

IOCCG Annual Report to SCOR

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The International Ocean-Colour Co-ordinating Group (IOCCG) is an Affiliated Program of SCOR, and an Associate member of CEOS (Committee on Earth Observation Satellites). With its wide-ranging mandate the IOCCG addresses technological and scientific issues related to ocean colour radiometry through scientific working groups and task forces, and also promotes capacity building through advanced training courses. The IOCCG also helps to ensure the continuity and quality of the ocean-colour data stream through the CEOS Ocean Colour Radiometry-Virtual Constellation (OCR-VC).

IOCCG's affiliation to SCOR is critical in helping the IOCCG secure funding from NASA for its programme. SCOR's support of students from developing countries to attend IOCCG training courses/IOCS meetings is gratefully acknowledged as well as SCOR's support for the IOCCG/GlobalHAB working group on harmful algal blooms (see below). The IOCCG is currently chaired by Cara Wilson (NOAA, USA), and the IOCCG Project Office is located at the Bedford Institute of Oceanography, Canada, staffed by Venetia Stuart. Raisha Lovindeer joined the group in May 2021 as the IOCCG Scientific Officer. Both Venetia and Raisha are currently working part-time.

1. IOCCG Scientific Working Groups

IOCCG scientific working groups are established to investigate various aspects of ocean colour science, technology and its applications. These working groups are relatively short-lived (2-4 years) and their findings are published in the form of an IOCCG Report, available through the IOCCG website, as well as the OceanBestPractises (OBP) repository (maintained by IODE of UNESCO-IOC). All IOCCG reports are easily accessible and citable using the digital object identifier (doi) assigned by OBP.

1.1 IOCCG Scientific Working Group on Harmful Algal Blooms

This working group on harmful algal blooms was sponsored jointly by the IOCCG as well as the GEOHAB Programme (now GlobalHAB) of SCOR and UNESCO-IOC, which is gratefully acknowledged. Over the past year the group, chaired by Stewart Bernard (SANSa, South Africa), completed their draft report, which was recently published as IOCCG Report 20, entitled "[*Observation of Harmful Algal Blooms with Ocean Colour Radiometry*](#)".

HAB and eutrophication events have had a significant global impact over the past decade or so, and the frequency of these events, as well as the geographic extent of toxic or harmful algal blooms has been increasing globally. This IOCCG working group produced a comprehensive guide to satellite ocean colour

remote sensing of HABs, summarizing the current state of knowledge and demonstrating the suitability of various ocean colour approaches through case studies as well as operational HAB applications. The primary focus areas are the technical difficulties of using ocean colour remote sensing in optically-complex coastal waters, and the need to understand the limitations of ocean colour for deriving phytoplankton community composition.

A major conclusion of the report is that ocean colour remote sensing is very effective in detecting high biomass blooms, but does not work well for low biomass blooms, which can nevertheless be addressed using indirect approaches. Satellite radiometry thus forms a very useful tool as part of a multi-pronged approach to HAB issues, providing improved biophysical observations which can be coupled with robust modelling approaches to provide a much better insight into the occurrence and nature of HABs.

Hardcopies of the report can be [requested](#) free of charge and the report can also be downloaded from the IOCCG website at: [ioccg_report_20-habs-2021-web.pdf](#). The report is also available for download from the IOC [OceanBestPractices Repository](#).

1.2 IOCCG Working Group on Evaluation of Atmospheric Correction over Turbid Waters

This working group is chaired by Cédric Jamet (LOG, Wimereux, France) and was tasked to evaluate 9 commonly-used atmospheric correction algorithms over turbid waters, using a simulated dataset for sensitivity studies. Atmospheric correction is vital to obtain accurate ocean colour radiometry measurements, and the process is more complicated in optically complex waters, especially turbid waters found in coastal environments. The group aims to understand retrieval differences, since these algorithms are often based on different physical assumptions. They will also provide guidance to end-users on how and where to use specific atmospheric correction schemes.

Since this report is more technical than traditional IOCCG reports, the IOCCG Committee suggested that it be published as an IOCCG Technical Report, as it deals primarily with methodology. It is anticipated that this report will be the first in the new “IOCCG Technical Report Series” and will likely be published early next year.

2.0 IOCCG Scientific Task Forces

In addition to the short-lived scientific working groups, the IOCCG has also established semi-permanent “Task Forces” to address issues that require an ongoing capability and/or expertise, and help to facilitate inter-agency collaboration on an ongoing basis.

2.1 Task Force on Satellite Sensor Calibration

Under this inter-agency framework, the IOCCG Task Force on *Satellite Sensor Calibration* facilitates collaboration among sensor characterization and calibration experts from various space agencies with the goal of maximizing the accuracy and temporal and spatial stability of ocean colour radiometry records

from individual missions. The Task Force is co-chaired Ewa Kwiatkowska (EUMETSAT, Germany) and Gerhard Meister (NASA, USA), and brings together global experts to collectively address the challenging requirements of calibration ocean colour instruments, by sharing their multi-mission experience. The group did not hold a meeting last year but there were nevertheless many successful inter-agency collaborations and exchanges (e.g., strategy and requirements for the PACE OCI Solar Calibration).

2.2 Task Force on Detecting Plastic Marine Debris

Plastic pollution is an environmental problem that impacts all marine life and also has wide ranging socio-economic impacts with implications for human health. A new IOCCG Task Force on “*Remote Sensing of Marine Litter and Debris*” was formed to complement on-going interdisciplinary research relevant to aquatic plastics. The Task Force is led by Shungu Garaba (University of Oldenburg, Germany), Manuel Arias (Argans Ltd., France), Lauren Biermann (Plymouth Marine Laboratory, UK) and Victor Martinez-Vicente (Plymouth Marine Laboratory, UK) together with four co-chairs from national space agencies (ESA, ISRO, JAXA and NASA).

The Task Force is considering all remote sensing technologies (with a special focus on radiometric approaches), and aims to coordinate the development of various approaches for detecting, identifying, quantifying and tracking requirements of aggregated plastic litter patches in all aquatic environments. These requirements will be supported by four interlinked Core Topics (Technologies, Algorithms & Applications, Datasets, and Interdisciplinary Aspects), which are essential for creating a scientific roadmap for remote sensing of plastic litter. The Task Force also aims to produce living guidelines on best practices in remote sensing of plastics.. A dedicated webpage for this very active Task Force has been set up on the IOCCG website at: <https://ioccg.org/group/marine-litter-debris/>. A virtual workshop was held on 7-9 July 2021 to update members on the activities, focusing on the OceanScan database and current remote sensing technologies to detect, quantify, characterise and track marine plastic litter.

2.3 Proposed New Task Force on Ocean Colour System Vicarious Calibration

The IOCCG Committee has recommended the formation of an IOCCG Task Force on “Ocean Colour System Vicarious Calibration” with representatives from the various space agencies. System vicarious calibration (SVC) of ocean colour sensors, along with instrumental calibration, is required to meet stringent accuracy requirements of the water-leaving radiance products and all downstream bio-optical products. Ewa Kwiatkowska and Carol Johnson have agreed to chair this new Task Force, which will provide a forum for inter-agency communication and discussion on the issue of ocean colour SVC. Many agencies are currently embarking on major ocean colour SVC development studies, so the Task Force will help to coordinate SVC infrastructure development and maintenance, including NOAA maintenance of MOBY, NASA development of SVC infrastructure for the PACE mission and EU Copernicus/EUMETSAT development of SVC infrastructure for the Sentinel missions.

3.0 IOCCG Protocol Series

The IOCCG established the IOCCG Protocol Series to publish peer-reviewed Ocean Optics and Biogeochemistry Protocols online. *In situ* optical and biogeochemical in- and above-water measurements are critical for calibration and validation of satellite ocean colour radiometry data products, and for refinement of ocean colour algorithms. Over the past few years NASA and IOCCG have sponsored several international workshops with the aim of updating and developing new community consensus protocols for ocean colour sensor validation. These new protocols are posted on the IOCCG webpage for a period of time for testing, public comment and review, before they are accepted as international reference standards.

A draft version of the protocol entitled “[Measurement Protocol of Absorption by Chromophoric Dissolved Organic Matter \(CDOM\) and Other Dissolved Materials](#)” (volume 5.0) is currently available on the IOCCG website for review. Measuring light absorption by CDOM *in situ* is a necessary condition for developing and validating current and future ocean colour algorithms for all applications. These revised protocols reflect the development of new instrumentation and a greater understanding of the importance of CDOM and its distribution in coastal and open ocean waters over the past twenty years.

A draft version of the protocol entitled “[Particulate Organic Carbon Sampling and Measurement Protocols: Consensus Towards Future Ocean Color Missions](#)”, is also available on the IOCCG website for review. The objective of this document is to produce community consensus protocols for sample collection, filtration, storage, analysis, and quality assurance for marine particulate organic carbon appropriate for satellite algorithm development and validation. These can be widely adopted by the academic scientific community engaged in ocean C and N cycle research, particularly those in activities that support ocean color validation.

4.0 Capacity Building

4.2 IOCCG Summer Lecture Series

The fifth IOCCG Summer Lecture Series, dedicated to high-level training in bio-optics and ocean colour remote sensing, was scheduled to take place at the Laboratoire d’Océanographie de Villefranche (LOV, France) from 22 June – 3 July 2020. A total of 112 excellent applications were received making for a very competitive field, and 24 students from 16 different countries were selected to attend the course. Unfortunately the course had to be cancelled at the last minute because of travel restrictions related to the global COVID-19 pandemic. This was a big disappointment for all the selected students, but several of the lecturers offered to conduct online Q&A discussion sessions for these students based on their lectures from the previous 2018 Summer Lecture Series (<https://ioccg.org/what-we-do/training-and-education/ioccg-sls-2018/>). Many students participated in these sessions and found it very helpful for their studies. The next IOCCG Summer Lecture Series is planned for July 2022.

5.0 IOCCG Committee Meetings

The IOCCG Committee meets once a year to coordinate the activities of the group as a whole, discuss plans for the year ahead and review the progress of the various working groups. The Executive Committee also meets to approve the budget for the coming year. This year, the annual IOCCG-25 Committee meeting was initially scheduled to take place in February 2021 in Rome, Italy, hosted by the European Space Agency (ESA) but had to be cancelled because of the pandemic, so the meeting was held virtually over 4 days. A total of 37 representatives from various space agencies and research institutions attended the meeting. The Committee received updates and plans for future ocean colour activities from agencies in Argentina, Canada, China, Europe, India, Italy, Japan, and USA, as well as from IOCCG working groups and task forces. Additional topics discussed included upcoming events and initiatives—such as the Ocean Carbon from Space workshop and journal special issue, and ESA’s Essential Climate Variable (ECV) for lake colour under their Climate Change Initiative (CCI)—as well as the future of IOCCG for the next 25 years. No rotation of Committee Members took place this year, to maintain stability during the pandemic. The final minutes of the meeting are available on the [IOCCG website](#).

6.0 IOCCG Membership (2021)

The IOCCG Committee consists of members drawn from space agencies as well as the scientific ocean-colour community. Rotation of members is usually implemented according to a roster, but membership is currently the same as for 2020 because of the pandemic. The Argentinian space agency (CONAE) have been invited to serve on the Committee (awaiting response). Representatives from the sponsoring agencies form the IOCCG Executive Committee together with the current IOCCG Chair and past-Chair.

Bernard, Stewart (past Chair)	-	SANSA, South Africa
Bontempi, Paula	-	NASA HQ, USA
Boss, Emmanuel	-	University of Maine, USA
Brando, Vittorio	-	CNR-ISMAR, Italy
Chauhan, Prakash	-	ISRO, India
Ciotti, Aurea	-	Universidade de São Paulo, Brazil
Devred, Emmanuel	-	Bedford Institute of Oceanography, Canada
Dogliotti, Ana	-	IAFE/CONICET, Argentina
Franz, Bryan	-	NASA GSFC, USA
Giardino, Claudia	-	CNR-IREA, Italy
Giugni, Laurent	-	CSA, Canada
He, Xianqiang	-	Second Institute of Oceanography, China
Hu, Chuanmin	-	University of South Florida, USA
Kampel, Milton	-	INPE, Brazil
Kim, Wonkook	-	Pusan National University, South Korea
Kwiatkowska, Ewa	-	EUMETSAT, EU, Germany
Lifermann, Anne	-	CNES, France

Loisel, Hubert	-	Université du Littoral, France
Malthus, Tim	-	CSIRO, Australia
Mélin, Frédéric	-	EU Joint Research Center, Italy
Murakami, Hiroshi	-	JAXA EORC, Japan
Rio, Marie-Hélène	-	ESA/ESRIN, Italy
Ryu, Joo-Hyung	-	KIOST, South Korea
Wang, Menghua	-	NOAA/NESDIS/STAR, USA
Wilson, Cara (Chair)	-	NOAA/NMFS, USA