

K.002 Aerosols in atmospheric chemistry and biogeochemical cycles.

Presenting Author:

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Abstract:

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

Humans have significantly modified the composition of atmospheric aerosol. Desert dust, the most abundant aerosol originating from natural continental sources, interacts with acidic compounds of anthropogenic origin that increase dust solubility and mobilize nutrients carried by dust, such as Fe and P. Organic ligands also interact with dust elements since water soluble organic di-acids present in aerosol water and in cloud droplets can form Fe-complexes, changing dust solubility as well as organics' chemical properties.

Furthermore, the organic pool in the atmosphere has variable content in C, H, O, N and other elements depending on the origin and the history of organics in the atmosphere. Organics are carriers of nutrients and thus key players in the biosphere-atmosphere-climate interactions, while they have a significant anthropogenic component due to primary emissions or interactions with pollution. Remarkably, organic aerosol is found to increase in the atmosphere, contrary to sulfate aerosol that has been mitigated the past decades.

In line with this vision for the role of aerosols in the atmosphere, we summarize recent global chemistry-transport modeling studies focusing on organic and dust aerosol components, which account for multiphase chemistry, aerosol ageing in the atmosphere, nutrients emissions, atmospheric transport and deposition. The importance of human-driven emissions is derived by sensitivity simulations using past and future anthropogenic emissions of pollutants. Uncertainties and implications of our findings are discussed.