Mixed Layer Controls on Ocean Carbon Cycling and Ocean Acidification

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The development of buoy-based autonomous carbon sensors has improved our ability to examine ocean carbon cycle dynamics and ocean acidification on time scales ranging from days to years. Processes contributing to mixed layer carbon inventory changes can be quantitatively assessed to understand the relative importance of physics, chemistry, and biology while helping us to better understand the magnitude of long-term change in the context of natural variability. Here we compare two North Pacific time series sites: The Kuroshio Extension Observatory (KEO) in the western subtropical North Pacific and Ocean Station Papa in the eastern subpolar North Pacific. Preliminary results at KEO indicate that 4.5 ±2.2 mol C m^{-2} yr^{-1} is exported as organic carbon and 0.4 ±1.1 mol C m^{-2} yr^{-1} is exported as calcium carbonate, with much of the export occurring during the spring bloom. At Papa, the organic and inorganic carbon exports are 2 ±1 and 0.3 ±0.3 mol C m^{-2} yr^{-1}, respectively. Unlike KEO, export at Papa is spread out over the spring and summer months, then switches to net heterotrophy during the winter. Net organic carbon export at KEO is twice that of Papa, but the particulate inorganic carbon to particulate organic carbon ratio at Papa is about twice that of KEO. Observations suggest that both sites experience present day surface pH and Ω_{arag} conditions outside the bounds of pre-industrial variability throughout the year.

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