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Long time-series of export fluxes in the western Ross Sea (Antarctica)

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The export of particulate organic carbon (POC) from the sea surface is an essential part of the biological pump. Export fluxes are the result of what is produced in surface water and how much is consumed during particle sinking in the water column. In the Ross Sea, fluxes of POC and total mass are well correlated implying that particle fluxes are dominated by biogenic debris.

Here, we report new and reference data of vertical particle fluxes to below the productive layer obtained on decadal time scales (1990-2017) by automatic sediment traps tethered to moorings in the western Ross Sea (Antarctica). Compilation of all data available in the Ross Sea (23 sites, >1000 samples) shows that annual POC fluxes to below 200 m average 4.4±3.3 g C m^{-2} y^{-1}. Particle fluxes are relatively low when primary production is high (spring-summer) followed by enhanced sedimentation in late summer-fall. The high degree of decoupling between production and sedimentation is unusual compared to records of Antarctic Peninsula and may represent low grazing rates. Furthermore, data exhibit a large interannual variability and a decreasing trend over time, with a clear shift after 2000. Do the reduced export fluxes depend on lower biological production, enhanced OM consumption, or other processes (e.g., lateral transfer of biogenic particles outside the study area)?

Satellite observations allow us to reconstruct the seasonal and interannual change of chlorophyll biomass, and sea ice extent and duration. Water temperature recorded at mid-depth is used to monitor the different intrusion over time of CDW, the main driver of temporal variability of Fe supply for the Ross Sea. Time series of particle fluxes, chlorophyll, sea ice cover and mid-depth temperature will be compared in order to test if the recent reduction of downward particle fluxes depend on primary production changes.

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