Cruise Report

Ocean Change Expedition 2024

Sailingship “Dagmar Aaen”

15th June 2024 to 14th September 2024

Master: Arved Fuchs

Chief Scientist: Dr. Johannes Karstensen

Co-Author of Cruise Report: Dr. Eberhard Sauter

Cruise Report

Cruise name/number: Ocean Change Expedition 2024 (OCE2024)

Authorizations:		
Coastal State	Authorization Document Number	National Participant(s)
Norway	2024/005237-017/DEFNON/414	

Brief description of scientific objective:
OCE2024 was a citizen science cruise along the Norwegian Coast with the purpose to collect oceanographic underway data at the sea surface and depth profiles at selected stations. Data were made freely accessible for public information and scientific use.

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Cruise Summary

The Ocean Change Expedition 2024 (OCE2024) is a major tool within a marine citizen science project aiming to raise public awareness of the importance to protect the oceans under the pressure of climate change and other (anthropogenic) stressors. Different types of observational data were collect during the expedition. With an underway flow-through system oceanographic parameters were measured continuously close to the sea surface along the Norwegian Coast up north to Bear Island. The underway system was complemented by vertical profiles collected at selected stations using a CTD probe. In addition, ocean color measurements were performed semi automized and transmitted to the citizen science portal EyeOnWater.org. Finally, meteorological observations were collected for the German Weather Service (DWD). This data were transmitted via satellite telemetry in near real-time to shore and visualized and made accessible via the BELUGA platform (https://beluga.geomar.de/ocean-change-2024) operated at the GEOMAR Helmholtz Center for Ocean Research Kiel.

Ocean Change Expedition 2024 sailed under the flag of the United Nations Decade of Ocean Science for Sustainable Development which is an international initiative for more ocean observation, marine research and effective measures and information campaigns to protect our seas and oceans.

Fig. 1: The Sailing ship "Dagmar Aaen" in the harbor of Skrova (Lofoten Islands) during the Ocean Change Expedition 2024

Itinerary

The Cruise started on 15th June 2024 in Flensburg and first went for an official information event to Kiel. The "Dagmar Aaen" set sail from there on June 18th. After a voyage through the Danish Baltic Sea with short port calls in Faaborg, Middelfart, Vesterø Havn and Strandby, the Dagmar Aaen rounded Skagen to call at **Kristiansand as the first Norwegian port on June 25th, 2024**. From there, the cruise continued north along the Norwegian coast via Haugesund (June 27th), Leirvik (June 29th) into the Hardangerfjord to Norheimsund (June 30th). The "Dagmar Aaen" then sailed via Fedje (July 3rd), Florø (July 4th) to Ålesund (July 6th), from where the journey continued northwards to the Island of Lovund (July 11th). The cruise was then continued into the Holandsfjord to Litlvika (July 13th) for a shore excursion to the Svartisen Glacier. After a detour to the island of Fleina (July 15th), we continued to Bodø (July 16th).

After crossing the Vestfjorden, the "Dagmar Aaen" reached the Island of Værøy on the south-western tip of the Lofoten Archipelago. From here, she continued along the west coast of the Lofoten via Melbu on Hadselöya (July 20th) to the Vesterålen Islands to Myre on Longøya (July 21st). On July 24th, the ship reached Andenes on the Island of Andøya, from where it sailed back towards the Norwegian mainland via Skrollsvika (July 25th) to Tromsø (July 27th). On July 30th, the voyage continued from here along the northern coast of Norway. After a brief stopover on Skervøya (July 30th), the "Dagmar Aaen" reached Hammerfest on August 1st, from where, after some preparations, it sailed on August 3rd for the challenging leg to Bear Island.

The ship reached the south-east of Bear Island on the morning of August 5th after a two-day passage in good weather conditions. In initially foggy conditions, the ship circumnavigated Måkeholmen and then, after a brief visit to Hvalrossbukta, sailed around the east side of the island. After passing the mouth of the

Engelskelva, the “Dagmar Aaen” reached the Herwighamna Meteorological Station in the north of Bear Island, the northernmost point of the OCE2024, on the evening of August 5th. With official permission, the crew was able to go ashore here and to explore parts of the island. On August 7th, the “DagmarAaen” set off from this northernmost point of the Ocean Change Expedition 2024 and circumnavigated Bear Island on the west side in southerly direction in order to reach Tromsø on a non-stop route by August 10th.

Fig. 2: Overview of ports visited during OCE2024.

On August 12th, the "Dagmar Aaen" left Tromsø in a southerly direction. After a night at anchor in the bay of Stonglandseidet at the southern end of the Island of Senja the ship took the route via Lødingen (August 13th) back to the Lofoten Islands where it entered the port of Skrova on August 14th after having visited Trollfjorden. Until then, the weather was characterized by sunshine and low winds. Now the wind was predicted to increase, so the ship's command decided to cross the Vestfjorden the next day before sea conditions further deteriorated. From now on, the crew had to cope with strong winds from southerly directions and bad weather off Norway caused by a persistent Icelandic low. After a rough crossing, the ship reached Bodø on August 15th and on day later the harbor of Ørnes. The "Dagmar Aaen" continued her journey south on August 17th, passing between the islands off the coast due to the sometimes strong, opposing winds. After a short port call in Sandnessjøen, the voyage continued to Brønnøysund, where the ship arrived on August 18th and spent a day in berth. On August 21st Trondheim was reached, where an important meeting with scientists with SINTEF Ocean took place, which was followed by a second port visit to Ålesund from August 26th to 28th. From there the ship first sailed to the island of Kvamsøya, where the crew waited in the harbor of Bringsinghaug (August 28th) for a favorable weather window to circumnavigate the Stadlandet headland. This was achieved in the early morning of August 29th before the "Dagmar Aaen" sailed to Florø and on to Fedje (August 30th), protected by the offshore islands from the increasing winds. From August 31st to September 2nd the "Dagmar Aaen" was in Bergen, from where the journey continued to Leirvik and on, passing by Haugesund, to Skudeneshavn (September 3rd). From this last Norwegian port called on the Ocean Change Expedition 2024, the voyage continued non-stop, following the south coast of Norway to the Danish port of Hanstholm, **leaving Norwegian territorial waters around midday on 5th September 2024**. The "Dagmar Aaen" then returned through Danish waters with port calls in Skagen, Strandby, Bønnerup, Kolby, Middelfart and Sønderborg to finally moor at the port of departure, Flensburg, on 14th September 2024.

An overview of the ports of call is provided in Figure 2. In addition, the itinerary of the cruise can be followed on the interactive map on https://www.arved-fuchs.de/de/ocean-change-2024/live-position (please move / zoom-in within the map to the region of interest).

Scientific Measurements / Ocean Observations

In addition to the important role of ship owner Arved Fuchs in sharing his years of observations of climate-induced changes in the oceans with the public and experts as an Ambassador of the Ocean Decade, a key purpose of this voyage was to record the following ocean and weather data:

1) Underway Flow-Through System

The collection of underway data close to the sea surface was performed outside harbor environments by the automized flow-through system "Ocean Pack" (Fig. 3) manufactured and maintained by SubCTech

(https://subctech.com/de/ocean-monitoring/systeme/oberflaeche/oceanpack-race/). Measured parameters were sea-water temperature, salinity, carbon dioxide (CO_2) partial pressure, and dissolved oxygen concentration. Data are transmitted in near real-time via satellite communication to GEOMAR and visualized on BELUGA Website which also provided free public access to the raw data. The recorded data can be obtained via the ship owner or the chief scientist for further use.

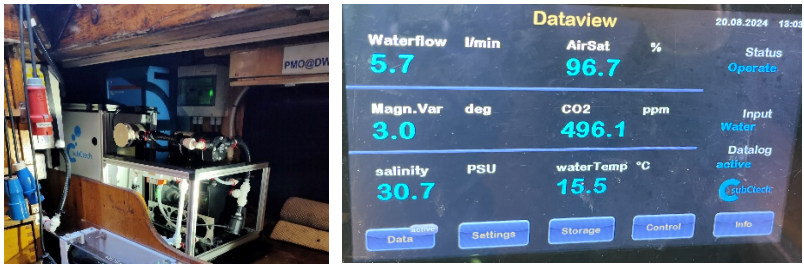

Fig. 3: *Left*: SubCTech OceanPack installed in the stern of the "Dagmar Aaen". *Right*: OceanPack control screen with real-time values for surface temperature, CO_2 partial pressure, dissolved oxygen concentration (expressed as oxygen saturation) and salinity. These values are transferred to GEOMAR in near-real time via a Starlink connection.

2) Oceanographic Depth Profiles (CTD Casts)

At selected positions and when possible to stop the vessel safely (depending on the wind and wave conditions) measurements of the vertical structure of the water column were performed using a conductivity, temperature, depth (CTD) sonde. The CTD was equipped with a couple of sensors that allowed to derive the following parameters: pressure, temperature, salinity (conductivity), dissolved oxygen content (expressed in saturation), and chlorophyll-a (via fluorescence). Measurements were performed with a self-recording CTD probe of the type Sea & Sun Technology, Multiparameter Probe CTD 48 (https://www.sea-sun-tech.com/product/multiparameter-probe-ctd-48/). After each CTD cast, data were downloaded from the device and transmitted (within several hours) via satellite communication to GEOMAR and fed into the above-mentioned BELUGA Website for visualization and free public access. CTD casts were performed at the stations shown in the overview map on Figure 1A and Table 2 in the Appendix. An example for the recorded depth profiles is given in Figure 4.

3) Water Color Measurements

As the inherent color of natural waters is determined by the absorption and scattering of light as well as by the concentrations of dissolved and suspended water constituents, a measurement of the color value at the sea surface allows to draw conclusions about its constituents and water quality. Such determination goes back to the scientists François-Alphonse Forel and Wilhelm Ule who introduced the Forel-Ule color scale as a historical

standard some 130 years ago that has since been calibrated with modern spectrometers. The scale contains 21 different color tones, from the blue of a clear ocean to the green and brown of waters rich in algae and humic substances. This easy-to-use method is well suitable for the “Dagmar Aaen”

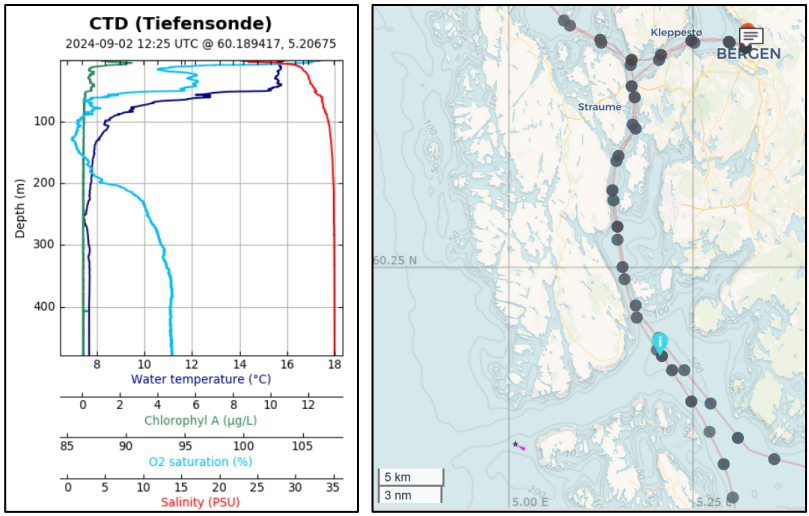

Fig. 4: Left: Example of CTD casts recorded south of Bergen (Lysefjorden) Sept. 2nd 2024. Right: Map view from the interactive BELUGA website https://www.arved-fuchs.de/de/ocean-change-2024/live-position (please move / zoom-in within the map to the region of interest).

since it does not require room for extensive analyses.
The results of the color measurements are fed into the citizen science platform EyeOnWater.org (https://www.eyeonwater.org/observations/map/color) for free and open public access to the data.
During the Ocean Change Expedition 2024, an approach for the automated recording of color values was made for these observations for the first time. For this purpose, a camera was attached to the jib boom's nock, taking images of the water surface at 15-minute intervals (see Figure 5). Since the environmental conditions (such as the degree of cloud cover) are important as metadata for a correct recording of the color values, the process is to be further improved for future missions, e.g., by the extraction of such conditions from the webcam attached to the mast or from satellite data. For the time being logbook entries of the Dagmar Aaen (every two hours) are used.

Fig. 5: Left: Forel-Ule Color Scale for manual determination (appropriately deployed concomitant with a Secchi Disk). Middle: Installation of a downward-looking camera at the nock of the jib boom for automated recordings of Forel-Ule color values. Right: Forel-Ule values accessible on the BELUGA website with the link to EyeOnWater.org.

4) Water Turbidity Measurements

At selected locations a Secchi Disk was deployed at the sea surface for the determination of water clarity / transparency. The Secchi depth data were manually fed into the Citizen Science Platform EyeOnWater.org (www.eyeonwater.org/observations/map/clarity#) for free public access.

5) Meteorological Observations

"Dagmar Aaen" is also registered as Voluntary Observing Ship (VOS) to the National Meteorological Service of Germany (Deutscher Wetterdienst, DWD). Equipped with an Automatic Weather Station of the type EUCAWS, the parameters air pressure, air temperature, rel. humidty and wind speed and direction were recorded. VOS is an Observing Program under the umbrella of the World Meteorological Organization (WMO), and is endorsed by the International Maritime Organization (IMO, with MSC.1-Circ.1293-Rev.1) and by the SOLAS V/5.2.4. The VOS data of "Dagmar Aaen" were transmitted via satellite telemetry to the DWD and broadcasted via the Global Telecommunication System (GTS) for use in weather models and thus improvement of forecasts and weather warnings as well as a contribution to climate analysis.

6) Deployment of Drift Buoys

Meteorological Drift buoys provided by the EUMETNET E-Surfmar program, and embedded in the global drifter program (GDP) of the Data Buoy Cooperation Panel (DBCP), were deployed during OCE2024. The GDP buoys used are equipped with air pressure and sea surface temperature sensors and transit the data and position every 6 hours via satellite to a ground station. During OCE2024 buoys were deployed on the way to Bear Island on the 4th and 5th of August 2024:

- Drift Buoy IMEI 3005 34065828770, deployed 4.8.2024, 13:00 UTC at Position 72°59,9'N 021°06,8'E; traceable on the BELUGA website via https://beluga.geomar.de/ocean-change-2024?embed# as Drifter SVP6401603.
- Drift Buoy IMEI 3005 34065281020, deployed 5.8.2024, 04:00 UTC at Position 73°59,9'N 019°49,9'E traceable on the BELUGA website via https://beluga.geomar.de/ocean-change-2024?embed# as Drifter SVP6301582.

Since their deployment the buoys drifted through the Norwegian Sea and the southern Fram Strait, respectively.

Results and further usage of data

OCE2024 is a citizen science project that combines public outreach events during and after the cruise with means of data collection for immediate release. Data is broadcasted via satellite telemetry and visualized and distributed through the BELUGA website (https://www.arved-fuchs.de/de/ocean-change-2024/live-position) and, for the weather station data, via the German Weather Service GTS system. In case a user has problem with data access a requested can be send to mail@arved-fuchs.de. The data will then be made accessible by suitable means, including its metadata, so far as available.

Given the open data policy, further data analysis is in the hands of the individual scientific users. The “Dagmar Aaen” team of the OCE2024 do not plan at this stage ot make use of the data, simply also for capacity reasons. However, as part of a student project at the GEOMAR the sea surface temperature recording from OCE2024 expedition were compared with the long term mean observations, considering data form 1982 to 2010, and also a respective temperature anomaly was derived (Figure 6).

The comparison reveals that the surface temperatures recorded along the course of the Ocean Change Expedition 2024 show in geneal much warmer condition in 2024 compared with the long term mean. Warming of surface waters of more than 5°C (with maximum values exceeding 7.5°C) are found over extended areas. Putting the time series data into a geographical context (Figure 7) nicely shows the regional differences in warming patterns.

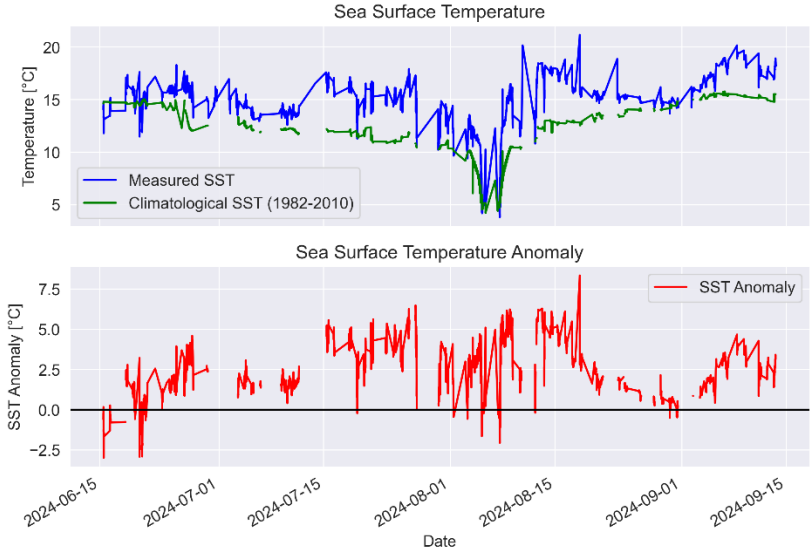

Fig. 6: Top: Sea surface temperatures recorded during OCE2024 compared with the long-term mean value (1982-2010) at the respective locations. Bottom: Sea surface temperature anomaly calculated as the difference between the observed and the long term mean (personal communication, Lasse Glüsen, GEOMAR).

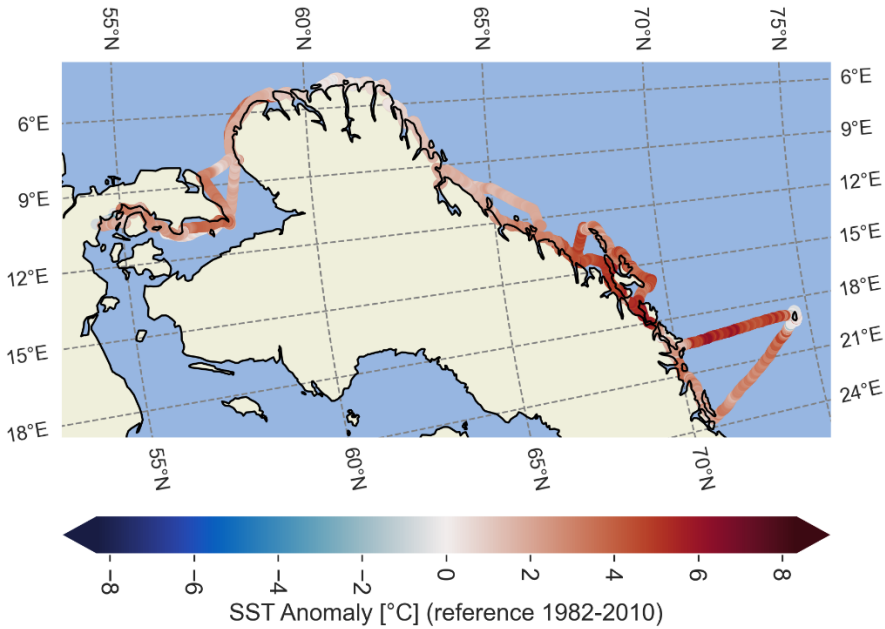

Fig. 7: Sea surface temperature anomaly derived from measurements during OCE2024 in comparison with long-term average values (1982-2010).

It becomes evident that in 2024 particularly the northern Norwegian waters exhibit high positive heat anomalies. This is in accordance with the findings of

recent satellite measurements suggesting so-called heatwaves in northern Norway during the summer 2024 (Fig. 8).

Further analysis is required to understand the divers of the warming and the regionalization of the patterns.

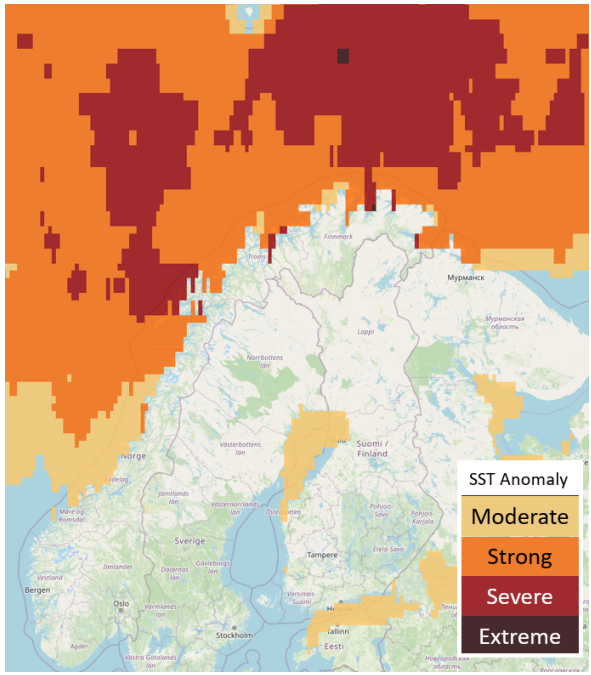

Fig. 8: Map of sea surface temperature anomalies for Aug. 10th 2024 against the long-term average (1982-2011) based on satellite data in categories from moderate to extreme (Source: https://www.marineheatwaves.org/tracker.html#).

Interactions with Norwegian Scientists and Stakeholders

Ålesund

On July 9th the "Dagmar Aaen" crew was invited to the Norwegian Maritime Competence Center in Ålesund (NMCC, https://www.nmcc.com/en/) where we were able to get an impression of how far digital simulation (digital twins) has come in the maritime branch (e.g. training of nautical ship officers). We were introduced to some of the innovative start-ups as well as large offshore and shipping companies hosted at the NMCC. We visited large bridge simulators in which offshore personnel is trained before put into practice. Other simulators showed threats posed by rising sea levels.

More detailed information about the visit can be found in the web blog of the OCE2024 https://www.arved-fuchs.de/de/ocean-change-2024/logbuch2024?view=article&id=1727&catid=209

Lofoten
On July 18th we reached the harbor of Sørland on Vaerøy in southern Lofoten Islands. After a visit in winter 2013, we met again with the Bensvik fisher family, three generations of fishermen from Sørland. Tommy Bensvik and his father Kent, along with two younger brothers, are still fishing, though the family now uses a trawler instead of smaller boats. We met for a chat aboard the Dagmar Aaen, where they explain the changes in the fishing industry, including their decision to stop stockfish production in 2017.

See more information in the web blog of the OCE2024: https://www.arved-fuchs.de/en/ocean-change-2024/logbuch2024/1731-reunion-on-vaeroey

Bear Island
On August 5 we arrived in the north of Bear Island. With an official permission, obtained from the Svalbard Sysselmesteren, we reached Herwighamna Meteorological Station on the island's northern shore by dinghy and met with the staff of the station. We were introduced by them into their main tasks in collecting weather data, including launching helium balloons twice a day to measure temperature and air pressure. In return, we explained our Ocean Change Expedition to them.

More information can be found in the web blog of the OCE2024: https://www.arved-fuchs.de/en/ocean-change-2024/logbuch2024/1734-red-houses-in-the-middle-of-nowhere

Trondheim
On August 22, we met with the Norwegian Research Foundation SINTEF Ocean to explore potential collaborations in aquaculture and marine research. The day began with a lecture on using small plankton organisms for fish feed, focusing on the sustainable use of Calanus crustaceans as an alternative to fishmeal in salmon farming. SINTEF is also investigating the cultivation of macroalgae and the extraction of valuable compounds from microalgae. We presented our Ocean Change Expedition 2024, emphasizing the importance of the engagement of non-scientific ships for improving ocean observation. SINTEF introduced us to a "digital twin" of the Trondheim Fjord, integrating data and models to monitor and predict environmental changes. We were also shown the large measuring buoy in the Trondheim Fjord. This productive exchange could lead to joint projects with German marine research institutes.

See more information in the web blog of the OCE2024: https://www.arved-fuchs.de/en/ocean-change-2024/logbuch2024/1737-joint-meeting-with-sintef

Appendix

Table 1: Ports visited during Ocean Change Expedition 2024

Port / Town	Arrival (dd.mm.yyyy)	Departure (dd.mm.yyyy)
Flensburg		15.06.2024
Kiel	16.06.2024	18.06.2024
Faaborg	18.06.2024	19.06.2024
Middelfart	19.06.2024	20.06.2024
Vesterø Havn	21.06.2024	23.06.2024
Strandby	23.06.2024	24.06.2024
Kristiansand	25.06.2024	26.06.2024
Haugesund	27.06.2024	29.06.2024
Leirvik	29.06.2024	30.06.2024
Norheimsund	30.06.2024	02.07.2024
Fedje	03.07.2024	04.07.2024
Florø	04.07.2024	05.07.2024
Ålesund	06.07.2024	09.07.2024
Lovund	11.07.2024	13.07.2024
Litlvika	13.07.2024	15.07.2024
Bodø	16.07.2024	18.07.2024
Værøy	18.07.2024	19.07.2024
Ramberg	19.07.2024	20.07.2024
Melbu	20.07.2024	21.07.2024
Myre	21.07.2024	23.07.2024
Stø	23.07.2024	24.07.2024
Andenes	24.07.2024	25.07.2024
Skrollsvika	25.07.2024	26.07.2024
Tromsø	27.07.2024	30.07.2024
Skervøya	30.07.2024	31.07.2024
Hammerfest	01.08.2024	03.08.2024
Herwighamna Meteorological Station (Bear Island)	05.08.2024	07.08.2024
Tromsø	10.08.2024	12.08.2024
Lødingen	13.08.2024	14.08.2024
Skrova	14.08.2024	15.08.2024
Bodø	15.08.2024	16.08.2024
Ørnes	16.08.2024	17.08.2024
Sandnessjøen	17.08.2024	18.08.2024
Brønnøysund	18.08.2024	20.08.2024
Trondheim	21.08.2024	23.08.2024
Ålesund	26.08.2024	28.08.2024
Bringsinghaug	28.08.2024	29.08.2024
Florø	29.08.2024	30.08.2024
Fedje	30.08.2024	31.08.2024

Table 1: Ports visited during Ocean Change Expedition 2024 (continued)

Bergen	31.08.2024	02.09.2024
Leirvik	02.09.2024	03.09.2024
Skudeneshavn	03.09.2024	04.09.2024
Hanstholm	05.09.2024	06.09.2024
Skagen	07.09.2024	08.09.2024
Strandby	08.09.2024	09.09.2024
Bønnerup	09.09.2024	11.09.2024
Kolby	11.09.2024	12.09.2024
Middelfart	12.09.2024	13.09.2024
Sønderborg	13.09.2024	14.09.2024
Flensburg	14.09.2024	

Table 2: Station List of CTD casts

Date (dd.mm.yyyy)	**Time (hh:mm) [UTC]**	**Latitude [Deg N]**	**Longitude [Deg E]**	**Latitude [Deg Min]**	**Longitude [Deg Min]**	**Depth [m]**
26.06.2024	16:29	57,9345	7,2880	57° 56,07' N	7° 17,28' E	152
26.06.2024	20:47	58,0033	6,6064	58° 00,20' N	6° 36,38' E	286
30.06.2024	10:28	59,8339	5,6391	59° 50,04' N	5° 38,34' E	277
30.06.2024	15:33	60,1550	6,0869	60° 09,30' N	6° 05,21' E	474
03.07.2024	10:52	60,1054	5,5330	60° 06,32' N	5° 31,98' E	424
06.07.2024	12:17	62,2089	5,8201	62° 12,53' N	5° 49,21' E	330
09.07.2024	13:52	62,7068	6,9543	62° 42,41' N	6° 57,26' E	264
11.07.2024	20:57	66,1798	11,5475	66° 10,78' N	11° 32,85' E	193
13.07.2024	10:29	66,4250	12,5275	66° 25,50' N	12° 31,65' E	297
18.07.2024	17:21	67,3634	14,0660	67° 21,80' N	14° 03,96' E	433
18.07.2024	17:21	67,5054	13,2829	67° 30,33' N	13° 16,97' E	228
19.07.2024	14:54	67,8531	12,7369	67° 51,18' N	12° 44,21' E	79
20.07.2024	20:40	68,4760	14,6934	68° 28,56' N	14° 41,60' E	146
21.07.2024	11:58	68,5508	14,3843	68° 33,05' N	14° 23,06' E	179
21.07.2024	13:00	68,6010	14,1866	68° 36,06' N	14° 11,20' E	180
21.07.2024	14:40	68,7462	14,2810	68° 44,77' N	14° 16,86' E	139
23.07.2024	10:35	68,9343	14,9940	68° 56,06' N	14° 59,64' E	76
24.07.2024	14:08	69,4018	15,7043	69° 24,11' N	15° 42,26' E	384
24.07.2024	17:14	69,4926	16,0914	69° 29,55' N	16° 05,48' E	231
24.07.2024	15:52	69,5734	15,8296	69° 34,40' N	15° 49,77' E	346
25.07.2024	17:34	69,0789	16,6754	69° 04,73' N	16° 40,53' E	331
26.07.2024	11:15	68,9998	16,9132	68° 59,99' N	16° 54,79' E	350
26.07.2024	13:53	69,0908	17,4029	69° 05,45' N	17° 24,17' E	343

Table 2: Station List of CTD casts (continued)

Date (dd.mm.yyyy)	Time (hh:mm) [UTC]	Latitude [Deg N]	Longitude [Deg E]	Latitude [Deg Min]	Longitude [Deg Min]	Depth [m]
31.07.2024	10:45	70,1504	21,1026	70° 09,02' N	21° 06,16' E	389
01.08.2024	10:55	70,5672	23,1015	70° 34,03' N	23° 06,09' E	307
04.08.2024	21:11	73,4316	20,5245	73° 25,89' N	20° 31,47' E	412
08.08.2024	19:18	71,7113	19,2289	71° 42,68' N	19° 13,73' E	238
08.08.2024	12:44	72,3296	19,1306	72° 19,78' N	19° 07,84' E	365
08.08.2024	04:32	73,1326	19,0015	73° 7,96' N	19° 00,09' E	426
10.08.2024	11:11	70,0622	19,6487	70° 3,73' N	19° 38,92' E	205
12.08.2024	13:11	69,4916	18,2619	69° 29,5' N	18° 15,71' E	213
13.08.2024	12:51	68,8499	16,8920	68° 50,99' N	16° 53,52' E	292
13.08.2024	09:54	69,0525	17,3123	69° 3,15' N	17° 18,74' E	392
14.08.2024	13:47	68,2177	15,2937	68° 13,06' N	15° 17,62' E	458
14.08.2024	11:18	68,2987	15,8057	68° 17,92' N	15° 48,34' E	420
15.08.2024	10:35	68,0605	14,5484	68° 3,63' N	14° 32,91' E	283
18.08.2024	16:11	65,6029	12,2220	65° 36,17' N	12° 13,32' E	265
18.08.2024	14:04	65,7609	12,3162	65° 45,65' N	12° 18,97' E	303
18.08.2024	11:08	65,9893	12,4982	65° 59,36' N	12° 29,89' E	242
20.08.2024	15:27	64,9953	11,4659	64° 59,72' N	11° 27,95' E	280
20.08.2024	11:27	65,2831	11,9648	65° 16,98' N	11° 57,89' E	173
21.08.2024	12:45	63,5724	9,8362	63° 34,34' N	9° 50,17' E	380
23.08.2024	14:47	63,5778	9,8418	63° 34,67' N	9° 50,51' E	307
24.08.2024	10:22	63,3977	8,5026	63° 23,86' N	8° 30,15' E	248
28.08.2024	10:51	62,2994	6,0293	62° 17,96' N	6° 01,76' E	317
30.08.2024	15:59	61,0819	5,0136	61° 4,91' N	5° 00,82' E	234
31.08.2024	10:35	60,7007	4,8008	60° 42,04' N	4° 48,05' E	327
02.09.2024	17:11	59,8095	5,5559	59° 48,57' N	5° 33,36' E	239
02.09.2024	12:25	60,1894	5,2068	60° 11,37' N	5° 12,41' E	477
03.09.2024	18:48	59,1532	5,3229	59° 9,19' N	5° 19,38' E	216
04.09.2024	20:36	58,1504	6,3824	58° 9,02' N	6° 22,95' E	287

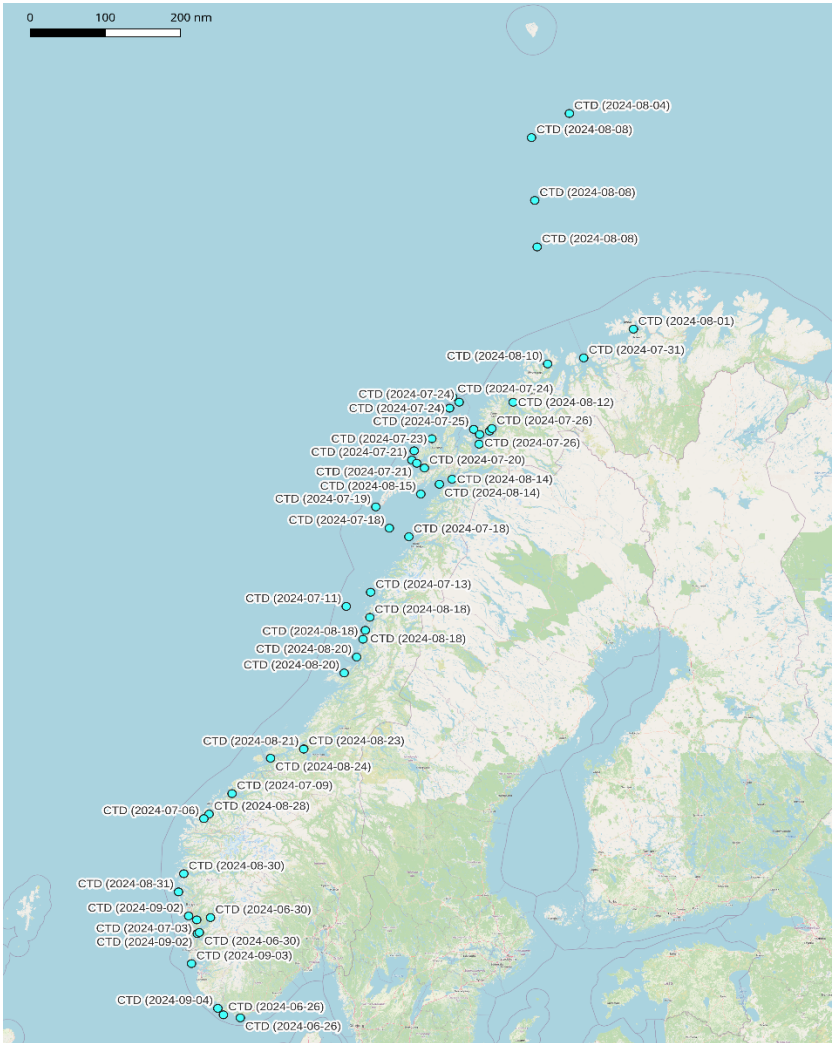

Fig. 1A: Overview map of CTD casts.