RV Maria S. Merian

Cruise MSM130 POLAR BEAST

9th July – 14th August 2024

Reykjavik (Iceland) – Reykjavik (Iceland)

MSM130

4. Weekly Report

Reporting Period: 29th July – 4th August 2024

Sermilik Fjord in east Greenland

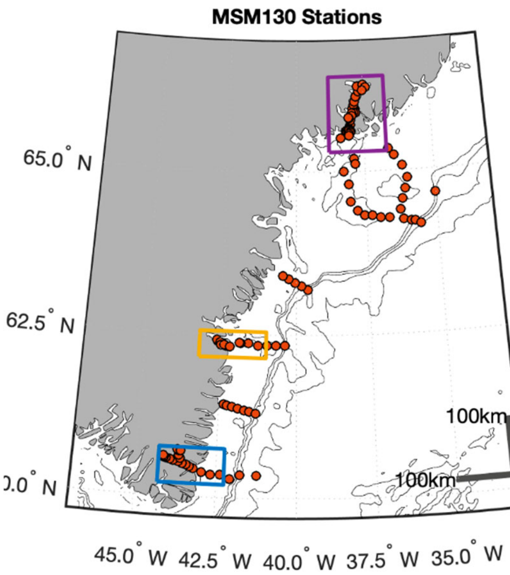

Figure 1. Overview of progress with sampling on MSM130

Progress: We are 4 weeks into our cruise programme, and made excellent progress with our sampling programme (Fig. 1)). We are currently sailing at 65°36 N, 38°05 W in our study area near Sermilik Fjord. We had a very successful week in Sermilik Fjord and conducted in-depth surveys in the fjord on physics, particle transport and biogeochemistry (Fig. 2). We were able to sample right at the glacier edge, allowing collection of valuable samples on particle release from glaciers (Fig. 3).

We endured a strong storm on July 30 whilst in the fjord (windforce 8 and above) which moved the ice and iceberg around the fjord and made operations difficult. We managed to sail from the northern part of the fjord towards the open waters outside and occupied numerous stations for CTDs, trace metal sampling, MUCs and gravity cores (Fig. 3).

On August 3 we moved into the waters outside of Sermilik Fjord to investigate the present and past transfer of material from Sermilik Fjord into the North Atlantic Ocean through CTD and coring operations. We will also assess the southward movement of polar waters in the East Greenland Current through cross shelf sections in the area.

The difficult wind, ice and fog conditions over the last 2 weeks have slowed down our progress. We will therefore make use of our remaining ship-time to study the region outside the Sermilik Fjord in more detail, and not move north to Kajser Franz Josef Fjord.

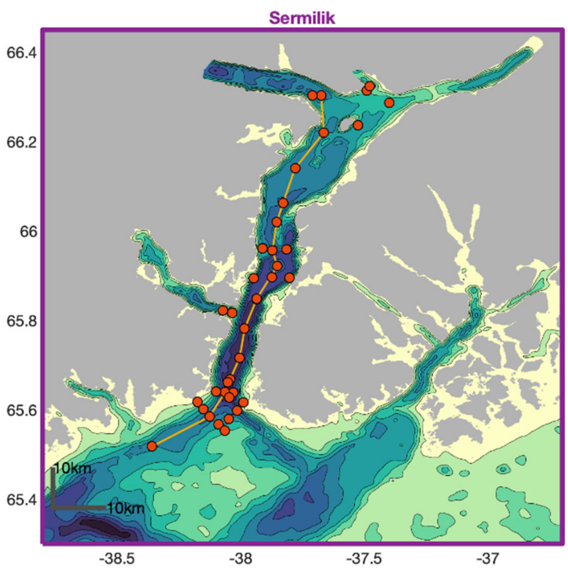

Figure 2. Station in Sermilik Fjord.

Figure 3. Sampling close to glacier in Sermilik Fjord (photo Eric Achterberg)

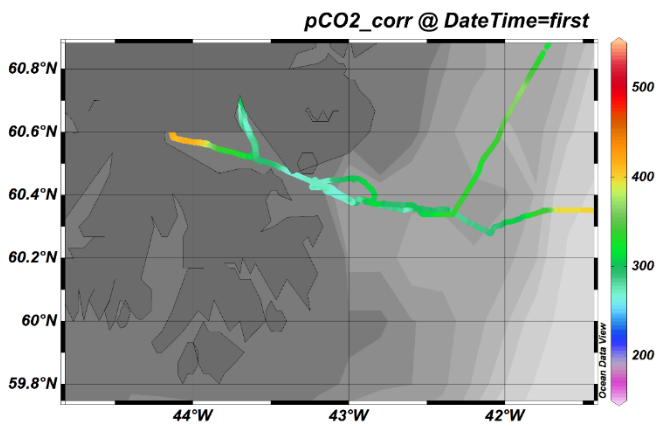

Figure 4. pCO2 in surface waters outside and within Lindenow Fjord (data Mario Esposito).

Surface water pCO_2 observations: High latitude fjord systems are considered net CO_2 sinks, with carbon storage in sediments. To investigate this, we collect sediment samples and also water samples on the CTD casts from surface waters to the seafloor for land-based analysis of dissolved inorganic carbon and total alkalinity. In addition, Dr. Mario Esposito (GEOMAR) is conducting continuous surface water measurements of total alkalinity, pCO_2 and pH. The underway measurements are conducted from the ship's underway supply, which is taking water from a depth of 6.5 m. The pCO_2 measurements are conducted every minute, and the sensor is based on infrared detection of CO_2 after membrane equilibration (Contros HydroC sensor).

The pCO_2 data (Fig. 4) indicates values below current atmospheric pCO_2 (ca. 424 ppm) on the shelf outside Lindenow Fjord and gradually increasing inside the fjord towards atmospheric pCO2 levels. These observations indicate drawdown of pCO_2 levels in the surface waters on the shelf due to primary productivity, with a decrease in productivity towards the inner fjord. The Sermilik Fjord showed contrasting conditions with enhanced productivity and consequent

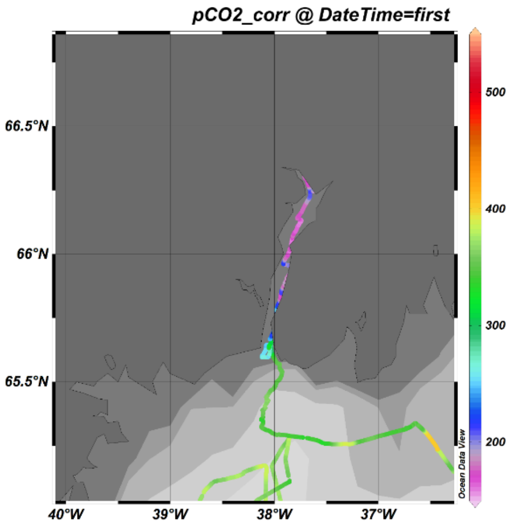

Figure 5. pCO2 in surface waters outside and within Sermilik Fjord (data Mario Esposito).

CO_2 uptake by phytoplankton. The pCO_2 decreased below 200 µatm in the inner Sermilik Fjord, indicating pronounced uptake of atmospheric CO_2 in the fjord system (Fig. 5).

Underwater Vision Profiler: We are deploying an underwater vision profiler (UVP) on our stainless steel CTD frame (Fig. 6). The UVP is operated by Emilia Trudnowska (IOPAN, Poland), The UVP provides high performance images using a camera that takes rapid pictures of an illuminated parcel of water under the CTD frame.

The role of the UVP is twofold: 1) as an intercalibrated camera-based counter it provides concentrations of particles in the size range between 80 and 2000 µm, and 2) provides images of plankton and marine aggregates of the size > 700 µm. So far more than 100 of depth profiles have been performed and showed that the patterns of concentrations of particles differed clearly between the investigated fjords, with the peak abundances confined to the very upper layer in Lindenow fjord, the subsurface peak at approximately 200 m in Mogens fjord and very wide range of deep plumes observed in Sermilik (Fig. 7).

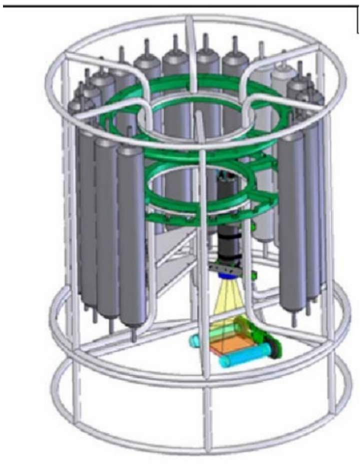

Figure 6. The UVP system in use on MSM130. View of the UVP lamps that illuminate a volume of seawater to allow camera to image particles and zooplankton (modified from Picheral et al., 2010, modified by Chris Galley).

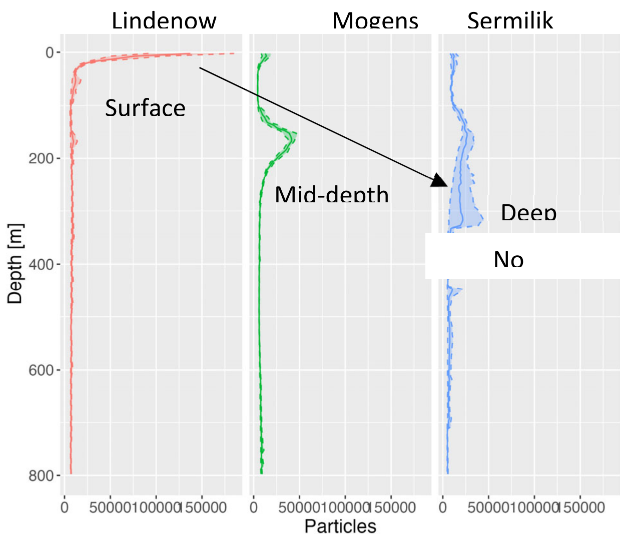

Figure 7. Vertical profiles of concentrations of particles averaged over fiords.

RV Maria S. Merian at sea 65°36 N, 38°05 W

Eric Achterberg, GEOMAR Helmholtz Centre for Ocean Research Kiel/University of Kiel
You can follow our Ocean Blog at http://www.oceanblogs.org/msm130