Project Summary

Intellectual Merit

The objectives of the GEOTRACES program are 1) to determine the global distributions of selected trace elements and isotopes and evaluate the sources, sinks and internal cycling of these species to better understand the physical, chemical and biological processes regulating their distributions, 2) develop an understanding of the processes involved in oceanic trace element cycles sufficiently well that the response of these cycles to global change can be predicted and their impact on the carbon cycle and climate understood, and 3) to understand the processes that control the concentrations of geochemical species used for proxies of the past environment, both in the water column and in the substrates that reflect the water column. Understanding how the physical processes of advection, mixing, and water mass formation affect the distributions of trace elements and isotopes is critical to meeting these objectives. The evolving CFC and SF6 distributions in the ocean provide strong constraints on these processes. CFCs have been measured extensively in the global ocean for the past two and a half decades as part of several large scale oceanographic programs (e.g. SAVE, WOCE, CLIVAR) as well as many smaller programs and SF6 has become a standard measurement on the CLIVAR cruises. Measurement of CFCs and SF6 on the GEOTRACES program places the GEOTRACES data in the context of large scale ventilation patterns established by CFC/SF6 measurements on these cruises. The work proposed here is to measure the CFC-11, CFC-12 and SF6 distributions along the US GEOTRACES North Atlantic cruise track and to use these data to identify the most recently ventilated cores of the North Atlantic water masses, to estimate transit times of these water masses from their source regions, and to estimate oxygen consumption rates and rates of production or decomposition of selected trace elements measured on this program using the transit time information.

Broader Impacts

In addition to providing information on ventilation and transit times for the GEOTRACES project, the CFC and SF6 data collected on this cruise will also expand the transient tracer data base for the North Atlantic Ocean. The data will be disseminated widely to the research community following NSF guidelines. Several CLIVAR cruises to the North Atlantic are planned for the 2010 – 2012 time period, and the GEOTRACES cruise will increase the coverage for CFCs and SF6. This database of the temporally evolving CFC and SF6 concentrations in the North Atlantic Ocean is used in studies of the earth's climate and the ocean's role in the earth's climate and the global CO2 cycle. It is used to validate models of ocean circulation and to quantify the uptake and storage of anthropogenic CO2 in the ocean. Such information is critical for society to make sound decisions on policies to deal with climate change. The project enhances the infrastructure for measuring CFCs and SF6 through the support of a senior technician. The state of the art laboratory facility he maintains is routinely used by students for various research projects. Outreach activities include participating in annual open houses and communicating scientific results to the public when opportunities arise.