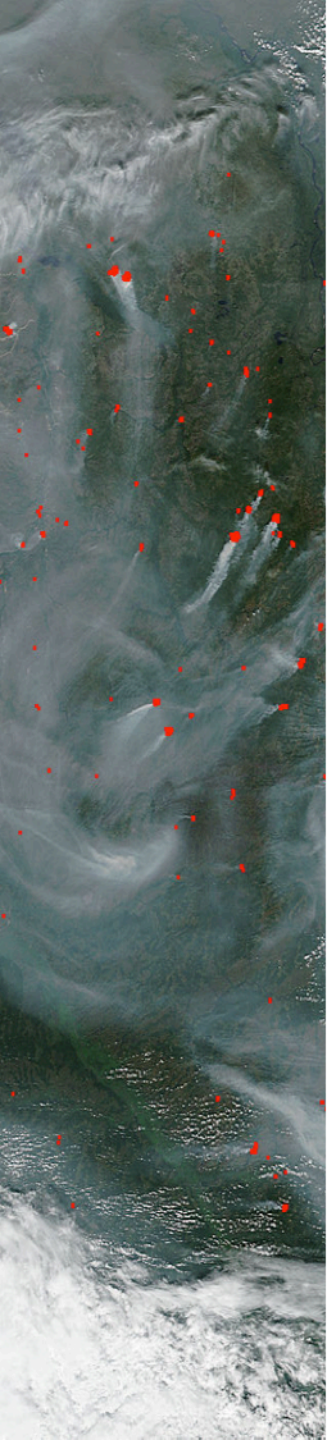


National Aeronautics and Space Administration

ARSET
Applied Remote Sensing Training
http://arset.gsfc.nasa.gov
@NASAARSET

Satellite Aerosol Validation

NASA ARSET Workshop: NASA Earth Observations, Data and Tools for Air Quality Applications

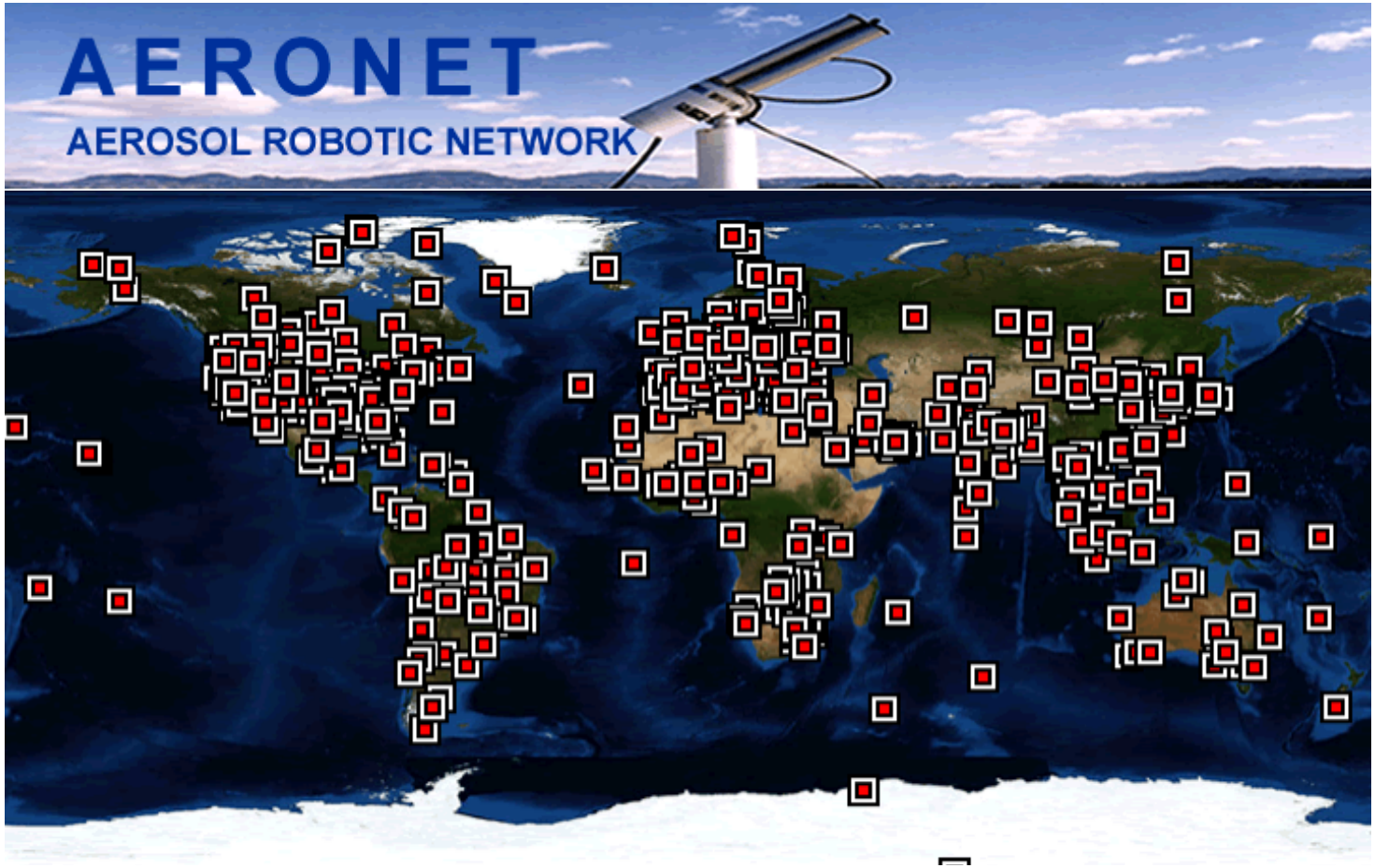
Sunday, August 28, 2016 to Monday, August 29, 2016
17th IUAPPA World Clean Air Congress and 9th CAA Better Air Quality (BAQ) Conference
Pusan National University, Busan, South Korea

Objectives

- To learn how to validate satellite derived aerosol optical depth
- To understand the uncertainties in MODIS aerosol product
- To access data and tools for validating satellite aerosol products

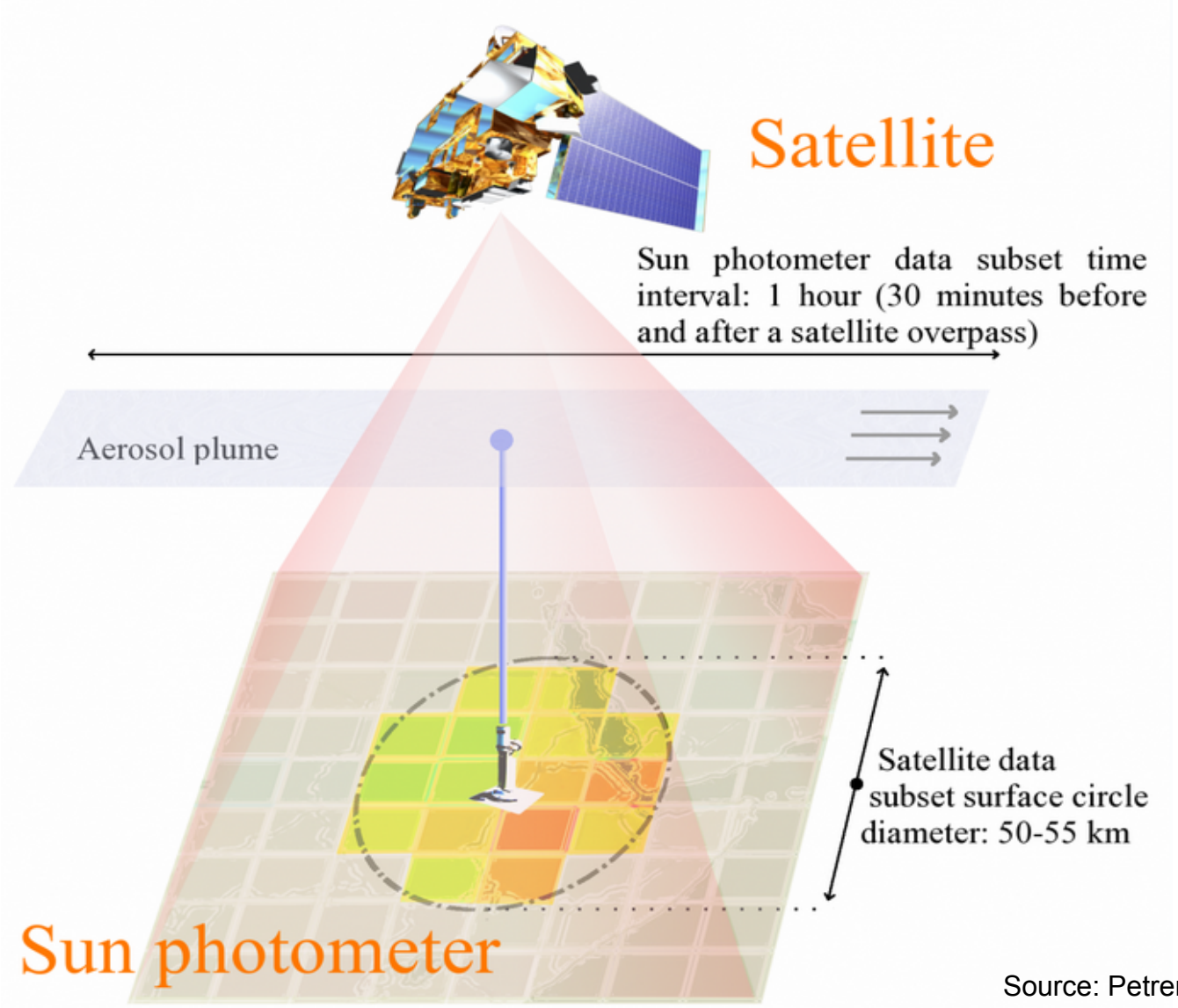
AERONET

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



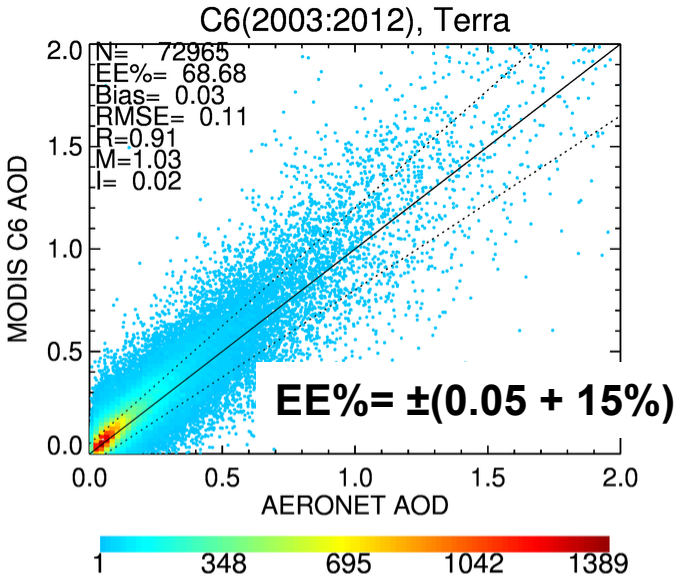
Serves as a validation tool for satellite air quality products

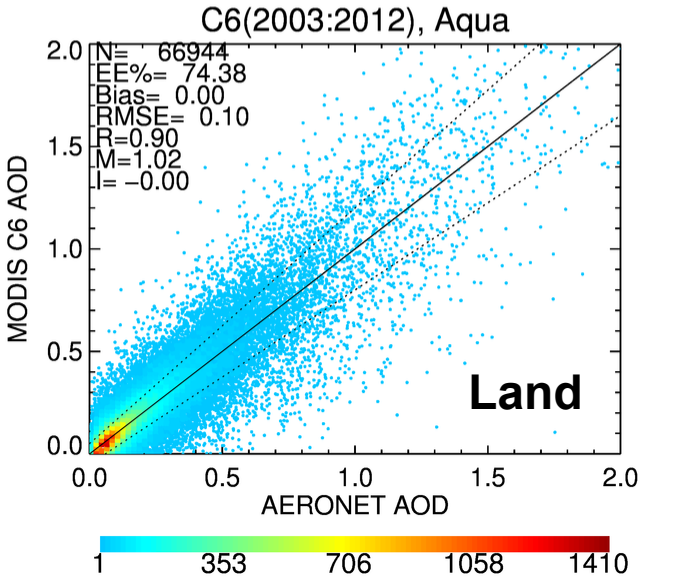
Spatial and Temporal Collocation

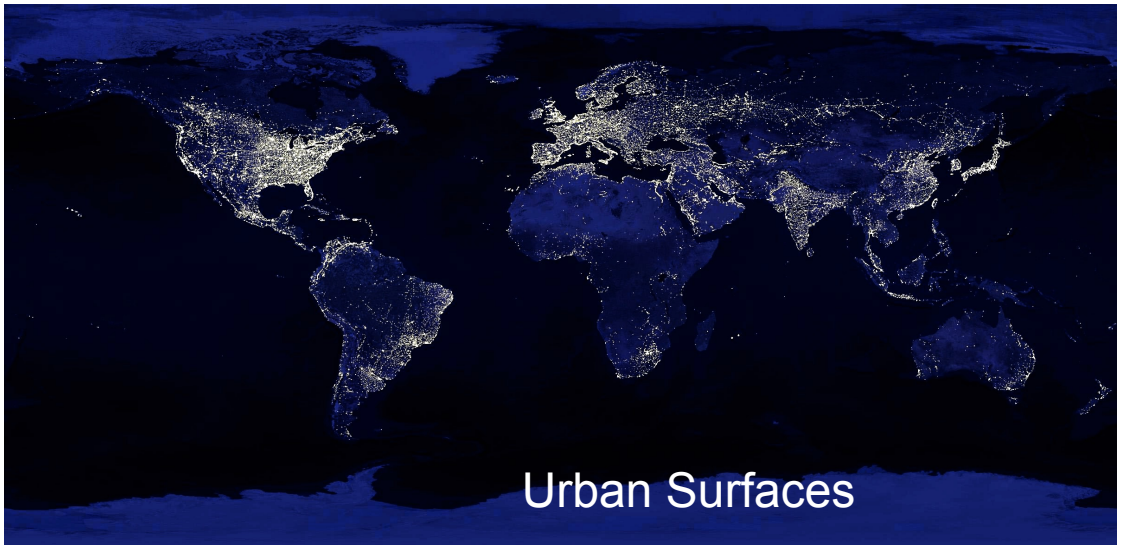


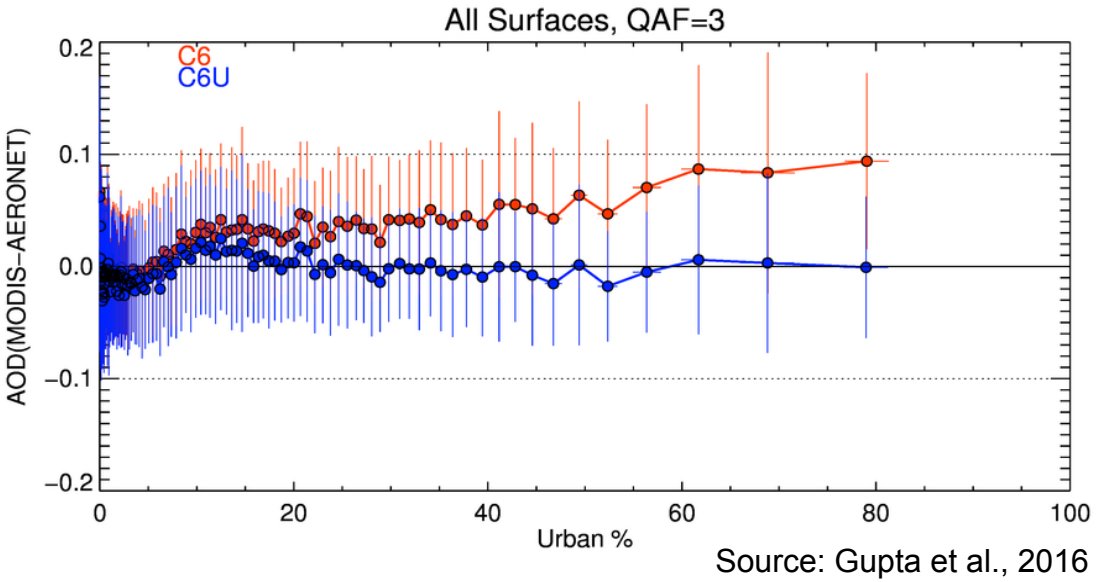
Source: Petrenko et al., 2012

MODIS Dark Target AOD Validation





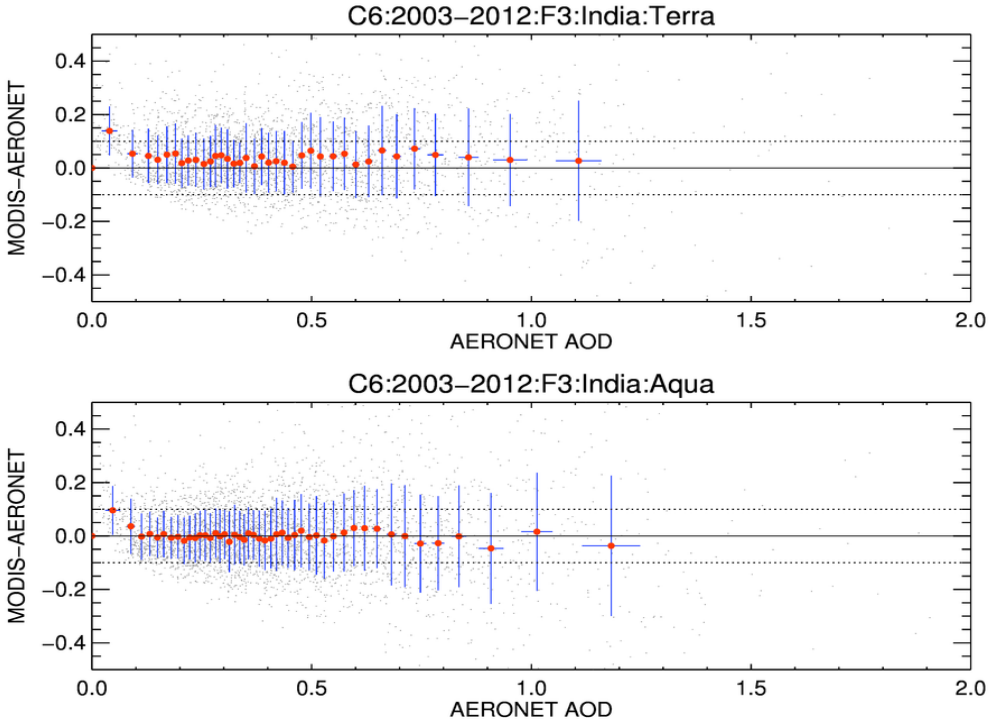




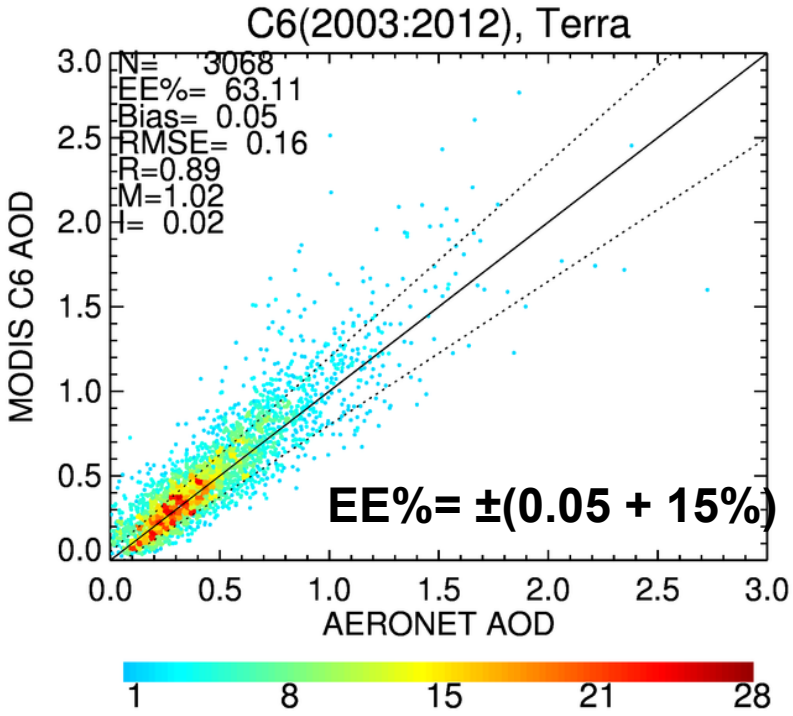
Source: Gupta et al., 2016

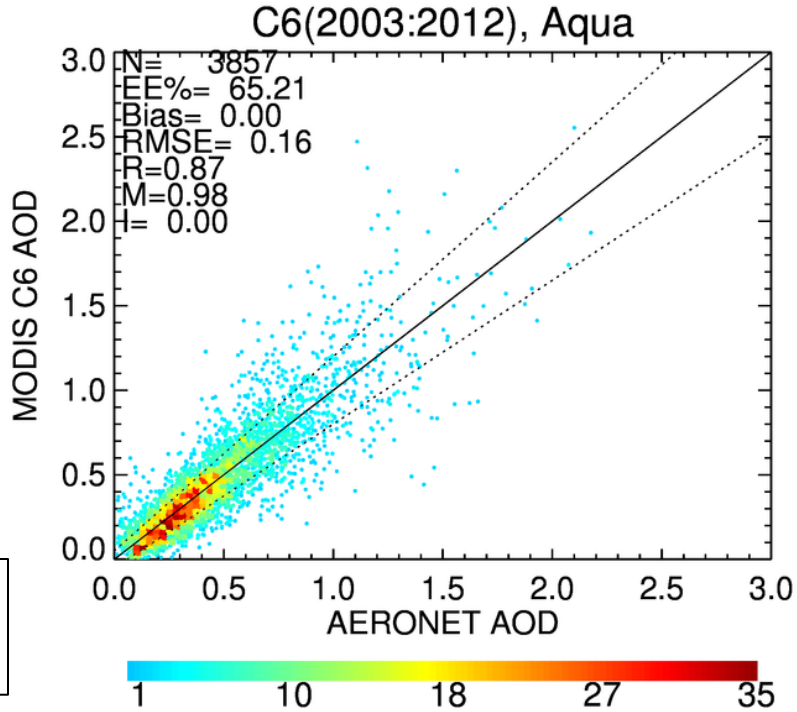
AERONET Comparisons

Aqua & Terra
Include all stations in the region (Indian Subcontinent)



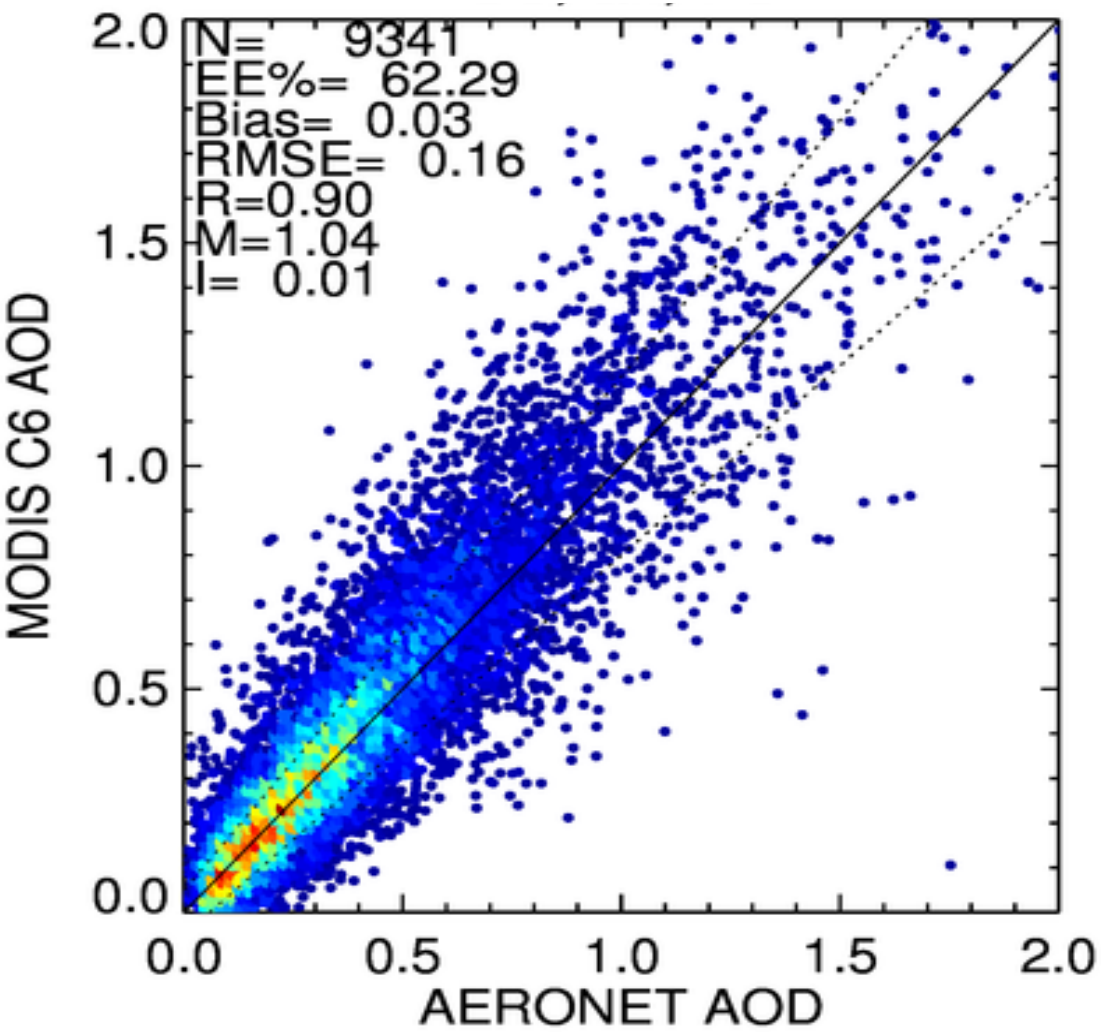
Terra is biased (0.05) high whereas Aqua has close to zero bias





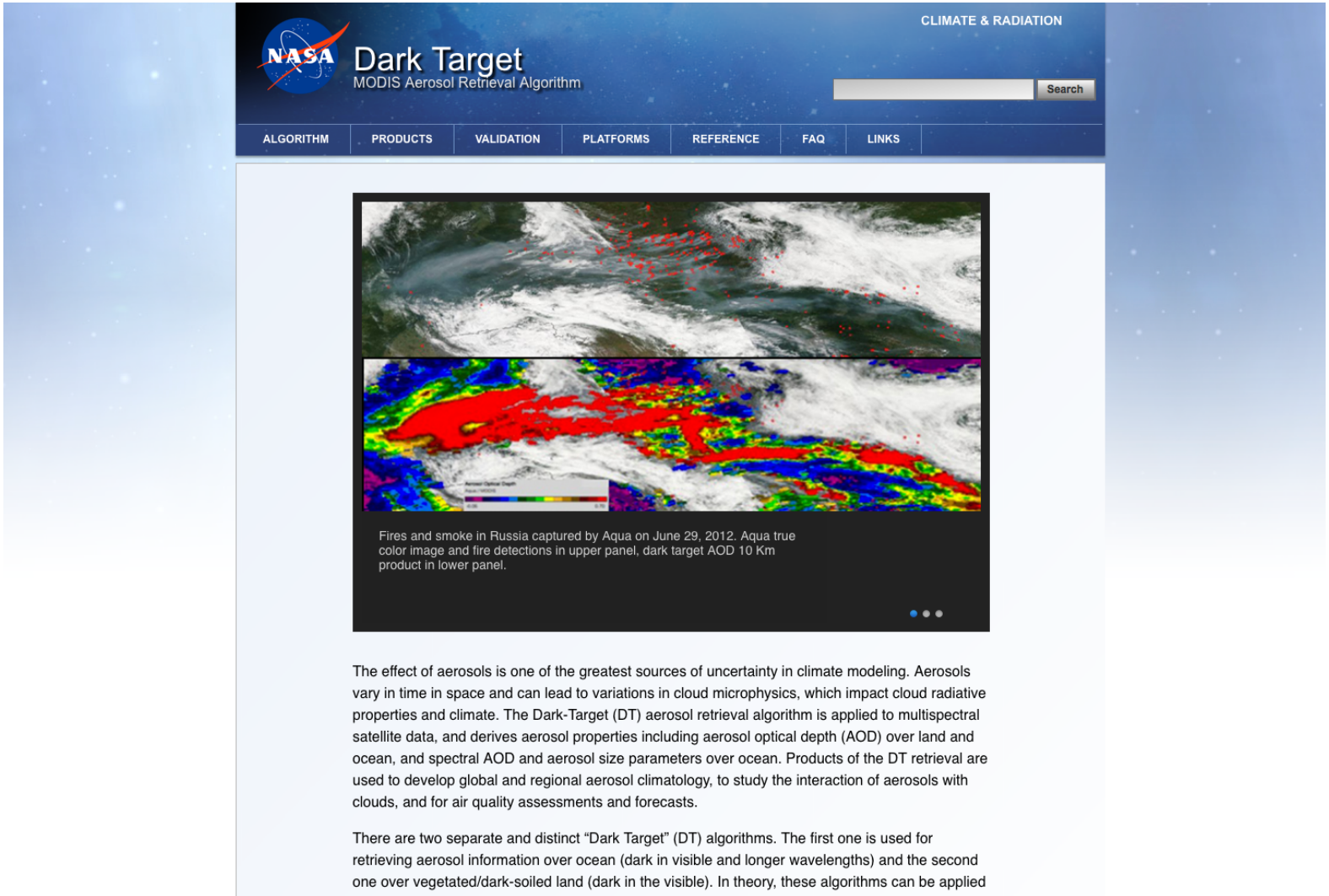
MODIS Dark Target AOD Validation

MODIS – AQUA for Asia



Dark Target

http://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

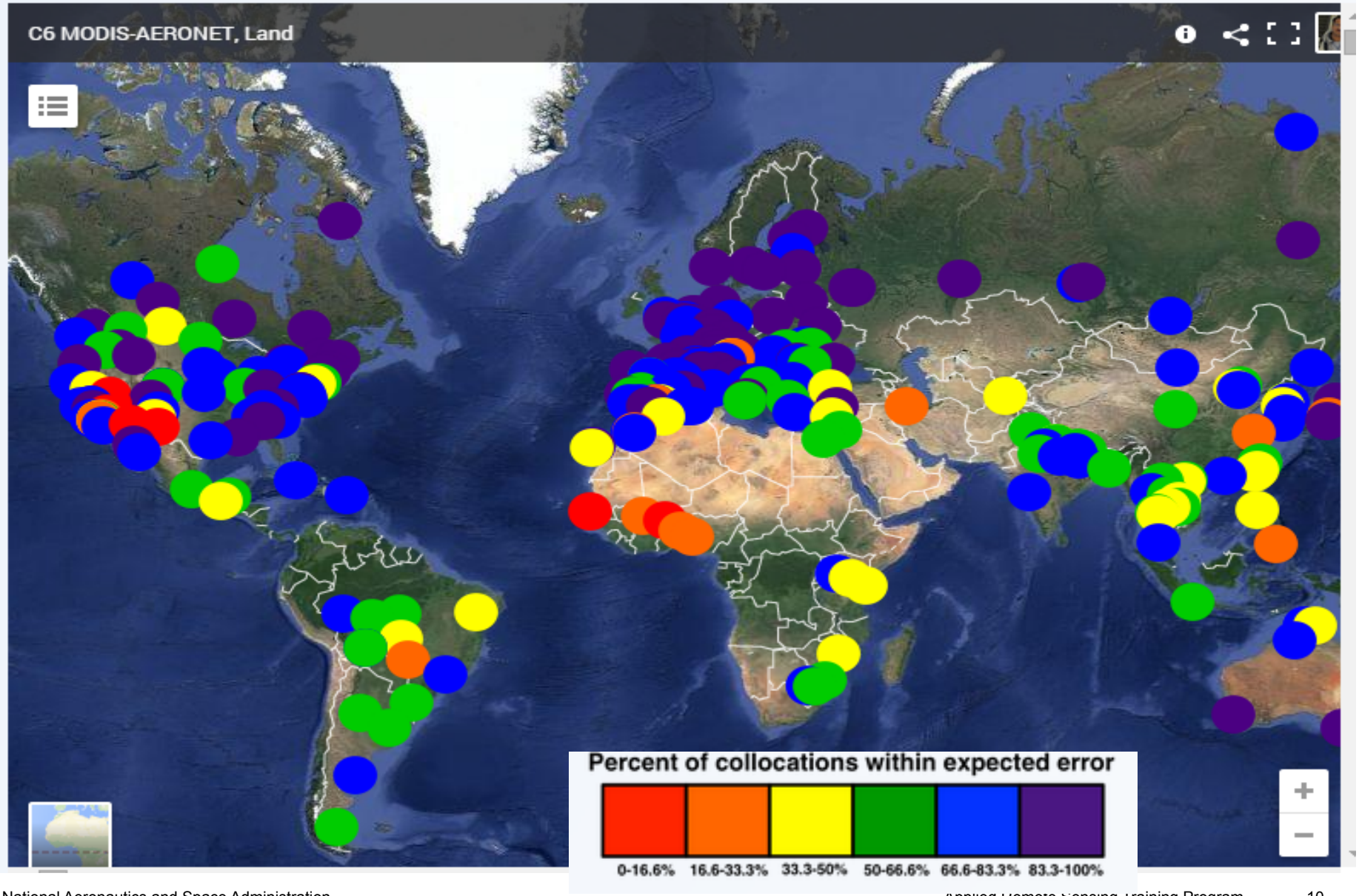
MODIS 3 km Product Uncertainty Values for Collection 6 (Interim Values)

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

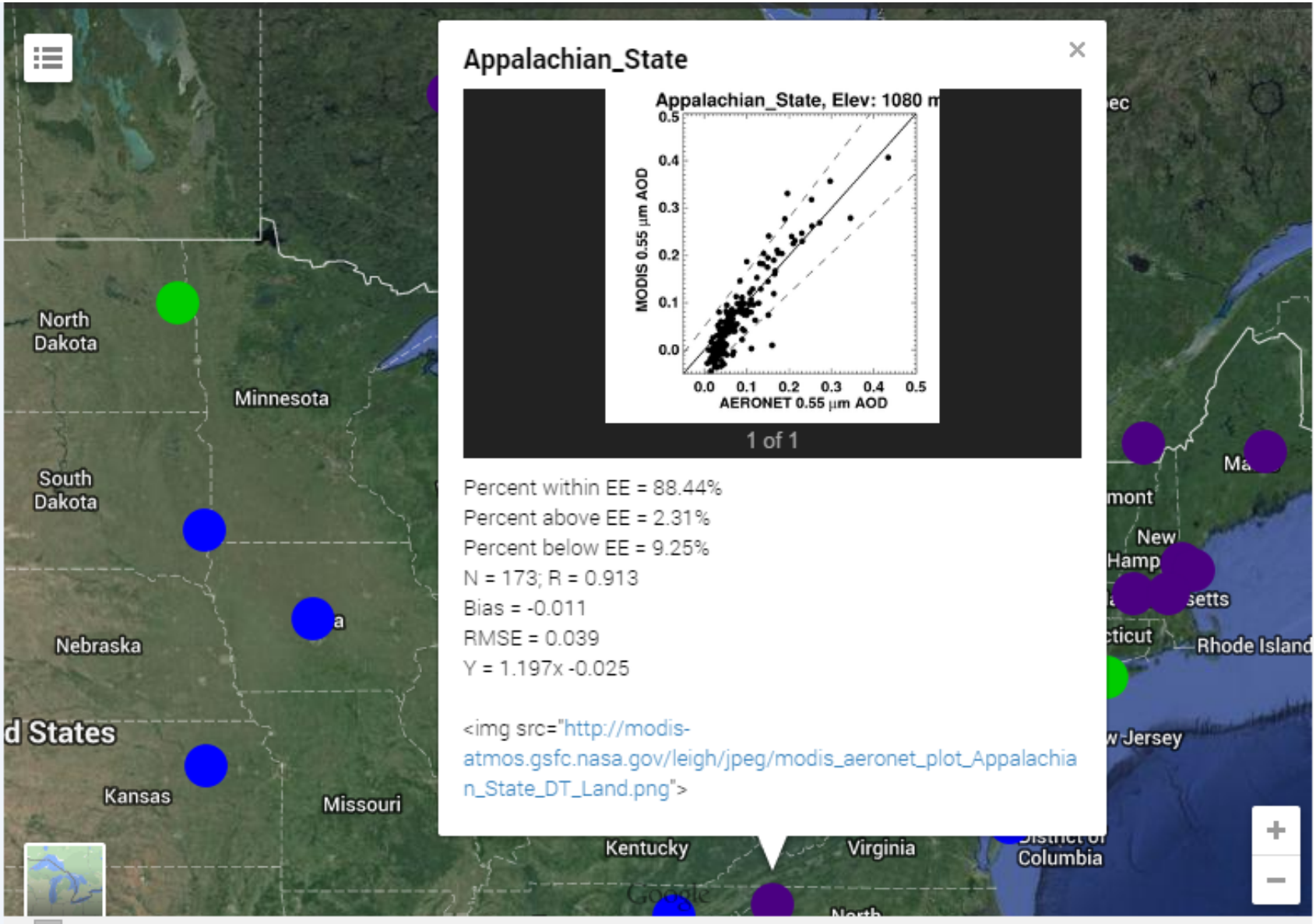
Source: darktarget.gsfc.nasa.gov

Validation Maps

http://darktarget.gsfc.nasa.gov/

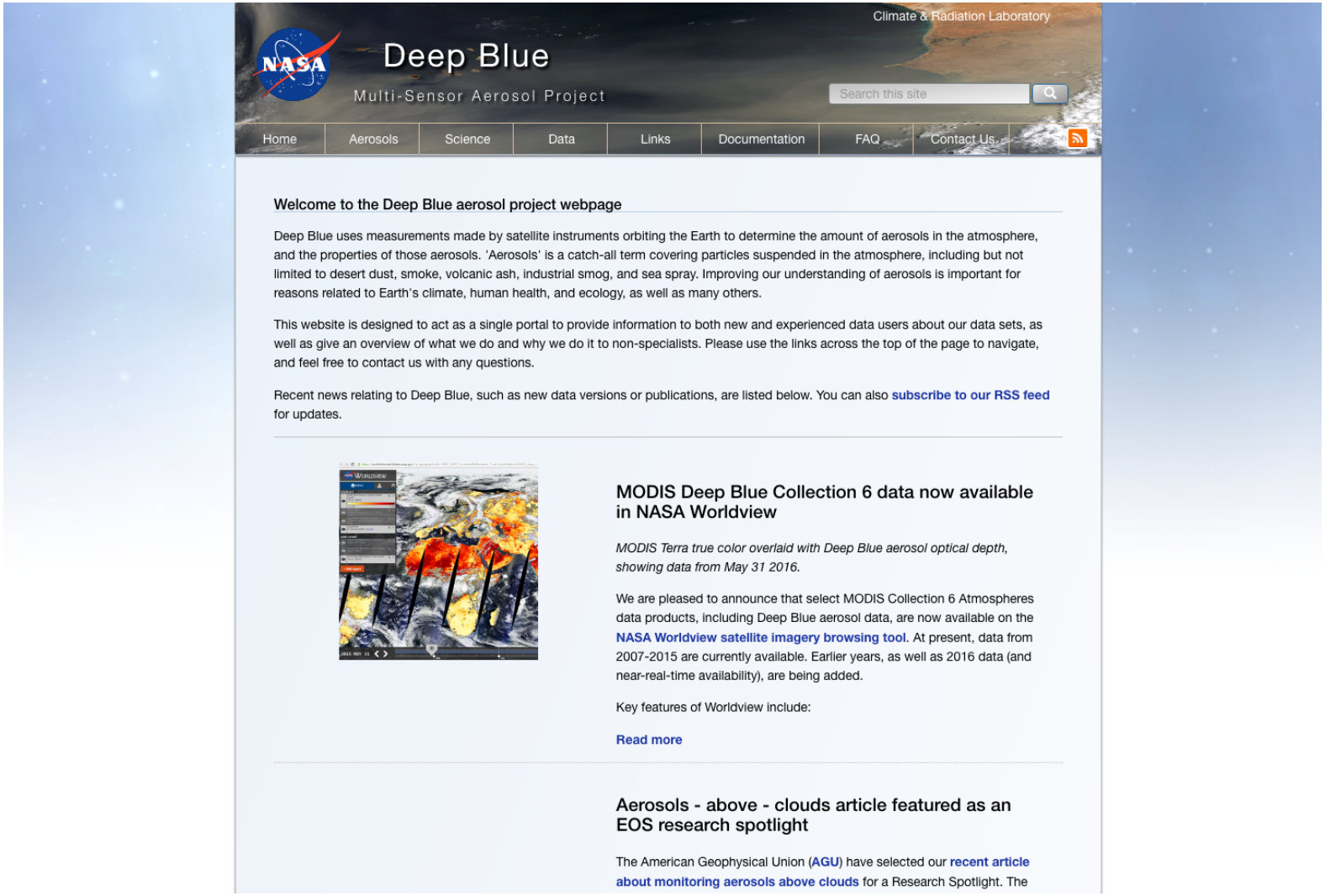


Scatter Plot



Deep Blue Product

http://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

This user interface is used to obtain selected parameter statistics from the MAPSS database for a chosen location and time period. Time Series Plot is the available service. Plot output is rendered as a graph and is also available in ASCII format.

Data Selection | Results

NEW Try out the MAPSS Statistical Explorer

Plot Data | Reset | Clear | Send Us Feedback! | Help

Select Station

Click 'Browse' button or type in comma separated names of s | Browse

Select Plot

Satellite Colocated with AERONET

- (•) Time Series
- ( ) Scatter Plot

Select Measurements

Click each list below (beginning with the left-most list) to show the set of fully qualified measurements. Sel

(•) Basic ( ) Advanced

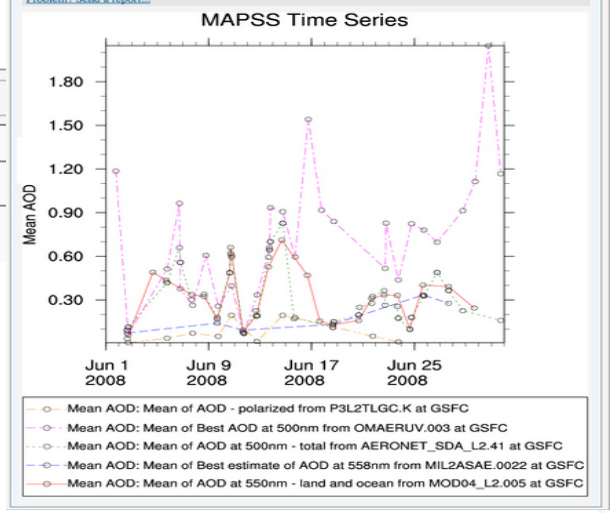
Product	Parameter	Layer	Measurement
AERONET aerosols L2, ver. 2			
AERONET deconvolution L2, ver. 41			
AERONET inversions L1.5, ver. 2			
AERONET inversions L2, ver. 2			
CALIPSO column and layer aerosols			
More...			

Selected Measurements

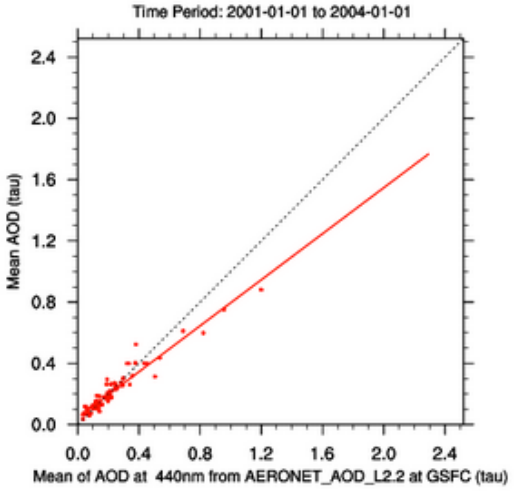
Current Result: MAPSS TIME SERIES (6C2294D97C9F) | Load

View Plots | View Lineage | Download Data

Problem? Send a report...

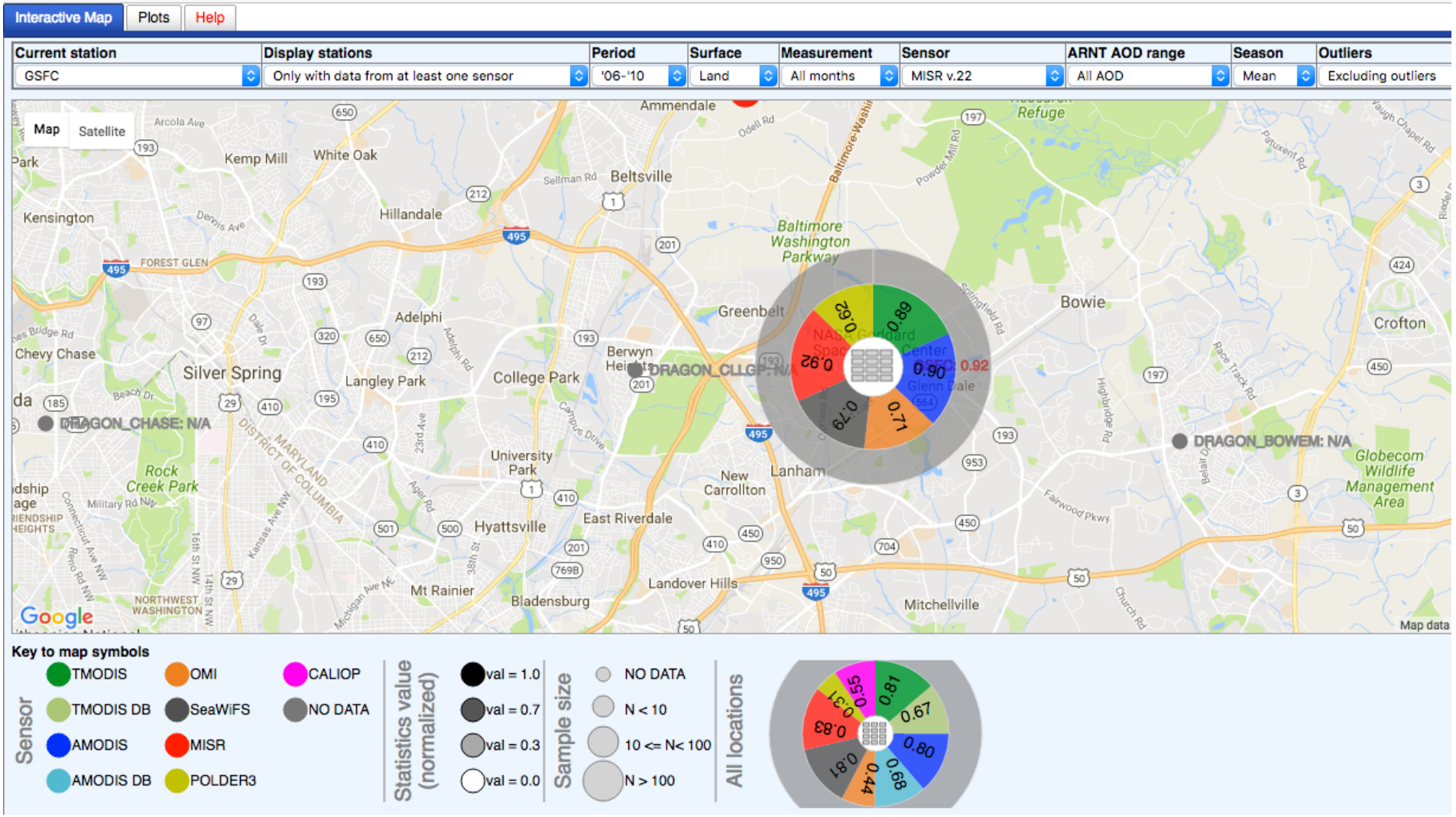


Result 3 - AERONET_SCATTER_PLOT: | View Criteria | Problem? Send a report...

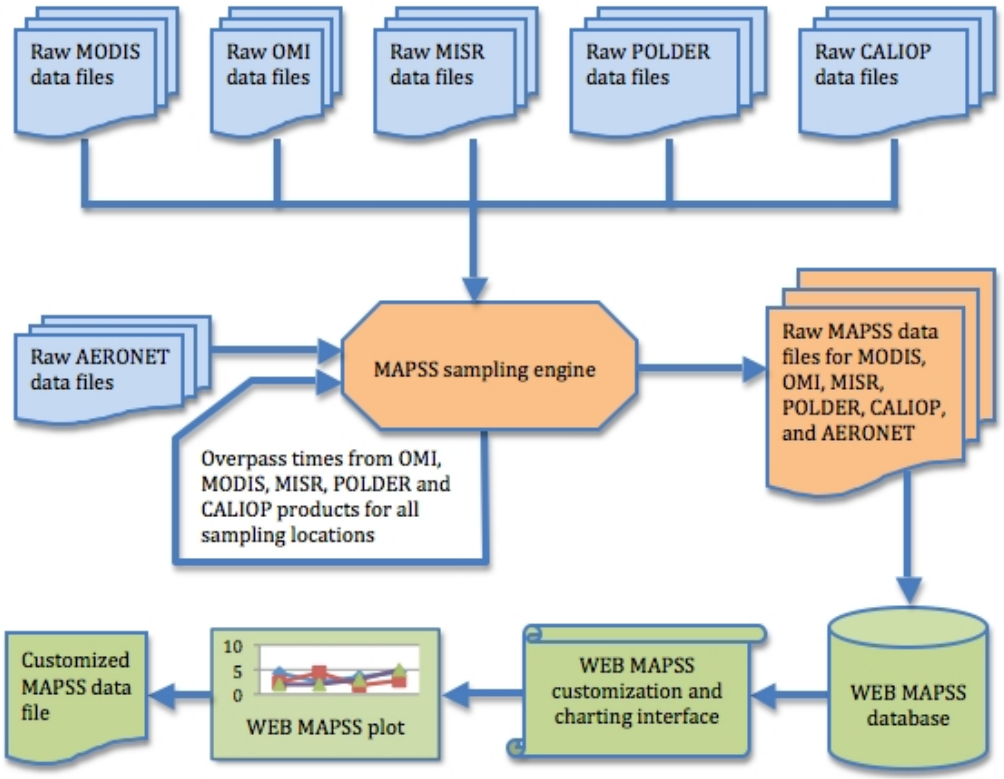


MAPSS Statistical Explorer

http://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]