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An updated estimate of the impact of nutrient deposition to the global ocean using EC-Earth

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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. Particles fall through the ocean mixed layer within a few hours to days, but only the soluble fraction of aerosols may be available to the ocean primary producers (i.e. bioavailable). Among other species that are deposited into the open ocean, nitrogen (N), iron (Fe) and phosphorus (P) are significant nutrients that can limit marine phytoplankton growth and thus directly impact on ocean carbon fluxes into the ocean - particularly where the nutrient deposited is the limiting nutrient for some phytoplankton species.
For this work, we take into account the up-to-date understanding of the effects of air quality on the aerosol cycles to investigate the potential ocean biogeochemistry perturbations due to atmospheric deposition - in the context of atmosphere-biogeochemistry interactions - in the European Community Earth System Model EC-Earth (http://www.ec-earth.org/), which is jointly developed by several European institutes. State-of-the-art N, Fe and P deposition fields (Kanakidou et al., JAS, 2016; Myriokefalitakis et al., Biogeosciences, 2015; 2016), calculated using recent estimates of anthropogenic emissions and cutting edge knowledge on atmospheric processes and anthropogenic emissions, are coupled to the embedded marine biogeochemistry model PISCES. Overall, the response of oceanic biogeochemistry to changes in natural and anthropogenic aerosols deposition is demonstrated and quantified. The results are discussed with regard to the impact of the expected changes in atmospheric nutrient deposition, either due to climate change and/or due to air pollution mitigation strategies, on the marine biogeochemistry and on the marine carbon cycle feedback to climate.
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