Aerosol Chemistry from the Pacific and North Atlantic Oceans: Results from the CLIVAR/Repeat Hydrography Program

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Introduction

Daily-integrated aerosol samples were collected on CLIVAR/Repeat Hydrography cruises from 2003-2006 using a bow-mounted sector-controlled aerosol sampling system. In addition, a Micro-Orifice Deposit Impactor (MODI) was deployed to provide size-fractionated aerosol samples. The goals of this research were to measure the concentration and solubility of aerosol Fe and other trace elements, to estimate their deposition to the oceans, and to study the factors responsible for creating soluble aerosol trace elements.

Experimental

Aerosol filters were leached with 100 mL of either 0.2 μm filtered surface seawater (pH 8.2) or unacidified ultrapure water (pH 5.6). The seawater filtrates were analyzed for soluble Fe(II) by the FeLume chemiluminescent method and for total dissolved Fe using ion-exchange column chromatography and isotope dilution ICP-MS. Ultrapure water filtrates were analyzed for soluble major anions and soluble oxalate by ion chromatography, as well as soluble Fe and other elements by ICP-MS. Replicate aerosol filters were analyzed at NOAA/PMEL for total Fe (and other elements) by energy dispersive X-ray fluorescence, and using synchrotron radiation (XANES) at the Brookhaven synchrotron (NSLS). Air-mass back trajectory analysis was conducted using the NOAA/HYSPLIT model. Rainfall samples were also collected to quantify the fraction of soluble aerosol Fe and other trace elements using ICP-MS.

Results and Discussion

These data are used to discuss the sources, transport, and deposition of soluble and total aerosol trace elements and major ions. Samples from the North Atlantic include those impacted by anthropogenic emissions and the Saharan dust plume. Samples from the Pacific Ocean (including samples from the South Pacific and the Southern Ocean) illustrate the influences of anthropogenic emissions and mineral dust from Asia and Australia, and the extremely low aerosol loads found south of the equator.

Conclusions

Our conclusions are still being developed since many samples remain for analysis, and several more journal articles are anticipated after the data interpretation has been completed in 2009.

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References

Aerosol Chemistry from the Pacific and North Atlantic Oceans: Results from the CLIVAR/Repeat Hydrography Program. Clifton S. Buck, William M. Landing, Joseph A. Resing, Nathan Buck, Phoebe Lam, Dan Ohnemus. Fall 2008 Meeting of the American Geophysical Union.

Particle size and aerosol iron solubility: A high-resolution analysis of Atlantic aerosols
Clifton S. Buck, William M. Landing, Joseph A. Resing, Marine Chemistry (online 2008).

The solubility and deposition of aerosol Fe and other trace elements in the North Atlantic Ocean: Observations from the A16N CLIVAR/CO2 repeat hydrography section. Clifton S. Buck, William M. Landing, Joseph A. Resing, Christopher I. Measures. Marine Chemistry (online 2008).