29th IOCCG Committee Meeting
Online: 14 - 17 April 2025 | 1 - 3 pm UTC daily

DRAFT MINUTES

1. Welcome and Opening Session

1.1. Opening of meeting & adoption of the agenda

Shubha welcomed the entire group and staggered. Shubha requested feedback for the way we are doing the meetings. To reduce carbon footprint, we are alternating the mee. Paula moved to approve the agenda.

1.2. Approval of the Minutes of the IOCCG-28 meeting & status of action items

The minutes and 28th Committee Meeting were approved and the status of the IOCCG-28 action items were reviewed.

- *28/1 Carolina Tauro and Robert Frouin to create and send a specific list of items where help is required for SABIA-Mar to the IOCCG Project Office for distribution to the Sensor Calibration TF and IOCCG Committee members for assistance.* [Completed | Needs Follow-up]. Carolina indicated that they have solved most of the items, but need help with the BRDF solar diffusers characterization. After some discussion, Robert indicated that NASA has already been contacted about this, but are awaiting approval from the headquarters to move forward. Kelsey Bisson indicated that she would check with Laura and Jeremy.

Action 29/1: Laura Lorenzoni (via Kelsey Bisson) to follow up about the status of NASA assistance to CONAE re: BRDF solar diffusers characterization.

- *28/2 Ana Dogliotti & Aurea Ciotti to create a census of the instruments already available in South America.* Survey issued on 28 Feb 2025. 19 replies from 10 countries so far! Preparing a Report with all the ideas, survey questions, results, and the follow-up actions, and specifically where we think IOCCG and space agencies could contribute.
- *28/3 IOCCG Project Office to create a new page of sensors leveraged for ocean colour with support from space agencies who should send the information on sensors that should be included*. Completed but still needs to be better populated https://ioccg.org/resources/missions-instruments/current-ocean-colour-sensors/
- *28/4 Raisha Lovindeer & Shubha Sathyendranath to go through the list of expectations made by the space agencies and implement follow-up actions*. The list was reviewed, and inputs from the Committee given, below. This item remains open as action is continuous.
    - Under the *need to identify and document our users and their applications, and the development of the next generation of services* - Paula indicated that (during Stewart Bernard's tenure as Chair) IOCCG conducted a user survey. She suggested that it might be a good opportunity to put out another survey, possibly leveraging the IOCS registration process.
    - Under *better execution on our ideas and plans* - it was noted that better execution may call for more resources.
    - Under *Promotion and lobbying for ocean colour as essential. Many operational agencies focus on parameters that go into numerical weather predictions (SST, waves, winds) but ocean colour is omitted*. Paula indicated that the promotion and lobbying for OC as essential has made a lot of progress in getting us into the IPCC etc. It is progress, but we probably have to start working with the weather community, and maybe new IOCCG memberships could consider adding someone from

that community to grow the attachment. Kelsey agreed. Shubha agreed that we have made links with CEOS, IPCC etc, but it's good to get specific suggestions that we can continue to do.

- *Get involved with ocean colour happening outside of the institutional space agencies (private sector) to aid in its direction* - Chuanmin indicated that NASA has put a lot of effort into promoting commercial sensors in OC, which are powerful for coastal and inland waters. He thinks IOCCG should be able to promote collaborations and new directions in the future, and highlight what we can do with commercial sensors, but in what format should this be done. Kelsey shared the following resources as examples of partnering with commercial sensors.
  - NASA Extends Contract with Planet Labs for SmallSat Data
  - Commercial Satellite Data Acquisition (https://www.earthdata.nasa.gov/about/csda)

  Emmanuel Devred indicated that it might be a good idea to have an IOCCG report on the benefit of commercial satellite collaborations. Paula suggested the utility of a comparison between commercial satellites and a climate-quality ocean colour sensor, and that maybe this is something IOCCG could do. Other suggestions were passed around about how to promote without endorsement. Shubha suggested pieces in the news bulletin. Raisha added that the pieces could focus on the science that has already been achieved with commercial sensors, to avoid endorsements. Emmanuel agreed that we could cite desirable characteristics, e.g. the revisit times, resolution, etc and highlight the science that is achievable. Shubha was happy to see all these suggestions on how to include commercial satellite data, and that we should give it more thought.

- *28/5 Jeremy Werdell to begin to collate the inventory of validation activities in a document with the help of the IOCCG Project Office*. Draft inventory - Juan

Gossn (with Jeremy and Lachlan McKinna) working on this to develop the tables, and enhance data sources at ioccg.org/resources/data/

- *28/8 Cara Wilson to put together the first draft list of items (based on IOCS recommendations) that could be collated for the US Decadal Survey white papers, and work backwards from the timeline of the white paper submissions to set some deadlines by June 2024*. Completed | Needs Follow-up. Draft list sent to Project Office on 10 May 2024. Included in call for leaders of white papers in May, but no responses received. Call should probably be repeated
- *28/9 IOCCG Project Office to publish links to open access code for algorithm development in the software tab on the IOCCG website*. In Progress https://ioccg.org/resources/software/ updated May 2024. April 2025, Juan Gossn working to ensure all open access software is listed.
- *28/15 IOCCG to invite a leader from CEOS Coast / GEO AquaWatch to be on the IOCCG Committee* - Maybe already fulfilled as Aurelien Carbonniere is co-lead for CEOS Coast and an Exec Member of IOCCG.
- *28/18 IOCCG Project Office to investigate the resources to implement a forum or mechanism for information sharing on protocol documents on the IOCCG website*. Completed | Needs Follow Up - discussion forum for each protocol created on new IOCCG Github (https://github.com/ioccg). Still to be used.
- *28/21 Fréd Mélin and Aurelien Carbonniere to coordinate and make a census on potential contributions to the UN Ocean Conference* [OPEN]. Fred indicated that this action has been superseded by many initiatives for this very political and high level event. The European Commission has a booth, so the ocean will be present, and there will be a number of EU projects that cover our mandate. Aurellien will present (Under Item 3: CEOS Activities & Integration), the current statement and the launch of the *Space4Oceans* that will occur at the UN Ocean Conference.

2. IOCS-2025

2.1. Review of proposals for breakout workshops

Ten proposals for IOCS breakout workshops were submitted. Two proposals were selected for a possible merger, pending communication with the breakout sessions proposal chairs. The following nine breakout workshops were therefore approved for the IOCS-2025 meeting:

- Ocean Carbon from Space
- Priority list of marine biodiversity metrics to observe from space: synthesis and planning for next steps
- Challenges on Optical Remote Sensing for Marine Litter and Floating Matter
- Merged, long-term ocean-colour products for climate analyses
- Blueprint for large-scale, operational, Earth Observation-based systems for Harmful Algal Blooms monitoring
- Water Quality Demonstration
- Inland and coastal water remote sensing: current status and future directions in the correction of adjacency effects
- Ocean Colour Satellite Sensor Calibration
- A merged session: SI-Traceable In-Situ Aquatic Radiometry, including in-water radiometry on autonomous profiling floats in support of satellite ocean color validation activities

2.2. Selection of topics and speakers for plenary sessions

The Committee discussed and suggested topics and keynote speakers for the upcoming IOCS meeting, surrounding the topics of carbon and climate, biodiversity, and water quality, and in service to the overall theme to the meeting—*Ocean Colour: serving Earth system science & our society.* It was agreed after a discussion that the opening keynote should be inspirational, with a focus on the future of ocean colour, noting also that what OC might look like in the future would also be discussed throughout the course of the meeting. There were also discussions about the

inclusion of policy-relevant ocean colour applications, gap analyses, and allowing the application and operational needs to inform future data products.

The format of the meeting was also discussed, including whether or not to add more panel discussions into the plenary sessions for topics that have a wide appeal (such as the theme topics) and whether to keep or modify the format and number of keynote talks. It was decided to continue the discussion by email and through follow-up virtual meetings focussed on the IOCS scientific planning.

3. CEOS Activities & Integration [OCR-VC]

3.1. Review and Endorsement of the CEOS-ARD Aquatic Reflectance PFS v2.0

Version 2 of the CEOS Analysis Ready Data (CEOS-ARD) Aquatic Reflectance Product Family Specification (PFS) was circulated to the IOCCG for comment prior to the meeting by Matthew Steventon, CEOS-ARD Secretariat. Arnold Dekker, lead of the CEOS-ARD Aquatic Reflectance PFS, presented the updates on this activity to the IOCCG Committee for their endorsement.

CEOS Analysis Ready Data (CEOS-ARD) are satellite data that have been processed to a minimum set of requirements and organized into a form that allows immediate analysis with a minimum of additional user effort and interoperability both through time and with other datasets. It is not a full interoperability system. The aim is to have satellite Earth observation data reach new users and facilitate new applications. It is also a helpful reference for data providers, providing a benchmark of metadata requirements and pre-processing steps that are most needed by the user community – particularly non-expert users. CEOS-ARD is an open and transparent starting point for data providers looking to ease the use of EO and improve interoperability.

Product Family Specifications detail specific 'Threshold' and 'Goal' requirements for General Metadata, Per-pixel Metadata, Radiometric and Atmospheric Corrections, and Geometric Corrections. Arnold explained the changes that went into advancing the

Aquatic Reflectance PFS from version 1 to version 2, which expands applicability beyond inland and coastal waters to also cover the oceans. Incorporating all aquatic domains into the PFS added complexity (e.g. from 10-100 m resolution in version 1, to sub-meter to 4x4 km resolution in version 2). The team had a year of biweekly meetings of 8 to 12 experts each time, and spread over different continents. With the inclusion of the ocean colour community, they started looking at PFS metadata that was inherited from the Land Surface Interactions Virtual Constellation (LSI-VC) derived products and found some definitions were not always suitable. Several of these were updated and some changes warrant review by the CEOS-ARD Oversight Group, since the changes might help improve other product types. Version 2 was presented to the CEOS LSI-VC-17 meeting on 14 April 2025 and formally endorsed, pending minor changes to reflect feedback received during the meeting. IOCCG and CEOS OCR-VC endorsement was sought at this meeting.

The group was reminded that this document is meant to outline the minimum requirements that should be met by providers when creating analysis ready data for the aquatic environment. ARD providers would conduct a self-assessment, send their sample products for checks and review, and then be approved by the CEOS-ARD peer review team. More information is available on ceos.org/ard and everyone is welcome to join the ongoing development on the CEOS-ARD Github (github.com/ceos-org/ceos-ard).

Some additional questions and comments were raised, including a discrepancy with the understanding of the word “mask” as used in the document. It was noted that the document sought to harmonize terminology across all the product family specifications, and certain terms were chosen to be in-line with the PFS for land.

IOCCG Committee members requested more time to review and comment on the document before endorsement, as they were not able to add all their comments before the end of the review period. This request was granted, and members were

asked to make their final comments in the document by the end of the week (Friday, 18 April 2025). Once the comments have been addressed, IOCCG's endorsement would be implied. Shubha thanked the team for their hard work on producing version 2.

Action 29/2: IOCCG members to give their final feedback on CEOS-ARD Aquatic Reflectance PFS v2.0 by 18 April 2025, after which the received comments will be addressed and, barring any major issues upon review, CEOS-ARD Aquatic Reflectance PFS v2.0 will be considered endorsed by IOCCG and CEOS OCR-VC.

3.2. Synergies of IOCCG activities and CEOS Coast

Aurelien Carboniere, IOCCG Committee member and co-Lead for CEOS Coastal Observations Applications Services and Tools Virtual Constellation (COAST-VC) gave a presentation to update the IOCCG on the COAST-VC. The request to know more about COAST emerged from an action from IOCCG-28, and the desire to integrate the CEOS Ocean Colour Radiometry (OCR) VC by having a leader from CEOS COAST on the IOCCG Committee. As Aurelien sat in both groups, he was selected to bridge this gap.

The secretariat for CEOS COAST is led by Merrie Beth Neely. COAST aims to put satellite data in the hands of decision makers to help to fill gaps in knowledge. They plan to co-design projects to access new datasets based on need, and to work with all the other CEOS VC and working groups (broader than OC). COAST works across the land-ocean continuum: land impacts to the sea, and sea impacts to the land. They help to bridge land and sea observations within CEOS and will continue to integrate across multiple CEOS domains. Aurelien shared some pilot projects within COAST that are currently being used as test beds for product development. An application knowledge hub is still under development, being created by NOAA in collaboration with COAST.

The agencies currently involved in COAST meet once a month/2 months to exchange best practices, and update on current projects. Aurelien outlined the following as potential points of collaboration between COAST and IOCCG

- Maintain close relationships with downstream services and users
- OC data integrated into future operational CEOS COAST products
- CEOS Coast can provide user needs data
- COAST can help to catalyze public-private partnership
- Validation of OC data products
- Better reporting on uncertainties for OC products

More about CEOS COAST can be found on the CEOS website at: https://ceos.org/ourwork/virtual-constellations/coast/

Chuanmin Hu indicated that he loved the approach of pilot sites, but that they all seem to be turbid waters (estuaries or deltas) and do not cover optically shallow water. He wondered if there was room to add just one optical shallow water site. Aurelien indicated that site and pilot project selection was highly dependent on the relationships built with the local stakeholders, and the local demand. If there were a need for complementary assessments (and a local stakeholder to lead), it could be discussed. Emmanuel Devred responded that the tropical islands included in the pilot could potentially meet the need of shallow water optics.

Bob Brewin was curious about whether there were any citizen science aspects to the pilot projects. Aurelien indicated he would need to check the stakeholder participation, and later confirmed that the main contacts were natural resource managers, so one step removed from citizen science. Bob indicated that he had an interest regarding turbidity and ocean colour applications.

Shubha and Aurelien suggested continued dialogue between IOCCG and CEOS COAST, through the secretariats. Aurelien indicated that membership to the COAST-VC was still open, and Shubha asked whether the space agencies wished to contribute to the

existing initiatives. Marie-Helene indicated that ESA is already represented on the COAST-VC, as are other agencies.

3.2.1. Space4Ocean Alliance

Aurelien gave an overview of the Space4Ocean Alliance being launched by CNES, with action towards SDG 14: *life below water*. The UN Ocean Conference is set to take place in Nice, France, on 9-13 June 2025, and the Space4Ocean Alliance aims to create more synergy and overlap in leveraging Earth Observation for operational solutions. CNES has taken the lead to coordinate and then contact marine and maritime private users. All this is being done in coordination with the Office of Spatial Affairs in the UN. If any agency is interested to join the Alliance, you can still express your interest and get more information by contacting CNES at selma.cherchali@cnes.fr.

Ewa indicated that it was an ambitious and welcomed initiative. It is good to see the goal from data to services to implementation. She wondered whether there was funding commitment on resources, and whether the members were expected to commit such resources towards these activities. Aurelien indicated that agency contributions to date have been in-kind, through employee time. The implementation plan (next stage) will clarify how agencies or stakeholders can provide support, whether in-kind or otherwise.

Shubha indicated that this initiative aligned with IOCCG's goal to engage more towards service to the society. She encouraged members to think seriously about their possible involvement.

Action 29/3: IOCCG Agency representatives to review the COAST & Space4Ocean Alliance presentations and explore modes of engagement with these two initiatives.

3.3. Aquatic Carbon Roadmap

Marie-Helene gave a status of the Aquatic Carbon Roadmap that we are developing in the context of CEOS. It is the aquatic leg of the CEOS carbon strategy, and follows the

Greenhouse Gas (GHG) and the Agriculture, Forestry and Other Land Use (AFOLU) roadmaps. In the CEOS work plan, the roadmap is due to be delivered in 2025, and we have asked for an extension to 2026 to bring on board outcomes from two events: the Living Planet Symposium and the Ocean Carbon from Space workshop. The coordination team is Marie-Helene (ESA), Laura Lorenzoni (NASA), Hiroshi Murakami (JAXA) and other scientific leaders Jamie Shutler, Bob Brewin, Cecile Rousseaux, and Kelsey Bisson.

Marie-Helene indicated the list of contributors (~20 so far) from the scientific community, and there is still room to join if others are interested and can bring additional perspectives to the roadmap. The timeline for roadmap deliver was as follows:

- April 2025 - The CEOS SIT-40 meeting occurred and gave a timeline for all the contributors to provide a list of bullet points for their sections to understand the key points they will be developing.
- June 2025 - The Living Planet Symposium (LPS): will have a specific session for coordination between the 3 roadmaps (GHG, AFOLU, Aquatic Carbon).
- September 2025 - SIT Technical Workshop: aim is to produce a second draft of the roadmap by this time
- November 2025 - CEOS Plenary: aim to have a consolidated draft of the roadmap
- November - December 2025 - Ocean Carbon from Space Workshop, IOCS Plenary and IOCS breakout sessions on carbon, which will allow the group to get more feedback from the community to be incorporated into the roadmap
- 1st quarter 2026 - Delivery of the roadmap to CEOS

Marie-Helene indicated that there was an idea by Jamie and Bob to take the information from the roadmap and its development and write an accompanying peer-reviewed publication (short and impactful paper, possibly a comment article), as an important benefit to help justify the voluntary effort of the scientific contributors.

The outline of the roadmap document and five main topics (with their lead contributors) were presented, and Marie-Helene requested comments or recommendations for missing elements or missing contributors.

Regarding the LPS in Vienna in June, Marie-Helene shared the proposed agenda for the dedicated ocean carbon session, and the session to discuss all the roadmaps as an integrated contribution towards the Global Carbon Stocktake. She requested feedback on this. Shubha asked about the panel and whether there would be more aquatic carbon contributors. Marie-Helene indicated that speakers needed to be identified by the end of May, but others for the panel may still join afterwards, and she is happy to take suggestions on names for the panel. Claudia Giardino said she was happy to see the representation of in-land waters. She suggested Hubert Loisel may be a good resource (for the roadmap), as they wrote a proposal that seems like it overlaps and could be helpful. Claudia agreed that she would help to contact Hubert about this.

Ewa asked to see the roadmap as she figures that CEOS agencies might ask the following questions: what satellite products are required; what is the timeline within the roadmap; what observing capabilities are missing, etc? She said that from the point of view of an agency, she would love to know what products or upgrades or new missions should be planned to address the gaps, and whether the work should be on the satellite data directly, or more on the algorithms to derive the services, as well as how these could be scheduled in time. Marie-Helene shared a slide that indicated some of the goals of the roadmap. It aims to answer exactly these questions for the agencies and the community for the next 15+ years. Discussions with other roadmaps that are more mature will help us to determine the timeline for the deliverables / objectives within the roadmap.

Hiroshi Murakami indicated that SST-VC and other VCs (outside of the OCR-VC) wanted an opportunity to make comments on the Aquatic Carbon Roadmap, so maybe before

September it might be good to request comments from other VCs. Marie-Helene agreed that other ocean-based VCs and the COAST VC have indeed asked about the ability to make comments on the roadmap, so this is a good idea to circulate the draft and get feedback. Marie-Helene asked for advice on when and to what extent others could contribute, especially as some of the other VC variables may not be completely applicable. Hiroshi indicated that maybe before the second draft it would be good to ask the SIT team members to distribute to other VCs for comment, he has links to the SST-team but not the other teams. Marie-Helene asked Aurelien if he would request comments from COAST when it is time to do so, and he agreed. Marie-Helene also indicated that the other VCs are welcome to participate and give feedback at the LPS in June.

Action 29/4: IOCCG Committee members to review and give feedback, if any, on the outline of the Aquatic Carbon Roadmap by the end of May.

3.4. Review and approval of the CEOS Work Plan 2025-2027

The CEOS work plan for 2025-2027 was reviewed and approved. All IOCCG activities are represented and subsumed within activities of the OCR-VC, and Marie-Helene reiterated that all the activities of the IOCCG could therefore be part of the CEOS work plan. The long-term time series activities are starting now, and so it could be good to add it, however the work plan requires deliverables. It was indicated that the group for this activity would need to meet to decide on their deliverables, which could then be incorporated into future versions of the work plan. This was agreed. There were no objections or additions to the current work plan as written.

4. Agency Discussions & Inter-Agency Collaborations

4.1. Progress: Harmonizing Global OC for Long-Term Climate and Ecosystem Monitoring

Shubha gave an update on the topic of long term time series data products, which are being undertaken by the newly formed Task Force on Harmonizing Global OC for

Long-Term Climate and Ecosystem Monitoring. The initial response from the agencies has been positive. A first meeting occurred online and participants were positive on the need and formation of the task force. The terms of reference (ToR) for the group was presented to the task force members and IOCCG Executive last month, and their input requested. Shubha thanked Robert for his assistance in putting together the ToR.

The Task Force plans to meet fairly soon (early May) to finalize the ToR. Shubha indicated that Robert Frouin has gratefully agreed to chair the Task Force. The Task Force is also organizing an in-person meeting in conjunction with the IOCS, and will be leading a breakout session within the IOCS to get input from the Community. If Committee members wish to comment on the ToR, they are free to do so before the Task Force meets.

Vittorio asked if CMEMs could be added. Shubha indicated that yes, as long as their activities could not be addressed by anyone already in the membership. Vittorio confirmed that this was indeed the case, and that he or a designate from CMEMS would be interested to join. Shubah agreed.

Robert indicated that the task force needs to think about the deliverables, and these need to be identified and agreed upon. Shubha agreed with this.

Action 29/5: Task Force on Harmonizing Global OC for Long-Term Climate and Ecosystem Monitoring to identify and agree on their deliverables.

4.2. Key Recommendations from the OC-System Vicarious Calibration Task Force

Carol Johnson presented key recommendations from the Task Force on OC System Vicarious Calibration, chaired by her and Giuseppe Zibordi. A white paper emerged as a result of a two-day workshop that occurred after the IOCS-2023 meeting in St.

Petersburg, FL, USA. The white paper was delivered to IOCCG and is available on the IOCCG website, and a peer-reviewed publication was also done in BAMS (https://doi.org/10.1175/BAMS-D-24-0085.1). Both documents were structured around 9 topic areas and each had requirements and listed recommendations.

Carol shared the following key recommendations that we could think about tackling in the future that are quite important

- Given the nature of evolving algorithms, products and new sensors, we should reassess uncertainty estimates (and requirements) with the goal of revising the spectral uncertainty requirements for the OC-SVC products.
- Investigate the consequences of the different OC-SVC site characteristics on the satellite gain correction factors, for example by fielding identical instrumentation at different locations.
- Carry out regularly planned and supported intercomparisons of Rrs to verify the performance of the OC-SVC sites.
- Develop a community shared standard procedure for the assembly of the gain factor matchup data set, including screening, quality control, and statistical measures.
- Process multi-mission data sets with the same atmospheric correction code.
- Improve the methodology surrounding the near infrared role allowing to set gain factors different from 1 at any band in the NIR. This may imply identifying the aerosol optical properties, for example by defining common Earth references for the NIR observations and comparing satellite retrieved aerosol optical properties to in situ results.
- Ensure the veracity of the continuum of ocean color satellite data records by maintaining long-term in situ data from an operational OC-SVC site with robust characterization and demonstrated traceability to the SI.

Carol requested feedback on how to proceed. She hopes that the community would self-assemble around these recommendations, but the task force has no mandate yet around next steps.

Shubha congratulated the task force on an excellent job, and especially having gotten their work published in BAMS. She asked about the recommendation for multiple sites for SVC. How many sites do we need, and are we close to getting there . Carol indicated the site she knew about (MaroNET, though not insured, MOBY refresh site in Hawaii, HyperNAVS, and in the future the EU Copernicus Programme site) stating that two might be a minimum, but how we compare the consequences of the sites is more technical.

Ewa thought that some of the recommendations are easier to tackle than others, but all of them are important and would depend on the organization of the task force and which ones can be tackled first (e.g. in order of simple to more difficult, or addressed in parallel). She suggests that the task force continues and addresses the recommendations as they see fit, and progress with the work as required. She suggested that on-going work could lead to additional publications or a community guideline.

Chuanmin agreed that the list is quite comprehensive. Regarding the processing of multi-mission data with the same atmospheric correction and determining the gain factor, he assumes that it is implicit to have the same atmospheric correction code to be able to determine the gain. Perhaps it could be made more explicit that the same atmospheric correction code is required. Carol agreed.

For the final recommendation listed, Chuanmin indicated that it mentioned one SVC site, but could it say one or more, to ensure that we do not just maintain one? Carol agreed that this wording could also be adjusted. She indicated that the dream would be for at least one SVC site to be internationally supported for the long-term, because

the data are used internationally. Chuanmin indicated that he thinks of MOBY, but other sites have been equally valuable, such as BOUSSOLE. Shubha indicated that unfortunately BOUSSOLE no longer exists, and asked if there was any plan to revive BOUSSOLE. David Antoine indicated that BOUSSOLE has already been dismantled, which is irreversible, so cannot be revived. Our thinking that we can rely on one site in the US is a bit dangerous and complacent. Shubha agreed that we cannot have just one site, but need fall-back sites as well, and is something that we need to consider seriously.

Shubha asked Carol if she was OK to move forward with the recommendations made from this meeting. Carol indicated she received good feedback and, with Giuseppe, will think seriously about scheduling a virtual meeting of the task force to discuss the path forward.

5. Progress on IOCCG Scientific Reports & Protocols

5.1. Review of new proposal: *Working Group on LIDAR for Ocean Applications*

Cédric Jamet presented the proposal for a working group to develop an IOCCG report on the use of Lidar for ocean colour applications. Lidar is an active remote sensing technique using laser pulses. It can help to fill some of the limitations of passive ocean colour observations, including: the lack of observations at night, over clouds and absorbing aerosols, and at high solar angles (> 70°, high latitudes); lack of vertical detection over the water column; and (until PACE) no polarization. The working group will provide an overview of the capabilities of lidar technique to study and monitor the upper ocean layer from ships, airplanes, and satellites, and will discuss advantages and limitations. He showed examples of current Lidar applications (e.g. for detection of particle backscattering, b_{bp}, over the vertical) and new and emerging Lidar missions. Proposed members were people that had already worked together in other capacities and were international in nature (from USA, China, Italy, France, Poland). Cédric shared a brief outline of what was expected to be covered in the 8 chapters of the report, as well as the report timeline of two years.

Shubha asked about going down to 100 m with the Lidar signal, can this be done by satellite and what would be the signal to noise ratio? Cédric indicated that for airborne lidar, you can go down to 85 m, but the signal to noise ratio at this depth is very low, and mainly because of particle scattering in the ocean, so realistically for spaceborne it would be 50 m in subtropical gyres, and 20-30 m in more productive waters. Shubha asked about the focus on backscattering, and that she assumed there would also be a fluorescence signal. Cédric focused on b_{bp} and k_d because those parameters are related to the parameters in the Lidar equation, but if you add a fluorescence sensor, then yes, fluorescence can be estimated, and this will be done on the XXX space mission. Emmanuel Devred thanked Cédric for the presentation and indicated that this report is welcome. He suggested a new work group member and asked if a section on the limitations of Lidar could be included, as well as how validation is done. Cédric indicated that indeed limitations were not explicitly shown in the report outline, and would be part of recommendations, but they will explicitly add limitations to the outline.

Chuanmin also applauded the effort to form a working group on Lidar, indicating that the report is overdue, as it has already been shown to have many advantages and applications. He asked whether the scope of the applications could be enlarged to include subsurface plumes, of oil or macroalgae (e.g. *Sargassum*), due to Lidar penetration into water. Cédric thanked Chuanmin for his addition, and indicated that the group could consider investigating this application, as indeed the list he showed was not exhaustive.

The Committee was pleased with the proposed work and the scale, and approved the working group to go forward. It was noted that CNES has also inserted marine Lidar in its prospective roadmap, and this output is welcome. Additional suggestions were shared with Cédric about potential members to the group.

5.2. Progress on Scientific Report on Conducting Benthic Reflectance Measurements

Heidi Dierssen indicated that a draft of the working group report on conducting benthic reflectance measurements is now available, with only a few chapters still to be completed. She outlined details of which chapters were still to be completed, and a few that may be omitted from the original outline, but the report is still rather long. She noted that the report did not recommend any single method or measurement, but discusses the challenges and different methods for conducting benthic reflectance that have been used.

Heidi indicated that the group has a metadata template that they wish to make available online that will be associated with the report. The working group also wants to collate some of the benthic reflectance data into a database in a usable format. There is a wealth of unpublished data that would be good to make available, but this effort may be a follow-up project. Heidi indicated that she is working with Raisha to get the report into a draft, perhaps by fall this year.

Shubha congratulated the group on their progress and looked forward to the draft report.

5.3. Progress on Ocean Primary Production Scientific Report

On the status of the working group on ocean primary production, Bob Brewin indicated that since the last Committee Meeting, the group has set up a Sharepoint and Teams channel on which all the draft chapters, communication, and meeting minutes etc, are stored. The working group has had 2 progress meetings online (Oct 2024, Jan 2025) and another one planned for the end of this month. The report is partitioned into 11 chapters, and Bob gave an overview of their contents. The next six months are critical, as many draft chapters are due by the end of June/Sep, with the aim to have a draft report available by the end of the year. The pace of the working

group meetings have increased to every 3 months, and the working group is planning a potential in-person meeting at IOCS-2025, in December.

Shubha applauded the group's activity on the report thus far. Aurelien asked if Bob foresees any links between the OPP working group and the newly formed working group on Lidar. Bob indicated that aspects of Lidar are included in one the chapters (Future Applications, led by David Antoine), and there is a subsection lead within that chapter.

5.4. Progress on Protocol for HPLC measurement of chlorophyll a and phytoplankton pigment

Elisabetta Canuti presented the progress on the Protocol document for conducting HPLC measurements of chlorophyll a and phytoplankton pigments, co-chaired by Crystal Thomas (also present at the meeting). Coauthors were invited and they had a preliminary meeting and checked the availability of the authors. Writing of the protocol has commenced. In December there was a hybrid kick-off meeting to determine the structure of how to work together, and divided into subgroups. A roadmap for the protocol was also developed. The working group has bimonthly meetings with all the authors, and each chapter is assigned to one lead for each subgroup. The aim is that by December 2025, the draft protocol will be ready for community review. The authors were chosen to be internationally representative (Brazil, Germany, France, Japan, USA). Potential reviewers have also been listed for reviewing the draft once completed. The protocol is so far divided into 6 chapters plus introduction and annexes. Elisabetta outlined the contents of these chapters and their lead authors.

Shubha thanked the group for their work on this, and reiterated the usefulness of this document. Claudia asked if they were also considering the uncertainty relating to the measurements. Crystal indicated that yes, uncertainty measurements would be covered under the quality assurance chapter. Shubha asked whether they were

planning an intercomparison across labs. Crystal indicated that many authors are part of an intercalibration exercise and will continue to be, even though a unique intercomparison exercise is not being planned as part of the protocol writing. She indicated that all in-person participants of the hybrid meeting in December were part of the same intercalibration exercise.

5.5. Revisiting the Technical Report Series

Raisha Lovindeer indicated that she had received the final version of the IOCCG scientific report on *Evaluation of Atmospheric Correction Algorithms over Turbid Waters* that addressed the reviewer comments after public review. Editing of the report is underway, as well as review of the response to reviewers. She wished to revisit the idea of this report forming a new *Technical Report Series*, and argued that the report was no more technical than some previous IOCCG Reports. The distinction for what made a report part of the *Scientific Report Series* versus a new *Technical Report Series* was not clear. The output from IOCCG groups should ideally fall into the following types of documents that IOCCG currently produces:

1. **IOCCG Scientific Report** (Investigation and recommendations on a specific topic, resulting from the work of a scientific working group)
2. **Ocean Optics & Biogeochemistry Protocol** (Standardized methodology)
3. **White paper** (Recommendations or technical positions on a topic that requires implementation, typically emerging from a scientific task force.)
4. **Publication** in an external peer-reviewed journal for technical results from an IOCCG body (working group or task force) that do not fit into an IOCCG Report.

As the current report was much more comprehensive than a typical peer-reviewed publication in an external journal, she requested that it be considered the 21st report of the IOCCG Scientific Report Series.

Xianqiang He indicated that he is part of the working group and knows the contents of the document, and agreed that the report had no distinction (even in page number) to other IOCCG Scientific Reports. Cédric indicated that he thought the

report was indeed technical with many repetitive results and not as easy to read as other reports in the series. The working group tried to explain algorithms and give recommendations, but perhaps not deep enough for it to be a Scientific Report. He prefers the technical designation, but will honour the decision of the IOCCG Committee.

As there were no objections from the Committee, Shubha indicated that Raisha's proposal to not start a *Technical Report Series* was accepted. The Committee would accept *Evaluation of Atmospheric Correction Algorithms over Turbid Waters* as Scientific Report 21 in the IOCCG Report Series.

6. Capacity Building

6.1. Report of SLS-2024 and the way forward

The 6th IOCCG Summer Lecture Series (SLS), the biennial 2-week advanced training course on the fundamentals of ocean optics, bio-optics and ocean colour remote sensing, was held on 4 - 16 November 2024, graciously hosted and supported by INCOIS in Hyderabad India. This was the first time that the SLS was being hosted in Hyderabad, with previous editions in Villefranche-sur-Mer. The course planning team consisted of Nimit Kumar (INCOIS, SLS Coordinator), David Antoine (Previous SLS Coordinator), Uday Bhaskar, Vittorio Brando, Laura Zoffoli, Susanne Kratzer, Shubha Sathyendranath, and Raisha Lovindeer. We received 128 applications from 29 countries. Applications were reviewed by David Antoine, Laura Zoffoli, Nimit Kumar, and Raisha Lovindeer, and 30 students were selected for the course. In the end, only 28 of the selected students attended, due to visa issues.

As in previous editions, lecture topics covered the interaction of light & matter, inversion and application of IOPs, radiometry and AOPs including measurements and uncertainties, retrievals from satellite data and measuring primary production, and application to coastal monitoring and human health (HABs, water quality, etc). Lecturers were recorded, and all course material is available on the IOCCG website at

ioccg.org/what-we-do/training-and-education/ioccg-sls-2024. The course report is available online ioccg.org/what-we-do/training-and-education/reports-of-past-ioccg-training-courses-workshops/

Following the close of the 2024 edition, and the change in job position of Nimit Kumar from INCOIS to IOC, the IOCCG opened a new call for SLS coordinator(s). Two applications were received, and are being reviewed. Results of the selection should be available by the end of April.

6.2. Updates on IOCCG Platt Scholarships (2024 & 2025)

Emmanuel Devred gave a brief summary update of the 2024 and 2025 IOCCG Platt Scholars. The 2024 Scholar, Hellen Kizenga (with exchange planned at the Bedford Institute of Oceanography, Canada), had a few issues obtaining her Canadian visa to embark on her exchange last year. She has now reapplied for her visa to Canada from Italy, where she recently started her PhD. Thus, her scholarship activity has been postponed until her visa is approved. For 2025 only 2 applications were received for the IOCCG Platt Scholarship, both from India. The reviewers (Wonkook Kim, Corinne Bourgault-Brunelle, Frédéric Mélin, and Raisha Lovindeer) were acknowledged and thanked for their time and dedication. The awarded Scholar, R Chandra Sekhar Naik (for exchange to NASA Goddard Space Flight Center & Columbia University, USA), is also currently pursuing his visa for the USA to embark on his exchange research this year.

Shubha congratulated the scholars and thanked all the reviewers and hosts. She raised concern about the low number of applications received last year (only 2), indicating that it seems the message is not being sent out broadly enough, and we need to raise more awareness about the opportunity across a wide range of people and countries. Emmanuel indicated that perhaps the process of match-making between students and labs is not easy. In fact, it was Emmanuel's initiative that allowed for Hellen's application. Shubha indicated that this question of

match-making also came up at the Trevor Platt Symposium, as students are hesitant to contact mentors or do not know about potential opportunities in their labs. Fred indicated that the IOCS could help with that type of match-making to favour applications for the following year. Shubha indicated that this might be a good idea. There was a brief discussion about contingencies regarding visas, that would be explored further if required.

6.3. ESA Ocean Training Course (OTC25)

Kelsey Bisson gave an update on IOCCG's role in supporting students for the ESA's 2025 Ocean Training Course (OTC25 https://oceantrainingcourse2025.esa.int/), which is part of the One Ocean Expedition, a scientific and educational voyage around the Northern Hemisphere oceans, aboard the tall ship Statsraad Lehmkuhl. The training course is taking place from April to June, 2025, starting in Tromø, Norway and ending in Nice, France. ESA provided funding for participants from the EU, and NASA, through IOCCG, supported 8 non-EU berths for the training course. A number of strong applications were received. The funding allowed for participants from North America (USA and Puerto Rico), South America, and Africa. Emmanuel Boss has also been funded as an instructor on the course. Kelsey suggested that there should be an update after the training course to share pictures and results from the funded students.

Shubha thanked Kelsey for her update, and explained a bit more about the type of living that the students will encounter on the ship and the training. The course will end in Nice in time for the UN Ocean Conference 2025, and so the students will get to engage in these activities before they fly home. There is a lot of excitement, and we wish the crew and participants all the success. There is not yet any assurance that the cruise or opportunity will be repeated.

6.4. Multi-sensor Satellite Ocean Colour Training

Ewa Kwiatkowska gave an overview of a proposal for a multi-sensor satellite OC training course, to be led by Hayley Evers-King and Ben Loveday from EUMETSAT. The

course is planned in conjunction with the IOCS-2025 meeting, to be held in Darmstadt, Germany, at EUMETSAT Headquarters. The course aims to take advantage of the gathering of ocean colour experts in the centre of European satellite operations (Darmstadt); and provide a multi-sensor view towards the development of downstream services using both operational and research missions. The team hopes to include perspectives on OLCI, PACE, MSI, GEO OC sensors, downstream products (CMEMS / CoastWatch) etc., with the exact scope dependent on volunteer lecturers and their contributions. Ewa showed the expected outline for the days of the course, and the topics that would be covered, including applications that would be of interest to the participants.

The plan is that the course would be in-person for approximately 25 people, and aimed at early to mid-career researchers and application developers looking to scale up their skills. Limited travel funding could be available for European students who will also attend the IOCS meeting, but the hope is that the course is international and multi-mission, so other sponsors are welcome to ensure good coverage for international participants and lecturers. Shubha indicated that she was keen to ensure that international participants could also be funded. The course is being planned in conjunction with IOCCG and other partners to facilitate this international involvement. Shubha requested that members give their comments, suggestions, and offers to either Ewa or directly to Hayley.

Action 29/6: IOCCG Committee Members and Agency representatives to think about contributing and/or lending support to the training, and express interest to Hayley Evers-King directly (copied to the IOCCG Project Office).

7. Administration and Closing Session

7.1. Committee Member Rotations

Shubha indicated that no Committee Members have rotated off the Committee this year. A few members are slated to rotate after the 2026 meeting, and suggestions for

replacement members are welcome. Members requested to have access to the list of current nominations.

Action 29/7: IOCCG Project Office to circulate the list of current nominations for new IOCCG Committee Members for consideration.

7.2. Next Committee Meeting (IOCCG-30), Tokyo, Japan

The 30th IOCCG Committee Meeting will be in-person, graciously hosted by JAXA and the Japanese ocean colour community in Tokyo next year. Hiroshi Murakami gave a brief overview presentation of the proposed meeting venues in Tokyo, and the dates of the meeting. Due to existing conflicts or constraints, the following dates in May 2026 were proposed: the weeks of May 11-15, or May 18-22. There were no immediate objections to these dates. Shubha thanked JAXA for graciously planning to host the next in-person meeting, and requested that final dates be selected by a poll of the Committee members.

Action 29/8: IOCCG Project Office to send a poll to decide on the final dates of the IOCCG-30 Committee Meeting in Tokyo in 2026.

Appendix I: List of Participants

Committee Members

- Shubha Sathyendranath, IOCCG Chair, PML
- Aurelien Carbonniere, CNES
- Bob Brewin, U. Exeter
- Carolina Tauro, CONAE
- Corinne Bourgault-Brunelle, CSA
- Chuanmin Hu, USF
- Claudia Giardino, CNR-IREA
- Emmanuel Devred, Bedford Institute of Oceanography
- Ewa Kwiatkowska, EUMETSAT
- Frédéric Mélin, EC JRC
- Hiroshi Murakami, JAXA
- Jongkuk Choi, KIOST
- Marie-Hélène Rio, ESA
- Paula Bontempi, U. Rhode Island
- Steve Groom, NCEO
- Tim Malthus, CSIRO
- Vittorio Brando, CNR-ISMAR
- Xianqiang He, SIO
- Raisha Lovindeer, IOCCG Project Office

Invited Participants

- Carol Johnson, Co-Chair, OC-SVC Task Force, NIST
- Cédric Jamet, Proposal Chair, Working Group on LIDAR, U. Littoral
- Crystal Thomas, Co-Chair, HPLC Protocol Working Group, NASA
- David Antoine, IOCCG Past Chair, Curtin University
- Elisabetta Canuti, Co-Chair, HPLC Protocol Working Group, EC JRC
- Giuseppe Zibordi, Co-Chair, OC-SVC Task Force
- Heidi Dierssen, Chair, Benthic Reflectance Working Group, U Conn
- Kelsey Bisson, NASA
- Matthew Steventon, CEOS Secretariat & CEOS ARD Aquatic Reflectance PFS Team:
    - Arnold Dekker, Carsten Brockmann, Daniela Gurlin, Peter Gege
- Nima Pahlaven, IOCS Scientific Committee, NASA
- Robert Frouin, Scripps Institute of Oceanography
- Stewart Bernard, IOCCG Past Chair

Apologies

- Áurea Ciotti, Universidade de São Paulo
- Ana Dogliotti, CONICET
- Cara Wilson, IOCCG Immediate Past-Chair, NOAA Fisheries
- Jeremy Werdell, NASA Space Flight Center
- Laura Lorenzoni, NASA
- Mark Barid, CSIRO
- Menghua Wang, NOAA

Appendix II: List of Action items

	Action	Status
29/1	Laura Lorenzoni (via Kelsey Bisson) to follow up about the status of NASA assistance to CONAE re: BRDF solar diffusers characterization.	
29/2	IOCCG members to give their final feedback on CEOS-ARD Aquatic Reflectance PFS v2.0 by 18 April 2025, after which the received comments will be addressed and, barring any major issues upon review, CEOS-ARD Aquatic Reflectance PFS v2.0 will be considered endorsed by IOCCG and CEOS OCR-VC.	Completed
29/3	IOCCG Agency representatives to review the COAST & *Space4Ocean* Alliance presentations and explore modes of engagement with these two initiatives.	Completed
29/4	IOCCG Committee members to review and give feedback, if any, on the outline of the Aquatic Carbon Roadmap by the end of May.	Completed
29/5	Task Force on Harmonizing Global OC for Long-Term Climate and Ecosystem Monitoring to identify and agree on their deliverables.	
29/6	IOCCG Committee Members and Agency representatives to think about contributing and/or lending support to the multi-sensor satellite OC training, and express interest to Hayley Evers-King directly (copied to the IOCCG Project Office).	On-going
29/7	IOCCG Project Office to circulate the list of current nominations for new IOCCG Committee Members for consideration.	Completed
29/8	IOCCG Project Office to send a poll to decide on the final dates of the IOCCG-30 Committee Meeting in Tokyo in 2026.	Completed