



Understanding North Pacific Carbon-cycle Changes: A Data Synthesis and Modeling Workshop

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Introduction

A number of studies in the literature have investigated carbon cycle variability in the central and North Pacific (e.g. *Chavez et al. 1999; Cosca et al., 2002; Emerson et al., 2001; Feely et al., 1994, 1995, 1997, 1999, 2002; Gruber et al., 2000; Karl et al., 1997, 2001; Karl, 1999; Keeling et al., 2002; Keller et al., 2002; McPhaden and Zhang, 2002; Mecking, 2001; Ono et al., 2001; Sabine et al., 2002; Feely et al., in press*). Many of these studies have been related to the effects of El Niño-Southern Oscillation (ENSO) on the upwelling regions of the Equatorial Pacific (e.g. *Feely et al., 1999*). Recently, however, there have been several studies that have indicated significant variability over other regions of the North Pacific (e.g. *Emerson et al., 2001; Feely et al., in press*). Most of these studies have covered a relatively short time frame, examined a relatively small portion of the North Pacific, or considered a limited number of parameters. What is lacking is an overall picture of North Pacific variability that draws together all of these individual lines of evidence and looks for coherent patterns that may help us understand the regional significance of this variability and the possible mechanisms controlling the observed spatial and temporal patterns. We propose to host a workshop that will bring together those researchers that have studied variability in the North Pacific to synthesize the individual experiences into a basin-scale picture of the North Pacific carbon-cycle. The workshop will not simply recount published studies, but will enhance these studies by gathering the relevant data sets together and re-analyzing them with a view toward the larger picture. This data synthesis will be further enhanced by a simultaneous examination of North Pacific variability in a variety of models. The model runs will be used to predict where variability signals should be most prominent and to evaluate whether the modeled variability is consistent with the data-based signals that develop from the synthesis.

The workshop will be focused on three central questions about the North Pacific carbon cycle:

- **How are air-sea CO₂ fluxes in the North Pacific affected by different modes of variability?**
- **How and why are the North Pacific distribution patterns of carbon, nutrients and oxygen in the water column changing with time?**

- **What are the requirements for detecting a climate change signal in the North Pacific carbon cycle?**

The PIs will organize a small international group of scientists (~10 people per question) to begin working together on addressing these issues. The group will include both modelers and observationalists that are experts in the North Pacific. Participants will be expected to provide details of the techniques they have used to identify the North Pacific variability, a summary of their findings, and will be asked to ensure that the data used for these studies are included in the data collection made available to all participants. Modeler participants will be asked to provide summaries of predicted North Pacific variability and indications of where the largest biogeochemical signals are expected. They will also be asked to provide the relevant model output fields to the meeting participants for further analysis. We hope to attract a number of international scientists to help promote more international collaborations in data synthesis and interpretation.

The “analysis phase” will be coordinated through a web site developed at PMEL. The web site will provide a forum for discussion of developing new results and will coordinate and promote the use of data and models together to develop a coherent picture of carbon-cycle variability in the North Pacific. The groups at PMEL and Princeton will be responsible for the data synthesis and will act as a point of contact for participants performing additional analyses of the data. The UCLA and Princeton groups will be responsible for compiling the model results and acting as a point of contact for the modeling groups that will be analyzing the models or conducting sensitivity runs based on the picture being developed by the new analyses. All of the organizing groups will keep track of who has contributed which results so proper credit is assigned when the final results are published.

The culmination of this work will be a 3-day workshop held in the Seattle area in early June, 2004. This workshop will provide an opportunity for the participants to share information on new results obtained from the analysis phase. A few plenary talks will be given by those that have exciting new results. The afternoons will be devoted to breakout groups to discuss various aspects of the variability signal, to further develop the ideas of coherent patterns of variability, and work out plans for collaborative manuscripts to publish the results. Although the primary funding for this project is coming from NOAA Office of Global Programs, the IGBP/WCRP/IHDP Global Carbon Project (GCP) and the North Pacific Marine Organization (PICES) have endorsed the workshop and will assist in funding some participants. We are also working with the University of Washington Program on Climate Change (<http://depts.washington.edu/uwpsc/index.html>) as a co-sponsor for the workshop. Adding another dimension to the workshop, the Program on Climate Change will encourage and facilitate the participation of a number of students in the workshop, making this an educational experience for young scientists. Although the senior scientists will likely be doing most of the background research, the students will be actively involved in the workshop as rapporteurs and discussion leaders.

The results of this project will be a workshop report and a white paper presenting a documented model-data integrated approach for looking for carbon-cycle changes and potentially the identification of one or more coherent patterns of variability for this limited region. These reports would likely be published as PICES or GCP reports. If all goes well, we would also like to coordinate a series of papers with the meeting participants as coauthors, which could be published together (e.g. special section of Global Biogeochemical Cycles) presenting the basin-scale assessment of carbon-cycle changes in the North Pacific Ocean.

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