SS-MSC2 Process cruise/ mooring service 2020

Cruise Report

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SS-MSC2 Process cruise/mooring service 2020

Cruise GOS 2020 113

G.O. SARS

Longyearbyen-Tromsø

October 6 - October 27, 2020

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Summary

The cruise GOS 2020113 (6 October 2020 Longyearbyen, 27 October 2020 Tromsø) aboard the Research Vessel G.O. SARS is a mooring service/deployment and process studies cruise of the Nansen LEGACY project.

The study region covered 24-35°E and 75-79°N, with objectives to deploy moorings for process studies (1 year duration), service and redeploy accessible gateway moorings (long term), deploy underwater gliders (cruise duration as well as 3-4 months missions), conduct ocean mixing and water transformation process studies in the Barents Sea Polar Front region east of Svalbard, and sample for biology, nutrients and the carbonate chemistry in the water column at selected stations. 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, T2-1 on ocean acidification, T3-2 on timing of critical biological processes.

Overall, we deployed 7 process moorings with physical oceanography focus, recovered and redeployed gateway moorings M3, M5 and M5-bioac and recovered the gateway mooring M6. 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 212 microstructure profiles down to 0-20 m above seabed; 64 CTD (32 with bottle sampling) and 63 LADCP profiles down to 5 m above seabed, and 20 days of underway current profiles. From gliders we obtained 801 profiles (16 days) including 266 profiles (6 days) using microstructure sensors in the polar front region north of Hopen Trench, and 678 profiles (10 days) between the Great Bank and the Central Bank.

Using the CTD's water sampler, we collected 149 water samples for nutrient and carbonate chemistry analyses, 136 for POC/PON analyses, 68 for dissolved oxygen analyses, 52 for chlorophyll analyses, and 48 for phytoplankton analyses. We used multinet and bongo net for mesozooplankton sampling. We performed 4 hauls with Multinet (2 with 64 μm and 2 with 180 μm meshed net) and 29 hauls Bongo net (18 profiles with the 180 μm and 40 profiles with the 64 μm meshed net).

1. Background

The cruise GOS 2020113 aboard the Research Vessel G.O. SARS is a mooring service/deployment and 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.

GOS 2020113 is primarily a physical oceanography cruise with objectives to deploy moorings for process studies (1 year duration), service and redeploy accessible gateway moorings (long term), deploy underwater gliders (cruise duration as well as 3-4 months missions) and conduct ocean mixing and water transformation process studies in the Barents Sea Polar Front region east of Svalbard. Objectives further include sampling for biology, nutrients and the carbonate chemistry in the water column at selected stations, which will help close the gap between the December 2019 (Q4) and March 2021 (Q1) seasonal cruises. The LEGACY seasonal transect covers 7 stations with a gradient from boreal to Arctic conditions and from shelf to basin. During this cruise, stations P1 (Atlantic reference station), P2 (shelf station) and P3 were sampled in detail.

The Barents Sea Polar Front is one of the selected sites for studies and the processes controlling the position and variability of the front is the focus of GOS 2020113. 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, T2-1 on ocean acidification, T3-2 on timing of critical biological processes. 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
T3-2.1 variations in abundance, biomass and species composition of mesozooplankton
T3-2.2 seasonality of copepod production

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

2. Survey area

An overview map and a detailed station map are shown in **Figure 1** and **Figure 2**, respectively.

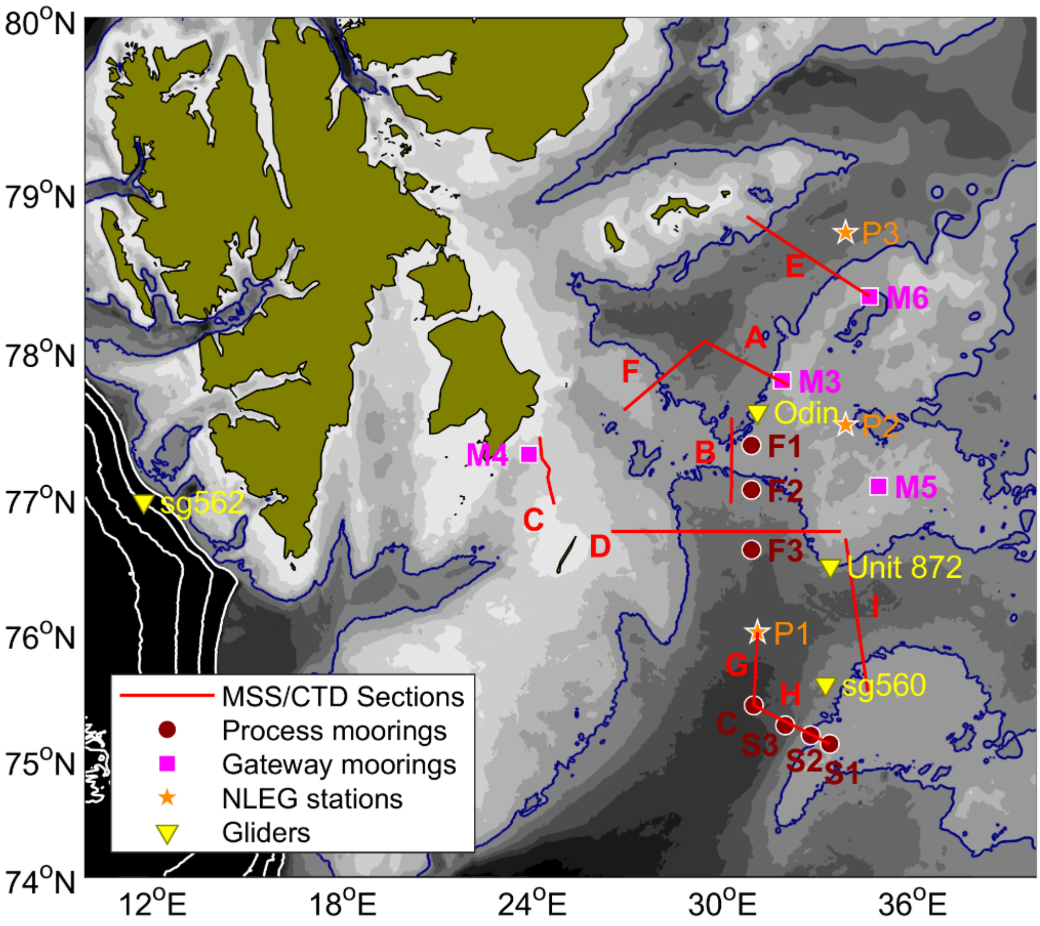

Figure 1. Isobaths (IBCAOv3) every 50 m at depths less than 500 m and every 500 m (white contours) deeper. Blue contour is the 200 m isobath. P3 is not occupied, instead a nearby station in the middle of Section E is taken. Sections worked with MSS and CTD (red lines) and mooring locations (see legend) are shown. Glider locations are shown at the deployment time.

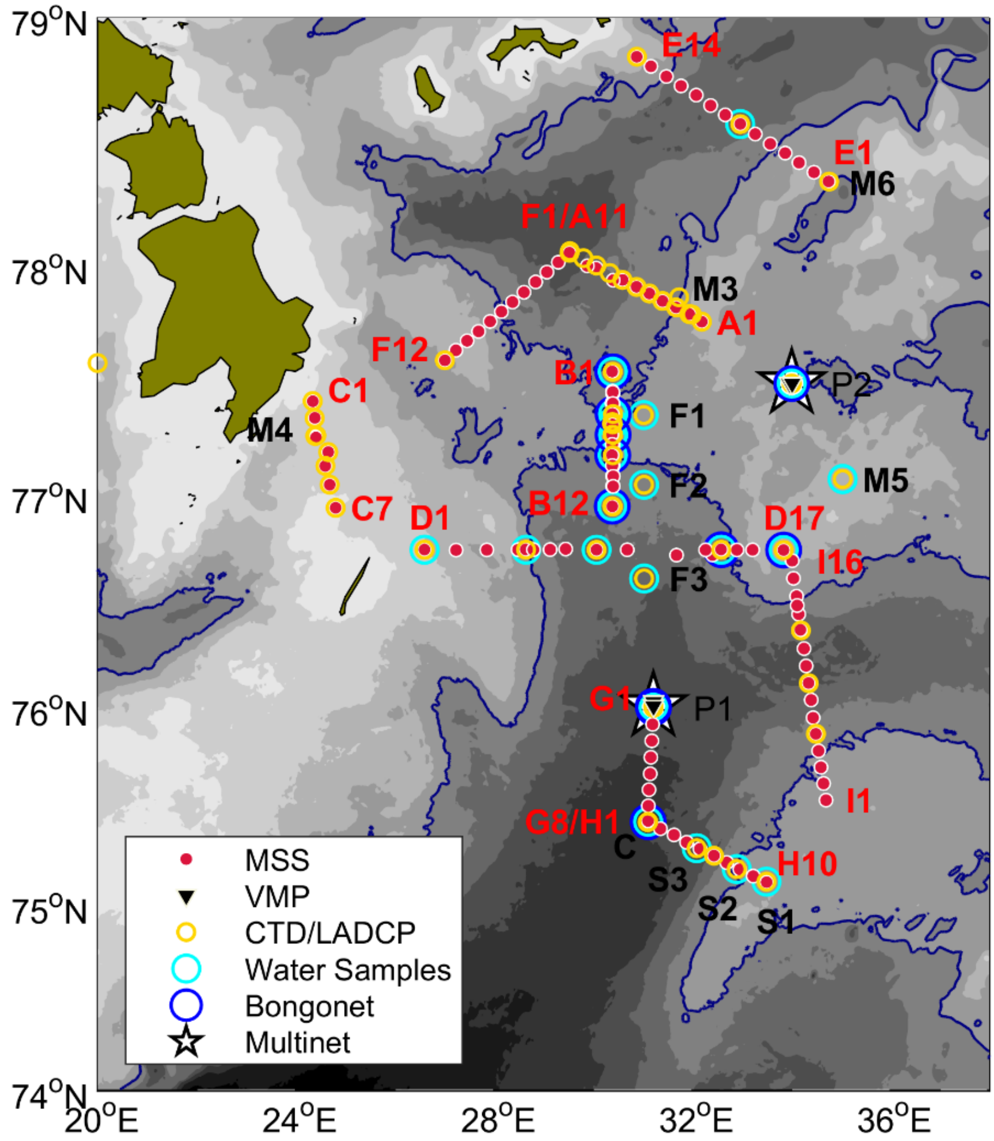

Figure 2. Station map. Isobaths are as in **Figure 1**. Sections are indicated by their numbered end stations in red. Black numbered letters refer to moorings. A station can have multiple activities as indicated in the legend. For example the middle stations of Section F are MSS only, whereas the end stations are MSS and CTD/LADCP. P1 and P2 have all the activities.

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 212 microstructure profiles down to 0-20 m above seabed; 64 CTD (32 with bottle sampling) and 63 LADCP profiles down to 5 m above seabed, and 20 days of underway current profiles. From gliders we obtained 801 profiles (16 days) including 266 profiles (6 days) using microstructure sensors in the polar front region north of Hopen Trench, and 678 profiles (10days) between the Great Bank and the Central Bank.

Using the CTD's water sampler, we collected 149 water samples for nutrient and carbonate chemistry analyses, 136 for POC/PON analyses, 68 for dissolved oxygen analyses, 52 for chlorophyll analyses, and 48 for phytoplankton analyses. We used multinet and bongo net for mesozooplankton sampling. We performed 4 hauls with Multinet (2 with 64 µm and 2 with 180 µm meshed net) and 29 hauls Bongo net (18 profiles with the 180 µm and 40 profiles with the 64 µm meshed net).

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 with sensors listed below. An altimeter allowed profiling close to the bottom. The CTD was equipped with a 12 position SBE 32 Caroussel. The rosette was fitted with 12 10-litre bottles for collecting water samples for salinity calibration at all stations, for dissolved oxygen calibration (selected stations), nutrient and carbonate chemistry analyses (selected stations), and biology analysis (selected stations). In total 64 CTD-stations were taken, recorded in files sta0346 to sta0409. Their locations are listed in Appendix I. Station positions are shown in **Figure 2**. At all stations, water samples for salinity calibration were collected at the deepest sampling level. At 6 stations, 68 samples were drawn at selected levels for oxygen concentration analysis.

Table 1. Sensor details installed on the CTD rosette.

Sensor	SN	Calibration/Service
Temperature	2491	16.10.2019
Conductivity	2694	01.10.2019
Pressure	1374	24.10.2018
Temperature, 2	5127	16.10.2019
Conductivity, 2	3848	01.10.2019
Altimeter	60144	May 2013
Oxygen, SBE 43	3527	16.10.2019
Fluorometer, Chelsea Aqua 3	088-251	03.02.2012
Par/Irradiance,	70657	13.01.2017
SPAR/Surface Irradiance	20538	13.01.2017
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, CDOM, 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 3**) and the conductivity (**Figure 4**, 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 0.015°C. The secondary conductivity sensor in the beginning of the cruise recorded erroneous values, particularly in the first two casts, then slowly adjusting in time to the primary sensor values. After the first 4 days elapsed after the first cast, the profile-averaged RMS differences are less than 0.015 on practical scale. In presentation of the data in this report, we use measurements from the primary sensor.

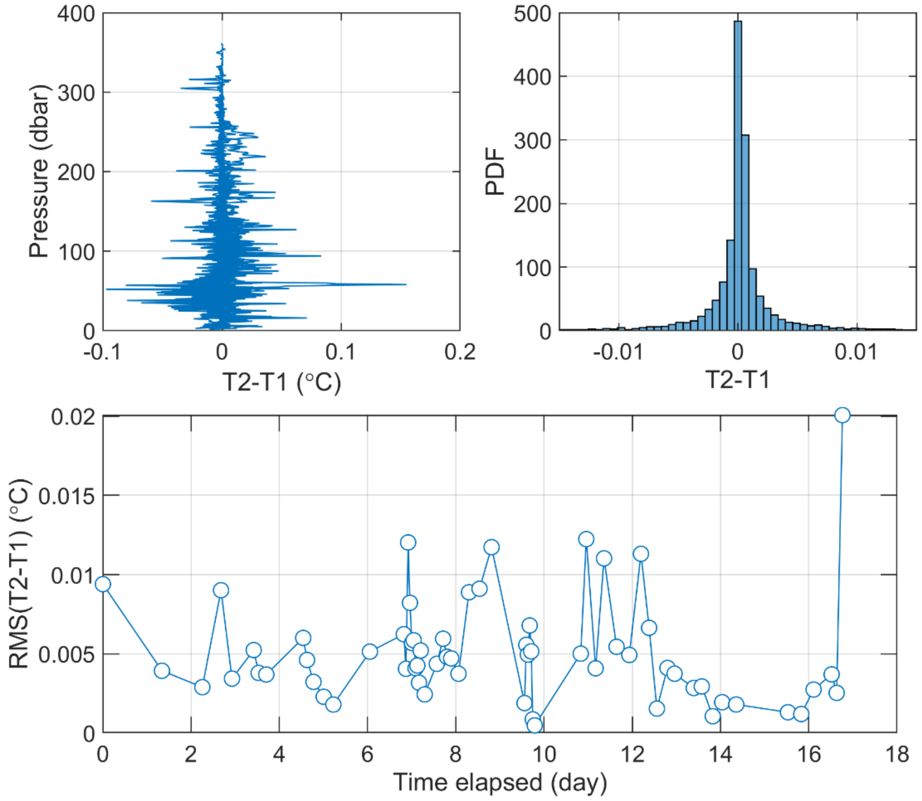

Figure 3. Comparison of temperature measurements from the two SBE units. Profiles of difference between the two sensors, its histogram, and RMS temperature difference for each profile throughout the cruise.

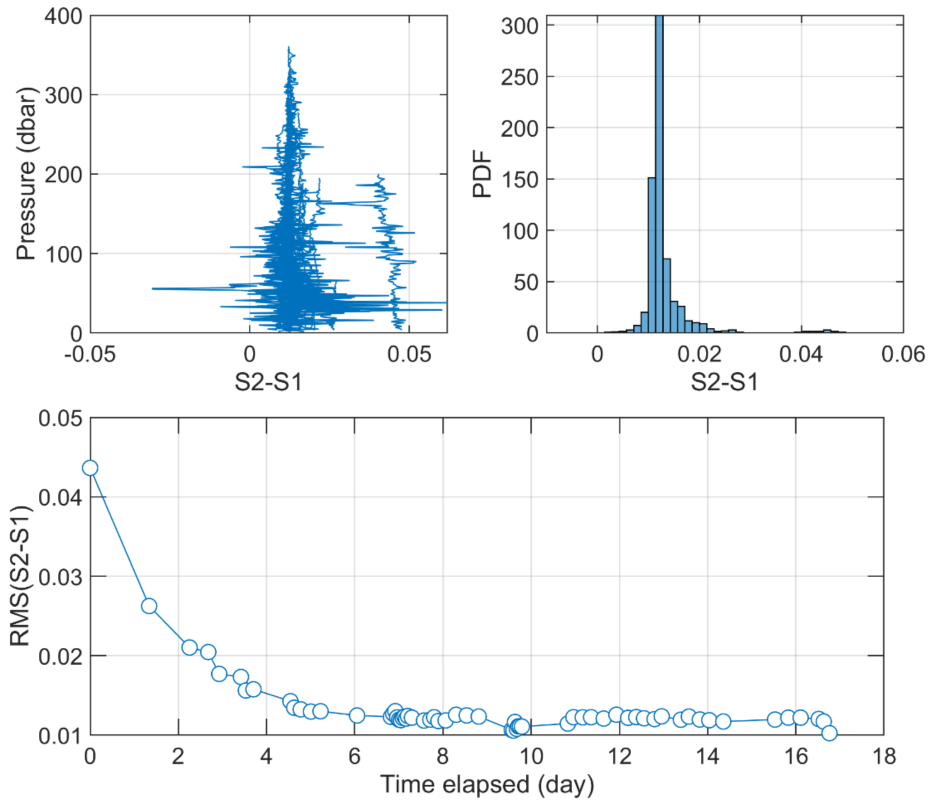

Figure 4. As in **Figure 3** but for comparison of the salinity measurements from the two SBE units.

3.1.3 Conductivity correction from 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. Following the procedure recommended by UNESCO [1988], only data within the 95% confidence interval are used to correct the calibration of the CTD conductivity.

Station 370 (sample 24) had all bad salinity data from the primary sensor and is excluded from the analysis. The sample 34 is from shallow water, drawn at 51m depth and is an outlier that is also excluded. These data points are shown as pentagrams in **Figure 5**. 60 data points are used for estimating a correction.

Histogram of $\Delta C = C_{CTD} - C_{Bot}$, difference of conductivity measured by CTD and inferred from the Portasal, is not normally distributed (**Figure 6**). 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 0.99966 is obtained, which reduced the RMS salinity difference from 0.014 to 0.005. An alternative correction is a constant salinity offset with 0.013 practical units, which also reduced the RMS salinity difference to 0.005.

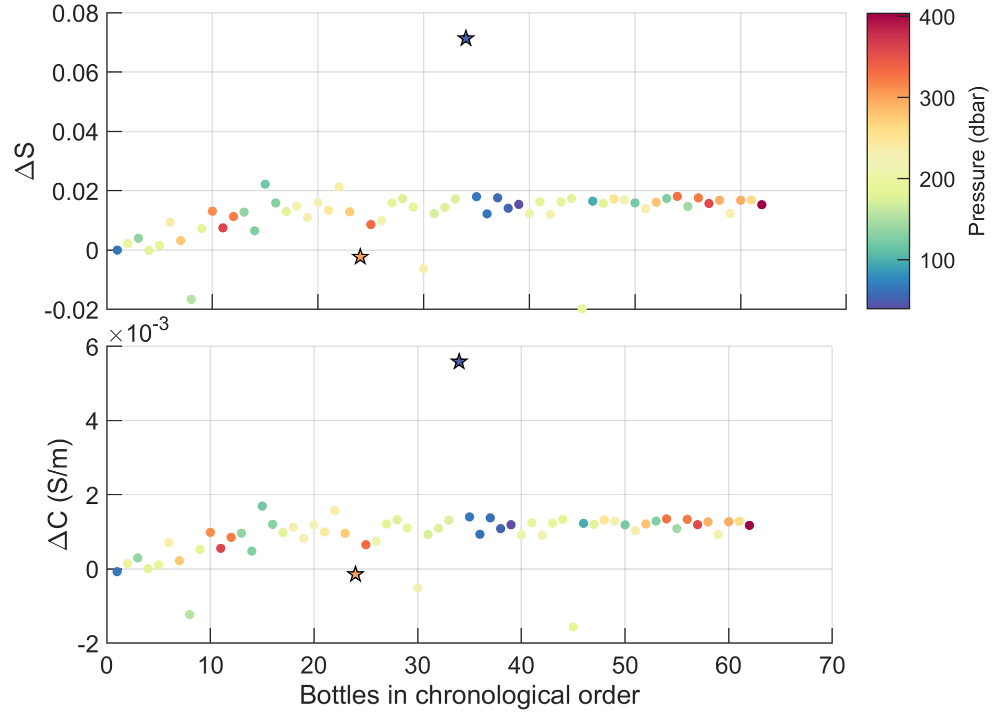

Figure 5. Difference between CTD-derived and bottle data: upper panel, salinity, lower panel, conductivity. An outlier (sample 34) from a shallow station and a station with erroneous primary salinity data (sample 24) are indicated by pentagrams.

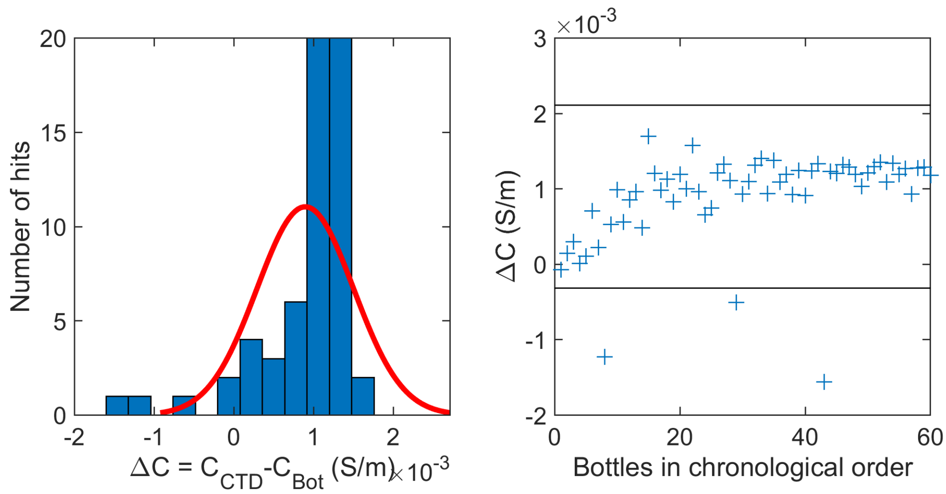

Figure 6. (Left) Histogram of CTD-derived and bottle conductivity differences. Red curve is the normal-distribution fit for the sample mean and standard deviation. (Right) ΔC in chronological order with 95% confidence intervals on the mean indicated (black envelopes).

3.1.4 Samples for oxygen calibration

During the cruise, 68 water samples were taken at several depth levels at 6 CTD stations (CTD-stations 351 to 356) on 10-11 October and analysed for dissolved oxygen. The Winkler titration method with visual detection of the end point was used. Of the 68 samples, 18 duplicates were excluded from the analysis. The dissolved oxygen concentrations obtained by the Winkler method (OX sample) were significantly different than the concentrations measured by the CTD dissolved oxygen sensor (OX CTD) (Figure 7). The relation was linear, and the difference between the two measurements is used to calculate an offset correction. The mean offset was 0.22 ml L^{-1}. We applied this offset correction to the concentrations measured by the CTD sensor. A more detailed, multiple-parameter calibration, for dependency on pressure was not deemed necessary.

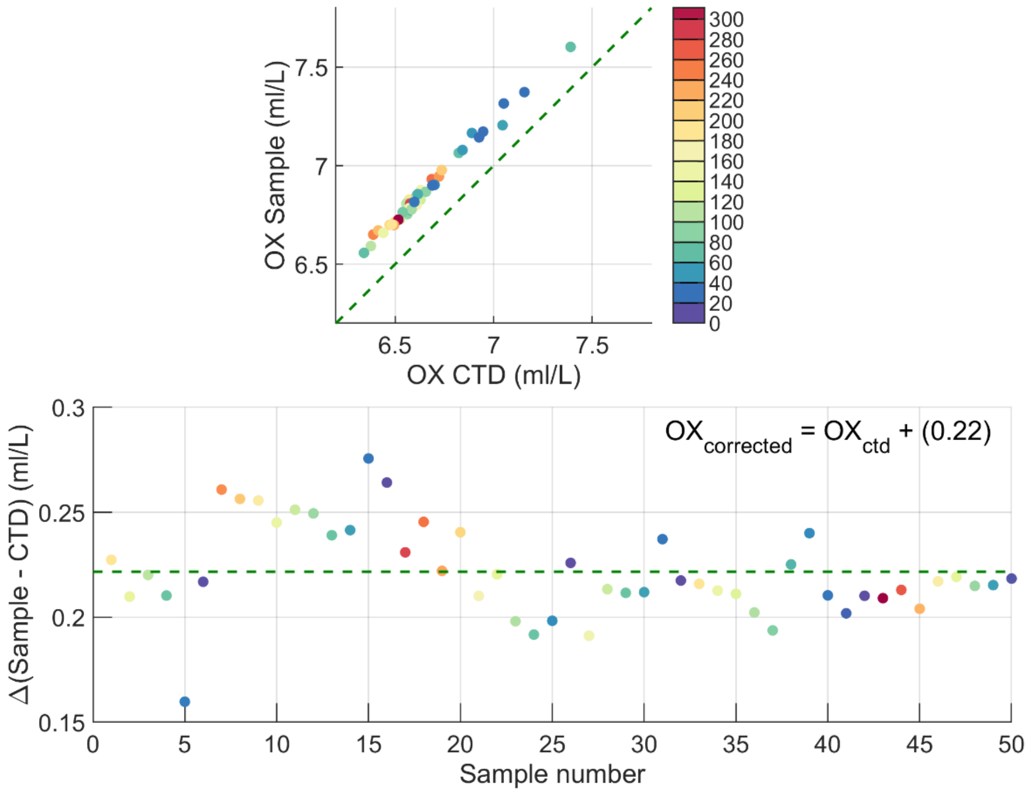

Figure 7. (upper panel) Scatter plot of CTD-measured oxygen values against oxygen samples analyzed on board, color coded with sample depth. (lower panel) difference between the sample reading and the CTD reading. The average offset is 0.22.

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 1-2°. Batteries were not replaced during the cruise (i.e., a compass re-calibration was not necessary). In total 63 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, except in shallow profiles (50-90 m depth) which will require care in postprocessing.

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)

Two downward looking Acoustic Current Doppler Profilers (ADCPs) are mounted in the hull of the ship:

75 kHz, transducer alignment angle 46.60°

150 kHz, transducer alignment angle 54.50°

Due to the drought of the ship, their mounting depth is effectively 8 m. The ADCPs were set up in broad-band mode and measured continuously during the cruise. They both have 4 beams with a 30° beam angle. The 75/150 kHz ADCP was set to measure with 70/167 pings per ensemble in 75/100 bins with 8m/4m bin size and 8m/4m blanking distance.

The collection of raw data (single-ping data from the ADCPs as well as vessel navigational data) and initial processing (generation of short-term averages (STA) and long-term averages (LTA)) was performed with the VmDAS software. The post-processing has been done using the single ping data with the CODAS package maintained at https://currents.soest.hawaii.edu. The typical processed horizontal velocity uncertainty is 2-3 cm s^{-1}.

3.3 Microstructure Profiling

3.3.1 VMP

The main instrument planned for ocean microstructure measurements was the vertical microstructure profiler VMP2000 SN009. However, already in the first casts, shear 1 and SBE-C channels returned erroneous signal. We experimented with different probes and concluded that the problem was in the circuit boards. We switched from VMP to the back-up microstructure system (MSS) described below. Further inspections of the VMP2000 concluded that the circuit board of sh1 and SBE-C needed repair, which was not possible on board.

We collected 7 microstructure profiles with the VMP. A complete list of casts is provided in Appendix I. Operation and deployment methods for the VMP system are similar to that described in earlier cruise reports. Because of the limited number of casts, and the reduced channels for each cast, we defer the reader to earlier cruise reports for a detailed description of the system. Briefly, it is a 2000-m depth rated, loosely tethered vertical microstructure profiler (http://www.rocklandscientific.com), equipped with shear probes, thermistors, a micro-conductivity sensor and a pumped SBE C-T sensor. The nominal fall rate is 0.6 m/s and data are transmitted in real time to a ship-board data acquisition system. VMP data reported here are from preliminary processing conducted during the cruise, based on RSI's ODAS MATLAB software v 4.04.

3.3.2 MSS

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 4.58e-04, SHE1) and SN068 (sensitivity 4.83e-4, SHE2). The same sensors were used throughout the cruise.

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 207 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 at the bottom. A full list of MSS casts is given in Appendix I.

3.4 Gliders

3.4.1 Seagliders

Two Seagliders were deployed during the cruise:

Sg562 (West Spitsbergen Current mission) was deployed on 7 Oct 2020, 07:00 UTC, at 76N 58', 11E 51', at the West Spitsbergen Slope off the South Cape at 1000 m depth.

Sg560 (Barents Sea mission) was deployed on 22 Oct 2020, 07:00 UTC, at 75N 35.85', 33E 22.0'. The day before (21 Oct), the Seaglider was tested with rope on as we suspected it was ballasted heavy. This was confirmed and 118 g foam (equivalent to 236 g buoyancy) was added.

The Seaglider missions will last for about 6 months before they are picked up. Sg562 will repeat a zonal section along 76N50. The planned track for Sg560 is shown in Figure **Figure 8**. The Seagliders operate between the surface and 1,000 m depth, sampling CTD and oxygen on both dives and climbs. CTD is sampled every 10 s in the upper 400 m while oxygen is sampled at every 50 s. Below 400 m depth the sampling frequency is lower. The vertical velocity is normally close to 10 cm s^{-1}. For each dive, a depth-averaged current (DAC) is estimated based on the deviation between expected surfacing location deduced from the flight model and the actual surfacing location. The Seagliders are equipped with Paine strain-gauge pressure sensors, SBE CT Sail and an Aanderaa dissolved oxygen sensors. The data is normally processed using the University of East Anglia Seaglider toolbox (**http://www.byqueste.com/toolbox.html**), based on the methods described by Garau et al. (2011) and Frajka-Williams et al. (2011). Processed Absolute Salinity, S_A, and Conservative Temperature, Θ, are accurate to 0.01 g kg^{-1} and 0.001°C, respectively, and DAC is accurate to 0.01 m s^{-1} (p. 9 "Seaglider Quality Control Manual," 2012).

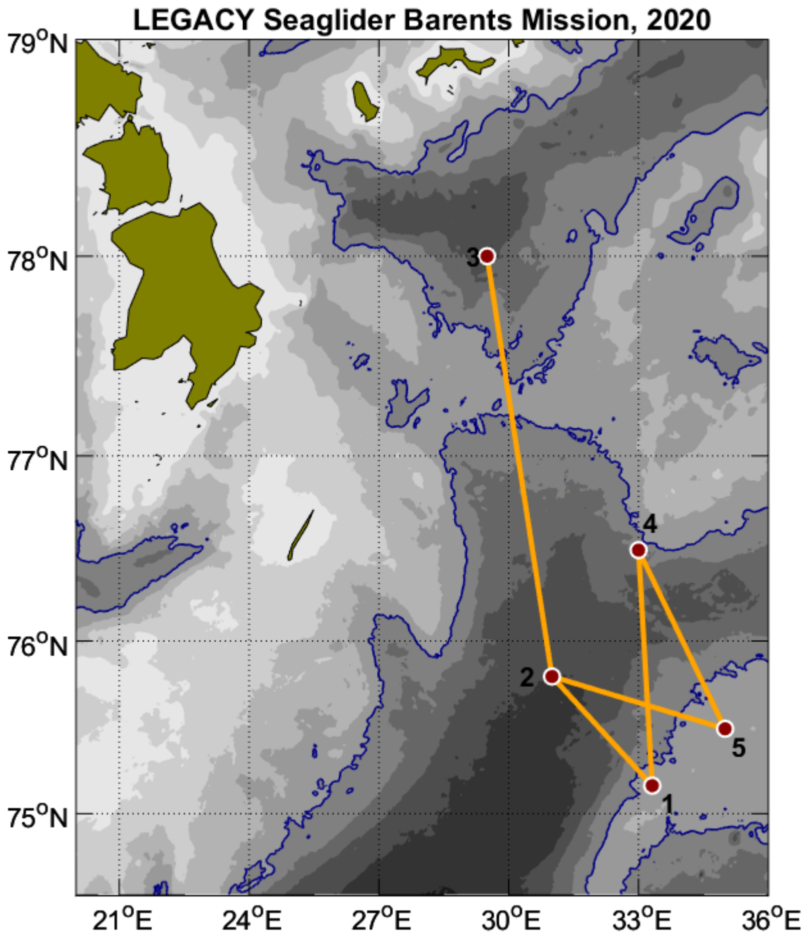

Figure 8. Waypoints for the planned mission of Sg560.

3.4.2 Slocum gliders

Two Teledyne Webb Research 1000m electric gliders were deployed during the cruise**.** The Slocum G3s are buoyancy-driven autonomous underwater vehicles that provide 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. Unit_872's payload consisted of a single CTD sensor (CTD41CP, SN9662).

Details of the two missions are given in **Table 2**. On both vehicles 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.

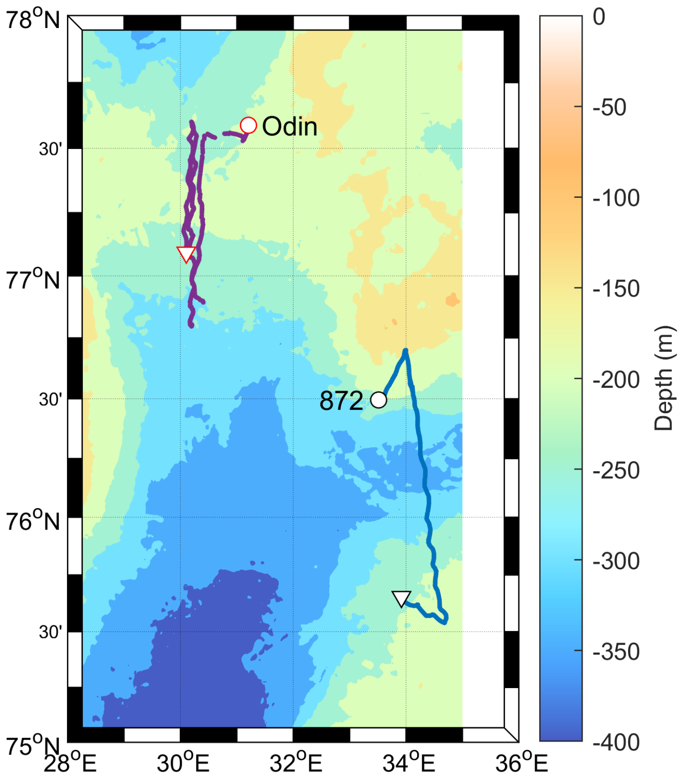

Figure 9. Tracks of Slocum gliders Odin and Unit 872. Deployment location is circle, and recovery location is the arrowhead.

Odin

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 minimise vibration noise in the vehicle and achieve the desired science goals, using the glider mission UIB01AMR.MI. The MicroRider and CTD sampling behaviours 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 uncommanded if the pressure sensor was offset when it reached to surface and this was monitored throughout the mission.

Odin was deployed on 8 October, at 22:00 UTC to run a transect between the F1 and F3 mooring sites. Due to a large number of fishing vessels at the F1 site the glider was deployed 20km to the East at 77°N 35.30', 31°E 12.52' and spent first leg of its mission transiting to F1.

There were a particularly high number of issues and aborts to resolve during this mission, for a complete summary refer to the deployment’s technical report (*201001-Barents-Odin – Technical report.pdf).* Aborts due to insufficient storage memory and rudder movement caused several pauses in glider sampling at the start of the mission, an issue with the MicroRider’s CR123 cell stopped MR sampling on October 15. The vehicle was left to drift on the sea surface for 24hrs while this issue was investigated and TWR engineers were consulted before resuming late October 16 with running only the CTD.

The glider was retrieved on the morning of October 24 at 77°N 05.53', 30°E 06.22' having completed the F1-F3 transect 3.5 times covering 320km and completing 801 profiles including 266 (308) with the MicroRider. **Figure 9** shows the surface locations of the glider over the 16-day mission.

Unit_872

Unit_872 was deployed on 10 October, at 22:00 UTC, at 76°N 29.62', 33°E 30.84'. Though this was primarily an opportunistic deployment intended to test the flight dynamics and performance of a new vehicle the glider was programmed to carry out a North-South transect to observe spatial and vertical distributions of physical ocean properties across the across the trough between the Great and Central banks. **Figure 9** shows the surface locations of the glider.

A few piloting issues arose during unit_872’s mission, the most frequent being behaviour aborts due the corruption of mission text files during the iridium transfer process, another was the bug in the glider piloting software 'SFMC' that kept ports open. These issues, despite keeping pilots occupied, resulted in a negligible loss of glider sampling time. At 0204 October 10, the glider aborted due to low battery voltage effectively ending the mission and prompting the retrieval of the vehicle 2 days later using the vessel workboat at 75°N 39.24', 33°E 55.12'. The vehicle travelled 222 km and performed 678 profiles over the 10-day mission.

Table 2. Slocum glider metadata

	Odin (775)	unit_872 (872)
Deployment date	08-Oct-2020 23:40	10-Oct-2020 22:41
Retrieval date	24-Oct-2020 03:46	20-Oct-2020 05:10
Deployment duration	16 days	10 days
Deployment location	77°N 35.30', 31°E 12.52'	76°N 29.62', 33°E 30.84'
Retrieval location	77°N 05.53', 30°E 06.22'	75°N 39.24', 33°E 55.12'
Number of profiles	801 (266 (308) with MR)	678
Distance covered	320km	222km
Mission	uib01amr.mi	astock.mi
Payload	CTD41CP, SN:9545 MR-1000, SN:324	CTD41CP, SN:9662

3.5 Moorings

Mooring deployment and recovery details are listed in the following tables. For mooring drawings please see the Appendix.

Table 3. Deployed Process Moorings (responsible UiB)

Mooring Name	Latitude (ddN mm.mmm)	Longitude (ddE mm.mmm)	Echo Depth (m)	Deployment Date (UTC) (yyyymmdd HHMM)
F1	77°N 21.629’	31°E 01.590’	189	20201010 0800
F2	77°N 02.925’	31°E 01.706’	237	20201010 1215
F3-1	76°N 37.012’	31°E 01.854’	277	20201010 1650
F3-2	76°N 37.064’	31°E 01.828’	277	20201010 1540
S1	75°N 07.198’	33°E 30.003’	160	20201011 1140
S2	75°N 11.394’	32°E 54.060’	188	20201011 1435
S3-1	75°N 17.845’	32°E 05.519’	310	20201011 1804
S3-2	75°N 17.789’	32°E 05.536’	308	20201011 1851
C	75°N 25.799’	31°E 05.979’	354	20201011 2325

Table 4. Recovered Gateway moorings

Mooring Name	Latitude (ddN mm.mmm)	Longitude (ddE mm.mmm)	Echo Depth (m)	Recovery Date (UTC) (yyyymmdd HHMM)
M4	77N 16.146'	24E 24.430'	71	Unsuccessful [1]
M4-hyd.	77N 16.194'	24E 24.426'	71	Unsuccessful [2]
M3	77N 52.080'	31E 42.684'	198	20201009 0600
M5	77N 04.48'	35E 02.208'	140	20201009 1230
M5-bioac	77N 04.947'	35E 03.470'	144	20201009 1130
M6	78N 20.868'	34E 45.744'	241	20201013 1200

[1] bottom frame upside down; [2] lost

Table 5. Deployed Gateway moorings

Mooring Name	Latitude (ddN mm.mmm)	Longitude (ddE mm.mmm)	Echo Depth (m)	Deployment Date (UTC) (yyyymmdd HHMM)
M3	77N 49.932	31E 59.874	130	20201013 1745
M5	77N 04.48'	35E 02.208'	140	20201013 0019
M5-bioac	77N 04.947'	35E 03.470'	144	20201012 2252

3.6 Biology

3.6.1. Mesozooplankton taxonomy, abundance and biomass

The main objective was to describe the mesozooplankton taxonomic composition, abundance and biomass along the AeN transect at stations P1 and P2. We have sampled with Multinets Midi (HydroBios, opening: 0.25m^2, net length: 250 cm) and Bongo nets (HydroBios, opening: 2 x 0.2827m^2, net lengths: 250 cm): For both nets we have been using both 180 µm and 64 µm mesh nets in order to cover all size groups. We refer to the samples from the two mesh sizes as “mesozooplankton” and “small mesozooplankton” respectively.

Taxonomy and abundance were sampled at 5 standard depth intervals using the Multinet. The depths were from bottom-200, 200-100, 100-50, 50-20 and 20-0 m. All samples were preserved in 4 % buffered formaldehyde free from acid.

Each Bongo net was equipped with one 64 µm and one 180 µm net.

In total 5 hauls were conducted from the bottom to surface at the two P-stations:

Haul 1: living samples for experiments and fatty acid and stable isotope samples
Haul 2: female:egg ratio and small copepod stages (5 % buffered Formaldehyde)
Haul 3: *Pseudocalanus* sample (half living, half 100 % Ethanol)
Haul 4: biomass (weighted dish)
Haul 5: biodiversity (half 100 % Ethanol, half 5 % buffered Formaldehyde)

At all other stations (B1, B4, B6, B8, B12, D14, D17, E8, G1, G8) the Bongo net was equipped with two 64 µm nets:

Haul 1, net 1: living samples for experiments and fatty acid and stable isotope samples
Haul 1, net 2: female:egg ratio and small copepod stages (5 % buffered Formaldehyde)
At some selected stations (B1, B6, B8, B12, G8) a second haul with one 64 µm and one 180 µm net was conducted:

Haul 2: *Pseudocalanus* sample (half living, half 100 % Ethanol)

At stations G8 and the Atlantic reference station samples were collected for Robynne Nowicki (*Calanus* energetics, *Calanus* individuals frozen) and Snorre Flo (diet of small mesozooplankton, 100 % Ethanol frozen).

Living samples were diluted with water from 20 m (collected with the CTD) and stored in the cold room until further analysis.

Female:egg ratio samples were split in half using a Plankton splitter, where one half was fixed in 100 % Ethanol and the other half in 5 % buffered Formaldehyde (except stations P1, P2 only Formaldehyde).

Pseudocalanus samples were split in half, where one-half was fixed in Ethanol and the other diluted with filtered seawater and stored in the fridge until further analysis.

The biomass samples were dried on board and will later be measured at UNIS.

Half of the biodiversity sample was fixed in 100 % Ethanol, the other in 5 % buffered Formaldehyde.

At stations P1, P2, B1, B12, E7, G1 and G8 3 x 50 individuals of *Oithona similis* were picked and frozen in Cryotubes at - 80 °C for fatty acid and stable isotope analyses.

At station P2, B1 and B12 2 x 100 females each were picked for CHN analysis (pre-combusted GFF filters).

Table 6. Overview of mesozooplankton sampling

Purpose	Gear	Station	N samples	Task
Mesozooplankton taxonomy	Multinet 180 µm	P1, P2	2	T3-2.1 & 2.2
Small mesozooplankton taxonomy	Multinet 64 µm	P1, P2	2	T3-2.1 & 2.2
Mesozooplankton biomass	Bongonet 180 µm	P1, P2	2	T3-2.1 & 2.2
Small mesozooplankton biomass	Bongonet 64 µm	P1, P2	2	T3-2.1 & 2.2
Mesozooplankton biodiversity	Bongonet 180 µm	P1, P2	2 (Ethanol) 2 (Formaldehyde)	T3-2.1 & 2.2
Small mesozooplankton biodiversity	Bongonet 64 µm	P1, P2	2 (Ethanol) 2 (Formaldehyde)	T3-2.1 & 2.2
Female:egg ratio	Bongonet 64 µm	P1, P2, B1, B4, B6, B8, B12, D14, D17, E8, G1, G8	12	T3-2.2
Pseudocalanus sample	Bongonet 64 µm	P1, P2, B1, B6, B8, B12, G8, reference station	8	Master thesis
Small copepod diet	Bongonet 64 µm	G8, reference station	2	Samples for Snorre Flo
Calanus energetics	Bongonet 64 µm	G8, reference station	2	Samples for Robynne Nowicki

Table 7. Overview of gear deployment

Gear	Sampling depth	Hauling speed (m/s)	
		lowering	heaving
Multinet 180 µm	Bot-200-100-50-20-0m	0.5	0.5
Multinet 64 µm	Bot-200-100-50-20-0m	0.5	0.3
Bongonet 180 µm	Bottom-0m	0.5	0.5
Bongonet 64 µm	Bottom-0m	0.5	0.3

3.6.2. Egg incubation experiments

To assess how population dynamics vary across space, egg incubation experiments were set up at three stations, namely P2 and B1 (warm side of the polar front) and B12 (cold side of the polar front), with focus on *Oithona similis.*

30 female *Oithona similis* were collected with a Bongo 64 µm net and were incubated in 2.5 ml of filtered sea water in 12-well culture plates at 2 °C (for stations P2, B1) and 3.5°C (station B12) in situ water temperature. Clutch size for each female was noted. The incubation chambers were checked every 12 h for newly hatched nauplii. In case of a hatching event the exact hatching time and number of hatchlings was noted and the nauplii were removed from the incubation chambers. After the experiment, females were photographed to determine prosome length.

Incubation time was 348 hours at P2 and 240 hours at B1 and B12.

At station P2 a total of 183 nauplii hatched from 24 of the 29 female *Oithona*. The maximum number of nauplii per hatching event was 14 nauplii. The earliest hatching event occurred after 12 h and the last hatching event after 348 h. Two females produced a second batch of eggs, one of these hatched nauplii 192 hours after the last nauplius of batch 1 had hatched. One copepod was lost due to rough sea.

At station B1 a total of 142 nauplii hatched from 15 of the 28 female *Oithona*. The maximum number of nauplii per hatching event was 15 nauplii. The earliest hatching event occurred after 36 h and the last hatching event after 216 h. Two females were lost due to rough weather.

At station B12 a total of 338 nauplii hatched from 22 of the 30 female *Oithona*. The maximum number of nauplii per hatching event was 20 nauplii. The earliest hatching event occurred after 24 h and the last hatching event after 240 h. One female was lost due to rough weather.

3.6.3 Water column sampling

To support the biological sampling, water samples were collected from 10 m, 20 m, 50 m and 90 m at all stations where a net was deployed.

Water was filtered for triplicate POC/PON analyses on pre-combusted GF/F filters and for size-fractionated algal pigments (total Chl a on GF/F filters and Chl a > 10 µm; on Polycarbonate filters). Filters for algal pigments were stored in aluminium foil, frozen at - 80 ˚C and will later be analysed at UiT. POC/PON filters were stored in pre-combusted aluminium foil and frozen at - 20 ˚C until further analysis. Additional water samples were taken for microscopic counts of phytoplankton communities, which were fixed with GA-Lugol.

3.7 Water sampling: Nutrients and carbonate chemistry analyses

149 discrete samples of nutrients (nitrate, phosphate, silicate) and carbonate chemistry (dissolved inorganic carbon and total alkalinity) were collected from the Niskin bottles on 24 stations (Figure 2). The nutrient samples were collected in 25-mL polypropylene Wheaton tubes vials. Immediately after sampling, 250 µL of chloroform was added to the samples and they were stored in the dark at 4°C. The nutrient samples were sent to the Institute of Marine Research in Bergen for analyses. The carbonate chemistry samples were transferred into 250-mL borosilicate bottles that were filled from the bottom to avoid contact with air. The water was allowed to overflow to flush out the water that had been in contact with air. The samples were poisoned with 50 µL of a saturated $HgCl_2$ solution to halt biological activity and stored in the dark, at 4°C. The carbonate chemistry samples were sent to the Institute of Marine Research in Tromsø for analyses.

3.8 Other underway measurements

3.8.1 Weather Station

Meteorological parameters including air temperature, wind speed and direction, air pressure, and humidity were measured continuously using the Vaisala AWS430 (S/N M5130576) weather station mounted atop the uppermost deck. The measurements are at 25 m above sea level, expect pressure is measured at the 4^{th} deck, at 10 m.

3.8.2 Thermosalinograph

The seawater intake for underway thermosalinograph measurements is at 8.5 m depth when the drop keel is lowered. This is the case throughout the cruise when we operated the SADCP. Close to the intake, a SBE38 temperature sensor records the temperature before the water is heated up as it continues towards the Clean Seawater Lab. There, a SBE21 SeaCAT thermosalinograph monitors temperature, salinity, and fluorescence (WET Labs WET star fluorometer).

SBE21: S/N3194, calibration date, 26.10.2017

SBE21: S/N3194, calibration date 26.10.2017

SBE38 S/N 0120. calibration date 10.11.2017

Fluorometer: WS3S-1253. calibration 01.11.2017

3.8.3 pCO2 measurements

The underway instrumentation for autonomous high-frequency surface water and atmospheric measurements of partial pressure of CO2, pCO2, (General Oceanics), sea surface salinity, and sea surface temperature are used to investigate the variability in the surface water along the cruise track. The pCO2 instrument and data contributes to global carbon projects such as SOCAT (Surface Ocean CO2 Atlas) and ICOS (Integrated Carbon Observatory Systems) aiming to estimate the oceans role in the carbon budget and estimates of anthropogenic CO2 uptake.

Maintenance was done on the pCO2 system in October by Ingunn Skjelvan.

4. Presentation of data

4.1 CTD

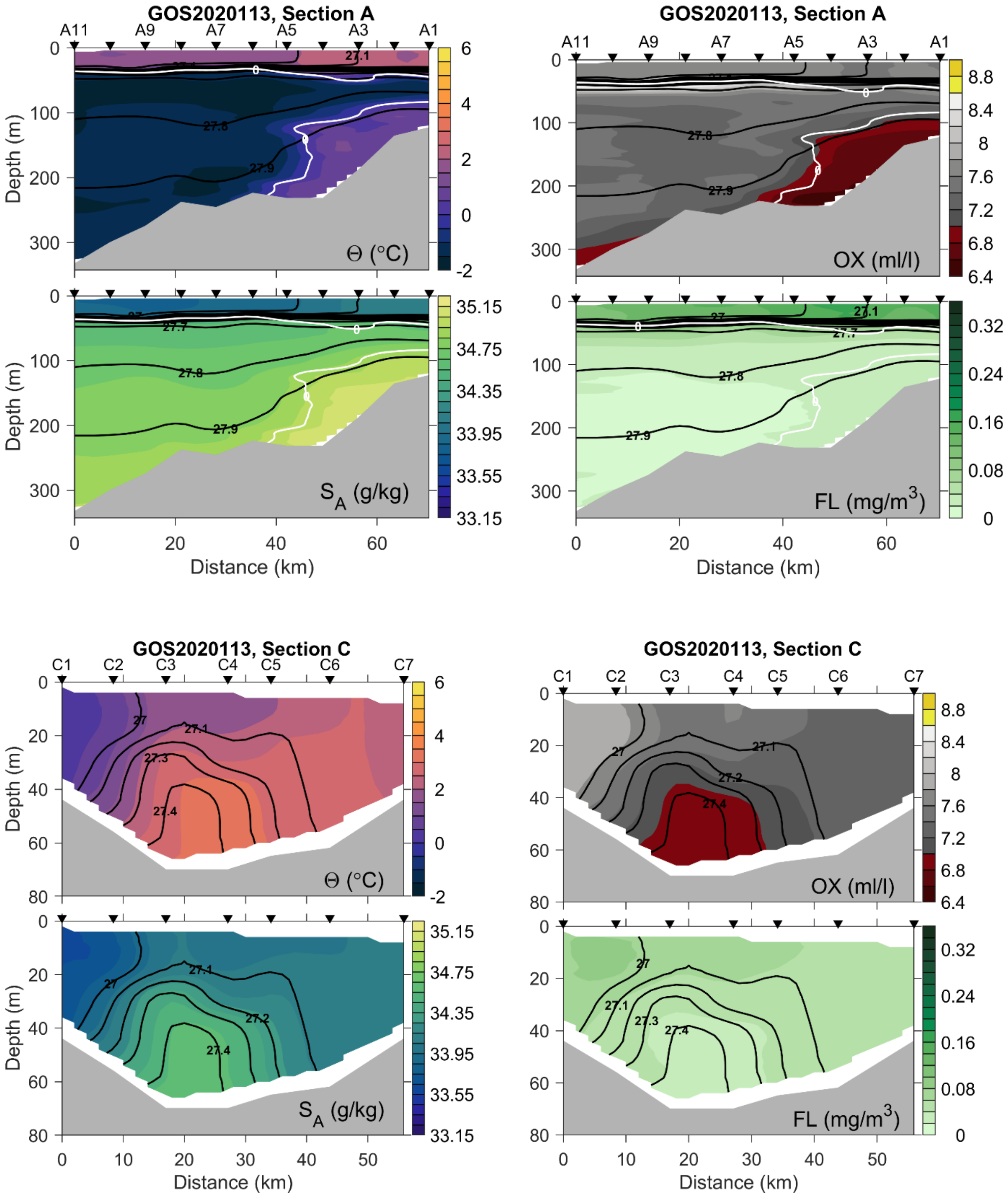

Figure 10. Selected CTD sections obtained from SBE sensor set 2, using gridding at 2 m x 2 km vertical x horizontal resolution, and smoothing over 3x3 data points. Panels are for Conservative Temperature, Absolute Salinity, dissolved oxygen concentration (corrected against water samples), and fluorescence (uncalibrated). Black contours are σ_0, and white contours are 0°C for reference. Arrowheads mark station locations with station name indicated.

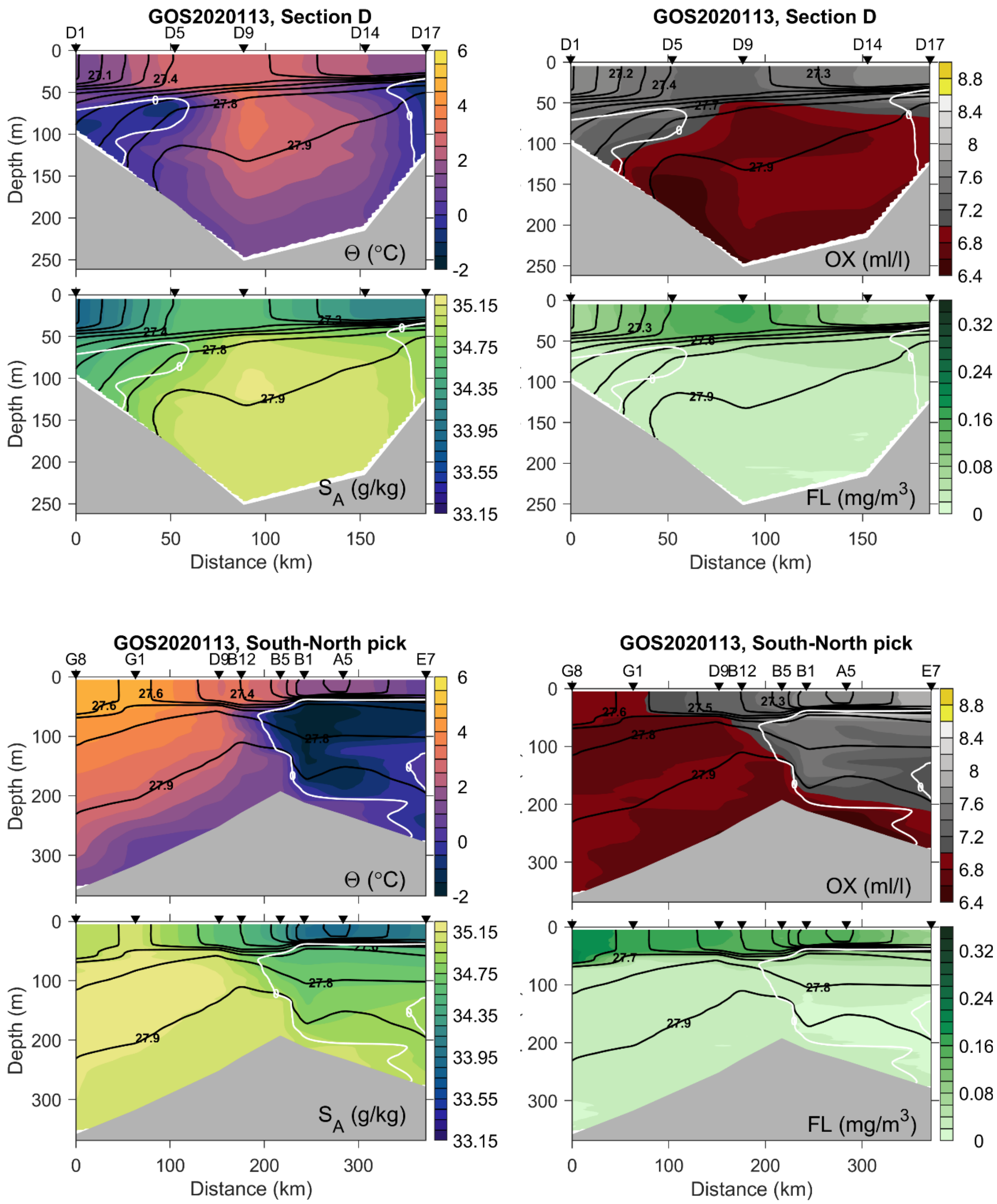

Figure 10., continued

4.2 SADCP

Because of their continuous operation, the vessel-mounted ADCPs are a valuable addition to our extensive dataset, and may help to shed light upon the complex spatio-temporal pattern of circulation in the region and especially across our hydrographic sections. In the following, we present preliminary processed data of the 75kHz ADCP that have been de-tided by removing the depth-independent barotropic tide obtained from the Arctic Ocean Inverse Tide Model (AOTIM) Arctic 5km 2018 model (https://www.esr.org/research/polar-tide-models/list-of-polar-tide-models/arc5km2018/).

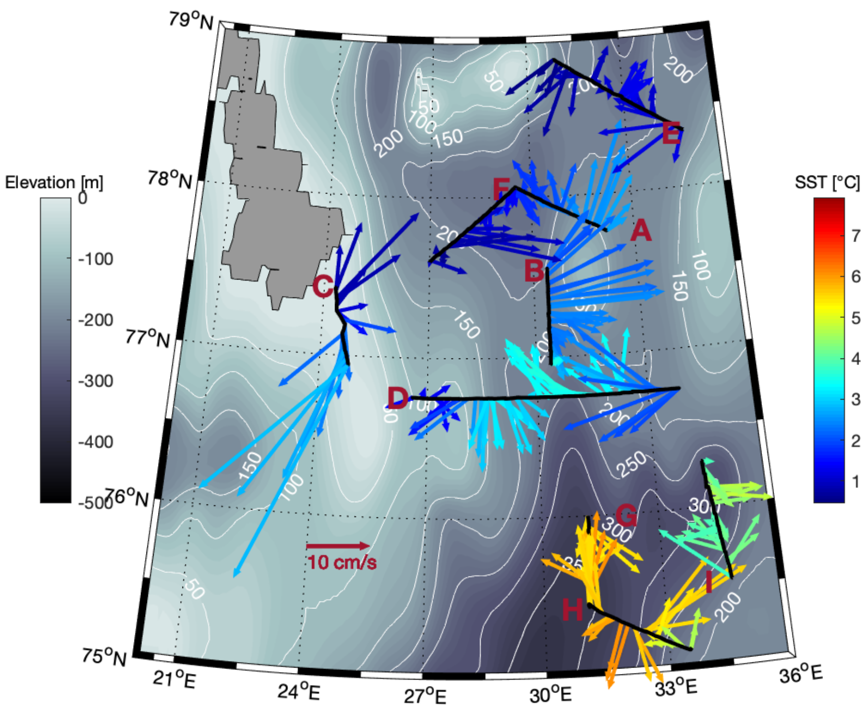

Figure 11. Vertical averaged, de-tided currents from the 75kHz vessel-mounted ADCP across the hydrographic sections (A-I). Colors show sea surface temperature (measured at ADCP transducer). The circulation pattern is complicated, but clearly topographically steered. Warm Atlantic Water is brought up from the south, crosses sections H, G, I and D (T > 3 °C) and is observed to veer north, crossing section D at the eastern flank.

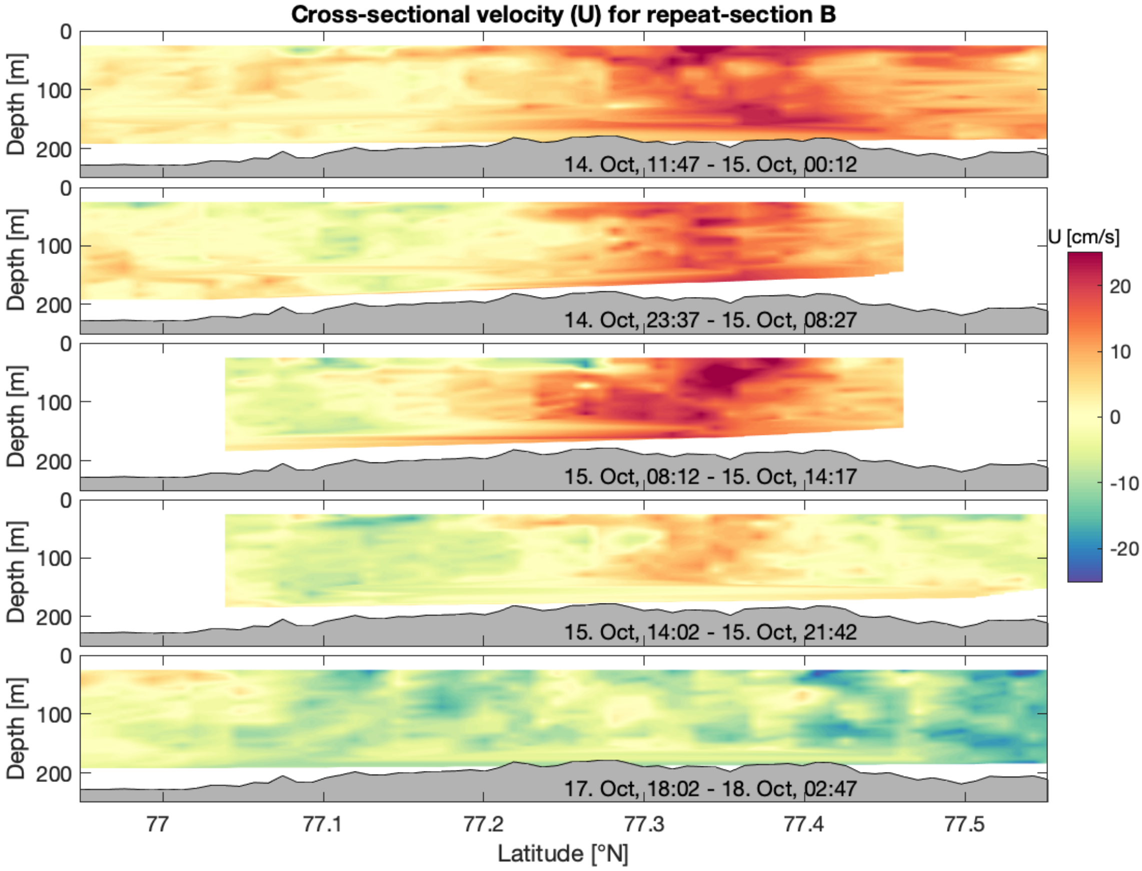

Figure 12. Zonal (i.e. cross-sectional) velocity component of the 75kHz vessel-mounted ADCP along section B. The section was repeated five times over several days and illustrates the substantial temporal variability of currents across this section, even after the removal of the dominant barotropic tide.

4.3 Microstructure

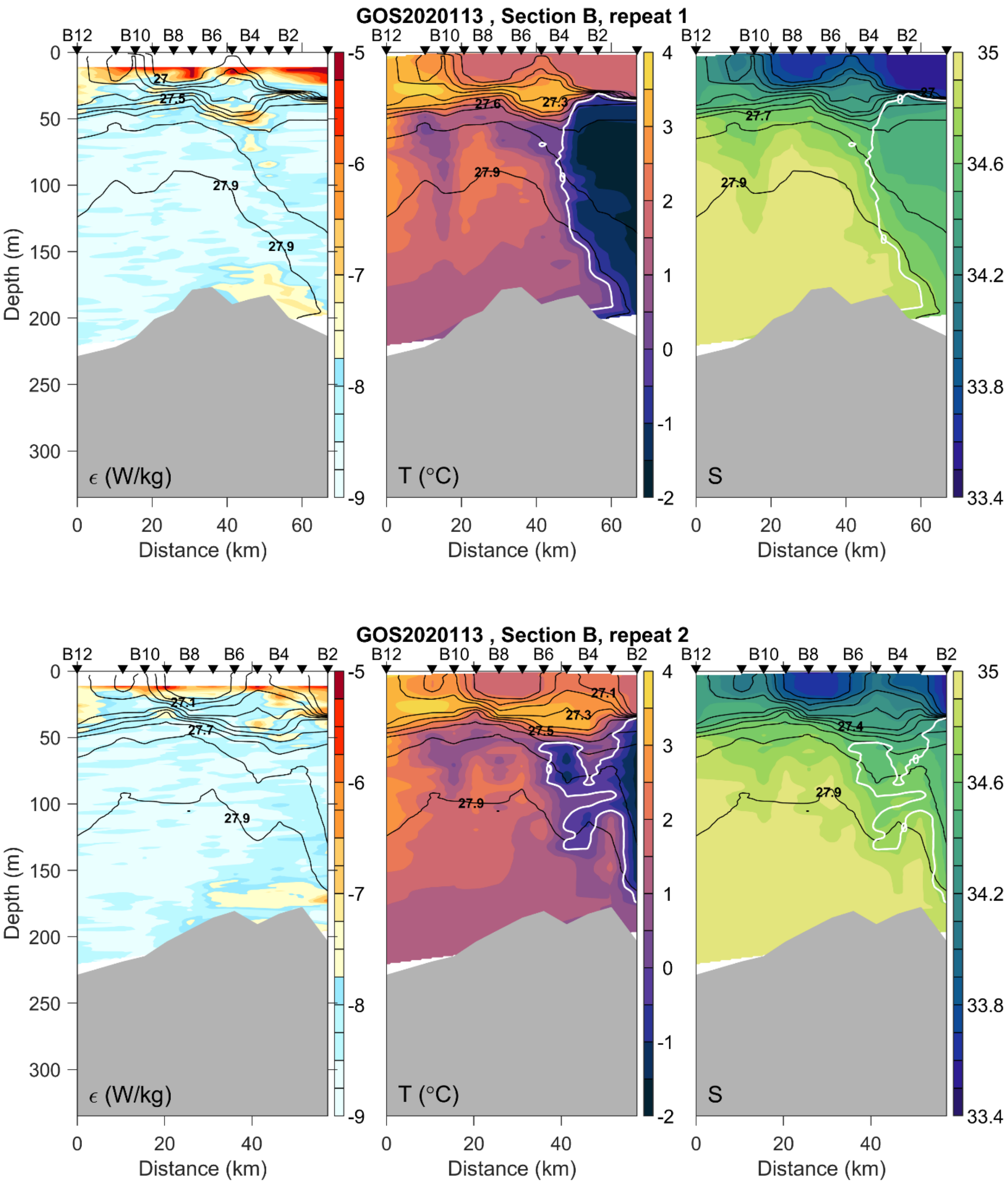

Figure 13. Selected sections obtained from the microstructure profiler MSS, using 1-m vertical averaged precision C/T sensor data dissipation rate averaged over the estimates from two probes. Temperature is ITS-90, and salinity is on practical scale. No smoothing applied. Black contours are σ_0, and white contours are 0°C for reference. Arrowheads mark station locations with station name indicated. Bottom topography is from the ship's echosounder at station location. Section B was repeated 5 times.

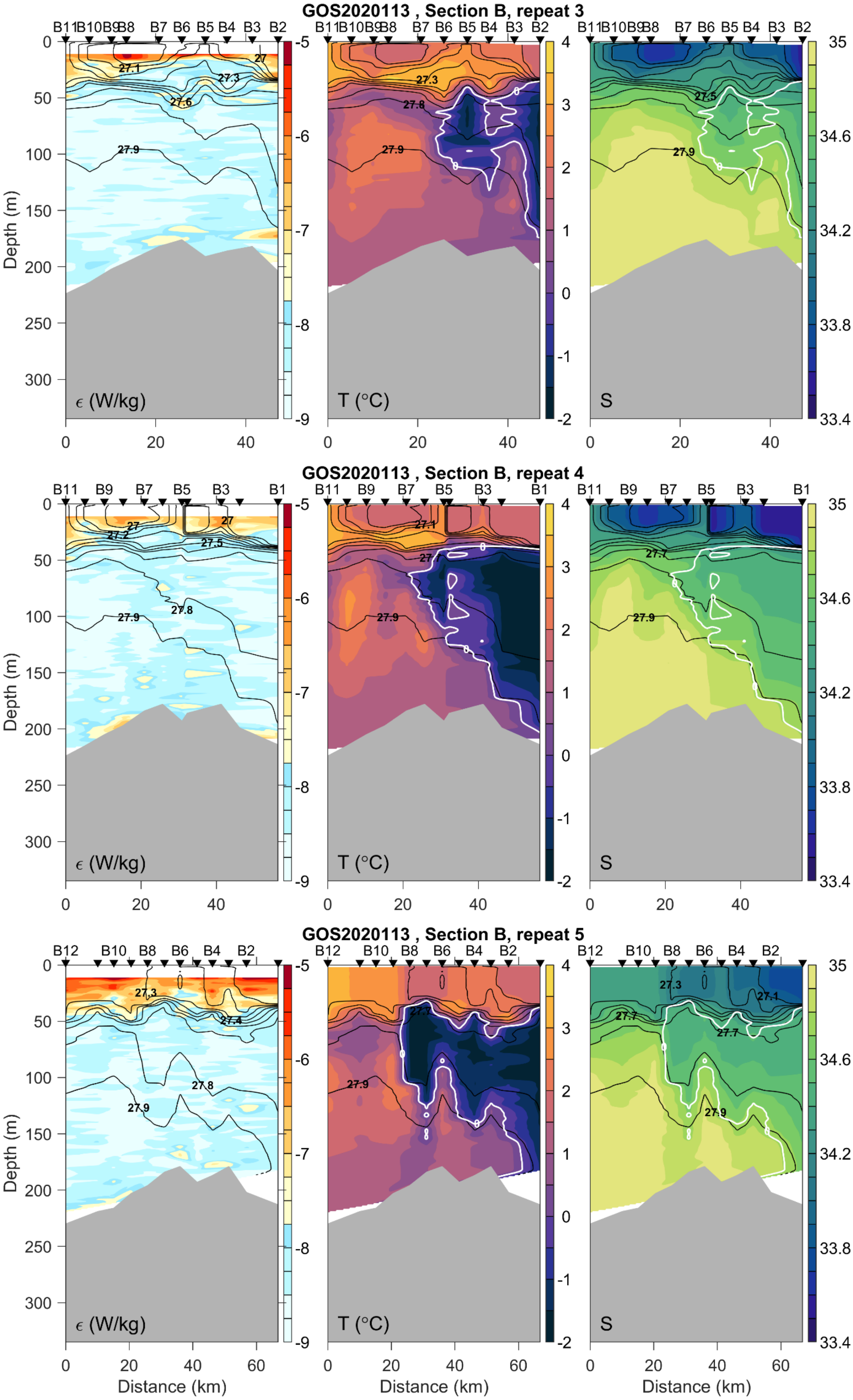

Figure 13. continued. Note horizontal distance is not referenced the same.

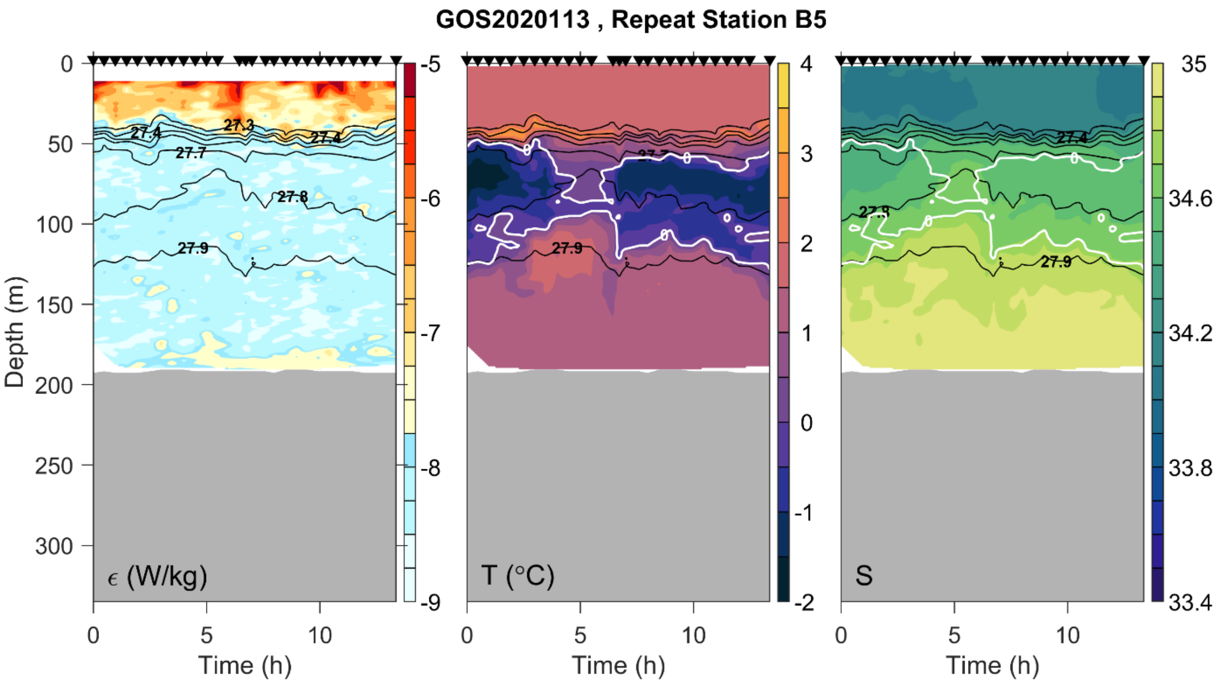

Figure 13. continued. Note horizontal axis is time.

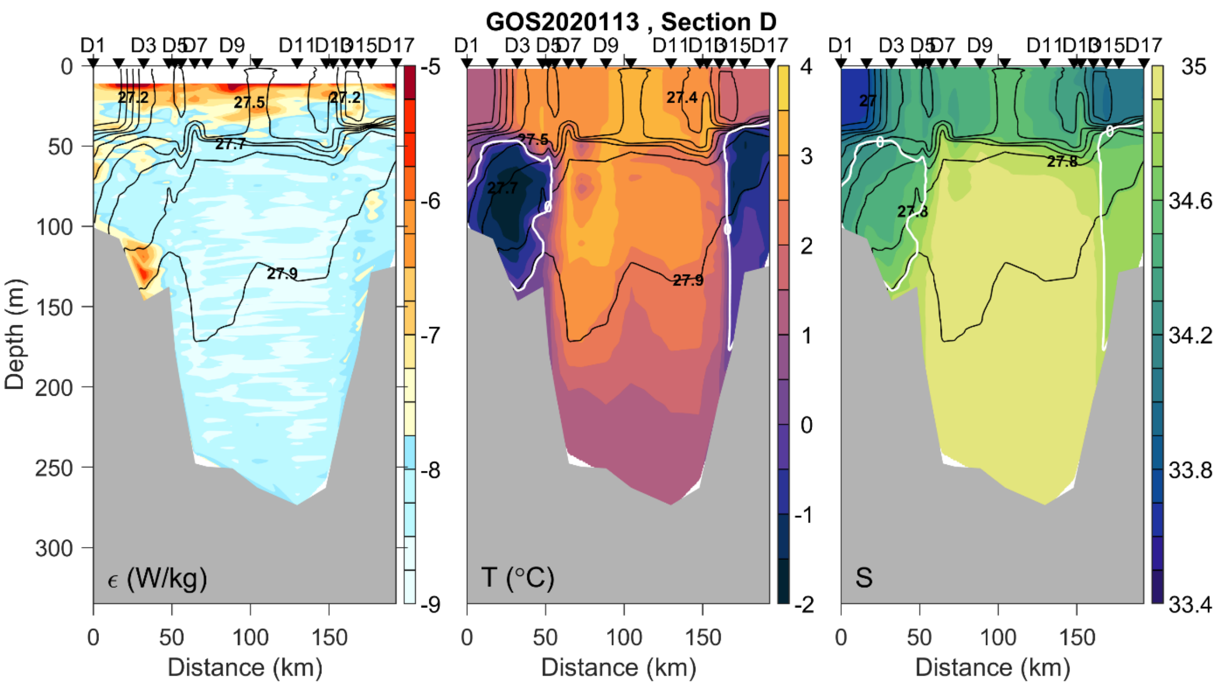

Figure 13. continued. Note horizontal distance is not referenced the same.

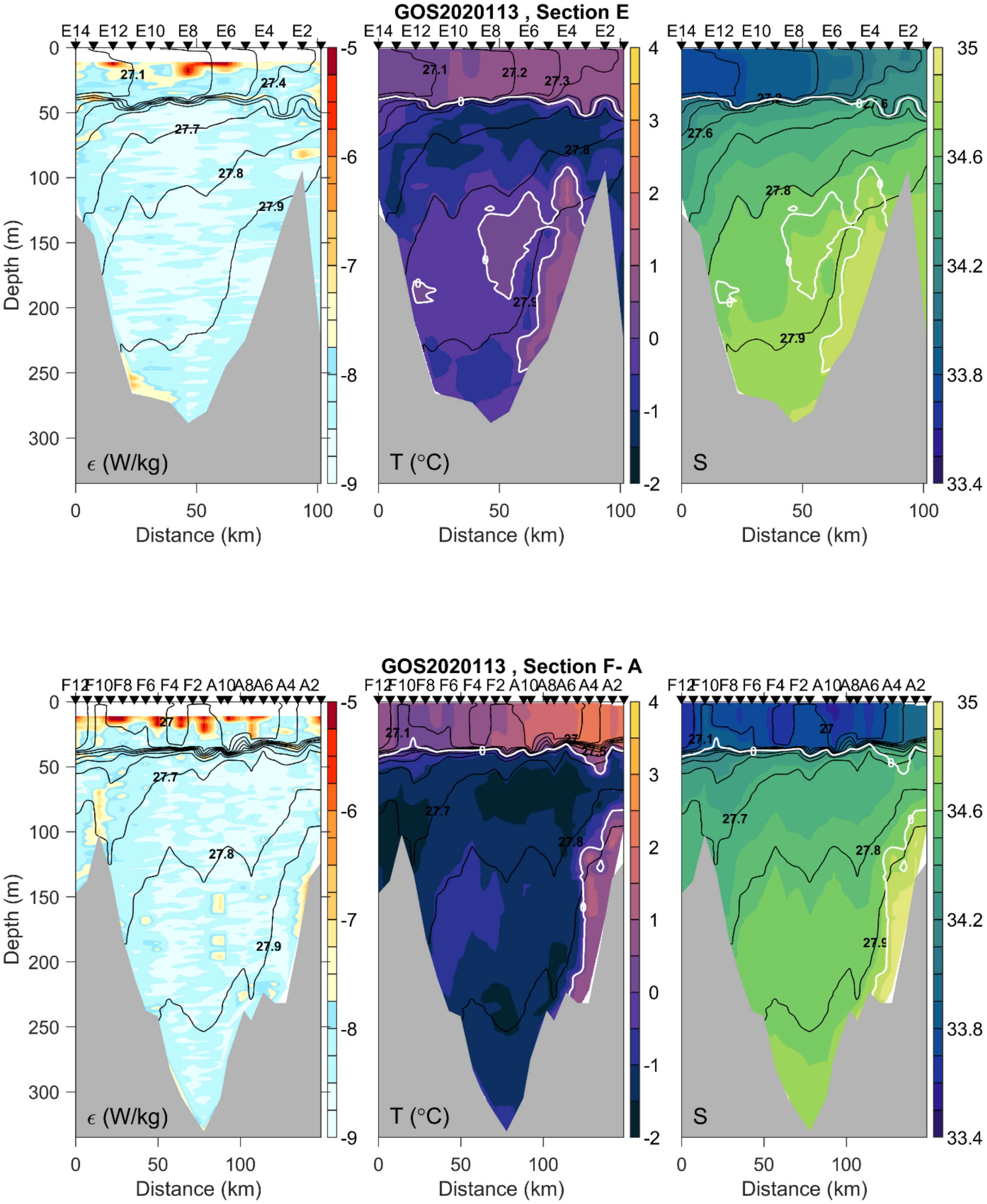

Figure 13. continued. Note horizontal distance is not referenced the same.

4.4 Gliders

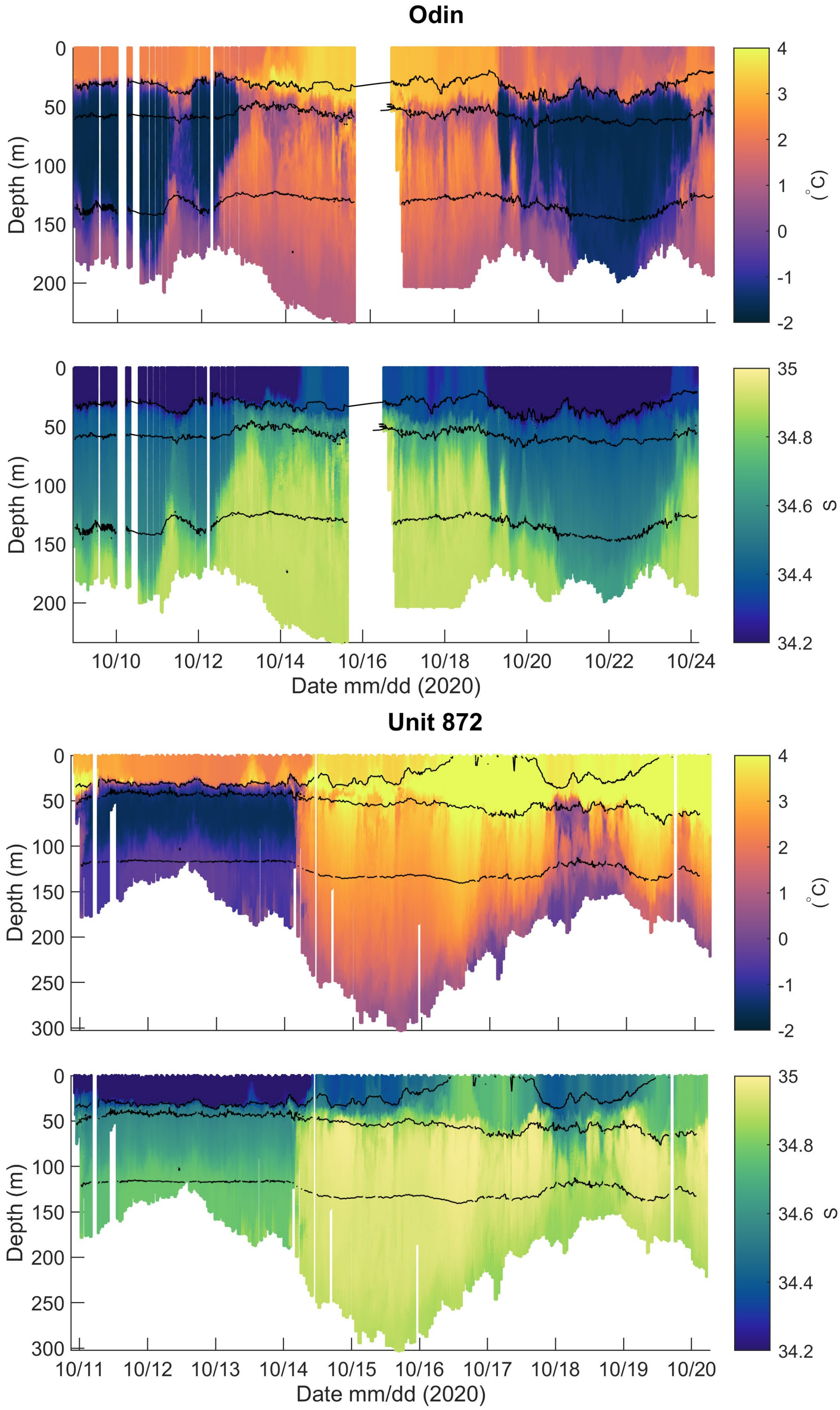

Figure 14. Time-Depth distribution of temperature and practical salinity measured by Odin (top panels) and unit 872 (bottom panels). Black contours are σ_0 for 27.5, 28 and 28.5 kg m^{-3}.

5. References

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Appendix I. Cruise timeline, station tables, participant list

a. Cruise timeline

Day (2020)	Time (UTC)	Activity / comment
6 Oct.	07:00	Some of the participants arrived onboard, Bykaien, LYR. Started with preparations. Loading of equipment
	12:30	All participants onboard
	13:00	Departure
	13:30	Security briefing, tour of the vessel
	17:50	SIOS-surface buoy mooring deployed (E015° 17.014'/N78° 14.187', 91m)
	19:15	SIOS-underwater mooring deployed (E015° 17.071'/N78° 14.234', 90.5m)
	23:30	I-SM mooring deployed (E013° 31.429'/N78° 03.665', 204m) (CTD, sta0346)
7 Oct.		Transit to Seaglider deployment position
8 Oct.	UTC	Seaglider SN deployed
	06:17	M4-Hydrography, CTD sta0347
	06:30	M4-Hydrography, recovery attempt. Unsuccessful (lost mooring)
	07:30	M4, lander recovery attempt. No show after release
	11:45	Triangulation before inspection with Blueye ROV, and located the lander (upside down)
	20:50	Deployed Slocum glider, Odin
9 Oct.	04:15	M3, CTD (sta0348)
	04:15	Triangulation before recovery of M3
	06:00	M3, lander recovered (E031° 42.684'/N77° 52.080', 198m)
	14:26	M5, CTD (sta0349)
	11:30	M5 BIOAC, recovered (77°N 04.947’, 035°E 03.470’, 144m)
	12:30	M5, recovered (77°N 04.480’, 035°E 02.208’, 140m)

	20:24	P2 process station, Full station (CTD sta0350 with water samples, 2 x VMP, 1 x Multinet, 2 x VMP, 1 x Multinet, 1 x Bongonet, 2 x VMP, 1 x Bongonet, 1 x VMP)
10 Oct.	08:00	F1 deployed (77°N 21.629’, 31°E 01.590’, 189m)
	08:14	F1, CTD (sta0351)
	10:54	F2, CTD (sta0352)
	12:15	F2 deployed (77°N 02.925’, 31°E 01.706’, 237m)
	15:03	F3, CTD (sta0353)
	15:40	F3-2 deployed (76°N 37.064’, 31°E 01.828’, 277m)
	16:50	F3-1 deployed (76°N 37.012’, 31°E 01.854’, 277m)
	21:50	Deployed, Slocum unit 872 (76N29.93, 33E31.16)
11 Oct.	11:00	S1, CTD (sta0354)
	11:40	S1 deployed (75°N 07.198’, 33°E 30.003’, 160m)
	13:10	S2, CTD (sta0355)
	14:35	S2 deployed (75°N 11.394’, 32°E 54.060’, 188m)
	16:44	S3, CTD (sta0356)
	18:04	S3-1 deployed (75°N 17.845’, 32°E 05.519’, 310m)
	18:51	S3-2 deployed (75°N 17.789’, 32°E 05.536’, 308m)
	22:20	C, CTD (sta0357)
	23:25	C deployed (75°N 25.799’ 31°E 05.979’, 354m)
12. Oct	03:30	P1 process station, Full station (CTD sta0358 with water samples, 2 x VMP, 2 x Multinet, 2 x VMP, 1 x Multinet, 2 x VMP, 5 x Bongonet, 3 x VMP)
12. Oct	23:20	M5, CTD (sta0359)
	23:52	M5 bio deployed (77°N 04.947', 035°E 03.470', 144 m)
13. Oct	00:19	M5 deployed (77°N 04.4805', 035°E 02.2082', 140 m)
	12:00	M6 recovered (78°N 20.868', 034°E 45.744', 241 m)
	17:37	M3 deployed (77° N 47.8875', 031° E 59.7958', 129 m)
	17:51	M3, CTD (sta0360)
	19:03	Start Section A (CTD and MSS, sta0361 to sta0371)
14. Oct	05:15	End Section A (CTD and MSS, sta0361 to sta0371)
	06:00	Testing of LAUV Harald. The Iridium antenna broke after an impact between the LAUV and G.O. Sars. Due to this, it was no longer possible to run long missions with the LAUV.
	11:49	Start Section B 1st (CTD with water sample at B1, B4, B6, B8, B12 (sta0372 to sta0376), MSS at B1 to B12)
15. Oct	00:50	End Section B 1st (CTD with water sample at B1, B4, B6, B8, B12 (sta0372 to sta0376), MSS at B1 to B12, Bongonet at B1, B4, B6, B8, B12)
	01:51	Start Section B 2nd (MSS at B11 to B2, CTD with water sample at B6 (sta0377)
	08:15	End Section B 2nd (MSS at B11 to B2, CTD with water sample at B6 (sta0377)
	08:15	Start Section B 3rd (MSS at B2 to B11, CTD with water sample at B6 (sta0378)
	14:08	End Section B 3rd (MSS at B2 to B11, CTD with water sample at B6 (sta0378)
	14:08	Start Section B 4th (MSS at B11 to B1, CTD with water sample at B6 (sta0379)

	21:35	End Section B 4th (MSS at B11 to B1, CTD with water sample at B6 (sta0379)
16. Oct	06:00	M4, second lander recovery attempt (dragging with two weights and chain). Unsuccessful, chain broke and lost the heaviest weight (mooring still in location).
	11:32	Start Section C (CTD sta0380 to sta0386, MSS)
	17:13	End Section C (CTD sta0380 to sta0386, MSS)
	20:25	Start repeat C3 with MSS every 30 min.
17. Oct	03:31	End repeat C3 with MSS every 30 min.
	18:06	Start Section B 5th (MSS at B1 to B12, CTD with water sample at B1, B5, and B12 (sta0387 to sta0389)
18. Oct	02:37	End Section B 5th (MSS at B1 to B12, CTD with water sample at B1, B5, and B12 (sta0387 to sta0389)
	06:47	Start repeat B5 (MSS every 30 min., 3 x CTD with water samples (sta0390 to sta0392)
	20:53	End repeat B5 (MSS every 30 min., 3 x CTD with water samples (sta0390 to sta0392)
19. Oct	02:53	Start Section D (MSS at D1 to D17, CTD with water samples at D1, D5, D9, D14, and D17 (sta0393 to sta0397), Bongonet at D14 and D17
	21:39	End Section D (MSS at D1-D17, CTD with water samples at D1, D5, D9, D14, and D17 (sta0393 to sta0397), Bongonet at D14&17
20. Oct	05:10	Recovered Slocum glider unit_872 (75N 39.24, 33E 55.12)
	07:35	Start Section E (MSS at E1 to E14, CTD at E1, D7 (water samples), and E14 (sta0398 to sta0400), Bongonet at E7&14
	18:13	End Section E (MSS at E1 to E14, CTD at E1, D7 (water samples), and E14 (sta0398-sta0400), Bongonet at E7, E14
	23:05	Start Section F (MSS at F1 to F12, CTD at F1 (sta0401) and F12 (sta0402)
21. Oct	06:54	End Section F (MSS at F1 to F12, CTD at F1 and F12
22. Oct	07:00	Seaglider Sg560 (Barents Sea mission) was deployed, 75N 35.85’, 33E 22.0’
	10:51	Start Section G (MSS at G1 to G8, CTD with water samples at G1 (sta0403) and G8 (sta0404), Bongonet at G1 and G8
	18:06	End Section G (MSS at G1 to G8, CTD with water samples at G1 and G8, Bongonet at G1 and G8
	18:06	Start Section H (MSS at G1 to H10, CTD with water samples at H1 (sta0404) and H6 (no water samples, sta0405), Bongonet at H1 and G8
23. Oct	04:12	End Section H (MSS at G1 to H10, CTD with water samples at H1 and H6 (no water samples), Bongonet at H1
	04:12	Start Section I (MSS at I1 to I16, CTD at I5 (sta0406), I8 (sta0407) and I11 (sta0408)
	20:40	End Section I (MSS at I1 to I16, CTD at I5, I8 and I11
24. Oct	03:46	Recovered Slocum glider Odin (77N 05.35, 30E 06.22)
	10:23	Start repeating D13, D14, D15 with MSS
	18:50	End repeating D13, D14, D15 with MSS
25. Oct	18:07	Referance station with CTD (sta0409) and Bongonet

b. Station tables

Table 8: CTD and LADCP stations

Cast	Station name	Date	Time (UTC)	LAT	LON	E. Depth (m)	LADCP
346	IS-I	2020-10-06	22:10	78N03.66	013E31.43	206	M346_000.000
347	M4 Hydrography	2020-10-08	06:17	77N16.06	024E23.60	71	M347_000.000
348	M3	2020-10-09	04:16	77N52.23	031E44.15	198	M348_000.000
349	M5	2020-10-09	14:26	77N04.45	035E02.20	141	M349_000.000
350	P2	2020-10-09	20:24	77N29.94	034E00.59	185	M350_000.000
351	F1	2020-10-10	08:14	77N21.63	031E01.35	193	M351_000.000
352	F2	2020-10-10	10:54	77N02.93	031E01.69	237	M352_000.000
353	F3	2020-10-10	15:03	76N37.06	031E01.82	277	M353_000.000
354	S1	2020-10-11	11:00	75N07.50	033E30.00	155	M354_000.000
355	S2	2020-10-11	13:10	75N11.40	032E54.00	193	M355_000.000
356	S3	2020-10-11	16:44	75N17.84	032E05.51	310	M356_000.000
357	C	2020-10-11	22:20	75N25.80	031E05.97	353	M357_000.000
358	P1	2020-10-12	03:32	76N00.43	031E13.02	318	M358_000.000
359	M5	2020-10-12	23:20	77N04.52	035E02.17	140	M359_000.000
360	M3	2020-10-13	17:51	77N47.83	031E59.66	130	M360_000.000
361	A1	2020-10-13	19:03	77N45.99	032E11.70	125	M361_000.000
362	A2	2020-10-13	20:11	77N47.94	031E56.61	136	M362_000.000
363	A3	2020-10-13	21:11	77N49.65	031E40.47	188	M363_000.000
364	A4	2020-10-13	22:50	77N51.29	031E24.05	220	M364_000.000
365	A5	2020-10-13	23:12	77N53.19	031E08.15	232	M365_000.000
366	A6	2020-10-14	00:15	77N54.86	030E52.62	225	M366_000.000
367	A7	2020-10-14	01:30	77N56.63	030E35.59	246	M367_000.000
368	A8	2020-10-14	02:07	77N58.39	030E20.10	238	M368_000.000
369	A9	2020-10-14	03:03	78N00.27	030E04.02	275	M369_000.000
370	A10	2020-10-14	04:01	78N02.11	029E48.28	300	M370_000.000
371	A11	2020-10-14	05:15	78N03.87	029E31.87	333	M371_000.000
372	B1	2020-10-14	11:49	77N33.03	030E23.87	213	M372_000.000
373	B4	2020-10-14	15:15	77N21.90	030E24.25	187	M373_000.000
374	B6	2020-10-14	17:21	77N16.37	030E24.24	176	M374_000.000
375	B8	2020-10-14	19:39	77N10.89	030E23.83	195	M375_000.000
376	B12	2020-10-14	23:37	76N57.07	030E23.19	229	M376_000.000
377	B6	2020-10-15	05:20	77N16.41	030E23.62	172	M377_000.000
378	B6	2020-10-15	11:03	77N16.40	030E23.80	176	M378_000.000
379	B6	2020-10-15	17:37	77N16.39	030E24.05	178	M379_000.000
380	C1	2020-10-16	11:32	77N25.31	024E20.56	44	M380_000.000
381	C2	2020-10-16	12:31	77N20.81	024E22.87	56	M381_000.000
382	C3	2020-10-16	13:21	77N16.20	024E24.88	70	M382_000.000
383	C4	2020-10-16	14:21	77N11.75	024E39.28	70	M383_000.000
384	C5	2020-10-16	15:09	77N08.03	024E35.87	65	M384_000.000
385	C6	2020-10-16	16:00	77N02.96	024E41.00	62	M385_000.000
386	C7	2020-10-16	17:05	76N56.64	024E48.29	44	M386_000.000
387	B1	2020-10-17	18:06	77N33.01	030E23.68	212	M387_000.000
388	B5	2020-10-17	21:09	77N19.32	030E22.97	193	M388_000.000
389	B12	2020-10-18	02:13	76N56.99	030E23.87	229	M389_000.000
390	B5	2020-10-18	06:47	77N19.77	030E23.36	192	M390_000.000
391	B5	2020-10-18	13:37	77N19.26	030E23.66	192	M391_000.000
392	B5	2020-10-18	20:32	77N19.15	030E23.62	193	M392_000.000
393	D1	2020-10-19	02:53	76N45.09	026E35.94	102	M393_000.000
394	D5	2020-10-19	07:19	76N45.10	028E38.88	183	M394_000.000

Cast	Station name	Date	Time (UTC)	LAT	LON	E. Depth (m)	LADCP
395	D9	2020-10-19	11:34	76N45.07	030E04.27	252	M395_000.000
396	D14	2020-10-19	17:18	76N45.08	032E35.25	216	M396_000.000
397	D17	2020-10-19	21:10	76N45.00	033E50.79	126	M397_000.000
398	E1	2020-10-20	07:35	78N21.10	034E45.83	238	M398_000.000
399	E7	2020-10-20	11:58	78N35.02	032E58.23	279	M399_000.000
400	E14	2020-10-20	17:56	78N50.99	030E53.04	130	M400_000.000
401	F1(A11)	2020-10-20	23:05	78N03.47	029E31.48	331	M401_000.000
402	F12	2020-10-21	06:43	77N36.01	027E00.57	149	M402_000.000
403	G1	2020-10-22	10:51	76N00.01	031E13.20	322	M403_000.000
404	G8/H1	2020-10-22	18:06	75N25.92	031E06.73	359	M404_000.000
405	H6	2020-10-23	00:48	75N15.51	032E26.46	293	M405_000.000
406	I5	2020-10-23	10:38	75N52.33	034E29.89	232	M406_000.000
407	I8	2020-10-23	13:21	76N07.17	034E21.13	298	M407_000.000
408	I11	2020-10-23	16:30	76N22.37	034E11.70	266	M408_000.000
409	Ref	2020-10-25	18:07	73N07.08	024E29.58	403	-

Table 9: MSS stations

Cast	Station Name	Date-UTC	Time (UTC)	LAT	LON	E. Depth (m)	Start (m)	End (m)	CTD File
1	A1	2020-10-13	19:29	77N00.46	32E00.12	124	3	98	361
2	A2	2020-10-13	20:26	77N47.94	31E56.55	136	3	138	362
3	A3	2020-10-13	21:27	77N49.66	31E40.43	188	2	183	363
4	A4	2020-10-13	22:33	77N51.28	31E24.10	232	2	221	364
5	A5	2020-10-13	23:31	77N53.20	31E08.12	232	2	225	365
6	A6	2020-10-14	00:30	77N54.89	30E52.66	224	2	215	366
7	A7	2020-10-14	01:27	77N56.64	30E35.79	246	2	225	367
8	A8	2020-10-14	02:22	77N56.57	30E24.36	238	2	225	368
9	A9	2020-10-14	03:20	77N59.63	30E03.76	275	2	255	369
10	A10	2020-10-14	04:19	78N00.17	29E53.01	305	1	299	370
11	B1	2020-10-14	12:17	77N33.07	30E23.86	214	0	0	372
12	B2	2020-10-14	14:05	77N27.41	30E24.31	200	0	0	-
13	B3	2020-10-14	14:40	77N24.59	30E24.23	183	0	0	-
14	B4	2020-10-14	15:38	77N21.91	30E24.30	186	0	0	373
15	B5	2020-10-14	16:39	77N19.28	30E24.27	190	0	0	-
16	B6	2020-10-14	17:41	77N16.39	30E23.98	177	0	0	374
17	B7	2020-10-14	19:03	77N13.57	30E24.14	179	0	0	-
18	B8	2020-10-14	20:03	77N10.87	30E23.77	195	0	0	375
19	B9	2020-10-14	21:30	77N08.15	30E23.95	201	0	0	-
20	B10	2020-10-14	22:07	77N05.36	30E24.42	215	0	0	-
21	B11	2020-10-14	22:39	77N02.56	30E23.49	222	2	0	-
22	B12	2020-10-15	00:05	76N56.99	30E22.90	229	2	220	376
23	B11	2020-10-15	01:51	77N02.62	30E24.30	219	3	214	-
24	B10	2020-10-15	02:24	77N05.34	30E24.45	215	2	210	-
25	B9	2020-10-15	02:59	77N08.06	30E24.23	204	2	188	-
26	B8	2020-10-15	03:36	77N10.89	30E23.69	195	2	193	-
27	B7	2020-10-15	04:12	77N13.76	30E23.78	186	2	180	-
28	B6	2020-10-15	05:41	77N16.40	30E23.17	181	2	163	377
29	B5	2020-10-15	06:20	77N19.24	30E23.81	191	2	175	-
30	B4	2020-10-15	06:58	77N21.93	30E23.84	183	2	167	-
31	B3	2020-10-15	07:35	77N24.74	30E23.58	178	2	174	-
32	B2	2020-10-15	08:15	77N27.93	30E23.48	204	2	196	-

Cast	Station Name	Date-UTC	Time (UTC)	LAT	LON	E. Depth (m)	Start (m)	End (m)	CTD File
33	B3	2020-10-15	08:50	77N24.83	30E22.93	182	2	168	-
34	B4	2020-10-15	09:26	77N21.82	30E23.87	186	2	177	-
35	B5	2020-10-15	10:21	77N19.21	30E24.09	191	2	170	-
36	B6	2020-10-15	11:23	77N16.40	30E23.75	176	2	165	378
37	B7	2020-10-15	11:56	77N13.65	30E23.28	182	2	177	-
38	B8	2020-10-15	12:31	77N09.74	30E23.92	196	2	193	-
39	B9	2020-10-15	13:05	77N07.97	30E24.16	202	2	195	-
40	B10	2020-10-15	13:37	77N05.31	30E23.55	214	1	211	-
41	B11	2020-10-15	14:08	77N02.48	30E23.90	224	2	215	-
42	B10	2020-10-15	14:48	77N05.24	30E23.84	215	2	209	-
43	B9	2020-10-15	15:24	77N08.04	30E24.12	205	2	199	-
44	B8	2020-10-15	16:05	77N10.72	30E24.15	197	2	197	-
45	B7	2020-10-15	16:52	77N13.76	30E24.16	184	2	177	-
46	B6	2020-10-15	17:56	77N16.37	30E23.33	178	2	166	379
47	B5	2020-10-15	18:36	77N19.14	30E24.06	193	2	185	-
48	B4	2020-10-15	19:17	77N19.90	30E23.95	186	2	176	-
49	B3	2020-10-15	19:58	77N24.76	30E24.13	178	2	173	-
50	B2	2020-10-15	20:39	77N27.40	30E23.54	199	2	190	-
51	B1	2020-10-15	21:35	77N32.90	30E23.89	214	2	209	-
52	C1	2020-10-16	11:42	77N25.30	24E20.56	42	2	34	380
53	C1	2020-10-16	11:44	77N25.27	24E20.64	43	1	29	-
54	C2	2020-10-16	12:36	77N20.89	24E23.10	54	1	43	381
55	C3	2020-10-16	13:31	77N16.29	24E24.87	70	2	58	382
56	C4	2020-10-16	14:30	77N11.75	24E39.36	70	2	68	383
57	C5	2020-10-16	15:17	77N08.02	24E35.65	65	2	57	384
58	C6	2020-10-16	16:08	77N02.94	24E41.10	60	2	58	385
59	C7	2020-10-16	17:13	76N56.65	24E48.25	44	2	38	386
60	C3	2020-10-16	20:25	77N16.00	24E22.50	68	2	61	-
61	C3	2020-10-16	21:01	77N16.11	24E23.32	70	2	66	-
62	C3	2020-10-16	21:30	77N16.09	24E23.64	69	2	67	-
63	C3	2020-10-16	22:01	77N16.15	24E24.10	71	2	70	-
64	C3	2020-10-16	22:31	77N16.16	24E24.31	69	2	66	-
65	C3	2020-10-16	23:01	77N16.18	24E24.06	70	2	64	-
66	C3	2020-10-16	23:32	77N16.18	24E24.86	70	2	63	-
67	C3	2020-10-16	23:57	77N15.90	24E24.48	68	2	62	-
68	C3	2020-10-17	00:30	77N15.64	24E24.49	67	2	61	-
69	C3	2020-10-17	00:58	77N15.65	24E24.49	70	2	64	-
70	C3	2020-10-17	01:29	77N15.65	24E24.49	66	3	62	-
71	C3	2020-10-17	02:00	77N15.65	24E24.49	69	2	66	-
72	C3	2020-10-17	02:32	77N15.65	24E24.49	67	3	61	-
73	C3	2020-10-17	03:00	77N15.65	24E24.49	68	3	63	-
74	C3	2020-10-17	03:31	77N15.65	24E24.49	70	5	66	-
75	B1	2020-10-17	18:29	77N33.08	30E23.10	213	1	183	387
76	B2	2020-10-17	19:19	77N27.69	30E23.90	202	2	182	-
77	B3	2020-10-17	19:55	77N24.70	30E23.96	179	2	172	-
78	B4	2020-10-17	20:29	77N21.93	30E23.36	187	3	177	-
79	B5	2020-10-17	21:29	77N19.33	30E22.62	193	2	186	388
80	B6	2020-10-17	22:08	77N16.44	30E22.64	179	2	170	-
81	B7	2020-10-17	22:45	77N13.80	30E23.20	184	2	172	-
82	B8	2020-10-17	23:23	77N10.93	30E23.03	196	2	189	-
83	B9	2020-10-18	00:01	77N08.13	30E23.37	203	2	192	-
84	B10	2020-10-18	00:41	77N05.21	30E24.42	216	2	210	-
85	B11	2020-10-18	01:16	77N02.49	30E24.31	219	2	215	-

Cast	Station Name	Date-UTC	Time (UTC)	LAT	LON	E. Depth (m)	Start (m)	End (m)	CTD File
86	B12	2020-10-18	02:37	76N57.04	30E23.31	230	3	220	389
87	B5	2020-10-18	07:31	77N19.24	30E23.47	193	2	185	390
88	B5	2020-10-18	08:00	77N19.14	30E23.85	192	2	178	-
89	B5	2020-10-18	08:30	77N19.06	30E23.17	193	2	188	-
90	B5	2020-10-18	09:00	77N19.22	30E23.21	193	3	190	-
91	B5	2020-10-18	09:28	77N19.12	30E23.56	193	2	190	-
92	B5	2020-10-18	10:02	77N19.12	30E23.46	192	2	190	-
93	B5	2020-10-18	10:31	77N19.26	30E23.67	191	2	190	-
94	B5	2020-10-18	10:59	77N19.24	30E23.66	191	2	188	-
95	B5	2020-10-18	11:30	77N19.15	30E23.71	191	2	187	-
96	B5	2020-10-18	12:01	77N19.16	30E23.25	192	2	183	-
97	B5	2020-10-18	12:31	77N19.11	30E23.52	192	3	187	-
98	B5	2020-10-18	13:01	77N19.15	30E24.00	192	2	186	-
99	B5	2020-10-18	13:58	77N19.29	30E23.36	192	2	183	391
100	B5	2020-10-18	14:15	77N19.14	30E22.16	192	5	178	-
101	B5	2020-10-18	14:32	77N19.13	30E23.08	192	2	184	-
102	B5	2020-10-18	15:02	77N19.17	30E24.15	193	3	100	-
103	B5	2020-10-18	15:07	77N19.08	30E23.63	192	3	186	-
104	B5	2020-10-18	15:30	77N19.16	30E24.29	193	3	184	-
105	B5	2020-10-18	16:00	77N19.18	30E23.87	191	2	189	-
106	B5	2020-10-18	16:30	77N19.22	30E24.31	191	2	190	-
107	B5	2020-10-18	16:58	77N19.32	30E24.04	191	4	191	-
108	B5	2020-10-18	17:27	77N19.18	30E24.16	192	3	190	-
109	B5	2020-10-18	17:58	77N19.17	30E24.07	192	2	183	-
110	B5	2020-10-18	18:28	77N19.16	30E23.94	192	2	187	-
111	B5	2020-10-18	19:00	77N19.22	30E24.37	192	2	187	-
112	B5	2020-10-18	19:29	77N19.13	30E24.13	193	2	189	-
113	B5	2020-10-18	20:00	77N19.12	30E23.35	193	2	189	-
114	B5	2020-10-18	20:53	77N19.12	30E23.37	193	2	188	392
115	D1	2020-10-19	03:09	76N45.14	26E35.84	101	2	96	393
116	D2	2020-10-19	04:19	76N44.99	27E14.11	108	3	105	-
117	D3	2020-10-19	05:24	76N45.05	27E51.36	147	2	145	-
118	D4	2020-10-19	06:41	76N45.09	28E29.18	138	2	130	-
119	D5	2020-10-19	07:38	76N45.18	28E38.39	180	2	178	394
120	D6	2020-10-19	08:12	76N45.10	28E47.77	203	2	201	-
121	D7	2020-10-19	09:15	76N45.12	29E07.99	248	3	243	-
122	D8	2020-10-19	10:10	76N45.29	29E26.88	250	2	242	-
123	D9	2020-10-19	11:59	76N45.10	30E04.20	251	2	245	395
124	D10	2020-10-19	13:12	76N45.08	30E41.40	263	2	247	-
125	D11	2020-10-19	14:24	76N43.59	31E41.08	274	2	277	-
126	D12	2020-10-19	15:39	76N43.64	32E24.62	263	2	258	-
127	D13	2020-10-19	16:26	76N45.05	32E16.28	243	3	213	-
128	D14	2020-10-19	17:40	76N45.17	32E34.98	208	3	206	396
129	D15	2020-10-19	19:02	76N45.03	32E54.21	178	2	168	-
130	D16	2020-10-19	19:49	76N45.06	33E13.20	129	2	112	-
131	D17	2020-10-19	21:27	76N45.00	33E50.62	125	2	116	397
132	E1	2020-10-20	07:50	78N21.14	34E45.15	230	2	228	398
133	E2	2020-10-20	08:30	78N23.37	34E27.50	95	2	95	-
134	E3	2020-10-20	09:11	78N25.71	34E09.38	136	2	135	-
135	E4	2020-10-20	09:49	78N28.04	33E52.65	182	2	176	-
136	E5	2020-10-20	10:28	78N30.26	33E34.57	225	2	214	-
137	E6	2020-10-20	11:12	78N32.63	33E16.39	245	2	237	-
138	E7	2020-10-20	12:26	78N35.06	32E58.28	280	2	280	399

Cast	Station Name	Date-UTC	Time (UTC)	LAT	LON	E. Depth (m)	Start (m)	End (m)	CTD File
139	E8	2020-10-20	13:43	78N37.23	32E40.09	289	2	288	-
140	E9	2020-10-20	14:25	78N39.46	32E22.34	273	2	273	-
141	E10	2020-10-20	15:07	78N41.94	32E04.93	269	2	267	-
142	E11	2020-10-20	15:48	78N44.11	31E46.57	266	3	264	-
143	E12	2020-10-20	16:35	78N46.35	31E28.74	217	2	207	-
144	E13	2020-10-20	17:17	78N48.74	31E10.06	144	2	128	-
145	E14	2020-10-20	18:07	78N50.98	30E52.85	128	2	117	400
146	F1	2020-10-20	23:27	78N03.49	29E31.28	331	2	336	401
147	F2	2020-10-21	00:09	78N01.09	29E17.92	318	2	308	-
148	F3	2020-10-21	00:49	77N58.61	29E04.11	304	2	293	-
149	F4	2020-10-21	01:28	77N56.12	28E50.47	283	2	274	-
150	F5	2020-10-21	02:09	77N53.50	28E36.32	242	2	234	-
151	F6	2020-10-21	02:49	77N51.01	28E22.49	238	2	239	-
152	F7	2020-10-21	03:27	77N48.56	28E09.02	213	2	211	-
153	F8	2020-10-21	04:07	77N46.06	27E55.36	182	2	177	-
154	F9	2020-10-21	04:44	77N43.49	27E41.32	133	2	125	-
155	F10	2020-10-21	05:20	77N41.07	27E27.41	103	2	100	-
156	F11	2020-10-21	05:57	77N38.61	27E13.93	138	2	134	-
157	F12	2020-10-21	06:54	77N36.01	27E00.55	148	2	149	402
158	G1	2020-10-22	11:25	75N60.00	31E12.79	323	2	320	403
159	G2	2020-10-22	12:52	75N55.15	31E12.08	321	2	316	-
160	G3	2020-10-22	13:40	75N50.25	31E11.14	321	2	308	-
161	G4	2020-10-22	14:29	75N45.35	31E09.96	351	2	330	-
162	G5	2020-10-22	15:18	75N40.44	31E09.18	350	2	245	-
163	G6	2020-10-22	16:11	75N35.64	31E07.70	347	2	344	-
164	G7	2020-10-22	17:09	75N30.80	31E06.93	358	2	352	-
165	G8/H1	2020-10-22	18:32	75N26.19	31E06.54	357	2	347	404
166	H2	2020-10-22	21:04	75N23.82	31E21.52	357	2	353	-
167	H3	2020-10-22	22:01	75N21.92	31E38.02	318	2	306	-
168	H4	2020-10-22	22:57	75N19.66	31E53.24	331	2	329	-
169	H5	2020-10-22	23:50	75N17.64	32E09.43	311	2	297	-
170	H6	2020-10-23	01:05	75N15.55	32E26.40	289	2	282	405
171	H7	2020-10-23	01:54	75N13.41	32E41.91	212	2	206	-
172	H8	2020-10-23	02:41	75N11.30	32E57.65	191	2	186	-
173	H9	2020-10-23	03:26	75N09.22	33E13.93	175	2	162	-
174	H10	2020-10-23	04:12	75N07.35	33E30.16	164	2	161	-
175	I1	2020-10-23	07:34	75N32.49	34E42.10	161	2	158	-
176	I2	2020-10-23	08:20	75N37.52	34E39.12	172	1	172	-
177	I3	2020-10-23	09:06	75N42.37	34E35.98	193	2	191	-
178	I4	2020-10-23	09:51	75N47.28	34E33.10	203	2	200	-
179	I5	2020-10-23	10:54	75N52.32	34E29.68	232	2	332	406
180	I6	2020-10-23	11:45	75N57.08	34E26.45	250	2	243	-
181	I7	2020-10-23	12:31	76N02.29	34E24.15	263	2	243	-
182	I8	2020-10-23	13:38	76N07.24	34E20.92	297	2	288	407
183	I9	2020-10-23	14:48	76N12.19	34E18.04	309	2	284	-
184	I10	2020-10-23	15:37	76N17.17	34E15.39	290	2	288	-
185	I11	2020-10-23	16:48	76N22.55	34E11.15	263	2	258	408
186	I12	2020-10-23	17:34	76N26.98	34E08.98	252	3	252	-
187	I14	2020-10-23	18:21	76N32.07	34E06.41	196	2	187	-
188	I13	2020-10-23	18:54	76N29.46	34E07.17	214	2	204	-
189	I15	2020-10-23	19:55	76N37.10	34E02.72	168	2	155	-
190	I16	2020-10-23	20:40	76N42.04	34E01.16	140	2	135	-
191	D13	2020-10-24	10:23	76N45.06	32E16.75	244	2	141	-

Cast	Station Name	Date-UTC	Time (UTC)	LAT	LON	E. Depth (m)	Start (m)	End (m)	CTD File
192	D14	2020-10-24	11:12	76N45.10	32E34.93	210	2	204	-
193	D15	2020-10-24	11:57	76N45.00	32E54.14	180	2	175	-
194	D14A	2020-10-24	12:24	76N45.04	32E44.95	193	2	193	-
195	D14	2020-10-24	12:51	76N45.08	32E35.43	218	2	209	-
196	D13A	2020-10-24	13:20	76N45.06	32E25.26	221	2	218	-
197	D14	2020-10-24	13:52	76N45.04	32E35.92	208	2	210	-
198	D14A	2020-10-24	14:23	76N45.10	32E44.79	196	2	196	-
199	D15	2020-10-24	14:52	76N45.14	32E54.01	181	3	175	-
200	D14A	2020-10-24	15:17	76N45.04	32E44.86	196	2	190	-
201	D14	2020-10-24	15:43	76N45.12	32E35.14	210	2	202	-
202	D13A	2020-10-24	16:13	76N45.16	32E25.14	226	2	225	-
203	D14	2020-10-24	16:54	76N45.10	32E34.83	206	2	195	-
204	D14A	2020-10-24	17:26	76N45.01	32E44.55	198	3	189	-
205	D15	2020-10-24	17:57	76N45.05	32E53.69	180	3	176	-
206	D14A	2020-10-24	18:24	76N45.14	32E44.57	190	2	181	-
207	D14	2020-10-24	18:50	76N45.08	32E35.55	216	2	211	-

Table 10: VMP stations

Cast	Station Name	Date-UTC	Time (UTC)	LAT	LON	E. Depth (m)	Start (m)	End (m)	CTD File
1	P2	2020-10-09	21:30	77N30.00	34E00.00	187	2	167	350
2	P2	2020-10-09	22:49	77N30.00	33E57.87	189	2	185	-
3	P2	2020-10-10	01:00	77N29.96	34E01.14	185	2	182	0
4	P1	2020-10-12	04:15	76N00.60	31E13.06	316	1	322	358
5	P1	2020-10-12	07:17	76N01.90	31E13.14	317	2	270	0
6	P1	2020-10-12	08:36	76N01.68	31E13.25	316	2	295	0
7	P1	2020-10-12	12:40	76N00.46	31E13.21	317	2	320	0
8	bench test	2020-10-13	10:42	NaNNNaN	NaNENaN	NaN	NaN	NaN	0

c. Cruise participant list

Cruise participants sorted with respect to institution (in no particular order).

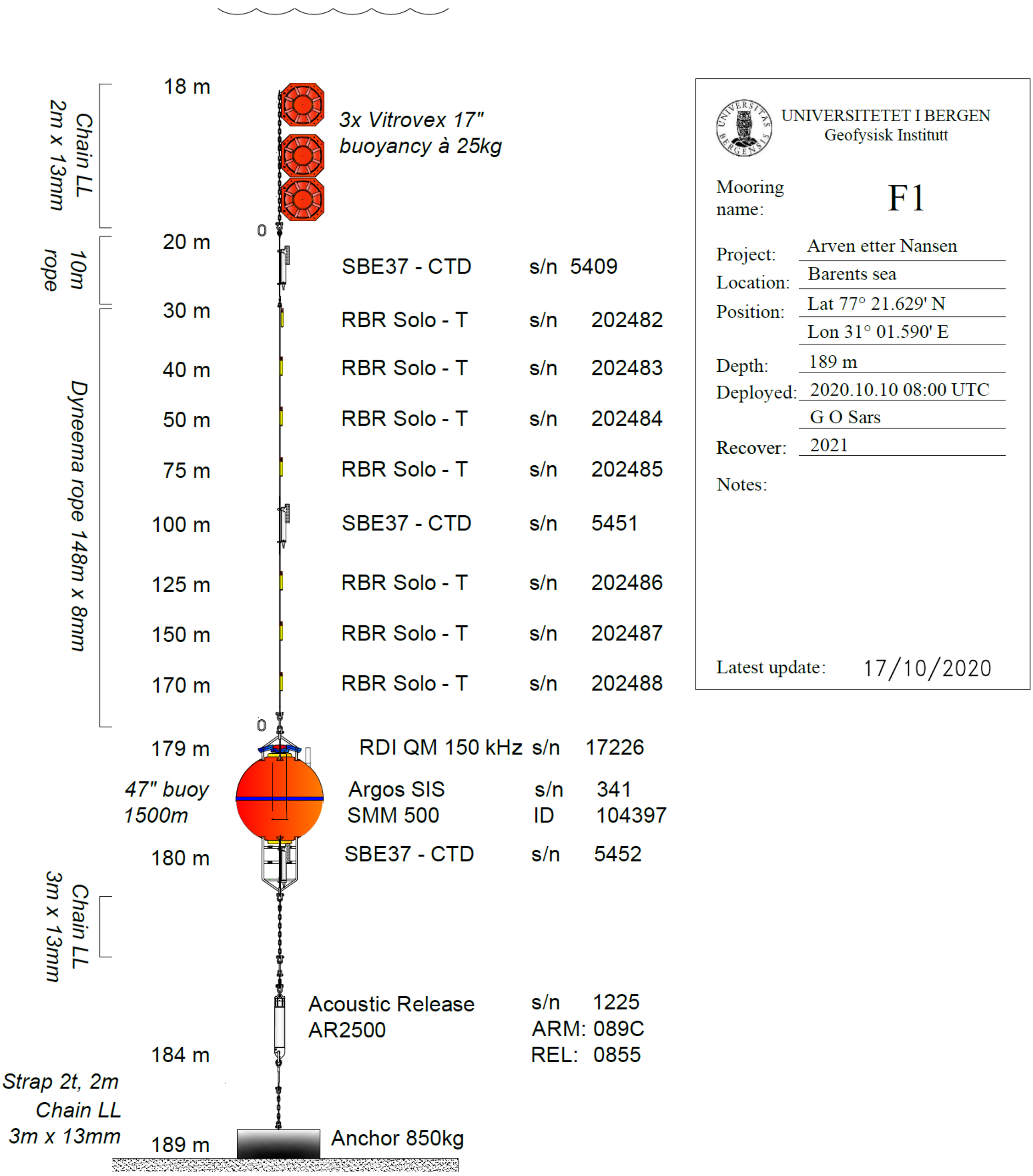
Name	**Affiliation**	**Responsibility**	**Task**
Ilker Fer	UIB	cruise leader	VMP/SADCP/LADCP
Till Baumann	UIB	PD, phys. Oceanogr.	VMP/ Moorings
Eivind Kolås	UIB	PhD, phys. Oceanogr.	Glider /AUV
Algot Peterson	UIB	Tech.	VMP / Moorings
Helge Bryhni	UIB	Tech.	VMP/ Moorings
Fiona Elliott	UIB	Tech.	Gliders
Ragnheid Skogseth	UNIS	cruise co-leader	CTD/LADCP
Marcos Porcires	UNIS	Tech.	Mooring
Kjersti Kalhagen	UNIS	PhD, phys. Oceanogr.	CTD / LADCP
Eva Falck	UNIS	forsker	dO2 / CTD
Sine-Sara Astad	UNIS	Tech.	plankton samples
Tore Mo-Bjørkelund	NTNU	PhD, phys. Oceanogr.	AUV
Christine Gawinski	UIT	PhD	copepods
Terje Hovland	IMR	Tech.	Mooring
Egil Frøyen	HI	Instrument	CTD/salinity samples
Jarle Wangensten	HI	Instrument	CTD/salinity samples

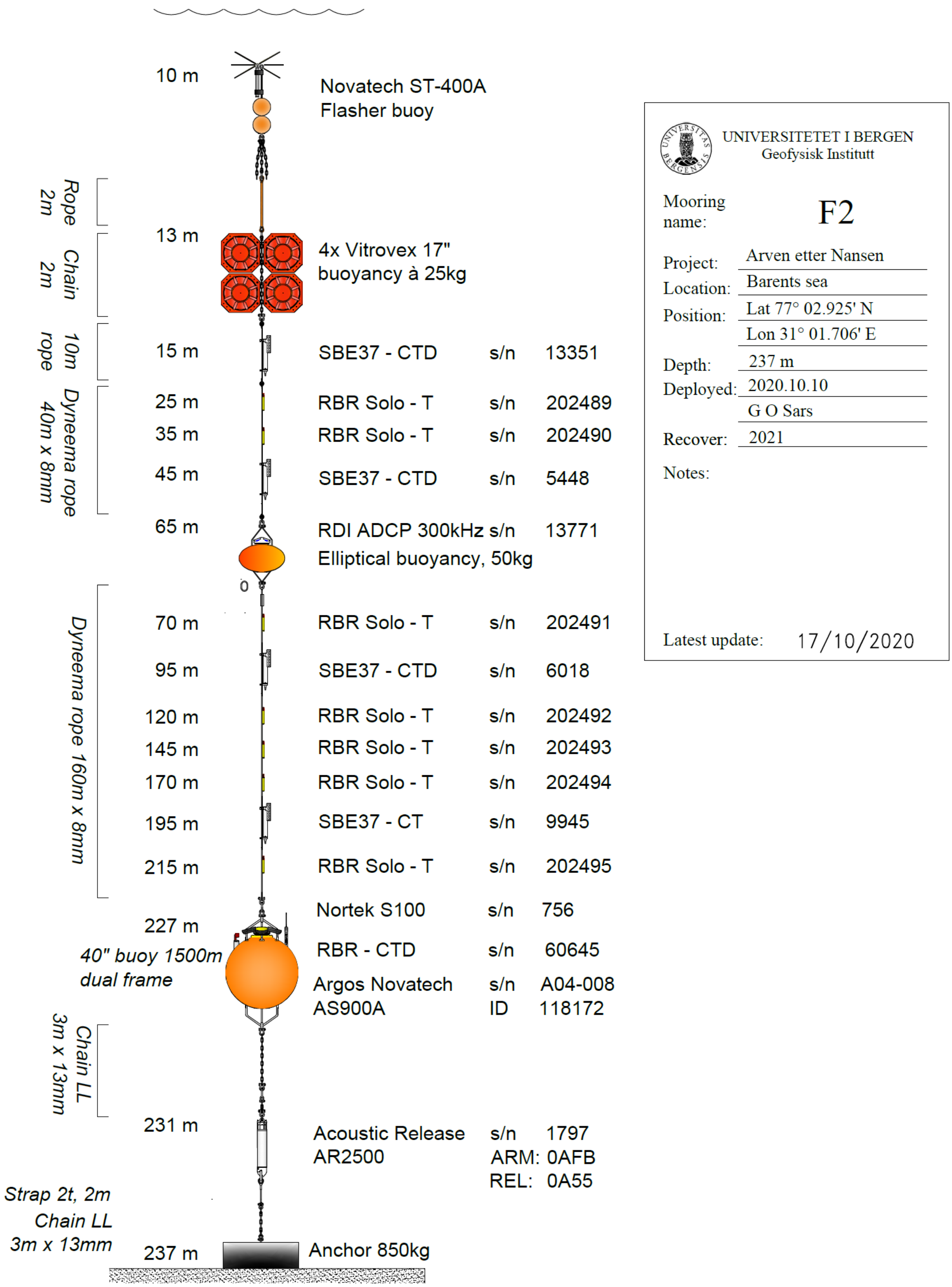
Appendix II. Outreach

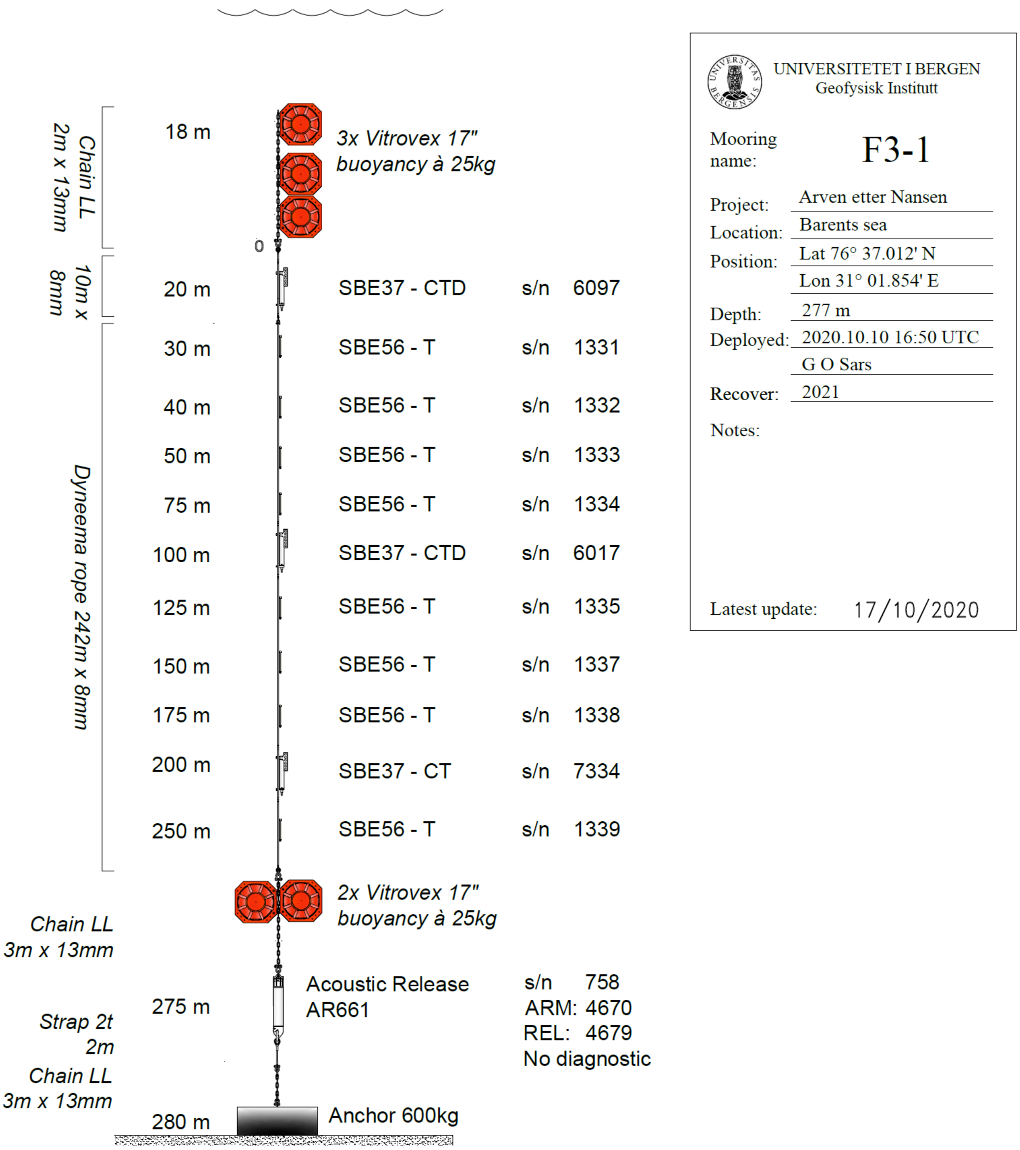
Risky Business, Ilker Fer, https://blogg.forskning.no/arven-etter-nansen/risky-business/1762763

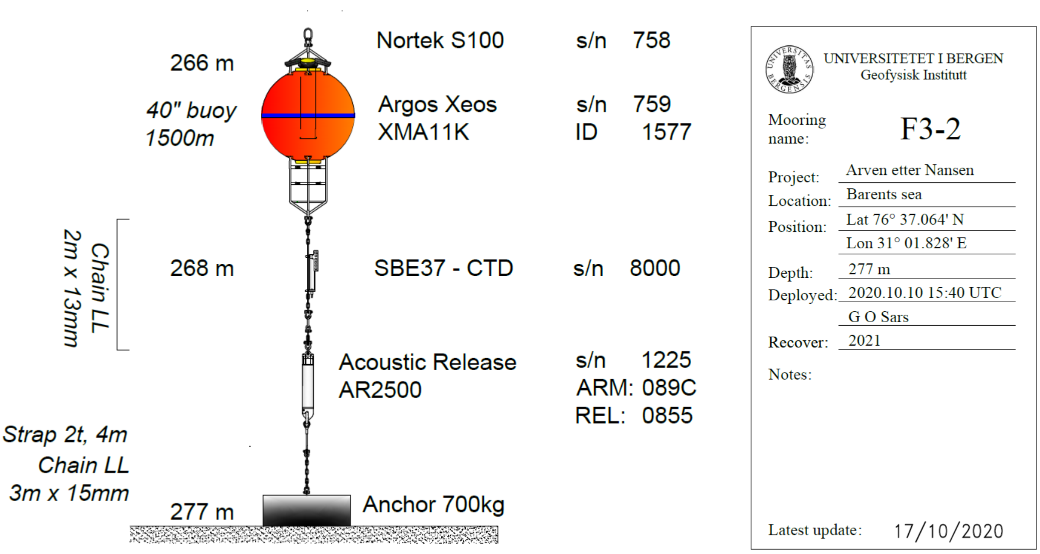
When Murphy Wins, Tore Mo-Bjørkelund, https://sciencenorway.no/blog-nansen-legacy-project-blog-researchers-zone/research-cruising-in-the-barents-sea-when-murphy-wins/1763286

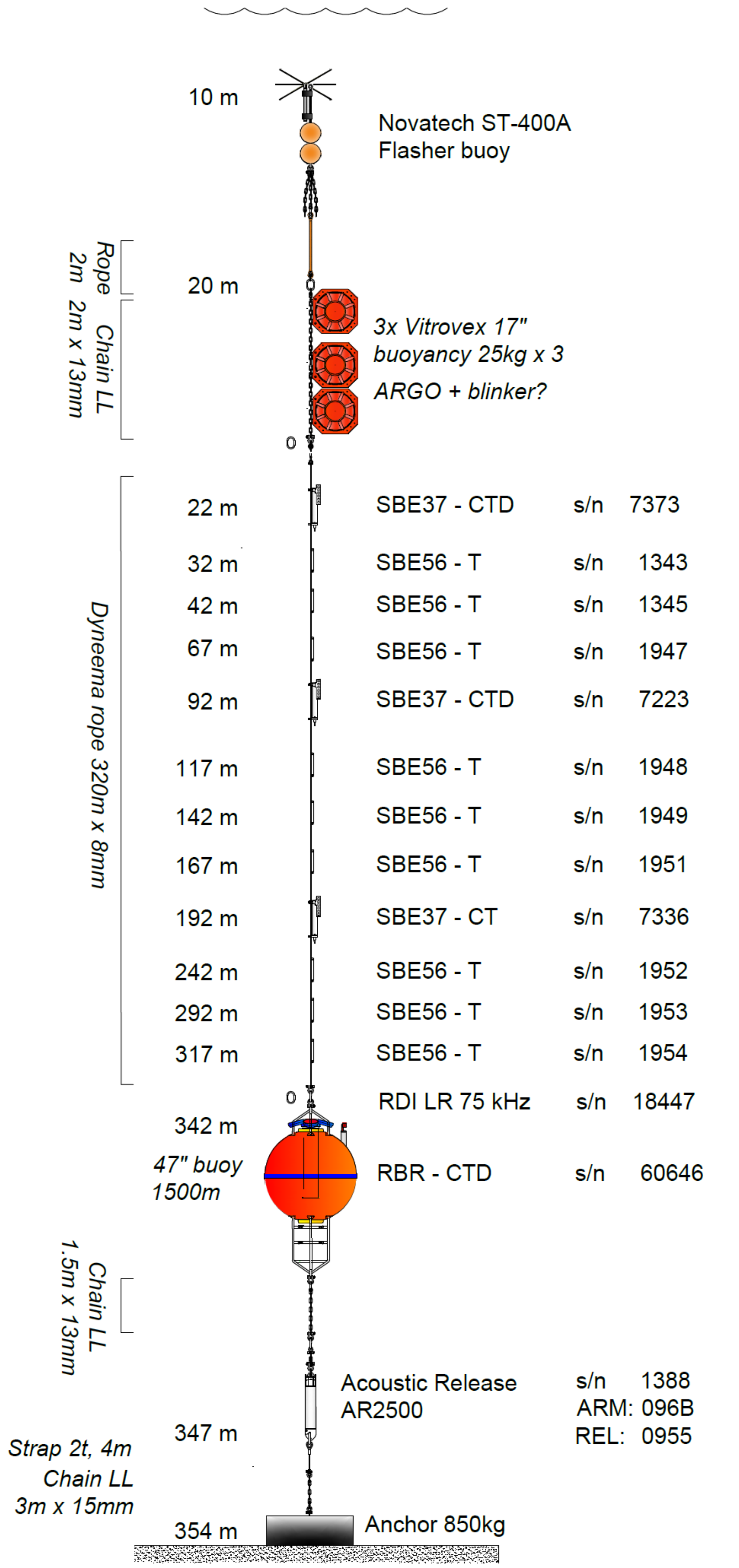
Appendix III. Moorings




10 m
Novatech ST-400A
Flasher buoy
Rope 2m
Chain 2m
13 m
4x Vitrovex 17"
buoyancy à 25kg
10m rope
15 m
SBE37 - CTD s/n 13351
Dyneema rope 40m x 8mm
25 m
RBR Solo - T s/n 202489
35 m
RBR Solo - T s/n 202490
45 m
SBE37 - CTD s/n 5448
65 m
RDI ADCP 300kHz s/n 13771
Elliptical buoyancy, 50kg
Dyneema rope 160m x 8mm
70 m
RBR Solo - T s/n 202491
95 m
SBE37 - CTD s/n 6018
120 m
RBR Solo - T s/n 202492
145 m
RBR Solo - T s/n 202493
170 m
RBR Solo - T s/n 202494
195 m
SBE37 - CT s/n 9945
215 m
RBR Solo - T s/n 202495
Nortek S100 s/n 756
227 m
RBR - CTD s/n 60645
40" buoy 1500m
dual frame
Argos Novatech s/n A04-008
AS900A ID 118172
Chain LL 3m x 13mm
231 m
Acoustic Release s/n 1797
AR2500 ARM: 0AFB
REL: 0A55
Strap 2t, 2m
Chain LL
3m x 13mm
237 m
Anchor 850kg
UNIVERSITETET I BERGEN
Geofysisk Institutt
Mooring name: F2
Project: Arven etter Nansen
Location: Barents sea
Position: Lat 77° 02.925' N
Lon 31° 01.706' E
Depth: 237 m
Deployed: 2020.10.10
G O Sars
Recover: 2021
Notes:
Latest update: 17/10/2020

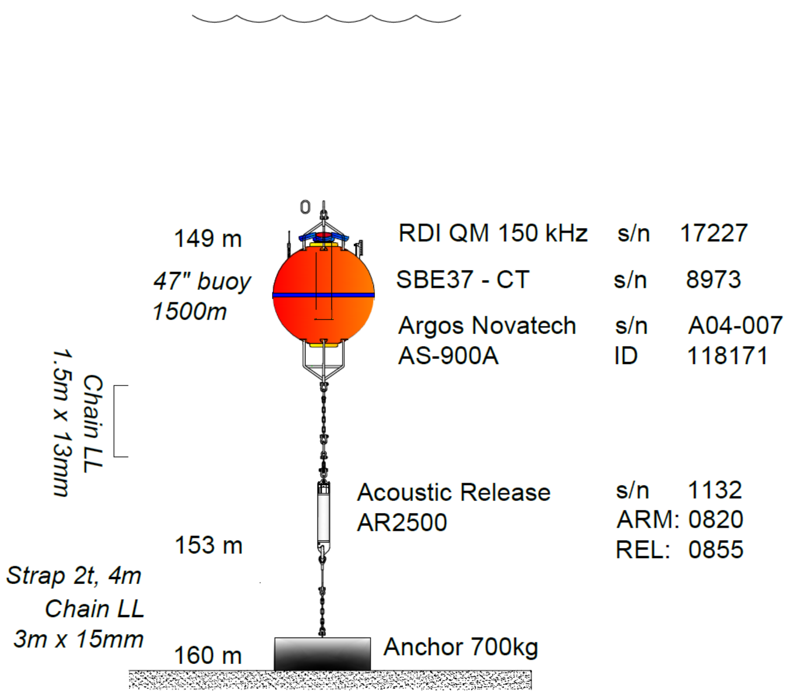

Chain LL 2m x 13mm
18 m
3x Vitrovex 17" buoyancy à 25kg
10m x 8mm
20 m SBE37 - CTD s/n 6097
Dyneema rope 242m x 8mm
30 m SBE56 - T s/n 1331
40 m SBE56 - T s/n 1332
50 m SBE56 - T s/n 1333
75 m SBE56 - T s/n 1334
100 m SBE37 - CTD s/n 6017
125 m SBE56 - T s/n 1335
150 m SBE56 - T s/n 1337
175 m SBE56 - T s/n 1338
200 m SBE37 - CT s/n 7334
250 m SBE56 - T s/n 1339
2x Vitrovex 17" buoyancy à 25kg
Chain LL 3m x 13mm
275 m Acoustic Release AR661
s/n 758
ARM: 4670
REL: 4679
No diagnostic
Strap 2t 2m
Chain LL 3m x 13mm
280 m Anchor 600kg
UNIVERSITETET I BERGEN
Geofysisk Institutt
Mooring name: F3-1
Project: Arven etter Nansen
Location: Barents sea
Position: Lat 76° 37.012' N
Lon 31° 01.854' E
Depth: 277 m
Deployed: 2020.10.10 16:50 UTC
G O Sars
Recover: 2021
Notes:
Latest update: 17/10/2020


266 m Nortek S100 s/n 758
40" buoy 1500m
Argos Xeos XMA11K s/n 759 ID 1577
Chain LL 2m x 13mm
268 m SBE37 - CTD s/n 8000
Acoustic Release AR2500
s/n 1225
ARM: 089C
REL: 0855
Strap 2t, 4m
Chain LL 3m x 15mm
277 m Anchor 700kg
UNIVERSITETET I BERGEN
Geofysisk Institutt
Mooring name: F3-2
Project: Arven etter Nansen
Location: Barents sea
Position: Lat 76° 37.064' N
Lon 31° 01.828' E
Depth: 277 m
Deployed: 2020.10.10 15:40 UTC
G O Sars
Recover: 2021
Notes:
Latest update: 17/10/2020



UNIVERSITETET I BERGEN
Geofysisk Institutt

Mooring name:	C
Project:	Arven etter Nansen
Location:	Barents sea
Position:	Lat 75° 25.799' N
	Lon 31° 05.979' E
Depth:	354 m
Deployed:	2020.10.11 23:25 UTC
	G O Sars
Recover:	
Notes:	
Latest update:	17/10/2020

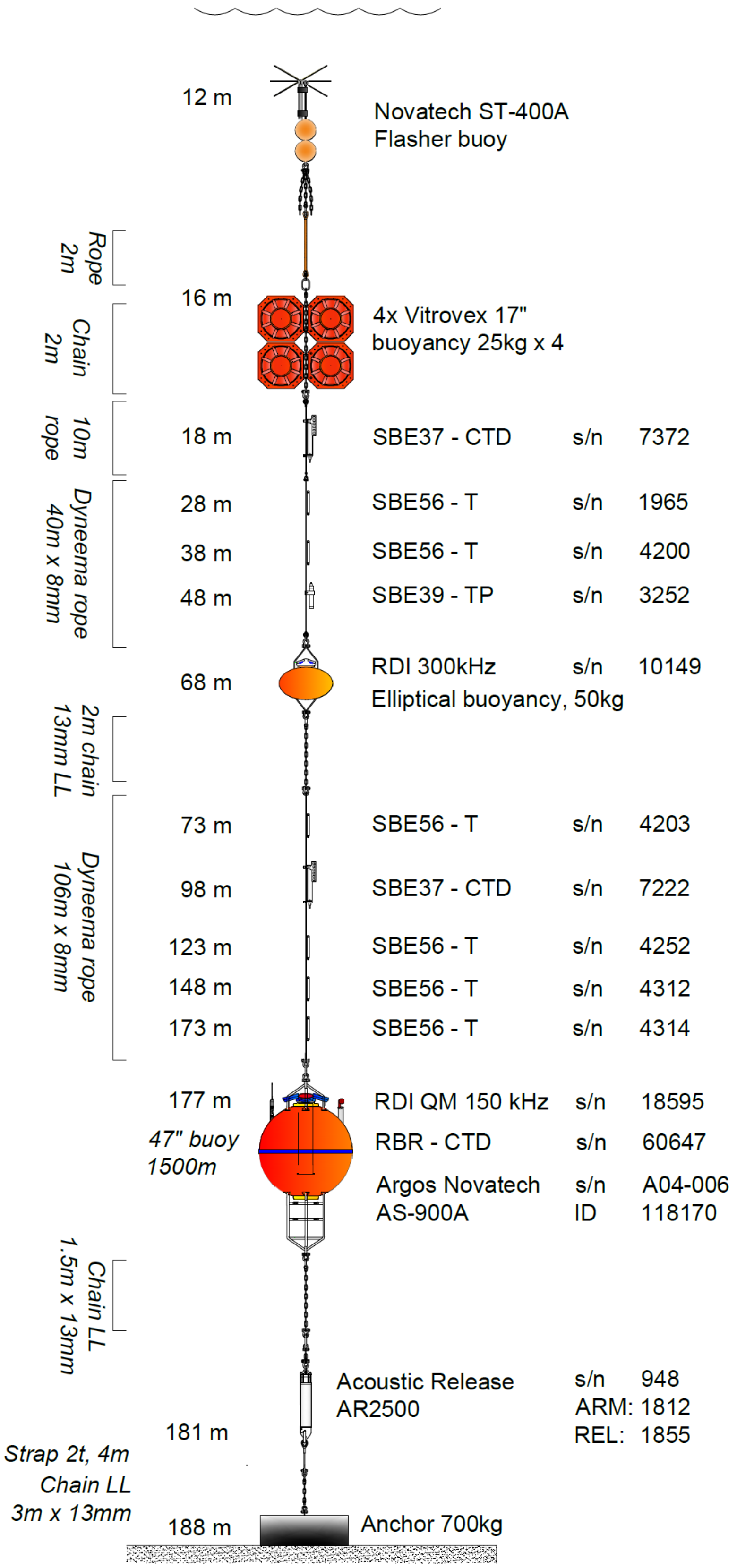


UNIVERSITETET I BERGEN
Geofysisk Institutt

Mooring name: **S1**

Project: Arven etter Nansen
Location: Barents sea
Position: Lat 75° 07.198' N
Lon 33° 30.003' E
Depth: 160 m
Deployed: 2020.10.11 11:40 UTC
G O Sars
Recover:
Notes:

Latest update: 14/10/2020

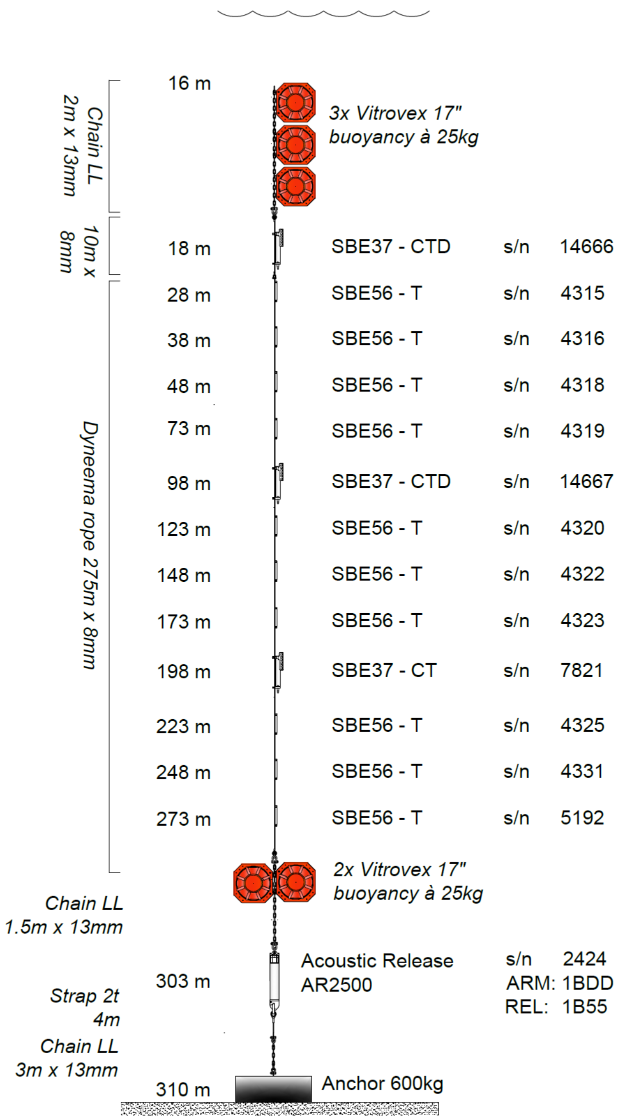


UNIVERSITETET I BERGEN
Geofysisk Institutt

Mooring name: S2

Project: Arven etter Nansen
Location: Barents sea
Position: Lat 75° 11.394' N
Lon 32° 54.060' E
Depth: 188 m
Deployed: 2020.10.11 14:35 UTC
G O Sars
Recover:
Notes:

Latest update: 17/10/2020

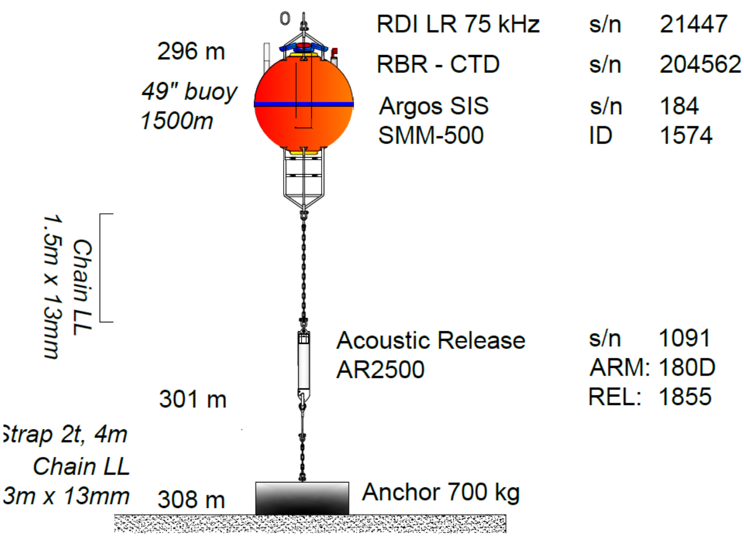


UNIVERSITETET I BERGEN
Geofysisk Institutt

Mooring name: S3-1

Project: Arven etter Nansen
Location: Barents sea
Position: Lat 75° 17.845' N
Lon 32° 05.519' E
Depth: 310 m
Deployed: 2020.10.11 18:04 UTC
G O Sars
Recover:
Notes:

Latest update: 14/10/2020

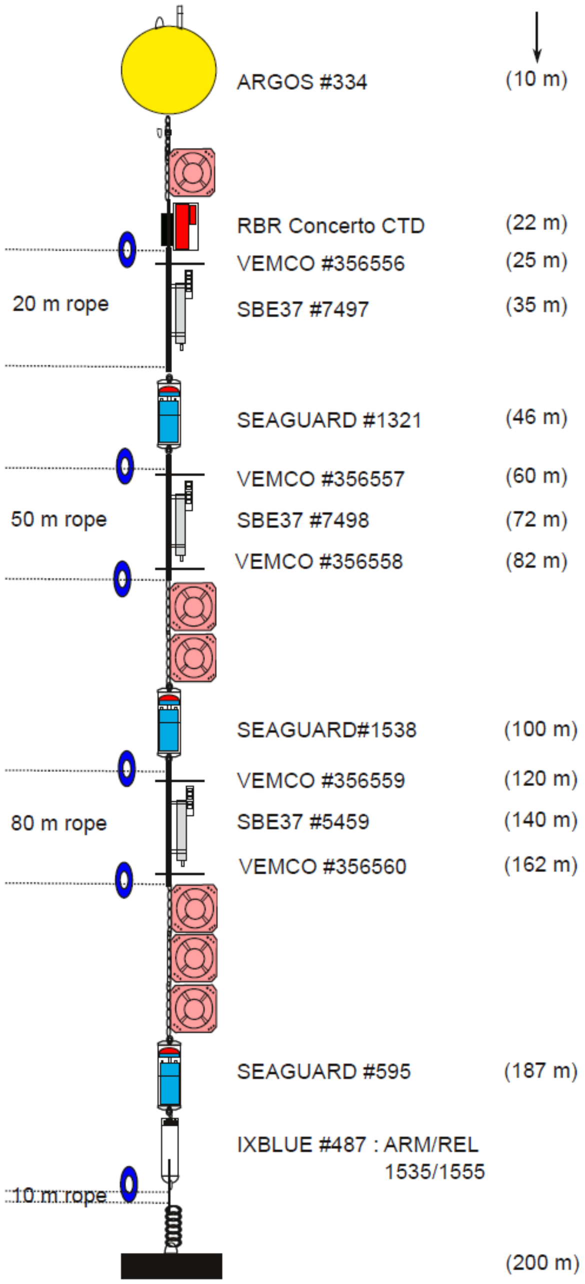


UNIVERSITETET I BERGEN
Geofysisk Institutt

Mooring name: S3-2

Project: Arven etter Nansen
Location: Barents sea
Position: Lat 75° 17.789' N
Lon 32° 05.536' E
Depth: 308 m
Deployed: 2020.10.11 18:51 UTC
G O Sars
Recover:
Notes:

Latest update: 17/10/2020



Name: I-SM

Location: N 78 03.659
E 13 31.429

Depth: 200 m

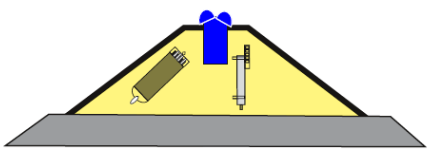
Deployment:

Start time:

SeaGuard: 1 hrs interval

Vemco: 20 min interval

SBE37: 20 min interval



Name: M4

Location: N77.2686 E24.4067

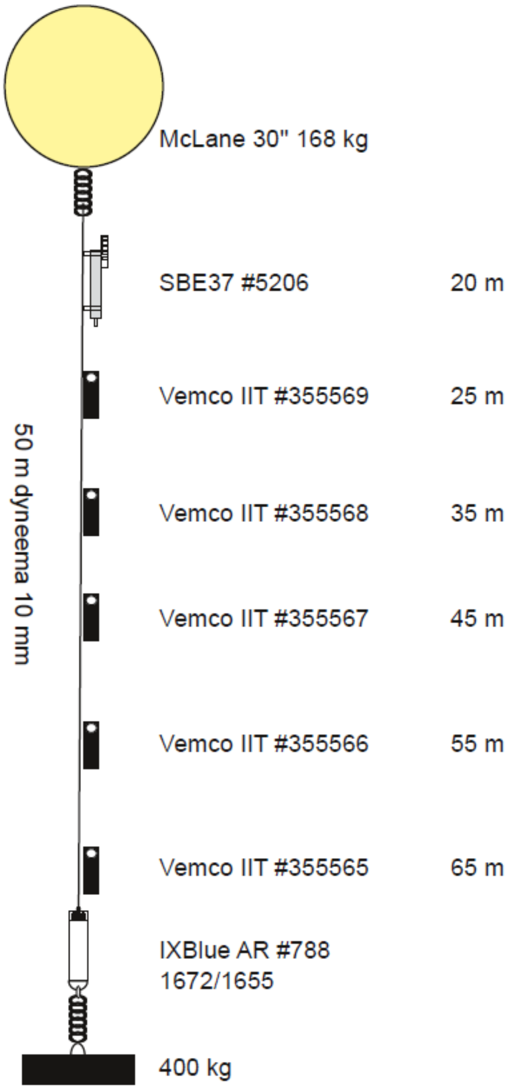
Depth: 71 m

Deployment: 14.11.2019

Name: M4 Hydrography

Location: N77.2699 E24.4071

Depth: 71 m
Deployment: 14.11.2019



Institute of Marine Research

Data Record Book for Mooring Instruments

Ship/Platform:	G.O. Sars
Location:	M5
Latitude:	N 77° 04.48
Longitude:	E 035° 02.208

Instruments / Sensors

#	Brand	Type	Serial No.	Depth	Comments
1	Sea Bird	SBE 37-SMP	37-20354	47	With exhaust plumbing new batt
2		SeapHOx pH	PHS-2068		Max 50 m
3	Sea Bird	SBE 37-SMP	37-20179	126	New batt
4	Nortek	Signature 250	100562	127	Lith.Batt
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Bottom depth: 140 m

Outgoing date: 2020.10.13

Outgoing time (UTC): 00:19

Incoming date: 9999.99.99

Incoming time (UTC):

Comments:

Responsible: Terje Hovland

ARGOS

PTTID:

Acoustic release: IXSEA ARX61

Serial no: 300 Battery expire: 2028.03.23

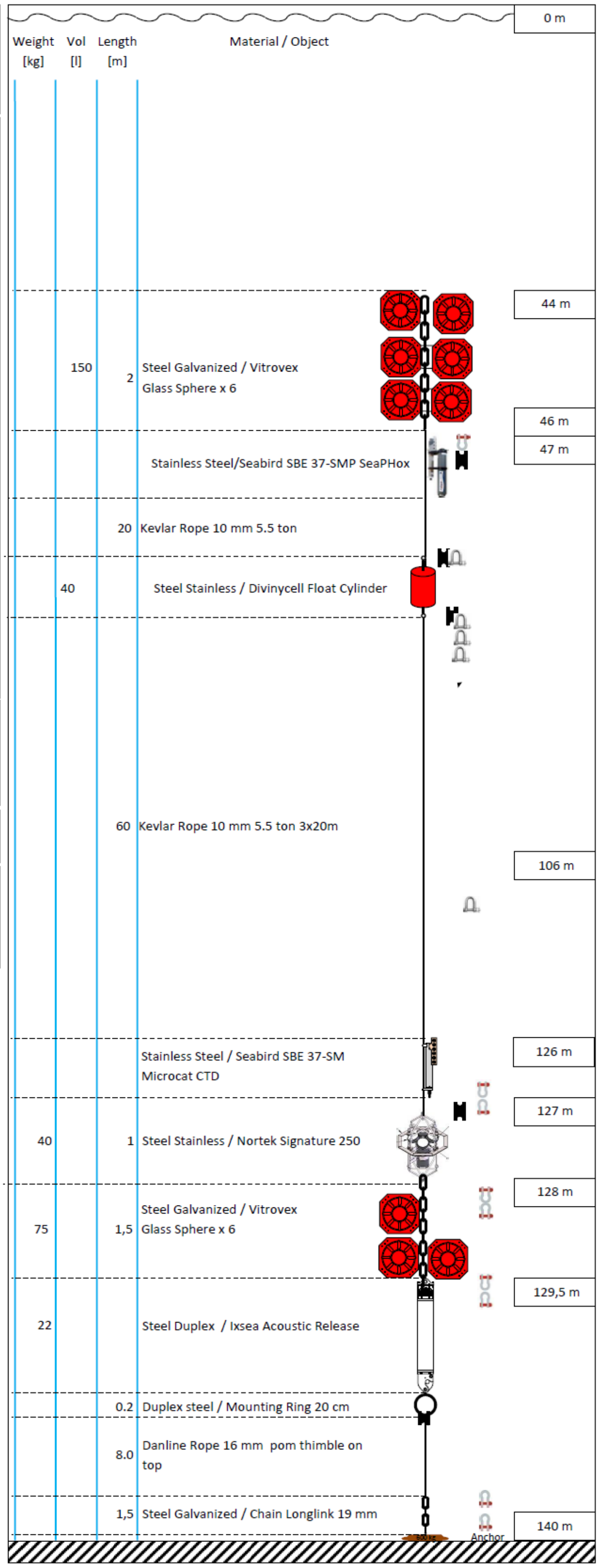
Range code: 1420

Release code: 1455

tation Name	M5	
Sum weight (incl. anchor):	[kg]	
Sum weight (excl. anchor):	[kg]	
Sum volume:	[l]	
Buoyancy (anchor on):	[kg]	
Buoyancy (anchor off):	[kg]	
Shackle Stainless Steel		
Shackle Galvanized Steel		
Thimble Stainless Steel		
Thimble Galvanized Steel		
Thimble Nylon		

Equipment

Description	Spec.	No.
Shackle Stainless Steel		
Shackle Stainless Steel	2.50	7
Shackle Galvanized Steel	0.50	
Shackle Galvanized Steel	2.00	
Shackle Galvanized Steel	3.25	11
Shackle Galvanized Steel	4.75	
Shackle Galvanized Steel	6.50	
Thimble Stainless Steel		
Thimble Stainless Steel		
Thimble Galvanized Steel		
Thimble Galvanized Steel		
Thimble Galvanized Steel		
Thimble Nylon		6



Institute of Marine Research

Data Record Book for Mooring Instruments

Ship/Platform:	G.O. Sars
Location:	M5-BIOAC
Latitude:	N 77° 04.947
Longitude:	E 035° 03.47

Instruments / Sensors

#	Brand	Type	Serial No.	Depth	Comments
1	Nortek	Signature 100	101121	133	
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

Bottom depth:	144 m
Outgoing date:	2020.10.12
Outgoing time (UTC):	22:52
Incoming date:	2013.09.24
Incoming time (UTC):	

Comments:

Responsible: Terje Hovland

ARGOS

PTTID:

Acoustic release: IXSEA ARX61

Serial no: 2123 Battery expire: 2024.01.19

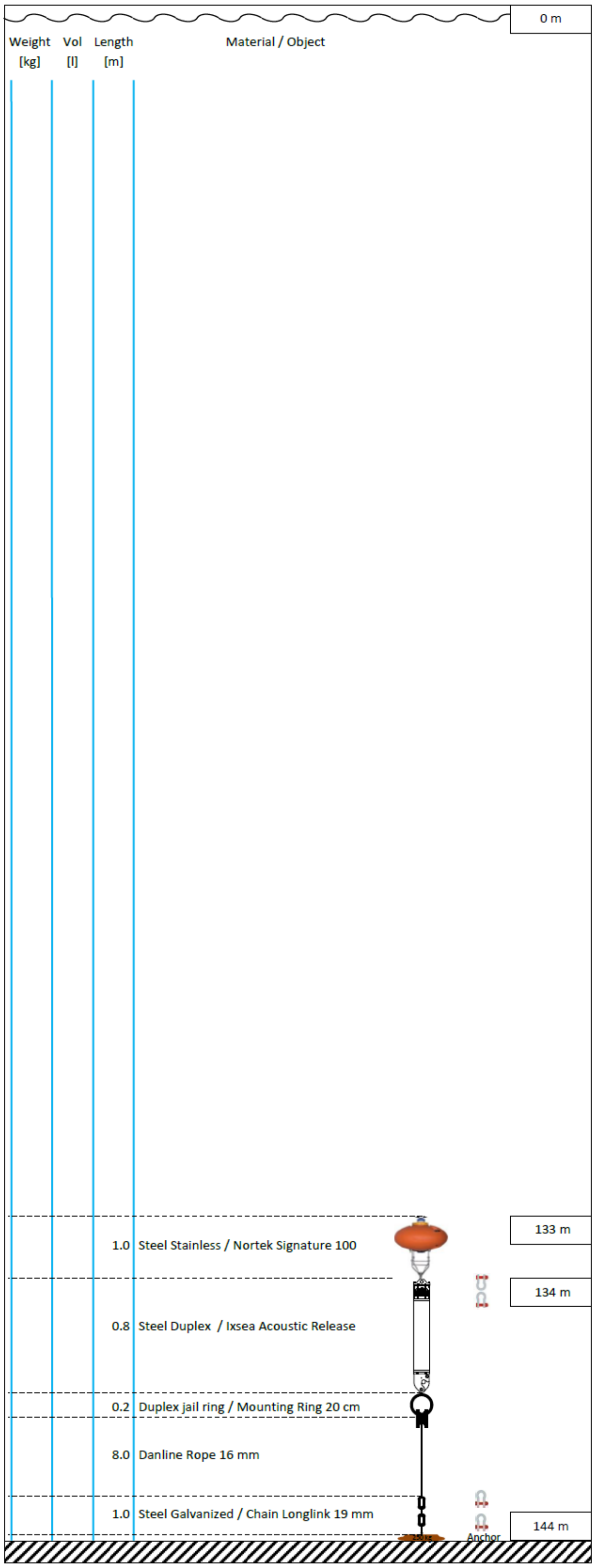
Range code: 0BAA

Release code: 0B55

Station Name	M5-BIOAC	
Sum weight (incl. anchor):	[kg]	
Sum weight (excl. anchor):	[kg]	
Sum volume:	[l]	
Buoyancy (anchor on):	[kg]	
Buoyancy (anchor off):	[kg]	
Shackle Stainless Steel		
Shackle Galvanized Steel		
Thimble Stainless Steel		
Thimble Galvanized Steel		
Thimble Nylon		

Equipment

Description	Spec.	No.
Shackle Stainless Steel		
Shackle Stainless Steel	2.50	
Shackle Galvanized Steel	0.50	
Shackle Galvanized Steel	2.00	1
Shackle Galvanized Steel	3.25	4
Shackle Galvanized Steel	4.75	
Shackle Galvanized Steel	6.50	
Thimble Stainless Steel		
Thimble Stainless Steel		
Thimble Galvanized Steel		
Thimble Galvanized Steel		
Thimble Galvanized Steel		
Thimble Nylon		



Institute of Marine Research
Data Record Book for Mooring Instruments

Ship/Platform:	Isbryter
Location:	M2-HI
Latitude:	N 78° 20.868
Longitude:	E 034° 45.744

Instruments / Sensors

#	Brand	Type	Serial No.	Depth	Comments
1	Nortek	Continental	975	128	
2	Sea Bird	SBE 37-SMP	37-20180	177	
3	Nortek	Continental	976	230	
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

Bottom depth:	241 m
Outgoing date:	2019.08.12
Outgoing time (UTC):	
Incoming date:	2013.09.24
Incoming time (UTC):	

Comments:

Responsible: Ronald Pedersen

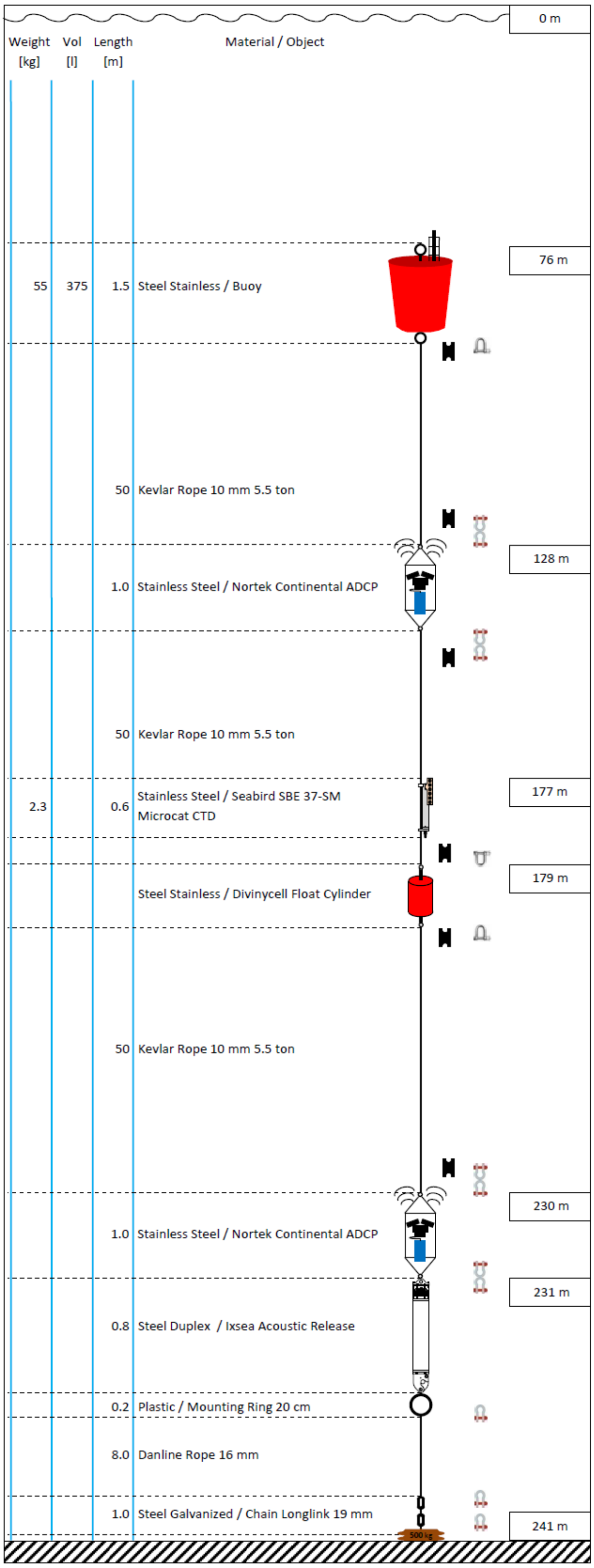
ARGOS
PTTID:

Acoustic release: IXSEA ARX61
Serial no: 0699 Battery expire: 2024.08.29
Range code: 4B15
Release code: 4B16

Station Name	M2-HI	
Sum weight (incl. anchor):	[kg]	
Sum weight (excl. anchor):	[kg]	
Sum volume:	[l]	
Buoyancy (anchor on):	[kg]	
Buoyancy (anchor off):	[kg]	
Shackle Stainless Steel		
Shackle Galvanized Steel		
Thimble Stainless Steel		
Thimble Galvanized Steel		
Thimble Nylon		

Equipment

Description	Spec.	No.
Shackle Stainless Steel		
Shackle Stainless Steel	2.50	3
Shackle Galvanized Steel	0.50	
Shackle Galvanized Steel	2.00	
Shackle Galvanized Steel	3.25	11
Shackle Galvanized Steel	4.75	
Shackle Galvanized Steel	6.50	
Thimble Stainless Steel		
Thimble Stainless Steel		
Thimble Galvanized Steel		
Thimble Galvanized Steel		
Thimble Galvanized Steel		
Thimble Nylon		6



(NOTE: Named M6 in mooring tables.)

The Nansen Legacy in numbers

6 years

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

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 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.

>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*.

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.

10 institutions

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

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.

Norwegian Ministry of Education and Research

With funding from The Research Council of Norway

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