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The Integrated Marine Biogeochemistry and Ecosystem Research Project: Support of Ocean Carbon Research

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The Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project, co-sponsored by the Scientific Committee on Oceanic Research (SCOR) and the International Geosphere-Biosphere Programme (IGBP), coordinates research that focuses on understanding and predicting changes in oceanic food webs and biogeochemical cycles that arise from global change. An integral part of this overall goal is to understand the marine carbon cycle, with emphasis on changes that may occur as a result of a changing climate, increased atmospheric CO_2 levels and/or reduced oceanic pH.

The recognition of the importance of the atmosphere-ocean linkage in modifying the ocean carbon cycle triggered the launch of a joint working group between IMBER and the IGBP Surface Ocean Lower Atmosphere Study (SOLAS) Project. Three major topics have been identified: 1) ocean-atmosphere CO_2 flux, (2) carbon and biogeochemical cycles in the ocean's interior and (3) ocean acidification. This poster highlights some results from the IMBER/SOLAS Carbon Working Group and indicates future challenges.

The activities of the IMBER/SOLAS Carbon Working Group on 'surface ocean' (WG1) have resulted in the organization and development of a standard global surface CO_2 dataset (Surface Ocean Carbon ATlas, SOCAT, www.socat.info) that brings together, in a common format, all publicly available data for the surface oceans. The SOCAT compilation includes data from over 14 countries, producing an initial database composed of more than 2300 cruises from 1968 - 2007 with more than 7.5 million measurements of pCO_2. The SOCAT product will help the international carbon community on various topics: it will improve regional and global air-sea CO_2 flux estimates; it will permit to evaluate pCO_2 changes and trends; it will offer new constraints for atmospheric and oceanic inverse methods and it will provide crucial data to evaluate ocean and climate models. SOCAT is strongly supported by IOCCP and CARBOOCEAN.

The IMBER/SOLAS Carbon Working Group on 'ocean interior' (WG2) has coordinated a review of vulnerabilities of the decadal variations of the interior ocean carbon and oxygen cycle. It has developed a plan to add dissolved oxygen sensors to the Argo float program in order to address the expected loss of oxygen as a result of ocean warming. WG2 currently focuses on the global synthesis of ocean interior carbon observations in order to determine the oceanic uptake of anthropogenic CO_2 since the mid 1990s.

The main goals of the IMBER/SOLAS Carbon Working Group on 'Ocean Acidification' (WG3) are to coordinate international research efforts in ocean acidification and undertake synthesis activities in ocean acidification at the international level. Several on-going synthesis activities, such as book projects and work by the Intergovernmental Panel on Climate Change (IPCC) are endorsed by this group. The WG3 is currently developing a package of activities which are critical to assess the effects of ocean acidification but are, for the most part, not funded at the national or regional levels and must be carried out at the international level. Among them is the promotion of international experiments, the sharing of experimental platforms, and the undertaking of inter-comparison exercises.

More globally, IMBER and SOLAS, in collaboration with IOCCP foster sustained, globally coordinated surface-ocean-carbon-observing system through ship-based hydrography, time-series moorings, floats and gliders. They also encourage synthesis and comparisons at basin scale. This is critical for several key issues: constraining the global carbon budget, understanding the variability and changes in the ocean processes that drive CO_2 sources and sinks, and assessing the impact of ocean acidification on biogeochemical cycles and ecosystems.