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Impact of crustal elements on global atmospheric deposition of Nitrogen

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Nitrogen deposition plays a significant role in ecosystem functioning and particularly in ocean productivity. Chemical transformations occurring in all phases present in the atmosphere, affect the solubility of reactive nitrogen pool and thus of N-deposition. A significant fraction of N-deposition occurs in the form of particulate matter (PM) deposition. Atmospheric PM is composed of water, inorganic salts, crustal material, organics and trace metals. Important contributors to the dry fine PM are inorganic compounds like ammonium (NH4+), and nitrate (NO_3-), sodium (Na+), sulfate (SO4=) and bisulfate (HSO4-). Crustal species like Ca2+, K+, Mg2+ are major components of dust and can neutralize part of the acidity of the atmosphere (e.g. NO_3-, SO4=). Their presence is thus affecting the partitioning of NO_3-, SO4= and NH4+ on atmospheric PM as well as N-solubility and deposition, especially in areas where dust comprises a significant portion of total PM such as the Mediterranean region.
The effect of crustal material on N-containing species deposition is here investigated using the global TM4-ECPL global chemistry-transport model that is able to simulate oxidant chemistry, accounting for non-methane volatile organic compounds and all major aerosol components, including secondary aerosols like sulfate, nitrate and secondary organic aerosols. The model also accounts for multiphase chemistry in clouds and aerosol water. Gas-particle partitioning of inorganic and crustal components is solved using the ISORROPIA II aerosol thermodynamics model. Global simulations have been performed considering and neglecting crustal material for the partitioning of HNO_3/NO_3 and H2SO4/SO4=. Differences between the N-deposition amounts and their solubility are presented and thoroughly discussed.