



MAIAC-OCI: Processing Over Land

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MAIAC OCI Products

1. Standard MAIAC (gridded, zonal Sinusoidal projection):

Use MODIS-like set of L1B OCI bands (412.5, 464.7, 552.4, 664.5, 864.5, 1250, 1618, 2130nm) plus UV (339.3, 388) and 3 red-edge bands (710.6, 740.5, 776.8).

Products

- Cloud Mask (**CM**), cloud shadow mask;
- Column Water Vapor (**CWV**);
- **AOD** with regional background model @ 1.2km resolution;

Atmospheric correction (**AC**) provides:

- **LER, BRF & BRDF** at 11 bands (8 MODIS + 3 Red Edge bands);
- At 6 bands (412.5, 464.7, 552.4, 664.5, 864.5, 1250) we compute **BLR** = BRF/LER ; **ALR** = $Albedo/LER$.
These data are re-projected back to swath and reported in hyperspectral dataset.

2. Hyperspectral Atmospheric Correction (swath)

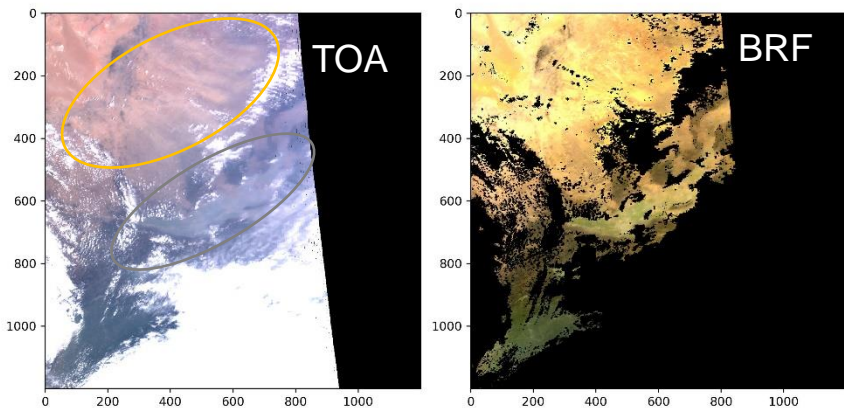
Products

- **LER** (Lambert Equivalent Reflectance) for 339.3 – 893.5 nm.
- **BLR, ALR, BRDF** (Kiso, Kvol, Kgeo) in 6 bands (total 20 layers). Using LER and these data, and the code we provide, the users can generate full hyperspectral **BRF**, **Albedo** and geometry-normalized **BRF_n** on the fly – this approach provides a factor of ~4 reduction on output file size.

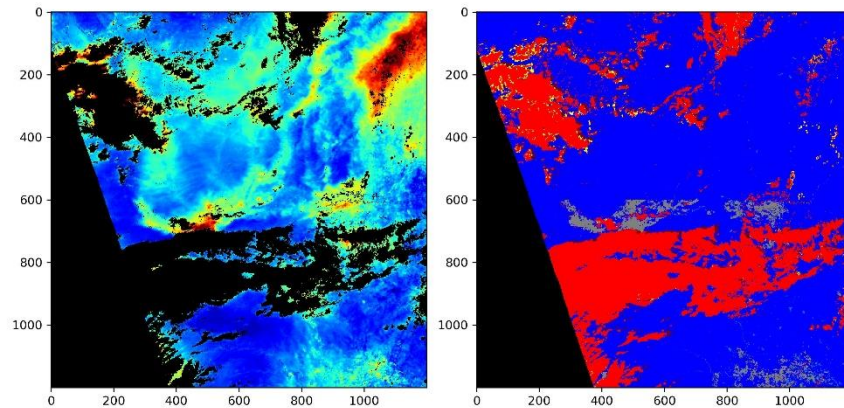
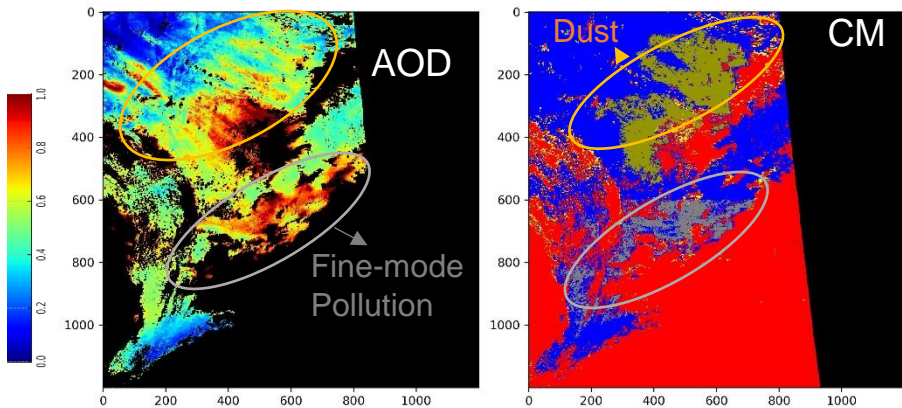
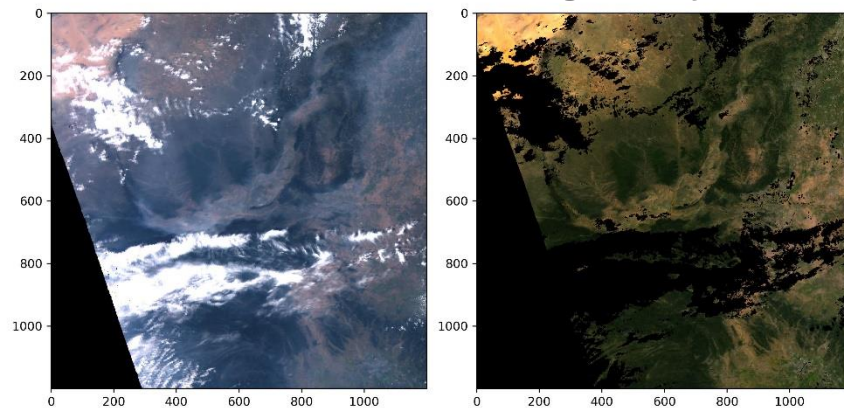


Examples: North-East China

Dust and Pollution



Effect of Topography

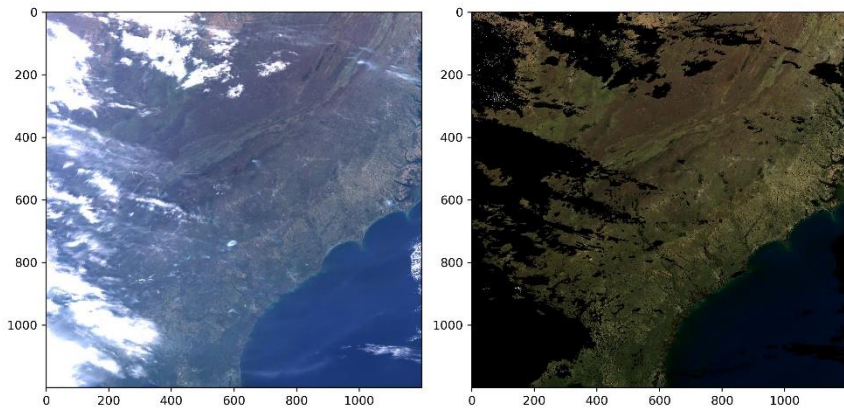




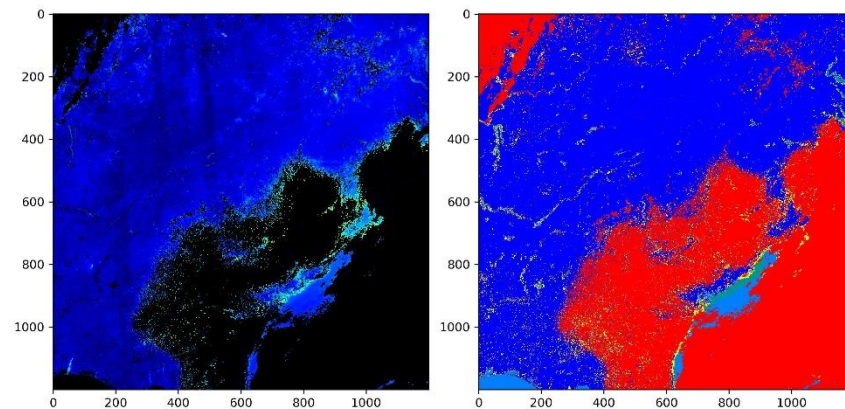
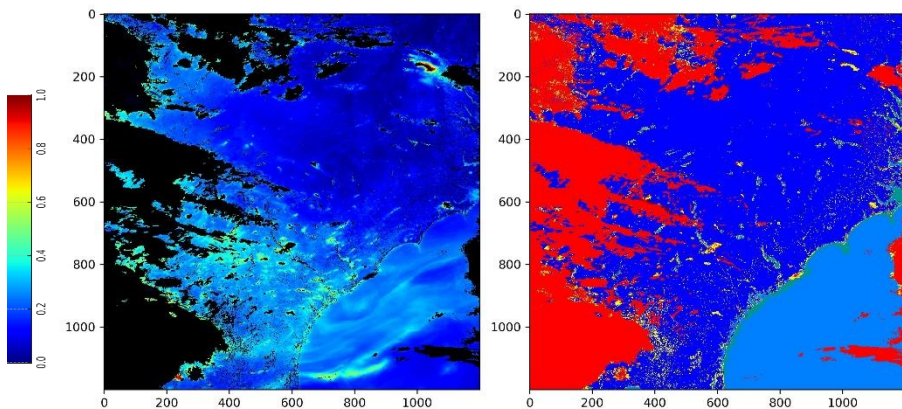
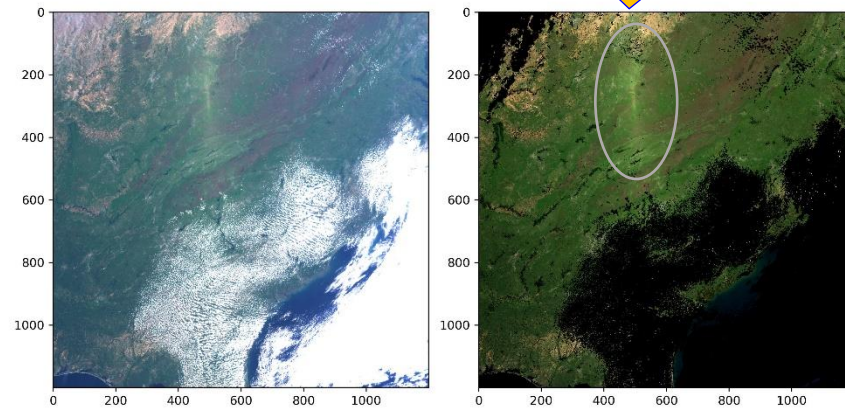
Examples: Georgia, USA

No shadows in the BS direction (Hot Spot). Visible reflectance may increase 2-3 times. HS characterizes vegetation structure (leaves-to-gaps ratio).

Agricultural Burning in Spring

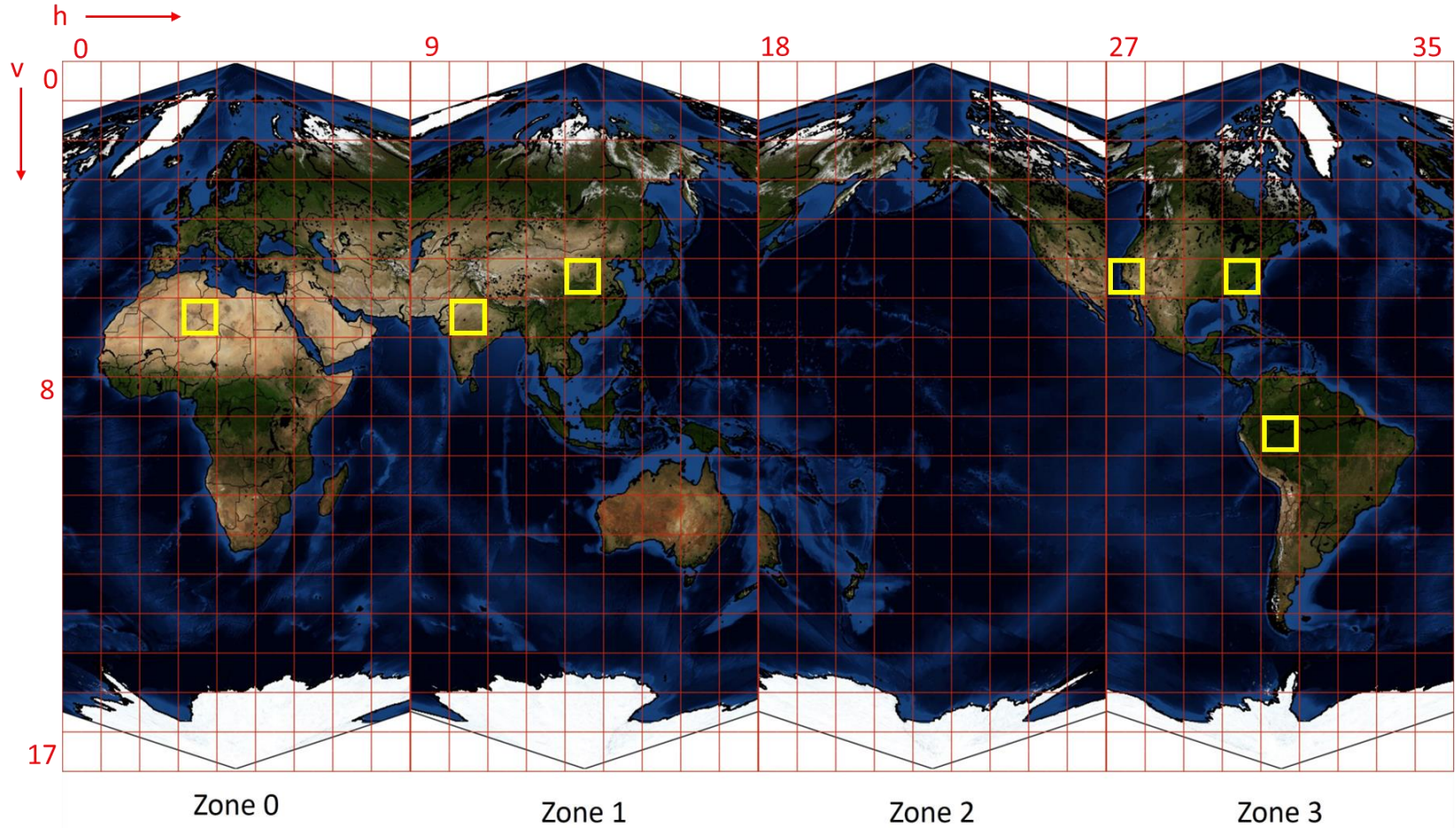


Hot Spot (HS)





Zonal Sinusoidal Projection & Tile Structure



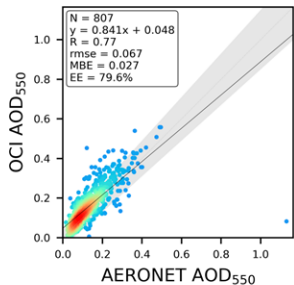


AERONET Validation (v2 L1B adjusted for v3 gain)

21×21 1.2km pixels; >50% coverage; AOD Expected Error (EE): $\pm(0.05 + 10\%)$; AERONET V3 Level 15;
Period: 3/5/2024 – 9/3/2024

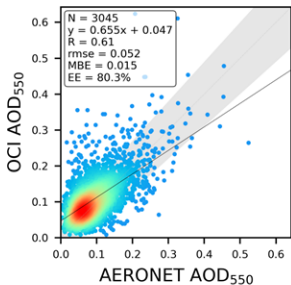
East US
(23 sites)

h30v05



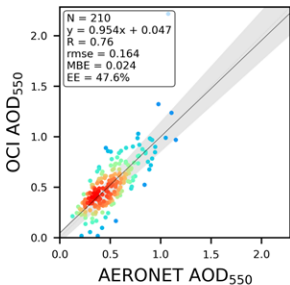
West US
(28 sites)

h27v05



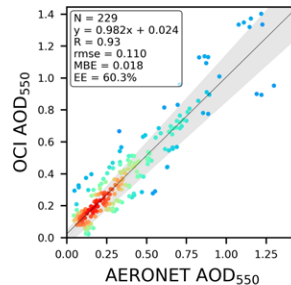
India
(5 sites)

h10v06



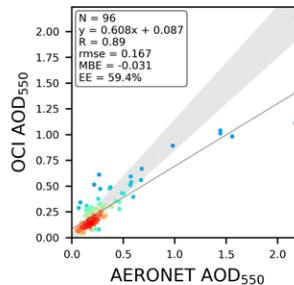
Northeast China
(3 sites)

h13v05

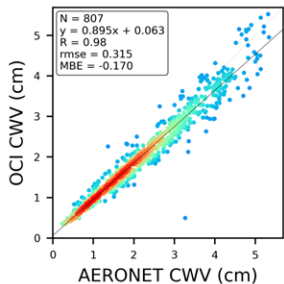


Sahara desert
(1 site)

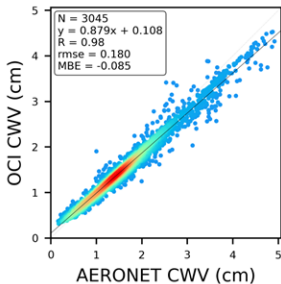
h03v06



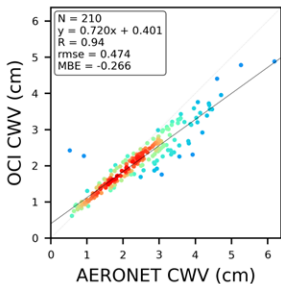
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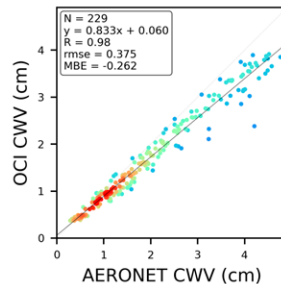
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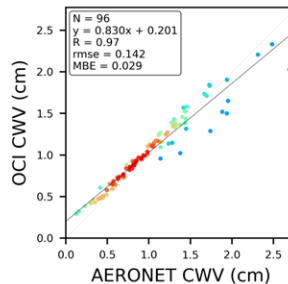
h10v06



h13v05

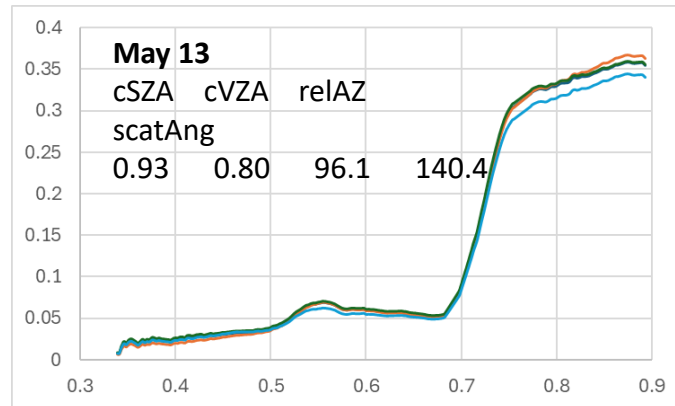
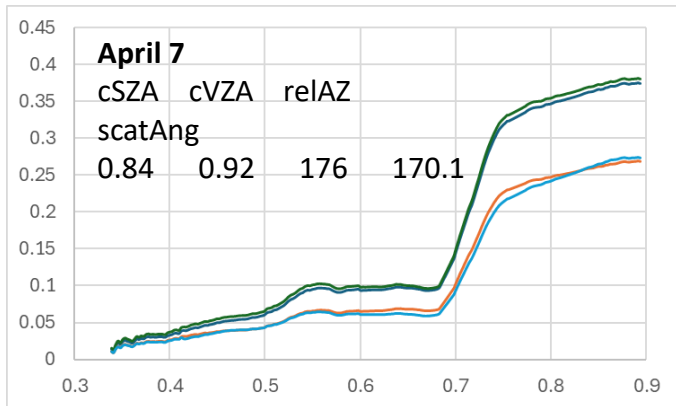
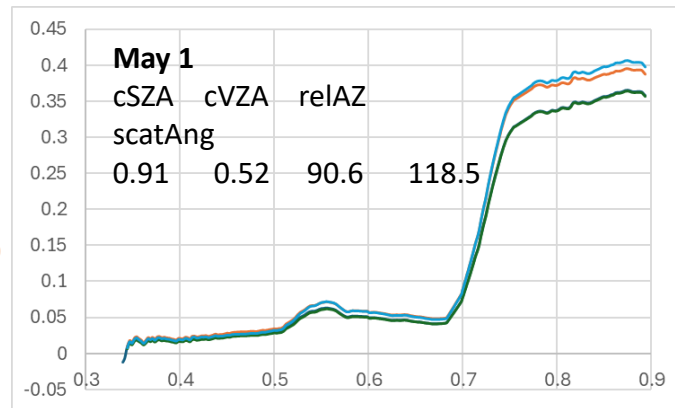
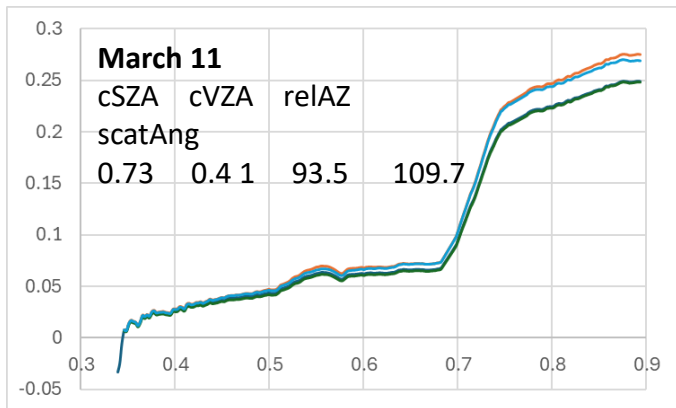


h03v06





Examples of Retrieved Spectra





SUMMARY

- The code (MAIAC-OCI) has been submitted to SDS;
- The current performance and accuracy are good;
- Waiting for v3 L1B; will use MDCA (MAIAC Desert Calibration Algorithm; [Lyapustin et al., 2014; 2023](#)) to verify OCI calibration against MODIS Aqua/VIIRS J1;
- We are working on adapting MAIAC-4D for advanced aerosol characterization (MAIAC-4D is operational on DSCOVR EPIC and is well validated: [Lyapustin et al., 2021; 2025; Go et al., 2022; Choi et al., 2024](#)):

Advanced aerosol characterization

- AOD_{443} , *spectral imaginary refractive index* (k_0 , SAE), *aerosol layer height* (ALH);
 - *Absorbing aerosol composition* (BC , BrC in smoke; Hematite, Goethite in dust)
- Absorption model: $k_\lambda = k_0 (\lambda / \lambda_0)^{-SAE}$ where $\lambda_0 = 680\text{nm}$, fixed real refractive index and size distribution;
- Levenberg-Marquart optimal fit of UV-Red and O₂ A-B:

$$F^2 = 1/N \sum \left(\frac{L_\lambda^m - L_\lambda^t}{\sigma_\lambda L_\lambda^m} \right)^2 = \min\{AOD_{443}, k_0, SAE, ALH\}$$