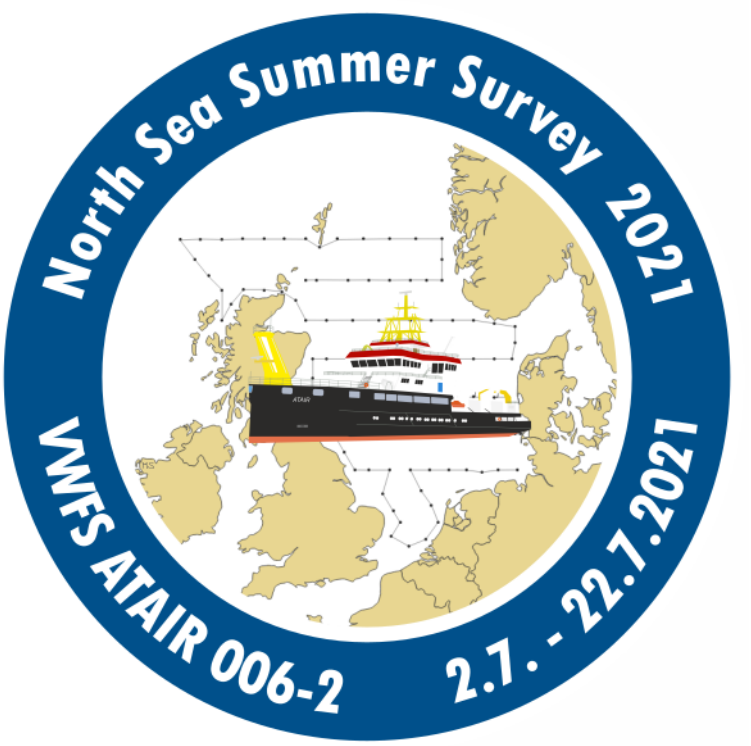
VWFS ATAIR

Cruise AT006-2

July 02 to 22, 2021

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE



Scientific Cruise Report

ICES Cruise Id: see next page

CSRREF: 20210100

Chief Scientist. Dr. Katrin Latarius

Hamburg, March 2022

Contents:

Appendix 1 is also available in excel.

The cruise summary report (CSR) is available at:
https://www.bsh.de/DE/DATEN/Klima-und-Meer/Ozeanographisches_Datenzentrum/Durchgefuehrte_Forschungsfahrten/_Anlagen/Jahre/2021_node.html
and
http://seadata.bsh.de/Cgi-csr/retrieve_sdn2/start_sdn2.pl
Later at
https://csr.seadatanet.org/
and
https://ocean.ices.dk/csr/
Then, also an ICES Cruise Id is provided.

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 its 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. Unfortunately, in 2021 the radioactivity, nutrient and environmental pollution working groups were not able to take part in the survey.
In 2021, as for many other years, the work was expanded to the Northwest to additionally monitor the inflow of Atlantic Water.

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 nuclides	air chemistry
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	●	●	●		●	
02.07.2021 – 22.07.2021	VWFS Atair AT006-2	3748	●	(●)				

Table 1: BSH North SEA Summer Surveys 1998-2021.

Station Map

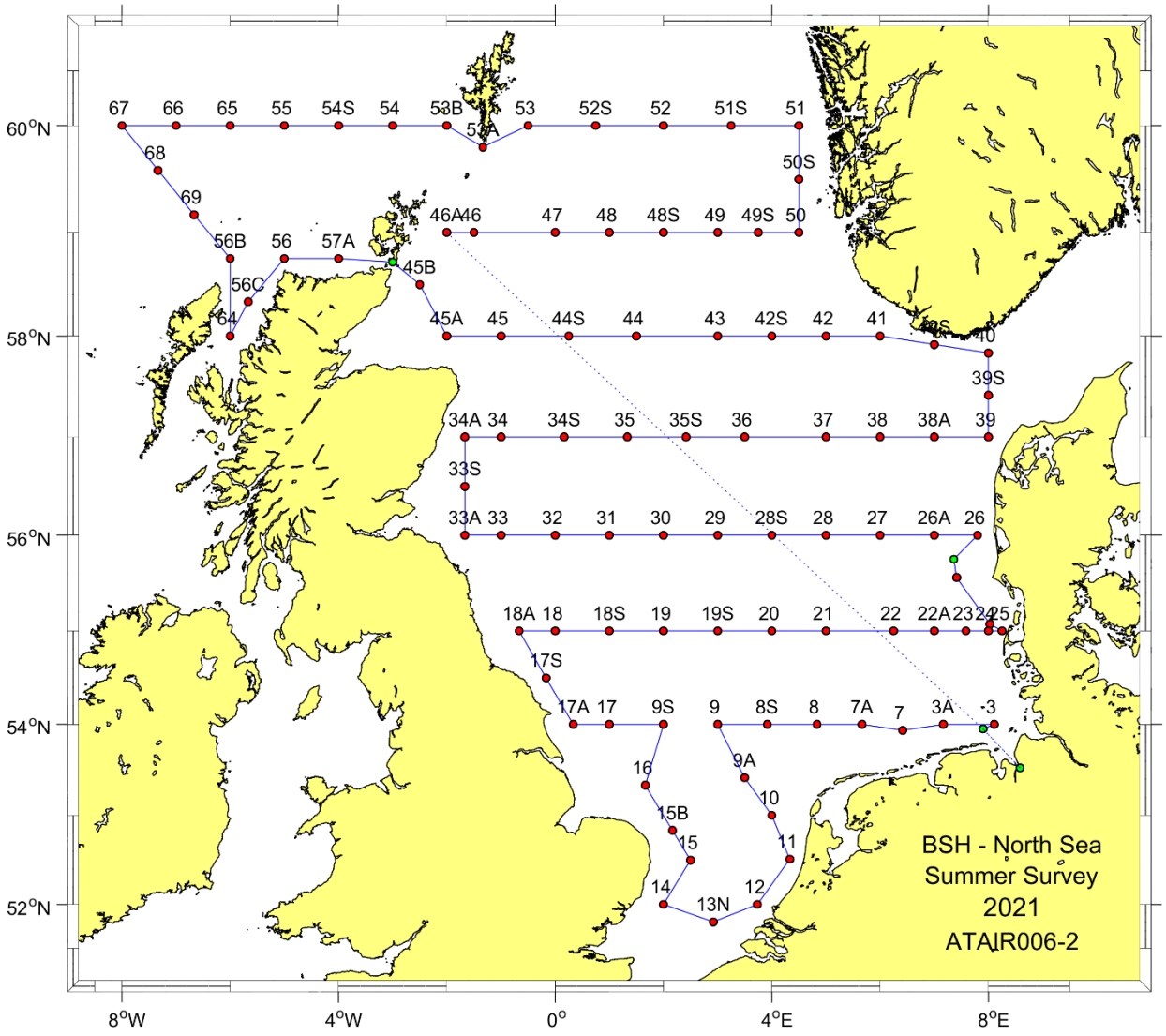


Figure 1: Stations and ship track of AT006-2.

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.

CTD profiles were **processed in near-real-time** on board and sent to the German Oceanographic Data Centre (DOD): They were made available via
https://www.geoseaportal.de
and
https://www.govdata.de/
These data are only visually checked and will be quality controlled ashore after the survey. Especially salinities, calculated from temperature, conductivity and pressure from the CTD, will be compared with ashore analysed salinities from water samples resulting in the possibly correction of CTD Conductivity/salinity.

Sensors:

CTD station 1-95:						
instrument		**sensor**	**manufact.**	**model**	**serial no.**	**calibration date**
Sonde S1, SBE911+	09P21787	press	Sea-Bird	SBE9P	577	06.02.19
		temp	Sea-Bird	SBE3T	5290	23.06.21
		cond	Sea-Bird	SBE4C	3772	23.06.21
		temp2	Sea-Bird	SBE3T	4753	23.06.21
		cond2	Sea-Bird	SBE4C	2378	23.06.21
Deck Unit CTD			Sea-Bird	SBE11+	11P29178-0620	
Rosette 1		12x10L (Niskin)				
Fluorometer			Wetlabs	WetlabECO	4964	15.01.18
Turbidity meter			Wetlabs	WetlabECO	""	"
Oximeter S2			Sea-Bird	SBE43	153	25.03.21
Altimeter	-	-	Teledyne	Benthos	978	14.03.02
pH			Sea-Bird	SBE18	1419	xx.xx.xx

Bottles:

Date:	03.-07.07.2021 Stat 1-22 (GN003-GN018)	07.-15.07.2021 from Stat 23 (GN018S) onward	15.-18.07.2021 from Stat 73 (GN068) onward	18.07.2021-end from Stat 87 (GN050S) onward
CTD:	**S1**	**S1**	**S1**	**S1**
Ros.Position	Bottle ID	Bottle ID	Bottle ID	Bottle ID
1	181001	181001	181001	181001
2	181002	181017	181017	181017
3	181003	181003	181003	181003
4	181004	181004	181004	181004
5	181005	181005	181005	181005
6			181018	181018
7				181014
8				181008
9				181009
10				
11				
12				

Nutrients:

- 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 at -80°C for the determination of chlorophyll according to Aminot and Rey after the cruise.

Visible pollution:

- Surface sampling of visible pollution (ViPo) using a 0.405 mm Neuston net and characterization of the non-biota part (e.g., paraffin wax, vegetable oil, plastics) in the lab after the survey. Individual net hauls for 30 min with 3 kn ship speed.

Technical Problems

CTD data acquisition:

In the beginning of the survey it was not possible to establish a stable NMEA-input (data from navigation: position and time for start, bottom and end of the profile) to the CTD deck unit. Thus, for stations 1-11, 17 and 33 these data were added afterwards on the basis of the DSHIP data set. Only the bottle-files were corrected during the cruise.

Journal

Time on station is given in UTC+2, as local time on AT006-2 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 occurrences are given.

Weather:
T_A = air temperature, T_W = 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: Manuela
04-08/16-20: Peter
08-12/20-00: Simon

Secchi/Chlorophyll/Neuston Net:
07-16: Lena
15-24: Lynn

Friday, July 02, 2021

09:00	Arrival of containers and equipment at Atair. Berth: Fischereihafen, Labradorkai, Ecke Seewindstraße – Am Luneort, 27572 Bremerhaven. Start of mobilisation by use of own crane.
11:00	Arrival of scientific crew.
11:00	Container loading is finished. Lashing of the containers. Preparation of dry lab and wet labs and installation of sensor system.
15:00	Welcome of captain and crew to scientific crew. Security instructions by the nautical officers Wiebke Okken and Viktor Hartwich.
18:30	Internal meeting of scientific crew.

Saturday, July 03, 2021

07:30	Sailing
08:00	Passing double lock
12:40	First station
Weather 12:00	T_A=15.7 °C, T_W= 17.0 °C, S=31.36, wind 4.8 m/s (3 Bft) from 330°, P_A= 1016.5 hPa, RH=74 %, cloudiness: 4-3/8, cumulus.
Stations	
12:40	GN003 (ELBE1)
17:22	GN003A Neuston net haul
21:05	GN007 (Borkumriffgrund) Practice alarm before dinner. In the evening RV Heincke was in sight south of us, steaming in the same direction. No NMEA-input for CTD data acquisition (work-around for some stations; for details see: „Technical problems“, page 7). Problems with CTD data acquisition laptop. Switch over to backup laptop.

Sunday, July 04, 2021

Weather 12:00	T_A=15.2 °C, T_W= 15.7 °C, S=34.21, wind 6.1 m/s (4 Bft) from 176°, P_A= 1008.5 hPa, RH=94 %, cloudiness: 4/8, stratocumulus and cirrus.
Stations	
00:10	GN007A
04:15	GN008
08:18	GN008S
11:44	GN009 Neuston net haul
19:07	GN009A
22:41	GN010 (west of Den Helder)
	Sunny afternoon!

Monday, July 05, 2021

Weather 12:00	T_A=15.2 °C, T_W= 15.4 °C, S=34.64, wind 8.7 m/s (5 Bft) from 209°, P_A= 1007 hPa, RH=84 %, cloudiness: 3/8, stratocumulus.
Stations	
02:40	GN011(west of Ijmuiden)

07:05 GN012 (west of Hoek van Holland)
11:14 GN013 (Rabsbank)
Neuston net haul
16:02 GN014 (Outer Gabbard)
19:58 GN015 (east of Lowestoft)
Neuston net haul
23:22 GN015B

GN011 is located in a traffic separation scheme. Because of some traffic the exact position was not reached, but it was still within the range of 0.02°N/S and 0.03°E/W of the station in the MUDAB.

Tuesday, July 06, 2021

Weather 12:00 T_A=14.0 °C, T_W= 14.1 °C, S=34.51, wind 8.2 m/s (5 Bft) from 179°, P_A= 995 hPa, RH=88 %, cloudiness: 8/8, stratus.

Stations
02:46 GN016 (Haddock Bank)
09:00 GN09S (Outer Silver Pit)
12:54 GN017 (east of Flamborough Head)
15:37 GN017A
Neuston net haul
20:11 GN017S
23:58 GN018A

Wednesday, July 07, 2021

Weather 12:00 T_A=14.7 °C, T_W= 15.1 °C, S=34.62, wind 7.1 m/s (4 Bft) from 231°, P_A= 1008 hPa, RH=93 %, cloudiness: 8/8, stratus, light rain, grey all-over.

Stations
02:43 GN018 (Baymans Hole)
06:29 GN018S (Bruceys Garden)
10:12 GN019 (Doggerbank)
Neuston net haul
14:45 GN019S
18:25 GN020 (east of Doggerbank)
22:19 GN021 (Nordschillgrund)

Smoothly riding the waves coming slantwise from behind and getting higher with increasing winds.

Thursday, July 08, 2021

Weather 12:00 T_A=18.2 °C, T_W= 16.9 °C, S=30.42, wind 2.7 m/s (2 Bft) from 182°, P_A= 1021 hPa, RH=90 %, cloudiness: 0/8, bright blue sky, in the afternoon slightly milky.

Stations
03:10 GN022 (Weiße Bank)
06.06 GN022A
08:24 GN023
10:11 GN024
11:19 GN025 (west of Sylt)
Neuston net haul

18:50 GN026 (west of Lyngvik)
21:53 GN026A

Summer time and the living is easy…

Friday, July 09, 2021

Weather T_A=16.0 °C, T_W= 16.5 °C, S=34.87, wind 2.2 m/s (2 Bft) from 179°,
16:00 P_A= 1022 hPa, RH=81 %, cloudiness: 0/8, later 4/8 cumulus/stratocumulus.

Stations
01:27 GN027
04:58 GN028
08:26 GN028S
12:04 GN029
15:37 GN030
Neuston net haul
19:36 GN031
23:10 GN032

Saturday, July 10, 2021

Weather T_A=13.3 °C, T_W= 12.3 °C, S=34.38, wind 7.3 m/s (4 Bft) from 72°,
12:00 P_A= 1017 hPa, RH=98 %, cloudiness: 7/8, stratus/stratocumulus.

Stations
02:45 GN033 (east of Firth of Forth)
05:18 GN033A
08:33 GN033S (Marr Bank)
Neuston net haul
12:07 GN034A
14:39 GN034 (Aberdeen Bank)
16:42 GN034S
Neuston net haul
23:17 GN035 (Coal Pitt)

In the afternoon cloud cover breaking up and warming, cumulus/alto-cumulus, 5/8.

Sunday, July 11, 2021

Weather T_A=16.2 °C, T_W= 16.0 °C, S=34.52, wind 4.7 m/s (3 Bft) from 154°,
12:00 P_A= 1018 hPa, RH=86 %, cloudiness: 0/8, sunny skies.

Stations
03:05 GN035S
06:57 GN036
12:17 GN037 (Große Fischerbank)
16:11 GN038 (Kleine Fischerbank)
19:33 GN038A
Neuston net haul
23:24 GN039 (east of Jyske rev)

Summertime and barbecue

Monday, July 12, 2021

Weather 12:00	T_A=17.9 °C, T_W= 17.3 °C, S=28.78, wind 4.7 m/s (3 Bft) from 96°, P_A= 1017 hPa, RH=76 %, cloudiness: 4/8, cirro/alto/strato-cumulus, to the west very dark strato-cumulus.

Stations	
02:10	GN039S
05:04	GN040 (Skagerrak)
09:02	GN040S Neuston net haul
12:58	GN041 (west of Lindesnes)
16:31	GN042(Eigersundbank)
20:05	GN042S Neuston net haul

Tuesday, July 13, 2021

Weather 12:00	T_A=14.9 °C, T_W= 14.6 °C, S=34.75, wind 5.3 m/s (3 Bft) from 11°, P_A= 1015.5 hPa, RH=97 %, cloudiness: 8/8, stratus, fog – very poor visibility. Although the wind was coming from NE, swell was coming from NNW as well.

Stations	
00:24	GN043 (Lingbank East)
05:17	GN044 (Lingbank West)
09:28	GN044S
15:29	GN045 Neuston net haul
21:18	GN045A Neuston net haul

We decided to pass Pentland Firth the next day to complete the northwesternmost stations first, as long as weather is permitting. The passage was planned for the early morning of the next day with tidal currents pushing us.

Wednesday, July 14, 2021

Weather 12:00	T_A=13.5 °C, T_W= 14.0 °C, S=34.58, wind 7.9 m/s (4 Bft) from 209°, P_A= 1016 hPa, RH=89 %, cloudiness: 7/8, stratus, freshening wind.

Stations	
03:13	GN045B (east of Pentland Firth)
07:57	GN057A (west of Pentland Firth)
11:23	GN056 (Cape Wrath)
15:37	GN056C (North Minch)
18:36	GN064 (Shiant East Bank)
23:54	GN056B (Sulisker Bank South)

We passed the Pentland Firth in the morning dawn and had good views towards the Orkneys and the very north of Scotland.
With freshening winds in the afternoon, the sea was getting rough, but today we had some shelter from the Outer Hebrides.

Thursday, July 15, 2021

Weather 12:00	T_A=12.8°C, T_W= 12.4 °C, S=35.30, wind 8.5 m/s (5 Bft) from 216°,

P_A= 1021 hPa, RH=92 %, cloudiness: 8/8, stratus, rough sea, sometimes misty up to foggy.

Stations
04:23 GN069 (Sulisker Bank North)
08:51 GN068
16:12 GN067 (Ymir Ridge)
19:59 GN066 (Wyville Thomson Ridge)
23:58 GN065 (Færoe Bank Channel)

Between station GN068 and GN067 the 1500 m wire was spooled out and drag behind, afterwards proper spooled on the drum again.
Increasing rough sea.
Telephone call from Faroe as we worked at station GN067. Uncertainty to whom this area belongs. We asked for diplomatic clearance at Great Britain, but the Faroese claim this corner for themselves. I sent them our application.

In the evening we are surrounded by numerous Pilot Whales. They showed impressive jumps for a long while.
Apart from that endless grey.

Friday, July 16, 2021

Weather 12:00 T_A=13.1 °C, T_W= 12.6 °C, S=34.77, wind 9.7 m/s (5 Bft) from 248°, P_A= 1021 hPa, RH=97 %, cloudiness: 8/8, stratus.

Stations
03:49 GN055
07:51 GN054S
11:51 GN054 (Otter Bank)
15:12 GN053B (Foula Bank)
17:53 GN053A (Sumburgh Head)

Fully developed rough sea. At the southern tip of the Shetlands, we switched over to the Clean CTD to test its hub compensation. Afterwards we rest in the shelter of the islands until middle of next day.
Misty day, almost impossible to see the Shetlands although we are very close.

Saturday, July 17, 2021

Weather 12:00 T_A=13.7 °C, T_W= 12.0 °C, S=35.24, wind 14.6 m/s (7 Bft) from 251°, P_A= 1019 hPa, RH=95 %, cloudiness: 8/8, stratus.

Stations
14:55 GN053 (east of Shetlands)
18:57 GN052S (Forty Mile Ground)
23:22 GN052 (Bergen Bank)

We switched back to our standard CTD.
Outside the lee of the Shetlands the sea is still rough. Luckily, we are having it from behind.

Sunday, July 18, 2021

Weather T_A=13.1 °C, T_W= 16.0 °C, S=31.00, wind 8.9 m/s (5 Bft) from 318°,

19:10 P_A= 1021 hPa, RH=76 %, cloudiness: 7/8, stratus.

Stations
03:25 GN051S
07:23 GN051 (west of Selbjörnsfjord)
11:13 GN050S
15:17 GN050 (Utsira Loch)
19:06 GN049S
22:07 GN049 (Utsira Grund)

Monday, July 19, 2021

Weather T_A=12.9 °C, T_W= 13.9 °C, S=34.95, Wind 5.9 m/s (4 Bft) from 257°,
12:00 P_A= 1022.5 hPa, RH=90 %, cloudiness: 5/8, alto cumulus.

Stations
01:33 GN048S
05:01 GN048
08:28 GN047 (Fladengrund Rinne)
13:15 GN046
15:04 GN046A

Finally, the sea calmed down. We enjoyed time on deck with sunshine. We celebrate Peter's very last station.

After finishing our CTD station work, we started a test run for the vessel-mounted ADCP in the afternoon. We did 6 parallel east-west sections of 6 nm with a distance of 1 nm. It was finished in the early morning of the next day.

Tuesday, July 20, 2021

Weather T_A=16.4 °C, T_W= 16.0 °C, Wind 6.0 m/s (4 Bft) from 319°,
12:00 P_A= 1021 hPa, RH=69 %, cloudiness: 6/8.
Heading for Bremerhaven.

Meeting of the scientific crew.

Wednesday, July 21, 2021

Weather T_A=18.3 °C, T_W= 18.5 °C, Wind 5.4 m/s (3 Bft) from 320°,
12:00 P_A= 1024 hPa, RH=66 %, cloudiness: 6/8.

15:00 Scientific talk for everyone about the work done and preliminary results:
„Warum machen wir was wie und wo…
… und was kommt dabei heraus?"

21:30 Anchored at Blexen Road for the night.

Thursday, July 22, 2021

10:30 Weigh anchor.
11:20 Passing Bremerhaven double lock.
11:00 Arrival at Bremerhaven Fischereihafen, Labradorkai.
Equipment stayed on board for third leg of AT006 to the German Bight and Baltic.

Handing over between current and next chief scientist.

15:00 Departure of BSH crew.

Preliminary findings

The following discussion of scientific results from the North Sea Summer Survey (NSSS) is based on CTD data from the real-time data processing, carried out during the survey (see „Equipment and methods", page 6).
A delayed-mode 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. In the surface layer temperatures increased from west to east in the central North Sea. Only two local features differed from this pattern. In the bottom layer, lowest temperatures were observed in the northern central part, increasing east and west to the coast and especially to the south and to the Channel entrance. The surface temperatures were similar to the 2000-2010 summer climatology, but at least 1 K lower in the south and southeast (figure 3.1, middle, left). In addition, two small-scale light warm anomalies occurred in the west around 57°N. In the bottom layer anomalies were negative almost everywhere, but most pronounced around 54°N and off the Danish coast where departures exceeded 5 K (figure 3.1, middle, right). Temperatures along the southwest coast of Norway were slightly too warm, which may be interpreted as a deep southward intrusion of warmer than normal waters from the Atlantic. At 55°N, 3°E a confined strong warm anomaly of up to 2 K was observed. It is the position of the Dogger Bank, where the bottom rises up to 25 m from surrounding depths at 50 m to 70 m. The thermal stratification, due to solar radiation, was well developed at all sections during the 2021 NSSS (see Appendix 4). Bottom water at the Dogger Bank pertains to the warm mixed layer (Figure 4.1), which is why bottom temperatures stand out here from surrounding bottom values.

BSH's 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 (figure 2, right). The seasonal maximum SST was reached during the last week of the survey (table 2). Thus, only the northern measurements are representative of the time span of surface temperatures and vertical stratification reaching their seasonal peak. The overall temperature anomalies are thus not well suited to speculate about warming trends of the area during the last decades, which also holds for the 20 NSSS (figure 2, left).

All sections show a well-developed thermocline at about 20 m depth and a well-mixed layer on top, which became weaker along the UK coast due to strong tidal mixing (see Appendix 4). Even the shallow sections along 54°N and 55°N display a thermocline, at least in central parts. On the whole, however, the depths of the thermocline were shallower than during the 2020 survey, when depths were at least at 30 m and at almost 100 m in the Norwegian Trench (section 58°N).

Salinity:
An inflow of Atlantic Water (S > 35) (appendix 3, Figure 3.2, top) at the surface was observed only in the northwestern part of the North Sea reaching down to 59°N. In the bottom layer, a broad inflow over the entire northern section (60°N) was observed, reaching farther south on the eastern side (58-57°N). An intrusion of Atlantic Water from the southwest through the English Channel was not observed, neither in summer 2020. In the Skagerrak and extending along the southwestern coast of Norway, the outflow from the Baltic is visible at the surface with salinities below 30 PSU. Salinity differences between surface and bottom of up to 6 PSU (appendix 3, Figure 3.2, bottom) mark the spreading of the Baltic outflow along the Norwegian southwest coast. This feature is also visible as a distinct deviation from the overall values around zero in the surface anomaly field (Figure 3.2, middle, left).

The southern sections (figure 4.2) show almost unstratified salinities increasing from east to west. Only at sections 58 to 60°N (figures 4.4. and 4.5) low salinity waters were focused on the eastern mixed layer with deeper waters reflecting the increasing influence of the Atlantic to the north.

Survey period	Cruise ID	Calendar week											
		26	27	28	29	30	31	32	33	34	35	36	37
24.06.1998 – 16.07.1998	Gauss 317								x				
02.07.1999 – 22.07.1999	Gauss 335							x					
09.08.2000 – 23.08.2000	Gauss 353									x			
11.07.2001 – 02.08.2001	Gauss 370					x	x			x			
16.07.2002 – 31.07.2002	Gauss 385									x			
28.07.2003 – 13.08.2003	Gauss 405							x					
05.08.2004 – 20.08.2004	Gauss 425								x				
10.08.2005 – 29.08.2005	Gauss 446										x		
02.08.2006 – 20.08.2006	Gauss 463					x							
03.08.2007 – 17.08.2007	Pelagia 273							x					
21.07.2008 – 05.08.2008	Pelagia 293						x						
20.08.2009 – 09.09.2009	Pelagia 311							x					
04.08.2010 – 22.08.2010	Pelagia 323								x	x			
08.08.2011 – 28.08.2011	CE11010							x					
07.08.2012 – 30.08.2012	CE12011								x	x			
10.08.2013 – 04.09.2013	CE13012						x	x					
01.08.2014 – 25.08.2014	CE14012					x							
07.08.2015 – 30.08.2015	CE15013									x	x		
03.08.2016 – 26.08.2016	CE16011					x				x			
11.08.2017 – 03.09.2017	CE 7013						x			x	x		
28.08.2018 – 13.09.2018	CE18019					x							
26.08.2019 – 17.09.2019	CE19016						x						
22.07.2020 – 09.08.2020	CE20017A								x				
02.07.2021 – 22.07.2021	AT006-2					x							

Table 2: Survey periods (grey coloured boxes) and temporal placement of reference period (red box; 2002 is excluded) for NSSS since 1998. The survey periods of 2019, 2020 and 2021 are coloured green, blue and red according to the coloured lines in Figure 2. The „X" mark the seasonal SST maxima from the 7 day averages (Wednesday to Tuesday) based on the SST maps from BSH [1)].

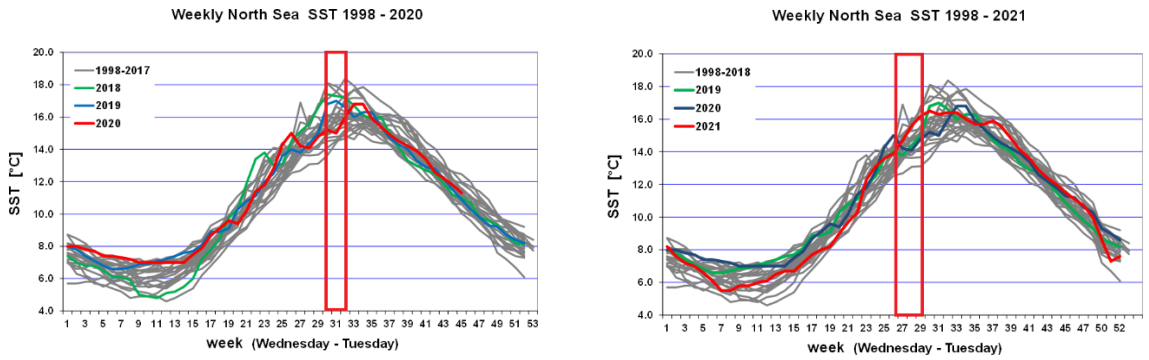


Figure 2: Seasonal signal of SST in the North Sea, based on weekly mean of the BSH merged product from ship observations and NOAA satellite, (left) red line for 2020, (right) red line for 2021. The red boxes mark the time span of the NSSS in 2020 (left) and 2021 (right).

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

Chlorophyll a:

During the survey, water samples from 5 m water depth were filtered for chlorophyll a analyses ashore.

Appendix 3, figure 3.3 shows a comparison between these in-situ measurements and the optical measurements made with the CTD for the surface layer.

Figure 3.3 (top, left) shows the distribution of chlorophyll a in the surface layer determined according to Aminot and Rey (2001) after the survey (see also “Equipment and methods”, page 7). The concentration ranges from more than 11 µg/L close to the coast in the southeast North Sea to almost 0 µg/L in the central part. High values mark the areas of high biological productivity at shallow waters and close to the coast.

Figure 3.3 (top, right) shows the same distribution measured by the CTD.

Differences between the two methods (Figure 3.3, middle, left) were especially high in areas of high chlorophyll a concentrations. Figure 3.3 (bottom) show a linear (left) and a quadratic (right) fit of CTD chlorophyll to in-situ chlorophyll. These fits are only meant as a first hint, that we are far away from seeing a one-to-one relationship between these two kinds of measurements.

Possibly, differences between CTD and in-situ measurements at high concentrations can be explained by effects of turbidity on the optical sensor, as turbidity is also high close to the coast and in shallow waters. Further analyses will be carried out on this topic.

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Container Plan

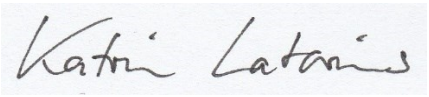
On AT006-2 no containers were stored.

Acknowledgement

We are grateful for the help provided by captain Ulrich Klüber and his crew. Apart from some typical childhood diseases we were impressed about the opportunities of our new BSH research vessel.
We all enjoyed the cruise on the ATAIR and thank captain and crew for professional and motivated work, for friendliness und helpfulness.

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

Otterndorf, March 2022



Appendix 1: Station list

Stat. Nr.	Stat. Name	Start [UTC]	Start Date	Start GPS Phi	Start GPS Lam	Start GPS Lat/Lon						Lot Start [m]	Water depth Start [m]	End [UTC]	End Date	End GPS Phi	End GPS Lam	End GPS Lat/Lon						Lot End [m]	Water depth End [m]	CTD	Secchi	Neuston Net
						Grad	Min	N S	Grad	Min	E W							Grad	Min	N S	Grad	Min	E W					
1	GN003	10:40:26	03-Jul-21	54.000	8.104	54	0.00	N	008	6.24	E	18.7	23.7	11:08:34	03-Jul-21	54.000	8.104	54	0.00	N	008	6.24	E	18.7	23.7	x	x	
2	GN003A	15:22:57	03-Jul-21	54.000	7.163	54	0.02	N	007	9.75	E	25.3	30.3	15:33:17	03-Jul-21	54.000	7.168	54	0.00	N	007	10.08	E	25.6	30.6	x	x	x
3	GN007	19:05:03	03-Jul-21	53.934	6.415	53	56.06	N	006	24.90	E	21.7	26.7	19:28:33	03-Jul-21	53.935	6.415	53	56.07	N	006	24.89	E	21.4	26.4	x	x	
4	GN007A	22:10:04	03-Jul-21	54.001	5.665	54	0.04	N	005	39.88	E	31.6	36.6	22:25:55	03-Jul-21	54.001	5.665	54	0.04	N	005	39.88	E	31.5	36.5	x		
5	GN008	02:15:37	04-Jul-21	54.001	4.832	54	0.03	N	004	49.92	E	37.6	42.6	02:26:33	04-Jul-21	54.001	4.832	54	0.03	N	004	49.92	E	37.6	42.6	x		
6	GN008S	06:17:38	04-Jul-21	54.000	3.918	54	0.02	N	003	55.08	E	41.1	46.1	06:22:53	04-Jul-21	54.000	3.918	54	0.02	N	003	55.08	E	41.1	46.1	x	x	
7	GN009	09:43:38	04-Jul-21	54.000	2.999	53	59.98	N	002	59.93	E	37.0	42.0	09:58:19	04-Jul-21	54.000	2.999	53	59.98	N	002	59.93	E	37.3	42.3	x	x	x
8	GN009A	17:07:27	04-Jul-21	53.417	3.502	53	25.01	N	003	30.12	E	23.0	28.0	17:16:25	04-Jul-21	53.417	3.502	53	25.01	N	003	30.12	E	22.9	27.9	x	x	
9	GN010	20:41:06	04-Jul-21	53.000	3.999	53	0.01	N	003	59.91	E	24.5	29.5	20:50:07	04-Jul-21	53.000	3.998	53	0.01	N	003	59.90	E	24.8	29.8	x		
10	GN011N	00:40:46	05-Jul-21	52.516	4.330	52	30.98	N	004	19.81	E	15.0	20.0	00:49:51	05-Jul-21	52.516	4.330	52	30.98	N	004	19.81	E	14.9	19.9	x		
11	GN012	05:04:35	05-Jul-21	51.998	3.731	51	59.89	N	003	43.84	E	19.3	24.3	05:15:19	05-Jul-21	51.998	3.731	51	59.89	N	003	43.84	E	19.1	24.1	x	x	
12	GN013N	09:13:56	05-Jul-21	51.800	2.919	51	48.00	N	002	55.12	E	27.1	32.1	09:23:51	05-Jul-21	51.800	2.919	51	48.00	N	002	55.12	E	24.7	29.7	x	x	x
13	GN014	14:01:58	05-Jul-21	52.000	2.000	52	0.01	N	001	59.99	E	24.8	29.8	14:11:54	05-Jul-21	52.000	2.000	52	0.01	N	001	59.98	E	25.0	30.0	x	x	
14	GN015	17:57:52	05-Jul-21	52.501	2.500	52	30.03	N	002	30.01	E	43.4	48.4	18:08:16	05-Jul-21	52.501	2.500	52	30.04	N	002	30.02	E	43.6	48.6	x	x	x
15	GN015B	21:21:48	05-Jul-21	52.834	2.167	52	50.05	N	002	10.00	E	36.1	41.1	21:30:34	05-Jul-21	52.834	2.167	52	50.05	N	002	10.01	E	36.3	41.3	x		
16	GN016	00:46:17	06-Jul-21	53.333	1.667	53	20.00	N	001	40.02	E	24.8	29.8	00:53:37	06-Jul-21	53.333	1.667	53	20.00	N	001	40.02	E	24.7	29.7	x		
17	GN009S	07:00:02	06-Jul-21	54.000	2.001	54	0.02	N	002	0.07	E	69.5	74.5	07:13.41	06-Jul-21	54.000	2.001	54	0.01	N	002	0.05	E	69.1	74.1	x	x	
18	GN017	10:54:28	06-Jul-21	54.000	1.001	53	59.99	N	001	0.07	E	37.0	42.0	11:05:07	06-Jul-21	54.000	1.001	54	0.00	N	001	0.08	E	39.3	44.3	x	x	
19	GN017A	13:36:42	06-Jul-21	54.000	0.333	53	59.97	N	000	19.95	E	49.7	54.7	13:46:20	06-Jul-21	54.000	0.332	53	59.97	N	000	19.94	E	49.8	54.8	x	x	x
20	GN017S	18:11:09	06-Jul-21	54.500	-0.166	54	29.97	N	000	9.95	W	56.0	61.0	18:25:20	06-Jul-21	54.500	-0.166	54	29.98	N	000	9.95	W	56.1	61.1	x	x	
21	GN018A	21:58:08	06-Jul-21	54.999	-0.668	54	59.96	N	000	40.07	W	60.0	65.0	22:11:12	06-Jul-21	55.000	-0.668	54	59.97	N	000	40.05	W	62.5	67.5	x		
22	GN018	00:42:51	07-Jul-21	55.000	0.001	54	59.97	N	000	0.04	E	70.0	75.0	00:53:16	07-Jul-21	55.000	0.001	54	59.97	N	000	0.04	E	71.0	76.0	x		
23	GN018S	04:28:31	07-Jul-21	55.000	1.001	55	0.02	N	001	0.08	E	58.3	63.3	04:41:55	07-Jul-21	55.000	1.001	55	0.02	N	001	0.07	E	58.5	63.5	x	x	
24	GN019	08:12:27	07-Jul-21	55.000	2.001	55	0.00	N	002	0.04	E	21.9	26.9	08:21:22	07-Jul-21	55.000	2.001	54	59.99	N	002	0.04	E	21.9	26.9	x	x	x
25	GN019S	12:44:34	07-Jul-21	55.001	3.001	55	0.03	N	003	0.05	E	22.0	27.0	12:49:56	07-Jul-21	55.000	3.001	55	0.02	N	003	0.06	E	20.0	25.0	x	x	
26	GN020	16:25:13	07-Jul-21	55.001	4.002	55	0.05	N	004	0.13	E	43.8	48.8	16:38:03	07-Jul-21	55.001	4.002	55	0.05	N	004	0.11	E	43.7	48.7	x	x	
27	GN021	20:18:50	07-Jul-21	55.000	5.002	55	0.02	N	005	0.10	E	38.0	43.0	20:26:56	07-Jul-21	55.000	5.001	55	0.02	N	005	0.08	E	36.0	41.0	x	x	
28	GN022	01:10:01	08-Jul-21	55.000	6.250	55	0.00	N	006	14.98	E	39.4	44.4	01:19:34	08-Jul-21	55.000	6.250	55	0.00	N	006	14.97	E	39.2	44.2	x		
29	GN022A	04:06:27	08-Jul-21	55.000	7.001	55	0.01	N	007	0.05	E	26.9	31.9	04:16:55	08-Jul-21	55.000	7.001	55	0.01	N	007	0.05	E	27.0	32.0	x	x	
30	GN023	06:24:25	08-Jul-21	55.000	7.584	54	59.99	N	007	35.03	E	22.0	27.0	06:33:36	08-Jul-21	55.000	7.583	54	59.99	N	007	35.00	E	20.2	25.2	x	x	
31	GN024	08:10:46	08-Jul-21	55.000	8.000	55	0.00	N	008	0.02	E	12.2	17.2	08:17:25	08-Jul-21	55.000	8.000	55	0.00	N	008	0.02	E	12.1	17.1	x	x	
32	GN025	09:19:15	08-Jul-21	55.000	8.250	55	0.02	N	008	14.99	E	9.7	14.7	09:23:41	08-Jul-21	55.000	8.250	55	0.01	N	008	14.99	E	9.7	14.7	x	x	x
33	GN026	16:50:22	08-Jul-21	56.001	7.801	56	0.07	N	007	48.06	E	22.3	27.3	16:59:59	08-Jul-21	56.001	7.801	56	0.07	N	007	48.07	E	22.2	27.2	x	x	
34	GN026A	19:52:34	08-Jul-21	56.000	7.000	56	0.00	N	006	59.98	E	30.3	35.3	20:00:02	08-Jul-21	56.000	7.000	56	0.00	N	006	59.98	E	30.4	35.4	x	x	
35	GN027	23:26:31	08-Jul-21	56.000	5.999	56	0.01	N	005	59.96	E	42.9	47.9	23:40:20	08-Jul-21	56.000	6.000	56	0.01	N	005	59.97	E	42.8	47.8	x		
36	GN028	02:57:50	09-Jul-21	56.000	5.000	56	0.00	N	004	59.98	E	38.3	43.3	03:08:04	09-Jul-21	56.000	5.000	56	0.00	N	004	59.98	E	38.3	43.3	x		
37	GN028S	06:28:07	09-Jul-21	56.000	3.999	56	0.02	N	003	59.92	E	52.7	57.7	06:41:37	09-Jul-21	56.000	3.999	56	0.02	N	003	59.93	E	52.7	57.7	x	x	
38	GN029	10:03:42	09-Jul-21	56.000	3.000	56	0.02	N	003	0.00	E	68.7	73.7	10:13:36	09-Jul-21	56.000	3.000	56	0.01	N	003	0.01	E	68.6	73.6	x	x	
39	GN030	13:36:48	09-Jul-21	56.000	2.000	55	59.99	N	001	59.98	E	81.6	86.6	13:47:55	09-Jul-21	56.000	2.000	55	59.99	N	001	59.98	E	81.6	86.6	x	x	x
40	GN031	17:36:02	09-Jul-21	56.000	0.999	55	59.99	N	000	59.96	E	72.5	77.5	17:48:37	09-Jul-21	56.000	0.999	56	0.00	N	000	59.95	E	72.4	77.4	x	x	
41	GN032	21:09:51	09-Jul-21	56.000	0.000	56	0.00	N	000	0.01	E	79.4	84.4	21:23:29	09-Jul-21	56.000	0.000	56	0.01	N	000	0.01	E	79.5	84.5	x	x	
42	GN033	00:44:54	10-Jul-21	56.000	-1.000	56	0.00	N	000	59.97	W	62.0	67.0	00:55:13	10-Jul-21	56.000	-1.000	55	59.99	N	000	59.99	W	60.2	65.2	x		
43	GN033A	03:17:50	10-Jul-21	56.000	-1.668	56	0.01	N	001	40.10	W	62.8	67.8	03:31:56	10-Jul-21	56.000	-1.668	56	0.00	N	001	40.10	W	62.6	67.6	x		
44	GN033S	06:32:33	10-Jul-21	56.500	-1.666	56	29.99	N	001	39.94	W	45.7	50.7	06:42:48	10-Jul-21	56.500	-1.666	56	29.99	N	001	39.95	W	45.5	50.5	x	x	
45	GN034A	10:06:50	10-Jul-21	56.999	-1.666	56	59.96	N	001	39.96	W	70.0	75.0	10:19:41	10-Jul-21	57.000	-1.666	56	59.97	N	001	39.96	W	70.0	75.0	x	x	

46	GN034	12:38:44	10-Jul-21	57.000	-1.001	57	0.00	N	001	0.03	W	68.0	73.0	12:51:04	10-Jul-21	57.000	-1.000	56	59.99	N	001	0.01	W	67.1	72.1	x	x	
47	GN034S	16:42:12	10-Jul-21	57.000	0.167	57	0.00	N	000	10.03	E	79.9	84.9	16:55:45	10-Jul-21	57.000	0.167	57	0.00	N	000	10.02	E	79.8	84.8	x	x	x
48	GN035	21:17:13	10-Jul-21	57.000	1.336	56	59.98	N	001	20.13	E	93.2	98.2	21:32:55	10-Jul-21	57.000	1.336	56	59.98	N	001	20.14	E	93.3	98.3	x	x	
49	GN035S	01:04:56	11-Jul-21	57.000	2.417	57	0.02	N	002	25.03	E	75.8	80.8	01:17:39	11-Jul-21	57.000	2.417	57	0.01	N	002	25.03	E	75.8	80.8	x		
50	GN036	04:56:48	11-Jul-21	57.000	3.500	56	59.98	N	003	29.98	E	60.1	65.1	05:11:16	11-Jul-21	57.000	3.500	56	59.99	N	003	29.97	E	60.1	65.1	x		
51	GN037	10:17:02	11-Jul-21	57.001	5.000	57	0.03	N	005	0.01	E	53.2	58.2	10:28:41	11-Jul-21	57.001	5.000	57	0.03	N	005	0.00	E	53.0	58.0	x	x	x
52	GN038	14:10:29	11-Jul-21	57.000	6.001	57	0.00	N	006	0.03	E	47.0	52.0	14:20:47	11-Jul-21	57.000	6.001	57	0.01	N	006	0.03	E	46.8	51.8	x	x	
53	GN038A	17:33:27	11-Jul-21	57.000	7.000	56	59.99	N	006	59.99	E	28.1	33.1	17:42:45	11-Jul-21	57.000	7.000	57	0.00	N	006	59.98	E	28.2	33.2	x	x	x
54	GN039	21:23:47	11-Jul-21	57.001	8.001	57	0.08	N	008	0.06	E	30.0	35.0	21:30:24	11-Jul-21	57.002	8.001	57	0.09	N	008	0.05	E	28.4	33.4	x	x	
55	GN039S	00:10:24	12-Jul-21	57.417	8.002	57	24.99	N	008	0.10	E	88.0	93.0	00:24:45	12-Jul-21	57.417	8.002	57	24.99	N	008	0.11	E	85.9	90.9	x		
56	GN040	03:03:48	12-Jul-21	57.835	8.000	57	50.09	N	007	59.98	E	522.0	527.0	03:49:19	12-Jul-21	57.835	8.000	57	50.10	N	007	59.99	E	522.0	527.0	x		
57	GN040S	07:01:59	12-Jul-21	57.917	6.999	57	54.99	N	006	59.95	E	356.3	361.3	07:26:39	12-Jul-21	57.917	6.999	57	54.99	N	006	59.96	E	355.9	360.9	x	x	x
58	GN041	10:58:16	12-Jul-21	58.000	6.000	58	0.01	N	006	0.02	E	303.0	308.0	11:24:48	12-Jul-21	58.000	6.000	58	0.01	N	006	0.02	E	304.5	309.5	x	x	
59	GN042	14:31:13	12-Jul-21	58.000	5.000	57	59.99	N	005	0.02	E	127.0	132.0	14:52:06	12-Jul-21	58.000	5.000	57	59.98	N	005	0.01	E	127.0	132.0	x	x	
60	GN042S	18:04:33	12-Jul-21	58.000	3.999	57	59.98	N	003	59.96	E	93.0	98.0	18:17:03	12-Jul-21	58.000	3.999	57	59.98	N	003	59.96	E	93.3	98.3	x	x	x
61	GN043	22:24:14	12-Jul-21	58.000	3.003	57	59.99	N	003	0.18	E	71.4	76.4	22:37:40	12-Jul-21	58.000	3.003	58	0.00	N	003	0.17	E	71.8	76.8	x		
62	GN044	03:16:46	13-Jul-21	58.000	1.499	57	59.99	N	001	29.95	E	100.3	105.3	03:36:20	13-Jul-21	58.000	1.499	57	59.99	N	001	29.95	E	100.1	105.1	x		
63	GN044S	07:28:27	13-Jul-21	58.001	0.250	58	0.03	N	000	14.99	E	135.2	140.2	07:42:47	13-Jul-21	58.000	0.250	58	0.02	N	000	14.99	E	134.4	139.4	x	x	
64	GN045	13:29:28	13-Jul-21	58.000	-1.000	58	0.00	N	001	0.02	W	109.7	114.7	13:42:39	13-Jul-21	58.000	-1.001	58	0.01	N	001	0.04	W	109.5	114.5	x	x	x
65	GN045A	19:18:10	13-Jul-21	58.000	-1.999	58	0.01	N	001	59.96	W	77.2	82.2	19:27:39	13-Jul-21	58.000	-1.999	58	0.01	N	001	59.96	W	77.4	82.4	x	x	
66	GN045B	01:12:30	14-Jul-21	58.501	-2.500	58	30.04	N	002	29.99	W	67.5	72.5	01:22:11	14-Jul-21	58.501	-2.500	58	30.03	N	002	30.01	W	66.9	71.9	x		
67	GN057A	05:57:11	14-Jul-21	58.750	-4.001	58	45.01	N	004	0.04	W	76.0	81.0	06:07:44	14-Jul-21	58.750	-4.001	58	45.01	N	004	0.05	W	74.3	79.3	x	x	
68	GN056	09:22:35	14-Jul-21	58.749	-5.004	58	44.94	N	005	0.21	W	82.9	87.9	09:34:41	14-Jul-21	58.749	-5.004	58	44.94	N	005	0.22	W	82.9	87.9	x	x	
69	GN056C	13:36:59	14-Jul-21	58.333	-5.667	58	20.00	N	005	40.01	W	103.0	108.0	13:52:28	14-Jul-21	58.333	-5.667	58	19.99	N	005	40.00	W	102.0	107.0	x	x	
70	GN064	16:38:23	14-Jul-21	58.001	-6.000	58	0.03	N	006	0.00	W	52.0	57.0	16:53:51	14-Jul-21	58.001	-6.000	58	0.03	N	006	0.00	W	53.4	58.4	x		
71	GN056B	21:54:04	14-Jul-21	58.750	-6.000	58	45.00	N	005	59.97	W	113.0	118.0	22:07:27	14-Jul-21	58.750	-6.000	58	45.00	N	005	59.98	W	114.1	119.1	x		
72	GN069	02:22:55	15-Jul-21	59.167	-6.667	59	10.03	N	006	40.03	W	128.7	133.7	02:43:24	15-Jul-21	59.167	-6.667	59	10.02	N	006	40.03	W	130.8	135.8	x		
73	GN068	06:51:00	15-Jul-21	59.584	-7.330	59	35.03	N	007	19.80	W	1000.0	1005.0	08:08:00	15-Jul-21	59.584	-7.330	59	35.03	N	007	19.82	W	1000.0	1005.0	x	x	
74	GN067	14:12:26	15-Jul-21	60.001	-8.003	60	0.07	N	008	0.20	W	751.7	756.7	14:55:20	15-Jul-21	60.001	-8.003	60	0.06	N	008	0.15	W	752.2	757.2	x	x	
75	GN066	17:59:01	15-Jul-21	60.000	-7.000	60	0.00	N	006	59.99	W	449.0	454.0	18:26:10	15-Jul-21	60.000	-6.999	59	59.99	N	006	59.95	W	447.2	452.2	x	x	
76	GN065	21:58:42	15-Jul-21	60.000	-5.999	60	0.02	N	005	59.91	W	1058.0	1063.0	22:45:35	15-Jul-21	60.001	-5.999	60	0.03	N	005	59.94	W	1058.0	1063.0	x		
77	GN055	01:49:09	16-Jul-21	60.000	-4.999	59	59.99	N	004	59.92	W	406.4	411.4	02:25:30	16-Jul-21	60.000	-4.999	60	0.00	N	004	59.94	W	407.8	412.8	x		
78	GN054S	05:50:58	16-Jul-21	60.000	-4.001	59	59.98	N	004	0.03	W	122.0	127.0	06:12:15	16-Jul-21	60.000	-4.000	59	59.98	N	004	0.01	W	122.0	127.0	x	x	
79	GN054	09:51:27	16-Jul-21	60.000	-3.000	60	0.00	N	003	0.02	W	100.6	105.6	10:03:05	16-Jul-21	60.000	-3.000	59	59.99	N	003	0.00	W	100.6	105.6	x	x	
80	GN053B	13:12:27	16-Jul-21	59.998	-1.998	59	59.89	N	001	59.85	W	83.1	88.1	13:23:00	16-Jul-21	59.998	-1.998	59	59.90	N	001	59.86	W	82.3	87.3	x	x	
81	GN053A	15:52:46	16-Jul-21	59.798	-1.331	59	47.86	N	001	19.83	W	81.4	86.4	16:02:24	16-Jul-21	59.798	-1.330	59	47.87	N	001	19.78	W	81.4	86.4	x	x	
82	GN053	12:54:43	17-Jul-21	60.000	-0.499	59	59.98	N	000	29.91	W	120.2	125.2	13:07:50	17-Jul-21	60.000	-0.499	59	59.99	N	000	29.91	W	120.1	125.1	x	x	
83	GN052S	16:57:26	17-Jul-21	60.000	0.752	59	59.98	N	000	45.10	E	122.9	127.9	17:17:42	17-Jul-21	60.000	0.752	59	59.97	N	000	45.10	E	122.5	127.5	x	x	
84	GN052	21:21:36	17-Jul-21	60.000	1.996	59	59.97	N	001	59.78	E	96.0	101.0	21:32:53	17-Jul-21	59.999	1.996	59	59.96	N	001	59.77	E	96.0	101.0	x		
85	GN051S	01:24:34	18-Jul-21	60.000	3.250	59	59.98	N	003	15.00	E	210.0	215.0	01:39:33	18-Jul-21	60.000	3.250	59	59.99	N	003	14.98	E	210.0	215.0	x		
86	GN051	05:22:59	18-Jul-21	60.001	4.507	60	0.06	N	004	30.39	E	252.9	257.9	05:53:50	18-Jul-21	60.001	4.506	60	0.05	N	004	30.35	E	254.0	259.0	x	x	
87	GN050S	09:13:26	18-Jul-21	59.500	4.500	59	29.98	N	004	29.98	E	260.3	265.3	09:38:43	18-Jul-21	59.500	4.500	59	29.98	N	004	29.97	E	259.8	264.8	2	x	
88	GN050	13:16:53	18-Jul-21	59.001	4.501	59	0.03	N	004	30.05	E	253.6	258.6	13:47:50	18-Jul-21	59.001	4.501	59	0.03	N	004	30.05	E	254.4	259.4	2	x	
89	GN049S	17:06:23	18-Jul-21	59.001	3.749	59	0.03	N	003	44.92	E	266.5	271.5	17:31:10	18-Jul-21	59.000	3.749	59	0.02	N	003	44.94	E	266.7	271.7	x	x	
90	GN049	20:07:15	18-Jul-21	59.000	3.001	58	59.99	N	003	0.06	E	132.3	137.3	20:17:44	18-Jul-21	59.000	3.000	59	0.00	N	003	0.00	E	131.9	136.9	x	x	
91	GN048S	23:33:14	18-Jul-21	59.000	2.000	59	0.01	N	002	0.02	E	109.1	114.1	23:47:01	18-Jul-21	59.000	2.001	59	0.00	N	002	0.03	E	109.0	114.0	x		
92	GN048	03:01:27	19-Jul-21	59.001	1.000	59	0.03	N	000	59.99	E	119.4	124.4	03:16:31	19-Jul-21	59.000	1.000	59	0.02	N	001	0.00	E	119.7	124.7	x		
93	GN047	06:28:21	19-Jul-21	59.000	-0.001	58	59.99	N	000	0.08	W	127.1	132.1	06:39:12	19-Jul-21	59.000	-0.001	58	59.99	N	000	0.06	W	127.4	132.4	x	x	
94	GN046	11:14:36	19-Jul-21	59.001	-1.501	59	0.04	N	001	30.06	W	102.0	107.0	11:23:47	19-Jul-21	59.001	-1.500	59	0.03	N	001	30.02	W	100.8	105.8	x	x	
95	GN046A	13:04:12	19-Jul-21	59.001	-1.999	59	0.05	N	001	59.94	W	72.7	77.7	13:16:41	19-Jul-21	59.001	-1.999	59	0.05	N	001	59.95	W	72.7	77.7	x	x	

The complete Station-list is available at:
https://www.bsh.de/DE/DATEN/Klima-und-Meer/Ozeanographisches_Datenzentrum/Durchgefuehrte_Forschungsfahrten/_Anlagen/Jahre/2021_node.html
later at
http://seadata.bsh.de/Cgi-csr/retrieve_sdn2/start_sdn2.pl and https://csr.seadatanet.org/

Appendix 2: List of samples

CTD-profiles with	
rosette	95 stations
Secchi-depth	66 stations, 66 samples
Salinity	95 stations, 250 samples incl. duplicates
Chlorophyll	74 stations, 123 samples incl. duplicates and 10 fold determination
Neuston net	14 hauls

Appendix 3: Maps of temperature, salinity and oxygen

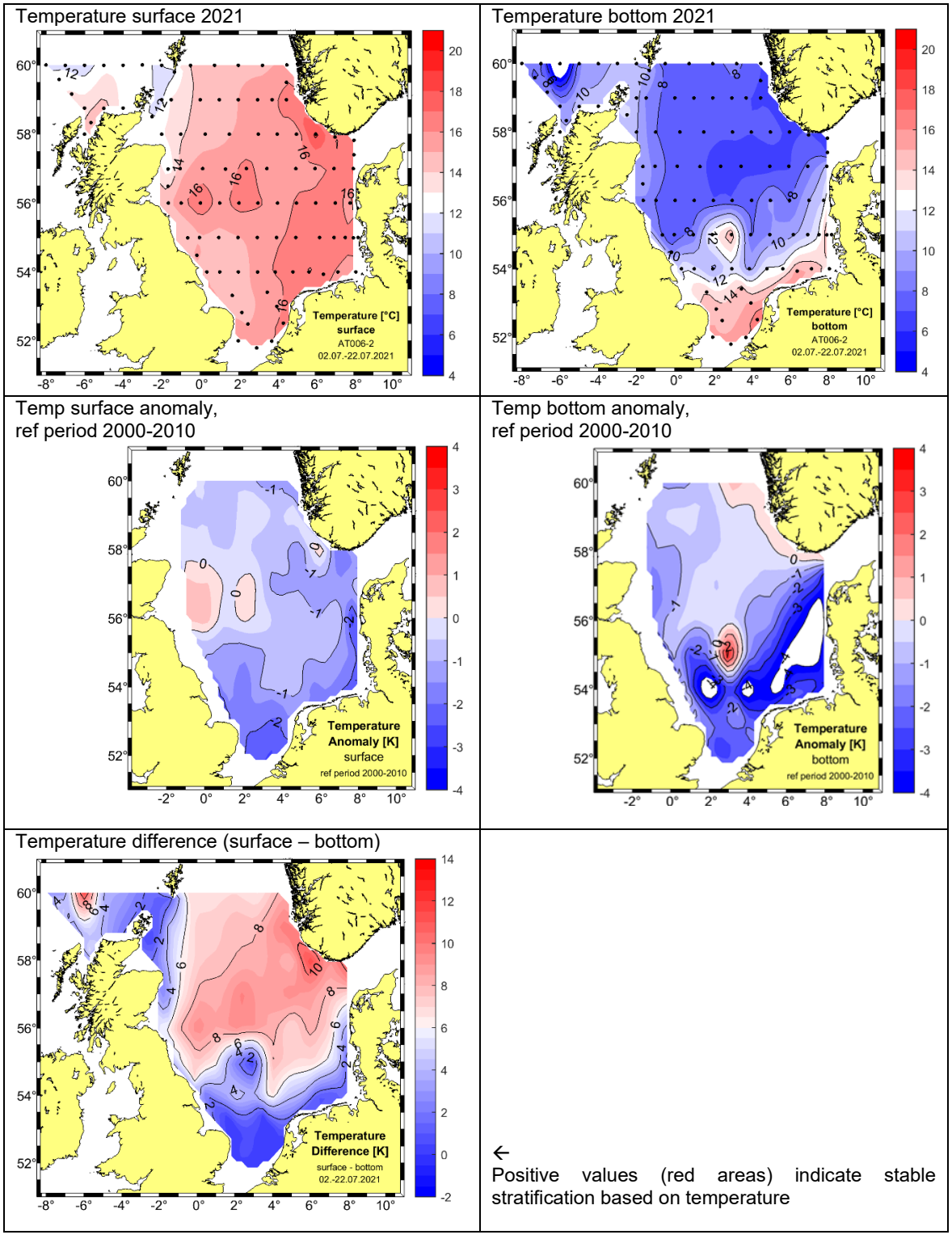


Figure 3.1 (top) temperature distribution at surface/bottom, (middle) temperature anomaly surface/bottom, (bottom) temperature difference between surface and bottom.

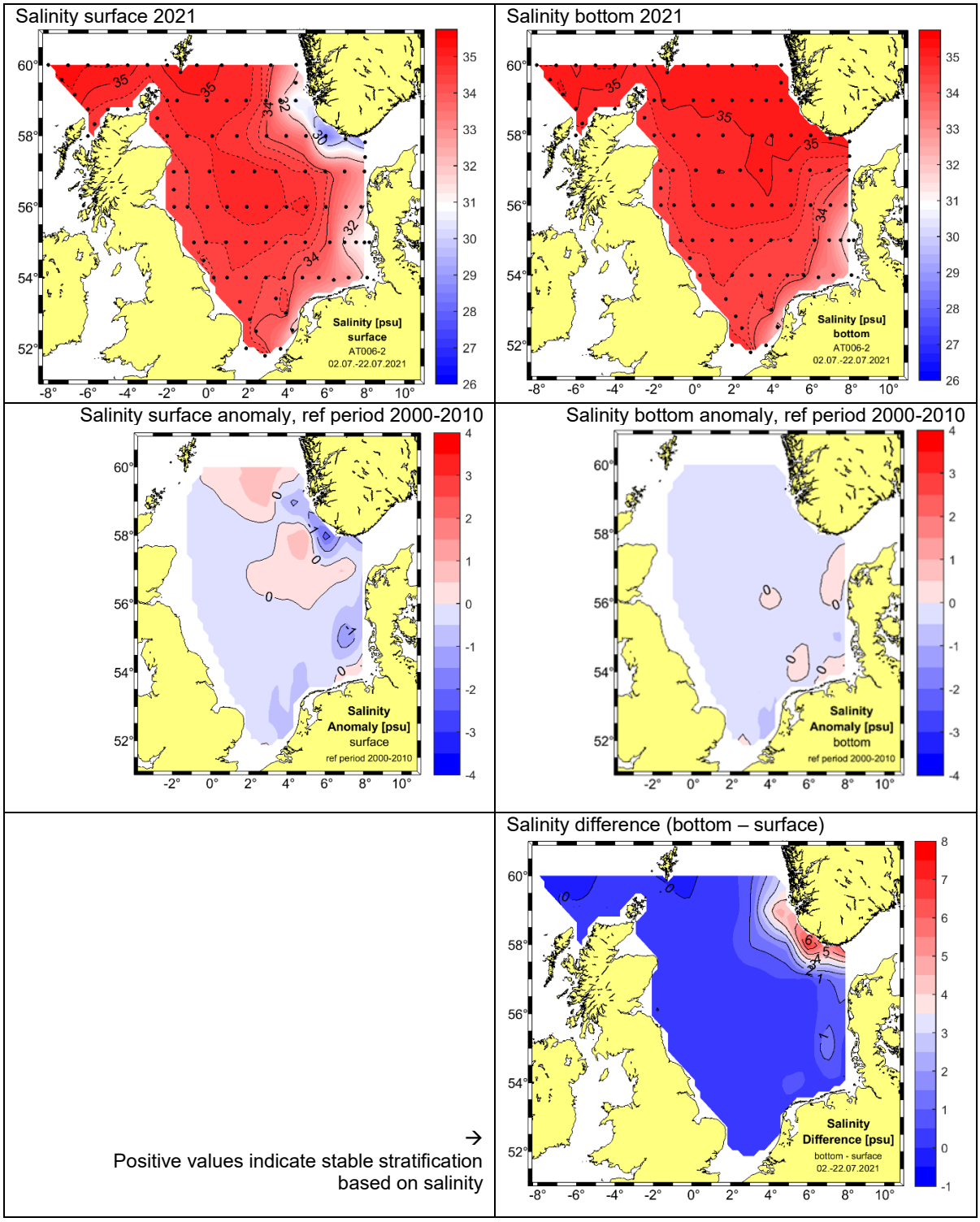


Figure 3.2 (top) salinity distribution at surface/bottom, (middle) salinity anomaly surface/bottom, (bottom) salinity difference between bottom and surface.

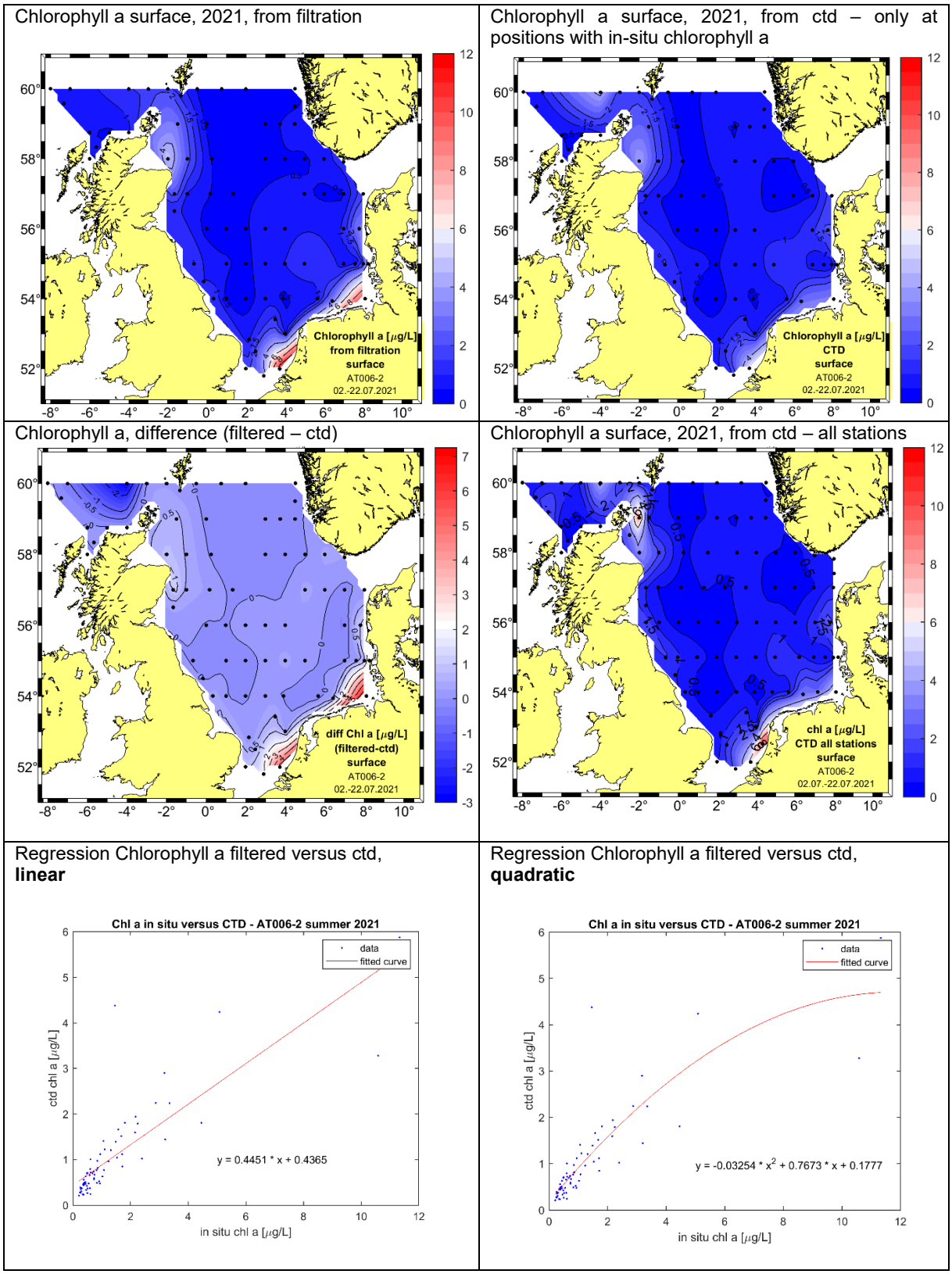


Figure 3.3 (top) Chlorophyll a distribution at surface from filtration (left) and from CTD, only stations with in situ chl a (right), (middle) chlorophyll a difference between filtration and CTD (left) and chlorophyll a from CTD, all stations(right), (bottom) chlorophyll a filtered versus from CTD, (left) linear fit (right) quadratic fit.

Appendix 4: Temperature and salinity sections

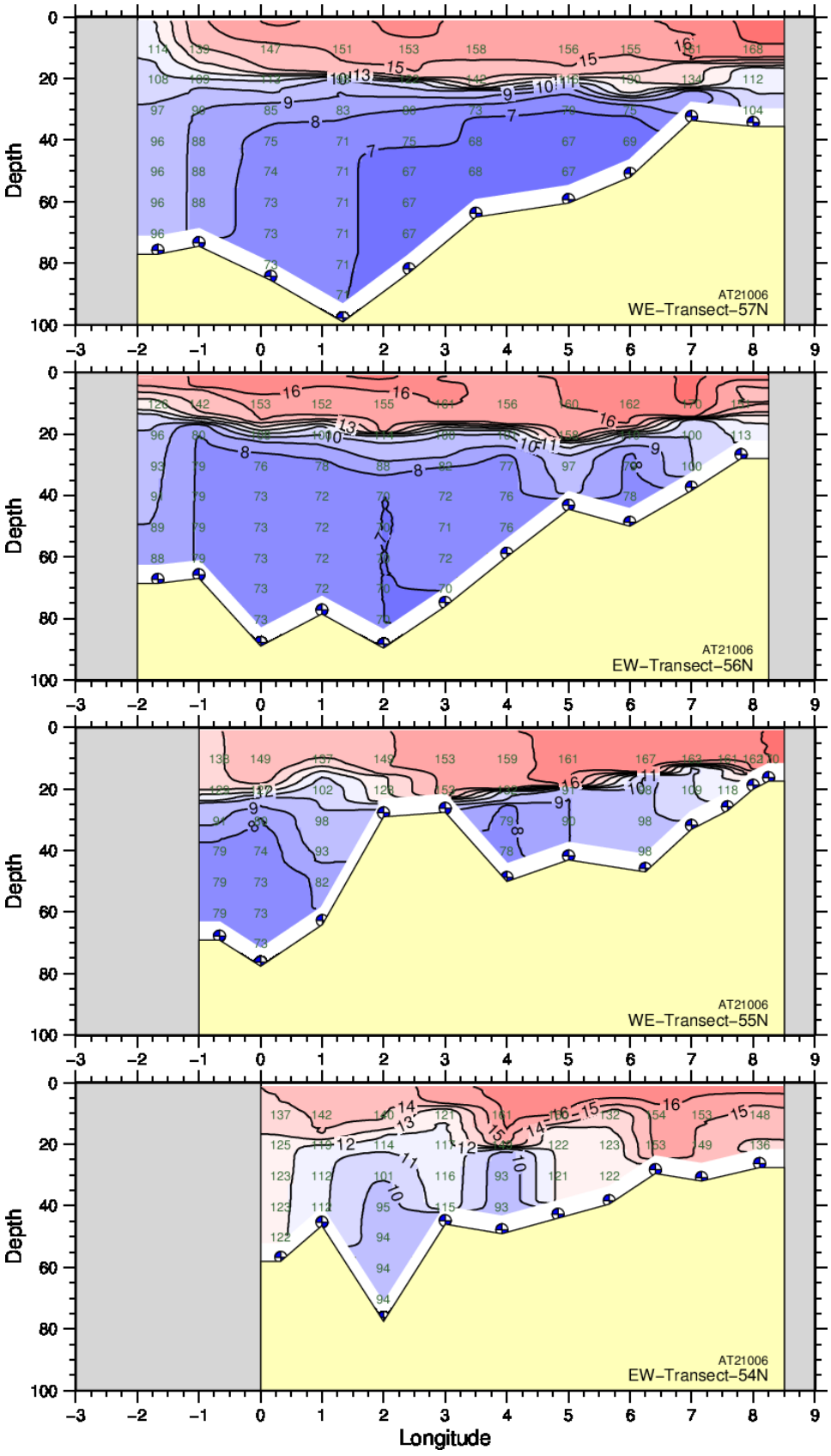


Figure 4.1: Temperature sections along 54°, 55°, 56°, and 57°N based on CTD raw data. The numbers in the sections give temperature [°C] x 10 at selected station depths.

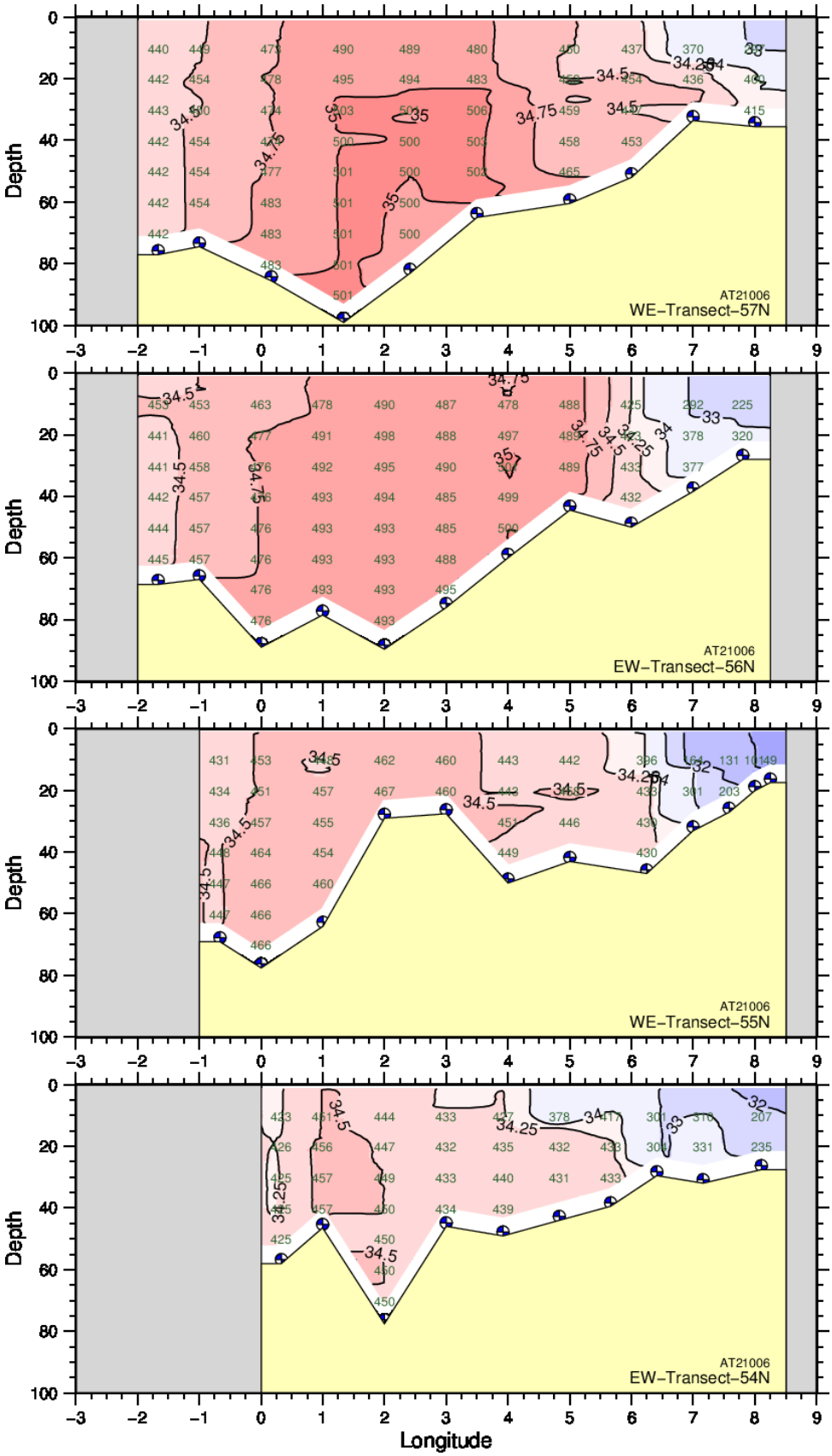


Figure 4.2: Salinity sections along the 54°, 55°, 56°, and 57°N based on CTD raw data. The numbers in the sections give (salinity x 100)-3000 at selected station depths.

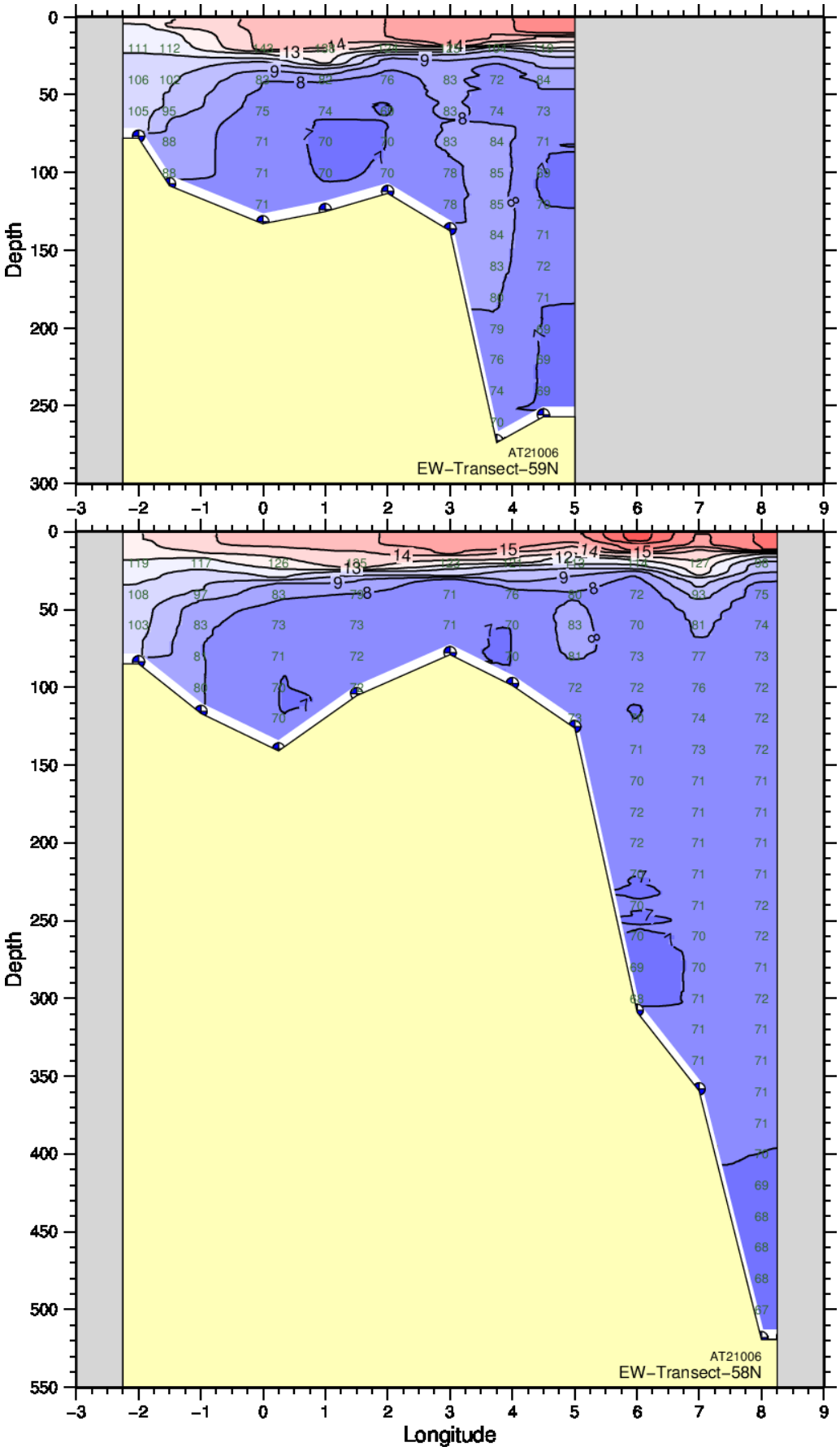


Figure 4.3: Temperature sections along 58° and 59°N based on CTD raw data. The numbers in the sections give temperature [°C] x 10 at selected station depths.

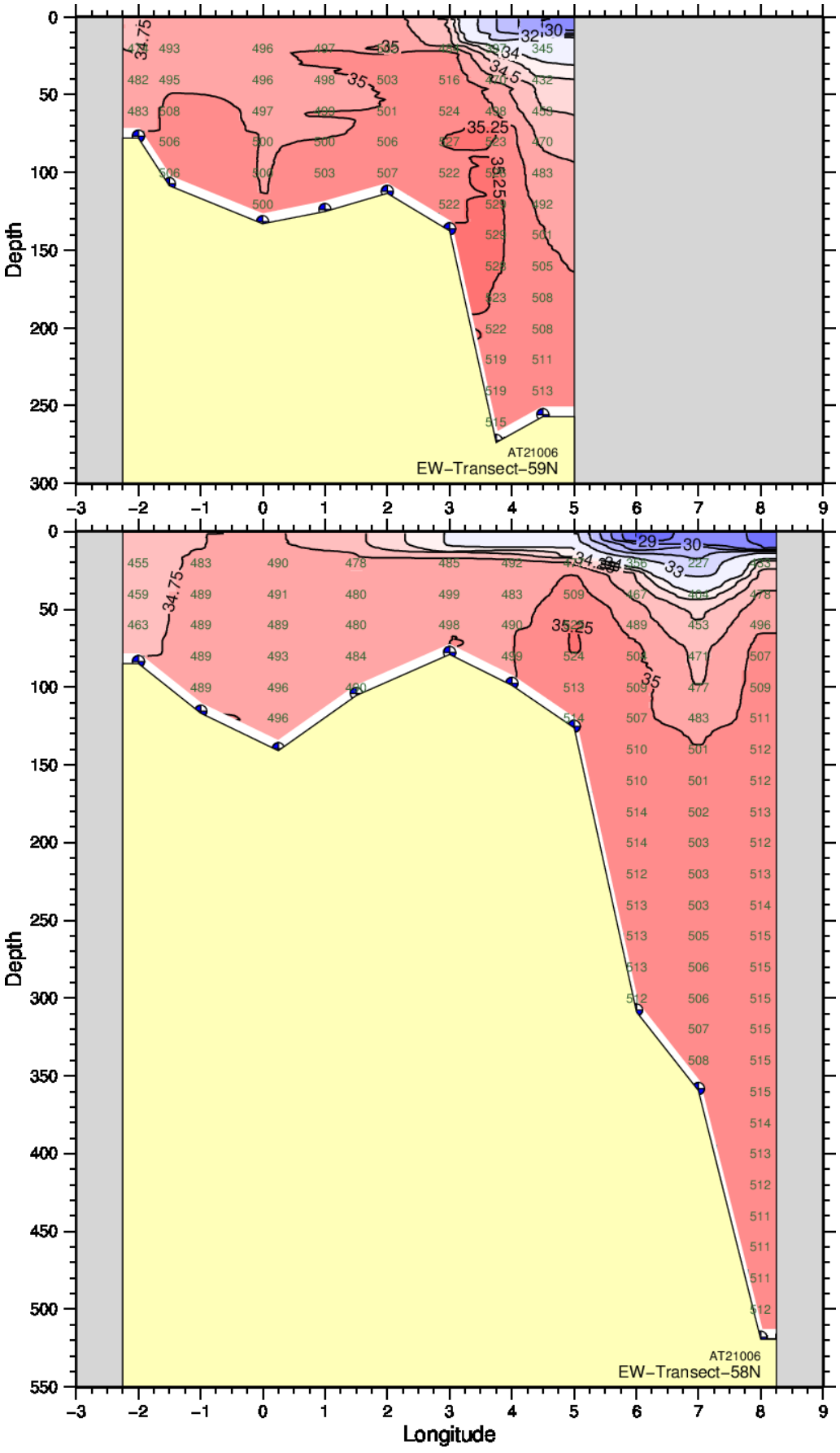


Figure 4.4: Salinity sections along 58° and 59°N based on CTD raw data.
The numbers in the sections give (salinity x 100)-3000 at selected station depths.

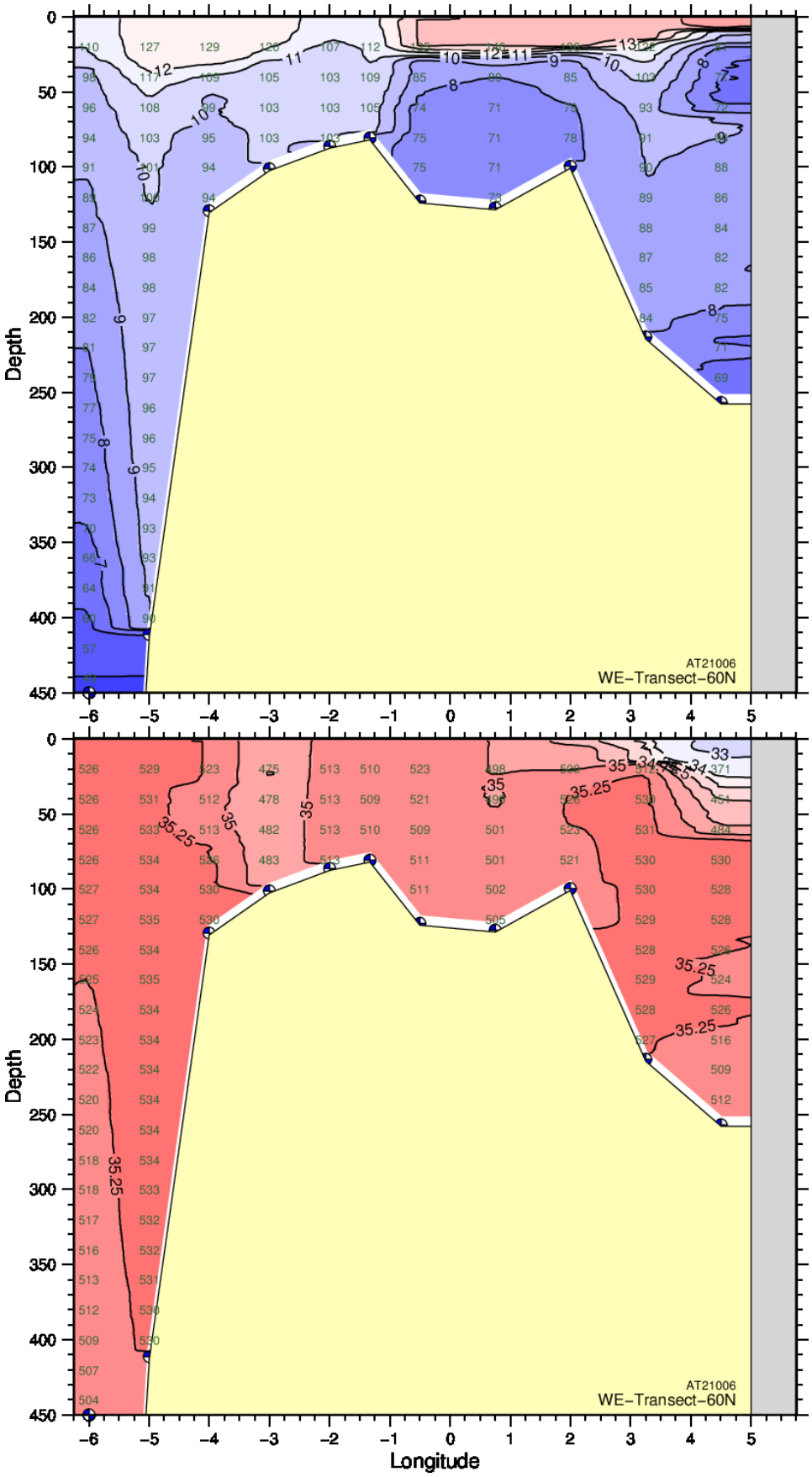
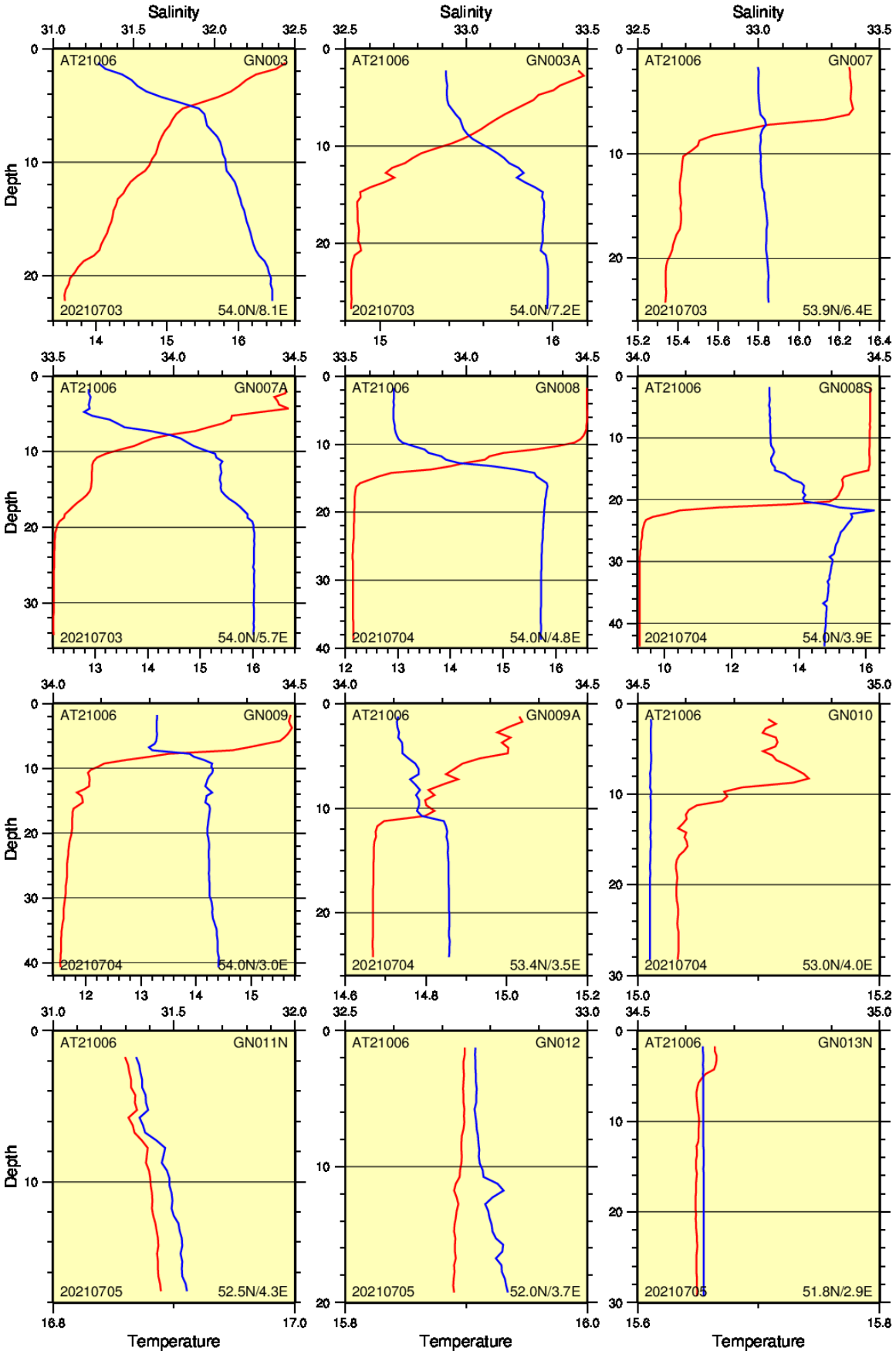
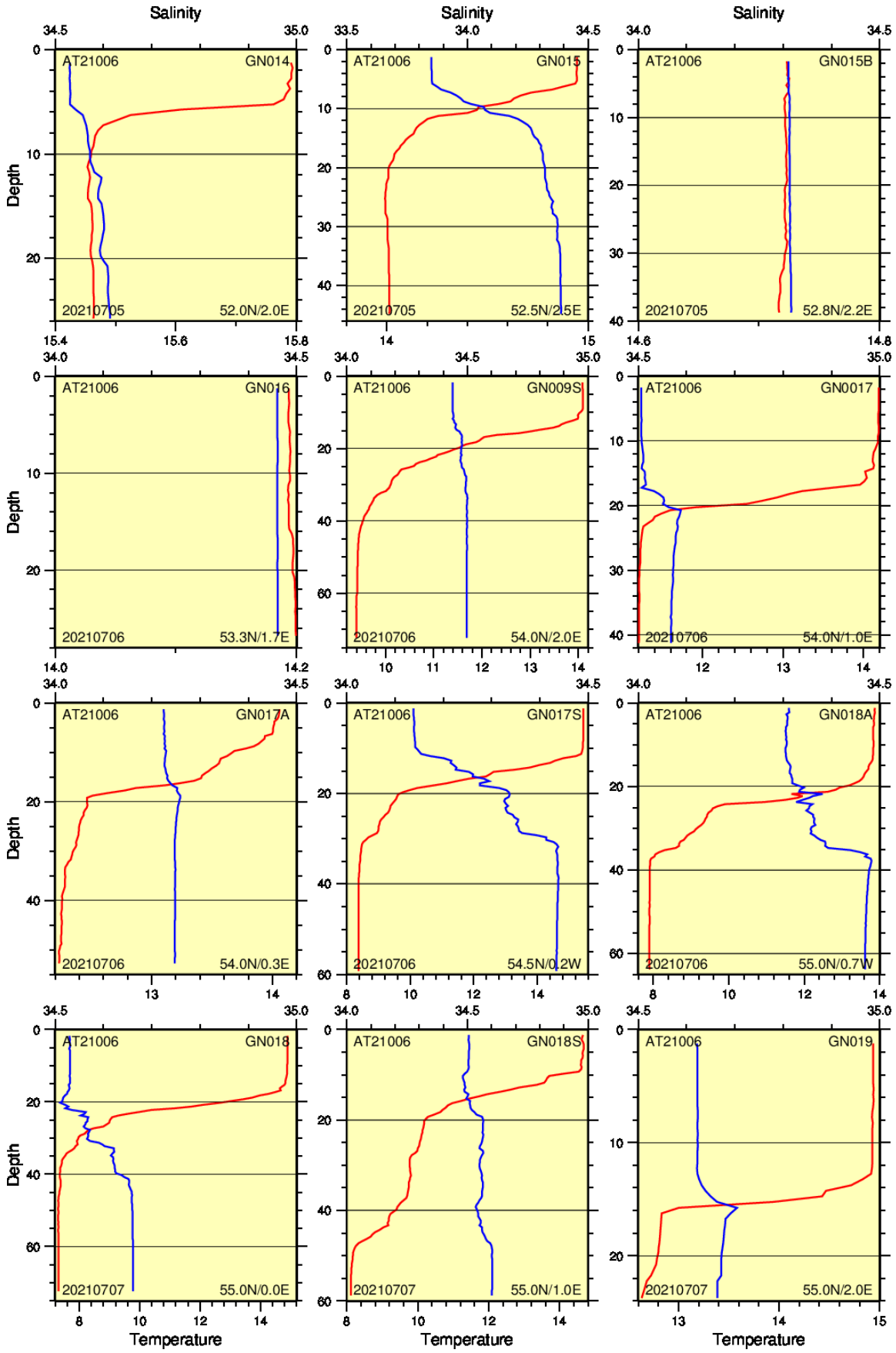


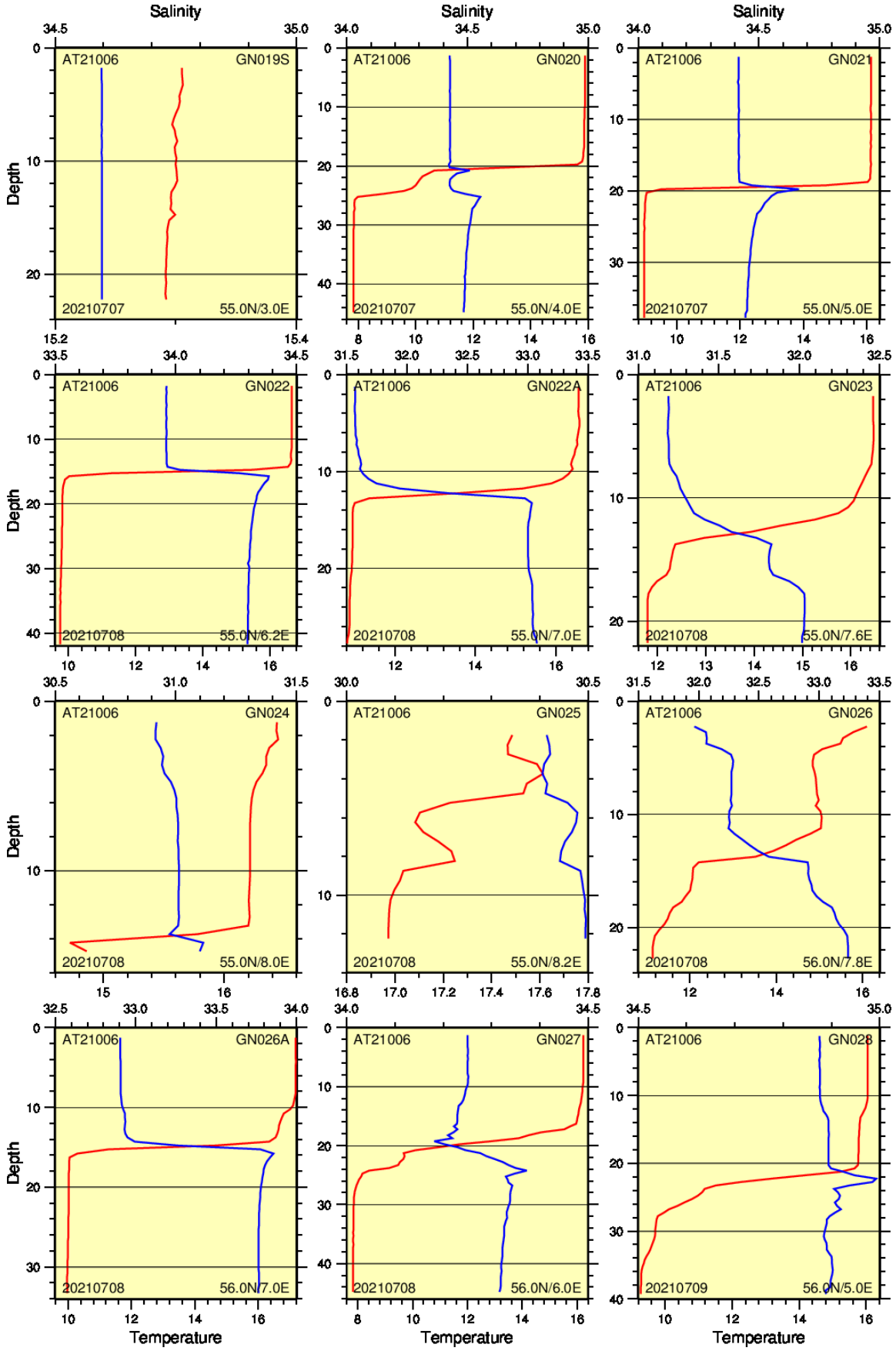
Figure 4.5: Temperature (top) and salinity (bottom) sections along 60°N based on CTD raw data. The numbers in the sections give temperature [°C] x 10 and (salinity x 100) -3000 at selected station depths.

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
Depth
Temperature
Temperature
Temperature
AT21006 GN014 20210705 52.0N/2.0E
AT21006 GN015 20210705 52.5N/2.5E
AT21006 GN015B 20210705 52.8N/2.2E
AT21006 GN016 20210706 53.3N/1.7E
AT21006 GN009S 20210706 54.0N/2.0E
AT21006 GN0017 20210706 54.0N/1.0E
AT21006 GN017A 20210706 54.0N/0.3E
AT21006 GN017S 20210706 54.5N/0.2W
AT21006 GN018A 20210706 55.0N/0.7W
AT21006 GN018 20210707 55.0N/0.0E
AT21006 GN018S 20210707 55.0N/1.0E
AT21006 GN019 20210707 55.0N/2.0E


Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
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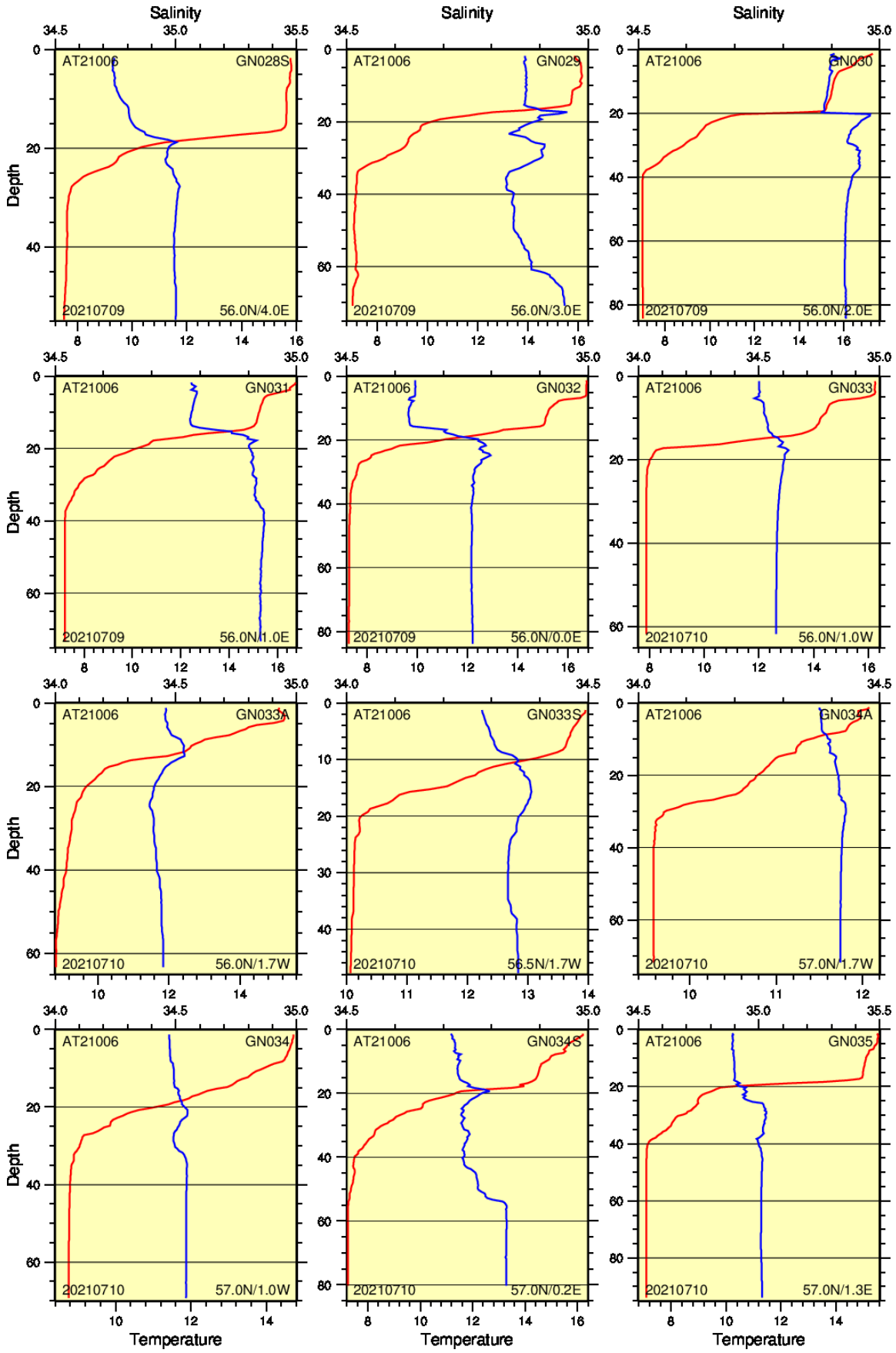
AT21006 GN020 20210707 55.0N/4.0E
AT21006 GN021 20210707 55.0N/5.0E
AT21006 GN022 20210708 55.0N/6.2E
AT21006 GN022A 20210708 55.0N/7.0E
AT21006 GN023 20210708 55.0N/7.6E
AT21006 GN024 20210708 55.0N/8.0E
AT21006 GN025 20210708 55.0N/8.2E
AT21006 GN026 20210708 56.0N/7.8E
AT21006 GN026A 20210708 56.0N/7.0E
AT21006 GN027 20210708 56.0N/6.0E
AT21006 GN028 20210709 56.0N/5.0E


Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
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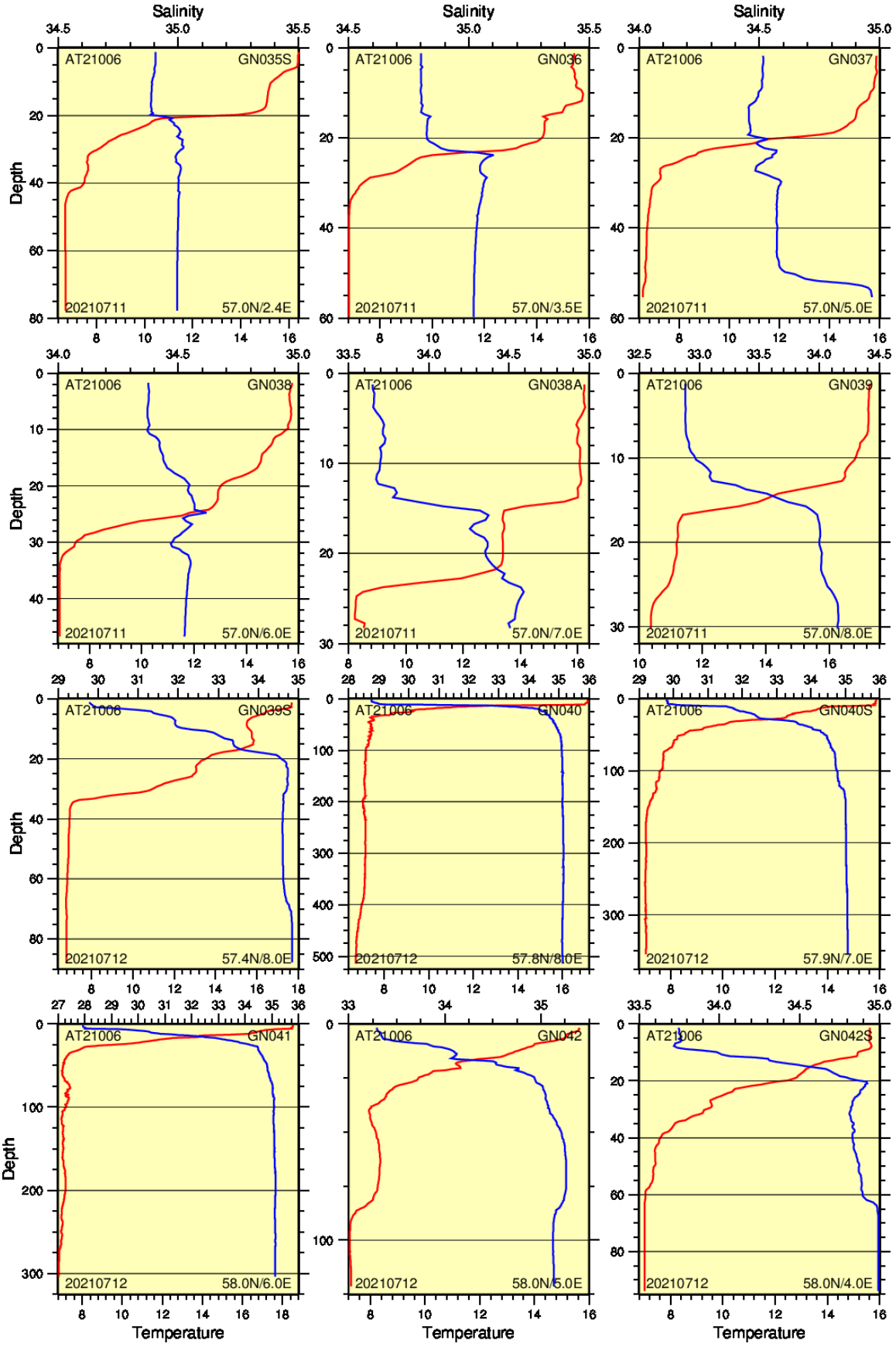
AT21006 GN030 20210709 56.0N/2.0E
AT21006 GN031 20210709 56.0N/1.0E
AT21006 GN032 20210709 56.0N/0.0E
AT21006 GN033 20210710 56.0N/1.0W
AT21006 GN033A 20210710 56.0N/1.7W
AT21006 GN033S 20210710 56.5N/1.7W
AT21006 GN034A 20210710 57.0N/1.7W
AT21006 GN034 20210710 57.0N/1.0W
AT21006 GN034S 20210710 57.0N/0.2E
AT21006 GN035 20210710 57.0N/1.3E


Salinity
Depth
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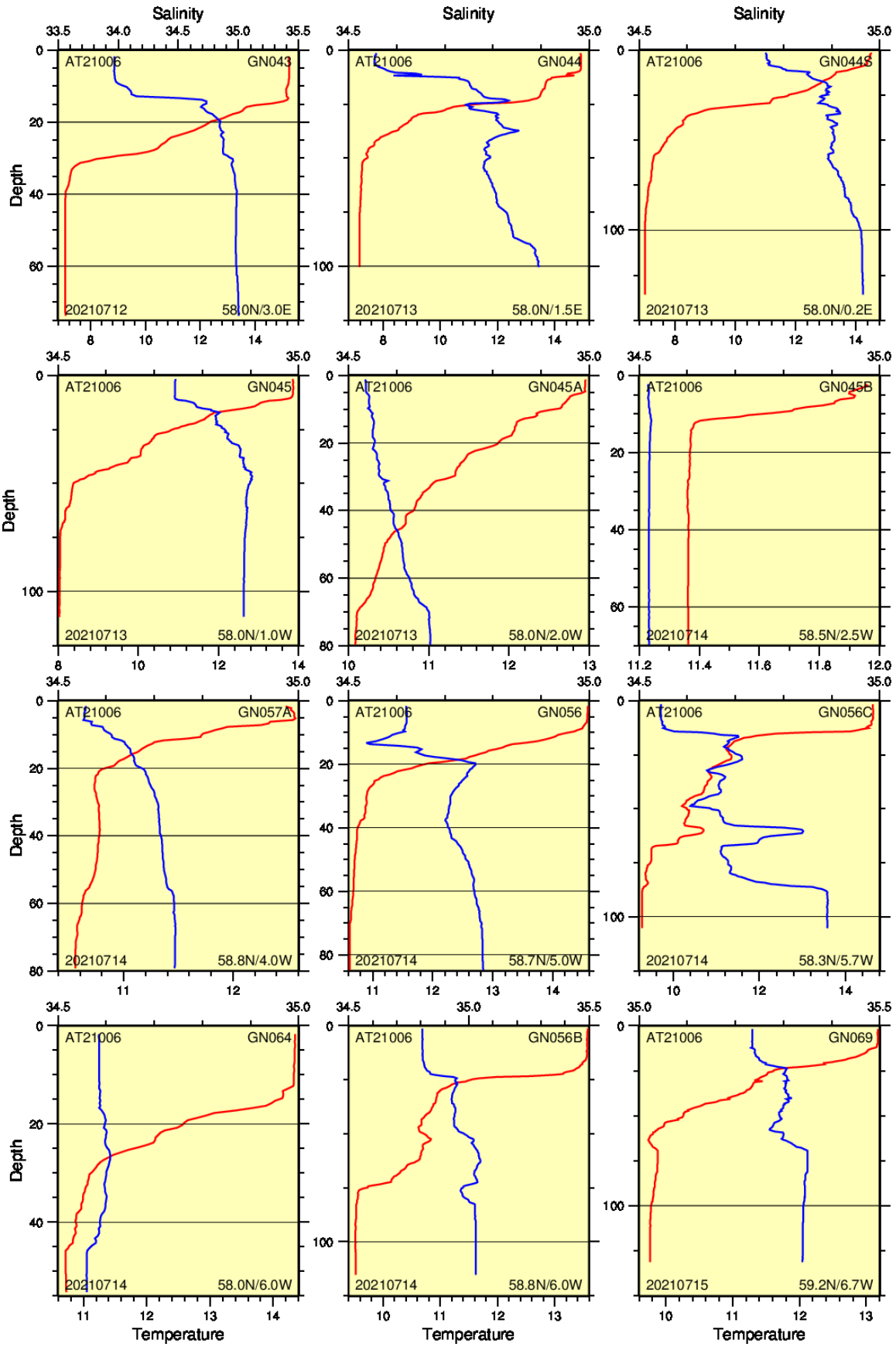
GN035S
20210711
57.0N/2.4E
AT21006
GN036
20210711
57.0N/3.5E
AT21006
GN037
20210711
57.0N/5.0E
AT21006
GN038
20210711
57.0N/6.0E
AT21006
GN038A
20210711
57.0N/7.0E
AT21006
GN039
20210711
57.0N/8.0E
AT21006
GN039S
20210712
57.4N/8.0E
AT21006
GN040
20210712
57.8N/8.0E
AT21006
GN040S
20210712
57.9N/7.0E
AT21006
GN041
20210712
58.0N/6.0E
AT21006
GN042
20210712
58.0N/5.0E
AT21006
GN042S
20210712
58.0N/4.0E
Temperature


Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
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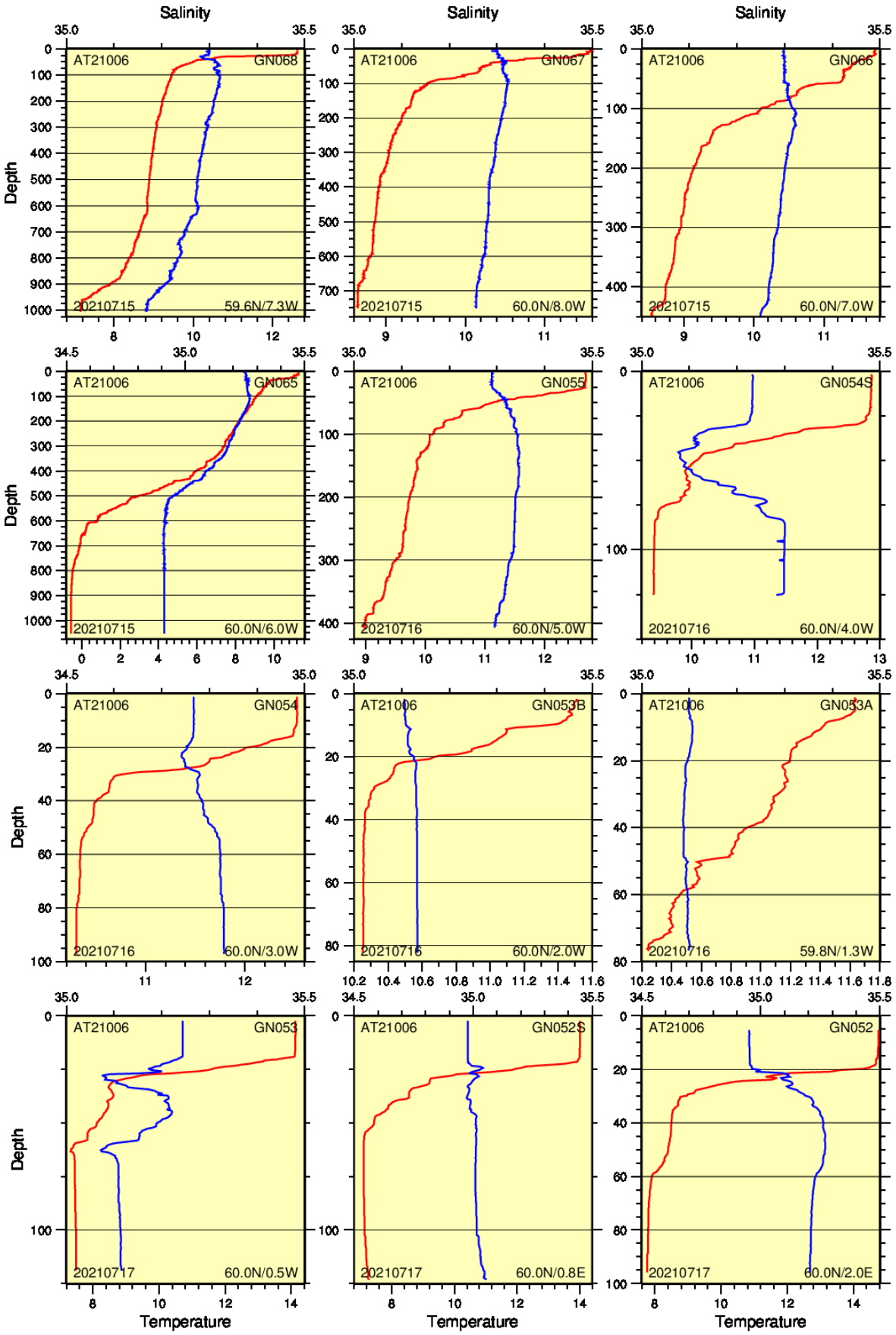
20210712 58.0N/3.0E
AT21006 GN044
20210713 58.0N/1.5E
AT21006 GN044S
20210713 58.0N/0.2E
AT21006 GN045
20210713 58.0N/1.0W
AT21006 GN045A
20210713 58.0N/2.0W
AT21006 GN045B
20210714 58.5N/2.5W
AT21006 GN057A
20210714 58.8N/4.0W
AT21006 GN056
20210714 58.7N/5.0W
AT21006 GN056C
20210714 58.3N/5.7W
AT21006 GN064
20210714 58.0N/6.0W
AT21006 GN056B
20210714 58.8N/6.0W
AT21006 GN069
20210715 59.2N/6.7W


Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
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20210715 60.0N/8.0W
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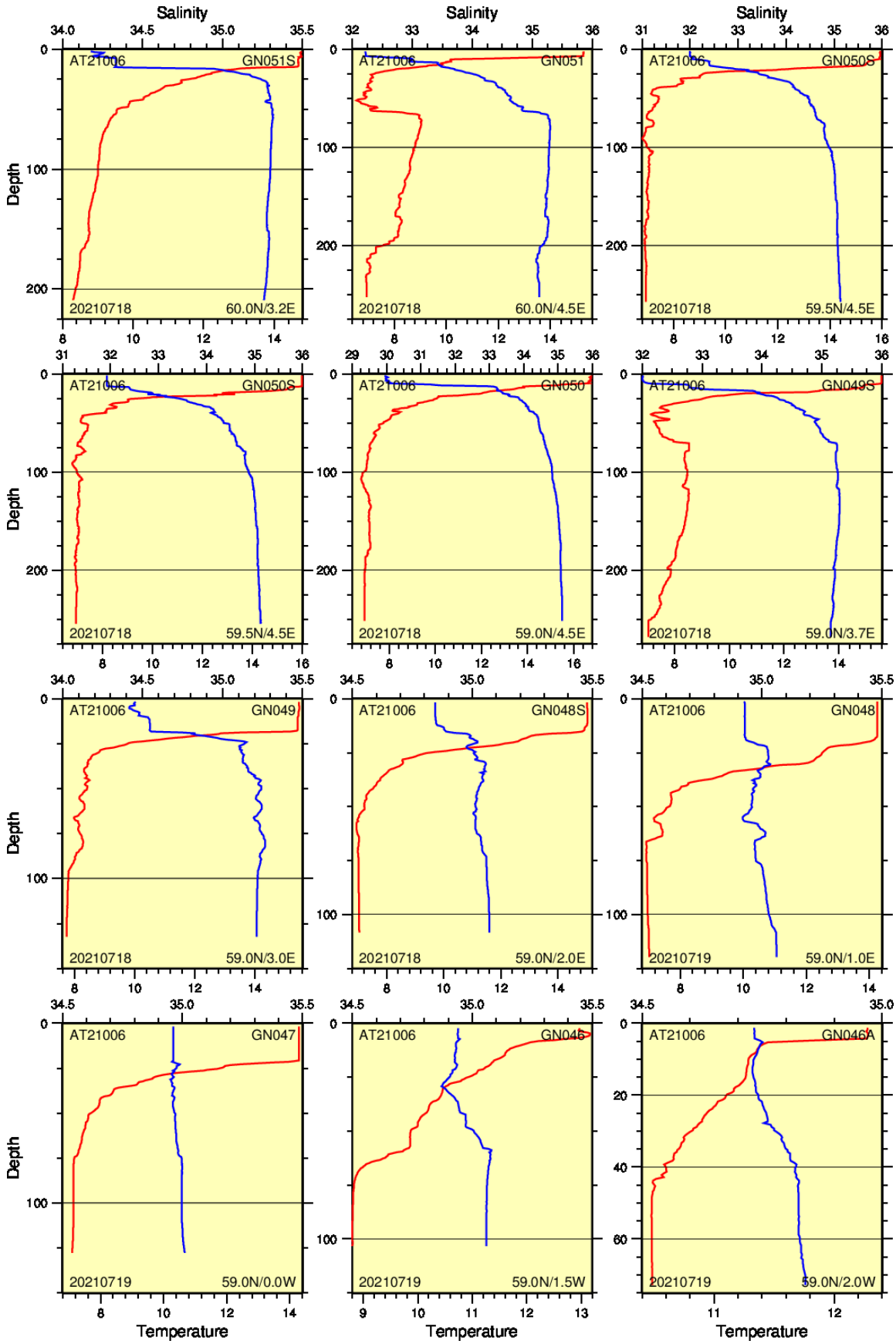
20210715 60.0N/7.0W
AT21006 GN065
20210715 60.0N/6.0W
AT21006 GN055
20210716 60.0N/5.0W
AT21006 GN054S
20210716 60.0N/4.0W
AT21006 GN054
20210716 60.0N/3.0W
AT21006 GN053B
20210716 60.0N/2.0W
AT21006 GN053A
20210716 59.8N/1.3W
AT21006 GN053
20210717 60.0N/0.5W
AT21006 GN052S
20210717 60.0N/0.8E
AT21006 GN052
20210717 60.0N/2.0E


Salinity
Salinity
Salinity
Depth
Depth
Depth
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Temperature
Temperature
Temperature
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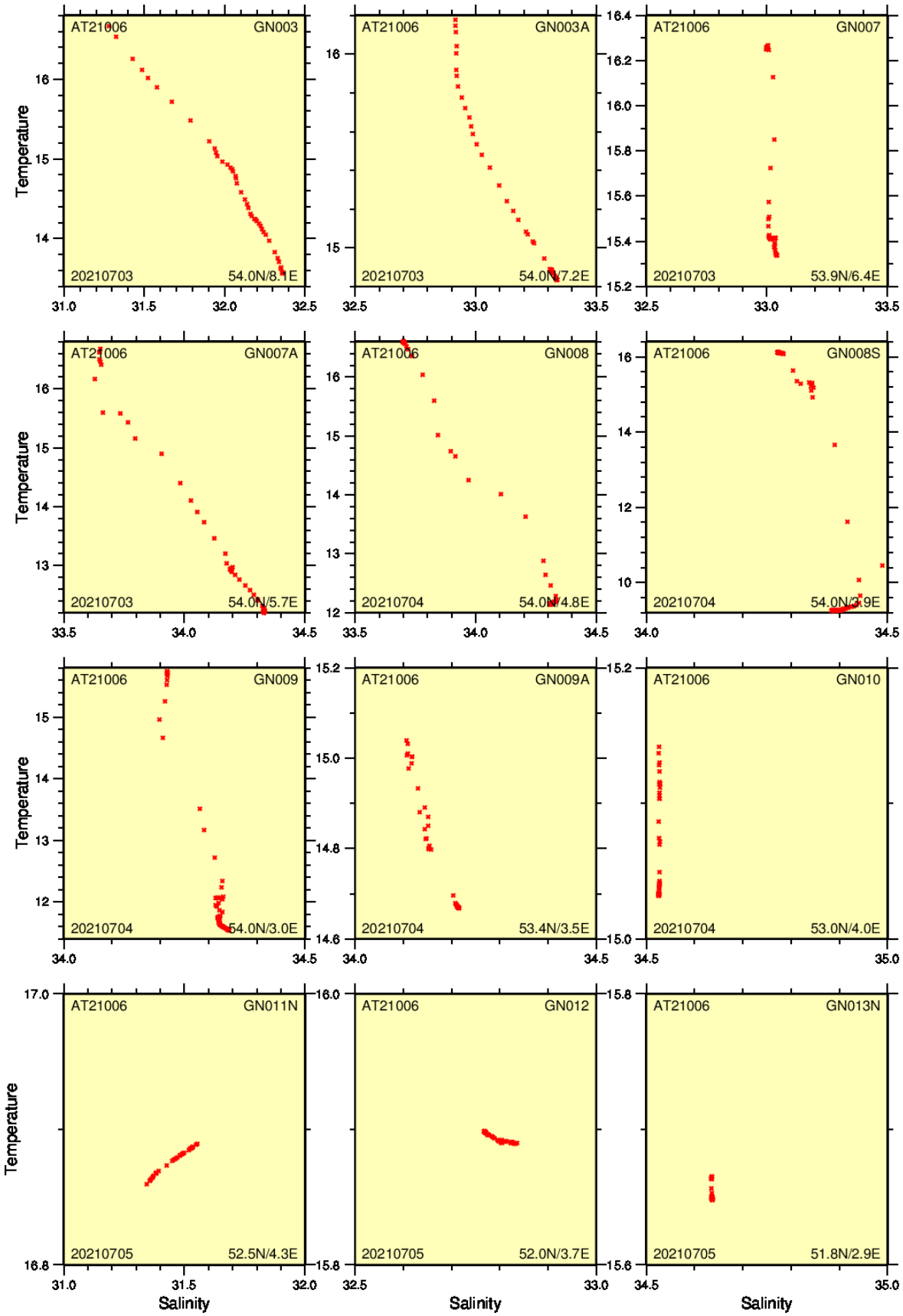
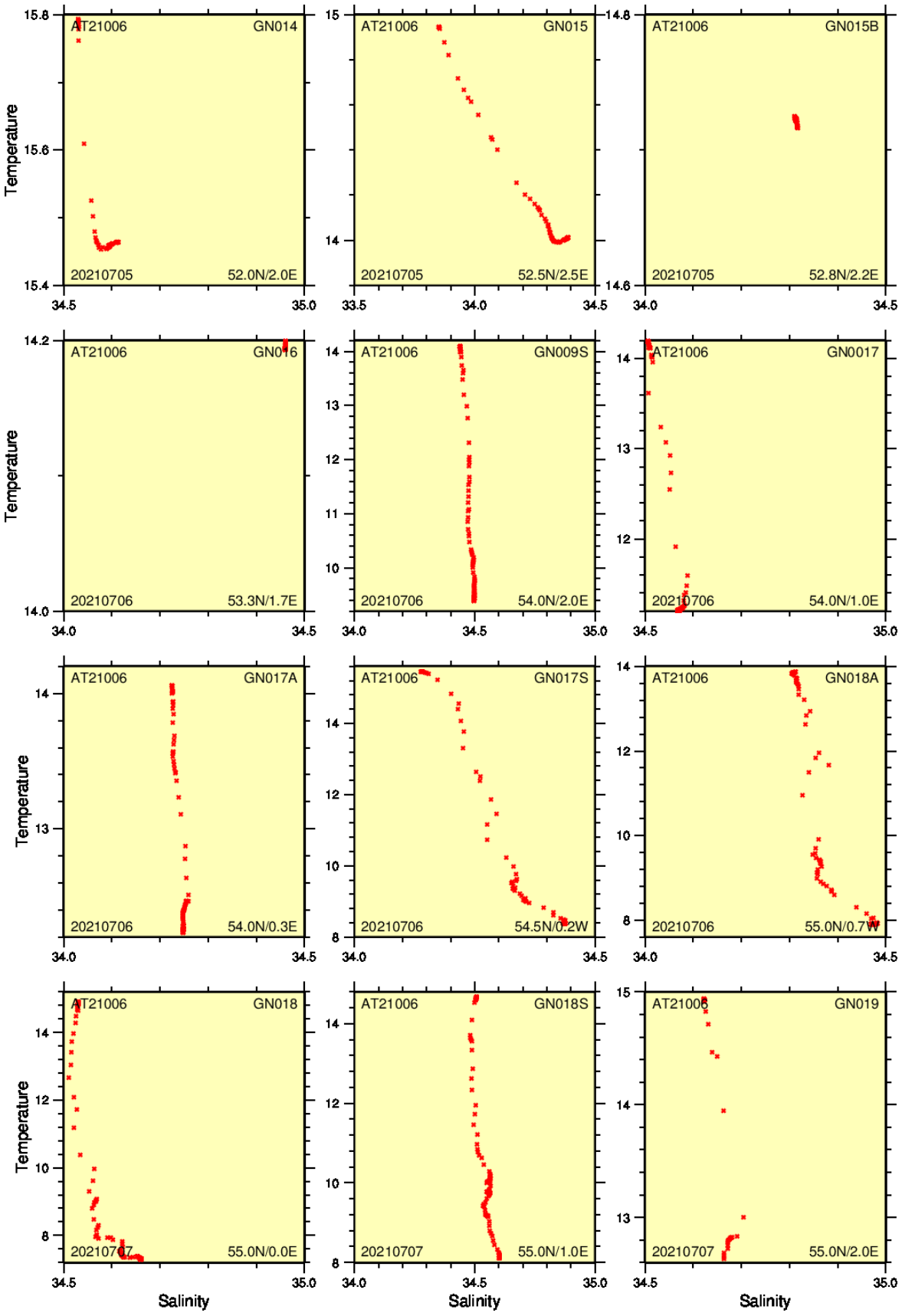
AT21006 GN050S 20210718 59.5N/4.5E
AT21006 GN050S 20210718 59.5N/4.5E
AT21006 GN050 20210718 59.0N/4.5E
AT21006 GN049S 20210718 59.0N/3.7E
AT21006 GN049 20210718 59.0N/3.0E
AT21006 GN048S 20210718 59.0N/2.0E
AT21006 GN048 20210719 59.0N/1.0E
AT21006 GN047 20210719 59.0N/0.0W
AT21006 GN046 20210719 59.0N/1.5W
AT21006 GN046A 20210719 59.0N/2.0W

Appendix 6: T-S-diagrams of all stations

The following diagrams are based on CTD-raw data.




AT21006 GN014
20210705 52.0N/2.0E
AT21006 GN015
20210705 52.5N/2.5E
AT21006 GN015B
20210705 52.8N/2.2E
AT21006 GN016
20210706 53.3N/1.7E
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20210706 54.0N/2.0E
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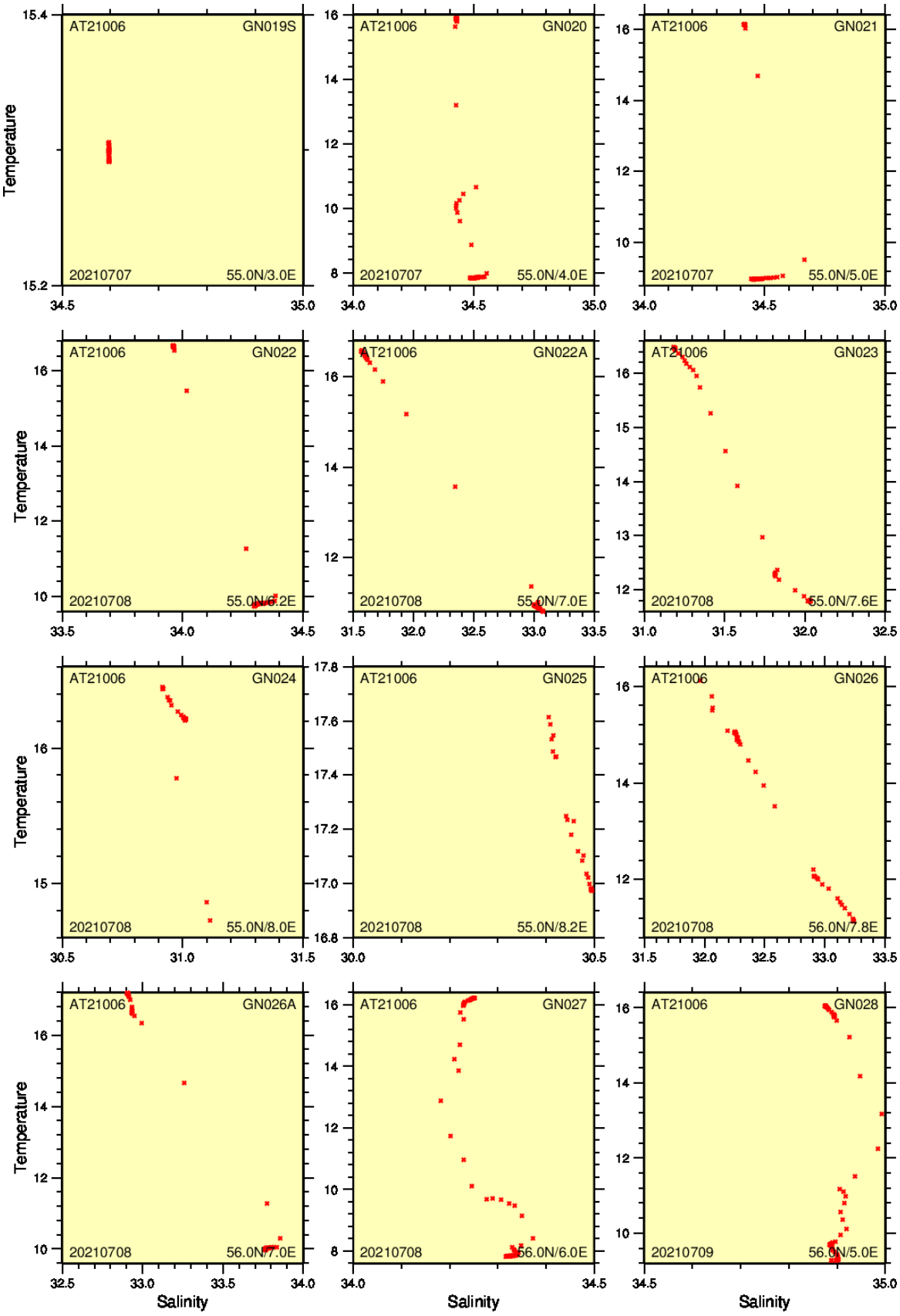
20210707 55.0N/2.0E
Temperature
Salinity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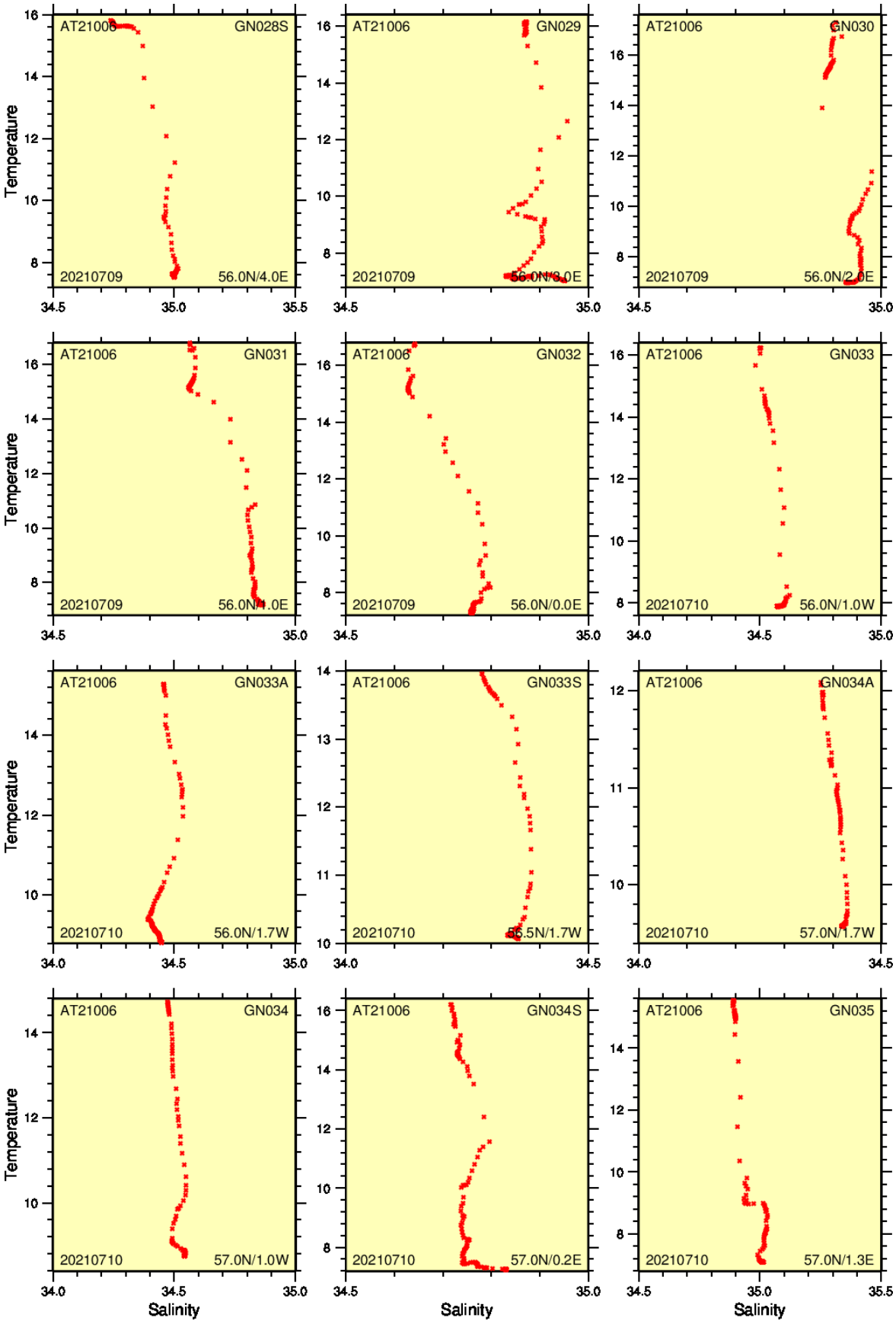
Temperature
Salinity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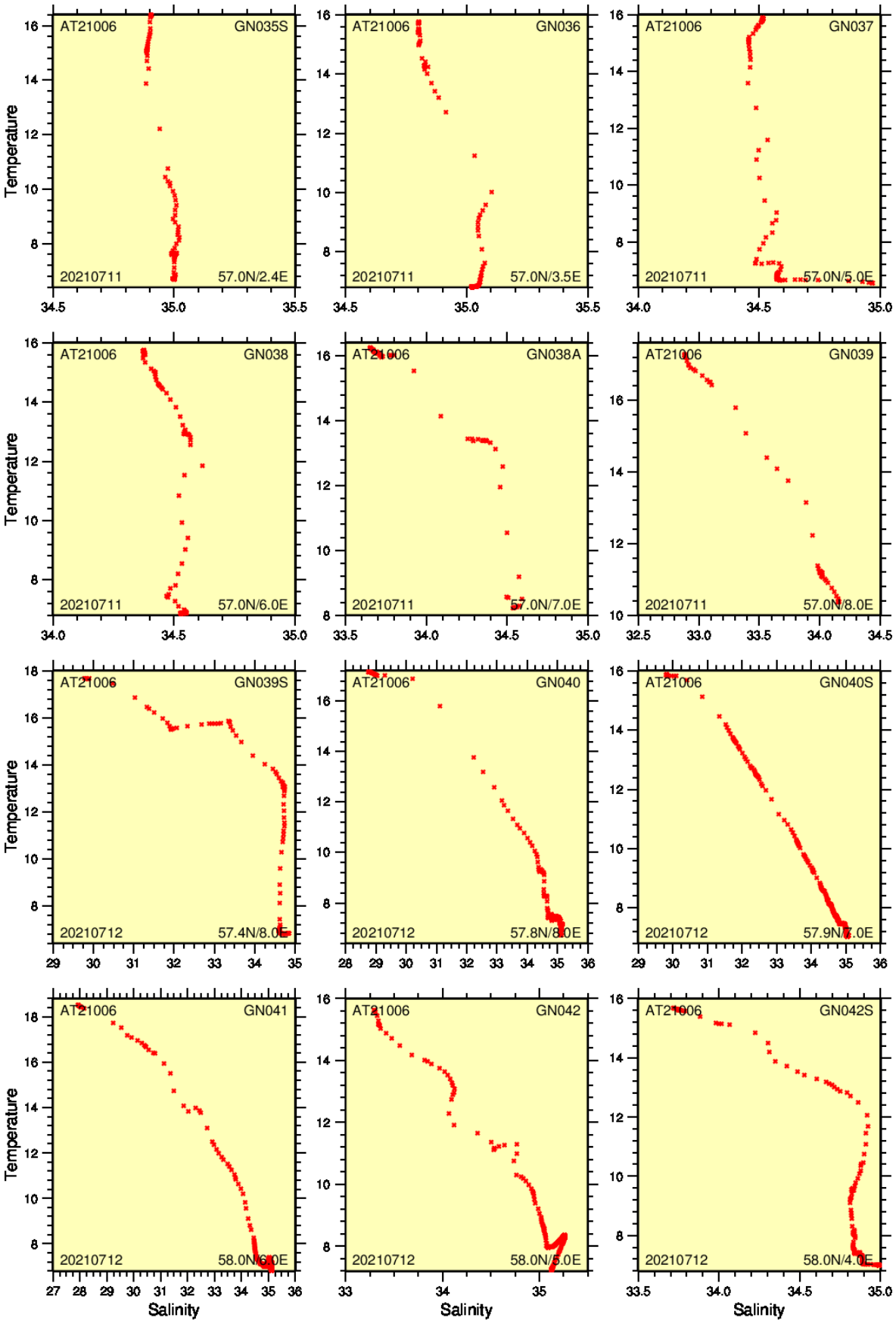
Temperature
Salinity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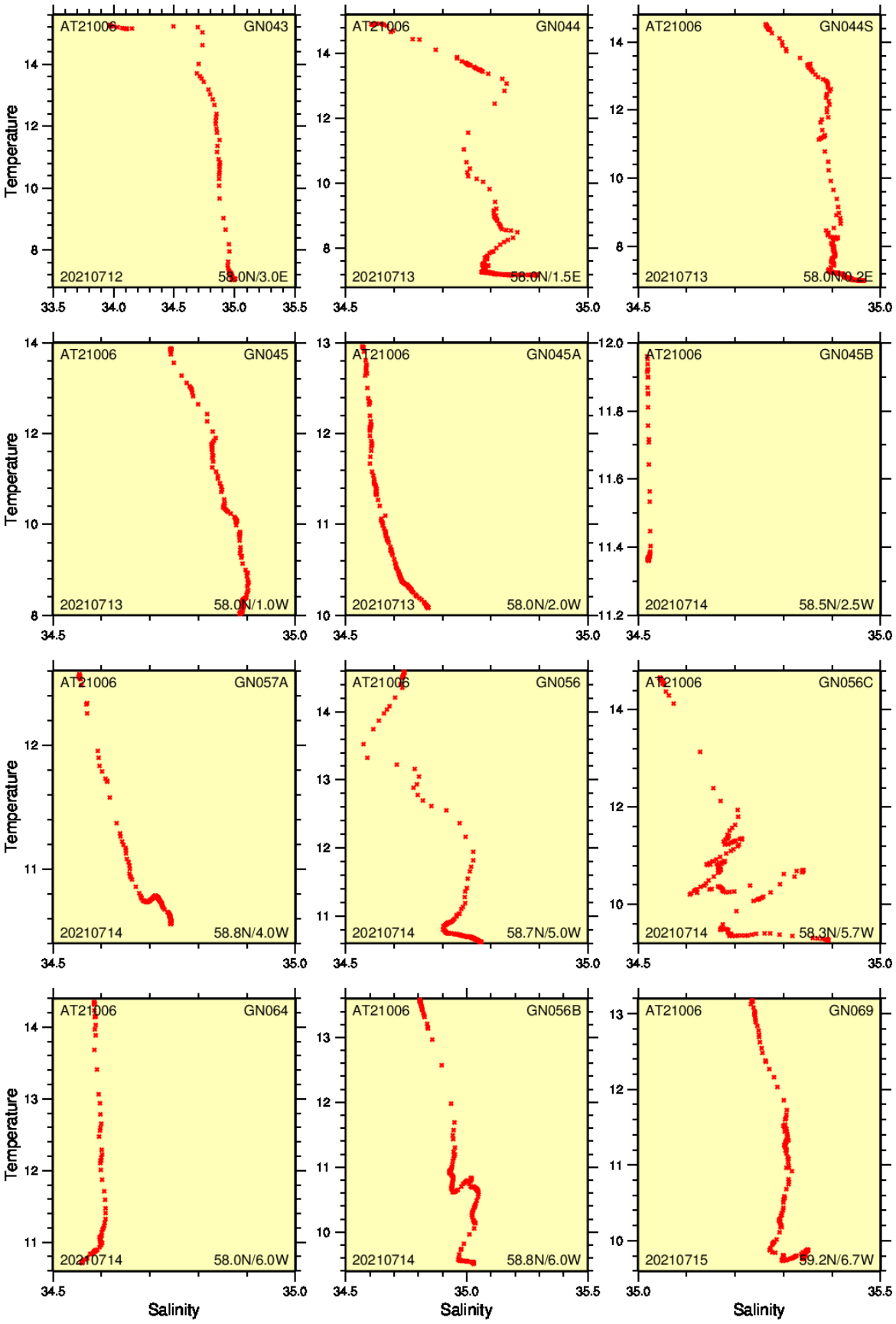
Temperature
Salinity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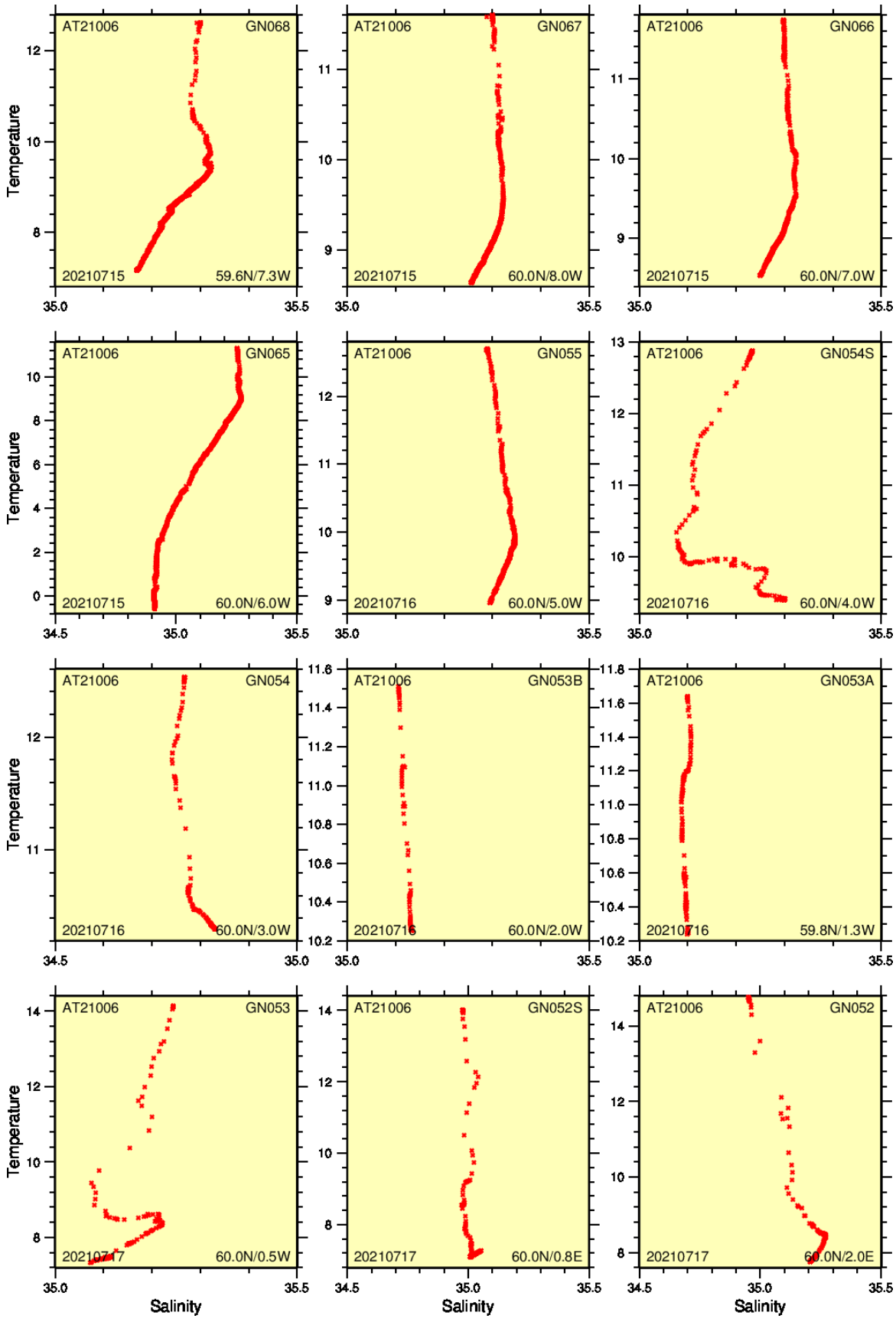
Temperature
Salinity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20210716 60.0N/4.0W
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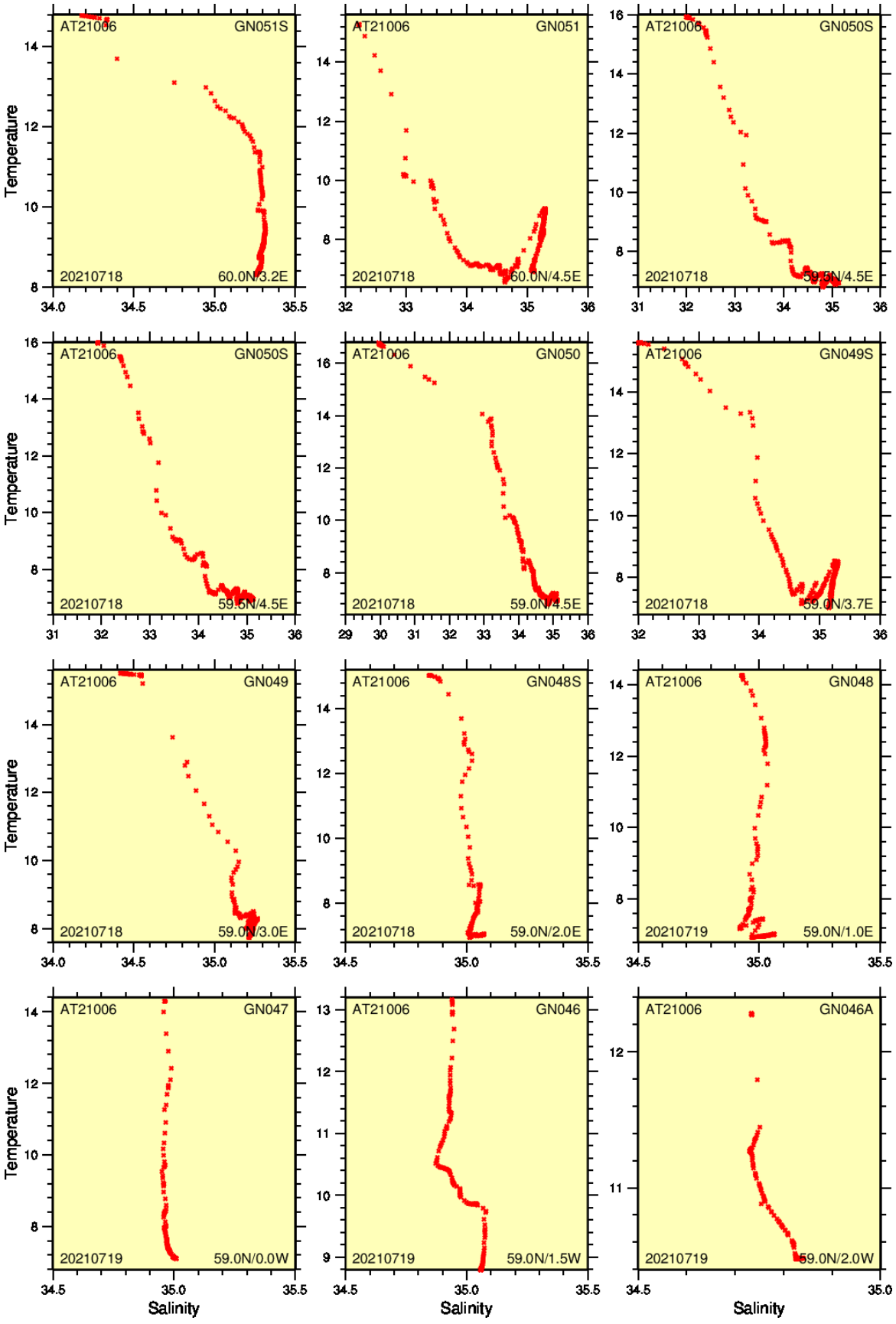
Temperature
Salinity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20210718 59.0N/2.0E
AT21006 GN048
20210719 59.0N/1.0E
AT21006 GN047
20210719 59.0N/0.0W
AT21006 GN046
20210719 59.0N/1.5W
AT21006 GN046A
20210719 59.0N/2.0W
Temperature
Salinity

Station	no	Lot	water depth	Phi	Lam	N°	N'	N	E°	E'	E	date [dd.mm.yy]	time [UTC] begin	time [UTC] end	Bedford ID 217nnn	CTD	water sampling [m]	Chloro phyll	Neuston Net surface	Secchi
GN003	1	18.7	23.7	54.000	8.104	54	0.00	N	008	6.24	E	03-Jul-21	10:40:26	11:08:34	001+002	x	bo, 5	5		x
GN003A	2	25.3	30.3	54.000	7.163	54	0.02	N	007	9.75	E	03-Jul-21	15:22:57	15:33:17	003+004	x	bo, 5	5	x	x
GN007	3	21.7	26.7	53.934	6.415	53	56.06	N	006	24.90	E	03-Jul-21	19:05:03	19:28:33	005+006	x	bo, 5	5		x
GN007A	4	31.6	36.6	54.001	5.665	54	0.04	N	005	39.88	E	03-Jul-21	22:10:04	22:25:55	007+008	x	bo, 5	5		
GN008	5	37.6	42.6	54.001	4.832	54	0.03	N	004	49.92	E	04-Jul-21	02:15:37	02:26:33	009+010	x	bo, 5			
GN008S	6	41.1	46.1	54.000	3.918	54	0.02	N	003	55.08	E	04-Jul-21	06:17:38	06:22:53	011+012	x	bo, 5	5		x
GN009	7	37.0	42.0	54.000	2.999	53	59.98	N	002	59.93	E	04-Jul-21	09:43:38	09:58:19	013+014	x	bo, 5	5	x	x
GN009A	8	23.0	28.0	53.417	3.502	53	25.01	N	003	30.12	E	04-Jul-21	17:07:27	17:16:25	015+016	x	bo, 5	5		x
GN010	9	24.5	29.5	53.000	3.999	53	0.01	N	003	59.91	E	04-Jul-21	20:41:06	20:50:07	017+018	x	bo, 5	5		
GN011N	10	15.0	20.0	52.516	4.330	52	30.98	N	004	19.81	E	05-Jul-21	00:40:46	00:49:51	019+020	x	bo, 5			
GN012	11	19.3	24.3	51.998	3.731	51	59.89	N	003	43.84	E	05-Jul-21	05:04:35	05:15:19	021+022	x	bo, 5	5		x
GN013N	12	27.1	32.1	51.800	2.919	51	48.00	N	002	55.12	E	05-Jul-21	09:13:56	09:23:51	023+024	x	bo, 5	5	x	x
GN014	13	24.8	29.8	52.000	2.000	52	0.01	N	001	59.99	E	05-Jul-21	14:01:58	14:11:54	025+026	x	bo, 5	5		x
GN015	14	43.4	48.4	52.501	2.500	52	30.03	N	002	30.01	E	05-Jul-21	17:57:52	18:08:16	027+028	x	bo, 5	5	x	x
GN015B	15	36.1	41.1	52.834	2.167	52	50.05	N	002	10.00	E	05-Jul-21	21:21:48	21:30:34	029+030	x	bo, 5	5		
GN016	16	24.8	29.8	53.333	1.667	53	20.00	N	001	40.02	E	06-Jul-21	00:46:17	00:53:37	031+032	x	bo, 5			
GN009S	17	69.5	74.5	54.000	2.001	54	0.02	N	002	0.07	E	06-Jul-21	07:00:02	07:13.41	033+034	x	bo, 5	5 2x		x
GN017	18	37.0	42.0	54.000	1.001	53	59.99	N	001	0.07	E	06-Jul-21	10:54:28	11:05:07	035+036	x	bo, 5	5		x
GN017A	19	49.7	54.7	54.000	0.333	53	59.97	N	000	19.95	E	06-Jul-21	13:36:42	13:46:20	037+038	x	bo, 5	5	x	x
GN017S	20	56.0	61.0	54.500	-0.166	54	29.97	N	000	9.95	W	06-Jul-21	18:11:09	18:25:20	039+040	x	bo, 5	5		x
GN018A	21	60.0	65.0	54.999	-0.668	54	59.96	N	000	40.07	W	06-Jul-21	21:58:08	22:11:12	041+042	x	bo, 5	5		
GN018	22	70.0	75.0	55.000	0.001	54	59.97	N	000	0.04	E	07-Jul-21	00:42:51	00:53:16	043+044	x	bo, 5	5		
GN018S	23	58.3	63.3	55.000	1.001	55	0.02	N	001	0.08	E	07-Jul-21	04:28:31	04:41:55	045+046	x	bo, 5	5 2x		x
GN019	24	21.9	26.9	55.000	2.001	55	0.00	N	002	0.04	E	07-Jul-21	08:12:27	08:21:22	047+048	x	bo, 5	5	x	x
GN019S	25	22.0	27.0	55.001	3.001	55	0.03	N	003	0.05	E	07-Jul-21	12:44:34	12:49:56	049+050	x	bo, 5	5		x
GN020	26	43.8	48.8	55.001	4.002	55	0.05	N	004	0.13	E	07-Jul-21	16:25:13	16:38:03	051+052	x	bo, 5	5		x
GN021	27	38.0	43.0	55.000	5.002	55	0.02	N	005	0.10	E	07-Jul-21	20:18:50	20:26:56	053+054	x	bo, 5	5		x
GN022	28	39.4	44.4	55.000	6.250	55	0.00	N	006	14.98	E	08-Jul-21	01:10:01	01:19:34	055+056	x	bo, 5			
GN022A	29	26.9	31.9	55.000	7.001	55	0.01	N	007	0.05	E	08-Jul-21	04:06:27	04:16:55	057+058	x	bo, 5	5 2x		x
GN023	30	22.0	27.0	55.000	7.584	54	59.99	N	007	35.03	E	08-Jul-21	06:24:25	06:33:36	059+060	x	bo, 5	5		x
GN024	31	12.2	17.2	55.000	8.000	55	0.00	N	008	0.02	E	08-Jul-21	08:10:46	08:17:25	061+062	x	bo, 5	5		x
GN025	32	9.7	14.7	55.000	8.250	55	0.02	N	008	14.99	E	08-Jul-21	09:19:15	09:23:41	063+064	x	bo, 5	5	x	x
GN026	33	22.3	27.3	56.001	7.801	56	0.07	N	007	48.06	E	08-Jul-21	16:50:22	16:59:59	065+066	x	bo, 5	5		x
GN026A	34	30.3	35.3	56.000	7.000	56	0.00	N	006	59.98	E	08-Jul-21	19:52:34	20:00:02	067+068	x	bo, 5	5 2x		x
GN027	35	42.9	47.9	56.000	5.999	56	0.01	N	005	59.96	E	08-Jul-21	23:26:31	23:40:20	069+070	x	bo, 5			
GN028	36	38.3	43.3	56.000	5.000	56	0.00	N	004	59.98	E	09-Jul-21	02:57:50	03:08:04	071+072	x	bo, 5			
GN028S	37	52.7	57.7	56.000	3.999	56	0.02	N	003	59.92	E	09-Jul-21	06:28:07	06:41:37	073+074	x	bo, 5	5 2x		x
GN029	38	68.7	73.7	56.000	3.000	56	0.02	N	003	0.00	E	09-Jul-21	10:03:42	10:13:36	075+076	x	bo, 5	5		x
GN030	39	81.6	86.6	56.000	2.000	55	59.99	N	001	59.98	E	09-Jul-21	13:36:48	13:47:55	077+078	x	bo, 5	5	x	x

GN031	40	72.5	77.5	56.000	0.999	55	59.99	N	000	59.96	E	09-Jul-21	17:36:02	17:48:37	079+080	x	bo, 5	5 2x		x
GN032	41	79.4	84.4	56.000	0.000	56	0.00	N	000	0.01	E	09-Jul-21	21:09:51	21:23:29	081-083	x	bo, 50, 5	5		x
GN033	42	62.0	67.0	56.000	-1.000	56	0.00	N	000	59.97	W	10-Jul-21	00:44:54	00:55:13	084+085	x	bo, 5			
GN033A	43	62.8	67.8	56.000	-1.668	56	0.01	N	001	40.10	W	10-Jul-21	03:17:50	03:31:56	086-088	x	bo, 20, 5			
GN033S	44	45.7	50.7	56.500	-1.666	56	29.99	N	001	39.94	W	10-Jul-21	06:32:33	06:42:48	089-091	x	bo, 30, 5	5 2x	?	x
GN034A	45	70.0	75.0	56.999	-1.666	56	59.96	N	001	39.96	W	10-Jul-21	10:06:50	10:19:41	092-094	x	bo, 18, 5	5		x
GN034	46	68.0	73.0	57.000	-1.001	57	0.00	N	001	0.03	W	10-Jul-21	12:38:44	12:51:04	095+096	x	bo, 5	5		x
GN034S	47	79.9	84.9	57.000	0.167	57	0.00	N	000	10.03	E	10-Jul-21	16:42:12	16:55:45	097-099	x	bo, 55, 5	5 2x	x	x
GN035	48	93.2	98.2	57.000	1.336	56	59.98	N	001	20.13	E	10-Jul-21	21:17:13	21:32:55	100-102	x	bo, 51, 5	5		x
GN035S	49	75.8	80.8	57.000	2.417	57	0.02	N	002	25.03	E	11-Jul-21	01:04:56	01:17:39	103-105	x	DP: bo, 15, 5			
GN036	50	60.1	65.1	57.000	3.500	56	59.98	N	003	29.98	E	11-Jul-21	04:56:48	05:11:16	106-108	x	bo, 30, 5			
GN037	51	53.2	58.2	57.001	5.000	57	0.03	N	005	0.01	E	11-Jul-21	10:17:02	10:28:41	109-111	x	bo, 40, 5	5 2x	x	x
GN038	52	47.0	52.0	57.000	6.001	57	0.00	N	006	0.03	E	11-Jul-21	14:10:29	14:20:47	112+113	x	bo, 5	5 2x		x
GN038A	53	28.1	33.1	57.000	7.000	56	59.99	N	006	59.99	E	11-Jul-21	17:33:27	17:42:45	114+115	x	bo, 5	5	x	x
GN039	54	30.0	35.0	57.001	8.001	57	0.08	N	008	0.06	E	11-Jul-21	21:23:47	21:30:24	116+117	x	bo, 5	5		x
GN039S	55	88.0	93.0	57.417	8.002	57	24.99	N	008	0.10	E	12-Jul-21	00:10:24	00:24:45	118-120	x	DP: bo, 50, 5			
GN040	56	522.0	527.0	57.835	8.000	57	50.09	N	007	59.98	E	12-Jul-21	03:03:48	03:49:19	121-123	x	bo, 200, 5			
GN040S	57	356.3	361.3	57.917	6.999	57	54.99	N	006	59.95	E	12-Jul-21	07:01:59	07:26:39	124-126	x	bo, 91, 5	5 2x	x	x
GN041	58	303.0	308.0	58.000	6.000	58	0.01	N	006	0.02	E	12-Jul-21	10:58:16	11:24:48	127-129	x	bo, 196, 5	5		x
GN042	59	127.0	132.0	58.000	5.000	57	59.99	N	005	0.02	E	12-Jul-21	14:31:13	14:52:06	130-132	x	bo, 40, 5	5		x
GN042S	60	93.0	98.0	58.000	3.999	57	59.98	N	003	59.96	E	12-Jul-21	18:04:33	18:17:03	133-135	x	bo, 48, 5	5 2x	x	x
GN043	61	71.4	76.4	58.000	3.003	57	59.99	N	003	0.18	E	12-Jul-21	22:24:14	22:37:40	136-138	x	bo, 40, 5	5		
GN044	62	100.3	105.3	58.000	1.499	57	59.99	N	001	29.95	E	13-Jul-21	03:16:46	03:36:20	139-141	x	bo, 37, 5			
GN044S	63	135.2	140.2	58.001	0.250	58	0.03	N	000	14.99	E	13-Jul-21	07:28:27	07:42:47	142-144	x	DP: bo, 40, 5	5 2x		x
GN045	64	109.7	114.7	58.000	-1.000	58	0.00	N	001	0.02	W	13-Jul-21	13:29:28	13:42:39	145-147	x	bo, 55, 5	5	x	x
GN045A	65	77.2	82.2	58.000	-1.999	58	0.01	N	001	59.96	W	13-Jul-21	19:18:10	19:27:39	148+149	x	bo, 5	5 2x		x
GN045B	66	67.5	72.5	58.501	-2.500	58	30.04	N	002	29.99	W	14-Jul-21	01:12:30	01:22:11	150+151	x	bo, 5			
GN057A	67	76.0	81.0	58.750	-4.001	58	45.01	N	004	0.04	W	14-Jul-21	05:57:11	06:07:44	152-154	x	bo, 30, 5	5 2x		x
GN056	68	82.9	87.9	58.749	-5.004	58	44.94	N	005	0.21	W	14-Jul-21	09:22:35	09:34:41	155+156	x	bo, 5	5		x
GN056C	69	103.0	108.0	58.333	-5.667	58	20.00	N	005	40.01	W	14-Jul-21	13:36:59	13:52:28	157-159	x	bo, 55, 5	5		x
GN064	70	52.0	57.0	58.001	-6.000	58	0.03	N	006	0.00	W	14-Jul-21	16:38:23	16:53:51	160-162	x	bo, 18, 5	5 2x		
GN056B	71	113.0	118.0	58.750	-6.000	58	45.00	N	005	59.97	W	14-Jul-21	21:54:04	22:07:27	163-165	x	bo, 34, 5	5		
GN069	72	128.7	133.7	59.167	-6.667	59	10.03	N	006	40.03	W	15-Jul-21	02:22:55	02:43:24	166-168	x	bo, 64, 5			
GN068	73	1000.0	1005.0	59.584	-7.330	59	35.03	N	007	19.80	W	15-Jul-21	06:51:00	08:08:00	169-171	x	bo, 500, 5	5 2x		x
GN067	74	751.7	756.7	60.001	-8.003	60	0.07	N	008	0.20	W	15-Jul-21	14:12:26	14:55:20	172-175	x	bo, 413, 205, 5	5 2x		x
GN066	75	449.0	454.0	60.000	-7.000	60	0.00	N	006	59.99	W	15-Jul-21	17:59:01	18:26:10	176+177	x	bo, 5	5		x
GN065	76	1058.0	1063.0	60.000	-5.999	60	0.02	N	005	59.91	W	15-Jul-21	21:58:42	22:45:35	178-181	x	bo, 629, 106, 5			
GN055	77	406.4	411.4	60.000	-4.999	59	59.99	N	004	59.92	W	16-Jul-21	01:49:09	02:25:30	182-185	x	bo, 286, 122, 5			
GN054S	78	122.0	127.0	60.000	-4.001	59	59.98	N	004	0.03	W	16-Jul-21	05:50:58	06:12:15	186-189	x	bo, 84, 46, 5	5 2x		x
GN054	79	100.6	105.6	60.000	-3.000	60	0.00	N	003	0.02	W	16-Jul-21	09:51:27	10:03:05	190-192	x	bo, 33, 5	5		x
GN053B	80	83.1	88.1	59.998	-1.998	59	59.89	N	001	59.85	W	16-Jul-21	13:12:27	13:23:00	193+194	x	DP: bo, 5	5		x
GN053A	81	81.4	86.4	59.798	-1.331	59	47.86	N	001	19.83	W	16-Jul-21	15:52:46	16:02:24	195-197	x	bo, 50, 5	5		x

GN053	82	120.2	125.2	60.000	-0.499	59	59.98	N	000	29.91	W	17-Jul-21	12:54:43	13:07:50	198-200	x	bo, 71, 5	5 2x		x
GN052S	83	122.9	127.9	60.000	0.752	59	59.98	N	000	45.10	E	17-Jul-21	16:57:26	17:17:42	201-204	x	bo, 56, 25, 5	5 2x		x
GN052	84	96.0	101.0	60.000	1.996	59	59.97	N	001	59.78	E	17-Jul-21	21:21:36	21:32:53	205+206	x	bo, 5			
GN051S	85	210.0	215.0	60.000	3.250	59	59.98	N	003	15.00	E	18-Jul-21	01:24:34	01:39:33	207-209	x	bo, 102, 5			
GN051	86	252.9	257.9	60.001	4.507	60	0.06	N	004	30.39	E	18-Jul-21	05:22:59	05:53:50	210-213	x	bo, 181, 67, 5	5 2x		x
GN050S	87	260.3	265.3	59.500	4.500	59	29.98	N	004	29.98	E	18-Jul-21	09:13:26	09:38:43	214-219	x	DP*: bo, 143, 5 + 2. cast	5 2x		x
GN050	88	253.6	258.6	59.001	4.501	59	0.03	N	004	30.05	E	18-Jul-21	13:16:53	13:47:50	220-228	x	DP*: bo, 143, 5 + 2. cast	5 10x		x
GN049S	89	266.5	271.5	59.001	3.749	59	0.03	N	003	44.92	E	18-Jul-21	17:06:23	17:31:10	229+230	x	bo, 5	5 2x		x
GN049	90	132.3	137.3	59.000	3.001	58	59.99	N	003	0.06	E	18-Jul-21	20:07:15	20:17:44	231+232	x	bo, 5	5		x
GN048S	91	109.1	114.1	59.000	2.000	59	0.01	N	002	0.02	E	18-Jul-21	23:33:14	23:47:01	233+234	x	bo, 5			
GN048	92	119.4	124.4	59.001	1.000	59	0.03	N	000	59.99	E	19-Jul-21	03:01:27	03:16:31	235+236	x	bo, 5			
GN047	93	127.1	132.1	59.000	-0.001	58	59.99	N	000	0.08	W	19-Jul-21	06:28:21	06:39:12	237+238	x	bo, 5	5		x
GN046	94	102.0	107.0	59.001	-1.501	59	0.04	N	001	30.06	W	19-Jul-21	11:14:36	11:23:47	239-240	x	bo, 5	5 2x		x
GN046A	95	72.7	77.7	59.001	-1.999	59	0.05	N	001	59.94	W	19-Jul-21	13:04:12	13:16:41	241-242	x	bo, 5	5 8x		x

DP:
Doppelprobe

DP*: first sample without, second with 3 min waiting period