Breakout Workshop: Atmospheric correction under complex or extreme conditions/ environments

Chair: Constant Mazeran (constant.mazeran@solvo.fr)
Co-Chair: Amir Ibrahim (Amir.Ibrahim@nasa.gov)
Co-Chair: Robert Frouin (rfrouin@ucsd.edu)

Description of Breakout Workshop

Space agencies have been successful in producing high quality ocean color (OC) data from satellite remote sensing over the open ocean where the atmospheric conditions are near ideal. However, there is still a strong necessity to improve OC remote sensing under more complex conditions frequently observed by satellites. The OC signal is only a small fraction of the total signal measured by a sensor at the top of atmosphere, rendering the atmospheric correction (AC) a challenging task. A non-robust AC algorithm can induce failures in OC retrievals under complex conditions, resulting in loss of a significant volume of OC data. These complex conditions include for instance strongly scattering waters in the near-infrared, highly absorbing waters in the visible, strongly absorbing aerosols, presence of thin clouds, sub-pixel variability, adjacency effects near bright targets, shallow waters, residual sun glint, and high viewing or solar zenith angles. Another technical challenge to foster OC data in complex environments is to provide users with an evolved level of confidence, such as per-pixel uncertainties (e.g. mission requirements of Sentinel-3), instead of binary flags (success/failure).

Building on the earlier IOCS 2013 session about atmospheric correction (Advances in atmospheric correction of satellite Ocean-Color imagery), the goal of the present workshop is to review the recent progress achieved by the OC community and help identifying the remaining gaps in current algorithms. The outcome is to provide space agencies with the priority focus that would extend the benefit of operational OC missions. To maintain a focused and fruitful discussion, the workshop will be structured around three main topics and a final discussion: atmospheric correction over optically-complex waters (Part 1); atmospheric correction in the presence of absorbing aerosols (Part 2); uncertainty estimates (Part 3); and a final discussion to exchange about other important topics that should receive more attention in the future (e.g. AC over shallow waters, synergy between sensors, use of global numerical model outputs). The workshop will provide the audience with a quick feedback about the on-going international OC activities (notably two IOCCG working groups: Inter-comparison of Atmospheric Correction Algorithms Over Optically-Complex Waters and Uncertainties in Ocean Color Remote Sensing) and will keep two-thirds of the time for live discussion guided by seed questions. The workshop will reflect on the active context in OC embracing both operational and emerging technologies: long-term Sentinel-3 program (OLCI), high resolution missions (Sentinel-2, Landsat), hyperspectral sensor (PACE) and geostationary orbit (GOCI-II).

Key Questions

Question 1: What is the most robust strategy for AC over optically-complex waters?
Possible outcomes: strategies and recommendations in the development of AC: evolutions from the classical “Gordon-Wang-Antoine-like” and spectral matching “POLYMER-like” (bands, models, inverse method), ideas to handle the variety of IOP models at global scale, robustness to instrument radiometric calibration and noise.

Question 2: How to detect and correct for absorbing aerosols?
Possible outcomes: capabilities and limitations of optical radiometry, use of bands for assessing the altitude of aerosol plumes (e.g. O_2 band), requirements for future sensors (e.g. bands, polarization, LIDAR), challenge in the RTM, use of ancillary data (transport model)

Question 3: How to derive uncertainties in the atmospheric correction?
Possible outcomes: main sources of uncertainty, generic methodology for uncertainty propagation, per-pixel estimates, importance of spectral correlation, method to detect out-of-scope conditions, best practice for efficient delivery to users