Impacts of acidity on atmospheric Fe input to ocean biogeochemical cycles

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Atmospheric deposition of labile iron (Fe) to the ocean has been suggested to modulate primary ocean productivity and thus indirectly affect the climate. Significant progress has been made in our understanding of atmospheric inputs of labile Fe from natural and anthropogenic sources to the oceans. Different emission sources and transformation processes affect aerosol Fe solubility. Mineral dust contains a small amount of ferrihydrite on the surface (about 1% of Fe solubility) and thus may deliver insignificant labile Fe fluxes to the polar oceans in present days. However, about 10% of mean Fe solubility is measured for the Last Glacial Maximum (LGM) aerosols in Antarctica. If this value is applied to mineral dust during the LGM, the atmospheric input of labile Fe could be comparable to that provided by upwelling in present days. However, there are still large uncertainties regarding the relative importance of different sources of Fe and effects of atmospheric processing on the bioavailability of the delivered Fe.

This talk will focus on effects of atmospheric processing on Fe solubility and contribution of different sources of Fe to labile Fe in the atmosphere. A key process contributing to atmospheric sources of labile Fe is associated with atmospheric acidity, which leads to Fe transformation from insoluble to soluble forms. Fe-containing aerosols from combustion sources are characterized by low loading and high solubility, compared to mineral dust. Combustion aerosols might contribute to labile Fe loading measured at high solubility in the atmosphere. Thus, assessments of dust-borne Fe fertilization of the oceans should include Fe-containing mineral aerosols affected by combustion sources.