SI-Traceable In-Situ Aquatic Radiometry: Bridging the Gap Between Different Measurement Methodologies

Chairs: Agnieszka Bialek, Carol Johnson, Giuseppe Zibordi

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1 - 4 December 2025

Goals of the Breakout Workshop

Well established systems as AERONET-OC and MOBY and new technologies allowed for the development of in situ networks of hyperspectral radiometers including “un-docked” profilers (BGC Argo, HyperNAV), and drones (AUV).

All instrumentation require a robust link to SI units, instruments characterisation in changing environmental conditions, coherent measurement, data reduction and quality assurance protocols and open-for-scrutiny processing.

Modelling of correction steps is crucial for all aquatic radiometry

Goals of the Breakout Workshop

1. What should be our priority when addressing existing discrepancies between the aquatic radiometry methods? (SI –traceability)
2. Could the global SVC sites be used as “primary standard laboratories” at sea from where the in situ radiometry scale can be disseminated to all other measurements?
3. How can we design a field experiment that profits from SVC instrumentation and allows us to test optical closure between the aquatic radiometry methods?

Session summary 4 presentations

SI Traceable Aquatic Radiometry:
Elements for Discussion

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Field radiometry methods:
some elements for discussion

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SI-Traceable In-Situ Aquatic Radiometry:
Bridging the Gap Between Different Measurement Methodologies
Modelling and simulations

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In collaboration with
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Uncertainty:
Elements for Discussion

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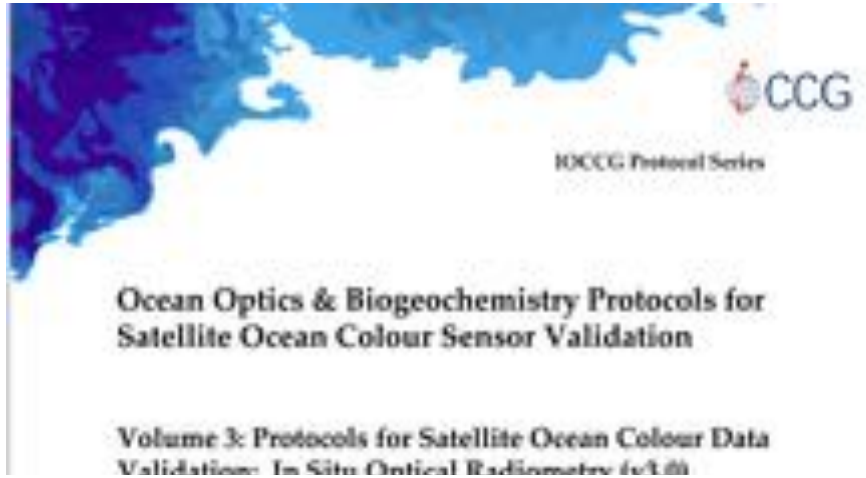
Session summary discussions points

- Protocols:
  - Additional instruments like sky cameras, polarisation
  - Update for coastal waters fresh water, incorporation of surface reflectance may need collaboration with land or atmosphere communities
  - New methods (drones, floats) measurements protocols, how many comparison data are needed to reach a robust conclusion
- Modelling
  - Complex task but urgently needed to address ρ – factor. Platform perturbation hard to create a model fit for all, suggestion to focus on high data rate providers
- Processors useful and should be supported
- Uncertainty
- Training
- Comparisons – on verified methodologies

Review of Existing Recommendations

- Ensure that they are commonly applied
- Update protocols for a new measurement methods/platforms



IOCCG International Ocean Colour Coordinating Group

Request to manufacturers of in situ and above-water spectral imaging radiometers in the UV, VIS and NIR range

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Open Access Review

A Review of Protocols for Fiducial Reference Measurements of Downwelling Irradiance for the Validation of Satellite Remote Sensing Data over Water

by Kevin G. Ruddick [1,*], Kenneth Voss [2], Andrew C. Banks [3], Emmanuel Boss [4], Alexandre Castagna [5], Robert Frouin [6], Martin Hieronymi [7], Cedric Jamet [8], B. Carol Johnson [9], Joel Kuusk [10], Zhongping Lee [11], Michael Ondrusek [12], Viktor Vabson [10] and Riho Vendt [10]

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Open Access Review

A Review of Protocols for Fiducial Reference Measurements of Water-Leaving Radiance for Validation of Satellite Remote-Sensing Data over Water

by Kevin G. Ruddick [1,*], Kenneth Voss [2], Emmanuel Boss [3], Alexandre Castagna [4], Robert Frouin [5], Alex Gilerson [6], Martin Hieronymi [7], B. Carol Johnson [8], Joel Kuusk [9], Zhongping Lee [10], Michael Ondrusek [11], Viktor Vabson [9] and Riho Vendt [9]

Review of Existing Recommendations

2013.12.2	A permanent calibration task force should be established to share expertise and information on instrument calibration and characterization. It should be supported by space agencies and should have close interaction with the extended ocean-colour community. It could be established either under the CEOS-IVOS framework, or the IOCCG/INSITU-OCR.	IOCCG	Actioned	
2013.06.1	In situ measurement protocols should not be revised by a single investigator but through an international community effort spanning multiple universities and space agencies e.g. under the IOCCG umbrella.	IOCCG	Actioned	IOCCG Protocol documents
2013.06.2	Some support for protocol development should be secured from various agencies (NASA, ESA, EUMESAT, etc.).	IOCCG	Actioned	IOCCG now funds Protocol development
2013.06.3	Participants agreed on the following workshops to revise the protocols (ranked highest to lowest): IOPs, AOPs, Particle Sizes, Carbon Stocks and rates, Bio-fouling and depoyment	Community	Actioned	
2017.08.1	The current best practices for in-water measurements are not described and need to be detailed.	Community	Actioned	We worked on a protocol document that detailed the in-water measurement practices
2015.03.6	More work be done to compare and understand the pros and cons of the various methods that are being developed for the evaluation of uncertainties associated with ocean colour products	Community	Actioned	

New IOCS Recommendations SMART

- **Continuous** support for global **training** initiatives with coordinated and coherent approach to radiometry so participants get full understanding of motives behind protocols and uncertainty with hand on experience. (**IOCCG and Agency**) **to not see decrease in training**

- Dedicated effort in **sea-surface reflectance factor modelling ,** comparisons and uncertainty evaluations summarised in a dedicated WB at **IOCS meeting 2027** (**Community**) **see an increase in dedicated investigations**

- **Regular (every 3-5 years) Comparisons** should be supported by **Agency** with funding available for participants, including uncertainty workshops and participants involvements in the planning phase. **See focussed inter-comparisons planned and executed by international teams.**

New IOCS Recommendations

must be SMART

- **SPECIFIC** area of focus
- that is **MEASURABLE**
- **ASSIGN** who is responsible for undertaking the task (community/agencies/IOCCG)
- ensure recommendation is **REALISTIC** given the resources
- suggest a **TIME** by when it should be achieved