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Soluble dust as source of nutrients to the global ocean and the role of humans.

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Atmospheric deposition of trace constituents, both of natural and anthropogenic origin, can act as a nutrient source into the open ocean and affect marine ecosystem functioning and subsequently the exchange of CO_2 between the atmosphere and the global ocean. Dust is known as a major source of nutrients (Fe and P) into the atmosphere, but only a fraction of these nutrients is released in soluble form that can be assimilated by the ecosystems. Dust is also known to enhance N deposition by interacting with anthropogenic pollutants and neutralisation of part of the acidity of the atmosphere by crustal alkaline species. The link between the soluble iron (Fe) and phosphorus (P) atmospheric deposition and atmospheric acidity, as well as anthropogenic sources, is investigated. The global atmospheric Fe, P and N cycle are parameterized in the global 3-D chemical transport model TM4-ECPL. Both primary emissions of total and soluble Fe and P associated with dust and combustion processes are taken into account, as well as inorganic and organic N emissions. The impact of atmospheric acidity on nutrient solubility is parameterised based on experimental findings. The model results are evaluated by comparison with available observations. The impact of air-quality changes on soluble nutrient deposition is studied by performing sensitivity simulations using preindustrial, present and future emission scenarios. The response of the chemical composition of nutrient-containing aerosols to environmental changes is demonstrated and quantified. This work has been supported by ARISTEIA – PANOPLY grant co-financed by European Union (ESF) and Greek national funds NSRF.