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Phosphate and Iron Control Global Surface Ocean Dissolved Organic Phosphorus Concentrations

Dissolved organic phosphorus (DOP) has a dual role in the surface

ocean as both a product of primary production and as an organic nutrient fueling primary production and nitrogen fixation, especially in oligotrophic gyres. Though poorly constrained, understanding the geographic distribution and environmental controls of surface ocean DOP concentration is critical to estimating distributions and rates of primary production and nitrogen fixation in the global ocean. Here we pair DOP concentration measurements with a metric of phosphate (PO43-) stress (P*), satellite-based chlorophyll *a* concentrations, and iron stress estimates to explore their relationship with upper 50 m DOP stocks. Our results show that PO43- and iron stress work together to control surface DOP concentrations at basin scales. Specifically, upper 50 m DOP stocks decrease with increasing phosphate stress, while alleviated iron stress leads to either surface DOP accumulation or loss depending on PO43- availability. Our work suggests an interdependence between DOP concentration, inorganic nutrient ratios, and iron availability, and establishes a predictive framework for DOP distributions in the global surface ocean.

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