

**Fourth Committee Meeting, IOCCG  
Kailua-Kona, Hawaii, 5-7 November, 1998**

**MINUTES**

The meeting took place at the Kona Surf Resort, Kailua-Kona, Hawaii. Fifteen committee members were present, plus two observers (see attached list of participants). Apologies were received from Drs. Aiken, McClain, Naval Gund and Yoo. In addition, the Executive Director of SCOR (Elizabeth Gross) was unable to attend.

**1. Welcome and Opening Remarks**

The Chairman, Dr. Platt, opened the meeting and thanked participants for traveling to Hawaii to attend the fourth meeting of the IOCCG Committee. He noted that the committee was maturing rapidly and that it provided a resource for the sponsoring organizations. The Chairman welcomed two new committee members: Dr. Ishizaka from Japan, who was a replacement for Dr. Kawamura, and Dr. Ulloa from Chile. He also welcomed two guests: Prof. Yun from the East China Normal University and Prof. Li from the National Taiwan Ocean University.

**2. Adoption of the Agenda**

The Chairman proposed rearranging the Agenda to accommodate Dr. Tanaka, who would be leaving early to represent the IOCCG at the CEOS Plenary in Bangalore. Several new Agenda items were proposed *i.e.* the SEI sensor (Dr. Yoder, Agenda item 5j), the German MERIS Application Program (Dr. Neumann, Agenda item 8), the IVOS meeting (Dr. Rast, Agenda item 11), the Coastal GOOS Pilot Project (Dr. Campbell, Agenda item 16a), Ocean-Colour events in South America (Dr. Ulloa, Agenda item 16b) and a proposal to ESA for a new sensor (Dr. Neumann, Agenda item 16c).

**3. Matters Arising from the Minutes of the Previous Committee Meeting**

- (a) The Chairman informed the committee that the report from the IOCCG workshop on minimal requirements for future ocean-colour sensors (held in October, 1997) had been printed and could be cited as IOCCG Report Number 1 (1998). The Chairman extended his appreciation to the group that worked on the report and especially to Prof. Morel for his excellent input and all the effort that went into producing the report. Regarding distribution of the report, it was agreed that the report be distributed free of charge to PI's from each agency (Dr. Campbell to supply list) and that it be installed onto the IOCCG homepage. IOCCG committee members would be supplied with a number of copies for distribution within their own organizations.
  
- b) The IOCCG information kit-folder (with three removable inserts) had been printed and was available for distribution. The Chairman encouraged committee members to draft new material for the inserts. Suggestions for new inserts included: upcoming missions (one insert each), the IOCCG workplan, an image gallery (including unusual applications such as coccolithophore blooms), reference to aerosol maps (which would

extend the use of ocean-colour instruments) and applications of ocean-colour data (e.g. SIMBIOS, JGOFS). Members were requested to send material for the inserts to the Project Scientist, preferably as camera-ready files. The purpose of the kit-folder was to promote the activities of the IOCCG, which in turn is strongly oriented towards promoting ocean colour in its broadest sense, and to expand the application of ocean-colour data. The target audience is variable, which is why the inserts are removable. The committee recommended that future inserts should be dated and numbered, and a list of all inserts currently available be included in each kit-folder. There should also be a statement indicating that new inserts were being prepared on an ongoing basis. It was also recommended that the kit-folders be distributed through the CEOS Secretariat and at scientific meetings and symposia.

- (c) At the “Complementarity” workshop in June, 1998 (Halifax) it was proposed that the IOCCG communicate once again with the Korean Aerospace Research Institute, suggesting that they consider preflight calibration of an additional NIR atmospheric correction band (around 750 nm) for their OSMI sensor. This letter, drafted by Dr. Parslow, had been sent but no reply had been received to date. It was proposed that a copy of Report Number 1 be sent to the head of KARI (Dr. Paik), with a letter referring to page 13 of the report.
- (d) Three IOCCG committee members (Morel, Platt and Yoder) presented lectures during a session on “Living Resources” at the ICSOS meeting in Lisbon (August, 1998). The session was initiated by the IOCCG and the lectures were well received. Initially, Dr. Halpern intended publishing a book containing a series of invited lectures, but according to Dr. Yoder this was not going ahead. The Chairman suggested making inquiries whether this was due to financial constraints or other factors. Several committee members indicated they would appreciate such a book.

#### 4. Issues Related to the Project Office

The Chairman reported that when the IOCCG Executive Committee was first established, a decision was made to use the *backscatter* magazine as a vehicle for disseminating information. It was agreed that the IOCCG would provide 5 pages of material for each issue, at a rate of half the real cost per page. In reciprocation, IOCCG members would receive free copies of the magazine. In addition, since AMRS needed to expand their distribution, the IOCCG provided names and addresses of IOC and CEOS delegates. Historically, AMRS was supported by the province of Nova Scotia, but this source of funding had been progressively reduced. Recently, AMRS informed the IOCCG that they could no longer provide free copies of the magazine to IOC delegates or to certain IOCCG members, and that they could not continue to subsidize the IOCCG pages to the same extent. In addition, the editorial policy of the magazine was changing. Most of their revenue was from display advertisers so their target circulation was mainly government employees, offshore oil industry representatives or Space Agency representatives from North America and Europe. Perhaps the time had come to consider other opportunities.

The Chairman put forward a proposal to establish a new scientific journal (similar in physical appearance to *Nature*) which would serve two purposes: (i) dissemination of the kind of material that was published in the *backscatter* magazine (news and general articles) and (ii) dissemination of peer-reviewed articles on ocean colour which would normally appear in a scientific journal. Several members recommended establishing a web-based journal or approaching other publishers to see whether any would be interested in setting up a journal dedicated to ocean colour. Others suggestions included using the IOCCG web site to disseminate information or using existing newsletters, such as the ESA Quarterly, the CEOS Newsletter or Oceanography (published by *The Oceanography Society*), as a publication outlet. In general, the committee agreed that the news and promotional articles published in the *backscatter* magazine were informative and useful and served a different purpose to those published in a scientific journal. Although the committee endorsed the idea of an ocean-colour journal in principle, and agreed that there was a need for one, the general consensus was that the work load might be too great for the IOCCG as presently established. It was recommended that the IOCCG approach established publishers to see what kind of arrangement might be made.

The status of the IOCCG homepage was briefly reviewed, including a summary of the user statistics for the period July, 1997 to October, 1998. Maintenance for the homepage was provided by the JRC, through a subcontract to a private company. It was suggested that an insert be prepared for the IOCCG kit-folder containing information on the homepage, and that all future inserts should state what information was available on the website.

## **5. Status of Ocean Colour Missions**

### **(a) MOS**

Dr. Neumann noted that there had been a major restructuring of the German Space Program and that the outcome was optimistic, despite the fact that the MOS team in Berlin, and the ground segment, had been reduced in size. The Chairman inquired whether the IOCCG could do anything to help, but Dr. Neumann said he was reluctant to mix the Agencies' internal problems with the business of the IOCCG. Despite the internal problems, the MOS mission was very successful. A very successful workshop on MOS-IRS and Ocean Colour had been held in June, 1998, and a report on the proceeding was being published. The MOS instrument was performing well, showing no significant degradation, and it was anticipated that the instrument would be functional up to the year 2002. Dr. Neumann also reported that the MOS receiving station at NASA/Goddard was technically ready, and operations were planned to start in January, 1999. DLR, in agreement with ESA was also planning to use a mobile receiving station installed in Kourou, to receive MOS data. Depending on technical and financial issues, this could be operational by mid-1999.

### **(b) SeaWiFS**

Dr. Campbell presented a brief review of the SeaWiFS instrument, which was performing well. Monthly lunar calibrations had detected a trend of degradation in channel 8 (which could be corrected for), but the visible bands were very stable. Vicarious calibration of the sensor was carried out through the Atlantic Meridional Program (AMT). In addition, the SeaWiFS project maintained a moored optical buoy (MOBY) off Hawaii, which provided optical data for calibration of the sensor. All SeaWiFS data had been reprocessed (starting September, 1997) using refined radiometric calibrations and a new algorithm for chlorophyll retrieval.

Dr. Campbell also briefly reviewed NASA's SIMBIOS project (Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies) on behalf of Dr. McClain. SIMBIOS was currently involved in three main activities: (i) cross-calibration of various ocean-colour sensors, (ii) validation of the geophysical products and (iii) merging data products from various ocean-colour missions *e.g.* producing a time-series using OCTS and SeaWiFS global chlorophyll datasets, with complementary information from the MOS sensor (MOS operated during both missions and would help characterize differences between sensors).

**(c) MODIS**

Dr. Campbell gave a brief presentation on NASA's Science Program in general, including the MODIS-AM instrument, which was nominally scheduled for launch on May 30, 1999. Ocean-colour data from this sensor would probably be processed by PI's rather than by a central data processing system.

Three types activities were funded by NASA's Science Program including (i) ongoing research programs such as SIMBIOS, the SeaWiFS Science Team, the JGOFS program and the Earth Observing System (MODIS and interdisciplinary science), (ii) interagency activities such as the National Ocean Partnership Program which coordinates all U.S. contributions to Global Ocean Observing Systems and NPOESS (National Polar Orbiting Environmental Satellite System) and (iii) Intergovernmental activities such as UNESCO/IOC (*e.g.* GOOS, LMR, GODAE) and IGOS (CEOS, Long-term Ocean Biology Project). Within the U.S., the Navy was also involved in ocean colour and had developed a hyperspectral instrument (NEMO), which was scheduled for launch in the year 2000.

In planning future global space observing missions, NASA recommended that three time-series be maintained: altimetry, surface winds and ocean colour. For ocean colour, SeaWiFS would cover the period 1997 to present, MODIS AM1/PM1 would cover the period 1999 - 2005, a bridging mission would cover the period 2005 - 2009 and NPOESS would cover the period 2009 and beyond. There was some pressure to limit the number of ocean-colour bands (to 8 or less), which would limit the evolution of ocean-colour capability. NASA had no plans for advanced ocean-colour missions. The bridging mission would consist of a simple sensor with no tilt, early equatorial crossing time and a primary focus on land.

MODIS-PM was nominally on schedule (June 2000). The MODIS budget would allow for one reprocessing of data during the first year, which might not be sufficient. A global, 1 km grid had been proposed and may be implemented.

(d) **MERIS**

Dr. Rast briefly reviewed the status of the MERIS program. The instrument had been tested, the ground segment contract was almost complete and the sensor was scheduled for launch in June 2000. Marginal adjustments were required on four of the sensor's 15 bands to avoid atmospheric influences. Besides Level-2 products (normalized reflectance, algal pigments, suspended matter, yellow substances *etc.*) the reflectances per band would also be given. Validation of the ATBD's was ongoing. The aim was to deliver a "distributed" product which would be processed using different algorithms *i.e.* land, Case-1/Case-2 waters and clouds. ENVISAT's Announcement of Opportunity had received over 700 proposals, 150 of which had been for calibration and validation.

(e) **OCTS, GLI and S-GLI**

Mr. Tanaka reported that NASDA/EORC had completed the reprocessing of OCTS LAC data (Version 4), while the reprocessing of GAC data would be finished by March, 1999. Version 4 reprocessing included improved vicarious calibration and minor changes to the atmospheric correction algorithm. Reprocessed OCTS data were currently available through the ADEOS homepage, whereas Level 0 data from the United States, Europe and Australia would be available as of December, 1998. NASDA also had plans to process SeaWiFS data using the OCTS algorithm.

The GLI sensor was still on schedule to be launched in November, 2000, onboard ADEOS-2, but no progress had been made for ADEOS-3. In addition, a Mission Demonstration Satellite (MDS) was scheduled for launch around the year 2000, (between the ADEOS-2 and ADEOS-3 missions). This satellite would carry several atmospheric instruments as well as the IMG sensor. Dr. Frouin stressed that it was important to have more interaction between the POLDER and OCTS teams now that there was more opportunity to merge data.

(f) **POLDER**

Dr. Lifermann gave a brief report on POLDER's ocean-colour products (mainly marine directional reflectances, chlorophyll pigment concentration and water type). For each orbit two kinds of Level 2 products were generated: directional parameters with marine reflectances (useful for validation of directional models of sea surface reflectance) and non-directional parameters with underwater diffuse marine reflectances, water type and pigment concentration. In addition, a monthly Level-3 product was also provided. Studies were underway to investigate merging ocean-colour data and altimetry.

Calibration of the sensor was better than 3% at the longer wavelengths and approximately 5% at 443 nm. A rigorous step-wise approach was used for ocean-colour validation including validation of the calibration (vicarious calibration), validation of retrieved directional reflectances after atmospheric correction and validation of the retrieved pigment concentration (this relied on measurements from SIMBAD and other *in situ* measurements).

The NDPI algorithm (Normalized Difference Pigment Index) developed by Dr. Frouin was used to estimate chlorophyll concentration as it was less sensitive to noise

and gave a better performance at low concentrations. Other CNES projects included intercalibration of various ocean-colour sensors using desertic sites and the continued development of the SIMBAD instrument.

Dr. Lifermann also informed the committee that the Validation Review Panel recommended restricting the release of POLDER data, because the present quality of the data could be improved. A lengthy debate ensued about the desirability of releasing POLDER data to the community at large, and protecting scientists from using data that was not final. Dr. Campbell mentioned that the feedback on SeaWiFS data (before reprocessing) had been extremely useful. The committee noted the great care taken in the error analysis of the data and concluded that the POLDER data set was probably mature enough to be released on a broader scale as long as the users were aware of the problems with the data, and that another version would be available shortly. In addition, a comparison of OCTS and POLDER data would be extremely valuable. The committee concluded that it was appropriate for the IOCCG to make a clear statement encouraging release of the data. The Chairman agreed to write a letter to CNES expressing interest in obtaining the data and recognizing the reasons for caution with respect to release of the data. Drs. Lifermann, Frouin and Morel would review the contents of the draft letter.

**(g) OCI**

Prof. Li presented a brief overview of Taiwan's OCI sensor (Ocean Colour Imager). The sensor is one of three scientific payloads onboard the ROCSAT-1 satellite, which is scheduled for launch on January 27, 1999 and which will be placed in orbit at an inclination of 35° to monitor the low-latitude oceans. Scientific data will be transmitted via S-band to a ground receiving station in Taiwan. OCI has seven spectral bands, six of which are identical to those of SeaWiFS, facilitating intercomparisons between sensors. NEAL values would be the same as for the OCTS sensor, since OCI was also designed by NEC of Japan. Simulated data have indicated that the quality of OCI data has the potential of being as good as other satellite ocean-colour sensors. In addition, the bio-optical algorithm used for chlorophyll retrieval produces very similar results to that of the SeaWiFS algorithm. Because SeaWiFS has an automatic sun-glint avoidance capability, there are several areas with no recorded data, which could be provided by OCI.

Data from the OCI instrument will be processed and distributed by the OCI Science Data Distribution Center (SDDC). Standard OCI data products will include normalized water leaving radiance and chlorophyll-a concentration. OCI data will be distributed free for scientific and educational purposes and can be requested through the OCI web site (<http://www.oci.ntou.edu.tw>).

**(h) China's ocean-colour sensors**

Prof. Yun reported that China intended to launch two small ocean-colour satellites (HY-1) in the year 2000 (using one rocket), but as yet there had been no official announcement. China's OCTS sensor (Ocean Colour and Temperature Scanner) was designed by the Shanghai Institute of Technical Physics and will have visible and infrared channels for monitoring ocean colour and sea surface temperature, while the

CZI sensor (Coastal Zone Imager) will have four spectral bands between 420 and 890 nm. This sensor was designed to monitor coastal areas at a spatial resolution of 250 m. In China, several large rivers discharge high concentrations of suspended sediments and organic fertilizers into the shallow coastal waters each year, which has far-reaching influences on the marine environment. Investigating Case-2 waters is thus one of the focal points of ocean-colour research in China.

**(i) OSMI**

Dr. Yoo submitted an update on the developmental status of the Korean OSMI sensor. In summary, the OSMI flight module had been successfully installed on the KOMPSAT-1 spacecraft and would undergo space environment tests. The satellite was scheduled for launch from Vandenberg, USA, in July, 1999. Level-2 data products would include normalized water leaving radiance, aerosol radiance, chlorophyll concentration, diffuse attenuation coefficient, epsilon of aerosol correction and aerosol optical thickness. Dr. Campbell informed the committee that the software for processing the data would be done by a Californian company and would be based on the SeaDAS system.

**(j) OCM**

Dr. Navalgund was unable to attend the meeting but submitted an article on the Indian OCM instrument (Ocean Colour Monitor) for publication in the *backscatter* magazine. The sensor is apparently scheduled for launch in March, 1999 (not late 1998, as stated in the paper) and, as yet, there is no official agreement on data distribution policy.

**(k) SEI**

Prof. Yoder gave a brief review of the Special Events Imager (SEI), a NASA/NOAA proposal for an ocean-colour instrument to be placed in geostationary orbit (not yet approved). This type of instrument would have practical applications such as monitoring red-tide blooms, pollution plumes, oil spills and floods. The sensor would have a reasonable number of spectral bands, with a spectral resolution of 300 m. It would operate in the field of view of a geostationary satellite, collecting images every 30 minutes. It was proposed that NASA would build the instrument and then turn it over to NOAA to be placed on the GOES-N or GOES-O geostationary weather satellites. Contact people for the proposed imager are Dr. Wayne Esaias (NASA) and Dr. Chris Brown (NOAA).

## **6. IOCCG Working Groups**

### **(a) Complementarity of ocean-colour sensors**

This working group met in Halifax (16-18 June, 1998) and produced an advanced draft report. Mr. Tanaka outlined the basic structure and conclusions of the report, which also formed the basis of his presentation to the CEOS plenary (November 10-12, 1998). Ocean-colour sensors were divided into three groups providing (i) global coverage (*e.g.* OCTS, SeasWiFS), (ii) comprehensive observations in the visible and near-infrared (*e.g.* MODIS, MERIS, GLI) and (iii) multi-directional and multi-

polarization observations (*e.g.* POLDER, MISR). According to the draft report, one satellite could not fulfill the temporal and spatial requirements for global ocean observation. The group recommended that at least three synchronized global ocean-colour satellites should be in orbit at one time, to generate an integrated data-set that would fulfill global observation requirements. The working group also drew attention to the fact that there was no clear coordinated plan for ocean-colour observations in the post-2005 era.

A sub-group, chaired by Dr. Parslow, was formed to review the draft report. A number of points were raised and Prof. Yoder volunteered to prepare a revised draft which would be circulated to IOCCG committee members for comments. Dr. Rast implied that additional calculations might be required to prove that satellites could be phased, but the committee agreed that there was some urgency in finalizing the report in the light of the envisaged “Post-2005” meeting with senior space agency representatives.

**(b) Calibration of Ocean-Colour Sensors to Common Standards**

Dr. Neumann reported that he had little success in establishing a working group to investigate the absolute calibration of ocean-colour instruments to common standards, because of a general lack of interest. Dr. Lifermann stated that CNES would be interested in a workshop on intercalibration of sensors, but Dr. Neumann pointed out that there were two issues: intercalibration *per se*, and the reference to common standards. Dr. Campbell offered to forward information on the working group to relevant people at NASA. Representatives from ESA and France agreed to cooperate on developing a study. Dr. Neumann agreed to identify specialists from each agency for the group, and then to proceed with a workshop.

**(c) Standard Validation Data Set**

Dr. Ishizaka reported that the target of this working group was to establish a source of sea truth data for Space Agencies and users with the aim of: (i) confirming the calibration of new sensors, (ii) ensuring the accuracy of satellite data (validation), (iii) detecting the bias of each sensor (merging data sets) and (iv) detecting regional biases (related to Case-2 aerosols). He outlined the requirements for such a data set (*i.e.* chlorophyll and perhaps water leaving radiance, phaeopigments, attenuation *etc.*) as well as the strategy (request oceanographic community to support this effort, create a web-site to provide information for agencies and users). The outcome of the working group would be a brief report elaborating various points, including protocols on how to collect the data. The committee recommended preparing an insert for the kit-folder emphasizing the constant search for validation data-sets.

Dr. Parslow noted that three levels of activity were involved: (i) vicarious calibration *e.g.* atmospheric measurements and water-leaving radiance (supported by space agencies) (ii) collection of data for algorithm testing and development and (iii) validation *i.e.* chlorophyll measurements. Dr. Parslow stated that much of the GOOS program was devoted to collection of data that could support ocean-colour remote sensing and he felt it was important to work closely with GOOS to collect these data sets. Dr. Yoder proposed that the working group focus only on the last point *i.e.*



chlorophyll validation. The aim of the IOCCG would be to help Space Agencies and users locate these data bases, but not to compile the databases *per se*.

**(d) International Ocean-Colour Cruise**

According to Dr. Frouin, the objectives of this proposed cruise were vicarious calibration, evaluation of atmospheric and bio-optical algorithms, intercalibration of instruments, education and promotion of ocean colour. The duration of the cruise would be six months, with six legs of one month each. A planning committee would be formed and would consist of a chairman, a science committee, and an education committee plus members to handle logistics, technical, financial and local aspects. SCOR had indicated that they could not handle the finances without an additional staff person. Dr. Frouin had visited the Shirshov Institute of Oceanology in Russia and found a suitable ship (some of the laboratories required refurbishing). He had not yet formed a committee, but proposed setting up a Project Office at Scripps. Dr. Frouin was of the opinion that funding could be obtained from several sources, including Space Agencies. Dr. Campbell agreed to organize a meeting with NASA program managers to obtain their endorsement for the cruise. This project would be a good opportunity to support coastal-GOOS activities as well as capacity building. The Chairman advised Dr. Frouin to name his committee as soon as possible and to make inquiries vis-à-vis finances. CNES, ESA and DLR representatives indicated that their institutes would not be able to provide funding for this type of activity, but other members suggested that funding could be obtained from sources such as education and capacity building programs (*e.g.* START).

**7. Case-2 Waters**

**(a) Characteristics of Case-2 Waters off the Coast of China**

Prof. Yun outlined the basic features of Case-2 waters off the coast of China including anthropogenic and terrigenous inputs, active re-suspension of fine grain sediments, the effect of dust storms on the west Pacific Ocean and flocculation and adsorption of organic matter and fine-grain sediments. The primary focus of ocean-colour research in China was thus oriented towards characterizing these complex waters.

**(b) Algorithms for Case-2 Waters**

Dr. Campbell reviewed the different types of algorithms being developed (inversion radiance models, neural networks, empirical and statistical models etc.) as well as the types of data required to parametrize and validate algorithms. Dr. Campbell proposed holding a one-day workshop at the next SeaWiFS Science Team meeting (mid-May, 1999) to focus on algorithms for Case-2 waters. In addition, a small, international working group would be formed (chaired by Drs. Campbell and Schlittenhardt) which would meet in Ispra (May/June, 1999). The aim of the working group would be to prepare a comprehensive IOCCG report on algorithms and products in Case-2 waters. The Chairman thanked the members concerned and urged them to proceed with this initiative.

#### 8(a-d) **Merged Data Products**

Dr. Rast gave a brief overview of the latest CEOS IVOS (Infra-Red/Visible Optical Systems) meeting, including sensor calibration and atmospheric correction issues. Recent calculations indicated that there were still large differences in data sets corrected with different codes. The committee recommended that Dr. Neumann liaise with this group when forming his working group.

Following this presentation, there was a lengthy debate about the selection of appropriate targets for calibration of instruments (desert sites, basins of unialgal blooms, oligotrophic oceans *etc.*) and whether there was a need for external targets. The group concluded that the IOCCG should concentrate more on the *method* of calibrating instruments, rather than looking for specific sites. There was also much discussion about vicarious calibration of individual sensors, intercalibration issues at the TOA level and the need for absolute units. The general consensus was that there should be two working groups to tackle these issues: one to deal with the absolute calibration of ocean-colour sensors to common standards (chaired by Dr. Neumann) and one to focus more on the radiometric calibration of ocean-colour sensors in space. Dr. Lifermann agreed to convene a small working group to review the radiometric calibration of ocean-colour sensors, with the aim of producing a report in the IOCCG report series. Dr. Frouin agreed to help with this initiative.

#### (e) **The German MERIS Application Program**

Dr. Neumann informed the committee about the new MERIS Application and Regional Products Project (MAPP), which aimed to provide enhanced ocean-colour products for regional applications around Germany (Baltic Sea, North Sea, Bodensee). This project would use the Level-2 products provided by ESA, and would generate daily complementary regional products using IOP's specific for these waters. New algorithms for regional applications would also be developed and tested. The project would run to the end of 2001, and would promote MERIS data, as well as serve an educational role.

#### 9. **Recommendation for Common Software**

The committee discussed the overall requirements for common software for processing ocean-colour data, and concluded that it would be extremely cumbersome and difficult to produce. One alternative would be to endorse the development of software such as SeaDAS which incorporates algorithms for several sensors in one package, although it was felt that government agencies should not be encouraged to compete with the private sector. In addition, many countries launching their own sensors would require their own specialized software. The Chairman suggested that the IOCCG examine a number of the relatively cheap, commercial processing packages and publish a review of the merits of each package.

#### 10. **Coordination of Ocean-Colour Sensors in the Post-2005 timeframe**

The Chairman proposed that the IOCCG should take the initiative to convene a meeting, at the senior level, with various space agencies to point out the lack of

coordination of ocean-colour sensors in the post-2005 timeframe and to implement a long-term plan. Dr. Campbell advised the committee that NASA had conducted its own planning exercise for all remote sensing beyond 2005 and had received over 100 proposed mission concepts (32 of which were for ocean observations). NASA had a commitment to long-term measurements of altimetry, scatterometry and ocean colour, but as yet, did not have an integrated plan. The Chairman agreed to take up this issue with the Agencies.

#### **11. Liaison between CEOS and IOCCG**

Dr. Parslow reported that Graham Harris had taken over as the Australian delegate to the CEOS plenary. At a meeting in March, 1998, CEOS and SIT recognized the need for IGOS to be integrated with other global observation programs, so it was decided to set up an IGOS partnership consisting of CEOS, GCOS, GTOS, GOOS, IGBP, WCRP and their sponsoring organizations. Thus IGOS is now integrated with other global observing programs. It was also agreed that the Global Observing Systems Space Panel (GOSSP) would act as mediator between the IGOS partners and SIT/CEOS. The IOCCG has therefore been assigned a dual role by SIT. One role is to provide an integrated set of user requirements for ocean-colour missions and to consolidate satellite data needs. The second role is to run the Ocean Biology Pilot Project, which was still seen as a demonstration project. Dr. Parslow suggested that the pilot projects should map their attributes onto an IGOS template and that the IOCCG should be seen to be closely linked to JGOFS and LOICZ *e.g.* the IOCCG could propose the assimilation of ocean-colour data into carbon cycle models, a key part of JGOFS synthesis, or, the IOCCG could incorporate an application of ocean-colour data into LOICZ/Coastal GOOS at regional to global scales.

The Chairman pointed out that JGOFS synthesis was ongoing and did rely on ocean colour, and that JGOFS had requested that the IOCCG act as their liaison with the remote sensing community. It was also pointed out that the agencies looked to CEOS for confirmation of activities and programs to support.

Following this discussion there was some debate about the implementation of GOOS, the lack of collaboration between CEOS delegates, and the formulation of a plan of action for the Ocean Biology Project. Committee members communicated ideas that Mr. Tanaka could expose at the CEOS Plenary (10- 12 November, 1998), and prepared overhead transparencies for his presentation, which outlined the achievements and plans of the IOCCG and emphasized that the IOCCG reports directly to JGOFS.

#### **12. Relations between IOCCG and the IOC Secretariat**

The Chairman summarized events relating to the IOC over the past year, including his reply to a letter from the IOC purporting to present an “objective” accounting of IOCCG funds. The Chairman of the IOC (Mr. Holland) had been invited to participate in the June Executive meeting of the IOCCG, but there were no new initiatives on the part of the IOC. On April 1, 1998, a new Executive Secretary was appointed to the IOC. Dr. Platt requested discussions with him at the ICSOS meeting in Lisbon, and he was sympathetic towards the IOCCG and said he would try to

resolve any outstanding issues by writing an formal letter rescinding the IOC's derogatory comments and apologizing for the way in which the IOC had treated the IOCCG (this letter had not been received at the time of the meeting).

### **13. Proposed Monograph on Ocean-Colour Studies**

Dr. Kopelevich suggested that the time was right for a new monograph on remote sensing of ocean colour. He presented a tentative outline for such a monograph which would combine technical and scientific aspects of ocean-colour and its applications. It was recommended that the monograph be published in several volumes, each with a number of chapters written by experts in the field. The Chairman inquired whether such a multi-author volume should be based on a symposium, but the committee felt that the normal outcome of a symposium would be a collection of papers rather than a book. The committee agreed that such a reference book would be extremely useful for scientists in general, and would also be useful for teaching purposes. Although there was consensus on the need of such a monograph, no one volunteered on the spot to chair the editorial committee as it was such an enormous task, so the discussion was temporarily suspended.

### **14. Training Course in SE Asia**

Dr. Schlittenhardt reported that the proposed SE Asia training course on ocean-colour would be based on an outline of the Chile course, adapted for the SE Asia area. Negotiations were underway to integrate the course into the summer session program of the International Space University, which will take place in Bangkok from June 26 to September 4, 1999. IOCCG members who were interested in lecturing for this course were requested to contact Dr. Schlittenhardt as soon as possible. Dr. Ulloa cautioned that the course should be a coherent program, integrating physical and biological aspects, and that it was important to carefully select students who would benefit from the course and who would make an impact once they returned home. Dr. Schlittenhardt planned to go Strasbourg within the next few weeks to finalize plans.

### **15. Membership Policy**

As an affiliated program of SCOR, the IOCCG is expected to work within the SCOR operating guidelines, one of which is that the committee should include rotation of membership in its policy. This rotation would apply only to Scientific members, because the IOCCG does not nominate agency representatives. The normal term of service would be three years, which would ensure turnover of membership and allow for representation from other countries. The Chairman noted this was a difficult policy to implement, especially since the present committee was so productive and harmonious. It was noted that rotation had already begun, as Dr. Kawamura had requested to step down and had been replaced by Dr. Ishizaka. The Chairman requested that any other members who were thinking of stepping down should notify him in advance so that this information could be taken into account when drafting a table of phased rotation (one to three years).

### **16. Any Other Business**

**(a) Coastal GOOS Pilot Project**

Dr. Campbell reported that the recently-formed coastal panel of GOOS had met in Brazil and drafted proposals for various pilot projects which could demonstrate large-scale applications for coastal data and information. Data would be collected in the East China Sea and in Chesapeake Bay, with the aim of developing algorithms for retrieval of chlorophyll, sediments and CDOM from remotely sensed ocean-colour data. Dr. Parslow suggested that the IOCCG should try to cultivate a positive relationship with the coastal GOOS panel.

**(b) Ocean Colour in South America**

Dr. Ulloa reported that five countries in South America had applied to receive ocean-colour data from SeaWiFS, but many were experiencing problems in setting up the receiving stations (customs regulations, decoding problems *etc.*) as well as archiving, distributing and processing the data. These countries were currently collecting *in situ* data which would be useful for sensor validation. Dr. Yoder suggested that the IOCCG could fund a technical person from Goddard/Orbital to help with the installation of receiving stations. Dr. Ulloa also requested that NASA consider running one of their SeaDAS courses in South America. The Chairman noted that it was within the IOCCG's mandate to allocate money for training and education, but a set of rules needed to be established for such applications.

**(c) ECOMON Proposal**

Dr. Neumann gave a brief presentation on a joint proposal by DLR and JRC for a dedicated ocean-colour sensor for regional ECological research and MONitoring of coastal waters and adjacent lands (ECOMON). This proposal had been submitted to ESA in the context of their Living Planet Program, mainly the Earth Explorer Opportunity Missions. The proposed payload would consist of an imaging spectrometer with approximately 16 channels in the VIS/NIR, 4 fixed channels in the SWIR and an optional TIR channel. It would have a swath of 400 km and a ground resolution of 100 m. The instrument would not provide global coverage, as the aim was to provide high quality data for research applications in Case-2 waters including quantifying chlorophyll concentration, different algal species, red-tides, dissolved organic matter and sediments.

Prof. Morel mentioned another proposal to ESA for a simple, cheap satellite with 7 channels which would provide global coverage (ECOSPACE) and which would be complementary to ECOMON. It was proposed to phase this small mini-satellite to complement the MERIS mission.

Following these informal presentations, the committee agreed that the IOCCG was not in a position to endorse either or both of the missions *per se*, but the proposals were consistent with the strategy and orientation of the group, and that it was important for the committee to be informed of new initiatives. The group also recommended that this information be incorporated into IOCCG Report Number 2, under a section entitled Planned and Exploratory Missions. Dr. Neumann agreed to provide the relevant material for ECOMON.

**(d) Discussion Meeting**

The Chairman briefed the committee about the “Discussion Meetings” organized by the Royal Society of London around a specific theme. Invited speakers were requested to produce a manuscript in advance, which was refereed and published promptly. The meetings were generally very well organized and the Royal Society provided excellent support and sponsored much of the proceedings. Proposals were being solicited for the period September, 2000 to July, 2001 and the Chairman agreed to submit the necessary proposals if there was interest in organizing a meeting around the theme of Ocean Colour.

**17. Time and Place of the Next Meeting and Closure**

The Chairman informed the committee that Dr. Parslow had offered to host the next IOCCG Committee meeting in Tasmania. The timing was flexible (sometime between November, 1998 and January, 1999) and members would be informed of the date in due course.

**Fourth IOCCG Committee Meeting  
Kailua-Kona, Hawaii (5-7 November, 1998)**

**Participants List**

**Committee Members**

- |                       |   |
|-----------------------|---|
| CAMPBELL, Janet       | - NASA HQ, Washington, USA                            |
| FROUIN, Robert        | - Scripps Institution of Oceanography, USA            |
| ISHIZAKA, Joji        | - Nagasaki University, Japan                          |
| KOPELEVICH, Oleg      | - Russian Academy of Sciences, Russia                 |
| LIFERMANN, Anne       | - CNES, France  |
| MOREL, André          | - Laboratoire de Physique et Chimie Marines, France   |
| NEUMANN, Andreas      | - German Aerospace Center, Germany                    |
| PARSLOW, John         | - CSIRO Division of Fisheries, Tasmania, Australia    |
| PLATT, Trevor         | - Bedford Institute of Oceanography, N.S. Canada      |
| RAST, Michael         | - ESA/ESTEC, Netherlands                              |
| SCHLITTENHARDT, Peter | - Joint Research Center, Ispra, Italy                 |
| SHILINGTON, Frank     | - Department of Oceanography, University of Cape Town |
| TANAKA, Tasuku        | - EORC/NASDA, Tokyo, Japan                            |
| ULLOA, Osvaldo        | - University of Concepción, Chile                     |
| YODER, James          | - University of Rhode Island, USA                     |

**Other Participants**

- |                 |  |
|-----------------|--|
| LI, Hsien-Wen   | - National Taiwan Ocean University, Taiwan |
| STUART, Venetia | - Project Scientist, IOCCG                 |
| YUN, Caixing    | - East China Normal University, China      |

**Apologies**

- |                     |  |
|---------------------|--|
| AIKEN, James        | - Plymouth Marine Laboratory, United Kingdom     |
| GROSS, Elizabeth    | - Executive Director, SCOR                       |
| McCLAIN, Charles    | - NASA/GSFC, USA                                 |
| NAVALGUND, Rangnath | - Indian Space Research Organization, India      |
| YOO, Sinjae         | - Korea Ocean Research and Development Institute |