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7.1 International Council for Science (ICSU)

7.1.1 International Geosphere-Biosphere Programme



International Geosphere-Biosphere Programme: an update *IGBP Secretariat, June 2010*

The collaboration between IGBP and SCOR has been strong for nearly two decades. Current joint activities include co-sponsorship of the major international research projects IMBER and SOLAS, a Fast Track Initiative on Open Ocean Nutrient Limitation and the Third Symposium on the Ocean in a High-CO₂ World planned for 2012. In this short article, we provide some recent updates of IGBP science and direction.

IGBP activities 2009-2010

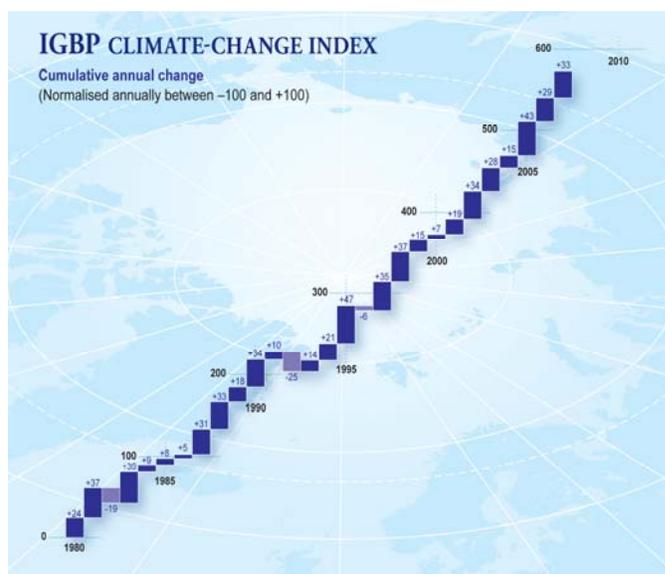
IGBP Climate-change index

Recent media articles show many people, including journalists and politicians, struggle to comprehend the reason why climate scientists are so concerned about climate trends. At the Copenhagen climate negotiations, IGBP launched the Climate-Change Index to help address this issue.

The index, which will be updated annually, brings together four key components of Earth's climate system representing the land, atmosphere, oceans and cryosphere. The components are: global average surface temperatures on land, atmospheric carbon dioxide levels, the Arctic sea-ice minimum and global average sea-level rise.

IGBP has produced a series of graphics to illustrate the index, a two-minute film on YouTube and a pocket-sized leaflet. IGBP held a press conference at the COP15 climate negotiations and gave presentations about the index at the COP15 Climate Kiosk. IGBP plans to develop the index into a global-change index in the coming years.

A vision for closer integration: Global Change Open Science Conference 2012



London, UK has been chosen to host a major international global-change science conference in 2012 (7-10 May). The open science conference, **Planet Under Pressure: new knowledge towards solutions**, will attract 2500 global-change thinkers.

The conference, a planetary conference focusing on solutions, was initiated by IGBP and is sponsored by ICSU's global environmental-change programmes. It will bring natural scientists together with economists, social scientists, engineers, health specialists and others plus national and international policymakers. The conference will form a solid scientific foundation for the Earth Summit, Rio +20, also scheduled for 2012.

IGBP's second synthesis

In 2004, IGBP published its first synthesis, *Global Change and the Earth System: a planet under pressure*. This widely-cited synthesis has had considerable influence and showed that humans are now the primary driver of change at the planetary scale. Now IGBP is preparing its second synthesis. Through a series of consultations in 2009 and 2010 with IPCC, ICSU and its global-change programmes, and others, IGBP's main decision-making bodies have identified the areas in Earth system science most requiring synthesis. The synthesis will inform policy and pinpoint the knowledge gaps for further exploration.

The themes under discussion are: a global nitrogen assessment and future outlook; geoengineering; global environmental change and sustainable development: the needs of least developed nations; megacities in the coastal zone; changing aerosols in the Earth system, air pollution and climate, Earth system impacts from changes in the cryosphere; the role of land cover and land use in modulating climate; the role of changing nutrient loads in coastal zones and the open ocean in an increased CO₂ world; and, acting on adaptation to global environmental change. More information: <http://www.igbp.net/page.php?pid=510>

Many of the synthesis themes, while building on IGBP science, will require a high degree of collaboration across natural and social scientists. The outcomes will be highlighted at the Global Change Open Science Conference in 2012.

Ocean Obs '09

IGBP participated in the Ocean Obs '09 conference in Venice, which aimed to build a common vision for the provision of routine and sustained global marine observations. IGBP is participating in the working group arising from this conference to recommend a framework for global sustained observations in the coming decade, to be delivered in October 2010. There is a focus on integrating new biogeochemical, ecosystem and physical observations.

International coordination of ocean acidification research

In 2009, it was agreed that IMBER and SOLAS will coordinate ocean acidification research internationally. The move recognises the need for urgent and coordinated research in this area. If current trends persist, by 2100 the oceans will be more acidic than they have been for 20 million years. The implications for marine life and biological, physical and chemical cycles are poorly

understood.

In 2009, IGBP, SCOR, IOC and IAEA produced an **Ocean Acidification Summary for Policymakers**. 10,000 copies of the summary have been printed and distributed. It is now available in French and Spanish.

Upper Ocean Nutrient Limitation: processes, patterns and potential for change

Studies conducted during the past few decades have demonstrated that the productivity of the upper oceans is limited by the availability of a range of nutrients including nitrogen, iron and phosphorus. However, several aspects remain to be fully understood, for example, the nutrients that limit nitrogen fixation in the modern oceans and the role of trace elements other than iron. The term “limitation” itself has several definitions, resulting in confusion and hindering effective communication between researchers in different disciplines. With this in mind, this joint IGBP-SCOR fast-track initiative aims to survey our current understanding of nutrient limitation in the upper oceans, identify gaps in knowledge and evaluate methodologies used to assess nutrient limitation. All potentially limiting nutrients (macronutrients such as nitrogen, micronutrients such as iron and organic nutrients such as vitamin B12) will be considered. A special session took place at AGU/ASLO Ocean Sciences meeting in Oregon (February 2010) and a workshop is planned in November 2010 in the UK.

UN Climate negotiations, Copenhagen 2009 (COP15)

In the lead up to the United Nations Framework Convention on Climate Change Conference of the Parties (COP15) in Denmark, IGBP presented recent global-change findings to the Subsidiary Body for Scientific and Technological Advice (SBSTA). The body counsels the Conference of the Parties on matters of climate, the environment, technology, and method. It meets twice a year and IGBP now regularly contributes to these meetings. The next meeting is in June 2010.

At COP15, IGBP organised a full programme of activities. IGBP jointly sponsored two side events: the Global Nitrogen Initiative event with the US State Department and others, and an event on adaptation to climate change with the International Human Dimensions Programme on Global Environmental Change (IHDP). The latter included a presentation on the recently released 2008 global carbon budget. At COP15, IGBP launched the Climate-change index and *Global Change* magazine.

Impacts, adaptation and vulnerability in developing countries

In November 2009, IGBP and IPCC jointly sponsored a workshop in Brazil on impact, adaptation and vulnerability to climate change in the developing world. The workshop, convened by IGBP Chair, Carlos Nobre, brought together leading researchers from the developing world to discuss research requirements. The workshop, which was funded by NASA and others and organised by IGBP’s regional office in Brazil, concluded that much stronger networks of researchers in the southern hemisphere would be “invaluable” to IPCC.



Global change magazine launched

In December 2009, IGBP published a new magazine Global Change. The magazine includes news, research and opinion from IGBP and the broader global-change research community. The first issue, launched at the Copenhagen climate talks, focused on climate and the carbon cycle. The magazine, which will be published twice a year, is aimed at scientists, policymakers, NGOs, journalists and the general public. The positive feedback has been tremendous. In February 2010, IGBP launched a “Global Change Research” page on the popular social-networking site, Facebook.

New website

In 2010, IGBP will launch a new website that will reflect that IGBP is a world-class provider of expertise, communication and coordination of global-change research.

The IGBP vision and ICSU’s Earth-system science visioning process

Starting with an online consultation, which closed in September 2009, ICSU is developing a new vision for international Earth-system research. IGBP has been working closely with ICSU to feed into this process and participate in the development of the new vision. In addition, IGBP is updating its own vision to reflect changing priorities and the latest information on our understanding of the planet’s major biogeochemical cycles.

World Climate Conference, Geneva, September 2009

IGBP participated fully in the expert segment of the World Climate Conference in Geneva that has led to a new initiative: a global framework for climate services. UN Secretary General Ban Ki-moon warned the UN delegates not to ignore the scientific community: "Our foot is stuck on the accelerator and we are heading for an abyss." A key recommendation from the conference is increased interaction between the World Climate Research Programme, IGBP, DIVERSITAS, the International Human Dimensions Programme (IHDP). The Geneva conference also called on governments to provide more powerful computing resources for the Earth-system research community.

Black carbon assessment coming soon

An assessment of black carbon’s role in climate is being led by IGBP’s Global Atmospheric Chemistry project (International Project Office: Seattle) and the World Climate Research Programme’s SPARC project (Stratospheric processes and their role in climate). The assessment will be important for the IPCC Fifth Assessment Report and the United Nations Environment Programme. Publication: summer 2010.

Observations task force announced

There are many gaps in *in situ* observations, particularly in areas sensitive to global change, for example the Arctic, Africa, and high elevations. There is a strong drive for a coordinated approach to measurements and networks of measurement sites, rather than networks of research teams. IGBP can play a role in coordinating what is needed. At its Scientific Committee meeting in Grenoble, 2010, IGBP announced it would create a task force on observations, led by David Schimel from the National Ecological Observatory Network, Washington DC. This task force will develop IGBP recommendations on measurements that are needed (what and where) and the level of funding required to create this network. IGBP also wants to discuss with space agencies how they can become more involved in observations more generally, particularly *in situ* measurements. All IGBP projects as well as GEO, NASA and ESA will be involved in this process. A report is due December 2010.

ANNEX: 2009 research highlights

IGBP's projects published some of 2009 and early 2010's most significant global-change research papers.

IGBP projects

Analysis, Integration and Modelling of the Earth System (AIMES)
 Global Ocean Ecosystem Dynamics (GLOBEC) – with SCOR and IOC
 Global Land Project (GLP) – with IHDP
 International Global Atmospheric Chemistry (IGAC) – with CACGP
 Integrated Land Ecosystem–Atmosphere Processes Study (iLEAPS)
 Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) – with SCOR
 Land-Ocean Interaction in the Coastal Zone (LOICZ) – with IHDP
 Past Global Changes (PAGES)
 Surface Ocean Lower Atmosphere Study (SOLAS) – with SCOR, WCRP and CACGP

Major endorsed projects

African Monsoon Multidisciplinary Analysis (AMMA)
 International Nitrogen Initiative (INI)
 Northern Eurasia Earth Science Partnership Initiative (NEESPI)

New approach to emissions scenarios

Scientists led by the US-based AIMES project published a new set of **emissions scenarios** that will form a key foundation for the Intergovernmental Panel on Climate Change's Fifth Assessment Report. Four scenarios, or **representative concentration pathways (RCPs)** have been chosen. The new emissions scenarios feature significant improvements on previous scenarios, notably, they include mitigation options and also allow for emissions peaking then falling. *Nature* doi:10.1038/nature08823.

Sinking deltas

Researchers on the **LOICZ** project published a report showing **24 out of the world's 33 major deltas are sinking**. Half a billion people live on the world's deltas. The report was led by James Syvitski, University of Colorado. *Nature Geoscience* doi:10.1038/ngeo629.

Reversal of 2000-year Arctic cooling trend

The **PAGES** project reported a cooling trend in the Arctic extending back 2000 years. But the research shows a dramatic reversal of this cooling trend since 1950. Four of the five warmest decades of the last 2000 years have occurred between 1950 and 2000. The research was led by Darrell Kaufman, Northern Arizona University. *Science* doi 10.1126/science.1173983.

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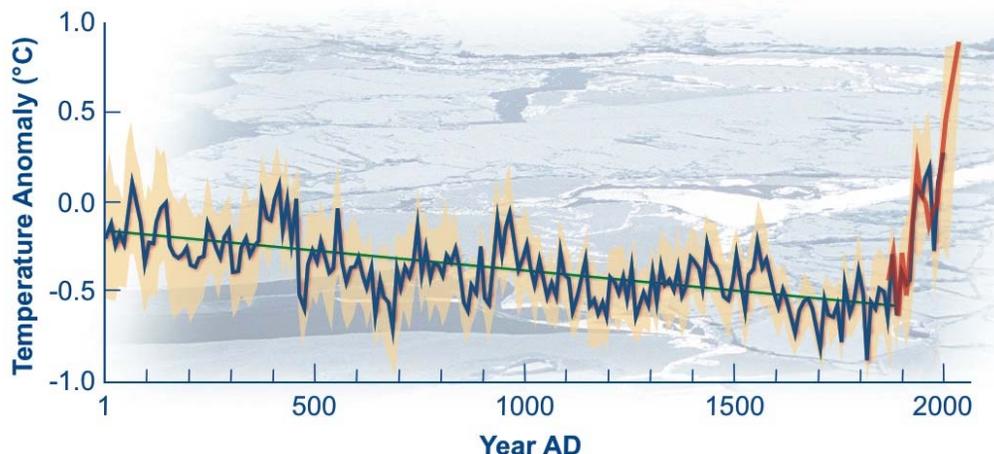


Figure reproduced from Kaufman et al (2009), *Science* 325: 1236-1239

60,000 species in plant classification database

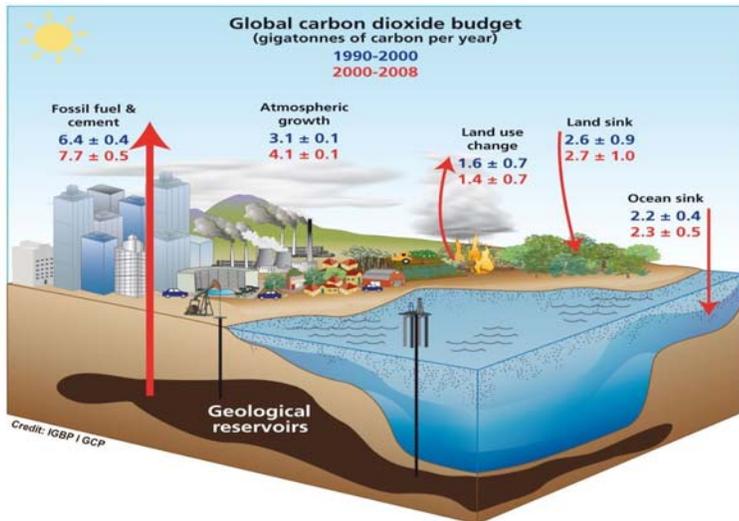
A new database for plant functional classifications now holds 60,000 species and over 2.5 million trait data entries. The database is the fruit of an IGBP-DIVERSITAS fast-track initiative, Plant Functional Classification, that began in 2006 to improve how climate models represent the terrestrial biosphere.

Acidifying oceans

Ongoing acidification of the Earth's oceans may impair the ability of some marine organisms to make their calcium carbonate skeletons. According to a recent study in *Nature Geoscience*, the impacts of the current phase of acidification are likely to be more severe than those associated with a similar event that occurred some 55 million years ago, at the Palaeocene-Eocene boundary.

Andy Ridgwell and Daniela Schmidt of the University of Bristol, United Kingdom simulated and compared the response of the ocean to increased acidification in the future and at the Palaeocene-Eocene boundary. Assuming that atmospheric carbon dioxide concentrations will peak around the year 2150, they found that conditions favourable for the formation of calcium carbonate (calcite) skeletons become on average restricted to the uppermost 600 m of the ocean – as opposed to 4 km for the modern ocean. This change in ocean conditions occurs far more rapidly than estimated for the Palaeocene-Eocene boundary.

Marine organisms residing in the deep sea – also called benthic organisms – were particularly affected at the Palaeocene-Eocene boundary, leading to extinction. This has the potential to recur if the modern phase of acidification continues. Not only that, but the capacity of surface-dwelling micro-organisms to adapt to such changes will also be severely tested, say the researchers. Ridgwell A, Schmidt D (2010), *Nature Geoscience* DOI: 10.1038/NGEO755. This work arose out of the IGBP-SCOR Fast-Track Initiative on Past Ocean Acidification.



2008 Global carbon budget

IGBP's joint project, the **Global Carbon Project** published its global carbon budget (left) in the same month as the UN's **climate negotiations** in Copenhagen. The budget was highlighted at a side event at the conference co-sponsored by IGBP and IHDP. In addition, IGBP with the **US State Department** and others sponsored the **International Nitrogen Initiative** side event at COP15. *Nature Geoscience* 2, 831–836
doi:10.1038/ngeo689

Produced by IGBP for the Global Carbon Project

Ecosystems approach to fisheries management

After ten years, the **GLOBEC** project (co-sponsored by SCOR and IOC) drew to a close in 2009. GLOBEC has helped define an ecosystems approach to fisheries management. This was a specific challenge set to the international research community by the UN's Food and Agriculture Organization in 2001 (Reykjavik Declaration). A key part of the work involved producing a complete ecosystem budget for George's Bank off the north-east coast of the United States. The research suggests ways to rebuild collapsed cod and haddock stocks in the area.

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7.1.2 World Climate Research Programme (WCRP)

WCRP update for SCOR GM 2010

This document presents to SCOR an update on WCRP research on the role of ocean in climate. More information on WCRP activities is available from the WCRP website (<http://wcrp.wmo.int>), CLIVAR website (<http://www.clivar.org>), CliC website (<http://clic.npolar.no>), and from the report “WCRP Achievements: Scientific Knowledge for Climate Adaptation, Mitigation and Risk Management” published in August 2009 (http://wcrp.wmo.int/documents/WCRP_AR_2008_2009.pdf).

WCRP Strategic Planning

In 2007-2009 the WCRP Sponsors and the International Group of Funding Agencies for Global Change Research commissioned a review of the Programme. Responding to the recommendations of the Review Panel (http://wcrp.wmo.int/documents/WCRP_Review_2009.pdf), the WCRP has prepared an Implementation Plan for 2010–2015 (http://wcrp.wmo.int/documents/WCRP_IP.pdf), and is working on the WCRP strategy post-2015. To define the longer-term strategy, the JSC has embarked on a major “visioning” process, which includes, inter alia, preparation of a series of white papers on various aspects of climate science and requirements for it.

WCRP and SCOR

The current scope of cooperation between the WCRP and SCOR involves joint co-sponsorship of the SOLAS Project, SCOR/WCRP/IAPSO Working Group 136 on Climatic Importance of the Greater Agulhas System, and joint activities aimed at the development of the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) of the IOC-SCOR International Ocean Carbon Coordination Project (IOCCP) and the WCRP Climate Variability and Predictability Project (CLIVAR). WCRP and SCOR cosponsored the first IOC/ICES/PICES International Symposium “Effects of Climate Change on the World's Oceans” (Gijón, Spain, 19-23 May 2008) and will contribute to the organization of the second workshop (Yeosu, Republic of Korea, May 2012). The WCRP and SCOR Secretariats work in close contact. SCOR’s possible involvement in the future work of the WCRP-IOC Task Group on Sea-level Variability and Change and support to its activities would be highly appreciated.

The WCRP oceanographic research

Practically all WCRP core projects, working groups and cosponsored activities are actively involved in oceanographic research.

WCRP Climate Variability and Predictability Project (CLIVAR)

CLIVAR is the main WCRP core project spearheading a range of global, regional and thematic oceanographic activities. Global Synthesis and Observations Panel (GSOP) leads breakthrough activities on ocean data synthesis and reanalysis. The CCI/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) coordinates the development of key climate

change indices. The WGCM/CLIVAR Working Group on Ocean Model Development (WGOMD) is the only working group in the world addressing the development of ocean modules of climate models. Regional oceanographic activities under CLIVAR are coordinated by the Project's regional constituencies: Atlantic Implementation Panel, Pacific Implementation Panel, CLIVAR/IOC-GOOS Indian Ocean Panel, and CLIVAR/CliC/SCAR Southern Ocean Region Panel. The work of the CLIVAR Monsoon Panels – the Asian-Australian Monsoon Panel (AAMP), Variability of the American Monsoon Systems (VAMOS), Variability of the African Climate System Panel (VACS) - also has a very strong oceanographic dimension.

Some examples of CLIVAR major recent accomplishments in the area of oceanography are as follows:

- Collaborative intercomparison and assessment of global ocean synthesis (reanalysis) products aimed at determining their quality and potential for ocean model initialization in climate prediction
- Ongoing implementation of an integrated Indian Ocean Observing System in collaboration with IOC and Indian Ocean GOOS
- Development of the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA), contributions to IMBER through the Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) programme, and preparations for the Cooperative Indian Ocean experiment on intraseasonal variability in 2011 (CINDY 2011), the Dynamics of the MJO (DYNAMO) program, and TRIO (Thermocline Ridge of the Indian Ocean)
- Tropical Atlantic Climate Experiment (TACE, 2006–2011) to improve regional climate prediction. The observational network includes: the PIRATA array; AMMA field campaigns, particularly the French EGEE program; nationally funded TACE projects (US-TACE, German BMBF Nordatlantik)
- Support to and coordination of programmes to monitor the Meridional Overturning Circulation (MOC) in the Atlantic, a key node of the global conveyor belt
- Coordination of key international climate process studies in the Pacific including a number of regional projects in the Pacific such as the Southwest Pacific Ocean Circulation and Climate Experiment (SPICE) and the North Pacific Ocean Circulation Experiment (NPOCE)
- Development of the Southern Ocean Observing System (SOOS) with several partners
- Model intercomparison activities aimed at improving seasonal predictions and ocean model performance
- Coordination of field studies to help improve parameterization schemes for atmosphere and ocean climate models and their interactions
- Development of an electronic African Climate Atlas, a tool for research on African climate
- Organizing and sponsoring training workshops on seasonal prediction in Africa, climate impacts on ocean ecosystems, climate data and extremes and ENSO

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Climate and Cryosphere Project (CliC)

The following scientific activities WCRP/IASC/SCAR CliC Project involve ocean research:

- CliC Marine Cryosphere and Climate (MarC) Theme and its Working Group on Arctic Sea-Ice
- Snow, Water, Ice, and Permafrost in the Arctic (SWIPA) Assessment - with AMAP and IASC
- the Antarctic Sea Ice Processes & Climate (ASPeCt), an expert group on multi-disciplinary Antarctic sea ice zone research within the SCAR Physical Sciences programme cosponsored by CliC
- Integrated Arctic Ocean Observation System (iAOOS, by AOSB and CliC)
- A Freshwater Balance of the Arctic and Southern Ocean initiative
- An intercomparison of sea-ice extent satellite algorithms

CliC reports the following recent advances in the oceanic research:

- Input from the cryosphere and climate research community shaped the scientific programme of IPY 2007–2008 leading to formulating the concepts and planning of the Arctic Ocean Observing System and Sustaining Arctic Observing Networks (through the International Arctic Science Committee and its Arctic Ocean Sciences Board (AOSB)) and Southern Ocean Observing System (SOOS, with SCAR, SCOR and several other partners)
- Establishing an Arctic hydrological cycle observing system to advance polar hydrology and enable global studies of ocean freshwater balance.

Global Energy and Water Cycle Experiment (GEWEX)

GEWEX leads production of surface flux research (through the Project “SeaFlux”) and facilitates regional climate studies. Its regional BALTEX project has a very strong oceanographic component.

Surface Fluxes

Research on surface fluxes is undertaken under SOLAS, CLIVAR, CliC, and GEWEX. Distribution of work and means of coordinating it are being reviewed by WCRP.

WCRP-IOC Task Group on sea-level variability and change

The overall goal of the group is to improve our ability to monitor, explain, and predict global and regional sea level and all environmental factors related to it, and use this information for informed decision making. There is now good understanding of the observed sea-level change: estimates of the different contributions add up to the total observed, from the 1960s through the middle of the last decade. The first session of the Task Group Steering Committee took place in Bern, Switzerland, in 24 March 2010. A WCRP update on sea-level rise was prepared for and presented to the UNFCCC

COP15 (http://wcrp.wmo.int/documents/sea_level_4page_en1.pdf). Several workshops have been conducted and are being planned to address cryospheric (especially ice sheet) contribution to the future sea-level rise. Review papers will be produced as input to the IPCC AR5. The Steering Committee is also planning a workshop to address the main issues associated with regional aspects of the sea-level variability and change including extreme sea levels.

Ocean Observations

WCRP co-sponsors the three observing panels of the Global Climate Observing System (GCOS) to help ensure that ocean, atmosphere and terrestrial observations requirements for climate research are met. The WCRP Observation and Assimilation Panel (WOAP) is embarking on an inventory of WCRP data sets to facilitate access and assist in model validation and verification. Coordination of the many ongoing reanalysis activities is also a high priority for the near future. The Third WCRP International Conference on Reanalysis (28 January–1 February 2008, Tokyo, Japan) included sessions on the oceans and sea-ice issues and coupled atmosphere-ocean data assimilation.

Ocean modelling

A key activity of the Working Group on Ocean Model Development (WGOMD) are the Coordinated Ocean-ice Reference Experiments (CORE) that provide benchmark simulations for global ocean-ice models. Their protocols facilitate detailed model comparisons. CORE-I provided multi-century simulations with a repeat annual cycle forcing. CORE-II hindcast simulations with 1948-2007 forcing will help to evaluate ocean model performance and investigate mechanisms of ocean phenomena and their variability from seasonal to decadal time scales. The experimental design is flexible and subject to refinement as the community gains experience and provides feedback. Work to develop the WGOMD Repository for Evaluating Ocean Simulations (REOS) has also continued. WGOMD held a recent Workshop “Ocean Mesoscale Eddies: Representations, Parameterizations and Observations” (April 2009, Met Office, Exeter UK) that attracted some 140 participants.

Climate Prediction

Decadal and centennial time scale

Under the auspices of the WCRP/CLIVAR Working Group on Coupled Modelling, 21 modelling groups are participating in the largest-ever WCRP Climate Model Intercomparison Project (CMIP5). It will provide global climate model projections for Fifth IPCC Assessment Report (AR5). WCRP will make results of climate model runs available to worldwide community through a comprehensive archive. Improvements from CMIP3, which was a key contribution to AR4, include better evaluations, documentation and use of integrated Earth system models. In 2005–2006 the archive of CMIP3 predictions has been accessed by over 2,000 scientists from many countries of the world, both developing and developed. CMIP5 includes a series of experiments on shorter-term climate prediction for the next 30 years. CLIVAR recently organized a workshop to address some of the technical challenges that decadal prediction poses. The workshop reviewed initialization and perturbation techniques in Earth system models and developed a roadmap to making skilful decadal predictions. This work is centred at the role of ocean in climate and depends on the availability and

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accuracy of ocean data syntheses.

Seasonal time scale

A major ongoing effort within WCRP is the Climate-system Historical Forecast Project (CHFP) aimed at the development of seasonal predictions. This project is a multi-model, multi-institutional experimental framework for the assessment of state-of-the-science seasonal forecast systems, and to evaluate the potential for untapped predictability due to interactions between the components of the climate system that are currently not fully accounted for in seasonal forecasts. Ocean components of such seasonal predictive system undergo systematic assessment and development.

Regional prediction / downscaling

The CMIP5 output will be complemented by regionally-downscaled climate predictions through the Coordinated Regional Downscaling Experiment (CORDEX), which will provide a quality-controlled regional climate downscaling dataset for the recent historical past and 21st century projections, make this dataset available to climate impact assessment and adaptation groups via an agreed protocol, and will offer support in using the dataset.

Noting the observed rapid loss of sea ice in the Arctic and the large spread of simulated sea-ice extent predictions in present models, the JSC prepared a white paper on this subject. CliC and SPARC in cooperation with several partners are organizing a workshop (25–29 October 2010, Bergen, Norway) on polar climate predictability on seasonal to multi-decadal timescales with an aim to develop a WCRP-wide research strategy.

Major scientific and technical meetings

WCRP was a major contributor to and sponsor of the OceanObs'09 (21–25 September 2009, Venice, Italy) organized by IOC and European Space Agency (ESA). Chairs of the GCOS/GOOS/WCRP OOPC and CLIVAR Global Synthesis and Observations Panel were Co-chairs of the Conference. WCRP and its constituencies are actively contributing to the implementation of ideas developed by the Conference. The WCRP community actively participated in the World Climate Conference – 3 (31 August – 4 September 2009, Geneva, Switzerland), and WCRP will make an essential contribution to the development of the science basis of the Global Framework for Climate Services.

The WCRP Open Science Conference (OSC, www.wcrp-climate.org/conference2011), to be held 24–28 October 2011 in Denver, Colorado, is expected to assemble between 1200 and 1800 participants. This important forum for climate research community will have several themes/sessions focussed on the role of oceans in climate. There will be opportunities for side meetings. SCOR – affiliated programmes, working groups and individual scientists are cordially invited to send an abstract and participate in the OSC. The SCOR General Meeting delegates are indly asked to distribute the information about the OSC to their communities.

7.1.3 Scientific Committee on Antarctic Research (SCAR)

SCOR and SCAR continue their productive partnership as co-sponsors of the SCAR/SCOR Expert Group on Oceanography (see <http://www.clivar.org/organization/southern/expertgroup/index.htm>). The group's major focus for the past few years has been the development of a Southern Ocean Observing System (SOOS). The SOOS Planning Document is nearly completed and was recently sent out to the community for review.

***SCAR/SCOR Interactions
Report to SCOR, July 2010***

SCAR and SCOR have a strong overlap of interest in the Southern Ocean region and therefore interact through several groups with an interest in this area:

The SCAR/SCOR Oceanography Expert Group and the Southern Ocean Observing System:

The SCAR/SCOR Oceanography Expert Group has been tasked with taking forward a plan for a Southern Ocean Observing System (SOOS). It works closely in this regard with the CLIVAR/CliC/SCAR Southern Ocean Panel.

The design of a SOOS was led by a partnership of organisations: SCAR, SCOR, The Census of Antarctic Marine Life (CAML), the Global Ocean Observing System (GOOS), the World Climate Research Programme (WCRP) and the Partnership for Observations of the Global Ocean (POGO). Other groups, such as IAATO and COMNAP, have provided significant feedback. The U.S. NOAA programme also provided funds for holding SOOS workshops to further the SOOS design plan.

A proposal to form a SOOS Secretariat has been put forward by Australia. Having such a secretariat is essential if the SOOS is to be taken forward.

A final version of the SOOS plan was recently made available for comment by the community. SCOR are requested to make the draft as widely available as possible.

(ii) The International Bathymetric Chart of the Southern Ocean Expert Group:

<http://www.ibcso.org/>

Both SCAR and SCOR have an interest in ensuring good quality Southern Ocean bathymetric data are collected and made available. The collection of bathymetric data is also part of the SOOS (see previous paragraph). The aim of the IBCSO Expert Group is to collect existing bathymetric data from archives, data centers and databases from hydrographic offices and scientific institutions.

Note that IBCSO has some problems with possible discontinuation of funding for the main PI involved (Norbet Ott) at AWI. SCAR is investigating ways of resolving this issue.

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Several initiatives are co-sponsored by both SCAR and SCOR, but report directly to SCOR, for example:

- The International Antarctic Zone Program (iAnZone)
<http://www.ldeo.columbia.edu/res/fac/physocean/ianzone/>)
- Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED)
<http://www.iced.ac.uk/>

SCAR also has several other programmes, groups or projects that have an oceanography focus and therefore may be of interest to SCOR:

- Action Group on Acoustics in the Marine Environment
- Expert Group on Birds and Marine Mammals
- The Census of Antarctic Marine Life (www.caml.aq)
- Scientific Research Programme Antarctica and the Global Climate System
(http://www.antarctica.ac.uk/met/SCAR_ssg_ps/AGCS.htm)
- Continuous Plankton Recorder Expert Group (<http://data.aad.gov.au/aadc/cpr/index.cfm>)
- The Marine Biodiversity Information Network (<http://www.scarmarbin.be/>)
- Seeps And Vents Antarctica Action Group
(<http://www.scar.org/researchgroups/savant.html>)

During the SCAR Business Meetings in Buenos Aires (August 2010) SCAR will be considering if it needs a group with a focus on ocean acidification in the Southern Ocean.

7.2 Affiliated Organizations

7.2.1 International Association for Biological Oceanography (IABO) IABO Report to SCOR for 2009

Next IABO General Assembly

The next General Assembly of IABO will be held at the 2nd World Conference on Marine Biodiversity in Aberdeen, Scotland, 26-30 September 2010 (<http://www.abdn.ac.uk/marine-biodiversity>). This follows the success of the 1st congress in Valencia, Spain (<http://www.marbef.org/worldconference/>). This conference will be the regular venue for IABO General Assemblies, and IABO will help support the conference.

World Association of Marine Stations (WAMS)

Dr David Paterson attended the World Association of Marine Stations (WAMS) meeting in Paris in April 2010 on behalf of IABO. He gave a presentation on IABO, including our remit and membership. WAMS membership will include marine laboratories of the world, and complements the IOC membership of countries, and IABO's of individual scientists nominated by national academies.

IABO email list launched

IABO has joined with an existing international email network on marine biodiversity called MARINE-B so as not to duplicate a well established network of over 600 scientists from 42 countries whose network aims are the same. This will be the official email network for IABO. MARINE-B, the MARine Research Information NETwork on Biodiversity, is for communication related to marine biodiversity research. The archive of MARINE-B messages is at <https://listserv.heanet.ie/marine-b.html>. To join send message "SUBSCRIBE MARINE-B firstname surname" to listserv@listserv.heanet.ie (to leave say UNSUBSCRIBE). Omit your signature and anything else you may normally add. You will get an automated response.

National Representatives

During 2009 IABO began renewing its national representatives and has written to all IUBS affiliated academies in this regard.

The IABO Past President Dr Annelies Pierrot will be attending the SCOR General Meeting on 14-16 Sept. 2010 in Toulouse, France, on behalf of IABO.

2009 IABO General Assembly

The IABO General Assembly was held on 14th October 2009 in Capetown, South Africa. Mark Costello (New Zealand) was elected President and Charles Griffiths (South Africa) as General Secretary. The Past President, Annelies Pierrot (The Netherlands), automatically remains a member of the Executive Committee. Prof David Paterson (UK) was subsequently appointed to the Executive Committee. A full report is on the IABO website.

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IABO endorsed two meetings in 2009:

(1) *“Our Warming Planet” conference MOCA-09*

19 – 29 July 2009, Palais des Congrès, Montréal, www.moca_09.org

Topics included mesoscale ocean eddies; effects of climate variability on nearshore coastal environments, including physical, geomorphologic and biological interactions; the Southern Ocean: its physics, chemistry, biology and links to the global climate system, and coastal currents and large marine ecosystems. The IAPSO symposium on mesoscale ocean eddies was co-sponsored by IABO. MOCA'09 stands for **IAMAS-IAPSO-IACS-Assembly-2009**, where IAMAS: The International Association for Meteorology and Atmospheric Sciences; IAPSO: The International Association for the Physical Sciences of the Oceans; IACS: The International Association for the Cryospheric Sciences.

(2) *2nd DIVERSITAS Open Science Conference (OSC2)*,

13 – 16 October 2009, Cape Town, South Africa, www.diversitas-osc.org/

On a theme of “Biodiversity and society: understanding connections, adapting to change”

7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS)



International Association of Meteorology & Atmospheric Sciences
(www.IAMAS.org)

IAMAS is the association of the International Union of Geodesy and Geophysics (IUGG) that deals with the atmosphere of the Earth and other planets. IAMAS is made up of ten International Commissions (IC) that play a major role in carrying through IAMAS activities. The ten ICs cover (alphabetically) *Atmospheric Chemistry and Global Pollution* (ICACGP), *Atmospheric Electricity* (ICAE), *Climate* (ICCL), *Clouds and Precipitation* (ICCP), *Dynamical Meteorology* (ICDM), the *Middle Atmosphere* (ICMA), *stratospheric Ozone* (IOC), *Planetary Atmospheres and their Evolution* (ICPAE), *Polar Meteorology* (ICPM), and *atmospheric Radiation* (IRC). Many of these commissions play international leadership roles in their specialty areas [see www.iamas.org/Commissions.html]. This set of commissions provides an important supplement and extension to leadership and research role of the *World Meteorological Organization* (WMO), which is the governmental equivalent to IAMAS; for example, the IOC entered into a *letter of agreement* with WMO for the establishment of an ad hoc expert team that will assess ozone absorption cross sections used in atmospheric observations.

The highlight of 2009 was the very successful MOCA-09 Joint Special Assembly of IAMAS, IAPSO, and IACS held in Montreal in July 2009. Roughly two-thirds of the nearly 1400 registered participants were affiliated with IAMAS, contributing to 20 (of 21) joint symposia and 18 IAMAS-only symposia. The meeting of the IAMAS Executive Committee in Montreal started the planning process for the IAMAS contribution to the program of the IUGG quadrennial General Assembly to be held in Melbourne in July 2011. Based on efforts completed to date, IAMAS is responsible for several of the dozen Union symposia that are planned as well as participating in 13 of the joint association symposia and 14 IAMAS-only symposia. Many of these are likely of interest to the ocean sciences community. The latest information on the IUGG General Assembly is posted at <http://www.iugg2011.com/>.

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IAMAS commissions coordinate a number of activities between the IAMAS and IUGG assemblies. In addition to helping organize symposia at a range of scientific meetings led by other organizations, these included:

- (a) The 9th Workshop on *Layered Phenomena in the Mesopause Region* was co-sponsored in Stockholm (Sweden; mid-July 2009);
- (b) The International Committee on Nucleation and Atmospheric Aerosols (ICNAA), which is part of ICCP, held its 18th international conference in Prague in August 2009;
- (c) The 12th ICACGP Symposium, which will be held jointly with the 11th Science Conference of the International Global Atmosphere Chemistry (IGAC) Project in Halifax, Canada, July 11-16, 2010;
- (d) ICMA will co-sponsor the *Solar-Terrestrial Physics Symposium* (STP-12) during the COSPAR assembly in Bremen (Germany, July 2010); and
- (e) ICDM is considering a dedicated workshop regarding joint activities with the WMO-THROPEX programme for 2012 in China.

A couple of books/reports have also been published as a result of IAMAS activities. These include:

- (a) *Twenty Years of Ozone Decline* (online under www.springerlink.com/content/tmv484/, 472 pp., edited by Zerefos, Skalkeas and Contopoulos) was published by Springer. It includes articles presented by leading scientists in ozone research at the Symposium for the 20th Anniversary of the Montreal Protocol, co-organized by IOC, UNEP, the Academy of Athens and the Mariolopoulos-Kanaginis Foundation in Athens (Greece; September 2007);
- (b) *Aerosol Pollution Impact on Precipitation: A Scientific Review* (386 pp., edited by Levin and Cotton) was published by Springer with numerous contributions from members of the cloud physics community. This scientific review, which was sponsored by the IUGG, IAMAS and the WMO, received the Atmospheric Science Librarians International (ASLI) 2009 choice as *Honorable Mention* for an authoritative, well-organized, forum-based approach to the evaluation of the problem;
- (c) ICPM authors contributed to SCAR's broad survey *Antarctic Climate Change and the Environment* (526 pp., ISBN 978-0-948277-22-1, edited by Turner, Bindshadler et al.).

Beyond the IUGG General Assembly in Melbourne in July 2011, the IAMAS Executive Committee accepted the bid from Switzerland to host the IAMAS Scientific Assembly in 2013, to be jointly organized with IACS. The meeting dates are 8-12 July 2013 and the location will be Davos, so at the atmosphere-cryosphere boundary. Werner Schmutz (vice-president of IAMAS-IRC) as well as Michael Lehnig and Charles Fierz (both of IACS) work at scientific institutes in Davos and will oversee the local organization.

At the General Assembly in July, IAMAS will elect new officers, including a new president. IUGG will also select a new IUGG/IAMAS representative to SCOR, especially as my term as past president will end. I would very much like to express my appreciation to all of the SCOR members for having the opportunity to serve as an ex officio member of the SCOR Executive Committee and

to Executive Director Ed Urban and all the members for all of the wonderful experiences over the past 8 years. I have learned a tremendous amount and really come to appreciate the efforts required and committed of the many scientists who help make international science activities as strong and important and well run as they are. Merci beaucoup.

Submitted by Michael MacCracken, IUGG/IAMAS representative to SCOR
June 10, 2010

P. S. The assembly of information by Hans Volkert, IAMAS Secretary General, is greatly appreciated.

7.2.3 International Association for the Physical Sciences of the Ocean (IAPSO)



International Association for the Physical Sciences of the Oceans (IAPSO)

2009-2010 IAPSO Activities -- Report to SCOR (June 2010)

IAPSO is a constituent Association of IUGG (The International Union of Geodesy and Geophysics). The main activity of IAPSO is to arrange scientific assemblies. IAPSO also works through Permanent Services to aid the ocean science community, Commissions dealing with specific phenomena with severe impact on society, and through Working Groups jointly with SCOR, which put focus on special scientific questions for some years. In the IAPSO activities, it is important to spread knowledge to developing countries. This is done, by including developing country scientists in the activities, and by financially supporting their attendance at scientific meetings.

Every fourth year IUGG together with its associations arrange a General Assembly. The next IUGG General Assembly "Earth on the Edge: Science for a Sustainable Planet" will take place in Melbourne, Australia 28 June – 7 July 2011. In Oct. 2009 the IAPSO President and SG met with the IUGG EC in Melbourne to start the detailed planning of the Assembly. The main activity of this period has been related to the General Assembly. The scientific program was made public 4 June, see <http://www.iugg2011.com>. Later in June 2010, a call will be sent out to all the IAPSO National Correspondents for nominations for the IAPSO Prince Albert I Medal, which will be awarded at the next IUGG Assembly in Melbourne.

Between two IUGG General Assemblies, IAPSO arranges an assembly jointly with other organizations. The Assembly "MOCA-09 - Our warming planet" in July 2009 was reported to SCOR last year. The next "in-between assembly" will take place in Gothenburg, Sweden, in July 2013 jointly with IAHS (Hydrology) and IASPEI (Physics of the Earth Interior).

IAPSO is currently co-sponsoring the SCOR Working groups OceanScope (WG 133) and The Climatic Implications of the Greater Agulhas System (WG 136). The SCOR/IAPSO Working Groups send their own reports to SCOR.

General information about IAPSO can be found on website <http://iapso.sweweb.net/db>

Members of IAPSO EC (for 2007-2011):

President: Lawrence Mysak, Canada

Secretary General: Johan Rodhe, Sweden

Past President: Shiro Imawaki, Japan
Vice President: Denise Smythe-Wright, UK
Vice President: Eugene Morozov, Russia
Treasurer: Fred Camfield, USA

EC Members:

Isabelle Ansorge, South Africa
Silvia Blanc, Argentina
W. John Gould, UK
John Middleton, Australia
Temel Oguz, Turkey
Stefania Sparnocchia, Italy

Report prepared by
Johan Rodhe, SG of IAPSO

7.3 Affiliated Programs

SCOR-Affiliated Projects and Programs

SCOR sponsors many, but not all, of the major international ocean research projects and programs. Some projects not co-sponsored by SCOR can gain benefits from association with SCOR, such as (1) increased visibility; (2) participation in SCOR activities, such as project coordination meetings and annual SCOR meetings; (3) opportunities to provide comments on working group proposals and membership; (4) access to national SCOR contacts; and (5) opportunities to apply for SCOR funding for travel of scientists from developing countries and countries with economies in transition to their workshops and symposia. In 1995, SCOR developed the option of formal affiliation of relevant projects/programs with SCOR. Unlike projects sponsored by SCOR, affiliated projects and programs receive funding from organizations besides SCOR and do not need staff support from SCOR.

SCOR's role in relation to affiliated projects and programs is one of advice and regular review. SCOR gives advice about appropriate balances on the projects' steering committees and adequate rotations of these committees to renew the committees' memberships regularly. SCOR's national contacts can be used to find new members in regions where there is a need, or to entrain new countries into projects. SCOR can also provide an independent mechanism for the review of planning documents such as science or implementation plans.

Application for SCOR Affiliation

Application to SCOR for program affiliation should be initiated with a proposal of 2 to 5 pages, sent to SCOR at least three months before an annual SCOR meeting. The proposal should include an outline of the program's science plan, the terms of reference, current membership of the steering committee, and rotation procedures and schedule. The proposal for SCOR affiliation should also address the following criteria, accepted at the 1995 SCOR Executive Committee meeting (see *1995 SCOR Proceedings*). The Executive Committee agreed that in order to become a SCOR-affiliated project/program, an activity must

- be truly international, with a committee membership that rotates on a regular basis;
- show evidence of existing financial and/or organizational support;
- demonstrate a benefit from SCOR affiliation;
- have a scientifically well-integrated theme;
- show that it is in SCOR's interests to establish this affiliation;
- be of broad scale and global importance;
- show, as appropriate, that any scheme of membership dues includes some nominal level so as to encourage the widest possible international participation by all countries; and
- be willing to adhere to the SCOR Publication Policy.

After a program is affiliated with SCOR, annual reports are required, and scientific presentations may be requested at any annual SCOR meeting, as a basis for the decision on continuing the relationship between SCOR and each project/program. The Chair of each affiliated project/program serves as an ex-officio member of SCOR as a Scientific Rapporteur (see SCOR Constitution, paragraph 4). Continued affiliation with SCOR depends on the project meeting the guidelines specified above, and maintaining high scientific quality and adequate rotations of committee members and chairs.

Reports to SCOR

Annual reports to SCOR should answer the following questions and present any additional information that the project/program would like to transmit to SCOR:

- What scientific accomplishments have been achieved by the project/program in the past year?
- How has the project's steering committee membership changed in the past year?
- What is the financial status of the project?
- What is the status of the project's secretariat?
- What are the plans for the scientific development and implementation of the project over the next two to three years?
- How is the project interacting with and contributing to other SCOR activities?

In addition, projects/programs should communicate regularly with their SCOR Executive Committee Reporter regarding their activities and progress.

7.3.1 Program to Study Ocean Mixing Processes

7.3.2 Census of Marine Life (CoML) (affiliated in 2002)

Mission:

Assess and explain the changing diversity, distribution, and abundance of marine species from the past to the present, and project future marine life.

Chair:

Ian Poiner
CEO, Australian Institute of
Marine Science (AIMS)
Cape Ferguson,
Queensland, Australia
PMB No. 3, Townsville MC
Qld 4810, AUSTRALIA
Tel: +61 (0)7 4753 4490
Fax: +61 (0)7 4753 4386
Email:
i.poiner@aims.gov.au

Vice-Chair:

Victor Ariel Gallardo
Centro de Investigacion
Oceanografica en el Pacifico
Sur-Oriental (COPAS)
Universidad de Concepción
Concepción, CHILE
Phones: +56 41 203726 or +56
41 204024
Fax: +56 41 207524
E-mail:
vgallardo@coreocean.org

Vice-Chair:

Myriam Sibuet
Institut Océanographique
195 rue Saint Jacques
F-75005 Paris
44 rue du cloître
F- 29280 Plouzané
FRANCE
E-mail: msibuet@ifremer.fr

Other Members:

Vera Alexander	USA		
D. James Baker	USA	Carlo Heip	NETHERLANDS
Patricio Bernal	FRANCE	Poul Holm	DENMARK
D. Chandramohan	INDIA	Yoshihisa Shirayama	JAPAN
David Farmer	USA	Michael Sinclair	CANADA
Serge Garcia	ITALY	Song Sun	CHINA-Beijing
J. Frederick Grassle	USA	Meryl J. Williams	MALAYSIA

Executive Committee Reporter: Peter Burkill

Census of Marine Life Annual Report to SCOR

June 2010

The Census of Marine Life was formally established in 2000 and became an Affiliated Program of SCOR in 2002. In October this year, this international research program will release its first report on the status of knowledge of marine biodiversity at a series of events in London called “A Decade of Discovery.” The report will cover the results from 14 Ocean Realm Field Projects, historical studies (HMAP – History of Marine Animal Populations), modeling and prediction (FMAP – Future of Marine Animal Populations), 22 cross-project thematic studies, and 13 national and regional committees (NRICs). All of the data from the Census, as well as from other sources of biodiversity information, will be accessible through the Ocean Biogeographic Information System (OBIS – www.iobis.org). In 2010 the Census community has been working diligently to finalize the products that will be presented as part of the overall Census of Marine Life results. The following is a list of the expected products by October 2010:

- (1) the Census overview book, a science book written by Paul Snelgrove for a general audience (*Discoveries of the Census of Marine Life: Making Ocean Life Count*, published by Cambridge University Press);
- (2) a science book written for a general scientific audience and including chapters contributed by the History of Marine Animal Populations, Future of Marine Animal Populations, and each of the 14 Ocean Realm projects (*Life in the World's Oceans: Diversity, Distribution and Abundance*, published by Blackwell Publishing Ltd.);
- (3) a special collection of papers for *PLoS-ONE* contributed by each of the NRICs (*Marine Biodiversity and Biogeography: Regional Comparisons of Global Issues*);
- (4) more than 200 papers in the scientific literature, based on synthesis and analysis within individual Census projects and across multiple projects (“cross-project” efforts);
- (5) a series of videos to provide contextual information about the oceans for the general audiences and highlighting the major messages and scientific accomplishments of the Census;
- (6) a map of marine life diversity, distribution and abundance produced by National Geographic and the Census Mapping & Visualization Team;
- (7) a popular book of marine life for the general public by Nancy Knowlton of the Census Coral Reefs project (*Citizens of the Sea: Wondrous Creatures from the Census of Marine Life*, published by National Geographic); and
- (8) a report summarizing the scientific findings of the Census (the “2010 Report” – formal title to be determined).

Preparations for the London Decade of Discovery events are entering the final phase, and a preparatory workshop will be held in July at the University of Rhode Island for representatives from each project of the Census and designated spokespeople. The London events will include a News Conference (October 4), a science symposium (October 5-6), a “celebration” (October 6)

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and a final meeting of the Census leadership (October 7). These events are mainly by invitation, but several participants from Census-related SCOR activities would be present, including, but not limited to, Ed Urban, Alex Rogers, John Gunn and David Farmer. The Census has also extended invitations to Wolfgang Fennel and Peter Burkill.

Scientific Accomplishments

In 2010 the majority of the work of the Census of Marine Life focused on analyzing data, synthesizing results, and preparing publications for the overall presentation of Census results in October. Still, the work that occurred in late 2009 and 2010 resulted in exciting discoveries.

Diversity

The Census continues to discover and name new species. CeDAMAR, a project on the abyssal ocean discovered a new copepod species in the New Guinea basin to be named *Mesocletodes equatorialis*. The Continental Margins project (COMARGE) has discovered several new species including a deep-sea shrimp of the genus *Plesionika*. A deep sea carnivorous sponge *Chondrocladia (Meliiderma) turbiformis*, discovered by the Census of Seamounts project was selected as a 2010 Top 10 New Species by the International Institute for Species Exploration. In all, Census projects have reported over 1,200 new species formally described to date.

Distribution

The project on Chemosynthetic ecosystems (ChEss) completed exploration on Costa Rican cold seeps. The preliminary findings suggest that the Costa Rica seep fauna has affinities with taxa from seeps in the Gulf of Mexico and West Africa. Additionally, ChEss successfully conducted the first exploration cruise to locate hydrothermal vents south of the Polar Front in 2009. Two vent sites were discovered on the East Scotia Ridge.

TOPP researchers produced maps showing the movements of bluefin tuna off the coast of California. The maps showed three “hotspots” of bluefin activity that varied throughout the calendar year. These results could help to manage the population of bluefin, a species experiencing rapid decline due to overfishing.

Abundance

FMAP researchers reviewed historical population changes in exploited populations of large marine mammals, birds, reptiles, and fish. Overall it was found that these populations declined 89% from historical abundance levels. In many cases, the long-term fluctuations are related to climate variation, rapid declines to overexploitation and recent recoveries to conservation measures. These emerging historical patterns can offer new insights into past ecosystems, and provide important context for contemporary ocean management.

Data obtained from the Pacific Ocean Tracking array was used in the designation of critical habitat for the Southern Distinct Population of green sturgeon, which is listed as threatened under the U.S. Endangered Species Act.

Technology, Ocean Observing & Other Contributions to the Community

The Ocean Biogeographic Information System (OBIS) currently serves 27.7 million records of 114,000 species from 817 databases. This means that there are geo-referenced species points in OBIS for about 50 percent of the known marine species. In June 2009, the Intergovernmental Oceanographic Commission (IOC) adopted a resolution accepting OBIS as a program within its International Oceanographic Data and Information Exchange (IODE) program. Under the terms of the resolution, OBIS activity would continue under IODE. Since this announcement, OBIS has received several offers of support-in-kind, including a special data centre located at INCOIS in Hyderabad, India and IT development and data management from the Flanders Marine Institute (VLIZ) in Oostende, Belgium. Additionally, the International Project Office for IODE/OBIS will continue to be hosted at Rutgers University. Funding is still needed for the operations of this program office and a multi-source fund has been set up by the IOC to allow member nations to contribute toward OBIS' continued research and operation into the future. However, these offers-in-kind, the technical developments with the OBIS SEAMAP team, and the Centre for Marine Biodiversity, Simon Bolivar University, Venezuela, have ensured the continuation of OBIS.

OBIS is a leading partner in the World Register of Marine Species (WoRMS), an international effort to consolidate the world databases of ocean organisms. Part of this process involves identifying aliases. WoRMS now contains 180,416 validated marine species names, 76 percent of which have been checked for aliases.

Upward-looking sonar technology developed by the MAR-ECO project is in place in the Charlie Gibson Fracture Zone of the Mid-Atlantic Ridge. This technology allows researchers to identify crucial ecosystem components in areas that can be continuously monitored in near real time. Some images show 100m whale dives and the dramatic reduction of diurnal plankton between winter and summer.

In September 2009, the Census of Marine Life, led by Ron O'Dor, organized a community forum on Biodiversity at the Ocean Obs '09 meeting in Venice, Italy. The Census of Marine Life scientific community contributed several white papers to the conference, including Ron O'Dor's plenary paper *Bringing New Life to Ocean Observations*. From Ocean Obs '09, the Integrated Framework for Sustained Ocean Observations Task Team (IFSOO-TT) was formed to recommend a framework for ocean observations in the next decade. Chairman John Gunn serves as the Census of Marine Life liaison to the task team. The Census SSC has noted the importance of providing a list of special priorities and associated costs, and Senior Scientist Ron O'Dor is putting together a preliminary set of specific examples based on Census technologies for consideration by the task team.

The three possible examples of Census technology for establishing and maintaining global biological monitoring systems in 2010-2020 were the Ocean Tracking Network, a novel system that utilizes acoustic tags that are uniquely recognized anywhere in the world and coordinated through a common data system, so that animal migrations across borders and between continents can be tracked. These lines also record physical and chemical data on the sea floor that complements surface satellite data. The recommendation also included Autonomous Reef

Monitoring Structures (ARMS) technology, developed by the Census of Coral Reefs (CReefs) project. ARMS are artificial structures designed to mimic the complex structure of a natural reef and are colonized by organisms that inhabit coral reefs. As invertebrates and other reef creatures inhabit the cracks and crevices in the structure, researchers see how colonization of coral reef space occurs. The group also recommended the development of an Acoustic Global Observing Network (AGON); an operational package that monitors the pelagic component of ocean ecosystems, including temporal density distribution assessments of resident or migratory populations, vertical migrations and horizontal fluxes, predator-prey interactions, scale-dependent distribution variability, species-specific habitat uses, and ecosystem indicators of biological responses to climate-induced environmental change.

Partnerships

The Census continues its successful partnership with National Geographic, which incorporates Census content into its many products such as websites, film, television, short format video, radio, photo galleries, maps, magazines, and books. National Geographic's inclusion of Census video, imagery, and information significantly increases the visibility of our program. National Geographic will co-produce the Public Presentation and Press Conference to announce the culmination of the Census' ten years of research at the Decade of Discovery Events in London on October 4, 2010.

The Census partners with the Encyclopedia of Life (EOL) toward the development of marine species pages. Census websites and electronically-available products in 2010 will contain links from taxon names to pages on EOL. Census participants are also contributing information and imagery to EOL. The goal is to have pages for as many of the 230,000 marine species as possible by October 2010.

The Census continues to work closely with Galatée Films on the release of the film *Oceans*. The Census has co-organized successful science symposia with Galatée to promote marine science and the scientific approach of filmmaking in several countries including Mexico, Spain, France, Germany, Japan, and Indonesia. More symposia are anticipated throughout 2010.

The Marine Barcode of Life (MarBOL), representing a partnership between the Consortium for the Barcode of Life and the Census, has captured the DNA barcodes of more than 17,000 marine species, including 1,500 of 7,000 zooplankton species spanning 18 phyla (reported as of March 2010). Its goal is to barcode 50,000 species by October 2010. MarBOL contributors are also preparing a special collection of papers for *PLoS-ONE*.

The Census of Marine Life and the Convention on Biological Diversity entered into a Memorandum of Understanding in 2009 to "establish a framework of collaboration between the CoML and the SCBD with a view to further common goals." Since then, the Census of Marine Life and the Convention on Biological Diversity have worked together on several joint projects including determining criteria for biologically and ecologically significant areas in the open oceans and deep seas, participation in the International Year of Biodiversity (2010), and the promotion of the findings of the Census and their relevance to the CBD and its member

countries. The Census will participate in the Conference of the Parties 10 (COP10) in October 2010 in Nagoya, Japan.

Education & Outreach

In addition to the above-mentioned partnerships, the Census of Marine Life continues to be successful in media outreach. At the peak of its field phase, the program was named one of the “Six most important experiments in the world” by Discover magazine (December 2007) and its studies in the Antarctic were highlighted as one of Time magazine’s “10 best scientific discoveries” of 2007 (24 December). Since then, the Census has been featured in the LA Times, the BBC, the Washington Post, the Economist and Popular Science, among others. The reach of its three press releases per year has grown to more than 50 countries and around 20 languages. The Census produced its widest-reaching press release to date in November 2009, focused on the creatures of the Deep Sea. A press release in April 2010 focused on the Census of the “Hard-to-See;” discoveries of the marine microbial world. The Census has been closely working Dr. Pat Halpin’s Mapping and Visualization team at Duke University to produce a cohesive set of graphics and maps for many of the 2010 products and to maintain a presence in Google “Oceans.”

Program Governance and Administration

The Census international Scientific Steering Committee (SSC), the governing body of the program, meets three times per year. It includes 16 members from around the world:

- Dr. Ian Poiner (Chair), Australian Institute for Marine Science, Australia
- Dr. Victor Ariel Gallardo (Vice Chair), University of Concepcion, Chile
- Dr. Myriam Sibuet (Vice Chair), Ifremer (Retired), France
- Dr. Vera Alexander, University of Alaska Fairbanks, USA
- Dr. D. James Baker, Science and Management Consultant, USA
- Dr. Patricio Bernal, Intergovernmental Oceanographic Commission, France/Chile
- Dr. Dorairajasingam Chandramohan, National Institute of Oceanography (Retired), India
- Dr. David Farmer, University of Rhode Island, USA
- Dr. Serge Garcia, Food and Agriculture Organization (Retired), Italy
- Dr. J. Frederick Grassle, Rutgers University, USA
- Dr. Carlo Heip, Netherlands Institute of Ecology, Netherlands/Belgium
- Dr. Poul Holm, Trinity College Dublin, Ireland/Denmark
- Dr. Yoshihisa Shirayama, Kyoto University, Japan
- Dr. Michael Sinclair, Bedford Institute of Oceanography, Canada
- Dr. Song Sun, Institute of Oceanology, China
- Dr. Meryl J. Williams, Future Harvest Alliance Office, Malaysia/Australia

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The SSC also includes six ex-officio members, which ensure strong links to important synthesis- and legacy-related efforts within the program:

Dr. Daniel Costa, University of California Santa Cruz, USA (“Census 2020”)
Dr. Patrick Halpin, Duke University, USA (Mapping & Visualization)
Ms. Sara Hickox, University of Rhode Island, USA (Education & Outreach)
Dr. Enric Sala, National Geographic Pristine Seas Project, USA/Spain
Dr. Paul Snelgrove, Memorial University, Canada (Census Synthesis)
Dr. Edward Vanden Berghe, Rutgers University, USA/Belgium (OBIS)

The program has 13 national and regional committees that are compiling regional synthesis papers, assembling national and regional OBIS datasets, and addressing local research priorities. The hope is that the NRIC networks will continue to serve as a legacy of the Census after 2010 and promote Census findings, technologies, and approaches to surveying marine biodiversity for societal applications, research, and monitoring programs and ocean and coastal observation systems. National committees are located in Australia, Canada, China, Indonesia, Japan, Korea, and the United States. Regional committees are located in the Arabian Sea, the Caribbean, Europe, the Indian Ocean, South America, and Sub-Saharan Africa.

In 2008, the Census formally established a Synthesis Group, chaired by Paul Snelgrove. This group is responsible for oversight and intellectual guidance on the overall synthesis of Census findings. The Synthesis Group meets four times per year.

The Census international Secretariat is located at the Consortium for Ocean Leadership in Washington, D.C. In April 2008, it received renewed funding to continue administering the program through its formal culmination in December 2010. In November 2009, the Secretariat received additional funding from the Sloan Foundation to support the October 2010 Decade of Discovery Events in London. The Secretariat supports two half-time Senior Scientists: Dr. Patricia Miloslavich (Universidad Simon Bolivar, Venezuela) and Dr. Ron O’Dor (Dalhousie University, Canada).

We estimate total commitments to the Census, including ship-time and other contributions, to be about \$650 million. These funds come from traditional sources, including governments and private organizations, and support scientific research, outreach and education, and project management.

Plans for the remainder of 2010 and beyond

The Census announces its findings at the London Decade of Discovery Events in October 2010 and formally ends in December 2010, but Census findings in scientific journals and other publications will appear throughout 2010. All publications will be tracked and incorporated into overall communications efforts throughout the year, including not only press releases but also information through websites, newsletters, blogs, and social networking sites. The most significant Census publications in 2010—the Cambridge University Press book, National Geographic book and map, and important papers from the cross-project efforts—will be kept

embargoed for a News Conference and associated press release on October 4, 2010. This robust strategy of “rolling out” the products and using a variety of media and publication types will ensure we reach a number of audiences and are not overshadowed by world events by focusing on a single release.

After the Decade of Discovery Events in October and into 2011, the NRICs will hold briefings on the findings of the Census of Marine Life in their respective countries and regions with goal of promoting the scientific findings of the Census of Marine Life, encouraging their use in policy and management decisions, and advocating further research on global marine biodiversity.

The Census SSC is developing a set of Future Research Recommendations and an analysis of the gaps in marine biodiversity knowledge in 2010. From this, the hope is that the science community can identify research priorities and the “next big things” for marine biodiversity science in order to develop a research plan and seek support for more large-scale marine biodiversity study. Though the Census will be completed, it may organize a workshop on these topics at the 2011 World Conference on Marine Biodiversity in Aberdeen, Scotland.

The Census SSC and the Sloan Foundation will commission an external evaluation of the program focused on its governance and management structure. The goal will be a document presenting the scalable lessons learned from the Census that can be applied in the implementation and management of any large science program. This product will most likely be available in 2011.

Relationship to other SCOR activities

CoML has ongoing collaboration with the SCOR Panel on New Technologies for Observing Marine Life. Chaired by Alex Rogers (Institute of Zoology, London), this Panel makes recommendations to the CoML projects regarding technologies that are applicable to their research and more broadly communicates the benefits and potential of novel technologies for studying marine life. The Panel will develop comprehensive web pages for the Census of Marine Life portal (www.coml.org) describing the technologies of the Census, with hyperlinks to current information on the topics.

The Census is actively promoting methodologies and technologies to the ocean observing community, namely the Global Ocean Observing System (GOOS) and the Global Earth Observing System of Systems (GEOSS). We work with the Partnership for Observation of the Global Oceans (POGO) on many of our efforts with the observing community and also look to SCOR, specifically the Technology Panel to support us, as appropriate. The Census shares—and supports to the extent possible—SCOR’s goals toward community collaboration, data sharing, education and outreach, and capacity building.

There is natural cross-over between CoML and SCOR through their vast networks of scientists. CoML shares active personnel with both SCOR-sponsored programs IMBER and GLOBEC. Ann Bucklin, Principal Investigator of the Census CMarZ and leader of the Census’ integrative initiative in DNA barcoding (MarBOL), is a former member of the IMBER SSC. Mike Roman, a

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former member of the Census U.S. Committee, is a current member of the IMBER SSC. Dave Karl, of the CoML ICoMM project, and Rory Wilson, of TOPP, were members of the IMBER-GLOBEC working group for “end-to-end food webs.” Dan Costa, ex-officio member of the CoML SSC is a member of the SSC for the IMBER-GLOBEC Integrating Climate and Ecosystem Dynamics (ICED) program. Ruben Escribano, former chair and current member of the CoML South American regional committee, and Jeff Runge, an advisor to the CoML Gulf of Maine project, are current members of the GLOBEC SSC. Peter Wiebe, a participant of the Census CMarZ project, leads U.S. GLOBEC in Georges Bank. Additional personnel from CMarZ, TOPP, MAR-ECO, and the Gulf of Maine projects are active in GLOBEC regional and science activities. Senior Scientist Ron O’Dor participates in CLIOTOP meetings.

Additionally, many of the individual Census projects have partnerships with other programs of interest to SCOR. The Chemosynthetic (ChEss) project collaborates with InterRidge, a SCOR Affiliated Program, on cruises, workshops and database development. The Census ArcOD and CAML projects were lead coordinating projects for marine biology in the International Polar Year. Through our efforts to integrate Census and ocean technologies and data into GOOS and GEOSS, we work closely with POGO, which is also a close partner of SCOR in many activities.

7.3.3 International Antarctic Zone Program - iAnZone (Affiliated in 1996)

Goal and Objectives:

The primary goal of the international Antarctic Zone (iAnZone) program is to advance our quantitative knowledge and modeling capability of the seasonal cycle and interannual variability of the ocean and its sea ice cover, with emphasis on climate-relevant fluxes that couple the Antarctic Zone to the atmosphere and to the global ocean. The iAnZone group has been involved in the development and coordination of three large Antarctic zone projects and also organizes meetings intended to inform others of national research and field programs for the purpose of “value-added” linkages among the participants.

Terms of Reference

- To identify, develop, and coordinate research projects meeting the iAnZone goal.
- To provide a forum for the exchange of iAnZone research plans, results, and data.
- To participate in and assist with the coordination between Antarctic Zone and global climate research programs, with other Southern Ocean programs, and with colleagues.
- To advise SCOR on the development of appropriate observing system (e.g., for GOOS, GCOS), data sets, and modeling strategies needed to understand the scales and mechanisms of climate variability within the Antarctic Zone.

For more detailed information on iAnZone’s scientific programs, see their Web site at <http://www.ldeo.columbia.edu/physocean/ianzone/>

Co-Chairs:

Alejandro Orsi
Department of Oceanography
Texas A&M University
College Station, TX 77843-3146, USA
E-mail: aorsi@tamu.edu
Tel: +1-979-845-4014
Fax: +1-979-847-8879
E-mail: aorsi@neo.tamu.edu

Andrea Bergamasco
CNR - ISMAR (National Research Council -
Institute for Marine Science)
S.Polo 1364, I30125 Venice, ITALY
Tel. +39-041-5216836
Fax. +39-041-2602340
E-mail andrea.bergamasco@ismar.cnr.it

Mar Flexas	SPAIN	Mike Schroeder	GERMANY
Karen Heywood	UK	Shuki Ushio	JAPAN
Emanuelle Houssais	FRANCE	Timo Vihma	FINLAND
Alexander Klepikov	RUSSIA	Guy Williams	AUSTRALIA
Vicky Lytle	NORWAY	Zhanhai Zhang	CHINA-Beijing
Mauricio Mata	BRAZIL		

Executive Committee Reporter: Jorma Kuparinen

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From: Alejandro Orsi [mailto:aorsi@tamu.edu]
Sent: Monday, August 02, 2010 11:03 AM
To: ed.urban@scor-int.org
Cc: Alejandro H. Orsi; Andrea Bergamasco; Karen Heywood
Subject: Re: Report from iAnZone to SCOR

Dear Ed,

Activities by iAnZone have concentrated around the IPY during the past few years, specifically through a series of researches programs related to the IPY-SASSI cluster-program lead by Dr. Karen Heywood at the University of East Anglia, UK.

The last iAnZone Biannual Meeting was held simultaneously with a SASSI workshop about a year ago (July 2009) in Montreal, Canada. At that point a consensus of opinion among the many participants from the international community was that the lack of any new large joint research program in Physical Oceanography undermined iAnZone's continued affiliation with SCOR. Another SASSI meeting was held in Oslo, Norway in June 2010, again well represented by Antarctic scientists from diverse nationalities. The future of iAnZone within SCOR was discussed again. Unfortunately recent efforts to secure funding to coordinate the final global analysis of IPY-SASSI data sets felt short of what was expected to revitalize iAnZone's contribution to SCOR.

The group concluded that iAnZone's affiliation with SCOR is no longer justifiable. However it was also unanimously recognized by all attendants to this meeting that iAnZone scientists around the world still need and will continue to exchange ideas, share results, coordinate logistics and human expertise to best conduct Antarctic research in the future. To that effect iAnZone researchers will maintain open channels to disseminate science progress through a series of informal resources, such as the existing email list server, related programs web sites and by holding workshops. Thus until further notice to the contrary, iAnZone will no longer have a formal governing body with Co-Chairs and committee members.

We take this opportunity to express our gratitude to SCOR for its official recognition of iAnZone's scientific activities during the past few decades.

Best regards,
Alex Orsi and Andrea Bergamasco

7.3.4 International Marine Global Change Study (IMAGES) (affiliated in 1995)

IMAGES (International Marine Global Change Study) is a program of Past Global Changes (PAGES), a core project of the International Geosphere-Biosphere Programme (IGBP), and is affiliated with SCOR. IMAGES was initiated to respond to the challenge of understanding the mechanisms and consequences of climatic changes using oceanic sedimentary records. The overriding IMAGES science issue is to quantify climate and chemical variability of the ocean on time scales of oceanic and cryospheric processes; to determine its sensitivity to identified internal and external forcings, and to determine its role in controlling atmospheric CO₂. In order to achieve these scientific objectives, IMAGES proposes to coordinate a global program to collect and study marine sediment records to address three fundamental questions:

1. How have changes in surface ocean properties controlled the evolution of global heat transfer through the deep and surface ocean and thereby modified climate?
2. How have changes in ocean circulation, ocean chemistry, and biological activity interacted to generate the observed record of atmospheric pCO₂ over the past 300 kyr?
3. How closely has continental climate linked to ocean surface and deep-water properties?

Chair:

Larry C. Peterson
Associate Dean for Graduate Studies
Rosenstiel School of Marine & Atmospheric
Science
University of Miami

4600 Rickenbacker Causeway
Miami, FL 33149 U.S.A.
Tel.: +1 305.421.4010
Fax: +1 305.421.4632
Email: lpeterson@rsmas.miami.edu

Members:

J.A. Flores	SPAIN	C. Lange	CHILE
F. Florindo	ITALY	M.L. Machain-Castillo	MEXICO
B. Flower	USA	A. Mackensen	GERMANY
F. Grousset	FRANCE	H. Neil	NEW ZEALAND
I. Hall	UK	B. Opdyke	AUSTRALIA
E. Ivanova	RUSSIA	T. Pederson	CANADA
E. Jansen	NORWAY	V. Ramaswamy	INDIA
Z. Jian	CHINA	J. Rogers	SOUTH AFRICA
N. Kallel	TUNISIA	J. Sopaheluwakan	INDONESIA
H. Kawahata	JAPAN	T. Stocker	SWITZERLAND
K.L. Knudsen	DENMARK	A. Völker	PORTUGAL
D. Kroon	NETHERLANDS		

Director: Ralph Schneider

Executive Committee Reporter: John Compton

In preparation of the SCOR General Meeting, Toulouse, 13-16 September 2010

IMAGES (International Marine Global Change Study)

Marine program of IGBP-PAGES

IMAGES (International Marine Global Change Study) is a core program of PAGES (Past Global Changes), a core project of the International Geosphere-Biosphere Programme (IGBP), and has been affiliated to SCOR since 1995. IMAGES was initiated to respond to the challenge of understanding the mechanisms and consequences of climatic changes using oceanic sedimentary records. The overriding IMAGES science issue is to quantify climate and chemical variability of the ocean on time scales of oceanic and cryospheric processes i.e. 1-100 kyrs; to determine its sensitivity to identified internal and external forcings, and to determine its role in controlling atmospheric CO₂. In order to achieve these scientific objectives, IMAGES coordinates a global program to collect and study marine sediment records to address three fundamental questions:

1. How have changes in surface ocean properties controlled the evolution of global heat transfer through the deep and surface ocean and thereby modified climate?
2. How have changes in ocean circulation, ocean chemistry, and biological activity interacted to generate the observed record of atmospheric pCO₂ over the past 300 kyr?
3. How closely has continental climate linked to ocean surface and deep-water properties?

IMAGES accomplishes these objectives through (1) the planning and coordination of oceanic cruises to retrieve and exploit in international collaboration giant sediment cores from long, continuous time series in high sedimentation rate areas of the ocean, and (2) the support of symposia, working groups and their workshops.

Chair

Larry C. Peterson
Associate Dean for Graduate Studies
Rosenstiel School of Marine &
Atmospheric Science
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149
U.S.A.

Tel.: +001 305.421.4010
Fax: +001 305.421.4632
Email: lpeterson@rsmas.miami.edu

Executive Director

Ralph Schneider
 Director Institute of Geosciences
 Christian-Albrechts-University Kiel
 Ludewig-Meyn-Str. 10
 24118 Kiel
 Germany

Tel.: +49(0) 431.880.1457 (.2883)
 Fax: +49(0) 431.880.1912
 Email: Schneider@gpi.uni-kiel.de

IMAGES Administration

The program has an interim office now hosted at the University of Kiel in Germany. It is managed by Birgit Reiner and she will be responsible for administration and updating the website. (Tel. +49 (0)431.880.4000, Email: breiner@gpi.uni-kiel.de)

Working Groups

Over the last year IMAGES supports several joint activities, as follows:

- SCOR/WCRP/IAPSO on the “*Climatic importance of the greater Agulhas System*” www.scor-int.org/Working_Groups/wg136.htm (SCOR 136); installed in 2009
- PALSEA “*Paleo-constraints in SEA-level rise*” (PAGES-IMAGES working group) www.eis.bris.ac.uk/~glyms/working_group.html ; installed in 2009
- “*Paleoclimate Records in Evaporative Basins*” International Workshop held in 2009 in Tübingen, Germany
http://www.ifg.uni-tuebingen.de/departments/bio_pal/micropalaeontology/Activities

Futhermore, IMAGES has financially supported the “*Urbino Summer School in Paleoclimatology 2009*” - <http://www.urbinosp.it/default.aspx> - and the workshop: NICOPP (PAGES) global synthesis of sedimentary nitrogen isotope data in comparison with biogeochemical/ocean modeling - <http://www.pages-igbp.org/science/databases.html>.

In addition to this workshop IMAGES promoted two international workshops, one held in Trins, Austria, which successfully demonstrated the improved level of cooperation between climate research teams focusing on climate modeling (meteorology, physical and chemical oceanography, atmosphere-ocean-vegetation coupling) and paleoclimatic reconstructions (paleoceanography, micropaleontology, palynology, isotope geo-chemistry, and paleoclimatology from various continental archives) http://images-pages.org/documents/trins2007_ws-report.pdf.

The other workshop, held in Potsdam, Germany, together with IODP had the objective of identifying key questions best addressable with high- to ultra-high resolution records and designing scientific drilling strategies to recover them (see <http://www.iodp.org/climate-workshop/>).

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7.3.5 InterRidge - International Ridge Studies (affiliated in 1996)

Terms of reference:

- To build and maintain an interactive international ridge-research community
- To identify, through InterRidge working groups and the workshops and conferences they organize, the most compelling questions in ridge research and develop program plans to address these questions
- To continue to develop scientific, technical and logistical co-operation among nations and to strengthen international foundations for innovative research.
- To provide current information about research activities through the InterRidge website and *IR News*.
- To encourage participation of smaller oceanographic countries and individual scientists from non-seagoing countries.
- Through education and outreach, to communicate the importance and excitement of ridge research to the general public and decision makers worldwide.
- To act as a representative body for international ridge scientists in policy discussions.

Chair: Bramley Murton
National Oceanography Centre, Southampton,
University of Southampton Waterfront
Campus, European Way, Southampton SO14
3ZH, UNITED KINGDOM
Phone: +44-23-8059-6543
E-mail: bjm@noc.soton.ac.uk

Co-chair: . Jon Copley
School of Ocean & Earth Science
University of Southampton, Waterfront
Campus
European Way, Southampton SO14 3ZH
UNITED KINGDOM
Phone: +44-23-8059-6621
E-mail jtc@soton.ac.uk

Members:

Fernando Barriga	PORTUGAL	Françoise Gaill	FRANCE
Donna Blackman	USA	Timothy Henstock	UK
John Chen	CHINA-Beijing	Sung-Hyun Park	KOREA
Paul R. Dando	UK	Rosario Lunar	SPAIN
Colin Devey	GERMANY	Rolf Pedersen	NORWAY
Nicole Dubilier	FRANCE	K.A. Kamesh Raju	INDIA
Jérôme Dymont	USA	Nobukazu Seama	JAPAN
		Steve Scott	CANADA

Coordinator: Debbie Milton

Executive Committee Reporter: John Compton

2010 InterRidge Update for SCOR

The InterRidge office moved in January 2010 to the National Oceanography Centre, Southampton, UK. The IR Chair is Dr Bramley Murton, a researcher specialising in geological and geochemical evolution of oceanic crust. He has been a member of InterRidge working groups, convened InterRidge meetings, and sits on several research programme panels (e.g. UK-IODP, IODP EPSP and NOAA Ocean Exploration). Jon Copley is the Co-Chair, an ecologist specialising in chemosynthetic ecosystems. He coordinated a national research programme for the use of AUV technology to investigate challenging polar environments. He also holds several awards for science communication and teaching and has been a news editor of *New Scientist* magazine. The office Co-ordinator is Dr Debbie Milton, whose background is in physical geography and education.

National and regional membership stands at 64 and during 2010, IR has strengthened ties with Hong Kong, by encouraging researchers there to work closely with IR China. Individual IR membership is ~2600. The bi-weekly "interridge-mail" e-news is received by ~1200 IR members and ~180 members obtain job postings by subscribing to the interridge-classifieds mailing list.

InterRidge (<http://www.interridge.org>) promotes interdisciplinary, international studies of oceanic spreading centres by creating a global research community, planning and coordinating new science programmes that no single nation can achieve alone, exchanging scientific information, and sharing new technologies and facilities. InterRidge is also dedicated to reaching out to the public, scientists and governments, and to providing a unified voice for ocean ridge researchers worldwide. An increasing role for InterRidge is our involvement in compiling information and advice for policy makers. This includes meetings and workshops where protocols for codes of scientific conduct for studying chemosynthetic environments, and identifying sites of special scientific interest, are proposed and discussed. InterRidge also has formal links with the United Nations Environment Programme and informal links with the Integrated Ocean Drilling program and the International Seabed Authority.

Working Groups are the principal mechanism for achieving the InterRidge programme, their main function being to identify new areas of high priority scientific research. Each Working Group has clear goals and a timescale in which to achieve them (~ 5 years). InterRidge supports those scientific projects which would benefit from IR coordination by convening group meetings, community-wide workshops, symposia and theoretical institutes. The resulting reports represent a synthesis of international and interdisciplinary efforts to define scientific questions and a methodology of addressing them. There are currently six active IR Working Groups in 2010.

Examples of IR-led Working Group activity in 2010:

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Mantle Imaging WG

(Contact: Nobukazu (Nobi) Seama, Japan)

The WG convened a special session at the 2010 EGU General Assembly: “GD4.1/GMPV52: Melt generation to crustal formation beneath mid-ocean ridges.” InterRidge co-sponsored the conference "The Mohole - A Crustal Journey and Mantle Quest". In 2011 the WG is planning to organize an IRTI (or symposium) with a workshop in Japan in summer or fall 2011. Potential participants at the IRTI will include those who work on results from large-scale experiments, rock laboratory experiments, petrology, and numerical modelling.

Seafloor Mineralisation

(Contact: Maurice Tivey, USA)

In 2010, IR co-sponsored a workshop: “Design of Marine Protected Areas for Chemosynthetic Ecosystems Potentially Threatened by Human Activities in the Deep Sea.” A list of design principles for seep and vent protected areas was developed and an outcome of this workshop was a request to InterRidge to survey the IR community for a justified list of vent sites that should have priority protection. Later in 2010, IR has been asked to co-sponsor the UMI 2010 conference: Toward the Sustainable Development of Marine Minerals.

Long-Range Exploration of the Ridge Crest workshop

(Contact: Colin Devey, Germany)

This Working Group held its main meeting in June 2010 at NOC, Southampton, UK. There were three main outcomes: (1) At the segment scale, technology is now available to consider conducting total coverage studies of the seafloor, but resource implications mean that there is a need for InterRidge involvement in coordinating such an ambitious project. (2) Five priority areas were identified for global exploration, identified as having multiple scientific drivers. (3) It was recognised that many institutions worldwide now have the technological capabilities for deep-ocean exploration, including AUVs and ROVs. The WG report is available at: http://www.interridge.org/files/interridge/LREWG_Report_Final_web_0.pdf.

The InterRidge Coordinator, Debbie Milton, has worked with Cindy Van Dover, Laurent Godet and Kevin Zelnio on a survey of the InterRidge Statement of Commitment to Responsible Research Practices at Deep-Sea Hydrothermal Vents and the results are expected to be published and posted on the InterRidge website this year. The previous IR Coordinator, Stace Beaulieu, has produced a revised, on-line vents database, which will be available from the InterRidge website later in 2010.

The next few years will be an exciting time for the UK to host the InterRidge Office, with UK researchers engaged in several major programmes on mid-ocean ridge systems including the East Scotia Ridge and Bransfield Strait; 13°N, Mid-Atlantic Ridge (MAR); Lucky Strike, MoMAR area; 45°N, MAR; the Mid-Cayman Rise; and the Reykjanes Ridge flanks.

7.3.6 International Ocean Colour Coordinating Group (IOCCG) (Affiliated in 1997)

IOCCG is an international group of experts in the field of satellite ocean colour that acts as a liaison and communication channel between users, managers, and agencies in the ocean colour arena.

Terms of Reference:

- To serve as a communication and coordination channel between data providers and the global user community of satellite ocean-colour data, and so to maximize the benefits that accumulate from international investments in ocean-colour science and technology.
- To construct a partnership, at the international level, between the space agencies and the users of satellite ocean-colour data to develop and coordinate data utilization.
- To work closely with the appropriate international bodies (including CEOS, IOC and SCOR), international scientific programs (such as IGBP and GOOS), satellite ocean-colour mission offices and other agencies (such as environmental and fishing agencies) to harmonize the international effort and advance ocean-colour science and its applications.
- To develop a collective voice for the community of users of ocean-colour data and to articulate this voice to the appropriate international bodies, international scientific programs and space agencies.
- To promote the long-term continuity of satellite ocean-colour data sets; the development of operational, ocean-colour data services and new generations of ocean-colour sensors; and the integration of data from complementary ocean sensors.

Chair:

David Antoine

Membership:

Yu-Hwan Ahn	KOREA		
David Antoine	FRANCE	Milton Kampel	BRAZIL/INPE
Stuart Bernard	SOUTH AFRICA	Samantha Lavender	UK
Hans Bonecamp	Eumetsat, EC	Zhihua Mao	CHINA-Beijing
Paula Bontempi	USA/NASA	Hiroshi Murakami	JAPAN
Yves Crevier	CANADA	Rangnath Navalgund	INDIA
Curtiss Davis	USA/Naval Res. Lab	Peter Regner	ITALY
Paul DiGiacomo	USA	Tasuku Tanaka	JAPAN
Roland Doerffer	GERMANY	Eric Thouvenot	FRANCE/CNES
Mark Dowel	ITALY/JRC	Scarla Weeks	AUSTRALIA
Nicolas Hoepffner	ITALY/JRC		

Executive Committee Reporter: Jorma Kuparinen

Project Scientist: Venetia Stuart

SCOR AFFILIATED PROGRAM**International Ocean-Colour Co-ordinating Group (IOCCG)
Report of Activities 2009 - 2010****Venetia Stuart (IOCCG Project Scientist)*****1. Background***

The International Ocean-Colour Co-ordinating Group (IOCCG) was founded in 1996 under the auspices of the IOC (Intergovernmental Oceanographic Commission), and has been an Affiliated Program of SCOR since 1998. This affiliation to SCOR is critical to the operations of the IOCCG, since it provides a reliable avenue for obtaining funding from U.S. agencies, such as NASA (a major sponsor). The IOCCG greatly appreciates the efficient and professional manner in which the NASA funds have been managed by SCOR, at very little cost. In addition, the IOCCG has been strengthened by having visible links with one of the major international and intergovernmental organizations in the marine sphere.

The IOCCG was formed to encourage communication and international co-operation between the providers of ocean-colour data (*i.e.* the various space agencies), and the various user groups (students, scientists, researchers and program managers). Information retrieved from ocean-colour remote sensing can contribute to our understanding of the planetary carbon cycle and climate research, as well as other biological and biogeochemical processes in the oceans. Ocean-colour data also has many other important applications including management of marine resources and coastal zone monitoring and management. The IOCCG has a wide-ranging mandate, including addressing scientific issues through a number of scientific working groups, building capacity, both in developing countries as well as at the higher level through training courses (introductory and advanced), and ensuring the continuity of the ocean-colour data stream through the CEOS Ocean Colour Radiometry-Virtual Constellation (OCR-VC). The group is currently chaired by Dr. David Antoine (LOV, Villefrance, France) and the IOCCG Project Office is located at the Bedford Institute of Oceanography, Canada, staffed by Project Scientist, Dr. Venetia Stuart.

2. Major Scientific Achievements

The IOCCG has made a number of important advances in the field of satellite ocean colour, principally through the activities of its specialized scientific working groups (WGs) and the production of a series of reports. Three reports were published by the IOCCG during the last performance period and are listed below under the relevant IOCCG working groups. These reports are always in high demand by scientists, managers and students from around the world and are frequently used as a teaching tool in training courses. In addition, there are four on-going IOCCG

WGs in various stages of deliberation, plus three new IOCCG working groups which were accepted at the recent IOCCG meeting. Information on all these working groups and projects is given below.

2.1 Recently-Published IOCCG Reports

The reports from the three working groups/projects listed below were published by the IOCCG over the last year and have been distributed free of charge to more than 1,000 subscribers on the IOCCG mailing list.

2.1.1 SAFARI Project (*Societal Applications in Fisheries & Aquaculture using Remote Sensing Imagery*):

The IOCCG helps to coordinate the activities of the CSA-sponsored SAFARI Project, which is addressing GEO Task AG-06-02: Data Utilization in Fisheries and Aquaculture. The aim of the SAFARI Project was to stimulate interest in the use of satellite remote sensing as an important tool to address problems in fisheries research and management. The SAFARI Project produced a report entitled “*Remote Sensing in Fisheries and Aquaculture*” (IOCCG Report 8) which was edited, published and distributed by the IOCCG in November 2009. A PDF copy of the report can be downloaded from the IOCCG website at: <http://www.ioccg.org/reports/report8.pdf>. The IOCCG also sponsored and helped to co-ordinate the successful SAFARI International Symposium on Fisheries and Remote Sensing, which recently took place in Kochi, India (15-17 February 2010). The symposium was attended by 157 participants from 30 different countries, including seven prominent keynote speakers. Themes addressed during the symposium included applications of remote sensing to fish harvesting, ecosystem-based management of fisheries, harmful algal blooms, fisheries models, implications of climate variability on fisheries, and management of coastal zones and fisheries.

2.1.2 *Global Ecological Provinces*:

The aim of the WG was to review the utility of ocean partitions as a tool for the interpretation and application of ocean-colour data, including applications dealing with the ocean carbon cycle, climate change and resource management. The partition of the global oceans into biogeographical provinces was first undertaken by Alan Longhurst and provides a useful framework for understanding the mechanisms controlling biological, physical and chemical processes in the oceans, as well as their interactions. Ocean-colour radiometry provides a new and formidable tool to identify basin-scale boundaries in different marine biomes. The WG prepared an IOCCG report entitled “*Partition of the Ocean into Ecological Provinces: Role of Ocean-Colour Radiometry*” which reviews the state-of-the-art in ocean biogeographical methods, both in the use of ocean-colour imagery, and also in the implementation of existing biogeographies in ocean-colour related applications (e.g. primary production modelling). The final report (IOCCG Report 9) was published by the IOCCG in late 2009, and was printed and distributed by the EU Joint Research Centre (Italy) which is gratefully acknowledged. A PDF copy of the report can be downloaded from the IOCCG website at: <http://www.ioccg.org/reports/report9.pdf>.

2.1.3 Atmospheric Correction Algorithms:

This working group, chaired by Menghua Wang (NOAA, USA) evaluated the atmospheric correction algorithms for the processing of MERIS, OCTS/GLI, POLDER, and SeaWiFS/MODIS ocean-colour data using common simulated data sets. The evaluations and comparisons were carried out for Case-1 (phytoplankton dominated) and Case-2 (sediment and yellow-substance dominated) waters, and for various atmospheric properties including cases with non- or weakly absorbing aerosols, as well as for strongly absorbing aerosols. The group concluded that most algorithms perform well in Case-1 waters (which comprise the bulk of the global oceans) but they made several recommendations for atmospheric corrections in Case-2 waters. The final report entitled “*Atmospheric Correction for Remotely-Sensed Ocean-Colour Products*” (IOCCG Report 10) was published by the IOCCG in early 2010 (electronic copy), and hardcopies will be printed and distributed by NOAA after this year, which is gratefully acknowledged. A PDF copy of the report can be downloaded from the IOCCG website at: <http://www.ioccg.org/reports/report10.pdf>

2.2 On-going IOCCG WGs

These four working groups are in various stages of progress, and at least one WG is expected to provide a draft copy of their report within the next year.

2.2.1 Ocean Colour from a Geostationary Platform:

This WG, chaired by David Antoine (Laboratoire d'Océanographie de Villefranche, France), is addressing requirements of ocean-colour observations from a geostationary orbit. The complementarities between LEO and GEO missions will also be examined. Advantages of a geostationary orbit for ocean-colour studies include better temporal coverage, the possibility of following episodic events at the scale of hours, and improving the match between the temporal scale of satellite observations and those of models. Several space agencies have plans to develop a geostationary ocean-colour sensor, and South Korea will launch a new mission in May this year a focus on geostationary observations, so the working group is very timely. Membership of the group includes representatives from USA, Korea, India, China, Japan and CNES. A preliminary draft report has been distributed for review and the group hopes to have a final report ready for publication within a year.

2.2.2 Bio-optical Sensors on Argo Floats:

This WG, chaired by Hervé Claustre (Laboratoire d'Océanographie de Villefranche, France), is examining the feasibility of equipping Argo floats with optical/biogeochemical sensors to provide high density, biogeochemical data at relatively low cost. Bio-optical sensors on floats are a promising avenue for synergistic applications with remote sensing of ocean colour, including calibration/validation activities. The WG is currently examining the scientific and strategic challenges of designing such a program based on Argo float technology. The group has proposed three types of Argo-like floats for bio-optical activities: the CAL-VAL-float (for validation only), the BIO-ARGO (for biogeochemistry and validation) and the Carbon-float (for a more complete

range of biogeochemical measurements, including carbon). A pilot study was also recommended, which NASA is interested in funding, especially since the data will be useful to study carbon cycle processes. An outline of a report on the topic has been drafted, and contributions for the various chapters are being reviewed.

2.2.3 Phytoplankton Functional Types (PFTs):

This WG was chaired by Cyril Moulin (CEA, France) but he stepped down due to work commitments and Shubha Sathyendranath (PML, UK) was invited to take over as Chair. PFTs are conceptual groupings of phytoplankton species which have an ecological functionality in common *e.g.* nitrogen fixers or calcifiers. They are of interest to the biogeochemical community because they are relevant proxies of ecosystem function and can be potentially derived from ocean-colour remote sensing through direct or indirect effects. A draft report is currently being prepared by the WG. Chapter 1 is complete and provides an introduction and background to PFTs, while Chapter 2, dealing with complementary *in situ* methods of measuring phytoplankton functional types, is still in preparation. The rest of the report is still in the planning stages. The research area of PFTs is moving so fast so the perceived delay in publication will not harm the report, and it should be better in the long run.

2.2.4 Level-1 Requirements

This new WG, co-chaired by Chuck McClain, Gerhard Meister and Paula Bontempi (all from NASA), was formed because the requirements for ocean-colour sensors have changed dramatically over the past 10 years. It is now possible to measure more complex ocean variables, as well as physiological features of phytoplankton using ocean-colour radiometry. The new ocean radiometers therefore will have more stringent requirements. The WG will address the relevant science questions and ocean properties that can be measured, and the current suite of requirements will be updated. The proposed report will also include pre-launch and on-orbit requirements including vicarious calibration and on-orbit calibration. Furthermore the report will also address desired measurements for which there is no capability at the present time *e.g.* mixed layer depth. The WG membership has been finalized and the objectives and Terms of Reference for the group have been defined. The first WG meeting took place in Bethesda, Maryland, USA from 20-21 April 2010 where the science questions were addressed and an outline of the IOCCG report was drafted.

2.3 Newly-Formed IOCCG Working Groups

Proposals for three new IOCCG working groups were received at the recent IOCCG Committee meeting (Rio de Janeiro, 18-20 January 2010), two of which were resubmissions from the previous year. All three proposals were accepted in principle, and an outline of each is given below.

2.3.1 Using Ocean Colour Remote Sensing to Study and Monitor the Arctic Ocean:

This proposal was put forward by Marcel Babin (LOV, France) to address the use of ocean colour remote sensing in the Arctic Ocean, which is essential to monitor the entire Arctic Ocean on a regular and sustained basis, in order to assess the impact of climate change. Potential difficulties of

using ocean-colour remote sensing over the Arctic Ocean include high CDOM absorption and high package effect leading to problems with current algorithms. Cloud cover is also an issue (only cloud free 10-20% of the time) and prevailing sun elevations are low. The IOCCG Committee recommended that the group revise their proposal to encompass all high-latitude/low-sun angle waters (i.e. to include the Antarctic) and re-submit for approval by the IOCCG Executive Committee.

2.3.2 *Uncertainties in Ocean-Colour Remote Sensing:*

This proposal was put forward by Roland Doerffer (GKSS, Germany) to address errors and uncertainties in ocean-colour remote sensing. Complex coastal waters contain a variety of constituents with different optical properties, as well as large concentration ranges. In addition, there are inherent difficulties with atmospheric correction, which can lead to large sources of error and retrieval uncertainties. Procedures are required to detect conditions which are out of scope of an algorithm, and to determine the remaining uncertainties on a pixel-by-pixel basis. The errors and uncertainties need to be presented in a proper form, which is the goal of the working group. The IOCCG Committee agreed that errors and uncertainties were a very important topic, and that this information is also important for the modelling community and for data assimilation. The working group was accepted and a draft set of Terms of Reference has been reviewed. The WG is now recruiting members and planning for their first meeting.

2.3.3 *Joint GEOHAB/IOCCG WG on HABs*

This proposal for a combined GEOHAB/IOCCG working group was put forward by Stewart Bernard (CSIR, South Africa). Harmful algal blooms (HABs) are a global problem with high impact, and ocean-colour radiometry is a powerful, cost-effective and relatively easy to use tool for observing many of these blooms. Currently no synopsis or guide is available for ocean-colour HAB applications across different ecosystems. This WG aims to summarise the different techniques available for detecting HABs, and also to review the characteristics of different ecosystems where HABs might occur, using various ecosystem case studies, including inland freshwater case studies. The first meeting is provisionally scheduled for August 2010 and will focus on finalising the Terms of Reference and reviewing preliminary analyses of case study material. The final output would be aimed at a journal special issue, in addition to an IOCCG monograph on the topic.

3.0 Continuity of the Ocean Colour Data stream

The IOCCG recently established the “Ocean Colour Radiometry-Virtual Constellation (OCR-VC)” to ensure the provision of long time-series of calibrated ocean-colour radiance (OCR) at key wavelength bands from measurements obtained from multiple satellites. CEOS developed the concept of virtual, space-based Constellations in support of GEO (Group on Earth Observations) objectives. Observations from a virtual constellation would provide better temporal, spatial, and spectral resolution as well as related data management and dissemination, and can help agencies avoid duplication in Earth Observation efforts, in order to establish a globally-sustained Earth Observation network. The IOCCG OCR-VC is a contribution to GEO Task AR-09-02:

Interoperable Systems for GEOSS. All the other major space agencies with an interest in ocean colour are represented in the OCR-VC. An implementation plan for the OCR-VC has been prepared, and has been endorsed by CEOS. A meeting of the OCR-VC full steering group took place in Rio de Janeiro (January 2010). Two items were selected to be promoted at the next SIT meeting: (i) an international SIMBIOS-like programme, to be called INSITU OCR (International Network for Sensor InTer-comparison and Uncertainty assessment of Ocean Colour Radiometry) to promote cross-calibration of instruments, product and algorithm validation etc. and (ii) Essential Climate Variable (ECV) implementation and production of Climate Quality Data Records (CQDRs). The Level-1 WG will provide more precise requirements for radiometric accuracy. A small *ad hoc* meeting was held at the Oceans from Space symposium (April 2010) to bring people together at the international scale to discuss the formation of the INSITU OCR programme.

4. Capacity Building Initiatives

The IOCCG has a strong interest in capacity building and has sponsored and coordinated numerous training courses in many parts of the world. This year the IOCCG is co-sponsoring two different types of training events: an advanced, highly-specialized training course, and an introductory course in a developing country.

4.1 Training Course on Inversion Procedures (10-14 August 2009, Germany)

The GKSS Research Centre (Germany), in conjunction with the IOCCG, conducted an advanced training course on inversion procedures in ocean-colour remote sensing. The course was aimed at scientists and advanced graduate students working with ocean-colour data in coastal waters, with a strong mathematical background and experience in programming. The course was attended by 27 participants from 18 different countries. The main objective of the course was to teach participants how to use various inversion techniques to deal with complex waters with different optical components. Software used included Excel spreadsheets, Scilab with optimization and artificial neural network packages, and the BEAM-VISAT image processing program. All programs were prepared beforehand by the lecturers so that the trainees only had to understand and modify the programs according to the different tasks. A full report of the training course can be found on the IOCCG website at:

http://www.ioccg.org/news/Sept2009/summary_GKSS_training.doc

4.2 Ocean Colour Training Course (12-23 October 2009, Tanzania)

The Joint Research Centre (EC), in conjunction with the IOCCG, conducted an introductory training course on "Methods and Applications of Ocean Colour Remote Sensing in African Coastal and Regional Seas" at the University of Dar-es-Salaam, Tanzania. A total of 18 participants from 10 different African countries were selected for the course (out of a total of 85 applications). The training was designed to provide the theoretical basis of ocean colour satellite measurements, as well as key applications in monitoring and managing the coastal zone, and in protecting the marine ecosystems and their resources. In the practical sessions, the students were trained in the use of various image processing and application software, such as SeaDAS, Envisat-BEAM and BILKO.

A full report of the training course can be found on the IOCCG website at: http://www.ioccg.org/training/Report_OC2009_Africa_sm.pdf

5. Project Management and Coordination

5.1 Annual IOCCG meeting

The IOCCG Committee meets once a year to coordinate the activities of the group as a whole, and to review the progress of the various working groups, discuss plans for the year ahead and propose new working groups and training initiatives. The last meeting of the IOCCG Committee was hosted by INPE (National Institute for Space Research, Brazil), and took place in Rio de Janeiro, Brazil from 18-20 January 2010. The minutes of the meeting are available on the IOCCG website at: http://www.ioccg.org/reports/Minutes_IOCCG_15.pdf. The next IOCCG Committee meeting is scheduled to take place in Plymouth, UK from 15-17 February 2011.

5. Outreach

The IOCCG connects with the global user community through a variety of outreach information schemes including a website, newsletters, training courses, brochures, reports and information sessions at conferences and workshops. The comprehensive IOCCG website (see <http://www.ioccg.org>) provides a wealth of information on data sources, software, training opportunities, conferences, an extensive bibliography, employment opportunities and status of current and future ocean-colour sensors. In addition, a quarterly electronic newsletter is distributed to over 1,000 subscribers, keeping the ocean-colour user community informed of important events, research activities, training initiatives and mission status news. Furthermore the IOCCG Reports are distributed free of charge to the ocean-colour user community, and the IOCCG brochure entitled “*Why Ocean Colour? The Societal Benefits of Ocean Colour Radiometry*” is now available in English, Portuguese, Spanish, Japanese, Chinese and Korean (French in prep).

6.0 Current IOCCG Membership

The IOCCG Committee consists of members drawn from space agencies as well as the scientific ocean-colour community, and are selected to reflect a balance of both providers and users of ocean-colour data, as well as geographical location. The term of service is usually three years, except for members of the Executive Committee (representatives of sponsoring agencies), whose nomination is governed by a space agency appointments. Rotation of members is being implemented according to a roster (four members marked with an asterisk are new members for 2010, the two marked with # are newly appointed sponsoring agency members).

6.1 IOCCG Committee Members (2009/2010)

Ahn, Yu-Hwan	-	Korea Ocean Research and Development Institute, Korea
Antoine, David (Chairman)	-	Laboratoire de Physique et Chimie Marines, France
Bernard, Stewart	-	University of Cape Town, South Africa
Bonekamp, Hans	-	EUMETSAT, European Union
Bontempi, Paula	-	NASA HQ, USA
Chauhan, Prakash [#]	-	ISRO, India
Crevier, Yves	-	Canadian Space Agency, Canada
DiGiacomo, Paul	-	NOAA, USA
Doerffer, Roland	-	GKSS, Germany
Dowell, Mark	-	JRC, Italy
Dutkiewicz, Stephanie*	-	MIT, USA
Greb, Steven*	-	Wisconsin Department of Natural Resources, USA
Helbig, Jim	-	Department of Fisheries and Oceans, Canada
Ishizaka, Joji*(2 nd term)	-	Nagoya University, Japan
Kampel, Milton	-	INPE, Brazil
Mao, Zhihua	-	Second Institute of Oceanography, China
Murakami, Hiroshi	-	JAXA EORC, Japan
Pozdnyakov, Dmitry*	-	NIERSC, Russia
Regner, Peter	-	ESA/ESRIN, Italy
Sathyendranath, Shubha [#]	-	Plymouth Marine Laboratory, UK
Tanaka, Tasuku	-	Yamaguchi University, Japan
Thouvenot, Eric	-	CNES, France
Weeks, Scarla	-	University of Queensland, Australia
Yoder, James (Past-Chair)	-	Woods Hole Oceanographic Institution, USA

7.0 List of IOCCG Sponsors

Activities of the IOCCG are supported by contributions from various national space agencies as well as other organisations listed below, and upon infrastructure support from SCOR. Representatives from these funding agencies are members of the Executive Committee.

- CNES (Centre National d'Etudes Spatiales, France)
- CSA (Canadian Space Agency)
- DFO (Department of Fisheries and Oceans, Canada)
- ESA (European Space Agency)
- GKSS (Germany)
- INPE (National Institute for Space Research, Brazil)
- ISRO (Indian Space Research Organisation)
- JRC (Joint Research Centre, EC)
- KORDI (Korean Oceanographic Research Institute)

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- NASA (National Aeronautics Space Administration)
- NCEO (National Centre for Earth Observation, UK)
- NOAA (National Oceanic and Atmospheric Administration)
- SIO (Second Institute of Oceanography, China)

The Bedford Institute of Oceanography (DFO, Canada) provides in-kind support (office space, computer, informatics support, fax, phone and postage). SCOR provides logistic support and manages the NASA funds.

7.4 Other Organizations

7.4.1 Arctic Ocean Sciences Board

International Arctic Science Committee Marine Working Group: the Arctic Ocean Sciences Board

Summary

The Arctic Ocean Sciences Board met in Nuuk, Greenland on 15 April 2010 for a very productive meeting. During the course of the meeting the Board determined that it will continue to support its key initiatives including the integrated Arctic Ocean Observing System (iAOOS), the Arctic in Rapid Transitions initiative, and support of deep sea Arctic drilling. In addition, the Board endorsed several new tasks including support of the Distributed Biological Observatory beginning first in the Western Arctic but expanding to a pan-Arctic initiative over the coming years; an effort to organize an integrated analysis of all 173 ocean moorings in place for the IPY period and potentially expand this to include a full ocean reanalysis of the Arctic to be undertaken with WCRP and CliC. The AOSB also approved a small group to develop a five-year strategic plan for the new IASC Marine Working Group. The Board elected a new Chair, Dr. Savi Narayanan from Canada, and a new Vice Chair, Dr. Jackie Grebmeier from the United States, to its SG. The AOSB web site is moving to the Arctic Portal within the IASC website. Its new web address is <http://aosb.arcticportal.org/>.