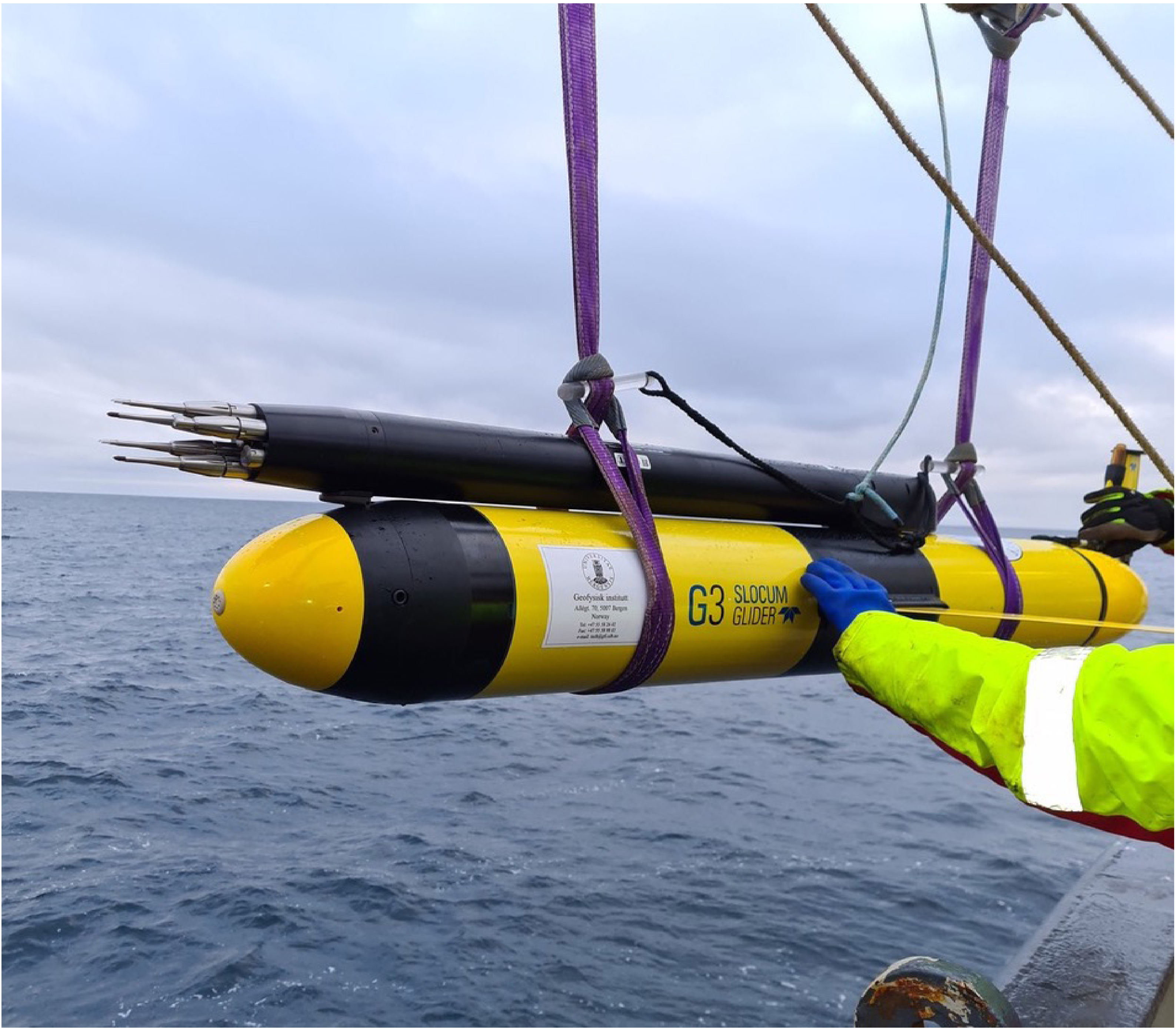
Polar Front Process Cruise 2022

Cruise Report



The Nansen Legacy Report Series 39/2023

Polar Front Process Cruise 2022: Cruise report

Cruise 2022625

R/V Kristine Bonnevie

Tromsø-Tromsø

18 September – 13 October 2022

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Summary
The cruise KB2022625 (28. September 2022, Tromsø to 13. October 2022, Tromsø) aboard the Research Vessel Kristine Bonnevie is a Polar Front process studies cruise of the Nansen LEGACY project.

The study region covered the steep topographic slope southeast of Bjørnøya and the Polar Front region between Hopen and Storebanken, all-in-all spreading 73.5°- 78°N and 19.5°-34.5°E. The objectives are to study frontal mixing processes using microstructure profilers, to deploy and recover a short-term mooring at the Polar Front and to deploy and recover an underwater glider equipped with turbulence sensors. The overarching goal is to collect data allowing for the analysis of physical processes at the Polar Front on sub-tidal to synoptic timescales. Combined with data from previous cruises, the timescales of investigation may be expanded to seasonal and inter-annual periods.

During the cruise, we collected measurements of ocean stratification, currents, and microstructure from the vessel as well as from transects using an ocean glider. From the vessel we obtained 267 microstructure profiles down to 0-20 m above seabed, 62 CTD/LADCP profiles down to 5 m above seabed (all with salinity calibration samples taken at the deepest point), and 14 days of underway current profiles. From the glider we obtained 207 profiles (7 days) including using microstructure sensors in the Polar Front region between Hopen and Storebanken.

1 Background

The cruise KB2022625 aboard the Research Vessel Kristine Bonnevie is a process studies cruise of the Nansen LEGACY project. LEGACY aims to establish a holistic understanding of a changing Arctic Ocean and ecosystem and will provide the observation-based scientific knowledge needed for future sustainable resource management in the Barents Sea and the adjacent Arctic Basin.
KB2022625 is a physical oceanography cruise with the objective to investigate processes associated with the position and variability of the Barents Sea Polar Front separating warm and salty Atlantic Water (AW) in the southwest from colder and fresher Polar Water (PW) in the north. The front is especially pronounced on the sill between Hopen and Storebanken but extends to a degree all along AW inflow pathways. The region around Bjørnøya is known for vigorous tidal currents; in conjunction with steep topography, these currents may cause substantial mixing between the inflowing AW and surrounding waters. To test this hypothesis, we conduct hydrographic sections across the continental slope south of Bjørnøya. Along this section, we perform two separate 24-h stations of repeat microstructure casts, to capture the temporal change of mixing over complete tidal cycles.
At the Polar Front on the sill spanning between Hopen and Storebanken, we investigate temporal variability up to synoptic time scales using short-term (~1 week long) mooring and glider deployments. These observations are complemented by ship-based hydrographic transects and ocean mixing measurements.
The cruise contributes to tasks T1-1 on the Atlantic Water inflow to the northern Barents Sea at key gateways, T1-2 on processes that control sea ice and stratification in the northern Barents Sea. More specifically, the cruise contributes to deliverables associated with subtasks:

T1-1.2 Ocean and sea ice fluxes into the northern Barents Sea
T1-2.1, Oceanic processes
T2-1.1. Current variability and drivers of ocean acidification

This report provides an overview of the methods employed and the data collected.

2 Survey area

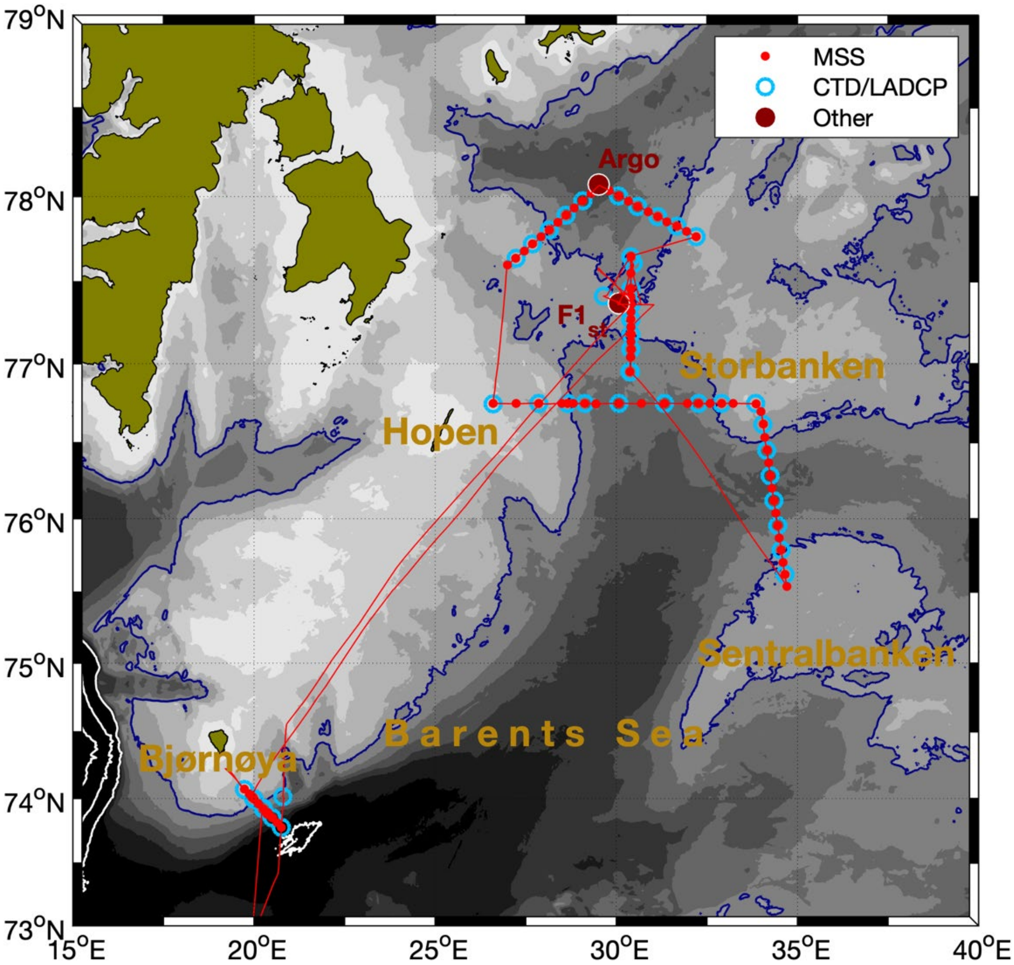

Figure 1: Map of the study area with shading indicating topography (IBCAOv4, darker (lighter) indicates deeper (shallower)). The 200 m isobath is drawn in blue. The cruise track is given as red lines. MSS microstructure profiler stations are shown as red dots and CTD/LADCP profiles as blue circles. The deployment sites of the F1_st (short-term) mooring and Argo floats are indicated.

3 Activity reports

We collected measurements of ocean stratification, currents, and microstructure from the vessel as well as from transects using ocean gliders. From the vessel we obtained 267 microstructure profiles down to 0-20 m above seabed: 62 CTD/LADCP profiles down to 5 m above seabed, and 14 days of underway current profiles. From gliders we obtained 207 profiles (7 days) including using microstructure sensors in the Polar Front region.

3.1 Hydrography

The hydrographic work was carried out using a CTD-water sampling package from SeaBird Inc., acquiring data during both down and upcast. The package consisted of a SBE 911plus CTD (SN: 09P0510) with sensors listed below. An altimeter allowed profiling close to the bottom. The CTD was equipped with a 12 position SBE 32 Carousel (SN 32-1109). The rosette was fitted with one 10-litre bottle for collecting water samples for salinity calibration at all stations. Because temperature and salinity profiles are also obtained from the MSS microstructure casts, we performed somewhat fewer CTD-casts (usually every other station on the sections). In total 62 CTD-stations were taken, recorded in files sta1121 to sta1182. Their locations are listed in Appendix I. Station positions are shown in Figure 1. At all stations, water samples for salinity calibration were collected at the deepest sampling level.

Table 1: Sensors installed on the CTD rosette

Sensor	SN
Temperature	5234
Conductivity	4387
Pressure	70766
Temperature, 2	5183
Conductivity, 2	4727
Altimeter	67087
Oxygen, SBE 43	3087
Fluorometer, Chelsea Aqua 3	FLRTD-
Par/Irradiance, Biospherical/Licor	70656
SPAR/Surface Irradiance	20539
RDI WH300 L-ADCP, downward	10012
RDI WH300 L-ADCP, upward	10151

3.1.1 Data processing

SBEDataProcessing-Win32, standard Seabird Electronics software for Windows (version 7.23.2), is used for post-processing of the CTD data. Only data from downcasts are used to avoid turbulence caused by rosette package on the upcast. Raw data (pressure, temperature and conductivity from dual sensors) are converted to physical units using calibration files modified for air pressure and conductivity slope factor (DATCNV). Outliers, differing more than 2 and 20 standard deviations for the first and second pass, respectively, from the mean of 100 scan windows are flagged and excluded from analysis (WILDEDIT). WILDEDIT flags only the bad data point of each parameter and does not flag the entire scan. The thermal mass effects in the conductivity cell are corrected for (CELLTM, with parameters alpha = 0.03 and 1/beta = 7.0). Pressure is low-pass filtered with a time constant of 0.15 s. Following the SBE recommendation, the conductivity or temperature signals were low-pass filtered. Auxiliary sensors (oxygen, flC, Trans) were filtered using a time constant of 0.03 s. Scans when the CTD package moved less than the set minimum fall rate of 0.25 m s^{-1} are flagged to remove pressure reversals due to ship heave (LOOPEDIT). Data are then averaged (BINAVG) into 1-dbar vertical bins and 1-s temporal bins (the latter is for the LADCP data processing).
In the final (converted and bin-averaged) data files, temperature is saved using the ITS-90 scale, and salinity on the practical salinity scale (PSS-78). Pressure, temperature, and salinity data are accurate to ±0.5 dbar, $\pm 2\times 10^{-3}$ °C, and $\pm 3\times 10^{-3}$, respectively.

3.1.2 Comparison of the sensor sets 1 and 2

The CTD package was equipped with two sets of temperature and conductivity sensors. Below figures show a comparison of the records from the temperature (Figure 2) and the conductivity (Figure 3, as derived salinity) sensors, as the difference of the sensor pairs, its histogram, and the RMS value of the difference for each profile throughout the cruise. Temperature measurements agree very well, with profile-averaged RMS values to within 0.016°C. Apart from two outliers, the profile-average RMS differences for salinity are less than 0.012. However, investigation of profiles showed that the conductivity probe of CTD 2 was less noisy than the probe of CTD 1. CTD 2 is thus used for scientific analyses.

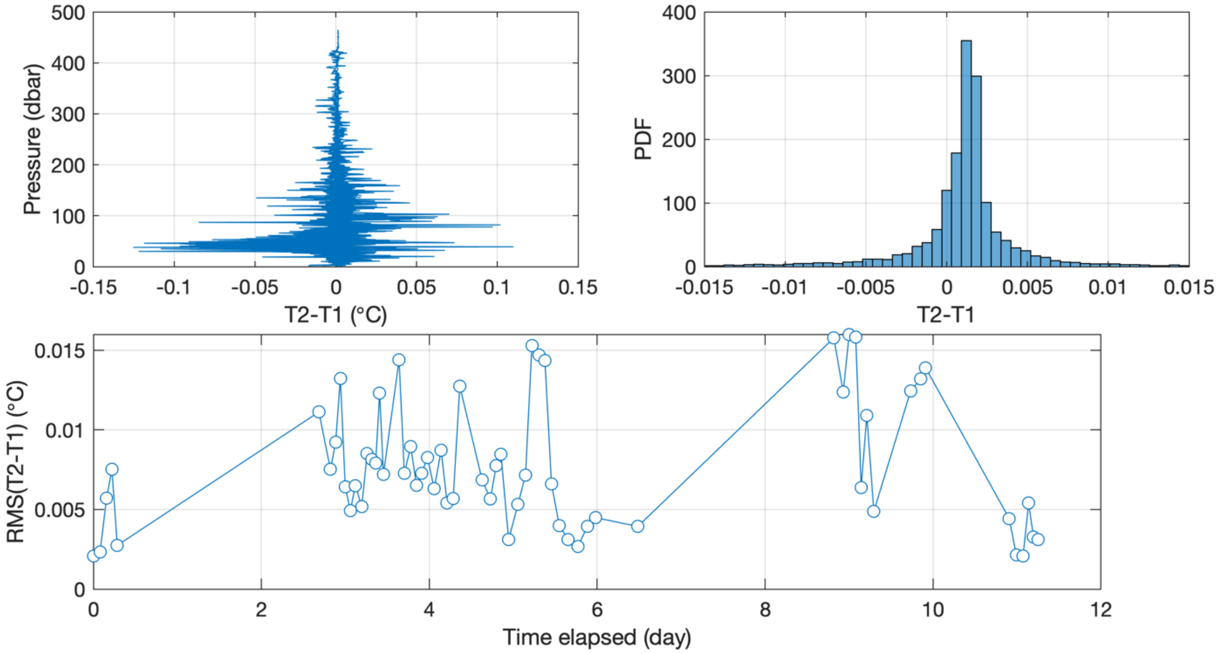

Figure 2: Comparison of temperature measurements from the two SBE units. Profiles of difference between the two sensors, its histogram, and RMS temperature difference for each profile throughout the cruise.

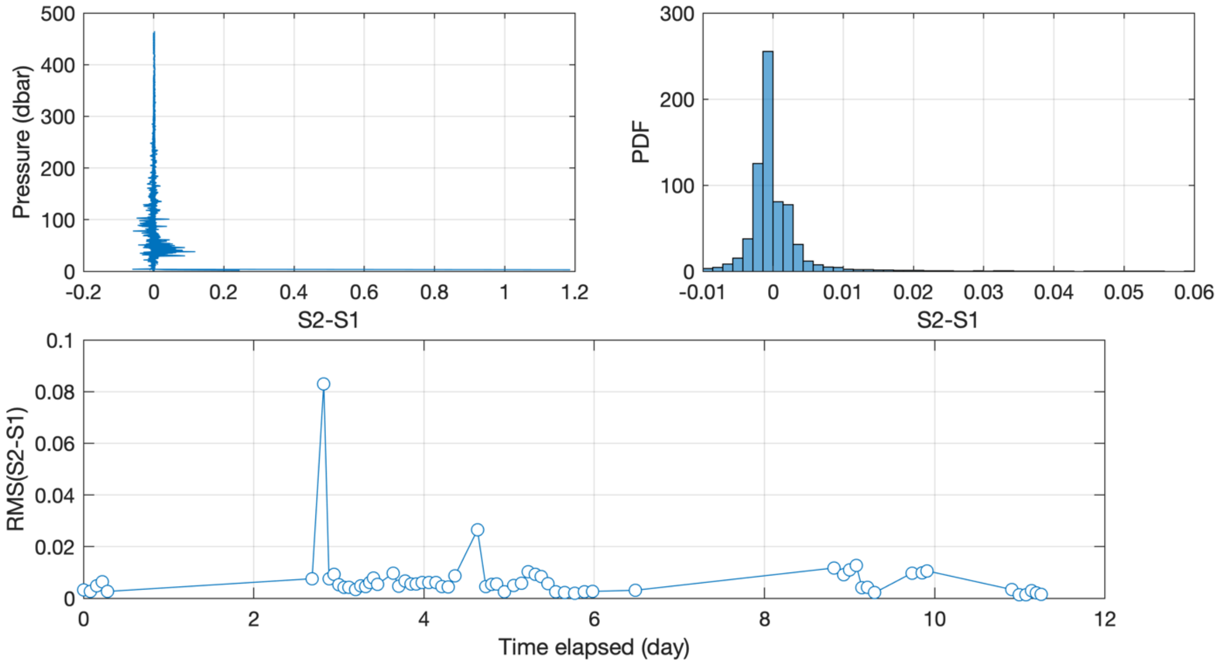

Figure 3: As in Figure 2, but for comparison of the salinity measurements from the two SBE units.

3.1.3 Conductivity correction form salinity bottle samples

A total of 62 salinity bottle samples are analyzed at IMR with a Guildline Portasal 8410 salinometer. Salinity and conductivity values measured by the Portasal for each sample are compared with the corresponding CTD data.

The histogram of $\Delta C = C_{CTD} - C_{Bot}$, difference of conductivity measured by CTD and inferred from the Portasal, is already nearly normally distributed (Figure 5). Following the recommendations given by Seabird Electronics, the conductivity values are corrected by the formula, $C_{new} = m\, C_{old}$, where m is the slope calculated by

$$m = \frac{\sum_{i=1}^{n} a_i \times b_i}{\sum_{i=1}^{n} a_i \times a_i}.$$

Here a_i and b_i are the CTD conductivity and the bottle conductivity, respectively and n is the total number of bottles. The results from the selected samples are shown in the following two figures.

A slope correction of 0.99987 is obtained, which reduced the RMS salinity difference from 0.00943 to 0.00774. An alternative correction is a constant salinity offset with 0.00538 practical units, which also reduced the RMS salinity difference to 0.00775.

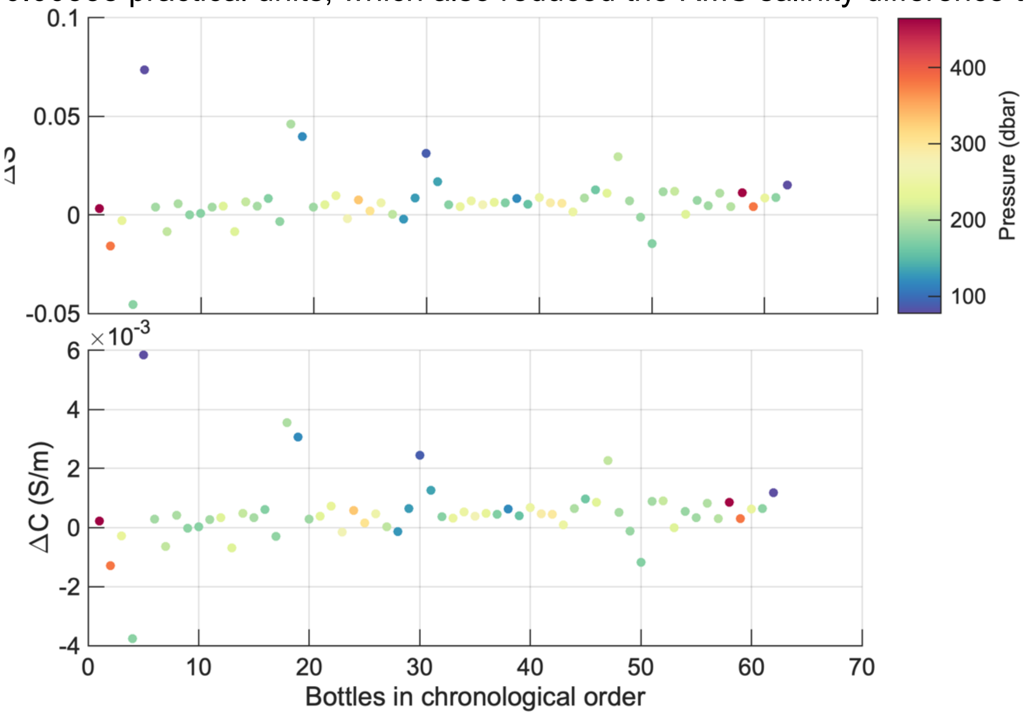

Figure 4: Difference between CTD-derived and bottle data: upper panel, salinity, lower panel, conductivity.

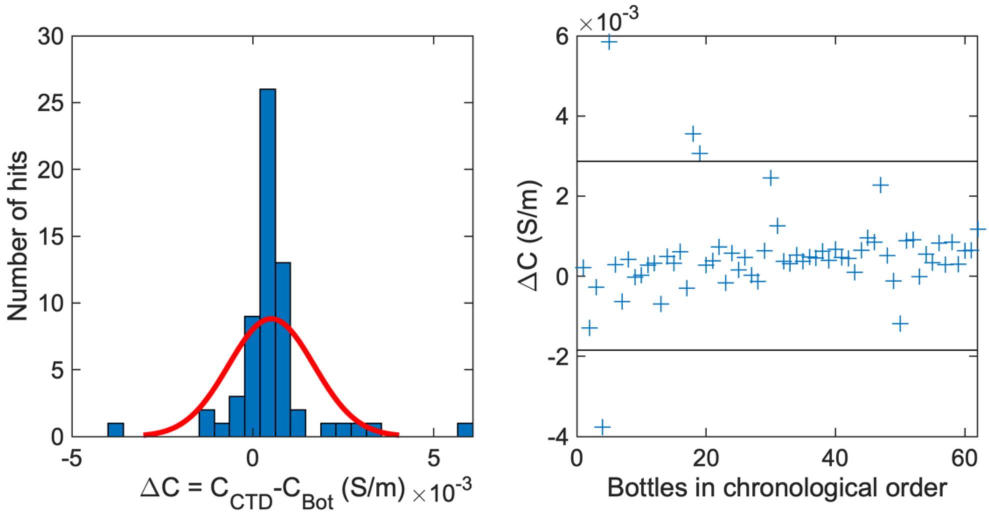

Figure 5: (Left) Histogram of CTD-derived and bottle conductivity differences. Red curve is the normal-distribution fit for the sample mean and standard deviation. (Right) ΔC in chronological order with 95% confidence intervals on the mean indicated (black envelopes).

3.2 Current profiling

3.2.1 Lowered-ADCP (LADCP)

Two LADCP-profilers (RD Instruments) were mounted on the CTD rosette in order to obtain current profiles. The ADCPs are 6000-m rated, 300 kHz Sentinel Workhorses. Each unit contained an internal battery pack (we did not have an external battery canister). Both units are installed on the rosette in a balanced distribution to ensure minimum tilt.

Each ADCP has the L-ADCP option installed. The ADCPs were configured to sample in master/slave mode to ensure synchronization. The master ADCP pointed downward (SN 10012) and the slave ADCP pointed upward (SN 10151). The compass of each instrument was calibrated on land (in Bergen) in their respective orientation prior to the cruise and the resulting compass errors were <5°. Batteries were not replaced during the cruise (i.e., a compass re-calibration was not necessary). In total 62 profiles were collected using the LADCP. Communication with the instruments, start & stop of data acquisition and data download were done using the BBTalk software. PC time (UTC) was transferred to each instrument before each cast. The vertical bin size (and pulse length) was set to 8 m for each ADCP. Single ping data were recorded in narrow bandwidth (to increase range), in beam coordinates, with blank distance set to zero. The data from the first bin are discarded during post processing. In order to mitigate a possible influence of previous pinging, especially close to steep slopes, staggered pinging with alternating sampling intervals of 0.8 s and 1.2 s were used. The altimeter worked reliably and no sign of degradation of LADCP data quality was observed.

The LADCP data are processed using the LDEO software version IX-13 based on Visbeck (2002). For each master/slave profile data, synchronized time series of CTD and navigation is used. The NMEA GPS stream is automatically stored in the CTD *.hex files with each scan and are post-processed as 1-s bin averages, same as the ADCP ping rate. LADCP-relevant processing of the CTD data included the identical steps in the SBE-Data Processing software. 5-minute time averaged profiles from the SADCP are included for additional constraint on the inversion of the LADCP data.

3.2.2 Shipboard-ADCP (SADCP)

Kristine Bonnevie has a 150KHz "Ocean Surveyor" ADCP made by Teledyne R.D.Instruments mounted in the hull of the ship. The ADCP measures with 4 beams at a 30° beam angle and reaches up to 250m depth. The ADCP is set to measure in Narrow Band (NB) mode and 50 bins of 8-m vertical thickness. Bottom tracking was disabled. The transducer alignment angle was determined to be 45.5°. Raw data (single-ping data) from the ADCP is collected and automatically processed by the ship software that is based on the UHDAS routine generating short-term and long-term averages. Data below the bottom and interference with other acoustic instruments is automatically removed. Preliminary post-processing of the NB data was applied using the UHDAS software available at https://currents.soest.hawaii.edu. The post-processing includes small corrections in the heading and amplitude calibrations, as well as manual removal of bad data close to the surface, below the bottom and in the ocean interior. The manual removal is based on outliers, the bottom topography and low values of “percent good” of the measurements. Typical final processed horizontal velocity uncertainty is 1-2 cm s^{-1}.

3.3 Microstructure profiling

Ocean microstructure measurements were made using the Microstructure Sensor Profiler (MSS, Sea&Sun Technology, Germany). We used the long version, MSS90L (SN 047). It is a loosely tethered free-fall instrument equipped with two airfoil probes aligned parallel to each other, a fast-tip thermistor (FP07), an acceleration sensor and conventional CTD sensors for precision measurements. The shear probes used were SN067 (sensitivity 4.63e-04, SHE1) and SN068 (sensitivity 4.60e-4, SHE2). The same sensors were used throughout the cruise. The MSS probe was serviced and calibrated in May 2021.

The sensors point downward when the instrument profiles vertically, and all sample at 1024 Hz. The instrument is ballasted for a typical fall speed of 0.6-0.7 m s^{-1} and is decoupled from operation induced tension by paying out cable at sufficient speed to keep it slack. Data are transmitted in real time to a ship-board data acquisition system. In total 267 casts were made down to about 5-15 m height above bottom. The profiler is equipped with a sensor protection guard at the leading end, and occasionally the profiler landed on the bottom. A full list of MSS casts is given in Appendix I.

The deployment of the MSS from the ship was done from the starboard side of the ship, on the main deck. A motor-driven winch was mounted on the railing of the ship and an arm was used to keep the cable clear of the ship's side. The profiler was lowered in the water and brought back on board by hand, lifting it by the data transmission cable. Usually, one cast was performed at each station.

To avoid the instrument or cable coming under the ship during the cast, the ship is generally oriented with the starboard side into the wind, so that it drifts away from the free-falling profiler using a minimal amount of thruster power. This procedure also requires a decoupling of the ship's main propeller. This was done during the first 87 casts. Due to the captain's concerns about the wear and tear on the clutch during the recoupling of the main propeller after each cast, at cast 88, we started to use the DP system of the ship to drift at a speed of about 0.2-0.5 kn away from the profiler. This alleviated the need to decouple (and crucially, recouple) the propeller at every cast. As this practice was both challenging for the operator (the MSS cable was sucked under the ship several times) and likely detrimental to the data quality in the upper ocean, we reverted to free drift at cast 120. However, now the rpm of the engine was lowered from 600 to 400 rpm, allowing for smoother clutching. After cast 185, the transmission

cable was reterminated at its connection to the MSS (this is a common maintenance procedure).
For the 24h stations DS1 and DS2 (DS2 was cut shorter to 21h because of bad weather conditions) the ship was anchored from the stern via the trawl winch to avoid having to relocate (and thereby clutching) frequently. This worked quite well.
The processing of the data and the format of this data set follows the recommendations and guidelines of the SCOR Working Group 160, ATOMIX (https://wiki.uib.no/atomix). The conversion from the native binary files to physical units were done using own routines. Processing of the obtained time series was based on the standard Matlab routines provided by Rockland Scientific, which were adjusted for the ATOMIX recommendations. Spectra are obtained using 2-s fft length. Dissipation estimates are obtained over 6 s segments, overlapping by 3 s (50% overlap), from the cleaned shear spectra using the Goodman coherent-noise reduction algorithm. We used the record from the one-axis body vibration sensor of the MSS for cleaning the shear spectra.
Resulting values from both probes were quality screened following the recommendations of ATOMIX. A dissipation estimate is flagged when for the analyzed segment the figure of merit of spectrum is larger than 1.15, when the despike fraction is larger than 5%, when the estimate is anomalously large relative to a second probe, or when data transmission error fraction is more than 20%. A final dissipation rate estimate is obtained by averaging the estimates from the two probes when they agree within 95% confidence intervals following Lueck (2022) , or the minimum estimate if they do not. Noise level of the dissipation rate measured by the MSS is about 10^{-9} W kg^{-1}. Dissipation measurements from the upper 12 m were excluded because of the disturbance from the ship's keel, and the profiler's adjustment to free fall.
The practical salinity and temperature obtained from the MSS is compared against the shipboard SBE-911plus CTD system from stations collected within 1.5 h and 1.5 km. The ship CTD was calibrated against salinity water samples. 10-m averaged values in quasi-mixed layers agreed to within 1e-3 for salinity and 4e-3 C for temperature, and no correction was applied.

3.4 Glider

Table 2: Meta data of glider missions

Deployment date	2-Oct-2022	09-Aug-2022
Retrieval date	9-Oct-2022	9-Oct-2022
Deployment duration	7 days	61 days
Deployment location	77˚36.036N, 30˚23,974E	74˚0.705N, 19˚8.725E
Retrieval location	77°20.525'N 30°16.44'E	77˚24.815N, 29˚38.536E
Number of profiles	201	1246
Distance covered	116 km	890 km
Mission	uibicemr.mi	
Payload	CTD41CP, SN:9545 MR-1000, SN:324	SBE41, SN: 0187 Kistler, SN: 5023283 AA4831F, SN: 913 BB2FLVMT, SN: 870

3.4.1 Hydroid Seaglider

One Seaglider was recovered during the cruise. Sg564 was recovered on 09 October 2022 08:15 UTC near the Barents Sea Polar Front (77˚24.815N, 29˚38.536E), after 61 days in the water. The sea state was calming but yet challenging after approximately 3 m waves and 15 m/s winds for one day, and we made the recovery using a net. The net was attached to a hexagonal frame, which we lowered under the glider. A CTD cast (sta1174) was conducted upon recovery.

The Sg564 is 1000 m depth-rated and was equipped with Paine strain-gauge pressure sensors, SBE CT Sail, Aanderaa dissolved oxygen sensors and WetLabs ECOpuck sensor and operated between the surface and about 10 m above seabed (mission depths were shallower than 1,000 m). CTD, oxygen, fluorescence and backscatter were sampled on both dives and climbs. CTD was sampled approximately every 1 m in the upper 400 m while oxygen, fluorescence, and backscatter were sampled at every 2 m between 0-100m depth, every 3m between 100-200m depth, and approximately every 5m below 200m. The vertical velocity was about 10 cm s^{-1}. For each dive, a depth-averaged current (DAC) was estimated based on the deviation between expected surfacing location deduced from the flight model, and the actual surfacing location.

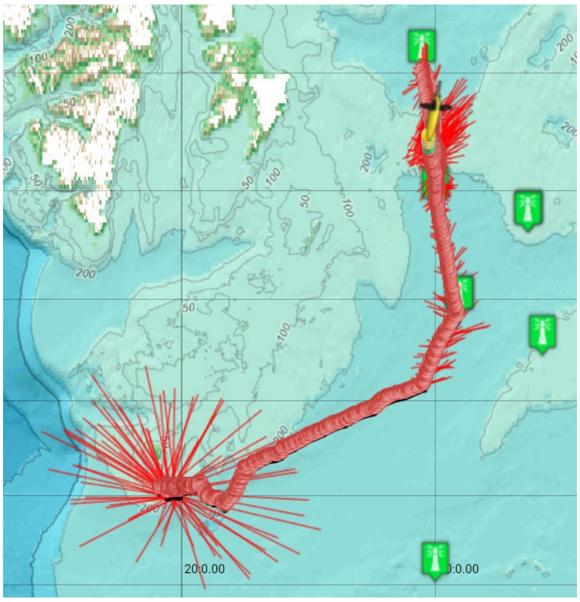

Figure 6: Full track of the Seaglider sg564, from deployment south of Bear Island to recovery near the Barents Sea Polar Front. Surface fixes (circles) and the depth-averaged currents (sticks) are shown, as displayed in the Norgliders portal (https://gp.gfi.uib.no).

The pressure sensor was replaced before this mission. Since the pressure sensor used was the one from sg563 (a rev E glider) and sg564 is a rev B glider, the calibration coefficients of the pressure sensor were wrong in the beginning of the mission and were updated on dive 204. The compass was not calibrated before this problem was solved either as the glider was exposed to strong currents on the shelf/slope of Bjørnøya. Compass calibration dives were 217-219. We received pitch retries/errors throughout the entire mission, but this has not affected the glider dives and data, as the retries and errors happens during the surface maneuver when the battery pitch all the way forward.

3.4.2 Slocum glider

One Teledyne Webb Research 1000m electric glider (Slocum G3) was deployed on 2 October 2022, 10:25 UTC, during the cruise. All pre-deployment tests were made by the onshore pilot Ailin Brakstad at the Geophysical Institute, Bergen. (No free-wave communication was set up for this deployment and recovery.) After the start piloting and trimming by Brakstad, further piloting was carried out by Anna-Marie Strehl at the Geophysical Institute, Bergen.

The Slocum G3's are buoyancy-driven autonomous underwater vehicles that provide high-resolution surveys of the physical properties of the water column. Our Slocum G3, named Odin, (SN775) was equipped with a pumped Seabird conductivity-temperature sensor (CTD41CP, SN9545) and an integrated RSI MicroRider (MR-1000, SN324) with two shear probes (S1=M2033, S2=M2034) and two thermistors (T1=T2060, T2=T1107) for measuring turbulence microstructure. CTD was sampled during the dives and climbs. Final profiles have an average horizontal along-track resolution of 0.5 km and vertical bins of 1 m.

The MicroRider was configured to sample on dive and climb. To minimize vibration noise in the vehicle and achieve the desired science goals the glider mission was configured as follows:

- “Fixed mode” battery position was used to control the trim of the glider, which prevented the pitch motor from running during the glide. The fixed position was determined from test dives to 180 m and implemented from 3 October 2022.
- Auto ballast control determined pump volumes for diving and climbing to keep the profiles symmetrical while maintaining a minimum vehicle speed of 0.1 m/s. The pump volume was set to fixed values and adjusted manually from 5 October to avoid adjustments during the flight. A minimum of auto ballast control was maintained for optimizing the flight. Flight data did not indicate adjustments that should impact the measurements.
- To capture the complete water column, particularly the top few meters, the glider carried out one dive-climb profile per segment. The “climb to” depth was set to 0 m to avoid noise contamination from the air bladder and ballast bump that automatically switch on when the glider reaches surface. We were aware that this could cause the glider to sit on the surface un-commanded if the pressure sensor were offset when it reached surface, and thus it was monitored throughout the mission.
- The glider dived to 30 m above ground. From the 6 October, it dived to 22m above ground.

Odin ran the transect along the “B” section once, starting from the northern end. The MicroRider and the SBE-CT sampled without any issues.

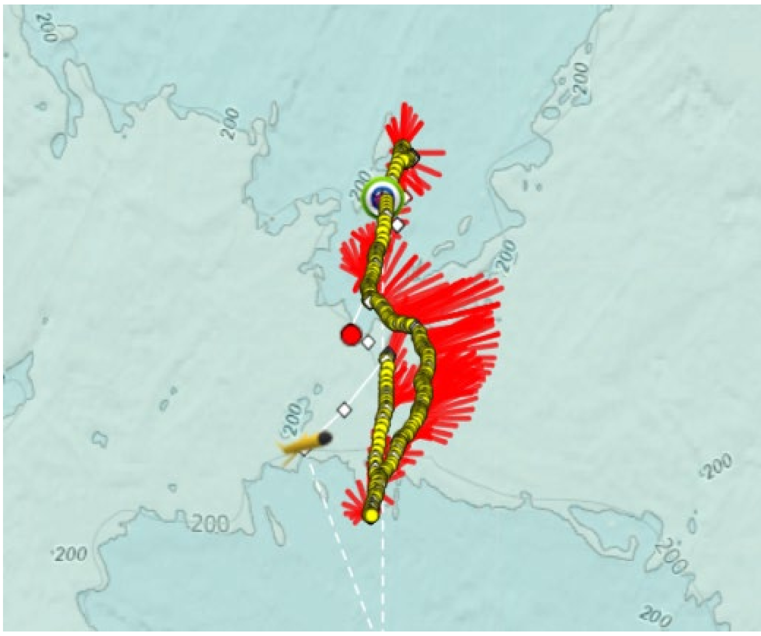

Figure 7: Odin's track as displayed on the Slocum Fleet Mission Control dashboard, showing the surface fixes (yellow circles) and the depth-averaged currents (red sticks). The deployment was on the northern end of the transect. Odin completed one southward transect across the front, turned northward and it was recovered as it approached the front once more.

The glider was retrieved on 9 October 12:30 UTC using the same net as for the Seaglider. There was no apparent damage on the turbulence sensors during recovery. A Teledyne Webb Research 1000m electric glider was deployed during the cruise**.** The Slocum G3 is a buoyancy-driven autonomous underwater vehicle that provides high-resolution surveys of the physical properties of the water column. Odin (SN775) was equipped with a Seabird conductivity-temperature-depth sensor (CTD41CP, SN9545) and an integrated RSI MicroRider (MR-1000, SN324) with two shear probes (S1=M2031, S2=M2032) and two thermistors (T1=T1849, T2=T1851) for measuring turbulence microstructure. The CTD was sampled during the dive, climb, inflection and surfacing at 0.25Hz (as fast as possible).

Quality control procedures from the Balearic Islands Coastal Observing and Forecasting System (SOCIB) data processing toolbox was used for data (Troupin et al., 2015) and include salinity corrections for the thermal lag error for the un-pumped CTD data (Garau et al., 2011). Final profiles have an average horizontal along-track resolution of 0.5 km and vertical bins of 1 m.
The MicroRider was configured to sample on dive, climb and inflection. The glider initiated MicroRider sampling by sending the following odasir message: *odas5ir -f setup.cfg -l 3000 -D*
Care was taken to minimize vibration noise in the vehicle and achieve the desired science goals, using the glider mission UIB01AMR.MI. The MicroRider and CTD sampling behaviors were defined separately. Sampling science sensors individually reduces the number of science oddities occurring and allows for more control of individual sensors. 'Fixed mode' battery position was used to control the trim of the glider, this prevented the pitch motor from running during the glide. Autoballast control was used to command pump volumes for diving and climbing in order to the keep the profiles symmetrical while maintaining a minimum vehicle speed of 0.1m/s. We

targeted a vertical velocity of .15m/s but set the minimum as 0.1m/s to the account for slower velocities during AB adjustments and avoid aborts.
After testing altimeter functionality, the glider was configured to inflect 15m above the seabed. In order to capture the complete water column, particularly the top few meters, the glider carried out one yo per segment. The 'climb to' depth was set to 0m to avoid noise contamination from the air bladder and ballast bump that are automatically switched on when the glider is instructed to surface. We were aware that this may cause the glider to sit on the surface un-commanded if the pressure sensor was offset when it reached the surface and this was monitored throughout the mission.

3.5 Mooring

To supplement the snapshot-type measurements obtained from hydrographic sections, a short-term mooring was deployed at the Polar Front location. The goal was to measure hydrographic properties throughout the water column for as long as possible during the cruise. The mooring was designed to be deployed in 195 m water depth and was extensively equipped with temperature loggers, CTDs and ADCPs (see Appendix II. Mooring).
At the planned position, a CTD cast (#1126) showed both Polar Water and Atlantic Water in the water column, indicating the presence of the front. The ship went ~1.5 miles Northwest of this location to begin with the deployment. The mooring was deployed buoy-first over the stern via the Starboard main winch and A-frame while slow steaming towards the mooring location (towing at 1.5kn for ~1h). The anchor drop was 08:39 UTC on 2 October at 77° 22.212' N, 30° 04.418'E.
Recovery took place on October 9. It was released at an acoustic range of 280 m at 10:28 UTC. The mooring came up very tangled and was taken on board effectively all at once.

A calibration dip for all temperature loggers and CTDs that were at the mooring was performed on 10 October at 12:30 UTC, by fixing all instruments to the CTD rosette. The calibration cast (CTD cast #1177) included 3-minute calibration stops on the up-cast at depths of 200 m, 150 m, 58 m and 17 m.

3.6 Wave buoys

Two OpenMetBuoys (v2021a) were provided by the Norwegian Meteorological Service to measure frequency spectra of sea surface elevation. Their design follows Rabault et al. (2022). They were deployed on October 4 at 12:40 UTC and on October 6 at 4:40 UTC, respectively.

3.7 Argo floats

On behalf of the Finnish Meteorological Institute, two ice-tolerant APEX Argo floats were deployed at the northernmost point of the cruise (see Figure 1) on October 3 at 14:55 UTC, with about 200 m between them. Their status and data is openly accessible at https://fleetmonitoring.euro-argo.eu/float/5906973 and https://fleetmonitoring.euro-argo.eu/float/6990507.

4 Data presentation

4.1 LADCP

Velocity components (u = eastwards, v= northwards) for a selection of transects measured by the LADCP

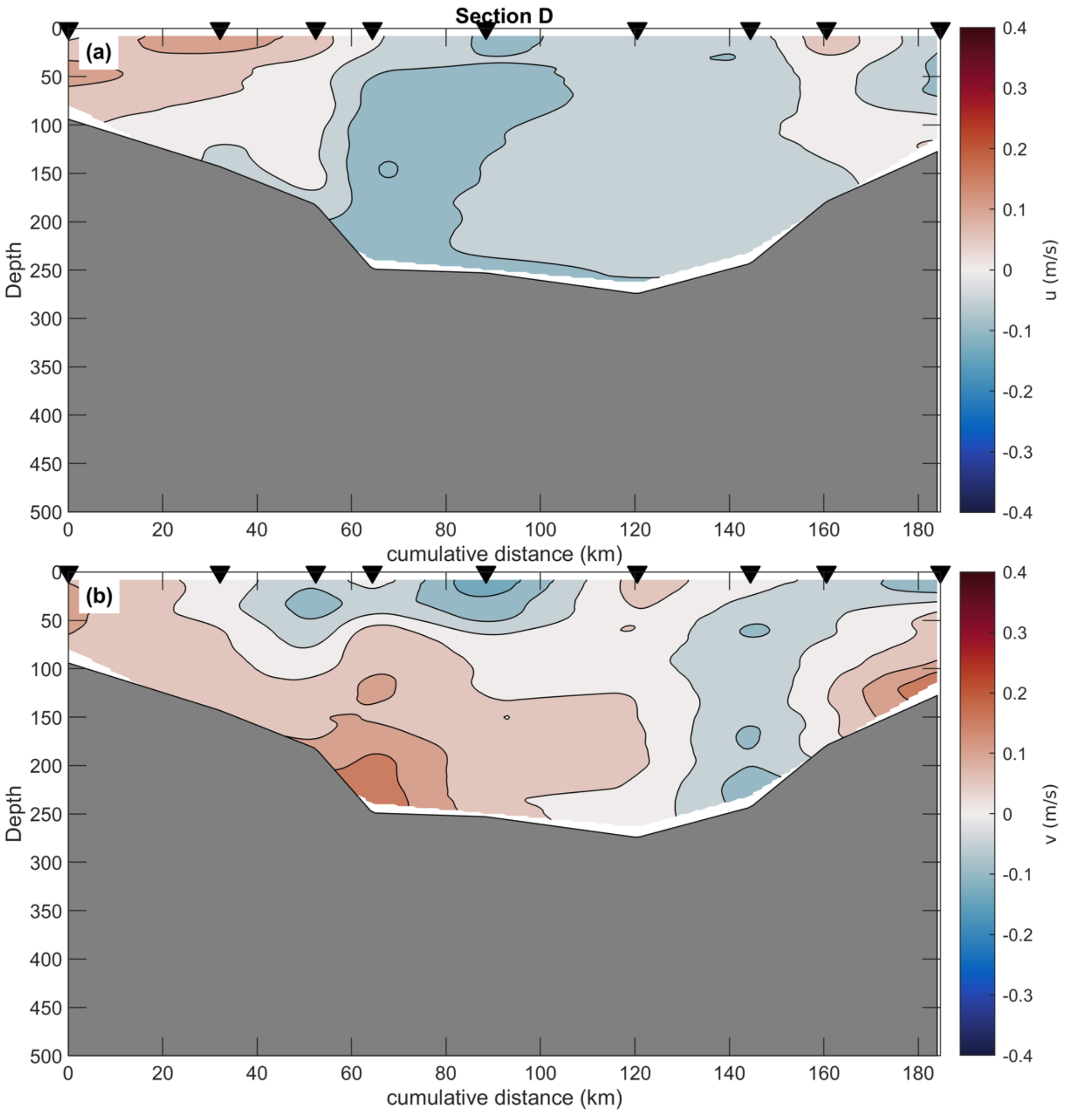

Figure 8: Velocity components (u = eastwards, v= northwards) for section D.

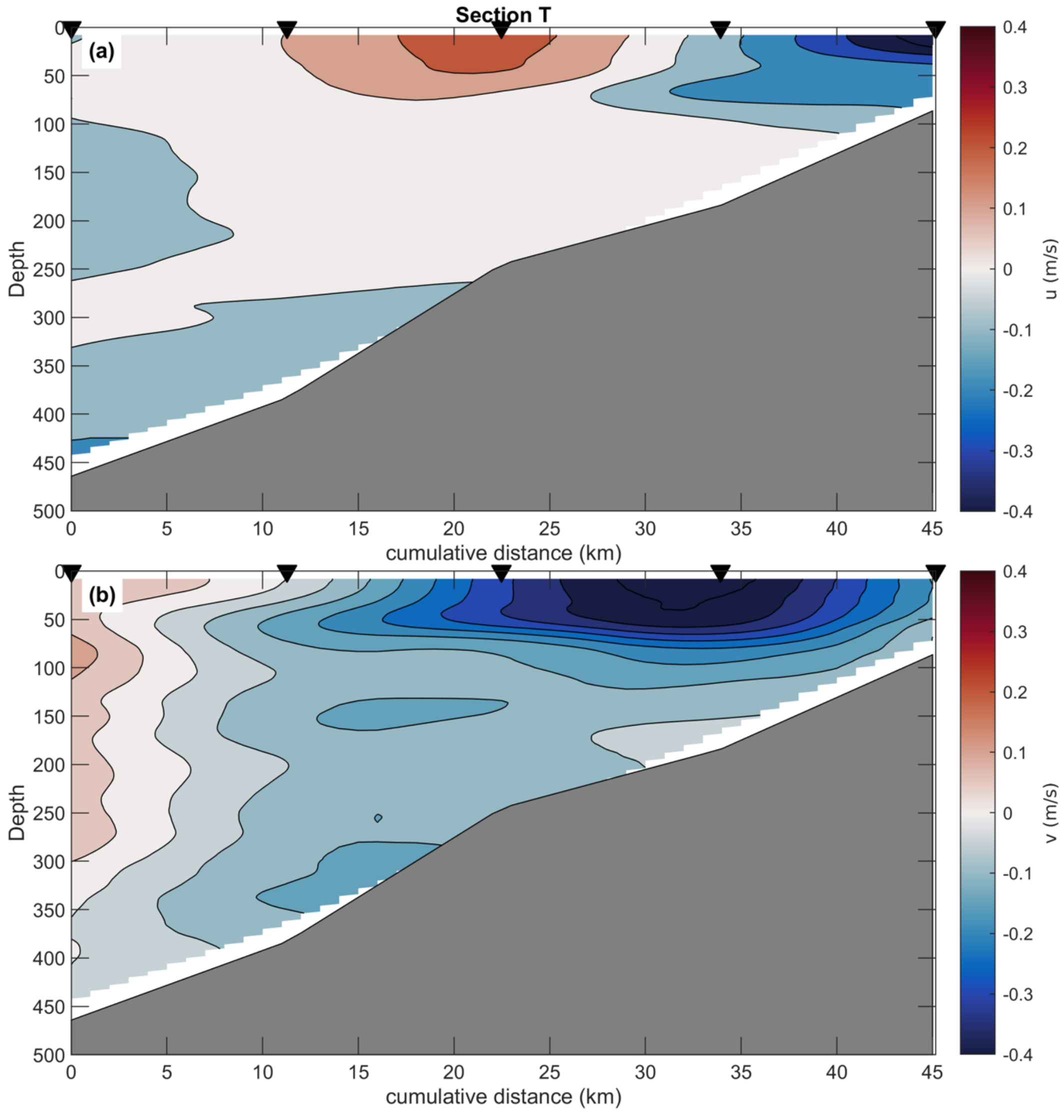

Figure 9: As above, but for section T.

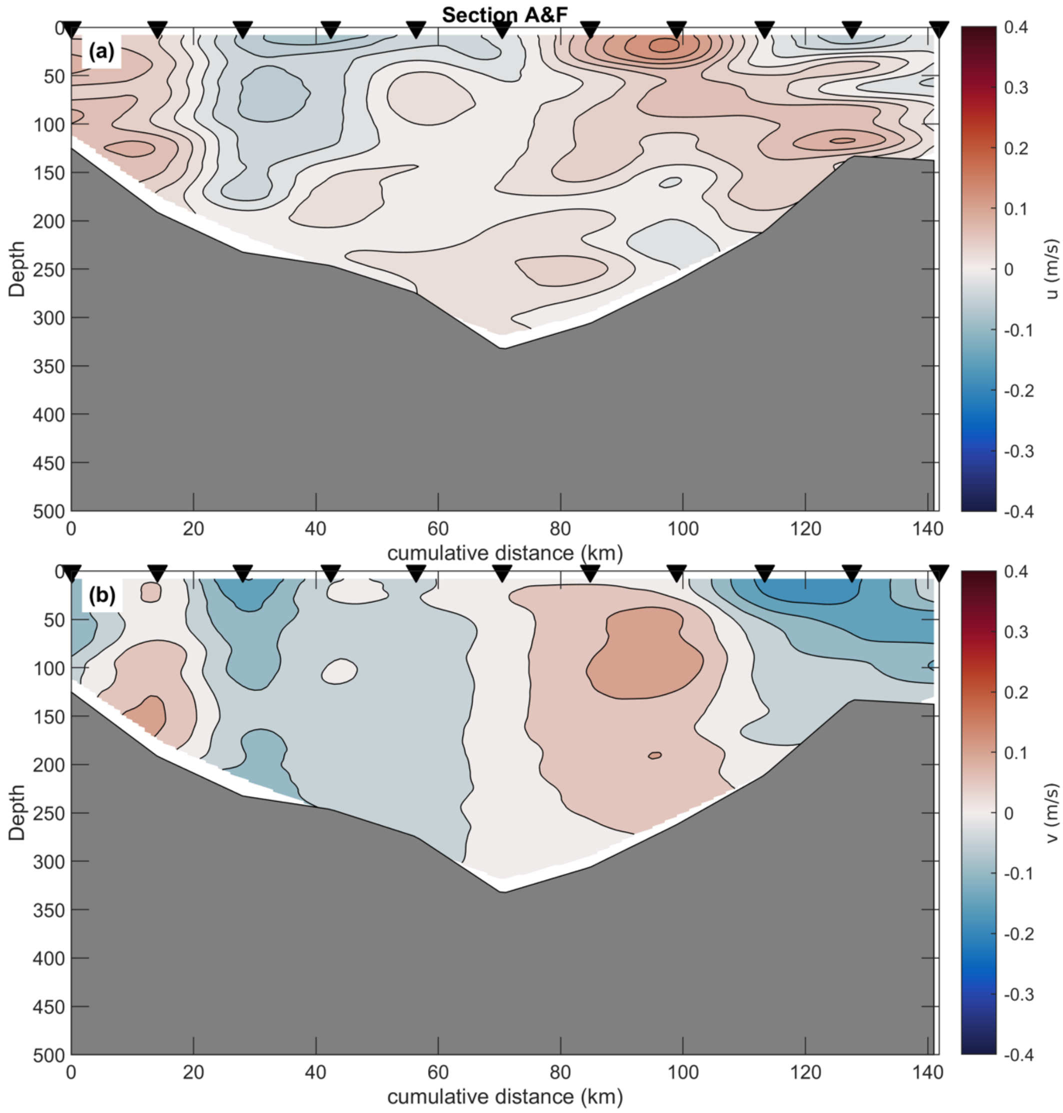

Figure 10: As above, but for section A/F.

4.2 SADCP

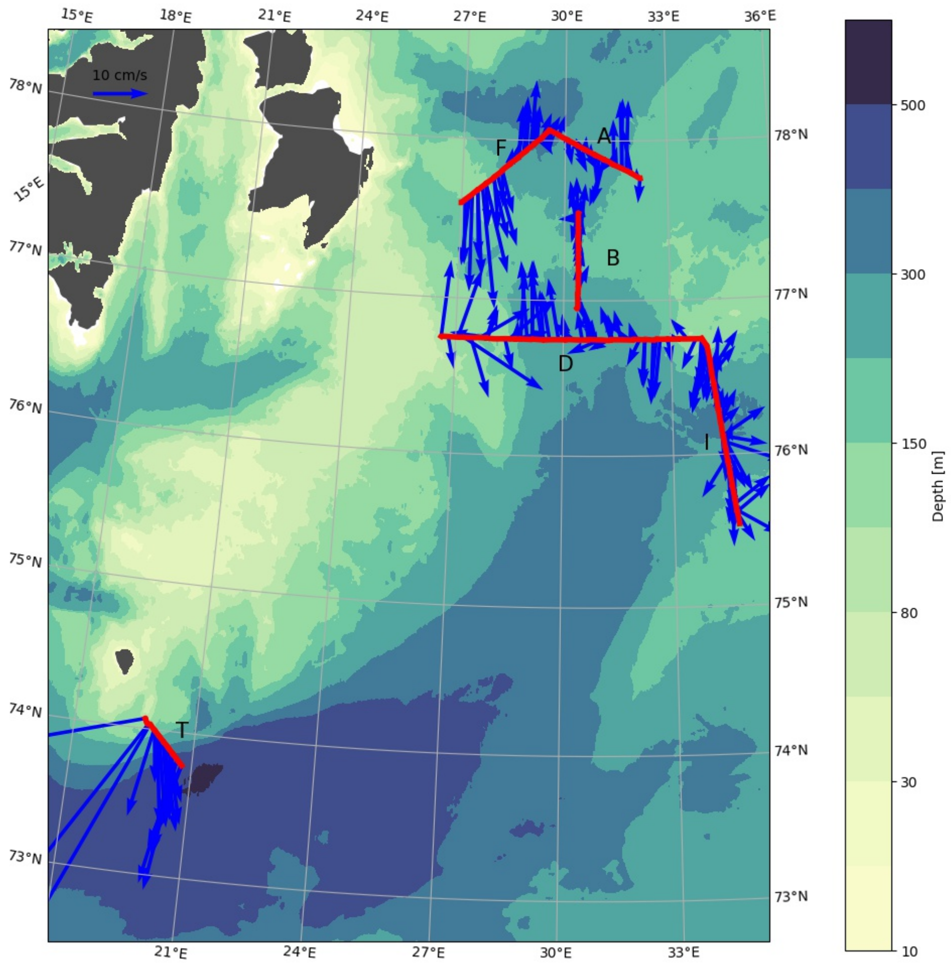

Figure 11: Map showing vertically averaged currents at the main sections measured from the ship-ADCP.

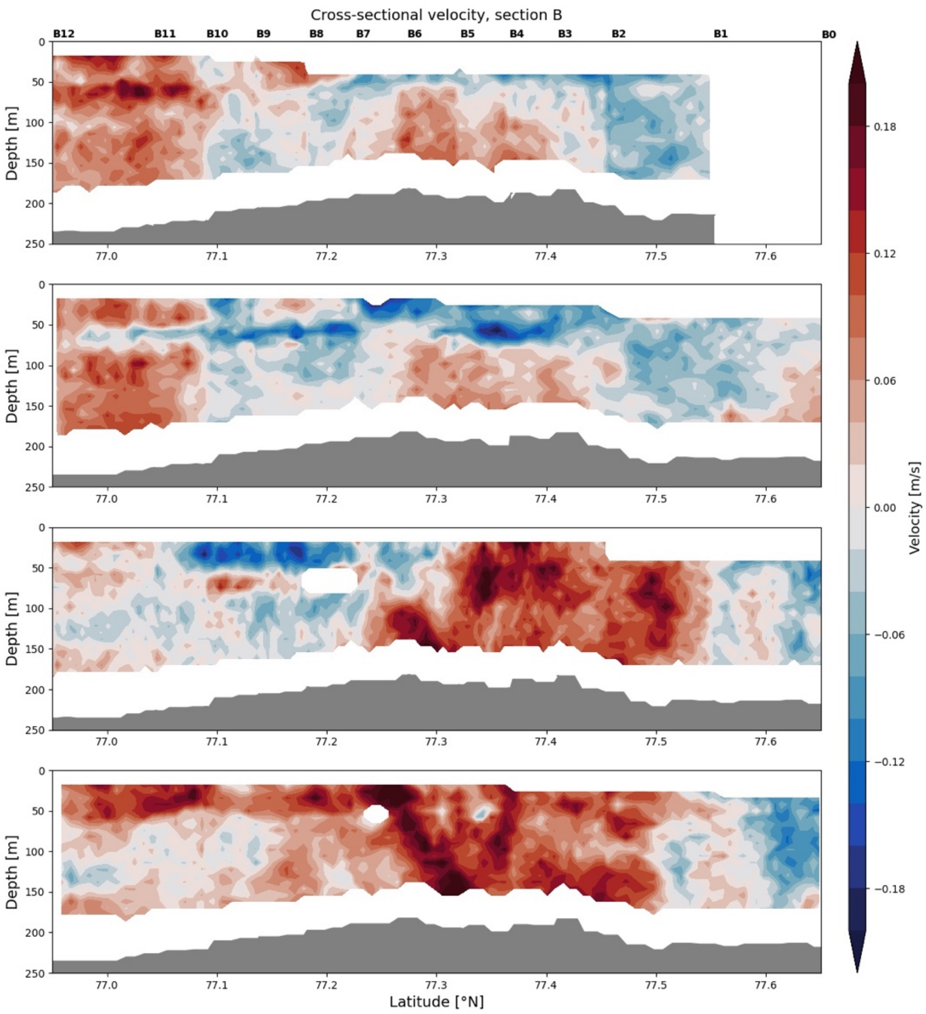

Figure 12: Cross-sectional velocities measured by the ship-ADCP for repeat transects of the B-section.

4.3 MSS

The different sections are presented in the following panels. X-axis is the distance in km to the start of the section. Left panels are the dissipation rate (W kg^{-1}), middle panels are temperature (°C) and the right panels are practical salinity. Black lines are isopycnals, the white line is the 0°C isotherm.

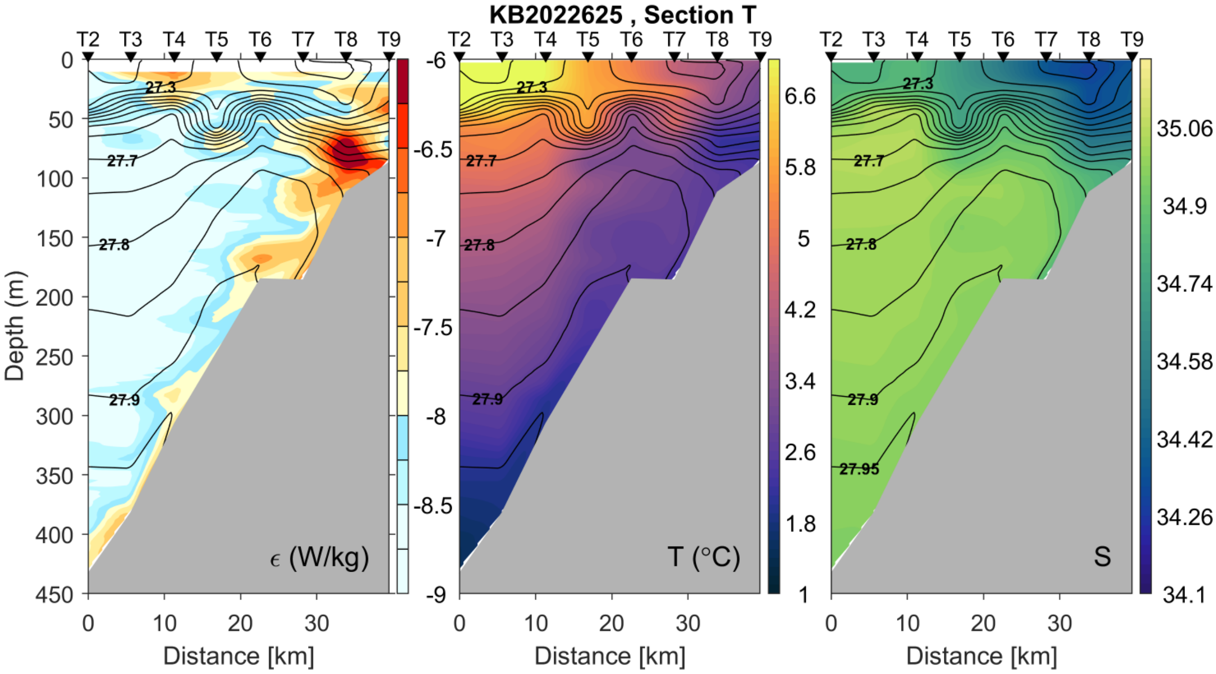

Figure 13: Measurements of dissipation rate (left), temperature (middle) and salinity (right) for section T, repeat 1. Black lines are isopycnals, the white line is the 0°C isotherm.

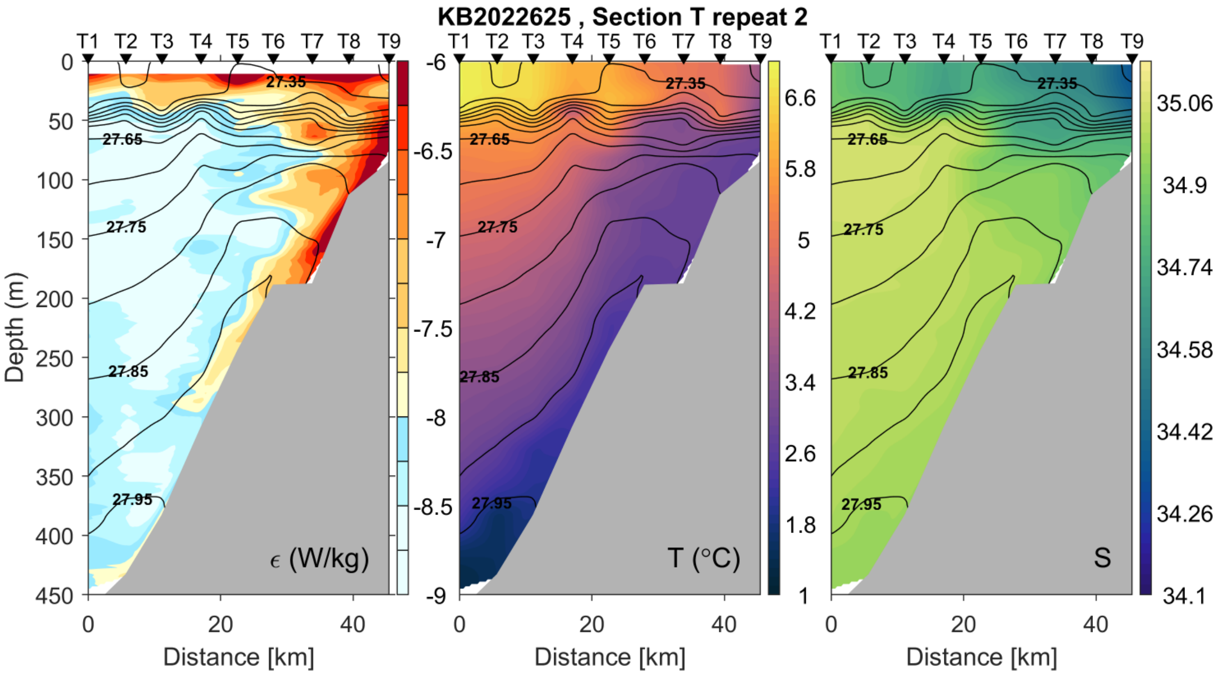

Figure 14: As above, but for section T, repeat 2.

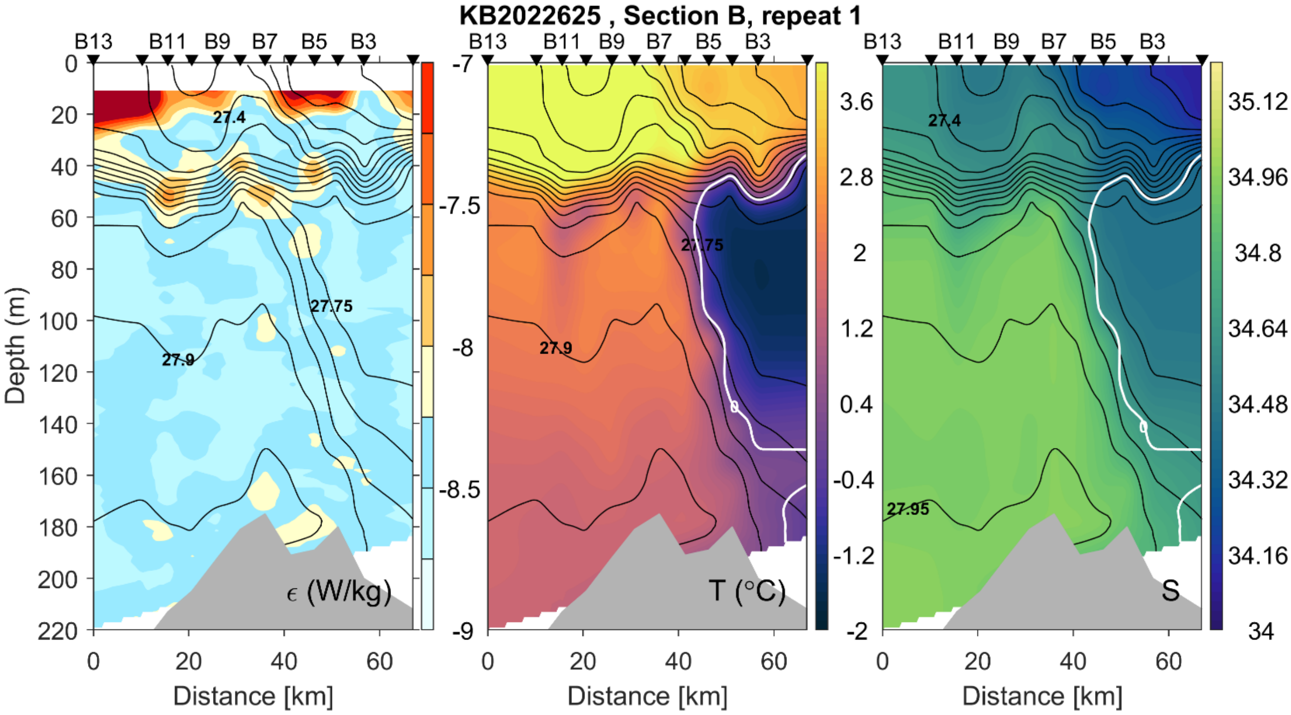

Figure 15: As above, but for section B, repeat 1.

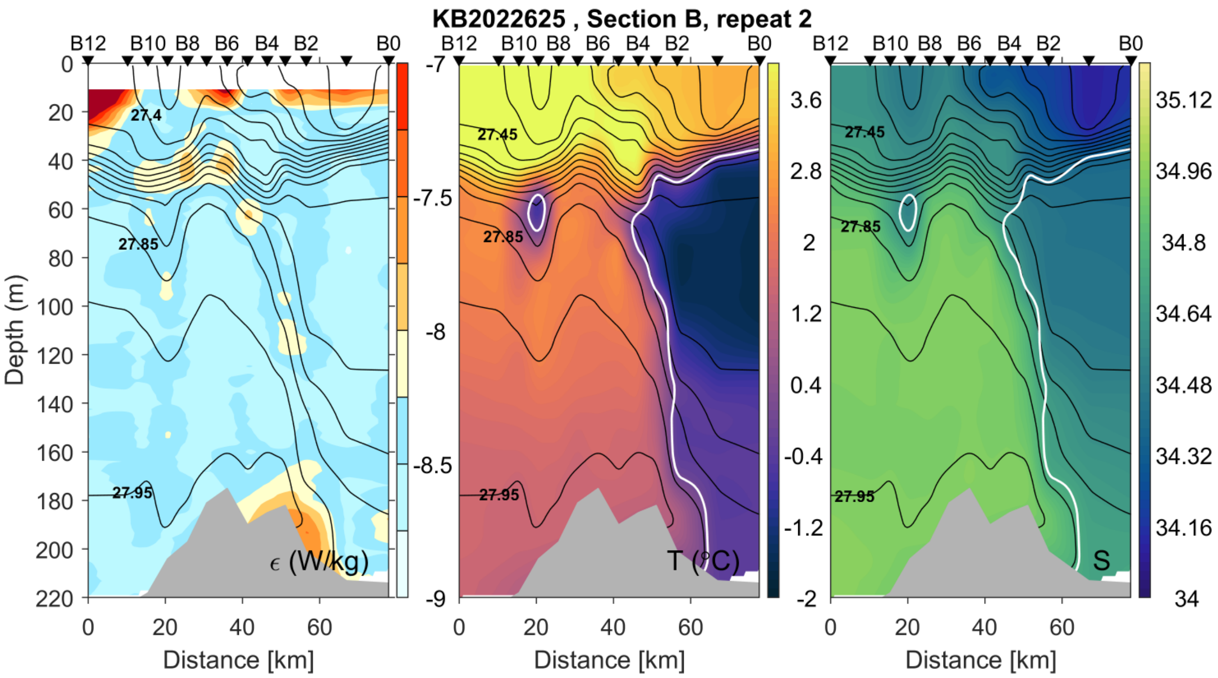

Figure 16: As above, but for section B, repeat 2.

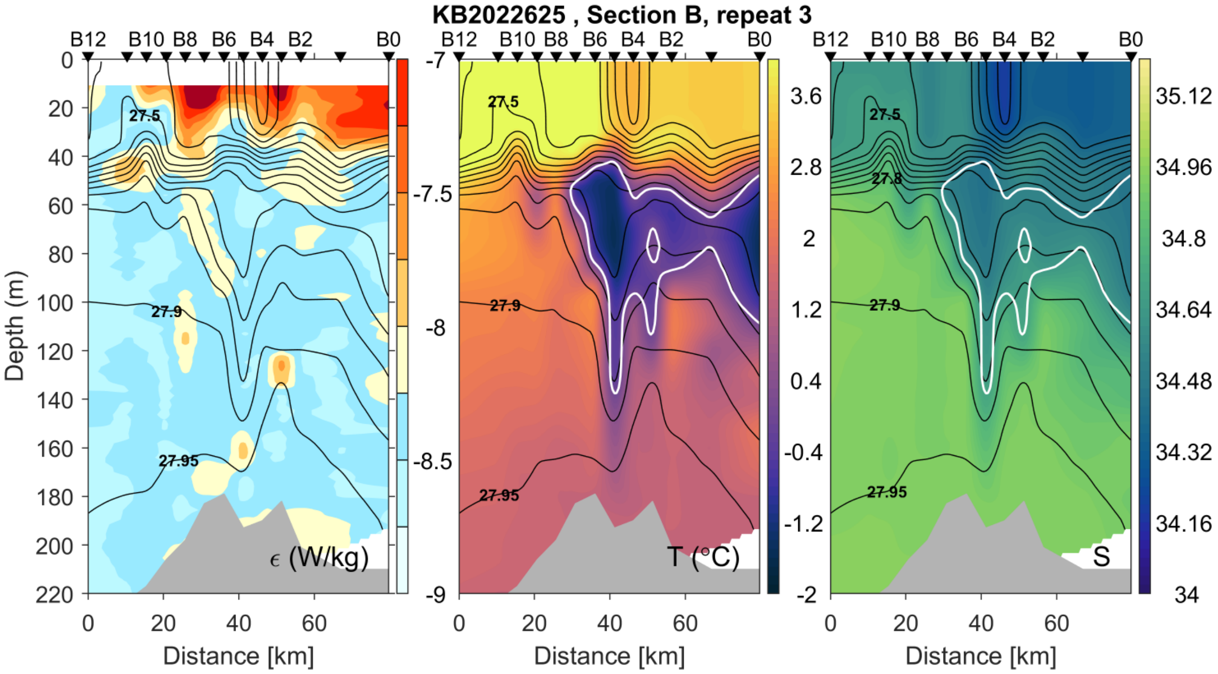

Figure 17: As above, but for section B, repeat 3.

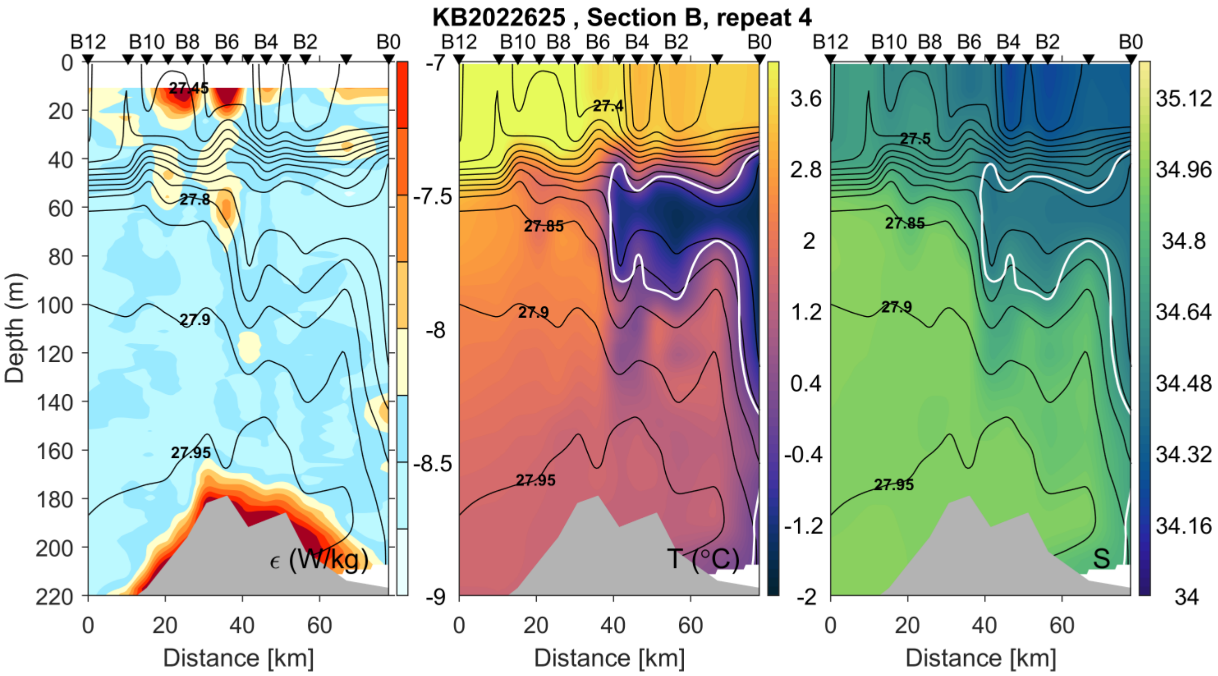

Figure 18: As above, but for section B, repeat 4.

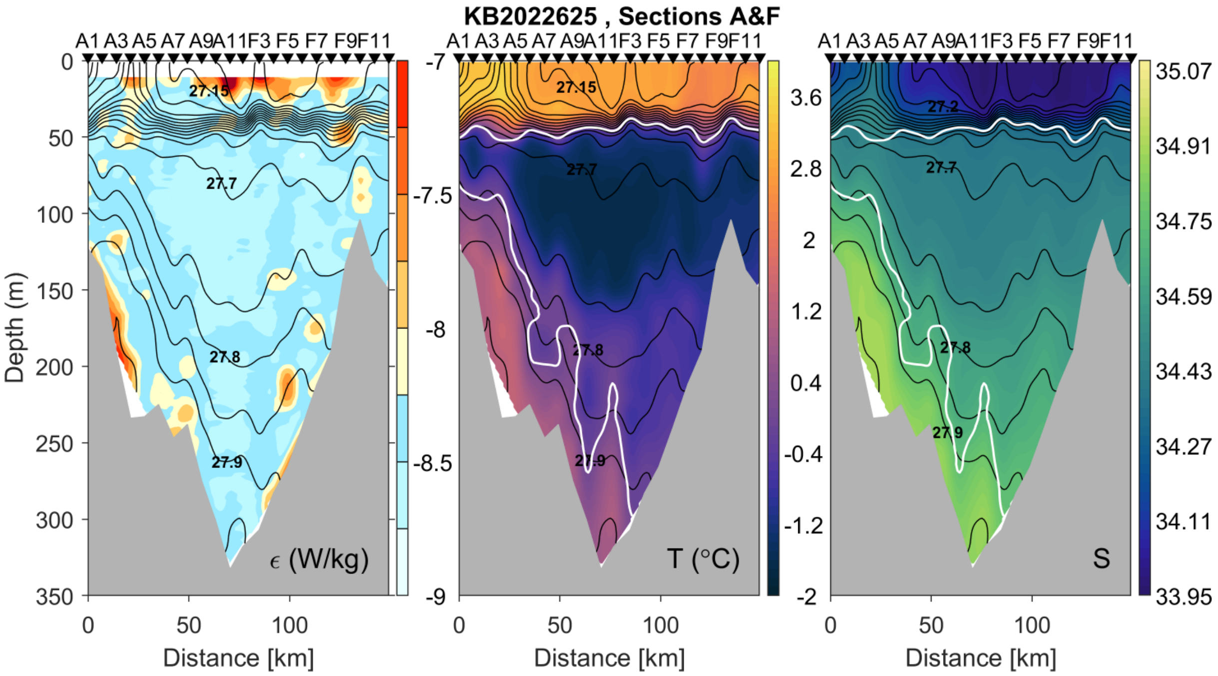

Figure 19:As above, but for section A/F.

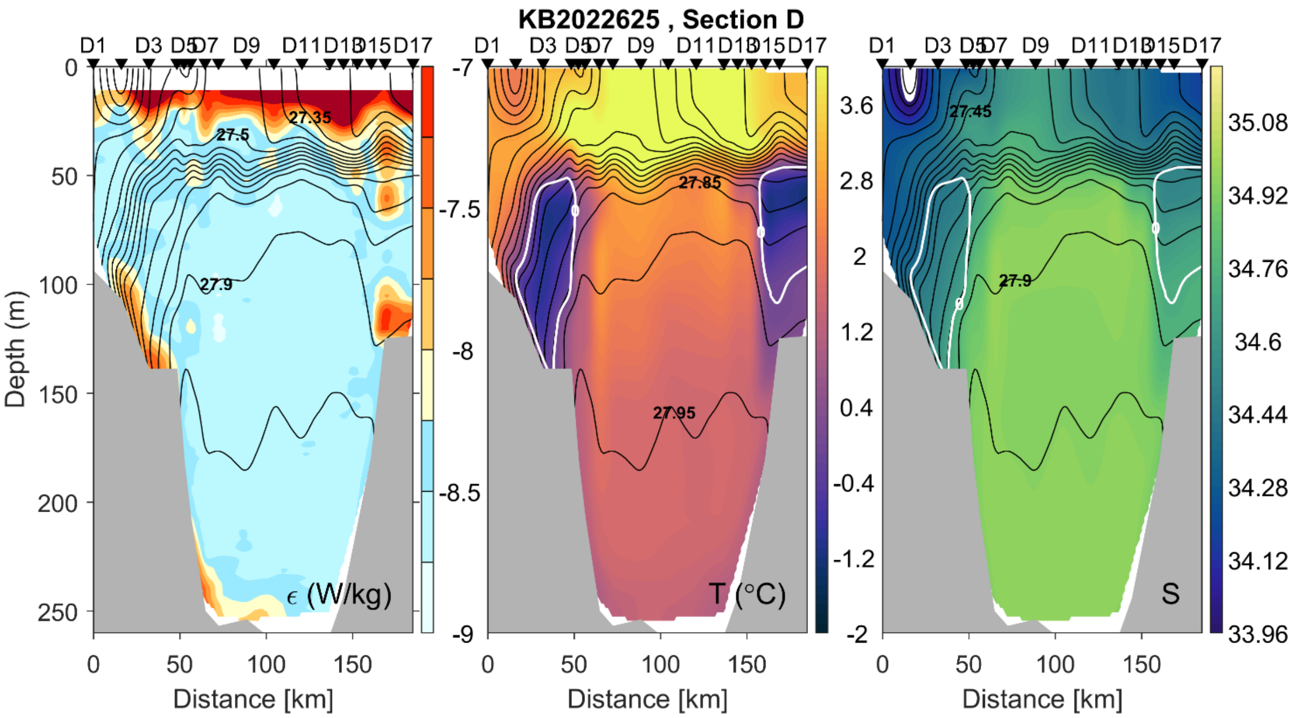

Figure 20: As above, but for section D.

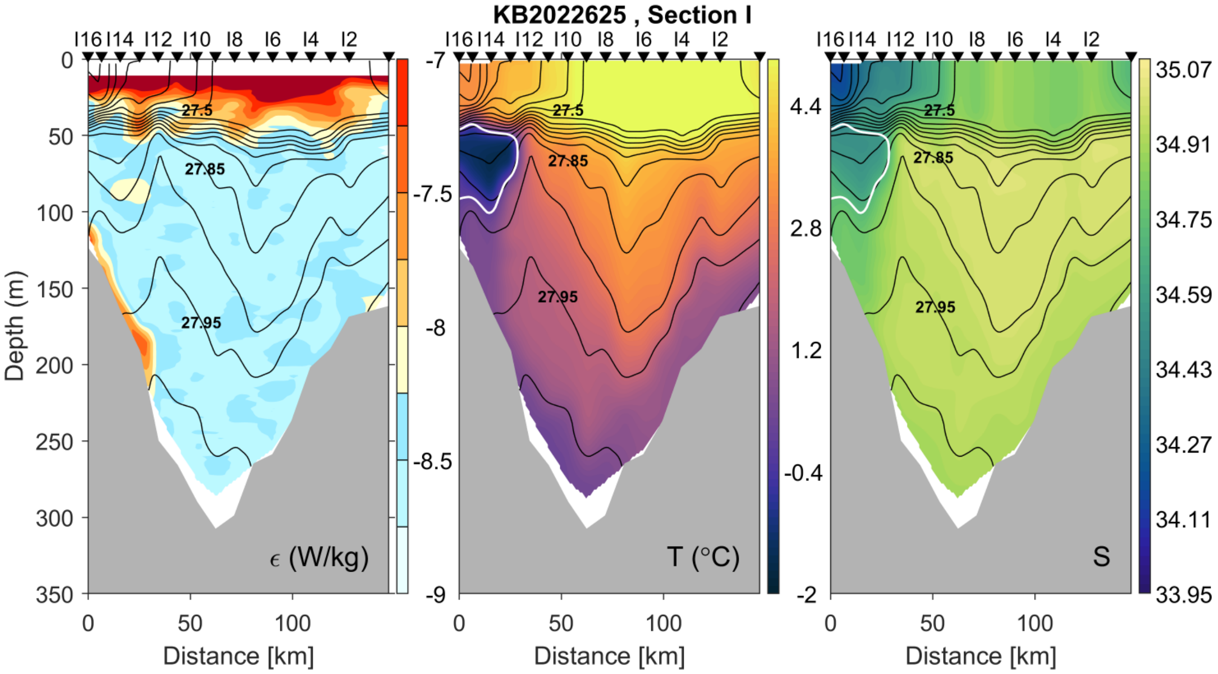

Figure 21: As above, but for section I.

24h stations

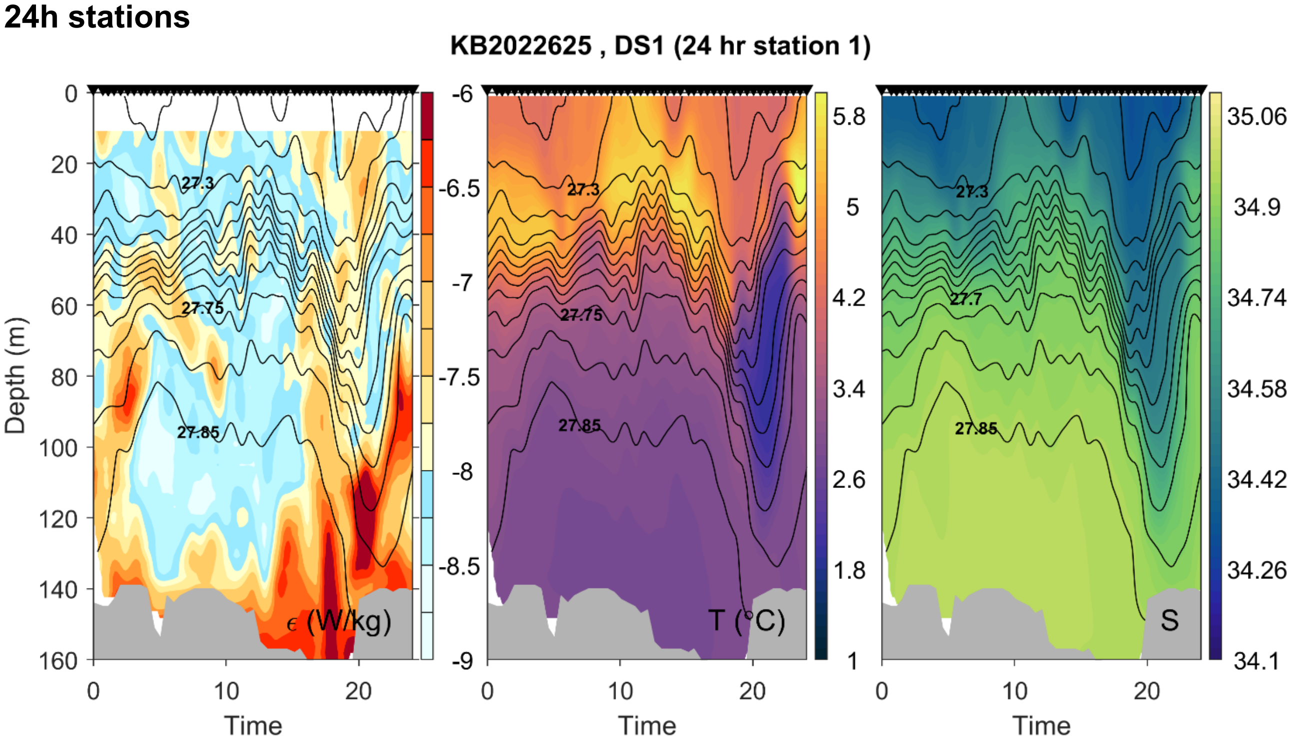

Figure 22: As above, but for the 24-h station DS1 (x-axis is time in hours).

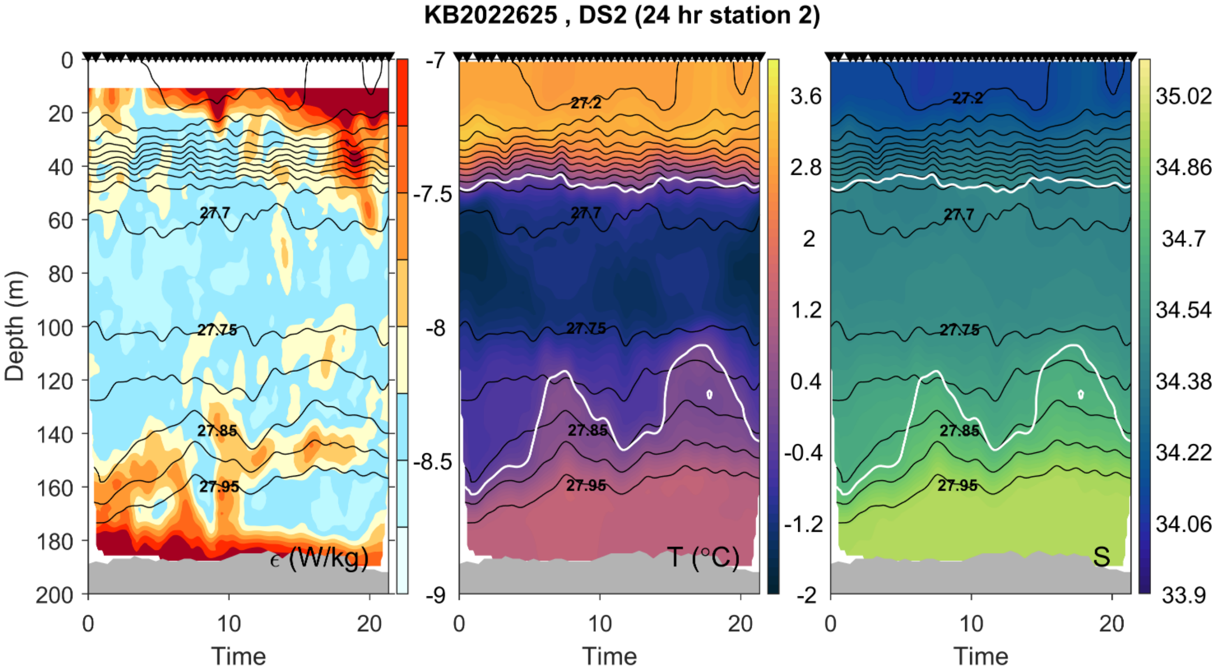

Figure 23: As above, but for the 24-h station DS2.

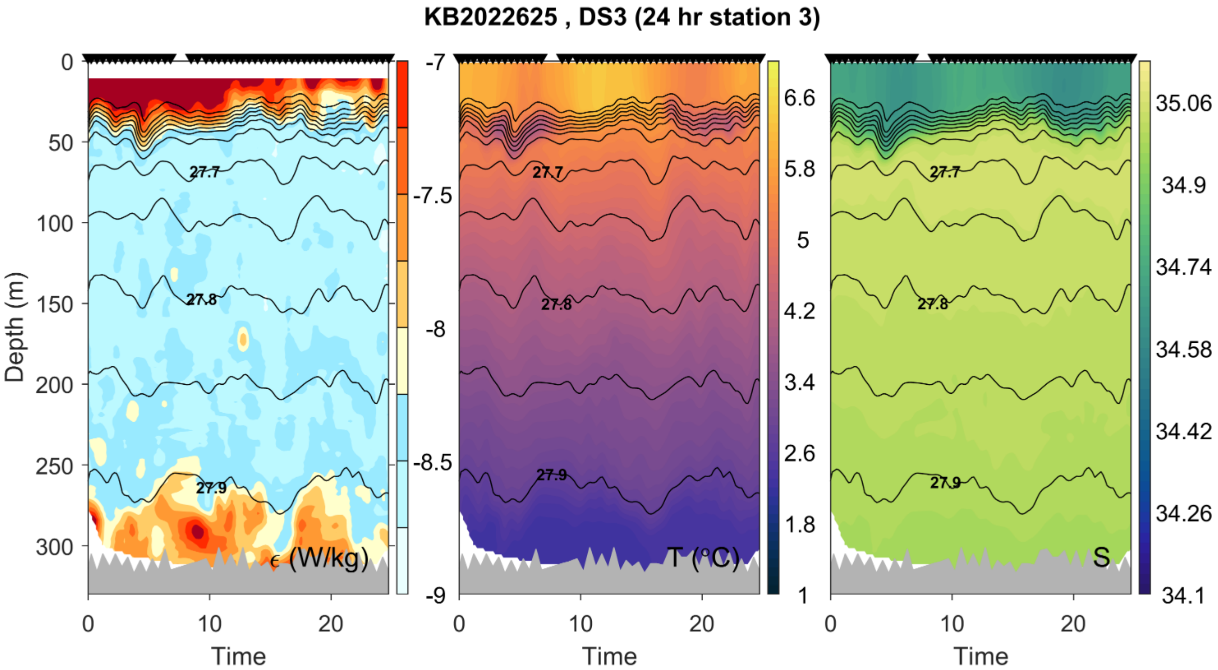

Figure 24: As above, but for the 24-h station DS3.

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Appendix I. Timeline and station tables

a. Cruise timeline

Table 3: Cruise timeline

Date	Time (UTC)	Activity
28.09.2022	09:00	Arrival on Board, loading of equipment, preparations
	10:30	Security briefing, tour of the vessel
	13:00	Departure from Tromsø
29.09.2022	12:53	Test station for VMP winch system (without probes). Line-puller does not work reliably and there was no communication with the instrument. Decided to use MSS instead
	14:47	Begin T-Section using MSS. CTD (with LADCP) at every other station
	22:00	Finish T-Section
30.09.2022	03:11	Begin 24h MSS-station on T-Section at 150m depth. Using trawl anchor to stay in place
1.10.2022	03:25	End 24h station, begin transit to F1 (2020) mooring location
2.10.2022	04:40	Looking for mooring F1 (2020) with hydrophone and echosounder. No response. It is lost
	07:45	Deployed short-term mooring F1_st after CTD cast at prospective location
	10:24	Set out glider Odin with microrider using Helge's T-frame
	11:15	Begin Section B (repeat1) north-to-south using MSS with CTD at every other station
	19:45	End of Section B (repeat1), begin repeat 2 northward.
3.10.2022	03:40	End of Section B (repeat2)
	06:21	Begin Section A (MSS, with CTD on every other station)
	14:34	End of Section A, Begin Section F (MSS, with CTD on every other station)
	14:55	Deployment of 2 APEX Argo Floats for the Finnish Meteorological Institute
4.10.2022	00:20	End of Section F, transit to Section D
	06:07	Begin Section D (MSS, with CTD on every other station)
	12:30	Deployment of one of the MET wave buoys
	22:25	End of Section D, begin of Section I (MSS, with CTD on every other station)
5.10.2022	15:40	End of Section I, transit to 24-h-station at B4 (Polar Front)
06.10.2022	04:30	Deployment of the second MET wave buoy
	05:30	Begin 24h MSS-station at B4 (Polar Front). Using trawl anchor to stay in place

07.10.2022	03:00	Abandoned sampling 2.5h early due to safty concerns with high sea state
		Weather day
8.10.2022	10:50	Begin Section B (repeat3) north-to-south (MSS, with CTD on every other station)
	22:10	End of Section B (repeat3), begin repeat 4 northward. (Only MSS, no CTD)
9.10.2022	06:00	End of Section B (repeat 4)
	08:15	SeaGlider SG564 recovered
	08:32	CTD cast for glider calibration
	10:00	Safety meeting for mooring recovery
	10:25	Release of the mooring, sighted immediately
	10:50	Mooring on deck
	11:19	CTD cast at mooring location, transit to glider Odin location for recovery
	12:33	Recovered Odin using the "Humpback" net, MR probes likely survived
	12:40	CTD cast for glider calibration
	12:50	Transit to Section T at Bjørnøya
10.10.2022	15:00	Begin Section T (MSS, with CTD on every other station)
	21:05	End Section T
	23:30	Begin 24-h station at T4
12.10.2022	00:30	End 24-station, begin transit to Tromsø
13.10.2022	06:30	Arrival in Tromsø, unloading and debarking

b. Station tables

Table 4: CTD/LADCP stations

Cast (stnXXXX)	Station Name	Date	Time (UTC)	LAT	LON	E. Depth (m)
1121	T1	2022-09-29	14:50	73N46.64	020E45.45	469
1122	T3	2022-09-29	16:44	73N51.05	020E30.37	384
1123	T5	2022-09-29	18:34	73N55.43	020E15.04	247
1124	T7	2022-09-29	20:06	73N59.86	019E59.63	186
1125	T9	2022-09-29	21:36	74N04.17	019E44.27	85
1126	F1_st	2022-10-02	07:17	77N22.20	030E04.37	195
1127	Glider Odin	2022-10-02	10:33	77N36.49	030E27.77	214
1128	B2	2022-10-02	12:01	77N27.40	030E23.94	201
1129	B4	2022-10-02	13:23	77N21.90	030E24.00	187
1130	B6	2022-10-02	14:49	77N16.39	030E24.17	178
1131	B8	2022-10-02	16:16	77N10.88	030E24.49	193
1132	B10	2022-10-02	17:41	77N05.38	030E24.47	216
1133	B12	2022-10-02	19:29	76N56.99	030E22.92	232
1134	B10	2022-10-02	21:03	77N05.37	030E24.47	216

1135	B8	2022-10-02	22:17	77N10.90	030E23.81	197
1136	B6	2022-10-02	23:29	77N16.37	030E23.88	178
1137	B4	2022-10-03	00:36	77N21.90	030E24.23	187
1138	B2	2022-10-03	01:42	77N27.41	030E24.25	200
1139	A1	2022-10-03	06:12	77N45.96	032E11.80	125
1140	A3	2022-10-03	07:42	77N49.68	031E40.39	190
1141	A5	2022-10-03	09:30	77N53.13	031E08.42	233
1142	A7	2022-10-03	11:09	77N56.62	031E35.54	247
1143	A9	2022-10-03	12:39	78N00.28	030E03.79	275
1144	A11/F1	2022-10-03	14:13	78N00.39	029E31.62	233
1145	F3	2022-10-03	16:14	77N58.58	029E04.23	307
1146	F5	2022-10-03	18:07	77N53.64	028E37.14	250
1147	F7	2022-10-03	19:55	77N48.45	028E08.97	211
1148	F9	2022-10-03	21:39	77N43.49	027E41.39	133
1149	F11	2022-10-03	23:32	77N38.49	027E13.77	138
1150	D1	2022-10-04	5:49	76N44.93	026E35.88	94
1151	D3	2022-10-04	8:14	76N45.02	027E51.58	143
1152	D5	2022-10-04	9:59	76N45.03	028E39.42	181
1153	D7	2022-10-04	11:17	76N45.03	029E07.44	249
1154	D9	2022-10-04	13:29	76N45.02	030E04.08	254
1155	D11	2022-10-04	16:10	76N44.97	031E19.70	275
1156	D13	2022-10-04	18:17	76N45.00	032E16.26	243
1157	D15	2022-10-04	20:08	76N45.03	032E54.09	179
1158	D17	2022-10-04	22:15	76N44.96	033E51.07	126
1159	I14	2022-10-04	23:54	76N37.08	034E03.09	165
1160	I12	2022-10-05	01:44	76N27.08	034E09.02	250
1161	I10	2022-10-05	3:58	76N17.15	034E15.01	291
1162	I8	2022-10-05	6:32	76N07.20	034E21.00	297
1163	I6	2022-10-05	9:17	75N57.21	034E27.17	252
1164	I4	2022-10-05	11:59	75N47.34	034E32.71	203
1165	I2	2022-10-05	14:19	75N37.35	034E39.19	169
1166	B12	2022-10-06	4:24	#VALUE!	030E22.94	233
1167	B0	2022-10-08	10:23	77N39.97	030E24.04	215
1168	B2	2022-10-08	13:08	77N27.40	030E24.31	200
1169	B4	2022-10-08	14:50	77N21.93	030E24.53	189
1170	B6	2022-10-08	16:40	77N16.41	030E23.93	180
1171	B8	2022-10-08	18:15	77N10.90	030E24.02	198
1172	B10	2022-10-08	19:52	77N05.34	030E24.29	218
1173	B12	2022-10-08	21:54	77N56.99	030E22.84	233
1174	Seaglider recovery	2022-10-09	08:27	77N24.84	029E38.81	191
1175	Mooring recovery	2022-10-09	11:15	77N22.66	030E04.83	197
1176	Slocum glider recovery	2022-10-09	12:40	77N20.81	030E17.06	203
1177	Cal mooring	2022-10-10	12:33	74N00.73	020E47.60	273
1178	T1	2022-10-10	14:36	73N46.62	020E45.75	464
1179	T3	2022-10-10	16:34	73N51.00	020E30.49	382
1180	T5	2022-10-10	18:07	73N55.40	020E14.88	247
1181	T7	2022-10-10	19:30	73N59.76	019E59.67	186
1182	T9	2022-10-10	20:44	74N04.21	019E44.16	86

Table 5: MSS stations

Cast	Station Name	Date-UTC	Time (UTC)	LAT	LON	Echo Depth (m)	Start (m)	End (m)	CTD File
1	T1	2022-09-29	15:17	73N46.66	20E45.42	469	1	471	1121
2	T2	2022-09-29	16:02	73N48.85	20E37.79	433	1	430	nan
3	T3	2022-09-29	17:07	73N51.04	20E30.33	382	1	381	1122
4	T4	2022-09-29	17:54	73N53.29	20E22.71	307	1	288	nan
5	T5	2022-09-29	18:51	73N55.43	20E15.15	247	1	4	1123
6	T6	2022-09-29	19:30	73N57.64	20E07.38	185	1	175	nan
7	T7	2022-09-29	20:20	73N59.83	19E59.76	186	1	167	1124
8	T8	2022-09-29	20:55	74N02.02	19E52.14	112	1	96	nan
9	T9	2022-09-29	21:47	74N04.16	19E44.23	87	1	84	1125
10	24h-T	2022-09-30	03:11	74N00.81	19E57.26	144	1	124	nan
11	24h-T	2022-09-30	03:55	74N00.86	19E57.00	145	1	144	nan
12	24h-T	2022-09-30	04:17	74N00.95	19E57.04	145	1	44	nan
13	24h-T	2022-09-30	04:20	74N00.70	19E57.04	145	3	127	nan
14	24h-T	2022-09-30	04:45	74N00.70	19E56.90	143	1	143	nan
15	24h-T	2022-09-30	05:15	74N00.74	19E56.77	139	1	139	nan
16	24h-T	2022-09-30	05:45	74N00.70	19E56.74	139	1	139	nan
17	24h-T	2022-09-30	06:15	74N00.70	19E56.72	139	1	139	nan
18	24h-T	2022-09-30	06:46	74N00.67	19E56.63	139	1	138	nan
19	24h-T	2022-09-30	07:14	74N00.60	19E56.51	140	1	138	nan
20	24h-T	2022-09-30	07:45	74N00.54	19E56.54	151	1	140	nan
21	24h-T	2022-09-30	08:16	74N00.53	19E56.48	154	1	141	nan
22	24h-T	2022-09-30	08:45	74N00.59	19E56.39	142	1	127	nan
23	24h-T	2022-09-30	09:15	74N00.56	19E56.43	144	1	134	nan
24	24h-T	2022-09-30	09:45	74N00.59	19E56.39	142	1	135	nan
25	24h-T	2022-09-30	10:15	74N00.62	19E56.38	141	1	110	nan
26	24h-T	2022-09-30	10:50	74N00.66	19E56.40	140	1	130	nan
27	24h-T	2022-09-30	11:15	74N00.68	19E56.42	140	1	135	nan
28	24h-T	2022-09-30	11:45	74N00.67	19E56.41	140	1	135	nan
29	24h-T	2022-09-30	12:15	74N00.71	19E56.46	140	1	140	nan
30	24h-T	2022-09-30	12:45	74N00.77	19E56.67	141	1	141	nan
31	24h-T	2022-09-30	13:15	74N00.80	19E56.93	143	1	138	nan
32	24h-T	2022-09-30	13:45	74N00.81	19E57.23	144	1	138	nan
33	24h-T	2022-09-30	14:18	74N00.75	19E57.70	145	1	133	nan
34	24h-T	2022-09-30	14:45	74N00.65	19E57.77	147	1	136	nan
35	24h-T	2022-09-30	15:15	74N00.62	19E57.78	146	1	144	nan
36	24h-T	2022-09-30	15:45	74N00.57	19E58.05	155	1	146	nan
37	24h-T	2022-09-30	16:17	74N00.46	19E58.07	157	1	146	nan
38	24h-T	2022-09-30	16:45	74N00.58	19E58.25	157	1	149	nan
39	24h-T	2022-09-30	17:15	74N00.41	19E57.80	157	1	143	nan
40	24h-T	2022-09-30	17:44	74N00.59	19E58.27	157	1	150	nan
41	24h-T	2022-09-30	18:21	74N00.42	19E57.73	158	1	154	nan
42	24h-T	2022-09-30	18:45	74N00.41	19E57.79	157	1	155	nan
43	24h-T	2022-09-30	19:15	74N00.39	19E57.51	160	1	154	nan
44	24h-T	2022-09-30	19:45	74N00.37	19E57.55	160	1	151	nan
45	24h-T	2022-09-30	20:15	74N00.37	19E57.39	161	1	157	nan
46	24h-T	2022-09-30	20:45	74N00.37	19E57.32	164	1	158	nan
47	24h-T	2022-09-30	21:15	74N00.37	19E57.06	167	1	166	nan
48	24h-T	2022-09-30	21:45	74N00.42	19E56.70	165	1	159	nan
49	24h-T	2022-09-30	22:15	74N00.49	19E56.51	162	1	144	nan
50	24h-T	2022-09-30	22:45	74N00.50	19E56.49	160	1	154	nan
51	24h-T	2022-09-30	23:15	74N00.57	19E56.39	143	1	135	nan
52	24h-T	2022-09-30	23:45	74N00.61	19E56.39	142	1	133	nan
53	24h-T	2022-10-01	00:15	74N00.65	19E56.38	141	1	130	nan

54	24h-T	2022-10-01	00:45	74N00.69	19E56.44	140	1	137	nan
55	24h-T	2022-10-01	01:15	74N00.72	19E56.46	140	1	141	nan
56	24h-T	2022-10-01	01:45	74N00.71	19E56.44	141	1	141	nan
57	24h-T	2022-10-01	02:15	74N00.69	19E56.43	140	1	141	nan
58	24h-T	2022-10-01	02:45	74N00.71	19E56.45	140	2	141	nan
59	24h-T	2022-10-01	03:15	74N00.75	19E56.53	141	1	141	nan
60	B1	2022-10-02	11:14	77N33.13	30E23.93	212	1	184	nan
61	B2	2022-10-02	12:14	77N27.55	30E24.10	200	1	186	1128
62	B3	2022-10-02	12:47	77N24.63	30E23.75	180	1	170	nan
63	B4	2022-10-02	13:35	77N22.00	30E24.45	189	1	180	1129
64	B5	2022-10-02	14:09	77N19.30	30E24.40	191	1	185	nan
65	B6	2022-10-02	15:00	77N16.40	30E24.40	175	1	169	1130
66	B7	2022-10-02	15:35	77N13.60	30E24.25	181	1	165	nan
67	B8	2022-10-02	16:27	77N11.05	30E25.10	192	1	192	1131
68	B9	2022-10-02	17:03	77N08.14	30E24.05	205	1	198	nan
69	B10	2022-10-02	17:55	77N05.43	30E24.87	213	1	198	1132
70	B11	2022-10-02	18:36	77N02.56	30E23.45	226	1	215	nan
71	B12	2022-10-02	19:42	76N57.04	30E22.77	231	1	220	1133
72	B11	2022-10-02	20:31	77N02.57	30E23.51	223	1	207	nan
73	B10	2022-10-02	21:15	77N05.40	30E24.12	218	1	203	1134
74	B9	2022-10-02	21:47	77N08.14	30E23.92	204	1	193	nan
75	B8	2022-10-02	22:32	77N10.95	30E23.87	197	1	190	1135
76	B7	2022-10-02	23:01	77N13.60	30E24.28	181	1	174	nan
77	B6	2022-10-02	23:40	77N16.47	30E23.78	175	1	170	1136
78	B5	2022-10-03	00:09	77N19.32	30E24.11	190	1	174	nan
79	B4	2022-10-03	00:49	77N22.07	30E23.96	185	1	173	1137
80	B3	2022-10-03	01:16	77N24.58	30E24.07	182	1	177	nan
81	B2	2022-10-03	01:58	77N27.51	30E23.82	201	1	193	1138
82	B1	2022-10-03	02:46	77N33.13	30E23.91	213	1	215	nan
83	B0	2022-10-03	03:36	77N39.05	30E23.99	214	1	209	nan
84	A1	2022-10-03	06:21	77N46.00	32E11.79	124	1	40	1139
85	A1	2022-10-03	06:25	77N46.00	32E11.70	123	1	120	1139
86	A2	2022-10-03	07:02	77N47.95	31E56.53	137	1	123	nan
87	A3	2022-10-03	07:53	77N49.71	31E40.31	191	1	191	1140
88	A4	2022-10-03	08:35	77N51.29	31E24.10	234	1	180	nan
89	A5	2022-10-03	09:48	77N53.11	31E08.44	233	1	230	1141
90	A6	2022-10-03	10:32	77N54.85	30E52.60	225	1	220	nan
91	A7	2022-10-03	11:23	77N56.65	30E35.44	247	1	248	1142
92	A8	2022-10-03	12:02	77N58.43	30E19.93	238	1	229	nan
93	A9	2022-10-03	12:52	78N00.29	30E03.82	275	1	271	1143
94	A10	2022-10-03	13:32	78N02.12	29E48.16	301	1	300	nan
95	A11/F1	2022-10-03	14:34	78N03.88	29E31.62	333	1	331	1144
96	F2	2022-10-03	15:30	78N01.90	29E18.16	318	1	313	nan
97	F3	2022-10-03	16:36	77N58.58	29E04.23	307	1	302	1145
98	F4	2022-10-03	17:22	77N56.04	28E50.44	283	1	285	nan
99	F5	2022-10-03	18:28	77N53.54	28E36.95	266	1	244	1146
100	F6	2022-10-03	19:12	77N51.06	28E22.91	240	1	232	nan
101	F7	2022-10-03	20:08	77N48.44	28E09.05	212	1	211	1147
102	F8	2022-10-03	20:45	77N45.98	27E55.11	190	1	184	nan
103	F8	2022-10-03	21:02	77N45.98	27E55.11	190	1	186	nan
104	F9	2022-10-03	21:51	77N43.48	27E41.16	133	1	104	1148
105	F9	2022-10-03	22:00	77N43.48	27E41.16	133	1	120	1148
106	F10	2022-10-03	22:40	77N40.99	27E27.32	104	1	79	nan
107	F10	2022-10-03	22:59	77N40.99	27E27.32	104	1	94	nan
108	F11	2022-10-03	23:45	77N38.42	27E13.57	137	1	126	1149
109	F12	2022-10-04	00:20	77N36.00	26E59.75	150	1	144	nan
110	D1	2022-10-04	06:07	76N44.97	26E35.84	94	1	78	1150
111	D2	2022-10-04	#REF!	76N45.02	27E14.00	10	1	100	nan

112	D3	2022-10-04	08:27	76N45.00	27E51.50	139	1	130	1151
113	D4	2022-10-04	09:33	76N44.97	28E29.61	139	1	132	nan
114	D5	2022-10-04	10:09	76N44.98	28E39.40	181	1	172	1152
115	D6	2022-10-04	10:35	76N44.99	28E48.39	207	1	203	nan
116	D7	2022-10-04	11:32	76N45.03	29E07.88	250	1	247	1153
117	D8	2022-10-04	12:17	76N44.96	29E26.29	257	1	258	nan
118	D9	2022-10-04	13:45	76N45.03	30E04.38	254	1	256	1154
119	D10	2022-10-04	14:51	76N45.01	30E41.72	264	1	240	nan
120	D11	2022-10-04	16:23	76N45.00	31E19.93	275	1	250	1155
121	D12	2022-10-04	17:35	76N45.00	31E57.60	262	1	251	nan
122	D13	2022-10-04	18:32	76N45.02	32E16.46	244	1	228	1156
123	D14	2022-10-04	19:18	76N44.90	32E35.43	221	1	208	nan
124	D14	2022-10-04	19:28	76N45.12	32E35.31	212	1	187	nan
125	D15	2022-10-04	20:20	76N45.01	32E54.37	180	1	165	1157
126	D16	2022-10-04	21:04	76N45.02	33E13.14	125	1	114	nan
127	D17/I16	2022-10-04	22:25	76N44.93	33E51.23	124	1	115	1158
128	I15	2022-10-04	23:07	76N41.97	33E59.86	136	1	134	nan
129	I14	2022-10-05	00:05	76N37.11	34E03.20	165	1	154	1159
130	I13	2022-10-05	00:55	76N32.04	34E05.70	191	1	181	nan
131	I12	2022-10-05	02:02	76N27.22	34E09.37	250	1	230	1160
132	I11	2022-10-05	03:00	76N22.20	34E12.07	266	1	250	nan
133	I10	2022-10-05	04:14	76N17.11	34E15.08	290	1	276	1161
134	I9	2022-10-05	05:20	76N12.23	34E18.15	308	1	287	nan
135	I8	2022-10-05	06:49	76N07.26	34E21.99	299	1	270	1162
136	I7	2022-10-05	08:01	76N02.20	34E24.10	265	1	250	nan
137	I6	2022-10-05	09:33	75N57.31	34E27.30	259	1	256	1163
138	I5	2022-10-05	10:43	75N52.28	34E30.02	237	1	237	nan
139	I4	2022-10-05	12:13	75N47.37	34E32.92	202	1	197	1164
140	I3	2022-10-05	13:25	75N42.16	34E36.23	190	1	179	nan
141	I2	2022-10-05	14:34	75N37.35	34E39.19	169	1	155	1165
142	I1	2022-10-05	15:30	75N32.40	34E02.12	162	1	152	nan
143	24h-B4	2022-10-06	05:26	77N21.87	30E00.24	189	1	110	nan
144	24h-B4	2022-10-06	06:00	77N22.02	30E23.91	188	1	182	nan
145	24h-B4	2022-10-06	06:51	77N21.98	30E23.88	189	1	187	nan
146	24h-B4	2022-10-06	07:15	77N21.96	30E23.66	187	1	183	nan
147	24h-B4	2022-10-06	07:45	77N21.93	30E23.49	187	1	186	nan
148	24h-B4	2022-10-06	08:30	77N21.92	30E23.45	187	1	187	nan
149	24h-B4	2022-10-06	08:45	77N21.92	30E23.48	186	1	187	nan
150	24h-B4	2022-10-06	09:15	77N21.95	30E23.62	187	2	186	nan
151	24h-B4	2022-10-06	09:45	77N21.97	30E23.73	187	2	182	nan
152	24h-B4	2022-10-06	10:15	77N22.01	30E23.69	188	1	185	nan
153	24h-B4	2022-10-06	10:45	77N22.00	30E23.79	187	1	187	nan
154	24h-B4	2022-10-06	11:15	77N22.01	30E23.68	188	1	181	nan
155	24h-B4	2022-10-06	11:45	77N22.00	30E23.61	188	1	186	nan
156	24h-B4	2022-10-06	12:15	77N21.97	30E23.43	187	1	186	nan
157	24h-B4	2022-10-06	12:45	77N21.93	30E23.29	187	1	183	nan
158	24h-B4	2022-10-06	13:15	77N21.91	30E23.21	188	1	187	nan
159	24h-B4	2022-10-06	13:45	77N21.91	30E23.21	188	1	178	nan
160	24h-B4	2022-10-06	14:15	77N21.90	30E23.17	188	1	188	nan
161	24h-B4	2022-10-06	14:45	77N21.88	30E23.11	188	1	186	nan
162	24h-B4	2022-10-06	15:15	77N21.90	30E23.15	187	1	187	nan
163	24h-B4	2022-10-06	15:45	77N21.88	30E23.10	186	1	187	nan
164	24h-B4	2022-10-06	16:15	77N21.87	30E23.06	185	1	185	nan
165	24h-B4	2022-10-06	16:45	77N21.88	30E23.10	185	1	175	nan
166	24h-B4	2022-10-06	17:15	77N21.87	30E23.04	185	1	182	nan
167	24h-B4	2022-10-06	17:45	77N21.87	30E23.07	185	1	183	nan
168	24h-B4	2022-10-06	18:14	77N21.87	30E23.07	184	1	184	nan
169	24h-B4	2022-10-06	18:45	77N21.88	30E23.08	185	1	176	nan

170	24h-B4	2022-10-06	19:15	77N21.90	30E23.12	187	1	175	nan
171	24h-B4	2022-10-06	19:44	77N21.88	30E23.10	185	1	179	nan
172	24h-B4	2022-10-06	20:15	77N21.88	30E23.07	184	1	179	nan
173	24h-B4	2022-10-06	20:45	77N21.87	30E23.04	185	1	181	nan
174	24h-B4	2022-10-06	21:13	77N21.84	30E23.02	186	1	185	nan
175	24h-B4	2022-10-06	21:45	77N21.84	30E22.99	185	1	172	nan
176	24h-B4	2022-10-06	22:15	77N21.82	30E22.96	186	1	183	nan
177	24h-B4	2022-10-06	22:45	77N21.82	30E22.92	185	1	187	nan
178	24h-B4	2022-10-06	23:15	77N21.82	30E22.90	186	1	178	nan
179	24h-B4	2022-10-06	23:45	77N21.81	30E22.91	186	1	177	nan
180	24h-B4	2022-10-07	00:15	77N21.76	30E22.86	190	1	188	nan
181	24h-B4	2022-10-07	00:45	77N21.77	30E22.87	190	1	179	nan
182	24h-B4	2022-10-07	01:15	77N21.73	30E22.85	191	1	180	nan
183	24h-B4	2022-10-07	01:43	77N21.73	30E22.85	191	1	181	nan
184	24h-B4	2022-10-07	02:16	77N21.74	30E22.84	192	1	190	nan
185	24h-B4	2022-10-07	02:48	77N21.73	30E22.84	192	1	163	nan
186	B0	2022-10-08	10:47	77N39.98	30E23.97	210	1	194	1167
187	B1	2022-10-08	12:06	77N33.05	30E23.83	210	1	203	nan
188	B2	2022-10-08	13:20	77N27.39	30E24.33	201	1	190	1168
189	B3	2022-10-08	13:55	77N24.64	30E24.16	182	1	161	nan
190	B4	2022-10-08	15:04	77N21.90	30E24.60	190	1	189	1169
191	B5	2022-10-08	15:58	77N19.19	30E24.22	193	1	175	nan
192	B6	2022-10-08	16:52	77N16.43	30E24.01	179	1	172	1170
193	B7	2022-10-08	17:35	77N13.61	30E24.13	183	1	176	nan
194	B8	2022-10-08	18:28	77N10.89	30E23.99	198	1	180	1171
195	B9	2022-10-08	19:10	77N08.17	30E23.96	206	1	201	nan
196	B10	2022-10-08	20:06	77N05.33	30E24.00	217	1	210	1172
197	B11	2022-10-08	20:49	77N02.57	30E23.53	223	1	213	nan
198	B12	2022-10-08	22:07	76N56.99	30E22.80	232	1	231	1173
199	B11	2022-10-08	22:57	77N02.58	30E23.72	223	1	224	nan
200	B10	2022-10-08	23:29	77N05.21	30E24.07	217	1	212	nan
201	B9	2022-10-09	00:02	77N08.18	30E23.94	206	1	207	nan
202	B8	2022-10-09	00:32	77N10.92	30E23.72	196	1	190	nan
203	B7	2022-10-09	01:04	77N13.57	30E23.98	182	1	183	nan
204	B6	2022-10-09	01:35	77N16.41	30E24.01	179	1	175	nan
205	B5	2022-10-09	02:09	77N19.34	30E24.54	192	1	192	nan
206	B4	2022-10-09	02:44	77N21.91	30E24.60	189	1	190	nan
207	B3	2022-10-09	03:18	77N24.58	30E24.29	186	1	176	nan
208	B2	2022-10-09	03:56	77N27.36	30E24.33	202	1	197	nan
209	B1	2022-10-09	04:46	77N33.06	30E23.97	214	1	190	nan
210	B0	2022-10-09	05:52	77N38.98	30E21.16	217	1	208	nan
211	T1	2022-10-10	14:59	73N46.64	20E45.75	464	1	446	1178
212	T2	2022-10-10	15:51	73N48.80	20E37.89	433	2	435	nan
213	T3	2022-10-10	16:51	73N51.00	20E30.89	383	1	370	1179
214	T4	2022-10-10	17:32	73N53.25	20E22.81	309	1	294	nan
215	T5	2022-10-10	18:22	73N55.28	20E14.87	244	1	230	1180
216	T6	2022-10-10	18:59	73N57.32	20E07.41	189	1	185	nan
217	T7	2022-10-10	19:47	73N59.66	19E59.66	188	1	173	1181
218	T8	2022-10-10	20:18	74N01.98	19E52.85	113	1	95	nan
219	T9	2022-10-10	20:56	74N04.23	19E44.19	85	1	77	1182
220	24h-T4	2022-10-10	23:30	73N53.09	20E23.56	314	1	277	nan
221	24h-T4	2022-10-10	23:45	73N53.45	20E23.07	305	1	276	nan
222	24h-T4	2022-10-11	00:15	73N52.91	20E23.34	316	1	221	nan
223	24h-T4	2022-10-11	00:45	73N53.47	20E22.69	305	1	301	nan
224	24h-T4	2022-10-11	01:15	73N52.91	20E23.04	313	1	297	nan
225	24h-T4	2022-10-11	01:45	73N53.53	20E22.95	305	1	298	nan
226	24h-T4	2022-10-11	02:16	73N52.93	20E23.16	313	1	279	nan
227	24h-T4	2022-10-11	02:45	73N53.35	20E22.87	307	1	295	nan

228	24h-T4	2022-10-11	03:15	73N52.85	20E23.32	317	1	308	nan
229	24h-T4	2022-10-11	03:48	73N53.24	20E22.80	309	3	302	nan
230	24h-T4	2022-10-11	04:15	73N52.85	20E22.83	317	1	309	nan
231	24h-T4	2022-10-11	04:46	73N53.11	20E21.68	308	1	304	nan
232	24h-T4	2022-10-11	05:16	73N53.00	20E23.90	315	1	295	nan
233	24h-T4	2022-10-11	05:50	73N53.50	20E22.12	302	1	290	nan
234	24h-T4	2022-10-11	06:17	73N52.97	20E23.52	315	1	290	nan
235	24h-T4	2022-10-11	07:58	73N52.90	20E23.33	311	1	285	nan
236	24h-T4	2022-10-11	08:30	73N53.30	20E23.43	310	1	295	nan
237	24h-T4	2022-10-11	09:12	73N53.06	20E23.20	308	1	295	nan
238	24h-T4	2022-10-11	09:44	73N53.00	20E23.87	316	1	301	nan
239	24h-T4	2022-10-11	10:15	73N54.48	20E21.67	301	1	297	nan
240	24h-T4	2022-10-11	10:45	73N53.04	20E23.56	313	1	298	nan
241	24h-T4	2022-10-11	11:15	73N53.53	20E22.40	305	1	342	nan
242	24h-T4	2022-10-11	11:45	73N52.85	20E22.02	314	1	309	nan
243	24h-T4	2022-10-11	12:15	73N53.41	20E22.03	301	1	300	nan
244	24h-T4	2022-10-11	12:45	73N52.79	20E22.18	316	1	318	nan
245	24h-T4	2022-10-11	13:15	73N53.29	20E22.96	309	1	185	nan
246	24h-T4	2022-10-11	13:15	73N52.84	20E22.00	313	1	304	nan
247	24h-T4	2022-10-11	14:15	73N53.19	20E23.13	310	1	310	nan
248	24h-T4	2022-10-11	14:45	73N52.78	20E22.05	317	1	318	nan
249	24h-T4	2022-10-11	15:15	73N52.96	20E23.28	311	1	318	nan
250	24h-T4	2022-10-11	15:45	73N52.85	20E21.63	311	1	310	nan
251	24h-T4	2022-10-11	16:15	73N52.92	20E22.49	312	1	305	nan
252	24h-T4	2022-10-11	16:46	73N53.35	20E21.91	303	1	308	nan
253	24h-T4	2022-10-11	17:15	73N53.40	20E21.94	302	1	280	nan
254	24h-T4	2022-10-11	17:46	73N53.35	20E22.52	307	1	305	nan
255	24h-T4	2022-10-11	18:15	73N53.29	20E22.56	307	1	304	nan
256	24h-T4	2022-10-11	18:45	73N53.31	20E22.03	303	1	304	nan
257	24h-T4	2022-10-11	19:15	73N53.08	20E22.99	313	1	285	nan
258	24h-T4	2022-10-11	19:44	73N53.32	20E21.99	303	1	300	nan
259	24h-T4	2022-10-11	20:15	73N53.03	20E23.20	315	1	280	nan
260	24h-T4	2022-10-11	20:45	73N53.29	20E21.82	302	1	304	nan
261	24h-T4	2022-10-11	21:15	73N53.05	20E23.79	313	1	304	nan
262	24h-T4	2022-10-11	21:45	73N53.45	20E22.89	304	1	289	nan
263	24h-T4	2022-10-11	22:15	73N52.89	20E23.43	316	1	304	nan
264	24h-T4	2022-10-11	22:45	73N53.33	20E22.90	308	1	291	nan
265	24h-T4	2022-10-11	23:15	73N52.83	20E22.98	317	1	310	nan
266	24h-T4	2022-10-11	23:45	73N53.31	20E23.06	307	1	290	nan
267	24h-T4	2022-10-11	00:15	73N52.90	20E23.23	316	1	304	nan

c. Cruise participant list (in no particular order)

Name	E-mail	Affiliation	Responsibility	Task
Ilker Fer	Ilker.fer@uib.no	UIB	cruise co-leader	MSS, Glider
Till Baumann	till.baumann@uib.no	UIB	cruise leader	MSS, Mooring
Helge Bryhni	Helge.Bryhni@uib.no	UIB	Engineer	MSS, Mooring
Zoé Koenig	Zoe.Koenig@npolar.no	UIB/NP	Postdoc	MSS, Glider
Achim Randelhoff	ara@akvaplan.niva.no	Akvaplan Niva	Scientist	MSS, Glider
Ole Rieke	O.Rieke@uib.no	UIB	Tech. assistant	SADCP, MSS

Idunn Hana	idunn.hana@gmail.com	UIB	Student	MSS, LADCP
Anne Årvik	Anne.Arvik@student.uib.no	UIB	Student	MSS, LADCP

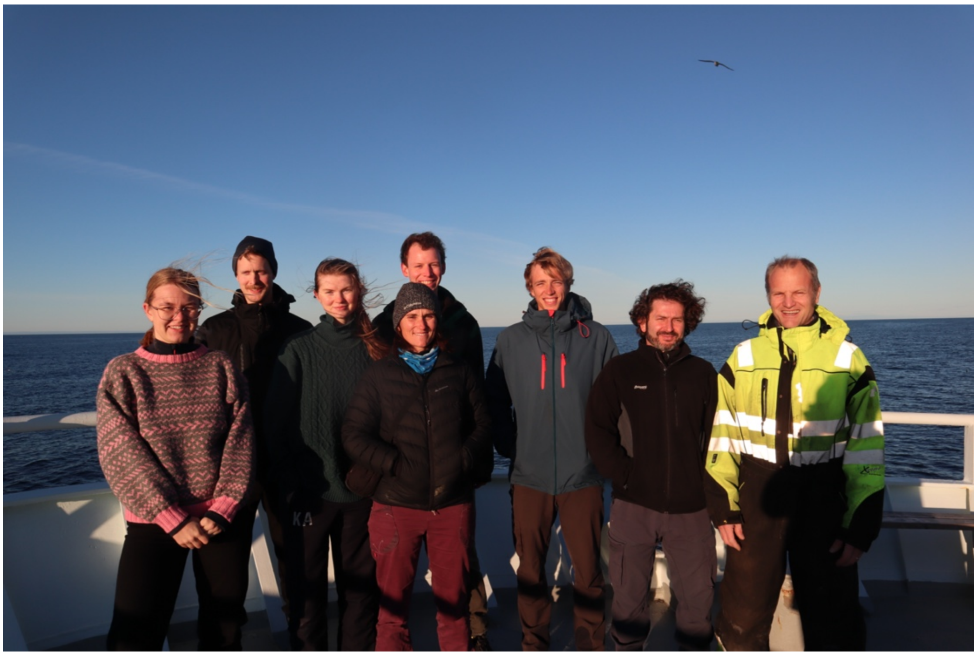


Figure 25: Group photo of the cruise participants.

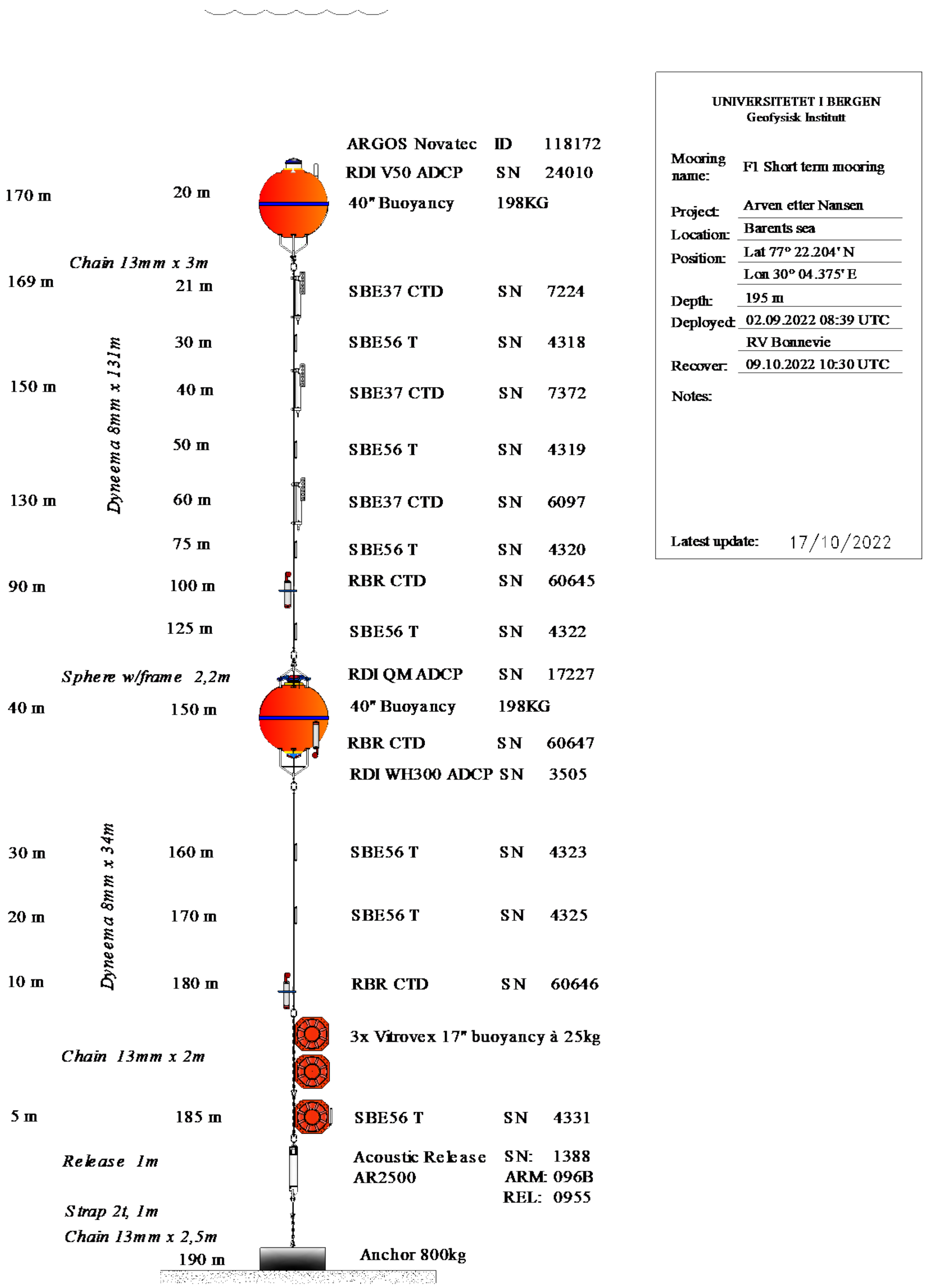
Appendix II. Datasets

Table 6: List of planned datasets

PI	**Gear type**	**Parameter**	RF	Sharing within project	Publish data	Ask for embargo of data?
Ilker Fer	MSS (Microstructure Sensor Profiler)	Ocean temperature, conductivity, pressure, dissipation rate of turbulent kinetic energy	RF1	yes	yes, 2023	no
Øyvind Breivik	OpenMetBuoy wave buoys	GPS location, wave spectra	RF1	yes	no	no
Ilker Fer	Glider	Temperature, Conductivity, Depth-average-current	RF1, RA-C	yes	yes, 2023	no

Ilker Fer	Microrider on slocum glider	Ocean temperature, pressure, dissipation rate of turbulent kinetic energy	RF1, RA-C	yes	yes, 2023	no
Ilker Fer	Short-term Mooring (deployed for 7 days) with CTDs, temperature loggers, ADCPs	Temperature and salinity at different levels. Current direction and speed through water collumn and under water surface.	RF1	yes	yes, 2023	no
Simo-Matti Siiriä	Apex Argo Float	Temperature, Conductivity,Pressure, location	RF1	yes	already done	no
Ilker Fer	2 RDI 300kHz ADCPs mounted upwards and downward looking at the CTD frame	vertical profile of horizontal velocity	RF1	yes	yes, 2023	no
Ilker Fer	Ship mounted 150 kHz RDI Ocean Surveyor ADCP	time series of vertical profiles of horizontal velocity	RF1	yes	yes, 2023	no

Appendix III. Mooring


ARGOS Novatec ID 118172
RDI V50 ADCP SN 24010
40" Buoyancy 198KG
170 m 20 m
Chain 13mm x 3m
169 m 21 m SBE37 CTD SN 7224
30 m SBE56 T SN 4318
150 m 40 m SBE37 CTD SN 7372
50 m SBE56 T SN 4319
130 m 60 m SBE37 CTD SN 6097
Dyneema 8mm x 131m
75 m SBE56 T SN 4320
90 m 100 m RBR CTD SN 60645
125 m SBE56 T SN 4322
Sphere w/frame 2,2m
RDI QM ADCP SN 17227
40 m 150 m 40" Buoyancy 198KG
RBR CTD SN 60647
RDI WH300 ADCP SN 3505
30 m 160 m SBE56 T SN 4323
20 m 170 m SBE56 T SN 4325
10 m 180 m RBR CTD SN 60646
Dyneema 8mm x 34m
3x Vitrovex 17" buoyancy à 25kg
Chain 13mm x 2m
5 m 185 m SBE56 T SN 4331
Release 1m
Acoustic Release AR2500
SN: 1388
ARM: 096B
REL: 0955
Strap 2t, 1m
Chain 13mm x 2,5m
190 m Anchor 800kg
UNIVERSITETET I BERGEN
Geofysisk Institutt
Mooring name: F1 Short term mooring
Project: Arven etter Nansen
Location: Barents sea
Position: Lat 77° 22.204' N
Lon 30° 04.375' E
Depth: 195 m
Deployed: 02.09.2022 08:39 UTC
RV Bonnevie
Recover: 09.10.2022 10:30 UTC
Notes:
Latest update: 17/10/2022

The Nansen Legacy in numbers

6 years

The Nansen Legacy is a six-year project, running from 2018 to 2023.

280 people

There are about 230 researchers working with the Nansen Legacy, of which 73 are early career scientists. In addition, 50 persons are involved as technicians, project coordinators, communication advisers and board members.

1 400 000 km² of sea

The Nansen Legacy investigates the physical and biological environment of the northern Barents Sea and adjacent Arctic Ocean.

10 institutions

The Nansen Legacy unites the complimentary scientific expertise of ten Norwegian institutions dedicated to Arctic research.

>10 fields

The Nansen Legacy includes scientists from the fields of biology, chemistry, climate research, ecosystem modelling, ecotoxicology, geology, ice physics, meteorology, observational technology, and physical oceanography.

50/50 financing

The Nansen Legacy has a total budget of 740 million NOK. Half the budget comes from the consortiums' own funding, while the other half is provided by the Research Council of Norway and the Ministry of Education and Research.

>350 days at sea

The Nansen Legacy will conduct 15 scientific cruises and spend more than 350 days in the northern Barents Sea and adjacent Arctic Ocean between 2018 and 2022. Most of these cruises are conducted on the new Norwegian research icebreaker RV *Kronprins Haakon*.

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Photo cover: Ilker Fer