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## Short Cruise Report

**MSM110**

**Reykjavik - Reykjavik**

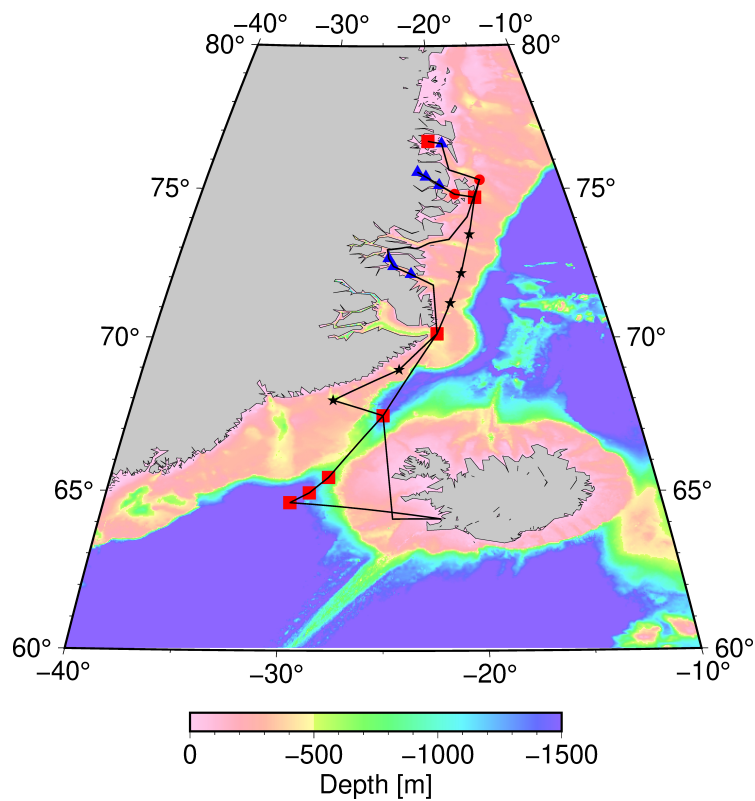
**07.08.2022 – 29.08.2022**

**Chief Scientist:**

**Prof. Dr. Helmuth Thomas**

**Captain:**

**Ralf Schmidt**



## Objectives

The cruise MSM110 will lead into into three selected fjords along the coastline of East Greenland in August 2022, i.e. during late summer with minimal ice coverage) as an important element of the HORIZON-2020 supported project ECOTIP. ECOTIP aims at improving our understanding of anthropogenic changes in the biological production and diversity in the Arctic marine regions, and their effects on the ecosystem services. Special emphasis is put on evaluating whether a change in the lower trophic levels due to the increased temperature and freshwater outflow or other physico-chemical conditions can trigger an ecosystem tipping cascade that ultimately will change benthic-pelagic coupling, carbon sequestration and fisheries production.

## Narrative

The first days were spent in arriving and setting up, which was started by a small vanguard on 4.8. Most of the voyage participants were confronted with the spectacle of a volcano erupting on 3.8.2022 during the approach to Reykjavik, but this apparently did not lead to any noticeable stress. Equipment and cargo were in place on time, so the ship was ready to depart on schedule to begin expedition MSM110. Unfortunately, however, for one participant who had been in Greenland prior to the trip, the weather had other plans and made it impossible for her to leave Greenland and thus to arrive in Reykjavik for several days. The departure from Reykjavik was therefore postponed by one day, so that MSM 110 left Reykjavik at about 11am on 7.8.2022 and is now on the approach to the first station. This station is located in an area central to the global climate, the Denmark Strait Overflow Water, which is one of the crucial links between the Arctic deep water formation areas and the southward currents of the deep North Atlantic.

Two of the main objectives of the H2020 project ECOTIP focus on the impact of environmental, climatic and anthropogenic changes on Arctic ecosystems and their interactions with the North Atlantic. MSM110 investigates Arctic marine ecosystems along the East Greenland coast, especially in fjords, and their interactions with the East Greenland shelf. At the first station on 8.8.2022, just north of Denmark Strait, which separates the Greenland Sea in the north from the Irminger Sea in the south, a CTD station of several hours was carried out to record physical, chemical and biological parameters, which together with the stations to be sampled later in the shallower central part as well as the more southern side will then provide information about the interactions, especially biological, between the Arctic ecosystems and those of the North Atlantic. The station, located approximately at 67°30'N / 25°W, was then extensively sampled. Logistically, this was "a jump in the deep end" for us and the ship's crew, as almost all parameters were sampled at this first station shortly after departure. However, thanks to the expert support provided by the ship, there were no problems whatsoever.

Due to the short-term withdrawal of the permission to sample the Kangerlussuaq Fjord as the southernmost fjord of this cruise, for the protection of the narwhals, we left the station at Denmark Strait directly in northwesterly direction to the Greenland coast and sampled the surface of two underway stations on the Greenland shelf on 8.8. and 9.9. during our cruise northwards.

Later on 9.8. we arrived at the mouth of Scoresby Sound, located about 70°11'N / 21°28'W, our first permanent station. Here, as a special event, we met RV Polarstern in the evening hours, the two ships lay alongside for a while before RV Polarstern then continued its journey into Scoresby Sound. The extensive sampling at this station now also included sediment sampling, so that we were already able to implement one of the MSM110 main goals here, a sampling of the marine ecosystems as comprehensively as possible.

After completion of this long station, we continued our journey north along the Greenland coast and sampled 3 more underway stations during this time. In the early morning hours of Aug. 12, 2022, we then reached the shelf area off Ardencaple Fjord, which was sampled with 2 stations. The more ocean side shelf station, approx. 74°45'N / 17°30'W, was again sampled very extensively and similar to the station at Scoresby Sound, while "only" water column samples were taken at the more land side shelf station.

The cruise then took us further into Ardencaple Fjord, partly through intermittent ice fields, which in the evening sun provided ample opportunity to photograph this picturesque situation.

In the early morning hours of the 13.08.2022 we reached then the land-side end of the Ardencaple Fjord, into which directly a glacier flowed. Here we then conducted another permanent station, this time including the 24-hour deployment of a sediment trap, so that all target parameters of the physical, biological, geological, and chemical environment could be successfully sampled here. In order to obtain samples close to the glacier and the surface, sampling was also carried out from a zodiac in the immediate vicinity of the station, which will facilitate special insights into the surface layer, which is lapped by fresher water, as well as into the direct influence of the glacier meltwater and its composition. On August 14, 2022, an almost identical daily program was carried out at a station centrally located in the fjord. As a special feature on this day, we succeeded in obtaining samples with a salinity of about  $S_p=4$ , which corresponds to almost pure fresh water, in an outflow of a glacier located far inland. Thus, as one of the main "chemical" targets, we are able to map as well as possible the entire salinity range for this fjord. On these two stations also all further work could be carried out quite successfully, so that we are now on our way to the outer station in Ardencaple Fjord after the end of the 2nd permanent station in the morning of 15.8.2022.

The main focus of cruise MSM110 is the detailed sampling of three East Greenlandic fjord systems that (ideally) cover different climatic, topo- and geographic as well as ecosystem conditions. Sampling will be as comprehensive as possible in the water column, sediments and with sediment traps and is planned for 24 hours per station. Typically, the first activities will be acoustic measurements of topography and sediment structure at the station and determining the location for trap deployment. At the beginning of week 2 of MSM110, we began this in Ardencaple Fjord and sampled the third and outer station here on 8/15.

After finishing this station, we set out on the approximately half-day trip to the entrance to Dove Bight. The Fahrt was accompanied by more wind and a snowstorm, so at times some snow actually accumulated on the ship. However, the weather conditions proved favorable for us as the wind had driven the ice in the entrance to Dove Bight so that we could easily get into the bay and to the stations at the head of the bay. This had looked somewhat hopeless when we left Reykjavik.

In the late evening of the 16.8. we carried out a CTD station on the shelf in front of Dove Bight, before we reached the first station in Dove Bight on 17.08.2022 in the morning. The trip there had taken a little longer than originally planned, because for the protection of the narwhals, which so far have remained invisible to us, only a maximum speed of 5kn was allowed. In the Dove Bight, which was partly characterized by drifting ice, we then conducted two all-day permanent stations from 17.08.2202 to 19.08.2022.

After completing the last station in Dove Bight, we then headed south again for about 36 hours, into Kong Oskar Fjord, where we started our first permanent station early in the morning on 21.08.2022. The Dove Bight saw us off with a late halfway point party in gorgeous weather, we continued this steam route in beautiful weather under the Greenland coast, while the scientific part of the crew could use the time to catch back a bit

their breath quite well.

The last working week of cruise MSM110 was dominated by sampling Kong Oskar Fjord, where, as in the other fjords before, three permanent stations were conducted. The program was similar to the other long-term stations, with sediment traps deployed for 24 hours, CTD and sediment sampling. Samples were also taken by zodiac near the, rarely found, freshwater outlets, so from a chemical point of view, we may hope to be able to characterize the freshwater sources well. After finishing the last permanent station on the morning of 24.8.2022 we started our return journey towards Reykjavik, which first led us back to our first station in the northern part of the Denmark Strait. Here we were able to complete the initial sampling with multiple nets and sediment cores. During three more stations we sampled the Denmark Strait extensively with CTD, multinet and sediment samples, and successfully completed the work in the early morning hours on 28.8.2022. We are now heading directly towards Reykjavik and expect our arrival on 29.08.2022 around 9am.

## **Acknowledgments**

The great support by the ship's crew and Cpt. Schmidt is gratefully acknowledged. Without the tremendous and efficient collaboration of the Leitstelle, who facilitated solutions to all accompanying problems, this expedition would not have been possible. The expedition contributed to the H2020 project ECOTIP, grant #869383.

## Teilnehmerliste

Helmuth Thomas, chief scientist, Hereon

Camilla Svensen, Sediment traps, UiT

Ingrid Wiedmann; Sediment Traps, UiT

Chantal Mears, Radium Isotope, Hereon

Claudia Schmidt, Trace Metals, Hereon

Niklas Hempel, Trace Metals, Hereon

Tristan Zimmermann, Microplastic, Hereon

Phoebe Armitage, box coring, whale observer, Abo

Elena Terzić, e-DNA, Sopot

LOPEZ-QUIROS, Adrian, coring, Aarhus

Pavla Debeljak, Viruses, Vienna

Delove Abraham Asiedu, Incubations, DTU

Sigrun Huld Jonasdottir, Zooplankton, DTU

Joanna Davies, coring, Aarhus

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Thomas Reinthaler, Viruses, Vienna

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Olivia Dawn Rempel, Journalist, GRID

## Institutes:

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ECOTIP coordinator

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The Arctic University of Norway, Tromsø, Norway

University of Vienna, Vienna, Austria

GRID Arendal (UNEP), Arendal, Norway

## Stations list:

Station	Date, Time	Latitude	Longitude	Depth (m)	Comment
MSM110_0_Underway-1	03/08/2022 08:37	64° 09,227' N	021° 56,427' W	3586	surface CTD
MSM110_1-1	08/08/2022 11:49	67° 30,629' N	025° 01,250' W	1398	water colum CTD
MSM110_0_Underway-2	08/08/2022 16:21	67° 31,053' N	025° 01,062' W	1398	surface CTD
MSM110_0_Underway-3	08/08/2022 16:21	67° 31,053' N	025° 01,062' W	1398	surface CTD
MSM110_0_Underway-3	28/08/2022 03:30	64° 40,995' N	029° 59,953' W	2232	surface CTD
MSM110_0_Underway-2	28/08/2022 03:30	64° 40,995' N	029° 59,953' W	2232	surface CTD
MSM110_2-1	08/08/2022 23:43	67° 59,995' N	028° 00,101' W	689	water colum CTD
MSM110_3-1	09/08/2022 10:42	68° 59,991' N	024° 00,004' W	253	water colum CTD
MSM110_0_Underway-4	09/08/2022 13:25	69° 17,663' N	023° 22,923' W	235	surface CTD
MSM110_4-1	09/08/2022 19:59	70° 11,798' N	021° 30,373' W	504	24h station
MSM110_5-1	11/08/2022 03:41	71° 12,003' N	020° 24,023' W	352	water colum CTD
MSM110_6-1	11/08/2022 10:23	72° 11,994' N	019° 24,026' W	275	water colum CTD
MSM110_7-1	11/08/2022 18:31	73° 29,986' N	018° 23,978' W	232	water colum CTD
MSM110_8-1	12/08/2022 03:01	74° 42,356' N	017° 25,878' W	275	24h station
MSM110_9-1	12/08/2022 20:32	74° 51,823' N	019° 05,942' W	321	water colum CTD
MSM110_10-1	13/08/2022 06:56	75° 38,058' N	022° 00,536' W	492	24h station
MSM110_11-1	14/08/2022 08:35	75° 27,548' N	021° 20,558' W	401	24h station
MSM110_12-1	15/08/2022 12:52	75° 10,199' N	020° 17,409' W	389	24h station
MSM110_13-1	16/08/2022 23:52	75° 20,566' N	016° 49,071' W	321	water colum CTD
MSM110_14-1	17/08/2022 17:27	76° 35,645' N	019° 37,864' W	156	24h station
MSM110_15-1	18/08/2022 21:45	76° 40,549' N	020° 51,698' W	156	24h station
MSM110_16-1	21/08/2022 05:37	72° 41,986' N	024° 34,999' W	606	24h station
MSM110_17-1	22/08/2022 09:41	72° 25,886' N	024° 14,347' W	504	24h station
MSM110_18-1	23/08/2022 12:35	72° 10,232' N	023° 02,980' W	389	24h station
MSM110_19-1	25/08/2022 16:18	67° 30,026' N	025° 00,067' W	1405	water column CTD, coring
MSM110_20-1	26/08/2022 20:19	65° 30,016' N	027° 59,977' W	848	water column CTD, coring
MSM110_21-1	27/08/2022 05:45	64° 59,996' N	028° 59,952' W	1370	water colum CTD
MSM110_22-1	27/08/2022 12:09	64° 41,006' N	029° 59,986' W	2233	water column CTD, coring, nets

### 24h station:

CTD, plankton nets, sediment trap, coring