PHYTOPLANKTON SIZE IMPACT ON EXPORT FLUX IN THE GLOBAL OCEAN

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The efficiency of the biological pump of carbon to the deep ocean depends largely on the biologically-mediated export of carbon from the surface ocean and its remineralization with depth. Global satellite studies thus far have focused on the use of chlorophyll concentration and primary production to understand the role of phytoplankton in these processes. Recent satellite retrievals of phytoplankton composition now allow for the size of phytoplankton cells to be considered in the biological pump at large scales. The goal of this study is to improve understanding of how phytoplankton size structure controls particle export and remineralization. Particulate organic carbon (POC) flux observations from sediment traps and 234-Thorium were compiled across the global ocean and the distribution of the data is presented. Annual climatologies of primary production, percent microplankton, and POC flux at key time series locations and within biogeochemical provinces were compiled. Sinking velocity was calculated to align surface production with POC flux. Parameters that characterize POC flux vs. depth (export flux ratio, labile fraction and remineralization length scale) were fit to the aligned dataset. Times of the year dominated by different size compositions were identified and fit separately in regions of the ocean where phytoplankton cell size varied enough over the annual cycle. Cell size impacts were observed in export flux and remineralization length scales. Generally, periods dominated by small cells had lower transfer efficiency and greater export flux than periods when microplankton comprised a greater proportion of the phytoplankton community.

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