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Long-term trends in suspended chlorophyll a and vertical particle flux with respect to changing physical conditions in eastern Fram Strait, Arctic Ocean

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The Fram Strait is the main gateway for water, heat, sea ice and plankton exchanges between the Arctic Ocean and the North Atlantic. The abundance and composition of phyto- and zooplankton communities is governed to a large extent by key physical factors such as water temperature, salinity, currents, stratification of the water column and the presence or absence of sea ice. With our study we aim at tracing effects of environmental changes in pelagic system structure and impacts on the fate of organic matter produced in the upper water column in a region that is anticipated to react rapidly to climate change.

Chlorophyll a, an indicator of biomass standing stock of phytoplankton, has been measured in the upper 100 m of the water column since 1991 during several summer cruises (with RV 'Polarstern') across Fram Strait. Chlorophyll a measurements are used to validate productivity estimates by remote sensing from space. The quantity and composition of export fluxes of organic matter including biomarker have been measured since 2000 by annually moored sediment traps deployed at 200-300m at the AWI long-term observatory HAUSGARTEN in eastern Fram Strait (79°/4°E). Along with sinking particles, zooplankton (so-called 'swimmers') was also caught in the traps. Analyses of the material collected by the sediment traps allowed us to track seasonal and inter-annual changes in the surface waters at HAUSGARTEN.

We present temporal trends in the chlorophyll a distribution (1991-2012), in swimmer composition in the traps (2000-2009), and in the export of biomarker (2000-2008), particulate organic carbon, particulate biogenic silica, calcium carbonate, and the protist composition (2000-2012), in relation to the changing sea ice cover and water temperature. Whereas chlorophyll a (integrated values 0-100m) showed only a slight increase, the swimmer composition and the composition of the annual particle flux changed after a warm water event occurring from 2005-2007. The warm anomaly was accompanied by a considerable decrease in particulate biogenic silica (a proxy for diatoms), and a 3- to 5-fold increase in $CaCO_3$ (a proxy for foraminifera & pteropods). In contrast, the export of organic carbon and total biogenic matter hardly showed any variation.

The evaluation of the results obtained during our time-series study in the eastern Fram Strait was only possible in close cooperation with physical oceanographers, and with a participation in oceanographic research projects originally initiated by Eberhard Fahrbach.