Update on Algorithm MAIAC

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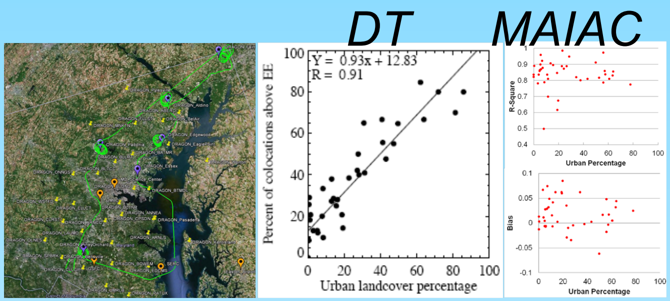
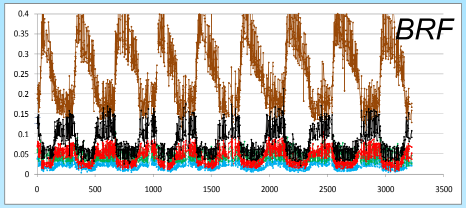
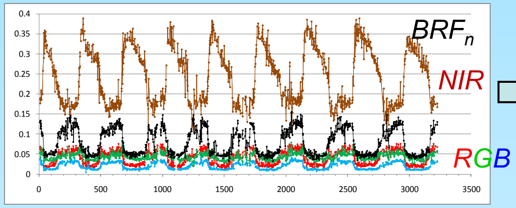
MAIAC: Building a Complete Physical Model of Atmosphere-Surface (RT)

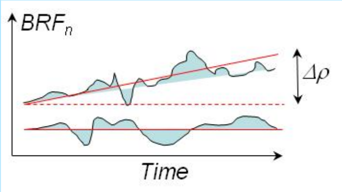
- *Anisotropic surface;*
- *SRC Retrieval* *(global aerosol retrievals; low urban bias)* →



- *Detection of seasonal and rapid change:*

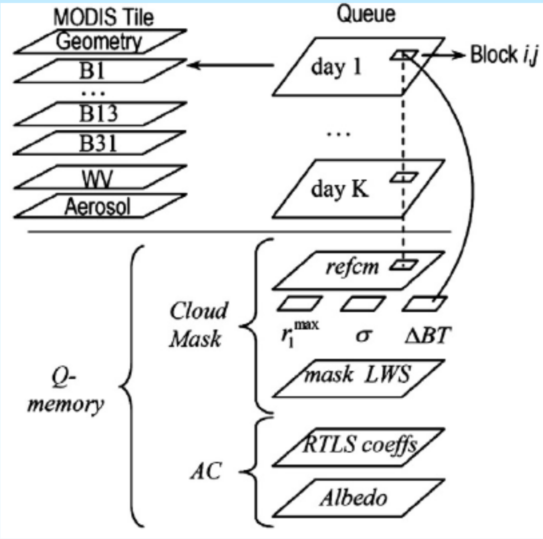






- *Dynamic LWS classification;*
- *Adaptive and learning system:*

(store and dynamically update clear-sky TOA reflectance; spectral BRDF; spatial variability metrics; brightness temperature and contrasts @1km) →



- *Aerosol Type Discrimination;*
- *Synergy among WV, CM, aerosol and AC;*

Current Status

- *MAIAC is at MODAPS;*
- *MAIAC MODIS reprocessing expected to start this summer;*
- *MAIAC MODIS for North America, South America, Africa (±10°), and Europe for 2000-mid-2014 is available at NASA NCCS ftp:*

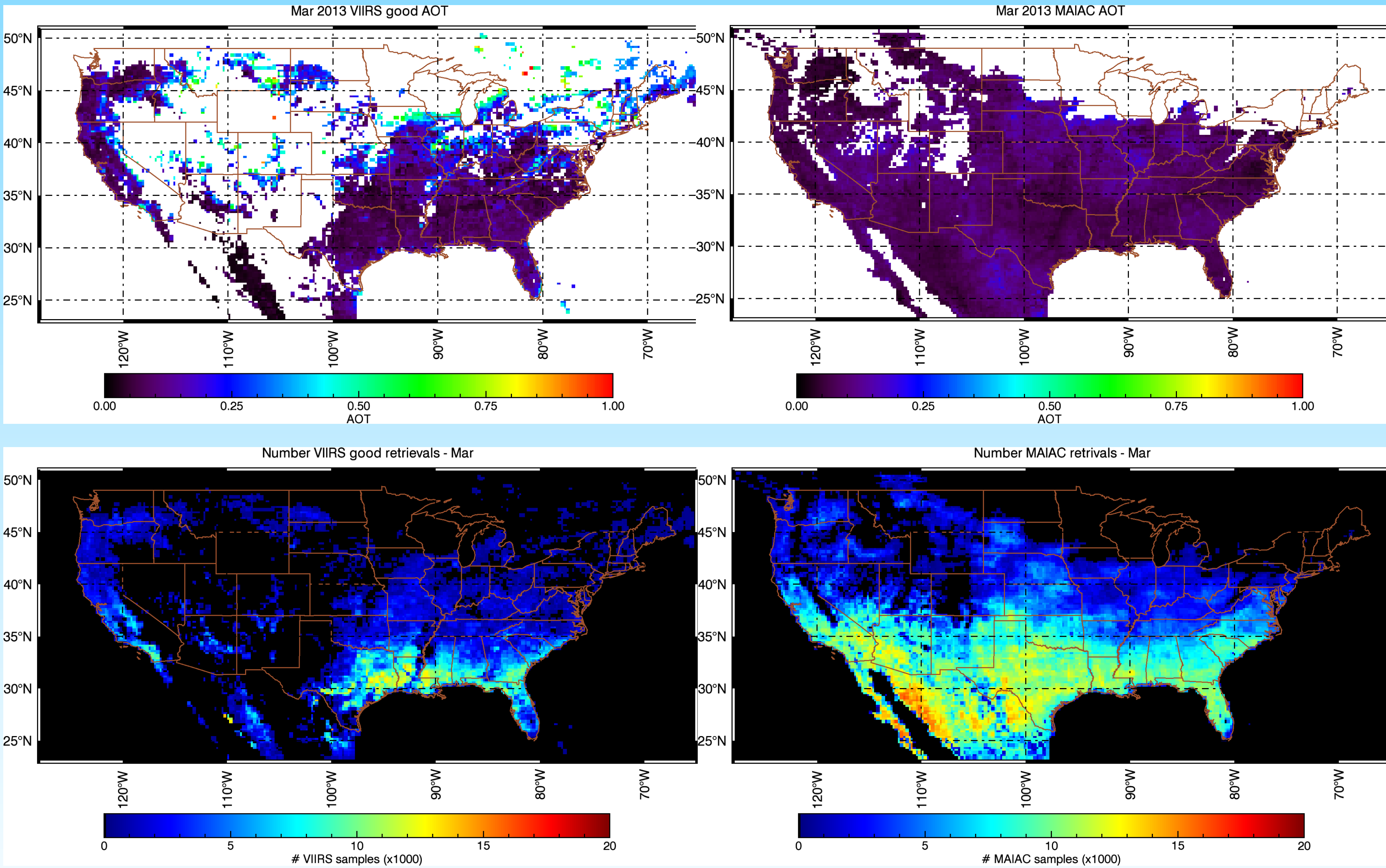
ftp://maiac@dataportal.nccs.nasa.gov/DataRelease/

(if asked for password, press Enter);

- *Continuous science development: CM, snow detection and characterization, aerosol typing; specific developments for tropics.*

VIIRS AOT IP vs MODIS MAIAC (25km)

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



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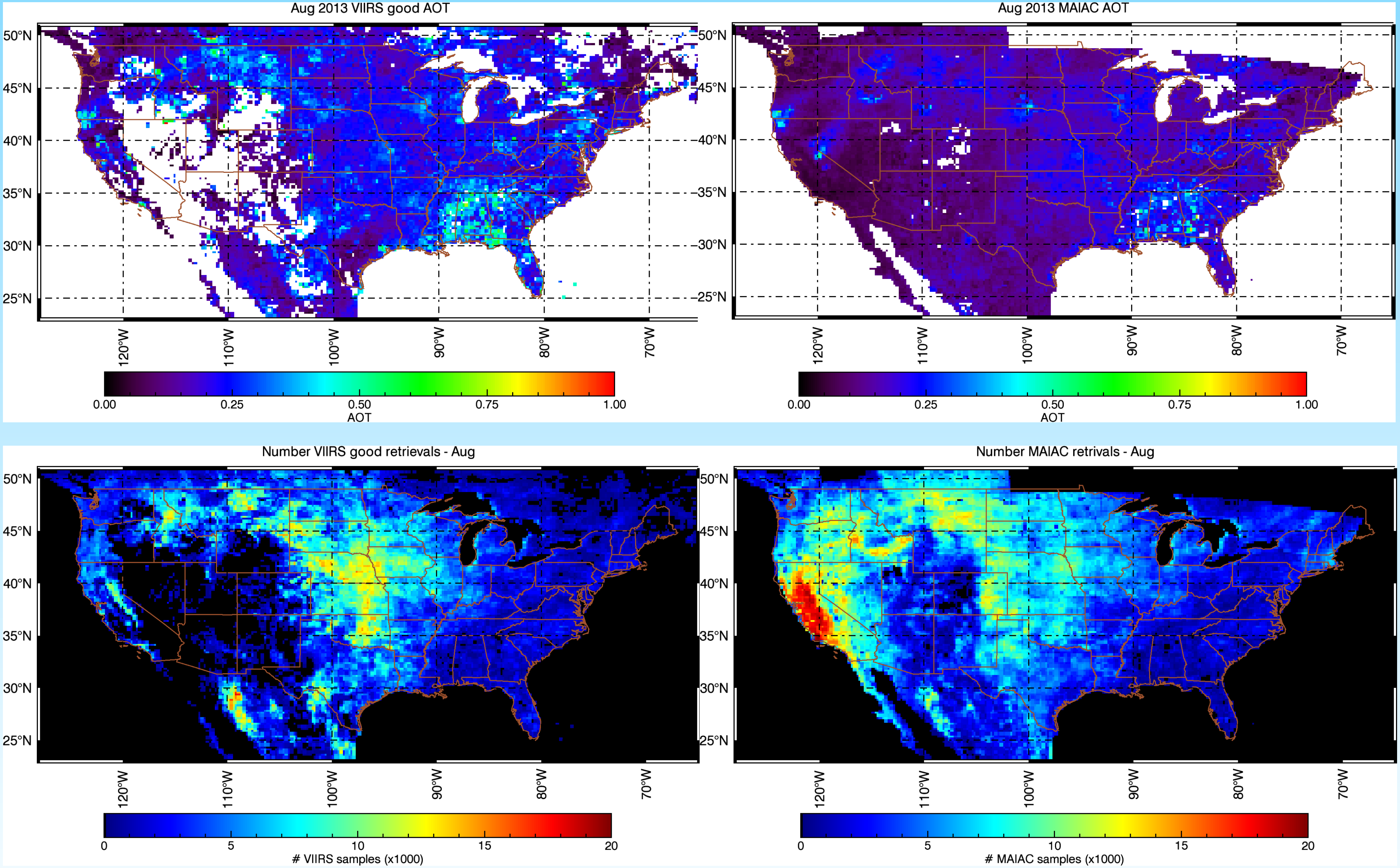

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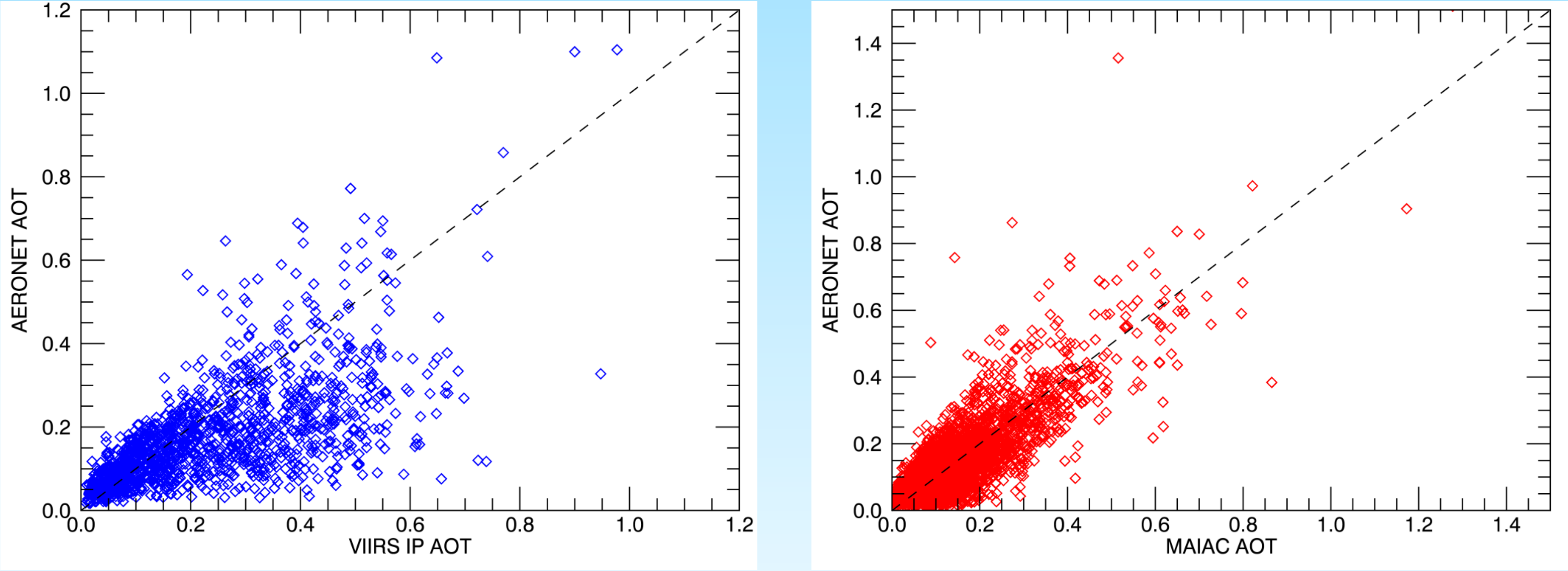
AERONET Comparisons



VIIRS AOT IP vs MODIS MAIAC (25km)

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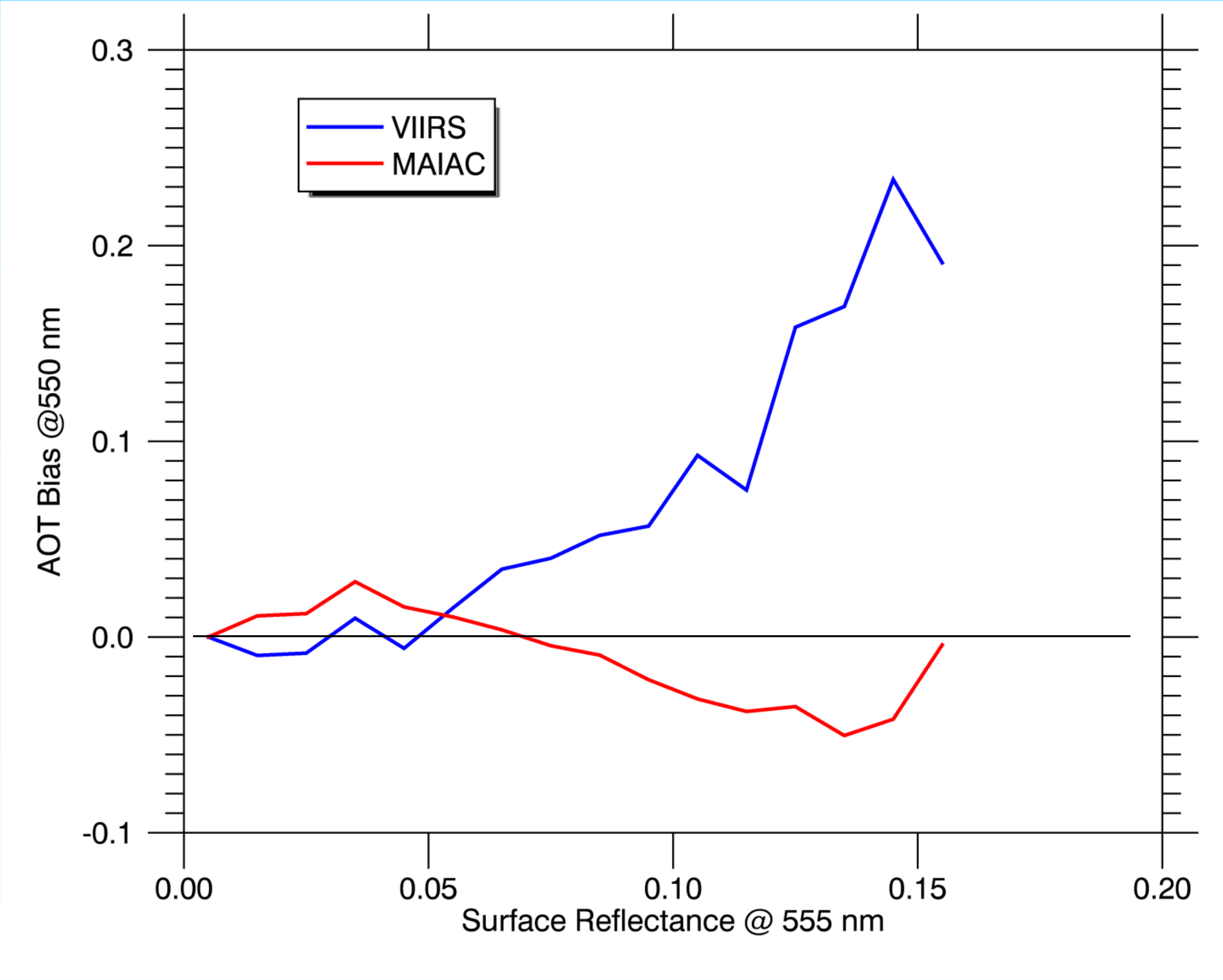
Bias vs. Surface Reflectance



- MAIAC and VIIRS comparable at sfc. reflectances below 0.05

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

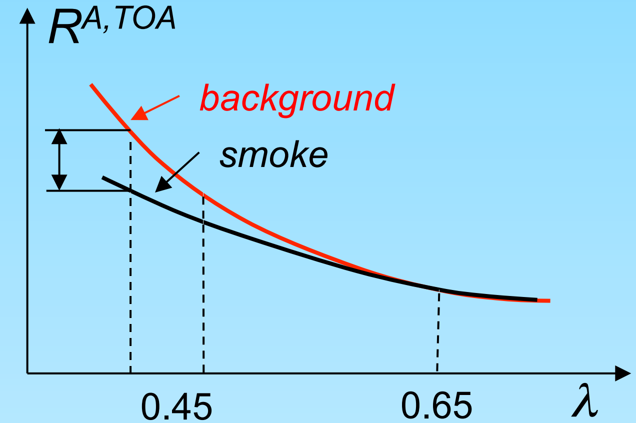
Aerosol Type Discrimination (Smoke/Dust)

Lyapustin, A. et al., 2012: Discrimination of biomass burning smoke and clouds in MAIAC algorithm, ***ACP****, 12, 9679–9686.*

Phys. principles (~OMI) – ***enhanced shortwave absorption*** *(Red →Blue →DB)*

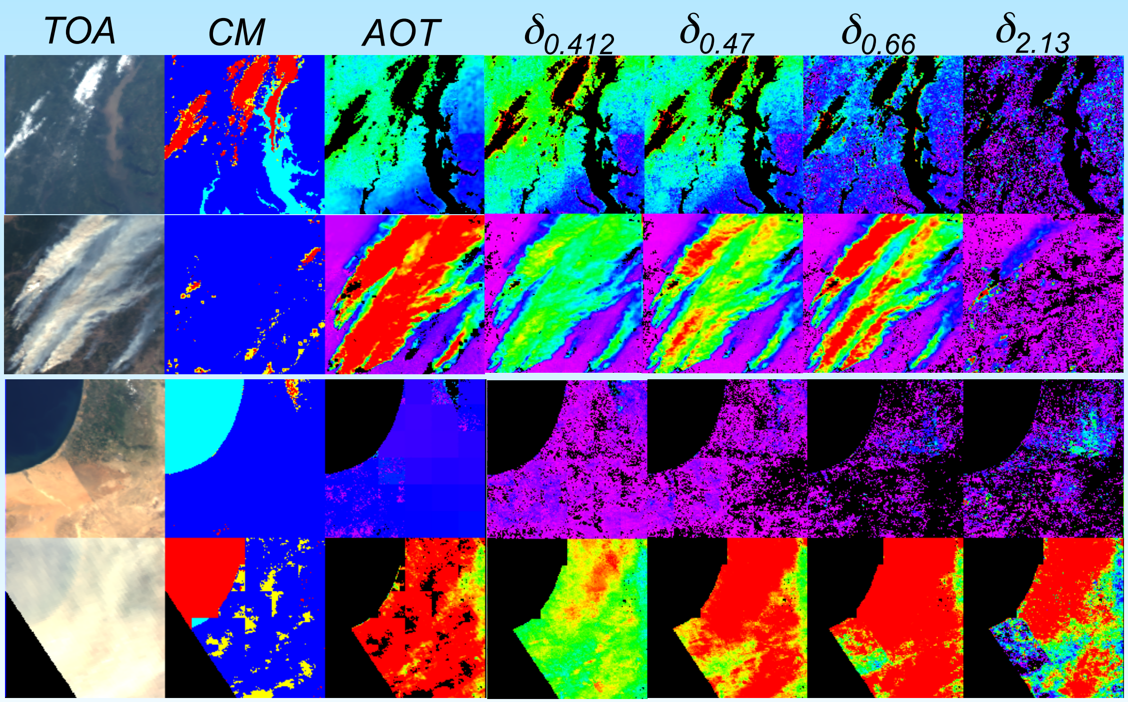
$$R_\lambda^{Aer} = R_\lambda^{Meas} - R_\lambda^{Molec} - R_\lambda^{Surf}(\tau^a)$$

- proxy of aerosol reflectance



1) n_i increases R→DB for OC (smoke) and dust;

2) Multiple scattering, for absorbing aerosols.



Backgr./Smoke/Dust

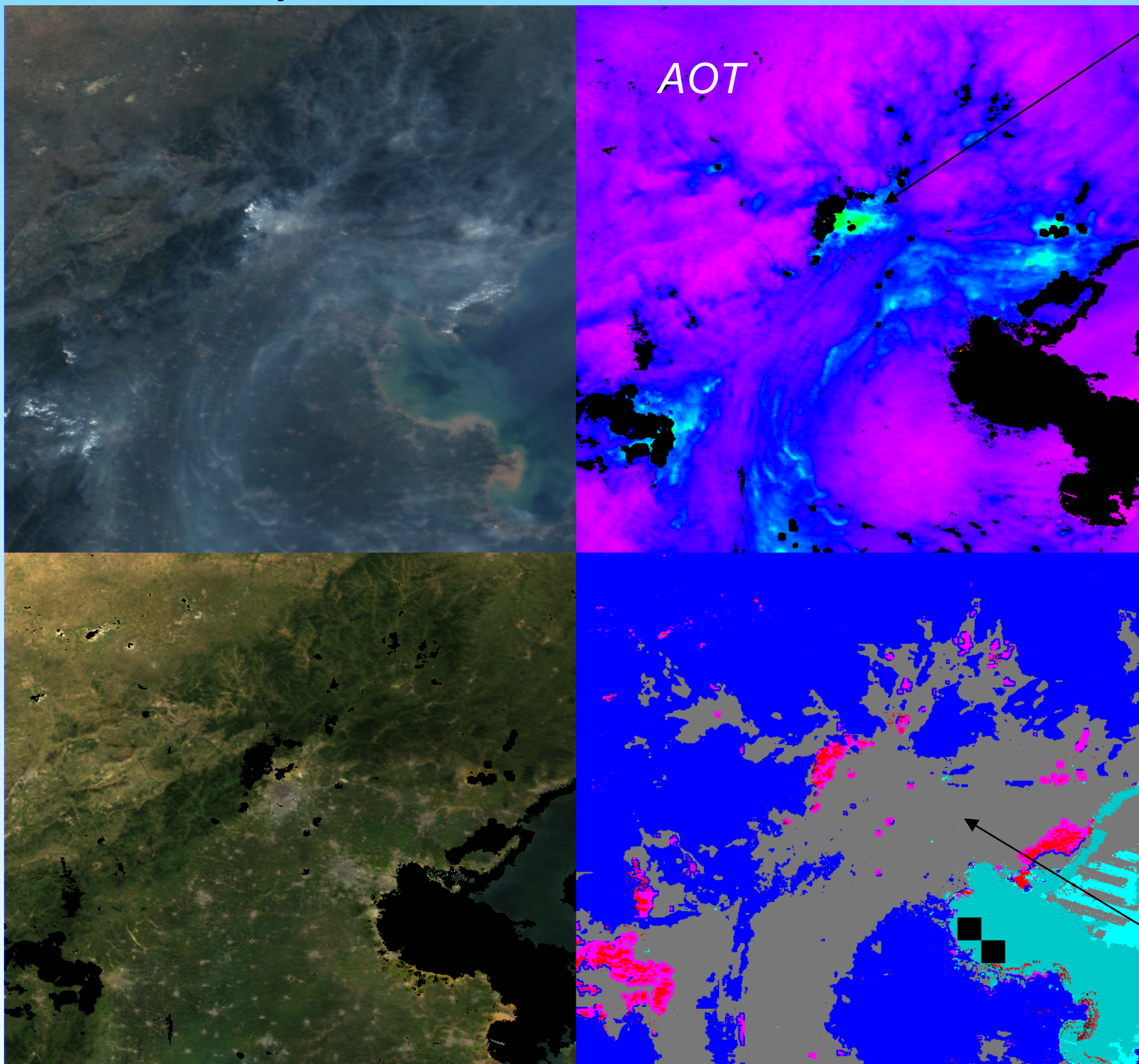
$$\delta_\lambda = R_\lambda^{M} - R_\lambda^{T}(\tau_{0.47}^{a} = 0.05)$$

Model	Abs.	Size
Backgr.	No	Small
Smoke	Yes	Small
Dust	Yes	Large

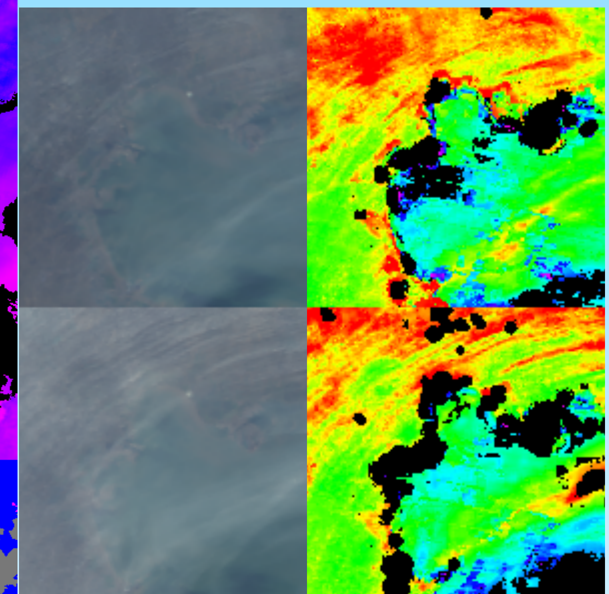
Aerosol @1km: China

July 2013

Beijing (AOT~2.5)

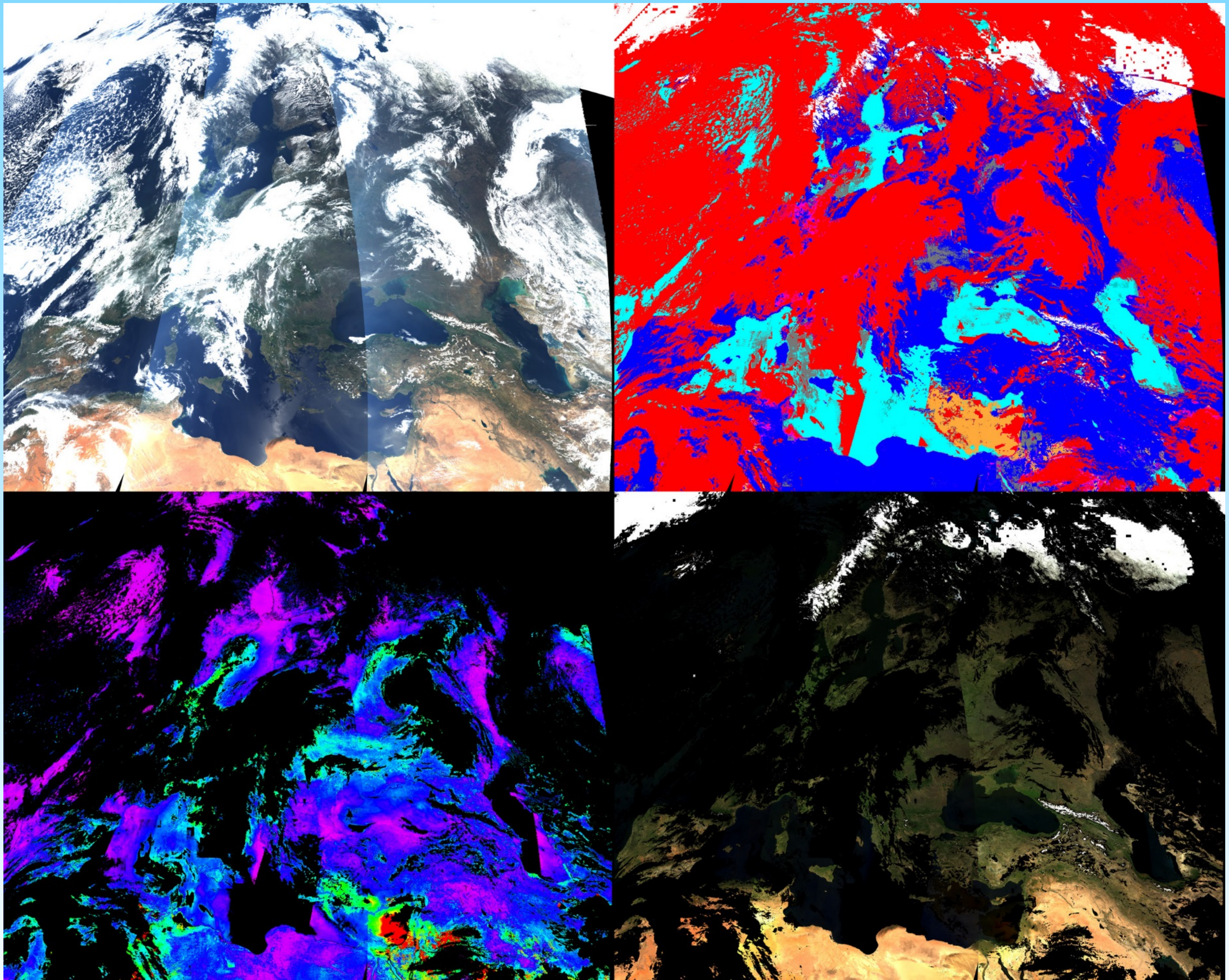


November 2011



Detected “smoke” (fine mode, absorbing)

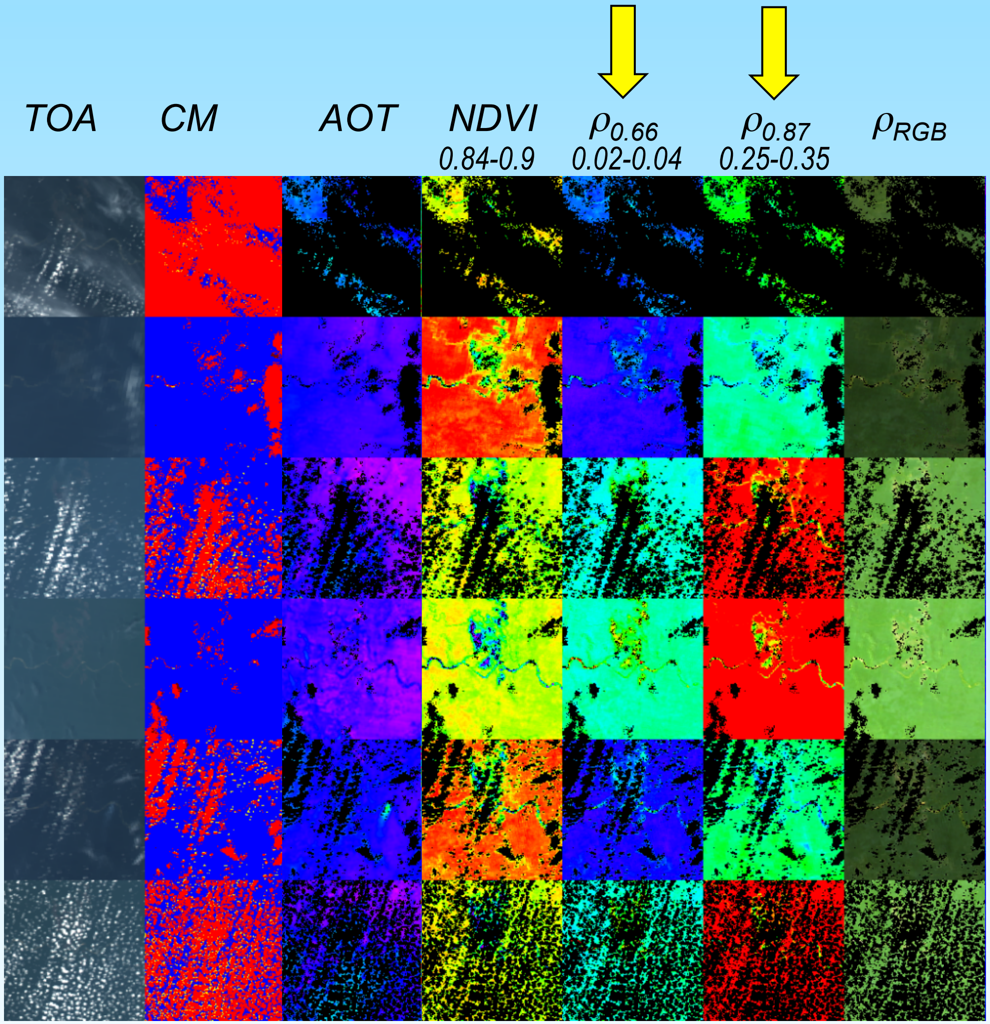
Europe-North Africa: Aerosol Types



Recent Developments

Morton et al. (Nature, 2014): BRDF retrieval in Amazon doesn't happen often

Equatorial Amazon, 150km: Rare 3-day period of low cloud cover (BRDF variation >> spatial variation)

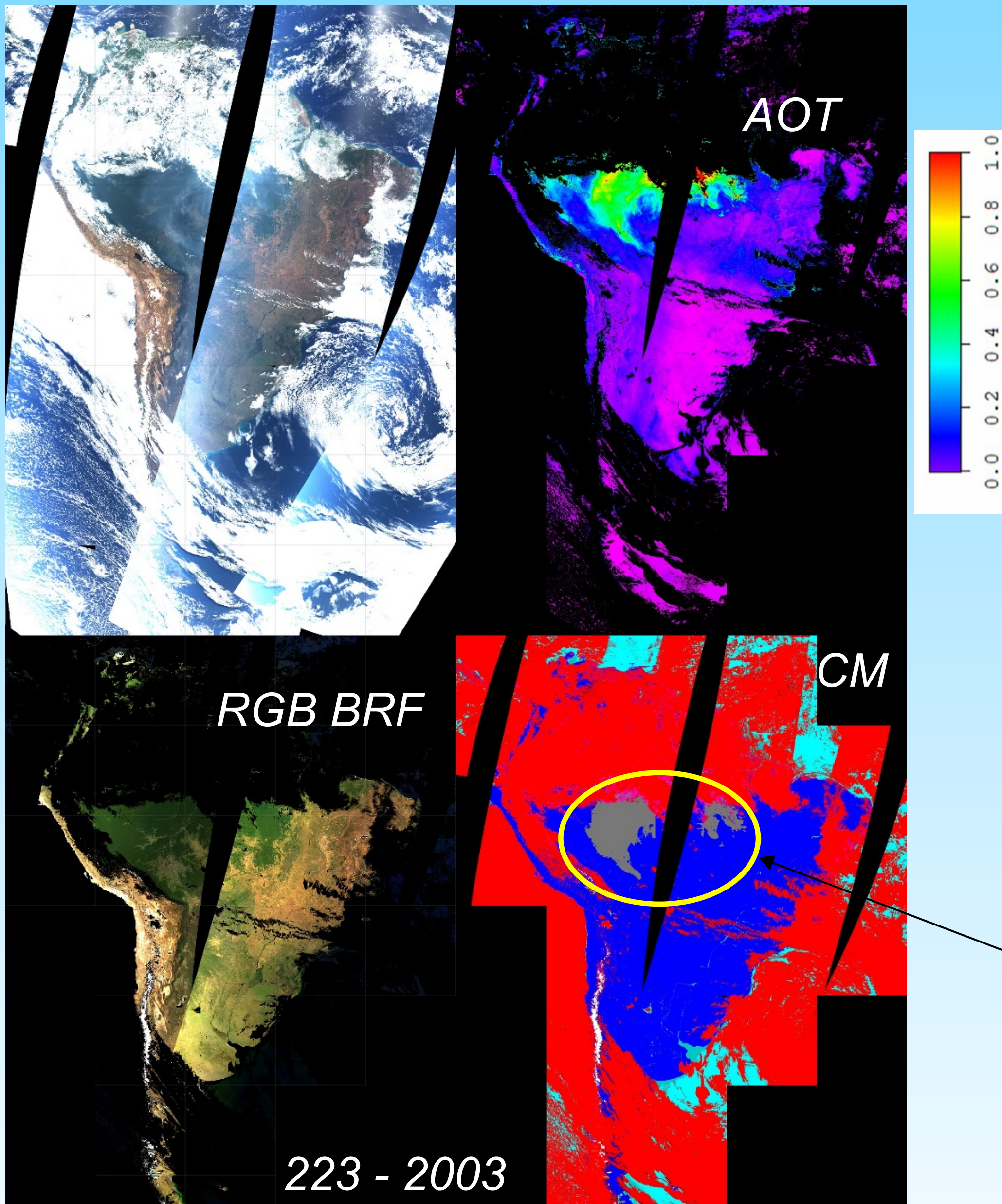


Meso-scale (50km) RTLS retrieval

- *Select high NDVI (>0.75) pixels;*
- *Get average $\rho_{0.66}$ for 20-50th percentile (N>20); filter residual clouds (~0.005) and shadows;*
- *If sufficient angular sampling during 10 days (Terra+Aqua), then RTLS inversion;*
- *Joint inversion of RGB and 2.1μm channels for more robust retrieval;*
- *Get pixel's BRDF by scaling using single good observation*

BRDF shape update every 1-2 weeks to track geometry and phenology changes

Dry Season and Biomass Burning



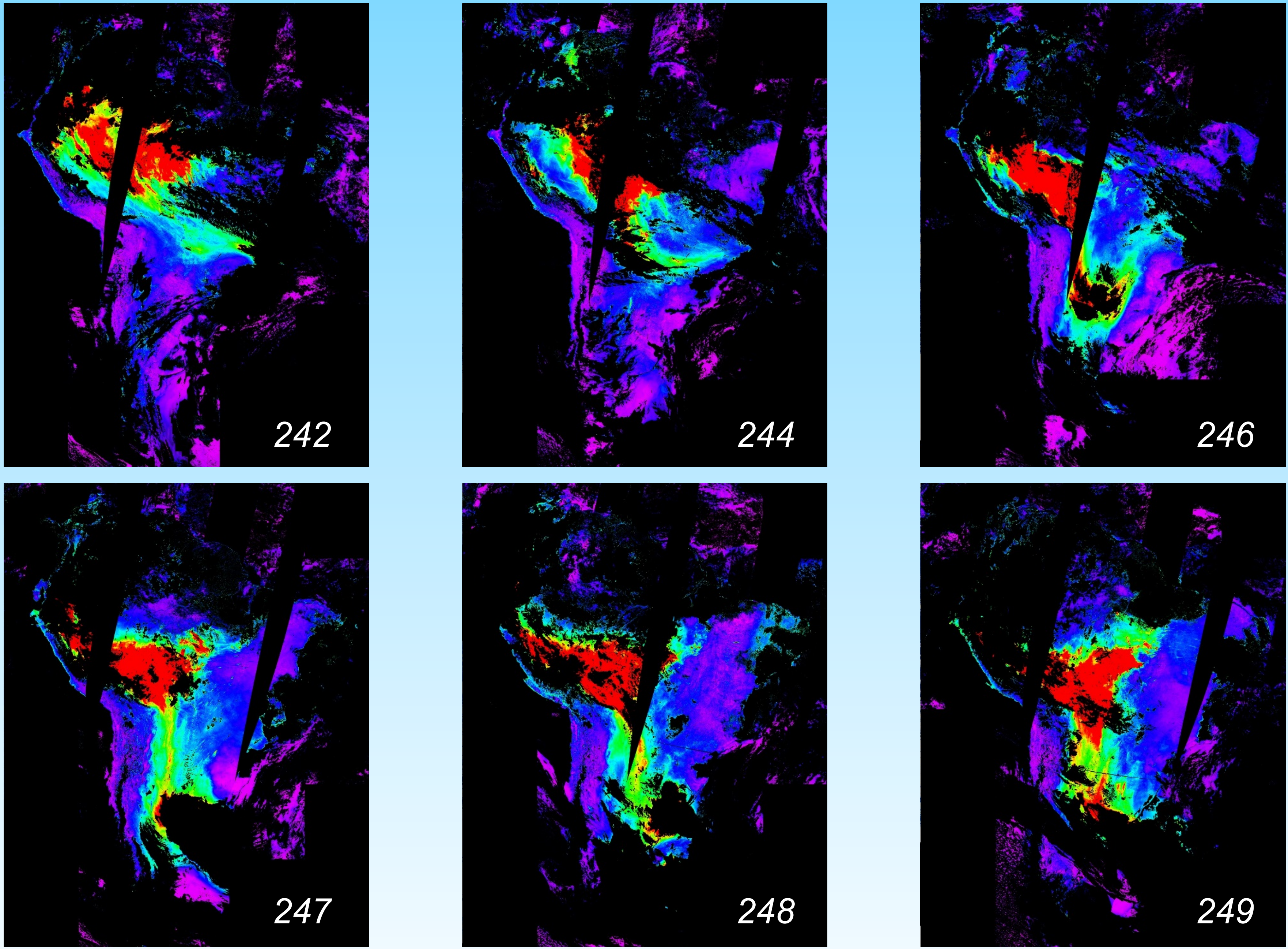
Clearing of Amazon forests for agricultural development.

As timber dries, biomass burning begins.

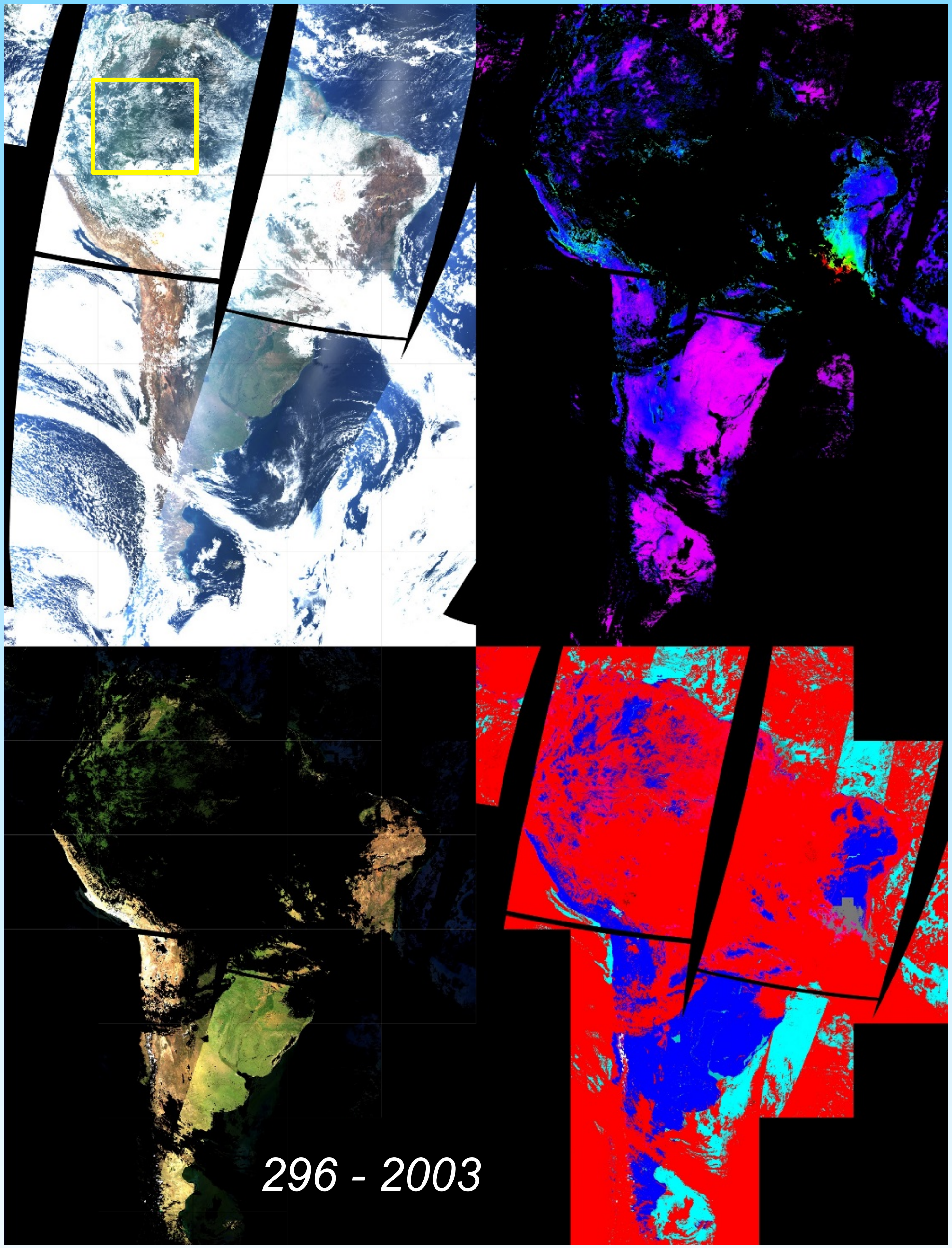
CM Legend

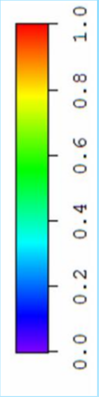
- ***Clear Land***
- ***Clear Water***
- ***Detected Smoke***
- ***Clouds***
- ***Cloud Shadows***

… Biomass Burning (2003)



Quality of Atmospheric Correction





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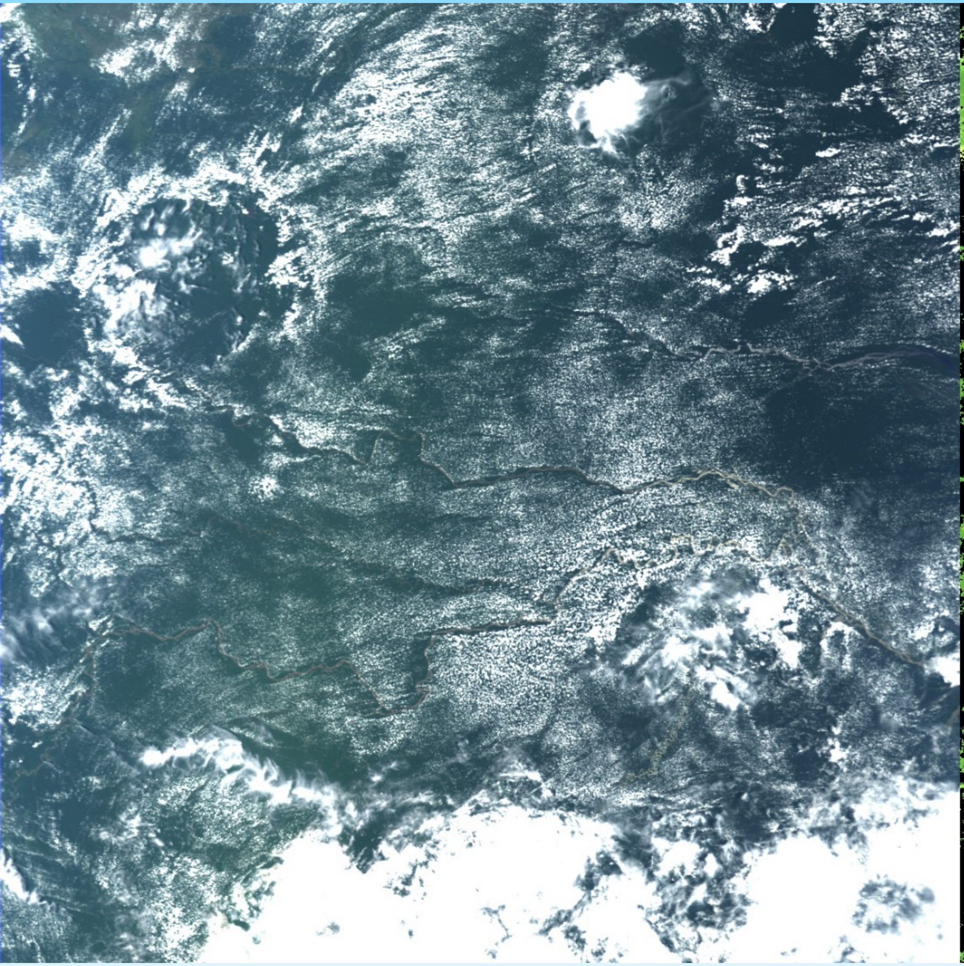
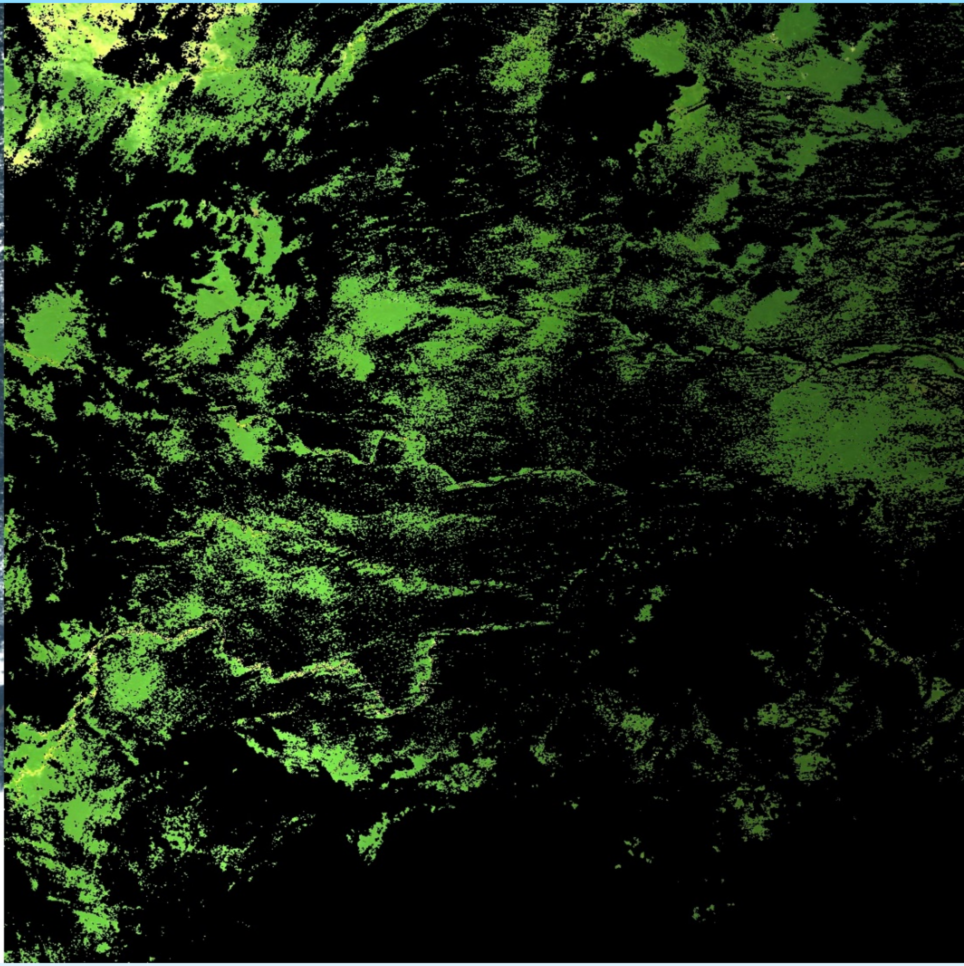
Quality of Atmospheric Correction …

TOA RGB



BRF RGB

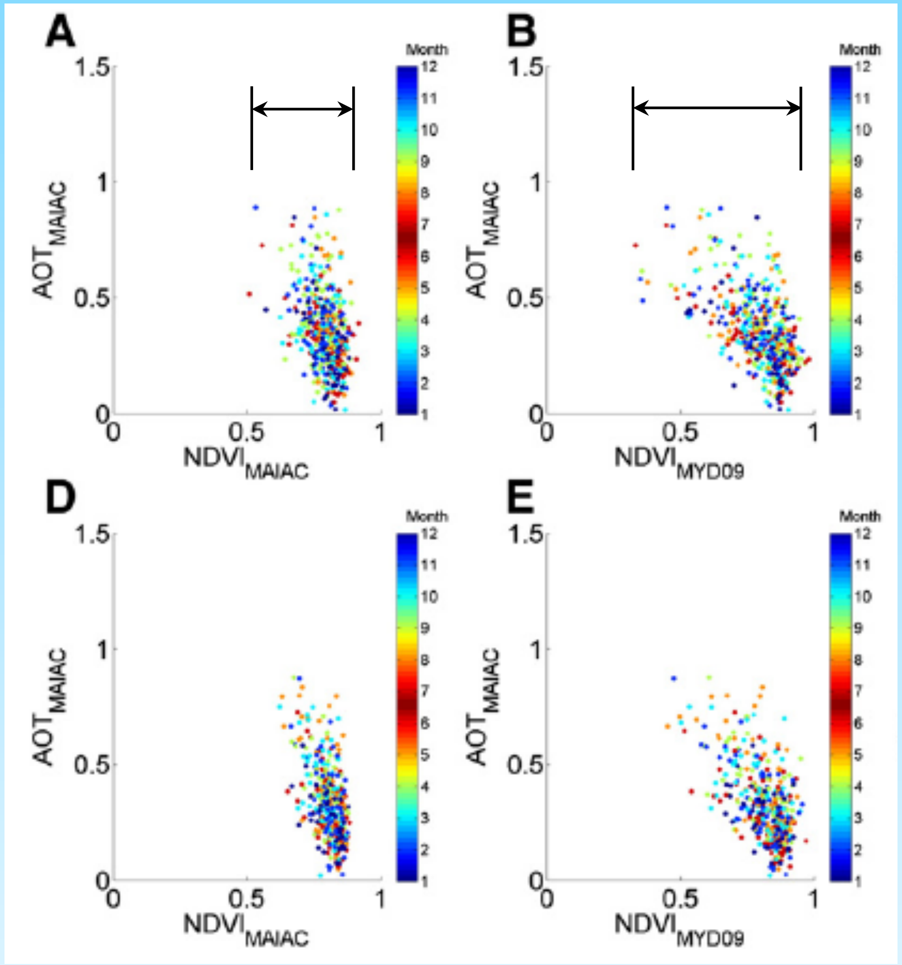


1200 km

Decreasing brightness – moving from backscattering towards forward scattering

Aerosol Effect on NDVI

(from Hilker et al., 2012)



Northern area (7°30' N, 70° W)

Southern area (7°30' S, 70° W)

Smoke aerosol model (more absorption at 0.47μm) gives larger AOT resulting in lower $BRF_{0.67}$.