Update on MODIS De-Trending and X-Calibration Analysis

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MODIS De-trending and X-calibration

1. MCST: Trending Moon (1 angle) and Earth Targets (EV views - ***Deserts***) to get changing RVS;

2. OBPG - Polarization Correction: use Aqua L3 retrievals (as true) to compute expected TOA radiances for Terra view geometry (over open **Ocean**);

   Based on that, compute M_{11}, m_{12}, m_{13};

   $$L_m/M_{11} = L_t + m_{12}*Q + m_{13}*U$$

   L_m: measured TOA radiance (Terra)

   L_t: expected TOA radiance (from L3 Aqua)

   Q, U : linear Stokes vector components, modeled from Rayleigh and glint

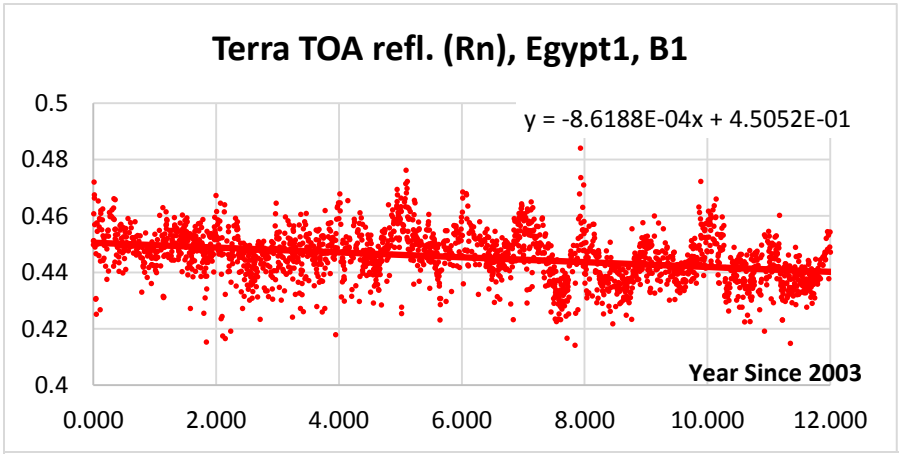
   M_{11}, m_{12}, m_{13} : fitted instrument characterization parameters (depend on band, MS, detector, scan angle)

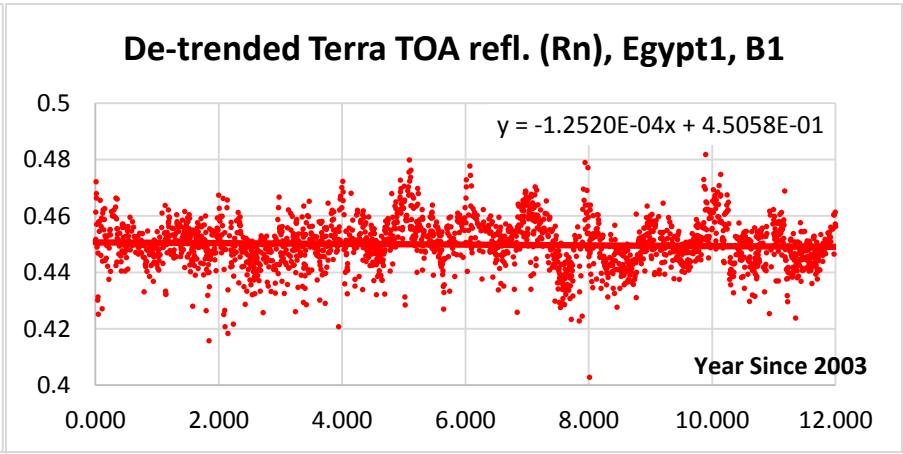
3. LWK: Apply PC and do residual de-trending and X-cal (gain adjustment).

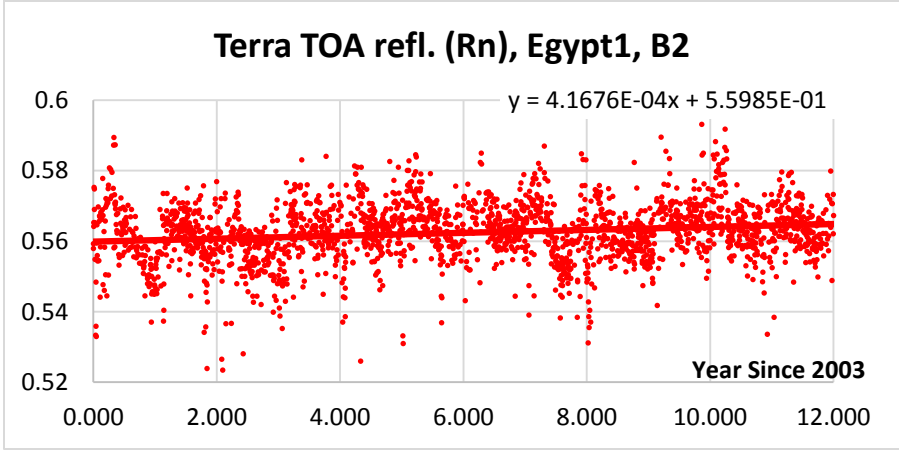
MODIS de-trending

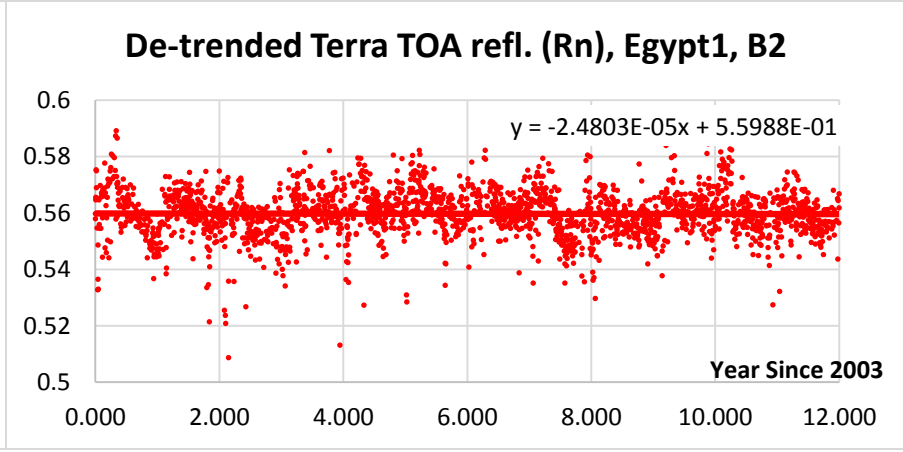
- New MCST RVS characterization for Aqua → new OBPG Terra Polarization Correction (PC) coefficients → MODAPS generated 50km L1B subsets for CEOS desert cal. sites;
- Method: a) run MAIAC retrievals (AOT, BRDF etc.); 2) compute TOA reflectance (R_n) for fixed geometry (VZA=0°, SZA=45°) and evaluate trends in both Terra and Aqua; 3) Apply de-trending and compute T-A X-calibration factor (gain correction for T)

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

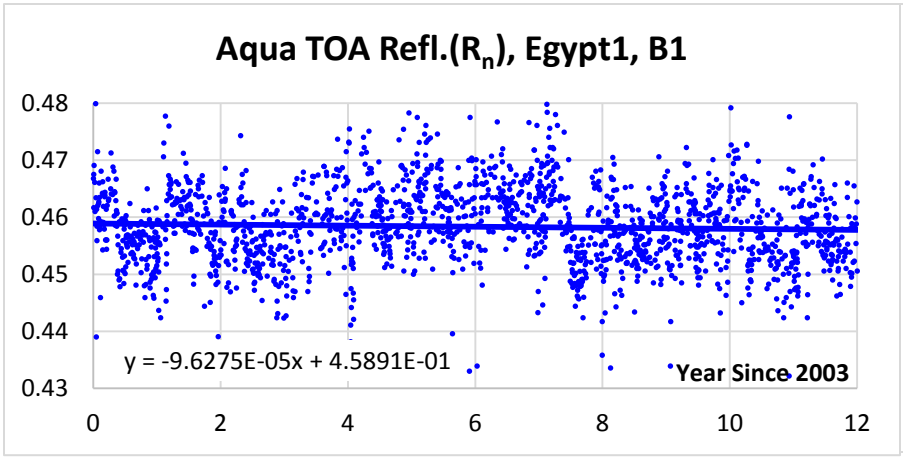


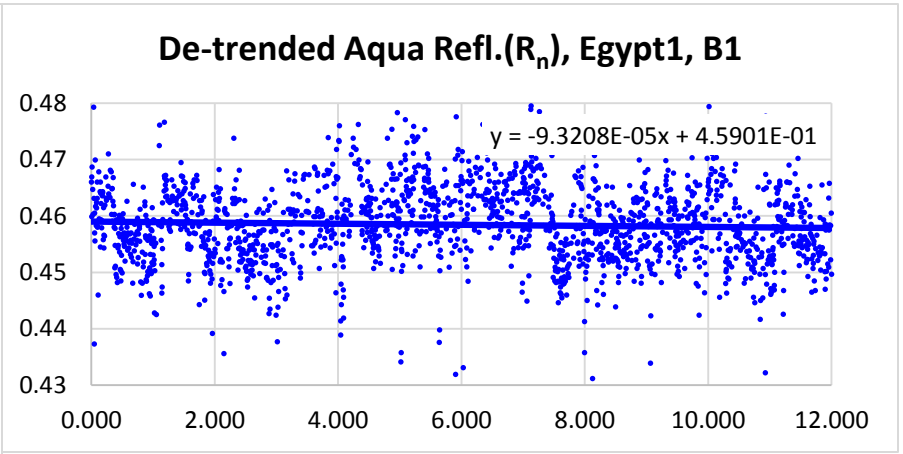


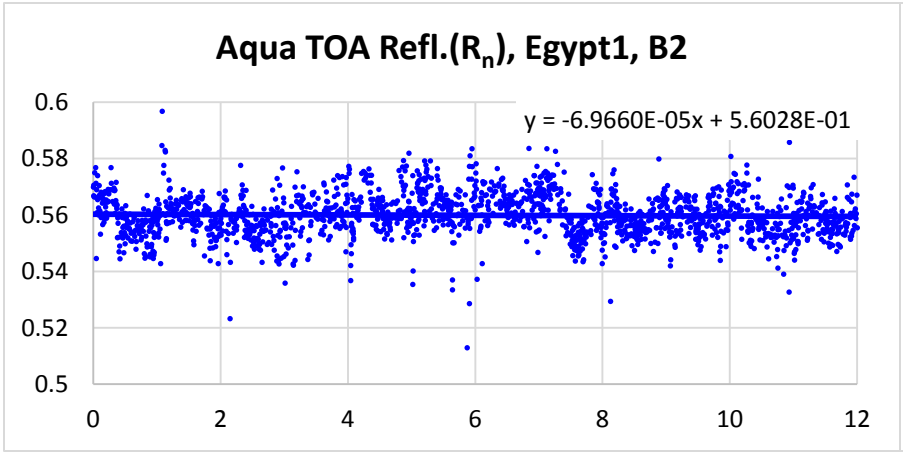


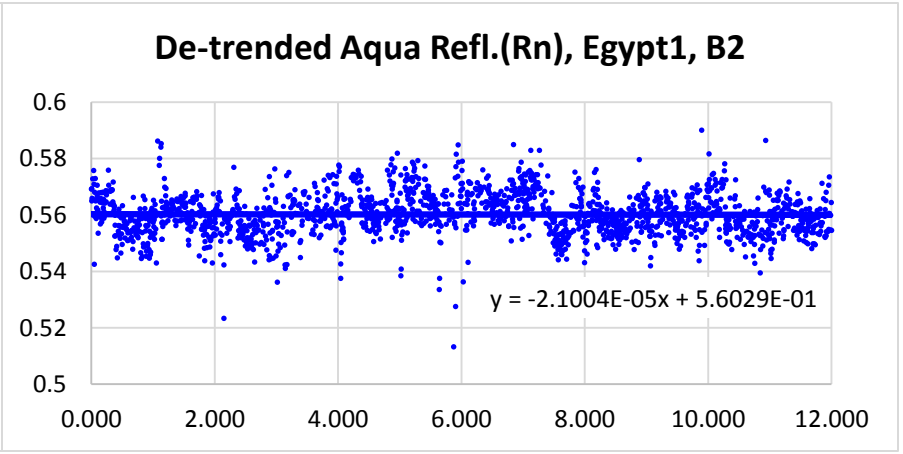


MODIS de-trending (cont.)



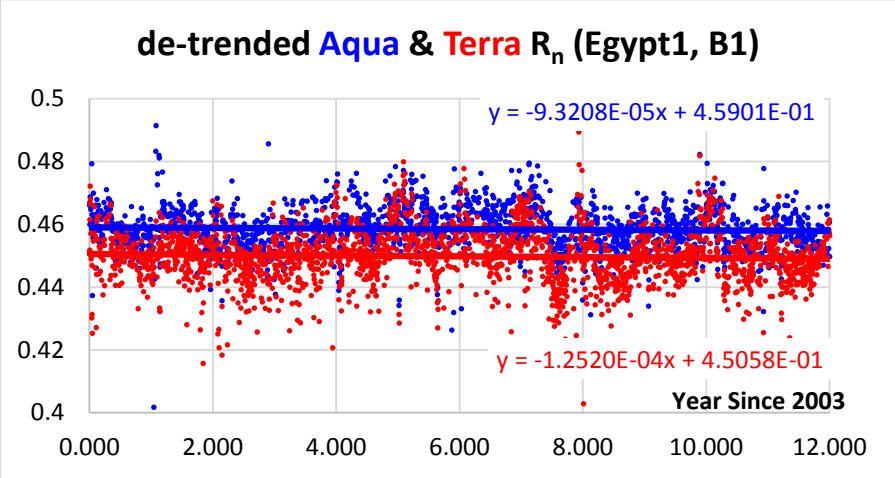


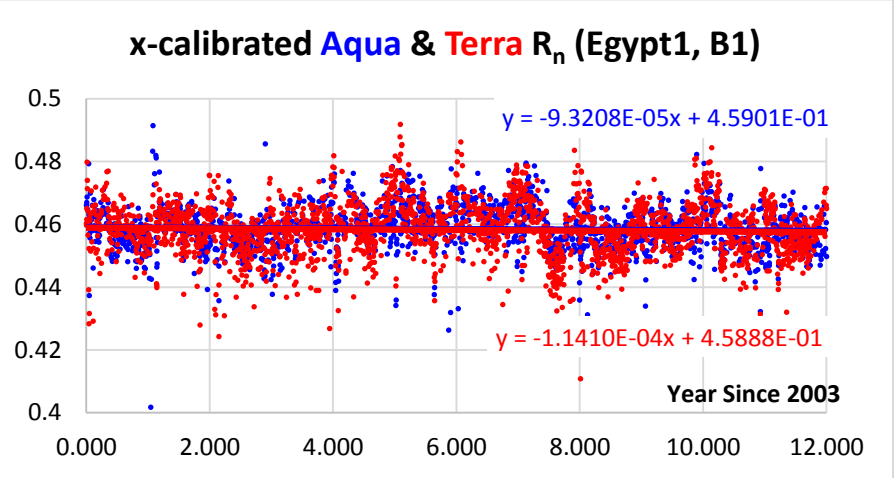


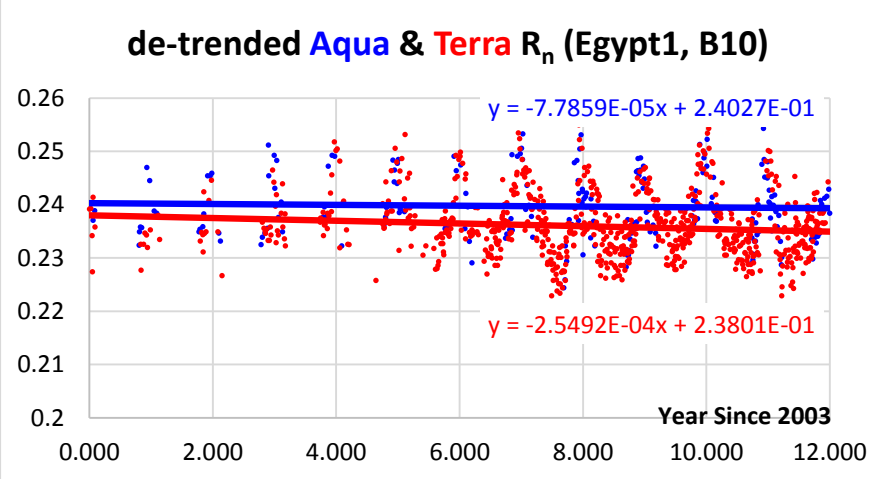


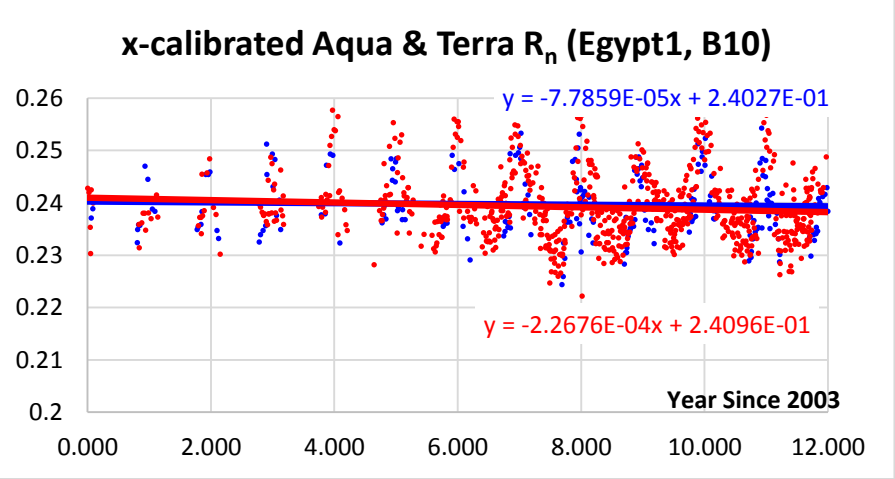
MODIS X-calibration

After MCST RVS de-trending for Aqua, we see trend reduction (a factor of 12 in B1 and a factor of 2 in B3) compared to our previous analysis.









Summary

Average trend/year/unit_refl.

	Δ_{Terra}	σ_{Terra}	Δ_{Aqua}	σ_{Aqua}
TOA_B01	-1.6884E-03	2.6114E-04	1.5848E-06	3.9377E-04
TOA_B02	7.7780E-04	2.4303E-04	-6.5120E-05	3.5583E-04
TOA_B03	-8.8922E-04	4.5314E-04	-3.1763E-04	2.8486E-04
TOA_B04	-5.6629E-04	3.2829E-04	-3.9831E-05	5.0202E-04
TOA_B05	1.9477E-04	3.3019E-04	4.5784E-06	3.3528E-04
TOA_B06	-3.9516E-04	3.0211E-04	-3.1194E-04	2.8191E-04
TOA_B07	2.0259E-04	2.4491E-04	-5.8419E-04	3.2705E-04
TOA_B08	-1.2627E-03	1.0018E-03	-5.5178E-04	1.0915E-04
TOA_B09	-3.9874E-04	5.2176E-04	1.3724E-04	2.1120E-04
TOA_B10	-7.2800E-04	8.2601E-04	-3.0632E-04	7.1498E-04

Average X-gain for Terra

	Average	Stdev
TOA_B01	1.018776	0.000949
TOA_B02	1.000523	0.001054
TOA_B03	0.989436	0.001268
TOA_B04	1.00109	0.001448
TOA_B05	0.98862	0.001855
TOA_B06	0.997128	0.000898
TOA_B07	0.999368	0.000373
TOA_B08	1.003774	0.000948
TOA_B09	1.0014	0.001488
TOA_B10	1.014141	0.002077

Conclusions

- Largest residual trends in Terra B1 and B8 (>0.01 per decade);
- Largest Terra gain adjustment in B1 (~2%);
- Expanded analysis and added B5-B7 and B9-B10 (unsaturated).