Joint AOT-SSA Retrieval in Algorithm MAIAC

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Credits to O. Torres (GSFC)

14 AeroCom Meeting, Frascatti, Italy

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MAIAC = Time Series + Spatial Analysis

MODIS, TOA RGB
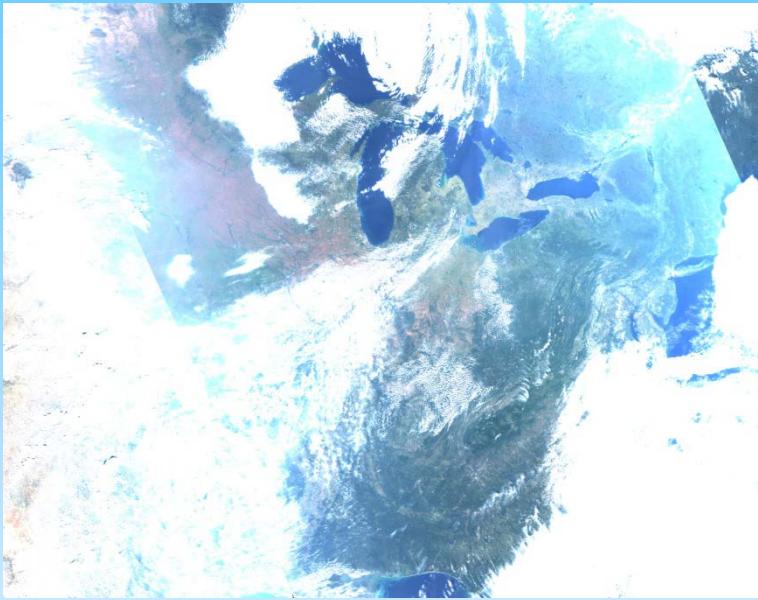
NBRF

AOT
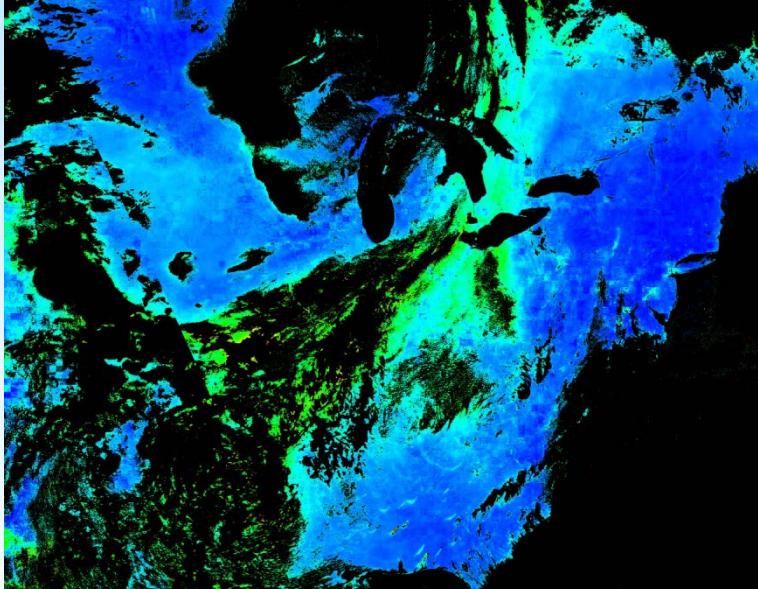
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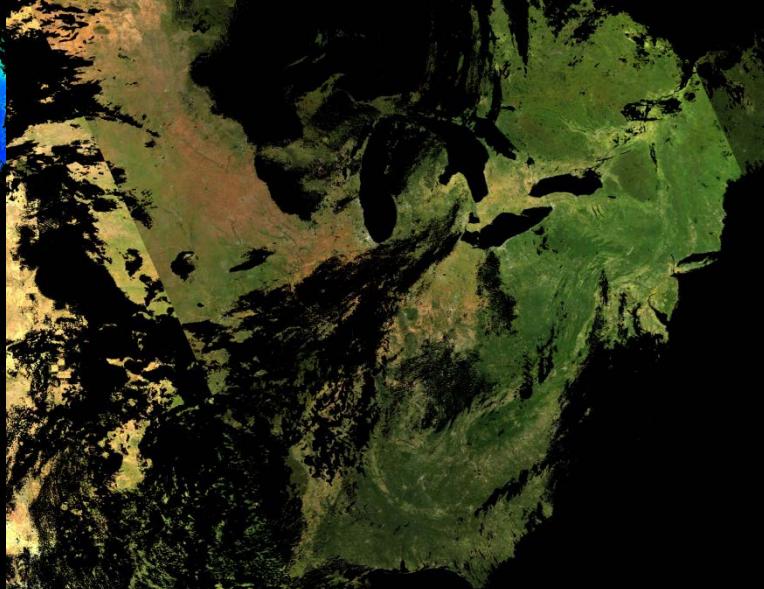
MAIAC: General Information

Status:

- *MODAPS C6+ re-processing of MODIS with MAIAC is scheduled for late November 2015 ("official" - MCD19)*

Products (gridded):

- **Atmosphere**: *WV, CM, AOT, SSA, aerosol type (background/smoke/dust), AE @1km resolution;*

- **Land Surface**: *spectral BRDF (RTLS model, naturally gap-filled), BRF (surface reflectance) @1km and 500m, albedo;*

- **Detected Snow**: *snow grain size, and sub-pixel snow fraction (1km);*

- **Coastal Waters**: *spectral reflectance for water-leaving radiance*

Current Data availability

- *North America, South America, Africa ($\pm 10°$), and Europe for 2000-mid-2014 at ftp: ftp://maiac@dataportal.nccs.nasa.gov/DataRelease/*

    (if asked for password, press Enter);

VIIRS AOT IP vs MODIS MAIAC (25km)

(S. Kondragunta, S. Superczynski (NOAA), study for NASA GeoCAPE project)

NOAA VIIRS *MAIAC MODIS*
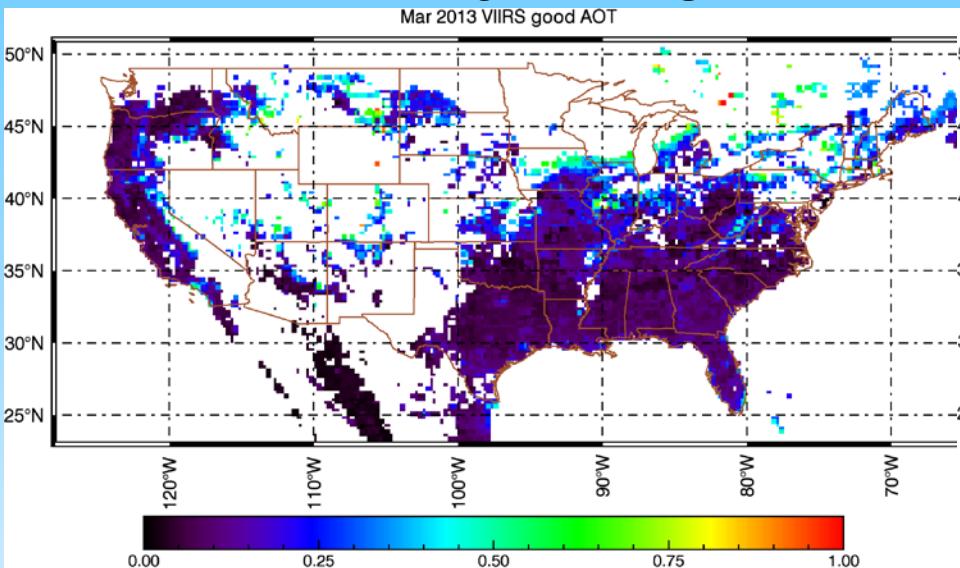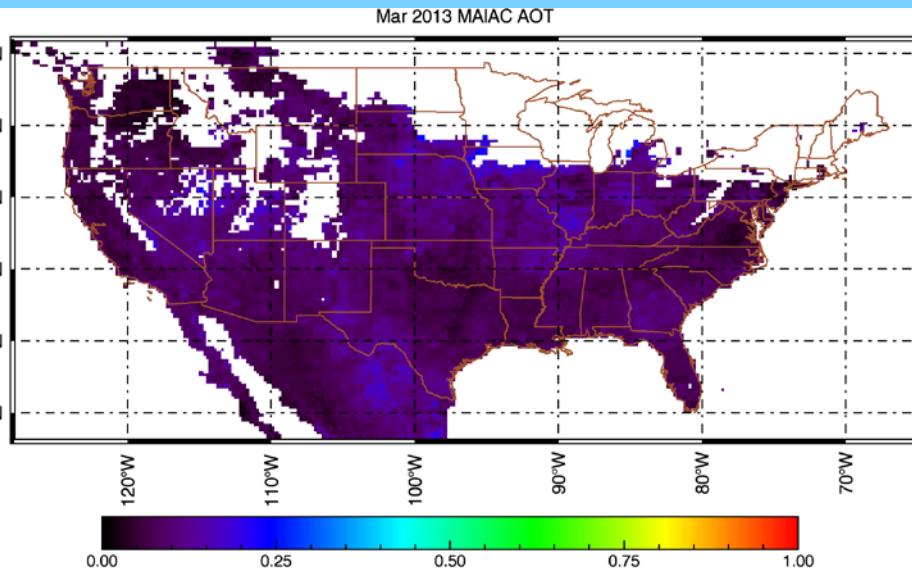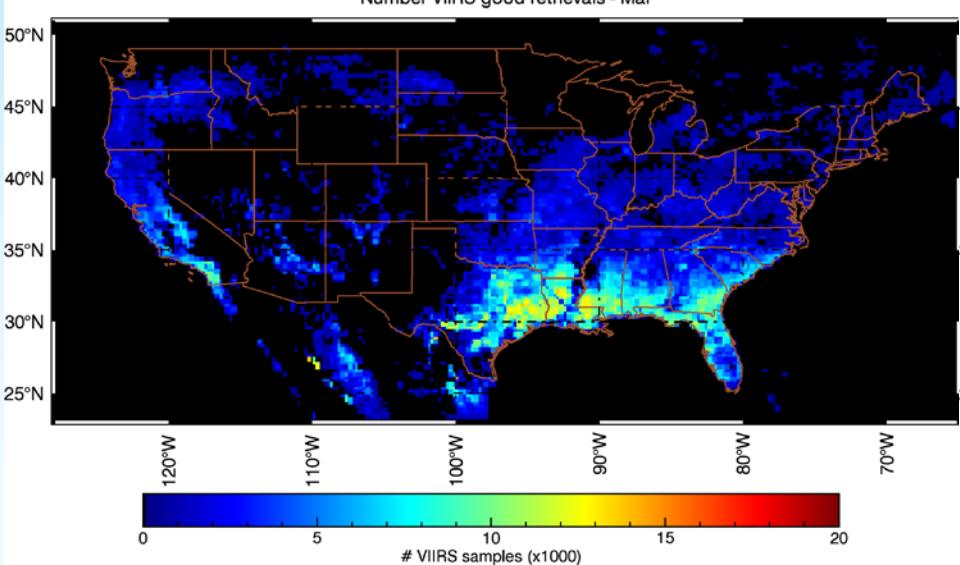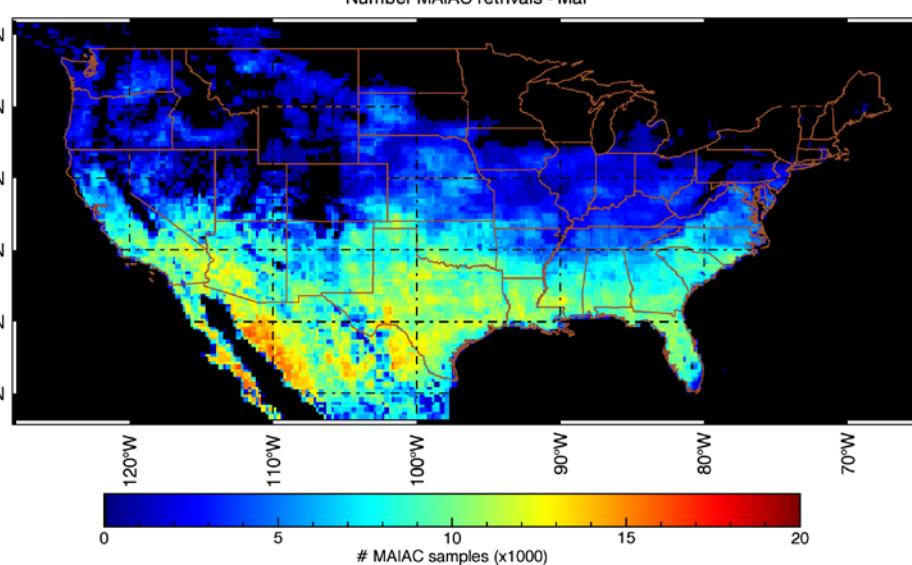
VIIRS AOT IP vs MODIS MAIAC (25km)

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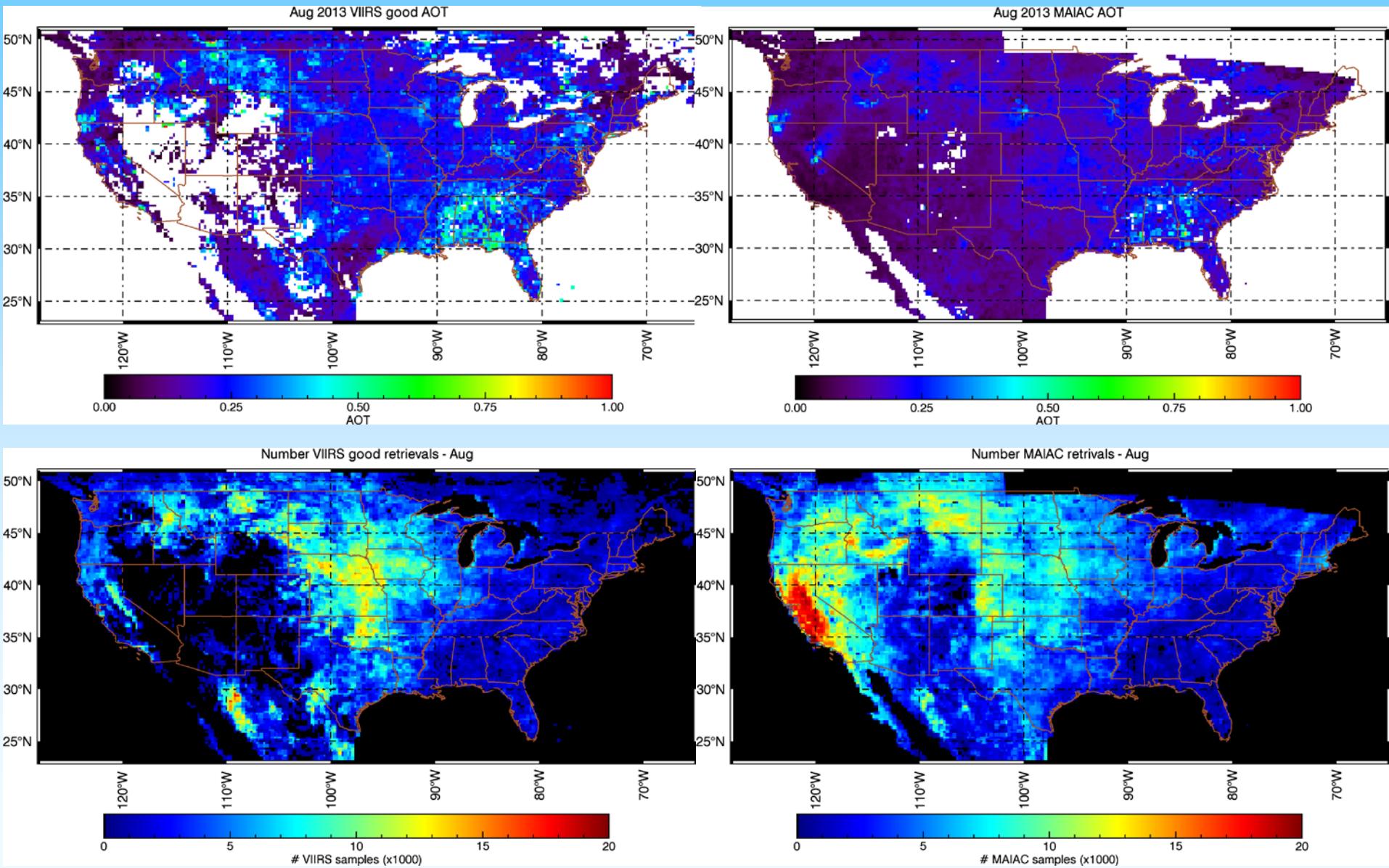
VIIRS AOT IP vs MODIS MAIAC (25km)

(S. Kondragunta, S. Superczynski (NOAA), study for NASA GeoCAPE project)

# AERONET Comparisons
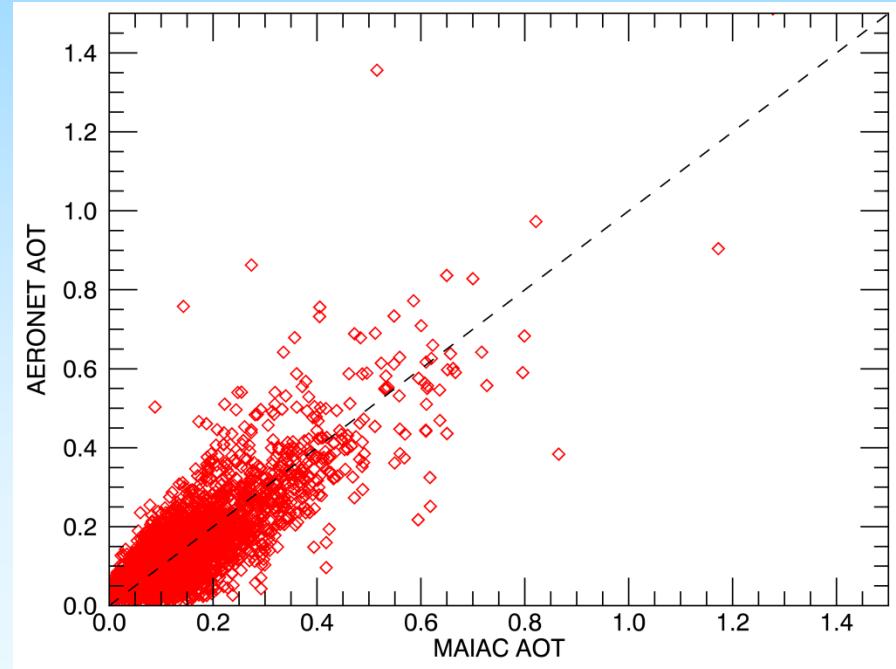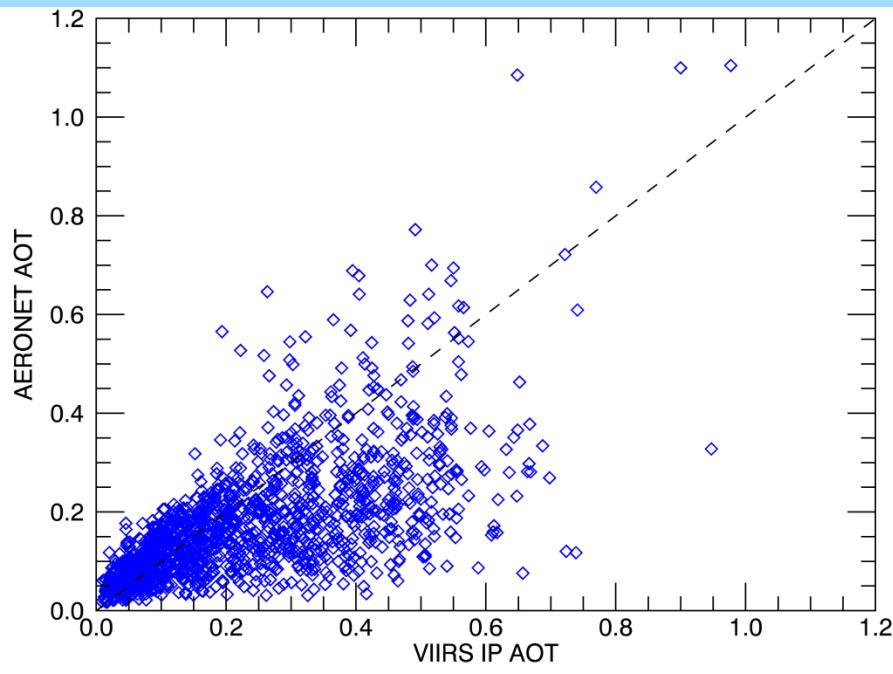
VIIRS AOT IP vs MODIS MAIAC (25km)

(S. Kondragunta, S. Superczynski (NOAA), study for NASA GeoCAPE project)

Bias vs. Surface Reflectance
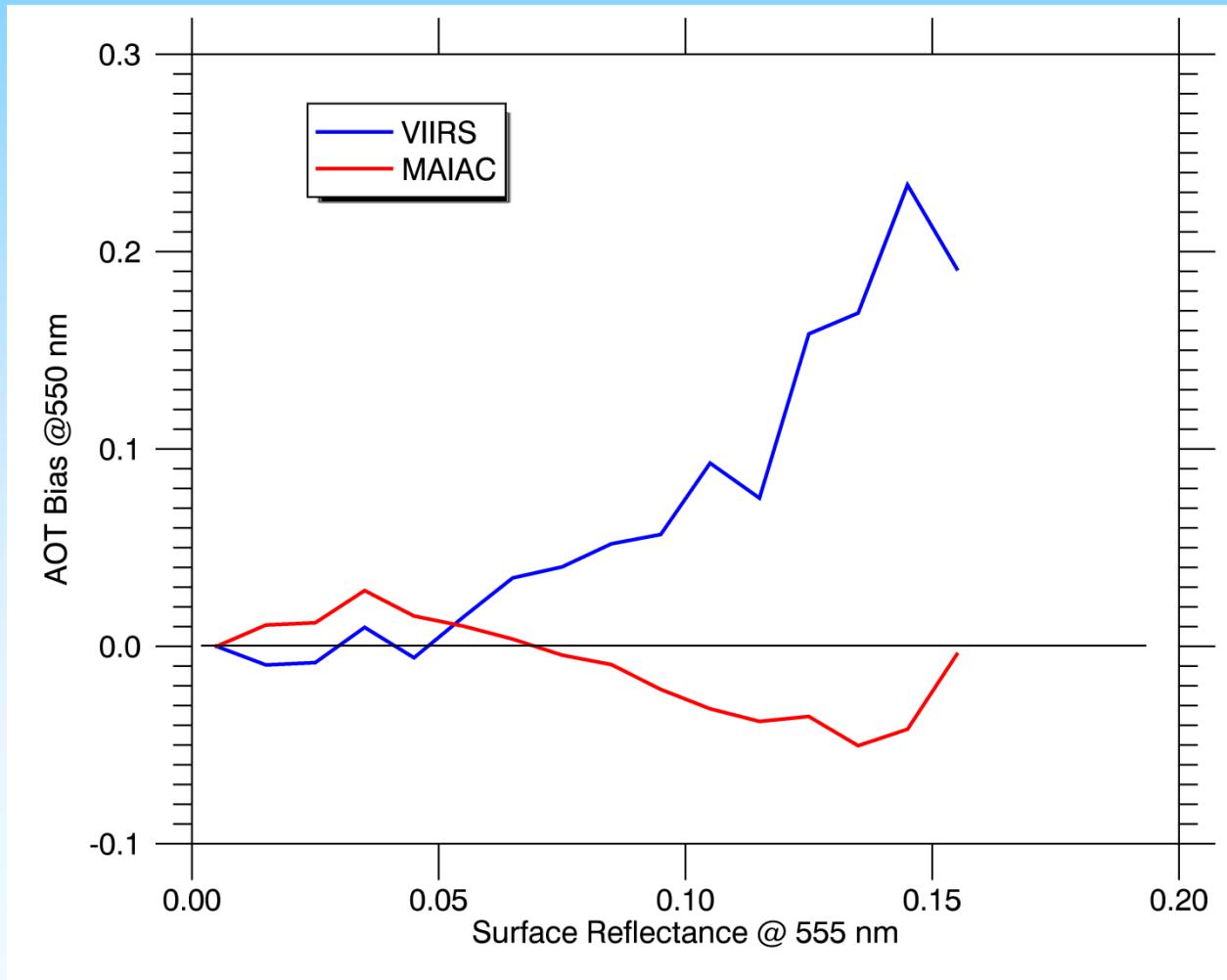
- MAIAC and VIIRS comparable at sfc. reflectances below 0.05

- Similar slope (opposite sign) from 0.05 - 0.1, then VIIRS bias increases dramatically.

Joint AOT-SSA Retrieval

- Approach – based on O. Torres et al., using $L_{0.47}$ and $L_{0.41}/L_{0.47}$ instead of UV channels (0.34 and 388 μm). Uses LUT built for 6 different n_i=0.002-0.04 and AOT=0-8 with fixed n_r, size dist. and AAE

AERONET Validation of AOT & SSA

Alta Floresta (AOT$_{0.47}$)
y = 0.963x - 0.047
R^2 = 0.972

XiangHe (AOT$_{0.47}$)
y = 0.996x - 0.055
R^2 = 0.934

Alta Floresta (SSA$_{0.47}$)
y = 0.4059x + 0.549
R^2 = 0.1019

correct range of values!

XiangHe (SSA$_{0.47}$)
y = 0.415x + 0.568
R^2 = 0.399

biased ~0.03 but good correlation!
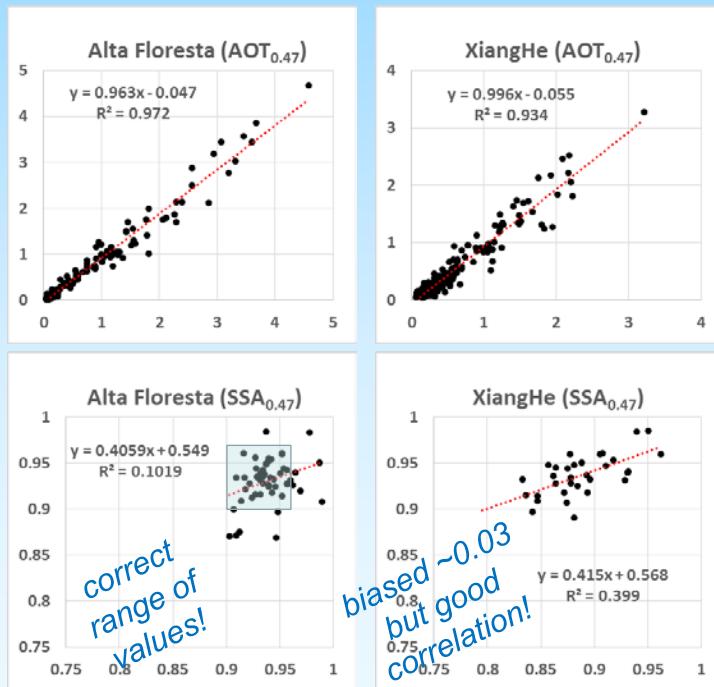
First demonstration of AOT-SSA retrieval from MODIS

Ratio 0.41 / 0.47 vs Reflectance 0.47

τ = 0.0
τ = 0.3
τ = 0.75
τ = 2.0
τ = 8.0

SSA=0.985
SSA=0.905
SSA=0.860
SSA=0.814

TOA   CM   AOT   SSA   BRF
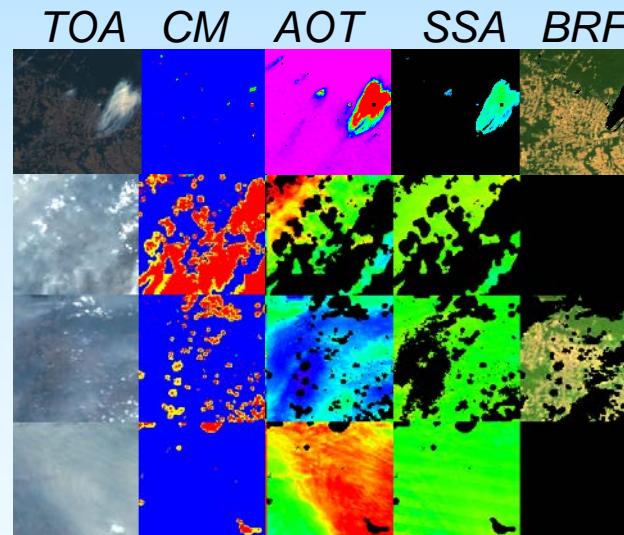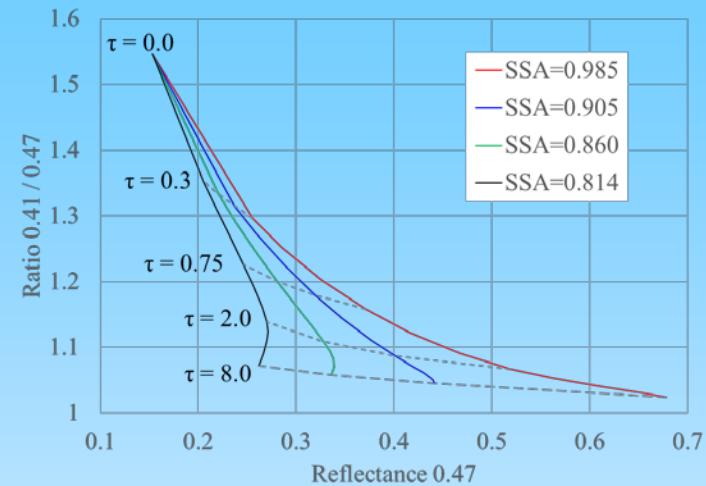
*Example for Alta Floresta, biomass burning season of 2002 (4 days, area size 150 km).*
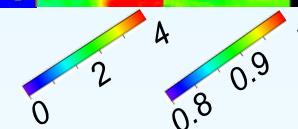
Reasonable sensitivity to SSA at AOT$_{0.47}$>0.8

Idaho/Wyoming-Iosemite Fires, Aug.2013
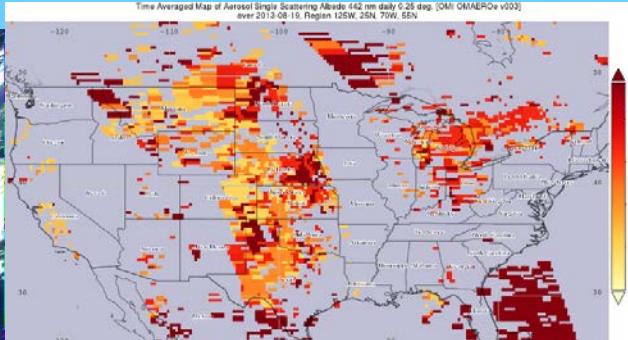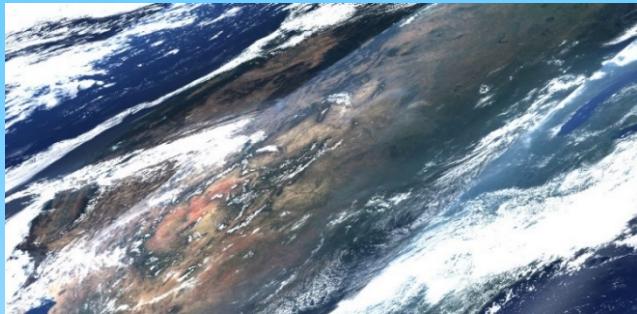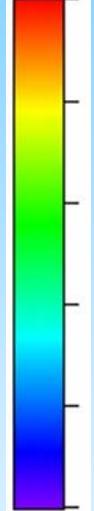
DOY 231
OMI SSA$_{0.44}$
0.85-0.93
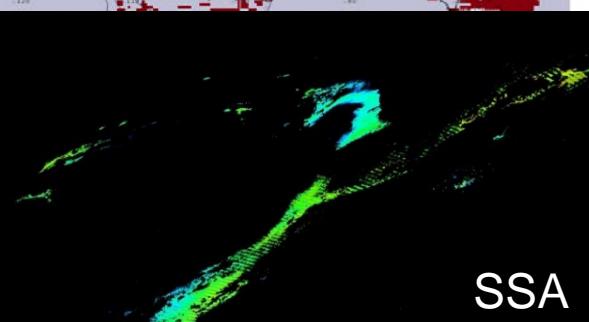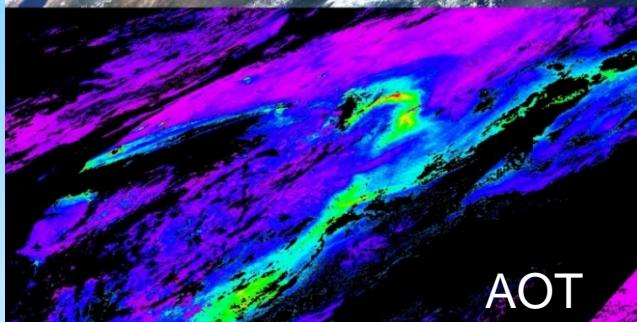
MAIAC
SSA$_{0.47}$
0.88-0.93

AOT

SSA
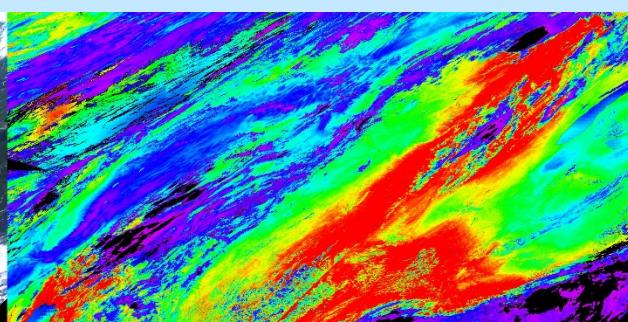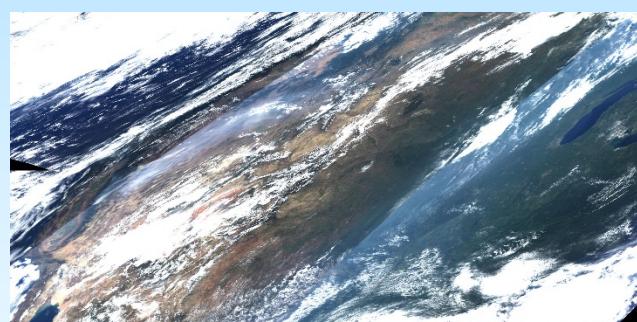
DOY 237
MAIAC SSA$_{0.47}$
0.9-0.93

AOT

SSA
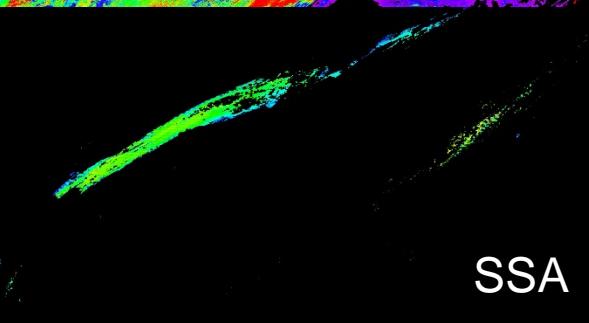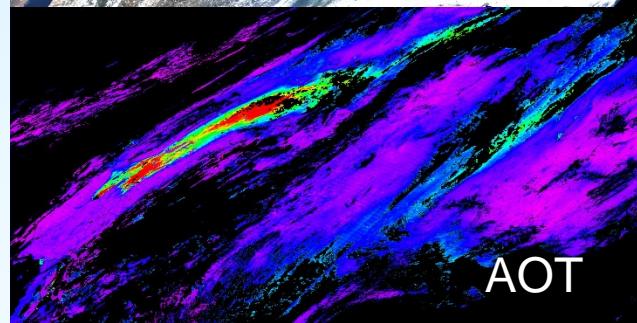
Features (from preliminary analysis)

- *Good spatial and temporal coherence of SSA;*

- *Correct seasonality of SSA over XiangHe and Mongu;*

- *Qualitatively correct regional values (NA vs SA vs Africa);*

Remaining Issues

- *Residual mirror-side dependence for MODIS Terra (pol. Sensitivity @412nm)*
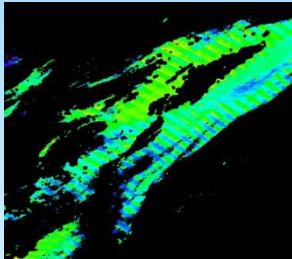
2013 DOY 232

will have to re-visit Terra C6+ calibration:

Lyapustin, A., Y. Wang, X. Xiong, G. Meister, et al., Science Impact of MODIS C5 Calibration Degradation and C6+ Improvements, AMT, 7, 7281-7319, 2014.

- *AOT from standard background aerosol model may give a better correlation with AERONET than AOT from AOT-SSA retrieval;*

- *Sensitivity of AOT-SSA to assumed AAE (as in Jethva and Torres, "Satellite-based evidence of wavelength dependent aerosol absorption in biomass burning smoke inferred from Ozone Monitoring Instrument," ACP, 11 (3), 7291–7319, 2011); also, SD, n_r, H;*

Biomass Burning in Amazonia - 2005