R/V „Celtic Explorer“

Cruise 17013a, August 11th – September 3rd, 2017

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

20 Years
BSH NORTH SEA SUMMER SURVEY
1998 - 2017

R/V *Celtic Explorer* 17013a
11.08. - 03.09.2017
Hamburg - Aberdeen

Report of the Chief Scientist

ICES Cruise Id: 45CE17013a

CSRREF: 20173179

Holger Klein

Hamburg, September 2017

(CR-Celtic-Explorer-17013A.docx)

Contents:

Participants

Science Crew BSH	Working Group	Ship Crew	Rank
Holger Klein	Marine Physics, Chief Scientist	Denis Rowan	Master
Peter Löwe	Marine Physics	Adrian Byrne	Chief Engineer
Sören Joswig	Marine Physics	Basil Murphy	Chief Officer
Francisco de la Granda Grandoso	Marine Physics	Barry Hooper	2nd Officer
Simon Tewes	Marine Physics	David (Dave) Stack	2nd Engineer
Klaus Becker	Marine Chemistry, Radioactivity	Michael Slyne	ETO
Dr. Stefanie Schmied	Marine Chemistry, Radioactivity	Frank Kenny	Bosun
Roswitha Velten	Marine Chemistry, Nutrients	Jimmy Moran	Cook
Anna Elisabeth Lau	Marine Chemistry, Organic	Shane Horan	Bosun's Mate
Ina Raschke	Marine Chemistry, Trace Metals	Martin Goggin	AB Deckhand 06-12
Simone Griesel	Air Chemistry	Tom Gilmartin	AB Deckhand 12-06
		Maurice Murphy	Assistant Cook
		Anthony English	Technician
		Cathal Murrin	AB Deckhand 06-12
		Noel O'Driscoll	AB Deckhand 12-06

Fig. 1: *The BSH crew from left to right: Simone Griesel, Ina Raschke, Anna E. Lau, Roswitha Velten, Sören Joswig, Klaus Becker, Holger Klein, Simon Tewes, Stefanie Schmied, Francisco (Kiko) de la Granda Grandoso und Peter Löwe.*

Objectives and scientific background

The North Sea is a shallow shelf sea with a deep trough along the Norwegian coast with depth exceeding 700 m locally. Its physical status, primarily characterised by temperature and salinity, is to a large extent determined by the exchange of water masses with the Atlantic at its open northern boundary. There is also a link to the Atlantic via the English Channel which is important for the shallow southern North Sea. The Baltic Sea is linked to the North Sea via Skagerrak, Kattegat, Great and Little Belt, and The Sound. The Baltic outflow with its low saline water influences significantly the oceanographic conditions of the Skagerrak and Norwegian Coastal Current. Other drivers are inter alia continental river run-offs, the ocean-atmosphere heat exchange, and the rate of precipitation to evaporation.

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 with vertical gradients exceeding 3 K/m in most of the years. Strength and depth of the thermocline vary locally and from year to year. Near-bottom tidal mixing and wind induced mixing at the surface suppress stratification in areas shallower than 25 to 30 m. Stratified and vertically mixed areas are separated by so-called tidal mixing fronts.

In order to assess the physical and chemical state of the North Sea during summer the BSH started its North Sea Summer Surveys (NSSS) in 1998. They cover the entire North Sea with seven coast to coast east-west sections between 54° and 60°N and additional stations between 54°N and the entrance of the English Channel. The surveys were realised at a time when thermal stratification is expected to be at its maximum and phytoplankton production has passed its maximum. With the exception of the first survey in 1998 all surveys served a fixed grid of vertical CTD casts (see station without an A, B, or S in Fig. 1). Between the CTD-stations ship-mounted temperature-, salinity- and optical sensors provided data at about 4 m depth.

For the monitoring of artificial radio nuclides additional stations in the English Channel respectively in the Skagerrak are served alternately every second year.

The objective of the NSSSs is the assessment of the oceanographic and chemical state of the North Sea, the calculation of heat and salt budgets, and the identification of changes due to climate change. The data 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. All NSSSs are listed in Table 1. Most of the data are available via the German Oceanographic Data Centre (DOD) and 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	●	●	(●)	●	●	●

Table 1: *BSH North Sea Summer Surveys 1998-2017.*

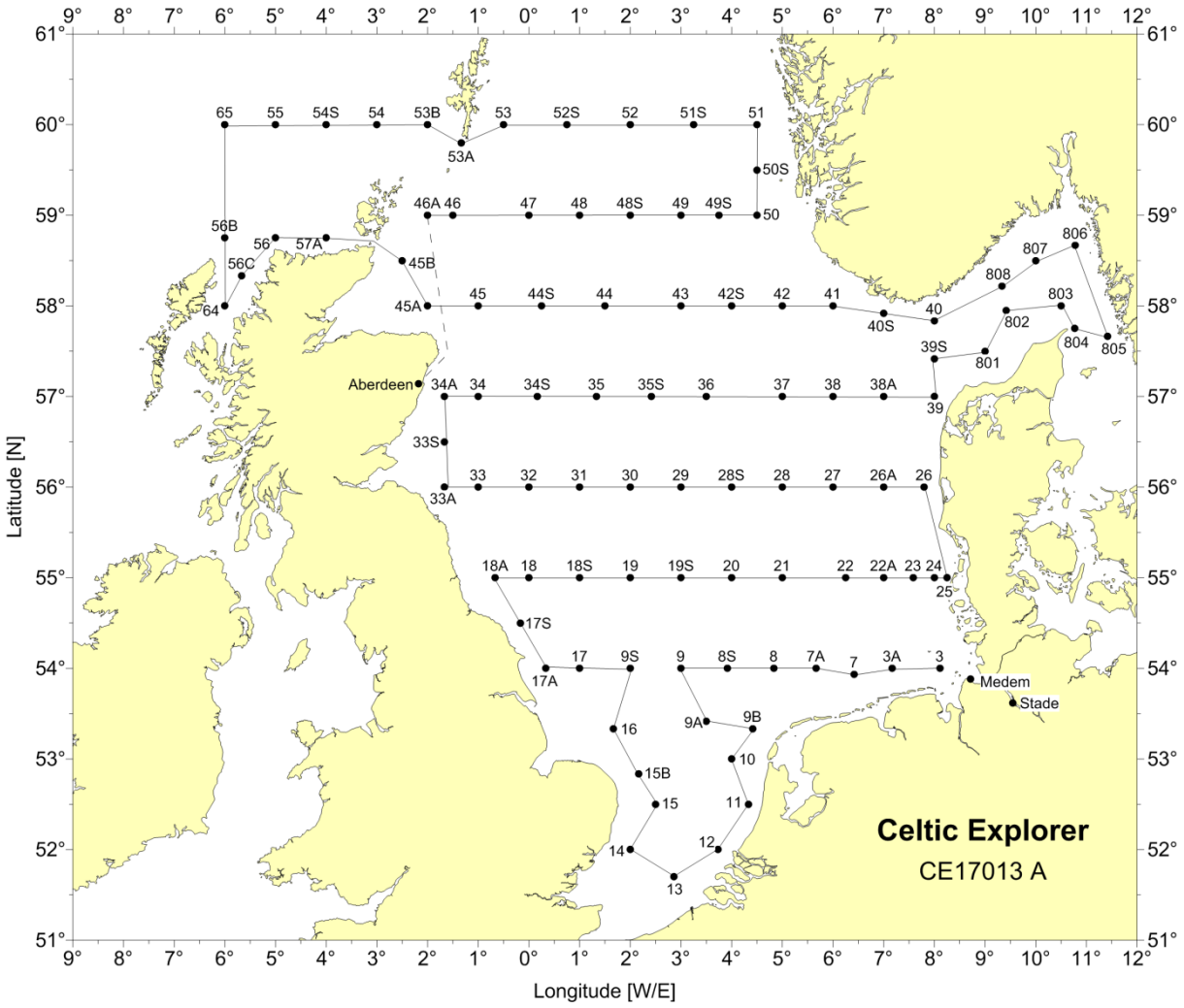


Fig. 2: *Ship track and sampling stations.*

Equipment and Methods

Marine Physics:

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

instrument/sensor	typ	S/N	last calibration
CTD S6 (Clean CTD)	SBE911+	09P56228	
p-sensor	SBE9P	1005	03.02.2014
T-sensor	SBE3T	5278	16.06.2017
C-sensor	SBE4C	3694	16.06.2017
CTD S1	SBE911+	09P21787	
p-sensor	SBE9P	577	03.02.2014
T-sensor	SBE3T	2584	16.06.2017
C-sensor	SBE4C	2886	16.06.2017
CTD S2 (back-up system)	SBE911+	09P83014	
p-sensor	SBE9P	641	28.06.2011
T-sensor	SBE3T	5254	18.07.2016
C-sensor	SBE4C	3691	18.07.2016
Deck Unit	SBE11+	P31787-0526	
Spare Deck Unit	SBE11+	P25457-0585	
O_2-sensor	SBE43	153	11.04.2017
Fluorometer & Turbidity	WetlabECO	4738	04.05.2017
Altimeter	Benthos Teledyne	978	14.03.2002
Rosette Sampler S1	11 × Niskin 10 l		
Rosette Sampler S6 (Clean CTD)	10 × Niskin 10 l 8 × GoFlow	N7	
Vessel mounted sensors:			
Thermosal	SBE21	2148425-3315	July 2017
Fluorimeter for turbidity and chlorophyll	10 AU Turner		July 2017

Nutrients:

- Oxygen determination according to Winkler-Carpenter by means of a SIS Dissolved Oxygen Analyser (DOA) with photometric end point determination at selected depths.
- Continuous pH determination via the sea water pipe.
- Continuous phosphate, silicate, nitrite, and nitrate determination by MiniMon via the sea water pipe and daily reference samples.
- Determination of the pH value (CTD samples and continuously).
- 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 Jeffrey and Humphrey after the cruise.
- The determination of alkalinity of sea water was not feasible due to a malfunction of the instrument. Only the first two stations could be sampled.

Radiochemistry:

- 2 x 35 l surface water for the extraction of strontium-90 after the cruise.
- One liter surface samples for the analysis of tritium after the cruise.
- 270 l samples taken at selected stations at great depths for the determination of strontium and tritium after the cruise and of cesium and transuranic elements on board.
- 100-150 l surface water samples for the on-board analysis of cesium-137 by means of an ion exchanger (KNiFC-PAN).
- 100 l surface water samples for the on-board analysis of transuranic elements.

Atmospheric Chemistry

- Continuous trace gas measurements of nitric oxides (NO_x, NO und NO_2), of sulphur dioxide (SO_2), ozone (O_3), and of carbon dioxide (CO_2) by means of Airpointer (Co. recordum/MLU, S/N: 2016-590).
- Remote sensing of NO_2 and SO_2 by MAX-DOAS measurements (Multi-axis Differential Optical Absorption Spectroscopy, Institute of Environmental Physics, University of Bremen, system of station Wedel).
- Monitoring of current AIS signals in order to relate measured increased concentrations to surrounding ships.

Organic Pollutants

- Determination of polar and non-polar organic and inorganic pollutants as, e.g. pesticides, chlorinated hydrocarbons (CHC), polycyclic aromatic hydrocarbons (PAH) and trace metals in sediment cores and sediment pore water (Project NOAH-Synthesis).

Trace Metals:

- Determination of metal concentrations in sea water and suspended matter. Sampling via Clean CTD with GoFlo sampler or MERCOS sampler with plastic covered wire.

Container Plan for leg a & b

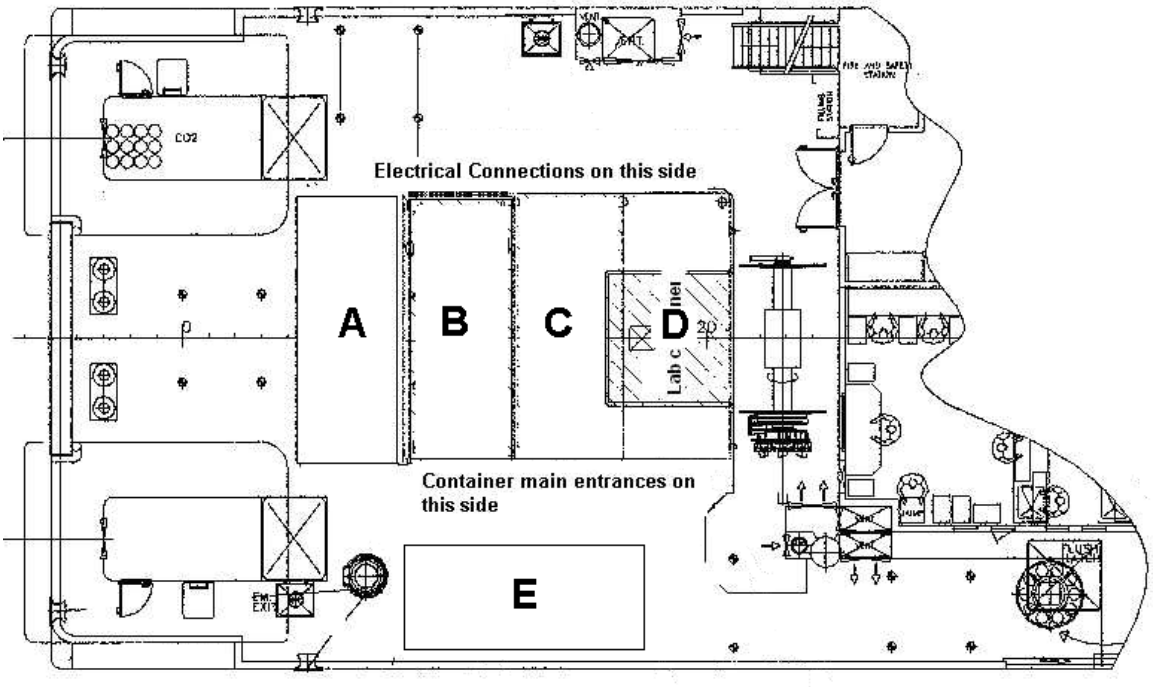


Fig. 3: *Container plan Celtic Explorer*

	container type	**weight**	**power supply**	**used on leg**
A	Four 600 l drums for nutrients and calibration lab			1
B B	Bottom: 20" M33 lab container, height 3.1 m (HM) Top: -	9	2 x 32 A	2
C C	Bottom: 20" Transport and store container Top: 10” 10" Store container for marine chemistry	5 t 2 t	- -	1&2 2
D D	Bottom: 20“ M32 lab container for radioactivity, fresh- and sea water	5 t	32 A	1
E	20" Transport container radioactivity	9 t	-	1
F	-			

F: Bow position

Diary

Time: UTC

🡻 Specifications regarding fixed stations, ship stops for vertical CTD profiles and water sampling.

W&S Weather & Sea: T_A = air temperature, T_W = water temperature at 4 m depth T_w and salinity data are raw data from the ships thermosal SBE 21.

Definition Cloud Cover	Category
0/8 Sky clear	fine
1/8 of sky 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

RA Radioactivity, sea water samples are taken for the following artificial nuclides: Cs-137 = cesium-137; Sr-90 = strontium-90; H-3 = tritium, Pu = plutonium, Am = americium, Cm = curium. If no samplers are used, samples are taken from the Seawater pipe. KNiFC-PAN = 100 liter sea water samples for the determination of cesium-137 by Potassium-Nickel Hexacyanoferrate.

T Neuston trawl for for visible pollutions (e.g. paraffin wax and vegetable oils) at 3 kn speed.

Watch table marine physics:

00-04/12-16: Francisco (Kiko)
04-08/16-20: Peter
08-12/20-00: Sören

Watch table nutrients:

08-20: Roswitha

Watch table radioactivity:

00-12: Steffi
12-00: Klaus

Friday, August 11th, 2017

07:30 Arrival of the science crew at Celtic Explorer. Berth: Schuppen 62, Süd-West-Terminal, Am Kamerunkai 5, 20457 Hamburg.

11:00 Arrival of containers and equipment and mobilisation by use of the local crane.

14:45 Container loading and crane assistance is finished.
Preparation of dry and wet labs and installation of sensor systems.

15:00 Security instructions by the second mate Barry Hooper.

Saturday, August 12th, 2017

06:30 Sailing.

🡻 **08:17 – 08:35 Station STADE:**
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. GoFlow sampler for Trace metals.
W&S: Bft. 2-3, 230°, 1011 hPa, T_A = 14.8 °C, overcast.

🡻 **11:48 – 12:05 Station MEDEM:**
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. GoFlow sampler for Trace metals.
W&S: Bft. 4, 230°, 1010 hPa, T_A = 16.0 °C, overcast.

🡻 **14:46 - 15:08 Station GN003/ELBE1:**
Secchi depth, CTD profile with rosette sampler and nutrients.
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 5-6, 300°, 1008 hPa, T_A = 18.4 °C, cloudy, T_w = 18.6 °C,S = 32.84 psu.

15:50: Muster Station exercise.

T **17:35 – 17:55 Neuston trawl for micro plastic (ViPo 76):**
Start: 54° 00.34’ N; 007° 24.99’ E
End: 54° 00.80’ N; 007° 23.30’ E

🡻 **18:50 – 19:06 Station GN003A:**
CTD profile with rosette sampler, RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 4-5, 280°, 1012 hPa, T_A = 18.0 °C, cloudy, T_w = 18.9 °C, S = 33.33 psu.

🡻 **22:08 – 22:23 Station GN007 (Borkumriffgrund):**
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 5, 300°, 1014 hPa, T_A = 17.8 °C, cloudy, T_w = 19.2 °C, S = 34.18 psu.

Sunday, August, 13th, 2017

🡻 **01:21 – 01:37 Station GN007A:**
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 3-4, 340°, 1016 hPa, T_A = 16.4 °C, T_w = 18.5 °C, S = 34.57 psu.

🡻 **04:31 – 05:15 Station GN008:**
Secchi depth, Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137. Trace metals.
W&S: Bft. 4, 340°, 1016 hPa, T_A = 16.5 °C, fine, T_w = 18.5 °C, S = 34.57 psu.

No samples for Bedford No. 175013, Niskin bottle didn’t closed.

↓ **08:38 – 08:53 <u>Station GN008S</u>:**
Secchi depth and CTD profile with rosette sampler
W&S: Bft. 2, 350°, 1020 hPa, T_A = 19.9 °C, fine, T_w = 17.5 °C, S = 34.46 psu.

↓ **12:24 – 13:20 <u>Station GN009</u> (Outer Well Bank):**
Secchi depth, Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
W&S: Bft. 1-2, 230°, 1021 hPa, T_A = 18.7 °C, fine, T_w = 17.5 °C, S = 34.42 psu.

Three CTD casts due to problems with the automatic pressure release for opening the GoFlow bottles at 10 m depth. Last cast (used for sampling) was taken with open GoFlow samplers.
There is a pressure off-set of +2.47 dbar at the S6 pressure sensor.

T **14:09 – 14:54 Neuston trawl for micro plastic (ViPo 77):**
Start: 53° 56.39' N; 003° 10.00' E
End: 53° 55.40' N; 003° 12.58' E

↓ **19:07 – 19:20 <u>Station GN009A</u>:**
CTD profile with rosette sampler. RA: Cs-137.
W&S: Bft. 2, 160°, 1022 hPa, T_A = 17.2 °C, fine, T_w = 19.2 °C, S = 34.13 psu.

Due to strong traffic and strong tidal currents the position was slightly shifted to the SW.

↓ **22:36 – 22:53 <u>Station GN009B</u>:**
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 4-5, 130°, 1022 hPa, T_A = 17.4 °C, T_w = 18,9 °C, S = 34.75 psu.

Monday, August 14th, 2017

↓ **01:27 – 01:39 <u>Station GN010</u> (west of Den Helder):**
Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137. Trace metals.
W&S: Bft. 4, 140°, 1020 hPa, T_A = 17.2 °C, fine, T_w = 18.6 °C, S = 34.91 psu.

↓ **05:05 – 05:16 <u>Station GN011</u> (west of Ijmuiden):**
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
W&S: Bft. 4, 170°, 1020 hPa, T_A = 17.1 °C, partly cloudy, T_w = 19.5 °C, S = 34.89 psu.

↓ **10:17 – 10:36 <u>Station GN012</u> (west of Hoek van Holland):**
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
W&S: Bft. 2, 80°, 1019 hPa, T_A = 21.7 °C, fine, T_w = 20.0 °C, S = 34.44 psu.

↓ **13:59 – 14:14 <u>Station GN013</u> (Rabsbank):**
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
W&S: Bft. 2, 120°, 1017 hPa, T_A = 20.5 °C, fine, T_w = 19.2 °C, S = 34.99 psu.

T **16:33 – 17:20 Neuston trawl for micro plastic (ViPo 78):**
Start: 51° 55.56' N; 002° 22.27' E
End: 51° 57.00' N; 002° 19.31' E

- **18:47 - 19:05 Station GN014 (Outer Gabbard):**
  Secchi depth, CTD profile with rosette sampler and nutrients RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
  W&S: Bft. 3, 140°, 1016 hPa, T_A = 18.7 °C, partly cloudy, T_w = 18.9 °C, S = 35.01 psu.

- **22:17 – 22:35 Station GN015 (east of Lowestoft):**
  CTD profile with rosette sampler and nutrients. RA: Cs-137.
  W&S: Bft. 2-3, 160°, 1015 hPa, T_A = 19.0 °C, T_w = 19.1 °C, S = 34.82 psu

Tuesday, August 15th, 2017

- **01:16 – 01:28 Station GN015B:**
  CTD profile with rosette sampler. RA: Cs-137.
  W&S: Bft. 3-4, 160°, 1013 hPa, T_A = 18.0 °C, T_w = 18.0 °C, S = 34.10 psu

- **05:17 – 05:34 Station GN016 (Haddock Bank):**
  Secchi depth, Clean-CTD profile with rosette sampler and nutrients RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Nutrients. Trace metals.
  W&S: Bft. 2-3, 230°, 1013 hPa, T_A = 16.5 °C, partly cloudy, T_w = 16.5.0 °C, S = 34.34 psu.

- **09:53 – 10:05 Station GN009S (Outer Silver Pit):**
  Secci depth, CTD profile with rosette sampler.
  W&S: Bft. 4, 230°, 1013 hPa, T_A = 18.0 °C, partly cloudy, T_w = 16.8 °C, S = 34.54 psu.

- **14:04 – 14:20 Station GN017 (east of Flamborough Head):**
  Secchi depth, Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137. Trace metals.
  W&S: Bft. 3-4, 210°, 1013 hPa, T_A = 17.5 °C, fine, T_w = 15.6 °C, S = 34.33 psu.

- **T** **15:03 – 15:43 Neuston trawl for micro plastic (ViPo 79):**
  Start: 54° 00.08’ N; 000° 48.34’ E
  End: 54° 00.54’ N; 000° 45.22’ E

- **17:18 – 17:33 Station GN017A:**
  CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
  W&S: Bft. 3-4, 290°, 1015 hPa, T_A = 17.6 °C, fine, T_w = 15.2 °C, S = 34.13 psu.

- **21:16 – 21:28 Station GN0017S:**
  CTD profile with rosette sampler.
  W&S: Bft. 4, 250°, 1017 hPa, T_A = 15.4 °C, T_w = 15.4 °C, S = 34.35 psu.

Wednesday, August 16th, 2017

- **01:07 – 01:20 Station GN018A:**
  CTD profile with rosette sampler. RA: Cs-137.
  W&S: Bft. 3-4, 240°, 1017 hPa, T_A = 14.8 °C, fine, T_w = 15.3 °C, S = 34.42 psu.

- **03:40 – 03:59 Station GN018 (Baymans Hole):**
  Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137. Trace metals.
  W&S: Bft. 2-3, 230°, 1017 hPa, T_A = 14.6 °C, partly cloudy, T_w = 16.0 °C, S = 34.50 psu.

↓ **07:31 – 07:45 <u>Station GN0018S (Bruceys Garden)</u>:**
Secchi depth, CTD profile with rosette sampler.
W&S: Bft. 3, 200°, 1018 hPa, T_A = 16.2 °C, partly cloudy, T_w = 16.1 °C, S = 34.40 psu.

↓ **11:16 – 11:34 <u>Station GN019</u> (Doggerbank):**
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Nutrients.
W&S: Bft. 3, 180°, 1019 hPa, T_A = 16.8 °C, partly cloudy, T_w = 16.7 °C, S = 34.50 psu

↓ **14:57 – 15:21 <u>Station GN0019S</u>:**
Secchi depth, CTD profile with rosette sampler.
W&S: Bft. 4-5, 170°, 1018 hPa, T_A = 19.0 °C, partly cloudy, T_w = 17.5 °C, S = 34.63 psu.

T **16:34 – 17:16 Neuston trawl for micro plastic (ViPo 80):**
Start: 55° 00.02’ N; 003° 19.23’ E
End: 55° 00.29’ N; 003° 22.08’ E

↓ **19:37 – 19:52 <u>Station GN020</u> (east of Doggerbank):**
Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137. Trace metals.
W&S: Bft. 4-5, 180°, 1017 hPa, T_A = 16.2 °C, partly cloudy, T_w = 17.8 °C, S = 34.69 psu.

↓ **23:29 – 23:41 <u>Station GN021/AWZW2</u> (Nordschillgrund):**
CTD profile with rosette sampler and nutrients. RA: Cs-137.
W&S: Bft. 4-5, 180°, 1016 hPa, T_A = 18.5 °C, T_w = 17.8 °C, S = 34.47 psu

Thursday, August 17th, 2017

↓ **03:58 – 04:14 <u>Station GN022</u> (Weiße Bank):**
CTD profile with rosette sampler and nutrients. RA: Cs-137.
W&S: Bft. 5, 180°, 1014 hPa, T_A = 18.6 °C, overcast, T_w = 18.1 °C, S = 34.36 psu.

↓ **07:01 – 07:16 <u>Station GN022A</u>:**
Secchi depth, CTD profile with rosette sampler. RA: Cs-137.
W&S: Bft. 4-5, 160°, 1014 hPa, T_A = 18.4 °C, overcast, T_w = 18.1 °C, S = 33.86 psu.

↓ **09:31 – 09:45 <u>Station GN023</u>:**
Secchi depth, CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 5, 150°, 1012 hPa, T_A = 19.3 °C, overcast, T_w = 18.5 °C, S = 32.27 psu.

↓ **11:35 – 12:17 <u>Station GN024</u>:**
Secchi depth, CTD profile with rosette sampler and nutrients. Two CTD casts because one bottle was not closed correctly. A first test of the HZG multi-corer was successful.
W&S: Bft. 4-5, 190°, 1012 hPa, T_A = 19.1 °C, overcast, rain, T_w = 18.9 °C, S = 31.22 psu.

↓ **13:15 – 13:33 <u>Station GN025</u> (west of Sylt):**
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 5, 220°, 1012 hPa, T_A = 17.9 °C, overcast, rain, T_w = 19.1 °C, S = 30.48 psu.

↓ **21:08 – 21:25 <u>Station GN026</u> (west of Lyngvik):**
Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
W&S: Bft. 4, 240°, 1009 hPa, T_A = 17.6 °C, overcast, T_w = 11.1 °C, S = 32.30 psu.

Friday, August 18th, 2014

↓ **00:33 – 00:49 <u>Station GN026A</u>:**
Clean-CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
W&S: Bft. 2-3, 220°, 1009 hPa, T_A = 17.6 °C, T_w = 17.5 °C, S = 33.77 psu.

↓ **04:26 – 04:40 <u>Station GN027</u>:**
CTD profile with rosette sampler and nutrients. RA: Cs-137.
W&S: Bft. 3-4, 180°, 1007 hPa, T_A = 17.2 °C, partly cloudy, T_w = 17.2 °C, S = 34.57 psu.

↓ **08:14 – 08:29 Station GN028:**
Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137. Trace metals.
W&S: Bft. 4, 200°, 1005 hPa, T_A = 18.2 °C, cloudy, T_w = 16.9 °C, S = 34.83 psu.

↓ **12:12 – 12:25 Station GN0028S:**
Secchi depth and CTD profile with rosette sampler.
W&S: Bft. 6, 230°, 1004 hPa, T_A = 17.6 °C, partly cloudy, T_w = 17.0 °C, S = 34.77 psu.

T **12:26 – 12:56 Neuston trawl for micro plastic (ViPo 81):**
Start: 55° 59.96’ N; 003° 59.83’ E
End: 55° 59.99’ N; 003° 36.36’ E

↓ **17:09 – 17:27 <u>Station GN029</u>:**
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 5, 220°, 1004 hPa, T_A = 16.9 °C, partly cloudy, T_w = 16.7 °C, S = 34.78 psu.

↓ **21:54 – 22:11 <u>Station GN030</u>:**
Clean-CTD profile with rosette sampler RA: Cs-137. Trace metals.
W&S: Bft6, 240°, 1004 hPa, T_A = 16.2 °C, T_w = 16.3 °C, S = 34.77 psu.

Saturday, August 19th, 2017

↓ **04:19 – 04:44 <u>Station GN031</u>:**
CTD profile with rosette sampler. RA: Cs-137.
W&S: Bft. 6-7, 280°, 1003 hPa, T_A = 15.4 °C, partly cloudy, T_w = 16.2 °C, S = 34.70 psu.

↓ **10:53 – 11:05 <u>Station GN032</u>:**
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
W&S: Bft. 5-6, 260°, 1006 hPa, T_A = 16.0 °C, partly cloudy, T_w = 15.9 °C, S = 34.58 psu.

- **15:30 – 15:44 <u>Station GN033</u> (east of Firth of Forth):**
  Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137. Trace metals.
  W&S: Bft. 4-5, 260°, 1007 hPa, T_A = 16.3 °C, cloudy, T_w = 14.7 °C, S = 34.59 psu.

- **18:30 – 18:45 <u>Station GN033A:</u>**
  CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
  W&S: Bft. 6, 290°, 1009 hPa, T_A = 15.6 °C cloudy, T_w = 13.9 °C, S = 34.38 psu.

- **22:01 – 22:11 <u>Station GN0033S (Marr Bank)</u>:**
  CTD profile with rosette sampler.
  W&S: Bft. 5, 280°, 1011 hPa, T_A = 14.6 °C, T_w = 13.3 °C, S = 34.63 psu.

Sunday, August 20th, 2017

- **01:37 – 01:52 <u>Station GN034A:</u>**
  CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
  W&S: Bft. 3-4, 290°, 1013 hPa, T_A = 14.2 °C, T_w = 13.9 °C, S = 34.69 psu.

- **04:07 – 04:26 <u>Station GN034</u> (Aberdeen Bank):**
  Secchi depth, Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137. Trace metals.
  W&S: Bft. 4-5, 280°, 1014 hPa, T_A = 14.2 °C, cloudy, T_w = 13.7 °C, S = 34.77 psu.

- **08:19 – 08:33 <u>Station GN0034S</u>:**
  Secchi depth, CTD profile with rosette sampler.
  W&S: Bft. 5-6, 310°, 1016 hPa, T_A = 14.5 °C, cloudy, T_w = 15.3 °C, S = 34.79 psu.

- **13:00 – 13:13 <u>Station GN035</u> (Coal Pitt):**
  Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
  W&S: Bft. 5-6, 320°, 1018 hPa, T_A = 15.6 °C, cloudy, T_w = 15.5 °C, S = 34.81 psu.

  13:15 – 16:00 Two 600 litre containers have been flushed and filled with sea water for the nutrient lab.

- **17:04 – 17:22 <u>Station GN0035S</u>:**
  Secchi depth, CTD profile with rosette sampler.
  W&S: Bft. 5-6, 320°, 1019 hPa, T_A = 15.0 °C, cloudy, T_w = 15.9 °C, S = 34.80 psu.

- **21:12 – 21:33 <u>Station GN036</u>:**
  Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
  W&S: Bft. 5, 320°, 1019 hPa, T_A = 15.2 °C, T_w = 16.1 °C, S = 34.73 psu.

  The outer blue plastic cover of the Clean-CTD cable was damaged during deployment ca. 1 m above the CTD. The cover was sealed with two layers of selfbonding tape and a second cover of Scotch tape.

Monday, August 21st, 2017

- **02:49 – 03:05 <u>Station GN037</u> (Große Fischerbank):**
  CTD profile with rosette sampler and nutrients. RA: Cs-137.
  W&S: Bft. 6, 320°, 1019 hPa, T_A = 14.5 °C, T_w = 16.5 °C, S = 34.72 psu.

- **06:37 – 06:54 Station GN038 (Kleine Fischerbank):**
  Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
  Trace metals.
  W&S: Bft. 5-6, 320°, 1019 hPa, T_A = 15.8 °C, partly cloudy, T_w = 16.5 °C, S = 34.59 psu.

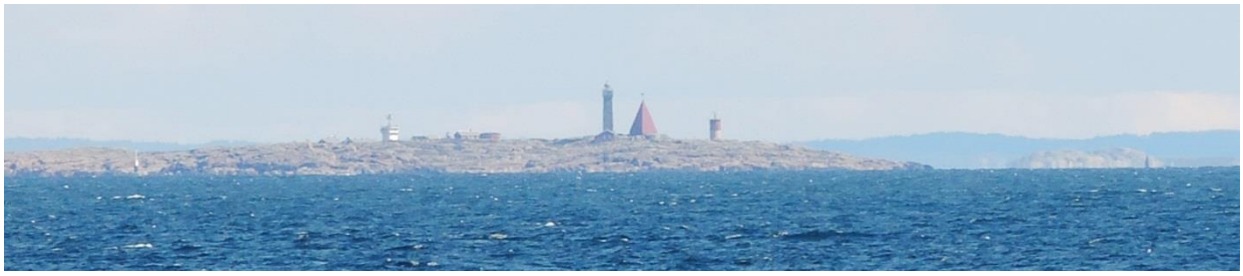
- **10:12 – 10:34 Station GN038A:**
  Secchi depth and CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
  W&S: Bft. 5-6, 310°, 1019 hPa, T_A = 16.0 °C, partly cloudy, T_w = 15.9 °C, S = 34.63 psu.

- **14:04 – 14:23 Station GN039 (east of Jyske Rev):**
  Clean-CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
  W&S: Bft. 5-6, 310°, 1018 hPa, T_A = 16.7 °C, partly cloudy, T_w = 17.0 °C, S = 33.91 psu.

- **18:06 – 18:20 Station GN039S:**
  CTD profile with rosette sampler.
  W&S: Bft. 6-7, 290°, 1017 hPa, T_A = 15.8 °C, partly cloudy, T_w = 16.8 °C, S = 30.10 psu.

- **21:43 – 22:07 Station GN801:**
  CTD profile with rosette sampler and MERCOS sampler for trace metals.
  RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
  W&S: Bft. 5, 300°, 1016 hPa, T_A = 16.4 °C, T_w = 16.8 °C, S = 34.06 psu.

Tuesday, August 22nd, 2017



Skagerrak, Swedish coast

- **02:59 – 03:53 Station GN802:**
  CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Multicorer for eight bottom samples.
  W&S: Bft. 4, 30°, 1018 hPa, T_A = 16.8 °C, partly cloudy, T_w = 17.1 °C, S = 29.20 psu.

- **07:25 – 07:44 Station GN803:**
  Secchi, CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
  W&S: Bft. 4, 30°, 1019 hPa, T_A = 16.5 °C, partly cloudy, T_w = 17.4 °C, S = 28.53 psu.

- **09:43 – 10:14 Station GN804:**
  Secchi, CTD profile with rosette sampler and MERCOS sampler for trace metals.
  RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Trace metals.
  W&S: Bft. 2, 10°, 1019 hPa, T_A = 16.7 °C, fine, T_w = 17.2 °C, S = 24.30 psu.

↓ **12:28 – 13:13 <u>Station GN805</u>:**
Secchi, CTD profile with rosette sampler and MERCOS sampler for trace metals. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 3, 350°, 1019 hPa, T_A = 20.0 °C, fine, T_w = 18.1 °C, S = 27.59 psu.

↓ **20:29 – 20:45 <u>Station GN806</u>:**
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 4, 30°, 1020 hPa, T_A = 16.8 °C, fine, T_w = 17.8 °C, S = 24.66 psu.

↓ **23:22 – 00:25 <u>Station GN807</u>:**
CTD profile with rosette sampler and MERCOS sampler for trace metals.
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 3, 70°, 1020 hPa, T_A = 16.4 °C, T_w = 17.4 °C, S = 28.95 psu.

Wednesday, August 23rd, 2017

↓ **03:15 – 07:47 <u>Station GN808</u>:**
Secchi, CTD profile with rosette sampler and MERCOS sampler for trace metals. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm, two yellow bottles a‘ 270 L at 108 and 263 m depth. Multicorer for eight bottom samples.
W&S: Bft. 2, 190°, 1020 hPa, T_A = 16.2 °C, fine, T_w = 16.9 °C, S = 34.40 psu.

↓ **12:31 – 14:37 <u>Station GN040</u> (Skagerrak):**
Secchi depth, CTD profile with rosette sampler and MERCOS sampler for trace metals. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm. Nutrients. Multicorer for eight bottom samples and one gravity corer sample.
W&S: Bft. 2, 220°, 1019 hPa, T_A = 16.6 °C, fine, T_w = 17.9°C, S = 29.36 psu.

↓ **17:38 – 18:13 <u>Station GN040S</u> (south off Lindesnes):**
CTD profile with rosette sampler.
W&S: Bft. 0-1, 100°, 1016 hPa, T_A = 16.8 °C, fine, T_w = 17.8 °C, S = 30.48 psu.

T **18:16 – 18:46 Neuston trawl for micro plastic (ViPo 82):**
Start: 57° 55.,35’ N; 006° 59.42’ E
End: 57° 55.64’ N; 006° 56.23’ E

↓ **21:42 – 22:23 <u>Station GN041</u> (west of Lindesnes):**
CTD profile with rosette sampler, nutrients and MERCOS for trace metals. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 3, 130°, 1014 hPa, T_A = 16.2 °C, partly cloudy, T_w = 16.9 °C, S = 32.20 psu.

Thursday, August 24th, 2017

↓ **01:46 – 02:15 <u>Station GN042</u> (Eigersundbank):**
CTD profile with rosette sampler, nutrients and MERCOS for trace metals. RA: Cs-137.
W&S: Bft. 3, 130°, 1012 hPa, T_A = 15.3 °C, T_w = 16.4 °C, S = 31.43 psu.

↓ **05:24 – 05:40 <u>Station GN0042S</u>:**
CTD profile with rosette sampler.
W&S: Bft. 4-5, 110°, 1008 hPa, T_A = 15.2 °C, overcast, T_w = 15.1 °C, S = 34.94 psu.

↓ **09:00 – 09:12 Station GN043 (Lingbank East):**
Secchi, CTD profile with rosette sampler and nutrients. RA: Cs-137.
W&S: Bft. 3, 100°, 1017 hPa, T_A = 15.7 °C, fog, T_w = 15.4 °C, S = 34.77 psu.

↓ **14:09 – 14:36 Station GN044 (Lingbank West):**
Secchi depth, CTD profile with rosette sampler, nutrients and MERCOS for trace metals. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 4-5, 290°, 1008 hPa, T_A = 15.2 °C, cloudy, T_w = 14.8 °C, S = 35.08 psu.

T **19:00 – 19:30 Neuston trawl for micro plastic (ViPo 83):**
Start: 57° 59.97' N; 000° 49.20' E
End: 58° 00.32' N; 000° 47.25' E

↓ **19:27 – 19:44 Station GN0044S:**
CTD profile with rosette sampler.
W&S: Bft. 4, 280°, 1010 hPa, T_A = 15.2 °C, partly cloudy, T_w = 14.9 °C, S = 35.03 psu.

Friday, August 25st, 2017

↓ **00:04 – 00:30 Station GN045 (east of South Bank):**
CTD profile with rosette sampler and MERCOS for trace metals.
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 1, variable, 1011 hPa, T_A = 14.1 °C, T_w = 14.2 °C, S = 35.04 psu.

↓ **03:49 – 04:10 Station GN045A (West Bank):**
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 2-3, 70°, 1011 hPa, T_A = 12.9 °C, T_w = 14.0 °C, S = 34.86 psu.

↓ **09:19 – 09:35 Station GN045B (east of Pentland Firth):**
Secchi, CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 3, 90°, 1013 hPa, T_A = 12.2 °C, overcast, T_w = 13.4 °C, S = 34.88 psu.

T **09:40 – 10:12 Neuston trawl for micro plastic (ViPo 84):**
Start: 58° 30.16' N; 002° 30.25' W
End: 58° 30.78' N; 002° 32.49' W

↓ **16:27 – 16:44 Station GN057A:**
Secchi depth and CTD profile with rosette sampler. RA: Cs-137.
W&S: Bft. 4, 90°, 1013 hPa, T_A = 14.3 °C, cloudy, T_w = 13.8 °C, S = 34.77 psu.

↓ **19:45 – 20:14 Station GN056 (Cape Wrath):**
CTD profile with rosette sampler, nutrients and MERCOS for trace metals.
RA: Cs-137.
W&S: Bft. 5, 90°, 1013 hPa, T_A = 14.1 °C, partly cloudy, T_w = 13.8 °C, S = 34.59 psu.

Butt of Lewis, Outer Hebrides

Saturday, August 26th, 2017

↓ **00:01 – 00:17 Station GN056C (North Minch):**
CTD profile with rosette sampler RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 2, 80°, 1013 hPa, T_A = 13.9 °C, T_w = 14.7 °C, S = 34.61 psu.

↓ **02:42 – 03:11 Station GN064 (Shiant East Bank):**
CTD profile with rosette sampler and MERCOS for trace metals.
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 1, variable, 1013 hPa, T_A = 14.4 °C, T_w = 13.8 °C, S = 34.60 psu.

↓ **08:05 – 08:21 Station GN056B (Sulisker Bank South):**
Secchi depth, CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 3, 90°, 1014 hPa, T_A = 14.4 °C, overcast, T_w = 16.6 °C, S = 34.92 psu.

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T **08:26 – 08:56 Neuston trawl for micro plastic (ViPo 85):**
Start: 58° 45.20' N; 005° 59.97' W
End: 58° 46.21' N; 005° 59.99' W

↓ **16:26 – 19:45 Station GN065 (Færoe Bank Channel):**
Secchi depth, CTD profile with rosette sampler and MERCOS for trace metals.
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm (5 Yellow Bottles a' 270 L!).
W&S: Bft. 2-3, 160°, 1014 hPa, T_A = 13.9 °C, partly cloudy, T_w = 14.0 °C, S = 35.21 psu.

No samples for Bedford No. 175229 and 175231, Niskin bottles didn't closed.

↓ **22:48 – 23:27 Station GN055**
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 4-5, 150°, 1014 hPa, T_A = 13.4 °C, T_w = 13.8 °C, S = 35.22 psu.

Sunday, August 27th, 2017

↓ **02:29 – 02:46 Station GN0054S:**
CTD profile with rosette sampler.
W&S: Bft. 4, 170°, 1013 hPa, T_A = 13.3 °C, T_w = 16.1 °C, S = 35.22 psu.

↓ **05:56 – 06:23 Station GN054 (Otter Bank):**
Secchi depth, CTD profile with rosette sampler, nutrients and MERCOS for trace metals. RA: Cs-137.
W&S: Bft. 4, 180°, 1013 hPa, T_A = 13.9 °C, cloudy, T_w = 13.5 °C, S = 35.08 psu.

Between GN54 and GN053B: Filling two 600 l containers with surface sea water samples for calibration lab.

↓ **09:42 – 09:53 <u>Station GN053B</u> (Foula Bank):**
Secchi depth, CTD profile with rosette sampler. RA: Cs-137.
W&S: Bft. 3, 190°, 1013 hPa, T_A = 13.7 °C, overcast. T_w = 12.4 °C, S = 35.19 psu.

↓ **12:22 – 12:34 <u>Station GN053A</u> (Sumburgh Head):**
CTD profile with rosette sampler. RA: Cs-137.
W&S: Bft. 5, 190°, 1013 hPa, T_A = 14.1 °C, cloudy, T_w = 14.2 °C, S = 35.15 psu.

T **12:40 – 13:13 Neuston trawl for micro plastic (ViPo 86):**
Start: 59° 47.99' N; 001° 18.86' W
End: 59° 49.33' N; 001° 13.65' W

↓ **15:38 – 16:13 <u>Station GN053</u> (E-lich Shetlands):**
Secchi depth, CTD profile with rosette sampler and nutrients.
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 4, 210°, 1012 hPa, T_A = 14.1 °C, overcast, T_w = 14.1 °C, S = 35.17 psu.
No samples for Bedford No. 175245, Niskin bottle didn't closed.

↓ **23:43 – 23:57 <u>Station GN0052S</u>:**
CTD profile with rosette sampler.
W&S: Bft. 4-5, 180°, 1012 hPa, T_A = 14.4 °C, T_w = 14.3 °C, S = 35.16 psu.

Monday, August 28th, 2017

↓ **00:06 – 00:32 <u>Station GN052</u> (Bergen Bank):**
CTD profile with rosette sampler, nutrients and MERCOS for trace metals.
RA: Cs-137.
W&S: Bft. 4-5, 190°, 1011 hPa, T_A = 14.6 °C, T_w = 14.7 °C, S = 34.96 psu.

↓ **04:26 – 04:50 <u>Station GN0051S</u>:**
CTD profile with rosette sampler.
W&S: Bft. 6, 170°, 1010 hPa, T_A = 14.8 °C, overcast, T_w = 14.4 °C, S = 34.98 psu.

↓ **10:13 – 10:48 <u>Station GN051</u> (west of Selbjörnsfjord):**
Secchi depth, CTD profile with rosette sampler, nutrients and MERCOS for trace metals. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 6, 180°, 1010 hPa, T_A = 15.0 °C, overcast, rain. T_w = 15.6 °C, S = 32.52 psu.

↓ **15:04 – 15:27 <u>Station GN0050S</u>:**
Secchi depth and CTD profile with rosette sampler.
W&S: Bft. 6, 190°, 1009 hPa, T_A = 16.7 °C, overcast, T_w = 16.4 °C, S = 31.69 psu.

↓ **19:38 – 20:13 <u>Station GN050</u> (Utsira Loch):**
CTD profile with rosette sampler, nutrients and MERCOS for trace metals.
RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 4-5, 210°, 1009 hPa, T_A = 16.5 °C, rain, T_w = 16.6 °C, S = 31.77 psu.

↓ **23:26 – 23:49 <u>Station GN0049S</u>:**
CTD profile with rosette sampler.
W&S: Bft. 1-2, variable°, 1018 hPa, T_A = 14.6 °C, T_w = 15.2 °C, S = 33.54 psu.

Tuesday, August 29th, 2017

↓ **02:36 – 02:54 Station GN049 (Utsira Grund):**
CTD profile with rosette sampler. RA: Cs-137.
W&S: Bft. 3, 240°, 1009 hPa, T_A = 14.9 °C, T_w = 14.9 °C, S = 34.95 psu.

↓ **06:35 – 06:48 Station GN0048S:**
Secchi depth and CTD profile with rosette sampler.
W&S: Bft. 3-4, 260°, 1008 hPa, T_A = 14.6°C, cloudy, T_w = 14.7 °C, S = 34.98 psu.

↓ **10:34 – 11:02 Station GN048:**
Secchi depth, CTD profile with rosette sampler, nutrients and MERCOS for trace metals. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 4-5, 250°, 1008 hPa, T_A = 14.9 °C, overcast, T_w = 14.7 °C, S = 34.96 psu.

T **12:02 – 12:31 Neuston trawl for micro plastic (ViPo 87):**
Start: 59° 00.02' N; 000° 45.10' E
End: 59° 00.10' N; 000° 41.57' E

↓ **15:13 – 15:30 Station GN047 (Fladengrund Rinne):**
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
W&S: Bft. 5, 240°, 1007 hPa, T_A = 14.5 °C, partly cloudy, T_w = 14.6 °C, S = 34.99 psu.

↓ **21:02 – 21:32 Station GN046:**
CTD profile with rosette sampler and MERCOS for trace metals. RA: Cs-137.
W&S: Bft. 4-5, 230°, 1006 hPa, T_A = 13.6 °C, T_w = 13.0 °C, S = 35.12 psu.

↓ **23:17 – 23:32 Station GN046A:**
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, Pu, Am, Cm.
W&S: Bft. 5, 230°, 1005 hPa, T_A = 13.5 °C, T_w = 13.5 °C, S = 34.93 psu.

Wednesday, August 30th, 2017

17:00 Arrival at Aberdeen.

Thursday, August 31st and Friday, September 1st, 2017

Final processing of the last water samples for RA and nutrients. The science crew made preparations for the second leg, cleaning of facilities.

Saturday, September 2nd, 2017

After lunch arrival of the new ships crew for the second leg. 15:30: Arrival of a new science crew for the second leg. Handover of chemistry labs and last arrangements for the second leg. Arrangements for next day the crew change. The old Celtic Explorer crew is leaving the ship, the new crew took over. Refueling of the ship for next leg.

Sunday, September 3rd, 2017

08:00 Leg 2 science team came on board, leg 1 team return left for flights to Hamburg via London.

Preliminary findings

With the exception of statements concerning the area averaged North Sea sea surface temperature (SST), the following assessments are based on CTD raw data collected during the cruise. There will be a second check of the CTD data after the cruise and - if necessary - temperature and salinity data will be re-calibrated before the final processing and analysis of the data.

SST

SST is a reliable representative for the temperature of the seasonal mixed layer. Due to increasing solar radiation the North Sea established a seasonal stratification during spring over wide areas of the North Sea which lasts normally until end of August or beginning of September. Then the water column will be vertically mixed again by the first fall storms. At water depth greater than about 30 m the upper layer is separated from the colder bottom layer by a sharp thermocline with vertical gradients in the order of up to 3 K/m. While the oceanographic conditions in the upper layer are mainly determined by local radiation, the conditions in the bottom layer are influenced by the inflow of Atlantic Water (AW) with salinities greater 35 psu[2] via the northern open boundary to the Atlantic and to a lesser degree via the English Channel. Only the knowledge of the hydrographic conditions in both layers, determined by the spatial distribution of temperature and salinity, allows the calculation of heat and salt budgets.

During the first eight months of 2017 the monthly anomalies of the area averaged North Sea SST varied between 0.7 and 1.0 K compared to the reference period 1971-1993. At 16 °C the North Sea SST reached its seasonal Maximum in the beginning of August and virtually remained at this level through the first week of September (see red line in Fig. 5). Hence, the current seasonal cycle established - like in 2016 - a plateau-shaped maximum rather than a distinguished peak. That confirms that the complete survey took place during the seasonal heat maximum of the North Sea which can be expected in the bottom layer about 4 weeks after reaching its maximum in the surface layer.

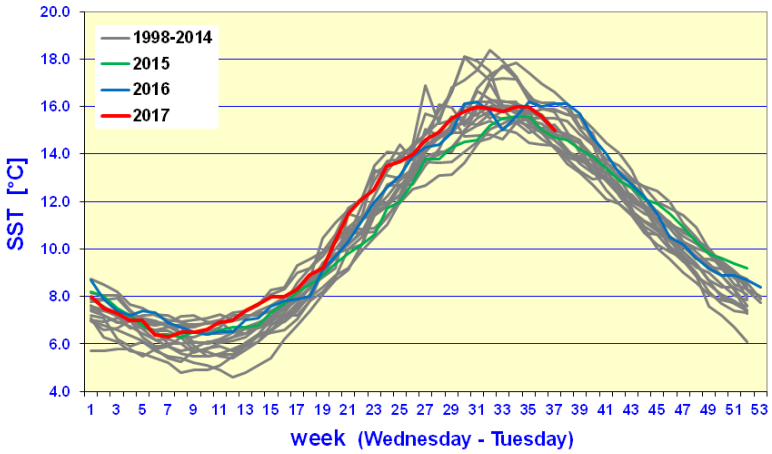


Fig. 5: *Weekly area averaged North Sea SST January from 1998 until end of September 2017.*

Temperature

While the temperature sections along 54° and 55° N are vertically mixed due to low water depth in their eastern parts, the zonal (east-west) temperature sections between 56° and 60° N show a massive homogeneous mixed surface layer with a strong thermocline at about 30

[2] psu = practical salinity units

m depth. Between 57° and 60° N the vertical temperature gradients weakens along the UK coast due to strong tidal currents. The temperatures of the upper mixed layer are about 1 K higher than last year. The calculation of the North Sea's total heat budget will be done after the final processing and check of the data after the cruise.

Salinity

The salinity sections show a massive inflow of Atlantic Water (S >35 psu) from the north across the 59° and 60° N sections via the Fair Isle Channel, the East-Shetland Shelf, and at the western slope of the Norwegian Trench (Fig. 9 and 10). This tongue of Atlantic Water narrows significantly at 58° N. At 57° N there is no Atlantic Water in the upper mixed layer, but a small volume in the bottom layer. There is less salt in the southern North Sea compared to the previous year. The total salt budget will not be calculated before the final processing of the data and the analysis of more than 270 in-situ salinity samples for CTD calibration.

Fig 4: *All stations done, a happy science crew!*

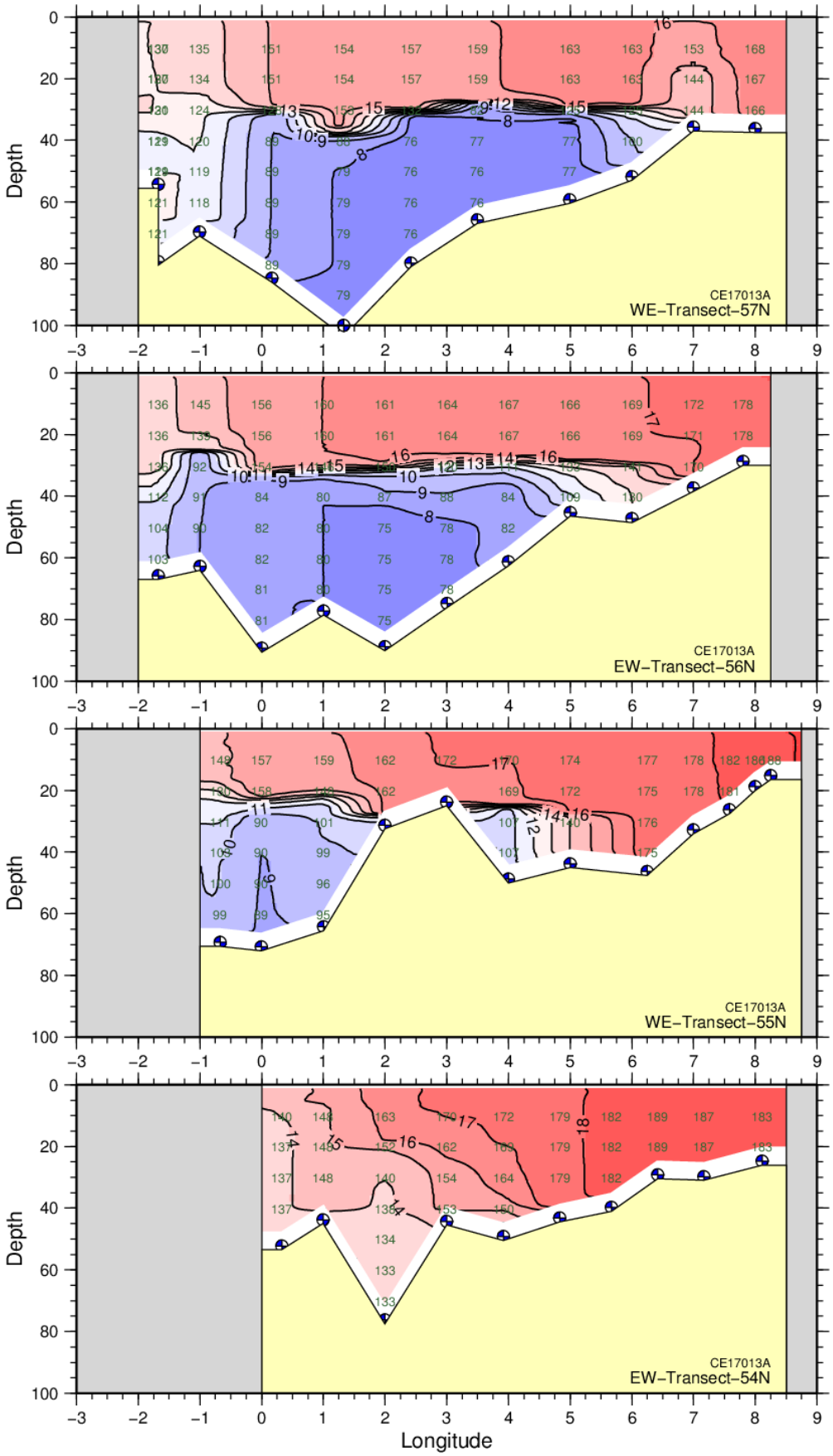


Fig. 6: *Vertical temperature distribution along the 54°, 55°, 56°, and 57°N sections basing on CTD raw data. The numbers in the section give temperatures × 10 for selected data points.*

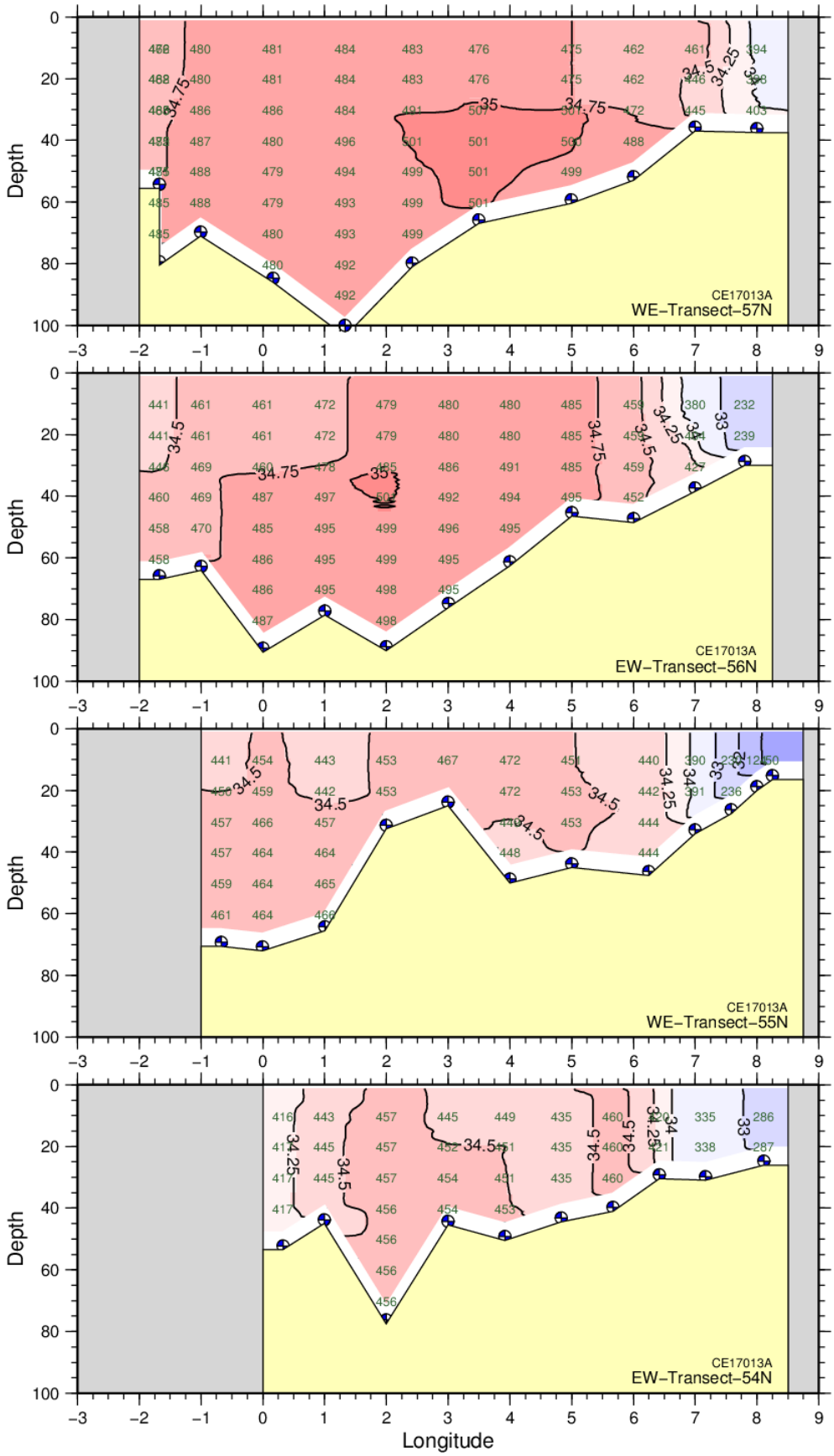


Fig. 7: *Vertical salinity distribution along the 54°, 55°, 56°, and 57°N sections basing on CTD raw data. The numbers in the section give (salinities × 100) - 3000 for selected data points.*

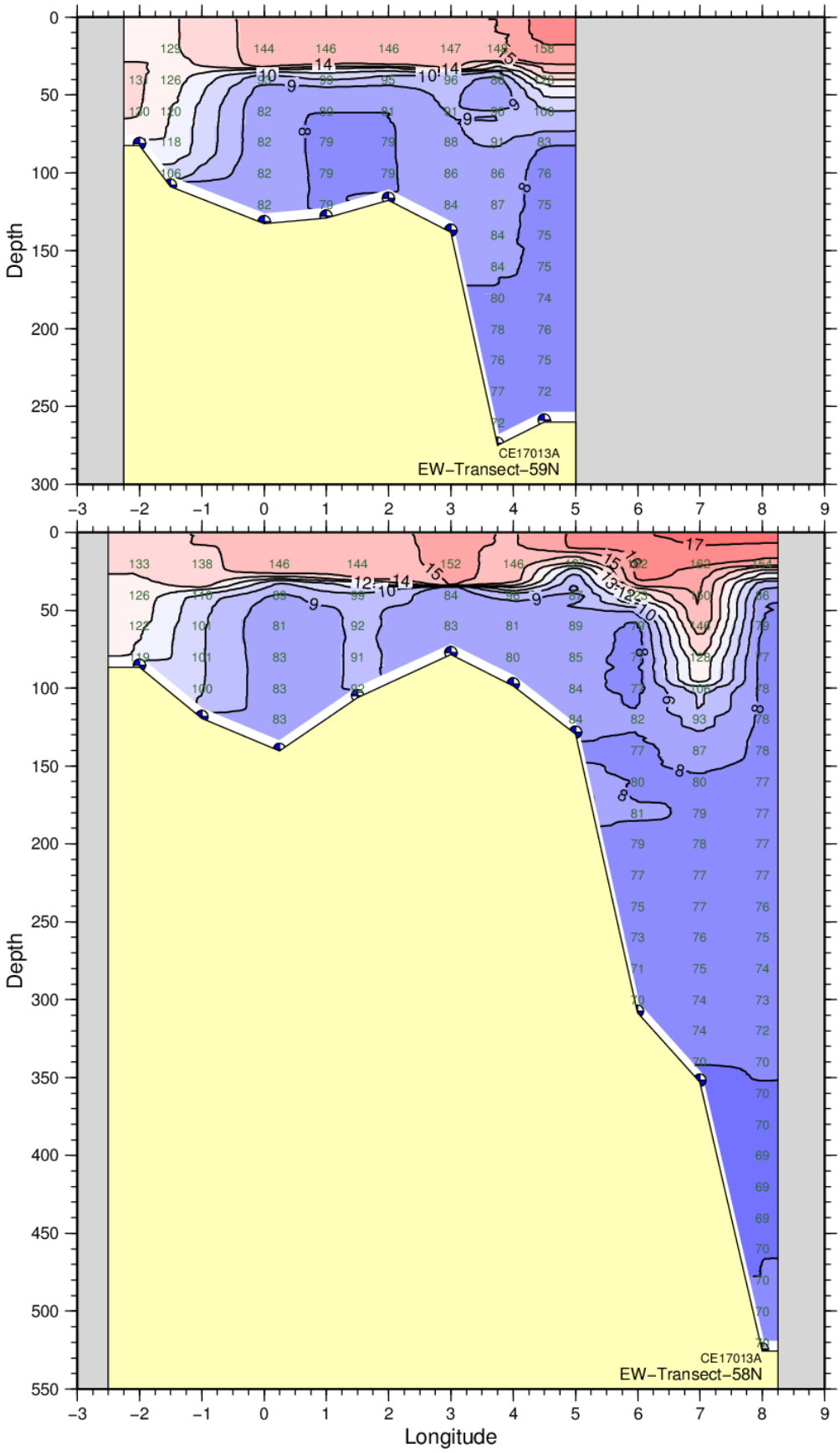


Fig. 8: *Vertical temperature distribution along the 58° and 59°N sections basing on CTD raw data. The numbers in the section give temperatures × 10 for selected data points.*

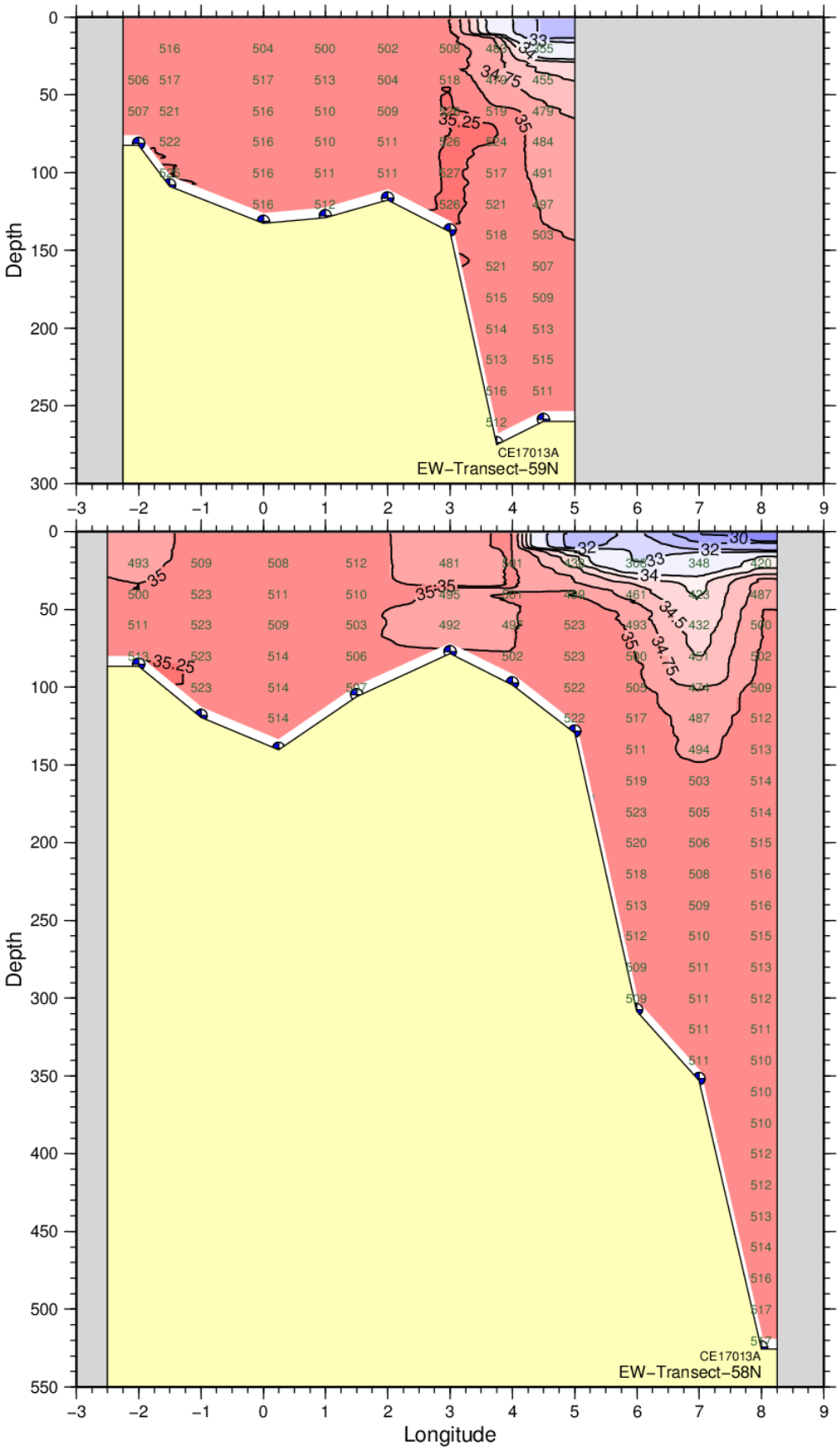


Fig. 9: *Vertical salinity distribution along the 58° and 59°N sections basing on CTD raw data. The numbers in the section give (salinities × 100) - 3000 for selected data points*.

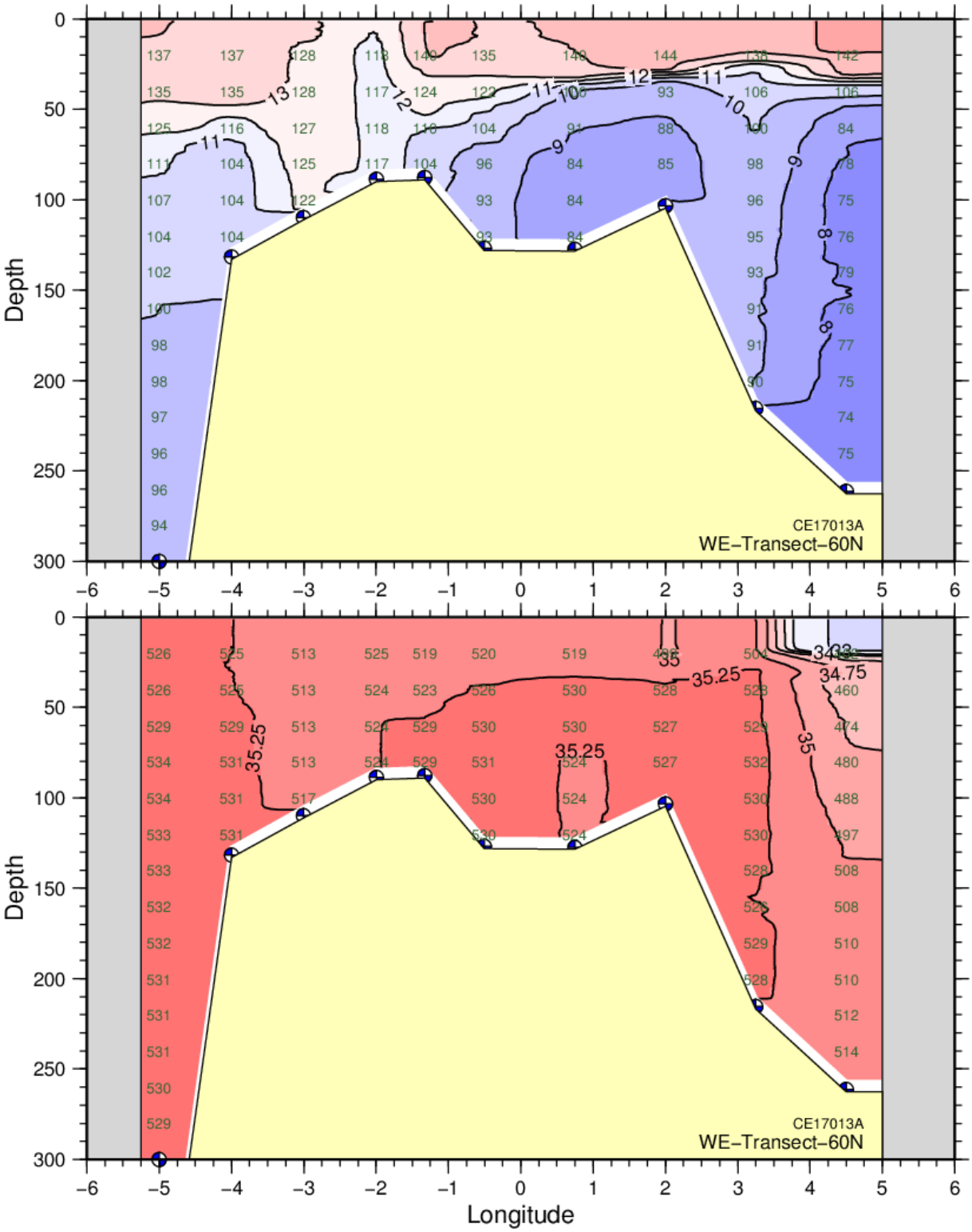


Fig. 10: *Vertical temperature (top) and salinity (bottom) distribution along the 60°N section basing on CTD raw data. The numbers in the section give the temperatures × 10 and (salinities × 100) - 3000 for selected data points.*

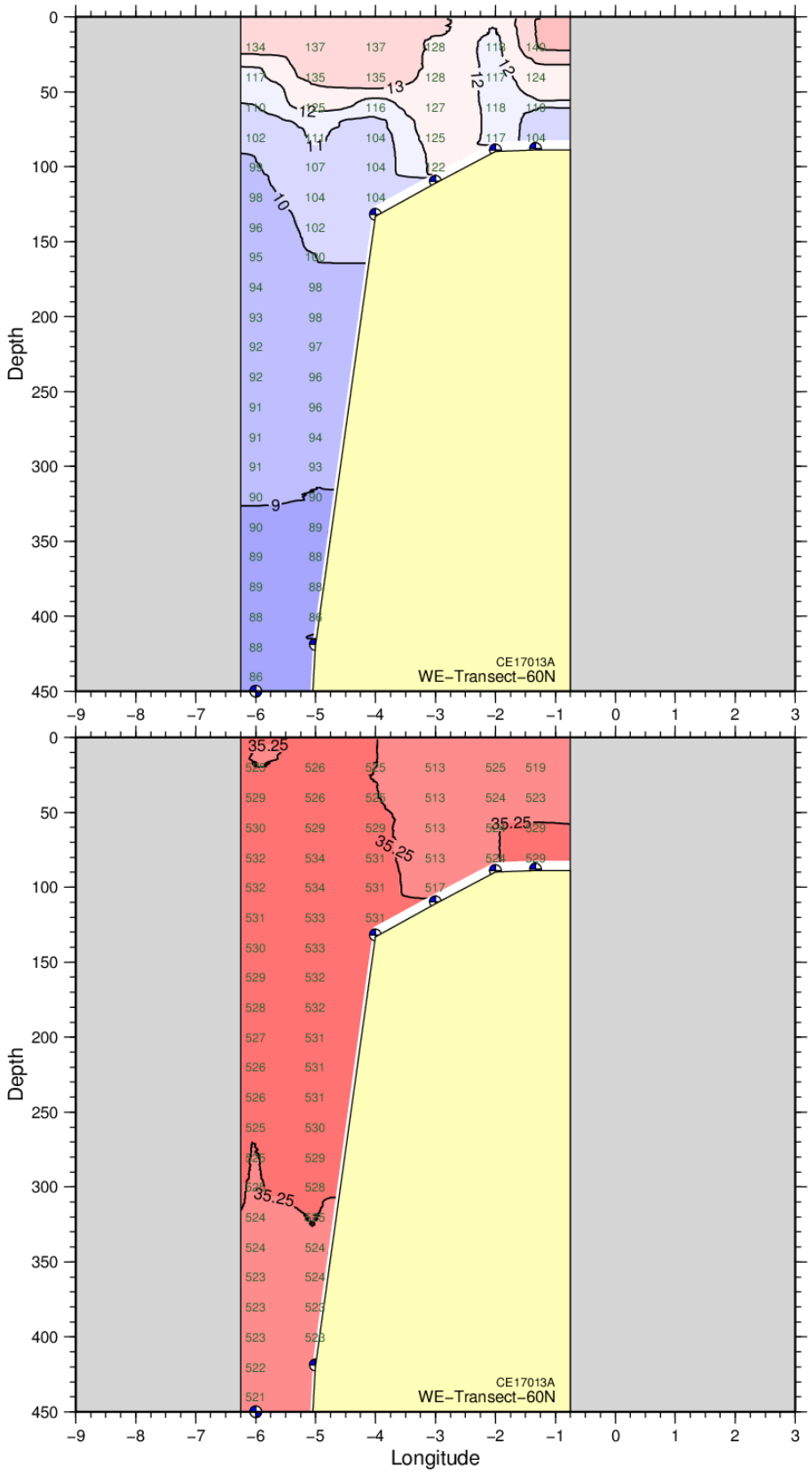


Fig. 11: *Vertical temperature (top) and salinity (bottom) distribution along the 60°N section west of Shetland Isles basing on CTD raw data. The numbers in the section give the temperatures × 10 and (salinities × 100) - 3000 for selected data points.*

Acknowledgement

All participants accomplished a big amount of work in a good temper and made the North Sea Summer Survey 2017 again a big success! Thank you very much to all of you!

The help and professional good-humoured support of captain Denis Rowan and his crew is gratefully acknowledged.

Holger Klein
Aberdeen, September 3rd, 2017

Appendix 1: List of samples

CTD-profiles with rosette:	102 stations
Secchi depth:	49 stations (daylight stations only)
Salinity:	279 samples
Trace metals:	39 stations, 156 samples
Total Alkalinity:	35 bottom and 35 surface (5 m) samples & 10fold determination
Oxygen:	36 bottom and 36 surface (5 m) samples & 10fold determination
pH-value:	35 bottom and 35 surface (5 m) samples & 10fold determination, 1 sample 41 m
Chlorophyll:	36 surface samples (5 m) & 10fold determination
Nutrients:	12 extra samplings for validation of the nutrient analysers. Run time nutrient auto analyser: Silicate: 18 days, Nitrate/Nitrite: 19 days, Phosphate: 18 days, pH: 14 days
Radioactivity (artificial nuclides):	82 stations 2 samples à 3 35-l-drums Caesium-137 and Strontium-90 (pure) 52 samples à 2 35-l-drums Strontium-90 (pure) 54 samples à 1-l-bottles Tritium (pure) 54 samples à 100 l transuranic elements (concentrated) 86 samples à 150 l Caesium-137 (concentrated)
Neuston net trawls for visible pollutions:	12 trawls 30 – 45 minutes
Sediment samples for determination of organic and inorganic pollutants (Project NOAH-Synthesis)	3 × 8 sediment cores (Multicorer), 1 sediment core (Frahm-Lot)

Appendix 2: Surface and bottom temperatures and salinities

The following tables are based on CTD raw data.

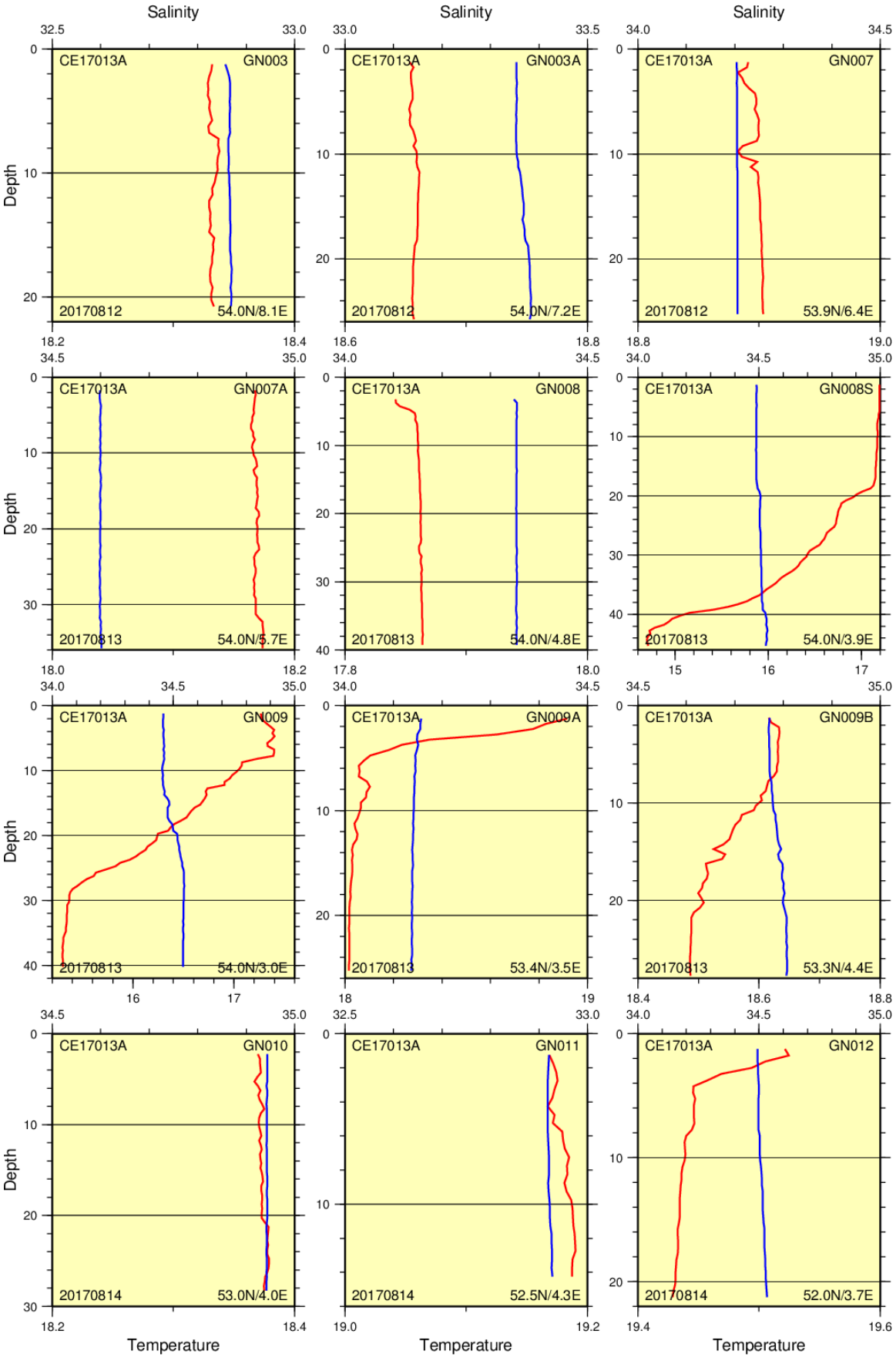
Station ID	Secchi depth [m]	water depth [m]	T_{sur} [°C]	T_{bot} [°C]	T_{sur}-T_{bot} [K]	S_{sur} [psu]	S_{bot} [psu]	S_{bot}-S_{sur} [psu]
GN003	4.5	26	18.3	18.3	0.0	32.86	32.87	0.01
GN003A	—	29	18.7	18.7	0.0	33.35	33.38	0.03
GN007	—	27	18.9	18.90	0.0	34.20	34.20	0.00
GN007A	—	37	18.2	18.2	0.0	34.60	34.60	0.00
GN008	3.5	42	17.8	17.9	-0.1	34.36	34.35	-0.01
GN008S	9.5	46	17.2	14.7	2.5	34.48	34.53	0.05
GN009	12.0	42	16.9	15.3	1.6	34.45	34.54	0.09
GN009A	—	27	18.1	18.0	0.1	34.14	34.14	0.00
GN009B	—	29	18.6	18.5	0.1	34.78	34.81	0.03
GN010	—	29	18.4	18.4	0.0	34.94	34.94	0.00
GN011	12.0	19	19.2	19.2	0.0	32.91	32.91	0.02
GN012	6.0	23	19.5	19.4	0.1	34.49	34.53	0.04
GN013	5.5	36	18.8	18.8	0.0	35.02	35.02	0.00
GN014	3.0	29	18.5	18.5	0.0	35.04	35.04	0.00
GN015	—	46	18.7	18.7	0.0	34.85	34.86	0.01
GN015B	—	42	17.6	17.6	0.0	34.13	34.12	-0.01
GN016	11.0	30	16.2	16.2	0.0	34.36	34.37	0.01
GN009S	12.0	73	16.5	13.3	3.2	34.57	34.56	-0.01
GN017	10.5	44	14.9	14.8	0.1	34.38	34.46	0.08
GN017A	11.0	52	14.8	13.6	1.2	34.15	34.17	0.02
GN017S	—	61	15.1	11.2	3.9	34.38	34.40	0.02
GN018A	—	73	14.9	9.9	5.0	34.42	34.61	0.19
GN018	—	72	15.7	8.9	6.8	34.53	34.64	0.11
GN018S	15.0	63	15.9	9.5	6.4	34.43	34.65	0.22
GN019	14.5	28	16.3	16.2	0.1	34.53	34.53	0.00
GN019S	12.0	24	17.2	16.9	0.3	34.67	34.67	0.00
GN020	—	47	17.2	10.7	6.5	34.72	34.48	-0.24
GN021	—	41	17.4	14.0	3.4	34.51	34.51	0.00
GN022	—	44	17.7	17.5	0.2	34.40	34.43	0.03
GN022A	9.5	32	17.8	17.7	0.1	33.88	33.92	0.04
GN023	7.5	24	18.2	18.1	0.1	32.30	32.37	0.07
GN024	6.0	16	18.6	18.6	0.0	31.25	31.25	0.00
GN025	6.0	12	18.8	18.8	0.0	30.50	30.50	0.00
GN026	—	27	18.8	17.7	1.1	32.32	32.41	0.09
GN026A	—	35	17.2	17.0	0.2	33.79	34.27	0.48
GN027	—	48	16.9	13.0	3.9	34.58	34.52	0.06
GN028	11.0	43	16.6	10.9	5.7	34.85	34.94	0.09
GN028S	13.5	58	16.7	8.2	8.5	34.79	34.94	0.15
GN029	13.0	73	16.4	7.8	8.6	34.80	34.95	0.15
GN030	—	87	16.1	7.5	8.6	34.79	34.98	0.19
GN031	—	77	16.0	8.0	8.0	34.72	34.95	0.23
GN032	9.0	87	16.1	7.5	8.6	34.60	34.87	0.27
GN033	10.0	64	14.5	9.0	5.5	34.61	34.70	0.09
GN033A	—	64	13.6	10.3	3.3	34.40	34.58	0.18
GN033S	—	51	13.0	11.9	1.1	34.66	34.71	0.05
GN034A	—	77	13.6	12.1	1.5	34.72	34.85	0.13
GN034	—	71	13.5	11.8	1.7	34.80	34.88	0.08
GN034S	13.0	83	15.1	8.9	6.2	34.80	34.80	0.00
GN035	13.9	99	15.3	7.9	7.4	34.84	34.92	0.08
GN035S	11.0	82	15.7	7.5	8.2	34.83	34.99	0.16
GN036	—	65	15.9	7.6	8.3	34.75	35.01	0.26

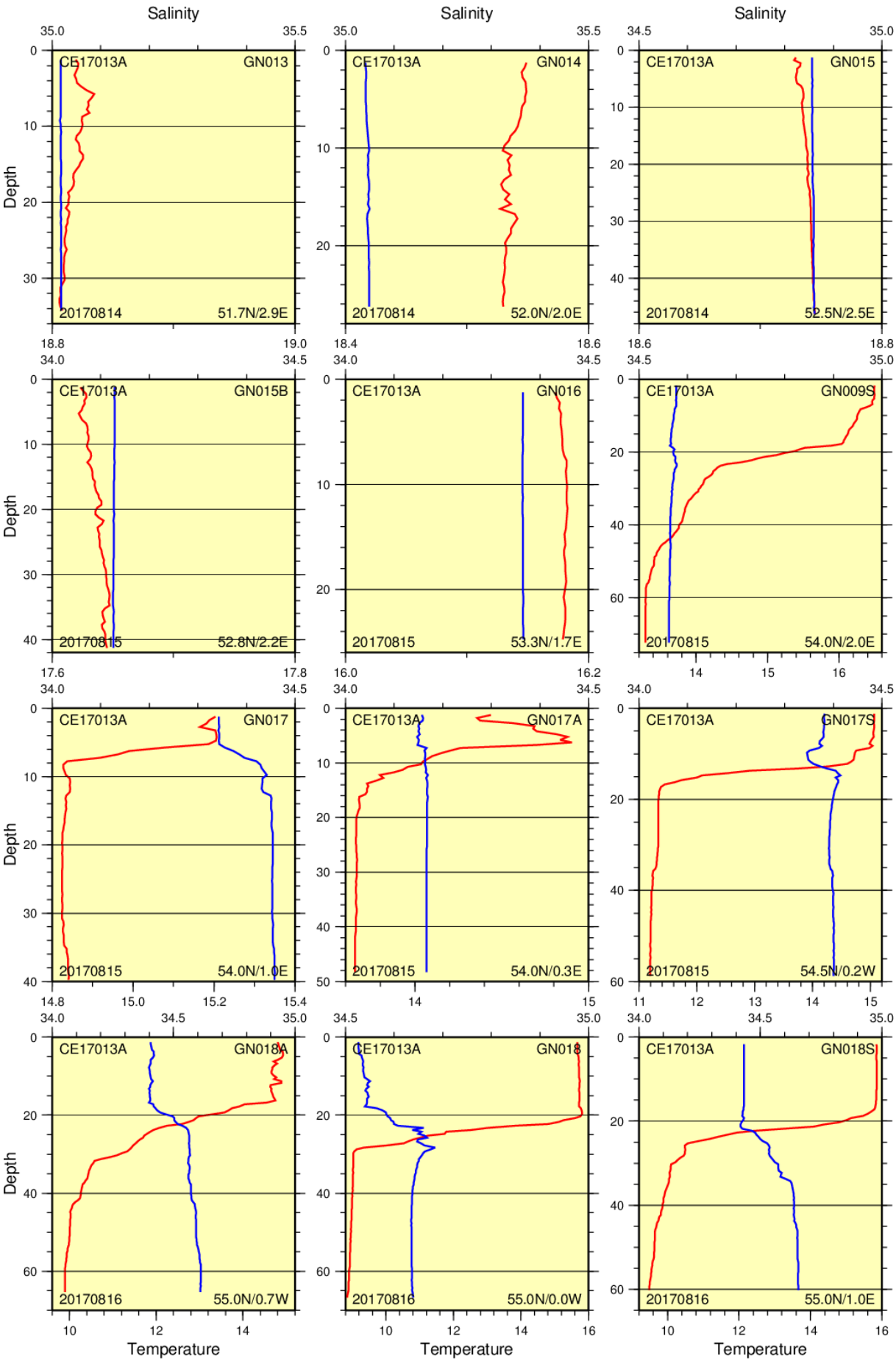
Station ID	Secchi depth [m]	water depth [m]	Tsur [°C]	Tbot [°C]	Tsur-Tbot [K]	Ssur [psu]	Sbot [psu]	Sbot-Ssur [psu]
GN037	—	58	16.3	7.7	8.6	34.75	34.98	0.23
GN038	14.5	51	16.3	9.9	6.4	34.62	34.87	0.25
GN038A	12.0	33	15.6	14.4	1.2	34.65	34.45	-0.20
GN039	7.5	35	16.8	16.5	0.3	33.94	34.03	0.09
GN039S	—	93	16.6	8.6	8.0	30.19	34.93	4.74
GN801	—	25	16.6	16.6	0.0	34.10	34.10	0.00
GN802	—	220	16.9	8.1	8.8	29.20	35.19	5.99
GN803	11.0	125	16.9	8.6	8.3	31.34	34.93	3.59
GN804	6.5	32	17.0	16.5	0.5	31.56	33.32	1.76
GN805	10.0	88	17.0*	11.5	5.5	32.60	34.14	1.54
GN806	—	92	17.2*	9.8	7.4	31.79	34.81	3.02
GN807	—	527	8.8*	7.0	1.8	34.87	35.17	0.30
GN808	12.5	676	16.7	7.0	9.7	31.28	35.18	3,90
GN040	11.5	524	17.1	7.0	10.1	29.77	35.16	5.39
GN040S	—	349	17.0	6.9	10.1	31.08	35.13	4.05
GN041	—	307	16.4	7.0	9.4	32.60	35.09	2.49
GN042	—	126	16.2	8.4	7.8	31.48	35.22	3.74
GN042S	—	98	14.9	8.0	6.9	34.98	35.11	0.13
GN043	>12.0	77	15.2	8.3	6.9	34.81	34.92	0.11
GN044	14.5	105	14.5	9.2	5.3	35.11	35.07	-0.04
GN044S	—	140	14.7	8.3	6.4	35.07	35.14	0.07
GN045	—	116	13.8	10.0	3.8	35.08	35.23	0.15
GN045A	—	86	13.8	11.9	1.9	34.89	35.13	0.24
GN045B	14.5	70	13.3	13.3	0.0	34.91	34.91	0.00
GN057A	12.0	90	13.6	13.4	0.2	34.81	34.86	0.05
GN056	—	87	13.6	13.2	0.4	34.62	34.70	0.08
GN056C	—	109	14.4	12.0	2.4	34.80	34.78	-0.02
GN064	—	55	13.6	13.0	0.6	34.64	34.70	0.06
GN056B	10.0	119	14.4	11.6	2.8	34.94	35.13	0.19
GN065	15.0	1060	13.7	-0.6	14.3	35.25	34.91	-0.34
GN055	—	412	13.6	7.8	5.8	35.25	35.18	-0.07
GN054S	—	132	13.7	10.4	3.3	35.25	35.31	0.06
GN054	8.0	102	13.3	12.2	1.1	35.12	35.17	0.05
GN053B	13.0	87	12.1	11.7	0.4	35.23	35.24	0.01
GN053A	—	86	14.1	10.4	3.7	35.18	35.29	0.11
GN053	10.0	127	13.9	9.3	4.6	35.21	35.30	0.09
GN052S	—	128	14.1	8.4	5.7	35.19	35.24	0.05
GN052	—	102	14.5	8.5	6.0	34.99	35.27	0.28
GN051S	—	217	14.2	8.9	5.3	35.02	35.28	0.26
GN051	10.0	262	15.4	7.5	7.9	32.53	35.13	2.60
GN050S	9.0	266	16.2	7.4	8.8	31.27	35.13	3.86
GN050	—	260	16.4	7.2	9.2	31.84	35.11	3.27
GN049S	—	273	15.0	7.2	7.8	33.74	35.12	1.38
GN049	—	138	14.7	8.4	6.6	35.07	35.26	0.19
GN048S	18.5	115	14.6	7.8	6.8	35.01	35.11	0.10
GN048	16.5	125	14.5	7.9	6.6	35.00	35.12	0.12
GN047	16.5	133	14.4	8.2	6.2	35.03	35.15	0.12
GN046	—	106	12.9	10.3	2.6	35.16	35.25	0.09
GN046A	—	78	13.4	12.7	0.7	34.98	35.13	0.15

T_{sur}, T_{bot}: surface (5 m)and bottom temperature (* 20 m temperature)
S_{sur}, S_{bot}: surface and bottom salinity. Blue: Coastal Water ≤34 psu, red: Atlantic Water ≥35 psu.

Appendix 3: T and S profiles, all stations

The following temperature and salinity profiles are based on CTD raw data.

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Salinity
Salinity
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CE17013A GN015B 20170815 52.8N/2.2E
CE17013A GN016 20170815 53.3N/1.7E
CE17013A GN009S 20170815 54.0N/2.0E
CE17013A GN017 20170815 54.0N/1.0E
CE17013A GN017A 20170815 54.0N/0.3E
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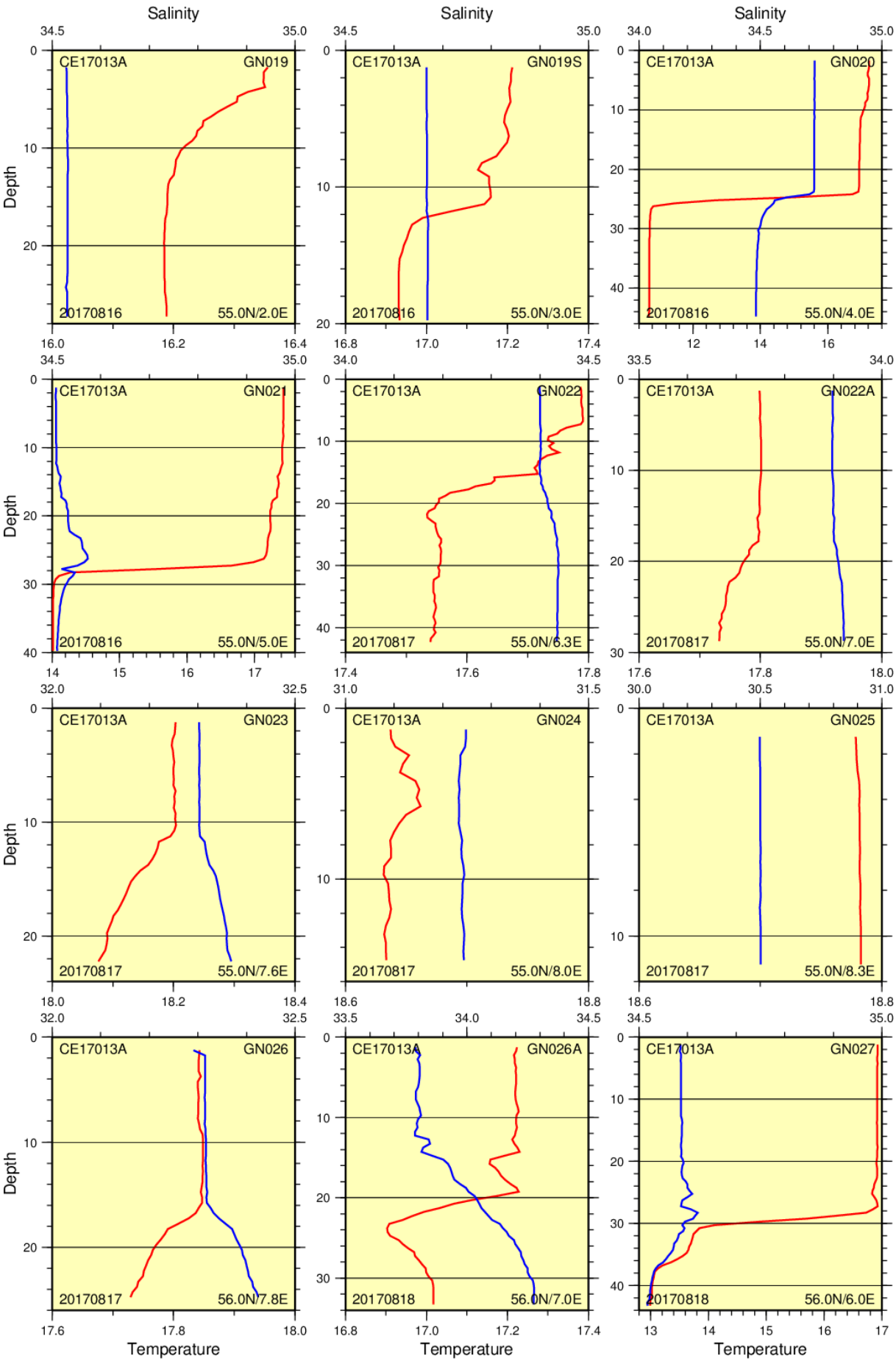
Depth
Temperature


Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
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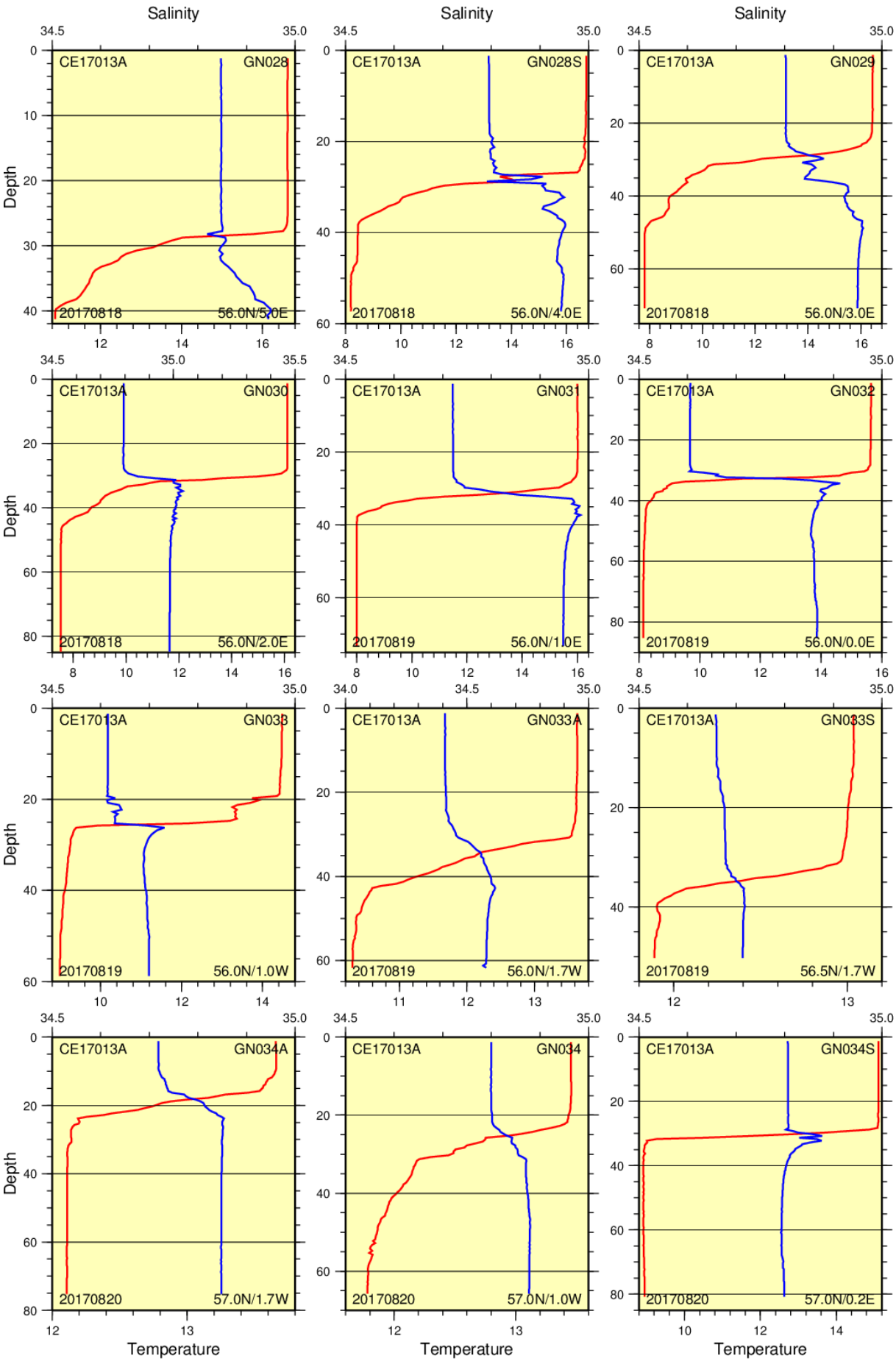
Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
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CE17013A GN029 20170818 56.0N/3.0E
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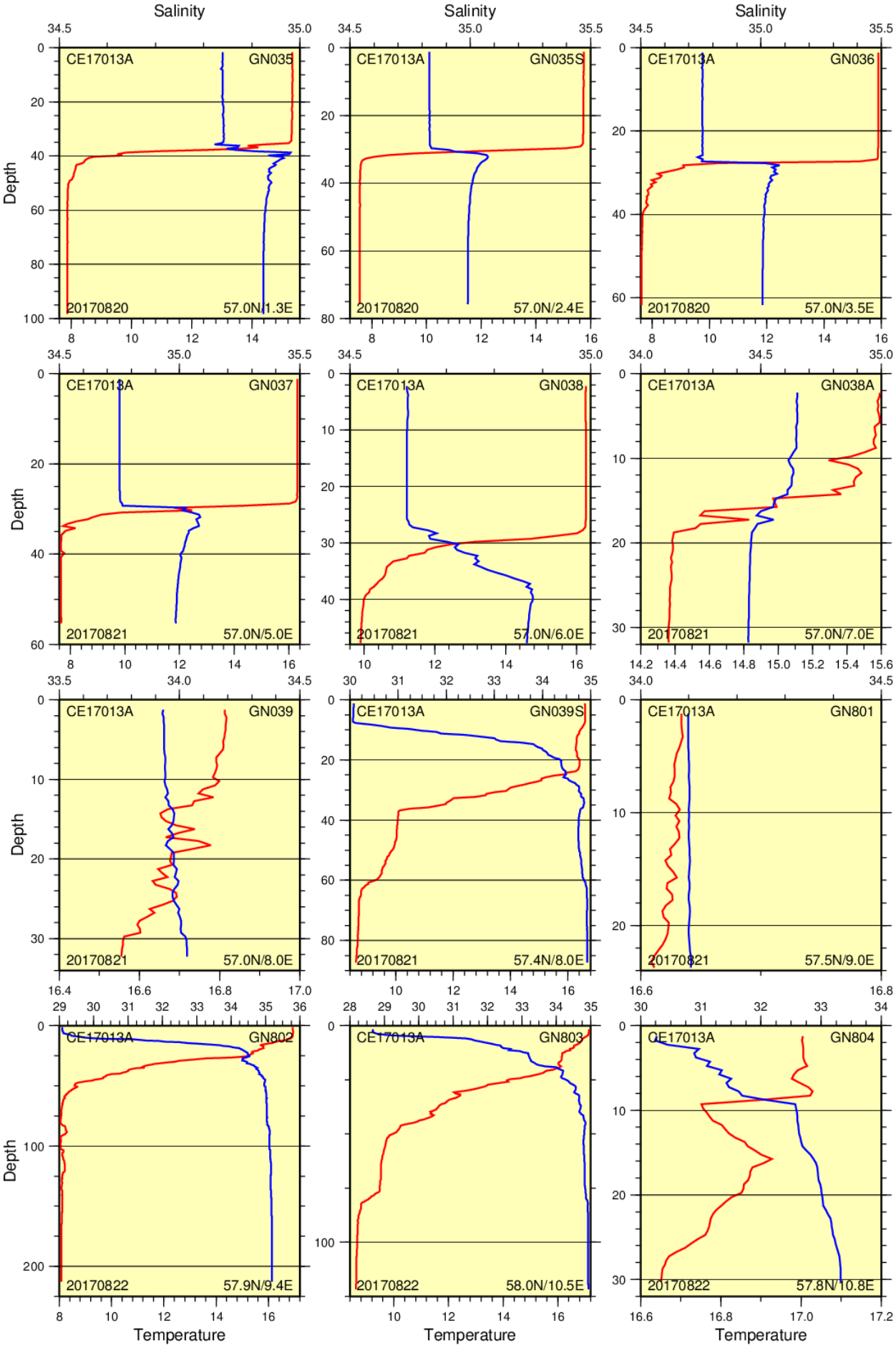
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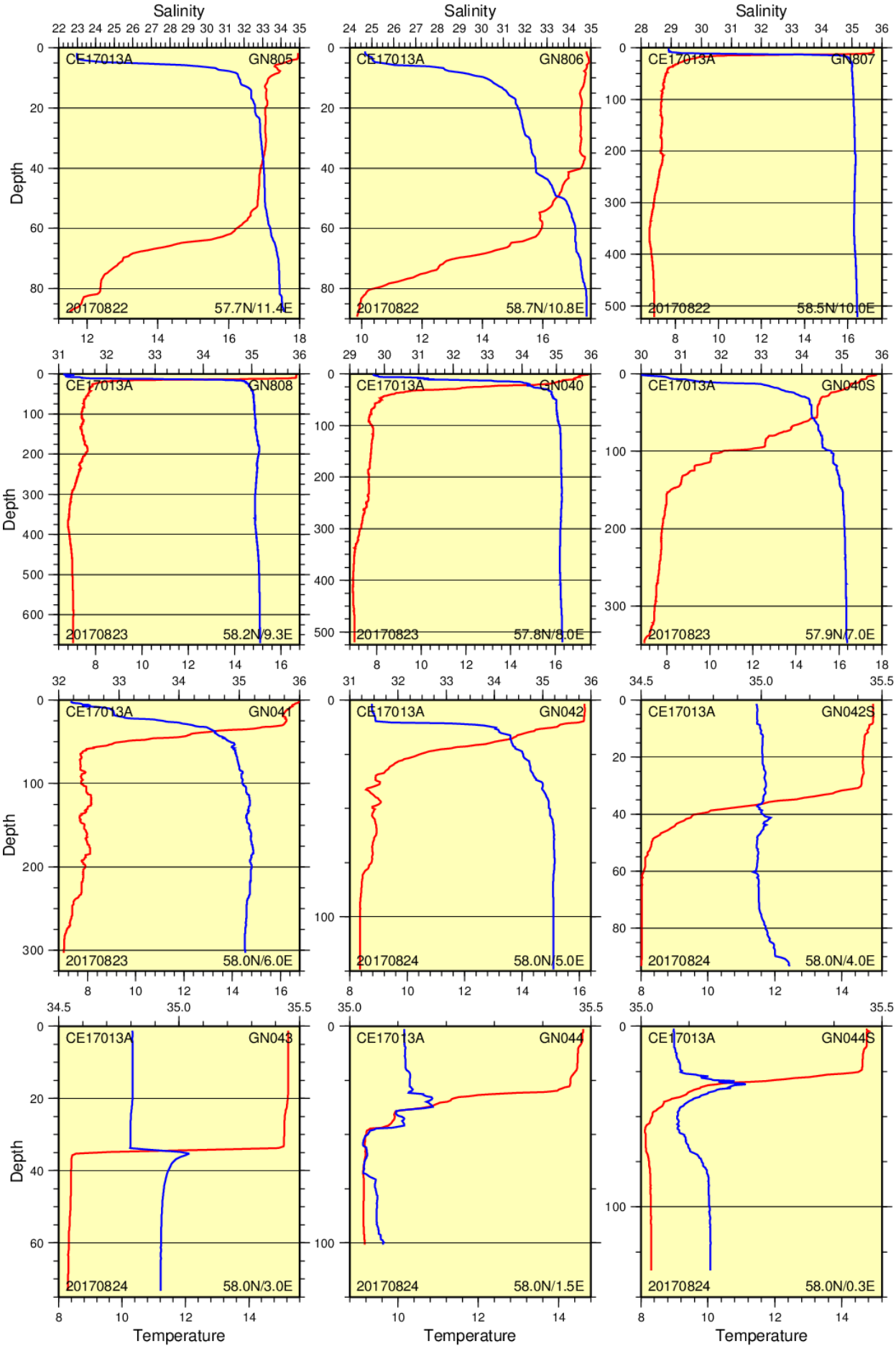
Temperature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Depth
Temperature
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GN040
20170823
57.8N/8.0E
GN040S
20170823
57.9N/7.0E
GN041
20170823
58.0N/6.0E
GN042
20170824
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GN042S
20170824
58.0N/4.0E
GN043
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GN044
20170824
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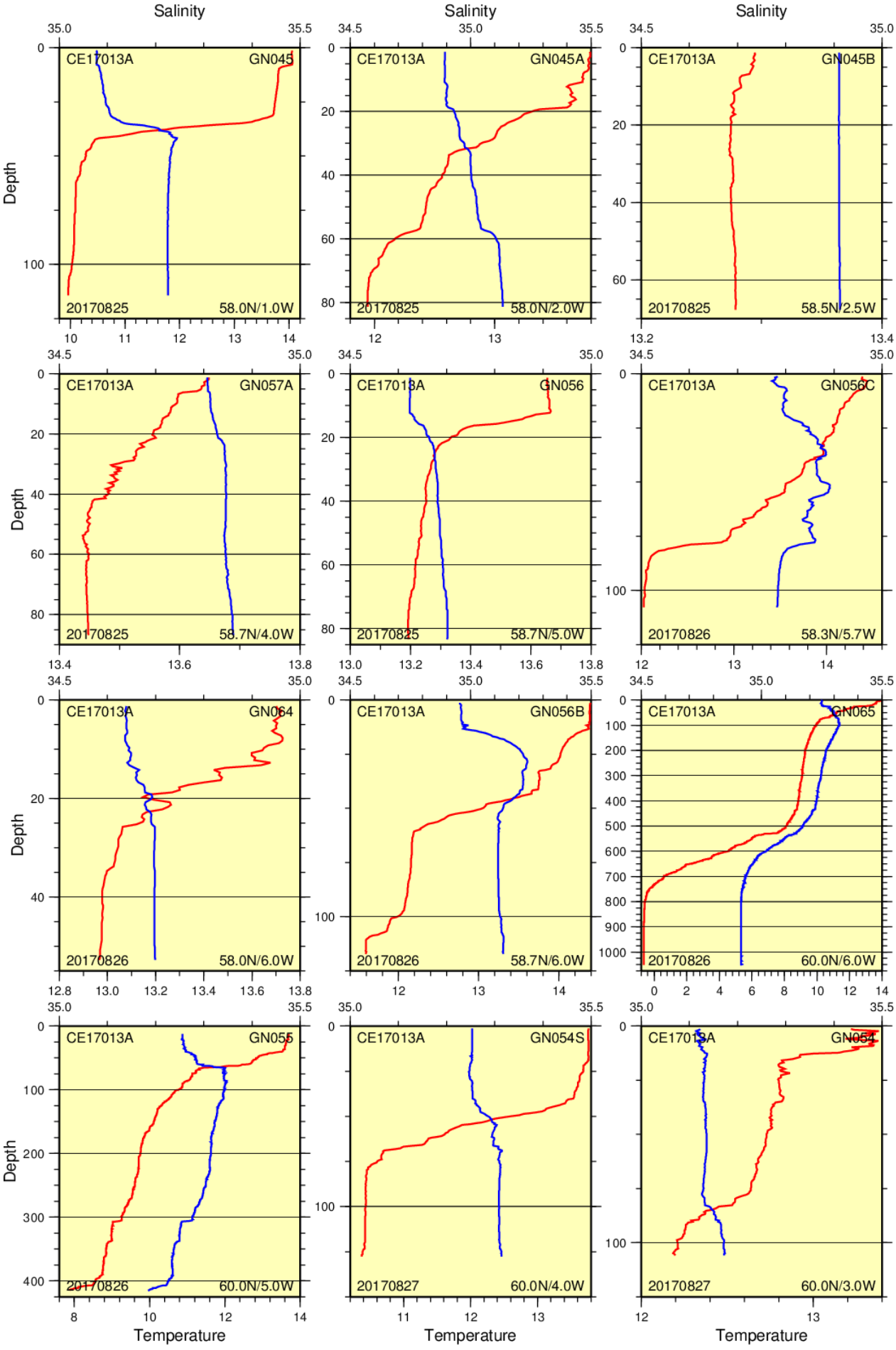
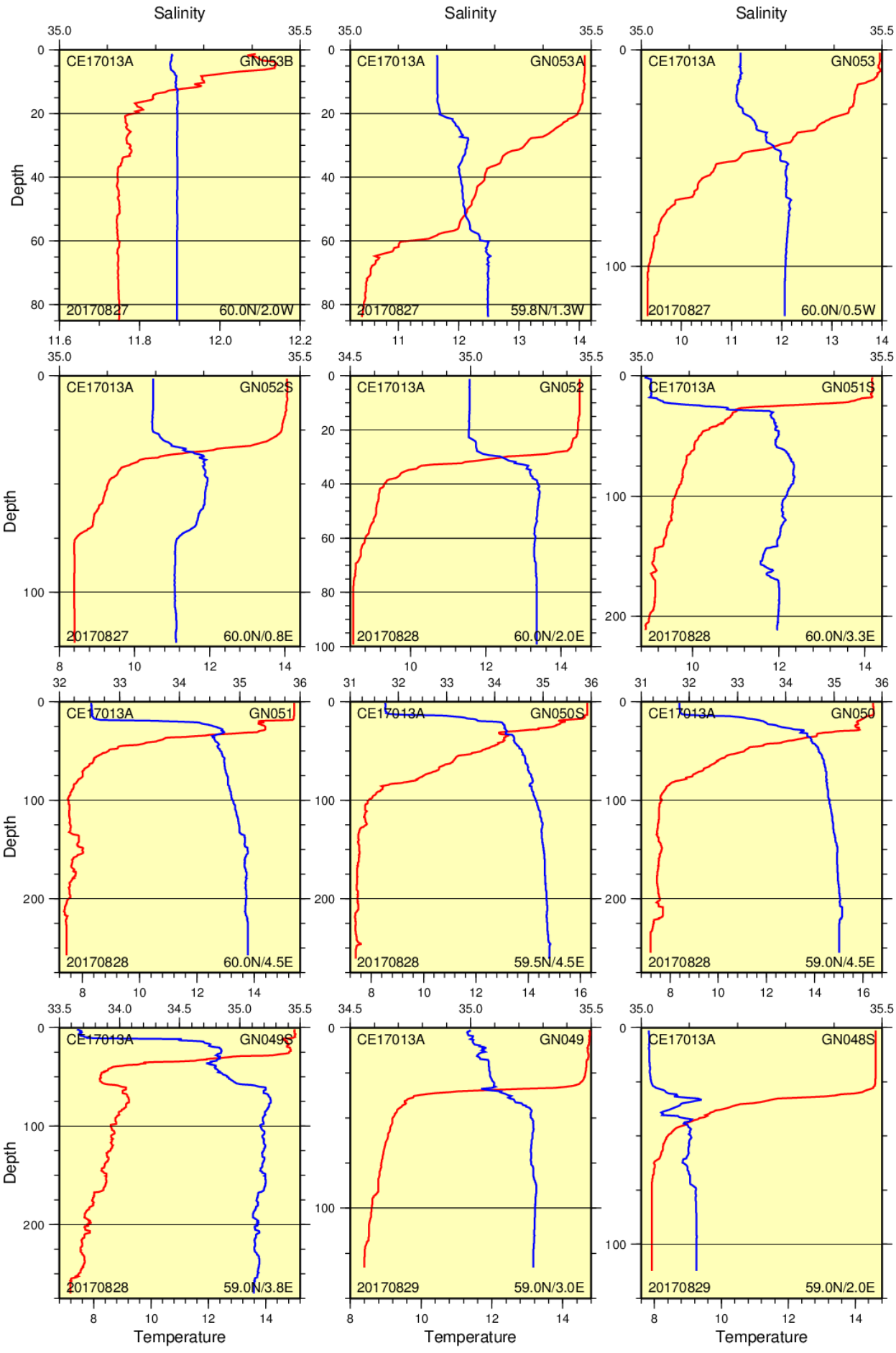
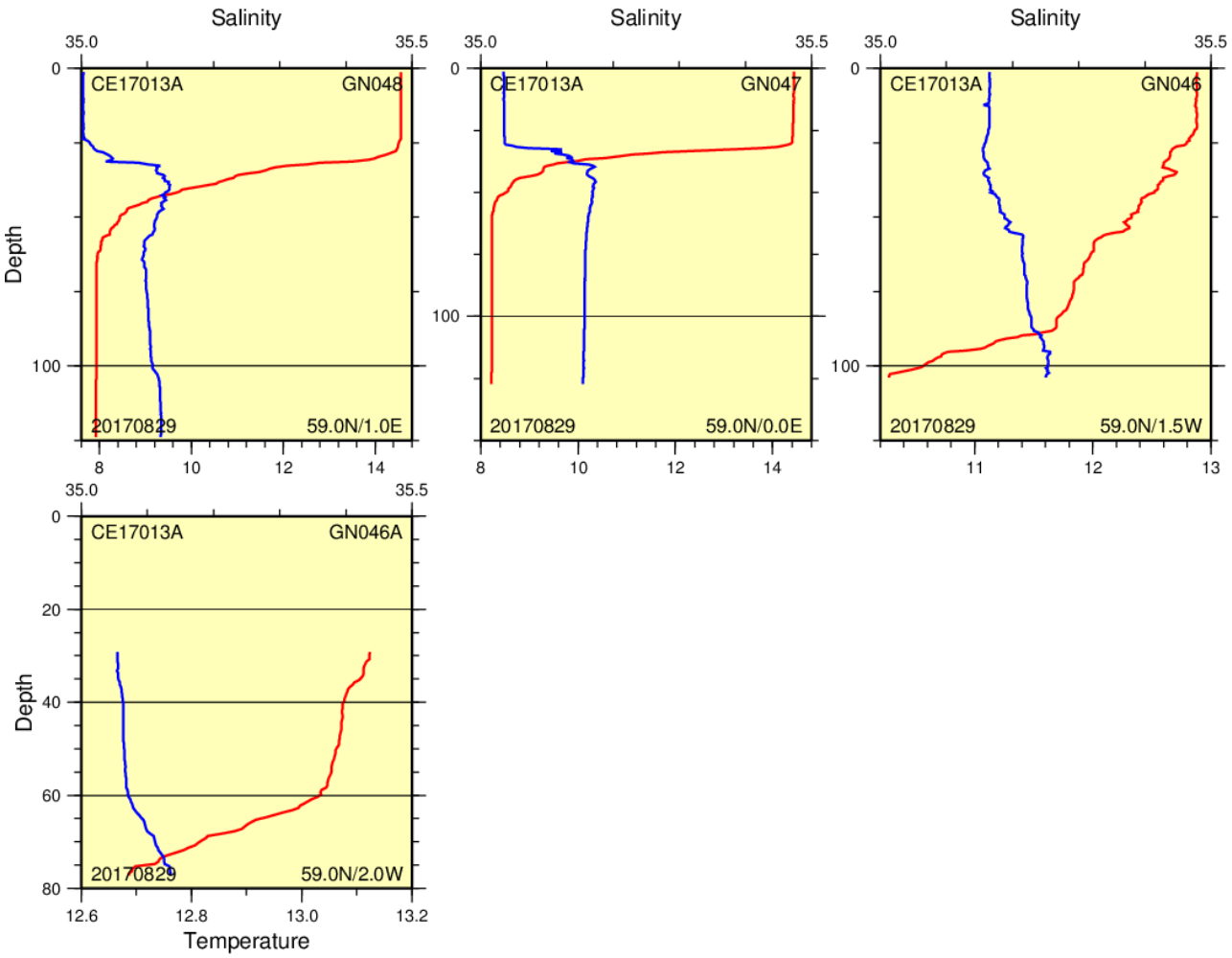
GN044S
20170824
58.0N/0.3E

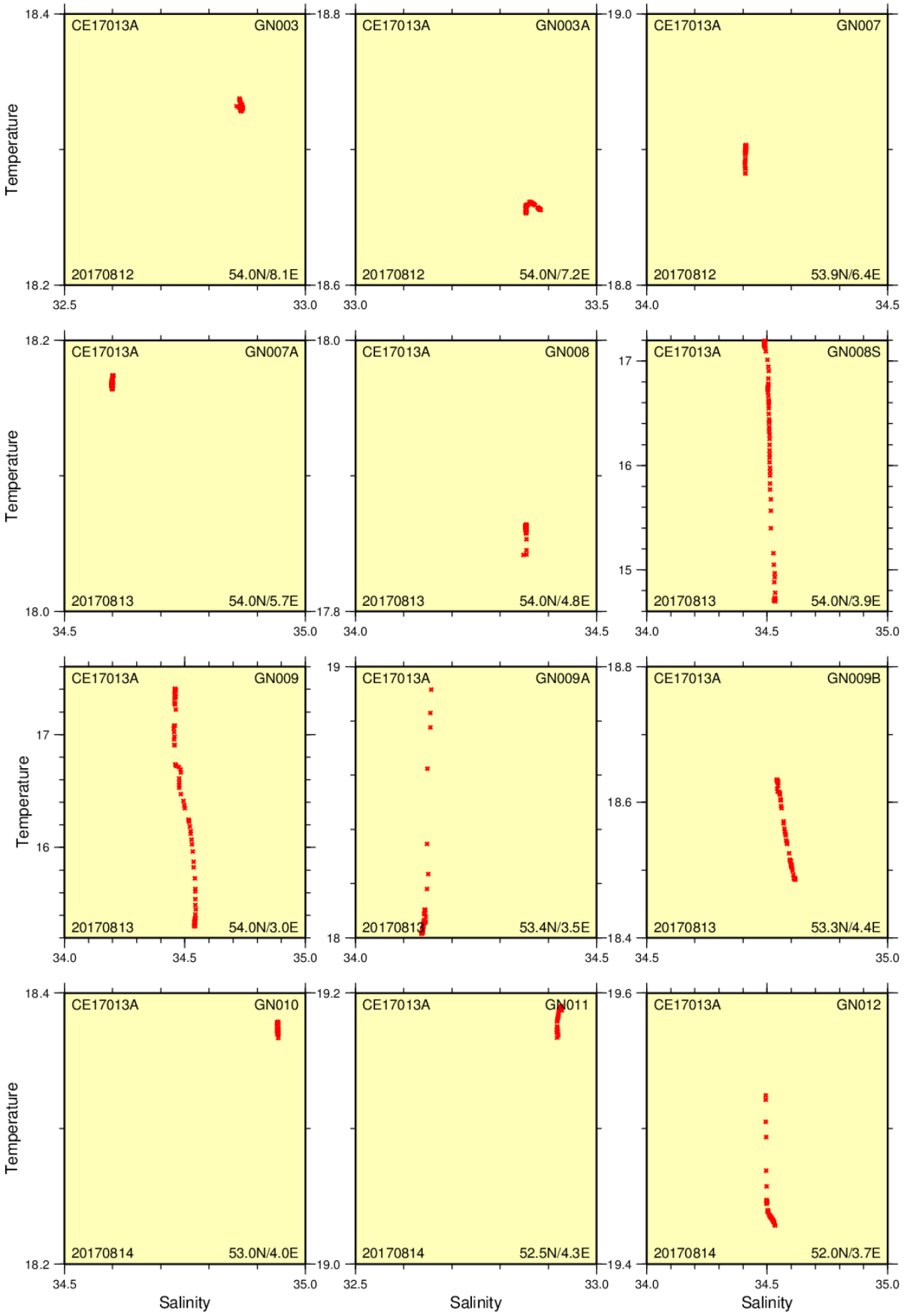

Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
CE17013A GN045 20170825 58.0N/1.0W
CE17013A GN045A 20170825 58.0N/2.0W
CE17013A GN045B 20170825 58.5N/2.5W
CE17013A GN057A 20170825 58.7N/4.0W
CE17013A GN056 20170825 58.7N/5.0W
CE17013A GN056C 20170826 58.3N/5.7W
CE17013A GN064 20170826 58.0N/6.0W
CE17013A GN056B 20170826 58.7N/6.0W
CE17013A GN065 20170826 60.0N/6.0W
CE17013A GN055 20170826 60.0N/5.0W
CE17013A GN054S 20170827 60.0N/4.0W
CE17013A GN054 20170827 60.0N/3.0W

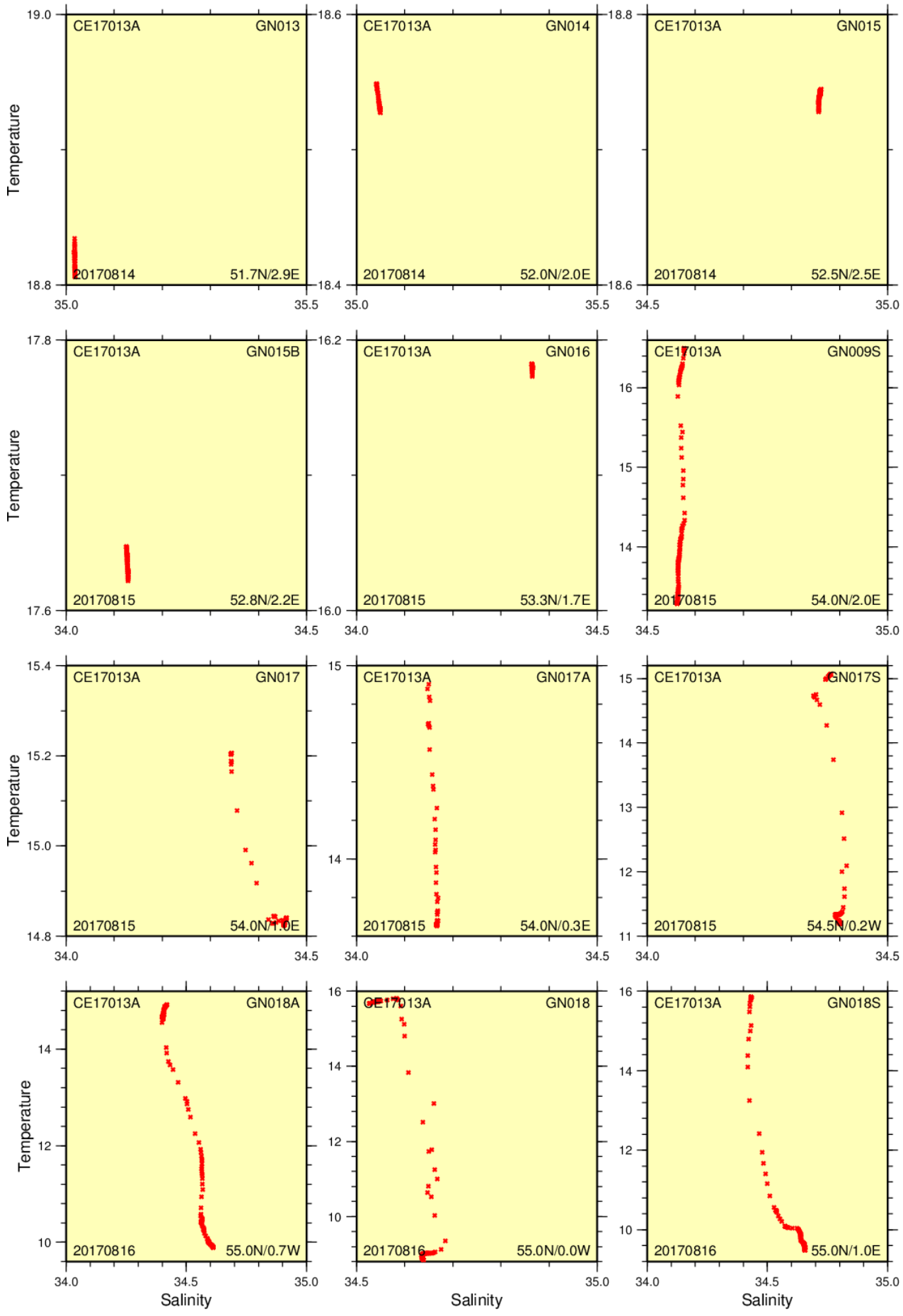

Salinity
Salinity
Salinity
CE17013A GN053B 20170827 60.0N/2.0W
CE17013A GN053A 20170827 59.8N/1.3W
CE17013A GN053 20170827 60.0N/0.5W
CE17013A GN052S 20170827 60.0N/0.8E
CE17013A GN052 20170828 60.0N/2.0E
CE17013A GN051S 20170828 60.0N/3.3E
CE17013A GN051 20170828 60.0N/4.5E
CE17013A GN050S 20170828 59.5N/4.5E
CE17013A GN050 20170828 59.0N/4.5E
CE17013A GN049S 20170828 59.0N/3.8E
CE17013A GN049 20170829 59.0N/3.0E
CE17013A GN048S 20170829 59.0N/2.0E
Depth
Temperature


Salinity
35.0
35.5
0
100
CE17013A
GN048
20170829
59.0N/1.0E
8
10
12
14
Depth
Salinity
CE17013A
GN047
20170829
59.0N/0.0E
Salinity
CE17013A
GN046
20170829
59.0N/1.5W
11
12
13
CE17013A
GN046A
20170829
59.0N/2.0W
20
40
60
80
12.6
12.8
13.0
13.2
Temperature

Appendix 4: T/S diagrams, all stations

The following diagrams are based on CTD raw data.




CE17013A GN013
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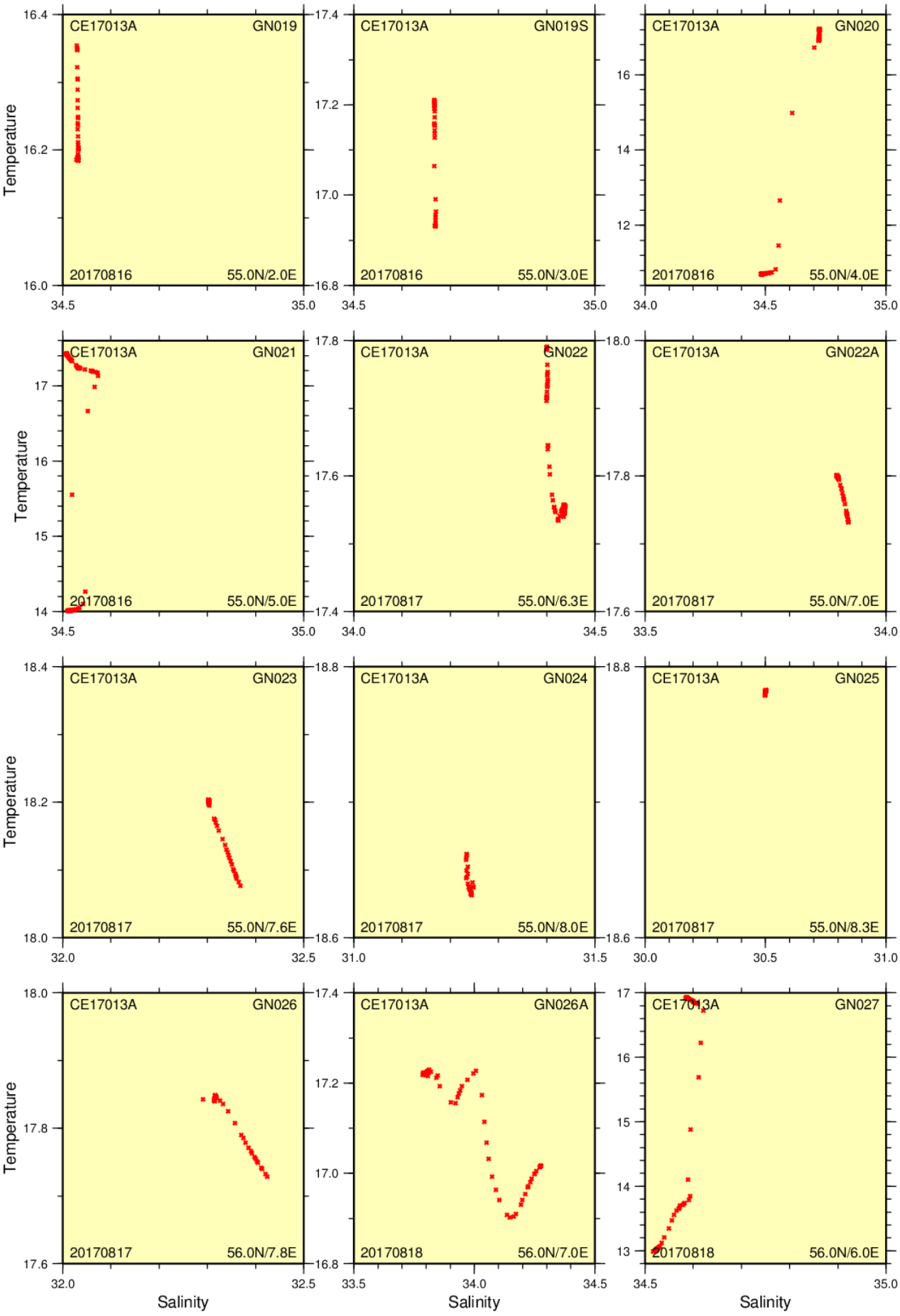
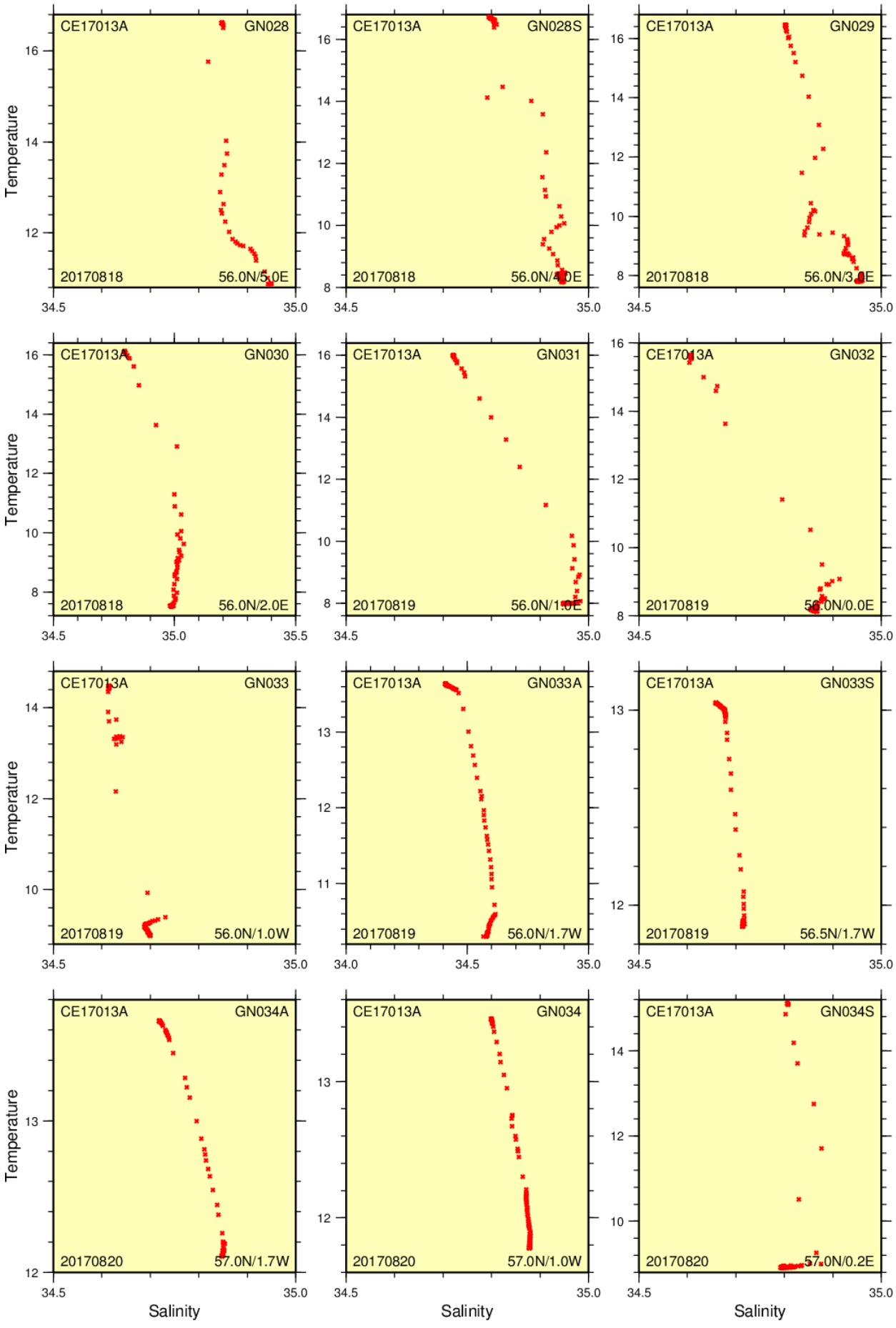
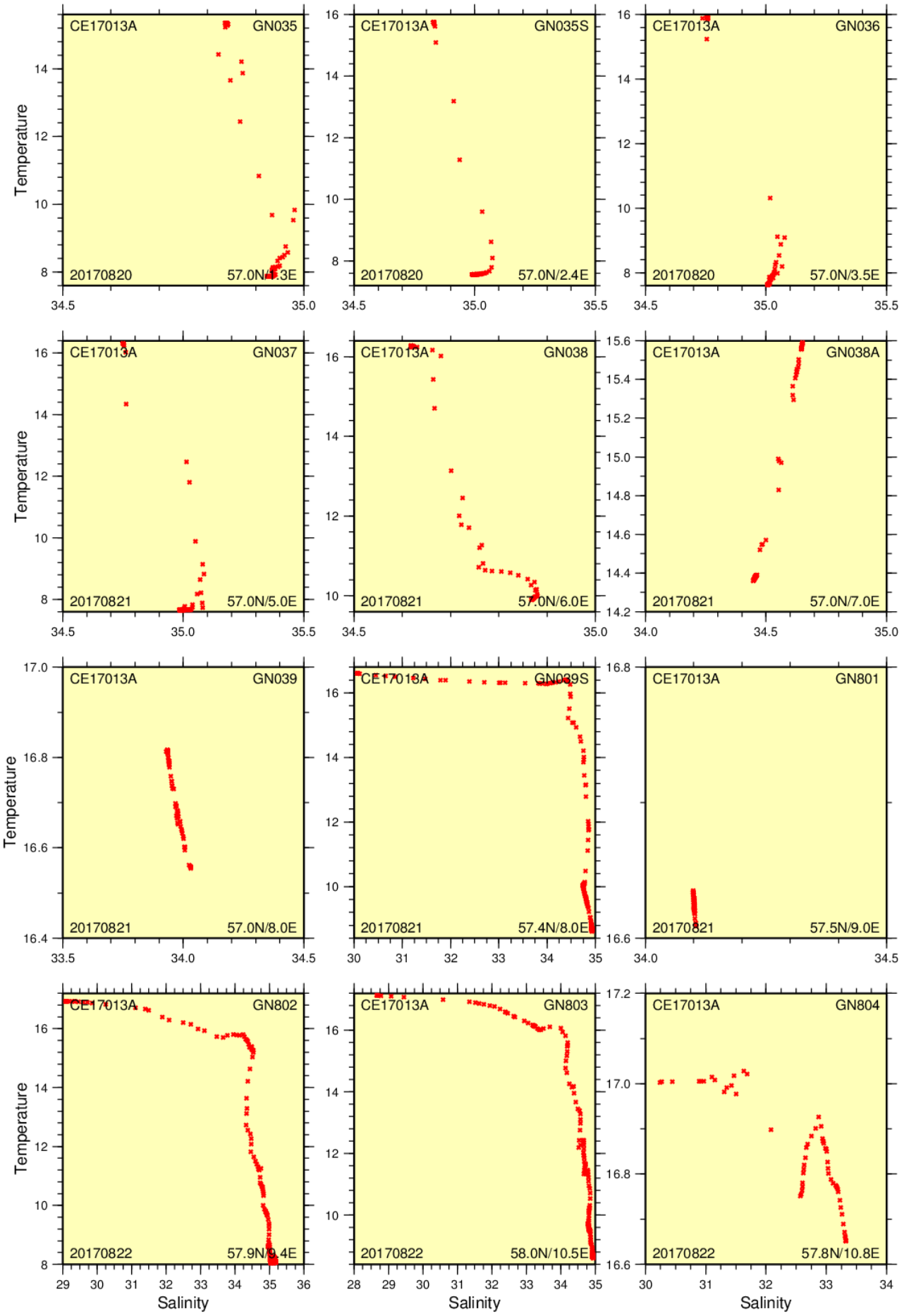
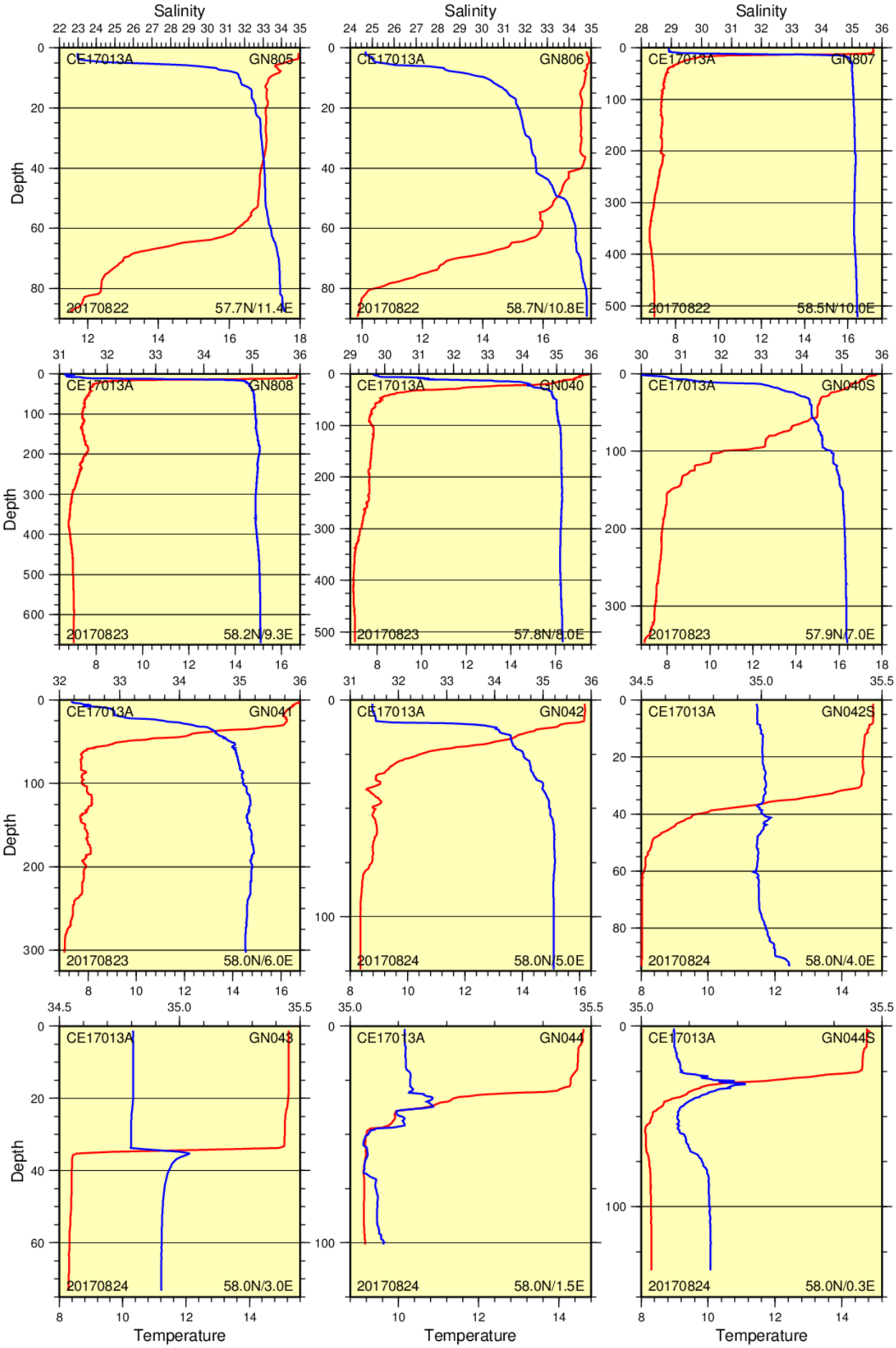
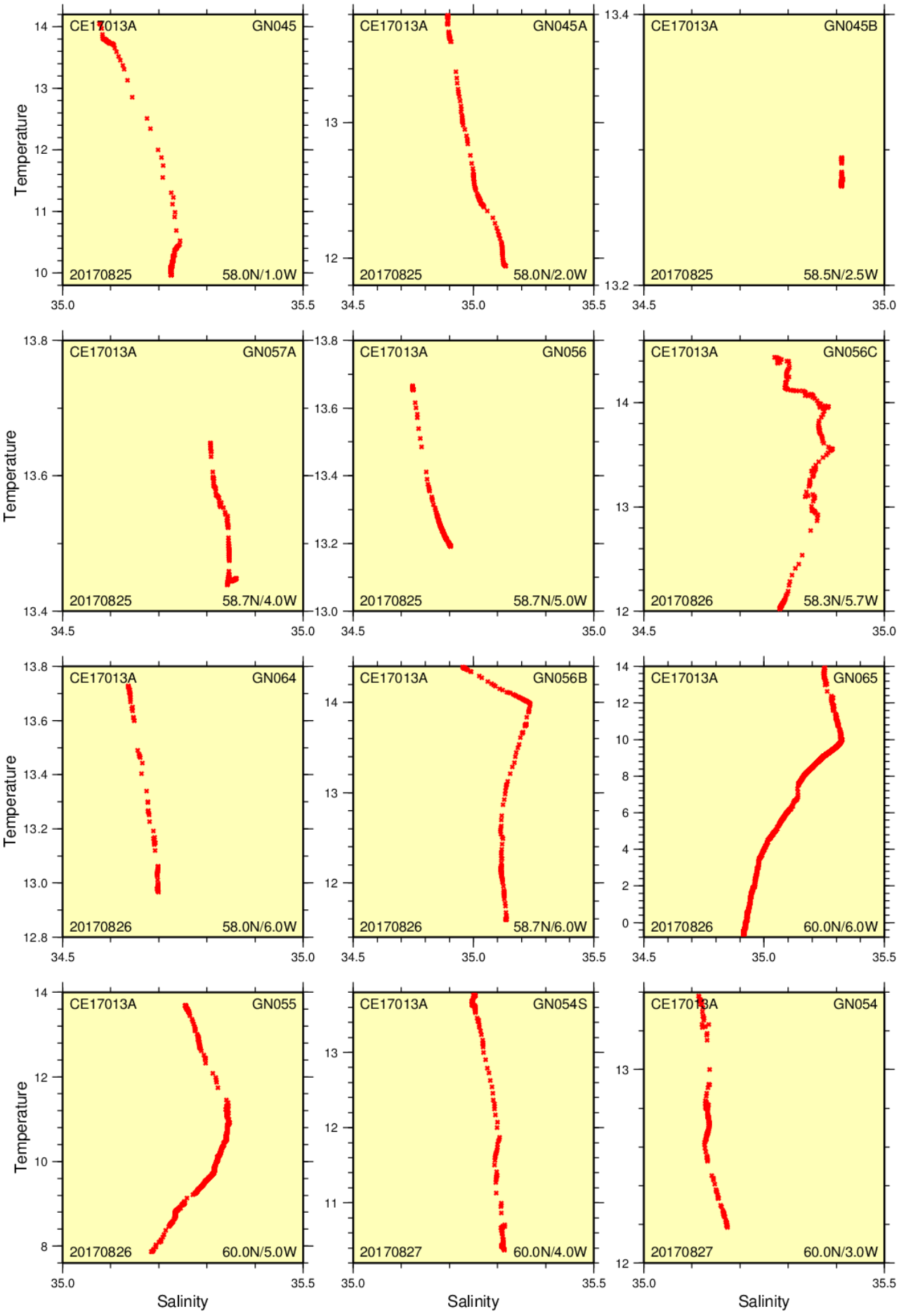
CE17013A GN014
20170814 52.0N/2.0E
CE17013A GN015
20170814 52.5N/2.5E
CE17013A GN015B
20170815 52.8N/2.2E
CE17013A GN016
20170815 53.3N/1.7E
CE17013A GN009S
20170815 54.0N/2.0E
CE17013A GN017
20170815 54.0N/1.0E
CE17013A GN017A
20170815 54.0N/0.3E
CE17013A GN017S
20170815 54.5N/0.2W
CE17013A GN018A
20170816 55.0N/0.7W
CE17013A GN018
20170816 55.0N/0.0W
CE17013A GN018S
20170816 55.0N/1.0E
Temperature
Salinity

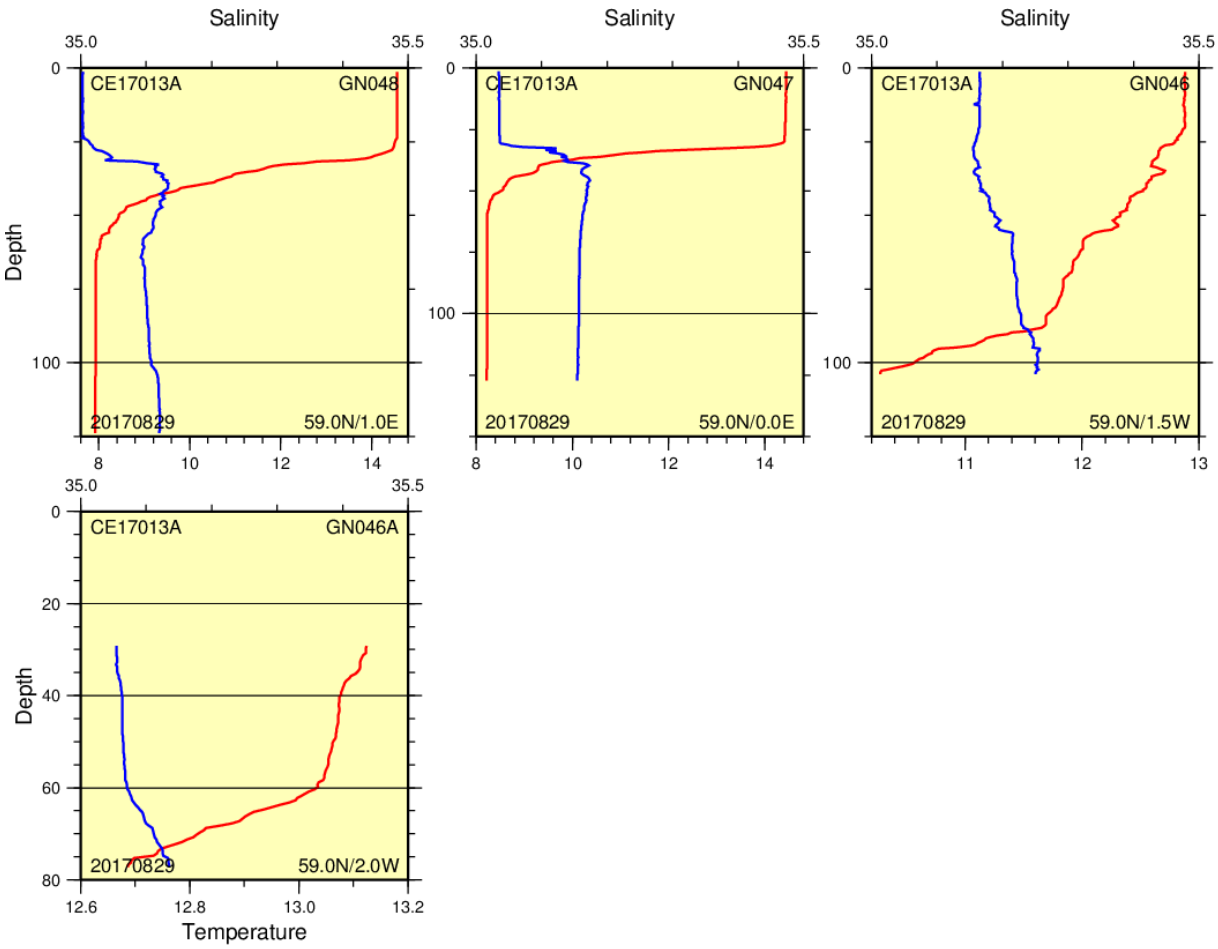

CE17013A GN019
20170816 55.0N/2.0E
CE17013A GN019S
20170816 55.0N/3.0E
CE17013A GN020
20170816 55.0N/4.0E
CE17013A GN021
20170816 55.0N/5.0E
CE17013A GN022
20170817 55.0N/6.3E
CE17013A GN022A
20170817 55.0N/7.0E
CE17013A GN023
20170817 55.0N/7.6E
CE17013A GN024
20170817 55.0N/8.0E
CE17013A GN025
20170817 55.0N/8.3E
CE17013A GN026
20170817 56.0N/7.8E
CE17013A GN026A
20170818 56.0N/7.0E
CE17013A GN027
20170818 56.0N/6.0E
Temperature
Salinity


CE17013A GN028 20170818 56.0N/5.0E
CE17013A GN028S 20170818 56.0N/4.0E
CE17013A GN029 20170818 56.0N/3.0E
CE17013A GN030 20170818 56.0N/2.0E
CE17013A GN031 20170819 56.0N/1.0E
CE17013A GN032 20170819 56.0N/0.0E
CE17013A GN033 20170819 56.0N/1.0W
CE17013A GN033A 20170819 56.0N/1.7W
CE17013A GN033S 20170819 56.5N/1.7W
CE17013A GN034A 20170820 57.0N/1.7W
CE17013A GN034 20170820 57.0N/1.0W
CE17013A GN034S 20170820 57.0N/0.2E
Temperature
Salinity


CE17013A GN035
20170820 57.0N/1.3E
CE17013A GN035S
20170820 57.0N/2.4E
CE17013A GN036
20170820 57.0N/3.5E
CE17013A GN037
20170821 57.0N/5.0E
CE17013A GN038
20170821 57.0N/6.0E
CE17013A GN038A
20170821 57.0N/7.0E
CE17013A GN039
20170821 57.0N/8.0E
CE17013A GN039S
20170821 57.4N/8.0E
CE17013A GN801
20170821 57.5N/9.0E
CE17013A GN802
20170822 57.9N/9.4E
CE17013A GN803
20170822 58.0N/10.5E
CE17013A GN804
20170822 57.8N/10.8E
Temperature
Salinity


Salinity
Depth
Temperature
CE17013A
GN805
20170822
57.7N/11.4E
GN806
20170822
58.7N/10.8E
GN807
20170822
58.5N/10.0E
GN808
20170823
58.2N/9.3E
GN040
20170823
57.8N/8.0E
GN040S
20170823
57.9N/7.0E
GN041
20170823
58.0N/6.0E
GN042
20170824
58.0N/5.0E
GN042S
20170824
58.0N/4.0E
GN043
20170824
58.0N/3.0E
GN044
20170824
58.0N/1.5E
GN044S
20170824
58.0N/0.3E


CE17013A GN045
20170825 58.0N/1.0W
CE17013A GN045A
20170825 58.0N/2.0W
CE17013A GN045B
20170825 58.5N/2.5W
CE17013A GN057A
20170825 58.7N/4.0W
CE17013A GN056
20170825 58.7N/5.0W
CE17013A GN056C
20170826 58.3N/5.7W
CE17013A GN064
20170826 58.0N/6.0W
CE17013A GN056B
20170826 58.7N/6.0W
CE17013A GN065
20170826 60.0N/6.0W
CE17013A GN055
20170826 60.0N/5.0W
CE17013A GN054S
20170827 60.0N/4.0W
CE17013A GN054
20170827 60.0N/3.0W
Temperature
Salinity


Salinity
35.0
35.5
0
100
CE17013A
GN048
20170829
59.0N/1.0E
8
10
12
14
Depth
Salinity
35.0
35.5
0
100
CE17013A
GN047
20170829
59.0N/0.0E
8
10
12
14
Salinity
35.0
35.5
0
100
CE17013A
GN046
20170829
59.0N/1.5W
11
12
13
35.0
35.5
0
20
40
60
80
CE17013A
GN046A
20170829
59.0N/2.0W
12.6
12.8
13.0
13.2
Depth
Temperature

Appendix 5: Station List

Positions are taken at the beginning of the stations!
Radioactivity: Cs = Cesium-137; Sr = Strontium-90; Pu = Plutonium; H3 = Tritium; TU = Plutonium, Americium und Curium
Water depth corrected for draft (5 m)!

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	trace metals [m]	nutrients [m]	Bedford-nr. 175nnn	date [dd.mm.yy]	time [UTC]
STADE	53° 37.34‘ N	009° 32.78‘ E	17	—	—	Cs/Sr//H3/TU	8	—	001	12.08.17	08:17 – 09:35
MEDEM	53° 52.80‘ N	008° 43.24‘ E	24	—	—	Cs/Sr//H3/TU	8	—	002	12.08.17	11:48 – 12:05
GN003 ELBE1	54° 00.11‘ N	008° 06,65‘ E	26	bottom, 5	4.5	Cs/Sr//H3/TU	—	bottom, 5	003-004	12.08.17	14:46 – 15:08
GN003A	54° 00.04‘ N	007° 10.08‘ E	29	bottom, 5	—	Cs/Sr//H3/TU	—	—	005-006	12.08.17	18:50 – 19:06
GN007	53° 55.83‘ N	006° 25.26‘ E	27	bottom, 5	—	Cs/Sr//H3/TU	—	—	007-008	12.08.17	22:08 – 22:23
GN007A	54° 00.04‘ N	005° 40.21‘ E	37	Bottom, 5	—	Cs/Sr//H3/TU	—	—	009-010	13.08.17	01:21 – 01:37
GN008	54° 00.02‘ N	004° 49.84‘ E	42	bottom, 2×10, 5	3.5	Cs	10	bottom, 5	011-014	13.08.17	04:31 – 05:15
GN008S	54° 00.02‘ N	003° 55.03‘ E	46	bottom, 5	9.5	—	—	bottom, 5	015-016	13.08.17	08:38 – 08:53
GN009	54° 00.01‘ N	002° 59.95‘ E	42	bottom, 2 x 10, 2×5	12.0	Cs/Sr//H3/TU	—	bottom, 5	017-021	13.08.17	12:24 – 13:20
GN009A	53° 24.75‘ N	003° 30.75‘ E	28	bottom, 5	—	Cs	10		022-023	13.08.17	19:07 – 19:20
GN009B	53° 19.78‘ N	004° 25.32‘ E	29	bottom, 5	—	Cs/Sr//H3/TU	—	—	024-025	13.08.17	22:36 – 22:53
GN010	52° 59.95‘ N	004° 00.01‘ E	30	bottom, 2 ×10, 5	—	Cs	10	—	026-029	14.08.17	01:27 – 01:39
GN011	52° 30.68‘ N	004° 19.52‘ E	20	bottom, 5	12.0	Cs	—	bottom, 5	030-031	14.08.17	05:05 – 05:16
GN012	51° 59.92‘ N	003° 43.81‘ E	23	bottom, 2 × 10, 5	6.0	Cs/Sr//H3/TU	10	bottom, 5	032-035	14.08.17	10:17 – 10:36
GN013	51° 41.97‘ N	002° 51.48‘ E	36	bottom, 2 × 10, 5	5.5	Cs/Sr//H3/TU	10	bottom, 5	036-039	14.08.17	13:59 – 14:14
GN014	52° 00.37‘ N	002° 00.46‘ E	29	bottom, 2 × 10, 5	3.0	Cs/Sr//H3/TU	10	bottom, 5	040-043	14.08.17	18:47 – 19:05
GN015	52° 30.04‘ N	002° 30.07‘ E	47	bottom, 5	—	Cs	—	—	044-045	14.08.17	22:18 – 22:35
GN015B	52° 49.75‘ N	002° 10.24‘ E	42	bottom, 5	—	Cs	—	—	046-047	15.08.17	01:16 – 01:28
GN016	53° 19.77’ N	001° 40.27‘ E	32	bottom, 2 × 10, 2×5	11.0	Cs/Sr//H3/TU	10	bottom, 5	048-052	15.08.17	05:17 – 05:34
GN009S	53° 59.95‘ N	002° 00.08‘ E	73	bottom, 5	12.0	—-	—	—	053-054	15.08.17	09:53 – 10:05
GN017	54° 00.03‘ N	000° 59.77‘ E	44	bottom, 2 × 10, 2×5	10.5	Cs	10	bottom, 5	055-059	15.08.17	14:07 – 14:20
GN017A	53° 59.99‘ N	000° 19.74‘ E	52	bottom, 5	11.0	Cs/Sr//H3/TU	—	—	060-061	15.08.17	17:18 – 17:33
GN017S	54° 30.08‘ N	000° 10.19‘ W	61	bottom, 5	—	—	—	—	062-063	15.08.17	21:16 – 21:28
GN018A	55° 00.00‘ N	000° 40.13‘ W	66	bottom, 5	—	Cs	—	—	064-065	16.08.17	01:07 – 01:20
GN018	55° 00.24‘ N	000° 00.44‘ W	73	bottom, 5	—	Cs	—	bottom, 5	066-070	16.08.17	03:40 – 03:59
GN018S	55° 00.00‘ N	001° 00.11‘ E	63	bottom, 5	15.0	—	10	—	071-072	16.08.17	07:31 – 07:45
GN019	55° 00.02‘ N	002° 00.05‘ E	28	bottom, 2×5	14.5	Cs/Sr//H3/TU	—	bottom, 5	073-075	16.08.17	11:16 – 11:34
GN019S	54° 59.81‘ N	002° 59.90‘ E	24	bottom, 2×5	12.0	—	—	—	076-078	16.08.17	14:57 – 15:21
GN020	55° 00.01‘ N	004° 00.09‘ E	47	bottom, 2 × 10, 2×5	—	Cs	10	bottom, 5	079-083	16.08.17	19:37 – 19:52

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	trace metals [m]	nutrients [m]	Bedford-nr. 175nnn	date dd.mm.yy	time [UTC]
GN021 AWZW2	54° 59.99‘ N	005° 00.02‘ E	41	bottom, 5	—	Cs	—	—	084-085	16.08.17	23:29 – 23:41
GN022	54° 59.91‘ N	006° 15.05‘ E	44	bottom, 2×5	—	Cs	—	bottom, 5	086-088	17.08.17	03:59 – 04:14
GN022A	55° 00.04‘ N	007° 00.25‘ E	32	bottom, 5	9.5	Cs	—	—	089-090	17.08.17	07:01 – 07:16
GN023	55° 00.07‘ N	007° 34.98‘ E	25	bottom, 5	7.5	Cs/Sr//H3/TU	—	—	091-092	17.08.17	09:31 – 09:45
GN024	54° 59.98‘ N	007° 59.97‘ E	16	bottom, 5	6.0	—	—	bottom, 5	093-094	17.08.17	11:35 – 12:17
GN025	54° 59.93‘ N	008° 15.07‘ E	13	bottom, 5	6.0	Cs/Sr//H3/TU	—	—	095-096	17.08.17	13:15 – 13:33
GN026	56° 00.04‘ N	007° 47.95‘ E	27	bottom, 2×10, 5	—	Cs/Sr//H3/TU	10	bottom, 5	097-100	17.08.17	21:08 – 21:25
GN026A	56° 00.02‘ N	007° 00.02‘ E	35	bottom, 2×10, 5	—	Cs/Sr//H3/TU	10	—	101-104	18.08.17	00:33 – 00:49
GN027	55° 59.92‘ N	006° 00.03‘ E	48	bottom, 2×5	—	Cs	—	—	105-106	18.08.17	04:26 – 04:40
GN028	55° 59.81‘ N	004° 59.99‘ E	43	bottom, 2×10, 2×5	11.0	Cs	10	bottom, 5	107-111	18.08.17	08:14 – 08:29
GN028S	55° 59.95‘ N	003° 59.97‘ E	57	bottom, 5	13.5	—	—	—	112-113	18.08.17	12:12 – 12:25
GN029	56° 00.01‘ N	003° 00.29‘ E	73	bottom, 2×5	13.0	Cs/Sr//H3/TU	—	bottom, 5	114-116	18.08.17	17:09 – 17:27
GN030	56° 00.00‘ N	002° 00.10‘ E	87	bottom, 2×10, 5	—	Cs	10	—	117-120	18.08.17	21:54 – 22:11
GN031	56° 00.03‘ N	001° 00.15‘ E	77	bottom, 3×5	—	Cs	—	—	121-124	19.08.17	04:19 – 04:44
GN032	55° 59.98‘ N	000° 00.09‘ E	87	bottom, 2×5	9.0	Cs	—	bottom, 5	125-127	19.08.17	10:53 – 11:05
GN033	55° 59.93‘ N	000° 59.78‘ W	64	bottom, 2×10, 2×5	10.0	Cs	10	bottom, 5	128-132	19.08.17	15:30 – 15:44
GN033A	55° 59.94‘ N	001° 40.50‘ W	64	bottom, 5	—	Cs/Sr//H3/TU	—	—	133-134	19.08.17	18:30 – 18:45
GN033S	56° 30.03‘ N	001° 40.32‘ W	52	bottom, 5	—	—	—	—	135-136	19.08.17	22:01 – 22:11
GN034A	56° 59.99‘ N	001° 40.30‘ W	77	bottom, 5	—	Cs/Sr//H3/TU	—	—	137-138	20.08.17	01:37 – 01:52
GN034	56° 59.96‘ N	001° 00.25‘ W	71	bottom, 2×10, 2×5	—	Cs	10	bottom, 5	139-143	20.08.17	04:07 – 04:26
GN034S	57° 00.05‘ N	000° 10.03‘ E	83	bottom, 5	13.0	—	—	—	144-145	20.08.17	08:19 – 08:33
GN035	56° 59.95‘ N	001° 19.80‘ E	99	bottom, 2×5	13.0	Cs	—	bottom, 5	146-148	20.08.17	13:00 – 13:13
GN035S	57° 00.07‘ N	002° 25.08‘ E	82	bottom, 5	11.0	—	—	2×	149-150	20.08.17	17:04 – 17:22
GN036	56° 59.99‘ N	003° 29.99‘ E	65	bottom, 2×10, 2×5	—	Cs/Sr//H3/TU	10	bottom, 5	151-155	20.08.17	21:12 – 21:33
GN037	57° 00.09‘ N	004° 59.71‘ E	58	bottom, 5	—	Cs	—	—	156-157	21.08.17	02:49 – 03:05
GN038	57° 00.02‘ N	006° 00.18‘ E	51	bottom, 2×10, 5	14.5	Cs	10	—	158-161	21.08.17	06:37 – 06:54
GN038A	56° 59.97‘ N	006° 59.99‘ E	33	bottom, 5	12.0	Cs/Sr//H3/TU	—	—	162-163	21.08.17	10:12 – 10:34
GN039	57° 00.01‘ N	008° 00.00‘ E	35	bottom, 2×10, 5	7.5	Cs/Sr//H3/TU	10	bottom, 5	164-167	21.08.17	14:04 – 14:23
GN039S	57° 25.14‘ N	008° 00.27‘ E	93	bottom, 5	—	—	—	—	168-169	21.08.17	18:06 – 18:20
GN801	57° 30.04‘ N	009° 00.16‘ E	25	bottom, 5	—	Cs/Sr//H3/TU	10	—	170-171	21.08.17	21:43 – 22:07
GN802	57° 56.94‘ N	009° 25.30‘ E	220	bottom, 5	—	Cs/Sr//H3/TU	—	—	172-173	22.08.17	02:59 – 03:53
GN803	57° 59.96‘ N	010° 29.97‘ E	125	bottom, 2×5	11.0	Cs/Sr//H3/TU	—	—	174-175	22.08.17	07:26 – 07:44
GN804	57° 45.99‘ N	010° 46.28‘ E	32	bottom, 10, 5	6.5	Cs/Sr//H3/TU	10	—	176-178	22.08.17	09:43 – 10:14
GN805	57° 40.22‘ N	011° 25.17‘ E	88	bottom, 20	10.0	Cs/Sr//H3/TU	12	—	179-180	22.08.17	12:28 – 13:13

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	trace metals [m]	nutrients [m]	Bedford-nr. 175nnn	date dd.mm.yy	time [UTC]
GN806	58° 40.18‘ N	010° 46.68‘ E	94	bottom, 20	—	Cs/Sr//H3/TU	—	—	181-182	22.08.17	20:29 – 20:46
GN807	58° 30.04‘ N	009° 59.98‘ E	527	bottom, 20	—	Cs/Sr//H3/TU	10	—	183-184	22.08.17	23:22 – 00:26
GN808	58° 13.25‘ N	009° 19.76‘ E	676	2×bottom, 5 270 l at 100 and 255 m	12.5	Cs/Sr//H3/TU	—	—	185-187	23.08.17	03:15 – 07:47
GN040	57° 49.78‘ N	007° 59.88‘ E	524	bottom, 2×5	11.5	Cs/Sr//H3/TU	5	bottom, 5	188-190	23.08.17	12:31 – 14:37
GN040S	57° 55.29‘ N	006° 59.85‘ E	349	bottom, 5	—	—	—	—	191-192	23.08.17	17:38 – 18:13
GN041	58° 00.02‘ N	005° 59.61‘ E	307	bottom, 2×5	—	Cs/Sr//H3/TU	15	bottom, 5	193-196	23.08.17	21:42 – 22:23
GN042	57° 59.97‘ N	005° 00.02‘ E	126	bottom, 5	—	Cs	5	—	197-198	24.08.17	01:46 – 02:15
GN042S	57° 59.93‘ N	004° 00.11‘ E	98	bottom, 5	—	—	—	—	199-200	24.08.17	05:24 – 05:40
GN043	58° 00.08‘ N	003° 00.17‘ E	77	bottom, 2×5	>12.0	Cs	—	bottom, 5	201-203	24.08.17	09:00 – 09:12
GN044	58° 00.03‘ N	001° 30.04‘ E	105	bottom, 10, 2×5	14.5	Cs/Sr//H3/TU	10	bottom, 5	204-207	24.08.17	14:09 – 14:36
GN044S	58° 00.02‘ N	000° 15.11‘ E	140	bottom, 5	—	—	—	—	208-209	24.08.17	19:27 – 19:44
GN045	57° 59.99‘ N	001° 00.08‘ W	115	bottom, 10	—	Cs/Sr//H3/TU	10	—	210-211	25.08.17	00:04 – 00:30
GN045A	58° 00.03‘ N	002° 00.04‘ W	86	bottom, 5	—	Cs/Sr//H3/TU	—	—	212-213	25.08.17	03:49 – 04:10
GN45B	58° 30.10‘ N	002° 30.10‘ W	70	bottom, 5	14.5	Cs/Sr//H3/TU	—	—	214-215	25.08.17	09:19 – 09:35
GN057A	58° 44.94‘ N	004° 00.32‘ W	90	bottom, 5	12.0	Cs	—	—	216-217	25.08.17	16:27 – 16:44
GN056	58° 44.93‘ N	005° 00.07‘ W	87	bottom, 10, 2×5	—	Cs	10	bottom, 5	218-221	25.08.17	19:45 – 20:14
GN056C	58° 19.86‘ N	005° 40.26‘ W	109	bottom, 5	—	Cs/Sr//H3/TU	—	—	222-223	26.08.17	00:01 – 00:17
GN064	58° 00.07‘ N	005° 59.63‘ W	55	bottom, 5	—	Cs/Sr//H3/TU	10	—	224-225	26.08.17	02:42 – 03:11
GN056B	58° 44.96‘ N	005° 59.97‘ W	119	bottom, 5	10.0	Cs/Sr//H3/TU	—	—	226-227	26.08.17	08:05 – 08:21
GN065	59° 59.83‘ N	005° 59.84‘ W	1060	2×bottom, 2×5 270 l at 44, 228, 486 and 1035 m	15.0	Cs/Sr//H3/TU	10	bottom, 5	228-231	26.08.17	16:26 – 19:45
GN055	60° 00.03‘ N	004° 59.99‘ W	412	bottom, 2	—	Cs/Sr//H3/TU	—	—	232-233	26.08.17	22:48 – 23:27
GN054S	59° 59.95‘ N	003° 59.92‘ W	132	2×bottom, 5	—	—	—	—	234-236	27.08.17	02:29 – 02:46
GN054	59° 59.93‘ N	003° 00.06‘ W	102	bottom, 2×5	—	Cs	10	bottom, 5	237-239	27.08.17	05:56 – 06:23
GN053B	60° 00.00‘ N	001° 59.91‘ W	87	bottom, 5	13.0	Cs	—	—	240-241	27.08.17	09:42 – 09:53
GN053A	59° 47.99‘ N	001° 19.68‘ W	86	bottom, 5	—	Cs	—	—	242-243	27.08.17	12:22 – 12:34
GN053	59° 59.88‘ N	000° 30.12‘ W	127	bottom, 2×5	10.0	Cs/Sr//H3/TU	—	bottom, 5	244-246	27.08.17	15:38 – 16:13
GN052S	60° 00.00‘ N	000° 45.13‘ E	128	bottom, 5	—	—	—	—	247-248	27.08.17	19:59 – 20:15
GN052	59° 59.97‘ N	001° 59.98‘ E	102	bottom, 5	—	Cs	10	—	249-250	28.08.17	00:06 – 00:32
GN051S	59° 59.93‘ N	003° 15.03‘ E	217	2×bottom, 5	—	—	—	—	251-253	28.08.17	04:26 – 04:50
GN051	60° 00.10‘ N	004° 30.05‘ E	262	2×bottom, 3×10, 2×5	10.0	Cs/Sr//H3/TU	10	bottom, 20, 5	254-260	28.08.17	09:03 – 09:42
GN050S	59° 29.99‘ N	004° 30.03‘ E	266	2×bottom, 5	9.0	—	—	—	261-263	28.08.17	15:05 – 15:27
GN050	58° 59.99‘ N	004° 30.02‘ E	260	2×bottom, 2×5	—	Cs/Sr//H3/TU	10	bottom, 5	264-267	28.08.17	19:38 – 20:13
GN049S	59° 00.04‘ N	003° 45.03‘ E	273	bottom, 5	—	—	—	—	268-269	28.08.17	00:06 – 00:30

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	trace metals [m]	nutrients [m]	Bedford-nr. 175nnn	date dd.mm.yy	time [UTC]
GN049	58° 59.97‘ N	002° 59.93‘ E	137	bottom, 5	—	Cs	—	—	270-271	29.08.17	02:36 – 02:54
GN048S	58° 59.91‘ N	001° 59.91‘ E	115	bottom, 5	18.8	—	—	—	272-273	29.08.17	06:35 – 06:48
GN048	59° 00.01‘ N	001° 00.04‘ E	125	bottom, 2×5	16.5	Cs/Sr//H3/TU	10	bottom, 5	274-276	29.08.17	10.34 – 11:02
GN047	59° 00.03‘ N	000° 00.17‘ E	133	bottom, 2×5	16.5	Cs	—	bottom, 5	277-279	29.08.17	15:14 – 15:29
GN046	58° 59.98‘ N	001° 30.18‘ W	106	bottom, 5	—	Cs	10	—	280-281	29.08.17	21:03 – 21:32
GN046A	59° 00.00‘ N	001° 59.98‘ W	78	bottom, 5	—	Cs/Sr//H3/TU	—	—	282-283	29.08.17	23:17 – 23:32