



Fire and Aerosol Products from NOAA Operational Satellites: Relevance to Topics Discussed



NOAA Satellites and Instruments

2

- Visible Infrared Imaging Radiometer Suite (VIIRS)
 - Suomi NPP – *Launched October 28, 2011*
 - NOAA-20 VIIRS – *Launched November 18, 2017*
- Advanced Baseline Imager (ABI)
 - GOES-16 – *Launched November 19, 2016*
 - GOES-17 ABI – *Launched March 1, 2018*

VIIRS Fires/AOD and Aerosol Detection (smoke/dust) : 750 m nadir

ABI Fires/AOD and Aerosol Detection (smoke/dust): 2 km nadir

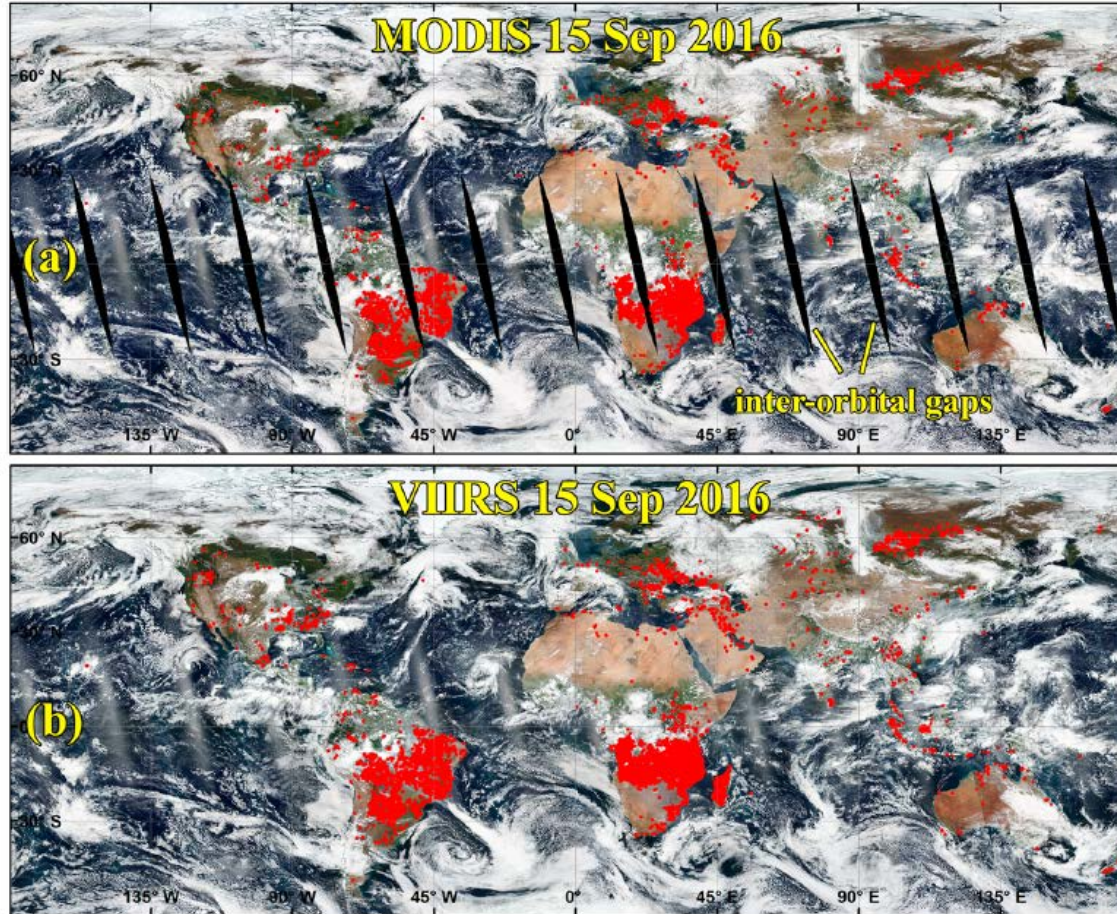
ABI every 5 min CONUS and every 15 min Full Disk

Biomass Burning



VIIRS vs. MODIS Fire Detection

4



F. Li, X. Zhang, S. Kondragunta, I. Csiszar, JGR, 2018

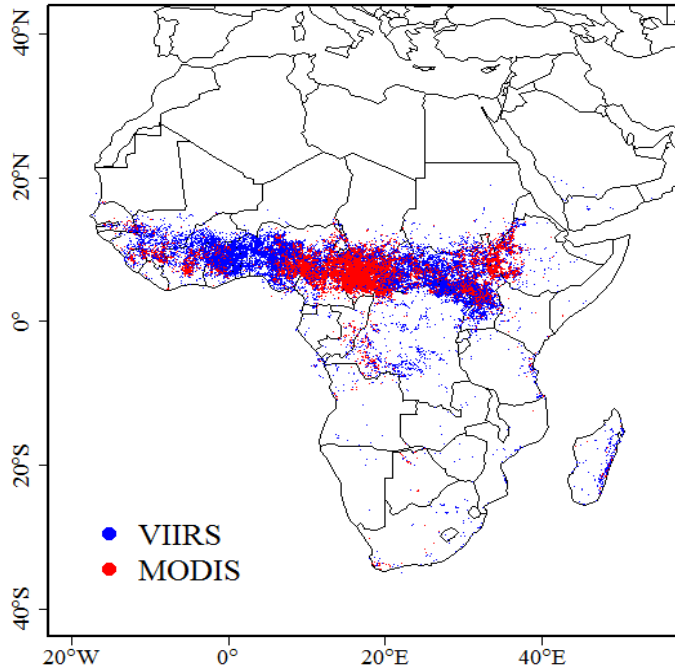


VIIRS vs. MODIS Fire Detection

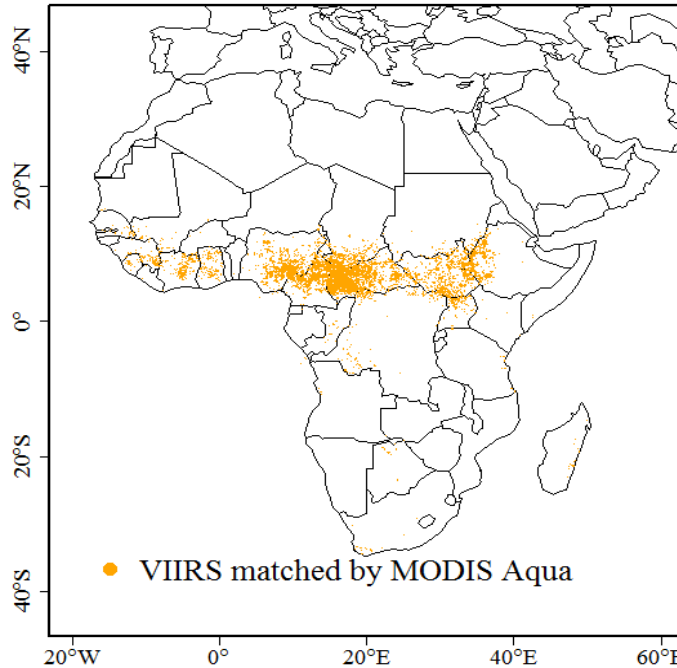
5

January 9, 2016

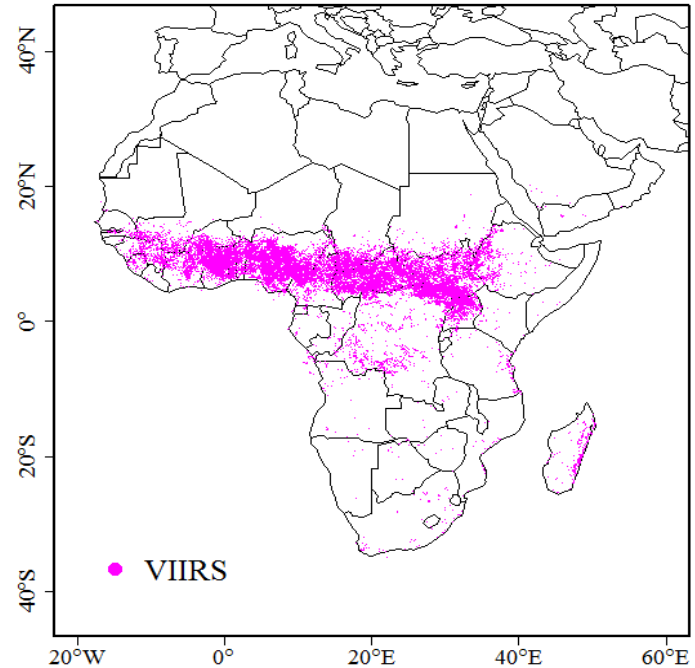
All detections by VIIRS and MODIS Aqua



Detected by VIIRS and MODIS Aqua



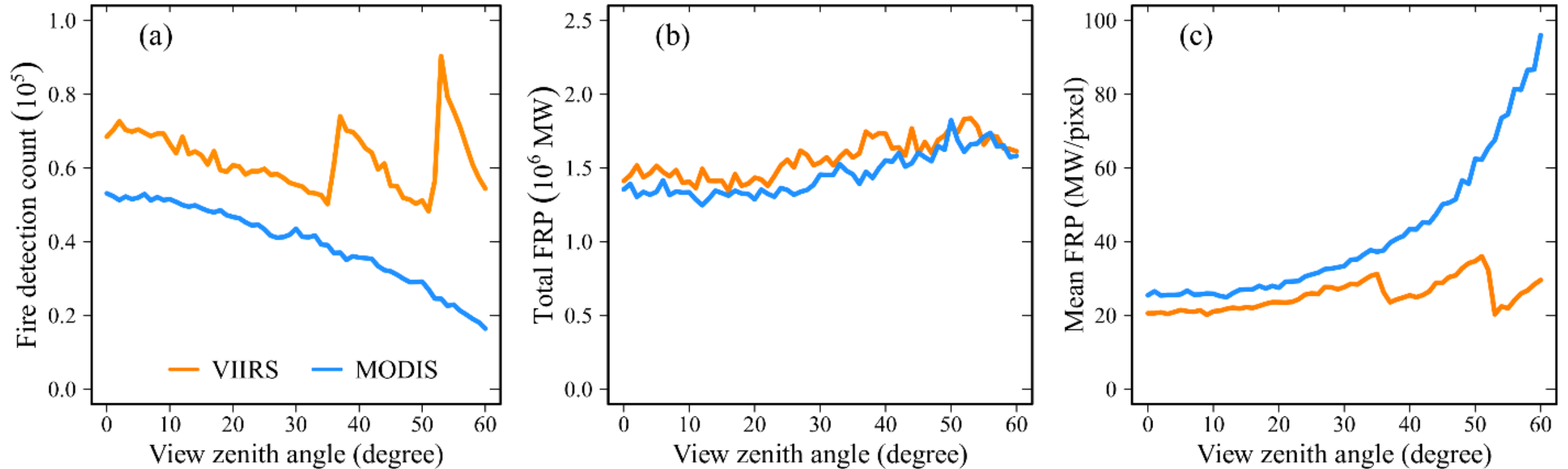
Detected by VIIRS only



F. Li, X. Zhang, S. Kondragunta, I. Csiszar, JGR, 2018

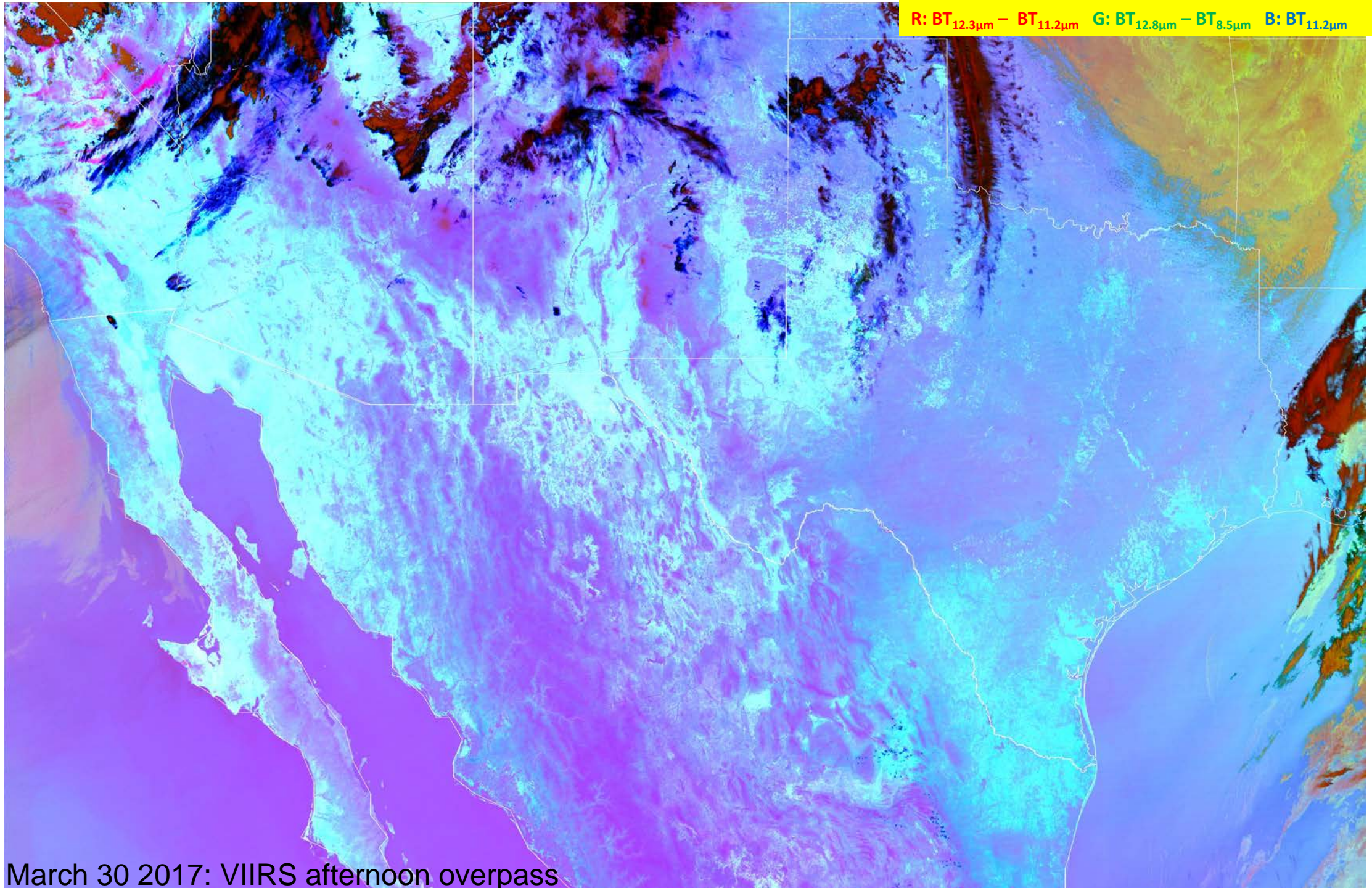


VIIRS vs. MODIS FRP

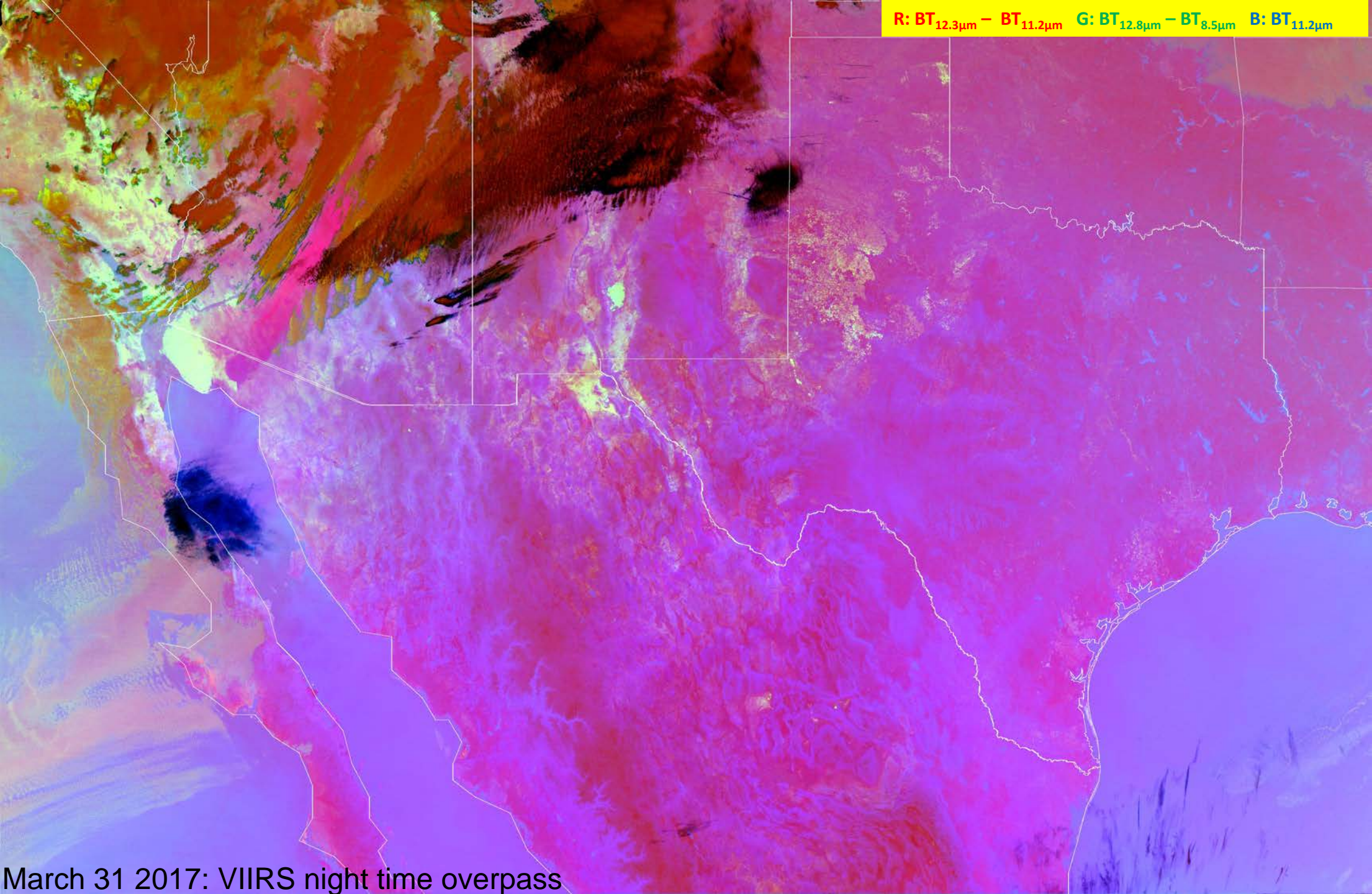


$$FRP = \frac{S_p \cdot \sigma \cdot (L_F - L_B)}{c} \cdot 10^{-6}$$

Dust Duration and Diurnal Observations



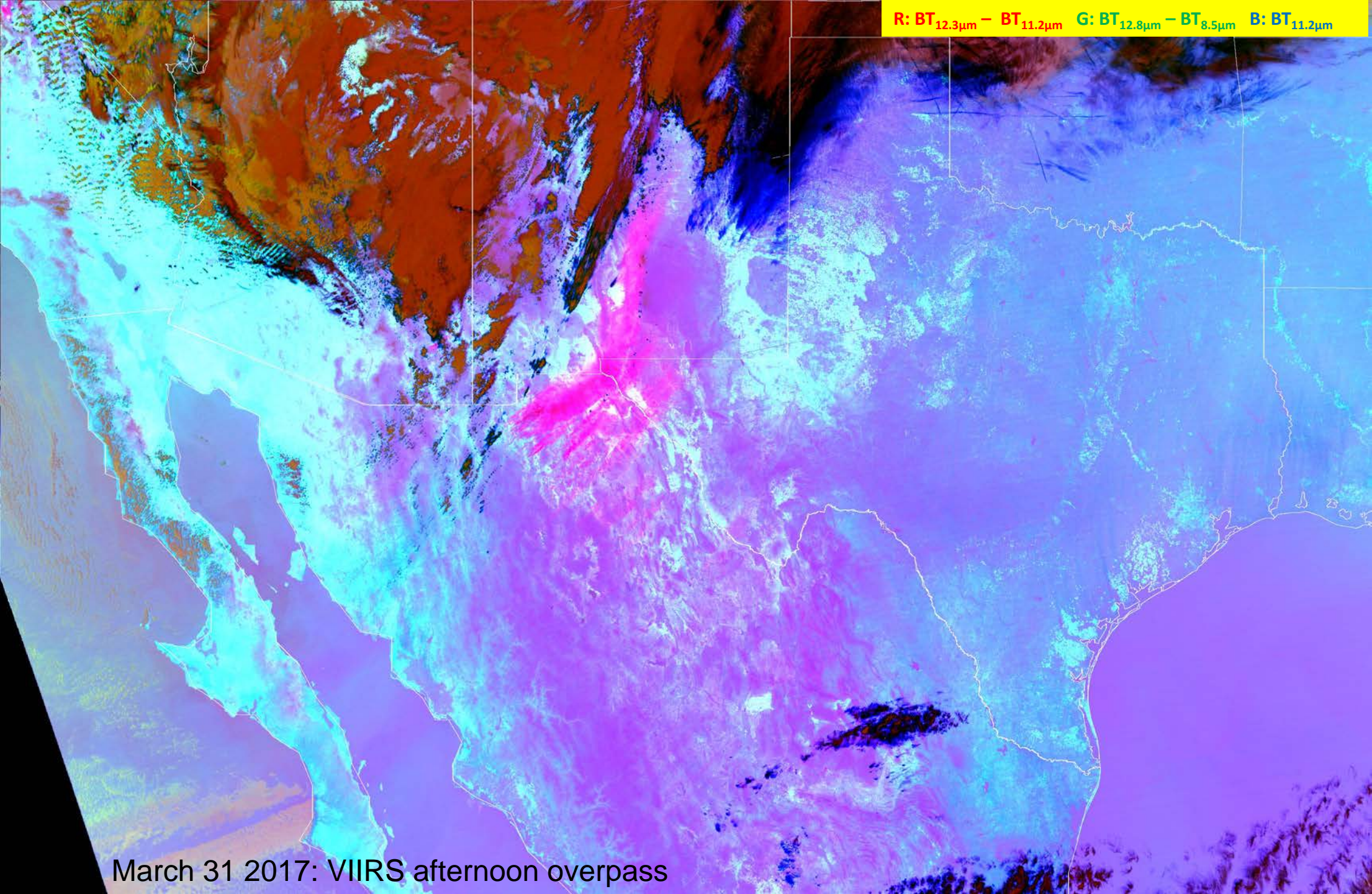
March 30 2017: VIIRS afternoon overpass



R: $BT_{12.3\mu m} - BT_{11.2\mu m}$ G: $BT_{12.8\mu m} - BT_{8.5\mu m}$ B: $BT_{11.2\mu m}$

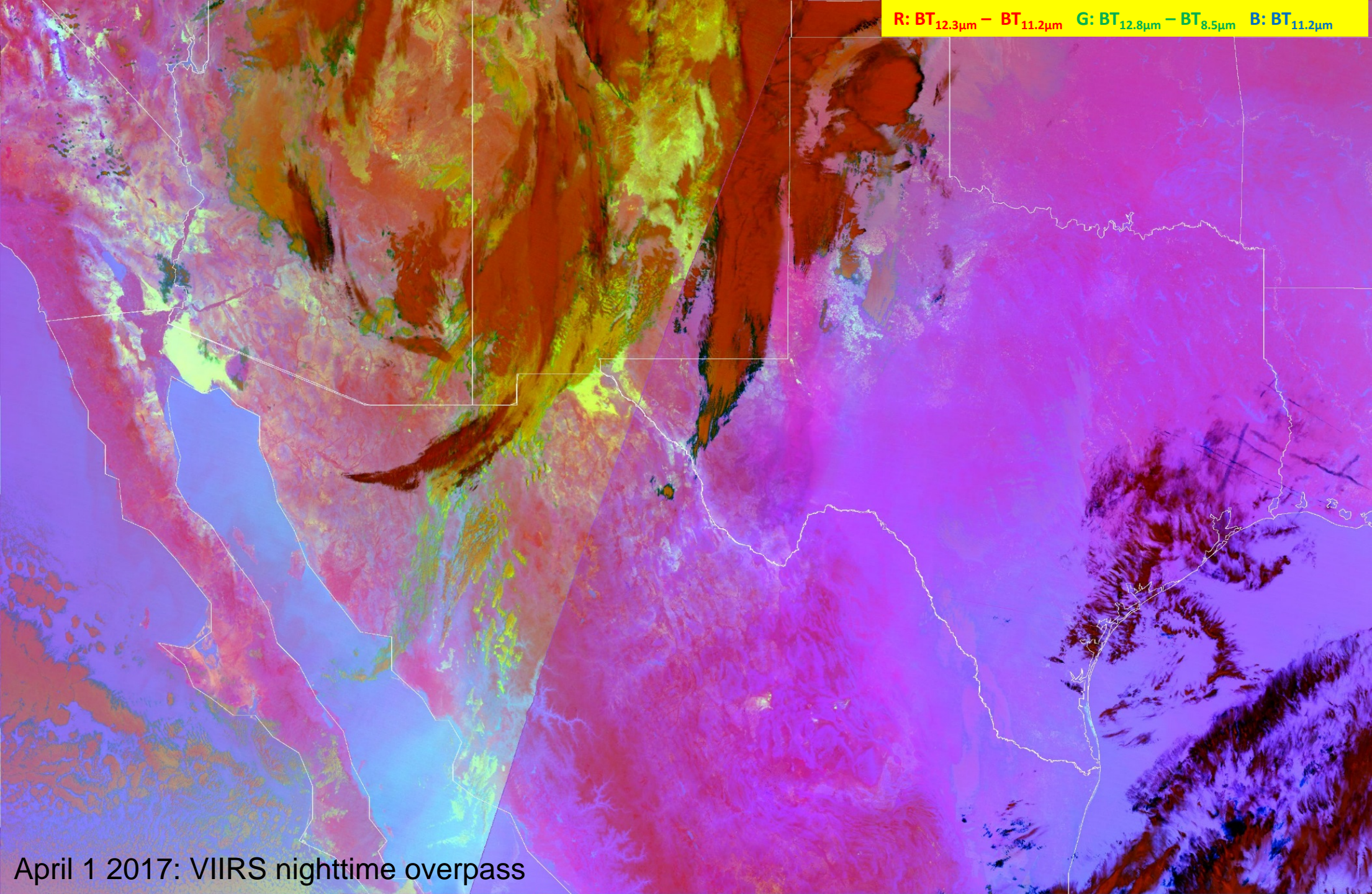
March 31 2017: VIIRS night time overpass

R: $BT_{12.3\mu m} - BT_{11.2\mu m}$ G: $BT_{12.8\mu m} - BT_{8.5\mu m}$ B: $BT_{11.2\mu m}$

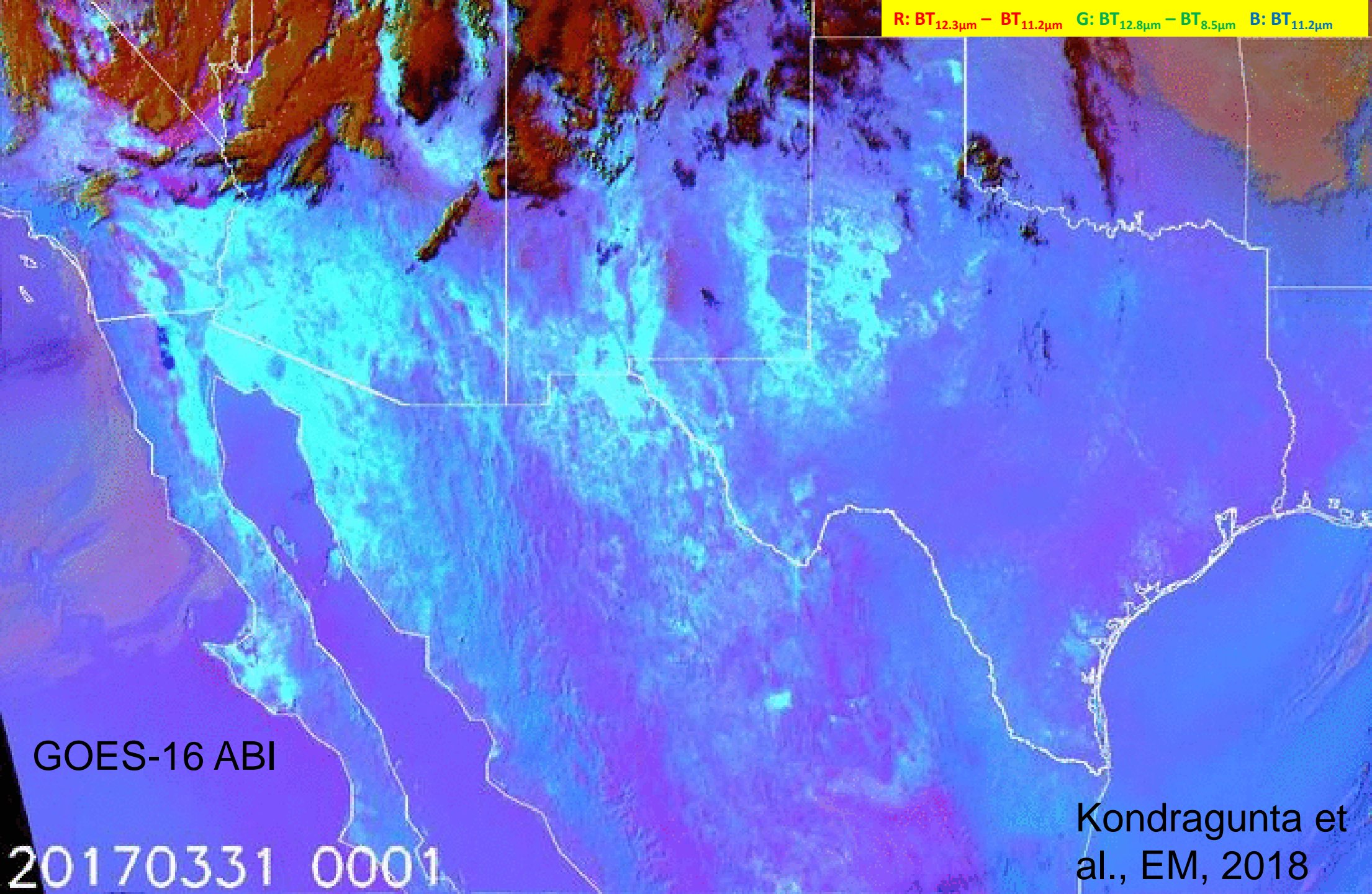


March 31 2017: VIIRS afternoon overpass

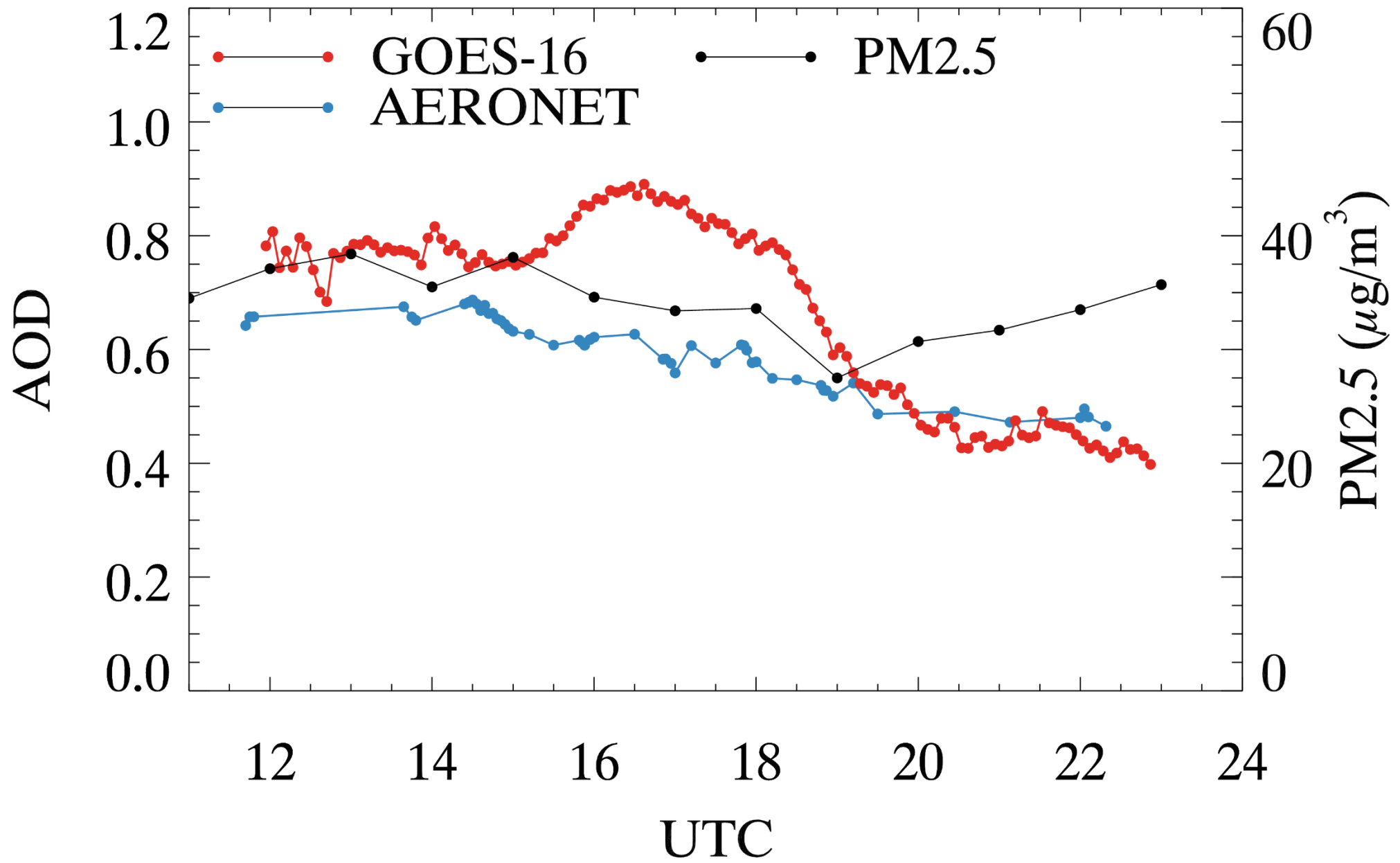
R: $BT_{12.3\mu m} - BT_{11.2\mu m}$ G: $BT_{12.8\mu m} - BT_{8.5\mu m}$ B: $BT_{11.2\mu m}$



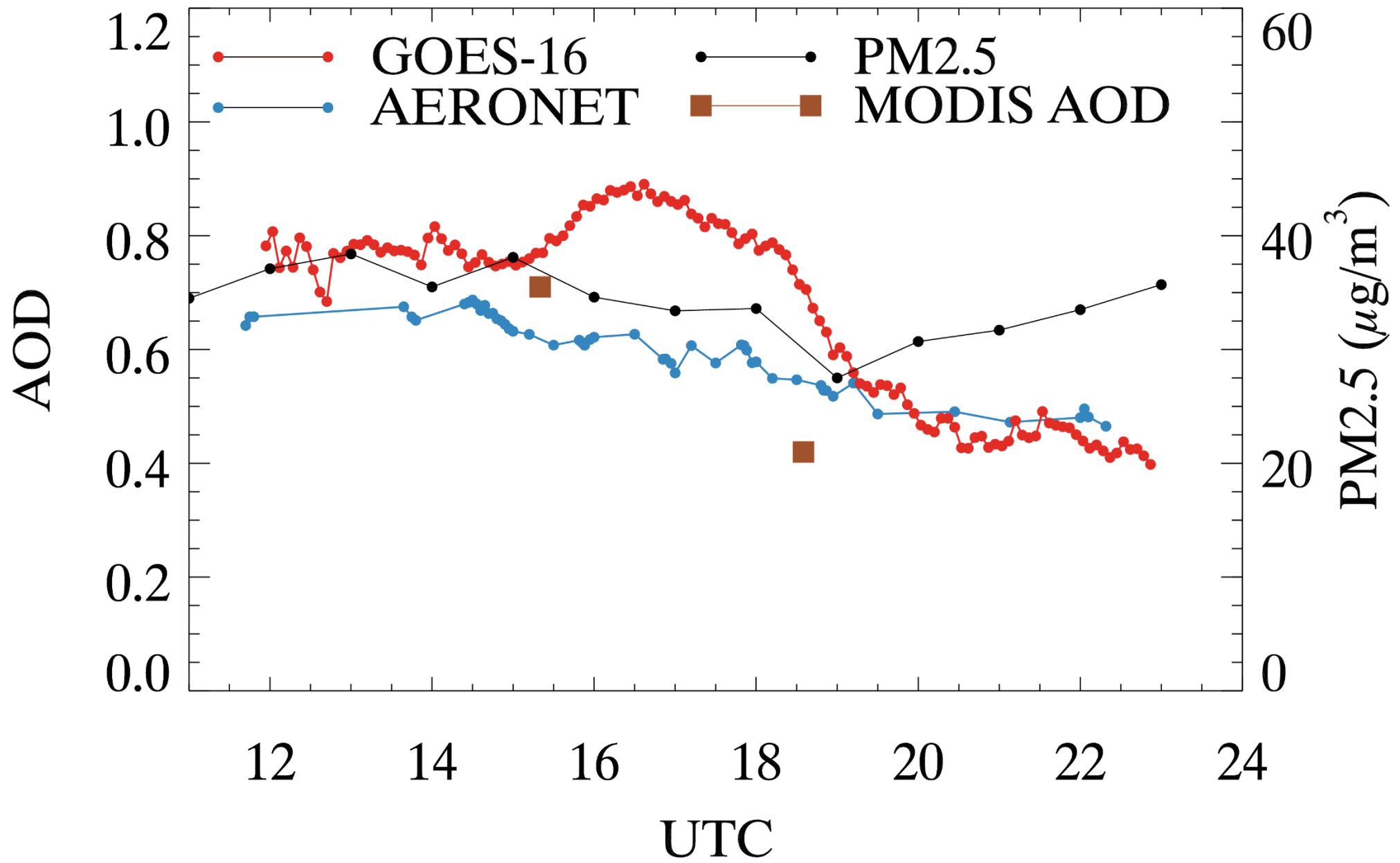
April 1 2017: VIIRS nighttime overpass



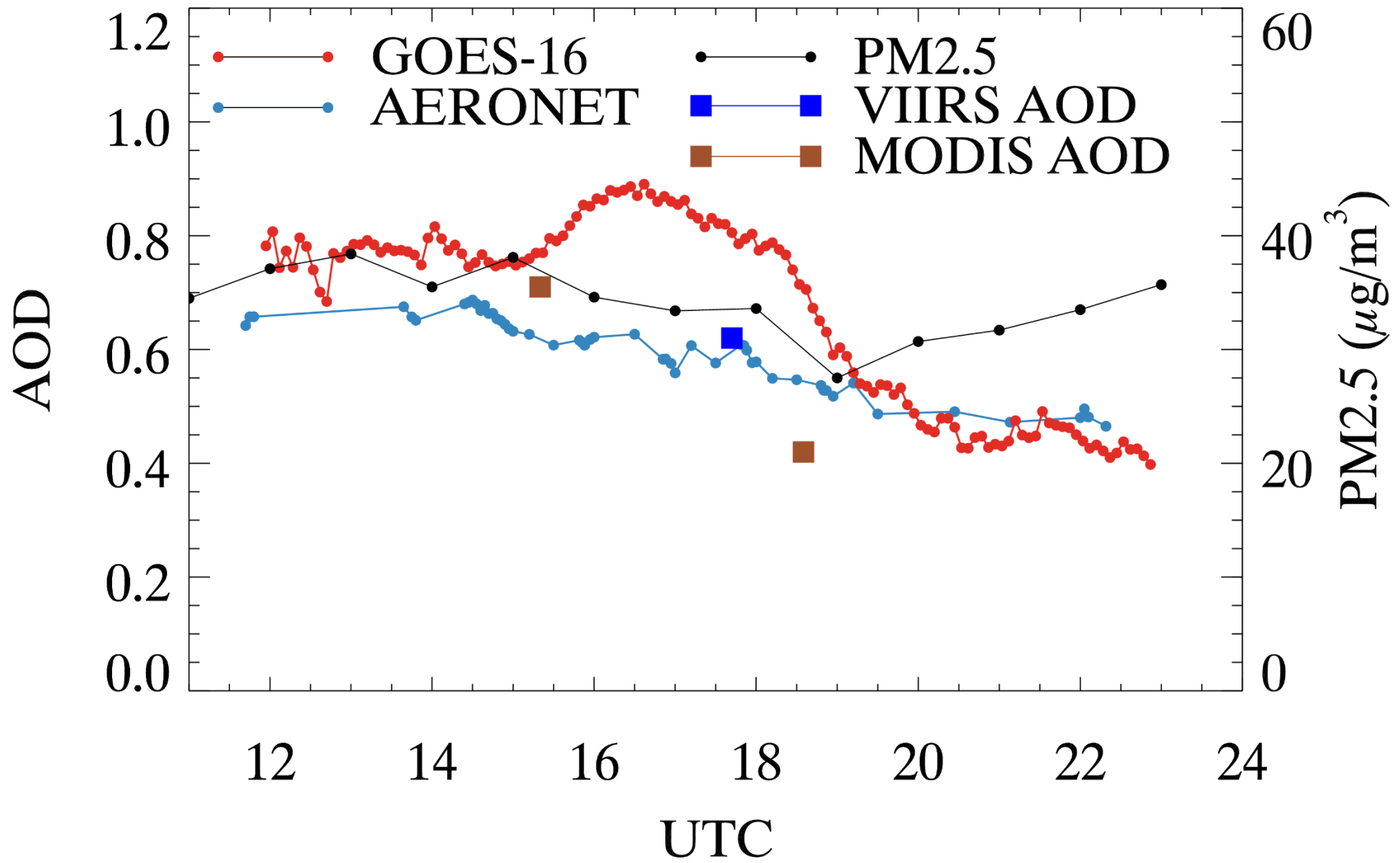
20180816



20180816



20180816



“Smoke AOD”

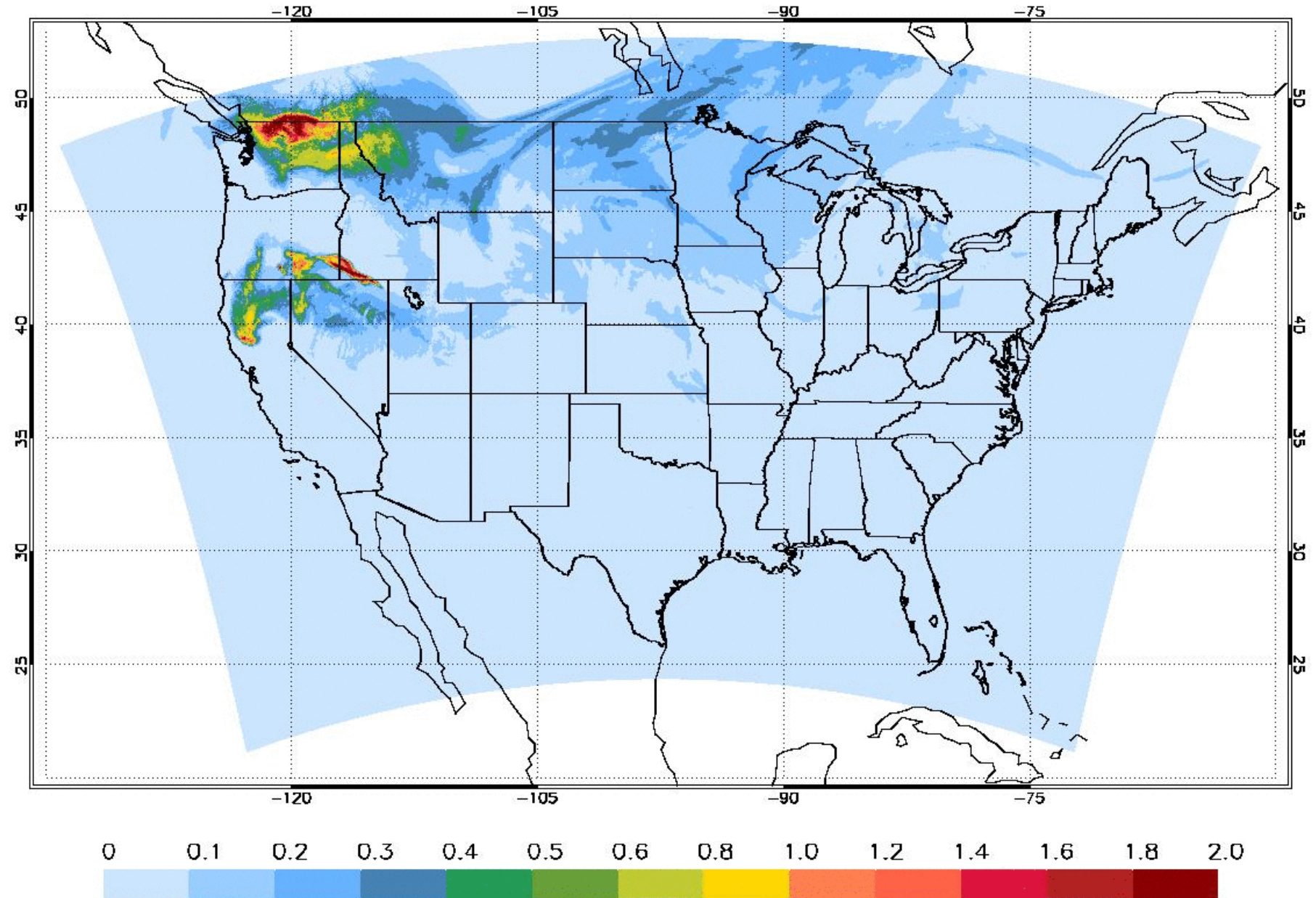


HRRR Smoke AOD 08-19-2018 06:00

Forecast time: 01

$$\text{AOD} = n_c \times \beta$$

n_c is column concentration (mg/m^2); β is mass extinction efficiency (m^2/g)

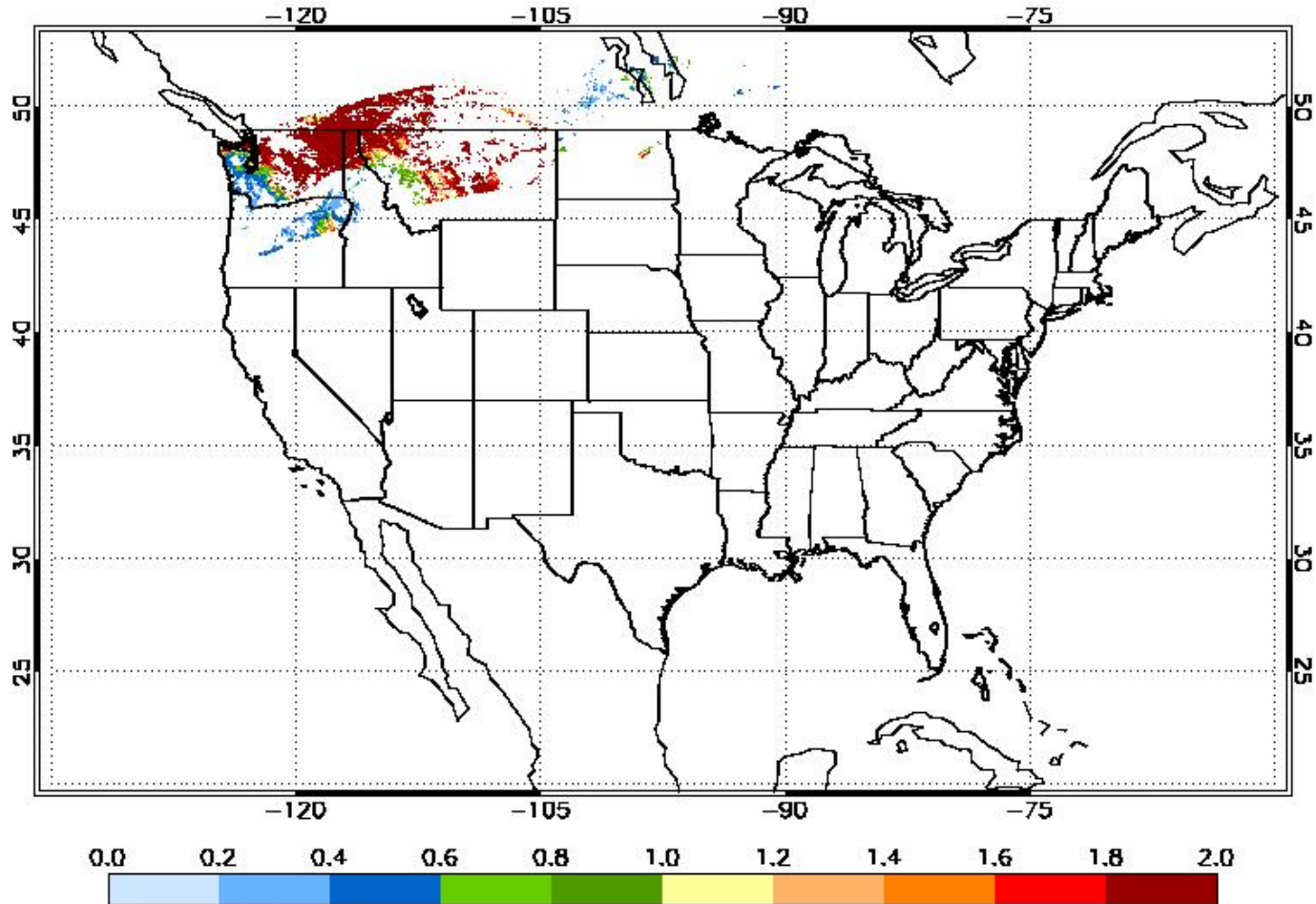




Tagging AOD with Smoke

18

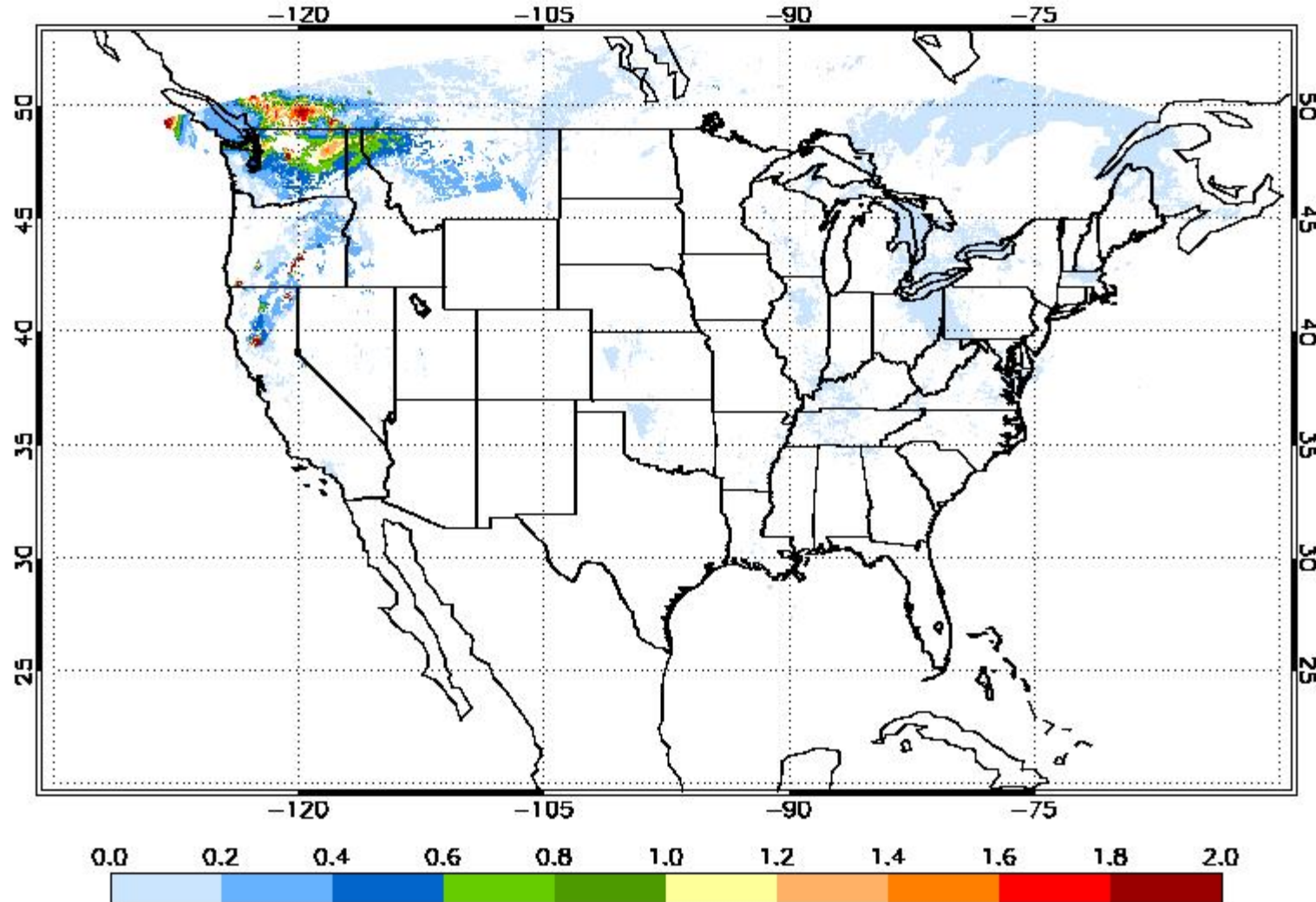
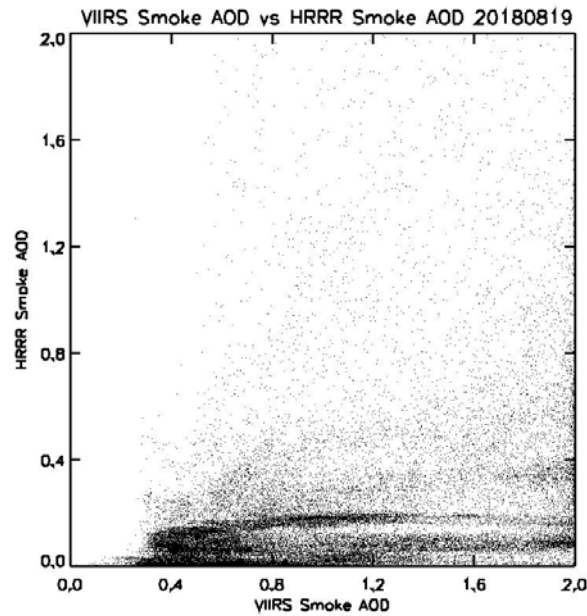
VIIRS SMOke AOD 201808192010





HRRR-Smoke vs. VIIRS Smoke AOD

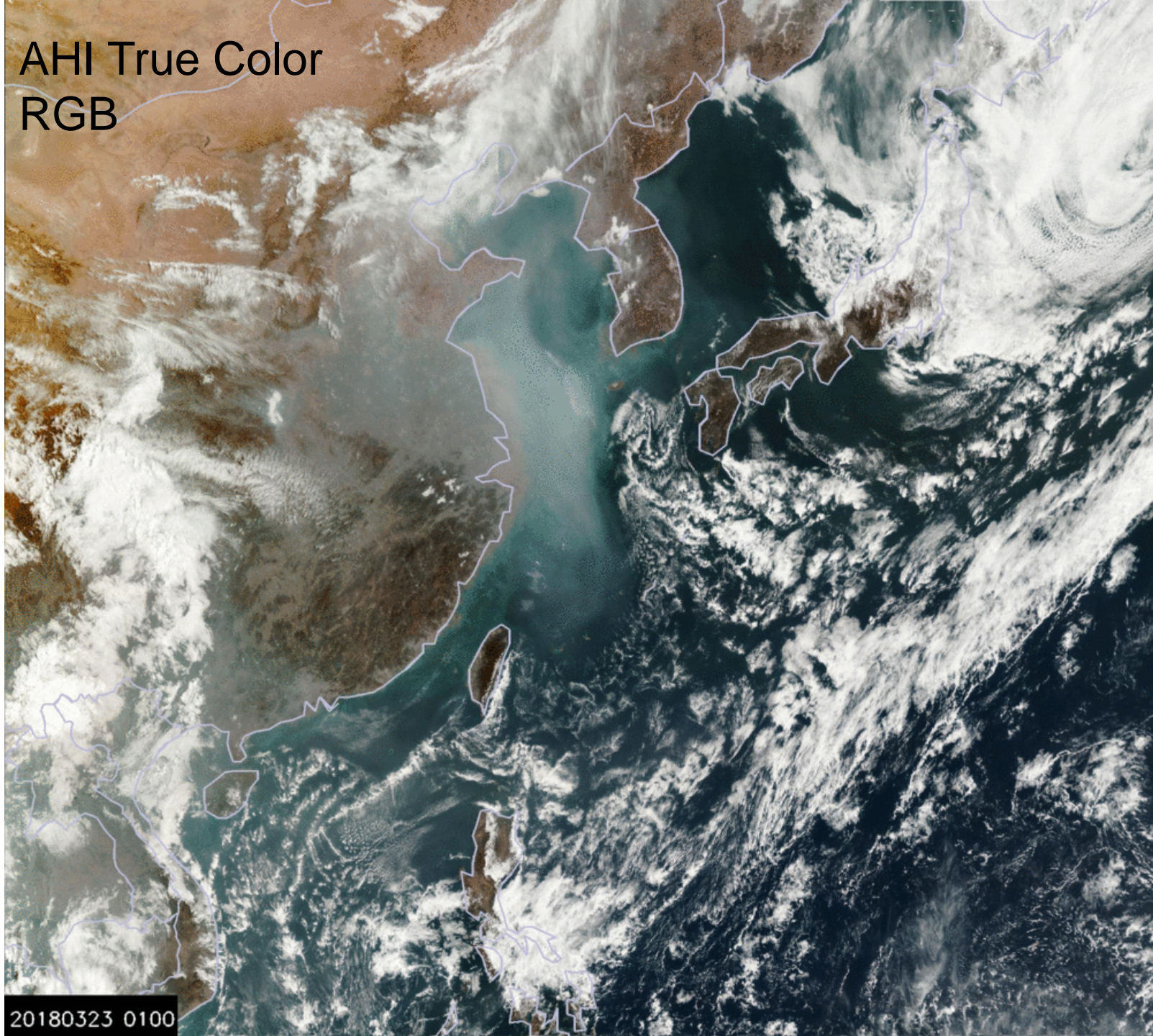
HRRR Smoke AOD 20180819



- Likely source of bias:
- Transported smoke
 - Fire emissions
 - Matchup method

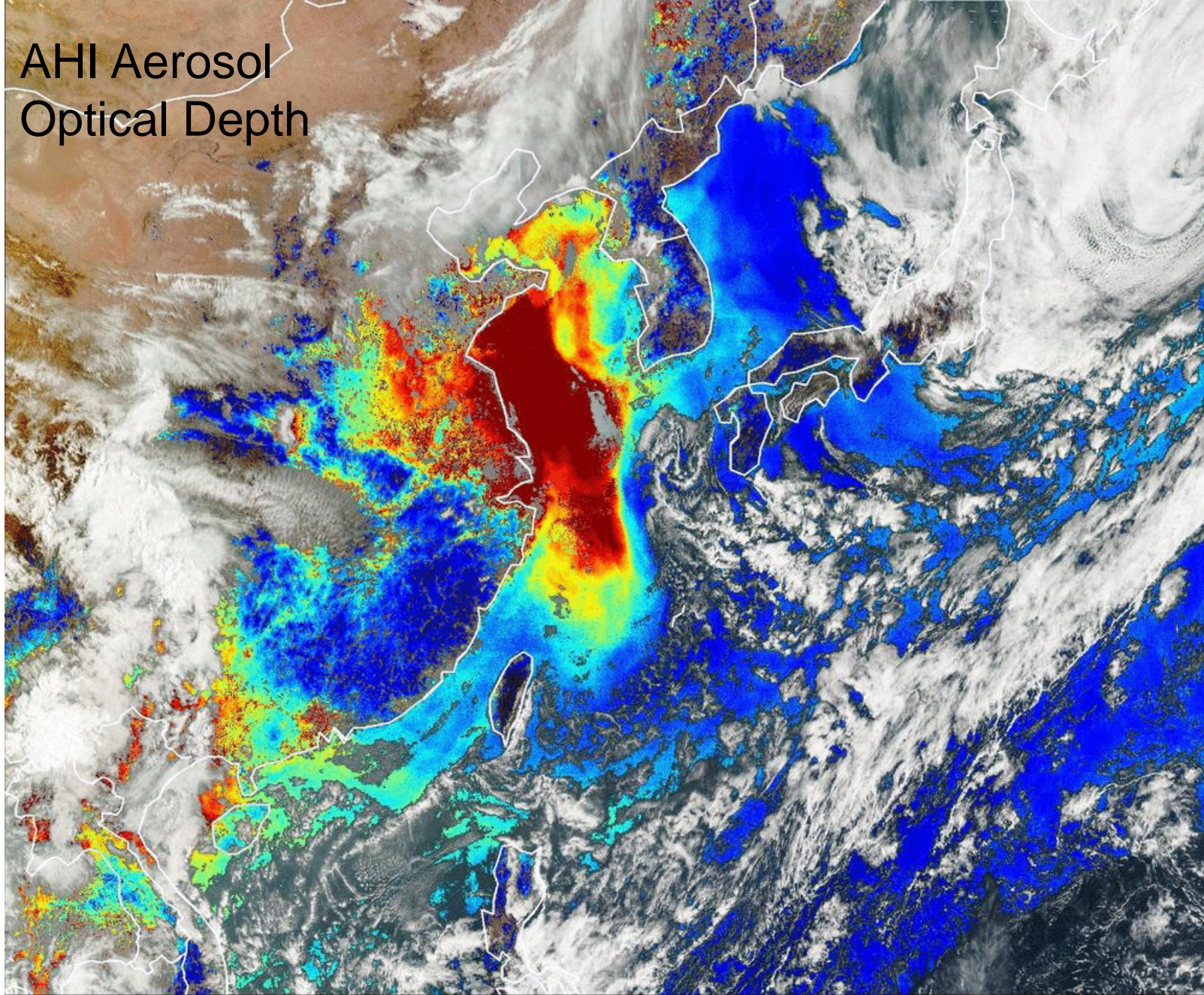
Asia Pollution

AHI True Color
RGB



20180323 0100

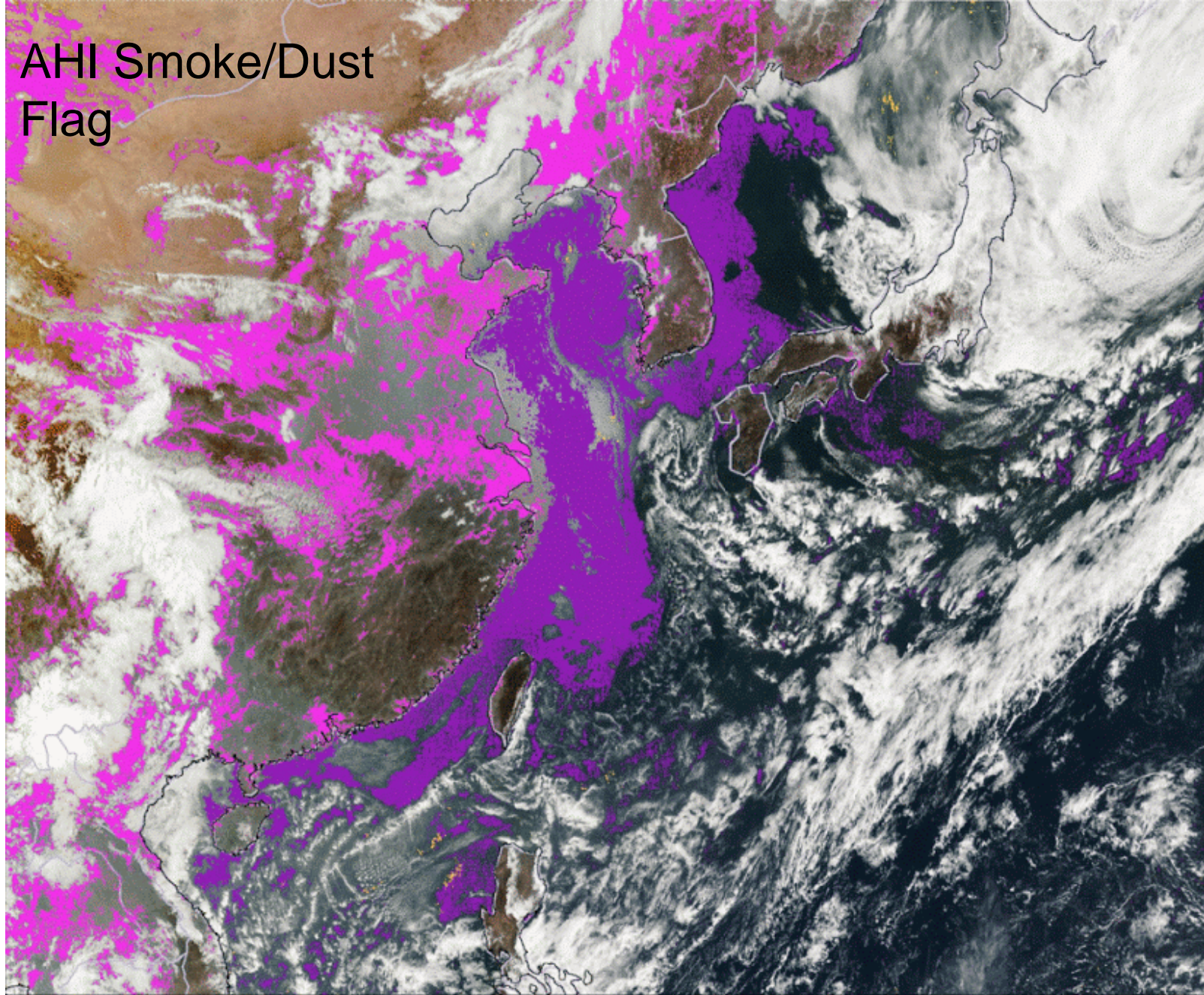
AHI Aerosol
Optical Depth



201803230100

0.0 0.2 0.4 0.6 0.8 1.0

AHI Smoke/Dust
Flag



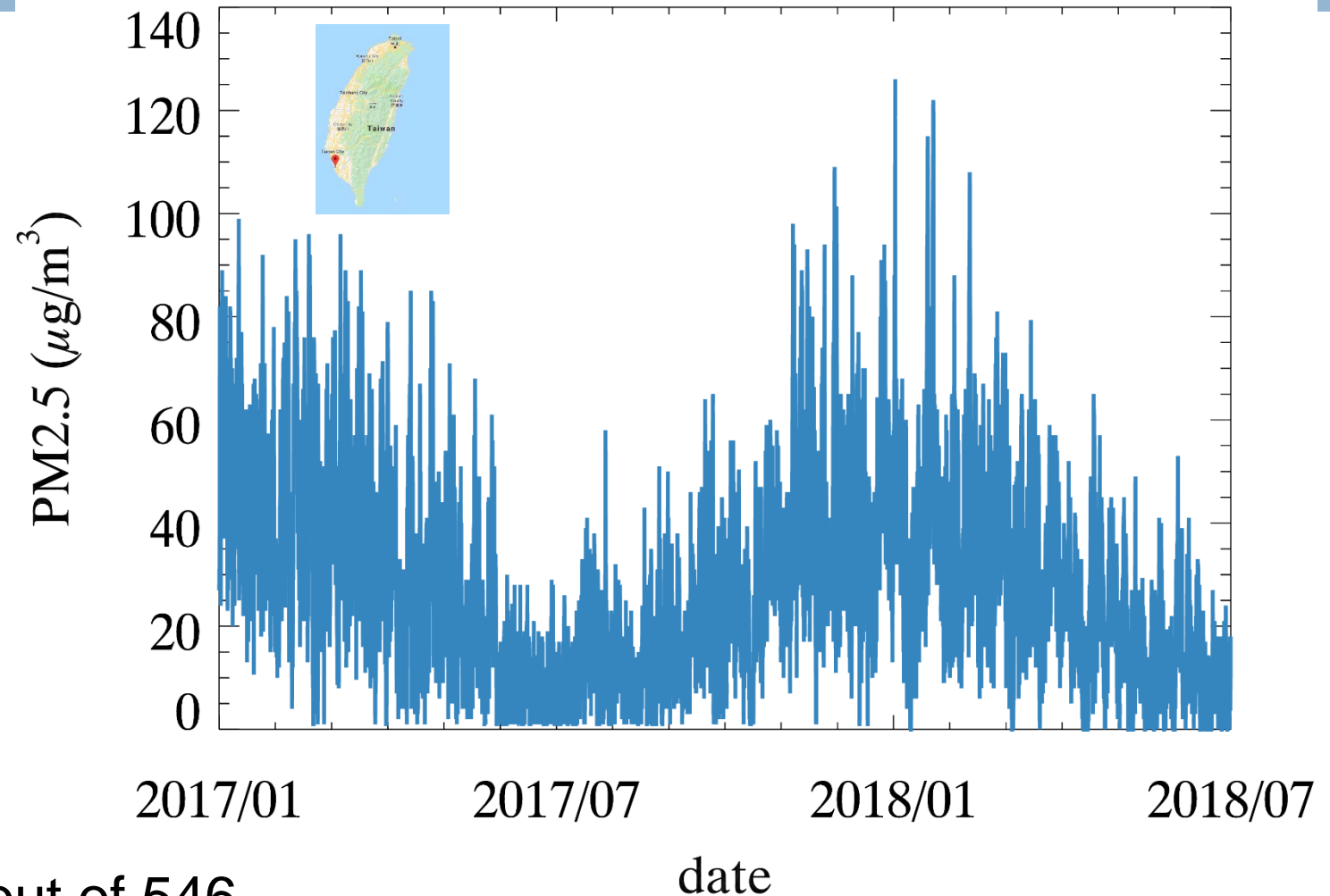
201803230100





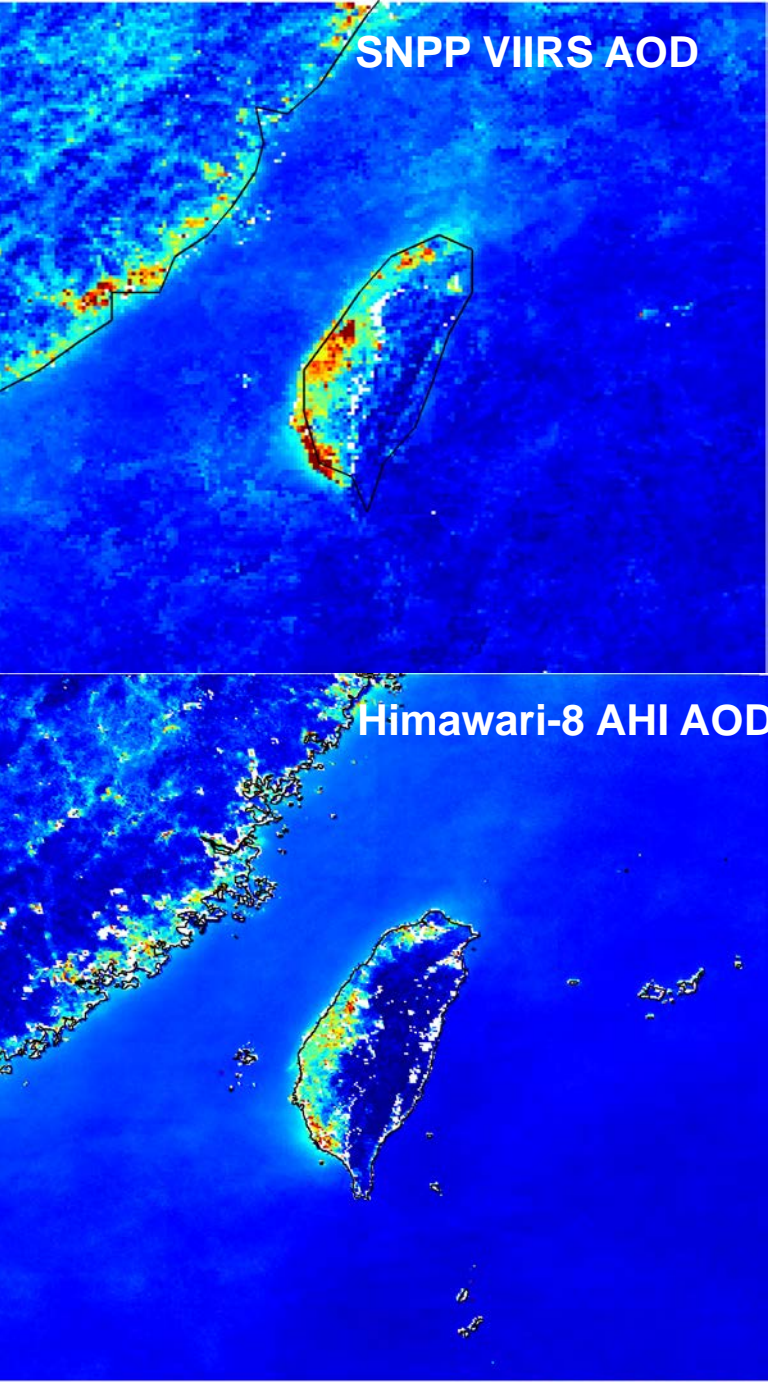
Air Quality in Taiwan

24



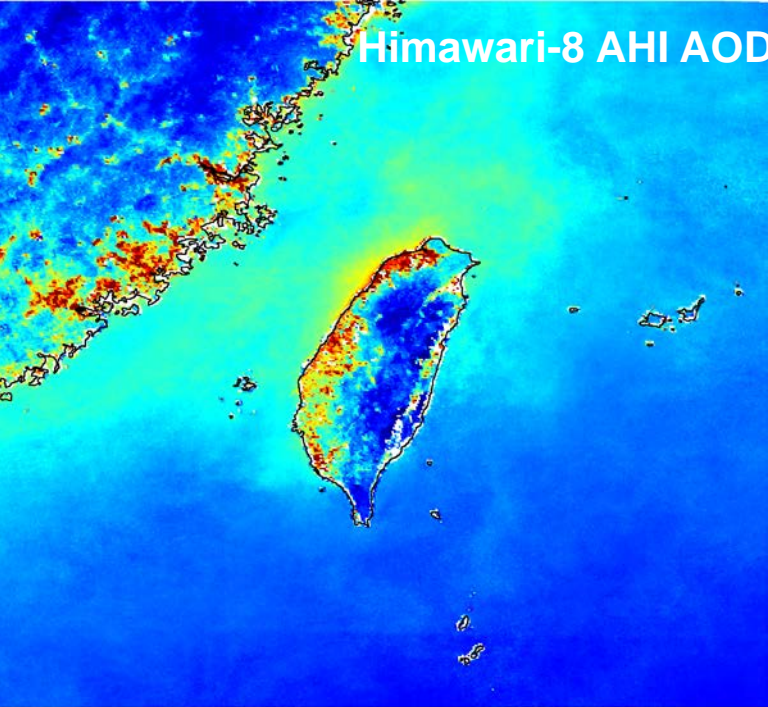
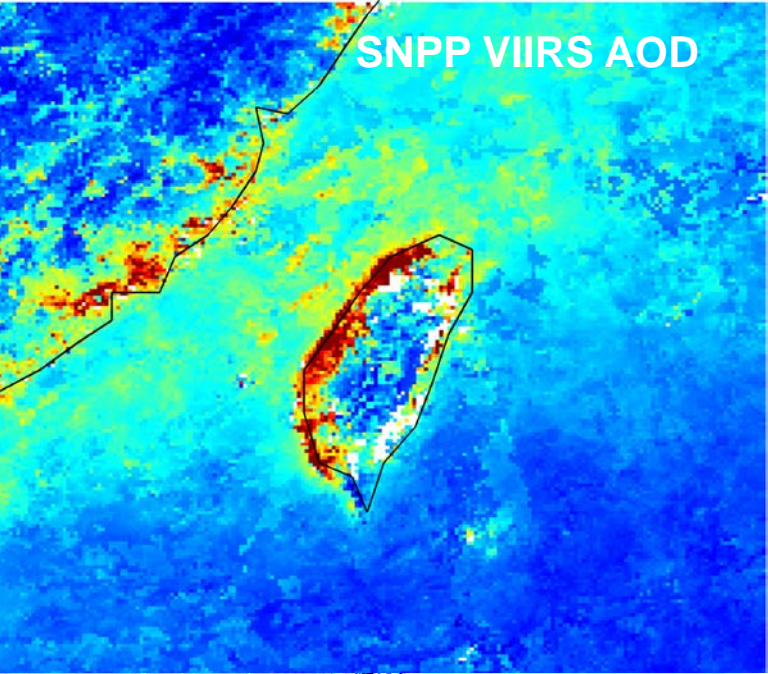
Daily max PM2.5 > 35 $\mu\text{g}/\text{m}^3$: 342 out of 546

Daily avg PM2.5 > 35 $\mu\text{g}/\text{m}^3$: 174 out of 546



Surface PM2.5 ($\mu\text{g}/\text{m}^3$)



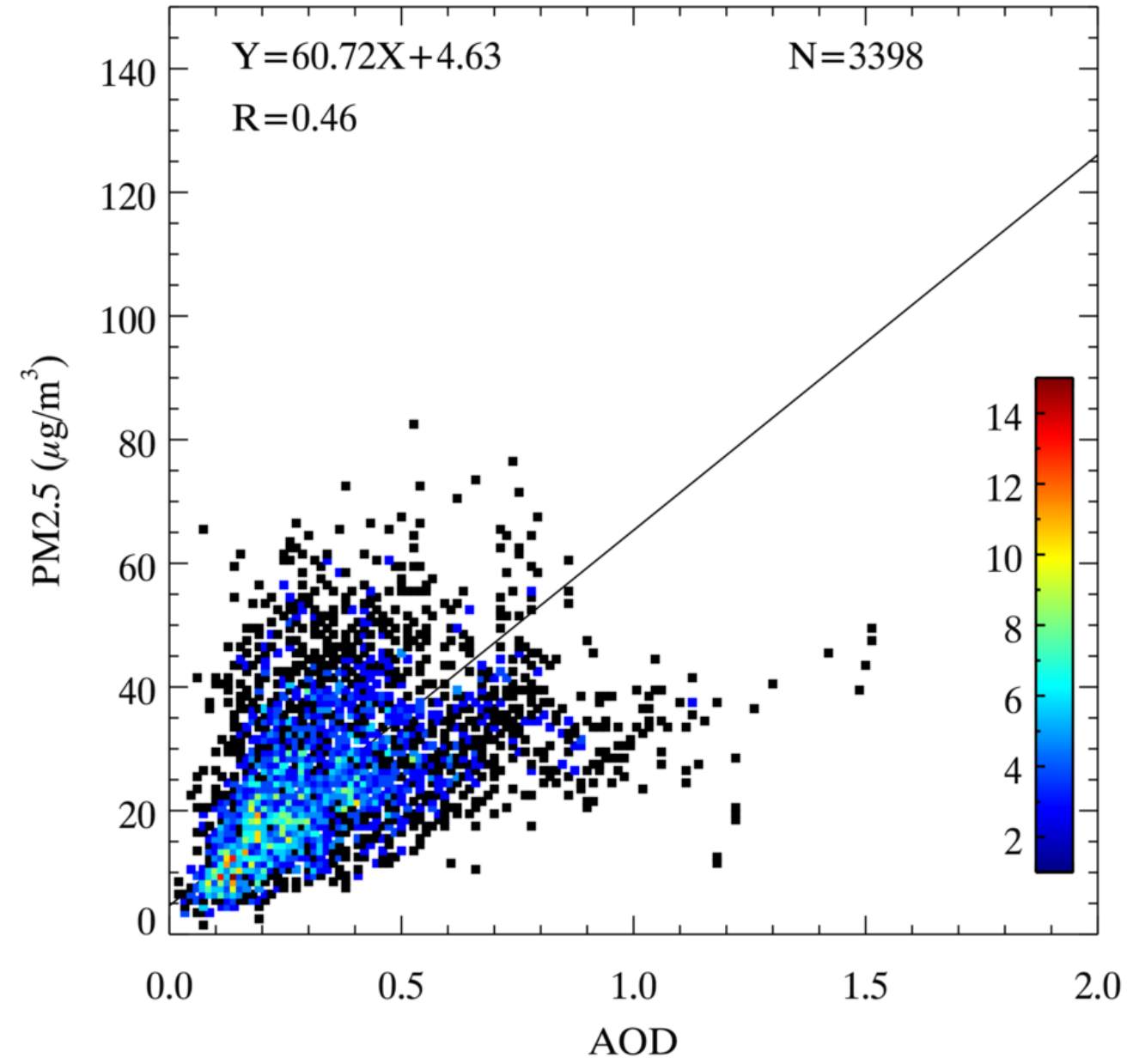


AOD (High+Medium) 201804 0.0 0.2 0.4 0.6 0.8 1.0

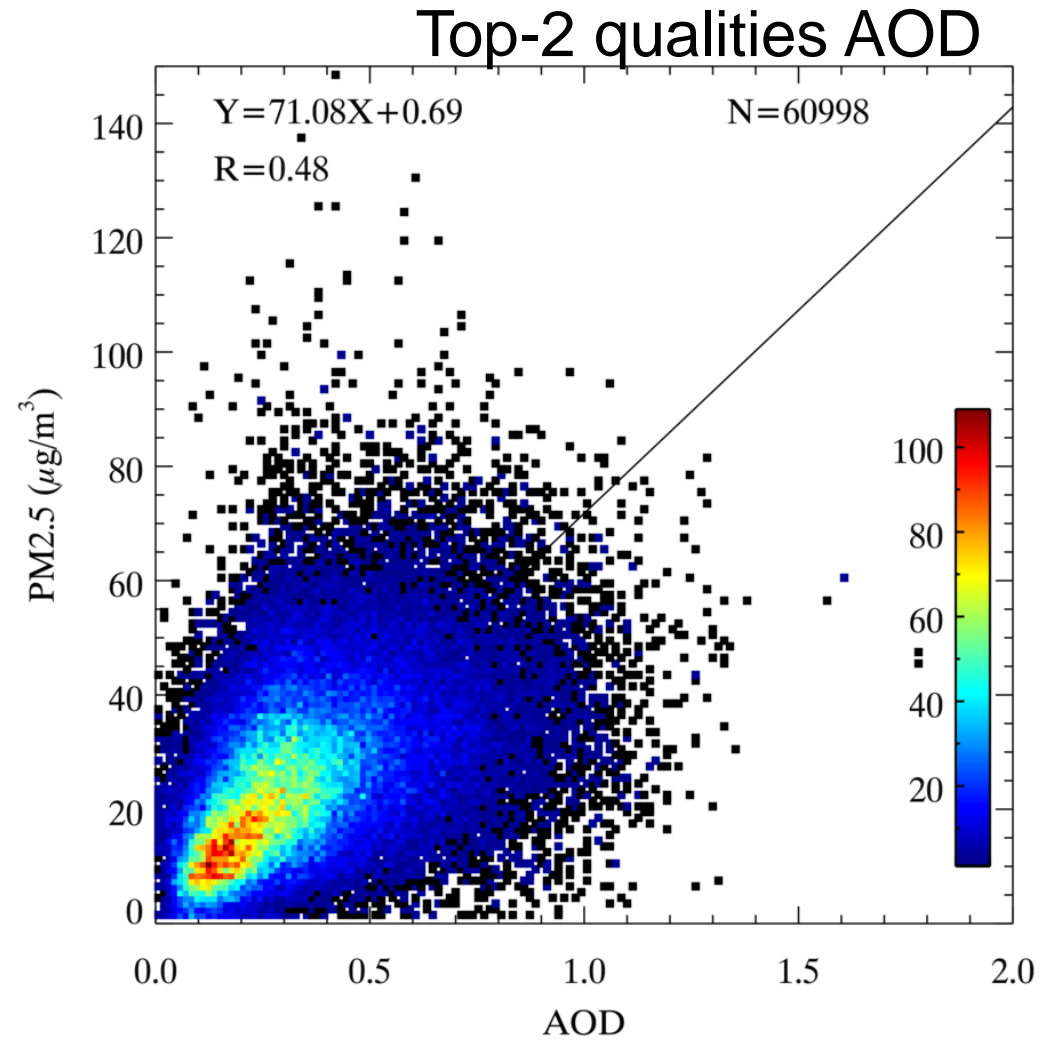
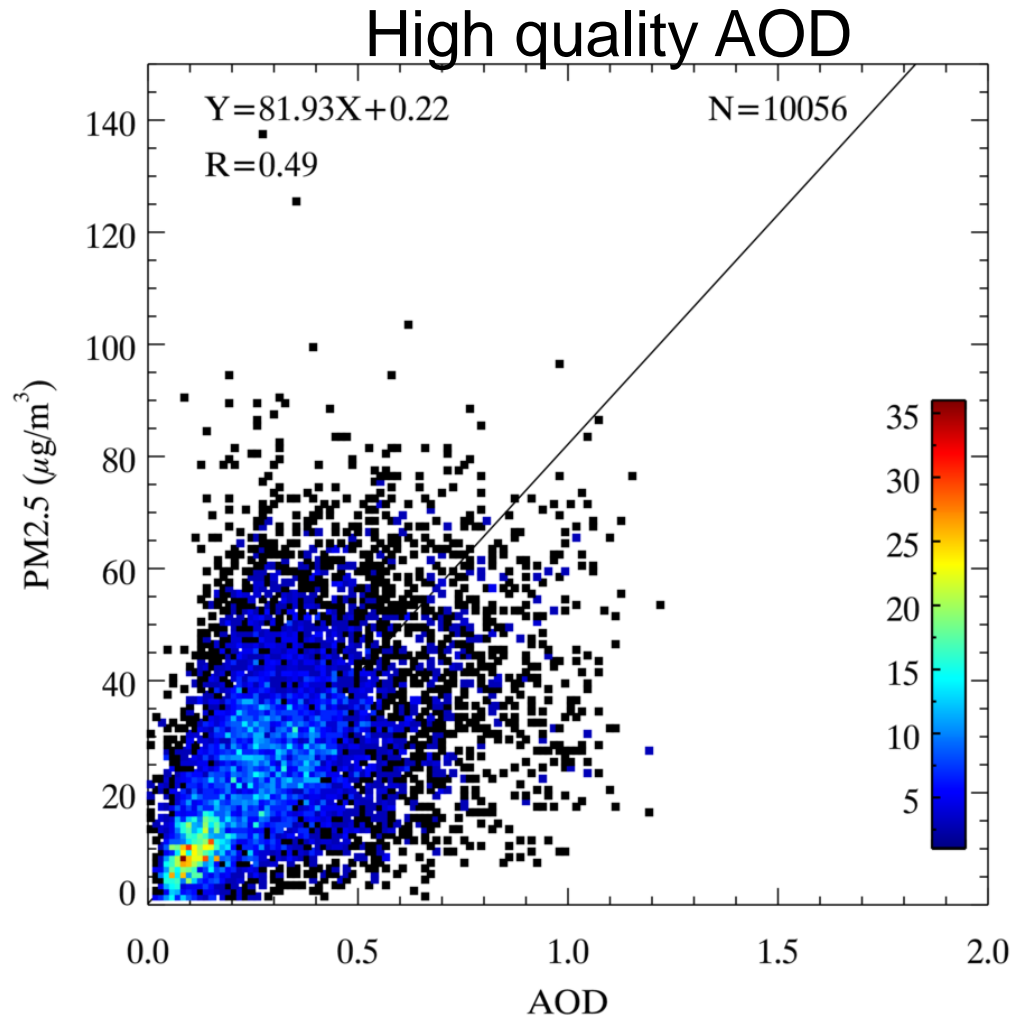
Surface PM2.5 ($\mu\text{g}/\text{m}^3$)



SNPP VIIRS AOD vs. Surface PM2.5



Hourly PM2.5 vs AHI AOD



Summary

29

- VIIRS and ABI AOD products are validated and ready for use
 - ▣ Pixel level uncertainties not available
- NOAA fire and aerosol products have a potential to be used in various applications
- NOAA satellite products primarily serve National Weather Service and air quality monitoring community
 - ▣ Research community yet to use NOAA products