

## Surface Ocean CO<sub>2</sub> Variability and Vulnerability workshop (SOCOV) 11-14 April 2007, UNESCO, Paris, France

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The oceans represent a crucial component in our Earth system with regard to global changes, biogeochemical cycles and resources. The oceans currently absorb around one-third of carbon emissions annually, in the short term. Understanding the physical, chemical and biological processes involved, feedback effects, and the future of this sink is critical for reducing uncertainty in the projections of climate change into the 21<sup>st</sup> century and beyond. For several decades surface water pCO<sub>2</sub> has been measured from research ships and volunteer observing ships (VOS) with the goal of inferring the air-sea flux of CO<sub>2</sub>. The community is now committed to understand not just the long-term averages but also the seasonal, interannual and decadal variability of these fluxes. This is a significant challenge as large parts of the world's oceans are rarely sampled. The interannual variability observed in the sections that are sampled on a regular basis now show significant changes that need to be confirmed and explained. In many regions, changes or long-term trends of pCO<sub>2</sub> are still difficult to detect.

### Short History and Objectives

In October 2005, the first joint meeting of the SOLAS-IMBER Carbon group (SIC) and the International Ocean Carbon Coordination Project (IOCCP) was held during the 7th International CO<sub>2</sub> conference in Broomfield, Colorado. A major outcome of the meeting was an agreement for the SIC-Surface Ocean Systems Sub-group to work with IOCCP to plan an international workshop on the scientific basis for the VOS network design and data synthesis efforts related to CO<sub>2</sub> sources and sinks in the ocean. At the time of planning it was clear that the research community needed to consider a broad range of issues concerning ocean CO<sub>2</sub> variability and vulnerability that covered observation system design, detection of trends of pCO<sub>2</sub> and related parameters, developments in instrumentation, regional and global synthesis, testing diagnostic approaches for interpolating sparse observations, improving models and data management, etc... This was only possible with the support of multiple sponsors (IOCCP, SOLAS, IMBER, GCP) and about 100 participants attended this highly successful workshop organized during 4 days at UNESCO (Paris, 11-14 April 2007).

### The main goals of the meeting were:

(i) to review our knowledge of the air-sea CO<sub>2</sub> flux variability and uncertainties from seasonal to decadal scales, and to promote global CO<sub>2</sub> data synthesis activities, (ii) to address new questions regarding the vulnerability of the oceanic carbon cycle, (iii) to synthesize information about current and planned national and regional programs for CO<sub>2</sub>-VOS lines and time-series stations and (iv) to develop future observing system and data management strategies for surface ocean carbon.

### The meeting resulted in several important outcomes.

There was a strong endorsement by the community that improving our knowledge of both pCO<sub>2</sub> variability and vulnerability requires sustained, observations, data management, and international coordination of the work. Other major outcomes resulting from the meeting were:

(i) the development of a coordinated international effort to produce a publicly available Global Ocean pCO<sub>2</sub> data synthesis (quality-controlled products for all regions, including the open ocean and coastal zones). This will start with a careful inspection of several existing global CO<sub>2</sub> data sets (coordination C. Sabine, NOAA in collaboration with CARBOOCEAN, CDIAC, LDEO,...). The Global Ocean pCO<sub>2</sub> data product will be revised on an annual basis as new observations are regularly included in the data-base.

(ii) plans for the production of a Surface CO<sub>2</sub> Atlas, composed of gridded average pCO<sub>2</sub> on monthly 1°x1° squares, with perhaps greater resolution in the coastal zone. Such a product will serve a large community of scientists to address many questions related to the detection of oceanic pCO<sub>2</sub> trends, better understanding of temporal and spatial variability in sources and sinks, the initialization and validation of ocean and coupled carbon/climate models, use in assimilation mode, testing and validating extrapolation/interpolation methods and constraints for atmospheric inverse models.

(iii) the development of regional synthesis groups to examine, in collaboration with modelers, physical and biological oceanographers, underlying causes for seasonal to centennial variability of surface CO<sub>2</sub>. Regions identified are: North Atlantic/Arctic (PI, U. Shuster, UK), North

Pacific (Y. Nojiri, Japan), Equatorial and South Pacific (D. Feely, USA), Indian Ocean (V. Sarma, India), Southern Oceans (B. Tilbrook, Australia), Coastal zones (A. Chen, Taiwan and A. Borges, Belgium).

[www.ioc.unesco.org/ioccp/pCO2\\_2007.htm](http://www.ioc.unesco.org/ioccp/pCO2_2007.htm). The workshop report, presentations, posters, abstracts and working group reports are also available on-line. A special issue of DEEP-SEA RESEARCH II will be published with a deadline for submission of August 31, 2007.

The workshop information, including maps and tables of CO<sub>2</sub>-VOS and time-series sites, are available on the meeting webpage:

\*Committee

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