Impact of Instrument Calibration and Instrument Characterization on Vicarious Calibration

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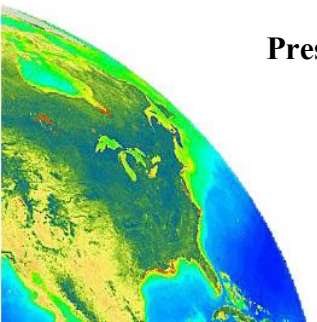
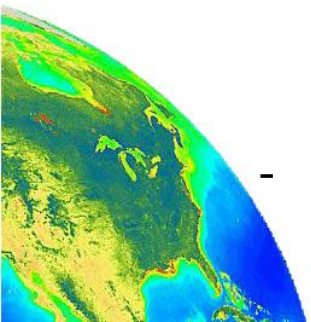


Presentation at workshop 'Ocean Color System Vicarious Calibration for Science and Operational Missions'
Frascati, Italy

Absolute calibration: does it matter?

- Vicarious calibration coefficients are relative to the absolute calibration of the instrument, effectively replacing it (uncertainty associated with abs. cal. is 'lost')
- Although the numeric values of the vicarious calibration/adjustment coefficients depend on the choice for absolute calibration approach, there should be no impact on the ocean color products
- Vicarious gain/adj. larger than combined uncertainty should be a warning flag (OCM-2)
- SeaWiFS: prelaunch absolute calibration (sphere radiance), on-orbit lunar trending
- MODIS, MERIS: on-orbit absolute calibration and relative trending with solar diffuser (reflectance)
- Uncertainty associated with sphere radiance is usually higher than uncertainty associated with reflectance, so MODIS/MERIS approach is preferred
- Absolute calibration still needed for those bands not vicariously calibrated (e.g. 865nm for SeaWiFS), but only with 5% uncertainty (Menghua Wang)



Temporal trending:

- Uncertainty in the temporal trending negatively impacts accuracy of vic. gain
- But by how much?
- Extreme example: instrument gain is too high at beginning of mission, too low at end of mission by same amount, changing linearly, matchups are evenly spaced in time: net effect zero?
- Another example: MOBY/MODIS matchups mainly in winter, seasonal error in instrument gain trending (e.g. via polarization sensitivity) would bias vic. gain

Scan/View angle dependence:

- Glint for non-tilted sensors favors matchups at certain view angles
- For example, MODIS third quarter of the scan has largest glint contamination, lowest number of matchups; for MERIS, number of matchups should vary strongly with camera
- Note that an observed variation of vic. gain coef. with sensor zenith angle could be due to
  - instrument characterization
  - atmospheric correction
  - ocean BRDF

Straylight:

- Straylight increases the measured radiance next to clouds
- Not a problem if there is a perfect straylight correction (haha)
- Screening of matchups for vicarious gains is usually more stringent than regular processing, which could lead to a bias

Other effects:

- **Imperfect Temperature correction:** If there is a significant temperature variation within an orbit, an in-situ site at a high latitude could cause a bias
- **Imperfect Polarization correction:** could lead to variations of vic. Gain coefs. with time and scan angle
- **Relative Spectral Response:** a varying RSR (e.g. varying with view angle) could impact vic. gain (depending on magnitude of RSR variation)
- **Imperfect Linearity correction:** most likely result would be a scan angle dependence of the vic. gain coefficients (radiances are highest at the edge of scan)