MODIS/Aqua Evaluations

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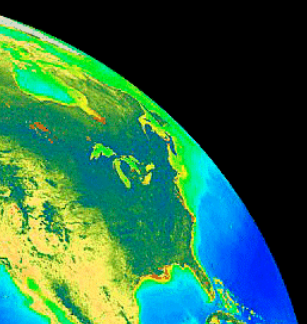


MODIS Processing Strategy

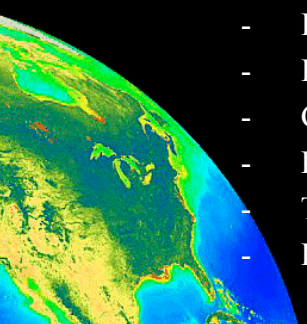
- Initial focus on MODIS/Aqua
  - MODIS/Aqua more stable than MODIS/Terra
  - MODIS/Aqua overlap with NPP/VIIRS
- Initial emphasis on calibration & Lwn's
  - Large seasonal/regional differences between MODIS/(Terra & Aqua) & SeaWiFS Lwn's
- Reduced product set until radiometry verified
  - Simplify processing for radiometry evaluations
  - Maintain a baseline consistent with SeaWiFS product suite. Expand product suite later.

MODIS Ocean Color Parameters

- **Previous OC Parameter Set**
  - Normalized water-leaving radiances (7)
  - Aerosol optical thickness (865 nm)
  - Atmospheric correction epsilon
  - Aerosol model numbers (2)
  - Clear water aerosol correction epsilon
  - CZCS pigment concentration
  - Chlorophyll-a concentration (3)
  - Total pigment concentration
  - Chlorophyll fluorescence line height
  - Chlorophyll fluorescence baseline
  - Chlorophyll fluorescence efficiency
  - Total suspended matter
  - Coccolithophore pigment concentration
  - Detached coccolithophore concentration
  - Calcite concentration
  - Diffuse attenuation at 490 nm
  - Phycoerythobilin concentration
  - Phycourobilin concentration
  - Instantaneous PAR
  - Instantaneous absorbed radiation for fluorescence
  - Gelbstoff absorption coefficient at 400 nm
  - Phytoplankton absorption coefficient at 675 nm
  - Total absorption coefficients (5)
  - Primary production (2 at Level-4)

- **Current OC Parameter Set**
  - Normalized water-leaving radiances (6)
  - Aerosol optical thickness
  - Atmospheric correction epsilon
  - Ångström exponent
  - Chlorophyll-a (1)
  - Diffuse attenuation coefficient at 490 nm

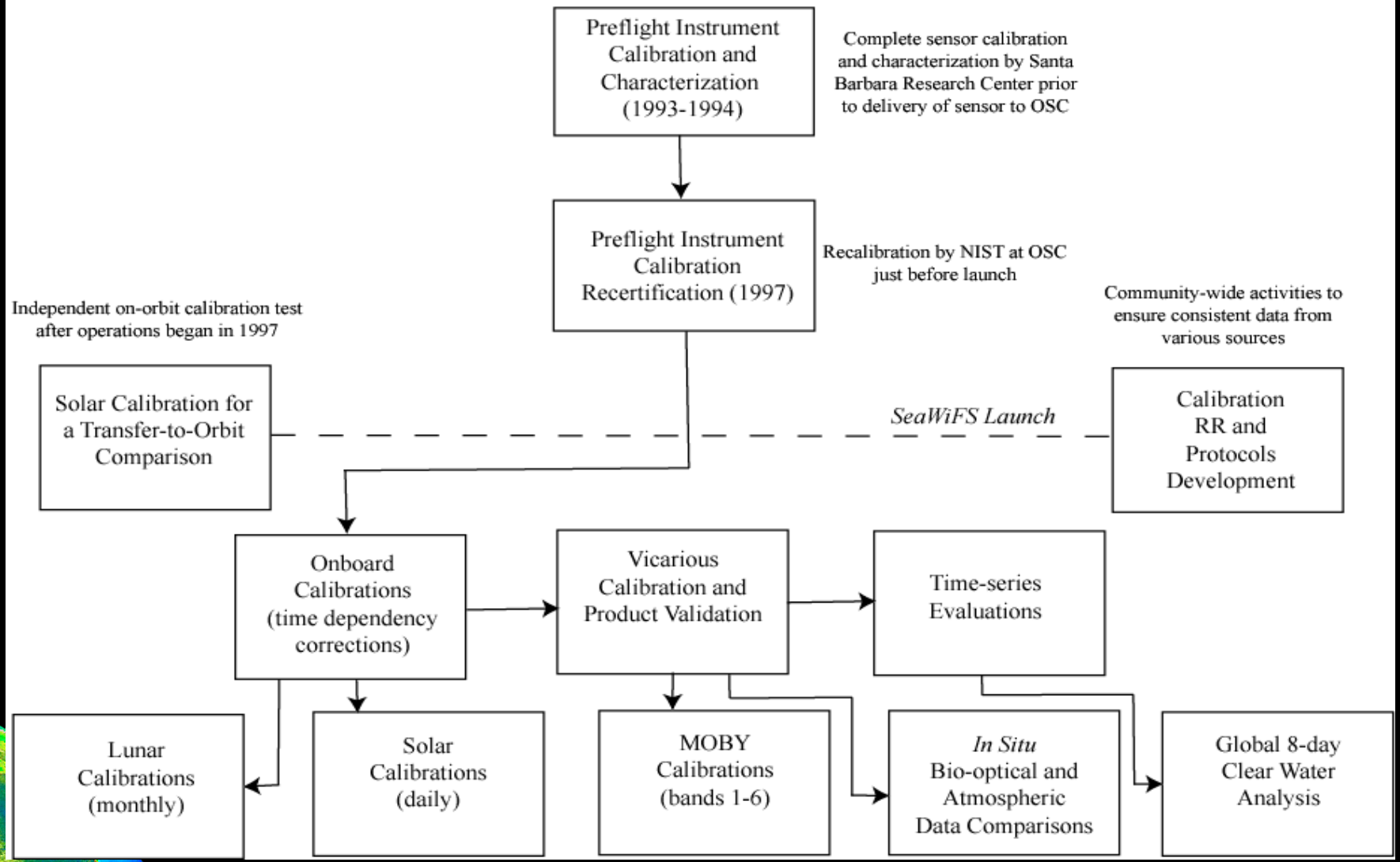
Previous OC Parameter Set (does not include archived ancillary data & quality control fields)	38
Current OC Parameter Suite (does not include archived ancillary data)	11



Evaluation Approach

- Apply same cal/val approach as for SeaWiFS
- Use common processing codes
- Work sensor calibration issues with MCST
  - Solar and lunar calibration analysis and products, e.g., calibration tables, response-vs-scan (RVS), sensor polarization.
- Systematically test algorithms using both SeaWiFS & MODIS for comparison
  - Polarization, BRDF, glint, cloud masking, etc.
  - Global time series with regional analyses (clear-water, deep-water, coastal, basin-latitude zones)

SeaWiFS Calibration Strategy

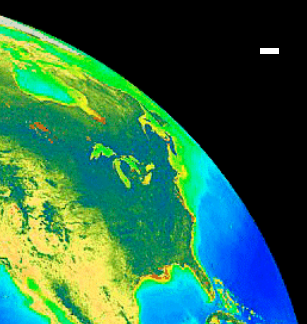


MODIS/SeaWiFS Comparisons

- MODIS polarization correction
  - Original tables
  - No correction
  - Phase-shifted tables
  - Phase-shifted and approximately 2X-amplitude tables

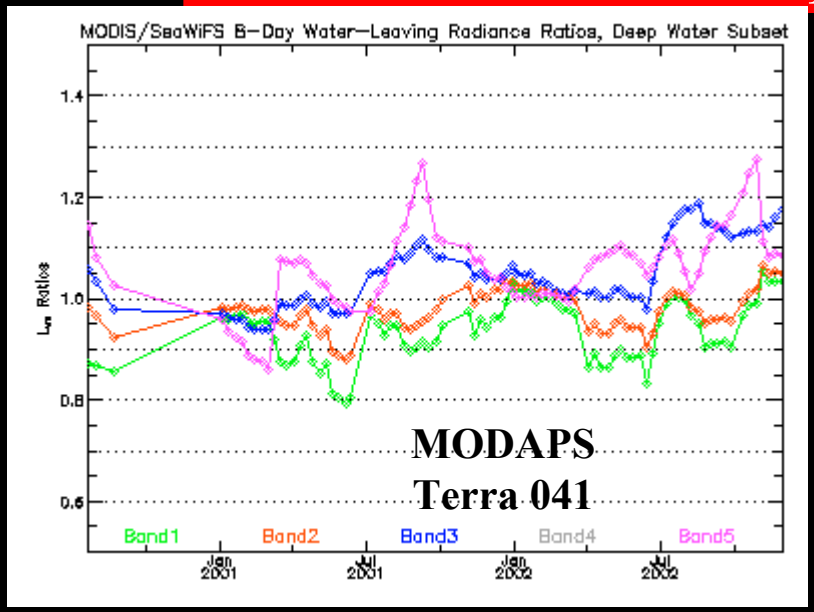
• MODIS polarization tables based on prelaunch characterization table.
• SeaWiFS essentially polarization insensitive.

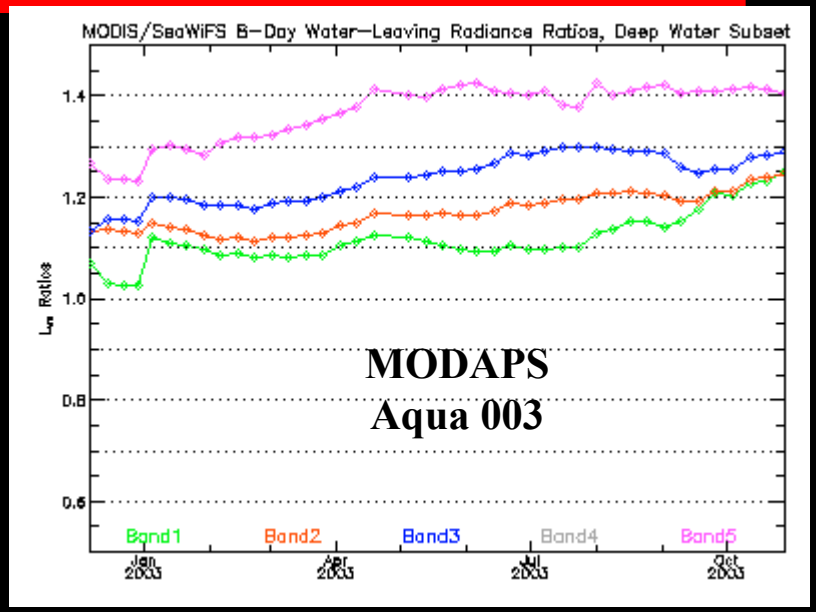
- BRDF correction (based on Morel et al., 2002)
  - Fresnel-only (flat surface; no wind speed dependence)
  - Morel $\Re$ (wind speed dependent)
  - Morel $\Re$ and f/Q
- Other
  - Sunglint radiance threshold
  - Cloud mask threshold

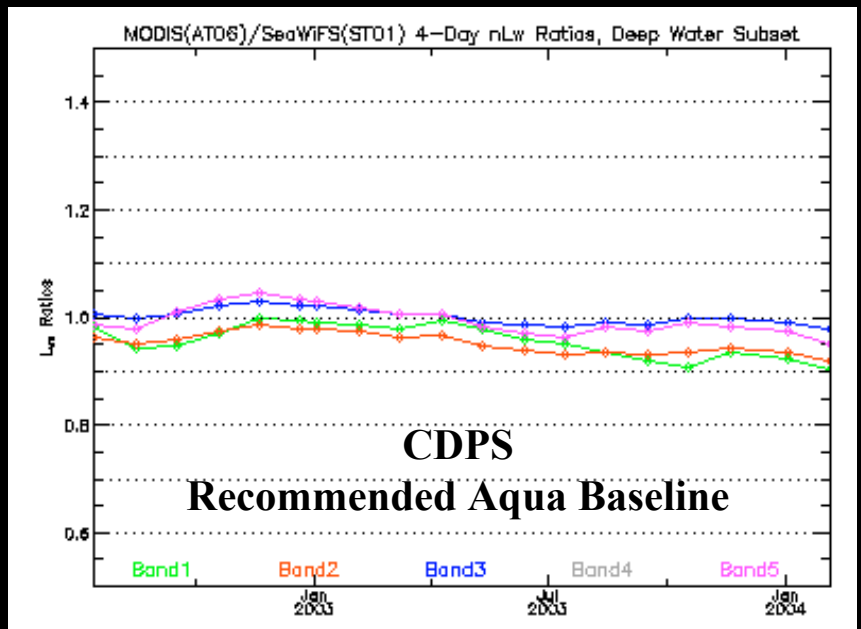


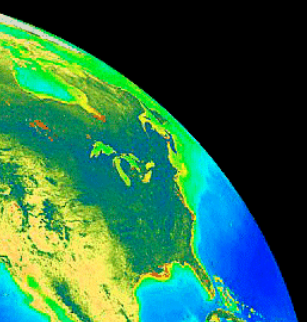
Lwn: MODIS/SeaWiFS Ratios

Deep-Water

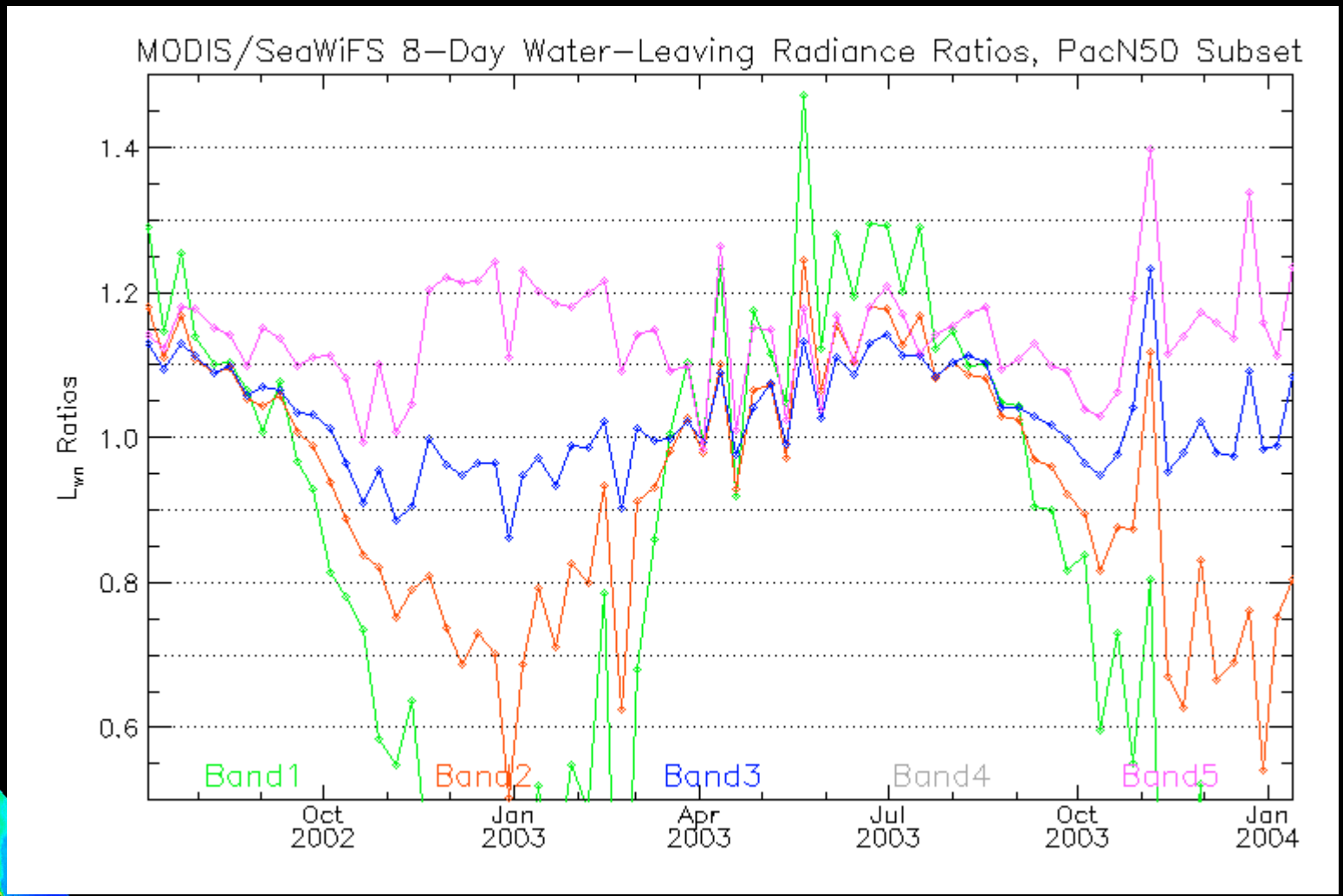




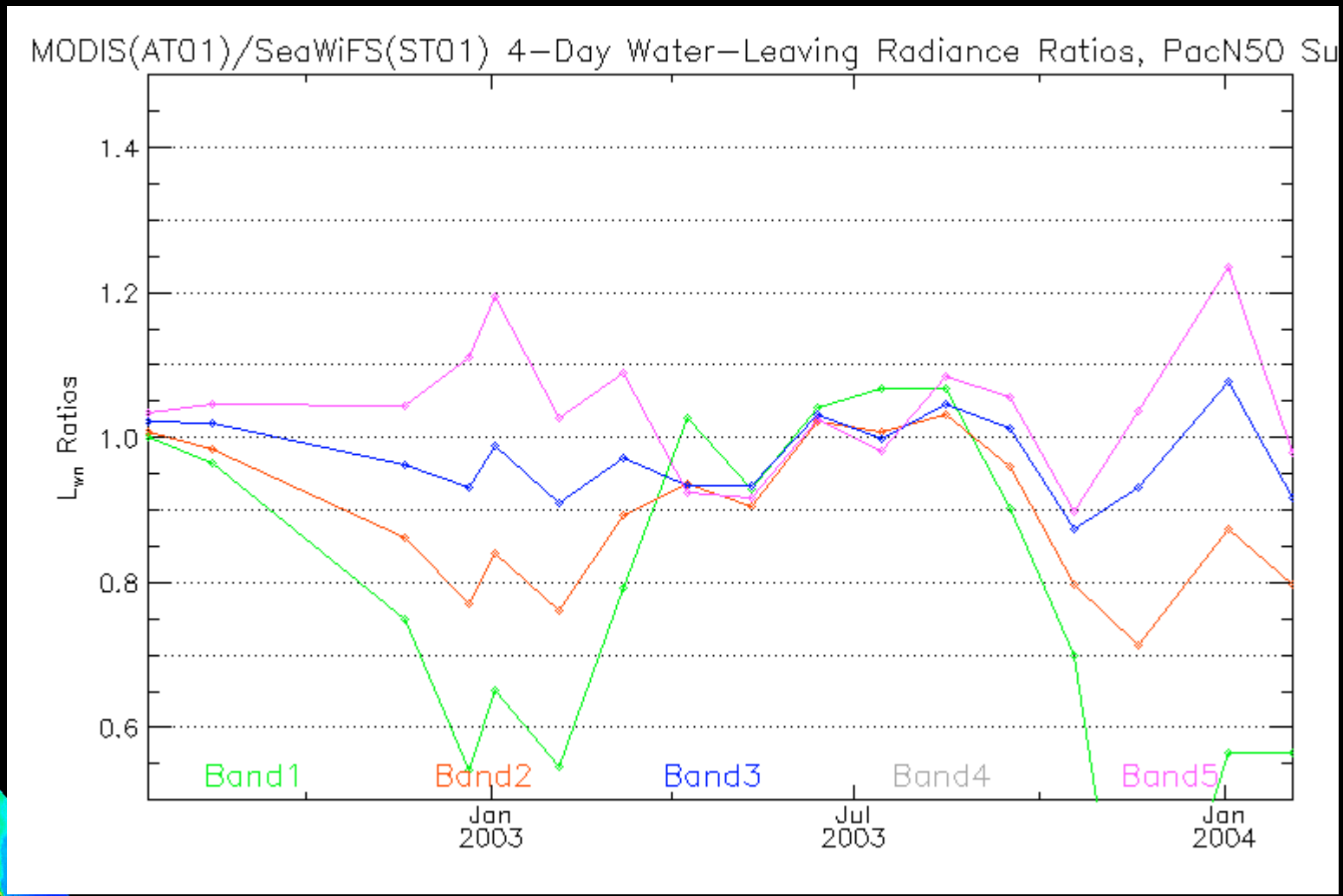




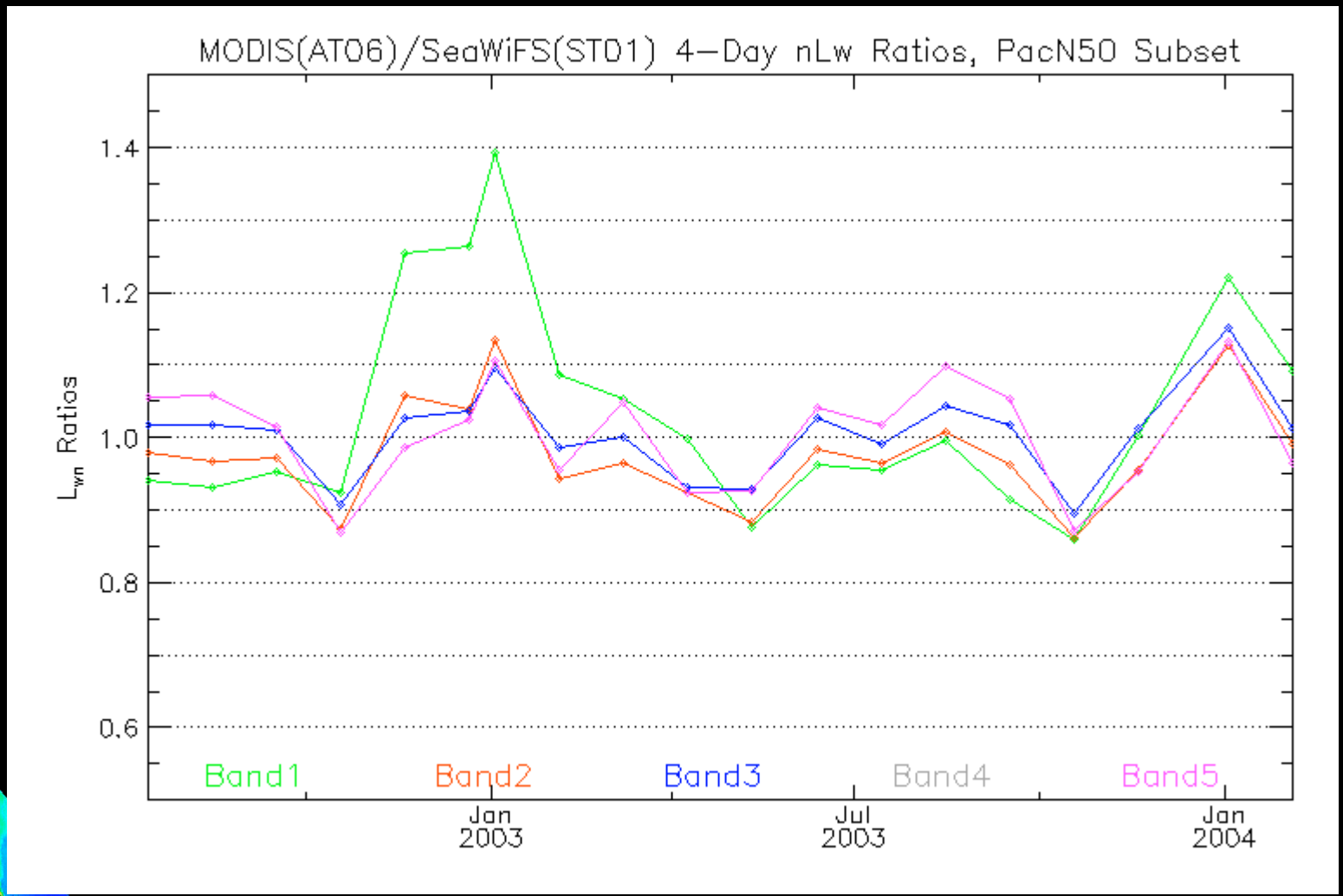
MODIS(Aqua)/SeaWiFS Lwn Ratios (N. Pacific): Original polarization correction



MODIS(Aqua)/SeaWiFS Lwn Ratios (N. Pacific): No polarization correction



MODIS(Aqua)/SeaWiFS Lwn Ratios (N. Pacific): Correct polarization (corrected phase & magnitude)

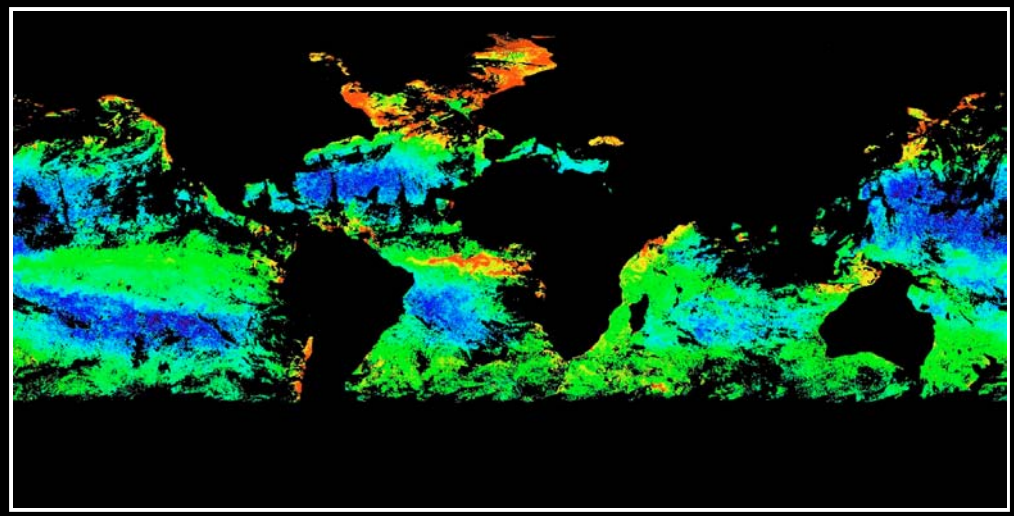


SeaWiFS & MODIS 4-Day Deep-Water Chlorophyll Images

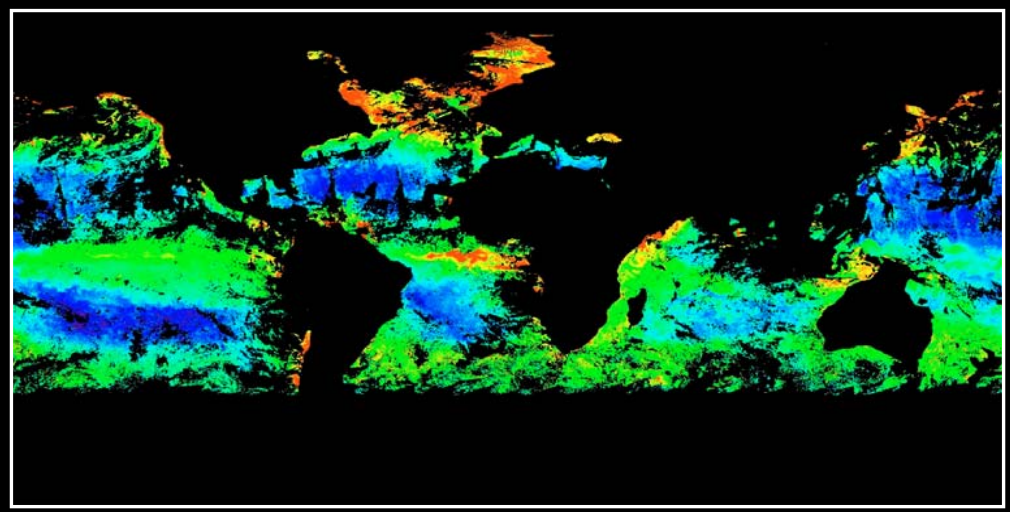
4 day composites, Summer 2002

0.01-1 mg/m^3

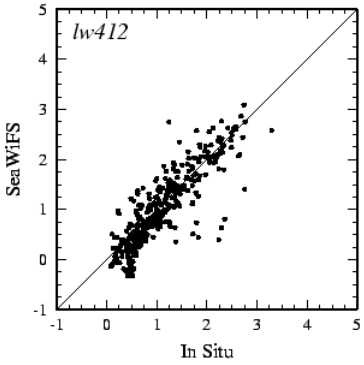
SeaWiFS

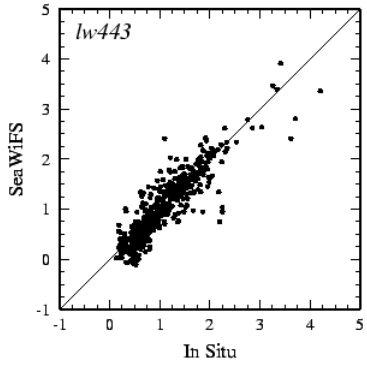


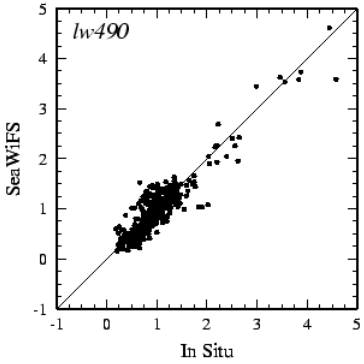
MODIS
(Correct polarization
phase & amplitude)

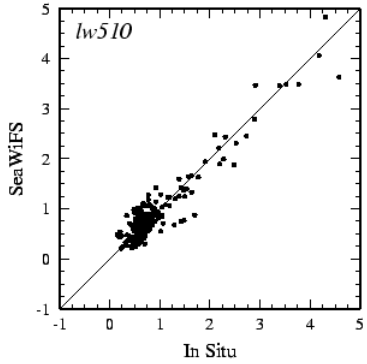


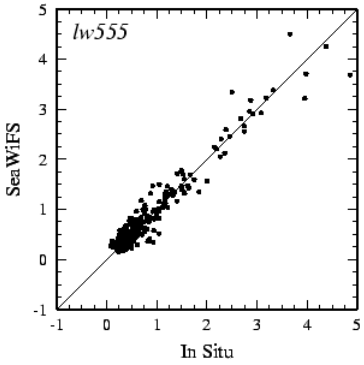
SeaWiFS Lw ODPS R4

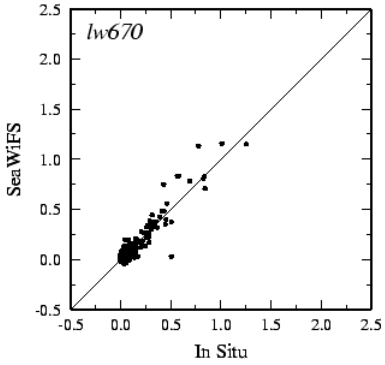




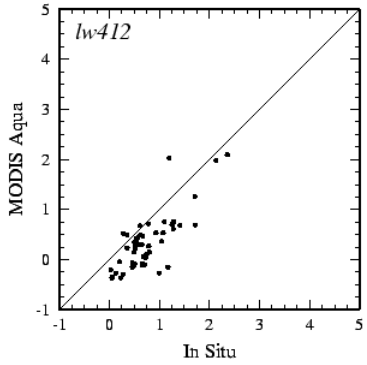


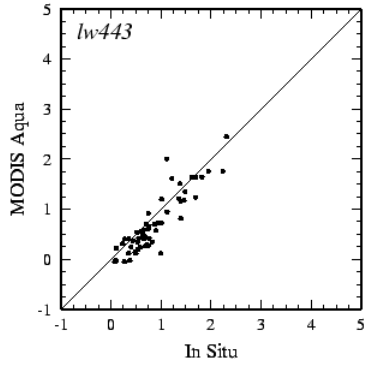


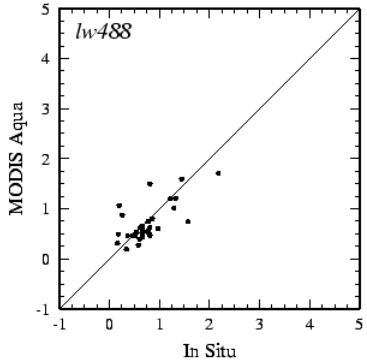


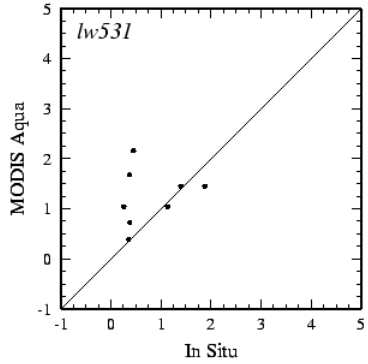


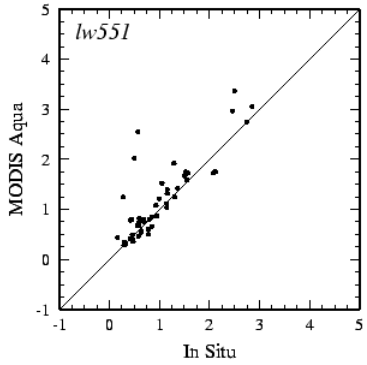
MODIS/Aqua Lw ODPS R1

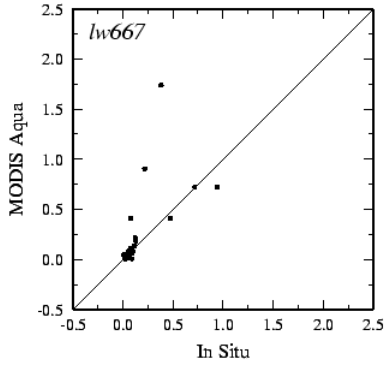




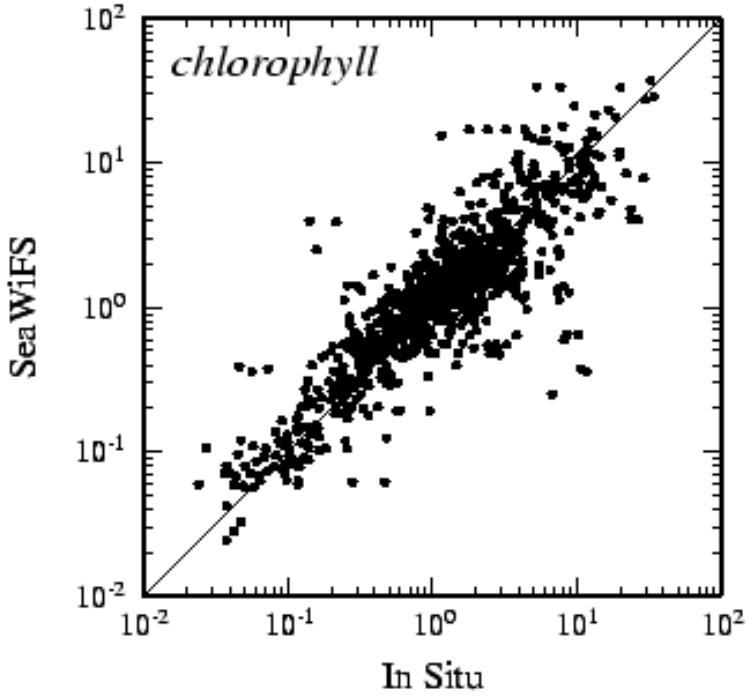




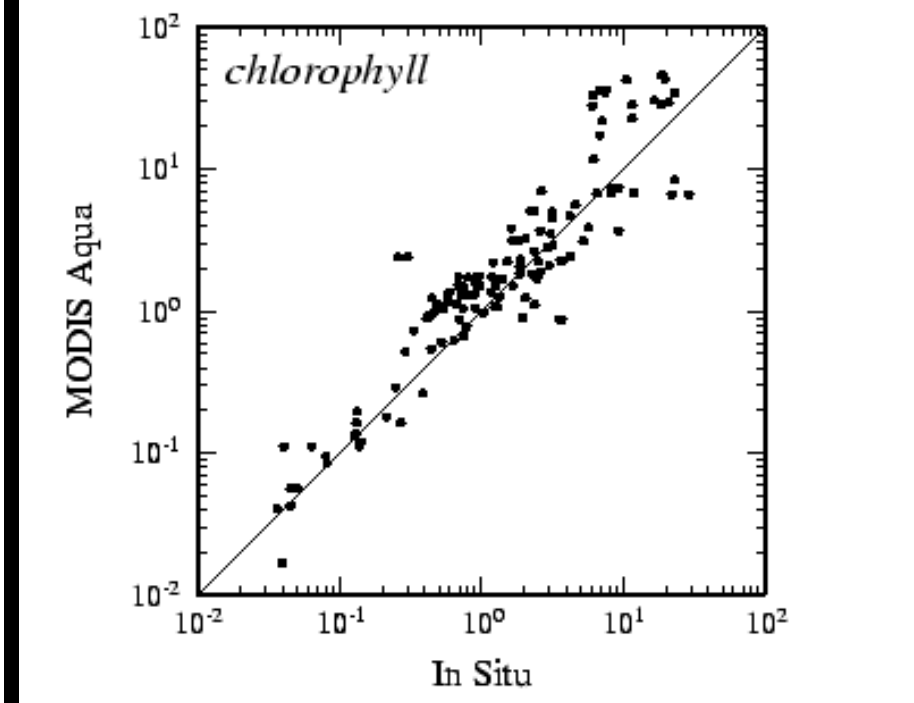


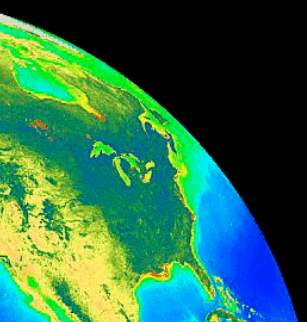


ODPS R4
OC4 Chlorophyll



ODPS R1
OC3 Chlorophyll





MODIS/Aqua Reprocessing Recommendations

- Use MCST temporally smoothed calibration tables
- Use phase & magnitude corrected polarization tables
  - Polarization working group to designate final table
    - Working group: Meister, Voss, Walushka, Xiong, Gordon
- Use "Fresnel-only" BRDF correction
  - Bio-optical algorithm working group needs to recommend standard algorithm for BRDF
- Use OC3 chlorophyll-a algorithm
  - Bio-optical algorithm working group needs to recommend standard chlorophyll algorithm for all sensors
- Keep current product set
  - Science team & HQ need to define updated product set

Additional Sensor Calibration Issues

- Temporal stability: long-term and seasonal
- Refine “Response vs. Scan” (RVS) or scan modulation functions
- Minimize mirror-side calibration differences (image banding)
- Detector to detector calibration (striping)

Analyses to be conducted in collaboration with MCST and science community.