The Brightest Idea: New Capabilities for Infusing Satellite Data into Environmental Applications--International (IDEA-I)

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HAQAST2020
WEBINAR SERIES

Introduction

- Infusing Satellite Data into Environmental Applications (IDEA, https://www.star.nesdis.noaa.gov/smcd/spb/aq/) is a satellite based aerosol forecasting, visualization, and data synthesis tool for use by the US air quality forecasting community [Al-Saadi, et al., 2005].

- IDEA-International (IDEA-I) provides a open source portable version of IDEA.

- By the end of this Webinar participants will have a better understanding of new capabilities that have been added to IDEA-I and where to go to obtain software and instructions for installing IDEA-I as well as real-time IDEA-I forecasts

FIREX-AQ Case-Studies

- We will demonstrate the new IDEA-I capabilities by considering case-studies during the 2019 NASA/NOAA Fire Influence on Regional to Global Environments Experiment - Air Quality (FIREX-AQ) field campaign

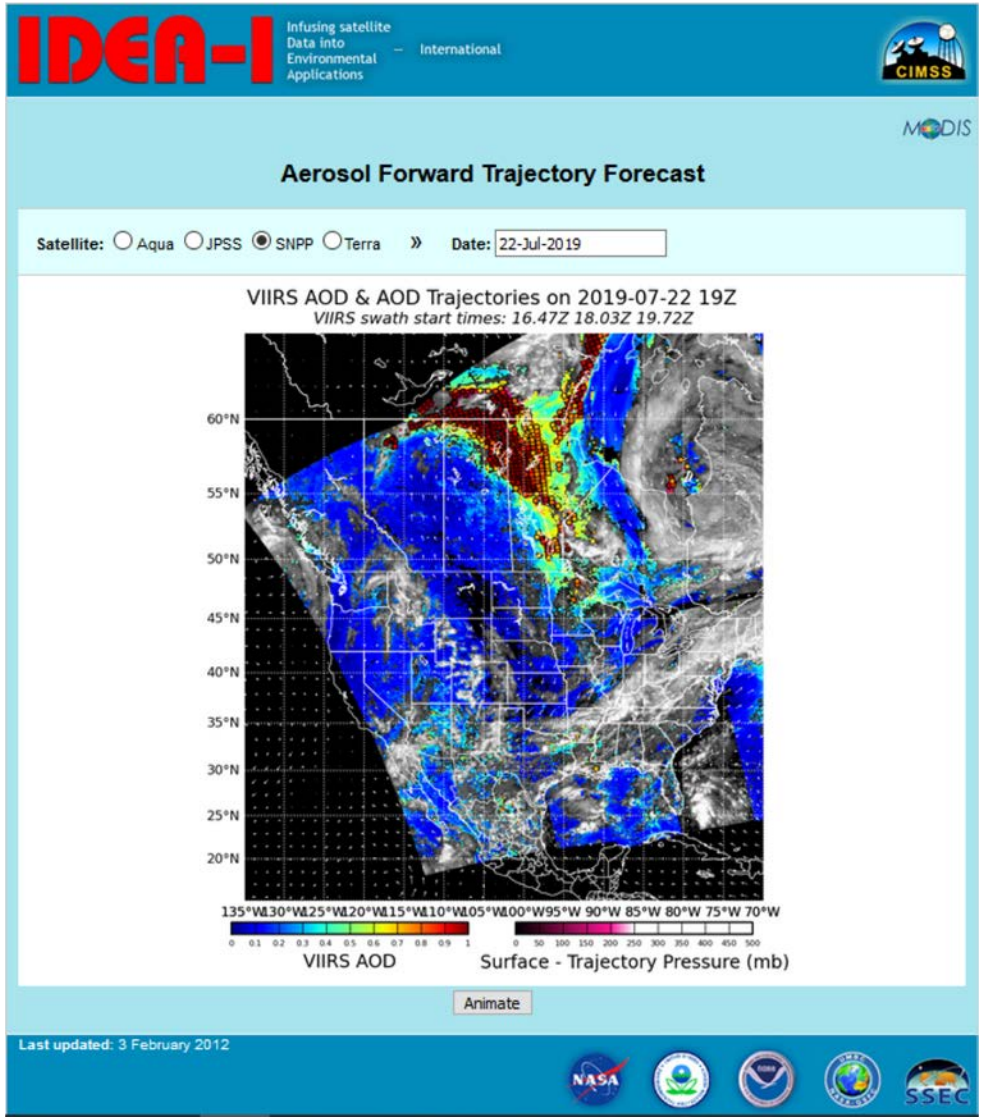
- FIREX-AQ provided measurements of trace gas and aerosol emissions for wildfires and prescribed fires to better understand chemical transformation and air quality impacts.

New IDEA-I Capabilities: MODIS/VIIRS

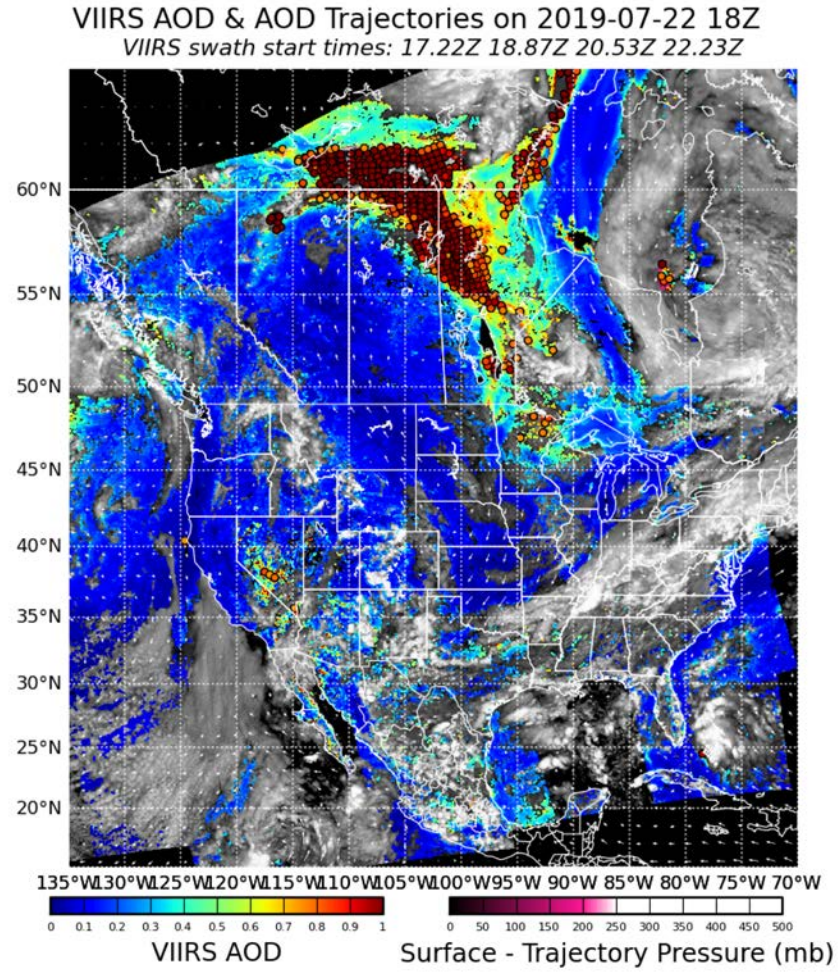
- The MODIS/VIIRS IDEA-I is globally configurable and uses ***aggregated*** Terra, Aqua, SNPP, and JPSS aerosol optical depth (AOD) retrievals to identify local regions of high aerosol loading from which trajectories are initialized.

- Trajectories are predicted using the NOAA Global Forecasting System (GFS) 0.5° winds

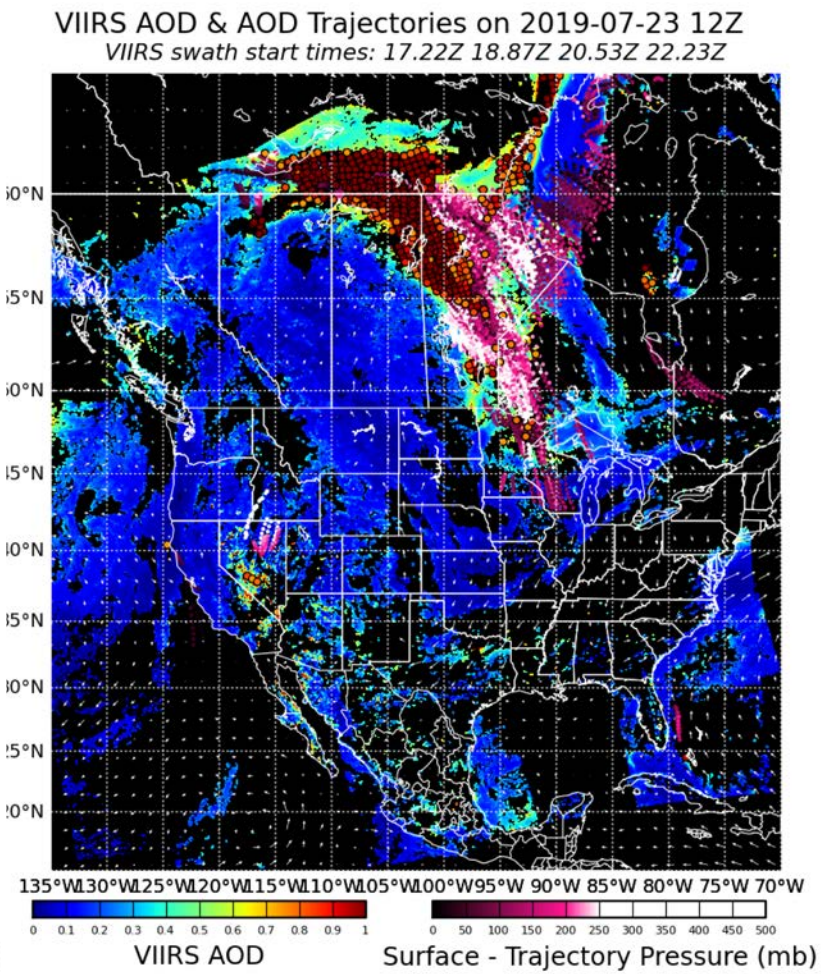
- The forecast trajectories are color coded **red** if the aerosols are expected to affect people at the surface.



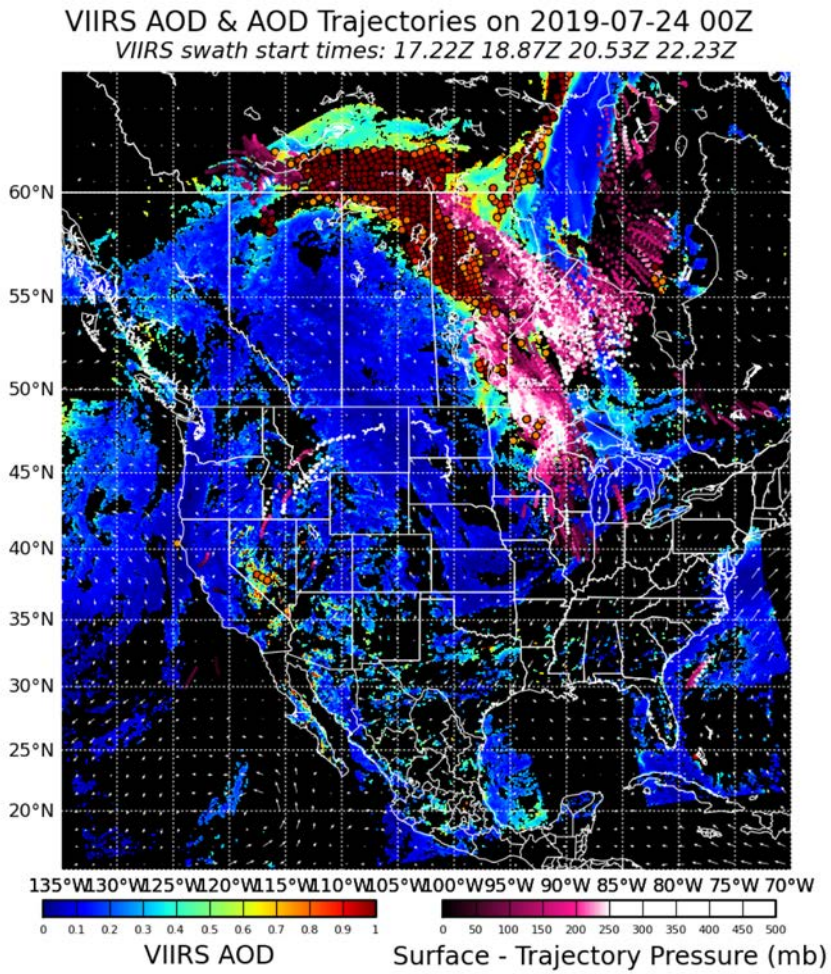
IDEA-I VIIRS Forecast on July 22, 2019



Initial VIIRS AOD

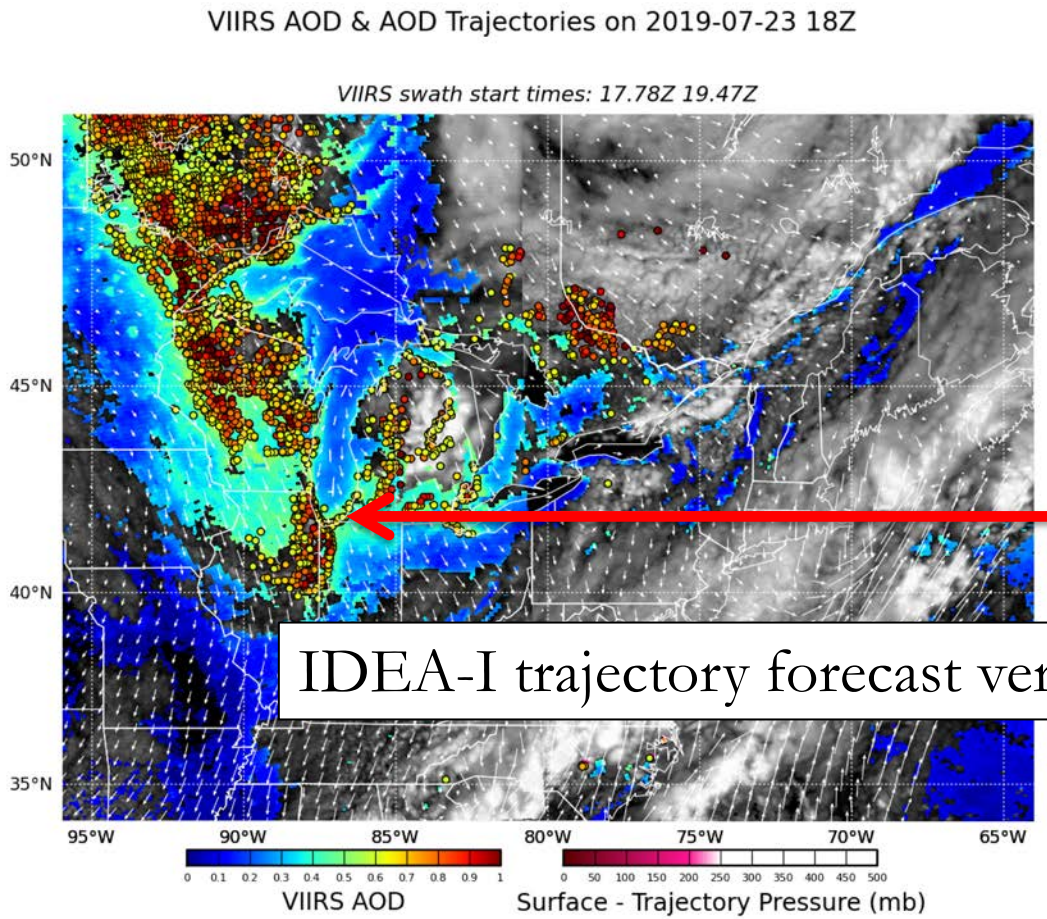


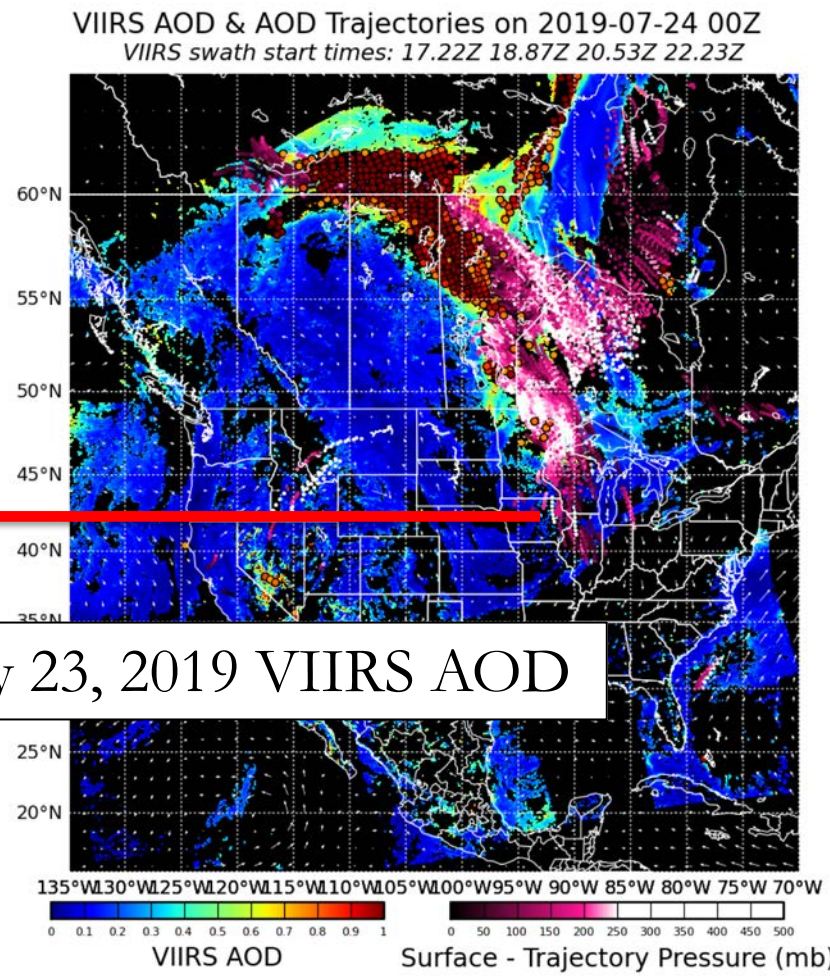
18hr Trajectory Forecast



30hr Trajectory Forecast

IDEA-I July 23, 2019 Forecast verification



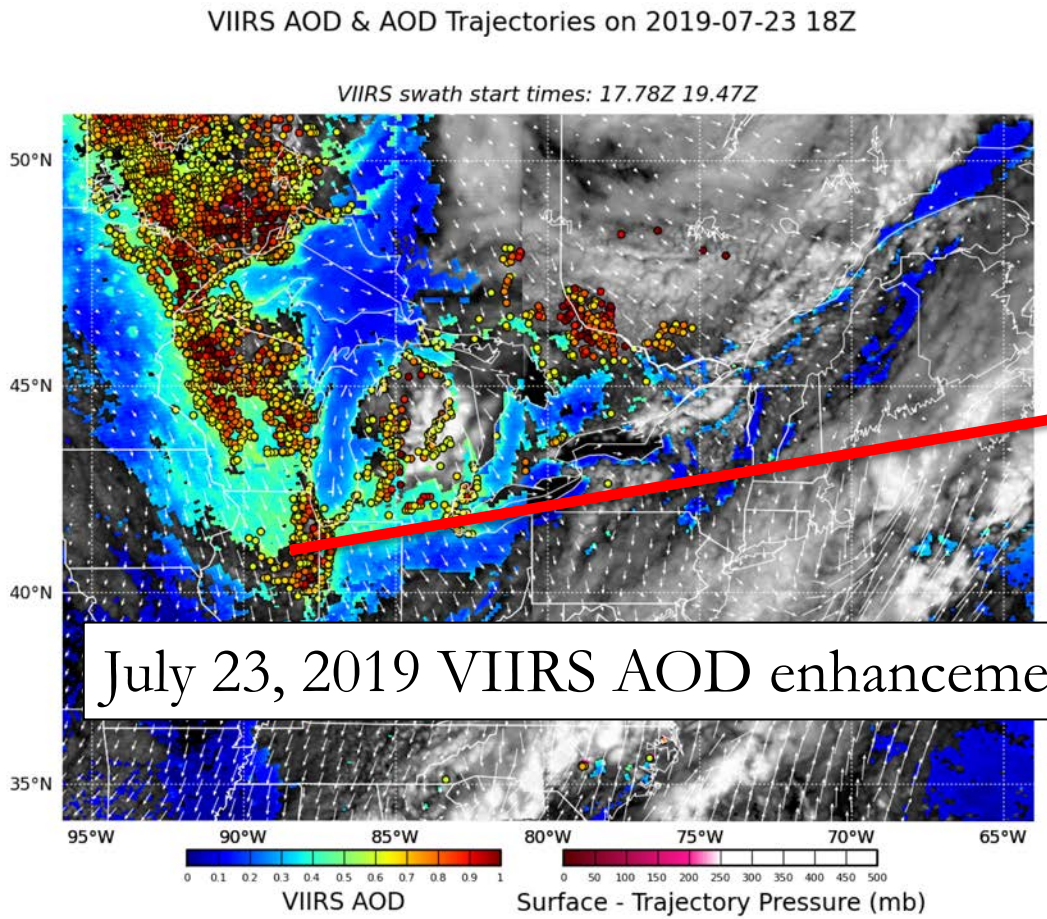


IDEA-I trajectory forecast verifies based on July 23, 2019 VIIRS AOD

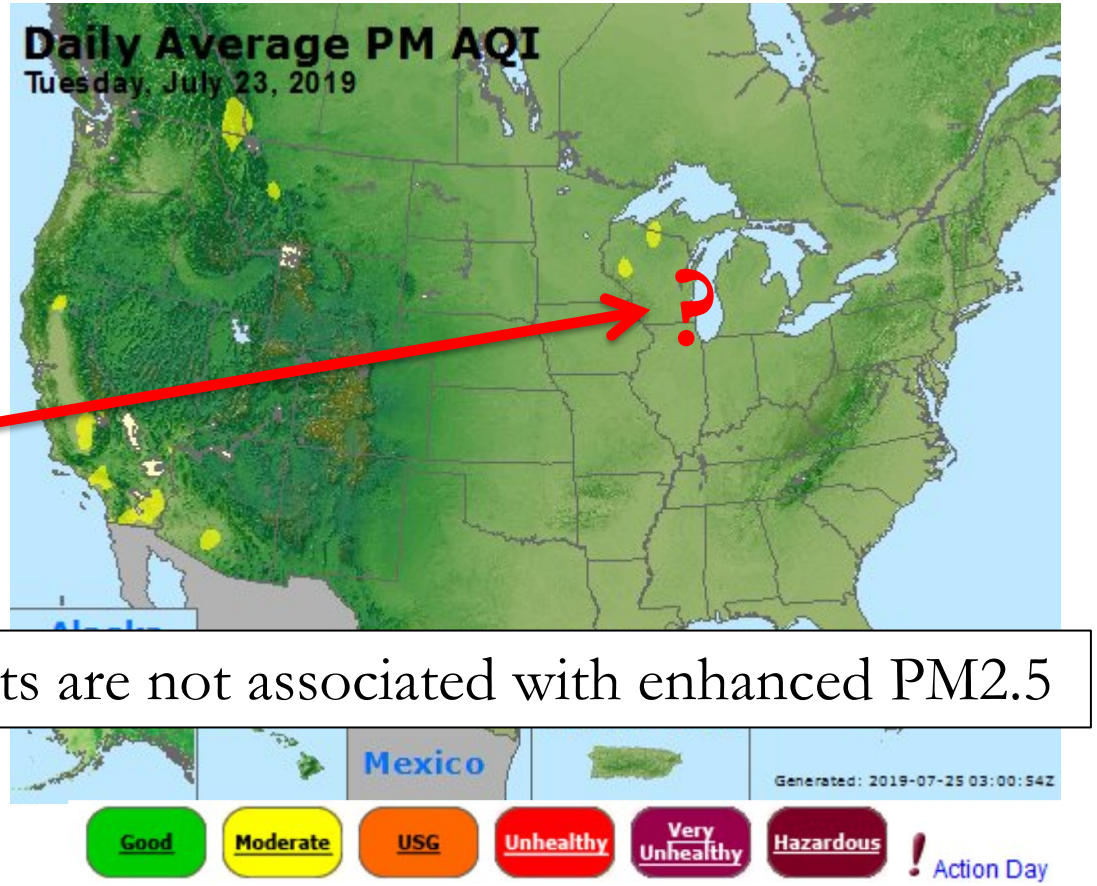
VIIRS AOD Verification

30hr Trajectory Forecast

IDEA-I July 23, 2019 Forecast verification



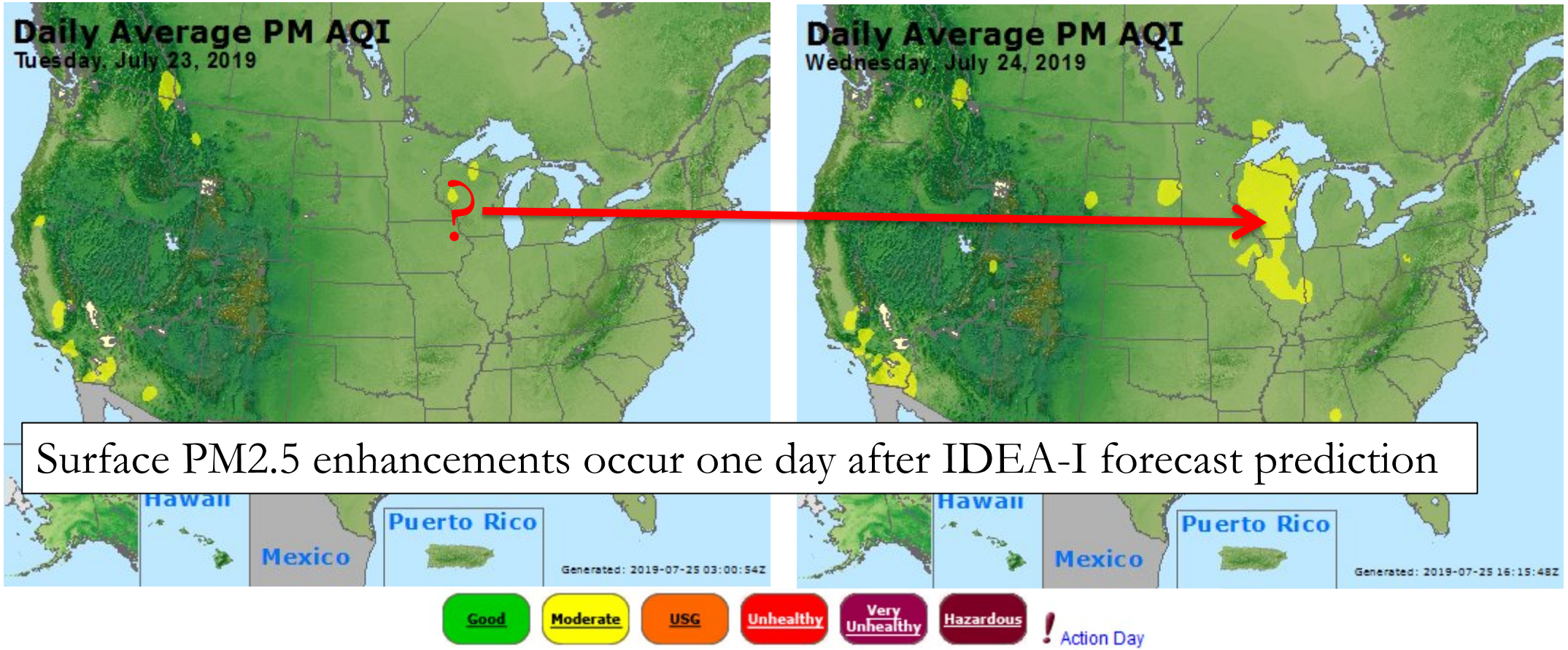
VIIRS AOD Verification



July 23, 2019 VIIRS AOD enhancements are not associated with enhanced PM2.5

Observed AirNOW surface PM2.5 AQI (https://www.airnow.gov/index.cfm)

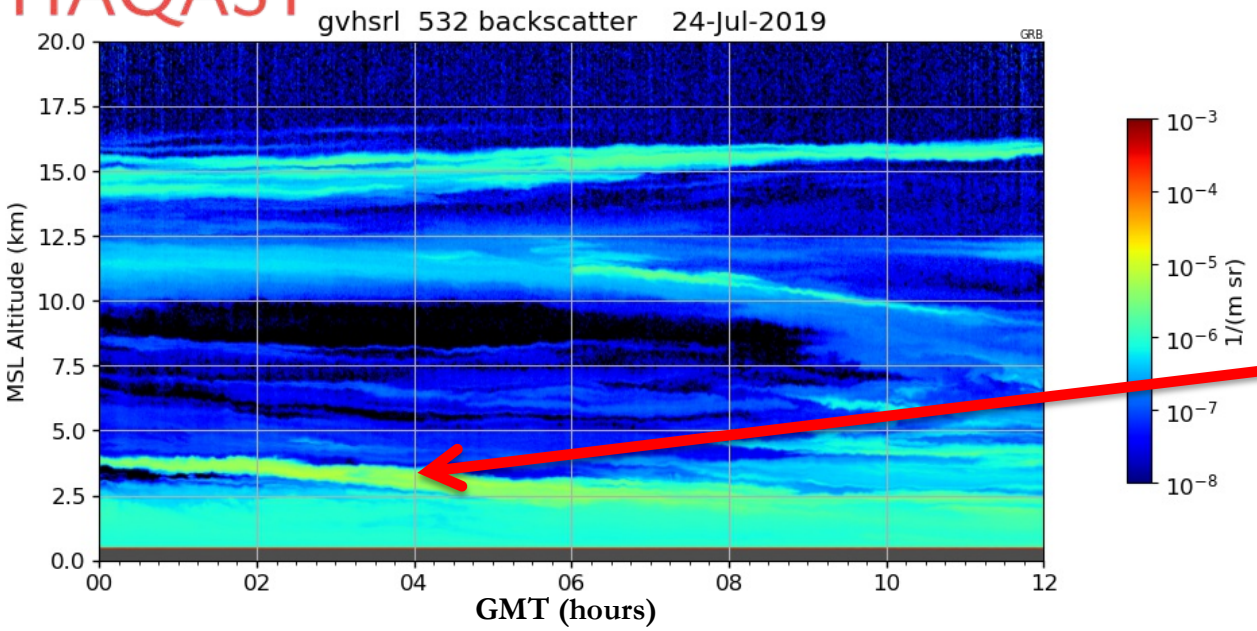
IDEA-I July 23, 2019 Forecast verification

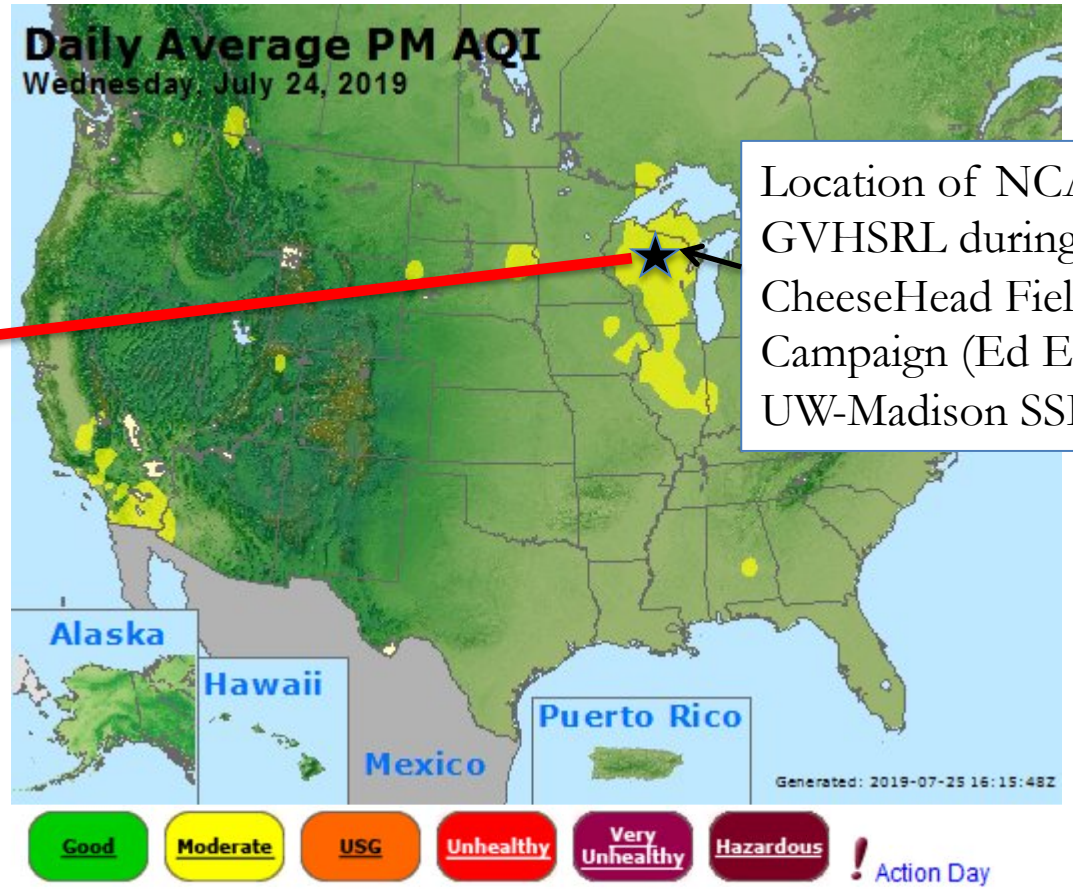


Surface PM2.5 enhancements occur one day after IDEA-I forecast prediction

Observed AirNOW surface PM2.5 AQI
(https://www.airnow.gov/index.cfm)

IDEA-I July 23, 2019 Forecast verification





Location of NCAR GVHSRL during NSF CheeseHead Field Campaign (Ed Eloranta, UW-Madison SSEC)

- IDEA-I trajectory forecast assumes that the aerosols are within the planetary boundary layer
- This was not the case on July 22, 2019
- ***Need additional information about the vertical distribution of the smoke***

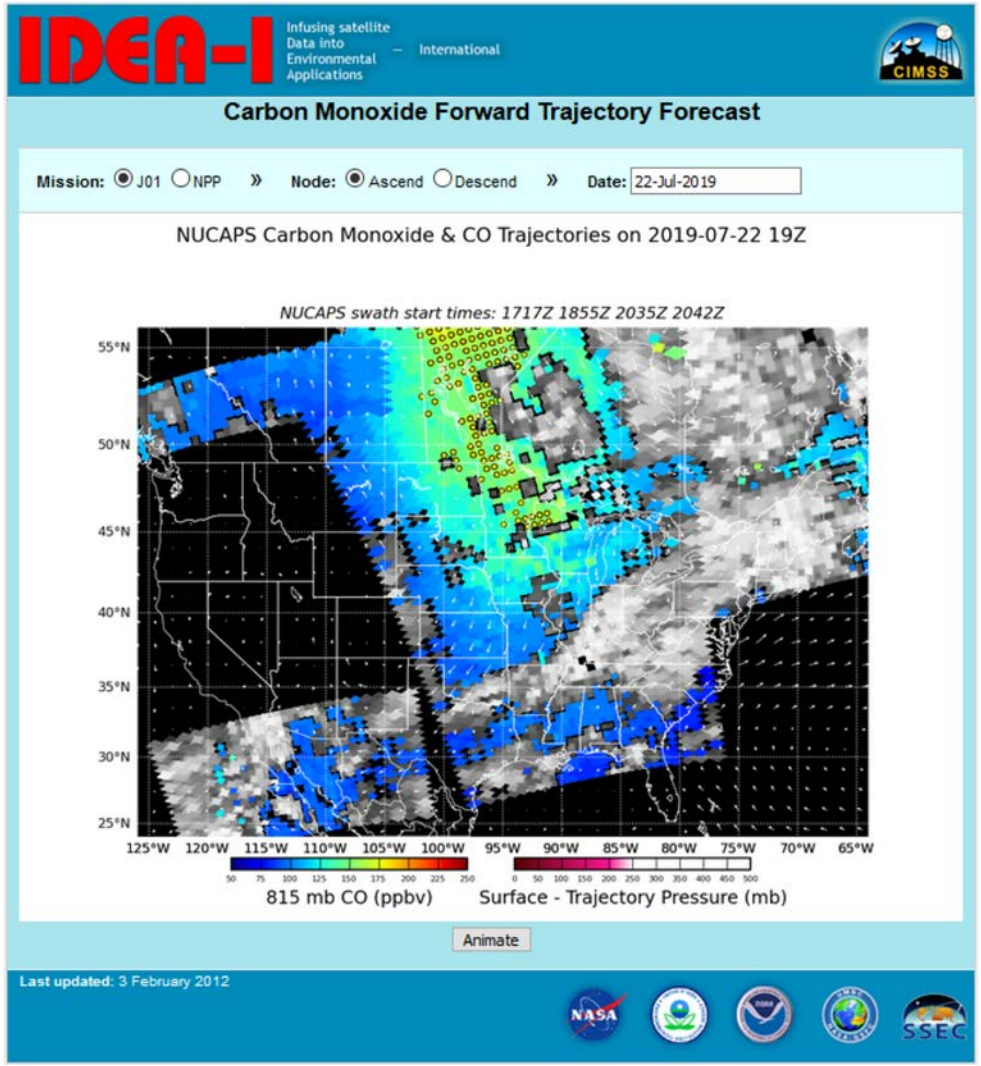
Observed AirNOW surface PM2.5 AQI (https://www.airnow.gov/index.cfm)

New IDEA-I Capabilities: NUCAPS

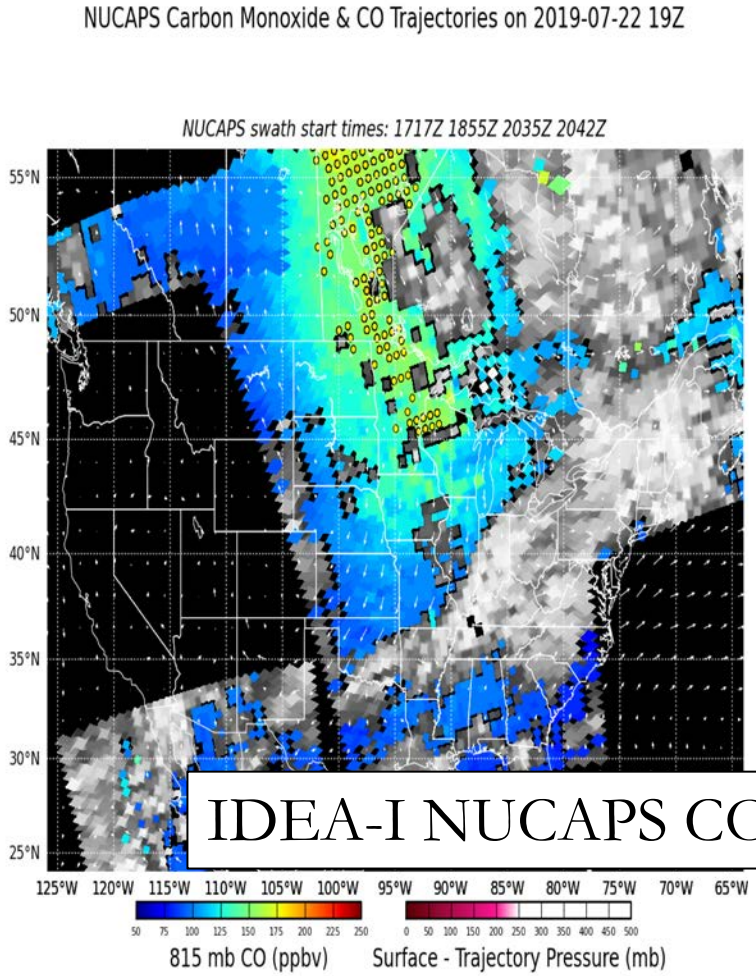
- The NOAA Unique Combined Atmospheric Processing System (NUCAPS) was developed to generate retrieved products such as profiles of temperature, moisture, trace gases and cloud-cleared radiances from the Cross-track Infrared Sounder (CrIS)

- IDEA-I NUCAPS uses carbon monoxide (CO) retrievals to identify ***altitudes*** of pollution layers from which trajectories are initialized.

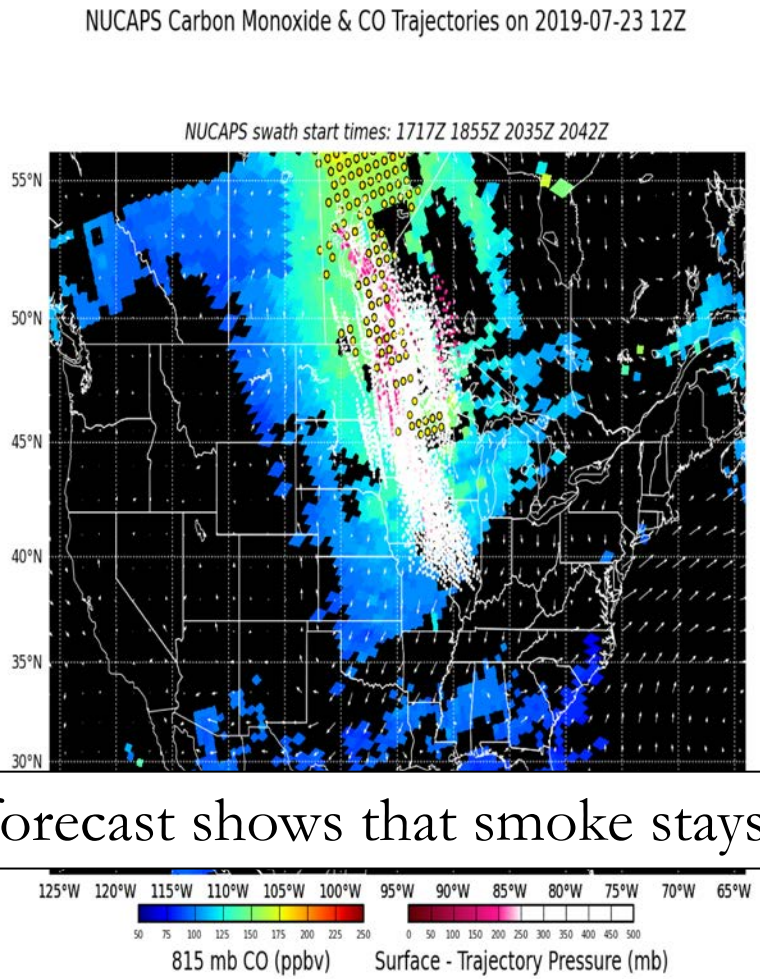
- The forecast trajectories are color coded **red** if the smoke is expected to affect people at the surface.



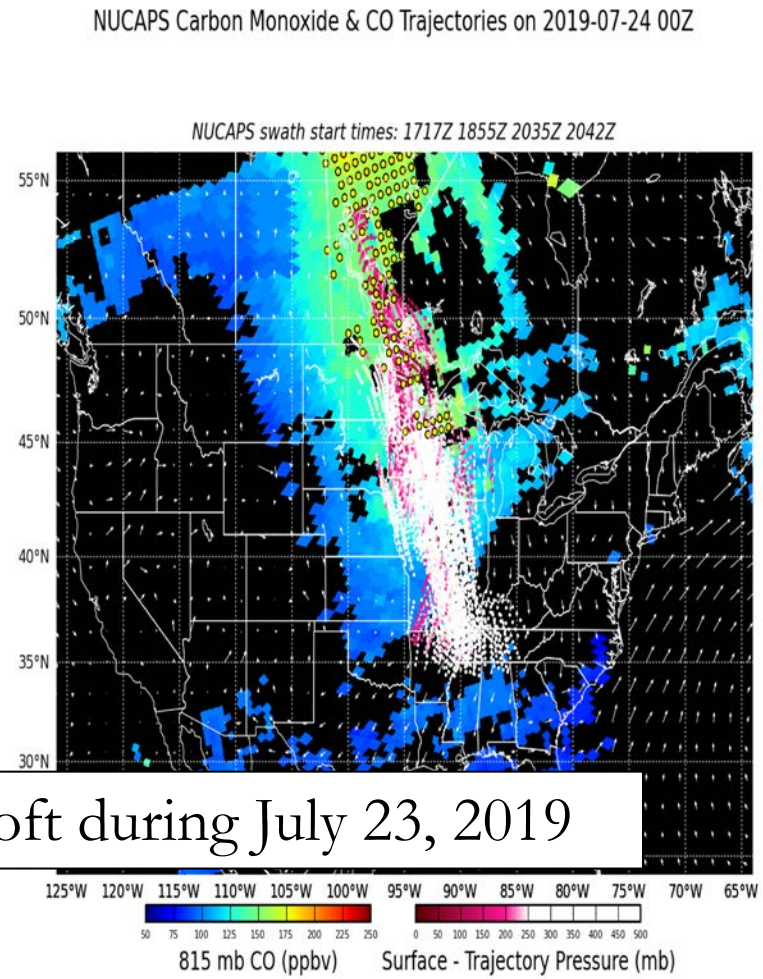
IDEA-I NUCAPS Forecast on July 22, 2019



Initial NUCAPS 850mb CO



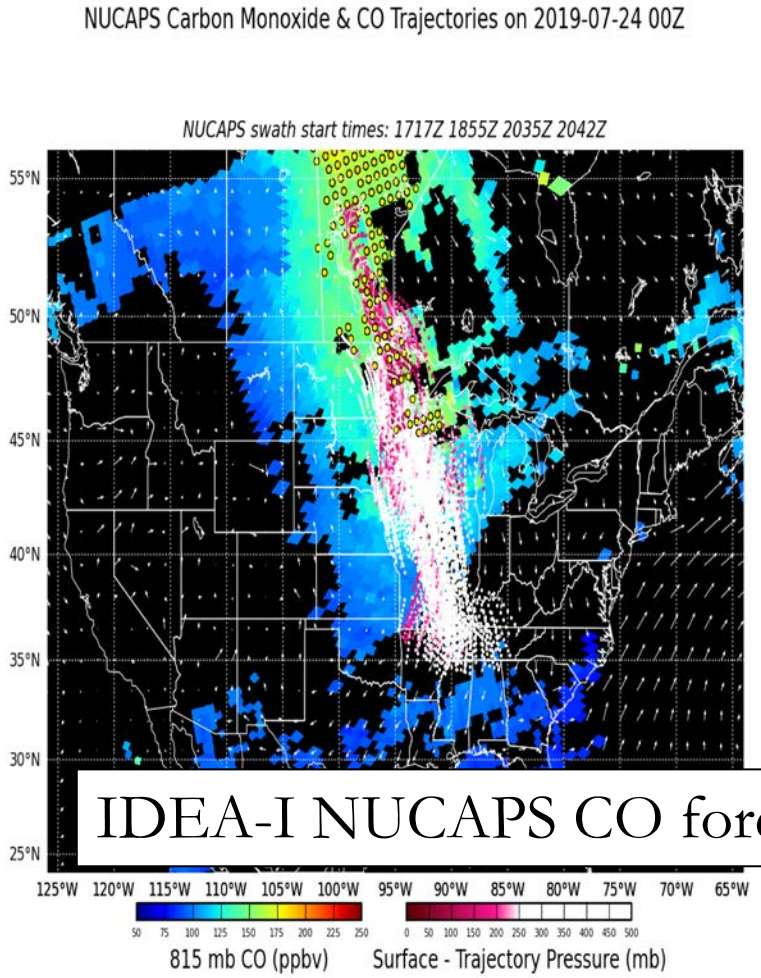
18hr Trajectory Forecast

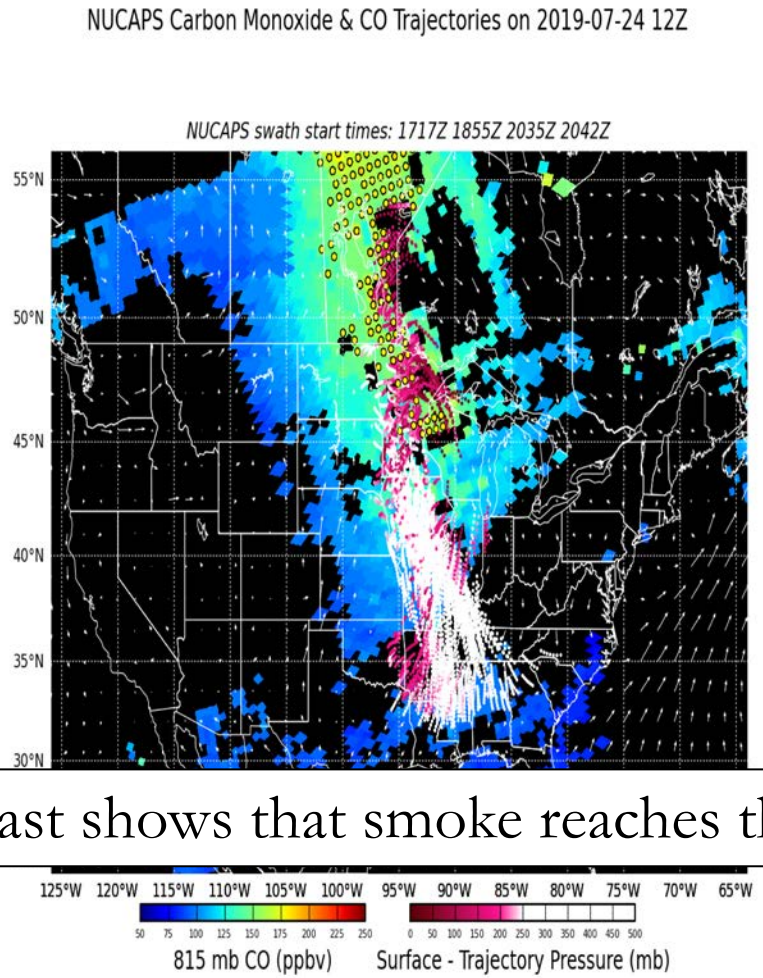


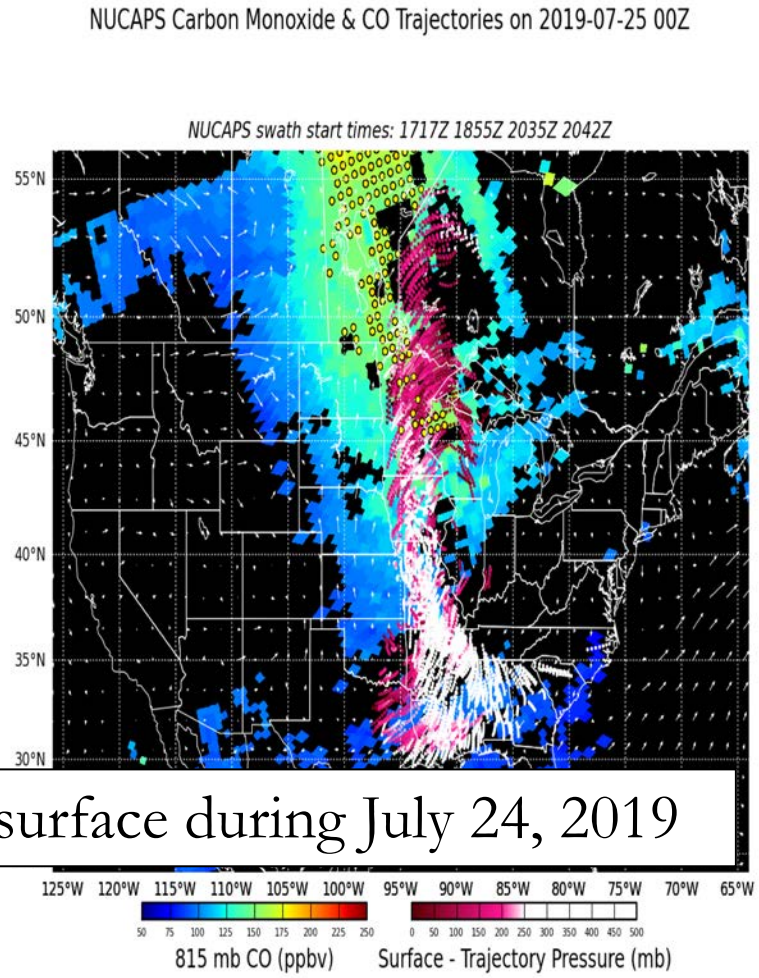
30hr Trajectory Forecast

IDEA-I NUCAPS CO forecast shows that smoke stays aloft during July 23, 2019

IDEA-I NUCAPS Forecast on July 22, 2019







IDEA-I NUCAPS CO forecast shows that smoke reaches the surface during July 24, 2019

30hr Trajectory Forecast

42hr Trajectory Forecast

54hr Trajectory Forecast

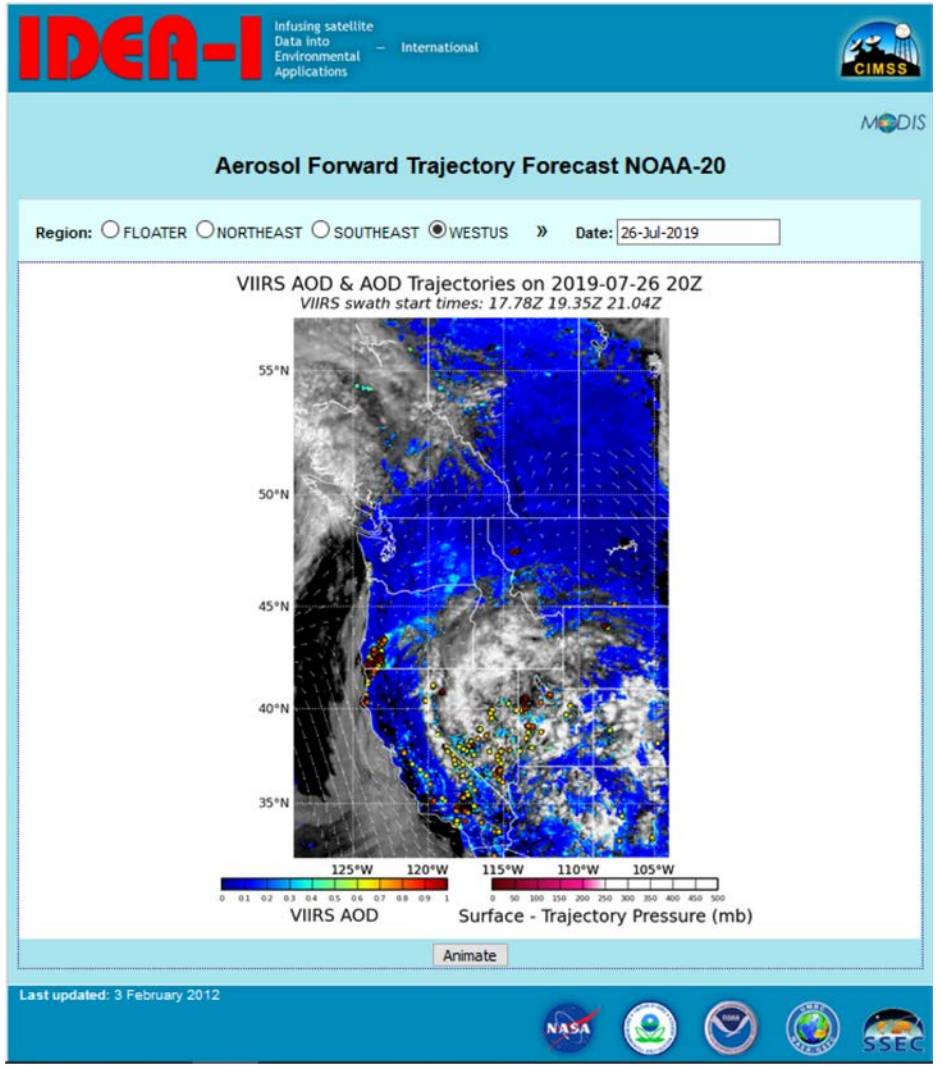
New IDEA-I Capabilities: High Res VIIRS

- IDEA-I high-resolution forecasts use ***full resolution*** SNPP, and JPSS aerosol optical depth (AOD) retrievals to identify local regions of high aerosol loading from which trajectories are initialized.

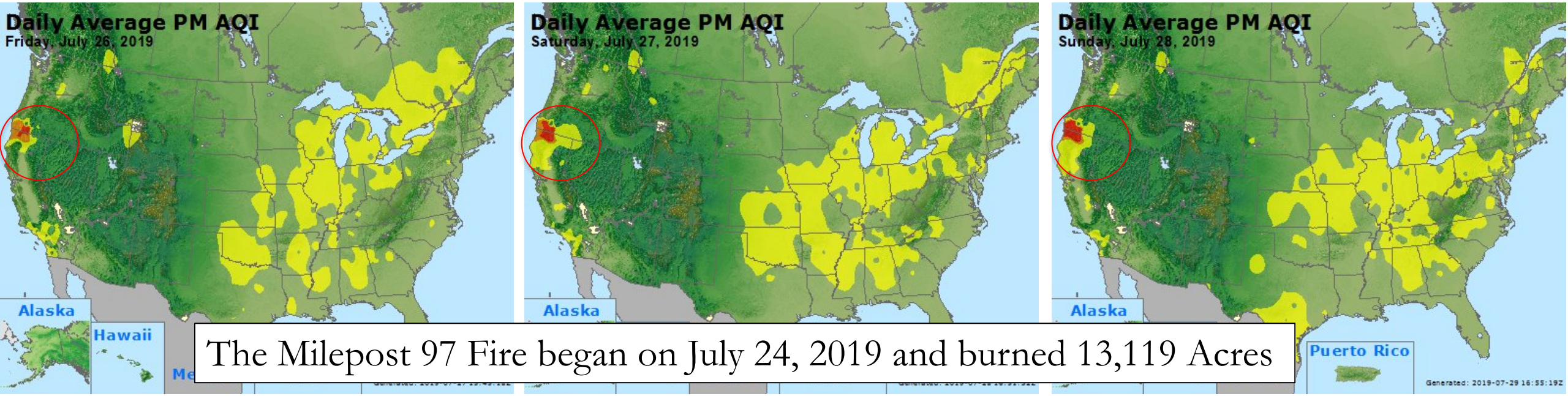
- Uses ***high resolution*** (3km) North American Model (NAM) forecasts for trajectory calculations.

- Allows for ***multiple*** forecast domains

- The forecast trajectories are color coded **red** if the aerosols are expected to affect people at the surface.



AirNOW July 26-28, 2019 Milepost 97 Fire

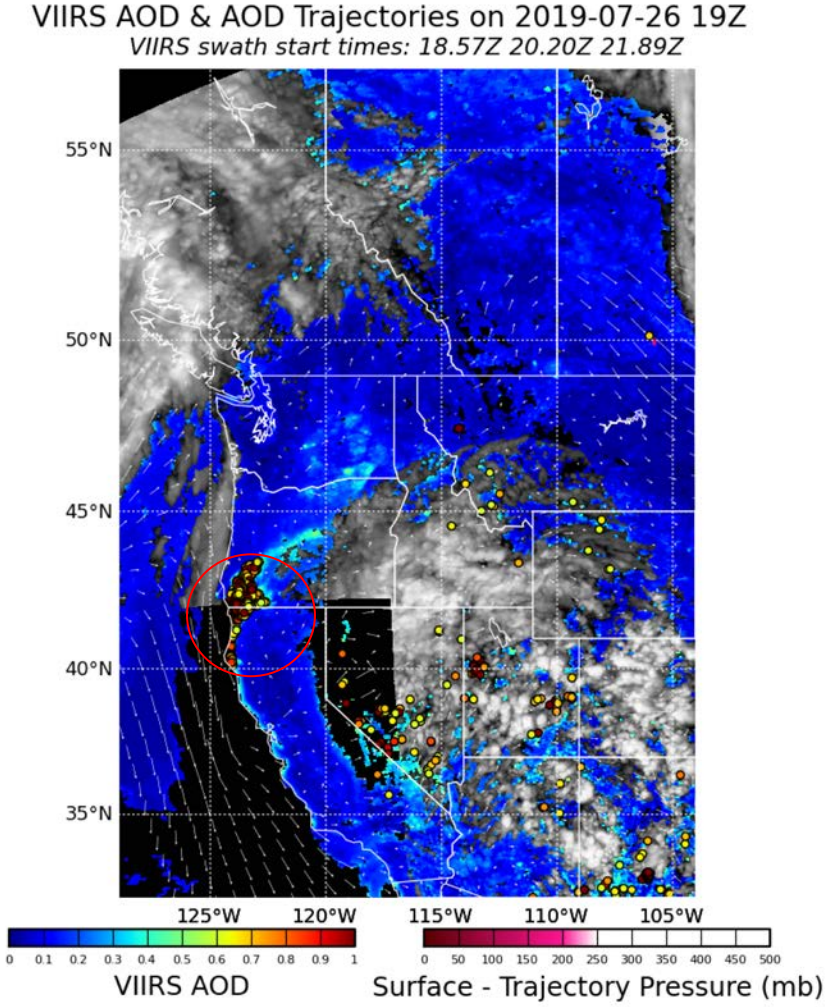


The Milepost 97 Fire began on July 24, 2019 and burned 13,119 Acres

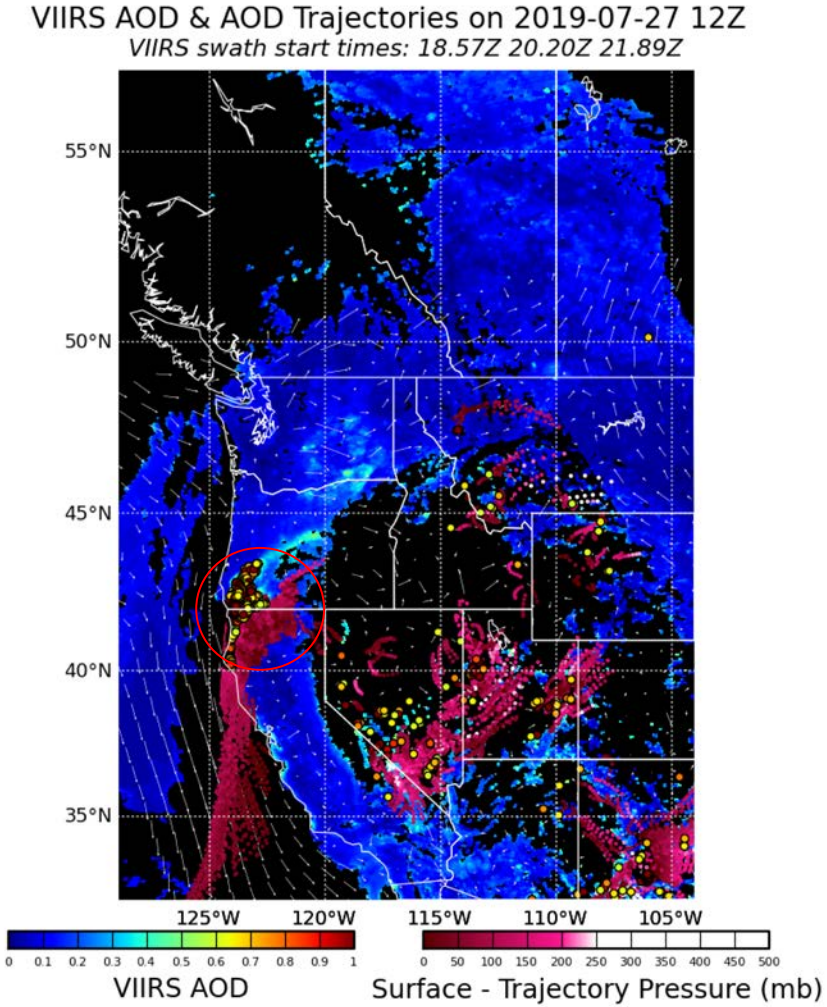
Good | Moderate | USG | Unhealthy | Very Unhealthy | Hazardous | ! Action Day

Observed AirNOW surface PM2.5 AQI
(https://www.airnow.gov/index.cfm)

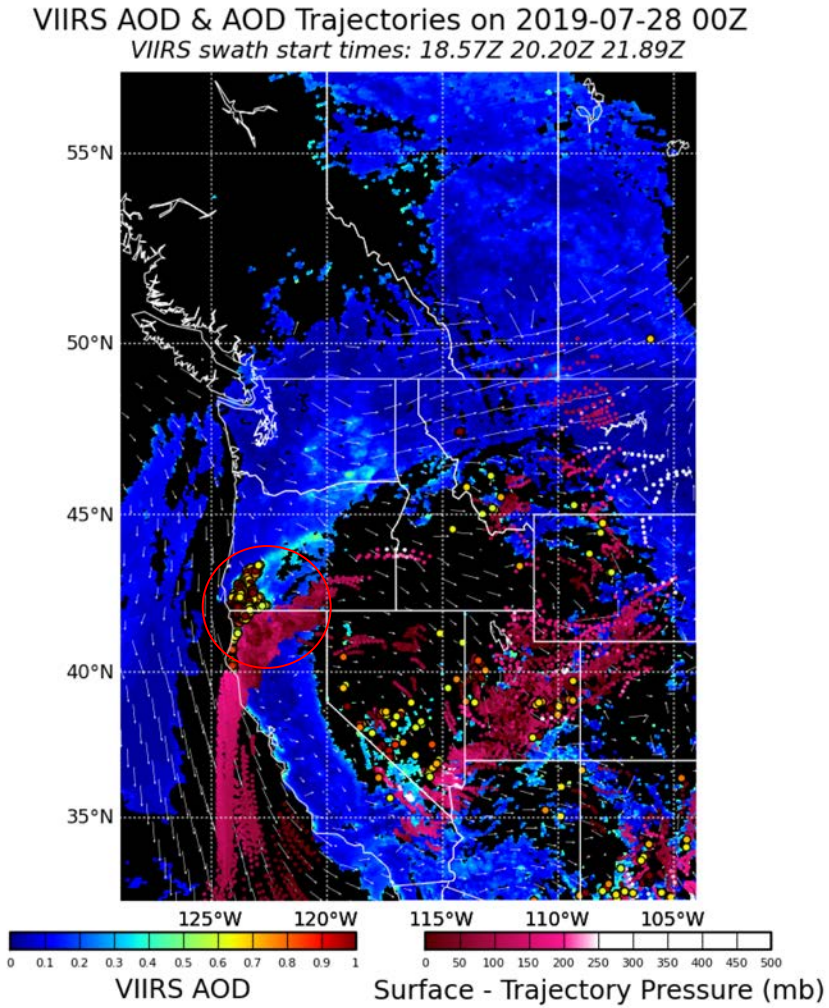
IDEA-I High Res VIIRS Forecast on July 27, 2019



Initial VIIRS AOD



18hr Trajectory Forecast



30hr Trajectory Forecast

IDEA-I High Res VIIRS Implementation

NEW YORK STATE OF OPPORTUNITY. NYSERDA

Configuration

	IDEA-NYS	IDEA-I aerosolEntHR
Domain	Lon: -90, -65 Lat: 35, 50	Lon: -96, -64 Lat: 34, 51
Met input	GFS 0.5°, 3hr (forecast 0-60hr)	NAM 3km, 1hr (forecast 0-36hr)
AOD	VIIRS EDR 6km (5x5)	VIIRS EPS 6km (8x8)
Clouds	AVHRR Extended (CLAVR-x) files	
Input	Met: 3.3G Satellite: CLAVR-x (7.9G), VIIRS (80M)	Met: 46G Satellite: CLAVR-x (7.9G), VIIRS (1.9G)
Output	42M	632M
Computing time	17min	120min (> 80min downloading data)

Slide provided by Sheng-Po Chen (University at Albany)

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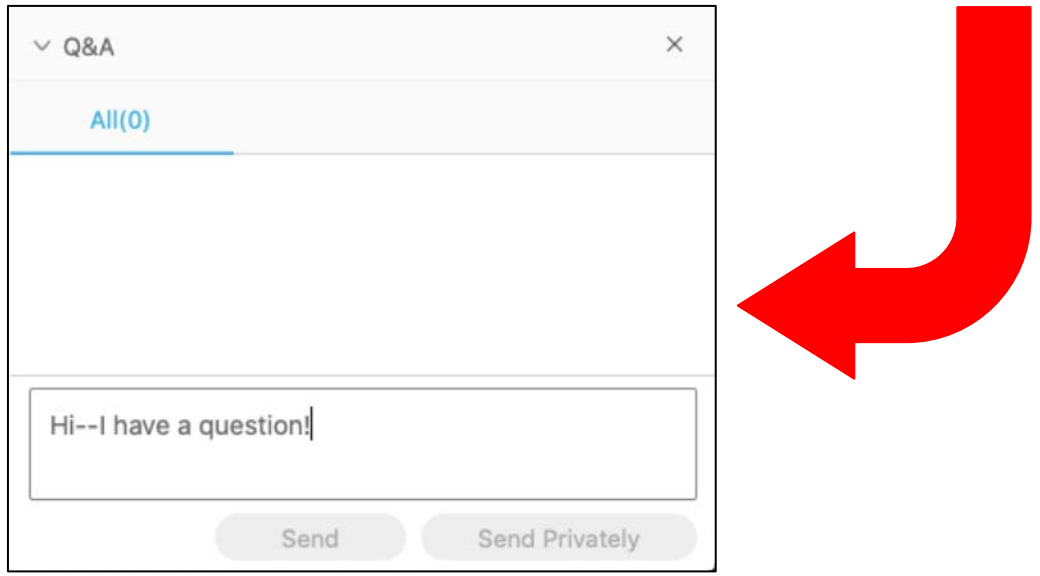
New IDEA-I Capabilities: Summary

- IDEA-I MODIS/VIIRS software and installation instructions are available at: https://cimss.ssec.wisc.edu/imapp/ideai_v1.2.shtml

- A North American version of IDEA-I MODIS/VIIRS forecasts are available at: http://smoke.ssec.wisc.edu/idea-i-aerosol-live-test/
- A US version of IDEA-I NUCAPS forecasts are available at: http://smoke.ssec.wisc.edu/idea-i-carbonmonoxide-live-test/
- Multi-domain IDEA-I High Res JPSS VIIRS forecasts are available at: http://smoke.ssec.wisc.edu/idea-i-aerosolEntHR-live-j01/
- Multi-domain IDEA-I S-NPP High Res VIIRS forecasts are available at: http://smoke.ssec.wisc.edu/idea-i-aerosolEntHR-live-test/

Questions?

Use the question function at the lower right of your screen



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