Modifications to MODIS Aqua ocean color bands calibration for 2010 OBPG reprocessing

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1/25/10

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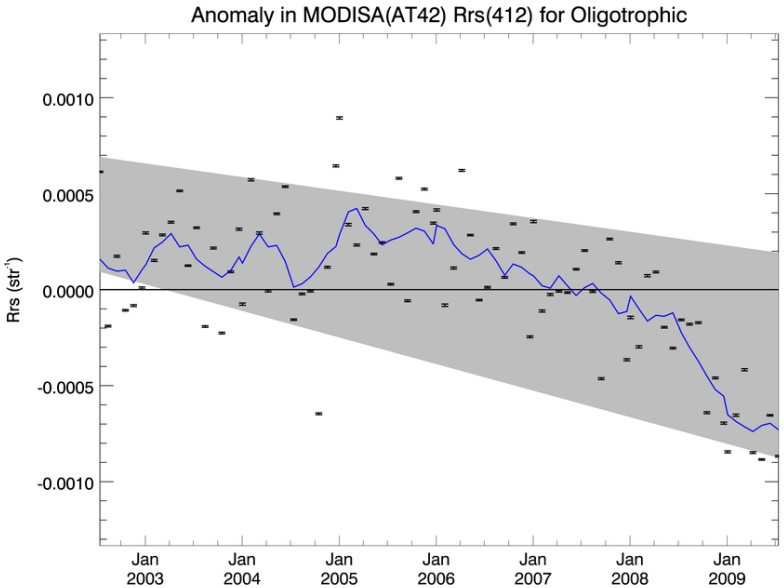
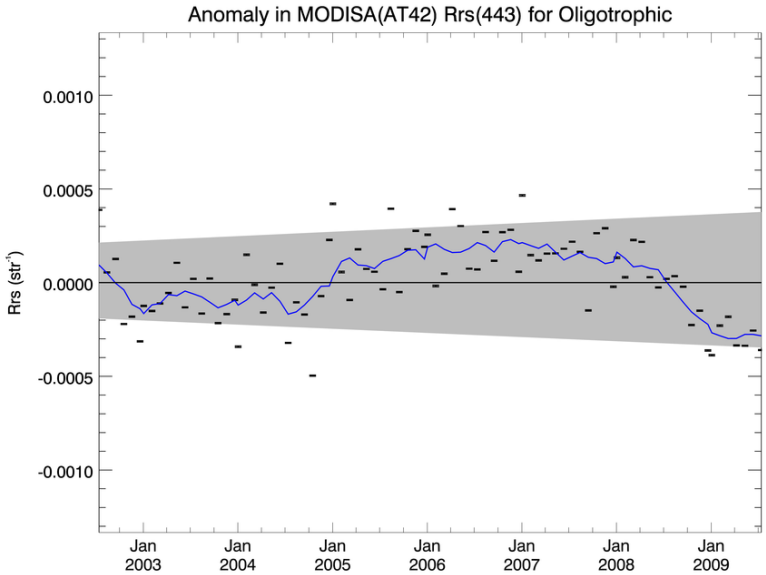
MODIS Calibration Workshop 2010, Greenbelt, MD

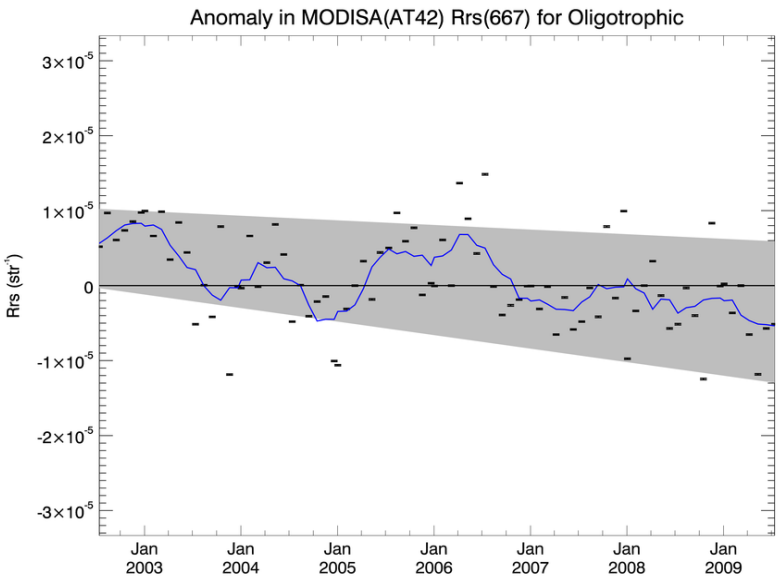
Methodology:

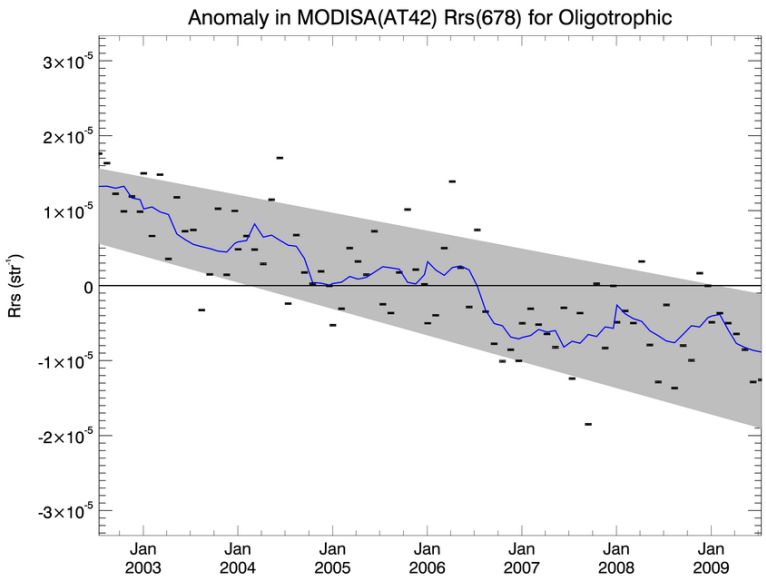
- Baseline: MCST lunar and SD trending (coll. 6)
- New MCST lunar analysis: time dependent NIR RVS
- MODIS Aqua crosscalibrated to SeaWiFS (as for Terra in Kwiatkowska et al., Applied Optics, 2008)
- Approach: Use SeaWiFS L3 nLw, bring to TOA, adjust MODIS cal. and pol., for every month of the mission (4-day L3)
- Verify with analysis using only MODIS Aqua data: temporal trends (seasonal cycle removed) and ratio of L2/L3 versus scan angle

Temporal issues: 412nm and red bands

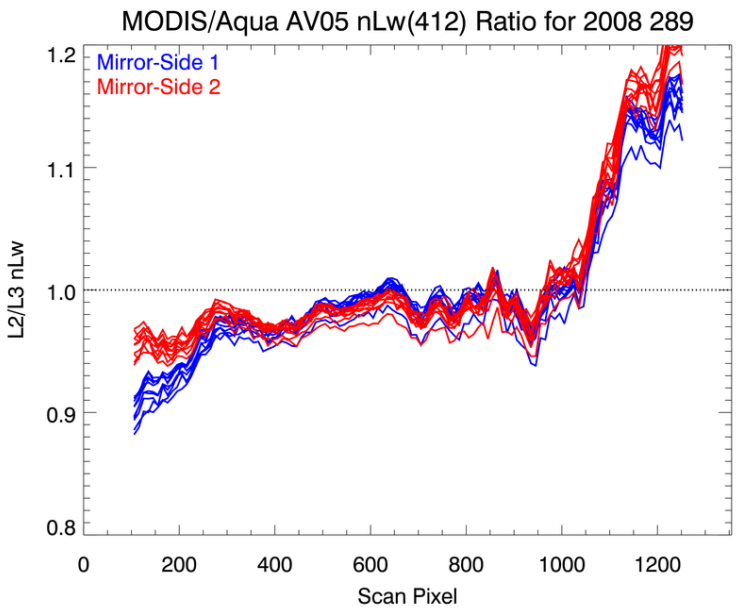


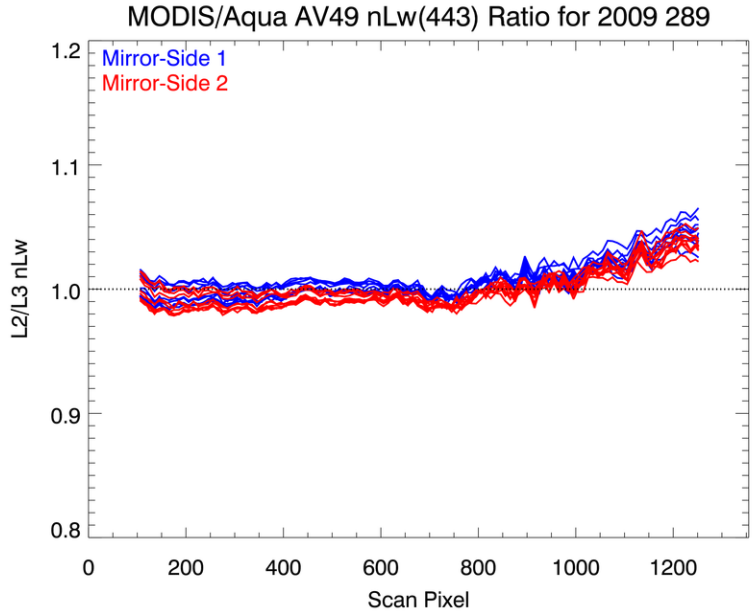


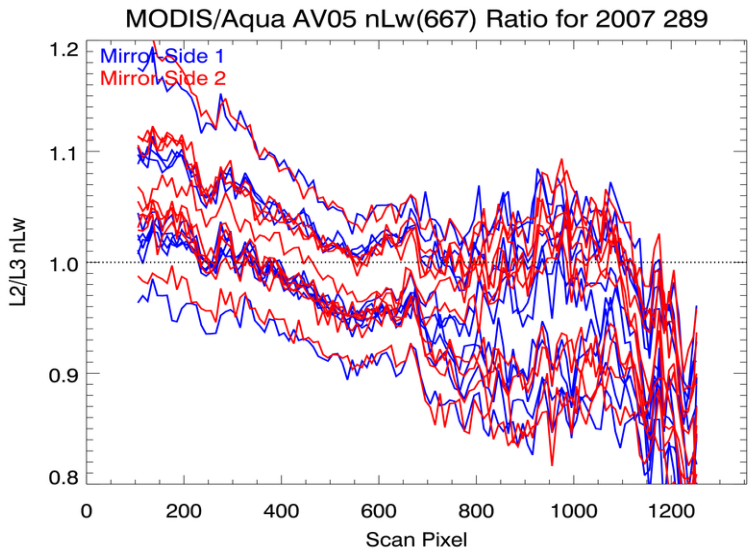


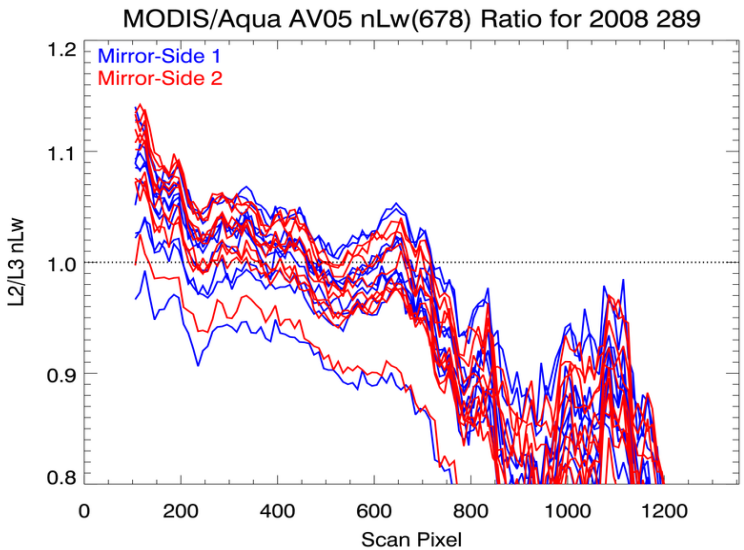


RVS issues: 412nm, red bands



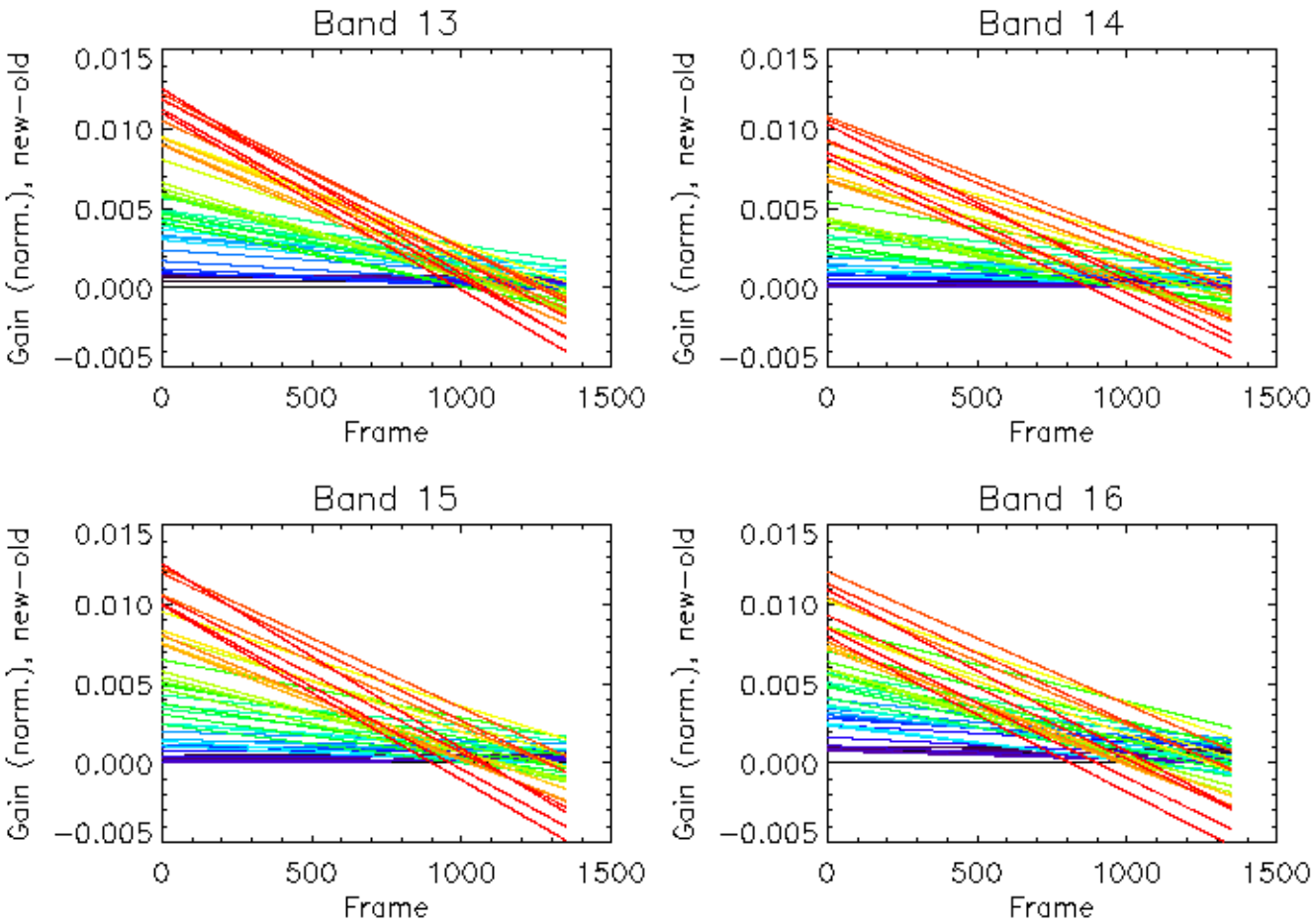




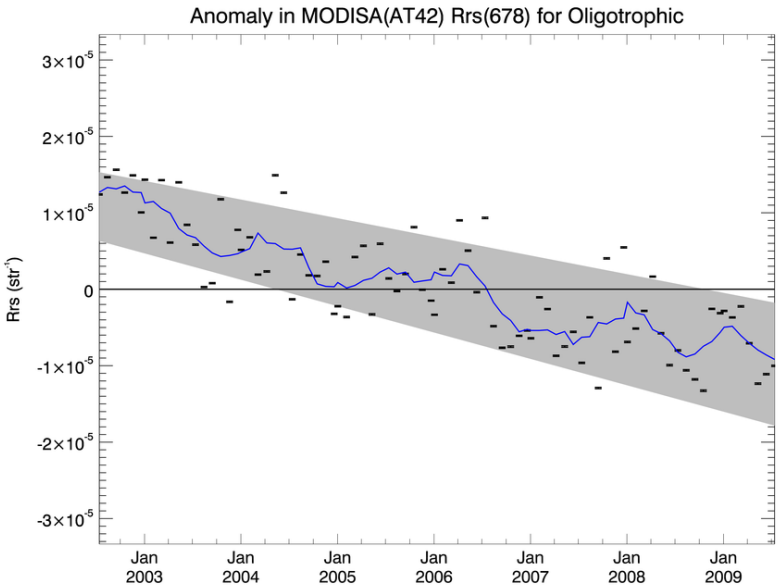


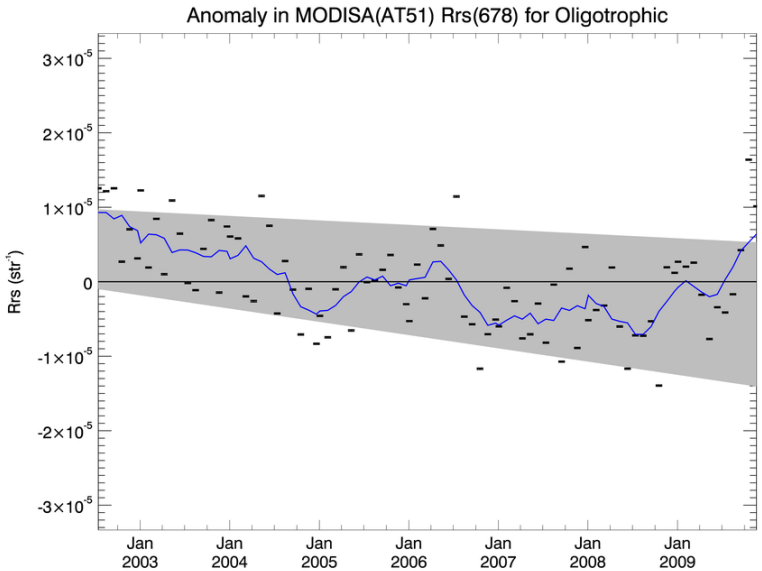
New lunar trending of bands 13-16 (667-869nm)

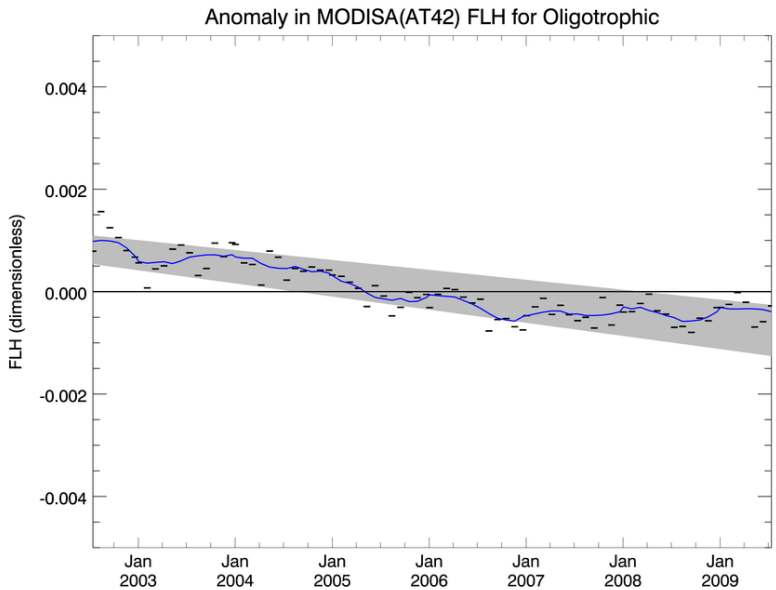
Comparison of collection 5 LUT to coll. 6:

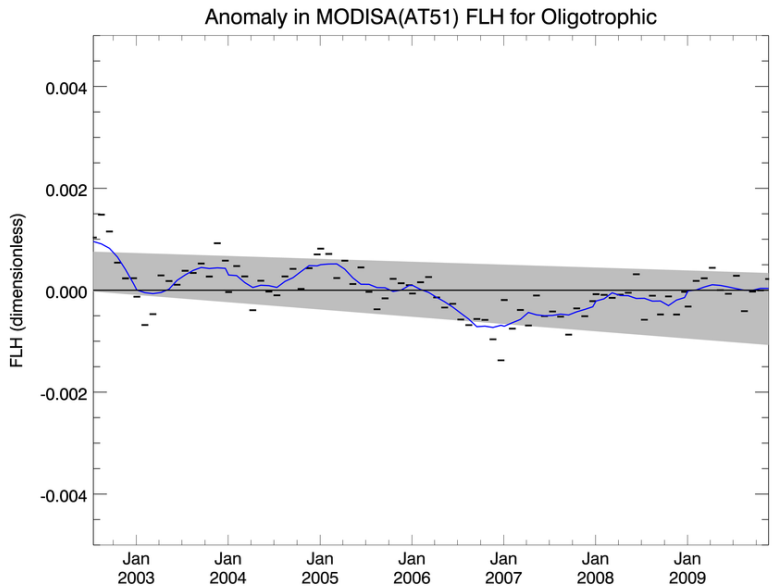


Temporal issue resolved: 678nm / FLH

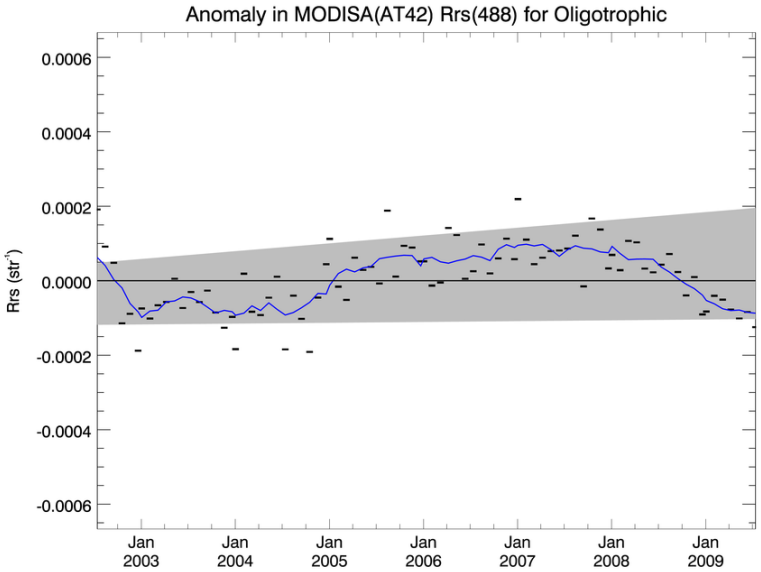


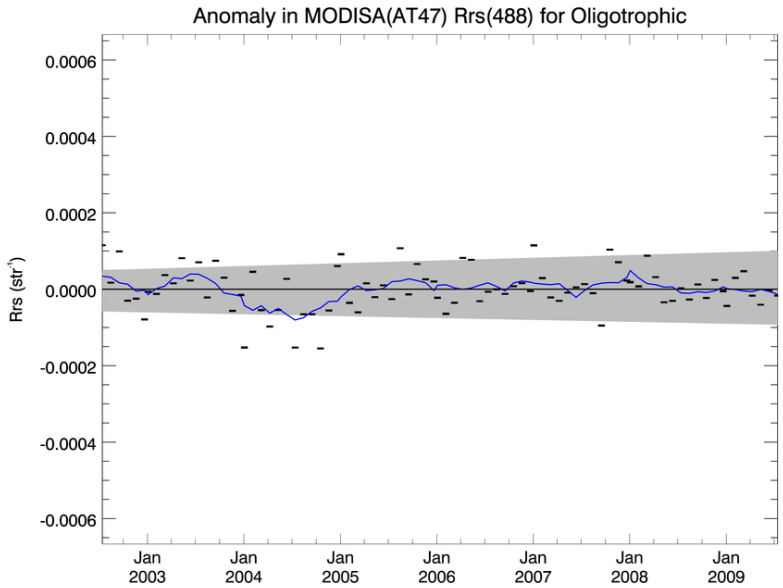


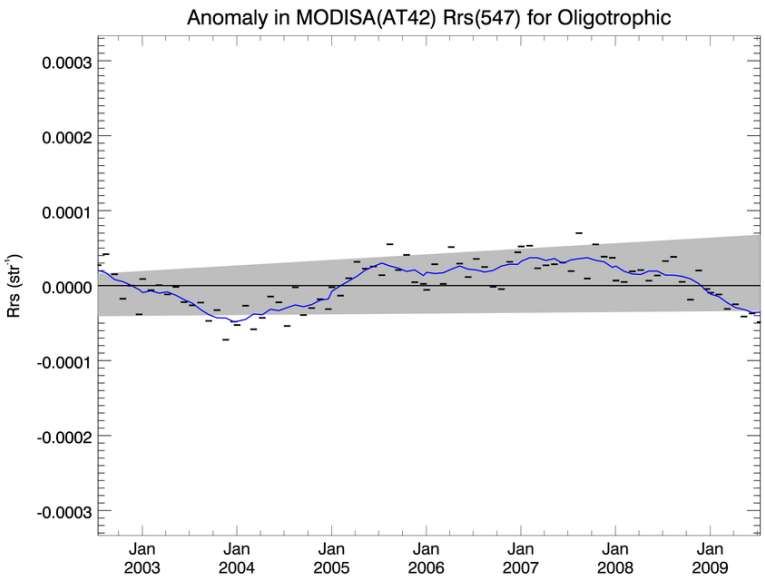


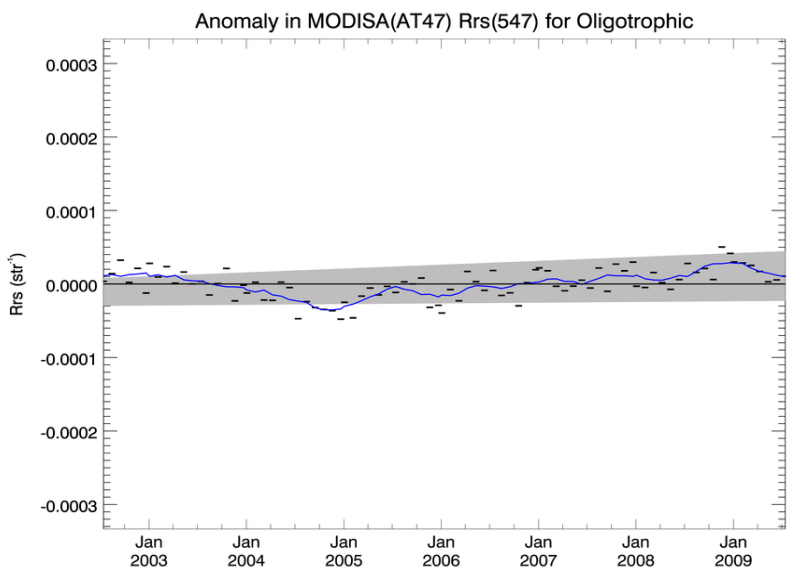


Reduced temporal variation for 488-547nm

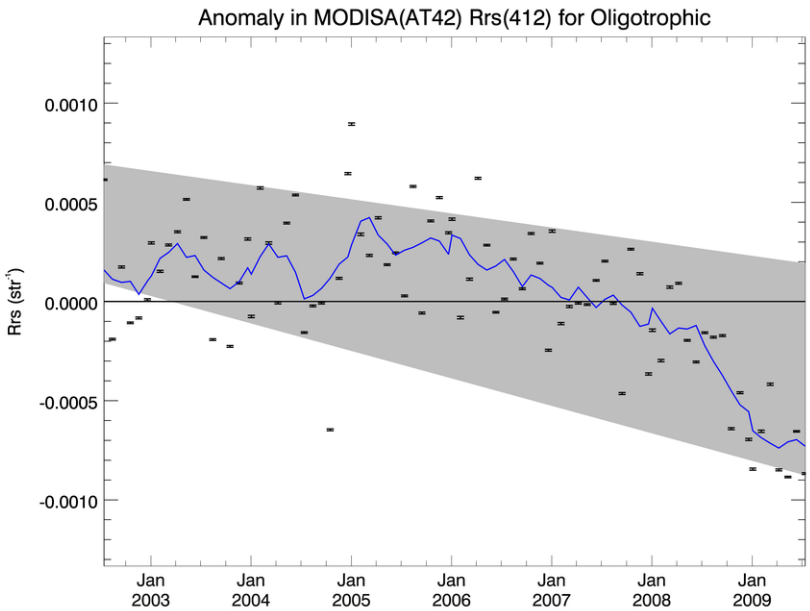


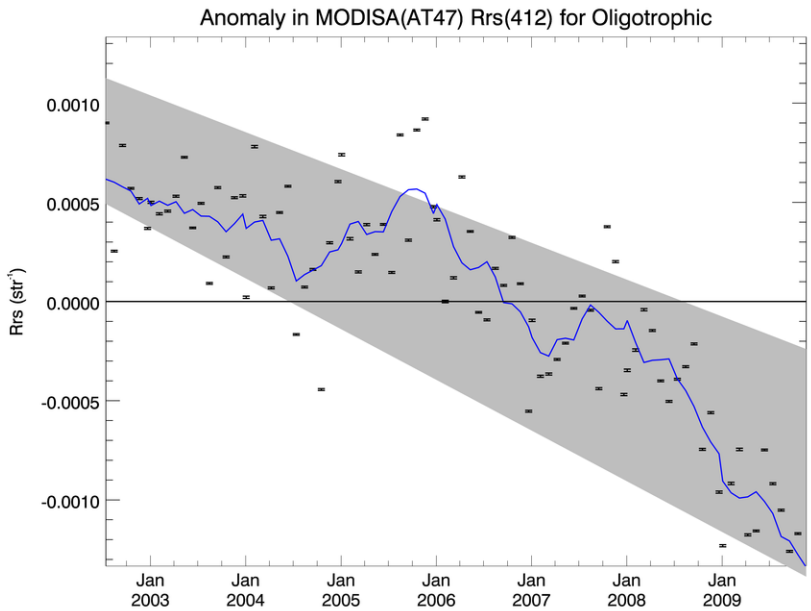


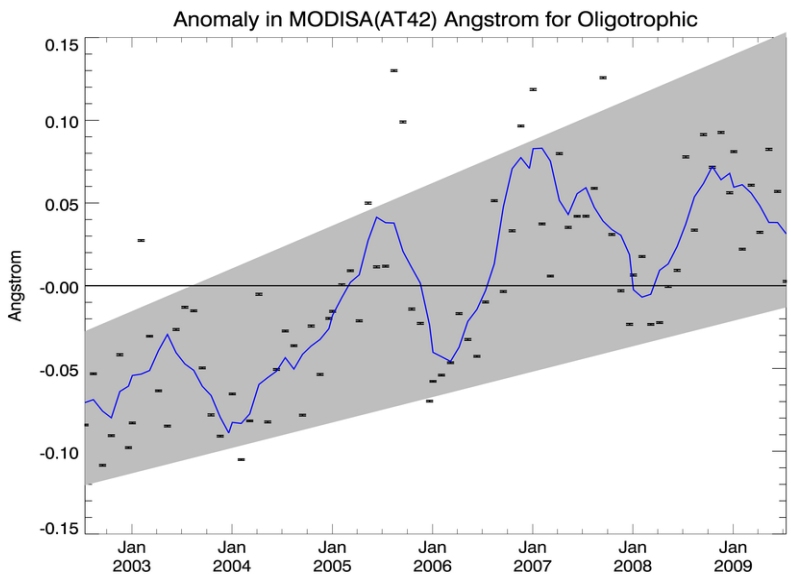


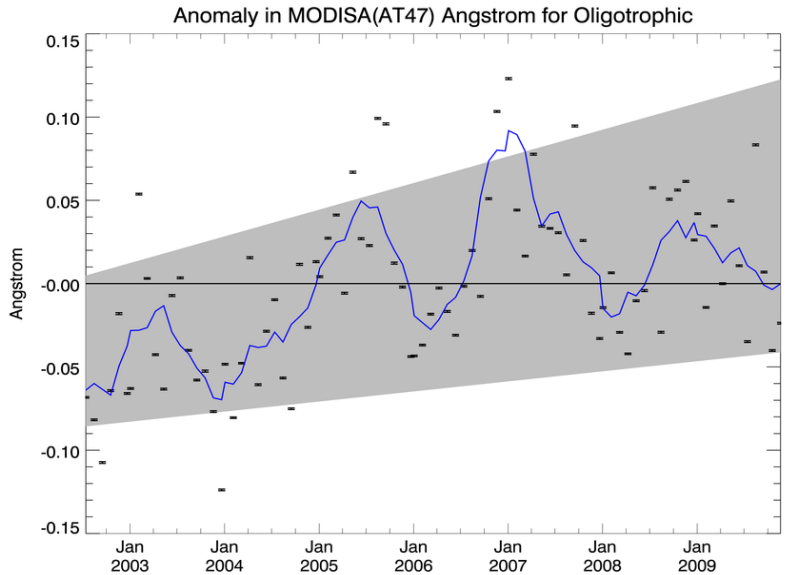


Increased trend in 412nm, angstrom improved:









Crosscalibration approach:

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

L_m: measured TOA radiance (MODIS)

L_t: true TOA radiance (from SeaWiFS)

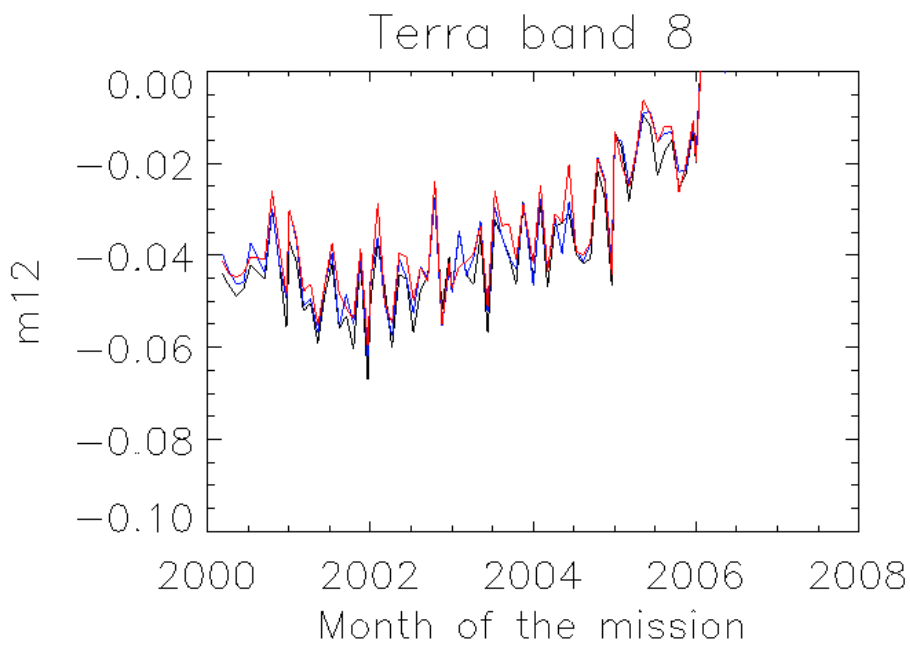
Q, U : linear Stokes vector components, modeled from Rayleigh and glint

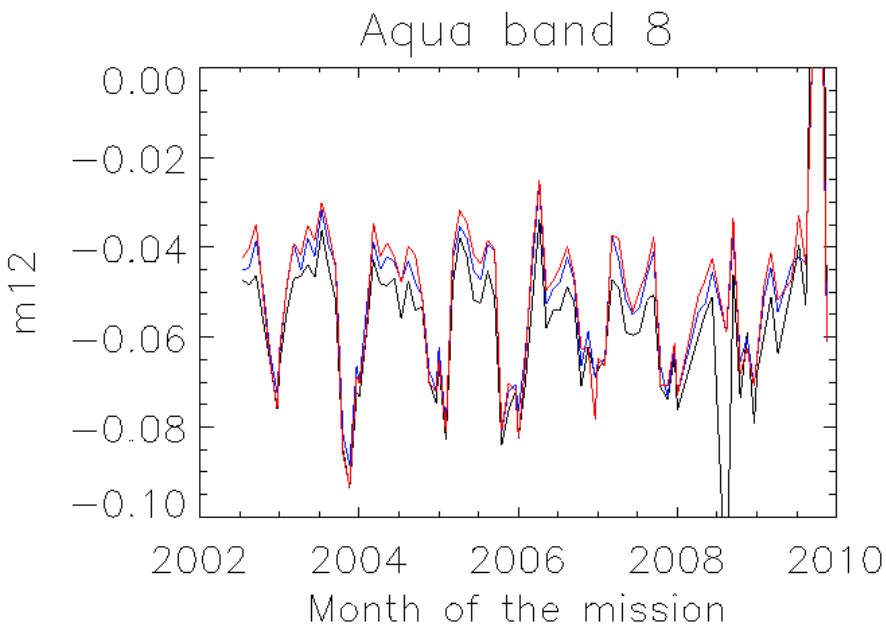
M_{11}, m_{12}, m_{13} : fitted instrument characterization parameters (depend on band, MS, detector, scan angle)

Crosscalibration results: Polarization (temporal)

- Larger seasonal cycle than in MODIS Terra
- No trend in polarization coefficient m12 until 2008, not clear if trend afterwards

Band 8: 412nm



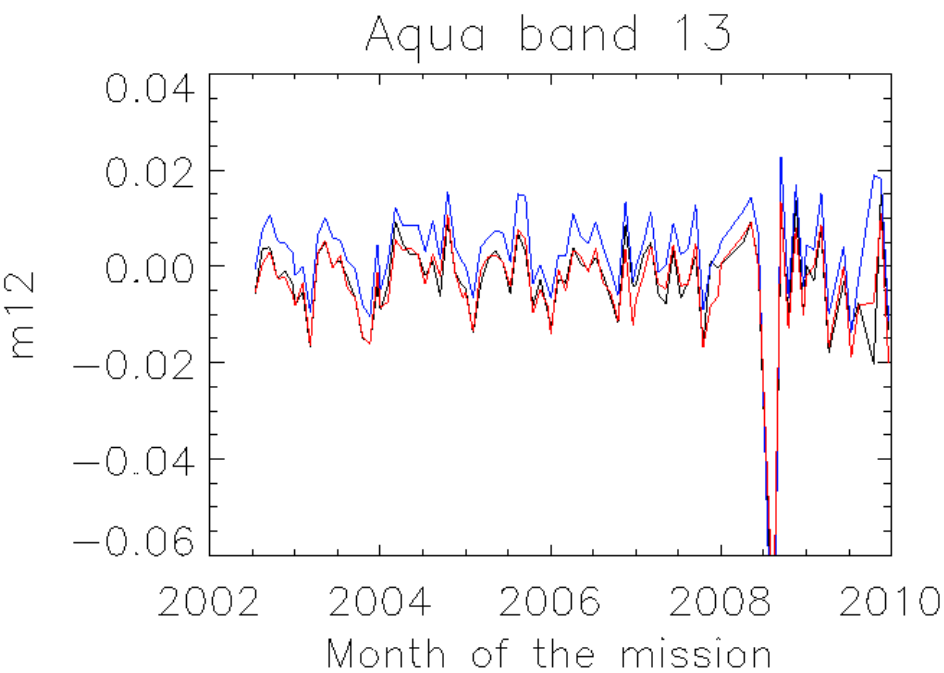


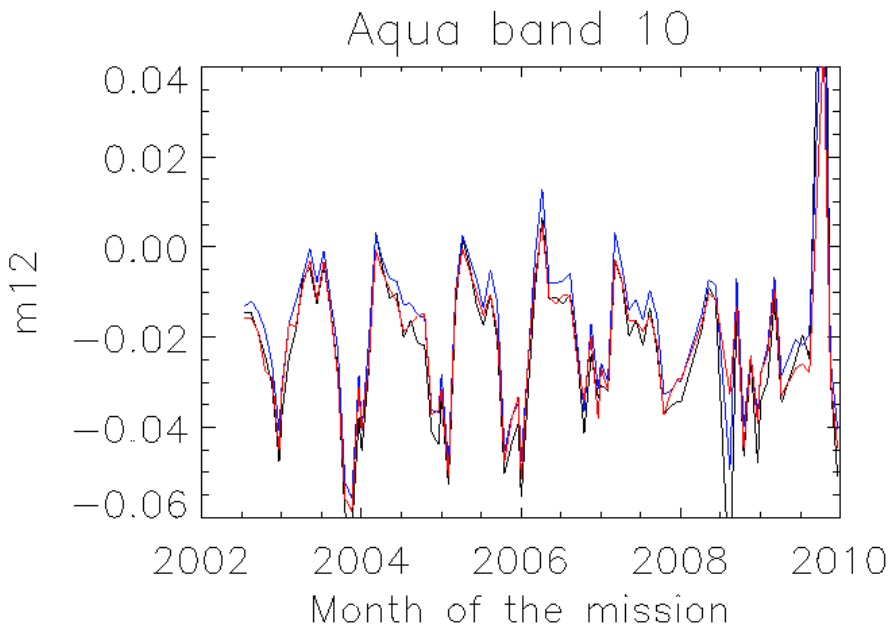
Black, blue, red: detectors 1,5,10, MS 1
View angle: nadir

Crosscalibration results: Polarization (temporal)

- Cycle in m12 decreases with wavelength
- All bands stable over time

Band 10: 488nm
Band 13: 667nm

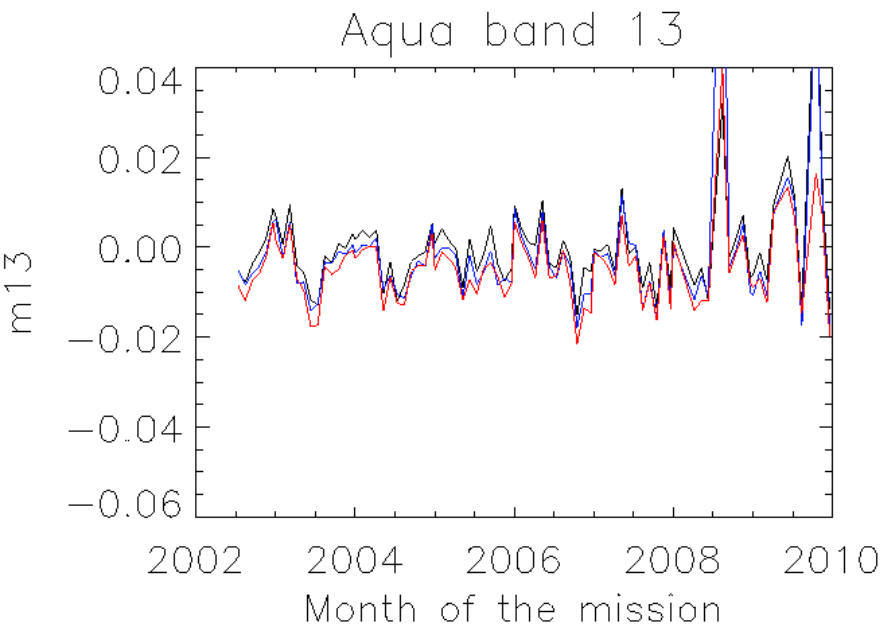


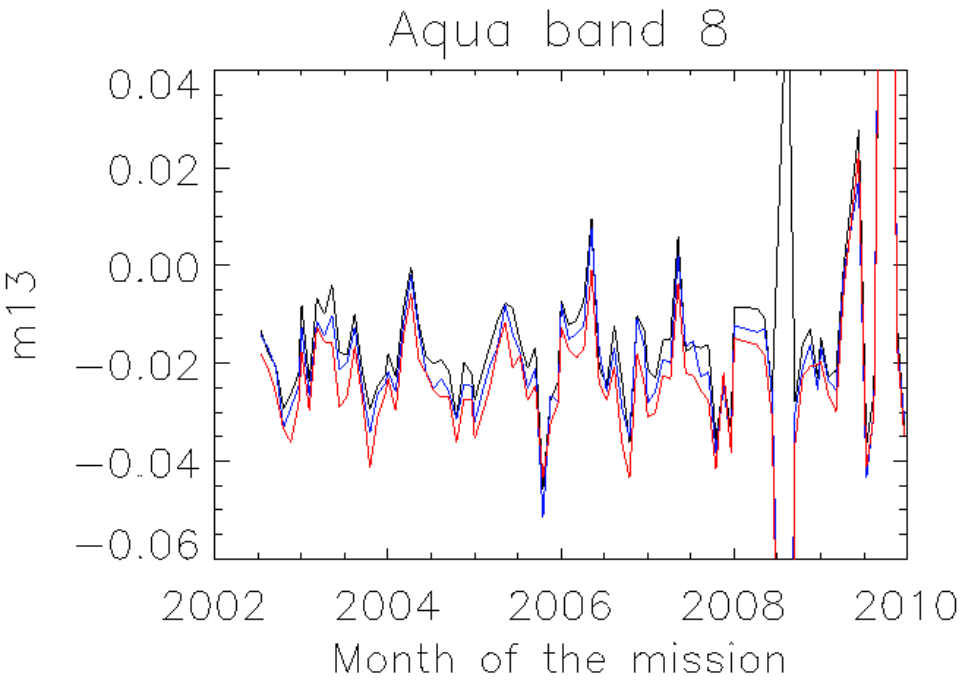


Crosscalibration results: Polarization (temporal)

- Variability in m13 similar as in Terra
- All bands stable over time, prelaunch values used

Band 8: 412nm
Band 13: 667nm

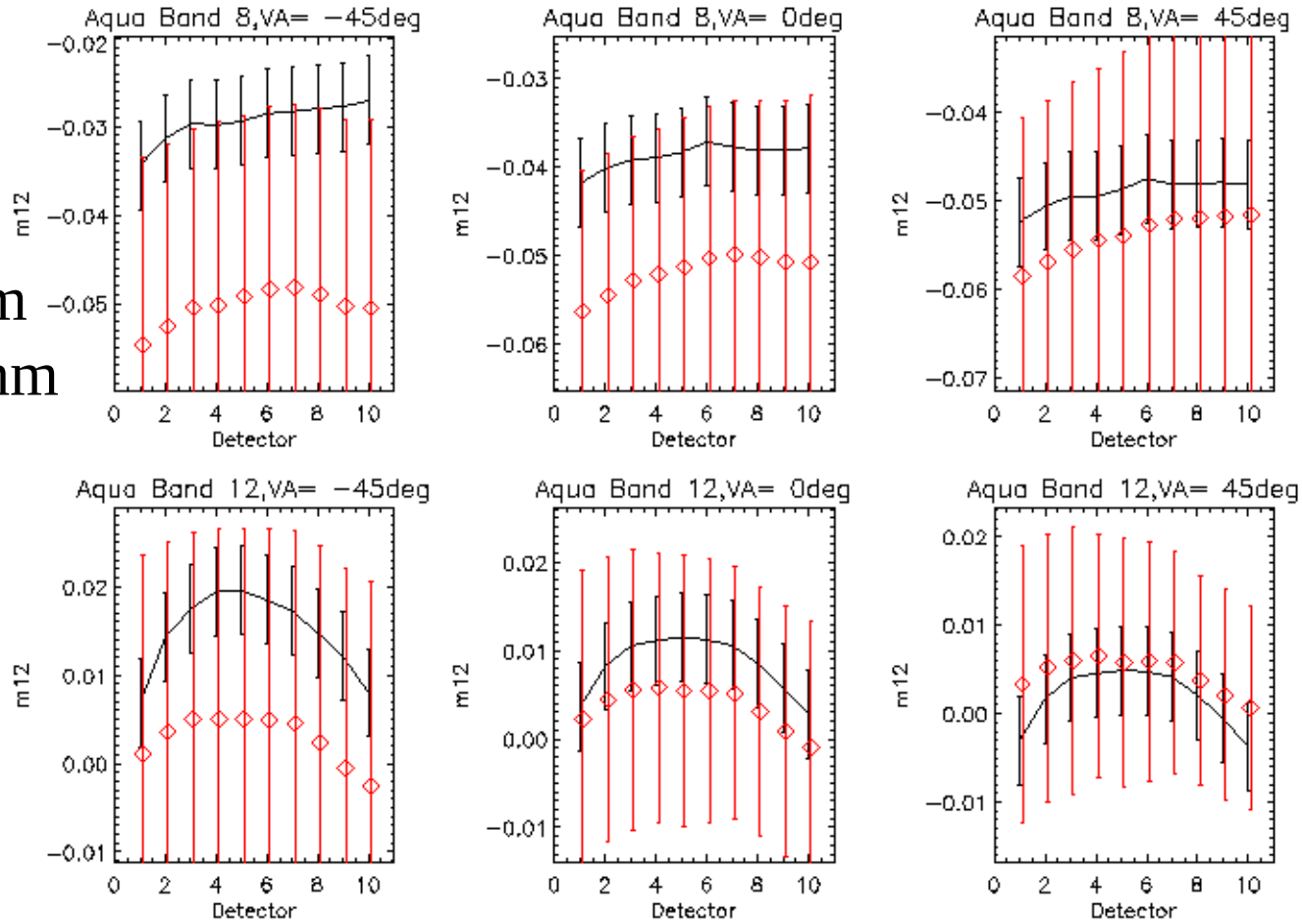




Crosscalibration results: Polarization (detectors)

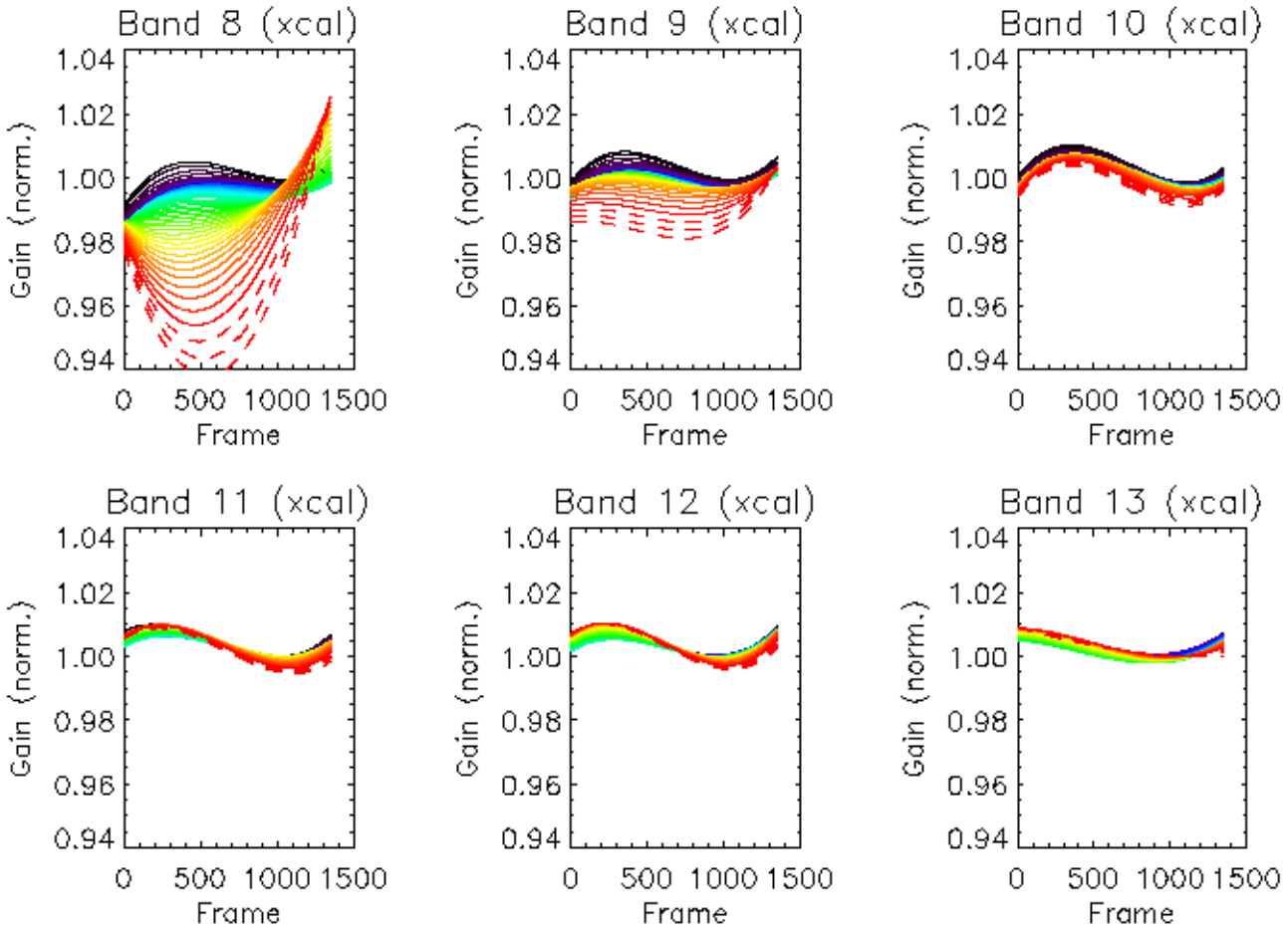
-Crosscalibration results confirm detector trend from prelaunch measurements (not used before)
- Absolute offset at BOS (low TOA deg. of pol.)

Band 8: 412nm
Band 12: 547nm

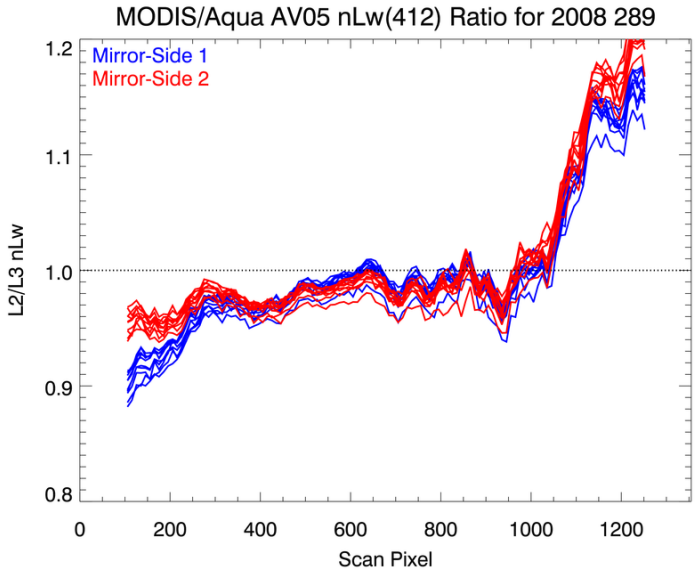


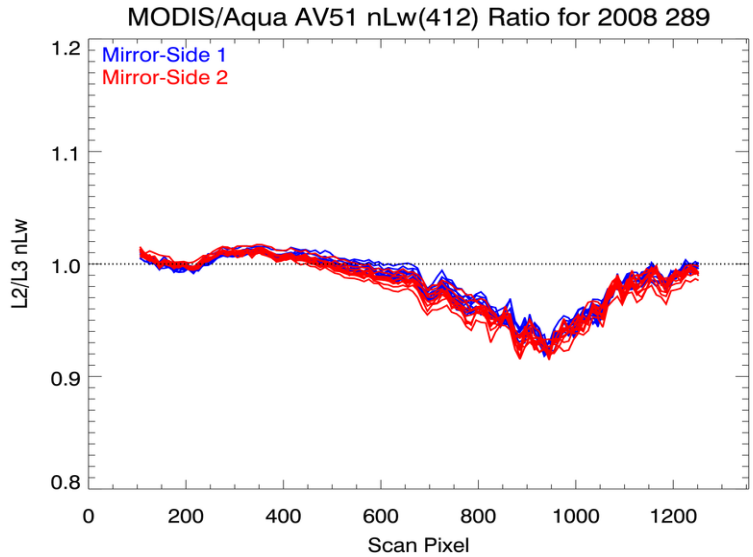
Crosscalibration results: Calibration (m1 and RVS)

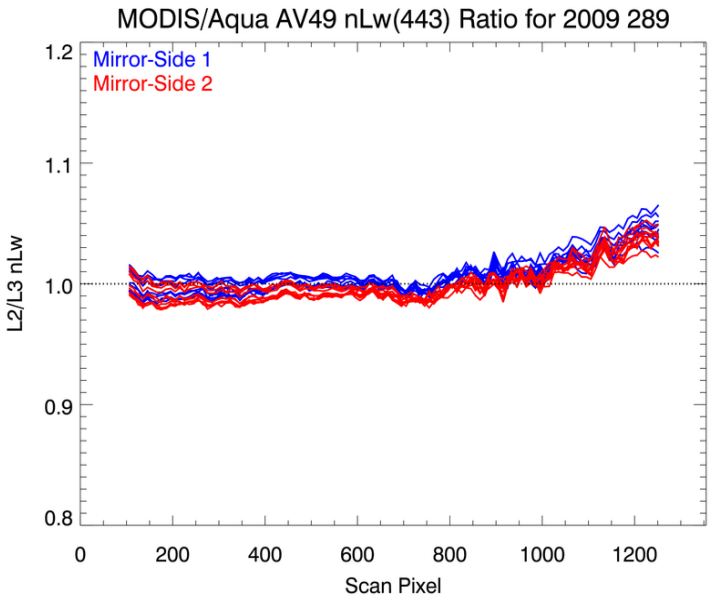
- Implementation for 2010 reprocessing: Temporal correction for 412-443nm, constant correction for 488-678nm

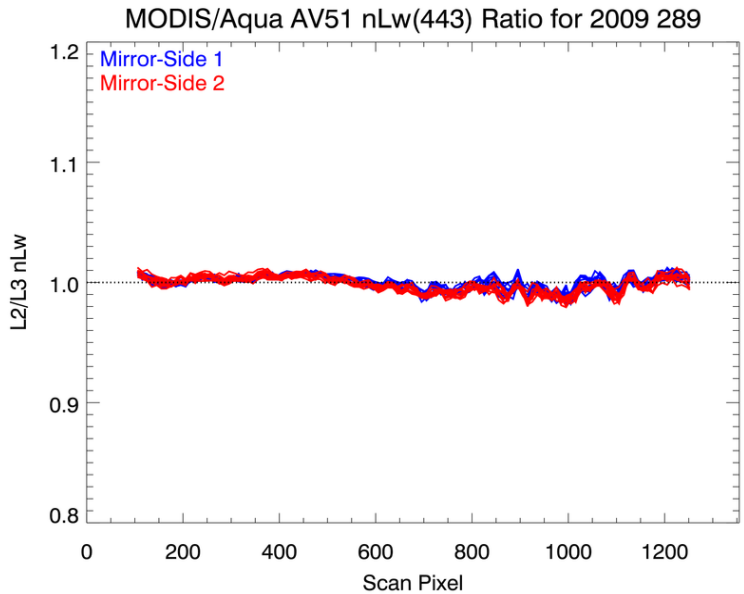


RVS issues resolved: 412nm, 443nm

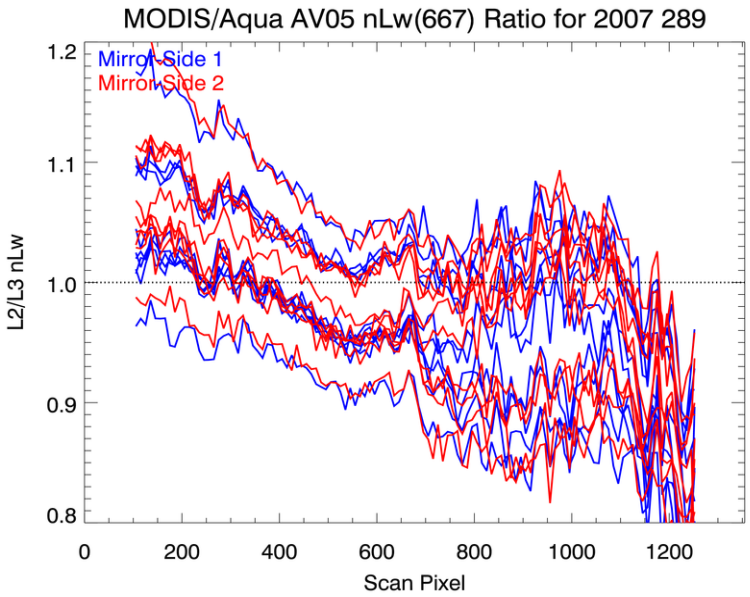


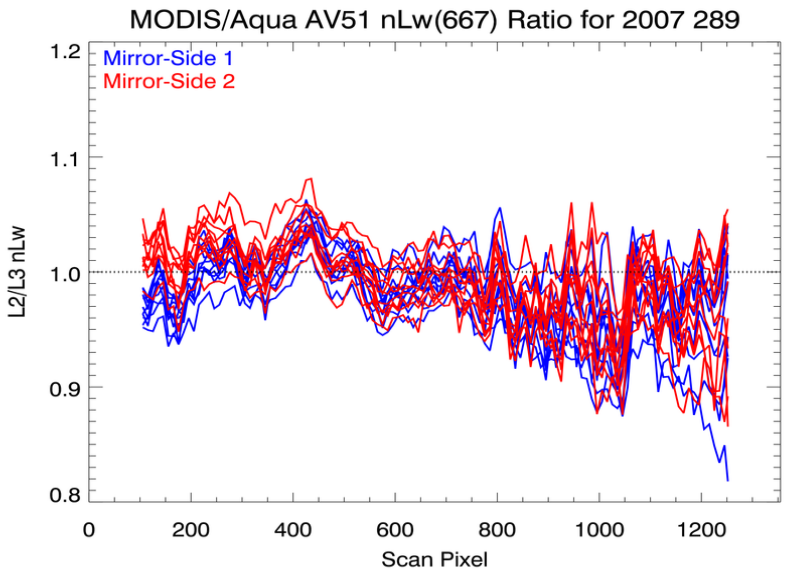


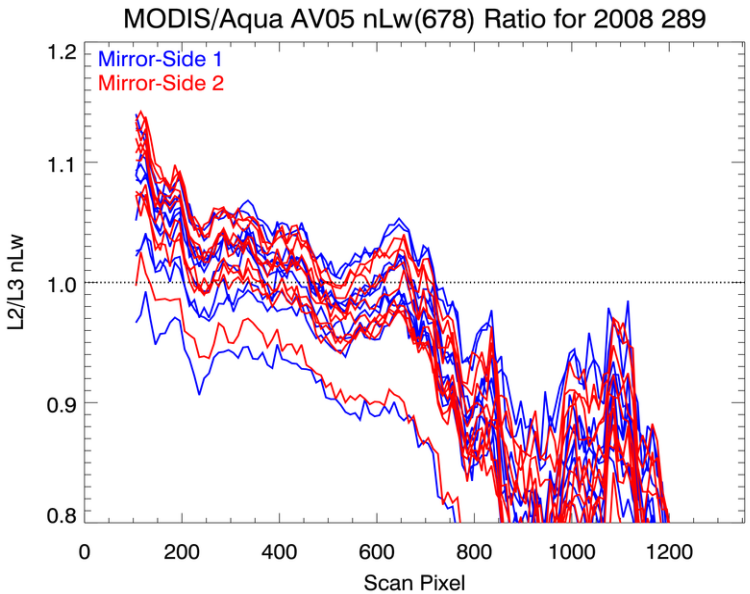


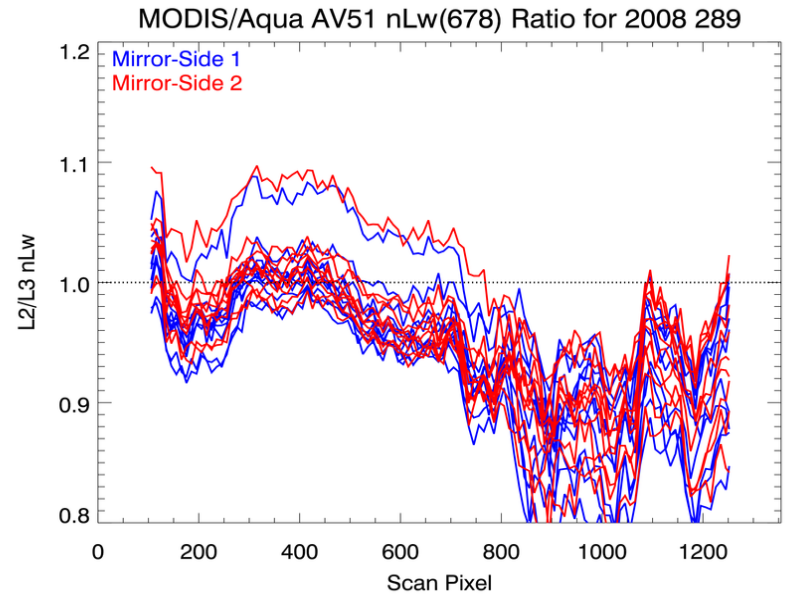


RVS issues resolved: red bands (not EOM)

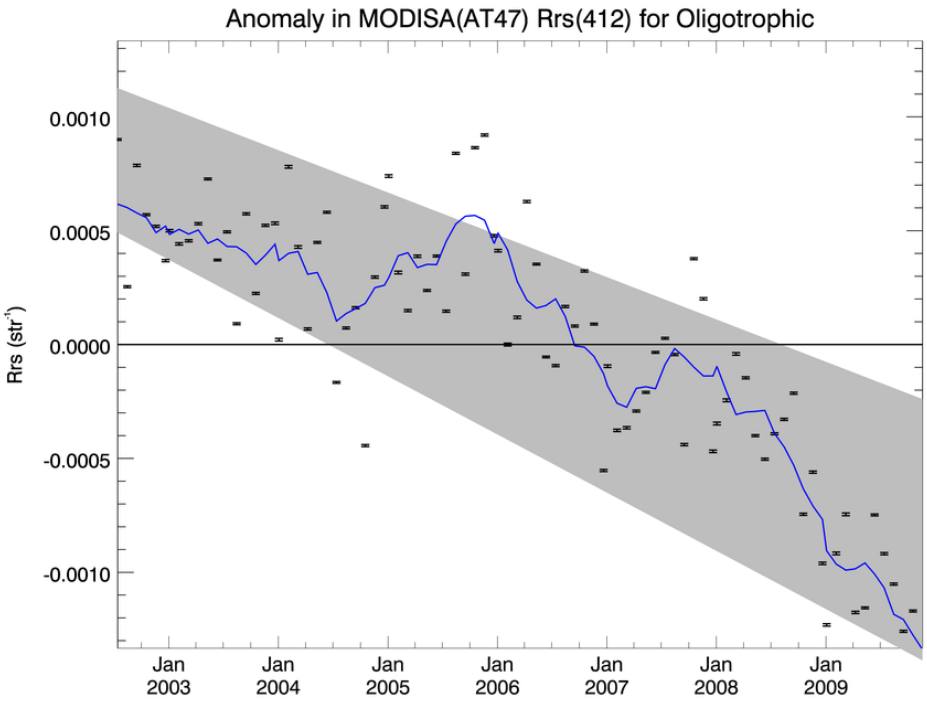


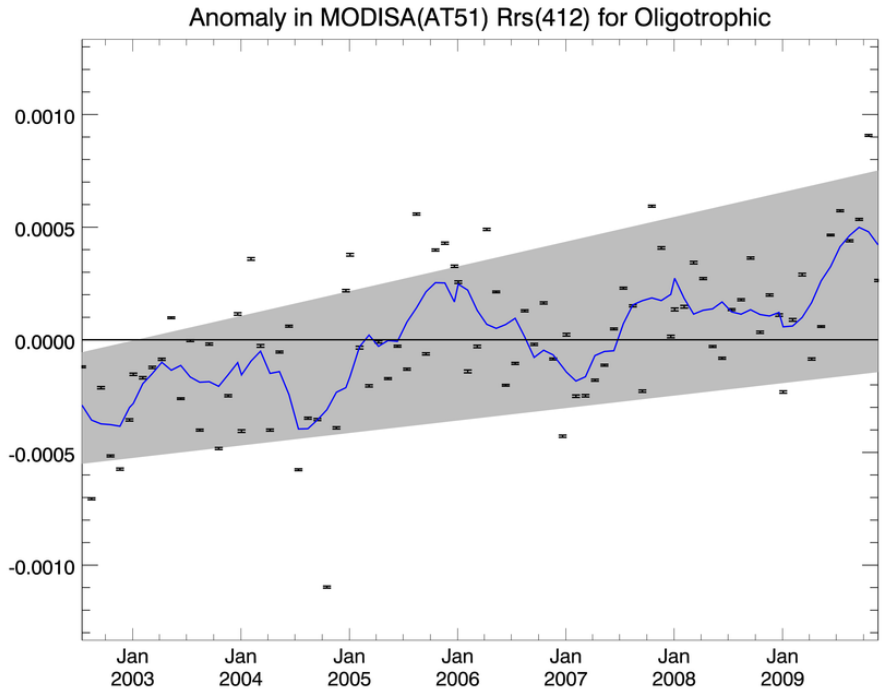




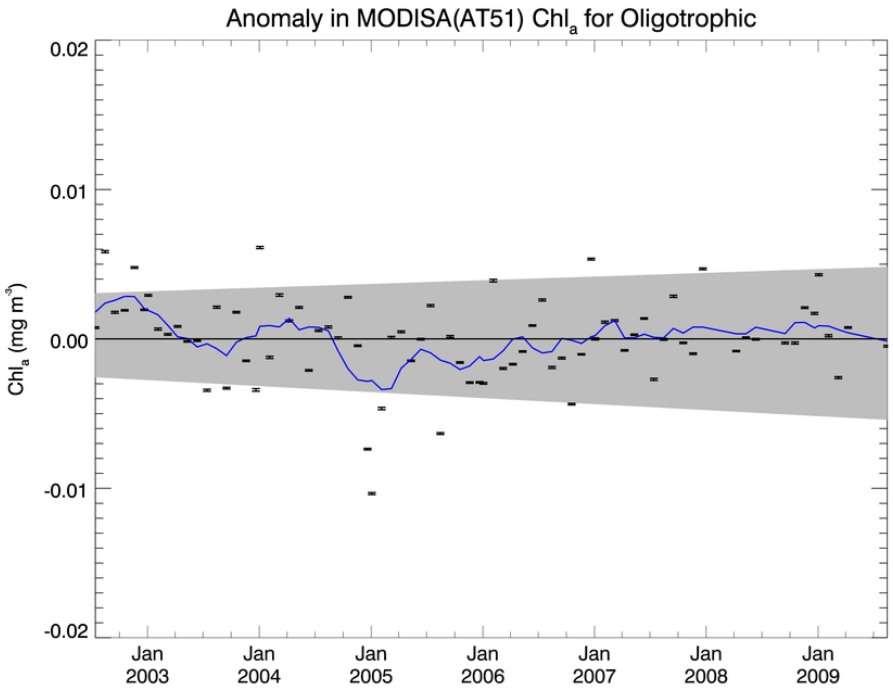


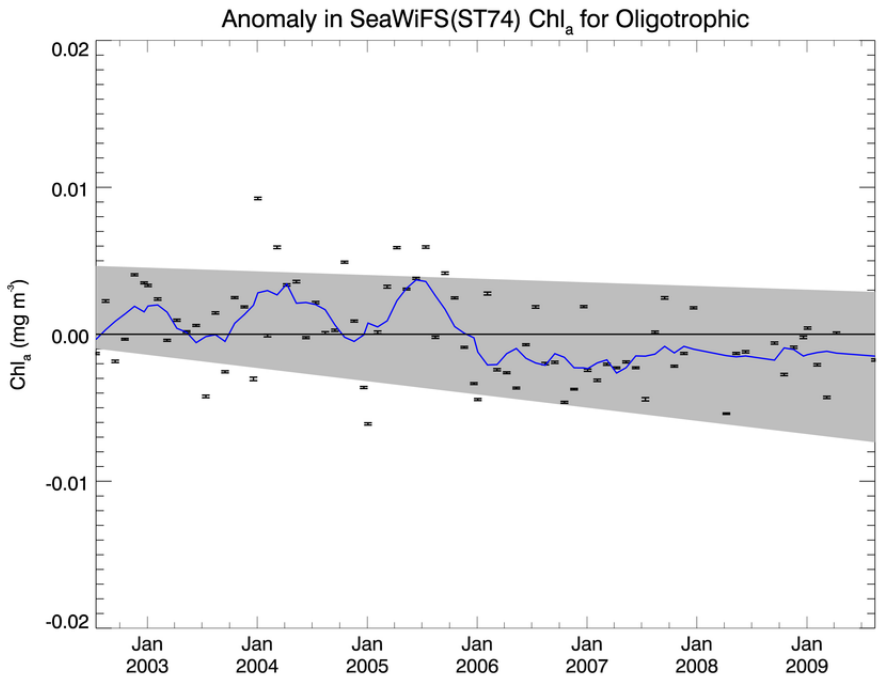
Temporal issue resolved: 412nm





Chlorophyll trends: similar to SeaWiFS





Summary

- Principal changes for MODIS Aqua calibration and characterization:
  - New temporal NIR scan angle dependence (MCST)
  - New temporal trends for 412-443nm (xcal)
  - New scan angle dependence for 488nm-678nm (xcal, no time dependence)
  - New detector dependence of polarization sensitivity (prelaunch)
- Resulting improvements to ocean color products:
  - FLH stable over mission in olig.
  - Rrs 412nm stable over mission, variability reduced for remaining bands
  - Large scan dependence at EOM removed for 412nm
  - Minor scan angle dependence removed for 443-547nm
  - Large scan angle dependence reduced for 667-678nm, but still present at EOM

Backup