Ocean Carbon from Space

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IOCS-2025 Darmstadt, Germany
1 - 4 December 2025

2nd Ocean Carbon from Space workshop

A 'hybrid' workshop

Online component

- 24-26 November 2025
- 4 themes across 6 sessions
- Keynotes, oral and poster presentations, and discussions

187 online participants from 37 countries

In-person component at IOCS

- Keynote 'Aquatic Carbon from Space' by Bob Brewin
- Panel discussion 'Ocean carbon: Policy, adaptation and mitigation'
- Breakout workshop 'Ocean Carbon from Space'   ~80

Goals of the Breakout Workshop

1) What are the critical gaps in our current satellite observing capabilities that prevent us from accurately quantifying the ocean carbon cycle, and how can we prioritise filling these gaps?

2) How can we improve our understanding of the physical, chemical and biological processes that govern the ocean carbon cycle, and assess how climate change affects carbon flow through marine ecosystems?

3) What specific, actionable steps should the international research community and space agencies take to ensure satellite-derived ocean carbon data can effectively inform climate model evaluation and policy decisions?

Please examine what can be done in the short (1-5 years), medium (5-10 years) and long-term (10-20 years)

Review of existing recommendations

Year	Recommendation	Actor	Status
2013	Calculation of **uncertainties**, including bias, in the time series of ocean-colour products is vitally important. Space agencies should ensure resources are made available to support these developments.	Agency	Actioned
2013	**Interactions between climate modellers and ocean-colour scientists** are essential to ensure that the ocean-colour time-series and models are appropriately used in describing and understanding the optical properties and signatures within the oceans.	IOCCG	Actioned
2017	Establish an **IOCCG Task Force on Carbon**	IOCCG	Actioned
2017	Implement **quasi / pre-operational** Rrs products on open-ocean **POC**, coastal **SPM** with clear indication of uncertainty	Agency	Actioned
2017	Develop **user engagement and training**	Community	Actioned
2023	The community should develop an **open-access database of POC and DOC for inland and coastal waters**	Community	Actioned

Review of existing recommendations

Year	Recommendation	Actor	Status
2023	The community needs to conduct more research to identify all sources of **discrepancies in merged datasets** (beyond time and space, including geometry and other factors) and to quantify and correct them.	Community	OPEN
2023	The community needs to improve **description of continuity metrics** including reporting of possible extremes (tails), possibly using Probability Density Functions.	Community	OPEN
2023	Space agencies and distribution services (in collaboration with the ocean colour and metrology communities) need to prioritise calculating and distributing **uncertainties** associated with all products (pixel-based and composite), and including propagation through AC and algorithms **following metrological practices**.	Agency	OPEN
2023	The community and IOCCG need to consider **revising/updating the 2006 IOCCG report on data merging**.	IOCCG	OPEN
2023	Space agencies should advocate for **mission design to ensure backwards compatibility** to improve confidence in derived trends and ensure overlap between missions.	Agency	OPEN

New IOCS recommendations

Recommendation	Actor
Prioritise calculating and distributing **uncertainties** associated with all products (pixel-based and composite), and including error propagation following metrological practices.	Agency, Community
Funders should require collected and/or collated *in situ* **data**, that is quality-controlled, to be made publicly available in one coherent database.	Agency
Observations of **physics**, including winds, surface turbulence, ocean circulation and mixed layer depth should be improved.	Agency, Community
Include **bio- and functional diversity** and flow of carbon in the marine ecosystem in ocean carbon research.	Community
Continue to maintain and improve **primary observables** through cal/val activities and advances in atmospheric correction.	Agency
Resolve carbon pools and fluxes at the **regional scale**, including in tropical, polar and coastal regions, in lakes and in the deep ocean. Include Blue Carbon in ocean carbon budget assessments.	Community
Integrate ocean carbon research at **multiple levels**, i.e., between disciplines, between types of observations, between types of models.	Community

New IOCS recommendations

Recommendation	Actor
Exploit new types of satellite observations, including hyperspectral and SWOT, and integrate ocean colour and physical observables to study the ocean carbon cycle.	Community
Improve **interactions between EO and modelling** communities, also climate (CMIP) models, by organising dedicated workshop and update IOCCG report on modelling to include climate models.	Agency, IOCCG
Latency between **science and policy** needs to be understood and addressed. Consider the use of 'knowledge brokers' or knowledge hubs to bridge the gap between science and policy.	IOCCG
Develop tools to detect **change and the rate of change** in the ocean carbon cycle to address, for example, tipping points.	Community
Improve **coordination between space agencies**, for example through CEOS or OCB.	Agency
Include ocean carbon from space in existing and additional **training activities**.	IOCCG
Evidence is needed on the impact and effectiveness of **marine Carbon Dioxide Removal (mCDR)**, fast action is needed to respond to this.	Agency

Thank you!

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