

THE INTERNATIONAL OCEAN CARBON COORDINATION PROJECT (IOCCP)

A joint project of SCOR and IOC and an affiliate program of the Global Carbon Project.

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Ocean Carbon in the Southern Ocean Observing System

A planning meeting, co-sponsored by GOOS, Census of Marine Life, SCAR, SCOR, POGO, and NOAA was held from 1-3 October at the House of Science in Bremen, Germany to develop plans for a Southern Ocean Observing System as a follow-on from the International Polar Year (2007-2008). The IOCCP developed a background document for this workshop with inputs from Nicolas Gruber, Bronte Tilbrook, Chris Sabine, Nicolas Metzl, Mario Hoppema, and Dorothee Baker, and this paper was presented at the meeting by Mario Hoppema. The following summary of the meeting was contributed by Dr. Mike Sparrow of SCAR and published in the CLIVAR newsletter:

"The importance of the Southern Ocean to the global climate system and the uniqueness of its ecosystems are well known. The region is remote and logistically difficult to access and thus is one of the least sampled regions on the planet. Design and implementation of an observing system that encompasses physical, biogeochemical and ecological processes is therefore a formidable challenge.

Building on an initial Southern Ocean Observing System (SOOS) meeting in Hobart last year, a follow up meeting was held in Bremen this October. The aim of this meeting was to more fully develop the plans for such an observing system.

Thirty-two participants from backgrounds as diverse as physical oceanography, ecosystem studies and the tourist industry discussed various aspects of the observing system during the three days. The first day of the meeting consisted of a series of summary lectures and discussion about the SOOS structure. The second and third days saw attendees split into various groups to tackle different (though interconnected) aspects of the SOOS, for example (i) Marine Physics, (ii) Ecosystems/biology, (iii) Biogeochemistry/Carbon and (iv) Cryosphere and sea ice. During this time they looked at the main science questions that any hypothetical observing system should aim to answer and the types of measurements that would be needed in order to do so. The state of the observing system and gaps were also examined. Cross group interaction was actively encouraged and each group reported back on progress at regular intervals.

A plan for production of a SOOS document, with lead authors identified as responsible for writing sections, and identifying others to do so, was drawn up. This will be worked on over the next few months, with the idea that a near final draft document will be openly discussed at the SCAR/IASC Open Science Conference being held in St Petersburg in July 2008.”

For more information: Download the [Strategy for Ocean Carbon in the Southern Ocean Observing System](#) from the IOCCP web-site (pdf 256 kb) or visit the SOOS workshop web-site with background documents and available at:

http://www.clivar.org/organization/southern/expertgroup/SOOS_workshop.htm#background

The Surface Ocean CO₂ Global Dataset and Atlas Project Update

At the “Surface Ocean CO₂ Variability and Vulnerability” workshop in April 2007, co-sponsored by IOCCP, SOLAS, IMBER, and the Global Carbon Project, participants agreed to establish a standard global surface CO₂ data set that would bring together, in a common format, all publicly available surface CO₂ data. This is an activity that has been called for by many international groups for many years, and has now become a priority activity for the carbon community. This data set will serve as a foundation upon which the community will continue to build in the future, based on agreed data and metadata formats and standard 1st level quality-control procedures, building on earlier agreements established at the 2004 Tsukuba workshop on “Ocean Surface pCO₂ Data Integration and Database Development”.

This data set is meant to serve a wide range of user communities and it is envisaged that, in the future, 3 distinct versions will be made available:

- an extended 1st level quality-controlled data set made available on a rolling basis by concatenating new publicly-available data onto the existing data set using a common format and agreed 1st level QC procedures (to be determined, and not to be confused with essential primary QC procedures carried out by PIs);
- a 2nd level quality-controlled data set made available on a regular basis (to be determined) following agreed procedures (also to be determined) and regional review; and,
- a gridded “Surface Ocean CO₂ Atlas” consisting of a 1° x 1° grid of monthly surface pCO₂ means (including number of data points and standard deviation), with no interpolation.

For the extended 1st level quality-controlled data set, it was agreed to build on the work started in 2001 as part of the EU ORFOIS project by Dorothee Bakker (UEA), which now continues as part of the EU CARBOOCEAN project, where Benjamin Pfeil and Are Olsen (Bjerknes Centre for Climate Research) have compiled the historical, publicly-available surface CO₂ data held at CDIAC into a common format database based on the IOCCP recommended formats for metadata and data reporting. This compilation will include data from over 10 countries, producing an initial database composed of more than 1250 cruises from 1972 - 2007 with approximately 4.5 million measurements of various carbon parameters, available in a common format, extended 1st level quality-controlled data set.

To date, the primary QC procedures have included correcting for missing values, correcting spatial outliers and unrealistic values in salinity, temperature at equilibration, water temperature, atmospheric pressure, pressure at equilibration, latitude and longitude by interpolation of closest neighboring stations, as well as calculation of fCO₂ in the water column at SST and 100% humidity from various reported variables (xCO₂, fCO₂, pCO₂).

In early 2008, the IOCCP will organize a small technical workshop to develop internationally-agreed 1st level and 2nd level quality-control procedures and to discuss the coordination of regional scientific groups to conduct the 2nd level quality control analyses.

It is anticipated that this data set will be available through CDIAC in early to mid 2008, and the Bjerknes Centre group has agreed to continue to serve as the extended 1st level QC “data assembly center” for the international community to regularly add new data to this common format data set. In addition, CDIAC has developed several metadata search techniques and has been working with NOAA/PMEL to implement live-access server products that will allow for searching, sub-selection, and visualization of the surface pCO₂ data set.

For more information: Visit the IOCCP web-site (<http://ioc.unesco.org/ioccp/>) for the workshop report of the “Surface Ocean CO₂ Variability and Vulnerability Workshop”, the report of the Tsukuba “Ocean Surface pCO₂ Data Integration and Database Development”, and the IOCCP recommended formats for data and metadata reporting. Please also see the CDIAC Ocean CO₂ site (<http://cdiac.ornl.gov/oceans/home.html>) for the latest available data and products.

Global Ocean Ship-based Hydrographic Investigations Panel (GO_SHIP)

One of the action items developed at the November 2005 International Repeat Hydrography and Carbon workshop in Shonan Village, Japan, was to establish a small interdisciplinary advisory group to bring together interests from physical hydrography, carbon, and biogeochemistry to develop guidelines and advice for the development of a globally coordinated network of sustained ship-based hydrographic sections that will become an integral component of the ocean observing system after the end of the CLIVAR programme (post-2012).

Taking these suggestions forward, the IOCCP, CLIVAR, and the SOLAS-IMBER Carbon Group each approved the development of this advisory group in 2006, and earlier this year, the Observations Coordination Group of the IOC-WMO Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM) and the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC) strongly endorsed its development.

The first meeting of the Hydrography Panel was held in Victoria, BC, Canada on 1-2 November. Over the next 18 months, this group will develop a draft strategy that will be circulated for review and comments in mid 2008, with a final strategy to be published in late 2009 and presented at OceanObs 09. Specifically, the Terms of Reference for this advisory group are as follows:

- i. To develop the scientific justification and general strategy for a ship-based repeat hydrography network, building on existing programs and future plans, that will constitute the core global network, post-CLIVAR; considerations should include:
 - a) a set of basic requirements to define a coordinated repeat hydrography network (e.g., sample spacing, repeat frequency, recommended core measurements, etc.);
 - b) an inventory of existing and planned sections that meet those criteria;
 - c) an assessment of other observing programs that can either contribute to or use hydrography data (e.g., Argo, OceanSITES, GeoTraces, etc.);
 - d) an assessment of data release needs to meet research and operational objectives;
 - e) an inventory of on-going or planned scientific synthesis activities (basin and global) that might benefit from closer collaboration;

- f) guidelines for the transition from the CLIVAR hydrographic program to the new system, including sections, data and information management, and synthesis activities.
- ii. To develop guidelines for a single global information and data center for ship-based repeat hydrography; and,
- iii. To review and provide guidance on the need to update the WOCE hydrographic manual, including a review and update of data quality control issues.

Hydrography Panel members include: Chris Sabine (NOAA – PMEL, USA), Nicolas Gruber (ETH, Switzerland), Arne Koertzing and Toste Tanhua (IfM-GEOMAR, Germany), Bernadette Sloyan (CSIRO, Australia), Greg Johnson (NOAA-PMEL, USA), and Masao Fukasawa (JAMSTEC, Japan).

This first meeting reviewed discussions and decision from the Shonan Village meeting and began drafting sections of the strategy on science goals, temporal and spatial sampling requirements, core and recommended variables, survey lines to be included as part of the sustained system, data release policies, and data and information center needs. The group also reviewed the WOCE hydrographic manual chapters and suggested lead reviewers and authors to update each section. It is envisaged that the advisory group will develop a report within a <2 year period that will be circulated widely for consultation and consensus on the way forward. The final strategy will be presented at OceanObs 09.

The IOCCP (Hood) and CLIVAR (Caltabiano) are providing project office support for the advisory group activities.

For more information: Visit the [GO SHIP site](#) and the [International Repeat Hydrography and Carbon Workshop site](#).

SeaCarb Program Revised

Aurélien Proye and Jean-Pierre Gattuso have made extensive revisions to the SeaCarb programme (an R programme that calculates carbonate chemistry parameters) including code contributed by Jim Orr.

For more information: The package can be downloaded from their web-site at: <http://www.obs-vlfr.fr/~gattuso/seacarb.php> or from the Comprehensive R Archive Network at: <http://cran.at.r-project.org/src/contrib/Descriptions/seacarb.html>.

Symposium Announcement: Effects of Climate Change on the World's Oceans

The International Council for Exploration of the Seas (ICES), the North Pacific Marine Science Organization (PICES), and the Intergovernmental Oceanographic Commission of UNESCO, along with WCRP, GLOBEC, and SCOR, are organizing an international symposium to provide a global overview of climate impacts in the oceans. Although local effects and consequences of climate change on the functioning of marine ecosystems are beginning to be documented, there is no comprehensive vision at the global scale, and only limited ability to forecast the effects of climate change. To close this gap, the Symposium will focus on the major issues of climate change

that affect the oceans: oceanic circulation, climate modelling, cycling of carbon and other elements, acidification, oligotrophy, changes in species distributions and migratory routes, sea-level rise, coastal erosion, etc. The Symposium will bring together results from observations, analyses and model simulations, at a global scale, and will include discussion of the climate change scenarios and the possibilities for mitigating and protecting the marine environment and living marine resources. The Symposium will be held in Gijon, Spain, May 19-23.

For more information: Visit the Symposium web-site at:
http://www.pices.int/climate_change.aspx

The First “State of the Carbon Cycle Report” Released

The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle, US CCSP Synthesis and Assessment Product 2.2, was released this week. The official release can be found at <http://www.climate-science.gov/Library/sap/sap2-2/final-report/default.htm> A copy will also be posted on the SOCCR website <http://cdiac.ornl.gov/SOCCR/> .