Distributions of oxygenated organic compounds in aerosols over the western Pacific and off the coast of East Asia

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Aerosol sampling for dicarboxylic acids, fatty acids, and levoglucosan was conducted from March 15 to April 20, 2001 on board the NOAA R/V Ronald H. Brown over the western North Pacific, East China Sea and the Sea of Japan, as part of the ACE-Asia campaign. Three types of air sampler (high volume air sampler, Micro-Orifice Uniform Deposit Impactor (MOUDI) and an annular denuder sampling system) were used for bulk aerosol sampling, size-segregated aerosol sampling, and organic-acid sampling in gas/particles, respectively. Organic acids and levoglucosan extracted from aerosol samples were derivertized with BF_3/n-butanol and N,N-bis(trimethylsilyl)fluoroacetamide (BSTFA), respectively, and determined by GC-FID and GC-MS.

Concentrations of total dicarboxylic acids, total fatty acids, and levoglucosan were found to be higher off the coast of East Asia than in the remote marine boundary layer. Particularly, concentrations of total dicarboxylic acids exceeding 1 μg m^{-3} were observed occasionally off the coast of East Asia. Due to their high (organic mass)/(organic carbon) ratios, their contribution to the total organic mass and oxygen contents was found to be substantial. The high positive correlations of dicarboxylic acids with nss SO_4^{2-} and NO_3^- was obtained, being consistent with the hypothesis that anthropogenic sources are important for diacid concentrations over the East Asia. For fatty acids, both terrestrial and marine biogenic sources were significant where their concentrations were high off the coast of the continent. The relative abundances of dicarboxylic acids between gas and particles were obtained, with C_2-C_5 diacids being found to be predominantly present in particles. The relative abundances between C_2-C_5 compounds were homogeneous throughout the cruise. This study suggests that wet and dry deposition was more important sink than chemical decomposition accompanying fractionation, and that they are stable end products of oxidation of organic compounds in the atmosphere.

Distribution and speciation of bioactive metals in the oceans

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There is increasing evidence that factors controlling the distribution of iron in the world's oceans determine the boundaries of vast areas where primary production is controlled by iron, phosphate and physical factors such as light limitation. Important features of the composition of phytoplankton assemblages, such as the abundance of diazotrophs and the relative abundance of diatoms versus coccolithophores, are also influenced by geochemical processres acting on iron and probably other metals as well. However, the boundaries of these regions are poorly defined, even with increasingly sophoisticated biogeochemical models, because our knowledge of the distribution of metals is still quite limited over most of the oceans. This makes it difficult to define the boundaries of these biogeochemical regimes accurately and also makes it difficult to predict how changes in such factors as dust transport or ocean circulation might influence primary production through their influence on metal geochemistry. In this presentation, I will examine regions where new data are most needed, focusing on the direct benefits that additional data would provide. In particular, I will show how complimentary data obtained using isotopic data is an essential part of this project. I will also argue for the importance of speciation measurements, and ultimately, for novel molecular biological diagnostics of physiological conditions like P limitation, that could be incorporated into a measurement-intensive program. Incorporation of novel methodologies and interdisciplinary approaches could be facilitated by incporporating a strong educational component into the program.