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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NEWSLETTER No. 23, February 2009

www.ioccp.org

The Monaco Declaration and Research Priorities Report launched at ASLO

From UNESCO Press Release No. 2009-08, January 30: More than 150 leading marine scientists from 26 countries are calling for immediate action by policymakers to reduce CO_2 emissions sharply so as to avoid widespread and severe damage to marine ecosystems from ocean acidification. They issued this warning in the Monaco Declaration, released on 30 January. The scientists note that ocean acidification is already detectable and that it is accelerating. They caution that its negative socio-economic impacts can only be avoided by limiting future atmospheric CO_2 levels. Prince Albert II of Monaco has urged political leaders to heed the Monaco Declaration as they prepare for climate negotiations at the United Nations Climate Change Conference in Copenhagen this year. "I strongly support this declaration, which is in full accord with my efforts and those of my Foundation to alleviate climate change," he said. The Monaco Declaration is based on the Research Priorities Report developed by participants at last October's 2nd international symposium on The Ocean in a High-CO_2 World, organized by UNESCO's Intergovernmental Oceanographic Commission, the Scientific Committee on Oceanic Research (SCOR), the International Atomic Energy Agency (IAEA) and the International Geosphere Biosphere Programme (IGBP), with the support of the Prince Albert II of Monaco Foundation and several other partners.

"The chemistry is so fundamental and changes so rapid and severe that impacts on organisms appear unavoidable." said James Orr of the Marine Environment Laboratories (MEL-IAEA) and chairman of the symposium. "The questions are now how bad will it be and how soon will it happen. The report from the symposium summarizes the state of the science and priorities for future research, while the Monaco Declaration implores political leaders to launch urgent actions to limit the source of the problem."

"In order to advance the science of ocean acidification, we need to bring together the best scientists to share their latest research results and to set priorities for research to improve our knowledge of the processes and of the impacts of acidification on marine ecosystems," explained Patricio Bernal, Executive Secretary of UNESCO IOC. "The Ocean in a High-CO_2 World Symposia Series provides this forum to scientists every four years, and the Research Priorities

Report it produces represents an authoritative assessment of what we know about acidification impacts."

The Declaration and Report were presented by James Orr, Jean-Pierre Gattuso, coordinator of the European Project on Ocean Acidification (EPOCA), Denis Allemand of the Prince Albert II Foundation, and Carlos Duarte, president of ASLO, at a press conference on 30 January at the Acropolis Convention Centre, Nice, France.

For more information: The Monaco Declaration and the Research Priorities Report are available on-line at www.ocean-acidification.net.

IOCCP Welcomes Kathy Tedesco as New Director

The Intergovernmental Oceanographic Commission of UNESCO and the Scientific Committee on Oceanic Research are pleased to announce that Dr. Kathy Tedesco has been appointed as the new director of the IOCCP, effective 2 March. Acting project director Maria Hood will continue to work part-time for the IOCCP to assist the new director.

Kathy comes to the IOCCP from the U.S. Geological Survey in St. Petersburg, Florida where she has been working as an oceanographer for the past two years. Prior to this, she served as Program Manager for the Global Carbon Cycle Program (GCC) in the Climate Program Office at the National Oceanic and Atmospheric Administration. Her work involved planning future research directions for GCC, drafting program plans, administering peer review of proposals and research projects, recommending and managing funded research, and reporting on performance and accomplishments. She represented NOAA on the Carbon Cycle Interagency Working Group under the U.S. Climate Change Science Program, along with representatives from more than ten federal agencies, coordinating carbon cycle research through linked interdisciplinary research elements and crosscutting activities.

Kathy received her Ph.D. in geological oceanography from the University of South Carolina. Her dissertation research focused on the calibration of paleoenvironmental proxies from the Cariaco Basin time series station and their application to paleoclimate reconstructions. Kathy is currently conducting a sediment trap experiment in the northern Gulf of Mexico to understand Holocene climate history of the region. In addition, she has participated in over twenty-five coring and hydrographic research cruises.

As a research scientist, with significant program management experience, Kathy has honed the skills necessary to meet the goals of the IOCCP such as prioritizing a diverse workload, managing budgets, organizing workshops and working with scientists to produce necessary planning documents and reports. She also has the perspective to understand the obligations and demands on scientists who are asked to contribute to IOCCP activities with no additional funding.

Nutrients Standards: a review and summary of the 2009 INSS workshop

The IOCCP co-sponsored and hosted the INSS workshop from 10-12 February at UNESCO headquarters in Paris. This workshop, led by Dr. Michio Aoyama, follows several workshops and intercomparison experiments held over the last several years to establish nutrient standards for

marine science. The following background information was prepared by the INSS organizers: Michio Aoyama, Andrew Dickson, David Hydes, Akihiko Murata, Jae Oh, Patrick Roose, and Malcolm Woodward.

The comparability and traceability of data on nutrients in the world's oceans are fundamental issues in marine science, particularly for studies of global climate change. Our community has been continuing to improve the comparability of nutrient data in many ways, including by intercomparison experiments and the development of nutrient reference materials. However, as *Climate Change 2007 – The Physical Science Basis* (IPCC 2007) stated, adequate comparability and traceability have not yet been achieved. The IPCC 2007 report comments as follows on nutrient comparability: "Using the same data set extended to the world, large regional changes in nutrient ratios were observed (Li and Peng, 2002) but no consistent basin-scale patterns. Uncertainties in deep ocean nutrient observations may be responsible for the lack of coherence in the nutrient changes. Sources of inaccuracy include the limited number of observations and the lack of compatibility between measurements from different laboratories at different times. (Bindoff et al., 2007)."

The IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials (GESREM, 1993) drew attention to an urgent need for certified reference seawater for nutrients. Dickson (2001) drew attention to the need to develop certified reference seawater covering several determinants in the one bottle. During the World Ocean Circulation Experiment (WOCE) period, the WOCE Hydrographic Program Planning Committee (WHPPC) recognized the importance of worldwide comparability of WOCE nutrient data.

In the 1990s a number of studies were organized under the ICES umbrella. These studies were well documented (see Aminot et al., 1995 and Aoyama, 2006 for details). In Europe, this led to the setting up of QUASIMEME (Topping, 1997), which annually validates the procedures of individual laboratories. But this system is inadequate for supporting the traceability that is required to link measurements from day to day in order to improve the overall precision within a laboratory or to achieve a known level of comparability between different laboratories.

In 2000 and 2002, the U.S. .National Oceanic and Atmospheric Administration and the National Research Council of Canada (NOAA/NRC) conducted two intercomparisons to certify MOSS-1 (Willie and Clancy, 2000; Clancy and Willie, 2003). However, adequate comparability and traceability of nutrients data have not yet been achieved. Various efforts have been made to change it, but these have been on too small a scale to meet the needs of the global community in measuring nutrients in seawater.

In 2003, Michio Aoyama, of the Meteorological Research Institute, Japan, organized an intercomparison study that included 18 laboratories (Aoyama, 2006; Aoyama et. al, 2007). In 2006, Aoyama organized a second intercomparison study that included 55 laboratories worldwide (Aoyama, 2008 in preparation). Both studies clearly showed that the global use of reference materials for nutrients in seawater would greatly improve the comparability of nutrient data worldwide. In early 2007, Aoyama visited the National Oceanography Centre in Southampton to discuss the results of the inter-calibration. The European participants in the inter-calibration and other interested nutrient chemists were also invited to attend discussions at NOC.

An International Workshop on Chemical Reference Materials in Ocean Science was held in Tsukuba, Japan, on 29 October to 1 November 2007. It focused on the measurement of nutrients and of ocean CO_2 parameters. The current status of available chemical reference materials, especially for nutrients references in ocean science were discussed, and the participants agreed to start a collaborative program, called the International Nutrients Scale System (INSS), to establish

global comparability and traceability. The agreements at the workshop in Tsukuba 2007 marked an epoch in the history of nutrients comparability. The 2009 INSS workshop in Paris is a follow-up meeting of 2007 workshop in Tsukuba to advance international collaboration to establish global comparability of nutrients data in the world ocean.

This meeting brought together 37 participants from 11 countries to update the manual of nutrients analyses by the INSS group, review the usage of nutrient data and carbonate system data in oceanography, summarize the 2008 reference materials intercomparison experiments, plan for a short-term stability experiment in 2009-2011, and to hear reports on reference materials development from several groups. A workshop report is in preparation. The group is also finalizing its "Recommendations for the determination of nutrients in seawater to high levels of precision and inter-comparability using Continuous Flow Analysers" as a contribution to the GO-SHIP project to revise the WOCE Hydrographic Program manual. To carry out the INSS work outlined, including the development of a review of the status of QC techniques for ocean biogeochemistry measurements, the organizers plan to submit a proposal for the establishment of a joint ICES-IOC working group. This proposal will be considered by the 25th IOC Assembly in June.

For more information: Visit the INSS web-site at: http://www.mri-jma.go.jp/Dep/ge/2009INSSworkshop/2009inss_workshop_index.html or the GO-SHIP manual site to review the Recommendations chapter and standard operating procedures at: http://cdiac3.ornl.gov/hydrography/

The Fundamentals of Carbon Biogeochemistry: A Training Workshop

A fundamental component of the effort to understand ocean acidification and the associated climate and ecological effects and feedbacks is a solid understanding of the functioning of the marine carbon cycle. It is also imperative to develop a common methodological approach and rigorous (meta)data reporting skills.

A training workshop, sponsored by the EU projects EPOCA and CARBOOCEAN, and the IOCCP, will be held at the Bjerknes Centre for Climate Research**,** University of Bergen**,** Norway from February 24-26 for Ph.D. students and early-stage post-docs. The workshop will bring together 52 Ph.D. students and early-stage post-docs to review the PICES-IOCCP "Guide of Best Practices for Oceanic CO_2 Measurement and Data Reporting" (A. Dickson, C. Sabine, and J. Christian, 2008) and hear lectures on:

- The marine carbon cycle - past, present, and future
- pH scales and dissociation constants
- Instrumentation for measurement of the marine CO_2 system
- Ecosystem carbon biogeochemistry – sensitivity and feedbacks to ocean acidification
- Data transfer and communication of results, and
- CO2 system calculations.

Lecturers include Richard Bellerby (Chair), Toby Tyrell, Ingunn Skjelvan, Jim Orr, Bjorn Rost, Markus Wienbauer, Fred Gazeau, Anne-Marin Nisumaa, and Mike DeGrandpre. The meeting also includes 2 substantial poster sessions for students to present their own research.

For more information: Visit the EPOCA web-site at: http://www.epoca-project.eu/ or contact Richard Bellerby (Richard.Bellerby at bjerknes.uib.no).

International ocean pCO_2 system intercomparison meeting planned

Dr. Yukihiro Nojiri is hosting an international ocean pCO_2 system intercomparison exercise from 26 February to 5 March at the indoor seawater pool of the National Research Institute of Fishery Engineering in Hazaki, Japan. This is a follow-up of the 2003 intercomparison experiment using a 170 ton seawater pool with stable temperature controls and pCO_2 ranging from 200 to 600 ppm controlled by HCL / NaOH. The facilities offer standard gas supplies (0, 270, 330, 390, 450 ppm CO_2 in air), a water line with a 300 L/min flow rate, 2 thermosalinographs, and calibrated temperature sensors (0.02°C accuracy) to ensure a 0.3 µatm resolution in the pCO_2 comparison. The intercomparison exercise will bring together 7 surface buoy systems of 4 types (JAMSTEC, NIES, NOAA, and SAMI) and 7 underway systems of 5 types (NIES, NOAA, NIO, PML, and NIWA). The experiment will include 2 days of set up and testing followed by 5 full days of intercomparisons.

Results from the 2003 experiment showed that appropriately operated systems agreed to within ± 1.5 ppm in dry air xCO_2 of equilibrated air and highlighted the major causes of error, including organic decomposition (especially in equilibrators with low water flow), badly located SST sensors, and problems with incomplete equilibration of resupply air. Avoiding these errors should provide better agreement in this next intercomparison experiment. The results of the 2003 experiment will be combined with this experiment and published by CDIAC as a data publication.

For more information: Contact Yukihiro Nojiri (hge02674 at nifty.com) or Maria Hood.

SOCAT Pacific Region Meeting Planned

At the "Surface Ocean CO_2 Variability and Vulnerability" (SOCOVV) workshop in April 2007, co-sponsored by IOCCP, SOLAS, IMBER, and the Global Carbon Project, participants agreed to establish a global surface CO_2 data set that would bring together, in a common format, all publicly available surface fCO_2 data for the surface oceans. The data set builds on the work started in 2001 by Dorothee Bakker as part of the EU ORFOIS project, and now continues as part of the EU CARBOOCEAN project. Are Olsen and Benjamin Pfeil (University of Bergen) have compiled data from over 2000 cruises from 1968 to 2007 with more than 5 million measurements. This data set will be published as a 2nd-level quality controlled, global surface ocean fCO_2 (fugacity of CO_2) data set following agreed procedures and regional review, and will serve as a foundation upon which the community will continue to build in the future. The data set will be made available via Live-Access Server in late 2009.

SOCAT has held two technical workshops to discuss 1st and 2nd level QC procedures, and a coastal workshop was held in January in Kiel under the leadership of Alberto Borges to discuss special needs for coastal zone data in the SOCAT data set (report in preparation). A regional workshop for the Pacific Ocean will be held from 18-20 March in Tsukuba with Yukihiro Nojiri and Steve Hankin as Co-chairs. The Pacific Ocean regional group will meet with the developers of the data set and Live-Access Server tools to learn how LAS can be used in the QC effort for SOCAT. The participants will install the tools and software on their computers, download the

data files for their regions, set up the shared QC environment, and work through several exercises to demonstrate the system. The groups will decide how to make QC decisions that are consistent across regions, and identify any scripts available or needed for reading cruise data into Matlab, ODV, or other software. Time permitting, the groups will begin working through the data set for their region (flagging, determining which 2nd level QC or consistency tests may be applied, testing those, etc.). A similar meeting for the Atlantic and Southern Ocean groups will be held tentatively in June 2009.

For more information: Visit the IOCCP web-site at www.ioccp.org >Synthesis Groups > SOCAT.