National Aeronautics and Space Administration

Satellite Aerosol Validation

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Satellite Remote Sensing of Air Quality, 18-19 November 2018

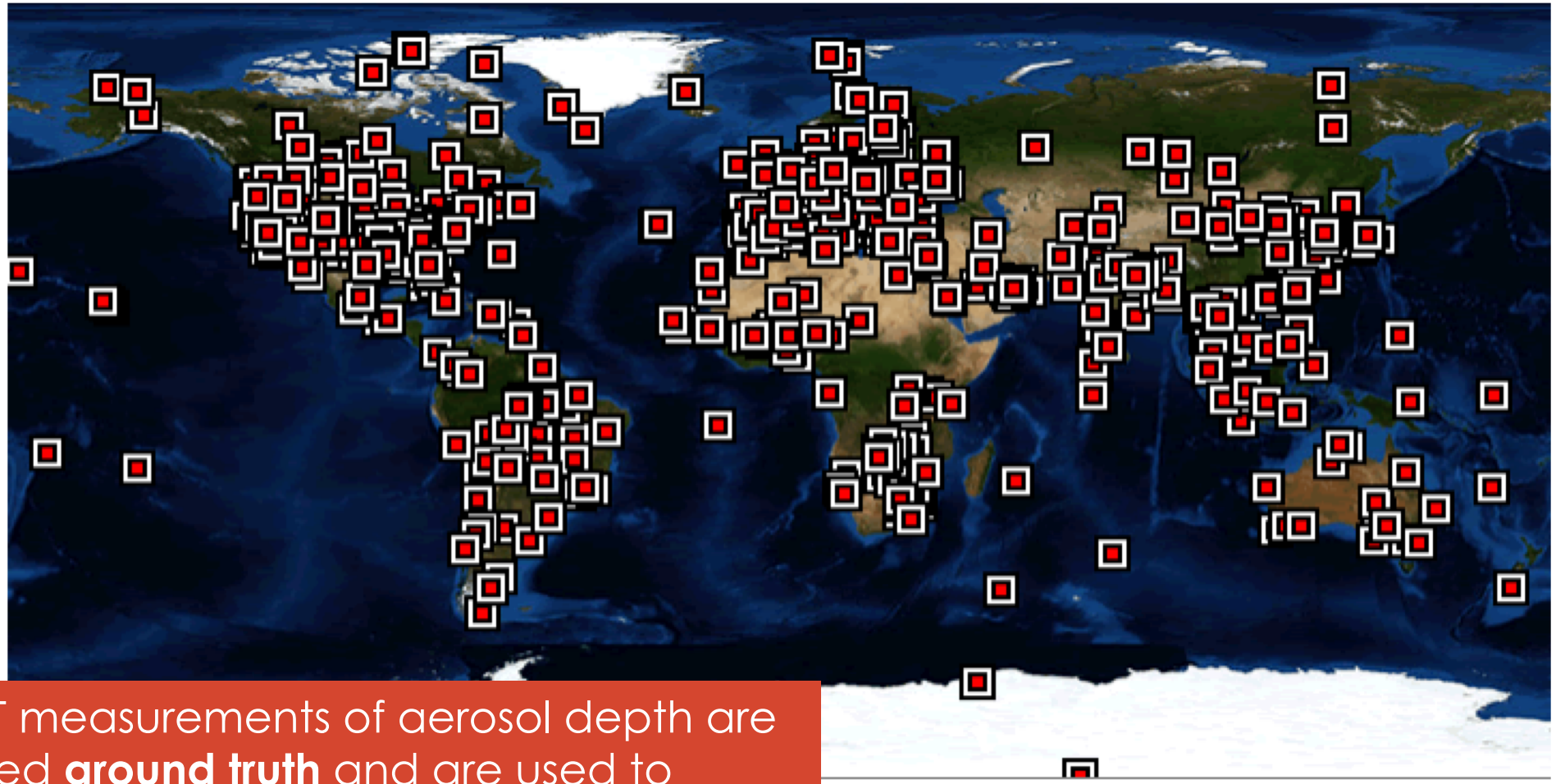
Objectives

By the end of this presentation, you will learn to:

- Validate satellite derived aerosol optical depth
- List the uncertainties in the MODIS aerosol product
- Access data and tools for validating satellite aerosol products

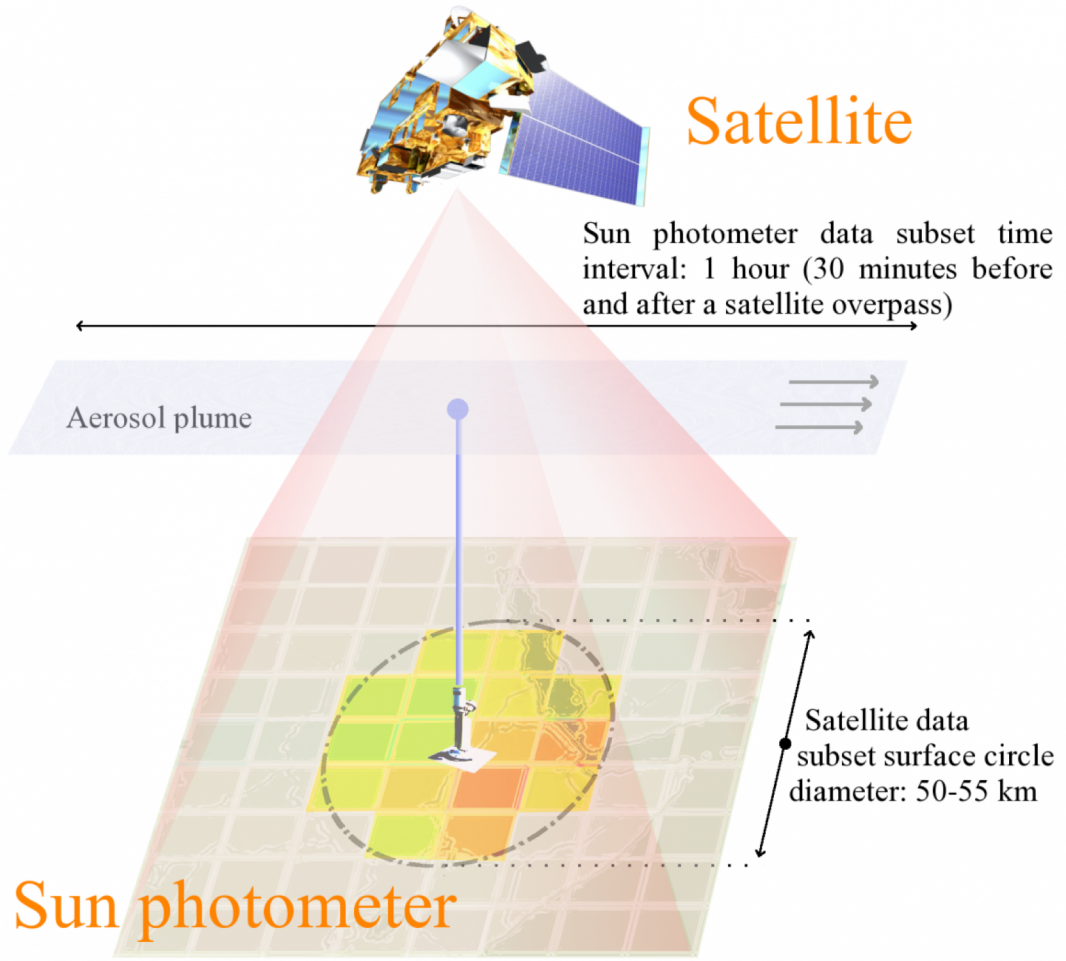
AERONET

http://aeronet.gsfc.nasa.gov/



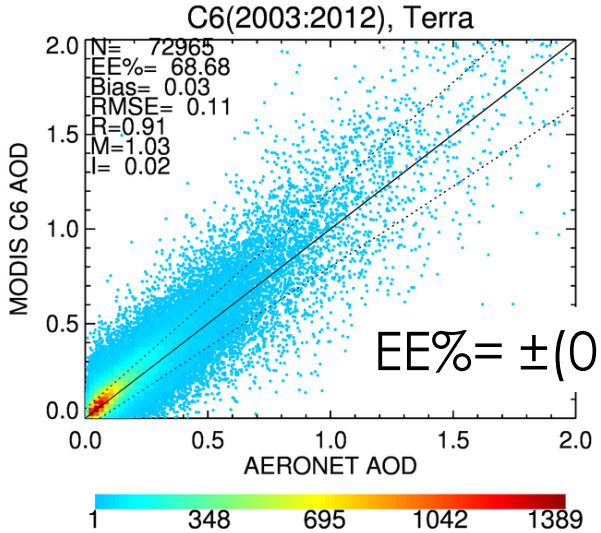
AERONET measurements of aerosol depth are considered **ground truth** and are used to validate satellite aerosol retrievals

Spatial and Temporal Collocation

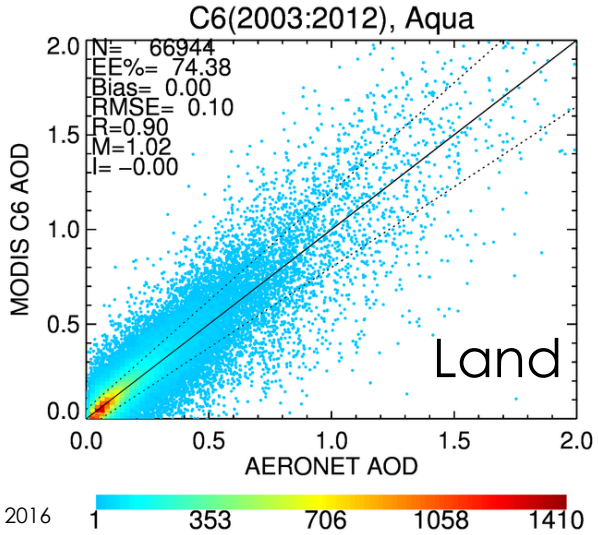


Petrenko et al., 2012

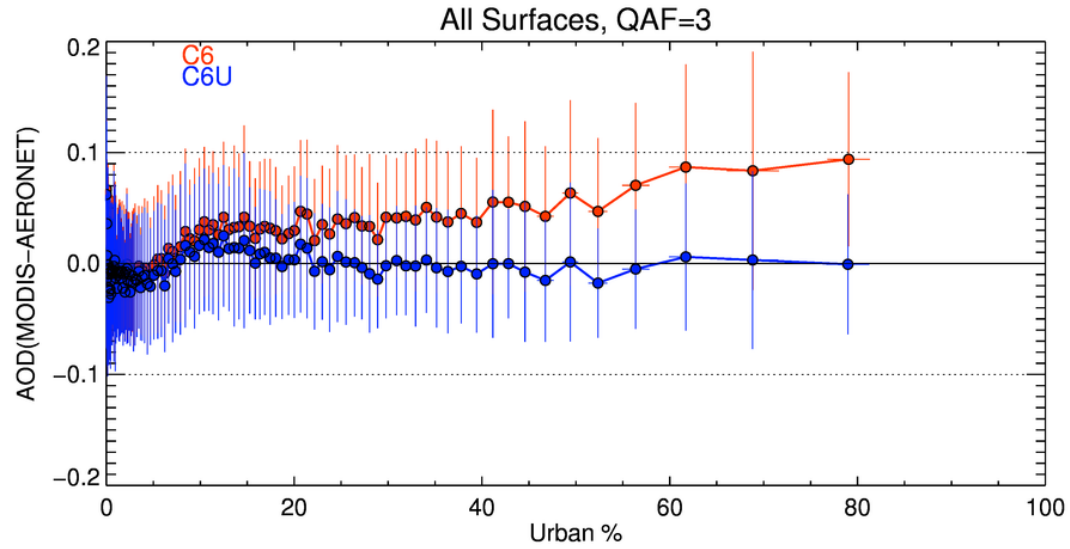
MODIS Dark Target (DT) AOD Validation



EE%= ±(0.05 + 15%)

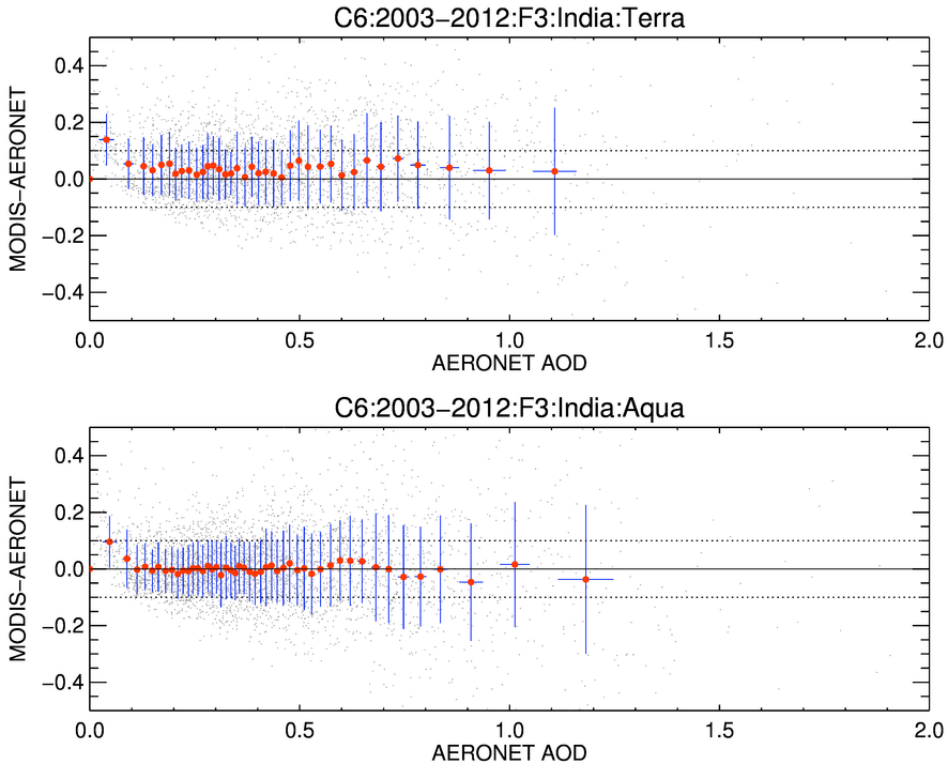


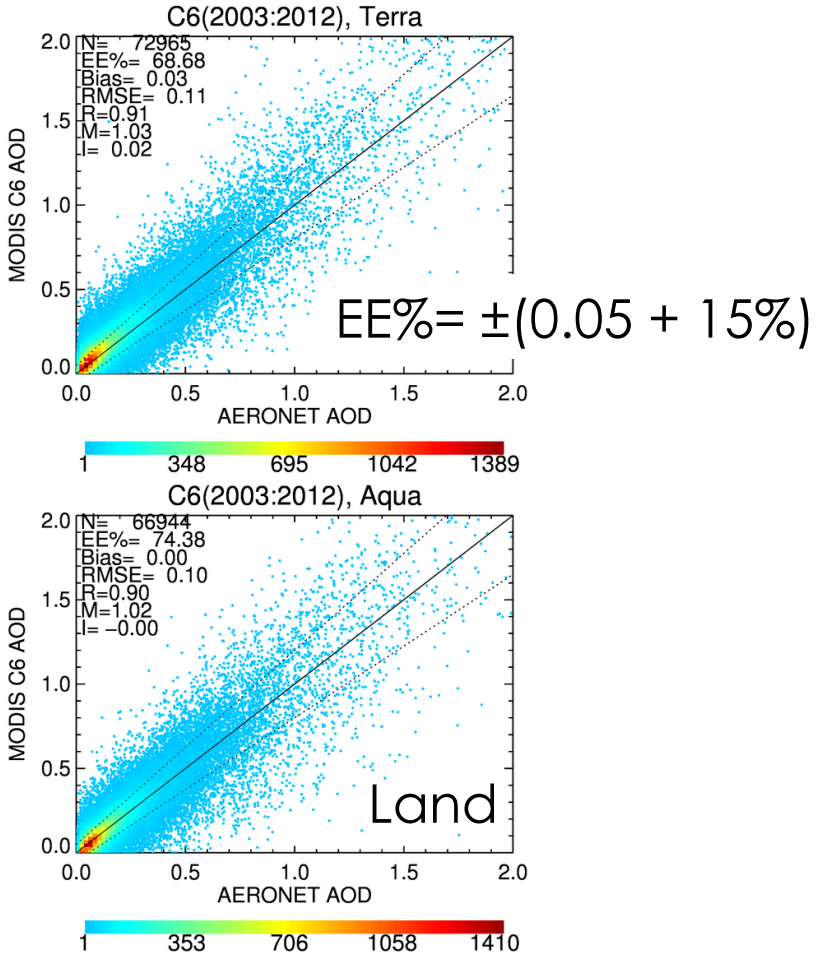
Source: Gupta et al., 2016



AERONET Comparisons with Aqua & Terra

Includes all stations in the region (Indian Subcontinent)



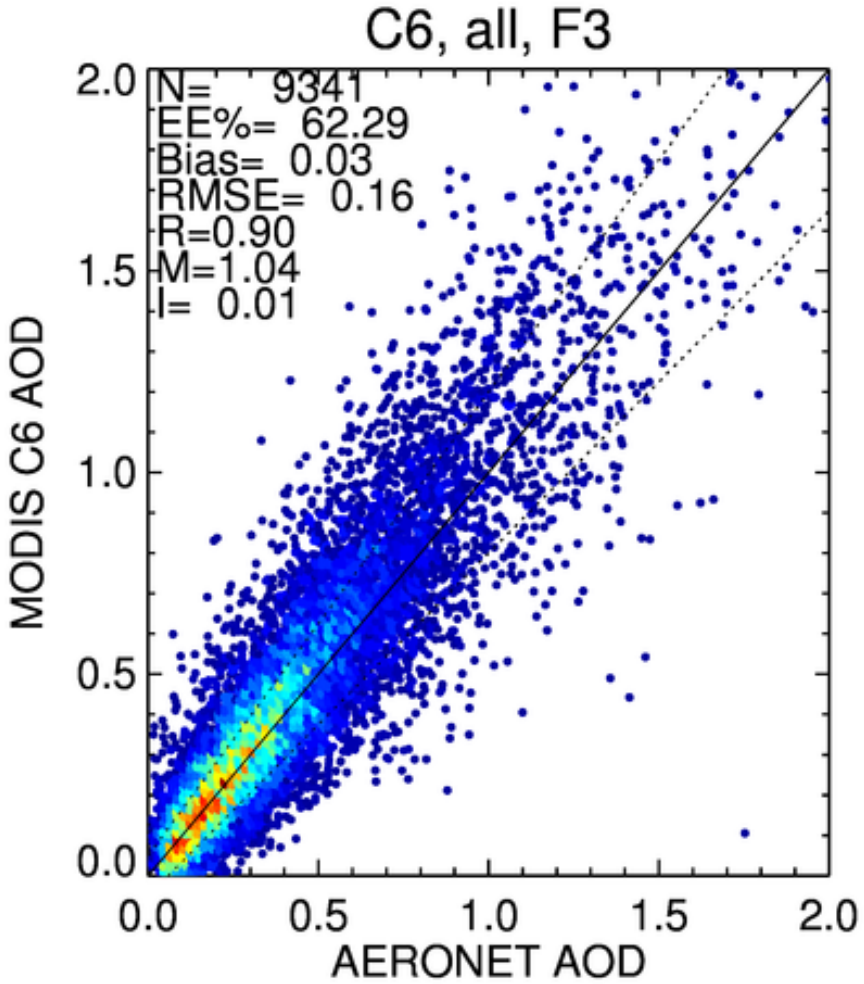


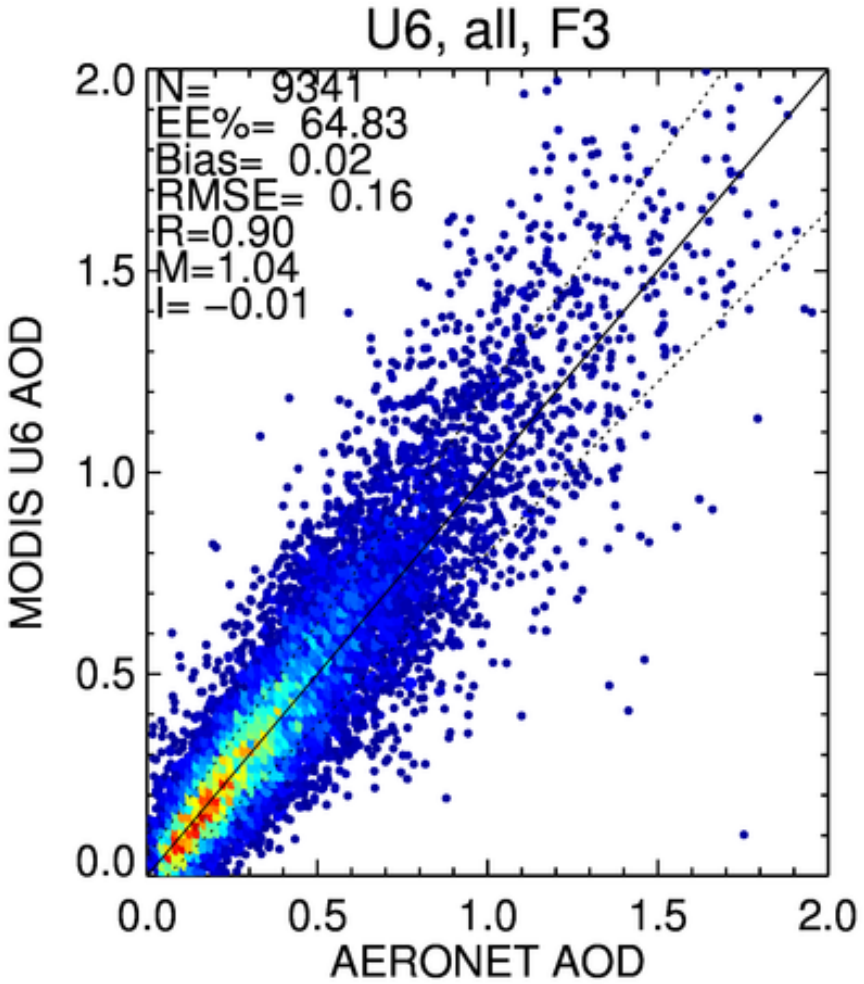
EE%= ±(0.05 + 15%)

Terra is biased (0.5), whereas Aqua has close to zero bias

MODIS Dark Target AOD Validation

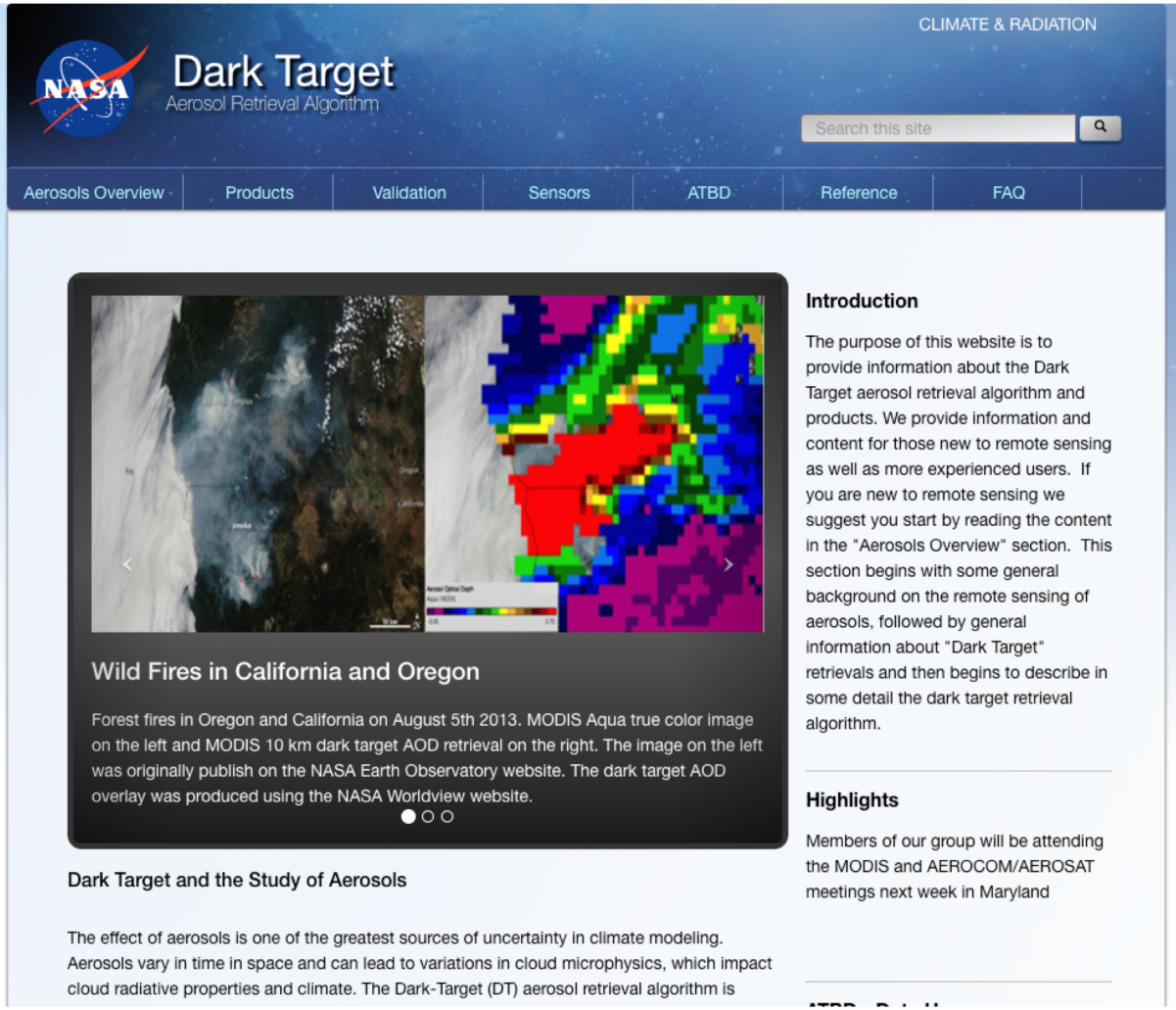
MODIS: Aqua for Asia





Dark Target

https://darktarget.gsfc.nasa.gov



MODIS Dark Target AOD Uncertainties

MODIS 10 Km Product

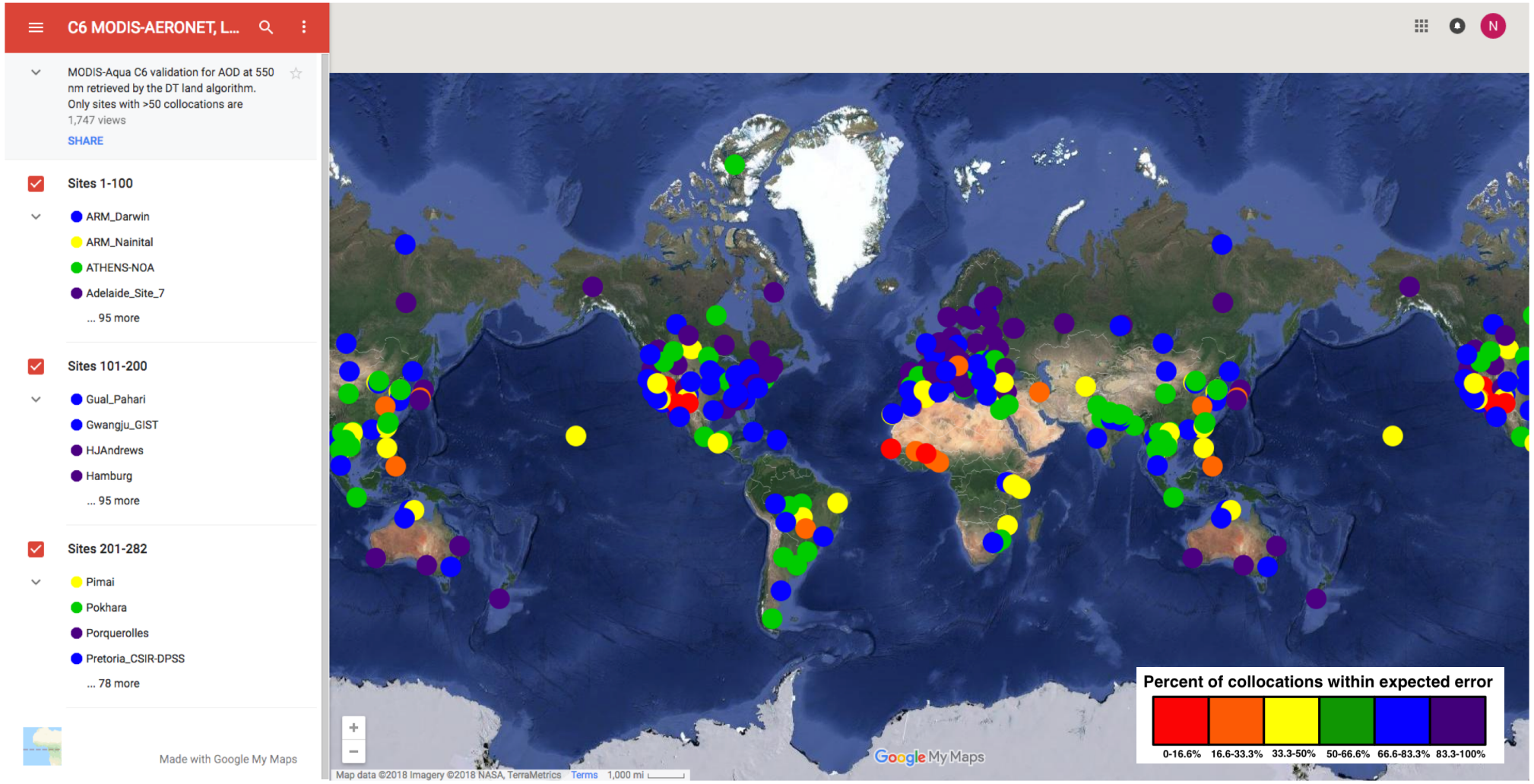
	Collection 5		Collection 6 (Interim Values)	
	Ocean	Land	Ocean	Land
Aqua	+/- (0.03 + 5% of τ)	+/-(0.05 + 15% of τ)	(-0.02 - 10% of τ) (+0.04 + 10% of τ)	+/-(0.05 + 15% of τ)
Terra	+/- (0.03 + 5% of τ)	+/-(0.05 + 15% of τ)	Data not yet available	Data not yet available

MODIS 3 km Product Uncertainty Values for Collection 6 (Interim Values)

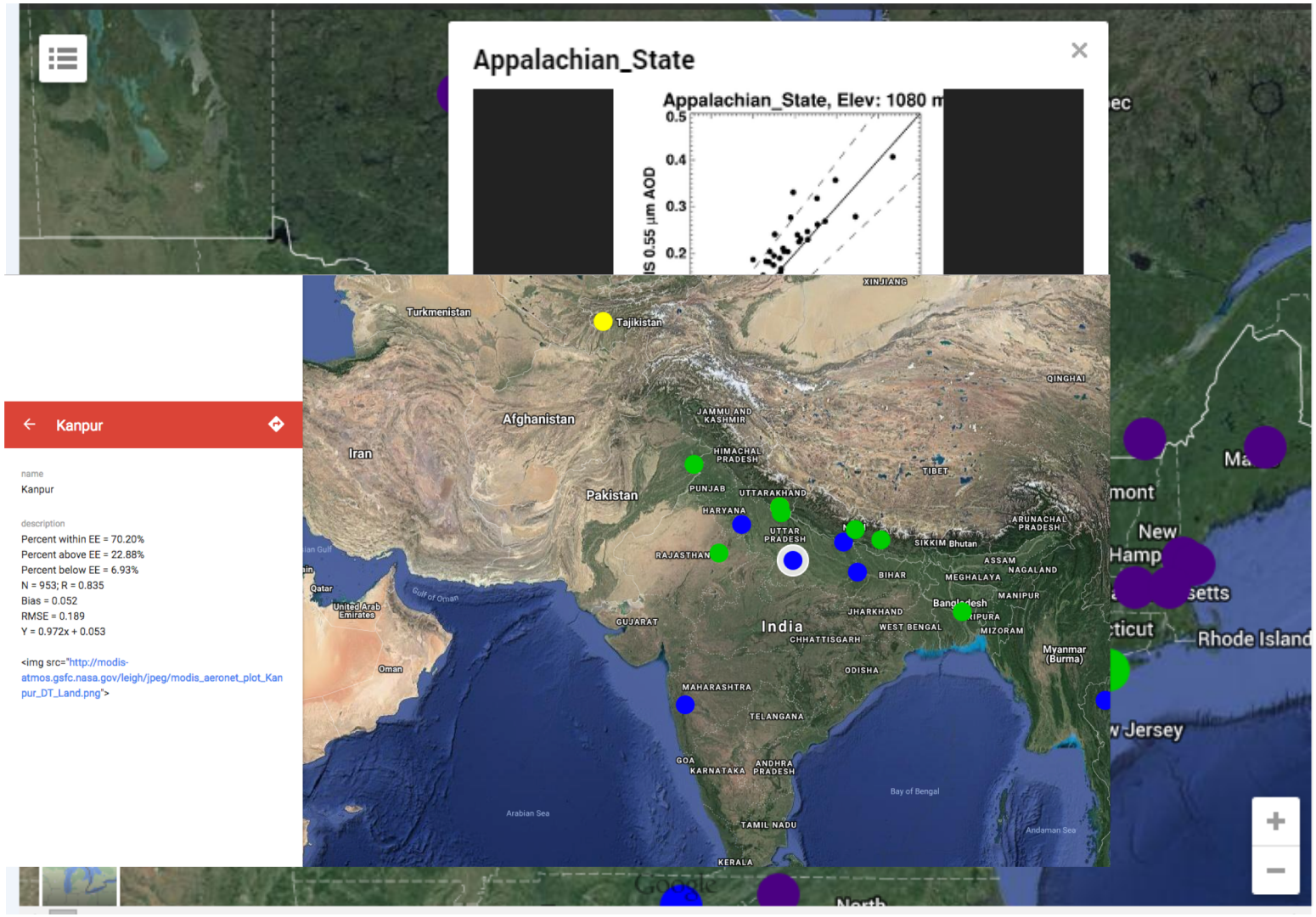
	Ocean	Land
Aqua	+/- (0.04 + 5% of τ)	+/- (0.05 + 20% of τ)
Terra	Data not yet available	Data not yet available

Validation Maps

https://darktarget.gsfc.nasa.gov/validation/maps

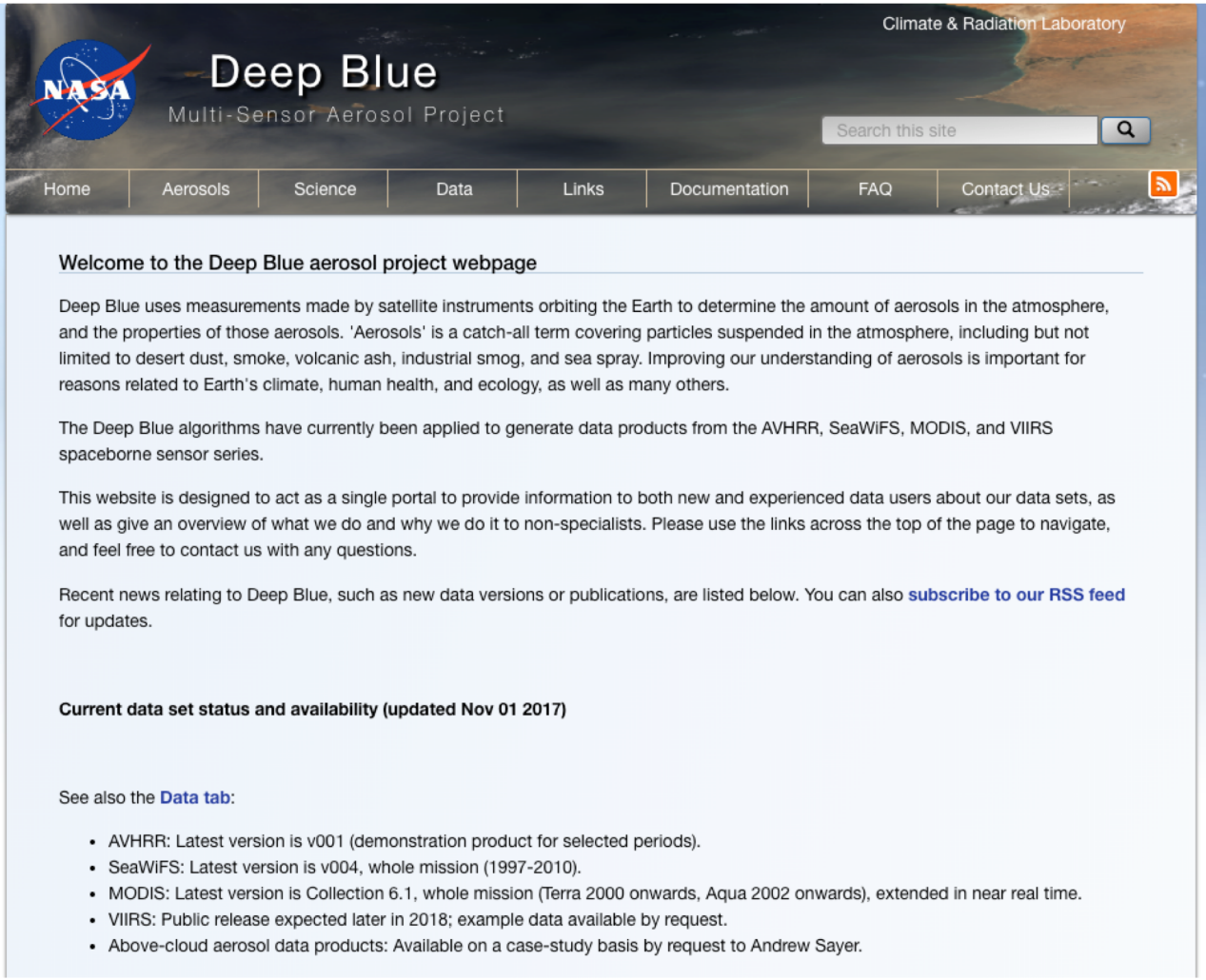


Scatter Plot



Deep Blue Product

https://deepblue.gsfc.nasa.gov

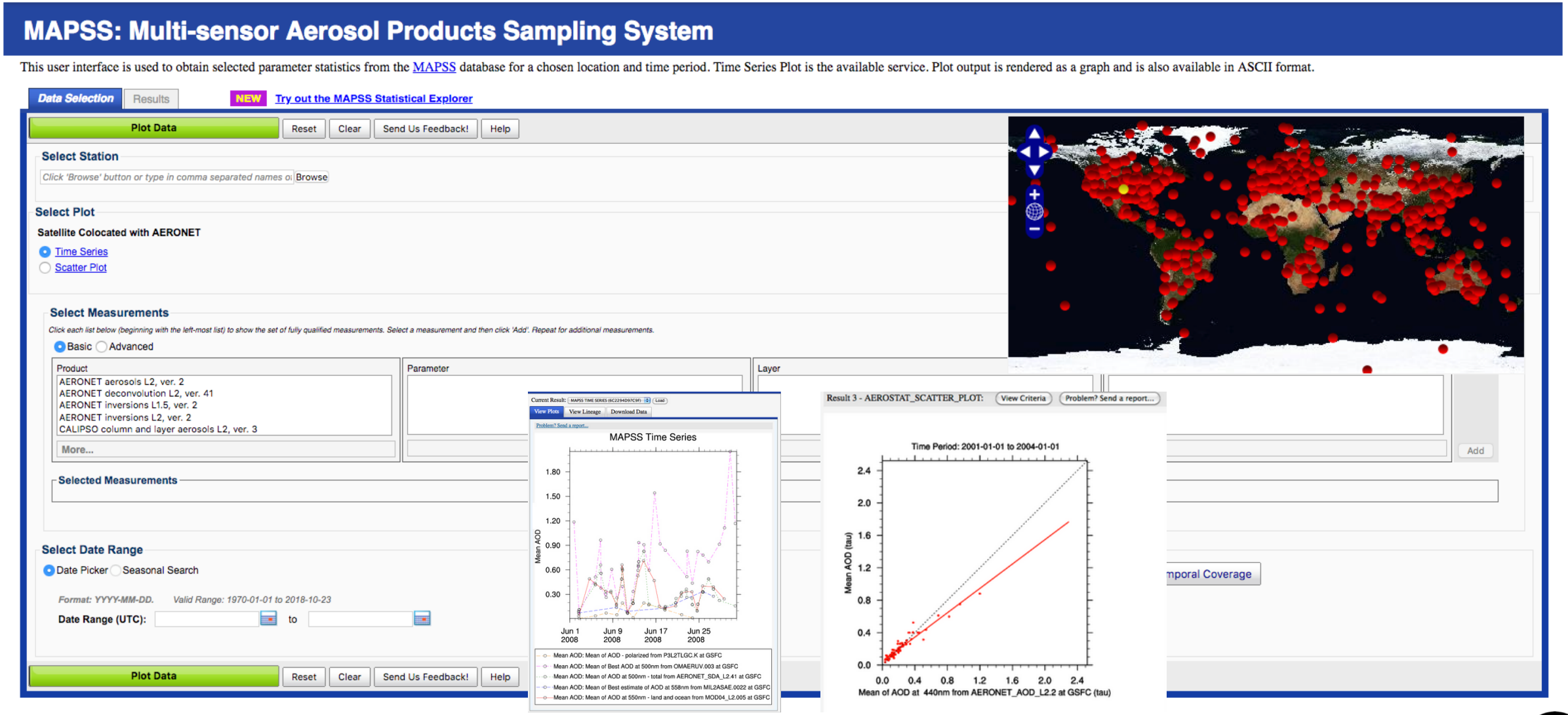


MAPSS

Multi-sensor Aerosol Products Sampling System

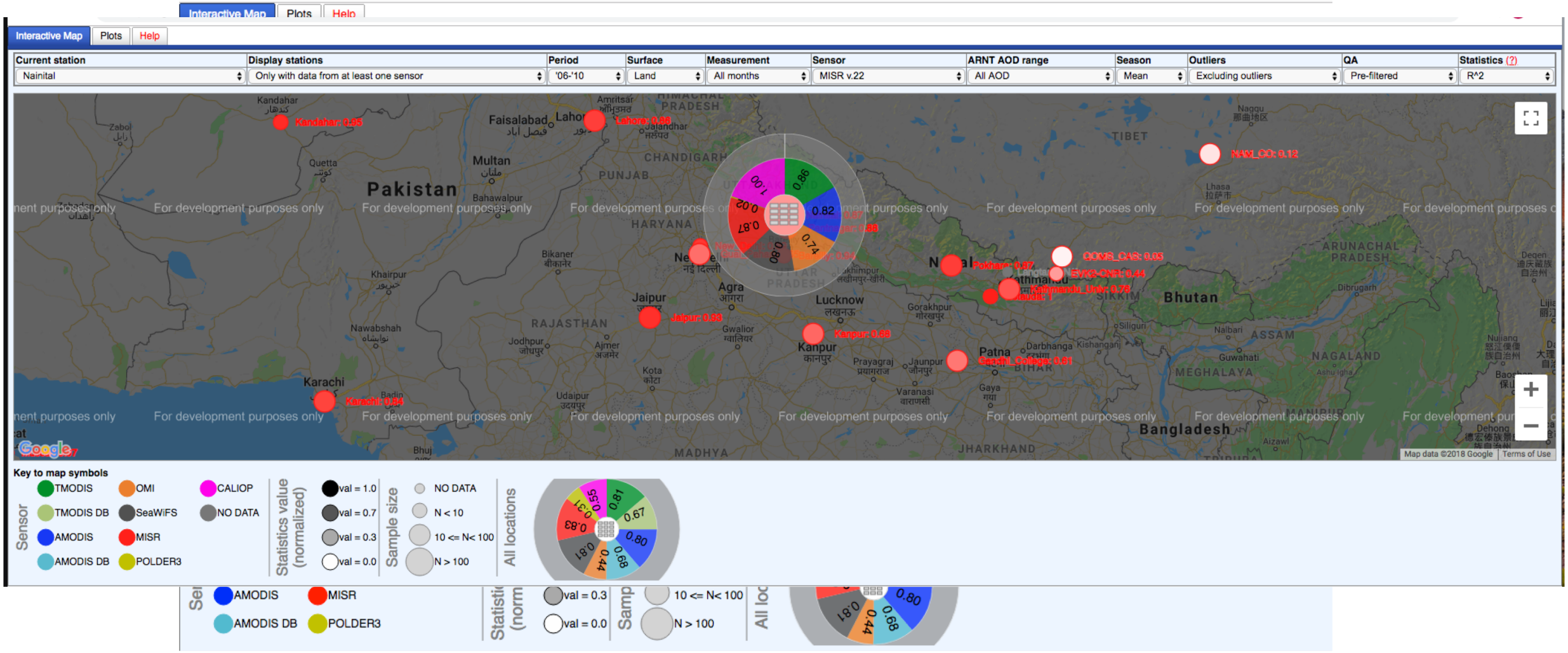
- Giovanni instances
- Used to evaluate the quality of satellite retrievals
- MAPSS allows you to compare AERONET data with coincident satellite data
- Quick and effective way to evaluate the quality of the satellite retrieval at particular locations for a range of dates or seasons
- Data from MODIS & MISR
  - Satellite-AERONET Inter-Comparison: http://giovanni.gsfc.nasa.gov/mapss/
  - Multi-Sensor Statistics: http://giovanni.gsfc.nasa.gov/mapss_explorer/

MAPSS: Multi-sensor Aerosol Products Sampling System

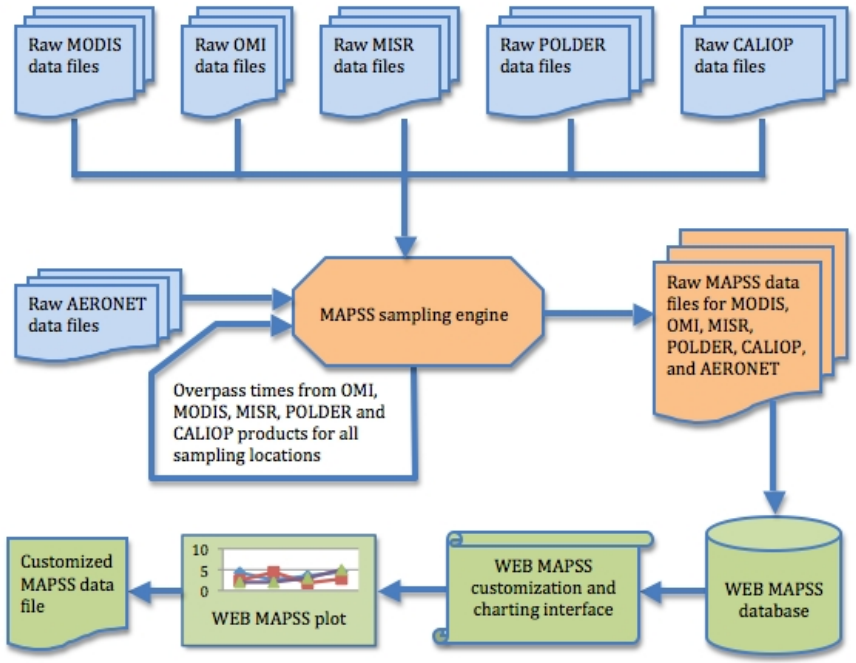


MAPSS Statistical Explorer

https://giovanni.gsfc.nasa.gov/mapss_explorer/



MAPSS: Further Reading



- Petrenko, M., and C. M. Ichoku. 2013. "Coherent uncertainty analysis of aerosol measurements from multiple satellite sensors." Atmos. Chem. Phys., 13 (14): 6777-6805 [10.5194/acp-13-6777-2013] [Journal Article/Letter]
- Petrenko, M., C. M. Ichoku, and G. Leptoukh. 2012. "Multi-sensor Aerosol Products Sampling System (MAPSS)." Atmospheric Measurement Techniques, 5 (5): 913-926 [10.5194/amt-5-913-2012] [Journal Article/Letter]

Published Validation Results

Levy, R. C., Mattoo, S., Munchak, L. A., Remer, L. A., Sayer, A. M., Patadia, F., & Hsu, N. C.. (2013). The Collection 6 MODIS aerosol products over land and ocean. Atmospheric Measurement Techniques, 6, 2989–3034. doi:10.5194/amt-6-2989-2013

Remer, L. A., Mattoo, S., Levy, R. C., & Munchak, L. A.. (2013). MODIS 3 km aerosol product: algorithm and global perspective. Atmospheric Measurement Techniques, 6, 1829–1844. doi:10.5194/amt-6-1829-2013

Sayer, A. M., N.-Y. C. Hsu, C. Bettenhausen, and M.-J. Jeong. 2013. "Validation and uncertainty estimates for MODIS Collection 6 “Deep Blue” aerosol data." J. Geophys. Res. Atmos., 118 (14): 7864-7872 [10.1002/jgrd.50600

Sayer, A. M., L. A. Munchak, N.-Y. C. Hsu, et al. 2014. "MODIS Collection 6 aerosol products: Comparison between Aqua's e-Deep Blue, Dark Target, and “merged” data sets, and usage recommendations." J. Geophys. Res.-Atmos, 119 (24): 13,965-13,989 [10.1002.2014JD022453]