

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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*** CARINA data publicly available at CDIAC

*** The Guide to Best Practices for Ocean CO₂ Measurements released

*** OceanObs'09 Conference, Venice, Italy

*** From Panel to Program: The Evolution of GO-SHIP

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*** Fourth Session of the IOCCP Scientific Steering Group

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The “Carbon in the North Atlantic’ Project (CARINA) was formed as an informal, unfunded project in 1999, organized by Ludger Mintrop and Douglas Wallace in Kiel. The result was the assembly of a large collection of previously unavailable carbon data. During the last couple of years, the CARINA data base has grown significantly, and four meetings have addressed data quality control and synthesis issues (Laugarvatn, Iceland, in 2006, Kiel, Germany in March 2007, and Delmenhorst, Germany in November 2007). CARINA held its final meeting at UNESCO in Paris from 18-19 June 2008 where 24 scientists from Europe and the US met to agree on a set of 2nd adjustments of the CARINA data. The workshop was co-sponsored by the EU Integrated Project CARBOOCEAN – Marine Sources and Sinks Assessment, and the International Ocean Carbon Coordination Project (IOCCP). In early 2009, the 1st and 2nd level quality control of the data was finalized.

Identified data biases were subjectively compared to predetermined accuracy limits, and special consideration is given to the fact that some of the regions studied are known to have experienced real change over the time period covered by the various cruises (1982-2007). Experience with the previous GLODAP synthesis project has shown that it is essential that the results obtained by the different methods of quality control can be compared and systematically assessed. In this way, a consistent data product can be produced containing data from many different cruises by many different laboratories in very different regions of the world oceans. We have gone to great lengths to document our efforts in CARINA, and the user should be able to find information about and justifications for adjustments to the data in the documentation. This effort of secondary quality control is a key step towards reaching the goals of CARINA and CarboOcean.

The CARINA collection now includes data and metadata from 188 cruises.

Approximately 80% of the cruise data included in CARINA has not been previously

available to the community. The majority of the cruises were contributed by European CARBOOCEAN participants; however, valuable additional data is included from the U.S. CLIVAR, WOCE, and NOAA programs, Japan, Canada, Australia, and Russia. Attribution to the various contributors is made via a Cruise Summary table that is available now at:

http://cdiac.ornl.gov/oceans/CARINA/Carina_table.html along with the data sets and in the individual cruise metadata. The value of the Cruise Summary table is enhanced by extensive reference to publications that have already used the various data sets.

The CARINA data base consist of the individual cruise data files, with short meta-data in the file header of the exchange format files, as well as 3 merged data products (one for each region: Arctic Mediterranean Seas, North Atlantic, Southern Ocean). The merged data files contain data adjusted accordingly to the results of the 2nd level QC. Additionally the merged data files contain interpolated missing data and calculated carbon parameters, if possible.

The CARINA data are publicly available at CDIAc (http://cdiac.ornl.gov/oceans/CARINA/Carina_inv.html). In addition, a special issue in Earth System Science Data (ESSD, <http://www.earth-system-science-data.net/index.html>) in detail describing the CARINA data product and the secondary quality control is being prepared. Nine of the twenty planned publications are available on the ESSD discussion forum with the rest expected by late-2009.

The Guide to Best Practices for Ocean CO₂ Measurements released

The Guide Best Practices for Ocean CO₂ Measurements was originally prepared at the request, and with the active participation, of a science team formed by the U.S. Department of Energy (DOE) to carry out the first global survey of carbon dioxide in the oceans (DOE. 1994. Handbook of methods for the analysis of the various parameters of the carbon dioxide system in sea water; version 2, A.G. Dickson and C. Goyet, Eds. ORNL/CDIAC-74).

The manual has been updated several times since, and the current version contains the most up-to-date information available on the chemistry of CO₂ in sea water and the methodology of determining carbon system parameters. This revision has been made possible by the generous support of the North Pacific Marine Science Organization (PICES), the Scientific Committee on Ocean Research (SCOR), the Intergovernmental Oceanographic Committee/UNESCO (IOC) and DOE through the Carbon Dioxide Information and Analysis Center (CDIAC).

The Guide to Best Practices for Ocean CO₂ Measurements. PICES Special Publication 3, 191 pp. is now available online from CDIAC:

http://cdiac.ornl.gov/oceans/Handbook_2007.html

A hard copy can be ordered from:

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Any errors in the text or corrections that arise as the methods evolve can be reported to Alex Kozyr at CDIAC (kozyra@ornl.gov).

OceanObs'09 Conference

The OceanObs'09 Conference held in Venice, Italy on 21-25 September 2009 was attended by more than 600 participants from thirty-six countries. The goals of the conference were to

- celebrate progress in implementing the existing initial ocean observing system, realizing societal benefits from it, and highlighting its potential.
- develop a process for building consensus for sustaining and evolving systematic and routine global ocean observations over the next 10 years in support of societal benefits.

The final draft conference statement, below, is available for comment through 4 October, 2009 at the meeting website (<http://www.oceanobs09.net/blog/?p=1170>).

VISION

Provision of routine and sustained global information on the marine environment sufficient to meet society's needs for useful hindcasts, nowcasts and forecasts of marine variability (including physical, biogeochemical, ecosystems and living marine resources), weather, seasonal to decadal climate variability, sustainable management of living marine resources, and assessment of longer term trends

We, the more than 600 Participants from 36 nations of the OceanObs'09 Conference in Venice,

Recognizing the progress in ocean observations in the last decade, the demonstrated societal benefits of the existing elements, the recent technical and scientific developments that enable enhancements to observing systems and ensuing services,

Having broadly consulted with the communities involved in the production, distribution, and use of ocean information,

Informed by 99 Community White Papers, 47 Plenary Papers, and discussions captured in the Conference Summary,

Call for significantly enhancing internationally-coordinated provision of sustained observation and information of the world ocean, as a part of the larger earth observing effort, for public good and stewardship.

Despite the profound importance of marine information to meet the needs of our societies, the resources necessary to observe, assess, and forecast global marine conditions are fragile and insufficient.

Core principles of participation in the sustained observing system include recognition that users require rapid access to all relevant data, free of charge. An integrated system, making use of remotely sensed and in-situ observations is essential. Observations are openly shared in near-real-time when technically feasible. They are collected, analyzed, archived, and distributed to internationally agreed standards with agreed best practices.

A true global partnership with strong local benefits requires involvement of all stakeholders. All nations must work together for mutual benefit, through educational programs and development of national capacity.

For more information: Visit the conference web-site at <http://www.oceanobs09.net/>

From Panel to Program: The evolution of GO-SHIP

The Global Ocean Ship-based Hydrographic Investigations Panel (GO-SHIP) presented its community white paper at the OceanObs09 conference from 21-25 September in Venice, Italy. The white paper brings together 46 co-authors from 9 countries to develop scientific justification and guidelines for the development of a regular and coordinated global survey, and includes sections on inorganic and anthropogenic carbon, dissolved organic carbon and export flux, ocean acidification, nutrients, oxygen, pigments and bio-optical measurements, trace elements and isotopes, understanding ocean changes below 2 kilometers and their contributions to global heat budget and sea-level budgets, understanding the variability in water masses, ventilation, and pathways, quantifying transports, evaluating ocean models, providing a platform for testing new shipboard sensors and providing an opportunity to deploy and evaluate other platforms, and climate quality surface meteorology and air-sea flux measurements.

The strategy describes two types of surveys required to meet scientific objectives: (1) a global decadal survey conducted such that each full ocean basin is observed over an approximately synoptic time-period (< 3 years), and (2) a sub-set of the decadal survey

lines sampled at high-frequency (repeats at least every 2-3 years). The strategy also recommends core variables for the decadal survey lines and advocates for a rapid release of data, with data measured on the ship to be released within 6 weeks of the end of the cruise, final physical data within 6 months, and all other data within 1 year, with exceptions for isotopes or tracers with shoreside analysis where 1 year is difficult.

The paper was well-received and used by many plenary speakers to develop their presentations. With the increased emphasis on biogeochemistry and biological variables to be included in the observing system for the next 10 years, repeat hydrography was recognized as the only method for obtaining high-quality, high spatial and vertical resolution measurements of a suite of physical, chemical, and biological parameters over the full water column. However, in several side meetings and key-note presentations about the future of the *in situ* observing system, ship-based repeat hydrography was missing. When asked about this omission, speakers replied that hydrography was assumed to continue as part of the system.

Formal organization of hydrography has been absent since the end of WOCE. Because of the integrated climate focus of CLIVAR, repeat hydrography did not continue as a distinct coordinated activity of the program, and it was thought that many hydrographic sections would be sustained without formal agreements. However, while hydrography has continued during CLIVAR, the lack of formal organization has led to a lack of visibility in the global observing system and a significant decrease in the number of trans-basin sections carried out by some countries. More importantly, the lack of international agreements for implementation of hydrographic sections has led to disparate data sharing policies, duplication of some sections, and sections being carried out without the full suite of core variables.

The Panel met during the conference to discuss the way forward for coordination of ship-based repeat hydrography. While it is essential to maintain a repeat hydrography program firmly linked to national, regional and global research programs, the Panel noted that some elements of coordination and implementation could benefit from a more pro-active oversight structure and formal agreements. The Panel recommends the development of a sustained repeat hydrography program to:

- develop formal international agreements for a sustained international repeat ship-based hydrography program, including an internationally-agreed strategy and implementation plan building on the guidelines in the Community White Paper,
- advocate for national contributions to this strategy and participation in the global program,
- provide a central forum for communication and coordination, and
- develop syntheses of hydrographic data, in partnership with national, regional, and global research programs.

The program would be guided by an international steering committee composed of scientists from disciplines or projects that use and collect hydrographic data, including physical oceanography, carbon and biogeochemistry, biological oceanography, the Argo

Project, and the OceanSITES Project. The committee should also include regional representation to ensure coordination and communication within and between regions. Initially, the IOCCP and CLIVAR International Project Offices could provide part-time project office support as the program develops. It is tentatively planned to hold a 1-day international planning meeting to discuss the way forward at the AGU/ASLO/TOS Ocean Sciences Meeting in February in Portland, Oregon, USA. Formal recognition, endorsement, and sponsorship of this project will be discussed at the next session of the IOC Executive Council (June 2010), and this initiative is described in the background documents for the November 2009 meeting of the WMO-IOC Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM).

For more information:

- see IOCCP Newsletter November 2007 about GO-SHIP
- download the Community White Paper at:
http://ioc3.unesco.org/ioccp/Docs/GOSHIP_ConfDraft.pdf
- visit the GO-SHIP Panel web-site at:
<http://ioc3.unesco.org/ioccp/Hydrography/GO-SHIP.html>.

International Carbon Dioxide Conference (ICDC8) held in Jena, Germany

Since the beginning of direct high-precision atmospheric carbon dioxide measurements at Mauna Loa and the South Pole more than 50 years ago, scientific interest into the study of the global carbon cycle and its perturbations by man and climate has increased almost exponentially. The recognition by the Intergovernmental Panel on Climate Change of carbon dioxide as a major driver behind the current and future warming of the world climate and the subsequent establishment of international initiatives to curb carbon dioxide emissions, such as the Kyoto protocol, has further greatly intensified global carbon cycle research. Since 1981, the worldwide scientific community has met every four years to exchange the latest knowledge and to gain a better understanding on the multitude of interdisciplinary aspects of the global carbon cycle.

The 8th International Carbon Dioxide Conference took place September 13-19, 2009 at the Friedrich-Schiller-University in Jena, Germany providing a multidisciplinary forum for all aspects of modern carbon cycle research pertinent to understanding the natural and anthropogenic controls of atmospheric carbon dioxide and its interactions in the global Earth system with a special focus on the contemporary anthropogenic perturbation.

Main conference topics included:

- Measurement and observational aspects and techniques (atmospheric, oceanic and terrestrial carbon measurements, monitoring networks, remote sensing, isotopes, ice-core and other paleo-carbon observations, new observational techniques, forward and inverse modeling)

- Assessments and syntheses of human and climate drivers, of key processes and of regional and global carbon balances including their spatiotemporal trends and variability
- Carbon cycle modeling studies for the estimation of past, present and future CO₂ sources and sinks including coupled carbon cycle - climate modeling studies for the quantification of climate-biogeochemistry feedbacks, and model-data fusion approaches
- Assessments of potentials and vulnerabilities of carbon sequestration, carbon cycle management and interactions with human activities.

For more information: Visit the meeting Web-site at <http://conventus.de/icdc8-information/>

Fourth Session of the IOCCP Scientific Steering Group

The Fourth IOCCP Scientific Steering Group meeting was held 14 September 2009 as a side event of the ICDC8 conference in Jena, Germany. IOCCP Chair Chris Sabine (NOAA/PMEL, USA) was joined by members Masao Fukasawa (JAMSTEC, Japan), Dorothee Bakker (UEA, UK), Toste Tanhua (IfM-Geomar, Germany), Alex Kozyr (CDIAC, USA), Ute Schuster (UEA, UK), Pedro Monteiro (CSIR, South Africa), and Yukihiro Nojiri (NIES, Japan). In addition Nicolas Metzl (LOCEAN-IPSL, France) and Nicolas Gruber (ETH, Switzerland) attended as chairs of the SOLAS-IMBER carbon groups.

Sabine noted that in the 7 years since its inception, IOCCP has held 18 workshops or meetings and has published and/or co-sponsored the publication of 16 reports, guides, and strategy documents. He noted that the IOCCP was currently leading several large coordination activities including the Global Ocean Ship-based Hydrographic Investigations Panel (GO-SHIP), and the Surface Ocean CO₂ Atlas Project (SOCAT). In 2010, the IOCCP plans to support the final GO-SHIP meeting and several SOCAT regional workshops prior to the release of SOCAT dataset version 1.3.. The meeting report is in preparation and will be available at the IOCCP web-site in mid-October.

For more information: Visit the IOCCP Web-site (www.ioccp.org).