

A satellite photograph of Earth from space, showing a massive, bright white dust front extending across the continent of Libya. The dust front is a thick, irregular band of white and light grey, contrasting sharply with the darker brown and tan colors of the land below. The curvature of the Earth is visible at the top of the frame, and the blackness of space is at the very top. The text is overlaid on the top and bottom portions of the image.

***Introducing New Deep Blue Aerosol Products from
VIIRS and GEO Sensors***

***Photo taken from Space
Shuttle:
Fierce dust front over Libya***

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Multi-Sensor Long-Term Deep Blue Aerosol Products

➤ **Science Objectives:**

- Our primary goal is to produce consistent long-term aerosol climate data record using multiple satellite sensor data from AVHRR (historic) to SeaWiFS and MODIS (EOS-era) to VIIRS (JPSS-era) as well as latest GEO sensors (such as ABI and AHI) for diurnal cycle

➤ **Status of the VIIRS Deep Blue aerosol products:**

- ✓ Standard and NRT VIIRS Version 1.1 L2 and L3 products have been operational and available at LAADS in 2021.
- ✓ VIIRS Version 2.0 algorithms are finalized, and the data release is imminent.
- ✓ Major updates include better retrievals over high elevation regions, improved surface database, and new fine-dominated aerosol optical models (in addition to nonspherical dust) over land.
- ✓ The implementation of the VIIRS calibration adjustments has been completed for both SNPP and NOAA20. Data products for these two sensors will be released to the public at the same time.
- ✓ In support of the MODIS C7 reprocessing, the effort of backporting VIIRS V2.0 Deep Blue algorithm to MODIS C7 has started.

Multi-Sensor Long-Term Deep Blue Aerosol Products

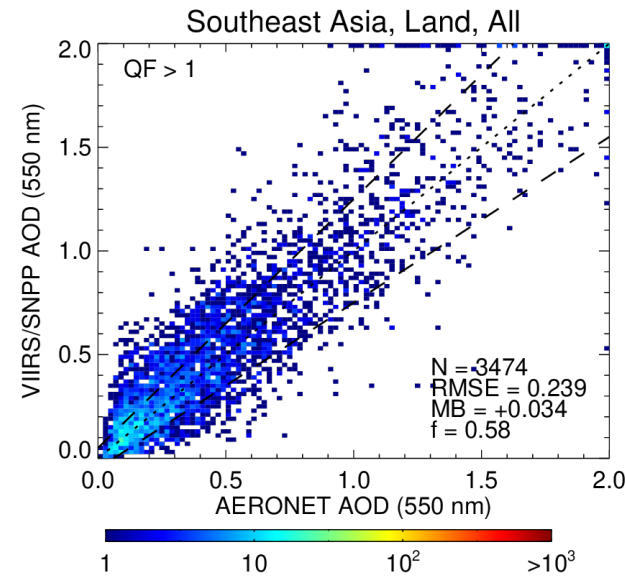
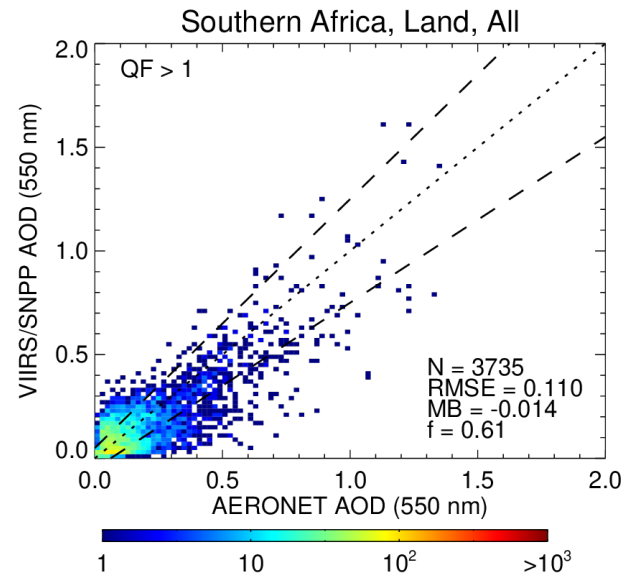
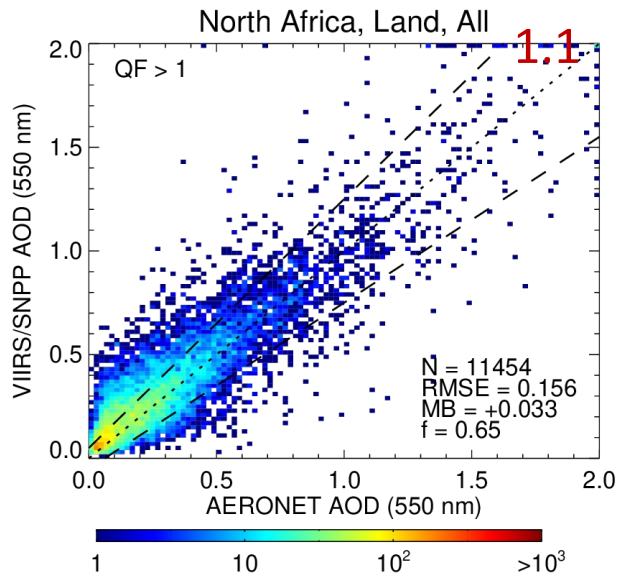
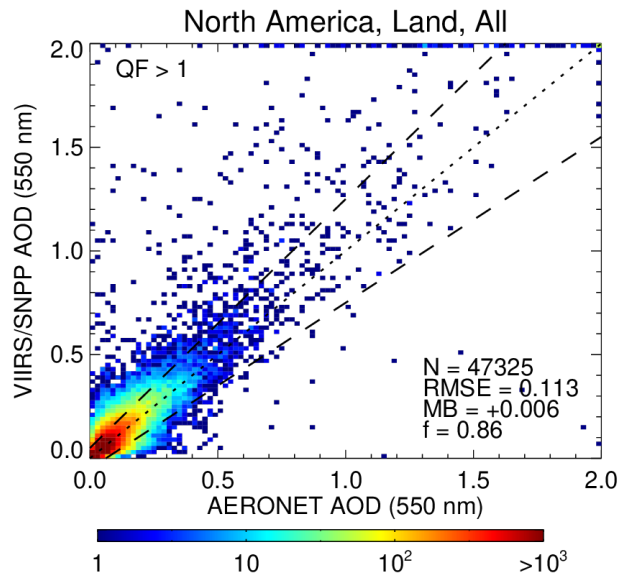
➤ *Status of the GEO (ABI and AHI) Deep Blue aerosol products:*

- ✓ Algorithms (Deep Blue over land, SOAR over water) are based on the latest VIIRS Version 2.0 production codes with modifications to account for different sensor characteristics (wavelength, spatial resolution, observation geometry, etc.).
- ✓ Output files are in netCDF4 format consistent with current VIIRS and future MODIS products.
- ✓ Half-hourly L2 products at an 8 km × 8 km resolution at nadir and temporal (hourly) as well as averaged daily and monthly L3 products with an 1° x 1° resolution are produced.
- ✓ 1 year (minimum) of demonstration data set will be released next year.

Improved VIIRS AOD retrievals over land (data from 2012-2017)

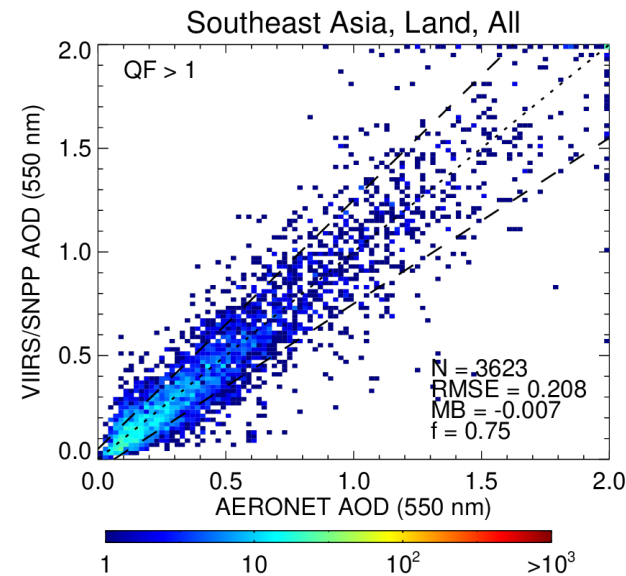
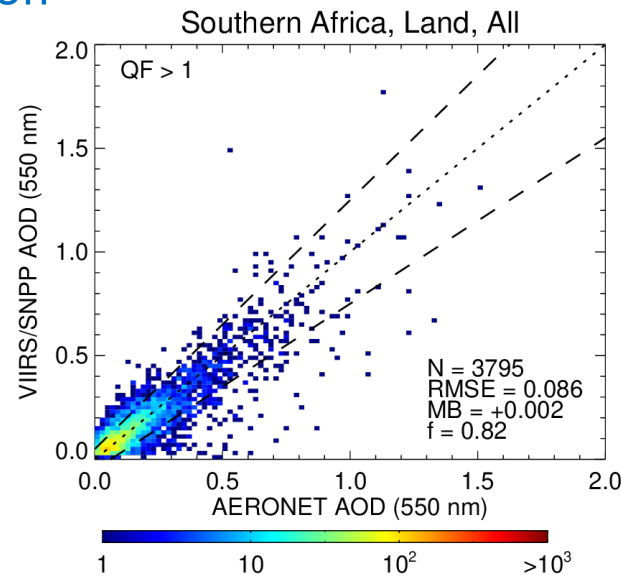
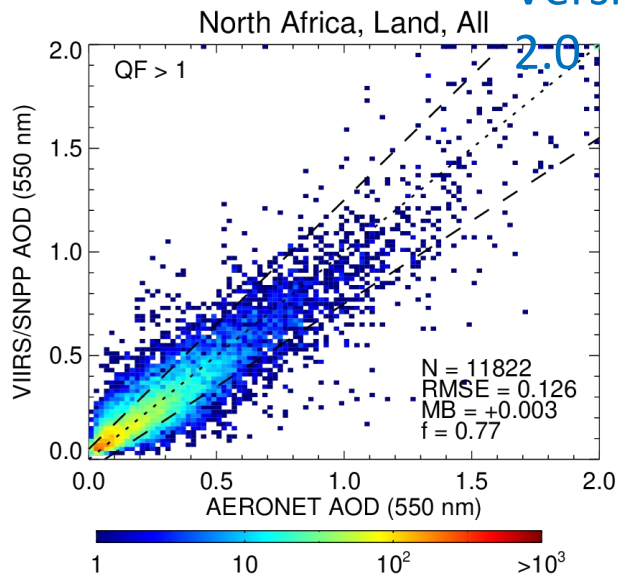
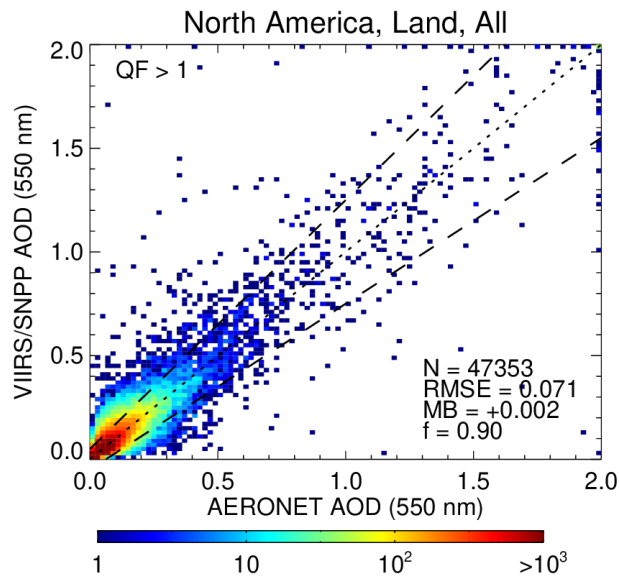
Version

1.1



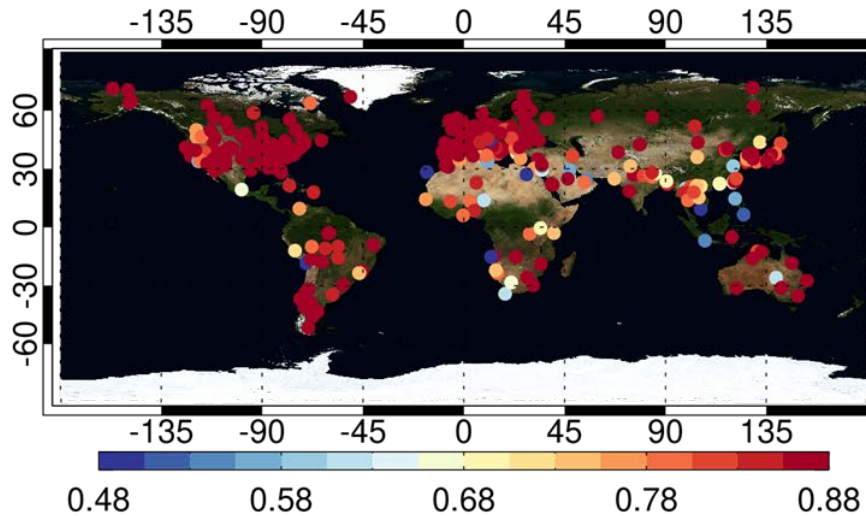
Version

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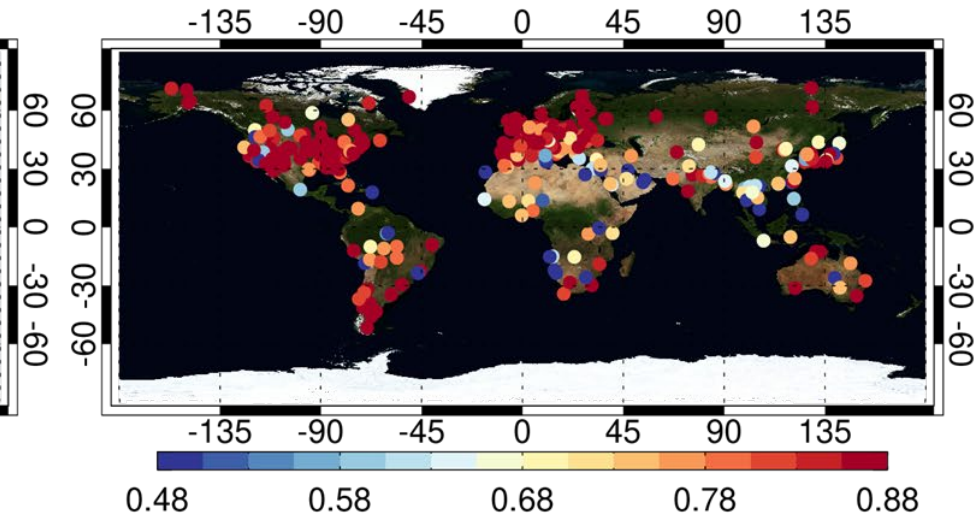


Comparisons of SNPP VIIRS V2 AOD against AERONET

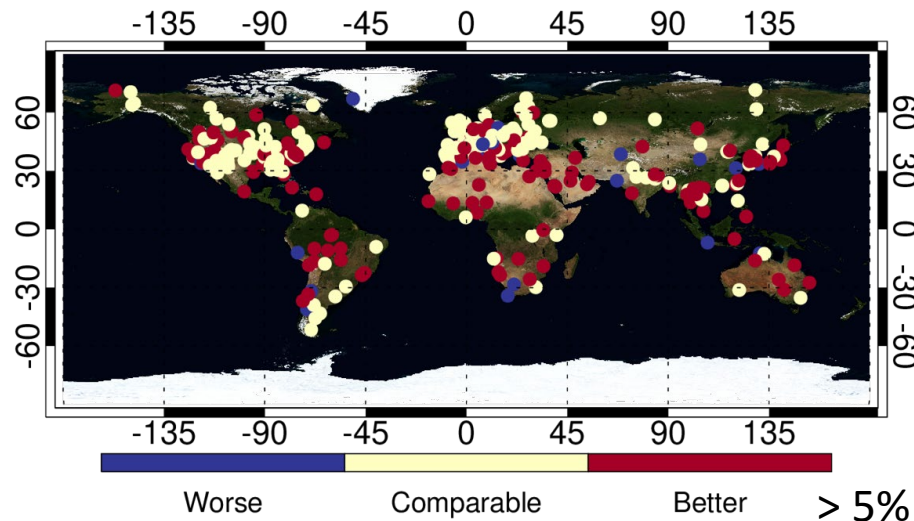
V2 Fraction within Expected Error



V1.1 Fraction within Expected Error



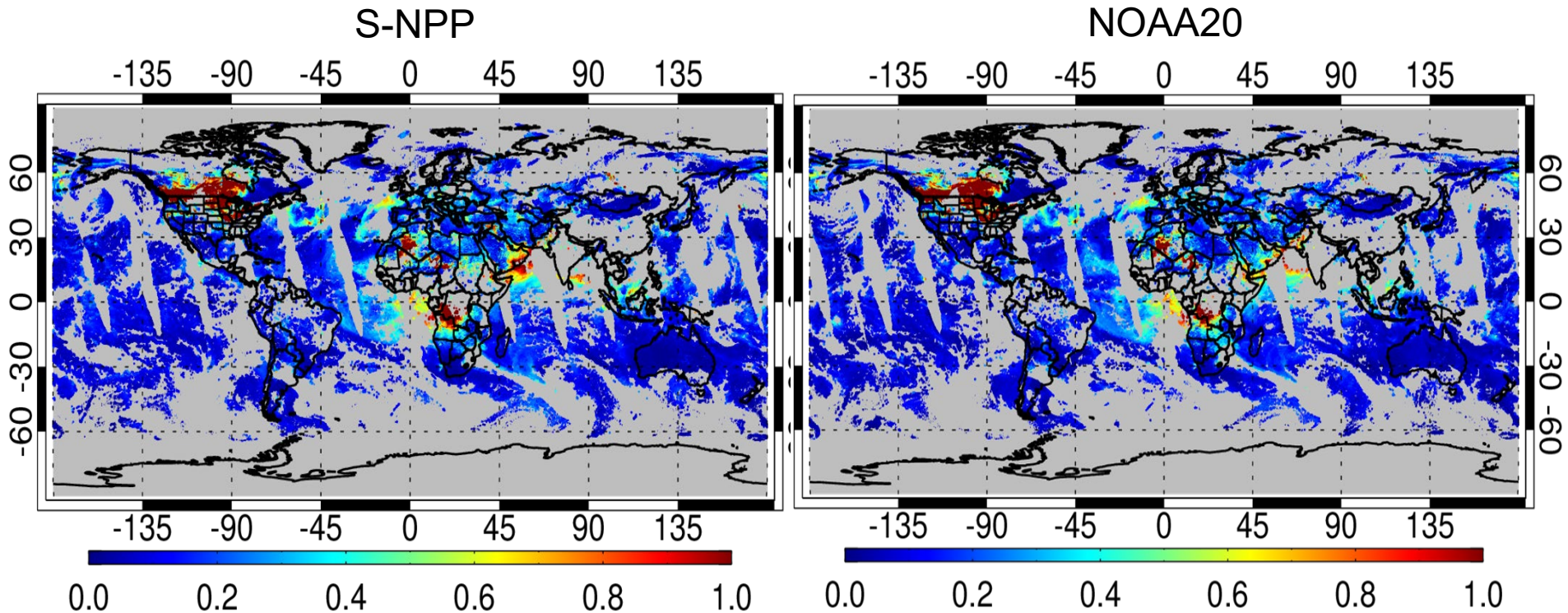
V2 vs. V1.1 performance



- Compared to V1, the performance of VIIRS V2 AOD against AERONET is generally much improved, particularly over high elevation regions. Expected error = $\pm(0.05+20\%)$.
- In support of MODIS C7 reprocessing, we will also apply VIIRS V2 DB algorithm to MODIS for Terra and Aqua.

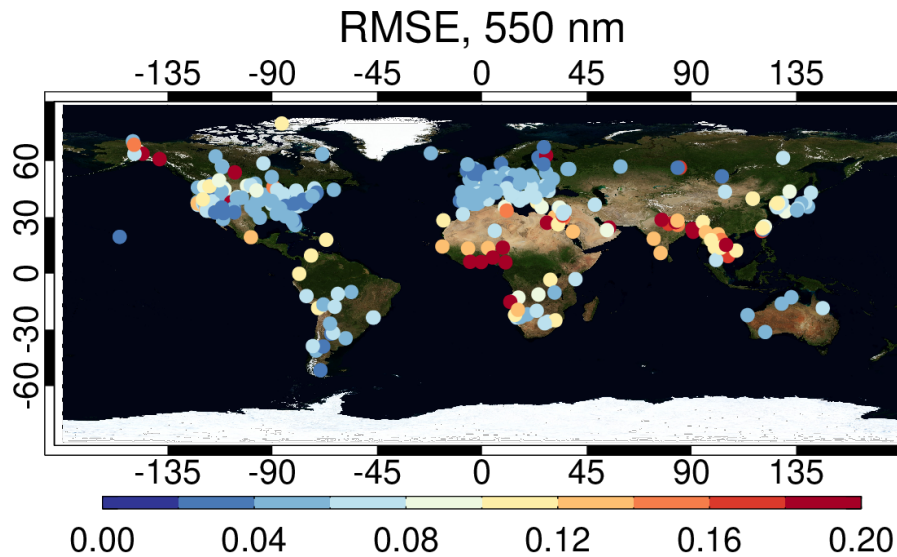
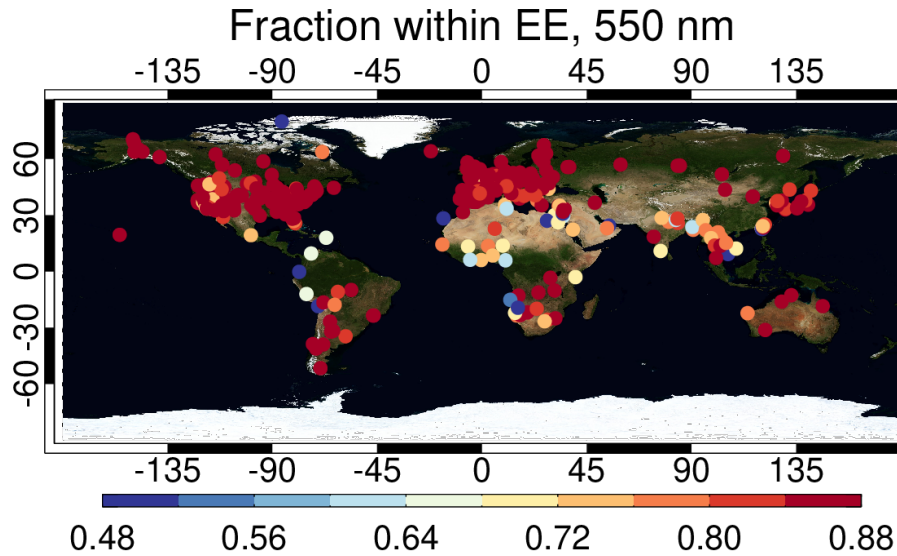
Producing VIIRS aerosol products from NOAA20

VIIRS DB AOD (550 nm) on 18 August 2018

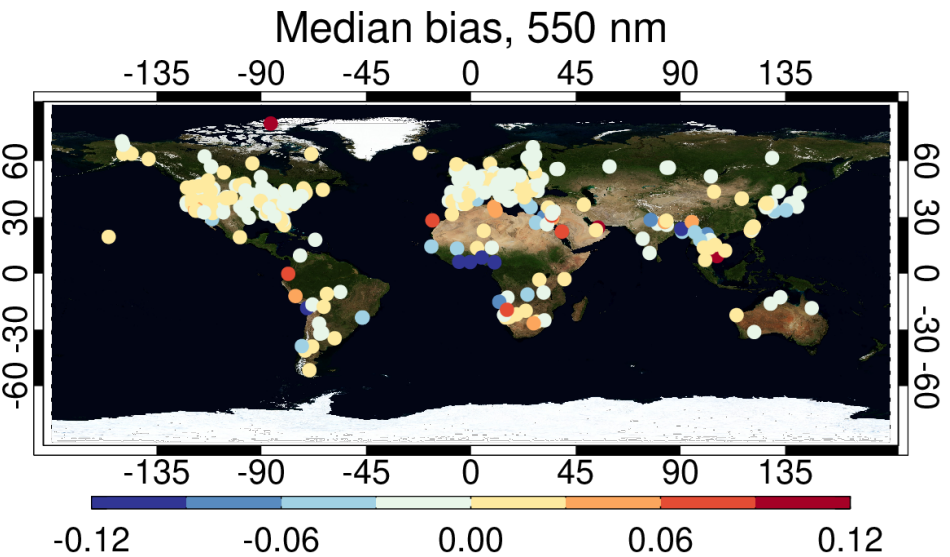


- There are significant calibration differences between SNPP and NOAA20 VIIRS. We have minimized these differences by normalizing both sensors to MODIS Aqua, using VIIRS/MODIS Aqua matchup files generated by A-SIPS.
- After applying these calibration adjustments to VIIRS L1B data, the global distributions of AOD from SNPP and NOAA20 are now comparable.

Comparisons of NOAA20 VIIRS AOD at 550 nm against AERONET over land from 2018-2020



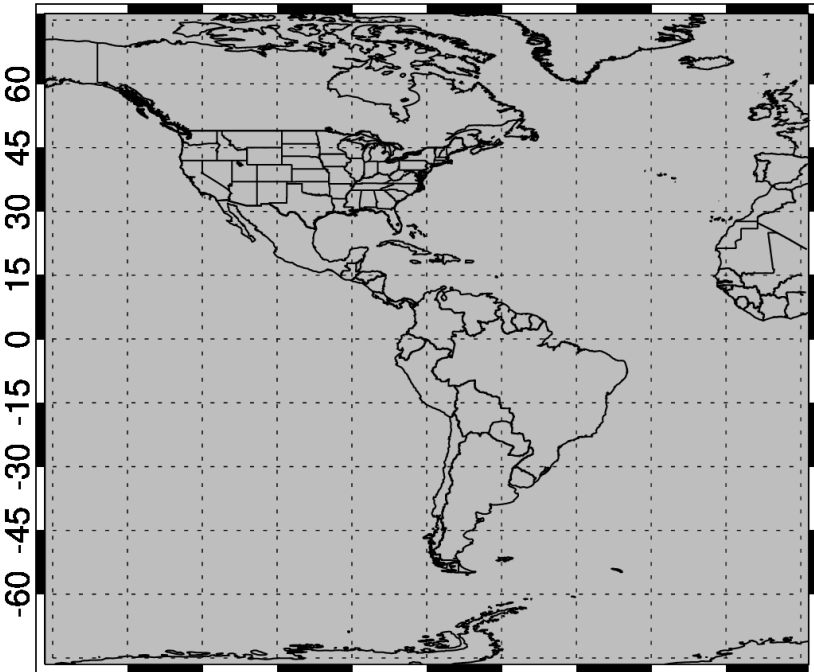
- The performance of NOAA20 VIIRS AOD product against AERONET is comparable to that for SNPP, after applying calibration correction.
- Most of the sites have more than 80% of retrieved data fallen into the expected error of $\pm(0.05+20\%)$ with small median bias and root-mean-square error (RMSE) compared to AERONET AOD.



GEO Deep Blue aerosol products (ABI/GOES-16)

SNPP/NOAA20 VIIRS DB AOD (550 nm)
15 SEP 2020, 09:30 UTC

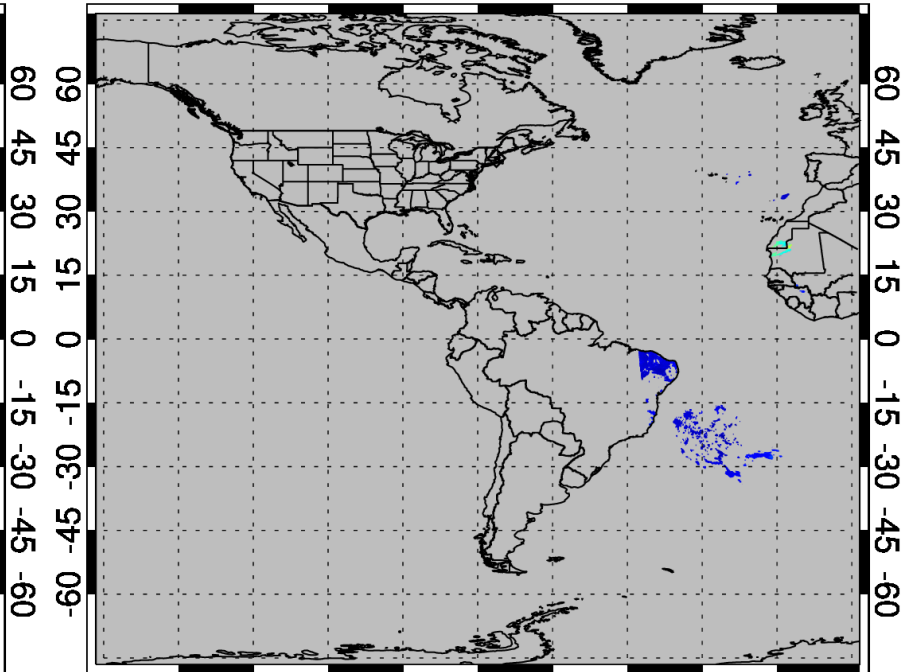
-135 -120 -105 -90 -75 -60 -45 -30 -15



0.0 0.2 0.4 0.6 0.8 1.0

ABI/G16 DB AOD (550 nm)
15 SEP 2020, 09:30 UTC

-135 -120 -105 -90 -75 -60 -45 -30 -15

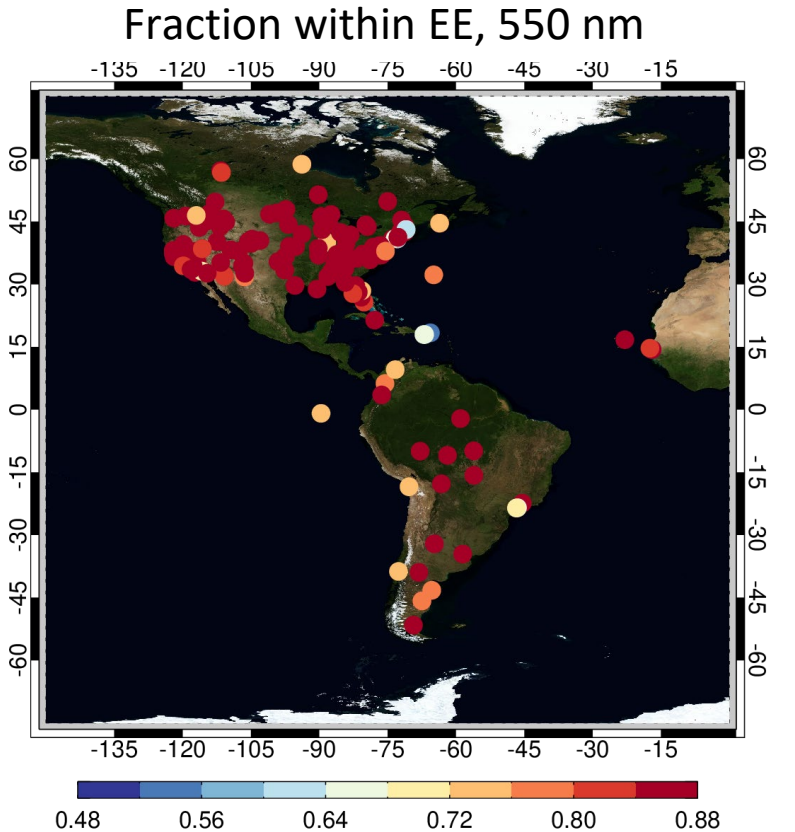
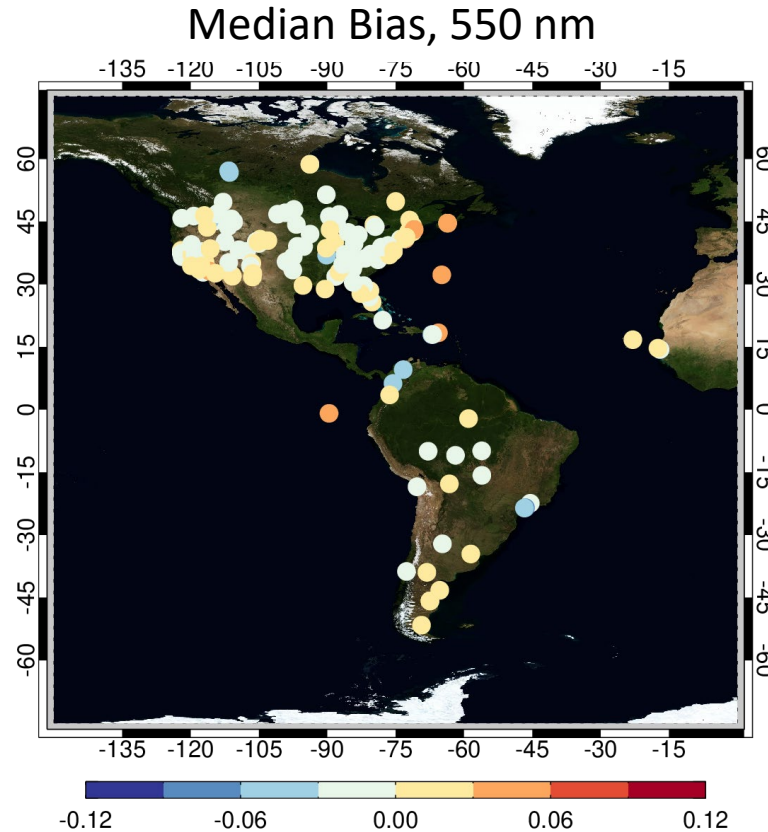
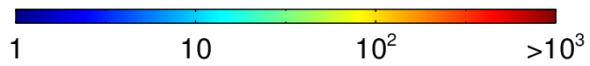
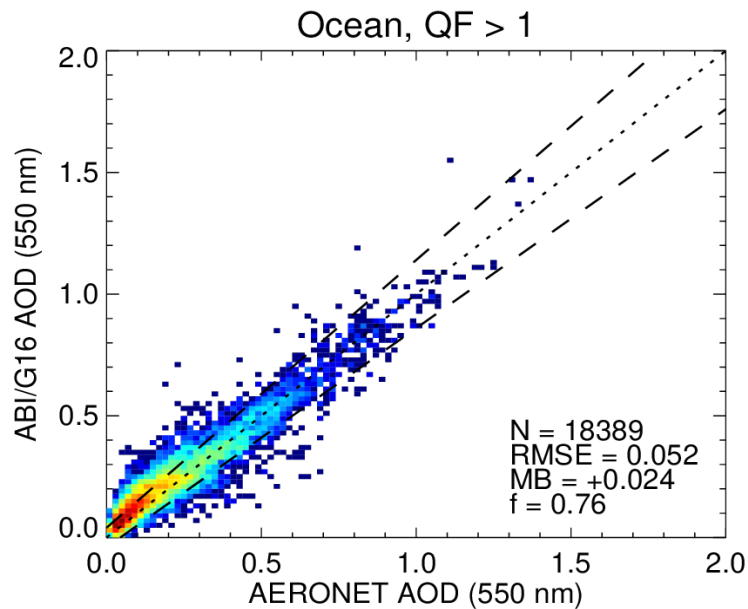
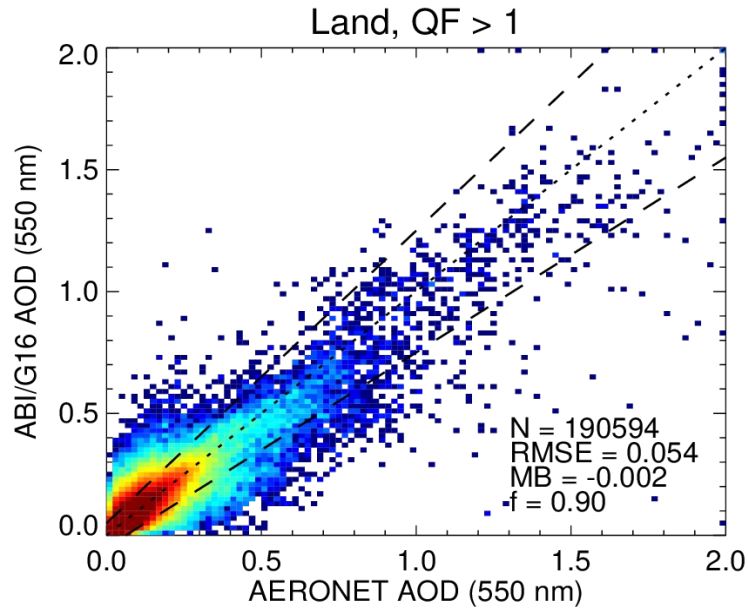


0.0 0.2 0.4 0.6 0.8 1.0

GEO DB aerosol product

- Retrieval parameters
 - 550 nm/spectral AOD (primary)
 - Ångström exponent
 - Fine-mode fraction (ocean only)
 - Aerosol type
- Half-hourly, 8 x 8 km² resolutions
- Consistent netCDF4 format with MODIS (C7) and VIIRS products
- Minimal learning curve for users of existing DB aerosol products

Initial validation of half-hourly ABI DB AOD in 2019



- Overall performance is comparable to MODIS/VIIRS DB products, except for conditions of extreme observation angles and “too bright” surfaces.
- AOD tends to be underestimated for high airmass factor conditions ($AMF > 6$).
- Sophisticated filters are under development for optimal balance between data quality and coverage.

* $EE = \pm(0.05+0.2 \times AOD)$ over land, $\pm(0.04+0.1 \times AOD)$ over ocean