

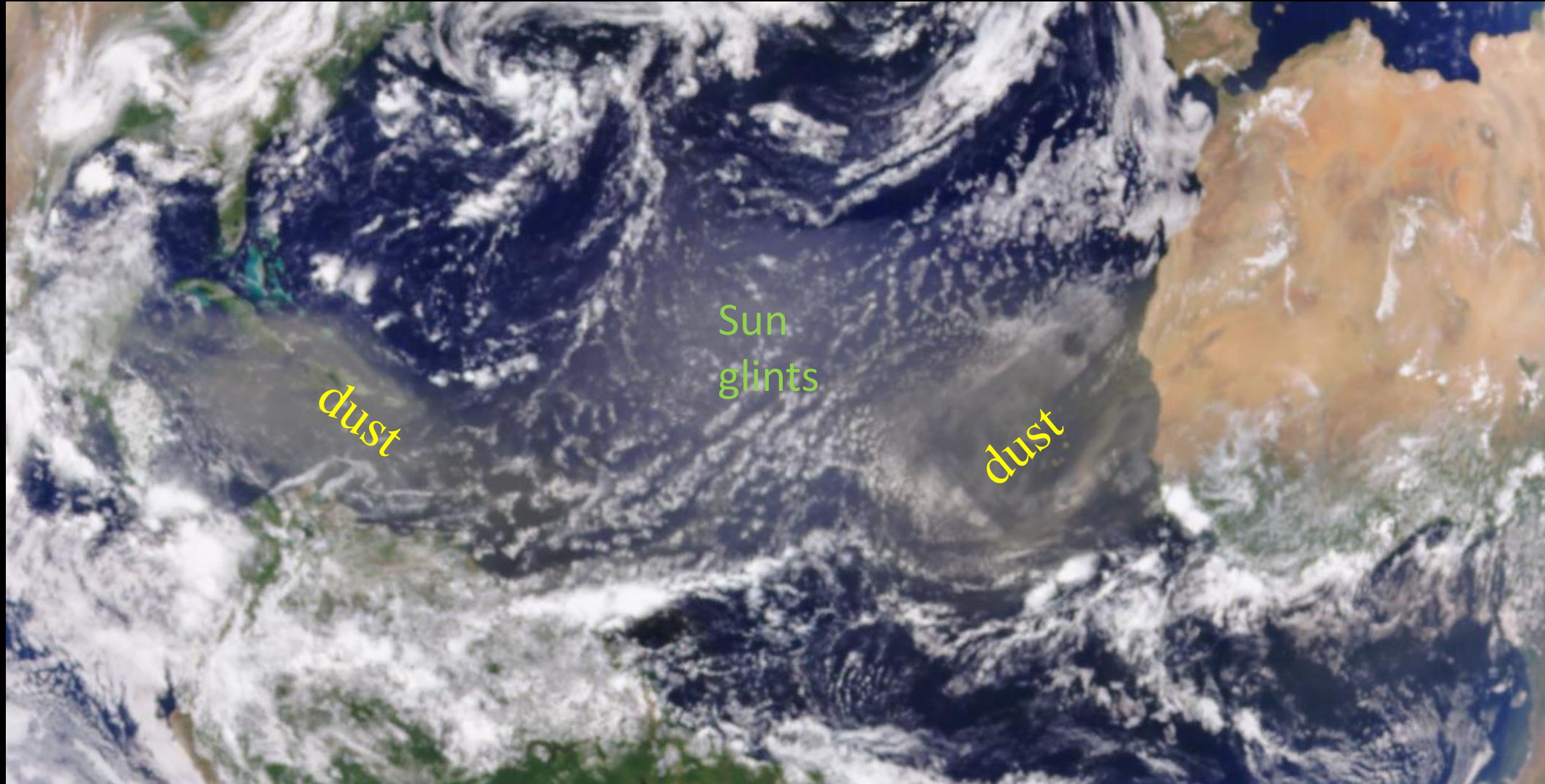
# Gigantic Dust Intrusion into the Caribbean Basin and Southern U.S. in June 2020

Hongbin Yu, NASA Goddard Space Flight Center

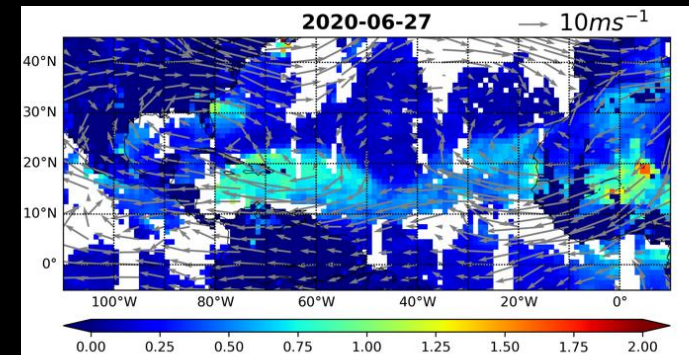
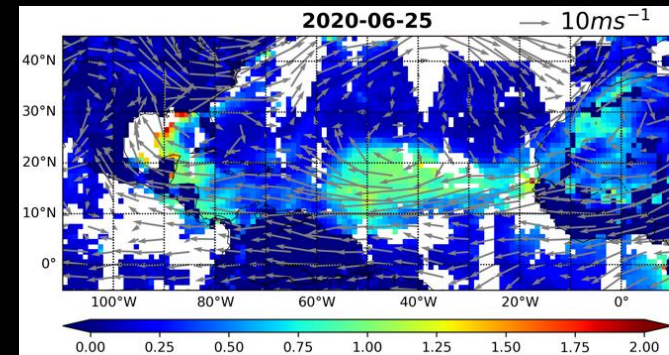
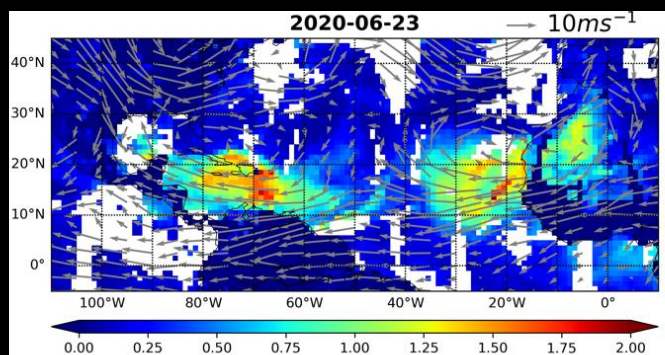
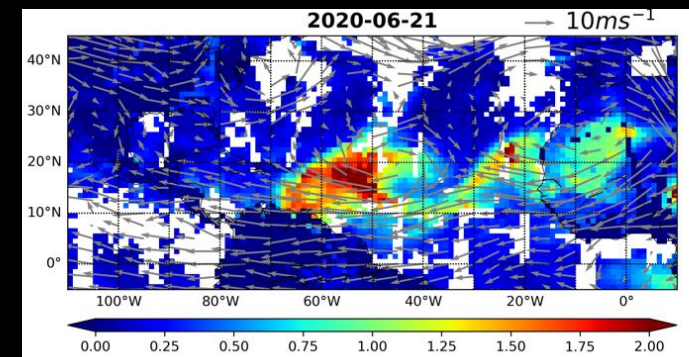
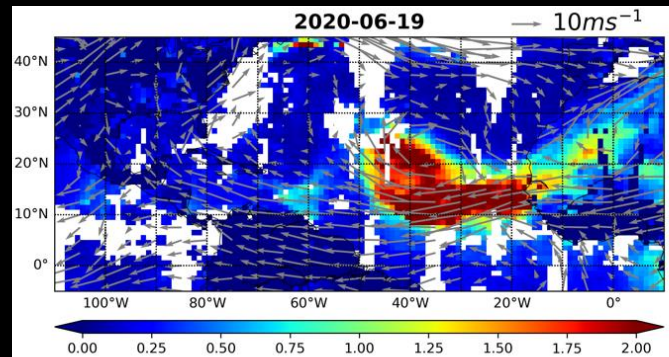
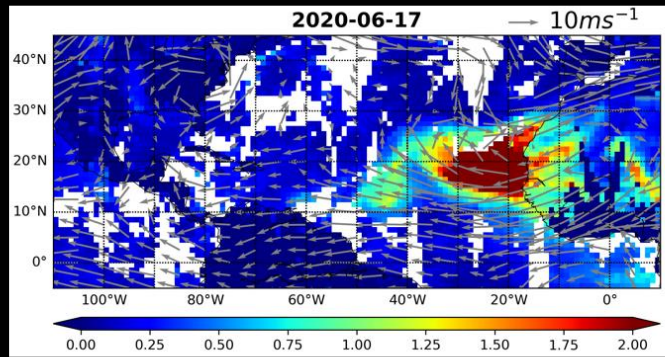
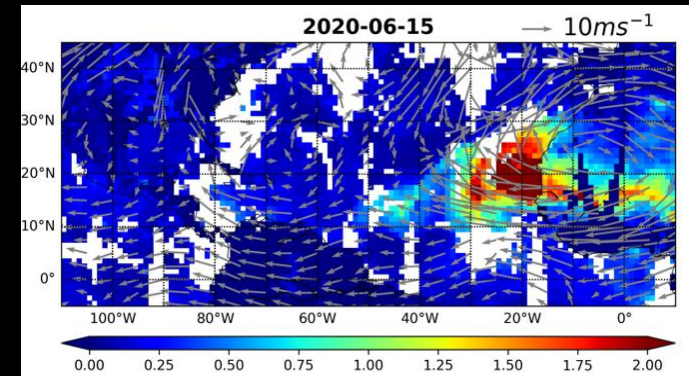
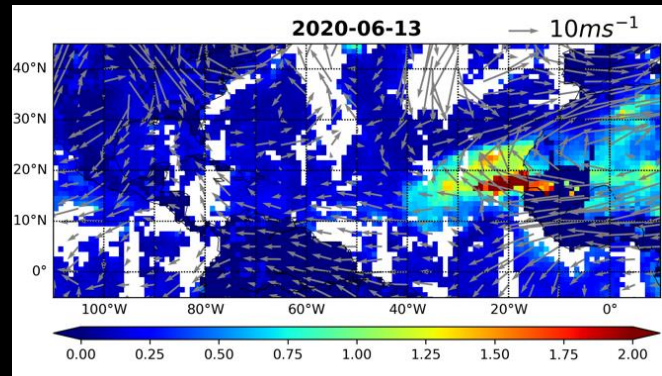
Qian Tan, Lillian Zhou, Yaping Zhou, Huisheng Bian, Mian Chin,  
Dongchul Kim, Robert Levy, Yingxi Shi, Lorraine Remer,  
Qianqian Song, Zhibo Zhang, Olga Mayol



A panorama of the plume from 1 million miles above snapped by EPIC/DSCOVR at 14:47:32 GMT on June 23, 2020



# Dust plumes as seen by MODIS

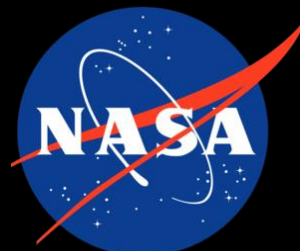
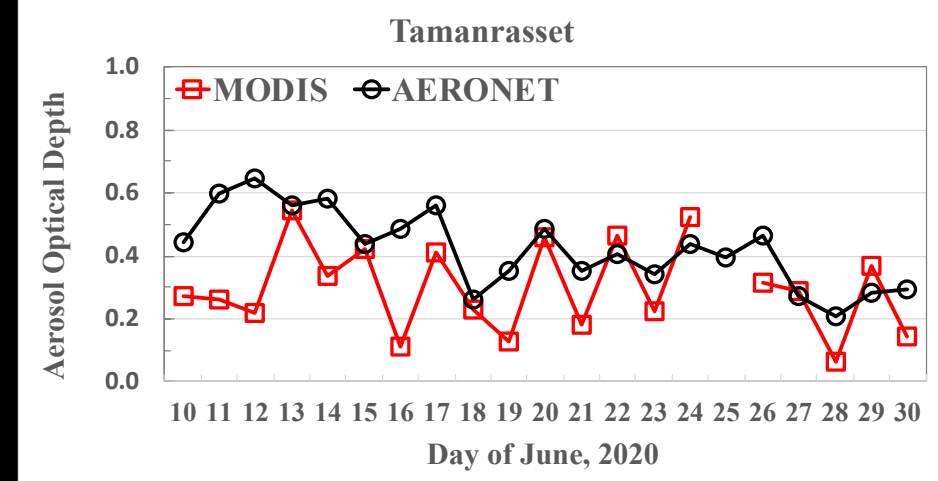
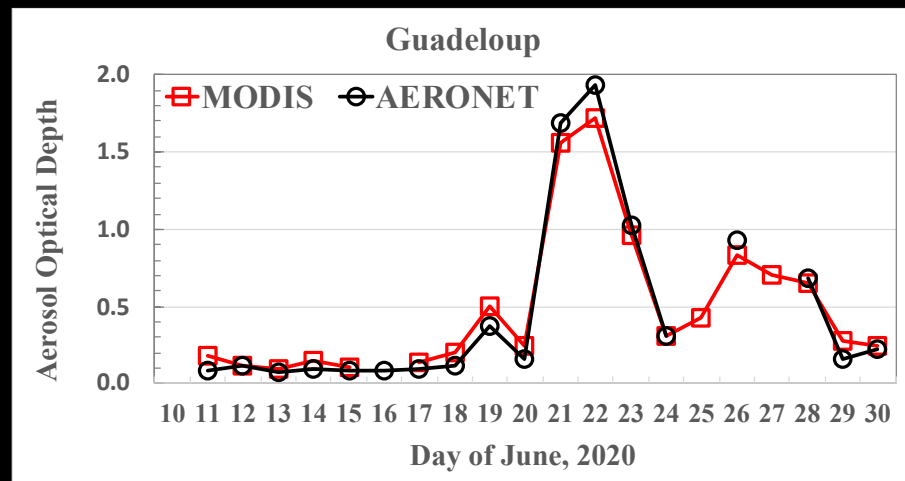
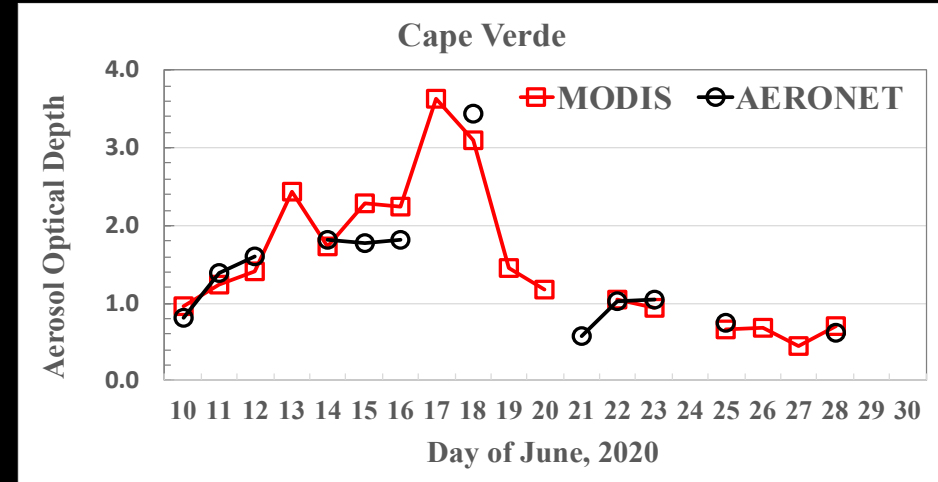
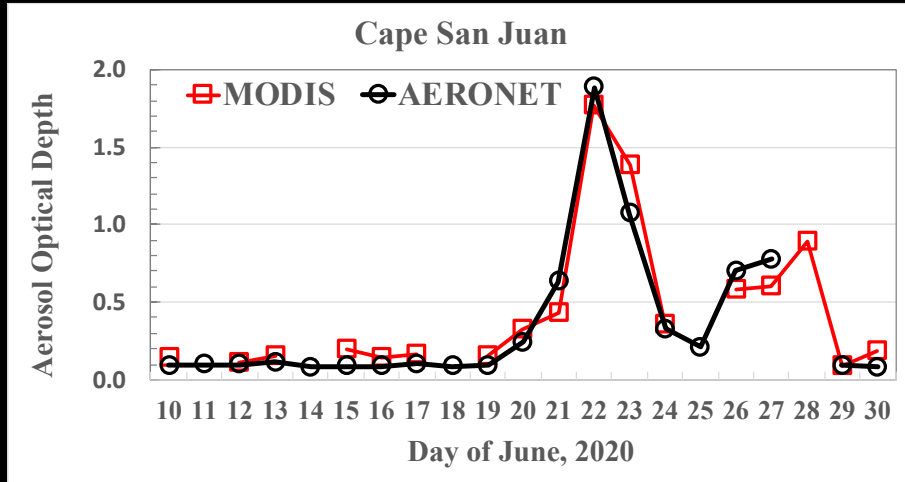


MODIS retrievals with new dust models, Terra & Aqua  
combined  
(data produced by Yaping Zhou/Robert Levy)

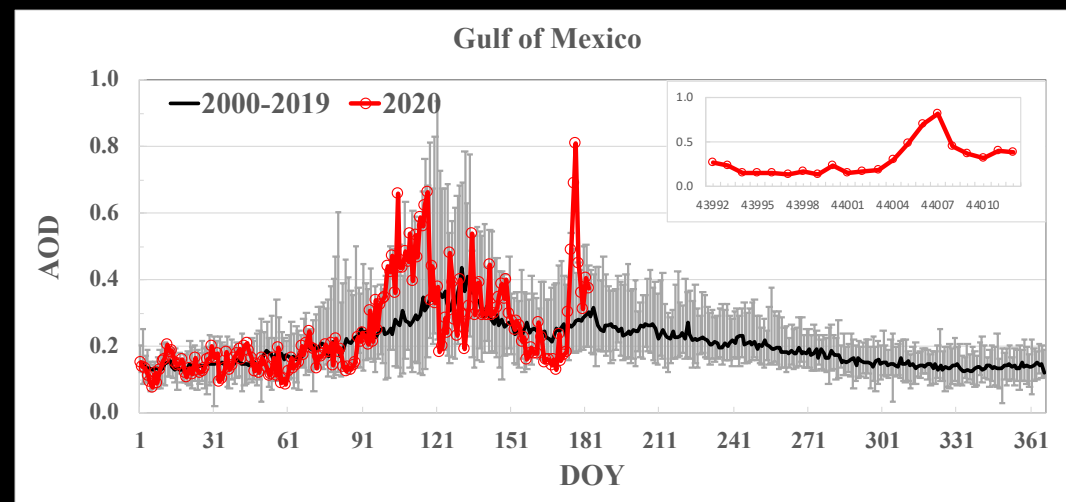
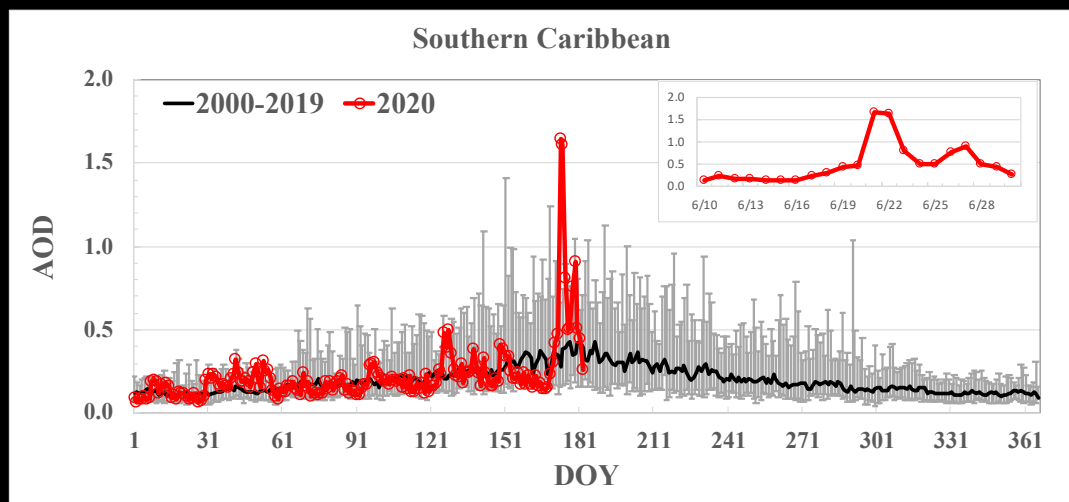
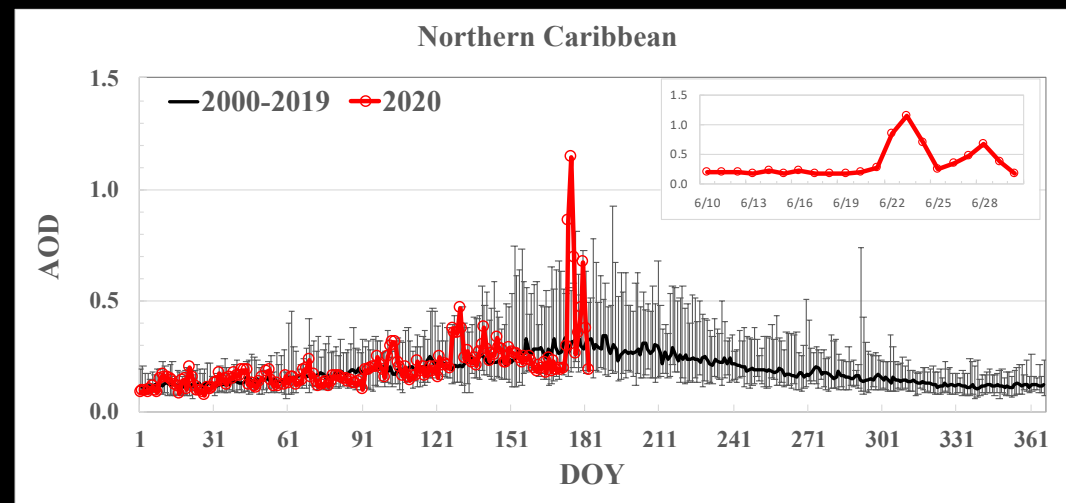
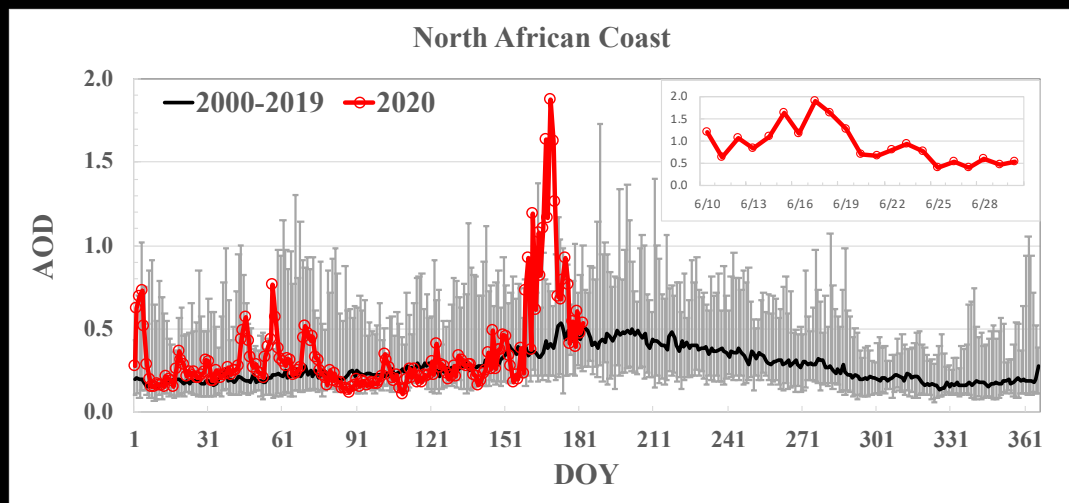


# The MODIS retrievals agree well with AERONET

(June 10-30, 2020)

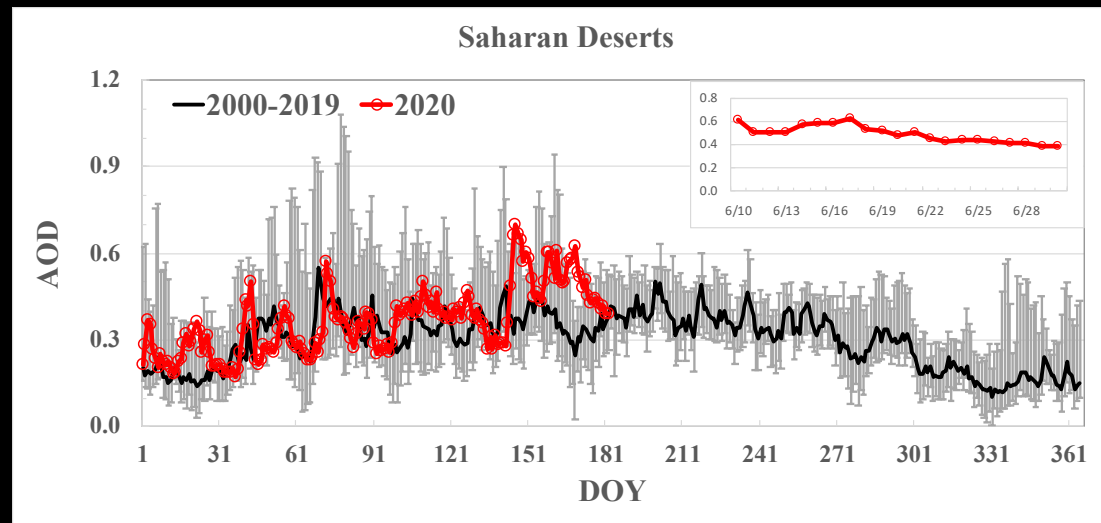


# MODIS registered this event as *historic* over the last 20 years



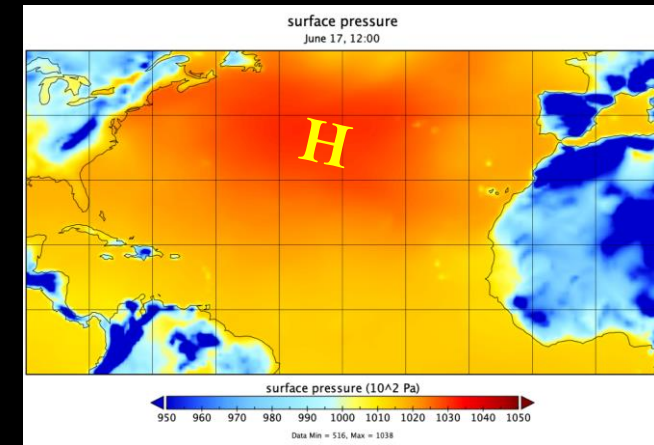
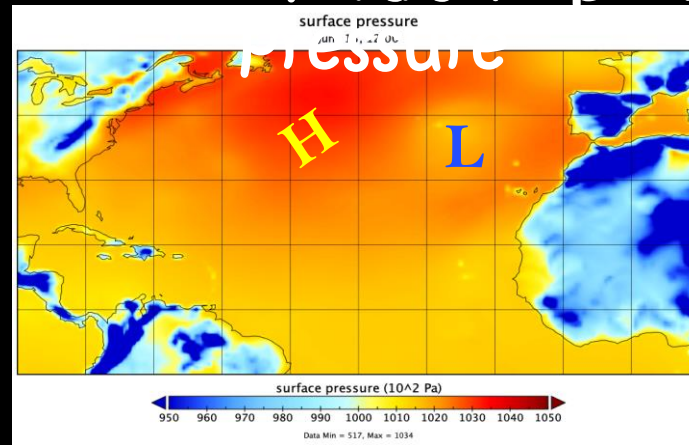
The historic dust intrusion into the Caribbean Basin was a result of dust accumulation spanning over several days in eastern Atlantic Ocean followed by the rapid transport in the trade winds

The accumulation was controlled by the anomalous northern drifting of the Bermuda-Azores High.



Emissions were not historic

## MERRA-2 Surface

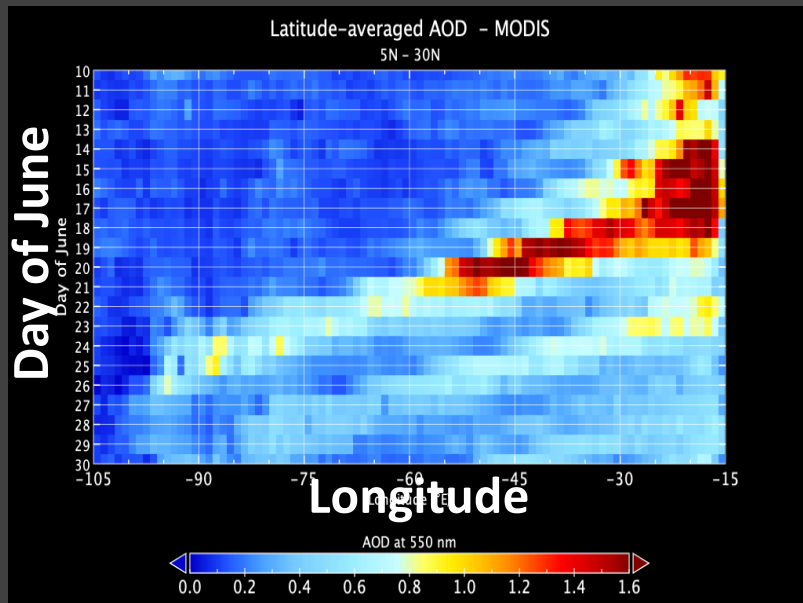


On June 15-16, the Bermuda-Azores High drifted northward, leading strong meridional winds and hence the dust accumulation in eastern Atlantic Ocean.

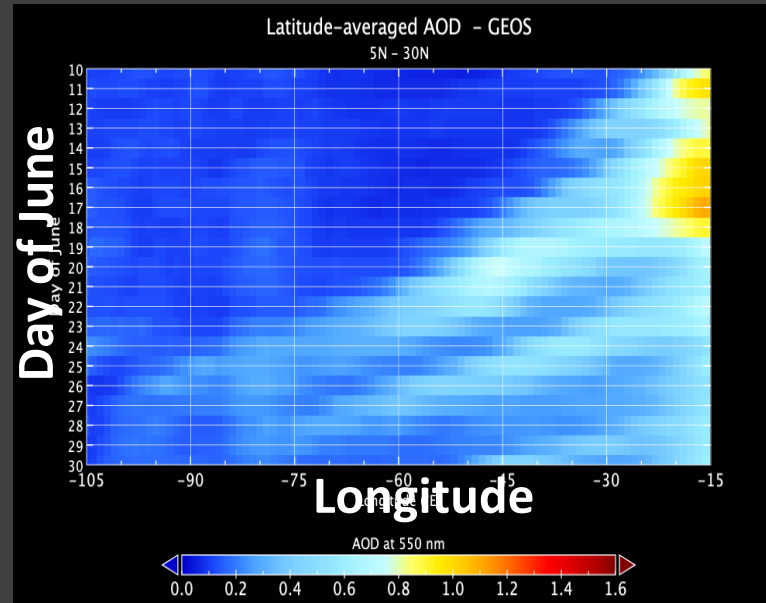


# AOD Longitude-Time Hovmöller Diagram

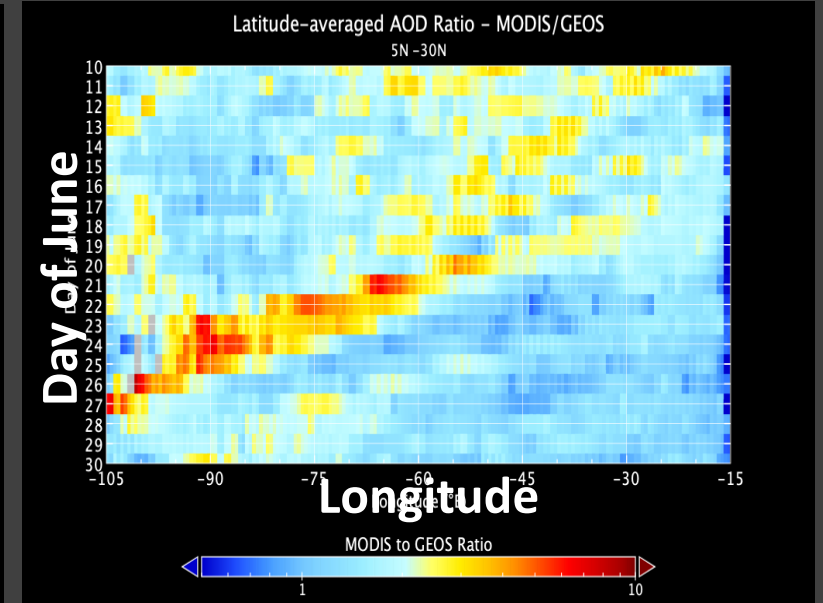
MODIS



GEOS



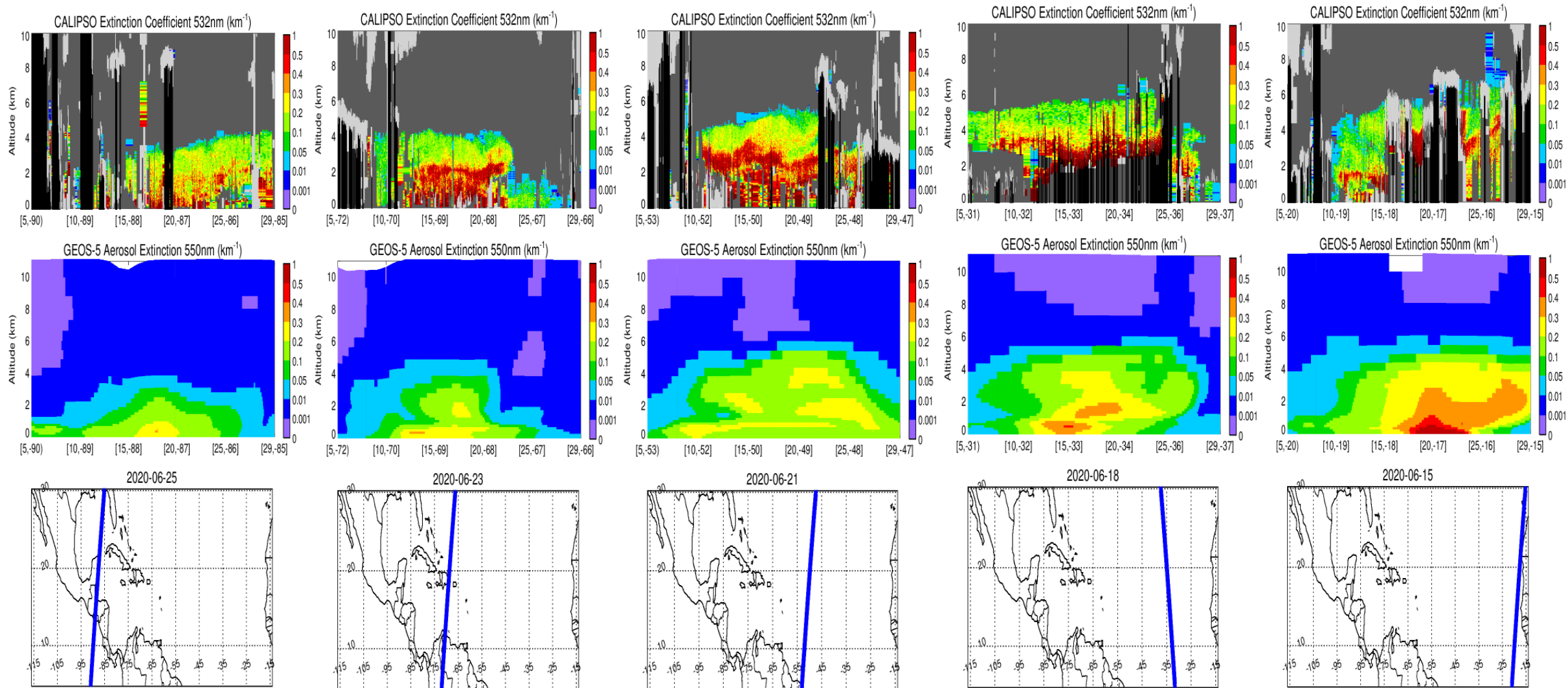
MODIS / GEOS



- GEOS underestimates MODIS AOD by 2-4x for the historic plume.
- GEOS captures the 2<sup>nd</sup> weaker plume much better

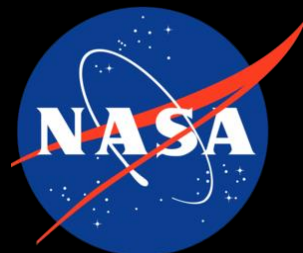
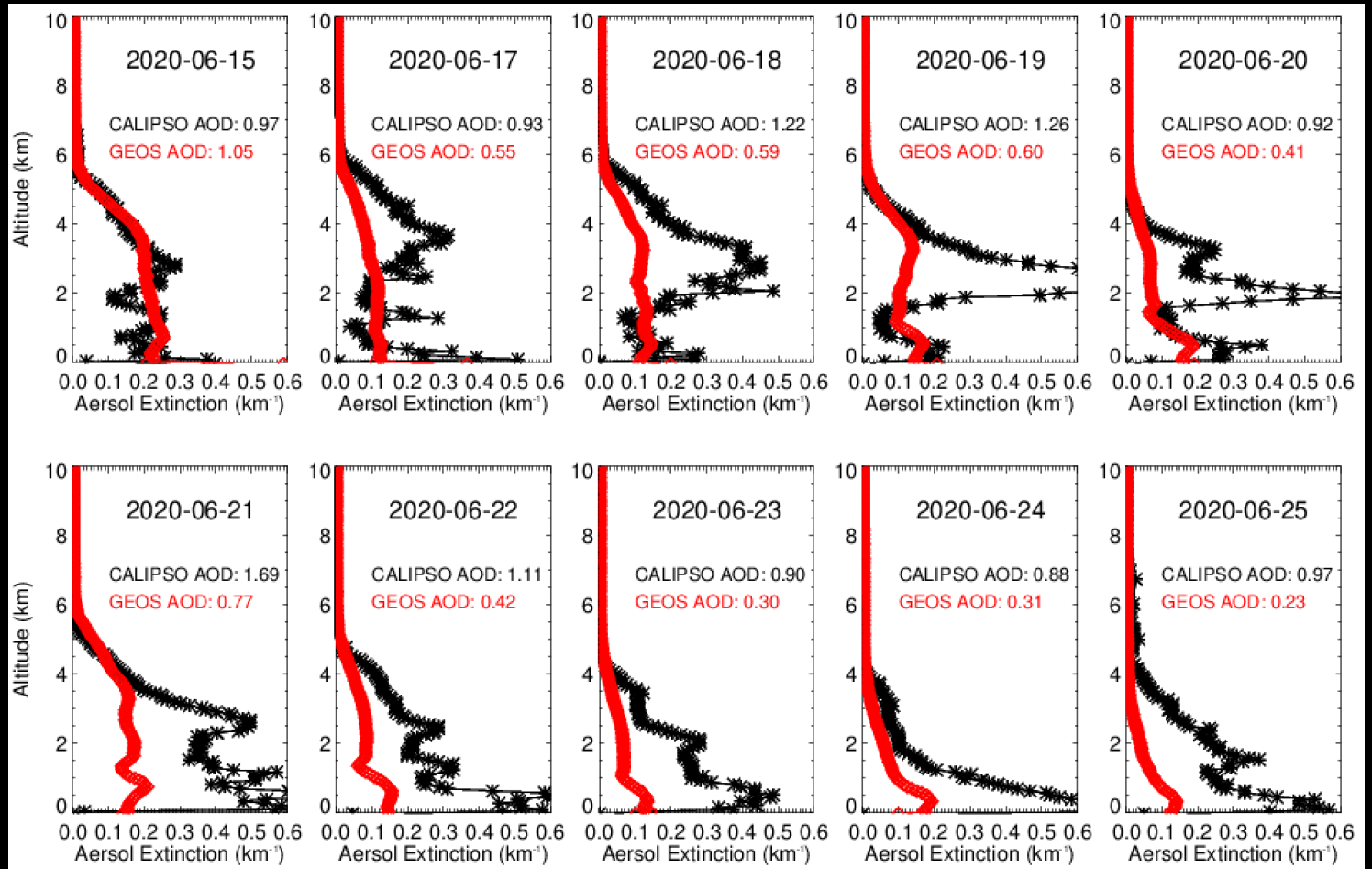
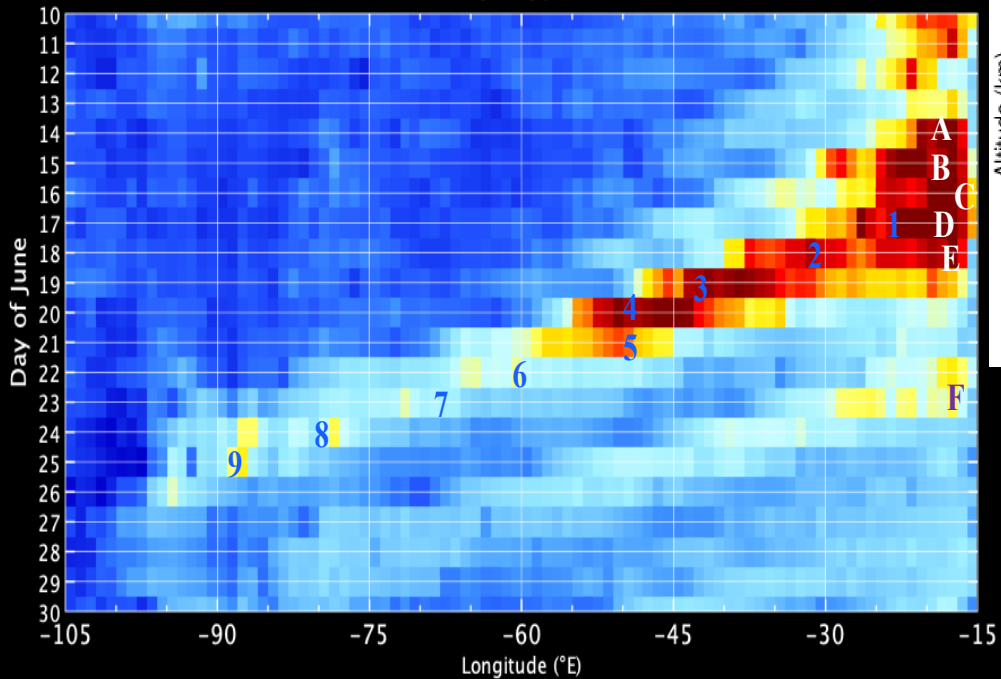


# Vertical structure along the trans-Atlantic transit

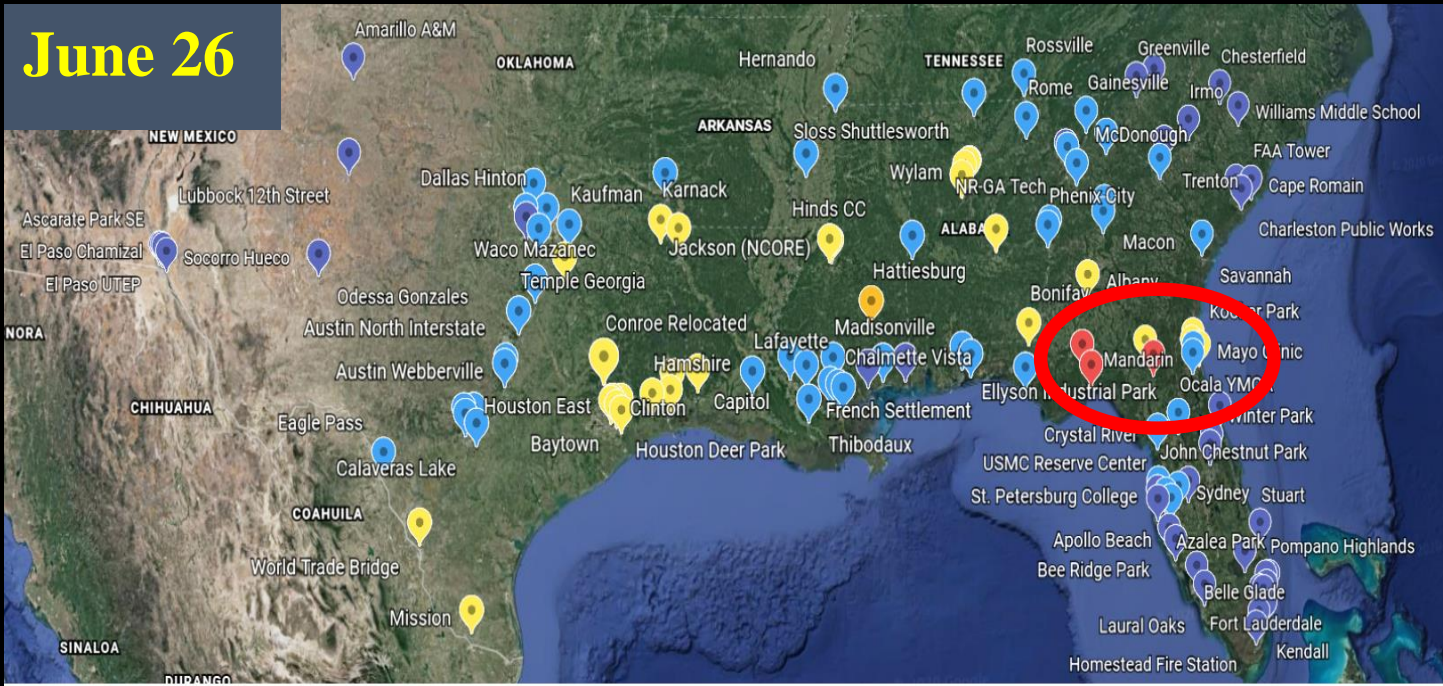




# Average profiles

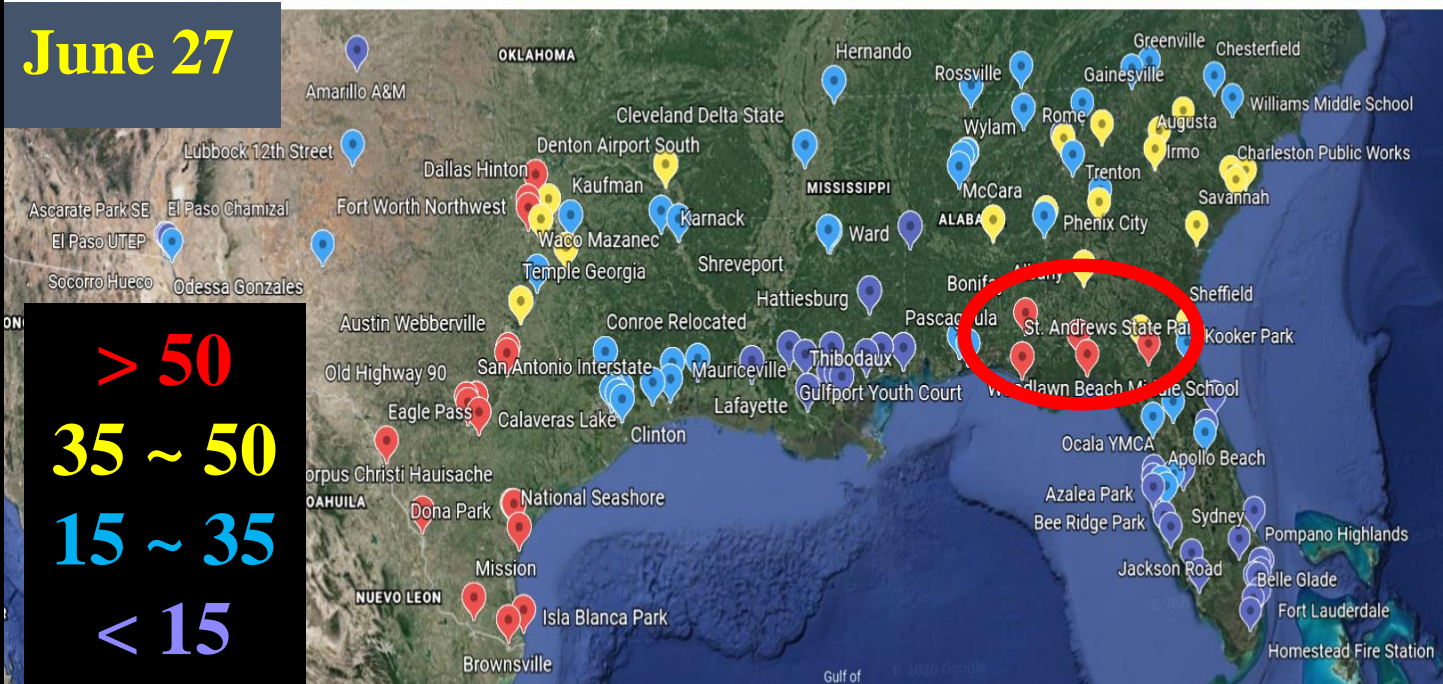


June 26



Dust plumes degraded air quality in southern U.S. on 6/26-27.

June 27

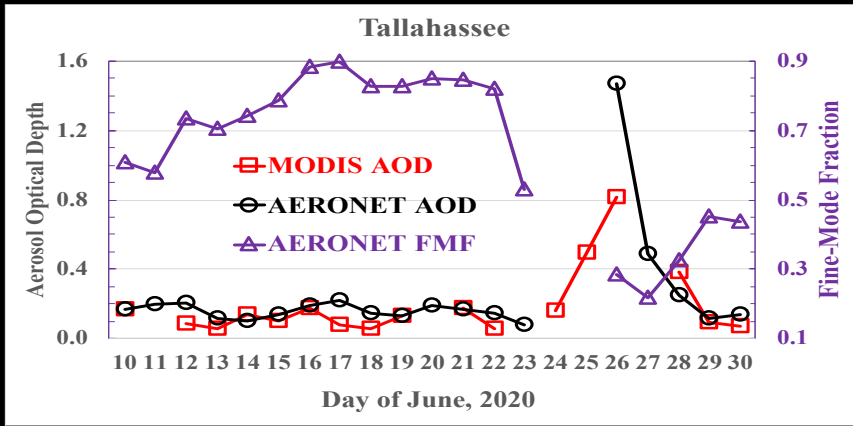


# of sites in 9 southern U.S. states with daily PM<sub>2.5</sub> exceeding the U.S. AQ standard of 35 µg/m<sup>3</sup>

- 6/26 - 31 out of 158 (20%)
- 6/27 - 62 out of 150 (41%)

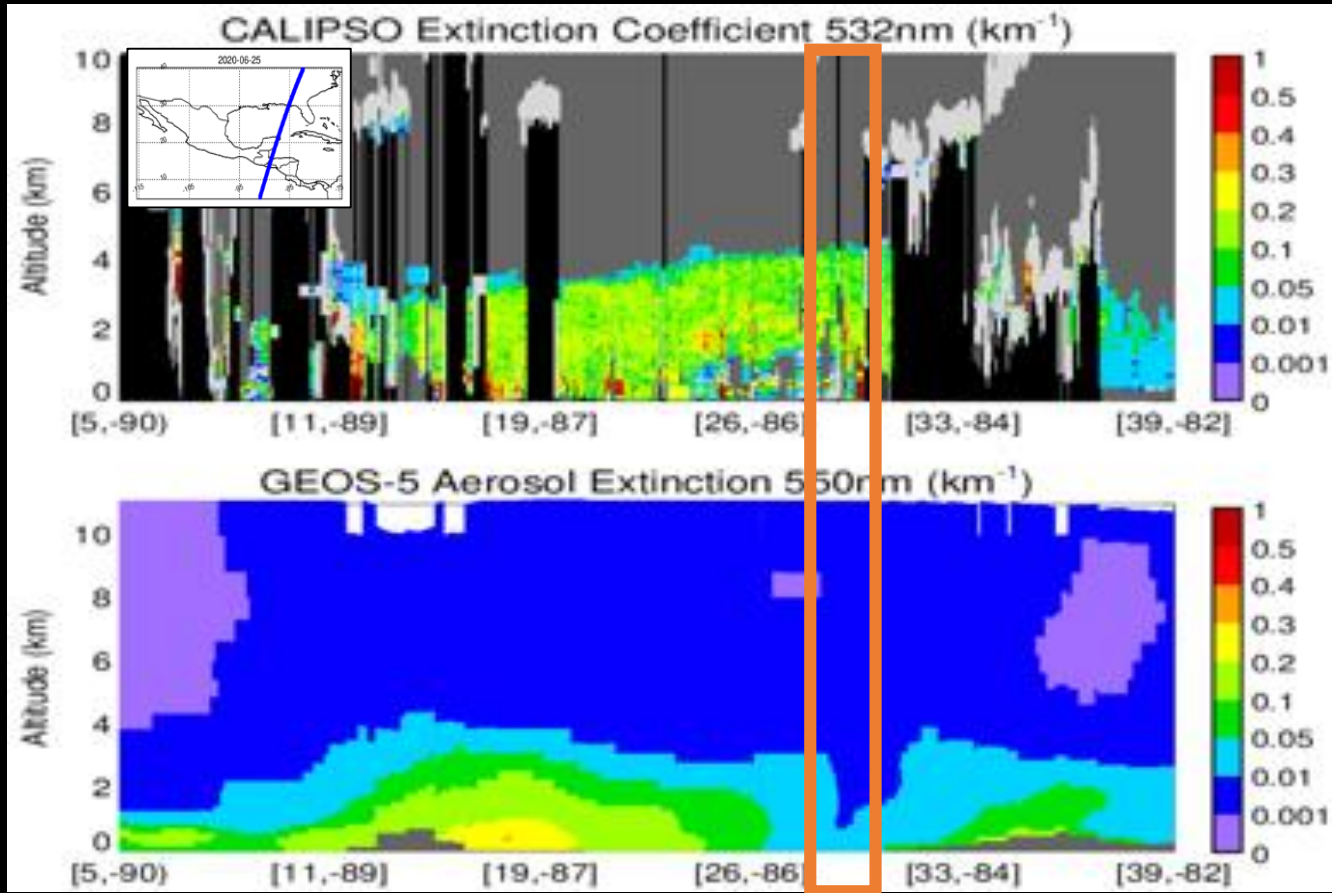
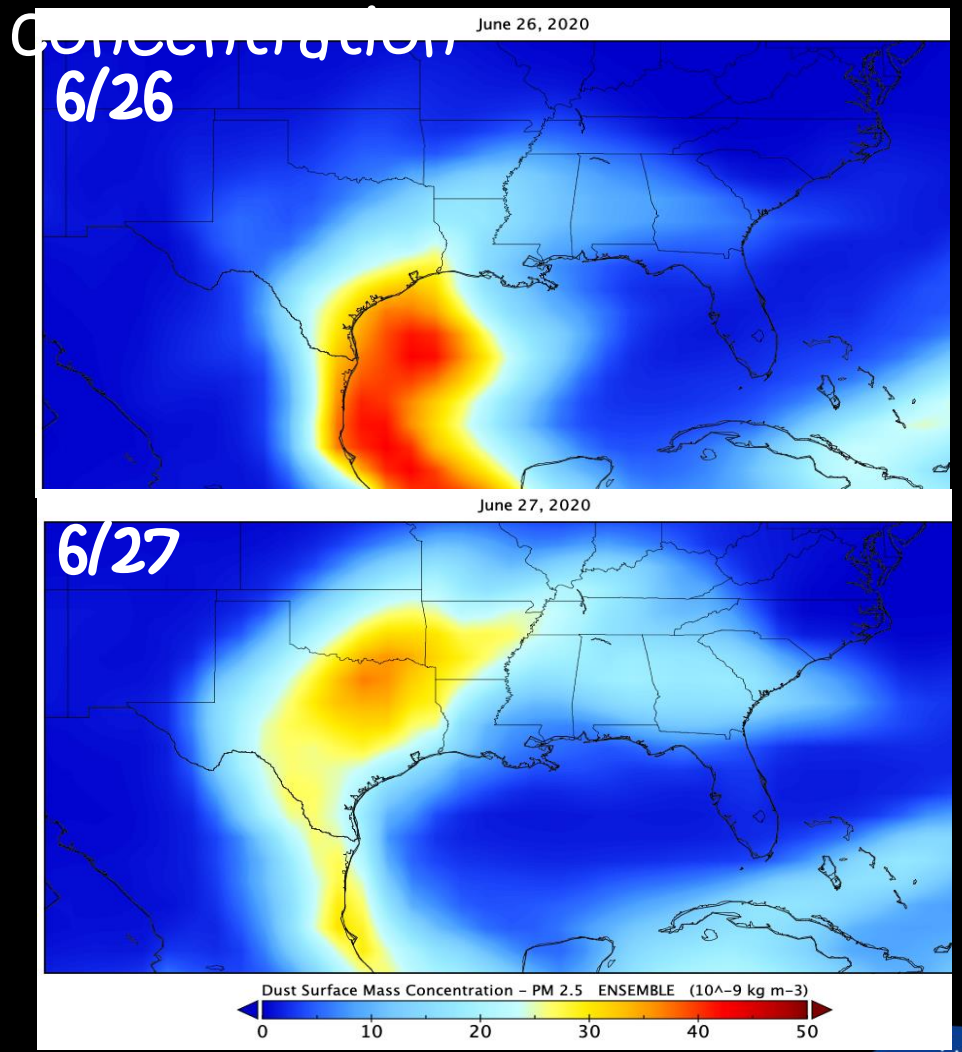


> 50  
 35 ~ 50  
 15 ~ 35  
 < 15



AERONET Tallahassee observed the elevation of AOD (up to 1.47) and FMF dropping of FMF (below 0.3)

# GEO5 dust surface



# Take-home Messages

- MODIS observations registered this event as historic over the past two decades.
- Impacts on air quality were significant in the southern U.S.
- The historic dust intrusion is a result of dust accumulation spanning over several days in eastern Atlantic Ocean followed by a rapid trade-wind transport, which is controlled by the anomalous drifting of the Bermuda-Azores High.
- GEOS substantially underestimates magnitude of the dust intrusion, although it captures plume track and height reasonably well.

