

**7<sup>th</sup> IOCCG Committee Meeting**  
**Villefranche-sur-Mer, France, 10 - 12 January 2002**

**MINUTES**

IOCCG Committee members met for the 7<sup>th</sup> time in Station Zoologique, Observatoire de Villefranche-sur-Mer, France, from 10 - 12 January, 2002 (see Appendix I for list of participants).

**1. Welcome Address and Logistics**

Dr. Trevor Platt, Chairman of the IOCCG, welcomed Committee members and thanked them all for attending the meeting. He noted that participants were guests of the Oceanographic Observatory of Villefranche, and introduced Dr. Michel Glass, Director of the Observatoire Océanologique Villefranche-sur-Mer. Dr. Glass warmly welcomed Committee members and gave a brief overview of the research programmes of the three main laboratories at the Observatory. He noted that the Laboratoire d'Océanographie de Villefranche (LOV) was deeply involved in ocean colour problems and had a station devoted to validation of satellite ocean-colour data. He then introduced Dr. Louis Legendre, head of LOV, who also welcomed the participants and commented that his laboratory had a strong input in ocean optics. Following the welcoming addresses, the Chairman introduced the new members of the Committee including Dr. Roland Doerffer, Prof. Mervyn Lynch and Dr. Chuck Trees. The Chair informed the Committee that Dr. Rangnath Navalgund had recently taken over the position of director of a laboratory in Hyderabad, and would be replaced on the Committee by Dr. Shailesh Nayak. The Chairman also noted that Dr. Jim Yoder had recently taken up a new position with NSF, and had been replaced by Dr. Robert Frouin, who had been asked to stay on the Committee for another term to ensure continuity. Congratulations were extended to Dr. Pan Delu who had been appointed to the Chinese Academy of Engineering.

**2. Adoption of the Agenda**

The agenda was adopted with the addition of the following agenda items: 13 (f) Web-Based Training, 17 (a) DIVERSITAS Programme, 17 (b) IOCCG Fellowship Program and 17 (c) Associate Membership. The final Agenda is given in Appendix II of this report.

**3. Record of the 6<sup>th</sup> Committee Meeting**

The record of the minutes of 6<sup>th</sup> IOCCG Committee meeting was approved without amendment. The Chair reviewed the list of action items from the 6<sup>th</sup> session and noted that the majority of action items had been closed, the remainder of which would be dealt with during the meeting. Regarding the issue of normalised water-leaving radiances (action items 6/1 and 6/2), the Chair mentioned that letters had been written to various

Agencies. The IOCCG had received a formal reply from NASA, and Prof. Morel had received an informal reply from ISRO (the Project Office received a reply from NOAA shortly after the meeting). These Agencies agreed that this was a problem but noted that it was not easy to solve. Since Dr. Marra did not attend the meeting on development of new sensors for ocean biogeochemistry, a report was not submitted (action item 6/19).

#### 4. Progress of Current IOCCG Working Groups

##### (a) *Calibration of ocean-colour sensors to common standards.*

Dr. Robert Frouin, current chair of this working group, mentioned that the group was first proposed in 1998 at the IOCCG meeting in Hawaii. Since that time not much progress had been made for various reasons: the Chair of the group had changed three times and there had been excessive discussion as to whether the report should contain both pre- and post-calibration procedures. Furthermore, all three Chairs had been very busy with previous commitments. Dr. Frouin noted that this was an important working group because the accurate calibration of ocean-colour sensors was essential for high quality ocean-colour data. The objective of the working group was to prepare a report outlining recommendations for calibration of satellite ocean-colour sensors based on requirements and available calibration techniques. The report would include pre-launch calibration procedures as well as calibration checks to be performed while the sensor is in orbit. A table of contents of the report was presented as well as a list of members of the working group (see Appendix III). The Committee recommended that the group be expanded to include members from ESA and other Agencies, since multi-sensor calibration was very important. Dr. Rast offered his assistance and Dr. Nayak agreed to provide a contact from ISRO. Dr. Doerffer suggested that the report also include an overview of how each instrument was calibrated. Dr. Fouin envisaged that all contributions would be received by fall, 2002, and that a rough draft of the report would be ready by end of the year.

##### (b) *Co-ordination of merged data sets.*

The Chairman noted that, historically, this was a joint initiative of Drs. Schlittenhardt, Campbell and Tanaka, which had run into difficulties with funding in the U.S. and E.C. Data-merging activities were still going on within SIMBIOS. According to Dr. Schlittenhardt, the aim of the working group was to promote the formation of a diagnostic data set as well as to co-ordinate merging of data sets. Dr. Rast mentioned that he had been trying to promote the diagnostic data set within ESA, but that there were problems with funding. Dr. Trees noted that SIMBIOS was willing to interact with ESA and would like to obtain MERIS data routinely over the diagnostic data sites. Dr. Rast advised that the approved procedure to obtain MERIS data was through an Announcement of Opportunity, and he agreed to support the SIMBIOS proposal. The Committee also expressed an interest in future co-ordination with SIMBIOS, and recommended writing a letter of support (addressed to Dr. Ghassem Asrar, copy to Dr. Jack Kaye) expressing an interest in continuation of the SIMBIOS agenda. Dr. Asanuma mentioned that GLI also planned to generate data over the diagnostic data sites.

**ACTION 7/1:** DR. RAST TO TAKE UP THE ISSUE OF ENSURING THAT MERIS DATA IS AVAILABLE TO SIMBIOS OVER THE DIAGNOSTIC DATA SITES.

**ACTION 7/2:** PROJECT OFFICE TO WRITE LETTER TO DR. ASRAR IN SUPPORT OF THE SIMBIOS AGENDA

The Chairman then inquired whether the IOCCG data-merging working group should be disbanded due to lack of funding. There was a general consensus that data merging was a critical issue for ocean colour and in line with IOCCG's mandate, and that the IOCCG should address the topic. Dr. Trees suggested that the IOCCG support a joint meeting with SIMBIOS and the various Agencies to help focus on the problems that exist and discuss ways to direct resources to data merging. A meeting was proposed for end of the third quarter of this year (in Canada or Tokyo) and Dr. Trees agreed to play a leading role, with the help of a planning Committee (Drs. Asanuma, Trees, Platt, Rast and Podaire). It was hoped to obtain the commitment of various agencies, and to establish an implementation plan. Dr. Trees noted that it was essential to identify problems and not just present a scientific review of merging data. He recommended bringing someone from ESA to Goddard to focus on data merging. Dr. Rast cautioned that merging was not in MERIS's mandate and that ESA might not be ready to make a commitment or donate funds to this activity.

**ACTION 7/3:** DR. TREES TO HELP COORDINATE A DATA MERGING MEETING WITH SIMBIOS, IOCCG AND VARIOUS AGENCIES.

Dr. Frouin gave a brief report on his research related to another form of data-merging *i.e.* combining CZCS, SeaWiFS, POLDER and OCTS data to produce a global climatology of chlorophyll concentration. The resulting data could be used as reference for interannual variability, or used to examine the interaction of chlorophyll and climate *e.g.* the effect of solar radiation absorption by phytoplankton on SST, or changes in TOA reflected solar flux. The effect of phytoplankton absorption was important and the values were of the order of the greenhouse effect due to CO<sub>2</sub>.

*(c) Comparison of atmospheric correction algorithms*

Dr. Frouin gave a brief presentation on the progress of this working group, on behalf of Dr. Wang. Simulated data sets were generated for various atmosphere and ocean optical properties as well as for various solar and viewing geometries, and were used to test the performance of atmospheric correction algorithms for MERIS, POLDER, OCTS/GLI, MODIS and SeaWiFS. The simulated data set was distributed in March, 2001 and some preliminary results were obtained for Case 1 waters. All algorithms performed reasonably well although there were some notable differences. Dr. Antoine pointed out that errors could be introduced even if the same atmospheric correction algorithm was used in the beginning, by using different ways of expressing the atmospheric transmittances when deriving the water-leaving radiance from the TOA marine radiance, and when normalising this water-leaving radiance. The next step would be a more complete comparison as well as testing the algorithms on selected SeaWiFS data sets. Various members of the Committee suggested that comparisons

should be limited to the simulated data set, and not include the selected SeaWiFS data sets, as there would be difficulties with vicarious calibrations, which was another issue.

The Chairman agreed to write to Dr. Wang to thank him for his excellent progress, and ask what the IOCCG could do to accelerate the conclusion of the working group. Dr. Podaire agreed to encourage CNES members to co-operate with this activity.

*(d) Operational Ocean Colour*

Dr. Brown was unable to attend the meeting and submitted a brief report stating that a list of working group members had been compiled and a tentative agenda for the group outlined. Several Committee members commented that there was a strong need for an operational ocean-colour data stream, and therefore some urgency to articulate the justification. The report was perceived as critical, as it could be used to support many different proposals. Some discussion ensued as to the definition of the word “operational”: the Chairman noted that it was a distinction between a tool for research vs. a tool for routine daily use while Dr. Nayak emphasised that the data should be used in near-real time, such as for fisheries applications. Dr. Sathyendranath mentioned that the POGO definition for operational ocean-colour data was a consistent, compatible, long-term data series with global coverage and free data access. Several examples of applications were also discussed including fisheries applications, HAB’s, oil slicks, water quality indicators, eddies as well as expanding some of the ideas in IOCCG Report Number 3. The Committee recommended writing a letter to Dr. Brown to encourage him to pursue his agenda and to produce a report.

**ACTION 7/4:** PROJECT OFFICE TO WRITE LETTER TO DR. BROWN TO ENCOURAGE HIM TO PURSUE HIS AGENDA FOR THE OPERATIONAL OCEAN COLOUR WORKING GROUP.

*(e) Ocean-colour data-binning issues*

The Chair noted that this working group had made tremendous progress within a very short space of time, so he presented Dr. David Antoine (Chair of the working group) with a small token of appreciation on behalf of the Committee. Dr. Antoine outlined the rationale for setting up the working group and noted that the diversity of the binning schemes and the absence of correction for bi-directional effects made the merging of different ocean-colour data sets a difficult task. He summarised the basic questions addressed in the report and illustrated the problem of diversity in binning schemes with some examples. He noted that noise was frequently introduced by using different scales and different methods of averaging pixels into bins. A tentative outline of the report was presented to the Committee, while a draft version of the report (Version 2) would be available by March, 2002. Dr. Lynch remarked that efficient screening would be required before binning and Dr. Sathyendranath commented that if derived products were binned, the issues of bi-directionality would not be apparent.

*(f) Standardising the Extraterrestrial Solar Flux Spectrum*

Prof. Morel reported that he and Dr. Mueller had started preparing a provisional document to examine this topic. The presently accepted solar flux spectrum within the SeaWiFS and MODIS ocean-colour communities was that of Neckel and Labs (1984).

Other Agencies such as CNES, ESA and NASDA have selected the Thuillier *et al.* (1998a, b) spectrum. He stressed that it was important that a single, common standard solar flux spectrum be used in every aspect of research and validation in ocean-colour remote sensing, since it enters into normalisation of water leaving radiance, calibration of atmospheric radiation measurements and atmospheric correction algorithms. There was some evidence to suggest that the recent measurements of Thuillier *et al.* (1998a, b) were more consistent with NIST traceable lamp-based irradiance and radiance sources. On the basis of these findings, it might be desirable that NASA and other Space Agencies reconsider their choice of a standard for extraterrestrial solar flux. The expected benefits are obvious (*e.g.* improved uncertainty budgets for atmospheric correction validation) but adopting a different solar spectrum would also require significant changes in the software used for operational processing and validation analyses with SeaWiFS and MODIS and other project offices. Prof. Morel proposed three solutions to the problem: i) Ignore the problem and not use measured surface irradiances to determine the exact normalised water-leaving radiance from *in situ* measurements (used for validation or vicarious calibration); ii) request Agencies to publish the particular  $\overline{F}_0(\lambda)$  (mean extraterrestrial solar irradiance) adopted; and iii) adopt a common international scale of  $\overline{F}_0(\lambda)$  for use by the entire ocean-colour community. Options 1 and 2 would be easiest to implement, but option 3 would be best, although it may be more costly and difficult to implement. The informal working group would further pursue these issues.

## 5. Proposal for New IOCCG Working Groups

The Chair reported that he had been communicating with Dr. Joseph, Past-President of ISPRS, who was concerned that engineering standards and specifications for sensors were misleading from a user's standpoint. He saw an urgent need to standardise the specified sensor parameters, such as radiometric resolution, in the context of the increasing relevance of merging data from various sensors. Committee members agreed that this was an important issue and were enthusiastic about the formation of a new IOCCG working group to examine the topic. They recommended that the group produce a user handbook with a definition of terms for various sensor parameters (tentatively entitled "Sensor Characterisation"). Dr. Nayak agreed to contact Dr. Joseph and request a proposal for the working group including the draft terms of reference and a list of proposed members.

**ACTION 7/5:** DR. NAYAK TO CONTACT DR. JOSEPH REGARDING A PROPOSAL FOR THE "SENSOR CHARACTERISATION" WORKING GROUP AND THE PUBLICATION OF A USER HANDBOOK.

Dr. Lynch also raised a number of issues that the IOCCG could perhaps address:

- (i) In-water radiative transfer models: As a community the IOCCG should be concerned about these models, as some free models were available, but not all were suitable.
- (ii) Spectral libraries: Is everyone using the same spectral absorption curve to retrieve various constituents?

- (iii) Use of Case 1 algorithms in Case 2 waters: A shallow-water flag is available but perhaps we should be flagging CDOM.
- (iv) Operational algorithms: None of the current satellite missions use a purely physical-based algorithm for Case 1 waters (rather a mix of statistical/regression/semi-analytical/neural network etc.) which implies that we do not understand the problem.
- (v) Data sets for algorithm testing: Easily accessible, high-quality data sets are required by the ocean-colour community to test algorithms. The data should be accompanied by comprehensive validation data and a range of bio-optical properties.
- (vi) Synthetic data sets: It would be useful to have synthetic data sets (accurate forward model, agreed pigment data base) covering an extensive range of Case 1 and Case 2 waters.

The Chair noted that it was useful to have a list of areas that required attention although they would need an organiser to translate into practical working groups. It was suggested that a discussion of underwater models would be of practical use but in the absence of a leader, the items would be placed on the Agenda for next year.

## 6. Overview of the SIMBIOS Program

Dr. Chuck Trees gave a brief overview of SIMBIOS activities. He reported that one of the major objectives of SIMBIOS was to ensure the development of internally consistent research products from multiple ocean-colour data sources as well as the development of methodologies for merging data from multiple ocean-colour missions. Program requirements included collection of global bio-optical and atmospheric *in situ* data, pre-launch sensor calibration protocols, on-orbit calibration evaluation, development of bio-optical and atmospheric correction algorithms and development of data merger algorithms. SIMBIOS was involved in cross calibration activities (SeaWiFS-MOS, OCTS-POLDER) as well as data merging (MOS and SeaWiFS), data processing and calibration (OSMI) and MODIS product validation activities. Furthermore, the project had completed two calibration round-robins, two chlorophyll (HPLC) round-robins, as well as sunphotometer deployment, maintenance and data processing. SIMBIOS also supported a number of field activities such as INDOEX (1999), ACE-Asia (2001) and the cruise onboard the Russian *R/V Akademik Ioffe* (2001), as well as the Marine Optical Buoy (MOBY), used for vicarious calibration.

## 7. SeaWiFS Data Set

The Chairman referred to the jeopardy of the SeaWiFS data stream after the end of the current data-buy contract. Dr. Trees noted that the current contract would end in November this year and that a new data buy contract had been proposed for the 02 budget which was still under discussion. The ocean-colour community were strongly supportive of continuing with the SeaWiFS mission as it was robust, the data were easy to process and SeaWiFS had become the standard and was fundamental to ocean-colour science. The Committee recommended writing letters of support to NASA, but Dr. Trees indicated that they were not necessary at this point in time, but agreed to approach groups such as IOCCG and POGO if necessary. Regarding the reprocessing of the SeaWiFS data set, comments had been requested from the oceanographic community.

Many Committee members indicated that they had already conveyed their comments to NASA.

## 8. Issues Relating to the Project Office

### (a) *IOCCG Pamphlet*

The Chair pointed out that the IOCCG information kit was becoming dated and solicited the Committee's view on replacing it with a 2-page pamphlet. The Committee supported the idea of a pamphlet, and noted that the information kit had not been used in the way it was originally intended.

### (b) *New Information Officer*

The Chair reported that during the course of the year, the information officer relocated, and had been replaced by Abhijit Bhadé. He was helping with the IOCCG web-page and would also help with the editing and production of the IOCCG monograph series.

## 9. Status of Current Ocean-Colour Missions

### (a) *MOS*

Dr. Neumann reported that MOS had almost finished 6 years in orbit and was still functioning well. The fuel supply was too low to allow for orbit corrections, so equatorial crossing times were getting earlier and earlier. DLR and ISRO were fully supportive of the mission and it was hoped that MOS would function for one more year in orbit, to ensure an overlap with the MERIS mission. The sensor could no longer be calibrated using the sun due to problems with the on board power supply, but calibration was maintained using known targets, as well as inter-comparisons with SeaWiFS data (provided by the SIMBIOS Project).

### (b) *SeaWiFS and MODIS-Terra*

Dr. Trees informed the Committee that the future SeaWiFS data distribution policy would depend upon whether NASA agreed to a data-buy from Orbital or whether NASA took over the mission. A decision would be made by the end of fall, 2002. A data product review had just been completed for the MODIS-Terra mission. There were many data products which took a long time to process. The team review committee recommended that the atmosphere, ocean and land communities each propose no more than three high priority products (total of 10) for faster processing. The ocean community would most likely propose SST, chl, and maybe attenuation coefficient (K). A lower spatial resolution would also be used to process products more rapidly. A validated MODIS ocean data set should be available by mid-2002.

### (c) *OCM*

Dr. Nayak reported that the Indian IRS-P4 satellite, carrying the Ocean Colour Monitor (OCM), was launched in May 1999. The SNR was comparable to that of SeaWiFS, and met the specifications for remote sensing of ocean-colour. Four ground-receiving stations were located in India, USA, Germany and North Korea. Standard Level-2 products included chlorophyll, suspended sediments, yellow substances, diffuse attenuation coefficient, aerosol optical depth and normalised water-leaving radiance (to

be incorporated). Weekly- and monthly-binned averages of the above products were also planned. OCM coverage ranged from Oman to Indonesia, and Level 1 and 2 data was available directly from NRSA, upon payment. Processing software was also distributed to users at a nominal cost. Two multidisciplinary cruises were conducted to validate the chlorophyll (OC2) and total suspended matter algorithms, both of which worked well in the Arabian Sea. OCM data were also being used for fisheries forecasting, with a 200-300% increase in catch for the pelagic fishery, and sediment transport studies in the littoral zone.

(d) *OSMI*

Dr. Kim submitted a brief report on the status of OSMI, which had been operating for two years since its launch in December 1999. Despite the initial difficulties of sensor calibration, about 1.5 terabytes of Level 1A data had been collected over the global oceans. The data had been used to monitor yellow dust, forest fires, red tides, and typhoons. KARI supported the calibration and validation efforts of OSMI in Korean waters and was currently collaborating with NASA, through the SIMBIOS Project, to cross-calibrate OSMI. The preliminary results of the cross-calibration were promising and KARI planned to distribute the OSMI data through NASA, if the NASA evaluation was satisfactory.

## 10. Future Ocean Colour Missions

(a) *MERIS*

Dr. Rast reported that the new launch date for MERIS was 1 March, 2002. Full calibration of all Level-1b data products and preliminary validation of the Level-2 data products would take place during the Commissioning Phase (9 months after launch). MERIS calibration and validation teams had been formed which included Principal Investigators of the selected calibration/validation projects, resulting from the Announcement of Opportunity (AO) proposals. MERIS marine products would include algal pigments, yellow substances, suspended matter, aerosol optical thickness, flags, water-leaving reflectances and aerosol spectral dependence.

New user-friendly software called the 'MERIS tool box' had been designed to facilitate use of data from MERIS, ATSR and ASAR sensors allowing data to be imported, manipulated, viewed and statistical calculations performed. Scientific modules were also available to retrieve new geophysical products. In principle, MERIS data would be available free for scientific research to those who had submitted an AO proposal. The next phase in ESA's Earth observation programme would be the 'Living Planet Programme' which would contain various national programmes proposed to make an Ocean Earth Watch Mission. From about 2007 onwards, this mission would provide continuity to ENVISAT observations. A suite of small VIS-IR sensors would be devoted to ocean colour and SST and would cover Case 1 and 2 waters.

(b) *MODIS-Aqua*

Dr. Trees reported that MODIS-Aqua was still scheduled for launch in April, 2002. All known problems had been corrected and the instrument had been improved over MODIS-Terra. Aqua data would not be processed until the Terra data was stable, so it



would take some time to get Aqua data calibrated. A NASA Research Announcement (NRA) had been released to solicit proposals for an interdisciplinary science team for MODIS (addressing algorithms, maintenance as well as science).

(c) *COCTS*

Dr. Delu submitted a brief report stating that the Chinese Ocean-Colour and Temperature Scanner (COCTS), aboard the HY-1 satellite, was scheduled to be launched May/June 2002. The data policy encouraged Chinese and international scientists to build ground stations to receive local data. Global data was limited because of satellite power problems. COCTS would have a spatial resolution of 1.1 km with a 10% radiometer accuracy and a 3-day repeat observation period. More detailed parameters for receiving or using data in other countries would be published after sensor calibration in orbit. Prof. Morel noted that the sensor met the basic requirements for an ocean-colour sensor as laid out by the IOCCG. The Chairman recommended writing a letter to Dr. Delu to wish the Chinese National Space Agency good luck with the launch of their satellite.

**ACTION 7/6:** PROJECT OFFICE TO WRITE TO DR. DELU REGARDING THE LAUNCH OF THE HY-1 SATELLITE.

(d) *GLI and S-GLI*

Dr. Asanuma reported that the launch of GLI had been delayed until November, 2002 because of problems with the H2-A launching rocket. During the first year of operation, data would be available for PI's only, but the following year the data would be open to the public, depending on processing capabilities.

The second-generation GLI, called the S-GLI, formed part of the Global Change Observation Mission (G-COM). The G-COM mission concept is to continue and advance observations from ADEOS-II, contributing to research on global warming, climate variability and ozone variability. Four satellites would be launched within the G-COM mission. The S-GLI sensor would be onboard the G-COM-B1 satellite, which is scheduled for launch in 2007. Tentative specifications for the Ocean Colour Imager (OCI) on S-GLI include 9 bands in the visible with a band width of 10-20 nm and an IFOV around 1000 m (the IRI/TMI sensor would include bands in the infrared). It was also report that next year NASDA would be merging with ISAS (Institute of Space and Astronautical Science) and NAL (National Aerospace Laboratory of Japan).

(e) *POLDER-II*

Dr. Podaire reported that POLDER-II was already installed onboard the ADEOS-II satellite and that test performances had given satisfactory results. A new ground segment would be developed for the operational phase. A number of improvements would be made to the algorithms for POLDER-II such as improvement of atmospheric corrections to correct for the 670 nm non-zero reflectance effect and correction of the absorbing aerosol effect. Other activities funded by CNES include cal/val activities and MERIS Level 3 product and algorithm development. Cal/val activities comprise the Boussolle Project, with an optical buoy located on the DYFAMED site (30 km from

Nice), for subsurface profiles of marine optical parameters, and SIMBAD radiometers for characterisation of atmospheric and ocean surface optical properties.

CNES also supported new mission concepts such as BIOGEOSAT (proposed by Dr. D. Antoine) and CARBOSAT (proposed by Dr. P. Ciais). The BIOGEOSAT mission aims to provide a long-term assessment of algal biomass, primary production and its response to changing climate conditions, through the development of a new range of ocean-colour products and assimilation into 3-D ocean biogeochemical models. The proposed system would include four polar orbiting micro-satellites, three of which would have medium (1 km) resolution, and one would have high (95 m) resolution, plus a geostationary satellite with lower resolution. The goals of the CARBOSAT mission are to quantify spatial and temporal variations of CO<sub>2</sub> sources and sinks and to estimate the origin of carbon sources. The payload would be a high resolution SWIR spectrometer capable of deriving column CO and CO<sub>2</sub> concentrations. There would be a high degree of complementarity between ocean colour and CARBOSAT. Both these mission concepts were still in the form of proposals to ESA, backed by CNES.

(f) *OCM on IRS-P7 (Oceansat-2)*

Dr. Nayak reported that the specified mission life of OCM on IRS-P3 (Oceansat-1) would end in 2002 May, but the satellite was nevertheless expected to last another 2-3 years. ISRO were now preparing for OCM-2, which is scheduled for launch onboard the Oceansat-2 satellite some time in 2005-06 (forward from 2008-09). Oceansat-2 would be a global mission, and there would be slight modifications to certain bands compared to OCM-1 (slightly reduced band widths, the 670 nm band might be dropped in favour of a 620 nm band). Specifications for the mission are currently being finalised after which the mission would have to be approved. The data distribution policy had not been finalised but it should be along same lines as for OCM-1 (PI's obtain data free of charge, others pay a nominal cost).

(g) *NPP and NPOESS*

Dr. Trees reported that the NPOESS Preparatory Project (NPP) was designed to provide a bridge between the research-oriented EOS mission and the operational NPOESS mission. NPP will carry three sensors: the Visible Infrared Imaging Radiometer Suite (VIIRS) for ocean-colour measurements, the Cross-track Infrared Sounder (CrIS) and the Advanced Technology Microwave Sounder (ATMS). The mission was scheduled for launch in late 2005 with a 10:30 am equatorial crossing time. Although NPP was designed as an operational satellite, models for new algorithms would still be examined. The NRA for NPP would be released later this year and would include maintenance, calibration, as well as post launch algorithm validation. Mission requirements for NPP had been defined and VIIRS products would include chlorophyll, suspended sediments, turbidity etc.

## 11. Strategic Plan for Ocean Colour

Dr. Trees noted that he would be meeting with Dr. Esaias in the near future to discuss a strategy for ocean colour in general. NASA had not changed its views on ocean colour but funding had to be divided between algorithm development, maintenance, cal/val and

science. The Chairman requested that Dr. Trees submit the plans for NASA's ocean colour strategy to the IOCCG for review, if possible. The Chairman also noted that this was an element of a broader issue on the global scale, which bears on agenda item 12.

**ACTION 7/7: DR. TREES TO SUBMIT PLANS FOR NASA'S OCEAN COLOUR STRATEGY TO IOCCG FOR REVIEW.**

## **12. IOCCG Involvement in CEOS and IGOS**

### *(a) IGOS Partnership Status*

The Chairman informed the Committee that he had requested IGOS partnership status following the IOCCG's acceptance into CEOS (2 years ago). The motivation was that the IOCCG met the criteria for partnership in IGOS as written by IGOS principals, and that a partnership status would provide a better chance to influence IGOS from the inside. There was a view that the IOCCG did not need to be a partner because members could have a voice as part of another delegation such as ICSU or IGBP. In practice this did not work. The IOCCG's application was still pending as IGOS had not yet decided on a mechanism by which new partners could be adopted. The Chairman reported that he had attended the recent CEOS Plenary and IGOS Partners meetings in Kyoto, where it was decided that there would be 2 chairs for IGOS (one from CEOS and one from IGOS) and that the meetings of CEOS and IGOS would be separated in time.

### *(b) Integrated Global Carbon Observation Theme*

The Chairman informed the Committee that Dr. Maria Hood (IOC) and colleagues were preparing a report to integrate global carbon observations for GOOS, and the IOCCG had submitted information relevant to ocean colour for the document. Related to this, the theme paper for the Integrated Global Carbon Observation Theme (IGCO) of IGOS would be released in August, 2002 and would incorporate sections of Dr. Hood's document (Dr. Podaire has a copy of the report). Furthermore, a science plan was being developed for a future ocean carbon program within IGBP and JGOFS and an open science conference would be held later this year in France.

## **13. Training Courses/Workshops**

### *(a) Training Course in Ahmedabad, India (12 - 23 February, 2001)*

Dr. Nayak reported that the training course had been sponsored by ISRO, IOCCG and POGO and was held in the Space Application Centre in Ahmedabad. He conveyed his appreciation to Drs. Platt and Sathyendranath for their support and for deciding to go ahead with the course despite the severe earthquake. A total of 19 participants (9 foreign, 10 Indian) attended the course and were given detailed scientific lectures as well as hands-on tutorials. The syllabus covered the fundamentals of remote sensing and ocean optics, sensors, cal/val, algorithms and applications, while tutorials covered atmospheric correction, determination of sediments, yellow substances and potential fishing zones. According to a feedback from students, 63 % intended to use ocean-colour data for applications such as fisheries or coastal zone management while very few were interested in algorithm development. Only 40 % of the students had the facilities to process the data in their home institute. These two issues should be

considered in future training courses. A few students also requested a more intense training course related to fisheries. Dr. Nayak proposed that there should be some continuity after the training courses and suggested organising a more specialised course as a follow-on.

(b) *New Caledonia Workshop, 25-28 September, 2001*

Dr. Lynch reported that this workshop had been proposed by Dr. Bill Erb, from the Perth regional IOC office. The IOC sponsored 11 delegates from various South Pacific to attend the workshop while a further 12 non-sponsored delegates also participated. Other sponsors included IRD (use of facilities in Noumea), Curtin University and the IOCCG. The level of marine remote-sensing was almost non-existent amongst participants, so the goal of the workshop was to address potential regional applications of ocean-colour data, identify management priorities and formulate management strategies. Two areas of interest emerged in terms of applications: management and understanding of the tuna fishery, as well as environmental management of *Trichodesmium* blooms. The outcome of this short, focussed workshop was an increased understanding of ocean colour and its applications, with the potential for a follow on workshop in 2002. Dr. Lynch would be sending a workshop report to the IOC as well as the IOCCG (for website).

**ACTION 7/8:** DR. LYNCH TO SEND NEW CALEDONIA WORKSHOP REPORT TO PROJECT OFFICE FOR WEBSITE.

(c) *Conference in St Petersburg, Russia (25-29 September, 2001)*

Dr. Kopelevich expressed his thanks to the IOCCG Committee for supporting eight Russian students to attend the conference on 'Optics of Natural Waters'. The conference covered many topics associated with ocean optics, radiative transfer theory and optical properties of natural waters, with 19 oral or poster presentations being directly concerned with ocean colour.

(d) *SEAMEO/BIOTROP Training Course, Indonesia (23 October – 3 November, 2001)*

The Chairman noted that the IOCCG had received a letter from Dr. Siregar in Indonesia requesting that we send an ocean-colour lecturer to their training course. Dr. Nayak had kindly obliged to help IOCCG meet this request. Dr. Nayak reported that the course focussed on coastal zone management using GIS, microwave and GPS and that he lectured on overall coastal zone management using remote sensing and ocean colour. Approximately 14 participants from 6 countries attended the course, which was also sponsored by UNESCO. Dr. Stefano Fazi of the Jakarta UNESCO Office was keen to have continuity in this region, and stated that UNESCO was prepared to sponsor a long-term programme. Participants were mainly concerned with degradation of coral reefs, mangroves and conservation of the fisheries resource. Committee members advocated that the IOCCG establish a closer interaction with UNESCO, and the Chairman recommended writing a letter to UNESCO in Paris (copy to Dr. Fazi) noting possibilities for future co-operation.

**ACTION 7/9:** PROJECT OFFICE TO WRITE LETTER TO UNESCO NOTING POSSIBILITIES FOR FUTURE CO-OPERATION IN THE AREA OF CAPACITY BUILDING.

(e) *Training Course in Cape Town, South Africa (3 - 13 December, 2001)*

Dr. Shillington submitted a brief report on the recent IOCCG-sponsored training course held at the University of Cape Town. Eighteen young students from nine different countries participated in the course. Satellite data from the dynamic Benguela Upwelling System was used during the course to demonstrate fundamental SeaWiFS image analysis. Students were introduced to the problems associated with cloud cover and digital representation of the images, and were also given hands-on demonstrations on the use of SeaDAS software. The course also included a number of lectures covering the fundamentals of satellite remote sensing, *in situ* pigments, apparent and inherent optical properties, and calculation of primary productivity. A full report is available on the IOCCG website.

(f) *Web-based Training.*

Dr. Lynch informed the Committee about the Ocean Colour Educational web resources (OCEwr) website that has been developed at Curtin University (Perth). The site aimed to provide a set of resources on ocean colour that could be used by lecturers developing training courses or study programmes. The OCEwr site holds resources ranging from introductory subjects to more technical aspects of ocean colour. Material had been contributed by a number of lecturers from IOCCG training courses as well as by the Remote Sensing and Satellite Research Group at Curtin University. The web-site could be used to stimulate pre-reading for training courses, or for development of student exercises.

Dr. Frouin remarked that the IOCCG was devoting considerable resources to training activities, which could be perceived as being excessive, since there were so many other issues the IOCCG might address. The Chair pointed out that no more than 25% of the IOCCG's annual budget was set aside for training, and that capacity building was a leading issue. The Committee agreed that the IOCCG's training programme was held in high esteem but suggested that more effort should be made to promote ocean colour and its applications (*i.e.* operational ocean-colour working group). Dr. Neumann also advocated promoting inter-agency communication and providing a common voice for the user community.

Prof. Morel proposed that the IOCCG also consider holding high-level training courses in Europe or North America to cover the fundamental principals of ocean colour. The Chairman noted that the mandate of the IOCCG was to broaden the user base, which did not exclude this type of training course. The Committee were generally supportive of Prof. Morel's view, and agreed there was a need for higher-end courses. Dr. Lynch recommended linking an ocean-colour workshop with a conference such as Ocean Optics, which was favourably received. He also pointed out that careful attention should be paid to the selection of students, especially in developing countries.

## 14. Future IOCCG-Sponsored Training Initiatives

### (a) *Noumea, New Caledonia*

Dr. Lynch reported that the follow-on training course to the Noumea workshop would be held in Fiji, as the plan was to link the course with an ARGO workshop organised by Dr. Stan Wilson. The theme of the course would include science and applications, management of the marine environment and fisheries. The course would be sponsored by the IOC, IOCCG and perhaps SOPAC and would take place in September 2002.

Dr. Lynch also informed the Committee of two other ocean-colour training initiatives. The first was a proposed training workshop on ocean colour and ocean temperature to be held in Mauritius or Pakistan as part of the Indian Ocean GOOS Programme. The course would be sponsored by the IOC, Perth Regional Office and would take place in November 2002. The second was a training initiative sponsored by the Australian international aid agency (AusAID). Several scientists from the Maldives would be funded to travel Perth for training, to encourage the use of remote sensing data for coastal monitoring and management. This would be followed by a formal training course and field work in the Maldives, to initiate an *in situ* measurement programme. The course would probably take place in 2003. Dr. Lynch inquired whether the IOCCG would be interested in sponsoring this initiative, perhaps through an IOCCG Fellowship. The Chairman advised Dr. Lynch to keep the IOCCG informed and to collaborate with existing and regional agencies as well as neighbouring countries. Dr. Nayak also informed the Committee that ocean colour was a useful tool to chart the coralline shelves, a very productive area for fisheries. He noted that it should be possible to monitor coral bleaching, resulting from global warming, by using ocean-colour data.

**ACTION 7/10:** DR. LYNCH TO KEEP IOCCG INFORMED OF DEVELOPMENTS FOR PACIFIC TRAINING COURSE AS WELL AS TRAINING IN THE INDIAN OCEAN AND MALDIVES.

### (b) *International Ocean Colour Cruise*

Dr. Frouin presented a proposal for an international ocean-colour training cruise using the Russian *R/V Akademik Ioffe* on its return trip from Ushuaya to Kalingrad. The Scripps Institution of Oceanology had set up a collaborative project with the Shirshov Institute of Oceanology to carry out ocean-colour validation studies onboard this vessel. Optical instrumentation and other scientific equipment for comprehensive ocean colour studies were already onboard. Dr. Frouin proposed that students board the ship in Miami and disembark in Kiel. Additional ship's time would amount to ~\$200K, of which \$70K could be provided by a Russian source (for 2002 only). Other sources could potentially contribute ~\$60K. Dr. Frouin had approached NASA for the difference but had not obtained the funding, so he intended to submit a proposal to NSF for funding (for 2003). The Chair suggested that he also explore the possibility of obtaining funding through the IOC floating university programme.

## 15. Liaison with Other International Programmes

### (a) JGOFS

The Chair informed the Committee that Dr. Nick Hoepffner had represented IOCCG at the JGOFS Scientific Steering Committee meeting in July last year, in the IOCCG's capacity as remote sensing advisor to JGOFS. The IOCCG reports had attracted a great deal of interest. Since JGOFS was in their synthesis phase and coming to an end, a series of meetings had been held to discuss the future of internationally co-ordinated ocean biogeochemistry. Remote sensing was prominent in these meetings and ocean colour was seen as crucial to the future plan. Ms. Gross mentioned that the Ocean Futures Committee, chaired by Dr. Julie Hall and set up by IGBP and SCOR to examine the future of ocean biogeochemical studies, also had a strong interest in ocean colour.

### (b) POGO

Dr. Sathyendranath reported on the activities of POGO, a newly formed organisation that brought together oceanographic institutions around the world. It was established to promote and enhance the implementation and integration of global oceanographic activities. POGO supported two major activities over the past year: a workshop on time-series measurements and a biology workshop. At the biology workshop (which included IOCCG representation) participants discussed how POGO could promote biological observations at the global scale. It was recommended that POGO members act in a co-ordinated fashion to promote long-term collection of *in situ* measurements of a few key variables: chlorophyll-a,  $p\text{CO}_2$ ,  $\text{NO}_3$ , along with the physical variables wind and CTD. Remote sensing was seen as complementary to *in situ* observations and it was recognised that there was a need for an operational data stream to complement research developments in ocean colour (*e.g.* calibration and validation). POGO also encouraged the development of algorithms for interpretation of ocean-colour data in coastal waters and the retrieval of other variables in addition to chlorophyll-a. At the workshop, the IOCCG recommended a series of *in situ* observations that would best serve the needs for validating the algorithms and enhancing the applications. Dr. Sathyendranath suggested that POGO join hands with IOCCG to communicate the message of the user community to CEOS members.

## 16. Membership Rotation

The Chair requested nominations for new members. These would be discussed at the upcoming Executive meeting. The Chair expressed his gratitude to the IOCCG members stepping down for their service, and hoped that they would continue to take an interest in Committee and help out whenever possible.

## 17. Any Other Business

### (a) Biodiversity Monitoring

The Director of DIVERSITAS (an international programme dedicated to biodiversity research) had enquired whether the IOCCG was interested in marine biodiversity monitoring, as measured by satellite ocean colour. Dr. Trees noted that a programme scientist at NASA HQ was interested in biodiversity, and he agreed to forward the

details. Dr. Nayak also reported that scientists at ISRO routinely identified broad areas of a homogeneous or diverse phytoplankton assemblage.

*(b) IOCCG Fellowship*

The Chairman proposed that another way of carrying out training was to offer a limited number of IOCCG fellowships to allow scientists or technicians to travel to another institute for specialised training. Dr. Sathyendranath mentioned that POGO had such a fellowship scheme, which covered travel and subsistence at a host institute. The fellowship was developed on a partnership basis: the parent institute must have a clear interest in topic and bear local costs, while the host institute bears the cost of training. POGO had received about 40 applications, approximately 10 of which requested training in ocean colour. The feedback had been extremely positive and POGO planned to continue with this initiative.

There was general agreement about the idea of an IOCCG Fellowship scheme, with some caution about terms and scope within the concept of terms of reference. Several Committee members tentatively agreed to host such trainees, with some conditions about what was expected in return. It was noted that the fellowship scheme would target students at a more advanced level than the training courses. It was also suggested that the fellowships be used to inter-link agencies to try and bring data together, since one of the core issues of the IOCCG was data merging and the development of a global, long-term data set. Dr. Rast suggested that the fellowships could be put to good use by focusing on data merging and operational ocean colour.

*(c) Associate Membership*

A suggestion was put forward by Dr. Lynch that the IOCCG consider creating an Associate Membership category, which could be conferred upon individuals who have made a significant contribution to the activities of the IOCCG. Associate Members would be invited to attend and participate in all IOCCG Committee meetings, and would be included in all relevant IOCCG correspondence. Committee members welcomed this proposal and it was agreed that the terms of reference should be drafted.

**ACTION 7/11:** PROJECT OFFICE TO DRAFT TERMS OF REFERENCE FOR IOCCG ASSOCIATE MEMBERSHIP.

**18. Time and Place of Next Meeting**

One suggestion for the next IOCCG meeting was to hold it in conjunction with the ISRPS meeting in Hyderabad, India, 3 - 6 December, 2002, rather than have it in January (to avoid potential conflicts with the SIMBIOS meeting). Dr. Nayak offered to help with organisation of the meeting in India.



## APPENDIX I

## LIST OF PARTICIPANTS

Seventh IOCCG Committee Meeting, Villefranche, France (10 – 12 January, 2002)

**IOCCG Members**

Asanuma, Ichio  
Doerffer, Roland  
Frouin, Robert  
Kopelevich, Oleg  
Lynch, Mervyn  
Morel, André  
Nayak, Shailesh  
Neumann, Andreas  
Platt, Trevor  
Podaire, Alan  
Rast, Michael  
Schlittenhardt, Peter  
Trees, Chuck  
Ulloa, Osvaldo

**Affiliation**

Jamstec/NASDA, Japam  
GKSS, Germany  
SIO, USA  
P.P. Shirshov, Russia  
Perth University, Australia  
Villefranche, France  
ISRO, India  
DLR, Germany  
Bedford Institute, Canada  
CNES, France  
ESA/ESTEC, Netherlands  
JRC, Italy  
NASA, USA  
Universidad de Concepción, Chile

**Invited Participants**

Antoine, David  
Gross, Elizabeth  
Sathyendranath, Shubha  
Stuart, Venetia

**Affiliation**

LOV, Villefranche, France  
SCOR, USA  
POGO, Canada  
IOCCG Project Office, Canada

**Apologies**

Ainsworth, Ewa  
Brown, Chris  
Delu, Pan  
Ishizaka, Joji  
Kim, Yongseung  
Navalgund, Rangnath  
Parslow, John  
Shillington, Frank  
Tanaka, Tasuku  
Wang, Menghua

**Affiliation**

SIMBIOS, USA  
NOAA-NESDIS, USA  
SOA, China  
Nagasaki University, Japan  
KARI, Korea  
ISRO, India (Represented by Dr. Shailesh Nayak)  
CSIRO, Australia  
University of Cape Town, South Africa  
NASDA, Japan (Represented by Dr. Ichio Asanuma)  
University of Maryland, USA

**APPENDIX II**

**AGENDA**

Seventh IOCCG Committee Meeting, Villefranche, France (10 – 12 January, 2002)

**1. Welcome Address and Logistics**

**2. Adoption of the Agenda**

**3. Record of the 6<sup>th</sup> Committee Meeting (Platt)**

Adoption of the minutes of the 6<sup>th</sup> committee meeting. Review of Action Items.

**4. Progress of Current IOCCG Working Groups**

- a) Calibration of ocean-colour sensors to common standards (Frouin)
- b) Co-ordination of merged data-sets (Platt)
- c) Comparison of atmospheric correction algorithms
- d) Operational ocean colour (Brown)
- e) Ocean colour data-binning issues (Antoine)
- f) Standardising the extraterrestrial solar flux spectrum (Morel)

**5. Proposals for New IOCCG Working Groups**

**6. Overview of the SIMBIOS Programme (Trees)**

**7. SeaWiFS Data Set**

Comments on reprocessing of the SeaWiFS data set and renewal of data buy contract.

**8. Issues Related to the Project Office**

- a) IOCCG pamphlet (Platt)
- b) New Information Officer (Platt)

**9. Status of Current Ocean-Colour Missions**

Brief reports will be given on the status of the current ocean-colour missions, with emphasis on data distribution policies and plans for Level 2 or Level 3 data products.

- a) MOS (Neumann)
- b) SeaWiFS and MODIS-Terra (Trees)
- c) OCM (Nayak)
- d) OSMI (Kim)

**10. Future Ocean-Colour Missions**

The status of future ocean-colour missions will be discussed.

- a) MERIS (Rast)
- b) MODIS-Aqua (Trees)
- c) COCTS on HY-1 (Delu)
- d) GLI and S-GLI (Asanuma)
- e) POLDER-II (Podaire)

- f) OCM on IRS-P7 (Nayak)
- g) NPP and NPOESS (Trees)

**11. Strategic Plan for Ocean Colour (Platt)**

Discussions regarding the need to develop a strategic plan to ensure the long-term continuity of the ocean-colour data stream, especially in the post 2006-era.

**12. IOCCG Involvement in CEOS and IGOS**

- a) IGOS Partnership status (Platt)
- b) Integrated Global Carbon Observations (IGCO) theme (Platt)
- c) Report on CEOS Plenary, November, 2001 (Platt)

**13. Training Courses/Workshops**

- a) Report on IOCCG training course held in Ahmedabad, India, 12-23 February, 2001 (Nayak)
- b) Report on ocean-colour workshop held in Noumea, New Caledonia, 25-28 September, 2001 (Lynch)
- c) IOCCG's contribution to the conference on 'Optics of Natural Waters', St. Petersburg, Russia, 25-28 September, 2001 (Kopelevich)
- d) IOCCG's contribution to the SEAMEO/BIOTROP training course in Bogor, Indonesia, 23 October - 3 November 2001 (Nayak).
- e) Report on IOCCG training course held in Cape Town, South Africa, 3-13 December 2001.
- f) Web-based training (Lynch)

**14. Future IOCCG-Sponsored Training Initiatives**

- a) Training course in Noumea, New Caledonia (Lynch)
- b) International ocean colour training cruise (Frouin/Kopelevich)

**15. Liaison with Other International Organizations**

- a) JGOFS (Platt)
- b) POGO (Sathyendranath)

**16. Membership Rotation (Platt)**

Six scientific members will be stepping down from the IOCCG Committee this year to continue the required rotation of the Committee (Ishizaka, Kopelevich, Neumann, Parslow, Shillington, Ulloa). Nominations for new Committee members will be discussed.

**17. Any Other Business**

- a) Biodiversity monitoring
- b) IOCCG Fellowship
- c) Associate Membership

**18. Time and Place of Next Meeting (Platt)**

## APPENDIX III

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–Inter-band	Barnes/CNES Team
–Multi-temporal	Barnes/CNES Team
7. Multi-sensor calibration	CNES Team
8. Issues	
9. Conclusions	

## MEMBERS OF THE WORKING GROUP

Ed Zalewski	University of Arizona
CNES Team	Olivier Hagolle, Bertrand Fougny, Francois Cabot
Robert Barnes	NASA
Robert Frouin	Scripps