MAIAC Update

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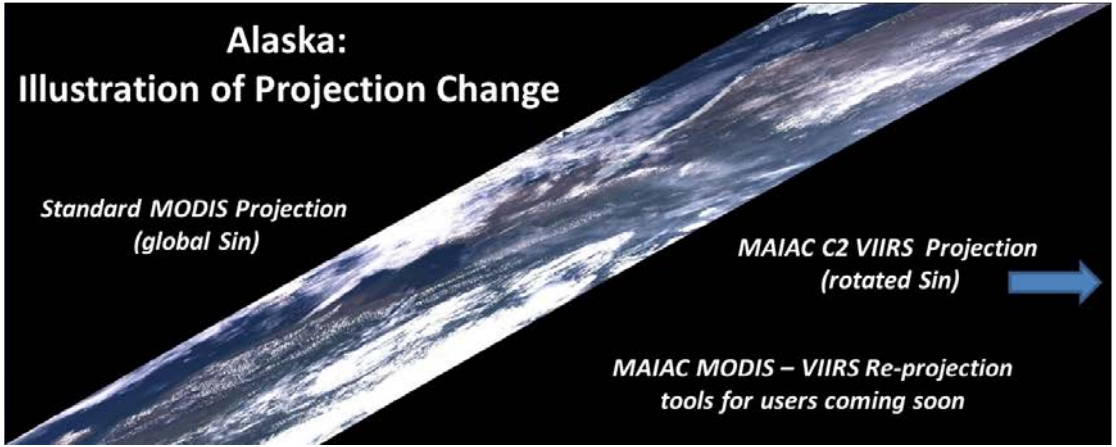
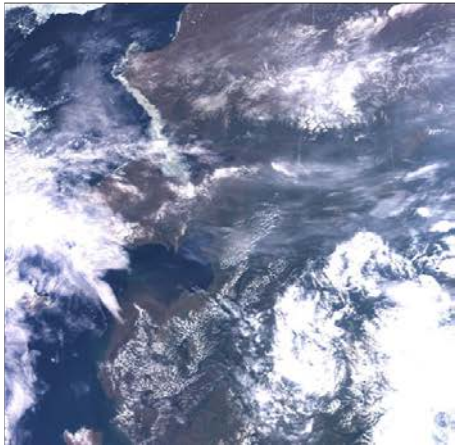
Status

- MAIAC MODIS C6.1 re-processing to start shortly;
- MAIAC VIIRS is in integration and testing for C2;
- We cross-calibrated SNPP and N20 VIIRS to MODIS Aqua for continuity of CDRs – used in MAIAC;
- MAIAC VIIRS (MOD C7) features Rotated Sin Projection.

MAIAC Products

- **Atm.**: Cloud/Shadow/Snow Mask, AOD, FMF (over water), CWV_{MODIS}, Smoke Plume Injection Height
- **Surf.**: BRF (M: 0.5, 1km; V: 0.375, 0.75km);
- **Surf. Daily Gap-Filled**: BRDF, NDVI (1/0.75km); Snow grain size and fraction (1/0.75km); $NBAR_{MODIS}$ (0.25km)
- **CMG Daily**: most of the above + additional VIs





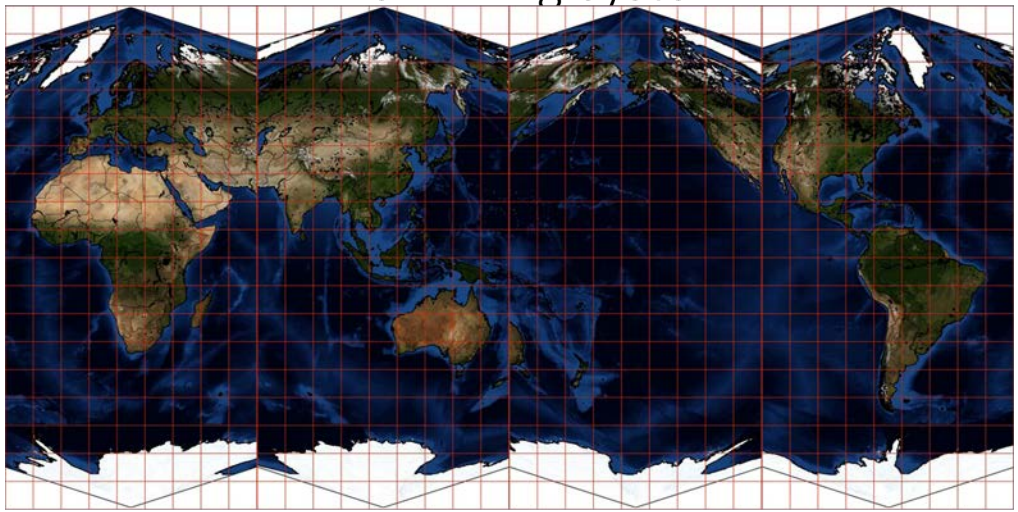
MAIAC Update

Standard Global Sin

We will provide re-projection tools for users.

Rotated Sin Projection

New Tiling System



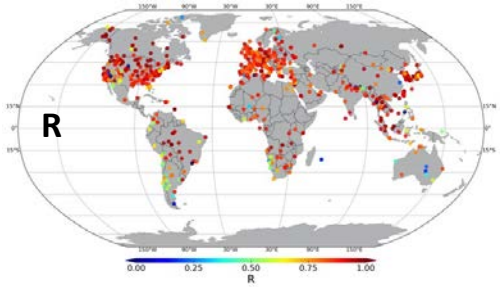
Zone 0 Zone 1 Zone 2 Zone 3

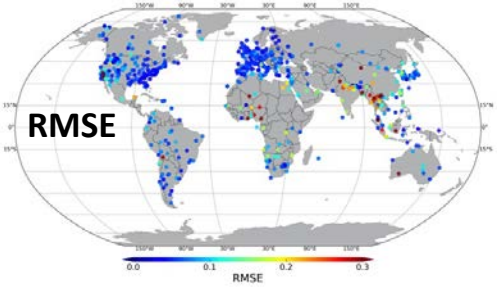
In each zone, there are 9x18 tiles, the total number of tiles is the same as that in standard MODIS tiling system (36 by 18)

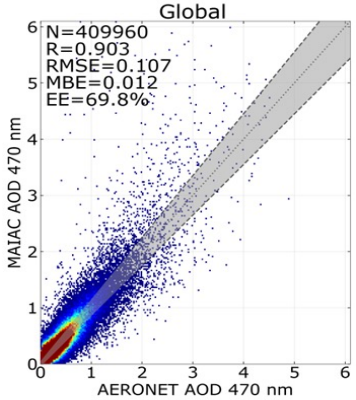
MAIAC Algorithm Updates vs C6

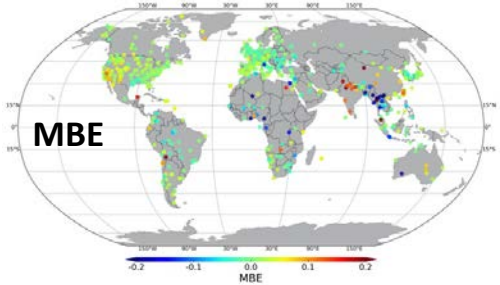
- Developed new regional aerosol models based on AERONET climatology → improves AOD and AC under smoke and dust conditions;

21x21 km² (50% coverage), 0.47µm



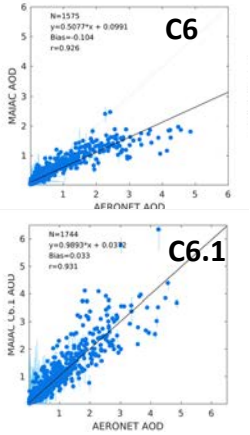






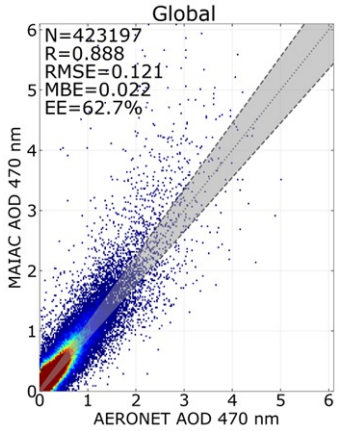
C6 EE = $\pm 0.05 \pm 0.1\tau_{0.47}$

Sept. 2020, Western USA



Courtesy: X. Ye, P. Saide (UCLA)

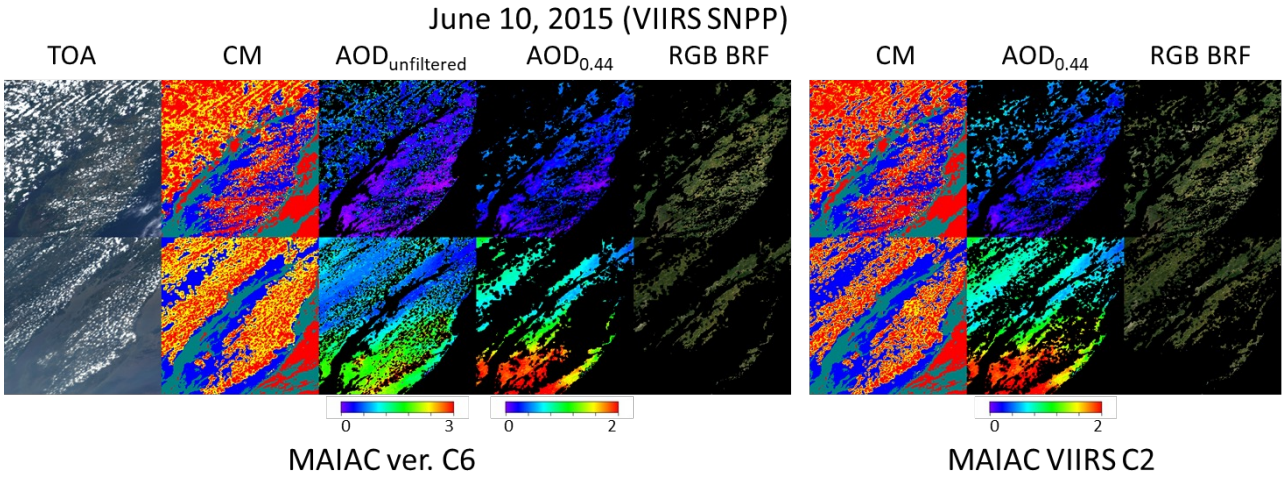
A single 1km pixel



MAIAC	C6	C6.1	C6.1 1km
N	304553	409960	423197
%EE	66%	69.8%	62.7%
R	0.84	0.903	0.888
RMSE	0.12	0.107	0.121
MBE	0.01	0.012	0.022

MAIAC Algorithm Updates vs C6

- Relaxed cloud adjacency analysis → increase in AOD and SR coverage
- *From Lyapustin et al. (2021)*: MAIAC C6 has 5-25% more high-quality data than MOD09 annually. This difference will further increase in MAIAC MODIS C6.1 and VIIRS C2;



- Improved snow detection;
- Aerosol retrievals and AC over high sediment (brown) waters;
- Amended RTLS BRDF model to work at high SZA, VZA>60° - important for VIIRS, EPIC, geo … and at high latitudes (*in preparation*)

Lyapustin A, Zhao F and Wang Y (2021) A Comparison of Multi-Angle Implementation of Atmospheric Correction and MOD09 Daily Surface Reflectance Products From MODIS. Front. Remote Sens. 2:712093. doi: 10.3389/frsen.2021.712093

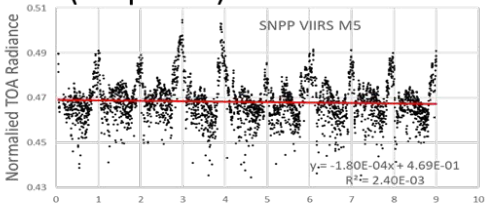
VIIRS Cross-Calibration to MODIS Aqua

MAIAC VIIRS Calibration (Libya 4)

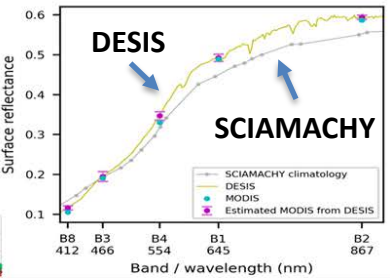
(based on Lyapustin et al., AMT, 2014)

1. Perform MAIAC retrievals (CM, AOD, WV, BRDF etc.);
2. Compute TOA reflectance (R_n) for a fixed view geometry (VZA=0°, SZA=30°) and evaluate trends in both MODIS Aqua and VIIRS SNPP and N20;
3. Applied spectral conversion factor based on DESIS to account for RSR difference;
4. Apply de-trending and compute VIIRS-MODIS Aqua X-calibration factors
5. Good overall agreement with MCST/VCST and NASA LaRC but more reliable in VIIRS X-calibration to MODIS Aqua (Lyapustin et al. (in preparation))
6. Continuity of MAIAC MODIS and VIIRS Aerosol, surface reflectance (BRF), BRDF, NDVI records.

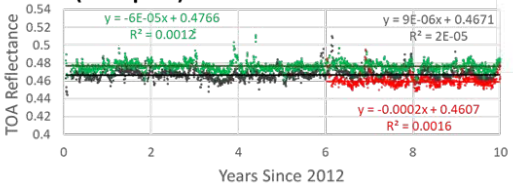
(Steps 1-2)



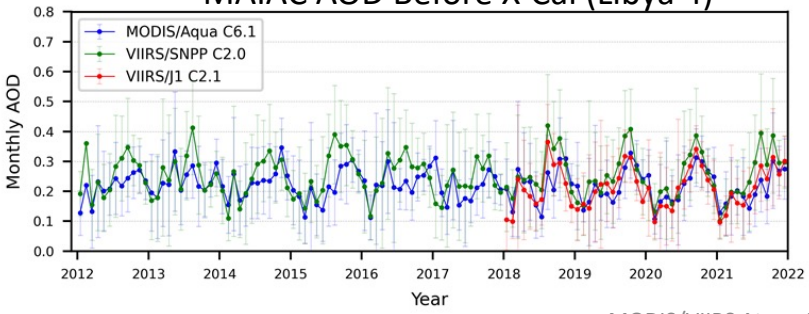
(Step 3) - Novel



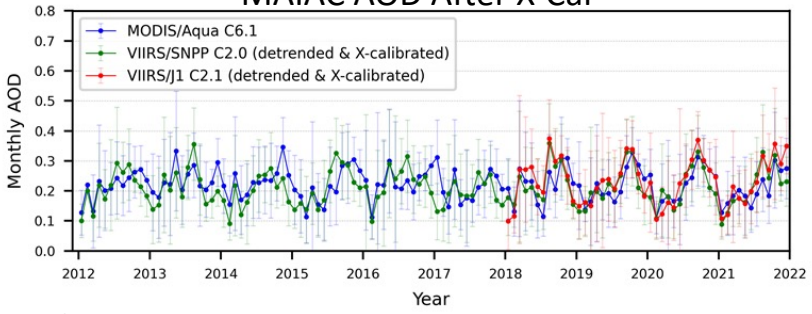
(Step 4)



MAIAC AOD Before X-Cal (Libya 4)



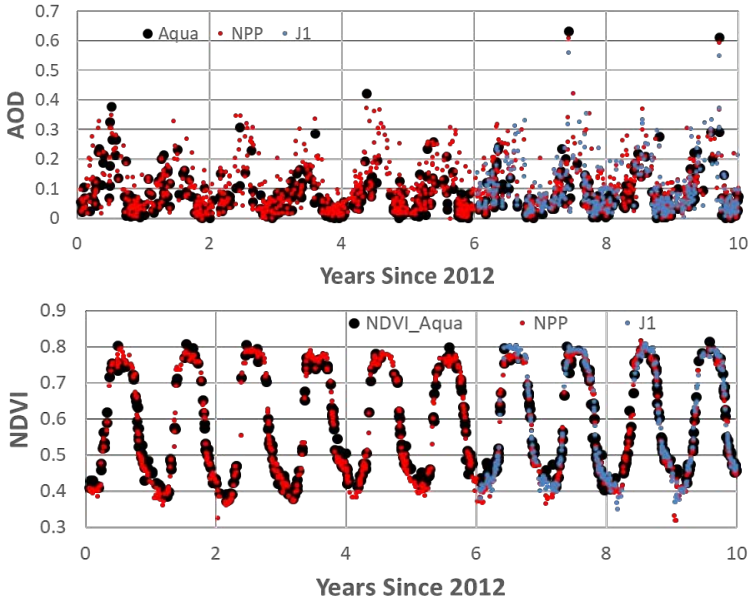
MAIAC AOD After X-Cal



VIIRS Cross-Calibration to MODIS Aqua

	Dome C, Deserts (DCC)			This Study		
	Xiong et al., 2000 (in %)			X-calibration Coefficients		
Band	(A-NPP)/NPP	(A-J1)/A	(NPP-J1)/J1	Aqua/NPP	Aqua/J1	NPP/J1
B8/M1	-	2.1-4.2	6.3-7.0 (1.0)	0.9738	1.0277	1.0554
B3/M2	-	5.0-5.3 (M2/B9)	4.7-6.1 (6.4)	0.9516	1.0137	1.0653
B3/M3	-	-	4.3-4.9	0.9818	1.0290	1.0481
B4/M4	-	2.4-3.2	3.4-5.2 (9.1)	0.9827	1.0367	1.0550
B1/M5	-	-	4.7-5.5 (3.1)	0.9780	1.0212	1.0442
B2/M7	-	0.6-2.8	2.8-3.5 (3.7)	0.9707	1.0083	1.0387
M8	-	-	2.2-3.3 (2.2)	-	-	1.0264
M10	-	-	1.5-5.2 (2.1)	-	-	1.0215
M11	-	-	0.8-4.1 (2.4)	-	-	1.0198
B1/I1	-	2.9-3.6	3.7-3.8 (6.1)	0.9917	1.0316	1.0402
B2/I2	-	0.9-2.7	3.1-3.6 (5.9)	0.9726	1.0131	1.0416

MAIAC: Appalachian_state



Xiong X, Angal A, Chang T, Chiang K, Lei N, Li Y, Sun J, Twedt K, Wu A. MODIS and VIIRS Calibration and Characterization in Support of Producing Long-Term High-Quality Data Products. Remote Sensing. 2020; 12(19):3167. https://doi.org/10.3390/rs12193167