Breakout Workshop: Remote sensing of optically complex and shallow waters

Chair: ZhongPing Lee (UMass Boston, ZhongPing.Lee@umb.edu)
Co-Chair: Dirk Aurin (NASA GSFC, dirk.a.aurin@nasa.gov)

Description:

Optically complex waters and shallow water environments continue to present unique challenges to our evolving understanding of ocean color remote sensing, and to the operational and mission capabilities we are bringing to bear on the problem even today. By definition, complex waters contain optically active constituents which fail to co-vary in concentration or optical characteristics with one another, thus belying the assumptions we usually tend to use in the open ocean to invert reflected sunlight for the estimation of those constituent properties such as chlorophyll concentration. Also, variations in the vertical dimension further complicate the matter. Shallow water reflectances, on the other hand, are often anomalously high (i.e. routinely masked and problematic for atmospheric correction), and characterized by extreme spatial heterogeneity compared to most other aquatic environments, while also contributing additional unknown parameters to the inversion of the light field beyond the capability of some operational semi-analytical approaches. Further, most current and legacy ocean color sensors are not optimized for observing optically complex or shallow waters – for example having too few spectral channels for accurate separation of inherent optical properties or characterization of phytoplankton pigments, saturating over shallow or turbid pixels, or underestimating constituent concentrations due to spatial/vertical sampling limitations, among other problems. These technological limitations exist despite the fact that many of these waters are situated near-shore or inshore and host fragile and important ecosystems such as coral reefs and fisheries that are important to human life, while being significantly impacted by human activity. As more sophisticated sensors are developed with higher spatial, temporal, and spectral resolutions, as well as polarization sensitivity and active sensing through LIDAR, their capabilities have the potential to vastly change and improve how we study optically complex and shallow waters remotely. This workshop is designed to explore these recent developments and consider whether our theoretical understanding is keeping pace with technological capabilities scheduled to come online in the near future.

Key Questions:

- What are the main challenges to accurate remote sensing in optically complex and/or shallow waters today? (Common issues vs regional-specific challenges)
- How will developments in mission and operational capabilities over the next 3-5 years impact current limitations in ocean color remote sensing within these

environments? (Plume evolution, PFTs/species differentiation/phytoplankton absorption coefficient distinction, CDOM source and properties (spectral slope, CDOM/DOC), masking/saturation of high turbidity pixels/regions, adjacency issues, marine aerosol discrimination, etc.)

- What new developments are there in global or regional algorithms in complex and/or shallow waters that will be able to take advantage of these technological improvements?
- How can we improve our ability to classify water types/bottom types in order to facilitate operational analysis of ocean color in optically complex and shallow environments?
- Aside from optical data, what information -- such as tides, currents, temperature, bathymetry, salinity, etc. -- can be made available through other means, can/should be employed when inverting a remote sensing spectrum?