

Global Ocean Productivity and the Fluxes of Carbon and Nutrients: Combining Observations and Models

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Translating net production to export: Biological impacts on efficiency.

The net production of organic material in the surface ocean can be measured with incubation experiments and remote sensing. However, neither approach directly measures the amount of biogenic material that is exported to depth, and this is the most important process redistributing material among major ocean and atmosphere reservoirs. In our comparison of net production and export, we found a significant lag between the two processes in systems that undergo significant seasonal changes in productivity. The export lag ranged from a short (or non-existent) period in the southern region of the Antarctic Circumpolar Current, to almost two months in the offshore regions of the northern Arabian Sea. The lag time also is related to the efficiency of export, in that the sedimenting flux of material relative to surface production decreased as the lag time increased. Some of the lag can be related to a faster response of microbial grazing at warmer temperatures, as suggested by previous export models that related lower f -ratios to temperature. However, to a large extent, the lag time is effected by the floristic composition of the phytoplankton, in that regions characterized by heavily silicified diatoms had significantly greater export efficiency than predicted by temperature alone. The dependence of export efficiency on the floristic composition of surface production adds significant uncertainty to global export predictions. Possible approaches for predicting the occurrence of heavily silicified diatoms include their dependence on iron and the advective supply of seed populations.