

# R/V „Celtic Explorer“

## Cruise 16011a, August 3<sup>rd</sup> – 26<sup>th</sup>, 2016



### Report of the Chief Scientist

ICES Cruise Id: 45CE16011a

CSRREF: 20163113

**Holger Klein**

Hamburg, Oktober 2016



(CR-Celtic-Explorer-16011A.docx)

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## Participants

Science Crew	Working Group	Ship Crew	Rank
Holger Klein	Marine Physics, Chief Scientist (BSH)	Antony Hobin	Master
Peter Löwe	Marine Physics (BSH)	Damien McCallig	Chief Engineer
Sören Joswig	Marine Physics (BSH)	John O'Regan	Chief Officer
Francisco de la Granda Grandoso	Marine Physics (BSH)	Diarmuid Joyce	2 <sup>nd</sup> Officer
		David Stack	2 <sup>nd</sup> Engineer
Ina Bendler	Marine Chemistry, Radioactivity (BSH)	Paul Taylor	ETO
Dr. Stefanie Schmied	Marine Chemistry, Radioactivity (BSH)	Ken O'Neill	Bosun
Roswitha Velten	Marine Chemistry, Nutrients (BSH)	Tony Reck	Cook
Wiebke Brandt	Marine Chemistry, Nutrients (BSH)	Michelin Faherty	Bosun's Mate
Elke Hammermeister	Marine Chemistry, Organic (BSH)	Philip Gunnip	AB Deckhand GP1
Dr. Torben Kirchgeorg	Marine Chemistry, Organic (BSH)	Jimmy Burke	AB Deckhand GP1
Ole Kattein	Marine Chemistry (BSH)	Adam Yunis	Assistant Cook
Lisa Kattner	Air Chemistry (University of Bremen)	Brian Sharkey	Technician
		Declan Horan	AB Deckhand GP1
		Noel O'Driscoll	AB Deckhand GP1



**Fig. 1:** The BSH Team, front row from left to right: Torben Kirchgeorg, Stefanie Schmied, Holger Klein, Elke Hammermeister, Roswitha Velten, Ina Bendler. Back row: Lisa Kattner, Ole Kattein, Peter Löwe, Wiebke Brandt, Francisco (Kiko) de la Granda Grandoso, Sören Joswig.

## 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, in the Skagerrak, and in the Northern Minch are served alternately every three years.

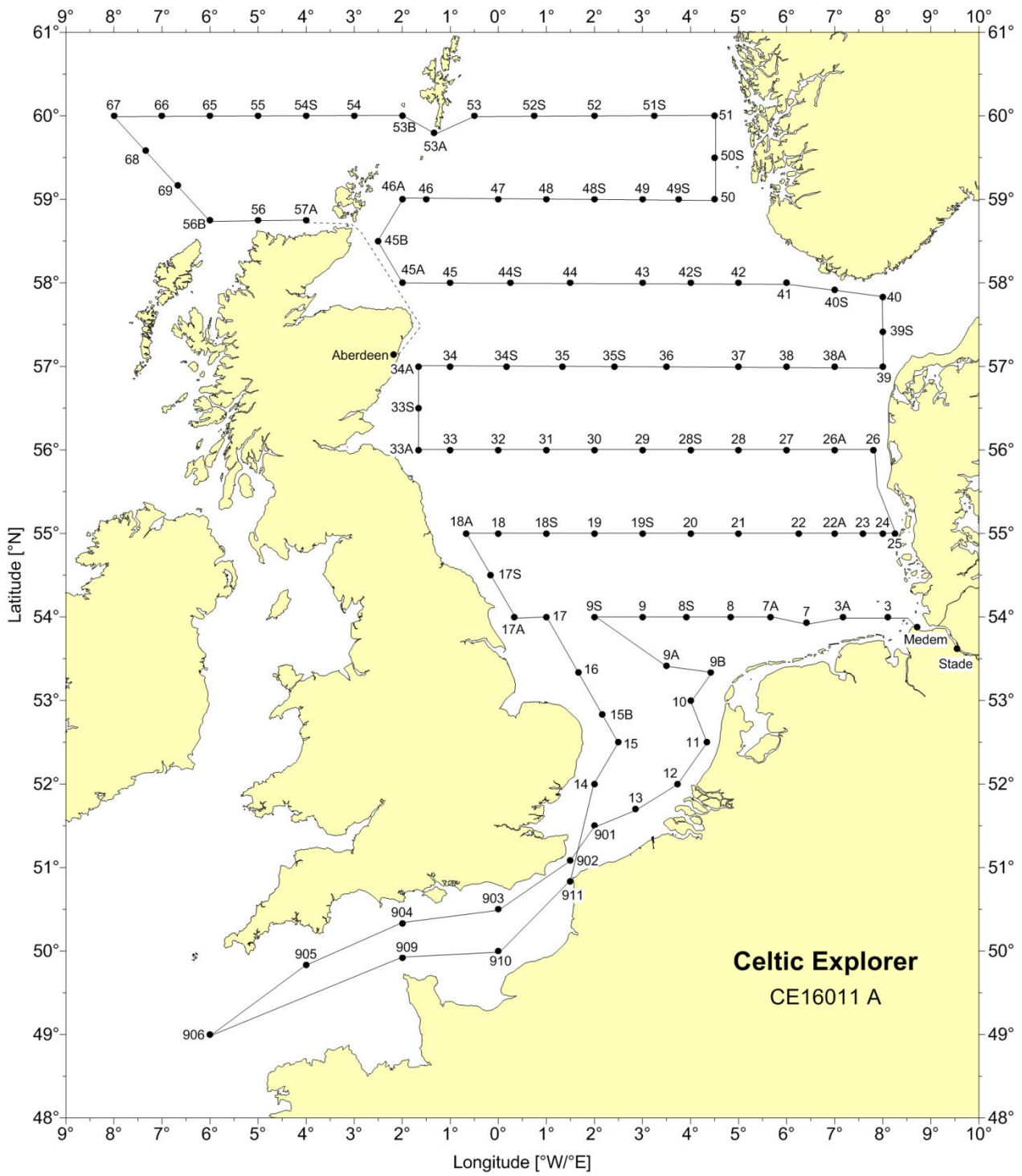
The objective of the NSSSs is the assessment of the oceanographic and chemical state of the North Sea, the calculation of heat and salt budgets, and the identification of changes due to climate change. The data are also used for the validation of operational and climate models and for the calibration 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.<sup>1</sup>

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<sup>1</sup> [http://www.bsh.de/en/Marine\\_data/Observations/DOD\\_Data\\_Centre/index.jsp](http://www.bsh.de/en/Marine_data/Observations/DOD_Data_Centre/index.jsp)  
<http://hermes.acri.fr/mermaid/home/home.php>

<b>date of cruise</b>	<b>ship &amp; cruise id</b>
24.06.1998 – 16.07.1998	R/V Gauss 317
02.07.1999 – 22.07.1999	R/V Gauss 335
09.08.2000 – 23.08.2000	R/V Gauss 353
11.07.2001 – 02.08.2001	R/V Gauss 370
16.07.2002 – 31.07.2002	R/V Gauss 385
28.07.2003 – 13.08.2003	R/V Gauss 405
05.08.2004 – 20.08.2004	R/V Gauss 425
10.08.2005 – 29.08.2005	R/V Gauss 446
02.08.2006 – 20.08.2006	R/V Gauss 463
03.08.2007 – 17.08.2007	R/V Pelagia 273
21.07.2008 – 05.08.2008	R/V Pelagia 293
20.08.2009 – 09.09.2009	R/V Pelagia 311
04.08.2010 – 22.08.2010	R/V Pelagia 323
08.08.2011 – 28.08.2011	R/V Celtic Explorer 11010
07.08.2012 – 30.08.2012	R/V Celtic Explorer 12011
10.08.2013 – 04.09.2013	R/V Celtic Explorer 13012
01.08.2014 – 25.08.2014	R/V Celtic Explorer 14012
07.08.2015 – 30.08.2015	R/V Celtic Explorer 15013
03.08.2016 – 26.08.2016	R/V Celtic Explorer 16011

**Table 1:** BSH North Sea Summer Surveys 1998-2016.



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

## Equipment and Methods

### Marine Physics:

	Typ	S/N	Calibration Date
<b>CTD 1</b>	SBE9	P21787-0577	
Deck Unit	SBE11	P31787-0526	
T-Sensor	SBE3	2584	07.10.15
C-Sensor	SBE4	2886	08.10.15
O <sub>2</sub> -Sensor	SBE43	3152	25.06.15
Fluorometer	WetlabECO	4390	20.06.11
Altimeter	978		
Rosette Sampler Nr. 1	12 x 10 l		
Configuration File	<a href="#">Sonde_1\CON_Files\Sonde1_151008_WetLabs3427_Ox3152_AN.xmlcon</a>		
<b>CTD 2 (back-up system)</b>	SBE9	83014	
Deck Unit	SBE11	P25457-0585	
T-Sensor	SBE3	2808	25.04.16
C-Sensor	SBE4	2602	25.04.16
O <sub>2</sub> -Sensor	SBE43	3152	25.06.15
<b>Vessel mounted sensors:</b>			
Thermosal	SBE21	2148425-3315	July 2016
Fluorimeter for turbidity and chlorophyll	10 AU Turner		

On this cruise CTD 1 was used only!

### 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 on board.
- One 600 l surface water samples for test purposes after the cruise.

- 100-150 l surface water samples for the on-board analysis of cesium-137 by means of an ion exchanger (KCFC).
- 100 liter sea water samples for tests on-board regarding the determination of cesium-137 by Potassium-Nickel Hexacyanoferrate (KNiFC).
- One sediment sample (grab sampler) for the determination of samarium and transuranic elements after the cruise.

### **Atmospheric Chemistry**

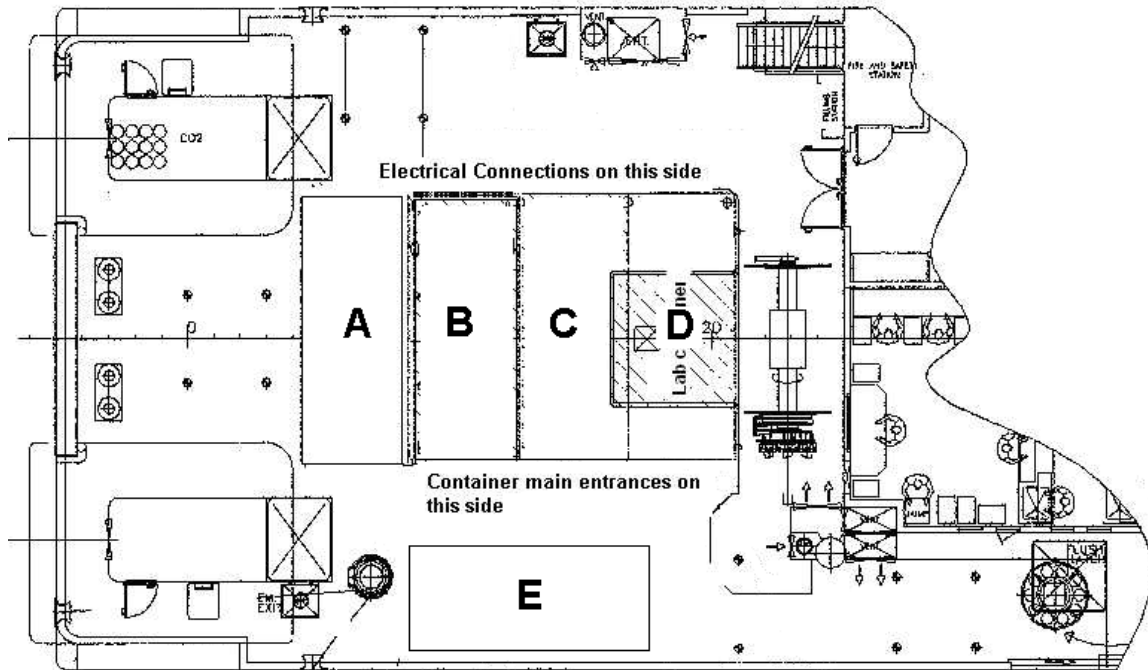
- Continuous trace gas analysis of nitric oxides ( $\text{NO}_x$ , NO und  $\text{NO}_2$ ), of sulphur dioxide ( $\text{SO}_2$ ), ozone ( $\text{O}_3$ ), and of carbon dioxide ( $\text{CO}_2$ ) by means of Airpointer (Co. recordum/MLU).
- Remote sensing of  $\text{NO}_2$ ,  $\text{SO}_2$ , and  $\text{O}_2$  by MAX-DOAS measurements (Multi-axis Differential Absorption Spectroscopy, Institute of Environmental Physics, University of Bremen)
- Monitoring of current AIS signals in order to relate recorded emissions to surrounding ships.

### **Organic Pollutants**

- Determination of non-polar organic pollutants as e.g. aliphates, chlorinated hydrocarbons (CHC), and polycyclic aromatic hydrocarbons (PAH) by liquid-liquid extraction from 100 l of sea water.
- Determination of polar organic pollutants as, e.g. pesticides by solid-phase extraction from 10 l of sea water.



## Container Plan for leg a & b



	container type	weight	power supply	used on leg
A	Five 600 l drums for radioactivity and calibration lab			1
B	Bottom: 20" M33 lab container, height 3.1 m (HM) Top: -	9	2 x 32 A	2
C	Bottom: 20" Transport and store container Top: -	5 t -	- -	1&2 -
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. If no samplers are used, samples are taken from the Seawater pipe. KNiFC = 100 liter sea water samples for tests on-board regarding the determination of cesium-137 by Potassium-Nickel Hexacyanoferrate.

### Watch table marine physics:

00-04/12-16: Kiko (Francisco)

04-08/16-20: Peter

08-12/20-00: Sören

### Watch table nutrients:

00-12: Roswitha

12-00: Wiebke

### Watch table radioactivity:

00-12: Steffi

12-00: Ina

## Wednesday, August 3<sup>rd</sup>, 2016

- 06:00** Arrival of the science crew at Celtic Explorer. Berth: Schuppen 62, Süd-West-Terminal, Am Kamerunkai 5, 20457 Hamburg.
- 08:00** Interview by Mr. Arndt (HTB, Daily Port Report).
- 09:30** Arrival of containers and equipment and start of loading by use of the local crane.
- 12:45** 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 Diarmuid Joyce.

## Thursday, August 4<sup>th</sup>, 2016

- W&S 05:00:** Bft. 3, 220°, 1007 hPa,  $T_A = 16.9$  °C, partly cloudy.
- 07:45** TV team from RTL Nord joins the vessel for a TV report (Alexander Müschen).
- 06:40** Sailing.
- ↓ **08:38 – 09:07 Station STADE:**  
RA: Cs-137, Sr-90, H-3, Pu and grab sampler.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres)
- 10.40 RTL TV team leaves vessel with the pilot at Brunsbüttel.
- W&S 11:00:** Bft. 5-6, 230°, 1007 hPa,  $T_A = 20.7$  °C, cloudy.
- ↓ **12:50 – 13:01 Station MEDEM:**  
RA: Cs-137, Sr-90, H-3.
- W&S 16:00:** Bft. 5, 270°, 1008 hPa,  $T_A = 17.8$  °C, cloudy.  $T_w = 18,9$  °C, 31.87 psu.
- ↓ **15:15 - 15:37 Station GN003/ELBE1:**  
Secchi depth, CTD profile with rosette sampler and nutrients.  
RA: Cs-137, Sr-90, H-3 and KNiFC.
- W&S 18:00:** Bft. 4-5, 260°, 1009 hPa,  $T_A = 18.5$  °C.  $T_w = 18,7$  °C, 32.01 psu.
- ↓ **19:16 – 19:32 Station GN003A:**  
CTD profile with rosette sampler, RA: Cs-137, Sr-90, H-3.
- ↓ **23:39 – 20:19 Station GN007 (Borkumriffgrund):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).

## Friday, August 5<sup>th</sup>, 2016

- ↓ **03:16 – 03:33 Station GN007A:**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3.
- W&S 05:00:** Bft. 4, 300°, 1012 hPa,  $T_A = 18.6$  °C.  $T_w = 17,8$  °C, 34.20 psu.
- ↓ **06:51 – 07:18 Station GN008:**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).

- ↓ **10:45 – 11:01 Station GN008S:**  
CTD profile with rosette sampler
- W&S 11:30:** Bft. 5, 320°, 1018 hPa,  $T_A = 18.8$  °C,  $T_W = 17.8$  °C, 34.60 psu.
- ↓ **14:11 – 14:48 Station GN009 (Outer Well Bank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3 and KNiFC. Organic: 2×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- ↓ **18:06 – 18:21 Station GN009S (Outer Silver Pit):**  
CTD profile with rosette sampler
- W&S 20:00:** Bft. 3-4, 220°, 1021 hPa,  $T_A = 16.1$  °C, partly cloudy.  $T_W = 16.5$  °C, 34.43 psu.

### Saturday, August 6<sup>th</sup>, 2016

- ↓ **00:06 – 00:19 Station GN009A:**  
CTD profile with rosette sampler. RA: Cs-137.
- ↓ **03:40 – 03:55 Station GN009B:**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3.
- W&S 05:00:** Bft. 4, 290°, 1022 hPa,  $T_A = 17.7$  °C, partly cloudy.  $T_W = 18.1$  °C, 34.94 psu.
- ↓ **06:35 – 06:45 Station GN010 (west of Den Helder):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- W&S 10:00:** Bft. 3-4, 320°, 1025 hPa,  $T_A = 19.4$  °C, partly cloudy.  $T_W = 19.4$  °C, 33.94 psu.
- ↓ **09:57 – 10:38 Station GN011 (west of Ijmuiden):**  
Secchi depth, CTD profile with rosette sampler and nutrients.  
Organic: 1×10 L at 5 m; 2×100 L at 5 m (glass spheres). RA: Cs-137.
- ↓ **15:00 – 15:34 Station GN012 (west of Hoek van Holland):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 16:00:** Bft. 3, 320°, 1028 hPa,  $T_A = 17.8$  °C, clear sky.  $T_W = 19.5$  °C, 33.94 psu.
- ↓ **19:53 – 20:18 Station GN013 (Rabsbank):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).

### Sunday, August 7<sup>th</sup>, 2016

- ↓ **00:15 – 00:32 Station GN901:**  
CTD profile with rosette sampler and RA: Cs-137, Sr-90, H-3.
- ↓ **04:49 – 05:16 Station GN902 (E-lich Dover):**  
CTD profile with rosette sampler, Organic: 1×10 L at 5 m; 2×100 L at 5 m (glass spheres). RA: Cs-137, Sr-90, H-3.
- W&S 05:00:** Bft. 4, 230°, 1027 hPa,  $T_A = 17.6$  °C, cloudy.  $T_W = 17.0$  °C.
- W&S 11:00:** Bft. 5-6, 250°, 1026 hPa,  $T_A = 17.4$  °C, cloudy.  $T_W = 16.8$  °C, 34.91 psu.
- ↓ **12:43 – 12:56 Station GN903 (S-lich Brighton):**  
CTD profile with rosette sampler, RA: Cs-137, Sr-90, H-3.

- W&S 13:00:** Bft. 5, 240°, 1025 hPa,  $T_A = 17.8$  °C, cloudy.  $T_W = 16.8$  °C, 34.96 psu.
- W&S 16:00:** Bft. 5-6, 240°, 1024 hPa,  $T_A = 17.8$  °C, clear sky.  $T_W = 17.5$  °C, 34.82 psu.
- W&S 20:00:** Bft. 4-5, 260°, 1024 hPa,  $T_A = 17.5$  °C, fine.  $T_W = 16.7$  °C, 35.11 psu.
- ↓ **20:07 – 20:36 Station GN904 (S-lich Bournemouth):**  
CTD profile with rosette sampler, Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres). RA: Cs-137, Sr-90, H-3.

### Monday, August 8<sup>th</sup>, 2016

- W&S 05:00:** Bft. 4-5, 300°, 1024 hPa,  $T_A = 16.8$  °C, fine.  $T_W = 17.8$  °C, 35.19 psu.
- ↓ **05:42 – 05:58 Station GN905 (S-lich Eddystone Rocks):**  
CTD profile with rosette sampler, RA: Cs-137, Sr-90, H-3.
- W&S 10:00:** Bft. 4, 320°, 1026 hPa,  $T_A = 17.6$  °C, fine.  $T_W = 18.2$  °C, 35.28 psu.
- ↓ **15:26 – 16:22 Station GN906 (Westlicher Kanaleingang):**  
CTD profile with rosette sampler, Organic: 1×10 L at 5 m; 1×100 L at 5 m; 1×10 L at 50 m; 1×100 L at 50 m (glass spheres). RA: Cs-137, Sr-90, H-3 and KNiFC.
- W&S 16:00:** Bft. 3-4, 320°, 1028 hPa,  $T_A = 18.7$  °C, cloudy.  $T_W = 18.7$  °C, 35.30 psu.
- W&S 20:00:** Bft. 4, 340°, 1027 hPa,  $T_A = 16.4$  °C, fine.  $T_W = 17.2$  °C, 35.29 psu.

### Tuesday, August 9<sup>th</sup>, 2016

- W&S 05:00:** Bft. 4, 0°, 1027 hPa,  $T_A = 14.8$  °C, fine.  $T_W = 17.0$  °C, 35.19 psu.
- W&S 11:00:** Bft. 2, 340°, 1028 hPa,  $T_A = 16.1$  °C, fine.  $T_W = 16.7$  °C, 35.08 psu.
- ↓ **10:48 – 11:19 Station GN909 (Cap de la Hague):**. RA: Cs-137, Sr-90, H-3.  
No CTD profile and organic samples possible due to strong tidal currents!
- W&S 16:00:** PC for meteorological data broke down! Fine.  $T_W = 17.0$  °C, 35.19 psu.
- ↓ **18:12 – 18:46 Station GN910 (N-lich Cap d'Antifer/Le Havre):**  
CTD profile with rosette sampler, RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 2×100 L at 5 m.
- W&S 20:30:** Bft. 4, 270°, 1025 hPa,  $T_A = 16.5$  °C.  $T_W = 16.5$  °C, 34.94 psu.

### Wednesday, August 10<sup>th</sup>, 2016

- ↓ **03:15 – 03:44 Station GN911 (Cap Gris Nez):**  
RA: Cs-137, Sr-90, H-3 and KNiFC.  
No CTD profile and organic samples possible due to strong tidal currents!
- W&S 05:00:** Bft. 5, 320°, 1022 hPa,  $T_A = 13.3$  °C, cloudy.  $T_W = 17.8$  °C, 34.52 psu.
- W&S 11:00:** Bft. 3-4, 10°, 1024 hPa,  $T_A = 17.1$  °C, cloudy.  $T_W = 18.1$  °C, 34.79 psu.
- ↓ **11:55 - 12:26 Station GN014 (Outer Gabbard):**  
Secchi depth, CTD profile with rosette sampler and nutrients RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 16:00:** Bft. 3-4, 10°, 1024 hPa,  $T_A = 16.8$  °C, clear sky.  $T_W = 17.8$  °C, 34.15 psu.

- ↓ **16:50 – 17:02 Station GN015 (east of Lowestoft):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- ↓ **19:15 – 19:28 Station GN015B:**  
CTD profile with rosette sampler. RA: Cs-137.
- W&S 19:30:** Bft. 2, 110°, 1023 hPa,  $T_A = 13.9$  °C, cloudy.  $T_W = 17.8$  °C, 33.77 psu.
- ↓ **22:56 – 23:11 Station GN016 (Haddock Bank):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3. Nutrients.

### Thursday, August 11<sup>th</sup>, 2016

- ↓ **04:19 – 04:58 Station GN017 (east of Flamborough Head):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137.  
Organic: 2×10 L at 5 m; 1×100 L at 5 m (glass spheres)
- W&S 05:00:** Bft. 4, 280°, 1017 hPa,  $T_A = 13.7$  °C, overcast.  $T_W = 14.5$  °C, 34.41 psu.
- ↓ **07:29 – 07:44 Station GN017A:**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3.
- W&S 10:30:** Bft. 4, 260°, 1016 hPa,  $T_A = 15.1$  °C, overcast.  $T_W = 14.8$  °C, 34.31 psu.
- ↓ **11:41 – 11:52 Station GN0017S:**  
CTD profile with rosette sampler.
- ↓ **15:25 – 15:38 Station GN018A:**  
CTD profile with rosette sampler. RA: Cs-137.
- W&S 16:00:** Bft. 5, 270°, 1015 hPa,  $T_A = 16.3$  °C, overcast.  $T_W = 14.6$  °C, 34.39 psu.
- ↓ **17:57 – 18:11 Station GN018 (Baymans Hole):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- W&S 21:00:** Bft. 5, 280°, 1016 hPa,  $T_A = 17.8$  °C, overcast.  $T_W = 15.9$  °C, 34.58 psu.
- ↓ **21:40 – 21:51 Station GN0018S (Bruceys Garden):**  
CTD profile with rosette sampler

### Friday, August 12<sup>th</sup>, 2014

- ↓ **01:15 – 01:26 Station GN019 (Doggerbank):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3. Nutrients.
- ↓ **04:57 – 05:07 Station GN0019S:**  
CTD profile with rosette sampler.
- W&S 05:00:** Bft. 5, 270°, 1016 hPa,  $T_A = 16.9$  °C, cloudy.  $T_W = 16.6$  °C, 34.66 psu.
- ↓ **08:44 – 09:09 Station GN020 (east of Doggerbank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres). Internal quality audit by Ina Raschke for taking and processing organic samples at sea.
- W&S 11:00:** Bft. 4, 260°, 1017 hPa,  $T_A = 16.9$  °C, clear sky.  $T_W = 16.5$  °C, 34.50 psu.
- ↓ **12:42 – 12:54 Station GN021/AWZW2 (Nordschillgrund):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.

- ↓ **17:11 – 17:24 Station GN022 (Weiße Bank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- W&S 18:00:** Bft. 5-6, 260°, 1017 hPa,  $T_A = 16.5$  °C, cloudy.  $T_W = 17.2$  °C, 34.16 psu.
- ↓ **20:11 – 20:24 Station GN022A:**  
CTD profile with rosette sampler. RA: Cs-137.
- W&S 20:30:** Bft. 6, 260°, 1017 hPa,  $T_A = 17.3$  °C.  $T_W = 17.3$  °C, 33.40 psu.
- ↓ **22:41 – 22:56 Station GN023:**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.

### Saturday, August 13<sup>th</sup>, 2016

- ↓ **01:05 – 01:17 Station GN024:**  
CTD profile with rosette sampler and nutrients.
- ↓ **02:18 – 02:55 Station GN025 (west of Sylt):**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3 and KNiFC. Nutrients. Nutrients. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 05:00:** Bft. 5, 260°, 1014 hPa,  $T_A = 17.2$  °C, cloudy.  $T_W = 18.0$  °C, 31.70 psu.
- W&S 10:00:** Bft. 6, 260°, 1013 hPa,  $T_A = 16.6$  °C, overcast.  $T_W = 16.9$  °C, 33.23 psu.
- ↓ **11:07 – 11:35 Station GN026 (west of Lyngvik):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- ↓ **15:07 – 15:26 Station GN026A:**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3.
- ↓ **19:38 – 20:01 Station GN027:**  
CTD profile with rosette sampler and nutrients. RA: Cs-137. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres)
- W&S 20:00:** Bft. 4, 290°, 1018 hPa,  $T_A = 16.1$  °C, cloudy.  $T_W = 15.9$  °C, 34.44 psu.
- ↓ **23:50 – 00:02 Station GN028:**  
CTD profile with rosette sampler and nutrients. RA: Cs-137.

### Sunday, August 14<sup>th</sup>, 2016

- ↓ **03:45 – 03:57 Station GN0028S:**  
CTD profile with rosette sampler. RA: Cs-137 and KNiFC.
- W&S 05:00:** Bft. 5, 300°, 1020 hPa,  $T_A = 15.5$  °C, overcast.  $T_W = 15.7$  °C, 34.89 psu.
- ↓ **07:20 – 07:55 Station GN029:**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3. Organic: 2×10 L at 5 m; 2×100 L at 5 m (glass spheres).
- W&S 10:00:** Bft. 3, 140°, 1023 hPa,  $T_A = 15.2$  °C, cloudy.  $T_W = 15.4$  °C, 34.94 psu.
- ↓ **11:20 – 11:36 Station GN030:**  
Secchi depth and CTD profile with rosette sampler. RA: Cs-137. Nutrients.

- ↓ **15:15 – 15:29 Station GN031:**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- W&S 15:30:** Bft. 1-2, 320°, 1025 hPa,  $T_A = 16.9$  °C, clear sky.  $T_W = 15.9$  °C, 34.74 psu.
- ↓ **19:02 – 19:15 Station GN032:**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- W&S 19:30:** Bft. 1, 0°, 1026 hPa,  $T_A = 14.2$  °C, partly cloudy.  $T_W = 15.1$  °C, 34.60 psu.
- ↓ **22:48 – 23:15 Station GN033 (east of Firth of Forth):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137.

### Monday, August 15<sup>th</sup>, 2016

- ↓ **01:46 – 02:08 Station GN033A:**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3, and 600 liter for transuranics.
- W&S 05:00:** Bft. 3, 240°, 1026 hPa,  $T_A = 12.5$  °C, clear sky.  $T_W = 12.8$  °C, 34.39 psu.
- ↓ **05:13 – 05:25 Station GN0033S (Marr Bank):**  
CTD profile with rosette sampler.
- ↓ **08:28 – 08:47 Station GN034A:**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.
- ↓ **11:06 – 11:21 Station GN034 (Aberdeen Bank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- W&S 12:00:** Bft. 3, 180°, 1026 hPa,  $T_A = 14.5$  °C, partly cloudy.  $T_W = 13.1$  °C, 34.62 psu.
- ↓ **15:22 – 15:39 Station GN0034S:**  
CTD profile with rosette sampler.
- W&S 16:00:** Bft. 3, 185°, 1026 hPa,  $T_A = 17.0$  °C, clear sky.  $T_W = 14.6$  °C, 34.71 psu.
- ↓ **19:45 – 20:34 Station GN035 (Coal Pitt):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137. Organic: 1×10 L at 5 m; 1×100 L at 5 m; 1×10 L at 50 m; 1×100 L at 50 m (glass spheres).
- W&S 20:00:** Bft. 2, 160°, 1025 hPa,  $T_A = 14.6$  °C, fine.  $T_W = 14.3$  °C, 34.83 psu.

### Tuesday, August 16<sup>th</sup>, 2016

- ↓ **00:23 – 00:34 Station GN0035S:**  
CTD profile with rosette sampler.
- ↓ **04:20 – 04:50 Station GN036:**  
CTD profile with rosette sampler and nutrients.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres). RA: Cs-137, Sr-90, H-3.
- W&S 05:00:** Bft. 2, 10°, 1024 hPa,  $T_A = 12.9$  °C, partly cloudy.  $T_W = 16.7$ , 34.83 psu.
- ↓ **09:46 – 09:58 Station GN037 (Große Fischerbank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- W&S 10:00:** Bft. 3, 350°, 1023 hPa,  $T_A = 15.0$  °C, cloudy.  $T_W = 14.7$ , 34.04 psu.



- ↓ **13:32 – 14:14 Station GN038 (Kleine Fischerbank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.  
Organic: 2×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 16:00:** Bft. 3, 10°, 1022 hPa,  $T_A = 17.2$  °C, partly cloudy.  $T_W = 15.3$  °C, 32.52 psu.
- ↓ **17:50 – 18:07 Station GN038A:**  
Secchi depth and CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3.
- ↓ **21:36 – 22:08 Station GN039 (east of Jyske Rev):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 2×100 L at 5 m (glass spheres).

### Wednesday, August 17<sup>th</sup>, 2016

- ↓ **01:00 – 01:28 Station GN039S:**  
CTD profile with rosette sampler. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- ↓ **04:18 – 05:28 Station GN040 (Skagerrak):**  
Secchi depth and CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m; 1×10 L at 50 m; 1×100 L at 50 m (glass spheres). Nutrients.
- ↓ **W&S 05:00:** Bft. 3, 310°, 1018 hPa,  $T_A = 14.8$  °C, fine.  $T_W = 16.5$  °C, 30.06 psu.
- ↓ **08:26 – 09:02 Station GN040S (south off Lindesnes):**  
Secchi depth and CTD profile with rosette sampler.
- W&S 10:00:** Bft. 3, 310°, 1018 hPa,  $T_A = 16.7$  °C, clear sky.  $T_W = 16.6$  °C, 30.98 psu.
- ↓ **12:22 – 13:11 Station GN041 (west of Lindesnes):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3 and KNiFC. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 16:00:** Bft. 3, 320°, 1017 hPa,  $T_A = 15.0$  °C, cloudy.  $T_W = 15.7$  °C, 31.58 psu.
- ↓ **16:59 – 17:13 Station GN042 (Eigersundbank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- ↓ **20:38 – 20:50 Station GN0042S:**  
CTD profile with rosette sampler.
- W&S 21:00:** Bft. 2-3, 350°, 1017 hPa,  $T_A = 13.3$  °C, obscured sky.  $T_W = 14.3$  °C, 33.41 psu.

### Thursday, August 18<sup>th</sup>, 2016

- ↓ **00:13 – 00:44 Station GN043 (Lingbank East):**  
CTD profile with rosette sampler and nutrients. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres). RA: Cs-137.
- W&S 05:00:** Bft.  $T_W = 14.0$  °C, 34.86 psu.
- ↓ **05:34 – 05:59 Station GN044 (Lingbank West):**  
Secchi depth and CTD profile with rosette sampler and nutrients.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres). RA: Cs-137, Sr-90, H-3.

- ↓ **10:07 – 10:24 Station GN0044S:**  
CTD profile with rosette sampler.
- ↓ **14:35 – 15:01 Station GN045 (east of South Bank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres). RA: Cs-137, Sr-90, H-3 and KNiFC.
- W&S 16:00:** Bft. 4, 160°, 1015 hPa,  $T_A = 13.6$  °C, overcast.  $T_W = 13.0$  °C, 34.70 psu.
- ↓ **18:21 – 18:39 Station GN045A (West Bank):**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3.
- W&S 20:30:** Bft. 5, 140°, 1013 hPa,  $T_A = 13.4$  °C, partly cloudy.  $T_W = 13.2$  °C, 34.50 psu.
- ↓ **22:10 – 22:37 Station GN045B (east of Pentland Firth):**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3.

### Friday, August 19st, 2016

- ↓ **02:28 – 02:47 Station GN046A:**  
CTD profile with rosette sampler. RA: Cs-137, Sr-90, H-3. Nutrients.
- ↓ **04:39 – 05:06 Station GN046:**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137, Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres)..
- W&S 05:00:** Bft. 3-4, 180°, 1011 hPa,  $T_A = 12.7$  °C, overcast.  $T_W = 12.6$  °C, 34.73 psu.
- W&S 10:00:** Bft. 2, 110°, 1011 hPa,  $T_A = 14.9$  °C, cloudy.  $T_W = 13.9$  °C, 34.71 psu.
- ↓ **10:00 – 10:15 Station GN047 (Fladengrund Rinne):**  
Secchi depth and CTD profile with rosette sampler and nutrients.. RA: Cs-137.
- ↓ **13:40 – 14:07 Station GN048:**  
Secchi depth and CTD profile with rosette sampler and nutrients.  
RA: Cs-137, Sr-90, H-3. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres)..
- W&S 17:00:** Bft. 3, 125°, 1009 hPa,  $T_A = 17.3$  °C, fine.  $T_W = 15.0$  °C, 34.98 psu.
- ↓ **17:30 – 17:47 Station GN0048S:**  
CTD profile with rosette sampler.
- W&S 21:00:** Bft. 3, 100°, 1009 hPa,  $T_A = 15.5$  °C, fine.  $T_W = 14.9$  °C, 33.65 psu.
- ↓ **21:08 – 21:22 Station GN049 (Utsira Grund):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137.

### Saturday, August 20<sup>nd</sup>, 2016

- ↓ **00:06 – 00:30 Station GN0049S:**  
CTD profile with rosette sampler.
- ↓ **03:03 – 03:41 Station GN050 (Utsira Loch):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 05:00:** Bft. 3, 120°, 1007 hPa,  $T_A = 15.5$  °C, partly cloudy.  $T_W = 15.5$  °C, (30.81 psu).  
The salinity values of the ships SBE21 are now about 2/10 psu below the CTD values

and the difference is continuously increasing. Therefore, the following salinity values are set in brackets.

- ↓ **06:51 – 07:11 Station GN0050S:**  
CTD profile with rosette sampler.
- ↓ **10:13 – 10:48 Station GN051 (west of Selbjørnsfjord):**  
Secchi depth, CTD profile with rosette sampler and nutrients.  
RA: Cs-137, Sr-90, H-3. Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 11:30:** Bft. 4, 100°, 1006 hPa,  $T_A = 17.8$  °C, overcast.  $T_W = 15.4$  °C, (31.27 psu).
- ↓ **14:47 – 15:07 Station GN0051S:**  
CTD profile with rosette sampler.
- W&S 17:00:** Bft. 5-6, 100°, 1004 hPa,  $T_A = 15.3$  °C, overcast.  $T_W = 13.7$  °C, (34.00 psu).  
Southerly swell.
- ↓ **19:01 – 19:31 Station GN052 (Bergen Bank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.  
Organic: 2×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 20:00:** Bft. 4, 120°, 1004 hPa,  $T_A = 13.9$  °C, overcast.  $T_W = 13.8$  °C, (33.68 psu).
- ↓ **23:43 – 23:57 Station GN0052S:**  
CTD profile with rosette sampler.

### Sunday, August 21<sup>rd</sup>, 2016

- ↓ **03:58 – 04:26 Station GN053 (E-lich Shetlands):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 1×100 L at 5 m (glass spheres).
- W&S 05:00:** Bft. 4, 50°, 1006 hPa,  $T_A = 13.0$  °C, overcast.  $T_W = 13.2$  °C, (34.97) psu.  
Between GN53 and GN053A: Filling two 600 l containers with surface sea water samples for calibration lab.
- ↓ **07:23 – 07:41 Station GN053A (Sumburgh Head):**  
CTD profile with rosette sampler. RA: Cs-137 and KNiFC.
- W&S 10:00:** Bft. 3, 25°, 1008 hPa,  $T_A = 12.8$  °C, overcast.  $T_W = 12.3$  °C, (34.80 psu).
- ↓ **10:17 – 10:32 Station GN053B (Foula Bank):**  
CTD profile with rosette sampler. RA: Cs-137.
- ↓ **14:05 – 14:19 Station GN054 (Otter Bank):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- W&S 16:00:** Bft. 3, 30°, 1010 hPa,  $T_A = 13.7$  °C, partly cloudy.  $T_W = 12.8$  °C, (34.92 psu).
- ↓ **18:23 – 18:49 Station GN0054S:**  
CTD profile with rosette sampler.  
Station was shifted to 4° 20'W due to seismic exploration in the proper station area.
- W&S 21:00:** Bft. 2, 45°, 1011 hPa,  $T_A = 12.6$  °C, obscured sky.  $T_W = 13.2$  °C, (35.03 psu).
- ↓ **21:06 – 21:55 Station GN055**  
CTD profile with rosette sampler and nutrients. RA: Cs-137, Sr-90, H-3.  
Organic: 1×10 L at 5 m; 2×100 L at 5 m (glass spheres).

## Monday, August 22<sup>nd</sup>, 2016

- ↓ **01:19 – 02:24 Station GN065 (Færoe Bank Channel):**  
CTD profile with rosette sampler. RA: Cs-137.
- W&S 05:00:** Bft. 4, 140°, 1010 hPa,  $T_A = 11.8$  °C, overcast.  $T_W = 12.5$  °C, (34.96 psu).
- ↓ **05:35 – 06:08 Station GN066 (Wyville Thomson Ridge):**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- ↓ **09:23 – 12:58 Station GN067 (Ymir Ridge):**  
Secchi depth, CTD profile with rosette sampler and nutrients.  
RA: Cs-137, Sr-90, H-3 and 5x270-I-Sampler at 50, 100, 250, 500, and 750m.  
Organic: 2x10 L at 5 m; 2x100 L at 5 m (glass spheres).
- W&S 13:00:** Bft. 4, 140°, 1009 hPa,  $T_A = 13.7$  °C, overcast.  $T_W = 13.0$  °C, (34.98 psu).
- W&S 16:00:** Bft.3- 4, 260°, 1013 hPa,  $T_A = 14.0$  °C, cloudy.  $T_W = 13.2$  °C, (34.96 psu).
- ↓ **16:46 – 17:45 Station GN068:**  
Secchi depth, CTD profile with rosette sampler and nutrients. RA: Cs-137.
- ↓ **21:19 – 21:34 Station GN069 (Sulisker Bank North):**  
CTD profile with rosette sampler and nutrients. RA: Cs-137.

## Tuesday, August 23<sup>rd</sup>, 2016

- ↓ **01:11 – 01:29 Station GN056B (Sulisker Bank South):**  
CTD profile with rosette sampler. RA: Cs-137 and KNiFC. Nutrients.
- ↓ **05:06 – 05:30 Station GN056 (Cape Wrath):**  
Secchi depth, CTD profile with rosette sampler and nutrients. One bottle at 5 m not closed! RA: Cs-137. Nutrients. Organic: 1x10 L at 5 m; 2x100 L at 5 m (glass spheres).
- W&S 06:30:** Bft. 3, 150°, 1022 hPa,  $T_A = 13.6$  °C, cloudy.  $T_W = 13.2$  °C, (34.18 psu).
- ↓ **09:04 – 09:15 Station GN057A:**  
CTD profile with rosette sampler. RA: Cs-137.
- W&S 09:30:** Bft. 4, 140°, 1022 hPa,  $T_A = 14.4$  °C, cloudy.  $T_W = 13.2$  °C, (34.40 psu).

## Wednesday, August 24<sup>th</sup>, 2016

**07:30** Arrival at Aberdeen bunker station. After lunch shift to final berth.

Final processing of the last water samples for RA and nutrients. The science crew made last preparations for the second leg and run a test of the Clean-CTD. Cleaning of facilities.

## Thursday, August 25<sup>th</sup>, 2016

After lunch arrival of the new ships crew for the second leg. 18:30: 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.

19:00: The old Celtic Explorer crew is leaving the ship.

**Friday, August 26<sup>th</sup>, 2016**

Crew change of BSH team and return flight to Hamburg via Copenhagen.

## 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 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 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<sup>2</sup> via the northern open boundary to the Atlantic and to a lesser degree via the English Channel. Only the knowledge of the hydrographic condition in both layers, determined by the spatial distribution of temperature and salinity, allows the calculation of heat and salt budgets.

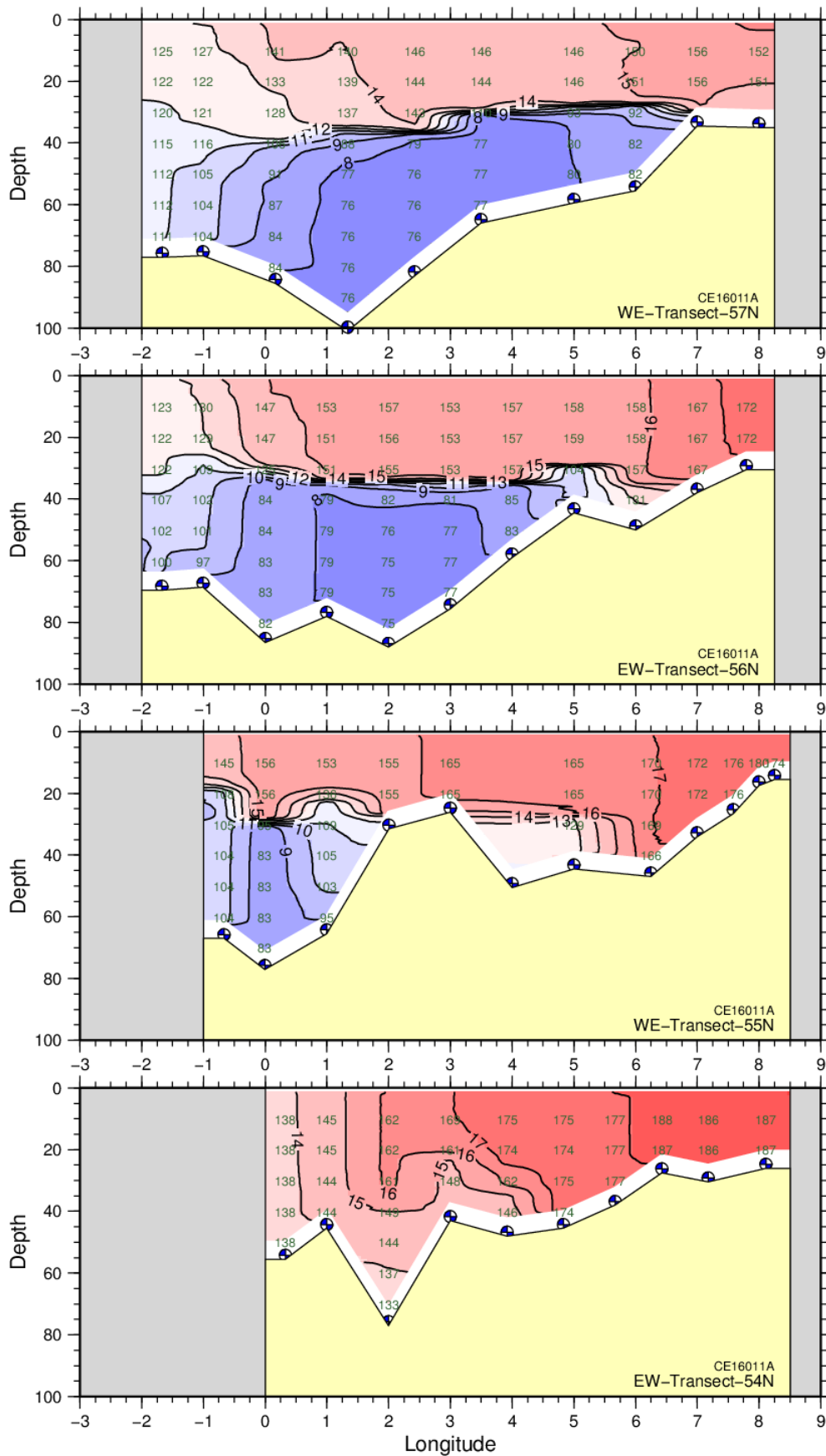
During the first eight months of 2016 the monthly anomalies of the area averaged North Sea SST varied between 1.3 °C (January) and 0.8 °C (March, May, June, and August) compared to the reference period 1971-1993. Regarding the seasonal cycle 2016, the survey lies exactly between the two seasonal maxima of 16.2 °C recorded in the seven days periods from July 27<sup>th</sup> to August 2<sup>nd</sup> and from August 24<sup>th</sup> to 30<sup>th</sup>. During the survey period from August 4<sup>th</sup> to 23<sup>th</sup> the area averaged SST was 15.5 °C. That confirms that the survey took place very close to the total 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.

While the southernmost temperature section along 54° N is vertically mixed due to low water depth, the zonal (east-west) temperature sections between 55 and 57° N show a massive homogeneous mixed surface layer with a strong thermocline at depth between 30 and 40 m. Further north, there is still a strong deep thermocline, but the Baltic outflow – which expands far to the west in 2016 – together with the Norwegian Coastal current cause slight temperature gradients within the surface layer (Fig. 4, 6, and 8). The calculation of the North Sea's total heat budget will be done after the final check of the data.

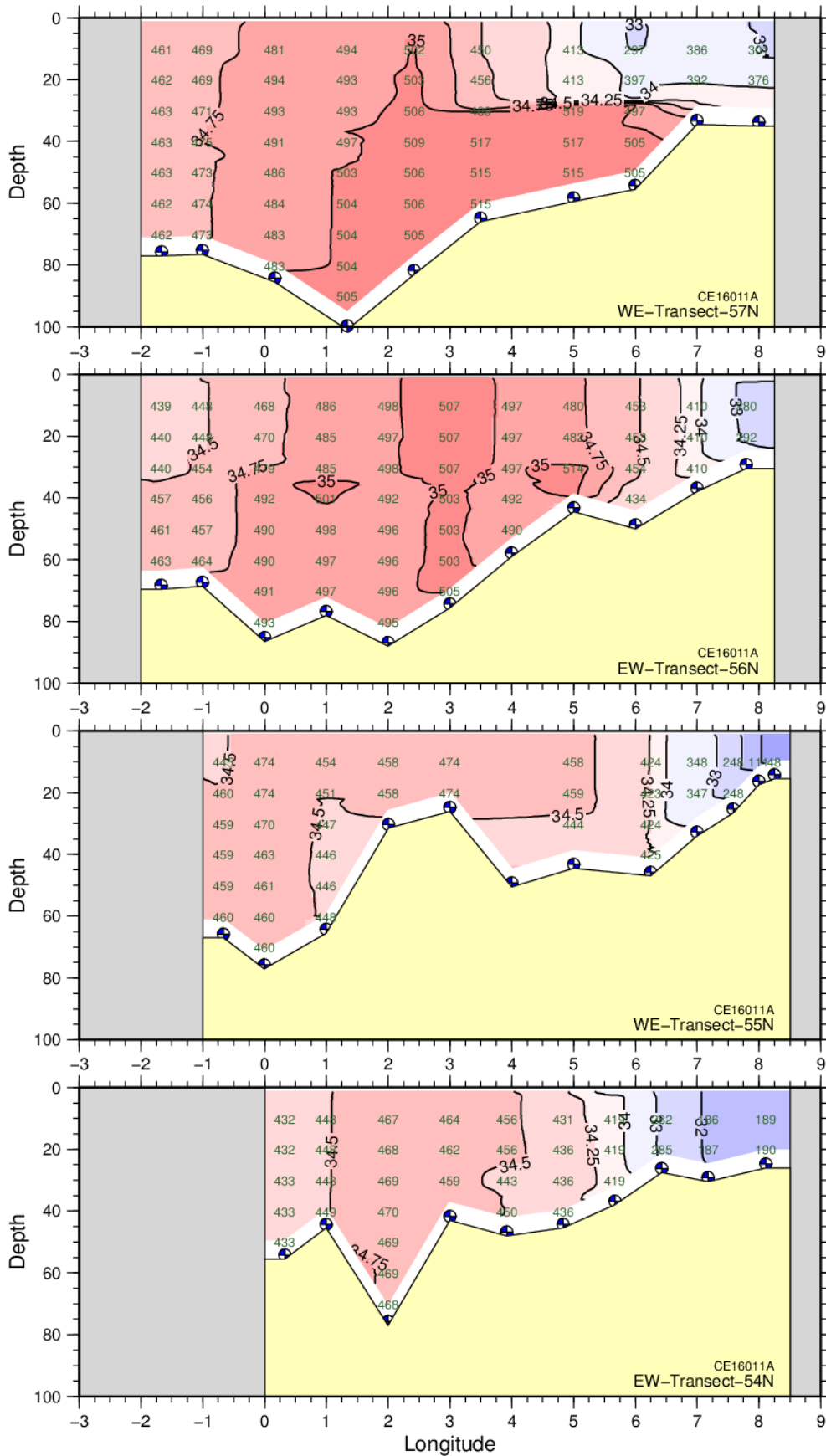
The salinity sections show a massive inflow of Atlantic Water (S >35 psu) from the north. The main inflow paths through the Fair Isle Channel, the East-Shetland Shelf, and at the western slope of the Norwegian Trench at 350 to 400 m depth are clearly visible (Fig. 7). This tongue of Atlantic Water intrudes southward to 56° N where it is still covering the whole water column from surface to bottom in the central North Sea. It can be expected that the total salt content in 2016 will be much higher than in the previous year, however, also the total heat budget will not be calculated before the final processing of the data and the analysis of over 200 in-situ salinity samples for CTD calibration.

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<sup>2</sup> psu = practical salinity units

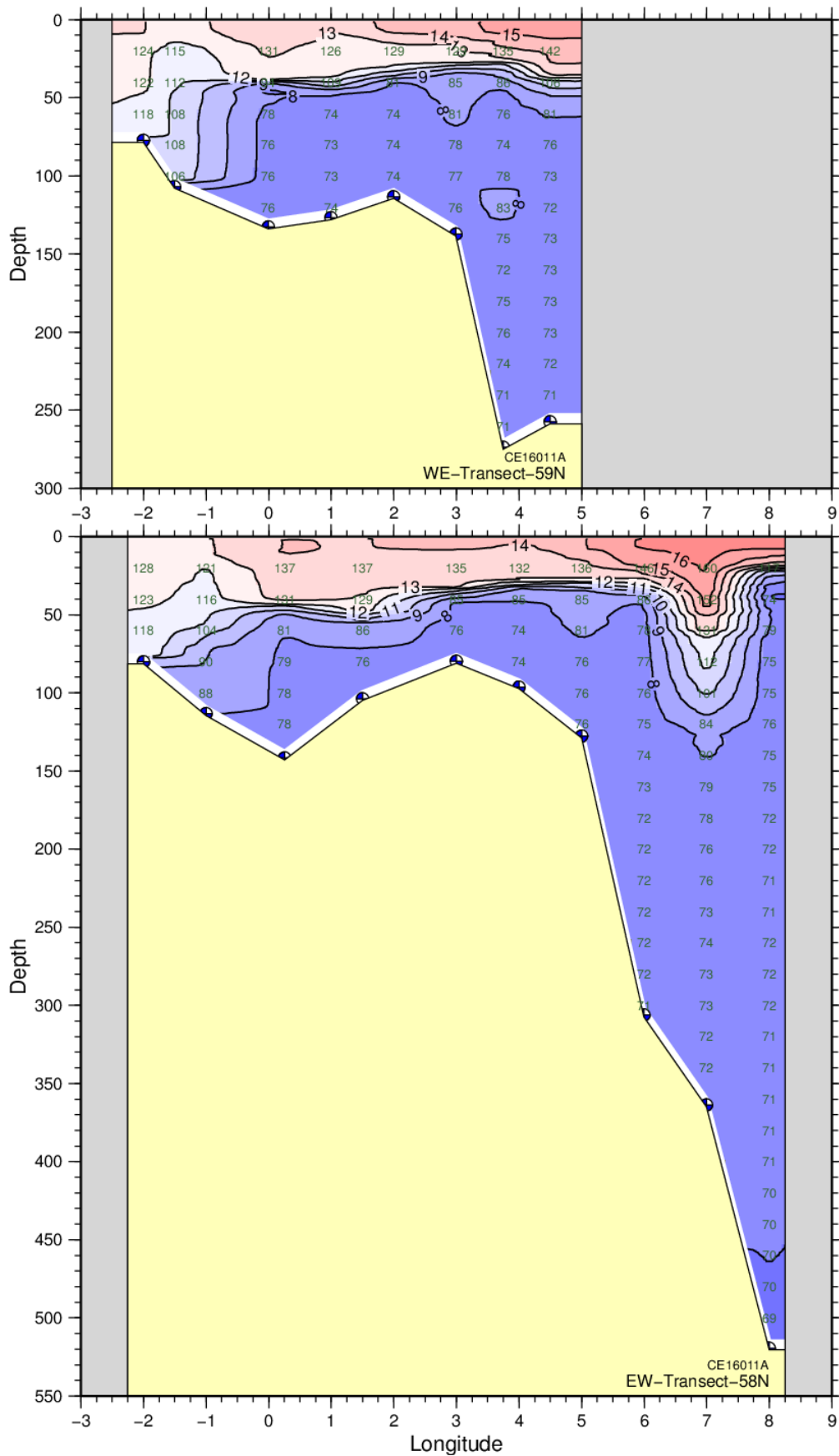


**Fig. 4:** Vertical temperature distribution along the 54°, 55°, 56°, and 57°N sections basing on CTD raw data. The numbers in the section give temperatures  $\times 10$  for selected data points.

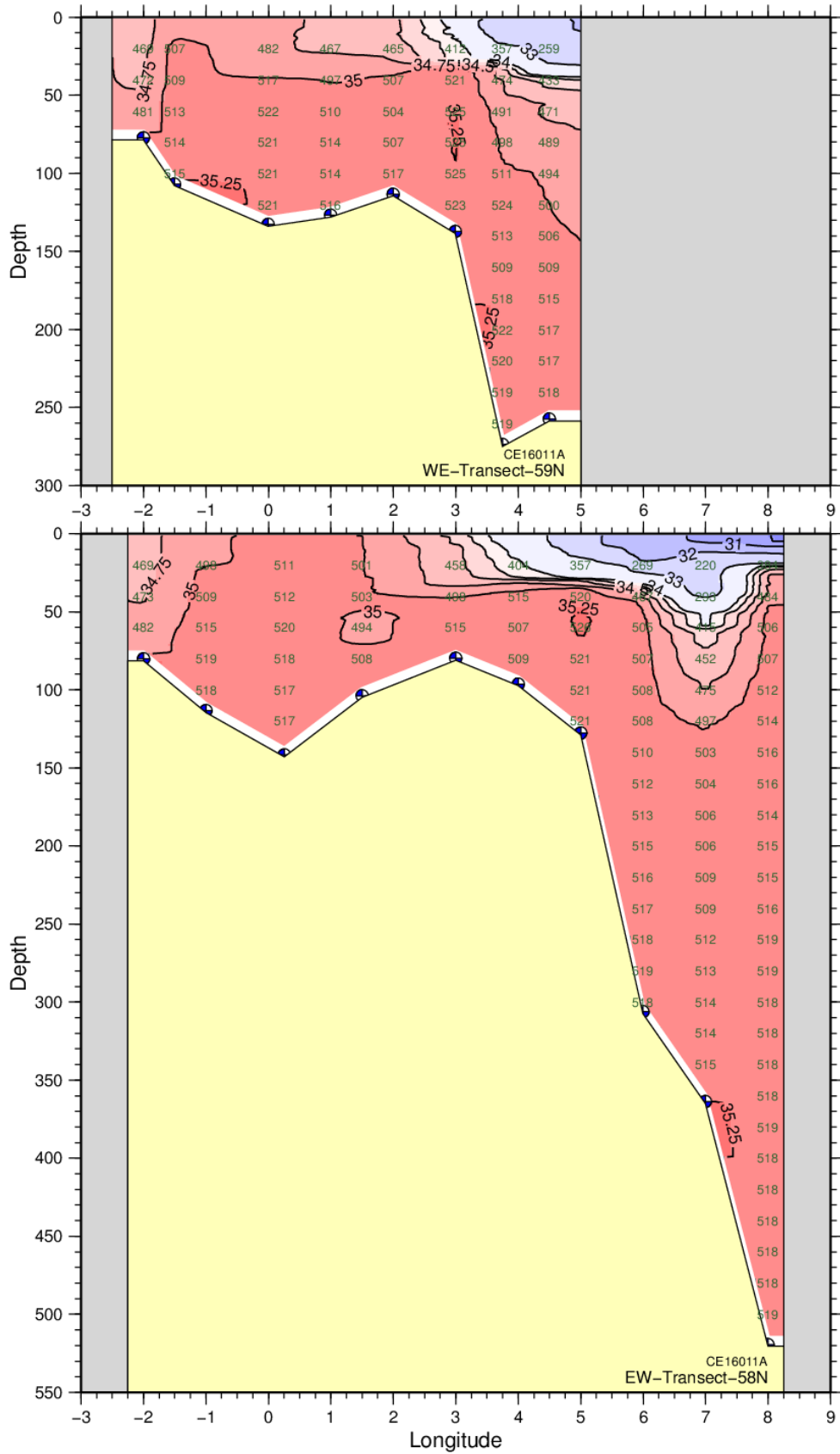


**Fig. 5:** Vertical salinity distribution along the 54°, 55°, 56°, and 57°N sections basing on CTD raw data. The numbers in the section give (salinities  $\times$  100) - 3000 for selected data points.

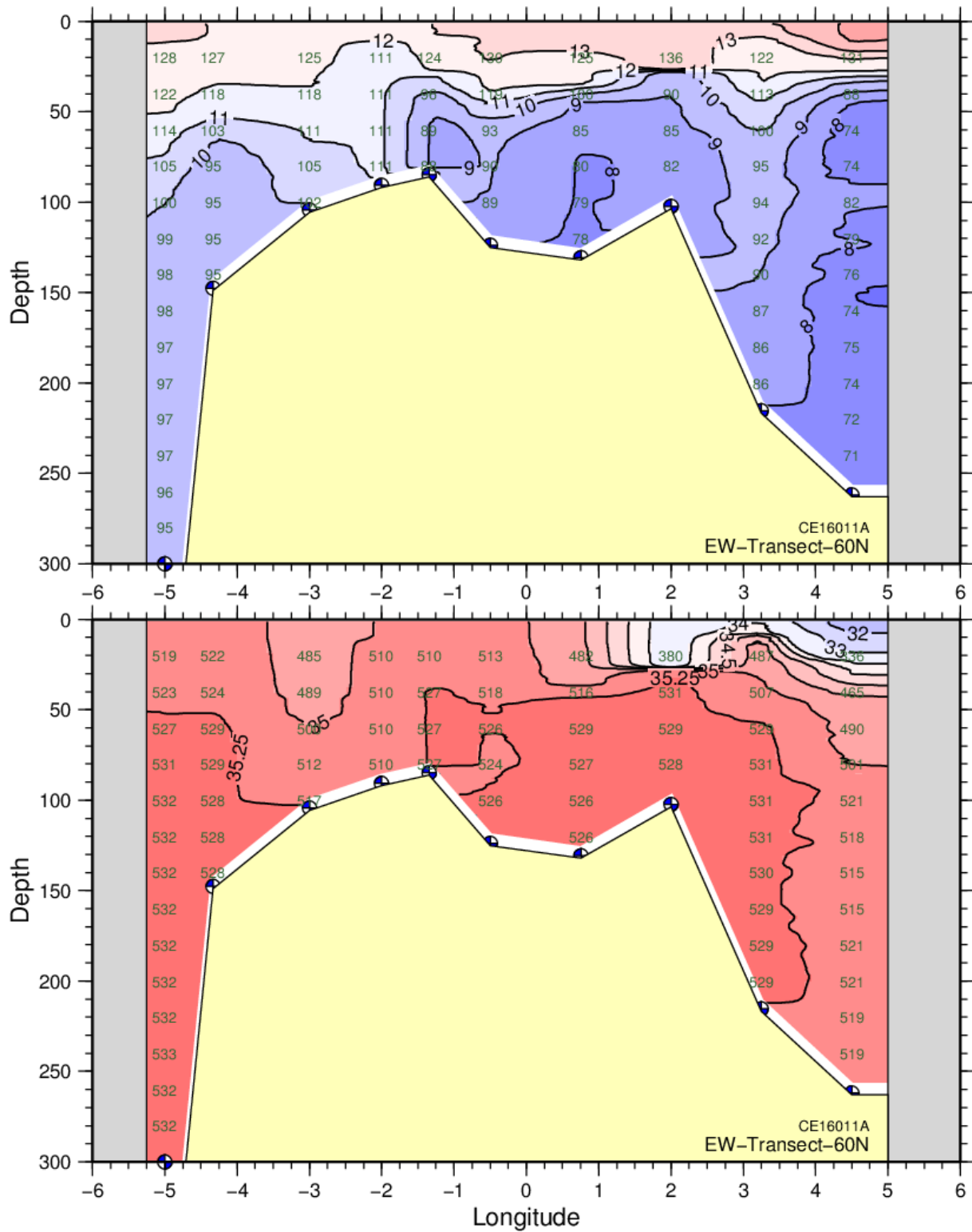




**Fig. 6:** Vertical temperature distribution along the 58° and 59°N sections basing on CTD raw data. The numbers in the section give temperatures  $\times 10$  for selected data points.



**Fig. 7:** 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. 8:** 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  $\times 10$  and (salinities  $\times 100$ ) - 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 2016 again a big success! Thank you very much to all of you!

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

Holger Klein

Aberdeen, August 26<sup>th</sup>, 2016

## Appendix 1: List of samples

CTD-profiles with rosette:	103 stations
Secchi depth:	36 stations (daylight stations only)
Salinity:	279 samples
Stations for radioactivity:	87 stations
Oxygen:	129 samples & 10fold determination
pH-value:	129 samples & 10fold determination
Chlorophyll:	112 samples
Nutrients:	20 extra samplings for validation of the nutrient analysers. Run time nutrient auto analyser: Silicate: 7 days, Nitrate/Nitrite: 19 days, Phosphate: 19 days, pH: 19 days
Polar organic contaminants:	50 samples
Un-polar organic contaminants:	45 samples
Radioactivity (artificial nuclides):	2 samples à 3 35-l-drums Caesium-137 and Strontium-90 (pure) 49 samples à 2 35-l-drums Strontium-90 (pure) 51 samples à 1-l-bottles Tritium (pure) 1 sample à 3 35-l-drums Plutonium and Americium (pure) 1 sample à 600 l transuranics (pure) 89 samples à 150 l Caesium-137 (concentrated) 10 samples à 100 l KNiFC (concentrated) 1 sediment sample à 2 cans Samarium and transuranics

## 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 <sub>sur</sub> [°C]	T <sub>bot</sub> [°C]	T <sub>sur</sub> -T <sub>bot</sub> [K]	S <sub>sur</sub> [psu]	S <sub>bot</sub> [psu]	S <sub>bot</sub> -S <sub>sur</sub> [psu]
GN003	4.5	25	18.73	18.71	0.02	31.89	31.89	0.00
GN003A		29	18.60	18.58	0.02	31.85	31.87	0.02
GN007		27	18.76	18.75	0.01	32.82	32.85	0.03
GN007A		36	17.74	17.73	0.01	34.18	34.19	0.01
GN008	4.0	43	17.49	17.44	0.04	34.30	34.36	0.06
GN008S		46	17.52	14.60	2.29	34.55	34.49	-0.06
GN009	14.5	56	16.94	14.75	2.19	34.64	34.58	-0.06
GN009S		80	16.20	13.34	2.86	34.66	34.68	0.02
GN009A		28	17.46	17.47	-0.01	34.12	34.13	0.01
GN009B		28	18.11	18.12	-0.01	35.00	35.00	0.00
GN010	9.0	31	17.86	17.86	0.00	34.87	34.87	0.00
GN011	5.0	20	19.25	19.20	0.05	31.86	31.97	0.11
GN012	7.5	27	19.37	19.21	0.16	33.73	33.77	0.04
GN013		40	18.45	18.46	-0.01	34.61	34.61	0.00
GN901		46	17.43	17.43	0.00	34.90	34.90	0.00
GN902		56	16.83	16.84	-0.01	35.05	35.06	0.01
GN903		51	16.65	16.64	0.01	35.00	35.01	0.01
GN904		53	16.58	16.57	0.01	35.16	35.17	0.01
GN905		78	17.51	13.43	4.08	35.25	35.29	0.04
Gn906		120	18.54	11.22	7.32	35.33	35.39	0.06
GN910		42	17.12	17.08	0.04	34.56	34.59	0.03
GN014	3.5	32	18.63	18.56	0.07	34.68	34.68	0.00
GN015	7.5	49	17.74	17.71	0.03	34.47	34.46	-0.01
GN015B		41	17.71	17.57	0.14	33.84	33.88	0.04
GN016		32	16.46	16.48	-0.02	34.09	34.20	0.11
GN017		44	14.50	14.36	0.14	34.48	34.49	0.01
GN017A		54	13.82	13.78	0.04	34.32	34.33	0.01
GN017S		63	14.96	11.18	3.78	34.37	34.47	0.10
GN018A		66	14.53	10.36	4.17	34.45	34.60	0.15
GN018	13.5	76	15.58	8.26	7.32	34.74	34.59	-0.15
GN018S		64	15.37	9.52	5.85	34.54	34.47	-0.07
GN019		28	15.47	15.47	0.00	34.58	34.58	0.00
GN019S		25	16.47	16.45	0.02	34.74	34.74	0.00
GN020	14.0	48	16.34	10.50	5.84	34.85	34.69	-0.16
GN021	13.5	42	16.53	12.72	3.81	34.58	34.43	-0.15
GN022	10.0	45	16.95	16.64	0.31	34.23	34.24	0.01
GN022A		32	17.19	17.13	0.06	33.48	33.47	-0.01
GN023		26	17.62	17.62	0.00	32.48	32.48	0.00
GN024		18	17.97	17.97	0.00	31.11	31.10	-0.01
GN025		15	17.36	17.36	0.00	30.47	30.48	0.01
GN026	4.5	29	17.24	17.11	0.13	32.79	33.01	0.22
GN026A		36	16.74	16.74	0.00	34.10	34.10	0.00
GN027		49	15.78	12.65	3.13	34.52	34.34	-0.18
GN028		43	15.82	10.49	5.33	34.80	35.03	0.23
GN028S		58	15.73	8.33	7.40	34.97	34.89	-0.08
GN029	16.0	74	15.31	7.69	7.62	35.07	35.05	-0.02
GN030	13.5	87	15.67	7.55	8.12	34.98	34.95	-0.03
GN031	15.0	77	15.28	7.93	7.35	34.86	34.97	0.11
GN032	17.5	85	14.89	8.25	6.64	34.69	34.92	0.23
GN033		6	13.26	9.69	2.57	34.48	34.64	0.16

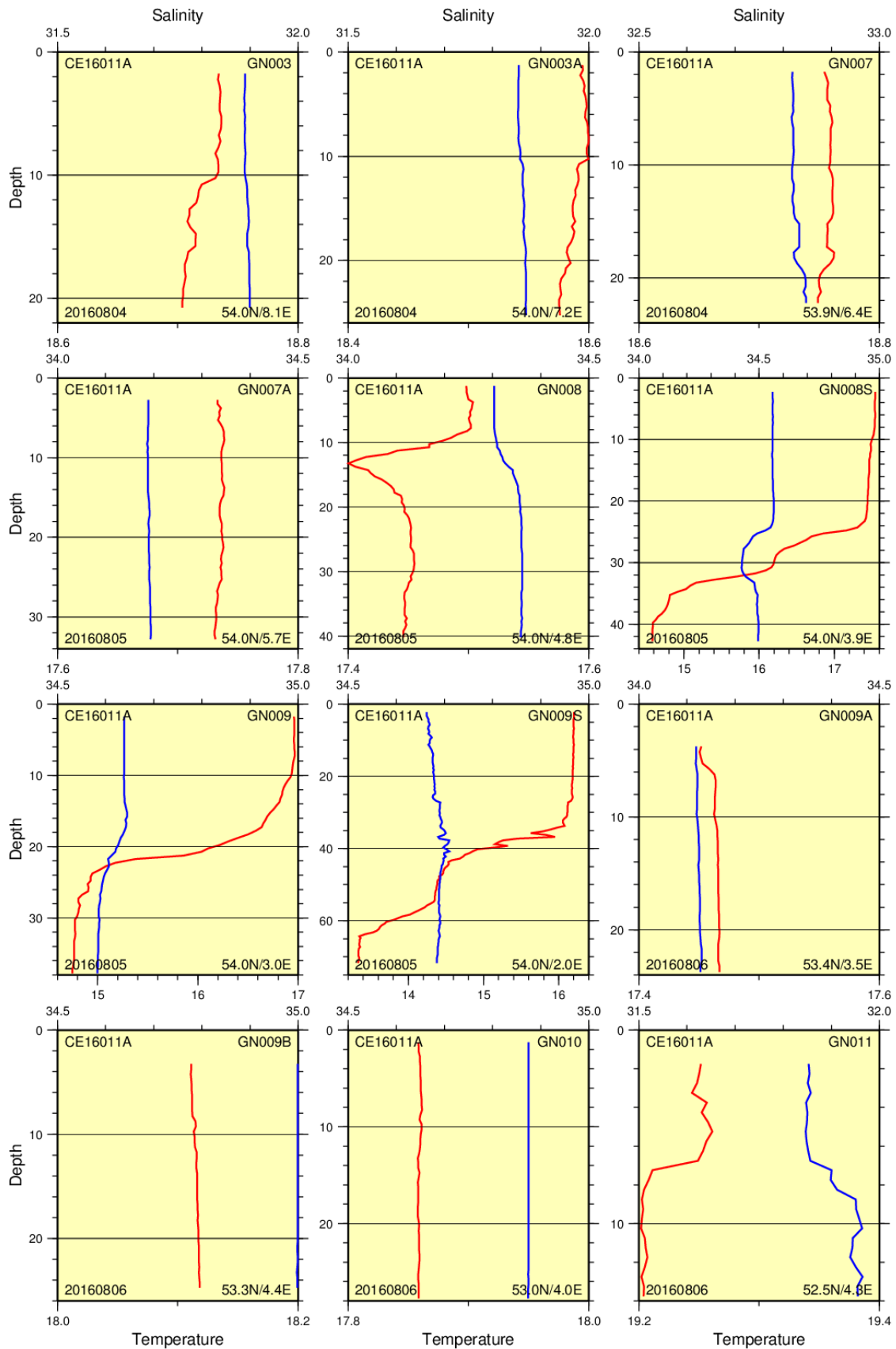
Station ID	Secchi depth [m]	water depth [m]	T <sub>sur</sub> [°C]	T <sub>bot</sub> [°C]	T <sub>sur</sub> -T <sub>bot</sub> [K]	S <sub>sur</sub> [psu]	S <sub>bot</sub> [psu]	S <sub>bot</sub> -S <sub>sur</sub> [psu]
GN033A		67	12.22	10.05	2.17	34.39	34.62	0.23
GN033S		59	12.79	11.14	1.65	34.48	34.52	0.04
GN034A		76	12.58	11.07	1.51	34.60	34.62	0.02
GN034	13.5	73	12.85	10.38	2.47	34.69	34.73	0.04
GN034S		84	14.19	8.42	5.77	34.80	34.83	0.03
GN035		99	14.06	7.60	6.46	34.94	35.05	0.11
GN035S		81	14.84	7.60	7.24	35.01	35.05	0.04
GN036		65	14.55	7.70	6.85	34.52	35.14	0.62
GN037		58	14.62	8.02	6.60	34.13	35.15	1.02
GN038	11.5	52	15.24	8.19	7.05	32.85	35.05	2.20
GN038A	15.5	33	15.62	14.73	0.89	33.82	34.33	0.51
GN039		33	15.50	14.54	0.96	32.93	34.11	1.18
GN039S		94	15.68	7.89	7.79	31.78	35.07	3.29
GN040	8.0	522	16.42	6.90	9.52	30.14	35.19	5.05
GN041	11.0	308	16.18	7.08	9.10	31.47	35.18	0.71
GN042	10.5	128	14.92	7.58	7.34	32.28	35.21	2.93
GN042S		98	14.20	7.46	6.74	33.61	35.15	1.54
GN043		78	14.57	7.65	6.92	34.44	35.16	0.72
GN044	17.5	105	13.93	7.60	6.33	35.00	35.07	0.07
GN044S		141	13.95	7.63	6.32	35.11	35.17	0.06
GN045	16.0	114	12.92	8.83	4.09	34.94	35.18	0.25
GN045A		78	12.91	11.72	1.19	34.68	34.84	0.16
GN045B		73	12.97	12.56	0.41	34.64	34.64	0.00
GN046A		79	13.04	11.77	1.27	34.65	34.82	0.17
GN046	6.5	106	12.50	10.59	1.91	34.94	35.15	0.21
GN047	17.5	132	13.91	7.59	6.32	34.88	35.21	0.33
GN048	18.8	126	13.55	7.36	6.19	34.63	35.26	0.63
GN048S		115	14.17	7.38	6.79	34.56	35.17	0.61
GN049		138	14.84	7.51	7.33	33.77	35.23	1.46
GN049S		273	15.53	7.08	8.45	32.12	35.19	3.07
GN050		260	15.40	7.11	8.29	32.07	35.18	3.11
GN050S		266	14.85	7.12	7.73	32.27	35.18	2.91
GN051	12.0	261	15.20	7.13	8.07	31.87	35.19	3.32
GN051S		217	13.35	8.62	7.73	34.25	35.29	1.04
GN052	13.0	101	13.66	8.18	5.48	33.78	35.28	1.50
GN052S		130	13.09	7.75	5.35	34.79	35.25	0.46
GN053		124	13.04	8.27	4.77	35.13	35.27	0.14
GN053A		86	13.00	8.84	4.16	34.79	35.25	0.46
GN053B		88	12.28	11.09	1.19	35.02	35.10	0.08
GN054	9.0	102	12.71	10.22	2.49	34.84	35.17	0.33
GN054S		147	12.98	9.52	3.46	35.21	35.28	0.07
GN055		415	13.03	9.41	3.62	35.19	35.31	0.12
GN065		1063	12.91	-0.51	13.42	35.20	34.91	-0.29
GN066	10.5	454	12.31	8.81	3.50	35.24	35.28	0.04
GN067	9.0	753	12.67	8.32	4.35	35.21	35.23	0.02
GN068	13.5	1006	13.14	7.58	5.56	35.19	35.23	0.04
GN069		137	13.56	9.71	3.85	35.12	35.30	0.18
GN056B		121	13.90	9.98	3.92	34.60	35.06	1.54
GN056	12.5	84	13.73	12.11	1.62	34.38	34.77	0.39
GN057A		81	12.93	12.78	0.15	34.61	34.70	0.09

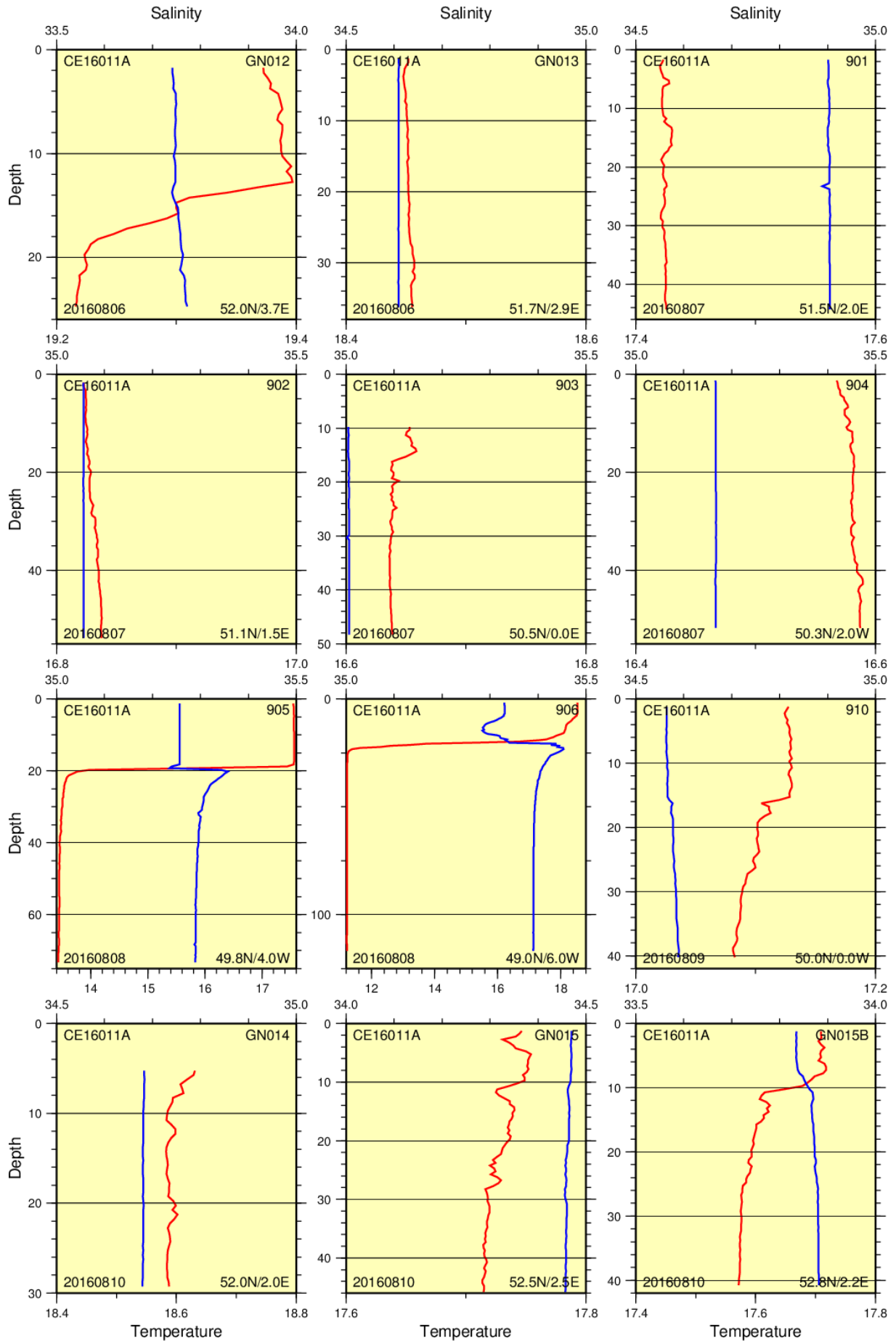
T<sub>sur</sub>, T<sub>bot</sub>: surface and bottom temperature.

S<sub>sur</sub>, S<sub>bot</sub>: surface and bottom salinity. **Blue**: Coastal Water ≤34 psu, **red**: Atlantic Water ≥35 psu.

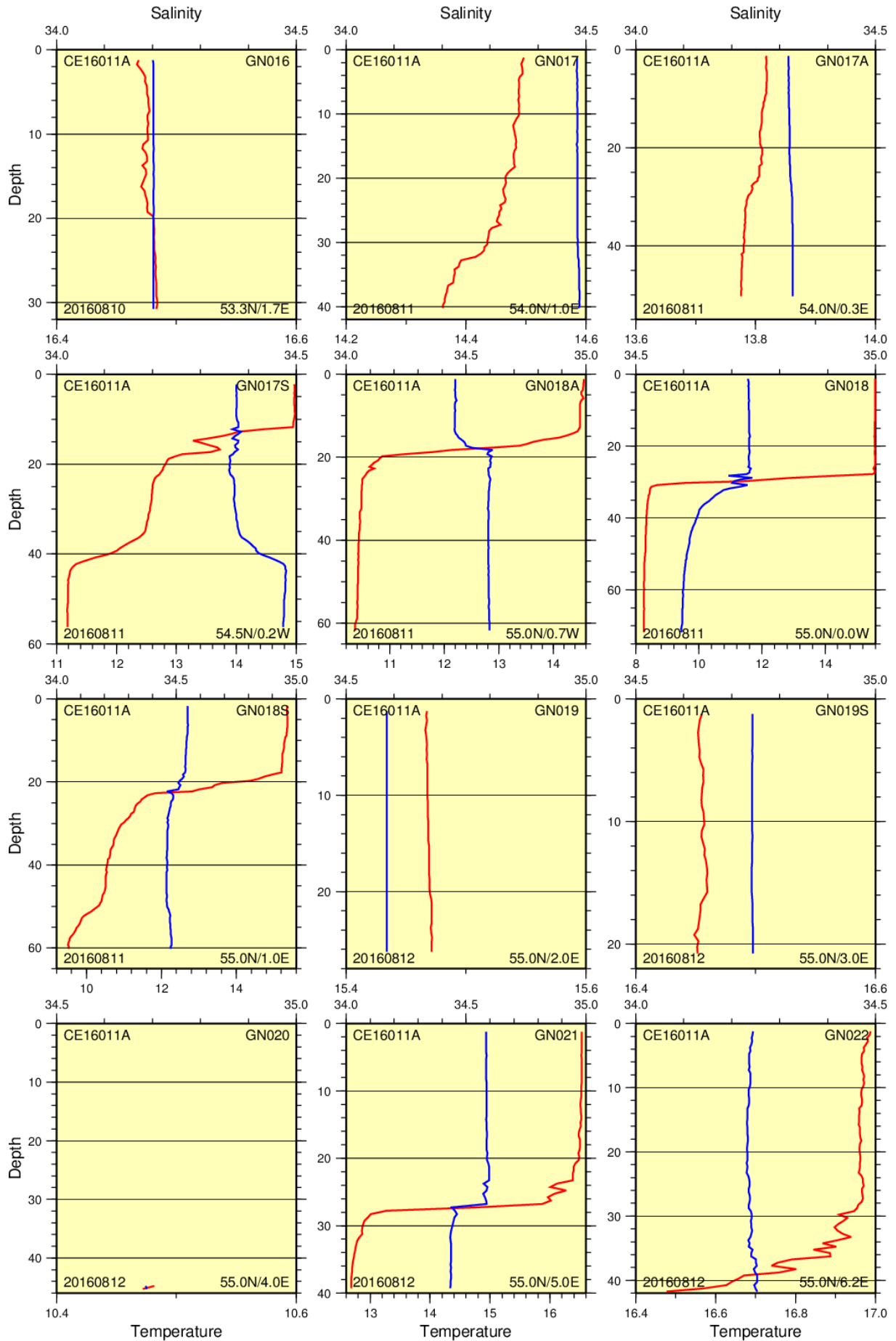
### Appendix 3: T and S profiles, all stations

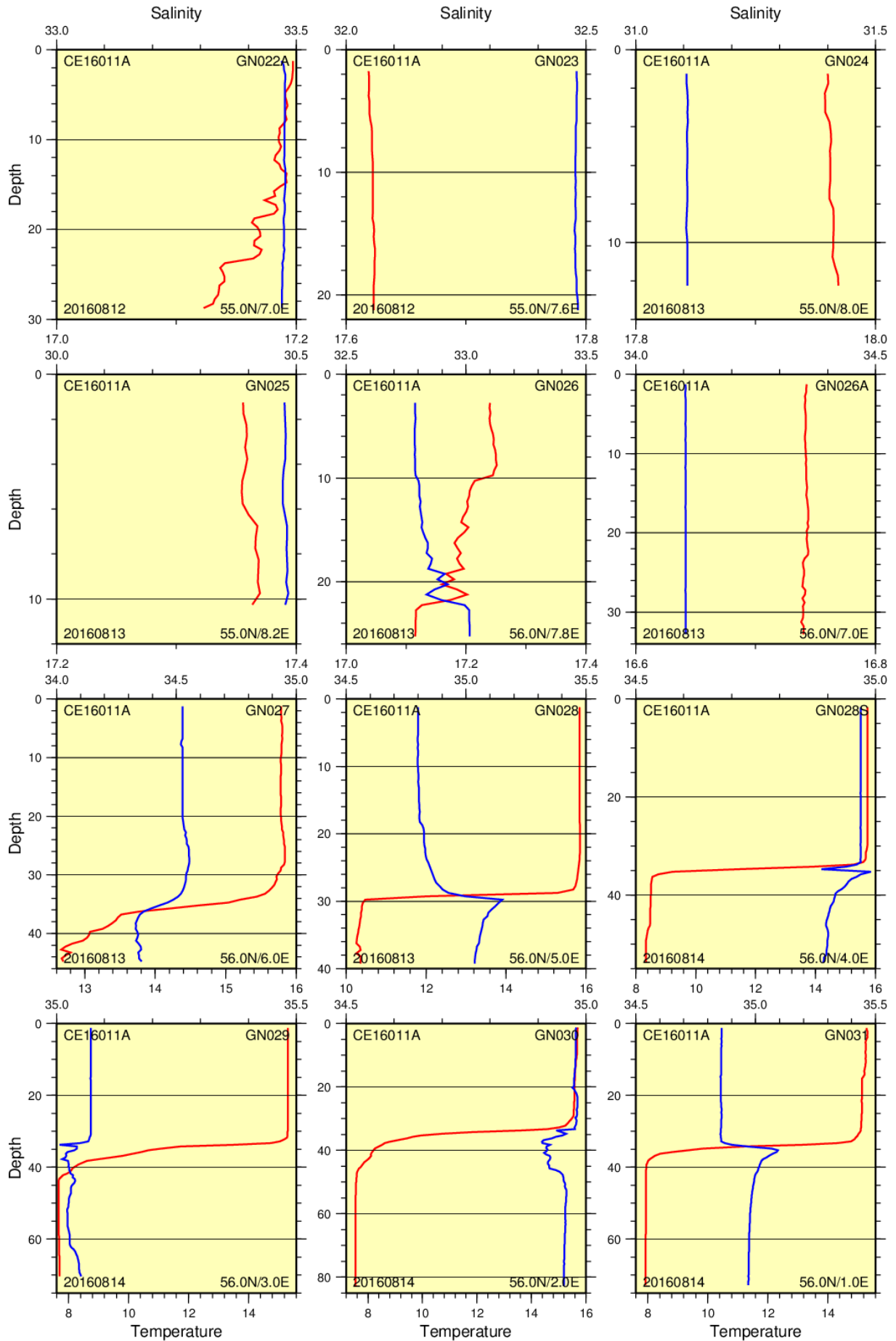
The following temperature and salinity profiles are based on CTD raw data.

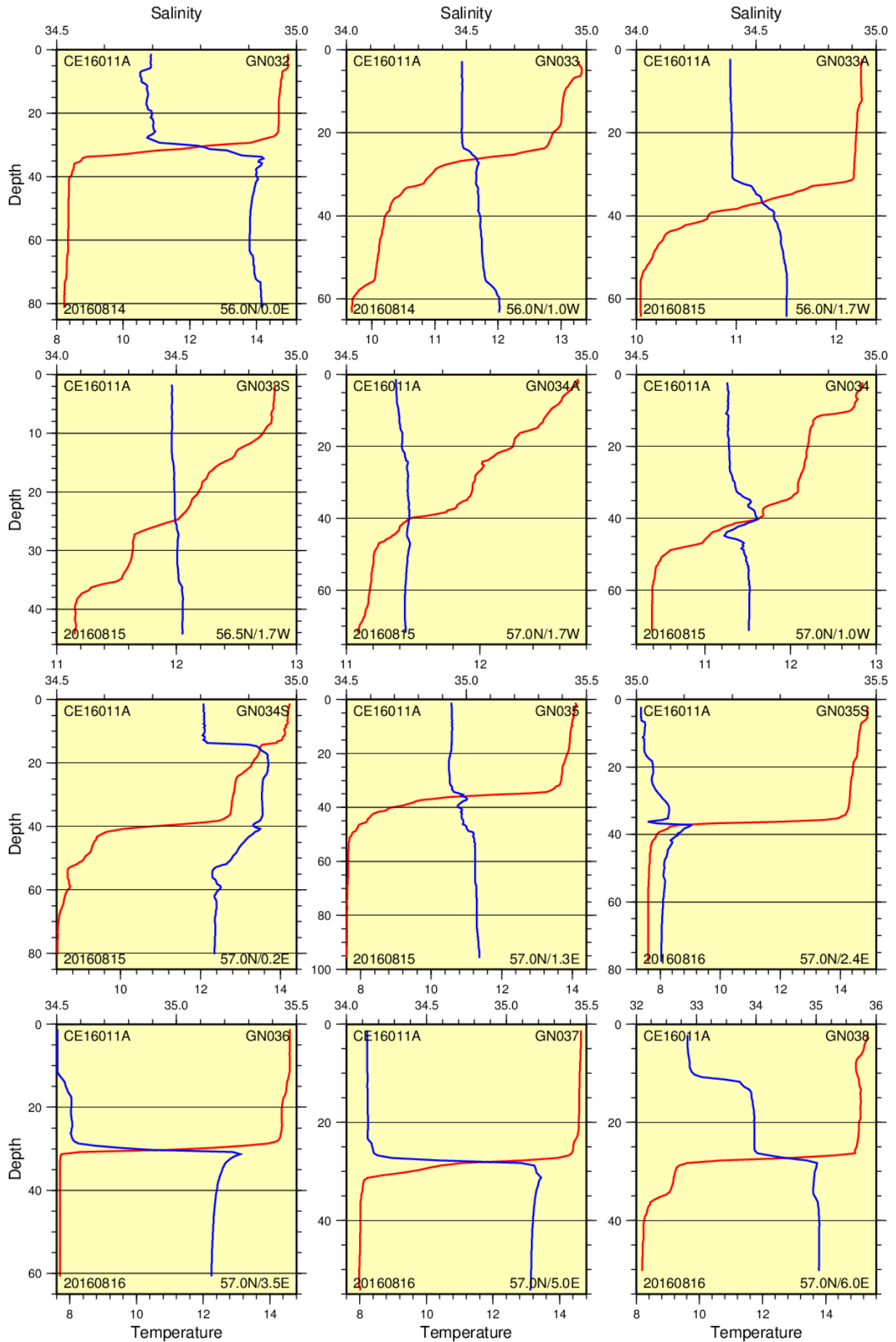


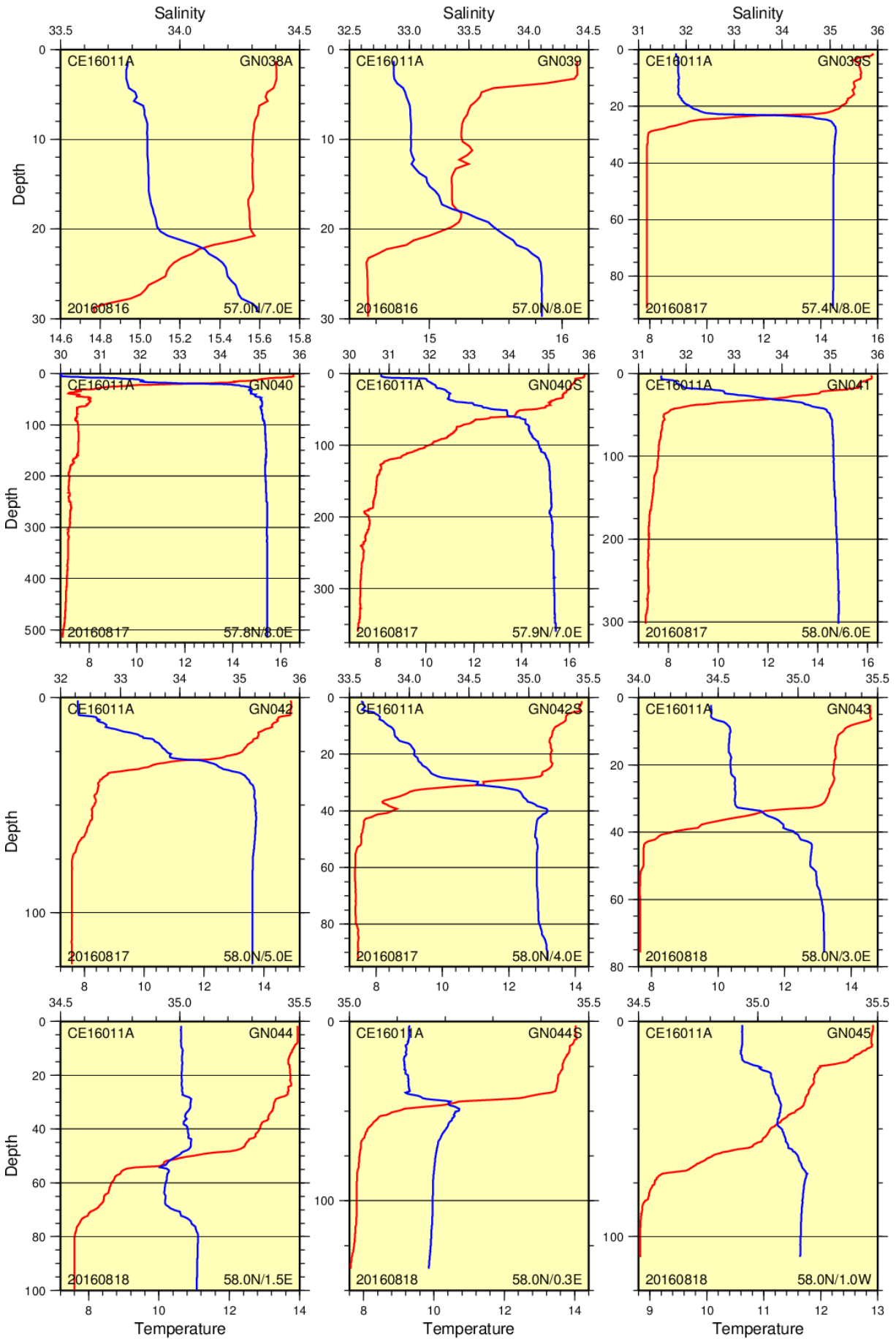


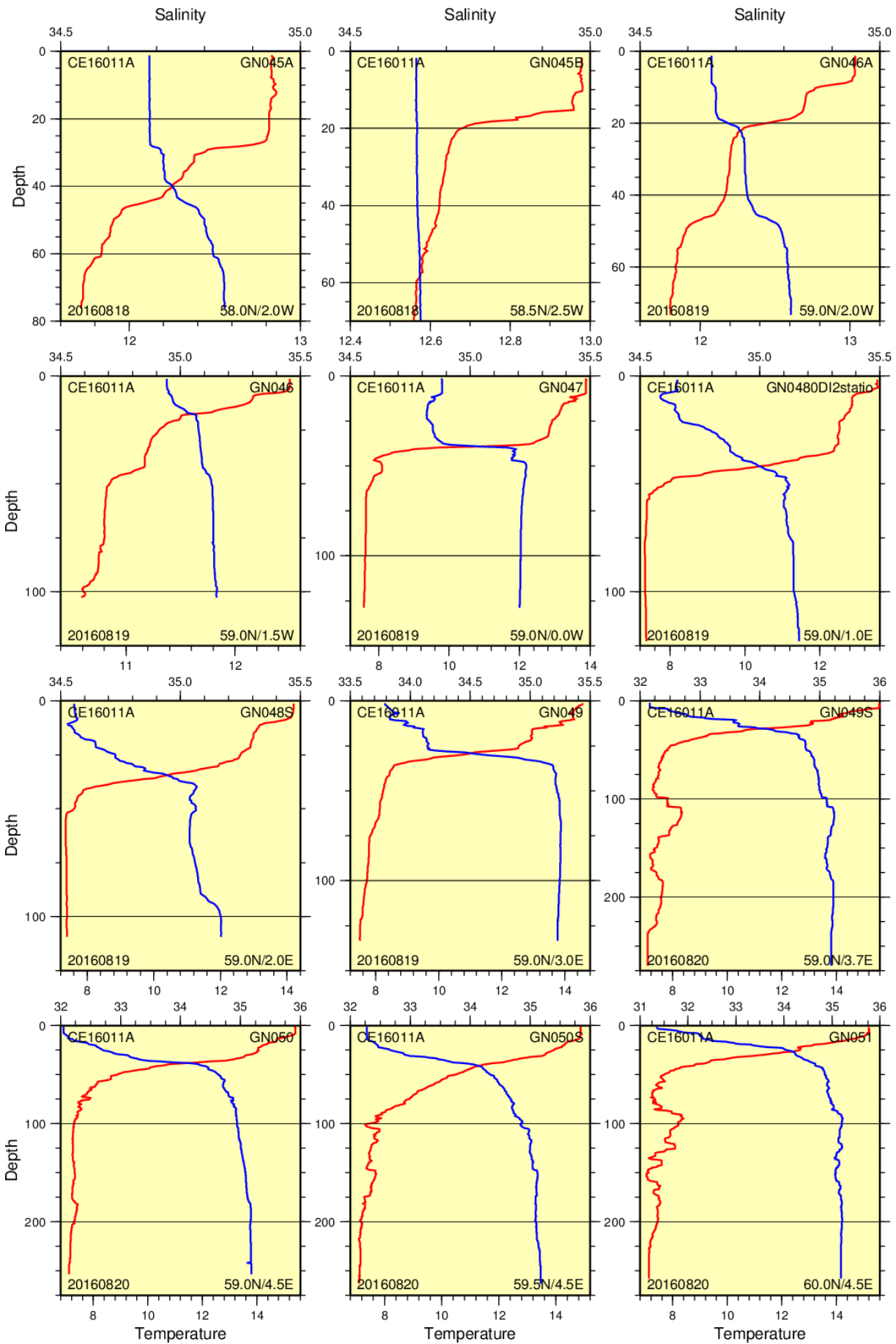


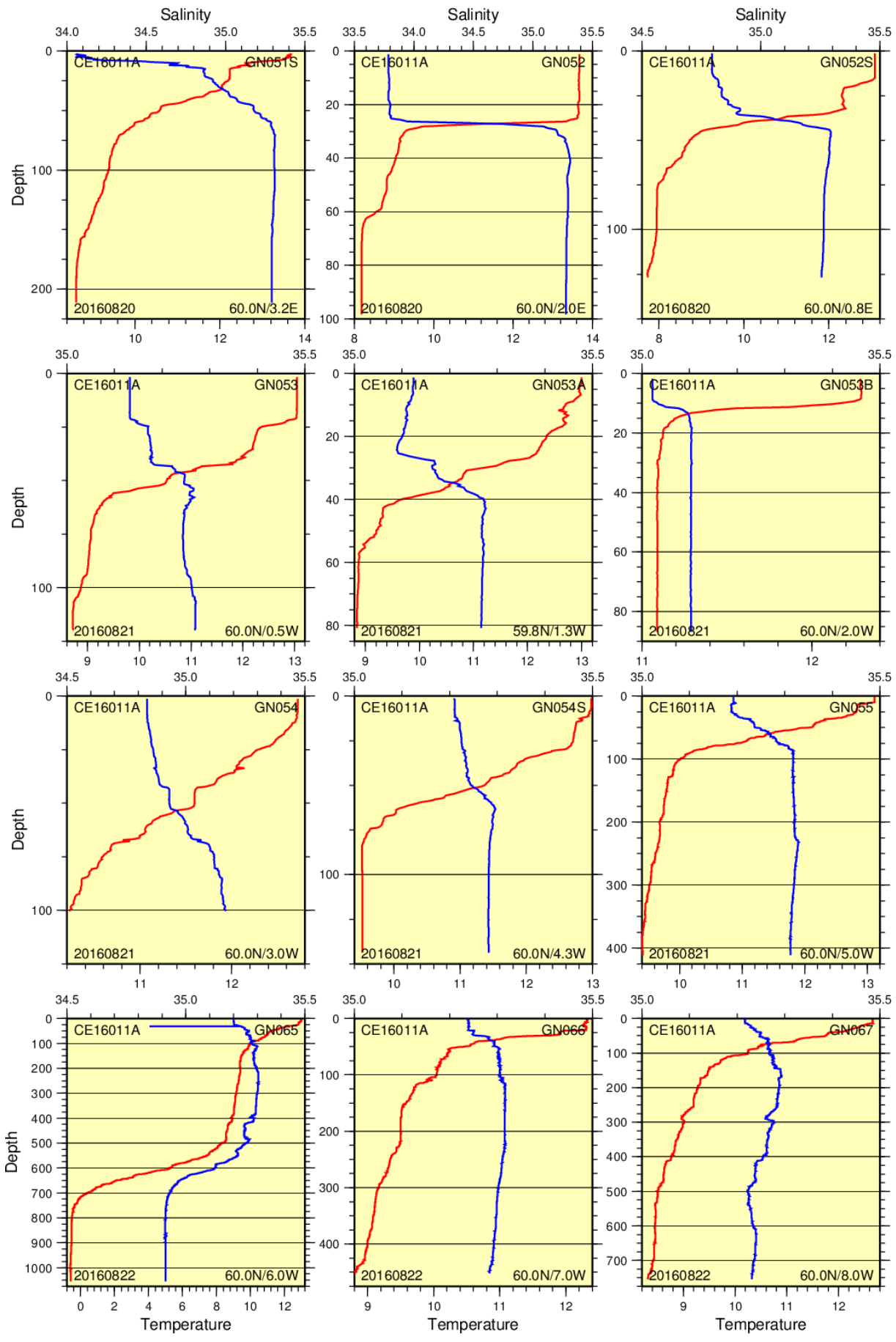


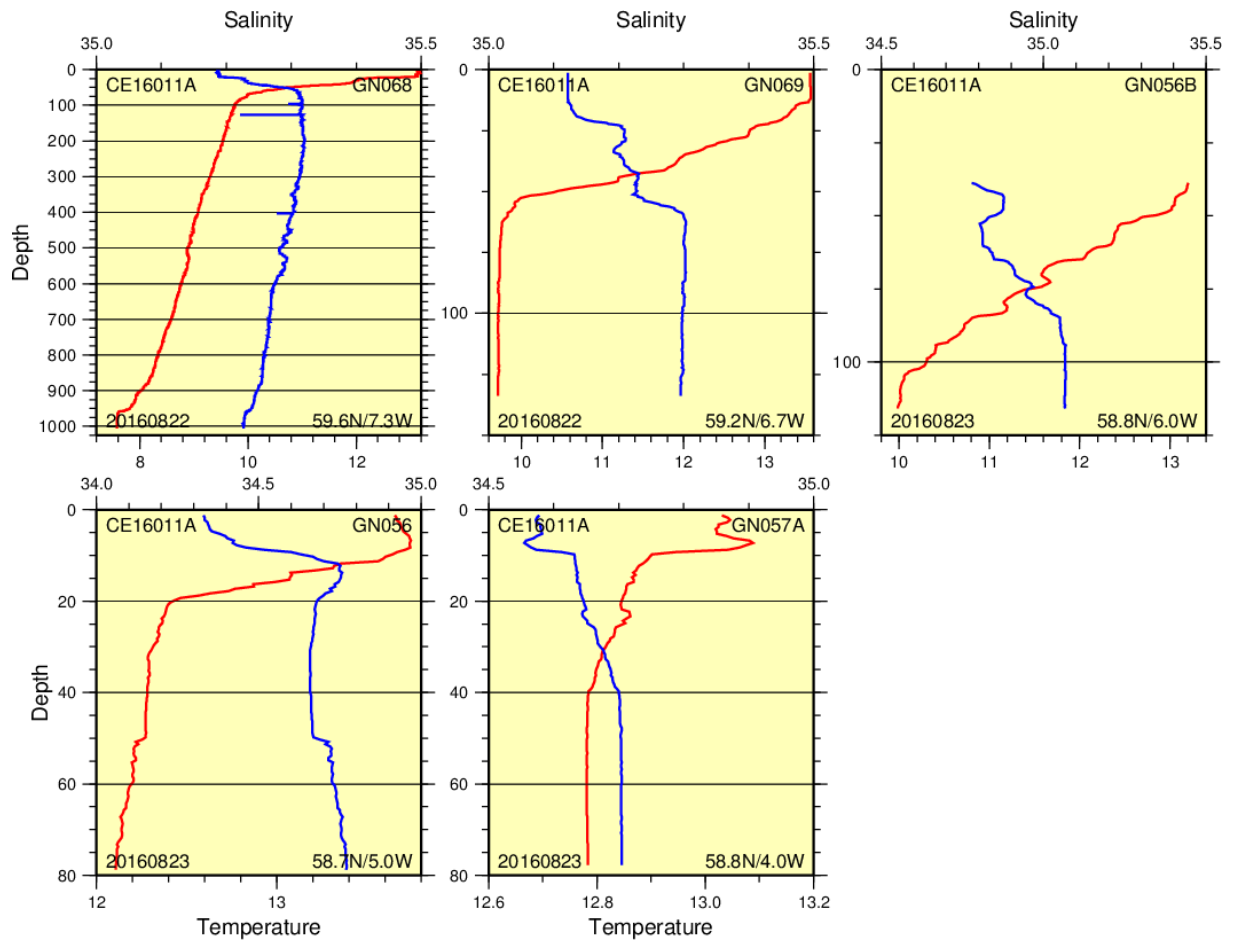






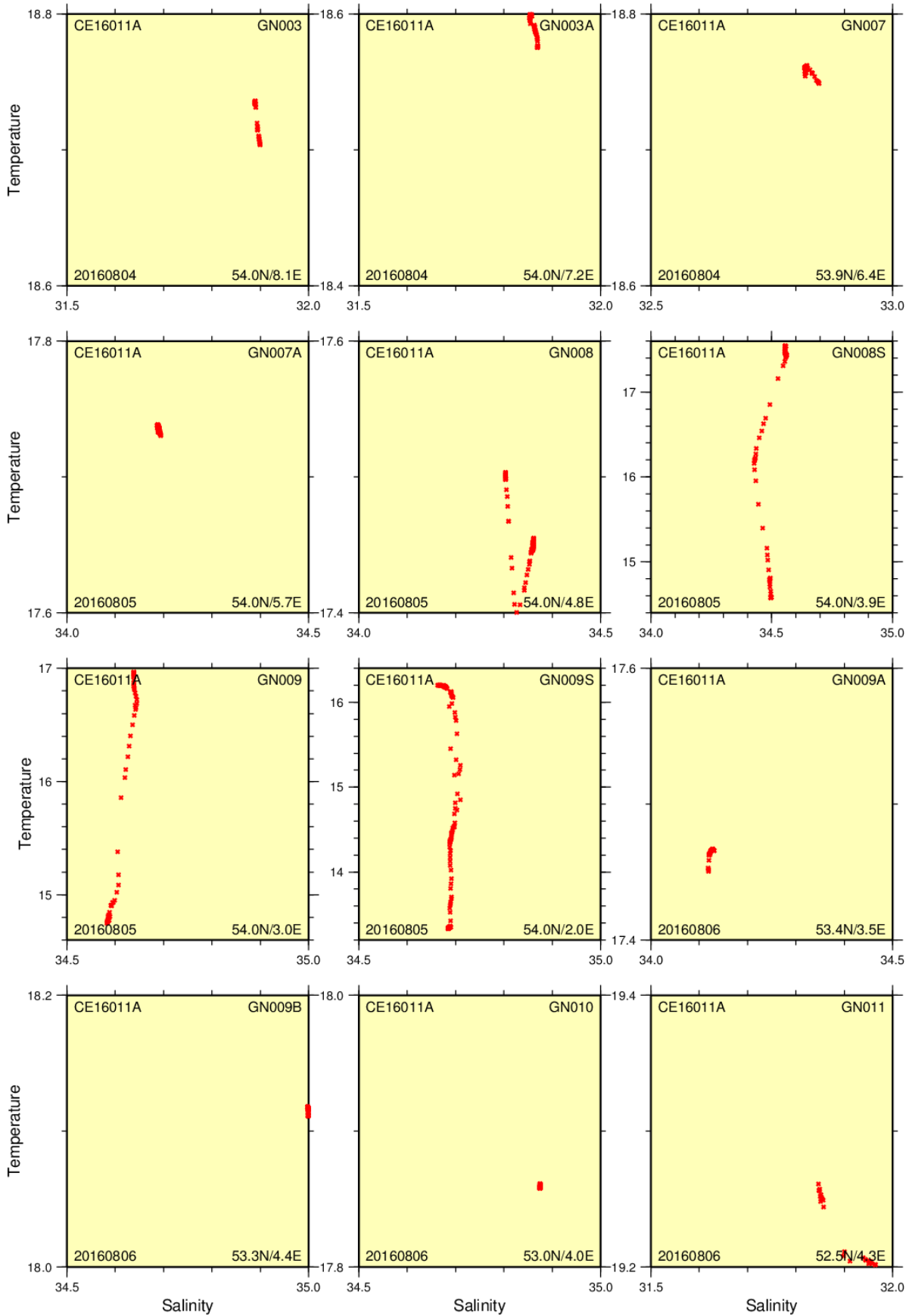




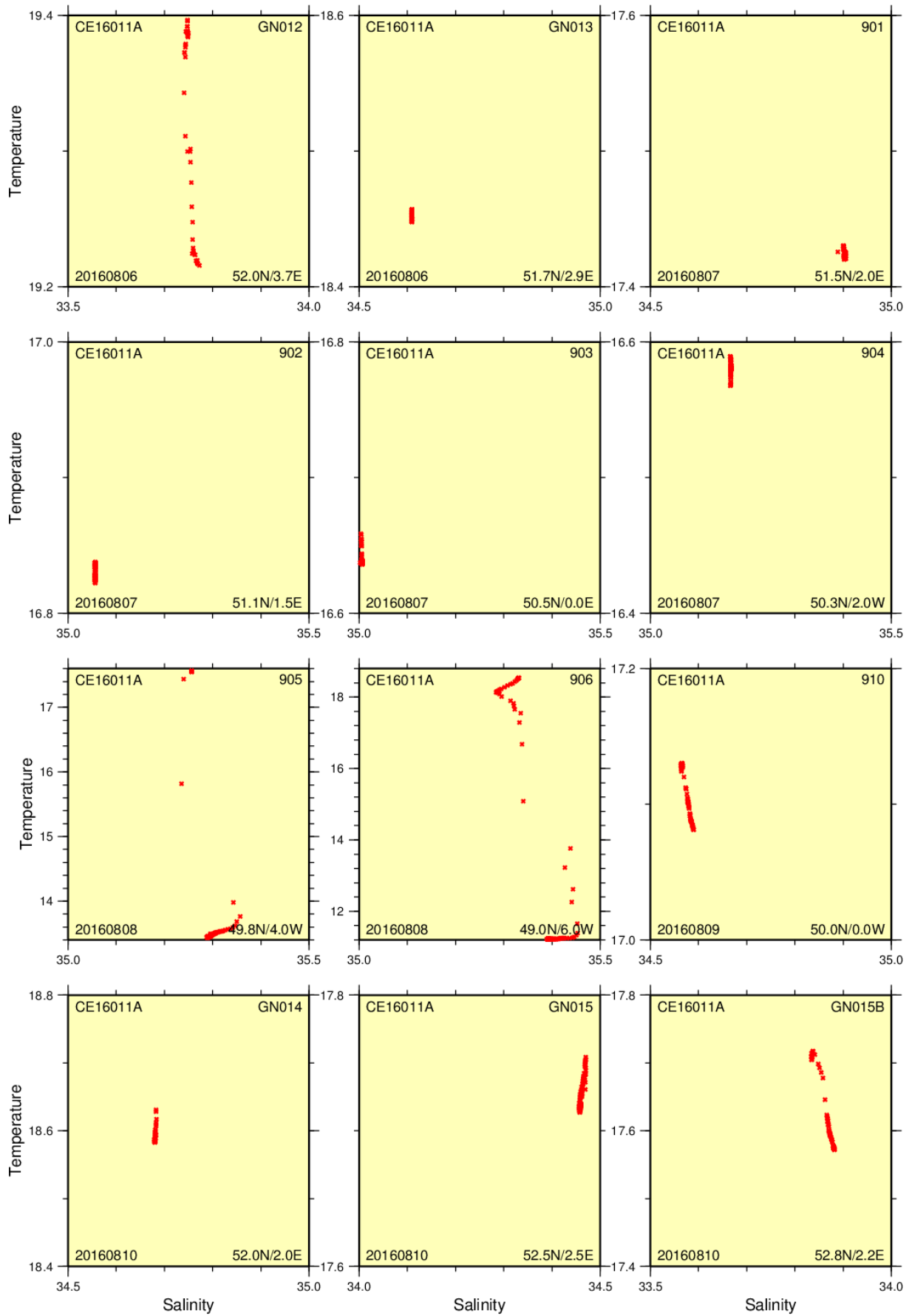


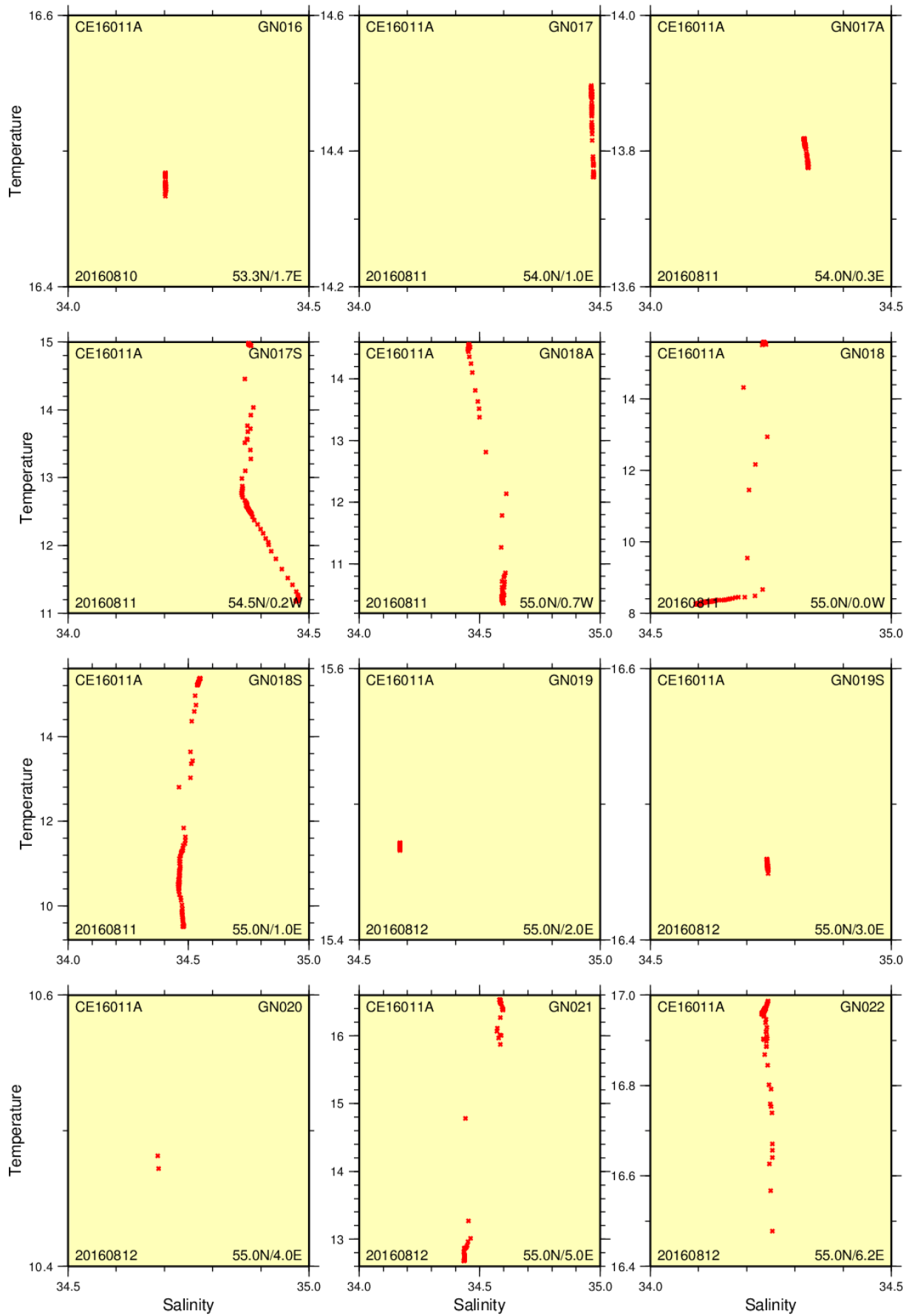
## Appendix 4: T/S diagrams, all stations

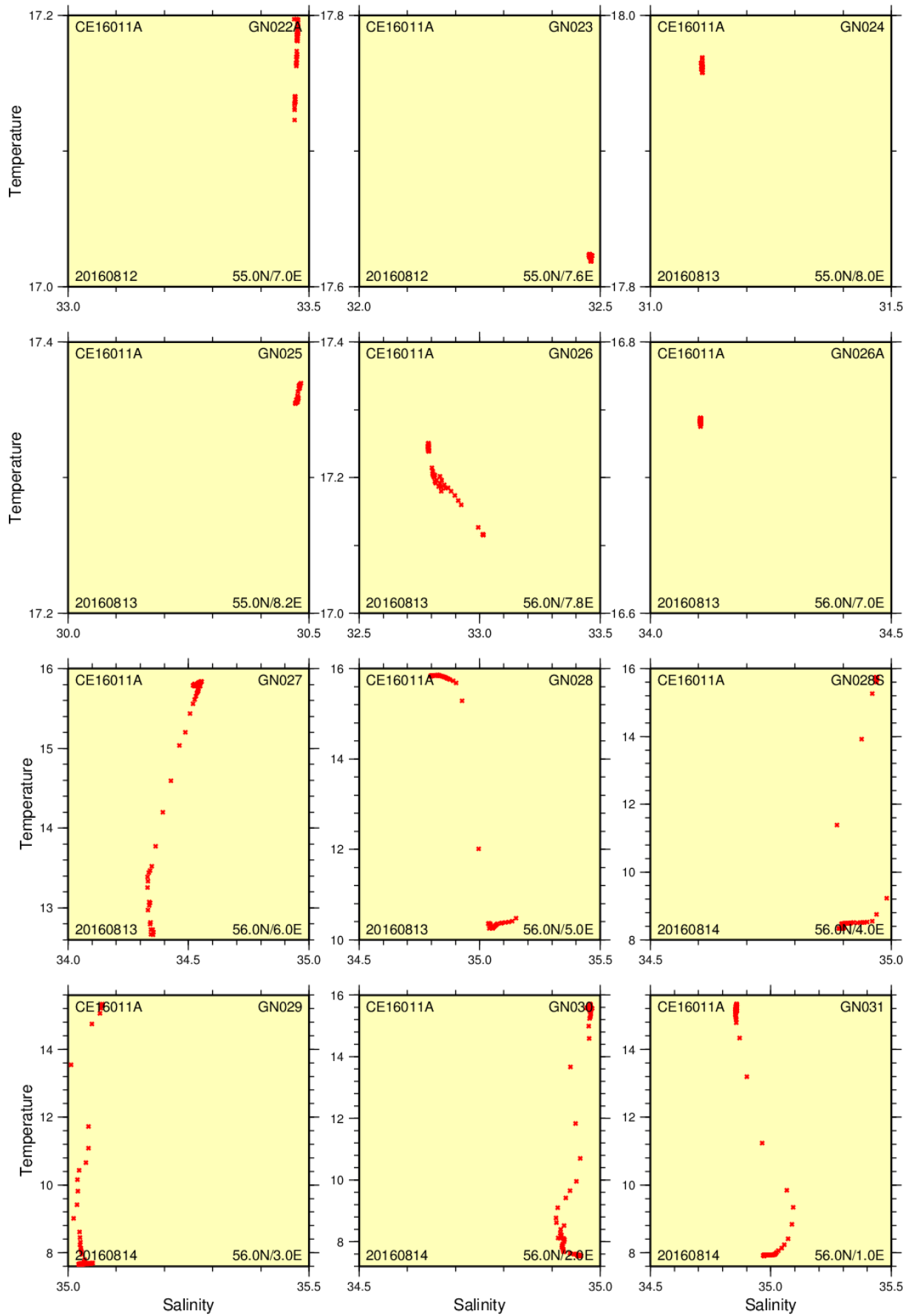
The following diagrams are based on CTD raw data.

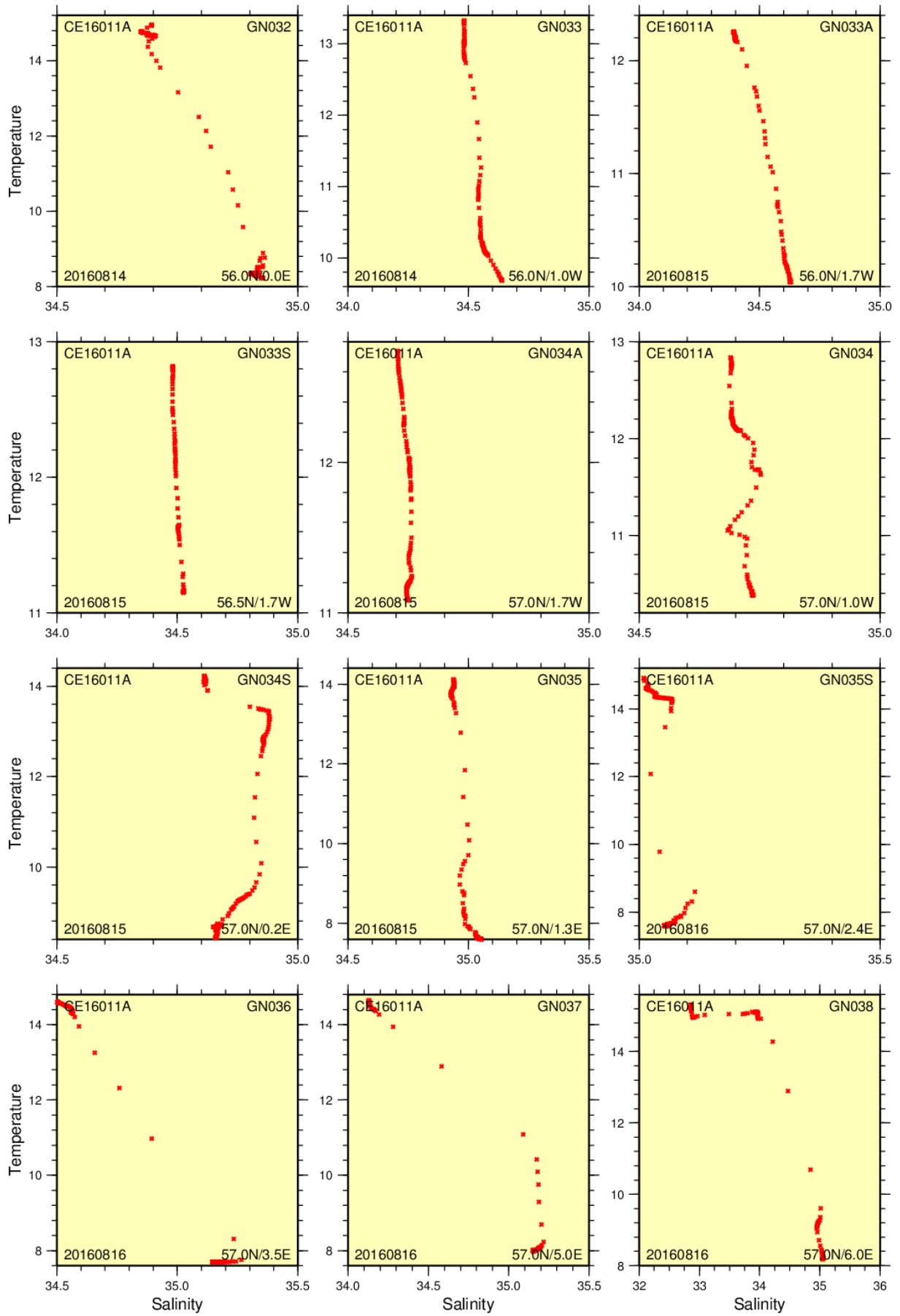


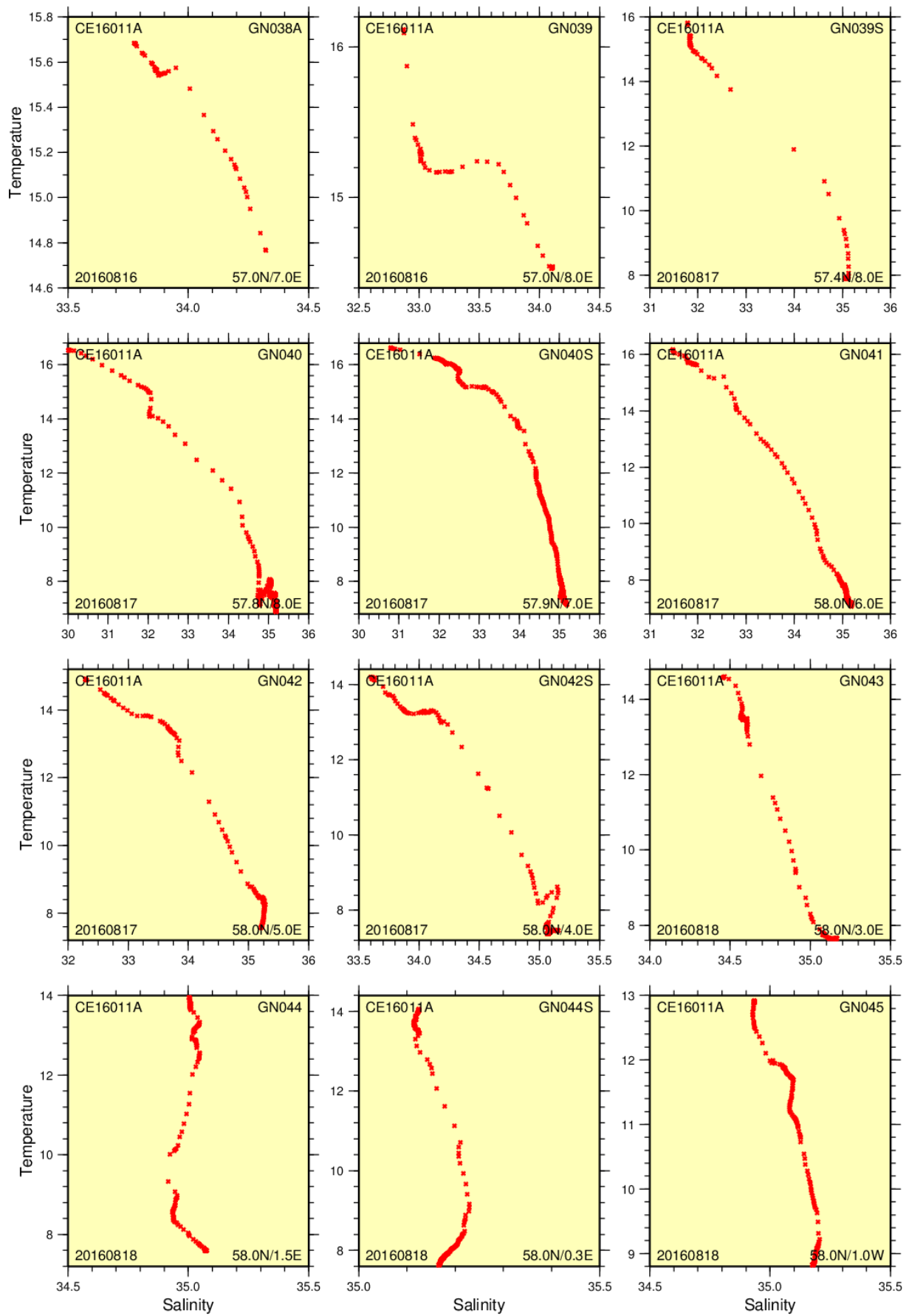


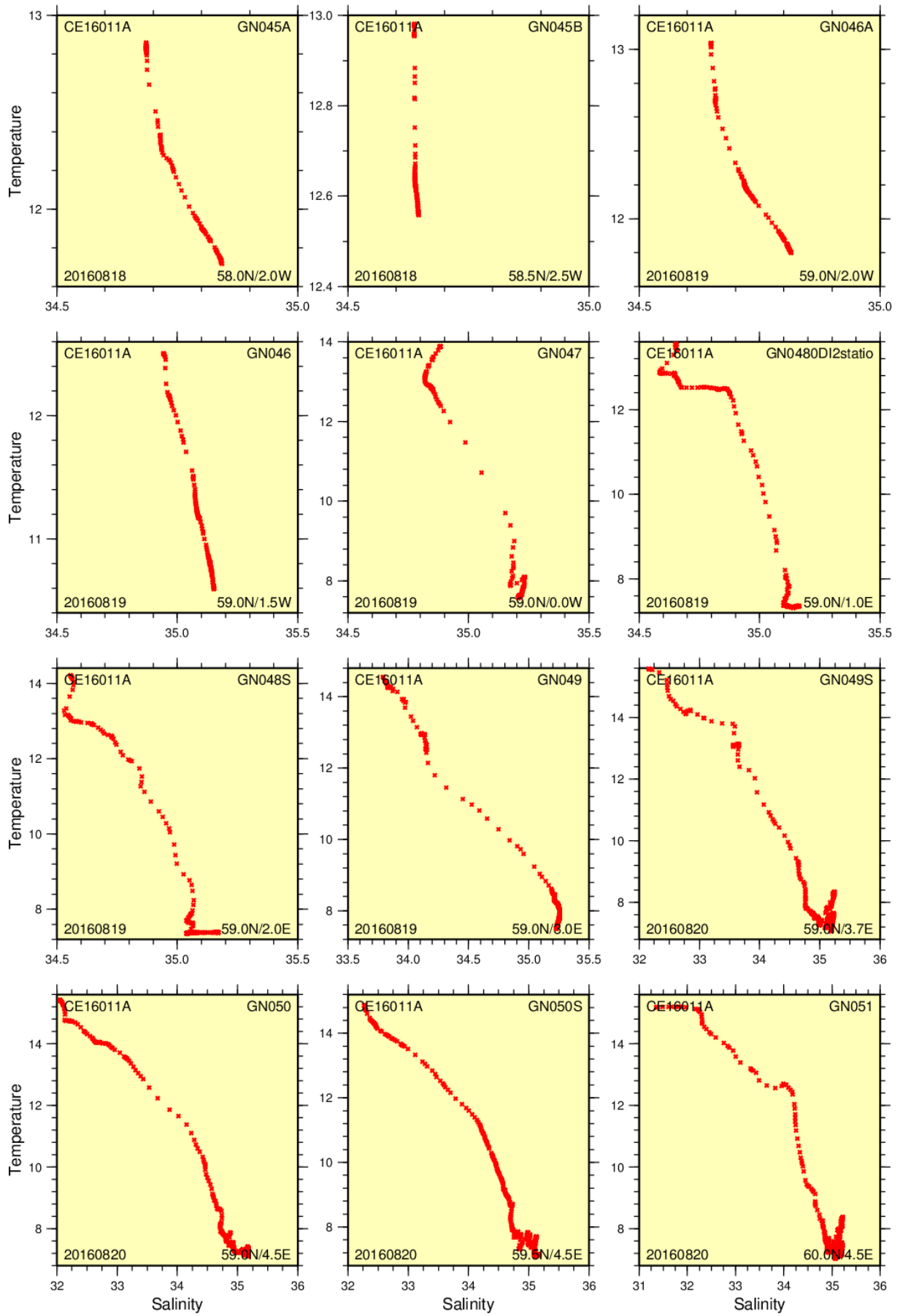


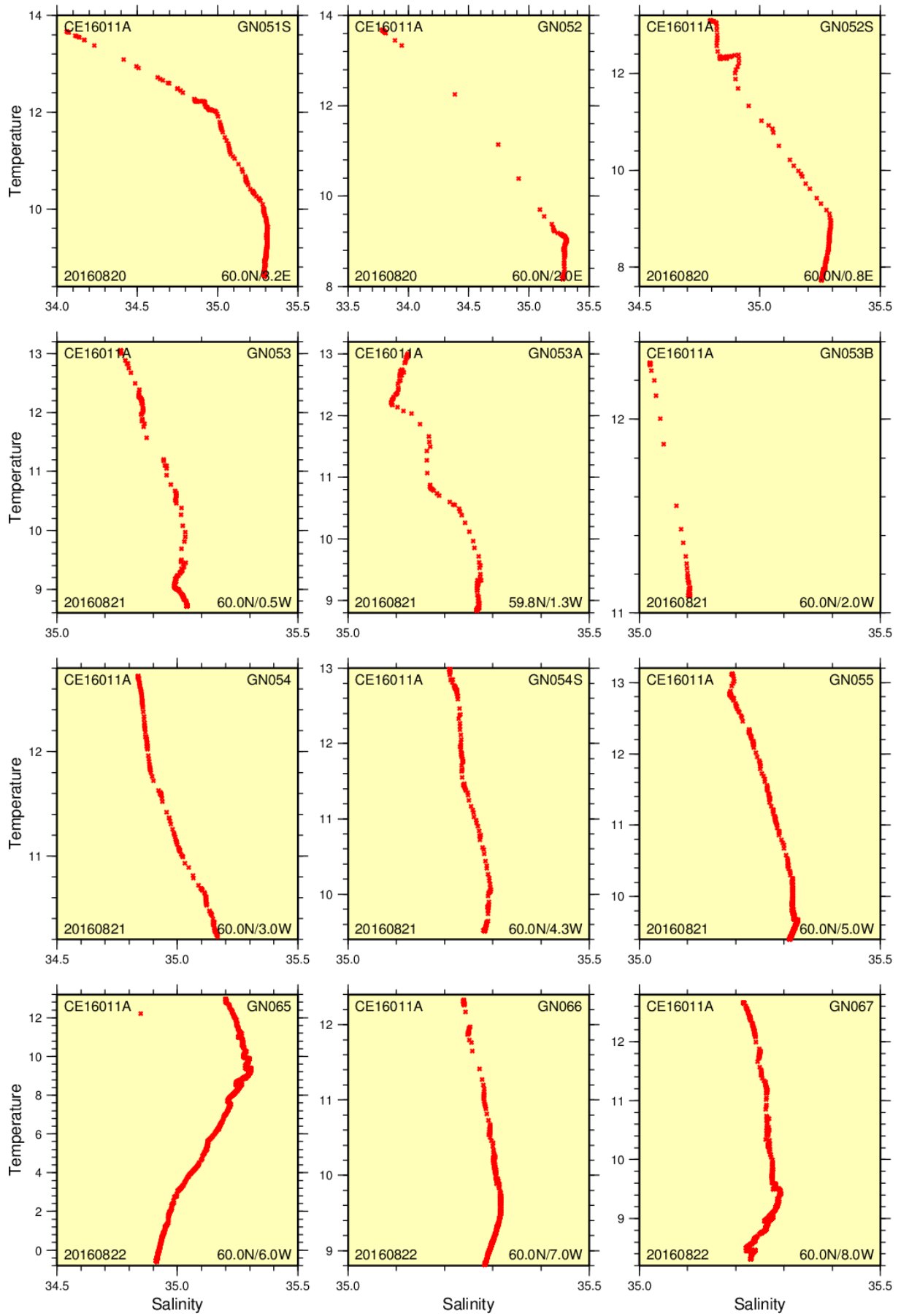


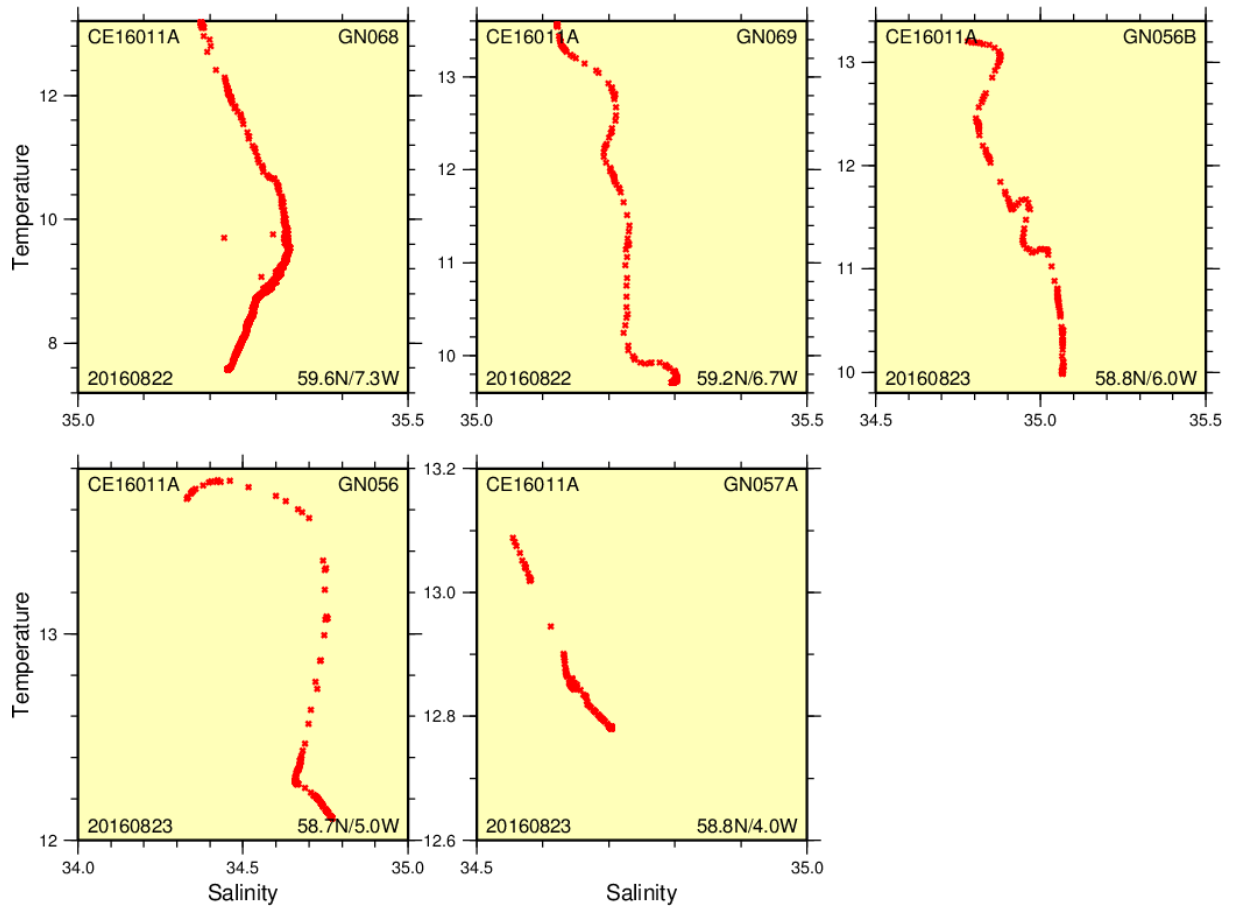














## Appendix 5: Station List

Positions are taken at the beginning of the stations! Radioactivity: Cs = Cesium-137; Sr = Strontium-90; Pu = Plutonium; H3 = Tritium; KNiFC = Potassium-Nickel Hexacyanoferrate

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	Organic 100 L	Organic 10 L	Bedford-Nr. 164nnn	date dd.mm.yy	time [UTC]
STADE	53° 27.22' N	009° 32.66' E	16	-	-	Cs/Sr//H3/Pu grab sampler	1x5 m	1x5 m		04.08.16	08:38 – 09:07
MEDEM	53° 52.71' N	008° 43.21' E	19	-	-	Cs/Sr/H3				04.08.16	12:50 – 13:01
GN003 ELBE1	54° 00.02' N	008° 06,70' E	25	bottom, 5	4.5	Cs/Sr/H3/KNiFC			001-002	04.08.16	15:15 – 15:37
GN003A	53° 59.99' N	007° 10.50' E	29	Bottom, 5	-	Cs/Sr/H3			003-004	04.08.16	19:16 – 19:32
GN007	53° 55.09' N	006° 25.49' E	27	bottom, 2 x 5	-	Cs/Sr/H3	1x5 m	1x5 m	005-007	04.08.16	23:39 – 00:09
GN007A	54° 00.06' N	005° 40.32' E	36	Bottom, 5	-	Cs/Sr/H3			008-009	05.08.16	03:16 – 03:33
GN008	54° 00.01' N	004° 50.06' E	43	bottom, 2 x 5	-	Cs	1x5 m	1x5 m	010-012	05.08.16	06:51 – 07:18
GN008S	54° 00.07' N	003° 55.33' E	46	bottom, 5	-	-			013-014	05.08.16	10:45 – 11:01
GN009	54° 00.01' N	003° 00.02' E	56	bottom, 2 x 5	14.5	Cs/Sr/H3/KNiFC	1x5 m	2x5 m	015-017	05.08.16	14:11 – 14:48
GN009S	54° 00.01' N	002° 00.08' E	80	bottom, 5	-	-			018-019	05.08.16	18:06 – 18:21
GN009A	53° 25.11' N	003° 10.15' E	28	bottom, 5	-	Cs			020-021	06.08.16	00:06 – 00:19
GN009B	53° 19.73' N	004° 25.07' E	28	bottom, 5	-	Cs/Sr/H3			022-023	06.08.16	03:40 – 03:55
GN010	53° 00.13' N	003° 59.97' E	31	bottom, 5	9.0	Cs			024-026	06.08.16	06:35 – 06:45
GN011	52° 30.66' N	004° 19.57' E	20	bottom, 2 x 5	5.0	Cs	2x5 m	1x5 m	027-029	06.08.16	09:57 – 10:38
GN012	52° 00.10' N	003° 45.85' E	27	bottom, 2 x 5	7.5	Cs/Sr/H3	1x5 m	1x5 m	030-032	06.08.16	15:44 – 15:34
GN013	51° 42.07' N	002° 51.66' E	40	bottom, 2 x 5		Cs/Sr/H3	1x5 m	1x5 m	033-035	06.08.16	19:53 – 20:18
GN901	51° 29.89' N	001° 59.63' E	46	bottom, 5		Cs/Sr/H3			036-037	07.08.16	00:15 – 00:32
GN902	51° 05.03' N	001° 29.97' E	56	bottom, 2 x 5		Cs/Sr/H3	1x5 m	1x5 m	038-040	07.08.16	04:49 – 05:16
GN903	50° 29.98' N	000° 00.01' E	51	bottom, 5		Cs/Sr/H3			041-042	07.08.16	12:43 – 12:56
GN904	50° 20.01' N	001° 59.85' W	53	bottom, 5		Cs/Sr/H3	1x5 m	1x5 m	043-044	07.08.16	20:07 – 20:36
GN905	49° 50.03' N	004° 00.05' W	78	bottom, 5		Cs/Sr/H3			045-046	08.08.16	05:42 – 05:58
GN906	49° 00.02' N	006° 00.07' W	120	bottom, 50, 5		Cs/Sr/H3/KNiFC	1x5 m 1x50 m	1x5 m 1x50m	047-049	08.08.16	15:26 – 16:22
GN909	49° 55.20' N	001° 59.49' W	95			Cs/Sr/H3				09.08.16	10:48 – 11:19
GN910	50° 00.05' N	000° 00.06' W	42	bottom, 5		Cs/Sr/H3	2x5 m	1x5 m	050-051	09.08.16	18:12 – 18:46
GN911	50° 50.12' N	001° 30.12' E	37			Cs/Sr/H3/KNiFC				10.08.16	03:15 – 03:44
GN014	51° 59.94' N	002° 00.39' E	32	bottom, 2 x 5	3.5	Cs/Sr/H3	1x5 m	1x5 m	052-054	10.08.16	11:55 – 12:26
GN015	52° 29.97' N	002° 29.88' E	49	bottom, 5	7.5	Cs			055-056	10.08.16	16:50 – 17:02
GN015B	52° 49.78' N	002° 10.23' E	41	bottom, 5		Cs			057-058	10.08.16	19:15 – 19:28
GN016	53° 19.77' N	001° 40.27' E	32	bottom, 5		Cs/Sr/H3			059-060	10.08.16	22:56 – 23:11
GN017	53° 59.89' N	001° 00.01' E	44	bottom, 2 x 5		Cs	1x5 m	3x5 m	061-063	11.08.16	04:19 – 04:58

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	Organic 100 L	Organic 10 L	Bedford-Nr. 164nnn	date dd.mm.yy	time [UTC]
GN017A	53° 59.82' N	000° 19.92' E	54	bottom, 5		Cs/Sr/H3			064-065	11.08.16	07:29 – 07:44
GN017S	54° 30.04' N	000° 09.95' W	63	bottom, 5		-			066-067	11.08.16	11:41 – 11:52
GN018A	54° 59.92' N	000° 40.04' W	66	bottom, 5		Cs			068-069	11.08.16	15:25 – 15:38
GN018	54° 59.95' N	000° 00.40' W	76	bottom, 5	13.5	Cs			070-071	11.08.16	17:57 – 18:11
GN018S	55° 00.00' N	000° 59.94' E	64	bottom, 5		-			072-073	11.08.16	21:40 – 21:51
GN019	55° 00.05' N	002° 00.23' E	28	bottom, 2 x 5		Cs/Sr/H3			074-076	12.08.16	01:15 – 01:26
GN019S	54° 59.94' N	002° 59.91' E	25	bottom, 5		-			077-078	12.08.16	04:57 – 05:07
GN020	54° 59.97' N	003° 59.89' E	48	bottom, 3 x 5	14.0	Cs	1x5 m	1x5 m	079-082	12.08.16	08:44 – 09:09
GN021 AWZW2	54° 59.93' N	005° 00.12' E	42	bottom, 2 x 5	13.5	Cs			083-085	12.08.16	12:42 – 12:54
GN022	55° 00.00' N	006° 14.98' E	45	bottom, 5	10.0	Cs			086-087	12.08.16	17:11 – 17:24
GN022A	55° 00.02' N	006° 59.87' E	32	bottom, 5		Cs			088-089	12.08.16	20:11 – 20:24
GN023	55° 00.00' N	007° 34.94' E	26	bottom, 5		Cs/Sr/H3			090-091	12.08.16	22:41 – 22:56
GN024	54° 59.93' N	007° 59.92' E	18	bottom, 5					092-093	13.08.16	01:05 – 01:17
GN025	54° 59.93' N	008° 14.96' E	15	bottom, 5		Cs/Sr/H3/KNiFC	1x5 m	1x5 m	094-095	13.08.16	02:18 – 02:55
GN026	56° 00.09' N	007° 47.78' E	29	bottom, 2 x 5	4.5	Cs/Sr/H3	1x5 m	1x5 m	096-098	13.08.16	11:07 – 11:35
GN026A	55° 59.99' N	007° 00.04' E	36	bottom, 5		Cs/Sr/H3			099-100	13.08.16	15:07 – 15:26
GN027	56° 00.03' N	006° 00.21' E	49	bottom, 2 x 5		Cs	1x5 m	1x5 m	101-103	13.08.16	19:38 – 20:01
GN028	55° 59.99' N	004° 59.99' E	43	bottom, 5		Cs			104-105	13.08.16	23:50 – 00:02
GN028S	56° 00.00' N	003° 59.95' E	58	bottom, 5		Cs/KNiFC			106-107	14.08.16	03:45 – 03:57
GN029	56° 00.03' N	003° 00.15' E	74	bottom, 3 x 5	16.0	Cs/Sr/H3	2x5 m	2x5 m	108-111	14.08.16	07:20 – 07:55
GN030	56° 00.08' N	001° 59.79' E	87	bottom, 2 x 5	13.5	Cs			112-114	14.08.16	11:20 – 11:36
GN031	56° 00.01' N	000° 59.84' E	77	bottom, 2 x 5	15.0	Cs			115-117	14.08.16	15:15 – 15:36
GN032	56° 00.03' N	000° 00.04' E	85	bottom, 2 x 5	17.5	Cs			118-120	14.08.16	19:02 – 19:15
GN033	56° 00.06' N	001° 00.17' W	66	bottom, 3 x 5		Cs	1x5 m	1x5 m	121-124	14.08.16	22:48 – 23:15
GN033A	56° 00.00' N	001° 40.25' W	67	bottom, 5		Cs/Sr/H3			125-126	15.08.16	01:46 – 02:08
GN033S	56° 30.10' N	001° 40.09' W	59	bottom, 5		-			127-128	15.08.16	05:13 – 05:25
GN034A	56° 59.92' N	001° 40.00' W	76	bottom, 5		Cs/Sr/H3/Pu			129-130	15.08.16	08:28 – 08:47
GN034	56° 59.89' N	001° 00.23' W	73	5 x bottom, 2x5	13.5	Cs			131-133	15.08.16	11:06 – 11:21
GN034S	56° 59.99' N	000° 10.10' E	84	bottom, 5		-			134-135	15.08.16	15:27 – 15:39
GN035	56° 59.79' N	001° 20.27' E	99	bottom, 55, 3 x 5		Cs	1x5 m 1x50 m	1x5 m 1x50m	136-140	15.08.16	19:45 – 20:34
GN035S	57° 00.03' N	002° 25.13' E	81	bottom, 5		-			141-142	16.08.16	00:23 – 00:34
GN036	57° 00.05' N	003° 29.97' E	65	bottom, 3x5		Cs/Sr/H3	1x5 m	1x5 m	143-146	16.08.16	04:20 – 04:50
GN037	56° 59.98' N	004° 59.39' E	50	bottom, 2 x 5	15.5	Cs			147-149	16.08.16	09:46 – 09:58
GN038	57° 00.01' N	005° 59.94' E	52	bottom, 5 x 20, 2 x 5	11.5	Cs	1x5 m	2x5 m	150-157	16.08.16	13:32 – 14:15

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	Organic 100 L	Organic 10 L	Bedford-Nr. 164nnn	date dd.mm.yy	time [UTC]
GN038A	57° 00.07' N	006° 59.95' E	33	bottom, 2 x 5	15.5	Cs/Sr/H3			158-160	16.08.16	17:50 – 18:07
GN039	57° 00.03' N	007° 59.96' E	33	bottom, 2 x 5		Cs/Sr/H3	2x5 m	1x5 m	161-163	16.08.16	21:36 – 22:08
GN039S	57° 25.12' N	007° 59.88' E	94	bottom, 2 x 5		-	1x5 m	1x5 m	164-166	17.08.16	01:00 – 01:28
GN040	57° 49.96' N	007° 59.84' E	522	bottom, 50, 5 x 10, 2 x 5	8.0	Cs/Sr/H3	1x5 m 1x50 m	1x5 m 1x50m	167-175	17.08.16	04:14 – 05:28
GN040S	57° 55.04' N	006° 59.76' E	363	bottom, 5					176-177	17.08.16	08:26 – 09:02
GN041	58° 00.00' N	005° 59.95' E	308	bottom, 2 x 5	11.0	Cs/Sr/H3/KNiFC	1x5 m	1x5 m	178-180	17.08.16	12:22 – 13:11
GN042	58° 00.04' N	005° 00.12' E	128	bottom, 5	10.5	Cs			181-182	17.08.16	16:59 – 17:13
GN042S	58° 00.04' N	004° 00.11' E	98	bottom, 5		-			183-184	17.08.16	20:38 – 20:50
GN043	58° 00.12' N	003° 00.13' E	78	bottom, 2 x 5		Cs	1x5 m	1x5 m	185-187	18.08.16	00:13 – 00:44
GN044	57° 59.99' N	001° 30.05' E	105	bottom, 3 x 5	17.5	Cs/Sr/H3	1x5 m	1x5 m	188-191	18.08.16	05:34 – 05:59
GN044S	58° 00.04' N	000° 15.17' E	141	bottom, 5		-			192-193	18.08.16	10:07 – 10:24
GN045	57° 59.93' N	000° 59.93' W	114	bottom, 3x5		Cs/Sr/H3/KNiFC	1x5 m	1x5 m	194-197	18.08.16	14:35 – 15:01
GN045A	57° 59.94' N	001° 59.77' W	78	bottom, 5		Cs/Sr/H3			198-199	18.08.16	18:21 – 18:39
GN45B	58° 30.08' N	002° 29.93' W	73	bottom, 5		Cs/Sr/H3			200-201	18.08.16	22:10 – 22:37
GN046A	58° 59.97' N	002° 00.05' W	79	bottom, 5		Cs/Sr/H3			202-203	19.08.16	02:28 – 02:47
GN046	58° 59.97' N	001° 29.97' W	106	bottom, 3 x 5	6.5	Cs	1x5 m	1x5 m	204-207	19.08.16	04:39 – 05:06
GN047	58° 59.94' N	000° 00.21' W	132	bottom, 2 x 5	17.5	Cs			208-210	19.08.16	10:00 – 10:15
GN048	58° 59.96' N	000° 59.74' E	126	bottom, 3 x 5	18.5	Cs/Sr/H3	1x5 m	1x5 m	211-214	19.08.16	13:40 – 14:07
GN048S	58° 59.99' N	001° 59.82' E	115	bottom, 5		-			215-216	19.08.16	17:30 – 17:47
GN049	59° 00.00' N	002° 59.72' E	138	bottom, 2 x 5		Cs			217-219	19.08.16	21:08 – 21:22
GN049S	59° 00.05' N	003° 44.99' E	273	bottom, 5		-			220-221	20.08.16	00:06 – 00:30
GN050	58° 59.92' N	004° 30.06' E	260	bottom, 2 x 5		Cs/Sr/H3	1x5 m	1x5 m	222-225	20.08.16	03:03 – 03:41
GN050S	59° 29.17' N	004° 30.29' E	266	bottom, 5		-			226-227	20.08.16	06:51 – 07:11
GN051	59° 59.99' N	004° 30.17' E	261	bottom, 3 x 5	12.0	Cs/Sr/H3	1x5 m	1x5 m	228-231	20.08.16	10:13 – 10:49
GN051S	59° 59.96' N	003° 14.95' E	217	bottom, 5		-			232-233	20.08.16	14:47 – 15:07
GN052	60° 00.05' N	001° 59.95' E	101	bottom, 3x5	13.0	Cs	1x5 m	2x5 m	234-237	20.08.16	19:01 – 19:31
GN052S	60° 00.05' N	000° 45.31' E	130	bottom, 5 2x600 l sea water for CL		-			238-239	20.08.16	23:43 – 23:57
GN053	60° 00.03' N	000° 29.96' W	124	bottom, 3 x 5		Cs/Sr/H3	1x5 m	1x5 m	240-243	21.08.16	03:58 – 04:26
GN053A	59° 48.04' N	001° 20.39' W	86	bottom, 5		Cs/KNiFC			244-245	21.08.16	07:23 – 07:41
GN053B	60° 00.01' N	001° 59.95' W	88	bottom, 5		Cs			246-247	21.08.16	10:17 – 10:32
GN054	60° 00.01' N	002° 59.95' W	102	bottom, 2x5	9.0	Cs			248-250	21.08.16	14:05 – 14:19
GN054S	59° 59.98' N	004° 19.80' W	147	bottom, 5		-			251-252	21.08.16	18:33 – 18:49
GN055	60° 00.05' N	004° 59.70' W	415	bottom, 2 x 5		Cs/Sr/H3	2x5 m	1x5 m	253-255	21.08.16	21:06 – 21:55
GN065	59° 59.92' N	005° 59.80' W	1063	bottom, 2 x 5		Cs			256-258	22.08.16	01:19 – 02:24

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	Organic 100 L	Organic 10 L	Bedford-Nr. 164nnn	date dd.mm.yy	time [UTC]
<b>GN066</b>	59° 59.91' N	007° 00.05' W	454	bottom, 2 x 5	10.5	Cs			259-261	22.08.16	05:35 – 06:08
<b>GN067</b>	60° 00.02' N	007° 59.94' W	753	bottom, 3x5 5 x 270 l at 50, 100, 250, 500, and 750	9.0	Cs/Sr/H3	1x5 m	2x5 m	262-265	22.08.16	09:23 – 12:58
<b>GN068</b>	59° 35.04' N	007° 20.11' E	1006	bottom, 2 x 5	13.5	Cs			266-268	22.08.16	16:46 – 17:45
<b>GN069</b>	59° 10.10' N	006° 39.97' E	237	bottom, 2 x 5		Cs			269-271	22.08.16	21:19 – 21:34
<b>GN056B</b>	58° 45.04' N	006° 00.09' E	121	bottom, 5		Cs/KNiFC			272-273	23.08.16	01:11 – 01:29
<b>GN056</b>	58° 44.96' N	004° 59.94' E	84	bottom, 3 x 5	12.5	Cs	1x5 m	1x5 m	274-277	23.08.16	05:06 – 05:30
<b>GN057A</b>	58° 45.00' N	004° 00.01' E	81	bottom, 5		Cs			278-279	23.08.16	09:04 – 09:15

Water depth corrected for draft (5 m)!