

Time-series and Underway Assessments of Ocean Acidification and Carbon System Properties in Coastal Waters

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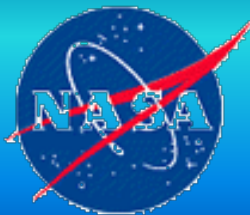


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Acknowledgements

- ▶ This project has been supported by funding from NOAA through the Northern Gulf Institute (Award# 191001363558-02/Task Order 14) with additional support from NASA (Award# NNX10AU06G).
- ▶ The project supports goals of the NACP and OCB programs

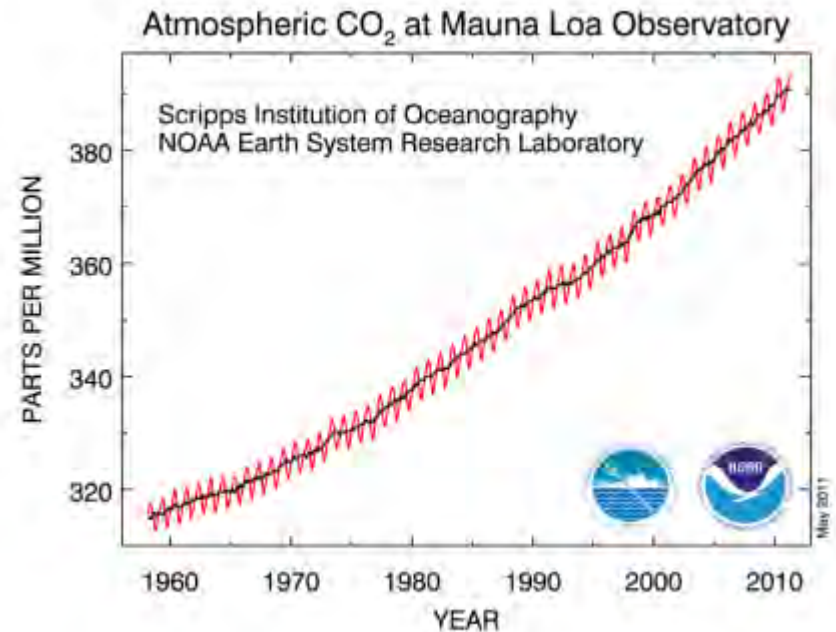
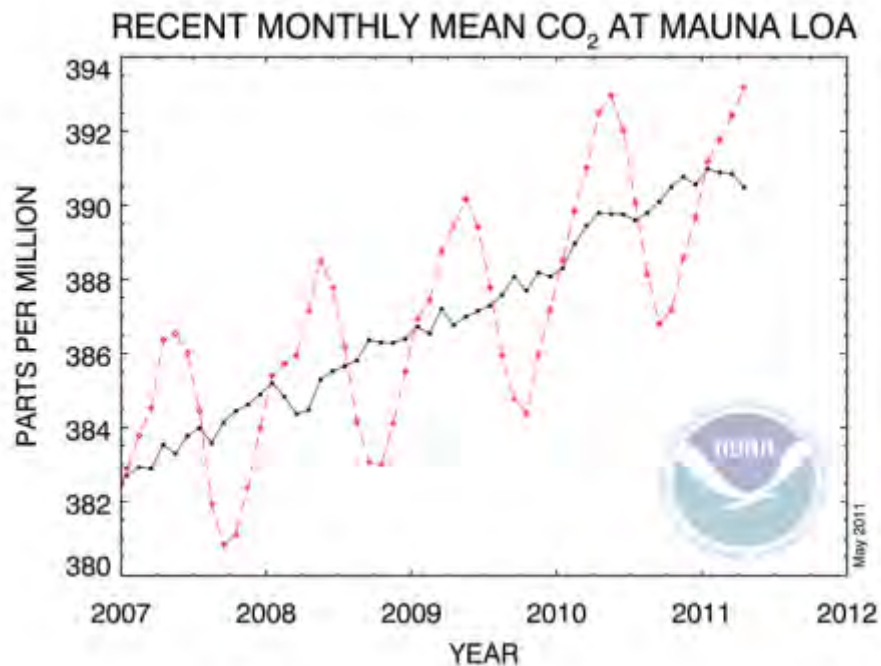


Overview

- ▶ Introduction – Atmospheric carbon dioxide and ocean acidification
- ▶ Project Goals
- ▶ Results
 - ▶ Coastal MS and Gulf of Mexico
 - ▶ Gray's Reef/South Atlantic Bight
 - ▶ Gulf of Maine

Introduction

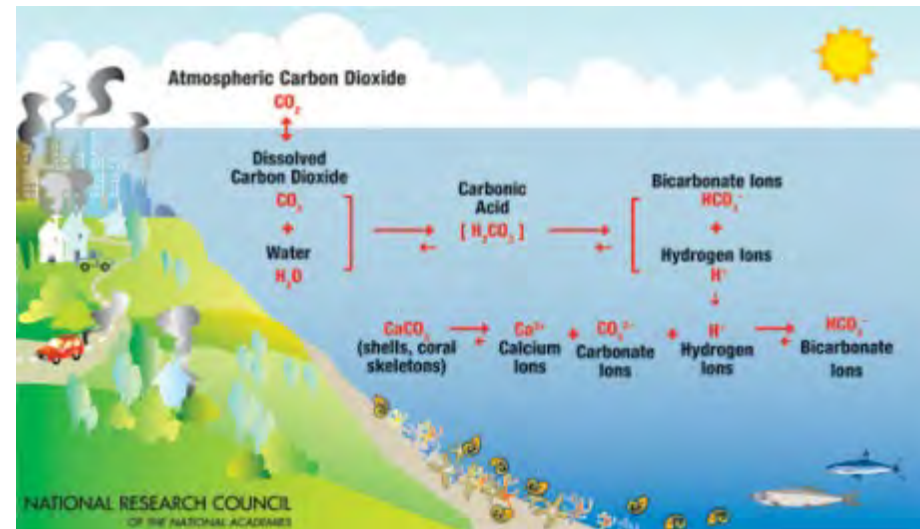
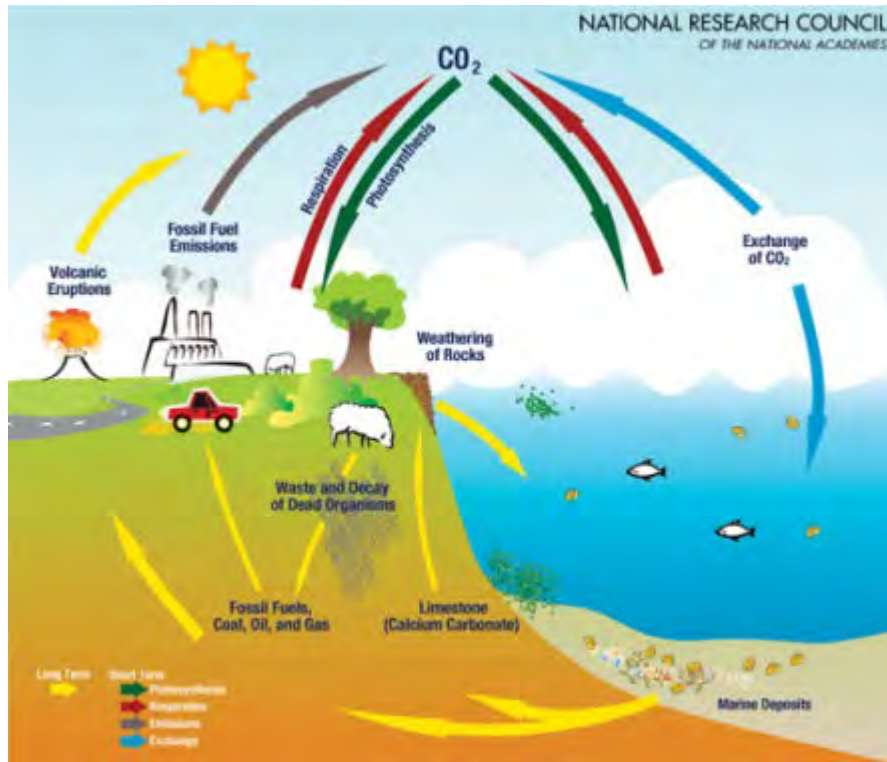
- ▶ Atmospheric CO₂ levels continue to rise as a result of fossil fuel emissions:



<http://www.esrl.noaa.gov/gmd/ccgg/trends/>

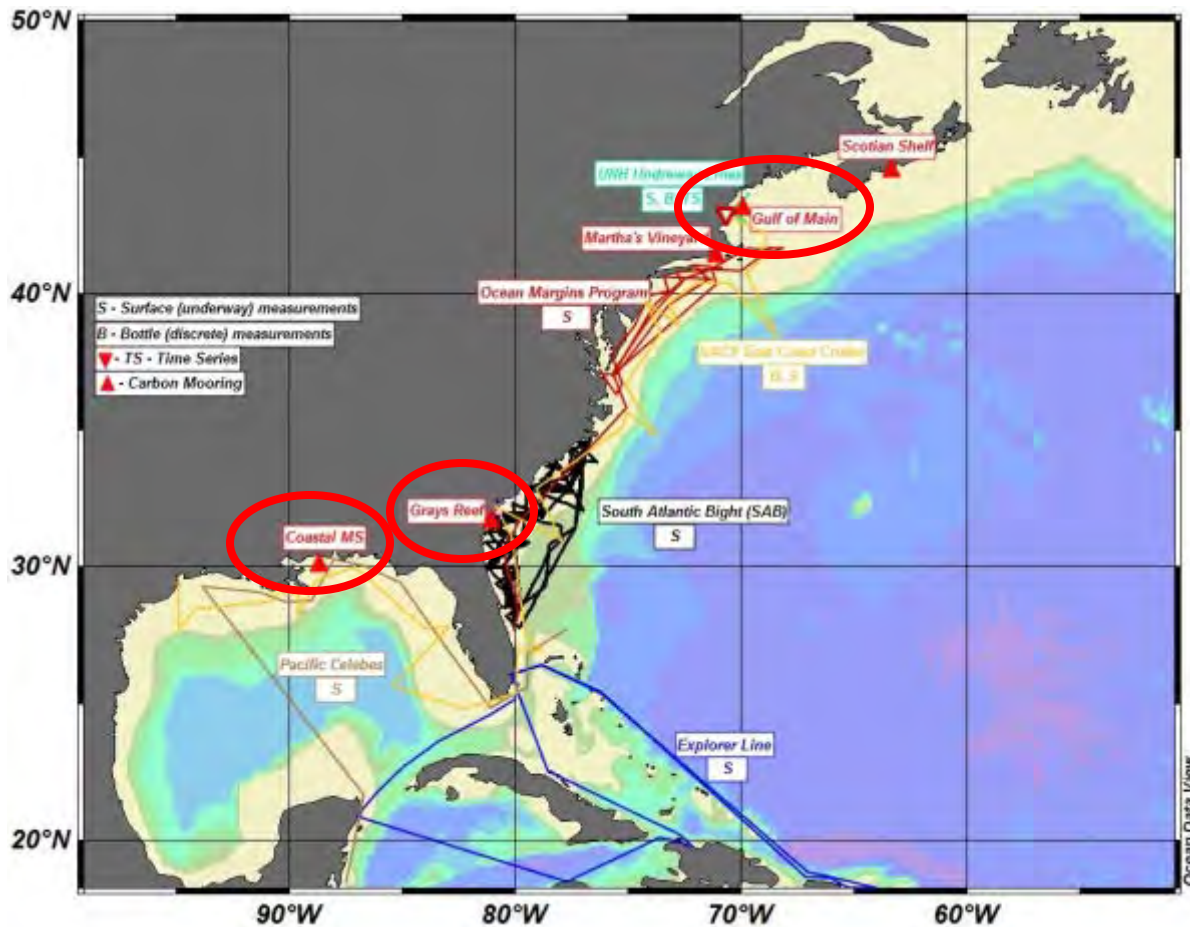
Introduction

- ▶ Uptake of CO_2 by the ocean represents a significant sink for atmospheric carbon dioxide, but also alters ocean chemistry, reducing pH (increasing acidity)



Project Goals

- ▶ The principal goals for the NOAA Ocean and Great Lakes Acidification Research Implementation Plan are to:
 - ▶ develop the monitoring capacity to quantify and track ocean acidification in open-ocean, coastal, and Great Lake systems;
 - ▶ assess the response of marine and freshwater organisms to ocean and lake acidification;
 - ▶ forecast biogeochemical and ecological responses to acidification;
 - ▶ provide a synthesis of ocean and Great Lake acidification data and information that aids in development of tools for managing coastal, open ocean, and Great Lakes ecosystems and preparing human communities for potential OA-related changes;
 - ▶ and provide information about ocean acidification to educators and develop materials for public outreach.
- ▶ This project will involve a close collaboration with NOAA scientists to provide information critical to NOAA's mission and global concerns regarding ocean acidification and its impacts on ecosystems.

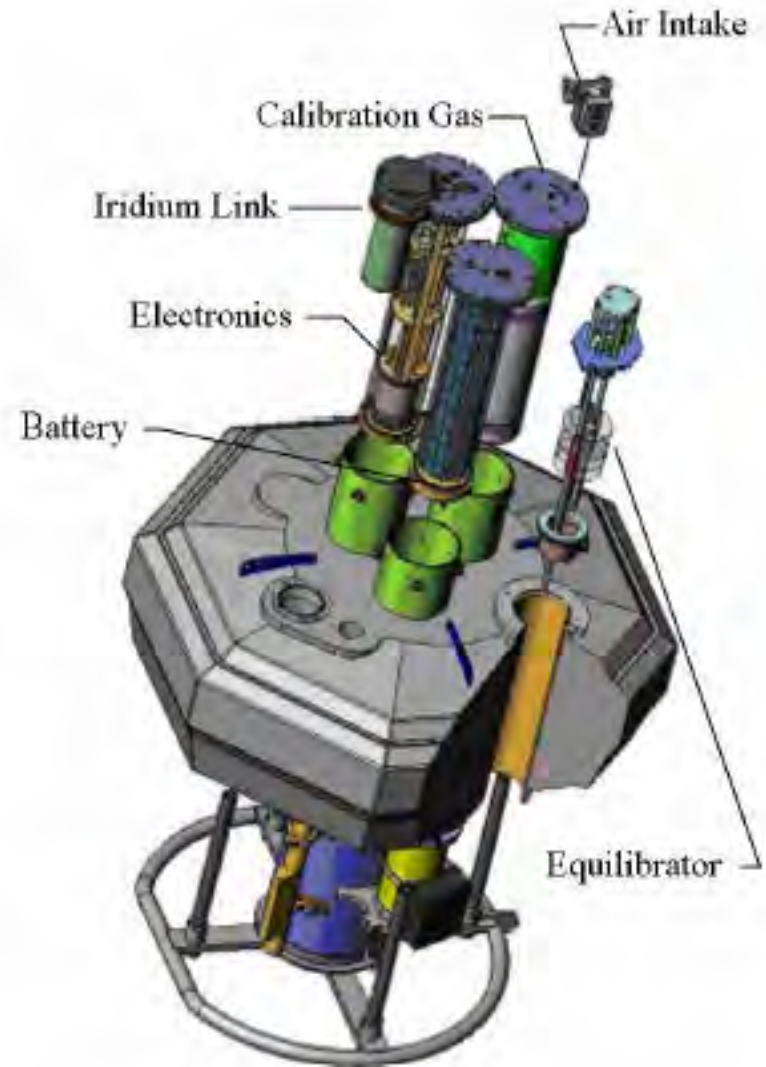


Results

Monitoring sites in Gulf and off East Coast provide a range of sites for comparison

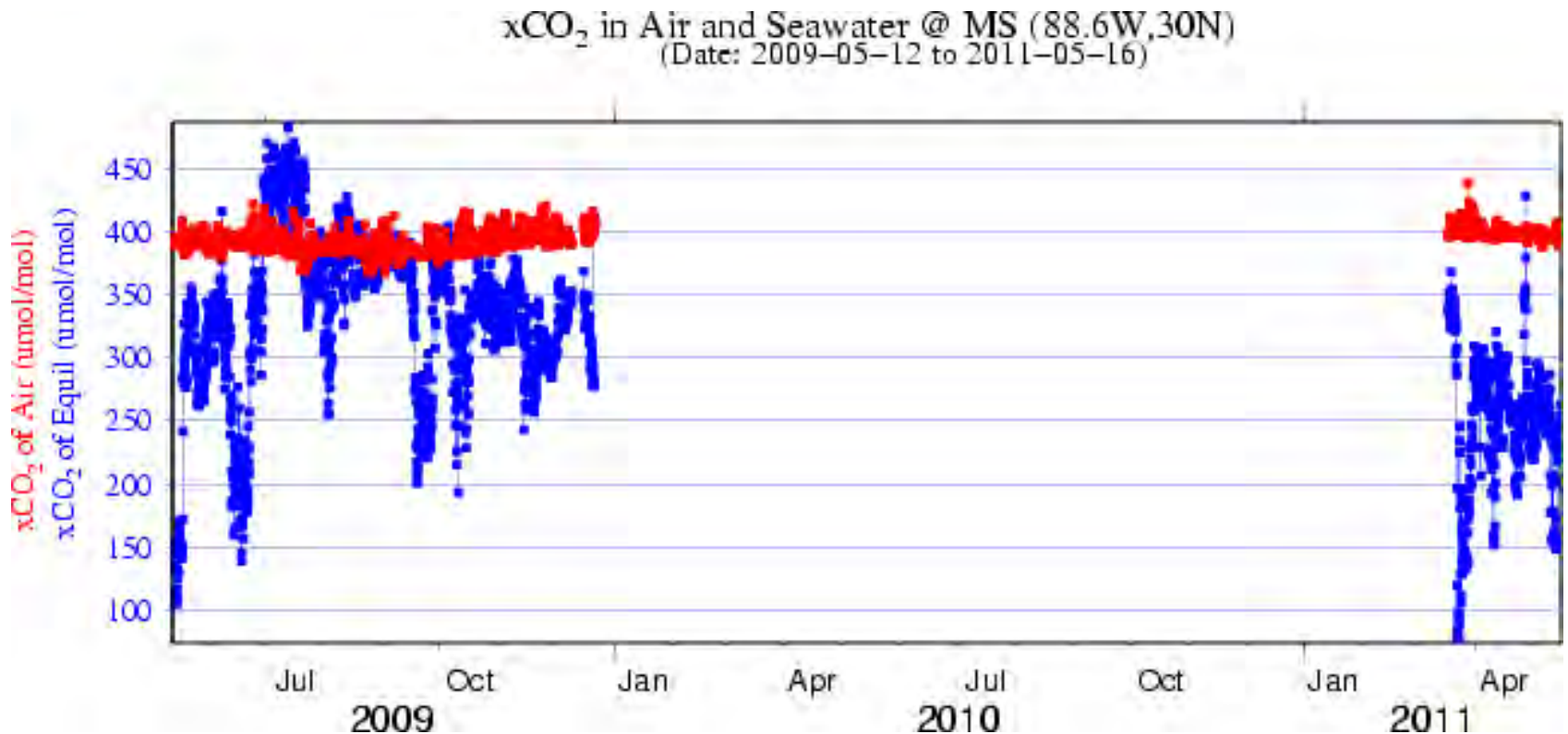
Approach

- ▶ NOAA/PMEL System
 - ▶ MAPCO2
 - ▶ SAMI pH
 - ▶ SeaBird MicroCat
 - ▶ Optode Oxygen Sensor



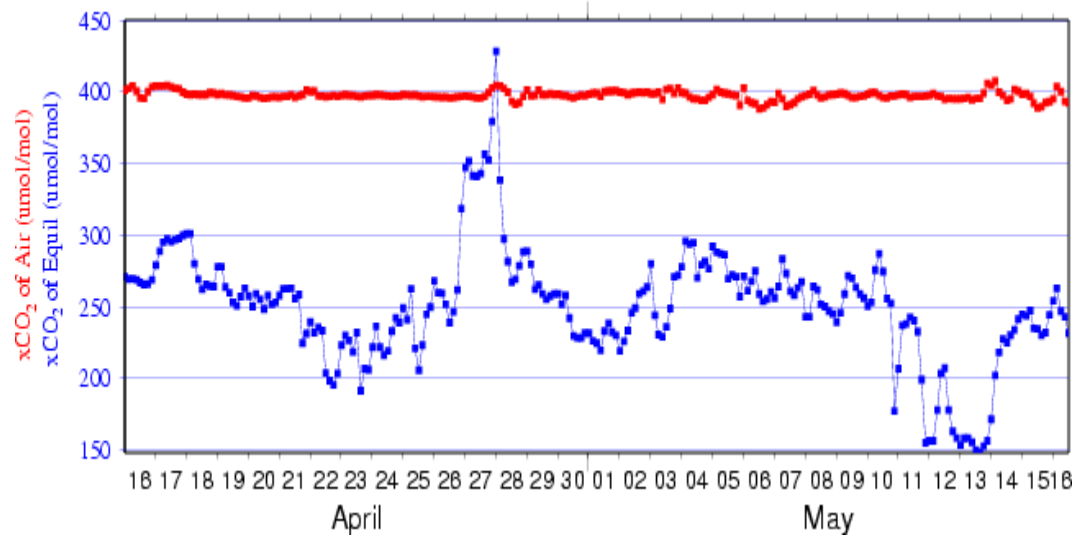
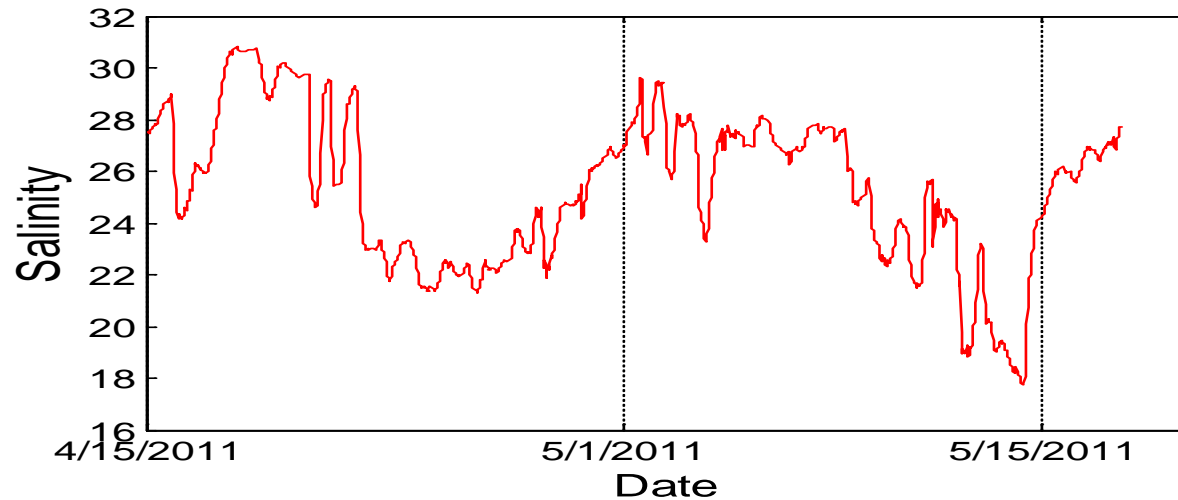
Mississippi Gulf Coast

- ▶ Time-series off Mississippi Gulf Coast show higher $p\text{CO}_2$ values in late summer and fall and low in spring

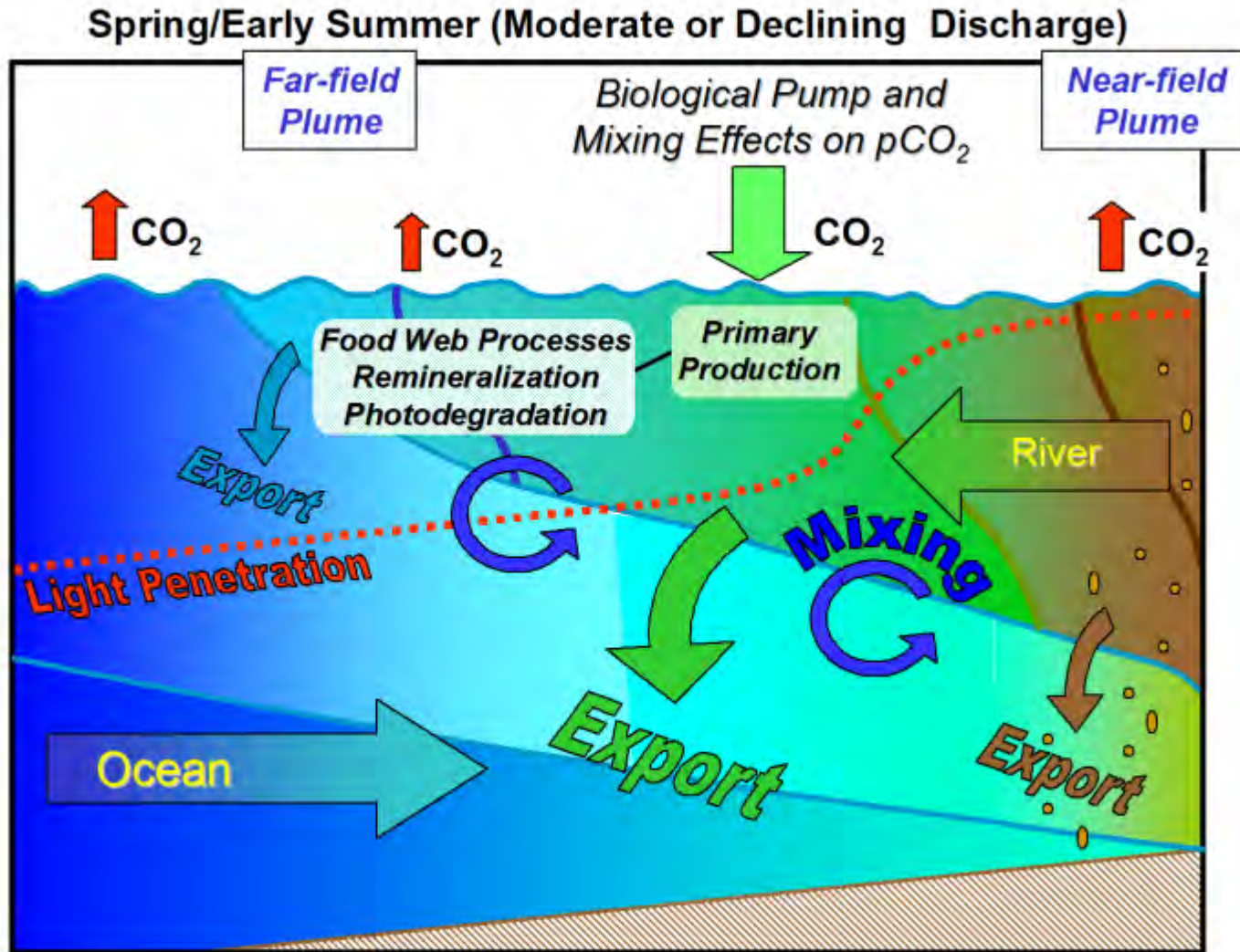


Mississippi Gulf Coast

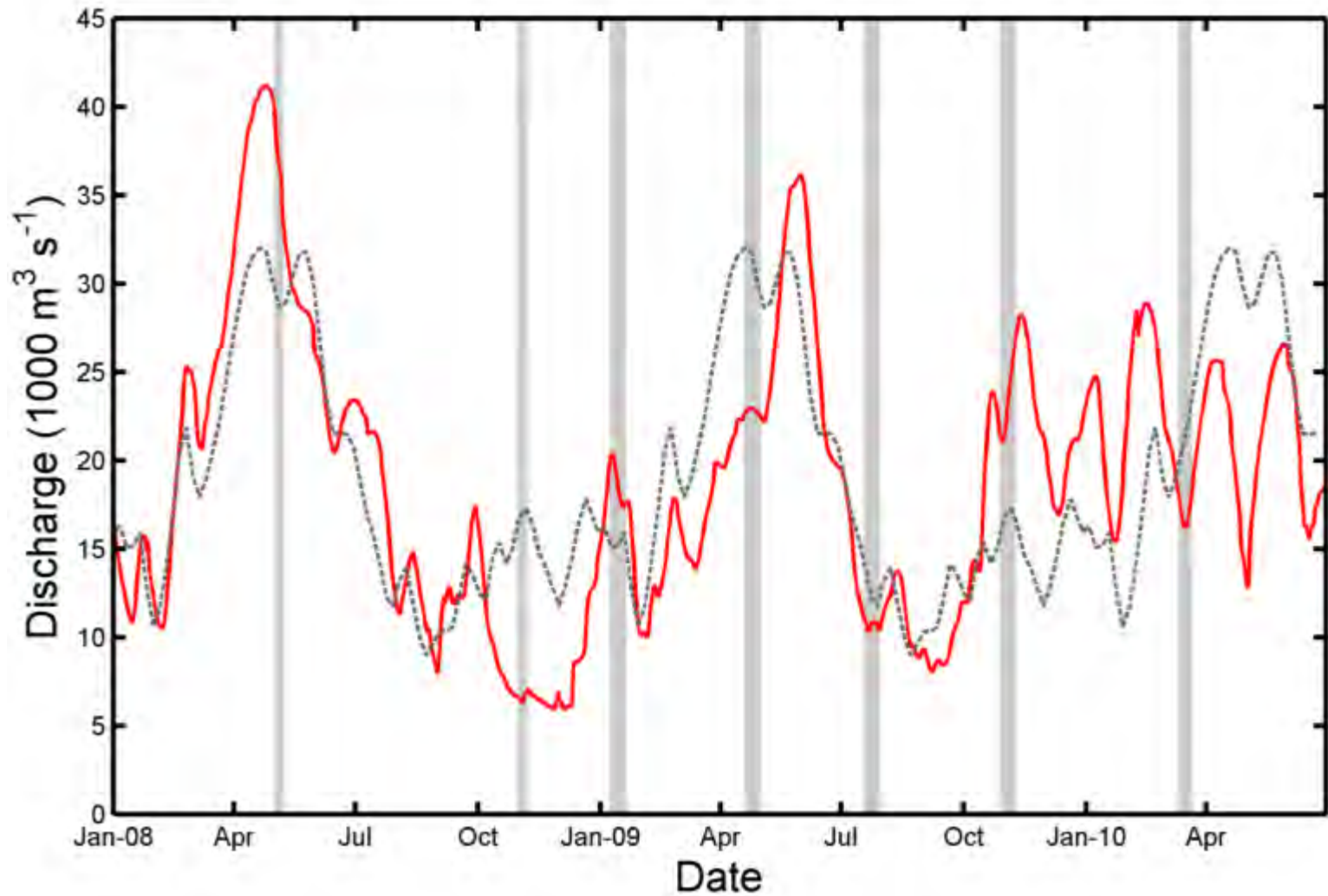
► Relationship to salinity



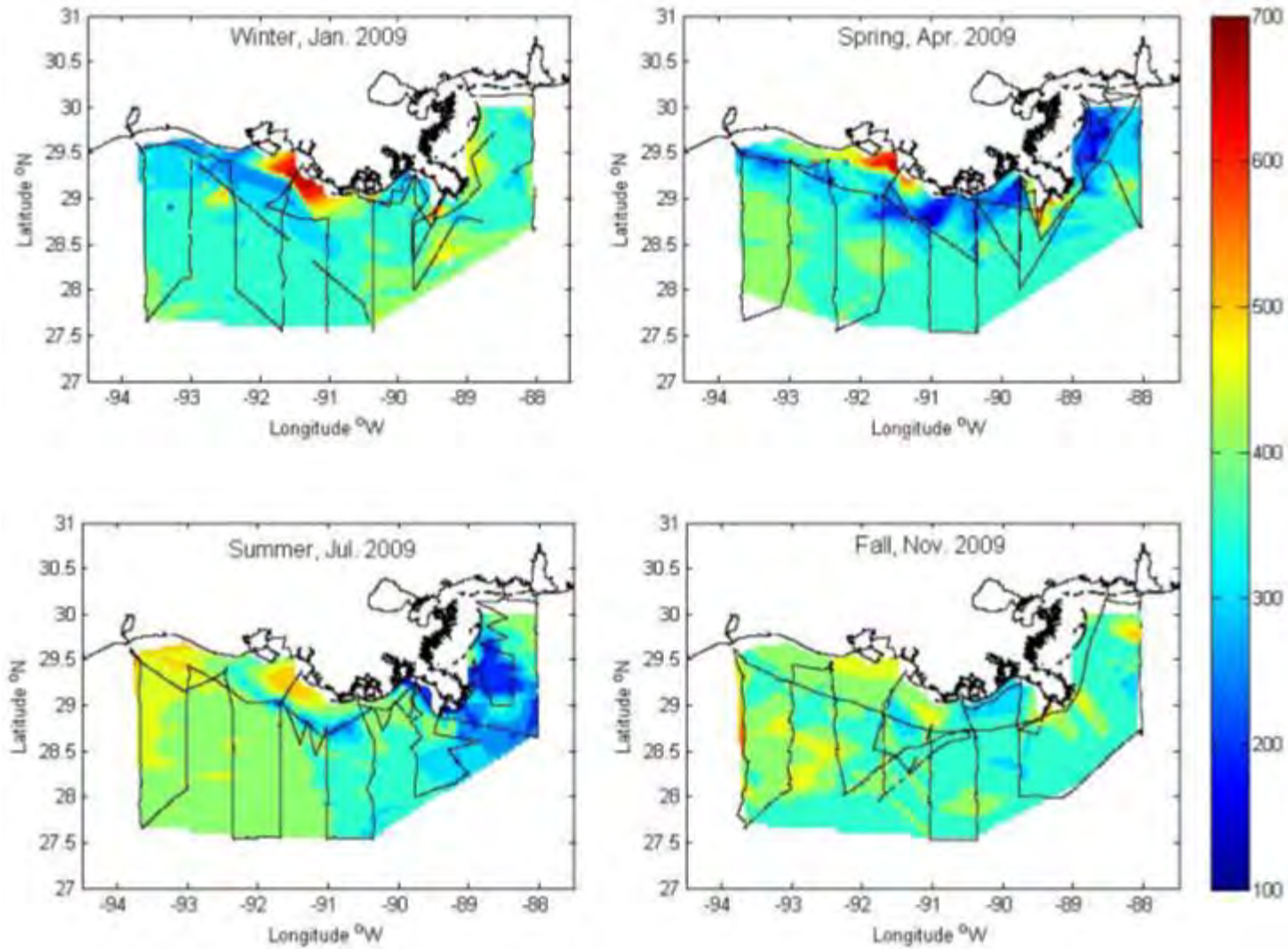
River Influence on Carbon Fluxes



River Discharge

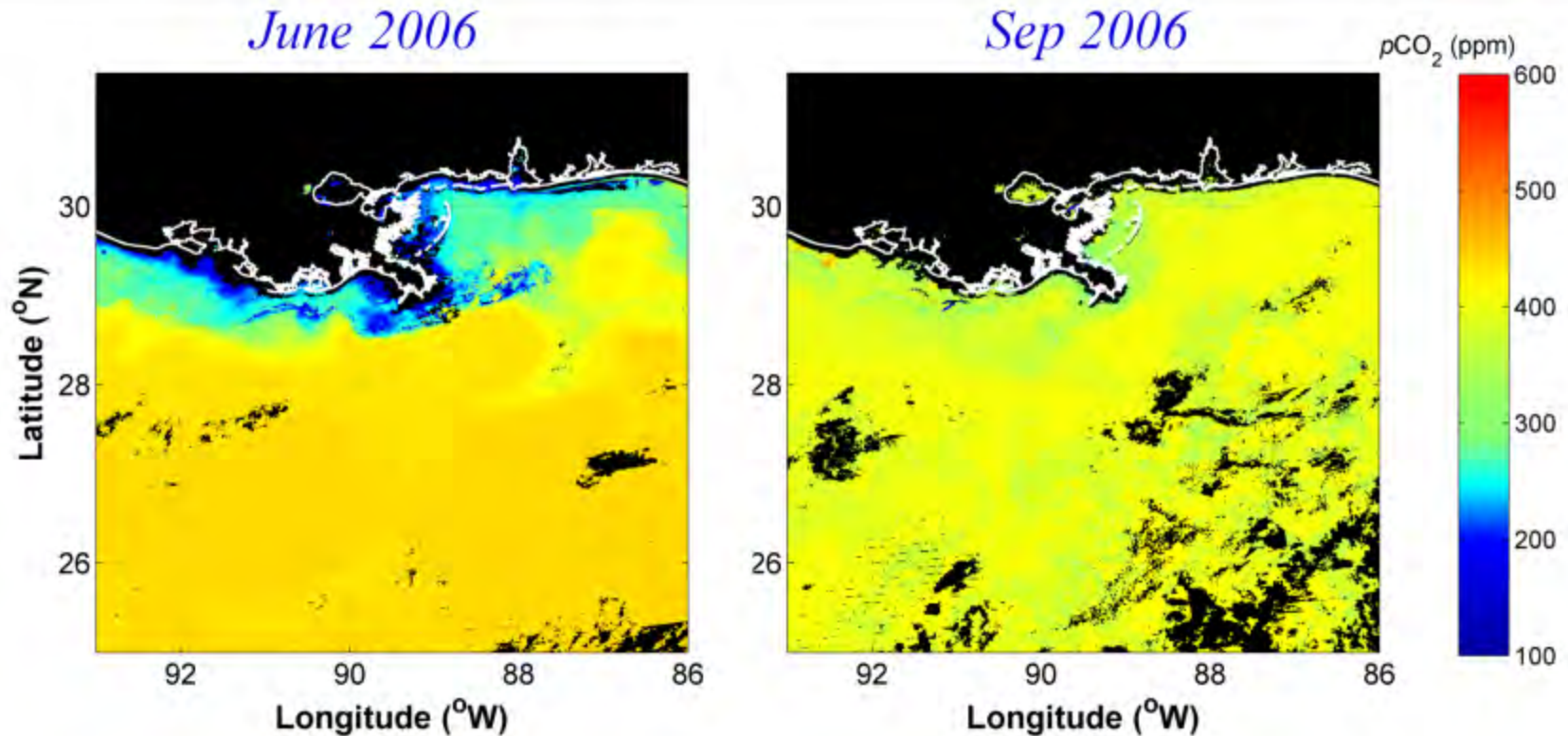


GulfCarbon $p\text{CO}_2$



Huang, Cai et al.

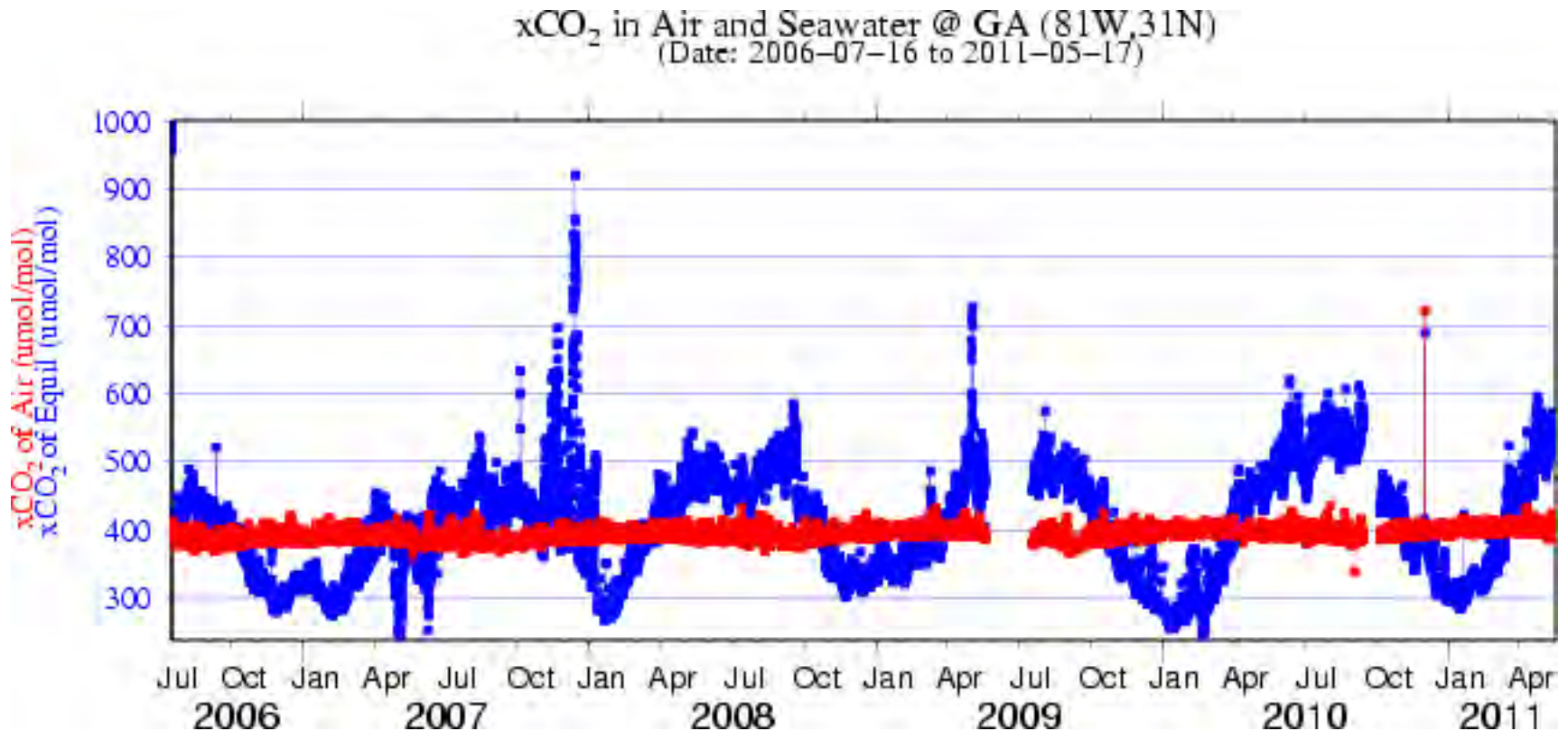
Satellite-derived $p\text{CO}_2$



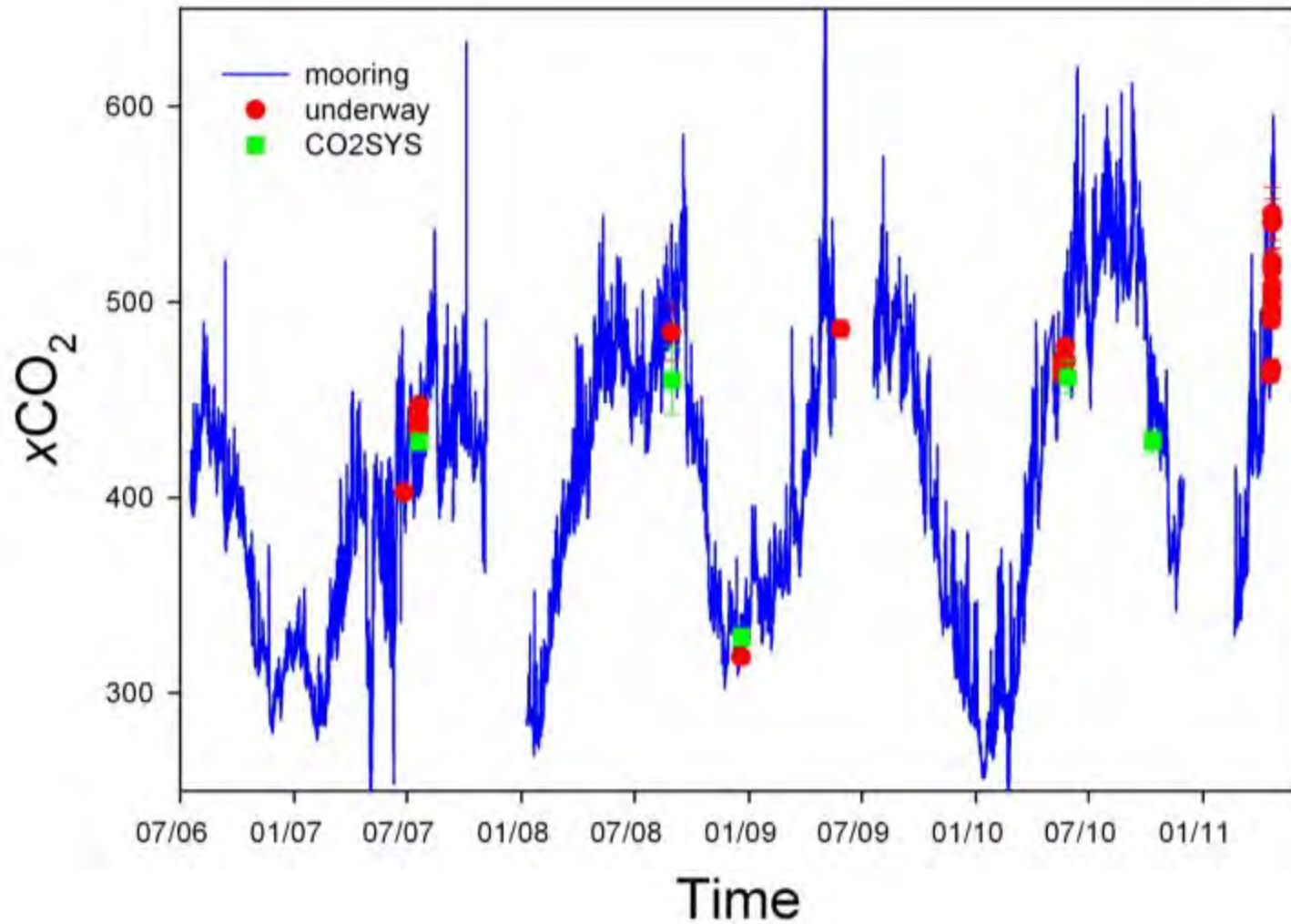
- Net sink inshore in June and net source offshore
- Source in Sep

Gray's Reef (SAB)

- ▶ Low $p\text{CO}_2$ in winter months and high in summer

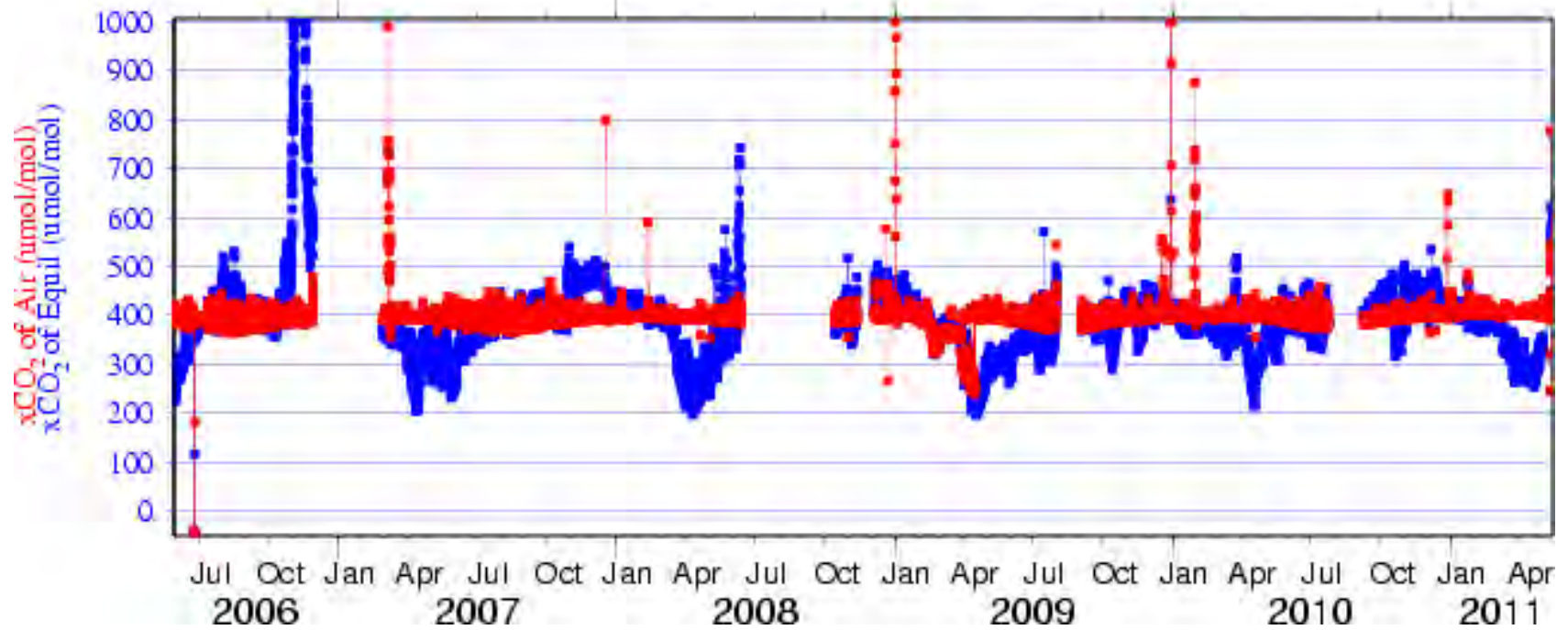


Gray's Reef (SAB)

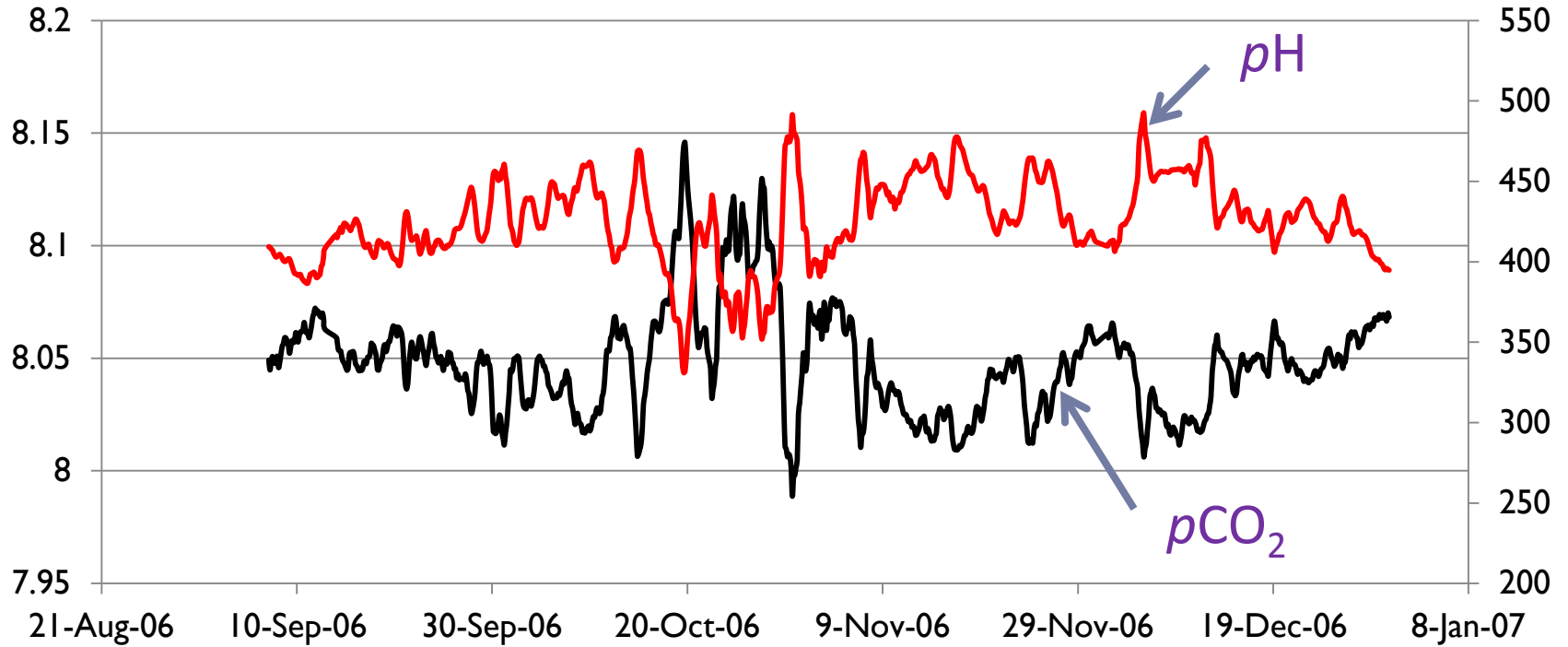


Gulf of Maine

$x\text{CO}_2$ in Air and Seawater @ NH (70W, 43N)
(Date: 2006-05-29 to 2011-05-15)



Gulf of Maine



Conclusions

- ▶ This project provides time-series observations of coastal ocean pH and carbon system properties in various coastal regions in support of NOAA goals
- ▶ The northern Gulf of Mexico and South Atlantic Bight regions are commonly influenced by one contiguous western boundary current system, which originates with the Loop Current in the Gulf of Mexico and then becomes the Gulf Stream along the southeastern U.S. continental shelf
- ▶ The Gulf Coast site is strongly influenced by freshwater discharge, while the SAB and Gulf of Maine sites show strong seasonal patterns
- ▶ Future work will examine relationship of carbon dioxide and pH to environmental forcings