

Title:

Iron and phytoplankton N:P utilization significantly impact the magnitude and distribution oceanic nitrogen fixation

Abstract:

The coupling of the nitrogen and phosphorus cycles in the ocean is assumed to operate via a feedback whereby nitrogen deficits generated by denitrification are restored by biological fixation of dinitrogen. However, iron limitation of N₂-fixation has the potential to contribute to spatial and/or temporal decoupling of nitrogen inputs and losses. Additionally, non-Redfield utilization of dissolved nitrogen and phosphorus by non-N₂-fixing phytoplankton can exert significant control over the magnitude and distribution of N₂-fixation in the oceans. I will show fieldwork from the North Atlantic Ocean that shows the large-scale distribution of nitrogen fixation is consistent with control by the availability of iron rather than phosphorus. I will also present model results demonstrating that systems dominated by rapidly growing phytoplankton with low nitrogen:phosphorus utilization ratios reduce the phosphorus available for N₂-fixation while regions where phytoplankton grow slowly and have high nitrogen:phosphorus utilization ratios enhance nitrogen deficits and promote nitrogen-fixation. Results from both regions will be discussed in terms of their effect on the oceanic fixed nitrogen inventory and the coupling between N₂-fixation and denitrification.

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