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TITLE: The change in oceanic O₂ inventory associated with recent global warming

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ABSTRACT:

Oceans general circulation models predict that global warming may cause a decrease in the oceanic O₂ inventory and an associated O₂ outgassing. An independent argument is presented here in support of this prediction based on observational evidence of the ocean's biogeochemical response to natural warming. On time scales from seasonal to centennial, natural O₂ flux/heat flux ratios are shown to occur in a range of 2 to 10 nmol of O₂ per joule of warming, with larger ratios typically occurring at higher latitudes and over longer time scales. The ratios are several times larger than would be expected solely from the effect of heating on the O₂ solubility, indicating that most of the O₂ exchange is biologically mediated through links between heating and stratification. The change in oceanic O₂ inventory through the 1990s is estimated to be 0.3 +/- 0.4 x 10¹⁴ mol of O₂ per year based on scaling the observed anomalous long-term ocean warming by natural O₂ flux/heating ratios and allowing for uncertainty due to decadal variability. Implications are discussed for carbon budgets based on observed changes in atmospheric O₂/N₂ ratio and based on observed changes in ocean dissolved inorganic carbon.

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