Final Technical Report

Grant No.: DE-FG02-96ER62256

Project Title: "Variability of Carbon System Parameters in Coastal Waters of the Mid-Atlantic Bight off New Jersey: A link to the Ocean Margins Program"

Principal Investigator: Clare E. Reimers, Rutgers University

Project Objective: The overall objective of this one year project was to maintain a measurement program of inorganic carbon system parameters for waters from a region of the inner continental shelf off New Jersey as a temporal record of chemical and physical conditions "upstream" of DOE's Ocean Margin Program experimental site off Cape Hatteras, NC.

Approach: Water column measurements of temperature, salinity, total carbon dioxide, total alkalinity, oxygen and nutrients were made approximately monthly at seven stations along a 32 km coastal transect. These measurements were used to calculate the fugacity of carbon dioxide, fCO_2, in these waters. A discrete sampler was applied to make direct fCO_2 measurements on some occasions and to determine the atmospheric fCO_2 signal in the region of the transect. Together these data were used with a record of local wind speed to calculate air-sea CO_2 fluxes at each of the seven stations throughout the year as well as an average yearly flux.

Results: CO_2 fluxes (-0.43 to -0.84 mol m^{-2} y^{-1}) calculated from local wind speed and the air-sea CO_2 difference for the period April 1994 to April 1996 indicate that the inner shelf region off New Jersey acts as a small net sink for atmospheric CO_2 on a yearly averaged basis. The inner and outer stations of our coastal transect varied on different time-scales, but in general, surface waters were a source of CO_2 to the atmosphere in the summer and fall, offset by large fluxes into the surface waters during the winter to early spring. The calculated fugacity of surface water carbon dioxide ranged from 211 to 658 µatm. Superimposed on the large spatial and temporal variability typical of the coastal environment, was a clear seasonal trend in fCO_2 which was primarily responsible for the observed trend in the flux. The dominant processes responsible for the observed changes in fCO_2 were temperature variations, organic matter cycling (i.e., primary production and respiration), air sea exchange and mixing. The magnitude of the effect of organic matter cycling on changes in fCO_2 generally decreased in the offshore direction.

Deliverables: 1 published journal article

Boehme, S.E., Sabine C.L., and Reimers, Clare E. (1998) CO_2 fluxes from a coastal transect: a time-series approach. Marine Chemistry 63: 49-67.

Our data have also been provided to OMP program scientists for incorporation in to their analyses of margin-wide carbon flow.

Collaborations: This study supported the post-doctoral research of Dr. Susan E. Boehme. Through the project, the P.I. established collaborations with Drs. Christopher Sabine and Robert

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Key of Princeton University and Dr. Michael Degrandpre of the University of Montana. A continuation of the project is currently underway with these investigators and is supported by the National Science Foundation. During this phase of our study we are examining temporal and spatial CO_2 variability in NJ coastal waters in greater detail. A moored fCO_2 sensor is being used to measure fCO_2 continuously at one location throughout the year, while an underway fCO_2 measurement system is being used every three months to provide a more detailed spatial picture of fCO_2 variability and its relation to physical fields. The methods developed in this project are being employed as an independent check on the above methods.