

30th IOCCG Committee Meeting
19 - 21 May 2026 Tokyo, Japan
Hosted by JAXA

MINUTES

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1. Welcome and Opening Session

IOCCG Chair Shubha Sathyendranath opened the meeting and welcomed everyone. She thanked JAXA for hosting the meeting in-person and online, and for their wonderful organization. The first meeting after the formation of the IOCCG in 1996 was hosted by JAXA (then NASDA, in 1997). It was fitting to return to Tokyo for the IOCCG's 30th Committee Meeting, with JAXA graciously hosting.

The director of JAXA's Earth Observation Research Center, Osamu Ochiai, welcomed everyone to Tokyo. The EO Research Center also celebrates 30 years, and their first international hosting was in 1997 for the IOCCG Committee Meeting. JAXA's GCOM (Global Change Observation Mission) SGLI builds on the history and technology within JAXA for atmospheric, land, and ocean applications. He expressed his interest in the continued discussions of science, and more so application—how EO technology can solve societal challenges around carbon accounting, marine debris, and other challenges as defined under the Ocean Decade program. He indicated that in order for JAXA to sustain their satellite technology they need a strong societal value chain and feedback towards their next set of missions. He thanked the IOCCG Committee and indicated his enthusiasm for JAXA to continue to be part of these discussions, now, and in the future.

All participants in-person and online introduced themselves. A full list of participants across the three days is listed in Appendix I.

The meeting agenda was adopted.

Minutes of virtual IOCCG-29 Meeting were accepted. There were no outstanding or open action items from that meeting.

2. Agency Discussions

2.1. Discussion on the operational extension of GCOM-C (led by Hiroshi Murakami)

Hiroshi Murakami presented on the status of GCOM-C. He indicated a pressure to reduce operating costs, with talks of giving responsibility for EO to the private sector while maintaining government involvement. Extension phase missions might, therefore, have cost reductions. Hiroshi showed some of the impacts of cost reductions, and what would be lost. He requested to know strategies from other agencies for mission continuity and examples of how to partner successfully with the commercial sector.

Laura Lorenzoni asked if the biggest cost was the downlink; why there was no follow-on mission; and whether a new mission would be able to be launched by 2031 to reduce data gaps. Hiroshi indicated that the processing system, CPU, and memory are very expensive, as is rent. Downlink costs are high. These costs cannot change quickly. He also indicated that they have been unable to identify a follow-on mission. However, JAXA is willing to have joint missions to continue GCOM-C. While MODIS, VIIRS, and Sentinel-3 have not had immediate cooperation in the past, cooperation in the future to ensure coverage could be helpful. Constellation concepts are a way forward. No discussions have occurred in this area, but are encouraged. Menghua indicated the importance of navigating international politics.

Osamu asked for examples of the societal solutions provided from missions like MODIS, VIIRS, and S3. Manghua indicated that VIIRS provides atmospheric weather tracking (including hurricanes and tornadoes) which are deemed highly important societal applications. VIIRS also has strong community demand, which helps to facilitate mission continuation. Paula Bontempi indicated that two of the largest applications for NASA EO data are aquaculture, and insurance and re-insurance industries. Marie Helene indicated the community push for the extension of the

Sentinel missions, in line with what others suggested regarding having a strong user-community. Existing funds within ESA to operate the mission was also helpful.

Shubha encouraged the agencies to continue their discussions with JAXA regarding the best ways to advocate for mission continuity since application needs are important. Hiroshi requested a letter of support towards GCOM-C follow-on missions. This was agreed.

Action 30/1: IOCCG Committee to provide a letter in support of the GCOM-C mission and continue to discuss with JAXA how to advocate for the mission

Marie-Helene Rio indicated that S2A was extended and indicated that the S2A mission managers had the community push as the main reason for the extension. This goes inline with IOCCG's community support for the GCOM-C mission extension. Funds to continue operating S2A was also an important point.

2.2. Update on the SABIA-Mar Mission

Carolina Tauro gave an overview of the SABIA-Mar ocean colour mission, and the mission's progress to date. Planned are two ocean colour cameras: a VIS-NIR: optical and near infrared (NIR) camera (412-865nm), 200m (regional) and 800m (global) spatial resolution at nadir, swath 1495km; and a NIR-SWIR: near infrared and short wave infrared (SWIR) camera (750-1640nm), 400m spatial resolution at nadir (only regional), swath 1495km, along with complementary instruments. The mission is in the testing and launch preparation phase, with a launch window expected for April to October 2027.

A series of meetings have taken place over the past year, including a joint workshop with Brazil (Amazonia 1-B) in November 2025, a pre-launch characterization review in Dec 2025, and science team meetings, the last in May 2026. She thanked all those who

have contributed so far to the preparation of the launch, especially Laura Lorenzoni and Robert Frouin.

In the context of the previous discussion after JAXA's presentation, Shubha asked about the target users for the mission in South America. Carolina mentioned that fisheries, aquaculture, and marine surveillance are the 3 most important users of Earth observation in Argentina. Shubha indicated that she was happy to see that the mission is on track and that the team has the support of IOCCG.

2.3. Discussion on progress with GOCI-III development

Jongkuk Choi (assisted by Jae-Hyun Ahn, who was also present at the meeting) presented on the progress of GOCI-III development. GOCI was the first geostationary ocean colour imager, launched in 2010. The GOCI-I mission ended in March 2021 and GOCI-II was launched in 2020 with a mission lifetime until 2030. The main advantage of geostationary orbit is the detection of diurnal variation (phytoplankton and turbidity) not able to be observed by other remote sensing techniques. However there are still challenging issues with diurnal variation, especially in case 1 waters where the diurnal variation in water reflectance is less than or equal to errors in atmospheric correction (AC).

Jongkuk went through planning options for GOCI-III, including the design options to remain within budget. The mission lifetime is expected to be 10 years with no change in the spatial resolution (250 m) as this already reaches Abbe's detection limit, but the signal-to-noise-ratio (SNR) in the NIR bands will be increased as much as possible within the available integration time window. Some applications of GOCI-II include marine surveillance (ship detection and validation with AIS data) so improvements in SNR would help to generate more accurate products. New spectral bands of 780 and 1030 nm have been added to GOCI-III to improve AC in turbid waters and distinguish between green and brown tide; 763 nm for bright atmospheric features like aerosol height, sea ice, and sea fog; and 650 nm for detecting cyanobacteria. Some existing

bands will be adjusted to avoid water vapour absorption for AC, and improve peak observations in the red bands, however the latter will weaken band consistency with GOCI-II and create discontinuity in the long-term data record. Jongkuk asked whether this was worth it to have this weakened band consistency. Also added to GOCI-III will be observations of Q-polarization and DoLP, both of which will be retrieved. Panchromatic bands for night-time observation will also be added, mounted together with the polarization filter, if the engineering requirement for solar ghost and starlight contamination suppressed to below 0.01% is able to be met. The advantages gained from night-time observations include detection of fishing vessels, fire, bioluminescence, and oil spills, and cross platform synergy with VIIRS DNB and GK-2A imager.

The preliminary feasibility test for GOCI-III is currently underway, and a budget request is expected this year. If successful, the development would begin in 2027-2028. However this timeline would lead to launch after 2033 and a potential data gap for >3 years. Laura asked whether it's possible to speed up the timeline to reduce the gap between the missions. Jongkuk said the only way would be for GOCI-II to run beyond its expected lifetime. If it does not, then there would be a gap in GOCI data before GOCI-III launches. Robert asked whether GOCI-III would be global or still focussed on the Korean peninsula. Jongkuk says it would be the same as GOCI-II, with the global area captured just once per day. Xianqiang He asked whether it might be possible to enlarge the study area of the GOCI sensors, beyond 2500 km. Jongkuk indicated that unfortunately it will be the same as for GOCI-II. Menghua commended the progress. He supported the addition of the PAN band as there are many applications with geostationary, but that it would be very useful to put a SWIR band further away. 2040 nm still has ocean contributions. Menghua acknowledged that there may be budget limitations to implementing this suggestion. Jongkuk agreed, and indicated that they have in the past, and will try again, to insert SWIR bands, but yes, limitations have prevented this in the past.

2.4. Recent CNES advances in OC and future plans

Aurelien Carbonniere gave some key highlights on projects and initiatives at CNES that he thought would be important for IOCCG to be aware of, as well as international activities and some future plans for ocean colour activities from the agency. Currently supported by CNES are:

- A project on the use of LiDAR for ocean colour studies. This field of research is ongoing for years now with a lot of international collaboration. There is now funding from ESA to conduct a European project that would last for 2 years (2025-2027) and this is a CNES priority at the moment.
- COUL-PNP led by Hubert Loisel to estimate particulate organic nitrogen and phosphorus, and the project has produced high-level publications thus far.
- UNDER ICE PAR project, led by joint teams between France and Canada to quantify radiation above and below the ice surface
- Remote sensing of invasive macroalgae in coastal areas to achieve EU intertidal classification of vegetation. This is still under development.
- An ODATIS marine data cluster-led project on medium resolution ocean colour products (300 m resolution) dedicated for French metropolitan coastal areas, but with potential to extend to the Indian Ocean and the Caribbean islands. Currently, there are daily, 8-day and monthly products, with the aim to get to near-real-time data in a few years.

Aurelien also gave an update on the CEOS Coast Virtual Constellation, which has been recorded under 4.0 CEOS Activities, as item 4.2

The Space4Ocean Alliance's work still continues. They aim to hand-over the secretariat to the United Nations Office for Outer Space Affairs (UNOOSA). The objectives are to start from reliable data and create operational services for climate change, marine biodiversity, etc., and to target countries that do not have space capacities.

For future OC activities, the Trishna mission (joint CNES, ISRO) is aimed to be launched by the end of 2027. 60 m resolution infrared and visible bands. Surface reflectance and temperature are yet to be confirmed. This is ongoing work and there are many issues to solve to get the combination of parameters needed for water quality observations.

CNES has decided to launch a Phase 0 design study for a geostationary ocean colour mission for application to carbon cycle science, marine biodiversity, and understanding coastal ecosystems and mesoscale ocean dynamics. They aim to kick off the activities in June 2026.

2.5. Update on upcoming OceanSat-3A launch for 2026

P.V. Nagamani was not present at the meeting, but sent slides ahead of time. Oceansat-3A (also known as EOS-10) is a planned Earth observation satellite from the ISRO that is designed to provide continuity of ocean colour data over the global oceans. It will work in tandem with the existing Oceansat-3 (EOS-06) to provide enhanced daily data for ocean and climate studies. It is the fourth satellite in the Oceansat series, and follows Oceansat-3 (EOS-06) which was launched in November 2022. The satellite was expected to be launched in the first quarter of 2026 aboard a Polar Satellite Launch Vehicle. The planned design lifetime is 5 years.

2.6. Update on Sentinel-3C launch for 2026

Ewa Kwiatkowska presented an update on the Sentinel 3C launch on behalf of the ESA and EUMETSAT S3 Teams. S3 is planned for launch in September 2026, and the exact date of launch might be known by the beginning of June 2026, with the start of the launch campaign in July. S3C will be launched on the Vega-C launcher together with the FLEX (FLuorescence EXplorer) mission which is also applicable to OC. FLEX will fall in tandem with S3. The launch will occur from French Guyana.

S3D is still available for launch in the future. It has completed the advanced assembly, integration, and test campaign and the contracts for launch are under preparation.

Ewa shared the S3C Commissioning and tandem timeline to show the overlaps of the missions. S3C will be drafted to fly in tandem with S3B and will be the core of the initial commissioning phase. Then it will start drifting towards the S3A orbit. After 6 months, an orbit commissioning review will occur and the satellites and mission will be commissioned and ESA will hand over operations to EUMETSAT. S3C will continue in tandem with S3A for 3 months, but the timeline is flexible because within the timeline the entire constellation will be commissioned (so all the data and services of the 2 satellites need to be commissioned to go into L1 and L2 products, etc). The end of the commissioning phase is a bit flexible providing that the constellation of S3B and C can take over smoothly from S3A and B. S3A will then be positioned in an in-orbit storage location and S3A optical (OLCI and SLSDR) will be put on orbit standby. Only TOPO (altimetry) will continue being operational for some time because of the capacity and budget available. However, recent developments involved EC instructing ESA and EUMETSAT to explore and present scenarios that include S3A continuing to be in orbit operationally (in reduced mode). Investigations are on-going and the decision of the EC will follow.

Laura asked when S3A will run out of fuel. Ewa indicated that the predictions are about a decade or so into the future. Shubha indicated that it was a bit shocking to hear that S3A will be put on standby when it is working so well, especially as many times new sensors stop working and we are left with gaps in coverage. Ewa explained that in-orbit storage allows for S3A to be revived if S3B or S3C stop working. Regular calibration is also being discussed while these instruments are in standby mode.

2.7. In light of commercial players - what is the long-term strategy of science from space for the agencies

Paula Bontempi indicated that it seems to be a unilateral push to have industry partners take over Earth observations from space. She highlighted the role of innovation that commercial companies play, making launches, for example, accessible and cheaper. However she questioned whether the quality and coverage of the data and its application for science could really be outsourced to commercial partners, who do not have the same missions and focus. Global science-quality data is not provided by any commercial company. She questioned the role of commercial partners in Earth observation from space, and wondered how we should evaluate the capabilities of their sensors for our scientific challenges and public needs. She made the case that the community needs to have and document a position on these questions prior to any decisions for commercial companies to take over managing the data for Earth observation missions. If this has already been done, then we need to immediately educate others of the outcome. Paula reminded the group of the shared priorities that she documented when she surveyed many scientists and agencies in preparation for her IOCS keynote talk in December. These priorities would be what commercial companies should be able to meet with their data if they were to take over observing Earth from space from national agencies.

Stewart Bernard thanked Paula for the introduction and agreed with what she presented. He indicated that for many years we engaged in public-private partnerships and that's how satellites get built, even now. The discussion is more about using commercial payloads to replace Earth science missions. Commercial missions are designed for profit and are typically poor at coherent radiometry. They are also not built for long-term high-precision science. There is a reason that agency-type missions are built, they are designed specifically for science and policy applications that probably have limited commercial market. He again called for an explicit and succinct expression of the ocean colour value chain, which right now is not available.

Laura, thinking of both sides, suggested that if we were to partition the landscape into global missions versus high resolution local missions, there might not be much of an issue. However, agencies also push to get more and more high resolution data, and thus begin to overlap with what commercial companies are trying to provide. Should we consider that the mandate of the space agencies should be more about the global level, and if yes, how dangerous is that for us (given the unreliability of companies to stay in business, data quality, etc)?

- Stewart mentioned, in the chat, that a hard resolution-type split is one approach, and one that is probably pragmatically in place already to some degree. However, the (ideally flexible) public/private split may be better served on desired outcomes & impact & required mission/ecosystem characteristics rather than technical splits.
- Ewa indicated that she thinks the mandate is more on the quality of the data that the agencies provide. She indicated that, for example, the Sentinel missions are funded because there is a public benefit (for all players, including private companies) that rely on agency data and use it for a variety of applications. If companies rely on our data, and can certify that the quality of the data that the missions provide is the best for their applications, then this is a powerful statement of value. Thus, activating commercial data users could be helpful for making the case of the missions in addition to commercial satellite data providers. The Sentinel missions are a case-study of this, as the need for the data is made clear.
- Marie-Helene believed that space agencies should be at the forefront of innovation and try to remain competitive, and therefore we should not limit our role to global and lower resolution only. She agreed with Ewa that the needs are linked to the users and that a key role of the agencies is that state of the art measurements are free and available, especially for people who cannot afford to pay for commercial satellite data. She therefore did not agree with trying to partition the landscape.

Menghua agreed that public-private partnerships are good for satellite hardware, but warned that for science, 90% of users are universities who push the limit and innovate, and if we set a policy of getting data only from commercial companies (instead of freely available), this will change.

Shubha agreed with everything expressed thus far. She raised 1) that going private might not be more economical, and 2) a government system is a reliable service to the public and if we commercialize an essential service, we tie our hands to the demands and price for the data when it is needed for critical services. We would be moving from service-oriented to profit-oriented thinking. National security also plays a role as governments cannot depend on commercial companies for such items. So it is a much more complex issue.

Frederic (Fred) Melin agreed with all the previous points raised. He stressed that independence is indeed a key aspect for keeping government missions. For innovation it is true that for science, space agencies are at the forefront of innovation, but we should be careful about this, because the market can sometimes surprise us. Governments do make data free and available, but the missions are not free—they are paid through tax-payers' money initially, and elections can jeopardize this if the value is not understood. National independence is a point that is very strong.

Ewa agreed and added that national independence and such points are excellent to bring up to management as a case for government funding. However, this is a political issue. She referred to Paula's slide and indicated that it is important for us as a community to have answers to the questions raised. Have we evaluated the capability of the commercial companies to be able to say whether this data can be used for the needs of the public. If these were documented then any of us could pull these

examples and show why government agencies are needed to produce high quality data.

Shubha indicated that from a developing country's perspective - the service that EO provides in fishing (alone) justifies the economic value of the missions. This data is used to improve the return of the fisheries for people who have no funds to pay for such data. These are survival-level fisheries, so fairness is also an issue.

Stewart indicated that Ewa's point about this being a political issue is an important one. In terms of documenting the importance of these missions, there needs to be a collection of arguments that people can use that are specific for their target audience (politician, government, science, etc). One key thing is that all the science addressed by the missions need to be brought into the preparation of the argument, not just OC since these all follow a similar argument—there is no commercially available mission because these missions were not designed to answer these science and policy questions. Constructing arguments with greater community heft would be very useful.

Marie-Helene came back to the cost. Missions are not free, but commercial missions are cheaper in building but then there is a cost for the data. Would it be possible to make an estimation of the complex costs of either route (government versus commercial). This would include building and launching, but also costs over 5, 10, and 15 years of buying commercial data. What is the compounded cost of that route, versus what is achievable when you have free and open data which is equal for everyone and not just those who could pay for it. Maybe this study should be done.

Laura asked about the landscape for commercial and space agency partnerships in Oceania and Asia. Shubha indicated that in India there is a thriving commercial sector building around Earth observation from space, and ISRO promotes these partnerships actively. She was unsure of the strategy around who controls which data, but the private sector is alive and growing in India. Xianqiang indicated that commercial

players are also alive and well in China, and many commercial companies launch small satellites. The major problem is the data quality, because commercial applications are focussed on phenomenon detection (red tides, disaster monitoring, etc.), so not science-quality data. He indicated that commercial *users* are very important for motivating the missions. Their needs led to government planning of the geostationary missions to get higher spatial and temporal resolution data. This is not limited to the OC community, but the entire oceanography community. Jongkuk indicated that in Korea, there is the idea that if higher resolution is needed for research or government application, these should be bought from commercial companies. Most of the commercial companies are in charge of development and launch of small satellites and they sell raw data, but almost all algorithm development happens at institutions (product development and data for applications). So in Korea, what can be done by the commercial sector is limited.

Claudia Giardino indicated that private companies take different roles. They cooperate to build satellites and run applications for targeted users, and the commercial companies are needed to shape the data for the users. She sees 2 market places: high spatial resolution data that is usually acquired where there is a need; and broader missions that can build time series data. She also expressed that the push for open science cannot really be met by commercial companies, as they do not really share in the mandate of open software and open science.

Shubha asked whether, given the importance of the topic, maybe there is a requirement for IOCCG to prepare a position paper on the issue. Paula suggested 3 things:

1. that the analysis that she did for the IOCS should probably be shared as a **brief** position page on what the IOCCG sees as priorities for the future for planetary protection and health and Earth system science. She was sure that there are common themes across the agencies, and the key is that the document should be worded for the public;

2. after we know our future and shared science, to address the question of what IOCCG can do to a) emphasize future science needs that dovetail with national needs, b) document the reason for the long-term role of government in EO, c) ensure we are working to bring costs and time to sensor/platform/satellite completion down, and d) ensure we are innovating; and
3. that the question of cost should probably be addressed. She indicated that in the last 40 years there were 3 trillion dollars spent on disasters in the US alone, and so the cost of an environmental satellite at 1 billion USD that can reduce that cost is actually quite valuable, cost-effective, and **not** expensive. The numbers would be even larger without such satellites. So we need to have a different narrative about the fact that government satellite technology is not expensive when the impact that EO has played economically is taken into consideration.

Paula therefore agreed that a position paper is a good place to start. Shubha asked for anyone who is willing to work on such a paper to give their names to Raisha

Action 30/2: Paula and Shuha to lead the drafting of a position page on IOCCG's science priorities and document the reason for the long-term role of government in EO versus commercial satellite data. IOCCG members interested in helping to draft should submit their names to Raisha.

2.8. Synergy with BGC Argo

Hervé Claustre gave an overview of the development of BGC Argo floats that could work in synergy with satellite ocean colour observations. Argo launched in 1999 with temperature, and salinity. In the early 2000s they incorporated a sensor to prototype BGC Argo. At the same time, thanks to IOCCG, there was a working group that looked into bio-optical sensors on Argo floats., and had defined three types of Argo missions: VAL for validation of OCR, BIO-Argo, and Carbon-Explorer Float for investigating carbon. The BGC-Argo science and implementation plan was launched in 2016 and there were 6 covariables defined at the time (Chl-a, b_{bp} , E_d , O_2 , NO_3 , and pH). At Ocean

Obs in 2019, Argo announced the move towards OneArgo - a unified program with 3 missions working in synergy. In 2025 at the One Ocean Science Congress, OneArgo promoted their connection more with end users and their goals towards ocean monitoring for societal applications. A fourth mission (Polar Argo) was also launched above 60° latitude. The target was 1000 floats for BGC-Argo. There are currently 600+ floats, however, current funding from the US might be affected, and the global community needs to take this into consideration for maintaining the number of floats.

He showed the global coverage of Chl-a as of November 2025, taken from 160K profiles of Chla. He proposed to design 3D projects for Chl-a, b_{bp} , E_d , and PAR. These products are operational products delivered by Copernicus Marine Services as part of the multi-ops operations. New BGC-Argo JUMBO floats are being developed for the 6 environmental variables, but also to meet community needs of resolution. Floats have extra energy to address new topics and explore new processes. He showcased how radiometers can be attached to BCG-Argo floats and serve the needs of the in situ data community, capturing vertical variability. The floats would benefit from the data systems already in-place with Argo for interoperability and processings. There are 2 global data centers (US and France) so in near-real-time (24 hours) the data can be made available, with automatic quality control. They have new calibration files and improved techniques to account for the relationship between fluorescence and Chl-a. He shared a processing scheme for OC applications (3 wavelengths and PAR). He indicated that other requirements can be accommodated. For example, Argo floats can use buoy mode to characterize the surface and measure R_{rs} , and for PACE, floats were switched from 10-day to 5-day frequencies to better capture surface conditions. He showed match-ups with satellite data, which still yielded good results even after severe match-up criteria was applied. These and other results were presented as part of the IOCS-2025 Breakout Session. A new project (2026-2028, led by V. Vellucci, LOV) is now funded to bring BGC-Argo radiometry to FRM-grade quality for satellite ocean colour validation. Finally, he mentioned that the Carbon Explorer Float uses

hyperspectral sensors to connect what the float measures in terms of carbon cycling and carbon export, and has potential interest to the space agencies. He summarized that there is infrastructure to use BGC-Argo for remote sensing reflectance application.

Laura thanked Herve for his presentation and indicated that the floats have a lot of potential to be a good validation platform. Both NASA and ESA are interested in a validation pilot (a short-term investment to investigate validation from passive and active remote sensing, the latter for application to LiDAR). All the data is public and would be useful for all agencies that use OC. She opened the floor to all other OC agencies to be part of the investment as a validation infrastructure (a few floats to start with), and possible expansion in the future. Marie-Helene supported Laura's point, as ESA had a strong interest in preparation and cal/val of the missions that BGC-Argo can help to address. She asked Herve about hyperspectral BGC-Argo measurements in coastal areas or if there would be any constraint to this, as both CHIME and S2-NextGen would cover European seas, so there is strong interest for these areas. Herve indicated that country EEZs are an issue and requires diplomacy for floats to enter these zones for coastal measurements. The first mandate of Argo is the global ocean, and floats can hit the bottom in coastal areas, so they are not meant to target coastal waters. Marie-Helene thought that in the frame of OneArgo, there was interest in enhancing coastal observation. Herve indicated that the floats exist for coastal areas, but for the moment it is not intentionally deployed in coastal waters. However, if there are end-users as countries/governments that request from Argo to have floats in coastal waters, this can be done, and he suggested that IOCCG could help to speak to governments about the requirements and the need for floats in coastal waters to help to get approvals. Herve mentioned that CNES is also supporting BGC-Argo for Ed/Lu.

Claudia asked whether the request for BGC-Argo in coastal waters could be expanded to include deep lakes (300-400 m), as well as large lakes. Herve said there is float technology that can handle lakes, but it is not yet included in the ones he presented.

Shubha went back to the discussion on BGC-Argo after the presentation on remote sensing of marine debris. She suggested using the link to the Argo community to give feedback on how the sensors could be improved for future to help to meet the needs of the OC community. She said that Robert's knowledge on calibration of sensors could also be a feedback to that community. BGC-Argo CHL comes from fluorescence, and fluorescence is more complicated, but there exists the possibility to use absorption in the red for CHL, and if we could use absorption rather than fluorescence we could get a better handle on CHL, and especially CHL absorption at the surface from BGC-Argo. Right now they have to discard surface values that appear to be under photoinhibition, and then go a depth without photoinhibition and extrapolate to the surface. Some of these issues could be improved if we could use this link to Argo to have a proper dialogue.

Laura indicated that the Argo community has taken our feedback and this is why they have hyperspectral sensors. She acknowledged the issue of CHL and it is why we currently do not use BGC-Argo for satellite validation. But for a couple of years they have been developing the hyperspectral sensor which has been proven and has given us faith that this is a good approach. So they are very receptive. Bob Brewin added that while he understands the issue of putting absorption meters on the floats, beam attenuation is being measured on the floats that Herve presented, and there has been work showing how you can get at CHL using beam attenuation. He shared the following study: <https://doi.org/10.1364/oe.397863>.

3. IOCS

3.1. Recap of IOCS-2025

Raisha Lovindeer gave a quick recap of the 6th International Ocean Colour Science Meeting which took place in Darmstadt, Germany, and was graciously hosted by EUMETSAT, ESA, and the European Union Copernicus Programme, with travel funding provided by IOCCG, EUMETSAT and EC-JRC. A total of 300 people attended in-person from 39 countries, and this represented 90% of registered attendees (334), while 49 streamed online out of a total of 148 free online registrations (33%). Of the attendees, 48% were from universities and research institutions, 37% from agencies, and 15% from industry or the commercial sector.

10 breakout sessions were conducted within the IOCS, and these generated a total of 64 new recommendations: 27 for the community, 24 for space agencies, and 13 for IOCCG. Many recommendations from previous years had already been actioned, showing the steady progress that has been made, though some from previous years are still open and serve as opportunities for the executors (community, agency, or IOCCG).

Paula asked how many of the participants of the IOCS were early-career scientists. Raisha indicated that the data was available for her to check it later. [From the count of PhD students and PostDoc positions from in-person registrations, 14% (42/300) were early-career. No data on positions was collected for online registrations].

3.2. Outcomes from the Commercial Data Providers Panel

Merrie Beth Neely gave an overview of the Industry Data Service Providers Panel that occurred following the IOCS meeting that was jointly co-hosted by GEO Blue Planet and GEO AquaWatch. The event was a 2-hour hybrid session moderated by Paula Bontempi (in-person) and Pedro Ribeiro (online), with panelists both in-person and online. The objectives of the panel were to 1-build capacity for industry participation

in the IOCS, since 15% (45 people) were from industry or the commercial section, and this number could be higher; and 2-to introduce a grand challenge for a public-private sector partnership opportunity for a sustained collaboration among industry, academics, agencies, and IOCCG over the next 2-4 years and through the next few IOCS meetings. She shared [this link to the recorded 2-hour session](#).

Merrie Beth indicated that there was a lot of good positive feedback about the value proposition of the IOCS and so she recommended creating a one page fact-sheet, promotional videos, or white paper and promoting the link to watch the panel. She also requested to engage the panelists further, together with IOCCG, in discussion of a public-private sector activity (as time did not permit this during the panel) via a follow-up workshop to settle the technical details surrounding a unifying grand challenge. She hopes that an outcome of this workshop could be a SMART recommendation for the formation of an IOCCG task team to oversee the execution of the grand challenge. She hoped to leverage the network and strength of both the IOCCG and GEO communities to move forward.

Jeremy Werdell asked Merrie Beth about the willingness of industry to participate in this grand challenge given a lack of funding for them. Merrie indicated that those present were not opposed to it and saw a mutual benefit, but she indicated that those present were the data service providers and not the commercial satellite companies (which might have a slightly different take). Menghua asked about the reach of the commercial companies and whether they were global, including whether companies from South American countries and more underrepresented groups were expected to be part of this grand challenge. Merrie indicated that the target was for global companies. GEO AquaWatch and GEO Blue Planet have contacts and reach in countries mentioned, however such a call would be open to those who wish to participate, and that might be a different challenge.

Shubha raised for discussion whether commercial companies had the capacity in the private sector to take over the satellite missions currently operated by national governments. Merrie indicated that many companies want to sell their products and packages but science-quality data might be an issue. So they may be willing to try, but would acknowledge that data quality might not be applicable to all users. Shubha asked whether the private sector emerges as an important user community. Merrie indicated that yes. There are companies that indeed are part of the user community and depend on national agencies to provide satellite data that they package for their users, so there are different kinds of commercial companies and some are indeed users.

Paula applauded Merrie for having the foresight to bring this topic to the IOCS Meeting. She indicated there is more discussion on this topic (see item 2.7), and that it might be important for national agencies to fully understand the role they fill that commercial companies cannot fill. We should consider whether there is a synergistic scientific objective (a grand challenge, or a series of observables) where the agencies could get together and put out a joint opportunity for commercial partners to bid on for a feasibility study. This is relatively cheaper than a mission. Can commercial companies meet science objectives while also making a mission or a sensor commercially viable? Can they have a return on this investment? Companies may make space accessible and launches cheaper than previously (the hardware side), but do commercial companies see a viable return on their investment for science? This is a question we need to answer, and we will discuss further. Merrie indicated, in the chat, that the model for private data service providers is subscription or fee-based, and this is inherently inequitable, especially for least developed countries. She also mentioned that the science-quality data gap persists.

See item 2.7 for further discussion on this topic.

3.3. New recommendations and actions/outcomes from IOCS-2025

3.3.1. IOCS-2025 Recommendations for IOCCG

The following 10 recommendations geared at IOCCG were reviewed by the Committee. Status updates, where available, were added directly to the [public online spreadsheet](#).

- 2025.01.04 Space agencies and IOCCG should promote intercomparison exercises of adjacency effects correction algorithms with reference to in situ data and potentially with synthetic data.

The lake community has old studies and this is on-going. It is part of the processing chain that inland water has been considering. There has been no intercomparison so it would be good for IOCCG to coordinate this type of intercomparison. Perhaps in a working group. Jeremy asked whether the data is available from all the agencies to do this correctly. Paula suggested that maybe one or 2 people could frame what needs to be available for an activity like this in order for us to action it. Menghua indicated that agencies have studies, but they are very instrument specific. Chuanmin wondered whether this should be reassigned to the community. Others agreed that agencies may not be able to undertake such an inter-comparison, but this could be a community effort. Robert suggested that the recommendation should be more that space agencies should perform routine adjacency effects correction as currently agencies do not perform adjacency correction. Shubha asked whether the desire was for agencies to explore better adjacency correction methods rather than just mask them. Robert agreed and said we know that adjacency effects impact more than just a few pixels so, more than just an exercise to compare which algorithm is better than the other, perhaps the action should be to request the correction rather than to provide a mask.

Action 30/3: IOCCG Project Office to gain clarity from the chairs of the IOCS Breakout Session on Adjacency Effects on their recommended intercomparison exercise and

request them to provide a list of what the agencies could provide to assist the community with this activity.

- 2025.02.03 Promote discussion between the BGC-Argo and ocean colour communities through dedicated actions (e.g. working groups and workshops).

Being discussed. See item 2.8

- 2025.03.10 Promote adoption of EBV Framework through an IOCCG WG/TF within 1-2 years (e.g. through workshops).
- 2025.05.10 Fund and coordinate systems for data curation, which are essential to support continued in situ data collection, harmonization, quality control and sharing.
- 2025.05.11 Make a coordinated, curated effort to integrate existing datasets, map the measured parameters, highlight gaps in data availability, and assess spatial coverage to guide future data collection.
- 2025.05.12 Implement the [recommendations of Water-ForCE for data collection, sharing, and new in situ measurements](#) (see section 4).

For the 3 recommendations under 2025.05: Claudia indicated that she is sitting on a panel for GCOS variables and ECVs and that global distributed in situ data for ECVs on lakes are not strong or available. Global coverage is lacking and there are time gaps. This is a clear blank spot. Even when there are national agencies that provide data continuously, at global scale there is a bias towards developed countries. Shubha agreed as it is hard to get data from some countries even when they exist. Shubha suggested that there could be a discussion on this topic at the TPSF Symposium occurring in November this year in India, and that she could raise it and gain feedback there as well. Tim Malthus suggested, in the chat, that these recommendations could be a potential topic for a working group.

Action 30/4: Shubha to request a discussion session at the next TPSF Symposium regarding recommendations under 2025.05 on coordinate systems for in situ data collection, curation, and sharing, and take outcomes to IOCCG.

- 2025.07.02 IOCCG and the community should continue to foster improved collaboration of diverse expert communities (e.g., citizen science, ocean colour, numerical modelling, industry, civil society, non-profit organisations, environmental agencies) for holistic remote sensing solutions for marine litter and debris.
- 2025.08.06 Assess and address the latency between science and policy (through a guidance document), including evaluating the uptake of key ocean carbon research information in decision-making. The use of ‘knowledge brokers’ or knowledge hubs should be considered to bridge the gap between science and policy.

Paula indicated that maybe a guidance document or links to information to train people to speak on topics that connect policy and science might be useful.

- 2025.09.03 Coordinate across the space agencies to deliver data products and services suited for water quality applications to managers and stakeholders (e.g. GeoTIFF images, presence/absence flags, or water quality indicators as used in reporting)
- 2025.09.04 Coordinate across the space agencies to provide long-term sustained maintenance of in situ datasets with FRM-quality required for coastal and inland water-quality monitoring

The following 3 recommendations on training geared to IOCCG were discussed in item 7.9

- 2025.06.01 Continue support for global training initiatives with coordinated and coherent approaches to radiometry to ensure that participants fully understand protocols and measurement uncertainties with hands-on experience (i.e. no decrease in training with time).
- 2025.08.05 Promote (within 1-5 yrs) inclusion of aquatic carbon from space in existing and new training activities.

- 2025.09.05 Support training to collect good FRM-quality data

The following recommendation from IOCS-2023 was still open:

- 2023.05.02 IOCCG should form a User Engagement Task Force to oversee the following goals to be accomplished in the next 2 to 3 years: bridge the service gaps between space agencies and end-users; quick start guide for ocean colour data access; enable the novice ocean colour data user to see the value in ocean colour data products for their research or application; build community confidence and enhance user knowledge of the relative performance of ocean colour models; develop plain language and recommended standards for reporting uncertainties for ocean colour.

A call for working group proposals was issued in May 2024, but none received. The goal of this task force needs to be defined. There were suggestions to review and possibly combined with recommendations from the commercial sector who utilize space-based data. The users and who we target needs to be defined as well. There were suggestions to check with Ben Loveday at EUMETSAT, as well as with other agencies who have user engagement already, and pool data together.

3.3.2. IOCS-2025 Recommendations for the space agencies

The following 24 recommendations geared towards space agencies were reviewed by the Committee. Status updates, where available, were added directly to the [public online spreadsheet](#).

- 2025.01.03 Space agencies should support the further development and validation of adjacency effects correction algorithms.
- 2025.02.02 Agencies should use BGC-Argo floats for validation of satellite OCR products.
- 2025.03.01 Promote development of satellite Earth Observation with higher spatial resolution (~ 2-5m) and revisit frequency, with good signal-to-noise and more spectral bands in the long term (constellation?) and LiDAR

Claudia indicated that spatial resolution of 1-2 m is currently handled by industry that builds satellites with that resolution. ESA is funding the uptake of commercial satellite providers to test their abilities in EO, so commercial hyperspectral is being tested in Europe to foster high resolution (e.g. in the Copernicus Marine Service).

- 2025.03.03 Support (within 5 years) research to upscale from field, drone, airborne data to satellite, and differentiate species distribution.
- 2025.03.06 Support GLIMR and/or studies with other geostationary sensors already deployed to investigate high frequency dependence of plankton diversity within ~5 years.
- 2025.03.08 Support (within ~5 years) regional algorithm development and in situ data collection in coastal areas in the presence of different levels of other optically active substances.
- 2025.03.09 Support (within ~5 years) the collocation of high spatial resolution in situ (as a minimum hyperspectral Rrs) and laboratory optical data for algorithm development.
- 2025.04.01 On-board solar diffusers should be characterized prelaunch as close to on-orbit conditions as possible ('as-you-fly'). High BRDF accuracy should be achieved at a reference solar geometry, which can then be used as a baseline for relative BRDF characterization via spacecraft rotations on-orbit. Characterization efforts must continue on-orbit with sensor temporal trending.
- 2025.04.02 Increased focus should be dedicated to the prelaunch characterization of the SWIR bands at low level radiances. This is because the dynamic range between the top-of-atmosphere radiance over ocean and the calibration radiance (prelaunch or on-orbit) is typically even larger in the SWIR than in the visible spectrum.
- 2025.04.03 Agencies are encouraged to support GSICS and CEOS/WGCV IVOS, which are undertaking activities to reduce uncertainties and achieve absolute calibration of lunar irradiance models with a goal to facilitate using the moon for on-orbit absolute calibration.

- 2025.05.05 Implement the [recommendations of Water-ForCE for multivariate, multi-mission service development](#) (see especially chapter 3 and 5).
- 2025.05.06 Increase observation frequency and observation capabilities for inland waters, particularly for small lakes.
- 2025.05.07 Consider constellations of multiple twin sensors that may support increasing temporal coverage and near-real-time services for HAB monitoring.
- 2025.06.03 Regular (every 3-5 years) inter-comparisons should be supported by the agencies with funding available for participants, including uncertainty workshops and participant involvement in the planning phase, which should lead to a number of intercomparisons planned and executed by international teams.
- 2025.07.01 Space agencies should support continued research on remote sensing of floating matter to understand the challenges and opportunities associated with the detection of floating matter to help define the roadmap for the way forward.
- 2025.07.04 Space agencies should expedite tasking or new acquisition requests by the community and extend quota allocations for commercial multimodal satellites to establish open-access representative datasets documenting diverse floating matter, especially after extreme weather events (e.g., tsunamis, flooding) and for dedicated field campaigns.
- 2025.08.03 Support efforts to generate robust evidence on impact and effectiveness of marine Carbon Dioxide removal (mCDR) within 1-5 yrs.
- 2025.08.04 Continue to maintain and improve the accuracy and stability of primary observables needed for ocean carbon research by sustaining robust cal/val activities and implementing advances in atmospheric correction within 10-20 yrs.
- 2025.09.02 Implement sustained operational missions with specifications suitable for coastal and inland water quality applications.
- 2025.10.03 Ensure users can access intermediate products (e.g., pre-SVC, sensor-specific fields) alongside merged products, enabling users to apply

application-specific uncertainty tolerances, regional analyses, or alternative merging strategies where appropriate.

- 2025.10.04 Establish and sustain coordinated local-regional-global networks for calibration, validation, and processing, building on existing international frameworks. Support shared investments in calibration sites, matchup databases, processing tools, and documentation to ensure long-term continuity.
- 2025.10.07 Design merging frameworks that explicitly accommodate different numbers of contributing sensors (e.g., two-sensor versus multi-sensor merges). Provide metadata indicating which missions contribute at each time step, and implement safeguards to avoid regional artifacts caused by gap-filling under aerosols, dust, or persistent cloud cover.
- 2025.10.09 Encourage innovation using AI/ML while requiring that such methods be traceable, physics-aware, and uncertainty-quantified. Ensure AI-based approaches do not introduce spurious or non-physical features, mask real variability, or create false temporal continuity in long-term records.
- 2025.10.10 Deliver pixel-level uncertainty estimates alongside methods for deriving regional and ensemble uncertainties, recognizing that aggregation reduces random error. Provide uncertainty PDFs or ensemble-based representations to characterize extreme behavior (tails), and document impacts of data gaps or regional data-sharing constraints on uncertainty.

Robert indicated that each recommendation is complicated and certainly cannot be addressed and solved in a short discussion. Robert was wondering about the procedural process. Perhaps we could assign each recommendation to see what has been done to close the recommendations. He expressed that, as written, many of these recommendations are difficult to close. Technical low level recommendations are the ones that can be implemented by the agencies and keep the community motivated and moving forward. Bob agreed with Robert, and suggested we provide a clearer structure (boundaries) or guidance on how to make a recommendation as

some seemed quite vague [Note that this was previously attempted with the implementation and on-going use of SMART recommendations in 2023]. Shuha indicated that sometimes high-level recommendations can be powerful (e.g. a single person saying they want a water-quality mission may not make a difference, but a community recommending they want this might have more weight). These types of high-level recommendations cannot be actioned for decades, but they are still needed.

3.4. Timing of next & future IOCS Meetings

This topic was a continuation of a discussion about a suggestion by Shubha to change the cadence of IOCS meetings to every 3 years instead of every 2 years, in an attempt to reduce IOCCG's carbon footprint. Laura gave context of the previous discussion about the overlap with Ocean Optics (OO) and IOCS if IOCS were to switch to a 3-year cadence while OO remains on 2 years. The meetings have different goals and aims, and a combined meeting did not seem feasible when Raisha and Jenny first explored this option. Laura showed a proposed timeline of meetings from 2025 to 2040 that had IOCS, OO, the Ocean Sciences Meeting (every 2 years on the even years) and the Living Planet Symposium (every 3 years), as these were relevant to the community and sometimes sponsored by IOCCG agencies. Labs and researchers also need funding for these meetings, and thus meetings will compete for attendance when held within the same year. Laura proposed that if we were to switch IOCS and OO to a cadence of 3 years, what would we do in the gap year? She proposed to have a hybrid meeting in years with no meeting of either OO or IOCS.

David Antoine indicated that there is increasing overlap between IOCS and OO, with more ocean colour at the OO meeting. The cadence is one thing, but the IOCS is a working meeting to keep the community going, so we should emphasize the clear difference between the two.

Vittorio Brando indicated that ESA has also organized ad-hoc meetings without a proper cadence, so this should also be taken into consideration when thinking about whether meetings might already exist in a specific year. Laura asked whether these ad-hoc meetings are community-specific, and whether there was a big focus on an international audience? Vittorio indicated that for the last Biodiversity meeting, there were 300 people from many countries, posters etc, so yes. But other meetings are not that large. He was not sure what was planned for future years and suggested that Marie-Helene (ESA) would be best to liaise with. He just raised it for consideration.

Claudia indicated that for labs, there are many overlapping meetings anyway and it is not a big issue as the choice of which meeting to attend is highly dependent on the meeting scope, timing, and funding. Overlaps create different opportunities and the locations matter, because if OO is in Europe when IOCS is in the US or Asia, then they might be attended by different audiences and whichever is more convenient at the time. Menghua indicated that, due to the rotation, the next IOCS should be in Asia. Vittorio raised that the meetings do compete. OSM was only 2 months after the last IOCS, and choices had to be made about which one could be attended by which students etc. depending on funding. Fred agreed that if in one year both IOCS and OO were scheduled, then it creates choice, but it would be better to have the meetings also coordinate locations so that there is choice across geographical spread as well.

Shubha asked whether OO even wanted to change the cadence of the meeting from 2 to 3 years, because if not, the discussion was a bit premature. Paula indicated that there is no appetite at the moment to have this change, but she could revisit it when the community meets in September. She also indicated that back to back meetings in off years might be better than hybrid meetings (which is what Laura had proposed). Shubha reminded the group that the discussion originally came up as a discussion on reducing the carbon footprint, but it can only really work if everyone is willing to coordinate and to compromise.

Menghua asked whether 3 years had already been decided. Laura clarified that it was not yet decided, but given that the meeting is for outreach to the community, is 3 years too long? On the flip side, there is not enough time for agencies to properly examine actions and recommendations from previous IOCS meetings before another rolls around. These are things that we should think about. She suggested to revisit the topic later. This was accepted.

Action 30/5: IOCCG Committee to revisit the topic of the cadence of the IOCS Meeting.

3.4.1. Host proposal for IOCS Meeting: Asia/Oceania rotation (SIO)

Xianqiang, after discussion with Zhonping Lee, preliminarily offered to host the next IOCS Meeting in China. He gave 2 potential locations that could be suitable to host the meeting near the end of the year: Sanya on Hainan Island, or Xiamen. China has a large OC community, and every year they have an ocean colour science conference with ~300 participants and especially with young scientists, so an IOCS in China would be well-supported by the local contingent, and the size would be significantly larger than a typical IOCS Meeting. Hosting the IOCS Meeting would also give the Chinese OC community good exposure to the international OC community. China has also engaged in many satellite missions, launching 5 OC missions. The first geostationary OC satellite is now formally approved and a lot of science is happening in China. So in summary, there is a preliminary offer by the Chinese OC community to host.

3.4.2. Host proposal for IOCS Meeting: Americas rotation (CONAE)

Carolina indicated that, although the year is not known, CONAE would love to host the IOCS meeting, and it would be very good to have it in South America. Given the upcoming launch of the SABIA-Mar Mission, CONAE is investigating, in principle, the possibility to organize an IOCS meeting in Buenos Aires, Argentina, for the Americas rotation in 2029 or later. However, their ability to host will seriously depend on the situation in Argentina at that moment.

4. CEOS Activities

4.1. CEOS Aquatic Carbon Roadmap

Marie-Helene presented the status of the CEOS Aquatic Carbon Roadmap, as they have reached an important milestone of the document. She gave the context of the roadmap, which covers the activities that contribute to the strategy paper in support of the global stocktake following the Paris Agreement. Aquatic carbon was needed to complete the coverage of the Earth system, as monitoring and understanding of the aquatic carbon sink, storage, and fluxes are key to the reliability of the global carbon stocktake. The concept of the Aquatic Carbon Roadmap was presented and endorsed in the 2023 CEOS Plenary. It has been a team effort from the agencies (OCR-VC) as well as the leads of the IOCCG Aquatic Carbon Task force, and the IOCCG Ocean Primary Production working group, and over 25 international scientists. The delivery of the roadmap was postponed to Q1 2026 so that input could be generated from the Ocean Carbon from Space workshop and the IOCS-2025 Breakout Workshop on Aquatic Carbon, in November-December 2025. A final draft was delivered on 1 April 2026 to CEOS for discussion at the CEOS SIT-41 Meeting. The document is not completed. The final document is due in advance of the next CEOS Plenary in November.

The scope of the roadmap is to address carbon dynamics across the land-ocean aquatic continuum (inland waters, coastal and blue carbon ecosystems, shelf seas, open ocean). For each geographical domain, the roadmap examines the current EO state of the art to monitor the carbon pools and fluxes, and identify the current gaps and opportunities, including future needs. It was not meant to be exhaustive regarding the foundational science but is still strongly based on this science. The roadmap identifies its main users, variables of interest, products needed, and specifications. An important component of the roadmap are the recommendations that were generated and checked against those made from the workshops held before and during the IOCS-2025. These were presented, with short-term, medium-term, and long-term timelines. Also important were on demonstrating the

power, and expanding the utilization of aquatic carbon Earth observation measurements, linkages with existing carbon roadmaps, and future work in this area.

The last opportunity to provide feedback is the CEOS SIT Technical Workshop, so a deadline of 25 August 2026 is the latest opportunity to make changes. Final feedback is being collected until 30 June 2026. The CEOS workplan for 2026 lists that the next stage for the OCR-VC will be to work on developing metrics to track the implementation of actionable priority areas identified in the roadmap.

Action 30/6: IOCCG Committee members to give their final feedback to Marie-Helene, Laura, and Hiroshi on the Aquatic Carbon Roadmap by June 30.

4.2. CEOS COAST-Virtual Constellation

Aurelien Carbonniere is the representative on the IOCCG of the CEOS COAST-Virtual Constellation and, in his update on CNES, gave the list of activities that are being pursued by the CEOS COAST-VC for 2026. One of the greatest efforts for this year is to supervise a CEOS-wide coastal data gap analysis effort with the aim to deliver an output in Q2 2027. The VC also aims to develop key activities in the Arctic and develop and release one polar product; and to purpose partnership to develop new coastal products at pilot sites of interest for users and for international policy priorities. This is all on-going work and there have been several meetings, the most recent of which was a plenary meeting in the UK in November 2025.

Activities of CEOS COAST fall within the CEOS SIT Chair priorities for 2026 surrounding water cycle data for community resilience.

5. Broader OC Discussions / Business

5.1. Inventory of validation instruments in S. America

Ana Dogliotti and Aurea Ciotti showed the results of the survey that they released in February 2025 in Latin America and the Caribbean to evaluate the status of ocean colour radiometric equipment. The survey tried to assess instrument availability, calibration facilities, measurement and funding opportunities, existing capacity, development opportunities, and collaborations, including within the Latin American & Caribbean Ocean Colour Community (LACOCC). This survey was disseminated via the IOCCG mailing list, and regional emailing lists. There were 24 replies from 10 countries, but only 15 had radiometers in 7 countries (Argentina, Brazil, Chile, Costa Rica, Honduras, Mexico, Peru, Uruguay, and Venezuela). Not all groups that are known to have instruments responded to the survey, so perhaps a broader reach is required.

From the responses, the main issues highlighted were:

- The length of time between calibration (never, 13 years, 5 years) associated with the costs for calibrating. Many work-arounds are done to try to see whether the instruments need to be recalibrated. This might affect the quality of the data. The effort from EUMETSAT to have the instruments calibrated was acknowledged, but importation and transportation costs were a bit prohibitive. Even when external funds were acquired from funders, local restrictions (e.g. of international funds not being able to be used at customs and border agencies) sometimes prohibit the initiative.
- A lack of regional calibration facilities was highlighted. Some have the facilities but they are incomplete or need updating.

Next steps are to try to identify places that we know have instruments and need calibration, and ask institutions to make a list of their needs - so far the main issue is personnel, but regional calibration capabilities would be an ideal solution.

- Laura asked whether they spoke to commercial companies that do remote sensing about how they calibrate their instruments. Ana answered that it seems the local commercial companies do not do calibrations. Shubha indicated that the issue of calibration is not just in Latin America and the Caribbean, but is a global issue.
- Robert indicated that laboratory calibration is not needed, and that you can check the calibration of the instrument using the sun as your source of light. If you make measurements under proper conditions you are able to simulate, very accurately, the signal that is measured. He says this is a way to do calibration in the field. When he uses instruments to validate radiation products, he checks the calibration using the sun. He does not trust calibration provided by the manufacturer. This is easily done in the field and is cost-effective and he offered to explain the techniques. He has used it on HyperNAV instruments.
- Ana indicated that it would be good to share this methodology. However, even if they had this sun-referenced calibration, their measurements always fall outside of FRM4SOC requirements. The requirements for error estimation and uncertainty for the data are not met. Robert indicated that, in his experience, the sun is a better source of light than that from a calibrating sphere. He understands that the instrument needs to be characterized for the cosine response, etc., but this can be done in the lab once in a while, and is not necessary to do every 6 months to a year.
- Bob added that maybe thinking about optical properties that are less sensitive to calibration is also good, for example, using the instruments to look at relative change in light. He gave the examples of diffuse attenuation, and irradiance reflectance where 2 irradiance sensors could be calibrated against each other.
- Shubha indicated that maybe we need innovation for calibration (miniaturized mobile calibration unit).

- Emmanuel Devred indicated that the Argo floats deployed for 7 years will not be calibrated, so maybe there is some knowledge sharing that could be beneficial here as well. Vittorio indicated that, within the orbit of ensuring Argo data meets FRM quality, there is actually a discussion about how to deal with instruments that cannot be fully characterized and calibrated.
- Ewa indicated that everything that has been developed within FRM4SOC is open and available and we hope to keep developing these activities. So if there is a way to contribute to the instruments and calibration in Latin America, they would be happy to try and support the LACOOOC activities as much as possible. Ana indicated that having a regional calibration workshop/hub might be very good as well, and Robert's suggestion would also be useful as well.
- Emmanuel suggested doing high-mountain (e.g. in 5000 m on the Andes) inter-calibration with a couple of sensors to reduce the impact of the atmosphere might be helpful. Robert added that yes, you can calculate an accurate signal if you minimize the impact of aerosols and diffuse light, then yes, it can work. Robert briefly went through the procedure for this type of calibration.

The survey also asked if anyone had a suggestion or ideas for an AERONET site. There were some interesting places in the responses. There are currently 2 sites in Argentina, with only 1 working. Aurea added that this is connected with calibration because they spoke about using some sites with AERONET for satellite verification.

Ana showed the data regarding existing collaborations in the region, but they are not really OC. There are also collaborations with many EU countries through their projects. Funding opportunities were a bit random. Currently there is some funding for regional networks. Other possibilities are calls from Europe that connect with LatAm. The survey also asked about ships and ferries that could be used for insitu/flow-through data sampling - nothing already exists, but there are possible opportunities. Regarding existing courses, there are some in Argentina and Brazil, and

she thought of asking for support for scholarships for others in the region to attend these courses where they exist.

There was an idea for regional connection of the LATAM Community through the LACOCC, and 100% were in support of this idea to be able to foster deeper knowledge and resource exchange and collaboration within the region. Perhaps a website, or mailing list. But there were questions around who or how, maybe even associated with the existing IOCCG page. Emmanuel shared that Canada tried a regional network, and he agreed that having a dedicated person (even part-time) is critical to keeping the network running as it is time consuming and difficult to keep it going.

Shubha praised Ana and Aurea for the work in putting together the survey and analyzing the data. She said the idea of capacity-building by supporting travel and scholarship within the region was good.

There was interest to learn more from Robert about his techniques for calibration. Shubha said it was worth having a small written report or webinar for those interested to learn these. Paula suggested teaching a short course before the next Ocean Optics conference. Aurea requested a video for easier access and reach.

5.2. Use and potential impact of artificial intelligence and machine-learning on OCR

Discussed with item 7.8 Are we losing the ability to teach basic optics

5.3. Oceans from Space 2030

Paula Bontempi introduced the Oceans from Space Symposium (OfS), a decadal conference held in Venice, with the next one planned to occur in 2030. The co-chairs have been Vittorio Barale and Jim Gower. As they are retired, Vittorio Brando, Craig Donlon, and Paula discussed how to handle chairing the conference, including the venue and timing, as venues in Venice go 3 years in advance. The conference is one

place where all the satellite communities come together (SST, OC, altimetry), and adding salinity. IOCCG has never been formally involved in the conference though members of the OC community attend, but the community groups are being approached to ensure that we are all aware, and to consider joining the program planning. The important part of OfS is that the meeting is limited by the number of people who can attend (200-250). There are plenaries, and dedicated talks and posters, with no parallel sessions, but they need to ensure the communities share in each other presentations and talks, and communicate more. Historically the extended abstracts are collected and last time, there was a special issue that emerged.

Laura said the goal was not clearly articulated when she attended. We are bringing the community together to advance satellite oceanography, but what is different about this meeting? And if you cap-it at 200 people, then would it not be invitation-only? Robert said he was there in 1980 and it was full, but the last one was a bit empty (2020, COVID?). Laura asked Robert, since he was there in '98, what was the goal of the conference/desired outcome. Robert indicated that it was the first time we had all these instruments observing the ocean from space, so it was to bring the community together around these new observations and possibilities. Shubha indicated that she attended the one 20 years ago, and that was an opportunity to learn across the fields and integrate. The plenaries were inspiring, and they gave an award to people who work behind the scenes (a rudder). But Shubha asked, should we have all these meetings, because since then we now have the Living Planet Symposium (LPS), for example, that is also cross-community and cross-area, but this is all Earth, not just the oceans, so it is very large. Paula asked if LPS is only focussed on ESA/EUMETSAT sensors, because this might be the difference, that OfS is not agency/sensor-specific. Paula thought the scientific needs and grand challenges should be the thing that drives OfS. Dynamic interfaces are able to be done. She expressed that she thought it should be driven by big-picture interdisciplinary science, but also near-term challenges in science that appear incremental but are breakthroughs in the past decade. Shubha indicated that co-location meetings across

disciplines that address common challenges can be useful for sharing knowledge, for example, uncertainty characterisation is done well by the SST community, so there can be good cross-fertilization with people with whom you would not normally interact.

Claudia attended the last OfS and believed COVID impacted the numbers. She agreed with Shubha about being able to talk across the community, but with the limited numbers, the attendees have to be experts in order to have these cross-disciplinary discussions. She also suggested rotating the topics within a day, so that all the groups hear all the talks. Marie-Helene agreed that the synergy makes this meeting different. There is a need that has evolved over time and with a focus on Earth system science, these scientific grand challenges are even more important to examine in a cross-disciplinary context. 2030 will also be the end of the UN Ocean Decade, so it is good for us to discuss what we have learned throughout these years.

Action 30/7: IOCCG to think about thematic topics that could be good to discuss across other disciplines, and agencies to consider funding for the OfS meeting.

Laura asked if larger audiences could be accommodated at the venues in Venice. Vittorio indicated that there is currently a venue that can hold ~500, so it might be possible to expand the numbers. But this is why they need to understand who will be on the organizing committee for the meeting and how it will be funded. Laura asked how the last OfS was funded. Claudia shared the list of sponsors for the 2020 meeting: <https://www.oceansfromspacevenice2020.org/sponsor/>. Laura indicated that there are too many meetings for NASA to sponsor, and it is untenable.

Ocean Optics is convened by TOS and Paula (current TOS President) wondered if TOS would be willing to take over OfS. If TOS is the convenor of both OO and OfS, then they can figure something out regarding the hosting of OO (Paula indicated that back-to-back has been done in the past). But the near-term problem is OO in 2028, so

she'd need to discuss with the program committee for OO, which she can do soon. Laura also said this brings the conversation back to IOCS - is 3 years good for us, considering that we keep carrying recommendations over for so many years before the next set get generated. Maybe the timeline is too short, but then maybe 3 years is too long to not hear from the community. She believed IOCCG needed to make their own decision. Shubha indicated that we need consensus before we can make such drastic changes, and it is not a decision that we should make in isolation. She said that OO is only one of the ingredients, the IOCCG Project Office has indicated that if we move IOCS to 3 years, we are out of sync with the 2 year cycle for the SLS (funding for both comes from similar sources). The discussion was parked for now until more information could be gathered.

Menghua asked about the next host. Raisha reminded that Asia is the next host. Xianqiang confirmed that either 2027 or 2028 might be OK to host in China, but the IOCCG Committee meeting is also being hosted in China that year. Menghua suggested having the two meetings combined (or back-to-back). Fred indicated that the Committee meeting is 3 days and the IOCS is 4 days, so it is doable. Marie-Helene indicated she would favour a combination of meetings. Shubha also reminded the group that the Committee Meeting is on a 2 year cycle, so many things would need to be aligned.

6. Review of IOCCG Working Groups & Task Forces

6.1. Working Group: Classification of Optical Water Types in Aquatic Radiometry

Tim Moore (OWT Working Group Co-Chair) gave an overview of the history of the development of optical water types, which moved from initial application oceans to including lakes and freshwater, and also now including AI methods. There has been considerable growth in this area of research, with many choices to be made by OWT developers. However, there is no central report to contain all the information or standardize the definitions, interpretations of OWTs. He showed the common

framework for developing an OWT scheme, but there is still a lot of debate over basic definitions and terminologies within the community. The report also aims to outline the maturity and limitations of the developmental techniques; establish guidelines for creation and application of statistical techniques; and document key areas for development and further investigation for the next phase of OWT classifications. The report also fully defines what OWT really are, and how they can be distinguished.

He outlined the seven chapters in the report, with the chapter leads. The leads for the chapters determine the frequency and meetings and methods used to get the chapters completed, with most chapters (1-6) estimated to be 60-70% completed. The final chapter (recommendations) will depend on the other chapters. The working group has set up a Github repository that has data and datasets (and links to reference datasets) that will accompany the report. The group met at IOCS-2025. Integration into a full report is needed as currently the chapters are operating in silos, but this will begin within June-July 2026. The time to work on the report is a challenge, and the meetings have only been online, but the in-person meetings are better (the group has met only at IOCS). They hope to meet again at Ocean Optics in September, and aim to get the report published by Fall 2027.

Shubha indicated that it was good to see progress being made. Paula asked whether the working group has cross-checked their report with recommendations made at the IOCS meeting, and whether actions that have been requested are being met with this report. Tim was not sure, but indicated that Thomas Jackson might know more about this. Paula wondered whether some of our existing IOCCG working groups may not already be tackling some of these recommendations. Paula also asked whether there might be any big-picture recommendations for future satellite missions to the space agencies based on needs for characterising OWTs. Tim indicated that this could be included. The approach that they have is currently flexible for existing missions, but could help to steer future work.

Raisha asked about the Github repository being developed as part of the report. IOCCG has a Github organization that it would be good to have the repository transferred there once the report is being published. Tim indicated that Bror Jönsson and Liz Atwood are the contacts for the Github repo.

Jongkuk Choi from KIOST asked about whether the target of this report is to cover coastal waters. KIOST is also developing OWTs based on GOCI, and the first thing they did was to test the applicability of OC-CCI, but, for example the Yellow Sea is highly turbid, so can we ensure that the report will include extremely turbid waters. Tim indicated that while they may not address regionally specific seas they do cover all water types, including extremely turbid waters, with OWT classifications from inland lakes, coastal waters and the open ocean.

Shubha stressed that the comments made are with the intention of making the report more usable and useful, and so please consider these comments seriously, especially for application to the space agencies. Shubha indicated that initial comments on the OWT working group included that the report should emphasize the biooptical and geophysical relevance of OWTs, but she was not sure that this point is being addressed by the current chapters. She strongly requested that the group consider this, in the interest of making the report and the method itself broadly usable.

Shubha asked about the advent of neural network applications and a possibility of an infinite number of classes. A healthy discussion about whether such applications might make classifications obsolete should also be tackled within the report. Tim indicated that indeed this is an existential question, and he does not know how AI will affect something like an OWT scheme. Most of these classifications have been developed through unsupervised clustering algorithms, which is machine learning, and so this has been involved from quite early. He is not sure how future developments in AI will affect these schemes.

6.2. Task Force: Ocean Colour System Vicarious Calibration (OC-SVC)

Carol Jonhson (OC-SVC Task Force Co-Chair) indicated that the task force is interested in facilitating the determination of gains (g- factors) exhibiting long-term stability to support climate data records from multi-mission data. The task force is self-organizing to tackle some of the recommendations made in their white paper and BAMS article from December 2024. This includes the evaluation of the impact of g-factors from multiple SVC sites (see 6.2.1), as there are now a number of these sites at different latitudes and atmospheric and aquatic optical properties. The task force membership has remained the same, save for one rotation.

Paula thanked Carol, Giuseppe, and the team for the grueling work the task force has been doing, and for collating their recommendations into a BAMS paper.

6.2.1. Statistical approaches to achieving global g-factors (Robert Frouin)

Robert Frouin presented two statistical approaches to estimate SVC gains from multiple sites. Accurate OC products require extremely accurate radiometry calibration and because water leaving radiance is only a small fraction of TOA radiance and small calibration biases propagate into IOPs and derived products. SVC is needed to adjust TOA radiances using in situ hyperspectral Lw measurements and atmospheric radiative transfer modelling. So the goal is to derive spectrally consistent gains that minimize biases in derived OC products. He covered the historical strategy, that one stable site is sufficient for global calibration, but now we have multiple sites. But the SVC gains from these sites are quite different, and different gains provide different products. So statistical approaches are needed to combine the various gains from different sites. Simple averaging provides limited uncertainty characterisation. The following statistical approaches can be used to help overcome these limitations are:

1. Optical ensemble averaging
2. Hierarchical Bayesian modelling

The key differences between the approaches is that ensemble averaging focuses on optical combinations of observations while hierarchical Bayesian modelling focuses on explicit representations of the sources of variability. Each technique and their advantages and limitations were fully described. He showed applications of these techniques to PACE OCI, that traditional methods would underestimate actual uncertainty because they do not systematically account for site-to-site variability, etc., but that the proposed statistical methods can provide rigorous uncertainty quantification, allow for the inclusion of environmental and instrument-related covariates, and reduce sensitivity to sparse or noisy observations through partial pooling across sites. Robert concluded that continued long-term multi-site SVC measurements are thus essential to better characterize site-dependent effects, improve uncertainty estimation, and support statistically robust determination of SVC gains for future ocean colour missions.

David indicated that there is a question of whether we should use only the best field measurements for SVC as this might be important for long-term climate data records. In that light, he asked Robert if he thought the statistical methodology to merge different sites could be used as a sort of quality control to select only the gains with the lowest uncertainties when it comes to building the long-term time series. Robert indicated that the methodology is not for selecting, deterministically, the best individual observations. When each observation is included, the uncertainty on the data would also be included, so the input is the data + the uncertainty. If the data have a good estimate of the uncertainties (and they are large), these observations may not count as much as others, but they will still provide information on the observation.

Menghua and Chuanmin indicated that the derived gain data seemed to have had a low bias from UV across all the bands, and so would bias the Rrs data. Robert indicated that the influence of atmospheric correction introduced spatial structure in

the differences so a lower biased gain will not systematically bias Rrs across all wavelengths. Robert clarified that he is not developing a new calibration method. The statistics are for optimally combining individual gains that result by doing the match-ups using the Lw information and propagating at the TOA. The methods for doing the latter remain unchanged.

6.3. Task Force: Ocean Colour Satellite Sensor Calibration (OC-SSC)

Gerhard Meister (OC-SSC Task Force Co-Chair) presented on behalf of the OC-SSC task force, which started in 2013. Their meetings usually coincide with the IOCS meetings, which provides a great opportunity for the calibration community to get to know each other better, and he thanked the IOCCG for hosting these meetings. All task force meetings have presentations that are available on the IOCCG website. At IOCS-2025, presentations covered on-orbit calibration of current sensors, prelaunch calibration of future sensors, and lunar calibration (i.e. absolute calibration work that has been done on lunar irradiance models). New for the last meeting was the inclusion of talks on polarimeters (SPEXone and HARP2) as usually the focus is on passive optical radiometers. The task force made 3 new recommendations from their last meeting (at IOCS-2025), and Gerhard went through them:

- On-board solar diffusers should be characterized prelaunch as close to on-orbit conditions as possible, and high BRDF accuracy should be achieved at a reference solar geometry to be used as a baseline for relative BRDF characterization via spacecraft rotations on-orbit.
- Increased focus should be dedicated to prelaunch characterization of the SWIR bands at low level radiances because the dynamic range between the TOA radiance over the ocean and the calibration radiance is typically larger in the SWIR than in the visible.
- Agencies are encouraged to support the effort of the Global Space-based Inter-Calibration System (GSICS) and CEOS to reduce uncertainties and achieve absolute calibration of lunar irradiance models to facilitate using the moon for on-orbit absolute calibration.

The task force plans to meet again in-person at IOCS-2027. If there is no IOCS meeting, they will hold a virtual-only meeting, and/or try to meet at other meetings of opportunity. Gerhard also mentioned that it had been difficult to recruit task force chairs, which may be an issue in the long-term, though not a problem at the moment. They hope to be more successful with engaging future scientists at in-person meetings.

Laura indicated that it would be good to examine the upcoming air-LUSI mission and see what else might be needed to improve lunar calibration and affect future missions. She indicated that this is a resource for every agency that has ocean colour.

Xianqiang indicated that the Chinese HY1 series has no direct calibration instruments, but it would be good to get recommendations for what to do in that case. He indicated that they are reprocessing HY1-C, D, and E data, and the SNR is not bad and derived products are comparable to NASA's products, but calibration is a problem without a dedicated calibration instrument.

Xianqiang also said that SVC should be based on the reference bands, but asked about the accuracy of the reference bands, like NIR and SWIR. Menghua indicated that the calibration accuracy for VIIRS is about 2%. For SWIR vicarious calibration, adjustments are made during orbit, and most important is that change (degradation) is monitored via the solar diffusers. Sensor calibration change with time is the most important part during the mission launch, and that is what can enable characterization. The moon can also be used if you maneuver carefully and account for different phase angles etc., and this can give you a reference to compare every month (for example) to see if there is sensor degradation change. Thus, absolute calibration for OC is not necessary.

6.4. Task Force: Harmonizing Global OC for Long-Term Monitoring (LTTS)

Robert Frouin (LTTS Task Force Co-Chair) gave an update on the LTTS task force. The task force has accomplished a lot since it began, with 5 meetings (4 virtual, and 1 in-person/hybrid at the IOCS-2027 meeting) to refine the terms of reference, governance structure, and initial deliverables, including the first deliverable, a report #1. The goal of the task force is to develop a roadmap for consistent, sustainable, long-term global ocean colour records from the wider global community. He outlined 5 main objectives:

1. Assess the current status of existing products in terms of calibration, processing differences, biases, discrepancies and uncertainties
2. Develop harmonized strategies for multi-sensor blending, continuity across missions and uncertainty propagation
3. Identify gaps and needs for data/metadata, infrastructure and validation
4. Support calibration and SVC across multiple missions in coordination with the SVC task force
5. Promote international collaboration across agencies for shared infrastructure and long-term sustainability

The TF had decided to produce 4 inter-related reports that will progress from assessment to methods to infrastructure and then to governance: 1-Status and Challenges; 2-Blending Strategies; 3-Calibration and Infrastructure; Policy and Interagency Coordination. The membership of the task force includes representatives from all the agencies, and there are not enough members to tackle all of the objectives of the task force, but each member can call on others to assist, especially with writing chapters of the report. The strategy for report-writing is staggered, as Report 1 will establish the baseline for the products, gaps, and inconsistencies, but the reports will run concurrently but staggered to reduce the timeline.

Robert shared that there has been good progress on Report 1, and a current draft structure that has 10 chapters. The leads for the chapters have been identified, and

they will reach out to other members as well as the larger OC community for expertise on the applicable topics. Editorial coordination will keep the chapters flowing together. Chapter drafting, product inventories and case study development is on-going. The target for the initial is late 2026, with 2027 for submission to IOCCG. Robert also covered some of the scientific, organizational and scientific challenges that the TF must overcome. Next steps are to start finalizing the leadership and concepts of Reports 2 and 3. They wish to continue engagement from the community, including integrating IOCS recommendations. Thus, the task force has transitioned from planning to coordination.

Laura wanted clarification on whether the task force was addressing where the product would live (from what was presented it seems the task force is not addressing this). Robert agreed that indeed the task force is not addressing that issue at the moment, but this coordination comes in the end and will likely be addressed at that point. Laura also raised that different types of atmospheric correction are applied to the products released, and that the sensors have different crossing times, so there is a mismatch in aquatic conditions - would the product be a daily average with the understanding of intrinsic error? Robert indicated that this will be addressed in the second report, but for the moment (Report 1) these details will be listed as things that need to be addressed and overcome. This is why Report 1 needs to be completed quickly so that these methodological issues can be addressed as soon as possible.

6.5. Task Force: Remote Sensing of Marine Litter and Debris (RSMLD)

Laura Lorenzoni presented on behalf of the RSMLD TF chairs. Many of the activities that the task force undertakes are funded by specific space agencies and the task force capitalizes on these opportunities. In the last year, there have been 3 main activities: participation in the Surface PLastic Remote SEnsing (SPARSE) workshop, a breakout session at IOCS-2025, and community activities that were part of IMDOS (Integrated Marine Debris Observing System) as some TF members serve on this committee. The task force (through Manual Arias) also contributed towards UN

SDG14.1.1 (identification of debris through remote sensing) with a number of publications on approaches and nomenclature for identifying marine debris from space.

The task force reviewed existing recommendations that came out of IOCS-2023. There are no standardized approaches for measuring or sampling floating matter, and this is outstanding. Also outstanding is the marine litter and debris roadmap, which is a work in progress, and would outline the gaps and needs over the next few years. They developed a living hyperspectral library and database that will continue to expand. A total of four new IOCS-2025 recommendations were made by the task force, to develop a sustainable strategy for supporting remote sensing of floating matter initiatives, continue to foster inter and multidisciplinary collaborations, sustain extension of fiduciary and high quality open access reference libraries, and develop a strategy to prioritize and facilitate tasking requests of satellite imagery that can be beneficial after extreme events and during dedicated field sampling.

Shubha was surprised about the tasking request issue of not getting the satellite data for disasters. She asked about whether it would be good to ask responding agencies for the images. Laura indicated that these agencies are usually so focussed on their tasks that it may not be a priority. The science community is the one that wants this data and finding the matching satellite data is a challenge. Shuha also raised that the spectral library could have an infinite series of characteristic spectra so wouldn't we need to highlight priorities by region or by type? Laura indicated that she believed this would be the point. The library is part of [Ocean Scan](#), which links sightings of marine debris to satellite data.

Claudia asked how the work of the task force can support new missions such as CHIME. Laura indicated that as we try to determine the best spectral wavelengths to detect marine debris, most of this is done in the lab under pristine conditions, and there is also the problem of scale. At the moment it is still a bit removed for

recommendations to be made for new space missions that can meet these needs, but some of this work is applicable to optimising sensors on drones that could capture the spatial resolution needed to identify marine debris, but then we move from a global or regional perspective, to a very local one, so still a major challenge.

Emmanuel indicated that it seems that most marine plastic is fishing gear, so for societal benefit, if the TF could tackle one of those problems it would be quite beneficial. Laura indicated that the problem with ghost fishing gear is usually at the bottom of the ocean, but Argo and LiDAR might be an avenue to address this question, along with other active remote sensing technology.

Paula asked, regarding the spectral library, could you run the spectra through a classification system to be able to detect what items created which signatures. Laura indicated that the spectral libraries are specific spectra for individual items, but the mixture has a different spectra, and agreed that this might be possible but there is still a lot of research to be done. Paula suggested that perhaps commercial entities might be interested in this, especially if the outcome is that they are able to improve their end-product or better meet the needs of their paying customers. Laura agreed that this was a good suggestion.

Chuanmin indicated that detecting plastic in open water is extremely challenging because there is way more other floating matter in the ocean. To be able to differentiate how much of the signal actually comes from plastic is a very big issue and a heavy research area. The library that Laura showed is from lab-based measurements of individual items, but in the real-world the spectra of the mixture of plastic is currently unknown. This is why it might be important to try and get the reflectance after some type of event, but we don't have such data and that's the next effort. Chuanmin has looked for images after hurricanes (from the Coast Guard and NOAA, collected by drones) but these are difficult to correlate with satellite images because of clouds and a lack of concurrent measurements, so it is very difficult. So we

need to continue working with these environmental groups to combine techniques and fill this knowledge gap.

6.6. Task Force: Aquatic Hyperspectral Remote Sensing

Jeremy Werdell (Hyperspectral TF Co-Chair) presented an update on the Hyperspectral TF that started in 2023, with the final group established in 2024. The TF aimed to capture the state of the art in hyperspectral remote sensing and help inform those who can support research and funding in this area of science. The TF addresses the new questions that hyperspectral could address and any constraints in terms of using the hyperspectral signal to address these questions. A report was published as a scientific roadmap by the TF that tried to address these goals. It captured the status and limitation of the various methods of collecting hyperspectral data, the science questions, and what progress could be made with additional research and funding, as well as the on-going work in calibration and validation, which is critical. The draft was presented to the community for feedback in a meeting held at IOCS-2027, as well as having comments received directly online. It was finalized and published early in 2026. The report will be updated every 18 - 24 months.

The TF had 7 framing questions in the TORs and these were used for the writing assignments of the scientific roadmap. Chapter 2 is the list of all the capabilities that currently exist for hyperspectral remote sensing. The 3rd chapter has many subsections that go into different geophysical and retrieval categories, and Jeremy offered thanks to the many people who contributed to this section especially. Chapter 4 gives the details of gaps in atmospheric correction and calibration, and how to guide best practices on data display and analysis for validation and performance assessment. Recommendations and an executive summary are given in Chapter 5.

Looking forward, the current TF membership remains unchanged. The TF plans to reconvene at OO in September 2026 and will refine the scope of the revision of the report, and define schedules for deliverables. The 2nd version would modernize the

scientific content, anything missed in the first report, and update the list of identified gaps. The report will have a guide for readers to see what changed from the last report, with a target publication date in 2027.

Raisha praised the TF for their great work on getting the roadmap completed and published in a relatively short space of time. She also indicated that the Ocean Best Practices Repository reached out to IOCCG for a highlight of the roadmap as it was the most downloaded publication within the first 2 weeks of publishing on the repository. Raisha asked whether the structure of the updated report would be largely similar with just a few updates, or if they intended to write a whole new document. Jeremy indicated that the structure would remain largely the same. They intended to have a living document on the website with version control. Raisha indicated to the committee that the report will exist as a kind of living document with version control. It was published as Report #22.1, and the new version will be 22.2 and exist on the website in the same location.

Paula asked whether the TF could bring in data and products from commercial companies. She felt that if we didn't include their data and products, it could lead to an argument that commercial companies can fill the gaps that are highlighted in the report. Jeremy indicated this was a good suggestion, because this could help to highlight any gaps in commercial data as well. Paula also thought that including lower atmosphere (maybe not in the next report, but in future), such as drones, and other platforms, might be useful as well. Jeremy indicated that atmospheric correction would need to be included. Jeremy noted these comments and thanked Paula for the suggestions.

Vittorio thanked the TF and indicated that the roadmap was very valuable, with the community indicating interest by the well-attended session at the IOCS meeting. He raised interest in how to evaluate data for performance, as this is indeed needed. He also indicated that Copernicus Marine Service is evaluating commercial data as part

of ESA's uptake of commercial providers, and they will have results to be able to share with the TF in this area within a year or so. Jeremy thanked Vittorio and indicated he would reach out at that time.

Claudia indicated that one of the last stages before the report was published, there were presentations at the 13th EARSeL Workshop on Imaging Spectroscopy on all the hyperspectral technology led by commercial entities. 78% of satellite imaging spectroscopy missions were from commercial companies (albeit local missions). This point was noted in the report but merits some expansion, as it is an active sector. She thanked Paula for the reminder to expand this section in the next version of the report.

6.7. Working Group: Lidar for Ocean Applications

Cedric Jamet presented an update on the working group for LiDAR. The membership is 10 people and the TORs have been finalized. The WG will focus on the use of active remote sensing, mainly LiDAR. He said there was a previous comment for looking at SAR, but there are only LiDAR specialists in the group and they plan to focus there. They aim to train and explain to the OC community the basics of LiDAR instrumentation and data processings, including example datasets and codes as references for visualizing and processing LiDAR data. They also plan to discuss advantages and limitations of LiDAR for monitoring the upper ocean layer, and provide recommendations and actions for increasing the use of LiDAR in the OC community, including training, instrumentation, algorithms and best practices.

The IOCCG Report will have 8 chapters for the report, including fundamentals and glossary, which will be an expansion of the differences in terms between LiDAR and passive remote sensing of OC as the terms are different between the two scientific communities. Chapters will also be dedicated to instrumentation, multiple scattering, data processings, applications, complementarity between LiDAR and standard OC data, and a summary of recommendations, at the end, to be able to make progress on using LiDAR within the OC community.

They are open to members to fill gaps, even though they are already at 10 members. The aim is to complete the draft report by the end of 2027. The WG has only met virtually, with a second meeting on 18 May 2026. They now plan to have online meetings every 2 months (next one in July) as well as an in-person meeting at Ocean Optics in September 2027. Planning a second in-person meeting at the U. Warsaw in Spring 2027.

Vittorio asked about the time that the members have to dedicate to this activity and meet the timeline. Cedric indicated that this report is mainly a literature review and not a science intercomparison (for example) so there is less of a time commitment. Also the members who have volunteered are also members of the ISSI working group and they work already together and so time is basically built into many of their schedules to manage the report, so he is confident that the report can be completed within a reasonable time frame. The working group wants the report to be published quickly, and especially a few years earlier than the LUCE mission so that the OC community can be prepared to use this LiDAR data and prepare students before the launch. So this is a good target and motivation to move the WG activities forward.

Shubha suggested that, in regards to members, as the WG adds new members for expertise, please look for those countries not already represented on the WG (there are only 5). Shubha also raised that she was worried about the differences in terms between the LiDAR and OC communities. Cedric indicated that the same exists across the aerosol community as well for different terms. He gave the example of attenuated backscatter in LiDAR = VSF in OC. Shubha says it is good to introduce the Glossary in this way, and would be useful for both communities to be able to speak the same language. Shubha also asked whether they were devoting the report to only satellite-based LiDAR. Cedric indicated that they would include all (satellite, airborne, and shipboard). Cedric also indicated that we have no commercial shipboard LiDAR, and is one of the recommendations, and so they will present a lot of the application

from ships. Shubha also asked about early efforts from NASA on LiDAR and whether the work of Frank and Hoge et al. would be included. Cedric indicated yes.

Laura indicated that NASA may be planning on an ocean capable mission before LUCE so she applauded the rapidity of the report as it would be a great foundation. She asked about whether salinity is being considered as well (she saw that bathymetry and internal waves were listed in the report outline). Cedric indicated that salinity and temperature are not included and there are no experts in the group for this. He knows about the development of temperature LiDAR, but they did not include salinity because there is nothing published about instrumentation and cases. Laura agreed, as it is work in progress, but she expects that by the time they are working on the report, it **might** be mature enough to be considered. Cedric indicated that they will look into adding this. Laura asked if there was anything that field data could assist with regarding the report. Cedric said they would like to provide sample data and codes (airborne and shipboard), and data access across countries is complicated. Laura indicated that the COSENSE field campaign is an opportunity to collect targeted in situ and airborne measurements. Cedric indicated that Kelsey Bisson is on the WG and discussed the COSENSE data. They are trying to organize a field campaign in the Mediterranean Sea during that campaign for coastal waters.

Emmanuel asked about the table of contents and whether the glossary (Chap 2) should be before the fundamentals of LiDAR (Chap 1) given the nature of the translations for the OC community. Cedric indicated that this is a good point. In the fundamentals of LiDAR they will introduce the LiDAR equation with the different terms, so this was the original thinking of putting the glossary next, but they could be combined. The WG really wanted the glossary to be a complete chapter so that people can see the differences. Chapters 1 and 2 could be swapped, but maybe after having a more advanced draft they can see how best to organize these two.

Robert was wondering about the recommendations that they hope to make, as this might influence the way the report is written. Cedric indicated that there are recommendations around wavelengths that are needed to develop LiDAR processing, also some around going towards neural networks, etc.

6.8. Working Group: Ocean Primary Production from Space

Bob Brewin gave an update on the WG on Ocean Primary Production (OPP). He reminded the group of the importance of OPP in the ocean carbon cycle, converting 50 gT C from inorganic into organic in the sunlit region of the ocean, with export to the deeper ocean contributing to the ocean's biological carbon pump. The deficit of CO₂ near the surface caused by photosynthesis promotes uptake of atmospheric CO₂ by the ocean. OPP has a long heritage with OC, with one of the main goals of OC being how we could map global OPP. There has not been a report on this topic, but there has been four decades of working in mapping OPP from space. The working group formed from a session at the XMAS conference in 2023, wrote a proposal that was accepted by IOCCG in April 2023, and had their kick-off workshop in November at IOCS-2023. The WG has a sharepoint site and a Team channel for communication and document sharing. The WG meets every 3-4 months, mainly online, with a hybrid meeting at IOCS-2025.

The report has 11 chapters covering: the mechanisms of photosynthesis and photoacclimation; fundamentals of measuring and modelling OPP; strategies and current understanding for estimating OPP from remote sensing; uncertainties; socio-economic value of satellites-based OPP; future perspectives; and recommendations. There are completed drafts for 6 chapters, drafts started for 4, and the final chapter will be put together after all the others are completed. They have a deadline of June 2026 to have chapters 1-10 completed.

Bob indicated that the glossary came a bit late in their work and so the group is just debating these now to have agreement on the wording. They are also converting

chapters to the IOCCG LaTeX report template. The aim is to have a final draft for peer review by Jan 2027.

Vittorio stated that within the last year Copernicus Marine Service has been introducing regional OPP models and products for the Mediterranean, Black Sea, and Baltic Sea. He wondered if there was still space for these to be introduced/discussed in one of the chapters in the report. Bob said this was a good point, but wondered where it would best sit. He suggested maybe in chapters 5 and 6—the input variables for regional PP models. He would give this feedback to the leads of Chapters 5 and 6 to make sure that regional-based view is included. He knew that for Chapter 6, there was work to assign parameters to different biogeographical regions, and ensuring a link to available operational products.

Laura indicated that she hoped there were linkages to the carbon from space work and the CEOS Aquatic Carbon Roadmap that the WG has contributed towards. Regarding the roadmap, she indicated that it might be beneficial to cross-reference, where appropriate, the priorities for carbon. Bob indicated that he planned to do that type of cross-referencing in the final chapters with the recommendations, to point out where there are those similarities and links across the documents.

Xianqiang asked whether there were any considerations for the merger of space observations and BGC-Argo observations. Bob indicated that indeed one of the original motivations is that the background of in situ observations are changing and there is huge incentive to use observations like BGC-Argo. There is a section in Chapter 9 that looks more into this topic.

6.9. Progress on new IOCCG Protocols

6.9.1. Determination of Chlorophyll a and accessories pigments by HPLC

Frederic Melin reported on behalf of Elisabetta Canuti (EC-JRC) and Crystal Thomas (NASA), who are leading this effort. The protocol plan was accepted in 2024 and was delayed initially as the group got their contributors together. Four coordination meetings have been held, and an updated target date for the draft is planned for the end of 2026.

The protocol document has 7 chapters and most are >50% complete. Harmonization and cross review is still needed to ensure that the document is consistent across the chapters. Additional meetings are planned for the coming months. Once the document is standardized (formatting, references, terminology) it will undergo internal technical review before submission to IOCCG for external peer review, by the end of the year.

6.9.2. Update on other on-going protocols

Raisha Lovindeer gave an update on behalf of Antonio Mannino (NASA) on the existing protocols that are in preparation. The CDOM protocol has been stalled for many years. The methodology for merging Ultrathin/LWCC data with conventional spectrophotometers has been published but Antonio needs to summarize this and make final edits to the document. The timeline is yet to be determined.

The DOC protocol requires some editing based on reviewers' comments. The timeline for this is also yet to be determined. Raisha had offered Antonio assistance with this where applicable.

There is an SPM protocol in development. A group is in the process of conducting experiments leading to a protocol document.

Raisha indicated that there is no presence of the protocol working groups on the IOCCG website, only the final documents for review or after publication. There are plans to develop individual working group pages for the protocol working groups, and invite the leads to give updates on their progress at IOCCG Committee Meetings. The reporting procedure would be similar to IOCCG Scientific Working Groups.

Robert asked if we are being pro-active about the protocols or just being a bit passive about which ones get generated. Raisha indicated that it has been passive on the part of IOCCG thus far, but having a handle on which protocols are in progress will allow us to be more active in having protocols for all areas of need.

Xianqiang asked if there could be a protocol teaching video for each protocol document. There was agreement to take this suggestion into consideration.

6.10. Working Group: Conducting benthic reflectance measurements final report

Heidi Dierssen gave an overview of the report on Conducting Benthic Reflectance Measurements. A large international team has been working on this report, and the report and working group facilitated, for the first time, a group coming together to discuss methodology. They have started with benthic reflectance (fundamentals), but also hope to move to another report (after this is completed) on optically shallow remote sensing.

She gave an overview of the 11 chapters (acknowledging the respective chapter leads) that the report entails. The group is now responding to questions and comments from the open peer review that ended earlier in 2026. For example, the introduction needs a bit of editing based on the reviews. Similarly, for Chapter 8 on remote sensing of optically shallow water, a reviewer indicated that the report only focuses on how to map the benthos, but it needs to be augmented because shallow waters are treated differently when measuring IOPs. So the report needs to acknowledge that it is not

just to map the habitat but also important for correcting the global ocean colour parameters. A summary chapter 12 is in progress and will be added.

She showed some examples of how to define benthic reflectance and the large variability, for example in corals and green cover (seagrass, turf algae, etc) that are not easy to be differentiated. Shadows also lead to challenges of creating representative spectra, and are typically classified as something they are not. Canopies move and create shadows and reflect light differently as the fronds wave in the water. Thus, remote sensing of this environment (and now with hyperspectral) is very challenging, and there is still a lot of work left to be done. Most of these edits are planned to be completed over the next month.

Heidi also indicated which groups might be most interested in reading the report and how they are applicable: to map the benthos, to remove optically shallow influences from OC products, studying benthic ecology non-destructively, map global change, and deep-sea application.

She shared, briefly, a draft outline of a potential follow-up report on remote sensing of benthic habitats. Though she was not proposing to lead this effort, the outline indicated that there was enough to explore for a new working group, if this were to be taken up by an interested party.

Robert wondered if the next report would include an analysis of the best compromise between spatial scale and spectral resolution to be able to differentiate the benthos. Heidi indicated that hyperspectral is needed if you want to differentiate between corals and sediment, but there are still unknowns about the spectral resolution needed to detect other aspects. The spatial scale is very interesting. There are some areas that you can see a lot, but then other areas (in-land, for example) that are not able to be observed with existing satellites. So yes, this would try to be included if we're discussing remote sensing of the benthos (but it is not in the current report,

just more of a small discussion). Shubha added that there is a hyperspectral task force, and some of these discussions could be discussed within that group as well.

Emmanuel congratulated Heidi on the working group's conclusion and indicated he was impressed to see an outline of the next report already. He asked whether the group might consider having the perspective of a macroalgae ecologist, as they may use the data, including for validation of macroalgal cover, and understand what level of detail might be needed for end-users. Heidi agreed that getting a broader perspective on the report would be very important.

7. Capacity Building

7.1. Update on plans for the IOCCG Summer Lecture Series 2026 (5-19 July)

Vittorio Brando (Co-Coordinator with Laura Zoffoli) gave the update on the 7th edition of the IOCCG SLS, being held by CNR-ISMAR and VIU at the VIU Campus in San Servolo Island, Venice, Italy. CNR is part of a joint venture with VIU and gets a discount on the facilities from the university. There is also support for the SLS from EUMETSAT, ESA, and the Copernicus Marine Service, Mercator Ocean International, in-kind support from the Biodiversity Gateway, and direct funds for travel from OCB, SCOR and IOCCG. There were 105 applications reviewed by 5 IOCCG members (who Vittorio thanked for their contribution to student selection). 30 students were selected.

The structure of the previous edition has been kept, especially with week 1 being about fundamentals, and week 2 on applications. There are 17 lecturers, a mix of previous lecturers and new ones. New to this year is an experiment to reduce the frontal load of lectures in week one and request that 2 lecturers be reviewed beforehand and discussed in a dedicated session. New lecture topics also included ocean colour multisensors, LiDAR, in-land waters, and fine-scale satellite oceanography. The biggest different from previous courses is that we decided not to have hands-on lab activities with the ACS, but instead do a 4-hour boat campaign in the Venice Lagoon to observe optical complexity and conduct inexpensive but robust

optical measurements, and dedicating four slots in the agenda for work on their mini-projects

Aurea suggested that viewing the videos before is not very helpful in terms of retention (~40% from in-person compared to 10% from videos), and so she would not recommend this as a way forward. She thinks it is more for studying later than to grasp initial concepts.

Claudia asked about the spread of the students, and their backgrounds. Vittorio indicated that there is a good spread by nationality and residency.

- 17 female: 13 male
- 18 countries (based on institution affiliation)
- 19 nationalities

Laura indicated that she was excited to see the changes this year. She appreciated Aurea's comments on the video as she was considering this kind of thing as well, but sometimes they are not effective. But the fact that there is an in-person Q&A/follow-up is good and might encourage more active engagement with the material. She asked how the applications compared to previous SLS years. David indicated that the count was a bit less than previous years (actual average from 2014-2024 is 127, so ~17% less than average).

Robert asked about the new lecture topics, and suggested that maybe we should emphasize AI in ocean remote sensing and biogeochemistry, because it is what people will use more and more in the future. Vittorio says this is a good point. The lecturers are meant to provide a review of existing topics but also to go beyond, to the state of the art. We could be proactive about asking them to comment on how they see the uptake of AI in their own topics. Most likely, this has to be something we will need to include in the next iteration, perhaps also asking our younger scientists how they make use of AI in their current applications.

7.2. Results and feedback from the IOCCG Capacity Building Survey

Raisha Lovindeer gave a presentation on the feedback from the survey that IOCCG conducted on capacity development. The survey was developed and issued in mid 2025 and distributed online through the IOCCG mailing list, agency channels, and partner organisations, and our IOCCG email list of trainees. There were 81 respondents to the survey, split relatively evenly between male and female. The majority of the respondents were academic researchers. More than half of the respondents were early career (ECOPs, postdocs, students). Over 50% of respondents had never participated in any IOCCG training initiatives. Of those that said yes, ~60% had positive knock-on effects, including collaborations, internships, and job opportunities. Over 60% were aware of IOCCG resources on the website. Open feedback through the form included a call for more regional training in underserved countries and continents (Africa) and training in local languages. Other suggestions included training on protocols and uncertainty estimation, and understanding how to use OC for societal applications.

IOCCG had a Capacity Building Town Hall at IOCS-2025 to discuss the survey results and get more feedback. During this event, the need for more training on in situ data collection and protocols were again highlighted. There was praise for the FRM4SOC training and the need to continue this program, as it was targeted and useful, including with free calibration and rental of instruments. There was also a call for more alumni networks from the trainings that have been conducted, and train-the-train programs which could help to meet the regional demands for training. Raisha shared that discussions on scaling existing interactive training (in-person and virtual) to include more participants had cautions that these do not scale 1:1. After a certain point, more trainees per trainer did not equal more effective training per person. She highlighted the suggestion made of a training model that included distributing low-cost sensors to the trainees, and data collection and submission as

part of course completion. Shubha indicated that this latter suggestion requires follow-up for it to be successful.

Jeremy expressed that there are many types of participants to the trainings on offer

- Those that want to know how to use and manipulate satellite data
- Those that want to know how to collect and curate field data for validation
- Those that don't care about the data source but want to interact with the data through online modules and Jupyter notebooks
- Those that want to understand downstream applications only

He worried that the content can increase exponentially when we then try to add new languages. He suggested that train-the-trainer programs and online content is good, so people can translate the content to their own languages. He asked what role does IOCCG play in helping to coordinate these. David shared Jeremy's feeling and indicated that there is a huge demand for training of all sorts and maybe we start to see a big mismatch between the demand and what IOCCG can do. The expectation of what IOCCG can do may be a bit too high.

With regards to protocols, David indicated there had historically been this question of how do we ensure that protocols are followed in the field. This comes back to the training on fundamentals, as if people do not understand why the protocols are there because they do not understand the scientific meaning behind the measurements, then we may always have this issue. This is why fundamentals are important, and what motivated the logic of the IOCCG SLS. We had already recognized at the time that training in the fundamentals of radiative transfer, etc., was hard for students to get because they were disappearing from many of the University courses.

Menghua expressed that it was important, and a sign of success, that those who have received training enter into a career of aquatic remote sensing. When they are active in this area, it is fulfilling. If they are trained and then go to another career, this is not

as effective. So there should be an emphasis on community-building, and a younger generation that are active in fundamental science.

7.3. Update on IOCCG Platt Scholars for 2024 - 2026

Raisha Lovindeer gave an update on the IOCCG Platt Scholars. Hellen Kizenga (2024) completed her scholarship training in Canada (BIO) and presented her scholarship research at IOCS-2025. R Chandra Sekhar Naik (2025) completed his scholarship training in the USA (LDEO, NASA Goddard) and presented his research at the 2026 Ocean Sciences Meeting, and published his results in a manuscript in the *Journal of Remote Sensing*.

Four applications were received for the 2026 round. Raisha thanked the volunteer reviewers for this round. The 2026 Platt Scholarship was awarded to B Goutami (India) to conduct research at Plymouth Marine Lab (UK) with Gemma Kulk.

7.4. IOCCG-sponsored Training: Observing Marine Ecosystem Structure & Function

Shubha Sathyendranath gave an update on the IOCCG-co-sponsored training (along with Nansen Society, PML, etc.,) on Observing Marine Ecosystem Structure and Function: from microbial communities to fisheries and human health, being conducted by the Trevor Platt Science Foundation (TPSF). The theme for the training was decided based on needs in the region. The training is organized as a 4-part training course:

1. Online introductory lectures from July to September. This format follows the last iteration of TPSF's training course. For general topics, over 300 people had remained online and took part in discussions afterwards, so it was seen as successful. Anyone doing the in-person training must complete at least 80% of the online training. Lectures are recorded and placed on YouTube, so that participants can watch if they miss the real-time virtual.

2. In-person classroom style lectures and practicals at INCOIS, Hyderabad from 27-31 October 2026
3. In-person trainees will have a field trip and sample analysis in Kochi (led by Cochin U.) from 1-3 November 2026.
4. Trainees are required to attend and present their work at the TREVOR-SAFARI Symposium from 4-6 November 2026.

Shubha wondered if rather than a mini-project, there could be a mentorship program where trainees discuss with an assigned trainer their plans for their research and help to improve and prepare to present at the symposium.

About ~100 valid applications were received for the course. IOCCG is sponsoring travel for some students. Five (5) have been selected who are suitable for this travel funding, but further budgeting is still needed to determine the final number that will be supported.

Shubha shared the list of lecturers, for online and in-person. She indicated that a few more lecturers would be added for the online lecture component. Included in the criteria for selection of lecturers were those who had participated in previous training, as a bit of community service to come back and teach. The list of local lecturers included IOCCG SLS alumni and previous IOCCG Platt Scholars.

Shubha indicated that there has been discussion about issuing small but effective instrumentation, and requesting the students to submit observations as part of the completion of the course. This is especially important because in some countries there is no emphasis on sharing data freely, and this is something that we wish to support and promote with the collection and then sharing of data as part of the course.

Paula asked whether we were paying attention in the applications to students who had received previous training. Shubha indicated that the applications typically ask them to list other training courses they have attended. Professional trainees (those who have received a lot of training) are typically ranked lower than those who might need it more. Patrick Gray nodded agreement on requesting previous training on applications, and indicated (in the chat) that 3 SLS alumni attended the last Ocean Optics Class.

7.5. Update from The Ocean Optics Class, U. Maine

Patrick Gray (Co-Coordinator with Meg Estapa) gave an update on the Ocean Optics Class, conducted by University of Maine. The next iteration will be held at the UMaine marine lab in 2027. The class is 4 weeks long in the summer. The rhythm of daily activities is lectures in the morning, hands-on practicals in the afternoon, students working on their data in the evening (after dinner) and then presenting their work the next morning, which is a core part of the class and the aspect from which students gain the most. There is typically a 1-day research cruise in week 3. There are discussions about moving the time of the cruise for 2027. There is a major focus on community building throughout the program.

Typically 18 students are selected. There were ~80 valid applications in 2025. There is an aim of $\frac{1}{3}$ international to $\frac{2}{3}$ USA-based for attendance. For the last 5 classes, this distribution held true, and nationality-wise ~50% US. Participants are mostly graduate students with a handful of postdocs over the year, and 1 or 2 professionals. The class typically has 4 faculty and a teaching assistant (recruited for the first time in 2025) present all throughout the course. The course overview is a balance of optical radiative transfer theory, in-water measurements, data closure, and links between optics and underlying biogeochemistry:

- Week 1: IOPs with extensive hands-on labs
- Week 2: radiometry, Mie theory, radiative transfer, Cal/Val
- Week 3: atmospheric correction, cruise, inversion algorithms

- Week 4: project work, special topics (Monte Carlo, machine learning, sensor design, sensor calibration, etc.,)

The lecture team is discussing some intended changes in 2027, which may include less project time, with maybe more guided project time, and a focus more on optical closure and fundamental optics. Some students requested more guided analysis time as well.

7.6. Update from The Cornell Satellite Remote Sensing Course

Bruce Monger (Coordinator) gave an update on the Cornell Satellite Remote Sensing course that takes place each summer on the Cornell Campus. The course is 2 weeks long, Monday to Friday, 9am to 5pm. The course started in 1999, and has had 300+ participants over the years, with a split of 80% US to 20% international participation. Courses have also been run in Thailand, Argentina, Fiji, and Cyprus.

Content is a mixture of lectures and hand-on computer work. Lectures introduce participants to basic concepts and key jargon of bio-optics, algorithms, atmospheric correction, and satellite processing steps; provide a history of the satellite ocean colour missions (CZCS to PACE); and introduce the fundamentals of measuring SST, wind, and altimetry from space. Computer work builds foundational python programming skills to work with geolocated raster data; introduces how to find and retrieve satellite data for a wide range of OC sensors; provides extensive work with SeaDAS for batch-processing; and retrieving L3 data for SST, wind and altimetry. For the future, he aims to use AI-supported coding (e.g. VS-Code with GitHub/CoPilot support).

Funding for this course is tuition-based, with funding from OCB for select students since 2016. Bruce plans to retire in the coming years and spoke about possibilities to continue the course with ties to Cornell, and internationally. However he is not yet sure of the future of the course as is after his retirement.

Laura asked about support via tuition, are these mostly US-based? Bruce indicated that there have been 80% participants from the US, but also 20% international, and they all pay their way. But usually the advisors pay for the course, and so anyone that takes the course is very motivated and he finds this to be a positive. He wished that he could get more students from developing countries, but the small investment in travel and time to bring the course to them in the countries where it has already been taken goes a very long way to opening up billions of dollars of OC data to countries that could use it. Laura asked if he tracks where the participants go afterwards and how they use the training? Bruce indicated that he does not. All past participants are listed on the course website and there are recognizable names in the OC community now that took the course, but he does not really track.

Emmanuel asked about whether course credit is given for the course. Bruce indicated that this used to be the case when it started, with credits issued by Cornell through their continued education program. However, it has now transitioned into a professional training workshop (with no course credits) because of some of the restrictions that existed as a part of the continued education program. Bruce supports students who request with letters they can use to petition to their home institutions for credit, if they so require, but this credit is not issued through Cornell.

7.7. Possible collaborations with Copernicus LAC Chile

Jamie Ortega (Scientific Director) gave a presentation on Copernicus LAC Chile which is the regional centre of Copernicus for Latin America and the Caribbean. They began in 2023, funded by the EC and University of Chile in Santiago, to bring the capabilities and benefits of the Copernicus Program to the region, and strengthen scientific and technical cooperation around EO. All the information is completely free and open to the public. There are 3 main services: the data center, the in-situ data strategy (publicly shared), and high-value public services. They have computing infrastructure

with virtual machines for regional processing, free to use through regional agreements, and will provide time savings and compute power for data processing.

Value-added services include land cover and land use change, urban atlases, and coastal monitoring, with the idea to generate products tailored for the needs of the partner countries. The urban atlas at the moment is focussed on cities of interest. The coastal monitoring service currently has SST and CHL, from 2016 to present. SST is an essential ocean variable that is important for heat exchange and gaseous exchange between the atmosphere and the ocean, and is important for many countries in the region. SST is GHRSSST GDS 2.1 compliant. Surface CHL is the other important indicator that they wish to advance. It enables identification of relevant ocean biogeochemical processes and is used for water quality monitoring, algal bloom detection, and assessment of conditions affecting fisheries and aquaculture. They use the IOCCG Report Series and Protocols as the standard for data processing. Maps are published on their website (copernicuslac-chile.eu).

They aim to have higher spatial and temporal resolution, and additional products, including Rrs and CDOM. They are also working on floating matter, as Sargassum is of priority in the region. Following the philosophy of Copernicus, all data and products are and will be free and open.

Jaime indicated that training opportunities are very important for them. They are part of the University of Chile and have a series of seminars coming up, and other regional training planned. They are open to collaborations with IOCCG as part of their training goals. They are trying to make short courses for the use of satellites and different kinds of services.

Laura thanked Jamie for his presentation and indicated that some of the products that were mentioned already exist (a Sargassum forecast, for example), so we should be careful of duplication of effort given limited resources. She wondered what the

unique value proposition was for the group. Jamie indicated that they are working with existing scientists and products to work for the region. Ana asked whether there were any specific regional algorithms that would be developed rather than to use the generic products that might not work well for the region, or closer to the CMEMS model. Jamie indicated that this is exactly the main idea, to develop new algorithms based in that region to capture the regional variation. Vittorio indicated that he was leader of the ocean colour data center within CMEMS and was very willing to help and share the expertise of creating regional algorithms and products, and about the consortium.

7.8. Are we losing the ability to teach basic optics? Combined with agenda item 5.2 Use and potential impact of artificial intelligence (AI) and machine-learning (ML) on OCR

Paula set the stage for the discussions by sharing a few slides. She indicated that professional guilds in general have been declining. Do early career scientists see the value of joining these professional guilds? How do we modernize these? How many optical oceanographers do we have? There are maybe about 1000 optical oceanographers (by Paula's estimation) and high demand for training in in-situ bio-optics, satellite remote sensing, handling and use of in-situ and satellite data - how do we reach all those who require this training? The IOCCG SLS had 105 applications with 30 accepted. How do we keep track of how well these groups are doing? She mentioned that advisors are also retiring with little retention in the field for replacements. She agreed that train-the-trainer programs might be helpful here. She shared the public needs and scientific grand challenges that were shared with her when preparing the opening keynote for IOCS-2025, and asked how do we make this happen? AI/ML were raised in this discussion because there were a high number of posters using large language models at the IOCS, and Paula raised how we can make use of these models without losing the knowledge that *should* go into them. Do the users even understand what they are doing? How can we ensure this, and how can we maintain public trust with the use of these models. She worried that students

may not pursue the extent and rigor of optical oceanography that they should because they might feel it unnecessary to do so. She shared that more than half of researchers now use AI for peer review [Naddaf \(2025\)](#) which is against editorial guidance. Editors use AI to help assign reviewers - this latter one might diversify the reviewer pool beyond what the editors know, which would be good, while not assigning the work of the reviewing to a computer. So there is room for AI in the process that can be helpful, but where do we draw the line? She closed the prompt with a figure from [Naddaf \(2026\)](#) showing that the scientific literature has an increasing number of papers over time with higher percentages being written by AI, which was very sobering. What do we do with the fact that more papers will be available that are generated with this tool.

Vittorio suggested that we could have a brown bag discussion at the Ocean Optics meeting about the use of AI/ML and what is appropriate. Algorithm analysis with neural networks has been used since the 1990's, so this has been a part of our tools for decades. However the support for coding and writing probably deserves a discussion within the ocean optics guild. Could we ask the OO Committee if they can fit this type of conversation at OOXVII. He also thought of having musings and discussions at the upcoming IOCCG SLS on how the lecturers use and see AI in their work, and have a dedicated discussion on it at the SLS in 2028.

On “professional trainees” Vittorio indicated that we did not have an explicit question on previous training for the IOCCG SLS, but where extensive training was already listed on CVs, we might have given the opportunity to others. Shubha indicated that the problem is large, and we should not make it too easy for participants to get directly to the answers. She gave an example of herself as an earlier scientist having to develop/code models to be able to get data, but fully understanding the model in the process. When this developmental component is missing, it may lead to less understanding of the methods. Shubha indicated that the next generation of scientists risk losing those who have this internal knowledge.

Paula expressed that she was happy to have heard the way that the Maine course is run via Patrick (coding in the evening, presentation in the morning) because she remembers this model having a strong impact on her. She thought that there were scientists within the next generation that could help to fill the void. She however agreed that the grinding and pioneering work of understanding basic concepts is not being carried forward. David agreed and indicated that he is convinced that part of this began before AI came in, when students were using libraries of functions without knowing what the functions do. So it is even more significant with AI but was already present. There is something related to how we teach that doesn't seem to spur the same curiosity and rigor. It encourages the easiest path. David said the very first thing you should do when you make a plot is ask "what did I do wrong?", to dig into the results and find out if it makes sense, and this kind of thinking is hard to develop.

Emmanuel is not in the academic world anymore, but many of those in optics started as physicists. He thinks maybe we're teaching the tools more than the science behind it. He wondered how many of the SLS alumni had a background in math or physics. He raised that remote sensing of the ocean is being taught in many universities in geography departments rather than to those with physics backgrounds.

Bob indicated that there is a broader issue that goes beyond the field of remote sensing. Early-career researchers are under pressure to publish and progress on short, fixed-term contracts, and so the motivation is to increase the number of publications rather than the deep work that happens when you have the time to work on it. Fred agreed with this, and is also a bit worried. The generation before was not trained with AI, but the current generation is being trained to include AI. Considering how fast AI is moving, it is hard to know how far the field will go. He raised the comments on trust, and whether writing and reviewing is being done by humans or computers. Whereas now we see telltale signs of computer-generated work, in the future it might be extremely difficult to tell.

Robert indicated that it seems we are talking about AI in negative ways, but it can be very helpful in many ways. The challenge is that we have to make sure that it does not replace physical understanding, but enhances it. Paula agrees that AI does have real potential and she suggested that someone be invited to discuss this further with the group, someone who studies it, and uses it well.

Robert asked why there is not enough training in ocean optics to meet the high demand. Is it a discipline that is at an intersection of larger disciplines, do we not have enough trainers/experts, or is too specialized? Paula theorized that research on ocean acoustics and optics was pushed initially for defense reasons, at least in the US, and now that this is not the case, the funding for these fields have reduced. Trying to continue early-career and student funding becomes difficult in these areas. The value of these observations need to be communicated more. She hopes that we're tracking the graduates of the training programs that we do have. Paula also mentioned that the number of AI-focussed degrees and certificates are increasing in universities while other programs are closing when they have low enrollment, and she is thus worried about this balance.

Menghua indicated that we definitely need to adapt to use AI. He suggested that if there are continued OC satellite missions, the agencies will create job opportunities and draw more people into the field. He reiterated that training needed to start with the physics (he, for example, did the radiative transfer code from scratch).

Shubha gave stories of giving good scientists space to be able to do their science, in agreement with Bob's point. She said that if we go back to the SLS, David started the course to emphasize the fundamentals, basics, and hard grind of learning optics. Is that course on track to fulfill that need, or are we responding to the pressures of the times and forgetting that initial goal to produce people who knew the physics that underlie OC? David thought the SLS had indeed lost a bit of the initial objective over

the years to the pressure. He asked, if we try to go back to this, will we lose the interest of the students? His message to the agencies is that when you support something like this, for the greater good, maybe do not expect a direct return on your activities. For example, the practicals on satellite remote sensing are a result of this kind of support and immediate return. Is it the best use of the resources and the people we have, or do we concentrate on more fundamental ideas - this is a question for the long term. On the flip side, the SLS is just two weeks. The Maine course, for example, is 4 weeks, and is very focussed on one thing. So maybe the SLS tries to cover a bit too much. Vittorio indicated that he was involved in the course on the use of satellite data (MSOC) as well as a very focussed course only on above-water radiometry. In these, there is a demand from students to learn how to use satellite data, and many are only users of data, and don't know how to develop a product. But maybe these are not the students we are targeting. Maybe we diversify and leave the use of satellite data to the agencies (PACE Hackweek, EUMETSAT Trainings, e.g.) or other courses through IOCCG (e.g. MSOC), and leave the SLS on fundamentals and basics, and gain more time within the two weeks that we have. We can review after this edition and see how we can shape the next one so that we can devote it to what we think is the gap. Vittorio appreciates the feedback. Jeremy indicated that the solution to this problem might be a bit untenable. The content that we have to teach grows, but the amount of time we have to teach it does not increase. We need more training events, and they need to be targeted on specific topics, but there are limitations on resources and funding. Shubha indicated that we are perhaps trying to be all things to all people at the same time. Are we missing out on the requirement to have a focused training course on the fundamentals of ocean optics and the basics of ocean colour, and if we did that, will people buy in? Fred said if the idea is to teach fundamentals of ocean optics and physics, there is so much you can teach during two weeks, but we should convey as much as possible to the students that if they happen to master these fundamentals, then in the world of tomorrow, they will be quite special. This could be an incentive for them to continue the work as they would be different and be leaders in the field. Fred said that space agencies have an important

role to play to favour this, because in the near future, the design for new missions requires exactly these kinds of minds and trained scientists and engineers.

Emmanuel indicated that the classes of people who want training (in-situ, satellite, end-user) are the training we have are complementary. He suggested that we could rotate training to target the different groups. He also indicated that it is better to have and quality > quantity, so if we only have 10 students who qualify for an in-depth class, then there is enough time and space to train these properly rather than trying to fill numbers. This could also free IOCCG to sponsor students to other trainings (e.g. the Ocean Optics Class) rather than put all the weight on the SLS.

Claudia indicated that we need to adapt to the increasing satellite missions. Maybe when the SLS was developed there was less opportunity for the application of satellite data. But now the field has grown so much, so in the same weeks, we have to teach more. She suggested that the series should be shaped with respect to this. She agreed that the current model (one week of fundamentals, one week on applications) is a bit short and a rotation or use of complementary training courses could be a good role for IOCCG. She indicated that she also did a summer school by ESA that was purely applications-based and gave her what she needed at the time on the application of aquatic ecosystems.

Robert suggested that maybe we need to listen to the survey. People indicated that they wanted regional and application-based training geared to their local needs. So on one hand it is good to teach fundamentals, but you also need to look at what people want. Shubha agreed that IOCCG should serve the needs of the community, but she reiterated that we should also serve the need to train a new generation of scientists to advance OC research. Shubha suggested we could do one-off training (2 weeks or more) with a carefully selected cohort of students, once in so many years, who are committed to learning the fundamentals.

Paula raised that we should not be stuck in thinking that we should train for the degree or path that we had, rather than the one that the students want. Though students may not always know what they want, she hopes IOCCG could take a look at all the training courses and understand if we are training students for the careers that they want. If we are not, what would that look like? Emmanuel indicated that we have to be OK with 50% engagement as long as there are those who are engaged and walk away having and eventually using the information.

David said the issue of the capacity of the community to develop these trainings have also been brought up, so we need to be careful because we have limited resources (time, energy, funds). He suggested that we need to use the right people for the right things. As much as he is critical of AI, if AI could help us to build online tools and resources that could help in delivering material, then this could be helpful as well.

Menghua indicated that two weeks is a bit short, and it is only when students solve problems that they realize whether they understand. Solving problems should be part of the training.

Shubha asked Bruce his opinion from the University side if there is opportunity for semester-long courses. Bruce said he teaches a course like this, and while AI tools incentivize intellectual laziness, there are students who still have intellectual curiosity, and nurturing this gift is good. So finding those rare students who have this ability is something we should do. Paula agreed, and asked about ensuring that we keep them in the field.

Shubha wanted to conclude with some concrete actions/suggestions.

1. Patrick suggested for the optics class (and maybe for SLS too) we could work to have a couple physics/math students each year and I think this could be a nudge to the culture and be very beneficial for the broader group.

2. Shubha suggested that we declare ocean colour living treasures (a handful of people) and get them to record lessons so that we try to safe-guard that knowledge and make it available to a broader audience.
 - a. Robert indicated that if we want to deeply understand the concepts of any discipline it takes a long time. There is value in having fundamental courses online but it is not the same. He wondered if this was really what the focus should be regarding training.
3. Paula suggested we have a look across classes to ensure we are maximizing student enrollment and engagement, by tracking the graduates and their employment. She also suggested cross-checking class focus with the survey outcomes, and consider, separately, how to make classes more inclusive

Action 30/8: IOCCG Committee to review the suggestions from the discussions on whether we are losing the ability to teach basic optics and decide on a way forward.

7.9. Discussion of training-related recommendations from IOCS-2025

Raisha Lovindeer went through the recommendations from the IOCS-2025 meeting that were geared at IOCCG specifically for training. These included training on protocols and measurement uncertainties (with hand-on experience), promoting the inclusion of aquatic carbon from space in new and existing training activities, and supporting training on the collection of good FRM-quality data. Claudia asked, for the latter, if they intended this to be targeted at in-situ Chl-a, TSM, etc, or radiometry data. Raisha indicated that she will request this information from the chairs of the IOCS-2025 Water Quality session.

Raisha also shared additional suggestions made throughout the IOCS on training, including from the panel on ocean carbon to have training exercises with carbon reporting stakeholders; from the community town hall to reach communities in SE Asia for training on in-situ data collection via IOCCG protocols; provide regional-specific training tailored to local environmental issues, etc.

Laura indicated that not all of these recommendations/suggestions could be enacted by IOCCG, so maybe we can start by saying what IOCCG can do. She suggested that IOCCG could look across the many training opportunities that exist and build a roadmap tool using the catalogue of training programs, differentiating what each training offers. This seems to be low effort but high impact. Raisha shared the existing list of trainings that are on the IOCCG website, acknowledging that the list currently does not give the descriptive roadmap that Laura has suggested, but could be used as a start to creating this roadmap. Laura agreed that yes, many people might not know where to start.

Laura also suggested that there is some standardisation that we could also do, to highlight those foundational training that we can then apply regionally. For example, find content and commonalities across courses and create standardized slides for use in regional training. Aurea indicated that it was a personal interest of hers to have all the content of the courses and see commonalities. She offered to help to review course content, and could start this. Laura said this could help, and having this content of what are the basics that should be known is helpful for others who want to start, or solicit expertise for, their own courses in their regions. Aurea also suggested we could have 2 categories: learning and training.

Vittorio indicated that capturing which courses were given in the past does not help in guiding what will be happening in the future. So a roadmap to training may have challenges as some courses occur regularly but others occur adhoc, and so it might be hard to integrate all the training. He indicated that students also tend to apply to all the courses that are available to them in a year, based on their funding, etc. Laura indicated that this was the point, as maybe highlighting the differences between the courses might help people understand which course is right for them.

Emmanuel asked whether students go on the website or watch the past videos. He suggested that doing short-form videos geared to the current generation, e.g. TikTok videos, for example, to learn about the radiative transfer equation, might promote more learning than the current long-form lectures on the website. He also suggested that in the newsletter, we could highlight a link to a training, especially a brief one each time, that might grab the younger audience. Laura asked about IOCCG social media. Raisha indicated that IOCCG tries to have social media that doesn't force the user to sign-in to be able to see the content, so there is an account on BlueSky.

Jae-Hyun agreed that although there are good resources on the IOCCG website (e.g. Ocean Optics web-book and IOCCG SLS material), they are too advanced for beginners. He thinks to attract new researchers to the field it is necessary to provide more introductory and beginner level courses.

Shubha asked, what does IOCCG want to recommend in the future. Laura recapped that Aurea suggested doing an inventory; then there is the roadmap to define the various training activities, and for whom they might be best suited. Shubha asked whether we wanted to create a standard for IOCCG to endorse training. Vittorio indicated that maybe not a standard per se, there are many different types of training and topics that we might ideally like to be covered. Some could be endorsed by IOCCG - the issue on the basics, and maybe we could leave the agencies to focus on growing their user base. Shubha said that if we are doing a roadmap, then it should also include a gap analysis. One gap that emerged during the discussion is a course on the physics of OC.

Jeremy raised that we have been discussing from the perspective of teaching students. If we are now looking at it from a socioeconomic benefit, there is little opportunity for professionals and for teaching them why OC data might be useful in their work - so bridging the gap with other communities to get them to understand

the benefit of using OC data might be useful. It would benefit the community for this to not be ignored.

Action 30/9: Aurea to start an inventory on the course content that could be used to help standardize across regional training.

Action 30/10: IOCCG Project Office to create a roadmap tool to helping students understand which existing training are suitable for them to pursue based on their level and needs

7.10. IOCCG-EUM MSOC Course: recap and future considerations

Ben Loveday (Co-Coordinator) gave a report on the 2025 Multi-sensor Ocean Colour (MSOC) course which was a week-long course held at EUMETSAT HQ after IOCS-2025, taking advantage of the meeting's presence in Darmstadt. The rationale for the course was that there was a gap for advanced hands-on courses that focused mostly on OC remote sensing. So it was not an introductory course, of which there are many, and it did not focus on in-water radiometry which is covered by other courses such as SLS, the Maine Course and FICE. As more OC missions are now available, the training was focussed on the current suite of instruments, highlighting their differing, overlapping, and complimentary capabilities. It had a synergistic perspective across sensors for how to bring multiple data sources together. The philosophy behind the course was to focus on why we generate OC products, as well as the challenges and limitations in developing products for the community, and for participants to understand how they can push the science forward. All sessions (90 mins) were designed interactively, with hand-on data manipulation (60 mins) that take advantage of content delivered in short presentations (30 mins) at the start. Participants also worked in groups, with group tasks designed to contribute to the outcome of the course (mini-projects). The material for the course was meant to be accessible beyond the course for review by participants and others. Pre-event online technical checks were mandatory for all participants so that the course could get going on day 1.

The participants were limited to 30 (out of 100 applications). There was a global audience but a strong European focus (based on travel support that was available via IOCCG, Copernicus, and NASA). There was representation from academia, private sector interest, and national centers. 6 teams of 5 people were formed for each mini-projects, with each focused on a case study area. The course was structured to be quite dense (data processing, atmospheric correction, data match-up and validation, sensor synergy and harmonisation, etc.), possibly too dense, so the atmosphere was kept light and the content engaging. There was also a lot of social engagement throughout the week of the course, including fun projects that were part of the learning. The course spanned 3 sensors predominantly: S3-OLCI, PACE OCI, S2-MSI.

For the mini projects, each group was given an area and a phenomenon that they had to try and observe using the tools and understand what was happening. These were integrated into the course and were a major part of the learning. There was also a board that allowed people to capture their thoughts (including anonymously) that could be addressed at the end of each day. Time was provided to develop presentations of the projects and the participants formed a collaborative social group throughout the week (roof-top yoga was self organized, for example).

Ben gave an overview of the results of the feedback survey, which had strong scores across the board for course content and set-up. Negative feedback was around the denseness of the course (it could have been longer, because the pacing and the depth of information covered added a bit of stress). All the material was developed under an open source licence and can be shared with others who would want to implement or run the course as well. Distribution of the course material (recordings with transcriptions) will happen soon.

Future self-paced learning will be developed. Ben asked for people to reach out if anyone wanted to use this course material in their training, or any parts of the course. It is freely distributable and reusable by all. He also indicated that they would be happy to run the course in collaboration with any interested party, and could extend the course to include additional sensors.

Paula thanked Ben for the work, and asked whether he thought the course could be delivered to more than 30 people. Ben thought that to go higher than 30 people the course would need more time and more check-in sessions to run it in an online context. If adding more people in-person it could be done, but there were 8 active trainers for a group of 30, so we would need to scale linearly to accommodate more people, as the course required a lot of hand-on support and in-room interactivity. Paula said each course that we discussed in the meeting so far had >100 applications and maximum 30 participants, with 8-10 people doing the training. She wondered where the sweet spot was. Ben indicated that the reason they are doing more self-paced learning is that the norm is ~200 applications to 30 places, and so we're not reaching the demand capacity, so there needs to be more learning modes (self-paced, online, hybrid) that supports this large group of people with less parallel resources.

Regarding people moving at different rates within the course, Shubha asked if it is possible to have a cohort and still have them move at their own pace. Ben speculated that one of the best ways is to have group work components. Participants who are very strong and grasp things quickly are better able to help their peers advance and support when trainers are not available.

7.11. Update on regional ocean colour/optics trainings

7.11.1. COCOBRAZ Training Course in Brazil

Hubert Loisel (Co-Coordinator with Vincent Vantrepotte) gave an update on the COCOBRAZ Training in Brazil. This training is organized by LOG and INPE and has occurred twice, in 2023 and in 2025 in two different parts of Brazil, to cover both the south and northern parts of the country. This course is 10-days long, fully funded (travel, meals, and housing), and is taught in English. There are 5 lecturers in total, with 1 Brazilian. The course covers ~22 participants (from 50 applications), mostly PhD students with a few Masters and Postdoc. Backgrounds range from physics to biology and experience also ranges from end-users to more experienced optical oceanographers.

The motivation of the course came because the use of OC remote sensing in Brazil was underexploited. The course covers the basics in OC remote sensing, with half practical (field bio-optical/radiometry measurements/validation, IOPs/AOP simplified RT model, data download and manipulation, OCR timeseries) and half theoretical (marine optics/light-water interactions/IOP definitions/links of IOP-AOP, OC principles of AC, bio-optical algorithms, select applications). Research projects, in groups of 2, were also conducted throughout the week - the objective is to determine which data can be used, in what timeline, and the budget to meet the research goal.

Feedback is globally very positive. They plan to propose *a la carte* dedicated session for the next round. The main outcome observed is a strengthened national and international collaboration (exchanges between France and Brazil) and the groups are active and still communicate with the organizers. The need still exists, and so new sessions will be developed in the future, but they require new funding as former sessions were funded via projects.

7.11.2. Ocean Color Summer School in China (slides provided by Zhongping Lee)

Xianqiang He presented on behalf of Zhongping Lee (Xiamen U.) on the OC Summer School in China, built off the IOCCG Summer Lecture Series. There have been four iterations of this course since 2017. Each has a selection of 30 students from >100 applications. It is organized by a consortium of Chinese academic and scientific institutions, led by Xiamen University. The training is 2-weeks long, with no tuition fee, and meals provided. There have been >20 lecturers of the course, including IOCCG members. The content of the course includes fundamentals, applications, AI, and project and proposal writing. The lectures are complemented by field measurements of AOPs, and students debates on specific topics in OC remote sensing. A one-day break is included for recreation and site-seeing. Certificates are issued at the end of the course. Some challenges include securing funding for the course as well as the selection of students.

Shubha praised the effort, and indicated that this exactly meets the need for regional training that we discussed in earlier sessions. It was good to see a course offered in Chinese.

8. Administration and Closing Session

8.1. Committee Member Rotations

As an affiliated program of SCOR, scientific members serve fixed (3-year) terms on the IOCCG Committee. The following scientific members rotated off the IOCCG Committee in 2026: Wonkook Kim, Chuanmin Hu, Aurea Ciotti, Jeremy Werdell (retained as OCR-VC Chair). Nominations for replacement members were discussed and made by the IOCCG Committee and added to the existing list of nominations (where applicable) for final selection in the Executive Committee Meeting and invitation by the IOCCG Project Office.

8.2. Plans for IOCCG-32 in Hangzhou, hosted by SIO

Xianqiang He indicated that SIO-MNR will graciously host the next in-person IOCCG Committee meeting in Hangzhou, China. Hangzhou is known as *paradise on Earth* in China, and is a modern metropolis. It is close to Xiaoshan International Airport, with flights to major international cities, and 0.5 hours from downtown. It is also 45 mins by high-speed train from Shanghai in the event that no flights are available to Xiaoshan. China is also visa-free for >50 countries.

The proposed date is the spring of 2028 (late March to early May). The west lake is the area where the meeting will be held, with many good hotels in the area for reasonable prices. SIO will make every effort to provide support for the meeting, including hotel rental, catering, and all meeting materials. China also has a broad OC domestic community (~300) and this is a good opportunity for Chinese OC scientists to communicate with IOCCG Committee members. Xianqiang welcomes everyone to Hangzhou, and to visit the institute in 2028.

8.3. Proposals for hosting IOCCG-34

The floor was open to proposals for hosting the IOCCG-34 meeting in 2030. As it was quite far away, only very preliminary proposals were issued, with possible venues in the USA or Italy.

8.4. AOB

8.4.1. Gap in Hyperspectral Data

Jeremy indicated that there might be a realistic gap in hyperspectral data between PACE-OCI (2 years old already) and S3-AOLCI (planned for mid 2030). Jeremy mentioned that the OCR-VC will be bringing this up in CEOS to try and address the gap and get them more invested. There are opportunities to fill this gap. Shubha indicated that it was an important point. There was a gap in the pre-Sentinel to Sentinel series,

and that 2 year gap was a big problem for creating time-series, so to start the hyperspectral era with a gap is something to be avoided. Jeremy agreed.

8.4.2. Public engagement

Cara had asked Shubha to make a talk to the NOCCG (NOAA Ocean Colour Coordinating Group) about IOCCG, which she did, and afterwards we discussed that the science experts are represented in IOCCG, but the home institutions do not really know about IOCCG, what it is and what is the value. Shubha said that Cara suggested that we should encourage members to talk to their home institutions. There is a common deck of slides that you may use to make talks to IOCCG, and Shubha encouraged all to use these slides and let others know more about IOCCG in their institutions.

Paula wondered if we could do something provocative, like do a townhall at the next LPS on pressing scientific challenges in ocean sciences, to talk about issues or challenges that we think are important. She advocated for better public engagement. Shubha raised examples like the agency town halls that took place at the last Ocean Sciences meeting, and agreed that we could look into taking advantage of more of these opportunities.

8.4.3. New Working Group Proposals

Robert suggested that maybe we should push for 2 working groups, as listed below, and that IOCCG should be active to contact people who might be working on these topics rather than wait until they contact us, to animate these working groups:

- Benefit of polarization for OC remote sensing
 - this is timeline as we have polarizers in space
 - Menghua suggested that we need to start with in-situ data on polarization, as he has not seen in-situ data in polarized light.
 - Shubha asked if any agencies are commissioning work in polarization. NASA indicated yes, and this working group could be timely.
- ML/AI for OC remote sensing and ocean biology

- Fred agreed about the AI aspects to ensure that our community is present on that topic, but AI moves so fast that we would need to understand what would be in such a report without making it obsolete as soon as it is published.

Xianqiang suggested a working group on

- higher geometry positions (high solar zenith angle, for example) / adverse viewing conditions.
 - Claudia agreed that higher latitudes are where most of the lakes are, and there are many challenges in observation capabilities. She would love that this be included if this work begins.
- For polar orbiting high latitudes, we have no OC data in the winter season. This is a community weak point and it is a community effort to resolve it.

Shubha indicated that we need to discuss whether there is innovation in these fields and enough people working on the problem to form a working group and produce a report. The suggestions will be taken.

Action 30/11: IOCCG Project Office to explore proposed topics for working groups: Polarization, AI/ML, and adverse geometry solar/viewing angles for ocean colour observation.

Appendix I: List of Participants

Committee Members (*online)

- Ana Dogliotti
- Aurea M Ciotti
- Aurelien Carbonniere* (CNES)
- Bob Brewin* (U. Exeter)
- Carolina Tauro* (CONAE)
- Chuanmin Hu* (USF)
- Claudia Giardino (CNR-IREA)
- Emmanuel Devred (BIO)
- Ewa Kwiatkowska* (EUMETSAT)
- Frederic MELIN (EC-JRC)
- Jeremy Werdell (NASA)
- Jongkuk Choi (KIOST)
- Laura Lorenzoni (NASA)
- Marie-Helene Rio* (ESA)
- Menghua Wang (NOAA)
- Hiroshi Murakami (JAXA)
- Paula Bontempi (U. Rhode Island)
- Shubha Sathyendranath (Chair, PML)
- Tim Malthus* (CSIRO)
- Vittorio Brando (CNR-ISMAR)
- Xianqiang He (SIO)

- Raisha Lovindeer, IOCCG Project Office

Invited Participants (*in-person)

- Ben Loveday (EUMETSAT)
- Bruce Monger (Cornell U.)
- Carol Johnson (NIST)
- Cédric Jamet (LOG)
- David Antoine, Past Chair (Curtin U.)
- Gerhard Meister (NASA)
- Heidi Dierssen (U. Connecticut)
- Hervé Claustre (LOV)
- Hubert Loisel (U. Littoral)
- Jae-Hyun Ahn* (KIOST)
- Jaime Ortega (CopernicusLAC-Chile)
- Kazuhisa Tanada (JAXA)
- Liz Atwood (PML)
- Lou Andrès (LOV, ACRI-ST)
- Lucas Amézquita (CopernicusLAC Chile)
- Meg Estapa (U. Maine)
- Merrie Beth Neely (GEO AquaWatch/BluePlanet)
- Osamu Ochiai* (JAXA)
- Patrick Gray (U. Maine)
- Robert Frouin* (Scripps, UCSD)
- Stewart Bernard, Past Chair
- Tim Moore (FAU)

Apologies

- Cara Wilson, Past-Chair (NOAA Fisheries)
- Steve Groom (NCEO)

Appendix II: List of Action items

	Action	Status
30/1	IOCCG Committee to provide a letter in support of the GCOM-C mission and continue to discuss with JAXA how to advocate for the mission.	Completed
30/2	Paula and Shuha to lead the drafting of a position page on IOCCG's science priorities and document the reason for the long-term role of government in EO versus commercial satellite data. IOCCG members interested in helping to draft should submit their names to Raisha.	Names: Paula, Shubha, Fred, Stewart, Robert
30/3	IOCCG Project Office to gain clarity from the chairs of the IOCS Breakout Session on Adjacency Effects on their recommended intercomparison exercise and request them to provide a list of what the agencies could provide to assist the community with this activity.	
30/4	Shubha to request a discussion session at the next TPSF Symposium regarding recommendations under 2025.05 on coordinate systems for in situ data collection, curation, and sharing, and take outcomes to IOCCG.	This has been requested
30/5	IOCCG Committee to revisit the topic of the cadence of the IOCS Meeting.	
30/6	IOCCG Committee members to give their final feedback to Marie, Laura, and Hiroshi on the Aquatic Carbon Roadmap by June 30.	

30/7	IOCCG to think about thematic topics that could be good to discuss across other disciplines, and agencies to consider funding for the Oceans from Space (2030) meeting.	
30/8	IOCCG Committee to review the suggestions from the discussions on whether we are losing the ability to teach basic optics and decide on a way forward.	
30/9	Aurea to start an inventory on the course content that could be used to help standardize across regional training.	
30/10	IOCCG Project Office to create a roadmap tool to helping students understand which existing training are suitable for them to pursue based on their level and needs	
30/11	IOCCG Project Office to explore proposed topics for new working groups: Polarization, AI/ML, and adverse geometry solar/viewing angles for ocean colour observation.	Discussed at Exec-42 meeting and action items generated.