

Annual Report to SCOR International Ocean Colour Coordinating Group (IOCCG) Affiliated Project

Reporting Period: 1 July 2023 – 30 June 2024

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1. Background

The International Ocean Colour Coordinating Group (IOCCG) is an affiliated project of SCOR since 1997, and is an associate member of the Committee on Earth Observation Satellites (CEOS). The mandate of IOCCG is to promote the development and application of science and technology that underpin remote sensing of ocean colour across all aquatic environments (in-land, coastal, open ocean). This mandate is achieved through coordination, training, liaising between providers and users, advocacy, and provision of expert advice. Details can be found on the IOCCG website at <http://ioccg.org>.

The IOCCG acknowledges the continued support from SCOR over the reporting period, especially SCOR's collaboration with IOCCG on proposals and grants to NASA, and SCOR's contributions to IOCCG activities.

2. IOCCG Project Office & Finances

The IOCCG Project Office is housed at the Bedford Institute of Oceanography, in Dartmouth, Canada, and is staffed by the IOCCG Project/Scientific Coordinator, Raisha Lovindeer. All finances for the IOCCG are managed by the IOCCG Project Office. The Executive committee meets once or twice a year to approve the annual budget and discuss IOCCG finances, as well as membership rotations and some program-related matters arising from IOCCG Committee meetings.

2.1. Income

IOCCG finances are tracked per calendar year. Total income for 2023 was USD 294K. This amount was the result of annual contributions from space agencies (including all in-kind contributions), as well as sponsorship for, and revenue from, the 2023 International Ocean Colour Science Meeting (IOCS-2023). From previous years of funding, the IOCCG maintains a cash buffer (currently 109K) that is essential for operation, as funding from NASA (especially) is reimbursed after expenses have occurred.

A new NASA grant was approved in 2023, and funding to support IOCCG’s activities is expected for the next 3 years (2023-2026). SCOR is a joint principal investigator on all IOCCG-related NASA grants. The IOCCG Project Office tracks its own grant spending, and the SCOR Secretariat manages and facilitates grant funding, including processing quarterly claims submitted by the IOCCG Project Office, and disbursing funds to IOCCG.

2.2. Expenses

Total expenses for 2023 amounted to USD \$303K, with the largest expense being IOCS-2023. Other expenses included kick-off workshops for new working groups; two (inaugural) IOCCG Platt Scholarships; travel support for developing-country participants for training courses as well as the 3rd International Operational Satellite Oceanography Symposium (OSOS-3) and the Remote Sensing of Marine Litter workshop; website maintenance, annual financial reviews, salaries, and other administrative expenses related to the IOCCG Project Office.

3. IOCCG Committee Membership & Rotations

The IOCCG Committee is composed of space agency representatives and experts from the ocean colour science community. The group is currently chaired by Shubha Sathyendranath (Plymouth Marine Lab, UK), supported by immediate past-chair Cara Wilson (NOAA, USA).

Within the reporting period, Ana Dogliotti (IAFE/CONICET, Argentina) was requested and consented to serve a second term. The following Committee Member(s) rotated off:

- Hubert Loisel - Université du Littoral, France
- Joo-Hyung Ryu - KIOST, South Korea
- Laurent Giugni - CSA, Canada
- Annick Sylvestre-Baron - CNES, France
- Milton Kampel - INPE, Brazil

and the following new Committee Member(s) were added:

- Bob Brewin - University of Exeter, UK
- Jongkuk Choi - KIOST, South Korea
- Corinne Bourgault-Brunelle - CSA, Canada
- Aurelien Carbonniere - CNES, France

The full Committee is listed in Table 1, along with their expected rotation dates. Scientific members serve 3-year terms, while the rotation of agency representatives is determined by their agencies.

Table 1: Listing and Rotation Schedule of IOCCG Committee Members. Agency Representatives have no rotation year listed, as their rotation is determined by their agency.

Committee Members	Agency	Rotation Year
Ana Dogliotti	IAFE/CONICET, Argentina	2027, 2nd term
Aurelien Carbonniere	CNES, France	-
Aurea Ciotti	Universidade de São Paulo, Brazil	2026
Bob Brewin	University of Exeter, UK	2027
Cara Wilson	NOAA/NMFS, USA	2025, Past-Chair
Carolina Tauro	CONAE, Argentina	-
Chuanmin Hu	University of South Florida, USA	2026, 2nd term
Claudia Giardino	CNR-IREA, Italy	2025
Corinne Bourgault-Brunelle	CSA, Canada	-
Emmanuel Devred	Bedford Institute of Oceanography, Canada	2025
Ewa Kwiatkowska	EUMETSAT, EU, Germany	-
Frédéric Mélin	EU Joint Research Center, Italy	-
Hiroshi Murakami	JAXA EORC, Japan	-
Jeremy Werdell	NASA GSFC, USA	2026
Jungkuk Choi	KIOST, South Korea	-
Laura Lorenzoni	NASA, USA	-
Marie-Hélène Rio	ESA/ESRIN, Italy	-
Mark Baird	CSIRO, Australia	2026
Menghua Wang	NOAA/NESDIS/STAR, USA	-
Paula Bontempi	University of Rhode Island, USA	2025
Prakash Chahaun	ISRO, India	-
Shubha Sathyendranath	Plymouth Marine Lab, UK	2028, Chair
Steve Groom	National Centre for Earth Observation, UK	-
Tim Malthus	CSIRO, Australia	-
Vittorio Brando	CNR-ISMAR, Italy	2025
Wonkook Kim	Pusan National University, South Korea	2026, 2nd term
Xianqiang He	Second Institute of Oceanography, China	-

3.1. The 28th IOCCG Committee meeting, 28-28 April 2024

The 28th IOCCG Committee meeting was hosted in hybrid format in Córdoba, Argentina by Comisión Nacional de Actividades Espaciales (CONAE) at the Centro Espacial Teófilo Tabanera (CETT). The committee reviewed the progress and documents from existing IOCCG working groups and task forces; approved the development of a new protocol document on the use of HPLC measurements for satellite ocean colour validation; approved a new ad hoc working group of the development of multi-agency-blended long-term time series ocean colour products; received updates on the recently launched PACE mission, and discussed the upcoming SABIA-Mar mission; discussed capacity building initiatives; advanced the CEOS

aquatic carbon roadmap and other CEOS initiatives under the Ocean Colour Radiometry-Virtual Constellation (OCR-VC), among other scientific discussions. See the IOCCG website for a copy of the [minutes of the IOCCG-28 meeting](#) and all previous meetings.

To manage the carbon footprint of the group, the committee decided to alternate between fully-virtual and in-person-hybrid annual meetings. The next meeting will be fully virtual in early 2025.

4. Scientific Accomplishments

Over the reporting period, several capacity building initiatives were spearheaded, the 5th International Ocean Colour Science Meeting (IOCS-2023) was convened and recommendations reviewed, the OCR-VC advanced initiatives under the CEOS work plan, a new white paper on ocean colour satellite systems vicarious calibration was released, and new protocol documents were added to the IOCCG Protocols Series. Details of these accomplishments are given below.

4.1. Capacity Building

4.1.1. Satellite-based tools for investigating aquatic ecosystems, Apr - Aug, 2023, Online and UK

The training was a joint effort led by the Trevor Platt Science Foundation and supported by many funders, including IOCCG. It consisted of two components: a virtual component held online from 5 April to 26 July 2023, and an in-person component from 7 to 8 August 2023. The online component had 17 webinars delivered once a week, and covered modules on the application of satellite data to water quality, human health, ocean ecosystems, and climate, as well as practical tools for data analysis and data processing. Number of participants for the webinars ranged from 160 - 400 per session, including for the Q&A segments at the end of each lecture. The in-person component was limited to 40 participants, and was conducted at the Plymouth Marine Lab, UK. This component was a hands-on exercise that covered extraction and application of satellite data, specifically for use in the participant's area of research focus. IOCCG supported travel for 5 participants to the training course, and 3 IOCCG Committee members served as virtual lecturers. A training report is available on the IOCCG website.

4.1.2. Satellite Ocean Colour Validation, 22-23 April 2024, Argentina

This training/workshop was hosted by CONAE at CETT, and was held in conjunction with the IOCCG-28 Committee Meeting. The training emerged from a mutual desire between CONAE and IOCCG to utilize the expertise of the IOCCG members that would be in the region for the meeting, to the benefit of the local participants. CONAE indicated that the largest gap in regional training needs was protocols for in situ measurements for satellite validation, so the training was built around this focus. Limited funding from IOCCG was made available for

travel of key training participants from the region who would not be able to participate otherwise. A total of 22 participants attended the training from Argentina and Brazil, including CONAE staff.

4.1.3. GOCI Toolbox (GTBX) on Snap, 18 July 2024, South Korea

An in-person training session was conducted on behalf of IOCCG by KIOST on the GOCI Toolbox (GTBX) on Snap. The training was held in Busan, South Korea, and was part of IOCCG support for the 45th Committee on Space Research (COSPAR) Scientific Assembly. It was held free for all registered participants of the Assembly. The training covered access to GOCI-II geostationary ocean colour data, and applications to environmental and research questions. An associated session on ocean colour was also available at the meeting, chaired by IOCCG member Jongkuk Choi. The session covered the progress in development and exploitation of satellite ocean colour and optical imagery.

All IOCCG training reports are available on the IOCCG website:

<https://ioccg.org/what-we-do/training-and-education/reports-of-past-ioccg-training-courses-workshops>

4.1.4. 2024 IOCCG Platt Scholarship

The 2024 IOCCG Platt Scholarship was awarded to Hellen Kizenga, an early career marine scientist from the western Indian Ocean region and an assistant lecturer at the Institute of Marine Sciences of the University of Dar es Salaam, Tanzania. She will work with Emmanuel Devred at the Bedford Institute of Oceanography in Canada on her proposed research: *Seasonal and interannual variability in phytoplankton biomass and phenology (bloom timing) along the Tanzanian waters using ocean colour sensors*. The 2024 round of applications opened in August 2023, with a deadline in December. The deadline was extended to January 2024, and the award was announced in February. The list of award recipients to-date, along with their scholarship reports, are available on the IOCCG website:

<https://ioccg.org/what-we-do/training-and-education/ioccg-fellowship-recipients/>

4.2. 5th International Ocean Colour Science Meeting, 14-17 November 2023, USA

The 5th IOCS meeting (IOCS-2023) was held from 14 to 17 November 2023 at the University of South Florida (USF) St. Petersburg Campus in Florida, USA. Over 270 people attended the meeting. Preceding the meeting, 6 training courses in ocean colour science and applications were offered, free to registered participants. These meetings are a forum for the ocean colour community to discuss and collaborate on topical issues, and to generate consensus recommendations on ways to advance the science on these issues. One key accomplishment for IOCS-2023 was that over 150 previously-made recommendations were reviewed before the meeting, and their statuses assessed and discussed at the meeting. All recommendations and their statuses, including those emerging from IOCS-2023, were made available by topic on the IOCCG's IOCS website for consistent access by the community, and will be updated periodically. <https://iocs.ioccg.org/iocs-recommendations>.

The IOCS-2023 was also the venue for kick-off meetings of the two newest IOCCG working groups on [Optical Water Type Classification](#), and [Ocean Primary Production](#). Both working groups have completed a preliminary outline for their scientific reports. The task forces on [Hyperspectral Remote Sensing of the Ocean](#), and [System Vicarious Calibration](#) also met at the IOCS meeting.

4.3. Contributions to the CEOS Aquatic Carbon Roadmap & Aquatic Reflectance Product Family Specification for Analysis Ready Data

The OCR-VC continues to focus on the development of an Aquatic Carbon Roadmap to support the Global Stocktake within CEOS. The roadmap builds upon the [Ocean Carbon from Space workshop](#), the International Network for Sensor Inter-comparison and Uncertainty assessment for Ocean Colour Radiometry ([INSITU-OCR white paper](#)), and the [Earth Science Reviews special issue on aquatic carbon stocks and fluxes](#). An outline document of the roadmap is in the early stages of development, with input from various scientists representing in-land, coastal, and oceanic waters.

The OCR-VC also continues to contribute to the development of the Aquatic Reflectance Product Family Specification for [CEOS Analysis-Ready Data \(ARD\)](#).

4.4. New white paper for Ocean Colour System Vicarious Calibration (OC-SVC)

The IOCCG Task Force on OC-SVC released a white paper [System Vicarious Calibration \(SVC\) requirements for satellite ocean colour missions targeting climate and global long-term operational applications](#). The white paper affirms the essential need for long-term and sustained SVC infrastructure and related activities. It outlines the main requirements for a comprehensive SVC framework to ensure high accuracy and consistency of global and multi-decadal ocean colour data products.

4.5. Updates to the IOCCG Protocols for Bio-optical In Situ Measurements

4.5.1. Addendum to IOCCG Protocols for Satellite Ocean Color Data Validation: In situ Optical Radiometry

High quality satellite ocean colour data products and services rely on good in situ radiometric measurements for algorithm development and product validation. The quality of these in situ measurements are determined by the instruments available to perform such measurements. [An addendum to IOCCG Protocols Volume 3: Satellite Ocean Color Data Validation: In situ Optical Radiometry](#) was recently published to request important data (namely, absolute calibration coefficients with associated uncertainties) from manufacturers about their field radiometers. This data will help users achieve fiducial reference measurement standards in the resulting measurements and data products.

4.5.2. DRAFT - Dissolved Organic Matter Sampling and Measurement Protocols: Consensus Towards Future Ocean Color Missions

A draft protocol on *Dissolved Organic Matter Sampling and Measurements: Consensus Towards Future Ocean Color Missions* was released to the ocean colour community for public comment in May 2024. This community protocol aims to integrate the latest advances in sampling, instrument measurement, and data analysis to provide reliable dissolved organic carbon values and associated uncertainties. It aims to support ocean colour satellite algorithm development and validation, as well as carbon cycle studies for inland, coastal, and oceanic waters.

5. Plans for Future Years

5.1. Planned capacity building initiatives

5.1.1. 6th IOCCG Summer Lecture Series, November 2024, India

The 2024 edition of the advanced [IOCCG Lecture Series](#) is planned for 4 to 16 November, 2024. It will be hosted for the first time at the International Training Centre for Operational Oceanography, Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, India. A total of 126 applications were received in January spanning over 30 countries. A total of 30 students were selected to attend, an increase from ~24 in previous years due to the increased capacity of the venue.

As in previous years, several research scientists have volunteered to provide lectures that cover the fundamentals of ocean optics, bio-optics and ocean colour remote sensing. Practicals using data from the Copernicus Sentinel series have remained on the agenda, and new practicals using hyperspectral data from the newly launched PACE mission have been added.

5.1.2. IOCCG Platt Scholarships

Applications for the 2025 round of the annual [IOCCG Platt Scholarship](#) will open on 12 August 2024, with an award expected in early 2025. The scholarship allows a scientist from a developing nation to conduct research or training outside of their home country for a maximum period of 3 months. The scholarship is expected to continue annually for the foreseeable future.

5.1.3. Other training opportunities

Other training opportunities will continue to be pursued, especially in conjunction with in-person meetings. One such example is a proposed training session at the next in-person-hybrid IOCCG Committee meeting (IOCCG-30), which will be hosted by JAXA in Toyko, Japan in 2026.

5.2. 6th International Ocean Colour Science Meeting, December 2025, Germany

The IOCS meeting occurs every 2 years and the host rotates to ensure global coverage. The 6th IOCS is scheduled for the first week of December 2025, and will be hosted by EUMETSAT and ESA in Darmstadt, Germany. The meeting is the main venue for the space agencies to communicate to, and get feedback from, the ocean colour community, and is expected to continue.

5.3. White Papers on Recommendations for the future of Ocean Colour, in support of the next US Decadal Survey

In an effort to maintain ocean colour science and missions in future planning and funding from satellite agencies, IOCCG will act as a clearing house for ocean colour white papers from the community that address recommendations and gaps arising from community meetings and IOCCG Reports. This effort is expected to be maintained over the next few years, with the intention to feed into the 2027/28 US Decadal Survey.

5.4. Long-term time series ocean colour data products

The IOCCG approved an ad hoc working group to understand the feasibility of producing a single, reliable, long term, blended, time series ocean colour product that could be used for, among other things, climate studies. The ad hoc working group is made up of experts with a broad knowledge of ocean colour product calibration and processing, uncertainties, and product intercomparison (including associated challenges) to help to determine the current status of ocean colour products produced by different space agencies, differences across these, potential challenges for a harmonized / blended product, existing data / metadata / processing gaps, and perhaps a path forward including needed resources. The ad hoc working group is formulating its terms of reference, and is expected to be active over the next few years.