

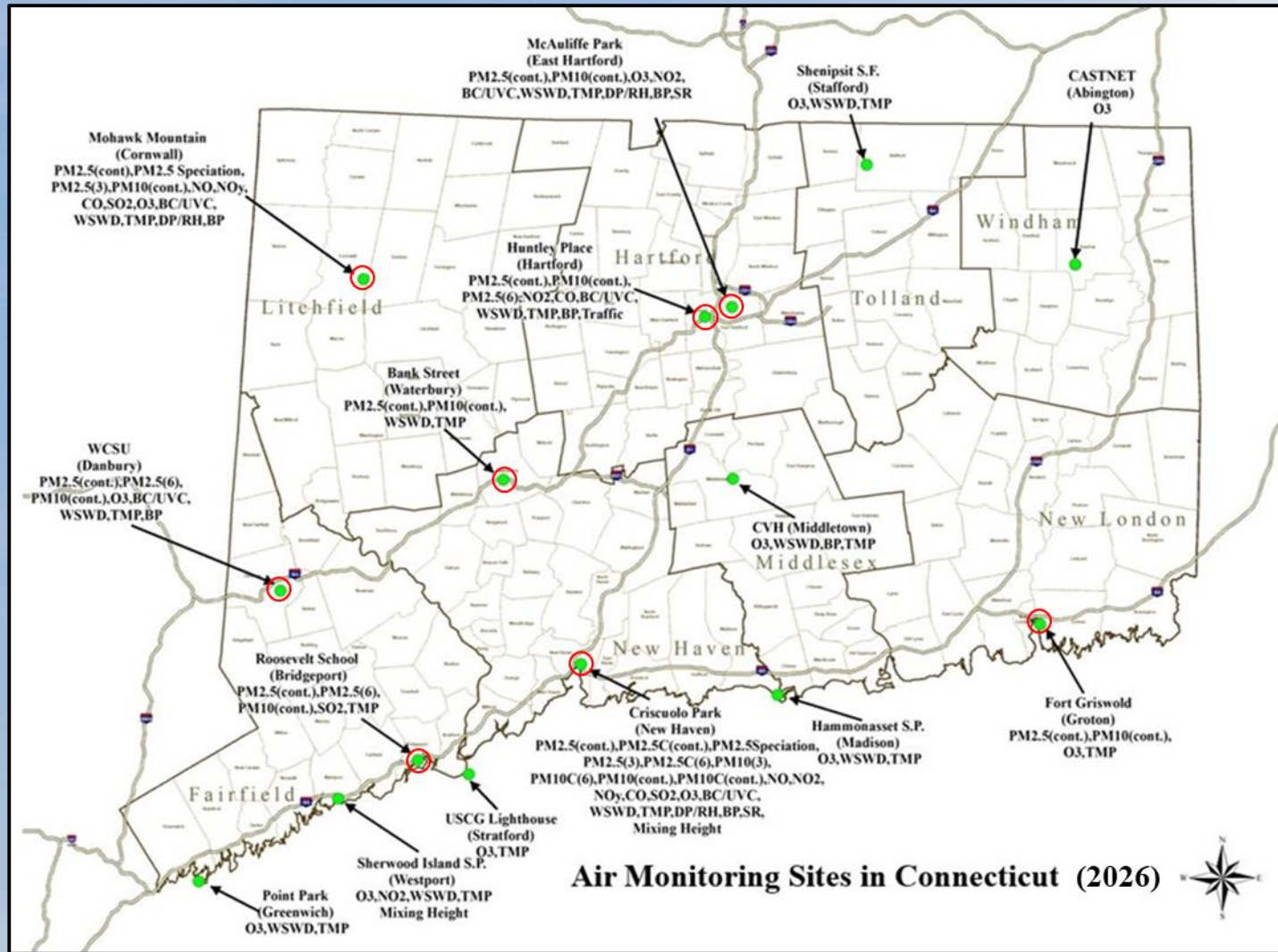
Tracking and Analyzing Smoke Plumes Using Satellite Data

Session 2A: Tracking Air Pollution Under Smoke and Dust with Satellite Data

HAQAST Madison

May 13 -14, 2026

Connecticut PM_{2.5} Monitoring Sites



- Connecticut has 12 monitoring sites across the state with 8 PM_{2.5} sites.
 - Each monitor measures a variety of pollutants and meteorological parameters.
- Red circles highlight PM_{2.5} monitor locations.

2023 Significant Smoke Days

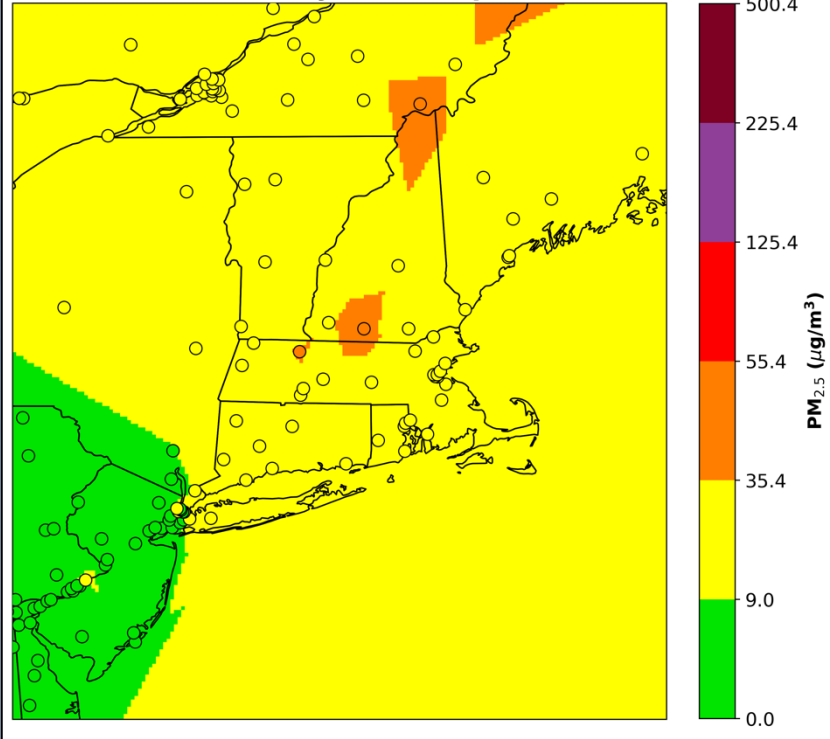
Month	June				July	October	
Site	6	7	8	30	1	1	Exceedances
Bridgeport	84	167	94	60	48	16	5
Cornwall	74	101	72	74	50	12	5
Danbury	72	131	66	48	45	15	5
East Hartford	57	75	71	46	46	M	5
Groton	60	68	77	39	33	41	5
Hartford	61	77	73	47	45	23	5
New Haven	66	129	82	51	40	28	5
Waterbury	60	98	73	50	51	16	5
Site Exceedances	8	8	8	8	7	1	40
# days > Federal Standard	1	2	3	4	5	6	

- Unhealthy for Sensitive Groups (USG) means air pollution levels are high enough to cause health issues for vulnerable people, like those with asthma, young children, and older adults.

Good (0 - 9.0 $\mu\text{g}/\text{m}^3$)
Moderate (9.1 - 35.4 $\mu\text{g}/\text{m}^3$)
Unhealthy for Sensitive Groups (35.5 - 55.4 $\mu\text{g}/\text{m}^3$)
Unhealthy (55.5 - 125.4 $\mu\text{g}/\text{m}^3$)
Very Unhealthy (125.5 - 225.4 $\mu\text{g}/\text{m}^3$)

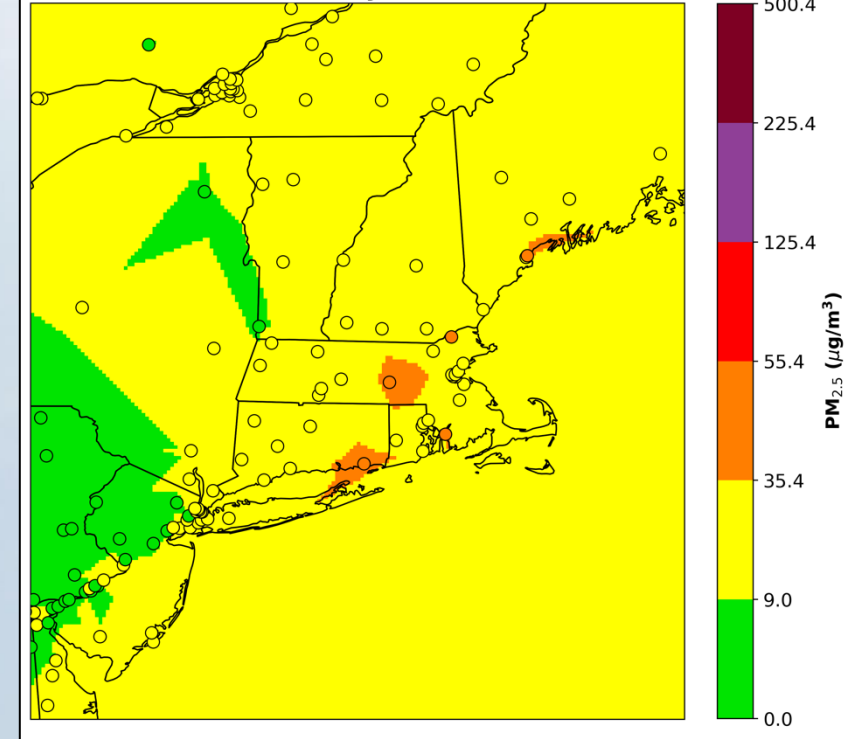
AirNow Daily PM_{2.5} Observations

AirNow Daily PM_{2.5}: September 30, 2023



- Range of **MODERATE** PM_{2.5} levels in Connecticut on both days with **USG** for Groton on October 1st.
- Mostly **MODERATE** PM_{2.5} for the remainder of New England with a few monitors reaching **USG** each day.

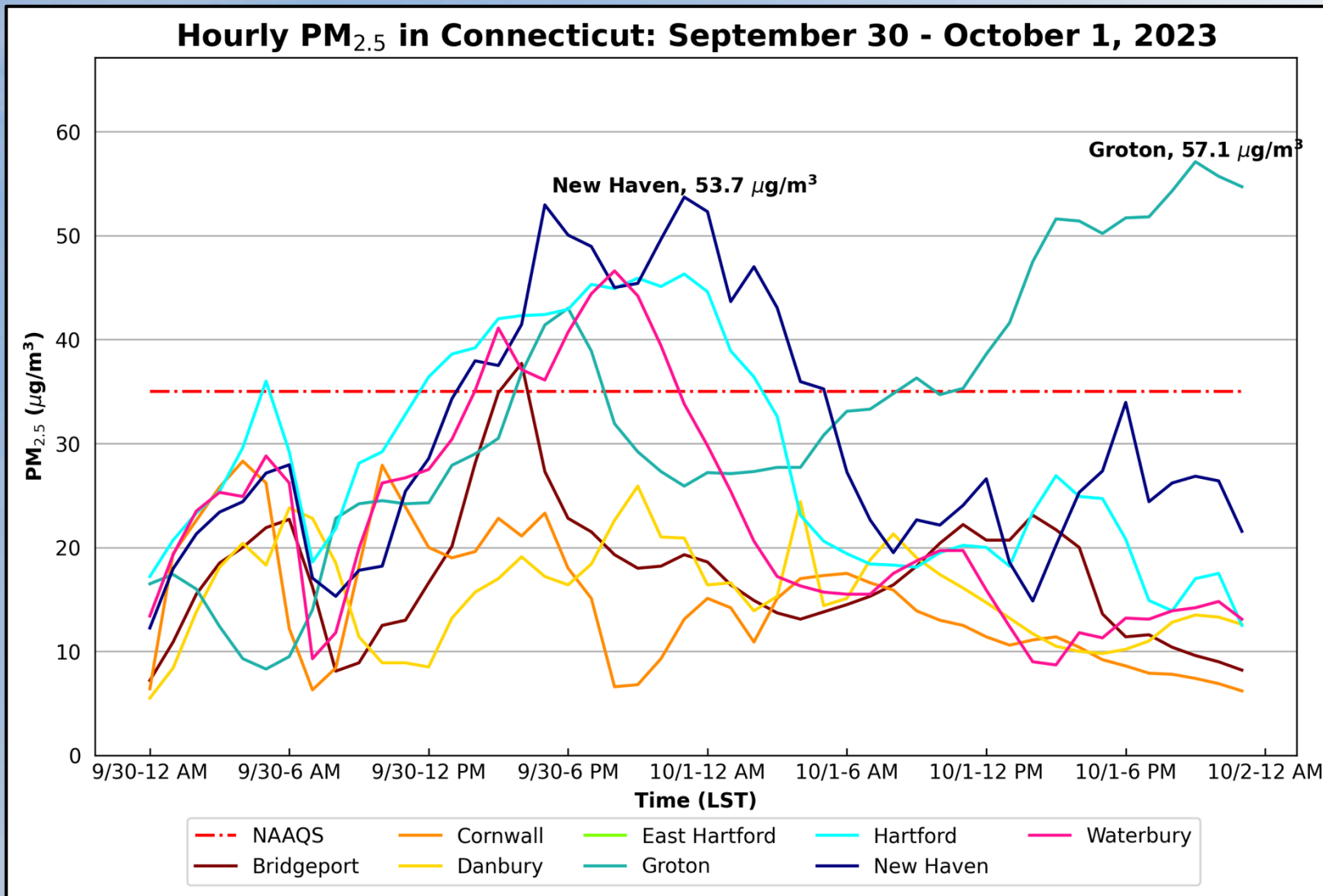
AirNow Daily PM_{2.5}: October 1, 2023



Date (LST)	Site	Site AQS	Daily Average PM _{2.5} (µg/m ³)
10/1/2023	Groton	90110124	40.8
10/1/2023	New Haven	90090027	27.5
10/1/2023	Hartford	90030025	22.7
10/1/2023	Waterbury	90092123	15.9
10/1/2023	Bridgeport	90010010	15.7
10/1/2023	Danbury	90011123	14.6
10/1/2023	Cornwall	90050005	11.9

Date (LST)	Site	Site AQS	Daily Average PM _{2.5} (µg/m ³)
9/30/2023	Hartford	90030025	34.3
9/30/2023	New Haven	90090027	31.0
9/30/2023	Waterbury	90092123	29.6
9/30/2023	Groton	90110124	24.3
9/30/2023	Bridgeport	90010010	19.1
9/30/2023	Cornwall	90050005	17.5
9/30/2023	Danbury	90011123	16.4

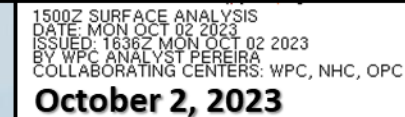
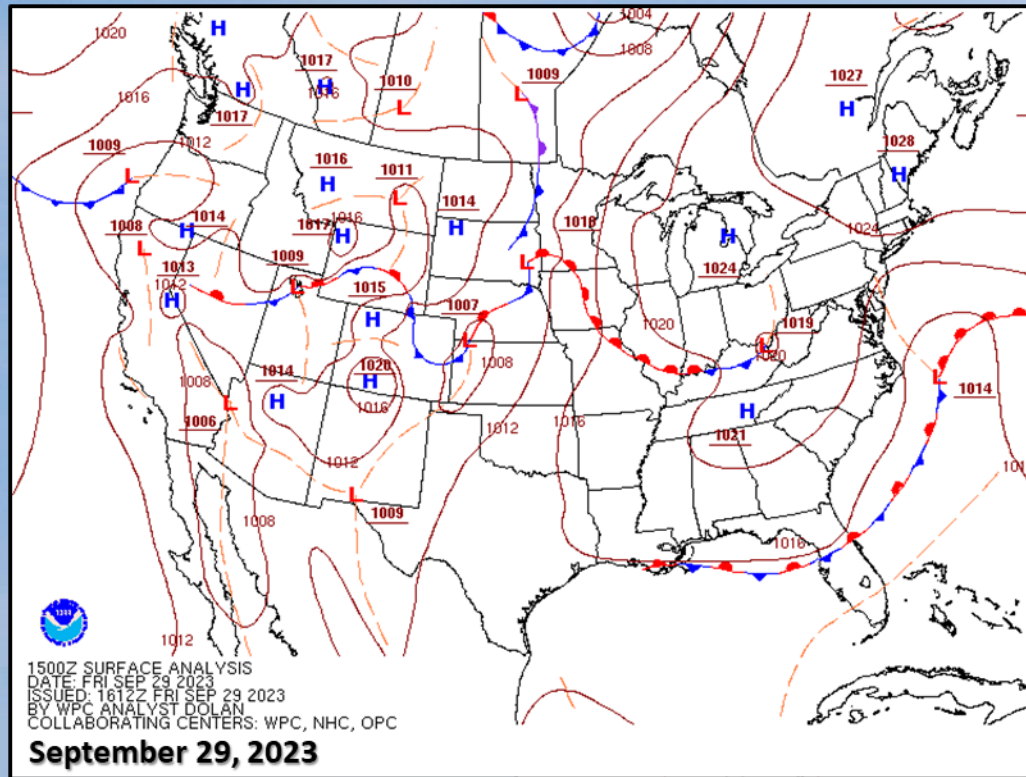
Hourly PM_{2.5} in Connecticut



- PM_{2.5} levels spiked to **USG** levels on September 30th and began decreasing in the afternoon, evening and overnight.
- Groton PM_{2.5} levels increased during most of the day on October 1st.

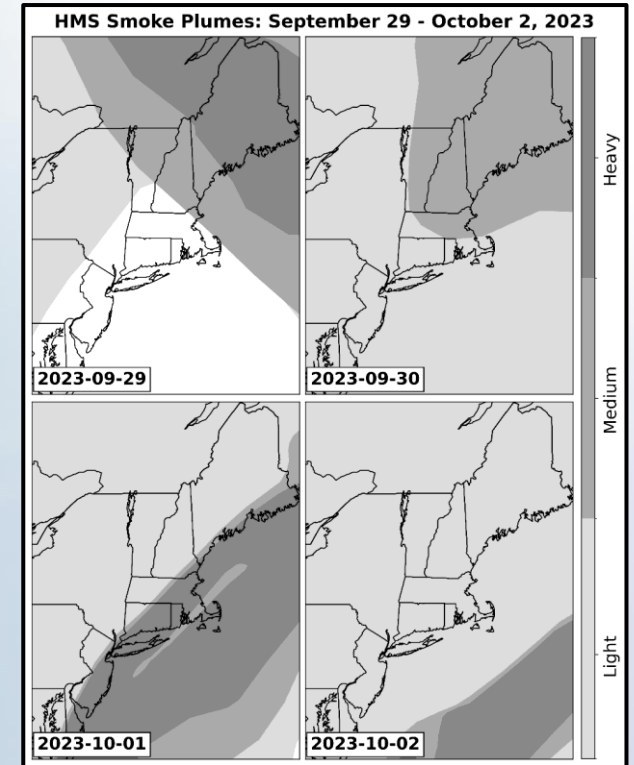
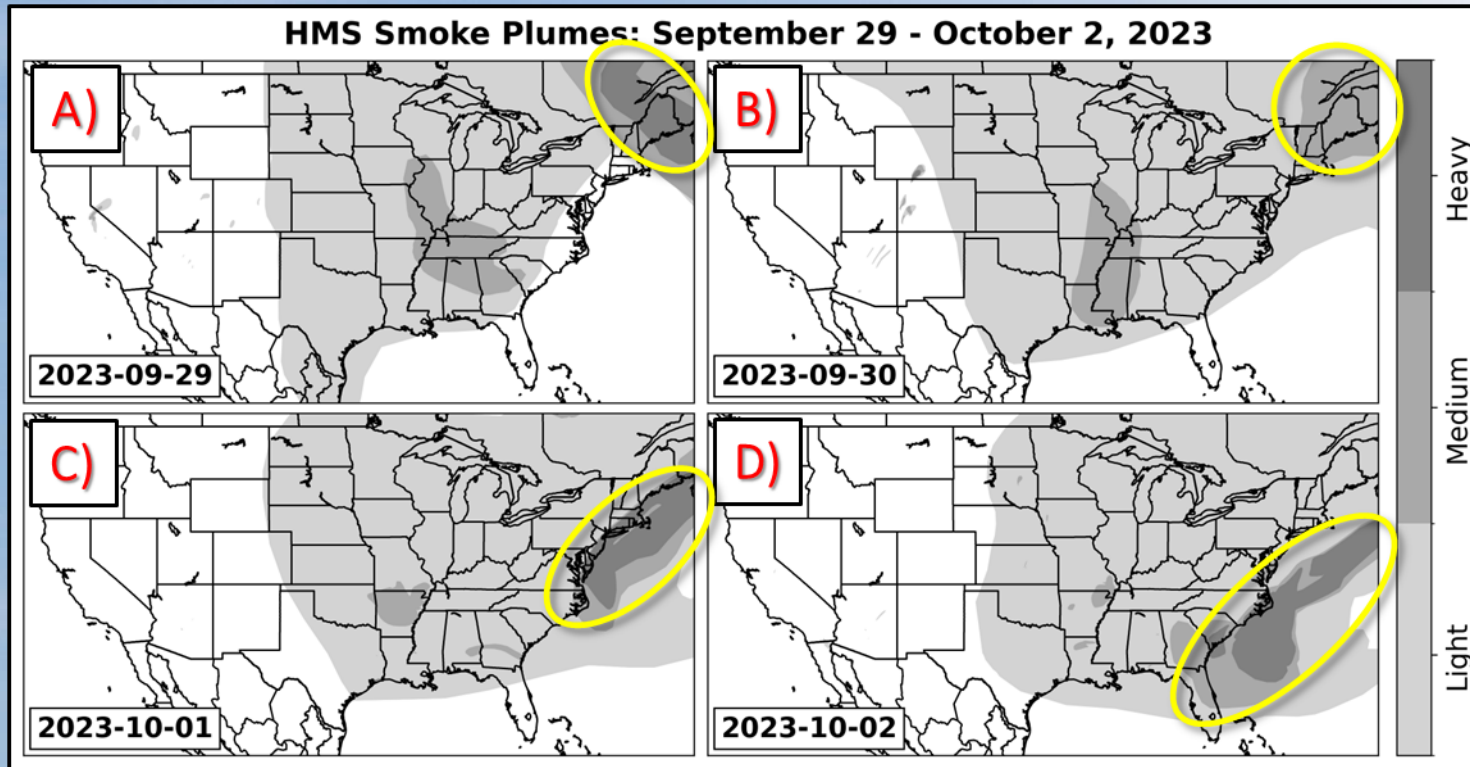
Surface Analysis Maps

- Low pressure offshore moves northward and then further offshore as the high pressure system over New England builds into the Great Lakes/Mid-Atlantic region.



- High pressure generally remains over the eastern US on each of these days.

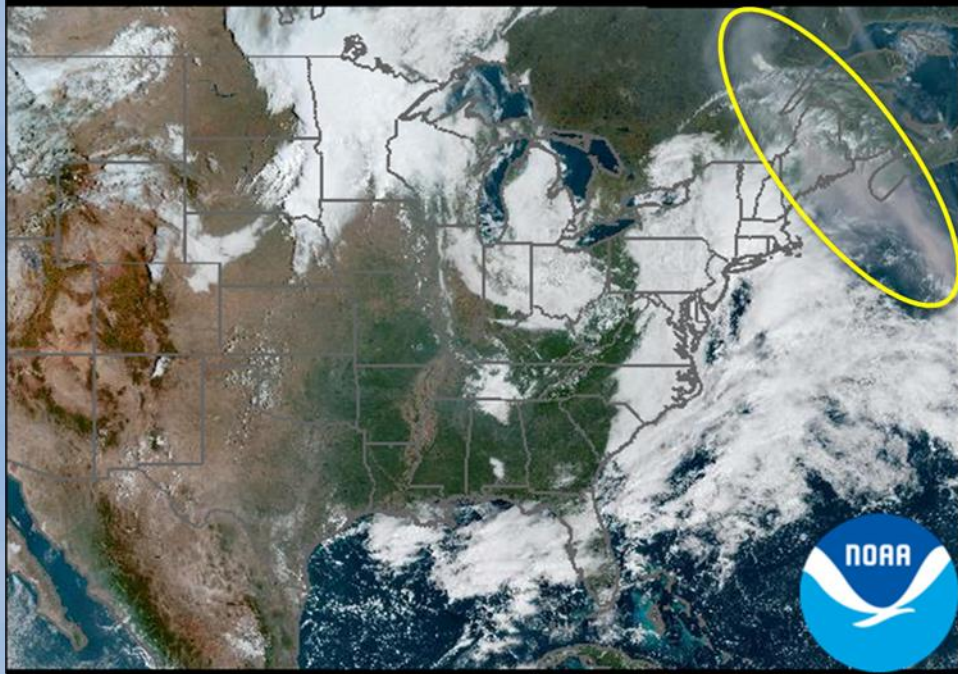
Hazard Mapping System (HMS) Smoke Plumes



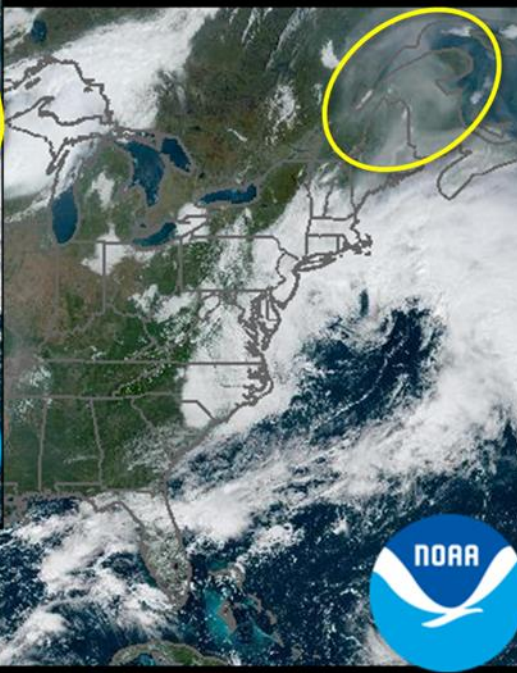
- Generally, the light smoke plume remains over the eastern US on all four days.
- The medium to heavy smoke plume over northern New England on September 29th and 30th is transported to coastal areas in New England and the Mid-Atlantic region on October 1st and offshore and to the southeast by October 2nd.

GOES-East GeoColor Imagery: Smoke Transport

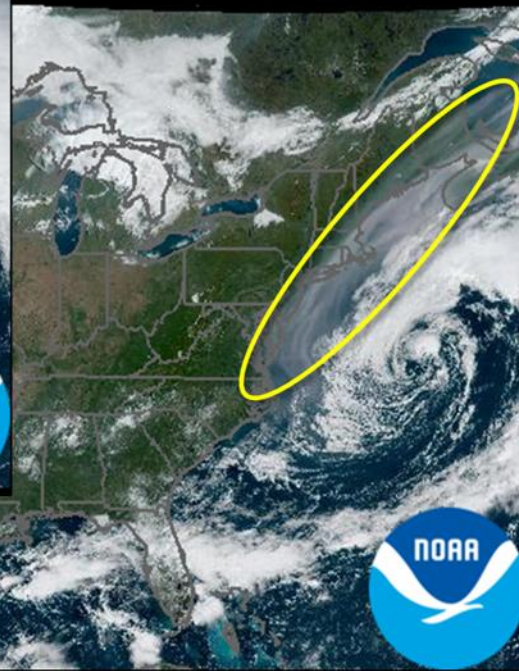
20230929 1501 September 29, 2023 - 11:01 AM



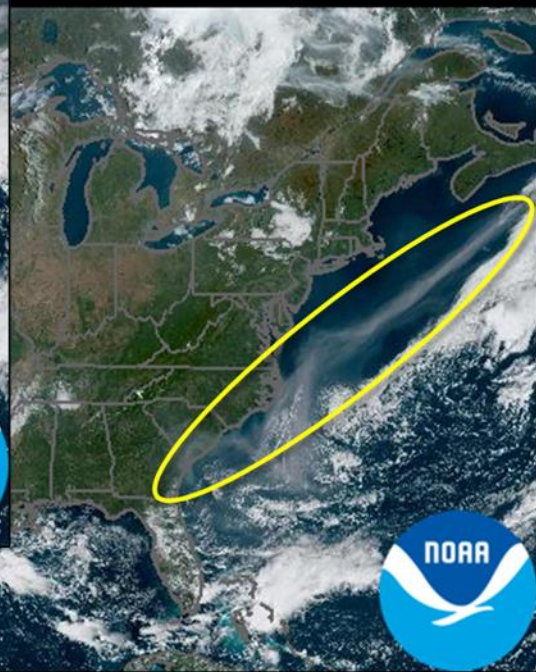
September 30, 2023 - 11:01 AM



October 1, 2023 - 11:01 AM

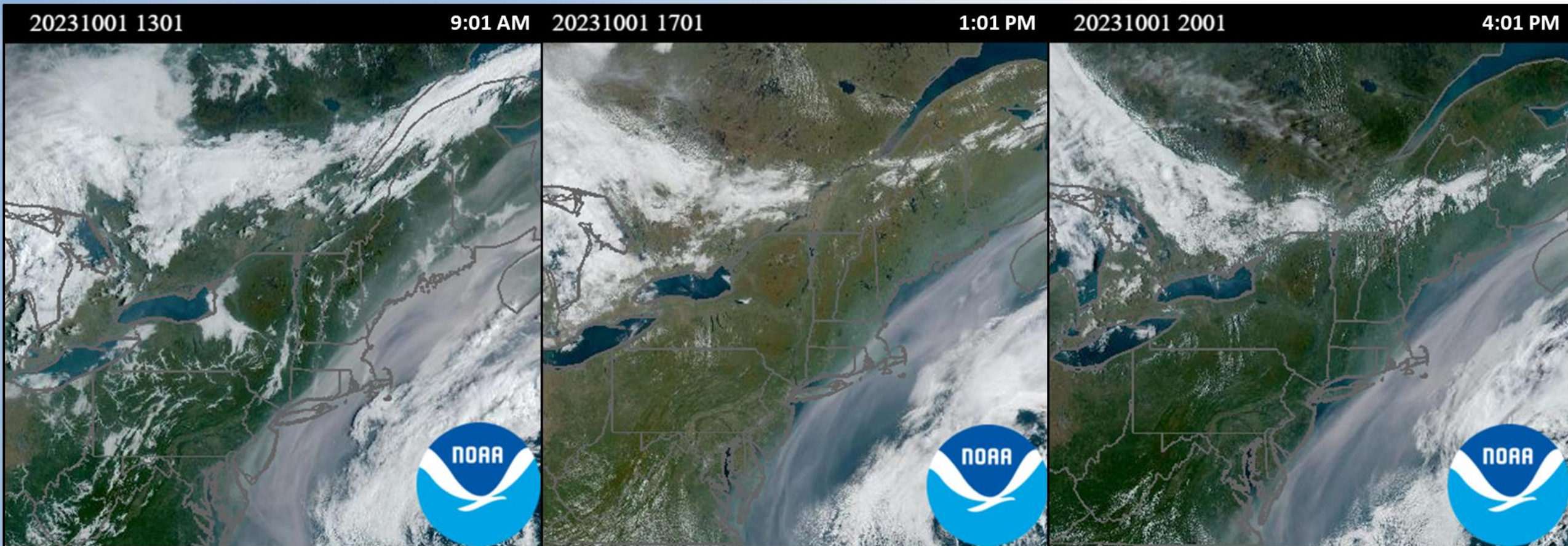


October 2, 2023 - 11:01 AM



- Portions of the smoke plume are obscured by clouds, particularly on September 29th and 30th.

GOES-East GeoColor Imagery: October 1, 2023



- The smoke plume impacts coastal areas from Virginia to Maine in the morning and slowly moves offshore in the afternoon.

Introduction to New Products

1. TEMPO Aerosol Optical Depth (AOD)

- AOD is a measure of how much sunlight is prevented from reaching the ground by aerosols like dust or smoke.
 - **AOD < 0.1:** Crystal clear sky, maximum visibility.
 - **AOD 0.1 – 0.2:** Clean to moderate conditions.
 - **AOD 0.5 – 1.0:** Hazy conditions, noticeably dirty air.
 - **AOD > 1.0:** Very hazy, significantly reduced visibility, similar to smoke from large fires.

2. TEMPO Aerosol Layer Height (ALH)

- ALH is an atmospheric parameter that measures how high in the atmosphere aerosols are located.

3. Surface PM_{2.5}

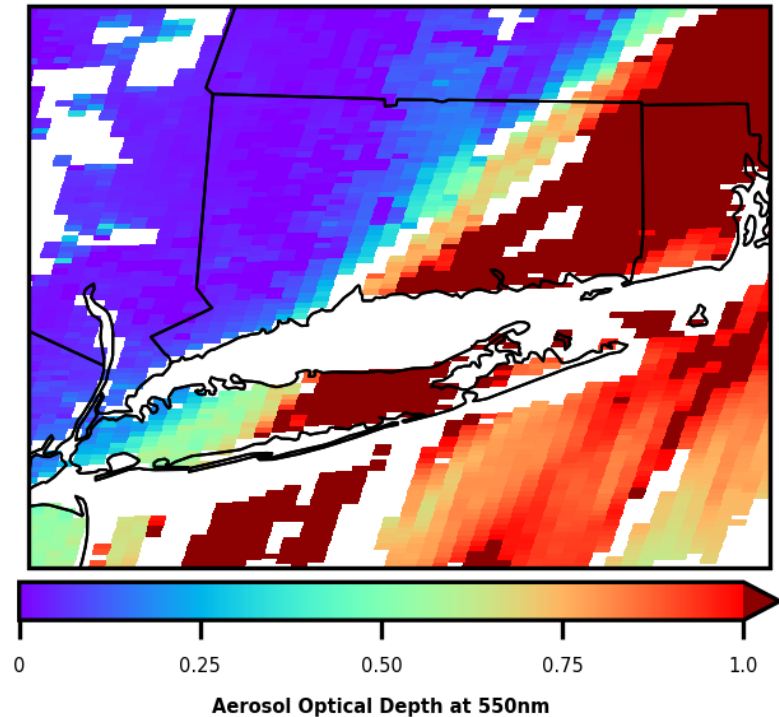
- Surface PM_{2.5} is calculated ground level PM_{2.5} based on satellite data.

NOAA and NASA are in the process of transitioning these products to be operational.

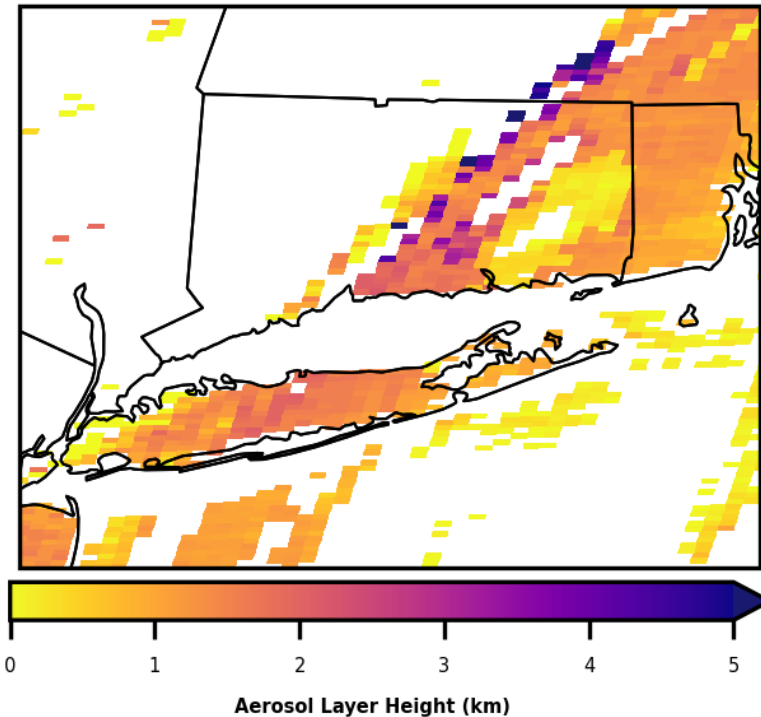
Thanks to Shobha Kondragunta (NOAA NESDIS), Amy Huff (STC), & Hai Zhang (STC)!

TEMPO AOD, TEMPO ALH, and Surface PM_{2.5}: 10 AM

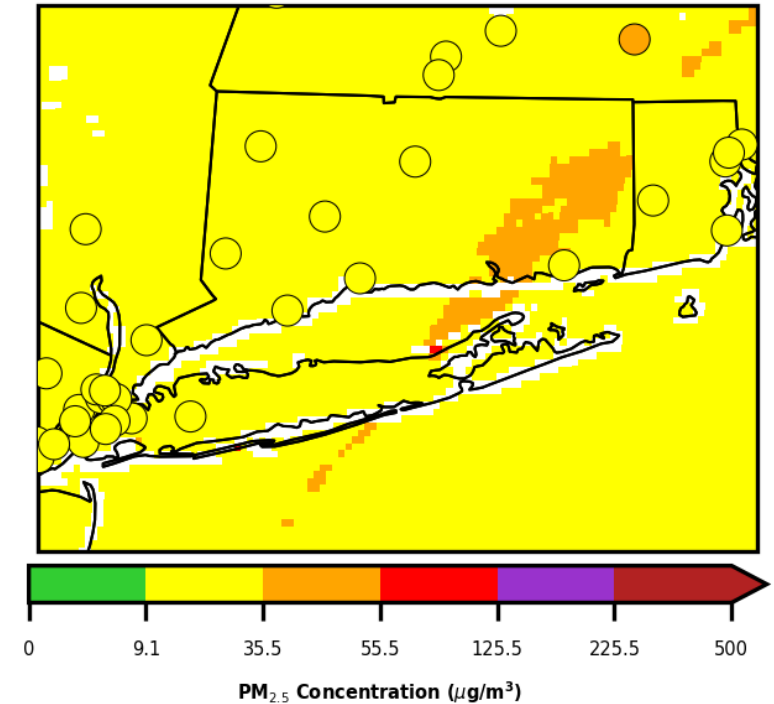
TEMPO AOD on October 1, 2023 at 10:05 AM



TEMPO ALH on October 1, 2023 at 10:05 AM



Fine Particles (1 Hr Average) on October 1, 2023 at 10:00 AM
Estimated by ABI AOD (shading) & Observed by Regulatory Monitors (dots)

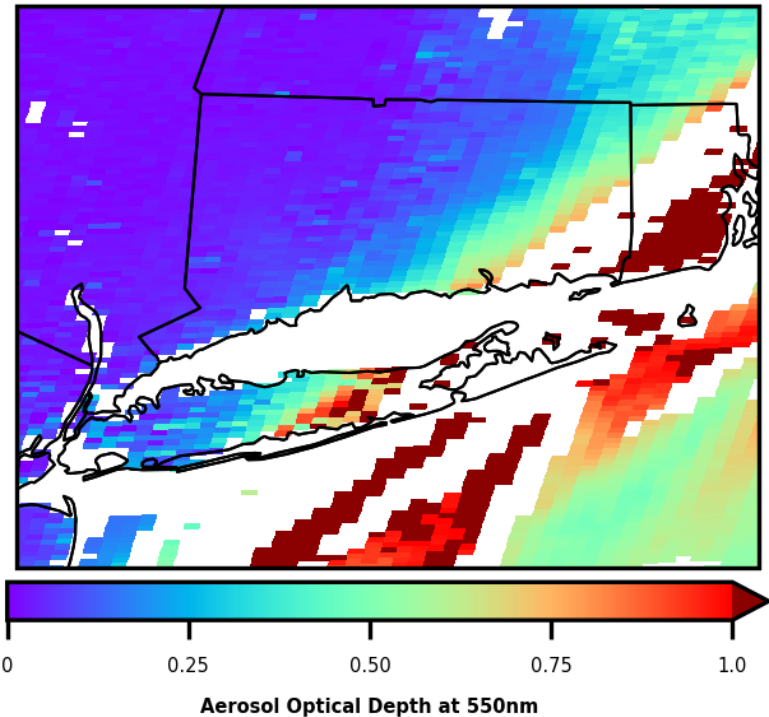


- In the morning, the smoke plume descends closer to the surface as it moves across eastern Connecticut and offshore.
- **USG** PM_{2.5} levels are approaching Groton.

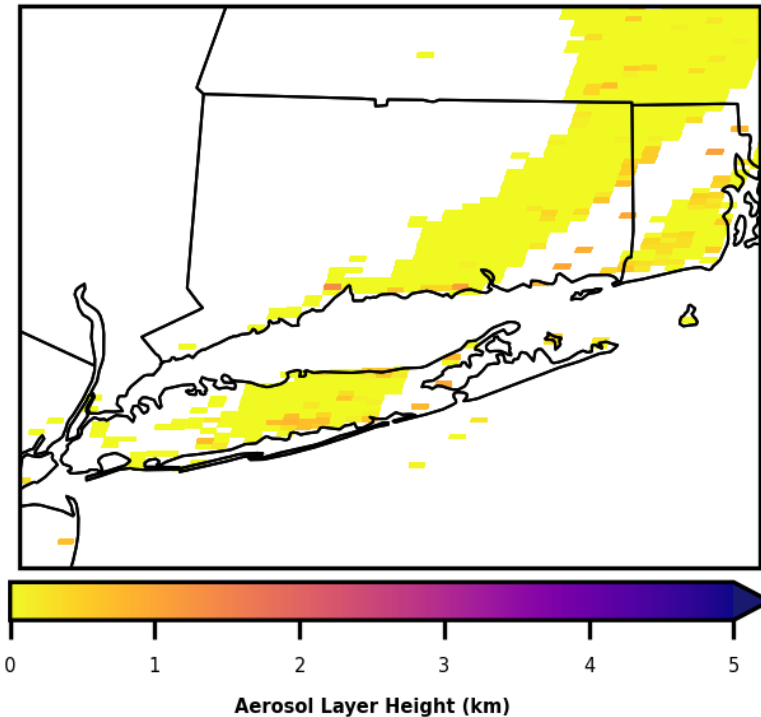
NOTE: ALH is only retrieved for pixels with AOD greater than 0.2.

TEMPO AOD, TEMPO ALH, and Surface PM_{2.5}: 1 PM

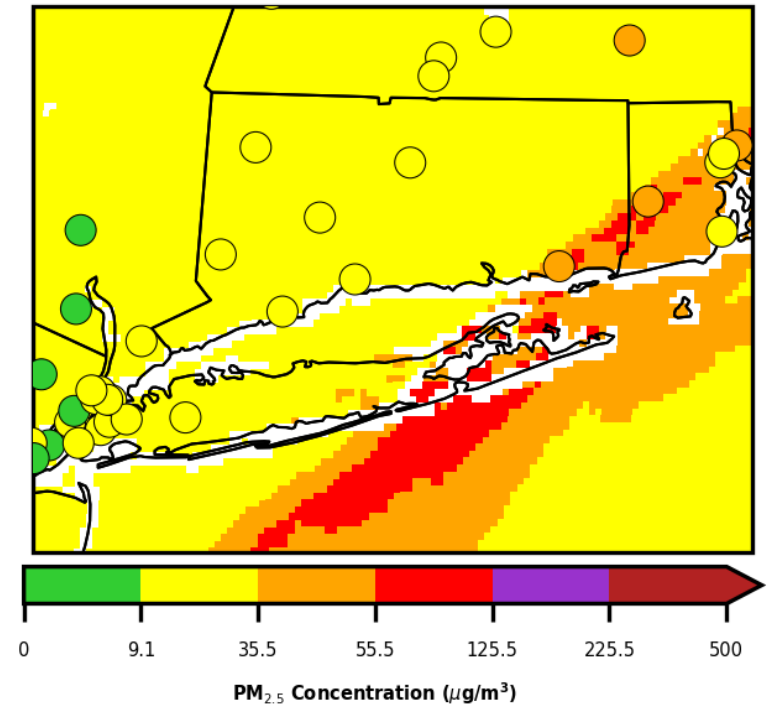
TEMPO AOD on October 1, 2023 at 1:04 PM



TEMPO ALH on October 1, 2023 at 1:04 PM



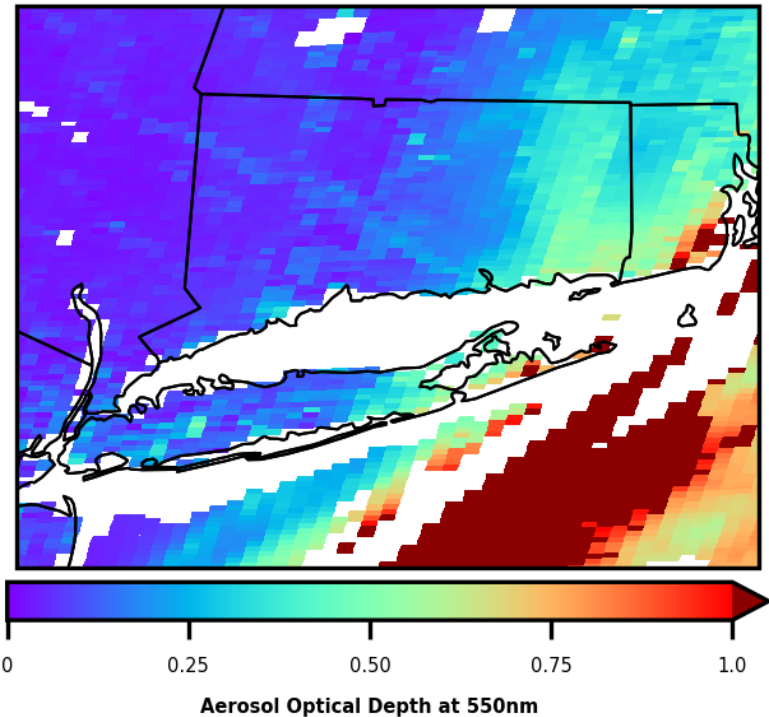
Fine Particles (1 Hr Average) on October 1, 2023 at 1:00 PM
Estimated by ABI AOD (shading) & Observed by Regulatory Monitors (dots)



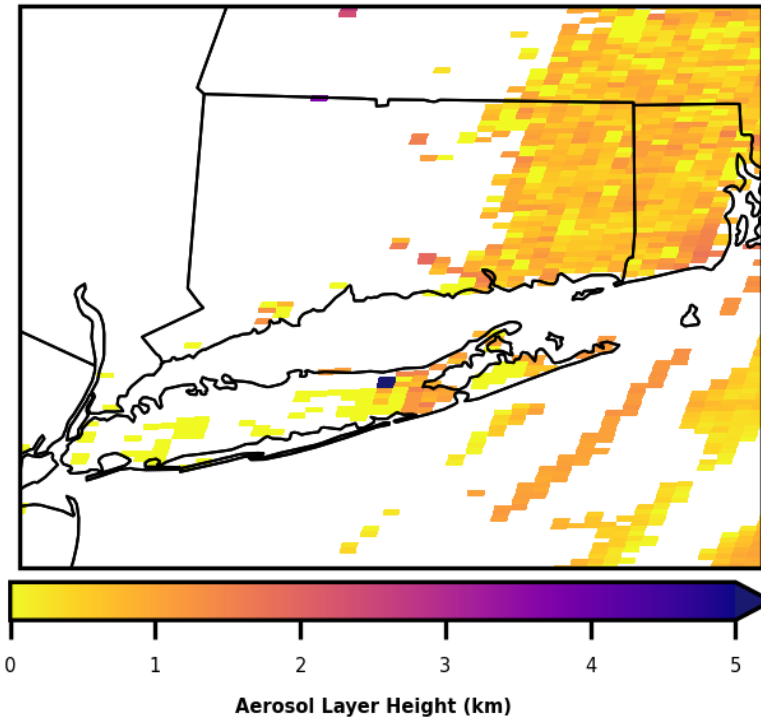
- In the early afternoon, the smoke plume continues to impact the surface with PM_{2.5} levels in the **USG** range for a few sites, including Groton.

TEMPO AOD, TEMPO ALH, and Surface PM_{2.5}: 4 PM

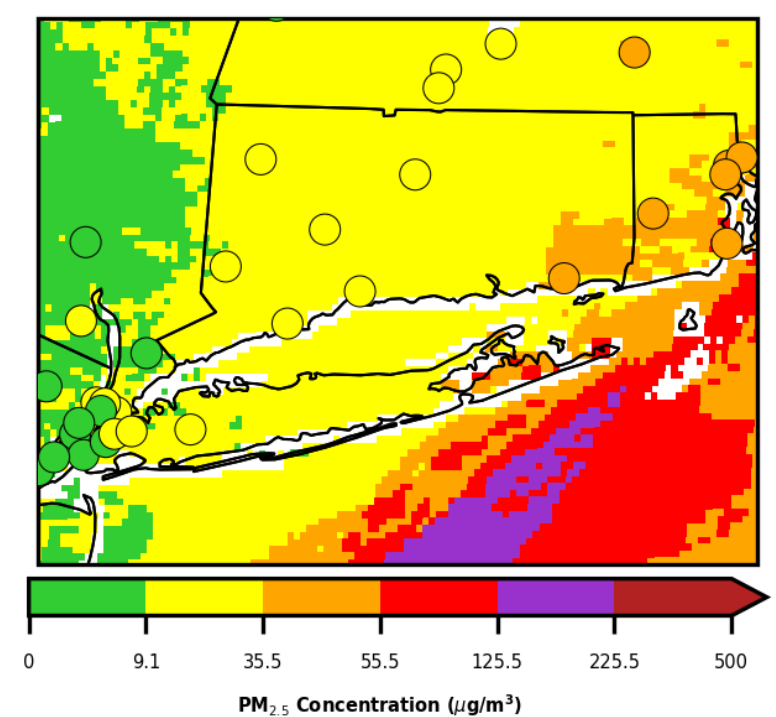
TEMPO AOD on October 1, 2023 at 4:04 PM



TEMPO ALH on October 1, 2023 at 4:04 PM



Fine Particles (1 Hr Average) on October 1, 2023 at 4:00 PM
Estimated by ABI AOD (shading) & Observed by Regulatory Monitors (dots)



- In the late afternoon, **GOOD** PM_{2.5} levels approach western Connecticut as **USG** levels remain for Groton due to the slow movement of the smoke plume.

Key Takeaways

- Historically, significant smoke events have not been a concern for Connecticut, but there have been increased occurrences in recent years.
- Surface analysis maps, HMS smoke, visible satellite images, and other related products can help forecasters track smoke plumes.
 - Allows for more accurate and timely air quality forecasts and warnings for the public.
- TEMPO AOD, TEMPO ALH, and satellite derived surface $PM_{2.5}$ help us understand previous smoke events and will aid in tracking smoke plumes and forecasting air quality in the future.

Contact Information

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