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A 3D parameterization of iron atmospheric deposition to the global ocean

Stelios Myriokefalitakis (1), Maarten C. Krol (1,2), Twan P.C. van Noije (3), and Philippe Le Sager (3)

(1) Utrecht University, Institute for Marine and Atmospheric Research (IMAU), Department of Physics and Astronomy, Utrecht, Netherlands (s.myriok@uu.nl), (2) Wageningen University, Wageningen, Netherlands, (3) Royal Netherlands Meteorological Institute (KNMI), De Bilt, the Netherlands, Netherlands

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 to the global ocean, but only a fraction of these nutrients is released in soluble form that can be assimilated by the ecosystems. Iron (Fe) is a key micronutrient that significantly modulates gross primary production in High-Nutrient-Low-Chlorophyll (HNLC) oceans, where macronutrients like nitrate are abundant but primary production is limited by Fe scarcity.
The global atmospheric Fe cycle is here parameterized in the state-of-the-art global Earth System Model EC-Earth. The model takes into account the primary emissions of both insoluble and soluble Fe, associated with dusts and combustion processes. The impact of atmospheric acidity on mineral solubility is parameterized based on updated experimental and theoretical findings, and model results are evaluated against available observations. The link between the soluble Fe atmospheric deposition and anthropogenic sources is also investigated. Overall, the response of the chemical composition of nutrient containing aerosols to atmospheric composition changes is demonstrated and quantified. This work has been financed by the Marie-Curie H2020-MSCA-IF-2015 grant (ID 705652) ODEON (Online DEposition over OceaNs: Modeling the effect of air pollution on ocean bio-geochemistry in an Earth System Model).