R/V CELTIC EXPLORER

Cruise 20017A

July 22 to August 9, 2020

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Scientific Cruise Report

ICES Cruise Id: 45CE20017A

CSRREF: 20203194

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Hamburg, January 2021

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Appendix 1 (english/german) and 7 are also available in excel.
(individual sheets of *Station_list_45CE20017A_germen_english_workplusdiv.xlsx*)

The cruise summary report (CSR) is available at:
http://seadata.bsh.de/Cgi-csr/retrieve_sdn2/csrreport.pl?project=SDN&session=22980&v1=10&v2=2&pcode=45CE

Objectives and scientific background

The objective of the BSH North Sea Summer Surveys (NSSS) is to monitor the oceanographic and chemical state of the North Sea at the time of expected maximum stratification and phytoplankton productivity having passed ist peak.
All parameters exhibit a strong seasonal and/or inter-annual variability. Seasonal heating leads to the establishment of a seasonal thermocline between spring and end of August or midst of September.
The data provide the basis for the calculation of heat and salt budgets, and the identification of long term changes, possibly due to climate change.
They are also used for the validation of operational and climate models and for the calibration of satellite-based ocean colour data and downstream products (Secchi depth, turbidity, CDOM, chlorophyll-a) which are used for assessments and MSFD reporting.

The BSH North Sea Summer Surveys started in 1998 (see Table 1) and were conducted yearly. They cover the entire North Sea with seven zonal coast to coast sections between 54° and 60°N and additional stations between 54°N and the entrance of the English Channel. As to monitor artificial radio nuclides more stations in the English Channel respectively in the Skagerrak are served alternately every second year.
In 2020 the Skagerrak was served.

Most of the data are available via the German Oceanographic Data Centre (DOD), selected surface data (5 m) are also fed into the MEris MAtchup In-situ Database (MERMAID).1

1 http://www.bsh.de/en/Marine_data/Observations/DOD_Data_Centre/index.jsp
http://hermes.acri.fr/mermaid/home/home.php

survey period	research vessel and cruise ID	nominal distance [nm]	marine physics, oxygen, pH-value	nutrients, chlorophyll	organic contaminants	Trace metals	artificial radio nucelides	air chemnistry
24.06.1998 – 16.07.1998	R/V Gauss 317	~ 2600	●	●				
02.07.1999 – 22.07.1999	R/V Gauss 335	~ 2600	●	●				
09.08.2000 – 23.08.2000	R/V Gauss 353	~ 2600	●	●				
11.07.2001 – 02.08.2001	R/V Gauss 370	~ 2600	●	●				
16.07.2002 – 31.07.2002	R/V Gauss 385	~ 2600	●	●	●			
28.07.2003 – 13.08.2003	R/V Gauss 405	~ 2600	●	●	●			
05.08.2004 – 20.08.2004	R/V Gauss 425	~ 2600	●	●		●		
10.08.2005 – 29.08.2005	R/V Gauss 446	~ 2600	●	●	●		●	
02.08.2006 – 20.08.2006	R/V Gauss 463	~ 2600	●	●		●		
03.08.2007 – 17.08.2007	R/V Pelagia 273	~ 2600	●	●	●			
21.07.2008 – 05.08.2008	R/V Pelagia 293	2715	●	●		●		
20.08.2009 – 09.09.2009	R/V Pelagia 311	3610	●	●	●		●	
04.08.2010 – 22.08.2010	R/V Pelagia 323	3310	●	●		●	●	
08.08.2011 – 28.08.2011	R/V Celtic Explorer 11010	3220	●	●	●		●	
07.08.2012 – 30.08.2012	R/V Celtic Explorer 12011	3500	●	●		●	●	
10.08.2013 – 04.09.2013	R/V Celtic Explorer 13012	4090	●	●	●		●	
01.08.2014 – 25.08.2014	R/V Celtic Explorer 14012	3470	●	●		●	●	●
07.08.2015 – 30.08.2015	R/V Celtic Explorer 15013	3580	●	●			●	●
03.08.2016 – 26.08.2016	R/V Celtic Explorer 16011	4000	●	●	●		●	●
11.08.2017 – 03.09.2017	R/V Celtic Explorer 17013	3600	●	●	(●)	●	●	●
28.08.2018 – 13.09.2018	R/V Celtic Explorer 18019	3150	●	●	●		●	
26.08.2019 – 17.09.2019	R/V Celtic Explorer 19016	3800	●	●		●	●	
22.07.2020 -- 09.08.2020	R/V Celtic Explorer 20017A	3232	●	●	●		●	

Table 1: BSH North SEA Summer Surveys 1998-2020.

Station Map

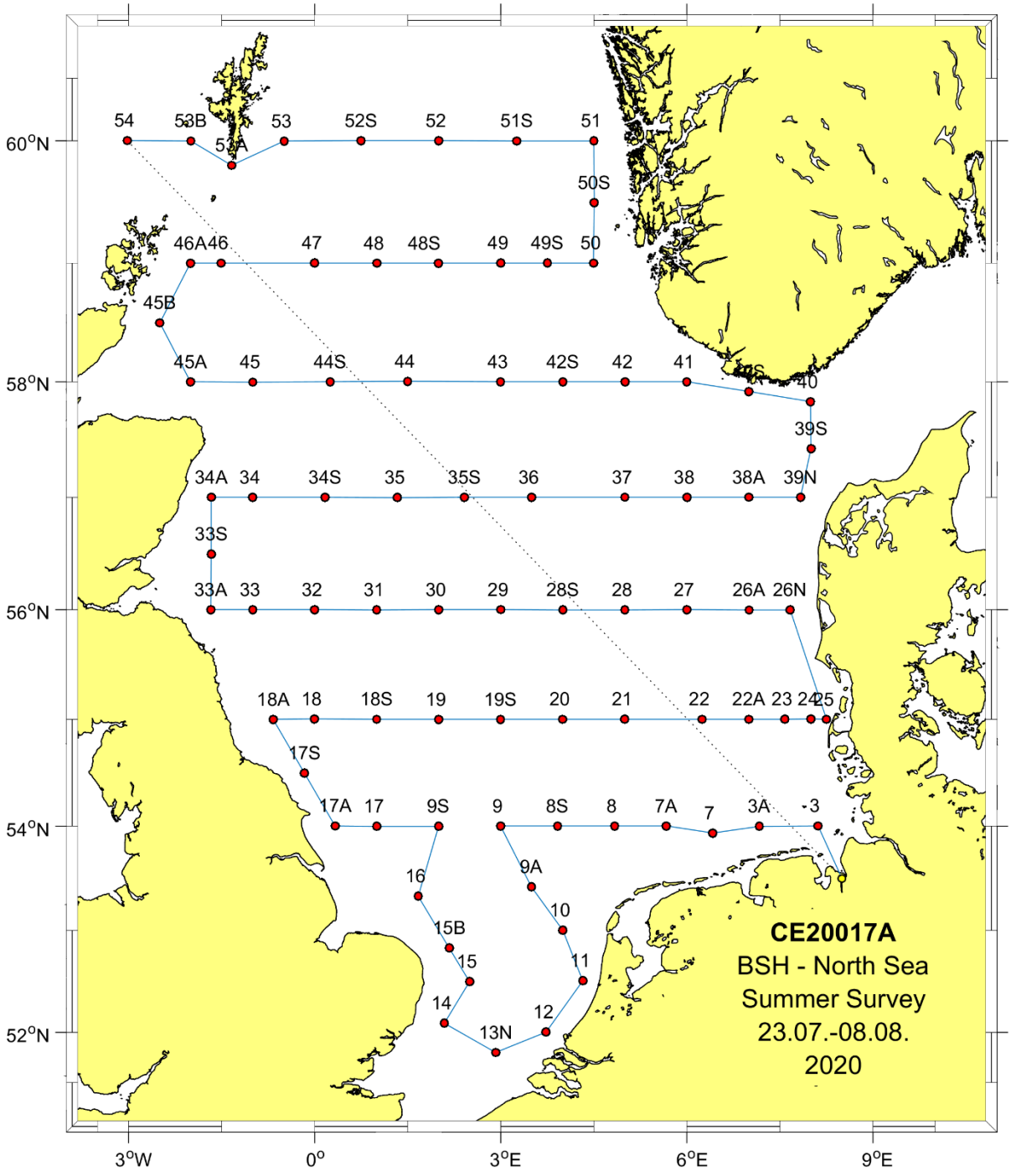

Figure 1: Stations and ship track of CE20017A.

Equipment and Methods

Marine Physics:

- Vertical CTD profiles (temperature, conductivity, pressure, chlorophyll, turbidity, oxygen, pH) and 10 l water samples at selected depths at all stations.

Sensoric:
(changes are marked in red)

CTD station 1-39:						
instrument			**sensor**	**manufact.**	**model**	**serial no.**	**calibration date**
Sonde S1, SBE911+	09P21787		press	Sea-Bird	SBE9P	577	06.02.19
			temp	Sea-Bird	SBE3T	2808	22.04.20
			cond	Sea-Bird	SBE4C	2602	22.04.20
			temp2	Sea-Bird	SBE3T	4228	22.04.20
			cond2	Sea-Bird	SBE4C	2886	22.04.20
Deck Unit CTD				Sea-Bird	SBE11+	11P-3	
Rosette 1			12x10L (Niskin)				
Fluorometer				Wetlabs	WetlabECO	4964	15.01.18
Turbidimeter				Wetlabs	WetlabECO	""	""
Oximeter S2				Sea-Bird	SBE43	204	10.12.19
Altimeter	-		-	Teledyne	Benthos	-	-
pH				Sea-Bird	SBE18	1419	19.06.20

CTD station 40-48:						
instrument			**sensor**	**manufact.**	**model**	**serial no.**	**calibration date**
Sonde S1, SBE911+	09P21787		press	Sea-Bird	SBE9P	577	06.02.19
			temp	Sea-Bird	SBE3T	2808	22.04.20
			cond	Sea-Bird	SBE4C	2602	22.04.20
			temp2	Sea-Bird	SBE3T	4228	22.04.20
			cond2	Sea-Bird	SBE4C	2886	22.04.20
Deck Unit CTD				Sea-Bird	SBE11+	11P-3	
Rosette 1			12x10L (Niskin)				
Fluorometer				Wetlabs	WetlabECO	4964	15.01.18
Turbidimeter				Wetlabs	WetlabECO	""	""
Oximeter S2				SBE43	SBE43	204	10.12.19
Altimeter	-		-	Teledyne	Benthos	-	-
pH				Sea-Bird	SBE18	1441	19.06.20
pH: from station 40, new serial no. 1441.							

CTD station 49-end:						
instrument		**sensor**	**manufact.**	**model**	**serial no.**	**calibration date**
Sonde S1, SBE911+	09P21787	press	Sea-Bird	SBE9P	577	06.02.19
		temp	Sea-Bird	SBE3T	2808	22.04.20
		cond	Sea-Bird	SBE4C	2602	22.04.20
		temp2	Sea-Bird	SBE3T	4228	22.04.20
		cond2	Sea-Bird	SBE4C	2886	22.04.20
Deck Unit CTD			Sea-Bird	SBE11+	11P-3	
Rosette 1		12x10L (Niskin)				
Fluorometer			Wetlabs	WetlabECO	4964	15.01.18
Turbidimeter			Wetlabs	WetlabECO	""	""
Oximeter S2			SBE43	SBE43	180	07.08.20
Altimeter	-	-	Teledyne	Benthos	-	-
pH			Sea-Bird	SBE18	1441	19.06.20
oxygen sensor: from station 49, new serial no. 180.						

Bottles:

Date:	**23.07.2020**	**24.07.2020 morning**	**24.07.20 afternoon**	**27.07.2020**	**28.07.2020**	**01.08.2020**
CTD:	**S1**	**S1**	**S1**	**S1**	**S1**	**S1**
Ros.Position	Bottle ID	Bottle ID	Bottle ID	Bottle ID	Bottle ID	Bottle ID
1	191007	181016	191007	191007	181003	181005
2	191008	181017	191008	191008	181013	181013
3	191009	181018	191009	191009	181017	181017
4	191010	181013	191010	181018	181018	181018
5	181005	181005	181005	181005	181005	181003
6	181006	181006	181006	181006	181006	181006
7	181018	181001	181001	181001	181001	181001
8	181001	181003	181003	181003	191007	191007
9	181013	191007	181013	181013	191008	191008
10	181016	191008	181017	181017	191009	191009
11	181003	191009	181018	191010	191010	191010
12	181017	191010	-	-	-	-

Nutrients:

- Oxygen determination according to Winkler-Carpenter by means of a SIS Dissolved Oxygen Analyser (DOA) with photometric end point determination at selected depths.
- Determination of the pH value (CTD samples and continuously via the sea water pipe).
- Determination of depth of visibility by means of a Secchi disk at daylight stations.
- Filtration of surface water samples and freezing of the glass fiber filters for the determination of chlorophyll according to Aminot and Rey after the cruise.
- Determination of sea water alkalinity.
- Sampling and freezing aboard for determination of Total-N and Total-P ashore (German-Bight-stations).

Radiochemistry:

- 2 x 35 l surface water samples for the determination of strontium-90 after the cruise.
- 1 l surface water samples for the analysis of tritium after the cruise.
- 150 l surface water samples for the analysis of caesium-137 by means of an ion exchanger (KNiFC-PAN) on board.
- 100 l surface water samples for the analysis of transuranic elements on board.
- Addotionally, 270 l water samples taken at station GN040 from different depths for the determination of strontium and tritium after the cruise and of caesium and transuranic elements on board.

Organic contiminants:

- Determination of polar and non-polar organic pollutants as, e.g. pesticides, chlorinated hydrocarbons (CHC), polycyclic aromatic hydrocarbons (PAH).

Journal

Time on station is given in UTC+2, as local time on CE20017A was UTC+2 and corresponds to watch times. (In the station list time is given in UTC)

For every day noon time weather, stations during the day and special occurences are given.

Weather:
T_A = air temperature, T_B = water temperature at the surface,
S = salinity at 5 m depth (calculated from CTD temperature and conductivity; see CTD btl-file)
P_A = air pressure, RH = relative humidity

definition cloud cover	category
0/8 sky clear	fine
1/8 of covered or less, but not zero	fine
2/8 of sky covered	fine
3/8 of sky covered	partly cloudy
4/8 of sky covered	partly cloudy
5/8 of sky covered	partly cloudy
6/8 of sky covered	cloudy
7/8 of sky covered or more, but not 8/8	cloudy
8/8 of sky completely covered, no breaks	overcast

Watch tables:
Marine physics/CTD:
00-04/12-16: Freya
04-08/16-20: Peter
08-12/20-00: Sören

Nutrients:
06-18: Simone
18-06: Rosa

Organics:
04-16: Lisett
10-22: Christina
16-04: Elke

Radioactivity:
00-12: Steffi
12-00: Klaus

Tuesday, July 21, 2020

10:00 Arrival of scientific crew at Hotel Adena in Bremerhaven: Covid-19-Test and quarantine until test result is available

Wednesday, July 22, 2020

We are relieved to get negative test results for all members of the scientific crew.
10:00 Arrival of scientific crew at CELTIC EXPLORER. Berth: German Dry Docks, Barkhausenstraße 60, 27568 Bremerhaven.
11:00 Security instructions by the 2nd officer Paddy Kenny
13:30 Arrival of containers and equipment. Start of mobilisation by use of the local crane.
16:00 Container loading and crane assistance is finished. Lashing of the containers. Preparation of dry lab and wet labs and installation of sensor system.

Thursday, July 23, 2020

08:00 Sailing
12:52 First station

Weather 12:00 T_A=17.2 °C, T_W= 18.2 °C, S=31.65, wind 5.7 m/s (4 Bft) from 198°, P_A= 1015 hPa, RH=61 %, cloudiness: 8/8, stratus.

Stations
12:52 GN003 (ELBE1)
16:50 GN003A - because of wind farm very little shifted to the east
19:46 GN007 (Borkumriffgrund)
23:19 GN007A

Practice alarm before dinner.
In the evening RV Heincke was in sight south of us, steaming in the same direction.

Friday, July 24, 2020

Weather 12:00 T_A=17.6 °C, T_W= 16.8 °C, S=34.59, wind 4.6 m/s (3 Bft) from 278°, P_A= 1009 hPa, RH=73 %, cloudiness: 7/8, strato cumulus.

Stations
03:19 GN008
07:15 GN008S
11:00 GN009
15:45 GN009A
19:31 GN010 (west of Den Helder)
23:32 GN011(west of Ijmuiden)

Sunny afternoon!

Satuday, July 25, 2020

Weather 12:00 T_A=17.7 °C, T_W= 17.3 °C, S=34.82, wind 12.6 m/s (6 Bft) from 190°, P_A= 1006 hPa, RH=88 %, cloudiness: 8/8, stratus, drizzle.

Stations
04:30 GN012 (west of Hoek van Holland)

09:48 GN013N - 6 sm north of GN013 (Rabsbank), which was found to be inside a new wind farm
15:05 GN014 (Outer Gabbard) – at position we had 2.5 kn currents to the south (we arrived at maximum current speed). Impossible to lower the CTD. We decided to steam to the north and then lower the CTD while drifting in direction to the station position. Even though it was difficult, as wind and currents moved in opposite directions.
18:38 GN015 (east of Lowestoft)
21:08 GN015B

Sunday, July 26, 2020

Weather 12:00 T_A=15.7 °C, T_W= 13.6 °C, S=34.21, wind 6.4 m/s (4 Bft) from 231°, P_A= 1005 hPa, RH=70 %, cloudiness: 4/8, cumulus.

Stations
01:15 GN016 (Haddock Bank)
07:07 GN09S (Outer Silver Pit)
11:29 GN017 (east of Flamborough Head)
14:44 GN017A
18:05 GN017S
22:05 GN018A

In the afternoon we came close to the British coast with a view of Flamborough Head and later Scarborough…

Monday, July 27, 2020

Weather 12:00 T_A=16.5 °C, T_W= 16.1 °C, S=34.65, wind 5.8 m/s (4 Bft) from 189°, P_A= 1005 hPa, RH=87 %, cloudiness: 8/8, stratus.

Stations
00:37 GN018 (Baymans Hole)
04:26 GN018S (Bruceys Garden)
08:22 GN019 (Doggerbank)
12:11 GN019S
15:54 GN020 (east of Doggerbank)
20:17 GN021 (Nordschillgrund)

Typical gloomy North Sea day.

Tuesday, July 28, 2020

Weather 12:00 T_A=16.4 °C, T_W= 17.9 °C, S=31.69, wind 12.5 m/s (6 Bft) from 252°, P_A= 1003 hPa, RH=74 %, cloudiness: 3/8, cumulus.

Stations
01:23 GN022 (Weiße Bank)
04.27 GN022A
06:51 GN023
09:18 GN024
10:40 GN025 (west of Sylt)
19:23 GN026N (west of Lyngvik)

In the morning view to Sylt. On the way north along the coast rough sea, getting better as we were steaming more to the east.

In the evening, after station GN026N, while steaming to the west, wind from the west steadily increased. Very uncomfortable to go against rough sea. During the night the speed was reduced to a minimum of 2 kn.

Wednesday, July 29, 2020

Weather	T_A=13.7 °C, T_W= 15 °C, S=34.89, wind 10.0 m/s (6 Bft) from 295°,
16:00	P_A= 1012 hPa, RH=71 %, cloudiness: 8/8, strato cumulus.

Stations	
00:57	GN026A
09:24	GN027
17:16	GN028
23:02	GN028S

During the day still bad weather, reduced ship speed and thus less stations. In the evening wind calmed down and sea conditions started to level out.

Thursday, July 30, 2020

Weather	T_A=14.1 °C, T_W= 14.7 °C, S=34.70, wind 5.0 m/s (3 Bft) from 233°,
12:00	P_A= 1017 hPa, RH=66 %, cloudiness: 6/8, strato cumulus.

Stations	
03:44	GN029
07:48	GN030
11:47	GN031
15:33	GN032
19:15	GN033 (east of Firth of Forth)
22:01	GN033A

Between GN030 und GN031 the pH-sensor was changed, as large differences between down- and upcast were visible. Anyway, the situation is unchanged, as the elektrolyte liquids of both sensors are clouded and must be renewed.

Friday, July 31, 2020

Weather	T_A=15.5 °C, T_W= 13.9 °C, S=34.66, wind 8.5 m/s (5 Bft) from 148°,
12:00	P_A= 1012 hPa, RH=83 %, cloudiness: 0/8, sunny sky.

Stations	
01:30	GN033S (Marr Bank)
04:46	GN034A
07:23	GN034 (Aberdeen Bank)
11:56	GN034S
16:34	GN035 (Coal Pitt)
21:30	GN035S

As O2-profiles were getting noisy we changed to second O2-sensor. Situation improved!
Long light nordic summer day…

Saturday, August 1, 2020

Weather 12:00 T_A=16.5 °C, T_W= 15.0 °C, S=33.76, wind 10.0 m/s (5 Bft) from 125°, P_A= 1010 hPa, RH=78 %, cloudiness: 7/8, strato cumulus.

Stations

01:52	GN036
07:50	GN037 (Große Fischerbank)
11:48	GN038 (Kleine Fischerbank)
16:07	GN038A
19:12	GN039N (east of Jyske rev)
22:09	GN039S

Winds from SE calm down during the evening and winds from W did not get up before sample station with yellow bottles was finished. Perfect timing!

Sunday, August 2, 2020

In Skagerrak we did samples for radioactivity with yellow bottles, at the stern of the ship. No wind and calm sea.
Samples from ~50m, 100m, 250m and 500m.

Weather 12:00 T_A=14.7 °C, T_W= 15.9 °C, S=31.47, wind 7.5 m/s (4 Bft) from 310°, P_A= 1008 hPa, RH=67 %, cloudiness: 2-3/8, cumulus + cirrus.

Stations

00:51	GN040 (Skagerrak) CTD and glos botttle until 01:40, 01:40-4:30 yellow bottles
07:36	GN040S
11:19	GN041 (west of Lindesnes)
15:17	GN042(Eigersundbank)
18:55	GN042S
22:31	GN043 (Lingbank East)

Monday, August 3, 2020

Weather 12:00 T_A=13.0 °C, T_W= 13.0 °C, S=34.93, wind 5.7 m/s (4 Bft) from 273°, P_A= 1011 hPa, RH=68 %, cloudiness: 1/8, cirrus.

Stations

03:43	GN044 (Lingbank West)
08:23	GN044S
12:55	GN045
16:54	GN045A
20:33	GN045B

We did not pass the Pentland Firth to do station work in direction to the deep Atlantic, but continue with section 59°N and later 60°N, as we were running out of time.

Tuesday, August 4, 2020

Weather 12:00 T_A=14.2°C, T_W= 14.2 °C, S=34.76, wind 5.5 m/s (3 Bft) from 190°, P_A= 1007 hPa, RH=86 %, cloudiness: 0-1/8, cumulus.

Stations

00:11	GN046A

02:01 GN046
07.07 GN047 (Fladengrund Rinne)
10:40 GN048
14:22 GN048S
17:53 GN049 (Utsira Grund)
20:49 GN049S

In the afternoon increasing „grayness“ and increqasing winds from the south – these are not able to hinder us.

Wednesday, August 5, 2020

Weather 12:00 T_A=14.2 °C, T_W= 14.6 °C, S=34.90, wind 8.5 m/s (5 Bft) from 218°, P_A= 998 hPa, RH=95 %, cloudiness: 8/8, stratus.

Stations
00:17 GN050 (Utsira Loch)
03:59 GN050S
07:28 GN051 (west of Selbjörnsfjord)
12:35 GN051S
17:19 GN052 (Bergen Bank)
21:43 GN052S (Forty Mile Ground)

During the day wind and waves steadily decrease, but still endless gray.

Thursday, August 6, 2020

Weather 12:00 T_A=13.5 °C, T_W= 12.9 °C, S=34.79, wind 4.5 m/s (3 Bft) from 108°, P_A= 1013 hPa, RH=88, % cloudiness: 0/8.

Stations
02:00 GN053 (east of Shetlands)
05:18 GN053A (Sumburgh Head)
07:38 GN053B (Foula Bank)
11:11 GN054 (Otter Bank)

In the morning we finished our station work west of the Shetlands. At lunch time we turned to SSE, steaming home.
The ocean glistened, only light winds and swell, all clouds disappeared. In the afternoon we were swallowed up in some fog banks for hours.

Friday, August 7, 2020

Weather 19:10 T_A=17.7 °C, T_W= 16.5 °C, S=34.93, wind 4.0 m/s (3 Bft) from 136°, P_A= 1016 hPa, RH=72 %, cloudiness: 0/8.

Endless sunshine and calm sea.
In the afternoon concluding discussion at chief scientists cabin with cakes and tea.

Saturday, August 8, 2020

Weather 12:00 T_A=20.8 °C, T_W= 20.3 °C, S=33.33, Wind 0.7 m/s (1 Bft) from 125°, P_A= 1019 hPa, RH=76 %, cloudiness: difficult to see, if 0/8 or 8/8 with high stratus – strange light and visibility.

19:30 Arrival at German Dry Docks, Bremerhaven.

Again endless sunshine and calm sea. It was getting warmer and warmer. Finishing work and packing the things, which will not be used on the second leg.

Sunday, August 9, 2020

08:00 De-mobilization/mobilization for leg B
11:00 Arrival of leg B BSH crew – handing over.
13:00 Departure of leg A BSH crew

Preliminary findings

The following discussion of scientific results from the Summer North Sea Survey is based on CTD data from the real-time data processing, carried out during the cruise. These data were also sent to Copernicus in real-time.
A delayed-mode final processing including an inspection of discrepancies between the CTD-measurements and water sample analyses will follow. The final, possibly corrected, CTD-data and a documentation of the delayed –mode processing will be archived at the DOD.

Temperature:
Appendix 3, figure 3.1 (top) shows the horizontal temperature distributions for the whole North Sea at the surface and bottom. Although the principal pattern, with highest values in the south to southeast at both layers, is similar to past years, absolute temperatures are up to 2 K lower. This is also reflected in the temperature anomaly to the reference period 2000-2010 (Figure 3.1, middle). At the surface the anomaly is overall negative, with values up to -2 K in the central North Sea. In the past two years the North Sea was separated in an anomalously warm southern part and an anomalously cold northern part. At the bottom, the pattern of negative and positiv anomalies is comparable to summer 2019, but again less pronounced by up to 2 K as to temperature levels.

The BSH weekly and monthly analyses of sea surface temperature [1)] (sst) in the North Sea enable us to put the observations during the cruise in a broader context. The spatially averaged sst was warmer than in the reference period 1990 to 2015 and also sligthly warmer than in 2019 from Januar to June (Figure 2). At July the warming of the surface layer came to a halt in cold weather conditions with low solar radiation. This situation was surveyed during the CE20017A cruise. However, still at sea, on the way home, a change to warm weather was experienced. The heating of the water close to the surface resumed such strongly that the average sst of the North Sea has exceeded the multiannual mean of the reference period from August until now (November).
The 2020 North Sea Summer Survey covered the last decade of July and the first decade of August. Evidently, (Figure 2, right panel) this survey took place prior to surface temperatures and vertical stratification reaching their seasonal peak. Unlike most of the other cruises done in the area (Table 1) the current survey was carried out 2 or 3 weeks too early in the summer. One has to keep this in mind when comparing the results from 2020 with past years.

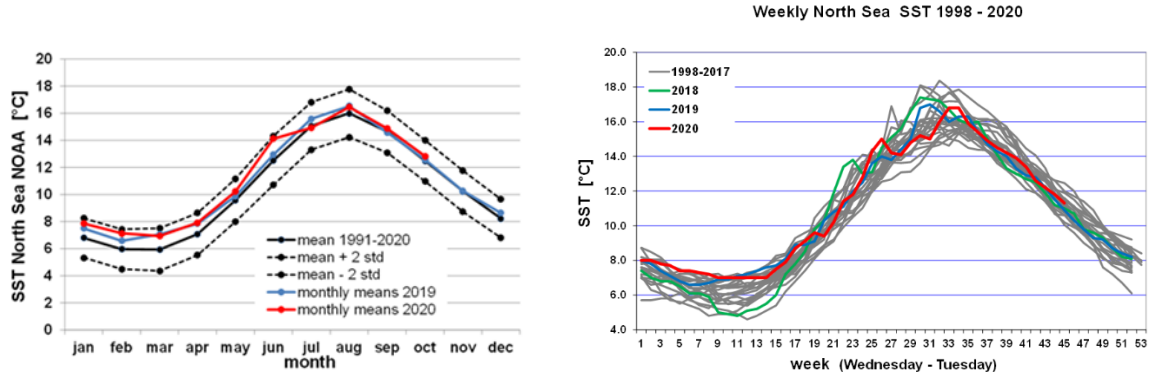

Figure 2: Sseasonal signal of sst in the North Sea, based on monthly mean of NOAA satellite data (left), based on weekly mean of the BSH merged product from ship observations and NOAA satellite.

However, the stratification, forced by solar radiation, was well developed (see sections in appendix 4). All sections show a pronounced thermocline at about 30 m depth and a well-mixed layer on top, which became weaker along the UK coast due to strong tidal mixing. Even the shallow sections along 54°N and 55°N display a thermocline in central parts. In the Norwegian Trench (section 58°N) the thermocline had deepened to almost 100 m.
The temperature difference between surface and bottom (appendix 3, figure 3.1, bottom) was around 8 K at the deep Skagerrak stations and about 6 K in the central North Sea.

[1)] https://www.bsh.de/DE/DATEN/Meerestemperaturen/Meeresoberflaechentemperaturen/meeresoberflaechentemperaturen_node.html

Salinity:
At the surface only in the northwestern part of the North Sea an inflow of Atlantic Water (S > 35) (appendix 3, Figure 3.2, top) was observed reaching down to 58°N. In the bottom layer a broad inflow over the entire northern sections down to 57°N was observed. The sections (appendix 4) reveal that it is reaching up to 40m. An intrusion of Atlantic Water from the southwest through the English Channel was not observed. In the Skagerrak the outflow of low-salinity water from the Baltic is visible at the surface. Salinity differences between surface and bottom of up to 3 (appendix 3, Figure 3.2, bottom) mark the spreading of the Baltic outflow along the Norwegian southeast coast.
Altogether the salinity situation is similar to those in summer 2019 and 2018.

Oxygen:
During the survey oxygen measurements were made with the CTD and oxygen was analysed from a large number of water samples by titration (see „instruments and methods“). Appendix 3, figure 3.3 and 3.4 show the comparison for the surface and bottom layer. Please note that all data are preliminary results (further steps of quality assurance will follow).

Fig. 3.3 (top, left) shows the distribution of dissolved oxygen in the surface layer measured by Winkler-titration. The concentration ranges from 5 mL/L in the southeast North Sea to 6.5 mL/L in the northwest North Sea.
Fig. 3.3 (top, right) shows the same distribution measured by CTD.
The difference between the concentration of dissolved oxygen in the surface, measured by titration on one and by a CTD sensor on the other hand (Fig. 3.3, bottom, left) is on average 0.129 mL/L.

Fig. 3.4 (top, left) shows the distribution of dissolved oxygen in the bottom layer measured by Winkler-titration. The concentrations of dissolved oxygen ranges between 5 mL/l and 6 mL/L. They are generally lower than the surface-values. For example at GN037 (57°N, 5°E), the concentration of dissolved oxygen is 4.99 mL/L in the bottom layer compared to 5.86 mL/L in the surface layer. This could be due to remineralisation processes in the bottom layer, resulting in oxygen consumption.
Fig. 3.4 (right) shows the same distribution as on the left site but measured by CTD.
The difference between the concentration values of dissolved oxygen in the bottom layer, measured by titration on one and by a CTD sensor on the other hand (Fig. 3.4, bottom) is on average 0.138 mL/L.

Overall the difference between the two different measurement methods (roughly estimated: 2.5 %) is lower than the expanded measurement uncertainty of the Winkler titration, witch is around 4.4 %, which means they are in good accordance.
This has to be verified with data from further cruises.

Participants

Science crew BSH	Working Group
Katrin Latarius	Marine Physics, Chief Scientist
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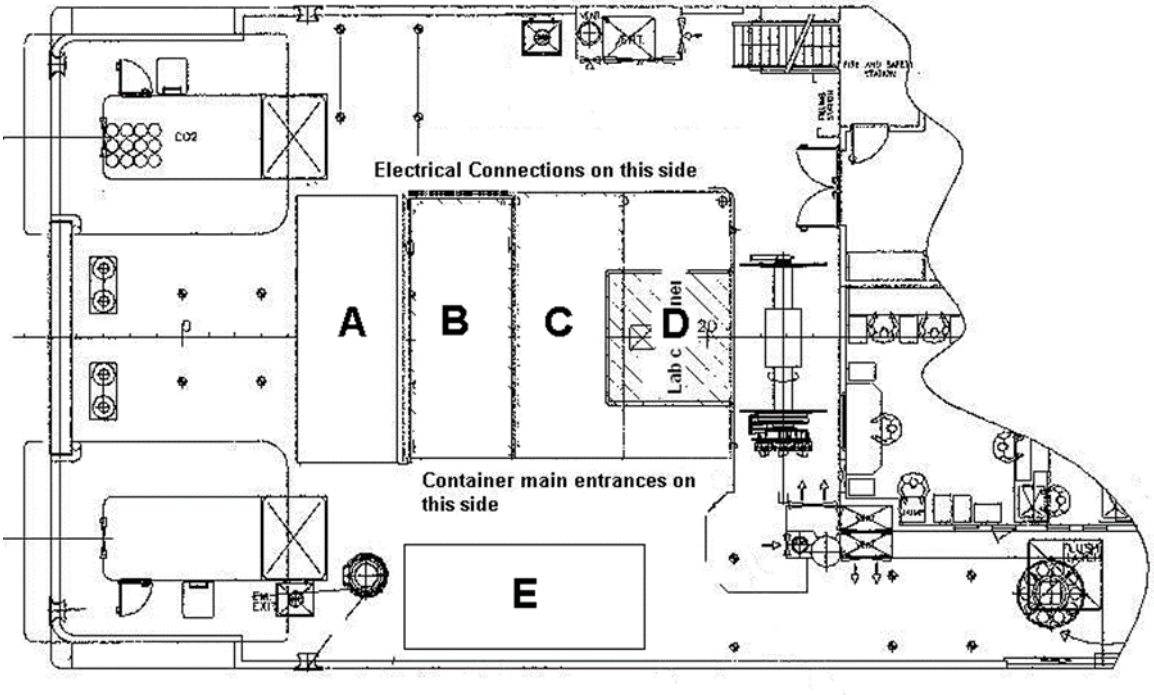
Stefanie Schmied	Marine Chemnistry, Radioactivity
Klaus Becker	Marine Chemnistry, Radioactivity
Ship Crew	Rank
Denis Rowan	Master
Garvan Meehan	Chief Engineer
Kenny Downing	Chief Officer
Paddy Kenny	2nd Officer
John Sammon	2nd Engineer
Paul Taylor	ETO
Frank Kenny	Bosun
James Moran	Cook
Tom Gilmartin	Bosun's Mate
Tommy Grealy	AB Deckshand
Noel O'Driscoll	AB Deckshand
Marc O'Connor	Technician
Simon Colyer	AB Deckhand
Peter Joyce	AB Deckhand
Maurice Murphy	Assistant Cook

Container Plan



	container type	weight	power supply	used on leg
A	2× 600 l drums (cal lab), 4× 300 l drums (nutrients), no container! Leg 2: unload drums and store at German Dry Docks 20" Transport and store container			1 2
B B	Bottom: 20" M34 Clean lab container (heavy metals) (heights 3.1 m) Top: —	11.5t —	2 x 32 A —	2 —
C C	Bottom: 20" M34 Lab container (organic pollutants) Top: 10" dissolvent container	9 t —	32 A —	1+2 1+2
D D	Bottom: 20“ M32 lab container, fresh- und sea water (radioactivity) Top: —	10 t —	32 A —	1+2 —
E	20" Transport container radioactivity In between see F	5 -8 t	—	1+2
F (bow position)	20" Transport and store container Unload/load before leg1 and switch to A between leg1 and leg2			1
	yellow bottles: Bb side working deck			1+2

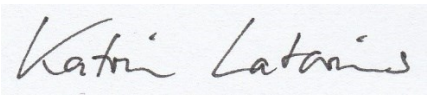
leg 2: CE20017B

Acknowlegdement

We are grateful for the help and good-humoured support provided by captain Denis Rowan and his crew. We all enjoyed the cruise and thank for making us feel belonging to the CELTIC family for a while.

I would also like to thank all participants from the BSH for professional and motivated work during the whole North Sea Summer Cruise, for helpfulness, friendliness and companionship.
Many thanks also to all colleagues from BSH supporting us from abroad.

Otterndorf, January 2021



Appendix 1: Station list

Stat. Name	Start [UTC]	Date	GPS Phi	GPS Lam	Grad	Min	N S	Grad	Min	E W	Water depth [m]	End [UTC]	Date	GPS Phi	GPS Lam	Grad	Min	N S	Grad	Min	E W	Water depth [m]	CTD	Secchi	100 l glass bottle	10 l glass bottle	Radioactivity	Relative humidity [%]	Air pressure [hPa]	Wind speed [m/s]	Wind direction [°]	Air temperature [°C]
GN003	10:52:09	23.07.20	54.002	8.114	54	0.11	N	008	6.84	E	25.2	11:26:22	23.07.20	54.002	8.111	54	0.13	N	008	6.66	E	25.5	+	+	+	+	+	63.8	1014.5	6.844	178.9	16.6
GN003A	14:50:55	23.07.20	54.000	7.167	53	59.99	N	007	10.03	E	29.4	15:05:32	23.07.20	54.000	7.167	53	59.98	N	007	10.03	E	29.1	+			+	+	80.4	1012.1	4.614	229.2	18.3
GN007	17:46:09	23.07.20	53.933	6.417	53	55.97	N	006	25.00	E	25.9	18:18:54	23.07.20	53.933	6.416	53	55.97	N	006	24.96	E	24.8	+	+	+	+	+	75.8	1010.4	6.844	254.6	18.0
GN007A	21:23:12	23.07.20	54.000	5.668	54	0.02	N	005	40.10	E	36.8	21:52:27	23.07.20	54.003	5.684	54	0.21	N	005	41.07	E	37.2	+			+	+	82.7	1008.5	4.614	242.7	17.3
GN008	01:19:38	24.07.20	54.000	4.835	53	59.99	N	004	50.12	E	41.9	01:45:19	24.07.20	54.000	4.836	53	59.98	N	004	50.15	E	41.6	+		+	+	+	85.7	1007.2	6.844	267.5	16.0
GN008S	05:15:11	24.07.20	54.000	3.917	54	0.00	N	003	55.01	E	45.6	05:33:13	24.07.20	54.000	3.917	54	0.01	N	003	55.02	E	45.6	+			+		75.9	1007.3	4.614	284.7	16.3
GN009	09:00:24	24.07.20	54.000	2.999	53	59.99	N	002	59.95	E	42.6	09:54:20	24.07.20	54.000	2.999	54	0.00	N	002	59.95	E	42.3	+	+	+	+	+	74.6	1008.6	4.614	290.3	16.0
GN009A	13:45:54	24.07.20	53.421	3.496	53	25.24	N	003	29.75	E	27.5	14:02:31	24.07.20	53.421	3.496	53	25.24	N	003	29.76	E	27.5	+	+		+	+	79.0	1010.3	2.682	272	16.3
GN010	17:31:45	24.07.20	53.002	3.999	53	0.11	N	003	59.92	E	30.0	17:46:28	24.07.20	53.002	3.998	53	0.11	N	003	59.91	E	29.9	+	+		+	+	65.5	1010.6	4.614	262	17.4
GN011	21:32:47	24.07.20	52.511	4.325	52	30.66	N	004	19.49	E	19.3	22:01:31	24.07.20	52.508	4.307	52	30.50	N	004	18.43	E	21.1	+		+	+	+	80.5	1010.4	4.614	186.6	17.8
GN012	02:30:01	25.07.20	52.004	3.728	52	0.22	N	003	43.70	E	26.4	02:57:44	25.07.20	52.003	3.728	52	0.21	N	003	43.71	E	26.4	+		+	+	+	82.1	1009.1	9.372	232.5	17.8
GN013N	07:48:04	25.07.20	51.800	2.920	51	47.99	N	002	55.21	E	28.4	08:09:11	25.07.20	51.800	2.920	51	48.00	N	002	55.21	E	29.5	+	+	+	+	+	89.0	1008.3	9.372	229.1	17.1
GN014	13:05:03	25.07.20	52.092	2.090	52	5.55	N	002	5.41	E	42.7	13:44:44	25.07.20	52.086	2.087	52	5.14	N	002	5.22	E	40.8	+	+	+	+	+	88.5	1005.1	9.372	207.5	18.0
GN015	16:38:39	25.07.20	52.501	2.499	52	30.06	N	002	29.92	E	47.5	17:01:43	25.07.20	52.507	2.502	52	30.42	N	002	30.10	E	48.1	+	+	+	+	+	92.5	1003.5	12.198	206.1	17.8
GN015B	19:08:38	25.07.20	52.830	2.171	52	49.79	N	002	10.24	E	41.0	19:24:09	25.07.20	52.844	2.166	52	50.65	N	002	9.98	E	44.3	+			+	+	89.6	1002.4	6.844	241.1	16.2
GN016	23:10:25	25.07.20	53.331	1.669	53	19.88	N	001	40.13	E	31.2	23:37:02	25.07.20	53.323	1.676	53	19.39	N	001	40.53	E	32.6	+		+	+	+	93.2	1001.1	6.844	287	14.9
GN009S	05:07:13	26.07.20	54.000	2.000	53	59.98	N	002	0.00	E	73.0	05:27:15	26.07.20	54.000	2.000	53	59.99	N	001	59.98	E	73.0	+			+		84.0	1001.7	6.844	259.2	15.2
GN017	09:29:36	26.07.20	53.999	1.001	53	59.93	N	001	0.04	E	46.2	10:09:19	26.07.20	53.999	0.999	53	59.92	N	000	59.96	E	46.1	+	+	+	+	+	71.0	1004.3	9.372	250.8	14.3
GN017A	12:44:08	26.07.20	54.002	0.331	54	0.12	N	000	19.88	E	52.2	12:59:47	26.07.20	54.002	0.331	54	0.12	N	000	19.88	E	51.6	+	+		+	+	66.7	1005.7	4.614	261	16.3
GN017S	16:05:32	26.07.20	54.499	-0.166	54	29.94	N	000	9.99	W	59.8	16:22:07	26.07.20	54.499	-0.166	54	29.95	N	000	9.98	W	60.3	+	+		+		62.6	1005.6	6.844	247.4	18.2
GN018A	20:05:50	26.07.20	54.999	-0.667	54	59.91	N	000	40.02	W	68.9	20:23:07	26.07.20	54.999	-0.667	54	59.93	N	000	40.03	W	69.0	+			+	+	78.9	1005.1	6.844	215.4	15.8
GN018	22:37:38	26.07.20	55.002	-0.005	55	0.11	N	000	0.28	W	75.0	22:58:48	26.07.20	55.002	-0.005	55	0.11	N	000	0.28	W	74.8	+		+	+	+	79.9	1006.1	6.844	227.6	16.2
GN018S	02:26:55	27.07.20	55.000	1.000	55	0.01	N	000	59.99	E	61.5	02:48:25	27.07.20	55.000	1.000	55	0.01	N	001	0.00	E	61.6	+			+		86.6	1006.1	6.844	208.6	16.2
GN019	06:22:59	27.07.20	54.998	2.001	54	59.88	N	002	0.05	E	26.6	06:42:20	27.07.20	54.998	2.001	54	59.88	N	002	0.04	E	27.1	+	+		+	+	89.2	1005.8	9.372	212.2	15.2
GN019S	10:11:39	27.07.20	54.999	2.995	54	59.95	N	002	59.69	E	25.5	10:24:24	27.07.20	54.999	2.995	54	59.95	N	002	59.70	E	25.4	+	+		+		86.4	1004.9	9.372	183.1	16.1
GN020	13:54:09	27.07.20	55.000	3.998	54	60.00	N	003	59.85	E	48.2	14:17:13	27.07.20	55.000	3.998	54	59.99	N	003	59.86	E	48.5	+	+	+	+		90.1	1004.0	9.372	176.8	16.1
GN021	18:17:16	27.07.20	55.001	4.998	55	0.06	N	004	59.87	E	40.6	18:47:37	27.07.20	55.001	4.998	55	0.07	N	004	59.86	E	41.0	+	+		+	+	77.2	1001.2	12.198	187.6	17.7
GN022	23:23:58	27.07.20	55.000	6.244	55	0.03	N	006	14.67	E	45.3	23:39:27	27.07.20	55.001	6.244	55	0.08	N	006	14.62	E	16.7	+			+	+	92.4	999.1	9.372	192.8	16.9
GN022A	02:27:42	28.07.20	55.000	7.000	55	0.00	N	006	59.97	E	32.6	02:47:33	28.07.20	55.000	7.000	55	0.00	N	007	0.01	E	32.2	+			+	+	90.5	999.5	9.372	242.8	16.9

GN023	04:51:07	28.07.20	55.001	7.579	55	0.06	N	007	34.75	E	26.0	05:14:34	28.07.20	55.001	7.580	55	0.05	N	007	34.79	E	25.8	+	+	+	+	+	75.4	1000.7	9.372	259.2	16.1
GN024	07:18:54	28.07.20	55.002	7.999	55	0.14	N	007	59.97	E	16.4	07:40:49	28.07.20	55.002	7.999	55	0.14	N	007	59.95	E	18.2	+	+		+		73.2	1002.2	9.372	259.3	16.5
GN025	08:40:26	28.07.20	55.000	8.251	54	59.98	N	008	15.03	E	14.7	08:54:25	28.07.20	54.999	8.253	54	59.92	N	008	15.15	E	14.0	+	+		+	+	74.3	1003.1	9.372	240.4	17.1
GN026N	17:23:43	28.07.20	55.999	7.665	55	59.95	N	007	39.89	E	27.4	18:01:39	28.07.20	56.000	7.665	55	59.98	N	007	39.91	E	28.7	+	+	+	+	+	72.5	1004.3	12.198	249.1	15.2
GN026A	22:57:26	28.07.20	55.998	7.004	55	59.88	N	007	0.26	E	35.7	23:27:57	28.07.20	55.998	7.005	55	59.88	N	007	0.29	E	35.5	+			+	+	78.1	1004.5	12.198	274.7	14.0
GN027	07:24:11	29.07.20	56.000	6.001	56	0.00	N	006	0.05	E	47.3	08:01:49	29.07.20	55.999	6.003	55	59.95	N	006	0.15	E	48.6	+			+	+	86.1	1005.9	18.743	274.8	12.8
GN028	15:16:24	29.07.20	55.999	4.999	55	59.94	N	004	59.97	E	44.1	15:38:01	29.07.20	55.998	4.999	55	59.91	N	004	59.96	E	43.7	+			+	+	65.5	1012.6	9.372	285.3	14.2
GN028S	21:02:56	29.07.20	55.999	4.001	55	59.96	N	004	0.04	E	56.5	21:38:34	29.07.20	55.999	4.000	55	59.96	N	004	0.03	E	56.5	+			+		75.0	1014.8	6.844	299.1	14.2
GN029	01:44:31	30.07.20	56.001	3.000	56	0.06	N	002	60.00	E	73.0	02:18:04	30.07.20	56.001	2.994	56	0.04	N	002	59.62	E	73.0	+		+	+	+	79.0	1015.6	6.844	273.7	14.1
GN030	05:48:59	30.07.20	56.000	2.000	55	60.00	N	002	0.00	E	85.7	06:08:43	30.07.20	56.000	2.000	55	59.99	N	002	0.02	E	86.9	+	+		+	+	63.6	1016.4	1.047	24.1	15.0
GN031	09:47:31	30.07.20	55.998	1.000	55	59.90	N	000	60.00	E	77.9	10:04:09	30.07.20	55.998	1.000	55	59.88	N	000	59.99	E	77.8	+	+		+	+	64.0	1017.0	2.682	214.6	15.1
GN032	13:33:57	30.07.20	56.000	-0.001	55	59.99	N	000	0.06	W	85.0	13:50:22	30.07.20	56.000	-0.001	55	59.99	N	000	0.07	W	84.4	+	+		+	+	78.0	1016.0	6.844	189.7	13.9
GN033	17:15:51	30.07.20	56.001	-0.999	56	0.03	N	000	59.92	W	62.4	17:56:30	30.07.20	56.000	-1.045	56	0.03	N	001	2.69	W	60.0	+	+	+	+	+	91.1	1015.0	4.614	156.5	13.7
GN033A	20:01:38	30.07.20	56.000	-1.674	55	59.97	N	001	40.41	W	65.9	20:17:54	30.07.20	56.000	-1.674	55	59.98	N	001	40.42	W	65.9	+			+	+	94.4	1014.0	6.844	142.8	13.3
GN033S	23:30:43	30.07.20	56.497	-1.665	56	29.85	N	001	39.91	W	53.9	23:44:42	30.07.20	56.497	-1.665	56	29.84	N	001	39.90	W	54.1	+			+		94.8	1013.5	4.614	154.1	13.5
GN034A	02:46:27	31.07.20	57.001	-1.667	57	0.06	N	001	40.01	W	74.1	03:04:25	31.07.20	57.001	-1.667	57	0.06	N	001	40.00	W	73.9	+			+	+	91.7	1012.1	4.614	160.6	13.5
GN034	05:23:02	31.07.20	57.000	-1.000	57	0.03	N	001	0.00	W	70.2	05:47:53	31.07.20	57.001	-1.001	57	0.04	N	001	0.06	W	70.0	+	+	+	+	+	84.7	1011.4	9.372	151.5	14.9
GN034S	09:56:09	31.07.20	57.000	0.168	57	0.02	N	000	10.07	E	85.0	10:12:56	31.07.20	57.001	0.168	57	0.03	N	000	10.06	E	84.9	+	+		+		81.2	1011.9	12.198	159.9	15.7
GN035	14:34:16	31.07.20	56.999	1.332	56	59.94	N	001	19.93	E	98.4	15:29:42	31.07.20	56.999	1.332	56	59.94	N	001	19.91	E	98.4	+	+	+	+	+	76.9	1012.5	12.198	144.8	15.4
GN035S	19:30:18	31.07.20	57.000	2.415	57	0.01	N	002	24.88	E	80.2	19:47:01	31.07.20	57.000	2.415	57	0.02	N	002	24.88	E	79.8	+	+		+		82.7	1011.7	9.372	143	15.1
GN036	23:52:08	31.07.20	57.000	3.497	56	59.97	N	003	29.83	E	65.2	00:16:16	01.08.20	57.000	3.497	56	59.98	N	003	29.83	E	65.2	+			+	+	86.1	1011.7	6.844	130.7	14.8
GN037	05:50:56	01.08.20	57.001	5.000	57	0.06	N	004	59.97	E	57.6	06:08:27	01.08.20	57.001	5.000	57	0.06	N	004	59.99	E	57.9	+	+		+	+	77.0	1010.2	9.372	131.4	16.8
GN038	09:48:39	01.08.20	56.999	6.002	56	59.96	N	006	0.13	E	51.9	10:21:10	01.08.20	56.999	6.003	56	59.96	N	006	0.15	E	52.1	+	+	+	+	+	78.9	1009.8	12.198	120.1	16.2
GN038A	14:07:08	01.08.20	57.001	6.998	57	0.04	N	006	59.91	E	33.2	14:21:39	01.08.20	57.001	6.999	57	0.04	N	006	59.92	E	33.2	+	+		+	+	70.3	1009.8	9.372	117.5	18.1
GN039N	17:12:52	01.08.20	57.000	7.833	57	0.01	N	007	50.00	E	40.9	17:35:01	01.08.20	57.000	7.833	57	0.02	N	007	50.01	E	40.9	+	+	+	+	+	68.3	1008.8	9.372	127	19.6
GN039S	20:09:42	01.08.20	57.425	8.004	57	25.50	N	008	0.26	E	98.4	20:29:07	01.08.20	57.425	8.005	57	25.51	N	008	0.28	E	98.8	+			+		78.0	1008.2	9.372	126.8	18.2
GN040	22:51:41	01.08.20	57.830	7.992	57	49.79	N	007	59.51	E	521.3	02:29:39	02.08.20	57.829	7.989	57	49.73	N	007	59.37	E	521.3	+		+	+	+	89.3	1007.0	9.372	195.7	16.9
GN040S	05:36:35	02.08.20	57.917	6.999	57	55.00	N	006	59.96	E	357.3	06:11:26	02.08.20	57.918	6.980	57	55.10	N	006	58.82	E	383.3	+	+		+		95.3	1006.5	9.372	292	14.6
GN041	09:19:46	02.08.20	58.000	5.999	58	0.01	N	005	59.97	E	307.4	09:54:46	02.08.20	58.000	6.000	58	0.01	N	005	59.97	E	307.3	+	+	+	+	+	71.5	1007.9	6.844	306.1	15.0
GN042	13:17:27	02.08.20	58.000	5.005	57	59.99	N	005	0.32	E	127.8	13:37:17	02.08.20	58.000	5.006	57	59.99	N	005	0.35	E	127.8	+	+		+	+	73.0	1008.9	4.614	297.3	14.4
GN042S	16:55:40	02.08.20	58.000	4.001	58	0.02	N	004	0.03	E	98.2	17:12:14	02.08.20	58.001	4.000	58	0.03	N	004	0.02	E	98.1	+	+		+		75.8	1009.0	2.682	253.9	13.8
GN043	20:31:37	02.08.20	57.999	2.996	57	59.96	N	002	59.76	E	75.5	20:53:59	02.08.20	57.999	2.997	57	59.95	N	002	59.84	E	76.0	+		+	+	+	80.3	1009.9	6.844	292.6	12.6
GN044	01:43:01	03.08.20	58.003	1.498	58	0.21	N	001	29.88	E	105.0	02:12:30	03.08.20	58.003	1.498	58	0.19	N	001	29.88	E	106.0	+		+	+	+	85.4	1010.1	2.682	259.3	13.0
GN044S	06:23:53	03.08.20	58.000	0.250	57	59.98	N	000	15.00	E	138.9	06:43:47	03.08.20	58.000	0.250	57	59.97	N	000	15.00	E	139.1	+	+		+		68.4	1010.6	6.844	305	13.1
GN045	10:55:26	03.08.20	57.998	-0.997	57	59.87	N	000	59.83	W	114.7	11:29:21	03.08.20	57.998	-0.997	57	59.85	N	000	59.83	W	115.0	+	+	+	+	+	66.7	1011.3	6.844	270.5	12.5
GN045A	14:54:36	03.08.20	58.000	-2.000	58	0.01	N	002	0.02	W	85	15:11:15	03.08.20	58.000	-2.001	58	0.02	N	002	0.05	W	85.7	+	+		+	+	65.7	1011.2	4.614	263.1	13.7
GN045B	18:33:02	03.08.20	58.501	-2.499	58	30.04	N	002	29.93	W	70.1	18:50:35	03.08.20	58.501	-2.498	58	30.09	N	002	29.90	W	69.3	+	+		+	+	75.5	1010.0	4.614	174.5	13.6

GN046A	22:11:59	03.08.20	58.998	-2.002	58	59.86	N	002	0.12	W	79.5	22:29:25	03.08.20	58.998	-2.002	58	59.86	N	002	0.14	W	79.8	+			+	+	85.5	1009.3	6.844	251.6	12.6
GN046	00:01:10	04.08.20	59.000	-1.508	58	59.99	N	001	30.47	W	106.8	00:28:50	04.08.20	59.000	-1.508	58	59.98	N	001	30.47	W	107	+		+	+	+	85.8	1009.0	6.844	237.1	12.7
GN047	05:07:13	04.08.20	59.000	-0.001	59	0.03	N	000	0.04	W	130.9	05:28:10	04.08.20	59.000	0.000	59	0.02	N	000	0.02	W	131	+	+		+	+	84.0	1008.2	6.844	225.6	13.4
GN048	08:40:33	04.08.20	58.999	1.003	58	59.96	N	001	0.16	E	124.3	09:14:45	04.08.20	58.999	1.002	58	59.97	N	001	0.14	E	124	+	+	+	+	+	79.6	1007.5	6.844	178	14.5
GN048S	12:22:46	04.08.20	58.998	1.996	58	59.89	N	001	59.75	E	114.5	12:41:05	04.08.20	58.998	1.996	58	59.91	N	001	59.76	E	115	+	+		+		81.0	1006.5	9.372	191.6	14.0
GN049	15:53:32	04.08.20	59.001	3.001	59	0.05	N	003	0.03	E	137.3	16:14:51	04.08.20	59.001	3.001	59	0.06	N	003	0.04	E	137	+	+		+	+	79.4	1005.3	9.372	176.8	14.0
GN049S	18:49:24	04.08.20	59.001	3.752	59	0.03	N	003	45.10	E	272.9	19:26:30	04.08.20	59.001	3.750	59	0.05	N	003	44.99	E	272	+			+		86.2	1003.7	12.198	167.6	13.8
GN050	22:17:02	04.08.20	59.000	4.495	58	59.98	N	004	29.71	E	259	23:05:30	04.08.20	59.000	4.494	58	60.00	N	004	29.67	E	259	+		+	+	+	89.9	1001.9	15.321	155.4	13.0
GN050S	01:59:16	05.08.20	59.498	4.505	59	29.89	N	004	30.32	E	265.2	02:33:59	05.08.20	59.503	4.504	59	30.17	N	004	30.27	E	265	+			+		96.2	996.5	15.321	166.7	14.2
GN051	05:28:41	05.08.20	60.000	4.502	59	59.98	N	004	30.11	E	260	06:04:20	05.08.20	60.000	4.502	59	59.99	N	004	30.12	E	260	+	+	+	+	+	97.3	996.0	12.198	190.5	14.8
GN051S	10:35:23	05.08.20	59.999	3.258	59	59.93	N	003	15.46	E	209.8	11:11:19	05.08.20	59.998	3.250	59	59.88	N	003	15.01	E	210	+	+		+		95.3	999.1	4.614	220.8	14.4
GN052	15:19:43	05.08.20	60.000	2.001	60	0.01	N	002	0.06	E	102.2	15:45:45	05.08.20	60.000	2.001	60	0.01	N	002	0.03	E	101	+	+	+	+	+	94.2	1002.1	4.614	196.9	14.4
GN052S	19:43:42	05.08.20	60.001	0.746	60	0.06	N	000	44.76	E	126.3	20:03:08	05.08.20	60.001	0.746	60	0.06	N	000	44.76	E	127	+			+		95.0	1003.7	2.682	179.2	14.1
GN053	00:00:35	06.08.20	59.998	-0.491	59	59.86	N	000	29.46	W	129	00:26:28	06.08.20	59.997	-0.491	59	59.85	N	000	29.43	W	129	+		+	+	+	95.1	1006.1	2.682	186.7	13.8
GN053A	03:18:45	06.08.20	59.802	-1.337	59	48.11	N	001	20.21	W	86.3	03:39:59	06.08.20	59.806	-1.356	59	48.37	N	001	21.37	W	79.8	+			+	+	95.3	1008.7	2.682	230.2	12.7
GN053B	05:38:25	06.08.20	59.999	-1.996	59	59.93	N	001	59.75	W	87.1	05:56:49	06.08.20	60.004	-2.006	60	0.24	N	002	0.37	W	86.6	+	+		+	+	95.5	1010.4	2.682	236.2	12.7
GN054	09:11:14	06.08.20	60.002	-3.021	60	0.15	N	003	1.23	W	108	09:35:17	06.08.20	60.008	-3.006	60	0.47	N	003	0.36	W	87.7	+	+	+	+	+	72.1	1012.1	4.614	232.2	13.2

The complete Station-list is available at:
http://seadata.bsh.de/Cgi-csr/retrieve_sdn2/csrreport.pl?project=SDN&session=19725&v1=10&v2=2

Appendix 2: List of samples

CTD-profiles with rosette	83 stations
Secchi-depth	43 stations, 43 samples
Salinity	83 stations, 180 samples
Total Alkalinity	49 stations, 124 samples incl. duplicates and 10 fold determination
Oxygen	49 stations, 126 samples incl. duplicates and 10 fold determination
pH-value	49 stations, 130 samples incl. duplicates and 10 fold determination
Chlorophyll	49 stations, 72 samples incl. duplicates and 10 fold determination
Radioactivity	63 stations
	Cäsium-137 (Cs-137): 67 samples
	Strontium-90 (Sr-90): 23 samples
	Tritium (H-3): 24 samples
	Transuranic elements (Pu-238, Pu-239/240, Am-241, Cm-244): 37 samples
	Bottle samples at GN040 from 499 m, 240 m, 92 m, approx. 50 m
Organic pollutants	polar (10L/5L): 83 stations, 101 samples (incl. blank, spike, duplicate)
	nonpolar (100L): 33 stations, 49 samples (inlcl. blank, spike, duplicate)

Appendix 3: Maps of temperature, salinity and oxygen

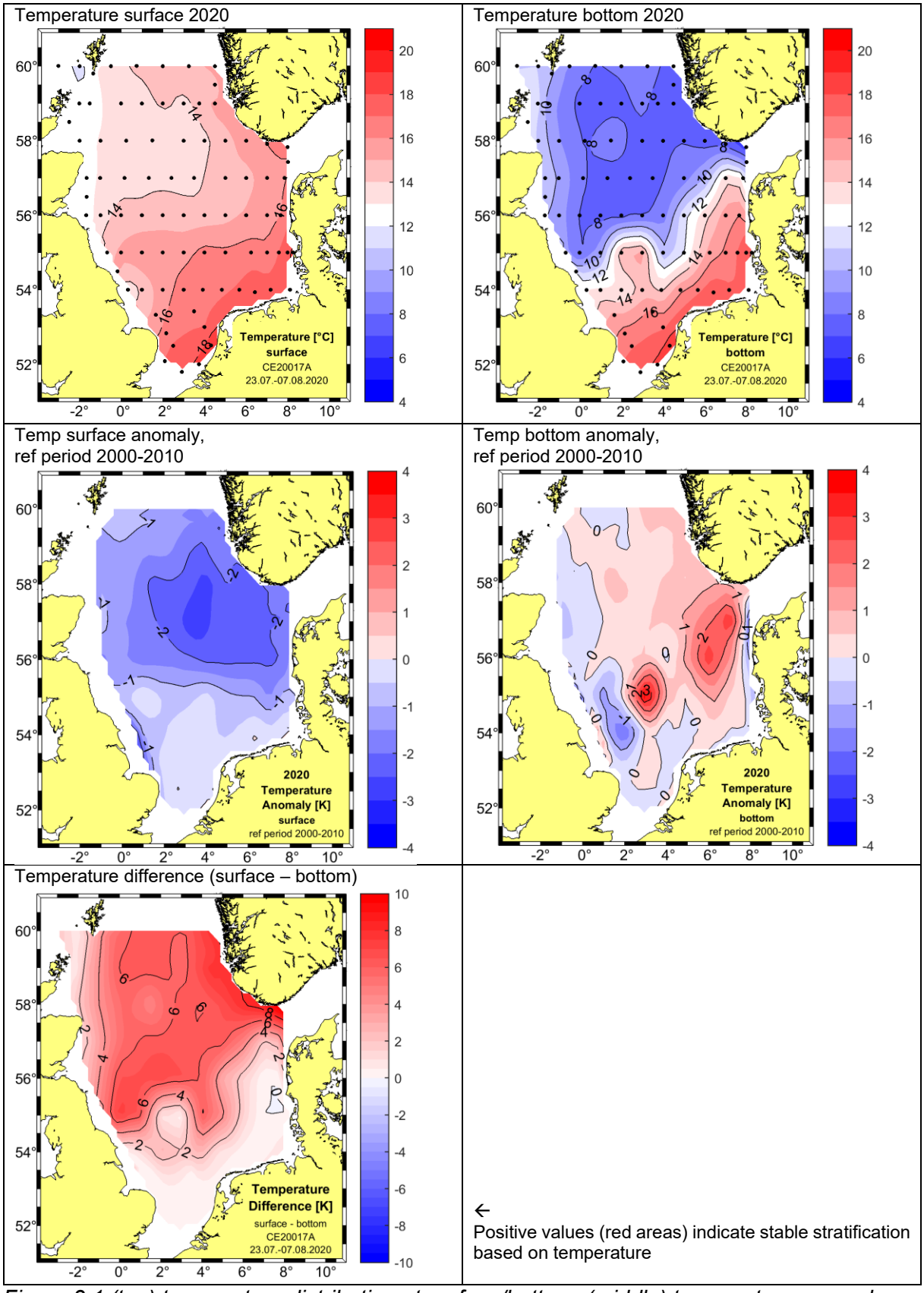


Figure 3.1 (top) temperature distribution at surface/bottom, (middle) temperature anomaly surface/bottom, (bottom) temperature difference between surface and bottom.

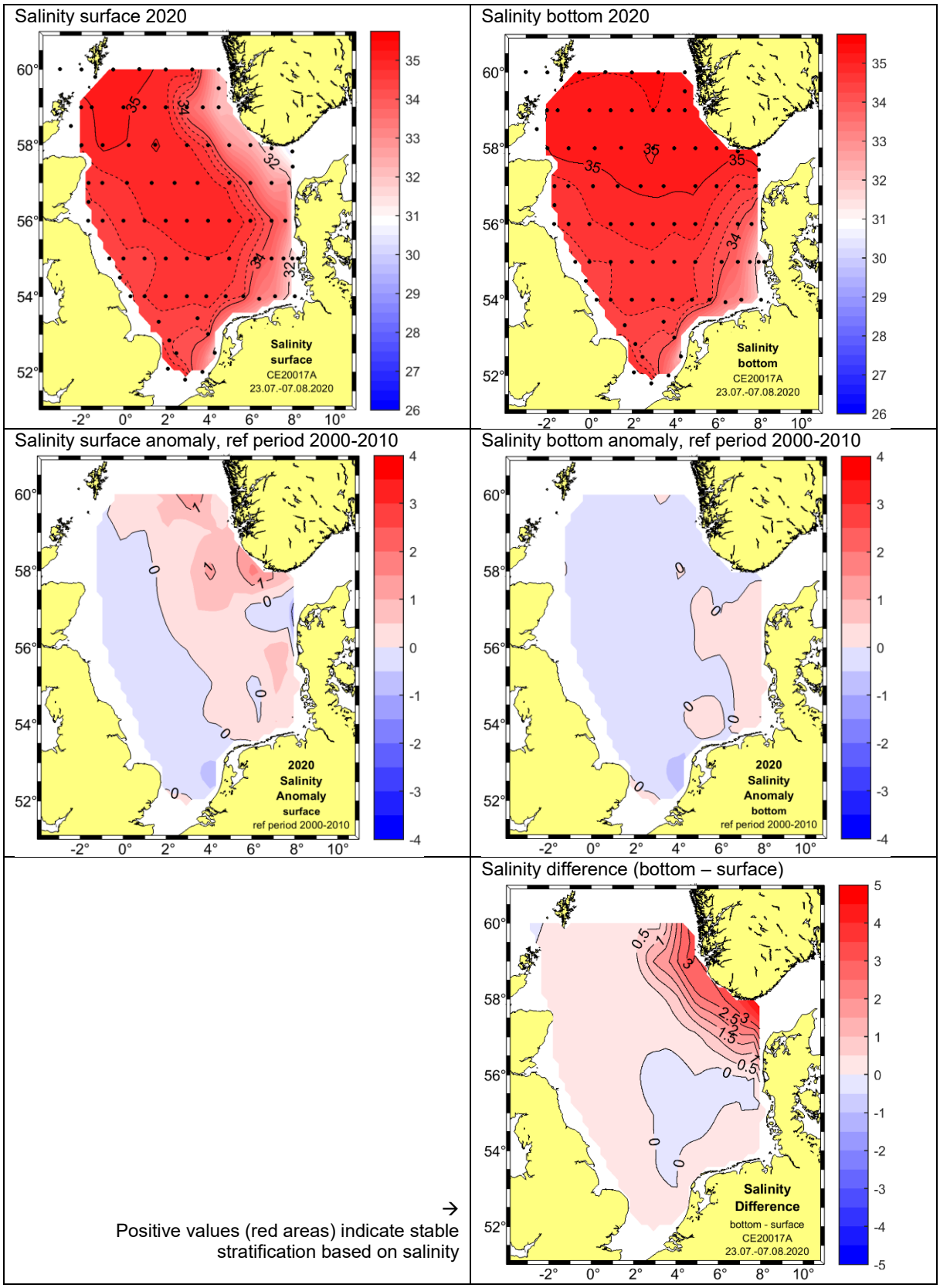


Figure 3.2 (top) salinity distribution at surface/bottom, (middle) salinity anomaly surface/bottom, (bottom) salinity difference between bottom and surface.

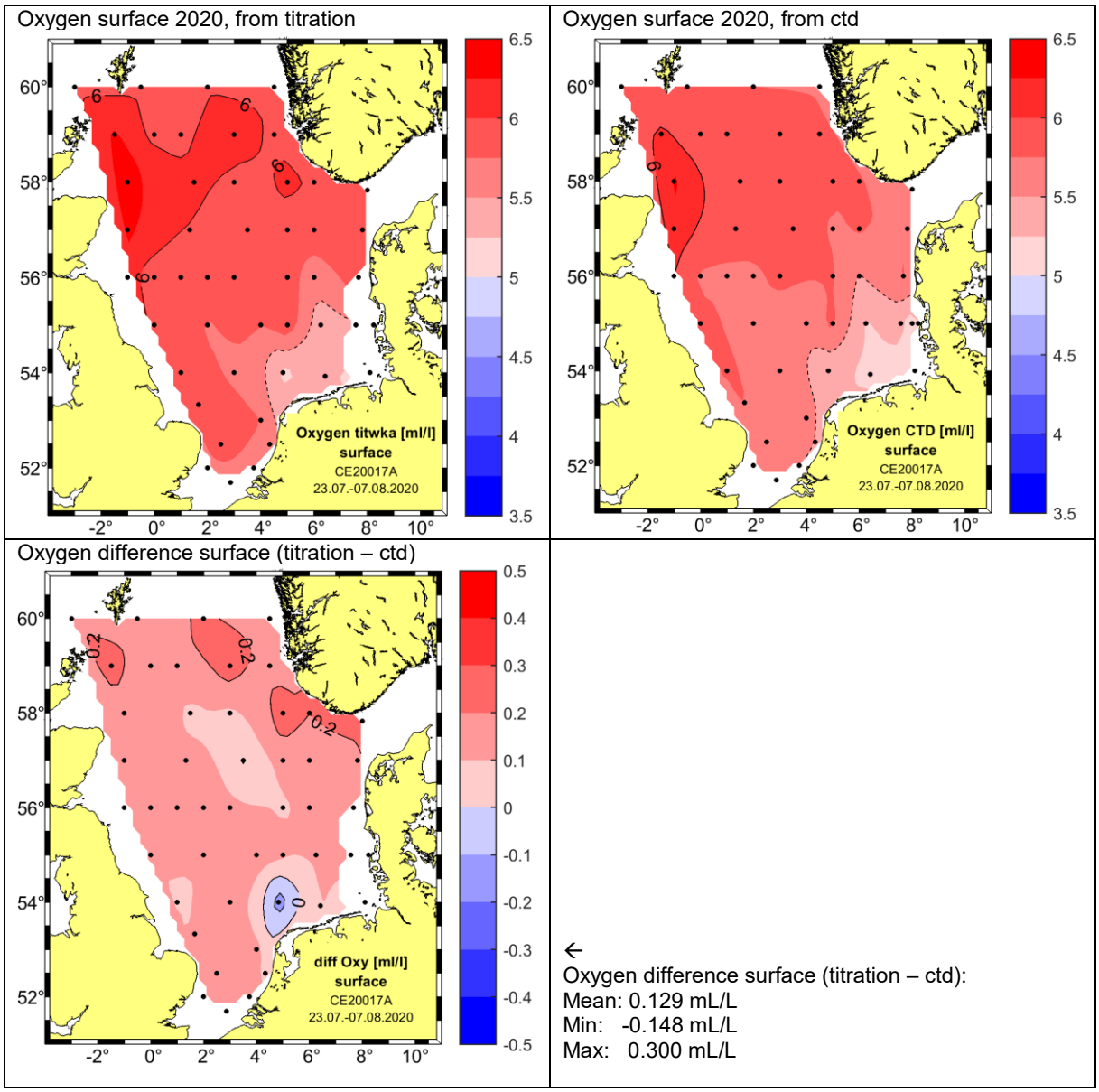


Figure 3.3 (top) dissolved oxygen distribution at surface from titration (left) and from ctd (right), (bottom) oxygen difference between titration and ctd.

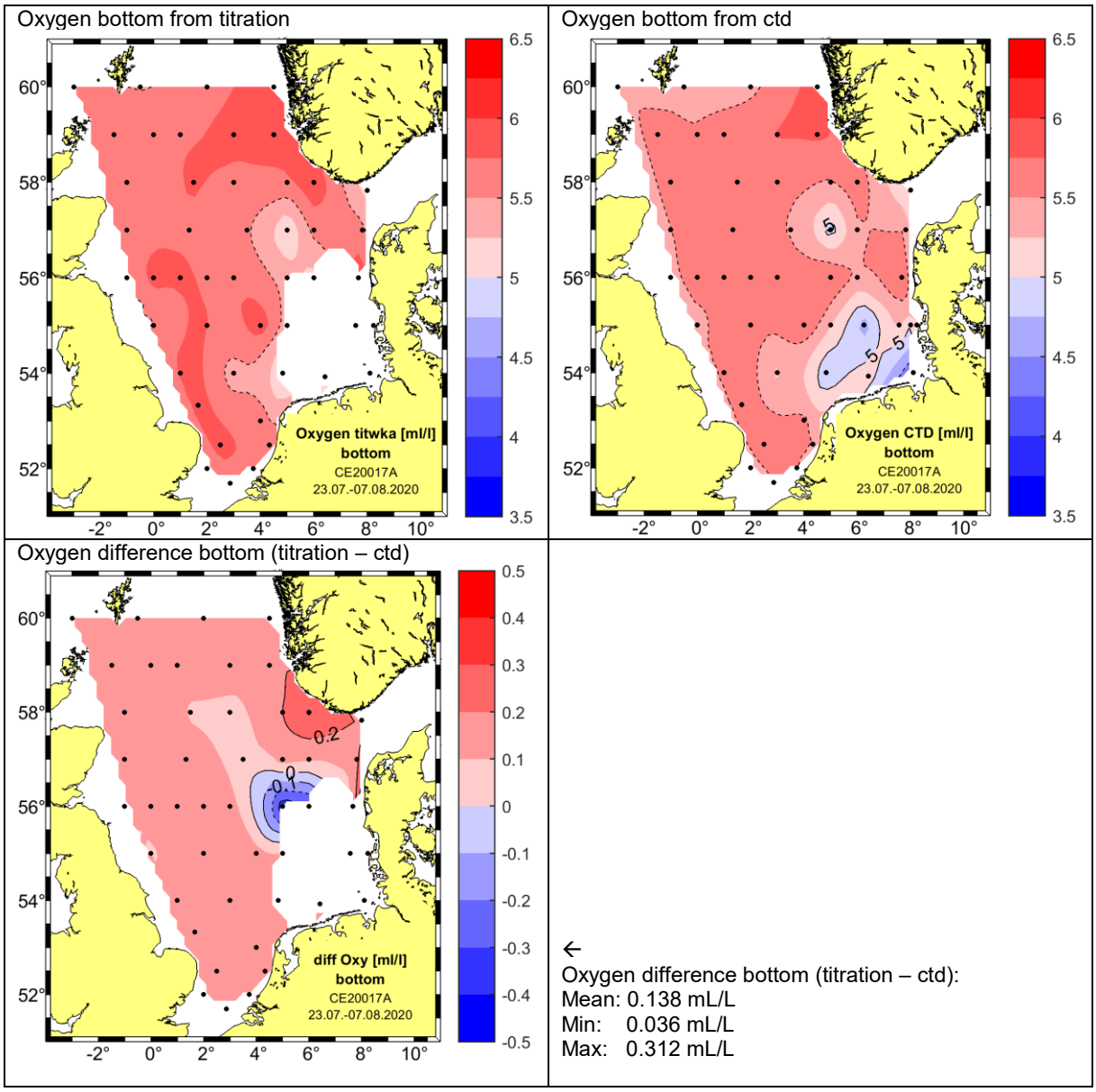


Figure 3.4 (top) dissolved oxygen distribution at bottom from titration (left) and from ctd (right), (bottom) oxygen difference between titration and ctd.

.

Appendix 4: Temperature and salinity sections

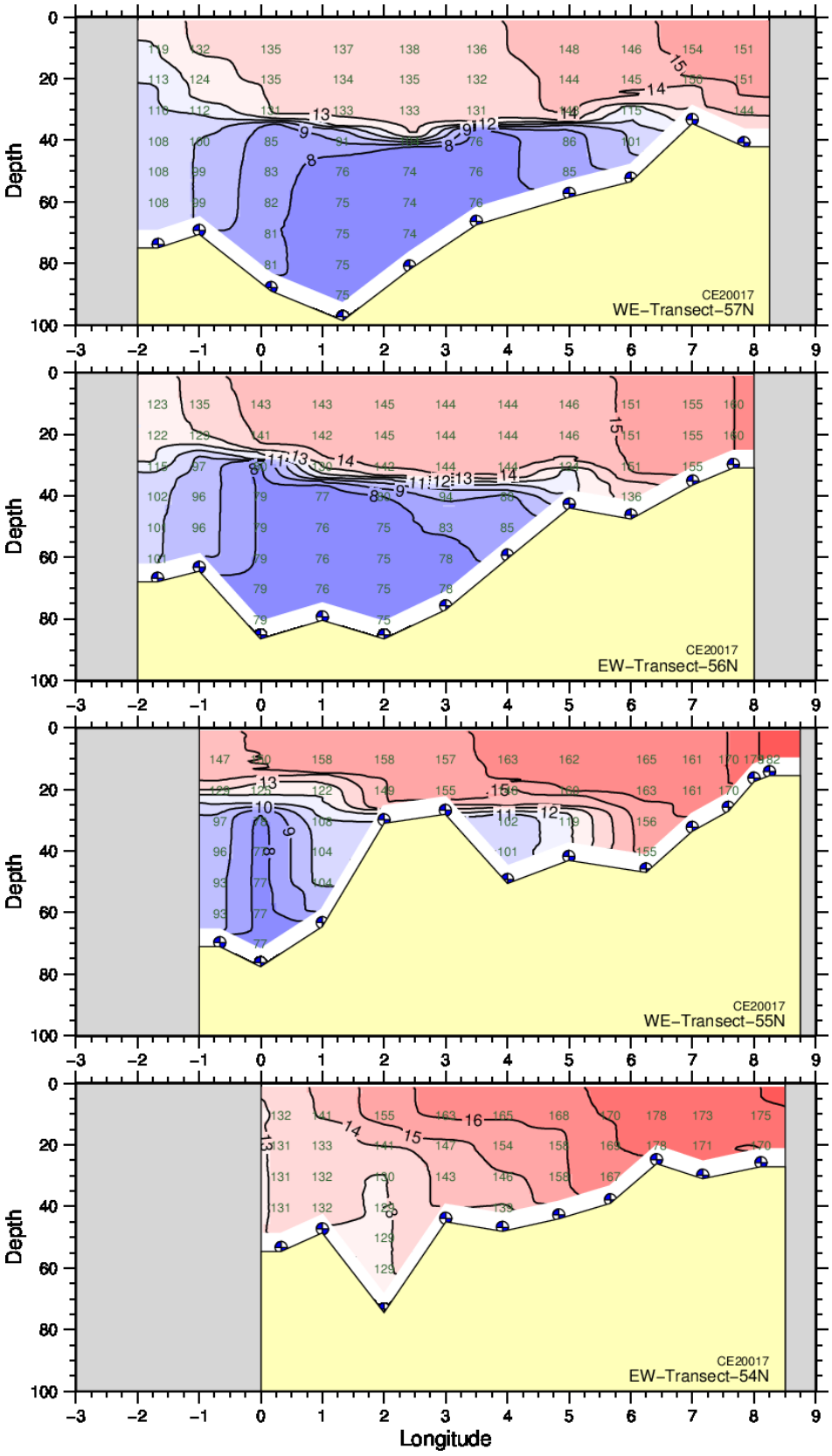


Figure 4.1: Temperature sections along 54°, 55°, 56°, and 57°N based on CTD raw data. The numbers in the sections give temperature [°C] x 10 at selected station depths.

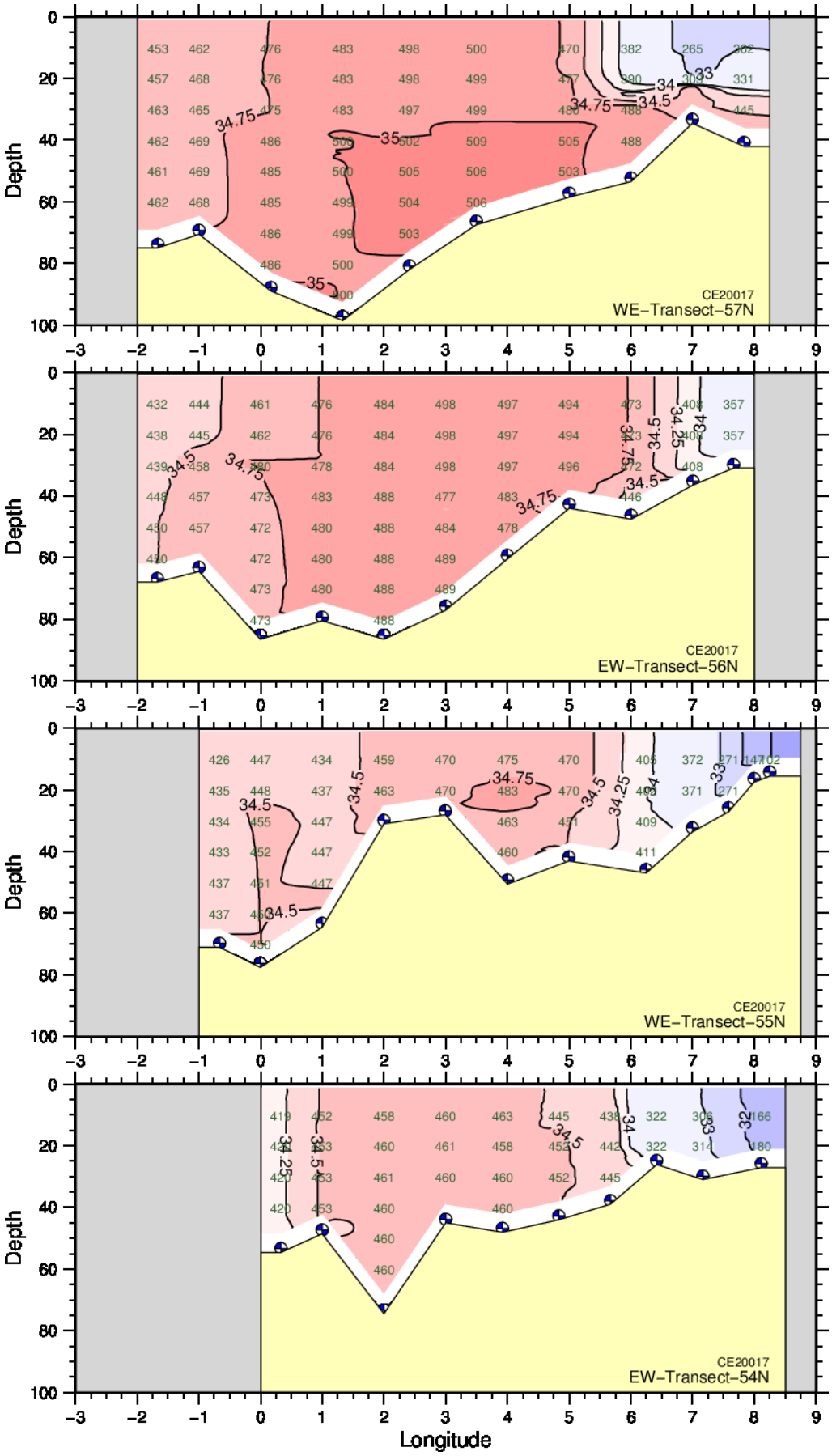


Figure 4.2: Salinity sections along the 54°, 55°, 56°, and 57°N based on CTD raw data. The numbers in the sections give (salinity x 100)-3000 at selected station depths.

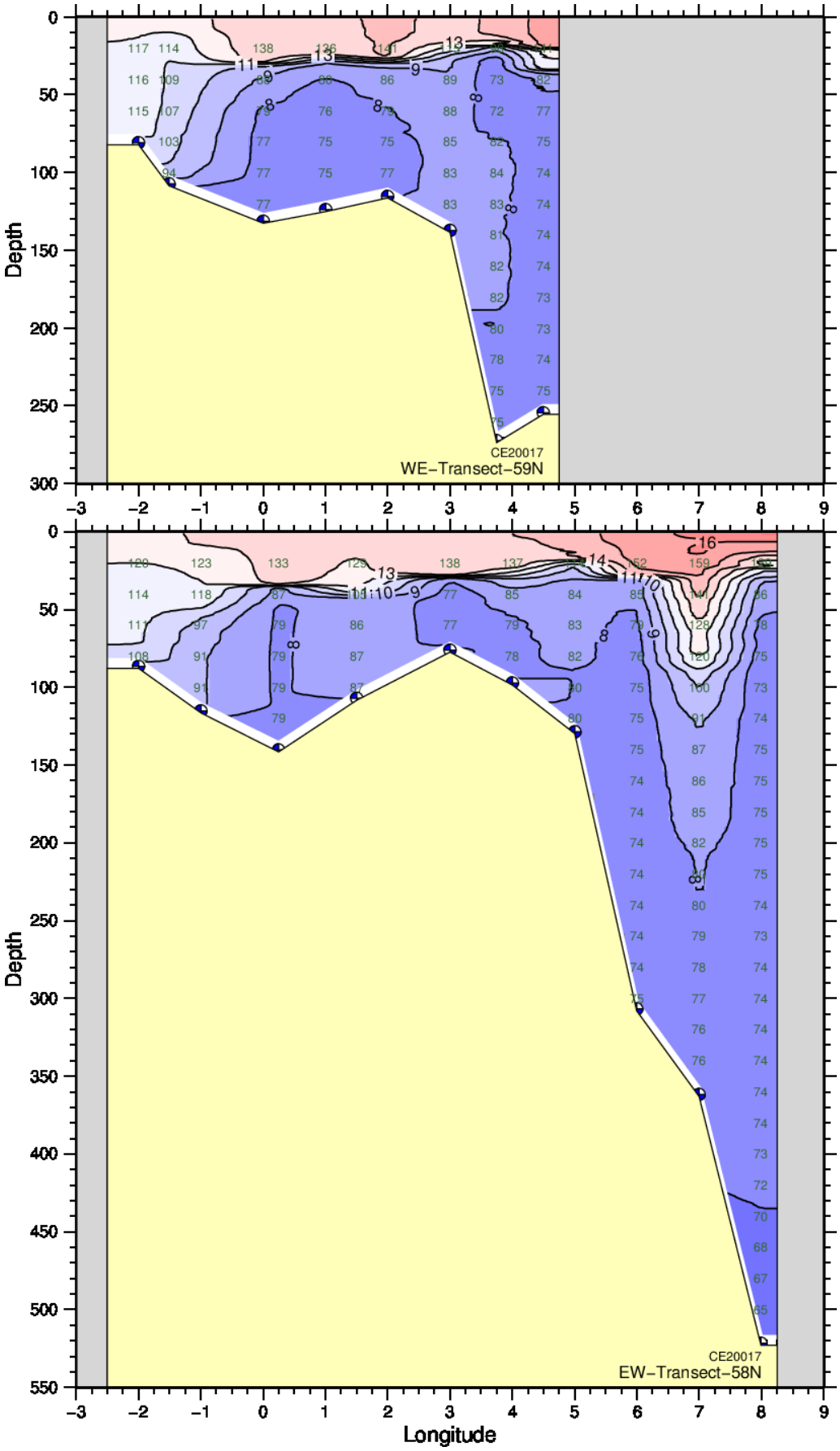


Figure 4.3: Temperature sections along 58° and 59°N based on CTD raw data. The numbers in the sections give temperature [°C] x 10 at selected station depths.

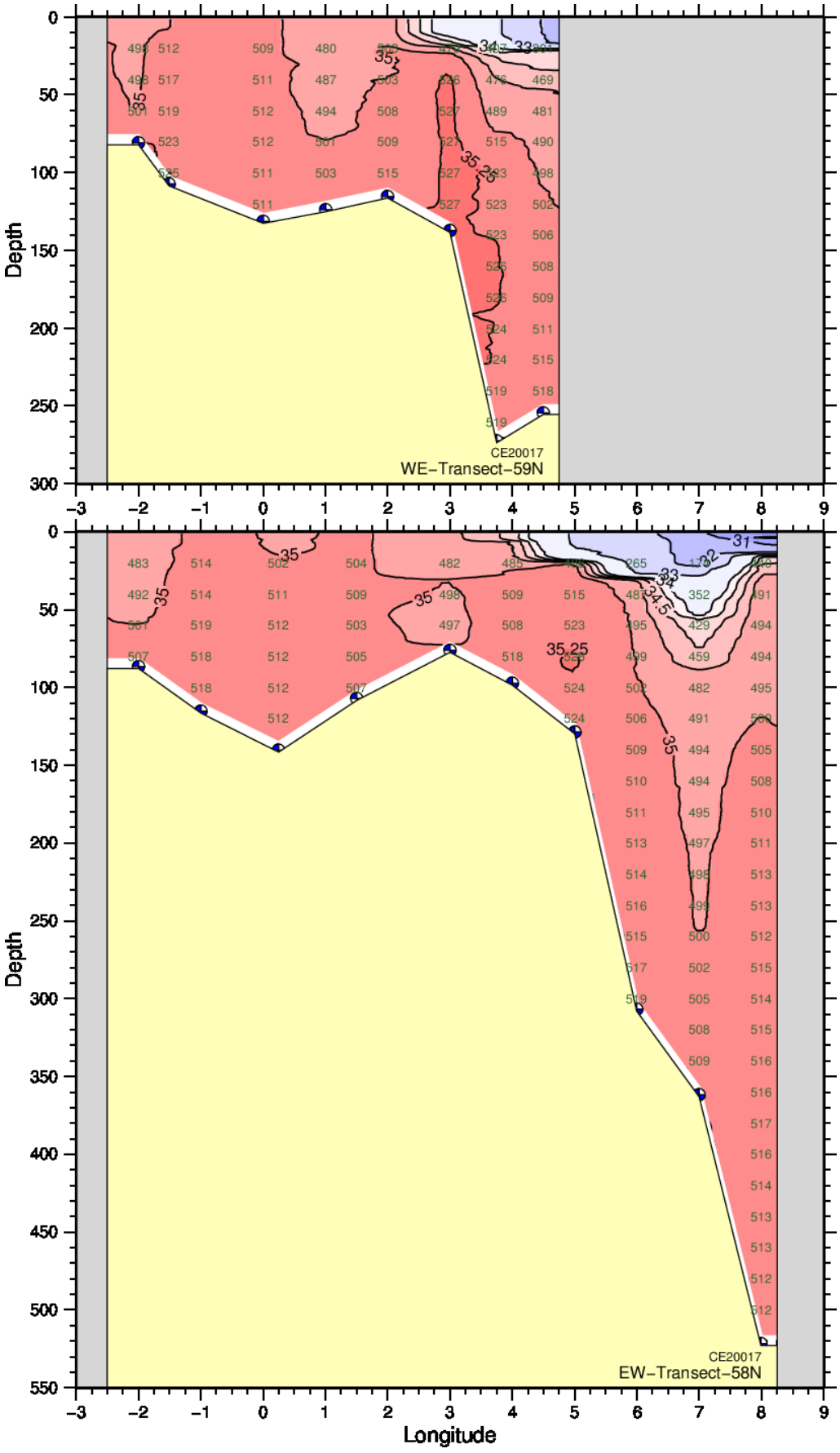


Figure 4.4: Salinity sections along 58° and 59°N based on CTD raw data.
The numbers in the sections give (salinity x 100)-3000 at selected station depths.

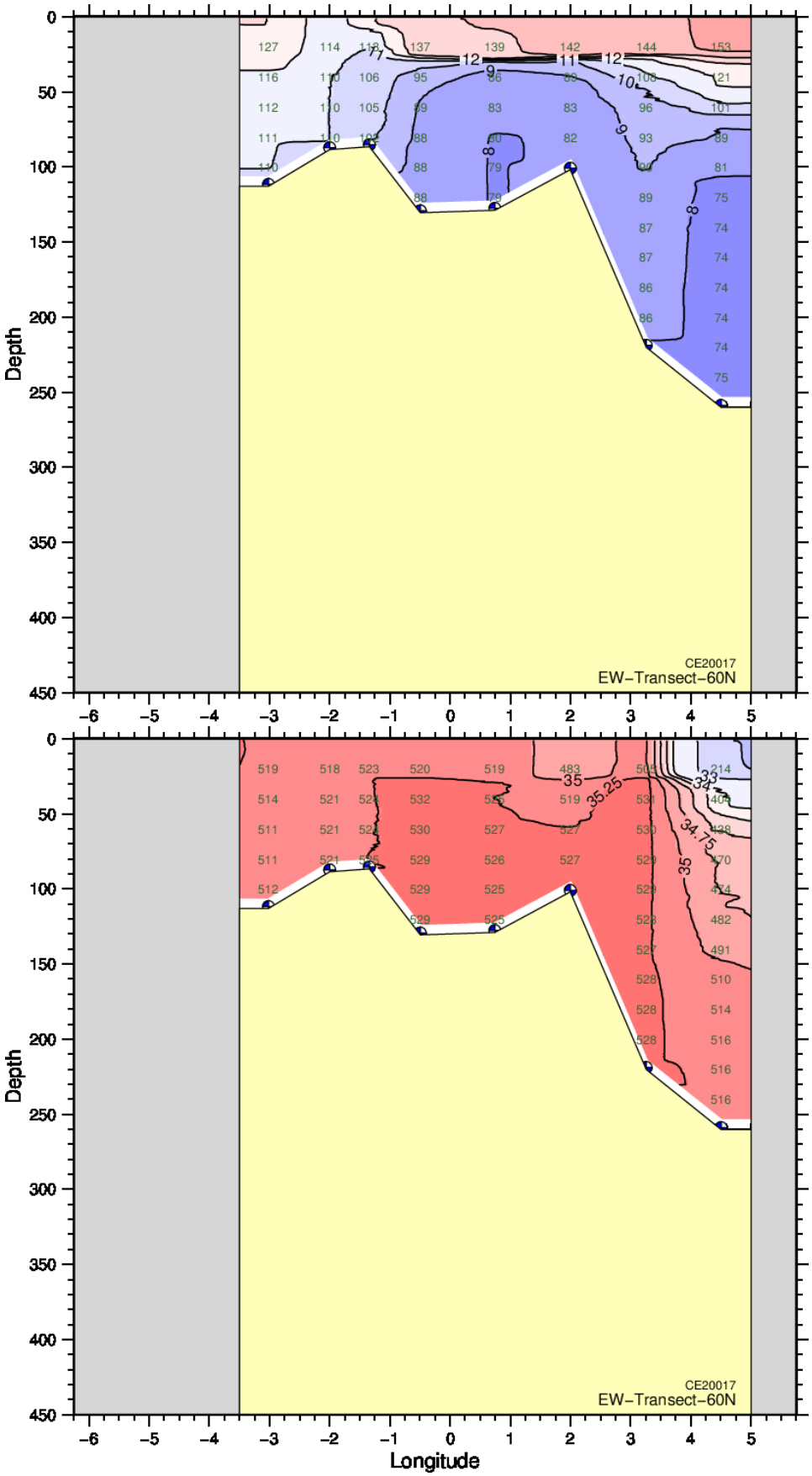
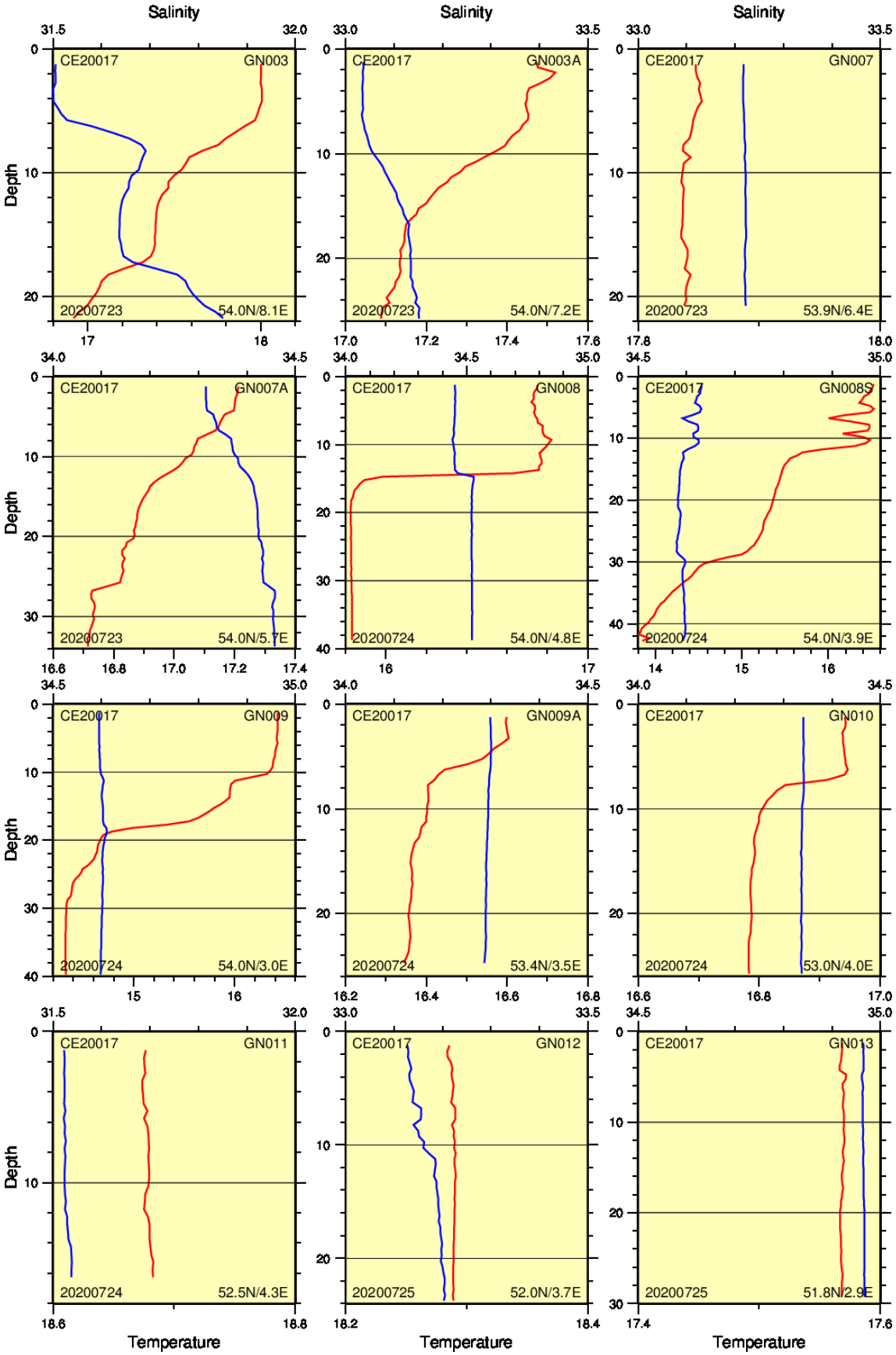
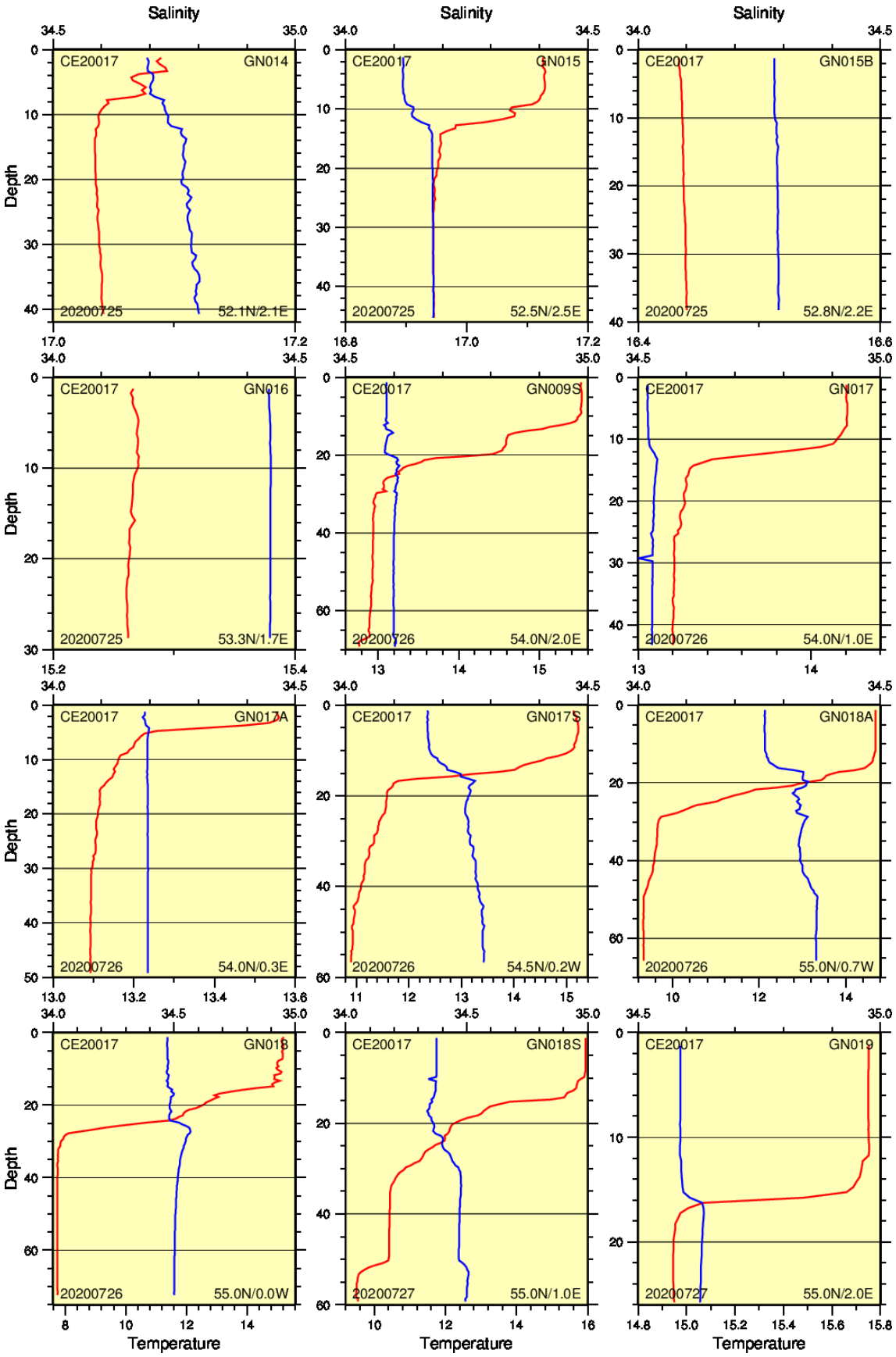


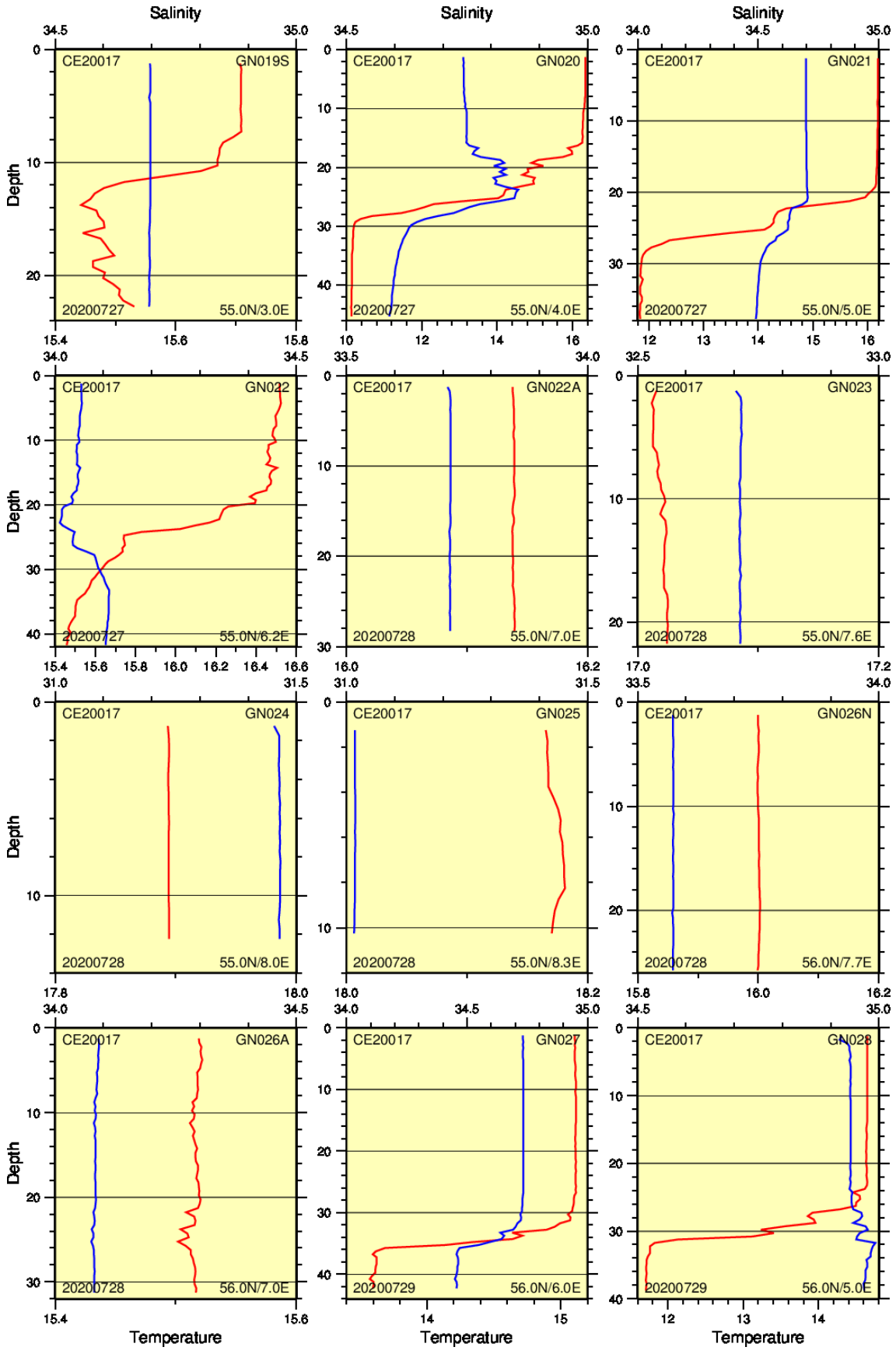
Figure 4.5: Temperature (top) and salinity (bottom) sections along 60°N based on CTD raw data. The numbers in the sections give temperature [°C] x 10 and (salinity x 100) -3000 at selected station depths.

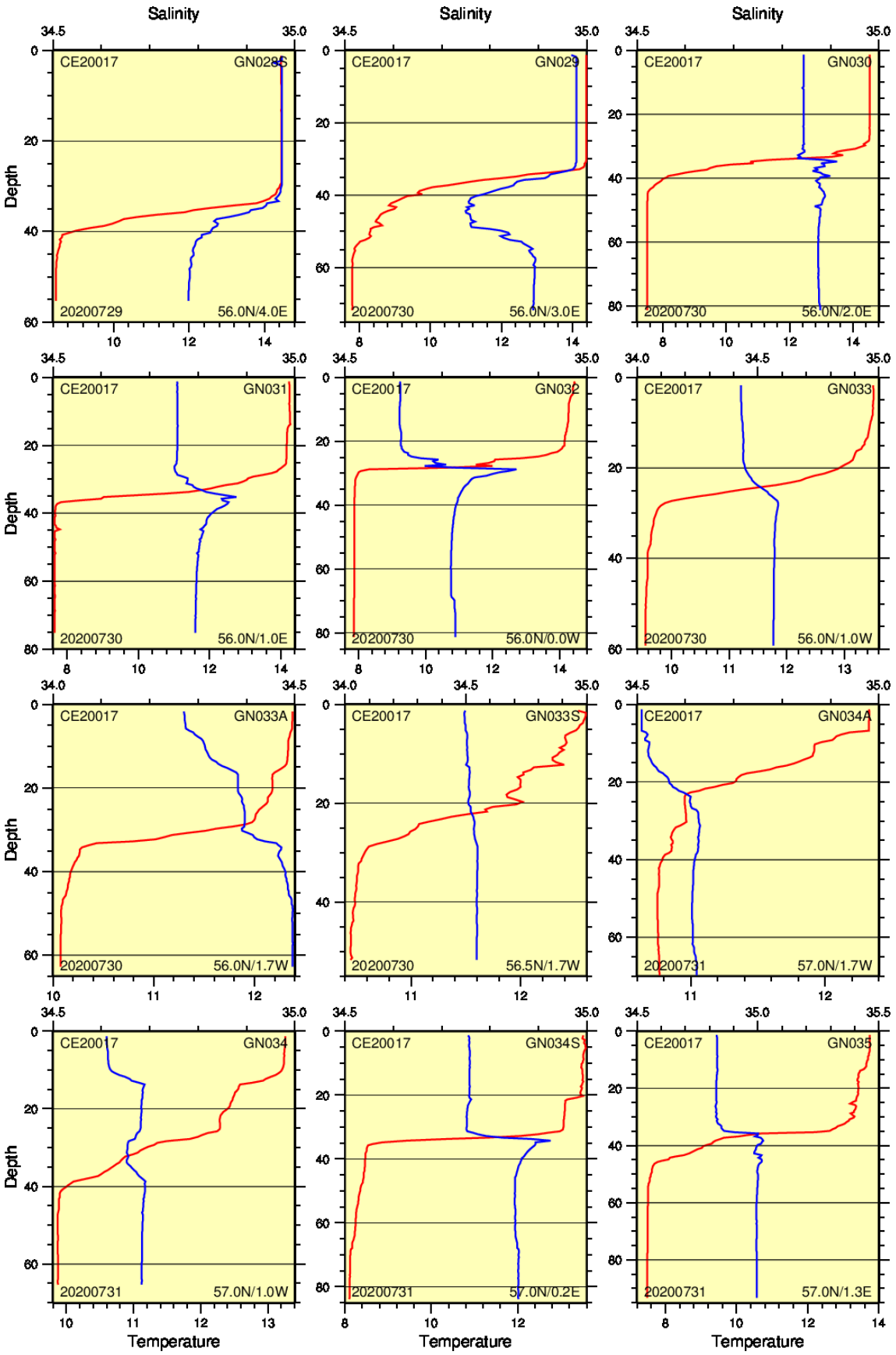
Appendix 5: Temperature and salinity profiles of all stations

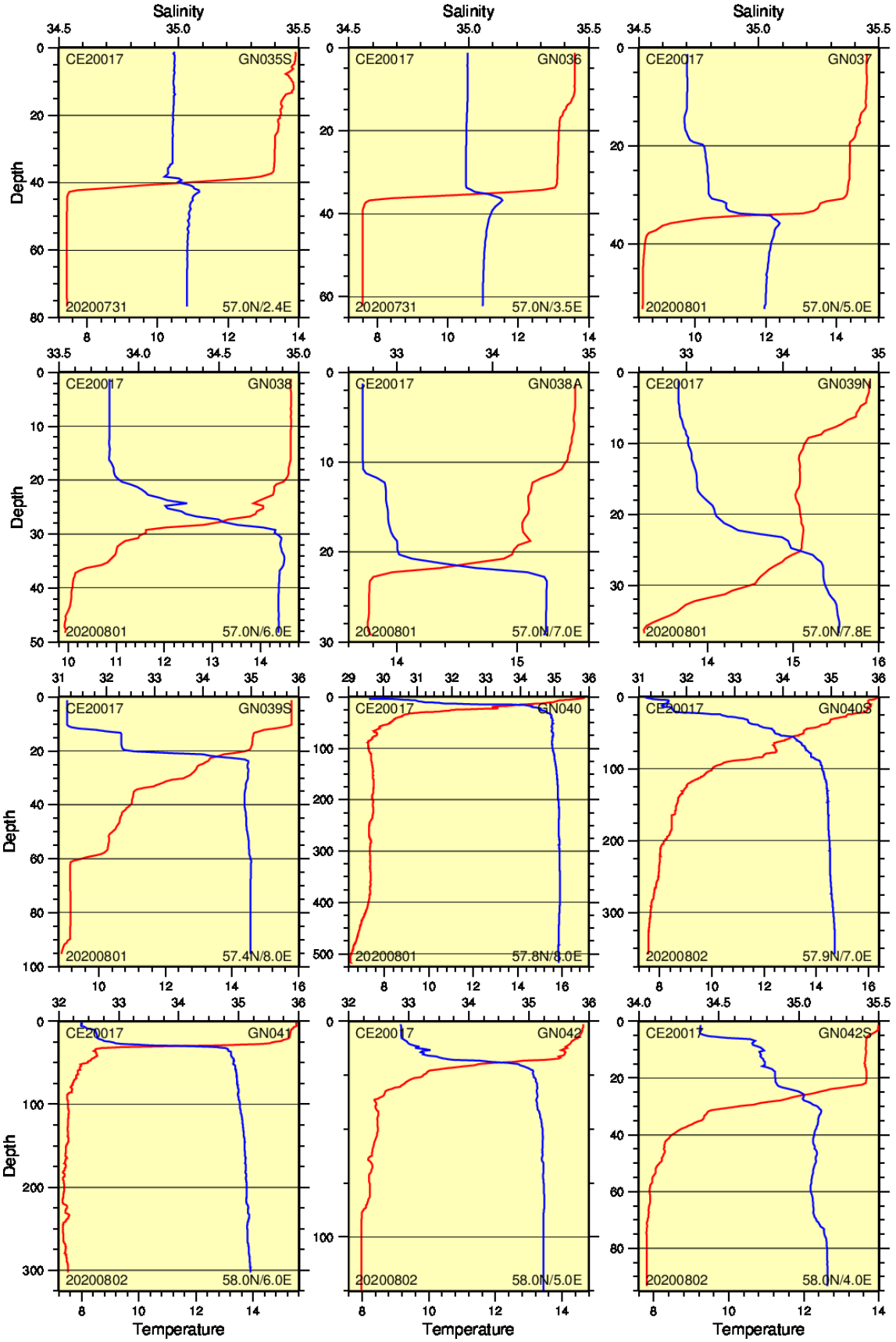
The following temperature (red) and salinity (blue) profiles are based on CTD-raw data.




Salinity
Salinity
Salinity
Depth
Depth
Depth
Temperature
Temperature
Temperature
CE20017 GN014 20200725 52.1N/2.1E
CE20017 GN015 20200725 52.5N/2.5E
CE20017 GN015B 20200725 52.8N/2.2E
CE20017 GN016 20200725 53.3N/1.7E
CE20017 GN009S 20200726 54.0N/2.0E
CE20017 GN017 20200726 54.0N/1.0E
CE20017 GN017A 20200726 54.0N/0.3E
CE20017 GN017S 20200726 54.5N/0.2W
CE20017 GN018A 20200726 55.0N/0.7W
CE20017 GN018 20200726 55.0N/0.0W
CE20017 GN018S 20200727 55.0N/1.0E
CE20017 GN019 20200727 55.0N/2.0E


Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
CE20017 GN019S 20200727 55.0N/3.0E
CE20017 GN020 20200727 55.0N/4.0E
CE20017 GN021 20200727 55.0N/5.0E
CE20017 GN022 20200727 55.0N/6.2E
CE20017 GN022A 20200728 55.0N/7.0E
CE20017 GN023 20200728 55.0N/7.6E
CE20017 GN024 20200728 55.0N/8.0E
CE20017 GN025 20200728 55.0N/8.3E
CE20017 GN026N 20200728 56.0N/7.7E
CE20017 GN026A 20200728 56.0N/7.0E
CE20017 GN027 20200729 56.0N/6.0E
CE20017 GN028 20200729 56.0N/5.0E


Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
CE20017 GN028S 20200729 56.0N/4.0E
CE20017 GN029 20200730 56.0N/3.0E
CE20017 GN030 20200730 56.0N/2.0E
CE20017 GN031 20200730 56.0N/1.0E
CE20017 GN032 20200730 56.0N/0.0W
CE20017 GN033 20200730 56.0N/1.0W
CE20017 GN033A 20200730 56.0N/1.7W
CE20017 GN033S 20200730 56.5N/1.7W
CE20017 GN034A 20200731 57.0N/1.7W
CE20017 GN034 20200731 57.0N/1.0W
CE20017 GN034S 20200731 57.0N/0.2E
CE20017 GN035 20200731 57.0N/1.3E


Salinity
Depth
Temperature
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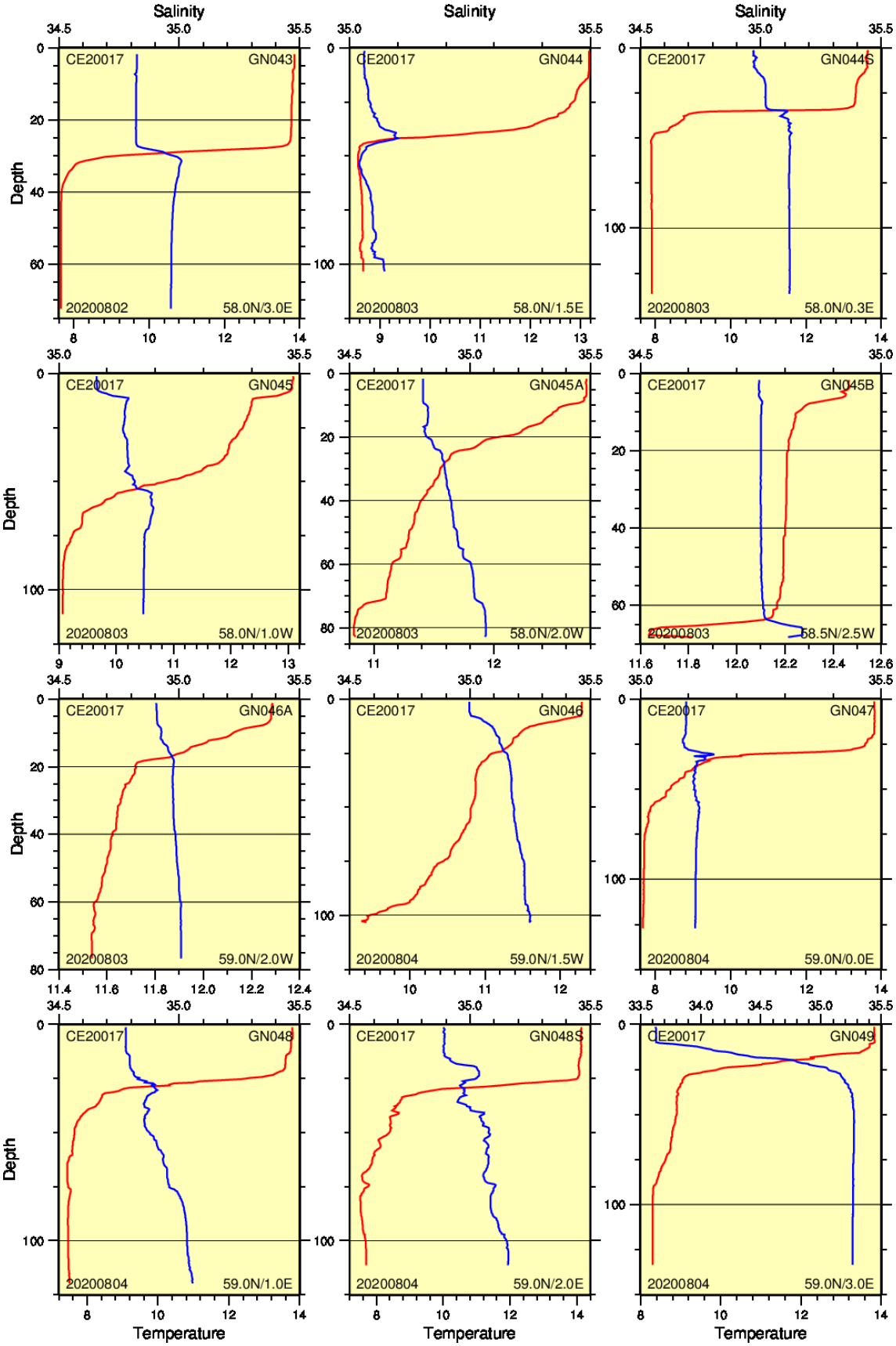
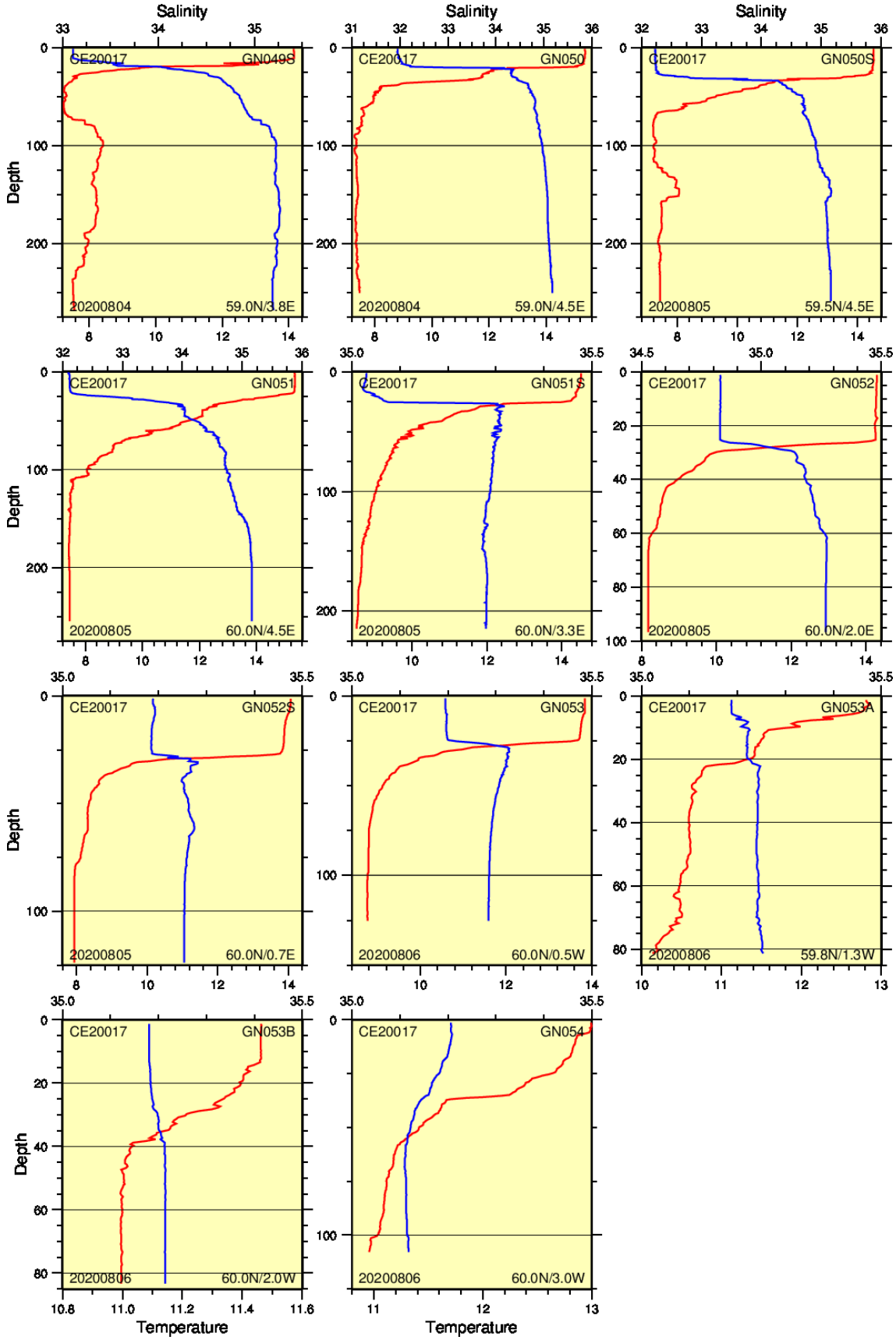
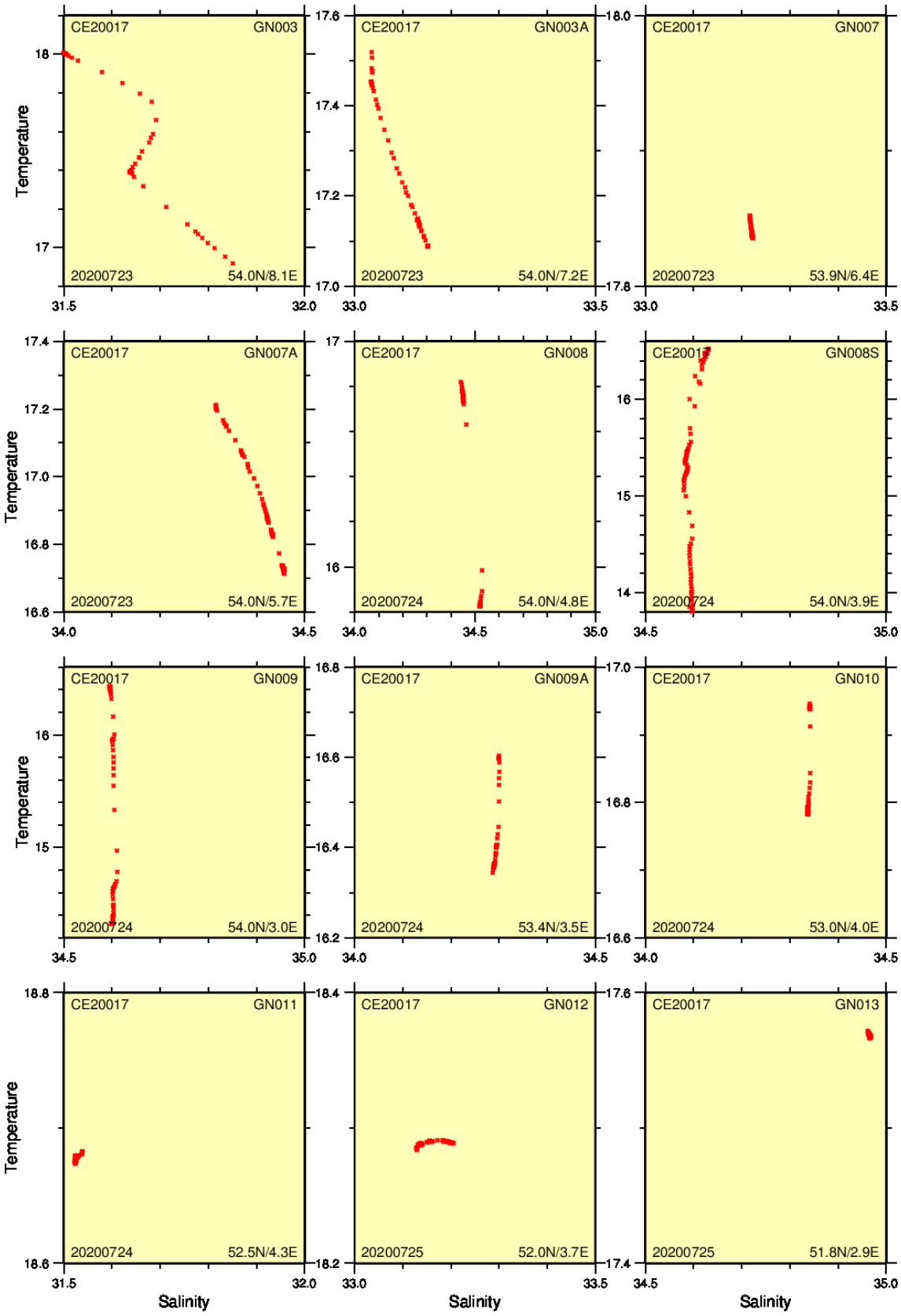
GN035S
20200731
57.0N/2.4E
GN036
20200731
57.0N/3.5E
GN037
20200801
57.0N/5.0E
GN038
20200801
57.0N/6.0E
GN038A
20200801
57.0N/7.0E
GN039N
20200801
57.0N/7.8E
GN039S
20200801
57.4N/8.0E
GN040
20200801
57.8N/8.0E
GN040S
20200802
57.9N/7.0E
GN041
20200802
58.0N/6.0E
GN042
20200802
58.0N/5.0E
GN042S
20200802
58.0N/4.0E

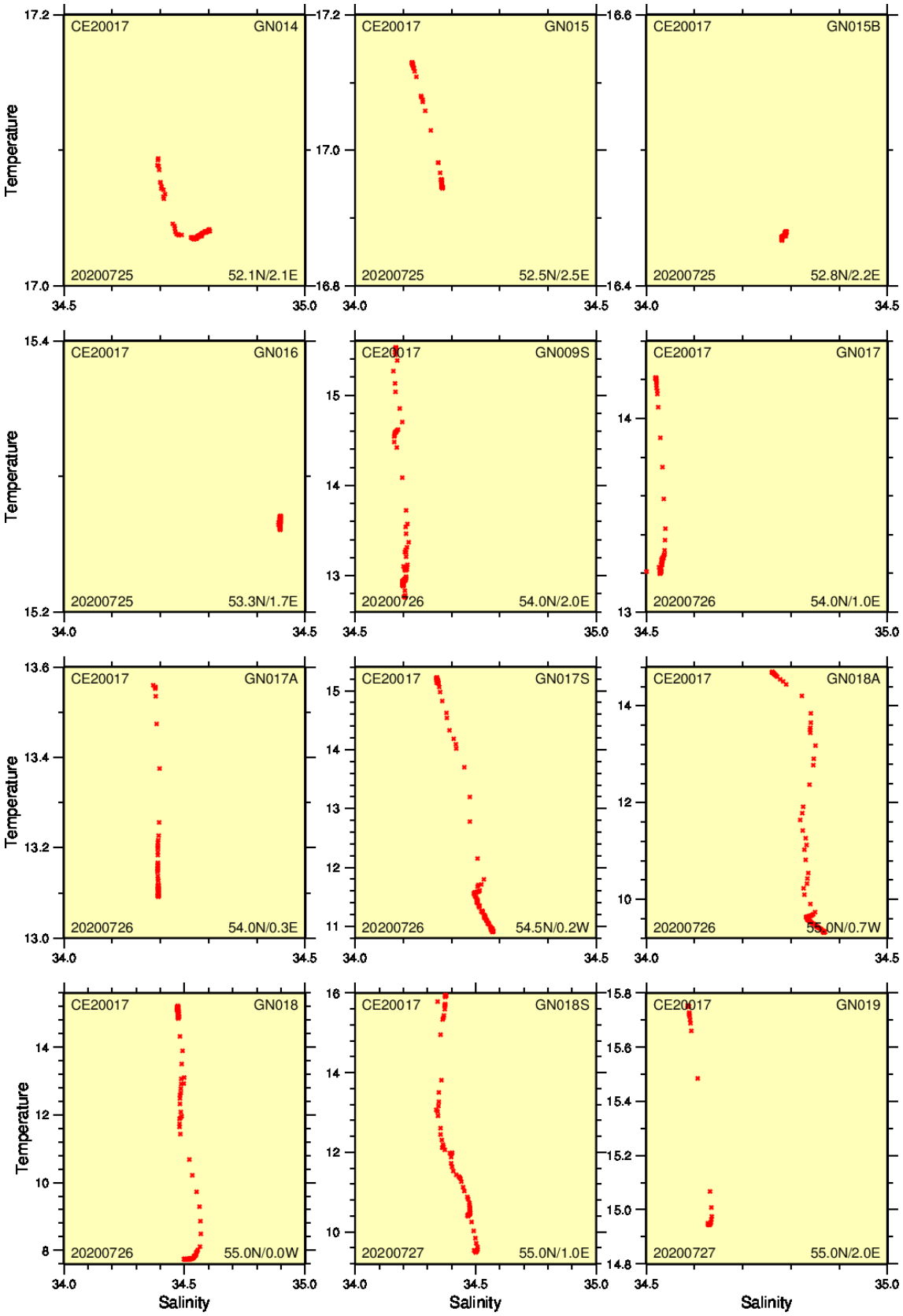

Salinity
Salinity
Salinity
Depth
Depth
Depth
Temperature
Temperature
Temperature
CE20017 GN043
20200802 58.0N/3.0E
CE20017 GN044
20200803 58.0N/1.5E
CE20017 GN044S
20200803 58.0N/0.3E
CE20017 GN045
20200803 58.0N/1.0W
CE20017 GN045A
20200803 58.0N/2.0W
CE20017 GN045B
20200803 58.5N/2.5W
CE20017 GN046A
20200803 59.0N/2.0W
CE20017 GN046
20200804 59.0N/1.5W
CE20017 GN047
20200804 59.0N/0.0E
CE20017 GN048
20200804 59.0N/1.0E
CE20017 GN048S
20200804 59.0N/2.0E
CE20017 GN049
20200804 59.0N/3.0E

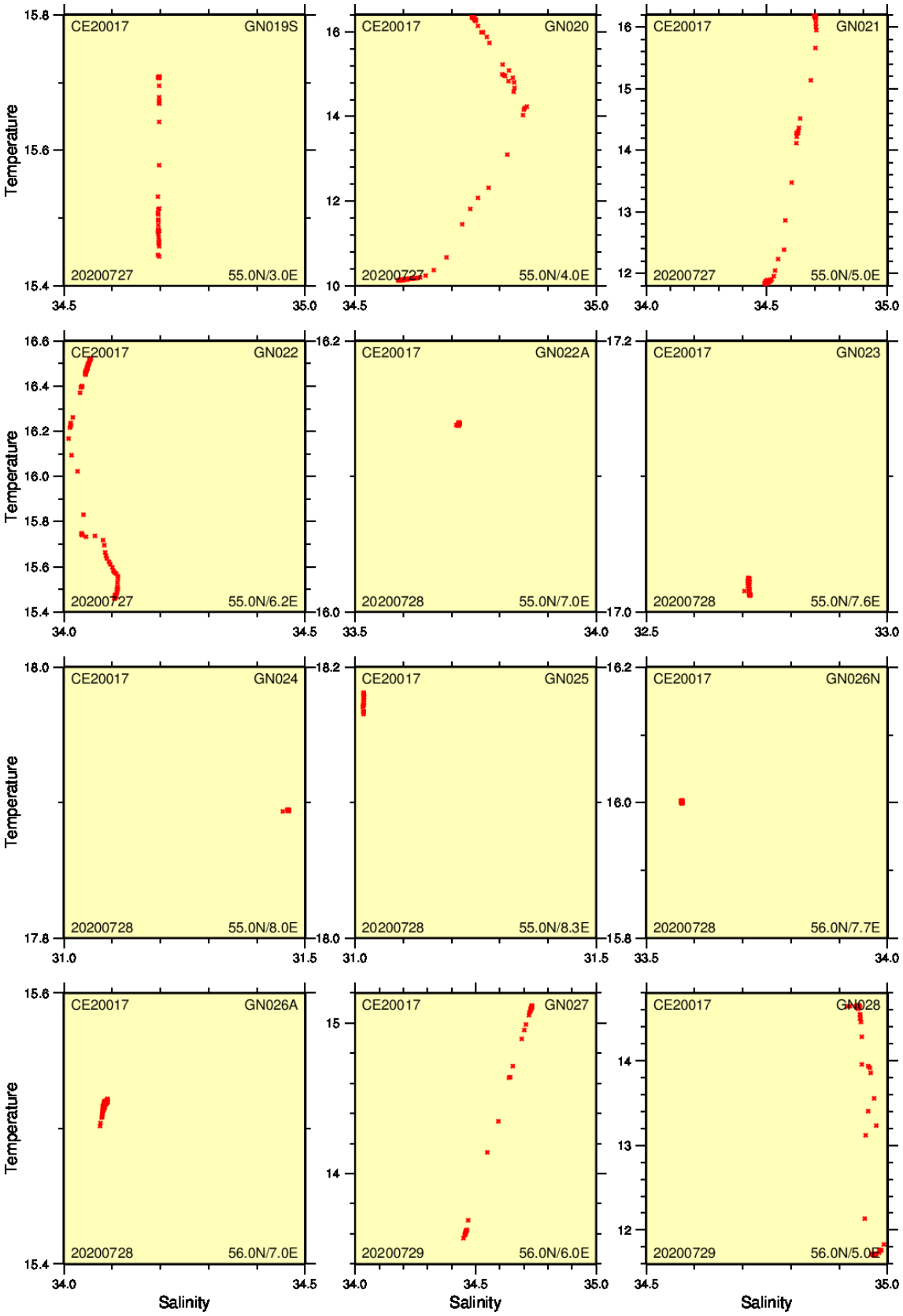

Salinity
Depth
Temperature
CE20017 GN049S 20200804 59.0N/3.8E
CE20017 GN050 20200804 59.0N/4.5E
CE20017 GN050S 20200805 59.5N/4.5E
CE20017 GN051 20200805 60.0N/4.5E
CE20017 GN051S 20200805 60.0N/3.3E
CE20017 GN052 20200805 60.0N/2.0E
CE20017 GN052S 20200805 60.0N/0.7E
CE20017 GN053 20200806 60.0N/0.5W
CE20017 GN053A 20200806 59.8N/1.3W
CE20017 GN053B 20200806 60.0N/2.0W
CE20017 GN054 20200806 60.0N/3.0W

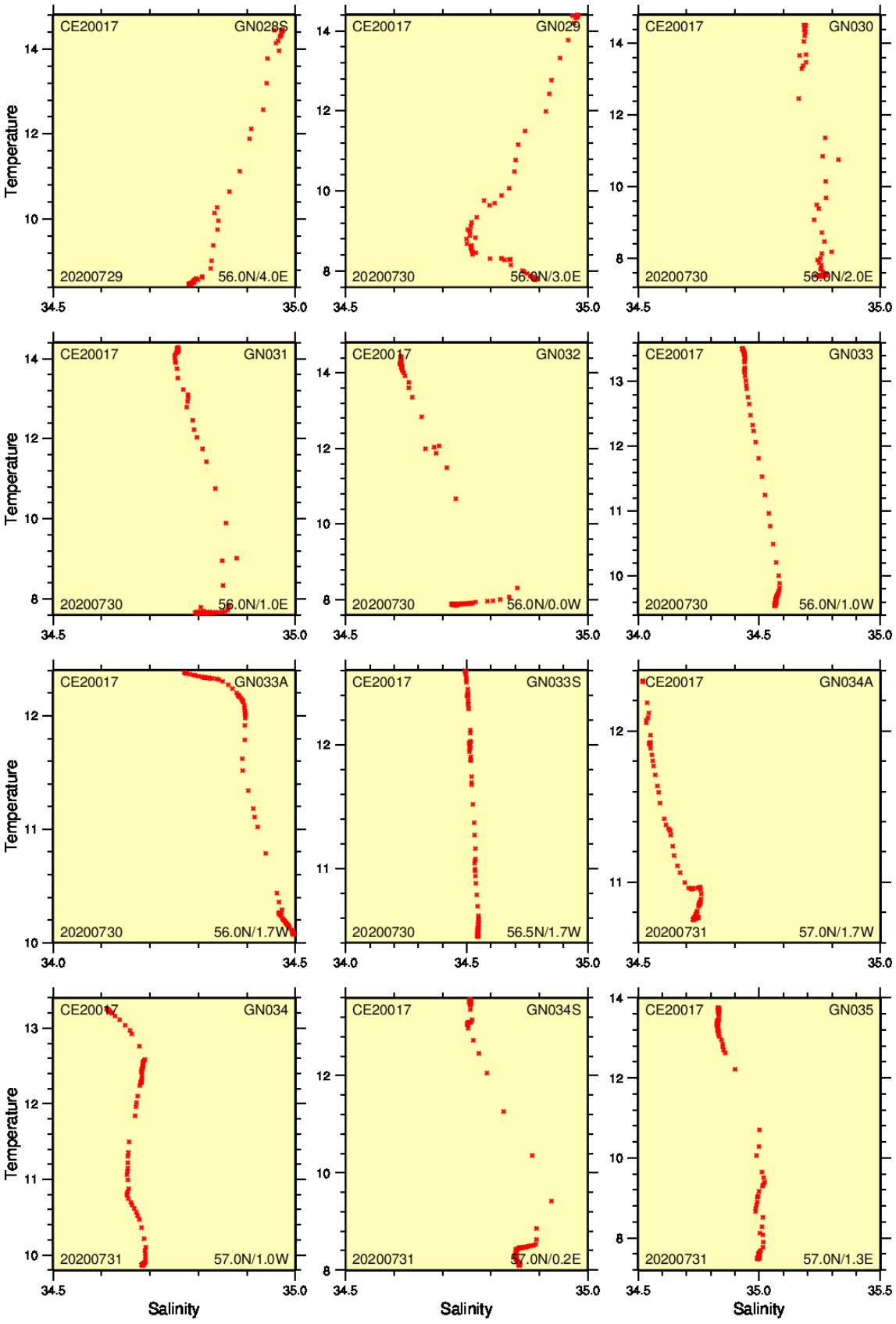
Appendix 6: T-S-diagrams of all stations

The following diagrams are based on CTD-raw data.




CE20017 GN014 20200725 52.1N/2.1E
CE20017 GN015 20200725 52.5N/2.5E
CE20017 GN015B 20200725 52.8N/2.2E
CE20017 GN016 20200725 53.3N/1.7E
CE20017 GN009S 20200726 54.0N/2.0E
CE20017 GN017 20200726 54.0N/1.0E
CE20017 GN017A 20200726 54.0N/0.3E
CE20017 GN017S 20200726 54.5N/0.2W
CE20017 GN018A 20200726 55.0N/0.7W
CE20017 GN018 20200726 55.0N/0.0W
CE20017 GN018S 20200727 55.0N/1.0E
CE20017 GN019 20200727 55.0N/2.0E
Temperature
Salinity


CE20017 GN019S 20200727 55.0N/3.0E
CE20017 GN020 20200727 55.0N/4.0E
CE20017 GN021 20200727 55.0N/5.0E
CE20017 GN022 20200727 55.0N/6.2E
CE20017 GN022A 20200728 55.0N/7.0E
CE20017 GN023 20200728 55.0N/7.6E
CE20017 GN024 20200728 55.0N/8.0E
CE20017 GN025 20200728 55.0N/8.3E
CE20017 GN026N 20200728 56.0N/7.7E
CE20017 GN026A 20200728 56.0N/7.0E
CE20017 GN027 20200729 56.0N/6.0E
CE20017 GN028 20200729 56.0N/5.0E
Temperature
Salinity


CE20017 GN028S
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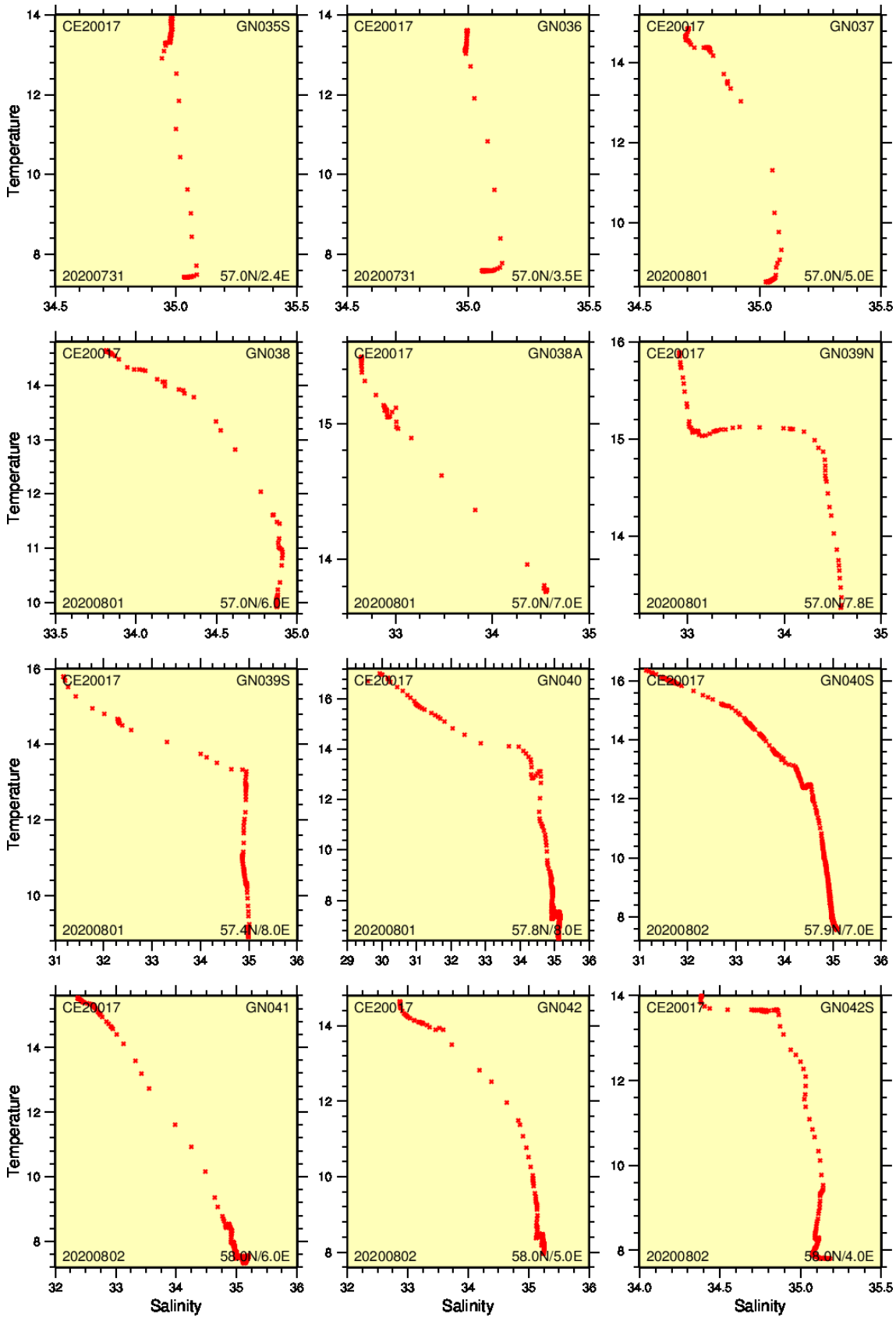
CE20017 GN029
20200730 56.0N/3.0E
CE20017 GN030
20200730 56.0N/2.0E
CE20017 GN031
20200730 56.0N/1.0E
CE20017 GN032
20200730 56.0N/0.0W
CE20017 GN033
20200730 56.0N/1.0W
CE20017 GN033A
20200730 56.0N/1.7W
CE20017 GN033S
20200730 56.5N/1.7W
CE20017 GN034A
20200731 57.0N/1.7W
CE20017 GN034
20200731 57.0N/1.0W
CE20017 GN034S
20200731 57.0N/0.2E
CE20017 GN035
20200731 57.0N/1.3E
Temperature
Salinity


CE20017 GN035S
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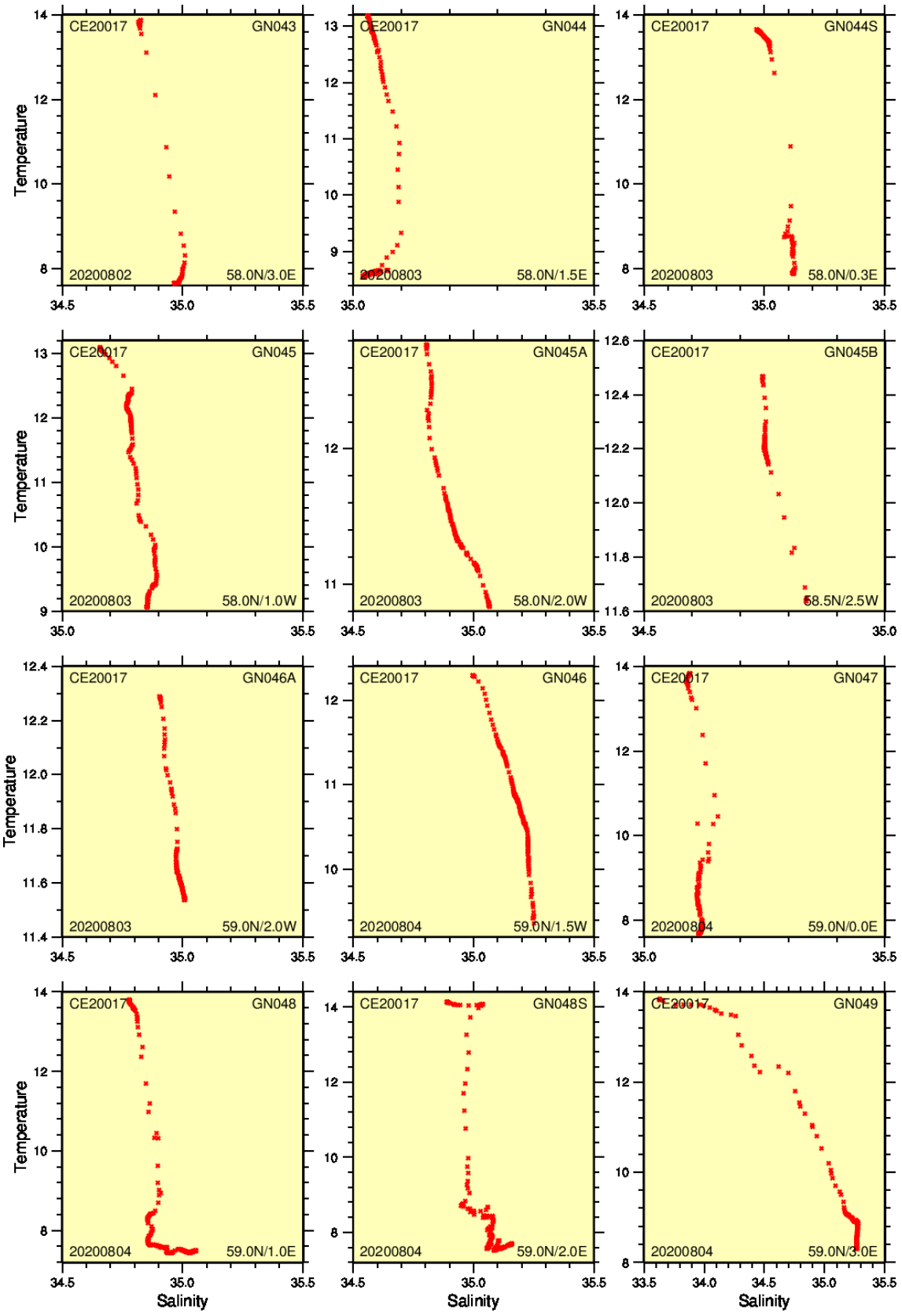
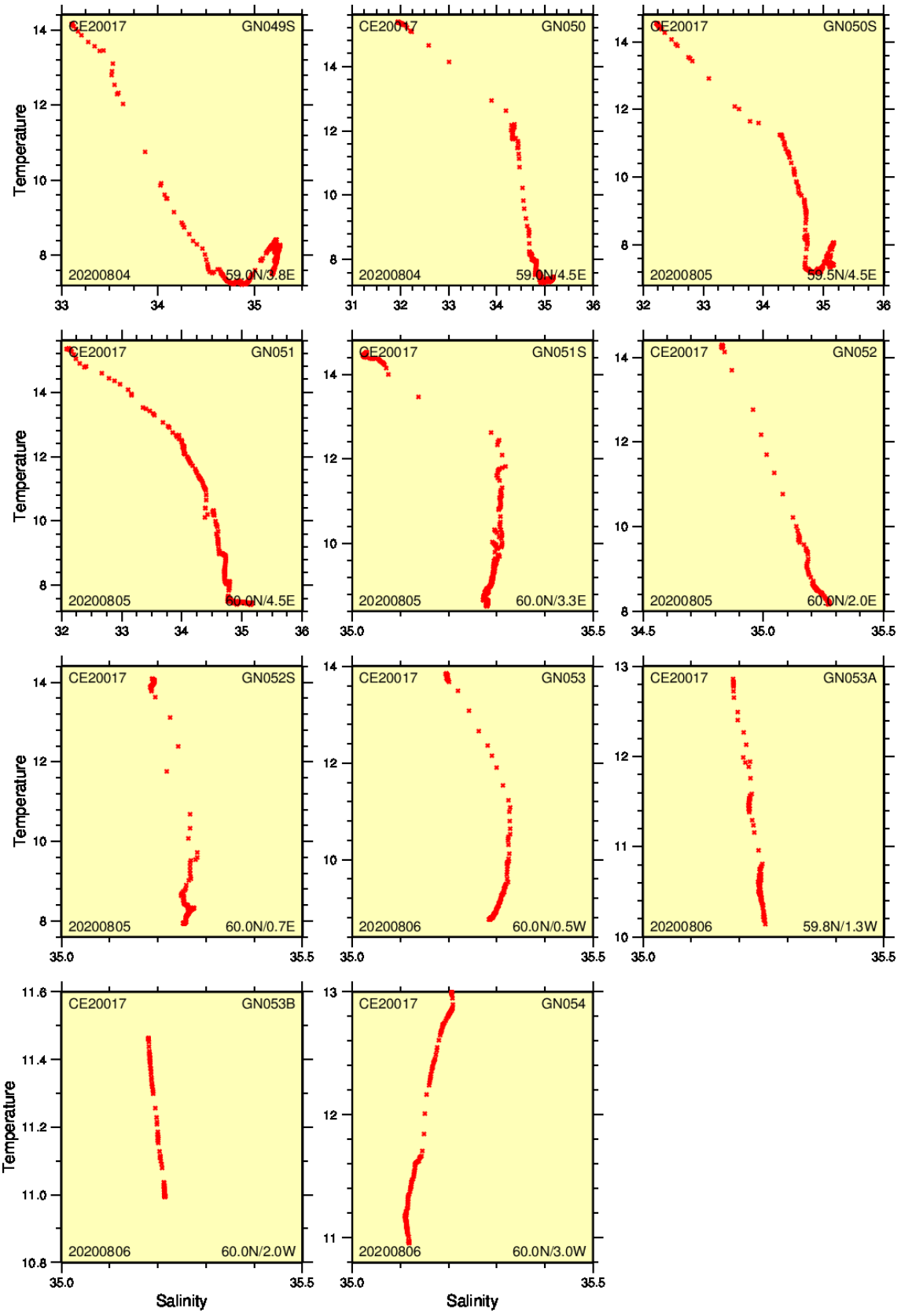
CE20017 GN036
20200731 57.0N/3.5E
CE20017 GN037
20200801 57.0N/5.0E
CE20017 GN038
20200801 57.0N/6.0E
CE20017 GN038A
20200801 57.0N/7.0E
CE20017 GN039N
20200801 57.0N/7.8E
CE20017 GN039S
20200801 57.4N/8.0E
CE20017 GN040
20200801 57.8N/8.0E
CE20017 GN040S
20200802 57.9N/7.0E
CE20017 GN041
20200802 58.0N/6.0E
CE20017 GN042
20200802 58.0N/5.0E
CE20017 GN042S
20200802 58.0N/4.0E
Temperature
Salinity


CE20017 GN043
20200802 58.0N/3.0E
CE20017 GN044
20200803 58.0N/1.5E
CE20017 GN044S
20200803 58.0N/0.3E
CE20017 GN045
20200803 58.0N/1.0W
CE20017 GN045A
20200803 58.0N/2.0W
CE20017 GN045B
20200803 58.5N/2.5W
CE20017 GN046A
20200803 59.0N/2.0W
CE20017 GN046
20200804 59.0N/1.5W
CE20017 GN047
20200804 59.0N/0.0E
CE20017 GN048
20200804 59.0N/1.0E
CE20017 GN048S
20200804 59.0N/2.0E
CE20017 GN049
20200804 59.0N/3.0E
Temperature
Salinity


CE20017 GN049S
20200804 59.0N/3.8E
CE20017 GN050
20200804 59.0N/4.5E
CE20017 GN050S
20200805 59.5N/4.5E
CE20017 GN051
20200805 60.0N/4.5E
CE20017 GN051S
20200805 60.0N/3.3E
CE20017 GN052
20200805 60.0N/2.0E
CE20017 GN052S
20200805 60.0N/0.7E
CE20017 GN053
20200806 60.0N/0.5W
CE20017 GN053A
20200806 59.8N/1.3W
CE20017 GN053B
20200806 60.0N/2.0W
CE20017 GN054
20200806 60.0N/3.0W
Temperature
Salinity

Appendix 7: List of sample details, temperature and salinity surface and bottom values and difference surface – bottom, depth of thermocline, and Secchi depth.

Station	Anz	water depth	Lot	N°	N'	N	E°	E'	E	Phi	Lam	date [dd.mm.yy]	time [UTC] begin	time [UTC] end	Bedford ID 202nnn	water sampling & CTD [m]	radio-activity	Nutrients [m]	Organic [m]	Secchi depth [m]	$T_{surface}$ [°C]	T_{bottom} [°C]	$T_{surf} - T_{bot}$ [K]	$S_{surface}$	S_{bottom}	$S_{surf} - S_{bot}$	depth of thermo-cline *
GN003	1	31	26	54	00.0	N	08	06.5	E	54.00	8.11	23.07.2020	10:52	11:26	001-002	bo, 5	Cs, TU	bo, 5	5	2.5	17.9428	16.9017	1.0411	31.5400	31.8594	-0.3194	
GN003A	2	35	30	54	00.0	N	07	10.0	E	54.00	7.17	23.07.2020	14:50	15:05	003-004	bo, 5	Cs, TU	-	5		17.4646	17.0918	0.3728	33.0334	33.1494	-0.1160	
GN007	3	34	29	53	56.0	N	06	25.0	E	53.93	6.42	23.07.2020	17:46	18:18	005-006	bo, 5	Cs, TU	bo, 5	5	5.5	17.8553	17.8355	0.0198	33.2142	33.2232	-0.0090	
GN007A	4	42	37	54	00.0	N	05	40.0	E	54.00	5.67	23.07.2020	21:23	21:52	007-008	bo, 5	Cs, Tu, H3, Sr	-	5		17.1884	16.7138	0.4746	34.3197	34.4569	-0.1372	
GN008	5	46	41	54	00.0	N	04	50.0	E	54.00	4.83	24.07.2020	01:19	01:45	009-010	bo, 5	Cs	bo, 5	5		16.6227	15.8320	0.7907	34.4610	34.5216	-0.0606	14.0
GN008S	6	51	46	54	00.0	N	03	55.0	E	54.00	3.92	24.07.2020	05:15	05:33	011-012	bo, 5		-	5		16.3732	13.7867	2.5865	34.6187	34.5914	0.0273	12.0
GN009	7	46	41	54	00.0	N	03	00.0	E	54.00	3.00	24.07.2020	09:00	09:45	013-014	bo, 5	Cs, TU, H3, Sr	bo, 5	5	11.5	16.4164	14.3256	2.0908	34.5926	34.5983	-0.0057	17.0
GN009A	8	34	29	53	25.0	N	03	30.0	E	53.42	3.50	24.07.2020	13:45	14:02	015-016	bo, 5	Cs	-	5	4.5	16.4848	16.3449	0.1399	34.2959	34.2874	0.0085	
GN010	9	34	29	53	00.0	N	04	00.0	E	53.00	4.00	24.07.2020	17:31	17:46	017-018	bo, 5	Cs, TU	bo, 5	5	6.0	16.9449	16.7846	0.1603	34.3405	34.3374	0.0031	
GN011	10	24	19	52	30.0	N	04	20.0	E	52.50	4.33	24.07.2020	21:32	22:01	019-020	bo, 5	Cs	bo, 5	5		18.6782	18.6825	-0.0043	31.5233	31.5387	-0.0154	
GN012	11	30	25	52	00.0	N	03	44.0	E	52.00	3.73	25.07.2020	02:30	02:57	021-022	bo, 5	Cs, TU, H3, Sr	bo, 5	5		18.2903	18.2878	0.0025	33.1474	33.2084	-0.0610	
GN013N	12	48	43	51	42.2	N	02	51.4	E	51.70	2.86	25.07.2020	07:48	08:09	023-024	bo, 5	Cs, TU, H3, Sr	bo, 5	5	6.0	17.5740	17.5685	0.0055	34.9605	34.9671	-0.0066	
GN014	13	33	28	52	00.0	N	02	00.0	E	52.00	2.00	25.07.2020	13:05	13:44	025-026	bo, 5	Cs, TU, H3, Sr	bo, 5	5	5.0	17.0764	17.0418	0.0346	34.7127	34.8027	-0.0900	
GN015	14	53	48	52	30.0	N	02	30.0	E	52.50	2.50	25.07.2020	16:38	17:01	027-028	bo, 5	Cs	bo, 5	5	6.0	17.1242	16.9474	0.1768	34.1205	34.1806	-0.0601	
GN015B	15	48	43	52	50.0	N	02	10.0	E	52.83	2.17	25.07.2020	19:08	19:24	029-030	bo, 5	Cs	-	5		16.4359	16.4407	-0.0048	34.2797	34.2892	-0.0095	
GN016	16	35	30	53	20.0	N	01	40.0	E	53.33	1.67	25.07.2020	23:10	23:37	031-032	bo, 5	Cs, TU	bo, 5	5		15.2674	15.2622	0.0052	34.4483	34.4484	-0.0001	
GN009S	17	79	74	54	00.0	N	02	00.0	E	54.00	2.00	26.07.2020	05:07	05:27	033-034	bo, 5		-	5		15.5239	12.8595	2.6644	34.5828	34.5987	-0.0159	15.0
GN017	18	20	15	54	00.0	N	01	00.0	E	54.00	1.00	26.07.2020	09:29	10:09	035-036	bo, 5	Cs	bo, 5	5	6.0	14.1958	13.1981	0.9977	34.5283	34.5284	-0.0001	12.5
GN017A	19	59	54	54	00.0	N	00	20.0	E	54.00	0.33	26.07.2020	12:44	12:59	037-043	bo, 20, 5	Cs, TU, H3, Sr	-	5	8.0	13.2281	13.0933	0.1348	34.1902	34.1957	-0.0055	
GN017S	20	66	61	54	30.0	N	00	10.0	W	54.50	-0.17	26.07.2020	16:05	16:22	044-045	bo, 5		-	5	8.5	15.1992	10.9059	4.2933	34.1625	34.2843	-0.1218	15.0
GN018A	21	73	68	55	00.0	N	00	40.0	W	55.00	-0.67	26.07.2020	20:05	20:23	046-047	bo, 5	Cs	-	5		14.6903	9.3245	5.3658	34.2543	34.3675	-0.1132	17.0
GN018	22	82	77	55	00.0	N	00	00.0	E	55.00	0.00	26.07.2020	22:37	22:58	048-049	bo, 5	Cs	bo, 5	5		15.2419	7.7480	7.4939	34.4603	34.5000	-0.0397	17.0
GN018S	23	69	64	55	00.0	N	01	00.0	E	55.00	1.00	27.07.2020	02:26	02:46	050-051	bo, 5		-	5		15.9468	9.5027	6.4441	34.3688	34.4930	-0.1242	15.0
GN019	24	32	27	55	00.0	N	02	00.0	E	55.00	2.00	27.07.2020	06:22	06:42	052-053	bo, 5	Cs, TU	bo, 5	5	12.0	15.7477	14.9481	0.7996	34.5837	34.6267	-0.0430	16.0
GN019S	25	30	25	55	00.0	N	03	00.0	E	55.00	3.00	27.07.2020	10:11	10:24	054-055	bo, 5		-	5	7.5	15.7009	15.5469	0.1540	34.6969	34.6944	0.0025	
GN020	26	56	51	55	00.0	N	04	00.0	E	55.00	4.00	27.07.2020	13:54	14:17	056-057	bo, 5		bo, 5	5	11.0	16.3406	10.1360	6.2046	34.7376	34.5884	0.1492	18.0
GN021	27	48	43	55	00.0	N	05	00.0	E	55.00	5.00	27.07.2020	18:17	18:47	058-059	bo, 5	Cs	bo, 5	5	7.5	16.1770	11.8409	4.3361	34.6946	34.4892	0.2054	22.0
GN022	28	50	45	55	00.0	N	06	15.0	E	55.00	6.25	27.07.2020	23:23	23:39	060-061	bo, 5	Cs	bo, 5	5		16.6023	15.4592	1.1431	34.0762	34.1044	-0.0282	24.0
GN022A	29	38	33	55	00.0	N	07	00.0	E	55.00	7.00	28.07.2020	02:27	02:47	062-063	bo, 5	Cs	-	5		16.1376	16.1397	-0.0021	33.7163	33.7152	0.0011	
GN023	30	32	27	55	00.0	N	07	35.0	E	55.00	7.58	28.07.2020	04:51	05:14	064-065	bo, 5	Cs, TU	bo, 5	5	7.5	17.0221	17.0218	0.0003	32.7114	32.7120	-0.0006	
GN024	31	27	22	55	00.0	N	08	00.0	E	55.00	8.00	28.07.2020	07:18	07:40	066-067	bo, 5		-	5	7.5	17.8937	17.8947	-0.0010	31.4654	31.4664	-0.0010	
GN025	32	21	16	55	00.0	N	08	15.0	E	55.00	8.25	28.07.2020	08:40	08:54	068-069	bo, 5	Cs, TU	bo, 5	5	3.0	18.1785	18.1708	0.0077	31.0185	31.0161	0.0024	

GN026N	33	32	27	56	00.0	N	07	40.0	E	56.00	7.67	28.07.2020	17:23	18:01	070-071	bo, 5	Cs, TU, H3, Sr	bo, 5	5	4.0	16.0074	15.9997	0.0077	33.5734	33.5734	0.0000	
GN026A	34	40	35	56	00.0	N	07	00.0	E	56.00	7.00	28.07.2020	22:57	23:27	072-073	bo, 5	Cs, TU, H3, Sr	-	5		15.5063	15.5162	-0.0099	34.0814	34.0807	0.0007	
GN027	35	52	47	56	00.0	N	06	00.0	E	56.00	6.00	29.07.2020	07:24	08:01	074-075	bo, 5	Cs	bo, 5	5		15.0640	13.6175	1.4465	34.7219	34.4592	0.2627	36.0
GN028	36	48	43	56	00.0	N	05	00.0	E	56.00	5.00	29.07.2020	15:16	15:38	076-077	bo, 5	Cs	bo, 5	5		14.6495	11.7066	2.9429	34.9415	34.9657	-0.0242	32.0
GN028S	37	62	57	56	00.0	N	04	00.0	E	56.00	4.00	29.07.2020	21:02	21:38	078-079	bo, 5		-	5		14.4379	8.4791	5.9588	34.9734	34.7804	0.1930	35.0
GN029	38	79	74	56	00.0	N	03	00.0	E	56.00	3.00	30.07.2020	01:44	02:18	080-081	bo, 5	Cs, TU, H3, Sr	bo, 5	5		14.3828	7.8063	6.5765	34.9765	34.8893	0.0872	35.0
GN030	39	92	87	56	00.0	N	02	00.0	E	56.00	2.00	30.07.2020	05:48	06:08	082-083	bo, 5	Cs	bo, 5	5	14.5	14.5165	7.5226	6.9939	34.8436	34.8789	-0.0353	35.0
GN031	40	84	79	56	00.0	N	01	00.0	E	56.00	1.00	30.07.2020	09:47	10:04	084-085	bo, 5	Cs	bo, 5	5	11.5	14.2324	7.6564	6.5760	34.7558	34.7947	-0.0389	35.0
GN032	41	85	80	56	00.0	N	00	00.0	E	56.00	0.00	30.07.2020	13:33	13:50	086-087	bo, 5	Cs	bo, 5	5	8.0	14.4398	7.8644	6.5754	34.6097	34.7280	-0.1183	28.0
GN033	42	71	66	56	00.0	N	01	00.0	W	56.00	-1.00	30.07.2020	17:15	17:56	088-089	bo, 5	Cs	bo, 5	5	5.5	13.5017	9.5473	3.9544	34.4293	34.5644	-0.1351	26.0
GN033A	43	73	68	56	00.0	N	01	40.0	W	56.00	-1.67	30.07.2020	20:01	20:17	090-091	bo, 5	Cs, TU	-	5		12.3650	10.0753	2.2897	34.2833	34.4955	-0.2122	32.0
GN033S	44	55	50	56	30.0	N	01	40.0	W	56.50	-1.67	30.07.2020	23:30	23:44	092-093	bo, 5		-	5		12.6658	10.4664	2.1994	34.4859	34.5437	-0.0578	
GN034A	45	81	76	57	00.0	N	01	40.0	W	57.00	-1.67	31.07.2020	02:46	03:04	094-095	bo, 5	Cs, TU, H3, Sr	-	5		12.3182	10.7676	1.5506	34.5069	34.6238	-0.1169	
GN034	46	78	73	57	00.0	N	01	00.0	W	57.00	-1.00	31.07.2020	05:23	05:47	096-097	bo, 5	Cs	bo, 5	5	6.0	13.2737	9.8768	3.3969	34.6084	34.6835	-0.0751	
GN034S	47	90	85	57	00.0	N	00	10.0	E	57.00	0.17	31.07.2020	09:56	10:12	098-099	bo, 5		-	5	7.0	13.4835	8.1025	5.3810	34.7545	34.8585	-0.1040	33.0
GN035	48	103	98	57	00.0	N	01	20.0	E	57.00	1.33	31.07.2020	14:34	15:29	100-102	bo, 50, 5	Cs	bo, 5	50, 5	10.0	13.6491	7.4843	6.1648	34.8290	34.9957	-0.1667	35.0
GN035S	49	86	81	57	00.0	N	02	25.0	E	57.00	2.42	31.07.2020	19:30	19:47	103-109	bo, 5x35, 5		35	5	9.5	13.8767	7.4414	6.4353	34.9811	35.0338	-0.0527	40.0
GN036	50	71	66	57	00.0	N	03	30.0	E	57.00	3.50	31.07.2020	23:52	00:16	110-111	bo, 5	Cs, TU	bo, 5	5		13.5143	7.5970	5.9173	34.9896	35.0580	-0.0684	35.0
GN037	51	64	59	57	00.0	N	05	00.0	E	57.00	5.00	01.08.2020	05:50	06:08	112-113	bo, 5	Cs	bo, 5	5	13.5	14.8580	8.5121	6.3459	34.6536	35.0232	-0.3696	34.0
GN038	52	57	52	57	00.0	N	06	00.0	E	57.00	6.00	01.08.2020	09:48	10:21	114-115	bo, 5	Cs	bo, 5	5	10.5	14.6050	9.9491	4.6559	33.8259	34.8723	-1.0464	28.0
GN038A	53	39	34	57	00.0	N	07	00.0	E	57.00	7.00	01.08.2020	14:07	14:21	116-117	bo, 5	Cs, TU, H3, Sr	-	5	10.5	15.4771	13.7782	1.6989	32.6428	34.5389	-1.8961	25.0
GN039N	54	38	33	57	00.0	N	07	50.0	E	57.00	7.83	01.08.2020	17:12	17:35	118-119	bo, 5	Cs, TU, H3, Sr	bo, 5	5	11.5	15.7945	13.2479	2.5466	32.9177	34.5810	-1.6633	
GN039S	55	98	93	57	25.0	N	08	00.0	E	57.42	8.00	01.08.2020	20:09	20:29	120-121	bo, 5		-	5		15.7567	8.8959	6.8608	31.1642	34.9934	-3.8292	
GN040	56	517	512	57	50.0	N	08	00.0	E	57.83	8.00	01.08.2020	22:51	02:29	122-124	bo, 50, 5	Cs, TU, H3, Sr	bo, 5	50, 5		16.9216	6.4843	10.4373	30.0859	35.1196	-5.0337	
GN040S	57	368	363	57	55.0	N	07	00.0	E	57.92	7.00	02.08.2020	05:36	06:11	125-126	bo, 5		-	5	4.5	16.3536	7.5707	8.7829	31.1168	35.0873	-3.9705	
GN041	58	313	308	58	00.0	N	06	00.0	E	58.00	6.00	02.08.2020	09:19	09:54	127-128	bo, 5	Cs, TU, H3, Sr	bo, 5	5	7.5	15.3669	7.5310	7.8359	32.5049	35.1943	-2.6894	30.0
GN042	59	131	126	58	00.0	N	05	00.0	E	58.00	5.00	02.08.2020	13:17	13:37	129-130	bo, 5	Cs	bo, 5	5	9.5	14.5411	7.9764	6.5647	32.8694	35.2425	-2.3731	23.0
GN042S	60	103	98	58	00.0	N	04	00.0	E	58.00	4.00	02.08.2020	16:55	17:12	131-132	bo, 5		-	5	11.5	13.7178	7.8124	5.9054	34.4192	35.1789	-0.7597	
GN043	61	81	76	58	00.0	N	03	00.0	E	58.00	3.00	02.08.2020	20:31	20:53	133-134	bo, 5	Cs	bo, 5	5		13.8048	7.6564	6.1484	34.8208	34.9661	-0.1453	30.0
GN044	62	110	105	58	00.0	N	01	30.0	E	58.00	1.50	03.08.2020	01:43	02:12	135-136	bo, 5	Cs, TU	bo, 5	5		13.1613	8.6717	4.4896	35.0269	35.0723	-0.0454	40.0
GN044S	63	144	139	58	00.0	N	00	15.0	E	58.00	0.25	03.08.2020	06:23	06:43	137-138	bo, 5		-	5	12.5	13.6821	7.9087	5.7734	34.9589	35.1200	-0.1611	35.0
GN045	64	118	113	58	00.0	N	01	00.0	W	58.00	-1.00	03.08.2020	10:55	11:29	139-140	bo, 5	Cs, TU	bo, 5	5	7.5	13.0565	9.0687	3.9878	35.0797	35.1756	-0.0959	
GN045A	65	93	88	58	00.0	N	02	00.0	W	58.00	-2.00	03.08.2020	14:54	15:11	141-142	bo, 5	Cs, TU, H3, Sr	-	5	10.0	12.7697	10.8328	1.9369	34.8044	35.0659	-0.2615	
GN045B	66	76	71	58	30.0	N	02	30.0	W	58.50	-2.50	03.08.2020	18:33	18:50	143-149	bo, 5x35, 5	Cs, TU, H3	35	5	10.5	12.4010	11.9120	0.4890	34.7457	34.7897	-0.0440	
GN046A	67	84	79	59	00.0	N	02	00.0	W	59.00	-2.00	03.08.2020	22:11	22:29	150-151	bo, 5	Cs, TU, H3, Sr	-	5		12.2558	11.5368	0.7190	34.9094	35.0083	-0.0989	
GN046	68	112	107	59	00.0	N	01	30.0	W	59.00	-1.50	04.08.2020	00:01	00:28	152-153	bo, 5	Cs	bo, 5	5		12.2619	9.3887	2.8732	34.9900	35.2478	-0.2578	

GN047	69	136	131	59	00.0	N	00	00.0	E	59.00	0.00	04.08.2020	05:07	05:28	154-155	bo, 5	Cs	bo, 5	5	15.0	13.8136	7.6691	6.1445	35.0939	35.1141	-0.0202	30.0
GN048	70	129	124	59	00.0	N	01	00.0	E	59.00	1.00	04.08.2020	08:40	09:14	156-157	bo, 5	Cs, TU, H3, Sr	bo, 5	5	14.5	13.7595	7.4988	6.2607	34.7760	35.0543	-0.2783	27.0
GN048S	71	119	114	59	00.0	N	02	00.0	E	59.00	2.00	04.08.2020	12:22	12:41	158-159	bo, 5		-	5	16.0	14.1411	7.6950	6.4461	34.8841	35.1589	-0.2748	30.0
GN049	72	142	137	59	00.0	N	03	00.0	E	59.00	3.00	04.08.2020	15:53	16:14	160-161	bo, 5	Cs	bo, 5	5	8.0	13.8032	8.3097	5.4935	33.6096	35.2647	-1.6551	23.0
GN049S	73	276	271	59	00.0	N	03	45.0	E	59.00	3.75	04.08.2020	18:49	19:26	162-163	bo, 5		-	5		14.1267	7.5577	6.5690	33.1094	35.1988	-2.0894	25.0
GN050	74	263	258	59	00.0	N	04	30.0	E	59.00	4.50	04.08.2020	22:17	23:05	164-165	bo, 5	Cs, TU, H3, Sr	bo, 5	5		15.3378	7.4586	7.8792	31.9820	35.1796	-3.1976	25.0
GN050S	75	270	265	59	30.0	N	04	30.0	E	59.50	4.50	05.08.2020	01:59	02:33	166-167	bo, 5		-	5		14.5483	7.4172	7.1311	32.2249	35.1609	-2.9360	27.0
GN051	76	265	260	60	00.0	N	04	30.0	E	60.00	4.50	05.08.2020	05:28	06:04	168-169	bo, 5	Cs, TU	bo, 5	5	8.0	15.3312	7.4537	7.8775	32.1081	35.1607	-3.0526	
GN051S	77	220	215	60	00.0	N	03	15.0	E	60.00	3.25	05.08.2020	10:35	11:11	170-171	bo, 5		-	5	9.0	14.5246	8.5237	6.0009	35.0223	35.2797	-0.2574	26.0
GN052	78	106	101	60	00.0	N	02	00.0	E	60.00	2.00	05.08.2020	15:19	15:45	172-173	bo, 5	Cs	bo, 5	5	13.0	14.2512	8.1784	6.0728	34.8285	35.2683	-0.4398	28.0
GN052S	79	133	128	60	00.0	N	00	45.0	E	60.00	0.75	05.08.2020	19:23	20:03	174-175	bo, 5		-	5		13.9414	7.9367	6.0047	35.1867	35.2540	-0.0673	28.0
GN053	80	130	125	60	00.0	N	00	30.0	W	60.00	-0.50	06.08.2020	00:00	00:26	176-177	bo, 5	Cs, TU, H3, Sr	bo, 5	5		13.8404	8.7648	5.0756	35.1892	35.2851	-0.0959	28.0
GN053A	81	105	100	59	48.0	N	01	20.0	W	59.80	-1.33	06.08.2020	03:18	03:39	178-179	bo, 5	Cs	-	5		12.3039	10.1980	2.1059	35.1923	35.2492	-0.0569	
GN053B	82	75	70	60	00.0	N	02	00.0	W	60.00	-2.00	06.08.2020	05:38	05:56	180-181	bo, 5	Cs	-	5	12.5	11.4718	10.9972	0.4746	35.1803	35.2144	-0.0341	
GN054	83	81	76	60	00.0	N	03	00.0	W	60.00	-3.00	06.08.2020	09:11	09:35	182-183	bo, 5	Cs	bo, 5	5	12.5	12.9758	10.9578	2.0180	35.2052	35.1181	0.0871	

* depth of thermocline: if delta(T) >=0.5K/m

This list is available as a separate sheet of the station-list at:
http://seadata.bsh.de/Cgi-csr/retrieve_sdn2/csrreport.pl?project=SDN&session=19725&v1=10&v2=2