

Annex 7 – Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project



Annual Report 2006
Submitted by Sylvie Roy
On behalf of the IMBER Scientific Steering Committee

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Establishment of the IMBER International Project Office

The official opening of the IMBER IPO was held on October 25, 2005 at the European Institute for Marine Studies (IUEM) in Brest. The IPO is funded by Centre National de la Recherche Scientifique (CNRS), Institut de Recherche pour le Développement (IRD), Université de Bretagne Occidentale (UBO) and the Brittany Region. The office is now fully staffed; Sylvie Roy was appointed Executive Officer in August 2005, Elena Fily started as administrative assistant in September 2005, Sophie Beauvais was appointed as the Deputy Executive Officer in October 2005. The IMBER IPO is actively working on the implementation and promotion of IMBER.

SSC and Executive Meetings

2005 Executive Meeting

The Second IMBER Executive Committee meeting was held in Brest on October 25-27. This meeting was jointly held with the GLOBEC Executive Committee. The focus was to continue work on the Implementation plans for IMBER over the next 6 to 12 months and to develop a plan for moving the relationship between IMBER and GLOBEC forward. A framework for interactions between IMBER and GLOBEC was drafted and circulated to the respective SSCs for approval.

2006 SSC Meeting

The Third IMBER Scientific Steering Committee Meeting was held on May 10-12, 2006, at the European Institute for Marine Studies in Brest (France) home of the IMBER International Project Office. The meeting focused on reviewing the implementation of IMBER to date and identifying future priorities including interactions with other projects.

Plans for 2006-2007

The next IMBER Executive meeting will be held jointly with GLOBEC in Plymouth (UK on September 27-29, 2006.

Implementation of IMBER

Four working groups or task teams have been formed and are active in the development and implementation of IMBER.

End-to-End food web Task Team

The End-to-End Food Web Task Team, a joint activity with GLOBEC, is co-chaired by Coleen Moloney (South Africa) and Mike St John (Germany). The team met in Hamburg (Germany) in December and is preparing a review for publication in 2006, which lays out i) why we need to tackle end-to-end food webs in our studies at this time, ii) what the key challenges are and how we can meet them, and iii) how we can make headway in the experimental, observational and modelling components of marine end-to-end food webs. The manuscript entitled "Newton and Kelvin meet Darwin in the complex sea of global change: Unravelling marine food webs end to end", with authorship (St John et al.) was submitted to *Science* in early July. The task team will be disbanded when the paper is published. However, the task team recommended the formation of a new IMBER/GLOBEC activity: an End-to-end Food Webs working group to be jointly appointed by the IMBER and GLOBEC SSCs. Some continuity in membership is preferred, but a new group composition is probably needed. The task team will make recommendations regarding scientific issues and refine the terms of reference for this group for the next IMBER/GLOBEC Executive meeting in September 2006. A budget of 10K USD was approved for the activities of this group in 2007.

In conjunction with this activity IMBER will co-sponsor the International Symposium on "Parameterization of Trophic Interactions in Ecosystem Modeling" that EUR-OCEANS is organising in early 2007. This symposium will provide a review, synthesis, and forum for discussion of the present understanding of trophic interactions at key interfaces and provide a vision for the development of future modelling strategies. IMBER has agreed to support five participants to attend this symposium.

IMBER/SOLAS Carbon Working Group

Recognizing the need for scientific discussion and coordination of marine carbon research within IMBER and SOLAS, the two projects have established a joint carbon implementation group. The group is co-chaired by Truls Johannessen (Norway) and Arne Körtzinger (Germany) and works closely with the IOCCP (International Ocean Carbon Coordination Project). It is understood that the joint SOLAS/IMBER Carbon (S.I.C.) group will oversee all scientific aspects of marine carbon process studies. A Joint SOLAS/IMBER Carbon Research implementation plan has been published electronically and is considered to be a living document that will be updated regularly (http://www.imber.info/products/Carbon_Plan_final.pdf). The S.I.C. group met in September 2005 in Broomfield, Colorado, (USA). One major outcome of this meeting was the creation of three sub-groups to move forward the implementation of the carbon research.

Sub-Group 1 Surface ocean CO₂ fluxes (Chair: Nicolas Metzl, France).

This group is focused on synthesis, instrumentation and technology development, VOS and mixed layer sampling strategy. Their first major action is to organize with IOCCP an International Workshop on Volunteer Observation Ships Network Design and Data Synthesis (UNESCO, Paris, 11-13 April 2007). The Co-chairs of the organizing committee are Nicolas Metzl and Bronte Tillbrook.

Sub-Group 2 Interior ocean carbon storage (Chair: Nicolas Gruber, Switzerland). This group will cover inventory and observations, natural variability, transformation, designing a strategy for leverage for the Argo program, and interaction with modeling. They took the lead on the initiative "Friends of Oxygen on Argo". Their objective is to submit a white paper suggesting the addition of oxygen sensors on Argo buoys to the Argo SSC by the end of 2006. The group met on June 28-30 at the North Atlantic Synthesis meeting in Iceland organized by CARBOOCEAN. This group is also involved with the International Repeat Hydrography Carbon Advisory Group. It was suggested that this group take the lead on a new activity aimed at broadening the Repeat Hydrography Strategy and identifying the most important questions. This activity could start in 2007 and involve CLIVAR.

Sub-Group 3 Carbon cycle climate sensitivities and feedbacks (Chair: Kitack Lee, Korea). This group has not yet been formed. It will focus on the response of ecosystems and biogeochemical cycle to natural and anthropogenic changes, feedbacks to the Earth System, and future perspective (prediction). Email discussion has been initiated between this group and IOCCP to identify the science issues and develop guidelines and protocols for mesocosm experiments. It was suggested to link Kitack Lee with the IGBP/SCOR Fast Track Initiative on Ocean Acidification.

Continental Margins Task Team

LOICZ and IMBER have agreed to form a joint LOICZ/IMBER Continental Margin Task Team. The task team consists of 10 members. The task of this group is to organize, by email and perhaps a short logistic meeting by a few, a small Open Science Conference in the second half of 2007 in Shanghai on the biogeochemistry and ecosystems for continental margins. As part of fund raising for this activity, IMBER plans on submitting a proposal to SCOR for travel funds for scientists from developing countries and countries with economies in transition. Based on the outcome of this conference, the task team will recommend to the IMBER and LOICZ SSCs a strategy for implementation of continental margins research in the two projects and suggest a group of people identified from the OSC to take the implementation forward.

Capacity Building Task Team

The Capacity Building Task Team chaired by Wajih Naqvi is composed of 8 members. The task team developed a capacity-building strategy and implementation plan to be used by IMBER to guide capacity-building issues. One objective of the strategy is to enhance research capabilities in developing countries, especially those geographically close to interesting biogeochemical/ecosystem provinces. Another objective is to enhance research capabilities globally in those IMBER activities that have few practitioners but are crucial for optimal implementation of the IMBER Science Plan. The aim is also to strengthen graduate education in ocean sciences. The task team is now developing the approach that should be taken to ensure that the strategy is implemented, and may recommend the formation of a longer term working group.

In relation to its capacity-building activities, IMBER is trying to develop a floating university program. This could potentially be accomplished in collaboration with EUR-OCEANS.

Data Management Task Team

IMBER has decided to focus on metadata management. A Data Management Task Team chaired by Raymond Pollard was appointed to develop and implement a data management plan, and develop metadata guidelines for IMBER projects. The IMBER Deputy Executive Officer, Sophie Beauvais, was appointed as the IMBER Data Liaison Officer at the IPO to support the Data Management task team. Raymond and Sophie are planning a meeting with Roy Lowry at the British Oceanographic Data Centre to determine the best strategy for IMBER.

Human Dimension

IMBER is exploring a collaborative approach with other IGBP core projects to bring together natural and social science communities to develop the issues and questions for Theme 4 in the IMBER SP/IS.

Promotion of IMBER in the science community

Communication Plan

An IMBER communication plan has been developed and made available on the IMBER website. The critical audiences targeted by this plan over the ten-year duration of the program are the scientific community, funding agencies, decision makers, and the broader public. It is proposed that the IMBER Communication Plan take a staggered multiphase approach to target these key audiences at the appropriate phase of the program. Thus, the first three years should focus on building awareness and involvement of the scientific community and promoting IMBER to the potential funding agencies. From year 4, outreach of science results should still include scientists and funding agencies, but also be more proactive to decision makers and the broader public. This second phase should start slowly after year 3 and last until year 10.

Website

The IPO has developed a new IMBER website which was made publicly available in March 2006 (see www.imber.info)

Newsletter

The three issues of the IMBER electronic "*IMBER update*" have been published in December 2005, March and June 2006. The IPO plans to publish the newsletter quarterly.

Brochure and poster

A brochure giving an overview of the IMBER project is being produced and will be sent out to scientists and institutions. A poster is being produced for use at conferences.

IMBER activities

Sponsored meetings

- Advances in Marine Ecosystem Modeling Research Symposium (AMEMR), June 27-29th 2005, Plymouth, UK.
- Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) workshop. October 3-6, 2006, Goa, India.
- PICES/IMBER session at the PICES XV Annual Meeting "Boundary Current Ecosystems" October 13-21, 2006 Yokohama, Japan.
- International Conference on the Humboldt Current System: Climate, ocean dynamics, ecosystem processes, and fisheries. Nov 27-Dec 1, 2006, Lima, Peru.
- Symposium on Parameterisation of trophic interactions in Ecosystem Modeling. March 7-9, 2007, Cadiz, Spain.

Regional Activities

ICED (Integrated analysis of Circumpolar Climate interactions and Ecosystem Dynamics in the Southern Ocean) ICED is a joint initiative between IMBER, GLOBEC, SCAR and EUR-OCEANS. The ICED initiative will develop a coordinated circumpolar approach to understand climate interactions in the Southern Ocean, the implications for ecosystem dynamics, the impacts on biogeochemical cycles and development of management procedures. The first Science Planning Workshop for ICED was held 24-26 May 2005 at the British Antarctic Survey, Cambridge, UK. ICED directly addresses the questions put forward as a science focus for IMBER such as: 1) how do climate processes affect the dynamics of circumpolar ecosystems? 2) how does ecosystem structure affect circumpolar ocean biogeochemical cycles? 3) how should ecosystem structure and dynamics be included in the development of sustainable approaches to managing exploitation? A Science Plan for the ICED project was developed and will be submitted to both IMBER and GLOBEC for approval. ICED is also preparing a special session at the XXIX SCAR meeting in Hobart on July 9-19, 2006.

OECOS (Ecodynamics Comparison in the Oceanic Subarctic Pacific)

Oregon State University (OSU, Corvallis) was the site of an international workshop sponsored by PICES (with assistance from the OSU Research Office and the OSU College of Oceanic and Atmospheric Sciences) on May 23-24, 2005. Japanese (OECOS-west) and North American (OECOS-east) scientists discussed the fundamental questions and observational details of proposed comparative studies of ecological processes in the upper waters of the oceanic subarctic Pacific. The questions addressed by the project will serve to improve our understanding of the range of ecosystem function within HNLC regions; specifically those areas with tight control on biomass accumulation, such as the eastern subarctic Pacific. IMBER is working to develop a strong relationship with OECOS.

PRIMO (Formation and dynamics of the Oxygen Minimum Zone in the Peru-Chile Current system)

Chile, Peru and France have proposed a multi-national project to study the Oxygen Minimum Zone in the Peru-Chile current system. The main objectives are to understand what physical and biogeochemical processes are involved in the formation and variability of the OMZ of the SE Pacific on time scales of a few days to the interannual time scales for the present ocean, and to assess the impacts of its variability on productivity and biological processes in the water and sedimentation.

SIBER (Sustained Indian Ocean Biogeochemical and Ecological Research)

The workshop on Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) will be held at the National Institute of Oceanography in Goa, India on October 3-6, 2006. The goals of the SIBER Workshop will be to 1) review the state of our knowledge and scientific understanding of the biogeochemical and ecological dynamics of the Indian Ocean in relation to physical oceanographic variability; 2) identify prominent gaps in our understanding, especially as they pertain to the role of physical and ecological processes in regulating biogeochemical cycles and the carbon cycle in particular; and 3) formulate a plan for the implementation of a biogeochemical and ecological observational and modelling research program that leverages and substantially enhances the planned CLIVAR/GOOS Indian Ocean observing system. At this workshop the development of an IMBER Indian Ocean regional activity will be discussed.

Contributing projects

EUR-OCEANS (European Network of Excellence for Ocean Ecosystems Analysis)

The European Network of Excellence EUR-OCEANS is a key contributing project in Europe as a Network of Excellence funded by the European Union. The overall networking objective of EUR-OCEANS is to achieve lasting integration of European research organizations on global change and pelagic marine ecosystems and the relevant scientific disciplines. EUR-OCEANS brings together 160 Principal Investigators (from 66 member organisations in 25 countries). An overview of the different work packages of EUR-OCEANS was presented during the last IMBER SSC meeting. This year, EUR-OCEANS and IMBER signed a memorandum of understanding (MOU) to formalize collaboration and are investigating areas where the two projects can work together. One clear example is the IMBER co-sponsorship of the International Symposium on "Parameterisation of trophic Interactions in Ecosystem Modeling" that EUR-OCEANS is organising in early 2007.

CARBO-OCEAN

CARBOOCEAN is a European integrated project aimed at an accurate scientific assessment of marine carbon sources and sinks, with special emphasis on the Atlantic and Southern Oceans on a time scale -200 to +200 years from now. An MOU was signed between IMBER and CARBO-OCEAN, which will focus on Themes 1 and 2 of IMBER. Forty-seven partners and associated collaborators are participating in the implementation. The second annual CARBOOCEAN meeting will be held 4-8 December 2006 in Las Palmas, Canary Islands.

National Activities

Canada

In Canada, the main initiative will come from funding for the IPY. A GEOTRACES/IMBER initiative has been submitted by Roger François; for the Canadian Arctic Margin Experiment.

Venus and Neptune observation: The cables are in the water for VENUS and the data are being collected. Neptune needs funding for instruments.

A meeting on the Line P Time-series organized by PICES will be held in Victoria (July 2006).

Chile

COPAS (Center for Oceanographic Research in the eastern South Pacific) was established in March 2002 at the University of Concepción in Chile. The COPAS Center is devoted to advanced basic scientific research on the circulation, biogeochemical cycling, ecology and paleoceanography of the Eastern South Pacific Ocean. The Center also provides advanced training opportunities to young scientists for research careers in oceanography and related areas. Three scientific questions have been identified and are being addressed from a multidisciplinary and synergistic point of view through six initial research programs. This multi- and inter-disciplinary research is based on direct observations, retrospective analyses, experimental work, and modelling.

China-Beijing

A new 5-year IMBER/GLOBEC programme has been approved by the Ministry of Science and Technology of China (MOST). Prof. Qisheng Tang and nearly 70 scientists are involved in the programme entitled "Key Processes and Sustainable Mechanisms of Ecosystem Food Production in the Coastal Ocean of China". The scientific focus of the programme will be on coupling mechanisms of the marine biogeochemical cycles and the end-to-end food web

interactions in the China seas to promote sustainable food production and ecosystem-based management in coastal ocean ecosystems from the perspectives of both anthropogenic impacts and natural changes. A kickoff meeting was held in Qingdao (China) in January 2006. During this meeting, the group leaders started developing the implementation strategy of the programme. Sylvie Roy attended this meeting at the invitation of the Chinese organizers.

Finland

The Finnish SCOR Committee expressed their interest in the IMBER programme. They decided to make actions to join IMBER by participating with researchers in international IMBER-oriented cruises and organizing international research cruises on the *R/V Aranda* in the Baltic Sea and elsewhere in near future.

France

The new French ocean program CYBER (CYcles Biogéochimiques, Ecosystèmes et Ressources, French acronym for “Biogeochemical Cycles, Ecosystems and Resources”) is a program that takes over the former PROOF program that was essentially dedicated to the study of ocean fluxes. Scientific activity within CYBER is now structured around four major themes, each of them being the French counterpart of international initiatives:

- Theme 1: Ecosystem structure, functional diversity and biogeochemical cycles (IMBER);
- Theme 2: Biogeochemical cycles of trace elements and isotopes (GEOTRACES);
- Theme 3: Biological and biogeochemical processes within continental margins (LOICZ-IMBER-GLOBEC);
- Theme 4: Biological and biogeochemical processes at air-sea interface (SOLAS).

Two major French campaigns have been successful recently: BIOSOPE (Oct-Dec 2004, South Pacific) and KEOPS (Jan-Feb 2005, Kerguelen Plateau). BIOSOPE focuses on the biogeochemical and optical characteristics of different trophic regimes in the southeast Pacific Ocean, and especially the oligotrophic area associated to the central part of South Pacific Gyre. This program has been endorsed by IMBER. The general objective of KEOPS is to improve our understanding of the response of the Southern Ocean to global climate change. Particularly, KEOPS will study the effect of natural iron fertilisation of the ocean by the Kerguelen Plateau on the biological pump of CO₂ and on the cycles of other chemical compounds relevant for climate.

Germany

Three IMBER-related initiatives are under way in Germany:

1. A German IMBER project proposal has been submitted to a German funding body with 2008 as a starting date and a planned duration of 2 to 3 years. The goal of the project is to understand how shelf ecosystems will react to global change and to develop predictive capacities for these reactions. The studies will focus on the North Sea and Northern Benguela Upwelling.
2. A new project focused on the determination of seasonal-to-decadal time changes in sub-surface oceanic oxygen storage and transport is being developed.
3. The University of Kiel (IFM-GEOMAR) has submitted a proposal entitled “The Future Ocean” to the Excellence Cluster initiative of the German Research Ministry. This project includes two main research topics: "Greenhouse Oceans" and "Resources and Risks". The funding decision will be made at the end of October 2006.

IMBER has also provided a letter of interest to support a national proposal to establish an open-access off-shore mesocosm facility administered by IFM-GEOMAR in Kiel. The purpose of the proposal is to set up a research platform dedicated to studying the consequences of ocean change (such as ocean warming, ocean acidification, changes in ocean redox state, and loss of species diversity ...) on an ecosystem level. The proposed facility will be comprised of two components: (1) an infrastructure component centered around a mobile, off-shore mesocosm and (2) a network component that coordinates and operates off-shore mesocosm activities.

India

The Council of Scientific and Industrial Research has approved a project entitled “Impact of anthropogenic perturbations on oceanographic – atmospheric processes in and around India in the context of Global Change”. This project is coordinated by the National Institute of Oceanography (NIO), Goa and comprises three activities of interest to IMBER:

- Transports and transformations of nitrogenous fertilizers from agricultural fields to the ocean: Impact on coastal ecosystem and exchanges with atmosphere;
- Reconstruction of upwelling intensity/anoxia on seasonal to centennial time scales from coral and sedimentary records; and
- Long-term times-series measurements including calibration of critical atmospheric and oceanographic parameters.

Japan

The Japanese IMBER National Committee was set up under the Global Environmental Research Liaison Committee of the Science Council of Japan (SCJ) in January 2005 in Nagoya (Japan). This group is developing a research strategy and funding proposal for an IMBER-related study, as well as developing relationships with SOLAS-Japan and Japan-GLOBEC. IMBER-Japan proposed a North-South transect cruise in the western North Pacific, and obtained 52 days ship time in 2008 with Japan-SOLAS. IMBER-related scientists also got ship time in 2009 for the subarctic Pacific and for the subtropical North Pacific.

DEEP (Deep-Sea Ecosystem and Exploitation Programme) is an ongoing GLOBEC-related research programme focusing on the interaction between epipelagic and mesopelagic ecosystems. The Agriculture, Forestry and Fisheries Research Council, the Japanese funding agency for agriculture, forestry and fisheries sciences, is planning a new research programme on the marine ecosystem regime shift after DEEP. If it takes off successfully (from 2007), the programme would be an IMBER-Japan activity with GLOBEC.

There are also several ongoing research programmes in Japan that will contribute to the IMBER project including the biological pump study in the NW North Pacific Ocean (JAMSTEC); carbon sequestration to the deep sea and the Subtropical Nitrogen Fixation Flux Study (SNIFFS); and the EAST-WEST comparison of the subarctic Pacific ecosystems (OECOS).

Netherlands

IMBER was presented to 140 scientist during a meeting held in April 2005. Following this meeting, a firm plan for a national oceanographic expedition in the Indian Ocean, including SOLAS and IMBER, have been made for 2007. Funding plans have been delayed for one year and there was a very recent SOLAS/IMBER/GEOTRACES joint meeting in Amsterdam to discuss future research plans.

New Zealand

An ocean ecosystem project has been funded for 12 years. Two cruises in the permanently oligotrophic region to the northeast of New Zealand investigating the nitrogen cycle will be contributions to the IMBER project. In 2008-2009, a cruise on the east coast of New Zealand will focus on mesopelagic processes and will link to a strong modeling component in the project.

South Africa

There is no national IMBER project in South Africa. The Benguela region is the focus of most ecosystem research, but there is little open ocean research undertaken. Marine ecosystem research is embedded in regional studies in Somali and Benguela currents and largely focused on continental margins. There is also a South African Marine Research program: "Society, Ecosystems and Changes" involving social and natural scientists.

USA

IMBER organized an evening informational session at the 2005 annual meeting of ASLO, held on Feb. 22, 2005, in Salt Lake City, Utah. The title of the session was “U.S. National and International Projects on Carbon, Ecosystems, and Global Change: Status and Discussion.” The session was intended to highlight IMBER in the context of other

international ocean projects that the United States was developing or involved with, such as GLOBEC, SOLAS and the U.S. Ocean Carbon and Climate Change (OCCC) project. The OCCC scientific steering group (SSG) is chaired by Scott Doney. The recently formed Ocean Carbon Biogeochemistry (OCB) activity is also chaired by Scott Doney and is composed of the OCCC SSG (8) and 8 additional members with a variety of expertise. An Ocean Carbon Cycle science workshop will be held at WHOI on July 10-13, 2006.

IMBER Scientific Steering Committee in 2005.

Name	Expertise	Institution	Gender	Country
Ann Bucklin	Biology and Ecosystems	University of Connecticut	F	United States
Jay T. Cullen	Chemistry	University of Victoria	M	Canada
Julie Hall (Chair)	Biology and Ecosystems	NIWA	F	New Zealand
Dennis A. Hansell (Vice Chair)	Carbon	University of Miami - RSMAS	M	United States
Wilco Hazeleger	Physics and Climate	Royal Netherlands Meteorological Institute	M	The Netherlands
David Hutchins	Biology and Ecosystems	University of Delaware Graduate College of Marine Studies	M	United States
Arne Körtzinger	Carbon	Institute of Marine Research University of Kiel	M	Germany
Carina Lange	Paleoceanography	University of Concepción - COPAS	F	Chile
Jack Middleburg	Sediment-Water Interface	NIOO-KNAW - CEME	M	Netherlands
Coleen Moloney	Sediment-Water Interface	University of Cape Town	F	South Africa
Patrick Monfray (Vice Chair)	Modeling and Integration	OMP/LEGOS	M	France
S. Wajih Ahmad Naqvi	Biogeochemistry	National Institute of Oceanography	M	India
Raymond Pollard	Physics and Climate	National Oceanography Centre, Southampton	M	United Kingdom
Hiroaki Saito	Biology and Ecosystems	Tohoku National Fisheries Research Institute	M	Japan
Carol Turley	Biology and Ecosystems	Plymouth Marine Laboratory	F	United Kingdom
Jing Zhang	Biogeochemistry	East China Normal University State Key Laboratory of Estuarine and Coastal Research	M	China-Beijing

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