A newly-recognized role for the Arctic throughflow in the global nutrient cycle

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Recent studies reveal that the rates of N_2 fixation and denitrification in the ocean have been substantially underestimated and therefore the revised residence time of N is only a few thousand years compared to that of ˜50,000 years for P. Although regions of N_2 fixation and denitrification are usually geographically separated, the mechanisms whereby the global N cycle in the ocean is balanced are still not fully understood. Here we propose that the Arctic throughflow plays an important role in the global N cycle. Denitrification in the Pacific Ocean and subsequently in the Bering and Chukchi seas is known to result in a large deficit of N relative to P in seawater. Such water enters the Arctic Ocean and eventually exits into the North Atlantic Ocean. We identify that excess P from the Arctic throughflow can account for 16 % or more of the total N_2 fixation in the North Atlantic Ocean. Because of the relatively short pathway, the transport of excess P via Arctic throughflow may act as a mediator to rapidly balance N_2 fixation and denitrification. Under global warming scenarios, transport of P into the North Atlantic may increase.