Impact of the 2020 California wildfires on North Dakota

Allen Hastings and Silas LittleDog

Sitting Bull College

- **California**:

4.2 million acres burned
9.279 major fires reported.
10,488 structures damaged
Approx. 31 fatalities
5 of the 6 biggest fires ever recorded in 88 years occurred in 2020

- **Oregon**:

Estimated 1million acres burned
Over 2,200 homes destroyed
Approx. 11 fatalities

- **Washington**:

713,328 acres burned
Approx. 200 homes destroyed

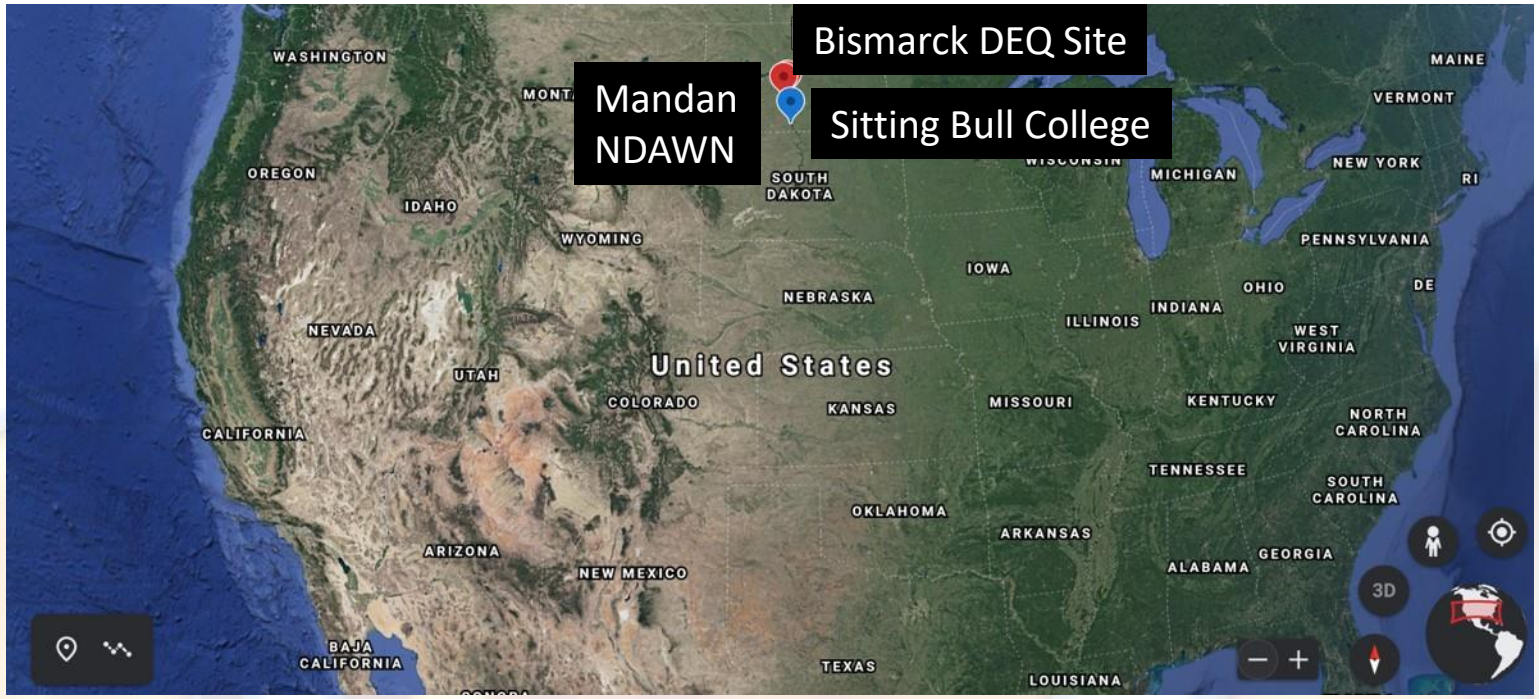
- **Northern Idaho**:

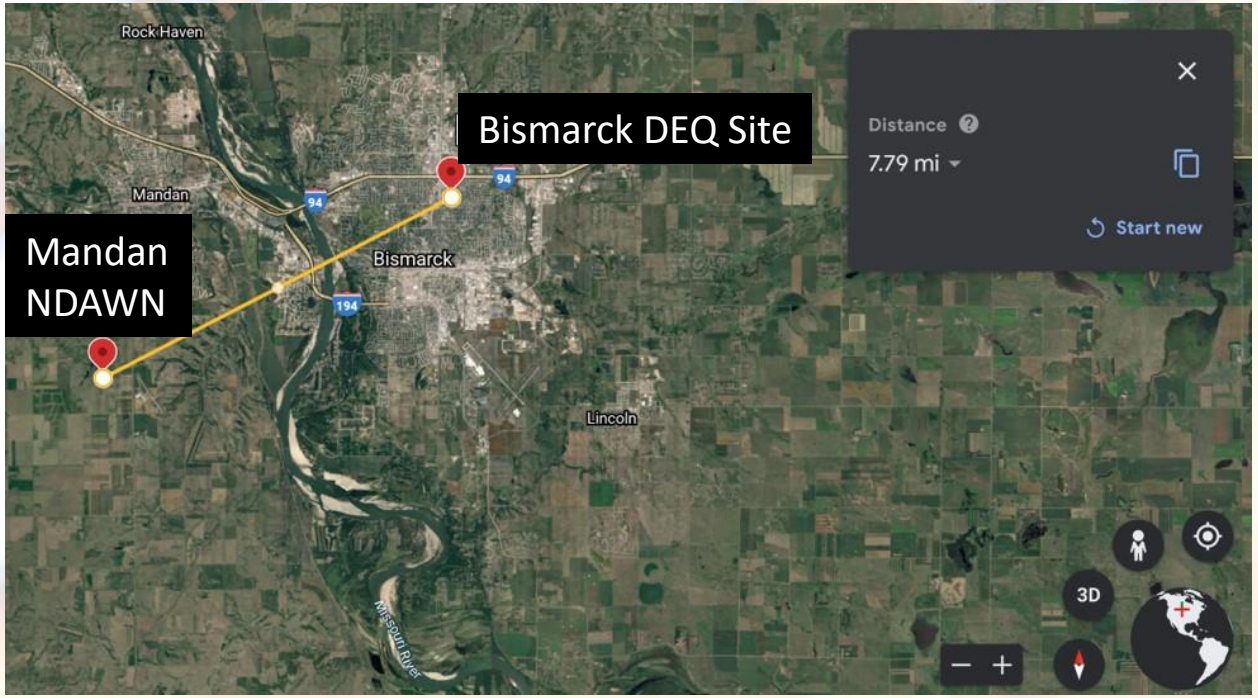
Approx. 11,500 acres burned

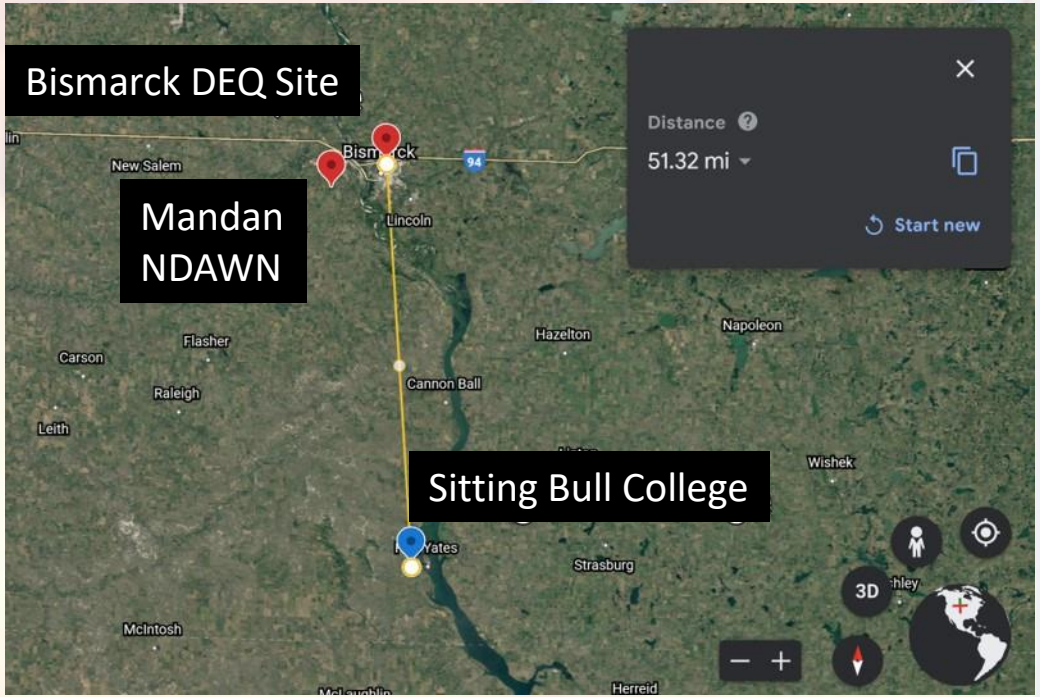
A firefighting aircraft flies over Healdsburg, California, to support efforts to contain the LNU Lightning Complex fire. | Ray Chavez/MediaNews Group/The Mercury News/Getty Images

An El Dorado County firefighter moves away from flames during the Rim fire near Yosemite National Park in 2013. Because of the COVID-19 pandemic, firefighters say they will be more aggressive in keeping wildland fires small this year, but may have to do it with fewer resources. (Don Bartletti / Los Angeles Times / MCT)

Where in the world are we?

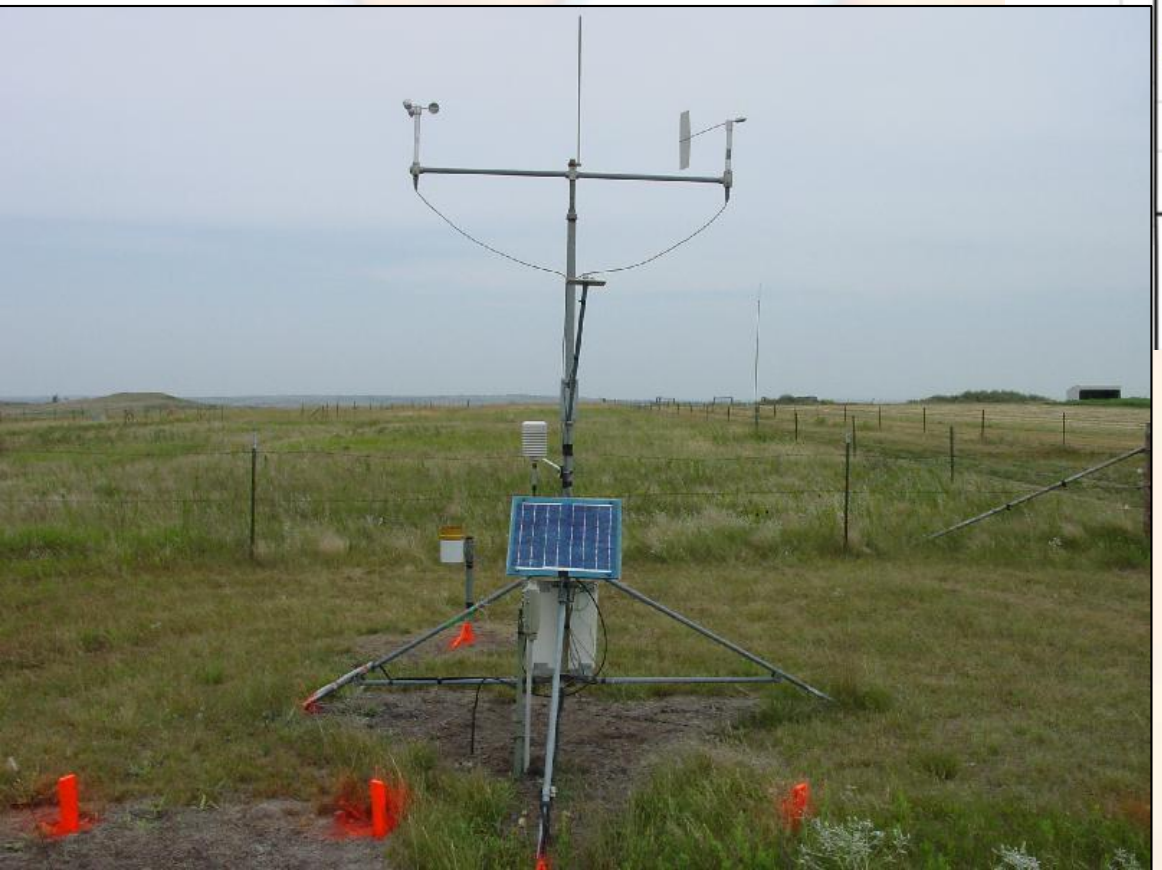


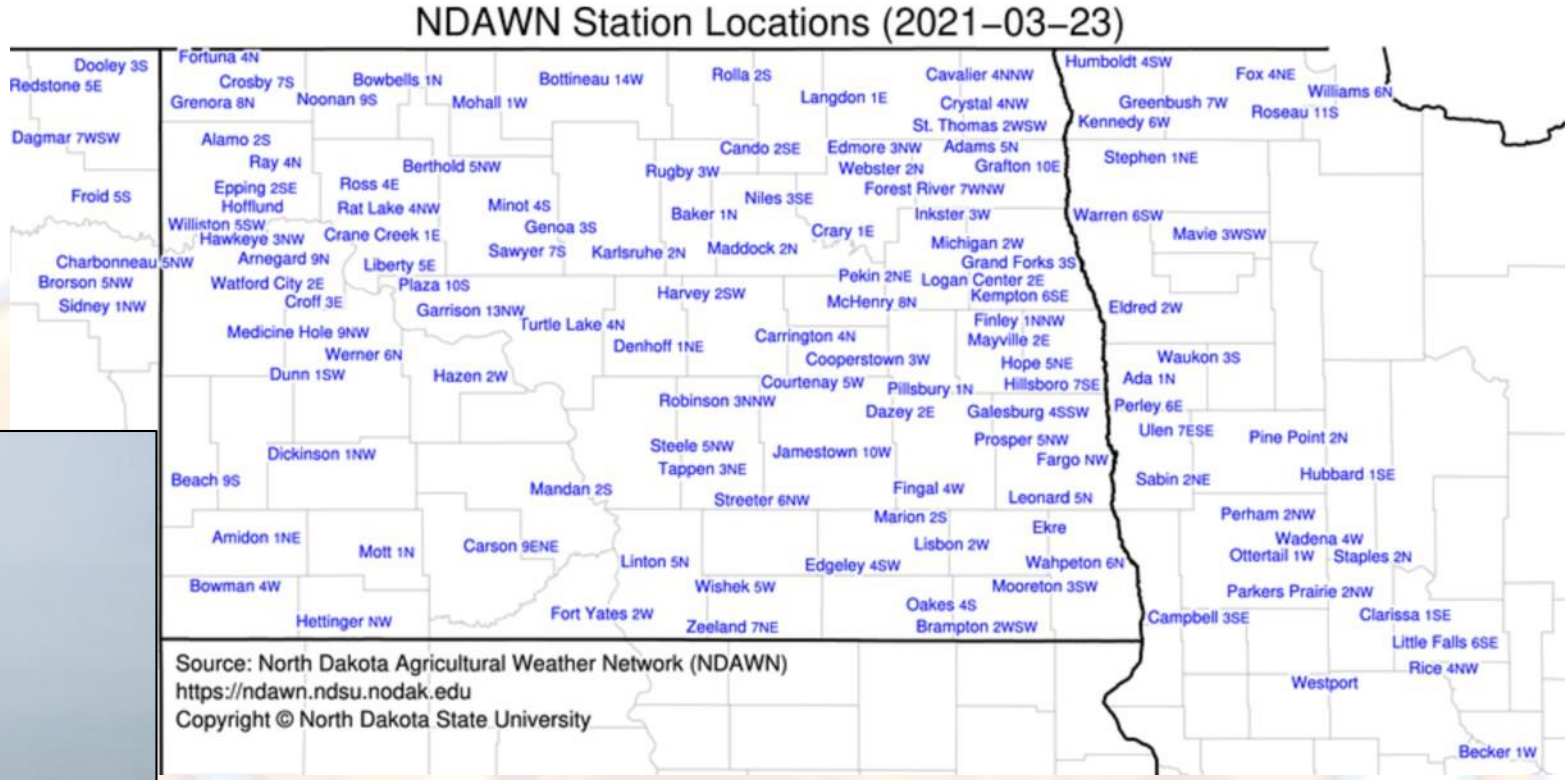




ND Agricultural Weather Network (NDAWN)

NDAWN Weather Station in Mandan





- Wind Direction

https://ndawn.ndsu.nodak.edu/

Particulate Matter $PM_{2.5}$

NAAQS for $PM_{2.5}$ is 35 µg/m^3 averaged over 24 hrs.

PM2.5 (µg/m3)	AQI Condition
0-12	Good
12-35	moderate
35-55	Unhealthy for Sensitive Individuals
55-150	Unhealthy
150-250	Very Unhealthy
>250	Hazardous

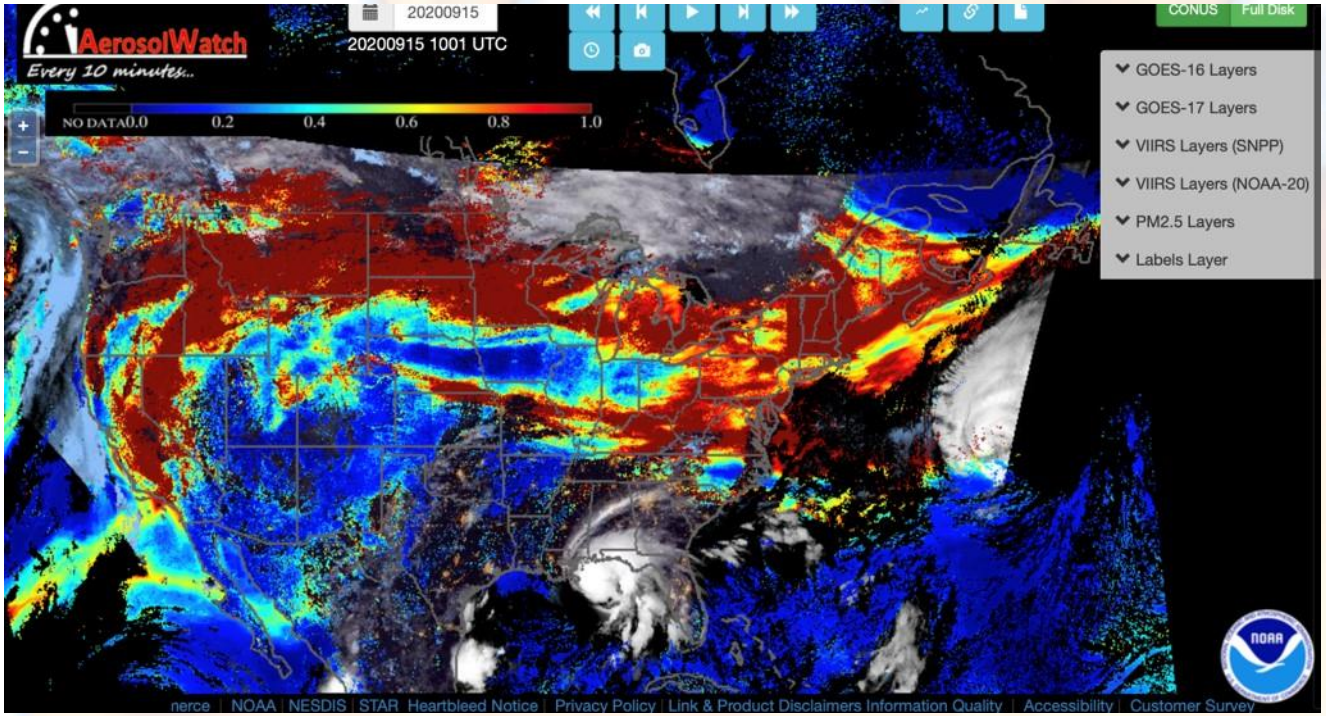
Bismarck DEQ Station -T640

https://www.epa.gov/outdoor-air-quality-data/download-daily-data

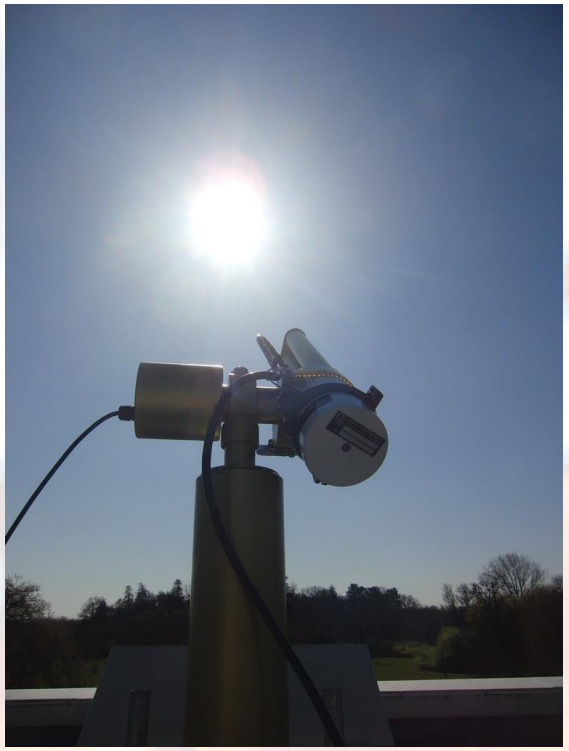
Aerosol Optical Depth (AOD)

DATA Sources

- Aeronet
- VIIRS



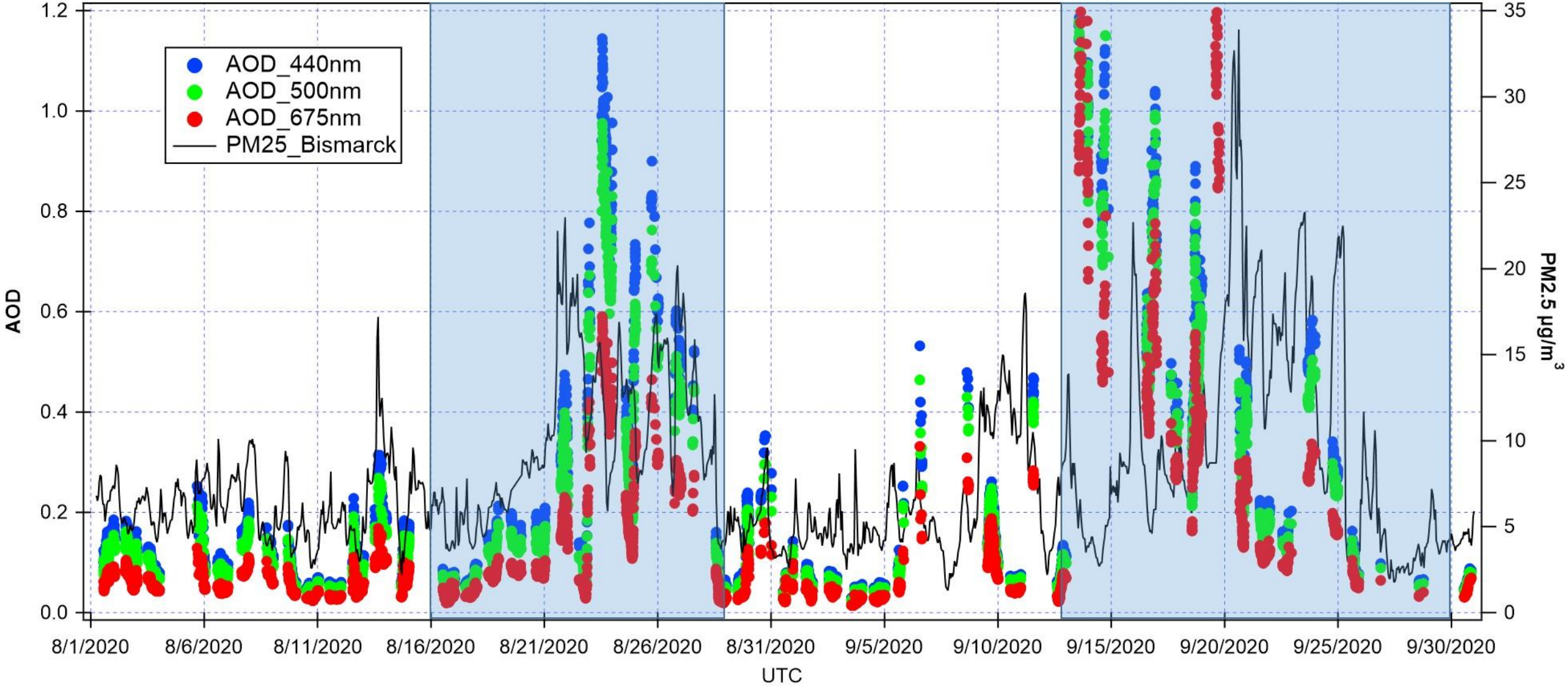
https://www.star.nesdis.noaa.gov/smcd/spb/aq/AerosolWatch/



Bismarck Aeronet (NEON_NOGP)

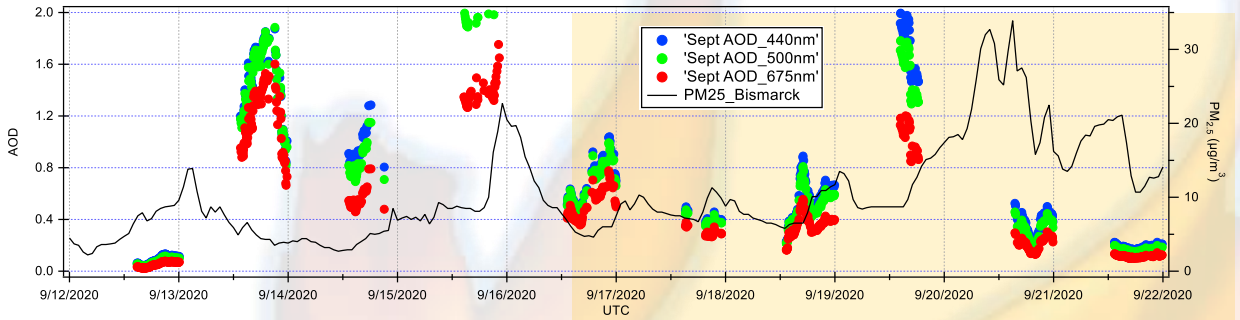
https://aeronet.gsfc.nasa.gov

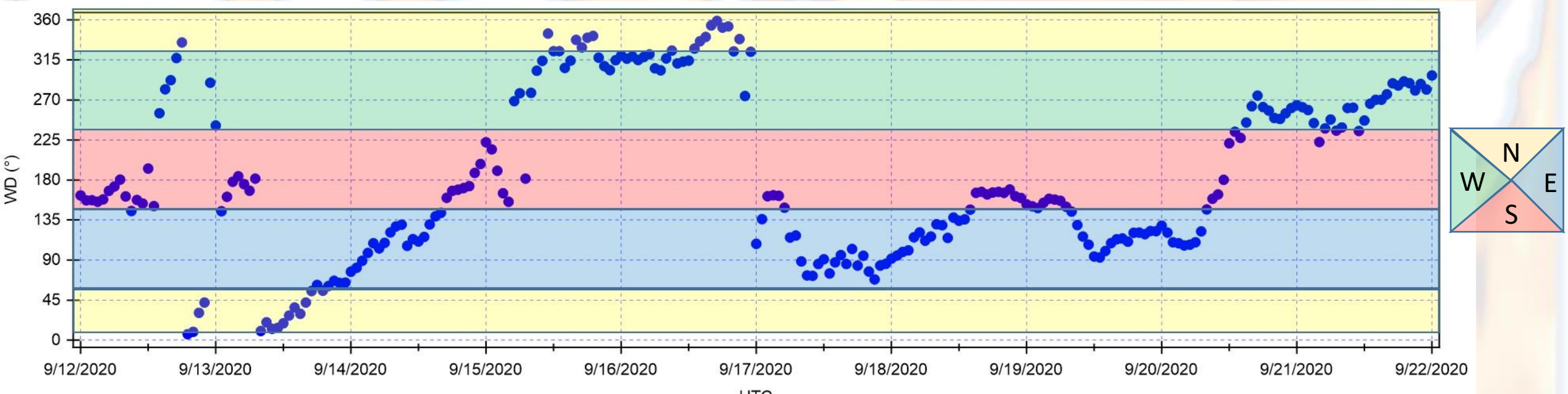
PM2.5 and AOD for Bismarck, ND
August thru Sept 2020



September
Case study

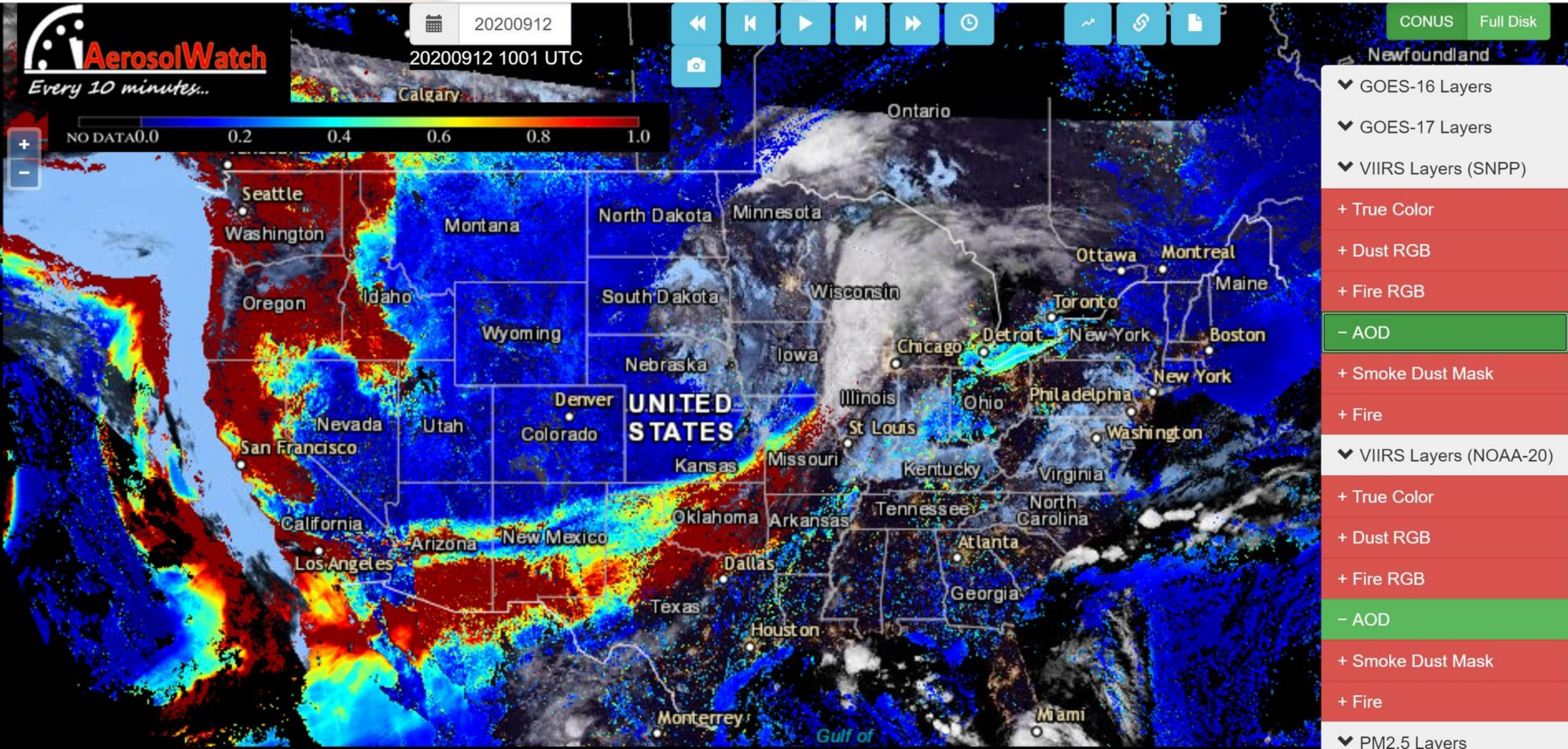
September Case Study – 9/12 thru 9/22. AOD, PM2.5 and Wind Direction





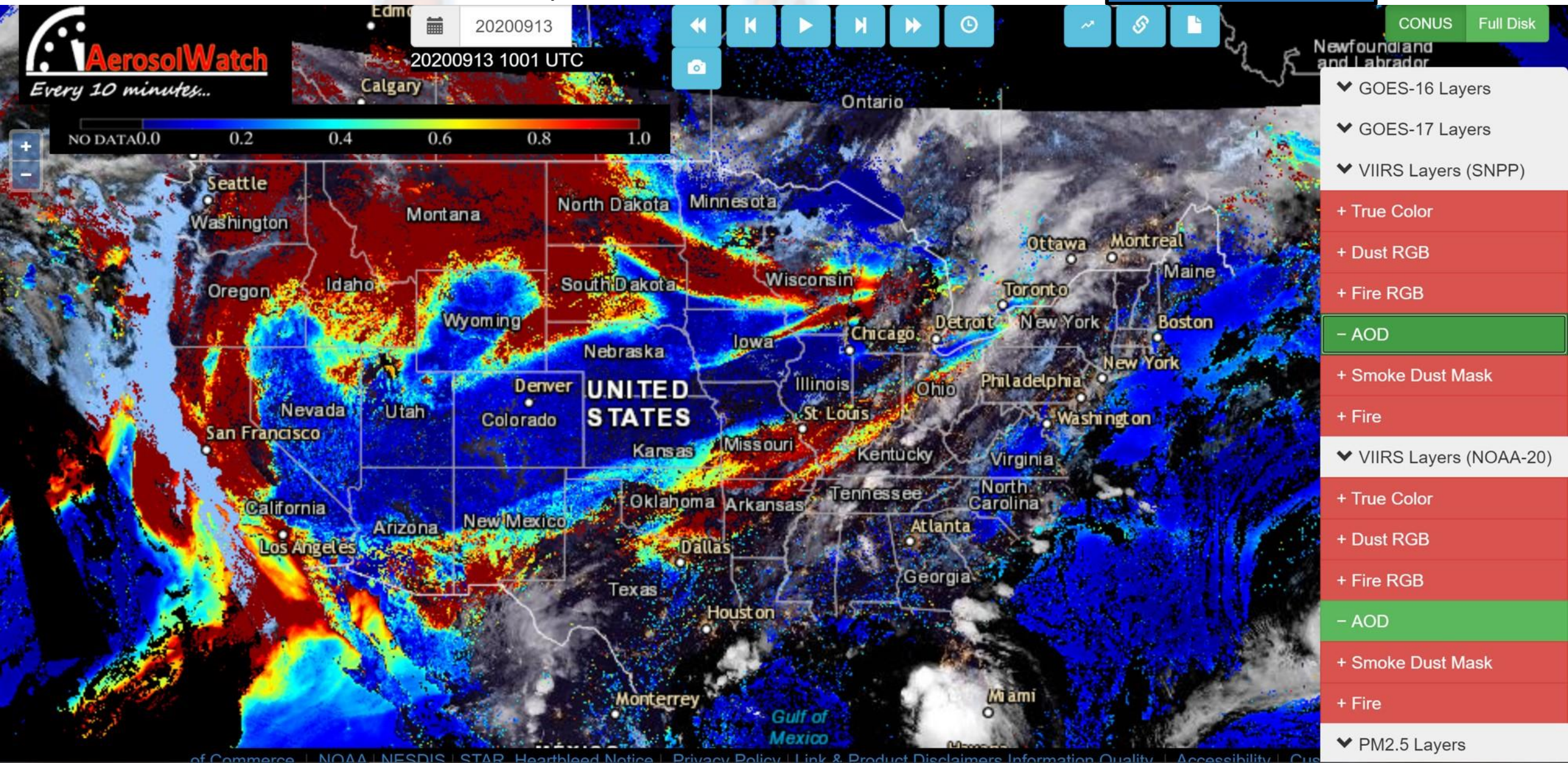
September Case Study – 9/12
AOD, PM2.5 and Wind Direction

$PM_{2.5}$ (µg/m³)
- Range: 2.2 – 8.9
- At 1000 UTC: 3.8



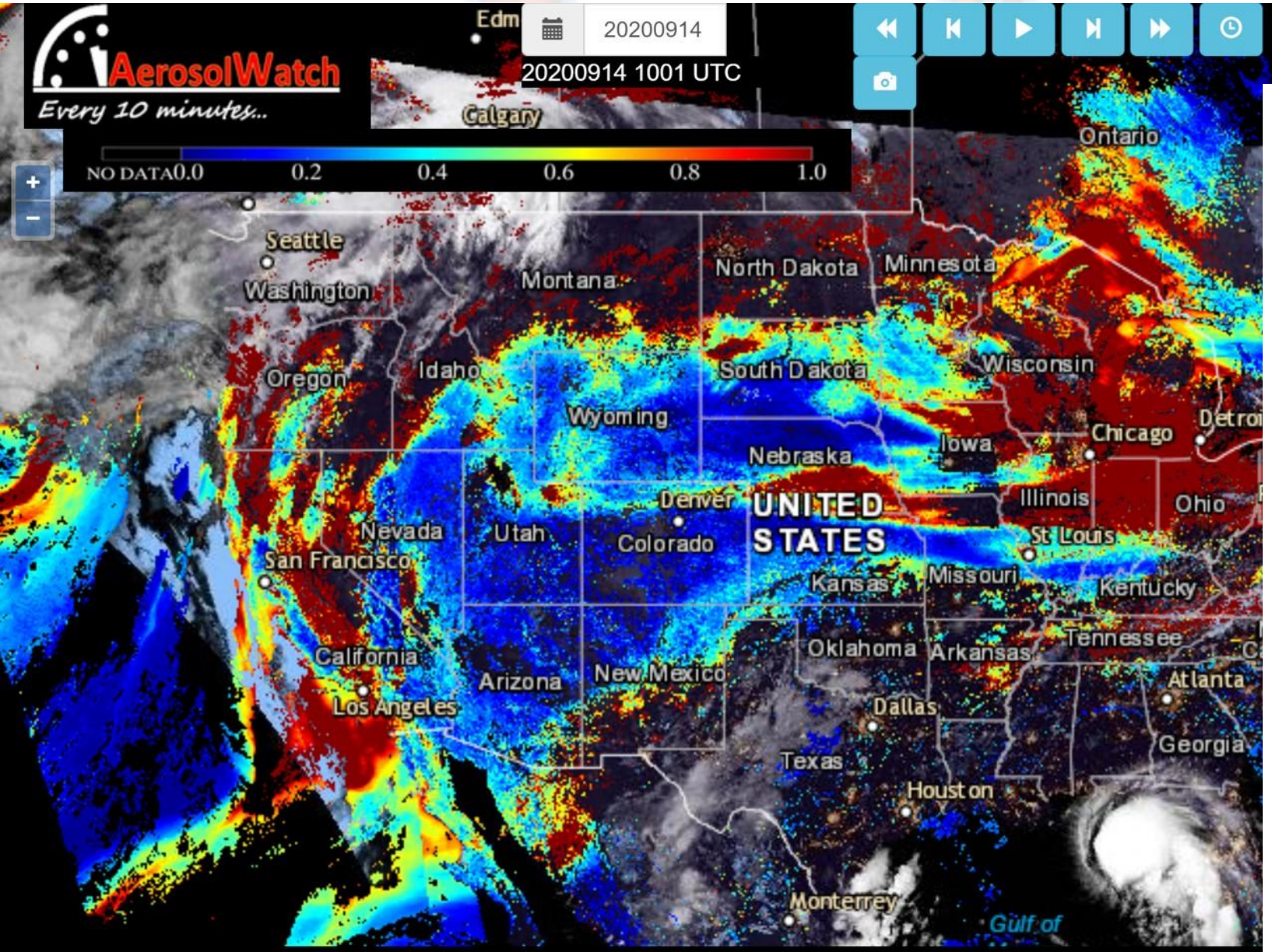
September Case Study – 9/13
AOD, PM2.5 and Wind Direction

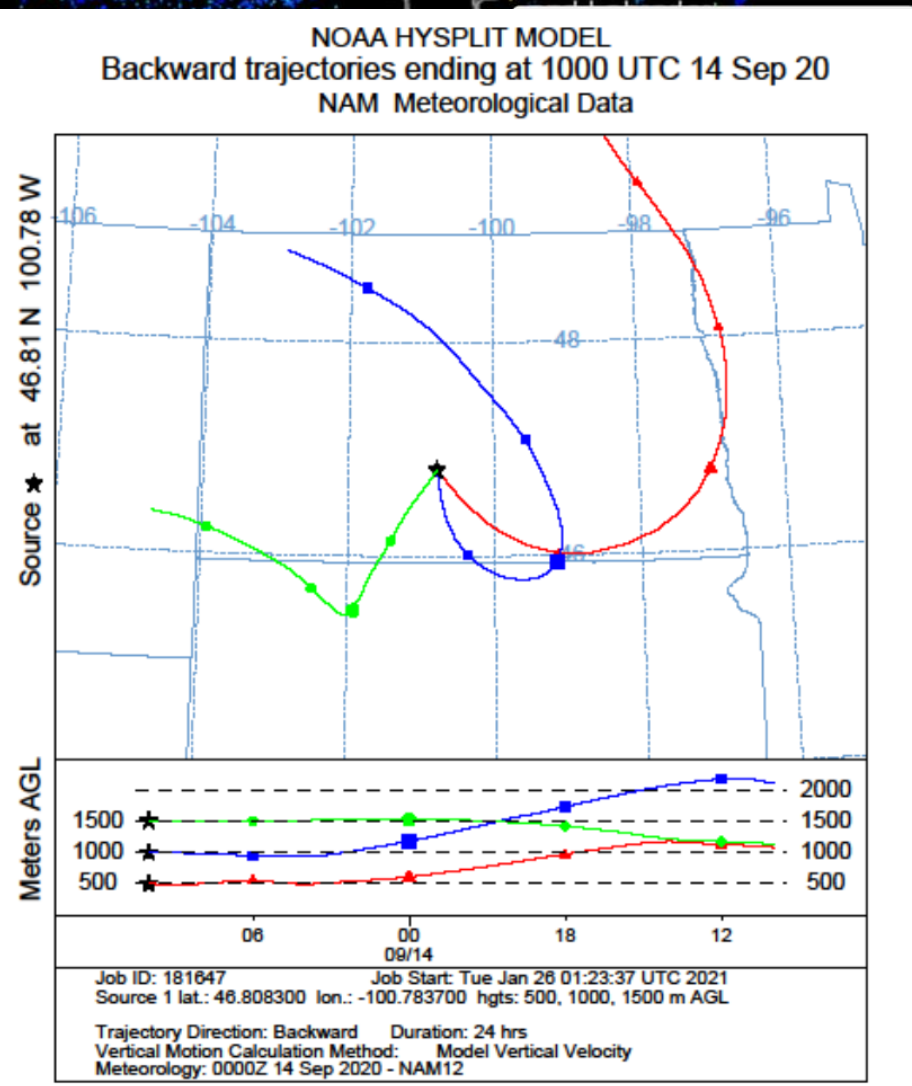
$PM_{2.5}$ (µg/m³)
- Range: 3.5 – 13.9
- At 1000 UTC: 7.6



September Case Study – 9/14
AOD, PM2.5 and Wind Direction

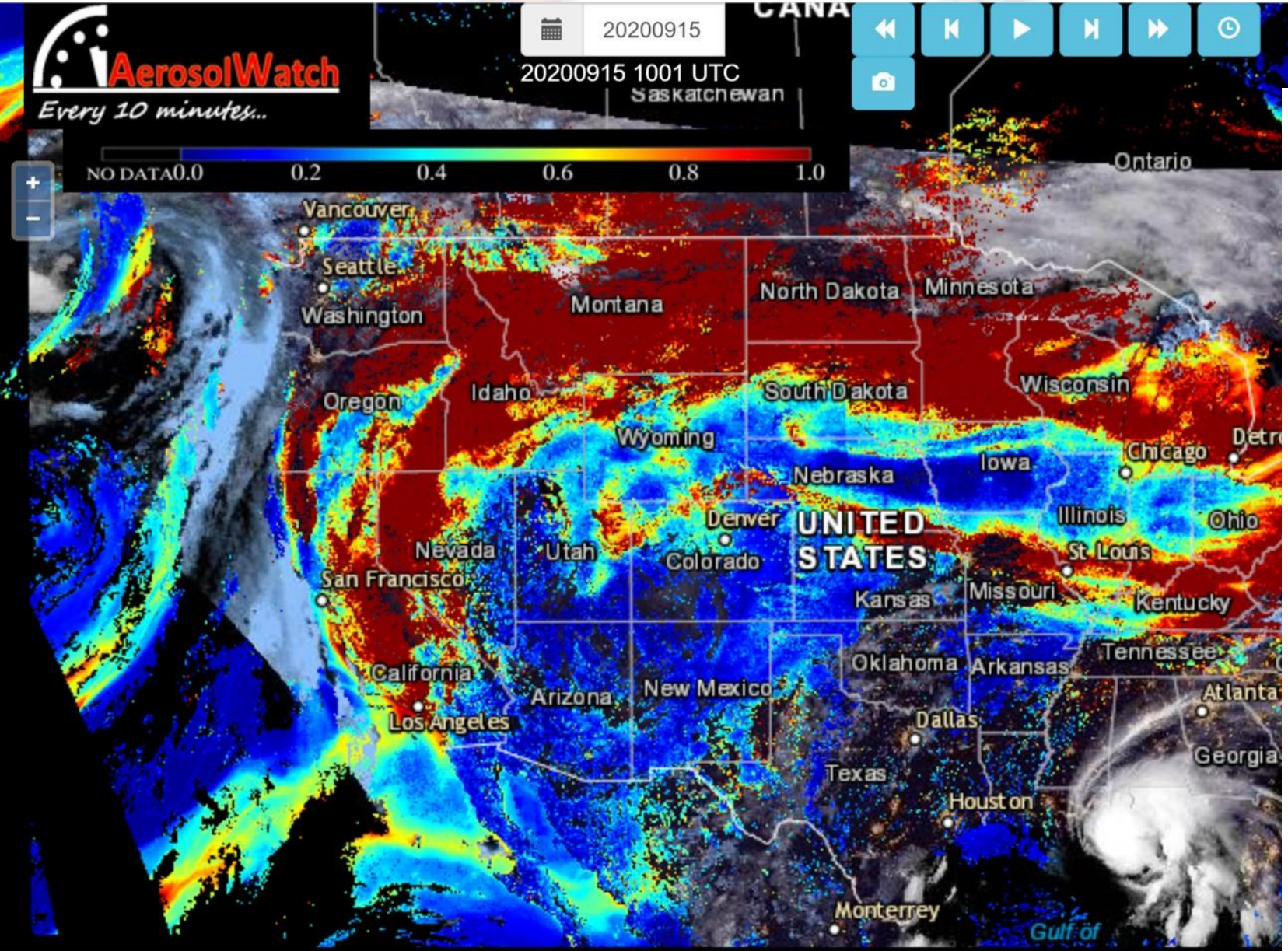
$PM_{2.5}$ (µg/m³)
- Range: 2.7 – 8.5
- At 1000 UTC: 2.9

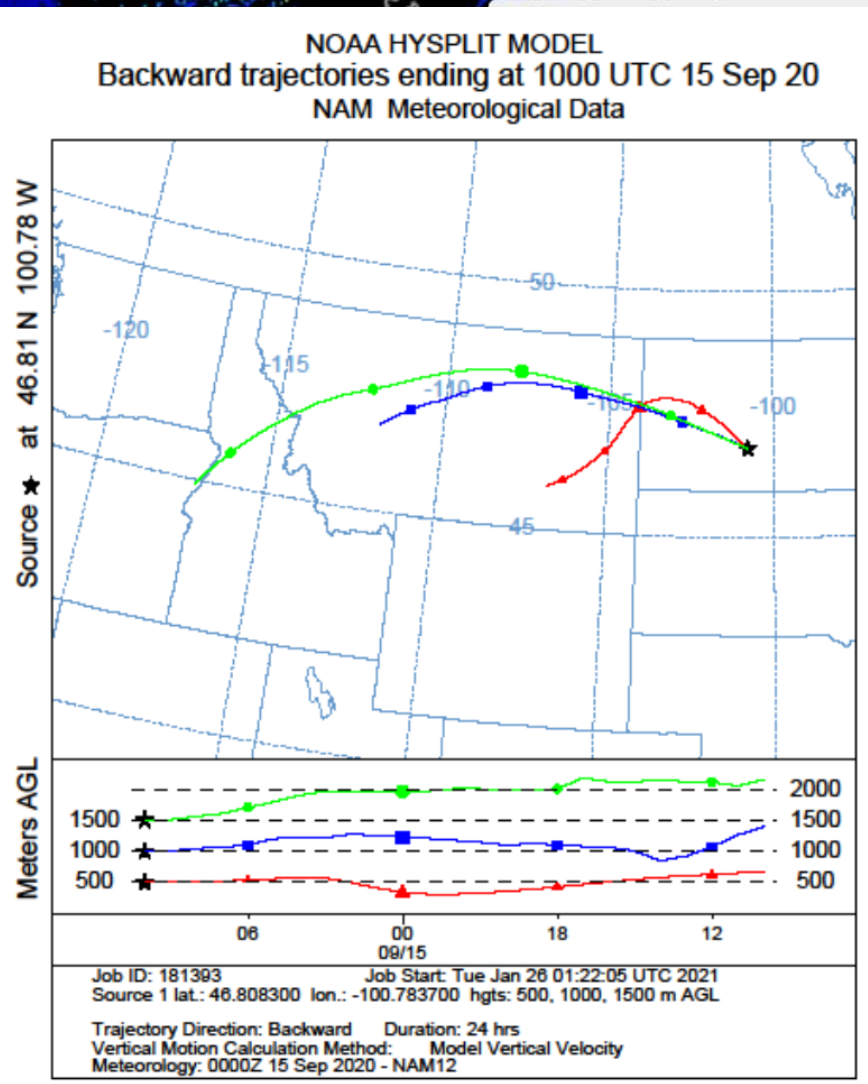




September Case Study – 9/15
AOD, PM2.5 and Wind Direction

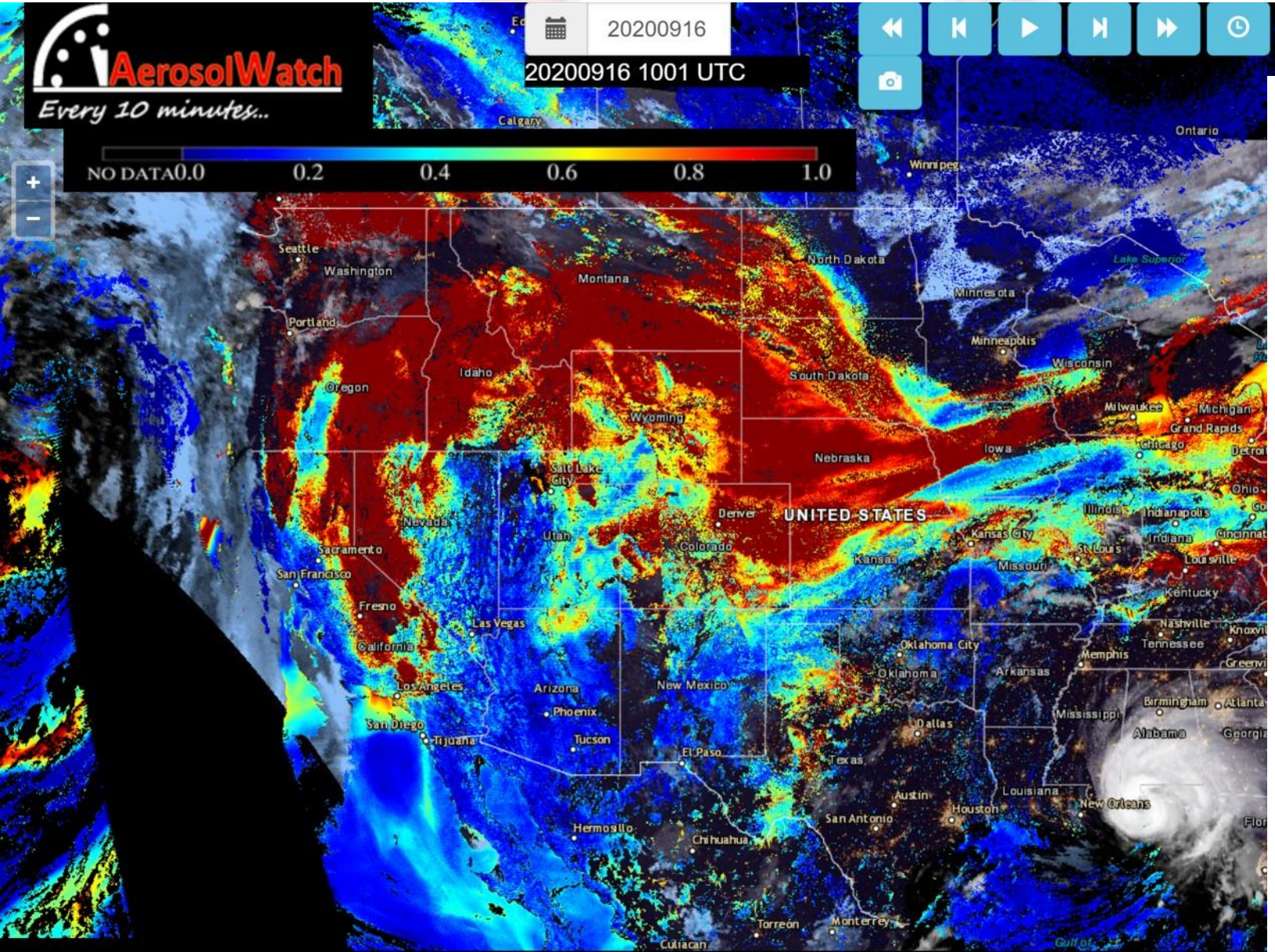
$PM_{2.5}$
- Range: 6.4 – 22.7
- At 1200 UTC: 9

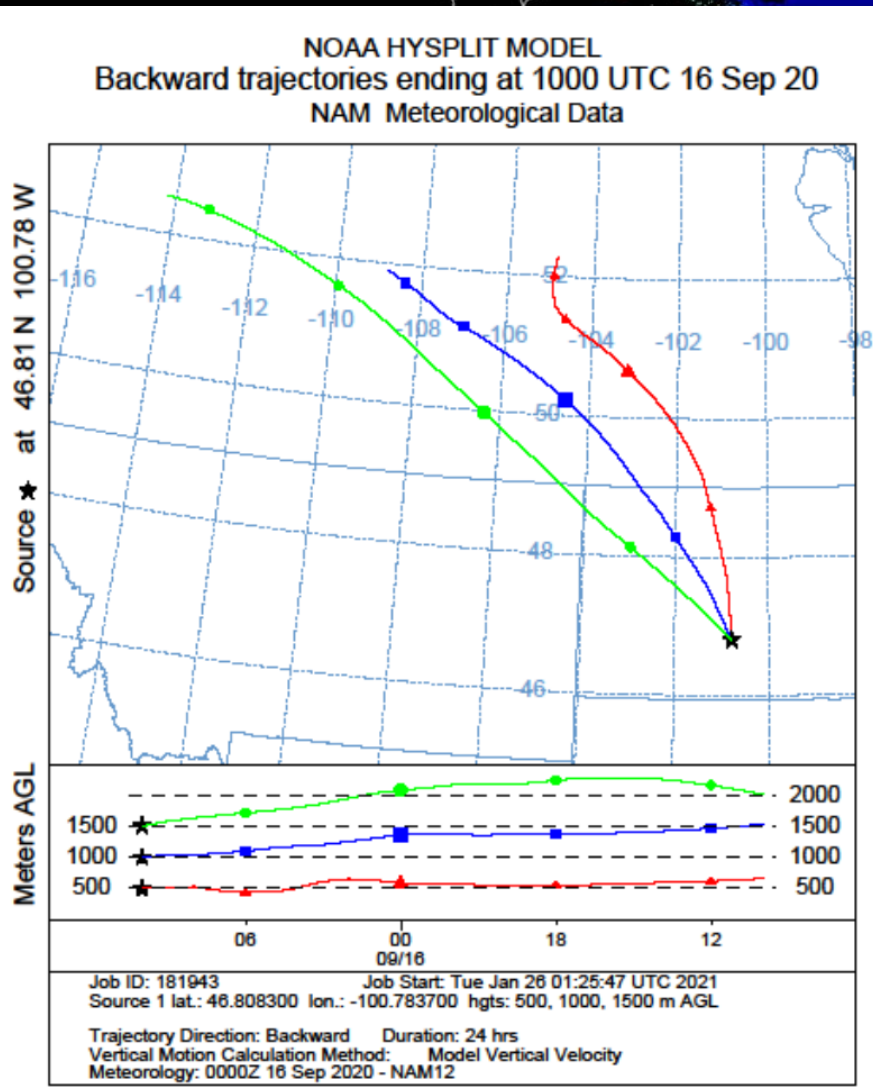




September Case Study – 9/16
AOD, PM2.5 and Wind Direction

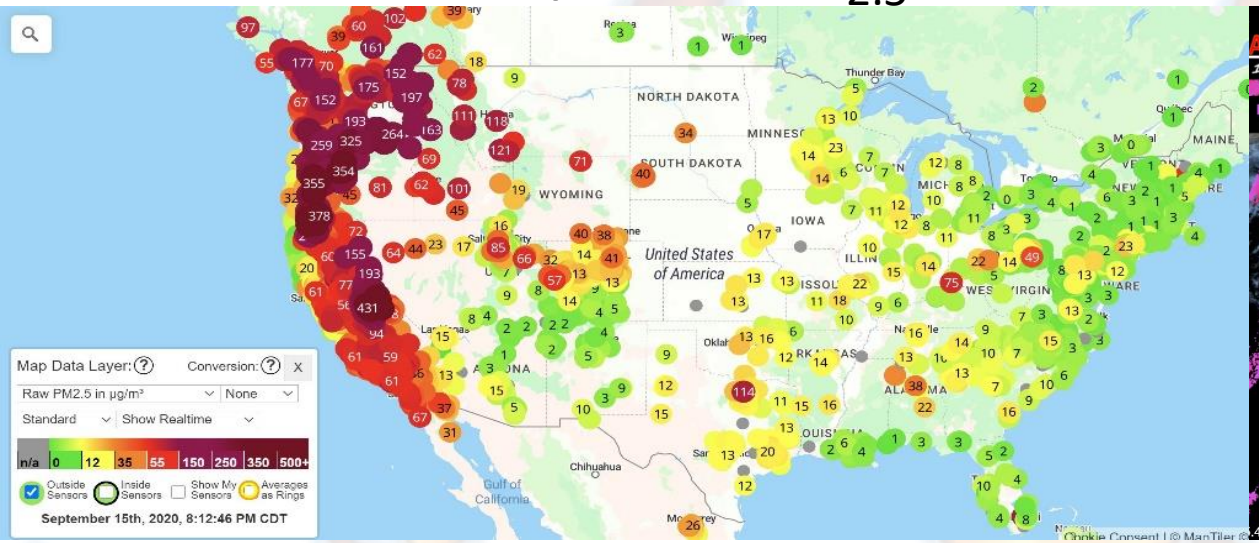
$PM_{2.5}$
- Range: 4.6 – 20.5
- At 1200 UTC: 8.6

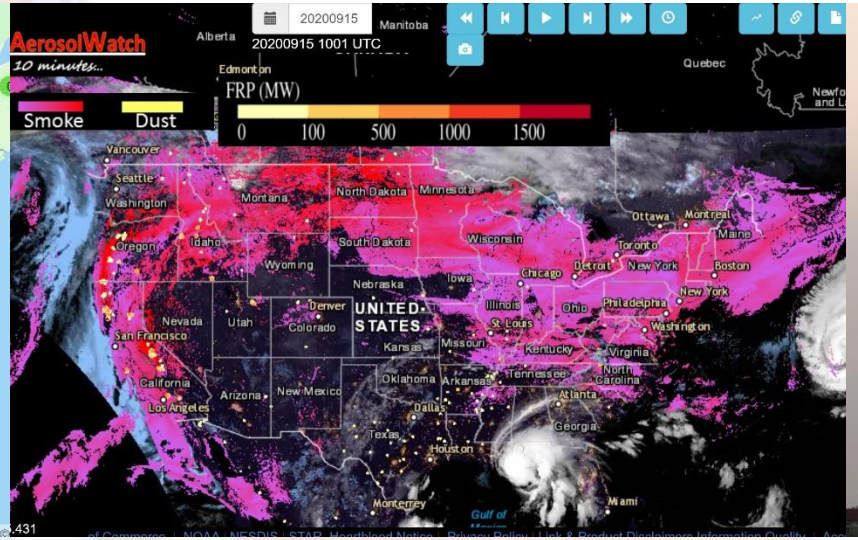




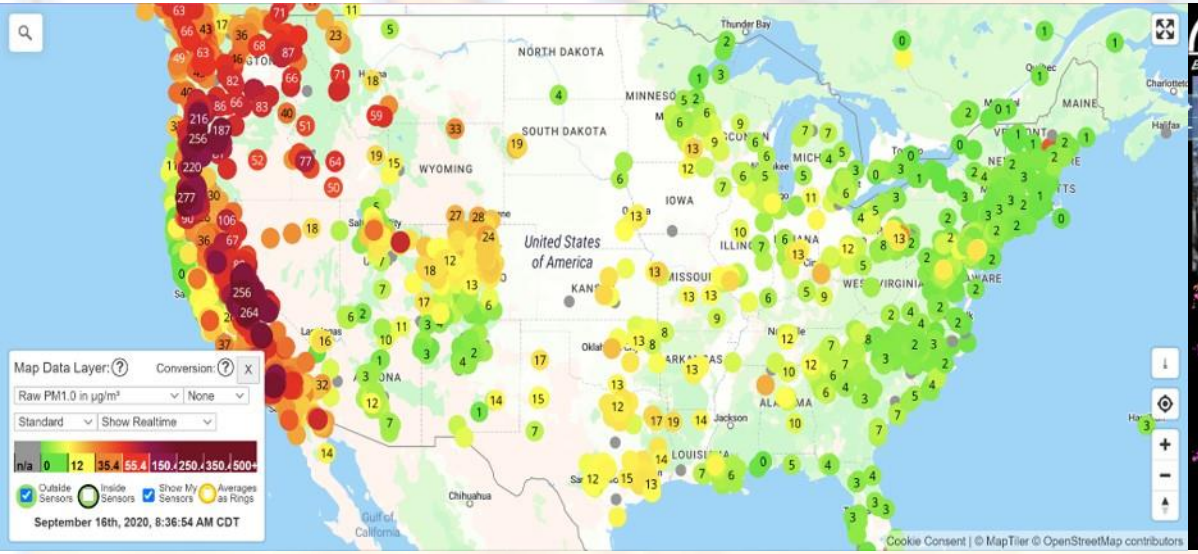
9/15 AND 9/16.

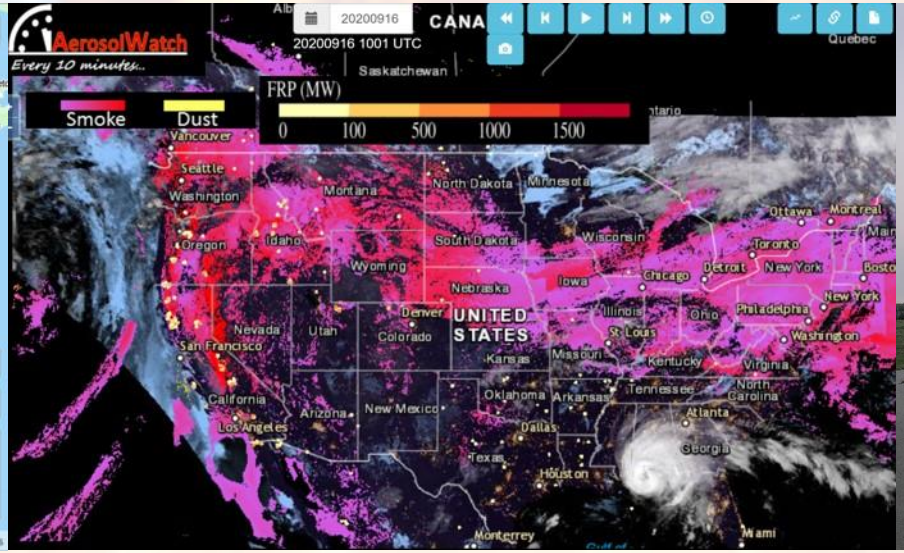
PurpleAir $PM_{2.5}$, AerosolWatch Smoke view, SBC Photos

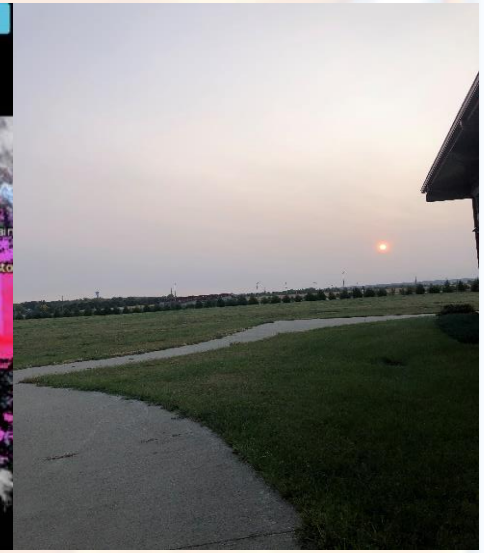




September 15, 2020



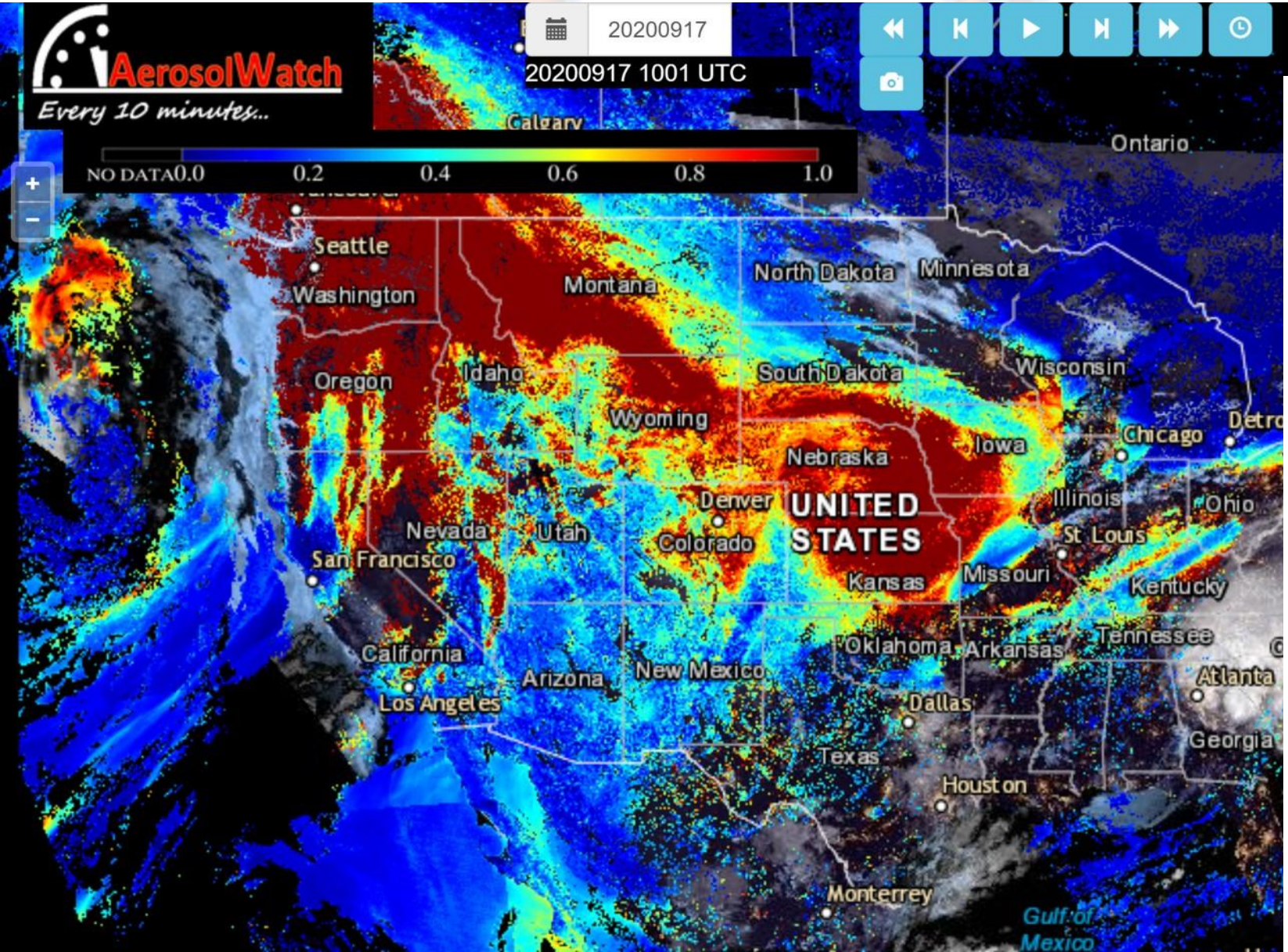


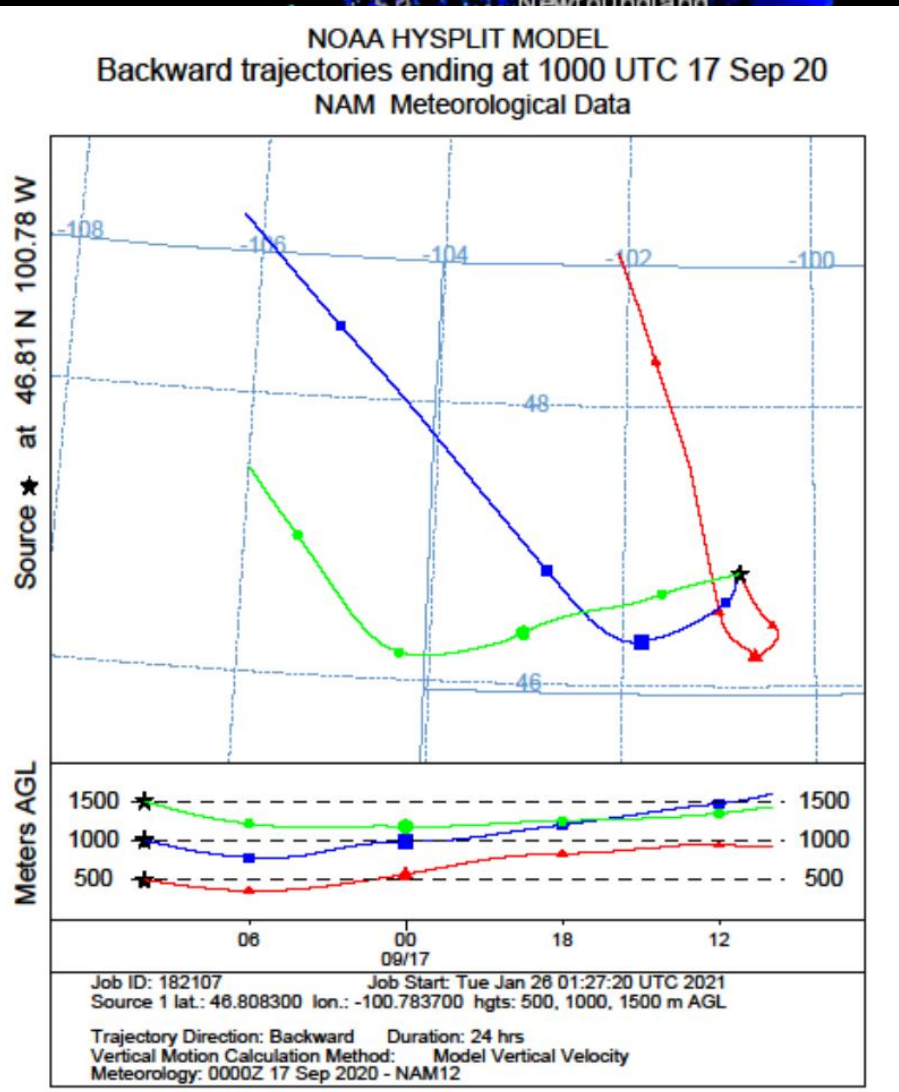


September 16, 2020

September Case Study – 9/17
AOD, PM2.5 and Wind Direction

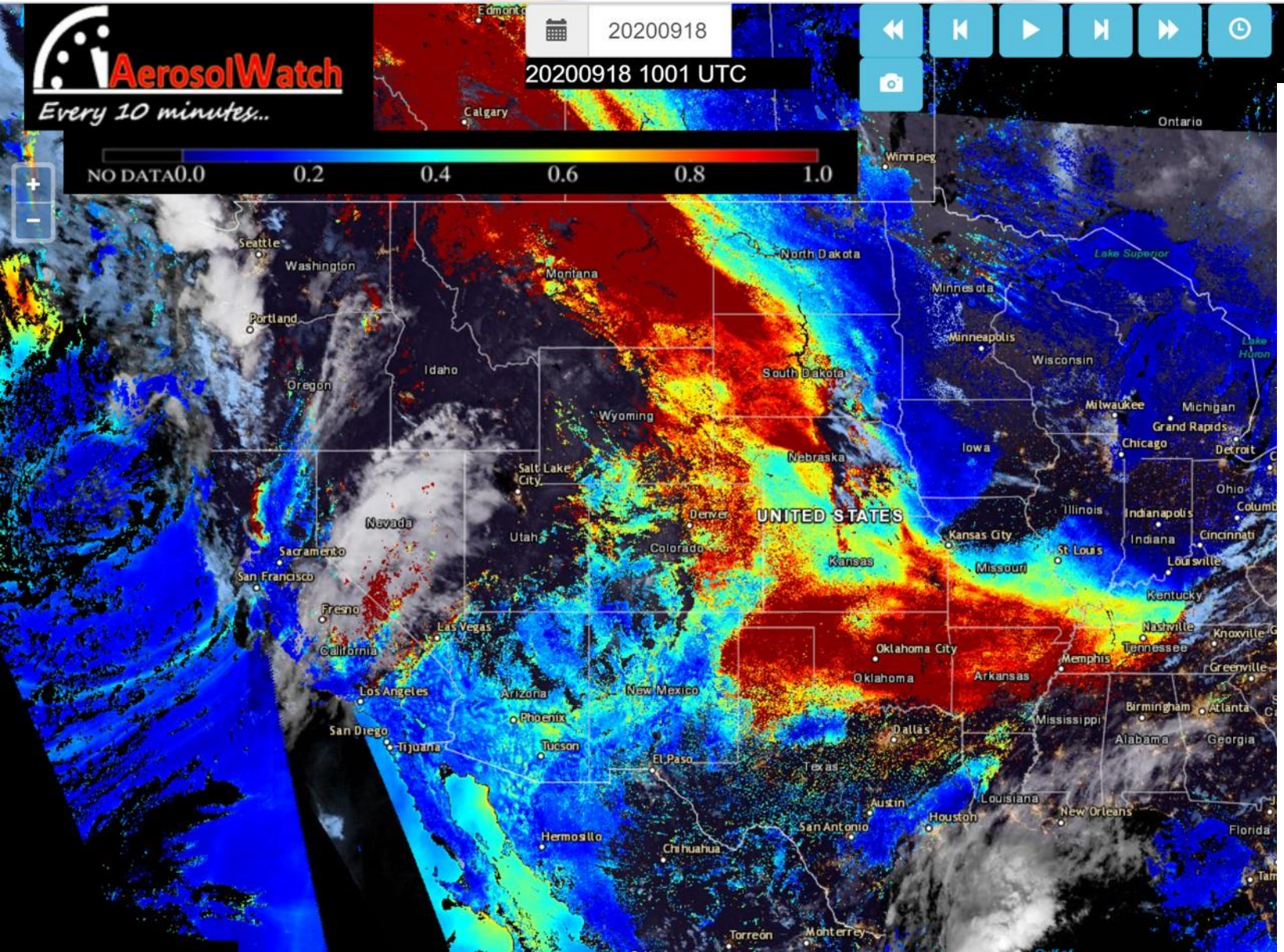
$PM_{2.5}$ ($\mu g/m^3$)
- Range: 6.7 – 11.3
- At 1000 UTC: 8

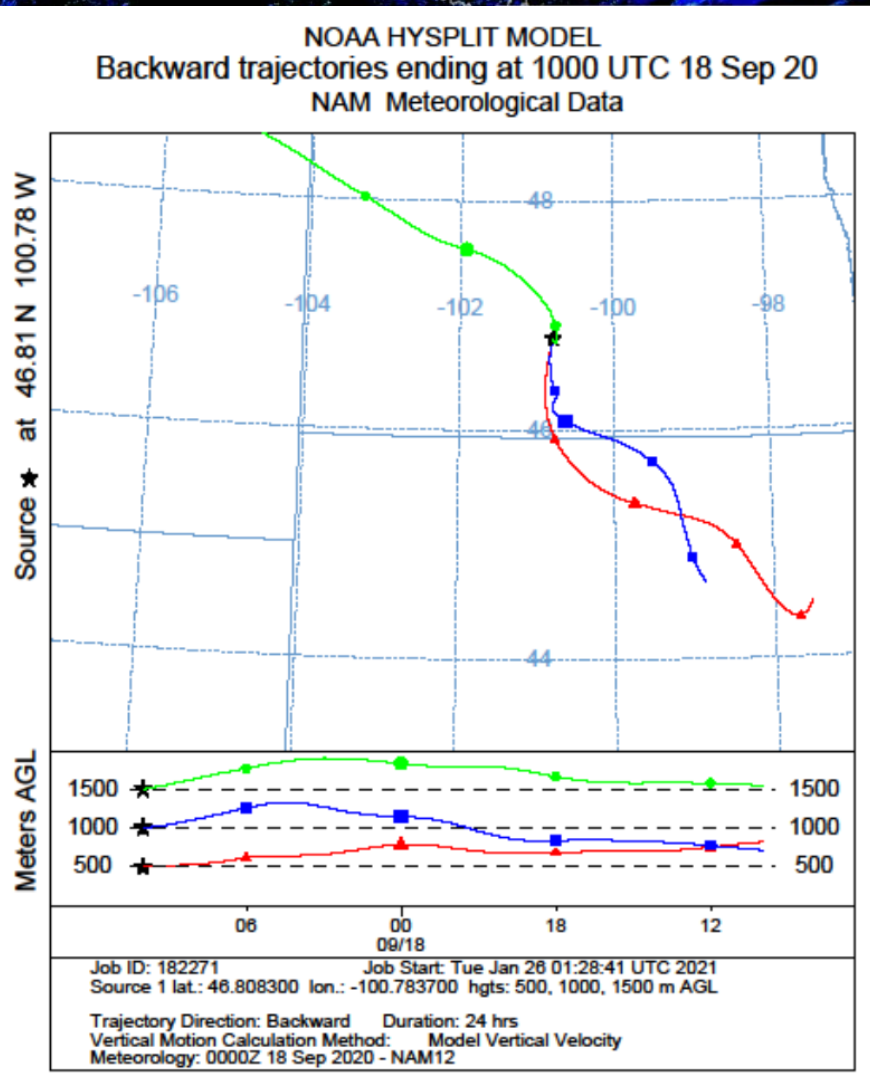




September Case Study – 9/18
AOD, PM2.5 and Wind Direction

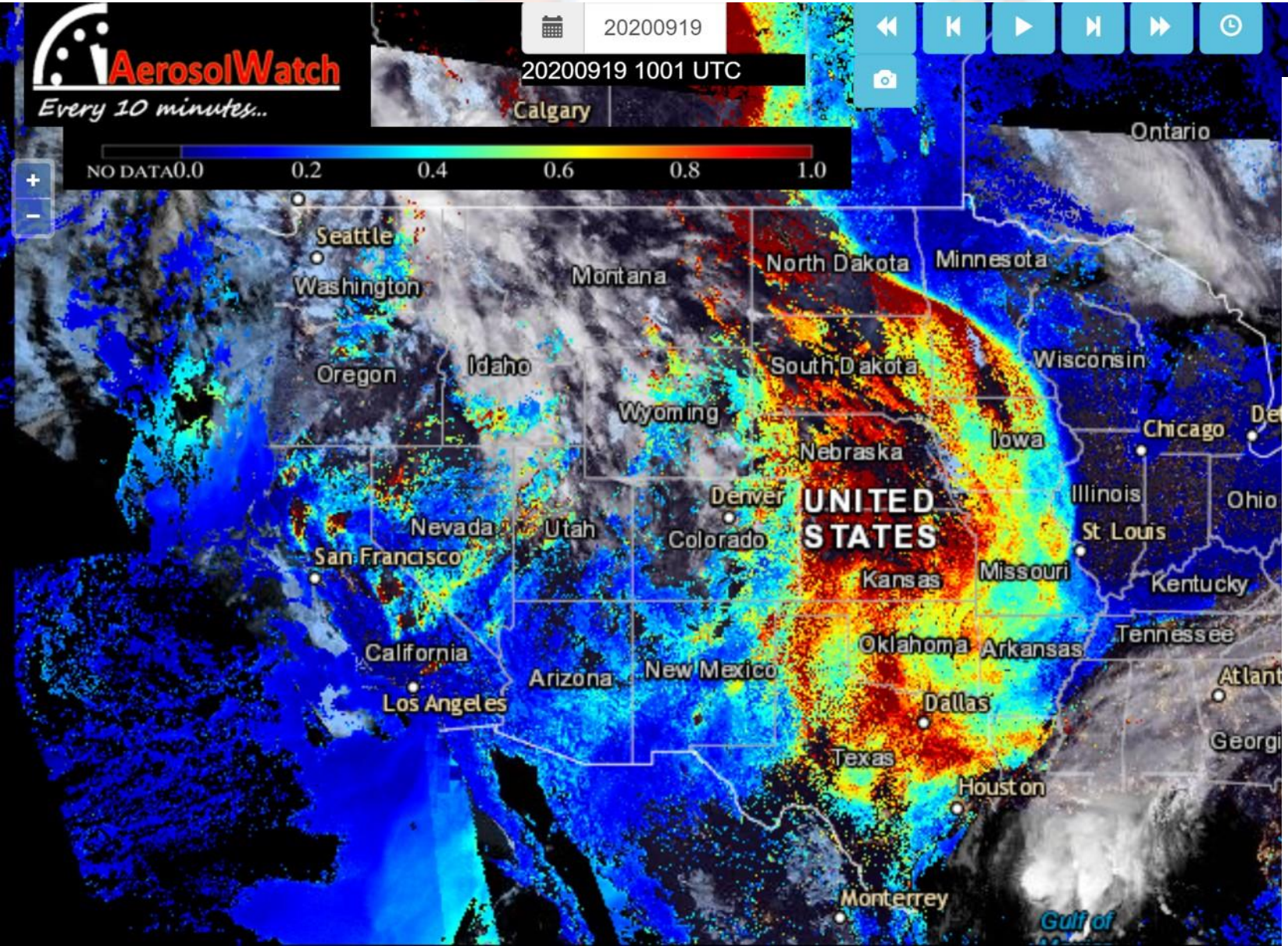
$PM_{2.5}$ (µg/m³)
- Range: 5.8 – 11.4
- At 1000 UTC: 6.5

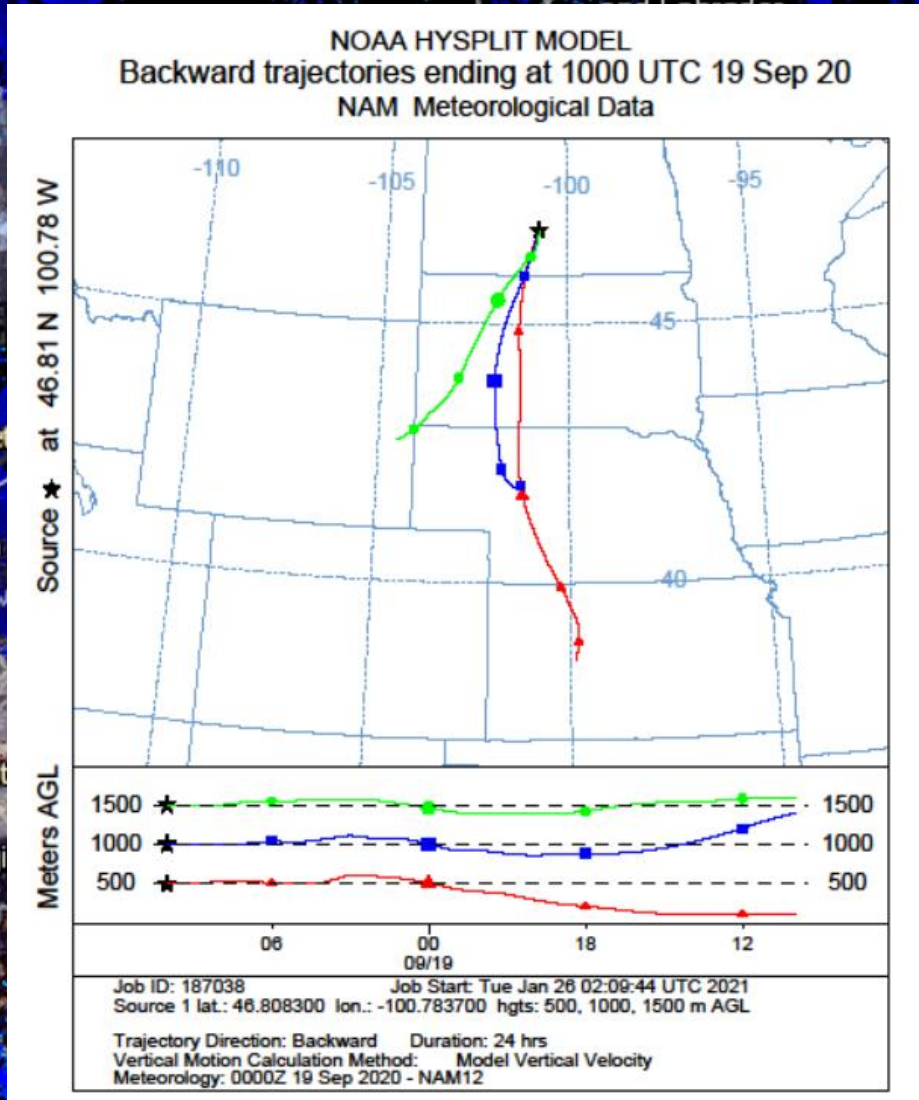




September Case Study – 9/19
AOD, PM2.5 and Wind Direction

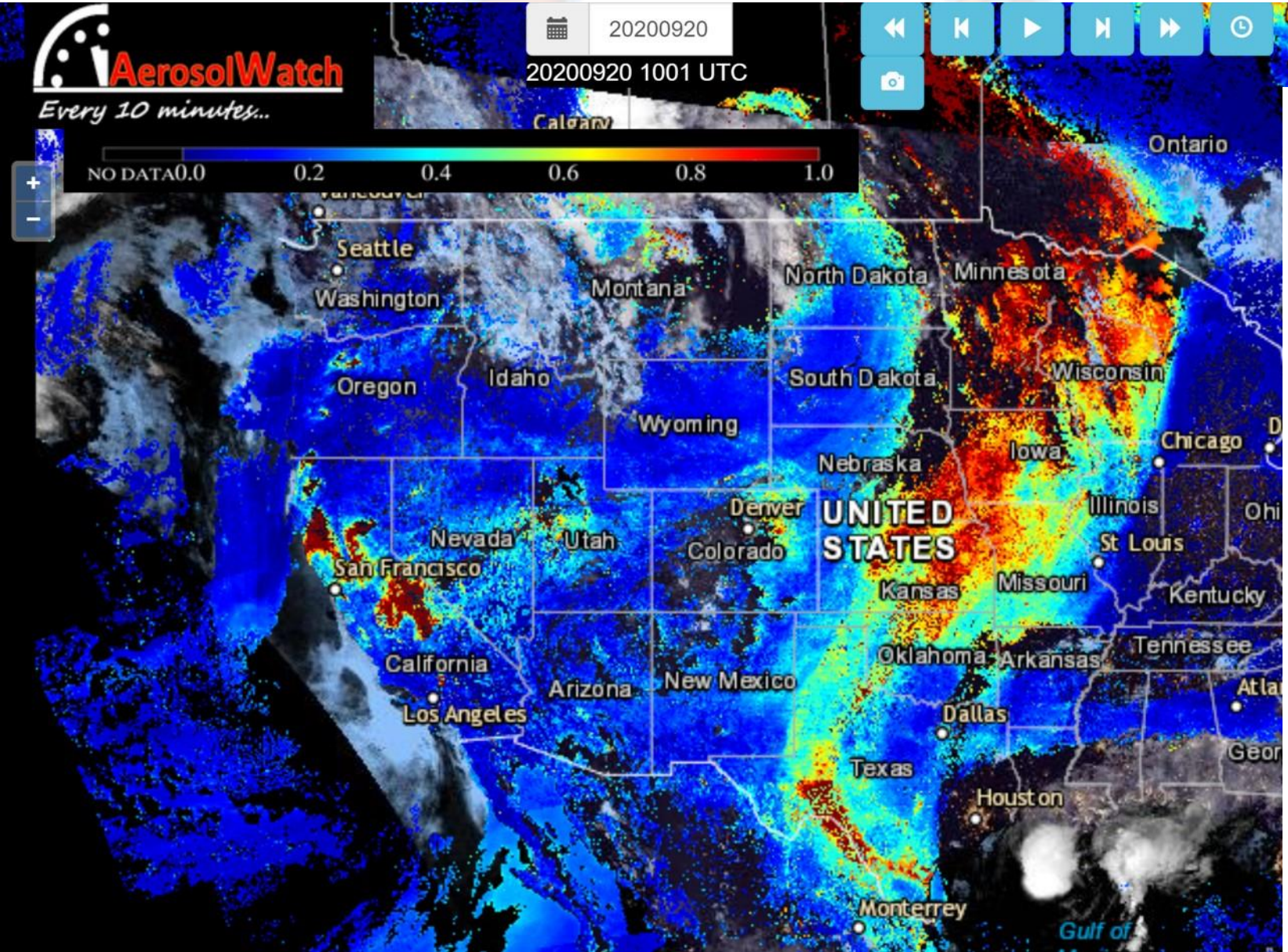
$PM_{2.5}$ ($\mu g/m^3$)
- Range: 8.4 – 16.7
- At 1000 UTC: 8.7

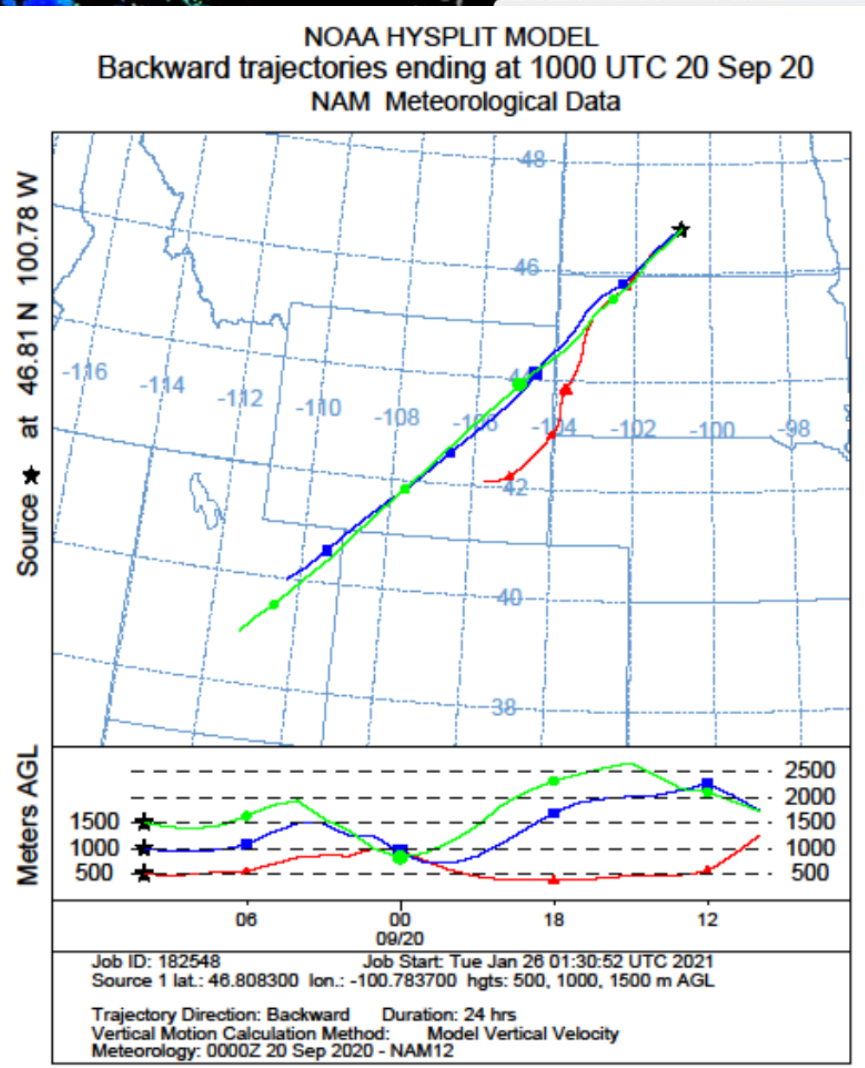




September Case Study – 9/20
AOD, PM2.5 and Wind Direction

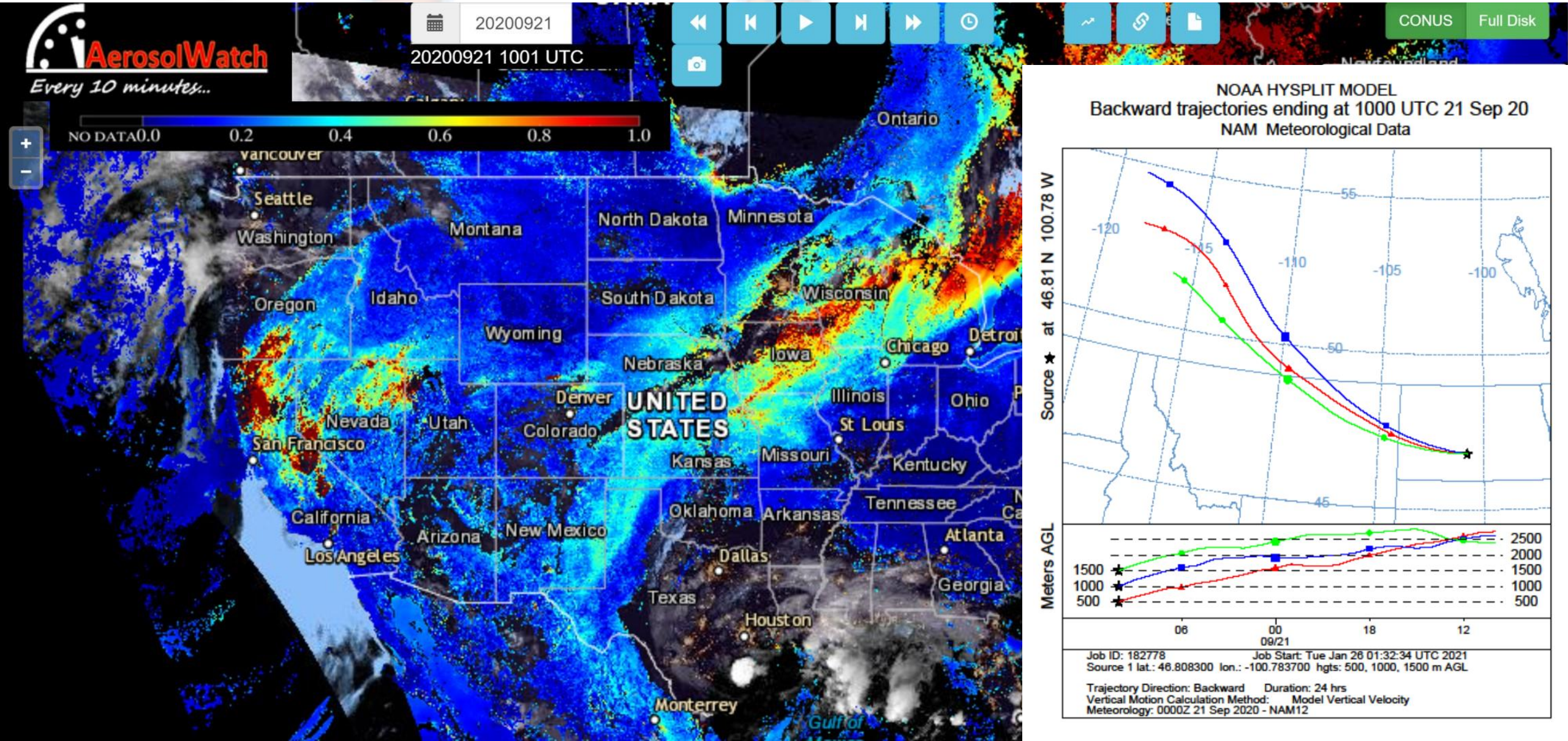
$PM_{2.5}$ ($\mu g/m^3$)
- Range: 15.8 – 33.9
- At 1000 UTC: 32.7





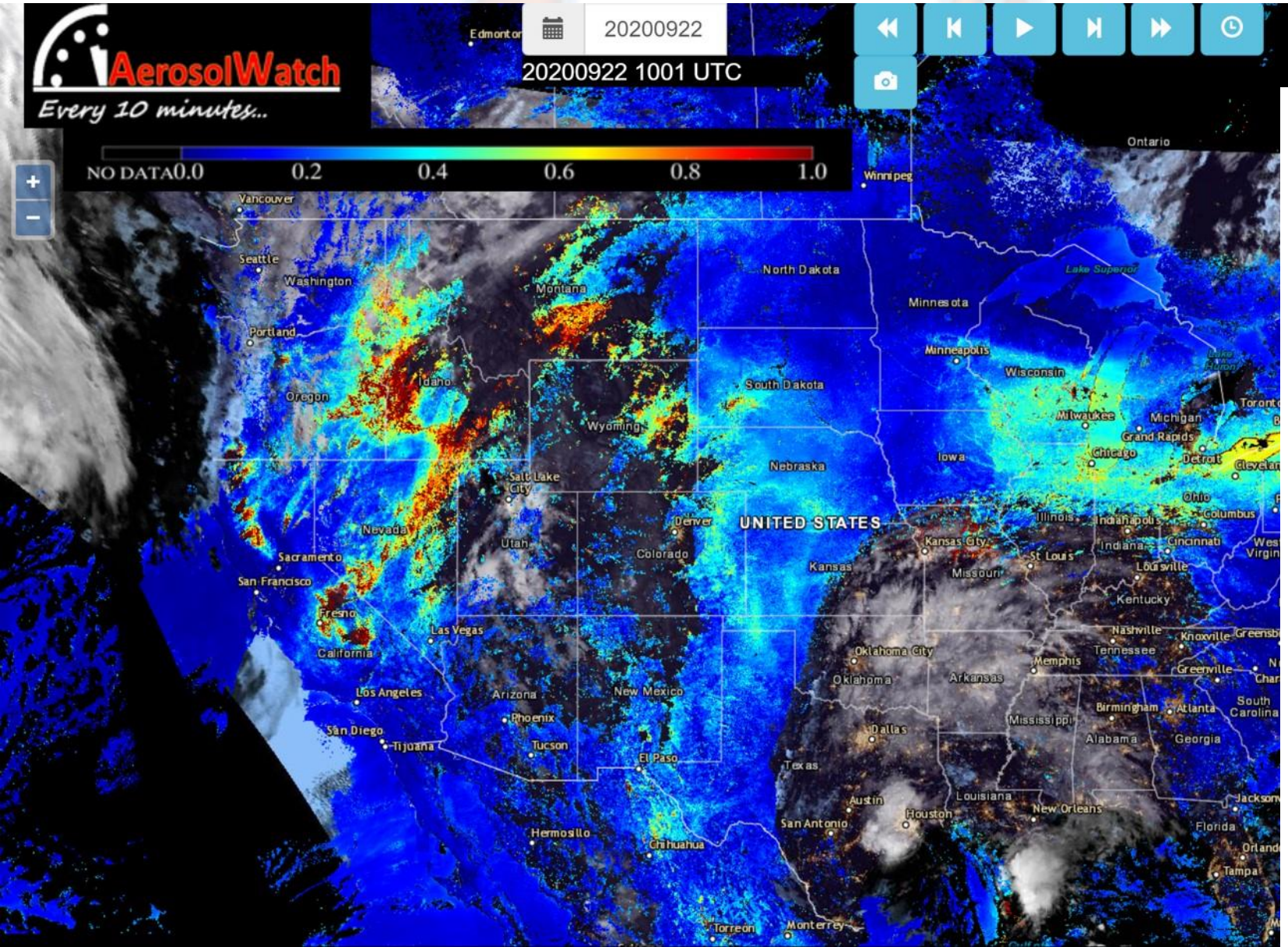
September Case Study – 9/21
AOD, PM2.5 and Wind Direction

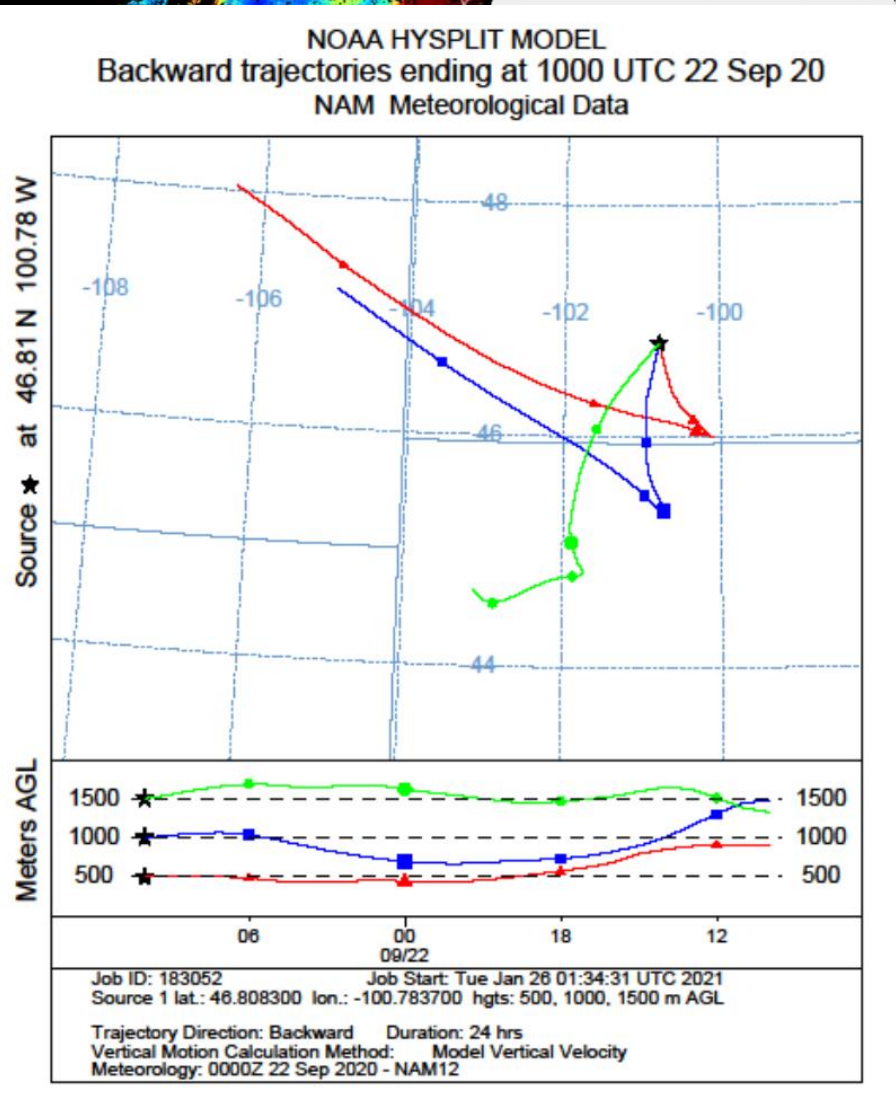
$PM_{2.5}$ (µg/m³)
- Range: 10.7 – 21.1
- At 1000 UTC: 19.8



September Case Study – 9/22
AOD, PM2.5 and Wind Direction

$PM_{2.5}$ (µg/m³)
- Range: 12.8 – 19.8
- At 1000 UTC: 16.6





Summary

- Integrated multiple data sets from different agencies
  - NDAWN – Wind Direction
  - ND DEQ – $PM_{2.5}$
  - SBC Purple Air - $PM_{2.5}$
  - Areonet – AOD
  - VIIRS – AOD
  - HYSPLIT – Back Trajectories
  - World View - AOD
- Much of the smoke from the fires that reached ND remained aloft, making it to ground level only a few times during our case studies.

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THANK
YOU