ABSTRACT

In this project, a coupled chemistry-aerosol-cloud-radiation model for the production of water-soluble iron (DFe) in ambient particles will be developed and applied to the transport and deposition of DFe to different parts of the global oceans. The main hypothesis is that atmospheric transport and transformation of mineral aerosols play an important role in mobilizing Fe from highly insoluble mineral phases to water-soluble forms that are available for biological uptake by phytoplankton. The objectives of this study are to reduce uncertainties in assessments of DFe fluxes to the oceans associated with the mineralogical composition of dust, crustal and combustion sources of Fe, photochemical reductive dissolution of Fe oxides, cloud processing of aerosols, chemical cycling of Fe, and model grid resolution. The GEOS-Chem (Goddard Earth Observing System-Chemistry) model will be used with a recently implemented dust iron mobilization mechanism. The model will be used to provide (1) coarse grid simulations to estimate average fluxes of DFe to different parts of the global ocean; (2) nested grid simulations to characterize regional features of Fe dissolution and deposition of DFe in coastal regions; (3) sensitivity studies of dust mineralogical composition and dissolution mechanisms; and (4) an assessment of capabilities in modeling mineral aerosols.

This study will lead to an improved understanding of processes responsible for the production of DFe in ambient particles and will facilitate the assessment of the role of dust in ocean productivity and the carbon cycle. This research will support the education of a diverse group of undergraduate and graduate students in atmospheric science. Outreach projects organized by the Science House of North Carolina State University will be carried out with a goal of increasing student enthusiasm for science by partnering with K-12 teachers to promote hands-on inquiry-based science learning.

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3. Johnson, M. S., N. Meskhidze, V.P. Kiliyanpilakkil (2012), A global comparison of GEOS-Chem predicted and remotely-sensed mineral dust aerosol optical depth, *J. Adv. Model. Earth Syst.*, 4, M07001, doi:10.1029/2011MS000109. <Full text PDF>

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