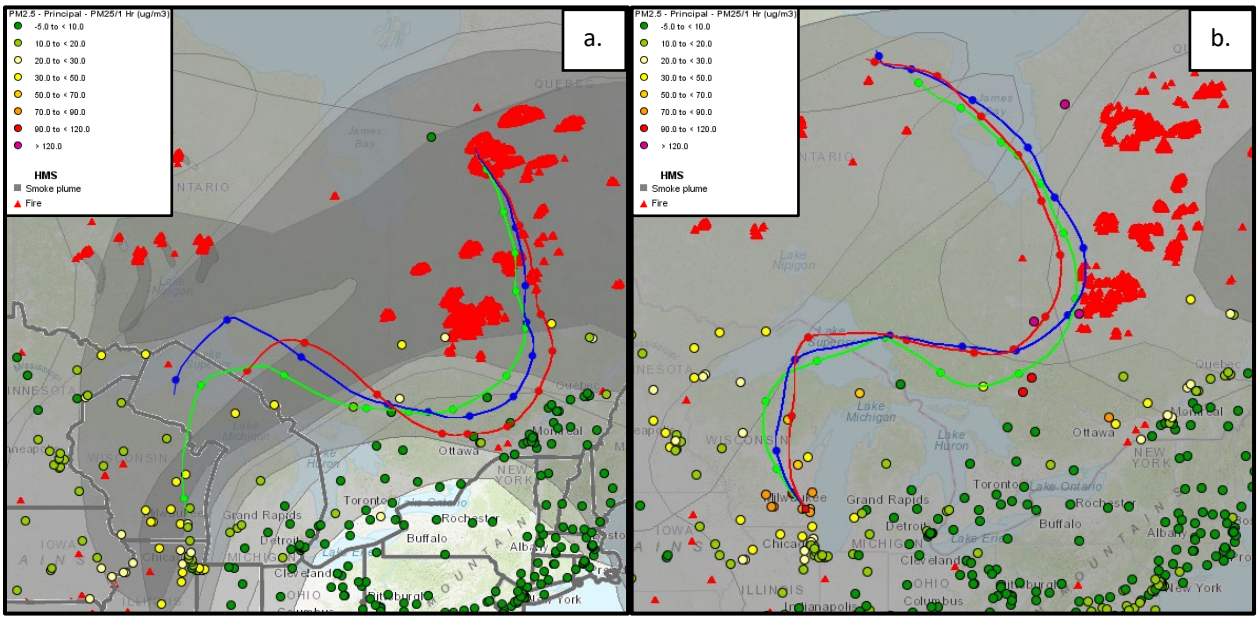

Figure 15. HYSPLIT trajectories initialized at 18Z on June 23, 2023, and run forward 72-hours (left) alongside HYSPLIT trajectories initialized at 18Z on June 26, 2023, and run backward 72-hours (right). The trajectories were initiated from heights of 100 m (green), 250 m (blue), and 500 m (red) AGL and are overlaid on $PM_{2.5}$ concentrations, HMS smoke contours, and HMS fire/hotspot data valid for respective initialization times.

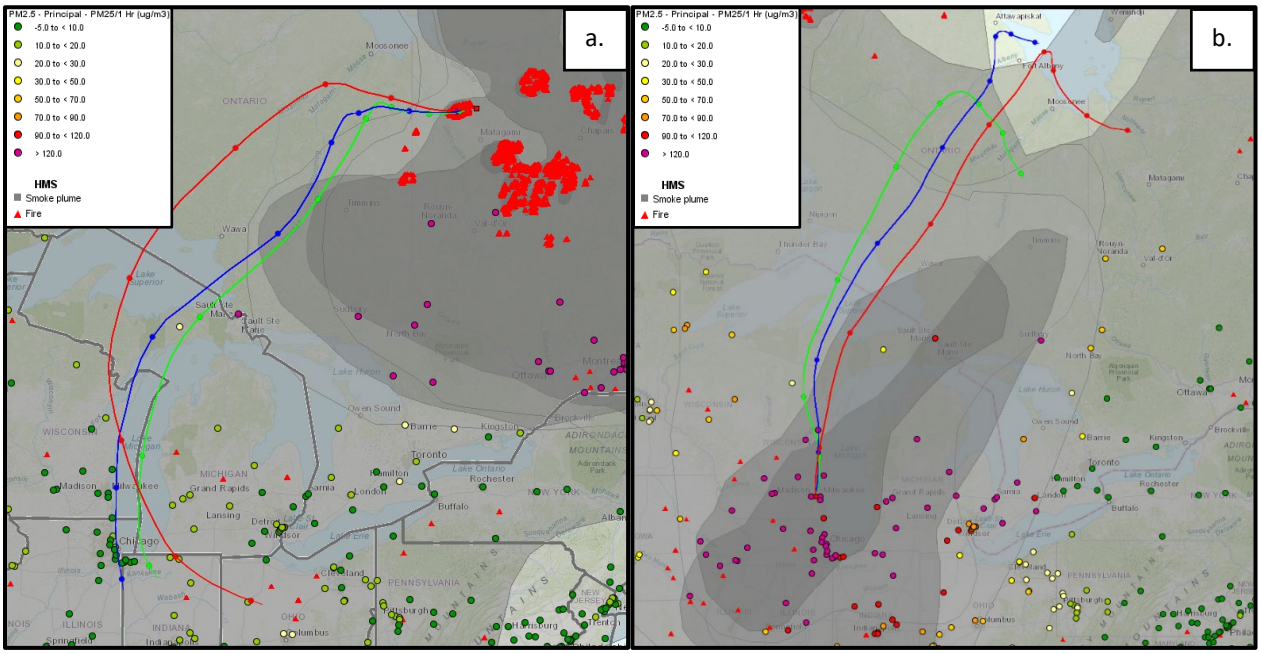

Figure 16. HYSPLIT trajectories initialized at 18Z on June 25, 2023, and run forward 48-hours (left) alongside HYSPLIT trajectories initialized at 18Z on June 27, 2023, and run backward 48-hours (right). The trajectories were initiated from heights of 100 m (green), 250 m (blue), and 500 m (red) AGL and are overlaid on $PM_{2.5}$ concentrations, HMS smoke contours, and HMS fire/hotspot data valid for respective initialization times.

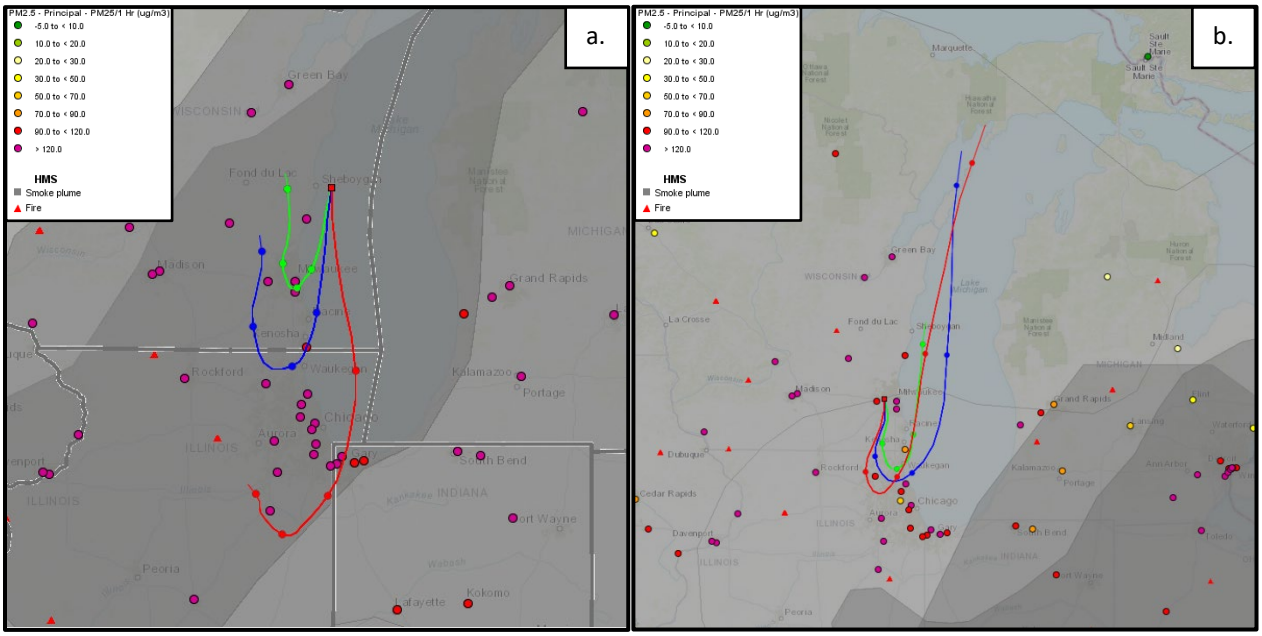

Figure 17. HYSPLIT trajectories initialized at 18Z on June 27, 2023, and run forward 24-hours (left) alongside HYSPLIT trajectories initialized at 18Z on June 28, 2023, and run backward 24-hours (right). The trajectories were initiated from heights of 100 m (green), 250 m (blue), and 500 m (red) AGL and are overlaid on $PM_{2.5}$ concentrations, HMS smoke contours, and HMS fire/hotspot data valid for respective initialization times.

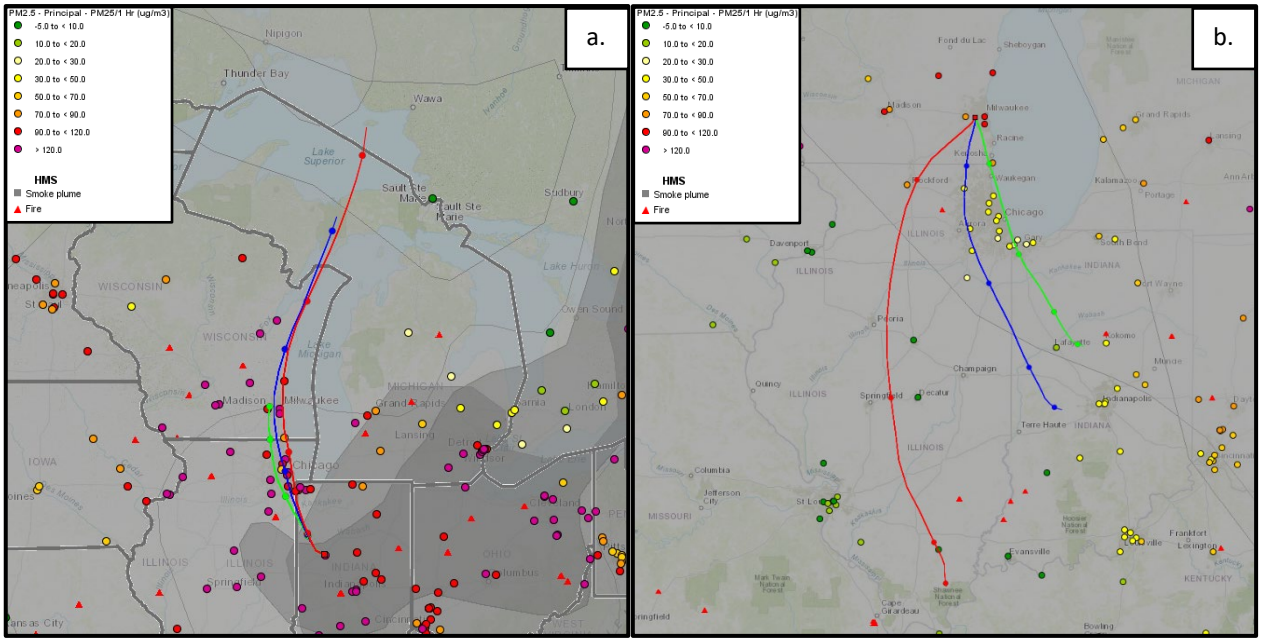

Figure 18. HYSPLIT trajectories initialized at 18Z on June 28, 2023, and run forward 24-hours (left) alongside HYSPLIT trajectories initialized at 18Z on June 29, 2023, and run backward 24-hours (right). The trajectories were initiated from heights of 100 m (green), 250 m (blue), and 500 m (red) AGL and are overlaid on PM2.5 concentrations, HMS smoke contours, and HMS fire/hotspot data valid for respective initialization times.

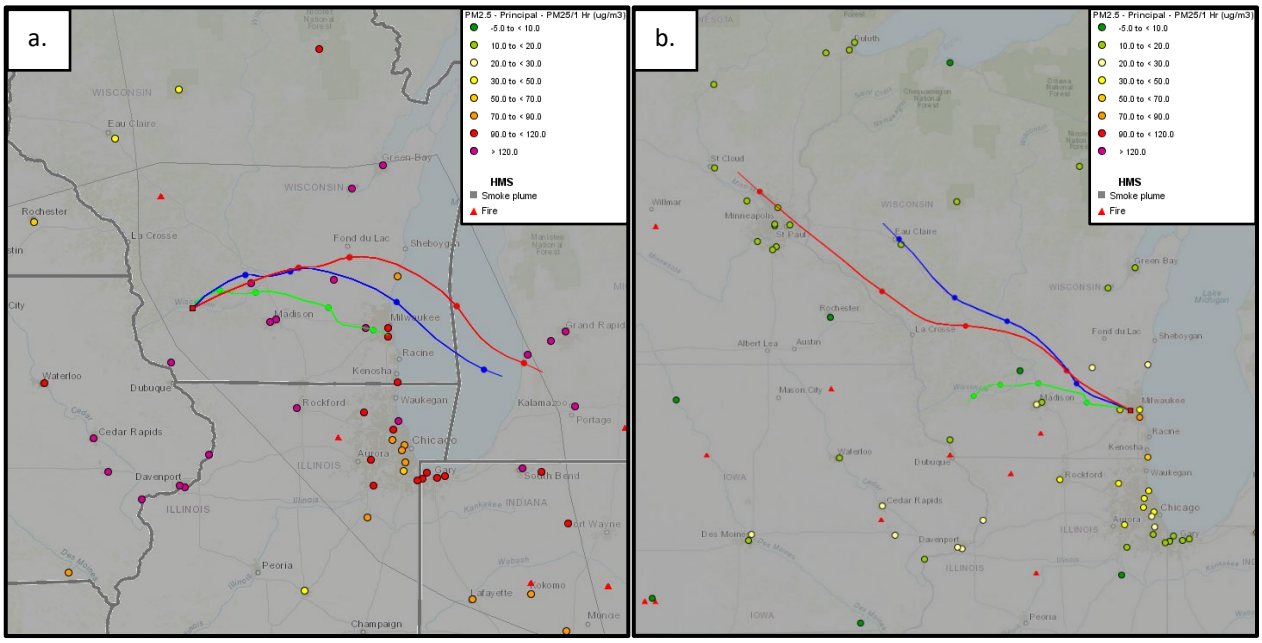

Figure 19. HYSPLIT trajectories initialized at 12Z on June 29, 2023, and run forward 24-hours (left) alongside HYSPLIT trajectories initialized at 12Z on June 30, 2023, and run backward 24-hours (right). The trajectories were initiated from heights of 100 m (green), 250 m (blue), and 500 m (red) AGL and are overlaid on $PM_{2.5}$ concentrations, HMS smoke contours, and HMS fire/hotspot data valid for respective initialization times.

Not Reasonably Controllable or Preventable

Section 40 CFR 50.14 (c)(3)(iv)(D) requires a demonstration that the event was both not reasonably controllable and not reasonably preventable. 40 CFR 50.14(b)(4) states that every wildfire occurring predominantly on wildland satisfies both the not reasonably controllable and not reasonably preventable criteria unless there is evidence that demonstrates otherwise.

The Canadian government estimates that on average 67% of the area burned in Canada annually from wildland fires is due to lightning-caused fires,[5] and the Canadian Interagency Forest Fire Centre (CIFFC) reported that 99.9% of the area burned in Quebec Province in 2023 was caused by lightning.[6] Thus, the late June Quebec fires were originally ignited by lightning and consumed natural fuels (trees, brush, grass, etc.) as they grew.

Based on the information provided above, the 2023 late June wildland fires in Quebec could not have been prevented and could not have been controlled by state or federal natural resources managers in the U.S. Therefore, the excessive wildland fire smoke emissions that caused preliminary violations of the annual $PM_{2.5}$ NAAQS at the MKE16 and WCA monitors were not reasonably controllable or preventable, nor were they the result of emissions from anthropogenic sources.

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

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

Natural Event

The EE Rule 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 50.14(c)(3)(iv)(E)). The definition of wildfire in the EE Rule is: "… any fire started by an unplanned ignition caused by lightning; … A wildfire that predominately occurs on wildland is a natural event." The EE Rule also 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."[7]

Based on the documentation provided in this demonstration, the 2023 late June Quebec events qualify as wildland fires because they were ignited by lightning and consumed natural fuels (trees, brush, grass, etc.). Additionally, the EPA considers the emissions of $PM_{2.5}$ from wildland fires to meet the regulatory definition of a natural event at 40 CFR 50.1(k), defined as one "in which human activity plays little or no direct causal role." Therefore, the late June Quebec events that are the subject of this demonstration were natural events and should be considered for treatment as EEs.

[7] 81 F.R. 68216

Public Outreach

The DNR's air quality forecasters tracked numerous Canadian wildfires and their impact on Wisconsin's air quality through the summer of 2023. The first $PM_{2.5}$ Air Quality Advisory associated with Canadian wildfire smoke was issued on May 18 and the last advisory ended on August 18. Forecasters specifically began tracking and communicating the potential for smoke impacts from eastern Canadian wildfires in the provinces of Ontario and Quebec on June 2. The first communication of potential surface air quality impacts over Wisconsin for the late June Quebec event occurred on June 23.

The DNR, in coordination with the Wisconsin Department of Health Services, quickly responded to the dense surface smoke impacting Wisconsinites in late June. Table 4 provides examples of outreach the DNR and other regional agencies provided to the public between June 26-29. The DNR had an Air Quality Advisory in effect within the Milwaukee-Waukesha CBSA from 6 a.m. on June 26 until noon on June 30, which was distributed on the DNR's air quality homepage (https://airquality.wi.gov), to the National Weather Service and through the DNR's GovDelivery service. The air quality homepage noted above was live throughout the late June Quebec event; all monitors within the Milwaukee-Waukesha CBSA (Figure 20; MKE16, WCA, Milwaukee – College Avenue, Harrington Beach) provided real-time air quality information to this site and to AirNow.

Date	Agency	Message
June 27, 2023	Wisconsin Dept of Natural Resources	Air Quality Alert
June 27, 2023	Public Health Madison and Dane County (WI)	Public Health Advisory
June 27, 2023	Michigan Dept of Environment, Great Lakes, and Energy	Air Quality Alert and Public Health Advisory
June 27, 2023	Ohio Dept of Health	Public Health Alert
June 28, 2023	City of Chicago	Public Health Advisory
June 28, 2023	City of Cleveland	Public Health Alert
June 29, 2023	Detroit Health Dept	Public Health Guidance

Table 4. Public health and air quality alerts for the Late June Quebec Wildfire Smoke Event in the Great Lakes region.

Figure 20. Map of $PM_{2.5}$ monitoring sites within the Milwaukee-Waukesha CBSA (red border).

Public Comment Process

The DNR published a notice of availability for this proposed exceptional events demonstration on its website on October 1, 2024, making this document available for public comment through October 31, 2024. The DNR will respond to any public comments received on this draft in the final Exceptional Events Demonstration it submits to the EPA.

Appendices

All public comments received and DNR's responses will be placed in the appendices.