

**IOCCG-17 Committee Meeting
Denpasar, Indonesia, 28 February - 1 March 2012**

MINUTES

1.0 Welcome and Opening Session

1.1 Welcoming address

Dr. Tasuku Tanaka, the host of the IOCCG-17 meeting and Director of the Center for Remote Sensing and Ocean Sciences (CreSOS), welcomed all the participants to the University of Udayana and to the island of Bali. He introduced Prof. Bakta, the Rector of the university who expressed his pride and joy at welcoming all the members of the IOCCG Committee to Udayana University. He noted that the IOCCG was very well known over the whole world and he was grateful to Dr. Tanaka for offering to host this meeting. He hoped that through the 17th IOCCG meeting in Denpasar, the IOCCG would work closely with international institutes to address climate change issues. He thanked the Committee once again for their trust in holding the meeting at the university on behalf of himself and Prof. Raka, Director of the post-graduate programme at Udayana University.

1.2 Adoption of the IOCCG-17 agenda, minutes from the 16th Committee meeting and status of actions

The agenda was adopted with no modifications, and the minutes from the 16th IOCCG Committee meeting were approved as written. The Chairman summarised the status of the actions from the 16th Committee meeting, most of which had either been completed, or would be addressed further during the meeting.

Action 16/1: The White Papers from the Venice symposium (2010) have been published.

Action 16/2: The Chairman had received comments from Committee members on the CDR strategy document.

Action 16/3: The BIO-Argo report is in the process of being printed by JRC:

Action 16/4: Comments were received on the geostationary report which is currently in the near-final stage of publishing.

Action 16/5: Kevin Ruddick provided justification for the inclusion of a 1020 nm band on future ocean-colour sensors.

Action 16/6: Members were proposed for the Uncertainty WG, which will be discussed under Agenda item 3.2

Action 16/7: A revised proposal for the Uncertainty Working Group was received. It will be posted on the IOCCG website once membership is confirmed.

Action 16/8: The status of the Calibration report will be discussed under Agenda item 3.6

Action 16/9: The membership of the Polar Seas WG has been finalised and will be discussed under Agenda item 3.7.

Action 16/10: A revised proposal for the WG on “ Intercomparison of retrieval algorithms for coastal waters” has been received and will be discussed under Agenda item 3.5.

Actions 16/11 and 12: Stephanie Dutkiewicz centralised comments on the CoastColour URD and has submitted them to Shubha Sathyendranath.

Action 16/13: Dmitry Pozdnyakov provided updates on the METEOR-3M mission.

Action 16/14: A letter was sent to NOAA reiterating the need for another MOBY.

Action 16/15: IOCCG members will continue to provide suggestions regarding band placement on OCM-3.

Action 16/16 and 16/17: An outline for the INSITU-OCR White Paper was prepared and a writing team assembled – to be discussed under Agenda item 4.3.

Action 16/18: Several members gave presentations in the lecture series at Udayana University.

Action 16/19: A new working group to produce standardised training material will be presented under Agenda item 7.4.

1.3 Report from the National Institute of Aeronautics and Space (LAPAN) Indonesia

Maryani Hartuti reported on the activities of the Indonesian National Institute of Aeronautics and Space (LAPAN) as related to ocean colour. LAPAN’S mandate was related to remote sensing for coastal and marine resources. LAPAN has four multi-mission remote sensing ground stations which receive data from NOAA, MODIS, Landsat and SPOT, with plans to received NPP VIIRS data. Ocean-colour data was used for site selection for marine aquaculture, fishing ground identification and distribution, primary production estimates and model development for coral reefs, bathymetry and suspended sediments. There was a possibility of including an ocean-colour sensor on a LAPAN micro-satellite.

1.4 Research activities at the Agency for Marine and Fisheries Research

Agus Setiawan gave a report on the Institute for Marine Research and Observation (IMRO) which falls under the under the Indonesian Ministry of Marine Affairs and Fisheries. IMRO has a mandate to conduct strategic research and development utilizing ocean remote sensing data and ocean numerical models to support the development of marine and fisheries sectors in Indonesia. The ocean remote sensing group use satellite data and *in situ* data combined with modelling for forecasting potential fishing grounds, identifying of suitable areas for mariculture and marine protected areas, ocean carbon flux studies, ocean acidification studies, as well as coral reef studies. MODIS data was used to identify and predict phytoplankton abundance, including the abundance of diatoms in the Bali Strait.

2.0 Related Ocean Colour Initiatives

2.1 Update on ESA's CoastColour Project since last meeting

Roland Doerffer outlined the progress of ESA's CoastColour Project. There had been three CoastColour User Consultation meetings to date, with plans for a fourth meeting at the end of the project. The project cooperates with several IOCCG working groups (Uncertainties, HABs, algorithm round-robin and the OCR-VC) as well as LOICZ, GEO and POGO. The project has a large dataset of consistent *in situ* data for validation and for regional algorithm development. Products required by users include improved TOA radiances (L1), water-leaving reflectances (L2) and water parameters (optical properties, Chl, TSM etc.). The project also has a large dataset from Chesapeake Bay and other special interest areas such the Tagus Estuary (high concentrations of detritus so difficult to derive Chl concentrations), and Polar regions, for example the Kara Sea (very high absorbance of yellow substances).

A number of algorithms of different types were inter-compared by the group using a test data set, with a wide range of results. A near-real time data service was provided for participants of the CoastColour Project, starting in November 2011, with data being disseminated within 24 h of acquisition. Final algorithm implementation should be completed by March 2012, to be followed by final product generation and validation. A final meeting of the CoastColour group is tentatively scheduled for June 2012, to be followed by the 4th CoastColour User Consultation meeting at the end of 2012 or beginning of 2013. A lot of work has been carried out by the project in a very short time frame. In response to a question about the potential for continuing forward stream processing, Peter Regner pointed out that since the project was carried out in the frame of the Data User element, the goal of the project has been achieved i.e. to demonstrate and promote MERIS capabilities for complex waters, and no further operational processing was planned. All developed regional algorithms will be made available in the BEAM toolbox, and all MERIS 300m L1 and L2 products over all 24 test sites are freely available from the web site www.coastcolour.org.

2.2 Update on ESA's Climate Change Initiative since last meeting

Peter Regner provided an update on ESA's Climate Change Initiative (CCI), a six year program (started in late 2010), the goal of which is to create a complete and consistent error-characterized time series of multi-sensor global satellite ECV products for climate research and modelling that would meet GCOS requirements.

13 Essential Climate Variables (ECVs) have been chosen to be addressed in the first phase of the program. The Ocean Colour CCI project is led by Shubha Sathyendranath, supported by a large team. The OC CCI is now well into its second year and has established well-informed user requirements, clearly defined data requirements, and global satellite data product specifications directly traceable to the high-level GCOS requirements.

In an algorithm round-robin some 20 candidate algorithms (4 atmospheric correction and 16 in-water algorithms) have been tested and an objective strategy for algorithm selection has been developed based on a number of qualitative criteria as well as match-ups of *in-situ* measurements from the MERMAID database. For the in-water algorithms, scatter plots were used to statistically compare the results with *in-situ* observations in the NOMAD archive. The results from the various comparisons did not yield a single clear winner as all algorithms performed reasonably well, although none reached the GCOS requirements.

For the atmospheric correction, a Gordon and Wang type algorithm (as implemented into SeaDAS) has been selected for the American sensors (SeaWiFs and MODIS) and Polymer, a French development, for MERIS. For the in-water algorithms, both the NASA band-ratio algorithms and the model-based QAA1 algorithm were selected. The possibility of further algorithm improvements will be explored and a second in-water Round-Robin will be carried out this year to evaluate the algorithms further, using an independent *in situ* dataset apart from NOMAD.

The project will also address data merging to produce a consistent, multi-sensor Level-3 data product combining data records from SeaWiFs, MODIS-A and MERIS. Depending on the algorithm used, the merging may also be used for bias-correcting and gap filling, and may also provide error estimation. The data merging definition phase is being led by Frédéric Mélin (EC/JRC). A number of different merging techniques are being compared, each with very different computational complexity.

2.3 Report on PFT intercomparison meeting

Nick Hardman-Mountford reported on the IOCCG-endorsed PFT intercomparison workshop which took place in Japan (22-23 November 2011). In recent years there has been a growth of papers determining multiple phytoplankton functional types (PFTs) or phytoplankton size classes (PSCs), using a variety of approaches, input data types and validation requirements. The objectives of the workshop were to bring together the international community working on satellite and *in situ* phytoplankton-type identification in an effort to understand the range of approaches being developed, and to provide a framework for a community algorithm intercomparison exercise. Discussion sessions addressed the definition of PFTs/PSCs, including diagnostic pigment approaches as well as size-structure approaches, and the compilation of a common *in situ* data source. A dataset for the project will be assembled over the next year, matching up data types to data sets. Intercomparison procedures and metrics were also discussed (temporal and spatial scales addressed, satellite data to be used, polar regions to be treated separately due to uncertainties in the satellite signal). Planned outputs included a user guide to PFT algorithms (draft to be ready by June 2012), the compilation of an *in situ* PFT data set, the intercomparison of algorithms (spatial and temporal), and the validation of the intercomparisons using *in situ* data. Another meeting of the group will take place at Ocean Optics in Glasgow (October 2012). A meeting report has been published in EOS (Hirata T, Hardman-Mountford N, and Brewin RJW (2012), Comparing satellite-based phytoplankton classification methods. *Eos Trans. AGU*, **93**(6): 59, doi:10.1029/2012EO060008).

2.4 CSA FARO Project (ChloroGIN and SAFARI Programs)

Venetia Stuart outlined the CSA-sponsored FARO Project (Fisheries Applications of Remotely-Sensed Ocean colour) which is a marriage of two GEO Initiatives in ocean colour: the SAFARI Project and the ChloroGIN Project. A FARO Secretariat has been established at the Bedford Institute of Oceanography, Canada. Both the SAFARI and ChloroGIN programmes are working towards the global dissemination of satellite ocean-colour data for use in fisheries research and other societal benefit areas, and both are included in the CEOS Ocean Colour Radiometry Virtual Constellation (OCR-VC) as the type of programs the OCR-VC will require to meet its objectives. The background and recent activities of the SAFARI and ChloroGIN projects was summarized, including the international ChloroGIN Workshop held at the Bedford Institute of Oceanography (9-11 August 2011), and the publication of an ICES Special Issues (March 2011) from the International Symposium on Remote Sensing and Fisheries. Upcoming activities include a workshop on Applications of Ocean-Colour Radiometry for the Study of Marine Ecosystems, Including Fisheries (Nanaimo, BC, Canada 20-22 March 2012) and tentative plans for an international FARO Symposium in conjunction with the POGO-led Initiative of GEO entitled Oceans and Society: Blue Planet, to precede the GEO Plenary (Foz de Iguazu, Brazil, 22-23 Nov 2012). The project also hoped to publish a book entitled *Satellite Biological Oceanography*, although the previous editor had stepped down and new editors would have to be found.

2.5 Update on GEO activities

Steve Greb presented a summary of the Inland and Near-Coastal Water Quality Remote Sensing working group, which was established in 2007 to address global water quality monitoring (part of GEO task WA-08-01 on Integrated Products for Water Resource Management and Research). A new component is the Global Water Quality Products and Services which aims to integrate water quality data from multiple sources through assimilation of Earth observation data with other sources of data such as hydrodynamics, and biogeochemical modelling, to generate higher level information products. A proposal has been submitted to EU COST (European Cooperation in Science and Technology) but was rejected, so it would be reviewed and re-submitted. Lakes have been added to ChloroGIN as a demonstration project to evaluate existing lake algorithms. A demonstration project on monitoring water quality in Lake Nicaragua using satellite data was also presented. The group had also received funding approval to run workshop on Remote Sensing of Near-Coastal and Inland Water at the University of Wisconsin (20-22 June 2012). The goals of the WS are to provide an overview of

the state of the science and to identify pressing needs for the advancement of remote sensing in optically complex waters.

3.0 Updates on IOCCG Scientific Working Groups

3.1 Harmful algal bloom working group

Stewart Bernard outlined the progress of the IOCCG HABs working group, which had held two WG meetings. The first meeting took place in South Africa (August 2010) and the second in Milan, Italy (December 2011). A core aim of the WG is provide a resource that improves communication between the ocean colour and harmful algal bloom scientific communities, and also addresses the needs of non-specialists. The GEOHAB comparative ecosystem approach can be used to classify ocean-colour techniques with regard to major organism type, impacts, geographical distribution and ecological function. Case studies will form a valuable component in demonstrating ocean-colour utility and performance.

The draft monograph outline includes an introduction, a chapter on HABs and ecosystems (including the GEOHAB science plan), a chapter introducing ocean-colour algorithms and technical issues, then a chapter on using ocean-colour remote sensing to detect phytoplankton biomass and community dynamics (including PFT techniques and other approaches). The last chapter will include a number of case studies reclassified by impact rather than by the algorithm used or type of HAB (e.g. toxin producers, fish killers, anoxia inducers, ecologically disruptive algal blooms). The two primary deliverables of the WG will be an IOCCG/GEOHAB monograph, followed by a special issue in a peer-reviewed journal (potentially Marine Ecology Progress Series). The aim is to complete the first draft by June 2012, hold an editorial meeting August 2012, and finish the monograph by the end of 2012.

Nick Hardman-Mountford pointed out that there was a fair amount of overlapping of methodology with the PFT WG and queried whether the two WGs should be merged. Stewart noted that he had held discussions with Shubha Sathyendranath (Chair of the PFT WG) and was aware of what they were doing. Most of the PFT methods look at the global ocean whereas most HABs are anomalies. The biophysical algorithms might work in HAB-type situations, but the abundance ones would not work and have no application. The Chairman recommended that the two working groups be kept separate.

3.2 Uncertainties in ocean-colour remote sensing

Roland Doerffer introduced the IOCCG WG on “Uncertainties in Ocean-Colour Remote Sensing”, which was established in October 2011 with two co-chairs: Roland Doerffer (HZG/BC, Germany) and Frédéric Mélin (JRC, Italy), and seven other members namely Marc Bouvet (ESA), Prakash Chauhan (ISRO), Stephanie Dutkiewicz (MIT, USA), Hiroshi Kobayashi (Japan), Ewa Kwiatkowska (EUMETSAT, EU), Menghua Wang (NOAA, USA) and Jeremy Werdell (NASA, USA). An additional member could be added, if necessary. The Terms of Reference were summarized and a draft timeline outlined. A password-protected Wiki would be established in February 2012 as the main working place for the WG to be used for information exchange and collection of material. Contributions will be collected in March/April 2012, a WG meeting is scheduled for May/June 2012, the first draft of an IOCCG report should be ready for review by October 2012, and a second version ready in time for the IOCCG-18 meeting. A final version of the report should be ready by summer 2013.

The report outline contains a general introduction, a chapter on the many and varied sources of uncertainty (e.g. calibration, sun glint, white caps, cloud cover etc.), a chapter on how to estimate uncertainties, a conclusions chapter summarizing the most robust variables, and a chapter on recommendations (how to include uncertainties in different products). Dr. Doerffer also introduced the Water Radiance project (13 participants and 2 advisors), the goals of which are to compile the latest results on pure water optics.

3.3 Mission requirements for future ocean-colour sensors

Paula Bontempi summarised the progress of the “Mission Requirements for Future Ocean-Colour Sensors” WG, which is moving forward quickly. A second draft of the report was distributed to the IOCCG Committee in February 2012 and a final version would be ready by mid-2012. The report is built around a Science Traceability Matrix (STM) and is a follow-on to IOCCG Report 1 (which focused on chlorophyll). Technology has evolved and new products and science questions are now available. The science questions covered general topics such as marine ecosystems and biogeochemical cycles, highlighting critical requirements. An example was given of the mapping of scientific questions to ocean-colour satellite data products needed to address the questions. The WG came up with 22 important products which were defined, and the range of observed geophysical parameter values given. A set of recommended spectral bands required for addressing all the STM questions was also defined. Recommendations were also given for pre-launch sensor characterisation, on-orbit sensor calibration, spacecraft/orbit considerations, field programmes and data processing and distribution (data products available within 3 months, open data access for research, full archiving, reprocessing every 2 years). The report also contains a chapter on International Cooperation with links to CEOS and INSITU-OCR. The conclusions chapter encourages new ocean-colour instruments to focus on global retrievals to support research and management objectives. This report should be “living” in the sense that science drives the instrument and mission requirements.

Jim Yoder queried the focus on 1-km spatial resolution which is too low for coastal regions. Paula noted that the cost for global observations at 300 m resolution would be enormous, but the WG would investigate some bands being dedicated to higher spatial resolution. Jim Yoder also recommended a 1% pre-launch calibration plus a vicarious calibration.

3.4 Standing WG on ECV assessment

Jim Yoder outlined the formation of a new type of IOCCG WG, i.e. a standing WG (no fixed term), approved at the last Executive meeting. Nicolas Hoepffner and Jim Yoder have agreed to co-chair the standing working group on “Essential Climate Variable (ECV) Assessment”. Other WG members are being discussed. The goal of the WG is to undertake a critical comparison of ocean-colour ECV data products and provide confidence limits for the establishment of a long and coherent time-series of global ocean-colour ECV products. The Terms of Reference were outlined and it was noted that the group will not be considering coastal products. There was some concern about duplication of efforts since ESA’s CCI Project seems to be doing something similar, and not just for ESA sensors but also for NASA instruments. The ECV working group will focus on the most useful aspects avoiding overlap. David Antoine suggested that the group start with a comparison of the ECV time series produced by various agencies and analyse why there are differences. Paula Bontempi pointed out that the standing WG should also be able to respond to requests from GCOS or to issues from GEO.

3.5 Intercomparison of retrieval algorithms for coastal waters

Kevin Ruddick presented an update of a proposal for a Round Robin Intercomparison of Retrieval Algorithms for Coastal Waters (CWRR). The WG had not yet kicked off officially, but there was a lot of action on algorithms in coastal waters. The objectives are to understand how algorithm performance relates to algorithm design/calibration. It is likely that there will be progress towards a consensus algorithm or approach, rather than one algorithm. The scope of the exercise will include Chl, TSM, Kd, euphotic depth and IOPs derived from hyperspectral sensors as well as generic sensors. The revised proposal included a comparison of algorithms for coastal water products and inland waters (if *in situ* data available) but not Case 1 or shallow waters. The revised Terms of Reference for the CWRR working group were also reviewed with the revised timeline (kick-off meeting at the Liège Colloquium in May 2012, final report delivered in June 2013). CoastColour provided a good start to the work which will carry on after the end of CoastColour using a new simulated data set.

3.6 In-flight calibration of satellite OC sensors

Robert Frouin reported on the goals of the “In-flight calibration of satellite OC sensors” WG, which are to review techniques for radiometric calibration of ocean-color sensors while they

operate in orbit and to provide recommendations on how to meet calibration requirements for science applications. The final report will be dedicated to Andreas Neuman who was very much involved in the early days of the WG. The report is long overdue but the techniques and capability are still not fully exploited by space agencies. The report is divided into the following chapters: introduction, a chapter on definitions, a chapter on techniques that utilize onboard calibration devices, a chapter on techniques that use natural Earth targets plus a chapter on recommendations. All techniques are presented in detail with their accuracy, advantages and application examples. The report is almost complete although some sections are still missing e.g. solar, lunar and spectral calibration, as well as a section about other radiometric considerations (transfer to orbit, polarization and linearity). More emphasis will be placed on sensor inter-calibration. Everyone should agree on the final recommendations. The requirements for water-leaving radiance were written as 5% but this should be discussed and refined. The report also addresses redundancy of techniques, selection of calibration sites and “purely radiometric” versus “system” vicarious calibration.

Menghua Wang recommended that the report should also focus on past experience regarding calibration. Ewa Kwiatkowska noted that a clear prioritisation was required (what should be used to achieve the required accuracies). Paula Bontempi pointed out that the L1 Mission Requirements report refers to this calibration report, but was purposely not very detailed. It is important that the two reports are published around same time and that they send out consistent messages. The calibration report is very important, and additional authors are required to finish the remaining chapters. The Committee recommended that the publication of the Mission Requirements report be delayed until the calibration report is ready.

3.7 Ocean-colour remote sensing in Polar Seas

Marie-Hélène Forget presented a report from the WG on “Remote Sensing of Ocean Colour in Polar Seas”, co-chaired by Marcel Babin, Kevin Arrigo and Simon Bélanger. Limitations of using ocean-colour remote sensing in polar seas include low sun elevation, ice-related adjacency effects, a pronounced deep Chl maximum related to stratification, cloud cover, and optical peculiarity. The WG had 14 members from 5 different countries. The Terms of Reference had been accepted after the first WG meeting which was held in Quebec City (10-11 November 2011) where an outline of the report was drafted. Contributors of each chapter plan to communicate via regular conference calls. A second meeting of the WG is planned for June 2012 (since moved to August 2012). The group hoped to have a first draft of the report by October 2012 and also planned to publish a summary paper in an international journal. The IOCCG report is divided into 6 chapters as follows: 1) introduction, 2) description of the polar environment, 3) from TOA to the ocean sub-surface, 4) IOPs, AOPs and ocean-colour algorithms

5) primary production, 6) recommendations. Marie-Hélène also presented a few slides on a proposal for a Canadian Ocean Colour Network (COCN) which had been submitted to CSA. Roland Doerffer suggested including Dmitry Pozdnyakov as a member of the WG, so that the data from the Siberian coast (dominated by CDOM) could also be used.

3.8 Phytoplankton functional types

David Antoine presented the progress of the PFT WG on behalf of Shubha Sathyendranath who was unable to attend the meeting. A lot of progress had been made on the report in 2011. The report contains 5 chapters and a complete first draft was available for chapter 1 (introduction), Chapter 2, on *in situ* methods of measuring PFTs, was almost complete and good progress had been made on Chapter 3 (detection of single algal blooms by remote sensing). The first complete draft of Chapter 4, on detection of phytoplankton size structure by remote sensing, is expected in March 2012 and will build on the results from the Intercomparison workshop held at the end of 2011. Good progress had also been made on Chapter 5 (methods for detecting multiple functional types). A complete draft report was expected by mid 2012 and the group will meet opportunistically at the Ocean Optics 2012 meeting.

4.0 Update on OCR-VC Activities

4.1 Strategy document for Climate Data Records

David Antoine summarised the strategy document for Climate Data Records (CDRs), which was related to many items on the agenda. This concept was first presented at IOCCG-15 (2010) and a draft strategy document was circulated in January 2011. The overall logic is that there are a number of OC missions producing CDRs but is this enough to ensure CDRs of desired quality? The document proposes a number of short term and longer term actions. Actions proposed include:

- Summer Lecture Series which will start in July 2012 (see agenda item 7.1)
- Standing WG on ECV assessment which is now ramping up (see agenda item 3.4)
- International OC community consultation meeting which is in the planning stages (see agenda item 4.4)
- IN SITU OCR which is making good progress (see agenda item 4.3)
- A standing WG to develop training material, which is now on hold (see agenda item 7.4)
- Other long-term actions that may be implemented by agencies e.g. global data assembly centers and long term storage facilities.

The document will be finalised by mid-2012 incorporating all comments and suggestions. Paula Bontempi suggested that a logical task for the ECV WG could be to review the CDR strategy document to make sure that everyone agrees on the content and consistency. The ECV group could also track agency progress as well as larger inter-agency documents, and respond to

requirements in the GCOS implementation plan. It is important that responses in all documents are consistent.

4.2 Current status of the CEOS OCR-VC Implementation Plan

Paula Bontempi outlined the status of the CEOS OCR-VC Implementation Plan, highlighting the changes/updates since the last meeting. The OCR-VC is co-chaired by Paula Bontempi, Prakash Chauhan and Peter Regner, who all work as a team to address issues that arise. They also consult with the previous co-chairs, Mark Dowell and Hiroshi Murakami. Mike Freilich (NASA) recently took over as Chair of SIT and there is a long list of meetings that may require CEOS attendance. Accomplishments and future plans include the establishment of the WG on evaluation of ECVs (to answer requests from CEOS to evaluate ECVs; to be done in an independent, systematic and recurrent way), the development of the INSITU OCR and associated White Paper, and the plans for an international ocean-colour community consultation meeting. It was recommended to SIT that agencies were expected to support such WGs. Another action that all agencies should respond to is the CEOS MIM (Mission, Instruments and Measurements) database. Perhaps the ECV WG should respond to what should be included in the GCOS Implementation Plan and also the MIM. The new CEOS chair intends to conduct regular “listening sessions” with all VCs to discuss concerns and help resolve issues. The next SIT meeting takes place in San Diego (March 2012) - Mark Dowell will present the OCR-VC.

To better engage with GCOS, Stewart Bernard suggested that a short document be produced explaining that the errors associated with biological systems are perfectly acceptable. Stephanie Dutkiewicz noted that the new IPCC models were using carbon for the first time, and that PAR was also important. Stephanie agreed to provide feedback to Paula regarding requirements.

4.3 INSITU-OCR White Paper and other developments

Paula Bontempi reported on the INSITU-OCR White Paper, which is working toward high accuracy and consistency of essential climate variables from multiple satellite ocean-colour missions. The components of the INSITU-OCR will include a core office with agency representatives that would liaise with missions and get feedback from the other components (product and algorithm validation, data processing software, consistent products and algorithms, a common calibration strategy for all missions, and collection of required *in situ* data). An INSITU-OCR workshop was held in February 2012, co-lead by Giuseppe Zibordi (EC/JRC) and Sean Bailey (NASA/GSFC). They were tasked to prepare a White Paper for the development and implementation of the INSITU-OCR. The workshop was attended by eight representatives from eight different agencies. Topics for discussion included (i) space sensor radiometric calibration, characterization and temporal stability; (ii) development and assessment of satellite products; (iii) *in situ* data; and (iv) information management and support. The group came up with 32 general and specific recommendations for space agencies toward the generation, continuity, high accuracy and traceability of time series of satellite

ocean-colour products (ECVs), satisfying requirements for climate change applications (e.g. climate models).

The co-leads will consolidate the recommendations from the writing team and the report will be presented at the NASA OCRT meeting in Seattle, WA (23-25 April 2012). The final report, a 10-15 pg White Paper representing a strategic plan for the INSITU-OCR, will be ready by May 2012. There was also consensus that the White Paper could be expanded into a chapter for the Calibration Report, led by Robert Frouin. Meeting participants concurred that the INSITU-OCR would be useful for the whole ocean-colour community. The first step is to set up a core office, and then examine what is already being funded. Menghua Wang pointed out that the White Paper is not only for *in situ* data, but also includes data from sensors to products. He thought that the acronym INSITU-OCR was not really appropriate and perhaps a new name should be considered, although Paula Bontempi pointed out that the name had already been proposed to CEOS so would be difficult to change at this stage. Peter Regner noted that the recommendations from the group are quite sensible, and go far beyond in-water components. Paula reiterated that the Calibration WG should coordinate with the INSITU-OCR group, which could help provide the missing sections for the Calibration Report.

ACTION 17/1: ROBERT FROUIN TO COORDINATE WITH THE INSITU-OCR GROUP REGARDING FINALISING THE CALIBRATION REPORT.

4.4 IOCCG international ocean-colour science meeting

David Antoine spoke about the planned IOCCG community consultation meeting, which is scheduled to take place in 2013. The meeting will provide a forum for discussions on various topics (an extended “town hall” meeting) thus reinforcing the scientific ocean-colour community, and may also help IOCCG in its oversight role. Furthermore, it will engage more people in the community than is feasible through IOCCG meetings, thus reinforcing the community voice when it comes to high-level agency discussions. The meeting will be sandwiched between a NASA OCRT meeting and an ESA meeting, to reach both the North American and European communities. The IOCCG has submitted a proposal to NASA for augmentation of the current NASA grant to IOCCG/SCOR, to support the meeting. A short session will also be held at the 2012 NASA OCRT meeting (April 2012) and at the ESA Envisat/S3 meeting (October 2012) to make people aware of the upcoming meeting in 2013, and to get comments on the organization, for maximum benefit to the community. Sessions will include IOCCG accomplishments since inception as related to global ocean-colour CDRs, examples illustrating international collaboration, and discussion sessions to ascertain what people expect from such a meeting (organisation, content, output etc.). The international meeting will target the academic community as well as management, environment agencies, policy makers, agency representatives and water quality managers. In addition, people working in the ground

segment, instrument manufacturers and software developers will be encouraged to attend. The Chairman requested suggestions for new topics, splinter sessions and invited talks.

ACTION 17/2: IOCCG MEMBERS ENCOURAGED TO SUBMIT SUGGESTIONS FOR DISCUSSION TOPICS, SPLINTER SESSIONS AND INVITED TALKS FOR THE PLANNED INTERNATIONAL OCEAN-COLOUR SCIENCE MEETING.

4.5 CEOS Carbon report for the ocean domain

Nicolas Hoepffner gave a talk on behalf of Shubha Sathyendranath who is leading the writing team for the report. CEOS has agreed to respond to the requirements for satellite observations laid out in the GEO Carbon Strategy Report of 2010, which outlines the long term plans for monitoring and modelling carbon in different domains (land, ocean and atmosphere). CEOS established the Carbon Task Force (CTF) to coordinate the response from space agencies taking into account UNFCCC and IPCC requirements and the GCOS and GEO Implementation Plans. The Carbon Task Force is co-lead by JAXA and NASA, with Shubha Sathyendranath as the domain lead for the oceans.

Four CTF meetings have taken place since 2010 and a draft ocean chapter was sent to the writing team as well as the IOCCG Committee in February 2012 for comment. The document will be reviewed at the SIT meeting in San Diego (29-30 March 2012) and the report will be finalised and released by the end of the year. Comments from IOCCG members were welcomed. The report includes sections on why the oceans are relevant (carbon pools and fluxes, C- pumps, carbon in the marine food web and not only in greenhouse gases, coastal systems) and the role of satellites in monitoring the ocean carbon cycles (multiple scales and long time series, assimilation in models, importance of *in-situ* data). The report also contains extensive tables listing the products along with inputs required to get the products as well as satellite sensors. The report also contains a section on recommendations. IOCCG Committee members were requested to provide feedback on the recommendations and the focus of the report.

5.0 Agency Contributions to the OCR-VC Implementation Plan

5.1 JAXA: GCOM-C/SGLI new developments

Hiroshi Murakami reported on the new developments of JAXA's SGLI mission. The launch date of GCOM-C has been delayed to May 2015. Algorithms are being developed and the schedule for the ground segment is being maintained. SGLI hardware development is also well underway. A number of sites for cross-calibration are being examined including high reflectance areas. Standard products (Chl, suspended solid, CDOM) as well as research

products (IOP, E_{2D} , PFT, red tides) will be developed. The first draft algorithms have been provided to JAXA by PIs and they are currently being evaluated (ATBD, codes etc.). JAXA will start operational testing of these codes in cooperation with the PIs, using test data (*in-situ* data and simulated satellite images with SGLI format). The basic observation modes of SGLI are 250-m and 1-km, although the 250-m mode is limited by downlink data volume per path. A strategy is being devised for the different modes: the area over Japan area will receive 250-m mode for NRT use, and coastal areas will also receive 250-m data. The coastal area is defined by $\text{MAX}\{\text{continental shelf} + \text{edge}, 200 \text{ sea-miles} (=304\text{km})\}$ covered by any part of the SGLI-IRS swath (1400 km). Small islands will be set to the “offshore” mode.

5.2 KORDI: GOCI-I and II mission updates since last meeting

Joo-Hyung Ryu gave a presentation on GOCI on behalf of Yu-Hwan Ahn. The GOCI detector has been stable since launch (June 2010). A lot of progress had been made on GOCI over the past year. GOCI’s data service (including the GDPS software) had increased to 690 users, with a NRT data service to 16 domestic institutes and departments. A successful GOCI PI workshop was held in KORDI in January 2012 and was attended by over 150 people. GOCI is the world’s first geostationary ocean-colour imagery, with 500-m spatial resolution and a temporal resolution of 1 h. Updates on the mission since the last meeting include a 2-D staring-frame capture mode, which can achieve high optical performance (SNR and MFT etc.) and high spatial resolution (500 m). The Inter-Slot Radiometric Discrepancy (ISRD) is an image quality issue visible in GOCI images (slope discrepancy). A simple ISRD correction model has been tested and looks promising. Further testing and improvements are required before implementation into the processing chain.

Comprehensive and consistent calibration and validation procedures are undertaken to provide quantitative control of the standard GOCI products. For the coordination of the GOCI Cal/Val activities, KOSC is organizing the GOCI Cal/Val Advisory Group, comprised of domestic and international experts. *In situ* measurements have been collected from diverse areas using research vessels, buoys and ocean research stations. An improved version of the processing software (GDPS Ver 1.1) will be released in April 2012. A number of different GOCI applications were shown, including hourly variations in suspended sediments with tidal changes, oil spill monitoring in Bohai Bay, food waste dumping, and monitoring green tides, sea fog, sea ice and yellow dust.

Development of the next generation GOCI-II mission, on board the GeoKompsat-2B satellite, will start next month, under the Ministry of Land, Transport and Maritime Affairs. GOCI-II is scheduled for launch in 2018 and is focused on coastal and global ocean environment monitoring with a higher spatial resolution (less than 250 m) and spectral performance, and 12-15 spectral bands (TBD). GOCI-II will have a new capability to select user-defined observation areas, and will perform observations 8 times per day, the same as GOCI. The main difference between GOCI-II and GOCI is the global-monitoring capability, which will meet the requirements for climate change monitoring and research. Daily global observations are planned for GOCI-II.

5.3 ESA: Updates on MERIS and Sentinel-3 development

Peter Regner provided an update on ESA's Envisat/MERIS and the future Sentinel-3 mission. Envisat has been in orbit for 10 years and was still performing well and delivering high quality data at the time of the meeting. Since October 2010 the mission has operated in a different orbit, which has resulted in a small orbit drift over time, but was necessary to extend the mission. Fuel availability is larger than expected, so a further extension of mission operations is technically feasible until mid-2015. Envisat mission extension was approved until the end of 2012 and funding has been requested from the member states for 2013. There was no negative impact of the orbital manoeuvre on the instrument. The MERIS 3rd reprocessing was completed last year and the full data set is now available (29 April 2002 to present). The reprocessing had an impact on both L1 and L2 data. There are plans for 4th reprocessing in 2013 (TBD), which will be further discussed at the MERIS workshop in October 2012.

Steps are being taken to integrate SeaDAS and BEAM. The SeaDAS IDL front-end is being migrated to the BEAM Java based GUI in collaboration with NASA OBPG and BEAM developers. The joint SeaDAS 7/BEAM4.10 will be released in May 2012 and represents one step towards harmonisation of data analysis tools in a multi-sensor context.

Sentinel-3 is an operational mission in high-inclination, low earth orbit. Full performance will be achieved with two satellites in orbit. The instruments flown include an ocean colour and global land mapping instrument (OLCI) continuing MERIS-type measurements, an infrared radiometer (AATSR type SST and land mapping instrument) and a radar altimeter package. The scheduled launch date of Sentinel-3A is Q4 2013, with Sentinel-3B being launched 18 months later. EUMETSAT is in charge of the operation of the OLCI marine observations. A Sentinel-3 calibration and validation planning meeting will take place in March 2012. The same methodologies, tools and infrastructure will be used for Sentinel-3 cal/val as for MERIS, using a MERMAID-like match-up database as a central tool for validation. Dedicated instrument Quality Working Groups (QWGs) will be established to advise the mission on instrumental/algorithmic evolution.

5.4 NASA: Updates on current and future NASA missions

Paula Bontempi reported on the developments of various NASA missions. SeaWiFS ceased operations in February 2011, and one further reprocessing was expected to maintain consistency with refinements in MODIS algorithms and product suites. NASA does not have any HRPT data collected after the end of NASA's contract with GeoEye in 2004. IOCCG member agencies and institutes were requested to negotiate with GeoEye for a broad release of SeaWiFS data to GSFC, using a contact address at GeoEye to be provided by Paula Bontempi.

ACTION 17/3: PAULA BONTEMPI TO OBTAIN DETAILS OF A CONTACT PERSON AT GEOEYE, AS WELL AS A LIST OF INSTITUTES THAT ACQUIRED SEAWIFS DATA FROM HRTP STATIONS AFTER 2004.

ACTION 17/4: IOCCG AGENCY AND INSTITUTE REPRESENTATIVES TO CONTACT GEOEYE TO REQUEST A BROAD RELEASE OF SEAWIFS DATA, COLLECTED FROM HRPT STATIONS AFTER 2004, TO GSFC.

In 2011 MODIS-Aqua ocean-colour products showed a large increase in water-leaving radiances for the short wavelengths (412nm and 443nm) because of calibration issues (corrections to standard lunar and solar diffuser calibration are only available until the end of SeaWiFS in December 2010). A new approach using desert sites as a calibration source seems to remove most of the erroneous trends. A reprocessing of the MODIS-Aqua ocean-colour data is expected in the near future (2012).

NASA is also responsible for evaluating NPP VIIRS data. VIIRS is performing well aside from a rapid decrease in key NIR and SWIR band responses, suggesting that components of the calibration system may be degrading faster than expected. Calibration is still a work in progress. NASA is generating VIIRS evaluation products for comparison with ocean-colour environmental data records, and the data look reasonable. Full functionality is expected by mid-March 2012. The mission will be handed over to NOAA within 4 months.

The next ocean-colour mission with a budget line is PACE (Pre-Aerosol, Clouds, and ocean Ecosystem Mission). The PACE mission will make global ocean-colour measurements to provide extended data records on ocean ecology and global biogeochemistry (e.g., carbon cycle) along with polarimetry measurements to provide extended data records on clouds and aerosols. The target launch date is the end of 2018. An Announcement of Opportunity (AO) would be released by November 2012.

Other planned NASA missions and instruments include (i) ACE (unrelated to PACE), an aerosol-cloud and ocean ecosystem mission with a payload that currently considers an ocean-colour multi-channel spectrometer as well as instruments to detect cloud and aerosol properties; (ii) the GEO-CAPE mission (beyond 2022 timeframe), a geostationary mission addressing coastal air pollution, focussing on short term processes (diurnal rate changes in primary productivity, tides, currents etc.) tentatively with 375 m spatial resolution, hourly sampling and UV to NIR spectral bands; (iii) the HysPIRI decadal survey mission concept, a Landsat-type instrument with capability for ocean-colour retrievals (60 m spatial resolution, 10 nm hyperspectral bands); and (iv) PRISM (Portable Remote Imaging SpectroMeter) - a new validated airborne facility instrument to identify constituents and quantify properties of complex coastal ocean waters using spectroscopic measurements with UV to SWIR channels.

NASA has also funded a field program support office for 5 years which could potentially support the INSITU-OCR. In addition, NASA is willing to provide common objective research announcements outlining the research that needs to be done to deliver INSITU-OCR objectives.

5.5 NOAA: Update on NOAA contributions to the OCR-VC

Paul DiGiacomo provided an overview of upcoming NOAA operational OCR products including MODIS-Aqua SWIR-based coastal ocean-colour products, MODIS-Terra Gulf-of-Mexico products, global MODIS-Aqua *E. huxleyi* bloom maps (June 2012), a MODIS-Aqua chlorophyll frontal product (July 2012) and NOAA Unique NPP OCR products (2013-2014). Menghua Wang has been working on the development of a TSS product for Chesapeake Bay which will eventually be operational. NOAA has also been collaborating with GEO-CAPE and PACE/ACE scientists. In addition, NOAA CoastWatch has been distributing NRT MERIS products, and there is active collaboration with GOCI, Sentinel-3, OCM and SGLI scientists.

Early VIIRS results appear promising and NOAA is assessing the impact of the VIIRS degradation anomaly (resulting from tungsten contamination on mirrors). The JPSS Algorithm Development Library (ADL) provides the science community with a simple method for testing and proving algorithms to be used in the Interface Data Processing Segment (IDPS) for VIIRS data processing. NOAA's Comprehensive Large Array-data Stewardship System (CLASS) is the official NPP data archive. VIIRS data will be made publically available after approval by NPP project scientist (~spring 2012). The NDE Project (NPOESS Data Exploitation) is focussed on NRT product delivery to the operational user community as well as the generation and dissemination of tailored NPP Data Records. CoastWatch is another NOAA data portal which will distribute coastal U.S. VIIRS data (spring 2012) as well as global VIIRS ocean-colour data (summer 2013). Since 23 February 2012, the NPP mission has broadcast instrument data real-time via the satellite High Rate Data (HRD) antenna. The HRD link provides global users direct access to instrument data, free of charge.

Menghua Wang addressed VIIRS calibration issues. Weekly updates of LUTs should improve the situation and take degradation effects into account. MOBY is required for vicarious calibration and a newly calibrated MOBY was deployed on 17 December 2011. MOBY (including main optical parts) is 20 years old and requires a technology refresh. A funding request has been submitted to the JPSS Program to replace MOBY optics and control system, originally planned for February 2012, but the funding is still uncertain. The current instrument operation will become increasingly risky without refresh due to system age and reliability issues.

If the degradation on VIIRS could be resolved within a year, the SNR should be within specifications. Preliminary results suggest that NPP VIIRS can potentially provide good quality ocean-colour products. Jim Yoder agreed that VIIRS has potential, but given the path that NASA and NOAA are going down, it will fail to produce science quality data. He queried whether there was any chance of reconsideration. Paul DiGiacomo assured him that NOAA will work

with NASA colleagues to ensure the best quality products from VIIRS. Paula Bontempi pointed out that it was essential for the instrument to be appropriately calibrated and characterised, but this could not be achieved by an operational agency. According to Jim Yoder the National Academy of Science is examining ways to improve this situation.

5.6 EUMETSAT: development of ocean-colour services

Ewa Kwiatkowska informed the committee about EUMETSAT's ocean-colour services. EUMETSAT is a European space data provider for weather, operational oceanography and climate and also redistributes relevant data from third party missions (NOAA, ISRO, Chinese SOA). ESA is leading the development of the Sentinel-3 space and ground segments while EUMETSAT's mandate is to process and distribute instrument data and marine products, monitor and control the Sentinel-3 platform and payloads (S-3A and S-3B) and provide support to the marine user community. A set of core Sentinel-3 optical geophysical products will be distributed operationally by EUMETSAT. Sentinel-3 data will be disseminated using EUMETCast direct broadcast, and there will also be a long-term data archive as well as on-line data access (Operations Internet Servers (OIS) rolling archive). EUMETSAT will support ESA in defining the calibration and validation plan.

Feedback was requested from IOCCG on many issues including vicarious calibration source requirements, stability (calibration model revisions), the frequency of full mission reprocessing, timeliness (near real time vs. NTC) and data policy (satellite data and validation measurements).

5.7 ISRO: Status of OCM data products and data access

Prakash Chauhan gave a brief overview of the status of Oceansat-2 OCM (launched 23 September 2009), a global mission configured to cover global oceans and provide continuity of ocean-colour data, along with global wind vectors and characterization of the lower atmosphere and ionosphere. Standard L2 products include chlorophyll, TSM, K_d490 and AOD at 865 nm, while L3 products include weekly, monthly and yearly 4-km binned products. OCM -2 L1B data can also be processed in SeaDAS to L2. A permanent Cal/Val site has been set up near Kavarratti in Lakshadweep Sea to collect *in situ* data for vicarious calibration of OCM-2 radiances. In addition, two lunar calibrations of OCM-2 have been carried out with the help of NASA. OCM-2 products are used to generate Potential Fisheries Zones (PFZ) advisories, in conjunction with INCOIS, a major application in India. GAC data products, including the geophysical products, are being disseminated through the OCM-2 data portal at www.nrsc.gov.in, while LAC data and geophysical products are available from the NRSC Data Centre in Hyderabad, India.

5.8 CNES: Ocean colour developments

Juliette Lambin reported on ocean-colour developments at CNES. Ocean science is of major interest to CNES Earth observation programs and they support a strong scientific community

through dedicated research funding. CNES supports several large scope projects and initiatives (e.g. Mercator-Ocean, CORIOLIS, GODAE, Boussole, BIO-Argo) and is involved in ocean-colour missions such as PARASOL, Sentinel-3 and GEOCAPI. The main objective of PARASOL (launched in December 2004) is to monitor clouds and aerosols, but it also has an ocean-colour observing capability. The mission has been extended up to 2013, providing an additional change of orbit (10 km lower), after which end-of-life preparations will be begin.

The Ocean Colour Advanced Permanent Imager (OCAPI) is still in phase 0 at CNES. OCAPI will be a multispectral imager in geostationary orbit with 250-m spatial resolution, 16-18 spectral bands and 5 min. to 1 h revisit time. The Phase 0 competitive design study has been completed and an extension of phase 0 has been granted (refinement of mission requirements).

There is strong French involvement in the GMES ocean component including cooperation with ESA on Sentinel-3, support for MERCATOR-ocean, formation of a collaborative marine ground segment, as well as support for GIS-COOC, an informal framework for coordinating ocean-colour activities between CNES, CNRS, ACRI and LOV. CNES is also the main contributor to BOUSSOLE although there is some concern as to how these activities can be continued.

5.9 INPE: Argentine-Brazilian SABIA-mar mission

Milton Kampel reported on Brazil's global Earth observation agenda. INPE is a research institute, now located under the Brazilian Space Agency (Agência Espacial Brasileira; AEB). The SABIA-Mar mission is being implemented jointly by CONAE (Argentina) and AEB/INPE (Brazil), and is based on a constellation of two satellites, SABIA-Mar 1 and SABIA-Mar 2. Brazil had been advocating for a global mission, while Argentina wanted a regional mission, which is why there are two missions (one for each). The principal instruments of the SABIA-Mar Mission are two cameras for ocean-colour observation (1-km and 200-m spatial resolution respectively) and bands in the UV, VIS, NIR, SWIR and TIR parts of the spectrum. CONAE will provide the 200-m resolution super spectral camera, the payload platform, the Córdoba ground station and the CONAE Integration and Test Laboratory, while AEB/INPE will provide the 1-km resolution super spectral camera, the multi-mission platform (MMP), the CUIABA ground station and the INPE Integration and Test Laboratory. The mission will have a sun synchronous, nearly circular frozen polar orbit. Commissioning will be completed by 2017 and mission science investigations will be augmented by an Announcement of Opportunity released by CONAE and AEB/INPE at least one year before launch. Data from both missions should be freely available.

5.10 Update on Russian OC satellite missions since last meeting

Dmitry Pozdnyakov gave a brief update on Russian ocean-colour satellite missions. METEOR-3M N^o 1 is the only operating mission with ocean-colour capability. The payload includes the M3 (MCY-M3) multi-spectral scanning sensor with 1-km spatial resolution and 6 spectral channels from 500-12,500 nm. Data from this mission is being stored at a special institute and should be available to users within 1 to 2 years. METEOR-3M N^o 2 is scheduled for launch in

2012 and will carry a similar payload. The Canopus B mission, which aims to monitor technogenic and natural extreme situations, is scheduled for launch in 2012, while the RESOURCE-Π mission is scheduled launch date in late 2012 and will carry a diverse payload of high spatial resolution sensors (an industrial requirement for viewing pipelines etc.).

5.11 Update on Chinese ocean-colour satellite missions

Zhihua Mao gave a brief update on Chinese ocean-colour satellite missions. There are currently four series of satellites for ocean remote sensing in China: the ocean observation HY series, the FY meteorological series, the HJ environment and disaster monitoring series, and the SZ spacecraft series. HY-1B satellite (launched in April 2007) is still working well and carries the 10-band Chinese Ocean Color and Temperature Scanner (COCTS) and the 4-band Coastal Zone Imager (CZI). The HY-2A satellite was launched on 16 August 2011 carrying a number of instruments to measure ocean dynamics (e.g. a scatterometer, an altimeter and a radiometer to monitor SST, sea level, wind speed etc.).

The FY-3 meteorological series, launched in 2008 and 2010 are still in orbit and carry 10 instruments including the Medium Resolution Spectral Imager (MERSI) which has 20 bands including 9 channels for global ocean-colour observations (1-km spatial resolution). The HJ environment and disaster monitoring series has optical satellites and SAR satellites with high spatial and spectral resolution. The sensors on the optical satellite include a wide field multi-spectrum camera with 4 bands (30 m resolution), and infrared scanner and a hyperspectral imager (100 m spatial resolution, 50 km swath). Satellite data from HY1/HY-2, FY-3A/3B and HJ1A/1B can be requested online from various data distribution centers.

Future Chinese satellite ocean-colour missions include the HY-1 C and 1D missions (to be launched together) as well as HY-2B and HY-3A. In addition there will be two experimental FY-3A/3B satellites and 9 satellites for the operational phase.

5.12 OCR-VC wrap-up discussions

Peter Regner raised the issue of proper cal/val, specifically related to MOBY and BOUSSOLE, which were suffering from a lack of funding. David Antoine suggested that the CEOS SIT meetings would be a good venue to stimulate discussions on this topic and bring it to the attention of the principals. Paula Bontempi agreed that the CEOS arena could help resolve these issues. Everyone relied on MOBY but it required upgrading and one agency should not have to bear the burden. Perhaps CEOS could help decide on how to implement the concept of the OCR-VC and how each agency could support specific activities. Each agency has a different mandate but the requirements are the same regarding cal/val i.e. to ensure the quality of the data. The message to CEOS should be that if we want to reach our objectives, other agencies, apart from space agencies, must be brought on board e.g. environment agencies that could

support *in situ* activities and provide decent quality data. The consensus was that the OCR-VC co-leads would propose something for the upcoming SIT meetings.

ACTION 17/5: PAULA BONTEMPI, PETER REGNER AND PRAKASH CHAUHAN TO RAISE THE ISSUE OF FUNDING FOR MOBY AND BOUSSOLE AT THE UPCOMING SIT MEETINGS.

6.0 Other Satellite and In Situ Programs

6.1 Australian remote sensing initiatives

Edward King spoke about how Australia was integrating ocean colour into Australia's marine observing system through IMOS (Integrated Marine Observing System). Australia has a large and diverse marine area but a small ocean-colour community, fragmented by agency and institution, each with a regional focus. IMOS was created in 2007 to provide science-driven research infrastructure and encompasses a number of different acquisition systems, including ocean colour. All data collected is publicly available, free of charge. The strategy for ocean colour in IMOS is to improve local and global products by compiling existing and new *in-situ* data, supplying data to the local and international community and compiling a satellite data archive and processing system. Investments include funding for the IMOS bio-optical database, ship-based radiometry (2 DALEC spectro-radiometers have been installed on research vessels), bio-optical measurements at 9 existing moorings, the Lucinda Jetty Coastal Observatory to support ocean-colour cal/val (data in SeaBASS), and a national archive and time series production system primarily for open ocean products, as a foundation to support regionalised near-shore algorithm development. The research community is mainly applications driven.

7.0 Capacity Building

7.1 Plans for the IOCCG Summer Lecture Series

David Antoine outlined the plans for the IOCCG Summer Lecture Series (SLS) which was proposed to complement other IOCCG training initiatives. The SLS is dedicated to high level training in the fundamentals of optics and bio-optics, highlighting the current critical issues in ocean-colour science. The course will take place from 2-14 July 2012 in Villefranche-sur-Mer, France, with 13 distinguished lecturers. The course will consist of lectures and practical hands-on sessions with a significant time for discussions between lecturers and students. A total of 34 applications had been received at the time of the meeting (a total of 105 applications were received overall). The budget is rather high because of the large number of lecturers, but it is nearly balanced (\$13K had been budgeted for recording but this could decrease significantly if done through the University).

Robert Frouin thought there were too many formal lectures, but David pointed out that this was done intentionally, since there were a number of other courses that offer the practical aspects of ocean-colour remote sensing. Paula Bontempi pointed out that NASA sponsored the intensive graduate-level course at the Darling Marine Center, led by Emmanuel Boss, which has an emphasis on optical oceanography and it might be beneficial to add the SLS remote sensing component to that class. Perhaps the IOCCG should consider merging the two courses to bring down the cost? The disadvantage would be that the course would be too long (unless it could be taken as a university credit) and that most students attending the Darling course are American because of funding issues. This is something that should be considered.

7.2 Plans for JRC remote sensing training course in Africa

Nicolas Hoepffner reported on JRC's plans for a training course in Africa. JRC has run two previous courses in Africa in 2007 (Mombassa) and 2009 (Zanzibar). A training course was scheduled for Mauritius last year, but did not take place due to budget constraints. The venue has been switched to Morocco for this year and will take place from 5 - 16 November 2012. The training course will follow the 9th AARSE symposium (African Association of Remote Sensing of Environment) that is taking place in Morocco from 29 October to 2 November 2012. JRC had also considered holding the course in Cape Verde and had received strong support from Doug Wallace and the Director of the INDP fisheries institute, but it was moved to Morocco because of strong support from EAMNet who will provide funding for 8-10 participants to stay on an extra two weeks to attend this course. The course will cover first principals of ocean colour, focussing on applications. Practical sessions will focus on processing software such as SeaDAS and BEAM. JRC has allocated a budget of 20K euro to cover logistics (renting computers) and travel for lecturers but and other sponsors are required for the students. It was hoped that IOCCG could sponsor 2-3 participants. The course will be announced shortly and participants will be selected.

7.3 Report on NOWPAP training course in Russia

Joji Ishizaka reported on CEARAC/NOWPAP remote sensing activities in the Northwest Pacific. The NOWPAP regional seas program was adopted in 1994 and consists of areas of China, Japan, Korea and Russia, with each country having different activities, for example CEARAC from Japan targets coastal environment assessment. The mission of NOWPAP CEARAC includes an assessment of marine and coastal environments using satellite remote sensing as a tool e.g. for HAB detection and assessment of eutrophication. CEARAC has published a number of national and integrated reports on ocean remote sensing (available on their website), as well as distributed satellite data through the internet and been involved in capacity building activities. The NW Pacific Region Environment Cooperation Center (NPEC) distributes satellite data for the entire region, as well as for sub sets, via the internet. NOWPAP has also been involved in a number of capacity building activities including a training course in Japan (September 2007), Korea (November 2008) and one in Russia (October 2011) coordinated by Genki Terauchi and

supported by IOCCG as well as NOWPAP CEARAC, PICES and IOC/WESTPAC. A fourth NOWPAP remote sensing training course is scheduled for 2013 (China) and IOCCG support was anticipated for one lecturer and one trainee.

7.4 Establishment of a standing working group to develop training material

At the last IOCCG Executive meeting the committee considered forming a standing working group to develop training material, but this had been put on hold because Nicolas Hoepffner is now co-chairing the ECV assessment standing WG. Dr. Hoepffner reported on the rationale behind the formation of a standing working group. Specific training modules would be useful for a larger community of users, not only scientists. There is a high demand for training in the basic principals behind the various products, and it is important for participants to have access to material before the training course. A comprehensive set of training material could be made available on the IOCCG website. Training modules could be adapted for different courses and could include introductory material, atmospheric correction, underwater optics, ocean-colour algorithms, cal/val, and remote sensing in inland waters, shallow water systems etc. The modules would be reviewed on a regular basis and updated. The training material also could be linked to a forum if placed on a website. Paula Bontempi noted that NASA has a lot of web-based material that could be used by the working group, if it were formed. IOCCG reports could also be used as reference material. The chairman noted that the formation of this standing WG would be further discussed at the Executive meeting.

8.0 Any other Business

8.1 Issues arising from IOCCG-17 meeting

Ewa Kwiatkowska reiterated the importance of the Mission Requirements (L1) report as well as Robert Frouin's Calibration report. Peter Regner was of the opinion that Steven Delwart could perhaps help Robert complete the report, but not before the summer. Paula Bontempi agreed to approach NASA scientists regarding completion of the missing chapters of the calibration report, and she emphasized that the INSITU-OCR and calibration reports should be really consistent. She recommended that the Chairman contact the INSITU-OCR chairs to request that they ensure consistency and overlap between the material for the INSITU-OCR White paper and that of the calibration report.

ACTION 17/6: PAULA BONTEMPI TO APPROACH NASA SCIENTISTS REGARDING COMPLETION OF THE MISSING CHAPTERS FOR THE IOCCG CALIBRATION REPORT.

ACTION 17/7: CHAIRMAN TO APPROACH INSITU-OCR CHAIRS REGARDING CONSISTENCY BETWEEN THE INSITU-OCR WHITE PAPER AND THE CALIBRATION REPORT.

Dr. Ryu noted that KORDI thinking of having mirror sites for GOCI data and requested that IOCCG write a letter to KORDI noting the importance of having mirror data sites.

ACTION 17/8: CHAIRMAN TO WRITE A LETTER TO KORDI/KIOST NOTING THE IMPORTANCE OF HAVING MIRROR DATA SITES FOR GOCI DATA.

Regarding the Wikipedia entry for Ocean Colour, Nick Hoepffner agreed to obtain the text from Mark Dowell and Nick Hardman-Mountford agreed to post it on the Internet. The IOCCG Committee was requested to edit it online.

ACTION 17/9: NICK HOEPFFNER TO OBTAIN TEXT FROM MARK DOWELL ON THE OCEAN COLOUR WIKIPEDIA ENTRY AND NICK HARDMAN-MOUNTFORD TO POST IT ON THE INTERNET.

ACTION 17/10: IOCCG COMMITTEE MEMBERS TO EDIT THE OCEAN COLOUR WIKIPEDIA ENTRY ON-LINE.

8.2 Any other business

8.2.1 Masters Course at Udayana University

Dr Tasuku Tanaka introduced the joint Masters Course between Udayana University, Indonesia (run through the Center for Satellite Remote Sensing and Ocean Sciences, CReSOS) and Yamaguchi University (Japan). The objectives of CReSOS are to educate Masters students to undertake research on climate change and disaster mitigation, to establish and maintain the Indonesian Ocean Data Archive, and to act as a national as well as international node for remote sensing research. There are 10 MSc students and only two lecturers/supervisors, so help from IOCCG Committee members would be appreciated. Shared lectures are broadcast simultaneously to both universities, via the Internet. Research interests cover four different areas: the coastal environment (including coral reefs and mangroves); fisheries; climate change & oceanography; and land process and precipitation. Dr Tanaka provided an overview of the thesis of one of his students from Yamaguchi University who used data from a number of different satellite archives, including OCTS and SeaWiFS, to examine the general characteristics of Indonesian seas. Dr. Tanaka noted that there was a lot of data available to conduct scientific research in the tropics and he requested help from retired IOCCG members who could come to Indonesia for 2 months.

8.2.2 Multi-mission ocean-colour processing software

Kevin Ruddick raised the issue of multi-mission ocean-colour processing software. A group of scientists had compiled a report in response to a request from ESA to the Sentinel-3 Mission Advisory group, on what software and tools should be made available to support the use of Sentinel-3 (OLCI) L1B and L2 data. The group undertook a survey via various mailing lists and web forums, and received responses from around the world. Most respondents wanted open source, modular processing software enabling them to both fully understand the existing algorithms (by looking at the source code) and to make their own modifications. In addition,

software for processing data from Level 1 to Level 2 was of highest priority and they indicated that it was important to distribute L1A (uncalibrated radiances) together with the processing code. The scientific user community greatly appreciates multi-agency initiatives to harmonise processing tools and many respondents requested software to process data from a number of different ocean-colour sensors at same time. A full summary of the report is on the NASA Ocean Color website.

Peter Regner noted that ESA had tasked this group to look into user needs and that ESA takes the responses very seriously. They intend to take most of the recommendations on board, in a timely fashion as related to budget. Some are already in the implementation process (~60%). ESA appreciates this user oriented approach, and will try to respond as best as possible.

8.2.3 Selection of students for Summer Lecture Series

The Chairman requested the help of a few Committee members in selecting the final 16 students. The application form has a series of questions to help define the profile of participants, including information on education, current position, computer skills, area of interest and motivation to attend the course, which will be useful to help rank the students. Applications will be pre-screened and the volunteers could help with the final selections. Paula Bontempi noted a shift in participants in training courses from research towards more applied careers and queried whether another type of training course was required to help train managers, for example. This was something that should be discussed for future training courses.

9.0 Organisation and Membership

9.1 Rotation of Committee members

The Chairman requested suggestions for new Committee members. There was some discussion about the possibility of appointing NASA scientists as scientific IOCCG members, as apposed to agency representatives (agency members are appointed by their respective agencies, and serve for indefinite terms). This would be further discussed in the IOCCG Executive meeting.

9.2 Proposal to host IOCCG-18 Committee meeting in Canada

Marie-Hélène Forget introduced the new International Joint Laboratory (Takuvik), a partnership between CNRS (France) and Université Laval (Canada). The theme is to study the impact of climate change and human activity on the aquatic and terrestrial ecosystems and geosystems in the Arctic and sub-Arctic regions. The joint lab consists of a team of 12 research professionals plus a large group of Masters, PhD and post-doctoral students (35 scholarships available). The ocean component comprises the Canada Excellence Research Chair in “Remote sensing of Canada’s new Arctic Frontier”, held by Marcel Babin. Current Arctic research focuses on eastern side of Canada and includes remote sensing as well as deployment of *in situ* instruments, marine optics, studies on the eco-physiology and biodiversity of phytoplankton.

The IOCCG-18 meeting will be hosted by the Canadian Space Agency and the remote sensing component of Takuvik (University of Laval) in the old town of Quebec City, Canada, a UNESCO World Heritage Site. It is a beautiful city with many winter activities including a winter carnival during the first two weeks of February. The meeting will take place at Auberge Saint Pierre in Quebec City some time during the first two weeks of February 2013.

9.3 Proposals to host IOCCG-19 Committee meeting (2014)

A proposal had been submitted by Prakash Chauhan to ISRO to host the IOCCG-19 meeting in Ahmedabad, India, but this was not approved. Stewart Bernard put forward a proposal to host the meeting in South Africa in February/March 2014. There is strong local scientific interest in ocean-colour research with studies using data from various sensors, buoys and floats as well as modelling work, processing remote sensing data for Africa and a wide range of user groups. The logistics would be investigated (central Cape Town or a coastal town).

9.4 Closing comments

The Chairman commented that the IOCCG activities were very important and thanked everyone for attending the meeting and for their active contributions. Special thanks were conveyed to Dr Tasuku Tanaka for hosting a most successful meeting in such a beautiful venue.

Actions - 17th IOCCG Committee Meeting
Denpasar, Indonesia, 28 February - 1 March 2012

Action	Brief description	Status
17/1	Robert Frouin to coordinate with the INSITU-OCR group regarding finalising the Calibration report.	Open
17/2	IOCCG members encouraged to submit suggestions for discussion topics, splinter sessions and invited talks for the planned International Ocean Colour Science meeting.	Open
17/3	Paula Bontempi to obtain details of a contact person at GeoEYE, as well as a list of Institutes that acquired SeaWiFS data from H RTP stations after 2004.	Open
17/4	IOCCG agency and institute representatives to contact GeoEye to request a broad release of SeaWiFS data collected from HRPT stations after 2004 to GSFC.	Open
17/5	Paula Bontempi, Peter Regner and Prakash Chauhan to raise the issue of funding for MOBY and BOUSSOLE at the upcoming SIT meetings.	Open
17/6	Paula Bontempi to approach NASA scientists regarding completion of the missing chapters for the IOCCG calibration report.	Open
17/7	Chairman to approach INSITU-OCR Chairs regarding consistency between the INSITU-OCR White Paper and the calibration report.	Open
17/8	Chairman to write a letter to KORDI/KIOST noting the importance of having mirror data sites for GOCI data.	Open
17/9	Nick Hoepffner to obtain text from Mark Dowell on the ocean colour Wikipedia entry, and Nick Hardman-Mountford to post it on the Internet.	Open
17/10	IOCCG Committee members to edit the Ocean Colour Wikipedia entry on-line, once it is posted.	Open

Appendix I: LIST OF PARTICIPANTS

Udayana University, Denpasar, Indonesia (28 February - 1 March 2012)

Invited Participants

Antoine, David (Chair)	-	LOV, Villefranche, France
Bernard, Stewart	-	CSIR, South Africa
Bontempi, Paula	-	NASA HQ, USA
Chauhan, Prakash	-	ISRO, India
DiGiacomo, Paul	-	NOAA, USA
Doerffer, Roland	-	Helmholtz Center Geesthacht, Germany
Dutkiewicz, Stephanie	-	Massachusetts Institute of Technology, USA
Forget, Marie-Hélène	-	Université Laval, Québec, Canada
Frouin, Robert	-	Scripps Institution of Oceanography, USA
Greb, Steven	-	Wisconsin Department of Natural Resources, USA
Hardman-Mountford, Nick	-	CSIRO, Perth, Australia
Hartuti, Maryani	-	LAPAN, Indonesian Nat. Institute of Aeronautics and Space
Hoepffner, Nicolas	-	Joint Research Centre, EU, Italy
Ishizaka, Joji	-	Nagoya University, Japan
Kampel, Milton	-	INPE, Brazil
King, Edward	-	CSIRO, Hobart, Australia
Kwiatkowska, Ewa	-	EUMETSAT, EU, Germany
Lambin, Juliette	-	CNES, France
Mao, Zihua	-	Second Institute of Oceanography, China
Murakami, Hiroshi	-	JAXA/EORC, Japan
Pozdnyakov, Dmitry	-	NIERSC, Russia
Regner, Peter	-	ESA-ESRIN, Italy
Ruddick, Kevin	-	Belgian Institute of Natural Sciences, Belgium
Ryu, Joo-Hyung	-	KORDI, Korea
Setiawan, Agus	-	Inst. for Marine Research & Observation (IMRO), Indonesia
Stuart, Venetia	-	IOCCG Project Office, BIO, Canada
Tanaka, Tasuku	-	Udayana University, Bali, Indonesia
Wang, Menghua	-	NOAA/NESDIS/STAR, USA
Yoder, James (Past-Chair)	-	Woods Hole Oceanographic Institution, USA

Apologies

Ahn, Yu-Hwan	-	KORDI, Korea
Babin, Marcel	-	Université Laval, Canada
Bonekamp, Hans	-	EUMETSAT, EU, Germany
Crevier, Yves	-	CSA, Canada
Dowell, Mark	-	Joint Research Centre, EU, Italy
Morel, André	-	LOV, Villefranche, France
Pan, Delu	-	Second Institute of Oceanography, China

Platt, Trevor,	-	POGO, Plymouth Marine Laboratory, UK
Sathyendranath, Shubha	-	Plymouth Marine Laboratory, UK
Weeks, Scarla	-	University of Queensland, Australia