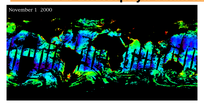
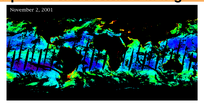
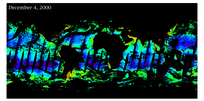
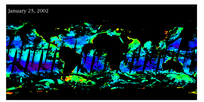
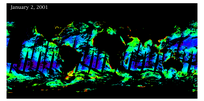
Interim Collection 4
Global Cholorphyll 36km maps MODIS SeaWiFS analog

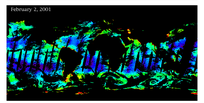


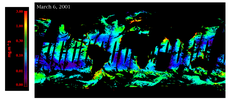


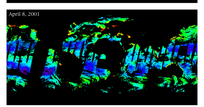


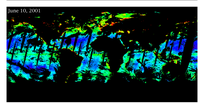


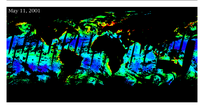


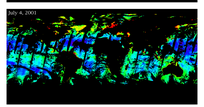






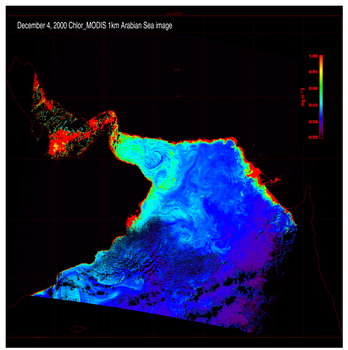






Regional 1km level 2 data show dramatic detail as seen in the Arabian sea image presented below.

1 km spatial resolution level 2



Time series of calibrated ocean products from NASA's Moderate resolution Scanning Spectrometer (MODIS)

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Abstract

Ocean color products as derived from radiances measured by the Moderate Resolution Imaging Spectrometer (MODIS) have undergone exhaustive corrections and calibrations since the instrument was activated aboard the Terra satellite. These corrections have been developed and applied both at the engineering and algorithm levels. The result is a global time series of 36km and 4km resolution ocean color products. Shown are MODIS global 36km daily chlorophyll maps using the SeaWiFS analogous OC3M algorithm. These images include only pixels with quality levels <=2.

The images were processed at the University of Miami using interim version 4 correction and calibration factors. Reprocessing of MODIS ocean color data is expected to begin in June, 2002 (Collection IV processing) and will be based on the calibration and corrections factors presented here. These Imagas are dramatically improved over previous versions, however, issues still remain and we expect to refine the correction factors before finalizing.

Comparisons to both insitu and SeaWiFS data show good agreement, and provide uncertainty and variability estimates that remain in the MODIS data in order to aid investigators who are beginning to use MODIS data sets for oceanographic research.

Summary of correction/calibration strategy:

Overall linear time trend removed from bands 8-12 using modal analysis
Minimum of 6 distinct epochs identified from MCST m1 coefficient times series
Bands 8-12 recalibrated to Moby insitu nlw for each epoch
Different polarizations(5a)
Remaining cross-scan dependence removed
Mirror side time dependence minimized
Inter-detector biases minimized
Remaining biases are approximately 1% for bands 8-12, RMS less than 10%

Time dependencies of cross scan and mirror side response before and after corrections

Cross scan response time dependencies

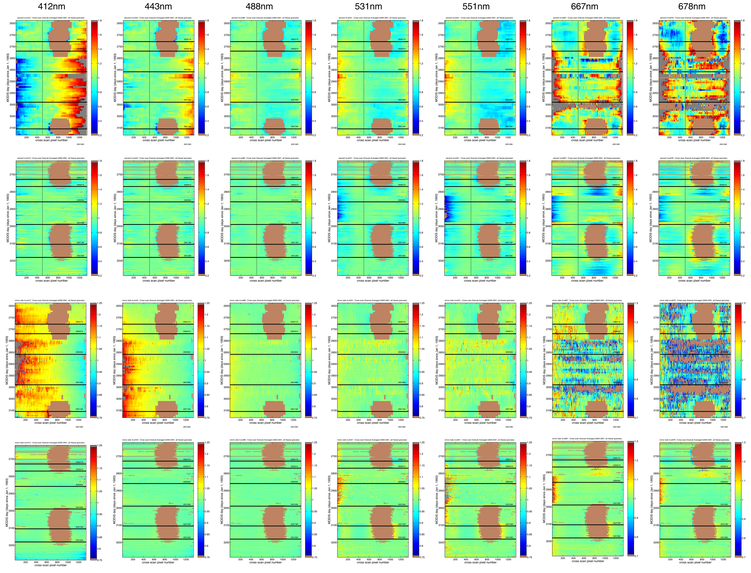
The plots below in row **A** show the before corrections time series of the average cross scan performance normalized to pixel 500 for granules over the Hawaii validation site. The continuous time coordinate on the y axis is seconds since Jan 1, 1993 (MODIS TIA time). These plots show a severe east-west bias in most bands, particularly 412nm. In addition the magnitude of these biases appear to change in time. The black lines identify the 6 epochs for which correction factors have been developed. These epochs correspond to changes in electronic state of the sensor and changes in rate of degradation in the mirror response as a function of scan angle.

The plots in row **B** are the results after cross scan corrections are applied to each epoch. The normalized cross scan performance in space and time is much more uniform and removes most of the east-west bias previously present.

Mirror side response time dependencies

The MODIS instrument has a rotating mirror such that every 10 scan lines are from opposite sides of the mirror. The plots below in row **C** show the before correction time series of the average absolute difference between the two mirror sides for all Hawaii granules. The plots indicate that the response of the two mirror sides changes as a function of time and scan angle, increasing the severity of the striping in images

The plots in row **D** are the results after mirror side corrections were applied to each epoch Both the cross scan and time dependencies of mirror side differences are dramatically reduced, although the early and current epochs (a-side electronics) require further refinement .

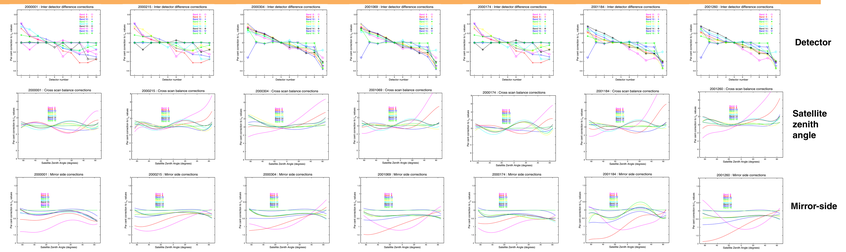


Sensor Correction Factors: inter detector, cross-scan, and mirror-side for 6 time epochs

Correction factors

These plots summarize the actual correction factors applied to the Level 1b radiance by the MODIS oceans software to correct problems associated with inter-detector discrepancies, response-versus-scan angle (RVS), and differences in mirror-side response. Each of these correction factors includes a time dependency due to changes in the sensor electronic state and mirror response degradation rate.

Factors for the 6 time epochs determined to date are shown, colored lines indicate the different MODIS wave bands. These factors are stored in the MODIS Oceans radcorr LUT and are applied during Level -2 processing.



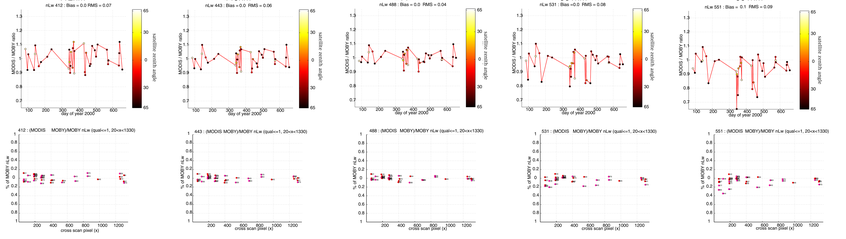
MODIS/MOBY insitu Matchups

Calibration MODIS/MOBY Matchups

The performance of the correction and calibration procedures can be evaluated from insitu matchups. The matchups shown are from MODIS Hawaii granules located over the MOBY buoy site. The insitu data includes a preliminary stray light correction determined by NIST for the MOS profiling instrument applied to both MOBY buoy instruments. Insitu data is included from only the top arm of the buoy measured at the time of the 2200hr overpass. Satellite Matchup points were required to have a quality <=1, tau <0.1, and not be within 20 pixels of the scan edge.

The remaining biases are generally <1% with an RMS <10%. This is on the order of the accuracy of the insitu measurements.

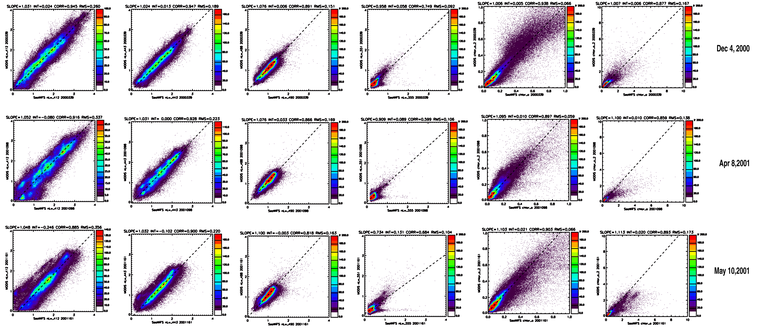
The cross scan correction factors appear to perform well, as seen in the relatively flat response across the scan line, removing most of the severe east-west bias previously present.



MODIS-SeaWiFS 4.63km global comparisons

MODIS SeaWiFS global matchup comparisons

Three days of MODIS 4.63km binned products were compared to same day retrieval SeaWiFS products binned to the same 4.63km spatial resolution as MODIS. The SeaWiFS data was from reprocessing 4 calibrated against stray light correct insitu data. The MODIS/SeaWiFS matchups include only collocated bins that had been assigned the highest quality for both sensors.

For the linear fits shown the bisector of the MODIS vs SeaWiFS and SeaWiFs vs MODIS was determined and the distance perpendicular to this line was used in calculating the weights. Thus, there is no true independent variable and the presence of errors in both sensors is assumed.

The nLw comparisons show good agreement, generally <3% difference. The MODIS OC3M chlorophyll algorithm (chlor_a2) produces results consistent with SeaWiFS, <10% difference depending on the retrieval day. Additional comparisons will be needed to evaluate any systematic differences between the two sensors.