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September 2011 – October 2012

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SCOR Proceedings, Volume 47
REPORT OF THE 40th SCOR ECECUTIVE COMMITTEE MEETING

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40th SCOR EXECUTIVE COMMITTEE MEETING

Helsinki, Finland
12-15 September 2011

1.0 OPENING

1.1 Opening Remarks and Administrative Arrangements

Jorma Kuparinen welcomed meeting participants (see Appendix 2) to Helsinki and reviewed the agenda for the meeting and locations of the different events. Riitta Autio of the Finnish SCOR Committee also welcomed everyone to Helsinki.

Wolfgang Fennel requested a moment of silence for two individuals who were involved in past SCOR activities who had passed away since last year's meeting: Peter Niiler and Johan Lutjeharms.

1.2 Approval of the Agenda (Appendix 1)

Corina Brussaard requested that the Finance Committee report on Wednesday afternoon. Otherwise, the agenda was approved as presented before the meeting.

1.3 Report of the President of SCOR

Wolfgang Fennel, the SCOR President, briefly reviewed his activities for SCOR since the General Meeting in September 2010 in Toulouse, France. Fennel attended the ICES meeting in Nantes, France and the Census of Marine Life Finale in London (with Ed Urban). They met with representatives of The Challenger Society for Marine Science (UK) regarding the society's assumption of responsibility for UK SCOR representation. Fennel traveled to the PICES meeting in Portland, the ESSAS Open Science Meeting in Seattle, and the IOC General Assembly in Paris. The Challenger Society invited Fennel to give a presentation on 12 September (conflicting with the SCOR annual meeting), but John Field, a former SCOR President, agreed to represent SCOR instead.

1.4 Report of SCOR Executive Director

Ed Urban reported on his activities for SCOR since the 2010 SCOR meeting, and on the current condition of SCOR. He welcomed participants to the meeting and announced that Johan Rodhe would not be able to attend the meeting, so the Finance Committee would need another Nominated Member to fill in for Rodhe and work with Corina Brussaard and Marta Estrada. Urban presented the highlights of 2010 finances. He announced that the new phytoplankton pigments book would be available soon[1] and that there had been more than 400 citations to the original *Phytoplankton Pigment in Oceanography* book. Both books are still valid and useful. SCOR has copies of the original book at UNESCO that can be given away at no charge. The high cost of publications from SCOR activities is an ongoing problem and more groups are publishing in open-access journals where the information can be accessed more easily.

[1]See www.cambridge.org/phytoplankton.

1.5 Appointment of an *ad hoc* Finance Committee

The SCOR Constitution requires that a Finance Committee be appointed at every SCOR meeting. It must consist of three members of SCOR who are not members of the Executive Committee. The Executive Committee approved Corina Brussaard (Netherlands), Marta Estrada (Spain), and Johan Rodhe (Sweden) as the three members. Unfortunately, Johan Rodhe had to cancel his participation in the meeting, so Wolfgang Fennel announced that Robie MacDonald (Canada) volunteered to fill the vacant position. The Finance Committee reviews the administration of SCOR finances during the previous fiscal year and the current year, and will propose a budget for 2012 activities. Fennel also thanked the committee members for their willingness to serve and reviewed the duties of the Finance Committee.

1.6 2012 Elections for SCOR Officers

The SCOR President and all three Vice-President positions are open for nominations for the 2012 elections. Bjørn Sundby, as Past President, is responsible to chair the Nominating Committee. Sundby reported that the procedure for the Nominating Committee requires at least 3 members, but the recent practice has been to appoint 4 members, to improve various balance factors in the committee. Sundby added that the actual process is outlined in the meeting book. (It can be found on the SCOR Web site at http://www.scor-int.org/constitution.htm). He announced that nominations will open on 22 April and there will be a deadline of 22 June to submit nominations. Anyone interested in serving on the committee was invited to contact Sundby during the meeting.

2.0 WORKING GROUPS

2.1 Disbanded Working Groups

2.1.1 SCOR/IAPSO WG 129—Deep Ocean Exchanges with the Shelf

WG 129 has completed is work with publication of a special issue of *Ocean Science*.[2] Working group members have been thanked for their work. The 2010 SCOR meeting agreed to disband the group when its work was completed. Ed Urban shared the image of the cover of WG129's special issue of *Ocean Science* and brought a copy for viewing. IAPSO was a co-sponsor of this group. The group did nice work and produced a good product. All the papers in *Ocean Science* are freely available from the journal Web site.

2.2 Current Working Groups

The Executive Committee Reporter for each working group presented an update on working group activities and progress, and made recommendations on actions to be taken. The Executive Committee made preliminary decisions, based on the progress of working groups and the merits of the requests, about whether funding should be provided for 2012 activities of working groups. The Finance Committee took into account the recommendations of the Executive Committee as it developed the 2012 SCOR budget, which was then subject to final

[2] Johnson, J., and P. Chapman (eds.). 2011. Deep ocean exchange with the shelf. *Ocean Science* http://www.oceansci.net/special_issue18.html.

approval by the meeting.

2.2.1 WG 125—Global Comparisons of Zooplankton Time Series

The group held its final meeting in May 2008 in Gijon, Spain, before the symposium on "Effects of Climate Change on the World's Oceans". The final papers, including the introductory ones, are being completed and the special issue of the journal *Progress in Oceanography*[3] was published in late 2011. The 2009 SCOR meeting approved disbanding the group when the special issue is completed. The proposed 2012 SCOR budget includes $3,000 for color in the special issue.

2.2.2 SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater

The TEOS-10 Manual was published (in English) as

> IOC, SCOR and IAPSO, 2010: *The international thermodynamic equation of seawater – 2010: Calculation and use of thermodynamic properties*. Intergovernmental Oceanographic Commission, Manuals and Guides No. 56, UNESCO (English), 196 pp.

It is available in hard copy from IOC and SCOR, and electronically from http://www.TEOS-10.org. A user guide has been created. The efforts of WG127 have since centered on providing the oceanographic community with computer software and appropriate documentation to implement the new thermodynamic relationships to the properties of seawater, ice and of humid air. The next version of the Ocean Data View (ODV) software will include TEOS-10 variables.

The 2010 SCOR meeting approved the continuation of the group until the end of 2011. Eugene Morozov reported that the group has created links with the International Association for the Properties of Water and Steam (IAPWS) and presented in its report draft terms of reference for a SCOR/IAPSO/IAPWS Joint Seawater Committee to continue the work of WG 127. There is no funding implication for the present time. If a decision is made to move forward, it can be made pending more financial information. Wolfgang Fennel suggested that we ask for clarification of financial implications.

2.2.3 SCOR WG 130 on Automatic Plankton Visual Identification

The group held its final meeting funded by SCOR in May 2010 in Villefranche-sur-Mer, France. They sponsored a special session at the 5th Zooplankton Production Symposium in Pucon, Chile in March 2011. The workshop on Automated Plankton Identification was very well attended by a diverse range of users of *in situ* and laboratory systems and by people who are interested in adopting these new technologies. The group's achievements in relation to their terms of reference are given in its report for the meeting. Mark Costello reported this was a successful group. It held a workshop in March 2011 and has completed its goals. The group has a FaceBook page. The publications listed in their report are those that their members have produced; some of the papers acknowledge the working group. Corina Brussaard suggested that

[3] Pepin, P., D. Mackas, and H. Verheye. 2012. Global Comparisons of Zooplankton Time Series. *Progress in Oceanography* 97-100: 1-186.

the group be disbanded after it provides more information about its projects, have updated their Web page, and provide any reports they have produced. Robbie MacDonald referred to a bullet on their site that says they will produce reports. SCOR could ask the group to do a paper for *EOS* to summarize its work. Mark Costello added that the group should provide a list of software and list of standards they refer to. Urban will work with Costello to create a message to the group.

2.2.4 SCOR WG 131 on The Legacy of in situ Iron Enrichment: Data Compilation and Modeling

The group is still represented by two co-chairs, Philip Boyd (New Zealand) and Dorothee Bakker (UK). Data and metadata have been assembled for 9 *in situ* iron enrichment experiments in open access databases at the Biological and Chemical Oceanography Data Management Office (BCO-DMO, http://bco-dmo.org) and Pangaea (http://wdc-mare.org/). The databases will be publicized through three articles, two shorter ones for *EOS* and *Earth System Science Data*, and a longer article being prepared for *Oceanography* magazine. Michael MacCracken reported that this working group has been going on for several years. The original terms of reference were to spend one year getting data sets together and to spend a couple of years interpreting them. However, it was much harder to obtain the data sets than anticipated. They are asking for continued funding for page charges. MacCracken suggested that the group should be disbanded when its publications are finished. Ed Urban noted that there are funds budgeted for the final expenses of the group. If they do not spend the funds this year the normal procedure would be to carry over the funds until they are finished. The recommendation was to disband the group when their work is completed and they will be reminded with a follow-up letter.

2.2.5 SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems

The group held its final meeting in Crete, Greece, in conjunction with the 14th International Conference on Harmful Algae in October 2010. Group members have published several papers related to their activities.[4] Satoru Taguchi gave a summary of the status and progress of the group. Mingjiang Zhou (present at the SCOR meeting) was a part of the group and added there was a special journal issue in the *Chinese Journal of Oceanology and Limnology* (just released) related to the topic, from the second open science meeting of the GEOHAB Core Research Project on Harmful Algal Blooms and Eutrophication. The open science meeting was held in China immediately before the SCOR meeting in 2009. The GEOHAB group has been working in conjunction with the working group. Marta Estrada asked if the database is completed. Urban replied that as far as he knows, it is not complete. There are no additional SCOR-funded meetings of the group scheduled, but they do not consider themselves finished. Satoru Taguchi noted that the group has worked very hard. Urban suggested that SCOR ask for a timeline for completion of the final products. Wolfgang Fennel added that there are no financial implications in relation to the group's final work.

[4] For example, Glibert, P.M., J.I Allen, A.F. Bouwman, C.W. Brown, K.J. Flynn, A.J. Lewitus, and C.J. Madden. 2010. Modeling of HABs and eutrophication: Status, advances, challenges. *Journal of Marine Systems* 83:262-275.

2.2.6 SCOR/IAPSO WG 133: OceanScope

The group has been working on its report and the SCOR and IAPSO reporters have reviewed two drafts. The Reporters and SCOR Executive Director are considering potential reviewers. The major chapters of the report present the scientific and societal needs for increased oceanographic observations from commercial ships, how the commercial shipping industry can participate, and how the OceanScope concept could be implemented. Appendixes present more technical detail of vessel types and their potential as OceanScope platforms, instrumentation, communications and data management, legal issues, organization, and a Draft Charter for OceanScope. Missy Feeley noted that the basic premise of this group is to provide a framework for increasing the use of commercial ships for oceanographic observations. There have been two major meetings with a diverse group of representatives. They have a very grand vision of what they want to do. SCOR and IAPSO suggested that the group's report focus on a particular area, the North Atlantic Ocean. One of the major issues the group has to deal with is to make stronger links with the commercial shipping industry. Lawrence Mysak, Missy Feeley, and Ed Urban wrote a preface to the report that thanks the group for its work, making clear that SCOR and IAPSO are pleased with the vision presented, but recognize that it may be hard to fulfill. The concept is still very exciting, but it is hard to see how to go from where they are now to what they propose. Mysak is willing to continue serving as the IAPSO Reporter until the report is completed. Feeley recommended that the report should be sent out for review, helping the group respond to reviewers' comments. There is no financial commitment needed from SCOR. Wolfgang Fennel recommended that the group be continued for another year and this recommendation was accepted by meeting participants.

2.2.7 SCOR WG 134 on The Microbial Carbon Pump in the Ocean

This working group met for the second time in San Juan, Puerto Rico, in February 2011, in conjunction with the 2011 ASLO meeting. The group organized a well-attended ASLO "emerging issue" workshop and a special session on the group's topic. So far, the group published a paper in *Nature Reviews Microbiology*[5] in 2010 and a special supplement to *Science* in 2011.[6] The next WG134 workshop, addressing microbial transformation of DOC, will be held at the Hansa Institute for Advanced Studies in Delmenhorst, Germany, in conjunction with the International Society for Microbial Ecology conference in Copenhagen in 2012.

Bjørn Sundby reported that this group has been very active. Their *Science* booklet is very impressive. The title of the first paper is "The Invisible Hand Behind a Vast Carbon Reservoir." The booklet includes short original papers with interesting figures, as well as reprints of relevant papers that appeared in *Science* previously. Sundby thought this area of research eventually might be welcomed as a new activity of IMBER. There is no action needed. The group is allowed one more meeting, included in the draft 2012 SCOR budget. Sundby finished by mentioning that one of the working group's members, Gerhard Herndl, received the highest Austrian science prize of 1.5M euro. SCOR can be very proud of this group.

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[5]Jiao, N., G.J. Herndl, D.A. Hansell, R. Benner, G. Kattner, S.W. Wilhelm, D.L. Kirchman, M.G. Weinbauer, T. Luo, F. Chen, and F. Azam. 2010. Microbial production of recalcitrant dissolved organic matter: long-term carbon storage in the global ocean. *Nature Reviews Microbiology* 8:593-599 (August 2010), doi:10.1038/nrmicro2386.
[6]Jiao, N., F. Azam, and S. Sanders (eds.). 2011. *Microbial Carbon Pump in the Ocean*. Supplement to Science. See http://science.imirus.com/Mpowered/book/vscim11/i2/p1.

2.2.8 SCOR/InterRidge WG 135 on Hydrothermal energy transfer and its impact on the ocean carbon cycles

Missy Feeley reported this is a joint SCOR/InterRidge working group and has been very active. This group met for the first time in Woods Hole (USA) on 23-24 November 2009 and plans to meet next in Hangzhou, China in October 2011. (This meeting was postponed from April.) The meeting will be dedicated to draft two synthesis papers and set the plans for the group's planned international workshop in 2012. Synthesis will be built on existing publications and on-going studies, particularly from working group members, which have been developed in the last 24 months. The community-wide workshop will be held in May/June 2012 in Europe, to help fulfill the group's terms of reference. The two review papers will capture key concepts and present them in an accessible form for the broad ocean science community, in advance of, and to set the scene for, the workshop. The first paper will focus on seafloor hydrothermal systems and the second review paper will consider the interaction of hydrothermal systems with the water column and with the sub-seafloor. Sylvia Sander (New Zealand) was added as an Associate Member of the group this year. The meeting in China is being supported using funds that were approved at last year's meeting. Typically, when the meeting already funded occurs after the SCOR meeting, SCOR should make the funds for the following meeting contingent on a report to SCOR. In other words, the funds for this group's 2012 meeting should be committed only provisionally until a report is received from its October 2012 meeting in China. Colin Devey agreed to communicate the message from SCOR about the need to produce interim products back to this group.

2.2.9 SCOR/WCRP/IAPSO Working Group 136 on the Climatic Importance of the Greater Agulhas System,

John Compton reported that SCOR/WCRP/IAPSO Working Group 136 held its second meeting in May 2011. The meeting was held in combination with the "In-Region Capacity Building Workshop of the WMO/IOC Data Buoy Cooperation Panel (DBCP)" in Mauritius (May 2-6, 2011). The group announced itself in *EOS* following its first meeting and published a major paper in *Nature* earlier this year.[7] The group is planning an AGU Chapman Conference on its topic, to be held in South Africa in October 2012,[8] for which they would like to obtain the remainder of their funding (less than for a full WG meeting). Mike Roberts (Oceans and Coasts, Department of Environment Affairs, Cape Town) was added as an Associate Member. David Obura was replaced by Francis Marsac (IRD/UCT) as the tenth Full Member of the working group. Compton reminded participants that, although this group focuses on a single region, the processes they are focusing on have global importance, as made clear in the group's 2011 article in *Nature*. Compton strongly endorsed SCOR's continued funding for the group. They have been productive with products giving SCOR high visibility. Ed Urban responded that, in terms of the budget, the meeting in Mauritius was more expensive than expected, due to high travel costs to Mauritius, and being locked into using the meeting venue selected by the organization with which the group was coordinating. The draft 2012 budget includes an amount less than is necessary for a full working group meeting, but the group knows that it can use the funds (if approved) toward the Chapman Conference.

[7] Beal, L.M., W.P.M. De Ruijter, A. Biastoch, R. Zahn, and SCOR/WCRP/IAPSO Working Group 136. 2011. On the role of the Agulhas system in ocean circulation and climate. *Nature* 472:429–436, doi:10.1038/nature09983.
[8] http://www.agu.org/meetings/chapman/2012/ecall/

2.2.10 WG 137: Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation

John Volkman reported that this is a very active working group. The group met for the first time in Hangzhou, China in October 2010. The group's meeting was documented in an article in *EOS*.[9] In the first meeting, participants discussed its data policy, including data contribution, authorships, acknowledgements, and data availability, and have achieved an agreement on the policy. The second working group meeting will be held in Villa Angelina in Massa Lubrense, Napoli, Italy, during 27-30 September 2011, with partial funding from the Stazione Zoologica A. Dohrn, Villa Communale, Italy. The Web site for data sets has been set up at http://wg137.net, which lists the sets they are looking at. Richard Gowen was added as an Associate Member this year. The group identified the key questions that need to be addressed and assigned small sub-groups to handle each question. Volkman believes the group may be a little ambitious in what they propose to do, but are making progress. The group has gone back to basic science to address issues and have made preliminary steps to get data into databases. John Compton thinks this group will produce excellent outputs. Wolfgang Fennel reported that there was a request to continue with funding for the group in 2012 and this funding was approved

2.2.11 SCOR/IGBP WG 138: Modern Planktic Foraminifera and Ocean Changes

The first task of the working group has been to organize a kick-off meeting where the schedule for individual deliverables will be agreed and where teams will be assigned to individual tasks. The group met for the first time in Amsterdam, Netherlands on 29 August-2 September 2011. Additional funding for the kick-off meeting has been secured from the EuroProx project of the University of Amsterdam. The group decided to consistently pursue the objective of engaging with young researchers from the very beginning of its existence. Therefore, one day of the kick-off meeting was devoted to a mini-symposium, which brought young researchers in contact with international experts in the field. Wolfgang Fennel presented an overview of this group's plans. He suggested that SCOR should consider funding for the group's 2012 meeting as soon as their report is received. Ed Urban responded that the group held their first meeting in the week before the SCOR meeting, so we should expect a report from them soon.

2.3 New Working Group Proposals

Eight working group proposals were received by the SCOR Secretariat. SCOR was able to fund two new working groups to begin in 2012, based on recommendations from the Finance Committee. Wolfgang Fennel went through the guidelines for discussion of working groups. Each proposal would be briefly discussed and then he would ask each national SCOR committee to provide comments and place the proposal into one of three general categories: must fund, may fund, and do not fund.

[9]Paerl, H., K. Yin, and J. Cloern. 2011. Global patterns of phytoplankton dynamics in coastal ecosystems. *EOS* 92(10):85.

2.3.1 Proposal for a SCOR Working Group to Investigate Physical and Biological Determinants of Population Connectivity: Are Perceived Temperate-Tropical Differences Real?

Wolfgang Fennel presented an overview of the justification for the working group, the terms of reference, and the proposed members of the group. Fennel pointed out that there was no mention of capacity-building activities in the proposal, although two of the members are from developing countries. Fennel summarized the positive and negative feedback received from national committees regarding this proposal before the meeting. The group proposed to hold both of its meetings in Santa Barbara, which could be a problem. There was some concern that this was not a good proposal technically, although the gender and geographic balances are good. The proposed work is interesting, but overly ambitious. Surprisingly, the proposal did not contain much physical oceanography, which would seem to be important for this topic. The consensus was that the proposal should not be funded in its current condition.

2.3.2 Proposal for a SCOR Working Group: Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean

John Compton reported that this proposal is revised from one submitted for last year's meeting. (The proposal was not approved by SCOR last year.) SCOR sent the group a letter to let them know what meeting participants thought were positive aspects of the proposal and what needed to be changed if they decided to resubmit it. The proposal was resubmitted and the general reaction from national SCOR committees was that the proposal had improved, and the activity is timely and important. This working group would add a fundamental missing component to understanding of trace metals. Although the terms of reference were a bit vague, they are still worth doing. They want to create a Web page and a special journal issue or book. Compton presented the proposed Full and Associate Members. No one questioned the expertise of the proposed members and their ability to fulfill the proposed terms of reference, but it was expressed that there was no real capacity development contemplated in the proposal. The proposed gender balance is very good. This is a specialized proposal of a small community of people involved in organic ligands and their relations with trace metals. Comments from national committees were largely similar and the ranking of the proposal was relatively high compared with the other proposals. There is a letter of support from GEOTRACES. Compton questioned why GEOTRACES did not organize this activity as a sub-committee. Ed Urban responded that GEOTRACES funds a Data Management Office, an International Project Office, and SSC meetings, and only has funding for about one other meeting every year. They do not have adequate funding for a group like this. The group was approved to start in 2012.

2.3.3 Proposal for a SCOR Working Group on Deep-sea biodiversity Patterns of the South Atlantic Ocean

Mark Costello reported that all the comments received agreed that it was interesting and an important topic. There is much research going on worldwide on this topic with well-qualified people. Two countries expressed that this year's proposal was not an improvement over last year's. Other national SCOR committees thought the proposal was premature, the data are not ready/adequate, the proposal was too regional and would prefer to see a global proposal; it lacked new science, questions, and innovation; and more expertise is needed and should include Europeans who have already done research in this part of the ocean and hold much of the data.

The proposal received a low ranking from most countries. However, the Brazilian SCOR Committee felt that the proposal was not too regional and would fill a knowledge gap.

2.3.4 Proposal for a SCOR Working Group on Common Challenges in Establishing Ocean Observatories

Missy Feeley summarized the comments from national SCOR committees. The consensus was that this is an important topic because observatories are needed, both globally and regionally. The proposal is interesting; clearly national committees recognized this is an issue and there are considerable areas of concern. Some committees expressed that the terms of reference were too broad and unfocused. The proposal was essentially a coordination project and the scientific content was minimal. There was a question of what SCOR sponsorship would bring to the group that could not be achieved without SCOR involvement. The membership would need to be broadened and diversified geographically. The objectives were not well defined. National committees recognized it is an important issue, but many groups exist with similar goals and it was not clear what a group sponsored by SCOR would add. The proposal was declined.

2.3.5 Proposal for a SCOR Working Group on Subterranean Estuaries

Bjørn Sundby presented this working group proposal. The comments were very interesting, but mostly expressing that the proposal was not ready to fund this year. Sundby conveyed that the most important point is that the proponents haven't really made a case that the questions haven't already been dealt with by others (i.e., it was not clear that the proposal considered all the important research from the past and made a case that the proposed work would break new ground.) The case was not convincing that submarine estuaries are a global phenomenon. There was interest in the topic among national SCOR committees, but they did not think the proposal was ambitious or focused enough. The proposed group membership was very Northern Hemisphere and U.S.-centric. The proposal may be more appropriate as a scientific project, rather than a SCOR working group. No biology was included in the proposed. The proposal was declined.

2.3.6 Proposal for a SCOR Working Group on Patterns of rocky shore dynamics in coastal ecosystems: Comparative analysis

Satoru Taguchi presented this proposal, which he found to be very interesting. Taguchi presented the terms of reference, products, and proposed membership. He thought that the proponents had suggested a good set of members. Unfortunately, the comments from national SCOR committees were not very favorable. Many thought it was not a priority for SCOR, although a few national committees thought the proposal should be funded this year. A positive point should be noted, that this proposal had the best capacity building plan of the proposals submitted this year. The proposal was declined.

2.3.7 Proposal for a SCOR Working Group on Biogeochemical Exchange Processes at the Sea-Ice Interfaces (BEPSII)

John Volkman presented this proposal. He reported that the proposal was well supported by most national SCOR committees. The group would focus on the sea-ice interface as a "biogeochemical factory." The proposed working group is fairly broad ranging in the topics included. The proposal refers a lot to models, but it is not clear which models would be

included; this should be clarified. Volkman expressed that the proposal gives a reasonable list of proposed members, but there are not many developing country members and not much capacity building proposed. It looks like there was not much thought given to being selective about the Associate Members proposed and what each would contribute. The proposal was relatively well received by national SCOR committees, being very timely and relevant, but some committees thought the work is poorly structured and that there should be more expertise and geographic breadth in the membership (e.g., Russia, Scandinavia, Chile, Argentina and Alaska). The group was approved.

2.3.8 Proposal for a SCOR working group on Understanding the global impacts and implications of range-shifting species in marine systems

Mark Costello presented this proposal and noted that national SCOR committees agreed this is an important area. However, the expertise was weak in several ways and the project lacked climate models and physical oceanographers. National SCOR committees said there was no social expertise on the panel, the geographic scope was limited, and it seemed would only study fish; more types of species are needed. National committees expressed that the proposal needed a wider geographic scope and the range of countries included in the membership is too limited. Some meeting participants expressed that the rationale on hot spots was limited. Lastly, the proposal did not cite some relevant studies published in this area. The proponents did cite their own studies, but did not provide a balanced review. The proposal was declined.

3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

SCOR currently sponsors four large-scale research programs; three of them are co-sponsored by other organizations.[10] Each project has its own scientific steering committee (SSC) to manage the project on a day-to-day basis. SCOR and other co-sponsors are still responsible to oversee the projects, which they do primarily through responsibility for the project SSC memberships and terms of reference, although sponsors also oversee the results of the projects' activities. Any proposed changes in membership or terms of reference are considered by the SCOR Executive Committee, in partnership with other co-sponsors, throughout the year. The SCOR Secretariat oversees the use of funds provided to the projects.

3.1 SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program

Satoru Taguchi reported that GEOHAB has been very productive in the past year in terms of special journal issues and GEOHAB reports. A special issue of the *Chinese Journal of Oceanology and Limnology* was published recently, based on the second open science meeting for the Core Research Project (CRP) on HABs and Eutrophication. A writing group for the CRP on Benthic HABs is working on the Science Plan from its June 2010 Open Science Meeting. The GEOHAB Modeling Report was recently completed and is being printed, and a special issue of the *Journal of Marine Systems* was produced from the GEOHAB modeling workshop.

[10] A fifth project has been approved since the 2011 SCOR meeting, the Southern Ocean Observing System, co-sponsored by the Scientific Committee on Antarctic Research (SCAR).

The Science Plan for GEOHAB research and cooperation in Asia was published in May 2011. SCOR and IOC have asked the GEOHAB SSC to present a plan for synthesis of GEOHAB results in 2012 and 2013, leading up to the completion of the research phase of GEOHAB at the end of 2013. 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 co-sponsors approved the extension of four SSC members for a second 3-year term and approved appointment of a new member of the SSC, Patricia Tester (USA).

Taguchi reminded participants of the GEOHAB Terms of Reference and membership of the GEOHAB SSC. Raphael Kudela from the United States is the Chair and Elisa Berdalet from Spain is the Vice-Chair. GEOHAB has compiled the publications from 2002 until 2010 that acknowledge the program; the number is growing and has surpassed 160, in more than 25 different journals. There are currently 8 reports in the GEOHAB report series and 5 special issues of journals. Taguchi commented that the list is very impressive. He then presented the five GEOHAB Core Research Projects:

1. HABs in Upwelling Systems
2. HABS in Eutrophied Systems
3. HABs in Fjords and Coastal Embayments
4. HABs in Stratified Systems
5. HABs in Benthic Systems

GEOHAB has established a working group with the International Ocean Colour Coordination Group (IOCCG, a SCOR-affiliated project) on HABs and ocean color. The group will prepare a monograph that will detail the state of the art in using remote and in-situ sensing to detect HABs. It will recommend future studies, measurements, protocols, etc. to develop, improve and better understand limitations of harmful algal bloom-focused ocean color algorithms. Finally, the report will summarize, recommend, and present a future outlook for the development of new ocean color observation systems, incorporating future sensors/systems. This group had met once and had a second meeting planned.

GEOHAB will reach the 10-year mark at the end of 2013 and is planning synthesis activities. SCOR support for GEOHAB will end at that time, but SCOR anticipates future activities to advance the field of HAB research. The series of GEOHAB research plans is an excellent foundation for future research.

3.2 SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project

Bjørn Sundby reported that IMBER has four themes:

- Theme 1: Interaction between biogeochemical cycles and marine food webs
- Theme 2: Sensitivity to global change
- Theme 3: Feedback to the Earth System
- Theme 4: Responses of society

The second IMBER IMBIZO open science meeting was held in October 2010 in Crete, Greece and the IMBER SSC met most recently in April 2011 in Marseille, France. Special journal issues have appeared from the first IMBIZO.[11] IMBER supports five working groups. The newest one, on human dimensions, was formed and met in mid-2011. The others are (1) a joint group with SOLAS on ocean carbon, (2) a joint group with the Land-Ocean Interactions in the Coastal Zone project on continental margins, (3) a group on capacity building, and (4) a data management task team. IMBER has four regional programs: (1) Integrating Climate and Ecosystem Dynamics (ICED), (2) Climate Impact on Oceanic Top Predators (CLIOTOP), (3) Ecological Studies of Sub-Arctic Seas (ESSAS), and (4) the Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) program. The regional programs each have their own steering committee and each gets some support from IMBER but they also have to obtain their own support.

Plans are under way for the third IMBER Summer School, which will be held at the Ankara University in August 2012. The theme will be the feedbacks between ecosystems, biogeochemistry, and the Earth System in a warming world. IMBER has held workshops 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. 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). Support for the IMBER International Project Office from French sources will end at the end of this year, after 6 years of funding. Therefore, the IPO is looking for a new home; a proposal has been submitted for funding of an office in a new location.[12] A new IMBER regional office was opened in March 2011 in Shanghai, China. IMBER is co-sponsored by SCOR and IGBP.

IMBER has taken on two regional projects from GLOBEC, which should last until about 2015 and some other IMBER regional projects have just started. This has some implications for the sunset of IMBER and IMBER is likely to ask for an extension beyond its nominal end date of 2015. Sundby noted that the merger of the GLOBEC projects into IMBER has been very well done and SCOR should be very pleased with the process.

Sundby's impression was that IMBER is very active in the area of summer schools. The Data Management Committee is very active and published the data management "Cookbook" in English and Spanish (see http://www.imber.info/index.php/Science/Working-Groups/Data-Management/Cookbook). The 5th IMBER China-Japan Korea meeting will be held November 22-24, 2011 in Shanghai, China, IMBER IMBIZO III will be early 2013 and 1st IMBER Open Science Meeting will be held in August 2014. Sundby completed his presentation by saying that he will send a letter to IMBER congratulating them and telling them that SCOR is very happy

[11]Special Issue of *Deep-Sea Research II*, Volume 57, Issue 16, Pages 1429-1592 (15 August 2010), Ecological and Biogeochemical Interactions in the Dark Ocean, edited by Deborah K. Steinberg and Dennis A. Hansell and special issue of *Progress in Oceanography*, Volume 84, Issues 1-2, Pages 1-138 (January-February 2010), Parameterisation of Trophic Interactions in Ecosystem Modelling, Edited by Michael A. St. John, Ivo Grigorov, Javier Ruiz and Patrick Monfray.

[12] The IMBER IPO moved to Bergen, Norway in 2012.

with their progress.

3.3 GEOTRACES Project

Bjørn Sundby introduced Catherine Jeandel to make the GEOTRACES presentation. Jeandel presented the mission and aim of GEOTRACES. She reported that the GEOTRACES Scientific Steering Committee held its fifth meeting in Toulouse, France in September 2010, the week after the SCOR meeting there. The next SSC and Data Management Committee meetings were to be held in Xiamen, China, in September 2011. The annual meetings of the GEOTRACES SSC discuss progress on data management and intercallibration, as well as national reports on completed and planned cruises, forthcoming workshops and conferences, capacity building, international partnership issues, program budget, and SSC rotations. The GEOTRACES "Sampling and Sample-handling Protocols for GEOTRACES Cruises" cookbook has been completed (see http://www.obsvlfr.fr/GEOTRACES/libraries/documents/Intercalibration/Cookbook.pdf). The International GEOTRACES Standards and Intercalibration Committee will maintain and update these protocols and are coordinating publication of the results from the intercalibration in a special issue of *Limnology and Oceanography: Methods.*[13] The grant that is paying for the special issue is also paying to make the papers open access.

Regional planning meetings were held for the Asia and Mediterranean Sea regions since the previous SCOR meeting, and plans are developing for a South American regional meeting. The next GEOTRACES Data-Model Synergy Workshop will be held at the "Universitat Autònoma de Barcelona", Spain, in November 14-17, 2011 (see http://www.obs-vlfr.fr/GEOTRACES/index.php/meetings/geotraces-workshops-and-meetings/icalrepeat.detail/2011/11/14/58/40/3rd-geotraces-data-model-synergy-workshop). GEOTRACES has used travel support from SCOR to make it possible for two developing country scientists to participate in GEOTRACES cruises.

The GEOTRACES International Project Office has been located within LEGOS in Toulouse, France since 2010. The international data center is located in Liverpool (UK). Jeandel described the GEOTRACES organizational structure and showed the global ocean coverage of GEOTRACES cruises, showing the high level of GEOTRACES activity. Twelve full GEOTRACES cruises and 13 GEOTRACES IPY cruises have been completed. GEOTRACES cruises have been completed by Australia, Canada, Germany, India, Japan, Netherlands, New Zealand, the United Kingdom, and the United States. The project has established an excellent Web site, which includes an analytical expertise database, a GEOTRACES publication database, and links to information about cruises and outreach.

John Compton asked if one of the GEOTRACES objectives is to compile TEI data and make it available on the Web site. Jeandel responded that this will be done. A major objective of GEOTRACES is to create global datasets of the key GEOTRACES parameters, which will be available through the GEOTRACES Data Assembly Centre Web site. Ilana Wainer asked about funding and how different projects receive funds. Jeandel answered that SCOR provides funding

[13] http://www.aslo.org/lomethods/si/intercal2012.html

from one of its NSF grants, and many other nations provide funds directly to the IPO and data office, including a recent donation from India for the data office. Other SCOR nations can give money through SCOR, as long as it is not part of the annual dues to SCOR. There is currently sufficient funding for the project through 2013.

3.4 SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study

Ilana Wainer reported that SOLAS is planning its fourth open science conference for a site in Washington State in 2012 and is holding its fifth summer school from 29 August to 10 September 2011 in Cargèse, Corsica, France. The SOLAS Scientific Steering Committee (SSC) held its 10th meeting in Kiel, Germany in May 2011, after the meeting in Tsukuba, Japan was cancelled due to the earthquake and tsunami. The SOLAS SSC continues development of its 7 mid-term strategy topics. Each theme is at a different stage in its implementation, but there is much scientific activity ongoing and planned. SOLAS resources (e.g., travel funds, meeting support, newsletters, Web page, outreach activities) are being used to highlight, advertise, define, and/or refine the topics and their associated scientific questions and develop white papers (see 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; and plan and conduct the research with a view to facilitating data and idea exchange that will permit an international, comprehensive synthesis. Diego Gaiero (Argentina), Christope Garbe (Germany), Lisa Miller (Canada), and Brian Ward (Ireland) were approved by the SOLAS co-sponsors for their first three-year terms on the SOLAS SSC. Eric Saltzman (USA) has assumed the role of SSC chair from July 2011. Twenty-eight nations are part of the SOLAS network. SOLAS is involved in two IGBP Fast-Track Initiatives to which SCOR is also contributing: (1) Upper Ocean Nutrient Limitation: processes, patterns and potential for change; and (2) Megacities and the Coastal Zone: air-sea interactions. The IPO is currently located in Kiel, Germany. Funding of the IPO ends in January 2013 and renewal options are being investigated.

Wainer noted that since 2009, nations involved in SOLAS have been requested to submit annual reports, which are posted on the SOLAS Web site. National research is funded by individual nations and SOLAS focuses on international coordination. Wainer presented information about the Mid-Term Strategy topics. The same people that submitted the white paper on sea-ice biogeochemistry have also submitted a proposal for a working group. He added that SCOR approved some funds yesterday to sponsor scientists from developing countries to attend the SOLAS Open Science Conference, and that copies of the SOLAS textbook were sent to 39 institutions in developing countries.

4.0 OCEAN CARBON AND OTHER ACTIVITIES

4.1 IOC/SCOR International Ocean Carbon Coordination Project (IOCCP)

Wolfgang Fennel reported that IOCCP has continued to be very productive in the past year. NSF is funding two positions at IOC for IOCCP and is providing activity funding through SCOR. The Surface Ocean CO_2 Atlas (SOCAT) is a global compilation of underway surface water fCO_2

(fugacity of CO_2) data with 6.3 million measurements from 1,767 cruises run between 1968 and 2008 by more than 10 countries. The first public release of SOCAT (version 1.4) will be on 14 September 2011. Two SOCAT products will be made publicly available: (1) a global surface ocean fCO_2 data set with second-level quality control; and (2) a global gridded product of monthly surface water fCO_2 means, with no temporal or spatial interpolation (i.e., bin averages). IOCCP will be hosting two meetings in September 2011: (1) the IOCCP Surface Ocean CO_2 Data-to-Flux Workshop and (2) the Ocean Carbon Cycle at a Time of Change Science meeting. The IOCCP Scientific Steering Group is currently updating the 2007 list of time-series stations where carbon variables are being measured or are expected to be measured in the near future, including contact information for the principle investigator or time-series administrator, as well as current and future operational concerns. Fennel reported there is no action required. IOCCP is in the process of transitioning the chair position. IOCCP works closely with SOLAS and IMBER on carbon activities. The meeting happening this week was the biggest IOCCP activity for the year. IOCCP has been a good joint venture between SCOR and IOC.

4.2 Symposia on The Ocean in a High-CO_2 World

John Volkman reported that the first symposium in this series was held in May 2004 in Paris, which produced a special issue of the *Journal of Geophysical Research-Oceans*. The second meeting was held in October 2008 in Monaco, which led to a special issue in *Biogeosciences*, which was published in the past year.[14] SCOR, IOC, and IGBP have begun planning for the third symposium, which will be held in Monterey, California, USA, in September 2012. The symposium planning committee met in December 2010 in Monterey. The meeting developed the structure for the symposium, identified topics and speakers, and set up a subcommittee for capacity building and another for outreach and communication. Registration for the meeting will be opened in Sept. 2011. The symposium will span 3.5 days, with 10 topics that will be covered in plenary session, and 6 additional topics covered only in parallel sessions. Volkman thought the topics are very balanced. Abstracts can be submitted beginning 15 September 2011 and the deadline for submissions is 1 April 2012. Planners expect 300 or more participants at the symposium.

Previous symposia included discussion sessions, but this time it was decided that due to the large number of participants it would be better to have more oral presentations in parallel sessions and not only posters. There were 225 participants at the 2008 symposium in Monaco, so there could be as many as 400-450 participants at the Monterey symposium. The registration is a little behind schedule due to waiting for an additional document on the early-career scientist travel support program. NSF requested that a high percentage of their grant to SCOR be set aside for travel support for early career scientists and information about the application process needs to be put on the meeting Web site about this funding.

Wendy Broadgate added that planners of the Policy Day are trying to bring in high-profile people to the meeting and will publicize the results. Elizabeth Gross is handling the logistics, as she did for the first two symposia.

[14] Gattuso, J.-P., J. Orr, S. Pantoja, H.-O. Pörtner, U. Riebesell, and T. Trull (eds.). Special issue of *Biogeosciences* on The ocean in the high-CO2 world II. http://www.biogeosciences.net/special_issue44.html

4.3 Other Activities

4.3.1 Phytoplankton Pigments in Oceanography

Ed Urban reported that this is an activity to update a successful book published from WG 78 on Determination of Photosynthetic Pigments in Seawater in 1997 and reprinted in 2005. The book is at Cambridge University Press and is expected to be published in September 2011.[15] SCOR is purchasing 100 copies of the book for distribution to the editors (who raised funding for production of the book) and to libraries in developing countries. SCOR received more than US$17,000 from the editors' institutions to support this book.

4.3.2 Data Publication Activity

SCOR, IOC's International Oceanographic Data and Information Exchange (IODE), and the MBLWHOI Library have been working together for the past several years on a project to promote getting data associated with research papers, as well as stand-alone data sets, into national and international data management systems. The group has issued a challenge to data centers and libraries to establish data publication activities. The results of two pilot projects have been reported at meetings of ocean scientists, data managers, and ocean librarians. The principals will meet next in Liverpool, UK in early November 2011 to assess progress on the pilot projects. Mark Costello reported that the group continues to work well and is trying to develop methodologies that could be used by other libraries and national data centers. The group meets once each year to update each other on action items and to develop plans for the following year. One of the two pilot projects is focused on trying to make it possible for people who are publishing papers in traditional journals to link their data to their papers. The concept is not entirely unique, but the group has been advocating it for ocean science. This activity came out of a meeting funded by SCOR. Urban is trying to implement the idea at the University of Delaware, but it is hard to find scientists in SCOR's host college to participate. There is a request in the draft 2012 SCOR budget for this group's next meeting.

4.3.3 SCOR/POGO Workshop on International Quiet Ocean Experiment

Ed Urban reported that the Alfred P. Sloan Foundation requested that SCOR and POGO convene a workshop to explore the idea of an International Quiet Ocean Experiment, which would involve a global or regional quieting of the ocean by stopping noise from human activities for a limited period. The workshop was held at the University of Rhode Island on 27-29 October 2010 and involved ocean acousticians, marine biologists, and representatives from navies and industry. The outcome of the meeting is documented in an article in *Oceanography* magazine.[16] An open science meeting was held at UNESCO Headquarters in Paris, France on 30 August-1 Sept. 2011 to develop a science plan for the project (see www.iqoe-2011.org); participants were enthusiastic about the development of an international project. The Science Plan will be reviewed by SCOR

[15] http://www.cambridge.org/us/knowledge/isbn/item6006763/?site_locale=en_US

[16] Boyd, I.L., G. Frisk, E. Urban, P. Tyack, J. Ausubel, S. Seeyave, D. Cato, B. Southall, M. Weise, R. Andrew, T. Akamatsu, R. Dekeling, C. Erbe, D. Farmer, R. Gentry, T. Gross, A. Hawkins, F. Li, K. Metcalf, J.H. Miller, D. Moretti, C. Rodrigo, and T. Shinke. 2011. An International Quiet Ocean Experiment. *Oceanography* 24(2):174–181, doi:10.5670/oceanog.2011.37.

and POGO after it is completed. The Sloan Foundation is encouraging a proposal for planning activities in 2012 and 2013. There has never been an international project on this topic. Although turning off all sound in the ocean is likely to be impractical and/or too expensive, there are other opportunities for both opportunistic observations (e.g., before and after shipping lanes change and pile driving ensues) and for planned experiments. There are two major foci for the project: (1) documenting the global sound field and how it changes over time and (2) studying the effects of chronic increases of sound on marine organisms. It has been estimated by some scientists that ambient sound in the ocean is increasing by an average of three decibels per decade (decibels are expressed on a logarithmic scale).

5.0 CAPACITY BUILDING

5.1 SCOR Committee on Capacity Building

Venu Ittekkot reported that the SCOR Committee on Capacity Building sponsored a meeting in Izmir, Turkey in April 2011 to explore possible capacity building initiatives in the Middle East/North Africa region. Local support for the meeting was provided by the Dokuz Eylul University. The membership of the committee was modified in mid-2011 to create a tighter linkage between the committee and the SCOR Executive Committee; thus, a subgroup of the committee met on Sept. 11 in Helsinki to prepare for the SCOR meeting discussions. The group's recommendations were discussed in the following items. The committee would like working group proposals to be more explicit about their capacity building activities, since only two had a mention of capacity building.

5.2 SCOR Visiting Scholars

SCOR started a program of SCOR Visiting Scholars in 2009 and has now funded 6 different Visiting Scholars. The program provides airfare and some funding for subsistence for ocean scientists to teach and mentor students for several weeks to months. Local hosts are expected to provide some support for local expenses. One Visiting Scholar, Kurt Hanselmann, will be sent on a second assignment to Namibia this year, to build on the work he started in 2010. Venu Ittekkot described the activities of past Visiting Scholars.

5.3 Regional Graduate Networks of Oceanography and Marine Environmental Sciences

This activity is still unfunded, but was a topic of discussion at the meeting in Izmir, Turkey. There was consensus among regional participants that a regional network should be explored for the Middle East/North Africa region. Venu Ittekkot stated that he would like to see capacity building expanded to other areas. We should try to initially provide the right atmosphere for institutions to work together in ways that they feel is worthwhile.

5.4 POGO-SCOR Visiting Fellowships for Oceanographic Observations

Ed Urban reported that POGO and SCOR have co-funded this program since 2001 and have supported about 100 participants so far. Both recipients and hosts have expressed that this

has been a worthwhile program. Many more applications are received than can be supported, so there is a selection process run by POGO and Urban participates in the process.

5.5 NSF Travel Support for Developing Country Scientists

Ed Urban reported that the grant to SCOR from the U.S. National Science Foundation was renewed for three years at a level of $75,000 per year. The grants have been an important source of support for several SCOR-related meetings in the past year. For the past few years, the Committee on Capacity Building has reviewed the requests and recommended funding for each meeting. The committee met yesterday and the recommendations were presented to and approved by SCOR meeting participants. The total recommended is still less than the amount that could be allocated, giving SCOR some flexibility to fund extra meetings during the coming year. The GEOTRACES program has used travel support to fund two developing country scientists to participant in GEOTRACES cruises in 2011, and a similar amount was requested and approved for 2012. Venu Ittekkot added that there should be guidelines when funding is provided to make sure funding results in the best impact. Michael MacCracken asked if we have a way to compile information from students that would be useful and said there is a need to have mentoring available. Ed Urban responded that we do receive reports from the POGO/SCOR Fellowship recipients and we have started to match students with mentors at meetings. Robie MacDonald asked if there has been follow-up to see how effective funding students has been and Urban replied that is an area that SCOR and partner organization need to do better on.

5.6 SCOR Reports to Developing Country Libraries

The Birth and First Years of the Scientific Committee on Oceanic Research (SCOR), Harmful Algal Blooms in Asia: A Regional Comparative Program, and *GEOHAB Core Research Project: HABs in Fjords and Coastal Embayments* were distributed to libraries in developing countries and countries with economies in transition this year.

6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

6.1 Intergovernmental Oceanographic Commission

Wolfgang Fennel and Ed Urban attended the IOC General Assembly in June 2011 to represent SCOR and ICSU. SCOR and IOC cooperate on several different activities, as discussed in other sections**:** the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program, the International Ocean Carbon Coordination Project, and the symposia on the Ocean in a High-CO_2 World. IOC also partners with SCOR on capacity building activities. In April 2011, IOC organized and hosted an international expert meeting entitled “Understanding deep-water biodiversity in the South Atlantic: Options for conservation and sustainable use of resources in the high-seas”, to follow up on the working group proposed to SCOR in 2010; the proposal has been re-submitted this year. Responsibility for the Ocean Biogeographic Information System (OBIS) was assumed by IOC after the completion of the Census of Marine

Life. Henrik Enevoldsen made a presentation about IOC. Capacity building and capacity development are high-priority areas for IOC, so they have appreciated the initiative by SCOR in convening the two workshops held on capacity development (the workshops in Bremen and in Izmir). Several members of IOC Headquarters participated. There is a need to focus on coordination among our organizations' international efforts. Bjørn Sundby commented that two years ago there was an effort to revise a document on research related to the UN Convention on the Law of the Sea, but it was not distributed.[17] Sundby asked about the status of this document and whether SCOR could do anything more to help. Enevoldsen answered that he did not know the status or why the document was not distributed as widely as it was intended. Sundby responded that he thought it was an excellent document and overlaps with capacity building. Ed Urban suggested an article in the *SCOR Newsletter* to make people aware of the document.

6.2 International Council for Exploration of the Seas

Wolfgang Fennel reported that ICES is a regional inter-governmental organization that provides advice to participating nations. Much ICES work focuses on climate change and impacts on ecosystems and fisheries. ICES has been involved in various SCOR activities in the past few years, including co-sponsoring a regional program of GLOBEC. ICES cooperates with several intergovernmental organizations with common interests. New Strategic Initiatives are on Biodiversity Science and Advice, Spatial Planning and Area-based Management, and Stock Assessment Methods. Fennel added that there is cooperation between GEOHAB and the ICES Working Group on Harmful Algal Bloom Dynamics. Fennel will attend the ICES meeting to be held the week after the SCOR meeting.

6.3 Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)

Ed Urban reported that SCOR provided support for one meeting of GESAMP Working Group 38 on The Atmospheric Input of Chemicals to the Ocean, which has published two papers, in which SCOR support was credited. A third paper is in progress. GESAMP is considering an extension of the group. Many of those who were involved are from the SOLAS community. GESAMP is supported by 9 UN organizations and most of its work is done at the request of the member organizations. Historically, GESAMP has focused on marine pollution and has issued some nice reports over the past 25-30 years. Urban suggested that SCOR should not appoint a regular liaison, but should keep informed of GESAMP activities and ask for information when GESAMP is pursuing topics of interest to SCOR.

6.4 North Pacific Marine Science Organization (PICES)

Satoru Taguchi introduced Alex Bychkov, the Executive Director of PICES. PICES is a regional intergovernmental scientific organization established by international convention in 1992 to promote and coordinate marine scientific research in the North Pacific and adjacent seas.

[17] The document was *A revised guide to the implementation of the relevant provisions of the United Nations Convention on the Law of the Sea*, available at http://www.un.org/depts/los/doalos_publications/publicationstexts/msr_guide%202010_final.pdf.

Bychkov reported that PICES' goals are to (1) advance scientific knowledge and capacity available for the member countries, including information on human activities affecting, and affected by, marine ecosystems; and (2) provide a mechanism for collaboration among scientists in addressing timely and critical scientific questions. In less than 20 years since its establishment, PICES has become a major forum for marine science in the North Pacific region. At the end of 2004, PICES published a report on North Pacific ecosystems, based on information obtained from 1998 through 2002. Last year, PICES published its second assessment report, based on information collected between 2003 and 2008, including chapters related to all marginal seas and several parts of the Pacific basin. PICES does not have an official advisory function, as ICES does, and it does not provide tactical advice, but provides other advice if asked. PICES conducts several activities that are relevant to SCOR interests and that implement SCOR activities in the North Pacific region, and often supports members of SCOR working groups related to PICES activities. The first time PICES became involved with a working group was WG 125, in that PICES funded an Associate Member from the North Pacific region to participate in the group's activities. PICES is currently supporting a member of WG137. PICES has activities relevant to each SCOR large-scale research project and many SCOR projects have held special sessions at PICES meeting.

Bychkov also described the essential components of the PICES strategy for capacity building, which was approved in 2003. In 2007, PICES and ICES held their first joint conference for early-career scientists in Baltimore, Maryland, USA and agreed to hold these conferences once every five years. Two types of summer schools were started in 2006, of which there have been three so far. There is no summer school next year, but one is planned for 2013. SCOR invited PICES to nominate a liaison to the SCOR Committee on Capacity Building, which has been Dr. George Boehlert for the past several years. Boehlert attended the SCOR-led conference on "*Developing a global strategy for capacity building in the ocean sciences*" (August 2010, Bremen, Germany) and the 2011 meeting of the SCOR Committee on Capacity Building (April 2011, Izmir, Turkey). Through SCOR, PICES started to be involved with summer schools organized by SOLAS and IMBER. SCOR continues to provide travel support for scientists from developing countries and countries with "economies in transition" to participate in SCOR-relevant sessions/workshops at PICES Annual Meetings and international symposia led/co-organized by PICES. Two requests were submitted to SCOR this year and both were approved.

7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

7.1 International Council for Science

Wolfgang Fennel reported that ICSU has designated SCOR its representative at IOC annual meetings. SCOR was invited to send a representative to the ICSU General Assembly in Rome at the end of September, but the timing made it difficult for SCOR Executive Committee members or staff to participate. ICSU is SCOR's parent organization. The ICSU Executive Director will be leaving his post at the end of September and ICSU is still in the process of seeking a replacement for him. Wendy Broadgate presented ICSU's long-term vision and Michael MacCracken added comments with respect to WCRP. ICSU asked all its committees for feedback on its visioning process early in its development. The SCOR Executive

Committee concluded that ICSU's proposed approach for global change science doesn't fit with how SCOR does its work. The proposed ICSU approach is very top-down and the focus is away from fundamental science, so SCOR will not be substantially involved. SCOR will need to see how the evolution of ICSU and the future of IGBP and WCRP plays out with SCOR's joint projects with IGBP and WCRP.

7.1.1 International Geosphere-Biosphere Program (IGBP)

Wendy Broadgate noted that IGBP is about global change, and impacts in all areas of Earth science. The IGBP strategic vision is "*To provide essential scientific leadership and knowledge of the Earth system to help guide society onto a sustainable pathway during rapid global change*". IGBP's mission is about understanding, communicating, and trying to engage people. IGBP collaborates with SCOR on a variety of marine issues. SCOR is co-sponsoring two IGBP Fast-track Initiatives:

1. Megacities in the coastal zone: air-sea interactions
2. Upper ocean nutrient limitation

and is co-sponsoring the Third Symposium on The Ocean in a High-CO_2 World, which is focused on the topic of ocean acidification.

ICSU has four global change programs: IGBP, WCRP, Diversitas, and the International Human Dimensions of Global Change Programme (IHDP). They are combined in a partnership called the Earth System Science Partnership. ICSU is conducting a Visioning Process, which produced a paper published in *Science*. The new ICSU vision includes five Grand Challenges:

1. Improve the usefulness of **forecasts**
2. Improve **observation** systems
3. **Anticipate**, avoid and manage GEC
4. Institutional, economic and behavioural **responses**
5. Encourage **innovation**

The national funders of global environmental research decided to coordinate funding better through an organization called the Belmont Forum. The countries involved were Australia, Austria, Canada, China, France, EC, Germany, Japan, India, South Africa, UK, and the United States. ICSU and the International Social Science Council (ISSC) were also involved. The Belmont Forum group is seeking to coordinate how to use their resources in the future. Their priorities are coastal vulnerability and freshwater security. A transition team has been formed and met in June 2011. Johan Rockström from Sweden and Diana Liverman from the United States are co-chairing the group. The Planet Under Pressure conference, to be held in London in March 2012, is including a lot of issues related to ICSU's vision. It is focusing on solutions to Earth's global environmental problems. 2,500 participants are expected and the organizers are raising funds for 40% of the participants to come from developing countries. So far, the demand is exceeding expectations and the organizers are overwhelmed with proposals for sessions and starting to be overwhelmed with abstracts.

Ilana Wainer asked about ICSU's vision not including or emphasizing fundamental science. Wendy Broadgate responded that this concern was expressed to ICSU and addressed by them. Wainer responded that there were very few fundamental scientists on the transition team. Ed Urban noted that he made the same comment at the IGBP Science Committee meeting that ICSU is not as focused on fundamental science as it used to be and that this was short sighted, in terms of producing the scientific knowledge we will need in the long term.

Urban added that he attended the 2011 IGBP Science Committee meeting in Bethesda, Maryland, USA to represent SCOR. SCOR and IGBP staff members have ongoing discussions in relation to cosponsored projects. SCOR and IGBP are co-sponsoring WG 138 on Modern Planktic Foraminifera and Ocean Changes, and SCOR is contributing support for travel of developing country scientists to two IGBP Fast-Track Initiatives. IGBP's incoming chairperson. James Syvitski, was co-chair of SCOR/LOICZ WG 122 on Mechanisms of Sediment Retention in Estuaries.

7.1.2 World Climate Research Programme (WCRP)

Michael MacCracken reported that WCRP continues to be very active. It is co-sponsoring the SOLAS project, the SCOR/WCRP/IAPSO WG 136 on Climatic Importance of the Greater Agulhas System, and development of the Southern Ocean Observing System. SCOR projects (including IOCCP) are working well with CLIVAR, the part of WCRP most relevant to SCOR. WCRP is organizing an Open Science Conference (OSC) to be held on 24-28 October 2011, in Denver, Colorado, USA. WCRP has been working on its strategy called Coordinated Observation and Prediction of the Earth System (COPES), which includes modeling activities and ocean observations. The CLIVAR project focuses on climate variations on various times scales. WCRP has also been putting together an activity on sea level issues. John Compton asked a question regarding whether it has been estimated how much sea level will rise as a result of ocean warming. MacCracken responded that predictions have been made using models, but the results have been controversial. For example, the IPCC 4th Assessment projected 21st century sea level rise to be in the range of 0.18 to 0.59 meters plus up to 0.2 m from the loss of mass from the Greenland Ice Sheet if dynamic processes are considered. By contrast, empirical and statistical approaches are suggesting higher values, generally 1 ± 0.5 m, with some even suggesting a higher upper bound.

7.1.3 Scientific Committee on Antarctic Research (SCAR)

Ilana Wainer reported that SCAR and SCOR are co-sponsoring a joint Expert Group on Oceanography. The major focus for this group in the past several years has been work on a plan for a Southern Ocean Observing System, which is now being prepared for publication (see http://www.scar.org/soos/). Ed Urban and Lora Carter worked on obtaining permissions to reprint graphics, getting some figures redrawn, and having the report formatted and printed at the University of Delaware. An office to promote implementation of the SOOS plan is being funded by Australia, and Louise Newman, formally of the PAGES office, was hired this summer to staff the SOOS office. The Expert Group will focus its activities on implementation of SOOS for the next few years. The group is planning to meet in February 2012 in conjunction with the Ocean Sciences meeting in Salt Lake City, Utah, USA. Ed Urban noted that he has been fairly involved for the past several months in getting the *SOOS Initial Science and Implementation Strategy*

ready for publication. The development of the document took place over several years, with funding primarily from SCOR and SCAR; some other organizations have endorsed the project, but have not contributed financially. The report has been through review and has been formatted. Urban showed the final draft report cover. The report should be printed in approximately three weeks. SCOR and SCAR are about to invite nominations for the scientific steering committee, which will be co-funded by the two organizations in equal amounts and will work to implement the SOOS plan in the next decade.

7.2 Affiliated Organizations

7.2.1 International Association for Biological Oceanography (IABO)

Mark Costello presented the IABO manifesto 2011. IABO is involved in the second international conference on marine biodiversity, which will be held in Scotland in two weeks. More than 600 people have registered. Costello noted that IABO is in the process of seeking new members. At the present time, there is no budget, but funding will be needed in the future to make IABO more active. Corina Brussaard commented that it is not clear to her as a national IABO member what is required and Costello responded that this has not been defined internationally. Costello welcomed ideas about how to raise new funds for IABO.

7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS)

Michael MacCracken made a presentation about IAMAS. It is made up of 10 commissions, one of which is the international Commission on Atmospheric Chemistry and Global Pollution, which is a co-sponsor of SOLAS. New officers were elected earlier this year. The new President is Athena Coustenis. The Vice Presidents are John Turner and Joyce Penner. Coustenis was unable to attend this meeting, but looks forward to being an active participant on the SCOR Executive Committee. IAMAS has done considerable work on new statutes for the organization. They will now have a new category of membership for "Other Organizations." They anticipate that this membership category will stimulate cooperative efforts at no extra cost. The next IAMAS General Assembly will be held with IACS in July 2013 in Davos, Switzerland. The next IUGG general assembly will be in Prague in 2015. MacCracken is concerned because they have held 50% of their assemblies since the 1950s, and 80% prior to that, in Europe. Given the IAMAS goal of bringing together international groups of scientists, the assemblies should move around to different parts of the world. There has been discussion of IAMAS doing joint work with SCOR as IAPSO does, but no conclusion. One obvious potential area of cooperation is in capacity building.

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

Eugene Morozov reported that SCOR and IAPSO are currently co-sponsoring WG 127 on Thermodynamics and Equation of State of Seawater, OceanScope WG 133, and WG 136 on Climatic Importance of the Greater Agulhas System (with WCRP). The next IAPSO Assembly will be held in 2013 in Gothenburg, Sweden. Working Groups 127 and 129 (Deep Ocean Exchanges with the Shelf) both resulted from an IAPSO strategic planning exercise. IAPSO arranged for people to write proposals for each of these ideas and both were approved.

Morozov reported that IAPSO currently has 61 members, of which 45 members are active. A new Executive Committee was elected for a four-year term at the IUGG meeting in July in Melbourne, Australia. Seven IAPSO symposiums were organized during the assembly in Melbourne, as well as three joint symposia. IAPSO is planning about 10-12 symposia for the next Joint Assembly, to be held in Gothenburg, Sweden in 2013. One symposium will be dedicated to the Baltic Sea and another to the North Atlantic Ocean. IAPSO also has two active commissions: (1) on mean sea level and tides and (2) on tsunamis.

IAPSO currently awards two medals. The 2011 Prince Albert I medal for outstanding results in physics and chemistry was awarded to Trevor McDougall from Australia for his very active work in oceanography, including his contributions related to SCOR/IAPSO WG 127. Another award, the Eugene LaFond Medal, is given for the best presentation during the assembly given by a scientist from a developing country. Eugene LaFond was the IAPSO Secretary General during the 1970s and 1980s. In 2011, the medal was awarded to a scientist from Bangladesh, Dr. Towhida Rashid.

7.3 Affiliated Programs

The benefit of continued affiliation to SCOR is evaluated at each General Meeting, but annual reports are requested from the programs for information.

7.3.1 International Marine Global Changes Study (IMAGES)

John Compton reported that SCOR WG 100 on Sediment Coring for International Global Change Research developed the original science plan for IMAGES. IMAGES Phase II is being planned, starting with a meeting in Brussels in January 2011 to develop a new science plan. IMAGES II will not fund research but will serve as a focal point for the pooling of global expertise, funding, and resources that maximizes individual contributions by assimilating them into an internationally integrated and thematically coherent science entity whose mission is to understand the role of marine processes in climate change. The program has an interim office hosted at the University of Kiel in Germany. Compton noted that the group has been active in the past and has had a cycle of ups and downs and has gone through a difficult period. They have not received the funding from member nations that they were expecting. Ralph Schneider from Kiel is now the Executive Director and trying to establish IMAGES II. There is a lot of hope and expectation that the future will look brighter. Compton encouraged SCOR to offer what support it could to IMAGES II and hoped that it has some success in re-launching as a group. They had a strong group in the past. IMAGES supported some graduate students to attend the International Conferences on Paleoceanography, which are large international meetings, but the organization does not know if they will have the money to do that again. Ed Urban commented that IMAGES has had continuing overlap with the PAGES project of IGBP. Perhaps the key to future success for IMAGES would depend on integration with PAGES. Compton agreed with Urban's suggestion, since IMAGES covers a sub-specialty of PAGES, and in light of their difficulties. Compton noted, however, that if a community is strong, it can do a lot of work without funds.

7.3.2 InterRidge - International, Interdisciplinary Ridge Studies

John Compton reported that InterRidge has an active set of working groups and scientific meetings, as well as significant education and outreach activities. It is focused on studying the mid-oceanic ridge system. Working Groups are the principal mechanism for implementing the InterRidge program, their main function being to identify new areas of high-priority scientific research. There are five active InterRidge Working Groups: (1) Mantle Imaging, (2) Seafloor Mineralisation, (3) Long-Range Exploration, (4) Vent Ecology and (5) SCOR and InterRidge are co-sponsoring WG 135 on Hydrothermal Energy Transfer and its Impact on the Ocean Carbon Cycles. This is the only working group that SCOR and InterRidge have co-sponsored, but there has always been good reporting and good interactions between the two organizations.

The InterRidge program office is now in its second year at the National Oceanography Centre, Southampton, UK. It is led by Bramley Murton (IR Chair) and Jon Copley (IR Co-Chair). The Office Coordinator is Debbie Milton. InterRidge supports a Cruise Travel Bursary program (see http://www.interridge.org/cruisebursary).

Compton added that InterRidge has a good Web site (see http://www.interridge.org/) and is very organized in its work, similar to SCOR in some ways. The InterRidge community has been very effective in cooperating on joint work. Ilana Wainer asked whether InterRIDGE does anything in the South Atlantic Ocean and Compton replied that they do have some cruises there. Wainer responded that she doesn't see any membership from South Atlantic region; Compton responded that he will inquire about this. Missy Feely pointed out that if you go to the InterRidge Web site there are members listed from the Southern Hemisphere, and the Web site also lists the locations of future cruises.

7.3.3 International Ocean Colour Coordinating Group (IOCCG)

John Volkman reported that IOCCG scientific activities are carried out by specialized scientific working groups that investigate various aspects of ocean-color technology and its applications, and produce a report on the topic, published in the growing IOCCG Report Series (10 reports published to date). IOCCG Working Groups that are currently active include Bio-Optical Sensors on Argo Floats, Ocean Colour from a Geostationary Platform, Level-1 Requirements, and the Joint GEOHAB/IOCCG WG on Harmful Algal Blooms. Groups that have been approved, but have not yet met, include the Working Group on Polar Seas, Working Group on Uncertainties in Ocean-Colour Remote Sensing, and Round-Robin Inter-Comparison of Retrieval Algorithms for Coastal Waters. The Joint GEOHAB/IOCCG WG on HABs began its work this year and is notable as the first joint activity of IOCCG and a SCOR project. Over the past decade, IOCCG has played an important role in training and capacity building on a global scale. Most of the training has been devoted to capacity building in developing countries, and to ocean color applications intended to give participants practical skills rather than fundamental knowledge. IOCCG has been affiliated with SCOR since 1997. The first IOCCG term of reference sums up the organization's main purpose: to serve as a communication and coordination channel between data providers and the global user community of satellite ocean-color data, and so to maximize the benefits that accumulate from international investments in ocean-color science and technology.

IOCCG has twenty members, broadly distributed geographically. The report for the SCOR meeting was put together by IOCCG's Project Scientist, Venetia Stuart, who is based in the Bedford Institute of Oceanography and has done a nice job. The groups on Argo Floats and on Ocean Colour from a Geostationary Platform have been successful.

7.4 Other Organizations

7.4.1 Arctic Ocean Sciences Board (AOSB)

Wolfgang Fennel reported that the Arctic Ocean Sciences Board (AOSB): Marine Working Group of the International Arctic Science Committee (IASC) is a non-governmental body that includes members and participants from research and governmental institutions in all 19 IASC countries. It was established in May 1984 to fill a recognized need to coordinate the priorities and programs of countries and institutions engaged in research in the Arctic Ocean. In 2009, AOSB merged with IASC as part of IASC's restructuring. The merger was designed to build synergy between the two organizations and to ensure seamless integration of the terrestrial, cryospheric, social, oceanic, and atmospheric sciences in the Arctic. The ASOB:MWG has identified the following priority themes for 2011-2015: Arctic Ocean System: predicting and understanding rapid changes in the Arctic; sea ice structure dynamics and the Arctic system; ecosystem responses to changing physical parameters in the Arctic; understanding geochemical process in the Arctic Ocean and Sub-Arctic Seas; and improving access to the paleo-record of the Arctic Ocean. Ed Urban added that he had communicated with AOSB that SCOR had received a proposal on sea ice, but does not know if that will translate into funding. We will pursue the contact to see if they want formal interaction related to the group, even without funding.

7.4.2 Partnership for Observation of the Global Oceans (POGO)

Wolfgang Fennel reported that POGO is a non-profit consortium of oceanographic institutions from around the world. POGO promotes global oceanography, particularly the implementation of international and integrated global ocean observing systems. POGO has focused much of its attention in recent years on interactions with the Group on Earth Observations (GEO) to represent ocean observation issues. A new Task on "Oceans and Society: the Blue Planet" is included in the draft GEO Workplan, and this task draws together POGO and many of the other organizations and projects involved in ocean observations. POGO and SCOR are cooperating on development of the International Quiet Ocean Experiment and co-fund the POGO-SCOR Visiting Fellowships for Oceanographic Observations. Ed Urban asked if anyone regularly attends annual POGO meetings, who might represent SCOR. There is not much overlap between SCOR and POGO memberships.

8.0 ORGANIZATION AND FINANCE

8.1 Membership

8.1.1 National Committees

The changes in Nominated Members since the 2010 General Meeting were given in the background book**.** Ed Urban asked to be notified of personal contacts in countries that are not currently SCOR members. The capacity building meeting in Turkey in 2010 allowed Urban to meet a lot of people from the Middle East and North Africa regions, from which SCOR has few members. SCOR membership is also weak in southeast Asia and Africa. SCOR has quite a few South American members, but it would be nice to get Argentina back as a member. There are currently no members in Central America. Mark Costello asked for information that he could use to promote SCOR among IABO members.

8.2 Publications Arising from SCOR Activities

Ed Urban reported on SCOR publications since the previous annual SCOR meeting. SCOR groups have been active in publishing this year, including publications in high-profile journals such as *Science* and *Nature*.
2010 *SCOR Proceedings*—The *Proceedings* was distributed in electronic form only.
SCOR Web site—The SCOR Web site is updated regularly and is checked for dead links monthly. Many historical documents from the SCOR files have been scanned and are available on the SCOR History page (http://www.scor-int.org/history.htm). The papers of Robert Snider (first coordinator of the International Indian Ocean Expedition) were scanned and are available on a specific page for the IIOE (http://www.scor-int.org/IIOE_History.htm).
SCOR Newsletter—The SCOR Newsletter was started late in 2004, to provide more frequent updates about SCOR activities between annual meetings. Nineteen issues have been distributed so far. (All are available on the SCOR Web site.) The Newsletter is printed in hard copy occasionally for limited distribution.

SCOR has been encouraging working groups to publish articles in *EOS* after their first meetings. Ed Urban noted that he would do an edition of the newsletter to report on this week's meeting and other actions. John Volkman asked about the process of working groups alerting us to their publications. Urban replied that he is pretty aware of what is coming out and asks to review the acknowledgement language to make sure it includes the NSF grant number and mentions SCOR. Groups occasionally publish items without proper acknowledgements, but this doesn't happen very often any more. After an article or special issue is published, it is announced in the *SCOR Newsletter* and listed on the Publications page on the SCOR Web site.

8.3 Finances

The annual audit of SCOR finances was competed in March. Elizabeth Gross worked to prepare information for the auditors. The financial records and financial controls were found to follow accepted standards. New U.S. government requirements resulted in a more expensive audit and more work for SCOR staff.

SCOR received the following new or renewal grants since the 2010 SCOR meeting:

- Three-year renewal of NSF grant to SCOR for travel of scientists from developing countries to ocean science meetings
- Second year of the three-year science grant from NSF.

Corina Brussaard chaired the Finance Committee and gave the presentation. The 2011 Finance Committee included Marta Estrada and Robie MacDonald as the other two members. Brussaard started by showing a graph of SCOR finances from 1991 through 2009. She then showed and explained a slide of the 2010 budget vs. actual income expenses and a summary of 2010 finances. SCOR had less income than expected, and an ending cash balance of $150,000.00, less than what had been budgeted in 2010. John Volkman asked why there is nothing shown for interest earned. Ed Urban replied that SCOR keeps its cash in U.S. Treasury Bills, on the advice of the SCOR auditor. These investments are very safe and earned high interest for first few years ($12,000-15,000 per year), but last year the interest was only $1.00. Costello then asked about the overhead on grants. Urban replied that SCOR receives 15% overhead on grants from the Sloan Foundation, but no overhead on grants from the U.S. government.

Brussaard reviewed the auditor's report. The auditor found no accounting discrepancies and found SCOR a low-risk client. The Finance Committee recommended acceptance of the 2010 finance report, given the opinion of the auditors. Brussaard then went through the 2011 budgets, including the 2011 budget approved at the 2010 SCOR meeting in Toulouse and the proposed revisions to that budget. Brussaard also presented draft budgets for 2012 and 2013. Wendy Broadgate asked about the smaller income from NSF than expected. Urban explained that this was due to SCOR not claiming as much from NSF as it could have. The Finance Committee recommended acceptance of the 2012 budget.

John Volkman commended Brussaard on her work chairing the Finance Committee. He commented that SCOR is heavily relying on NSF funding and asked if we are expecting a decrease. Ed Urban responded that no decrease is anticipated, but he would like the Executive Committee's help to seek other funds to diversity SCOR's income. Volkman asked whether conferences are a source of funds. Urban responded that there are two aspects. SCOR charges registration fees for most major meetings, but tries to keep the registration fees low. Most of the time the registration fees for SCOR-supported meetings are lower than for meetings convened by other organizations and are set at levels to cover per-participant incremental costs. SCOR does, however, include a contingency line item in the meeting budgets so that the risk of losing money on any given conference is kept low. The Executive Committee has agreed in past that leftover conference fees can be used towards the salaries of sponsors' staff members related to the meetings, but we have not used that approach yet. Since SCOR manages the funds for most of the conferences that it co-sponsors, SCOR assumes all the financial risks, so Urban is very careful of the contracts that he signs.

Mark Costello asked about member dues. Urban explained there are five different levels of membership and that each country chooses its own dues level. The levels increase by an average

of 3% each year. The Finance Committee approved a 5% increase in 2010, but rescinded this decision and went back to a 3% increase when the global economy weakened. Another option to increase dues income is to convince new countries to join. Corina Brussaard asked if SCOR could raise dues by US$1,000 for every country. Missy Feeley responded that this would probably not be a good time to take such a step, until the global economy recovers. Marta Estrada asked if it would be easier to get extra funds from SCOR nations hosting events. Mark Costello suggested soliciting other countries. Urban responded that we have tried to get other countries to attend our annual meetings and come at their own expense. Urban asked Wendy Broadgate what IGBP's increase is. She said it was 3% last year and will be the same this year. Luis Valdes commented that IOC meetings are a good opportunity to look for new members. Urban agreed and noted that he does try to talk with representatives from countries that don't belong to SCOR when he is attending the annual IOC meeting. Missy Feeley asked if there are dues guidelines listed somewhere and Urban responded that this information is on the SCOR Web site.

Michael MacCracken suggested soliciting new funds for SCOR capacity building activities. Motoyoshi Ikeda commented that he was relieved that two new working groups could be funded and there should be a general agreement to approve at least two working groups each year. John Volkman agreed with Ikeda; this will require that SCOR continue to increase its income. Corina Brussaard asked if working groups expect US$15,000 per year. Ed Urban responded that SCOR does ask working group members to self-fund their travel when possible, but $15,000 is still a small amount for 10 people to attend a meeting.

Wolfgang Fennel reviewed the recommendations from the Finance Committee:

1. Approve Revised budget for 2011
2. Approve Budget for 2012
3. Approved Dues Increase of 3% for 2013

Each of these recommendations was approved by meeting participants.

9.0 SCOR-RELATED MEETINGS

9.1 SCOR Annual Meetings

Meeting participants considered potential locations in which to hold future meetings, particularly in nations that have not recently hosted annual meetings.

9.1.1 2011 Executive Committee Meeting – Helsinki, Finland

Wolfgang thanked the meeting hosts for the well-prepared meeting and excellent breaks and entertainment. Ed Urban thanked the hosts for putting in a lot of work to host the meeting. Meeting participants had an excursion to Aker Arctic Technology, Inc. (http://www.akerarctic.fi/), a pioneering company in the design and oversight of icebreaker construction, where participants learned that Finland is the only country that becomes totally locked in by sea ice each winter, and that there are going to be many more icebreakers plying

Arctic waters as a result of global warming. Participants were able to view the Aker Arctic test laboratories.

9.1.2 2012 General Meeting – Halifax, Canada

Robie MacDonald reported that the SCOR Executive Committee has accepted an invitation to hold the 2012 SCOR General Meeting in Halifax, Canada, during the week of 22-26 October 2012. Parts of the meeting will be held both at Dalhousie University and at the Bedford Institute of Oceanography (BIO), to help meeting participants interact with scientists from both institutions. The reason that the Canadian National Committee for SCOR suggested holding the 2012 meeting in Halifax is because BIO is celebrating its 50th anniversary with a symposium during the proposed week. A few people have been working on the logistics and organizing the rooms. John Compton asked how the SCOR meeting should interact with the symposium. MacDonald answered that symposium would provide a good dose of science in combination with the SCOR meeting. The schedule for the symposium should be finalized soon. Mark Costello asked if the schedule would be of interest to everyone in the science community. MacDonald thought it would be and Bjørn Sundby agreed. Sundby noted that the SCOR Secretariat was formerly located at Dalhousie University.

9.1.3 2013 Executive Committee Meeting

The location of the 2013 Executive Committee meeting has not yet been decided although the Executive Committee is looking for a Southern Hemisphere venue where SCOR has not met in recent years, potentially in a developing country. Discussions are underway with one nation and back-up offers have been received. There had been in discussion with nominated SCOR members from Ecuador about having the 2013 SCOR meeting there and they are very enthusiastic and trying to work through the system to generate an official invitation. Ecuador is at least partially located in the Southern Hemisphere and it is a developing country. SCOR last held an annual meeting in Ecuador in 1974. They paid several years of dues in arrears this year. Back-up offers have been received from Brazil and New Zealand, and we do not have to make the decision until next year.[18]

9.1.4 2014 General Meeting – Bremen, Germany

The SCOR Executive Committee has accepted an invitation to hold the 2014 SCOR General Meeting in Bremen, Germany. Wolfgang Fennel expressed that he expected that the German hosts would plan a very nice meeting.

9.2 Gifts of Appreciation

Urban presented Jorma Kuparinen with a thank-you gift of pottery from his home state of Pennsylvania. Kuparinen credited Riitta Autio for putting the meeting together and thanked her for her hard work to make the meeting very successful. Fennel thanked meeting participants for attending and contributing to the meeting, and wished everyone a safe trip home.

[18] The Executive Committee approved an invitation to hold the meeting in New Zealand, as no official invitation was received from Ecuador.

Appendix 1

40th SCOR EXECUTIVE COMMITTEE MEETING
Helsinki, Finland

12-15 September 2011

AGENDA

1.0 OPENING

1.1	Opening Remarks and Administrative Arrangements	*Kuparinen, Fennel, Urban*
1.2	Approval of the Agenda	*Fennel*
1.3	Report of the President of SCOR	*Fennel*
1.4	Report of SCOR Executive Director, p. 1-5	*Urban*
1.5	Appointment of an *ad hoc* Finance Committee	*Fennel*
1.6	2012 Elections for SCOR Officers	*Sundby*

2.0 WORKING GROUPS

2.1 Disbanded Working Groups
- 2.1.1 SCOR/IAPSO WG 129—Deep Ocean Exchanges with the Shelf

2.2 Current Working Groups
- 2.2.1 WG 125—Global Comparisons of Zooplankton Time Series
- 2.2.2 SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater *Morozov*
- 2.2.3 SCOR WG 130 on Automatic Plankton Visual Identification *Costello*
- 2.2.4 SCOR WG 131 on The Legacy of in situ Iron Enrichment: Data Compilation and Modeling *MacCracken*
- 2.2.5 SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems *Taguchi*
- 2.2.6 SCOR/IAPSO WG 133: OceanScope *Feeley*
- 2.2.7 SCOR WG 134 on The Microbial Carbon Pump in the Ocean *Sundby*
- 2.2.8 SCOR/InterRidge WG 135 on Hydrothermal energy transfer and its impact on the ocean carbon cycles *Feeley*
- 2.2.9 SCOR/WCRP/IAPSO Working Group 136 On the Climatic Importance of the Greater Agulhas System *Compton*

2.2.10 WG 137: Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation *Volkman*

2.2.11 WG 138: Modern Planktic Foraminifera and Ocean Changes *Fennel*

2.3 New Working Group Proposals

2.3.1 Proposal for a SCOR Working Group to Investigate Physical and Biological Determinants of Population Connectivity: Are Perceived Temperate-Tropical Differences Real? *Fennel*

2.3.2 Proposal for a SCOR Working Group: Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean *Compton*

2.3.3 Proposal for a SCOR Working Group on Deep-sea biodiversity Patterns of the South Atlantic Ocean *Costello*

2.3.4 Proposal for a SCOR Working Group on Common Challenges in Establishing Ocean Observatories *Feeley/Wainer*

2.3.5 Proposal for a SCOR Working Group on Subterranean Estuaries *Sundby*

2.3.6 Proposal for a SCOR Working Group on Patterns of rocky shore dynamics in coastal ecosystems: comparative analysis *Taguchi*

2.3.7 Proposal for a SCOR Working Group on Biogeochemical Exchange Processes at the Sea-Ice Interfaces (BEPSII) *Volkman*

2.3.8 Proposal for a SCOR working group on Understanding the global impacts and implications of range-shifting species in marine systems *Costello*

3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

3.1 SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program *Taguchi*

3.2 SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project *Sundby*

3.3 GEOTRACES Project *Sundby*

3.4 SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study *Wainer*

4.0 OCEAN CARBON AND OTHER ACTIVITIES

4.1 IOC/SCOR International Ocean Carbon Coordination Project (IOCCP) *Fennel*

4.2 Symposia on The Ocean in a High-CO_2 World *Volkman*

4.3 Other Activities

4.3.1 Phytoplankton Pigments in Oceanography *Urban*

4.3.2 Data Publication Activity *Costello*

4.3.3 SCOR/POGO Workshop on International Quiet Ocean Experiment *Urban*

5.0 CAPACITY-BUILDING ACTIVITIES

5.1 SCOR Committee on Capacity Building *Ittekkot*

5.2 SCOR Visiting Scholars *Ittekkot*

5.3 Regional Graduate Networks of Oceanography and Marine Environmental Sciences *Ittekkot*

5.4 POGO-SCOR Visiting Fellowships for Oceanographic Observations *Urban*

5.5 NSF Travel Support for Developing Country Scientists *Urban*

5.6 SCOR Reports to Developing Country Libraries *Urban*

6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

6.1 Intergovernmental Oceanographic Commission *Enevoldsen, Fennel*

6.2 International Council for Exploration of the Seas *Fennel*

6.3 Joint Group of Experts on the Scientific Aspects of Marine Environmental

6.4 North Pacific Marine Science Organization (PICES) *Taguchi, Bychkov*

7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

7.1 International Council for Science *Fennel*
- 7.1.1 International Geosphere-Biosphere Program (IGBP) *Fennel, Broadgate*
- 7.1.2 World Climate Research Programme (WCRP) *MacCracken*
- 7.1.3 Scientific Committee on Antarctic Research (SCAR) *Wainer*

7.2 Affiliated Organizations
- 7.2.1 International Association for Biological Oceanography (IABO) *Costello*
- 7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS) *MacCracken*
- 7.2.3 International Association for the Physical Sciences of the Oceans (IAPSO) *Morozov*

7.3 Affiliated Programs

7.3.1	International Marine Global Changes Study (IMAGES)	*Compton*
7.3.2	InterRidge - International, Interdisciplinary Ridge Studies	*Compton*
7.3.3	International Ocean Colour Coordinating Group (IOCCG)	*Volkman*

7.4 Other Organizations

7.4.1	Arctic Ocean Sciences Board (AOSB)	*Fennel*
7.4.2	Partnership for Observation of the Global Oceans (POGO)	*Fennel*

8.0 ORGANIZATION AND FINANCE

8.1	Membership	
8.1.1	National Committees	*Urban*
8.2	Publications Arising from SCOR Activities	*Urban*
8.3	Finances	*Finance Committee, Urban*

9.0 SCOR-RELATED MEETINGS

9.1 SCOR Annual Meetings

9.1.1	2011 Executive Committee Meeting – Helsinki, Finland	*Fennel*
9.1.2	2012 General Meeting – Halifax, Canada	*Sundby*
9.1.3	2013 Executive Committee Meeting	*Fennel*
9.1.4	2014 General Meeting – Bremen, Germany	*Fennel*

9.2 Locations of Past SCOR Annual Meetings

9.3 SCOR-Related Meetings Since the 2010 SCOR General Meeting and Planned for the Future

Appendix 2

40th SCOR EXECUTIVE COMMITTEE MEETING
Helsinki, Finland
12-15 September 2011

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Appendix 3

Proposal for a SCOR Working Group: Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean

Abstract

The trace metals iron (Fe), copper (Cu), nickel (Ni), cobalt (Co), cadmium (Cd) and zinc (Zn) are essential micronutrients to marine phytoplankton, controlling primary productivity in up to half of the open ocean, from tropical to polar regions. Consequently, these metals exert a major influence on the global carbon cycle and play a key role in regulating global climate. However, the availability of these metals to the biota is governed by speciation, whereby trace metals are bound by organic ligands that may reduce or enhance metal bioavailability, depending on the metal and the resulting metal-ligand complex. Organic ligands are defined as molecules that can bind to, and form a stable complex with, trace metals in the aquatic dissolved (typically <0.2 μm) phase. Electrochemical techniques have shown that trace metals in seawater are overwhelming bound (up to 99.999%) by organic ligands, and that these ligands are ubiquitous in the ocean. More recently, organic geochemical techniques have shown that at least some Fe-binding ligands are produced by the biota. Over the past three decades, major advances in analytical techniques have led to a consensus on accuracy and precision for total dissolved trace metal analyses and dramatically improved our knowledge on the global and regional distributions of trace metals. In contrast, our understanding of trace metal-binding ligands and their pivotal biogeochemical functions remains at a comparatively early stage. ***To date, we know little about the composition, source and provenance of metal-binding ligands, which is hindering further advances in the field of trace metal biogeochemistry.***

The proposed working group would focus on advancing our understanding of trace metal-binding organic ligands in the oceans by bringing together expertise ranging from aquatic organic geochemistry to trace metal electrochemistry. Over a 4-year period the working group will (1) Summarize published results from electrochemical and organic geochemistry techniques to identify future collaborative research directions towards targeting specific approaches to determine the structure and source of metal-binding ligands; (2) Expand upon the ligand intercalibration programme, initiated by GEOTRACES, to evaluate key analytical issues with currently employed methodologies and determine how best to link ongoing efforts in trace metal and organic geochemistry to assess natural metal-binding ligands; (3) Identify how to best incorporate published and future data into biogeochemical models; (4) Employ a suite of proposed workshops and working group meetings as a forum to debate the nature of sampling strategies and experimental approaches to be employed in laboratory and field efforts that are needed to determine the composition and structure of these ligands; (5) Provide summarized recommendations at the proposed symposium for future research approaches into ligand biogeochemistry, especially with respect to complementing the ongoing decade-long GEOTRACES field efforts (*i.e.*, regional surveys and process studies) and the need for rapid incorporation of this research into biogeochemical models; (6) Establish a webpage for this SCOR working group, to promote a forum for discussion of ideas and results, soliciting input from the trace metal biogeochemistry, aquatic organic geochemistry and modelling communities, and provide a platform to propose special sessions on trace metal-binding ligands at international meetings such as Ocean Sciences, AGU and/or EGU.

Rationale

Improving our understanding of the role of metal-binding ligands in oceanic biogeochemistry is extremely important, as these ligands control the bioavailability of trace metals, and, thus, influence pivotal global elemental cycles, such as carbon and nitrogen. To a large extent, we simply do not adequately understand the role or chemical structure of metal-binding ligands in the oceans. Thus, we

cannot model them with sufficient confidence to predict how they, and consequently trace metal cycles, will respond to projected global alteration of continental aridity (dust supply), ocean acidification, and oceanic oxygen minimum zones due to a changing climate.

Historically, the primary technique for characterizing metal-binding ligands in seawater has been competitive ligand exchange-adsorptive cathodic stripping voltammetry (CLE-ACSV), which provides ligand concentrations and conditional stability constants for the ambient metal-ligand complexes. This technique, however, does not provide meaningful information on the structural characteristics required for identification of these ligands. In the past few years, analytical advances in organic geochemistry using liquid chromatography-electrospray ionization-mass spectrometry (LC-ESI-MS) methods, coupled with nuclear magnetic resonance (NMR), have led to novel research focused on determining the link between the binding strength of ligands measured in natural seawater and their structural identity. As CLE-ACSV provides ligand concentrations, but not structural characteristics, while LCESI-MS/NMR provides structural characteristics but no quantitative information on ligands, it is essential to combine these approaches in order to drive progress toward determining sources and composition of metal-binding ligands in the ocean. Each of these techniques alone constitute a powerful, though insufficient, approach to determining metal speciation- ***combining these approaches would constitute a significant step towards assessing metal-binding ligands in the ocean, and lead to new research directions for metal speciation similar to that achieved with 'The Biogeochemistry of Fe' (SCOR WG 109) for dissolved Fe analysis.***

It is timely to focus on the issue of trace-metal binding ligands now, as a SCOR-sponsored international programme, GEOTRACES, was launched in late 2009 with the goal of determining the distributions of trace metals in the global ocean. Trace metal speciation, at least for Fe, has been identified as a core measurement on the GEOTRACES section cruises. The GEOTRACES ocean section cruises commenced in 2010, generating a considerable body of metal speciation data for Fe, Cu, Co and Zn by CLE-ACSV from depth profiles on each cruise. Although the use of CLE-ACSV measurements on the GEOTRACES cruises will provide substantial insights into the distributions of metal-binding ligands measured and their respective binding constants, ***critically, they will not allow for characterization of the ligands themselves***, which requires the application of organic geochemistry techniques. Further, CLE-ACSV studies increasingly suggest that different types of metal-binding ligands (stronger vs. weaker, colloidal vs. truly soluble) play distinct roles in the biogeochemical cycling of trace metals like Fe and Cu, and yet the identities and sources of these ligands remain elusive.

Given the need for a multidisciplinary solution to this problem, a SCOR working group, consisting of trace metal biogeochemists, aquatic organic geochemists and modelers, is the best mechanism to focus current international scientific expertise on metal-binding ligands. Appropriate scientific expertise will be assembled from different countries and an international working group will help develop this topic in developing nations. Other organizations cannot ensure that such an activity is suitably interdisciplinary, involving scientists from a wide range of disciplines and countries, while also helping train young scientists. A webpage will be constructed to help facilitate discussion between working group members, as well as to ensure other large science programs like GEOTRACES, CLIVAR and SOLAS (and a proposed geochemical global ocean survey similar to GEOTRACES) remain involved. The results of this working group will be presented during the proposed symposium and published in a special issue of a journal or book, as well as a report to SCOR.

Background

A short background is provided here to summarize the issues that have motivated us to propose a working group on metal-binding ligands at this time.

Metal-binding ligands appear to facilitate bioavailability and uptake of the trace metals Fe and Co (Maldonado *et al.* 2005; Saito *et al.* 2005), while those binding Cu, Ni, Cd and Zn may sequester and decrease the bioavailability of these metals (Vraspir & Butler 2009). The pioneering work of Rue & Bruland (1995) and Gledhill & van den Berg (1994) established using CLE-ACSV measurements that dissolved Fe in the ocean was 99.99% bound to organic ligands, which in turn increased the solubility of this important micronutrient. Other trace metals such as Cu, Ni, Co, Cd and Zn are also bound to varying degrees by organic ligands, although there are considerably less data available on the organic complexation of these metals in the oceans. The lack of analytical technologies sensitive enough to directly characterize these organic ligands at ambient seawater concentrations has restricted research progress in this field until very recently. Siderophores produced by iron-limited bacteria to acquire Fe have been shown previously by CLE-ACSV to have similar measured stability constants as strong Fe-binding ligands (L1) measured in surface waters (Macrellis *et al.* 2001), and new approaches with LCESI-MS and NMR have now detected these siderophores directly in natural seawater (Mawji *et al.* 2008, Velasquez *et al.* 2011). Further, recent incubation studies of natural seawater have documented the production of strong Fe and Zn-binding ligands, presumably by the ambient biota, using CLEACSV (Buck *et al.* 2010; Lohan *et al.* 2005), as well as the production of siderophores by bacteria in seawater using LC-ESI-MS (Gledhill *et al.* 2004). This proposal aims to ***combine the strengths of both the biogeochemistry and aquatic organic geochemistry communities to take a substantial step forward in our knowledge of the source and provenance of metal binding ligands in the ocean.***

While most of the focus has been on Fe to date, very little is known about the composition and sources of other essential trace metal-binding ligands. Metal-binding ligands are typically present everywhere in the water column for the bioactive elements, suggesting that they are either highly recalcitrant, and/or a result of passive biological production *in-situ* (*e.g.*, remineralization). In the case of Fe, the bioremineralization of sinking particles contributes iron-binding ligands (Boyd *et al.* 2010), humic substances can bind Fe and may be the source of some Fe-binding ligands in the deep ocean (Laglera & van den Berg 2009), while zooplankton grazing on phytoplankton (Sato *et al.* 2007) and viral cell lysis (Poorvien *et al.* 2011) also release Fe-binding ligands. In surface waters, saccharides, which are an abundant component of the reactive dissolved organic matter (DOM) pool produced by phytoplankton (Benner 2011) have recently been shown to complex dissolved Fe and enhance Fe bioavailability to some phytoplankton (Hassler *et al.* 2011). In addition, hydrothermal input of organic ligands for both Fe and Cu to the deep ocean may be much larger than previously thought (Sander *et al.* 2007, Bennet *et al.* 2008, Sander & Koschinsky 2011), and has only just been incorporated into models for Fe cycling (Tagliabue *et al.* 2010). An over-arching question from these observations is: ***What is the relationship between the source and function of metal-binding ligands?***

The ubiquitous presence of metal-binding ligands, with similar ligand concentrations typically measured by CLE-ACSV for Fe, Cu and Zn, would seem to indicate that at least some of these ligands are not metal-specific (Hirose 2007). This is crucial as recent evidence suggests that Fe availability depends on Cu availability (Peers *et al.* 2005), with the bioavailability of both metals governed by organic complexation; similar synergistic behavior between other trace metals (*e.g.*, Co, Cd, Zn) may also be important. Further, these metal-binding ligands are all a component of the oceanic pool of DOM, which itself is largely uncharacterized other than the operationally defined refractory, recalcitrant and labile components. The working group will ***use compiled field speciation data to assess potential interplays between metal-binding ligands for the suite of bioactive metals and determine which DOM pools would be most appropriate to target for additional insights.***

Members of the working group in this proposal have recently set up a wiki on trace metal speciation data https://portal.ifm-geomar.de/web/tmsis/wiki/ to encourage community discussion of speciation techniques and of approaches to submitting speciation data for a database. Currently, in the absence of structural

characterization of ligands, conditional stability constants (determined by measuring the binding capacity of these ligands using CLE-ACSV) provide the only means to distinguish between different ambient metal-ligand complexes in the ocean. The distinction between strong L1 and weaker L2 ligands remains an operational definition that varies between analysts, and is dependent on the method employed and the analytical window applied. Compiling published speciation data for the elements from different analysts will provide a broader perspective for the ligand class divisions and highlight discrepancies between chosen definitions. We additionally propose to enhance the intercalibration efforts pioneered by GEOTRACES with attention toward the other organically bound trace metals (Cu, Co, Ni, Cd, Zn). The compilation of published speciation data combined with continuing intercalibration work for these methods will enable us to better ***characterize measured metal-binding ligand classes in terms of measured conditional stability constants and determine how to best standardize these ligand class definitions for future work.*** The interdisciplinary nature of this working group, including organic geochemists alongside analytical chemists and biogeochemists, will advance our understanding of the limits and potential applications of both CLE-ACSV and LC-ESIMS/NMR techniques to this problem. Assessing the available data from this perspective will allow insight into ligand sources and functions, as well as an additional framework for incorporating metal-binding ligands into models.

Modelling trace metal distributions is a formidable task at present. A good example is provided by recent attempts to model the Fe cycle, where models were restricted to broad assumptions because of poor knowledge about the speciation of Fe (see review by Boyd & Ellwood 2010). Even less is known about the speciation of other trace metals in the oceans, and these are typically left out of models despite their importance to phytoplankton growth and global elemental cycles. Thus, a primary goal of the proposed working group is to ***assess how to better incorporate metal-binding ligands into biogeochemical models***. Modellers require knowledge not only on the distribution of metal-binding ligands, but also on the speed of reactions between trace metals and these ligands. The database, workshops and interactive webpage will best facilitate evaluation of this issue, the results of which will be presented at the proposed dedicated symposium.

At present, GEOTRACES is primarily focused on accumulating field data for core parameters, including speciation, and does not have the resources to support the necessary synthesis activities proposed here. Therefore, to ensure that GEOTRACES maximally benefits from undertaken fieldwork, it is important that this SCOR working group is established as soon as possible and liaises appropriately with the GEOTRACES Scientific Steering Committee (SSC). Several members of the GEOTRACES SSC are included as members or corresponding members of this proposed working group. The synthesis activities proposed for this working group will both better help in interpretation of data on trace metals and ligands generated on the GEOTRACES cruises, as well as inform sampling and analytical strategies for future efforts. We anticipate that the combined interactions of the proposed working group will culminate in proposals targeting GEOTRACES process studies specifically designed to study ligand dynamics, ideally at an established reference site that may be used as a natural laboratory.

Statement of Work/Terms of Reference

1. To summarize published results on all aspects of metal-binding ligands in the oceans (*e.g.*, distributions, chemical structure, sources, sinks, stability constants), and to contribute to the organic ligand database for use in biogeochemical models and for those working in the field (including results from ongoing GEOTRACES, SOLAS and CLIVAR efforts).
2. To expand upon the ligand intercalibration programme, initiated by GEOTRACES, to evaluate key analytical issues with currently employed methodologies and determine how to best link ongoing efforts in trace metal and organic geochemistry to assess natural metal-binding ligand.
3. To identify how best to incorporate published and future data into biogeochemical models.

4. To debate the nature of sampling strategies and experimental approaches employed in laboratory and field efforts in workshops and meeting discussions that are needed to enhance our understanding of the links between the provenance, fate, distribution, and chemistry and biological functions of these organic metal-binding ligands in the oceans.
5. To recommend future approaches to ligand biogeochemistry in a designated symposium, including ongoing GEOTRACES field efforts (*i.e.*, regional surveys and process studies), integration of CLE-ACSV and organic geochemistry techniques, and the need for rapid incorporation of this research in biogeochemical models.
6. To establish a webpage for this SCOR working group, to promote a forum for discussion of ideas and results, soliciting input from the trace metal biogeochemistry, organic geochemistry and modeling communities and provide a platform to propose special sessions on trace metal-binding ligands at international meetings such as Ocean Sciences, AGU and/or EGU.
7. To produce conclusions resulting from the outcome of the above objectives in the form of a Website, a journal special issue or book, and a report to SCOR.

MEETINGS, WORKSHOPS AND SYMPOSIA:
It is proposed that the first formal meeting of this working group take place before the Ocean Sciences Meeting in Salt Lake City, Utah (Feb. 19-24, 2012). Preliminary communications leading up to this meeting will take place during the preceding year and will lead to identification of additional Corresponding Members, fine-tuning of the Terms of Reference, and creation of an Agenda. During the meeting, the WG will set up intercalibration efforts and start work on the format for the database and webpage, which will also act as a forum for information exchange and details of new meetings. Other funding sources for the intercalibration efforts, the workshop and final publication will be determined.

Approximately one year after the first meeting a second meeting and an international workshop on trace metal-binding ligands in seawater will be held. This will allow a nominal one-year period over which to structure the workshop agenda, issue announcements and invitations, secure needed funds, and make other necessary preparations. To keep costs at a minimum this would be in combination with the AGU Meeting in San Francisco, USA (Dec. 2012) The workshop will provide the opportunity for all Full and Corresponding members of the working group to discuss all points of the terms of references. Groups will be formed and tasks assigned to work on projects and prepare material to be presented at the special symposia and in the special issue or separate book.

Full members of the working group will meet again in year 3 to determine the progress made by different groups and discuss necessary actions to successfully present at a dedicated symposium in year 4 during the Ocean Science meeting in 2015. That conference would also set the date for the fourth and final meeting during which the working group will be rounding off the results and outcomes and finalize the publications. Separate funding will be sought from EU-GEOTRACES, COST Action, and other sources for the working group third meeting. Place and exact time for this meeting are to be determined but could again be in combination with the Aquatic Sciences Meeting 2014.

Working Group Membership
The final working group membership is proposed to consist of 10 specialists, which along with the Corresponding members includes several who serve on the GEOTRACES Scientific Steering Committee.

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Appendix 4

Proposal for a SCOR working group on Biogeochemical Exchange Processes at the Sea-Ice Interfaces (BEPSII)

Climate change has a *strong impact on the polar regions. Current models are inadequate* to *quantify the role of ice-covered oceans in climate change scenarios, which is* at *least partly due* to a *lack of the representation of biogeochemical processes. This SCOR* WG *has the aim* to *identify the feedbacks between biogeochemical and physical processes* at *the ocean-ice-snow-atmosphere interfaces and within the sea-ice matrix. By bringing together experimentalist and modellers,* a *major improvement of sea-ice biochemistry models from the micro to the global scale will be achieved.*

Background and rationale

Near-future climate change is predicted to have its strongest impact in polar regions due to direct changes in surface area of ice sheets and open water and to subsequent feedback processes. Our understanding of these processes and the accuracy of dedicated models is still in its infancy. Due to inherently different properties of the polar regions, climate change affects the North and South Pole significantly different. **In** the Arctic region, both sea-ice extent and thickness are reducing rapidly, with a record low summer ice extent in 2007 and dramatic shifts from multi-year ice to first-year ice. In the Antarctic, a modest increase of the total sea-ice extent is observed, but with strong regional deviations: major reductions in sea-ice extent are observed along the west coast of the Antarctic Peninsula (Cavalieri and Parkinson 2008) with dramatic shifts in plankton biomass and diversity (Montes-Hugo et at. 2009). With these ongoing rapid changes, it is important to realize that while sea ice will not completely disappear from polar regions, it will definitively experience a profound change in seasonality with subsequent changes in its biogeochemical and physical properties.

Current global models include the seasonal wax and wane of sea ice, but restrict associated properties to only a few physical features without considering biogeochemical effects. In such models, the major climatic effects of sea ice are associated with its albedo, deep water formation and air-sea heat exchanges. In terms of gas exchange, sea ice is represented as a "lid" on the ocean surface (e.g. Stephens and Keeling 2000). In many respects, Earth System Models (ESMs) are characterized by important uncertainties in the polar regions: The observed reductions in Arctic sea ice appear to be accelerated with respect to current model forecasts (Perovich and Richter-Menge 2009); simulated primary production is systematically less realistic in polar regions compared to the rest of the ocean (Carr et aI., 2006); end-of-the-century scenarios do not even agree on the sign of change of primary production in the Arctic Ocean (Steinacher et at., 2010). Also the impact on CO_2 fluxes when ice cover reduces is still unknown, with indications for both increased (Bates et al. 2006) and decreased (Cai et at. 2010) uptake. These examples not only illustrate the rapidity of the observed change, but also the difficulty of understanding and modelling the feedbacks involved in the change.

Emerging views indicate the importance of biogeochemical processes in and associated with sea ice for physical properties and exchange processes at the interfaces. Some examples:

- Sea-ice physical properties (porosity and strength) are affected by biology through the formation of exopolymeric substances (EPS) by algae and bacteria (Krembs et at. 2011).
- Trace metals, iron in particular, released from sea ice together with EPS during the spring ice melt are likely to play a pivotal role in triggering ice edge phytoplankton blooms (Lannuzel et al. 2010, Hassler et al. 2011).
- Model calculations have shown that phytoplankton blooms that occur concomitantly with the ice

retreat along the Arctic coastal shelves strongly impact the Arctic climate through the trapping of solar heat. The resulting surface warming triggers a reduction of sea-ice thickness and concentration with subsequent feedback processes (Lengaigne et al. 2009).

- The recent discovery of marine gels as precursors for cloud condensation nuclei, extends the coupling between biology and climate through the production of dimethylsulfide (DMS) to a new source of organic compounds (Leck & Bigg 2010)
- Although the mechanism remains enigmatic, sea-ice surfaces are involved in the photochemical production of reactive halogen species and subsequent destruction of ozone in the boundary layer. This has important implications for the oxidative capacity of the atmosphere and influences the atmospheric composition of trace gases (Simpson et al. 2007). Recent observation show that sea ice is also an important source for volatile organic compounds such as DMS (Tison et al. 2010), whereas areas of ice melt are sources for bromocarbons (Hughes et al. 2009). Bromocarbons may be important precursors for BrO. Since BrO oxidises DMS to DMSO, thereby reducing its potential to form cloud condensation nuclei, the potential simultaneous, biology driven, production of these volatile compounds may shed a different light on atmospheric processes, with direct consequences for current climate models (Breider et al. 2010).
- The complex inorganic carbon system in seawater is even more complex in sea ice, as extreme salinities and temperature result in precipitation of ikaite (Dieckmann et al 2008). The complexity of the brine structure, the biological activity in brines and composition of the ice will ultimately determine whether the net effect of ice will be a sink or source of CO_2 (Delille et al. 2007, Miller et al. 2011).

These are only a few examples that show the complexity of the processes we have to face when trying to understand the role of sea ice in the earth's system: processes at the micro scale have far-reaching implications for the regional to global scale. Hence, in order to understand this system it is a prerequisite that the main processes and feedbacks at each and every scale are examined from an integrated perspective. This is the aim of this working group, accomplished by active interaction between experimentalists and modellers. The experimentalists will need to assess the quality of the data that have been assembled and translate these in order to make them useful for modellers. The modellers will need to find ways to improve the flexibility of their models in order to translate processes from one scale to the other. Together they will identify, evaluate and parameterize the main biogeochemical and physical properties at the different scales, with the ultimate goal of realistically implementing polar biogeochemical processes in both ocean biogeochemistry and ESMs.

To achieve this, a multidisciplinary approach is needed. In the proposed SCOR WG, we intend to bring together sea-ice specialists from multiple disciplines and modellers of sea ice systems at the different scales, in order to:

- explore existing knowledge on the role of sea ice in influencing climate-relevant elemental fluxes,
- discuss and formulate the relevant biogeochemical processes and identify gaps in our knowledge,
- explore and compile available field data needed for model validation, and
- stimulate integrated model development.

The primary objective of SCOR is "to focus on promoting international cooperation in planning and conducting oceanographic research, and solving methodological and conceptual problems that hinder research". These are exactly the needs of the sea-ice community. Sea-ice biogeochemistry is an emerging topic, for which the scientific community.is small, not organized and spread all over the world. A SCOR working group will give a strong impulse to assembling current expertise around this

highly interdisciplinary topic.

Terms of reference

The proposed working group will bring together experimentalists and modellers that each have their own and combined goals.

1. In order to evaluate currently available data of important parameters affecting sea ice physics and biochemistry and to make recommendations for further data collection needed for the validation of models, a thorough evaluation of existing and new methods is required. The need for an evaluation arises from the specific challenges involved in sea-ice studies: sea ice is a complex medium, including ice matrices, brines, gases and solid salt precipitates and it exhibits substantial variability on all spatial and temporal scales. A comprehensive review of the current state-of-the-art in sea-ice biogeochemical methodology including an assessment of their relative strengths and weaknesses will be synthesised.
2. There is an urgent need to translate relevant processes from small-scale models to global ESMs. Since investment in development time for the insertion of new mechanisms into ESMs can be high, modellers not only need to develop simplified parameterizations, but also to develop small to intermediate scale models that are able to prioritize ice biogeochemistry to climate linkages.
3. Together experimentalists and modellers will summarize existing knowledge on biogeochemical and physical processes at the ocean-ice-snow-atmosphere interfaces and within sea-ice and identify gaps in model parameterizations of these processes. This also includes recommendations for improved data collection and analysis by preferred methods for model calibration and validation.
4. From this collaboration, models will be developed that will quantify our knowledge on the impact of sea ice biogeochemistry on climate and how climate change feeds back onto sea ice.

Timeline and products

We will initially be focusing on synthesising current knowledge and identifying gaps including the comparison of methods and available model parameterisations. Based on that we will proceed to bridging gaps by developing improved parameterisations and synthesize methods. We envision the work to be supported by funding on national levels with support for international collaboration via SCOR funding.

We intend to organise special sessions during larger scientific meetings such as AGU, EGU, ASLO, IGS sea ice conference and SOLAS-OSC. Additional funding for a I-day discussion session preceding or succeeding an ASLO meeting will be investigated through ASLO's new Emerging Topics initiative. At least 3 meetings are scheduled: 1. To evaluate sea-ice biogeochemical methods and formulate a guide of best practice. 2. To identify gaps in model parameterizations and make recommendations for improvements. 3. To discuss and formulate the up scaling of relevant processes in models.

A final report in the form of a special issue of a peer-reviewed journal will be published, in which the major findings of the thematic workshops are summarized and new parameterizations for coupled sea ice-ocean-atmosphere models are presented.

Relevance to other activities of SCOR or other international organizations

The initiation of a sea-ice biogeochemistry network took place during a workshop organized under the aegis of the European COST Action 735 ('Tools for Assessing Global Air-Sea Fluxes of Climate and Air Pollution Relevant Gases'; a SOLAS-related activity), 12-14 April 2011, where sea-ice specialists from Europe, Canada, USA and Australia met. During this meeting, both modellers and experimentalists presented their work and discussed the need to form a network for future collaboration. As a result, the

current SCOR proposal was formulated. It was also concluded that SCOR support may not be sufficient to achieve all our goals. Therefore, effort will be put in finding additional sources for collaboration in the coming months.

The proposed working group is closely related to the IGBP core-project SOLAS (Surface Ocean Lower Atmosphere Study), which is co-funded by SCOR. SOLAS' primary objective is: *"To achieve quantitative understanding of the key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere, and of how this coupled system affects and is affected by climate and environmental change."* SOLAS has recently formulated several new topical areas that deserve special attention because of their urgency in global change. With this initiative, SOLAS intends to stimulate international collaboration. One of these topics concerns sea-ice biogeochemistry. The proposed SCOR WG is therefore timely and would provide an important boost for this SOLAS initiative. Funding by SOLAS itself for such activities is very limited.

It is important to mention here that this initiative intends to benefit from the momentum generated by the IPY programs. One such program is the Ocean-Atmosphere-Sea Ice- Snow Pack (OASIS) project and several of its associated investigators are listed on this working-group membership list. During the OASIS-Telluride meeting in June 2011, further collaboration will be investigated.

The research in this proposal is also endorsed by the Nordic Top-level Research Initiative (Initiativehttp://www.toppforskningsinitiativet.org/en) programme on interaction between the climate change and the cryosphere.

Working group composition

The working group members have been chosen for their expertise in studying sea-ice associated biogeochemical cycles. They are chosen such as to cover a wide spectrum of sea-ice disciplines, but with an emphasis on disciplines dealing with biogeochemistry at the ocean-ice-snow-atmosphere interfaces. Since the collaboration between modellers and experimentalists is a prerequisite for this WG to succeed, the composition of the group of full members reflects this. Members are leading in her/his field of research, are involved in many ongoing international polar programs and capable of encouraging and involving other specialists and collaborators in their field of research. We made an effort in involving young scientists in this new network of sea-ice biogeochemists.

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Appendix 5

SCOR-IOC
Global Ecology and Oceanography of Harmful Algal Blooms
(GEOHAB) Program Activities, 2010-2011

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 Plan*[1], 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 (hold 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.

Appendix 6

Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project

IMBER Annual Report to SCOR, June 2011

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
- Third IMBER Summer School in Ankara, Turkey, August 2012
- IMBIZO III (possibly in China), 2013
- First IMBER Open Science Meeting, planning underway for 2014

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 CO_2). 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 CO_2 through time. This estimation of the change in oceanic storage of anthropogenic CO_2 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 ClimECO_2 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 (imber@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

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 Reykjavik, 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/ (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/

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 N_2-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 N_2-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 Tyrrhenian 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 and livestock. Further information at http://vector.conismamibi.it/sito%20inglese/e-index.htm.

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: http://www.amemr.info/http://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: http://www.challenger2010.org.uk/.

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 ClimECO$_2$ 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

ClimECO$_2$
In August 2010, IMBER, in collaboration with IUEM and GIS Europôle Mer, organized the ClimECO$_2$ 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. ClimECO$_2$ 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 ClimECO_2 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 Arístegui (IMBER SSC Vice-Chair) was one of the conveners. 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 CO_2 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-conveners and the organising committee 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

Drinkwater K, Beaugrand G, Kaeriyama M, Kim S, Poertner H, Polovina J, Ottersen G, Takasuka A, Perry I. 2010. On the processes linking climate to ecosystem changes. *Journal of Marine Systems*, 79: 374-388.

Feely R, Fabry V, Dickson A, Gattuso J-P, Bijma J, Riebesell U, Doney S, Turley C, Saino T, Lee K, Anthony K, Kleypas J. 2010. An International Observational Network for Ocean Acidification in *Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society* Vol 2, Venice, Italy, 21-25 September 2009, Hall J, Harrison D, Stammer D (eds.) ESA Publication WPP-306, doi:10.5270/OceanObs09.cwp.29.

Gruber N. 2011. Warming up, turning sour, losing breath: Ocean biogeochemistry under global change, *Phil. Trans. R. Soc*. A, 369: 1980-1996, doi: 10.1098/rsta.2011.0003.

Gruber N, Körtzinger A, Borges A, Claustre H, Doney S, Feely R, Hood M, Ishii M, Kozyr A, Monteiro P, Nojiri Y, Sabine C, Schuster U, Wallace D, Wanninkhof R. 2010. Towards An Integrated Observing System For Ocean Carbon and Biogeochemistry At a Time of Change In *Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society* Vol. 1, Venice, Italy, 21-25 September 2009, Hall J, Harrison DE, Stammer D (eds.) ESA Publication WPP-306, doi:10.5270/OceanObs09.pp.18.

Link J, Megrey B, Miller T, Essington T, Boldt J, Bundy A, Moksness E, Drinkwater K, Perry I. 2010. Comparative analysis of marine ecosystems: International surplus production modeling workshop. *Biological Letters*, doi: 10.1098/rsbl.2010.0526.

Michio K, Ito S-I, Megrey B, Rose K, Werner F. 2011. A review of the NEMURO and NEMURO.FISH models and their application to marine ecosystem investigations. *J Oceanogr*, 67:3-16 DOI 10.1007/s10872-011-0009-4.

Miller K, Charles A, Barange M, Brander K, Gallucci V, Gasalla M, Khan A, Munro G, Murtugudde R, Ommer R, Perry I. 2010. Climate change, uncertainty, and resilient fisheries: Institutional responses through integrative science *Progress in Oceanography*, 87: 338–346.

Moloney C, St John M, Denman K, Karl D, Köster F, Sundby S, Wilson R. Weaving marine food webs from end to end under global change. 2011. *Journal of Marine Systems*, 84: 106–116.

Monteiro P, Schuster U, Hood M, Lenton A, Metzl N, Olsen A, Rodgers K, Sabine C, Takahashi T, Tilbrook B, Yoder J, Wanninkhof R, Watson A. 2010. A global sea surface carbon observing system: assessment of changing sea surface CO_2 and air-sea CO_2 fluxes. *OceanObs'09 Community White Paper* Venice, Italy, 21-25 September 2009, Hall J, Harrison DE Stammer D (eds.) ESA Publication WPP-306. 13pp. doi:10.5270/OceanObs09.cwp.64.

Murphy E, Cavanagh R, Johnston N, Hofmann E (eds). 2010. Integrating Climate and Ecosystem Dynamics (ICED): Report of the Southern Ocean Food Web Modelling Workshop, 16-18 April 2008, Virginia, USA.

Planque B, Fromentin J-M, Cury P, Drinkwater K, Jennings S, Perry R. Kifani S. 2010. How does fishing alter marine populations and ecosystems sensitivity to climate? *Journal of Marine Systems*, 79 : 403-417.

Pollard R, Moncoiffé G, O'Brien T. 2011. The IMBER Data Management Cookbook - A project guide to good data practices. *IMBER Report No. 3*, IPO Secretariat, Plouzané, France. 16pp.

Turley C, Eby M, Ridgwell A, Schmidt D, Findlay, Brownlee C, Riebesell U, Fabry V, Feely R, Gattuso J-P. 2010. The societal challenge of ocean acidification *Marine Pollution Bulletin* 60: 787-792.

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 *Progress in Oceanography* Volume 86, Issues 1-2, Pages 1-316 (July-August 2010) Editors: (28 papers).

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:

Alheit J, Drinkwater K, Perry R (eds.). 2010. Impact of Climate Variability on Marine Ecosystems: A Comparative Approach. Proceedings of a GLOBEC Workshop, held in Berlin, Germany, 4-8 September, 2006. *Journal of Marine Systems*, 79:227-435.

UPCOMING PUBLICATIONS

SIBER Science Plan and Implementation Strategy (2011). IMBER Report No. 4.

Murphy E, Cavanagh R, Hofmann E, Hill S, Constable A, Costa D, Pinkerton M, Johnston N, Trathan P, Klinck J, Wolf-Gladrow D, Daly K, Maury O, Doney S. Submitted. Developing integrated models of Southern Ocean food webs: including ecological complexity, accounting for uncertainty and the importance of scale. Special issue of Progress in Oceanography on Comparative Analysis of Marine Food Webs.

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.

Appendix 7

Surface Ocean – Lower Atmosphere Study (SOLAS)

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:

Name	Gender	Country	Expertise	Term	Term ends
Isabel Cacho Lascorz	F	Spain	Paleoceanography	2	2011
Sergey Gulev (WCRP)	M	Russia	Air-sea physical interaction	2	2011
Doug Wallace	M	Germany	Ocean Carbon, air-sea overview. Chair	2	2011
Veronique Garcon	F	France	Ocean Biogeochemical modelling	2	2012
David Kieber	M	USA	Marine Photochemistry	2	2012
Cliff Law	M	New Zealanc	Air-sea exchange / nutrients	2	2012
Eric Saltzman	M	USA	Atmospheric chemistry	2	2013
Jacqueline Stefels	F	Netherlands	Sulfur cycle / sea ice	2	2013
Roland von Glasow	M	UK	Atmospheric halogens / modelling	2	2013
Min-Han Dai	M	China	Coastal Carbon / acidification	1	2011
Cecile Guieu	F	France	Marine ecosystems / nutrients	1	2011
Patricia Quinn	F	USA	Aerosols / atmos chemistry	1	2011
Rafel Simo	M	Spain	Ocean biogeochemistry / trace gases	1	2011
Christoph Heinze	M	Norway	Carbon cycle modeling / paleooceanogr.	1	2012
Yukihiro Nojiri	M	Japan	Ocean carbon	1	2012
Brian Ward (WCRP)	M	Ireland	Air-sea physical interaction	1	2013
Lisa Miller	F	Canada	Sea-ice / CO2 exchanges	1	2013
Christoph Garbe	M	Germany	Air-sea physical interaction	1	2013
Diego Gaiero	M	Argentina	Aerosol chemical composition / deposition	1	2013

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 the SCOR meeting (see http://www.scor-int.org/2011EC/AnnualReports2010-SOLAS%20Nations.pdf).

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/.

> Corinne Le Quéré and Eric S. Saltzman, *Geophysical Monograph Series*, Volume 187, 350 pp., hardbound, 2009, ISBN 978-0-87590-477-1, AGU Code GM1874771

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 Uematsu 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 CO_2 flux estimates; it will permit an evaluation of pCO_2 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 CO_2). 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 CO_2 through time. This estimation of the change in oceanic storage of anthropogenic CO_2 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/discsess.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.
  Wallace, D.W.R., Law, C.S., Boyd, P.W., Collos, Y., Croot, P., Denman, K., Lam, P.J., Riebesell, U., Takeda, S., & Williamson, P. (2010) Ocean Fertilization. A Scientific Summary for Policy Makers. IOC/UNESCO, Paris (IOC/BRO/2010/2). 17 pp

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.

Appendix 8

GEOTRACES SCIENTIFIC STEERING COMMITTEE
ANNUAL REPORT TO SCOR 2010/2011
June 2011

SCOR Scientific Steering Committee for GEOTRACES

Co-Chairs
Robert F. Anderson, USA
Gideon M. Henderson, UK

Members
Andrew Bowie, Australia
Philip Boyd, New Zealand
Ed Boyle, USA
Ken Bruland, USA
Pinghe Cai, China
Hein de Baar, Netherlands
Martin Frank, Germany
Jordi Garcia-Orellana, Spain
Catherine Jeandel, France
Maeve Lohan, UK
Olivier Marchal, USA
Maria T (Maite) Maldonado, Canada
Reiner Schlitzer, Germany
Igor Semilitov, Russia
Sunil Kumar Singh, India
David Turner, Sweden
Angela Wagener, Brazil
Jing Zhang, Japan

Rotating off members (end 2010)
Per Andersson, Sweden
Toshitaka Gamo, Japan
William Jenkins, USA
Pere Masqué, Spain
Kristin Orians, Canada
Carol Robinson, UK

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 Géophyisque 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 U.S scientists 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 Micha 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 U.S. 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

Pacific Ocean	GP13	2 cruise Australia and new Zealand	No data expected until 2013
Indian Ocean	GI04	1 cruise Japanese	No data expected until 2012
Atlantic Ocean	GA02	3 cruise -Netherlands	No data expected until 2013
Atlantic Ocean	GA10	1 cruise-UK	No data expected until 2013
Atlantic Ocean	GA06	1 cruise -UK	No data expected until 2013
Atlantic Ocean	GA11	1 cruise-Germany	No data expected until 2012
Atlantic Ocean	GA03	1 cruise-USA	No data expected until 2013

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.

Cruise /country	Metadata
PE319_NetherlandsA02- end date 26/5/2010	GDAC post cruise metadata form, full cruise report. CTD data expected in the next few months
PE321_NetherlandsA02 –end date8/7/2010	GDAC post cruise metadata form, full cruise report. CTD data expected in the next few months
KH09-05_Japan I04 –end date 10/1/2011	Metadata form no cruise report no data
M81-1_Germany A11 -end date 8/3/2010	Metadata form and intermediate cruise report. CTD data submitted
Cruise /country	Metadata
D357_UK A10-start date 17/10/2010	CTD +nutrient+oxygen data submitted to GDAC
KN199-4_America A03 -start date 15/10/2010	PI been in contact for full list of requirements-provided cruise name start and end dates
SK279_India I02 -start date 28/11/2011	Pre cruise metadata form
D361_UK A06-start data 02/07/2011	CSR, Cruise report CTD data expected in the next month
Pandora_France P12 -start date 02/07/2012	Planning document and proposed cruise track

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).

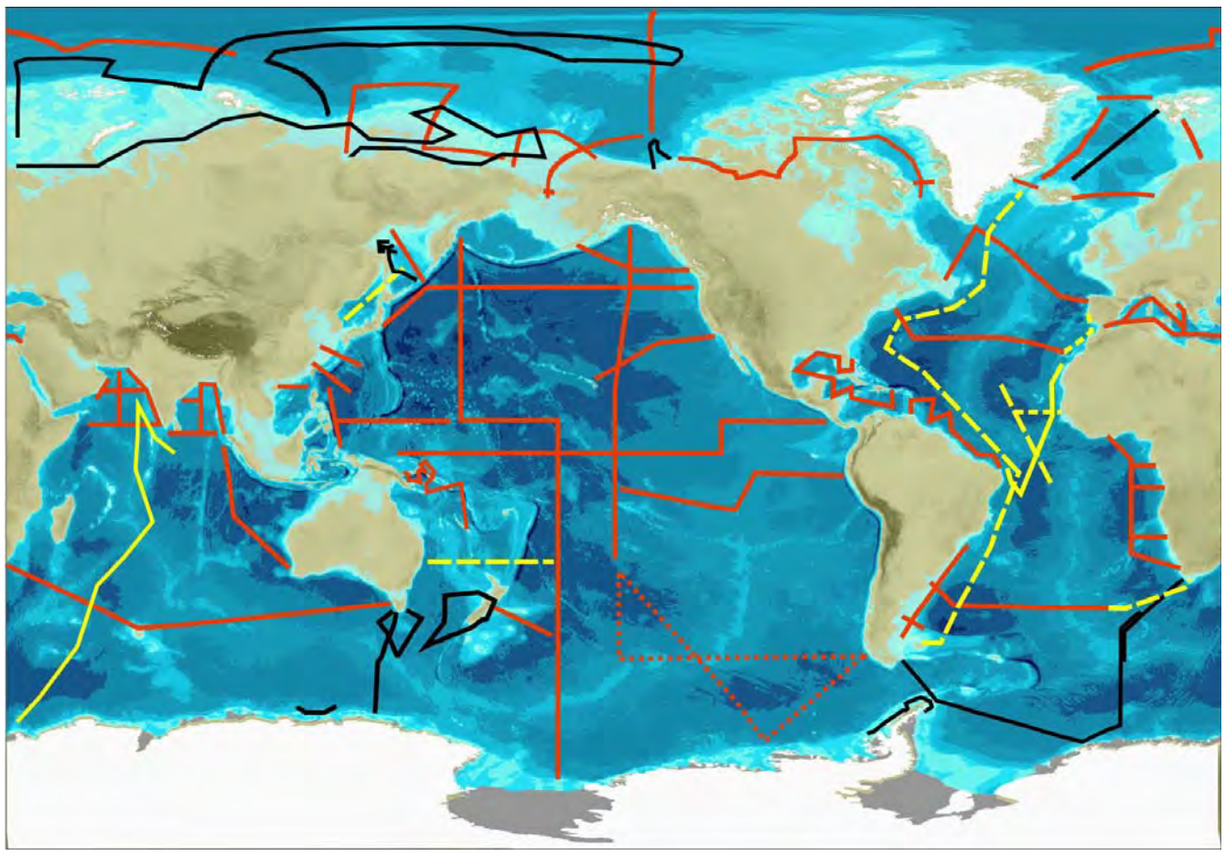


Figure 1. Status of GEOTRACES global survey of trace elements and their isotopes. In black: Sections completed as GEOTRACES contribution to the International Polar Year. In yellow: Sections completed to date as part of the primary GEOTRACES global survey (dotted yellow, completed during the past year). 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.

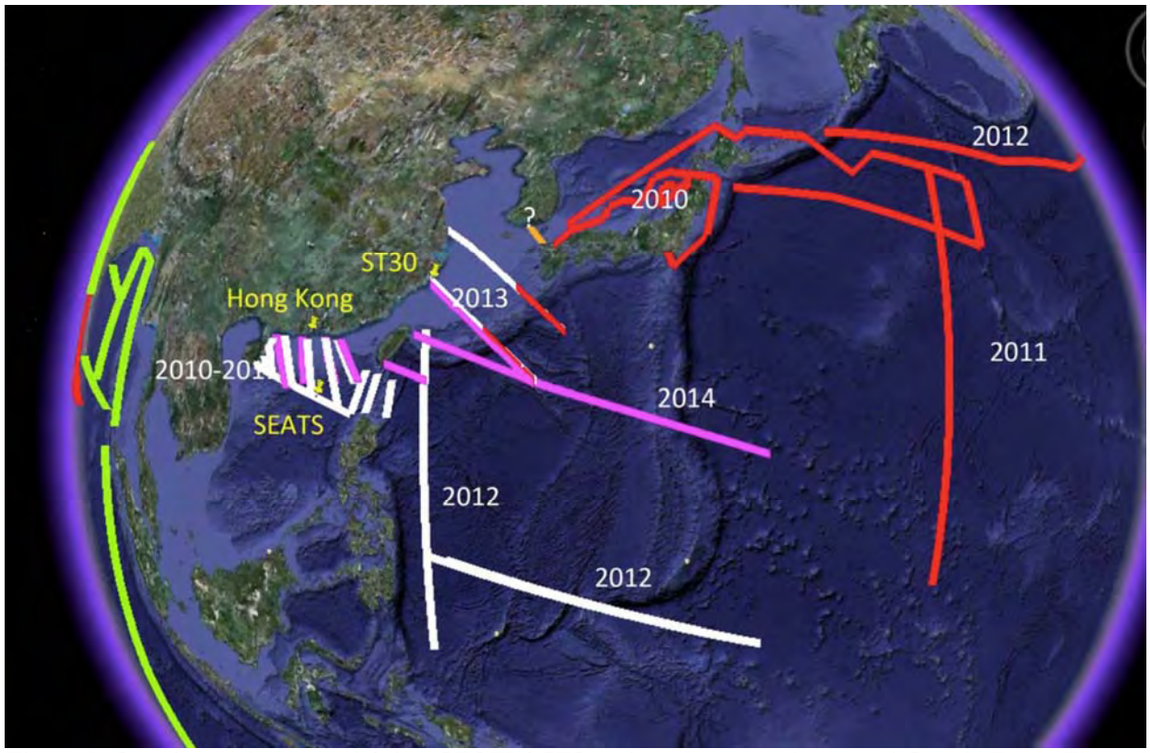


Figure 2. Ongoing and proposed Asian GEOTRACES cruises shown on the map of Google Earth. The red line cruises are or will be carried out by Japan; the white lines by China, the pink lines by Taiwan; the green lines by India. The yellow pins labeled as 'ST30' and 'Hong Kong' indicate SGD stations. The '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
Presentations available at:
https://www.sgmeet.com/aslo/sanjuan2011/sessionschedule.asp?SessionID=GS02
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
Presentations available at: http://www.sgmeet.com/aslo/sanjuan2011/sessionschedule.asp?SessionID=S87
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/

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)

For further information: http://www.icas2011.com/index.html

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 http://www.goldschmidt2011.org/index

Relevant sessions:
15a: The GEOTRACES Program
http://www.goldschmidt2011.org/themes?theme=15
Convener: Ed Boyle, Massachusetts Institute of Technology

15b: Deep Ocean Circulation in the Past
http://www.goldschmidt2011.org/themes?theme=15
Conveners: 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
Conveners: 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

http://www.grc.org/programs.aspx?year=2011&program=chemocean
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.

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

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.

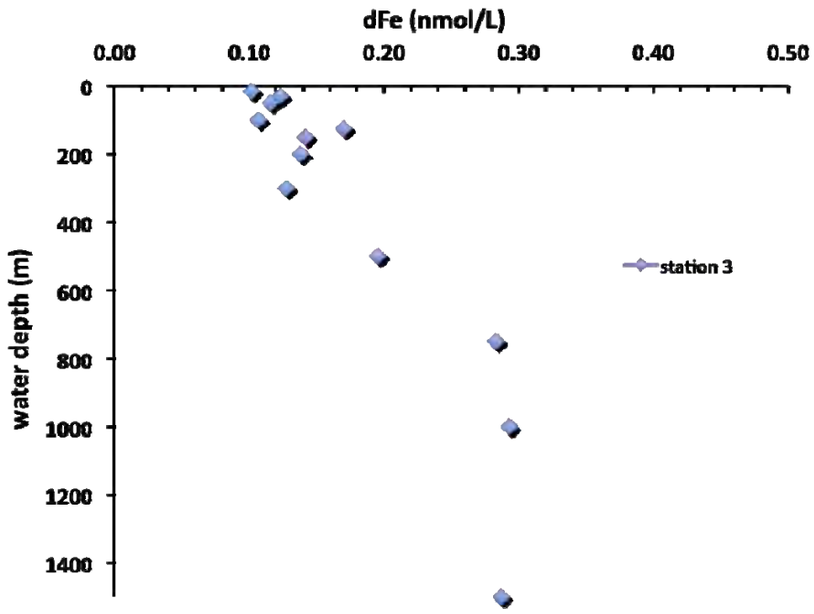


Figure 3. Dissolved iron (dFe) distribution in the upper 1500 m of the water column at mega-station #3 (30°S, 155°E).

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 the 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 ion 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 (focussing 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:

- Lannuzel D., van der Merwe P.C., Townsend A.T., Bowie A.R., 2011. Size fractionation of particulate metals during a time series in East Antarctic fast ice. Geochimica et Cosmochimica Acta, in review (submitted 10 May 2011)
- Wake B.D., Hassler C.S., Bowie A.R., Haddad P.R., Butler E.C.V., 2011. Phytoplankton selenium requirements: the case for species isolated from temperate and polar regions of the Southern Hemisphere. Journal of Phycology, in review (submitted 25 January 2011)
- Baeyens W., Bowie A.R., Buesseler K., Elskens M., Gao Y., Lamborg C., Leermakers M., Remenyi T.A., Zhang H., 2011. Size-fractionated labile trace elements in the Northwest Pacific and Southern Oceans. Marine Chemistry, doi: 10.1016/j.marchem.2011.04.004, in press (accepted 11 April 2011)
- Cossa D., Heimbürger L.-E., Lannuzel D., Rintoul S.R., Butler E.C.V, Bowie A.R., Averty B., Watson R., Remenyi T., 2011. Mercury in the Southern Ocean. Geochimica et Cosmochimica Acta, doi: 10.1016/j.gca.2011.05.001, in press (accepted 24 March 2011)
- van der Merwe P., Lannuzel D., Bowie A.R., Meiners K.M., 2011. High temporal resolution observations of spring fast-ice melt and seawater iron enrichment in East Antarctica. Journal of Geophysical Research – Biogeosciences, in press (accepted 15 March 2011)
- Lannuzel D., Schoemann V., Pasquer B., van der Merwe P., Bowie A.R., 2011. What controls the distribution of dissolved iron in Antarctic sea ice? Spatial, seasonal and inter-annual variability. Journal of Geophysical Research - Biogeosciences, doi:10.1029/2009JG001031, in press (accepted 14 April 2010)

- Bowie A.R., Griffiths F.B, Dehairs F., Trull T.W., 2011. Oceanography of the subantarctic and polar frontal zones south of Australia during summer: setting for the SAZ-Sense study. Deep-Sea Research II, in press (accepted 10 March 2011)
- Petrou K.L., Hassler C.S., Doblin M.A., Shelly K., Schoemann V., Ralph P.J., 2011. .Interaction of iron and light on Southern Ocean phytoplankton. Deep-Sea Research II, in press (accepted 07 September 2010)
- Lannuzel D., Remenyi T., Lam P., Townsend A., Ibisanmi E., Butler E., Wagener T., Schoemann V., Bowie A.R., 2011. Distributions of dissolved and particulate iron in the sub-Antarctic and polar frontal Southern Ocean (Australian sector). Deep-Sea Research II, in press (accepted 17 December 2009)
- Ibisanmi E.B., Hunter K.A., Sander S., Boyd P.W., Bowie A.R., 2011. Vertical distributions of iron-(III) complexing ligands in the Southern Ocean, Deep-Sea Research II, in press (accepted 26 August 2009)
- Hassler C.S., Schoemann V., Nichols C.A.M., Butler E.C.V., Boyd P.W., 2011. Saccharides enhance iron bioavailability to Southern Ocean phytoplankton. PNAS, 108: 1076-1081
- van der Merwe P., Lannuzel D., Mancuso Nichols C.A., Meiners K., Bowie A.R., 2011. Iron partitioning in pack and fast ice in East Antarctica: temporal decoupling between the release of dissolved and particulate iron during spring melt. Deep-Sea Research II, 58, 1222–1236, doi: 10.1016/j.dsr2.2010.10.036
- Lannuzel D., Bowie A.R., van der Merwe P., Townsend A., Schoemann V., 2011. Particulate and dissolved metals distribution in Antarctic sea ice and their role in tracing iron sources. Marine Chemistry, 124 (2011) 134-146, doi:10.1016/j.marchem.2011.01.004
- Hassler C.S., Alasonati E., Mancuso-Nichols C.A., Slaveykova V.I., 2011. Exopolysaccharides produced by bacteria isolated from the pelagic Southern Ocean: role in iron binding, chemical reactivity and bioavailability. Marine Chemistry, 123, 88-98
- Cassar N., DiFiore P., Barnett B.A., Bender M.L., Bowie A.R., Tilbrook B., Petrou K., Westwood K., Wright S., Wagener T., 2011. The influence of iron and light on net community production in the Subantarctic and Polar Frontal Zones. Biogeosciences, 8, 227-237, doi:10.5194/bg-8-227-2011
- Chever F., Sarthou G., Bucciarelli E., Blain S., Bowie A.R., 2010. An iron budget during the natural iron fertilization experiment KEOPS (Kerguelen Island, Southern Ocean). Biogeosciences, 7, 455–468

Book chapter
Hassler C.S., Schoemann V., Boye M., Tagliabue A., Rozmarynowycz M., McKay R.M.L., 2011. Iron Bioavailability in the Southern Ocean. In: Southern Ocean: Oceanography, Climatic Impact. Nova Publishers, in review (submitted 10 April 2011).

Prepared by:
Andrew Bowie (Antarctic Climate & Ecosystems CRC, University of Tasmania, Australia)

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, B, 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}Th, ^{228}Th, ^{228}Ra, ^{226}Ra, ^{224}Ra, ^{223}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}Be, ^{210}Pb, ^{228}Ra, ^{226}Ra, ^{224}Ra, ^{223}Ra, ^{232}Th, ^{230}Th, ^{234}Th, ^{228}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).
- GEOTRACES-France organized the Med Sea workshop, Nice, 4-6 Oct 2010 (L. Coppola, http://www.cybaes.org/gtmed/).
- 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 COST-GEOTRACES-GMOS International Workshop on Mercury in the marine environment: a global metrology challenge (9-12 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

Bown J., Boye M., Baker A., Duvieilbourg E., Lacan F., Le Moigne F., Planchon F., Speich S. and Nelson D.M., 2011. The biogeochemical cycle of dissolved cobalt in the Atlantic and the Southern Ocean south off the coast of South Africa. Marine Chemistry, in press. doi:10.1016/j.marchem.2011.03.008

Boye M., Achterberg E., Bown J., Bucciarelli E., Cardinal D., Cassar N., Cavagna A.-J., Chever F., Dehairs F., Fine R.A., Happell J., Joubert W., Le Moigne F., Masqué P., Monteiro P., Planchon F., Sarthou G., Verdeny E., Wake B., Waldron H., 2009. A First look at GEOTRACES issues from the IPY BONUS GOODHOPE cruise in the Southern Ocean. Geochim. Cosmochim. Acta, 73 (13): A152.

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

Jeandel C., Peucker-Ehrenbrink B., Jones M., Pearce C.R., Oelkers E., Godderis Y., Lacan, F., Aumont O. and Arsouze T. Ocean margins: the missing term for oceanic element budgets? Eos, in press

Lacan, F., A. Radic, C. Jeandel, F. Poitrasson, G. Sarthou, C. Pradoux, R. Freydier and J. Chmeleff. High precision determination of the isotopic composition of dissolved iron in iron depleted seawater by double spike MC-ICPMS., Anal. Chem. 2010, 82, 7103–7111

Oelkers, E, Gislason, S.R, Eiriksdottir, E.S, Jones, M., Pearce, C.R. and Jeandel, C. The role of riverine particulate material on the global cycles of the elements, Applied Geochemistry. 26, Suppl. 1, June 2011, Pages S365-S369

Radic, A., F. Lacan, et J. Murray (2011), Isotopic composition of dissolved iron in the equatorial Pacific Ocean: new constraints for the oceanic iron cycle, Earth And Planetary Science Letters, in press, doi:10.1016/j.epsl.2011.03.015.

Ussher, S.J., Achterberg, E.P., Sarthou, G, Laan, P., de Hein Baar J.W., Worsfold, P.J., 2010, Distribution of size fractionated dissolved iron in the Canary Basin, Marine Environmental Research, doi: 10.1016/j.marenvres.2010.03.001

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.

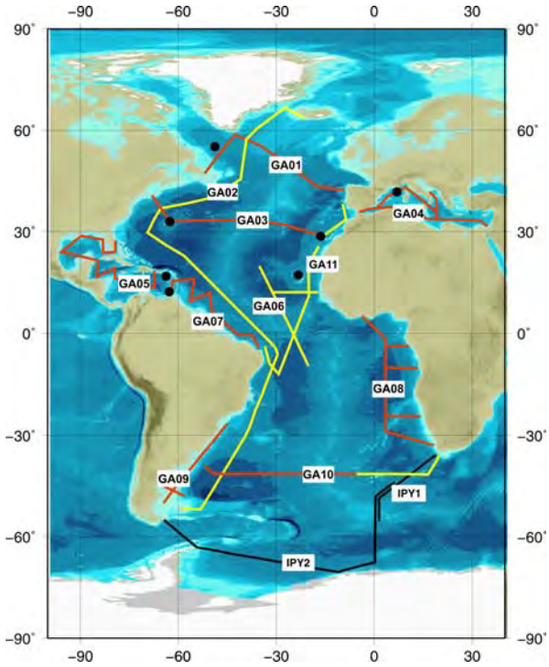


Figure 4. Completed GEOTRACES Sections in the Atlantic (in yellow)

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.

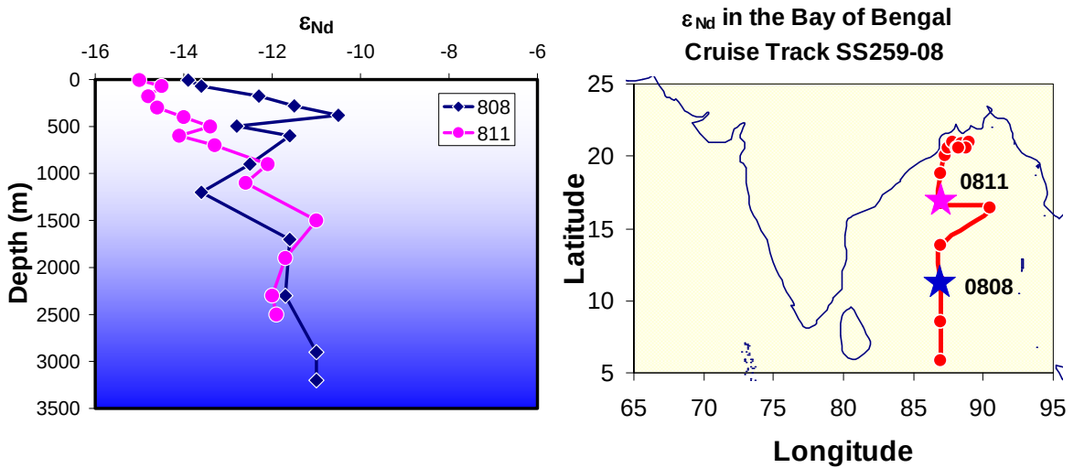


Figure 5: ε_{Nd} in the water columns of Bay of Bengal

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

1. Rahaman W., and Singh S. K. and Raghav S. (2010) Dissolved Mo and U in rivers and estuaries of India: Implication to geochemistry of redox sensitive elements and their marine budgets, Chemical Geology 278, 160–172, doi:10.1016/j.chemgeo.2010.09.009
2. Singh S. P., Singh S. K., Bhushan R. (2011) Behavior of dissolved redox sensitive elements (U, Mo and Re) in the water column of the Bay of Bengal, Marine Chemistry, doi:10.1016/j.marchem.2011.04.001

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:

- Special session: “Strengthening interdisciplinary regional ocean networks: The dynamic rapidly changing East/Japan Sea”, twelve oral presentations; in the 5th PEACE (Program of the East Asian Cooperative Experiments) workshop, Korea, 11-12 September, 2010.
- 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).

“Marine biogeochemical studies and behavior of trace elements and isotopes in the East Asian Marginal Seas (ASIAN GEOTRACES)”, in the Japan/East Sea and northwestern Pacific, 11 June – 23 July 2010 (PI: J. Zhang).

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.

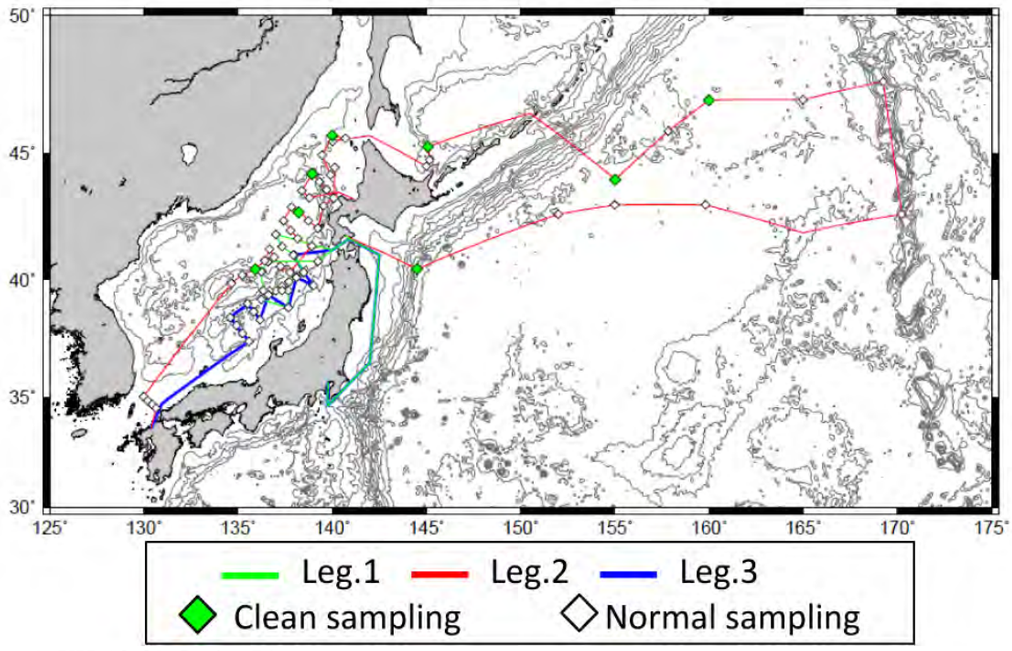


Figure 6. KH-10-02 Cruise Plan

Cruise Planning:

- KH-11-07 cruise by R/V Hakuho Maru (Figure 7).

"Marine biogeochemical studies and behavior of trace elements and isotopes in the Western North Pacific", 16 July – 4 August 2011 (PI: J. Zhang).

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.

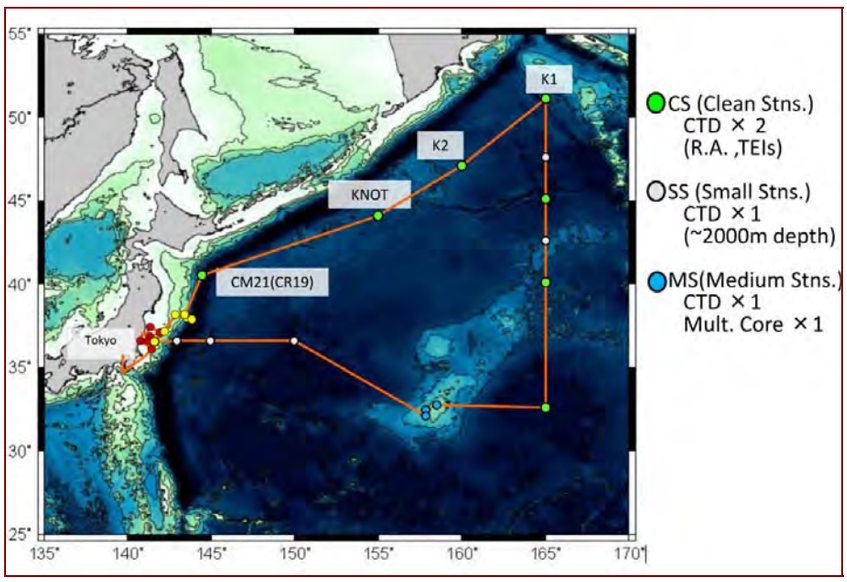


Figure 7. R/V Hakuho-Maru KH-11-07 Cruise Plan (Jul 16-Aug 04)

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.

<u>Netherlands</u>

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, ^{227}Ac, ^{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 65ºN to 50ºS, 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 CO_2 system, nutrients, organic speciation and size fractionation of Fe, ^{234}Th 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, ^{15}N, $^{13/14}$C, ^{230}Th, ^{231}Pa, ^{232}Th, ^{18}O, 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
Klunder, M.B., P. Laan, R. Middag, C-E Thuroczy, L. Gerringa, H.J.W. De Baar. Trace Metals in the Polar Oceans. IPY – Oslo Science Conference, Oslo, June 2010.
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 43rd International Liège Colloquium on Ocean Dynamics, Belgium, May 2011, see here below:

Abouchami W., S.J.G. Galer, H. De Baar, A.C. Alderkamp, R. Middag, P. Laan, H. Feldmann, M.O. Andreae, The Southern Ocean Cadmium Isotope Divide, oral presentation

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

van Heuven S.M.A.C., Salt L., De Baar H.J.W. and Meijer H.A.J., Initial results of 14C in GEOTRACES-NL, oral presentation

van Hulten M.M.P., A. Sterl, A. Tagliabue, 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

Laan P., M.B. Klunder, D. Bauch, H.J.W. De Baar, IPY – GEOTRACES: Dissolved Fe in the 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

Rutgers van der Loeff M., P. Cai, D. Bauch, T. Roeske, M. Klunder, R. Middag, K. Bakker, I. 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, P., Feldmann, H., Andreae, M.O., 2011. Modulation of the Southern Ocean cadmium isotope signature by ocean circulation and primary productivity. Earth and Planetary Science Letters 305, 83-91.

Gerringa, L.J.A, Alderkamp, A.-C, Laan, P, Thuróczy, C-E, de Baar, H.J.W., Mills, MM, van 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.

Klunder, M.B., D. Bauch, P. Laan, H.J. W. De Baar, S. v. Heuven, S. Ober. Dissolved iron in the 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.

Klunder, M. B., P. Laan, R. Middag, H. J. W. De Baar, and J. V. Ooijen. 2011. Dissolved iron in the Southern Ocean (Atlantic sector). Deep Sea Research Part II: Topical Studies in Oceanography in press

Middag, R., H. J. W. De Baar, P. Laan, and M. B. Klunder. 2011. Fluvial and hydrothermal input of manganese into the Arctic Ocean. Geochimica Et Cosmochimica Acta 75: 2393-2408.

Middag, R., H. J. W. De Baar, P. Laan, P. H. Cai, and J. C. Van Ooijen. 2011. Dissolved manganese in the Atlantic sector of the Southern Ocean. Deep Sea Research Part II: Topical Studies in Oceanography in press

Middag, R., C. Van Slooten, H. J. W. De Baar, and P. Laan. 2011. Dissolved aluminium in the Southern Ocean. Deep Sea Research Part II: Topical Studies in Oceanography in press

Rutgers Van Der Loeff, M., P. Cai, I. Stimac, A. Bracher, R. Middag, M. Klunder, and S. Van Heuven. 2011. 234Th in surface waters: Distribution of particle export flux across the Antarctic Circumpolar Current and in the Weddell Sea during the GEOTRACES expedition ZERO and DRAKE. Deep Sea Research Part II: Topical Studies in Oceanography in press

Thuróczy, C-E, Alderkamp, A-C. Laan, P, Gerringa, L.J.A., de Baar H.J.W., Arrigo, K.R. Key role of organic complexation of iron in sustaining phytoplankton blooms in the Pine Island and Amundsen Polynyas (Southern Ocean). Deep Sea Research II, special issue DynaLife, Submitted and in review.

Thuróczy, C-E., L.J.A. Gerringa, M. Klunder, P. Laan, M. Le Guitton, H.J.W. de Baar. Distinct trends in the speciation of iron between the shelf seas and the deep basins of the Arctic Ocean, Journal of Geophysical Research-Oceans, accepted for publication.

Thuróczy, C. E., L. J. A. Gerringa, M. B. Klunder, R. Middag, P. Laan, K. R. Timmermans, and H. J. W. De Baar. 2010. Speciation of Fe in the Eastern North Atlantic Ocean. Deep Sea Research Part I: Oceanographic Research Papers 57: 1444-1453.

Thuróczy, C. E., L. J. A. Gerringa, M. B. Klunder, P. Laan, and H. J. W. De Baar. 2011. Observation of consistent trends in the organic complexation of dissolved iron 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

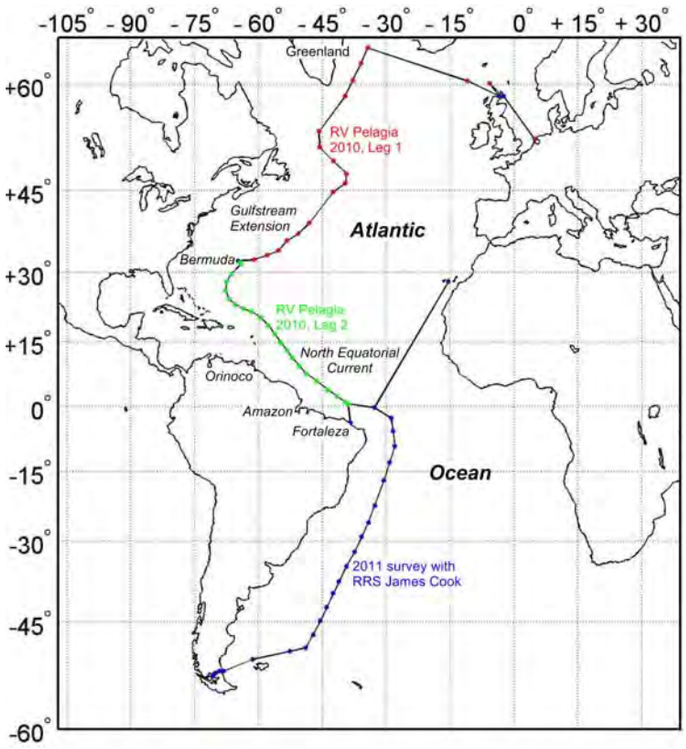
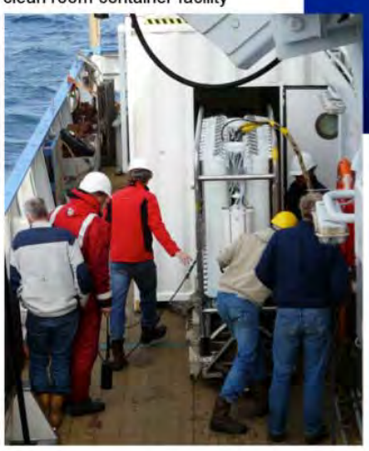


Figure 8: The completed West Atlantic Ocean transect of the Dutch GEOTRACES project.

Ultraclean titanium CTD system with 24 x 27 L PVDF samplers

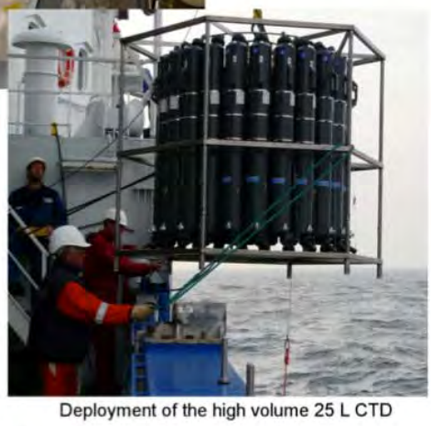
Coated stainless steel torpedo (FISH) for trace metal clean surface sampling

The ultraclean CTD is placed in the clean room container facility



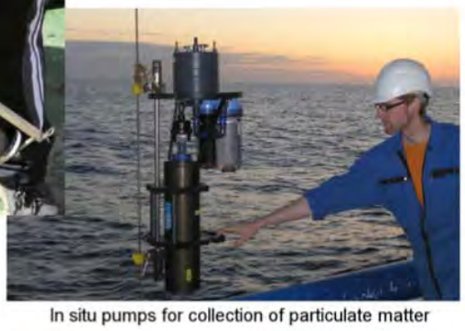
Trace metal clean sampling inside the clean room container

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.

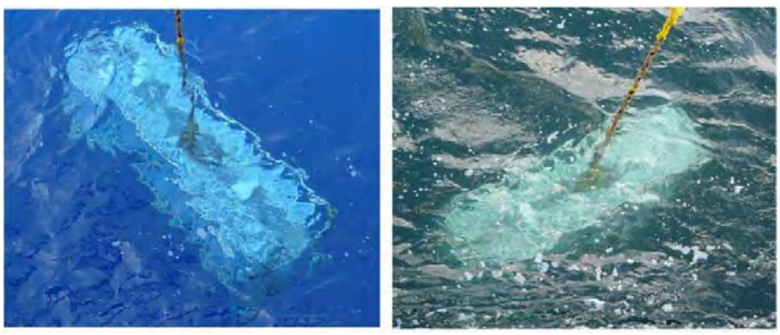


Figure10: On the left clear blue surface seawater at 28°05'N and 67°30'W and on the right the green black surface seawater affected by Amazon river outflow at 05°55'N and 46°25'W.

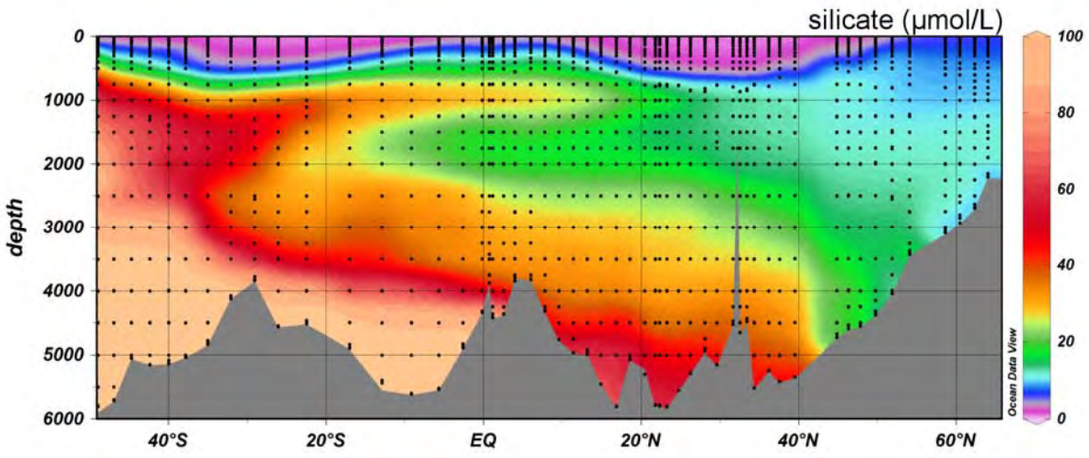


Figure 11: The silicate concentration for the whole West Atlantic Ocean transect.

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 rendezvous 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

Boyd P.W. and & M. J. Ellwood (2010) The biogeochemical cycle of iron in the ocean *Nature Geoscience*, 3, 675–682, doi:10.1038/ngeo964

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 GEOTRACES 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.

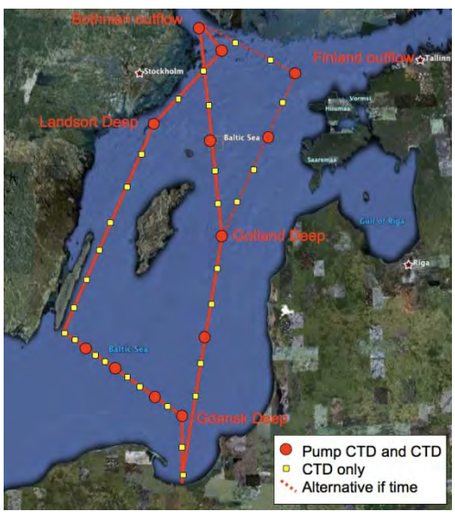


Figure 12. Cruise track and sampling stations location

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

Bełdowski J., Bełdowska M., Kuliński K., Darecki M., 2010. Vertical mercury, cadmium and lead distribution at two stratified stations in the Southern Baltic Sea, The Proceedings of 15th International Conference on Heavy Metals in the Environment, 537-540, ISBN978-83-928986-5-8

Saniewska D., Beldowska M., Beldowski J., Saniewski M., Kwaśniak J., Falkowska L. (2010), "Distribution of mercury in different environmental compartments in the aquatic ecosystem of the coastal zone of the Southern Baltic Sea" Journal of Environmental Sciences, 22, 1144-1150

M. Miotk, J. Bełdowski, J. Pempkowiak. Mercury fluxes through the sediment water interface and bioavailability of mercury in southern Baltic Sea sediments. The Proceedings of 15th International Conference on Heavy Metals in the Environment, 618, ISBN978-83-928986-5-8

South Africa

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 has played little role in Geotraces up until now. Once a vibrant community, marine researcher in South Africa has been a dying breed for the last few decades. Main reasons being continually degrading shipboard facilities and a serious lack of capacity to undertake elaborate projects. Barring the regular environmental monitoring of coastal oceans, much of other science related activities were confined to international collaborations and science done in conjunction with logistics voyages to support South African Antarctic base.

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

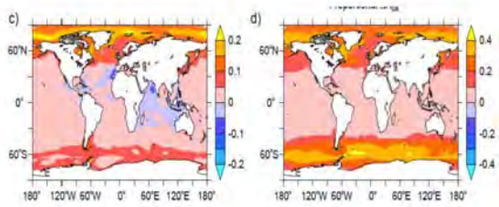
In 2010, South Africa has taken definite steps to enhance Geotraces related research. Much of the focus has been towards developing the capacity and research on iron in the Southern Ocean. The activities include modeling of iron cycling by Dr A. Tagliabue (CSIR) and set-up of FIA for measurement of nano- 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.

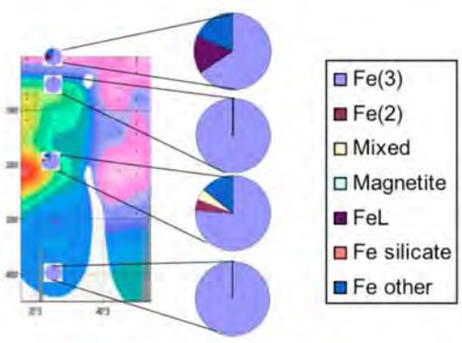
As part of a continuing collaboration with Dr. Christoph Völker of the AWI in Germany, we this year published a paper detailing a cost-effective method of modeling complex iron speciation and cycling in large scale ocean models and use this model to explore the response of iron speciation and bioavailability 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 lability of colloidal iron species.



The proportional change in bioavailable Fe concentrations in 2100 for species that can assimilate organically complexed iron (left hand side) and those that rely solely on free uncomplexed iron (Tagliabue, A. and Völker, C.: Towards accounting for dissolved iron speciation in global ocean models, Biogeosciences Discuss., 8, 2775-2810, doi:10.5194/bgd-8-2775-2011, 2011.

Iron nano-particles in open ocean waters



Particulate iron speciation and distribution in the water column at one station (Cruise D357) Unpublished data (Von der Heyden et al.)

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)
  - Tovar-Sanchez (Mallorca-CSIC)
  - 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 (Bèlgium), 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 (PIs: 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, Gothenberg 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 U.S.-Sweden 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:

Andersson P.S., Sherrell R.M., Planquette H. and Kylin H.(2010) *The Isotopic Composition of Nd in water from the Amundsen Sea: Influence of Detrital Material From the Antarctic Continent*

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:

Alling V., Sanchez-Garcia L., Porcelli D., Pugach S., Vonk J.E., van Dongen B. Mörth C.-M., Anderson L.G., Sokolov A., Andersson P.S., Humborg C., Semiletov I., Gustafsson Ö. (2010) Non-conservative behavior of dissolved organic carbon across the Laptev and East Siberian Seas. doi:10.1029/2010GB003834 Global Biogeochemical Cycles 24, GB4033

Persson P.-O., Andersson P.S., Zhang J. and Porcelli D. (2011) Determination of Nd isotopes in water: A chemical separation technique for extracting Nd from seawater using a chelating resin. dx.doi.org/10.1021/ac102529k Analytical Chemistry 83, 1336-1341.

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 fluxes, composition, and sources. *Limnology and Oceanography* 55: 1807-1820.

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 East China Sea. *Marine Chemistry* 120, 116-127.

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* 115, doi:10.1029/2009JD013442.

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

Hung, C.-C. *et al.* (2010) Comparative evaluation of sediment-trap and ^{234}Th-derived POC fluxes 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. *Marine Chemistry* 122, 51-58.

Shen, C.-C. *et al.* (2010) Sea-level rise and coral-reef development of Northwestern Luzon since 9.9 ka. *Palaeogeography, Palaeoclimatology, Palaeoecology* 292, 465-473.

Tseng, C.-M. *et al.* (2010) Development of a novel on-line flow injection mercury analyzer to 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 $^{234}Th/^{238}U$ 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.

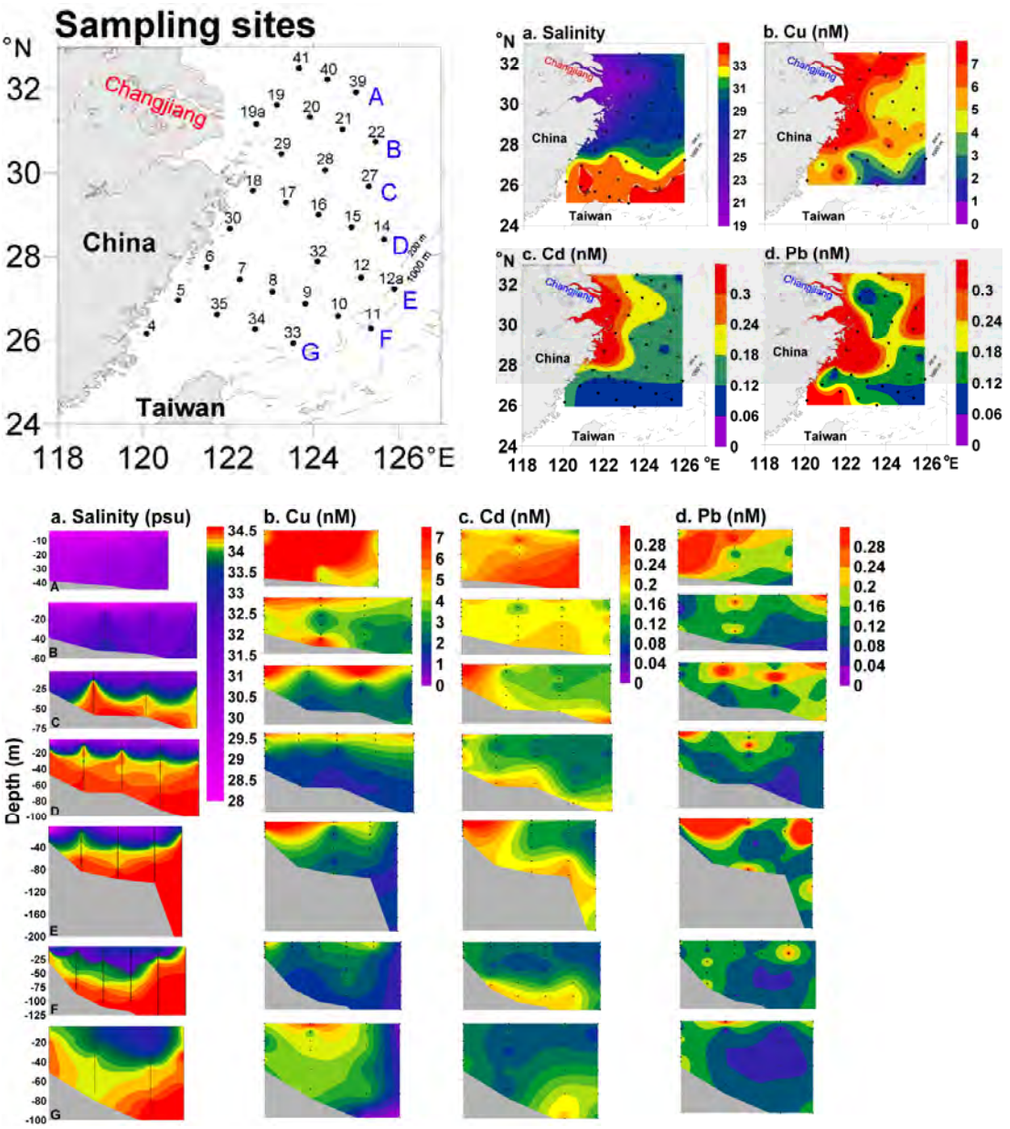


Figure 13. The distribution of some dissolved trace metals in the East China Sea in July in 2010 (Liu and Ho, unpublished data). Trace metals analyzed include: Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd and Pb. The concentrations shown in the up-right panel are surface concentrations. The sampling stations (up-left panel) are separated to 7 transects, A, B, C, D, E, F, and G.

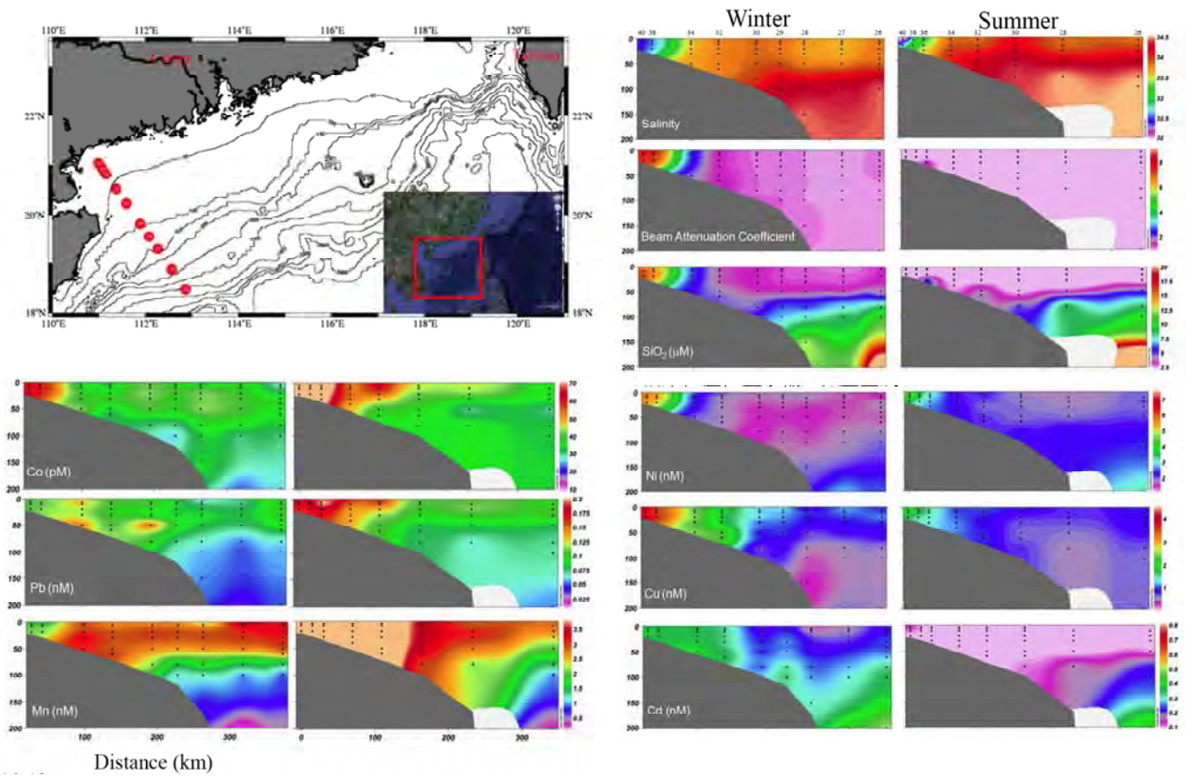


Figure 14. Seasonal variability of some dissolved trace metal distribution in the water column of the continental shelf of the northern South China Sea. The sampling sites are shown as the red circles in the map of the up-left panel. The cruises were carried out in July (summer) and December (winter) in 2010. Trace metals analyzed include: Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd and Pb. (Ho et al. unpublished data).

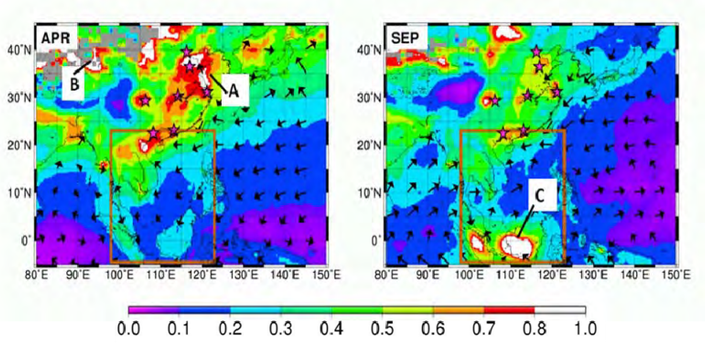


Figure 15. Terrestrial aerosol sources to the western North Pacific and the marginal seas as observed by three-year (2002–2004) averaged total AOT (Aerosol Optical Thickness) data from the NASA MODIS sensor. A: anthropogenic aerosols from Eastern China; B: desert dust; C:

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 ^{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.

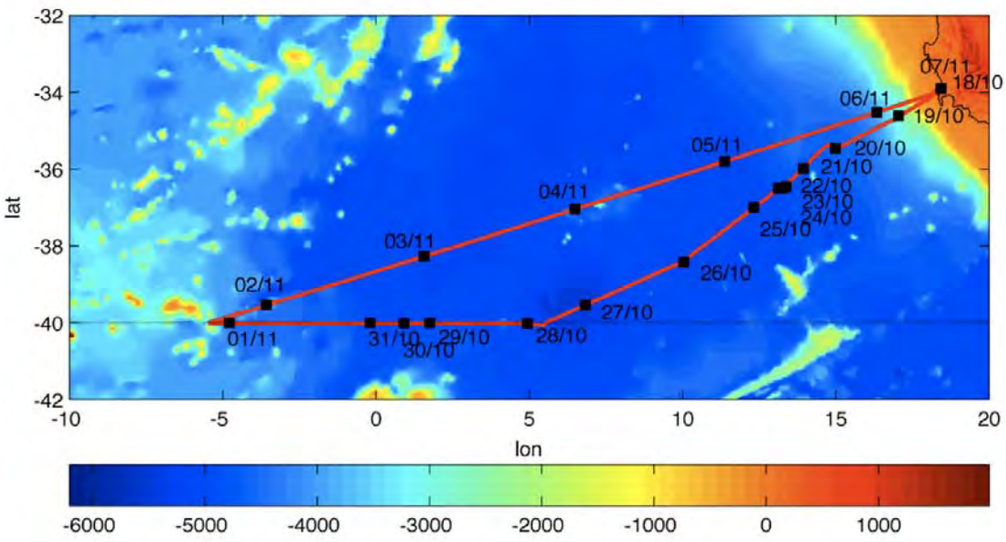


Figure 16*: Portion of the GA10 section completed during 2010.*

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.

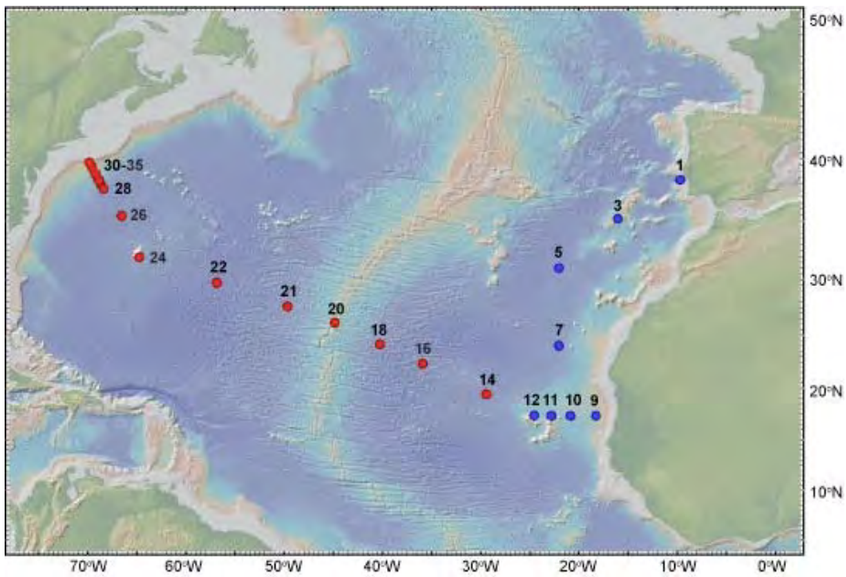


Figure 17. Locations of full depth stations planned for the U.S. North Atlantic zonal section (GA03). Shallow stations to 1000 m are not shown. Sampling was completed at stations in blue. Ship time has been scheduled to complete the remaining stations in November-December 2011. Map courtesy of K. Pahnke.

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).

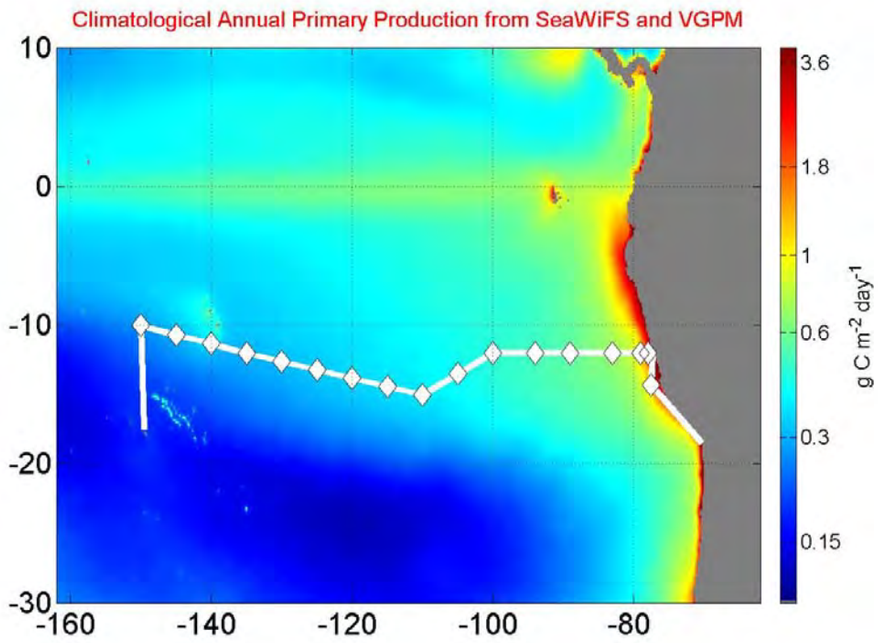


Figure 18. Tentative locations of full depth stations planned for the U.S. eastern tropical south Pacific zonal section. Shallow stations to 1000 m are not shown. The cruise is planned for late 2013. Map and productivity calculations courtesy of M-E Carr.

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 U.S. 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*)
*Crusius, J., Schroth, A.W., Gasso, S., Moy, C.M., Levy, R.C. and Gatica, M., 2011. Glacial flour dust storms in the Gulf of Alaska: Hydrologic and meteorological controls and their importance as a source of bioavailable iron. Geophysical Research Letters, 38: L06602 doi:10.1029/2010GL046573.

John, S.G. and Adkins, J.F., 2010. Analysis of dissolved iron isotopes in seawater. Marine Chemistry, 119(1-4): 65-76.

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.

Appendix 9

Post-Audit Financial Statement for 2010

	Revised 2010 Budget from Toulouse	Actual Income & Expense Jan. 1 – Dec. 31, 2010	
DISCRETIONARY FUNDING FOR SCOR			
Income			
Membership	335,000	311,058	
NSF Funding for WGs & Projects	70,000	37,496	
Sponsorship of WGs - Funds from IAPSO, LOICZ, WCRP	15,000	19,454	
Miscellaneous (interest, etc.)		1	
Total Discretionary Income	**420,000**	**368,009**	
Expenses			
Working Groups			
WG 125 - Zooplankton	3,000		
WG 129 - Deep Ocean Exchanges w/ the Shelf	288	288	
WG 130 - Automated Plankton Visual ID	14,880	14,652	
WG 131 - Iron	7,240	7,240	
WG 132 - Nutrients and HABs - with LOICZ	7,000	12,558	
WG 133 - OceanScope - with IAPSO	17,689	17,689	
WG 135 - Hydrothermal	3,482	3,482	
WG 136 - Agulhas System & Climate - with IAPSO & WCRP	7,698	9,188	
WG 137 - Phytoplankton Time Series	15,000		
Large-scale Programs			
SOLAS	31,151	16,494	
Miscellaneous Scientific Activities			
SCAR/SCOR Expert Group	5,000	74	
High-CO2 Planning Meeting	25,817	17,948	
Data Publication Activity	2,000	1,916	
Capacity Building	3,000	5,010	
Outreach	4,000	987	
Administrative Expenses			
Salaries and Benefits	164,865	164,492	
Salary charges to grants	(26,886)	(23,757)	
Outside Services (Finance Officer)	15,000	17,729	
Audit and Accounting Services	18,650	12,858	
Representation	10,000	11,432	
Meeting Management Expenses	3,401	2,506	
GoToMeeting and GoToWebinar software	5,500	5,872	
Publications	6,000	9,045	
Annual Meeting	30,000	34,043	
Postage, courier, telephone	2,338	2,309	
Office Equipment	645	1,394	
UD overhead charges	25,000	24,979	
Insurance	2,419	2,360	
Miscellaneous, office supplies, bank fees	4,600	6,615	
Total Discretionary Expenses	**408,777**	**379,405**	
Beginning Cash Balance	**181,159**	**181,159**	from 2009 audit
Income - Expenses (Discretionary Accounts)	11,223	(11,396)	agrees with 2010 audit
Discretionary Funds Available	192,382	169,763	agrees with 2010 audit
Less Commitments of funds held by SCOR for SOLAS & High CO2	-	(22,803)	
Ending Cash Balance	**192,382**	**146,960**	

Appendix 10

SCOR-Related Meetings (2010-2012)

20-21 February	SCOR/WCRP/IAPSO WG 136 on Climatic Importance of the Greater Agulhas System	Portland, Oregon, USA
21 February	WG 131 on The Legacy of in situ Iron Enrichment: Data Compilation and Modeling	Portland, Oregon, USA
8-10 March	Final GEOTRACES Intercalibration Workshop	Norfolk, Virginia, USA
2 April	SCOR/IODE/MBLWHOI Library Meeting on Data Publication	Paris, France
12-14 April	SCOR/IAPSO OceanScope Working Group	London, UK
26-28 April	SOLAS Scientific Steering Committee	Hamburg, Germany
5-7 May	IMBER Scientific Steering Committee	Washington, D.C., USA
26-27 May	SCOR WG 130 on Automatic Plankton Visual Identification	Villefrache-sur-Mer, France
21-23 June	GEOHAB Open Science Conference on Benthic Harmful Algal Blooms	Honolulu, Hawaii, USA
24-27 June	GEOHAB Training Workshop on Taxonomy challenges and identification of benthic dinoflagellates	Honolulu, Hawaii, USA
26-28 June	GEOHAB Scientific Steering Committee	Honolulu, Hawaii, USA
16-18 August	Summit on Capacity Building for Ocean Research	Bremen, Germany
24-26 August	IOCCG/GEOHAB Harmful Algal Bloom and Ocean Colour Working Group	Hermanus, South Africa
13-16 September	SCOR General Meeting	Toulouse, France
22-24 September	GEOTRACES SSC	Toulouse, France
10-14 October	IMBER Imbizo-II	Crete, Greece
18-22 October	WG 137 on Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation	Hangzhou, China
25-29 October	SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems	Crete, Greece
2-3 December	Planning Committee for Third Symposium on The Ocean in a High-CO_2 World	Monterey, California, USA

2011

10-11 February	International Quiet Ocean Experiment Meeting II	Ft. Lauderdale, Florida, USA
18-20 February	WG 134 on The Microbial Carbon Pump in the Ocean	San Juan, Puerto Rico
11-13 April	IMBER Scientific Steering Committee	Marseille, France
2-6 May	2nd DBCP Africa/Western Indian Ocean Capacity Building Workshop and SCOR/WCRP/IAPSO WG 136 Meeting	Quatre Bornes, Mauritius
21-23 August	GEOHAB Executive Committee	Copenhagen, Denmark
29 August - 2 September	WG 138 on Modern Planktic Foraminifera and Ocean Changes	Amsterdam, Netherlands
30 August - 1 September	International Quiet Ocean Experiment Open Science Meeting	Paris, France
4-8 September	GEOTRACES Data Management Committee and Scientific Steering Committee	Xiamen, China
12-15 September	SCOR Executive Committee Meeting	Helsinki, Finland
12-16 September	The Ocean Carbon Cycle at a Time of Change: Synthesis and Vulnerabilities	Paris, France
26-30 September	WG 137 on Global Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observations	Massalubrense (Naples), Italy
10-11 October	SCOR/InterRidge WG 135 on Hydrothermal Energy Transfer and its Impact on the Ocean Carbon Cycles	Hangzhou, China
1-4 November	GEOHAB Scientific Steering Committee	Plymouth, UK
3-4 November	SCOR/IODE/MBLWHOI Library Data Publication Committee	Liverpool, UK
14-17 November	Third GEOTRACES Data-Model Synergy Workshop	Barcelona, Spain

2012

18-19 February	SCAR-SCOR Southern Ocean Observing System Scientific Steering Committee	Salt Lake City, USA
25 February	SCOR WG 139 on Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean	Salt Lake City, USA
7-10 May	SOLAS Open Science Conference	Cle Elum, Washington State, USA
11-13 May	SOLAS Scientific Steering Committee	Washington State, USA

29-31 May	GEOHAB Conference on Progress in interpreting Life History and Growth Dynamics of Harmful Algal Blooms in Fjords and Coastal Environments	Victoria, British Columbia, Canada
12-14 June	IMBER Scientific Steering Committee	La Paz, Mexico
21-23 August	GEOHAB Conference on Advances and challenges for understanding physical-biological interactions in HABs in Stratified Environments	Moss Landing, California, USA
26-28 August	SCOR WG 134 on The Microbial Carbon Pump	Delmenhorst, Germany
24-27 September	Third Symposium on The Ocean in a High-CO_2 World	Monterey, California, USA
8-10 October	SCOR/IODE/MBLWHOI Library Data Publication Committee	Woods Hole, USA
8-12 October	AGU Chapman Conference on The Agulhas System and its Role in Changing Ocean Circulation, Climate, and Marine Ecosystems	Stellenbosch, Western Cape, South Africa
12-14 October	Joint SCOR WG 137/PICES Workshop and WG 137 Meeting	Hiroshima, Japan
21-24 October	SCOR General Meeting and Related Events	Halifax, Nova Scotia, Canada
29 October-2 November	GEOTRACES Data Management Committee and Scientific Steering Committee	India