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Human-driven changes in dissolved phosphorus deposition to the ocean

Stelios Myriokefalitakis (1), Athanasios Nenes (2,3,4), and Maria Kanakidou (1)

(1) University of Crete, Environmental Chemical Processes Laboratory, Department of Chemistry, Heraklion, Greece (mariak@chemistry.uoc.gr), (2) Institute of Chemical Engineering Sciences (ICE-HT), FORTH, Patras, Greece, (3) School of Earth and Atmospheric Sciences and School of Chemical and Biomolecular Engineering, Georgia Institute of Technology, 311 Ferst Drive, Atlanta, GA 30332-0100, USA, (4) National Observatory of Athens, Institute for Environmental Research and Sustainable Development, Athens

The atmospheric cycle of phosphorus (P) is parameterized in a global 3-D chemistry-transport model by taking into account the primary emissions of total (TP) and dissolved P (PO4) associated with dust, sea-salt, bioaerosols and combustion particles of anthropogenic and natural sources. Mineral sources are calculated to contribute by roughly 80% to the TP emissions. The calculated annual deposition flux of PO4 presents strong spatial and temporal variability with about 30% occurring over the ocean. Sensitivity simulations using preindustrial (year 1850), present (year 2008) and future (year 2100) anthropogenic and biomass burning emission scenarios, indicate that an increase in dust-P dissolution flux may have occurred in the last 150 years due to increasing atmospheric acidity due to anthropogenic emissions. On the opposite, a decrease of dust-P containing dissolution flux is projected for near future, since air-quality regulations are expected to reduce atmospheric acidity compared to present-day. Present day simulations of atmospheric P aerosol concentrations and deposition fluxes compare satisfactorily with available observations, thus, providing confidence to the model results. This work has been co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: ARISTEIA – PANOPLY (Pollution Alters Natural Aerosol Composition: implications for Ocean Productivity, cLimate and air qualitY) grant.