

Cruise Report: Hans Brattström, 2026009004

2-4 February 2026, GEOF337 cruise, part 1

Cruise overview

The cruise was organized as part of the course GEOF337 at the Geophysical Institute, UiB, and we visited Masfjorden, Fensfjorden and Lurefjorden to do hydrographic work, collect water samples and moorings. This cruise report is compiled by Ilker Fer with input from Elin Dareljus and GEOF337 students.

During the cruise, we performed a variety of tasks, one of which was recovering a mooring in the outer basin and deploying one on the sill in Masfjorden. In addition, we collected water samples at each station at selected depths for calibration of salinity and oxygen measurements from the profiler. At one station we also took samples for carbon and nutrients analysis. Station overview, details of sampling and analysis methods, and mooring details are given in the following sections.

Participants:

Cruise leader : Ilker Fer

Technicians : Helge Bryhni; Kristin M. Jackson

Students : Randi Birkeland; Aikaterini Katsiagoni

Niklas David Scheck ; Sander Assklidt Strømsheim

Crew : Carl-Magnus Nødtvedt Nilsen (captain) and Viggo Edvardsen

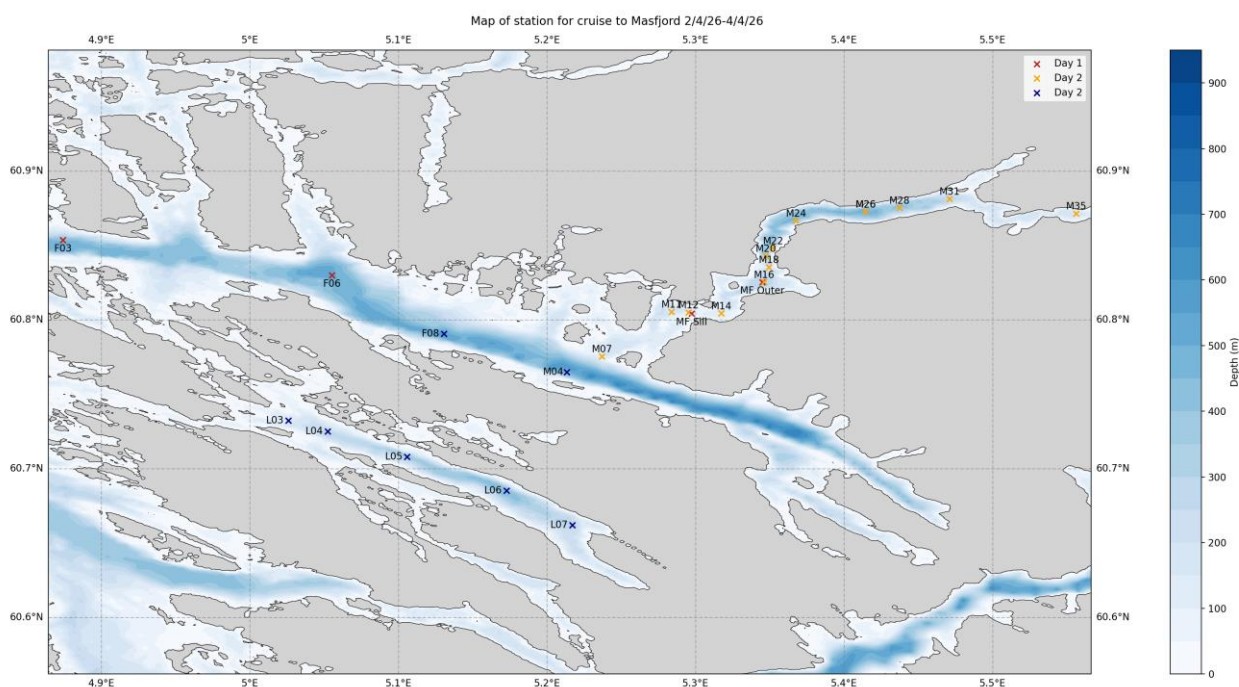


Fig. 1 Stations taken during the cruise. Markers are colored by the day of cruise.

CTD

The CTD used on board this cruise was the model RBRmaestro³ with serial number 205914. The sensors and factory calibration dates are listed in Table 1. The CTD was attached to a water sampler from Hydro Bios, Kiel, on a frame with 6 bottles. The CTD is an internal recording instrument without telemetry, and it was not possible to see the profile collected during a station.

Table 1. Sensors on the CTD rosette

Sensor	Units	Serial number	Calibration date
Conductivity	mS/cm	17TI50961	2/13/2025
Temperature	°C	3971	2/11/2025
Pressure	dbar	205591	2/12/2025
Chlorophyll	µg/L	207796	4/1/2000
Temperature	°C	212754	4/1/2000
Dissolved O ₂ concentration	µmol/L		4/1/2000
PAR	µmol/m ² /s		2/20/2025

We started with a test station in Byfjorden close to Bergen to test the CTD and water sampler, and to demonstrate water sampling. CTD profiling then continued in Fensfjorden, Masfjorden and Lurefjorden. At stations, we used a crane to lift the CTD sensor above the railing and into the water, profiled to a target depth of about 10 m from seafloor, and closed bottles at desired depths during the upcast. At each target depth, we waited 1 minute before closing the bottles. In total, we collected 26 CTD profiles (excluding one profile that was aborted). The instrument recorded continuously, and the data files were downloaded at the end of each day. The stations are shown in Fig 1 and listed in Table 2.

Water sampling

Water samples were obtained from the rosette available onboard during the upcast. As CTD data cannot be viewed live, sample depths were chosen beforehand. Sample depths are listed in Table 3, as recorded by the pressure sensor of the rosette. We waited at least one minute after the CTD was stopped before closing the bottle. We took water samples for salt, dissolved oxygen, DIC, and nutrients following standard procedures.

Winkler titration

Samples for measuring dissolved oxygen were collected using a tube, ensuring that each sample was as bubble-free and exposed to air as little as possible. Draw temperature was measured before we added 1 mL MnCl₂ and 1 mL NaOH/I₂ to the sample and put a cap on the flask. The sample was then shaken for about 20 sec, and stored dark and cool until Winkler titration started. Winkler titration was carried out

onboard by Kristin M. Jackson and the students using the SIO automated Winkler titration system.

Dissolved Inorganic Carbon / Alkalinity, and nutrients

Samples for carbon analysis (dissolved inorganic carbon and alkalinity) were collected using a tube, adding four drops (ca 0.1 mL) of mercury to the sampled bottles. Samples were kept cool and dark, and brought back to GFI for analysis.

Samples for nutrients were collected by rinsing the flasks three times, then adding four drops of chloroform to the sample. Samples were stored in the fridge and sent to IMR for analysis.

Salinity

The samples were collected following standard procedures, i.e., the bottles were rinsed three times and then brought back to GFI, where they were analyzed in the lab by the students, supervised by K. Jackson-Misje.

Surface salinity samples

In addition, for training purposes, samples from the surface were collected using a separate water sampler. These samples were collected using a messenger with the sampler about 1 m below the surface. Temperature is read from the thermometer in the sampling bottle.

Mooring work

During the cruise MF Outer mooring was recovered and MF_Sill mooring was deployed.

The deployment of MF_Sill commenced at 14:20 UTC, near the sill of Masfjorden, with the anchor released at 14:41 UTC (60N 48.228'; 5E 17.934', total depth 82.8 m). The recovery of the MF_Outer began at 15:30 UTC, situated in the outer part of Masfjorden, and was completed at 16:10 UTC when all instruments were safely on deck. Drawing illustrations of both moorings are shown in Figs. 2 and 3.

In addition, a Nortek ECO ADCP was deployed. It is a compact, simple ADCP from Nortek, with a maximum 20 m profiling range. It delivers average currents in three equidistant cells automatically set in the profiling range. ECO was armed to release on 2 Mar 16:30 LT. It was deployed at 60N 48.047', 5E 17.617' at 26 m depth.

UNIVERSITETET I BERGEN Geofysisk Institutt		Location: Masfjorden	Notes:
Mooring name: MF Outer	Project: FJO2RD	Position: Lat 60°49.4908' N	Deployed from H. Brattström BH2025009011.
		Lon 5° 20.603' E	
		Depth: 297 m	Deployed 2025
		Deploy: 2025.03.12 09:32 UTC	
		Recover: Planned Feb. 2026	
		Latest update: 24/03/2025	

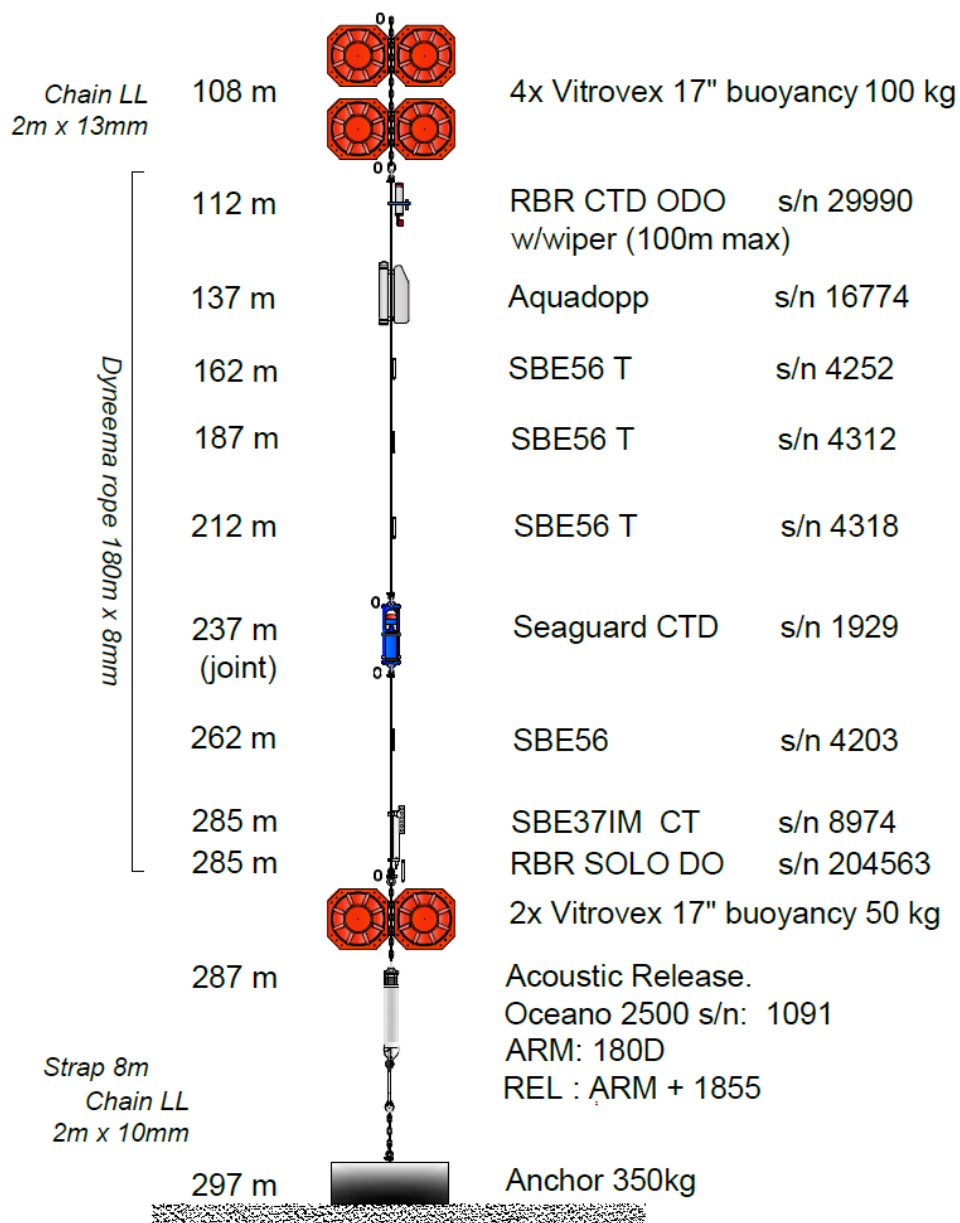


Fig 2. Mooring diagram: "outer" recovered.

Mooring name: **MF Sill**

Project: Undervisningstokt GEOF337

Location: Masfjorden Sill

Position: Lat 60° 48.2302' N

Lon 5° 17.897' E

Depth: 82 m

Deployed: Planned 2026.02.02

H.Brattsröm

Recover: _____

Notes:

••

Latest update: 14/01/2026

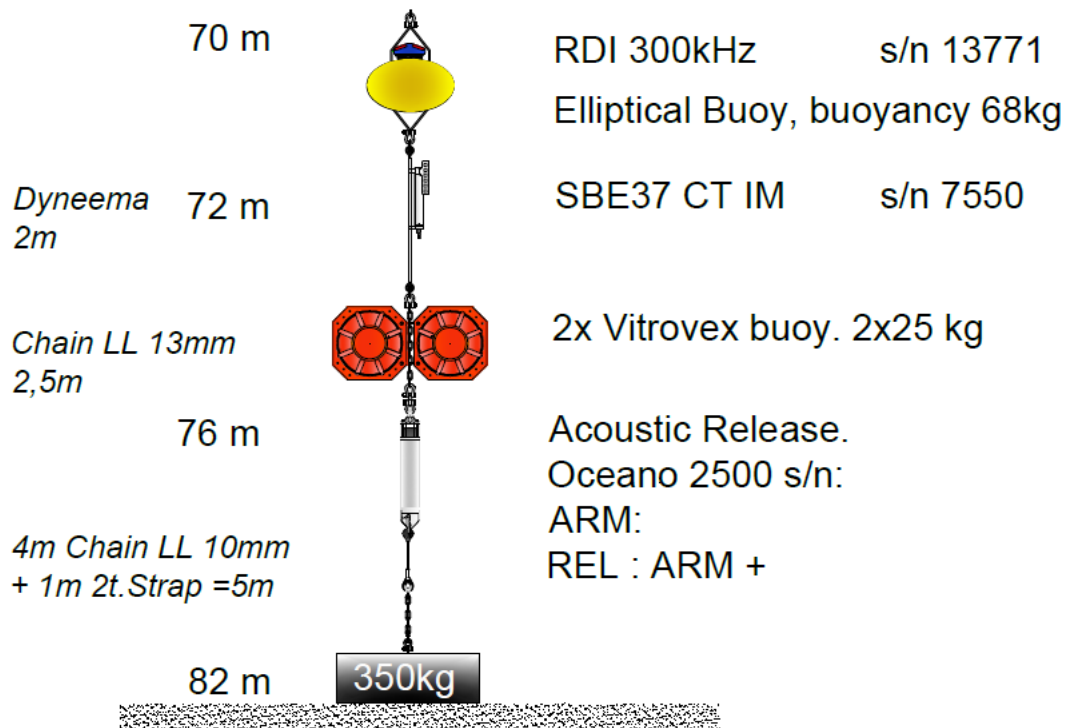


Fig 3. Mooring diagram: "Sill" mooring deployed

Processing of CTD data

The CTD-data were processed using the pyrsktools package and the following steps were included: computeprofiles, correcthold (interpolates when the instrument has been on hold), smooth conductivity, align channel (thermal lag correction), loopedit, bin average (1 dbar bins)

Calibration of CTD sensors

Salinity and dissolved oxygen measurements were calibrated against water sample analyses as described separately below. The following are common to both procedures:

1. Only data from the downcast are used.
2. Sensor data (salt, temperature and oxygen recorded by the RBR CTD) corresponding to the bottle closing depths are obtained from the downcast profile, interpolated to the depths of water samples recorded in the CTD-log, even though the bottles were closed during the upcast. The upcast data are of low quality and cannot be used.

Salinity

The salinity of the water samples was determined by K. Jackson together with the students using a Portasal.

The salinity calibration was conducted using data from cruise HB2026009004 and HB2026009009 jointly.

Only samples collected below 105 m depth were included in the analyses, resulting in 54 samples. Three samples were flagged as outliers ($>2 \times \text{std}$) and excluded.. The mean offset (Bottle-CTD) for the 51 remaining samples was -0.0020 (in practical salinity scale).

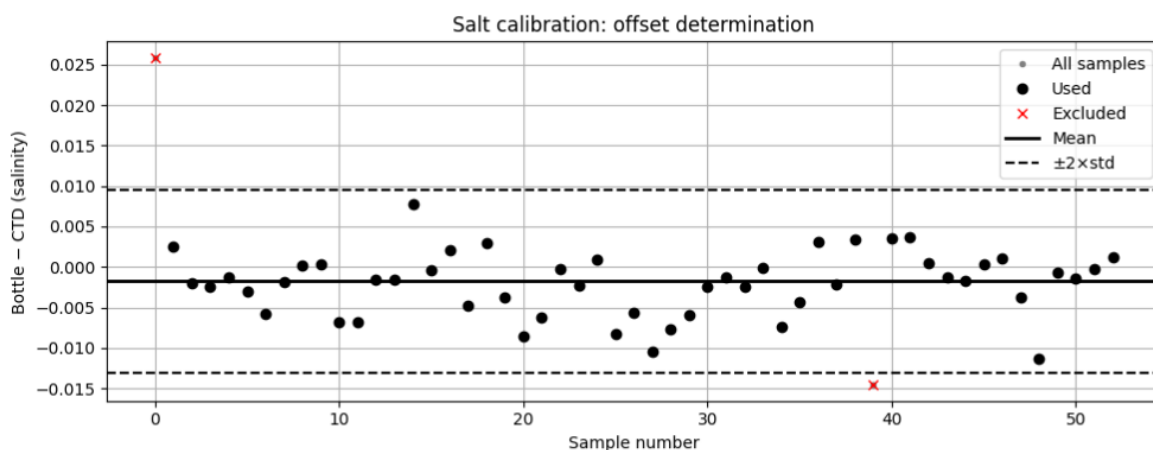


Fig.4. Vertical axis is the difference between the practical salinity from water sample analysis and measured by the CTD. Horizontal axis is the sample number.

The resulting correction is:

$$\text{PSAL_corrected} = \text{PSAL_measured} - 0.002$$

Dissolved Oxygen

Oxygen concentrations recorded by the CTD's sensor and those determined through manual Winkler titration (both converted to [$\mu\text{mol/kg}$]) are compared.

There were 75 samples plus 13 doubles. One of the samples had a note on errors during the analysis in the lab, so this value was flagged and excluded. Samples collected at depths shallower than 100 m and with oxygen concentrations below 50 $\mu\text{mol/kg}$ are excluded from the calibration.

First, outliers for which the difference between Winkler and CTD larger than the mean ± 3 standard deviations were flagged. This applied to two samples that were removed from further analysis.

When the difference between doubles (samples taken from the same depth and station, but not necessarily the same Niskin) was lower than 3 $\mu\text{mol/kg}$, the mean value was retained. If the value was higher than 3 $\mu\text{mol/kg}$ both samples were removed. Ten doubles were included, and no doubles were removed.

A line were fitted to the remaining 69 samples, and samples with residuals larger than 2.5 x root mean square error were removed iteratively until either no more samples were

removed or the root mean square error was smaller than 2 $\mu\text{mol/kg}$. 61 samples were included in the final regression and the linear correction applied to the data is:

$$\text{DO}_{\text{calibrated}} = \text{DO}_{\text{observed}} \times 1.051 - 6.4$$

The root mean square error is 1.44 $\mu\text{mol/kg}$.

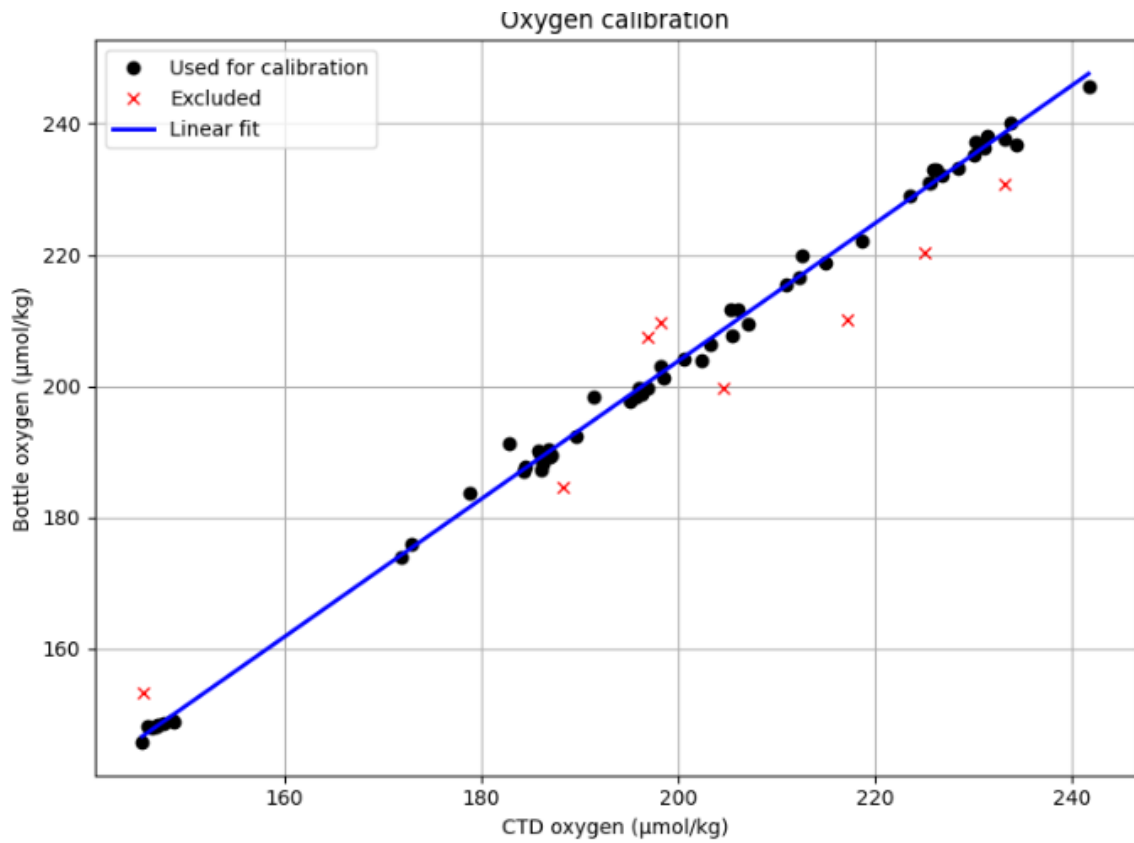


Fig.5. Dissolved oxygen concentration observed with the CTD versus that determined through Winkler titration. The blue line shows the regression line used to correct the CTD data using the data with black dots. Data points excluded during the regression analysis (see text) are marked with red crosses.

Table 2. CTD station log

CAST	St.name	Date			UTC	Depth	Latitude/ N		Longitude/ E		Water samples			Comments
		year	mon	day	hh:mm	m	deg	min	deg	min	Salt	O2	CT/nut	
0	test (Byfjorden)	2026	2	2	09:20	92	60	27.907	5	15.114		x		
1	F03	2026	2	2	11:45	460	60	51.225	4	52.452	x	x		salt 450m;OX: 450, 400, 300, 200, 100
2	F06	2026	2	2	12:39	540	60	49.804	5	3.309	x	x		salt 530; OX: 530, 300
3	F08	2026	2	2	13:20	-	-	-	-	-				CTD winch problem; Aborted; ctd in water to 10 m or so
4	MF Outer	2026	2	2	15:07	297	60	49.524	5	20.700	x	x		OX samples at sensor depths for calibration; before mooring recovery
5	MF Sill	2026	2	2	16:20	86	60	48.260	5	17.84	x			About 2h after mooring deployment
6	M35	2026	2	3	07:38	181	60	52.288	5	33.378	x	x		
7	M31	2026	2	3	08:07	270	60	52.880	5	28.260	x	x		Surface S (T=5.7C)
8	M28	2026	2	3	08:34	422	60	52.525	5	26.239	x	x		410: S/OX; 200: Ox
9	M26	2026	2	3	09:21	480	60	52.365	5	24.870	x	x	x	Surface S (T=5C)
10	M26	2026	2	3	10:09	480	60	52.365	5	24.870	x	x	x	
11	M24	2026	2	3	10:43	453	60	52.000	5	22.053	x	x		
12	M22	2026	2	3	11:26	425	60	50.889	5	21.125	x	x		
13	M20	2026	2	3	12:34	360	60	50.577	5	20.839	x	x		
14	M18	2026	2	3	13:00	196	60	50.125	5	20.962	x	x		
15	M16	2026	2	3	13:32	296	60	49.527	5	20.762	x	x		
16	M14	2026	2	3	14:01	149	60	48.267	5	19.040	x	x		
17	M12	2026	2	3	14:26	101	60	48.300	5	17.711	x	x		
18	M11	2026	2	3	14:45	196	60	48.328	5	17.029	x	x		
19	M07	2026	2	3	15:10	140	60	46.530	5	14.219	x	x		
20	M04	2026	2	4	07:30	654	60	45.897	5	12.792	x	x		
21	F08	2026	2	4	08:17	570	60	47.444	5	07.839	x	x		
22	L07	2026	2	4	10:15	308	60	39.720	5	13.030	x	x		
23	L06	2026	2	4	10:50	416	60	41.110	5	10.366	x	x		Surface S (T=7C)
24	L05	2026	2	4	11:45	377	60	42.472	5	06.349	x	x		In addition to bottom, collected 300, 200 and 100 for S calibration
25	L04	2026	2	4	12:10	251	60	43.510	5	03.144	x	x		
26	L03	2026	2	4	12:39	181	60	43.938	5	01.555	x	x		

Table 3. Water samples log

Cast	Station Name	Bottle 1 (pressure dbar)	Bottle 2 (pressure dbar)	Bottle 3 (pressure dbar)	Bottle 4 (pressure dbar)	Bottle 5 (pressure dbar)	Bottle 6 (pressure dbar)	SURFACE
0	test (Byfjorden)	21.0	21.0	21.0	21.0	21.0	nan	
1	F03	452.6	403.0	304.0	204.0	102.0	102.0	
2	F06	532.0	301.0					
3	F08							
4	MF Outer	289.3	289.3	289.3	115.4	115.4	115.4	
5	MF Sill	79.0						
6	M35	175.0	175.0	175.0	102.0	102.0	102.0	
7	M31	260.0	260.0	201.5	201.5	102.6	102.6	x
8	M28	416.9	416.9	416.9	202.8	202.8	202.8	
9	M26	473.0	473.0	404.4	404.4	303.5	303.5	x
10	M26	202.9	202.9	102.0	102.0	51.8	11.6	
11	M24	452.7	452.7	403.8	303.5	202.6	102.2	
12	M22	401.4	401.4	303.4	303.4	202.2	101.7	
13	M20	355.6	355.6	304.4	304.4	204.2	103.0	x
14	M18	190.0	190.0	190.0	102.0	102.0	102.0	x
15	M16	290.0	290.0	202.9	202.9	101.6	101.6	
16	M14	141.4	141.4	141.4	102.0	102.0	102.0	
17	M12	92.3	92.3	92.3	92.3	92.3	92.3	
18	M11	184.4	184.4	184.4	102.8	102.8	102.8	
19	M07	132.5	132.5	132.5	102.0	102.0	102.0	
20	M04	653.8	506.2	404.3	304.4	202.5	103.1	
21	F08	566.4	505.7	404.9	304.7	202.5	102.0	
22	L07	301.6	301.6	203.1	203.1	102.1	102.1	
23	L06	404.0	404.0	304.3	304.3	203.1	102.0	x
24	L05	363.1	363.1	302.1	302.1	202.4	101.6	
25	L04	242.6	242.6	242.6	101.4	101.4	101.4	
26	L03	172.4	172.4	172.4	102.0	102.0	102.0	

Cruise diary

2 Feb

Arrived 0800; loading gear; students shopping

0930- fueled, heading to test station

09:20 test station, cast 0; bottle 6 didn't close

Setup SBE37, sn7550, 300 sec sampling start 1000 UTC

CTD FS03 (11:45), bottle 6 leaking (after being fixed after test sta). Ox samples at standard depths 450, 400, 300, 200, 100m; salinity sample at 450

Lunch at 12:00

Confirmed RDI300 is pinging (13:00 UTC)

At FS08, problem with CTD winch (13:39 UTC); aborted

Mooring MF-Sill (start work at position 14:20 UTC). Anchor drop, 14:41, 60N48.228'; 5E17.934'; 82.8 m

Couldn't take a ctd after because of winch problems (will fix later), heading to MF-Outer recovery

CTD winch fixed and MF Outer CTD taken

MF Outer mooring recovery: released 15:30; all instruments on deck 16:10. All instruments recovered as in the drawing.

Heading back to MF-Sill location for the missed CTD; taken cast5 (16:20) at MF-Sill

Arrived by the kai, Sandnesbryggja Masfjordnes, 16:30; <<dinner

(Students accommodation at Sandnesbryggja; Ilker, Helge and Kristin onboard)

Downloaded data from AQD and SBE instruments from the outer mooring

3 Feb

Start 0730; steam to M35.

Cast 6, M35; salt and oxygen samples

Downloaded data from Seaguard and RBR instruments from the outer mooring

M31: also surface S and Secchi disk; M28

Haugsværfjorden was ice covered therefore we left that station to the March cruise

M26 full water sampling with nutrients, oxygen; CT/Alk; 2 casts;

M24

Preparing Nortek ECO for test

Lunch

Stations M22, M20, M18, M16, M14m M12, M11 and M7

Arrived by the kai, Sandnesbryggja Masfjordnes, 18:00; dinner

4 Feb

Start 07:00; stations M04, F08, L07, L06, L05, L04 and L03

Because one carbon bottle was damaged, we postponed the full station L06 to the March cruise. We did not have enough time to complete the Lurefjorden section

Arrived in Bergen at 16:00