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GLOBAL OCEAN SURVEY OF DISSOLVED IRON AND ALUMINUM AND AEROSOL IRON AND ALUMINUM SOLUBILITY SUPPORTING THE CLIVAR/CO2 REPEAT HYDROGRAPHY PROJECT

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Modeling the oceanic biological processes that sequester atmospheric carbon dioxide is complicated by the biological requirement for the micronutrient Fe and its limited availability in oceanic surface waters. Thus, successful models of the biological pump need to accurately reproduce the distribution of dissolved Fe in surface waters and its supply to the open ocean from the partial dissolution of mineral dust and anthropogenic aerosols. However, efforts to constrain these models are hampered by a lack of knowledge about the global distributions of dissolved Fe in surface waters, the deposition of atmospheric dust to the surface ocean, and the systematics of Fe release from the dust to ocean waters. The TM CLIVAR project is designed to alleviate that problem by developing a global data set that can be used by geochemists to understand the processes that control these distributions and by modelers who seek to reproduce them.

Our trace metals component of the CLIVAR CO2/Repeat Hydrography program (TM CLIVAR) has provided high-resolution sections of dissolved and particulate Al, Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb across major ocean basins that encompass significant biogeographic and hydrographic gradients. These high-resolution sections, comprised of vertical profiles in the upper 1,000m at ~ 60 nautical mile spacing, have revealed fine-scale features that were previously unrecognized. This work has also provided high resolution mapping of aerosol dust deposition and the solubility of Al, Fe, and other bioactive trace elements in these aerosols. Coupling aerosol and water column sampling has shown how dust input can influence the upper ocean chemistry of Al, Fe, and other bioactive trace elements, and has provided a data set that can be used to constrain modeling efforts in these regions.