

Long-term investigations of summertime chlorophyll a, particulate organic carbon and continuously observations of vertical particle flux in Fram Strait and the central Arctic Ocean

Eva-Maria Nöthig (1), Eduard Bauerfeind (1), Astrid Bracher (1), Alexandra Cherkasheva (2), Kirsten Fahl (1), Catherine Lalande (3), Katja Metfies (1), Ilka Peeken (1), Ian Salter (1), Antje Boetius (1), and Thomas Soltwedel (1)

(1) Alfred-Wegener-Institute Helmholtz-Centre for Polar and Marine Research, Bremerhaven, Germany (eva-maria.noethig@awi.de), (2) St. Petersburg State University, 7-9, Universitetskaya nab., St. Petersburg, 199034, Russia, (3) Université Laval, Québec-Océan, Département de Biologie, Pavillon Alexandre-Vachon, Québec, Québec, G1V 0A6, Canada

The Arctic Ocean is one of the key regions where the effect of climate change is most pronounced due to massive reduction of sea ice volume and extent. Most of the sea ice is transported out of the Arctic Ocean with the cold East Greenland Current (EGC) in the western Fram Strait, while warm Atlantic water enters the Arctic Ocean with the West Spitsbergen Current (WSC) in the eastern Fram Strait. In this scenario we conducted several cruises to Fram Strait and the central Arctic Ocean (CAO) between 1991 and 2015 to monitor phytoplankton biomass, particulate organic carbon standing stocks during summer at discrete depth using water bottle samples, and the sedimentation of organic matter by means of moored sediment traps throughout the year. With our study we aim at tracing effects of environmental changes in the pelagic system 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.

We will present data sets of phytoplankton biomass (chlorophyll a) and particulate organic carbon (POC) from the upper 100 m of the water column as well as results from vertical particle flux measurements with yearly deployed sediment traps at the LTER (Long-Term Ecological Research) observatory HAUSGARTEN in eastern Fram Strait (79°/4°E) between 2000 and 2012 and from two locations in the CAO close to the Lomonosov Ridge (1995/96) and the Gakkel Ridge (2011/12). Analyses of the material collected by the sediment traps allowed us to track seasonal and inter-annual changes in the upper water column at HAUSGARTEN and in the CAO. Whereas chlorophyll a (integrated values 0 -100 m) showed only a slight increase in eastern Fram Strait, it stayed more or less constant in the CAO and western Fram Strait, with the exception of 2015 exhibiting less biomass during late summer in the CAO. Highest biomass was found in the eastern Fram Strait and lowest in the heavily ice-covered regions. POC distribution patterns for the summertime show slightly different results than chlorophyll a. POC flux rates were at least one order of magnitude lower in the CAO than in eastern Fram Strait. Whereas in the CAO ice algae dominate the recognizable flux fraction, fecal material prevailed in eastern Fram Strait traps, pointing towards different systems of organic matter production and modification. These results were also confirmed by the biomarker composition pattern. Since 2014, investigations continue within a greater framework of the Arctic long-term observatory 'Frontiers of Arctic Marine Monitoring' (FRAM) that is established to improve our knowledge by using new developments and proven technologies to enable the recording of environmental and biological data in high temporal and spatial resolution.