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Aerosols, multiphase chemistry and biogeochemical cycles

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Atmospheric aerosols have complex and variable chemical composition and properties depending on their size, sources and atmospheric processing. They affect human health, the climate since they interact with radiation and atmospheric water, and the ecosystems because they can carry nutrients or toxic compounds. Aerosols and its associated water also serve as media for multiphase chemistry that changes both atmospheric oxidant levels and aerosol composition and properties.

While scientific interest is put on atmospheric aerosols for their health and climate effects, sufficient attention is given neither to their involvement in multiphase chemistry that changes their properties in the atmosphere nor to their role as carriers of nutrients for the ecosystems that is also affected by multiphase chemistry, subsequently impacting carbon sequestration and climate. This component of biogeochemical cycles is modified by humans and deserves attention because there is experimental proof that nutrients equilibria of both land and marine ecosystems have been disturbed during the Anthropocene period.

This study summarizes recent global chemistry-transport modeling studies that are based on laboratory and field experiments focusing on the organic and dust aerosol components and account for multiphase chemistry and aerosol ageing in the atmosphere together with nutrients (N, P, Fe) emissions, atmospheric transport and transformation, and deposition. The aim of this study is to consolidate knowledge on the impact of multiphase chemistry on aerosol acidity, composition and solubility of nutrients, focusing on the biogeochemical cycles of N, P and Fe, including their amounts present in organic compounds in both the gaseous and particulate phases.