3.0 LARGE-SCALE OCEAN RESEARCH PROJECTS

3.1 Global Ecology and Oceanography of Harmful Algal Blooms Program, p. 3-1  Taguchi

3.2 Integrated Marine Biogeochemistry and Ecosystem Research, p. 3-9  Sundby

3.3 GEOTRACES, p. 3-30  Sundby

3.4 Surface Ocean - Lower Atmosphere Study, p. 3-88  Wainer
3.1 Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)
(joint with IOC)

Terms of Reference:
The Scientific Steering Committee of the GEOHAB Programme will

1. Coordinate and manage GEOHAB Core Research Projects (CRPs) in accordance with the GEOHAB Science and Implementation Plans.
2. Identify gaps in knowledge required to execute CRPs, and encourage targeted research activities to fill those gaps.
3. Review progress on CRPs over time and initiate new CRPs in priority research areas.
4. Foster framework activities to facilitate implementation of GEOHAB, including dissemination and information tools.
5. Establish appropriate data management activities to ensure access to, sharing of, and preservation of GEOHAB data, taking into account the data policies of the sponsors.
6. Promote comparative and interdisciplinary research on harmful algal blooms by providing coordination and communication services to national and regional research groups, encouraging explicit affiliation with GEOHAB via the endorsement process.
7. Collaborate, as appropriate, with intergovernmental organizations and their subgroups (e.g., ICES, PICES, FANSA, ANCA, WESTPAC/HAB, HANA, NOWPAP), as well as related research projects (e.g., GLOBEC, LOICZ, IMBER) and observational systems such as the Global Ocean Observing System and its regional alliances.
8. Report regularly to SCOR, the IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB), and the global HAB research community on the state of planning and accomplishments of GEOHAB, through annual reports and, as appropriate, the GEOHAB Web site, a GEOHAB Newsletter, Harmful Algal News, special sessions at scientific meetings, and other venues.
9. Interact with agency sponsors to stimulate the support of GEOHAB implementation through various mechanisms (e.g., direct support of GEOHAB initiatives and integration of the GEOHAB approach in national programs).

Acronyms
ANCA = IOC HAB working group for Central America and Caribbean Sea
FANSA = IOC HAB working group for South America
HANA = IOC HAB working group for North Africa
GLOBEC = Global Ocean Ecosystem Dynamics project
ICES = International Council for the Exploration of the Seas
IMBER = Integrated Marine Biogeochemistry and Ecosystem Research project
IOC = Intergovernmental Oceanographic Commission
LOICZ = Land-Ocean Interactions in the Coastal Zone project
NOWPAP = UNEP Northwest Pacific Action Plan
PICES = North Pacific Marine Sciences Organization
SCOR = Scientific Committee on Oceanic Research
WESTPAC/HAB = IOC SubCommission for the Western Pacific HAB working group
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Michele Burford  AUSTRALIA

Liam Fernand  UK
Songhui Lu  CHINA-Beijing
Gires Usup  MALAYSIA

Ex-officio Member:  Robert Magnien (IOC IPHAB)
IOC Staff:  Henrik Enevoldsen
Executive Committee Reporter:  Satoru Taguchi
The past year has been productive for GEOHAB in the area of publications and meetings convened. Three special issues of journals and three GEOHAB reports have been published. The GEOHAB publication page shows the increase of GEOHAB peer-reviewed publications over the recent past. GEOHAB is up to about 10 reports from the program and is discussing distributing the set of reports on CD.

1. IPHAB-X Meeting: Paris, France, April 2011
GEOHAB was represented by the GEOHAB Chair (Raphe Kudela) at the Tenth Intergovernmental Panel on Harmful Algal Blooms (IPHAB-X) meeting, 12-14 April 2011. An update on GEOHAB activities during the past two years was presented, and a resolution was passed (see attached) recommending continuing support for GEOHAB through IOC, with an invitation to SCOR for continued joint oversight.

2. Implementation of Core Research Projects
The GEOHAB Implementation Plan¹, published in November 2003, specified the formation of Core Research Projects (CRPs) related to four ecosystem types—upwelling systems, fjords and coastal embayments, eutrophic systems, and stratified systems. Since then, initiation and implementation of these CRPs has been the primary GEOHAB objective through OSMs and other activities. All four of the CRP research plans have now been completed. A fifth CRP has been initiated (see below).

A. Core Research Project: HABs in Upwelling Systems
This sub-group is chaired by Grant Pitcher (South Africa). The group published a series of synthesis papers in the journal Progress in Oceanography last year (2010). The CRP will propose to dissolve the existing subcommittee and form a new subcommittee focusing on HABs in Upwelling Systems and the relationship with low oxygen zones as part of the 2011 SSC meeting.

B. Core Research Project: HABs in Fjords and Coastal Embayments
This sub-group is chaired by Suzanne Roy (Canada). Their CRP Report was published in May 2010, and is available on the GEOHAB Web site (see http://www.iocunesco.org/hab/index.php?option=com_oe&task=viewDocumentRecord&docID=5520). The CRP is currently developing a plan for a workshop on Life Cycles of HABs, focusing particularly on benthic resting stages. The Subcommittee has been adjusted to reflect this new focus, and currently includes:

- Suzanne Roy (Chair)
- Allan Cembella
- Leonardo Guzman
• Marina Montresor
• Don Anderson

C. Core Research Project: HABs and Eutrophication
The sub-group on HABs and Eutrophication is chaired by Patricia Glibert (USA). The research plan for this CRP was published in 2006. The group held a 2nd GEOHAB OSM on HABs and Eutrophication in Beijing, China, overlapping with the 2009 SCOR Executive Committee meeting and immediately after the second meeting of SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems. A special issue of the Chinese Journal of Oceanology will be published in 2011 based on that meeting. A brief overview of the meeting is shown at the GEOHAB Web page. The group met in Crete in conjunction with the international HAB meeting in October 2010, and is planning a third OSM in 2013.

D. Core Research Project: HABs and Stratification
The sub-group on HABs and Stratification was chaired by Patrick Gentien (France) until his death in June 2010, at which time Robin Raine (Ireland) took over as chair. The SSC discussed a new composition of the subcommittee for this CRP in order to proceed within the objectives and key questions indicated in the CRP report (completed in October 2008). The Subcommittee is currently composed of:

• Robin Raine (Chair)
• Elisa Berdalet (co-Chair)
• Hidekatsu Yamazaki
• Oliver Ross
• Margaret McManus

E. Core Research Project: HABs in Benthic Systems (BHABs)
GEOHAB sponsored an OSM on HABs in Benthic Systems in Honolulu, Hawaii in June 2010, with Paul Bienfang as the convener. Benthic HABs, which include algae that contribute to ciguatera, are probably the most widespread of all algae-related poisonings. About 60 people attended. A training workshop on identifying benthic HABs was held following the OSM and about 20 individuals attended. The OSM organizing committee is writing a report with the main contributions and open questions for the coming years in order to initiate and implement the CRP. An outline of the results was also presented at the November 2010 International HAB meeting in Crete, and at the International Congress on Ostreopsis Development in Villefranche (France) in April 2011. Two follow-on activities have been proposed and are being actively pursued:

• Sampling/ID workshop focusing on BHAB organisms, proposed by Wayne Litaker and Patricia Tester (USA). Gires Usup (Malaysia) has secured local funding for this activity, and the BHAB working group is following up on the potential for a 2012 workshop.
• YEOSU International Organization Collaboration Project (GEOHAB Asia & BHAB) proposal was submitted and successfully funded in 2011.

3. GEOHAB Modeling
A special issue of the *Journal of Marine Systems, 83* (3-4) with contributions at the GEOHAB Modeling Workshop (held in Galway, Ireland on 15-19 June 2009) edited by Dennis McGillicuddy, was published in 2010. In addition, the Report with the Discussions held by the participants on key modeling aspects that need to be incorporated for the advances of the GEOHAB CRPs and regional/national projects, has been printed and it is available on line at the GEOHAB webpage. Complete information about the contributions of the meeting will continue to be available at www.geohab-models.org. The future modeling activities and subcommittee, within the GEOHAB structure, were also discussed. The GEOHAB Modeling Report was recently (2011) completed and is being printed. Icarus Allen (UK) also organized co-sponsorship by GEOHAB of the Advances in Marine Ecosystem Modeling (AMEMR) 2011, to be held 27-30 June 2011 in Plymouth (UK).

4. GEOHAB Asia
The Science Plan for GEOHAB research and cooperation in Asia was published in May (available at the GEOHAB webpage at http://www.iocunesco.org/hab/index.php?option=com_oe&task=viewDocumentRecord&docID=5460). The report was developed from meetings in 2007 in Japan and in 2008 in Vietnam. Songhui Lu and Gires Usup are the new members of the SSC involved on the development of the GEOHAB Asia activities. Usup will chair the GEOHAB Asia subcommittee, and was also elected Vice-Chair of IPHAB for 2011-2012. Ongoing activities include the BHAB workshop and the YEOSU project (see item 3).

5. GEOHAB Sunset
SCOR and IOC agreed to close the GEOHAB program at the end of 2013, ten years from the publication of the GEOHAB Implementation Plan. Discussions were begun on what would be appropriate final products. At this time, ideas include a summary of program accomplishments for a broad audience and/or an update of the HABWATCH book on HAB observing technologies, as well as other GEOHAB products such as a review of the use of modeling for HABs and continued CRP reports. The timeline and synthesis plan of GLOBEC is being considered as a model. Different audiences for synthesis information from GEOHAB could include the scientific community, policymakers, and the public. Potential products could include a summary for policymakers, a video, and/or a special issue of a journal. There will be a final open science meeting in 2013. The upcoming sunset was discussed at IPHAB-X, and was one focus of the survey of the community presented at IPHAB-X (and included as part of this report). IOC proposed to continue GEOHAB activities beyond 2013, and requested synthesis of progress to date. The SSC is actively working towards this, and will be discussing these goals and the future of GEOHAB (including sunset activities) at two meetings, in August 2011 and November 2011.
6. 2011 SSC Meeting
The timing and location of the 2011 SSC meeting was originally set for June 2011 to coincide with the AMEMR workshop in Plymouth. Because of scheduling conflicts, the meeting of the full SSC has been postponed to November 2011 in Plymouth. To keep momentum going on the BHAB report, sunset activities, and reformulation of the CRP activities, the SSC agreed that a small group (representatives from each main activity) would also meet in Copenhagen (Denmark) in August 2011.

7. IOCCG/GEOHAB Working Group
The International Ocean Colour Coordination Group and GEOHAB are co-funding a working group on HABs and Ocean Colour. The group will

- Summarize the relevance of ocean colour-based harmful algal bloom observation systems.
- Summarize the wide variety of harmful algal bloom types with regard to ecosystem function, consistent with GEOHAB Core Research structures.
- Summarize the principal methodological difficulties for ocean colour in coastal and inland waters, with reference to previous IOCCG Working Groups and other ongoing initiatives, e.g. GEO Tasks, CoastColour etc
- Summarize our current understanding of the physics of phytoplankton community composition from a bio-optical and ocean colour perspective.
- Review the relevance of Phytoplankton Functional Type (PFT) approaches (with reference to IOCCG PFT Working Group) for harmful algal bloom observations across a variety of coastal and inland ecosystems.
- Review and summarize current and emerging harmful algal bloom-related ocean colour techniques, from reflectance-based community composition algorithms to ecosystem-specific change-detection algorithms, that is, research and operational applications.
- Compare the results of a variety of algorithms on selected bloom case studies, representative of the GEOHAB core research ecosystems with the specific addition of inland waters, and use these studies to provide a clear guide to ocean colour algorithm performance diagnostics, and optimal ocean colour-based approaches for various bloom and ecosystem types.
- Examine the utility of ocean colour observations beyond the event scale: multisensory and -temporal analyses of ecological drivers and response for example systems, analysing and demonstrating the value of routine synoptic data and integration with other observations and models.
- Recommend future studies, measurements, protocols, etc. to develop, improve and better understand application limitations for harmful algal bloom-focused ocean colour algorithms
- Summarize, recommend, and present a future outlook for the development of new ocean colour observation systems, incorporating future sensors/systems.
- Prepare a monograph to be published within the IOCCG or GEOHAB series.
• Prepare a special issue in a peer-reviewed journal incorporating suitable review and case study chapters as papers.

8. Other
A full list of GEOHAB reports, publications, and endorsed activities are available on the GEOHAB website. GEOHAB generated considerable interest from the community during this interval, and to acknowledge that, we present here a list of recently endorsed projects:

AUSTRALIA
• Can *Cylindrospermopsis raciborskii* utilize dissolved organic phosphorus?
• The Biogeographical and Biodiversity Assessment of Toxic Benthic Dinoflagellate Stocks in the Pacific Ocean and Implications of Bioinvasion on Marine Food webs

CANADA
• Canadian Aquatic Invasive Species Network – Harmful Algae (CAISN-HA)

CHILE
• Determination of adhesive strength, propagation mechanisms and methods of destruction of different life cycle stages of *Alexandrium catenella*

FRANCE
• PARALEX
• International Congress on *Ostreopsis* Development (ICOD)

SPAIN
• GAMBOS: Study of the benthic marine dinoflagellates *Gambierdiscus and Ostreopsis*, with a special emphasis on the toxin production and its relationship to public health
• ECOALFACS: ECOlogical mechanisms controlling (harmful) phytoplankton blooms in ALFACS Bay (Ebro Delta)

PHILIPPINES
• Ecology and Oceanography of Harmful Algal Blooms in the Philippines (PhilHABs)

SOUTH AFRICA
• A comparison of HAB dynamics in two upwelling regions using novel technology

UNITED KINGDOM
• Advances in Marine Ecosystem Modelling Research III The ‘Next Generation’

UNITED STATES
• ECOHAB – Modeling favorable habitat areas for *Alexandrium catenella* in Puget Sound and evaluating the effects of climate change
• The Ecophysiology and Toxicity of *Heterosigma akashiwo* in Puget Sound: A Living Laboratory Ecosystem Approach
9. Acknowledgements and SSC Members

The GEOHAB SSC acknowledges the great job of Robin Raine as chair of GEOHAB (2005-2009) and Ken Furuya (SSC member, 2003-2010), a key contributor to the GEOHAB Asia implementation. The new members of the SSC (Paul Bienfang (USA), Michelle Burford (Australia), Songhui Lu (China-Beijing), Gires Usup (Malaysia) were welcomed to the SSC at the Hawaii 2010 meeting.

The GEOHAB SSC proposed to add Patricia Tester (USA) to the SSC to build BHAB representation, and asked for other nominations at the IPHAB-X meeting. No objections to the addition of Tester were raised, nor were additional names put forth, although the IPHAB representatives did request that GEOHAB consider geographical balance in choosing new members. The SSC also recommended at IPHAB-X that Elisa Berdalet, Liam Fernand, Suzanne Roy, and Icarus Allen be extended for another term, to maintain continuity as we approach 2013 and the proposed sunset. No objections were raised.
3.2 Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) (joint with IGBP)

Terms of Reference:

*Agreed by IGBP and SCOR, April 2004*

- To develop the IMBER Science Plan and Implementation Strategy, in accordance with guidance from the sponsoring organisations.
- To oversee the development of IMBER in accordance with its Science Plan and Implementation Strategy.
- To collaborate, as appropriate, with related projects of the sponsors IGBP and SCOR, and other related programmes and organisations (e.g., IHDP, DIVERSITAS, IOC and the Global Ocean Observing System (GOOS), etc.)
- To establish appropriate data management policies to ensure access to, sharing of, and preservation of IMBER data, taking into account the policies of the sponsors.
- To report regularly to SCOR and IGBP on the state of planning and the accomplishments of IMBER.

The IMBER SSC, its subsidiary groups and International Project Office shall operate in accordance with the operating procedures for IGBP Projects and the requirements of the other co-sponsors.

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Executive Officer: Lisa Maddison
MAJOR ACTIVITIES AND ACHIEVEMENTS

- IMBER IMBIZO II
- Data Management Dry Cruise
- SIBER Science Plan and Implementation Strategy finalisation
- IMBER posters presented at IPY Oslo Polar Science Conference, WCRP OSC, ESSAS OSM, Liège Colloquium,
- Second ESSAS OSM
- First meeting of the IMBER Human Dimensions Working Group
- First SIBER SSC meeting
- SIBER establishes an International Project Office
- IMBER Special Session at the Liège Colloquium
- Official opening of the IMBER China Regional Project Office (RPO)
- Two IMBER Special Sessions at EGU
- IMBER Special Session at ASLO
- IMBER promotion at Portes overtes
- ICED/EUR-OCEANS Rapid change in polar systems workshop
- Five IMBER session proposals submitted for the Planet Under Pressure conference
- IMBER promotion at SEATECH week
- IMBER presentations at the NRC Ocean Studies Board Meeting and the OCB Summer Workshop
- First meeting of the IMBER Data Management Committee

PLANNED ACTIVITIES

- Joint SOLAS/IMBER/IOCCP Carbon Synthesis Meeting
- IMBER poster presentation at the Marine Sciences and European Research Infrastructure symposium, Brest, France June 2011
- 5th IMBER China/Japan/Korea meeting in Shanghai, China, November 2011
- Five possible IMBER sessions at Planet Under Pressure meeting, London, UK, March 2012
WORKING GROUPS
The Human Dimensions and Continental Margins working groups were finalized in late 2010 and early 2011, respectively. This brings the number of IMBER working groups to five. The activities of the IMBER working groups during the past year follow.

1 SOLAS-IMBER Carbon (SIC!) Working Group
The joint SOLAS-IMBER carbon group oversees the scientific aspects of marine carbon process studies as outlined in the SOLAS-IMBER Carbon Research Implementation Plan (http://www.imber.info/products/Carbon_Plan_final.pdf)

There are three sub-groups involved in moving carbon research forward. They focus on establishing and supporting ocean observing systems and aim to ensure that the different observing elements are integrated into a coherent set of observations. Several white papers and plans developed in the context of the OceanObs’09 conference were published during 2010 (see publications below – Monteiro et al 2010; Gruber et al 2010 and Feely et al 2010).

A meeting ‘The Ocean Carbon Cycle at a Time of Change: Synthesis and Vulnerabilities’ is being organised by SIC SG1 and SG2 and IOCCP at UNESCO, Paris from 14-16 September 2011. The goal is for new analyses and the global synthesis to be completed by early 2012, for inclusion in the IPCC AR5. A Special Issue will also be published on the science presented at the meeting.

Sub-group 1 (SG1) Surface Ocean CO$_2$ Fluxes (Leader: Dorothee Bakker, UK)

Dorothee Bakker has replaced Nicolas Metzl as Chair of SIC SG1.

The main goal of the SG1 is to enable a more accurate estimation of ocean-atmosphere CO$_2$ flux. The development of the Surface Ocean CO$_2$ Atlas (SOCAT) is a major accomplishment in this regard. It presents all the publically available surface water fCO$_2$ (fugacity of CO$_2$) data (8.8 million values) from the coastal seas and global oceans, in a common format. SOCAT will be launched at a special session at the SIC Synthesis meeting in Paris on 14 September 2011.

The global surface ocean fCO$_2$ data set with second level quality control and a global gridded product of monthly surface water fCO$_2$ means, with no temporal or spatial interpolation (i.e. bin averages) will be available. The SOCAT data set is seen as an important building block for future global carbon research, such as understanding the response of surface water fCO$_2$ and the oceanic CO$_2$ sink to increasing levels of atmospheric CO$_2$ in a changing climate.
A proposal to hold a special SOCAT session on ‘The Changing Ocean Carbon Cycle: Data Synthesis, Analyses and Modelling’ at the Ocean Sciences meeting on 20-24 February 2012 has been submitted.

Sub-group 2 (SG2) Ocean Interior (Leader: Nicolas Gruber, Switzerland)

The membership of the SIC SG2 has been revised and there are now eight members. They will hold their first meeting in conjunction with the Synthesis meeting in Paris in September 2011.

The group intends to provide a global synthesis of ocean interior carbon changes (oceanic uptake, transport and storage of anthropogenic CO2). Since 2009, the focus has been the quality control and synthesis of interior carbon observations from the Repeat Hydrography Programme. This is being done basin-by-basin, examining the changes in oceanic storage of anthropogenic CO2 through time. This estimation of the change in oceanic storage of anthropogenic CO2 is fundamental to understanding the global carbon cycle.

The working group also intends to support the establishment of an observing system for ocean biogeochemistry - Oxygen on Argo - by including oxygen, nitrate, chlorophyll and pH sensors on autonomous floats.

A joint meeting was held with the Global Carbon Project in October 2010 in the context of their REgional Carbon Cycle Assessment and Processes (RECCAP) project, which aims to establish the mean carbon balance of large regions of the globe at the scale of continents and large ocean basins.

Sub-group 3 (SIOA) SOLAS-IMBER Ocean Acidification (Leader: Jean-Pierre Gattuso, France)

The SOLAS-IMBER Ocean Acidification Working Group has representatives from ocean acidification research programmes from the Australia, China, France, Germany, Japan, UK and USA. The goal of the SIOA is to undertake synthesis activities and to coordinate research efforts in ocean acidification at the international level. Considerable synthesis work has already been undertaken, much of it by members of the SIOA (e.g. Ocean Acidification edited by Jean-Pierre Gattuso and Lina Hansson to be published in September 2011 by Oxford University Press).

At its first meeting in 2009, the SIOA recommended a programme of international activities which are critical to assess the effects of ocean acidification, but currently not funded at national or international. The SIOA met in Washington, DC (USA) in November 2010. Representatives of several of the US federal funding agencies also attended this meeting. It was concluded that the SIOA has neither the time nor the human and financial resources to independently launch any of the activities it identified in the coordinating program. This prompted the group to reassess its role in Ocean Acidification research. Following the recommendation of the International Reference User Group (RUG) on Ocean Acidification, the SIOA recommended the need to establish an “Ocean Acidification International Coordination Office (OA-ICO)” that would have the responsibility to oversee implementation of the activities that are needed to move ocean
acidification forward at the international level. If this recommendation comes to fruition, the terms of reference of the SIOA will be revised. The IMBER SSC were not in favour of disbanding the group, which is considered to be an important component of the SIC group.

An SIOA session proposal was submitted for the Planet Under Pressure conference in London in 2012.

2 Continental Margins Task Team
The membership of the new joint IMBER-LOICZ Continental Margins Task Team (CMTT) was finalised in January 2011. There are nine members led by Kon-Kee (KK) Liu (Taiwan), the IMBER co-chair, and Helmuth Thomas (Canada) the LOICZ co-chair. In addition, there are five Associates, whose specialised expertise can be called upon as required.

One of the first tasks for the CMTT is to finalise and publish the Continental Margins Implementation Strategy that was drafted by the original CMTT. IMBER and LOICZ SSC members have identified several sections that need to be included, for example, the impact of humans in the continental margins. Once the document is completed, terms of reference will be developed for the CMTT to move it forward.

The IMBER regional project office in China (IMBER RPO) is responsible for the coordination of IMBER continental margins activities. One of the first major events currently being investigated is the organisation of a Continental Margins – Human Dimensions IMBIZO in Shanghai, China in 2013.

A proposal to hold a continental margins session at the Planet Under Pressure Meeting in London in 2012 was submitted.

3 Capacity Building Task Team (CBTT)
The CBTT has eight members and is chaired by Jing Zhang (China). He also represents IMBER in an ex-officio capacity on the SCOR Capacity Building Committee (see http://www.scor-int.org/capacity.htm for details).

Capacity building is an important aspect in all IMBER activities, and the CBTT aims to facilitate the participation of early-career scientists and scientists from developing countries in IMBER and IMBER-related activities and training programmes. It also attempts to develop the research capabilities in regions where there are very few scientists involved in IMBER-related research. The Capacity Building Strategy and Implementation Plan is available at: http://www.imber.info/products/Capacity_Building_final.pdf.

The CBTT plans to undertake an IMBER training/capacity building needs analysis in early 2012. They also wish to instigate a mentoring system whereby established scientists mentor early-career and developing county scientists attending international conferences.
The IMBER Summer Schools, held every second year, have proved to be a successful capacity building mechanism. The ClimECO2 summer school (co-organized with IUEM and GIS Europôle Mer) was held at the Institut Universitaire Européen de la Mer (IUEM) in Brest, France on 23-27 August 2010. It was entitled: Oceans, Marine Ecosystems, and Society facing Climate Change - A Multidisciplinary Approach. Seventy-five participants from 26 countries attended. Additional information is available at: http://www.europolemer.eu/en/climeco2_0.php.

Plans are under way for the third IMBER Summer School, which will be held at the Ankara University in Ankara, Turkey in August 2012. The theme will be the feedbacks between ecosystems, biogeochemistry, and the Earth System in a warming world. Raghu Murtugudde (USA) and Baris Salihoglou (Turkey) will co-chair the organising committee that is currently being established.

4 Data Management Committee
The IMBER Data Management Committee (DMC) promotes a cooperative data management approach that includes involving experienced data management specialists from the start of a project, and also training young scientists in good data management procedures. The group is chaired by Alberto Piola (Argentina) and has six additional members. Su Mei Liu (China) was appointed to the group in 2010, to improve the geographic coverage of the DMC. The DMC held its first meeting in Crete, Greece on 9 October 2010.

The DMC organised a one-day Data Management Dry Cruise before the start of IMBIZO II for IMBIZO participants and local students and scientists (please see the report in the Training section below).

The Data Management Cookbook has been widely distributed to laboratories and research vessels and can be downloaded from the IMBER Web site (http://www.imber.info/DM_cookbook1.html). Alternatively, printed copies are available on request from the IMBER office (imer@univ-brest.fr). The document will soon be available in Spanish.

5 Working Group on Human Dimensions
The IMBER Human Dimensions Working Group (HDWG) was formed in 2010 in response to the recommendation of the IMBER-GLOBEC Transitional Task Team that the interactions between humans and marine systems should be incorporated into IMBER science. Recognising the challenge of integrating the natural and social science aspects, the group has a natural scientist co-chair, Alida Bundy (Canada) and two social scientist co-chairs, Marie-Caroline Badjeck (Malaysia) and Moenieba Isaacs (South Africa).

The HDWG held its first meeting in Paris, France in April 2011, where the scope of the working group was considered and a work plan devised. The report of the meeting can be seen at: http://www.imber.info/HD_WG.html. The organisation of an international scoping meeting is
being investigated, as is the possibility of a Continental Margins – Human Dimensions IMBIZO in 2013.

The HDWG, in collaboration with LOICZ, submitted a proposal to hold a session at the Planet Under Pressure Conference in London in 2012.

REGIONAL PROGRAMMES
IMBER has four regional programmes. Integrating Climate and Ecosystem Dynamics (ICED) was established jointly by GLOBEC and IMBER and moved fully into IMBER when GLOBEC ended in early 2010. Climate Impact on Oceanic Top Predators (CLIOTOP) and Ecological Studies of Sub-Arctic Seas (ESSAS) began under GLOBEC and are now officially IMBER programmes. The Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) Programme was initiated under IMBER. Updates on the activities of these regional programmes follow.

Climate Impact on Top Oceanic Predators (CLIOTOP)
CLIOTOP is a 10-year programme that started in 2005 that is focused on a global comparison of the impact of climate variability (at various scales) and fishing on the structure and function of open ocean pelagic ecosystems and their top predator species.

The incorporation of CLIOTOP into IMBER requires some modification of its Science Plan and Implementation Strategy (SPIS) to align it more with IMBER science. The changes were discussed at the CLIOTOP mid-term workshop, ‘CLIOTOP into the future - Building Scenarios for Oceanic Ecosystems in the XXI Century’, held in Paris, France in February 2010, with input provided by the IMBER SSC. The updated SPIS is expected before the end of 2011.

CLIOTOP has six interactive working groups that focus on key processes and scales.

WG 1: Early life history of top predators aims to determine the environmental characteristics that influence the timing and intensity of reproduction and larval survival.

WG 2: Physiology, behaviour and distribution investigates the factors (including anthropogenic forces) affecting spatial dynamics and population structure, as well as reproductive and feeding-related behaviour.

WG 3 Trophic pathways in the open ocean pelagic ecosystems compares trophic pathways among and within oceans and investigates whether seasonal and spatial variability can be used to explore the impacts of climate variability. It also considers the importance of mesopelagic versus epipelagic prey resources for oceanic top predators and if this is affected by climate change.

WG 4 Synthesis and modelling explores the importance of fisheries exploitation and the dynamic environment in structuring pelagic ecosystems and seeks the most appropriate mechanism(s) to provide the greatest predictive power.

WG 5 Socio-economic aspects and management strategies considers the socio-economic pressures on tuna fisheries and whether fisheries organisations addressed the impacts of climate variability and climate change. It also examines the usefulness of fisheries management decision
support tools and how the flows in capital and knowledge among the world's large fisheries respond to variability.

**MAAS (6) Mid-tropic automatic acoustic sampling** aims to provide global scale monitoring of mid-trophic level organisms through the development of observational platforms equipped with multi-frequency acoustics to identify and quantify mid-trophic organisms.

CLIOTOP submitted a position paper entitled ‘Global Science for Global Governance of Oceanic Ecosystems’ to Science in December 2010. The paper argues that new mechanisms of global governance resting on large scale international scientific endeavour are urgently needed to address impacts of global change on oceanic ecosystems and the sustainability of fisheries. It was not accepted by Science and is being revised for submission elsewhere.

CLIOTOP Publications include a special volume of Progress in Oceanography:

- CLimate Impacts on Oceanic TOp Predators (CLIOTOP)
- CLIOTOP International Symposium La Paz, Mexico 03-07 December 2007
- Volume 86, Issues 1-2, Pages 1-316 (July-August 2010)
- Editors: Patrick Lehodey, Olivier Maury and Mélanie Rathburn

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**Ecosystem Studies of Sub-Arctic Seas (ESSAS)**

ESSAS was initiated by GLOBEC and EUR-OCEANS in 2005 and the Science Plan and *Background to the Climatology, Physical Oceanography and Ecosystems of the Sub-arctic Seas* document were produced in the same year.

ESSAS focuses on comparative studies of the impacts of climate variability on the productivity and sustainability of Sub-Arctic marine ecosystems. There are four working groups and several national and multi-national projects.

The 2010 ESSAS Annual Science Meeting held in Reykjaviki, Iceland from 30 August - 1 September, 2010 highlighted the ongoing research by the working groups and in other ESSAS areas.

A major event was the second ESSAS OSM that was held in Seattle, WA USA from 22-26 May 2011. The meeting showcased the progress made by the ESSAS working groups, and the national and multi-national programs affiliated with ESSAS, and focused the future directions for ESSAS science, especially in regard to interfacing with IMBER science objectives.

Publications:

- NORway-CANada Comparison of Marine Ecosystems (NORCAN) special volume in *Progress in Oceanography* compares various aspects of the marine ecosystem in the Labrador Sea and shelves with those in the Barents and Norwegian Seas. It should be published later in 2011.

- A special volume of *Journal of Marine Systems* presenting the results of the IPY Norwegian Ecosystem Studies of Sub-Arctic and Arctic regions will be published in 2012.
Integrating Climate and Ecosystems Dynamics (ICED)
ICED was developed jointly by IMBER and GLOBEC to determine the main control of Southern Ocean ecosystem dynamics and potential for feedbacks as part of the Earth system. The ICED Science Plan was published in 2008 and is implemented through data synthesis, fieldwork coordination, and modelling.

ICED identified the coordination of Southern Ocean fieldwork as a priority and has developed online fieldwork mapping tool for collating information on relevant field activities. Progress is being made, particularly with respect to cruise planning information and data (particularly on zooplankton) rescue (see http://www.iced.ac.uk/science/fieldworkmap.htm).

The ICED/EUR-OCEANS Foresight Workshop ‘Rapid change in polar ecosystems’ was held in Bremerhaven, Germany in November 2010. The workshop focused on change in polar ecosystems and on strengthening and coordinating European research in this area.

Several important ICED publications have been submitted. These include: a key ICED paper based on the Food Web Modelling workshop and a book based on a Southern Ocean special issue of the Philosophical Transactions of the Royal Society.

Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER)
SIBER is a new regional programme sponsored by IMBER and Indian Ocean GOOS and is focused on understanding climate change and anthropogenic forcing on biogeochemical cycles and ecosystems in the Indian Ocean. The SIBER Science Plan and Implementation Strategy has been accepted by IMBER and IOGOOS and will be published by late summer 2011. The first SIBER SSC meeting took place from 12 to 16 July 2010 in Perth, Australia, together with IOGOOS, CLIVAR’s Indian Ocean Panel (IOP) and the newly formed Indian Ocean Resources Forum (IRF). At this meeting working groups dedicated to promoting SIBER science in the European Union, USA, Australia, Africa, Oman/Kuwait/Pakistan, Indonesia/Thailand and Japan/China were established.

Two major achievements for SIBER are: the establishment of the SIBER International Project Office in Hyderabad, India with Dr. Satya Prakash as the Executive Officer, and the initiation of the first national SIBER programme in India with funding from the India’s Ministry of Earth Sciences.

SIBER and IOP submitted a session proposal to the Planet Under Pressure conference. The proposed session will focus on climate and anthropogenic impacts on regional oceanography, ecosystems and fisheries in the Indian Ocean.

ENDORSED PROJECTS
IMBER currently has 26 endorsed projects from 14 countries (Argentina, Brazil, Canada, Chile, China, Denmark, France, Germany, Italy, Japan, New-Zealand, Spain, UK and USA).
The following projects have been endorsed by IMBER since the last annual report to SCOR:

**INTC-TMCO** (Materials transfer through the continent-sea interface)
Leading applicant: Luiz LACERDA (Brazil)

INTC-TMCO (2009-2014) aims to study the transport, accumulation, cycling and biogeochemistry of nutrients, organic matter and trace metals in the land-ocean interface in different coastal systems of Brazil.

In line with the IMBER themes, INTC-TMCO will evaluate the changes in sediment, organic matter, nutrients and pollutants fluxes from the continent downriver to the estuarine area. The human dimensions aspect of the project will examine the social-economic impacts of the artisan fisheries and irrigated agriculture of the basins and global/regional climate change scenarios (by analysing changes in biodiversity proxies of global and land use changes, including changing of natural ecosystems and biodiversity to construct future scenarios and propose planning strategies). Further information at [http://www.inct-tmcocean.com.br/](http://www.inct-tmcocean.com.br/) (in Portuguese)

**MEECE** (Marine Ecosystem Evolution in a Changing Environment)
Leading applicant: Icarus ALLEN (UK)

MEECE (2008-2012) aims to use predictive models to explore the impacts of both climate drivers (acidification, light, circulation and temperature) and human induced drivers (fishing, pollution, invasive species and eutrophication) on planktonic and benthic marine ecosystems. A regional approach has been chosen which includes: Barents Sea, NW European Shelf, North Sea, Baltic Sea, Biscay Bay, Black Sea, Adriatic, North Aegean Sea and Benguela ecosystem. MEECE is the first project to attempt to use predictive models that consider the full range of drivers to elucidate the responses of the marine ecosystem in a holistic manner, rather than driver-by-driver as has been done in the past. MEECE explores multiple driver impacts on complex environments through numerical simulation models which include dynamic feedbacks. Further information can be found at [http://www.meece.eu/](http://www.meece.eu/)

**ANACONDAS & ROCA** (Amazon iNfluence on the Atlantic: CarbOn export from Nitrogen fixation by DiAtom Symbioses (ANACONDAS) and The River Ocean Continuum of the Amazon (ROCA))
Leading applicant: Patricia L. Yager (USA)

The ANACONDAS & ROCA (2009-2012) projects aim to study the effects of the Amazon River on the carbon and nitrogen cycles of the western tropical North Atlantic Ocean. The links between riverine micronutrient ratios, enhanced N2-fixation, phytoplankton community structure and succession, and the sequestration of excess C into the deep ocean via the biological pump will be examined. To predict the evolution of this regional C export as climate changes, these links and their sensitivity to changes in the Amazon itself and other climate impacts on the
tropical Atlantic Ocean must be understood. The objectives are to address specifically how C
cycling and sequestration in the tropical North Atlantic is influenced by the Amazon River
through its impact on pelagic ecosystem dynamics and the sensitivity of this ecosystem to
anthropogenic climate change. Efforts will be made to identify the links between riverine
micronutrient ratios, enhanced N₂-fixation, phytoplankton community structure and succession,
and the sequestration of excess C into the deep ocean via the biological pump.

VECTOR (VulnErability of the Italian coastal area and marine Ecosystems to Climatic changes
and Their rOle in the Mediterranean caRbon cycles)
Leading applicant: Cesare Corselli (Italy)

The VECTOR project (2006-2010) aims to study the most significant impacts of climate change
on the Mediterranean marine environment and its role in carbon sequestration, to determine
possible future impact scenarios on the Italian coast. Five areas of study were selected: the
Northern Adriatic shelf, the Central Adriatic coastal area, the Calabrian margin in the Ionian Sea,
the Napoli Gulf and the Tuscan coast in the Tyrrenhenian Sea. The proposed scenarios concern (1)
the modification and the extension of the coastal areas, (2) the morphology of the backshore-
foreshore-shoreface, (3) the alongshore littoral transport, (4) the aerosol transport from the sea to
the coastal area; and (5) the related impacts on the areas subject to anthropogenic activities as
well as on freshwater reserves. These scenarios will be associated with those related to changes
in the Venice lagoon, in neritic and pelagic ecosystems in term of biodiversity, productivity,
invasive species and the distribution of commercially important species. The risks associated
with the proposed scenarios will focus on the impacts of climate change on coastal area
biodiversity (considered from a socio-economic point of view), tourism, agriculture, fisheries

IMBER-ENDORSED MEETINGS AND ACTIVITIES

"Open access for climate scientists" training, Copenhagen Denmark, 26 October 2011. More
information at: http://www.openaccessweek.org/.

Advances in Marine Ecosystem Modelling Symposium - AMEMR III 'The Next Generation',
Plymouth, UK, 27-30 June 2011. More information at:
hp://www.amemr.info

Workshop on paleo-ocean acidification and carbon cycle perturbation events, 26-28 August
2010, Catalina Island, USA

The 14th Biennial Challenger Conference for Marine Science on "OCEAN CHALLENGES IN
THE 21ST CENTURY", 6-9 September 2010, Southampton, UK. More information at:
OUTREACH ACTIVITIES

IMBER website
The IMBER web site (http://www.imber.info/) is the main communication tool for the dissemination of science results and other information relating to IMBER programmes and activities. The web site is currently being redesigned and updated and the new site will become active in mid-summer 2011.

The IPO has developed and maintains several other web sites for IMBER activities and events, such as the CLIOTOP web page (http://www.imber.info/cliotop.html), SIBER (http://www.imber.info/SIBER.html) and the SOLAS/IMBER/IOCCP Synthesis meeting (http://www.imber.info/sponsored_meetings_SIC_sept2011.html).

IMBER Update
The electronic newsletter "IMBER Update" is published three times each year. The end-of-year issue, published in December, was dedicated to the two major IMBER events of 2010—IMBIZO II and the ClimECO2 Summer School—and showcased some of the IMBER science that was presented.

The newsletter also provides highlights of recent IMBER science, reports of the activities of the IMBER working groups and regional programmes as well as upcoming IMBER-related conferences and workshops. IMBER Update can be downloaded at http://www.imber.info/newsletters.html. The newsletter is emailed to about 1200 people who have requested copies of the newsletter, or who are involved with IMBER in some way.

There are plans to produce a printed newsletter beginning in 2012.

eNews
The electronic eNews bulletin is published monthly to provide information on IMBER activities and current events within the IMBER scientific network. It includes calls for funding, job opportunities, conferences and workshops.

Promotional Material
Brochures and posters are used to promote IMBER at meetings and conferences. A new brochure, aimed at policy-makers, funding agency representatives and others who wish to know about IMBER, is currently being developed. The IMBER poster template can be adapted to a specific meeting topic or audience. The brochure and posters can be downloaded from the IMBER website (http://www.imber.info/useful-downloads.html) and are available on request from the IPO.
Training

ClimECO₂
In August 2010, IMBER, in collaboration with IUEM and GIS Europôle Mer, organized the ClimECO₂ Summer School in Brest, France. It aimed to provide participants with an overview of methods, models and approaches for analyzing the impact of climate change on marine ecosystems and the consequences for society. ClimECO₂ was by all accounts a great success and enjoyed by more than 70 participants (natural and social scientists working in the realm of ‘oceans and climate change’) from 26 countries.

Dry Cruise workshop
The Data Management Dry Cruise workshop mentioned in the Working Group section above, was aimed (though not exclusively) at early career scientists and students. The objective of this one-day workshop was to increase awareness of the importance and benefits of establishing and following data management procedures, and to provide hands-on training on data management and data preservation.

Alberto Piola (IMBER SSC member) and Cyndy Chandler (BCO-DMO, USA) led the workshop, and other members of the DMC also participated. Training was based on the data management procedures outlined in the extremely successful ‘IMBER Data Management Cookbook’ that was published by the DMC in April 2009.

There were about 50 participants (mostly early career scientists and local students from various Greek universities and institutions, but also some more established scientists). The meeting was very well received. Prior to the meeting, participants submitted specific problems or issues that they had encountered and the DMC addressed these at the workshop, making it a very practical course.

INTERNATIONAL PROJECT OFFICE (IPO)
The IMBER IPO is based in Brest, France at the Institut Universitaire Européen de la Mer (IUEM). Lisa Maddison is Executive Officer, and Virginie Le Saout is the Administrative Assistant. Sophie Beauvais resigned from the Deputy Executive Officer (DEO) position in March 2011. Juliette Remetz-Planchon is the Acting-DEO until the end of 2011.

The primary role of the IPO is to ensure that the decisions of the IMBER SSC are carried out. To do this, the IPO needs to secure funding for IMBER activities, support the IMBER working groups and task teams, provide administrative support for the programme’s activities, maintain communication links both within and outside the programme, and maintain a data and information archive.

The IPO is funded by a French consortium that includes: the University of Brest, IUEM, the Region of Brittany, Ifremer, the Conseil Général de Bretagne (Department authorities) and the City of Brest, Centre National de la Recherche Scientifique (CNRS), Institut de Recherche pour
le Développement (IRD), Université de Bretagne Occidentale (UBO). A meeting was held with representatives of the French sponsors in Paris, France in October 2010 where they unanimously agreed to renew the funding contract for a further three years at the same level of funding. However, subsequently, due to budget constraints, it has been decided to discontinue support for the IPO when the current contract expires at the end of 2011. A proposal has been submitted to the Norwegian Research Council for support for the IPO. If this proposal is successful, the IPO will be relocated to Bergen.

During 2010-2011, support for activities of the IPO and IMBER was provided by:

- **IGBP**: support for the SSC meeting ($18.3K).
- **SCOR**: support from NSF ($50K annually, grant until August 2012);
- **French Consortium**: support for IPO salaries and running expenses ($172K)

**IMBER REGIONAL PROJECT OFFICE IN CHINA (CHINA RPO)**
The IMBER China Regional Project Office (RPO) officially opened at the East China Normal University (ECNU) in Shanghai in March 2011. It is hosted and financially supported by the ECNU. Dr. Liuming Hu has been appointed as the Deputy Executive Officer and an Administrative Assistant will be appointed shortly. The RPO does not work independently but supports IMBER activities, focusing mainly on continental margins activities, as well as other IMBER activities in the Asia-Pacific region.

**INTERACTIONS WITH OTHER PROJECTS AND PROGRAMMES**

**SOLAS**
Joint SOLAS/IMBER Carbon Research group (SIC!)
The joint **SOLAS/IMBER Carbon Group (SIC!)** was formed in Oct 2005. This group works in close collaboration with IOCCP.
There are three sub-groups within the SIC group:
SG1-Surface Ocean Systems. Chair: Dorothee Bakker (UK)
SG2-Interior Ocean. Chair: Nicolas Gruber (Switzerland)
SG3-Ocean Acidification. Chair: Jean-Pierre Gattuso (France)
(See the activities of these groups on pages 3 and 4).

**LOICZ**
Joint IMBER/LOICZ Continental Margins Task Team (CMTT)
A new **IMBER/LOICZ CMTT** has been established. Kon-Kee (KK) Liu is the IMBER co-chair and Helmuth Thomas his LOICZ counterpart (see page 4).

**CARBOCHANGE**
IMBER had a MOU with the CARBOOCEAN. This project has now been finished and a new EU FP7 project ‘Changes in Carbon uptake and emissions by oceans in a changing climate’ (CARBOCHANGE), which follows on from CARBOOCEAN, has been developed.

The main foci of the project, which has a four year timeframe, are: understanding processes in the mesopelagic and twilight zone, observations, developing methodologies for data assimilation, synthesis activities and outreach. As these would contribute to IMBER’s goals, IMBER is currently investigating the possibility of signing a MOU with CARBOCHANGE so that it becomes a contributing project to IMBER.

CLIVAR
Climate Variability and Predictability (CLIVAR), is a core project of the World Climate Research Programme (WCRP). Its focus is the role of the oceans in climate variability and change, particularly on physical climate changes.

The Indian Ocean Panel (IOP) has developed strong links with SIBER to cooperate to implement both physical and biogeochemical instruments on the IndOOS infrastructure.

The Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) is co-sponsored by the IOC-SCOR International Ocean Carbon Coordination Project (IOCCP) and CLIVAR, in collaboration with IMBER, SOLAS, Argo and OceanSITES. The GO-SHIP Development Plan, which outlines priorities and timelines for coordinating national hydrography programmes into a global coordinated network, and the organizational framework and budget required to develop a sustained programme, will be published by early 2011.

IMBER and CLIVAR are investigating the possibility of holding back-to-back SSC meetings in 2012, with a one-day joint meeting.

EUR-OCEANS
IMBER signed a MOU with the EUR-OCEANS Network of Excellence, and continues to retain links with the new EUR-OCEANS Consortium (EO).

The MAAS (Mid-trophic Automatic Acoustic Sampler) component of CLIOTOP was selected for EO ‘Foresight workshop’ funding. The meeting entitled, ‘Toward a global observation and modelling system for studying the ecology of the open ocean using acoustics’, was held from 3-6 May 2011 in Bergen, Norway.

The IMBER IPO is assisting with the administrative and logistical organisation of EUR-OCEANS Conference – ‘Ocean deoxygenation and implications for marine biogeochemical cycles and ecosystems’ (24-26 October 2011, Toulouse, France). An IMBER poster will be presented. Several IMBER SSC members have been invited to speak at the conference.
IMBER applied to EUR-OCEANS for funding for IMBER/SOLAS synthesis meeting ‘The Ocean Carbon Cycle at a time of change: synthesis and vulnerabilities’. Although it does not fit into any of the usual EO calls, a small amount of funding (about €5K) will be provided.

**PICES**

Interaction and collaboration between PICES and IMBER has continued during the past year. For example, PICES generously supported nine early career scientists, from PICES member countries, to attend the ClimECO2 summer school.

As the workshop themes of IMBIZO II were of relevance to PICES’s science programme FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems), PICES co-sponsored IMBIZO II and provided travel support for three invited speakers from North Pacific countries.

There will be a joint IMBER-PICES session entitled, ‘How well do our models really work and what data do we need to check and improve them?’, at the PICES Annual Meeting in Khabarovsk, Russia, 14-23 October 2011. IMBER will provide the travel costs for one of the invited speakers in this session.

In the interest of continued collaboration and cooperation, IMBER has agreed to co-sponsor the second International PICES, ICES and IOC Symposium on “Effects of Climate Change on the World’s Oceans”, that will be held from 14-18 May 2012, in Yeosu (Korea). Support will be provided for an invited speaker to attend a joint IMBER-PICES session.

**NATIONAL ACTIVITIES**

IMBER National Contacts (NC) help to coordinate research and communication within countries and with the broader IMBER community. IMBER currently has national activities in 31 countries (Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Finland, France, Germany, Greece, India, Italy, Japan, Republic of Korea, Mexico, Namibia, The Netherlands, New-Zealand, Norway, Oman, Peru, Russia, South Africa, Spain, Switzerland, Taiwan, Turkey, UK, Uruguay and USA). Examples of some activities are the following:

**Belgium**

There are no specific IMBER endorsed/contributing projects in Belgium, but some national programmes contribute to IMBER aims and activities (e.g. BIANZO II, BIGSOUTH, DIAPICNA, FishPop Trace, FRFC COREAM, FWO-ODYSSEUS and FWO-TANA).

An IMBER special session ‘IMBER: Tracing physical and biogeochemical processes at the coastal and ocean interface’ was held at the 43rd International Liège Colloquium on Ocean Dynamics on 3-6 May 2011, Liège, Belgium. Javier Aristegui (IMBER SSC Vice-Chair) was one of the convenors. He also gave a key-note address and chaired the IMBER session.
France
CYBER (Biogeochemical Cycles, Ecosystems and Resources) is France’s contribution to IMBER. It deals with ecosystem structure, functional diversity and biogeochemical cycles in the oceans, through field observations, laboratory and modelling experiments. In addition, five other French projects have been endorsed by IMBER (BIOSOPE, POTES, EPOCA, BOUM and MALINA).

India
The most important development concerning IMBER in India has been the establishment of SIBER as an national programme. SIBER-India consists of 14 projects covering the Indian Ocean basin.

Japan
The IMBER-endorsed project POMAL (Population Outbreak in Marine Life) is the only national project of relevance to IMBER. It is due to finish in March 2012. IMBER scientists participated in the research cruise entitled ‘Biogeochemical interactions of aerosol, trace metals, organisms in the tropical and subtropical North Pacific’ carried out from 18 May - June 2010.

Mexico
Mexico recently joined the IMBER national network with the appointment of Salvador Lluch-Cota as the national contact. There are currently no IMBER-endorsed Mexican projects but the PIs of the Mexican projects IMECOCAL (a large-scale programme that conducts ecosystem level research), PMC (Mexican carbon programme) and ECORED (national research programme that considers biogeochemical cycles, climate change and the human dimension) have been contacted by the IMBER IPO to begin the endorsement procedure.

Namibia
Namibia recently joined the IMBER national network and Bronwen Currie is the national contact. There are no Namibian endorsed projects, but Namibia is involved in the IMBER-endorsed GENUS (Geochemistry and Ecology of the Namibian Upwelling System) project.

Netherlands
The Netherlands has no dedicated IMBER endorsed projects. Most of the marine research is focused in the Wadden Sea, but several small, individual projects relevant to IMBER are conducting research in the ocean and continental shelf areas. These include topics such as: ocean acidification, hypoxia research, Indian Atlantic Exchange and cold water coral and ecosystem functioning.

Russia
There are no Russian IMBER endorsed projects, but several research institutes are carrying out IMBER-relevant projects. These include studies of the changes in the Caspian Sea ecosystem in response to sea level rise and other forcings, and fluxes of CO₂ and methane in Arctic Seas.
Spain
Three national projects have been endorsed by IMBER: CAIBEX (Shelf-Ocean Exchange in the Canaries-Iberian Large Marine Ecosystem), MALASPINA (Circumnavigation Expedition - Global Change and Biodiversity Exploration of the Global Ocean) and LUCIFER (Lunar Cycles and Iron Fertilization).
There are several other projects that have recently been funded that are closely related to the IMBER goals and the IPO will approach the PIs of these projects to seek IMBER endorsement.

FUTURE ACTIVITIES

Third IMBER ClimECO Summer School at Ankara University, Ankara, Turkey, August 2012. Raghu Murtugudde and Baris Salihoglou have been appointed as co-convenors and the organising committe is currently being established. Once appointed, the committee will develop the programme.

5th IMBER China-Japan-Korea meeting, Shanghai, November 2011. Invitations have been sent to the IMBER SSC members in Japan and Korea on behalf of Jing Zhang, who is the convener of this meeting, asking them to appoint representatives from their respective countries to serve on the organising committee. The possibility of including Taiwan in the meeting is being investigated.

IMBER IMBIZO III. The IMBIZO is normally held every second year, but as there are several big meetings being held during 2012, it has been decided to delay IMBIZO III until 2013. The RPO is investigating the possibility of holding the meeting at the East China Normal University. It has been suggested that IMBIZO III be a dedicated Continental Margins-Human Dimensions meeting. Several people have been identified to serve on the Scientific Organising Committee.

First IMBER Open Science Meeting (OSM). It has been decided to hold an OSM in August 2014. A call for bids to host the meeting has been put out. The closing date is 1 October 2011.

PUBLICATIONS
There are currently more than 400 peer-reviewed research papers in the IMBER database. In 2010, 168 papers were published and 58 so far in 2011.

Selected publications


Special Issues

CLimate Impacts on Oceanic TOp Predators (CLIOTOP) CLIOTOP International Symposium
La Paz, Mexico 03-07 Patrick Lehodey, Olivier Maury and Mélanie Rathburn December 2007

Deep Sea Research II Special Issue: Ecological and Biogeochemical Interactions in the Dark Ocean. Steinberg DK and Hansell DA (eds.) (August 2010) Volume 57 Issue 16 Pages 1429-1592. (8 papers)

Edited volumes and books published:

UPCOMING PUBLICATIONS


REQUEST FOR FUNDING
IMBER requests SCOR Developing Country Travel Funds to assist scientists from developing countries to attend the third IMBER Summer School that will be held in Ankara, Turkey in August 2012. Amount requested: US$7,500

ACKNOWLEDGEMENTS
IMBER would like to take this opportunity to thank SCOR for its continued support. We are extremely grateful, not only for the financial contribution, but also for the help, advice and guidance provided by Ed Urban and Liz Gross.
3.3 GEOTRACES

Terms of Reference:

- Organize national and international planning workshops as well as special sessions at international conferences to obtain community input on the design and implementation of GEOTRACES.
- Establish priorities for research on the sources, sinks, internal cycling, transport, speciation and fate of TEIs, and develop this information into an International Science Plan.
- Promote intercalibration of analytical methods, and the development of standard reference materials.
- Identify new instrumentation and related infrastructure that will help achieve GEOTRACES objectives.
- Define a policy for data management and sample archival.
- Forge scientific linkages with other research programs holding overlapping interests to create synergies where possible and avoid duplication of efforts. To the extent practical, this will involve cross-membership between the GEOTRACES Planning Group and the Planning Groups and Science Steering Committees of other programs.
- Interact with SCOR Working Groups that share common interests including, but not limited to, SCOR/IMAGES WG 123 on Reconstruction of Past Ocean Circulation (PACE) and SCOR/IMAGES WG 124 on Analyzing the Links Between Present Oceanic Processes and Paleo-Records (LINKS).

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Ed Boyle  USA  Carol Robinson  UK
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Catherine Jeandel  FRANCE  Jing Zhang  JAPAN
Bill Jenkins  USA
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Reiner Schlitzer, Germany
Igor Semilitov, Russia
Sunil Kumar Singh, India
David Turner, Sweden
Angela Wagener, Brazil
Jing Zhang, Japan

The SSC membership (listed above) contains representatives of 15 different countries with diverse expertise including: Marine biogeochemistry of carbon and nutrients; Trace elements and isotopes as proxies for past climate conditions; Land-sea fluxes of trace elements/sediment-water interactions; Trace element effects on organisms; Hydrothermal fluxes of trace elements; Tracers of ocean circulation; Tracers of contaminant transport; Controls on distribution and speciation of trace elements; and Ocean Modelling.

1. **SSC meeting**

The fifth meeting of the GEOTRACES SSC was held for three days (22nd-24th September 2010) at the Laboratoire d’Etudes en Géophysique et Océanographie Spatiales (LEGOS) in Toulouse, France. Logistics were organized by the GEOTRACES International Project Office (Catherine Jeandel and Elena Masferrer). The meeting was attended by 19 member of the 2009/2010 SSC. Other attendees included Chris Measures (Co-chair of the Data Management Committee); Ed Urban (SCOR); Ed Mawji (GEOTRACES Data Assembly Centre) and Elena Masferrer (GEOTRACES International Project Office).

The morning of the first day, following introductions and welcome, was spent in national reports detailing GEOTRACES activities of the last year in 15 countries. The afternoon of the first day was dedicated to present the International Project Office activities and to discuss the first draft of
the “new” GEOTRACES Web site. The day was ended by a review of the national investments in GEOTRACES.

The second day of the SSC meeting started with a discussion of BioGEOTRACES and Organic GEOTRACES—two initiatives related to GEOTRACES. After this presentation the meeting focused on two issues that will be reported on elsewhere in this report: data management and intercalibration. Subsequent discussion addressed cross-national activities.

The third and final day of the SSC meeting started with discussion of applications from two studies to become GEOTRACES process studies: KEOPS-II (France) and KH-10-02 cruise (Japan). After this, a review of the Section Plan was done. Subsequent discussion addressed forthcoming workshops and conferences, capacity building, international partnership issues, programme budget, and SSC rotation.

The next SSC meeting is scheduled for 6-8 September 2001, in Xiamen, China.

2. GEOTRACES Intercalibration

During the last year, two major (unique) intercalibration activities occurred, the final Intercalibration Cruises Workshop and the creation of the GEOTRACES Cruise Protocols (cookbook). The “Final” GEOTRACES Intercalibration Workshop was held at Old Dominion University in Norfolk, Virginia USA from 8th-10th March 2010. Of the 48 attendees, most of the International GEOTRACES Standards and Intercalibration Committee (Cutter – Chair, Andersson, Codispoti, Croot, Geibert (for van der Loeff), and Lohan) were present to evaluate results of the intercalibration initiative. One of the principal findings of the meeting is that the US GEOTRACES Sampling System (carousel with sensors and GO Flo bottles, winch, and clean lab van) takes uncontaminated samples for all the trace elements and isotopes of interest in the GEOTRACES programme. Furthermore, hydrographic smearing of the water samples (i.e., the bottles are tripped while the carousel is moving upwards at ca. 3 m/min, thus potentially combining waters from a depth interval rather at a discrete point) is usually minimal (ca. 2 m), but more importantly quantifiable using GO Flo bottle salinity, CTD sensor salinity, and nutrient concentrations. For the radiogenic and radioactive isotopes, sampled using the ship’s rosette and Niskin bottles, sampling and handling did not have any effect on sample integrity (although the ship’s seawater system dramatically affected radium concentrations and therefore is not an acceptable means of collecting surface samples for this element). Nevertheless, intercalibration problems with the radionuclides were present, but largely due to lab/instrument calibrations. In this respect, further laboratory intercalibrations will be conducted with common radioisotope standards.

Particulate sampling showed surprisingly good agreement between the in situ systems (MULVFS and McLane pumps) and GO Flos on the carousel. It is not perfect, but consensus was reached on filter holders (MULVFS or “mini MULVFS”) and filter types (QMA and polysulfone such as Supor). The Supor filters had some heterogeneity problems at depth (pressure-related distortion?) for the in situ pumps, so other manufacturers of filters of this material will be investigated; whole filter processing rather than slices or plugs can also
circumvent this problem. GO Flos showed evidence of large particle sinking and loss during filtration, but in spite of this (and keeping the bottles mixed/shaken during filtration) GO Flo filters had very good agreement for depth distributions and concentrations for 90% of the GEOTRACES trace elements when compared to MULVFS samples during Cruise 2 in the Pacific Ocean. On the last day of the workshop, the International GEOTRACES Standards and Intercalibration Committee gave a strong endorsement for the results of the workshop – GEOTRACES is ready to go to sea (although some lab calibration problems still need to be resolved).

An intercalibration special session was held at the February 2010 Ocean Sciences Meeting in Portland, Oregon ("Getting the Right Number"; G. Cutter and R. Sherrell, conveners), and 16 talks and posters on the GEOTRACES Intercalibration were presented.

The most significant activity in 2010-2011 was the completion of “Sampling and Sample-handling Protocols for GEOTRACES Cruises” cookbook for the international GEOTRACES Program. These are posted on the international GEOTRACES Web site (http://www.obs-vlfr.fr/GEOTRACES/libraries/documents/Intercalibration/Cookbook.pdf). The International GEOTRACES Standards and Intercalibration Committee will maintain and update these protocols. In addition to web-publishing the Protocols, we are coordinating publication of results from the Intercalibration in a special issue of Limnology and Oceanography: Methods to be entitled, “Intercalibration in Chemical Oceanography.” Papers are due by 15 July 2011 and the plan is to have all of them published by early 2012. The editors of this special volume are Greg Cutter (USA), Peter Croot (UK), and Per Andersson (Sweden).

Of the three Atlantic cruises completed in the last year (Netherlands, GA02; UK, GA06; Germany, GA11), two occupied cross over stations (GA02 and 11) that will be re-occupied by the US GA02 cruises (eastern Atlantic one sampled by US in 2010, and western Atlantic, BATS, will be done in late 2011 when the cruise is restarted). The additional benefit of the BATS reoccupation is that it is a GEOTRACES Baseline Station for which key TEI data are already available. The UK GA06 Atlantic Ocean and Japanese Indian Ocean (GI04) cruises did not have any crossover stations, but took multiple samples at multiple depths to be distributed to several labs for key TEI determinations to effect an intercalibration. All of the crossover station and replicate sampling data will be independently evaluated by the Standards and Intercalibration Committee to assess the accuracy of sampling and analyses. The first of these evaluations will occur in 2012.

3. Data Management for GEOTRACES

The GEOTRACES Data Assembly Centre (GDAC) is hosted by the British Oceanography Data Centre (BODC), Liverpool, UK. GDAC is responsible for all GEOTRACES data activities from start to finish, including interacting with the PSO’s and national data centres, and will eventually become the central point for all GEOTRACES data. GDAC is staffed by Dr. Ed Mawji.

From the start of GDAC a high priority has been placed on meeting representatives from national data centers. Under the present data model GDAC will not contact the scientist directly (unless
the PSO has granted prior permission) and all requests for data are channelled through the local/national data centers. This requires GDAC to have a good working relationship with each national office.

A funding opportunity from the COST Action ES0801 has helped fund this task, with considerable resources being used in 2009-2010 to establish relationships with the French community and the local data center (2 meetings, including French GEOTRACES scientists). After discussions with Reiner Schlitzer and Gideon Henderson, COST money for 2010-2011 was made available for meeting with representatives from the Netherlands and Germany.

The most significant meetings of 2010-2011 will be summarised.

**Meetings**

17 - 19 January 2011, Royal NIOZ

In the last year the laboratory of Hein de Baar, Netherlands have completed three GEOTRACES cruises (line GA02) collecting >70 data sets. This increased the importance of developing relationships with the data management office based at NIOZ. Hein de Baar and Michal Rijkenberg invited Mawji to attend the post cruise meeting of GEOTRACES cruise GA02 leg 1 & 2 on 17 & 18 January 2011 at Royal NIOZ, Den Burg (Texel), Netherlands. This gave Mawji the opportunity to meet some of the senior scientists at NIOZ and to introduce the principle of the GEOTRACES data management.

More importantly, two days were spent with Taco de Bruin (Head of NIOZ data management) and Ira van den Broek (NIOZ/international IPY Data Manager). Before the meeting Taco had highlighted his main concerns, which had European wide implications- mainly concerning SeaDataNet, and CDI record submissions. Concerns were also raised about the 14 IPY cruises associated with GEOTRACES and how GDAC plans to manage this data which technically speaking are all pre-GEOTRACES.

Progress was made on the following topics:

- Preparing CDI records for SeaDataNet: This topic was of particular importance as BODC and NIOZ are both partners in SeaDataNet and data would not normally be stored at both sites. Technical protocols and assurances from BODC were made to insure no international GEOTRACES data will be submitted to SeaDataNet.
- A robust data version control mechanism needed to be established; principles of how this will happen were discussed in great detail and proposed protocols put forward. A model of how errors relating to data sets will be related back to the originator was decided upon.
- How to credit the data originator for submitting data to GDAC; an issue that is constantly raised by PI’s from the international community partly driven by funding bodies. This topic needs to be discussed in greater detail at the next DMC. But as far as GDAC/BODC are concerned this is not a problem as all data are tagged with the originators name and institution.
The IPY data manager was also satisfied with how GDAC plans to handle the IPY cruises; i.e., GDAC will only manage and collect GEOTRACES parameters and provide a link to other datasets collected on each cruise.

Since the meeting Ed Mawji has kept in regular communication with Micha Rijkenberg and Ira van den Broek, who updates Mawji when he receives IPY data.

14-December 2010
Reiner Schlitzer –BODC, Liverpool.–This meeting was used to discuss data submission and problems Mawji is encountering. Data products and how to credit PIs in future GEOTRACES data products were also discussed.

Future meetings 2011

November BODC Liverpool- Cyndy Chandler (US; BCO-DMO) is meeting with Roy Lowry (BODC) to discuss mapping data to BODC’s Ontology (which is been adopted by BCO-DMO) which is good news for GEOTRACES in the long term.

Mawji and Chandler have also put aside time to discuss progress of the US GEOTRACES data.

European funding from COST is still available to fund a further meeting with the German data managers.

Overall this year has been successful in establishing and keeping links between GDAC and national data centers but it has become apparent a greater effort needs to be made to build links with the Asian community. In 2011-2012, GDAC should concentrate time and effort to build and develop links with the Asia countries.

Working with the IPO
Since the last SSC meeting in Toulouse a good working mechanism has been established between GDAC and Elena Masferrer-Dodas at the IPO office. Information is freely exchanged between the two sites. The IPO office has helped GDAC keep up to date with new developments and upcoming cruises, which in the past has proved a difficult task.

Cruises
October 2010 – November 2010
The SSC and DMC have pushed for data management on cruises and in late 2010 Mawji was given the opportunity to participate in the first UK GEOTRACES cruise (GA10 40 °south). This was a success in regards to his time.

- It gave him valuable firsthand experience in GEOTRACES sampling protocols
- Allowed him to ask question about analytical techniques with which he is less familiar (this is important when tagging data with BODC parameters/ontology).
- Useful mechanism in assessing how information is passed from the ship to GDAC and what information is lost.
- Test of pre cruise sampling metadata forms developed by Gideon Henderson and Mawji and CTD cast specific log sheets. This proved a success and was adopted by Eric Achterberg in February 2011 for the second UK GEOTRACES cruise.

**Web site progress and data delivery mechanisms**
At present, the GDAC Web site has no delivery mechanism in place. Progress in this area is controlled by BODC and ultimately Roy Lowry. For the last 2 years this has been a high priority task for the BODC IT team. Implementation of this project finally started in January this year and a mechanism is expected to be in place by early September. Due to BODC’s large back catalogue of data all new IT projects have to take into account legacy issues hence the delays. A demonstration of this mechanism should be available at the DMC and SSC in China (September 2011). The disadvantages of the slow development are outweighed by the knowledge that a functioning data porthole for GEOTRACES will be maintained after the lifespan of the project as part of the BODC archive, providing a resource for the world community. Mawji has attended the relevant development meetings and put forward how he believes data should be delivered. After many discussions with Roy it is understood that web features will greatly improve over the next few years, but ultimately IT issues and the features are not controlled by GDAC.

**Data tracking and data submission**

**Post cruise Metadata**
To keep the GEOTRACES inventory up to date PI’s have been required to submit metadata forms. If forms are not submitted or completed in full, cruises cannot be added to the database and GDAC cannot track future GEOTRACES data.

The post cruise metadata form provides three levels of data:

- At the Project level
- At the Cruise level
- At Individual level

Have they been successful? Fourteen cruises were granted IPY GEOTRACES status. All 14 cruises have completed the metadata forms. Ten GEOTRACES section cruises – Nearly all have submitted the required metadata forms. Good progress has been made on the GEOTRACES data inventory. A full GEOTRACES inventory (cruise to dataset level) is available from GDAC (http://www.bodc.ac.uk/geotraces/cruises/programme/). PIs from most nations have been happy to complete the forms, which helps build the data inventory. Overall good progress has been made in the metadata collection from GEOTRACES cruises; scientists are willing to spend the time to complete the relevant forms, which is a vast improvement from past experiences. The principle scientists have also been willing to submit detailed cruise reports to GDAC. It appears the message of good metadata and the ability to communicate to the outside world via cruise reports is becoming clear.
IPY Data
2010 has been a mixed year for GDAC regarding communications between GDAC and national data centres and scientists is good but there is still a reluctance to submit data. This is not just a GDAC problem, but a historic issue which is slowly beginning to improve.

Note on data quality: At present GDAC has data that do not meet the high standards set by GEOTRACES. It appears that submitting data to a database is always a secondary thought and as a result data are submitted with less than adequate metadata. At present GDAC has a fair amount of data that cannot be loaded into the BODC database due to inaccurate sample metadata, where scientists tag data with the inaccurate collection details (station, event number, depth, bottle number, etc.).

Summary of the IPY cruises
- All GEOTRACES data from TAN0609 (IPY 1-Phil Boyd) have been received. Mawji helped highlight a few metadata and reporting issues, which need to be addressed. Phil Boyd has been informed of the issues.
- GEOTRACES data from the three Australian IPY cruises (IPY2, 3, 6) are expected in the next 3-4 months (Andy Bowie)
- Success in tracking down data from DynaLiFe (IPY7). Bob Anderson introduced GEOTRACES to Stan Jacobs who has now provided GDAC with a cruise report and fully processed CTD data. The IPY data manager at NIOZ has sent GDAC nutrient data and Fe ligand data.
- No data are expected from the two Russian/Japan cruises due to political reasons (IPY 9,12)
- Only 2 data sets have been collected from the two Spanish ATOS cruise that have been sent to GDAC (IPY 8, 10).
- IPY 14 - the Canadians have submitted CTD data; expect other GEOTRACES data in 2012.

During the IPY program the three cruises that had the largest GEOTRACES programmes and hence data sets are ANTXXIV3 (IPY5), ARKXXII2 (IPY11) and the French cruise Bonus Good Hope (IPY4). Tracking data from these cruises is proving difficult. The French are not submitting data to the national data centre so no data has been submitted to GDAC. GDAC has little to no contact with PANGAEA so a new approach has now been adopted by GDAC, which is to contact scientists directly; this has already started to produce results

GEOTRACES section cruises
The past two years have been a busy time for GEOTRACES especially in the Atlantic. Overall 10 full GEOTRACES cruises have taken place. With another 3 cruises planned for 2011 there are obviously a lot of data expected.

GEOTRACES sections- 10 cruises

<table>
<thead>
<tr>
<th>Pacific Ocean</th>
<th>GP13</th>
<th>2 cruise Australia and new Zealand</th>
<th>No data expected until 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Ocean</td>
<td>GI04</td>
<td>1 cruise Japanese</td>
<td>No data expected until 2012</td>
</tr>
<tr>
<td>Atlantic Ocean</td>
<td>GA02</td>
<td>3 cruise -Netherlands</td>
<td>No data expected until 2013</td>
</tr>
<tr>
<td>Atlantic Ocean</td>
<td>GA10</td>
<td>1 cruise-UK</td>
<td>No data expected until 2013</td>
</tr>
</tbody>
</table>
With the vast quantity of data expected in 2013 it becomes important that data are submitted by the time specified. As ever, it is vitally important that scientists submit data following the GEOTRACES / BODC submission guidelines to ensure smooth processing and archiving.

In summary GDAC policies are proving effective with clear results; PI’s are following guidelines and metadata is being submitted, CTD data and event logs have been submitted from 2 GEOTRACES sections already (1.5 years ahead of time), with another 1-2 sets of CTD data expected in the next few months.

<table>
<thead>
<tr>
<th>Cruise /country</th>
<th>Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE319_NetherlandsA02- end date 26/5/2010</td>
<td>GDAC post cruise metadata form, full cruise report. CTD data expected in the next few months</td>
</tr>
<tr>
<td>PE321_NetherlandsA02 –end date 8/7/2010</td>
<td>GDAC post cruise metadata form, full cruise report. CTD data expected in the next few months</td>
</tr>
<tr>
<td>KH09-05_JapanI04 –end date 10/1/2011</td>
<td>Metadata form no cruise report no data</td>
</tr>
<tr>
<td>M81-1_GermanyA11 -end date 8/3/2010</td>
<td>Metadata form and intermediate cruise report. CTD data submitted</td>
</tr>
<tr>
<td>Cruise /country</td>
<td>Metadata</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------</td>
</tr>
<tr>
<td>D357_UK A10-start date 17/10/2010</td>
<td>CTD +nutrient+oxygen data submitted to GDAC</td>
</tr>
<tr>
<td>KN199-4_AmericA03 -start date 15/10/2010</td>
<td>PI been in contact for full list of requirements-provided cruise name start and end dates</td>
</tr>
<tr>
<td>SK279_IndiaI02 -start date 28/11/2011</td>
<td>Pre cruise metadata form</td>
</tr>
<tr>
<td>D361_UK A06-start data 02/07/2011</td>
<td>CSR, Cruise report CTD data expected in the next month</td>
</tr>
<tr>
<td>Pandora_FranceP12 -start date 02/07/2012</td>
<td>Planning document and proposed cruise track</td>
</tr>
</tbody>
</table>
4. Status of GEOTRACES Section Cruises

As noted in the preceding section, GEOTRACES has had an active year of cruises. The anticipated decadal field program is now well underway. Although several of the cruises have experienced substantial difficulties at sea (see reports from individual nations), overall the field program has enjoyed a successful and substantial implementation (Figure 1).

![Figure 1. Status of GEOTRACES global survey of trace elements and their isotopes. In black: Sections completed as GEOTRACES contribution to the International Polar Year. In yellow: Sections completed to date as part of the primary GEOTRACES global survey (dotted yellow, completed during the past year). In red: Planned Sections. An updated version of this map can be found on the GEOTRACES home page <http://www.geotraces.org>.

5. GEOTRACES International Project Office

The GEOTRACES International Project Office (IPO) is based at the Laboratoire d’Etudes en Géophysique et Océanographie Spatiales (LEGOS) in Toulouse, France. The IPO is responsible for assisting the Scientific Steering Committee (SSC) in implementing the GEOTRACES Science Plan and implementation plans of the programme, organising and staffing meetings of the SSC, working groups and task teams, liaising with the sponsors and other relevant
organisations, seeking and managing programme finances, representing the project at international meetings, maintaining the project website assisting the GDAC in securing information about upcoming cruises and interacting with GEOTRACES national committees and groups, as well as other international projects. The office is presented staffed by a single person: the IPO Executive Officer, Elena Masferrer. She has set up a programme Web site <http://www.geotraces.org> which provides up-to-date information about all GEOTRACES activities. Main features and services provided by the web site are detailed below:

**Cruise information:** The homepage of the web site includes an up-to-date GEOTRACES Cruises Section Map that shows the current status of the GEOTRACES sections in different colours (Figure 1). Also a ticker with the number of stations completed is maintained (currently 372) and is visible on the homepage.

In addition, under the menu item “Cruises” the information on the GEOTRACES forthcoming (scheduled) cruises is available. For detailed cruise information and data the web site is linked to the GDAC site (Note that the IPO is working closely with the GDAC and helps it to secure up to date information about new developments and upcoming cruises).

A list of GEOTRACES endorsed Process Studies is also provided on the site.

**Calendar of meetings:** This feature serves as a repository for all the information about any (past, present and future) GEOTRACES or GEOTRACES-relevant meetings. This includes GEOTRACES meetings and workshops, GEOTRACES-relevant special sessions in conferences and other conferences of interest for the GEOTRACES community. The IPO is responsible to keep it up-to-date. Note that for past meetings the information archived includes the meeting presentations and reports.

Future GEOTRACES workshops may benefit from this feature since any GEOTRACES workshop website could be easily set up using this feature which includes as well an on-line registration form.

**Library:** It contains all GEOTRACES publications. This includes Scientific Publications (Peer-reviewed Papers, Cruise Reports, Workshop Reports and PhD Dissertations), Planning Documents, Policy Documents and Annual Activities Reports. Currently, the IPO is developing a database of GEOTRACES publications. As soon as completed, this database will be available under the Library web page.

**Science:** Information about the GEOTRACES Intercalibration effort is posted under the menu “Science”. It includes, for example, the GEOTRACES Cookbook and the Standard and Reference Materials. A webpage for the BIOGEOTRACES initiative has also been set-up. Other items posted under this menu include the National and Regional Activities webpage.

**Outreach:** A menu for GEOTRACES outreach activities has been included on the web site. The GP13 Cruise Blog is the most recent addition to this menu.

**News:** Latest GEOTRACES news items are posted on the web-site homepage and under a dedicated menu “News”. This includes job, funding and student opportunities; cruise updates;
forthcoming workshops and meetings, and any other “new” issue of interest for the GEOTRACES community. An RSS feed has been created to inform subscribers about the latest news.

General Information: The Web site includes as well a menu “About us” that presents an overview of the GEOTRACES programme and introduces the Scientific Committee Members. Other items listed under this menu are the funding and an introduction to other GEOTRACES relevant international programmes.

Mailing list: In Autumn 2010, a new GEOTRACES mailing list was set up. This list is maintained via the GEOTRACES web site. A module to subscribe is available on the site.

Other main tasks for the IPO this year have included to create a “GEOTRACES Researchers Expertise Database” based on the analytical expertise of researchers (this database will facilitate the search when a specific analytical expertise is required and it will be available on the GEOTRACES website in autumn 2011); to seek funding for the management aspects of the programme (especially, at the European level); to help organize the GEOTRACES Mediterranean Planning Workshop, the GEOTRACES Data-Model Synergy Workshop (see below) and the 2011 SSC meeting in Xiamen; and to develop a database of GEOTRACES publications.

6. Workshops and events

GEOTRACES Asia Planning Workshop:

The 2010 GEOTRACES Asia Planning Workshop was held in Taipei, Taiwan during October 3-7. The major objectives were first to identify the key processes that regulate the biogeochemical cycles of TEIs and then to generate a future action plan for research on TEIs. The participants included 25 Asian scientists (from China, India, Japan, Korea, and Taiwan), 10 American and European scientists, and about 30 local graduate students. Detailed workshop information is shown in the Web site: http://proj3.sinica.edu.tw/~geotrace/index.htm.

Following plenary talks presented in the first two days, three breakout groups were formed for further topical discussion, including water column, sinking particles, and submarine groundwater discharge (SGD) groups. The suggestions proposed by the groups were further discussed in the final plenary session. Some of the major conclusions are highlighted here. First, capacity building is essential for most Asian countries prior to initiating a complete GEOTRACES program. Currently, only Japan and Taiwan own clean sampling facilities and only Japan is capable of doing shipboard analysis for contamination prone trace metals. It is thus important to select crossover stations at deep-water sites to maintain an intercalibration effort for the key TEIs as Asian countries develop their capacity for TEIs analysis. The SGD group recommended selecting SGD sampling sites in the waters along Chinese coasts where the population is huge to evaluate the relative importance of SGD for nutrient and trace metal inputs in comparison to riverine and aeolian sources. The sinking particle group emphasized that the East Asia oceanic waters are regions with exceptionally high external particle inputs from both atmospheric and
riverine sources and also with high gradients of external inputs over the broad continental shelves. Evaluating the fate of aerosol deposition is a high priority for TEIs study in the regions. Some of the research topics proposed during the workshop match closely with the core study of SOLAS and provide opportunities for future collaboration.

Overall, the workshop was successful and productive. The organizers acknowledged the candid suggestions and insights provided by the American and European scientists that facilitated the regional planning and organization of cruises and scientific objectives, all of which requires substantial cooperation among participating Asian nations and research institutions. A tentative cruise plan developed by the Asian representatives is shown in Figure 2. Deliberations from the GEOTRACES Asia Planning Workshop will be recorded in a Workshop Report, which is currently in the draft form.

Figure 2. Ongoing and proposed Asian GEOTRACES cruises shown on the map of Google Earth. The red line cruises are or will be carried out by Japan; the white lines by China, the pink lines by Taiwan; the green lines by India. The yellow pins labeled as ‘ST30’ and ‘Hong Kong’ indicate SGD stations. The ‘SEATS’ site would be a crossover deep-water station. The numbers next to the lines stand for the possible years to carry out the cruises.
**GEOTRACES Mediterranean Planning Workshop:**

Since the inception of the international GEOTRACES Program, a strong interest developed in carrying out GEOTRACES-related activities on TEIs in the Mediterranean Sea, due to the proximity and importance of the ocean-land-atmosphere domains, as well as the variety and intensity of exchanges between these domains. A funding opportunity from COST Action ES0801 culminated in a GEOTRACES Mediterranean Planning Workshop, which was held in Nice, France, during the 4-6 October 2010. More than 50 participants from 15 countries met and discussed various aspects of implementing GEOTRACES in the Mediterranean. On day-1, keynote speeches demonstrated the large variety of themes that could be handle under the umbrella of GEOTRACES in the Mediterranean Sea. Among other things, the SOLAS-GEOTRACES cooperation in the Mediterranean was enhanced. Advocacy speeches were focusing on key parameters, tracers, processes, and sites of interest for Mediterranean GEOTRACES. Several parallel break-out sessions took place on day 2 with the goal of defining key questions and how a GEOTRACES section in the Mediterranean Sea (and Black Sea) could bring new insights regarding TEI fluxes and processes at ocean interfaces, particle cycles, Western and Eastern Mediterranean process study/studies, TEI as proxies for past change and TEI and models. The ideal Mediterranean GEOTRACES section(s) was/were discussed: (1) one central (W-E) section by the R/V Pelagia (Netherlands) will likely occur in 2013 and (2) other sections dedicated to focused process studies in key area such as the Gulf of Lions, Adriatic Sea, Black Sea, off the Egypt/Israel coasts etc. will have to be organized concomitantly to the central section, with other research vessels. Complementary to the work during GEOTRACES sections, process studies at key sites (such as time series coupling atmospheric deposition and sediment traps) were also discussed and will be considered in the implementation. Deliberations from the GEOTRACES Mediterranean Planning Workshop will be recorded in a Workshop Report, which is currently in draft form.

**3rd GEOTRACES Data Model Synergy Workshop**

The next GEOTRACES Data-Model Synergy Workshop will be held at the “Universitat Autònoma de Barcelona”, Spain, in November 14-17, 2011. A committee for the preparation of this meeting has been set up in Fall 2010. It is composed of the following members:

- **Robert Anderson** (Lamont Doherty Earth Observatory, Columbia U., USA)  
- **Christoph Heinze** (Geophysical Institute, U. Bergen, Norway)  
- **Gideon Henderson** (Department of Earth Sciences, U. Oxford, UK)  
- **Catherine Jeandel** (Laboratoire d’Etudes en Géophysique et Océanographie Spatiales, U. Paul Sabatier, Toulouse, France)  
- **Phoebe Lam** (Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, USA)  
- **Olivier Marchal, Chair** (Department of Geology and Geophysics, Woods Hole Oceanographic Institution, USA)  
- **Pere Masqué** (Department of Physics, U. Autònoma de Barcelona)  
- **Ben Twining** (Bigelow Laboratory for Ocean Sciences, USA)  
- **Pere Masqué and Elena Masferrer** (GEOTRACES International Project Office, Toulouse) have taken care of the preliminary organizational aspects of the workshop.
The planning committee has now completed the following tasks:

1) **Define the theme and goal of the workshop.** The workshop will focus on ocean particles, with emphasis on their role in the biogeochemical cycles of TEIs. The exchange with particulate phases is recognized as an essential process in the oceanic budget of a large number of substances present in trace amount in seawater, including that of key substances of GEOTRACES. However, various aspects of ocean particles remain poorly understood, such as the spatial variations in their concentration, chemical composition, and size distribution. Likewise, our knowledge of the processes affecting particles in the ocean water column, such as aggregation, disaggregation, precipitation, dissolution, sinking, and transport by currents, is incomplete. The goal of the workshop is to bring together analysts and modelers in an effort to answer to two specific questions:

   a. What measurements of particles should GEOTRACES make?
   b. How should models of ocean biogeochemistry represent particles?

2) **Define the format and content of the workshop.** The format and content of the workshop have been established after a significant amount of exchange (by email) between members of the planning committee. It was decided to hold the workshop for a period of four days. The first three days will consist of three sessions, each composed of keynotes, topical talks, and a round-table discussion. The three sessions are entitled (i) “Observing particles in the ocean: Methods, results, and lacunae”, (ii) “Role of particles in the cycle of TEIs in the ocean”, and (iii) “Transport and transformation of particles in the ocean”. The keynotes will be reviews summarizing present observational knowledge and should culminate with a statement of emerging hypotheses. The shorter talks following the keynotes will be topical studies illustrating some of the specific aspects discussed in the keynotes. Finally, the round-table discussions, including both analysts and modelers, should agree on a list of explicit hypotheses regarding the interactions of TEIs with particles in the ocean, which have been formulated during the corresponding session. These hypotheses will provide the necessary context for the last day of the meeting.

The last day of the meeting will be an essential component of the workshop, as it will rely on the material presented and discussed during the three sessions to provide a set of specific recommendations regarding the nature of future studies that would further our understanding of ocean particles. More specifically, the expected outcome of the workshop is a statement of future research priorities—observational, experimental, technological, and/or theoretical—which are the most likely to advance our understanding of ocean particles, both in the context of GEOTRACES and beyond. The actions items to be identified during the workshop will be posted on the GEOTRACES website and reported in a journal publication in order to provide higher visibility to the output of the workshop.

3) **Define the material to be covered in the keynotes and identify keynote speakers.** A list of keynotes and of keynote speakers has been established by the planning committee. Each session will be composed of 6-7 keynotes by experts in their field, so the total number of keynotes during the workshop will amount to nineteen. The keynote speakers have been
contacted by the committee and have committed to present a keynote and attend the workshop.

4) **Writing up the agenda of the workshop.** The detailed agenda of the workshop is reported in a word document (about 5 pages). It has been finalized by mid-April after a significant amount of exchange between members of the planning committee (about ten different versions of the agenda have been discussed). The final agenda is now available on the GEOTRACES website created by E. Masferrer (see http://www.geotraces.org).

5) **Advertise the workshop:** A preliminary advertisement of the workshop has been sent to a large number of members of the scientific community using an exhaustive email list maintained at the GEOTRACES International Project Office. The agenda of the workshop and a flyer designed by E. Masferrer have been attached to the email in an effort to widen the span of the advertisement. The flyer of the workshop can be downloaded from the GEOTRACES web site (http://www.geotraces.org). Details about the workshop have been posted on the same site. A second advertisement will be sent this coming summer. Deadline for abstract submission (topical talks) has been fixed to August 30, and deadline for registration has been fixed to September 30.

6) **Submission of proposals to support the workshop.** The workshop will be supported by various sources, such as the U.S. NSF, SCOR, and COST (http://costaction.earth.ox.ac.uk). Several proposals have been submitted to both the Spanish and Catalan governments, and at the time of writing this report the GEOTRACES International Project Office is negotiating the conclusion of an agreement with a commercial sponsor.

7. **Special sessions at international conferences featuring GEOTRACES findings**

**ASLO 2011, Aquatic Sciences Meeting, 13-18 February 2011, San Juan Puerto Rico**

Relevant sessions:

*GSO2: Chemical Oceanography/GEOTRACES*
Conveners: Greg Cutter, Old Dominion University and Pere Masqué, Universitat Autònoma de Barcelona

*S87: Trace Metals and their Nutritional Importance to Marine Phytoplankton and Bacteria*
Conveners: Mak Saito, Woods Hole Oceanographic Institution; Pete Sedwick, Old Dominion University.

**43th International Liège Colloquium on Ocean Dynamics, 2 - 6th May 2011, Liège - Belgium**

For further information: [http://modb.oce.ulg.ac.be/colloquium/](http://modb.oce.ulg.ac.be/colloquium/)
The theme of the 43rd Liege Colloquium was “Tracers of physical and biogeochemical processes, past changes and ongoing anthropogenic impacts.”

Tracers such as Trace Elements and Isotopes (TEI) play an important role in oceanography as tools to (1) describe physical processes, (2) quantify production and carbon export, energy transfer, and trophic pathways, (3) understand the role of limiting micronutrients regulating ecosystem production and structure, (4) reconstruct past ocean conditions, (5) study transport and fate of anthropogenic inputs and pollutants. These themes were investigated in the framework of several international projects: GEOTRACES, SOLAS, IMBER, among others. Section cruises and process studies have taken place in polar oceans during the International Polar Year (2007-2008) and are now underway in other oceans.

Speakers at the 43rd International Liege Colloquium on Ocean Dynamics reported on new developments and insights related to tracers and proxies (from temperature and salinity to gases and isotopes) with a particular attention on the use of TEI as tracers. Although one session of the colloquium explicitly emphasized GEOTRACES activities, presentations containing GEOTRACES results were distributed throughout the week-long colloquium.

ICAS 2011, IUPAC International Congress for Analytical Sciences, 22-26 May 2011, Kyoto, Japan

Co-organized by The Japan Society for Analytical Chemistry (JSAC) and International Union of Pure and Applied Chemistry (IUPAC)


Relevant session:
S17) Geochemical Analysis
Trace Elements and Isotopes in Marine Geochemistry
Co-chairs: Yoshiki Sohrin (Kyoto Univ.)
          Kenneth W. Bruland (Univ. of California, USA)
          Derek Vance (Univ. of Bristol, UK)

Goldschmidt 2011, 14-19 August 2011, Prague, Czech Republic

Relevant sessions:
15a: The GEOTRACES Program
Convenor: Ed Boyle, Massachusetts Institute of Technology

15b: Deep Ocean Circulation in the Past
Convenors: Bob Anderson, Lamont-Doherty Earth Observatory
          Jeanne Gherardi, Laboratoire des Sciences du Climat et de l'Environnement
11g: The Rare Earth Elements: Their Deposits, Geochemistry, and Environmental Impact

http://www.goldschmidt2011.org/themes?theme=11&showDescriptions=true - session_11g
Convenors: Michael Bau, Jacobs University
Ulrich Schwarz-Schampera, BGR
James R. Hein, USGS.

2011 Chemical Oceanography Gordon Research Conference, 14-18 August 2011, Andover, NH, USA
Relevant Session:
Trace Element Cycling in the Ocean: Biotic Influences and Responses
Discussion Leader: Peter Sedwick (Old Dominion University)

8. Outreach

Cruise Blogs  Where possible, GEOTRACES endeavours to maintain an active blog with regular reports from sea. The IPO readily cooperates with willing scientists to post cruise information on the GEOTRACES web site. The Australian cruise GP13 maintained an active and engaging blog presence throughout the expedition. Leaders of future cruises are encouraged to adopt a similar policy.

International Year of Planet Earth  An overview of the GEOTRACES programme at the transition from planning to implementation of the main field activity was drafted in 2009 for publication in the Ocean volume of the International Year of Planet Earth compendium. Subsequent to the completion of the GEOTRACES overview the project was placed on hold. In early June 2011, the editors revived the project and GEOTRACES staff are updating the overview to incorporate relevant recent information.

9. Capacity building

At-Sea Training  GEOTRACES gratefully acknowledges support from SCOR to enable scientists from developing nations to participate in GEOTRACES cruises. These opportunities are vital to the development of technical expertise in sampling and sample handling for contamination-prone elements aboard “dirty” (rusty) ships. During the past year, Dr. Thato Mtshali from South Africa was able to participate in the Australian cruise covering section GP13 in the SW Pacific Ocean, thanks to this program. The participation of a South African scientist is particularly timely in light of the expansion of GEOTRACES and related oceanographic activities in South Africa (see South Africa’s national report). In addition, SCOR supported José Marcus Godoy from Brazil to participate in a Netherlands cruise.
Latin American Planning Workshop
During its 2010 meeting in Toulouse the SSC asked several of its members to initiate planning for a workshop in South America. Dr. Angela Wagener, SSC member from Brazil, agreed to lead the effort and will serve as a local host. The workshop will serve multiple purposes:

- Define pressing research questions pertaining to waters offshore of Latin American nations,
- Identify opportunities for international collaboration, especially in working toward solutions to problems that exceed the technical and scientific capabilities of any single nation, and
- Related to the second item above, orchestrate a training program that will serve to build the capacity of Latin American nations for oceanographic research on trace elements and their isotopes.

The Latin American initiative is a joint effort of GEOTRACES and SOLAS, both operating under the SCOR umbrella. As planning moves forward the organizers will benefit from the collective knowledge and experience of SCOR.

Sampling Systems    It is a goal of GEOTRACES that every nation carrying out oceanographic research should have access to a trace metal-clean sampling system. GEOTRACES offers guidance based on past experience in the design and construction of sampling systems as well as advice in operating these systems as shared facilities. A complementary goal to establish a program whereby scientists who have accrued experience in operating these systems can share that knowledge with scientists from nations that either are now in the process of acquiring clean sampling systems or are looking forward to acquiring such systems in the near future.

An updated status of trace metal-clean sampling systems to support GEOTRACES research is provided in the table below. Scientists interested in developing one of these systems for their own use are encouraged to contact the GEOTRACES IPO or any member of the SSC, who will arrange for contact with an appropriate person to provide technical information about the design, construction and cost of a system.

<table>
<thead>
<tr>
<th>Nation</th>
<th>Status</th>
<th>System/ Carousel</th>
<th>Bottles</th>
<th>Depth</th>
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</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Complete</td>
<td>Powder coated aluminum</td>
<td>10-L Teflon-lined Niskin-X</td>
<td>4000 m; 8 mm Kevlar rope</td>
</tr>
<tr>
<td>Canada</td>
<td>Complete</td>
<td>Powder coated aluminum with titanium pressure housing for CTD</td>
<td>12 X 12-L GO-FLO</td>
<td>3000 m; conducting Vectran</td>
</tr>
<tr>
<td>China</td>
<td>Complete</td>
<td>Towed fish</td>
<td>NA</td>
<td>Surface</td>
</tr>
<tr>
<td>France</td>
<td>Funded, Under construction</td>
<td>Powder coated aluminum with titanium pressure housing for CTD</td>
<td>24 X 12-L GO-FLO</td>
<td>8000 m; conducting Kevlar</td>
</tr>
<tr>
<td>Germany</td>
<td>Planned</td>
<td>Powder coated aluminum with titanium pressure</td>
<td>12-L GO-FLO</td>
<td>8000 m; conducting Kevlar</td>
</tr>
<tr>
<td>Country</td>
<td>Status</td>
<td>Material and Description</td>
<td>Depth Range</td>
<td>Notes</td>
</tr>
<tr>
<td>---------------</td>
<td>----------</td>
<td>----------------------------------------------------------------</td>
<td>-------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>India</td>
<td>Planned</td>
<td>Powder coated aluminum with titanium pressure housings and fittings</td>
<td>24 × 12-L GO-FLO</td>
<td>8000m, 18.5 mm Aramide armoured cable,</td>
</tr>
<tr>
<td>Japan</td>
<td>Complete</td>
<td>Powder coated aluminum</td>
<td>12-L Niskin-X</td>
<td>10000 m; titanium armoured cable</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Complete</td>
<td>Titanium frame</td>
<td>24 X 27-liter ultraclean PVDF</td>
<td>10000 m; conducting Kevlar</td>
</tr>
<tr>
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<td>Complete</td>
<td>Titanium frame</td>
<td>24 X 12-liter GO-FLO</td>
<td>10000 m; conducting Kevlar</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Complete</td>
<td>Powder coated aluminum</td>
<td>5-L Teflon-lined Niskin-X</td>
<td>2000 m; 8 mm Kevlar rope</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Complete</td>
<td>Teflon coated rosette</td>
<td>24 X 12-L Teflon GO-FLO</td>
<td>3000 m; Kevlar</td>
</tr>
<tr>
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<td>Teflon coated rosette</td>
<td>Multi-size GO-FLO</td>
<td>3000 m; Kevlar</td>
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<tr>
<td>UK</td>
<td>In testing phase</td>
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<td>24 10-L OTE</td>
<td>8000m conducting Kevlar</td>
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<td>Powder coated aluminum</td>
<td>12 X 12-L GO-FLO</td>
<td>1500 m; conducting Kevlar</td>
</tr>
<tr>
<td>USA - GEOTRACES</td>
<td>Complete</td>
<td>Powder coated aluminum with titanium pressure housings and fittings</td>
<td>24 X 12-L GO-FLO</td>
<td>8000 m; conducting Kevlar</td>
</tr>
</tbody>
</table>

**Acknowledgements**
We offer our special thanks to Ed Urban, who continues to provide tremendous support and valuable advice to the planning of the GEOTRACES programme.

**National Reports**

**Australia**

**Meetings**
- GEOTRACES presentations at the Australian-UK joint Royal Society-Australian Academy of Science ‘Frontier of Science’ meeting in Perth (Australia), October 2010
- GEOTRACES process study ‘PINTS’ (voyage ss2010_v01) workshop held in Hobart (Australia), February 2011 (Principal Investigator: Hassler)

**Cruises**
- GEOTRACES section GP13 leg (voyage ss2011_v02) in Southwest Pacific Ocean completed by Australian scientists, 13 May – 5 June 2011, along approximately 30oS (see report below;
Chief Scientist: Bowie). Leg 2 further east to be undertaken by NZ colleagues on RV *Tangaroa* from June 6 to 30 (Chief Scientist: Boyd)

- Australian participation in GEOTRACES approved process study around the Kerguelen Plateau in Oct/Nov 2011 (project: KEOPS-2; PI: Blain). Dissolved and particulate trace element studies in naturally iron-fertilised region of the Southern Ocean region in the Indian Ocean sector

- Preliminary discussion on submission of an Expression of Interest for shiptime for the next Australia GEOTRACES section study in the Pacific (N-S along 170oW GP19) or Indian (Hobart to South Africa GI05 or Fremantle to India GI03) Oceans on the new research vessel *Investigator* in 2014-2015 (feedback from SSC as to which line to focus on; joint study with another nation; which countries have already committed to these sections?)

- In addition, a process study of the Tasman Sea aiming to study TEI, macronutrient and carbon cycling and budgets is under discussion. This project is a follow up of the PINTS voyage (ss2010_v01, GEOTRACES Process study) At this stage, the Australian GEOTRACES participants, researchers from CSIRO, as well as international researchers (e.g. from NIWA, NIOZ, CNRS, NOC Southampton) have shown interest in this project.

**New funding**

- Funding for GEOTRACES activities in Australia continues to be tight, with most projects carried out using small research grants from the institutions of the major GEOTRACES researchers (University of Tasmania, Australian National University, University Technology Sydney) and some national funding from the Australian Research Council

**New results**

- Data published from sea ice iron biogeochemistry time-series study undertaken at Casey Station (Antarctica) in November/December 2010 (PI: Lannuzel)

- Participation and sample analyses of GEOTRACES intercalibration exercises for dissolved (Bruland), particulate (Sherrell) and aerosols (Landing) trace elements (Bowie lab)

**Publications**

- Several manuscripts published with results from GEOTRACES activities, including during the International Polar Year; publication of *Deep-Sea Research* special issue on ‘Subantarctic Biogeochemistry’ in 2011 (detailed below; pdfs available on request)

**Other activities**

- Exchange of personnel and international training activities under EU-Cost Action ES0801 between laboratories in the UK (University of Plymouth) and Australia (University of Tasmania)

- Design specifications for GEOTRACES sampling requirements continue to be implemented for new Australian oceanographic research vessel, RV *Investigator* (to be commissioned in 2013)
Brief report on GEOTRACES GP13 section study in the Southwest Pacific

This project undertook an integrated oceanographic transect and dust monitoring program for iron, other trace elements, and their isotopes (TEIs) along the western end of the GP13 zonal section (~30°S) east of Australia.

Deployment of all equipment required for the GEOTRACES GP13 voyage was successful. The trace metal rosette (TMR), the McLane pumps, CTD and aerosol sampler all performed well. Three types of stations were used to achieve our aims: (i) 29 normal stations (every 1° of longitude), (ii) 3 super stations (every 5°), and (iii) 4 mega stations (every 10°). Deployments at normal stations were typically down to 1500 m, with deployments at super- and mega- stations to the full water column. We also collected samples and data from the TMR and CTD down to 6000 m at station 31 (32.5°S, 177°W) to characterise for the first time trace elements and isotopes in the deep waters passing through the Kermadec Trench.

Over 3000 dissolved water samples were collected from the TMR, over 400 particulate filter samples from the McLane pumps, over 2000 water samples from the CTD, and 7 filter samples from the aerosol sampler. Samples will be analysed in the 6-18 month period following the voyage in the laboratories of the respective Principal Investigator for the following parameters:

- Dissolved trace elements (Fe, Al, Cd, Zn, Co, Mn, Pb, etc, using FIA and ICP-MS techniques).
- Abundance and isotopic composition of trace elements in suspended marine particles
- Particulate organic carbon (POC) and nitrate (PON)
- Iron chemical speciation using an electrochemical approach
- Iron bioavailability
- Large sample volumes (1-2 L) for iron, zinc, cadmium and copper isotopes
- Large sample volumes (5-10 L) for radiogenic isotopes of Pa, Th, Nd
- Trace elements in atmospheric dusts collected on filters from an aerosol sampler
- Nutrients at the nanomolar levels
- Phytoplankton characterisation using microscopy, high-performance liquid chromatography and flow cytometry

A number of analyses were carried out on-board including dissolved Fe by flow injection analyses, iron chemical speciation by competitive ligand equilibration – cathodic stripping voltammetry, phytoplankton photophysiology and hydrography (major nutrients, salinity, oxygen) by standard techniques. Shipboard data indicate that the TMR was non-contaminating for dissolved Fe, one of the most contamination prone elements. At station #3, a typical micronutrient-type and oceanographically-consistent profile for dissolved Fe was observed (Figure 3). Surface subsamples for nanonutrients were collected from the TMR at all stations, and these will be analysed on the next leg of the GP13 section by New Zealand colleagues. Ocean colour satellite data (8 day MODIS image, 4 km resolution) and aerosol dust data and forecasts (NAAPS, hysplit forward trajectories) was relayed to the ship by colleagues at University of Technology Sydney (Dr Mark Baird) and Griffith University (Prof. Grant McTainsh and the Australian dustwatch network), respectively, in order to help with sampling strategies during the voyage.
Two stations were not carried out due to inclement weather (stations 09, and 25 CTD only deployed). Two deployments (station 03 cast 2, and station 04 cast 1) of the TMR were unsuccessful due to a software problem. This was resolved by reverting to an earlier version of the software, which was successfully tested at station 04 cast 2. An intermittent problem was identified with one of the McLane pumps. This was believed to be due to a faulty communications cable between the electronics housing and the pump head, and the CI is in consultation with the pump manufacturer to resolve this problem.

Operations were carried out in an efficient manner, which resulted in many deployments taking less time than that allocated. This allowed us to add an extra 2 normal stations at the end of the Australian leg of the GP13 section and finish our science at 32.5°S 170°W.

This project is the first time that data on the distribution of many trace elements and their isotopes along the GP13 section in the Tasman Sea and southwest Pacific has been collected, and the 8 deep water deployments (including a 6000 m deployment of the TMR in the Kermadec Trench at 32.5°S 177°W) represent some of the few deep profiles that presently exist in any ocean worldwide. Preliminary results from shipboard analysis of dissolved Fe indicate that the western end of the transect was extremely low concentrations of dissolved Fe, despite the proximity of sampling to the continental shelf and possible dust deposition sources. Upper mixed layer nutrient concentrations were below macromolar detection limit at all stations along section GP13, with typical increases below the mixed layer. These preliminary hydrography results demonstrate low NOx concentrations in the top 100 m. Based on the maximum quantum
yield (Fv/Fm), phytoplankton east of 170°E were nutrient limited. Complementary studies on the voyage will indicate the degree of iron and nitrogen co-limitation in these waters. In addition, new EM300 swath bathymetric data was collected along the ocean section from 153.5°E to 170°W along 30°S (diverting to 32.5°S at 177°E), an area of significant topography including ocean ridges and trenches, submerged reefs and seamounts. This data is archived and can be processed and quality controlled after the voyage.

In summary, voyage ss2011_v02 successfully achieved the following objectives:

1. We carried out an integrated zonal oceanographic transect east of Australia studying the marine biogeochemical cycles of TEIs, as part of Australasia’s contribution to the international GEOTRACES program;
2. Samples were collected to establish the full water column, basin-scale distribution of trace elements and isotopes along GP13 for the first time;
3. Data from subsequent laboratory analyses will determine the sources, sinks and fluxes of TEIs (focusing on atmospheric dust delivery and biomass burning), as well as their transport, solubility and chemical form in the ocean;
4. A number of subsamples were collected for later analysis of other GEOTRACES (such as stable, radioactive and radiogenic isotopes) and bioGEOTRACES (marine microbial biogeography and biogeochemistry; i.e., 'omics') key parameters by international colleagues who are not able to participate in the field program.

We were unable to carry-out all our planned analytical tasks on board due to contaminated Milli-Q pure water supply (flow injection analyser) and unstable power supply (cathodic stripping voltammeter) in the ANU 20' clean container. These samples will now be analysed in the home laboratories after the voyage.

Voyage Plan and Summary can be found online at www.marine.csiro.au/nationalfacility/voyagedocs/index.htm. A blog of the cruise is posted at http://www.obs-vlfr.fr/GEOTRACES/index.php/outreach/cruise-blogs/gp13-blog, as part of GEOTRACES Outreach activities. SCOR-sponsored participation of Dr Thato Mtshali from South Africa under GEOTRACES Training and Education activities.

Outputs from GEOTRACES activities involving Australian researchers (2010-2011):

Journal articles:


Brazil

Although a lot of progress has been made elsewhere, for instance in China and India, in the direction of contributing to GEOTRACES, the same does not apply to Brazil. Last year the National Research Council opened a call for large oceanographic projects with the goal to create National Institutes and promote integration. Twelve projects were submitted and to this date there is no result on the groups, which will be financed although the deadline to report results was due in December 2010. All proposing groups had to aggregate at least one institution housing an oceanographic ship so many groups requested funds to modernize their ships. I know three of the 12 groups: one is centered in Rio de Janeiro and was nucleated by the Navy Research Institute (they have a new ship) and includes PUC and other universities; one was nucleated by the University of São Paulo and the third group grew around FURG, the university where Felipe Niencheski is affiliated to. Any substantial change in our capability to perform oceanographic cruises at the quality level required by GEOTRACES will only occur within the next two or three years.

The actions of Petrobras has generated oceanographic data of quality but their goals are not coincidental with those of GEOTRACES. Ships and sampling is performed by hired companies and a good quality control is made. As for organics, stable isotopes, black carbon and metals in sediments I can ensure that we have for the Campos Basin a very good collection of data covering in detail a large area (isobaths 50 to 3000m). Metals were also determined in surface waters (Al, As, Ba, Cd, Cu, Cr, Mn, Hg, Ni, V, Zn) but detection limits were not appropriate for iron and could be better for zinc. Nutrients, pigments and other oceanographic properties were also obtained for several depths in the water column. A second large project will be implemented in the Santos Basin but I do not yet have information on the detailed program.

Angela Wagener made a presentation last March in Monaco (the IAEA Symposium) showing results on lipids and stable isotopes in sediments for the Campos Basin and the audience was really amazed with the large number of stations as well as with the data quality and the value of information. A short manuscript was submitted for publication in the proceedings since the goal is to publish in a journal reaching a wider audience.

Figures illustrating the spatial distribution of concentrations (organics and metals) can certainly be provided but permission must be obtained from Petrobras and this cannot be made so fast as to be available by June 15. It can possibly be available by the end of June.

The most recent contribution of Brazil to GEOTRACES was the active participation of Jose Marcus Godoy last March in the cruise organized by Hein de Baar in the South Atlantic. It is
hoped that other opportunities will come for Brazilians to participate of such cruises and learn more about the GEOTRACES methods as well as to contribute in data acquisition.

**Canada**

Most PIs are still working up their data from the Beaufort Sea cruise in 2009 (IPY).

PIs have made a number of presentations at meetings, but no publications have appeared as of yet.

Canadian GEOTRACES has funding to organize a workshop on the Canadian GEOTRACES IPY cruise. However, the cruise leaders do not want to hold the meeting before most of the data are in hand (i.e. later this year or early next year).

Prospects for new cruises/research program we are still at a very early stage.

**China**

*Activities*

1) A part of China-GEOTRACES was accommodated in the “973” Carbon project–CHOICE-C. There have been four cruises to the Chinese Marginal Seas. Measurements include $^{234}\text{Th}$, $^{228}\text{Th}$, $^{228}\text{Ra}$, $^{226}\text{Ra}$, $^{224}\text{Ra}$, $^{223}\text{Ra}$, Cu, Mn, Cd, Pb in seawater samples.

2) Another part of China-GEOTRACES was accommodated in a newly founded China “973” project. There will be a cruise in the Yangtze estuary this summer. Measurements for $^{7}\text{Be}$, $^{210}\text{Pb}$, $^{228}\text{Ra}$, $^{226}\text{Ra}$, $^{224}\text{Ra}$, $^{223}\text{Ra}$, $^{232}\text{Th}$, $^{230}\text{Th}$, $^{234}\text{Th}$, $^{228}\text{Th}$ will be conducted in the sediment samples to understand the processes of early diagenesis.

3) Field observations were carried out in the Changjiang drainage basin (main stream and major tributaries) during April 2011 to understand the impacts of Three Gorges Dam’s construction on the weathering characteristics of the drainage basin and also the variations of terrestrial flux on the marginal seas of China.

**France**

*Meetings*

- GEOTRACES-France organized the GEOTRACES SSC meeting (C. Jeandel and E. Masferrer, Toulouse, 22-24 September 2010).
- Participation to the GEOTRACES Asia Planning Workshop, 4-6 oct 2010 (F. Lacan invited as representative).
- KEOPS II kick off meeting (Banyuls, 17-18 march 2011).
- Participation to the Scientific Committee and large participation to the “Traces and Tracers” oceanographic meeting (Liège, 2-6 may 2011).
Participation to the French National meeting in the framework of the Joint Programming Initiative “Healthy and Productive Seas and Oceans” (G. Sarthou, Roscoff 30-31 may 2011).
Meeting for the GA01 cruise proposal preparation (G. Sarthou/C. Jeandel, Brest, 5 July 2011).

Cruises
Dates of KEOPSII: 6 October-28 November.

New funding
KEOPS II (G. process study) fully funded, both for the cruise and for the science.
Funds for the acquisition of the French clean sampling system are (finally) completed this year.

New results
The most recent results of the GEOMAR group in Toulouse on Nd and Fe isotopes and in Brest along the BGH section are confirming that dissolved elements are released by the dissolution of a fraction of the sediments that are deposited on the oceanic margins. Due to the large amount of these sediments, the resulting net flux to the ocean is very large, as discussed in a recent publication to EOS (Jeandel et al., in press).

Other activities
Participation to the Scientific Committee (with O. Marchal) for the organization of the 3rd GEOTRACES Data-Model Synergy Workshop (Barcelona).

Publications
Bourquin et al., Determination of 226Ra concentrations in seawater and suspended particles (NW Pacific) using MC-ICP-MS
Heimbürger L.H., H. Lavigne, C. Migon, L. Coppola, F. D'Ortenzio and J-C. Miquel Physical control on the interannual variability of the mass flux at the DYFAMED time-series station (Ligurian Sea). Submitted to Deep Sea Research II 2011


Submitted by Catherine Jeandel.

Germany

The German GEOTRACES activities of the past year were dominated by preparations for work on the material recovered from RV Meteor cruise M81/1 (GEOTRACES cruise GA11, chief scientist M. Frank, IFM-GEOMAR, Kiel) to the tropical Atlantic Ocean (Las Palmas, Canary Islands - Port of Spain, Trinidad and Tobago, 4th February until 8th March 2010), which was funded by the German Science Foundation. The most important activity directly related to the cruise was the writing of a bundle proposal to the German science foundation to fund two Ph.D. and a post doc position for work on the GEOTRACES core parameters on samples from this cruise. At the beginning of May 2011 we were informed that this proposal was successful and we can now start to work on the samples at IFM-GEOMAR (Martin Frank), Jacobs University Bremen (Andrea Koschinsky) and AWI-Bremerhaven (Sven Kretschmer).

In January 2011, Torben Stichel from GEOMAR, Kiel successfully defended his PhD thesis on Hf and Nd isotope distributions, which he obtained on samples from the German/Dutch IPY cruise ANTXXIV/3 in the Southern Ocean. In February 2011 he took up a GEOTRACES postdoctoral position in the laboratory of Katharina Pahnke in Hawaii to work on radiogenic isotope compositions of samples from the U.S. GEOTRACES cruise GA03 in the Atlantic Ocean. In June Oliver Baars will defend his thesis on trace metal distributions on the same samples. There are several manuscripts on the data of this IPY cruise already published (such as in the upcoming Deep-Sea Research special volume on the IPY cruise in the Southern Ocean (ANTXXIV/3) with papers of Celia Venchiarutti, Peter Croot, Oliver Baars, Katrin Bluhm, Michiel Rutgers van der Loeff) or in submission.

The main planning activities of the German GEOTRACES community in 2011 have been focused on a 12 days GEOTRACES cruise to the Baltic Sea made possible by the Polish GEOTRACES community in November 2011.
India
Nine groups from India initiated working on trace elements and isotope studies in the Arabian Sea, the Bay of Bengal and associated estuaries. Funding from Ministry of Earth Sciences (MoES) India has been released to some of the groups working on Indian GEOTRACES. Indian GEOTRACES contributed INR one million towards the GEOTRACES International Data Centre from the funding obtained from MoES. We are in process of acquiring clean sampling system for Indian GEOTRACES programme. The system should be operational by the end of this year.

Our studies on some of the less contamination prone trace elements and isotopes were continued on the samples collected using conventional techniques. Nd isotope compositions in water columns of the Bay of Bengal along 87° E transect (Figure 5) are analysed, results of two profiles are given in Figure 5. Results display significant contribution of non-radiogenic Nd from the Ganga and the Brahmaputra river system to the Bay of Bengal water.
Conference/meeting/Session arranged
Organised a session, “OS08: Trace Elements and Isotopes in Oceans” in Asia Oceania Geosciences Society conference 2010, Hyderabad, July 5-9, 2010

Publications

Planned Cruise
1. Arabian Sea: November to December 2011, onboard Sagar Kanya
2. Indian ocean: Chennai-Australia-Chennai: January to March 2013, onboard Sagar Kanya

**Submitted by Sunil Kumar Singh.
Japan

Summary
Japan GEOTRACES has been quite active this last year. The first ASIAN GEOTRACES cruise by R/V Hakuho Maru was completed and several international meetings were attended by Japanese scientists. Although Japan is in a very difficult situation now after the 11 March earthquake and tsunami, Japanese marine biogeochemists in the whole country are working hard together to reconstruct after the disaster, not only for the life, the economy, and the environment, but also for the ocean sciences. The next Hakuho Maru cruise to the Western North Pacific will sail within a month, and the zonal GEOTRACES cruise along 47N in the North Pacific has started preparations already. A new grant was awarded for international investigation and research for the next four years; broader international collaborations for our future expeditions/cruises are welcome.

Meetings
International meetings:
- Asian regional GEOTRACES workshop (2010 GEOTRACES Asia Planning Workshop) Taiwan, 4-6 October, 2010.

These meetings strengthened the cooperation of the Asian regional marine biogeochemical and ocean/environmental sciences community.

National meetings:
- National GEOTRACES symposium was planned for the Spring Meeting of Oceanography Society of Japan, 22 March 2011, but was canceled because of the disaster caused by the 11 March earthquake and tsunami. The abstracts (in Japanese) of fourteen presentations were posted on the Japanese GEOTRACES web page.
- National GEOTRACES Committee in the Science Council of Japan, was planned also for 22 March 2011 but was cancelled and postponed to autumn.

Cruises
Recent cruise:
- KH-10-2 cruise by R/V Hakuho Maru (Figure 6).
  The Hakuho Maru KH-10-2 cruise was successfully conducted by the Atmosphere and Ocean Research Institute (AORI) of the University of Tokyo, and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), from 11 June to 23 July 2010 (a total of 43 days) in the Japan Sea (East Sea), western North Pacific and Okhotsk Sea. This cruise was proposed five years ago, and has been internationally recognized as the first regional GEOTRACES study in Asia (ASIAN-GEOTRACES). The main study theme of this cruise
was marine biogeochemical observations in the Japan Sea (East Sea), Okhotsk Sea and western North Pacific. It had many specific objectives, including studies of the oceanic circulation and deep convection system, air-sea interaction, behaviors and structures of the subducted/advected water masses, marine biogeochemical cycles and fluxes of the TEIs and gasses, and ecosystems and associated spatio-temporal changes in this cruise. Results will enable the characterization of the physical, chemical, and biological processes and associated distributions, and their sensitivity to changing environmental conditions in the East Asian Marginal Seas and the western North Pacific region. A total of fifty-three scientists, graduate students and staff took part in the cruise to pursue international/regional collaborative studies on GEOTRACES. These scientists came from twenty-two institutions in five countries. As one of our aims of the KH-10-2 cruise was educating young scientists from Asia, we performed a water-sampling workshop for more than forty chemical analyses, and four seminars (Science Coffee in Hakuho-Maru) by Japanese, Korean and Russian scientists. This cruise and all its results will form one of the cornerstones of the GEOTRACES program as its first regional GEOTRACES study in Asia and covering the various marginal seas connecting to the North Pacific, and also serve to greatly strengthen the cooperation of the Asian regional marine biogeochemical and ocean/environmental sciences community.

Figure 6. KH-10-02 Cruise Plan

Cruise Planning:
- KH-11-07 cruise by R/V Hakuho Maru (Figure 7).
Part of GEOTRACES section GP18, including the process studies focusing on cold seep biogeochemistry and earthquake mechanisms/radionuclide impact studies off NE Japan and Fukushima area.

Cruise by R/V Hakuho Maru.
GEOTRACES section GP02, zonal GEOTRACES cruise in the North Pacific (47N), planned for summer, 2011 (PI: T. Gamo).

New funding
- Proposal for international investigation and research was funded.
  Grant in Aid for Scientific Research; US$ 0.4M, April 2011 – March 2014.

Netherlands

The Dutch GEOTRACES project aimed to map the distribution of important trace elements and isotopes and investigate the deep sea microbiology in the West Atlantic Ocean. Since the last report to SCOR of 2009/2010 two more Dutch GEOTRACES cruises have been performed together completing the Western Atlantic Transect from 65°N to 50°S, Figure 8.

PELAGIA 64PE321, 11 June through 8 July 2010, Bermuda to Fortaleza (Brazil), chief scientist Dr. Micha Rijkenberg (micha.rijkenberg@nioz.nl).
During leg 2 of the Geotraces cruise a total of 22 full depth stations were conducted with 1 test station, 14 normal stations (1 ultraclean 27 L & 1 normal 25 L hydrocast), 4 superstations (addition of deep in situ pump sampling and samples for Pa/Th) and 3 hyperstations (deep in situ pump sampling, 2 ultra clean & 3 normal hydrocasts).

Trace metal clean sampling was performed using the ultraclean Titan frame with PVDF samplers which was upon recovery immediately placed inside its clean laboratory container (Figure 9), where sub-sampling of a large variety of filtered or unfiltered seawater was done for (shipboard or afterwards) determinations of concentrations of Fe, Mn, Al, Co, Cu, Zn, Ag, Cd, Pt, Pb; physical-chemical speciation of Fe; large volumes for natural isotope systematics of Si, Fe, Zn, Cd, Pb, Nd; major nutrients; $^{14}$CO$_2$ and $^{13}$CO$_2$.

Underway trace metal clean aerosol samples were collected using air filter units. Surface seawater samples for Fe speciation, Pt and Pb isotopes were sampled inside a trace metal clean container from tubing connected to a torpedo towed alongside the ship (Figure 9). The regular Niskin-type samplers and the in situ pumps provided the often required large volumes for natural or anthropogenic (radio)-isotopes systematics of $^{15}$N, $^{99}$Tc, $^{129}$I, $^{137}$Cs, $^{210}$Pb, $^{210}$Po, $^{226}$Ra, $^{228}$Ra, $^{230}$Th, $^{234}$Th, $^{238}$U, $^{231}$Pa, $^{237}$Np, $^{239,240}$Pu and supporting parameter Dissolved Organic Matter (DOM).

Complementary to GEOTRACES, many samples were collected for a transient tracers program comprising DIC, ALK, O$_2$, nutrients, CFC's and above mentioned $^{14}$CO$_2$ and $^{13}$CO$_2$, and for a microbial oceanography program comprising DOC, DON, bacterial and viral abundance, bacterial and archaeal and viral production, $^3$H-FISH, $^{14}$C-FISH and DNA microbial biodiversity and POC, $^{13}$C plus $^{15}$N by NanoSims, Nitrification, qPCR. These complementary transient tracers and deep sea microbial oceanography will play a role in unraveling the processes controlling the GEOTRACES variables, and vice-versa.

Two cross over stations were sampled with i) BATS important as a cross over station with various US GEOTRACES cruises, and ii) our hyperstation 36 (lat: 7° 45' 57"N, long 48° 52' 58"W) as a cross-over station with RV Meteor cruise M81/1 (GEOTRACES cruise A11, 4 February until 8 March 2010, chief scientist M. Frank, IFMGEOMAR, Kiel).

An interesting aspect of leg 2 was our encounter with water masses consisting of seawater mixed with Amazon and Orinoco river water, Figure 10.

**RRS JAMES COOK JC057**, 2 March through 6 April 2011, Punta Arenas (Chile) to Las Palmas (Spain), chief scientist Dr. Micha Rijkenberg (micha.rijkenberg@nioz.nl). With 18 full depth stations sampled during our last leg 3 including 12 normal-, 2 super- and 4 hyperstations we now completed a transect of 54 stations from 65°N to 50°S, see Figure 8 for cruise track and full West Atlantic Ocean transect. In situ pumps were used in the surface 300 m of the hyperstations and two additional stations. Our hyperstation 6 at -39°58′06″ N and -42°29′15″ W forms the cross over station with the UK GEOTRACES cruise on the RRS Discovery (chief scientist Gideon Henderson) along 40°S to be completed in December 2011.

On board we had a diverse party of international scientists from Brazil, Germany, France, UK, USA, Austria and the Netherlands. We sampled an even more diverse set of parameters with
direct on board measurement of the trace metals Fe, Al, Mn, Co, Zn and Cd, the CO2 system, nutrients, organic speciation and size fractionation of Fe, 234Th and bacterial and archaeal production. We also sampled a large set of parameters for the international community including Ag, Pt, Cu, Zn, Hg, Ba, U, Mo, the rare earth elements, the isotopes of Cd, Cr, Ni, Nd (water column and bottom sediments), Pb, Fe, Zn, Si, 15N, 13/14C, 230Th, 231Pa, 232Th, 18O, D and other parameters as CFC’s and a whole range of parameters to increase our understanding of the deep sea microbiology.

Figure 11 shows as an example silicate concentrations for the full transect of the West Atlantic Ocean.

Planning of Mediterranean Geotraces, Hein de Baar and Micha Rijkenberg attended the Mediterranean Geotraces workshop on 4th to 6th October in Nice, France, to investigate the use of the Dutch Research vessel RV Pelagia for Geotraces transects in the Mediterranean and Black Sea.

Ocean Sciences 2012 conference in Salt Lake City, Utah, USA. Micha Rijkenberg, Rob Middag, Stephanie Owens and Patricia Cámara Mor organize a session on the Ocean Sciences 2012 conference in Salt Lake City with the title: “Advances in the oceanography of Trace Elements and Isotopes in the Atlantic and Polar Oceans” inviting topics on trace elements and isotopes in the Atlantic and polar oceans, including methods, intercalibration, field data and ocean modeling. Relevant topics in other oceans are most welcome as well.

Update on outputs from GEOTRACES activities involving Dutch researchers (July 2010-June 2011):

Meetings
Post cruise meeting Dutch GEOTRACES leg 1 & 2, 17 & 18 January 2011 at the Royal NIOZ, Texel, The Netherlands

Presentations
Middag, R. Dissolved Aluminium and Manganese in the Polar Oceans. Oral presentation at the 2010 DISCO XXII meeting (invited), 07-10-2010, Honolulu, Hawaii.
Thuroczy, C-E., Brest, IUEM, seminar at LEMAR-CNRS-UMR6539, November 2010, oral presentation.

First results of the complete West Atlantic GEOTRACES transect were presented at 43^{rd} International Liège Colloquium on Ocean Dynamics, Belgium, May 2011, see here below:

de Baar, Hein (Keynote), Southern Ocean Iron Fertilization; What do we know now, what needs to be investigated, oral presentation
de Baar H.J.W., R. Middag, P. Laan, Dissolved Aluminium and Manganese in the Arctic-
Atlantic-Antarctic Oceans, oral presentation
GEOTRACES-NL, oral presentation
van Hulten M.M.P., A. Sterl, A. Tagliahue, J.-C. Dutay, M. Gehlen, H.J.W. de Baar, R. Middag
and W. Hazeleger, Aluminium in a general circulation model. Optimising the model or
the measurements?, oral presentation
Arctic Ocean, oral presentation
Rijkenberg MJA, Gerringa, LJA, Laan, P, Schoemann, V, Middag, R, van Heuven, SMAC, Salt,
L, van Aken, HM, de Jong, JTM, de Baar, HJW, Dissolved Fe in the Western Atlantic
Ocean: distribution, sources, sinks and cycling, oral presentation
Stimac, Tracers of river inputs in the Transpolar Drift, Arctic Ocean during the Polarstern
IPY expedition, 2007, oral presentation

Journal articles
Rob Middag completed his PhD thesis comprising nine research articles on Al and Mn in the
Polar Oceans. Similarly several manuscripts/chapters are completed of the theses in progress of
Maarten Klunder on Fe in Polar Oceans and Charles-Edouard Thuroczy on Fe Physical-
Chemical Speciation in Polar Oceans. Several articles of the Antarctic Polarstern expedition
ANT XXIV/3 will appear in a special issue of Deep-Sea Research II.

Abouchami, W., Galer, S.J.G., de Baar, H.J.W., Alderkamp, A.C., Middag, R., Laan,
isotope signature by ocean circulation and primary productivity. Earth and Planetary
Dijken, G.L., van Haren,H., Arrigo, K.R. Iron from melting glacier fuels the algal bloom
in Pine Island Bay (Amundsen Sea). Deep Sea Research II,special issue DynaLife,
Submitted and in review.
Arctic shelf seas and surface waters of the Central Arctic Ocean: Impact of river water
and ice-melt. In review for publication in JGR---Oceans, March 2011.
Klunder, M.B., P. Laan, H.J.W. De Baar, R. Middag, Dissolved Fe in the Arctic Ocean:
important role of hydrothermal sources, shelf input and scavenging removal. In review
for publication in JGR-Oceans, March 2011.
Oceanography in press
manganese in the Atlantic sector of the Southern Ocean. Deep Sea Research Part II:
Topical Studies in Oceanography in press


Submitted on behalf of all participants by Micha Rijkenberg.

For general information about Netherlands GEOTRACES contact by email to: Hein.de.Baar@nioz.nl
Figure 8: The completed West Atlantic Ocean transect of the Dutch GEOTRACES project.
Ultraclean titanium CTD system with 24 x 27 L PVDF samplers

The ultraclean CTD is placed in the clean room container facility

Coated stainless steel torpedo (FISH) for trace metal clean surface sampling

Trace metal clean sampling inside the clean room container

The NIOZ Kley France winch with A frame and 10 km trace metal clean kevlar cable for CTD deployment on the RRS James Cook

Deployment of the high volume 25 L CTD

Mono corer placed underneath the high volume 25L CTD for bottom sediment sampling

In situ pumps for collection of particulate matter
Figure 9: Equipment used during the three Dutch GEOTRACES cruises in the West Atlantic Ocean.

Figure 10: On the left clear blue surface seawater at 28°05′N and 67°30′W and on the right the green black surface seawater affected by Amazon river outflow at 05°55′N and 46°25′W.

Figure 11: The silicate concentration for the whole West Atlantic Ocean transect.
New Zealand

In 2010/11 we have focussed on three main tasks: the final data analysis and write-up of papers from the GEOTRACES process voyage FeCycle II; preparations for our leg of the Brisbane to Lima GP13 zonal section; ongoing aerosol dust sampling from both ships-of-opportunity and a land-based site in the Pacific. Other broader activities have included liaising (along with Dr. Carol Robinson) with three labs involved in the fledgling bioGEOTRACES component of GEOTRACES, and participating in GEOTRACES-related workshops on nutrient limitation (IGBP) and molecular biology (OCB).

The FeCycle II process study yielded a suite of interesting insights into patterns of biological uptake and recycling of iron in high iron waters, that are now being compared with those from FeCycle I (also a quasi-lagrangian biogeochemical budgetary study but in low iron waters) in a series of manuscripts to be submitted for publication in late 2011. We have been working closely with the Australians to ensure that we have two successful legs on GP13. This has involved loaning of equipment such as TM rosettes and pumps to ensure that each voyage will have back-up equipment etc. The New Zealand voyage will set sail on June 6 for 24 days, and we will rendez-vous with the Australian vessel in Auckland on June 5th. As in previous years we have continued our aerosol dust sampling programme between Japan and New Zealand. The data from the first three years of this study are being written up in a comparative study with that of the Atlantic Meridional Transect dust sampling programme.

Relevant publications

Submitted by Philip Boyd.

Poland

Meetings
Cruise planning meeting (March 14-15 – SOPOT, Poland)
Participants: Jacek Beldowski, Martin Frank, Gideon Henderson, Johan Ingri, Jaromil Jakacki, Karl Kulinski, Janusz Pempkowiak (Tues only), Christa Pohl, Don Porcelli, Beata Szymczycha, Michael Staubwasser

Meeting included an outline of GEOTRACES goals and activities, and planning of Baltic GEOTRACERS cruise in November

Cruises
Planned cruise on the Polish RV Oceania in the Baltic for the period November 3-13. Three main scientific targets were discussed at the meeting as foci for the cruise:
1. Trace element and isotope (TEI) impact of the reducing conditions in the deep basins of the Baltic
2. TEI fluxes from marginal Baltic basins (e.g. Bothnia Gulf) and chemistry on mixing
3. TEI fluxes out of the Baltic to the Atlantic
Scientists from 6 institutions from UK, Germany, Sweden and Poland will perform the research. Cruise track includes 10 major stations and a number of minor stations for the monitoring of physical parameters variability between stations. Cruise track is presented in Figure 12.

![Figure 12. Cruise track and sampling stations location](image)

New results
Pilot study was performed in Gdansk Deep and Gotland Deep area, based on samples collected in 2009-2010. Results included dissolved and particulate metals concentration, chlorophyll concentration and DOC/POC levels. Results are now being compiled into the database and will be a subject of statistical interpretation.

Publications
South Africa

The new kid on the block
Report prepared by Prof AN Roychoudhury
Stellenbosch University, South Africa

Model drawing of the new South African polar research ship being built at STX Europe shipyard in Finland

SOUTH AFRICA

Change is on the horizon; however, and the future looks bright. The reasons being the imminent delivery of a brand new polar ship, to be christened SA Agulhas II, in April 2012 and a promise of large financial investment by the government on global environmental change science.

Unlike its predecessor, the second-generation polar ship is made to accommodate cargo, passengers and state of the art science laboratories. Other than the typical wet and dry laboratories found on a research vessel, Geotraces related activities on SA Agulhas II would get an immense boost by the presence of multiple isotope and metal free container clean labs. Specialized Seabird titanium CTD rosette on a 6500 m Kevlar line and a “fish” for continuous underway collection of surface water samples, while the ship steams ahead, would make up the water sampling facilities for trace substances. The ship would also come equipped with a piston corer for sediment sampling.

Activities of interest

In 2010, South Africa has taken definite steps to enhance Geotraces related research. Much of the focus has been towards developing the capacity and research on iron in the Southern Ocean. The activities include modeling of iron cycling by Dr A. Tagliabue (CSIR) and set-up of FIA for measurement of nano- to picomolar iron in ocean water. Dr Thato Mtshali of CSIR and Raimund Rentel, an MSc student are being trained on FIA in Prof Roychoudhury’s laboratory at Stellenbosch University. Once validated, FIA will be used to analyze water samples collected in 2010 on the Goodhope-SANAE-South Georgia line. All of this work will be conducted in a class 100 clean laboratory, equipped with class 10 Picotrace® laminar flow workstations, which is currently under construction at Stellenbosch University.
Fusing iron cycle models and observations

Global and regional ocean biogeochemistry models now routinely include iron and provide a means to test hypotheses and evaluate the importance of certain processes or parameters. Since arriving in Cape Town in November 2010, Alessandro Tagliabue is involved in employing these models in conjunction with in-situ observations and laboratory cultures to address these issues.

As part of a continuing collaboration with Dr. Christoph Völker of the AWI in Germany, we this year published a paper detailing a cost-effective method of modeling complex iron speciation and cycling in large-scale ocean models and use this model to explore the response of iron speciation and bioavailability to future ocean climate change and acidification (Tagliabue and Völker, 2011).

Such predictions rest on experimental evidence garnered from in situ experiments and laboratory cultures. Over the next year, in collaboration with local and international colleagues, we will gain insight into the iron demand of specific Southern Ocean phytoplankton, as a function of environmental variability, as well as documenting and understanding the liability of colloidal iron species.

Iron nano-particles in open ocean waters

Bjorn von der Heyden, a PhD student of Prof Roychoudhury at Stellenbosch University is investigating the speciation of iron nano-particles in open ocean waters. In 2010, he was fortunate to be able to participate in Geotraces Cruise D357 where he was able to collect depth and surface water samples for dissolved and particulate iron in South Atlantic. In the process he was trained in shipboard clean sampling techniques.

With an in-house developed technique and using the Molecular Environmental Sciences (MES) beamline 11.0.2 at the Advanced Light Source, Lawrence Berkeley National Laboratory, Bjorn was able to identify and show a wide spatial variation in speciation of iron in the water column. These results have major implications on dissolution kinetics and bioavailability of iron.
Spain

- National committee (under SCOR-Spain)
  - P. Masqué & J. Garcia-Orellana (Barcelona-UAB)
  - A. Tovar-Sanchez (Mallorca-CSIC)
  - A. Cobelo & R. Prego (Vigo-CSIC)

- Universitat Autònoma de Barcelona (UAB) contributing 10 k€/y (2 years) to IPO

- Co-organisation and several participants at the GEOTRACES Mediterranean Workshop, Nice, October 2010

- Co-organisation and several participants at the 43rd International Liege Colloquium on Ocean Dynamics (Tracers of physical and biogeochemical processes, past changes and ongoing anthropogenic impacts), Liège (Belgium), May 2011

- Chairing a session and several contributions to GEOTRACES-related sessions at the ASLO Aquatic Science Meeting, Puerto Rico, February 2010

- Co-organisation of the 3rd GEOTRACES Data-Model Synergy Workshop to be held at Universitat Autònoma de Barcelona (Spain) in November 2011.

- Participation in several intercalibration activities (metals and radionuclides)

- Participation in EU funded COST Action ES0801

- Participation in GEOTRACES expeditions in the Atlantic Ocean:
  - German RV Meteor GEOTRACES M81/1 (PI: M. Frank, 2010)
  - The Netherlands RV Pelagia cruises 64PE319 and 64PE321 (Pls: H. De Baar, L. Gerringa, M. Rijkenberg, 2010)

Sweden

The Swedish GEOTRACES activities during 2010 comprise four major themes: i) proposal and planning activities for a GEOTRACES project in the Arctic; ii) Participation in intercalibration efforts; iii) Participation in COST action ES0801; iv) GEOTRACES related activities in other projects/cruises.

Planning work related to GEOTRACES

Building upon the outcome of the Delmenhorst Arctic planning workshop a proposal has been submitted to the Swedish research council (VR) with the aim to use the icebreaker Oden as a research vessel for a GEOTRACES cruise in the Arctic Ocean (PI Per Andersson). The proposal was graded excellent and adopted for initial planning by Swedish Polar Research Secretariat (SPRS). The proposal includes international collaboration and the time frame for the proposed cruise is by the end of the coming 5 year period.

Participation and presentation (Per Andersson) of the Swedish Arctic GEOTRACES plans at the US GEOTRACES Arctic Workshop, 29 Sept. to 1 Oct., 2010, at NSF headquarters in Washington DC.

Robert Anderson was invited by the Royal Swedish Academy of Sciences (KVA) for a lecture in Nov. 2010. During his visit a presentation of GEOTRACES and the Swedish Arctic plans was
made for the KVA geoscience class. Also a meeting between Bob A., SPRS and Per Andersson was undertaken where possible collaboration US-Swedish collaboration was discussed.

**COST action ES 0801**
Within the COST action the ocean chemistry of bioactive trace elements and paleoclimate proxies Swedish scientist are participating in the following during 2010:

- The test and training cruise organised by Dutch researcher on *R/V Pelagia* from Texel to Iceland 22 to 28 April, 2010. Unfortunately the trip was cancelled due to the Icelandic volcanic ash over European air space.
- Swedish participation (Johan Ingri) in planning workshop during 2011 for planning Baltic Sea cruises

**GEOTRACES intercalibration work**
Swedish laboratories participated in the intercalibration effort of Nd, Th and Si isotopes and some trace elements. Results have been reported to the coordinators for each element. Participation in the GEOTRACES intercalibration workshop at ODU Norfolk VA, 8 to 10 March 2010.

**Funding**
Some supporting funds for the GEOTRACES IPO have been secured and transferred to the IPO in Toulouse.

**GEOTRACES promotion activities within Sweden**
- Per Andersson rotated off the GEOTRACES SSC at the end of 2010 and David Turner, Gothenburgh University, is a new SSC member from 2011. Per and David met in March 2011 for a discussion about GEOTRACES.
- An e-mail list is kept and maintained by P Andersson for distribution of information about the GEOTRACES project among marine scientists in Sweden. This list is now transferred to David Turner.
- Presentations of the GEOTRACES project for the Swedish Geophysical Committee at KVA and the Swedish SCOR group meeting in March 2010.

**Cruises, projects and publications**
*Amundsen Sea Polynya International Research Expedition (ASPIRE).* A joint US-Swe expedition on icebreaker *Oden* and *R/V Palmer* during 2010/2011 with GEOTRACES related activities. Participation in TEI projects from Stockholm University (Kuria Ndungu) and Swedish Museum of Natural History (Per Andersson).

Presentations of results from the Amundsen Sea cruises at OSM in Portland Oregon, February 2010. Abstract of presentation:

West Atlantic Leg3. Preparation of sampling material for collection of Th isotopes at the cruise GEOTRACES West Atlantic leg 3 Punta Arenas (Chile) 02-03-2011 to Las Palmas (Spain) 06-03-2011.

The International Siberian Shelf Study 2008 (ISSS-08) During 2010 publications from the GEOTRACES related cruise have been finalised for publication. A special volume of Biogeosciences Discussions for ISSS-08 results is in preparation. Selected references from ISSS-08 include:


Climate warming in Siberian Permafrost Regions; tracing the delivery of carbon and trace metals to the Arctic Ocean. This project (PI’s P Andersson and D Porcelli, Oxford) was funded by the VR as a three year project (2011-2013) and includes a field study in the Lena River Basin planned to take place during 2012. The main aim is to study a large basin dominated by permafrost and the impact of changing temperatures on the delivery of TEI to the Arctic Ocean.

Submitted by Per Andersson.

Taiwan
Taiwan had an active year for GEOTRACES-related activities in 2010. We held 2010 GEOTRACES Asia Planning Workshop in October in Taipei and held 2010 Western Pacific Geophysics Meeting, including a GEOTRACES session. Three scientific cruises were carried out to study trace metal sources and distribution in the water columns of the two major marginal seas, including a July cruise in the East China Sea and a summer (July) and a winter (December) cruises on the continental shelf of the northern South China Sea (Figure 13 and 14). In addition, Taiwan has been building a 2,700 ton new R/V, which is expected to be launched in 2012 and is able to equip trace metal clean sampling facility.

Personally, Prof. C.-A. Hu at Academia Sinica has been involved in Ra inter-calibration experiment in Asian region to study submarine groundwater discharge. The laboratories of Drs. D.-C. Lee and T.-Y. Ho at Academia Sinica have established double spike techniques for trace metal isotope composition analysis (including Cd, Zn, Fe, and Ni) in seawater and phytoplankton. In 2010, there were about 15 PIs who have been funded by Taiwanese National Science Council to carry out GEOTRACES related research. We have published about 20 papers in the GEOTRACES related topics in 2010. Some of the most GEOTRACES-related papers are
listed here. We have found that anthropogenic aerosols are major source for many trace metals in
the water column of the marginal seas (Ho et al. 2010) and are likely to be major trace metal
source in the western North Pacific Ocean as well (Figure 15).

**2010 GEOTRACES related publications in Taiwan**

Ho, T.-Y. *et al.* (2010) Trace metal cycling in the surface water of the South China Sea: Vertical

Ho, T.-Y. *et al.* (2010) Determination of trace metals in seawater by an automated flow injection
ion chromatograph pretreatment system with ICPMS. *Talanta* 82: 1478-1484.

Hsu, S.-C. *et al.* (2010) Sources, solubility, and dry deposition of aerosol trace elements over the

Hsu, S.-C. *et al.* (2010) Effects of acidic processing, transport history, and dust and sea salt
loadings on the dissolution of iron from Asian dust. *Journal of Geophysical Research*

Hung, C.-C. *et al.* (2010) POC/234Th ratios in particles collected in sediment traps in the northern
South China Sea. *Estuarine, Coastal and Shelf Science* 88, 303-301.

from the upper oligotrophic ocean in the Gulf of Mexico and the East China Sea. *Marine
Chemistry* 121, 132-144.

Lin, I.-T. *et al.* (2010) Deep submarine groundwater discharge indicated by tracers of oxygen,
strontium isotopes and barium content in the Pingtung coastal zone, southern Taiwan.


determine gaseous elemental mercury over the northern South China Sea. *Journal of
Analytical Atomic Spectrometry* 25, 526-533.

Wei, C.-L. *et al.* (2010) Scavenging phenomenon elucidated from 234Th/238U disequilibrium in
the surface water of the Taiwan Strait. *Terrestrial, Atmospheric and Oceanic Sciences* 21,
713-726.

Submitted by Tung-Yuan Ho, Research Center for Environmental Changes, Academia Sinica,
Taipei, Taiwan.
Figure 13. The distribution of some dissolved trace metals in the East China Sea in July in 2010 (Liu and Ho, unpublished data). Trace metals analyzed include: Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd and Pb. The concentrations shown in the up-right panel are surface concentrations. The sampling stations (up-left panel) are separated to 7 transects, A, B, C, D, E, F, and G.
Figure 14. Seasonal variability of some dissolved trace metal distribution in the water column of the continental shelf of the northern South China Sea. The sampling sites are shown as the red circles in the map of the up-left panel. The cruises were carried out in July (summer) and December (winter) in 2010. Trace metals analyzed include: Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd and Pb. (Ho et al. unpublished data).
Figure 15. Terrestrial aerosol sources to the western North Pacific and the marginal seas as observed by three-year (2002–2004) averaged total AOT (Aerosol Optical Thickness) data from the NASA MODIS sensor. A: anthropogenic aerosols from Eastern China; B: desert dust; C: biomass burning from Indo China. QuikSCAT ocean-surface wind vectors are overlaid. Major Chinese cities are annotated in stars. (I.-I. Lin, unpublished data)
UK

GEOTRACES activities in the UK have centred around three section cruises:

GA10: South Atlantic (Cape Town to Montevideo)
The RRS Discovery left Cape Town in October 2011 on this zonal section cruise. The cruise was led by Gideon Henderson (University of Oxford), and funded by a NERC consortium grant to ten UK institutes. It featured the full complement of GEOTRACES Key Parameters, to be measured over the full water column. Major science questions in this are:

i. What supplies the micronutrients to support the band of high productivity at 40°S
ii. What processes set the micronutrient concentration of AAIW and NADW before they upwell to the surface to the north and south of the section respectively
iii. What are the controls on key paleoproxies including Pa/Th and $\delta^{30}$Si in seawater and surface sediments.

Sadly a required medical emergency approximately one third the way across the Atlantic prevented the cruise from meeting its full set of objectives. Remaining ship time was used to accomplish repeat stations and high density sampling of the eastern third of the proposed section.

Following this incomplete cruise, NERC have generously provided additional funding and ship time to enable completion of the initial objectives. The rescheduled cruise will depart Port Elisabeth on 24th Dec 2011 on the RRS James Cook, heading for Montevideo on 27th January 2012.
GA06: Tropical Atlantic
The RRS Discovery sailed in February 2011 on a trajectory that ran perpendicular to the African coast to assess marginal fluxes from redox zones, and then on a broadly southward trajectory to cross the Saharan dust plume. The cruise was led by Eric Achterberg (University of Southampton) and funded by a NERC standard grant. The major scientific focus was on assessing the relative sizes of Fe fluxes in this region from sediments, dust, and upwelling, and to understand the relationship between Fe supply and nitrogen fixation. The cruise experienced initial delay due to engine problems, but made up time during the cruise and completed its sampling objectives. Samples were collected for the full range of GEOTRACES Key Parameters, and over the full water column.

N08: Greenland-Iceland-Norway Seas
The next UK target section broadly follows the N08 section proposed during the Arctic workshop in June 2009. A proposal is being prepared, led by Carol Robinson (University of East Anglia) with Co-Is Maeve Lohan (University of Plymouth) and Eric Achterberg (University of Southampton). This will be submitted for a July 1st deadline and, if successful, will lead to a cruise in 2013 or 2014. The scientific goal of the cruise will be to link nutrient and trace metal distributions to the distribution and activity of phytoplankton and bacteria in the GIN Seas.

In other activities, the UK continues to host the GEOTRACES Data Assembly Centre at Liverpool, employing Ed Mawji to oversee UK and International GEOTRACES data. GEOTRACES has been represented at a number of UK meetings, and there have been meetings dedicated to each of the three cruises. UK scientists also play an active role in COST activities, and will take part in the forthcoming Baltic GEOTRACES Section led by the Polish.

Further details about UK GEOTRACES activities can be found at http://www.ukgeotraces.com/

USA
Principal activities of the U.S. GEOTRACES program include:

1) Implementation of a North Atlantic zonal section,
2) Preparation for a Pacific section between Peru and Tahiti, and
3) Long-range planning for work in the Arctic Ocean

Cruises
North Atlantic  The RV Knorr (KN199-4) sailed from Lisbon Portugal on 15 October 2010 to carry out the first U.S. GEOTRACES section cruise. The planned cruise track (Figure 17) headed south to the Mauritanian upwelling system, and then west-northwest towards Woods Hole. The cruise was terminated prematurely on 4 November due to mechanical problems with the ship. Science personnel disembarked in the Cape Verde Islands to return to their home institutions. One third of the total number of planned stations was completed successfully before the cruise was terminated.
Scientific objectives of the cruise included:

1) Characterize the trace element and isotope (TEI) distribution in Mediterranean Outflow waters,
2) Provide a measure of interannual variability in the upper water column by reoccupying a portion of the CLIVAR A16 section (20°W) that had been sampled previously for selected TEIs,
3) Define the distributions of micronutrients in the highly productive eastern boundary current upwelling system,
4) Quantify sources of TEIs from Saharan aerosols,
5) Identify TEI sources and sinks associated with the oxygen minimum zone,
6) Compare and contrast TEI distributions in the well ventilated western basin vs. the less well ventilated eastern basin of the North Atlantic,
7) Compare and contrast TEI distributions, sources and sinks on the western (wide continental shelves) and eastern (narrow continental shelves) margins, and
8) Evaluate fluxes of TEIs carried by western boundary currents.

Following the unfortunate termination of the cruise the US NSF authorized ship time in late 2011 to complete the section, as well as funds to cover the added cost of demobilization of the
terminated cruise and remobilization for the completion of the section. The US GEOTRACES SSC coordinated the planning and re-budgeting for the completion of the section.

_Eastern Tropical Pacific_ The second major section planned by US GEOTRACES is a zonal section in the eastern tropical Pacific roughly between Peru and Tahiti (Figure 18).

Figure 18. Tentative locations of full depth stations planned for the U.S. eastern tropical south Pacific zonal section. Shallow stations to 1000 m are not shown. The cruise is planned for late 2013. Map and productivity calculations courtesy of M-E Carr.

The principal scientific objectives of this section are:

1) Characterize the distributions of micronutrients in the highly productive eastern boundary current upwelling system,
2) Compare and contrast TEI distributions between the biologically productive eastern end of the section and the oligotrophic western portion of the section,
3) Quantify sources and sinks of TEIs associated with hydrothermal systems of the East Pacific Rise,
4) Quantify TEI sources and sinks associated with the oxygen minimum zone.

Implementation of the Pacific cruise has been delayed by approximately one year by the disruption and delay in completion of the North Atlantic section. Target dates for the Pacific section are now late 2013.
New funding
Two proposals were submitted to the U.S. NSF in February 2011: 1) a management proposal for the Pacific section described above, which will secure ship time and support the cost of operating the clean sampling system and other cruise logistics, and 2) a proposal for three years of continuing support of the US GEOTRACES project office. A formal decision on funding of these proposals is anticipated soon.

New results
Preliminary results from the North Atlantic cruise were presented and discussed at a workshop in March (see below). Investigators are making good progress in analyzing samples and interpreting results, but none of the preliminary results are in yet in a state to present here.

Meetings
US GEOTRACES sponsored two large workshops during the past year.

An Arctic planning workshop held at the US NSF (29 September - 1 October, 2010) was attended by approximately 40 US investigators as well as by several key international partners. The workshop defined the rationale for a US GEOTRACES Arctic research program and identified options for international collaboration to secure access to this remote and logistically challenging region. A report from the workshop is posted on the US GEOTRACES web site <http://www.usgeotraces.org/documents/arcticDOC/ArcticWorkshopRpt.pdf>.

A follow-up meeting was held at NSF on 1 June that included David Kadko (Chair US GEOTRACES Arctic planning committee), Bob Anderson (Chair US GEOTRACES SSC), Don Rice (representing NSF Ocean Sciences) and Bill Wiseman and Hedy Edmonds (representing NSF Polar Programs). The principal outcome of this meeting was the decision that Kadko and Anderson will approach the US GEOTRACES SSC with a proposal to defer the third planned US GEOTRACES section (Alaska to Tahiti) and insert an Arctic GEOTRACES expedition into the decadal timeline of US GEOTRACES activities. This proposal will be reviewed when the SSC meets on 15 September 2011.

A second workshop was held 7-9 March 2011 (Old Dominion University) to plan the logistics for completion of the US GEOTRACES North Atlantic section. Logistics were particularly complicated because the vessel assigned to complete the section was changed twice before a firm plan was in place. Lessons learned during the first North Atlantic cruise were used to generate a revised station plan and cruise schedule for the remainder of the section. These lessons produced both changes to station schedules to allow for more efficient operation of the sampling systems and changes to the sampling plan to allow certain features in the water column at intermediate depths to be sampled with greater resolution.

This workshop also provided a venue for scientists to see preliminary results from their colleagues and discuss implications for interpretation of the overall data set.
Publications (GEOTRACES and GEOTRACES-related*)


Web site
The Web site hosted by the U.S. GEOTRACES project office at the Lamont-Doherty Earth Observatory has been revised. Information about international GEOTRACES activities has been removed, and transferred to the web site hosted by the IPO <www.geotraces.org>. The US GEOTRACES web site <www.usgeotraces.org> now presents information about US GEOTRACES activities as well as links to the Web sites managed by the IPO and the DMO.

Submitted by Bob Anderson.
3.4 Surface Ocean–Lower Atmosphere Study (SOLAS) (joint with IGBP, WCRP, and CACGP)

Terms of Reference:

- To develop the Surface Ocean - Lower Atmosphere Study (SOLAS) Science Plan and an Implementation Strategy, in accordance with guidance of the sponsoring organisations.
- To oversee the development of SOLAS in accordance with its Science Plan/Implementation Strategy.
- To collaborate, as appropriate, with other related projects of IGBP, WCRP, SCOR and CACGP and related projects and programmes (e.g., IHDP, DIVERSITAS, IOC and the Global Ocean Observing System (GOOS), etc.)
- To establish appropriate data management policies to ensure access to, sharing of, and preservation of SOLAS data, taking into account policies of the sponsors.
- To report regularly to SCOR, IGBP, WCRP and CACGP on the state of planning and accomplishments of SOLAS.
- The SOLAS SSC, its subsidiary groups and International Project Office shall operate in accordance with the operating procedures for IGBP Projects and as required by other co-sponsors.

Chair:
Eric Saltzman
Department of Earth System Science
University of California, Irvine
Phone: +1-949-285-2111
esaltzma@uci.edu

Members:

<table>
<thead>
<tr>
<th>Isabel Cacho Lascoorz</th>
<th>SPAIN</th>
<th>Lisa Miller</th>
<th>USA</th>
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<tr>
<td>Minhan Dai</td>
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<td>Yukihiro Nojiri</td>
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<td>RUSSIA</td>
<td>Roland Von Glasow</td>
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<td>Cliff Law</td>
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Executive Committee Reporter: Ilana Wainer
IGBP Liaison: Wendy Broadgate
Executive Officer: Emily Breviere
Annual Report from SOLAS to SCOR.

Reporting period: June 2010 - June 2011
Version of 17 June 2011 by Dr Emilie Breviere

SOLAS International Project Office, Kiel and Node Office, Norwich

Since April 2010, the SOLAS IPO is hosted at the Leibniz-Institut für Meereswissenschaften (IFM-GEOMAR) in Kiel, Germany, where the SOLAS Chair, Doug Wallace is located. The Executive Officer, Dr. Emilie Brévière moved to IFM-GEOMAR. The IPO is supported until January 2013 by the German Ministry of Education and Research (BMBF) and IFM-GEOMAR. A SOLAS Node office remains at UEA, UK, where the Project Officer (PO), Kath Mortimer, appointed in May 2010, is assisting the IPO. The UK NERC will financially support this Node Office until October 2011, the node will remain open until March 2011 and Kath employed until March 2011 too. In mid-October 2010, an additional PO position in the IPO, Kiel was filled by Dr. Stephanie Kastner. End of January 2011, she terminated her contract. Her replacement, Stefan Kontradowitz took over mid February.

SOLAS Scientific Steering Committee

Plans were underway to hold the 10th SSC meeting in Tsukuba, Japan on the 15-17 March 2011, however following the events of the 11 March in Japan, the decision was taken to cancelled the meeting.

Therefore the SOLAS SSC met in IFM-GEOMAR, Kiel, Germany, 24-26 May 2011 for its 10th SSC meeting.

The current membership of the SSC is listed below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Country</th>
<th>Expertise</th>
<th>Term</th>
<th>Term ends</th>
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<tr>
<td>Isabel Cacho Lasconz</td>
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<td>Spain</td>
<td>Paleoeceanography</td>
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<td>Russia</td>
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<td>Doug Wallace</td>
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<td>Marine Photochemistry</td>
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<td>Brian Ward (WCRP)</td>
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<td>2013</td>
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<td>Germany</td>
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<td>Diego Gaiero</td>
<td>M</td>
<td>Argentina</td>
<td>Aerosol chemical composition / deposition</td>
<td>1</td>
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</tbody>
</table>
In December 2011:

- Isabel Cacho Lascorz, Sergey Gulev and Douglas Wallace (Chair) will rotate off the SOLAS SSC.
- Minhan Dai, Rafel Simo, Trish Quinn and Cecile Guieu will end their first term on the SOLAS SSC and will be nominated for a 2nd term.

In April 2010, a search team to identify the future SOLAS Chair was set up. Roland von Glasow volunteered to lead the effort assisted by Emilie Breviere. In April 2011, SOLAS submitted its nomination to the four SOLAS sponsors, which officially agreed in May 2011 to appoint Eric Saltzman to serve as Chair from summer 2011. SOLAS nominated Veronique Garcon as vice Chair of SOLAS.

**SOLAS National Networks**

Twenty-eight nations are part of the SOLAS network. Each has a representative and/or a coordinator (see list below). The country and name underlined are changes which took place during the reporting time.

**Australia:** Sarah Lawson and Andrew Bowie  
**Belgium:** Christian Lancelot  
**Brazil:** Amauri Pereira de Oliveira  
**Canada:** Maurice Levasseur  
**Chile:** Giovanni Daneri, asked to rotate off  
**China:** Minhan Dai  
**Denmark:** Lise Lotte Soerensen and Mikael Sejr  
**France:** Remi Losno  
**Germany:** Hermann Bange and Ulrich Platt  
**India:** Dileep Kumar  
**Ireland:** Brian Ward  
**Italy:** Maurizio Ribera d’Alcala, asked to rotate off  
**Finland:** Gerrit de Leeuw  

**Japan:** Mitsuo Uematsu  
**Korea:** Kitack Lee  
**Mexico:** Jose Martin Hernandez Ayon  
**Netherlands:** Jacqueline Stefels  
**New Zealand:** Cliff Law  
**Norway:** Abdirahman Omar  
**Peru:** Michelle Graco  
**Russia:** Sergey Gulev  
**Spain:** Rafel Simo  
**Southern Africa:** Carl Palmer  
**Sweden:** Katarina Abrahamsson  
**Taiwan:** Gwo-Ching Gong  
**Turkey:** Baris Saglihoglu and Mustafa Koçak  
**UK:** Phil Williamson  
**USA:** Wade McGillis

Since Jan. 2009, the national representatives of the SOLAS nations have been asked to report annually about the SOLAS activities in their country. To facilitate the reporting effort, a template form is provided. In January 2011, 18 reports were received and posted on the SOLAS website. The information contained in the reports has been a great source of information for the IPO to report to sponsors but also to facilitate the coordination job and to redistribute the results and progress from some nations to the rest of the SOLAS community via the Newsletters and the Web site. All the reports received during the reporting period are available on the Web site for
Development of the SOLAS Mid-term strategy

The goals and priorities over the next years for SOLAS are to keep developing the SOLAS Mid-Term Strategy. The overall approach for implementation of the Mid-Term Strategy is to use SOLAS resources (e.g. travel funds, meeting support, newsletters, web-page, outreach activities) to:

- Highlight/advertise/define/refine the topics and their associated scientific questions. White papers were written in the last year and are available on the SOLAS website at www.solas-int.org/mts
- Identify groups of investigators worldwide that are capable of tackling the topics;
- Motivate these groups to coordinate their proposal writing and link their experimental/modelling activities at the international level
- Plan and conduct the research with a view to facilitating data and idea exchange that will permit an international, comprehensive synthesis. This might include design of common experiments to be conducted in different geographical regions, jointly planned field programmes, student exchanges between groups, intercalibrations and data exchanges, workshops, etc.

Each theme is at a different stage in its implementation but clearly there is a major amount of scientific activity ongoing and planned:

• Sea-ice biogeochemistry and interactions with the atmosphere
  Two consulting meetings took place to probe the international interest for the establishment of a sea-ice biogeochemistry network (At the IGS-Symposium on Sea Ice Dynamics in Tromsø, June 2010 and at the OASIS-side meeting at the IPY-Conference in Oslo, June 2010). The community showed a strong interest and they started to shape a workshop to take place about a year later. In April 2011, an international workshop supported by the COST Action 735 took place in Amsterdam. The workshop brought together 23 participants ice modellers and experimentalists. The goal was to find gaps in sea ice biogeochemistry knowledge and find common interests for collaborative research. It was identified that there is a need for a thorough evaluation of currents methods (review paper), which should be followed by a large intercomparison exercise, in order to arrive at a comprehensive manual on preferred methods. Future plans are to continue collaboration, seeking funding for it via SCOR (a WG proposal was submitted to SCOR in April 2011), COST, ESF…, keep strengthening bonds with OASIS (invitation for Telluride Meeting, 20-24 June 2011), establish a website to facilitate data exchange, provide a discussion platform and share general information.

• Atmospheric control of nutrient cycling and production in the surface ocean
  SOLAS took part to the GEOTRACES Mediterranean planning workshop, 6-8 October 2010, Nice that enhanced the SOLAS-GEOTRACES cooperation in the Mediterranean Sea. In
November 2010 took place the IGBP/SCOR Fast Track Initiative on ‘Upper Ocean Nutrient limitation: Processes, patterns and potential for changes’ coordinated by Mark Moore and Matt Mills (Full report in the SOLAS News Issue 12). A review article in Science is in prep. Then in Dec. 2010 followed the workshop on ‘Atmospheric versus land based controls of nutrient cycling and production in the surface: from fieldwork to modelling’ in Istanbul coordinated by Cecile Guieu and Baris Salihoglu sponsored by COST Action 735 (Full report in the SOLAS News Issue 12). In February 2011, a SOLAS session was devoted to the theme in the ASLO, Puerto Rico. On 29-30 June 2011, a meeting SOLAS/IGAC France is scheduled to take place in Paris, with a session in the preview program on the MTS theme. A large section of a chapter 4. Ocean-Atmosphere interactions of particles from the COST Action 735 book in prep. (cf COST Action 735 section) is focusing on some aspect of the MTS theme; the lead authors are Cecile Guieu and Gerrit de Leeuw. A session entitled ‘Atmospheric deposition impacts on biogeochemical cycling in the surface ocean: natural and anthropogenic disturbance’ was proposed to the conference ‘Planet under pressure’, London, March 2012.

- **Air-sea gas fluxes at Eastern Boundary upwelling systems**
  The workshop on ‘air-sea gas fluxes at Eastern Boundary Upwelling and Oxygen Minimum Zones (OMZs) systems’ took place in Lima, Peru, 8-10 Nov 2010, with about 50 attendees and sponsored by 7 bodies. Major outcomes are 1) to coordinate an international effort at sea and science flights with planned experiments from 2011 to 2015, set up section series and time-series stations and 2) creation of a SOLAS Peru network (Full report in the SOLAS News Issue 12). A EUR-OCEANS conference ‘Ocean deoxygenation and implications for marine biogeochemical cycles and ecosystems’ will take place in Toulouse, 24-26 October 2011, with 28 invited speakers, 86 participants (http://www.eur-oceans.net/conf-oxygen). There will be another day of meeting after the conference for keeping moving forward the planning started in Peru.

  Christoph Garbe and Veronique Garcon replied to a call ESA/SOLAS Oceanflux, the answer should be known by autumn 2011. Also, under EUR-OCEANS flagship, a 2-year post-doctoral fellow was selected (Ivonne Montes) to start working in Sept 2011 between Toulouse, Lima and Kiel on the theme. Regarding this theme, the structure is in place, the experimental part needs to be set up now.

- **SOLAS Observatory and MOIN: the Minimalist OceanSITES Interdisciplinary Network**
  An update summary was published in the SOLAS News Issue 11.

- **Ship plumes: impacts on atmospheric chemistry climate and nutrient supply to the oceans**
  Roland von Glasow, co-ordinator of this theme, in attempt to better engage the oceanographic community proposed to co-lead with Adina Paytan, a session at the European Geosciences Union General Assembly 2011, Vienna, Austria, however they did not receive abstract from the ocean community.

  The SOLAS News Issue 11 (Sept 2010) focuses on the SOLAS Mid-Term Strategy. It contains scientific articles relating to many of the strategy themes as well as an overview of the strategy
itself (historic, description, implementation strategy). The SOLAS News Issue 12 (Jan 2011), provide an update on the workshops and meetings that were held in 2010. The SOLAS News Issue 13 (Aug 2011) will focus on providing updates to the SOLAS community on the SOLAS Mid-Term Strategy.

**SOLAS Open Science Conference 2012**

Two locations were investigated to host the SOLAS Open Science Conference in 2012: the Suncadia Resort in Washington State, 150km away from Seattle and Ensenada in Baja California, Mexico. The choice was difficult but the votes went to having the OSC in US, near Seattle. The SOLAS OSC 2012 is scheduled to take place from 7 to 10 May 2012. The LOC is composed of Trish Quinn from PMEL and the Scientific Organizing Committee is composed of the SOLAS SSC members.

The Conference website is live at www.solas-int.org/osc2012. The first announcement was circulated in April 2011. It is plan to open the online registration in July 2011. Plans are still underway regarding the selection of invited speakers and logistics.

A request will be submitted to SCOR to sponsor scientists from developing countries to take part to the conference.

**International SOLAS Summer School 2011**

The 5th Summer School will take place in Cargèse, Corsica between the 29 August and 10 September 2011. All information about the SOLAS summer school may be found at http://www.solas-int.org/summerschool/.

Following the format of the previous four schools, the 2011 edition of the school will bring together 72 PhD students and early-career scientists from 24 countries and 17 world-leading international scientists, for a mix of lectures and practical workshops. This edition, 212 applications were received and 72 were selected and notified their acceptance in January 2011.

Following students and lecturers feedback from the school 2009, some changes were implemented while preparing the school 2011: the practical workshops are spread across the afternoons of the first week, some lecturers were changed, lectures were shortened when possible, the 1-min presentation were withdrawn from the program and there is no student presentation on the last day of the school. The detailed programme, practical contents and list of all lecturers are available on the SSS11 website http://www.solas-int.org/summerschool/.

The budget to run the school excluding all costs of students’ attendance is about 80,000Euros (room rental, equipment, cruise vessel, attendance expenses of all lecturers, hospitality, transports to and from airport and for practicals…). The students’ attendance costs around total 115,000Euros, the IPO developing and managing about 80,000Euros of this 115,000Euros too. The SSS organisers would like to thank the 50 sponsors that make the school possible.
‘Surface Ocean-Lower Atmosphere Processes’ textbook

The volume is designed to provide graduate students, postdoctoral fellows, and researchers from a wide range of academic backgrounds with a basis for understanding the nature of ocean-atmosphere interactions and the current research issues in this area. To order a copy visit http://www.agu.org/pubs/books/.


In 2010, copies of the SOLAP textbooks were sent to the libraries of nearly 40 institutions in developing countries and countries new to SOLAS relevant research so as many students and young researchers as possible could benefit from it. Copies were also distributed to some loyal regular sponsors of the SOLAS Summer School, acknowledging by this way their regular support.

COST Action 735

In late 2006, SOLAS was provided networking funds from the European Coordination in the field of Scientific and Technical Research office (COST) for a dedicated ‘Action’ 735 which seeks to develop global air-sea flux data sets of gases and aerosols. The IPO administers the networking funds.

Over the reporting period, the COST Action 735 has held one Management Committee meeting, in December 2010 in Istanbul, Turkey.

Listed below are the workshops that took place over the reporting period, which have facilitated coordinated efforts. Full reports are available to download at http://www.cost-735.org/meetings/meetings.html.

- Sub-WG3 meeting proposed by Alberto Borges on ‘Experimental, typological and modelling approaches to evaluate at global and regional scales horizontal and vertical fluxes from land to the open ocean through rivers, estuaries and the coastal ocean’. Oct 2010.
- Sub-WG1 meeting proposed by Peter Croot on ‘Trace metal speciation data in COST Actions 735 and 801: Current state of the art and towards the construction of a database’. Aug 2010.
- Sub-WG1&3 meeting proposed by Mark Moore on ‘Upper ocean nutrient limitation: Processes, patterns and potential for change’. (IGBP/SCOR FTI) 3-5 Nov 2010- financial contribution from COST.
- Sub-WG2&3 meeting proposed by Cecile Guieu on ‘Atmospheric versus land based controls of nutrient cycling and production in the surface ocean: from fieldwork to modelling’. Dec 2010.
• Sub-WG2&3 meeting proposed by Michael Cunliffe on ‘What is the sea surface microlayer? Towards a unified physical, chemical and biological definition of the air-ocean interface’. Jan 2011.
• Sub-WG1 meeting proposed by Jacqueline Stefels on ‘Sea-ice biogeochemistry and interactions with the atmosphere’. Apr 2011.
• Sub-WG 1,2&3 meeting ‘Cost Action 735 publication lead authors meeting, May 2011

In the COST Action 735 framework, a significant proportion of the funding is to be used to develop young research talent through the “Short Term Scientific Mission” mechanism (STSM). These missions provide resources for young talent to travel to a participating institution for the purpose of research coordination and development. 4 Missions have been accomplished in 2010. The list with details and reports is available at http://www.cost-735.org/science/STSM.html. Susana Flecha Saura (no 6897), Insituto de Ciencias Marinas de Andalusia (CSIC), Spain Sebastian Landwehr (no 7192), National University of Ireland, Galway Petri Vaattovaara (no 7462), University of Eastern Finland, Finland Jakub Kowalczyk (no 7856), Institytut Oceanologii PAN (IOPAS), Sopot, Poland Ru-Jin Huang (no 7680), National University of Ireland Galway, Ireland

Toward the ending of the COST Action 735
As the Action is drawing to a close (end October 2011), both a final action event and a publication to pull together the achievements of the Action are currently being planned.

The Action 735 final publication will be a book featuring 5 chapters covering the scope of the Action 735. Peter Liss, Action 735 chair, is the Editor. In order to progress, an initial planning meeting took place in May with the identified chapters lead authors. Another meeting is scheduled to the 28 Nov 2011 for the lead authors in Frascati, Italy. The Action 735 final event will be concurrent with the topical conference on ‘Earth Observation and Ocean-Atmosphere Interactions Science’ co-sponsored by ESA/SOLAS/EGU planned for December 2011 in Frascati, Italy. More info on this conference in a later section.

Fast Track Initiatives
In May 2009, IGBP launched two fast track initiatives (FTI) proposed by SOLAS and other IGBP core projects. Both FTIs were endorsed by SCOR.

1. SOLAS is coordinator of the IGBP/SCOR Fast Track Initiative on Upper Ocean Nutrient Limitation: processes, patterns and potential for change (2009-2011). The scientific coordinators are Mark Moore (NOCS, UK) and Matt Mills (Stanford Univ., USA). A workshop took place in Southampton, UK on 3-5 Nov. 2010 to address the FTI specific goals. The workshop was attended by 19 participants from 10 countries and four continents. A wide range of different disciplines were represented from microbiologists to paleo-oceanographers, reflecting the theme of the FTI cross-cutting IGBP projects including SOLAS, IMBER, AIMES and PAGES. Given the topics to be covered, several pre-workshop reports were prepared, with material on these presented during the first day of the workshop. Subsequent discussions were focused towards synthesising this material
alongside additional novel insights coming from the group. The participants continued to focus on four broad themes: (1) the concepts and definitions of nutrient limitation, (2) patterns of limitation in the modern ocean, including the development of a new database of prior published results, (3) expected changes in the future and finally (4) the potential implications of such changes. Overall the range and level of expertise facilitated a dynamic environment for stimulating and productive cross disciplinary discussions, which will hopefully be reflected in the quality of the outputs. The group are currently working towards the first of these, the submission of a major review to a high profile journal within the first half of 2011. Further details on the FTI and the workshop are available at http://ocean.stanford.edu/IGBP_FTI/. Workshop funded by IGBP, the U.S. Ocean Biogeochemistry Program, EU-COST 735 and SCOR. More info available at http://www.igbp.net/page.php?pid=503.

2. SOLAS is contributing to the IGBP/SCOR Fast Track Initiative on Megacities and the Coastal Zone: air-sea interactions (2009-2011). This initiative is coordinated by the IGAC IPO, Roland von Glasow (UEA, UK), Tim Jickells (UEA, UK), Tong Zhu (Peking University, China), Ramesh Ramachandran (Institute for Ocean Management, India) and Josef Pacyna (Norwegian Institute for Air Research, Norway). 3 IGBP core projects are contributing to this FTI: LOICZ, IGAC and SOLAS. A workshop took place in Norwich, UK, 13-15 April 2010 to address the FTI specific goals. The 15 participants had very lively and productive discussions and agreed on writing a brief overview/review paper for a high profile journal. This activity is led by Roland von Glasow. For more information read report in the SOLAS News Issue 11 or visit http://www.igbp.net/page.php?pid=509. In order to disseminate the result of the workshop, SOLAS agreed to financially support the attendance of Mits Ueamatsu to the 22nd Pacific Science Congress at Kuala Lumpur, Malaysia, 14-17 June 2011, and present the FTI result at the session “Coastal Zone Management under Rapid Urbanization”. A short report will be published in the SOLAS NL Issue 13, summer 2011.

Task teams:
The SOLAS task team: Asian Dust and Ocean EcoSystem (ADOES)
ADOES was officially acknowledged as a SOLAS Task Team in Jan 2010. SOLAS is encouraging ADOES to take a step forward in coordinating international activities related to Asian dust (See report 1 in SOLAS News 11). Over the past 12 months collaboration was established between SOLAS and IOC/WESTPAC through ADOES (See report 2 in SOLAS News 11). The 5th ADOES workshop took place in Nagasaki, Japan, 29 November–2 December 2010. The workshop goals were to improve the scientific understanding of the processes controlling the origin, transport, physicochemical nature, and effect of Asian dust on ocean biogeochemistry. Additionally, the meeting was intended to enhance regional cooperation among the ADOES group and with other similar SOLAS initiatives around the world. See report in the SOLAS News 12.
Update on the SOLAS/IGAC Task Team: Halogens in the Troposphere (HitT)
http://www.HitT-task.net/
Roland von Glasow led a session at the EGU General Assembly 2011, Vienna, Austria, 3-8 April 2011 and an AICI (Air-Ice Chemical Interactions) workshop took place in New York, on 6-7 June 2011, followed by Snow Chemistry Modeling workshop 8 June 2011.

**Endorsed projects:**
Over the reporting period, SOLAS received three requests for endorsement:

- SOAP-Surface Ocean Aerosol Production- NZ project
- MerMex-Marine Ecosystems Response in the Mediterranean Experiment–French project
- CARBOCHANGE- Changes in carbon uptake and emissions by oceans in a changing climate- EU FP7 large-scale integrating project

The endorsements are currently under process.

The endorsement submission forms and update when available of SOLAS endorsed projects are available on the SOLAS website. All the updates received during the reporting period are available in an Addendum to this report.

**SOLAS- IMBER Carbon Group**
Much of the science of SOLAS Focus 3 overlaps with IMBER and thus a joint SOLAS/IMBER Carbon Group (SIC) was formed during a meeting held in Colorado in Oct 2005. This group is working in close collaboration with the International Oceanic Carbon Coordination Project (IOCCP). The SIC group is currently subdivided into three working groups:

*WG1-Surface Ocean Systems*. Chair: Dorothee Bakker (UK) (since March 2011)
*WG2-Interior Ocean*. Chair: Nicolas Gruber (Switzerland)
*WG3-Ocean Acidification*. Chair: Jean-Pierre Gattuso (France)

The SOLAS News Issue 12 is focussing on the work of the SIC Group and featured an overview update article, reported below.

**WG1-Surface Ocean Systems : the Surface Ocean CO$_2$ Atlas (SOCAT)**
Dorothee Bakker from UK took over Nicolas Metzl, France in April 2011.
The main goal of the surface ocean working group (WG1) is to enable the community to estimate the ocean-atmosphere CO$_2$ flux globally and regionally with substantially higher accuracy than previously possible. The key current activity of WG1, to support this goal, is the collection and construction of an international sea surface pCO$_2$ data-base, called SOCAT (Surface Ocean Carbon ATlas, see www.socat.info/). Regional SOCAT meetings have been organised to progress on the data quality control (QC) and initial syntheses.
The QC effort has progressed well and the first release of SOCAT will take place at the SIC Synthesis meeting in Paris on 14 September 2011.

The SOCAT product will help the international carbon community on various topics: it will improve regional and global air-sea CO₂ flux estimates; it will permit an evaluation of pCO₂ changes and trends; it will offer new constraints for atmospheric and oceanic inverse methods and it will provide crucial data to evaluate ocean and climate models.

*WG2-Interior Ocean*

The membership of the SIC WG2 has been revised and there are now eight members. They will hold their first meeting in conjunction with the Synthesis meeting in Paris in September 2011. The group aims to provide a global synthesis of ocean interior carbon changes (oceanic uptake, transport and storage of anthropogenic CO₂). Since 2009, the focus has been the quality control and synthesis of interior carbon observations from the Repeat Hydrography Programme. This is being done basin-by-basin, examining the changes in oceanic storage of anthropogenic CO₂ through time. This estimation of the change in oceanic storage of anthropogenic CO₂ is fundamental to understanding the global carbon cycle. Another aim of the group is to establish an observing system for ocean biogeochemistry - Oxygen on Argo - by including oxygen, nitrate, chlorophyll and pH sensors on autonomous floats. A joint meeting was held with the Global Carbon Project in October 2010 in the context of their REgional Carbon Cycle Assessment and Processes (RECCAP) project, which aims to establish the mean carbon balance of large regions of the globe at the scale of continents and large ocean basins.

The SIC WG1 and WG2 and IOCCP are organizing a workshop ‘The Ocean Carbon Cycle at a Time of Change: Synthesis and Vulnerabilities’ at UNESCO, Paris from 14-16 September 2011. The goal is for new analyses and the global synthesis to be completed by early 2012, for inclusion in the IPCC AR5. A Special Issue will also be published on the science presented at the meeting. SOLAS, IMBER, IOCCP, Eur-OCEAN and SCOR are co-sponsoring the meeting.

*WG3-Ocean Acidification (SIOA)*

The main goal of the working group on Ocean Acidification (WG3) is to coordinate international research efforts in ocean acidification and undertake synthesis activities in ocean acidification at the international level. Considerable synthesis work has already been undertaken, much of it by members of the SIOA (e.g. Ocean Acidification edited by Jean-Pierre Gattuso and Lina Hansson to be published in September 2011 by Oxford University Press). One of the key current activities is the “SOLAS-IMBER ocean acidification coordinating program”, a package of activities which are critical to assess the effects of ocean acidification but are, for the most part, not funded at national or regional levels and must be carried out at the international level. Among them are the promotion of international experiments, the sharing of experimental platforms, and the undertaking of intercomparison exercises. The working group has realised that it does not have the time nor the human and financial resources to launch any of the activities that it has identified. Hence, it is considering establishing an “Ocean Acidification International Coordination Office (OA-ICO)”. Ways to achieve its implementation will be investigated in the coming months. A proposal for funding has been submitted to the IAEA.
An SIOA session proposal was submitted for the Planet Under Pressure conference in London in 2012.

Key joint goals and activities shared between the three working groups are the establishment and continuous support for ocean observing systems, and in particular the integration of the different observing elements into a coherent set of observations. To this end, several white papers and plans were developed in the context of the OceanObs ’09 conference (e.g. Monteiro et al., 2010; Gruber et al., 2010a, Hood et al., 2010, and Feely et al., 2010) and integrated into overarching frameworks by Gruber et al. (2010b) and Iglesias-Rodriguez et al. (2010). (Check the SOLAS News Issue 12 for the full references).

**SOLAS Project Integration**

**SOLAS Project Integration: Another 2 years of funding and a new project integrator**

Since November 2006, Tom Bell has been funded by the UK Natural Environment Research Council (NERC) on a Knowledge Transfer project within UK SOLAS. Tom was tasked with galvanising the international SOLAS community toward achieving large-scale synthesis of past and existing work. SOLAS Integration has been very successful, and projects have been developed to assemble surface ocean databases of DMS (DMS-GO), halocarbons (HalOcAt), methane and nitrous oxide (MEMENTO) and atmospheric measurements of aerosol iron over the Atlantic Ocean (IRONMAP). In 2010, funding has been secured for running the project for 2 more years and since November 2010, Shital Rohekar took over Tom’s position. As a Project Integrator, Shital will work towards achieving SOLAS’ key objectives of assembling datasets, largely in terms of quantitative estimates of air-sea fluxes of gases and particles. Initially, Shital will work with the aerosol community and focus on assembling the available aerosol/rain data. Some aerosol/rain data has already been submitted to define British Oceanographic Data Centre (BODC). Shital’s intention is to compile all the available data into a single database and link to this database through the SOLAS Integration website (http://www.bodc.ac.uk/solas_integration/). This could be of great importance to people who wish to compare their individual datasets or use it as input fields in their models.

**Other SOLAS activities:**

- **PICES 2010 Annual Meeting “North Pacific Ecosystems Today, and Challenges in Understanding and Forecasting Change”,** 22-31 October 1010, Portland, Oregon, U.S.A.
  This event was the occasion for SOLAS to strengthen the collaboration between SOLAS and PICES. SOLAS sponsored one speaker Huiwang Gao, to attend the session 2 entitled “Understanding the role of iron in regulating biogeochemical cycles and ecosystem structures in the North Pacific Ocean” and Emilie Brévière gave an overview talks of the existing areas of collaboration between SOLAS and PICES, and with other organisations and also on potential future areas of collaborations between SOLAS and PICES. Furthermore, PICES decided at this meeting to co-sponsor the 5th SOLAS Summer School. More info reported in the SOLAS News Issue 12 by Huiwang Gao (http://www.solas-int.org/news/newsletter/newsletter.html).

- **SOLAS/IMBER session at the European Geosciences General Assembly 2010**
  “Understanding biogeochemical-physical interactions (SOLAS/IMBER) and physical
oceanographic controls on marine species” - 2-7 May 2010 Vienna, Austria (see article in the SOLAS News Issue 11).

The OS3.1 SOLAS-IMBER special session on ‘Sensitivity of marine ecosystems and biogeochemical cycles to global change’ was held at the European Geosciences Union General Assembly 2011, 3-8 April 2011, Vienna, Austria. This session was convened by Baris Salihoglu, Christoph Garbe and Emilie Brévière. Key note speakers were Jean-Pierre Gattuso and John Plane. See article in the SOLAS News Issue 13.

**Strengthening of the collaboration with GEOTRACES**

SOLAS and GEOTRACES collaborated on the scientific planning of the following meetings.

- 2010 GEOTRACES Mediterranean Planning workshop 6-8 October 2010, Nice, France
- 2010 GEOTRACES Asia Planning workshop 4-6 October 2010, Taipei, Taiwan

See reports in SOLAS News 12.

**American Society of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting**, 13-18 February 2011, San Juan, Puerto Rico. Special sessions:
- S28: Biogeochemical, Ecological and Physical Dynamics of Eastern Boundary Upwelling Systems convened by Carol Robinson (IMBER SSC) and Veronique Garcon (SOLAS SSC)
- S49: Atmospheric Control of Nutrient Cycling and Production in the Surface Ocean convened by Cecile Guieu, Julie La Roche and Cliff Law

See article in the SOLAS News Issue 13.

**Workshop on “Sea Change: Charting the course for ecological and biogeochemical ocean time-series research”**

SOLAS financially supported 2 scientists to take part to the workshop on “Sea Change: Charting the course for ecological and biogeochemical ocean time-series research”, which took place on 21-23 September 2010 in Honolulu, Hawaii. In total, 65 participants attended the workshop representing five different countries and various time-series observatories. The main objective of the workshop was to gather members of the Ocean Carbon and Biogeochemistry (OCB) community to help define future research at the NSF-supported time-series sites (CARIACO, BATS and HOT). The workshop provided a synthesis of ongoing research at the US OCB time-series sites, summarised the knowledge gained on temporal variability and controls on key ecosystem processes and biogeochemical cycles though time-series research, highlighted capabilities at each of the time-series sites, and sought to promote community input in identifying priority directions and new opportunities for future research at the existing time-series sites. Yrene M. Astor from Venezuela and Carlos Ferreira Santos (Deputy Coordinator TENATSO) from Cape Verde, SOLAS-sponsored participants, wrote a report available in the SOLAS News Issue 12.
In 2010, the European Space Agency (ESA) decided to develop a thematic call in collaboration with the air-sea interaction community. The first meeting between ESA representatives Diego Fernandez and Graig Dolon and the SOLAS community took place at the SOLAS OSC in Barcelona in Nov 09. 3 or 4 themes thought to be key to an ESA/SOLAS collaboration a ‘leading group’ of 5-6 scientists were there identified. This group and ESA representatives met 30-31 March 2010, Toulouse, France. They identified and described in a 3-page document each, the following 4 scientific topics: (1) Sea spray aerosol production, (2) Sources and sinks of climatically-active gases in the Eastern Boundary Upwelling and Oxygen Minimum Zone (OMZ) systems, (3) Air-sea exchange of greenhouse gases using satellite data and (4) sea-ice biogeochemistry and interactions with the atmosphere. This meeting was sponsored by the COST Action 735. More info at http://www.solas-int.org/news/conferencemeetings/discesss.html.

During summer 2010, a call for 3 of the 4 topics above was issued; the topic on sea-ice biogeochemistry was unfortunately dropped. The call will be open to both public and private institutions and has opened in early Feb 2011. It closed in April 2011. The SOLAS community submitted one proposal to each of the ESA call.

In Sept, ESA approached SOLAS to assess our interest in organising a joint ESA-SOLAS conference on "EO for ocean atmosphere interactions science" to be hosted by ESA in Frascati, Italy in Fall 2011. Two new SOLAS SSC members Christoph Garbe and Brian Ward took the lead from the SOLAS side. The topical conference on ‘Earth Observation for ocean-atmosphere interactions science’ will take place on 29 Nov.- 2 Dec. 2011 in Italy. It will be co-sponsored by ESA, SOLAS, EGU and COST Action 735. 144 abstracts were received and are currently under review. Visit www.eo4oceanatmosphere.info.

SOLAS communication

- SOLAS website: http://www.solas-int.org/
  COST Action 735 website: http://www.cost-735.org/

- SOLASNews newsletter emailed to ~1700 scientists and airmailed to ~200 scientists mainly from developing countries. The NL is also available from the website. The SOLAS News is printed and airmailed from China. Since Issue 11, SOLAS also implemented an on screen reader pdf version, following a survey within the community this is a well-received improvement which the IPO will try to maintain in the future.
  - Issue 11 (Sept 2010), this issue focuses on the SOLAS Mid-Term Strategy and contains scientific articles relating to many of the strategy themes as well as an overview of the strategy itself. One will also find reports on recent conferences and meetings including COST Action 735 activities and reports from national SOLAS initiatives and partner projects.
Issue 12 (Jan 2011) This issue mainly featured the work of the SOLAS/IMBER Carbon Group (SIC) as well as updates on the SOLAS Mid-Term Strategy, COST Action-735 activities, recent conferences and meetings.

- A Scientific Summary for Policymakers on Ocean Fertilization, commissioned by the Intergovernmental Oceanographic Commission of UNESCO and prepared with the assistance of the SOLAS, is now available through online and in print. The Summary considers the practicalities, opportunities and threats associated with large-scale ocean fertilization. The Summary for Policymakers is available for download at: http://unesdoc.unesco.org/images/0019/001906/190674e.pdf.


SOLAS Funding
The nodal office in Norwich, UK will be operating until March 2011. As it is very unlikely that NERC renews its funding, there is no plan to submit a proposal. The IPO activities will be managed by the EO and PO in Kiel. Funding of the IPO in Kiel ends 9 months after the closure of the Node in Norwich, in January 2013. Renewal options are being investigated.