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MOBO-DIC: Recent Trends and Variability in the Oceanic Storage of Dissolved Inorganic Carbon

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Several methods have been developed to quantify the oceanic accumulation of anthropogenic carbon dioxide (CO_2) in response to rising atmospheric CO_2. Yet, we still lack a corresponding estimate of the changes in the total oceanic stock of dissolved inorganic carbon (DIC). In addition to the increase in anthropogenic CO_2, changes in DIC also include any alterations of the natural CO_2 pool. Once integrated globally, changes in DIC reflect the net oceanic sink for atmospheric CO_2, complementary to estimates of the air-sea CO_2 exchange based on surface measurements. Here, we extend the machine learning approach by Keppler et al. (2020) to estimate global monthly fields of Mapped Observation-Based Oceanic DIC (MOBO-DIC) at 1° resolution over the top 1500 m from January 2004 through December 2019. We find that over these 16 years and extrapolated to cover the whole global ocean down to 4000 m, the oceanic DIC pool increased close to linearly at an average rate of 3.2±0.7 Pg C yr^{-1}. This trend is statistically indistinguishable from current estimates of the oceanic uptake of anthropogenic CO_2 over the same period. Thus, our study implies no detectable net loss or gain of natural CO_2 by the ocean, albeit the large uncertainties could be masking it. Our reconstructions suggest substantial internal redistributions of the natural oceanic CO_2 pool, with a shift from the mid-latitudes to the tropics and from the surface to below ~200 m. Such redistributions correspond with the Pacific Decadal Oscillation and the Atlantic Multidecadal Oscillation. The interannual variability of DIC is strongest in the tropical Western Pacific, consistent with the El Niño Southern Oscillation.

Reference:

Keppler, L., Landschützer, P., Gruber, N., Lauvset, S. K., & Stemmler, I. (2020). Seasonal carbon dynamics in the near-global ocean. *Global Biogeochemical Cycles*, 34, e2020GB006571. https://doi.org/10.1029/2020GB006571