BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Scientific Cruise Reports

Reise 18019
August 28 - September 13, 2018
Hamburg (Germany) - Bremerhaven (Germany)

Holger Klein

RV Celtic Explorer

BSH Hamburg and Rostock, 2018

R/V *Celtic Explorer* 18019
August 28th – September 13th, 2018

BSH NORTH SEA SUMMER SURVEY 1998 - 2018

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

R/V *Celtic Explorer* 18019
28.08. - 13.09.2018
Hamburg - Bremerhaven

Report of the Chief Scientist

ICES Cruise Id: 45CE18019

CSRREF: 20183283

Holger Klein

Hamburg, September 2018

(CR-Celtic-Explorer-18019.docx)

Contents:

Participants

Science Crew BSH	Working Group	Ship Crew	Rank
Holger Klein	Marine Physics, Chief Scientist	Antony Hobin	Master
Peter Löwe	Marine Physics	Damien McCallig	Chief Engineer
Sören Joswig	Marine Physics	Basil Murphy	Chief Officer
Simon Tewes	Marine Physics	Paddy Kenny	2nd Officer
Dr. Stefanie Schmied	Marine Chemistry, Radioactivity	Adam Aleksa	2nd Engineer
Klaus Becker	Marine Chemistry, Radioactivity	Paul Taylor	ETO
Sven Hintze	Marine Chemistry, Radioactivity	Ken O'Neill	Bosun
Roswitha Velten	Marine Chemistry, Nutrients	Tony Reck	Cook
Wiebke Brandt	Marine Chemistry, Nutrients	Michelin Faherty	Bosun's Mate
Enno Meyer	Marine Chemistry, Organic	Jimmy Burke	AB Deckhand 06-12
Elke Hammermeister	Marine Chemistry, Organic	Declan Horan	AB Deckhand 12-06
Jan Neukirchen	Marine Chemistry, Organic	Gavin Cunningham	Assistant Cook
		Anthony English	Technician
		Martin Powell	AB Deckhand 06-12
		Laurence Moran	AB Deckhand 12-06

Fig. 1: *The BSH crew: 1. row (ltr): Stefanie Schmied, Roswitha Velten, Sören Joswig. 2. row: Elke Hammermeister, Jan Neukirchen, Wiebke Brandt, Holger Klein, Klaus Becker. Last row: Simon Tewes, Sven Hintze, Peter Löwe, Enno Meyer.*

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 C 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. This was not possible in 2018 due to limited ship time.

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	●	●	(●)	●	●	●
28.08.2018 – 13.09.2018	R/V Celtic Explorer 18019		●	●	●		●	

Table 1: *BSH North Sea Summer Surveys 1998-2018.*

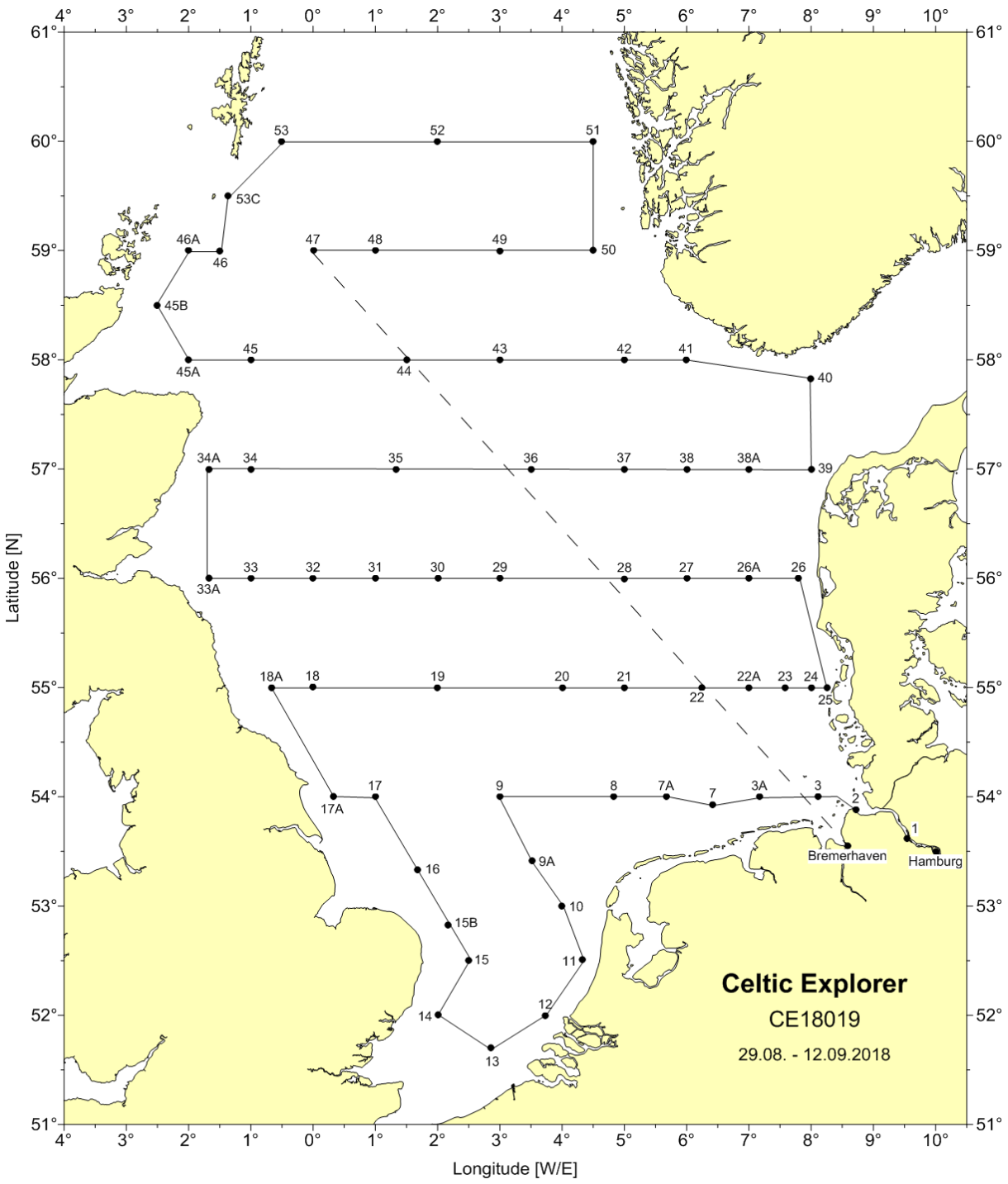


Fig. 2: *Ship track and sampling stations.*

Equipment and Methods

Marine Physics:

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

instrument/sensor	typ	S/N	last calibration
CTD S1	SBE911+	09P21787	
p-sensor	SBE9P	0577	03.02.2014
T-sensor	SBE3T	2584	26.06.2018
C-sensor	SBE4C	2886	26.06.2018
O_2-sensor	SBE43	0171	09.05.2018
Fluorometer & Turbidity	WetlabECO	4964	15.01.2018
pH-sensor	SBE 18	1419	18.06.2018
Altimeter	Benthos Teledyne	978	14.03.2002
Rosette Sampler S1	12 × Niskin 10 l	—	—
CTD S2 (back-up system)	SBE911+	09P25457	
p-sensor	SBE9P	0641	28.06.2011
T-sensor	SBE3T	2808	16.06.2017
C-sensor	SBE4C	2752	16.06.2017
O_2-sensor	SBE43	0153	01.06.2018
Deck Unit	SBE11+	P31787-0526	—
Spare Deck Unit	SBE11+	P25457-0585	—
Vessel mounted sensors:			
Thermosal	SBE21	2127556-3163	July 2018
Turner Fluorimeter for turbidity and chlorophyll	10-AU-005-CE	6401 RXX	July 2018 cleaning

10 liter Niskin sampler				
position release unit	**sampler ID**	**tension mechanism**	**rosette**	**date**
1	S-ID181005	spring	S1	June 2018
2	S-ID181006	spring	S1	June 2018
3	S-ID181007	spring	S1	June 2018
4	HydroBios test	spring	S1	June 1208
5	S-ID181014	spring	S1	June 2018
6	S-ID181002	spring	S1	June 2018
7	S-ID181013	spring	S1	June 2018
8	S-ID181001	spring	S1	June 2018
9	S-ID181011	spring	S1	June 2018
10	S-ID181003	spring	S1	June 2018
11	S-ID181004	spring	S1	June 2018
12	S-ID181012	spring	S1	June 2018

31.08.2018: S-ID181012 to position 6, S-ID181002 to position 12
03.09.2018: Bottles between position 3 and 6 have been exchanged (before GN026A)

Nutrients:

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

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.
- 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.

Organic Pollutants

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

Celtic Explorer at sea. Painting by Rosa Velten according to a photo of Declan Horan

Container Plan for leg a & b

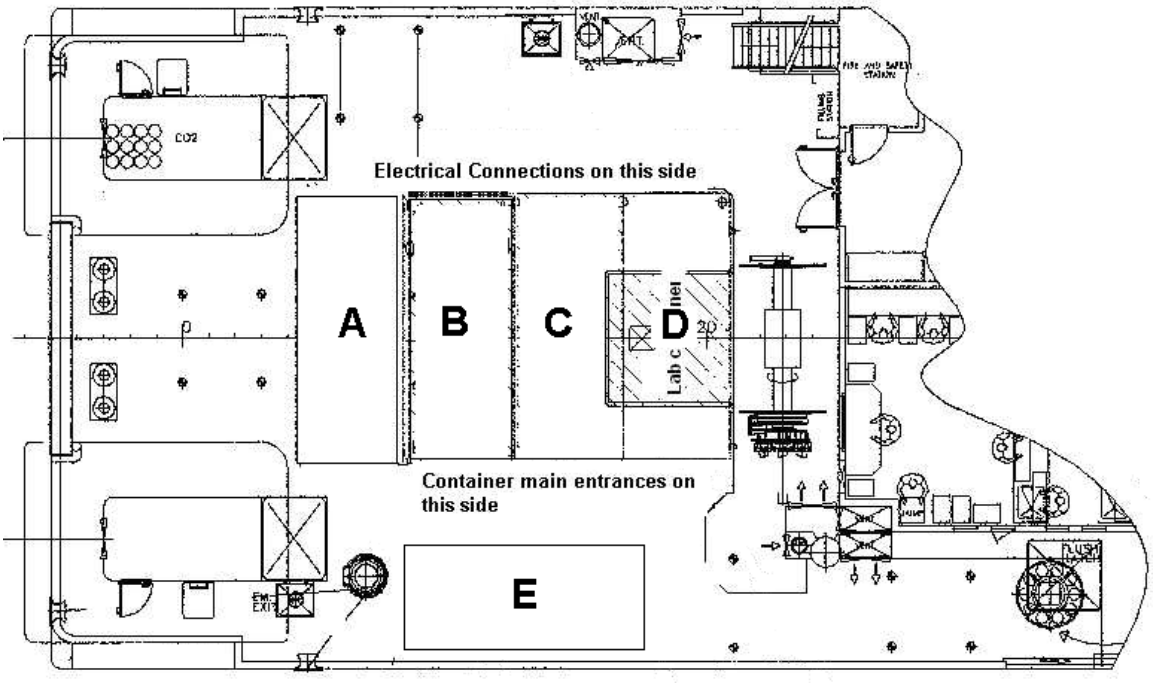


Fig. 3: *Container plan Celtic Explorer*

slot	container type	weight	power supply
A	Four 600 l drums for nutrients and calibration lab		
B	Bottom: 20" M33 lab container, height 3.1 m (HM) Top: —	9	2 x 32 A
C	Bottom: 20" Transport container radioactivity Top: 10” 10" Store container for marine chemistry	9 t 2 t	— —
D	Bottom: 20“ M32 lab container for radioactivity, fresh- and sea wate Top: —	5 t	32 A
E	20" Transport and store container	9 t	—
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 = 150 liter sea water samples for the determination of cesium-137 by Potassium-Nickel Hexacyanoferrate.

OG: Samples with 100, 10, and 5 L glass spheres for polar and nonpolar organic contaminants.

Watch table marine physics:

00-04/12-16: Simon
04-08/16-20: Peter
08-12/20-00: Sören

Watch table radioactivity:

00-12: Steffi
12-00: Klaus
08-20: Sven

Watch table nutrients:

06-18: Wiebke
18-06: Rosa

Watch table Organic contaminants:

variable

Tuesday, August 28th, 2018

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

09:30 Arrival of containers and equipment. Start of mobilisation by use of the local crane.

12:35 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 Paddy Kenny.

Celtic Explorer leaving Hamburg harbour. Painting by Rosa Velten

Wednesday, August 29th, 2018

03:50 Sailing.

🡻 **05:54 – 06:07 <u>Station STADE</u>:**
RA: Cs-137, Sr-90, Pu, H-3.
OG: 1×10 L nonpolar, 1×5 L polar, 5 m depth.
W&S: Bft. 3, 100°, 1016 hPa, T_A = 15.5 °C, fine. T_w = 20.5 °C.

🡻 **08:54 – 09:06 <u>Station MEDEM</u>:**
RA: Cs-137, Sr-90, Pu, H-3.
OG: 1×10 L nonpolar, 1×5 L polar, 5 m depth.
W&S: Bft. 3, 130°, 1015 hPa, T_A = 21.4 °C, fine. T_w = 19.1.5 °C, S = 20.42 psu.

09:45: Muster Station exercise.

- **11:23 - 11:50 <u>Station GN003/ELBE1</u>:**
  Secchi depth and CTD profile with rosette.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×10 L nonpolar, 1×10 L nonpolar, 1×5 L polar, 5 m depth.
  W&S: Bft. 3-4, 100°, 1012 hPa, T_A = 20.0 °C, fine, T_w = 19.4 °C,S = 32.89 psu.

- **15:11 – 15:39 <u>Station GN003A:</u>**
  CTD profile with rosette sampler,
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×5 L polar, 5 m depth.
  W&S: Bft. 4, 330°, 1012 hPa, T_A = 21.1 °C, overcast, T_w = 19.5 °C, S = 33.22 psu.

- **18:23 – 18:56 <u>Station GN007</u> (Borkumriffgrund):**
  Secchi depth and CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×10 L polar, 1×5 L polar, 5 m depth.
  W&S: Bft. 5, 340°, 1014 hPa, T_A = 18.8 °C, overcast, T_w = 19.5 °C, S = 33.80 psu.

- **22:06 – 22:17 <u>Station GN007A</u>:**
  CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 3, 330°, 1015 hPa, T_A = 18.0 °C, obscured sky, T_w = 19.1 °C, S = 34.90 psu.

Thursday, August 30th, 2018

- **01:27 – 01:55 <u>Station GN008</u>:**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 5-6, 340°, 1017 hPa, T_A = 16.8 °C, obscured sky, T_w = 17.9 °C, S = 34.48 psu.

- **08:24 – 09:06 <u>Station GN009</u> (Outer Well Bank):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom; tenfold determination of O_2 at 5 m.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 4×10 L polar, 5 m depth.
  W&S: Bft. 2, 250°, 1022 hPa, T_A = 19.2 °C, cloudy, T_w = 16.6 °C, S = 34.57 psu.

  Sample bottle S-ID181002 was leaking, the lower O-ring seal was missing and has been replaced. Sample bottle with Bedford ID 184015 was not closed.

- **13:09 – 13:21 <u>Station GN009A</u>:**
  CTD profile with rosette sampler.
  RA: Cs-137.
  W&S: Bft. 3, 340°, 1023 hPa, T_A = 18.1 °C, fine, T_w = 18.5 °C, S = 34.39 psu.

- **16:29 – 16:47 <u>Station GN010</u> (west of Den Helder):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 1, 350°, 1023 hPa, T_A = 19.8 °C, fine, T_w = 18.4 °C, S = 34.72 psu.

- **20:28 – 20:59 <u>Station GN011</u> (west of Ijmuiden):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom; tenfold determination of chlorophyll at 5 m.
  RA: Cs-137.
  OG: 2×100 L nonpolar, 1×5 L polar, 5 m depth.
  W&S: Bft. 2, 360°, 1023 hPa, T_A = 17.2 °C, obscured sky, T_w = 19.4 °C, S = 32.53 psu.

Friday, August 31st, 2018

- **01:10 – 01:35 <u>Station GN012</u> (west of Hoek van Holland):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 2×5 L polar, 5 m depth.
  W&S: Bft. 2, 120°, 1023 hPa, T_A = 17.6 °C, obscured sky, T_w = 19.7 °C, S = 32.83 psu.

- **05:43 – 06:11 <u>Station GN013</u> (Rabsbank):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×5 L polar, 5 m depth.
  W&S: Bft. 1-2, 150°, 1023 hPa, T_A = 17.3 °C, partly cloudy, T_w = 19.3 °C, S = 34.56 psu.

- **09:45 - 11:1 <u>Station GN014</u> (Outer Gabbard):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×5 L polar, 5 m depth.
  W&S: Bft. 3, 30°, 1024 hPa, T_A = 19.6 °C, fine, T_w = 19.1 °C, S = 34.75 psu.

- **14:19 – 14:36 <u>Station GN015</u> (east of Lowestoft):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  W&S: Bft. 1, 90°, 1024 hPa, T_A = 21.6 °C, fine, T_w = 19.1 °C, S = 33.96 psu

- **16:43 – 16:59 <u>Station GN015B</u>:**
  CTD profile with rosette sampler.
  RA: Cs-137.
  W&S: Bft. 1-2, 80°, 1024 hPa, T_A = 19.0 °C, fine, T_w = 19.0 °C, S = 34.19 psu

- **20:05 – 20:16 <u>Station GN016</u> (Haddock Bank):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  Tenfold determination of pH at 5 m.
  RA: Cs-137.
  W&S: Bft. 2, 130°, 1025 hPa, T_A = 15.9 °C, obscured sky, T_w = 16.4.0 °C, S = 34.57 psu.

  Sample bottle with Bedford ID 184047 (position 2 of release unit) was not closed.

Saturday, September 1st, 2018

- **01:02 – 01:42 <u>Station GN017</u> (east of Flamborough Head):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 4×10 L polar, 5 m depth.
  W&S: Bft. 3, 180°, 1025 hPa, T_A = 14.7 °C, obscured sky, T_w = 14.8 °C, S = 34.52 psu.

- **03:54 – 04:18 <u>Station GN017A</u>:**
  CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 3, 180°, 1024 hPa, T_A = 14.5 °C, fine, T_w = 13.7 °C, S = 34.42 psu.

- **11:15 – 11:28 <u>Station GN018A</u>:**
  CTD profile with rosette sampler.
  RA: Cs-137.
  W&S: Bft. 4, 160°, 1024 hPa, T_A = 17.1 °C, partly cloudy, T_w = 14.4 °C, S = 34.40 psu.

- **13:47 – 14:16 <u>Station GN018</u> (Baymans Hole):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137,
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 4, 170°, 1024 hPa, T_A = 11.1 °C, fine, T_w = 16.0 °C, S = 34.53 psu.

- **21:02 – 21:37 <u>Station GN019</u> (Doggerbank):**
  CTD profile with rosette sampler (2 casts due to technical problems).
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 5-6, 190°, 1026 hPa, T_A = 17.6 °C, obscured sky, T_w = 16.8 °C, S = 34.72 psu

Sunday, September 2nd, 2018

03:00 Filling of a 600 liter container with sea water for M31 group.

🡻 **04:06 – 04:40 Station GN020 (east of Doggerbank):**
CTD profile with rosette sampler.
pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
RA: Cs-137, Sr-90, Pu, H-3.
OG: 1×100 L nonpolar, 1×10 polar, 5 m depth.
W&S: Bft. 4, 180°, 1027 hPa, T_A = 17.0 °C, fine, T_w = 17.3 °C, S = 34.70 psu.

🡻 **08:04 – 23:41 Station GN021/AWZW2 (Nordschillgrund):**
Secchi depth, CTD profile with rosette sampler.
pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
RA: Cs-137.
W&S: Bft. 3, 170°, 1028 hPa, T_A = 17.8 °C, fine, T_w = 17.4 °C, S = 34.44 psu

🡻 **12:17 – 12:55 Station GN022 (Weiße Bank):**
Secchi depth, CTD profile with rosette sampler.
pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
RA: Cs-137.
OG: 1×100 L nonpolar, 1×10 L nonpolar, 1×10 L polar, 5 m depth.
W&S: Bft. 2, 140°, 1028 hPa, T_A = 20.3 °C, fine, T_w = 18.6 °C, S = 34.42 psu.

Sample bottle with Bedford ID 184072 (position 3 of release unit) was not closed.

🡻 **15:22 – 15:57 Station GN022A:**
Secchi depth, CTD profile with rosette sampler.
RA: Cs-137.
OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
W&S: Bft. 2, 20°, 1027 hPa, T_A = 21.6 °C, fine, T_w = 18.7 °C, S = 33.56 psu.

🡻 **18:10 – 18:31 Station GN023:**
Secchi depth, CTD profile with rosette sampler.
pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
RA: Cs-137, Sr-90, Pu, H-3
OG: 1×100 L nonpolar, 1×5 L polar, 5 m depth..
W&S: Bft. 4, 30°, 1026 hPa, T_A = 18.7 °C, fine, T_w = 18.8 °C, S = 32.32 psu.

🡻 **20:26 – 20:48 Station GN024:**
CTD profile with rosette sampler.
pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
RA: —
OG: 1×100 L nonpolar, 1×5 L polar, 5 m depth.
W&S: Bft. 3, 90°, 1026 hPa, T_A = 19.1 °C, fine, T_w = 19.1 °C, S = 31.91 psu.

🡻 **22:00 – 22:22 Station GN025 (west of Sylt):**
CTD profile with rosette sampler.
pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
RA: Cs-137, Sr-90, Pu, H-3.
OG: 1×100 L nonpolar, 1×5 L polar, 5 m depth.
W&S: Bft. 3, 70°, 1026 hPa, T_A = 18.1 °C, obscured sky, T_w = 18.6 °C, S = 32.04 psu.

Monday, September 3rd, 2018

- **06:07 – 06:29 Station GN026 (west of Lyngvik):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×5 L polar, 5 m depth.
  W&S: Bft. 4, 100°, 1024 hPa, T_A = 17.7 °C, overcast, T_w = 18.5 °C, S = 32.81 psu.

  Sample bottle on position 3 of release unit was not closed.

- **09:08 – 09:28 Station GN026A:**
  CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 3, 90°, 1023 hPa, fine, T_A = 19.2 °C, T_w = 18.0 °C, S = 33.34 psu.

  Sample bottles on position 2 and 3 of release unit were not closed.

  The release unit on top of the rosette sampler was replaced by a spare unit.

- **12:48 – 13:12 Station GN027:**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 3, 70°, 1022 hPa, T_A = 17.8 °C, cloudy, T_w = 17.9 °C, S = 34.08 psu.

- **16:30 – 16:41 Station GN028:**
  Secchi depths, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  W&S: Bft. 2, 50°, 1021 hPa, T_A = 17.6 °C, partly cloudy, T_w = 17.5 °C, S = 34.12 psu.

- **23:02 – 23:45 Station GN029:**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 2×100 L nonpolar, 2×10 L polar, 5 m depth.
  Filling of a 600 liter container with sea water for M31 group.
  W&S: Bft. 3, 20°, 1021 hPa, T_A = 16.7 °C, obscured sky, T_w = 17.2 °C, S = 35.03 psu.

Tuesday, September 4th, 2018

- **03:02 – 03:19 Station GN030:**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  W&S: Bft. 3, 20°, 1021 hPa, T_A = 15.7 °C, obscured sky, T_w = 16.8 °C, S = 35.05 psu.

- **06:35 – 06:44 Station GN031:**
  Secchi depths, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  W&S: Bft. 3, 60°, 1022 hPa, T_A = 16.1 °C, partly cloudy, T_w = 16.6 °C, S = 34.87 psu.

- **10:03 – 10:18 <u>Station GN032</u>:**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  W&S: Bft. 3, 50°, 1022 hPa, T_A = 16.2 °C, cloudy, T_w = 16.4 °C, S = 34.76 psu.

- **13:33 – 14:00 <u>Station GN033</u> (east of Firth of Forth):**
  Secchi depths, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 3, 10°, 1023 hPa, T_A = 14.3 °C, overcast, T_w = 14.4 °C, S = 34.63 psu.

- **16:11 – 16:37 <u>Station GN033A:</u>**
  CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 4, 10°, 1024 hPa, T_A = 11.9 °C cloudy, T_w = 13.2 °C, S = 34.54 psu.

- **22:40 – 22:55 <u>Station GN034A:</u>**
  CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 1, 340°, 1024 hPa, T_A = 13.6 °C, obscured sky, T_w = 13.2 °C, S = 34.63 psu.

Wednesday, September 5th, 2018

- **01:03 – 01:28 <u>Station GN034</u> (Aberdeen Bank):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 1, 320°, 1024 hPa, T_A = 13.0 °C, obscured sky, T_w = 13.2 °C, S = 34.62 psu.

- **09:04 – 10:16 <u>Station GN035</u> (Coal Pitt):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m and depth and about 3 m above bottom.
  Tenfold determination of alkalinity at 5 m depth.
  RA: Cs-137.
  OG: 2×100 L nonpolar, 2×10 L polar, 5 and 50 m.
  W&S: Bft. 3, 40°, 1023 hPa, T_A = 15.8 °C, fine, T_w = 15.8 °C, S = 34.79 psu.

- **17:16 – 17:47 <u>Station GN036</u>:**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 3, 30°, 1021 hPa, T_A = 15.3 °C, partly cloudy, T_w = 17.0 °C, S = 34.31 psu.

- **22:36 – 22:48 <u>Station GN037</u> (Große Fischerbank):**
  CTD profile with rosette sampler and nutrients.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  W&S: Bft. 2, 70°, 1019 hPa, T_A = 14.9 °C, obscured sky, T_w = 17.0 °C, S = 33.85 psu.

Thursday, September 6th, 2018

- **02:05 – 02:50 <u>Station GN038</u> (Kleine Fischerbank):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 4×10 L nonpolar, 5 m depth.
  W&S: Bft. 1, 70°, 1017 hPa, T_A = 16.8 °C, obscured sky, T_w = 16.7 °C, S = 33.73 psu.
- **06:04 – 06:18 <u>Station GN038A:</u>**
  CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 2, 130°, 1015 hPa, T_A = 17.6 °C, overcast, drizzle, T_w = 17.3 °C, S = 33.54 psu.
- **09:32 – 10:00 <u>Station GN039</u> (east of Jyske Rev):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 2×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 3-4, 140°, 1015 hPa, T_A = 19.4 °C, cloudy, T_w = 17.9 °C, S = 33.06 psu.
- **14:45 – 16:02 <u>Station GN040</u> (Skagerrak):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 2×100 L nonpolar, 2×10 L polar, 5 and 50 m depth.
  W&S: Bft. 4, 100°, 1014 hPa, T_A = 19.1 °C, partly cloudy, T_w = 17.5°C, S = 31.63 psu.
- **21:43 – 22:23 <u>Station GN041</u> (west of Lindesnes):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 5, 120°, 1009 hPa, T_A = 18.4 °C, obscured sky, T_w = 16.9 °C, S = 31.28 psu.

Friday, September 7th, 2018

- **01:25 – 01:44 <u>Station GN042</u> (Eigersundbank):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  W&S: Bft. 3, 40°, 1009 hPa, T_A = 13.6 °C, obscured sky, T_w = 16.1 °C, S = 32.99 psu.

- **07:51 – 08:13 <u>Station GN043</u> (Lingbank East):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 4, 10°, 1006 hPa, T_A = 14.5 °C, cloudy, T_w = 15.8 °C, S = 34.94 psu.

- **12:53 – 13:19 <u>Station GN044</u> (Lingbank West):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 4, 290°, 1007 hPa, T_A = 16.1 °C, cloudy, T_w = 14.7 °C, S = 34.83 psu.

- **21:28 – 22:02 <u>Station GN045</u> (east of South Bank):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 6, 290°, 1007 hPa, T_A = 13.7 °C, obscured sky, T_w = 13.4 °C, S = 34.85 psu.

Saturday, September 8th, 2018

- **01:31 – 01:44 <u>Station GN045A</u> (West Bank):**
  CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 6, 300°, 1008 hPa, T_A = 13.5 °C, obscured sky, T_w = 13.4 °C, S = 34.69 psu.

- **05:34 – 05:47 <u>Station GN045B</u> (east of Pentland Firth):**
  Secchi depth, CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 6, 310°, 1008 hPa, T_A = 12.6 °C, overcast, T_w = 13.3 °C, S = 34.65 psu.

- **09:25 – 09:38 <u>Station GN046A:</u>**
  Secchi depth, CTD profile with rosette sampler.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 4, 310°, 1007 hPa, T_A = 13.5 °C, fog, obscured sky, T_w = 13.2 °C, S = 34.83 psu.

- **11:16 – 11:51 <u>Station GN046:</u>**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 2×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 3-4, 320°, 1007 hPa, T_A = 13.2 °C, fog, obscured sky, T_w = 13.8 °C, S = 35.12 psu.

- **15:00 – 15:14 <u>Station GN053C</u> (Fair Isle East):**
  Secchi depth, CTD profile with rosette sampler.
  RA: Cs-137.
  W&S: Bft. 3, 290°, 1007 hPa, T_A = 13.4 °C, cloudy, T_w = 14.0 °C, S = 35.13 psu.

- **19:09 – 19:36 <u>Station GN053</u> (E-lich Shetlands):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  Filling of a 600 liter container with sea water >35 psu for calibration lab.
  W&S: Bft. 2, 140°, 1006 hPa, T_A = 14.4 °C, obscured sky, T_w = 13.6 °C, S = 35.12 psu.

Sunday, September 9th, 2018

- **03:08 – 03:48 <u>Station GN052</u> (Bergen Bank):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  OG: 1×100 L nonpolar, 1×10 L nonpolar, 2×10 L polar, 5 m depth.
  W&S: Bft. 4, 140°, 1007 hPa, T_A = 15.0 °C, obscured sky, T_w = 14.8 °C, S = 34.68 psu.

- **11:14 – 11:50 <u>Station GN051</u> (west of Selbjörnsfjord):**
  Secchi depth, CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 6-7, 150°, 1008 hPa, T_A = 14.6 °C, overcast, T_w = 16.0 °C, S = 32.40 psu.

- **19:56 – 20:40 <u>Station GN050</u> (Utsira Loch):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  OG: 1×100 L nonpolar, 1×10 L polar, 5 m depth.
  W&S: Bft. 7, 220°, 1007 hPa, T_A = 16.8 °C, overcast, T_w = 17.0 °C, S = 31.22 psu.

Monday, September 10th, 2018

- **01:53 – 02:10 <u>Station GN049</u> (Utsira Grund):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  W&S: Bft. 5, 210°, 1006 hPa, T_A = 14.8 °C, overcast, T_w = 15.4 °C, S = 34.02 psu.

- **10:28 – 10:59 <u>Station GN048</u>:**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137, Sr-90, Pu, H-3.
  W&S: Bft. 7, 250°, 1005 hPa, T_A = 14.9 °C, cloudy, T_w = 13.6 °C, S = 34.97 psu.

- **15:34 – 15:54 <u>Station GN047</u> (Fladengrund Rinne):**
  CTD profile with rosette sampler.
  pH value, alkalinity, chlorophyll and O_2 at 5 m depth and about 3 m above bottom.
  RA: Cs-137.
  Filling of a 600 liter container with sea water >35 psu for calibration lab.
  W&S: Bft. 6, 240°, 1007 hPa, T_A = 14.0 °C, cloudy, T_w = 14.3 °C, S = 35.06 psu.

  16:00 Heading for Bremerhaven.

Tuesday, September 11th, 2018

06:00: Wind W 7-8 Bft., gusts up to 9 Bft., overcast, rain.
Final processing of the last water samples for RA and nutrients. Cleaning of facilities.
In the evening the wind is slowing down to WNW 5-6 Bft.

Wednesday, September 12th, 2018

Wind WNW 4-5 Bft., overcast, rain.
15:15 Arrival at German Dry Dock, Bremerhaven

Thursday, September 13th, 2018

Demobilization. A part of the equipment was transferred to FS Wega for the German Bight cruise next week.

Regular visitors: Northern Gannets

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 prior to their final processing and analysis.

SST

SST is a reliable representative for of the seasonal mixed layer temperature. Due to increasing solar radiation a seasonal stratification is established 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 depths 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.

The area-averaged North Sea SSTs started in 2018 with moderate positive anomalies (0.4 K, See Table 2) and dropped due to unusually intense cooling to -0.9 K in March. This drop was followed by an extremely steep rise of 11.4 K from March to July, which has never been observed before (Fig. 4). At 16.3 °C (2 K), the monthly mean SST in July ranked 2nd warmest in the past 50 years, falling short of the record high of July 2014 by just 0.1 K. SST averaged 17.0 °C in August and remained at 2.0 K above normal. During the survey the North Sea had an average SST of 15.95 °C.

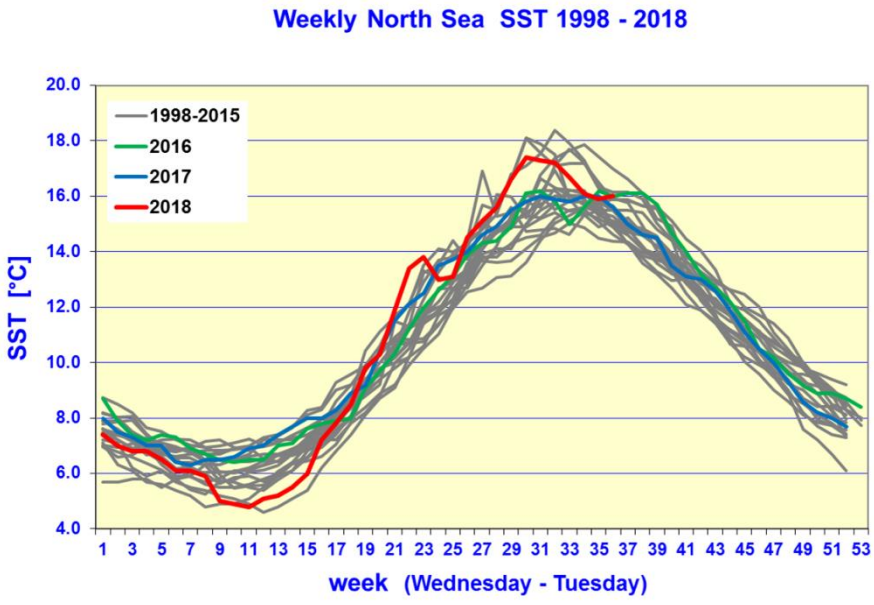


Fig. 4: *Weekly area averaged North Sea SST 1998 – 11.09.2018*

[2] psu = practical salinity units

Table 2: Monthly North Sea area-averaged SSTs and anomalies SST in 2018 (Reference period 1971-1993)

2018	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep
°C	7.0	6.1	4.8	6.3	9.9	13.5	16.2	17.0	15.0
K	0.4	0.4	-0.9	-0.3	0.8	1.5	2.0	2.0	1.3

Temperature

The water temperatures along the zonal (east-west) 54° N section are completely vertically mixed due to low water depths, the 55° N section is vertically mixed along its shallower eastern part. From 55° N (deeper western part only) and up to 60° N all sections show a massive, homogeneously mixed surface layer with a strong thermocline at about 30 m depth which grows weaker along the UK coast due to strong tidal currents. The temperatures of the upper mixed layer resemble those of the 2017 survey, which was carried out about one month early in August when SSTs were at their seasonal peak.

Salinity

At the surface the salinity sections show a relative narrow inflow of Atlantic Water (S >35 psu) over the East Shetland Shelf and the Fair Isle Channel which is also visible on the 59° N section but not on southern sections. In the bottom layer there is a broad inflow over the entire section reaching southward with a small tip to 56° N. This southern tip is part of an isolated column of Atlantic Water which extends from bottom to surface. At the southern connection between North Sea and Atlantic, the eastern approach to the Strait of Dover, no Atlantic Water was detected. The total salt budget will not be calculated prior to the final processing of the data and the analysis of the in-situ salinity samples for CTD calibration.

Where the ocean meets the sky. Peter Löwe

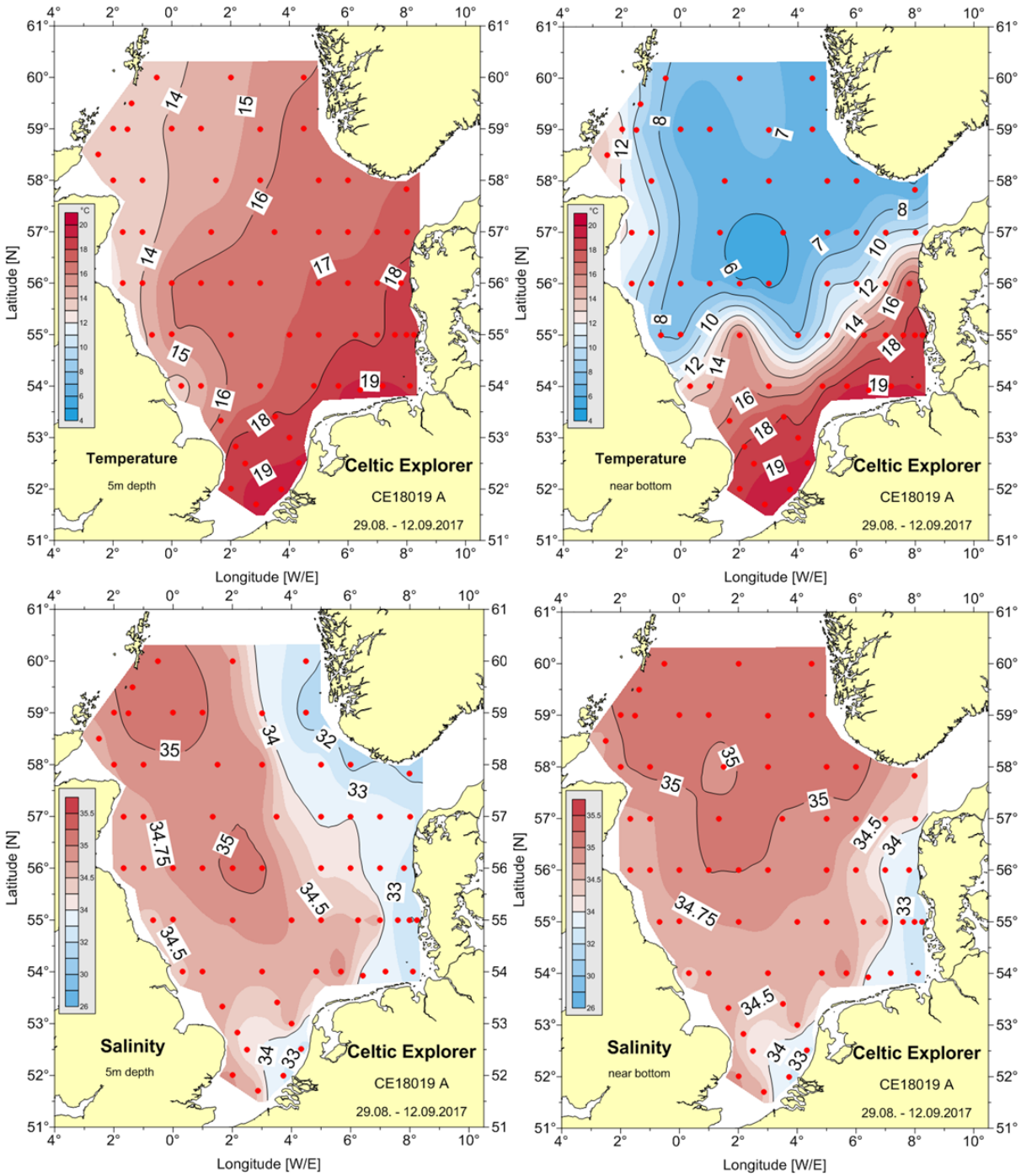


Fig: 5: *Top: Temperature distribution at 5 m depth (left) and near bottom (right). Bottom: Salinity distribution at 5 m depth (left) and near bottom (right).*

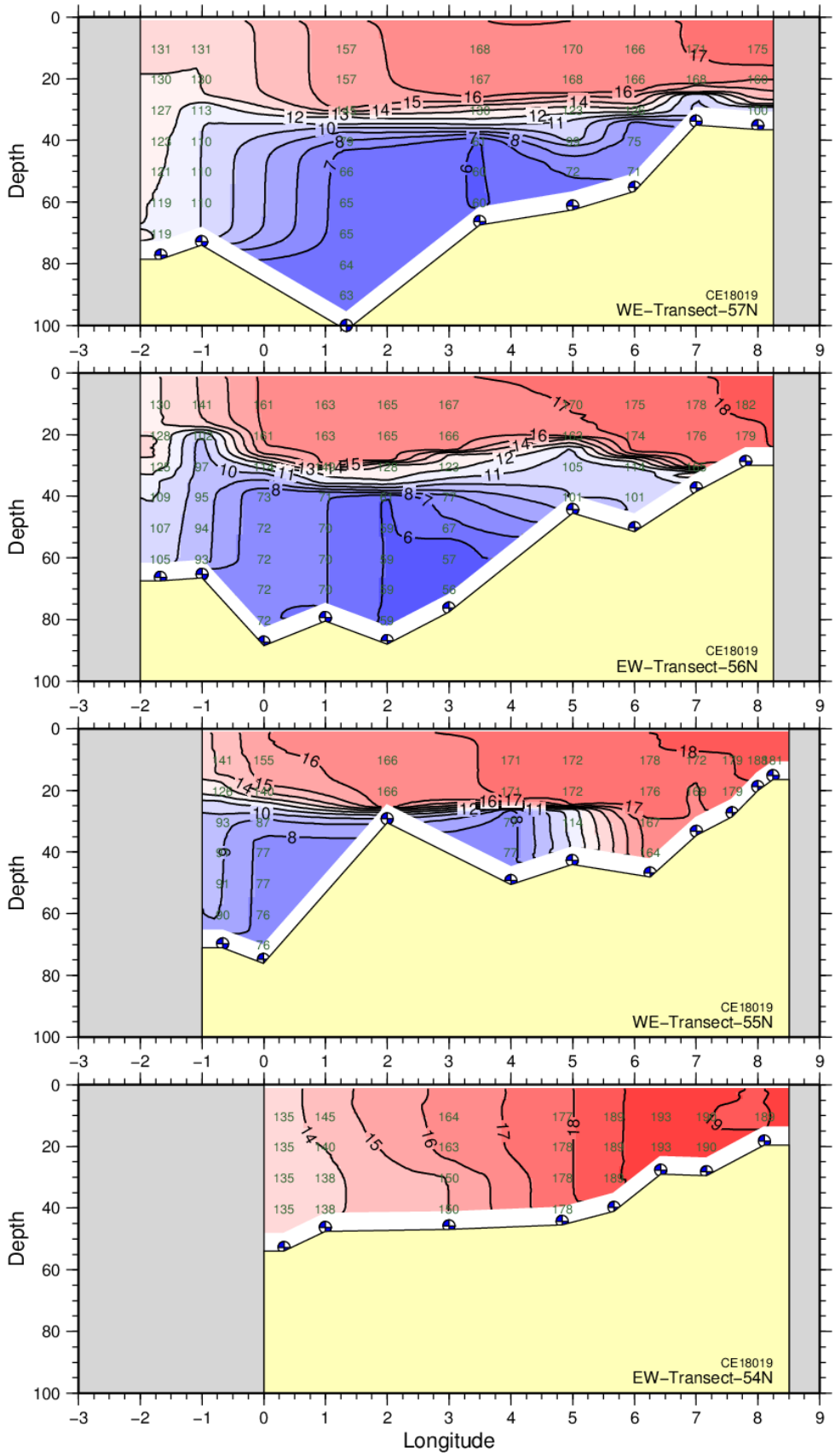


Fig. 6: *Vertical temperature distribution along the 54°, 55°, 56°, and 57°N sections basing on CTD raw data. The numbers in the section give temperatures × 10 for selected data points.*

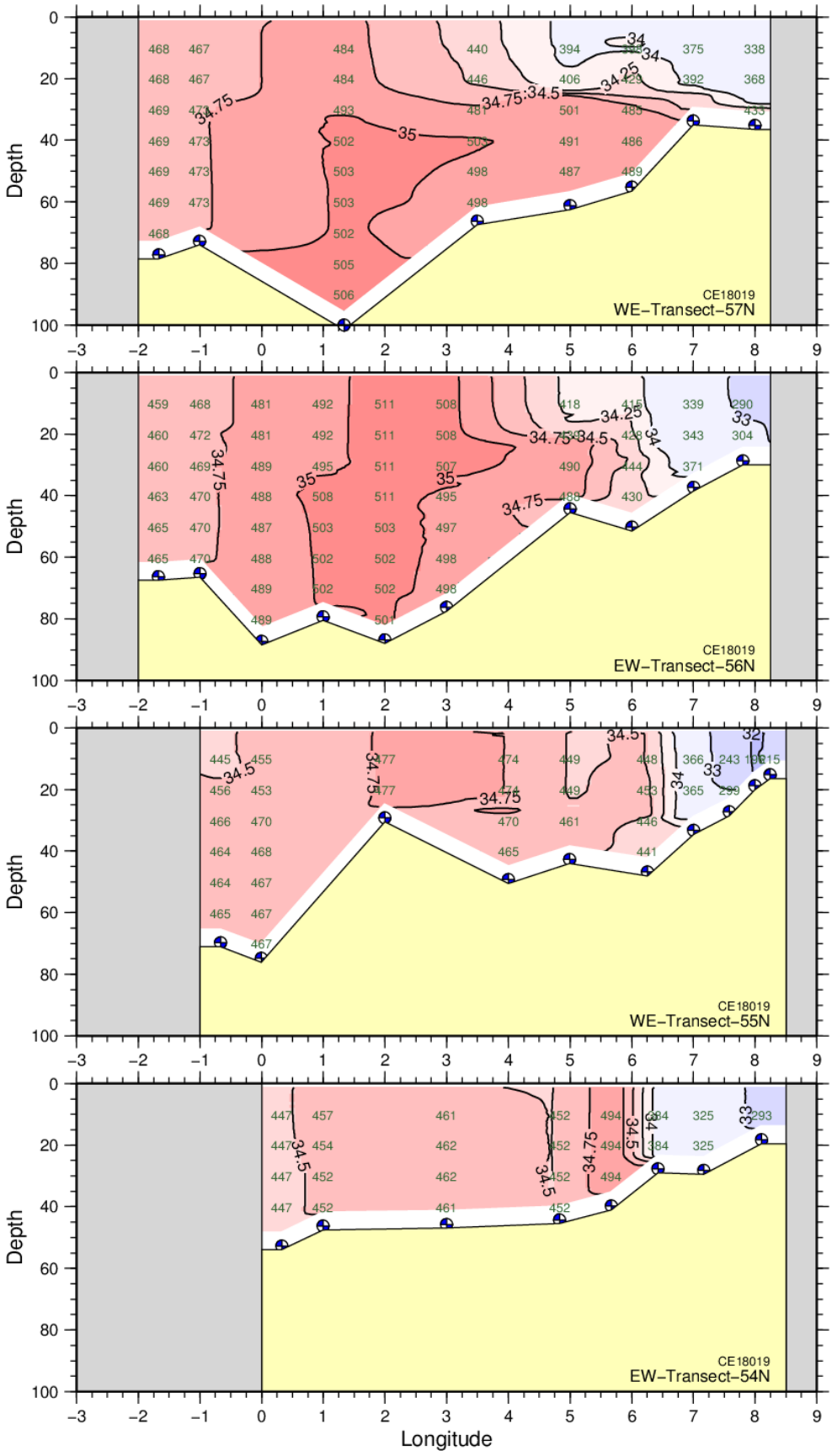


Fig. 7: *Vertical salinity distribution along the 54°, 55°, 56°, and 57°N sections basing on CTD raw data. The numbers in the section give (salinities × 100) - 3000 for selected data points.*

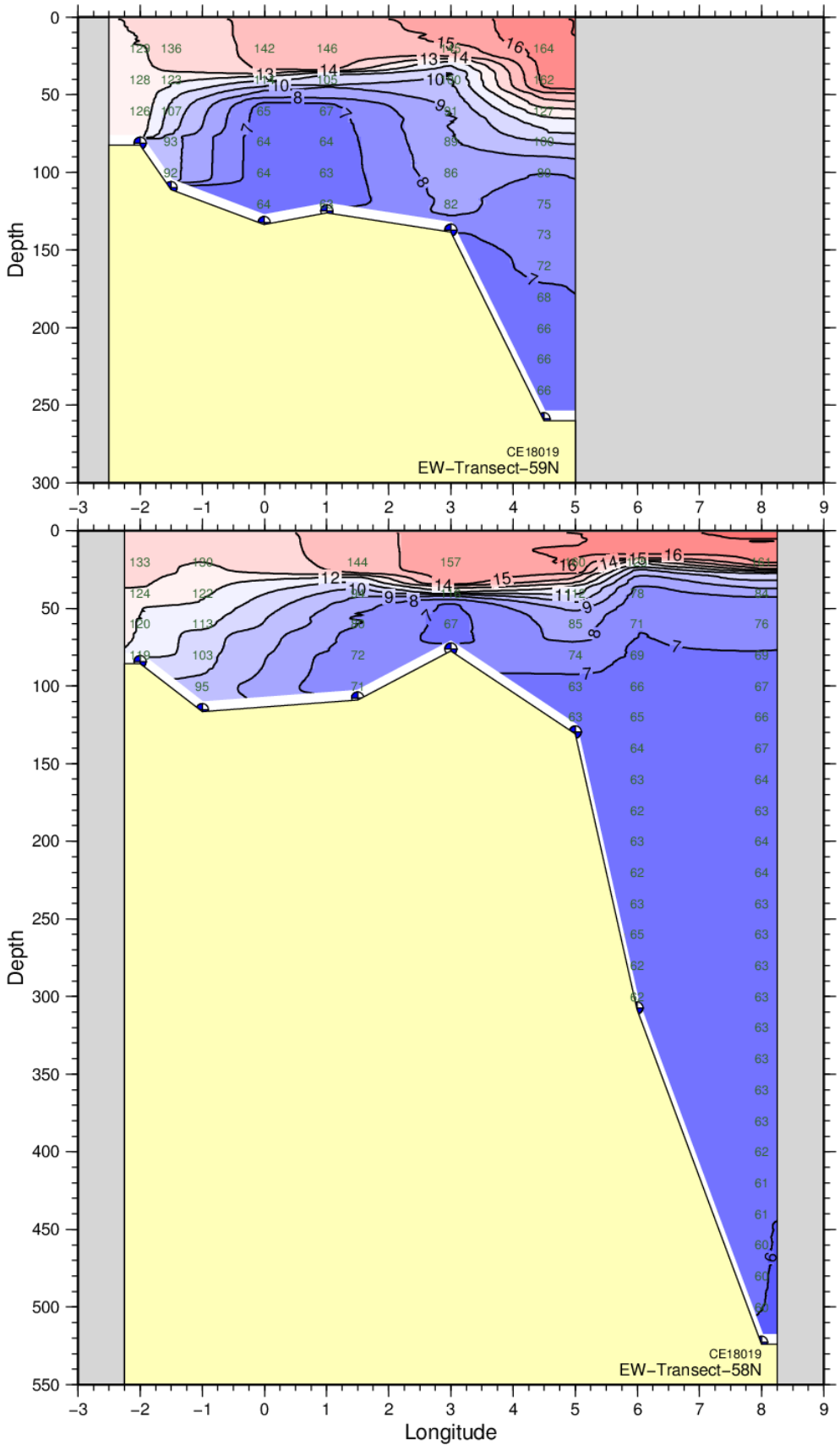


Fig. 8: *Vertical temperature distribution along the 58° and 59°N sections basing on CTD raw data. The numbers in the section give temperatures × 10 for selected data points.*

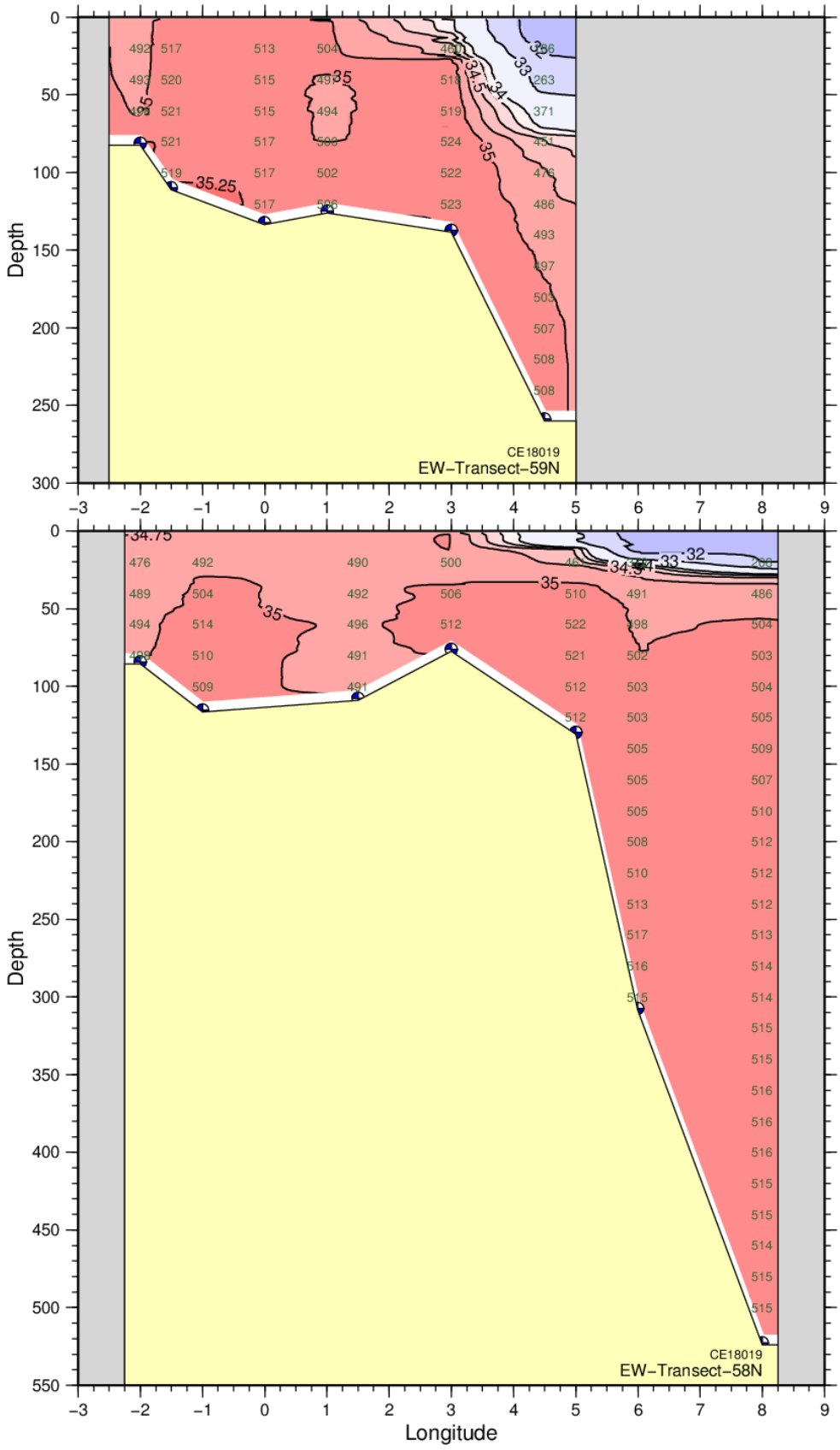


Fig. 9: *Vertical salinity distribution along the 58° and 59°N sections basing on CTD raw data. The numbers in the section give (salinities × 100) - 3000 for selected data points*.

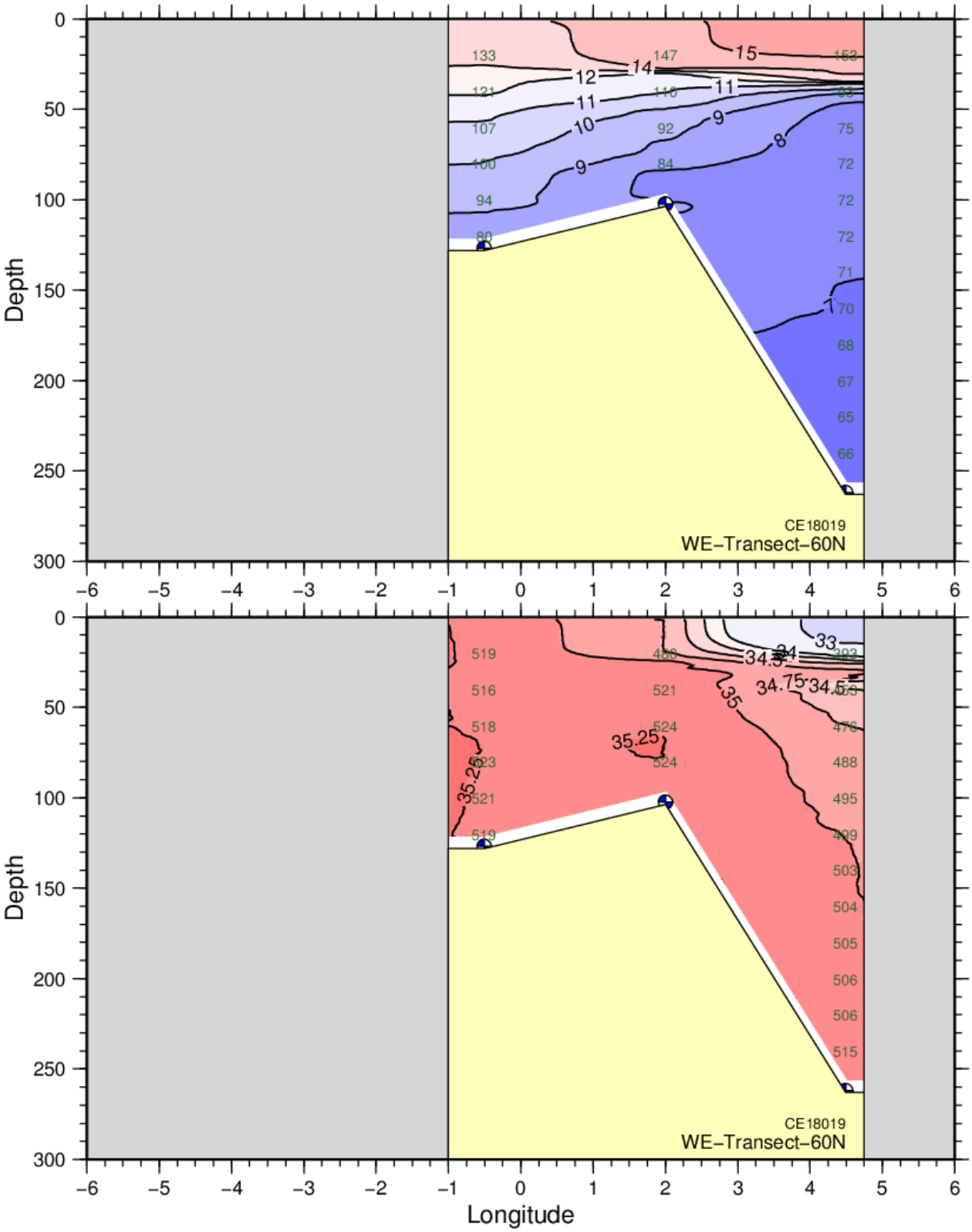


Fig. 10: *Vertical temperature (top) and salinity (bottom) distribution along the 60°N section basing on CTD raw data. The numbers in the section give the temperatures × 10 and (salinities × 100) - 3000 for selected data points.*

Acknowledgement

All participants accomplished a big amount of work in a good temper and made the North Sea Summer Survey 2018 again a big success! Thank you very much to all of you!

The help and professional good-humoured support provided by captain Antony Hobin and his crew is gratefully acknowledged. We are looking forward to our next Celtic Explorer cruise!

Holger Klein

Hamburg, September 2018

Photo by Declan Horan

Appendix 1: List of samples

CTD-profiles with rosette:	65 stations
Secchi depth:	28 stations (daylight stations only)
Salinity:	182 samples
Total Alkalinity:	116 samples incl. 10fold determination
Oxygen:	118 samples incl. 10fold determination
pH-value:	117 samples incl. 10fold determinationm
Chlorophyll:	68 samples incl. 10fold determination
Radioactivity (artificial nuclides):	64 stations 30 samples à 2 35-l-drums Strontium-90 (pure) 30 samples à 1-l-bottles Tritium (pure) 30 samples à 100 l transuranic elements (concentrated) 64 samples à 150 l Caesium-137 (concentrated)
Polar organic contaminants:	53 samples
Un-polar organic contaminants:	48 samples

Appendix 2: Surface and bottom temperatures and salinities

The following tables are based on CTD raw data.

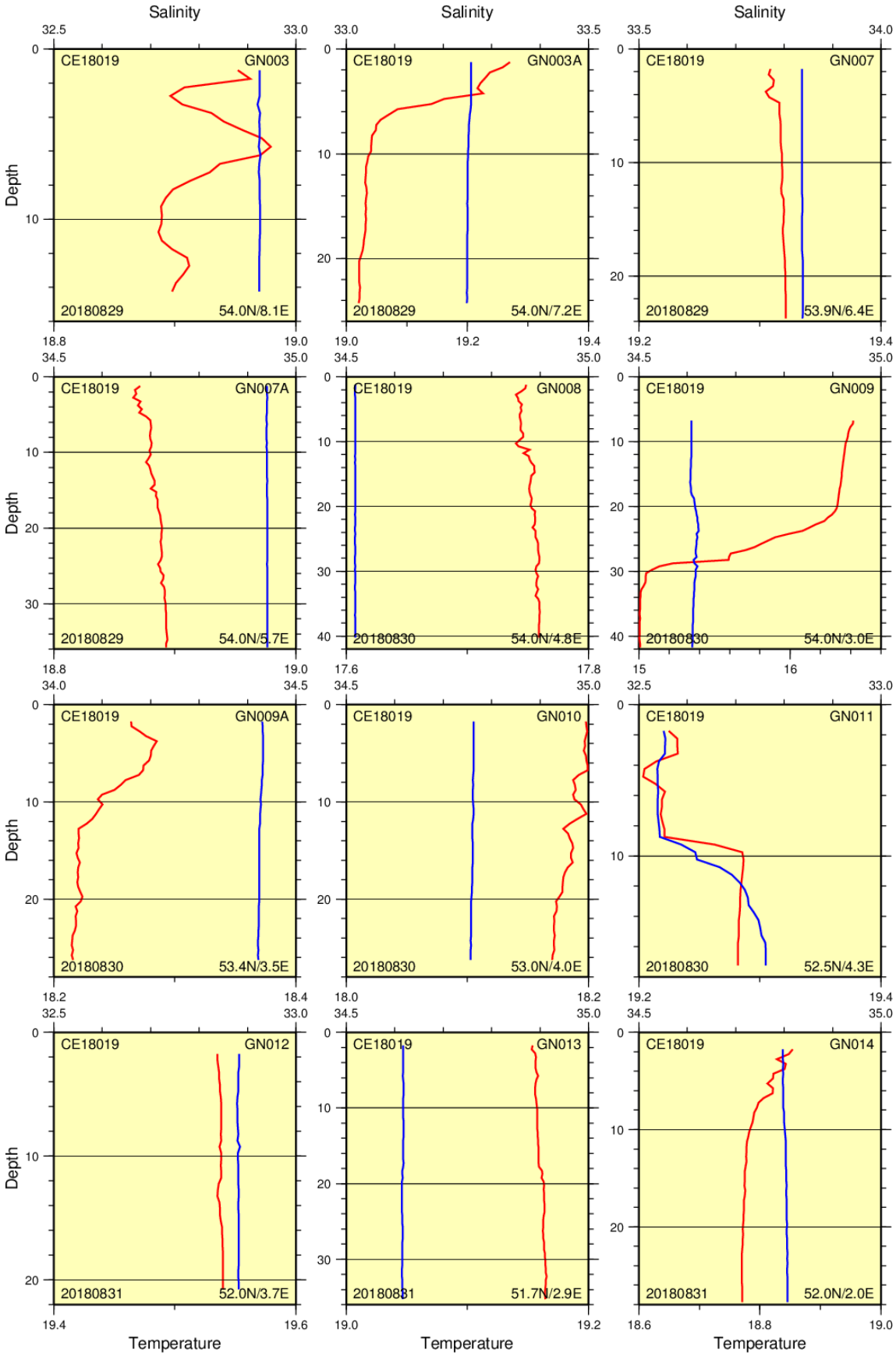
Station ID	Secchi depth [m]	water depth [m]	T_{sur} [°C]	T_{bot} [°C]	T_{sur}-T_{bot} [K]	S_{sur} [psu]	S_{bot} [psu]	S_{bot}-S_{sur} [psu]
GN003	4.5	17	18.9	18.9	0.0	32.92	32.92	0.00
GN003A	—	30	19.1	19.0	0.1	33.25	33.25	0.00
GN007	6.0	26	19.3	19.3	0.0	33.84	33.84	0.00
GN007A	—	37	18.9	18.9	0.0	34.94	34.94	0.00
GN008	—	42	17.8	17.8	0.0	34.52	34.52	0.00
GN009	11,0	43	16.3	15.0	1.3	34.60	34.61	0.01
GN009A	—	28	18.2	18.2	0.0	34.43	34.42	-0.01
GN010	5.0	30	18.2	18.2	0.0	34.76	34.76	0.00
GN011	—	20	19.2	19.3	-0.1	32.54	32.76	0.22
GN012	—	25	19.5	19.5	0.0	32.89	32.88	-0.01
GN013	7.5	41	19.1	19.2	-0.1	34.62	34.62	0.00
GN014	4.5	29	18.8	18.8	0.0	34.80	34.81	0.01
GN015	7.0	47	18.8	18.8	0.0	34.01	34.01	0.00
GN015B	—	42	18.5	18.1	0.4	34.25	34.34	0.09
GN016	—	32	16.2	16.2	0.0	34.62	34.62	0.00
GN017	—	44	14.6	13.8	0.8	34.55	34.52	-0.03
GN017A	—	53	13.5	13.5	0.0	34.47	34.47	0.00
GN018A	—	67	14.2	8.0	6.2	34.44	34.66	0.22
GN018	15.0	74	16.0	7.6	8.4	34.58	34.67	0.09
GN019	—	27	16.6	16.5	0.1	34.77	34.77	0.00
GN020	—	48	17.1	7.7	9.4	34.74	34.63	0.11
GN021	15.0	41	17.2	11.1	6.1	34.48	34.60	0.12
GN022	9.4	44	17.9	16.4	1.5	34.48	34.41	-0.07
GN022A	12.0	32	17.6	16.9	0.7	34.63	34.64	0.01
GN023	6.0	26	18.6	17.9	0.7	32.37	33.01	0.64
GN024	—	17	18.8	18.8	0.0	31.96	31.96	0.00
GN025	—	13	18.3	18.1	0.2	32.03	32.12	0.09
GN026	10.0	27	18.3	17.9	0.4	32.85	33.04	0.19
GN026A	—	35	17.8	13.1	4.7	33.39	33.83	0.44
GN027	14.5	48	17.6	10.2	7.4	34.13	34.29	0.16
GN028	14.5	44	17.1	10.0	7.1	34.17	34.87	0.70
GN029	—	75	16.2	5.6	10.6	35.08	34.98	-0.1
GN030	—	86	16.5	5.9	10.6	35.10	35.01	-0.09
GN031	20.0	78	16.3	7.0	9.3	34.92	35.01	0.09
GN032	16.5	87	16.1	7.1	9.0	34.81	34.89	0.08
GN033	15.0	64	14.1	9.3	4.8	34.67	34.70	0.03
GN033A	—	66	13.0	10.5	2.5	34.59	34.65	0.06
GN034A	—	75	13.1	11.9	1.2	34.68	34.68	0.00
GN034	—	71	13.1	11.0	2.1	34.67	34.72	0.05
GN035	19.0	99	15,7	6.3	9.4	34.84	35.06	0.22
GN036	19.5	65	16.9	6.0	10.9	34.37	34.98	0.61
GN037	—	59	16.9	6.7	10.2	33.91	34.87	0.96
GN038	—	52	16.3	7.2	9.1	34.05	34.88	0.83
GN038A	—	33	17.1	9.8	7.3	33.67	34.40	0.73
GN039	11.5	34	17.7	10.3	7.4	33.23	34.26	1.03
GN040	15.0	525	17.1	6.0	11.1	31.71	34.47	2.76
GN041	—	310	16.7	6.2	10.5	31.65	35.15	3.50
GN042	—	129	16.0	6.3	9.7	33.50	35.12	1.62
GN043	19.0	77	15.7	6.8	8.9	34.99	35.11	0.12

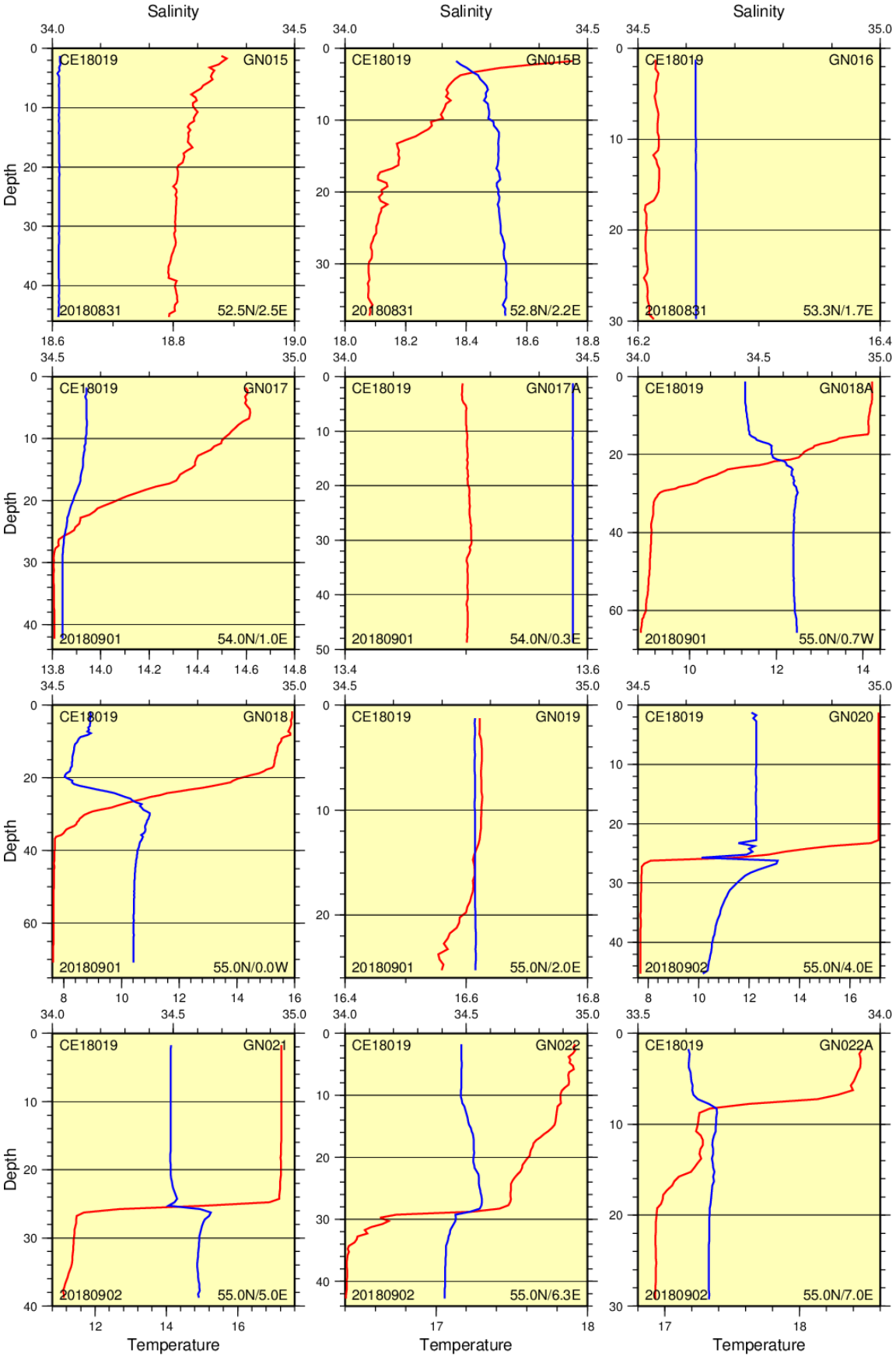
Station ID	Secchi depth [m]	water depth [m]	Tsur [°C]	Tbot [°C]	Tsur-Tbot [K]	Ssur [psu]	Sbot [psu]	Sbot-Ssur [psu]
GN044	17.0	106	14.5	7.0	7.5	34.89	34.92	0.03
GN045	—	115	13.2	9.5	3.7	34.89	35.08	0.19
GN045A	—	83	13.3	11.9	1.4	34.75	34.98	0.23
GN045B	—	71	13.2	13.2	0.0	34.70	34.71	0.01
GN046A	11.0	79	13.1	12.3	0.8	34.88	35.09	0.21
GN046	>10.5	107	13.7	9.2	4.5	35.17	35.19	0.02
GN053C	14.0	101	13.9	10.0	3.9	35.19	35.20	0.01
GN053	—	126	13.4	8.0	5.4	35.17	35.18	0.01
GN052	—	101	14.7	7.6	7.1	34.73	35.22	0.49
GN051	>10.0	263	15.9	6.4	9.5	32.46	35.14	2.68
GN050	—	260	16.8	6.6	10.2	31.27	35.08	3.81
GN049	—	138	15.3	7.3	8.0	34.08	35.21	1.13
GN048	—	123	14.6	6.3	8.3	35.03	35.06	0.03
GN047	—	131	14.2	6.4	7.8	35.12	35.17	0.05

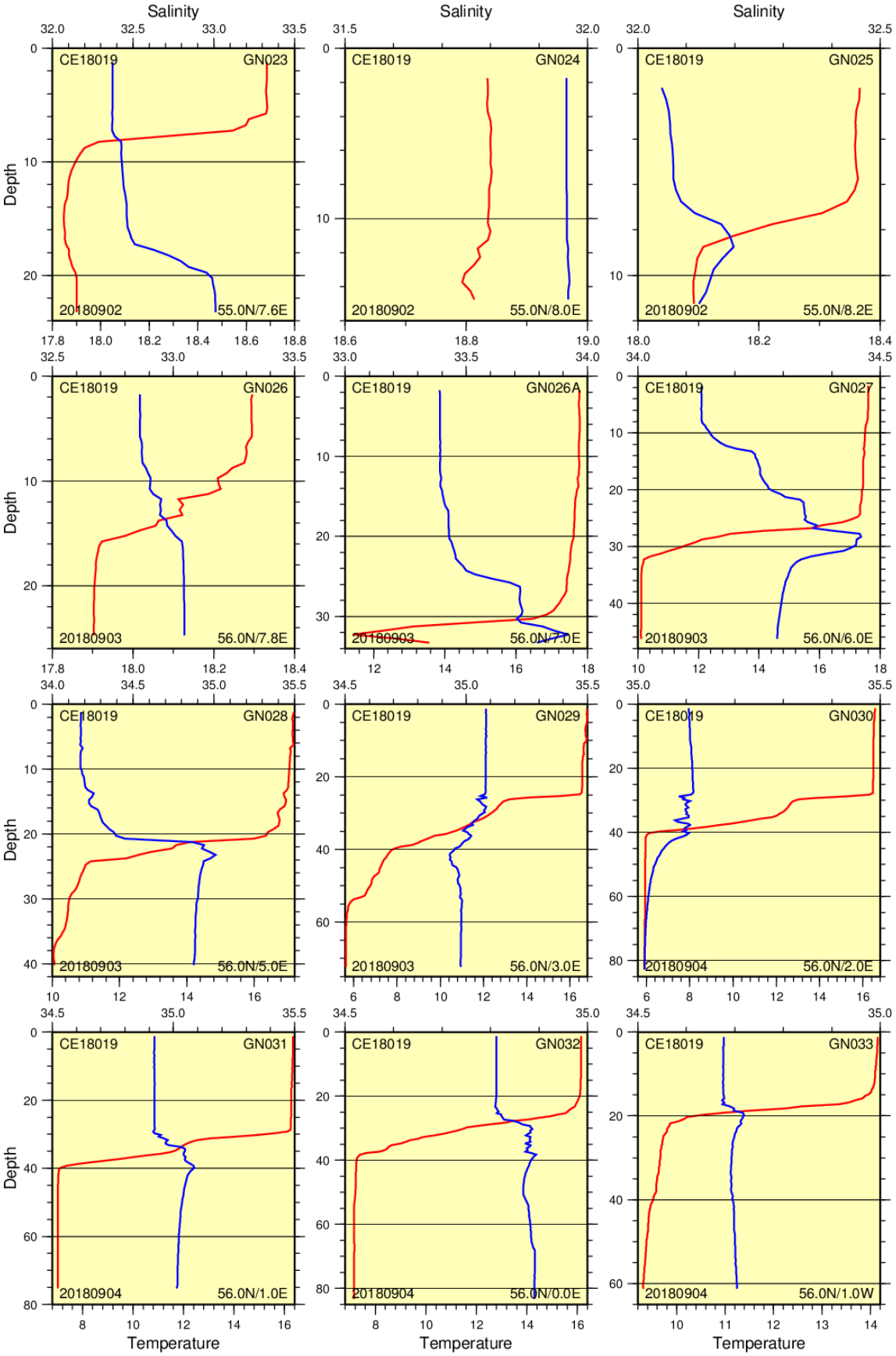
T_{sur}, T_{bot}: surface (5 m) and bottom temperature (* 20 m temperature)
S_{sur}, S_{bot}: surface and bottom salinity. Blue: Coastal Water ≤34 psu, red: Atlantic Water ≥35 psu.

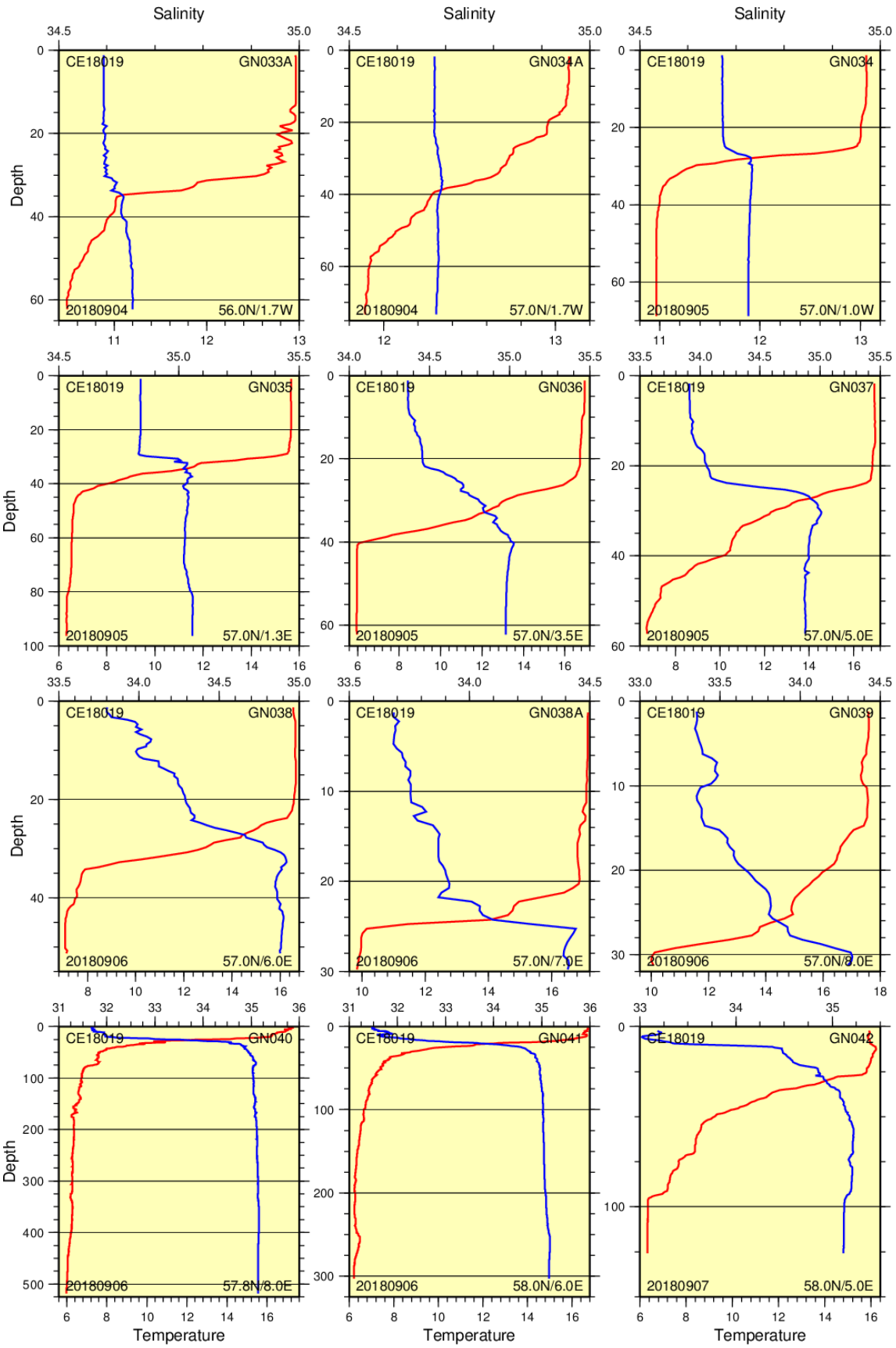
Appendix 3: T and S profiles, all stations

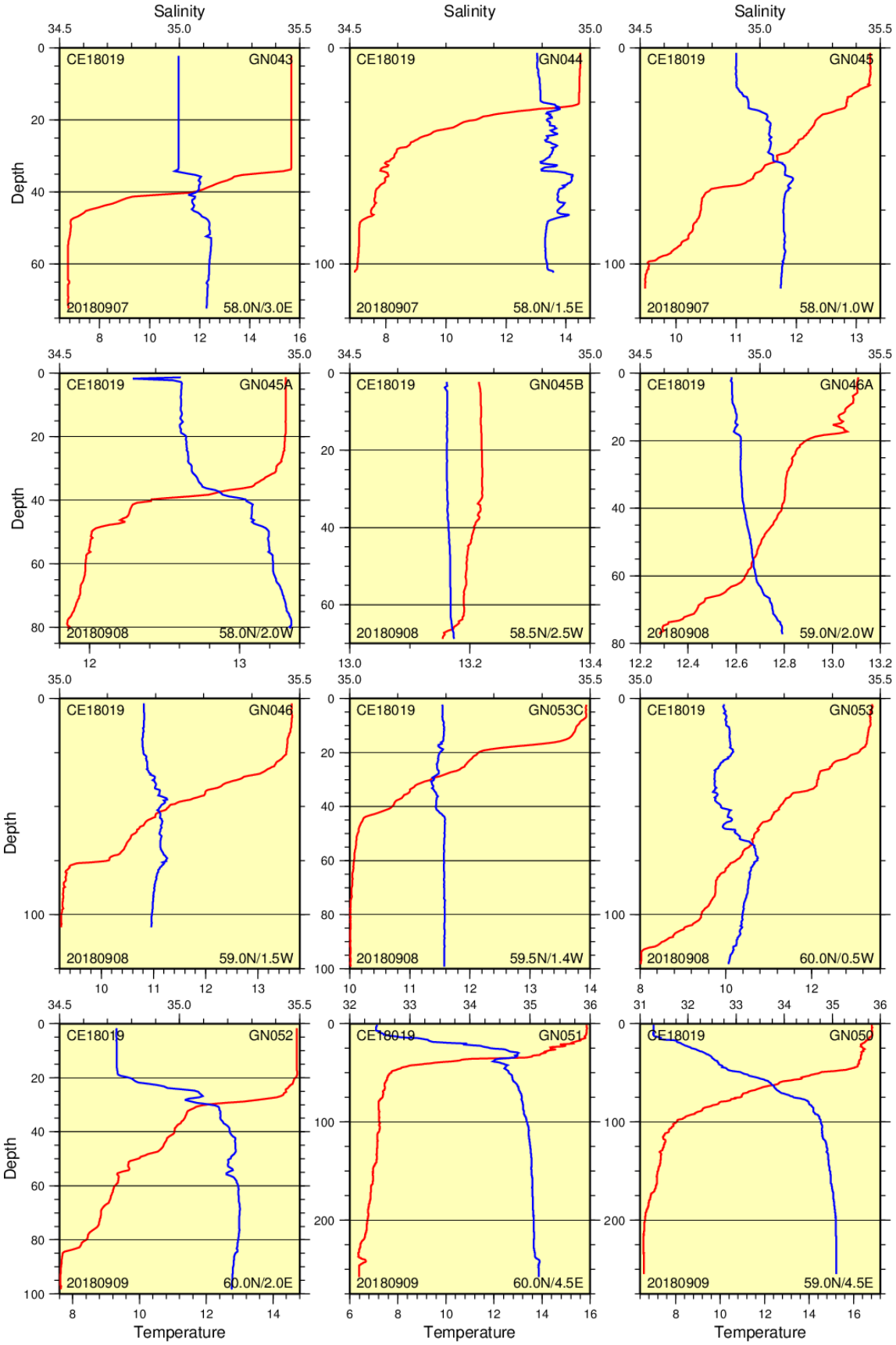
The following temperature and salinity profiles are based on CTD raw data.

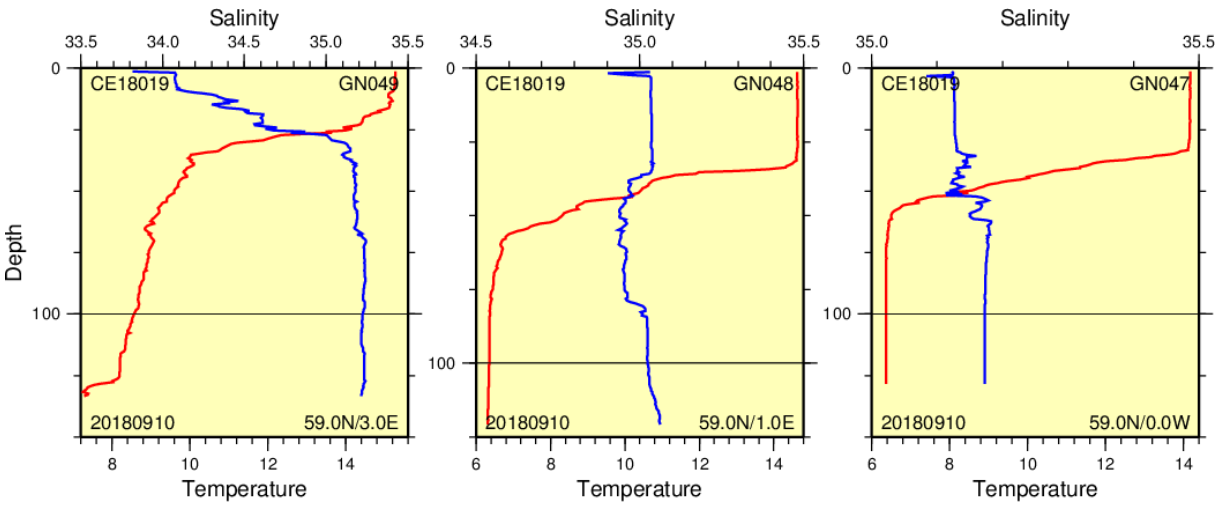



Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
CE18019 GN015
20180831 52.5N/2.5E
CE18019 GN015B
20180831 52.8N/2.2E
CE18019 GN016
20180831 53.3N/1.7E
CE18019 GN017
20180901 54.0N/1.0E
CE18019 GN017A
20180901 54.0N/0.3E
CE18019 GN018A
20180901 55.0N/0.7W
CE18019 GN018
20180901 55.0N/0.0W
CE18019 GN019
20180901 55.0N/2.0E
CE18019 GN020
20180902 55.0N/4.0E
CE18019 GN021
20180902 55.0N/5.0E
CE18019 GN022
20180902 55.0N/6.3E
CE18019 GN022A
20180902 55.0N/7.0E


Salinity
Salinity
Salinity
Depth
Depth
Depth
Depth
Temperature
Temperature
Temperature
CE18019 GN023
20180902 55.0N/7.6E
CE18019 GN024
20180902 55.0N/8.0E
CE18019 GN025
20180902 55.0N/8.2E
CE18019 GN026
20180903 56.0N/7.8E
CE18019 GN026A
20180903 56.0N/7.0E
CE18019 GN027
20180903 56.0N/6.0E
CE18019 GN028
20180903 56.0N/5.0E
CE18019 GN029
20180903 56.0N/3.0E
CE18019 GN030
20180904 56.0N/2.0E
CE18019 GN031
20180904 56.0N/1.0E
CE18019 GN032
20180904 56.0N/0.0E
CE18019 GN033
20180904 56.0N/1.0W

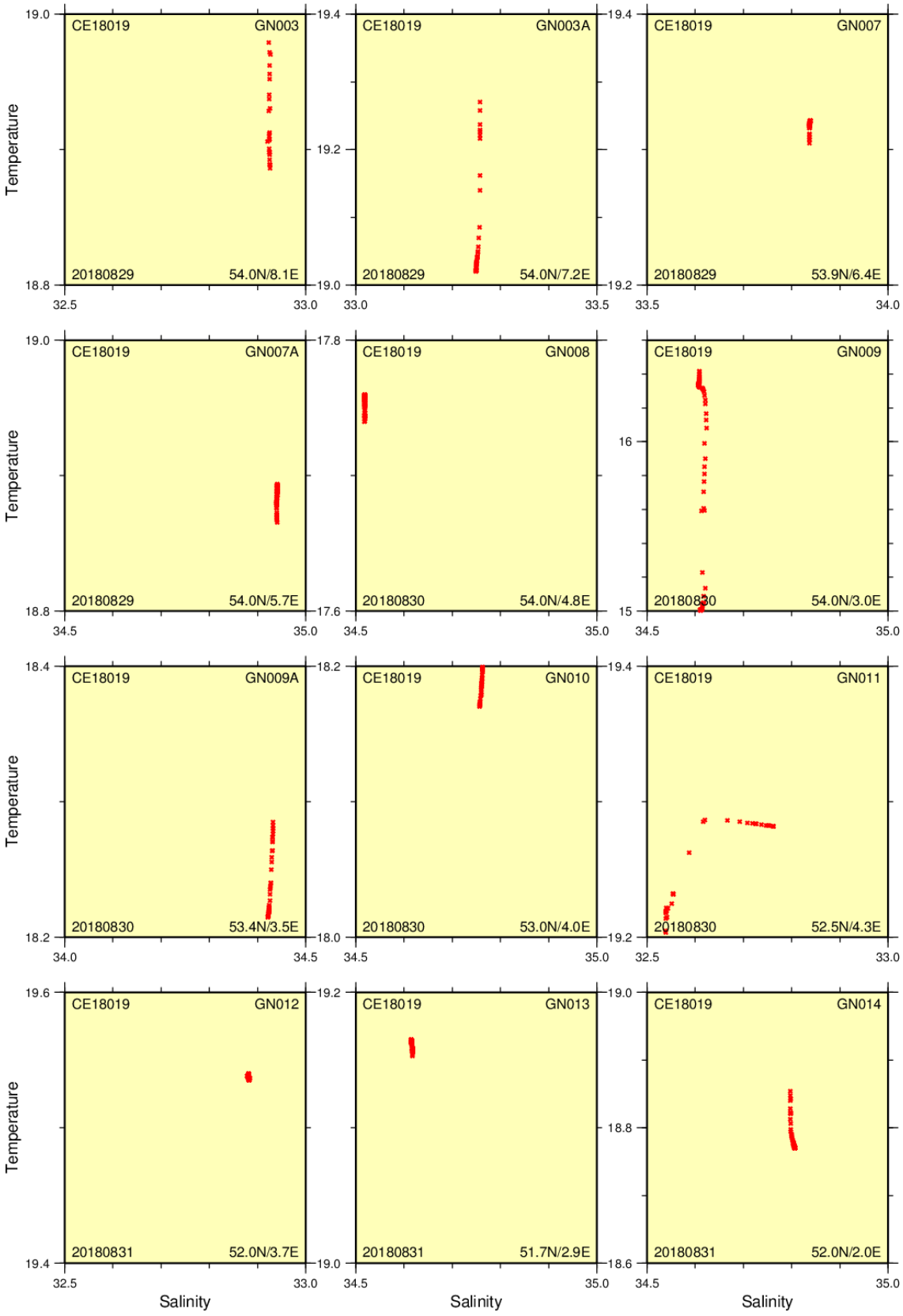

Salinity
Salinity
Salinity
Depth
Depth
Depth
Temperature
Temperature
Temperature
CE18019 GN033A 20180904 56.0N/1.7W
CE18019 GN034A 20180904 57.0N/1.7W
CE18019 GN034 20180905 57.0N/1.0W
CE18019 GN035 20180905 57.0N/1.3E
CE18019 GN036 20180905 57.0N/3.5E
CE18019 GN037 20180905 57.0N/5.0E
CE18019 GN038 20180906 57.0N/6.0E
CE18019 GN038A 20180906 57.0N/7.0E
CE18019 GN039 20180906 57.0N/8.0E
CE18019 GN040 20180906 57.8N/8.0E
CE18019 GN041 20180906 58.0N/6.0E
CE18019 GN042 20180907 58.0N/5.0E

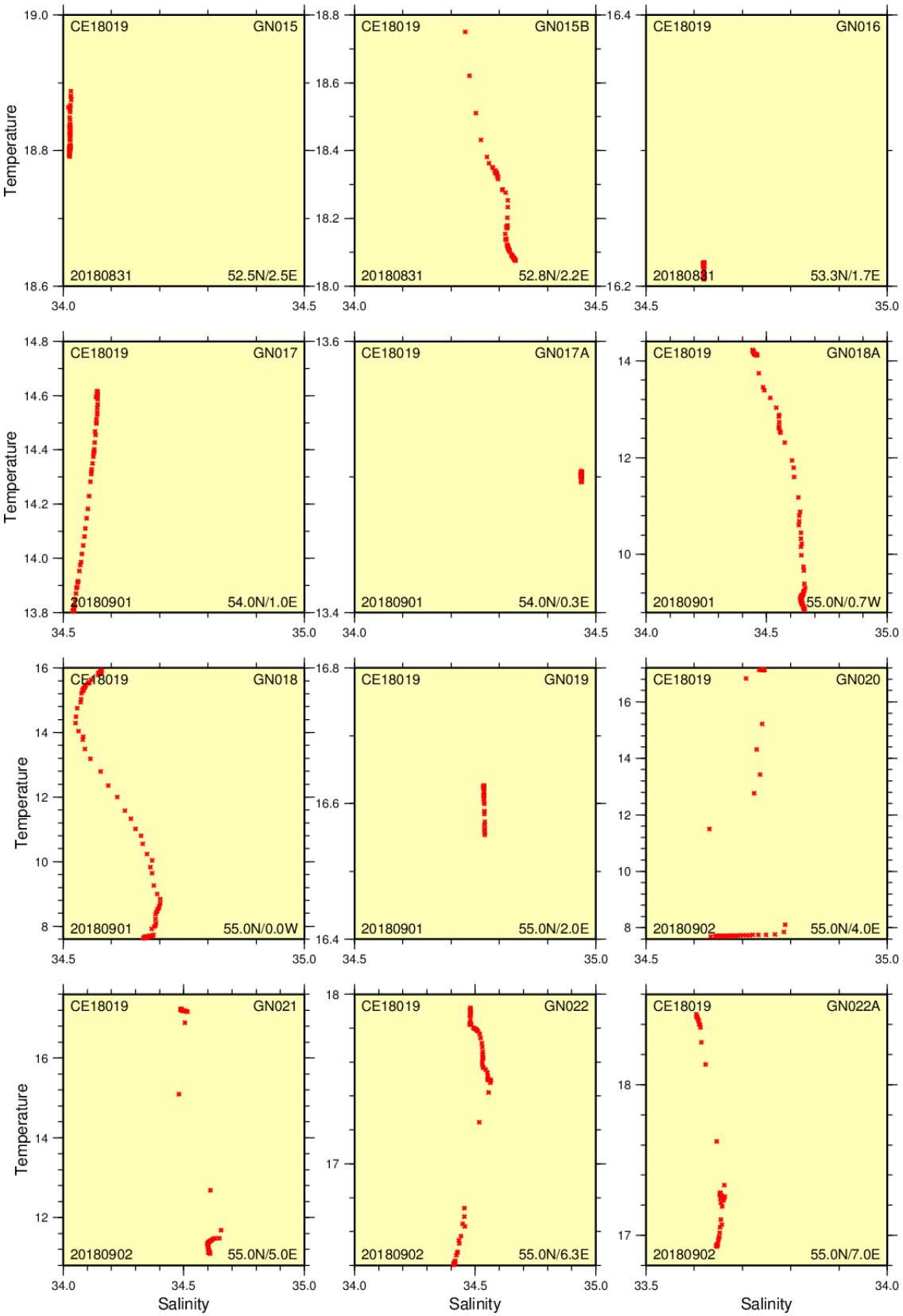

Salinity
Salinity
Salinity
CE18019 GN043
20180907 58.0N/3.0E
CE18019 GN044
20180907 58.0N/1.5E
CE18019 GN045
20180907 58.0N/1.0W
CE18019 GN045A
20180908 58.0N/2.0W
CE18019 GN045B
20180908 58.5N/2.5W
CE18019 GN046A
20180908 59.0N/2.0W
CE18019 GN046
20180908 59.0N/1.5W
CE18019 GN053C
20180908 59.5N/1.4W
CE18019 GN053
20180908 60.0N/0.5W
CE18019 GN052
20180909 60.0N/2.0E
CE18019 GN051
20180909 60.0N/4.5E
CE18019 GN050
20180909 59.0N/4.5E
Depth
Temperature


Salinity
33.5
34.0
34.5
35.0
35.5
0
100
Depth
CE18019
GN049
20180910
59.0N/3.0E
8
10
12
14
Temperature
Salinity
34.5
35.0
35.5
0
100
CE18019
GN048
20180910
59.0N/1.0E
6
8
10
12
14
Temperature
Salinity
35.0
35.5
0
100
CE18019
GN047
20180910
59.0N/0.0W
6
8
10
12
14
Temperature

Appendix 4: T/S diagrams, all stations

The following diagrams are based on CTD raw data.




CE18019 GN015
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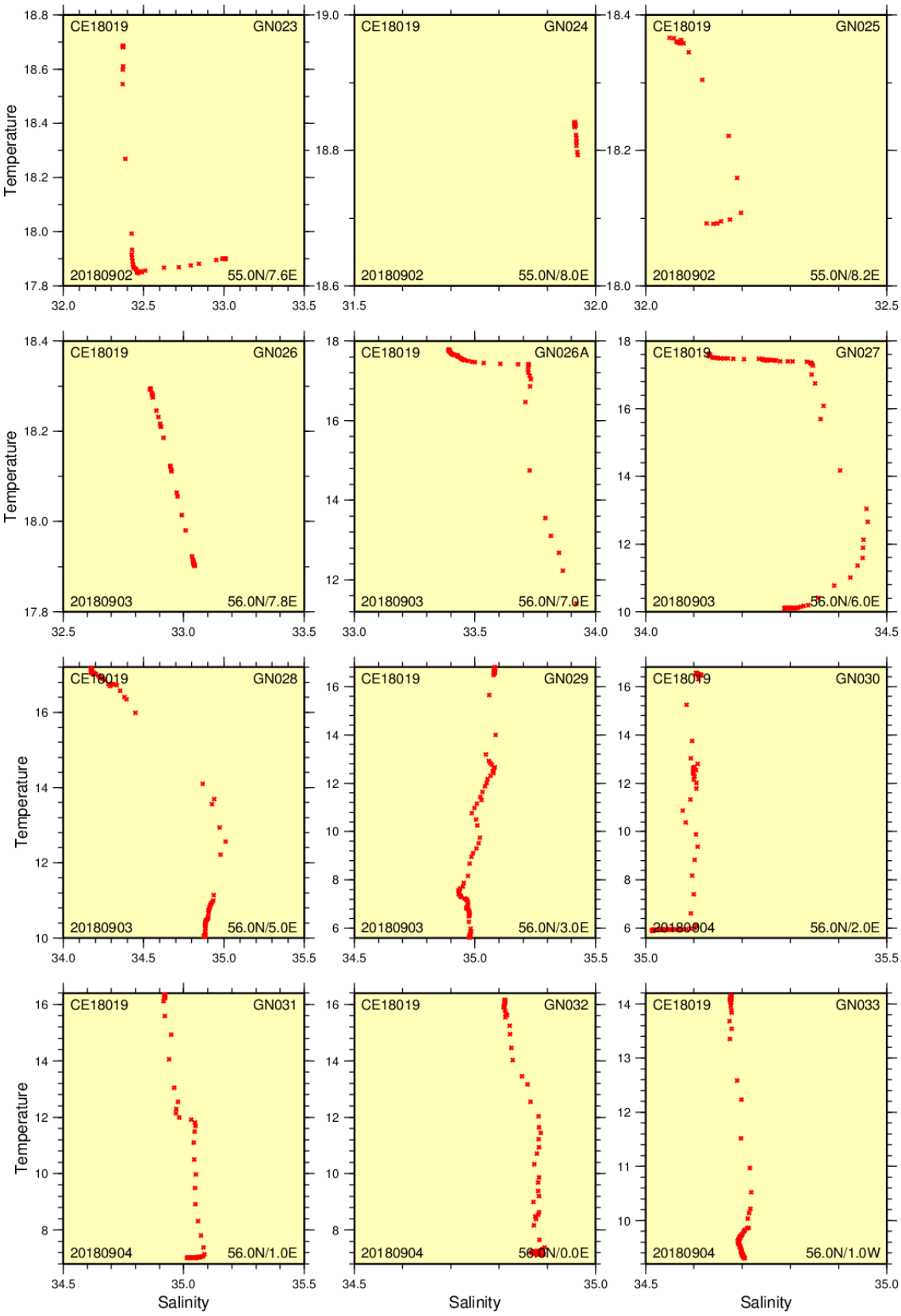
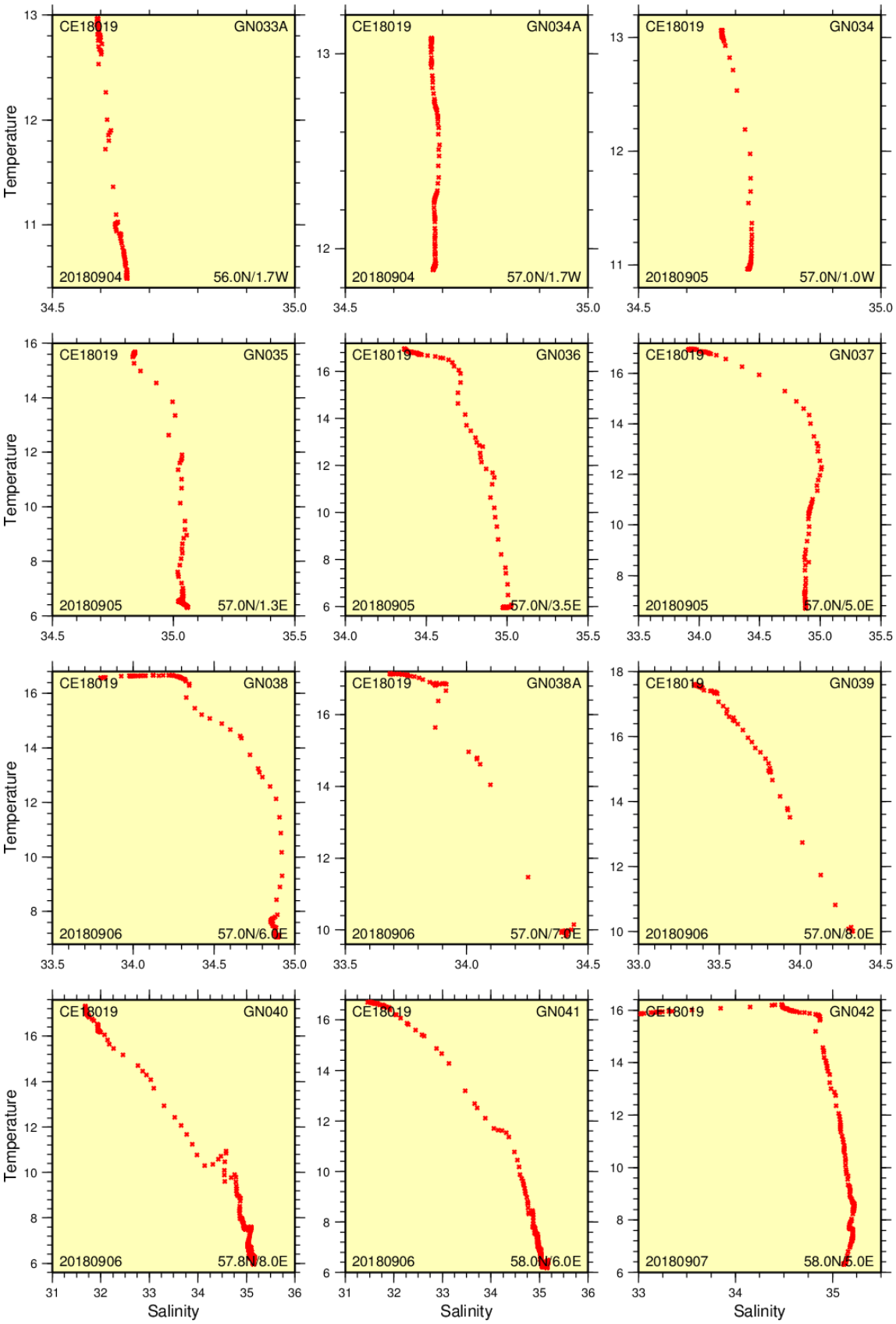
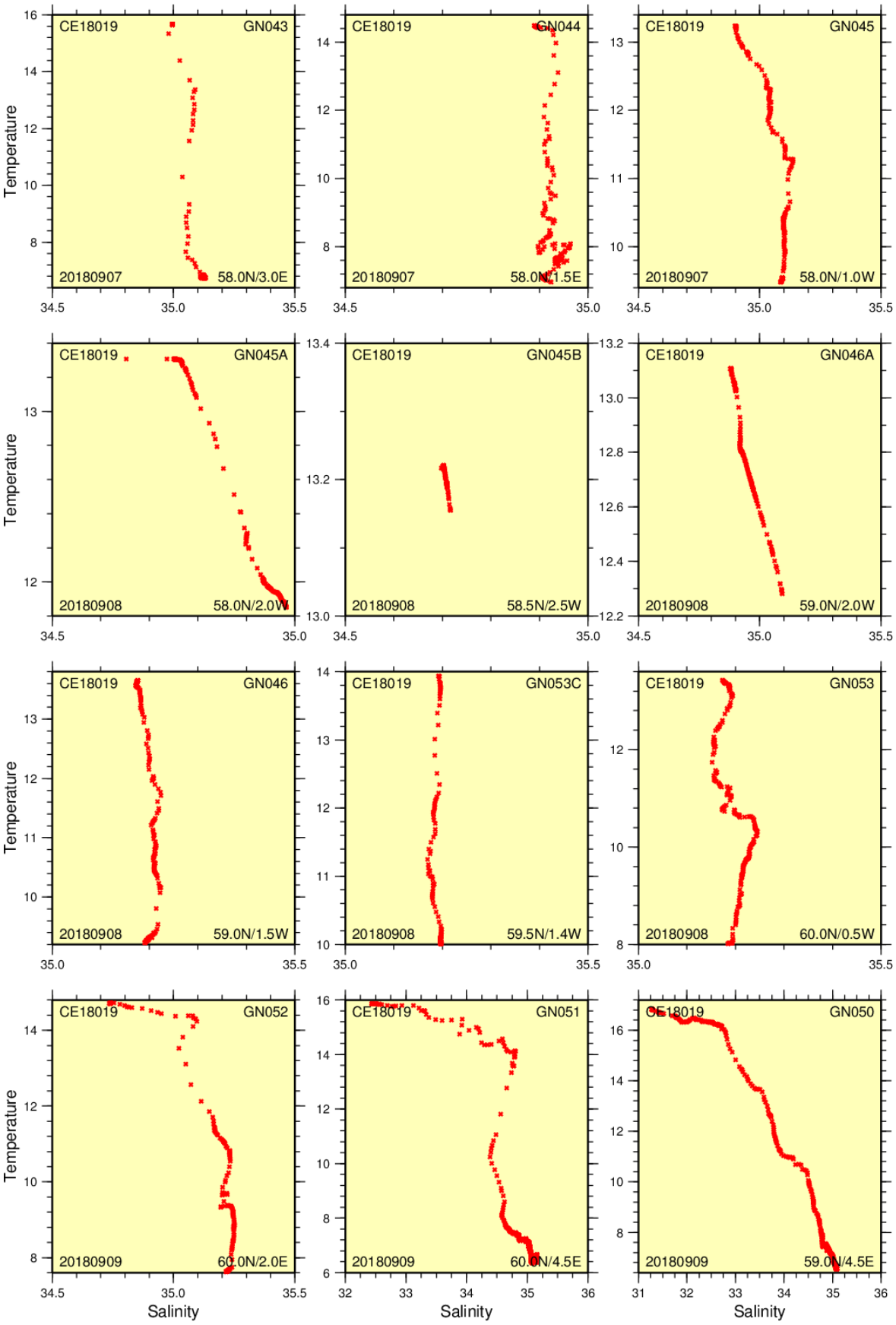
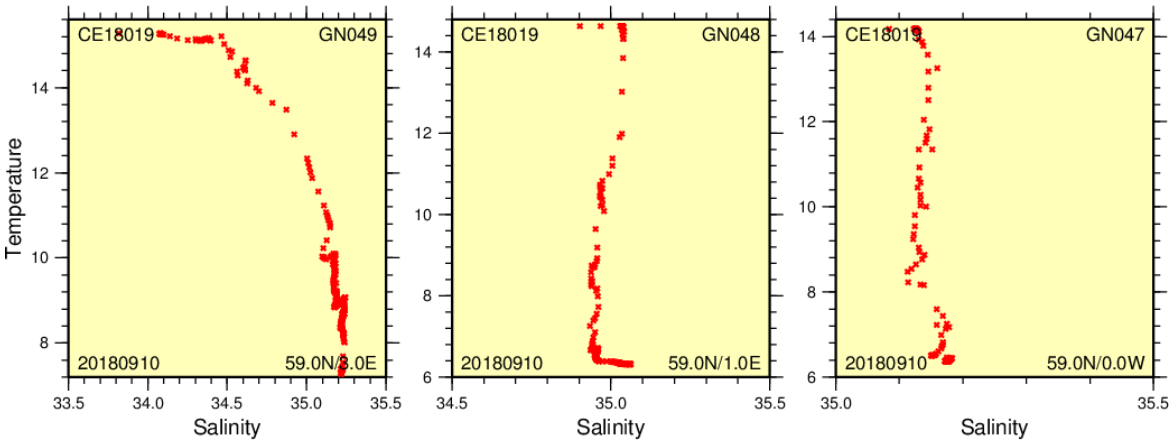
CE18019 GN015B
20180831 52.8N/2.2E
CE18019 GN016
20180831 53.3N/1.7E
CE18019 GN017
20180901 54.0N/1.0E
CE18019 GN017A
20180901 54.0N/0.3E
CE18019 GN018A
20180901 55.0N/0.7W
CE18019 GN018
20180901 55.0N/0.0W
CE18019 GN019
20180901 55.0N/2.0E
CE18019 GN020
20180902 55.0N/4.0E
CE18019 GN021
20180902 55.0N/5.0E
CE18019 GN022
20180902 55.0N/6.3E
CE18019 GN022A
20180902 55.0N/7.0E
Temperature
Salinity


CE18019 GN023
20180902 55.0N/7.6E
CE18019 GN024
20180902 55.0N/8.0E
CE18019 GN025
20180902 55.0N/8.2E
CE18019 GN026
20180903 56.0N/7.8E
CE18019 GN026A
20180903 56.0N/7.0E
CE18019 GN027
20180903 56.0N/6.0E
CE18019 GN028
20180903 56.0N/5.0E
CE18019 GN029
20180903 56.0N/3.0E
CE18019 GN030
20180904 56.0N/2.0E
CE18019 GN031
20180904 56.0N/1.0E
CE18019 GN032
20180904 56.0N/0.0E
CE18019 GN033
20180904 56.0N/1.0W
Temperature
Salinity


CE18019 GN033A 20180904 56.0N/1.7W
CE18019 GN034A 20180904 57.0N/1.7W
CE18019 GN034 20180905 57.0N/1.0W
CE18019 GN035 20180905 57.0N/1.3E
CE18019 GN036 20180905 57.0N/3.5E
CE18019 GN037 20180905 57.0N/5.0E
CE18019 GN038 20180906 57.0N/6.0E
CE18019 GN038A 20180906 57.0N/7.0E
CE18019 GN039 20180906 57.0N/8.0E
CE18019 GN040 20180906 57.8N/8.0E
CE18019 GN041 20180906 58.0N/6.0E
CE18019 GN042 20180907 58.0N/5.0E
Temperature
Salinity


CE18019 GN043
20180907 58.0N/3.0E
CE18019 GN044
20180907 58.0N/1.5E
CE18019 GN045
20180907 58.0N/1.0W
CE18019 GN045A
20180908 58.0N/2.0W
CE18019 GN045B
20180908 58.5N/2.5W
CE18019 GN046A
20180908 59.0N/2.0W
CE18019 GN046
20180908 59.0N/1.5W
CE18019 GN053C
20180908 59.5N/1.4W
CE18019 GN053
20180908 60.0N/0.5W
CE18019 GN052
20180909 60.0N/2.0E
CE18019 GN051
20180909 60.0N/4.5E
CE18019 GN050
20180909 59.0N/4.5E
Temperature
Salinity


CE18019
GN049
20180910
59.0N/3.0E
CE18019
GN048
20180910
59.0N/1.0E
CE18019
GN047
20180910
59.0N/0.0W
Temperature
Salinity
Salinity
Salinity

Appendix 5: Station List

Positions are taken at the beginning of station work!
Radioactivity: Cs = Cesium-137; Sr = Strontium-90; Tu = transuranic elements (Pu, Am, Cm); H3 = Tritium
Water depth corrected for draft (5 m)!

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi depth [m]	radio-activity	Organic [l]	nutrients [m]	Bedford ID 184nnn	date [dd.mm.yy]	time [UTC]
STADE	53° 36.92‘ N	009° 33.04‘ E	14	—	—	Cs/Sr/H3/Tu	5, 10	—	—	29.08.18	05:54 – 06:07
MEDEM	53° 52.67‘ N	008° 43.18‘ E	14	—	—	Cs/Sr/H3/Tu	5, 10	—	—	29.08.18	08:54 – 09:06
GN003 ELBE1	54° 00.13‘ N	008° 06,41‘ E	17	bottom, 2×5	4.5	Cs/Sr/H3/Tu	5, 10, 100	bottom, 5	001-003	29.08.18	11:23 – 11:50
GN003A	54° 00.11‘ N	007° 10.29‘ E	30	bottom, 5	—	Cs/Sr/H3/Tu	5, 100	—	004-005	29.08.18	15:11 – 15:39
GN007	53° 55.59‘ N	006° 25.45‘ E	26	bottom, 2×5	6.0	Cs/Sr/H3/Tu	5, 10, 100	bottom, 5	006-008	29.08.18	18:23 – 18:56
GN007A	54° 00.03‘ N	005° 40.41‘ E	37	bottom, 5	—	Cs/Sr/H3/Tu	—	—	009-010	29.08.18	22:06 – 22:17
GN008	54° 00.05‘ N	004° 49.86‘ E	42	bottom, 2×5	—	Cs	10, 100	bottom, 5	011-013	30.08.18	01:27 – 01:55
GN009	54° 00.06‘ N	003° 00.01‘ E	43	bottom, 4x10, 2×5	11.0	Cs/Sr/H3/Tu	4×10, 100	bottom, 10, 5	014-021	30.08.18	08:24 – 09:06
GN009A	53° 25.27‘ N	003° 29.88‘ E	28	bottom, 5	—	Cs	—	—	022-023	30.08.18	13:07 – 13:21
GN010	53° 00.05‘ N	003° 59.80‘ E	30	bottom, 5	5.0	Cs	—	bottom, 5	024-025	30.08.18	16:29 – 16:47
GN011	52° 31.12‘ N	004° 19.62‘ E	20	bottom, 5x5	—	Cs	5, 2×100	bottom, 5	026-032	30.08.18	20:28 – 20:59
GN012	52° 00.15‘ N	003° 43.37‘ E	25	bottom, 2×5	—	Cs/Sr/H3/Tu	5, 100	bottom, 5	033-035	31.08.18	01:10 – 01:35
GN013	51° 42.06‘ N	002° 51.67‘ E	41	bottom, 2×5	7.5	Cs/Sr/H3/Tu	5, 100	bottom, 5	036-038	31.08.18	05:43 – 06:11
GN014	52° 00.08‘ N	001° 59.97‘ E	29	bottom, 2×5	4.5	Cs/Sr/H3/Tu	5, 100	bottom, 5	039-041	31.08.18	09:45 – 10:11
GN015	52° 29.85‘ N	002° 30.09‘ E	47	bottom, 5	7.0	Cs	—	bottom, 5	042-043	31.08.18	14:19 – 14:36
GN015B	52° 49.86‘ N	002° 10.39‘ E	42	bottom, 5	—	Cs	—	bottom, 5	044-045	31.08.18	16:43 – 16:59
GN016	53° 19.74’ N	001° 40.23‘ E	32	bottom, 4×5	—	Cs/Sr/H3/Tu	—	bottom, 5	046-051	31.08.18	20:05 – 20:16
GN017	53° 59.95‘ N	000° 59.86‘ E	44	bottom, 2×5	—	Cs	4×10, 100	bottom, 5	052-054	01.09.18	01:02 – 01:42
GN017A	54° 00.02‘ N	000° 19.69‘ E	53	bottom, 5	—	Cs/Sr/H3/Tu	—	—	055-056	01.09.18	03:54 – 04:18
GN018A	55° 00.01‘ N	000° 39.97‘ W	67	bottom, 5	—	Cs	—	—	057-058	01.09.18	11:15 – 11:28
GN018	55° 00.04‘ N	000° 00.16‘ W	74	bottom, 2×5	15.0	Cs	10, 100	bottom, 5	059-061	01.09.18	13:47 – 14:16
GN019	55° 00.04‘ N	001° 59.86‘ E	27	bottom, 2×5	—	Cs/Sr/H3/Tu	10, 100	bottom, 5	062-064	01.09.18	21:02 – 11:37
GN020	54° 59.91‘ N	004° 00.06‘ E	48	bottom, 2×5	—	Cs	10, 100	bottom, 5	065-067	02.09.18	04:06 – 04:40
GN021 AWZW2	54° 59.94‘ N	004° 59.56‘ E	41	bottom, 5	15.0	Cs	—	bottom, 5	068-069	02.09.18	08:04 – 08:12
GN022	55° 00.00‘ N	006° 15.33‘ E	44	bottom, 2×5	9.5	Cs		bottom, 5	070-072	02.09.18	12:17 – 12:55
GN022A	54° 59.87‘ N	007° 00.07‘ E	32	bottom, 5	12.0	Cs	10, 100	—	073-074	02.09.18	15:22 – 15:57
GN023	55° 00.06‘ N	007° 34.97‘ E	26	bottom, 2×5	6.0	Cs/Sr/H3/Tu	5, 100	bottom, 5	075-077	02.09.18	18:10 – 18:31
GN024	55° 00.04‘ N	007° 59.88‘ E	17	bottom, 2×5	—	—	5, 100	bottom, 5	078-080	02.09.18	20:26 – 20:48

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi-depth [m]	radio-activity	Organic [l]	nutrients [m]	Bedford ID 184nnn	date dd.mm.yy	time [UTC]
GN025	54° 59.95‘ N	008° 14.76‘ E	13	bottom, 2×5	—	Cs/Sr/H3/Tu	5, 100	bottom, 5	081-083	02.09.18	22:00 – 22:22
GN026	56° 00.05‘ N	007° 48.05‘ E	27	bottom, 2×5	10.0	Cs/Sr/H3/Tu	5, 100	bottom, 5	084-086	03.09.18	06:07 – 06:29
GN026A	55° 59.96‘ N	007° 00.10‘ E	35	bottom, 5	—	Cs/Sr/H3/Tu	—	—	087-088	03.09.18	09:08 – 09:28
GN027	56° 00.03‘ N	006° 00.22‘ E	48	bottom, 2×5	14.5	Cs	10, 100	bottom, 5	089-091	03.09.18	12:48 – 13:12
GN028	55° 59.98‘ N	005° 00.10‘ E	44	bottom, 5	14.5	Cs	—	bottom, 5	092-093	03.09.18	16:30 – 16:42
GN029	56° 00.15‘ N	002° 59.86‘ E	75	bottom, 2×5	—	Cs/Sr/H3/Tu	2×10, 2×100	bottom, 5	094-096	03.09.18	23:02 – 23:45
GN030	56° 00.05‘ N	001° 59.98‘ E	86	bottom, 2×5	—	Cs	—	bottom, 5	097-099	04.09.18	03:02 – 03:19
GN031	55° 59.99‘ N	001° 00.02‘ E	78	bottom, 5	20.0	Cs	—	bottom, 5	100-101	04.09.18	06:35 – 06:44
GN032	56° 00.07‘ N	000° 00.11‘ E	87	bottom, 5	16.5	Cs	—	bottom, 5	102-103	04.09.18	10:03 – 10:18
GN033	56° 00.10‘ N	000° 59.92‘ W	64	bottom, 2×5	15.0	Cs	10, 100	bottom, 5	104-106	04.09.18	13:33 – 14:00
GN033A	55° 59.98‘ N	001° 40.17‘ W	66	bottom, 5	—	Cs/Sr/H3/Tu	—	—	107-108	04.09.18	16:11 – 16:37
GN034A	56° 59.98‘ N	001° 40.01‘ W	75	bottom, 5	—	Cs/Sr/H3/Tu		—	109-110	04.09.18	22:40 – 22:54
GN034	56° 59.97‘ N	001° 00.11‘ W	71	bottom, 2×5	—	Cs	10, 100	bottom, 5	111-113	05.09.18	01:03 – 01:29
GN035	56° 59.70‘ N	001° 20.33‘ E	99	bottom, 50, 6×5	19.0	Cs	2×10, 2×100	bottom, 5	114-121	05.09.18	09:04 – 10:16
GN036	57° 00.15‘ N	003° 29.96‘ E	65	bottom, 2×5	19.5	Cs/Sr/H3/Tu	2×10, 100	bottom, 5	122-124	05.09.18	17:16 – 17:47
GN037	56° 59.99‘ N	005° 00.00‘ E	59	bottom, 5	—	Cs	—	bottom, 5	125-126	05.09.18	22:36 – 22:48
GN038	56° 59.94‘ N	006° 00.13‘ E	52	bottom, 2×5	—	Cs	4×10, 100	bottom, 5	127-129	06.09.18	02:05 – 02:50
GN038A	57° 00.00‘ N	007° 00.04‘ E	33	bottom, 5	—	Cs/Sr/H3/Tu	—	—	130-131	06.09.18	06:04 – 06:18
GN039	57° 00.02‘ N	007° 59.99‘ E	34	bottom, 2×5	11.5	Cs/Sr/H3/Tu	2×10, 100	bottom, 5	132-134	06.09.18	09:32 – 10:00
GN040	57° 49.77‘ N	008° 00.02‘ E	525	bottom, 50, 2×5	15.5	Cs/Sr/H3/Tu	2×10, 2×100	bottom, 5	135-138	06.09.18	14:45 – 16:02
GN041	58° 00.01‘ N	005° 59.73‘ E	310	bottom, 2×5	—	Cs/Sr/H3/Tu	10, 100	bottom, 5	139-141	06.09.18	21:43 – 22:23
GN042	58° 00.06‘ N	005° 00.14‘ E	129	bottom, 5	—	Cs	—	bottom, 5	142-143	07.09.18	01:25 – 01:44
GN043	57° 59.98‘ N	003° 00.08‘ E	77	bottom, 2×5	19.0	Cs	10, 100	bottom, 5	144-146	07.09.18	07:51 – 08:13
GN044	57° 59.98‘ N	001° 29.90‘ E	106	bottom, 2×5	17.0	Cs/Sr/H3/Tu	10, 100	bottom, 5	147-149	07.09.18	12:53 – 13:19
GN045	57° 59.98‘ N	001° 00.07‘ W	115	bottom, 2×5	—	Cs/Sr/H3/Tu	10, 100	bottom, 5	150-152	07.09.18	21:28 – 22:02
GN045A	58° 00.06‘ N	001° 59.92‘ W	83	bottom, 5	—	Cs/Sr/H3/Tu	—	—	153-154	08.09.18	01:31 – 01:44
GN045B	58° 29.98‘ N	002° 29.93‘ W	71	bottom, 5	—	Cs/Sr/H3/Tu	—	—	155-156	08.09.18	05:34 – 05:47
GN046A	58° 59.89‘ N	002° 00.01‘ W	79	bottom, 5	11.0	Cs/Sr/H3/Tu	—	—	157-158	08.09.18	09:25 – 09:38
GN046	58° 59.98‘ N	001° 30.18‘ W	106	bottom, 5	>10.5	Cs	10, 2×100	bottom, 5	159-161	08.09.18	11:16 – 11:51
GN053C	59° 30.05‘ N	001° 22.21‘ W	101	bottom, 5	14.0	Cs/Sr/H3/Tu	—	—	162-163	08.09.18	15:00 – 15:14
GN053	59° 59.92‘ N	000° 30.05‘ W	126	bottom, 2×5	—	Cs/Sr/H3/Tu	10, 100	bottom, 5	164-166	08.09.18	19:09 – 19:36
GN052	59° 59.98‘ N	002° 00.12‘ E	101	bottom, 2×5	—	Cs	3×10, 100	bottom, 5	167-169	09.09.18	03:08 – 03:48
GN051	60° 00.04‘ N	004° 29.78‘ E	263	bottom, 2×5	>10.0	Cs/Sr/H3/Tu	10, 100	bottom, 5	170-172	09.09.18	11:14 – 11:50

station name	latitude	longitude	water depth [m]	water sampling CTD [m]	Secchi depth [m]	radio-activity	Organic [l]	nutrients [m]	Bedford ID 184nnn	date [dd.mm.yy]	time [UTC]
GN050	59° 00.04‘ N	004° 30.07‘ E	260	bottom, 2×5	—	Cs/Sr/H3/Tu	10, 100	bottom, 5	173-175	09.09.18	19:56 – 20:40
GN049	59° 00.00‘ N	002° 59.94‘ E	138	bottom, 2×5	—	Cs	—	bottom, 5	176-178	10.09.18	01:53 – 02:10
GN048	58° 59.97‘ N	001° 00.21‘ E	123	bottom, 5	—	Cs/Sr/H3/Tu	—	bottom, 5	179-180	10.09.18	10.28 – 10:59
GN047	58° 59.99‘ N	000° 00.05‘ W	131	bottom, 5	—	Cs	—	bottom, 5	181-182	10.09.18	15:34 – 15:54