Breakout Workshop:

Achieving long-term consistency in cross-sensor ocean color data products

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Description

Detecting long-term trends in satellite observations, including those influenced by climate change, requires timescales typically much longer than that of an individual sensor or sensor series. While 'marathon' missions (lasting > 20 years; e.g., MODIS) may offer some such ability to address long-term science questions, dedicated calibration activities are required to achieve and maintain ocean color radiometry (OCR) consistency, even for a single sensor. Nevertheless, with MODIS slated for decommissioning, the duration of the longest continuing single-sensor OCR dataset will soon be halved (> 20 years for MODIS to > 10 years for VIIRS), and combining data from multiple missions is still required to address multi-decadal time scales and to benefit from the enhanced coverage afforded by several sensors. Although several current and future sensors (e.g., OLCI on Sentinel-3A and -3B; VIIRS on SNPP, NOAA-20, and NOAA-21; OCI on PACE) will carry on the OCR legacy, substantial effort is required to ensure continuity of the multi-sensor ocean color record, and to reduce uncertainties when combining data across platforms. Indeed, numerous sensor-specific attributes (e.g., band placement and spatial resolution) and prevailing geometric characteristics (e.g., orbital elements and optical path geometries, with consequences on BRDF correction) may individually or synergistically contribute to cross-sensor discrepancies that show non-random spatial and temporal variations.

Consideration of these factors is required when merging data from disparate instrument series (e.g., MODIS/Aqua vs VIIRS/SNPP), as well as from sensors of the same series (e.g., MODIS/Aqua vs MODIS/Terra). Recently characterized seasonal biases in OCR datasets further complicate within- and cross-sensor consistency. Additionally, higher resolution sensors (e.g., MSI on Sentinel-2A and -2B; OLI on Landsat-8 and -9) are increasingly becoming integral to monitoring of coastal and in-land aquatic systems, and present unique intercalibration challenges, while some thinking may be required to optimally relate upcoming hyperspectral data to the existing multi-spectral data records. When assessing cross-sensor consistency using co-located and coincident data from multiple sensors, tandem orbital phases provide the optimal conditions for determination of radiometric consistency, while intersecting orbits allow for more geometric-based continuity assessment. Cross-sensor continuity can also be investigated by comparing multiple satellite sensors to the same in situ dataset(s). In either case, such assessments require accounting for uncertainties of the satellite products (and in situ data).

In this breakout workshop, invited presentations will establish the current knowledge base and moderated discussions will explore cross-sensor continuity, including underlying causes for discrepancies, reporting best practices, potential remediation, and implications for our ability to address long-term science questions with OCR.

Objectives

1. Solicit feedback from the ocean color community on existing knowledge gaps and their likely relative importance.
2. Encourage prioritization of cross-sensor assessments and open publication of results accounting for sensor uncertainties.
3. Stimulate the development of approaches to correct identified discrepancies.

Key Questions

1. Which sensor attributes / geometry characteristics are most critical to address when combining data from different sources? How do identified seasonal biases in OCR datasets affect cross- sensor dataset consistency?
2. To what extent do cross-sensor discrepancies diminish our ability to assess long-term (climate scale) issues?
3. Should the community advocate for ‘marathon’ missions (i.e., 20+ year expected life), or can merged products sufficiently capture relevant climatic trends? What criteria should be required to consider a merged-sensor dataset capable of detecting long-term trends?