

Table 12. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 7, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 7, 2023
00:00	15.1	33.8
01:00	14.8	26.1
02:00	14.6	21.0
03:00	15.3	24.5
04:00	15.5	28.6
05:00	16.0	23.2
06:00	17.4	30.6
07:00	17.6	31.4
08:00	16.2	64.6
09:00	13.9	64.8
10:00	13.4	63.1
11:00	12.6	58.0
12:00	12.3	36.7
13:00	11.8	36.8
14:00	11.3	28.9
15:00	10.9	25.0
16:00	11.2	23.8
17:00	10.8	17.4
18:00	10.5	17.1
19:00	11.3	29.5
20:00	12.6	52.7
21:00	14.0	45.9
22:00	15.3	52.9
23:00	15.6	51.0

Figure 127. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 7, 2023, and 2021-2025 average June concentrations.

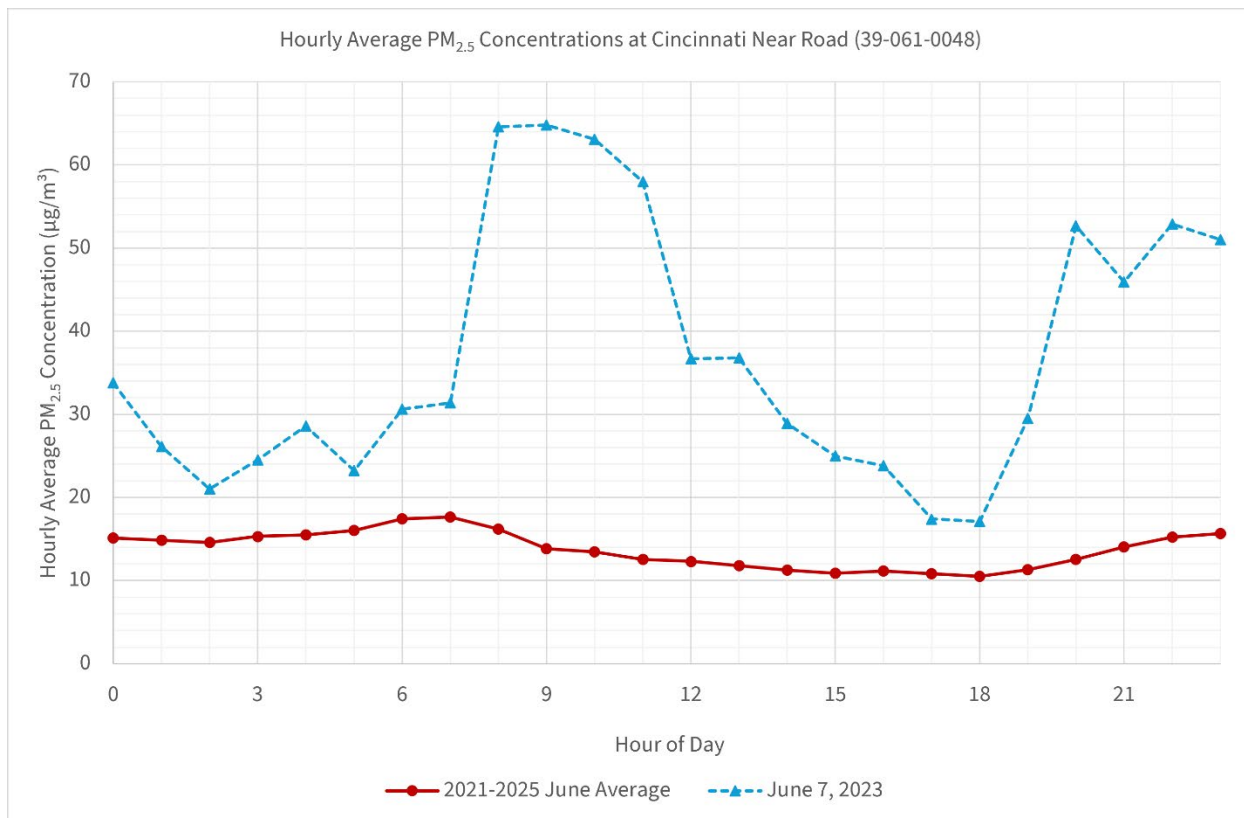
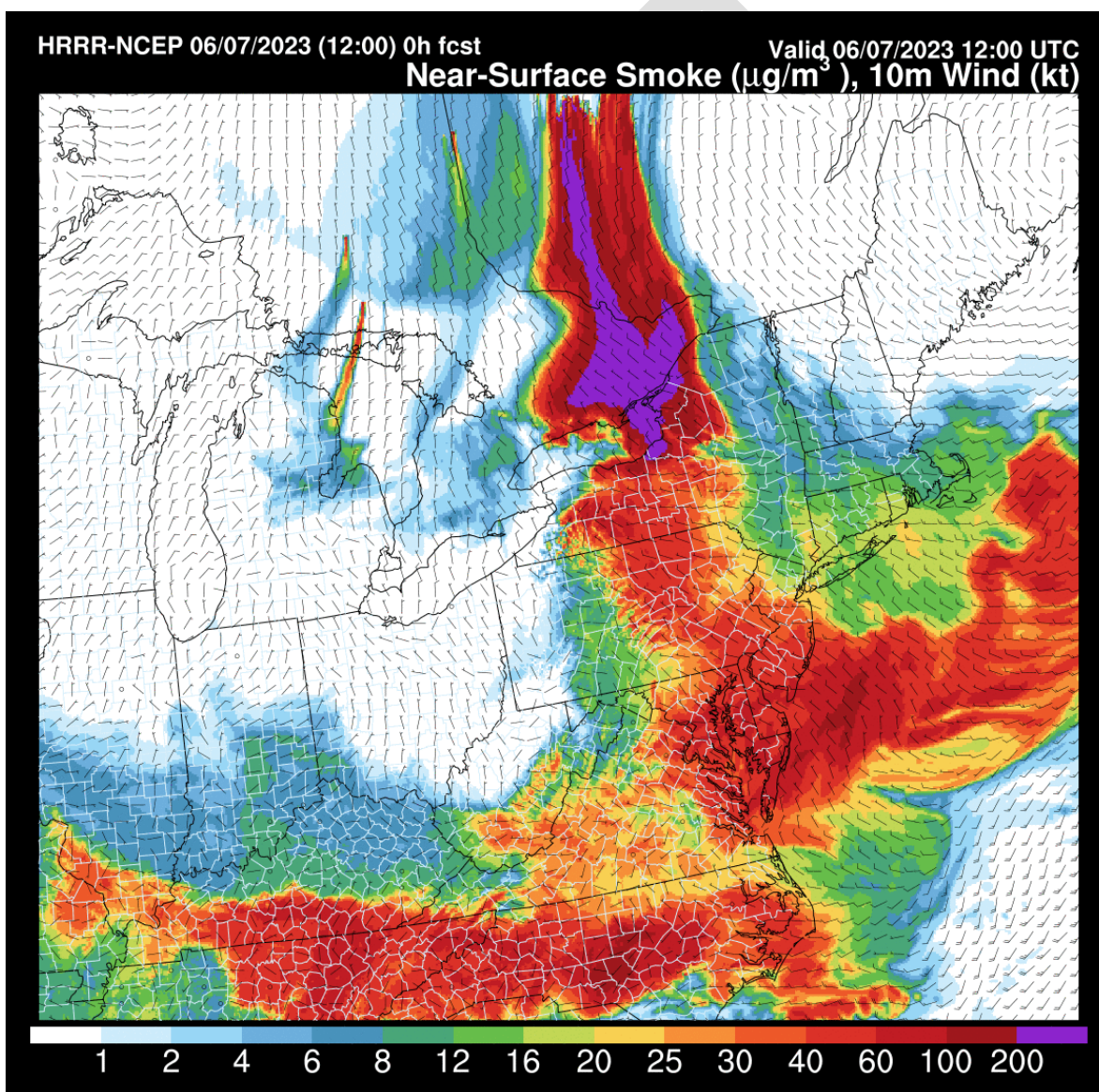


Figure 128 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 12Z (07:00 EST) on June 7, 2023. The HRRR model initialization showed near-surface smoke across Southwestern Ohio, including near-surface smoke concentrations of approximately $8 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 7, 2023.

Figure 128. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 12Z (07:00 EST) on June 7, 2023.



3.1.5. June 8, 2023

The HYSPLIT 48-hour back and 45-hour forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 8, 2023. Figure 129 shows the HYSPLIT 48-hour back trajectory plot for June 8, overlaid on a map of fire locations, monitored hourly average surface $PM_{2.5}$ concentrations at 05:00 EST, and HMS smoke polygons for June 6. Figure 130 shows the HYSPLIT 45-hour forward trajectory plot for June 6, overlaid on a map of fire locations, monitored hourly average surface $PM_{2.5}$ concentrations at 02:00 EST, and HMS smoke polygons for June 8. The wildfires burning 240 km (149.1 mi) east of Wemindji, Quebec coincide with the point (at 2129.8 meters AGL) at 05:00 EST on June 6 of the 500-meter release height back trajectory from Cincinnati and the 2125-meter release height forward trajectory from those wildfires at 05:00 EST on June 6 reaches Cincinnati (at 318.3 meters AGL) at 02:00 EST on June 8. The coincidence of the 48-hour back and 45-hour forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 8, 2023. The accompanying imagery map for June 8 presented in Figure 131 shows visible wildfire smoke over the western portion of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 8, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 129. HYSPLIT 48-hour back trajectory plot from 02:00 EST on June 8, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for 05:00 EST on June 6, 2023.

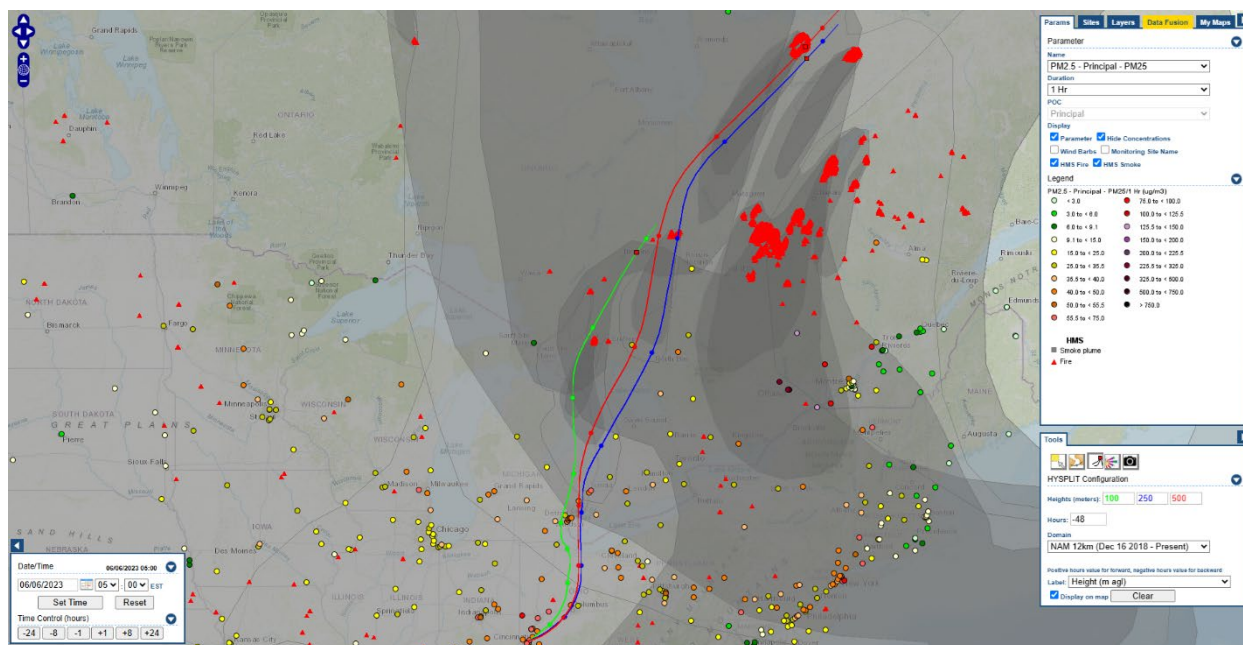


Figure 130. HYSPLIT 45-hour forward trajectory plot from 05:00 EST on June 6, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for 02:00 EST on June 8, 2023.

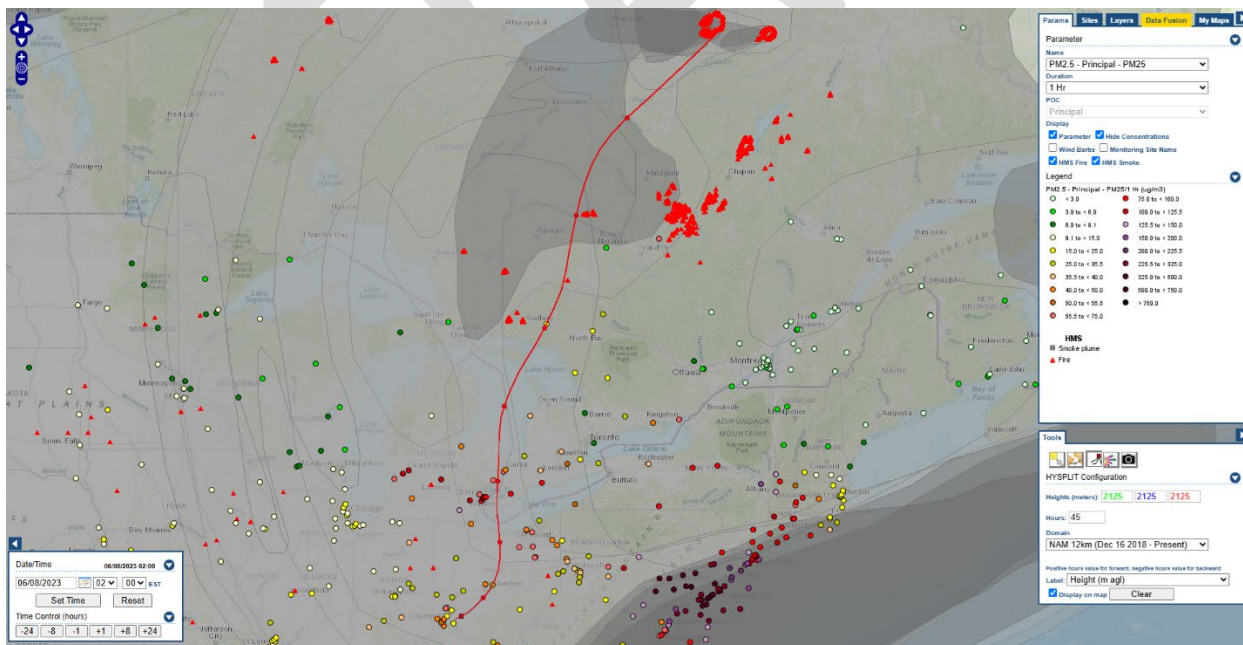


Figure 131. Terra satellite true color imagery of Ohio and surrounding states for June 8, 2023, showing visible wildfire smoke (outlined in yellow) over the western portion of Ohio, including Hamilton County.

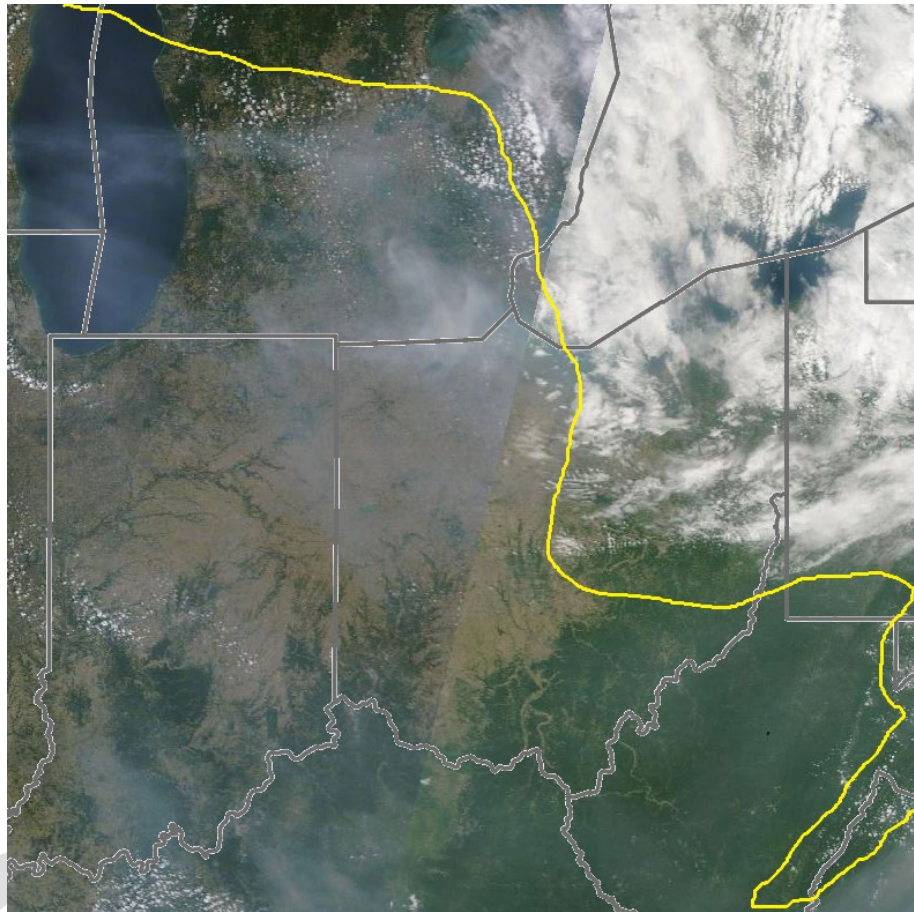


Table 13 and Figure 132 show the hourly average $PM_{2.5}$ concentrations on June 8, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 14 and Figure 133 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations were already elevated due to lingering wildfire smoke near the surface and remained elevated the rest of the day as more wildfire smoke aloft continually descended on the surface, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on June 8, 2023.

Table 13. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 8, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 8, 2023
00:00	12.8	61.7
01:00	12.9	53.2
02:00	12.5	41.7
03:00	12.5	34.9
04:00	12.7	35.4
05:00	13.0	34.8
06:00	13.6	38.2
07:00	14.5	47.3
08:00	14.7	44.3
09:00	13.9	36.1
10:00	14.1	33.2
11:00	13.7	29.7
12:00	13.4	28.3
13:00	13.2	25.7
14:00	12.5	23.5
15:00	12.2	22.1
16:00	11.9	21.0
17:00	11.3	24.1
18:00	11.0	25.4
19:00	11.6	26.4
20:00	12.5	27.7
21:00	13.3	27.3
22:00	13.8	31.1
23:00	13.3	30.5

Figure 132. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 8, 2023, and 2021-2025 average June concentrations.

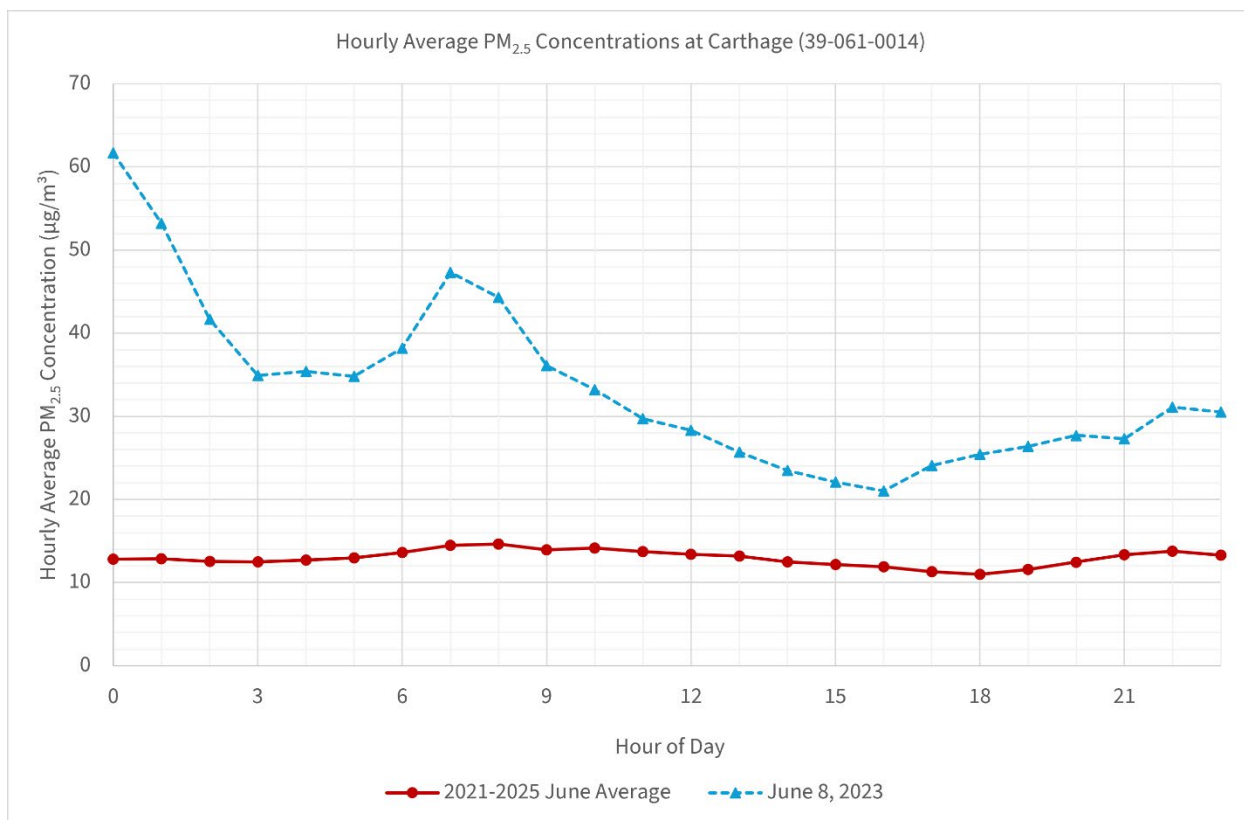


Table 14. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 8, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 8, 2023
00:00	15.1	47.8
01:00	14.8	50.5
02:00	14.6	42.9
03:00	15.3	40.9
04:00	15.5	25.1
05:00	16.0	26.0
06:00	17.4	28.2
07:00	17.6	35.5
08:00	16.2	32.3
09:00	13.9	24.1
10:00	13.4	21.6
11:00	12.6	18.5
12:00	12.3	18.4
13:00	11.8	15.9
14:00	11.3	15.0
15:00	10.9	16.3
16:00	11.2	15.7
17:00	10.8	10.1
18:00	10.5	19.7
19:00	11.3	19.9
20:00	12.6	27.1
21:00	14.0	21.8
22:00	15.3	21.8
23:00	15.6	25.4

Figure 133. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 8, 2023, and 2021-2025 average June concentrations.

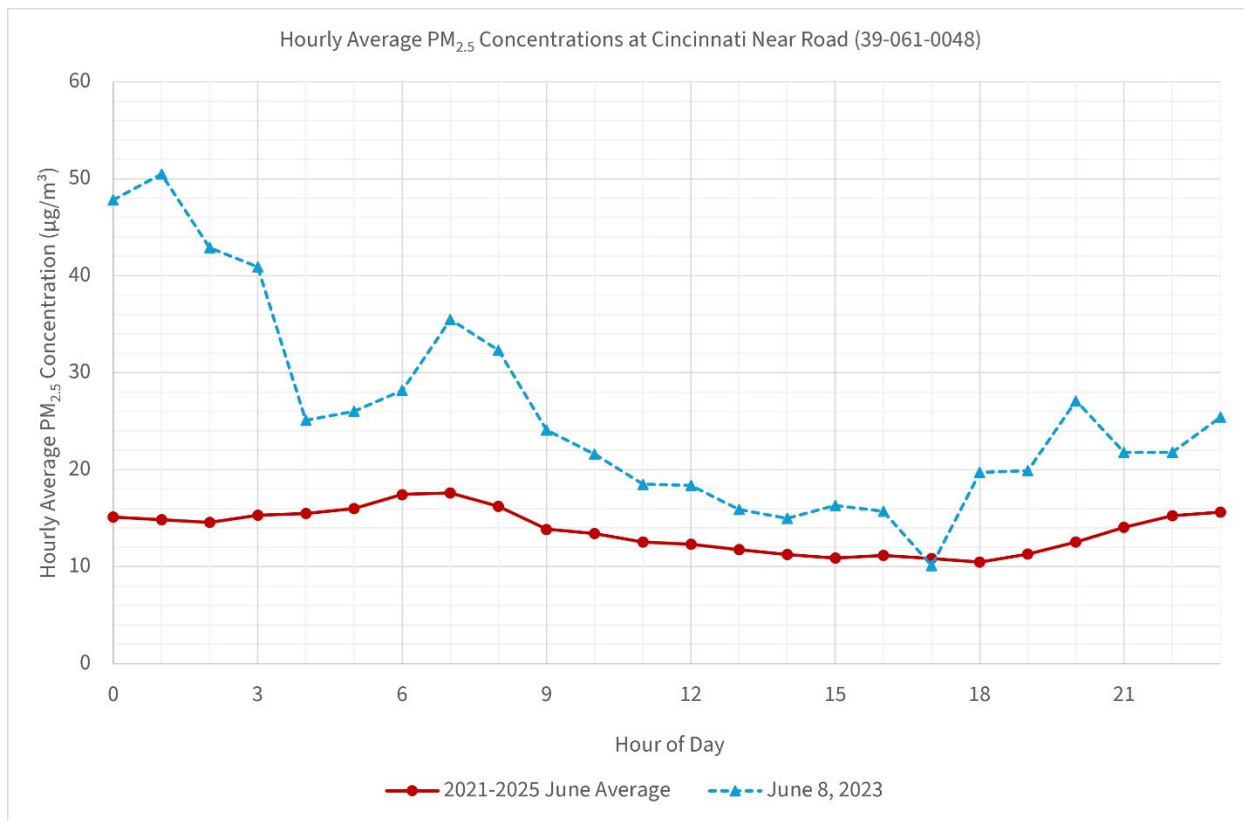
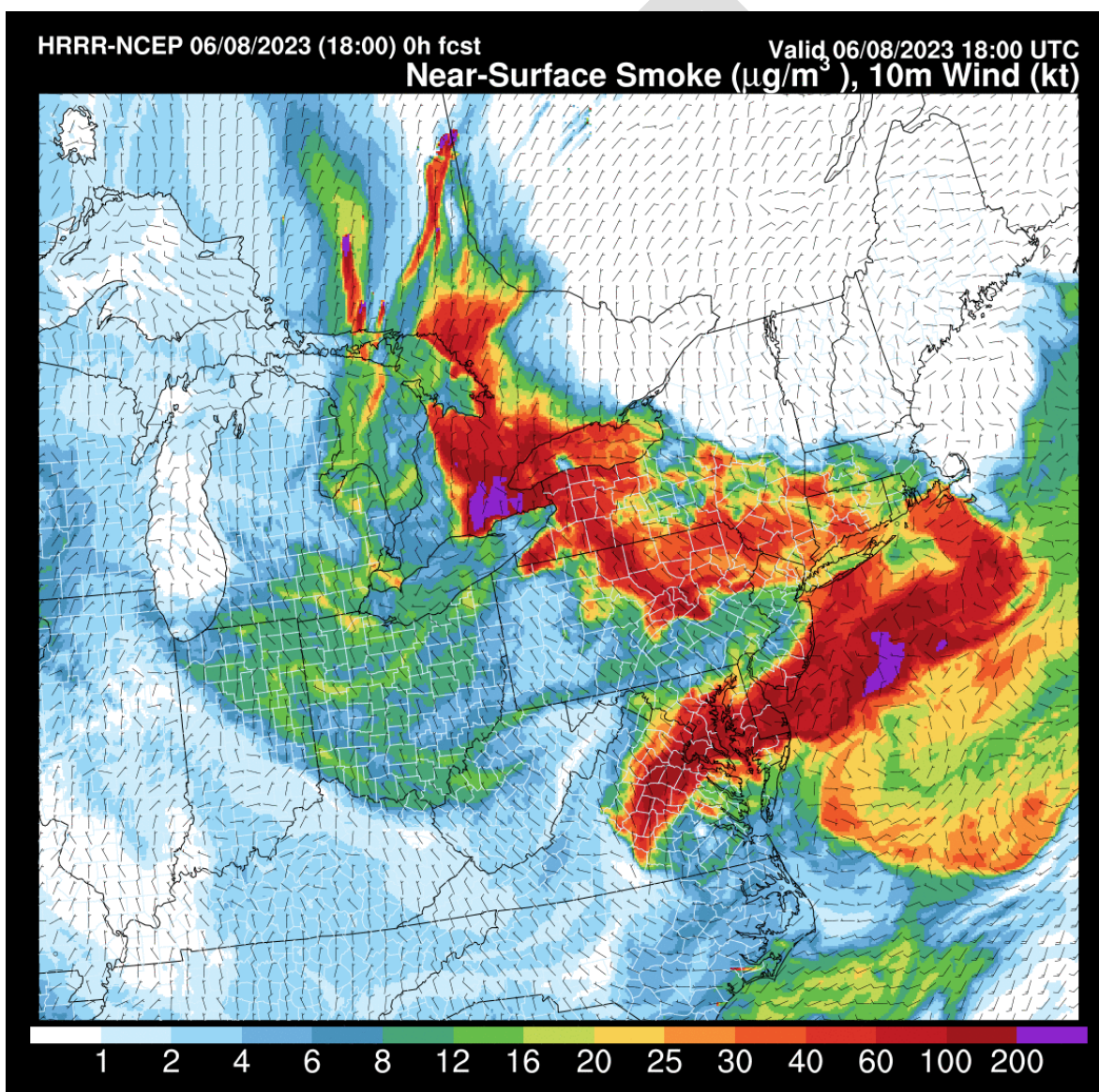


Figure 134 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 8, 2023. The HRRR model initialization showed near-surface smoke across Ohio, including near-surface smoke concentrations of approximately 8-12 $\mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 8, 2023.

Figure 134. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 8, 2023.



3.1.6. June 9, 2023

The HYSPLIT 60-hour back and 52-hour forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface $PM_{2.5}$ concentrations at the Carthage monitoring site in Hamilton County on June 9, 2023. Figure 135 shows the HYSPLIT 60-hour back trajectory plot for June 9, overlaid on a map of fire locations, monitored hourly average surface $PM_{2.5}$ concentrations at 20:00 EST, and HMS smoke polygons for June 6. Figure 136 shows the HYSPLIT 52-hour forward trajectory plot for June 6, overlaid on a map of fire locations, monitored hourly average surface $PM_{2.5}$ concentrations at 00:00 EST, and HMS smoke polygons for June 9. The wildfires burning 220 km (136.7 mi) east of Wemindji, Quebec coincide with the point (at 2679.4 meters AGL) at 20:00 EST on June 6 of the 500-meter release height back trajectory from the Carthage monitoring site in Cincinnati and the 2700-meter release height forward trajectory from those wildfires at 20:00 EST on June 6 reaches the Carthage monitoring site in Cincinnati (at 401.5 meters AGL) at 00:00 EST on June 9. The coincidence of the 60-hour back and 52-hour forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high $PM_{2.5}$ concentrations at the Carthage monitoring site in Hamilton County on June 9, 2023. The accompanying imagery map for June 9 presented in Figure 137 shows moderate to high AOD values over portions of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present at the Carthage monitoring site in Hamilton County on June 9, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the Carthage monitoring site in Hamilton County.

Figure 135. HYSPLIT 60-hour back trajectory plot from 00:00 EST on June 9, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for 20:00 EST on June 6, 2023.

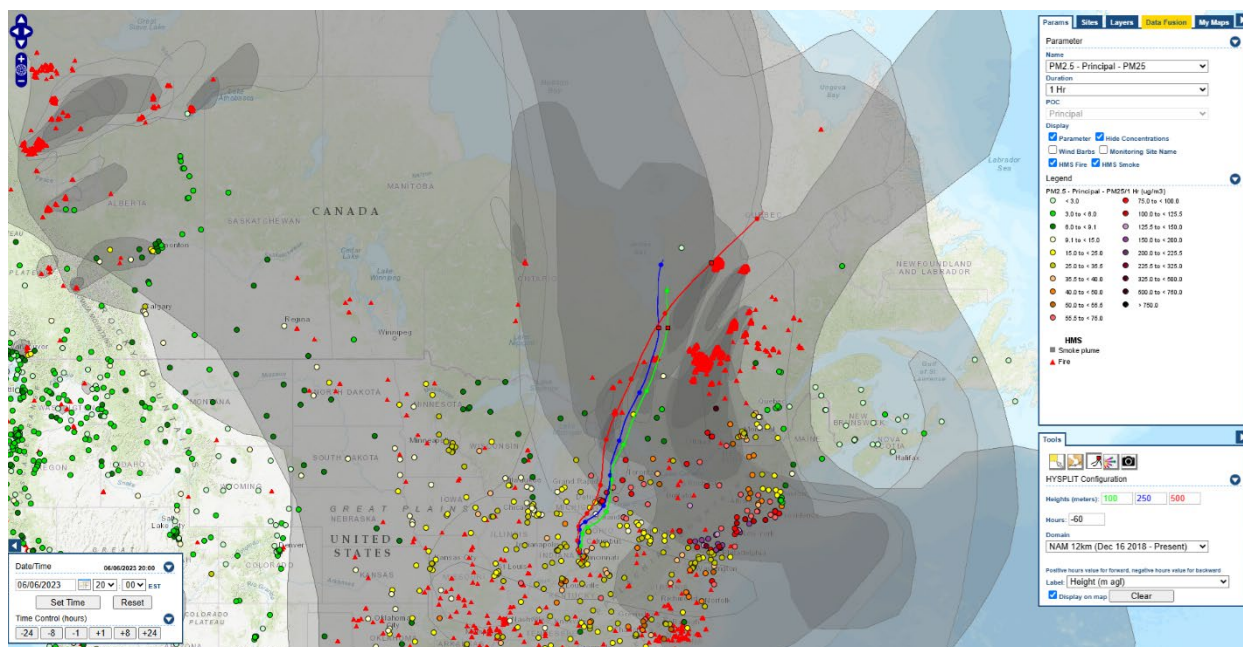


Figure 136. HYSPLIT 52-hour forward trajectory plot from 20:00 EST on June 6, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for 00:00 EST on June 9, 2023.

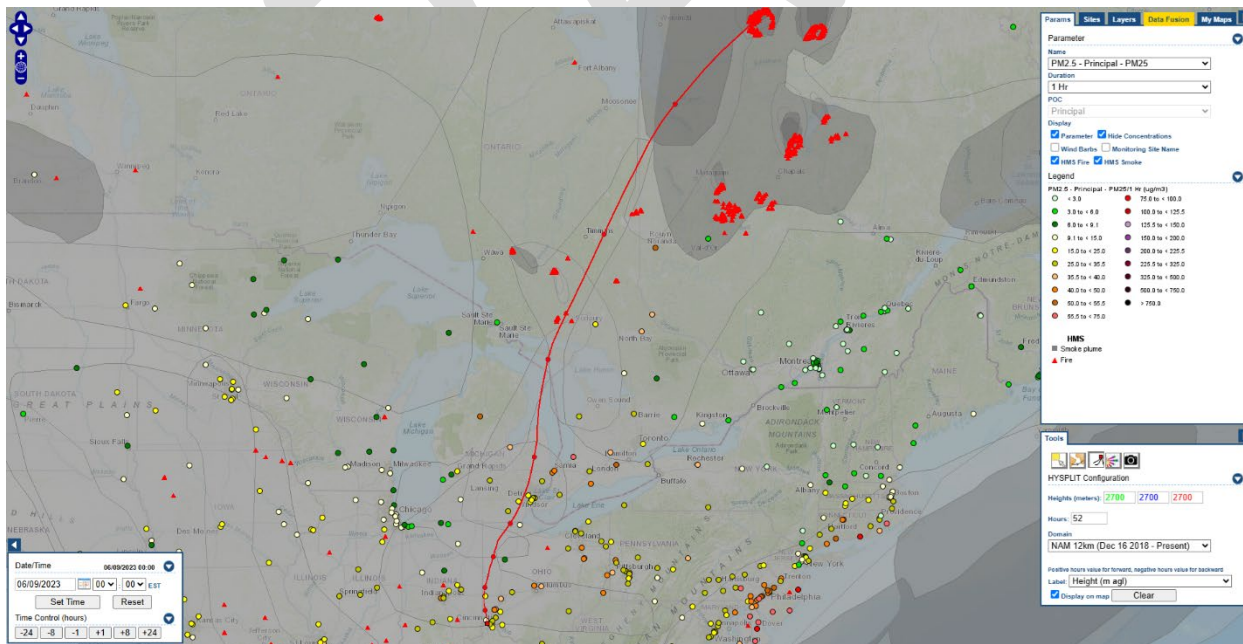


Figure 137. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for June 9, 2023, showing moderate to high AOD values over portions of Ohio, including Hamilton County.

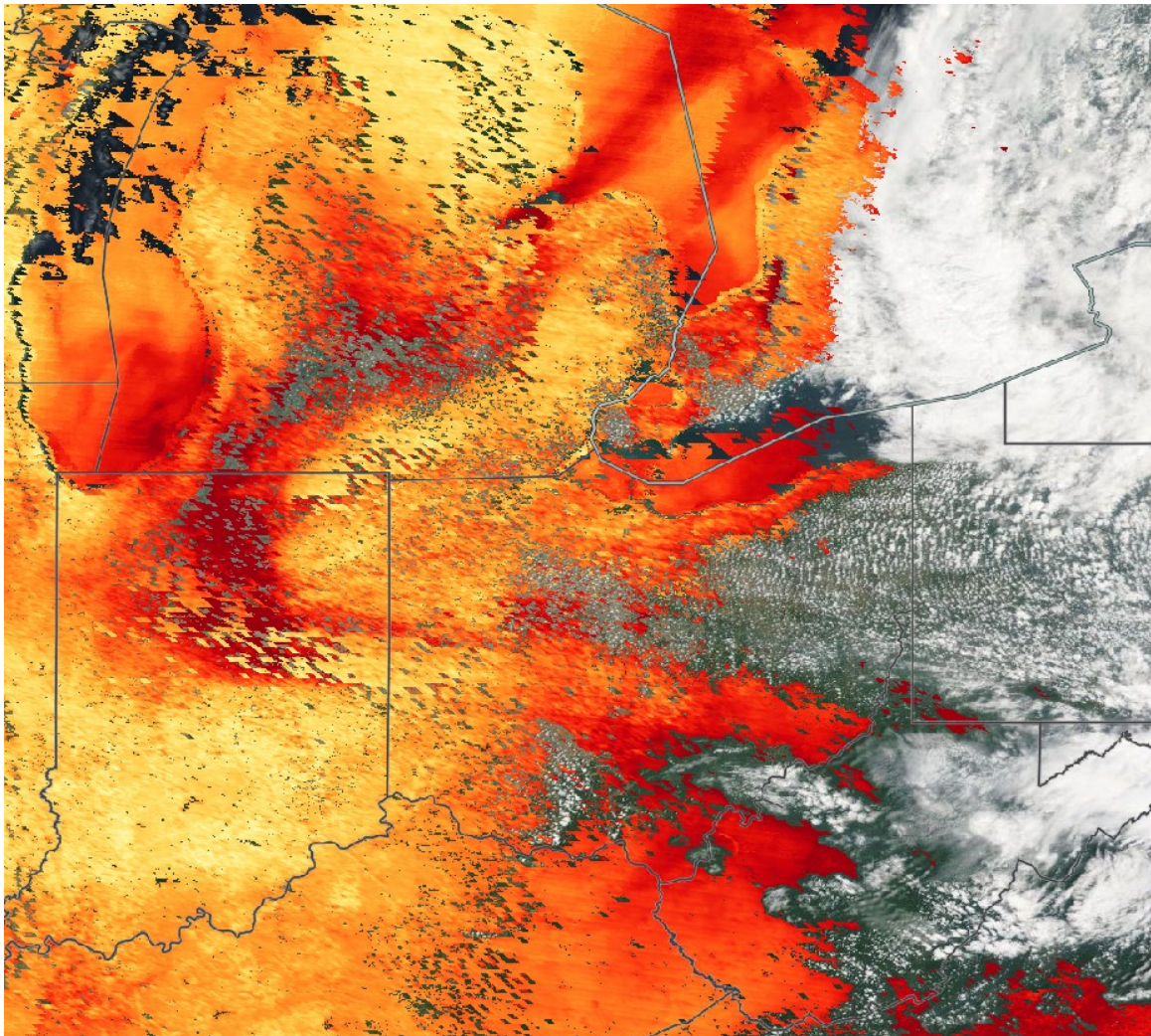


Table 15 and Figure 138 show the hourly average $PM_{2.5}$ concentrations on June 9, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations were already elevated due to lingering wildfire smoke near the surface and remained elevated the rest of the day as more wildfire smoke aloft continually descended on the surface, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations at the Carthage monitoring site in Hamilton County on June 9, 2023.

Table 15. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 9, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 9, 2023
00:00	12.8	30.0
01:00	12.9	29.5
02:00	12.5	28.4
03:00	12.5	28.0
04:00	12.7	27.3
05:00	13.0	27.6
06:00	13.6	27.6
07:00	14.5	22.2
08:00	14.7	14.4
09:00	13.9	16.2
10:00	14.1	18.1
11:00	13.7	29.7
12:00	13.4	25.7
13:00	13.2	25.0
14:00	12.5	23.2
15:00	12.2	21.5
16:00	11.9	21.5
17:00	11.3	18.9
18:00	11.0	15.0
19:00	11.6	15.3
20:00	12.5	17.7
21:00	13.3	17.4
22:00	13.8	17.4
23:00	13.3	23.5

Figure 138. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 9, 2023, and 2021-2025 average June concentrations.

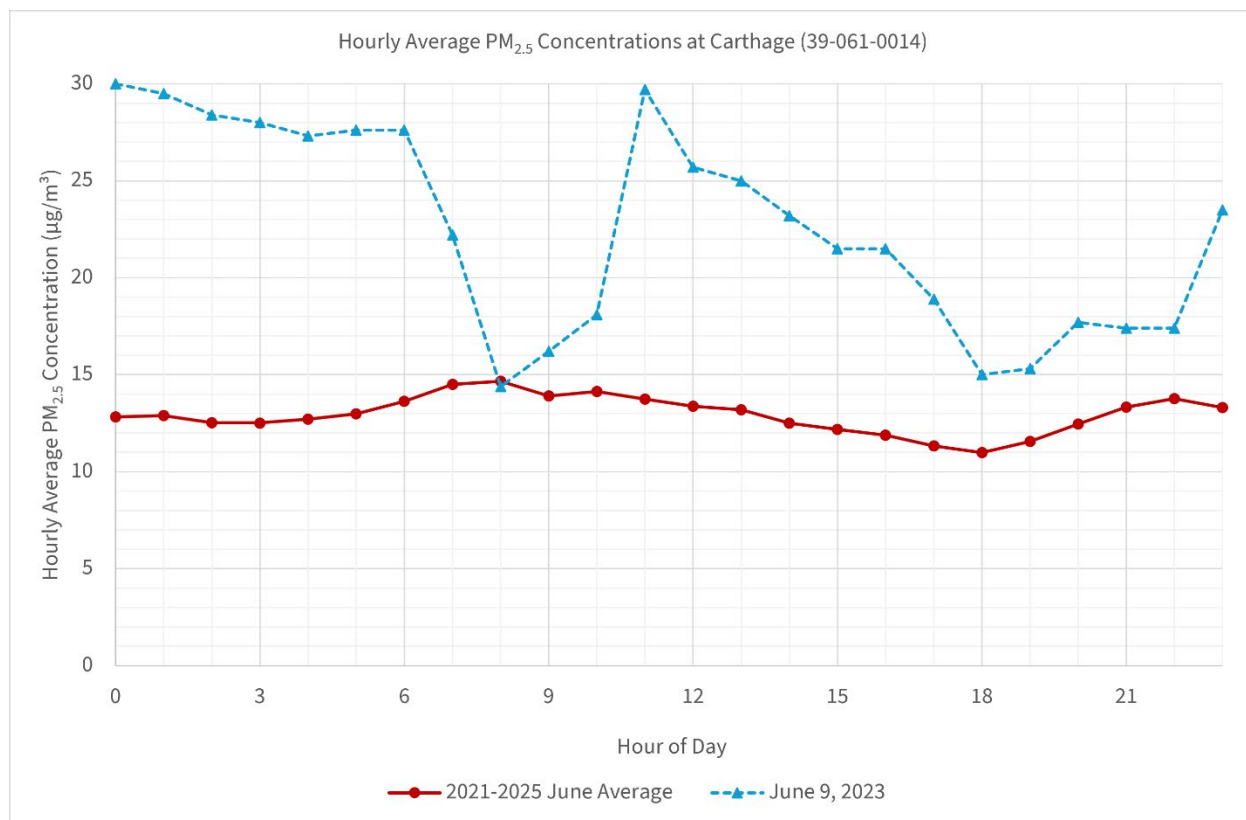
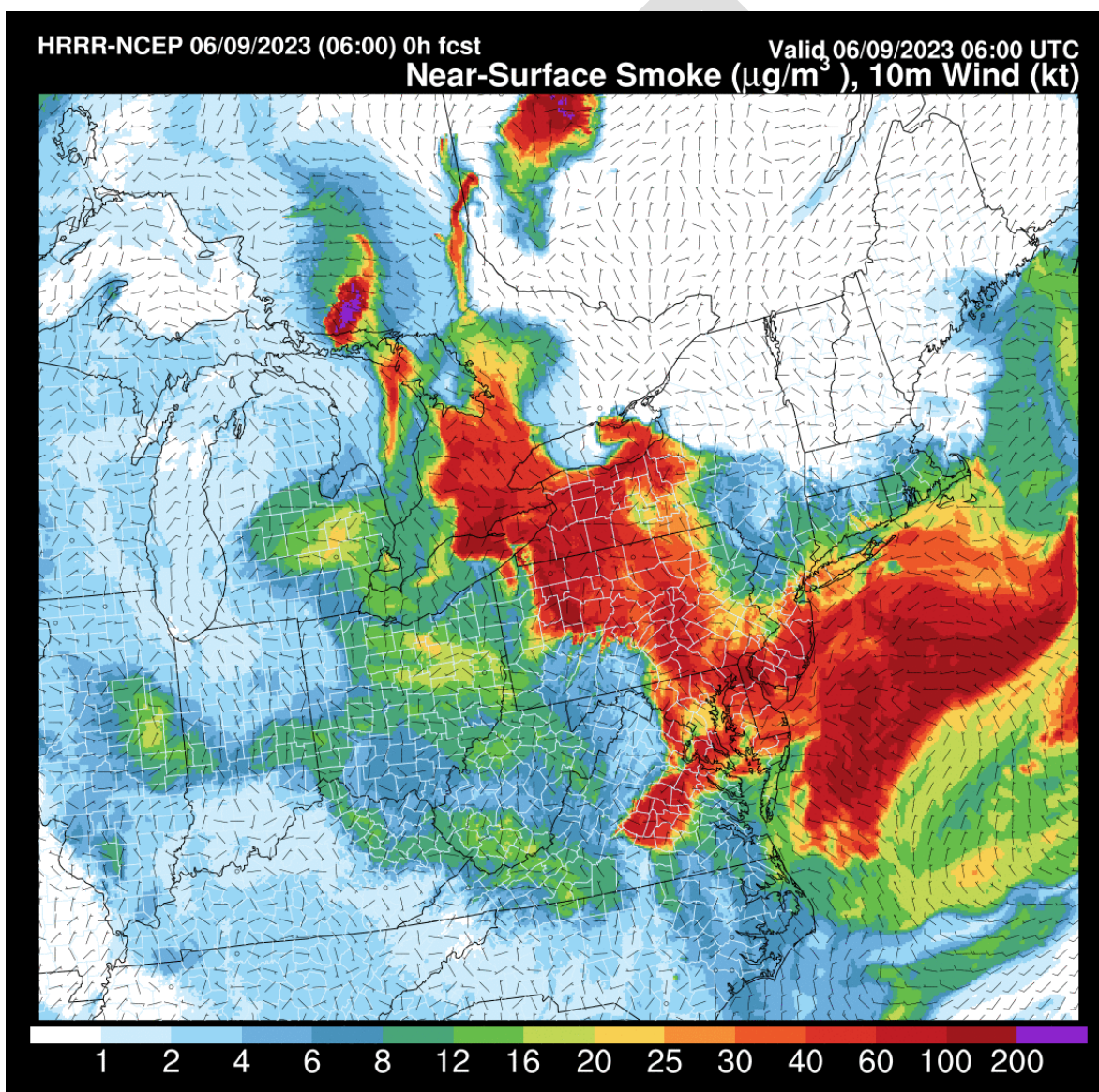


Figure 139 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on June 9, 2023. The HRRR model initialization showed near-surface smoke across Ohio, including near-surface smoke concentrations of approximately 8-12 $\mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage monitoring site on June 9, 2023.

Figure 139. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on June 9, 2023.



3.1.7. June 10, 2023

The HYSPLIT 72-hour back and 67-hour forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface $PM_{2.5}$ concentrations at the Carthage monitoring site in Hamilton County on June 10, 2023. Figure 140 shows the HYSPLIT 72-hour back trajectory plot for June 10, overlaid on a map of fire locations, monitored hourly average surface $PM_{2.5}$ concentrations at 14:00 EST, and HMS smoke polygons for June 7. Figure 141 shows the HYSPLIT 52-hour forward trajectory plot for June 7, overlaid on a map of fire locations, monitored hourly average surface $PM_{2.5}$ concentrations at 09:00 EST, and HMS smoke polygons for June 10. The wildfires burning 230 km (142.9 mi) east of Wemindji, Quebec coincide with the point (at 1932.2 meters AGL) at 14:00 EST on June 7 of the 600-meter release height back trajectory from the Carthage monitoring site in Cincinnati and the 1925-meter release height forward trajectory from those wildfires at 14:00 EST on June 7 reaches the Carthage monitoring site in Cincinnati (at 768.1 meters AGL) at 09:00 EST on June 10. The coincidence of the 72-hour back and 67-hour forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high $PM_{2.5}$ concentrations at the Carthage monitoring site in Hamilton County on June 10, 2023. The accompanying imagery map for June 10 presented in Figure 142 shows visible wildfire smoke over most of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present at the Carthage monitoring site in Hamilton County on June 10, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the Carthage monitoring site in Hamilton County.

Figure 140. HYSPLIT 72-hour back trajectory plot from 09:00 EST on June 10, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for 14:00 EST on June 7, 2023.

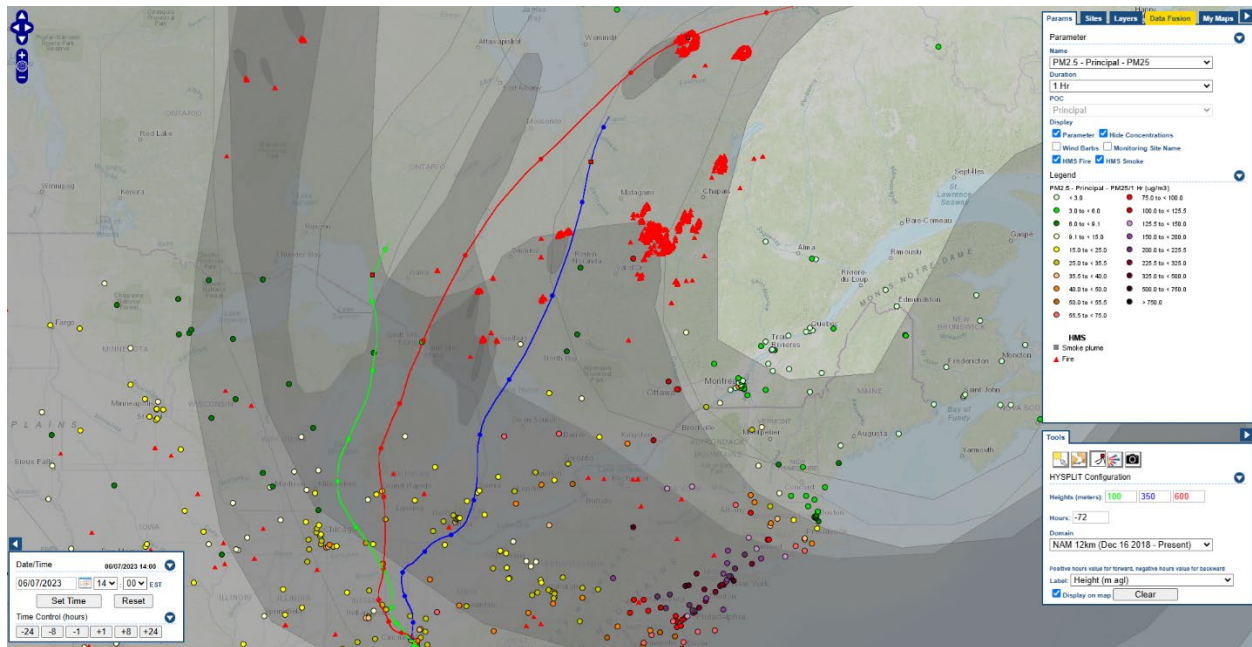


Figure 141. HYSPLIT 67-hour forward trajectory plot from 14:00 EST on June 7, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for 09:00 EST on June 10, 2023.

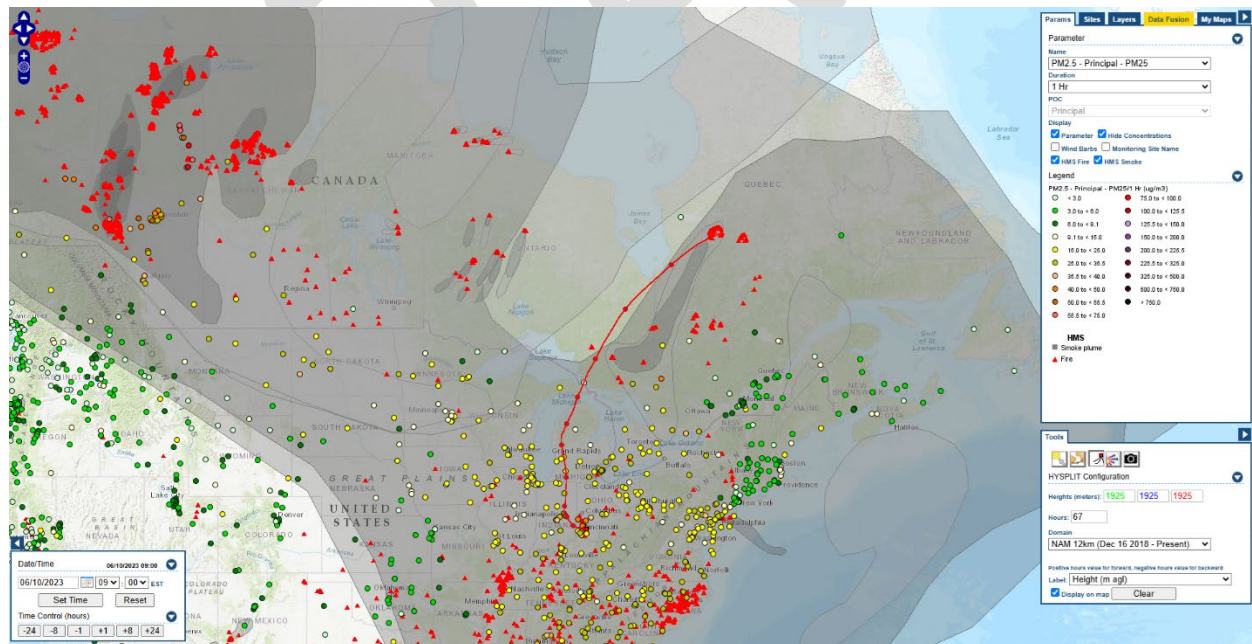


Figure 142. Terra satellite true color imagery of Ohio for June 10, 2023, showing visible wildfire smoke (outlined in yellow) over most of Ohio, including Hamilton County.

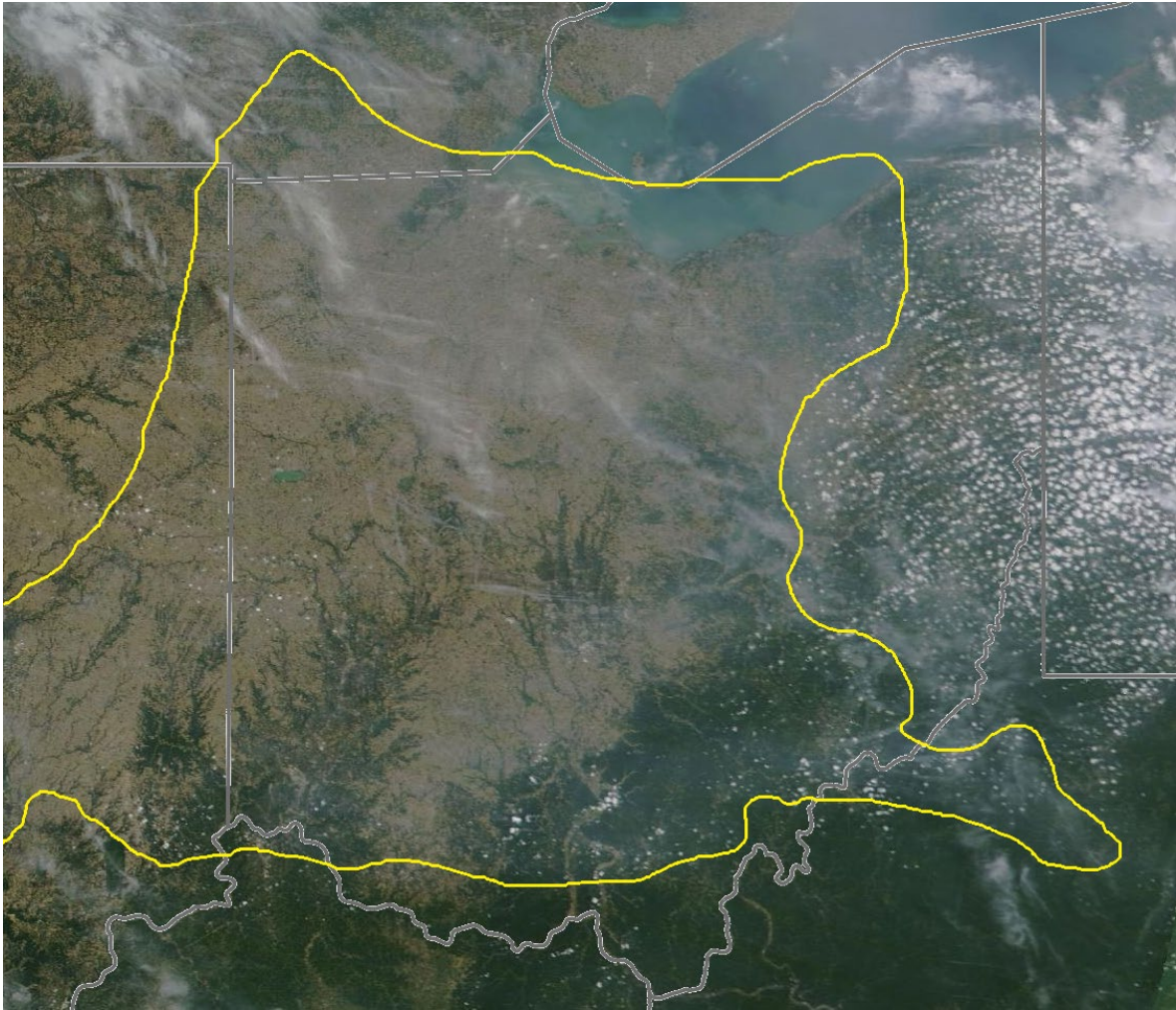


Table 16 and Figure 143 show the hourly average $PM_{2.5}$ concentrations on June 6, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations were already elevated due to lingering wildfire smoke near the surface and remained elevated the rest of the day as more wildfire smoke aloft continually descended on the surface, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations at the Carthage monitoring site in Hamilton County on June 10, 2023.

Table 16. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 10, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 10, 2023
00:00	12.8	26.4
01:00	12.9	23.3
02:00	12.5	31.6
03:00	12.5	28.4
04:00	12.7	30.7
05:00	13.0	26.7
06:00	13.6	25.9
07:00	14.5	26.3
08:00	14.7	29.3
09:00	13.9	33.2
10:00	14.1	39.4
11:00	13.7	35.7
12:00	13.4	32.6
13:00	13.2	27.1
14:00	12.5	17.9
15:00	12.2	15.1
16:00	11.9	13.8
17:00	11.3	14.0
18:00	11.0	13.7
19:00	11.6	14.8
20:00	12.5	16.2
21:00	13.3	20.1
22:00	13.8	25.2
23:00	13.3	21.2

Figure 143. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 10, 2023, and 2021-2025 average June concentrations.

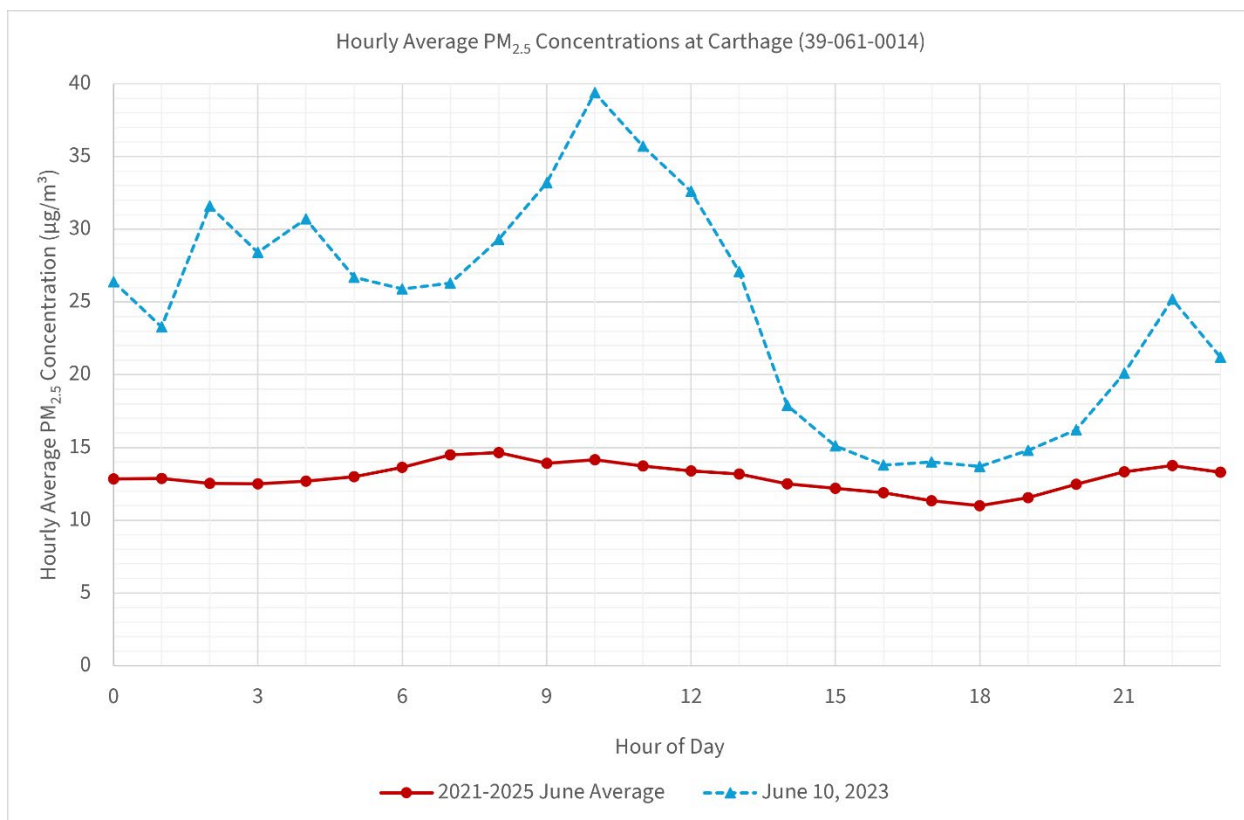
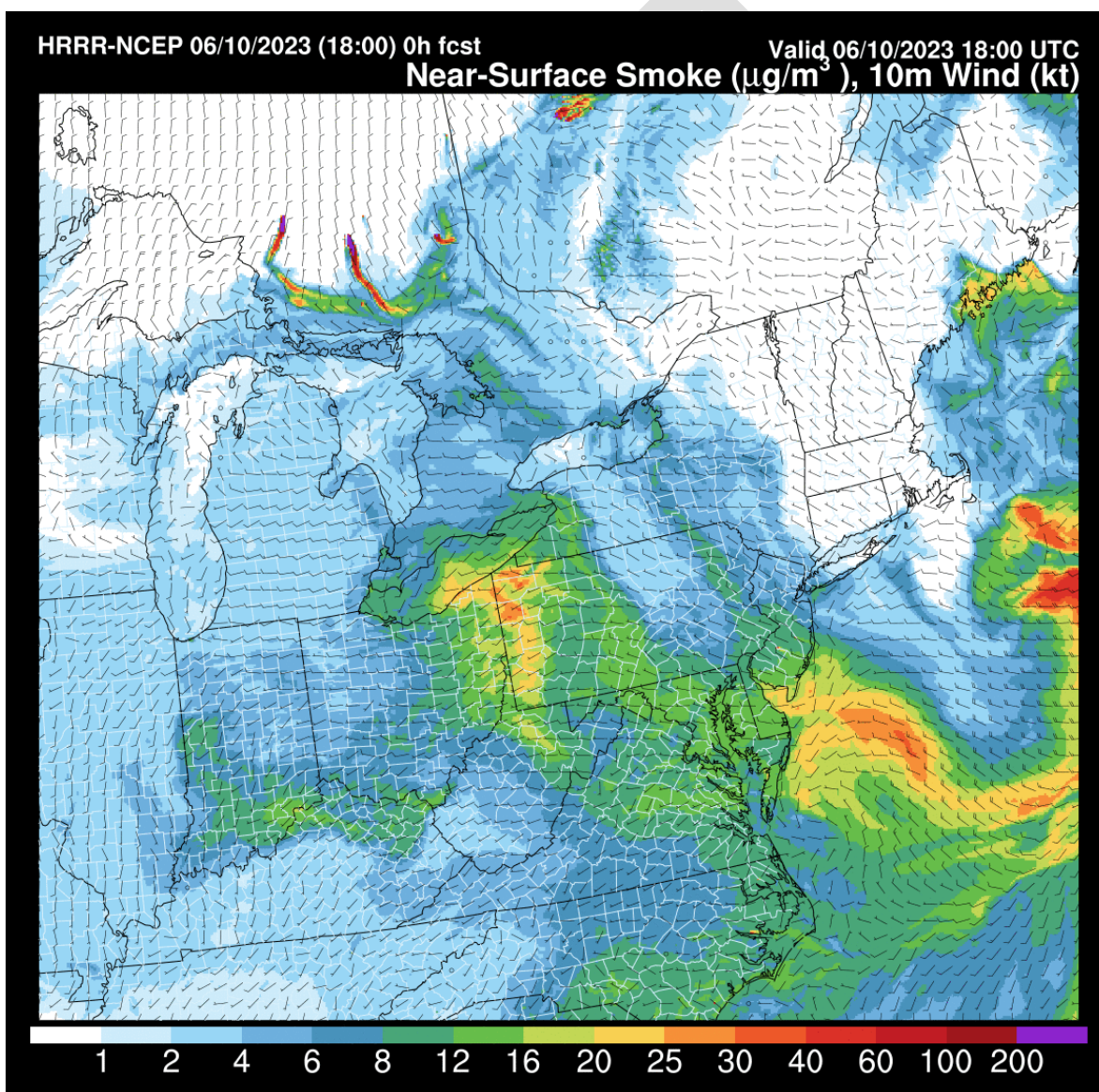


Figure 144 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 10, 2023. The HRRR model initialization showed near-surface smoke across Ohio, including near-surface smoke concentrations of approximately $8 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage monitoring site on June 10, 2023.

Figure 144. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 10, 2023.



3.2. Wildfire Smoke-Driven $PM_{2.5}$ Episode from June 15-19, 2023

3.2.1. June 15, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 15, 2023. Figure 145 shows the HYSPLIT 72-hour back 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 12. Figure 146 shows the HYSPLIT 72-hour forward trajectory plot for June 12, overlaid on a map of fire locations, monitored 24-hour average surface $PM_{2.5}$ concentrations, and HMS smoke polygons for June 15. The wildfires burning 65 km (40.4 mi) east-southeast of Lebel-sur-Quévillon, Quebec coincide with the point (at 1663.5 meters AGL) at 18:00 EST on June 12 of the 250-meter release height back trajectory from Cincinnati and the 1650-meter release height forward trajectory from that wildfire-impacted location at 18:00 EST on June 12 reaches Cincinnati (at 255.3 meters AGL) at 18:00 EST on June 15. The coincidence of the 72-hour back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 15, 2023. The accompanying imagery map for June 15 presented in Figure 147 shows visible dense wildfire smoke over most of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 15, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 145. HYSPLIT 72-hour back trajectory plot from June 15, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 12, 2023.

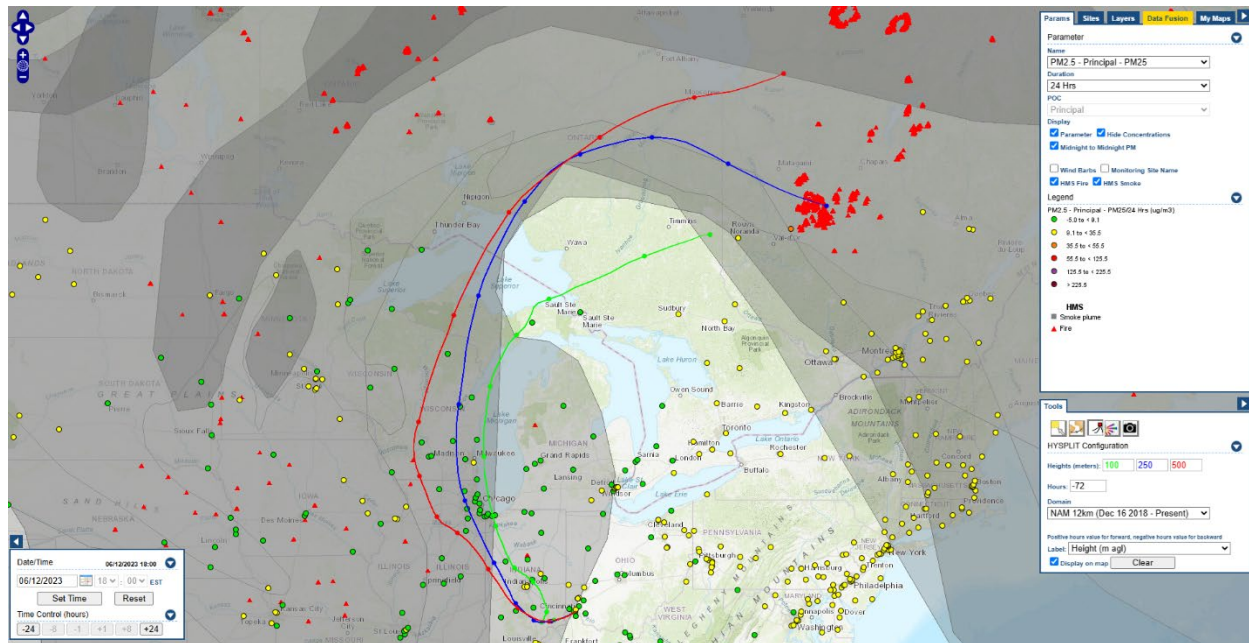


Figure 146. HYSPLIT 72-hour forward trajectory plot from June 12, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 15, 2023.

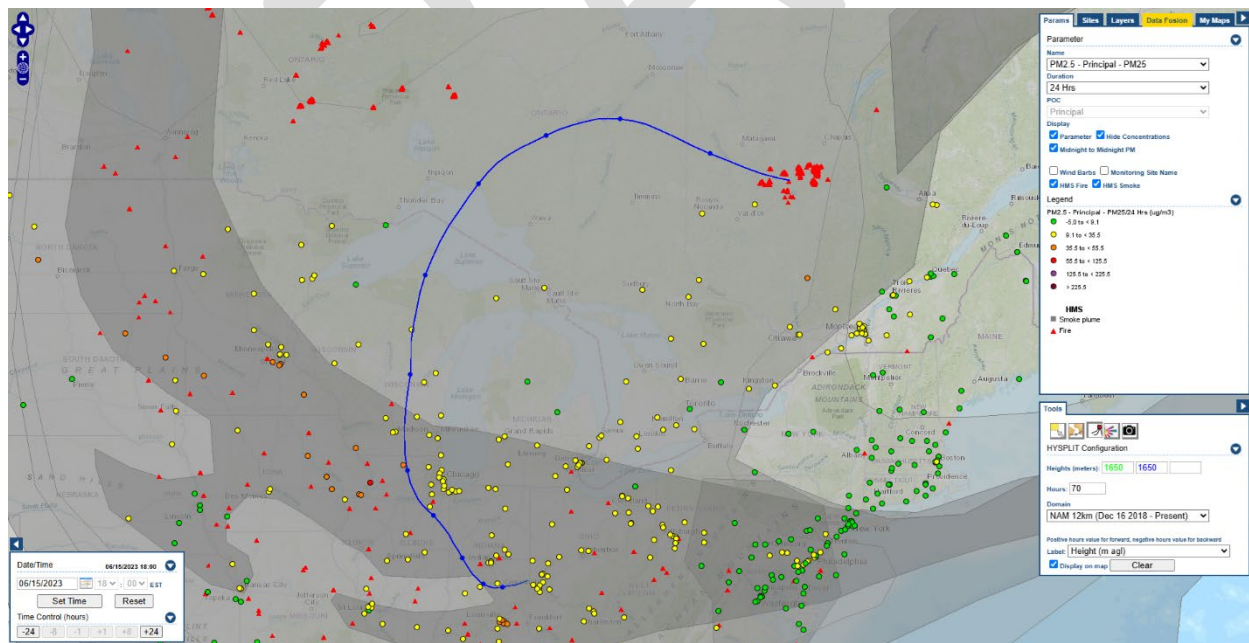


Figure 147. Terra satellite true color imagery of Ohio and surrounding states for June 15, 2023, showing visible dense wildfire smoke (outlined in yellow) over most of Ohio, including Hamilton County.

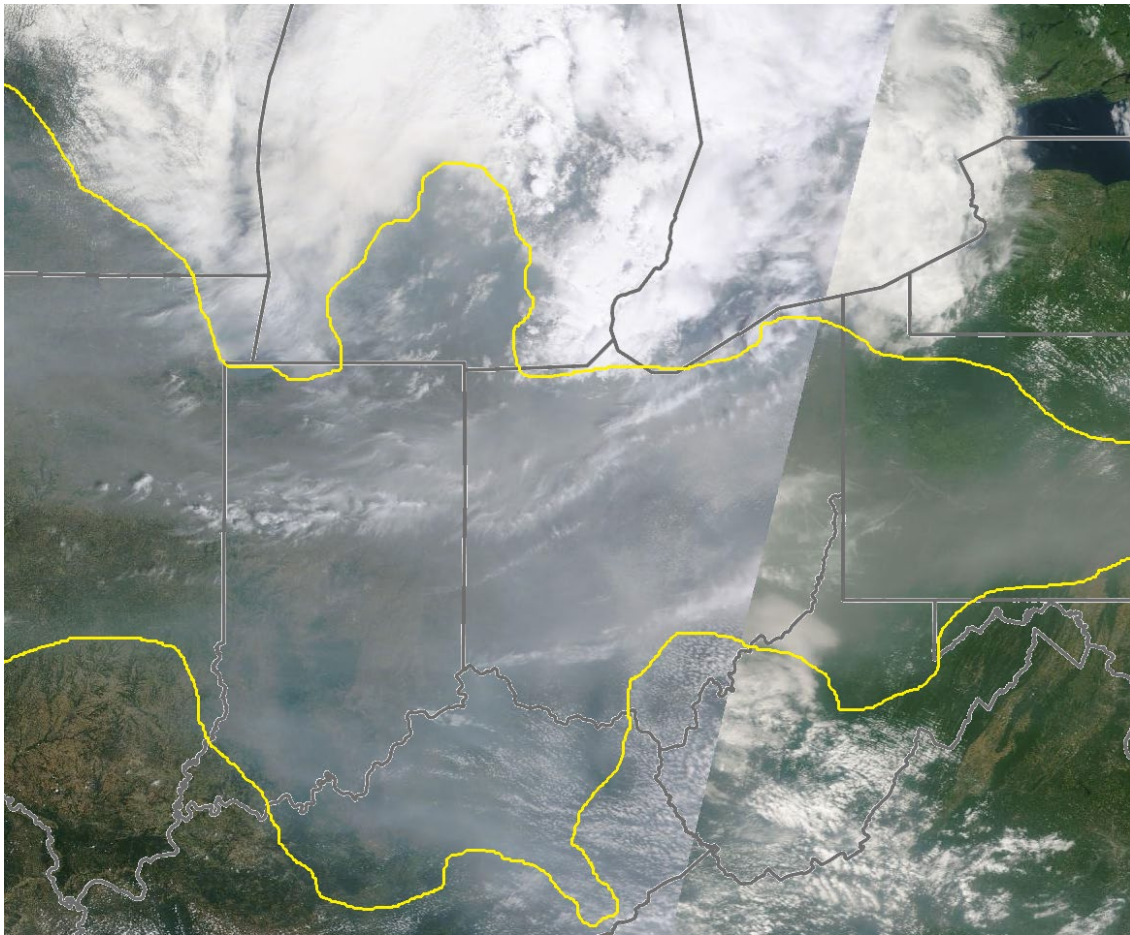


Table 17 and Figure 148 show the hourly average $PM_{2.5}$ concentrations on June 15, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 18 and Figure 149 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations began steadily increasing around 12:00 EST as wildfire smoke reached the area and began to descend on the surface, then concentrations remained elevated the rest of the day on June 15, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on June 15, 2023.

Table 17. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 15, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 15, 2023
00:00	12.8	7.0
01:00	12.9	7.2
02:00	12.5	7.8
03:00	12.5	6.9
04:00	12.7	8.1
05:00	13.0	8.9
06:00	13.6	9.3
07:00	14.5	10.9
08:00	14.7	13.4
09:00	13.9	11.2
10:00	14.1	13.6
11:00	13.7	17.8
12:00	13.4	24.6
13:00	13.2	25.8
14:00	12.5	28.2
15:00	12.2	30.6
16:00	11.9	31.5
17:00	11.3	32.4
18:00	11.0	33.3
19:00	11.6	35.2
20:00	12.5	36.2
21:00	13.3	38.1
22:00	13.8	43.5
23:00	13.3	44.9

Figure 148. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 15, 2023, and 2021-2025 average June concentrations.

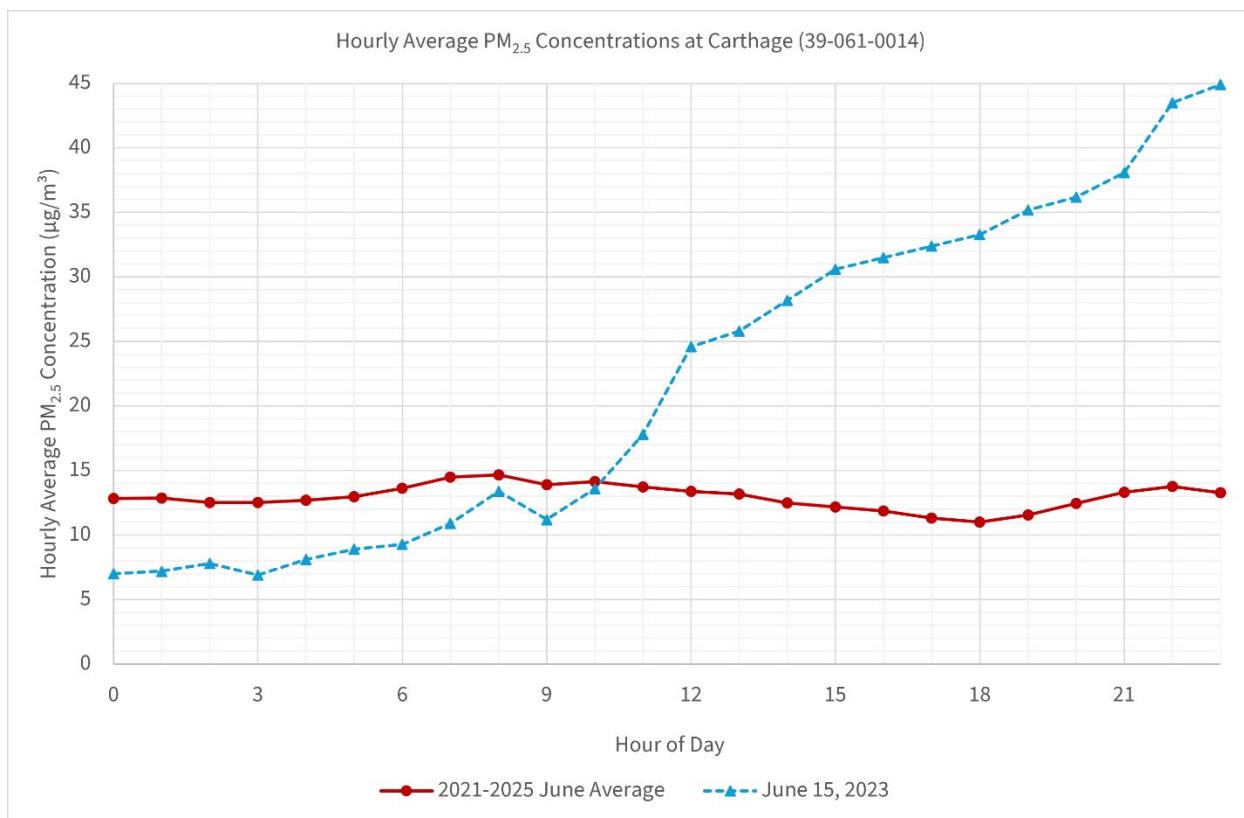


Table 18. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 15, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 15, 2023
00:00	15.1	9.3
01:00	14.8	8.7
02:00	14.6	7.5
03:00	15.3	5.8
04:00	15.5	8.8
05:00	16.0	8.1
06:00	17.4	9.5
07:00	17.6	12.7
08:00	16.2	17.9
09:00	13.9	22.0
10:00	13.4	20.4
11:00	12.6	14.1
12:00	12.3	19.4
13:00	11.8	21.2
14:00	11.3	30.3
15:00	10.9	24.1
16:00	11.2	25.0
17:00	10.8	26.1
18:00	10.5	28.3
19:00	11.3	27.5
20:00	12.6	30.4
21:00	14.0	35.9
22:00	15.3	37.8
23:00	15.6	44.9

Figure 149. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 15, 2023, and 2021-2025 average June concentrations.

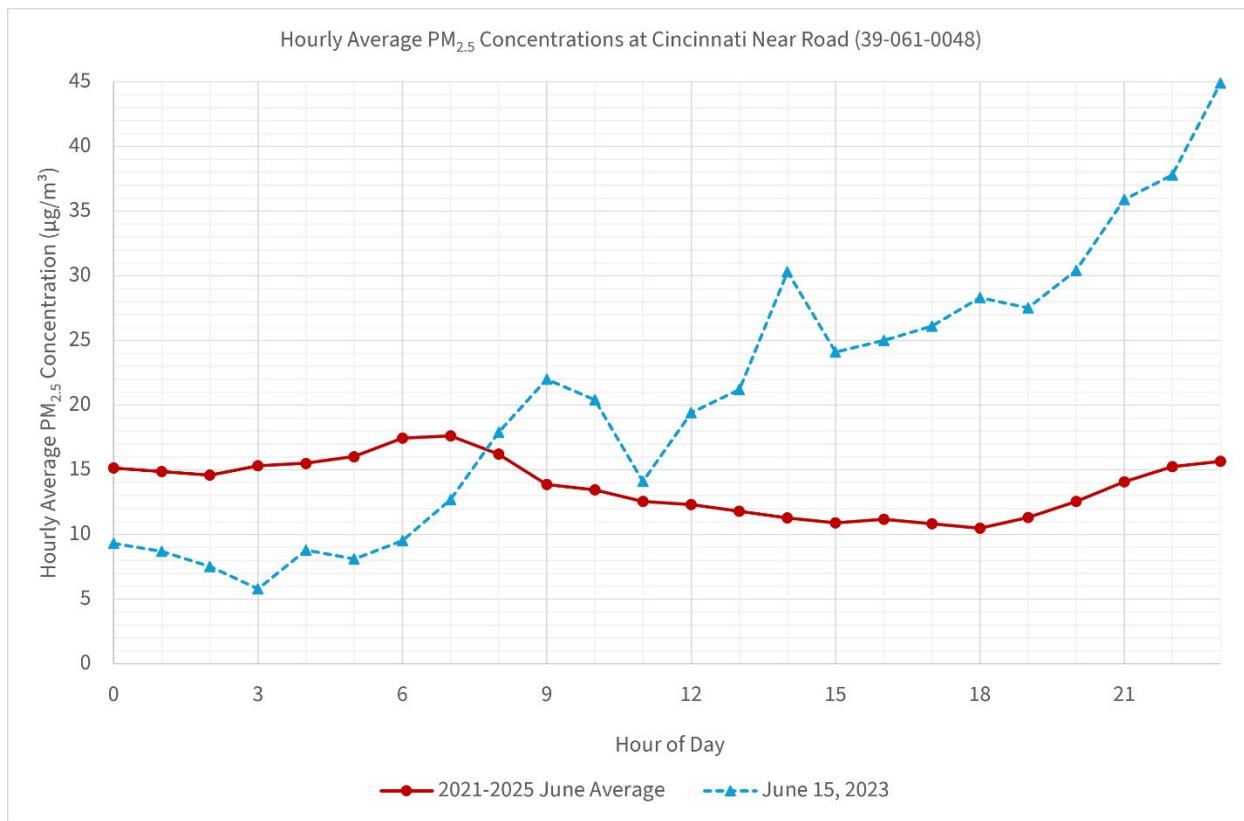
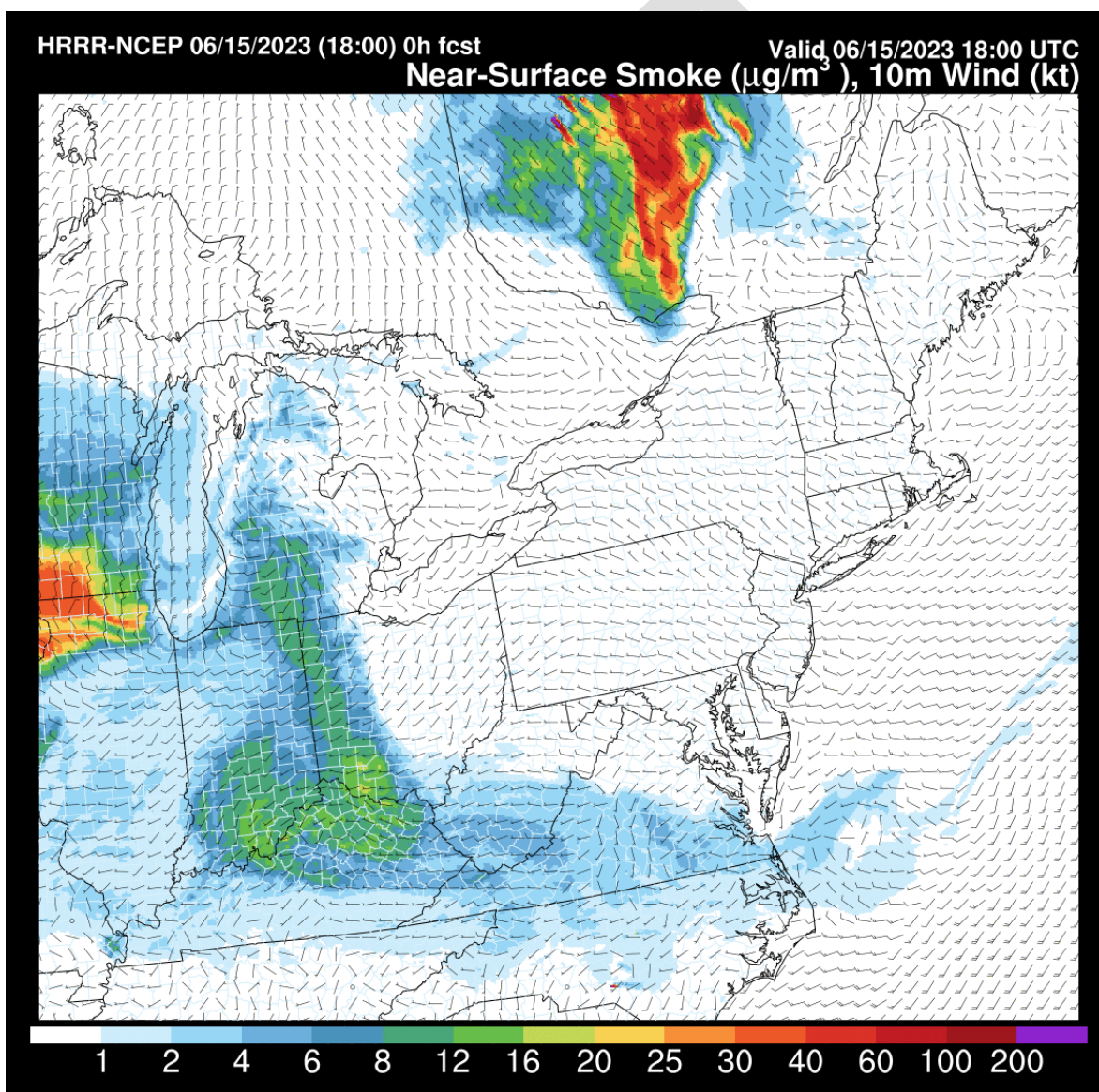


Figure 150 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 15, 2023. The HRRR model initialization showed near-surface smoke across the western portion of Ohio, including near-surface smoke concentrations of approximately $8 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 15, 2023.

Figure 150. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 15, 2023.



3.2.2. June 16, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 16, 2023. Figure 151 shows the HYSPLIT 72-hour back trajectory plot for June 16, overlaid on a map of fire locations, monitored 24-hour average surface PM_{2.5} concentrations, and HMS smoke polygons for June 13. Figure 152 shows the HYSPLIT 72-hour forward trajectory plot for June 13, overlaid on a map of fire locations, monitored 24-hour average surface PM_{2.5} concentrations, and HMS smoke polygons for June 16. The wildfires burning 70 km (43.5 mi) north-northwest of Aroland, Ontario coincide with the point (at 2275.9 meters AGL) at 01:00 EST on June 13 of the 500-meter release height back trajectory from Cincinnati and the 2275-meter release height forward trajectory from that wildfire-impacted location at 01:00 EST on June 13 reaches Cincinnati (at 661.5 meters AGL) at 01:00 EST on June 16. The coincidence of the 72-hour back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that, along with the lingering wildfire smoke already present in Hamilton County, the smoke from the wildfires in Quebec caused the high PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 16, 2023. The accompanying imagery map for June 16 presented in Figure 153 shows visible wildfire smoke across the Great Lakes regions surrounding the heavy cloud cover over Indiana, Michigan, and Ohio, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 16, 2023, and that this wildfire smoke was the cause of the high concentrations of PM_{2.5} at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 151. HYSPLIT 72-hour back trajectory plot from June 16, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 13, 2023.

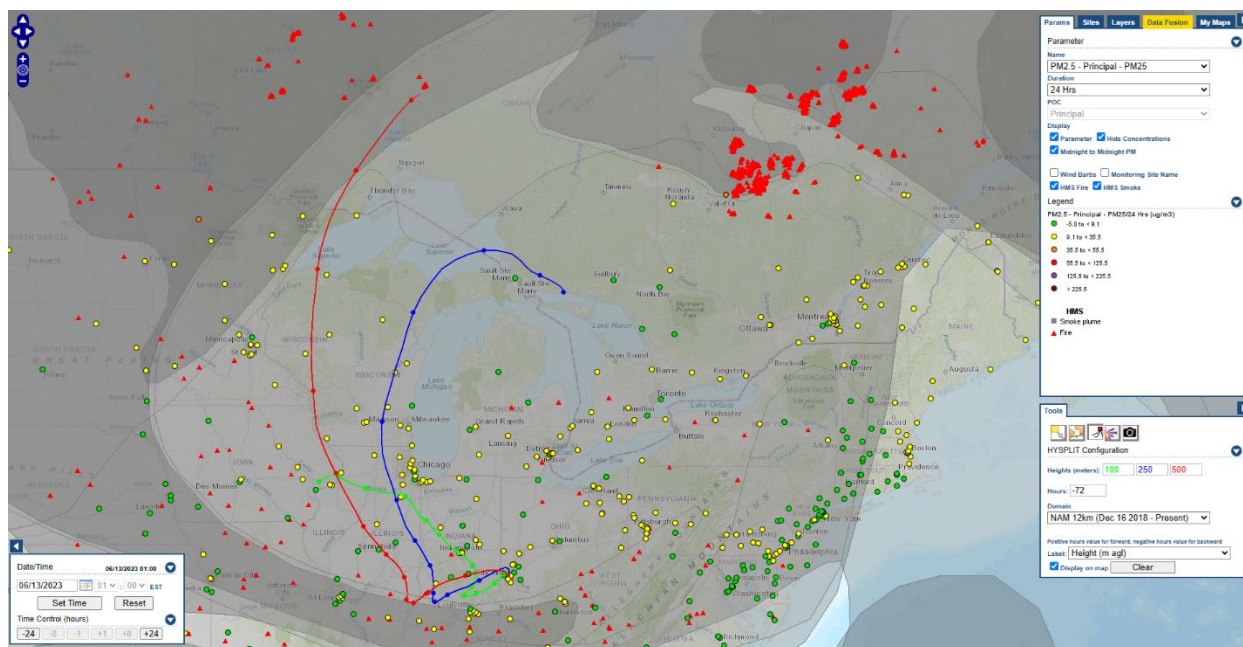


Figure 152. HYSPLIT 72-hour forward trajectory plot from June 13, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 16, 2023.

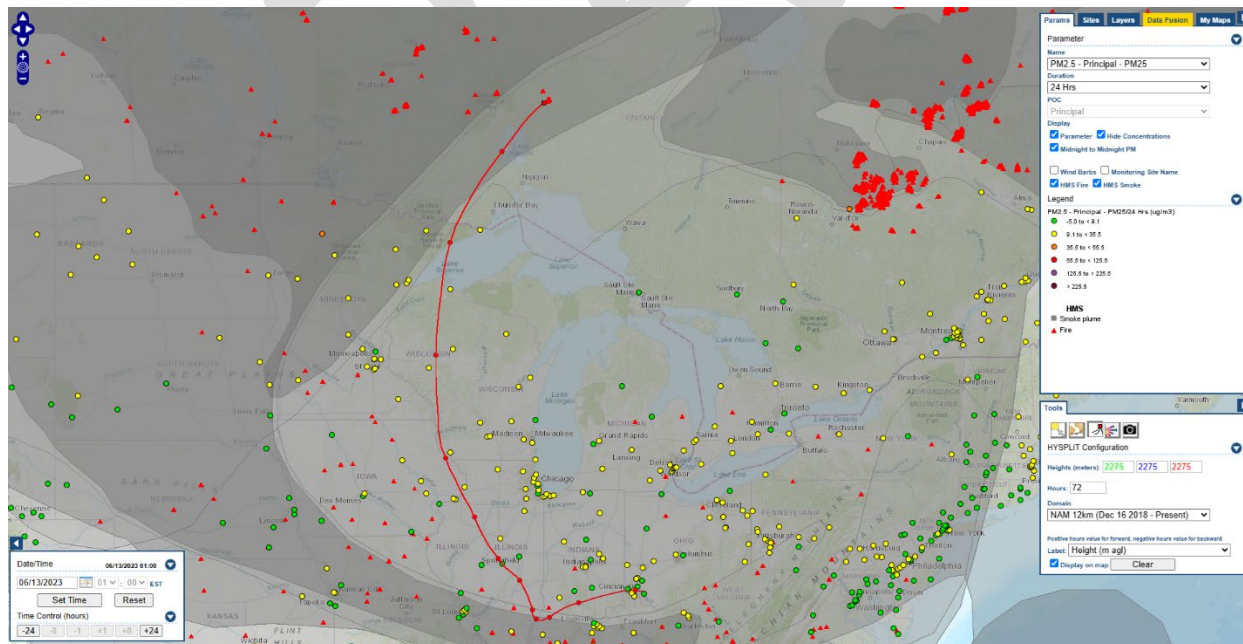


Figure 153. Terra satellite true color imagery of Ohio and surrounding states for June 16, 2023, showing visible wildfire smoke (outlined in yellow) across the Great Lakes regions surrounding the heavy cloud cover over Indiana, Michigan, and Ohio.

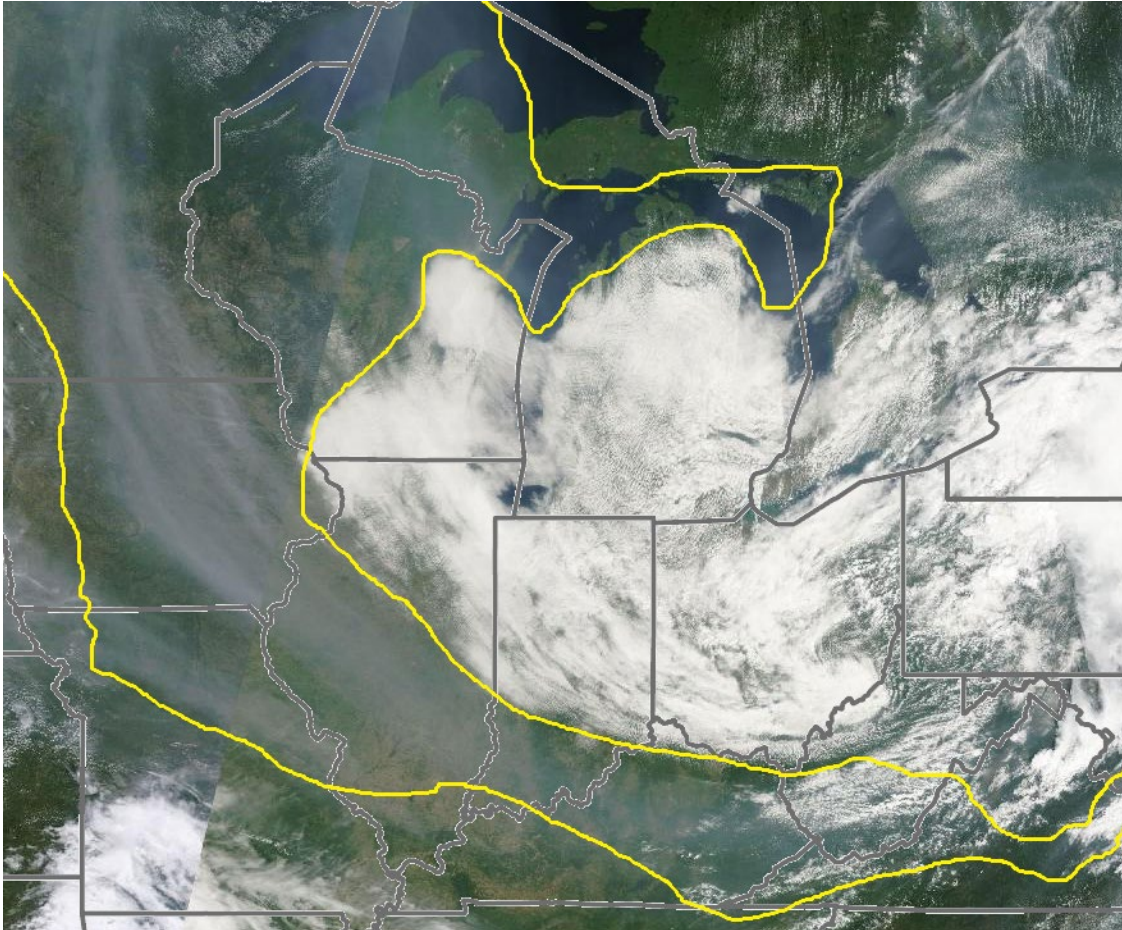


Table 19 and Figure 154 show the hourly average $PM_{2.5}$ concentrations on June 16, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 20 and Figure 155 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations remained elevated due to lingering wildfire smoke from wildfires in Quebec and fresh smoke from wildfires in Ontario descending on the surface throughout the day on June 16, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on June 16, 2023.

Table 19. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 16, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 16, 2023
00:00	12.8	40.5
01:00	12.9	38.6
02:00	12.5	30.6
03:00	12.5	23.4
04:00	12.7	21.8
05:00	13.0	19.8
06:00	13.6	17.9
07:00	14.5	15.7
08:00	14.7	14.5
09:00	13.9	14.1
10:00	14.1	14.1
11:00	13.7	13.8
12:00	13.4	14.5
13:00	13.2	15.2
14:00	12.5	18.0
15:00	12.2	19.2
16:00	11.9	19.4
17:00	11.3	18.5
18:00	11.0	18.1
19:00	11.6	19.0
20:00	12.5	20.6
21:00	13.3	19.9
22:00	13.8	20.7
23:00	13.3	21.4

Figure 154. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 16, 2023, and 2021-2025 average June concentrations.

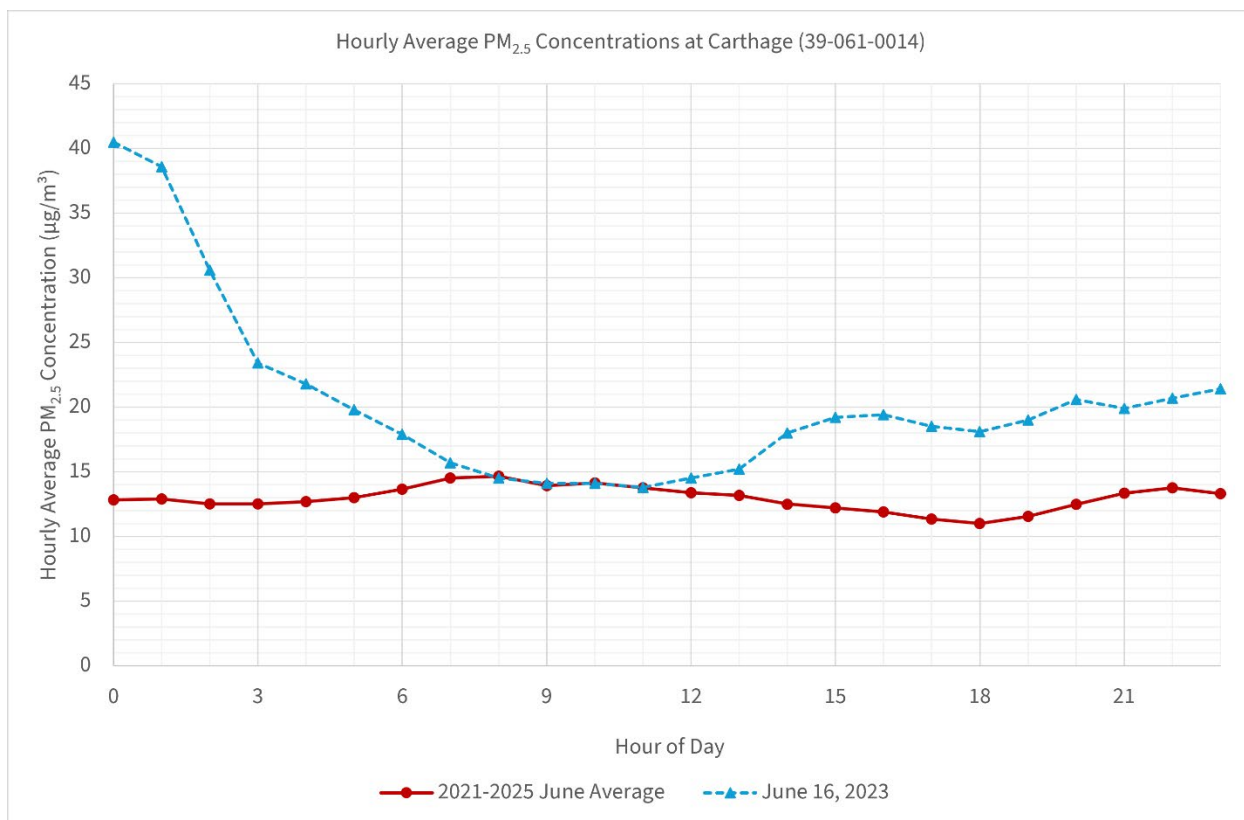


Table 20. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 16, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 16, 2023
00:00	15.1	38.5
01:00	14.8	35.6
02:00	14.6	25.1
03:00	15.3	23.9
04:00	15.5	23.3
05:00	16.0	22.8
06:00	17.4	18.3
07:00	17.6	12.8
08:00	16.2	16.2
09:00	13.9	14.2
10:00	13.4	17.0
11:00	12.6	10.8
12:00	12.3	12.6
13:00	11.8	15.2
14:00	11.3	10.5
15:00	10.9	11.5
16:00	11.2	18.2
17:00	10.8	18.2
18:00	10.5	14.2
19:00	11.3	15.7
20:00	12.6	18.2
21:00	14.0	19.8
22:00	15.3	22.5
23:00	15.6	19.6

Figure 155. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 16, 2023, and 2021-2025 average June concentrations.

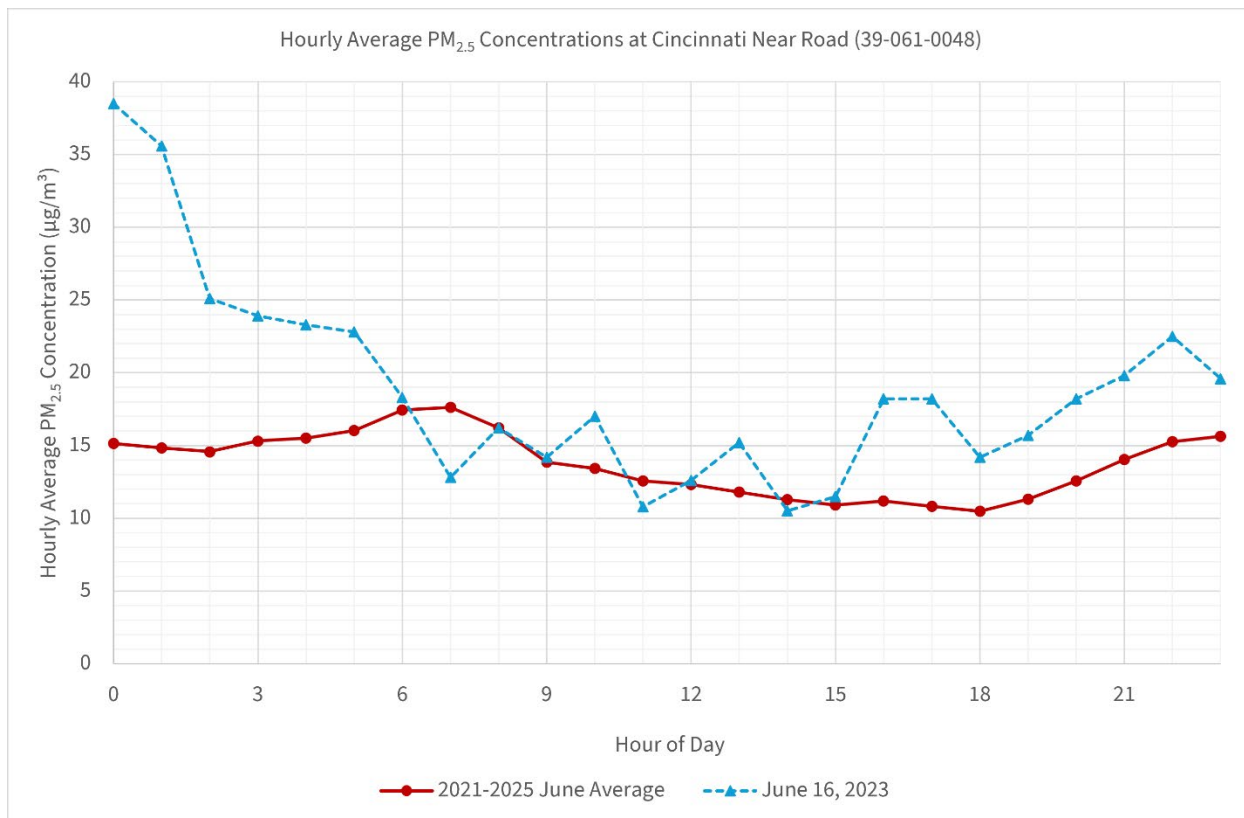
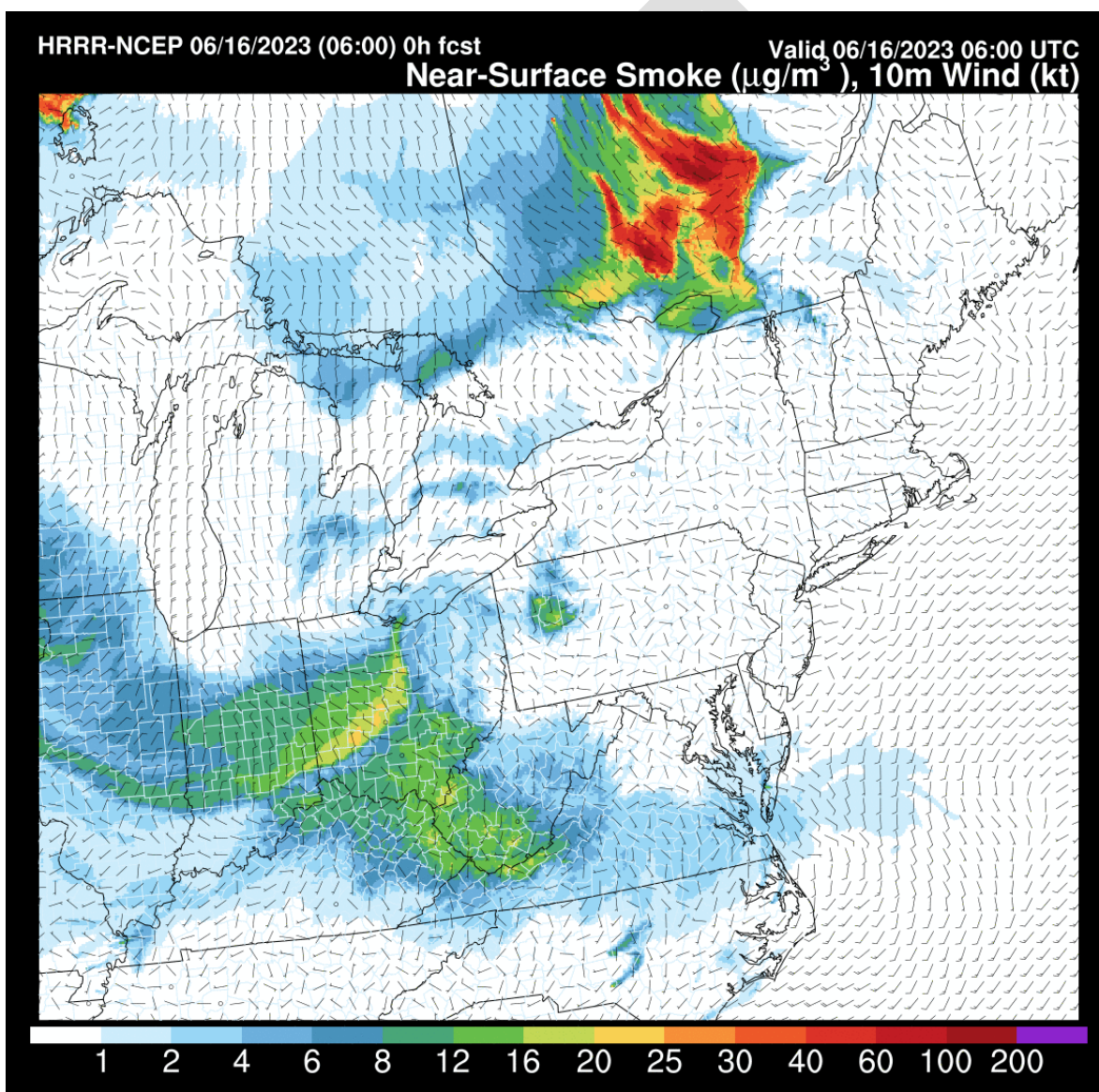


Figure 156 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on June 16, 2023. The HRRR model initialization showed near-surface smoke across most of Ohio, including near-surface smoke concentrations of approximately 6-8 $\mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 16, 2023.

Figure 156. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on June 16, 2023.



3.2.3. June 17, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 17, 2023. Figure 157 shows the HYSPLIT 72-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 14. Figure 158 shows the HYSPLIT 72-hour forward trajectory plot for June 14, overlaid on a map of fire locations, monitored 24-hour average surface PM_{2.5} concentrations, and HMS smoke polygons for June 17. The wildfires burning 210 km (130.5 mi) east of Wemindji, Quebec coincide with the point (at 1067.2 meters AGL) at 09:00 EST on June 14 of the 250-meter release height back trajectory from Cincinnati and the 1100-meter release height forward trajectory from that wildfire-impacted location at 09:00 EST on June 14 reaches Cincinnati (at 253.3 meters AGL) at 09:00 EST on June 17. The coincidence of the 72-hour back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 17, 2023. The accompanying imagery map for June 17 presented in Figure 159 shows moderate and high AOD values over portions of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 17, 2023, and that this wildfire smoke was the cause of the high concentrations of PM_{2.5} at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 157. HYSPLIT 72-hour back trajectory plot from June 17, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 14, 2023.

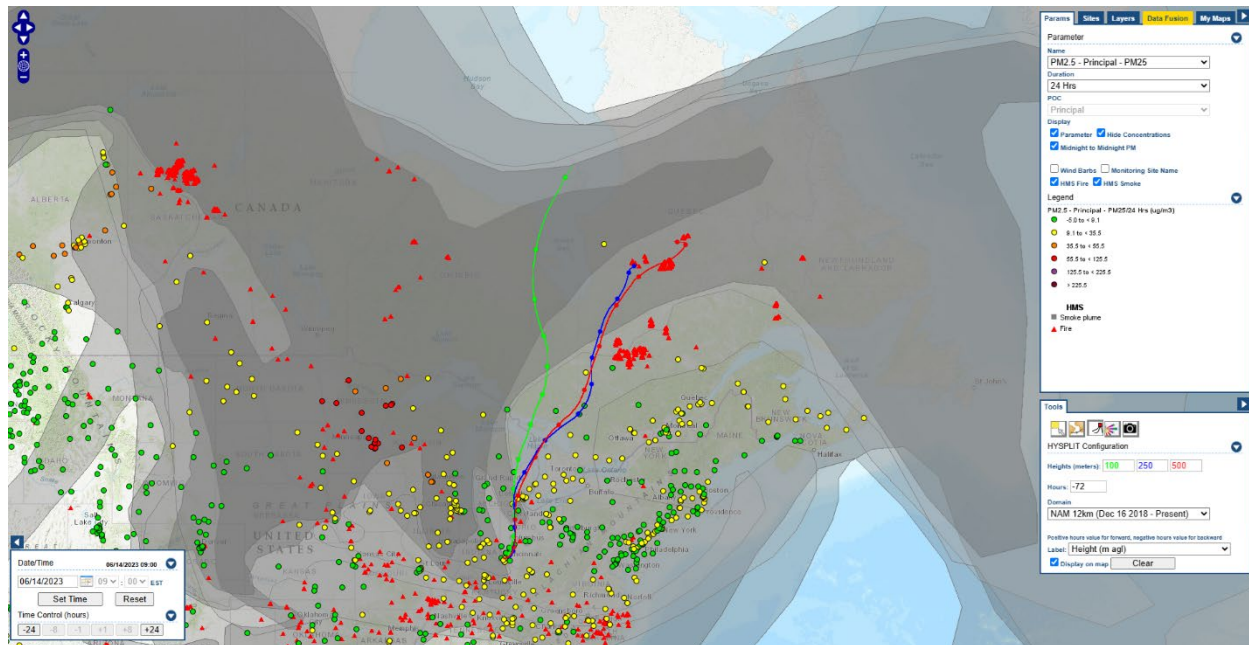


Figure 158. HYSPLIT 72-hour forward trajectory plot from June 14, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 17, 2023.

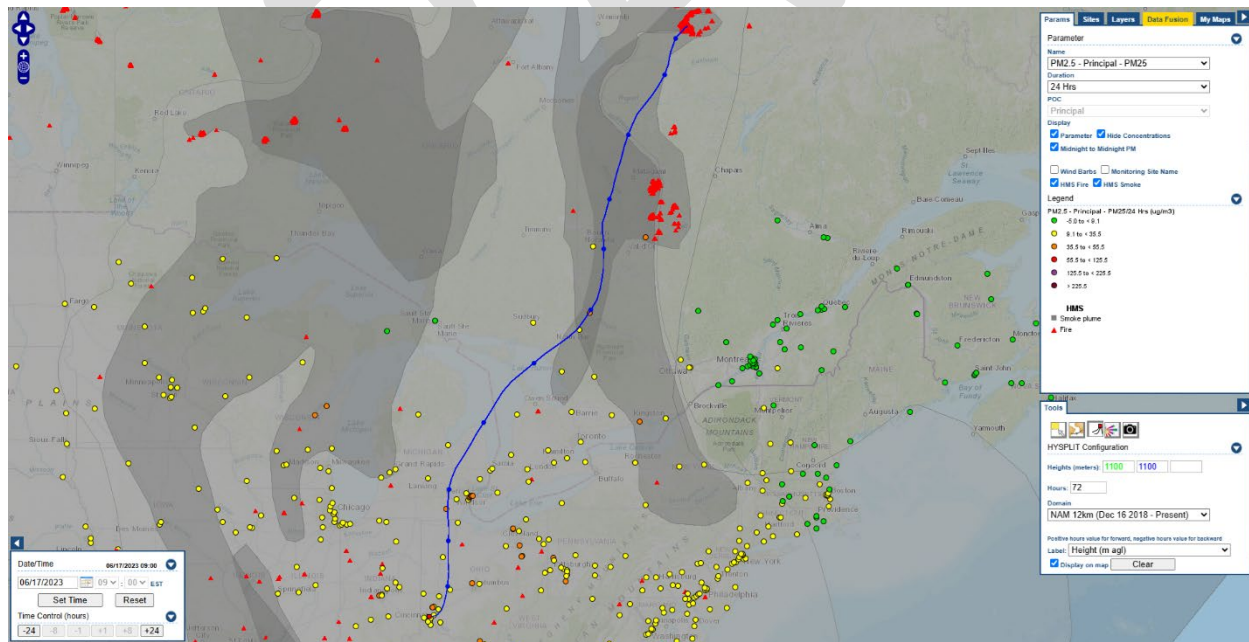


Figure 159. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for June 17, 2023, showing moderate and high AOD values over portions of Ohio, including Hamilton County.

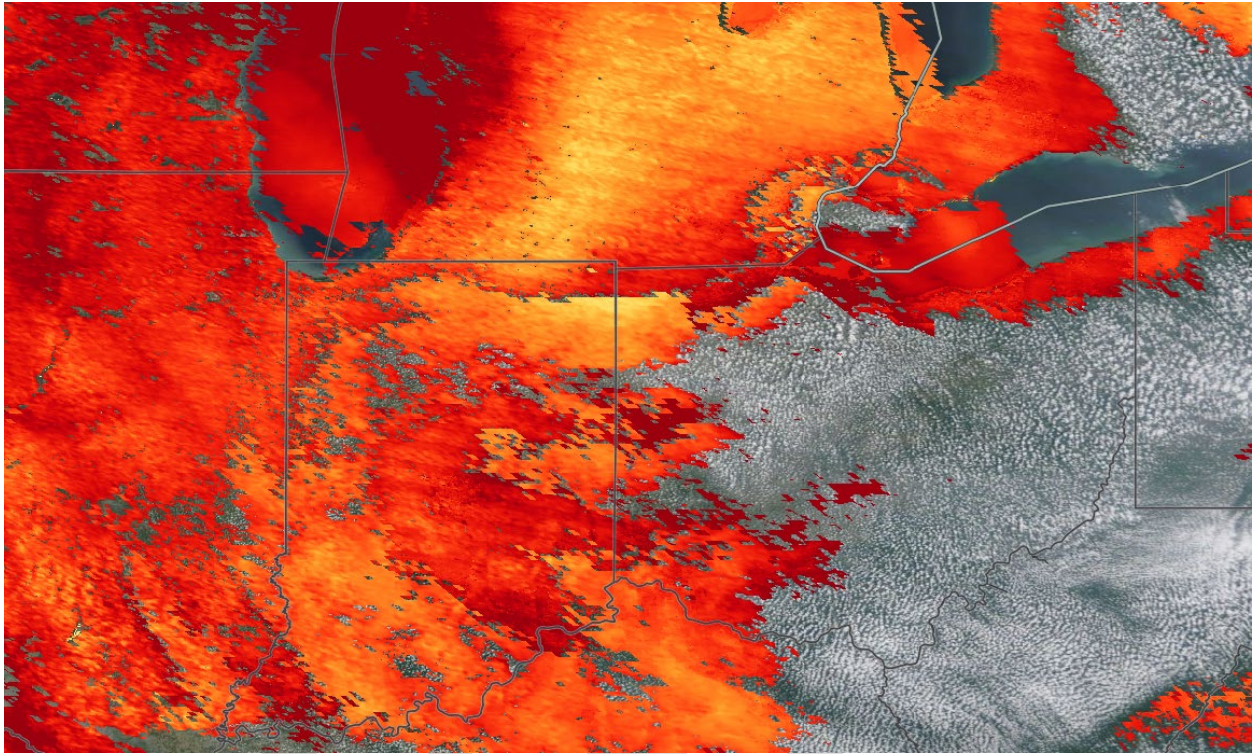


Table 21 and Figure 160 show the hourly average $PM_{2.5}$ concentrations on June 17, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 22 and Figure 161 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations remained elevated due to lingering wildfire smoke and further increased as fresh wildfire smoke rolled in and began descending on the surface around 08:00 EST on June 17, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on June 17, 2023.

Table 21. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 17, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 17, 2023
00:00	12.8	22.6
01:00	12.9	21.9
02:00	12.5	21.9
03:00	12.5	22.2
04:00	12.7	22.7
05:00	13.0	22.9
06:00	13.6	23.9
07:00	14.5	28.6
08:00	14.7	34.7
09:00	13.9	40.3
10:00	14.1	41.5
11:00	13.7	43.3
12:00	13.4	41.7
13:00	13.2	38.1
14:00	12.5	36.3
15:00	12.2	35.3
16:00	11.9	32.0
17:00	11.3	28.5
18:00	11.0	29.5
19:00	11.6	29.7
20:00	12.5	30.6
21:00	13.3	47.1
22:00	13.8	38.5
23:00	13.3	44.3

Figure 160. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 17, 2023, and 2021-2025 average June concentrations.

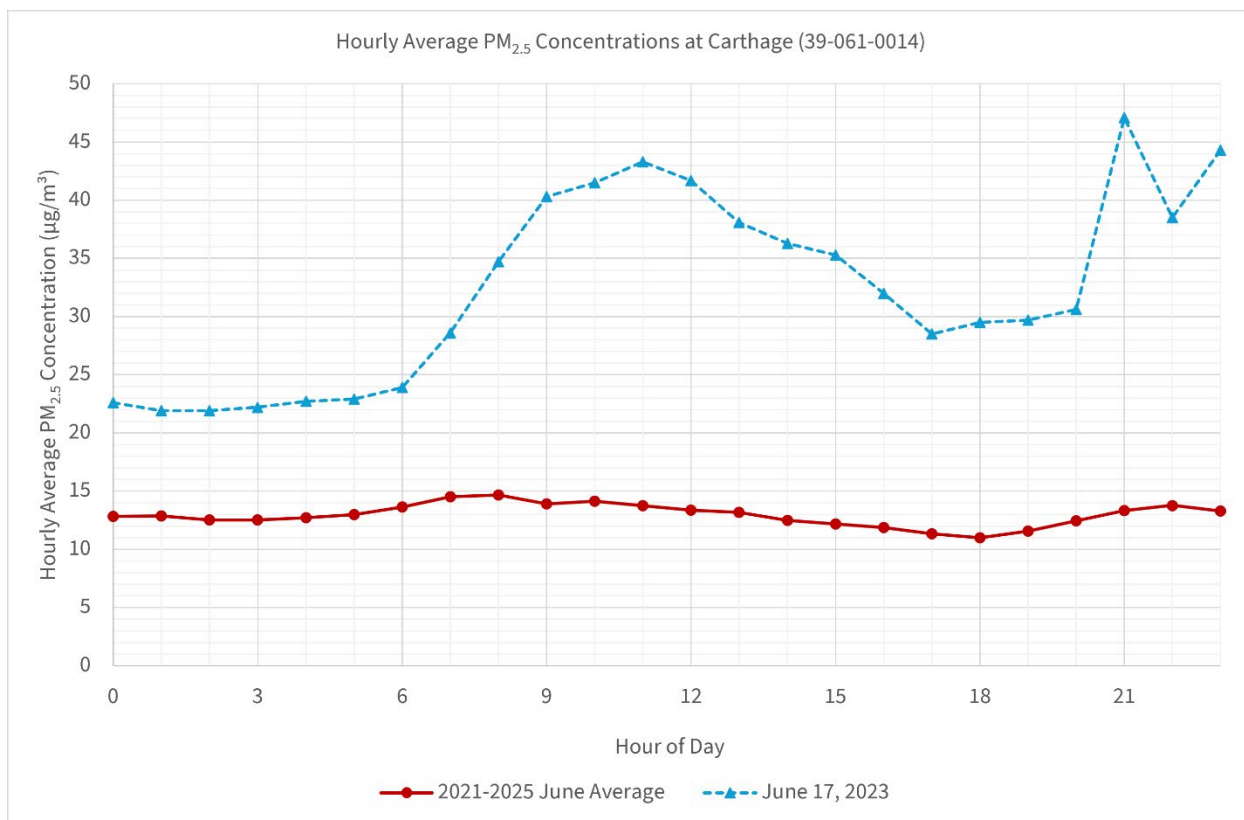


Table 22. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 17, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 17, 2023
00:00	15.1	19.8
01:00	14.8	20.3
02:00	14.6	19.3
03:00	15.3	20.4
04:00	15.5	23.6
05:00	16.0	18.6
06:00	17.4	23.4
07:00	17.6	21.6
08:00	16.2	28.2
09:00	13.9	33.2
10:00	13.4	35.4
11:00	12.6	34.3
12:00	12.3	34.9
13:00	11.8	35.8
14:00	11.3	34.0
15:00	10.9	27.8
16:00	11.2	25.9
17:00	10.8	28.1
18:00	10.5	23.5
19:00	11.3	22.1
20:00	12.6	30.3
21:00	14.0	27.1
22:00	15.3	27.6
23:00	15.6	27.1

Figure 161. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 17, 2023, and 2021-2025 average June concentrations.

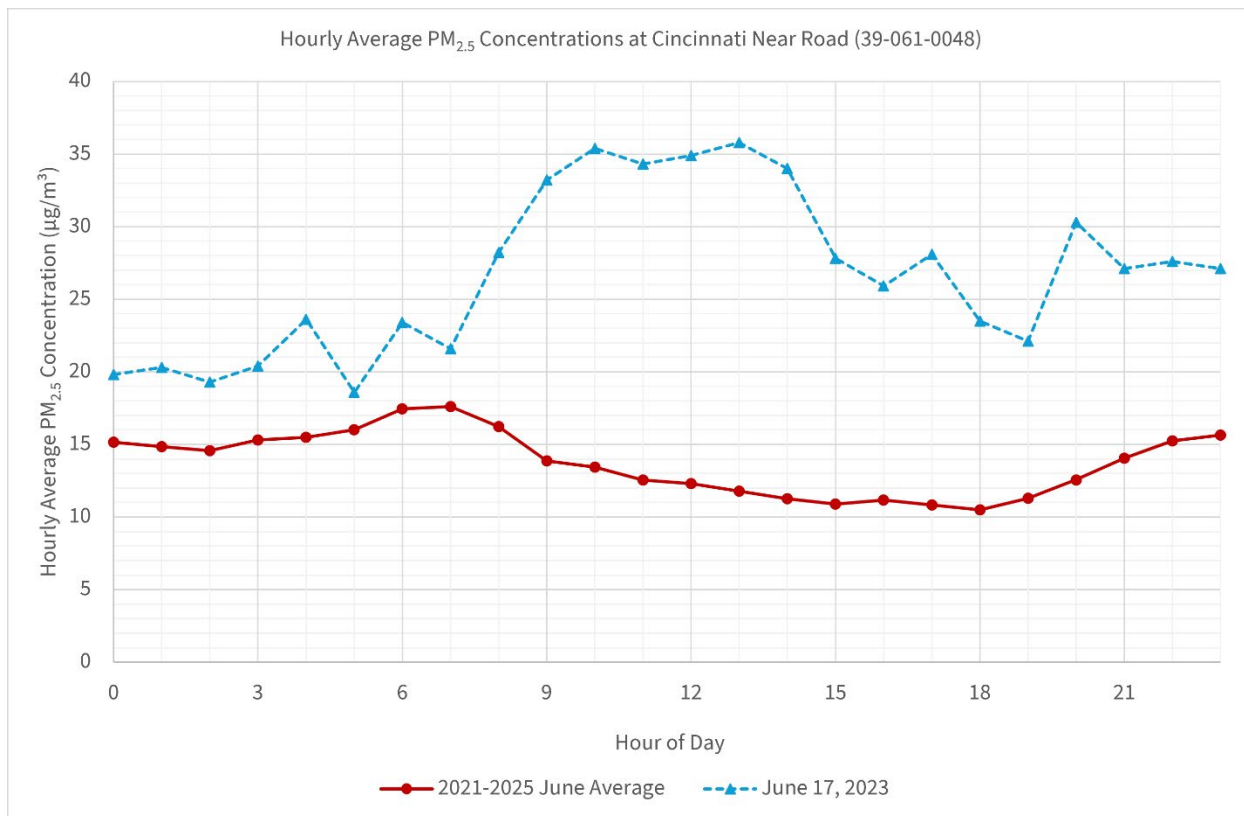
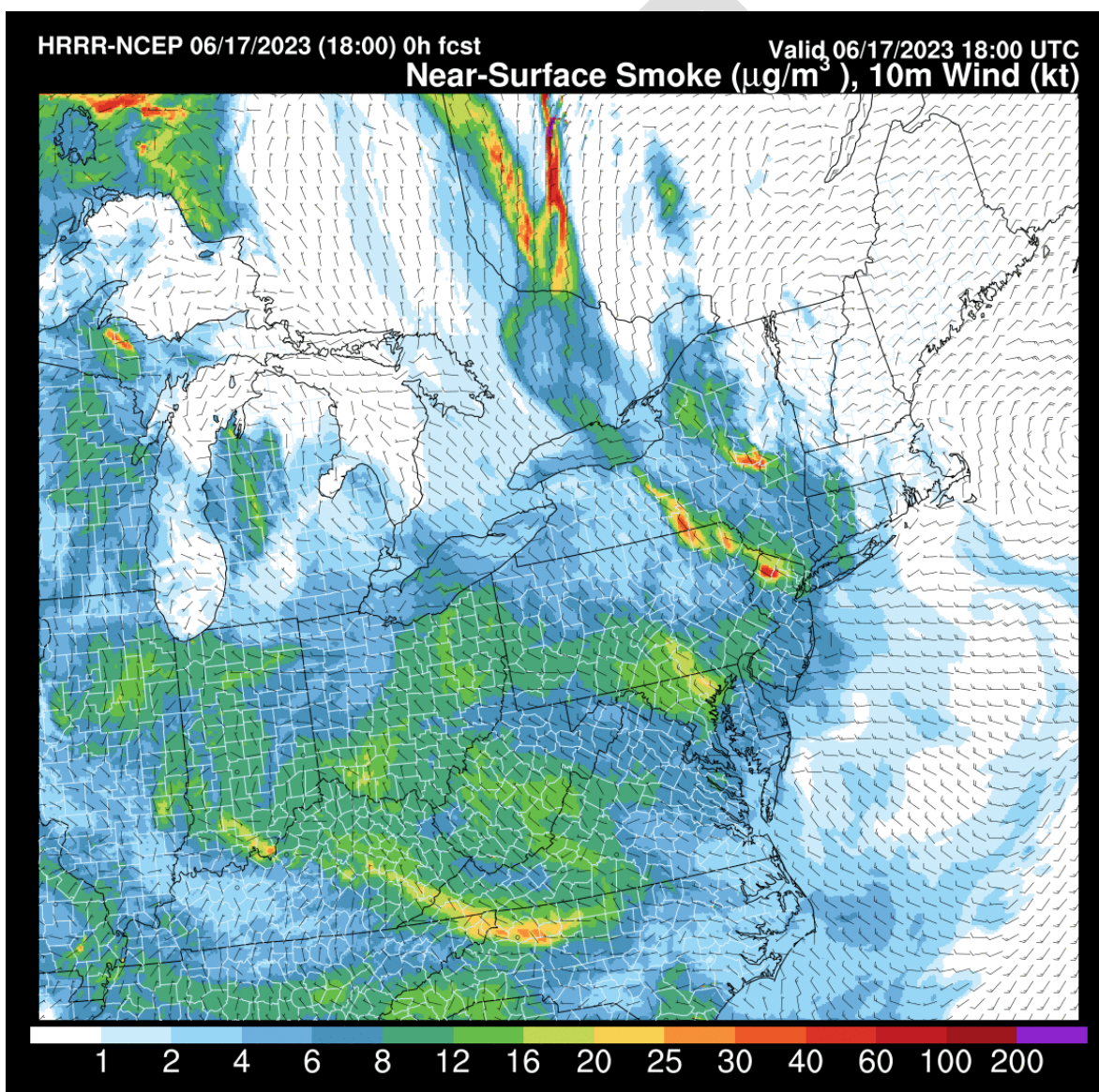


Figure 162 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 17, 2023. The HRRR model initialization showed near-surface smoke across all of Ohio, including near-surface smoke concentrations of approximately $12 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 17, 2023.

Figure 162. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 17, 2023.



3.2.4. June 18, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 18, 2023. Figure 163 shows the HYSPLIT 72-hour back trajectory plot for June 18, overlaid on a map of fire locations, monitored 24-hour average surface $PM_{2.5}$ concentrations, and HMS smoke polygons for June 15. Figure 164 shows the HYSPLIT 72-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 18. The wildfires burning 195 km (121.2 mi) east of Wemindji, Quebec coincide with the point (at 868.4 meters AGL) at 01:00 EST on June 15 of the 125-meter release height back trajectory from Cincinnati and the 875-meter release height forward trajectory from that wildfire-impacted location at 01:00 EST on June 15 reaches Cincinnati (at 109.2 meters AGL) at 01:00 EST on June 18. The coincidence of the 72-hour back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 18, 2023. The accompanying imagery map for June 18 presented in Figure 165 shows moderate and high AOD values over most of Ohio, including around Hamilton County, which is obscured by cloud cover, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 18, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 163. HYSPLIT 72-hour back trajectory plot from June 18, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 15, 2023.

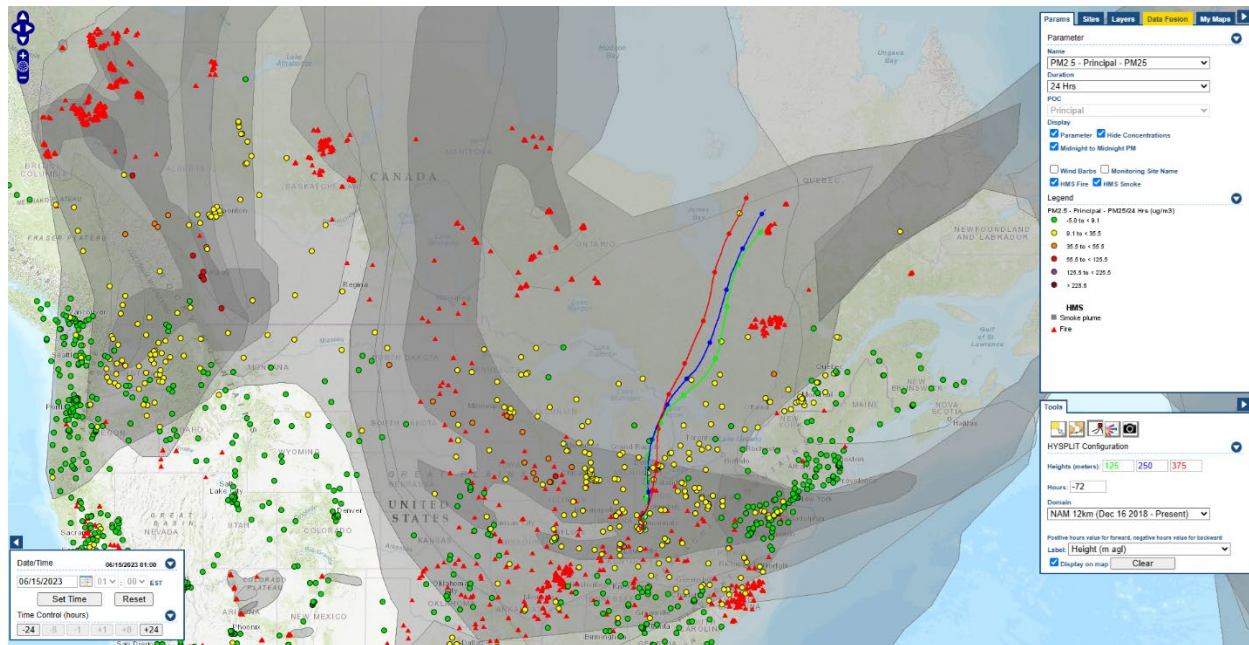


Figure 164. HYSPLIT 72-hour forward trajectory plot from June 15, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 18, 2023.

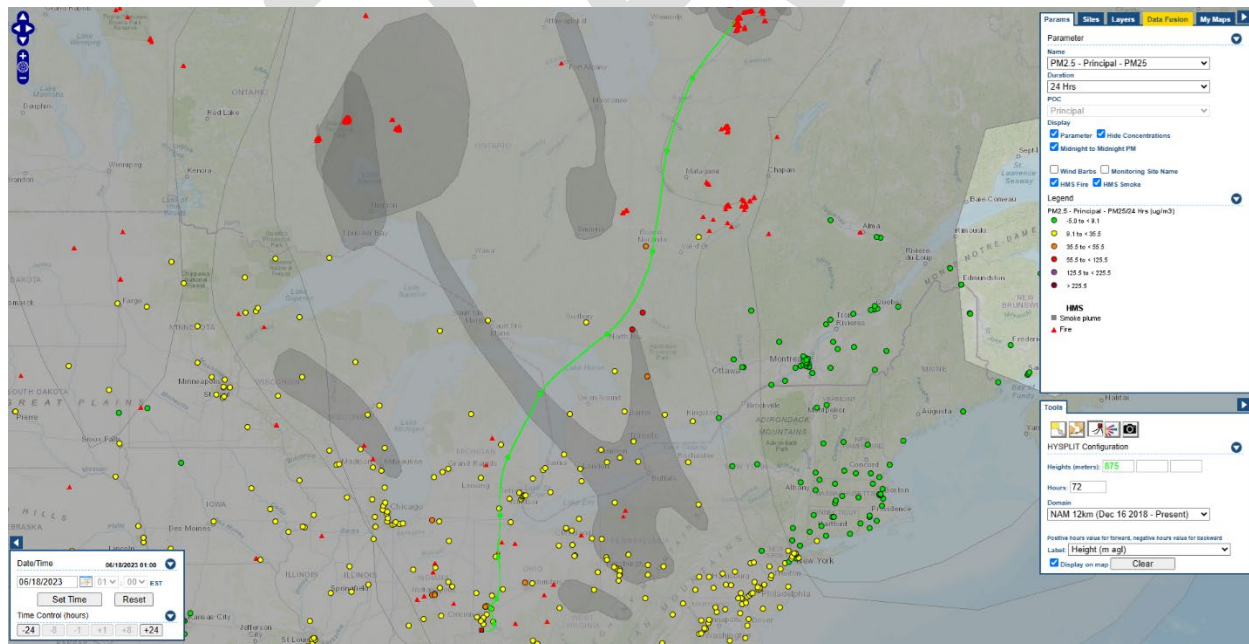


Figure 165. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for June 18, 2023, showing moderate and high AOD values over most of Ohio, including around Hamilton County, which is obscured by cloud cover.

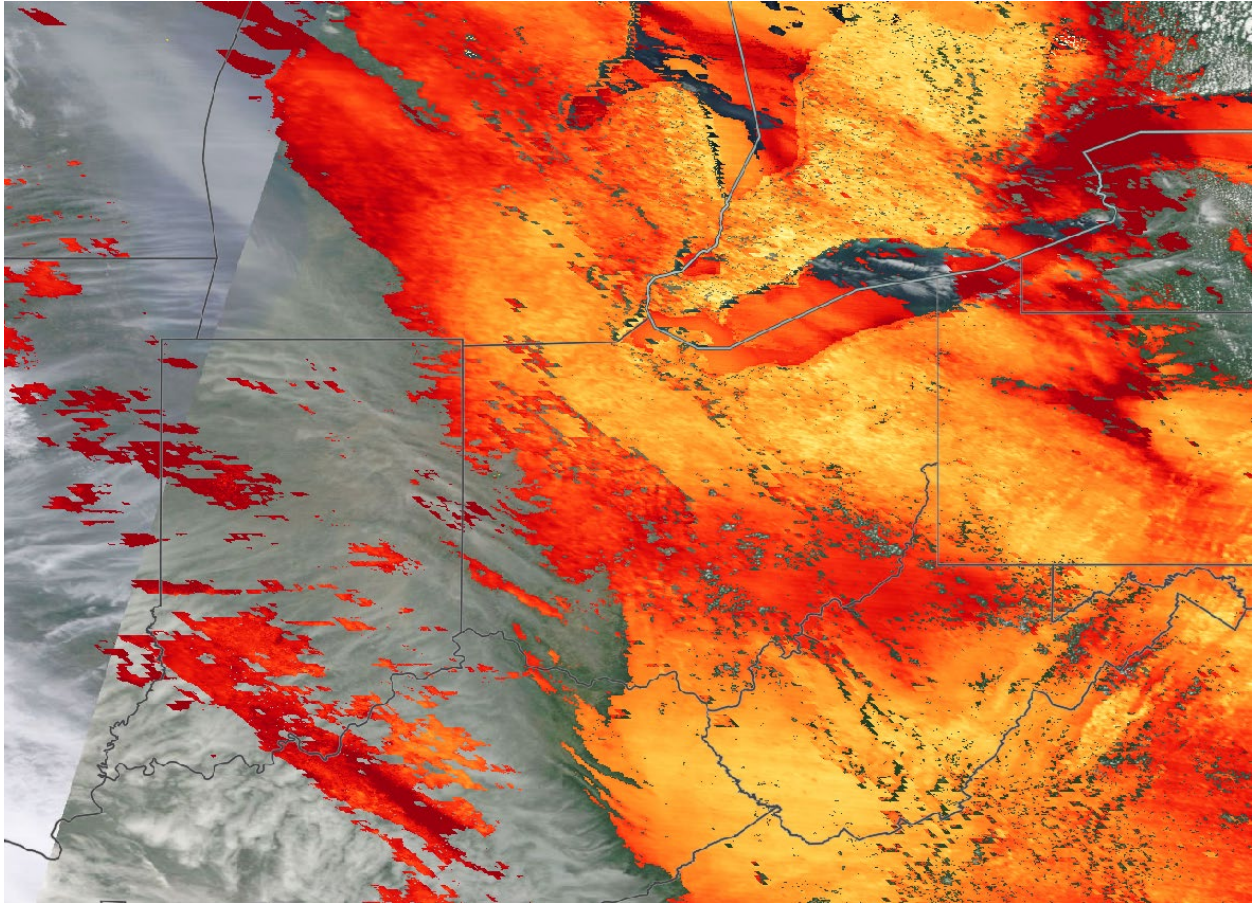


Table 23 and Figure 166 show the hourly average $PM_{2.5}$ concentrations on June 18, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 24 and Figure 167 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations remained elevated due to both lingering wildfire smoke descending to the surface and fresh wildfire smoke rolling in on June 18, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on June 18, 2023.

Table 23. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 18, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 18, 2023
00:00	12.8	36.2
01:00	12.9	38.2
02:00	12.5	36.5
03:00	12.5	36.7
04:00	12.7	33.4
05:00	13.0	33.5
06:00	13.6	34.9
07:00	14.5	37.3
08:00	14.7	37.3
09:00	13.9	36.8
10:00	14.1	31.9
11:00	13.7	30.1
12:00	13.4	28.8
13:00	13.2	29.5
14:00	12.5	30.2
15:00	12.2	30.3
16:00	11.9	27.2
17:00	11.3	27.4
18:00	11.0	25.1
19:00	11.6	22.4
20:00	12.5	25.9
21:00	13.3	24.3
22:00	13.8	23.9
23:00	13.3	22.7

Figure 166. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 18, 2023, and 2021-2025 average June concentrations.

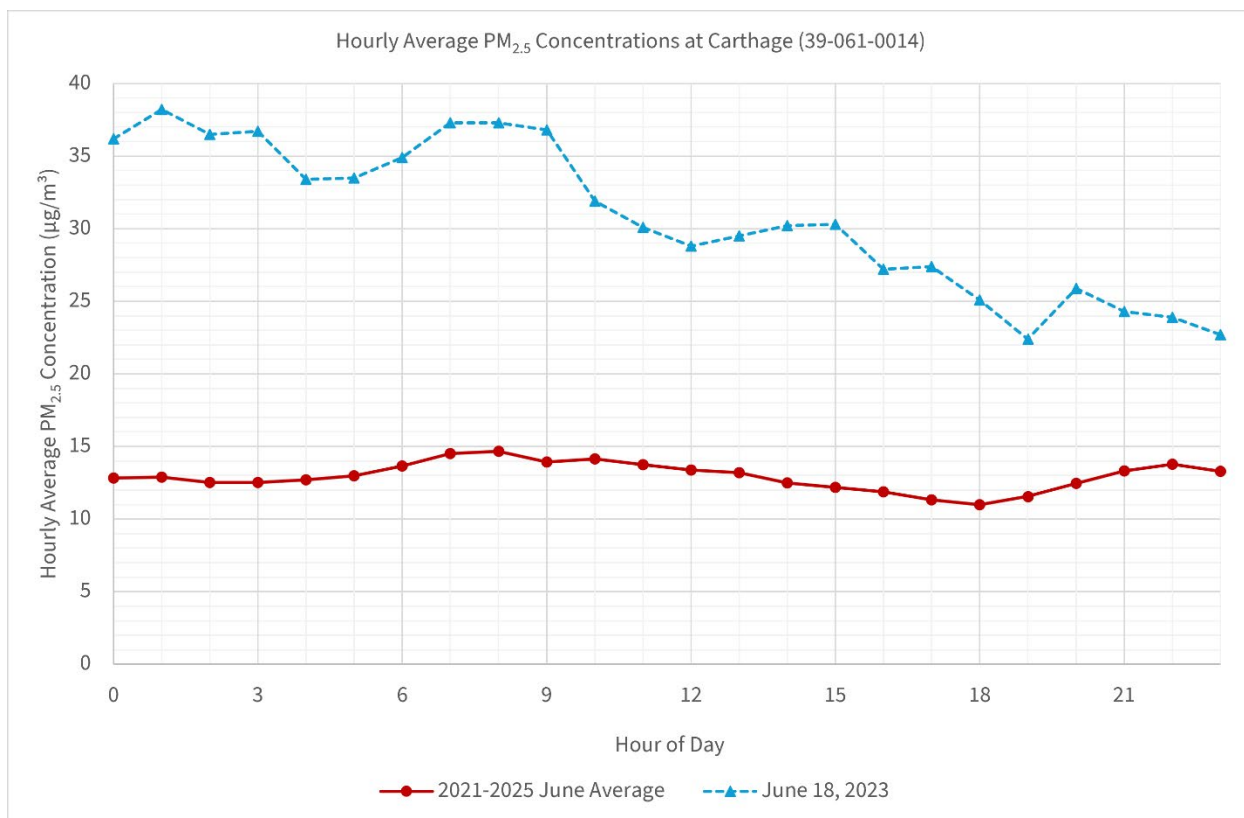


Table 24. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 18, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 18, 2023
00:00	15.1	32.4
01:00	14.8	37.2
02:00	14.6	30.7
03:00	15.3	34.9
04:00	15.5	31.4
05:00	16.0	30.2
06:00	17.4	38.5
07:00	17.6	38.3
08:00	16.2	29.6
09:00	13.9	29.4
10:00	13.4	21.8
11:00	12.6	25.9
12:00	12.3	25.2
13:00	11.8	24.5
14:00	11.3	24.0
15:00	10.9	22.9
16:00	11.2	19.3
17:00	10.8	13.7
18:00	10.5	15.7
19:00	11.3	18.2
20:00	12.6	19.1
21:00	14.0	16.9
22:00	15.3	17.8
23:00	15.6	18.3

Figure 167. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 18, 2023, and 2021-2025 average June concentrations.

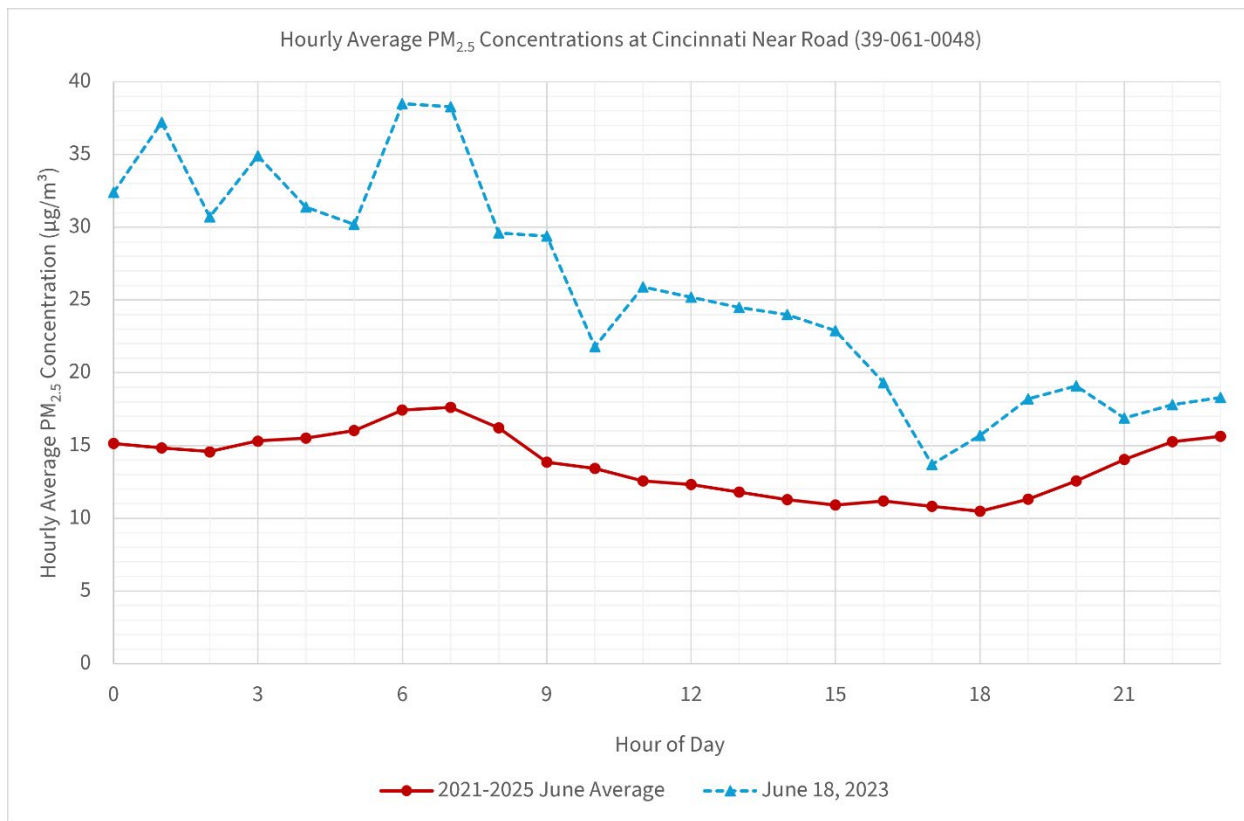
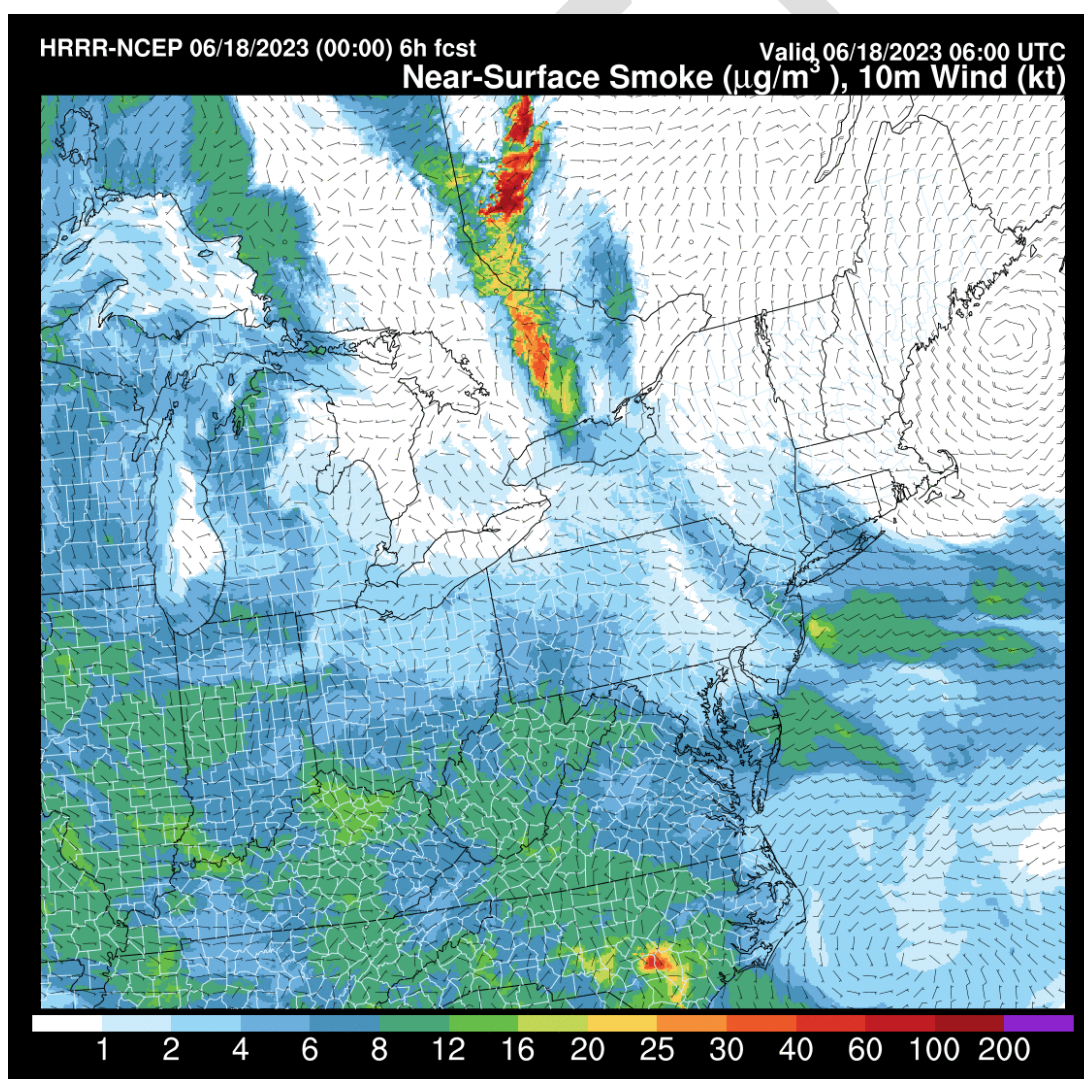


Figure 168 shows the near-surface smoke concentrations over the Northeast from the forecast for 01:00 EST on June 18, 2023, from the HRRR near-surface smoke density modeling run from 00Z on June 18, 2023 (19:00 EST on June 17, 2023). The HRRR model forecast showed near-surface smoke across all of Ohio, including near-surface smoke concentrations of approximately 8-12 $\mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 18, 2023.

Figure 168. Map of near-surface smoke concentrations over the Northeast from the forecast for 01:00 EST on June 18, 2023, from the HRRR near-surface smoke density modeling run from 00Z on June 18, 2023 (19:00 EST on June 17, 2023).



3.2.5. June 19, 2023

The HYSPLIT 120-hour back trajectory plot shows the origin and transport of the wildfire smoke plumes that caused the high surface PM_{2.5} concentrations in Hamilton County on June 19, 2025. Figure 169 shows the HYSPLIT 120-hour back trajectory plot from the Carthage monitoring site in Hamilton County, released at a height of 110.5 m AGL at 00:00 EST on June 19, with circles indicating the current smoke density at every hour along the back trajectory of the air parcel. Figure 170 shows the June 14 portion of the back trajectory plot with smoke plumes and wildfire locations overlaid on the map. A heavily wildfire smoke-impacted location near the wildfires burning 255 km (158.4 mi) east of Wemindji, Quebec coincides with the point (at 182.1 m AGL) at 06:00 EST on June 14 of the 120-hour back trajectory from the Carthage monitoring site in Hamilton County. The HYSPLIT back trajectory plot serves as clear evidence that the smoke from the wildfires burning east of Wemindji, Quebec ultimately caused the high PM_{2.5} concentrations in Hamilton County on June 19, 2025. The accompanying imagery map for June 19 presented in Figure 171 shows moderate and high AOD values surrounding the heavy cloud cover over Indiana, Kentucky, West Virginia, and Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 19, 2025, and that this wildfire smoke was the cause of the high concentrations of PM_{2.5} at monitoring sites in Hamilton County.

Figure 169. HYSPLIT 120-hour back trajectory plot from the Carthage (39-061-0014) monitoring site in Hamilton County at 00:00 EST on June 19, 2023, with red and orange circles respectively indicating heavy and medium smoke intensity.

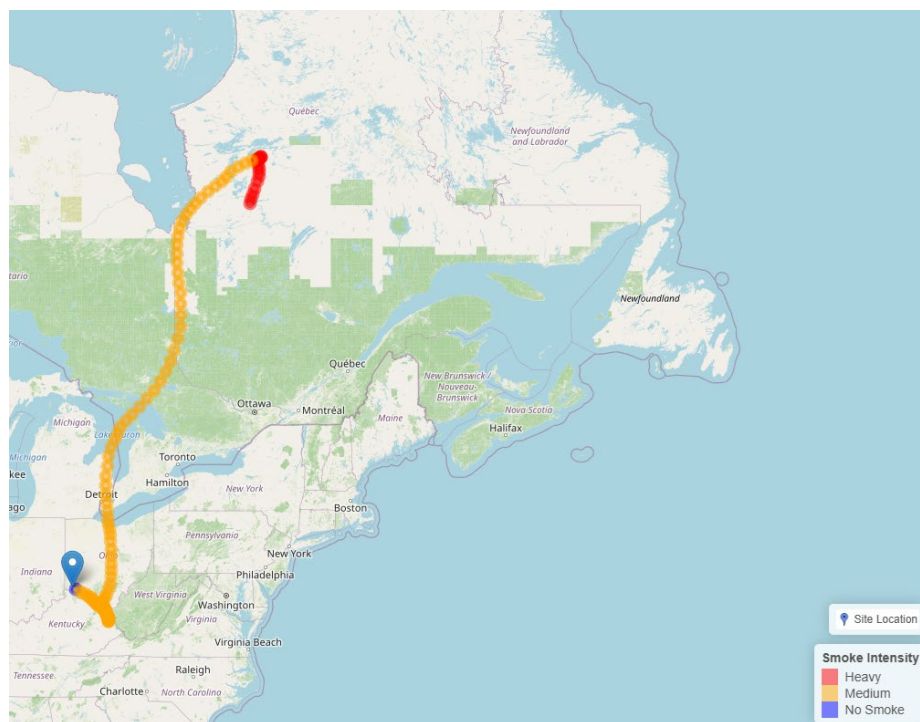


Figure 170. The June 14 portion of the HYSPLIT 120-hour back trajectory plot from the Carthage (39-061-0014) monitoring site in Hamilton County, with smoke plumes and wildfire locations overlaid on the map.

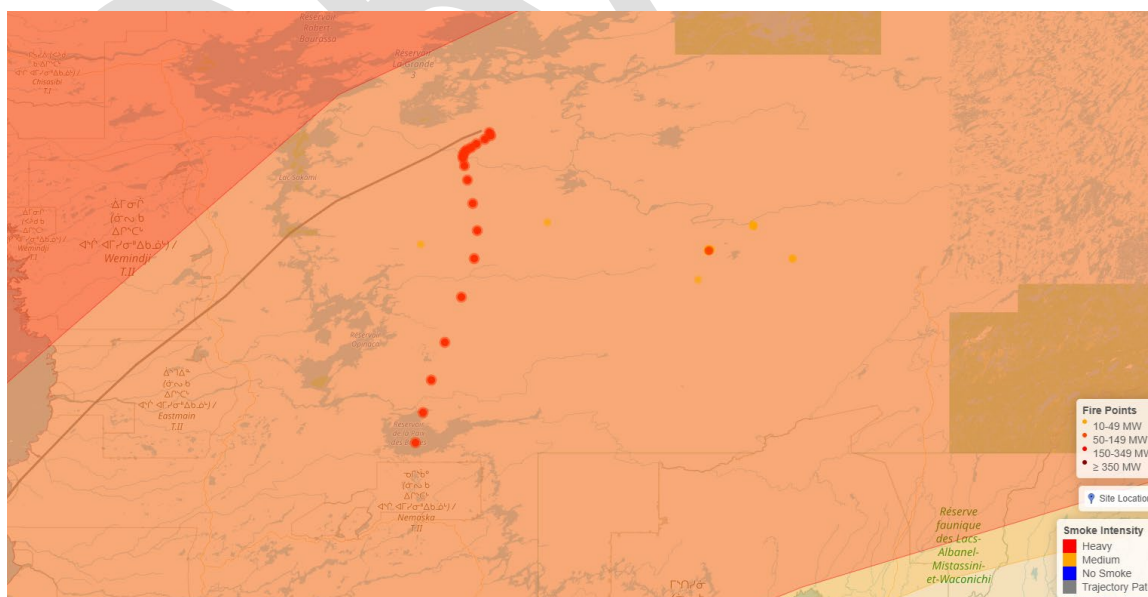


Figure 171. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for June 19, 2023, showing moderate and high AOD values surrounding the heavy cloud cover over Indiana, Kentucky, West Virginia, and Ohio, including Hamilton County.

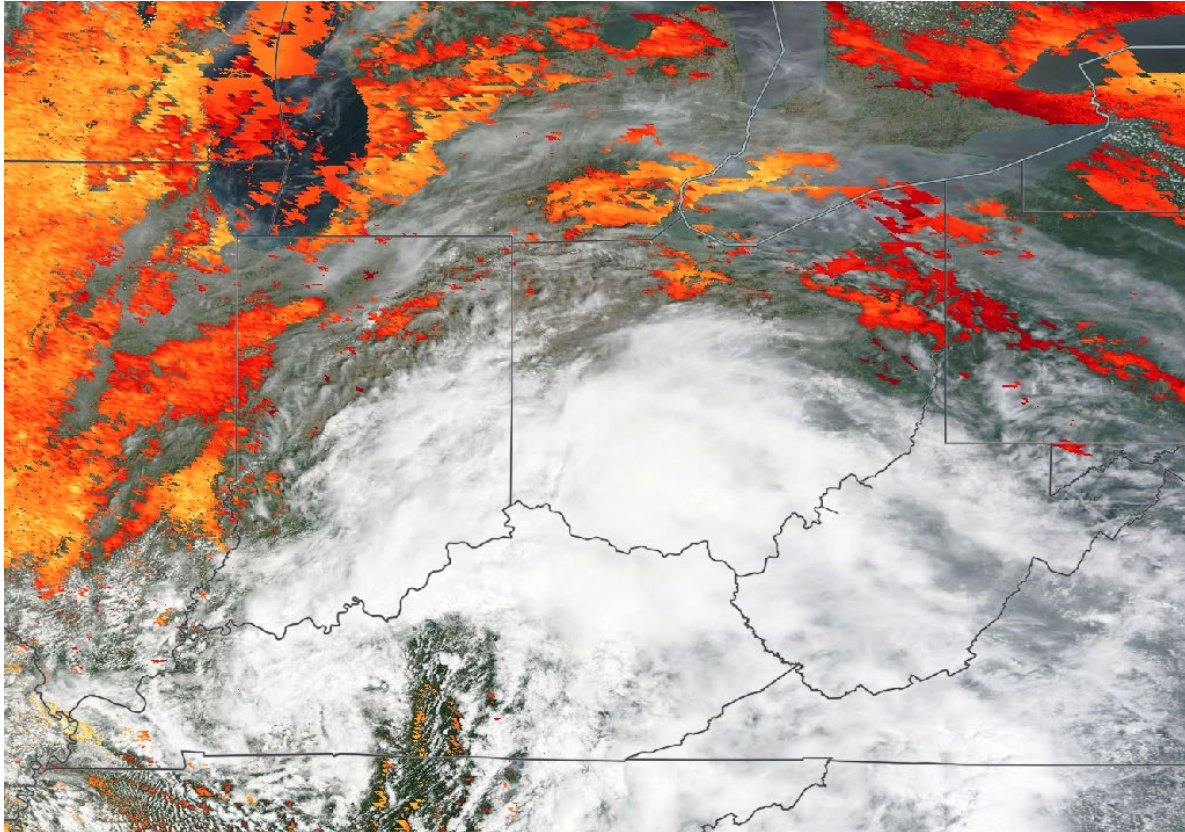


Table 25 and Figure 172 show the hourly average PM_{2.5} concentrations on June 19, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 26 and Figure 173 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average PM_{2.5} concentrations remained elevated throughout the day due to lingering wildfire smoke, providing further evidence that wildfire smoke impacted PM_{2.5} concentrations in Hamilton County on June 19, 2023.

Table 25. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 19, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 19, 2023
00:00	12.8	22.7
01:00	12.9	23.1
02:00	12.5	22.9
03:00	12.5	24.5
04:00	12.7	23.3
05:00	13.0	23.0
06:00	13.6	21.0
07:00	14.5	19.8
08:00	14.7	18.9
09:00	13.9	18.2
10:00	14.1	20.3
11:00	13.7	17.4
12:00	13.4	16.4
13:00	13.2	16.4
14:00	12.5	10.3
15:00	12.2	10.1
16:00	11.9	10.7
17:00	11.3	12.7
18:00	11.0	12.9
19:00	11.6	16.3
20:00	12.5	19.8
21:00	13.3	21.5
22:00	13.8	23.9
23:00	13.3	24.7

Figure 172. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 19, 2023, and 2021-2025 average June concentrations.

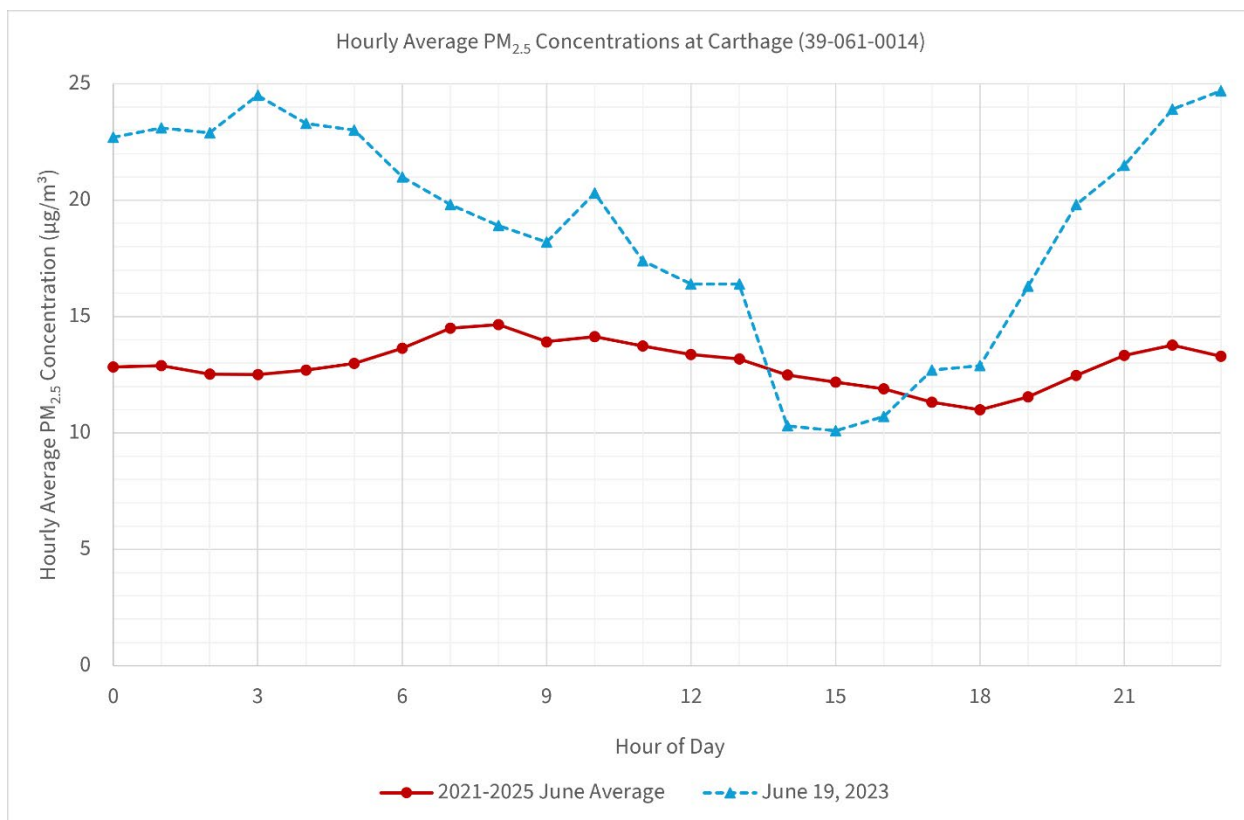


Table 26. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 19, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 19, 2023
00:00	15.1	19.1
01:00	14.8	27.7
02:00	14.6	22.5
03:00	15.3	26.4
04:00	15.5	20.3
05:00	16.0	23.4
06:00	17.4	23.4
07:00	17.6	21.3
08:00	16.2	17.5
09:00	13.9	16.4
10:00	13.4	23.0
11:00	12.6	16.9
12:00	12.3	15.3
13:00	11.8	19.1
14:00	11.3	13.6
15:00	10.9	9.2
16:00	11.2	11.5
17:00	10.8	17.2
18:00	10.5	11.6
19:00	11.3	11.7
20:00	12.6	14.6
21:00	14.0	21.7
22:00	15.3	26.4
23:00	15.6	21.8

Figure 173. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 19, 2023, and 2021-2025 average June concentrations.

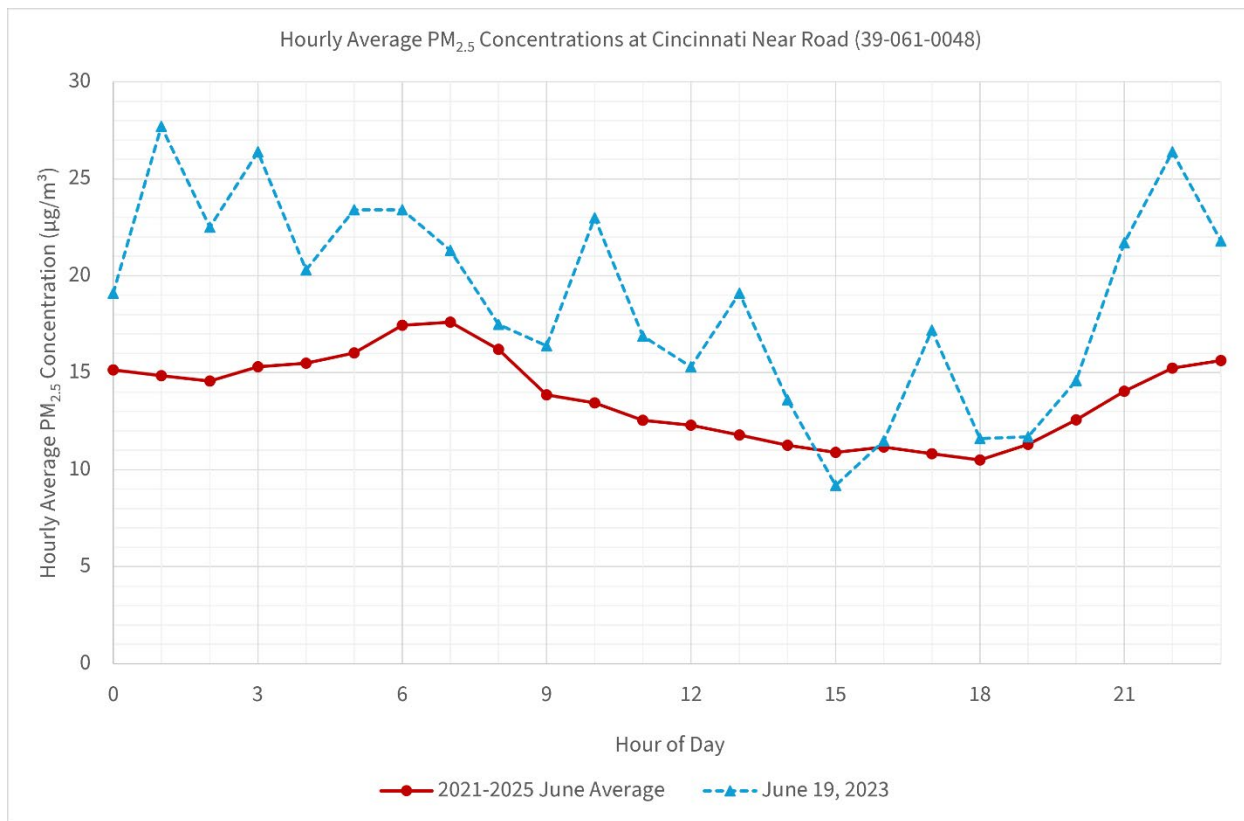
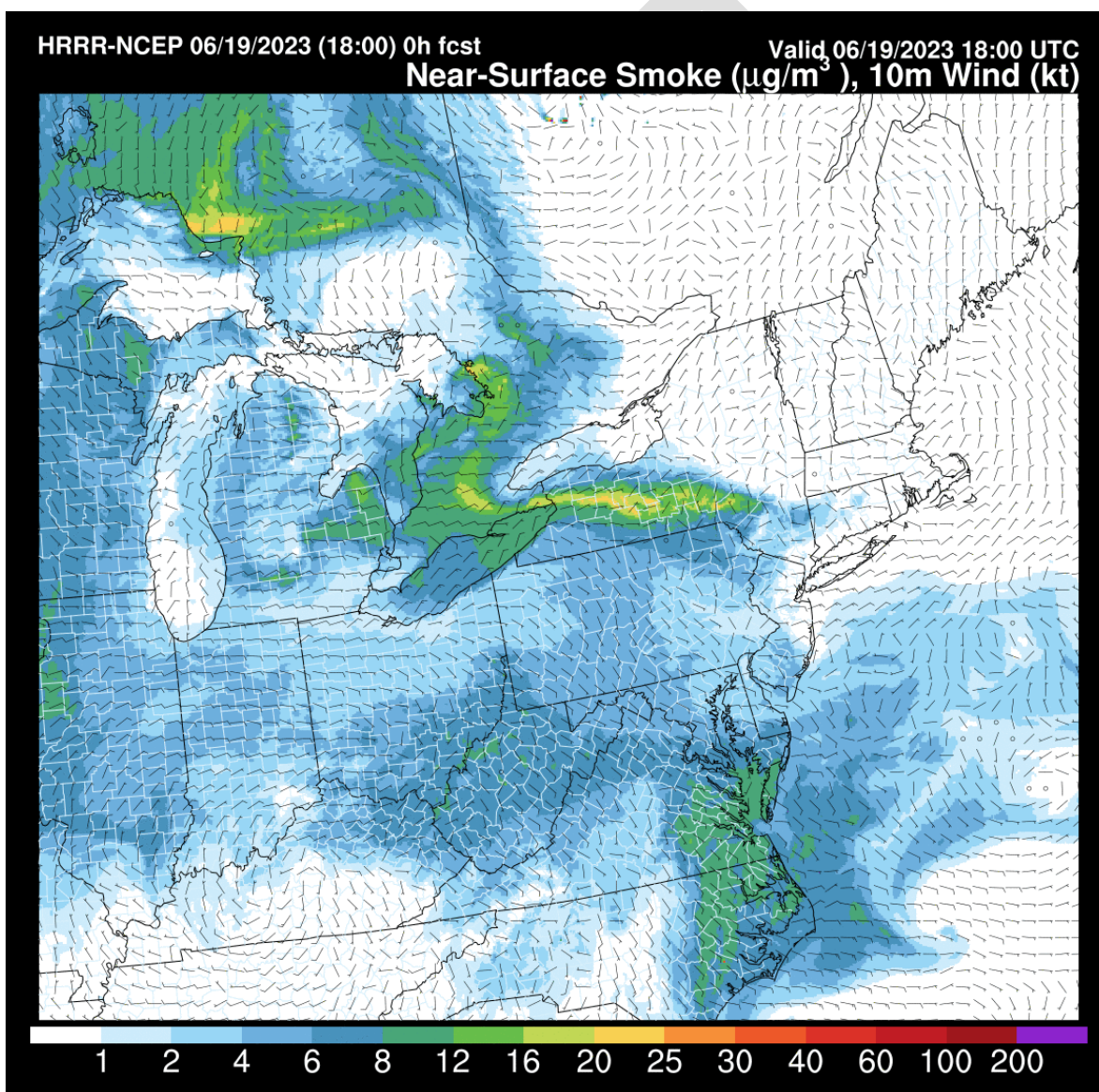


Figure 174 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 19, 2023. The HRRR model initialization showed near-surface smoke across all of Ohio, including near-surface smoke concentrations of approximately 6-8 $\mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 19, 2023.

Figure 174. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on June 19, 2023.



3.3. Wildfire Smoke-Driven $PM_{2.5}$ Episode from June 27-29, 2023

3.3.1. June 27, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 27, 2023. Figure 175 shows the HYSPLIT 72-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 24. Figure 176 shows the HYSPLIT 72-hour forward trajectory plot for June 24, overlaid on a map of fire locations, monitored 24-hour average surface $PM_{2.5}$ concentrations, and HMS smoke polygons for June 27. The wildfires burning 50 km (31.1 mi) southeast of Matagami, Quebec coincide with the point (at 658.0 meters AGL) at 04:00 EST on June 24 of the 250-meter release height back trajectory from Cincinnati and the 650-meter release height forward trajectory from that wildfire-impacted location at 04:00 EST on June 24 reaches Cincinnati (at 330.7 meters AGL) at 04:00 EST on June 27. The coincidence of the 72-hour back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 27, 2023. The accompanying imagery map for June 27 presented in Figure 177 shows high AOD values surrounding the heavy cloud cover over Michigan, Indiana, Kentucky, West Virginia, and Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 27, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 175. HYSPLIT 72-hour back trajectory plot from June 27, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 24, 2023.

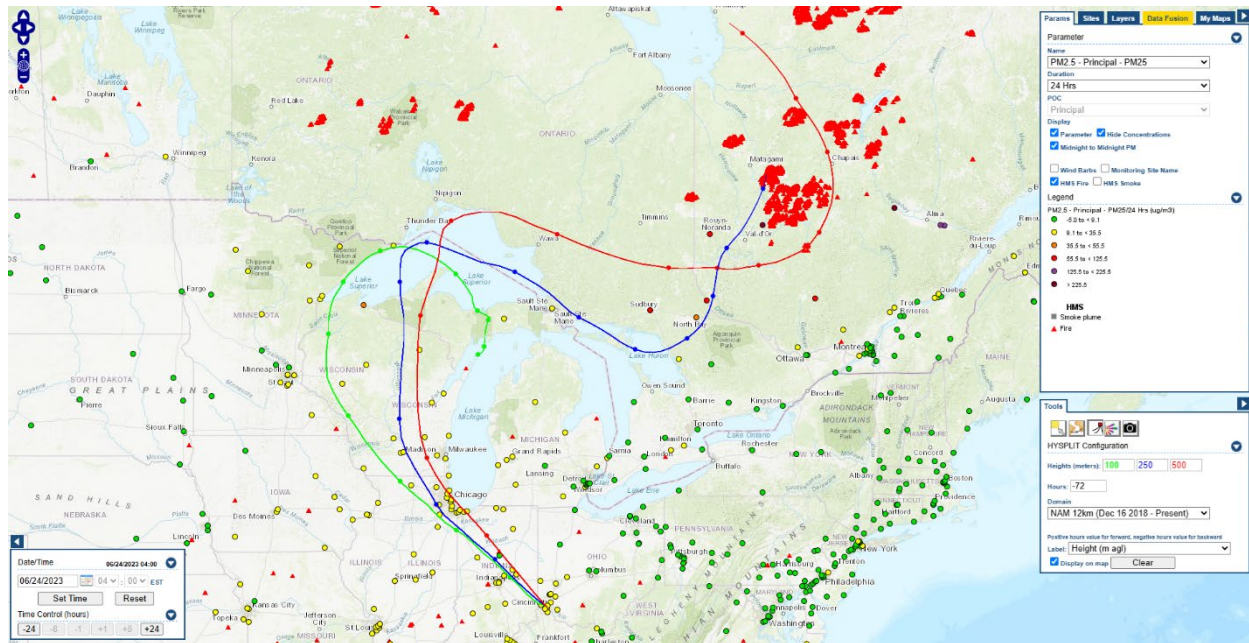


Figure 176. HYSPLIT 72-hour forward trajectory plot from June 24, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 27, 2023.

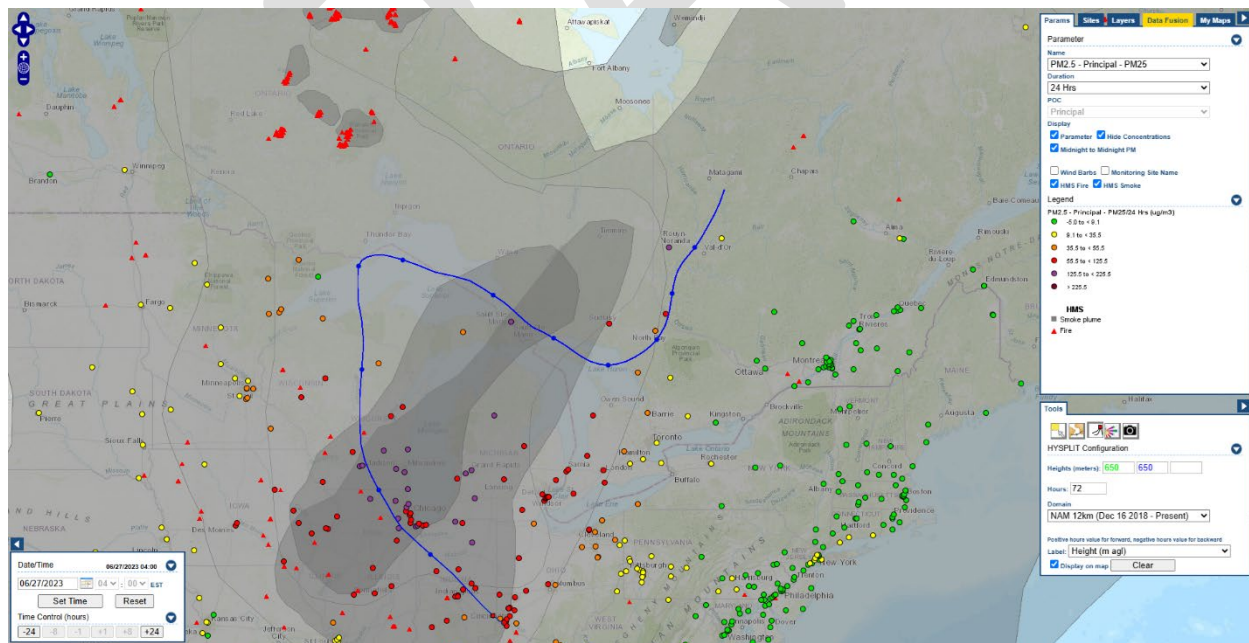


Figure 177. Aqua satellite true color and MAIAC AOD imagery of Ohio and surrounding states for June 27, 2023, showing high AOD values surrounding the heavy cloud cover over Michigan, Indiana, Kentucky, West Virginia, and Ohio, including Hamilton County.

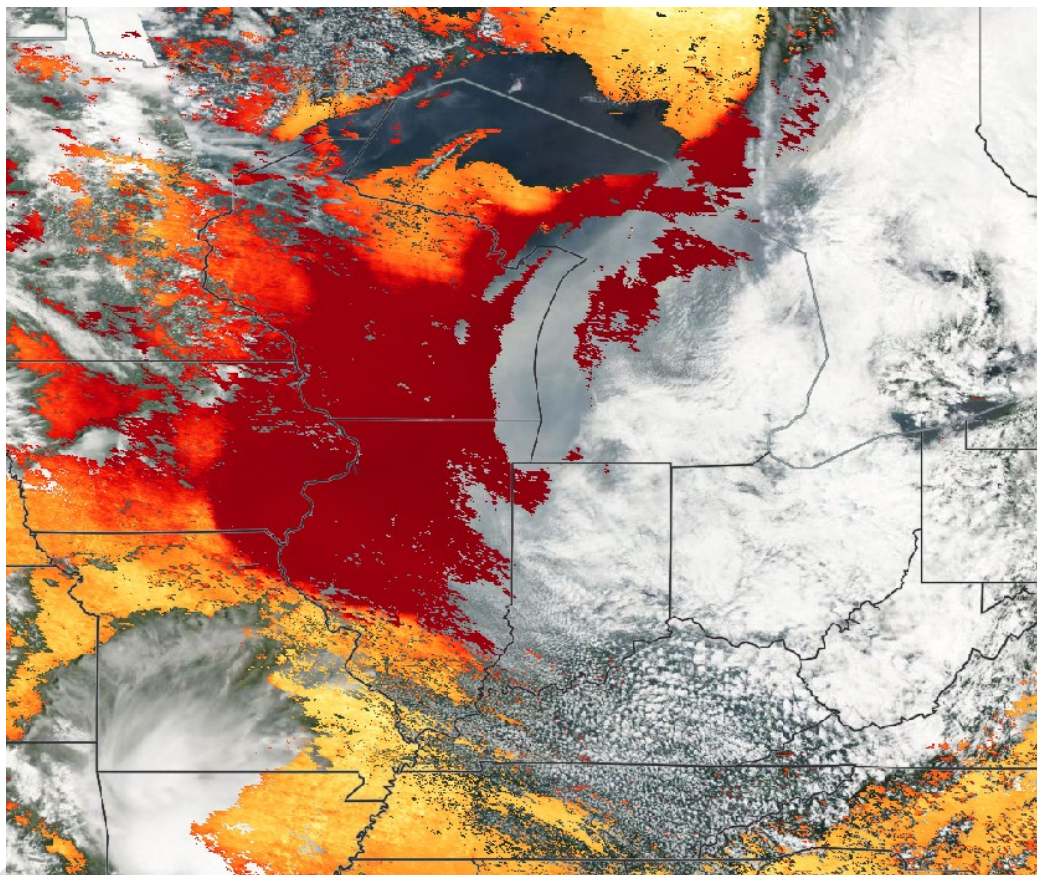


Table 27 and Figure 178 show the hourly average $PM_{2.5}$ concentrations on June 27, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 28 and Figure 179 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations began steadily increasing overnight as wildfire smoke reached the area and began to descend on the surface, then concentrations remained elevated the rest of the day on June 27, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on June 27, 2023.

Table 27. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 27, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 27, 2023
00:00	12.8	31.1
01:00	12.9	37.6
02:00	12.5	43.6
03:00	12.5	51.9
04:00	12.7	57.8
05:00	13.0	57.7
06:00	13.6	53.0
07:00	14.5	59.2
08:00	14.7	63.8
09:00	13.9	N/A (Null Code AZ; Quality Control Audit)
10:00	14.1	60.7
11:00	13.7	60.0
12:00	13.4	61.6
13:00	13.2	62.9
14:00	12.5	56.0
15:00	12.2	49.6
16:00	11.9	48.8
17:00	11.3	49.9
18:00	11.0	49.8
19:00	11.6	54.9
20:00	12.5	62.4
21:00	13.3	101.8
22:00	13.8	151.2
23:00	13.3	119.4

Figure 178. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 27, 2023, and 2021-2025 average June concentrations.

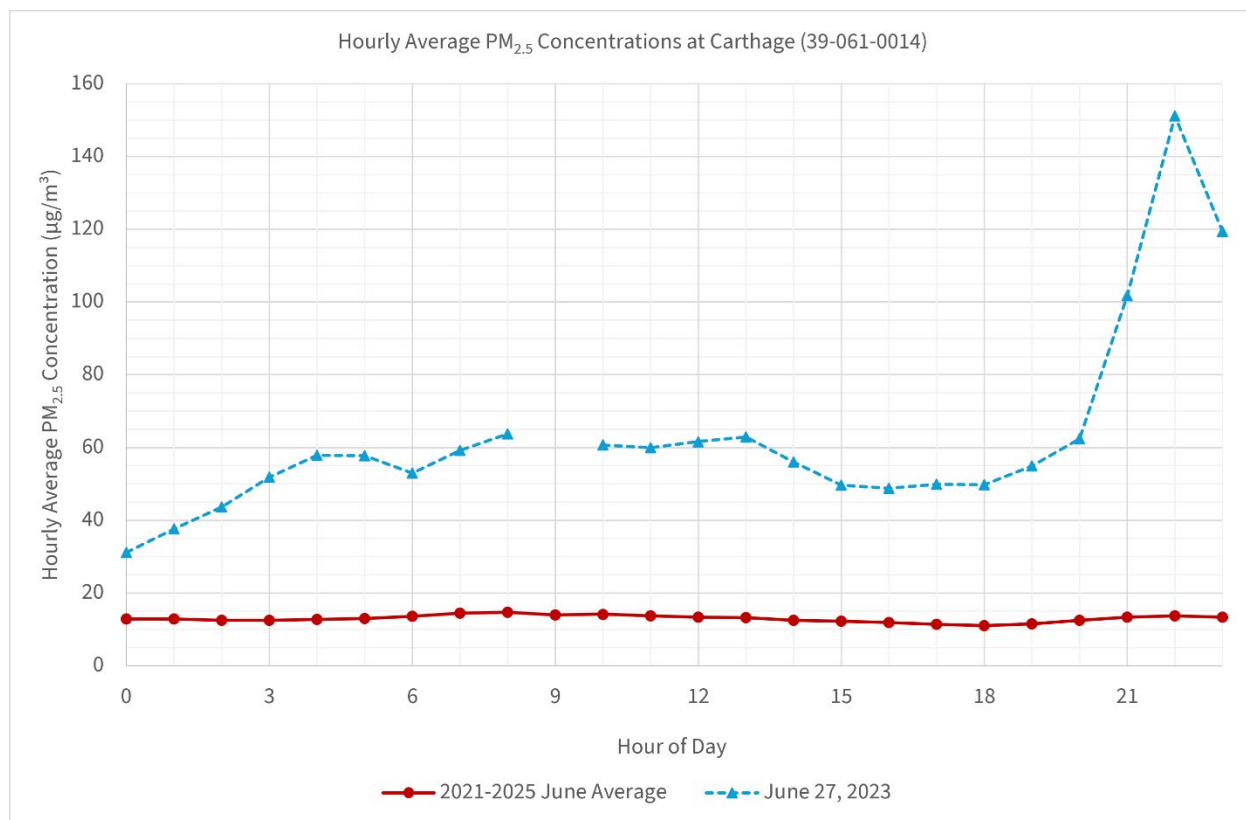


Table 28. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 27, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 27, 2023
00:00	15.1	25.3
01:00	14.8	35.6
02:00	14.6	41.7
03:00	15.3	41.5
04:00	15.5	48.7
05:00	16.0	45.2
06:00	17.4	40.2
07:00	17.6	51.1
08:00	16.2	52.9
09:00	13.9	54.8
10:00	13.4	52.5
11:00	12.6	51.4
12:00	12.3	50.4
13:00	11.8	52.2
14:00	11.3	45.8
15:00	10.9	41.8
16:00	11.2	39.6
17:00	10.8	42.0
18:00	10.5	40.7
19:00	11.3	46.1
20:00	12.6	50.2
21:00	14.0	76.4
22:00	15.3	128.5
23:00	15.6	129.9

Figure 179. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 27, 2023, and 2021-2025 average June concentrations.

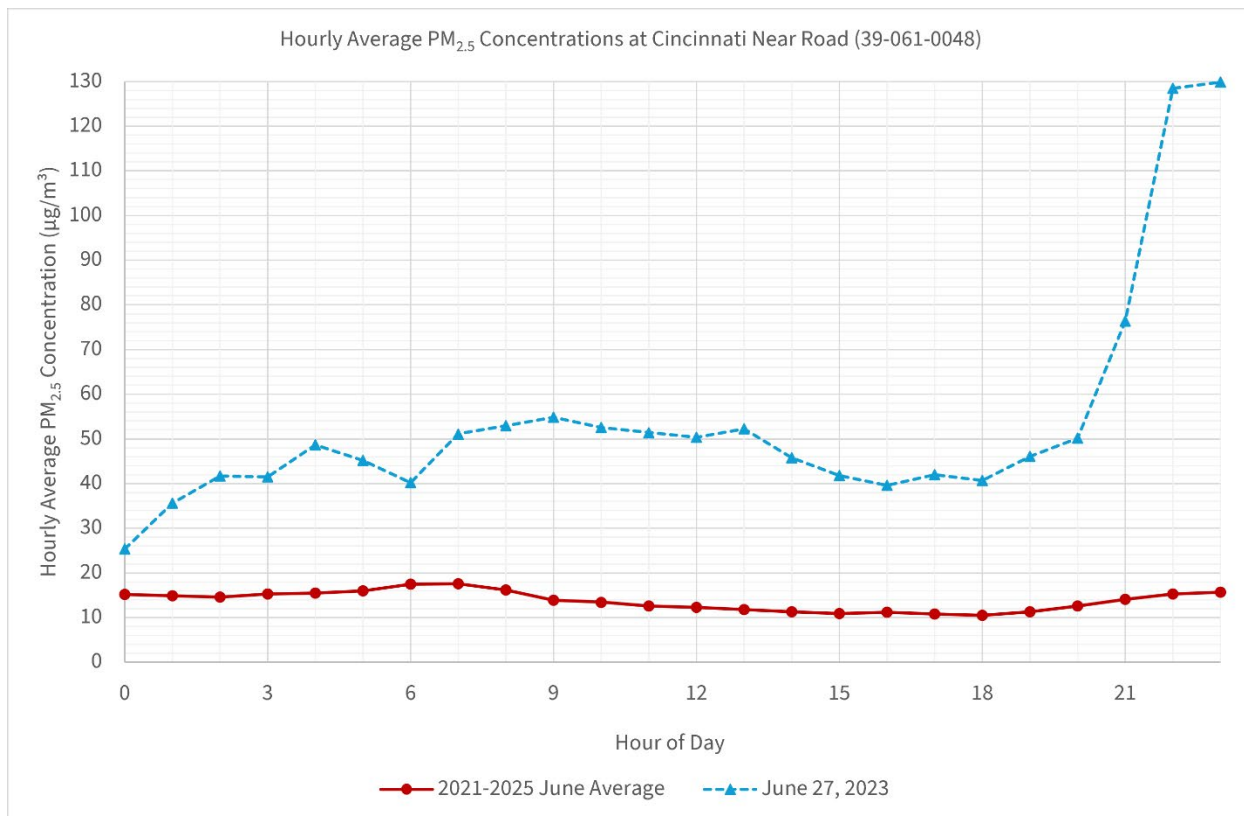
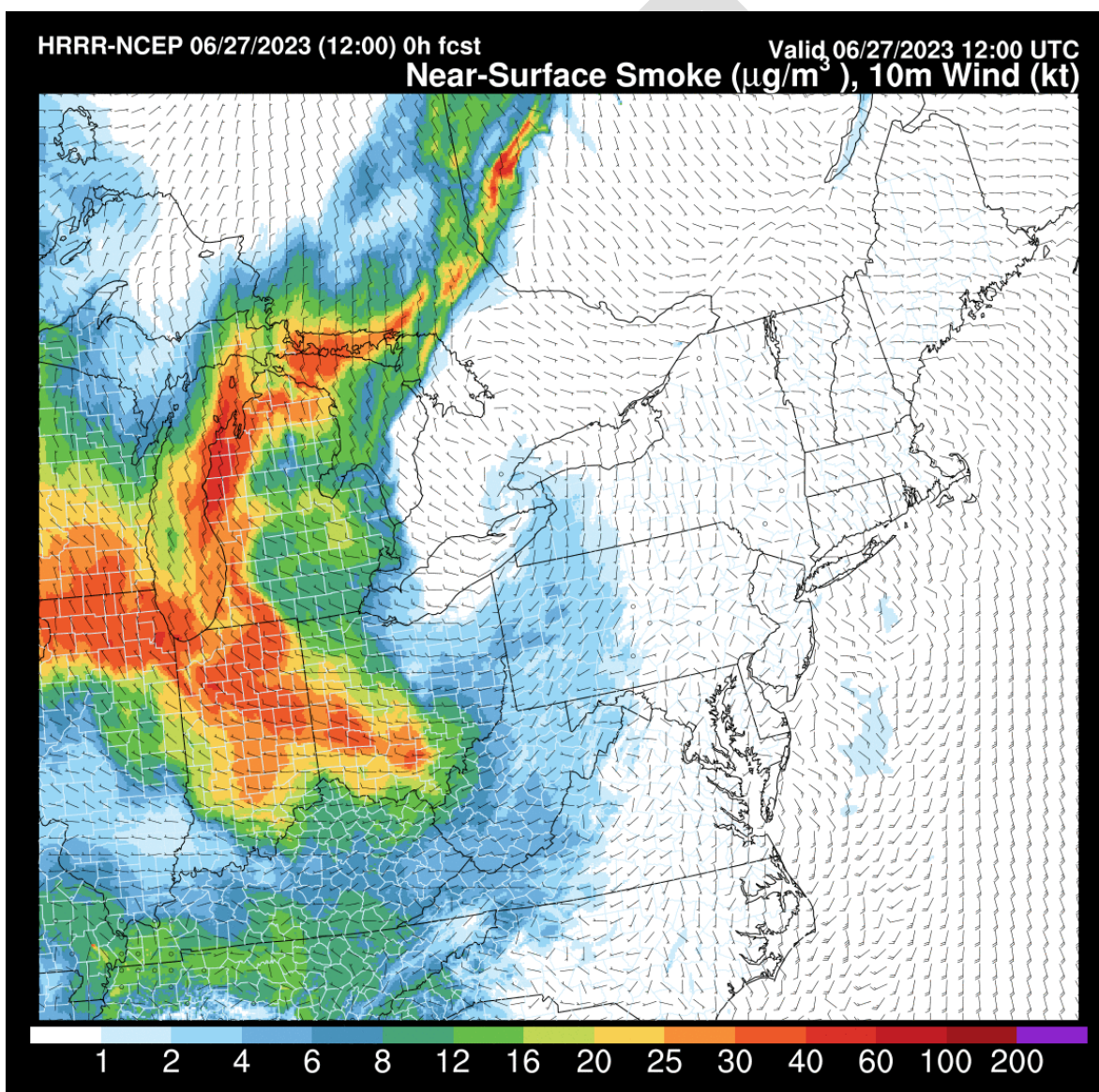


Figure 180 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 12Z (07:00 EST) on June 27, 2023. The HRRR model initialization showed near-surface smoke across most of Ohio, including near-surface smoke concentrations of approximately $20 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 27, 2023.

Figure 180. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 12Z (07:00 EST) on June 27, 2023.



3.3.2. June 28, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 28, 2023. Figure 181 shows the HYSPLIT 72-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 25. Figure 182 shows the HYSPLIT 72-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 28. The wildfires burning 55 km (34.2 mi) north-northeast of Chapais, Quebec coincide with the point (at 1520.4 meters AGL) at 01:00 EST on June 25 of the 500-meter release height back trajectory from Cincinnati and the 1525-meter release height forward trajectory from that wildfire-impacted location at 01:00 EST on June 25 reaches Cincinnati (at 547.5 meters AGL) at 01:00 EST on June 28. The coincidence of the 72-hour back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 28, 2023. The accompanying imagery map for June 28 presented in Figure 183 shows visible wildfire smoke and high AOD values over Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 28, 2023, and that this wildfire smoke was the cause of the high concentrations of $PM_{2.5}$ at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 181. HYSPLIT 72-hour back trajectory plot from June 28, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 25, 2023.

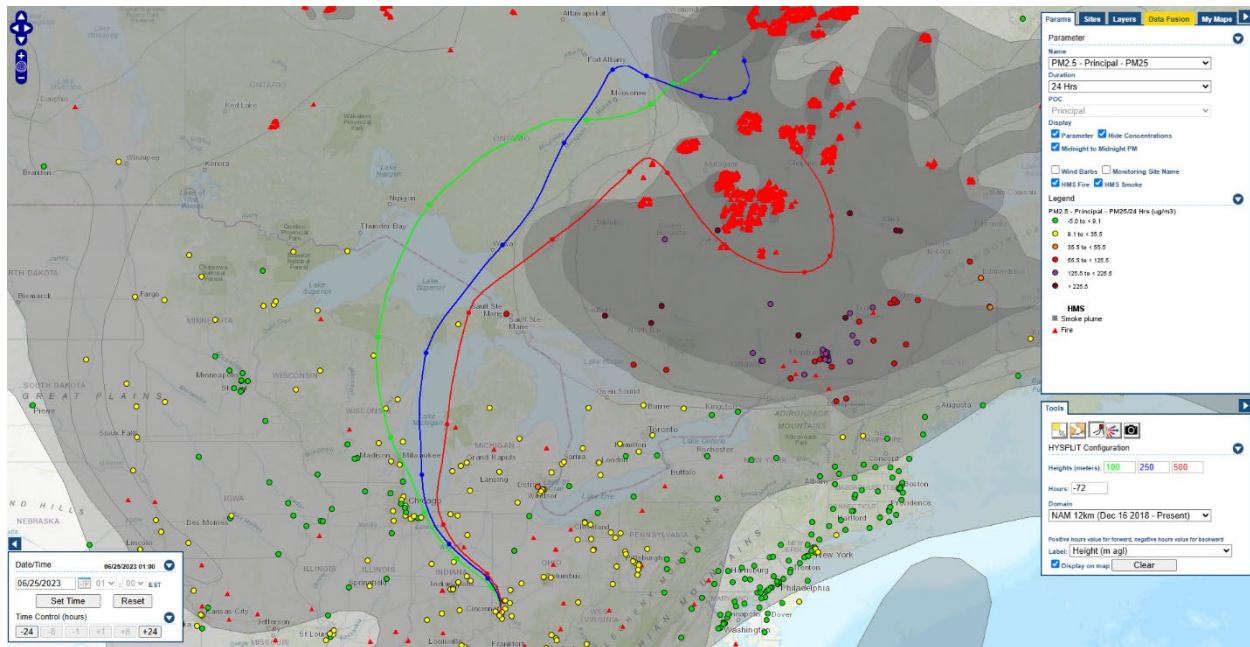


Figure 182. HYSPLIT 72-hour forward trajectory plot from June 25, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 28, 2023.

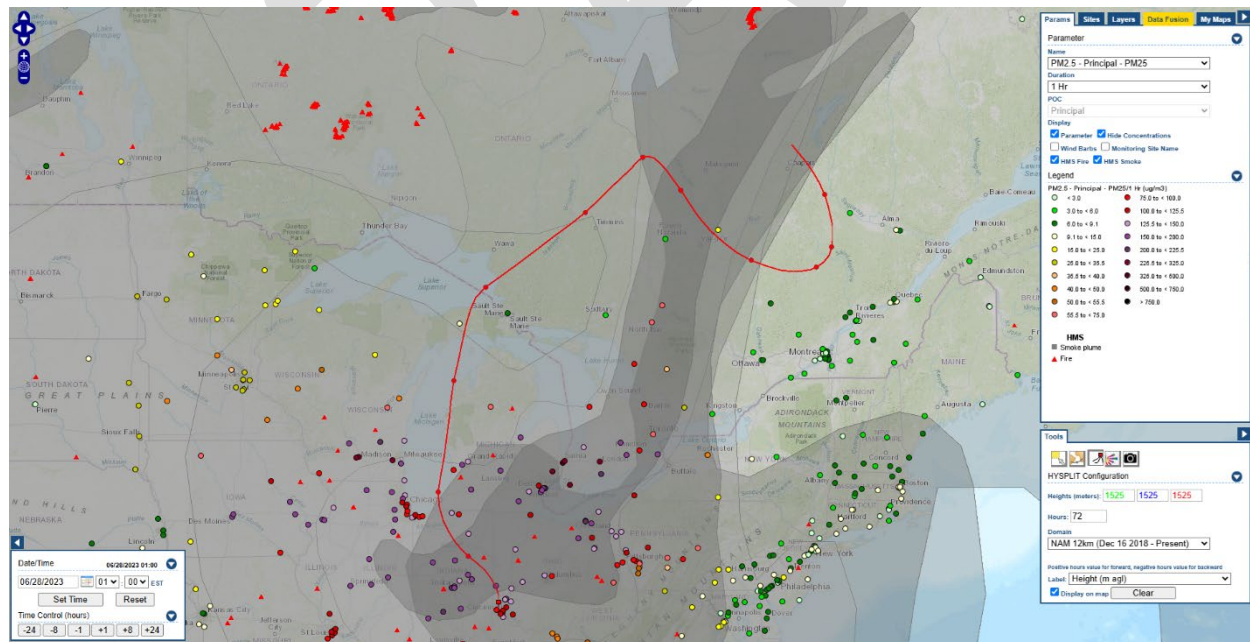


Figure 183. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for June 28, 2023, showing visible wildfire smoke and high AOD values over Hamilton County.

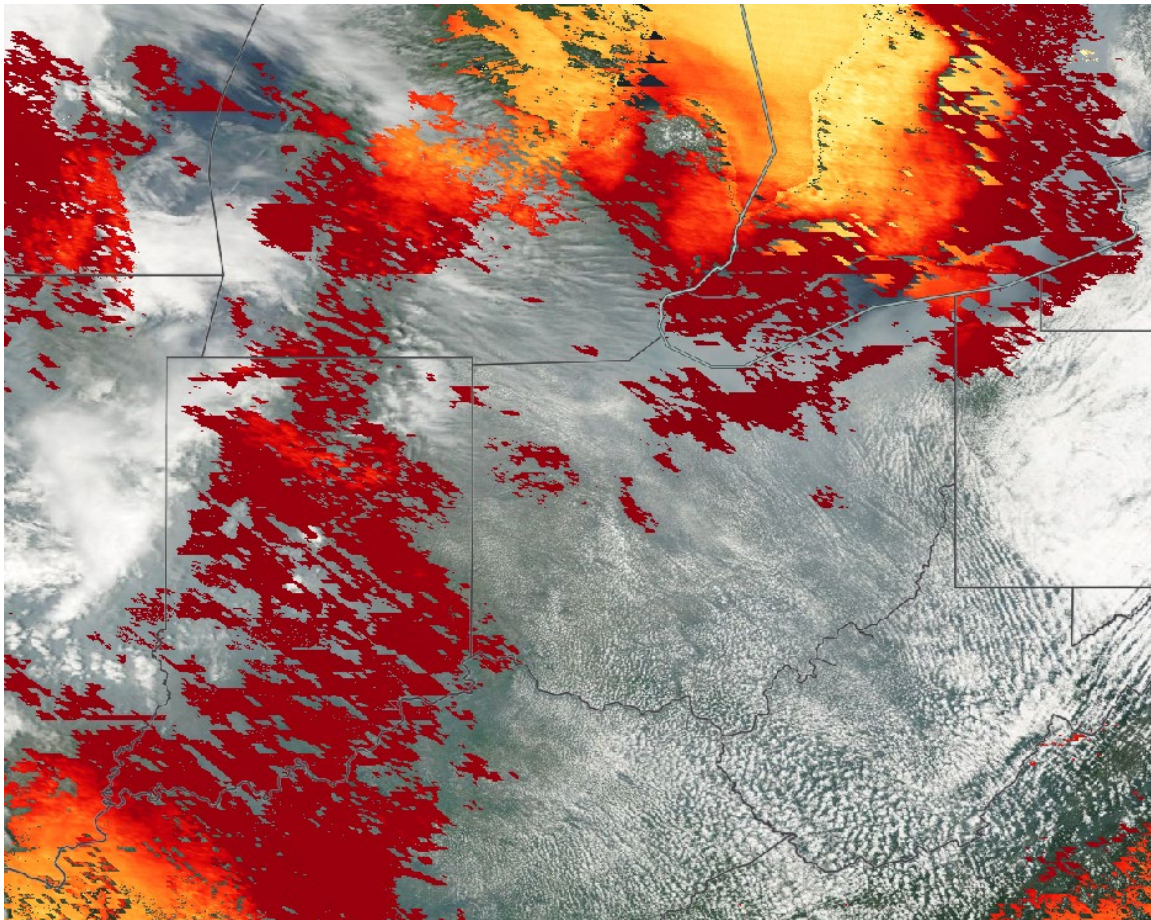


Table 29 and Figure 184 show the hourly average $PM_{2.5}$ concentrations on June 28, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 30 and Figure 185 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations remained elevated due to both lingering and newly transported wildfire smoke throughout the day on June 28, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on June 28, 2023.

Table 29. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 28, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 28, 2023
00:00	12.8	99.0
01:00	12.9	99.5
02:00	12.5	101.1
03:00	12.5	99.5
04:00	12.7	105.6
05:00	13.0	115.5
06:00	13.6	124.6
07:00	14.5	143.2
08:00	14.7	154.6
09:00	13.9	162.3
10:00	14.1	133.6
11:00	13.7	123.0
12:00	13.4	115.2
13:00	13.2	111.6
14:00	12.5	101.6
15:00	12.2	93.6
16:00	11.9	95.1
17:00	11.3	91.7
18:00	11.0	91.0
19:00	11.6	87.9
20:00	12.5	88.4
21:00	13.3	87.7
22:00	13.8	85.7
23:00	13.3	84.4

Figure 184. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 28, 2023, and 2021-2025 average June concentrations.

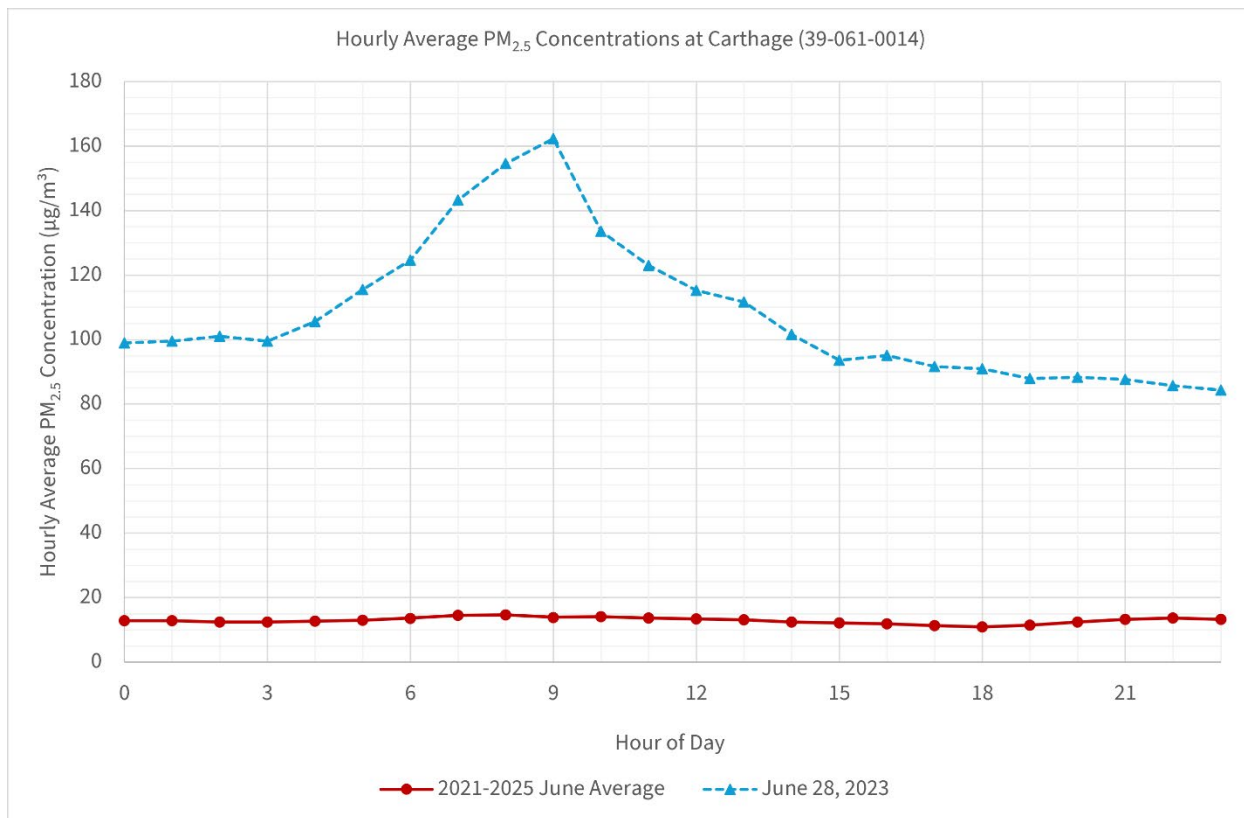


Table 30. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 28, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 28, 2023
00:00	15.1	119.5
01:00	14.8	109.6
02:00	14.6	103.7
03:00	15.3	103.2
04:00	15.5	113.1
05:00	16.0	114.5
06:00	17.4	122.3
07:00	17.6	132.8
08:00	16.2	131.0
09:00	13.9	134.0
10:00	13.4	92.9
11:00	12.6	92.3
12:00	12.3	95.2
13:00	11.8	98.1
14:00	11.3	95.3
15:00	10.9	80.6
16:00	11.2	79.0
17:00	10.8	77.9
18:00	10.5	79.8
19:00	11.3	77.0
20:00	12.6	73.1
21:00	14.0	78.5
22:00	15.3	78.4
23:00	15.6	78.0

Figure 185. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 28, 2023, and 2021-2025 average June concentrations.

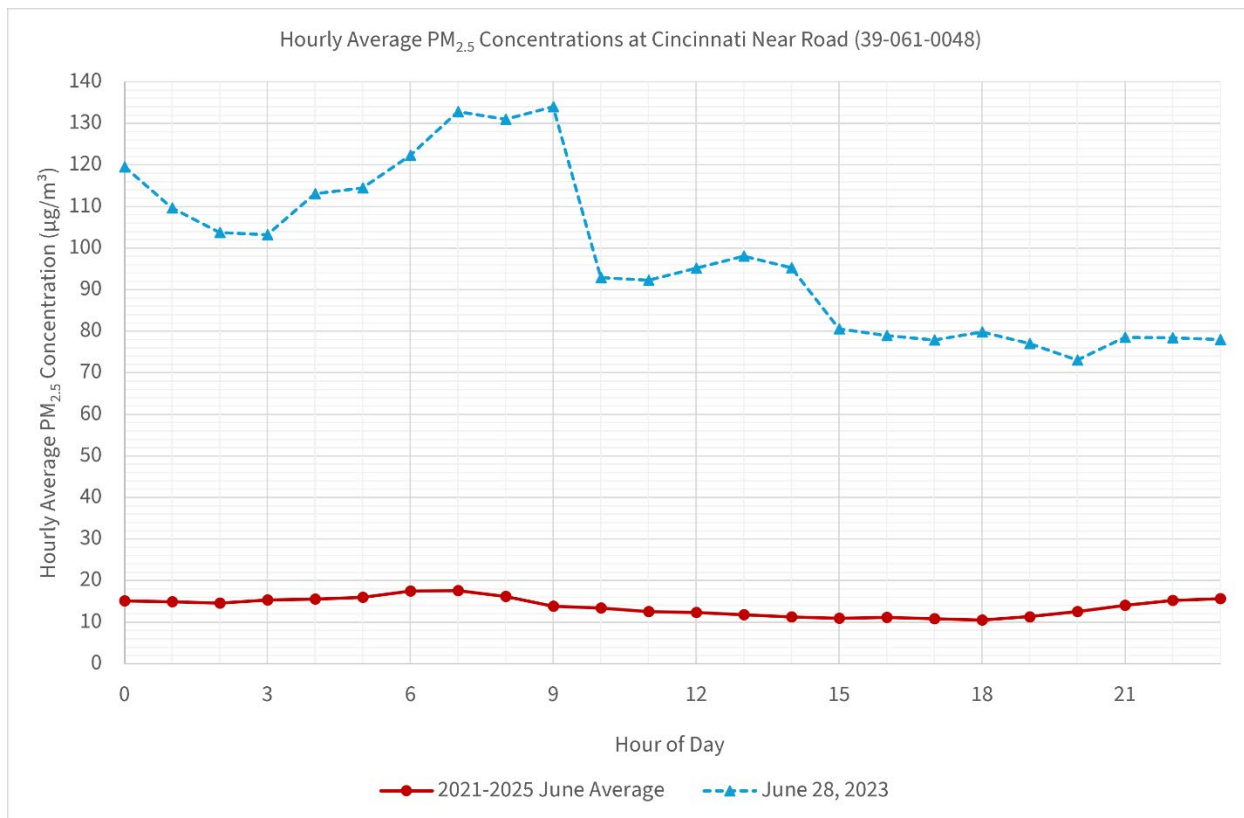
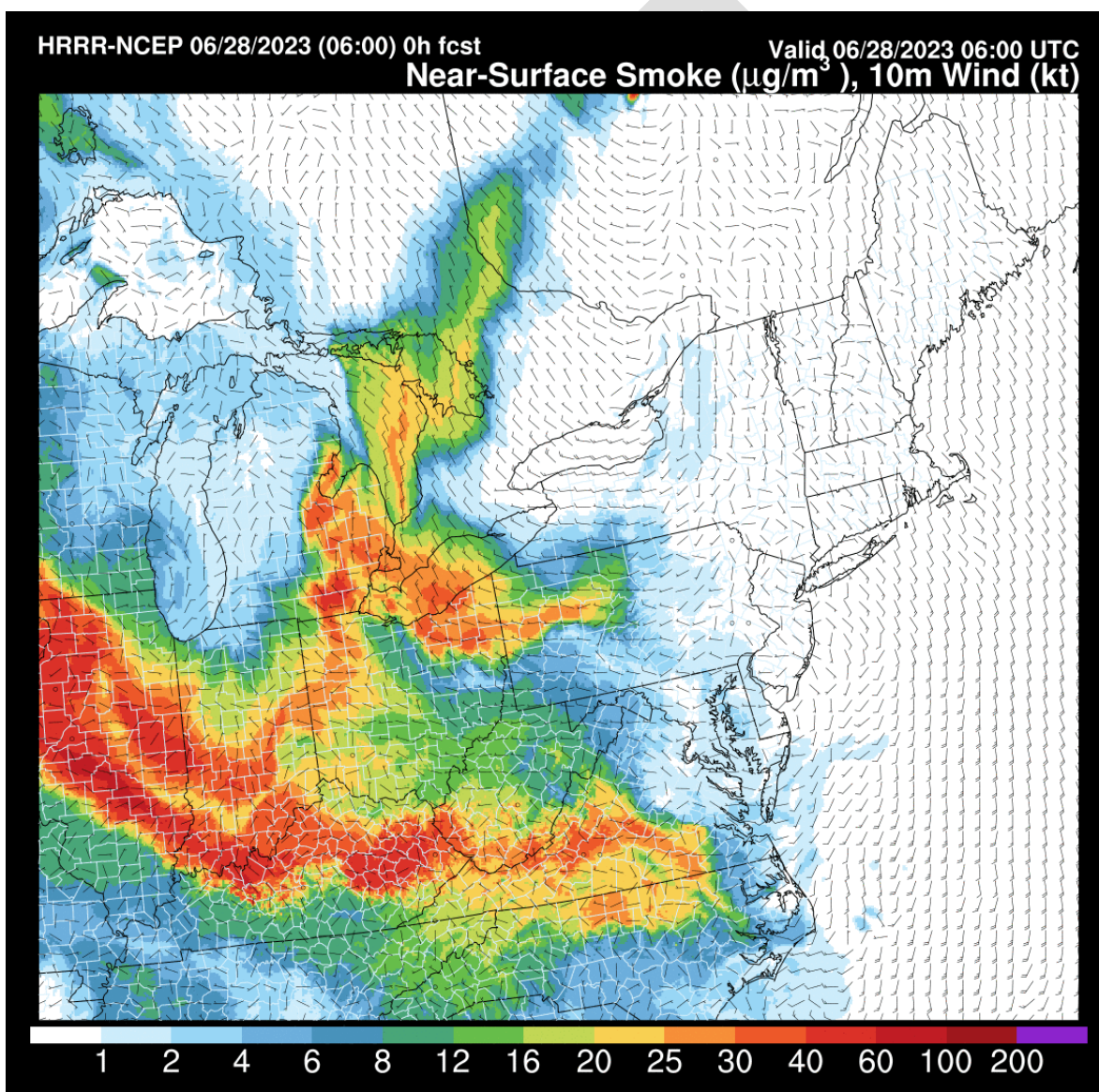


Figure 186 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on June 28, 2023. The HRRR model initialization showed near-surface smoke across most of Ohio, including near-surface smoke concentrations of approximately 20-25 $\mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 28, 2023.

Figure 186. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on June 28, 2023.



3.3.3. June 29, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 29, 2023. Figure 187 shows the HYSPLIT 72-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 26. Figure 188 shows the HYSPLIT 72-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 29. The wildfires burning 90 km (55.9 mi) southwest of Chapais, Quebec coincide with the point (at 1207.3 meters AGL) at 01:00 EST on June 26 of the 500-meter release height back trajectory from Cincinnati and the 1200-meter release height forward trajectory from that wildfire-impacted location at 01:00 EST on June 26 reaches Cincinnati (at 462.1 meters AGL) at 01:00 EST on June 29. The coincidence of the 72-hour back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in Quebec caused the high PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on June 29, 2023. The accompanying imagery map for June 29 presented in Figure 189 shows visible wildfire smoke and high AOD values over Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on June 29, 2023, and that this wildfire smoke was the cause of the high concentrations of PM_{2.5} at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 187. HYSPLIT 72-hour back trajectory plot from June 29, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 26, 2023.

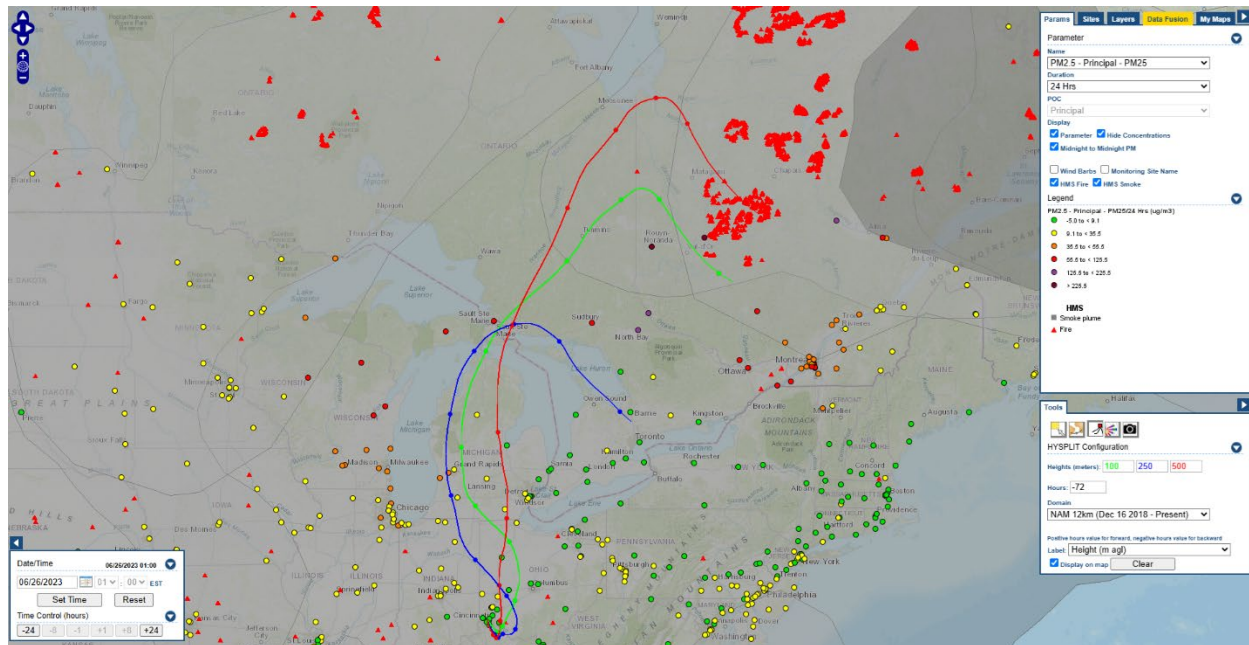


Figure 188. HYSPLIT 72-hour forward trajectory plot from June 26, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for June 29, 2023.

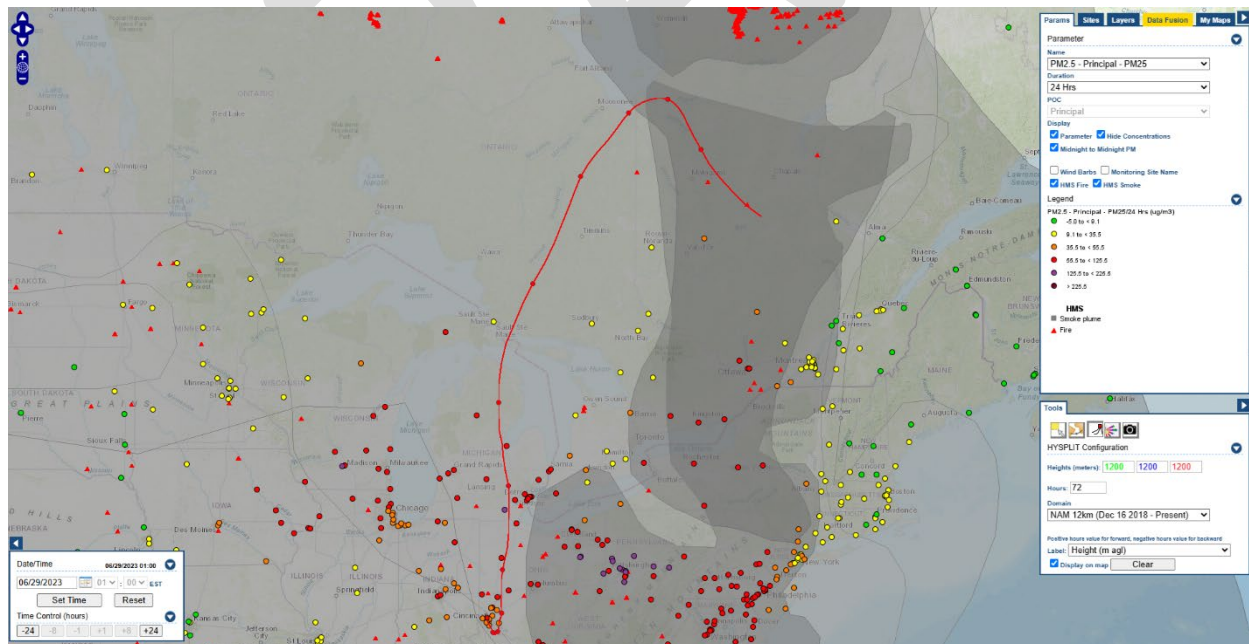


Figure 189. Aqua satellite true color imagery of Ohio and surrounding states for June 29, 2023, showing visible wildfire smoke (outlined in yellow) over most of Ohio, including Hamilton County.

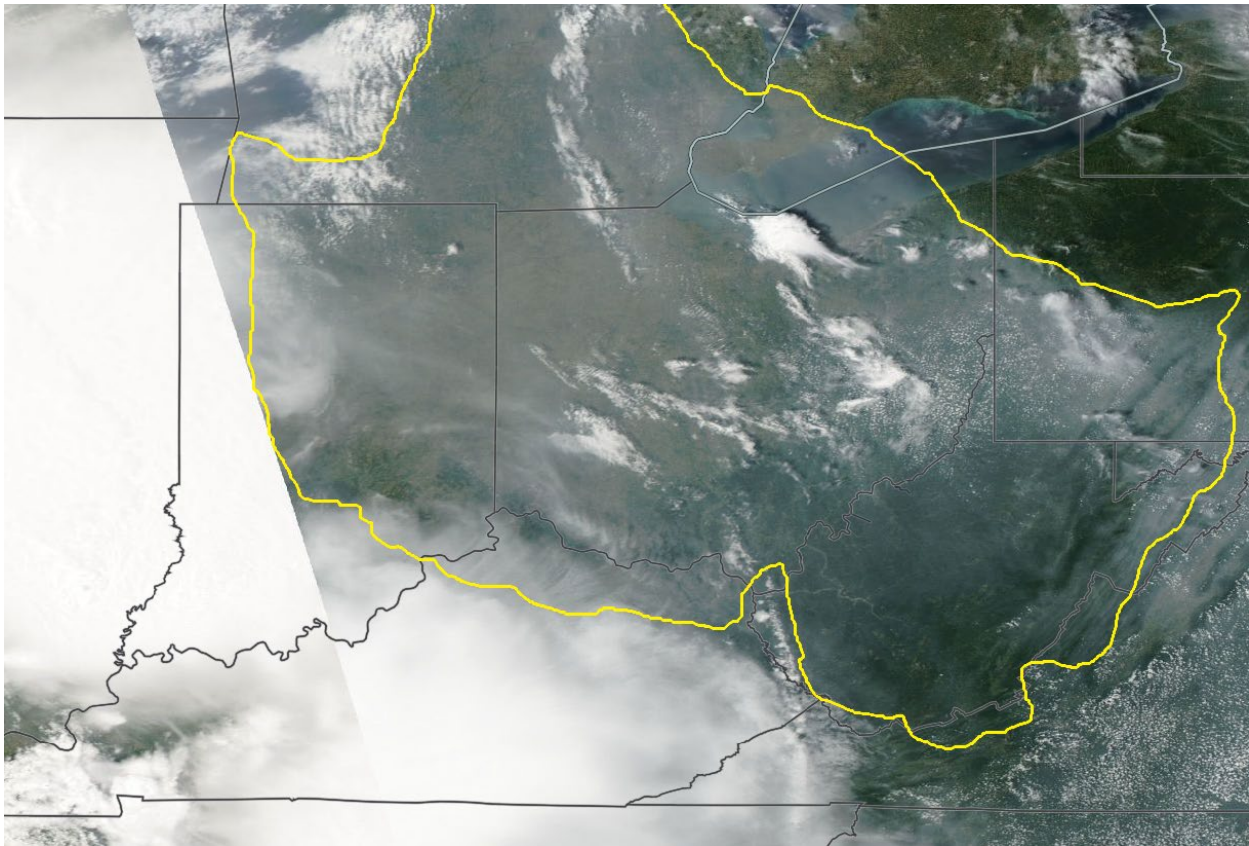


Table 31 and Figure 190 show the hourly average $PM_{2.5}$ concentrations on June 29, 2023, and the 2021-2025 average June concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 32 and Figure 191 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations remained elevated due to both lingering and newly transported wildfire smoke until a front with precipitation approached Southwestern Ohio and pushed out the remaining wildfire smoke around 17:00 EST on June 29, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on June 29, 2023.

Table 31. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on June 29, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on June 29, 2023
00:00	12.8	83.1
01:00	12.9	83.3
02:00	12.5	80.9
03:00	12.5	79.7
04:00	12.7	77.5
05:00	13.0	75.9
06:00	13.6	77.4
07:00	14.5	84.3
08:00	14.7	85.7
09:00	13.9	80.3
10:00	14.1	78.9
11:00	13.7	73.1
12:00	13.4	65.4
13:00	13.2	67.6
14:00	12.5	57.5
15:00	12.2	53.7
16:00	11.9	42.7
17:00	11.3	9.9
18:00	11.0	5.8
19:00	11.6	5.3
20:00	12.5	4.9
21:00	13.3	5.3
22:00	13.8	5.6
23:00	13.3	6.9

Figure 190. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on June 29, 2023, and 2021-2025 average June concentrations.

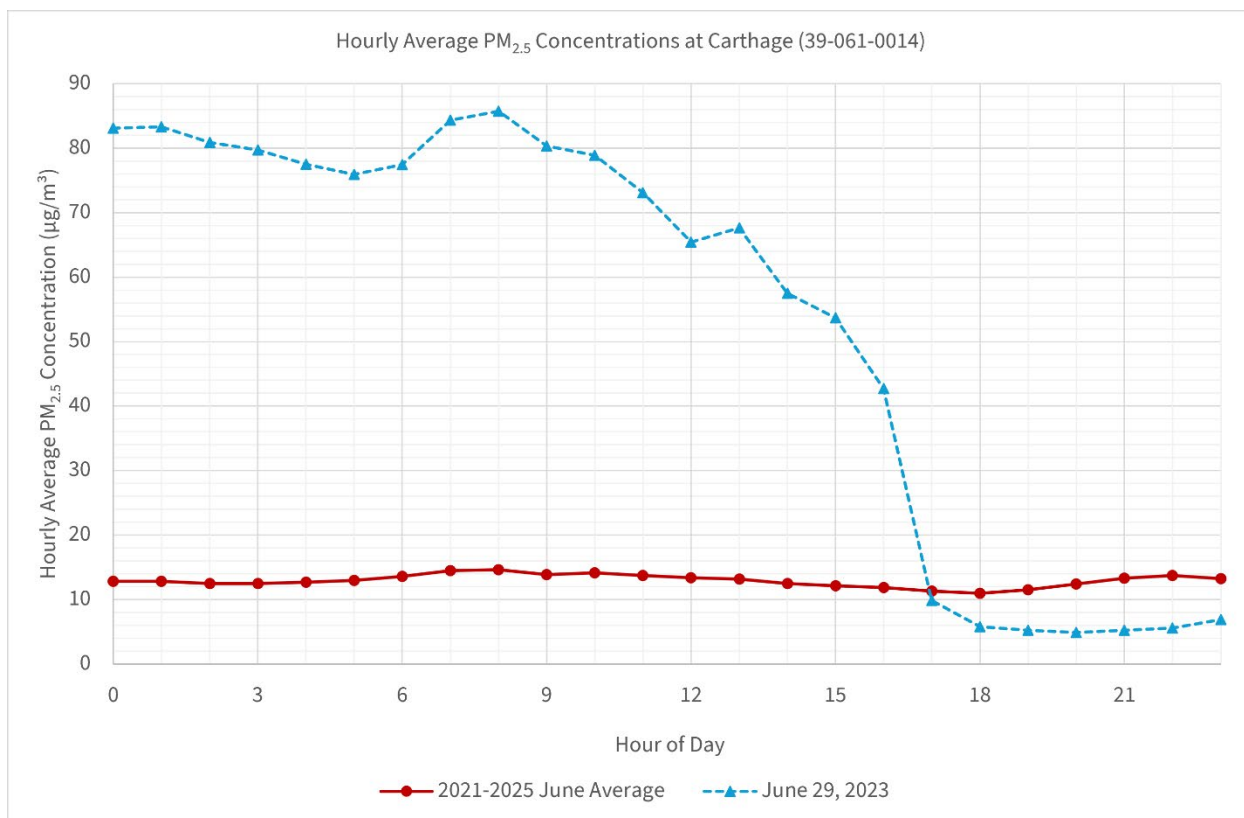


Table 32. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 29, 2023, and 2021-2025 average June concentration data.

Hour of Day	2021-2025 Average June Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on June 29, 2023
00:00	15.1	78.0
01:00	14.8	74.5
02:00	14.6	73.0
03:00	15.3	74.7
04:00	15.5	71.4
05:00	16.0	72.7
06:00	17.4	74.2
07:00	17.6	75.1
08:00	16.2	74.4
09:00	13.9	71.1
10:00	13.4	64.5
11:00	12.6	56.8
12:00	12.3	49.3
13:00	11.8	46.8
14:00	11.3	48.0
15:00	10.9	47.7
16:00	11.2	36.7
17:00	10.8	9.4
18:00	10.5	7.7
19:00	11.3	4.3
20:00	12.6	1.5
21:00	14.0	10.2
22:00	15.3	9.1
23:00	15.6	12.0

Figure 191. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on June 29, 2023, and 2021-2025 average June concentrations.

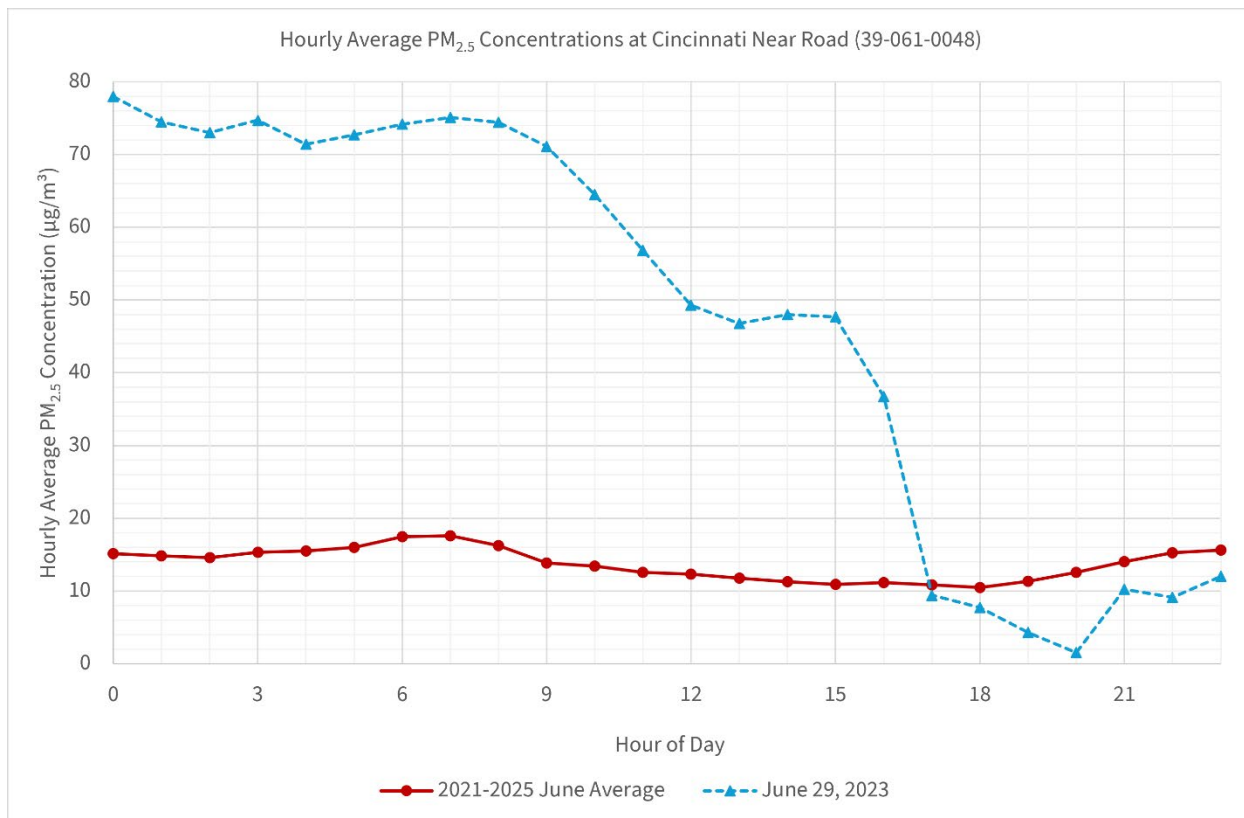
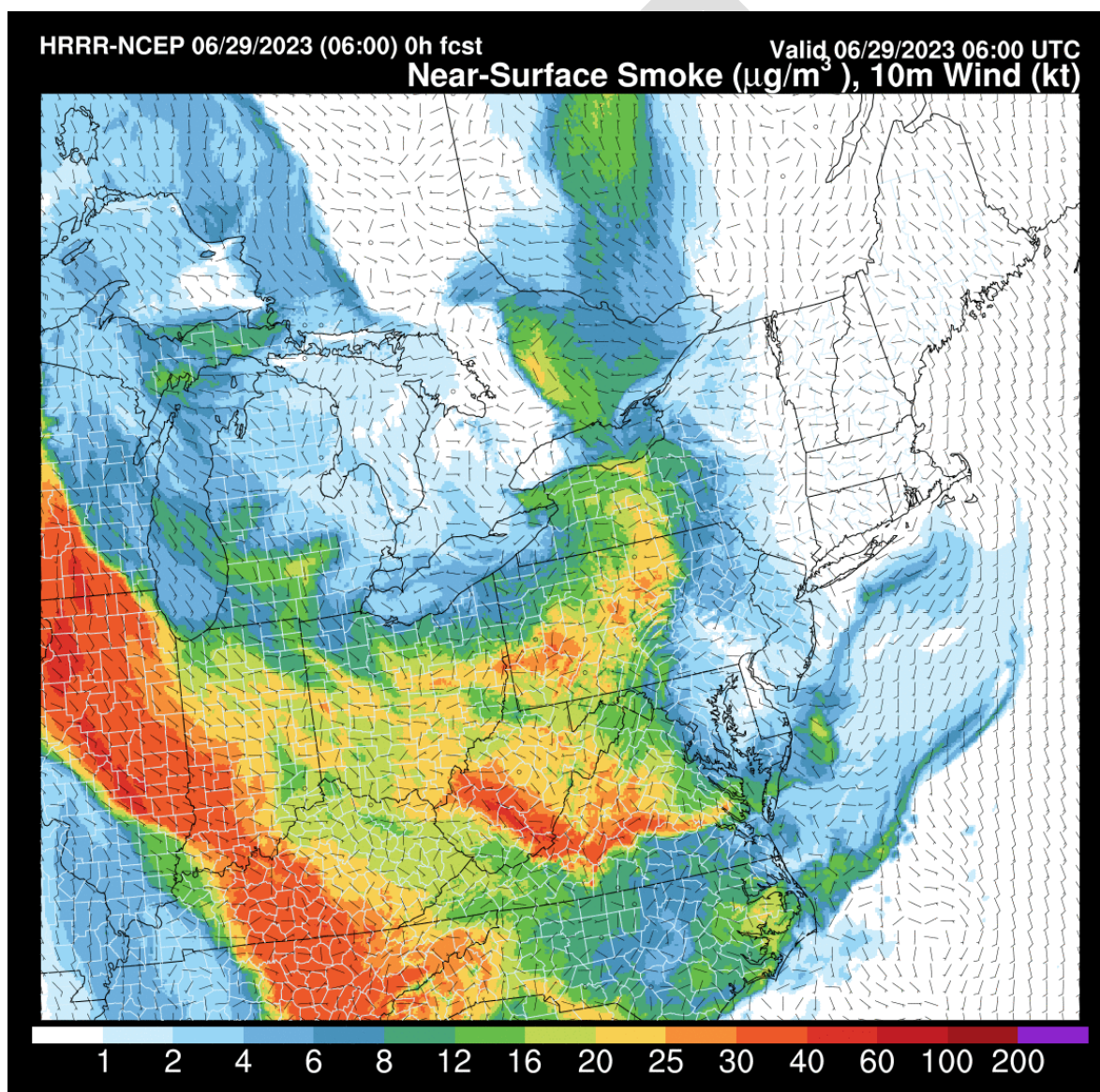


Figure 192 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on June 29, 2023. The HRRR model initialization showed near-surface smoke across most of Ohio, including near-surface smoke concentrations of approximately $16 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on June 29, 2023.

Figure 192. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on June 29, 2023.



3.4. Fireworks Smoke-Driven $PM_{2.5}$ Episode on July 4-5, 2023

3.4.1. July 4-5, 2023

The smoke from the various nearby Fourth of July holiday celebration-related fireworks displays caused high surface $PM_{2.5}$ concentrations across Hamilton County, including at the Carthage and Cincinnati Near Road monitoring sites, on July 4-5, 2023. Figure 193 shows Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for July 5, 2023, with Terra and Aqua satellite daytime orbital tracks and overpass times in UTC, in which moderate AOD values occur across Ohio, as well as some high AOD values occurring in Southwestern Ohio, including Hamilton County. On July 5, 2023, the Terra satellite had its closest daytime orbit track overpass of Cincinnati at 10:42 EST and the Aqua satellite had its closest daytime orbit track overpass of Cincinnati at 14:15 EST, so the high AOD values observed by the Terra satellite over Hamilton County on July 5 would have represented lingering smoke from fireworks displays prior to the mixing height increasing enough in the afternoon to allow for the fireworks smoke to dissipate. Figures 194-197 show the wind barbs and hourly average $PM_{2.5}$ concentrations measured at monitoring sites across the region at 21:00 EST on July 4, 00:00 EST on July 5, 03:00 EST on July 5, and 06:00 EST on July 5, respectively, illustrating the lingering nature of the smoke near the surface due to widespread Fourth of July holiday celebration-related fireworks displays. The moderate and high AOD values observed over Ohio, including Hamilton County, the large number of fireworks displays across the area, the calm winds in the Cincinnati area overnight, and the widespread elevated $PM_{2.5}$ concentrations at monitoring sites across the region, serve as clear evidence that the smoke from several fireworks displays across the area ultimately caused the high $PM_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on July 4-5, 2023.

Figure 193. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for July 5, 2023, with Terra and Aqua satellite daytime orbital tracks and overpass times in UTC, showing moderate AOD values occur across Ohio, as well as some high AOD values occurring in Southwestern Ohio, including Hamilton County, due to lingering fireworks smoke.

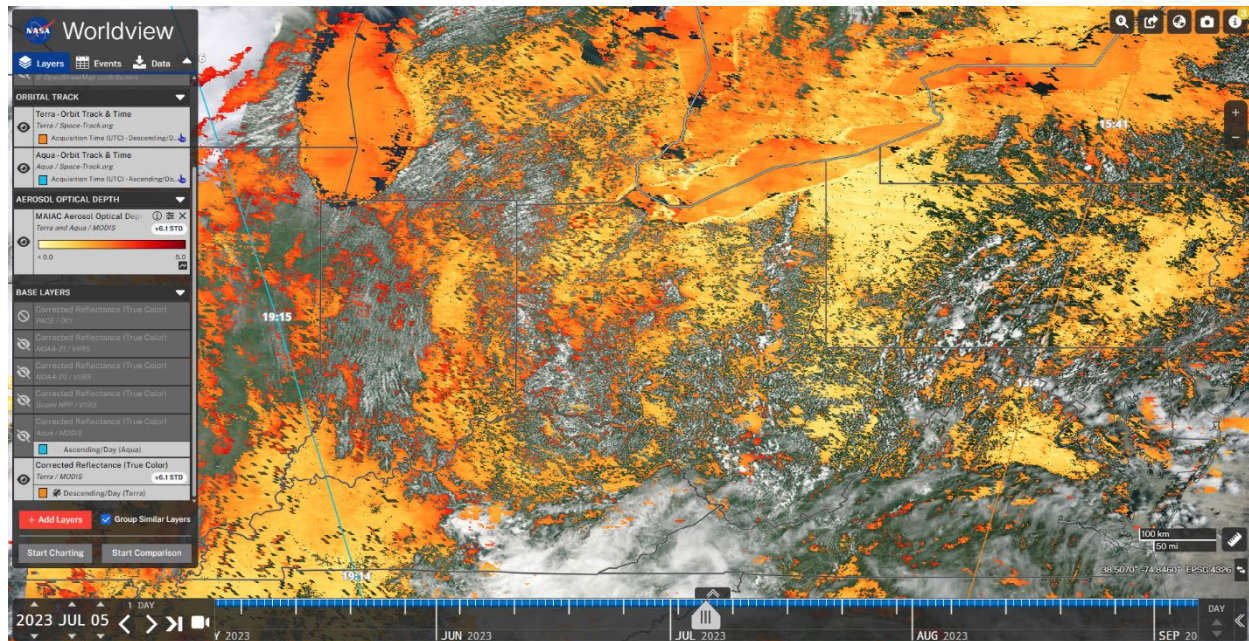


Figure 194. Map of wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 21:00 EST on July 4, 2023.

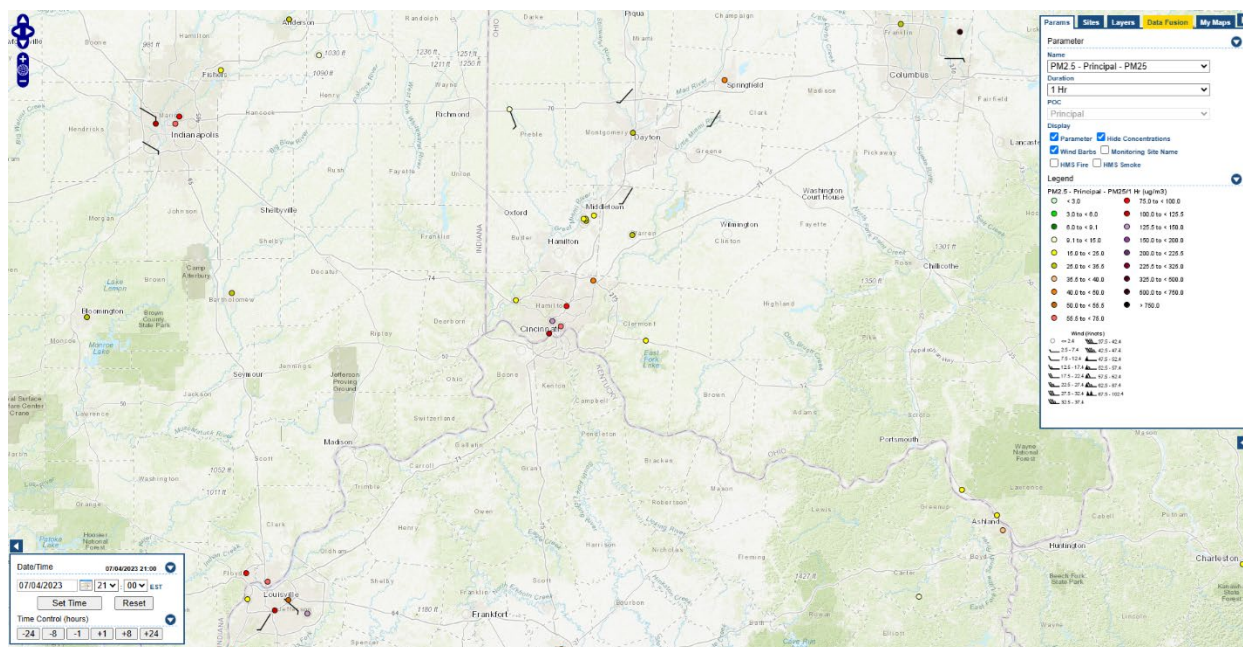


Figure 195. Map of wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 00:00 EST on July 5, 2023.

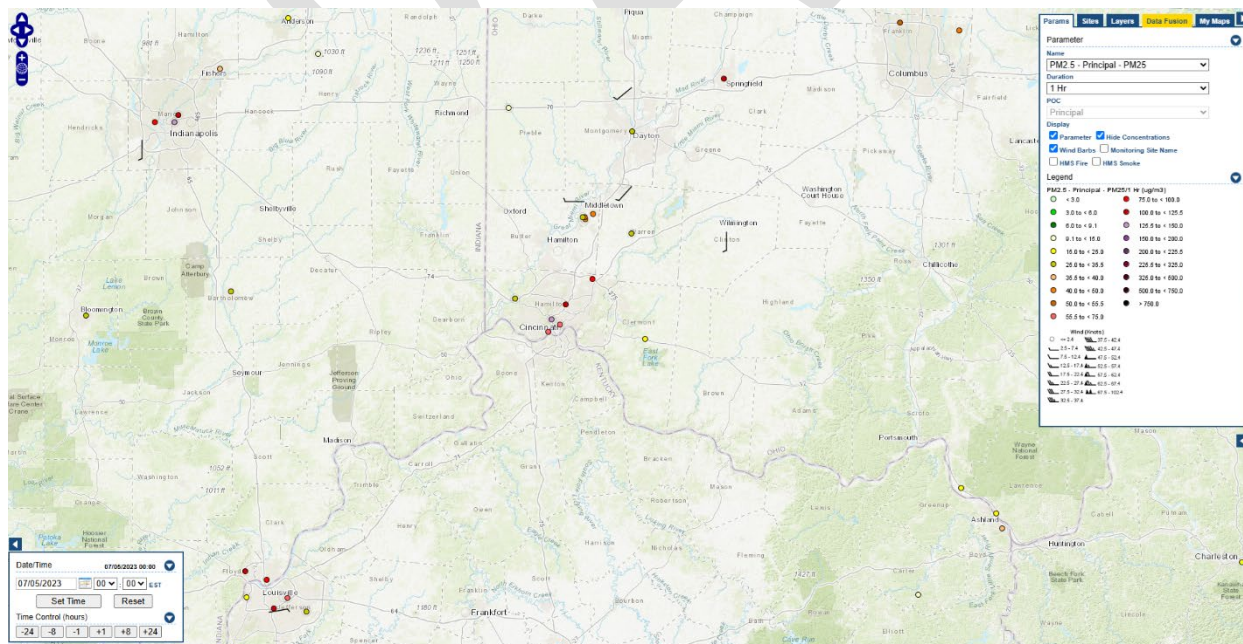


Figure 196. Map of wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 03:00 EST on July 5, 2023.

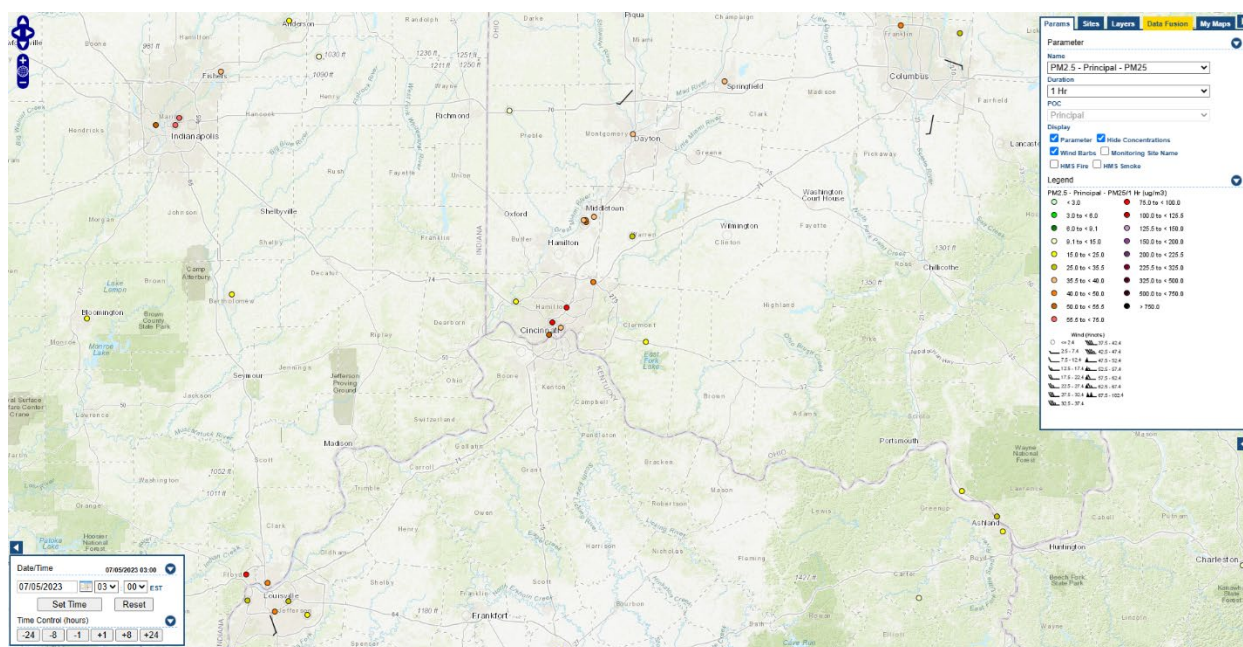


Figure 197. Map of wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 06:00 EST on July 5, 2023.

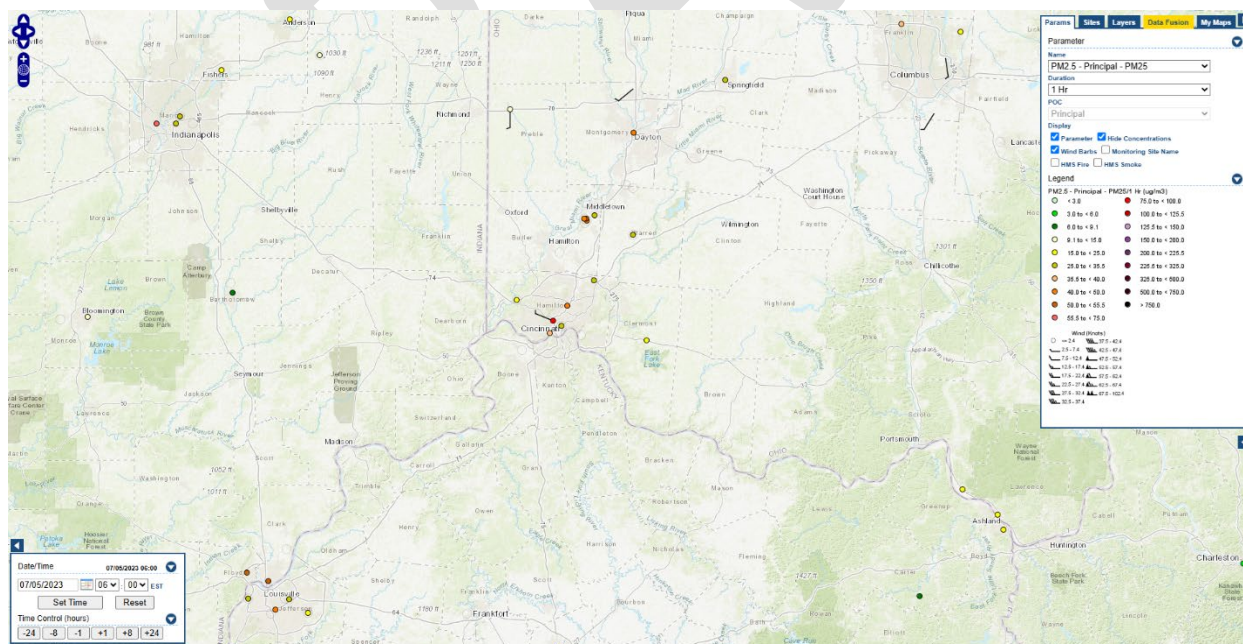


Table 33 and Figure 198 show the hourly average PM_{2.5} concentrations on July 4 and 5, 2023, and the 2021-2025 average July concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 34 and Figure 199 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average PM_{2.5} concentrations sharply increased at 21:00 EST on July 4 and remained elevated through 14:00 EST on July 5 as smoke from several Fourth of July holiday celebration-related fireworks displays descended on the surface, providing further evidence that smoke from Fourth of July holiday celebration-related fireworks displays impacted PM_{2.5} concentrations in Hamilton County on July 4-5, 2023.

Table 33. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on July 4 and 5, 2023, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 4, 2023	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 5, 2023
00:00	13.1	20.2	102.2
01:00	13.0	22.0	96.3
02:00	12.7	19.8	98.9
03:00	12.2	16.6	82.8
04:00	12.0	16.0	74.7
05:00	12.2	15.5	67.1
06:00	12.3	15.6	44.8
07:00	12.7	14.8	47.9
08:00	12.4	14.0	45.6
09:00	12.3	12.6	31.8
10:00	12.2	12.7	21.9
11:00	12.3	13.5	20.9
12:00	12.3	13.2	18.8
13:00	12.1	13.1	18.9
14:00	11.8	12.9	19.5
15:00	11.6	13.8	15.0
16:00	11.7	14.9	15.5
17:00	11.5	14.1	17.1
18:00	11.2	13.6	15.6
19:00	11.2	17.7	14.5
20:00	12.1	22.9	14.6
21:00	15.6	81.3	16.7
22:00	14.0	85.0	17.4
23:00	13.5	66.8	17.0

Figure 198. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on July 4 and 5, 2023, and 2021-2025 average July concentrations.

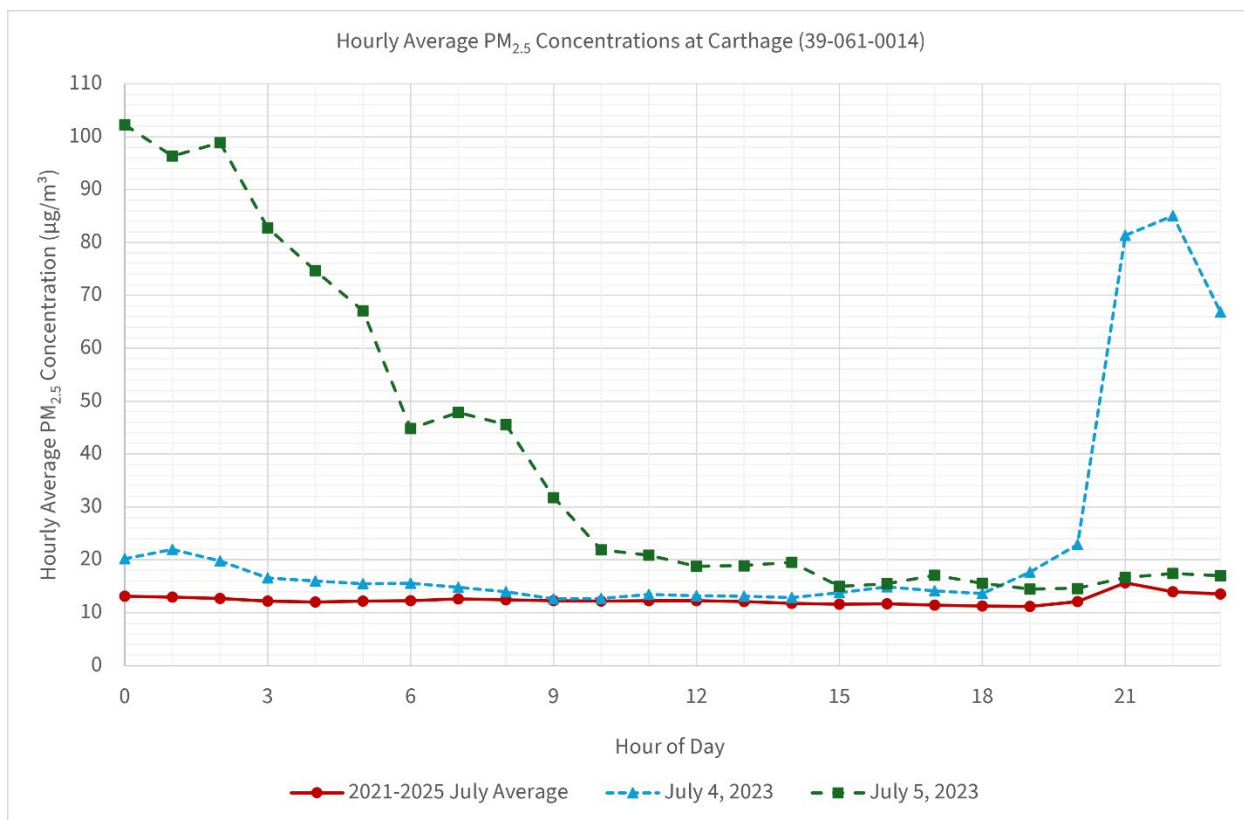
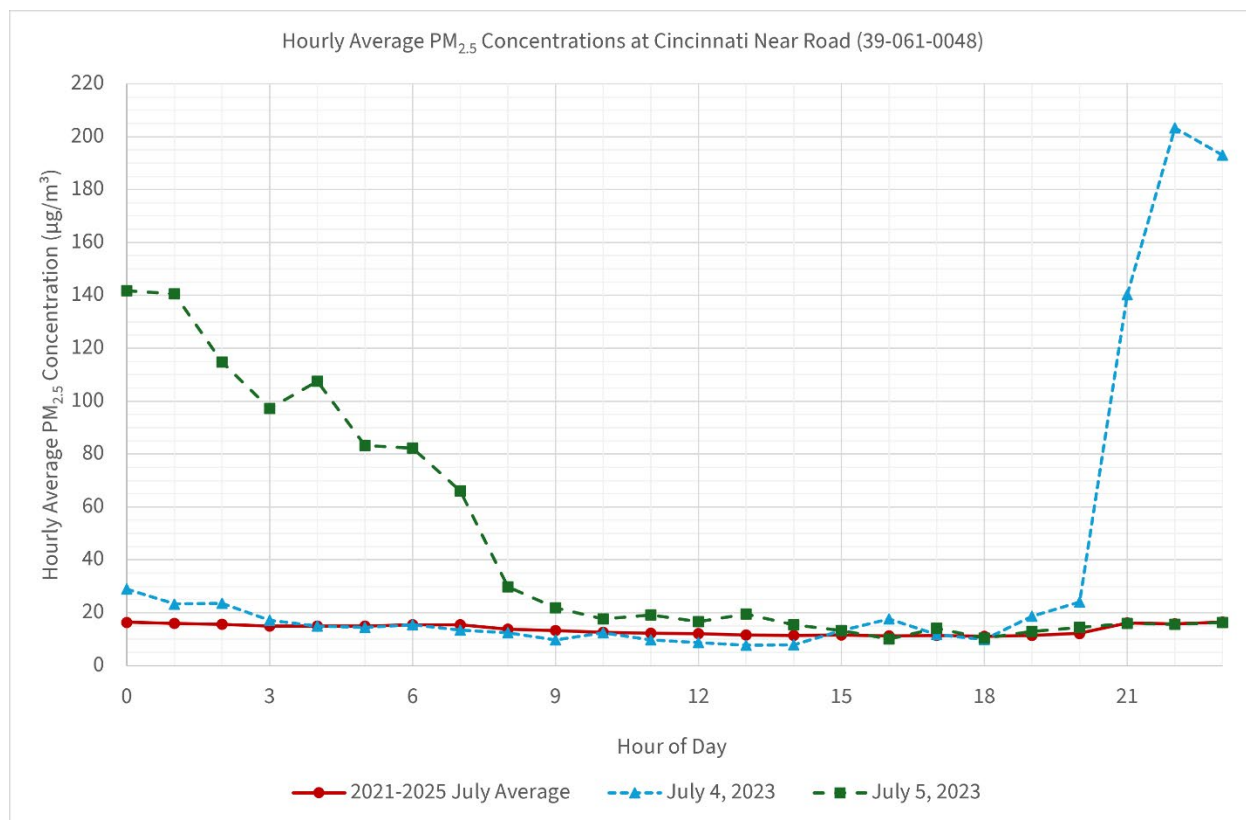


Table 34. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 4 and 5, 2023, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 4, 2023	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 5, 2023
00:00	16.4	29.0	141.7
01:00	16.0	23.3	140.6
02:00	15.6	23.5	114.8
03:00	14.9	17.1	97.3
04:00	14.9	14.9	107.6
05:00	15.0	14.5	83.2
06:00	15.4	15.5	82.2
07:00	15.5	13.5	66.0
08:00	13.8	12.4	29.8
09:00	13.3	9.8	21.8
10:00	12.6	12.5	17.7
11:00	12.3	9.7	19.1
12:00	12.1	8.7	16.6
13:00	11.6	7.7	19.5
14:00	11.4	7.8	15.5
15:00	11.6	13.2	13.3
16:00	11.2	17.6	10.0
17:00	11.3	11.7	14.1
18:00	11.0	9.9	10.4
19:00	11.4	18.7	12.9
20:00	12.2	24.0	14.5
21:00	16.1	140.2	16.0
22:00	15.8	203.3	15.6
23:00	16.6	193.0	16.3

Figure 199. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 4 and 5, 2023, and 2021-2025 average July concentrations.



3.5. Wildfire Smoke-Driven PM_{2.5} Episode from July 16-17, 2023

3.5.1. July 16, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on July 16, 2023. Figure 200 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 13. Figure 201 shows 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 16. The wildfires burning 75 km (46.6 mi) northeast of Garden Creek, Alberta coincide with the point (at 1894.3 meters AGL) at 12:00 EST on July 13 of the 1250-meter release height back trajectory from Cincinnati and the 1900-meter release height forward trajectory from that wildfire-impacted location at 12:00 EST on July 13 reaches Cincinnati (at 1262.2 meters AGL) at 12:00 EST on July 16. The coincidence of the 72-hour back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires in northern Alberta caused the high PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on July 16, 2023. The accompanying imagery map for July 16 presented in Figure 202 shows visible dense wildfire smoke over most of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on July 16, 2023, and that this wildfire smoke was the cause of the high concentrations of PM_{2.5} at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 200. 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 13, 2023.

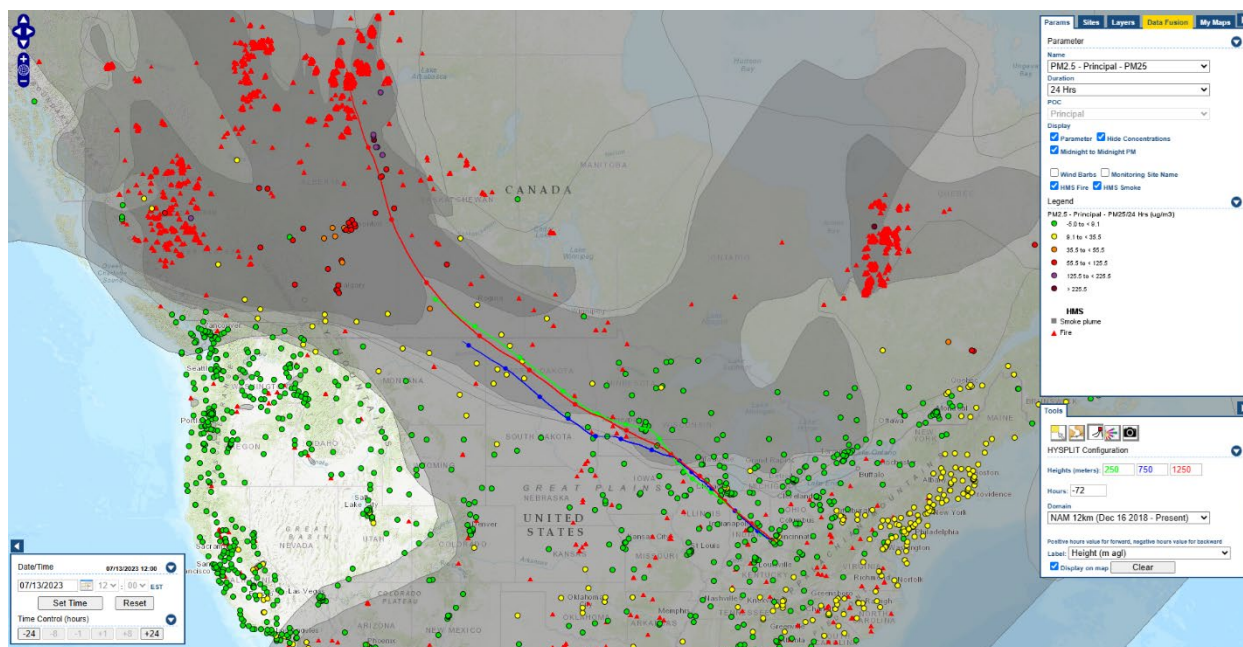


Figure 201. HYSPLIT 72-hour forward trajectory plot from July 13, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for July 16, 2023.

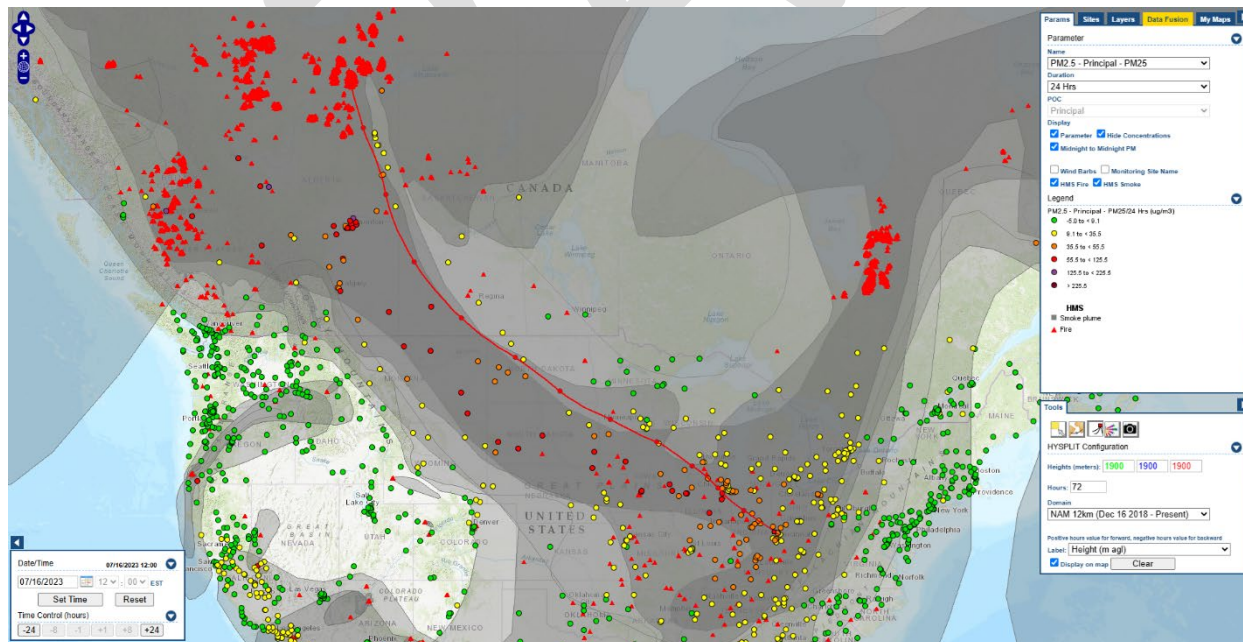


Figure 202. Aqua satellite true color imagery of Ohio and surrounding states for July 16, 2023, showing visible dense wildfire smoke (outlined in yellow) over most of Ohio, including Hamilton County.

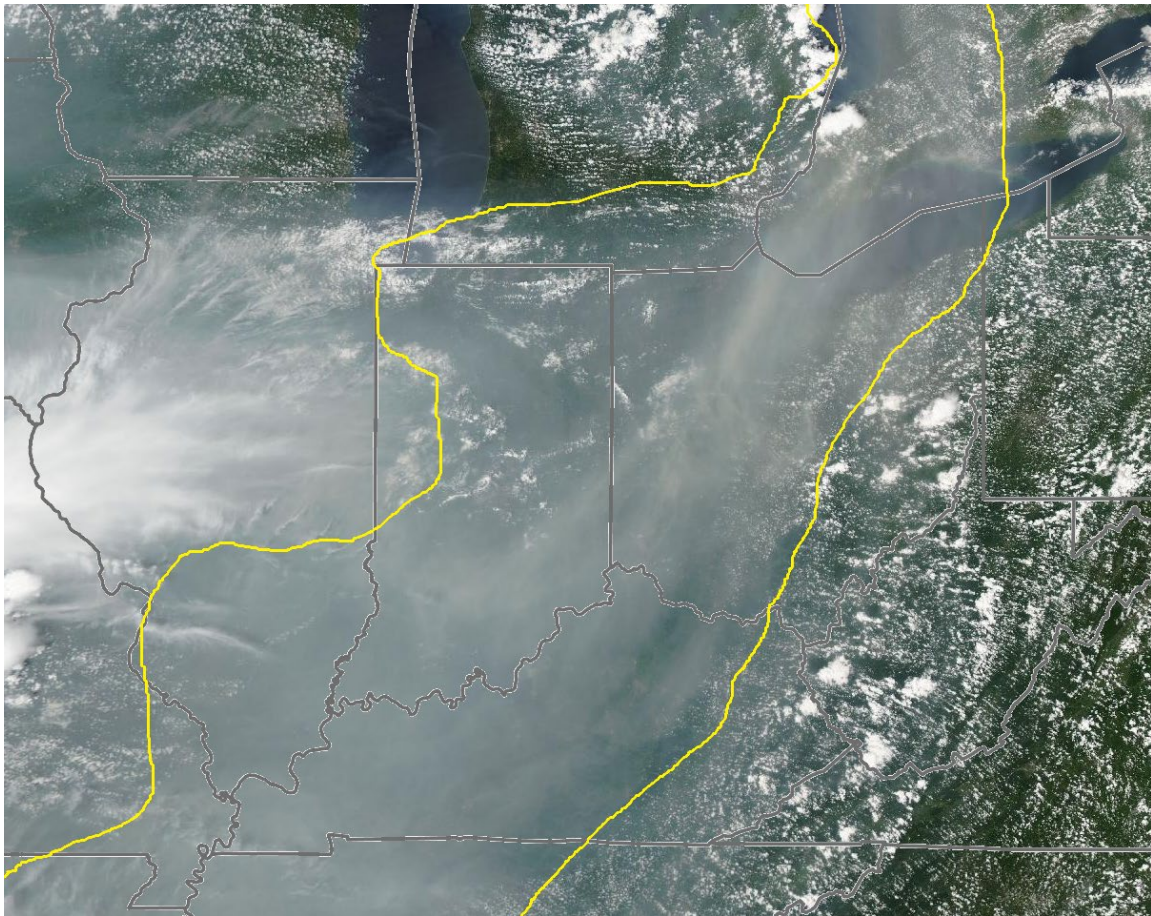


Table 35 and Figure 203 show the hourly average $PM_{2.5}$ concentrations on July 16, 2023, and the 2021-2025 average July concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 36 and Figure 204 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations began steadily increasing around 07:00 EST as wildfire smoke reached the area and began to descend on the surface, then concentrations remained elevated the rest of the day on July 16, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on July 16, 2023.

Table 35. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on July 16, 2023, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 16, 2023
00:00	13.1	6.9
01:00	13.0	7.8
02:00	12.7	7.9
03:00	12.2	8.5
04:00	12.0	12.1
05:00	12.2	8.9
06:00	12.3	11.1
07:00	12.7	16.4
08:00	12.4	25.9
09:00	12.3	35.0
10:00	12.2	39.9
11:00	12.3	43.3
12:00	12.3	49.8
13:00	12.1	59.0
14:00	11.8	64.5
15:00	11.6	71.2
16:00	11.7	73.8
17:00	11.5	72.2
18:00	11.2	71.4
19:00	11.2	70.0
20:00	12.1	62.9
21:00	15.6	43.9
22:00	14.0	43.7
23:00	13.5	50.1

Figure 203. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on July 16, 2023, and 2021-2025 average July concentrations.

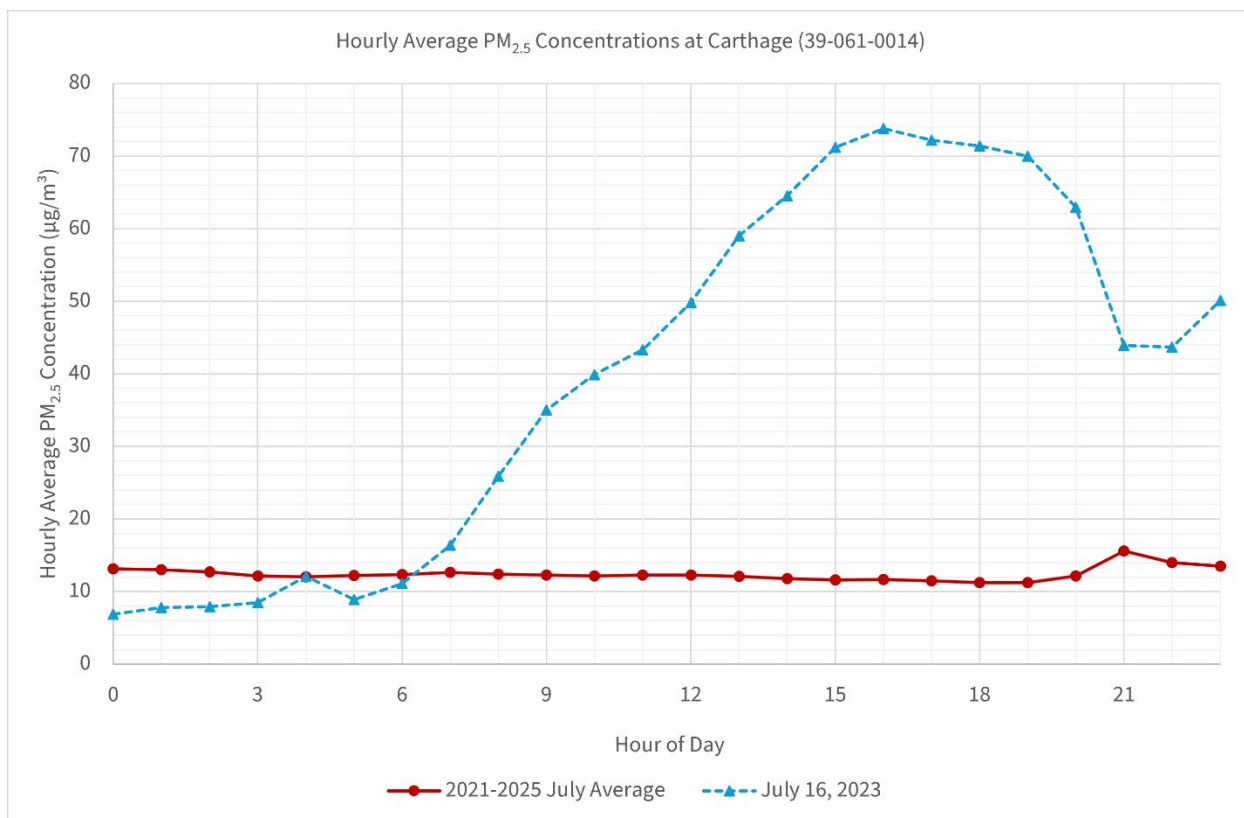


Table 36. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 16, 2023, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on July 16, 2023
00:00	16.4	8.8
01:00	16.0	10.4
02:00	15.6	10.7
03:00	14.9	8.8
04:00	14.9	9.9
05:00	15.0	6.6
06:00	15.4	7.2
07:00	15.5	14.2
08:00	13.8	18.4
09:00	13.3	25.1
10:00	12.6	22.9
11:00	12.3	29.2
12:00	12.1	30.2
13:00	11.6	43.1
14:00	11.4	46.6
15:00	11.6	54.5
16:00	11.2	50.0
17:00	11.3	53.9
18:00	11.0	48.8
19:00	11.4	57.8
20:00	12.2	52.8
21:00	16.1	37.5
22:00	15.8	42.4
23:00	16.6	45.9

Figure 204. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 16, 2023, and 2021-2025 average July concentrations.

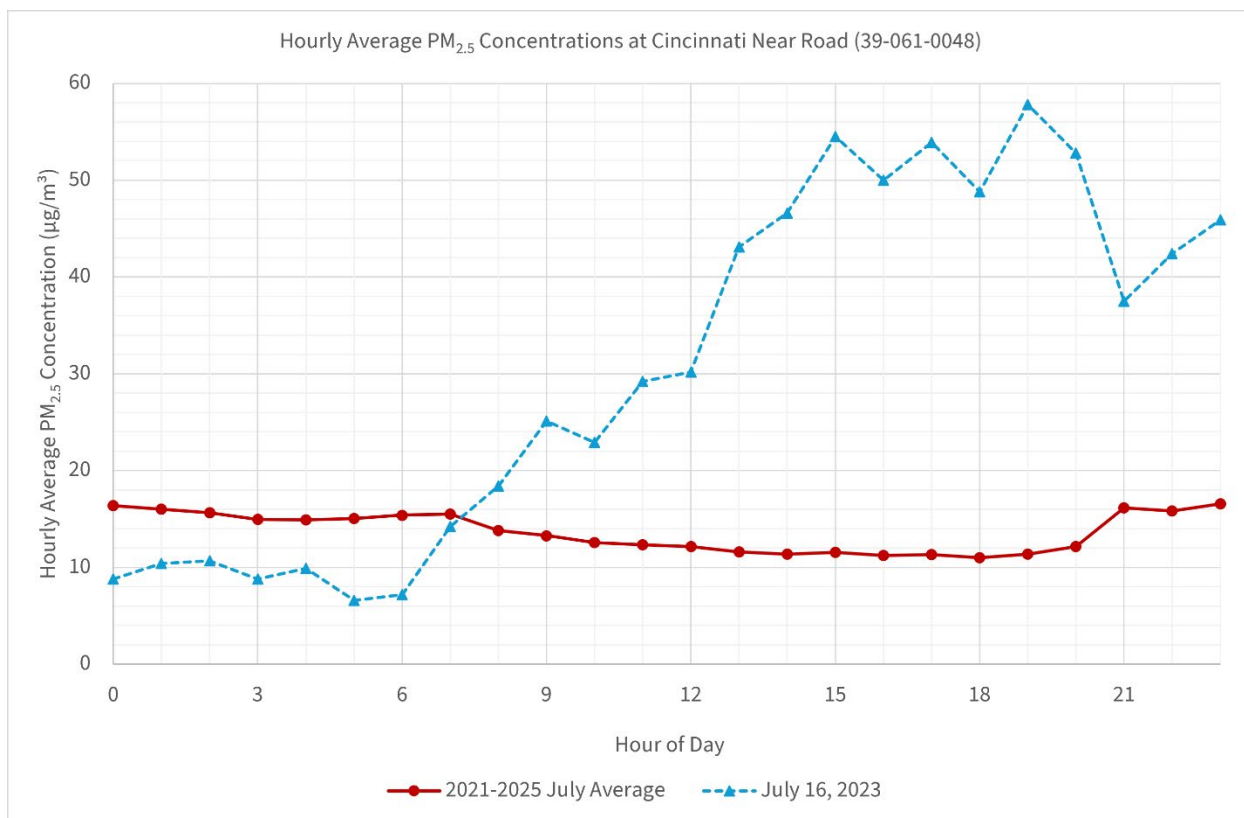
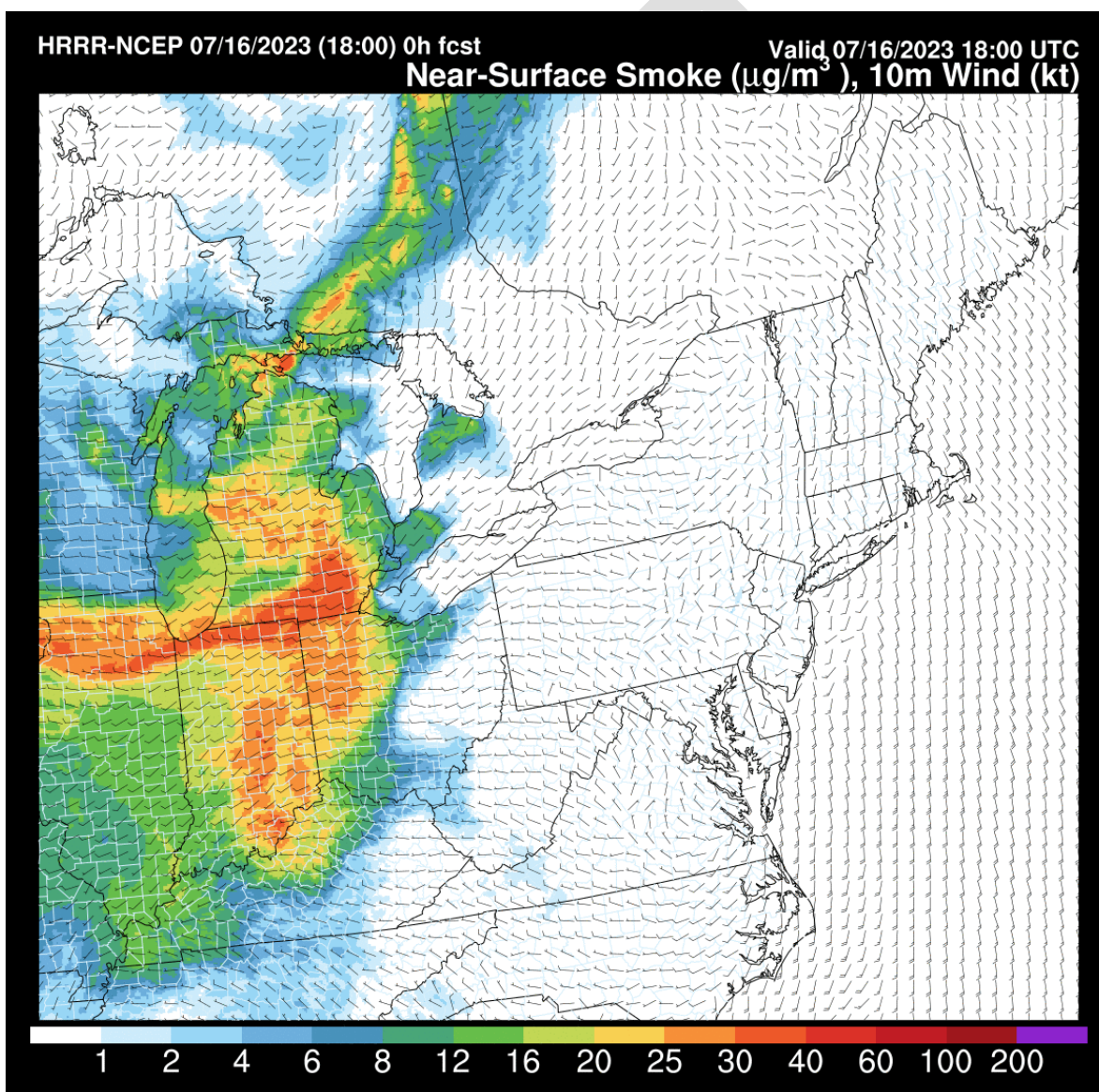


Figure 205 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on July 16, 2023. The HRRR model initialization showed near-surface smoke across portions of Ohio, including near-surface smoke concentrations of approximately $16 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on July 16, 2023.

Figure 205. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 18Z (13:00 EST) on July 16, 2023.



3.5.2. July 17, 2023

The HYSPLIT 120-hour back trajectory plot shows the origin and transport of the wildfire smoke plumes that caused the high surface PM_{2.5} concentrations in Hamilton County on July 17, 2023. Figure 206 shows the HYSPLIT 120-hour back trajectory plot from the Cincinnati Near Road monitoring site in Hamilton County, released at a height of 250.9 m AGL at 00:00 EST on July 17, with circles indicating the current smoke density at every hour along the back trajectory of the air parcel. Figure 207 shows the July 12 portion of the back trajectory plot with smoke plumes and wildfire locations overlaid on the map. A heavily wildfire smoke-impacted location near the wildfires burning 35 km (21.7 mi) west of Peace Point, Alberta coincides with the point (at 1773.7 m AGL) at 12:00 EST on July 12 of the 120-hour back trajectory from the Cincinnati Near Road monitoring site in Hamilton County. The HYSPLIT back trajectory plot serves as clear evidence that the smoke from the wildfires burning west of Peace Point, Alberta ultimately caused the high PM_{2.5} concentrations in Hamilton County on July 17, 2023. The accompanying imagery map for July 17 presented in Figure 208 shows visible wildfire smoke over most of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on July 17, 2023, and that this wildfire smoke was the cause of the high concentrations of PM_{2.5} at monitoring sites in Hamilton County.

Figure 206. HYSPLIT 120-hour back trajectory plot from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County at 00:00 EST on July 17, 2025, with red circles indicating heavy smoke intensity.

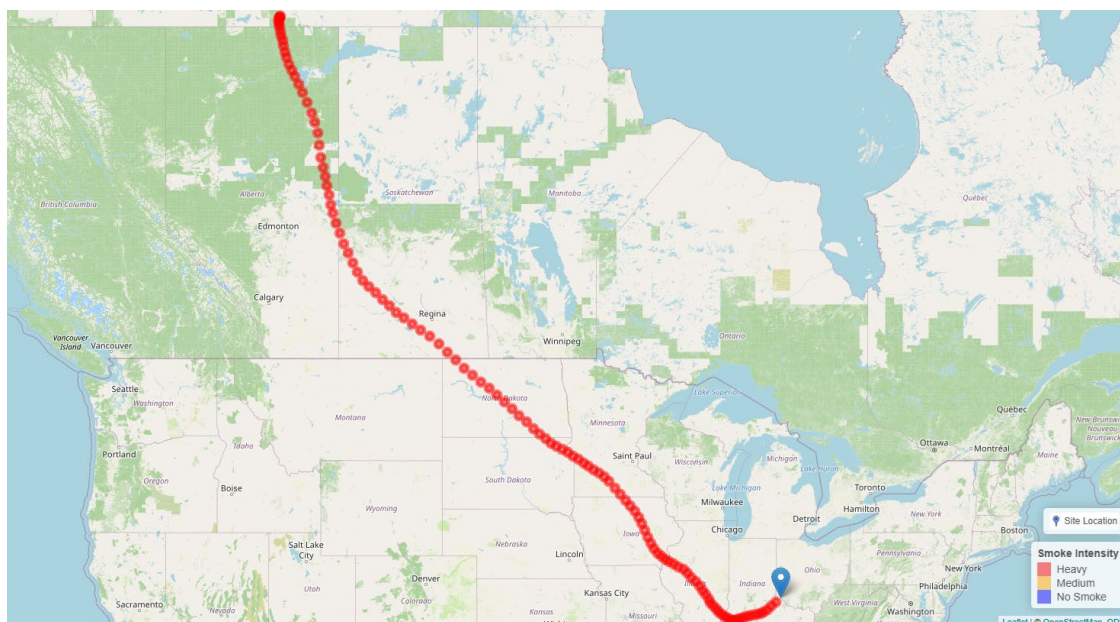


Figure 207. The July 12 portion of the HYSPLIT 120-hour back trajectory plot from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County, with smoke plumes and wildfire locations overlaid on the map.

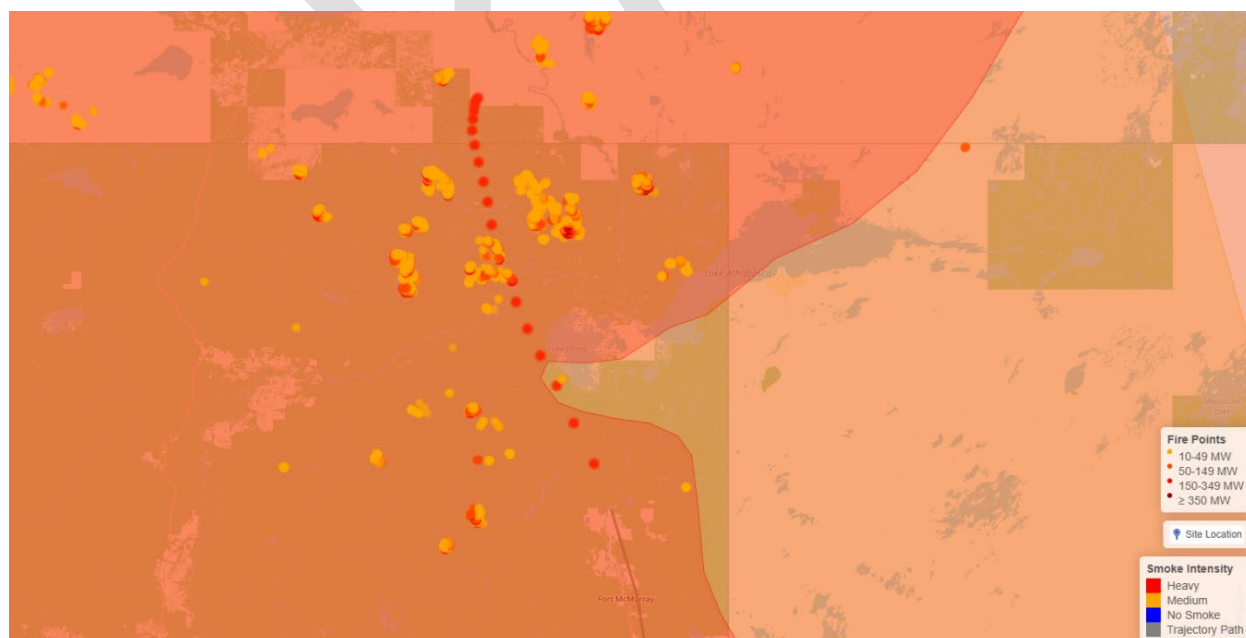


Figure 208. Terra satellite true color imagery of Ohio and surrounding states for July 17, 2023, showing visible wildfire smoke (outlined in yellow) over most of Ohio, including Hamilton County.

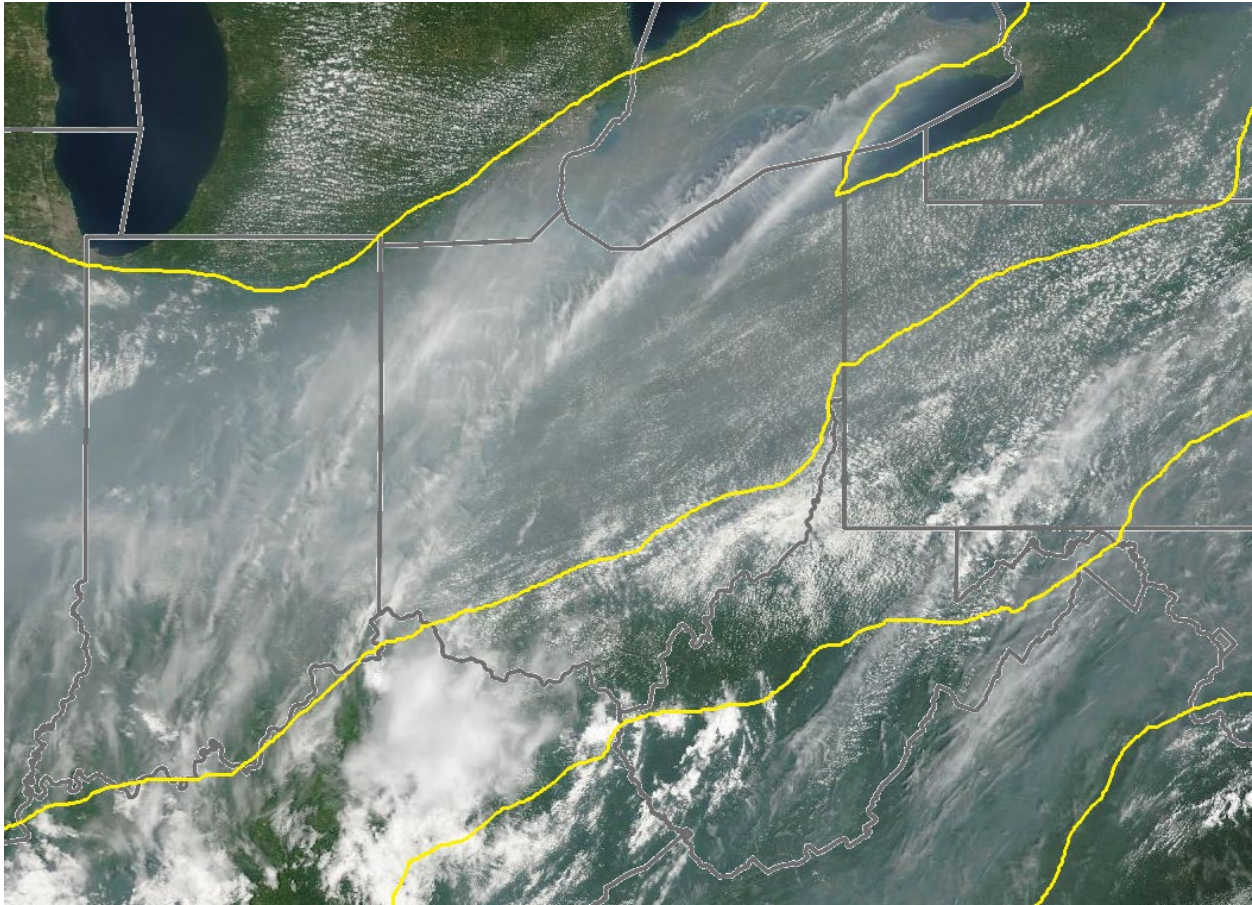


Table 37 and Figure 209 show the hourly average $PM_{2.5}$ concentrations on July 17, 2023, and the 2021-2025 average July concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 38 and Figure 210 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations remained elevated until a front with precipitation reached Hamilton County around 18:00 EST on July 17, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on July 17, 2023.

Table 37. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on July 17, 2023, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 17, 2023
00:00	13.1	53.2
01:00	13.0	54.0
02:00	12.7	57.1
03:00	12.2	45.9
04:00	12.0	38.0
05:00	12.2	35.4
06:00	12.3	34.3
07:00	12.7	34.3
08:00	12.4	38.9
09:00	12.3	47.9
10:00	12.2	45.3
11:00	12.3	39.4
12:00	12.3	41.6
13:00	12.1	31.7
14:00	11.8	26.4
15:00	11.6	25.3
16:00	11.7	22.8
17:00	11.5	19.6
18:00	11.2	12.3
19:00	11.2	11.4
20:00	12.1	19.7
21:00	15.6	16.8
22:00	14.0	16.1
23:00	13.5	16.5

Figure 209. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on July 17, 2023, and 2021-2025 average July concentrations.

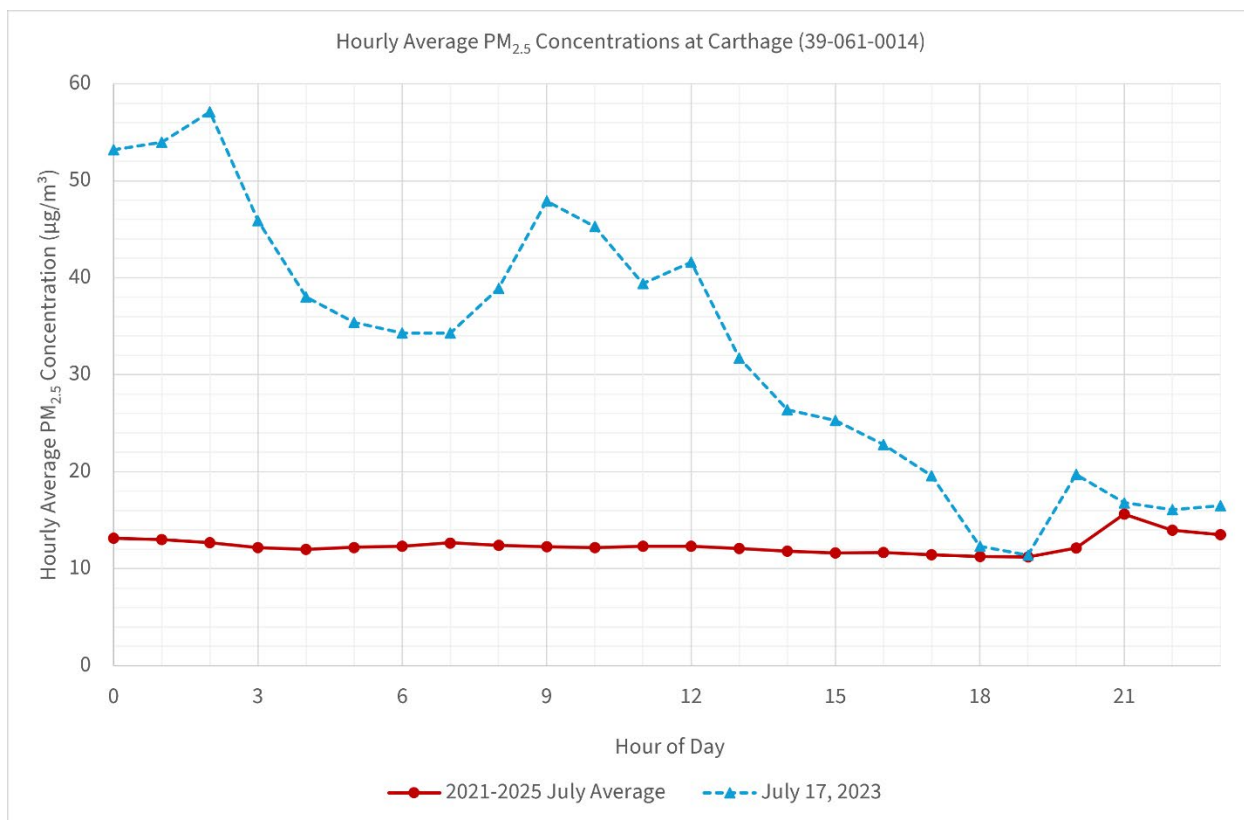


Table 38. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 17, 2023, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 17, 2023
00:00	16.4	48.9
01:00	16.0	50.1
02:00	15.6	50.4
03:00	14.9	39.5
04:00	14.9	31.2
05:00	15.0	30.3
06:00	15.4	23.1
07:00	15.5	25.9
08:00	13.8	32.7
09:00	13.3	42.6
10:00	12.6	33.5
11:00	12.3	29.0
12:00	12.1	30.4
13:00	11.6	22.5
14:00	11.4	18.6
15:00	11.6	13.8
16:00	11.2	14.2
17:00	11.3	10.6
18:00	11.0	7.1
19:00	11.4	7.2
20:00	12.2	19.3
21:00	16.1	16.2
22:00	15.8	17.8
23:00	16.6	17.2

Figure 210. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 17, 2023, and 2021-2025 average July concentrations.

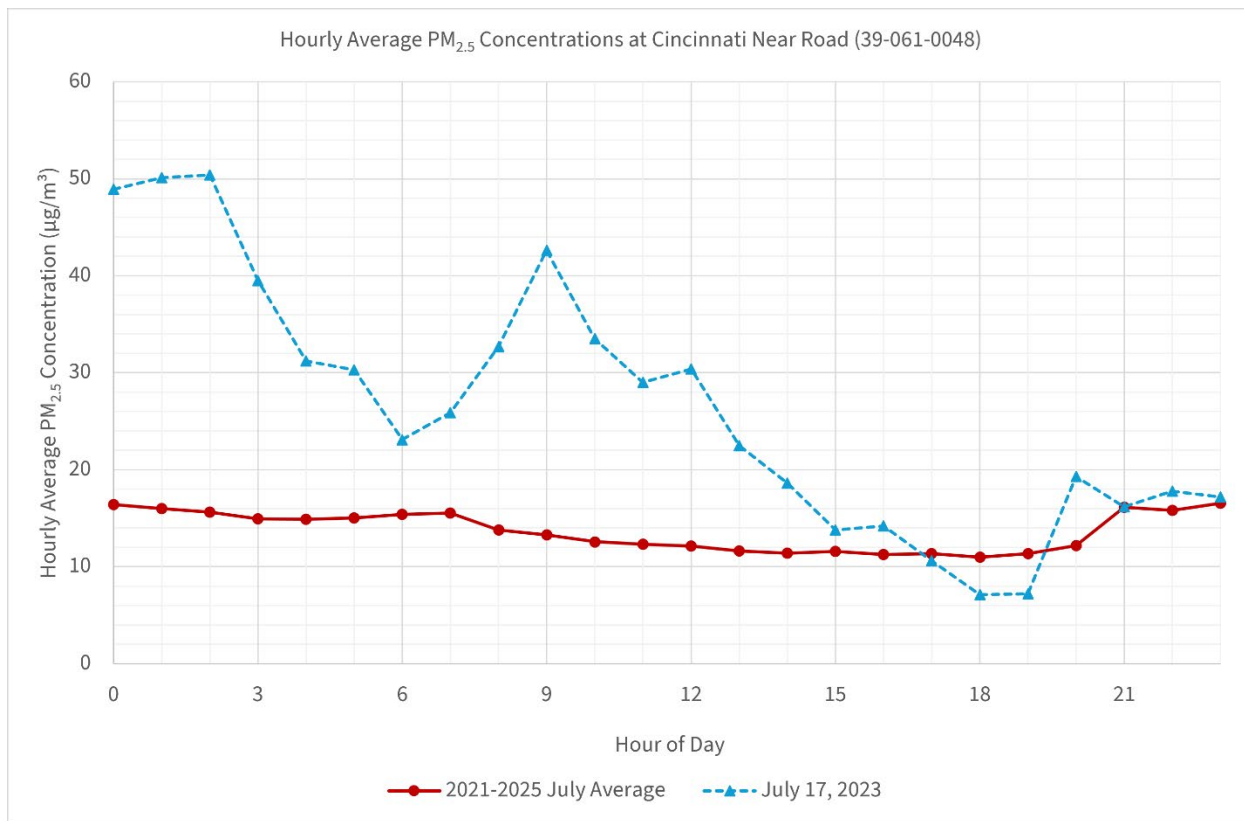
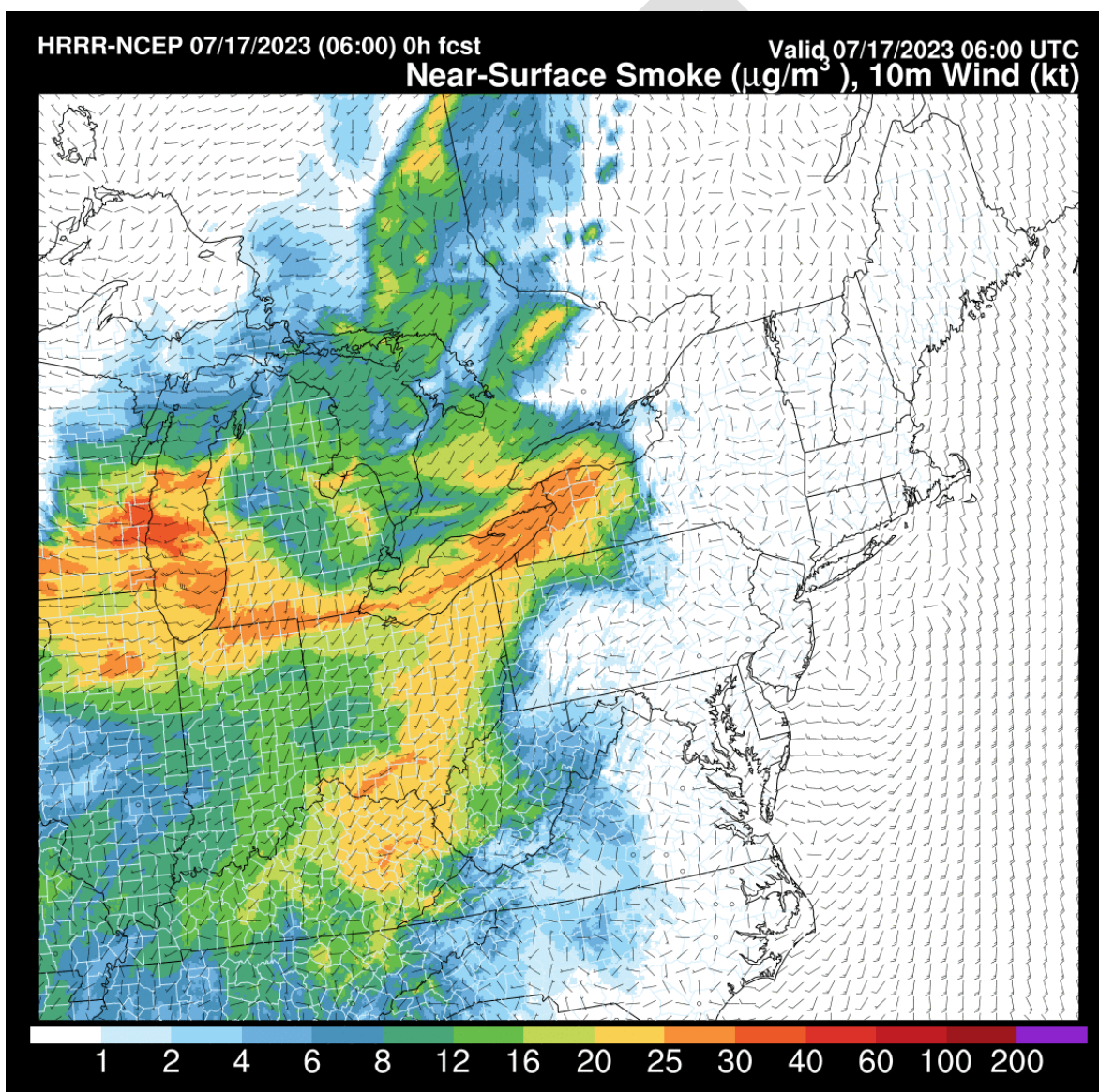


Figure 211 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on July 17, 2023. The HRRR model initialization showed near-surface smoke across portions of Ohio, including near-surface smoke concentrations of approximately $20 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on July 17, 2023.

Figure 211. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 06Z (01:00 EST) on July 17, 2023.



3.6. Wildfire Smoke-Driven PM_{2.5} Episode on July 25, 2023

3.6.1. July 25, 2023

The HYSPLIT 72-hour back and forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on July 25, 2023. Figure 212 shows the HYSPLIT 72-hour back trajectory plot for July 25, overlaid on a map of fire locations, monitored 24-hour average surface PM_{2.5} concentrations, and HMS smoke polygons for July 22. Figure 213 shows the HYSPLIT 72-hour forward trajectory plot for July 22, overlaid on a map of fire locations, monitored 24-hour average surface PM_{2.5} concentrations, and HMS smoke polygons for July 25. A heavily wildfire smoke-impacted location near the wildfires burning 25 km (15.5 mi) northwest of Grand Rapids, Manitoba coincides with the point (at 3086.2 meters AGL) at 09:00 EST on July 22 of the 1500-meter release height back trajectory from Cincinnati and the 3100-meter release height forward trajectory from those wildfires at 09:00 EST on July 22 reaches Cincinnati (at 1679.3 meters AGL) at 09:00 EST on July 25. The coincidence of the back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires northwest of Grand Rapids, Manitoba caused the high PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on July 25, 2023. The accompanying imagery map for July 25 presented in Figure 214 shows visible wildfire smoke and high AOD values over portions of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on July 25, 2023, and that this wildfire smoke was the cause of the high concentrations of PM_{2.5} at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County.

Figure 212. HYSPLIT 72-hour back trajectory plot from July 25, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for July 22, 2023.

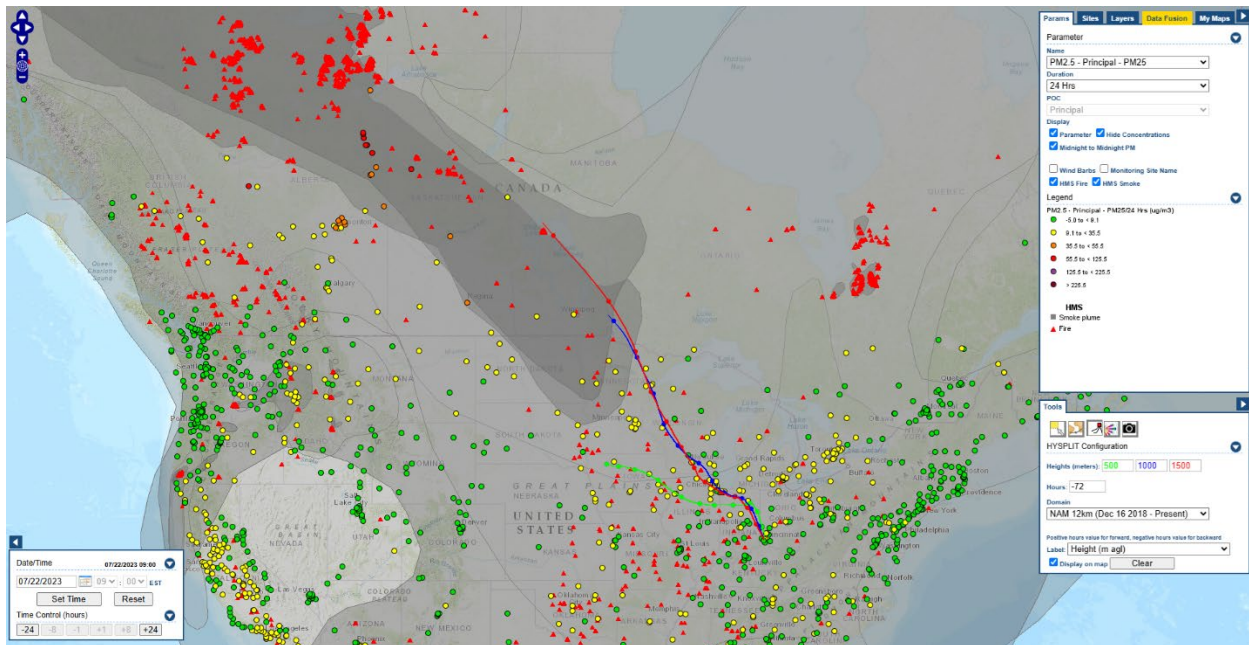


Figure 213. HYSPLIT 72-hour forward trajectory plot from July 22, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for July 25, 2023.

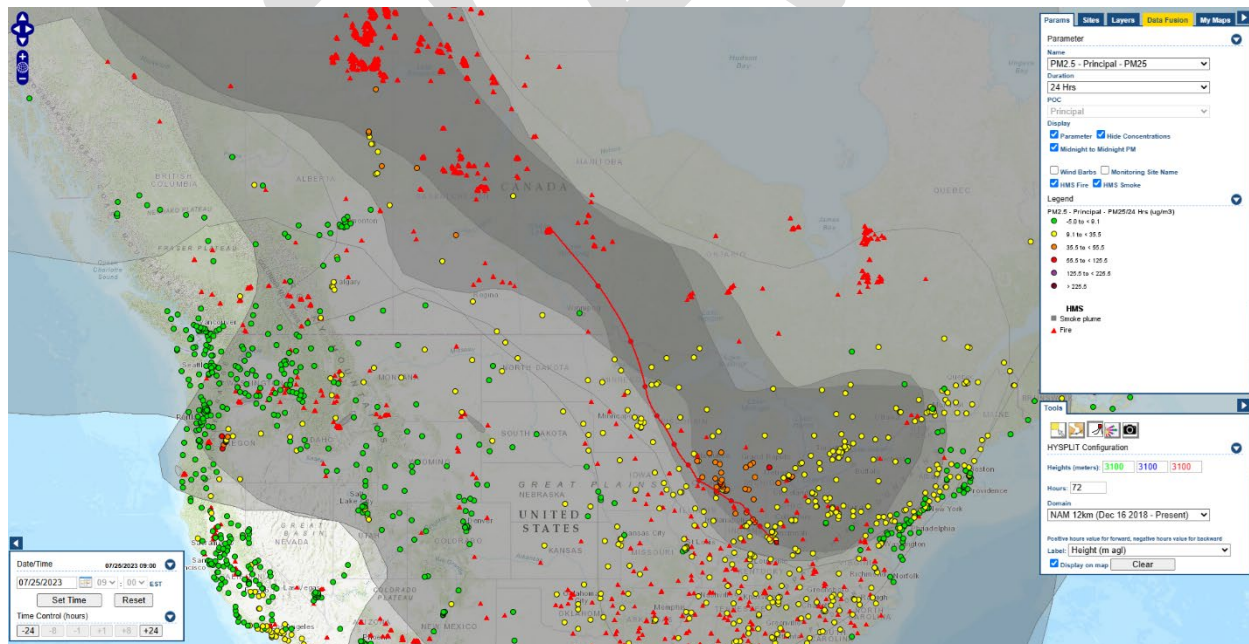


Figure 214. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for July 25, 2023, showing visible wildfire smoke and high AOD values over portions of Ohio, including Hamilton County.

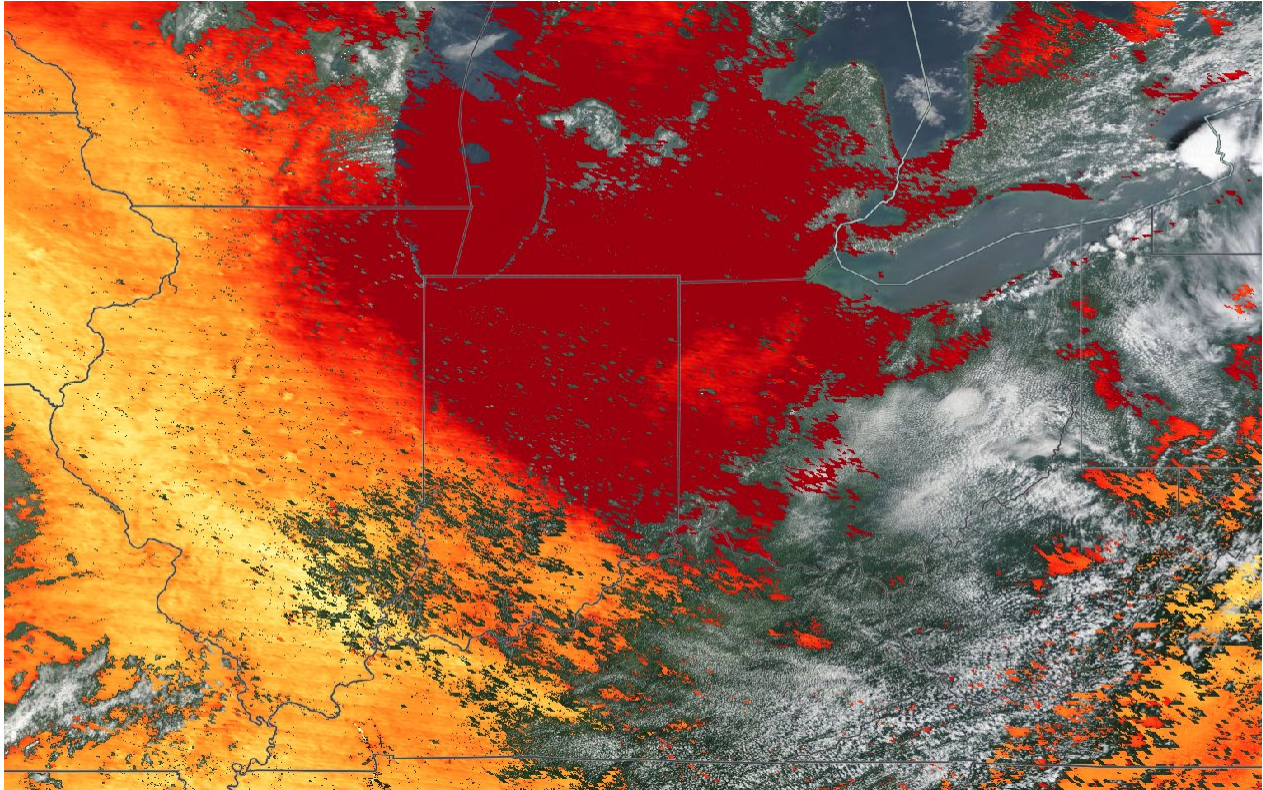


Table 39 and Figure 215 show the hourly average $PM_{2.5}$ concentrations on July 25, 2023, and the 2021-2025 average July concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 40 and Figure 216 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations began increasing around 09:00 EST as wildfire smoke reached the area and began to descend on the surface, then concentrations remained elevated the rest of the day on July 25, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations in Hamilton County on July 25, 2023.

Table 39. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on July 25, 2023, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on July 25, 2023
00:00	13.1	8.1
01:00	13.0	8.1
02:00	12.7	7.3
03:00	12.2	7.1
04:00	12.0	7.5
05:00	12.2	8.6
06:00	12.3	8.7
07:00	12.7	10.3
08:00	12.4	11.5
09:00	12.3	14.3
10:00	12.2	16.6
11:00	12.3	21.0
12:00	12.3	28.5
13:00	12.1	32.6
14:00	11.8	32.5
15:00	11.6	33.8
16:00	11.7	34.3
17:00	11.5	34.0
18:00	11.2	33.6
19:00	11.2	51.5
20:00	12.1	62.0
21:00	15.6	53.1
22:00	14.0	47.8
23:00	13.5	45.1

Figure 215. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on July 25, 2023, and 2021-2025 average July concentrations.

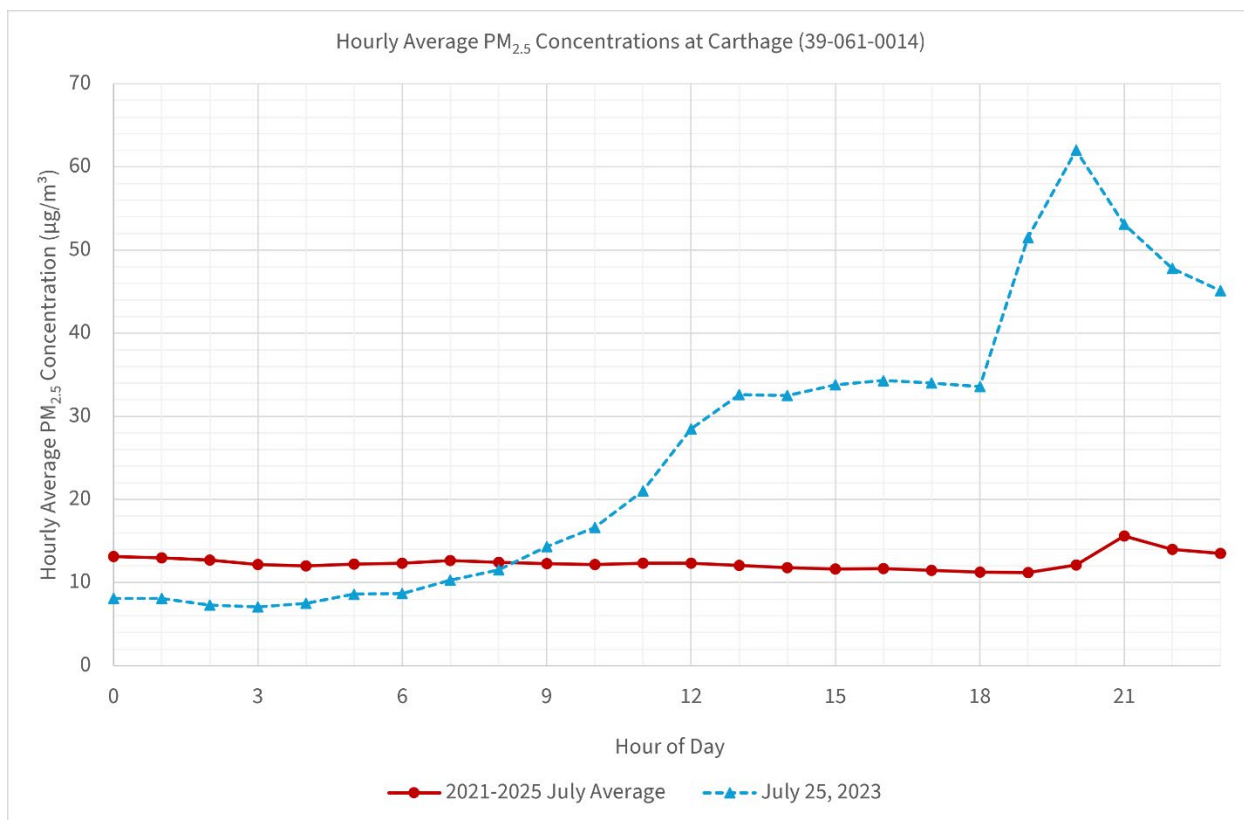


Table 40. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 25, 2023, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 25, 2023
00:00	16.4	8.9
01:00	16.0	10.8
02:00	15.6	11.4
03:00	14.9	9.6
04:00	14.9	12.3
05:00	15.0	11.8
06:00	15.4	8.1
07:00	15.5	9.3
08:00	13.8	11.6
09:00	13.3	13.5
10:00	12.6	19.0
11:00	12.3	27.2
12:00	12.1	28.7
13:00	11.6	28.2
14:00	11.4	28.3
15:00	11.6	28.0
16:00	11.2	38.5
17:00	11.3	41.7
18:00	11.0	47.4
19:00	11.4	50.0
20:00	12.2	50.6
21:00	16.1	47.5
22:00	15.8	45.6
23:00	16.6	45.1

Figure 216. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 25, 2023, and 2021-2025 average July concentrations.

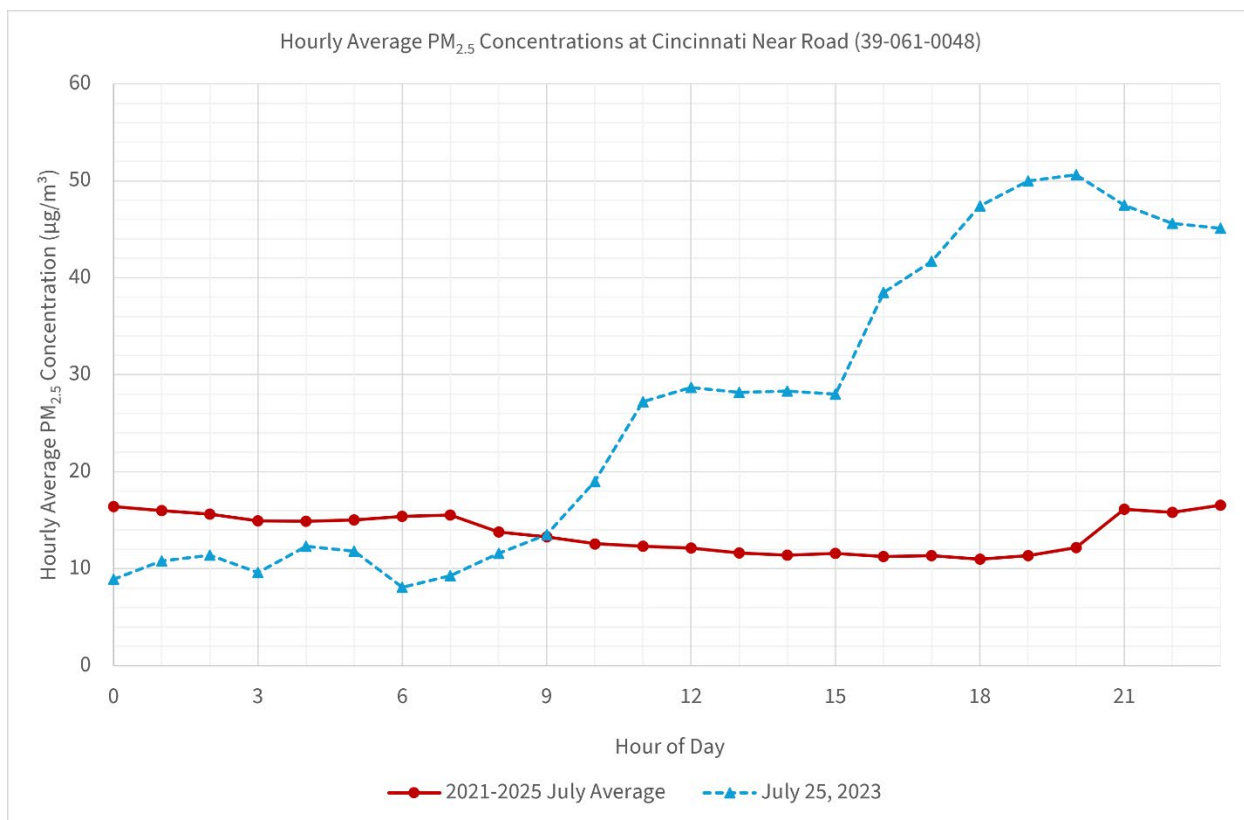
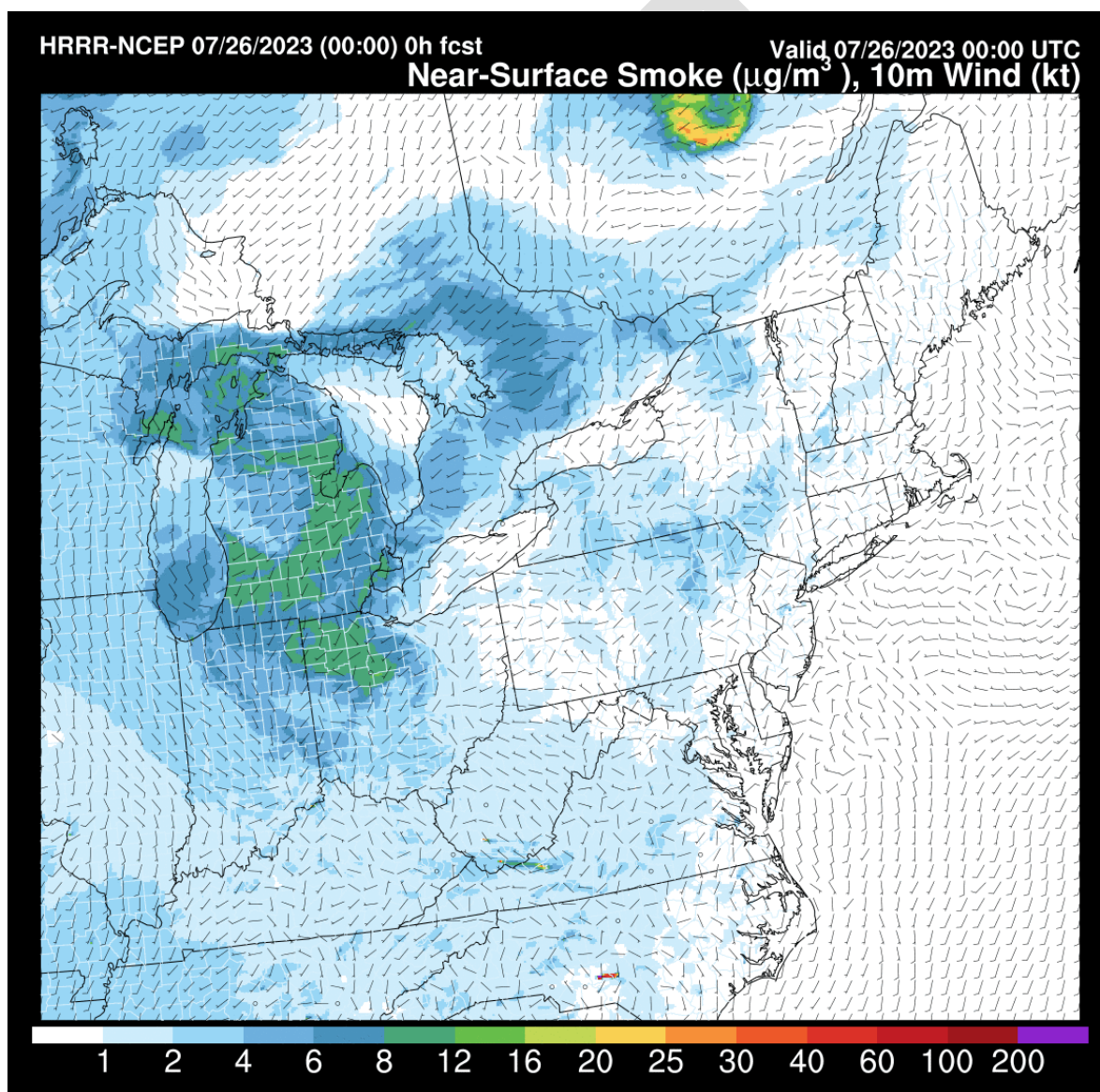


Figure 217 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 00Z on July 26, 2023 (19:00 EST on July 25, 2023). The HRRR model initialization showed near-surface smoke across portions of Ohio, including near-surface smoke concentrations of approximately $4 \mu\text{g}/\text{m}^3$ in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage and Cincinnati Near Road monitoring sites on July 25, 2023.

Figure 217. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 00Z on July 26, 2023 (19:00 EST on July 25, 2023).



3.7. Wildfire Smoke-Driven PM_{2.5} Episode on August 19, 2023

3.7.1. August 19, 2023

The HYSPLIT 72-hour back and 64-hour forward trajectory plots show the origin and transport of the wildfire smoke plumes that caused the high surface PM_{2.5} concentrations at the Carthage monitoring site in Hamilton County on August 19, 2023. Figure 218 shows the HYSPLIT 72-hour back trajectory plot for August 19, overlaid on a map of fire locations, monitored 24-hour average surface PM_{2.5} concentrations, and HMS smoke polygons for August 16. Figure 219 shows the HYSPLIT 64-hour forward trajectory plot for August 16, overlaid on a map of fire locations, monitored 24-hour average surface PM_{2.5} concentrations, and HMS smoke polygons for August 19. The wildfires burning 40 km (24.9 mi) west-northwest of Fitzgerald, Alberta coincide with the point (at 4634.7 meters AGL) at 18:00 EST on August 16 of the 1500-meter release height back trajectory from Cincinnati and the 4600-meter release height forward trajectory from those wildfires at 18:00 EST on August 16 reaches Cincinnati (at 1743.8 meters AGL) at 10:00 EST on August 19. The coincidence of the back and forward trajectories between the wildfire location and Cincinnati serves as clear evidence that the smoke from the wildfires west-northwest of Fitzgerald, Alberta caused the high PM_{2.5} concentrations at the Carthage monitoring site in Hamilton County on August 19, 2023. The accompanying imagery map for August 19 presented in Figure 220 shows moderate and high AOD values over nearly all of Ohio, including Hamilton County, providing further evidence that smoke from the Canadian wildfires was present in Hamilton County on August 19, 2023, and that this wildfire smoke was the cause of the high concentrations of PM_{2.5} at the Carthage monitoring site in Hamilton County.

Figure 218. HYSPLIT 72-hour back trajectory plot from August 19, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for August 16, 2023.

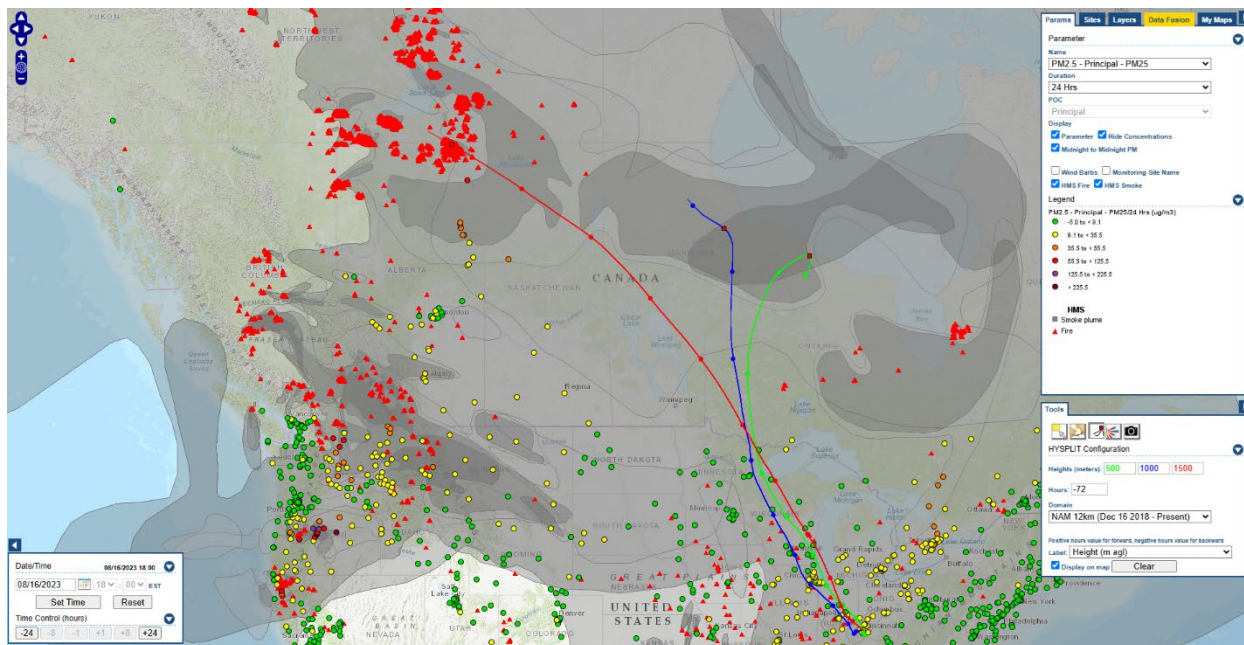


Figure 219. HYSPLIT 64-hour forward trajectory plot from August 16, 2023, with fire locations, monitored surface PM_{2.5} concentrations, and HMS smoke polygons for August 19, 2023.

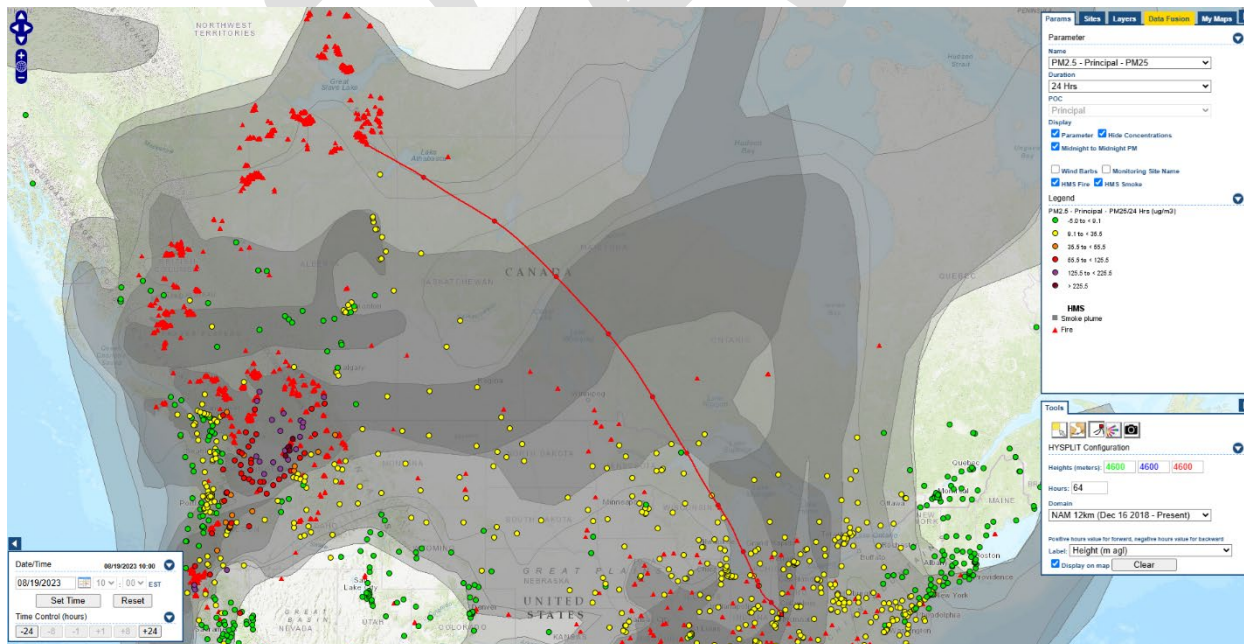


Figure 220. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for August 19, 2023, showing moderate and high AOD values over nearly all of Ohio, including Hamilton County.

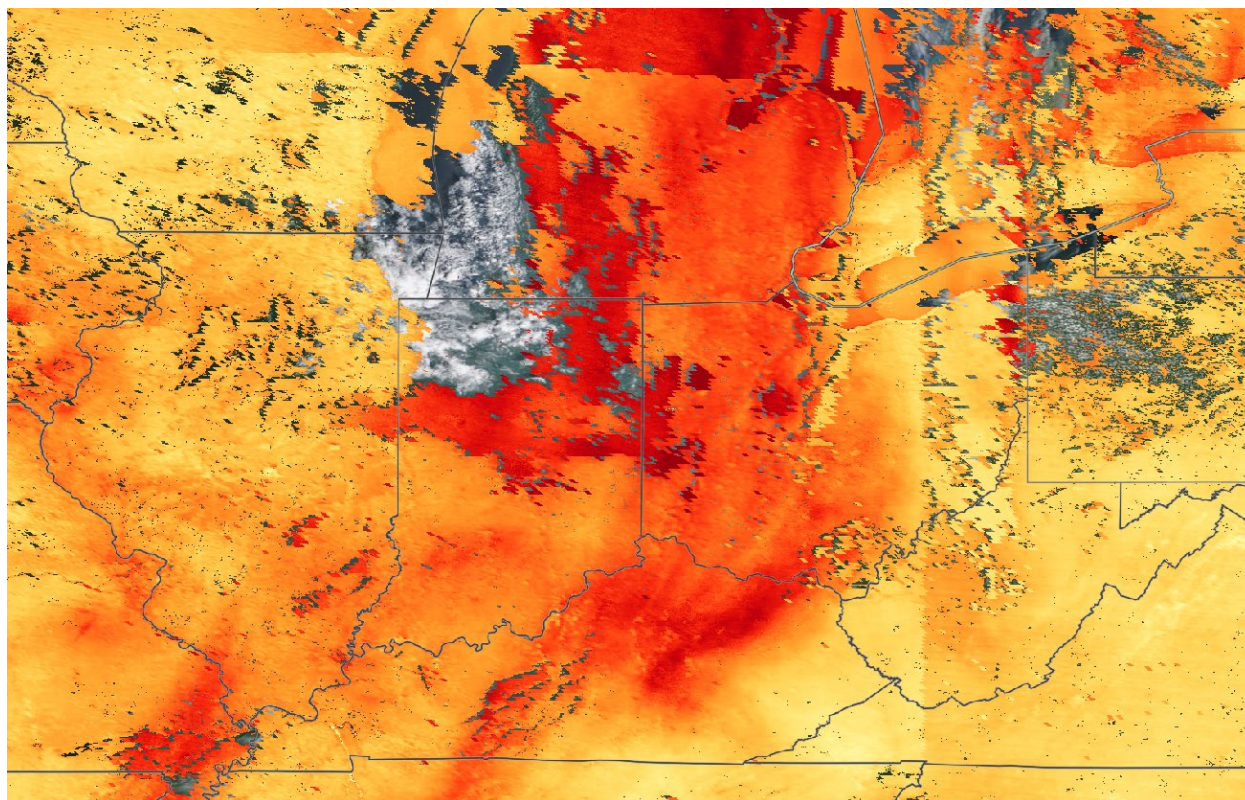


Table 41 and Figure 221 show the hourly average $PM_{2.5}$ concentrations on August 19, 2023, and the 2021-2025 average August concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County. The hourly average $PM_{2.5}$ concentrations remained elevated throughout the day on August 19 due to transported wildfire smoke continually descending on the surface, providing further evidence that wildfire smoke impacted $PM_{2.5}$ concentrations at the Carthage monitoring site in Hamilton County on August 19, 2023.

Table 41. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on August 19, 2023, and 2021-2025 average August concentration data.

Hour of Day	2021-2025 Average August Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on August 19, 2023
00:00	10.4	26.6
01:00	10.3	24.1
02:00	10.2	24.8
03:00	10.1	25.5
04:00	10.0	26.2
05:00	10.0	25.6
06:00	10.7	26.4
07:00	11.0	29.4
08:00	11.4	31.1
09:00	10.9	28.9
10:00	10.8	26.0
11:00	11.0	24.4
12:00	11.0	23.7
13:00	11.1	23.4
14:00	11.3	21.8
15:00	10.7	20.2
16:00	10.5	19.4
17:00	10.1	18.1
18:00	9.9	17.6
19:00	9.7	17.5
20:00	10.2	17.7
21:00	10.6	17.9
22:00	10.4	18.3
23:00	10.4	19.8

Figure 221. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on August 19, 2023, and 2021-2025 average August concentrations.

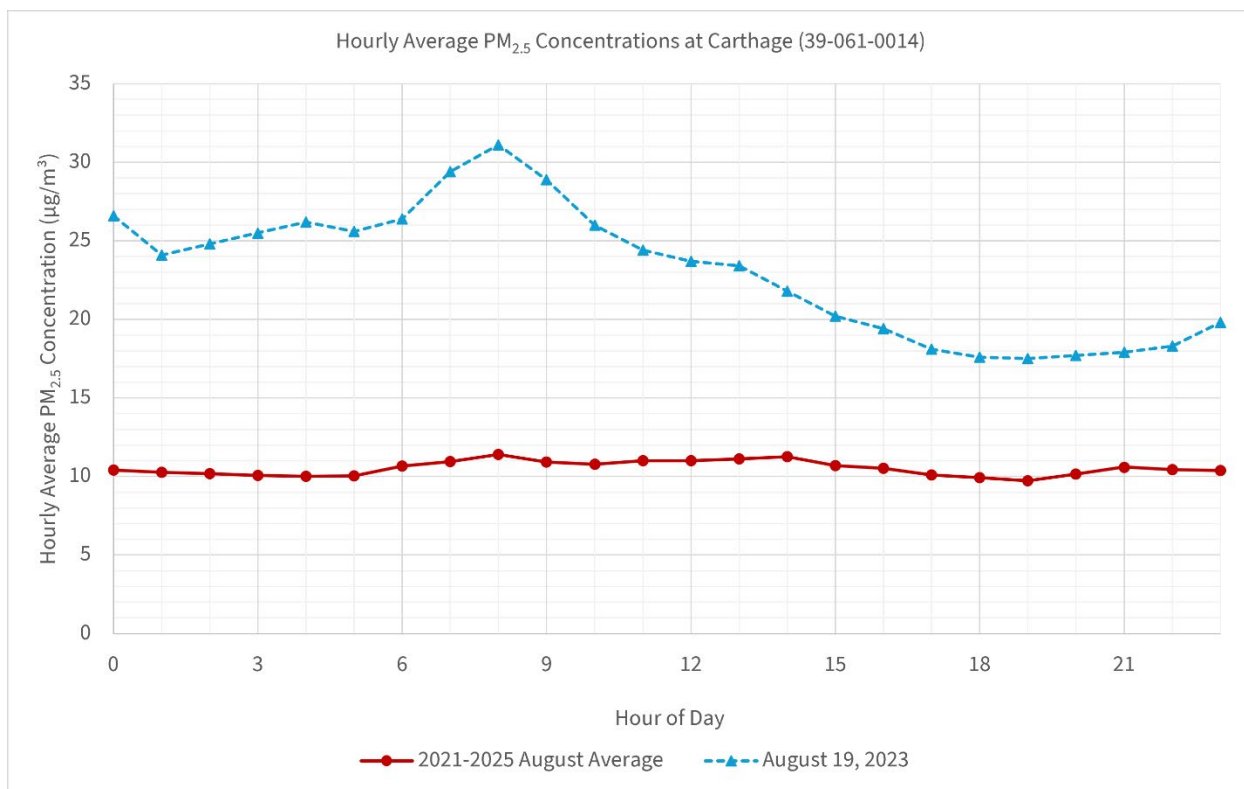
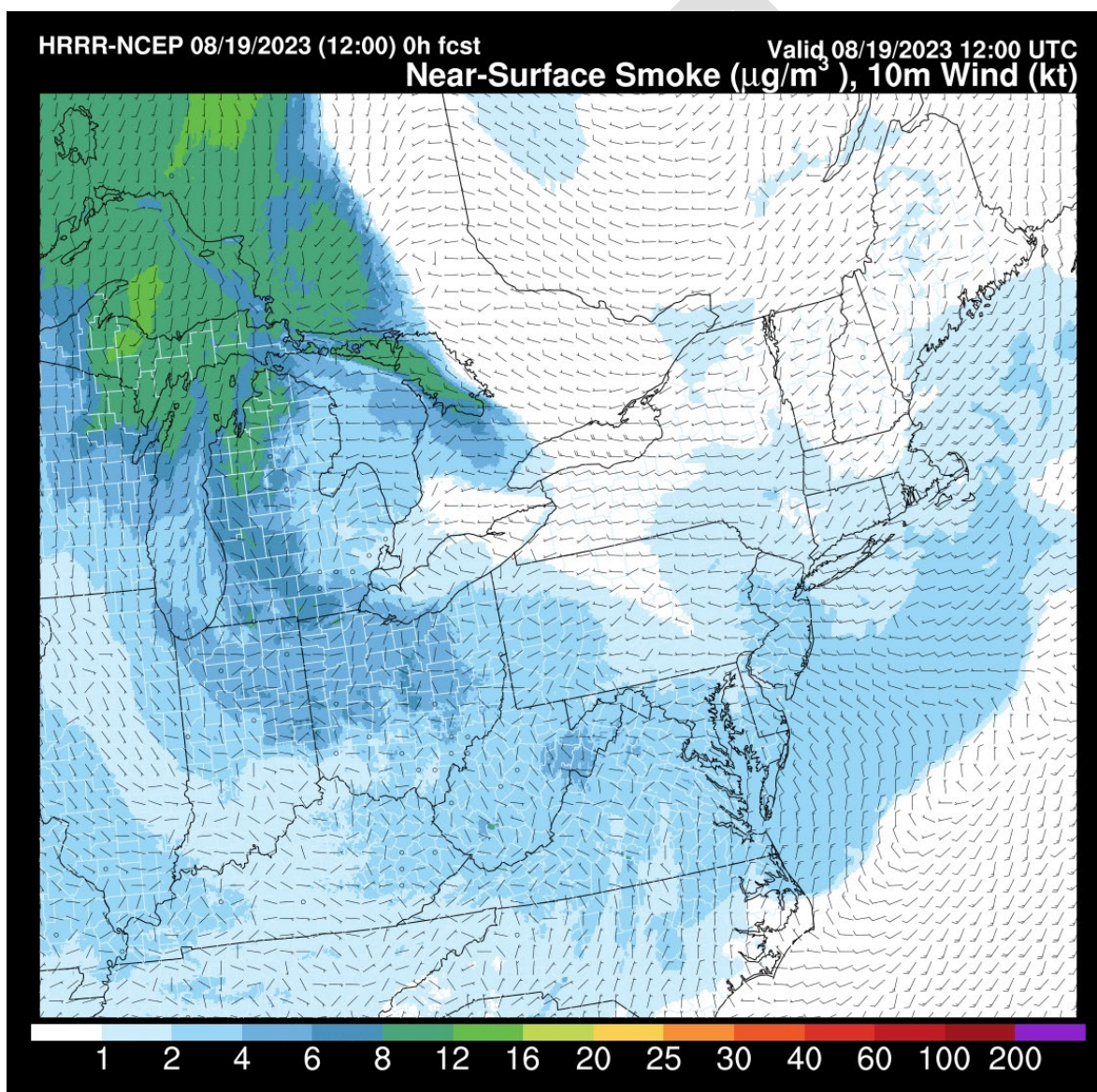


Figure 222 shows the near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 12Z (07:00 EST) on August 19, 2023. The HRRR model initialization showed near-surface smoke across portions of Ohio, including near-surface smoke concentrations of approximately $4 \mu\text{g}/\text{m}^3$ at the Carthage monitoring site in Hamilton County, providing further evidence that wildfire smoke impacted $\text{PM}_{2.5}$ concentrations at the Carthage monitoring site in Hamilton County on August 19, 2023.

Figure 222. Map of near-surface smoke concentrations over the Northeast from the initialization of the HRRR near-surface smoke density modeling run from 12Z (07:00 EST) on August 19, 2023.



3.8. Fireworks Smoke-Driven PM_{2.5} Episode on July 4-5, 2025

3.8.1. July 4-5, 2025

The smoke from the various nearby Fourth of July holiday celebration-related fireworks displays caused high surface PM_{2.5} concentrations across Hamilton County, including at the Carthage and Cincinnati Near Road monitoring sites, on July 4-5, 2025. Figure 223 shows Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for July 5, 2025, with Terra and Aqua satellite daytime orbital tracks and overpass times in UTC, in which moderate AOD values occur across Ohio, including Hamilton County. On July 5, 2025, the Terra satellite had its closest daytime orbit track overpass of Cincinnati at 09:34 EST and the Aqua satellite had its closest daytime orbit track overpass of Cincinnati at 14:51 EST, so the moderate AOD values observed by the Terra satellite over Hamilton County on July 5 would have represented lingering smoke from fireworks displays prior to the mixing height increasing enough in the afternoon to allow for the fireworks smoke to dissipate. Figures 224-227 show the wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 21:00 EST on July 4, 00:00 EST on July 5, 03:00 EST on July 5, and 06:00 EST on July 5, respectively, illustrating the lingering nature of the smoke near the surface due to widespread Fourth of July holiday celebration-related fireworks displays. The moderate AOD values observed over Ohio, including Hamilton County, the large number of fireworks displays across the area, the calm winds in the Cincinnati area overnight, and the widespread elevated PM_{2.5} concentrations at monitoring sites across the region, serve as clear evidence that the smoke from several fireworks displays across the area ultimately caused the high PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on July 4-5, 2025.

Figure 223. Terra satellite true color and MAIAC AOD imagery of Ohio and surrounding states for July 5, 2025, with Terra and Aqua satellite daytime orbital tracks and overpass times in UTC, showing moderate AOD values occur across Ohio, including Hamilton County, due to lingering fireworks smoke.

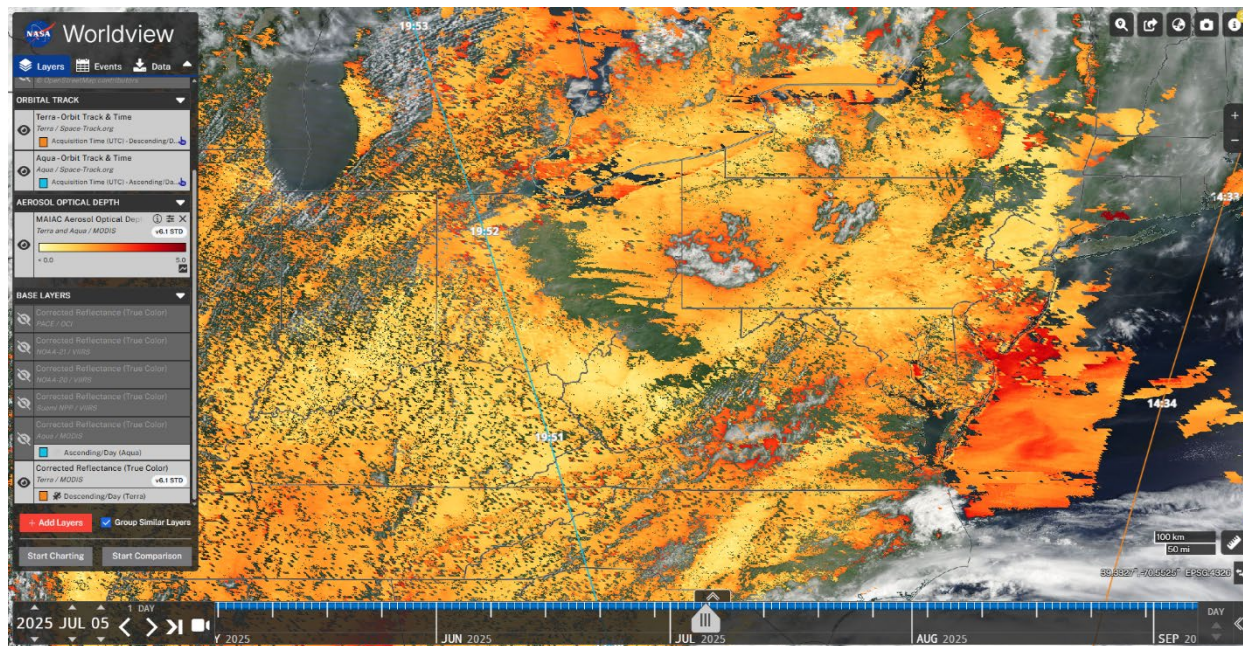


Figure 224. Map of wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 21:00 EST on July 4, 2025.

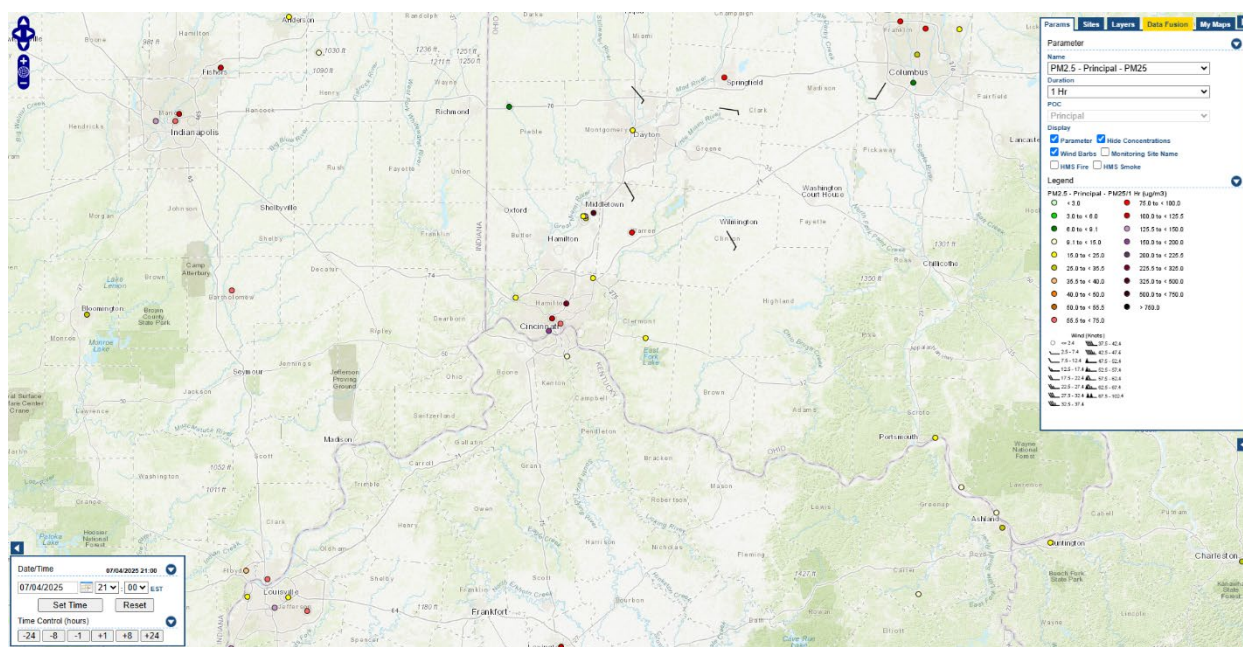


Figure 225. Map of wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 00:00 EST on July 5, 2025.

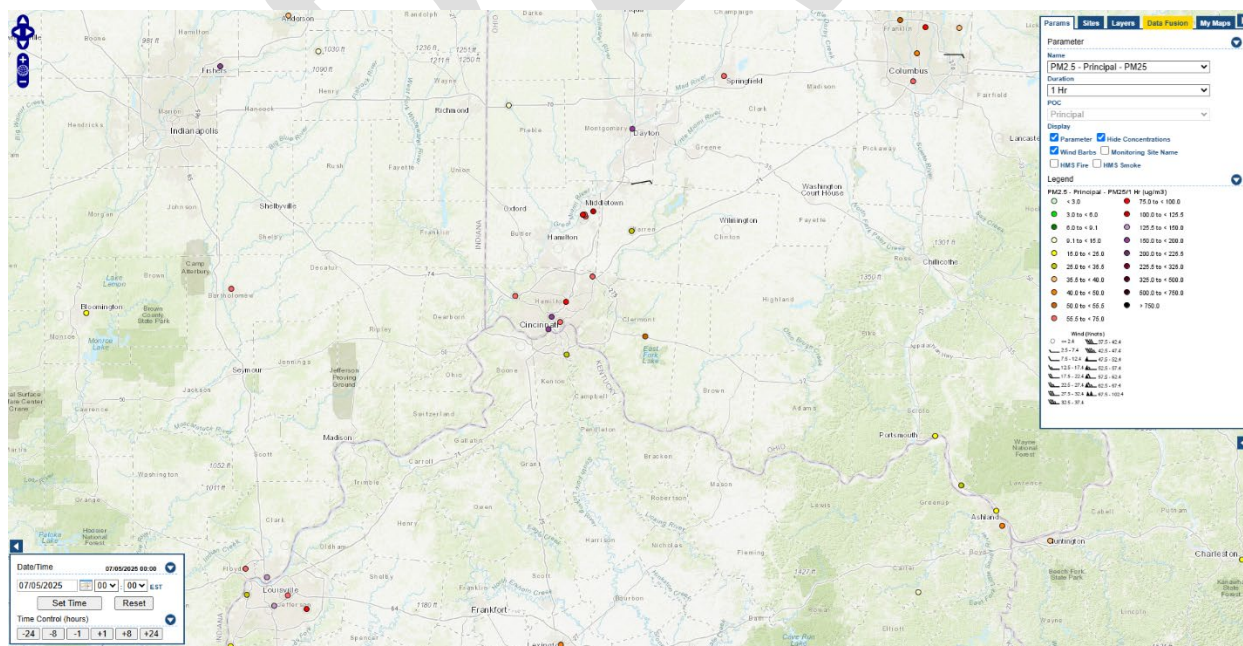


Figure 226. Map of wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 03:00 EST on July 5, 2025.

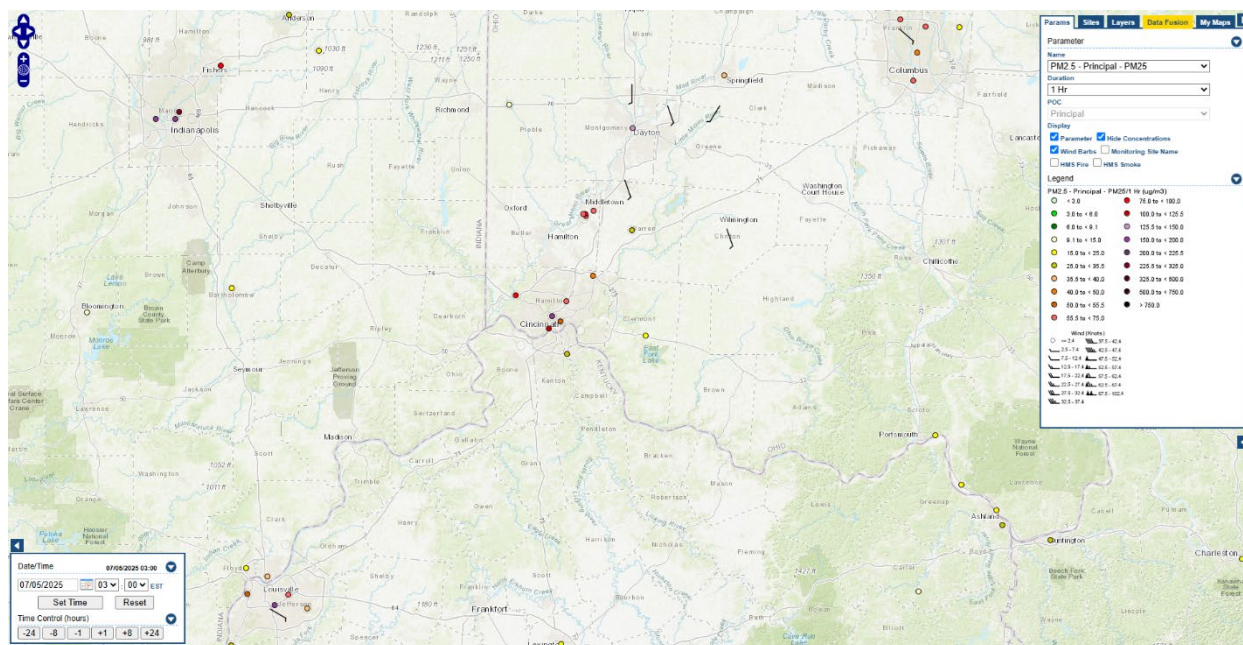


Figure 227. Map of wind barbs and hourly average PM_{2.5} concentrations measured at monitoring sites across the region at 06:00 EST on July 5, 2025.

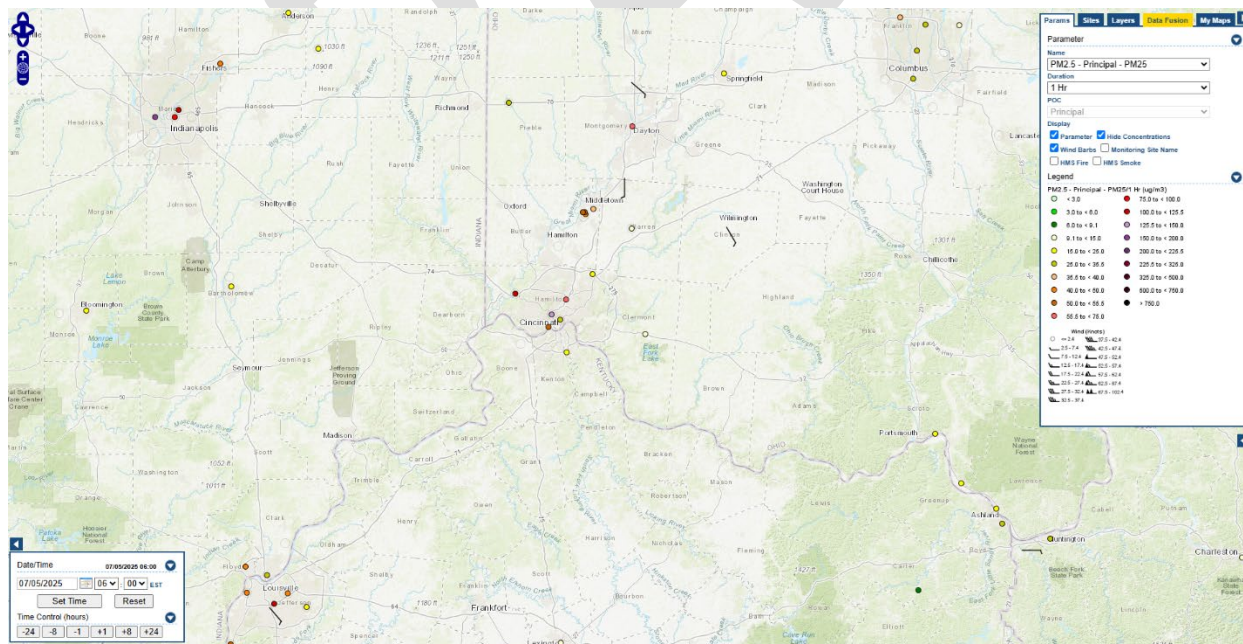


Table 42 and Figure 228 show the hourly average PM_{2.5} concentrations on July 4 and 5, 2025, and the 2021-2025 average July concentrations measured by the Teledyne T640 monitor at the Carthage (39-061-0014) monitoring site in Hamilton County, while Table 43 and Figure 229 show the same from the Met One BAM-1020 monitor at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County. The hourly average PM_{2.5} concentrations sharply increased at 21:00 EST on July 4 and remained elevated through 10:00 EST on July 5 as smoke from several Fourth of July holiday celebration-related fireworks displays descended on the surface, providing further evidence that smoke from Fourth of July holiday celebration-related fireworks displays impacted PM_{2.5} concentrations in Hamilton County on July 4-5, 2025.

Table 42. Hourly average PM_{2.5} concentration data from the Carthage (39-061-0014) monitoring site in Hamilton County on July 4 and 5, 2025, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM_{2.5} Concentration (µg/m³)	Hourly Average PM_{2.5} Concentration (µg/m³) on July 4, 2025	Hourly Average PM_{2.5} Concentration (µg/m³) on July 5, 2025
00:00	13.1	24.9	85.0
01:00	13.0	27.4	82.6
02:00	12.7	25.7	75.0
03:00	12.2	23.9	65.1
04:00	12.0	22.4	81.2
05:00	12.2	21.1	75.4
06:00	12.3	24.9	71.9
07:00	12.7	27.4	60.3
08:00	12.4	25.8	47.1
09:00	12.3	20.4	19.4
10:00	12.2	16.2	14.8
11:00	12.3	17.3	12.0
12:00	12.3	13.0	11.3
13:00	12.1	14.2	11.3
14:00	11.8	14.5	11.5
15:00	11.6	14.1	11.6
16:00	11.7	14.6	11.3
17:00	11.5	15.3	11.4
18:00	11.2	14.5	11.2
19:00	11.2	20.0	10.9
20:00	12.1	66.5	13.4
21:00	15.6	230.6	31.3
22:00	14.0	119.0	16.5
23:00	13.5	119.0	18.8

Figure 228. Plot of hourly average PM_{2.5} concentrations from the Carthage (39-061-0014) monitoring site in Hamilton County on July 4 and 5, 2025, and 2021-2025 average July concentrations.

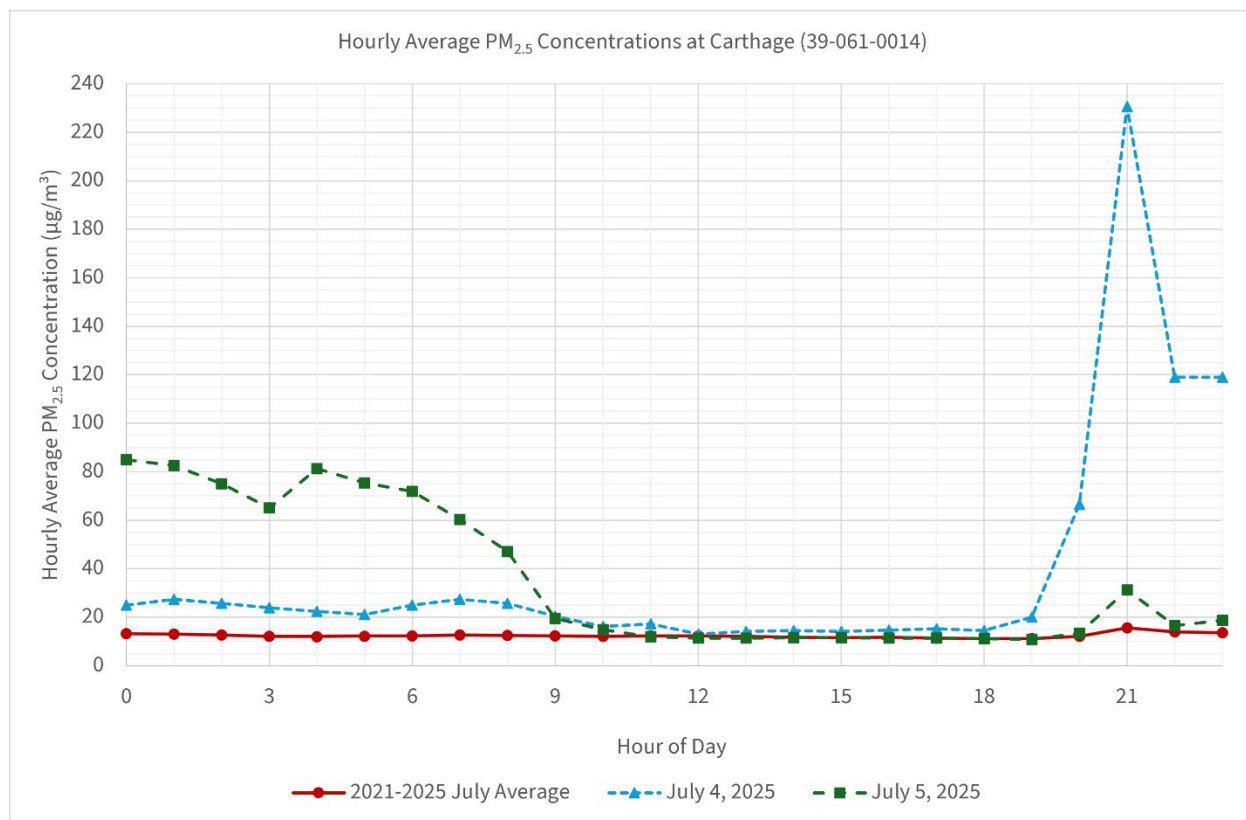
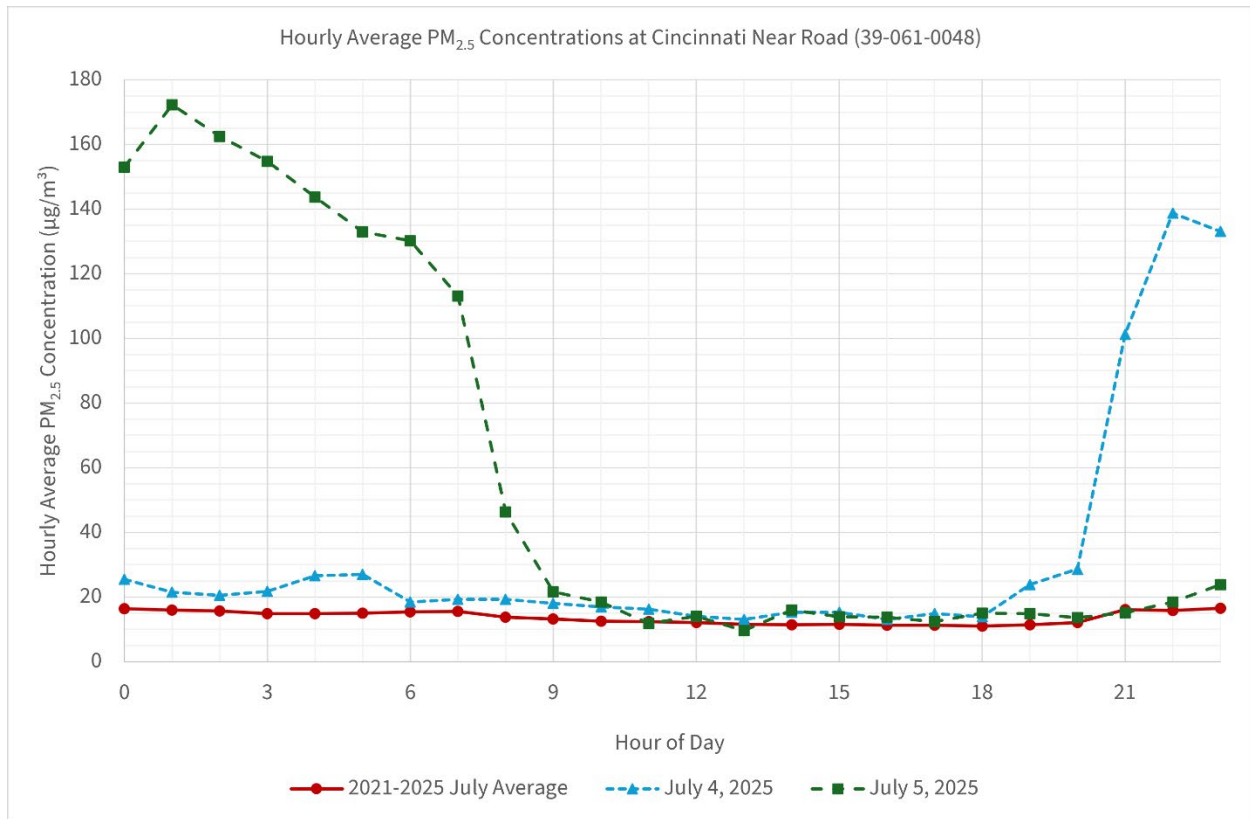


Table 43. Hourly average PM_{2.5} concentration data from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 4 and 5, 2025, and 2021-2025 average July concentration data.

Hour of Day	2021-2025 Average July Hourly PM _{2.5} Concentration (µg/m ³)	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 4, 2025	Hourly Average PM _{2.5} Concentration (µg/m ³) on July 5, 2025
00:00	16.4	25.5	153.0
01:00	16.0	21.5	172.3
02:00	15.6	20.5	162.5
03:00	14.9	21.8	154.7
04:00	14.9	26.6	143.7
05:00	15.0	27.0	132.9
06:00	15.4	18.5	130.2
07:00	15.5	19.3	113.1
08:00	13.8	19.3	46.3
09:00	13.3	18.0	21.7
10:00	12.6	17.0	18.4
11:00	12.3	16.3	11.8
12:00	12.1	14.1	14.1
13:00	11.6	13.1	9.7
14:00	11.4	15.3	16.0
15:00	11.6	15.3	13.9
16:00	11.2	13.1	13.8
17:00	11.3	14.9	12.4
18:00	11.0	13.9	15.0
19:00	11.4	23.9	14.9
20:00	12.2	28.6	13.6
21:00	16.1	101.3	15.1
22:00	15.8	138.7	18.4
23:00	16.6	133.1	23.9

Figure 229. Plot of hourly average PM_{2.5} concentrations from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on July 4 and 5, 2025, and 2021-2025 average July concentrations.



4. Fireworks Display or 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, or that the event was a fireworks display consistent with 40 CFR 50.14(b)(2). It has been demonstrated that widespread Fourth of July holiday celebration-related fireworks displays generated smoke that impacted PM_{2.5} concentrations at the Carthage (39-061-0014) and Cincinnati Near Road (39-061-0048) monitoring sites in Hamilton County from July 4-5 in both 2023 and 2025. 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”. Figures 230-247 show satellite imagery of the wildland areas on which wildfires generated plumes of smoke that ultimately impacted Hamilton County for each of the previously detailed wildfire-smoke driven PM_{2.5} episodes.

Figure 230. Satellite imagery of the wildland areas 150 km (93.2 mi) west-northwest of Baie-Comeau, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 2, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 4, 2023.

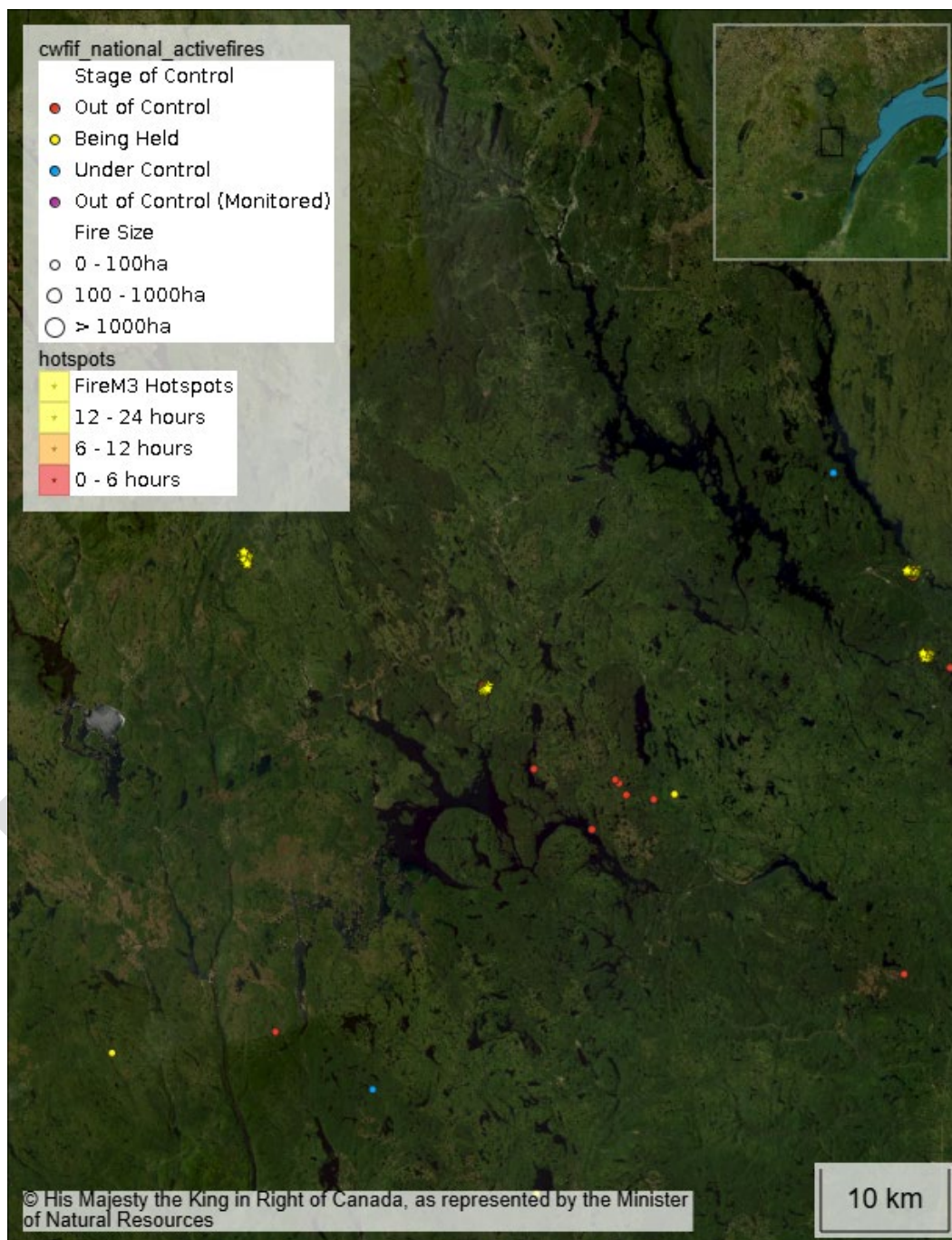


Figure 231. Satellite imagery of the wildland areas 50 km (31.1 mi) northwest of Baie-Comeau, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 3, 2023, that significantly contributed to the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 5, 2023.

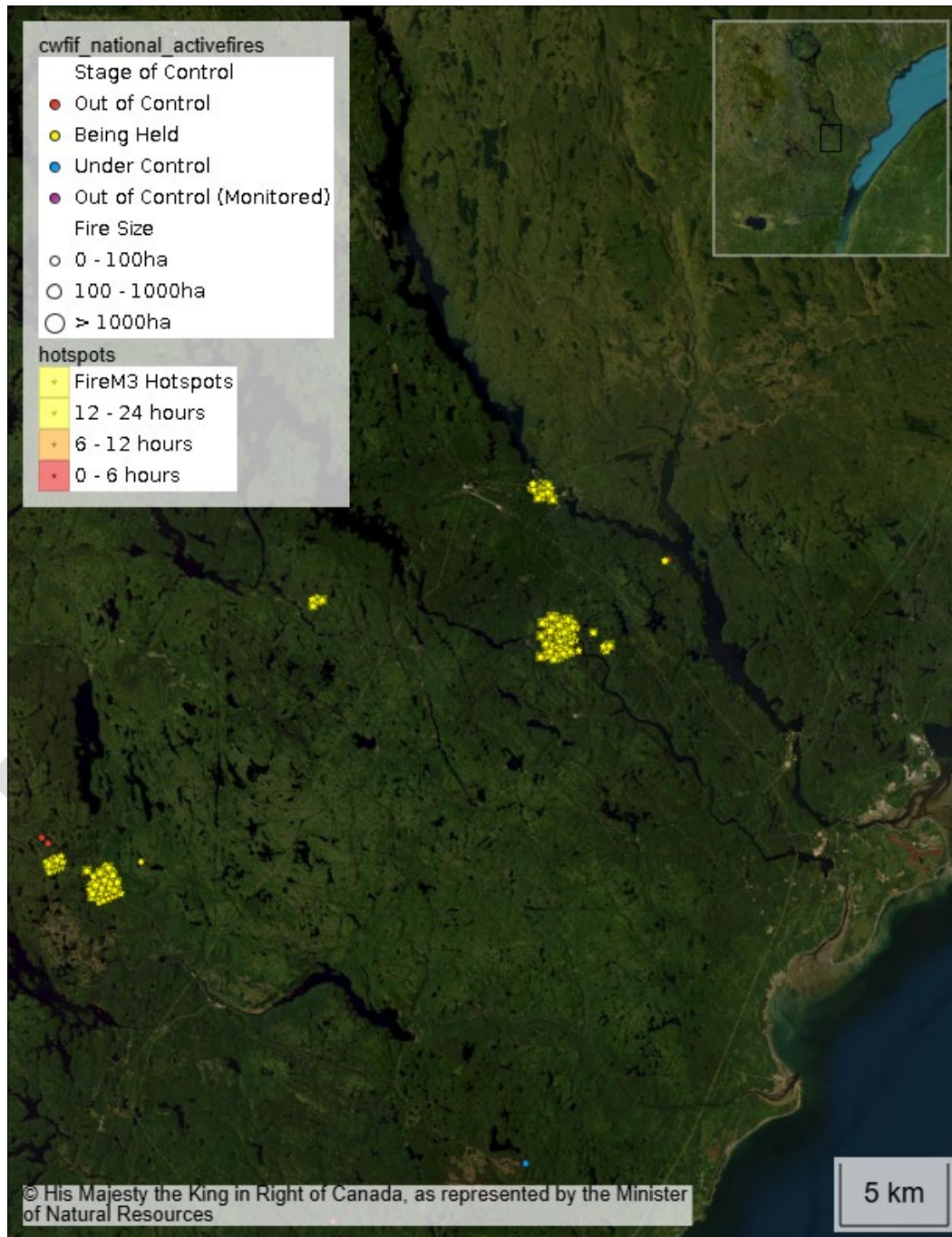


Figure 232. Satellite imagery of the wildland areas 45 km (28.0 mi) north-northeast of Sept-Îles, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 3, 2023, that significantly contributed to the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 5, 2023.

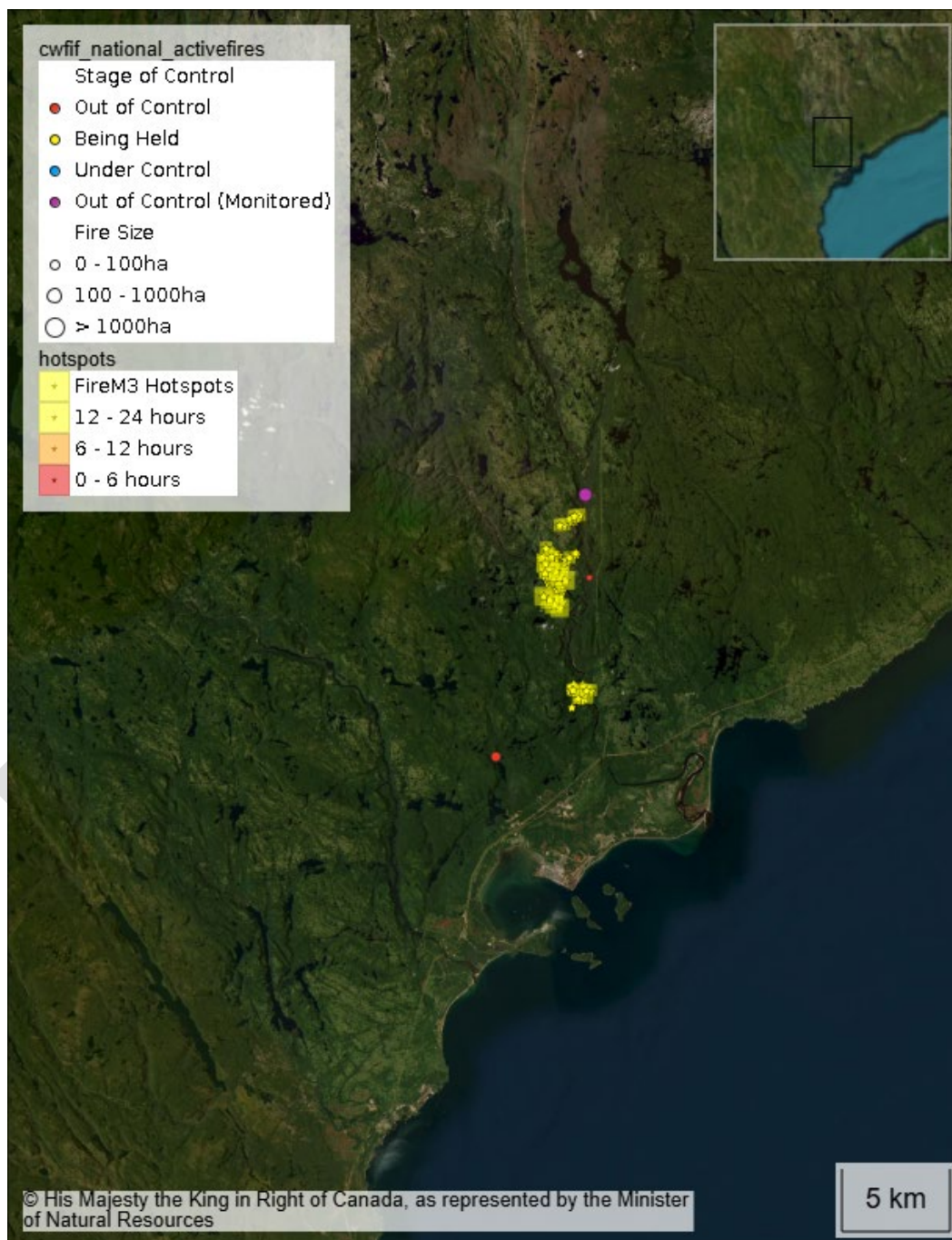


Figure 233. Satellite imagery of the wildland areas 65 km (40.4 mi) northwest of Baie-Comeau, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 3, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 6, 2023.

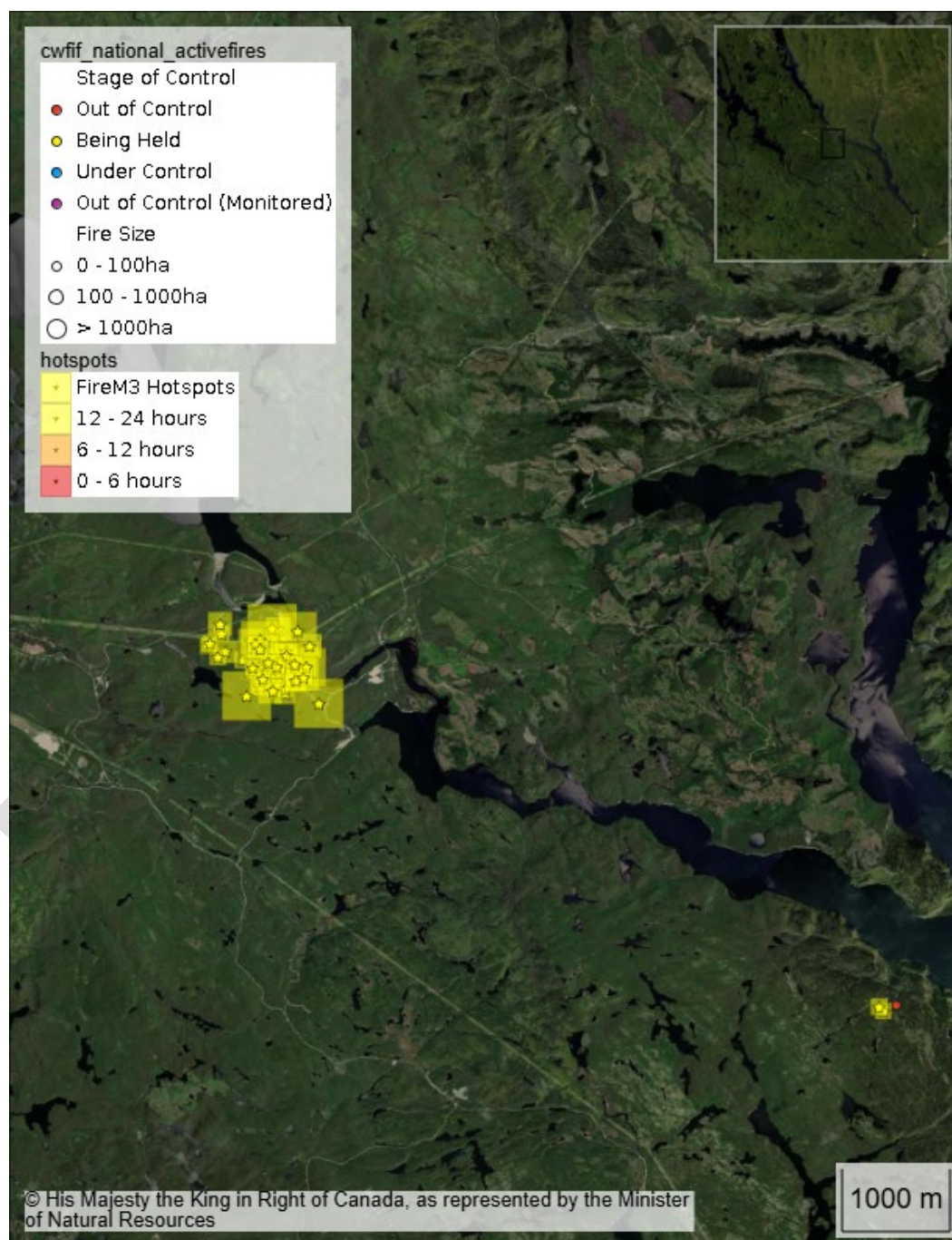


Figure 234. Satellite imagery of the wildland areas 205 km (127.4 mi) east of Wemindji, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 5, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 7, 2023.

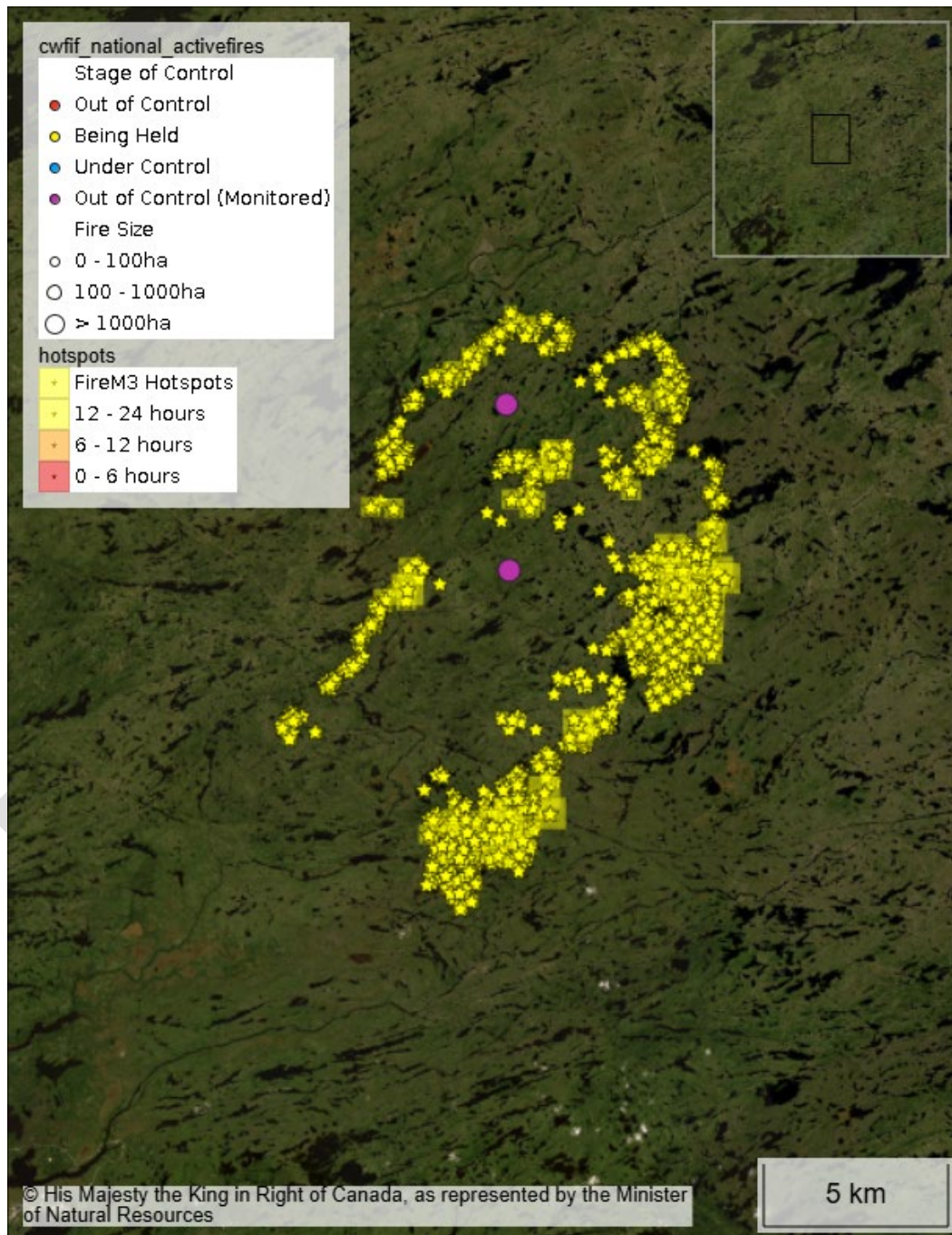


Figure 235. Satellite imagery of the wildland areas 220-240 km (136.7-149.1 mi) east of Wemindji, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 6, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 8 and 9, 2023.

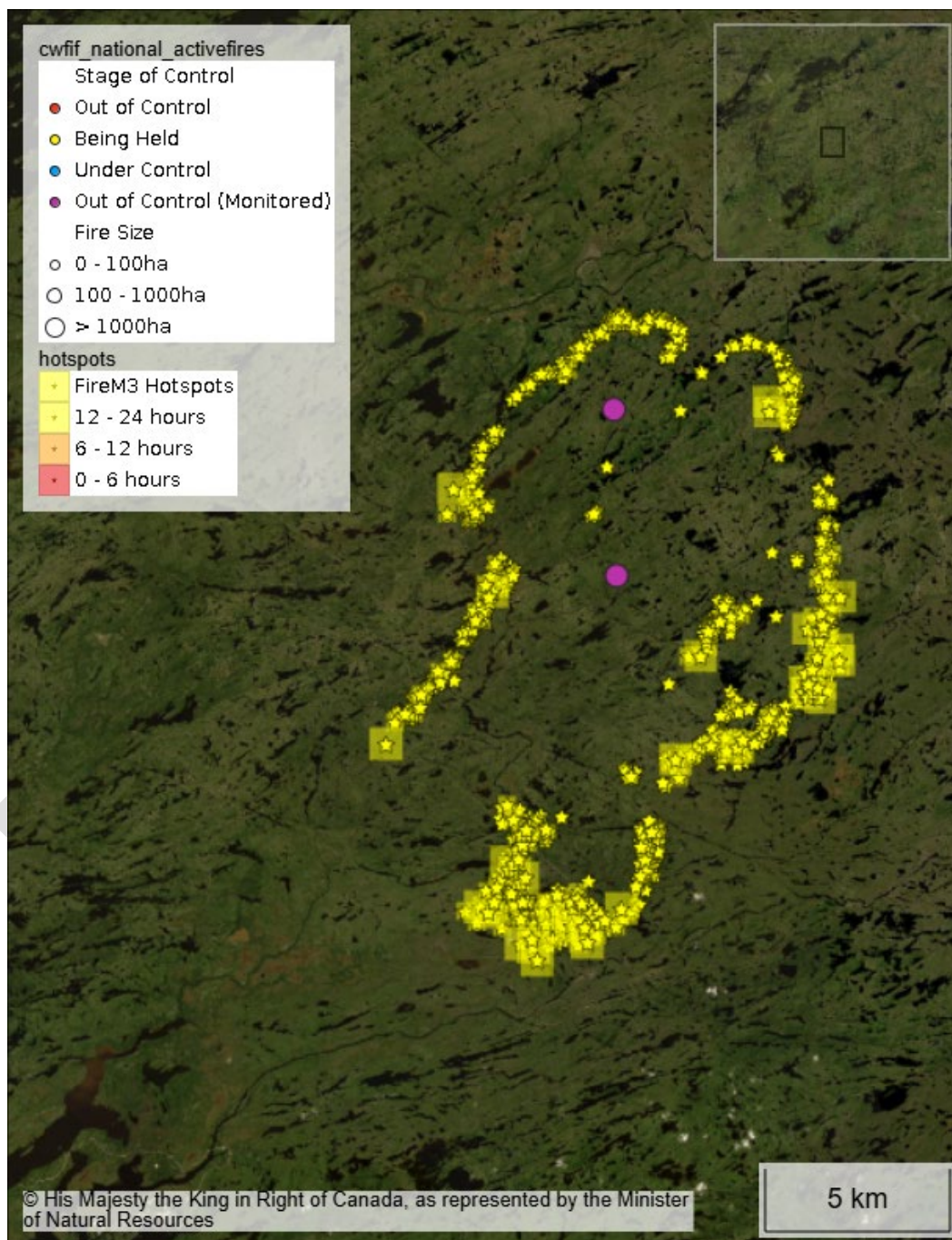


Figure 236. Satellite imagery of the wildland areas 230 km (142.9 mi) east of Wemindji, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 7, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 10, 2023.

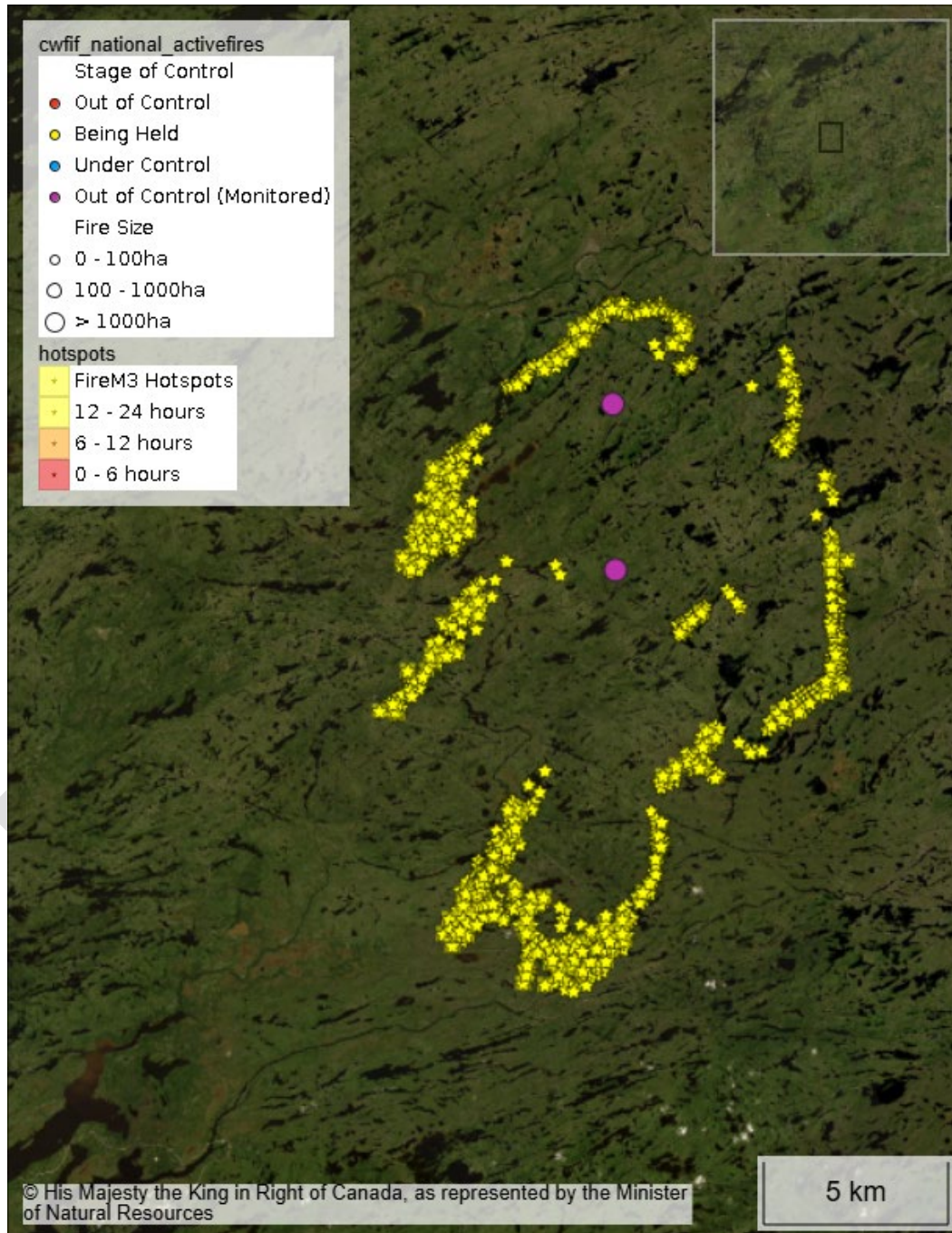


Figure 237. Satellite imagery of the wildland areas 65 km (40.4 mi) east-southeast of Lebel-sur-Quévillon, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 12, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 15, 2023.

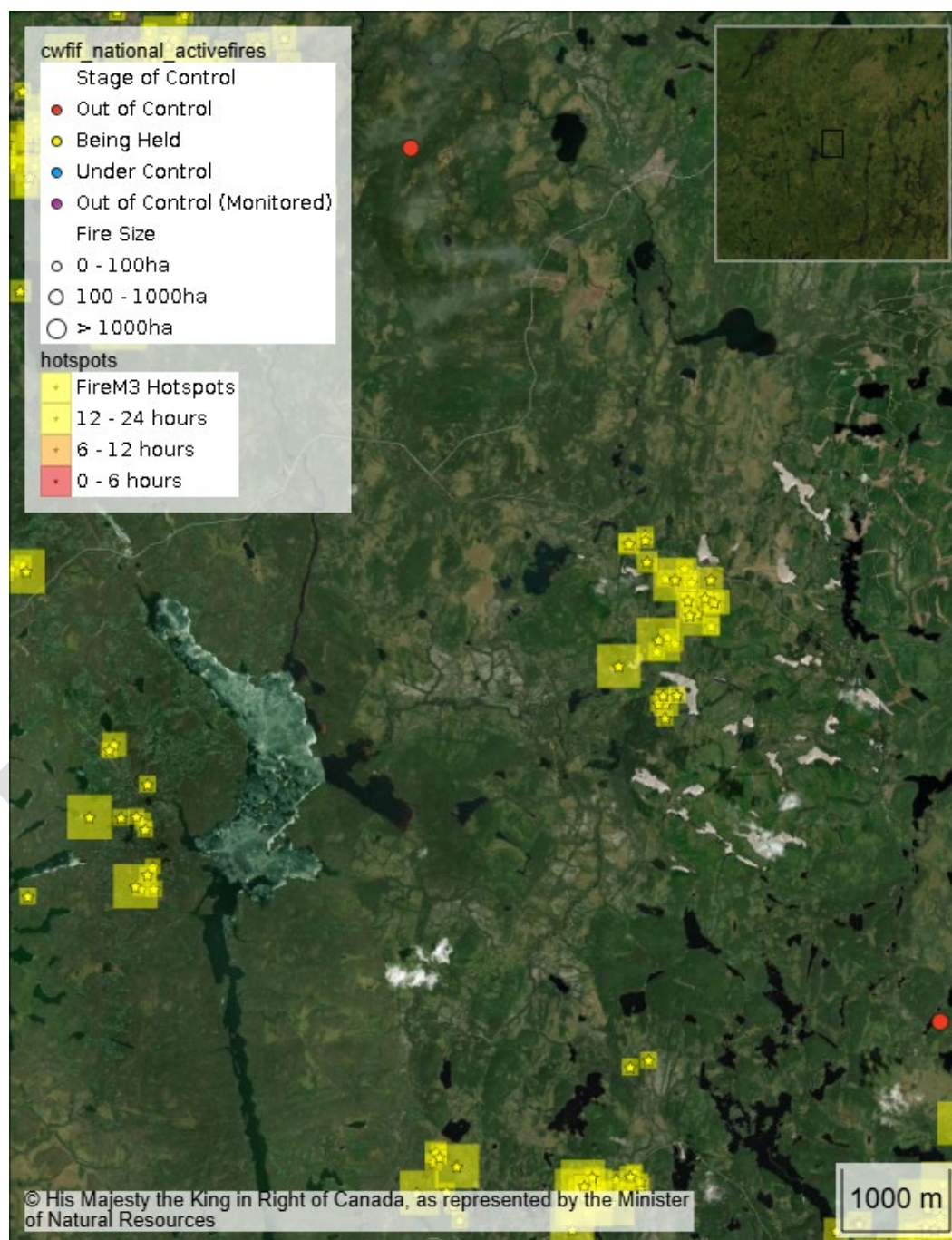


Figure 238. Satellite imagery of the wildland areas 70 km (43.5 mi) north-northwest of Aroland, Ontario, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 13, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 16, 2023.

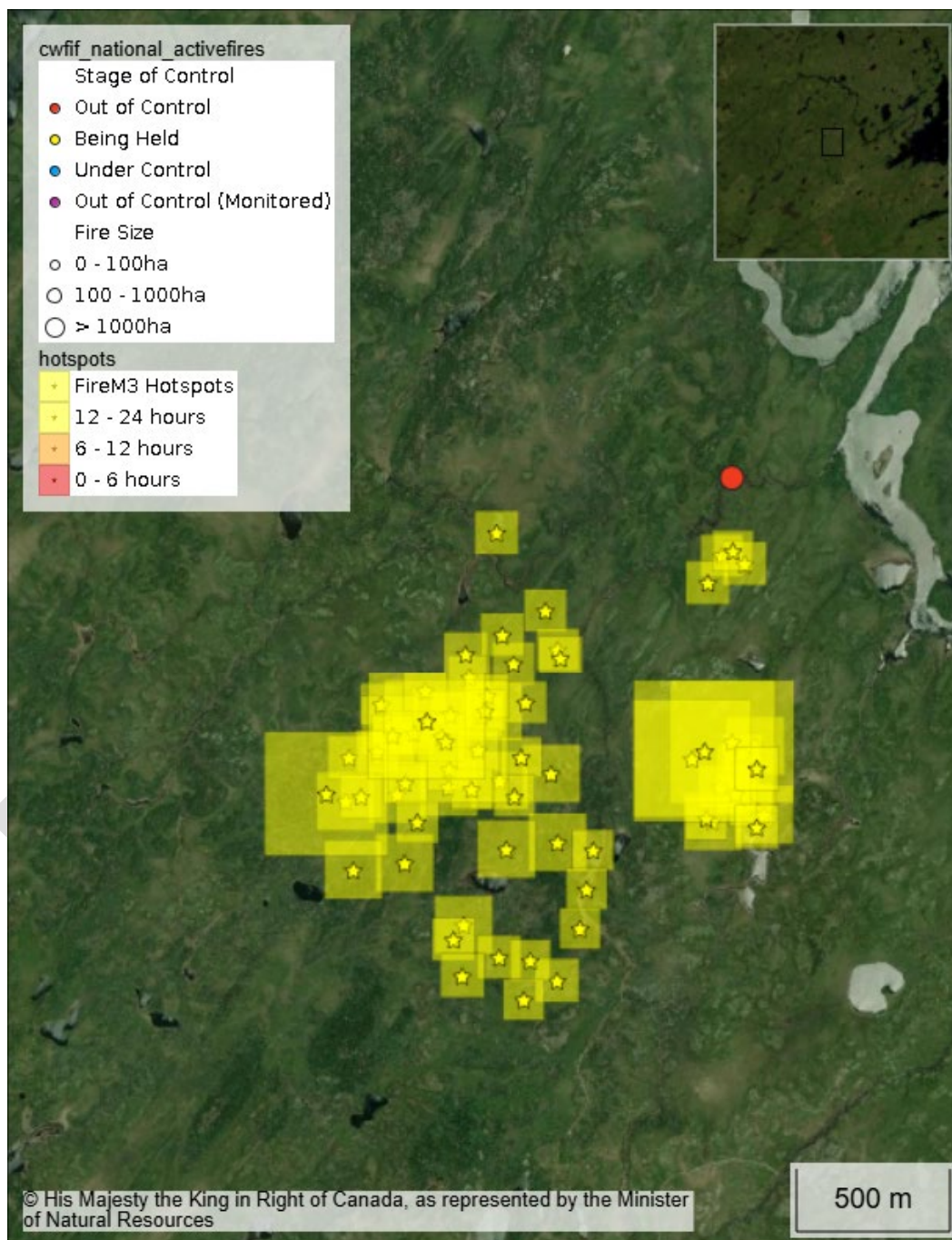


Figure 239. Satellite imagery of the wildland areas 210-255 km (130.5-158.4 mi) east of Wemindji, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 14, 2023, that resulted in the wildfire smoke-driven $PM_{2.5}$ episode in Hamilton County on June 17 and 19, 2023.

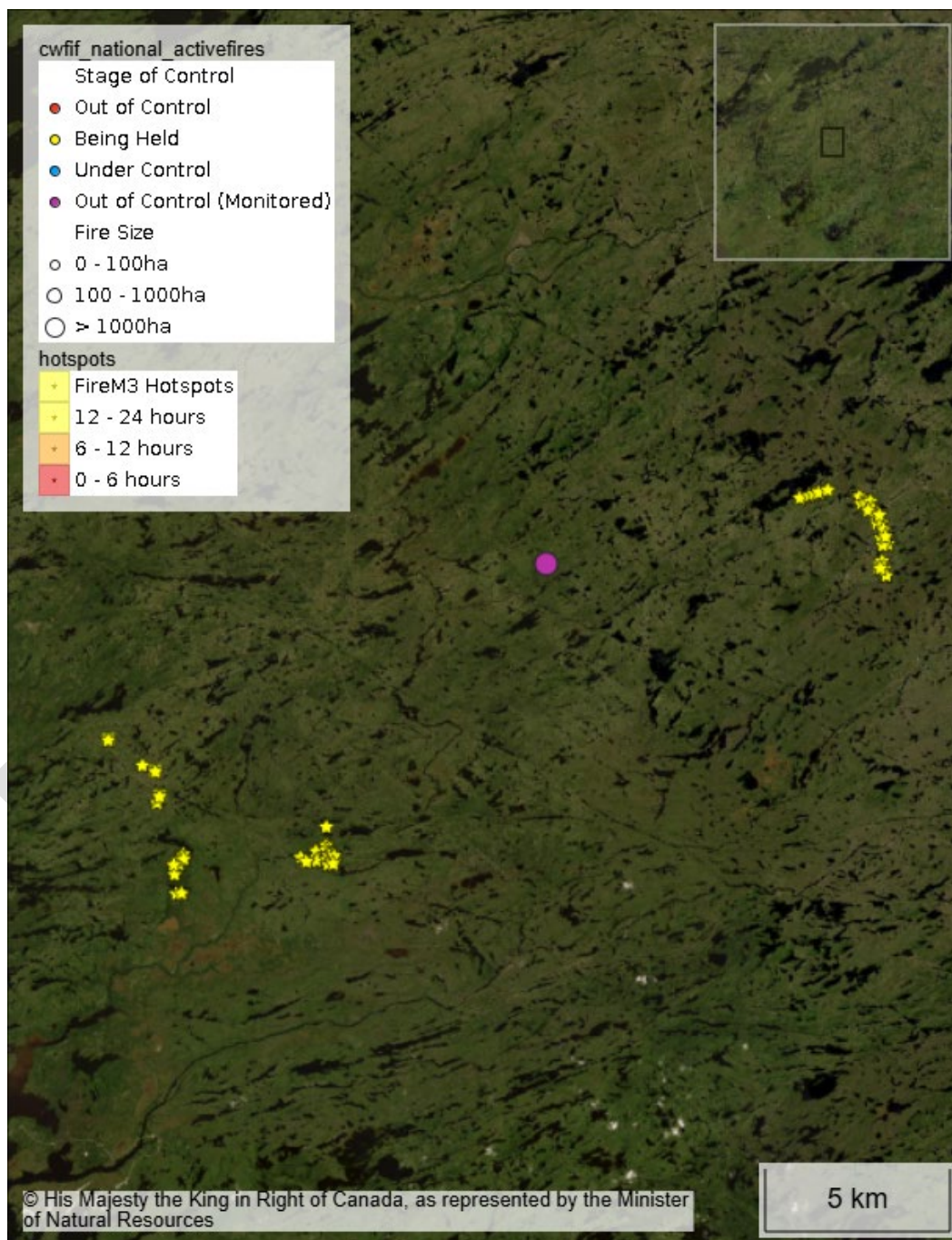


Figure 240. Satellite imagery of the wildland areas 195 km (121.2 mi) east of Wemindji, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 15, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 18, 2023.

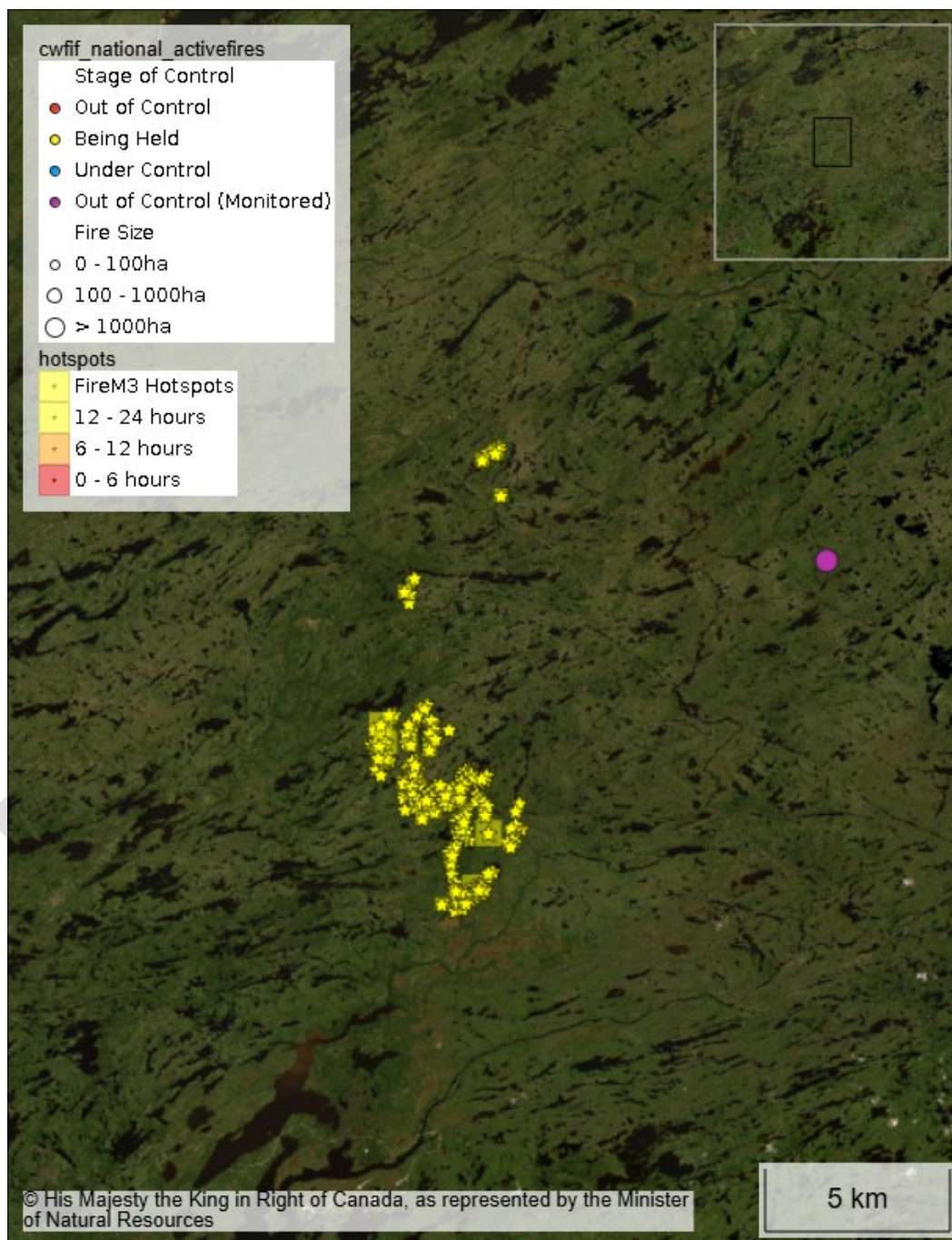


Figure 241. Satellite imagery of the wildland areas 50 km (31.1 mi) southeast of Matagami, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 24, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 27, 2023.

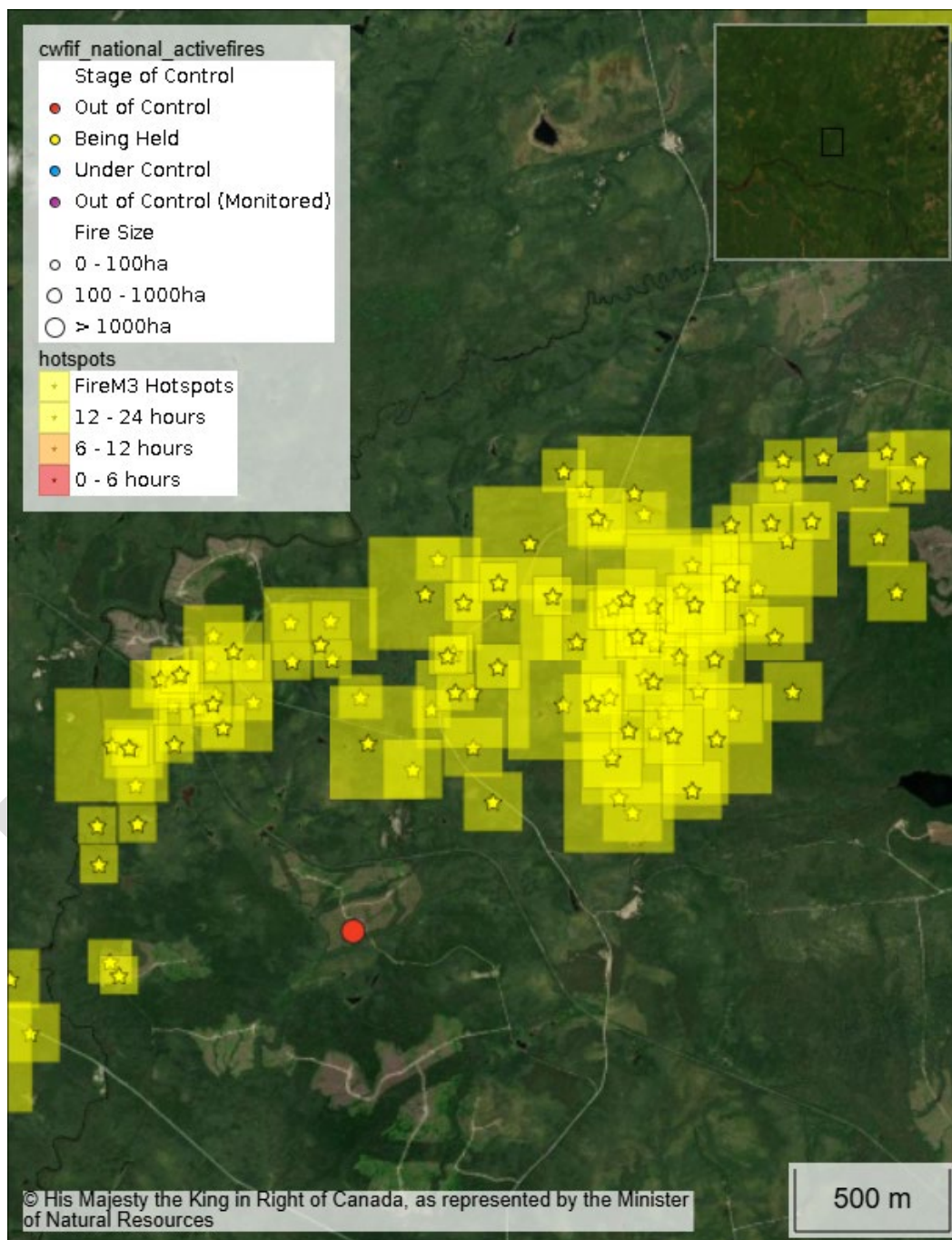


Figure 242. Satellite imagery of the wildland areas 55 km (34.2 mi) north-northeast of Chapais, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 25, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 28, 2023.

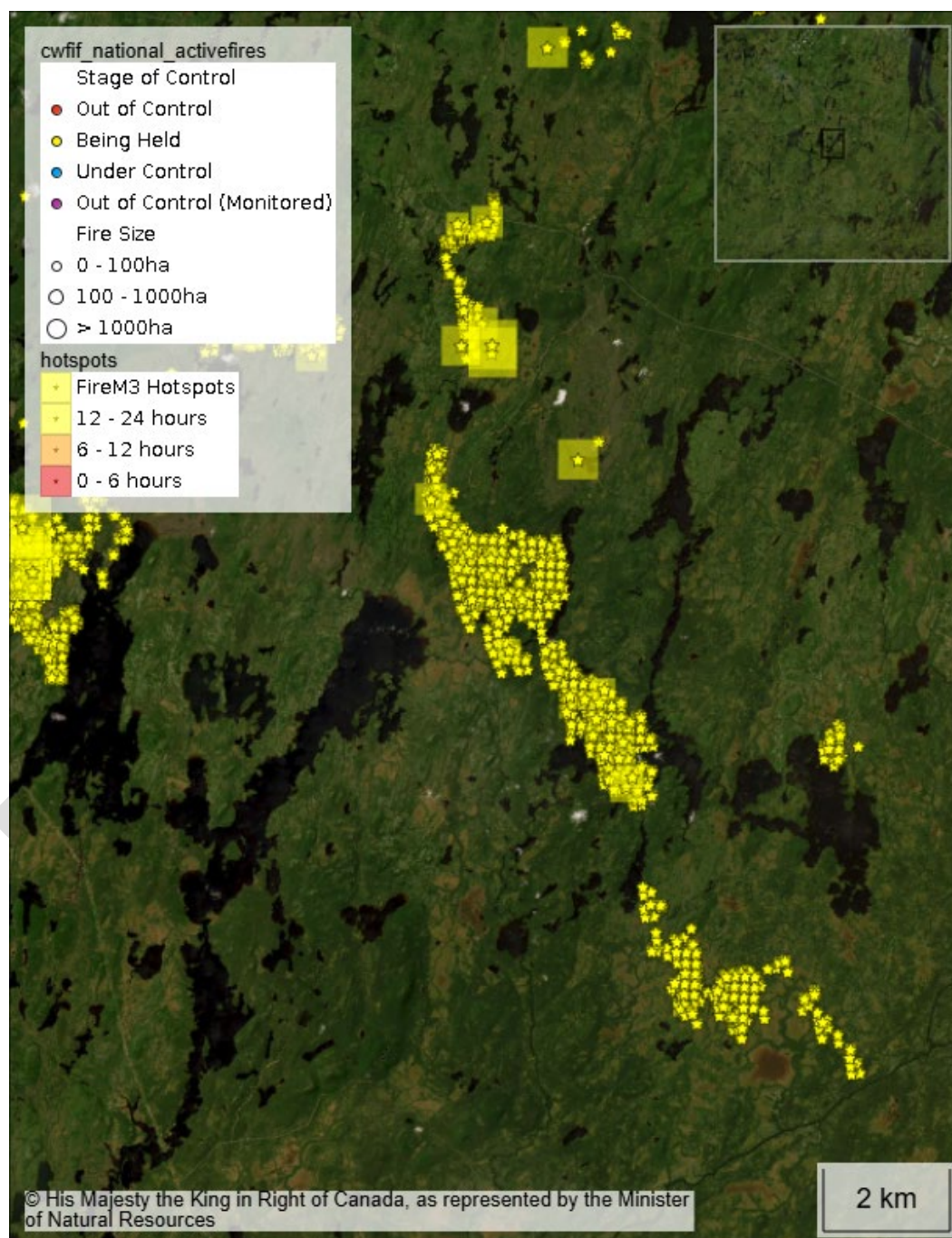


Figure 243. Satellite imagery of the wildland areas 90 km (55.9 mi) southwest of Chapais, Quebec, with circles and stars/squares respectively marking the active wildfires and recent hotspots on June 26, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on June 29, 2023.

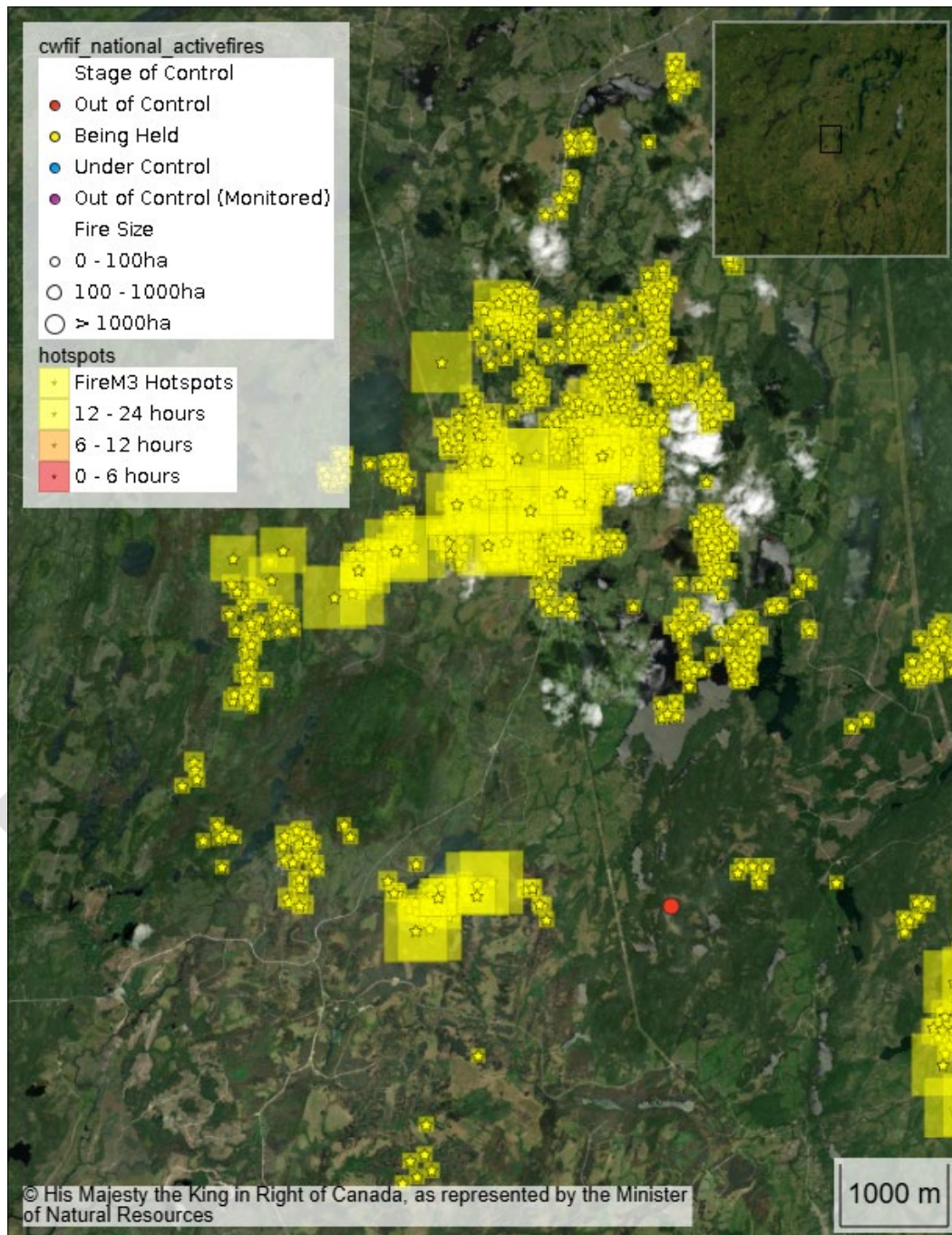


Figure 244. Satellite imagery of the wildland areas 75 km (46.6 mi) northeast of Garden Creek, Alberta, with circles and stars/squares respectively marking the active wildfires and recent hotspots on July 13, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on July 16, 2023.

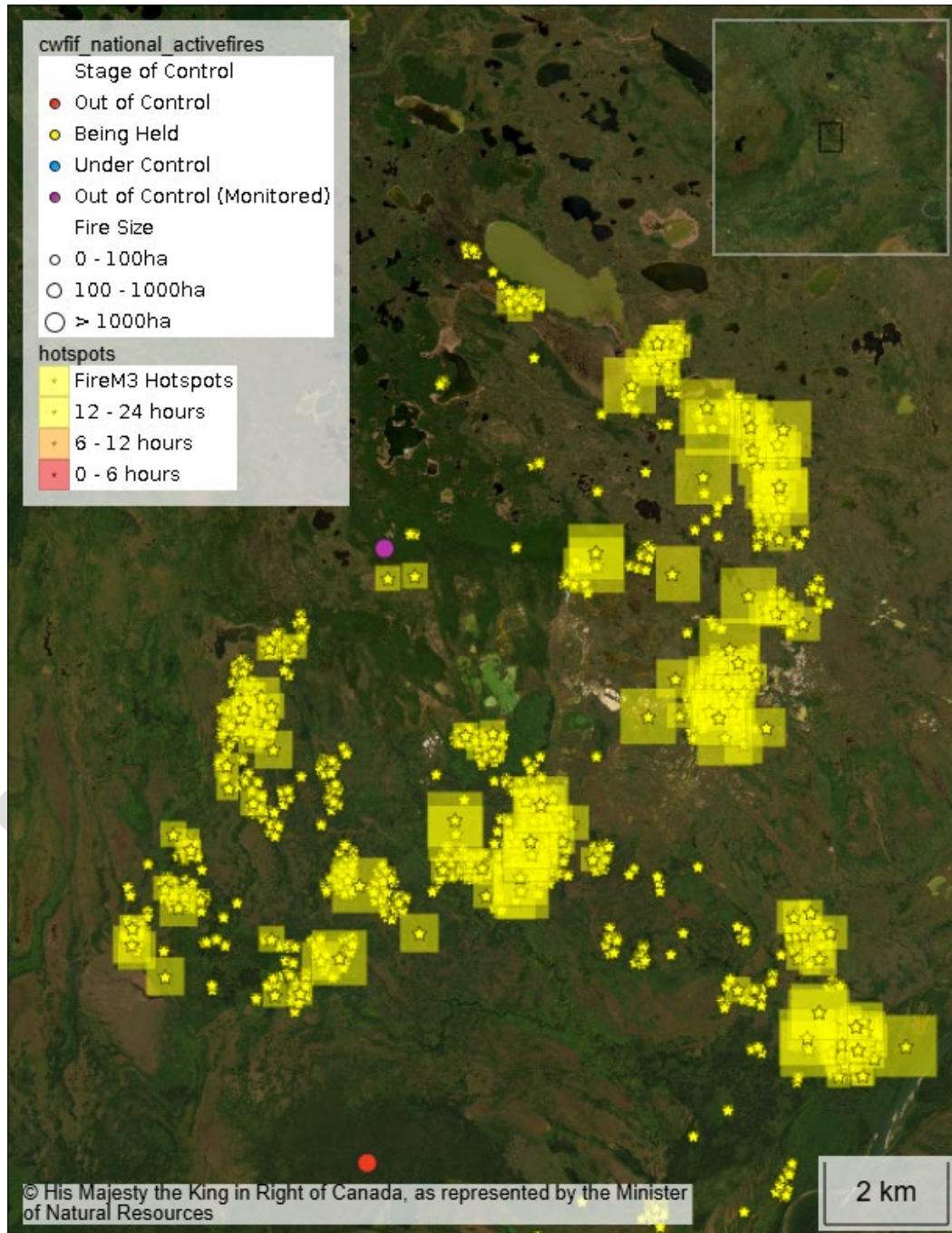


Figure 245. Satellite imagery of the wildland areas 35 km (21.7 mi) west of Peace Point, Alberta, with circles and stars/squares respectively marking the active wildfires and recent hotspots on July 12, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on July 17, 2023.

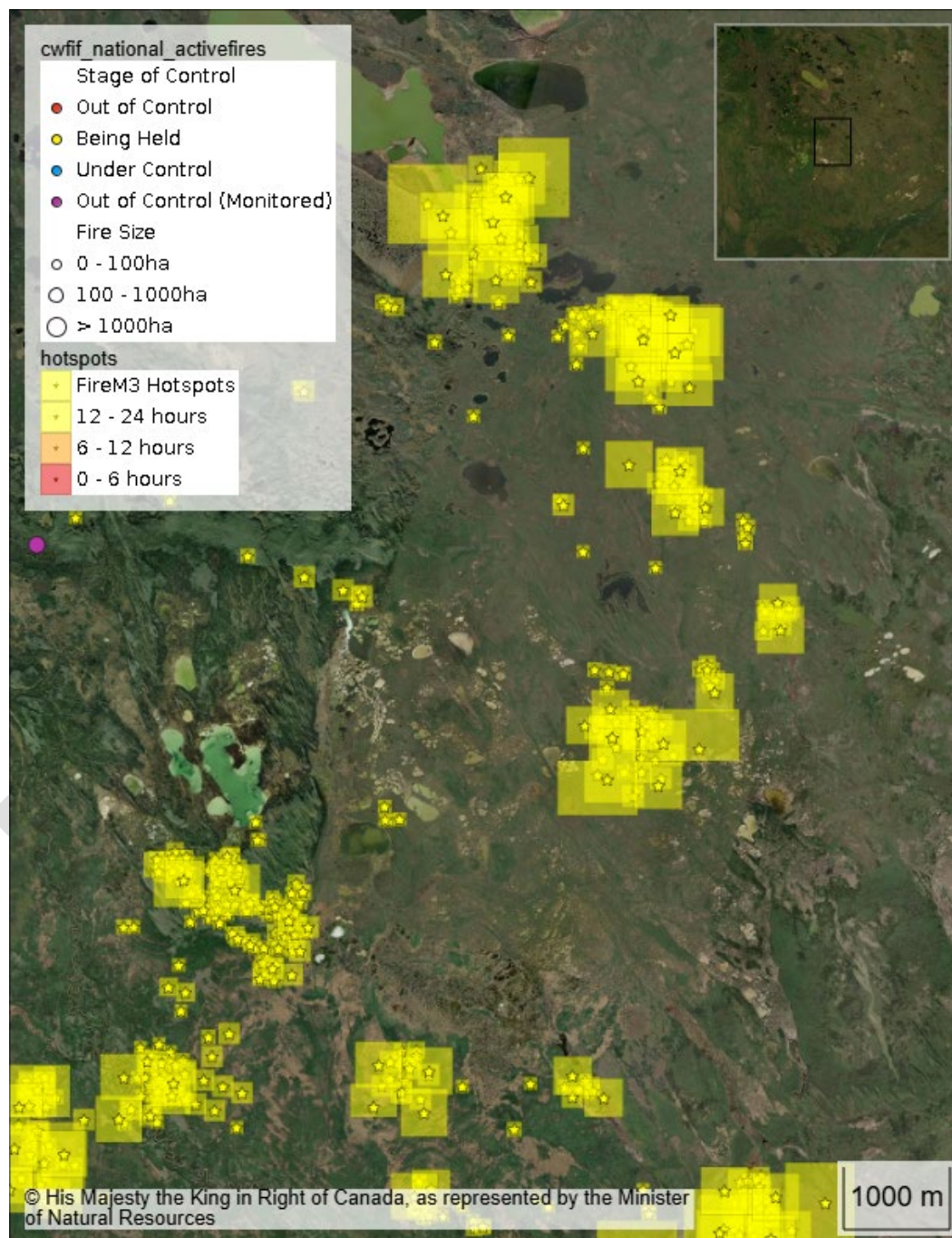


Figure 246. Satellite imagery of the wildland areas 25 km (15.5 mi) northwest of Grand Rapids, Manitoba, with circles and stars/squares respectively marking the active wildfires and recent hotspots on July 22, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on July 25, 2023.

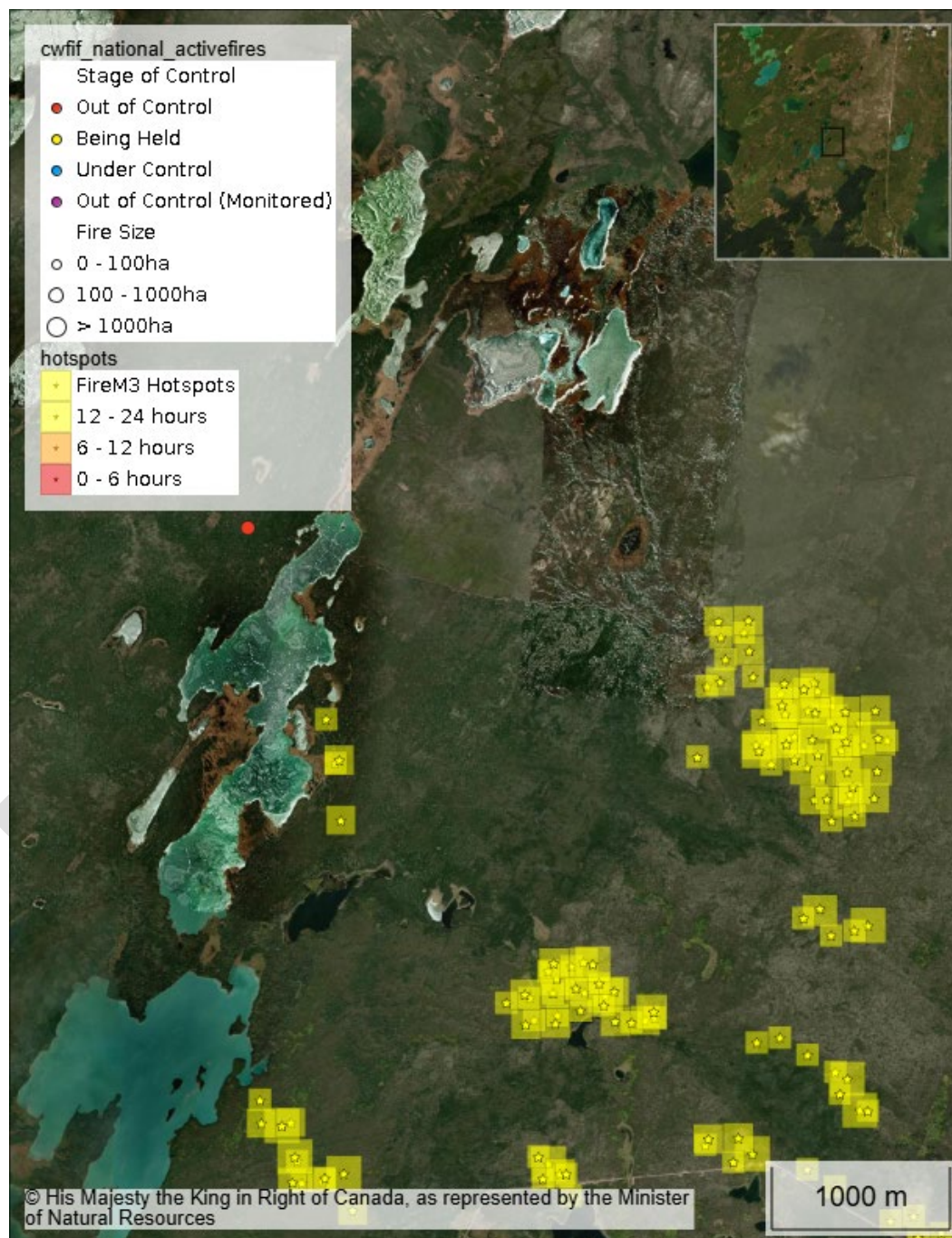
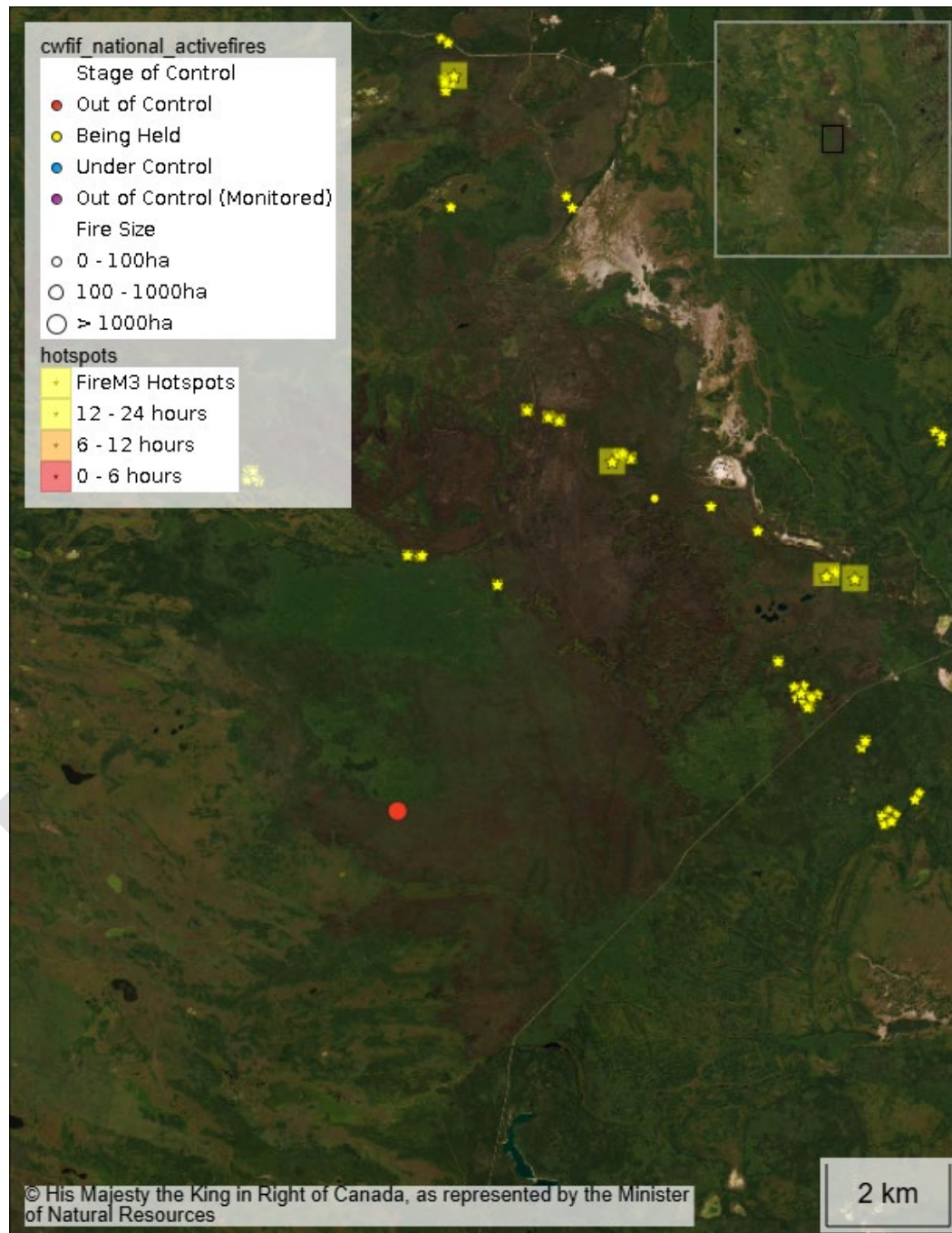


Figure 247. Satellite imagery of the wildland areas 40 km (24.9 mi) west-northwest of Fitzgerald, Alberta, with circles and stars/squares respectively marking the active wildfires and recent hotspots on August 16, 2023, that resulted in the wildfire smoke-driven PM_{2.5} episode in Hamilton County on August 19, 2023.



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 fires⁵². CIFCC⁵³ reported that on June 1, 2023, “a major lightning strike hit Quebec, igniting 182 forest fires in a single day”. Some of these wildfires ultimately led to the smoke plumes that impacted Hamilton County across June 2023. On June 10, 2023, OMNRF-AFFES informed CIFFC that eleven new fires started in the province the previous day, with the majority of these caused by lightning⁵⁴. On July 5, 2023, 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 conditions⁵⁵. On July 10, 2023, Alberta Wildfire informed CIFFC that an increased chance of lightning in central Alberta led to an expected increase in fire load over the next 24 hours⁵⁶. On July 25, 2023, Alberta Wildfire informed CIFFC of several new wildfires started by lightning over the previous few days, with more new starts expected over the next few days as well⁵⁷. On August 2, 2023, Parks Canada reported one new significant wildfire occurring in Wood Buffalo National Park⁵⁸. On August 12, 2023, Alberta Wildfire informed CIFFC that it was mobilizing more resources to assist with wildfires that were potentially threatening the communities of Fort Smith and Fitzgerald⁵⁹.

As the June, July, and August 2023 fires on wildlands 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

⁵² <https://natural-resources.canada.ca/our-natural-resources/forests/wildland-fires-insects-disturbances/forest-fires/fire-behaviour/13145>

⁵³ https://ciffc.ca/sites/default/files/2024-03/03.07.24_CIFFC_2023CanadaReport%20%281%29.pdf

⁵⁴ <https://ciffc.net/situation/2023-06-10>

⁵⁵ <https://ciffc.net/situation/2023-07-05>

⁵⁶ <https://ciffc.net/situation/2023-07-10>

⁵⁷ <https://ciffc.net/situation/2023-07-25>

⁵⁸ <https://ciffc.net/situation/2023-08-02>

⁵⁹ <https://ciffc.net/situation/2023-08-12>

August 2023 could not have been prevented and could not have been controlled by state or federal natural resources managers in the United States. The excessive wildfire smoke emissions in 2023 that contributed to monitored violations of the 2024 revised annual PM_{2.5} NAAQS at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County were caused by the wildfires and not the result of emissions from anthropogenic sources.

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

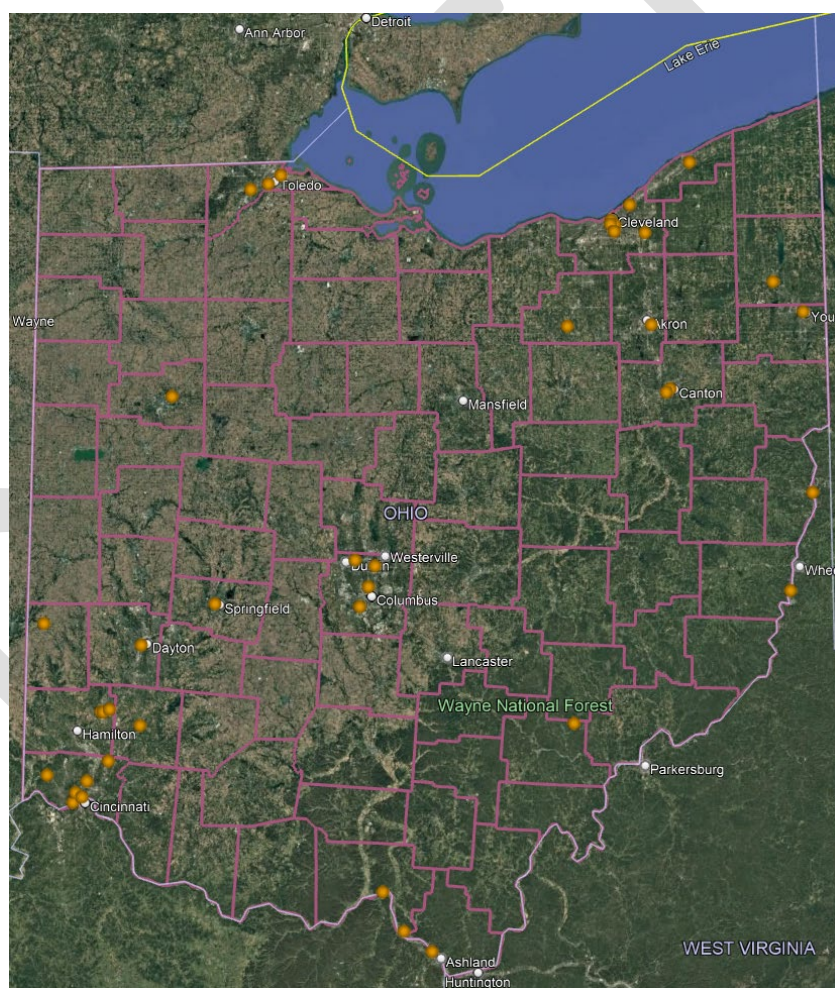
40 CFR 50.14(c)(3)(iv)(E) requires a demonstration that the event was a natural event or human activity that is unlikely to recur at a particular location, or that the event was a fireworks display consistent with 40 CFR 50.14(b)(2). 40 CFR 50.1(k) defines a natural event as “an event and its resulting 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 on wildlands across Canada. It has also been demonstrated that widespread Fourth of July holiday celebration-related fireworks displays generated smoke that impacted PM_{2.5} concentrations at the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on July 4-5 in both 2023 and 2025. Based on the documentation provided in this demonstration, the relevant June, July, and August 2023 events qualify as wildfires because lightning most likely caused these unplanned wildfire events. As these wildfire events occurred on wildlands and were caused by lightning, they were natural and should be considered for treatment as exceptional events.

6. Public Notification

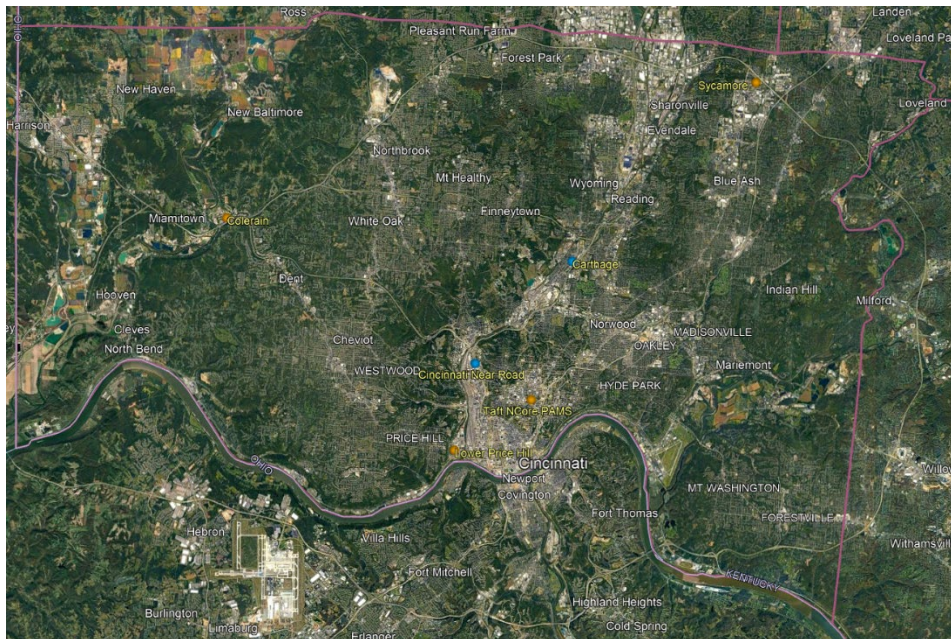
Ohio EPA maintains a public alert system as well as publicly available information via the Ohio EPA website⁶⁰ to keep residents informed of potential wildfire smoke impacts. As required by 40 CFR Part 58, Appendix D, Ohio EPA and partner public health and air pollution control agencies in the state install, operate, and maintain a network of instruments to measure ambient air quality at monitoring sites across the state. Figures 248 and 249 show the locations of active and recently active PM_{2.5} monitoring sites in the state of Ohio and in Hamilton County, respectively.

Figure 248. Map of active and recently active PM_{2.5} monitoring sites in the state of Ohio.



⁶⁰ <https://epa.ohio.gov>

Figure 249. Map of active and recently active PM_{2.5} monitoring sites in Hamilton County.



The Carthage (39-061-0014) and Cincinnati Near Road (39-061-0048) monitoring sites in Hamilton County were operational and collected ambient PM_{2.5} measurements throughout 2023 and 2025, including during the eight PM_{2.5} episodes detailed in this demonstration. Ohio EPA reported these data in real time to U.S. EPA for inclusion in the AirNow⁶¹ 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 PM_{2.5} ambient concentration data from the Carthage and Cincinnati Near Road monitoring sites in Hamilton County were also publicly accessible through the Ohio EPA Division of Air Pollution Control website⁶².

Data collected from the network of monitoring sites are used by Ohio EPA and partner agencies, such as metropolitan planning organizations, public health departments, and local air pollution control agencies, such as the Southwest Ohio Air Quality Agency (SWOAQA)⁶³, to

⁶¹ <https://www.airnow.gov>

⁶² <https://epa.ohio.gov/divisions-and-offices/air-pollution-control/reports-and-data/airohio-air-monitoring-data>

⁶³ <https://www.southwestohioair.org>

notify the public when air pollution may reach levels that are potentially harmful to public health. Table 44 lists the public notices issued by Ohio EPA and other agencies regarding the wildfire smoke-driven PM_{2.5} episode that impacted Hamilton County from June 4-10, 2023. Table 45 lists the public notices issued by Ohio EPA and other agencies regarding the wildfire smoke-driven PM_{2.5} episodes that impacted Hamilton County from June 15-19 and June 27-29 in 2023. Table 46 lists the public notices issued by Ohio EPA and other agencies regarding the wildfire smoke-driven PM_{2.5} episodes that impacted Hamilton County on July 16-17 and July 25 in 2023.

Table 44. Public notices issued regarding the wildfire smoke-driven PM_{2.5} episode that impacted Hamilton County from June 4-10, 2023.

Date Issued	Date(s) Covered	Issued By	Included Counties	Type of Notice
June 2, 2023	June 3-4, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁶⁴
June 6, 2023	June 7, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁶⁵
June 7, 2023	June 7, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory ⁶⁶
June 7, 2023	June 8-9, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁶⁷
June 8, 2023	June 8, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory ⁶⁸
June 9, 2023	June 10, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁶⁹

⁶⁴ <https://x.com/SWOHioAir/status/1664729916884107267>

⁶⁵ <https://x.com/swohioair/status/1666161967046836225>

⁶⁶ <https://web.archive.org/web/20230608201943/https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory>

⁶⁷ <https://x.com/swohioair/status/1666518746008002573>

⁶⁸ <https://web.archive.org/web/20230608200152/https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory-june-8>

⁶⁹ <https://x.com/swohioair/status/1667247062449115144>

Table 45. Public notices issued regarding the wildfire smoke-driven PM_{2.5} episodes that impacted Hamilton County from June 15-19 and June 27-29, 2023.

Date Issued	Date(s) Covered	Issued By	Included Counties	Type of Notice
June 16, 2023	June 17-18, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁷⁰
June 27, 2023	June 28, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁷¹
June 28, 2023	June 28, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory ⁷²
June 28, 2023	June 29, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁷³
June 29, 2023	June 29, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory ⁷⁴
June 29, 2023	June 30, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁷⁵

⁷⁰ <https://x.com/swohioair/status/1669792826308042758>

⁷¹ <https://x.com/swohioair/status/1673776014034366470>

⁷² <https://web.archive.org/web/20230701093314/https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory-june-28>

⁷³ <https://x.com/swohioair/status/1674128660763140096>

⁷⁴ <https://web.archive.org/web/20230701092911/https://epa.ohio.gov/about/media-center/news/statewide-air-quality-advisory-june-29>

⁷⁵ <https://x.com/swohioair/status/1674491235808034816>

Table 46. Public notices issued regarding the wildfire smoke-driven PM_{2.5} episodes that impacted Hamilton County on July 16-17, and July 25, 2023.

Date Issued	Date(s) Covered	Issued By	Included Counties	Type of Notice
July 15, 2023	July 16-17, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁷⁶
July 17, 2023	July 17, 2023	Ohio EPA	ALL (Statewide)	Statewide Air Quality Advisory ⁷⁷
July 25, 2023	July 26, 2023	SWOAQA	Butler, Clermont, Clinton, Hamilton, Warren	Air Quality Alert ⁷⁸

⁷⁶ <https://x.com/swohioair/status/1680288381895335936>

⁷⁷ <https://x.com/OhioEPA/status/1680938180428591109>

⁷⁸ <https://x.com/swohioair/status/1683914230943059968>

7. Public Participation

In accordance with the requirements of 40 CFR 50.14(c)(2)(i), on August 13, 2026, 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 Hamilton County is included as Appendix A. Ohio published solicitation for public comment concerning the draft Exceptional Events Demonstration for 2023 and 2025 PM_{2.5} Episodes in Hamilton County, OH on September 17, 2026. The public comment period closed on October 19, 2026. 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 the Carthage (39-061-0014) and Cincinnati Near Road (39-061-0048) monitoring sites in Hamilton County, Ohio on June 4, June 5, June 6, June 7, June 8, June 15, June 16, June 17, June 18, June 19, June 27, June 28, June 29, July 16, July 17, and July 25 in 2023. This exceptional events demonstration also shows that wildfires in Canada adversely affected ambient PM_{2.5} concentrations measured by the Carthage monitoring site in Hamilton County on June 9, June 10, and August 19 in 2023. Additionally, this exceptional events demonstration shows that smoke from Fourth of July holiday celebration-related fireworks displays adversely affected ambient PM_{2.5} concentrations measured by the Carthage and Cincinnati Near Road monitoring sites in Hamilton County on July 4-5 in both 2023 and 2025. The ambient PM_{2.5} concentrations measured at the Carthage (39-061-0014) monitoring site in Hamilton County on the 23 identified dates have been shown to have contributed to a monitored violation of the 2024 annual PM_{2.5} NAAQS, and it has been demonstrated that the exclusion of the ambient PM_{2.5} concentrations measured at the Carthage monitoring site on these 23 dates would result in a 2023-2025 annual PM_{2.5} design value that is at or below the 2024 annual PM_{2.5} NAAQS value of 9.0 µg/m³, which will help preclude Hamilton County from being designated a nonattainment area for the 2024 annual PM_{2.5} NAAQS, proving regulatory significance. Therefore, Ohio EPA requests that U.S. EPA exclude the PM_{2.5} data from the two identified dates in 2025 (July 4 and July 5) and the 21 identified dates in 2023 (June 4, June 5, June 6, June 7, June 8, June 9, June 10, June 15, June 16, June 17, June 18, June 19, June 27, June 28, June 29, July 4, July 5, July 16, July 17, July 25, and August 19) from the Carthage (39-061-0014) monitoring site in Hamilton County, Ohio from regulatory determinations, including calculations of annual PM_{2.5} design values, due to the influence of exceptional events, namely Canadian wildfire smoke or smoke from Fourth of July holiday celebration-related fireworks displays, on the monitored PM_{2.5} concentrations during those 23 dates. Similarly, the ambient PM_{2.5} concentrations measured at the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County on the 20 identified dates have been shown to have contributed to a monitored violation of the 2024 annual PM_{2.5} NAAQS, and it has been demonstrated that the exclusion of the ambient PM_{2.5} concentrations measured at the Cincinnati Near Road monitoring site on these 20 dates would result in a 2023-2025 annual PM_{2.5} design value that is at or below the 2024 annual PM_{2.5} NAAQS value of 9.0 µg/m³, which will help preclude Hamilton County from being designated a nonattainment area for the 2024 annual PM_{2.5} NAAQS, proving regulatory significance.

Therefore, Ohio EPA also requests that U.S. EPA exclude the PM_{2.5} data from the two identified dates in 2025 (July 4 and July 5) and the 18 identified dates in 2023 (June 4, June 5, June 6, June 7, June 8, June 15, June 16, June 17, June 18, June 19, June 27, June 28, June 29, July 4, July 5, July 16, July 17, and July 25) from the Cincinnati Near Road (39-061-0048) monitoring site in Hamilton County, Ohio from regulatory determinations, including calculations of annual PM_{2.5} design values, due to the influence of exceptional events, namely Canadian wildfire smoke or smoke from Fourth of July holiday celebration-related fireworks displays, on the monitored PM_{2.5} concentrations during those 20 dates.

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 and smoke from Fourth of July holiday celebration-related fireworks displays had significant adverse impacts on ambient PM_{2.5} concentrations measured at the Carthage (39-061-0014) and Cincinnati Near Road (39-061-0048) monitoring sites in Hamilton County, Ohio on the identified dates.