# Weekly Report – February 21, 2025

Cooperative Institute for Satellite Earth System Studies (CISESS)

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**PUBLICATION(S)**

**Upper-ocean nutrients in decline**

**Citation:** Gerace, Skylar D., Jun Yu, Keith Moore, and **Adam C. Martiny**, 2025: Observed declines in upper ocean phosphate-to-nitrate availability. Proc. Natl. Acad. Sci. U.S.A., 122, e2411835122, https://doi.org/10.1073/pnas.2411835122.

**Summary**: Phosphate and nitrate are important constituents of Earth's ocean ecosystems, key nutrients for phytoplankton productivity, for one. However, with climate warming, changes in the levels of these nutrients are likely happening. In their recent paper in the journal *Proceedings of the National Academy of Sciences of the United States of America*, CISESS Consortium Institute Scientist Adam Martiny from the University of California Irvine and coauthors quantify nutricline depths around the globe and examine trends in global nutrient availability. The nutricline is the layer of the ocean where nutrient concentrations are measurable, providing information about levels of nutrients available to the upper ocean. Using an Earth system model, Martiny first established that nutricline depths effectively represent nutrient and broader ecosystem dynamics across the global ocean. Then using five decades' worth of nitrate and phosphate depth profiles collected by the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP), nutricline depths were quantified. A trend analysis reveals that upper-ocean phosphate is mostly declining, mainly in the Southern Hemisphere, while nitrate is mostly stable. The cruise observations suggest that phosphacline depths have deepened by ~20 m, a rate that is an order of magnitude larger than most predictions from the Coupled Model Intercomparison Project Phase 6. A conversation about this study provides more interesting details, including the importance of programs such as GO-SHIP.

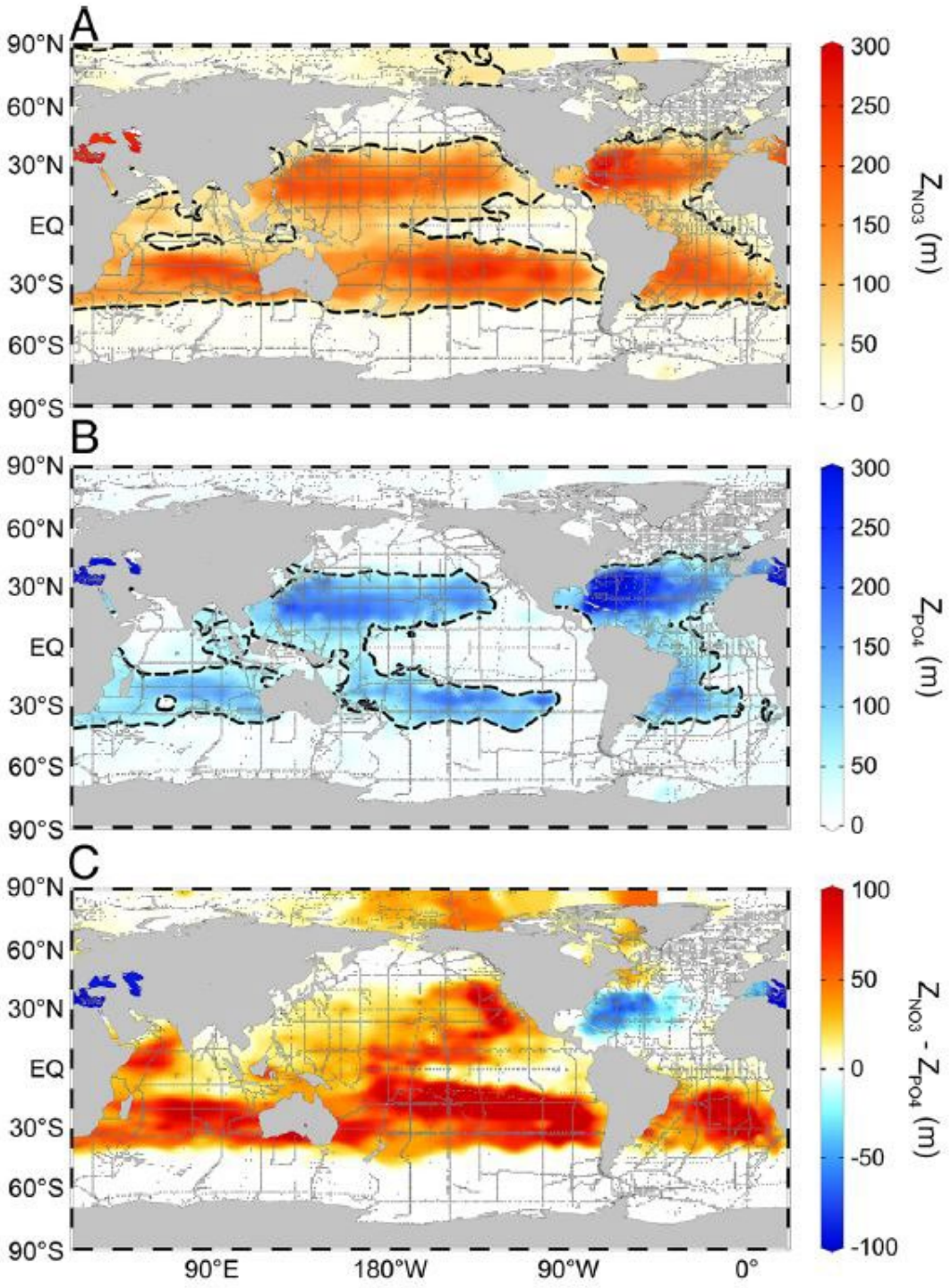


Figure. Mean nutricline depths from the GO-SHIP for the period 1972–2022: (A) nitracline depths ($Z_{NO3}$), (B) phosphacline depths ($Z_{PO4}$), and (C) their difference.

*(Adam Martiny, CISESS, amartiny@uci.edu; Funding: GOMO)*

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