Corrections to the calibration of MODIS Terra land bands derived from MODIS Aqua L3 data

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Calibration Breakout

Ocean Biology Processing Group:

- NASA Code 616, Ocean Sciences Research, Hydrospheric and Biospheric Sciences Research, Goddard Space Flight Center
- Responsible for producing Ocean Color (OC) products at NASA (CZCS, SeaWiFS, MODIS Aqua and Terra, MERIS, etc.)
- Website: oceancolor.gsfc.nasa.gov

Overview:

- OBPG crosscalibration method (using L3 OC products as truth)
- MCST C6 approach II is baseline for MODISA, then xcal to itself
- MODIST uses MODISA as truth, xcal derives gain and polarization corrections
- We recently improved the code to work for land bands, so far only applied to MODIST
- Gain and polarization corrections for 469nm band are similar to those for 443nm
- 555nm and 645nm have gain corrections of up to 2% (end of scan) and insignificant polarization corrections

How do we get ‘true’ TOA radiance ?

air aerosol whitecap glint water gas

$$L_t(\lambda) = [\, L_r(\lambda) + L^a(\lambda) + tL_f(\lambda) + TL_g(\lambda) + t_d(\lambda)L^w(\lambda)\,] \cdot t_g(\lambda)$$

from MODIST NIR
assumes MCST NIR band characterization

$\lambda' \rightarrow \lambda$
fit based on bio-optical models
(not needed for MODIST/MODISA)

$L^{wn}(\lambda')$

MODISA
7-day mean

Crosscalibration coefficients:

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

L_m: measured TOA radiance (MODIST)

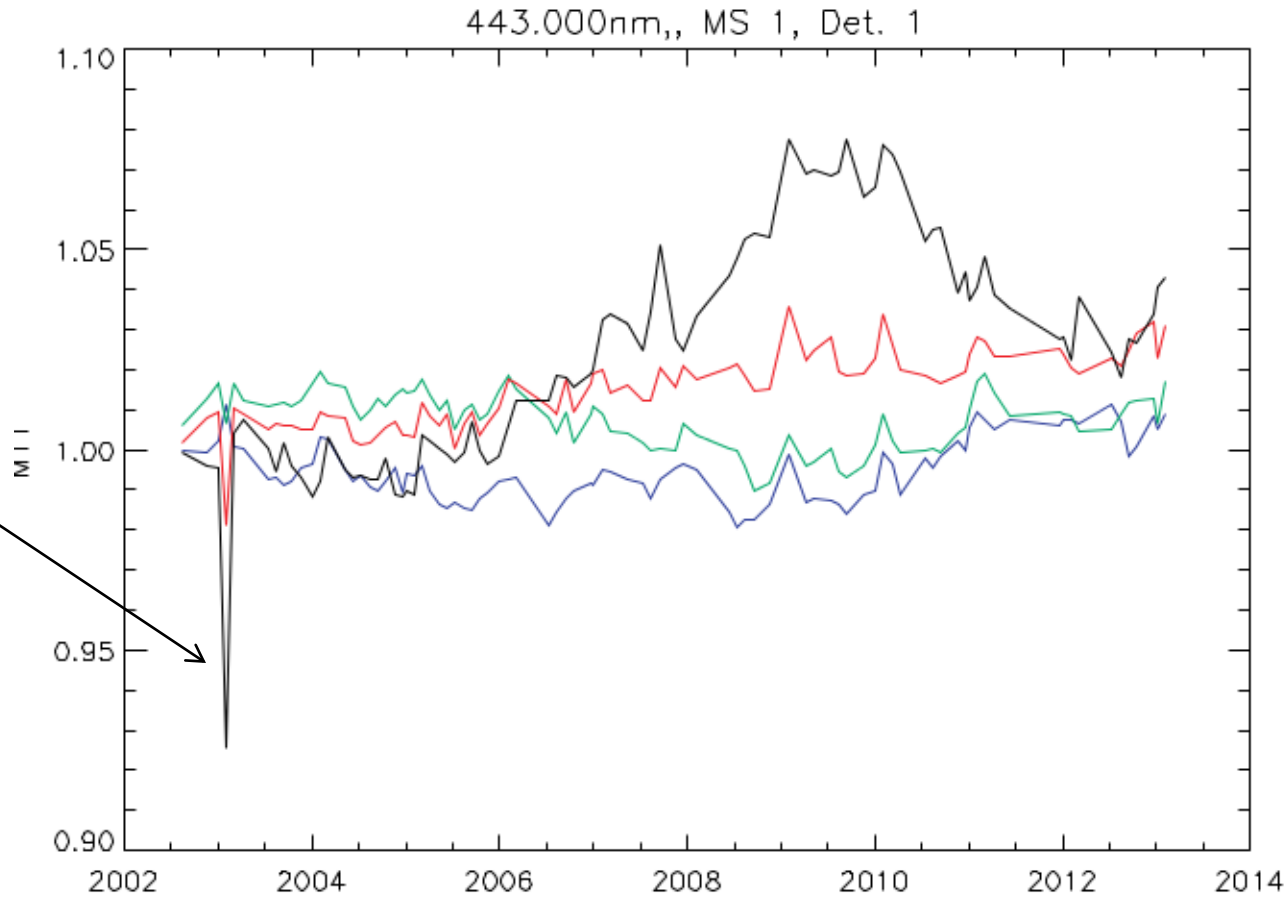
L_t: true TOA radiance (from MODISA)

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 of MODIST to MODISA: gain corrections for 443nm

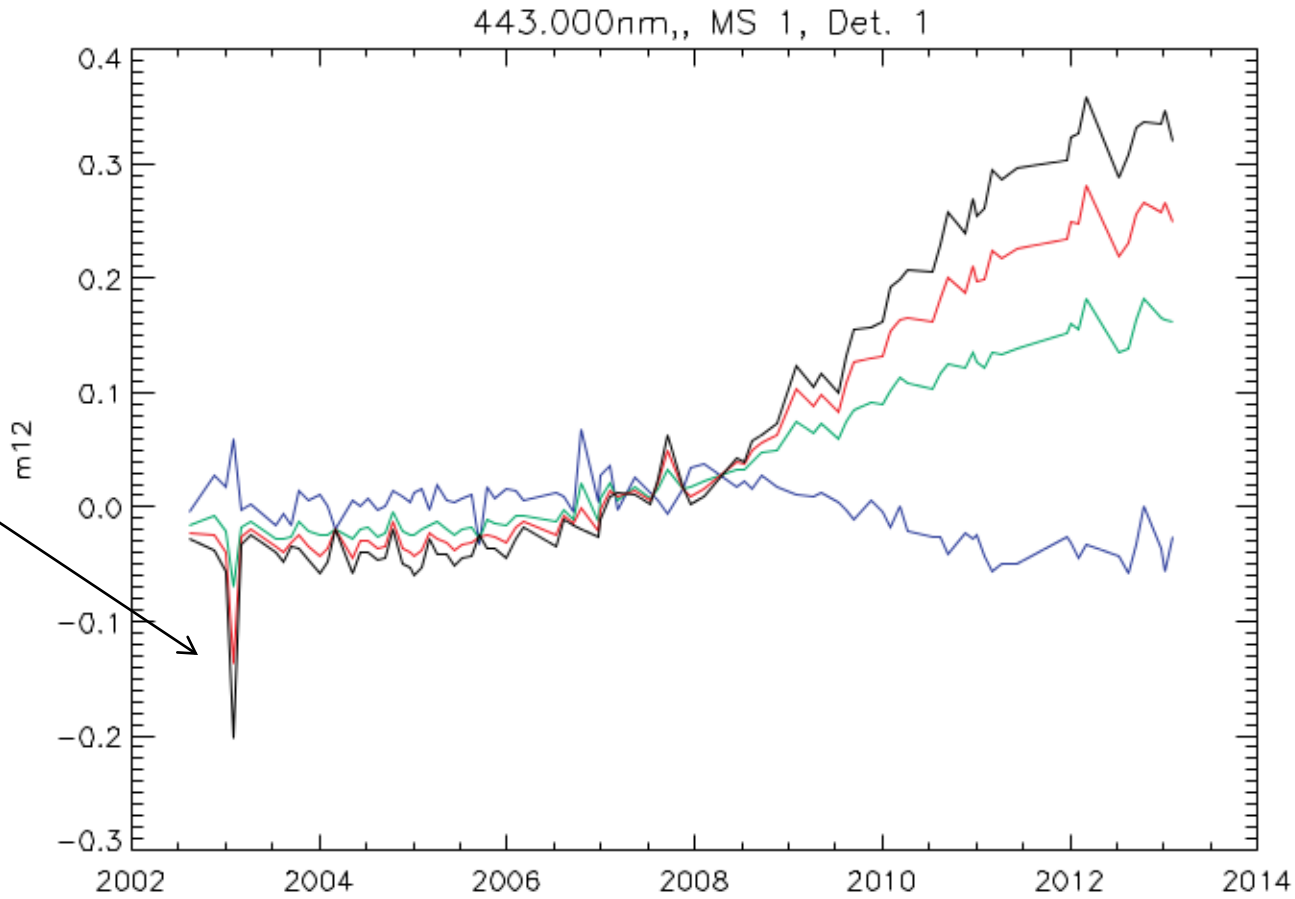
Ignore outlier



Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

Crosscalibration of MODIST to MODISA: polarization corrections for 443nm

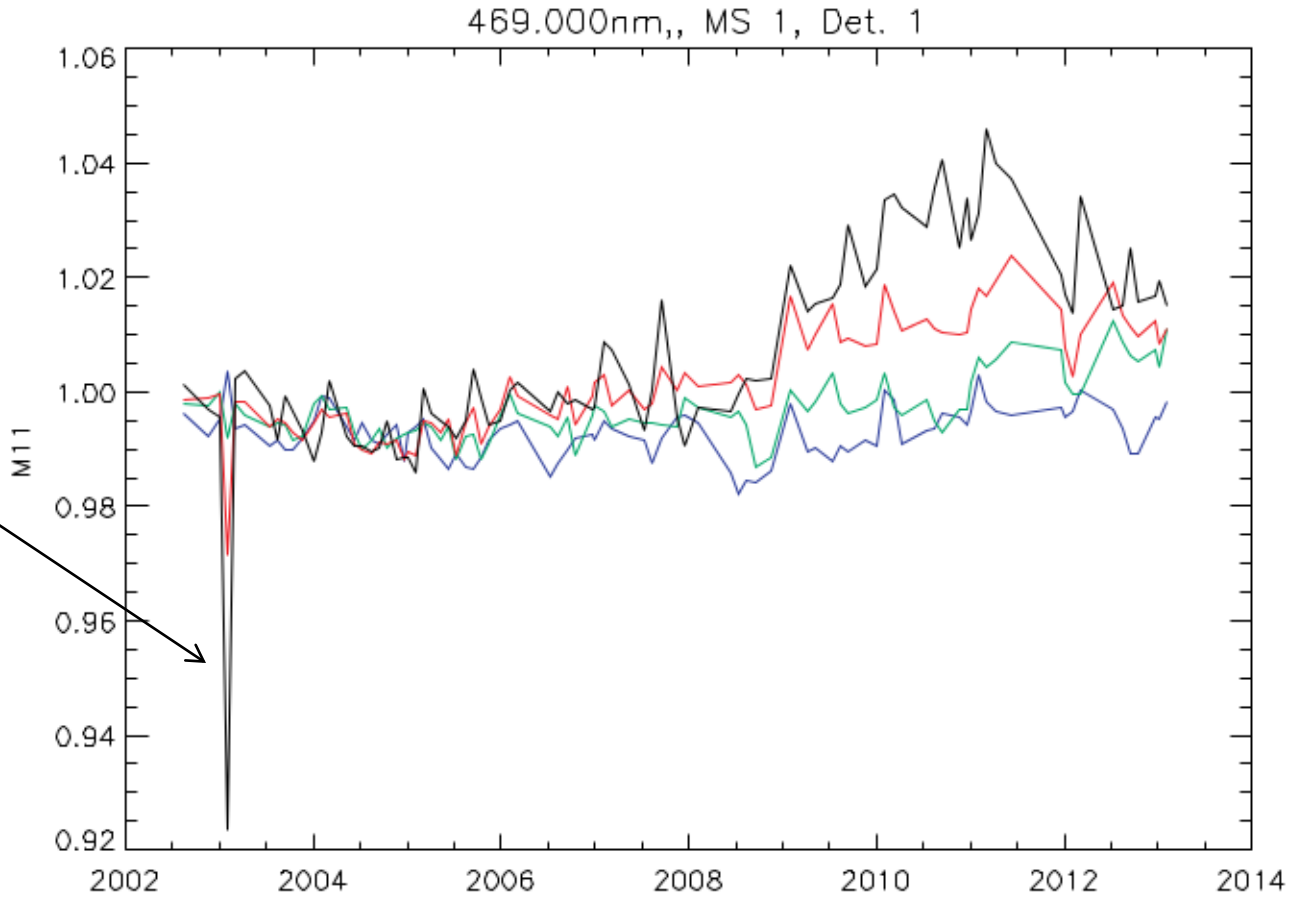
Ignore outlier



Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

Crosscalibration of MODIST to MODISA: gain corrections for 469nm

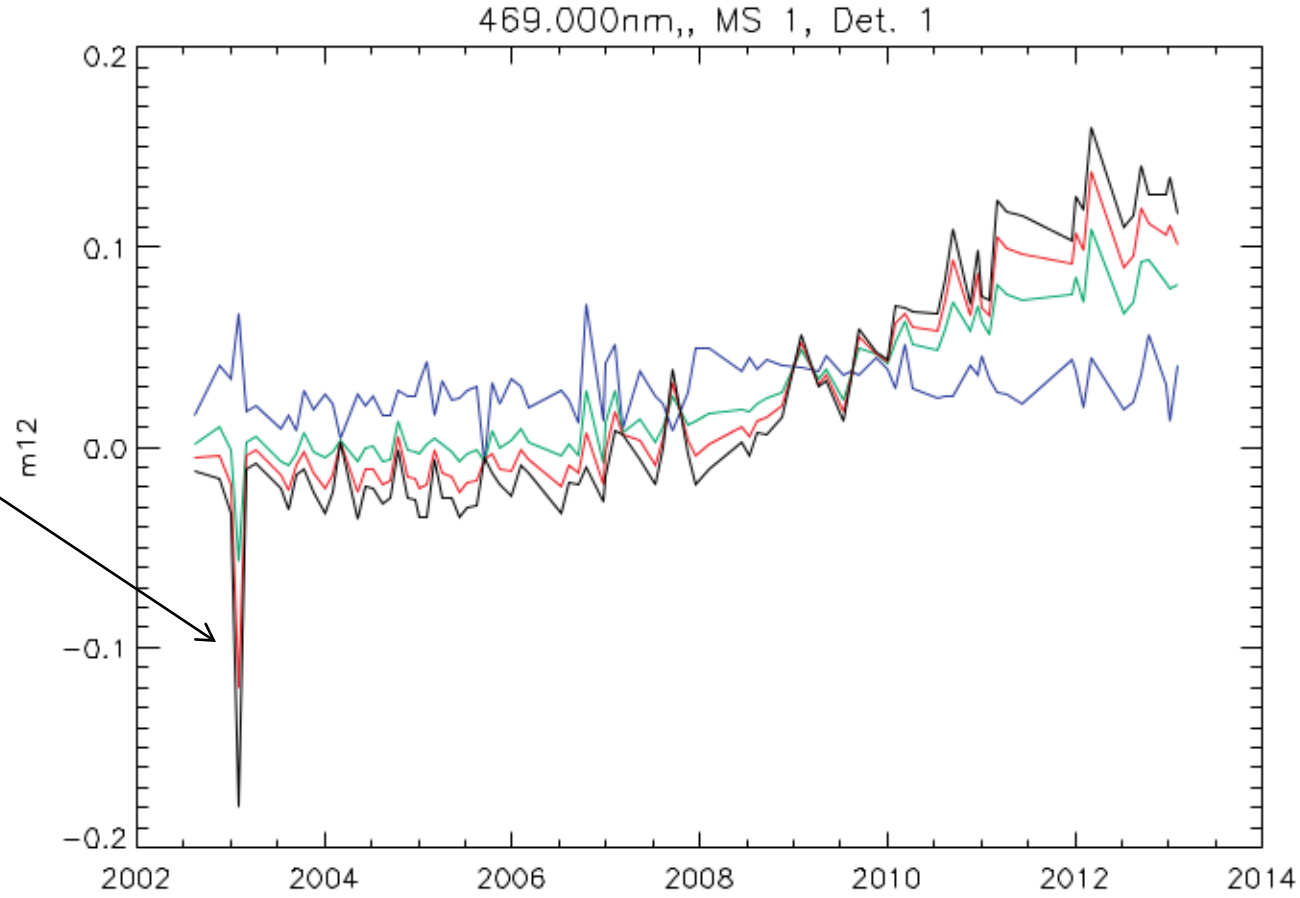
Ignore outlier



Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

Crosscalibration of MODIST to MODISA: polarization corrections for 469nm

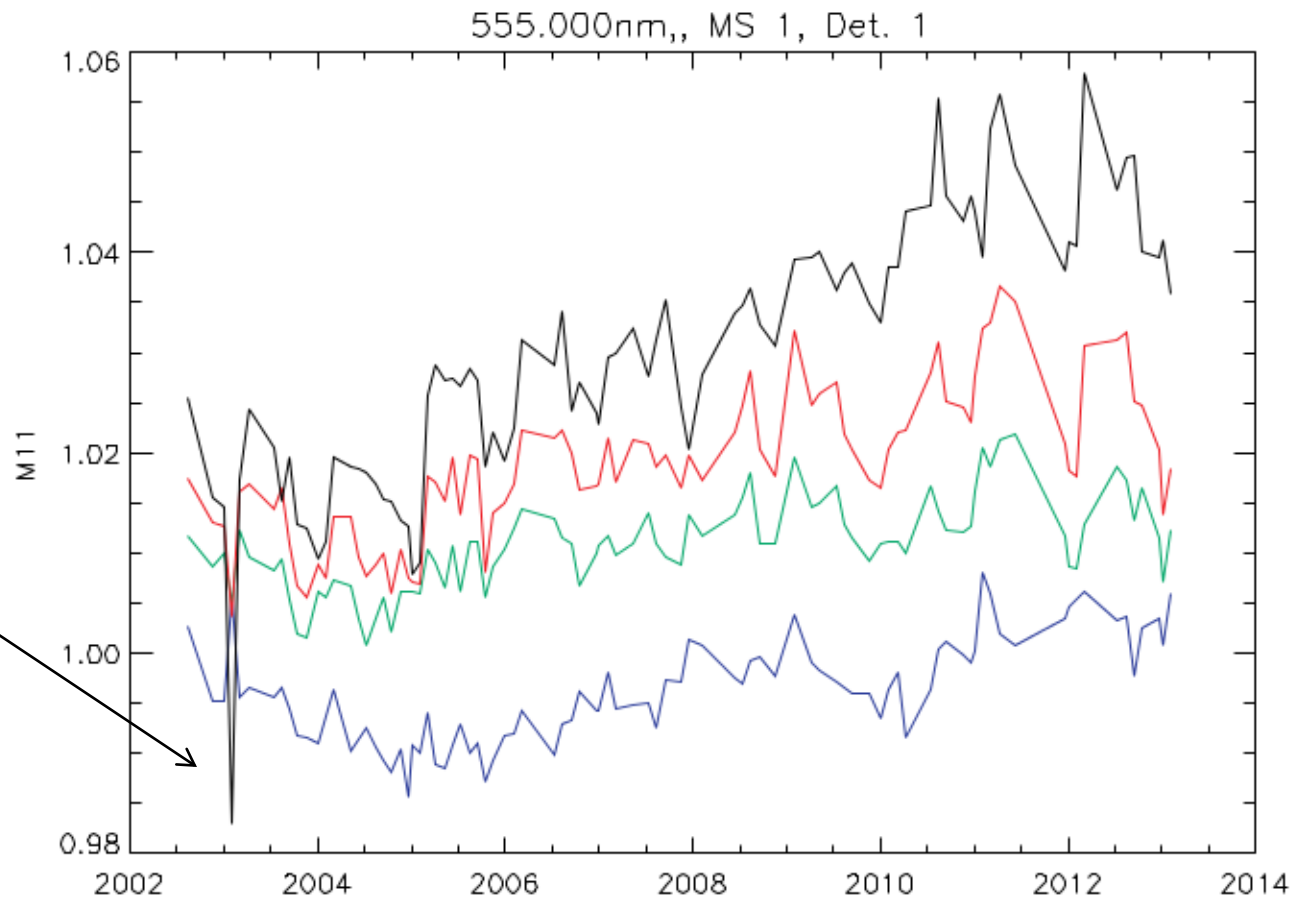
Ignore outlier



Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

Crosscalibration of MODIST to MODISA: gain corrections for 555nm

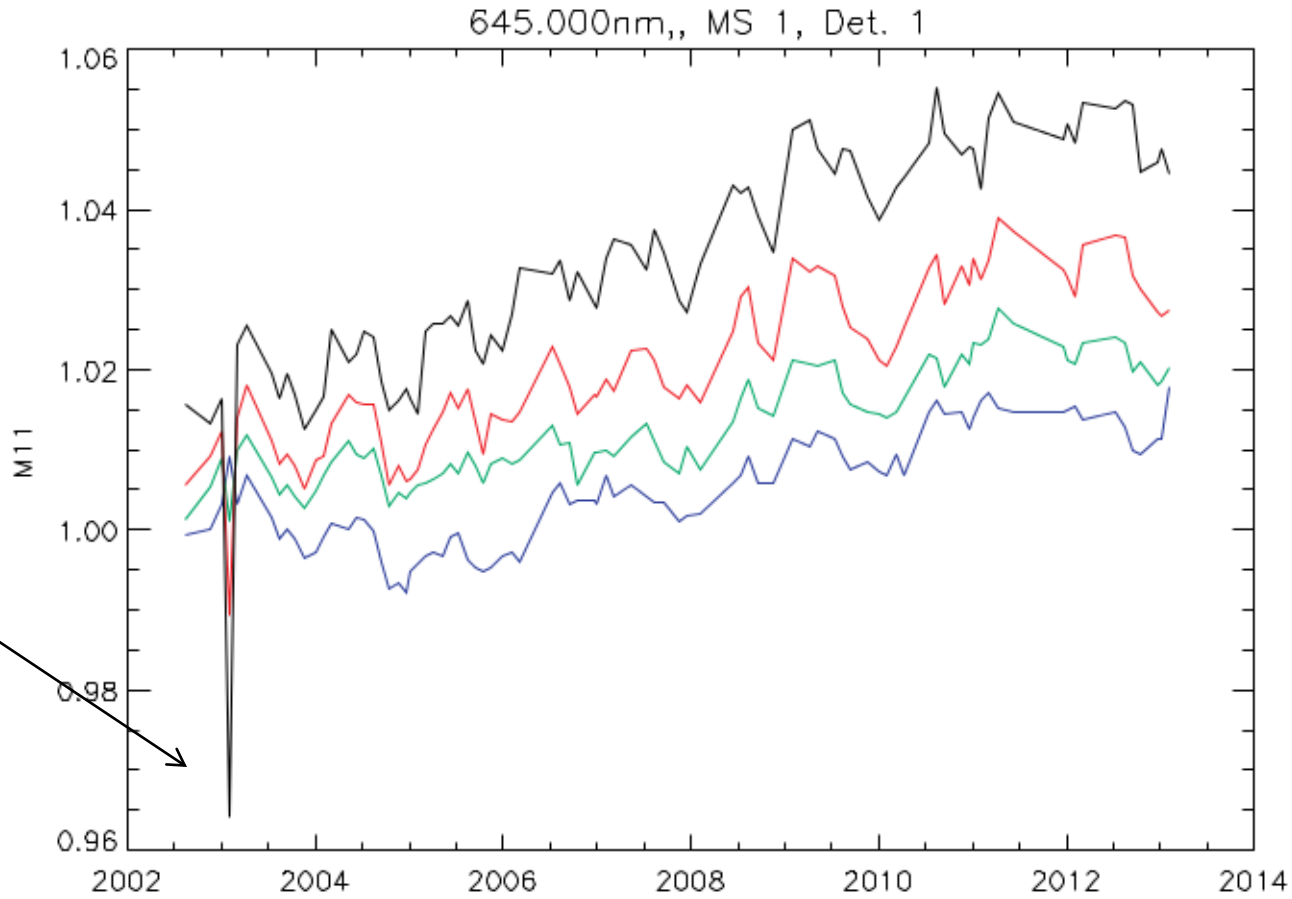
Ignore outlier



Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

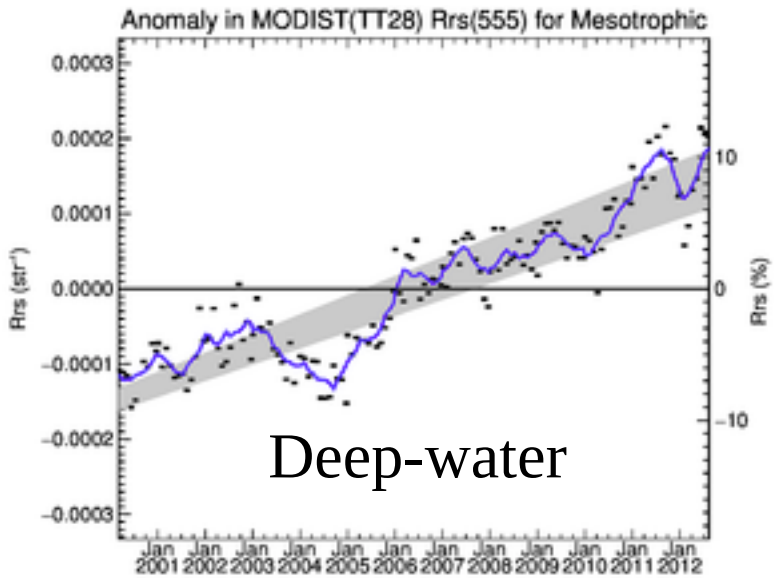
Crosscalibration of MODIST to MODISA: gain corrections for 645nm

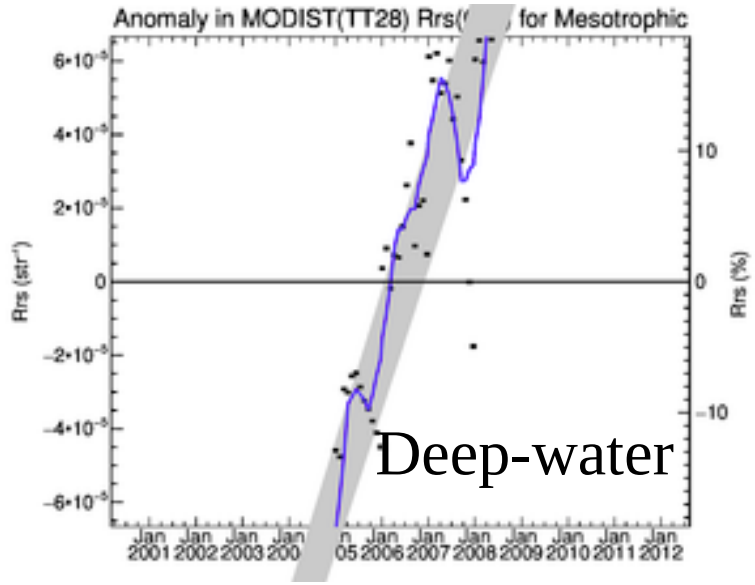
Ignore outlier

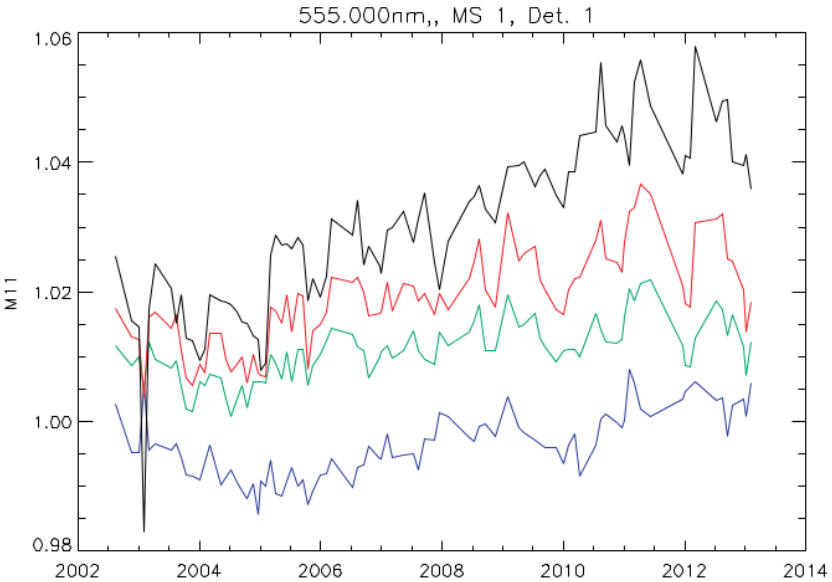


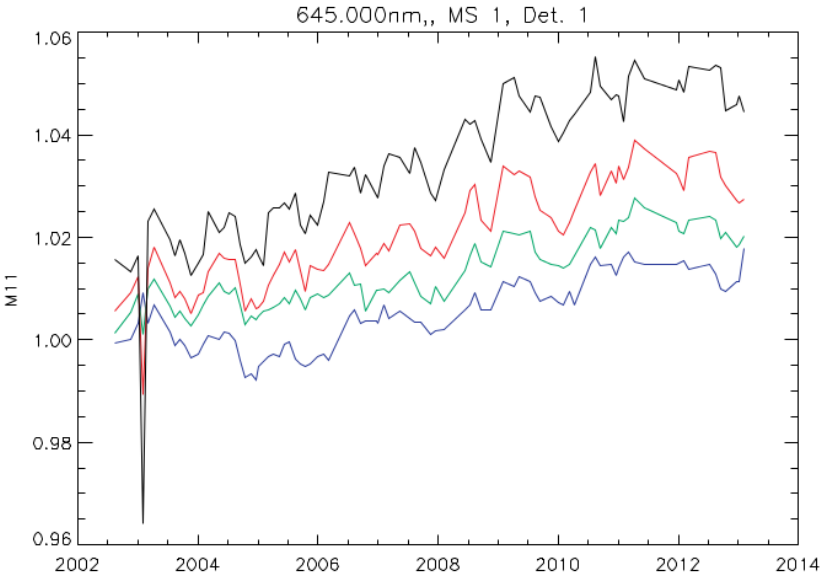
Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

TT28: Rrs anomalies (land bands)

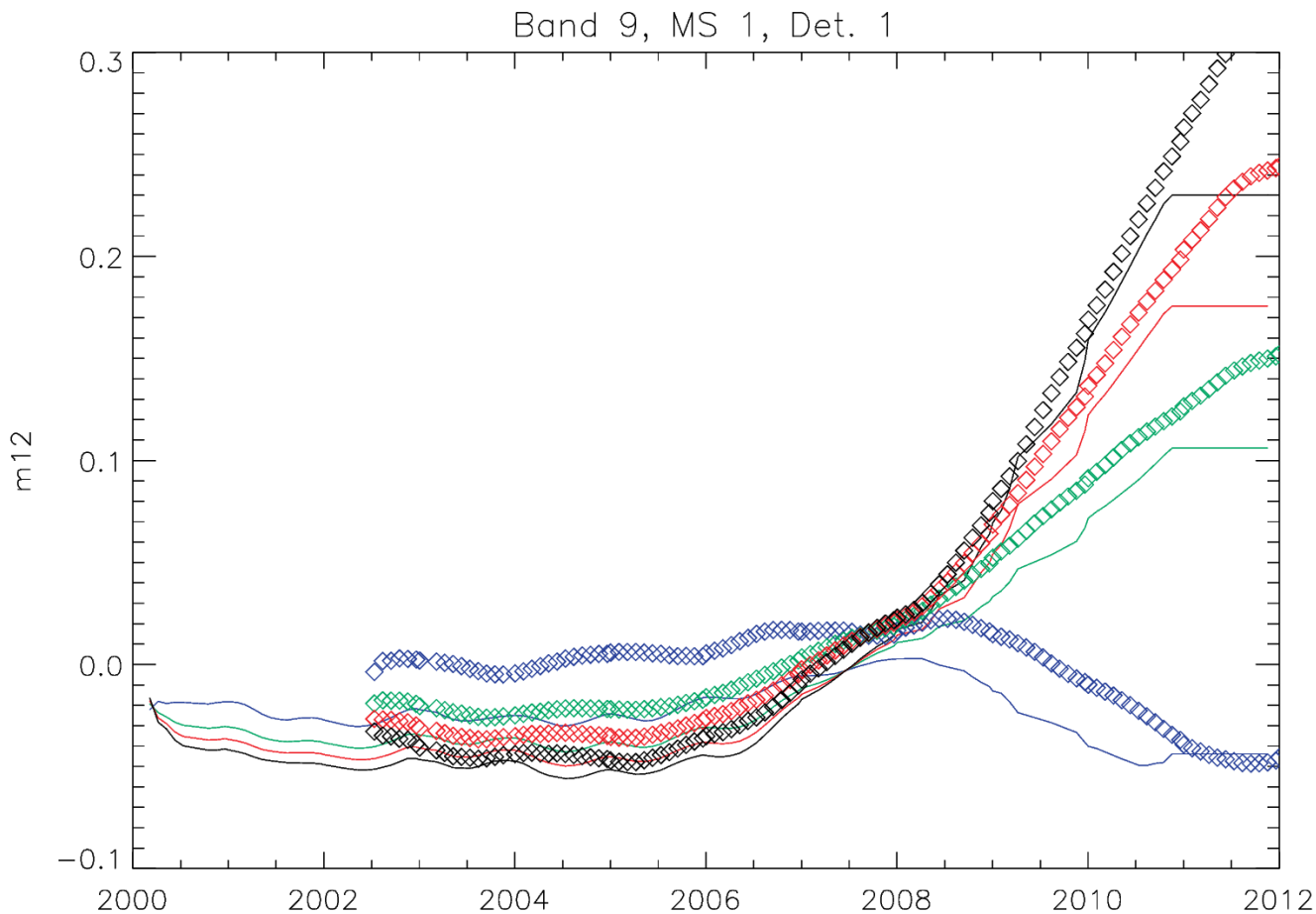






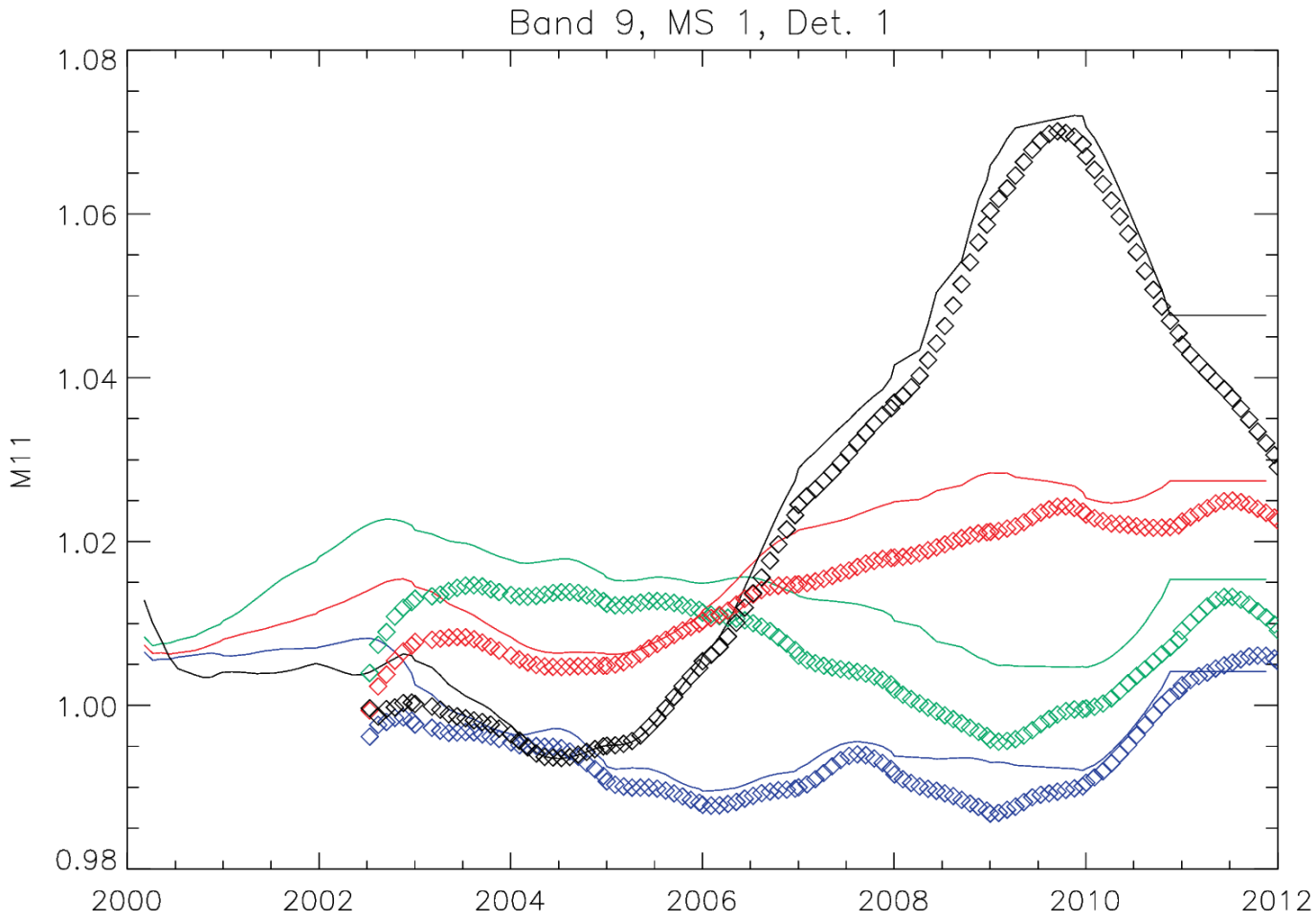


Polarization corrections for 443nm: SeaWiFS = solid line, Aqua = diamonds



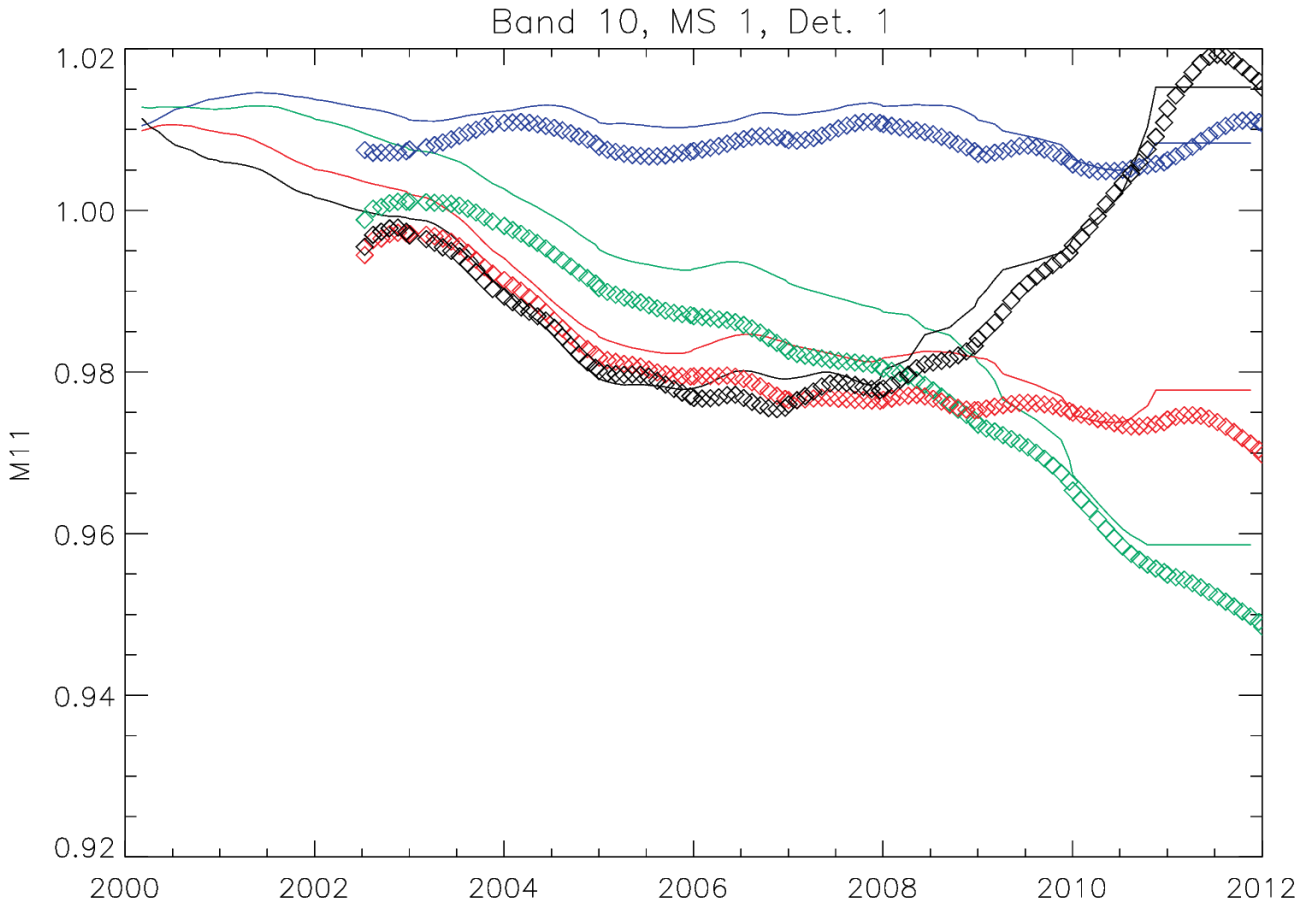
Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

Gain corrections for 443nm: SeaWiFS = solid line, Aqua = diamonds



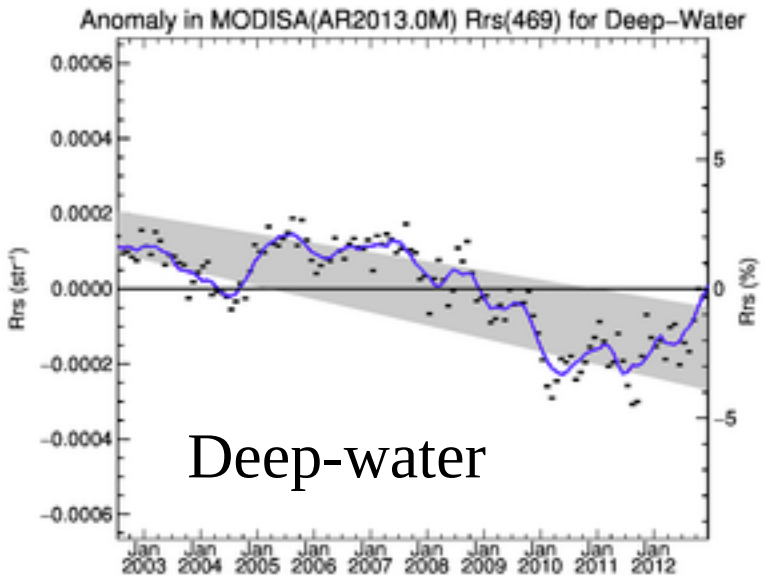
Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

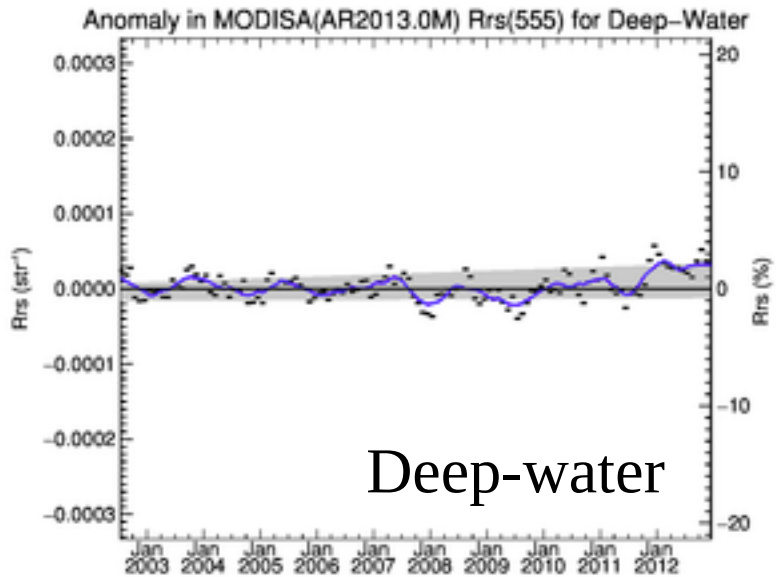
Gain corrections for 488nm: SeaWiFS = solid line, Aqua = diamonds

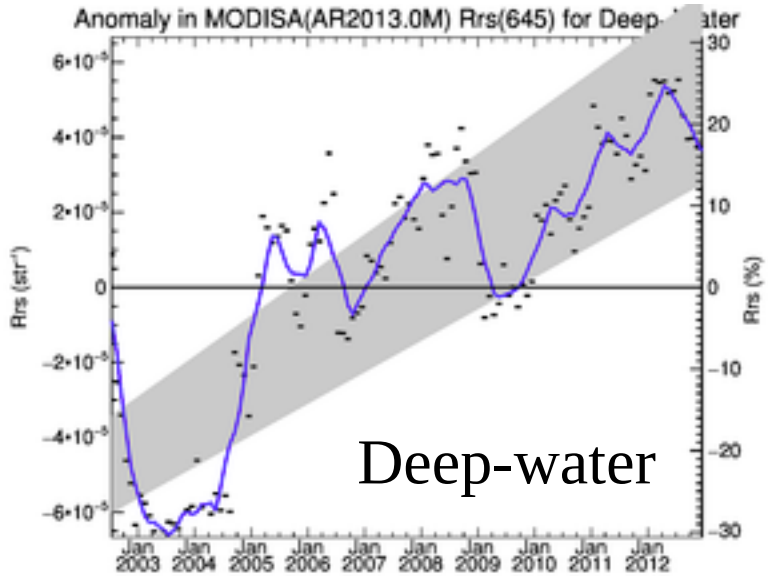


Scan angles (frame): lunar (22), nadir (675), Solar diffuser (989), end-of-scan (1250)

MODISA: Rrs anomalies (land bands, oper.)





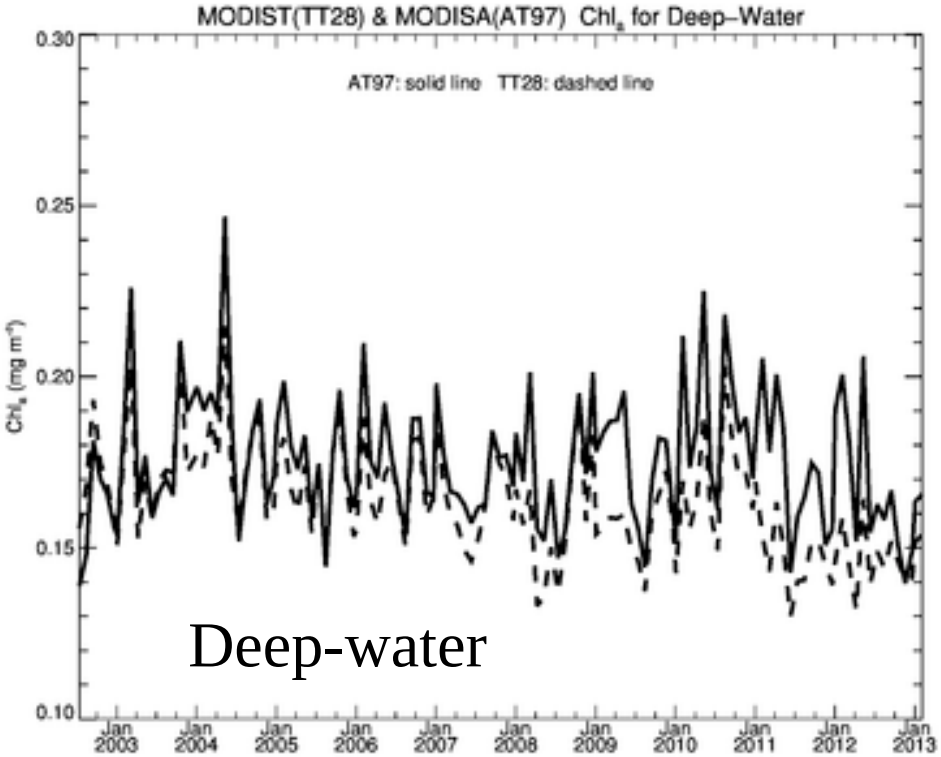
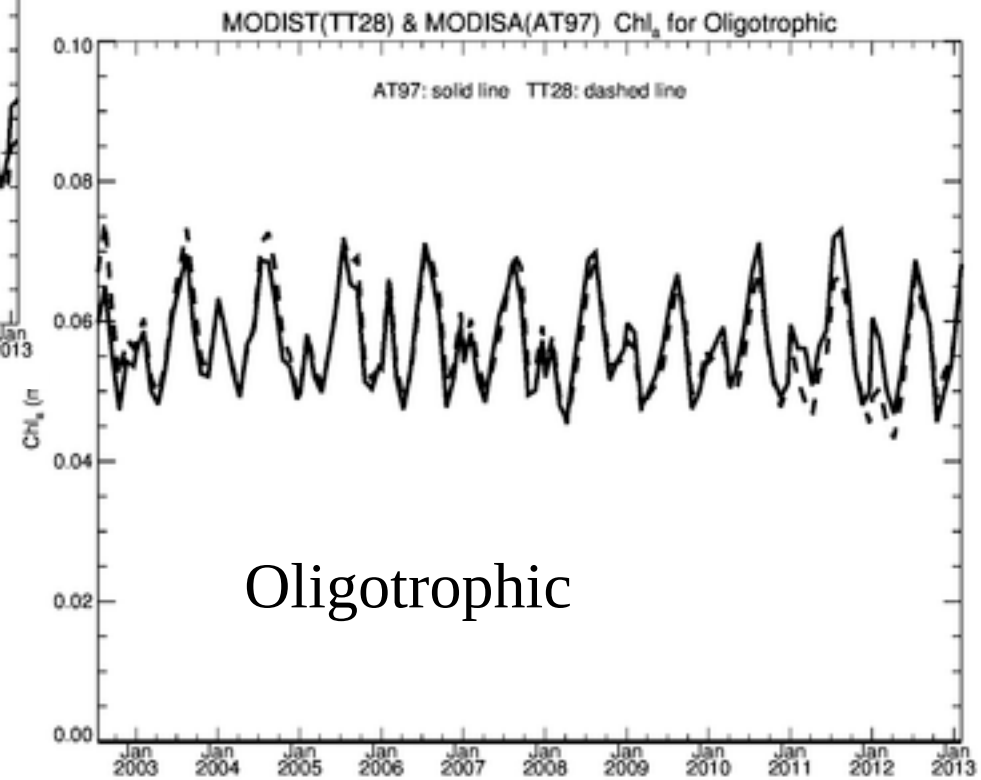


Summary:

- For the first time, OBPG applied crosscalibration approach to MODIS land bands (MODIST relative to MODISA)
- Evaluation performed at ocean radiances (very low, possible linearity issue) and using OBPG atmospheric correction approach (could affect RVS)
- Corrections for 469nm are similar to those for 443nm, but smaller (both for gain and polarization), as expected
- 555nm and 645nm show no change of polarization sensitivity (as expected), up to 2% change for gain (mostly for end-of-scan)

Backup

MODIST and MODISA global Chl-a



-Chl-a does not use land bands
-Xcal relative to SeaWiFS (up to 2003) and MODISA (from 2004)
-Agreement in olig. (used for xcal) better than in deep-water