Global Data Management and Synthesis Project

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Project Summary

1.1 Introduction

The global data management and synthesis project (DMCP) of ocean carbon observations focuses on quality control, collating, managing, storing, and dissemination of inorganic carbon and associated data. The creation of data products for the community at large and interpretation of results are important goals. Emphasis is on the data obtained by the efforts funded by the Climate Observation Division (COD) but appreciable efforts are extended to incorporate data from investigators worldwide in order to create truly global databases. Outreach activities include training in best practices, and advocacy for new technologies and new approaches. The COD observational efforts that feed into this project include the repeat hydrography program, the pCO_2 on ships effort, and the pCO_2 on moorings effort (See figure PS1, below). The data synthesis addresses the core questions:

1. Where has the anthropogenic (i.e. carbon produced by man's activities) entered the ocean and where is it stored?
2. What is the current pattern of uptake and storage and how will this change? And:
3. How is the increase in inorganic carbon impacting the inorganic carbon chemistry and biota of the ocean?

The last question is addressed largely with resources from the NOAA/OAR/Ocean Acidification program. The goal of the effort is to synthesize global data and create methods and products to meet the overall goal of the COD ocean carbon program to quantify global anthropogenic CO_2 storage to within 2 Pg C decade^{-1} and regional sea-air CO_2 fluxes to within 0.2 Pg C year^{-1}

The large-scale synthesis efforts are being done under the umbrella of the International Ocean Carbon Coordination Program (IOCCP). The program leads and personnel in the DMCP are leaders or active participants in these efforts. Interior ocean physical, tracer and biogeochemical data are synthesized under an ongoing project GLODAP (Global Data Analyses project that is set to release its first update GLODAP-2 in two years). The first release GLODAP (Key et al., 2004) is the most used consistent global product for ocean model initiation and/or assessment. The surface data is assembled in the Surface Ocean Carbon Atlas effort (SOCAT). The release with over 6 million quality controlled data points occurred during this performance period and a second release is planned in 2014. Both GLODAP and SOCAT benefitted immensely from the Live Access Server (LAS) utilities of lead investigator S. Hankin. The data visualization opportunities and "on the fly" product generation provide a means for contextual quality control and interpretation.

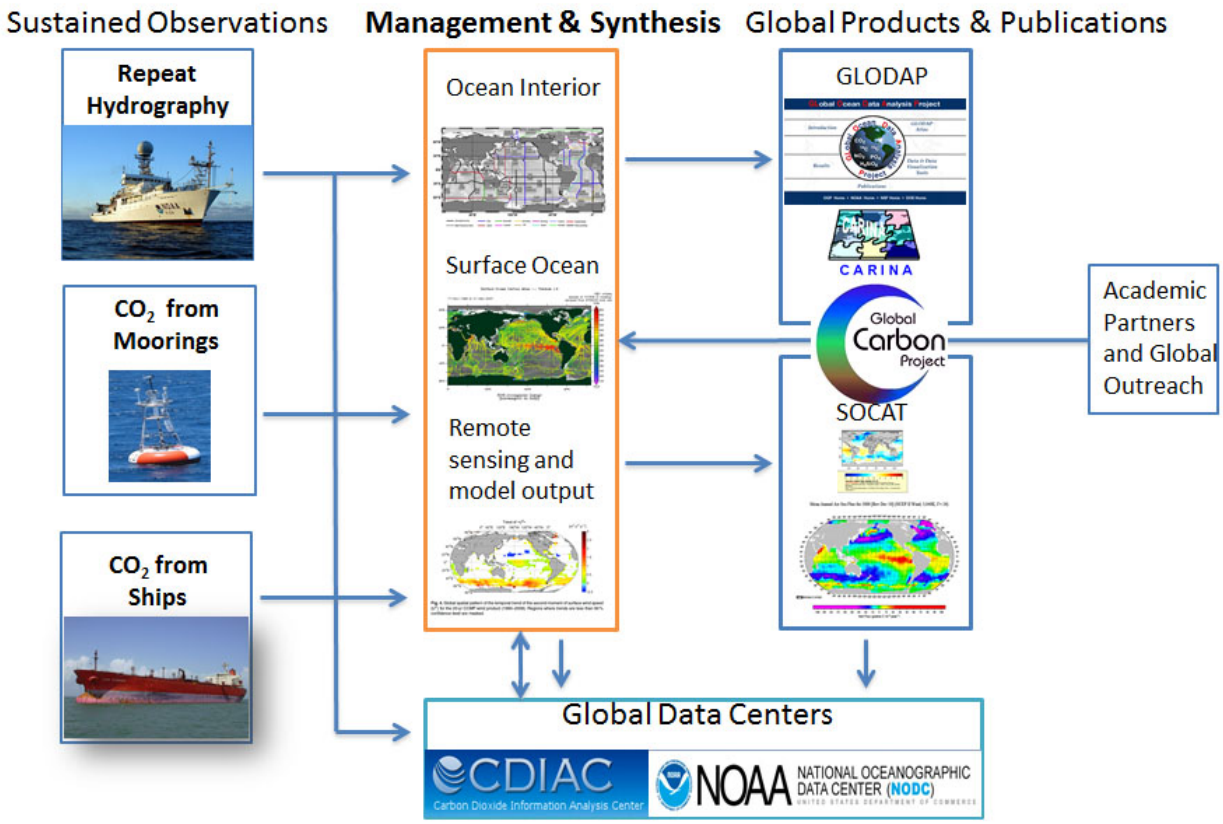

Figure PS1. Schematic of the data and product flow in the COD funded ocean carbon projects.

1.2 Project justification

The overriding issues that drive the ocean carbon programs in COD is that over the past two and a half centuries, the surface oceans have absorbed approximately 30% of the total anthropogenic carbon dioxide emissions from the atmosphere (Canadell et al., 2007). This absorption of CO_2 from the atmosphere has reduced the accumulation of greenhouse gases in the atmosphere, thus slowing the rate of climate change (IPCC, 2007; Sabine and Feely, 2007). The details of this uptake and storage as well as the mechanisms controlling them are still not fully understood. Continued monitoring and scientific analysis of the ocean carbon cycle is critical for understanding how this important sink for anthropogenic CO_2 is functioning and how ocean carbon storage might change in the future.

It is not sufficient, however, simply to collect and archive the data if we expect the data to improve our understanding of the global carbon cycle and the role of the ocean in climate change. Many pieces of the puzzle are interlinked and data management and synthesis must be done in a comprehensive and inclusive fashion. For example, the NOAA Climate Observations Division's (COD) Carbon Network (hydrographic sections, underway pCO_2, and CO_2 moorings) is a valuable contribution to the Global Ocean Observing System (GOOS) and Global Climate Observing System (GCOS). Carbon scientists and oceanographers are the primary direct users of ocean carbon data, but there is an increasing need to provide data and interpretation to climate scientists and modelers. Ultimately scientists are working to produce meaningful products from

these observations, such as assessments, that a wide range of decision makers and the public can use to make informed decisions about current and future CO_2 emissions.

The Global Carbon Data Management and Synthesis Project works together with the COD carbon measurement projects as well as other national and international colleagues with high-quality ocean carbon data to take the fundamental carbon observations and turn them into products that are useful for scientists and the public for understanding the ocean carbon cycle and how it is changing over time. This effort ranges from ensuring that the observations are of the highest quality and are mutually consistent with each other to combining the observations into a common data set that is available and easy for the community to use and explore to evaluating the time rate of change in global ocean carbon uptake and storage. This project brings together ocean carbon measurement experts and information technology experts working closely with data managers at the National Ocean Data Center (NOAA/NODC) and the Carbon Data Information and Analysis Center (CDIAC) and to ensure the most efficient and productive management and synthesis of the COD carbon observations.

References

Canadell, J. G., C. Le Quere, et al., 2007. "Contributions to accelerating atmospheric CO_2 growth from economic activity, carbon intensity, and efficiency of natural sinks." Proceedings Of The National Academy Of Sciences Of The United States Of America 104(47): 18866-18870.

IPCC, 2007. Climate Change 2007: The Physical Science Basis: Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom, Cambridge University Press.

Key, R.M. et al., 2004. A global ocean carbon climatology: Results from Global Data Analysis Project (GLODAP). *Global Biogeochemical Cycles*, 18(4).

Sabine, C. L. and R. A. Feely, 2007. The oceanic sink for carbon dioxide. Greenhouse Gas Sinks. D. Reay, N. Hewitt, J. Grace and K. Smith. Oxfordshire, UK, CABI Publishing: 31-49.