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Atmospheric inputs of iron to the upper-ocean

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Iron (Fe) is an essential micronutrient that governs biological activity over much of the ocean. Several decades of research have shown that the atmospheric deposition of Fe may affect ocean productivity, atmospheric CO_2 uptake, ecosystem diversity, and overall climate. To assess the response of ocean ecosystems to atmospheric Fe deposition, one would like to know what fraction of atmospherically-delivered Fe enters the seawater dissolved Fe pool, i.e., the fraction of aerosol iron that can be available to marine phytoplankton after deposition to surface ocean. However, characterization of bioaccessibility of atmospherically delivered Fe is challenging since it can depend on numerous atmospheric (anthropogenic, lithogenic, and pyrogenic sources, chemical and physical transformation during atmospheric transport, wet and dry deposition), and oceanic (processes mediated by the environment and controlled by microbes, such as light, temperature, excretion of organic ligands and varying microbial uptake mechanisms) factors. Therefore, studies have largely focused on labile/leachable forms of atmospherically delivered Fe. This talk will attempt to summarize some of the recent advances affecting the labile/leachable forms of aerosol iron such as source apportionment using the stable isotope ratios, new laboratory data for multiphase reactions in the presence of atmospheric organic matter, reactive radicals, and acidic gases, improvements to Fe-mobilization schemes in regional and global models, and advanced remotely sensed data analysis for improved understanding of the role of atmospheric Fe in marine ecosystems. This presentation will also offer some suggestions for future research on the bioaccessibility of atmospherically delivered Fe.