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TITLE: A reevaluation of the magnitude and impacts of anthropogenic atmospheric nitrogen inputs on the ocean

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ABSTRACT:

**Abstract** We report a new synthesis of best estimates of the inputs of fixed nitrogen to the world ocean via atmospheric deposition and compare this to fluvial inputs and dinitrogen fixation. We evaluate the scale of human perturbation of these fluxes. Fluvial inputs dominate inputs to the continental shelf, and we estimate that about 75% of this fluvial nitrogen escapes from the shelf to the open ocean. Biological dinitrogen fixation is the main external source of nitrogen to the open ocean, i.e., beyond the continental shelf. Atmospheric deposition is the primary mechanism by which land-based nitrogen inputs, and hence human perturbations of the nitrogen cycle, reach the open ocean. We estimate that anthropogenic inputs are currently leading to an increase in overall ocean carbon sequestration of ~0.4% (equivalent to an uptake of 0.15 Pg C yr<sup>-1</sup> and less than the Duce et al. (2008) estimate). The resulting reduction in climate change forcing from this ocean CO<sub>2</sub> uptake is offset to a small extent by an increase in ocean N<sub>2</sub>O emissions. We identify four important feedbacks in the ocean atmosphere nitrogen system that need to be better quantified to improve our understanding of the perturbation of ocean biogeochemistry by atmospheric nitrogen inputs. These feedbacks are recycling of (1) ammonia and (2) organic nitrogen from the ocean to the atmosphere and back, (3) the suppression of nitrogen fixation by increased nitrogen concentrations in surface waters from atmospheric deposition, and (4) increased loss of nitrogen from the ocean by denitrification due to increased productivity stimulated by atmospheric inputs.

SOURCE: Global biogeochemical cycles

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