

THE IOCCP CONVEYOR



THE INTERNATIONAL OCEAN CARBON COORDINATION PROJECT

*A joint project of Scientific Committee on Oceanic Research and
Intergovernmental Oceanographic Commission of UNESCO and an affiliate
program of the Global Carbon Project.*

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CARBOCHANGE Project Kick-Off Meeting

The kick-off meeting for CARBOCHANGE Project was held in Bergen, Norway on 8-10 March, 2011. CARBOCHANGE builds on the results of the previous EU's 6th Framework Programme Integrated Project CARBOOCEAN.

CARBOCHANGE – “Changes in carbon uptake and emissions by oceans in a changing climate” – is a large-scale integrating collaborative research project receiving 7 million Euros funded by the EU's 7th Framework Programme in the period March 2011- February 2015. It is coordinated by the Geophysical Institute at the University

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of Bergen and the Bjerknes Centre for Climate Research, Bergen, Norway. The CARBOCHANGE consortium consists of 28 research institutions from Europe, North America (USA and Canada) and Africa (Morocco and South Africa) with key scientific experts in the field.

CARBOCHANGE will provide the best possible process-based quantification of net ocean carbon uptake under changing climate conditions using past and present ocean carbon cycle changes for a better prediction of future ocean carbon uptake. CARBOCHANGE will combine observational efforts with model simulations and:

- improve the quantitative understanding of key biogeochemical and physical processes through a combination of observations and models,
- upscale new process understanding to large-scale integrative feedbacks of the ocean carbon cycle to climate change and rising carbon dioxide concentrations,
- quantify the vulnerability of the ocean carbon sources and sinks in a probabilistic sense using cutting edge coupled Earth system models under a spectrum of emission scenarios including climate stabilisation

scenarios as required for the 5th IPCC assessment report.

The drivers for the vulnerabilities will be identified. The most actual observations of the changing ocean carbon sink will be systematically integrated with the newest ocean carbon models, a coupled land-ocean model, an Earth system model of intermediate complexity, and fully-fledged Earth system models through a spectrum of data assimilation methods as well as advanced performance assessment tools.

Results will be optimal process descriptions and most realistic error margins for future ocean carbon uptake quantifications with models under the presently available observational evidence. The project will deliver calibrated future evolutions of ocean pH and carbonate saturation as required by the research community on ocean acidification in the EU project EPOCA and further projects in this field. The time history of atmosphere-ocean carbon fluxes past, present, and future will be synthesised globally as well as regionally for the transcontinental RECCAP project. Observations and model results will merge into GEOSS/GEO through links with the European coordination action COCOS and will prepare the marine branch of the European Research Infrastructure ICOS.

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A New Air-Sea CO₂ Flux Dataset Published at CDIAC

The new "Simulation and assimilation of global ocean pCO₂ and air-sea CO₂ fluxes using ship observations of surface ocean pCO₂ in a simplified biogeochemical offline model" contributed by Vinu Valsala and Shamil Maksyutov of NIES/Japan is available from CDIAC: http://cdiac.ornl.gov/oceans/CO2_Flux_1996_2004.html.

An offline tracer transport model was used, driven by reanalysis ocean currents and coupled to a simple biogeochemical model, to synthesize the surface ocean pCO₂ and air-sea CO₂ flux of the global ocean from 1996 to 2004, using a variational assimilation method. This oceanic CO₂ flux analysis system was developed at the National Institute for Environmental Studies (NIES), Japan, as part of a project that provides prior fluxes for atmospheric inversions using CO₂

measurements made from an on-board instrument attached to the Greenhouse gas Observing SATellite (GOSAT). Nearly 250,000 pCO₂ observations from the Takahashi et al. (2007) database have been assimilated into the model with a strong constraint provided by ship-track observations while maintaining a weak constraint of up to 20% on global averages of monthly mean pCO₂ in regions where observations are limited.

The synthesized global air-sea CO₂ flux shows a net sink of 1.48 PgC yr⁻¹. The Southern Ocean air-sea CO₂ flux is a sink of 0.41 PgC yr⁻¹. The interannual variability of synthesized CO₂ flux from the El Niño region suggests a weaker source (by an amplitude of 0.4 PgC yr⁻¹) during the El Niño events in 1997/1998 and 2003/2004. The assimilated air-sea CO₂ flux correlates with the CO₂ fluxes obtained from atmospheric inversions on interannual time-scales.

Ocean Carbon Observations As a Part of Inter-disciplinary Multi-platform Global Observing Network

As ocean scientists across various disciplines deploy new technologies to observe the dynamic ocean processes, the impacts of human activity are increasingly

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obvious and of growing concern. Sea level rise, ice melting, ocean acidification, dead zones, harmful algal blooms, coral bleaching, fish stock and ecosystem declines, and the possibility of major changes in ocean circulation, weather and climate, are all being seen, with both local and global impacts. These in turn have impacts on human well-being.

To date largely independent observing systems focused on individual disciplinary needs have been developed and continue to evolve. The integration and coordination of these individual efforts is critical as (1) many of the problems facing the world today are interdisciplinary in nature; and (2) the level of resources available for ocean observing necessitates leveraging – each require development of requirements, observations, data/product management, modeling and international collaboration.

The IOCCP recognizes the need for the ocean carbon community to actively participate in these integration and coordination efforts to take best advantage of existing observational structures around the world and to establish the requirements for the future sustained interdisciplinary global observing system, the essential variables to be measured, the approach to measuring these cost effectively, and the way in which the data and products will be managed and made widely available across all disciplines and levels of governance.

With this in mind, the current status and challenges of the main areas of the IOCCP's activities, as well as ideas for interdisciplinary synergies, were recently presented to the wider ocean observing community during the Sixth Session of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM)'s Ship Observations Team (SOT) Panel and the Fourth Session of the JCOMM's Observations Coordination Group Panel, which were held at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Division of Marine and Atmospheric Research (CMAR), Hobart, Australia from 11 to 20 April 2011.

In particular the challenges posed by (i) recruiting new ships for the underway ship-based surface pCO₂ observations network in the least sampled regions of the global ocean and (ii) sustaining and expanding ship-based and moored time series observations at key sites, including the coastal ocean were discussed.

Key discussions include:

- i. The Chairperson of the SOT's Ship-of-Opportunity-Programme Implementation Panel (Gustavo Jorge Goni, NOAA/AOML, Miami, FL, USA) responded by offering concrete synergies regarding some of the ship lines recruited by the SOOP. Discussions were initialized and are underway with Principal Investigators

responsible for installation of specialized shipboard instrumentation. Discussions were also initialized and are underway with Executive Director of the World Ocean Council (WOC), Paul Holthus. WOC is a high profile advocacy group aiming at improving ocean understanding through the involvement of ocean user industries (e.g. shipping, oil and gas, fisheries, tourism) in ocean observations. The IOCCP was invited to take an active role in designing the Industry - Global Ocean Observing and Data System (I-GOODS). Such system based on experience of IOCCP and other global ocean observing networks, would (i) be designed to incorporate opportunities from various industries into our scientific efforts and (ii) allow synergies between ocean users' industries, technology industry and key national, regional and global ocean observing coordinators.

- ii. Fruitful negotiations on coordination of time series projects between IOCCP and OceanSITES (Professor Uwe Send, Scripps Institution of Oceanography) took place throughout the meeting. It was finally agreed that IOCCP coordinated coastal time series sites, which are not part of any national network, will be included within the OceanSITES network, which at

present is restricted to mainly mid-ocean, fixed-point stations. The main concern for coastal time series stations is reduced funding, especially for sites that require ship-operations, which are expensive and require long-term national and international commitments. Demonstrating how these sites contribute to a larger international network of time series stations can help justify the investments that nations are making in these projects.

In addition to that, several issues of common interest including logistical aspects, and the sharing of the data were discussed with the Southern Ocean Observing System, JCOMM Observing Program Support Center and the Argo profiling float programme.

Scientists Offer Warning and Plan For Protecting Earth's 'Blue Carbon'

The destruction of coastal carbon ecosystems, such as mangroves, seagrasses and tidal marshes, is leading to rapid and long-lasting emissions of CO₂ into the ocean and atmosphere, according to 32 of the world's leading scientists in the field.

That key conclusion highlights a series of warnings and recommendations developed

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by the new **International Working Group on Coastal “Blue” Carbon**, which convened its first meeting at UNESCO Headquarters in Paris last February. The Working Group was created as an initial step in advancing the scientific, management and policy goals of the **Blue Carbon Initiative**, whose founding members include Conservation International (CI), the International Union for Conservation of Nature (IUCN), and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

Much of the carbon emitted when mangroves, seagrasses or tidal marshes are destroyed is estimated to be thousands of years old because the CO₂ stored in these ecosystems is found not only in the plants, but in layer upon layer of soil underneath. Total carbon deposits per square kilometer in these coastal systems may be up to five times the carbon stored in tropical forests, due to their ability to absorb, or sequester, carbon at rates up to 50 times those of the same area of tropical forest. The management of coastal ecosystems can supplement efforts to reduce emissions from tropical forest degradation.

According to recommendations from scientists in the Blue Carbon Working Group, whose collaboration pools expertise from 11 countries on five different continents, the existing knowledge of carbon stocks and emissions from degraded or converted

coastal ecosystems is “sufficient to warrant enhanced management actions now.”

The importance of coastal ecosystems for fisheries and coastal protection from storms and tsunamis is relatively well understood. The community is now coming to realize that, if destroyed or degraded, these coastal ecosystems become major emitters of CO₂ for years after the plants are removed.

Draining a typical coastal wetland, such as a mangrove or marsh, releases 0.25 million tons of carbon dioxide per square kilometer for every meter of soil that is lost. Global data shows that seagrasses, tidal marshes, and mangroves are being degraded or destroyed along the world’s coastlines at a rapid pace. In fact, between 1980 and 2005, 35,000 square kilometers of mangroves were removed globally – an area the size of the nation of Belgium. This degraded area still continues to release up to 0.175 gigatons of carbon dioxide each year – equivalent to the annual emissions of countries such as the Netherlands or Venezuela.

Studies have shown that although mangroves, seagrasses and salt marshes account for less than 1% of the total plant biomass on land and forests, they cycle almost the same amount of carbon as the remaining 99%. So the decline of these carbon-efficient ecosystems is a valid cause of concern.

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Over the course of three days in Paris, scientists concluded the meeting with a set of key priorities and recommendations:

- **Enhanced national and international research efforts:** such as developing inventory and accounting methodologies for coastal carbon; conducting carbon inventories, conducting targeted research and monitoring to more accurately quantify the greenhouse gas emissions from coastal ecosystem loss, and establishing a network of field demonstrations to build capacity and community input.
- **Enhanced local and regional management practices:** such as identifying and reducing the primary drivers of high-carbon coastal system degradation, (urban development, agriculture, aquaculture, pollutant and nutrient run-off, dredging, and introduction of artificial constructions), strengthening national to local conservation and protection measures of high-carbon coastal systems, and beginning restoration of lost/degraded systems
- **Enhanced international recognition of coastal carbon ecosystems:** through established international bodies such as the

Intergovernmental Panel on Climate Change (IPCC) and United Nations Framework Convention on Climate Change (UNFCCC)

Scientists emphasized that improved management of coastal marine ecosystems is not meant to become a patent roadblock to nations' economic development or food production, but rather, a targeted strategy that prioritizes conservation of specific, unique, high-carbon coastal zones, which act like global sponges for global CO₂. They are recommending that nations and managers better recognize the vital services that these wetlands provide humanity, and prioritize their protection.

The working group will meet next in July, and continue their collaborative scientific study. Additional funding was provided by the Waterloo Foundation, National Aeronautics and Space Administration (NASA), and the United Nations Environment Programme (UNEP).

The International Workshop on the Economics of Ocean Acidification

The conclusions of the Workshop on the socioeconomic impacts of Ocean Acidification, which took place at the

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Oceanographic Museum in Monaco 16-18 November 2010, have just been released and are available on the websites of the Scientific Centre of Monaco (www.centrescientifique.mc) and the IAEA Environment Laboratories (<http://www.iaea.org/monaco>).

Following the recommendations of the Monaco Declaration, this workshop brought together fifteen economists, fifteen scientists, and ten representatives from international organizations in Monaco to initiate a discussion aiming to define the future socioeconomic impacts of Ocean Acidification. This workshop has thus formed the first real multidisciplinary meeting on Ocean Acidification with the purpose of delivering accurate messages to the policy makers in order to deal with the issue in a timely manner as to minimize both the biodiversity and human costs.

The first conclusions of this workshop were divided into four topics:

- **Defining the extent of the threat:** Even though the threat is currently known with certainty by the scientists, its socioeconomic impact, although certain, is not yet well-defined because of a lack of data. Some regions will, however, be more vulnerable than others. The workshop participants have specified key areas to study in order to reduce this uncertainty.

- **Modeling:** In order to provide clear elements to the policy makers, it is necessary to develop a range of decision-making tools taking into account all the effects of Ocean Acidification. To do so, a close collaboration between disciplines is essential. Each discipline being at the service of the other.
- **Recommendation:** All the participants of the workshop agreed that Ocean Acidification represents a real threat and is an additional reason to reduce the atmospheric concentration of CO₂. Although a global solution is the key to the problem of Ocean Acidification, the participants have also recognized that local solutions could help minimize its effects.
- **Financial means:** A "Blue" Fund could unite countries against the risks of Ocean Acidification, by returning part of the funds as dividends to those who have made some environmental efforts. The remaining resources could be allocated to restore ecosystems damaged by Ocean Acidification.

These topics are still open to discussion by the workshop participants. Publications are being drafted to materialize the efforts of the participants before the next workshop to

be held in the U.S.A. following the "The Oceans in a High-CO₂ World" Symposium in 2012.

This workshop received grants from the Monegasque Government, the Prince Albert II of Monaco Foundation, the French Ministry of Ecology, Sustainable Development, Transport and Housing, and the IAEA "Peaceful Uses Initiative" (PUI) programme funded by the U.S. State Department.

The New Portal for Ocean Science Summer Schools

In August 2010, a group of organizations that sponsor capacity development activities related to ocean science met at the University of Bremen, Germany to share their current activities and discuss how they could work better together on capacity development.

One need that was identified was for a portal for ocean science summer schools. Many of these schools take place each year, but there is no single Web-site where graduate students and early career scientists can go to find out what is available. The International Oceanographic Data and Information Exchange (IODE) of UNESCO's Intergovernmental Oceanographic Commission (IOC) offered to set up and

maintain such a portal, the Ocean Summer Schools site, which was recently launched and is available at <http://www.oceansummerschools.org/>.

The site sponsors are seeking new listings and new users. For projects and organizations that frequently sponsor summer schools and want to be able to list your summer schools directly, please contact Ed Urban (Ed.Urban@scor-int.org) and he will forward your message to the site administrator to set up a user account for you. For those projects that only occasionally conduct summer schools, Ed Urban can post the information for you. Please note that the label of "Organizing Institution" will be changed to "Listing Institution" and other improvements will be made to the site over time.

The site uses a rather loose definition of summer schools, including short courses in any season of the year, training cruises, and longer courses. However, the events listed should have young scientists as their primary target

The site is co-sponsored by IODE/IOC, SCOR, and the Partnership for Observation of the Global Oceans (POGO).

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