

## **Increasing pollutant N in the North Pacific and North Atlantic oceans**

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The growing use of fossil fuels and fertilizers during the past ~5 decades has increased the concentration of reactive nitrogen species in environments throughout the world. Quantification of nitrate (N) concentration changes in the major ocean basins arising from these anthropogenic nitrogen deposition has not been explored on a basin-wide scale due to a lack of adequate oceanic measurements. Here, we used the nutrient concentrations and ventilation age of a water parcel (the time passed since the water parcel last contacted the atmosphere, determined from dissolved chlorofluorocarbon-12 measurements), to reconstruct the recent evolution of the excess of N (relative to phosphate, P) in the upper water column of the North Pacific and North Atlantic. Excess N in the mid-latitude regions, located downwind of the source continents, has increased considerably since the 1960s. The excess N was found to be highest in the vicinity of the source continent, and values decreased eastward, consistent with the distribution of airborne anthropogenic N. The increase in N availability will switch extensive parts of the major ocean basins from being N-limited to P-limited.