Proposal for a New IOCCG Working Group

Proposed by (name, affiliation, and contact information)

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Working group title

Guidelines for algorithm selection for Optically-Complex Waters

GASOCW

Scientific and programmatic background and rationale

Coastal and inland water bodies play host to an enormous suite of vital ecosystem services, yet are under increasing pressure from both a rapidly changing climate and anthropogenic pressures. Ocean colour radiometry has the potential to reveal the response of these systems to these pressures and, thus, facilitate rapid and appropriate responses and mitigation measures.
In coastal and inland waters, a large variety of processes affect concentration, size, and physico-chemical composition of particulate and dissolved matter in the water column. Hence concentrations as well as specific inherent optical properties of chlorophyll (CHL), total suspended matter (TSM) and coloured dissolved organic matter concentrations (CDOM) are subject to potentially large and independent variations across (and within) water bodies.
Universally applicable algorithms for the retrieval of water constituents from optically complex waters are not known, thus a large variety of specific algorithms and approaches are available in the optical oceanography literature. However, there remains much uncertainty both by specialists and non-specialists over how to choose the appropriate algorithm for their area of interest.
A framework is required, therefore, to objectively guide algorithm implementation for optically complex waters. In so doing, we would develop a deeper understanding of algorithms' strengths and weaknesses, provide a robust, unambiguous operational strategy for end users, and exploit the full potential of a new generation of ocean colour radiometry sensors.

Several international space agencies have ocean colour sensors with spatial resolution and SNR characteristics necessary for imaging optically complex waters either in orbit, about to be launched, or launched within the decade. Drawing on the collective experience and expertise from all of these programs will allow insight into the challenges of retrieving robust water colour products from a wide variety of perspectives and, it is hoped, help to produce a document that is relevant and useful worldwide.

This WG will carry out a study of how the algorithms work and what components of their form perform best under which conditions to define a set of evaluation metrics to quantify the best algorithm performance for a given coastal/inland system. This WG will hence revisit parts of IOCCG Reports Number 3 and Number 5, taking into consideration novel methodologies and numerical approaches. It is also complementary to the work currently being carried in out in the uncertainty, water quality and the coastal atmospheric correction working groups.

The main 'deliverable' of the WG will be documentation of an integrated approach to assess algorithm performance (and, thus, algorithm improvement) that combines fundamental scientific principles and real life requirements of managers and researchers. This will include acceptable uncertainties, definition of metrics of improvement or 'goodness of fit' of the algorithms, and perhaps an IFTT (if this then that) process based on our analyses of the algorithms, that allow specialists and non-specialists to make informed decisions on how to decide upon and use an algorithm.

Terms of reference

- Identify current algorithms currently applied in optically complex waters (band ratio, SAA, NN, GAs,)
- Characterise the underlying principles for each algorithm class to identify what components of their form perform well or not (when/where)
- Define which geophysical parameters is possible to estimate (and how accurately) for a given coastal/inland system
- Define a procedure and set of evaluation metrics to identify the best performing algorithm(s) for a given coastal/inland system
- Formulation of guidelines for algorithm selection and use for specialists and non-specialists by addressing the following questions:
  - How do you evaluate if an algorithm/sensor/parametrization performs better than another?
  - Can we give indication on how/why an algorithm will work?
  - For spectral pre-classification/blending approach, how do you decide what to use?

- This group will NOT perform a comparison exercise of existing algorithms for optically complex waters

Proposed membership

Academic/government researcher community

- Vittorio Brando (co-chair), CNR, Italy
- Susanne Craig (co-chair), Dalhousie, Canada
- Jeremy Werdell, NASA, USA
- Zhongping Lee, UBoston, USA
- Chuanmin Hu, USF, USA
- Timothy Moore, UNH, USA
- Rick Stumpf, NOAA, USA
- Caren Binding, Environment Canada, Canada (still tbc)
- Vincent Vantrepotte, CNRS, France
- Hubert Loisel, IRD France & STI Vietnam
- Bouchra Nechad, RBINS, Belgium
- Thomas Schroeder, CSIRO, Australia

Private sector

- Daniel Odermatt, O&B, Switzerland (still tbc)
- Mark Matthews, South Africa (still tbc)
- Steef Peters, Water Insight, the Netherlands

Draft time line

One 2-day workshop in second half of 2016 to setup report structure (probably before/after Ocean Optics)
12 months for draft report
One 1-day workshop in first half of 2017 to check progress on the report (probably before/after the IOCS)
One 2-day workshop in second half of 2017 to finalize report