

5.048 Ocean-Atmosphere Exchange of Ammonia in the 21st Century and the Competing Effects of Temperature and Ocean Acidification.

Early Career Scientist

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Abstract:

Ammonia is the principal alkaline gas in the atmosphere. It therefore plays an important role in atmospheric chemistry, reacting with sulphuric and nitric acids to form ammonium aerosols, which serve as cloud condensation nuclei and negatively impact human health. Anthropogenic ammonia emissions are increasing rapidly in many areas of the world, and are expected to increase dramatically in the future due to the strong effect of temperature on the emission of ammonia. It is therefore of interest to understand the impact of increasing temperatures, atmospheric CO₂, and anthropogenic emissions on ocean-atmosphere exchange. Precise estimates of ocean-atmosphere ammonia exchange are unavailable due to the variability of fluxes and the difficulties in measuring them. A modelling approach is therefore required. Global ocean-atmosphere exchange of ammonia was simulated, applying an observationally-constrained physico-chemical model, for present-day and future scenarios, taking into account changes in temperature, terrestrial ammonia emissions, and ocean pH. Results show that ocean acidification has the largest effect, leading to a decrease in global ocean ammonia emissions from a range of 2.8 to 6.6 Tg-N/yr for the present day to a range of -1.1 to 2.3 Tg-N/yr for 2100 (RCP 8.5). Ongoing work includes incorporating this interactive ocean-atmosphere ammonia exchange scheme into the global atmospheric chemistry and aerosol model UKCA to explore resulting impacts on atmospheric composition and the global nitrogen cycle.