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Global patterns of organic carbon export and sequestration in the ocean (Arne Richter Award for Outstanding Young Scientists)

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A major term in the global carbon cycle is the ocean's biological carbon pump which is dominated by sinking of small organic particles from the surface ocean to its interior. Here we examine global patterns in particle export efficiency (PE_{eff}), the proportion of primary production that is exported from the surface ocean, and transfer efficiency (T_{eff}), the fraction of exported organic matter that reaches the deep ocean. This is achieved through extrapolating from *in situ* estimates of particulate organic carbon export to the global scale using satellite-derived data. Global scale estimates derived from satellite data show, in keeping with earlier studies, that PE_{eff} is high at high latitudes and low at low latitudes, but that T_{eff} is low at high latitudes and high at low latitudes. However, in contrast to the relationship observed for deep biomineral fluxes in previous studies, we find that T_{eff} is strongly negatively correlated with opal export flux from the upper ocean, but uncorrelated with calcium carbonate export flux. We hypothesise that the underlying factor governing the spatial patterns observed in T_{eff} is ecosystem function, specifically the degree of recycling occurring in the upper ocean, rather than the availability of calcium carbonate for ballasting. Finally, our estimate of global integrated carbon export is only 50% of previous estimates. The lack of consensus amongst different methodologies on the strength of the biological carbon pump emphasises that our knowledge of a major planetary carbon flux remains incomplete.