RV Maria S. Merian

MSM130

Cruise MSM130 POLAR BEAST

9th July – 14th August 2024

Reykjavik (Iceland) – Reykjavik (Iceland)

3. Weekly Report

Reporting Period: 21st July – 28th July 2024

Towards Sermilik Fjord in east Greenland

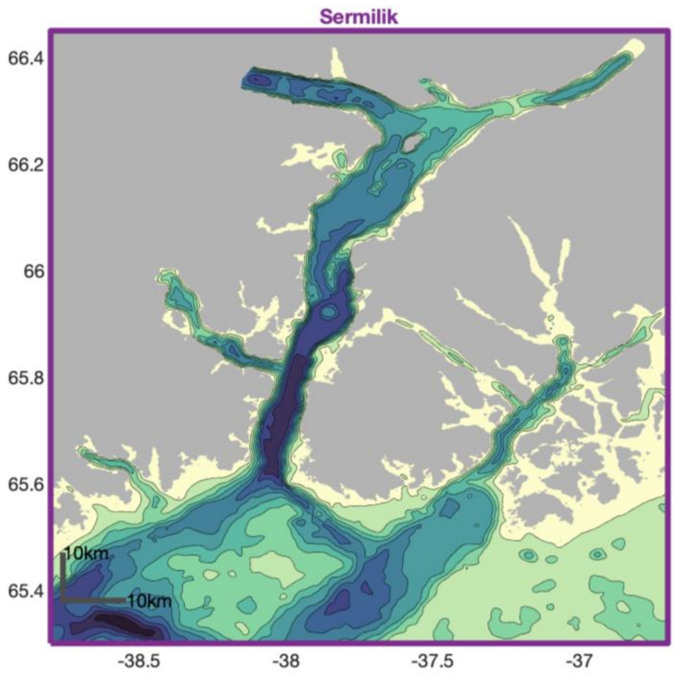

Figure 1. Sermilik Fjord in southeast Greenland

Progress: We are 3 weeks into our cruise programme, and sailing at 65°46 N, 37°59 W in our third study area of the Sermilik Fjord. We had a very eventful week with cross-shelf sections in the region between Mogens Heinesens Fjord and Sermilik Fjord and a lot of dense ice and thick fog. The shelf work included more than 20 stations and geophysical surveys. We finally arrived in Sermilik Fjord (Figure 1 and 2) this morning (July 28) and started operations with the CTD, trace metal clean Niskins on the Kevlar wire, multi-corer and gravity corer.

The delayed arrival at Sermilik was the result of heavy ice and fog on the shelf between Mogens Heinesens and Sermilik Fjords, with a wide and dense ice cover blocking Sermilik Fjord. The ice situation is this year very difficult for the late July period. We therefore had to wait to sail into the Sermilik until July 27th when the ice conditions had improved sufficiently.

A French yacht of 22 m length had attempted to cross the dense ice region and reach Sermilik Fjord, but got stuck in the ice in thick fog. The skipper had no up to date ice charts and got into difficulties and had to send out a Mayday call. Maria S. Merian moved to the area and positioned itself next to the dense ice region. The visibility and ice conditions were treacherous and prevented us from sailing into the ice. Fortunately, the ice broke up sufficiently to allow our vessel to escort the yacht out of the ice and into safety. They continued their voyage to Reykjavik, and we continued our shelf work until ice conditions improved later in the week.

We will work in Sermilik Fjord over the coming days and then sail north to Kejser Franz Josef Fjord.

Figure 2. Arrival of Maria S. Merian in the rain in Sermilik Fjord (photo Eric Achterberg)

Mogens Heinesens Fjord; oceanographic conditions: In the period July 18th to 20th, Maria S. Merian (MSM) took measurements across the main transect of the fjord Sikuijivitteq (also known as Mogens Heinesens Fjord) in southeast Greenland. Several tidewater glaciers terminate in Mogens Heinesens. The ice conditions restricted us from taking measurements in the inner fjord (further west than 42°38'W), but MSM was able to capture the water characteristics in the fjord and on the adjacent continental shelf, which links the fjords to the open ocean. These measurements will help us to better understand how Greenland glacier melt due to climate change affects both local ecosystems within the fjords and more large-scale conditions outside of the fjord through export from the fjord to the shelf.

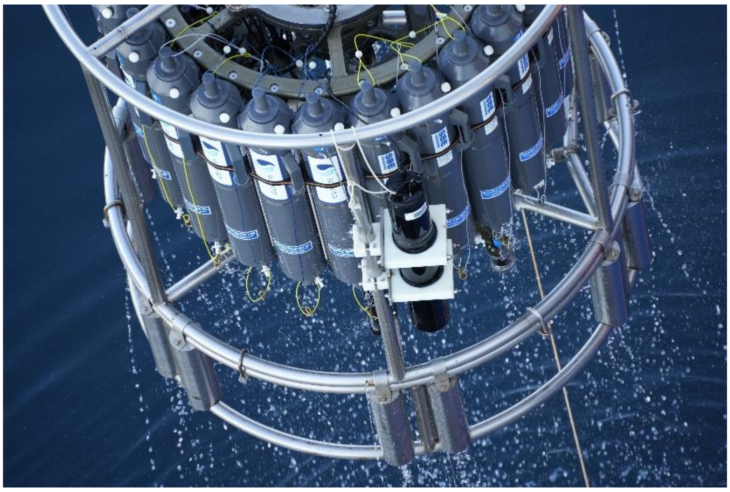

Figure 3. Retrieval of CTD (photo Eric Achterberg)

While a lot of activities on the ship focuses on filtering of seawater samples for analysis in the home laboratories post-cruise, some ocean data becomes readily available when lowering CTD rosette frame (Fig. 3) over the side of the ship by the physical oceanography team: Lukas Lobert and Hilde Oliver. These data, presented in panels A to E of Fig. 4 give a first idea at the ocean conditions and help to decide where to collect water samples for further analysis. Here, we show contours of various pre-processed ocean variables, spanning from the open ocean (on the left) to the mid-fjord (on the right) to characterize the conditions in Mogens Heinesens Fjord and on the adjacent shelf.

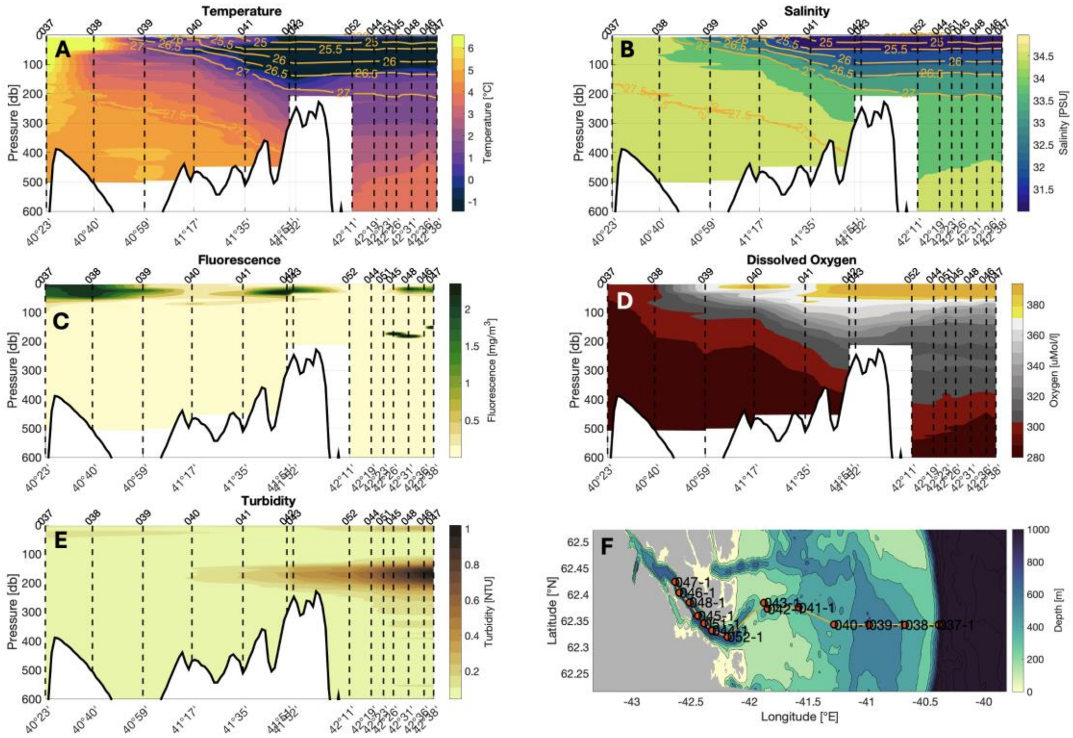

Figure 4. Oceanographic conditions in Mogen Heinesens Fjord. Panel A: temperature; B: salinity; C: Fluorescence; D: dissolved oxygen; E: Turbidity and F: station locations in Fjord. Lukas Lobert.

The fjord entrance is just west of station 52. Locations of measurement are marked with vertical dashed lines. Temperature (panel A) and salinity (panel B) provide information about the water characteristics and allow a first guess of where the present water might have originated from. Salty and warm water to the east is called ‘Atlantic Water,’ which can rapidly melt ice in the fjords. So-called ‘Modified Atlantic Water’ has previously made it into Mogens Heinesens Fjord and this warm and salty water is omnipresent below roughly 300 m depth. In contrast, the surface waters within the fjord and its entrance are considerably colder and less salty. This water mass is called ‘Polar Water’ and likely originates from local ice melt. The rapid changes in temperature and salinity on the continental shelf cause an East-West density difference between stations 39 and 43, which drives an ocean current to the south, the so-called East Greenland Coastal Current. Density contours are shown in both panels A and B as ocean-density – 1000 kg/m^3. Dissolved oxygen (panel D) corresponds well with salinity and temperature, which makes us believe that oxygen in the area was mainly distributed by physical processes, i.e., ocean currents and mixing.

Bio-optical sensors on the CTD frame capture more detailed water characteristics. Fluorescence (panel D) indicates the amount of biomass (phytoplankton) in the water column without the need to filter the water in the lab. We use fluorescence to determine where to take water samples for further bio-geochemical analysis in the laboratory. Turbidity (panel E) is a measure of how murky the water column is, either from suspended sediments in the water column or biology. We believe that the strong subsurface maximum of turbid water in the fjord at roughly 180 m depth originates from subsurface glacier melt further inside the fjord. According to previous scientific work, the tidewater glacier releases melted freshwater at its base, which rises fast since it is lighter than the surrounding salt water. On its way to the surface, the so-called meltwater ‘plume’ mixes with the surrounding salt water until the plume gets so heavy that it cannot rise any longer. The plume contains sediments from the glacier and is slightly warmer when compared with shelf water at the same depth. On its way towards the mouth of the fjord and the shelf, the plume thins out due to mixing with the surrounding water. Measuring the chemistry and biology within these plumes is a main objective of this cruise and we many water samples within the plume.

RV Maria S. Merian at sea 65°46 N, 37°59 W

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