



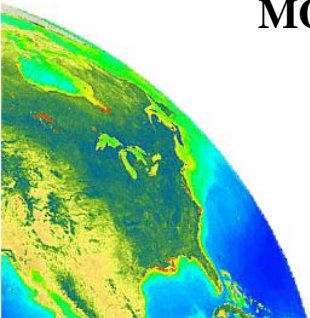
Recent updates to the MODIS Terra Polarization

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OBPG (Ocean Biology Processing Group)

5/1/2014

MODIS Science Team Meeting, Calibration Workshop, April 2014, Columbia, MD



Ocean Biology Processing Group:

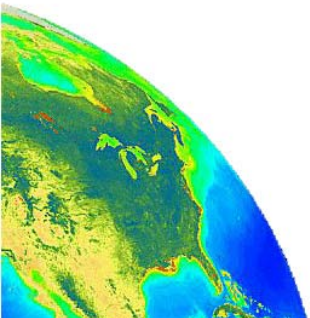
- Our polarization correction code is available from our website as part of the SeaDAS software package
- Website: oceancolor.gsfc.nasa.gov



The image shows a screenshot of a Firefox browser window displaying the OceanColor WEB website. The browser's address bar shows the URL <http://oceancolor.gsfc.nasa.gov/>. The website features a large header image of a satellite map of the ocean with the text "OceanColor WEB" overlaid. Below the header is a navigation menu with links for Missions, Data, Documents, Analyses, People, Forum, Services, and Links. A search bar is located on the right side of the page. The main content area is divided into three columns: "Data Access" with a "Data Distribution Status" section showing a traffic light icon and the text "All systems nominal" and "NOTE: FTP connections must be made in PASSIVE mode"; "Ocean Color Feature" with a section titled "A Boost for SeaWiFS" and a small image of a satellite orbit; and "Support Services" with a section titled "SeaDAS" and a description of the software package.

Overview:

- Recently, increased interest in MODIS polarization correction from other disciplines (land, atmosphere)
- This talk will serve as a review of the methodologies and results from the OBPG
- OBPG crosscalibration method (using L3 OC products as truth)
- MODIS Terra uses MODIS Aqua as truth to derive gain and polarization corrections
- Largest effect is for 412nm, end of scan (40%)
- MODISA does not show strong changes in polarization sensitivity



How do we get MODIST 'true' TOA radiance ?

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

air
aerosol
whitecap
glint
water
gas

from MODIST NIR
assumes MCST NIR band characterization
from MODISA $L^w(\lambda)$ 15-day mean

Bandpass differences: $\lambda' \rightarrow \lambda$
 fit based on bio-optical models
 (needed for SeaWiFS to MODIS)



Crosscalibration coefficients:

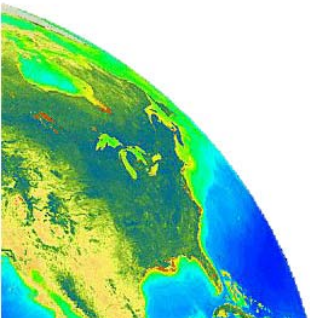
$$L_m/M_{11} = L_t + m_{12} * Q + m_{13} * U$$

L_m : measured TOA radiance (MODIST)

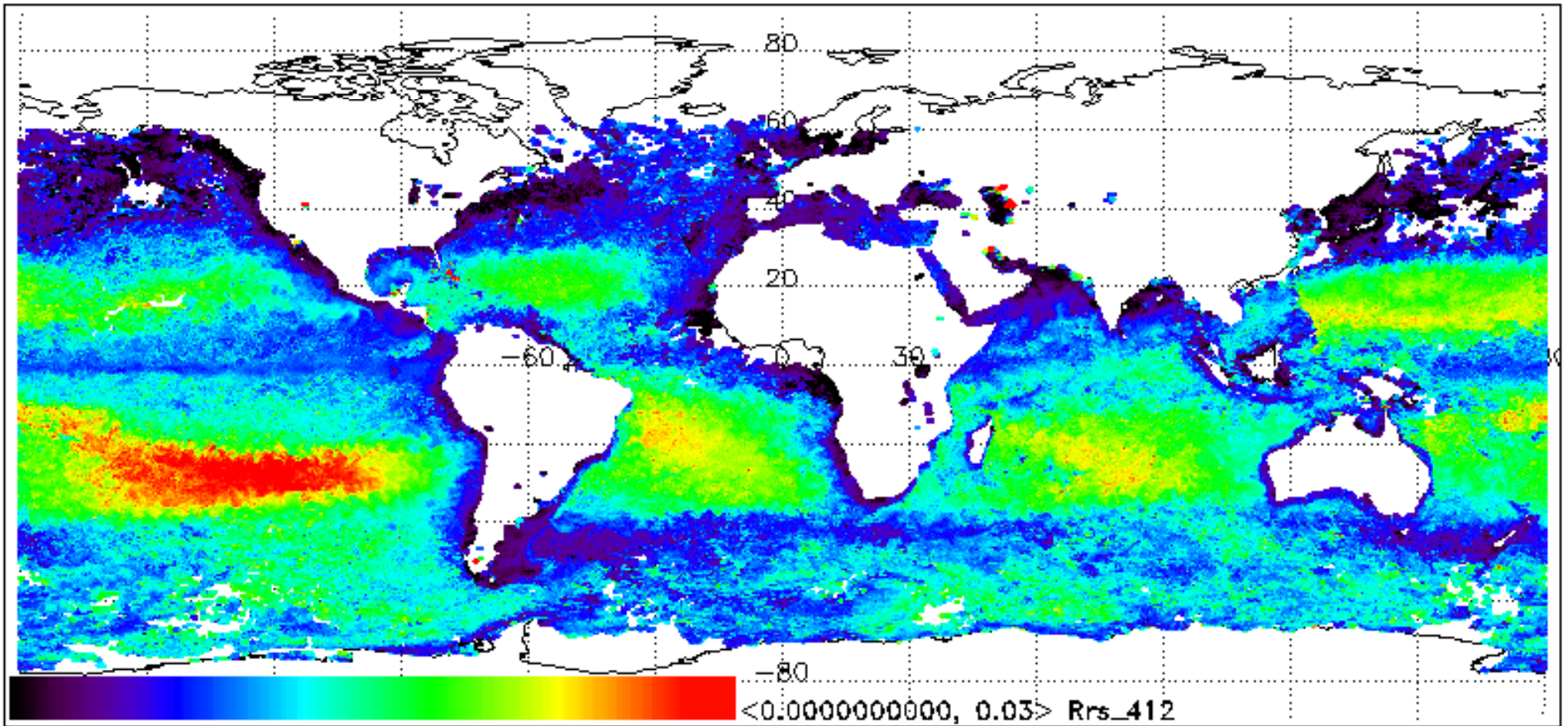
L_t : true TOA radiance (from MODISA)

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

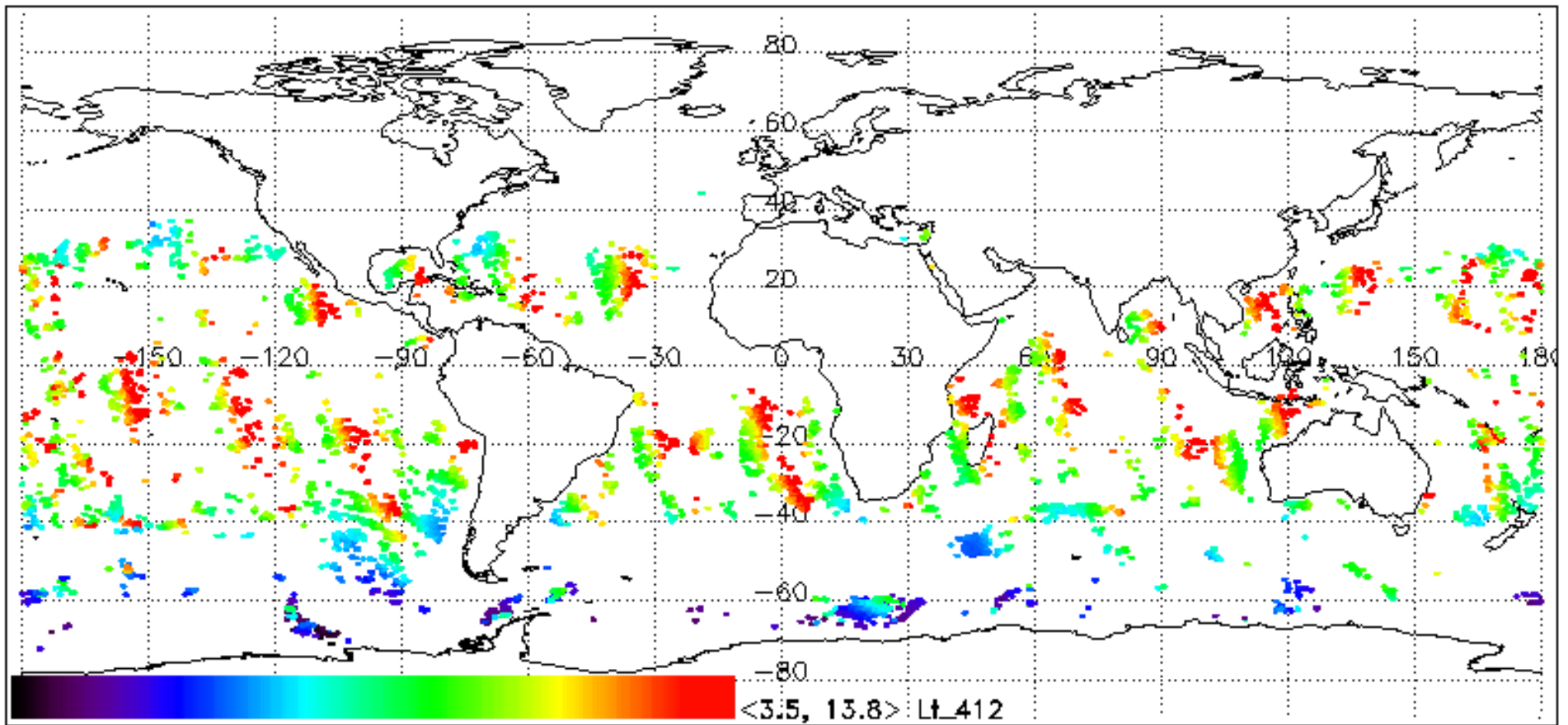
M_{11}, m_{12}, m_{13} : fitted instrument
characterization parameters (depend on band,
MS, detector, scan angle (polynomial 4th order
for M_{11} , 2nd for m_{12} and m_{13})



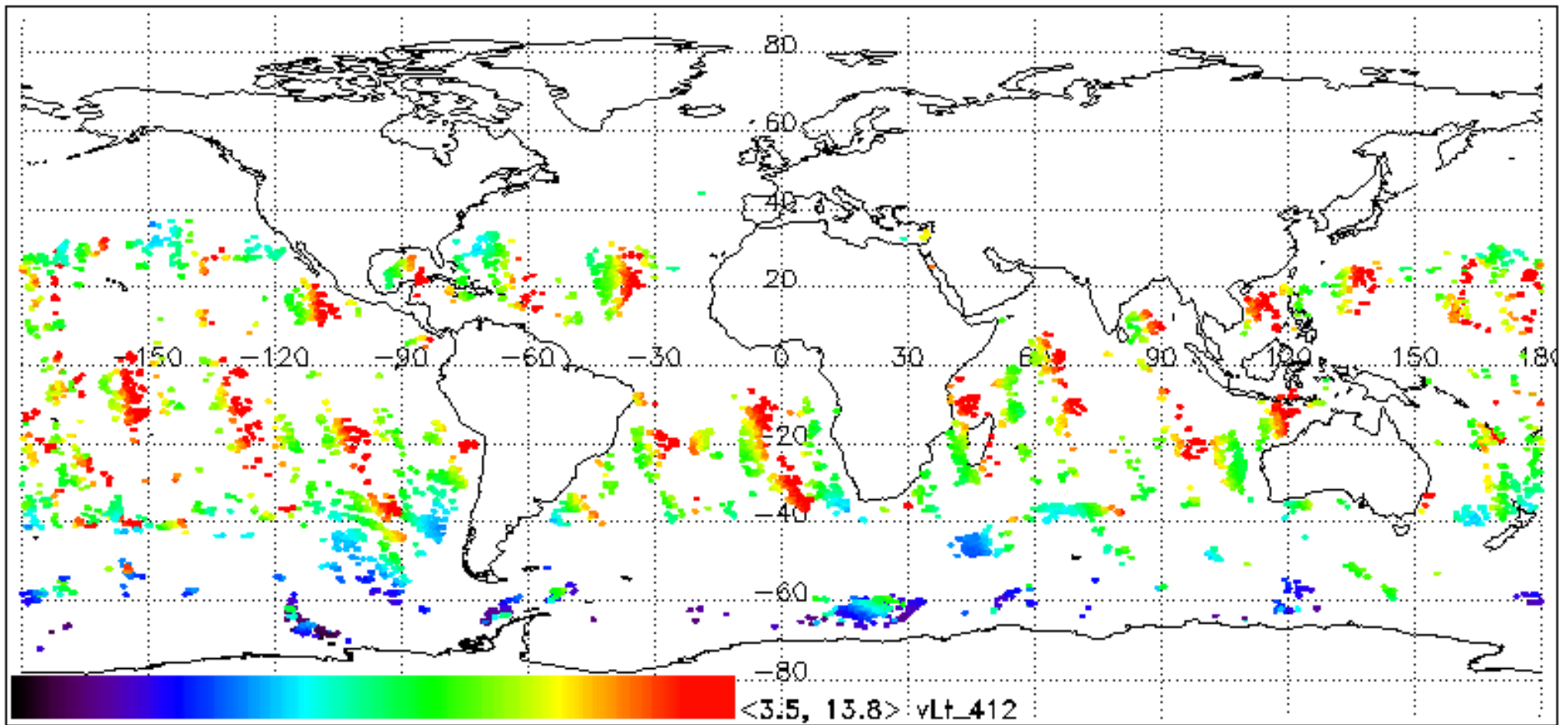
Xcal approach (Step 1): input 'true' L3 (15 days) Rrs



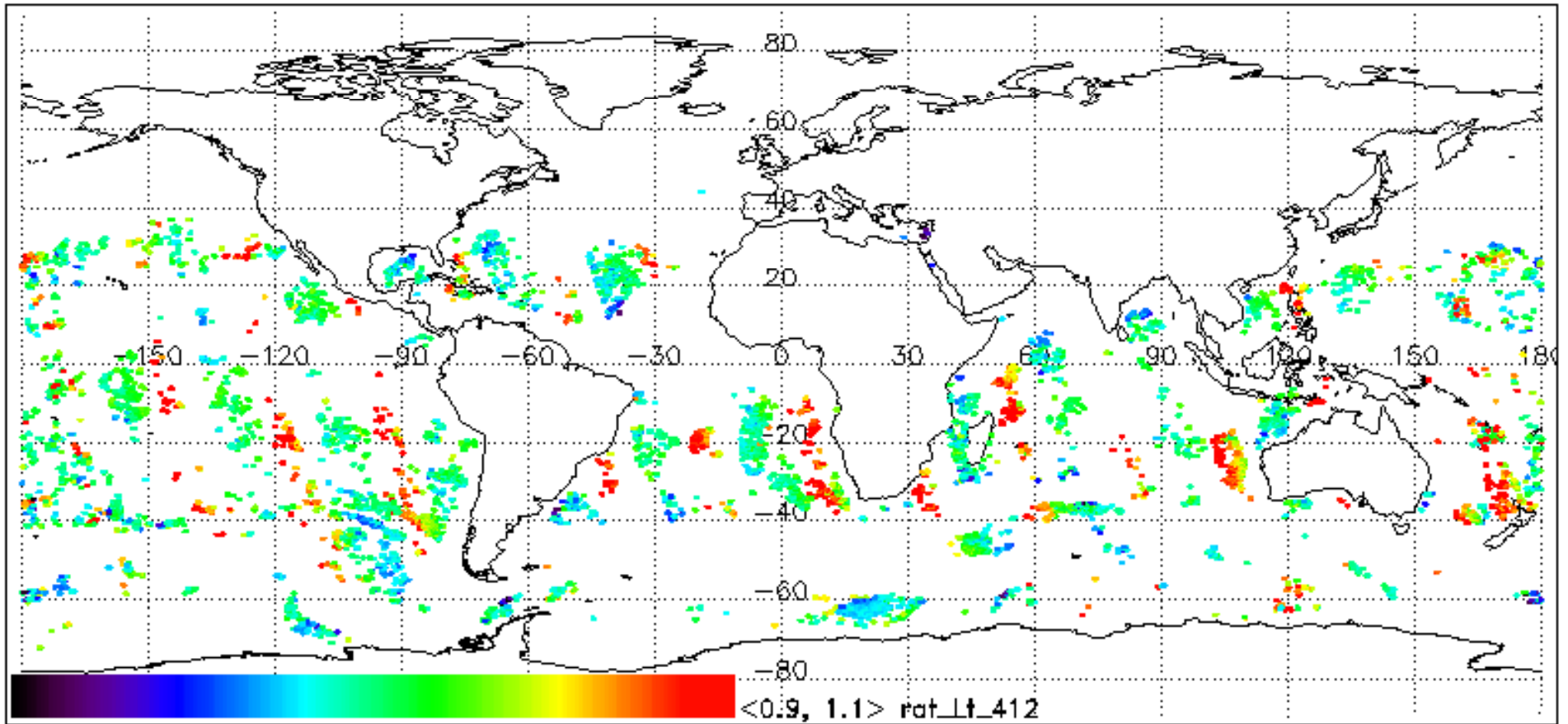
Xcal approach (Step 2): input MODIS Lm



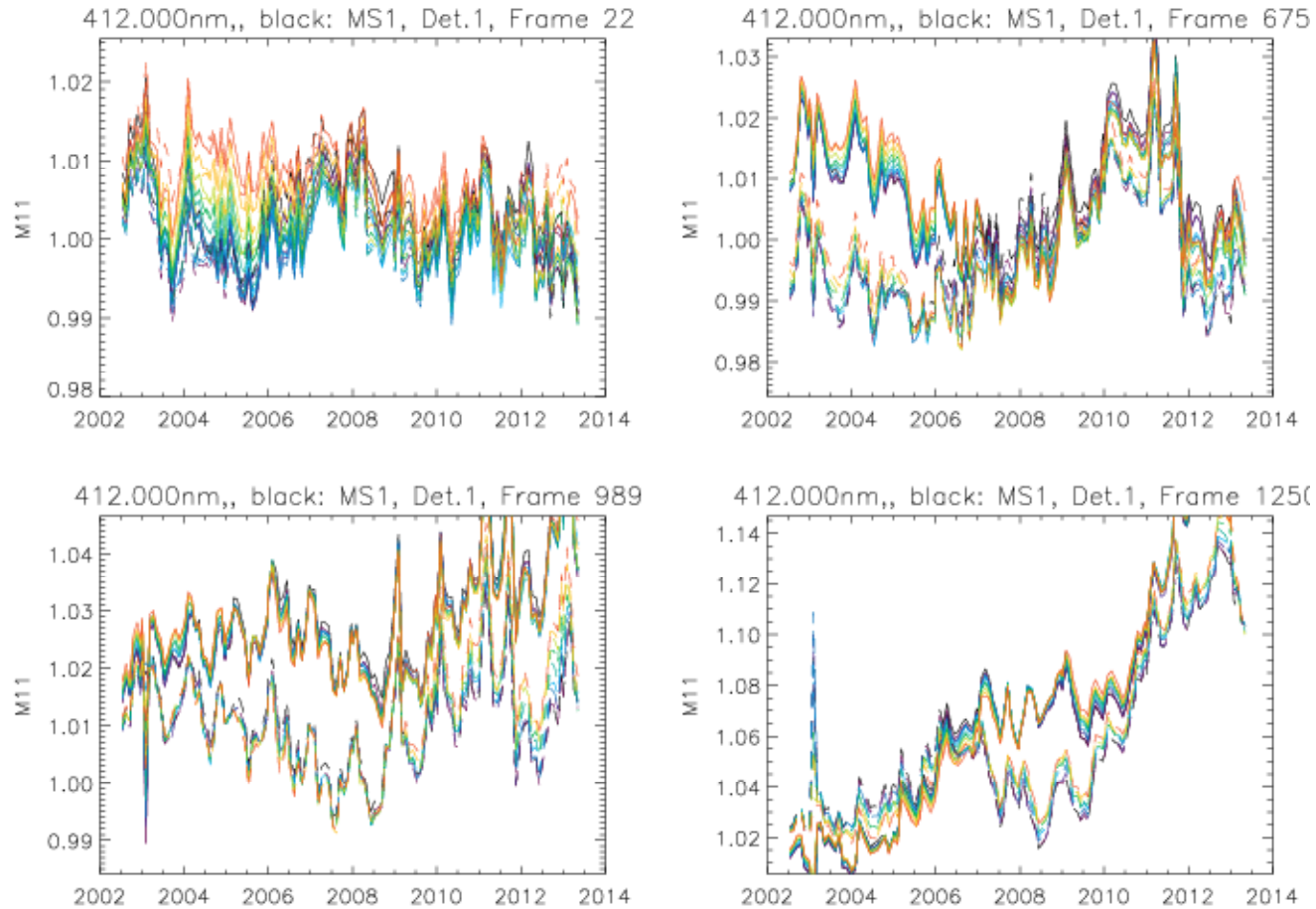
Xcal approach (Step 3): vicarious Lt (from 'true' L3)



Xcal approach (Step 4): Ratio L_m/vL_t

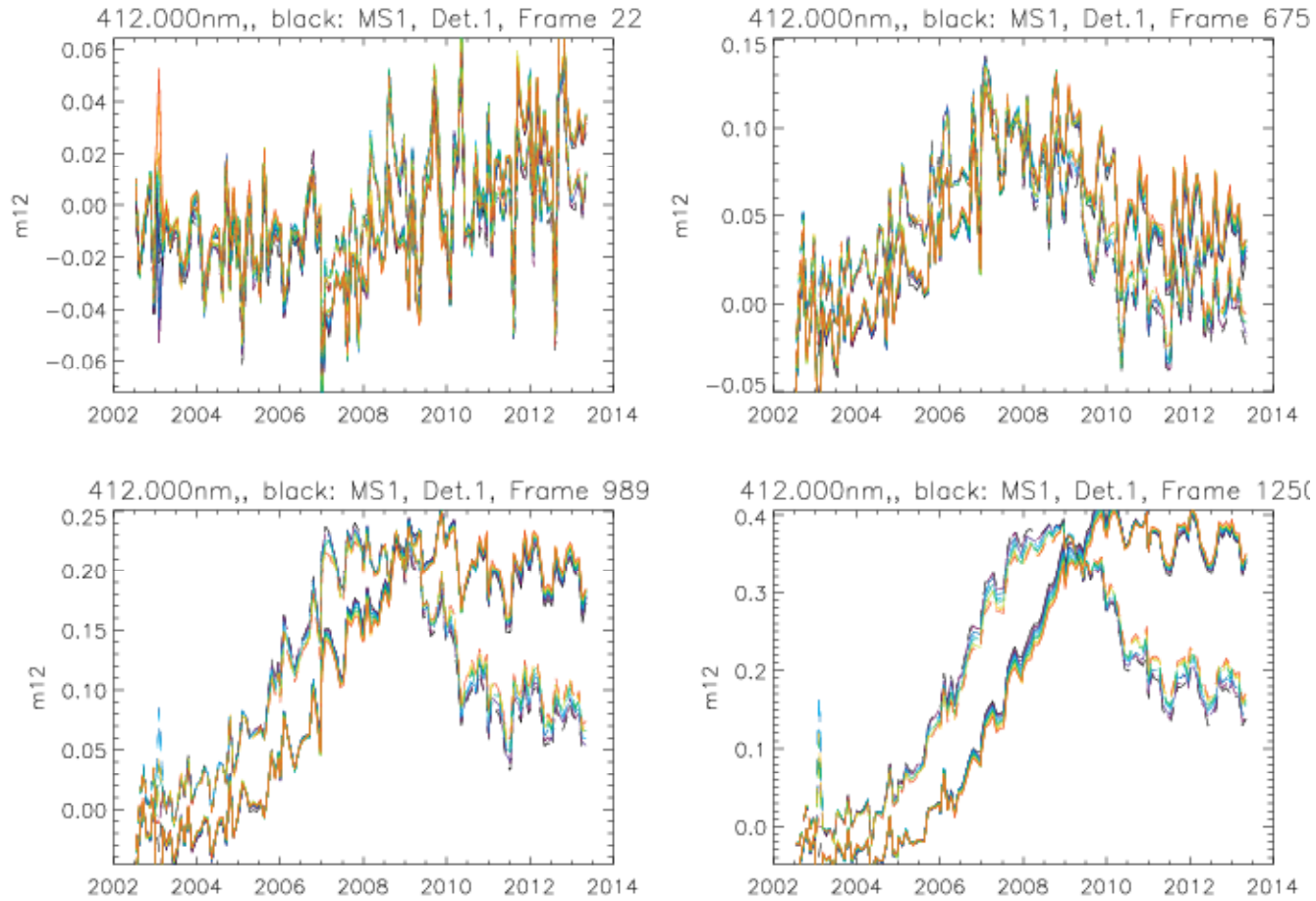


Xcal results (1 of 6, 412nm): M11 ('gains')



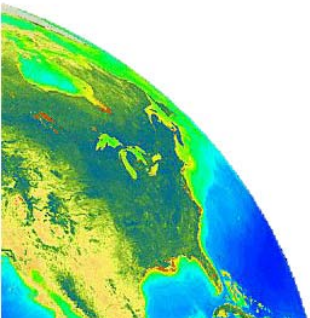
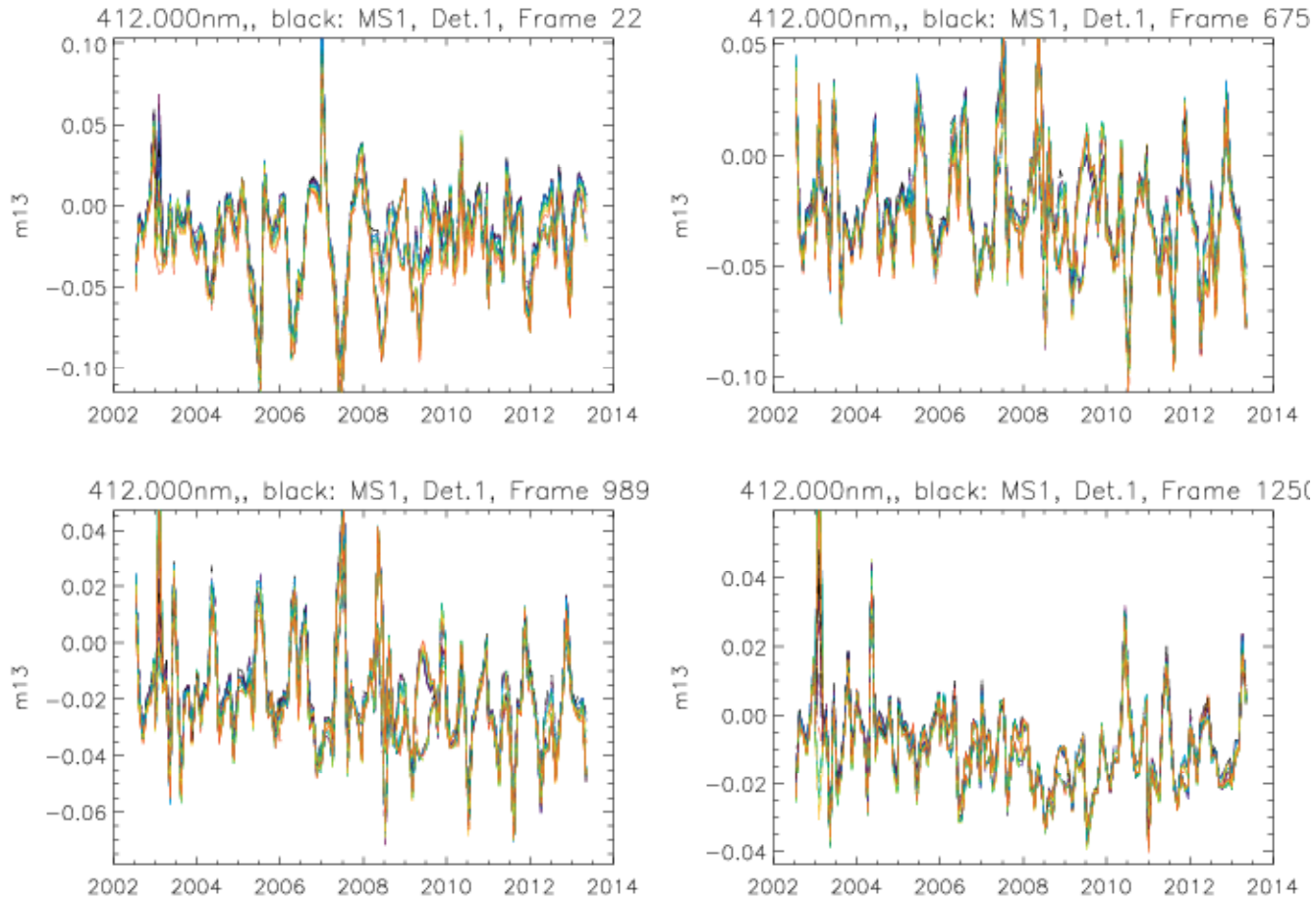
Before temporal fitting

Xcal results (2 of 6, 412nm): m12 (coef. for Q)



Before temporal fitting

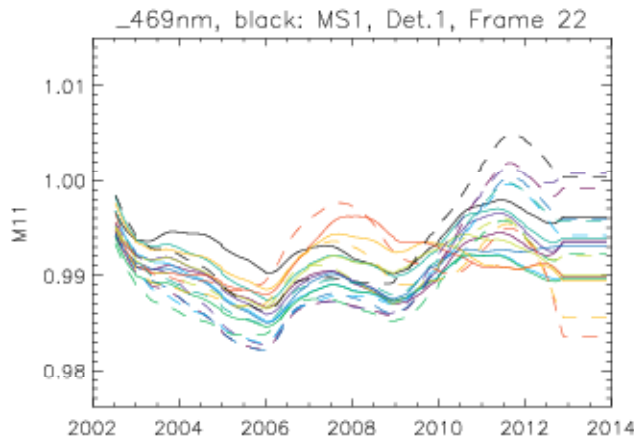
Xcal results (3 of 6, 412nm): m13 (coef. for U)



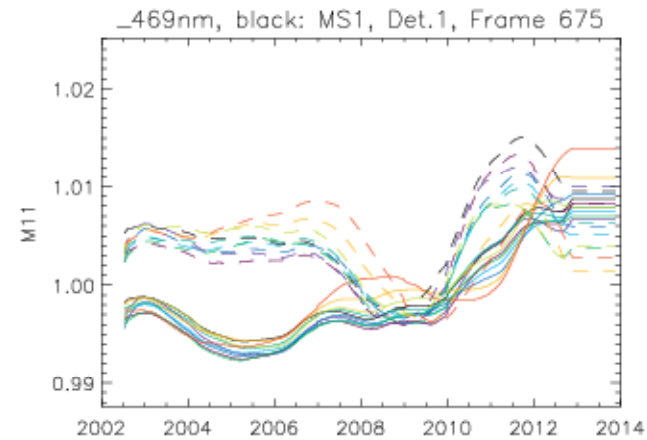
No temporal fitting

Xcal results (4 of 6, 469nm): M11 ('gains')

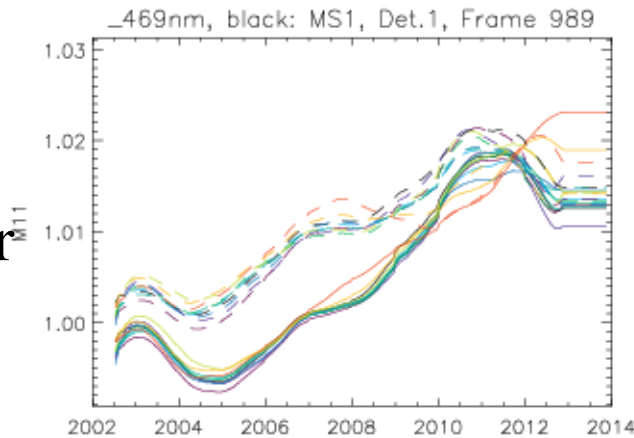
Lunar



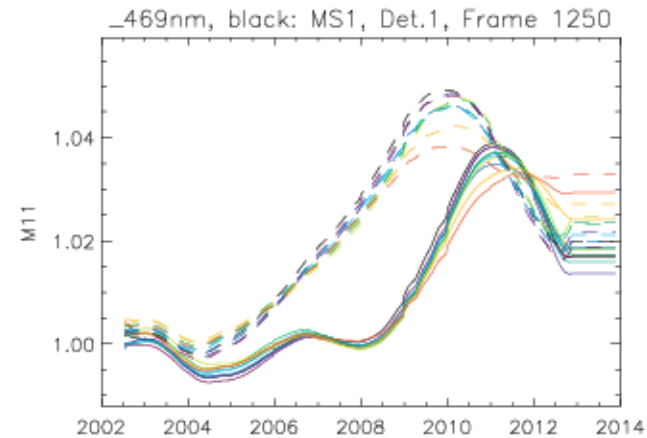
Nadir



Solar
Diffuser



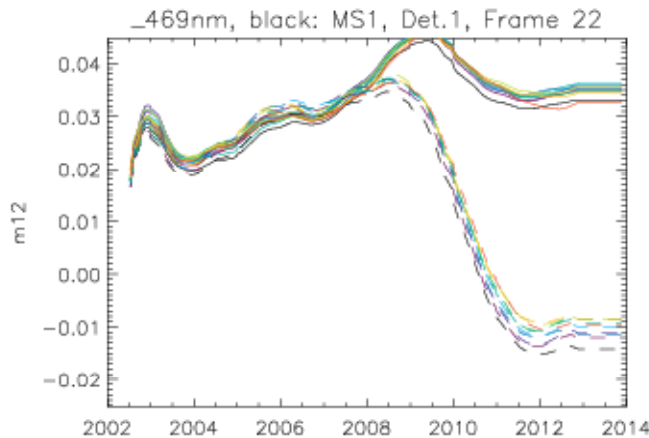
End of
scan



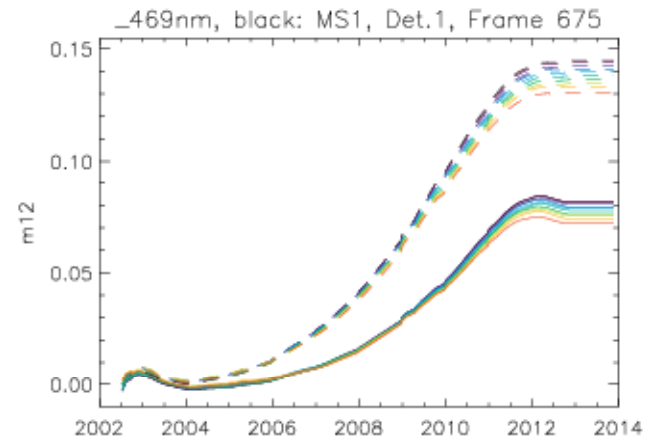
Solid/dashed line: Mirror side 1/2
Black, purple, ... orange, red: detectors 1-10

Xcal results (5 of 6, 469nm): m12 (coef. for Q)

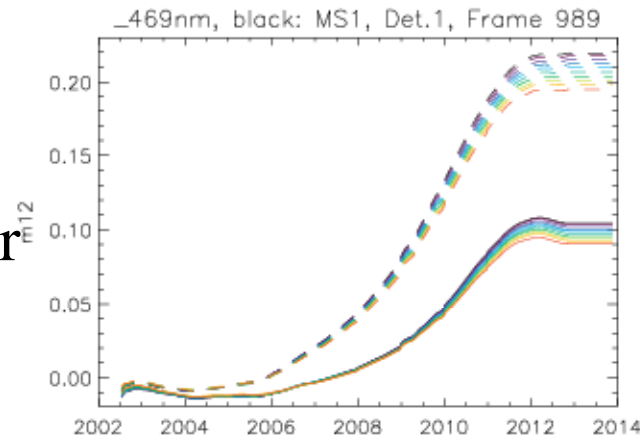
Lunar



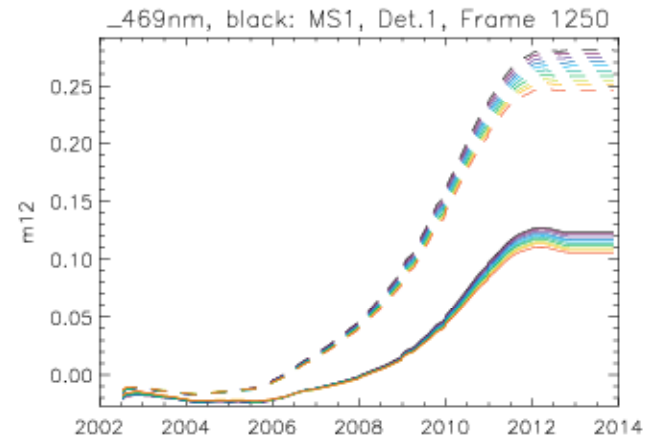
Nadir



Solar
Diffuser



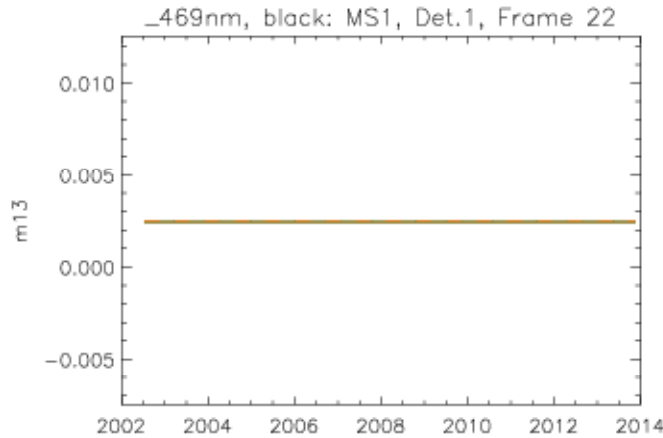
End of
scan



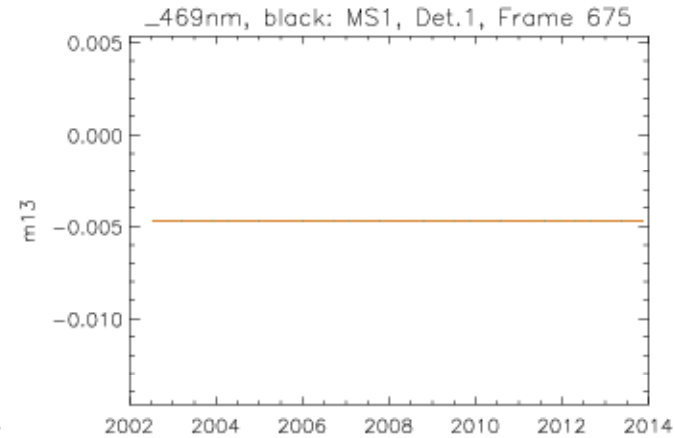
Solid/dashed line: Mirror side 1/2
Black, purple, ... orange, red: detectors 1-10

Xcal results (6 of 6, 469nm): m13 (coef. for U)

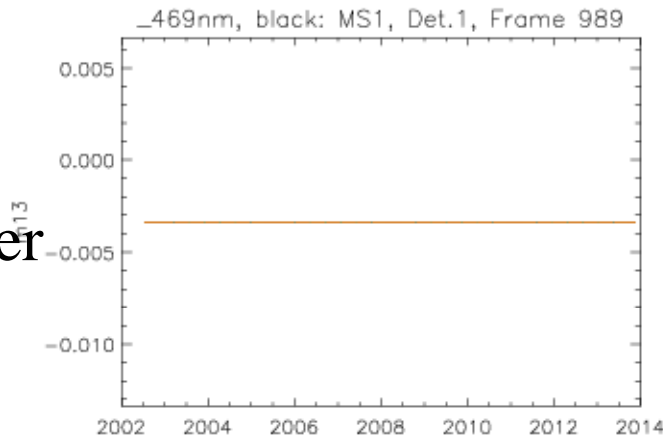
Lunar



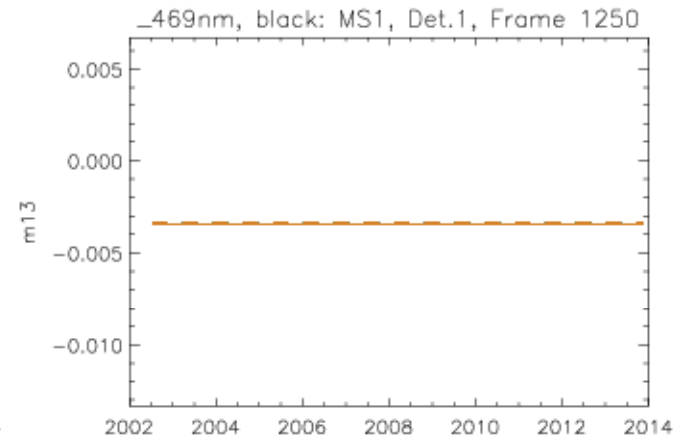
Nadir



Solar
Diffuser



End of
scan

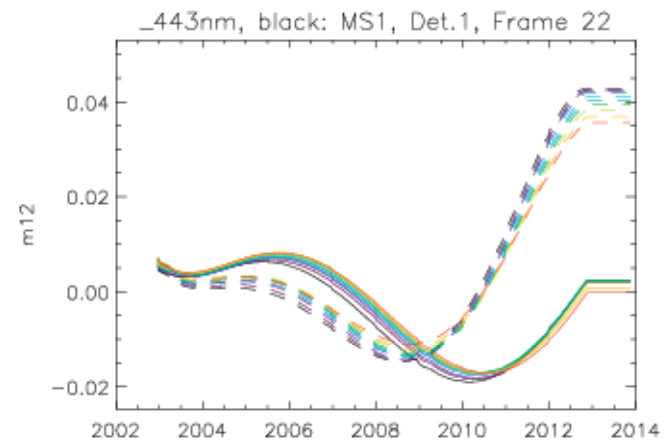
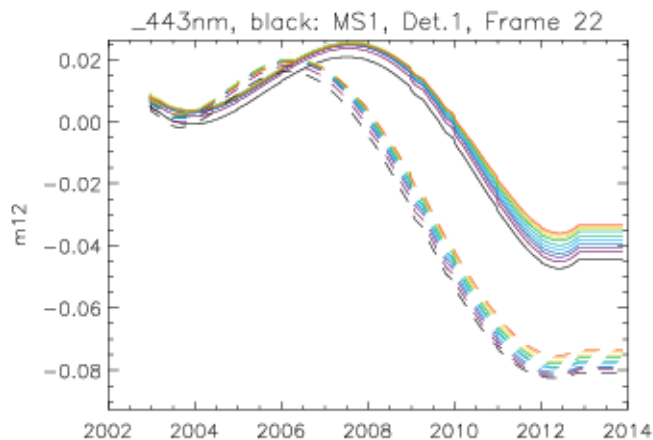


Solid/dashed line: Mirror side 1/2

Black, purple, ... orange, red: detectors 1-10

Improved Xcal results: (in progress)

- Alex Lyapustin reported overcorrection at beginning of scan
- Code issue found in xcal code (linear vs 2nd order)
- New results (right plot below) show smaller m12 correction for beginning of scan than operational results (left plot)

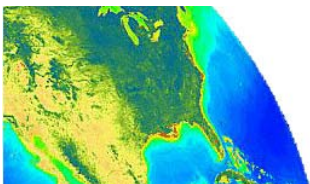
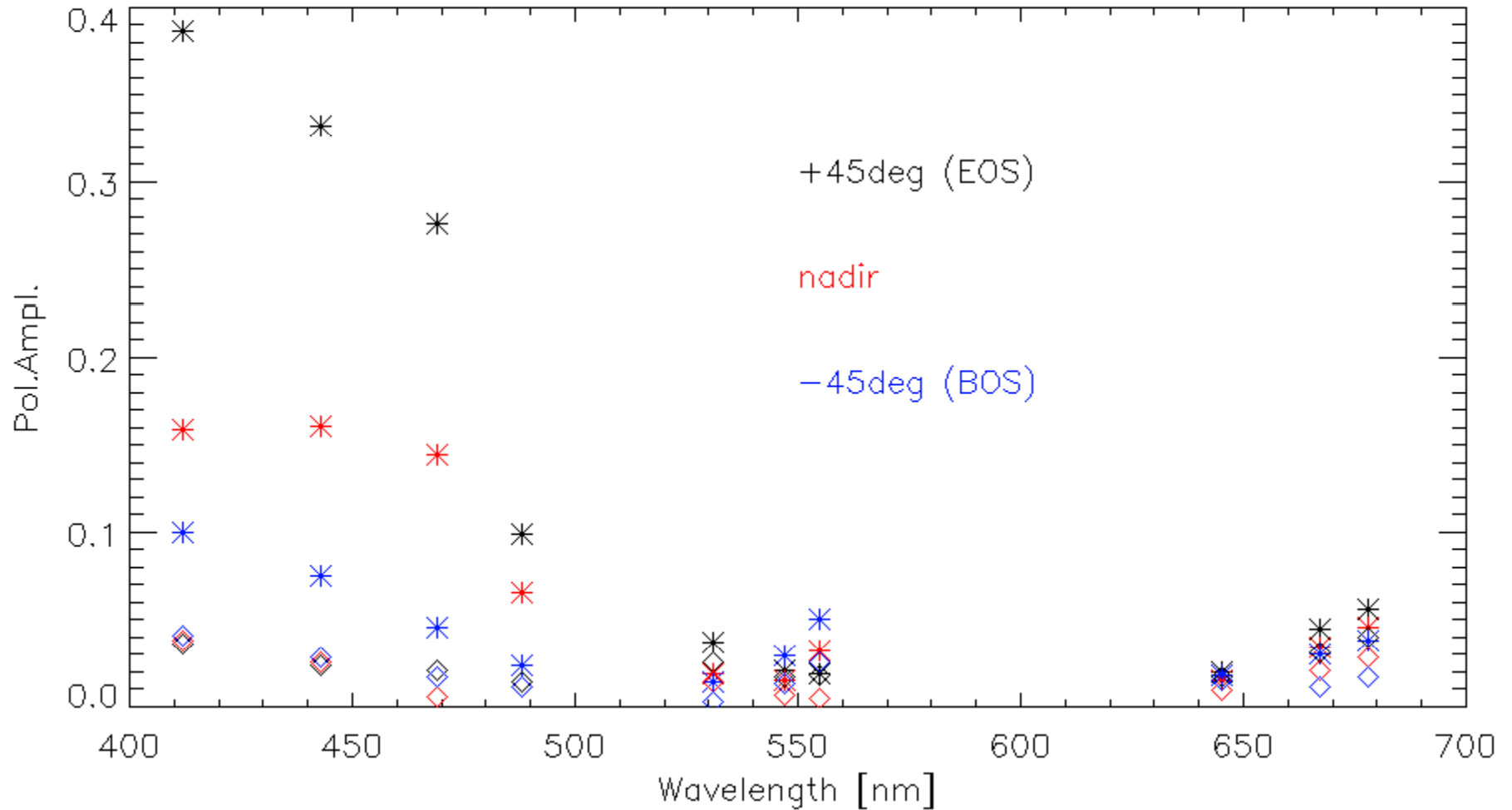


Solid/dashed line: Mirror side 1/2

Black, purple, ... orange, red: detectors 1-10

Xcal results: Max. Polarization Amplitude

MODIS Terra Polarization

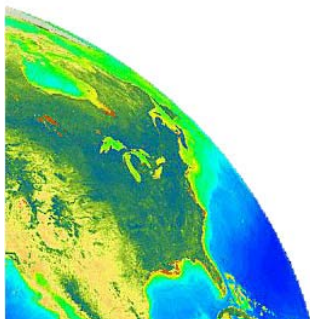


Stars: mission max.

Diamonds: beginning of mission

Summary:

- No large change in polarization sensitivity for MODISA
- OBPG xcal of MODIST to MODISA shows large change of polarization sensitivity for 412nm (40% at end of scan) with significant mirror side dependency
- End of scan still shows 10% difference to MCST gain trending for 412nm at end of scan, but overall MCST approach II is a huge improvement
- Evaluation performed at ocean radiances (very low, possible linearity issue) and using OBPG atmospheric correction approach ('potential' error would cancel for ocean, but probably not for other disciplines)
- Corrections for 469nm are similar to those for 443nm, but smaller (both for gain and polarization), as expected
- Wavelengths above 500nm have polarization amplitudes <5% throughout the mission



Backup

