We are creating a new algorithm that combines observations from MISR and MODIS (both on the NASA Terra spacecraft) to improve atmospheric correction and coverage for ocean color data products. The algorithm utilizes information-rich, multi-angle MISR observations for atmospheric correction, applied to MODIS. Our goal is to produce atmospherically corrected Remote Sensing Reflectance from MISR with enhanced coverage and accuracy, for input to downstream bio-optical ocean parameter retrieval algorithms.

An important aspect of this work is the utilization of multi-angle views of the reflected ocean surface sun glint. Usually, such observations are avoided, since the intensity of the glint overwhelms any contribution from the ocean body. However, MISR’s multi-angle observations do see varying degrees of glint, which means they can be used to better determine aerosol optical properties (Kaufman et al., 2002; Ottaviani et al., 2013), and to identify surface wind speeds that govern the glint pattern. The latter could be utilized to replace the wind speeds taken from ancillary sources that are currently used to conservatively mask potential glint contamination in MODIS observations.

To assess this capability, and to identify the appropriate parameterization, we present an analysis using the Generalized Nonlinear Retrieval Analysis (GENRA, Vukicevic et al., 2009) information content assessment. This technique is also easily modified to act as a Bayesian retrieval algorithm, for which initial results are discussed. Finally, we describe the status of integrating MISR data into the processing capabilities of the Ocean Biology Processing Group (OBPG) at NASA, and show the first ocean color vicarious calibration (Franz et al., 2007) of the MISR instrument.

Our goal: create a research algorithm that provides an atmospheric correction to MODIS-Terra observations within the MISR swath.

This will use MISR’s unique multi-angle observations to:
- better constrain wind-driven reflected sun glint (ancillary wind products are currently used),
- confidently extend MODIS retrievals closer to glint at low latitudes
- Provide improved aerosol selection / atmospheric correction

The algorithm will be created and tested at the Ocean Biology Processing Group (OBPG) at the NASA-Goddard Space Flight Center. OBPG creates ocean color products from MODIS, VIIRS, SeaWiFS and other multi-spectral sensors.

Do MISR observations have the information content to do this? Analysis with Generalized Nonlinear Retrieval Analysis (GENRA)

We use the Generalized Nonlinear Retrieval Analysis (GENRA, Vukicevic et al., 2010) technique to estimate the posterior distribution of simulated observations given MISR measurement uncertainty.

Example for 3% radiometric uncertainly

Same, but geometry with no glint

1st scene, but excluding 2 angles

Parameter space (m)
- Aerosol Optical Thickness
- Aerosol Angstrom parameter
- Surface wind speed

Lookup table (LUT) typically used for retrieval is repurposed for GENRA.

Measurement space (y)
- TOA radiance at 865nm
- MISR channels (9 view angles / 3 angles)

Measurement space (g)
- Observations
- Data
- Posterior
- Normalization constant

Initial retrieval using MISR 865nm data

This first demonstration shows the potential for reasonable results, but with interpolation artifacts. Compared to SeaBASS in situ results, MODIS works in otherwise glint contaminated regions, and retrieves wind speed, rather than ingesting ancillary values.

Next steps:
- Relative interpolation/depolarization issues indicated above.
- Using GENRA as a tool, refine LUT so it appropriately parameterizes our problem.
- Apply Ocean Color standard vicarious calibration to MISR.
- Investigate application of MISR retrieval to MODIS atmospheric correction
- Process results for comparison to SeaBASS in situ results.

Initial retrieval using MISR 865nm data from ancillary sources that are currently used to conservatively mask potential glint contamination in MODIS observations.

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