

R/V *Celtic Explorer* 19016
August 26th – September 17th, 2019



BUNDESAMT FÜR
SEESCHIFFFAHRT
UND
HYDROGRAPHIE

**BSH NORTH SEA
SUMMER SURVEY 1998 - 2019**



R/V *Celtic Explorer* 19016 ✦ 26.08. - 17.09.2019
Hamburg - Bremerhaven

Report of the Chief Scientist

ICES Cruise Id: 45CE19016

CSRREF: 20193201

Holger Klein

Hamburg, September 2019



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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 |
| Katrin Latarius | Marine Physics | Basil Murphy | Chief Officer |
| Sören Joswig | Marine Physics | Paddy Kenny | 2 nd Officer |
| Dr. Stefanie Schmied | Marine Chemistry, Radioactivity | Caoimhin Costello | 2 nd Engineer |
| Andrea Meyer | Marine Chemistry, Radioactivity | Paul Taylor | ETO |
| Roswitha Velten | Marine Chemistry, Nutrients | Ken O'Neill | Bosun |
| Wiebke Brandt | Marine Chemistry, Nutrients | Gavin Cunningham | Cook |
| Andreas Jacobsen | Marine Chemistry, Metals | Michelin Faherty | Bosun's Mate |
| Ina Raschke | Marine Chemistry, Metals | Jimmy Burke | AB Deckhand |
| | | Declan Horan | AB Deckhand |
| | | Jacek Ronowicz | Assistant Cook |
| | | Marc O'Connor | Technician |
| | | Philip Gunnip | AB Deckhand |
| | | Jason Reynolds | AB Deckhand |
| | | Conor Kiely | Cadet |
| | | Máirtín ÓMéalóid | Cadet |



Fig. 1: The crew (ltr): Jimmy Burke, Basil Murphy, Paddy Kenny, Wiebke Brandt, Sören Joswig, Ina Raschke, Andreas Jacobsen, Jacek Ronowicz, Peter Löwe, Antony Hobin, Ken O'Neill, Holger Klein, Gavin Cunningham, Roswitha Velten, Katrin Latarius, Damien McCallig, Paul Taylor, Stefanie Schmied, Conor Kiely, Michelin Faherty, Máirtín ÓMéalóid, Caoimhin Costello, Jason Reynolds, and Philip Gunnip.

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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.

The BSH North Sea Summer Surveys (NSSS) started in 1998 and 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. They were realised at a time when thermal stratification was 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. 3). Between the CTD-stations ship-mounted temperature-, salinity- and optical sensors provided data at about 4 m depth.

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

The objective of the NSSSs is the assessment of the oceanographic and chemical state of the North Sea, the calculation of heat and salt budgets, and the identification of changes due to climate change. The data are also used for the validation of operational and climate models and for the calibration of satellite-based ocean colour data and downstream products (Secchi depth, turbidity, CDOM, chlorophyll-a) which are used for assessments and MSFD reporting. All NSSSs are listed in Table 1. Most of the data are available via the German Oceanographic Data Centre (DOD), selected surface data (5 m) are also fed into the MERis MAtchup In-situ Database (MERMAID).¹

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

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

Table 1: BSH North Sea Summer Surveys 1998-2019.

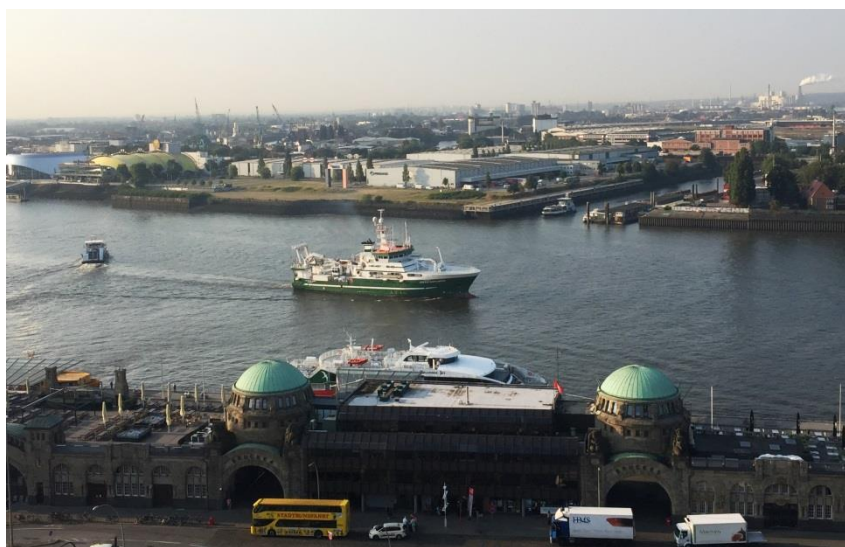


Fig. 2: Celtic Explorer leaving Hamburg
(© D. Hauck)

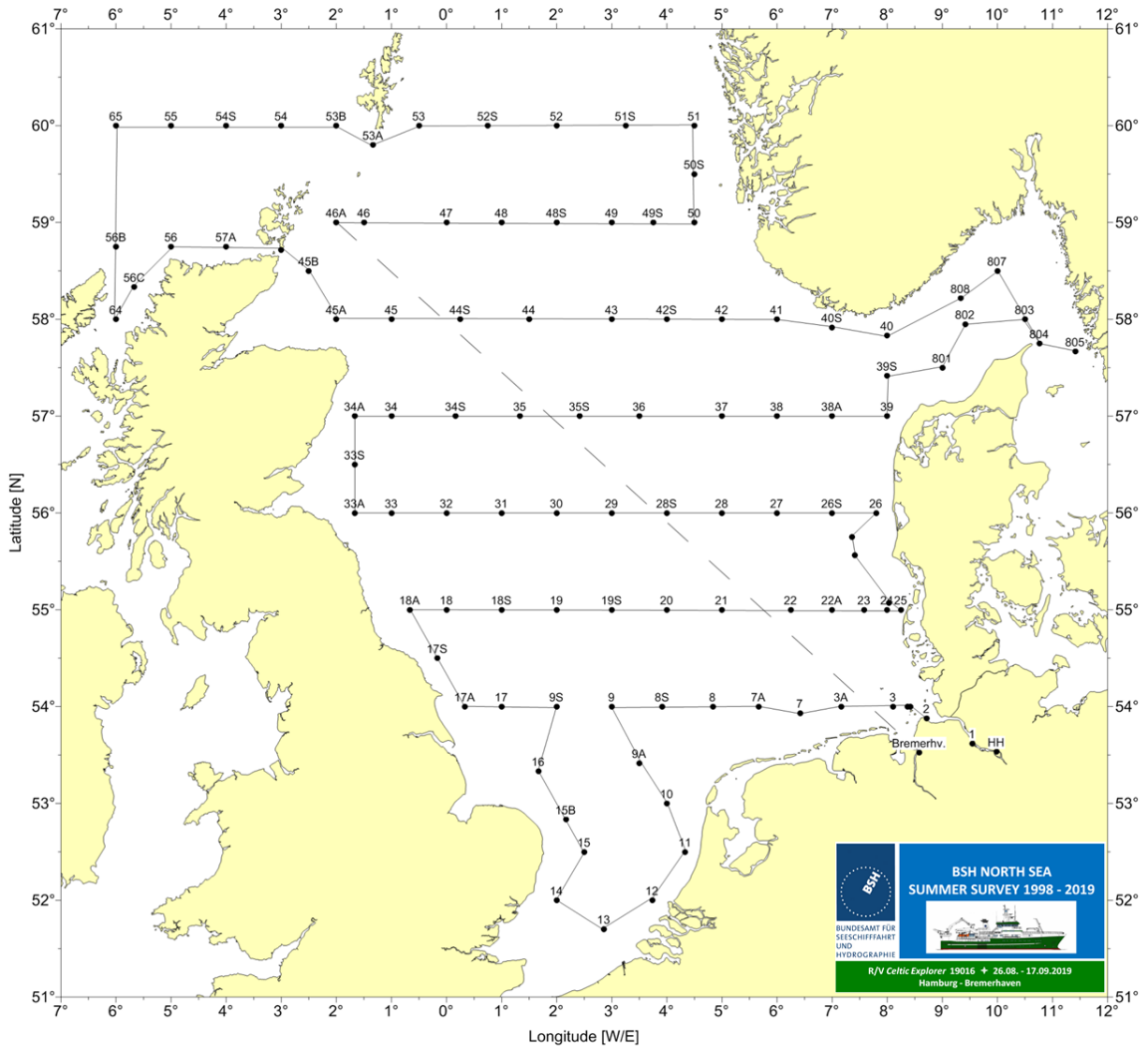


Fig. 3: Ship track and sampling stations (26S = 26A).

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.

| CTD Station 1-55: S6, bei Station 55 werden keine brauchbaren Daten aufgenommen - Kabel/Übergang Einleiter-Sonde defekt | | | | | | |
|---|----------|-----------------------------|----------|-----------|----------|---------------------------|
| Sonde S6 SBE911+ | 09P56228 | Druck | Sea-Bird | SBE9P | 1005 | 20.03.19 |
| | | Temperatur | Sea-Bird | SBE3T | 5254 | 27.05.19 |
| | | Leitfähigkeit | Sea-Bird | SBE4C | 3694 | 15.04.19 |
| Deck Unit CTD | | | Sea-Bird | SBE11+ | 11P-0529 | |
| Rosette 7 | | 24 x 10L (Goflos+Niskin) | | | | |
| Fluorometer | | | Wetlabs | WetlabECO | 4964 | 15.01.18 |
| Turbidimeter | | | Wetlabs | WetlabECO | 4964 | " |
| Oximeter | | | SBE43 | SBE43 | 3152 | 04.01.19 |
| Altimeter | | | Teledyne | Benthos | | |
| pH | | | Sea-Bird | SBE18 | 1441 | <i>kurz vor der Reise</i> |

| CTD Station 56-60: S1 | | | | | | |
|----------------------------|----------|-----------------|----------|-----------|----------|----------|
| Sonde S1 SBE911+ | 09P21787 | Druck | Sea-Bird | SBE9P | 577 | 06.02.19 |
| | | Temperatur | Sea-Bird | SBE3T | 2584 | 07.06.19 |
| | | Leitfähigkeit | Sea-Bird | SBE4C | 2886 | 07.06.19 |
| Deck Unit CTD | | | Sea-Bird | SBE11+ | 11P-0529 | |
| Rosette 1 | | 12 x 10L | | | | |
| Fluorometer | | | Wetlabs | WetlabECO | 3427 | 30.06.15 |
| Turbidimeter | | | Wetlabs | WetlabECO | 3427 | " |
| Oximeter S2 | | | SBE43 | SBE43 | 3266 | 29.12.18 |
| Altimeter | | | Teledyne | Benthos | | - |
| pH | | | - | - | - | |

CTD Station 61-101: S1 mit Fluorometer von S6, mit pH-Sensor, Station 63/GN806 wurde nicht genommen

| | | | | | | |
|---------------------|----------|---------------|----------|-----------|----------|--------------------|
| Sonde S1 SBE911+ | | Druck | Sea-Bird | SBE9P | 577 | 06.02.19 |
| | 09P21787 | Temperatur | Sea-Bird | SBE3T | 2584 | 07.06.19 |
| | | Leitfähigkeit | Sea-Bird | SBE4C | 2886 | 07.06.19 |
| Deck Unit CTD | | | Sea-Bird | SBE11+ | 11P-0529 | |
| Rosette 1 | | 12 x 10L | | | | |
| Fluorometer | | | Wetlabs | WetlabECO | 4964 | 15.01.18 |
| Turbidimeter | | | Wetlabs | WetlabECO | 4964 | " |
| Oximeter | | | SBE43 | SBE43 | 3152 | 04.01.19 |
| Altimeter | | | Teledyne | Benthos | | |
| pH | | | Sea-Bird | SBE18 | 1441 | kurz vor der Reise |

| Date: | 26.08.19 | 30.08.19 | 01.09.19 | 04.09.19 | 06.09.19 | 11.09.19 |
|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| CTD: | S6 | S6 | S6 | S1 | S1 | S1 |
| Position Release Module | Bottle ID | Bottle ID | Bottle ID | Bottle ID | Bottle ID | Bottle ID |
| 1 | 181004 | 181004 | 181004 | 181001 | 181001 | 181001 |
| 2 | Goflo | Goflo | Goflo | 9 | 9 | 9 |
| 3 | Goflo | Goflo | Goflo | 181003 | 181003 | 181006 |
| 4 | Goflo | Goflo | Goflo | 11 | 11 | 181014 |
| 5 | 181011 | 181006 | 181006 | 181005 | 181005 | 181005 |
| 6 | 181013 | 181013 | 181013 | — | 181006 | |
| 7 | 181014 | 181014 | 181014 | — | 181013 | 181013 |
| 8 | 181015 | 181015 | 181015 | — | 181014 | 181003 |
| 9 | 181009 | 181009 | 181010 | — | — | — |
| 10 | 181002 | 181002 | 181002 | — | — | — |
| 11 | 181006 | 181011 | 181011 | — | 191010 | 191010 |
| 12 | 191010 | 191010 | 191010 | — | 191009 | 191009 |

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.
- Sampling and freezing aboard for determination of Total-N and Total-P ashore (German-Bight-stations).

Radiochemistry:

- 2 x 35 l surface water for the determination 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 caesium-137 by means of an ion exchanger (KNiFC-PAN).
- 100 l surface water samples for the on-board analysis of transuranic elements.
- 270 l samples taken at station GN808 for the determination of strontium and tritium after the cruise and of caesium and transuranic elements on board.

Trace Metals:

- Determination of metal concentrations in sea water and suspended matter. Sampling via Clean CTD with GoFlo sampler or - if Clean CTD is not possible - MERCOS sampler with plastic covered wire.

Container Plan

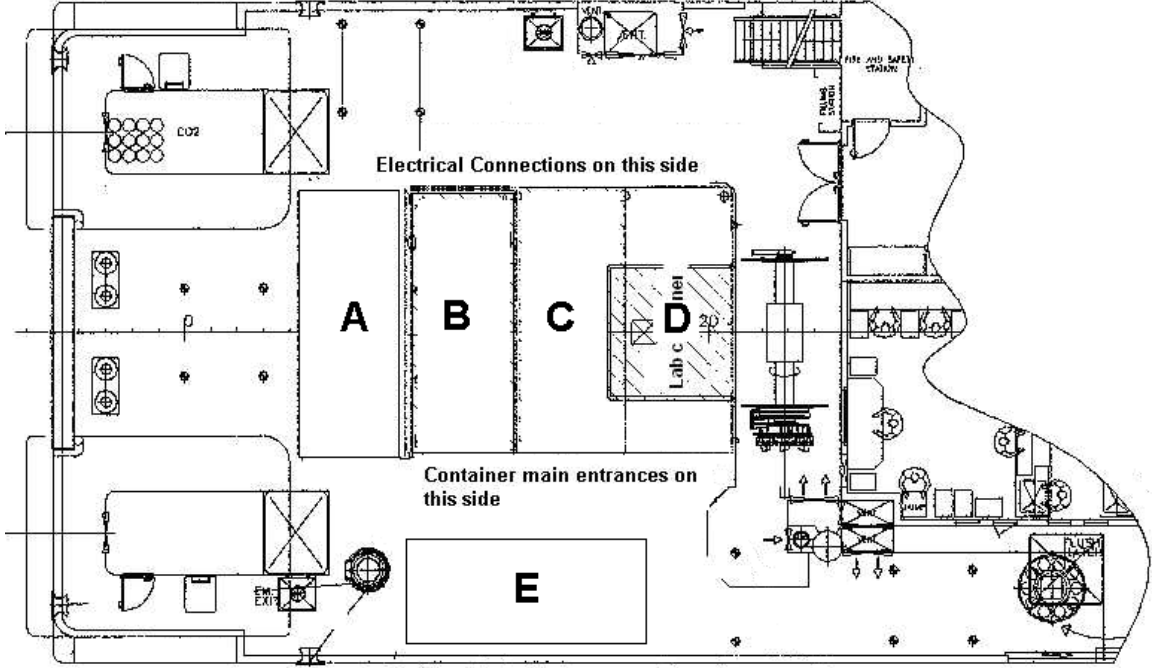


Fig. 4: Container plan Celtic Explorer

| slot | container type | weight | power supply |
|------|--|----------|--------------|
| A | Four 600 l drums for nutrients and calibration lab | | |
| B | Bottom: 20" M34 lab container, height 3.1 m (HM) Top: — | 9 t | 2 x 32 A |
| C | Bottom: 20" Transport container radioactivity Top: — | 9 t — | — — |
| D | Bottom: 20" M32 lab container for radioactivity, fresh- and sea water 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,

Water temperature (T_w) and salinity data are raw data from the CTD bottle file for 5 m depth.

| 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 |

Radioactivity (artificial nuclides), sea water samples are taken for the following artificial nuclides: Cs-137 = cesium-137; Cs-134 = cesium-134; Sr-90 = strontium-90; H-3 = tritium, Pu = plutonium, Am = americium, Cm = curium, TU = transuranic elements (Pu, Am, Cm). If no samplers are used, samples are taken from the seawater pipe.

Trace Metals: Samples taken by Clean-CTD with GoFlo sampler or separately with MERCOS sampler.

Watch table marine physics:

00-04/12-16: Katrin

04-08/16-20: Peter

08-12/20-00: Sören

Watch table radioactivity:

00-12: Steffi

12-00: Andrea

Watch table nutrients:

06-18: Rosa

18-06: Wiebke

Watch table metals:

04-16 Ina

16-04 Andreas

For sample details see Appendix 5!

Monday, August 26th, 2019

- 07:30** Arrival of science crew at Celtic Explorer. Berth: Schuppen 62, Süd-West-Terminal, Am Kamerunkai 5, 20457 Hamburg.
- 09:20** 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 lab and wet labs and installation of sensor systems.
- 15:00** Security instructions by the chief officer Basil Murphy.

Tuesday, August 27th, 2019

05:50 Sailing.

↓ **07:55 – 08:09 Station STADE:**

Water samples for artificial nuclides and GoFlo sampler for metals.

W&S: No wind data, 1018 hPa, $T_A = 26.6$ °C, fine. $T_w = 21.7$ °C.

↓ **11:49 – 12:03 Station MEDEM:**

Water samples for artificial nuclides and GoFlo sampler for metals.

W&S: Bft. 2-3, 70°, 1017 hPa, $T_A = 27.8$ °C, fine. $T_w = 20.9$ °C.

↓ **13:53 - 14:10 Station GN003/ELBE1:**

Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.

W&S: Bft. 2, 50°, 1016 hPa, $T_A = 25.2$ °C, fine, $T_w = 19.3$ °C, $S = 32.90$ psu.

15:50: Muster Station exercise

↓ **17:39 – 17:51 Station GN003A:**

Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.

W&S: Bft. 3-4, 80°, 1015 hPa, $T_A = 22.2$ °C, fine, $T_w = 20.0$ °C, $S = 32.90$ psu.

↓ **20:54 – 21:10 Station GN007 (Borkumriffgrund):**

Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.

W&S: Bft. 4, 80°, 1014 hPa, $T_A = 22.4$ °C, obscured sky, $T_w = 19.8$ °C, $S = 33.29$ psu.

↓ **23:43 – 23:59 Station GN007A:**

Clean-CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.

W&S: Bft. 4, 120°, 1013 hPa, $T_A = 21.9$ °C, obscured sky, $T_w = 20.1$ °C, $S = 34.58$ psu.

Wednesday, August 28th, 2019

↓ **02:50 – 03:08 Station GN008:**

Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.

W&S: Bft. 4, 160°, 1011 hPa, $T_A = 21.0$ °C, obscured sky, $T_w = 19.8$ °C, $S = 34.49$ psu.

- ↓ **06:53 – 07:02 Station GN008S:**
 Clean-CTD profile with rosette sampler for salinity.
W&S: Bft. 2, 250°, 1011 hPa, $T_A = 22.7$ °C, fine, $T_w = 19.2$ °C, $S = 34.67$ psu.
- ↓ **10:17 – 10:45 Station GN009 (Outer Well Bank):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 3, 270°, 1012 hPa, $T_A = 19.9$ °C, cloudy, $T_w = 17.5$ °C, $S = 34.66$ psu.
- ↓ **14:55 – 15:15 Station GN009A:**
 Secchi depth and Clean-CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 2, 230°, 1013 hPa, $T_A = 21.1$ °C, cloudy, $T_w = 18.8$ °C, $S = 34.42$ psu.
- ↓ **18:09 – 18:19 Station GN010 (west of Den Helder):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 3, 200°, 1013 hPa, $T_A = 20.2$ °C, cloudy, $T_w = 19.1$ °C, $S = 35.14$ psu.
- ↓ **21:38 – 21:46 Station GN011 (west of IJmuiden):**
 Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1015 hPa, $T_A = 19.9$ °C, obscured sky, $T_w = 19.6$ °C, $S = 32.54$ psu.

Thursday, August 29th, 2019

- ↓ **02:40 – 02:54 Station GN012 (west of Hoek van Holland):**
 Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1015 hPa, $T_A = 19.1$ °C, obscured sky, $T_w = 19.9$ °C, $S = 34.50$ psu.
- ↓ **06:50 – 07:02 Station GN013 (Rabsbank):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 260°, 1017 hPa, $T_A = 19.1$ °C, partly cloudy, $T_w = 19.1$ °C, $S = 35.03$ psu.
- ↓ **09:45 - 11:1 Station GN014 (Outer Gabbard):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 2, 270°, 1020 hPa, $T_A = 19.2$ °C, fine, $T_w = 18.6$ °C, $S = 35.12$ psu.
- ↓ **14:04 – 14:17 Station GN015 (east of Lowestoft):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 2-3, 210°, 1020 hPa, $T_A = 21.8$ °C, fine, $T_w = 19.1$ °C, $S = 34.70$ psu
 Due to strong tidal currents no near-bottom sampling.
- ↓ **16:31 – 16:43 Station GN015B:**
 Secchi depth and Clean-CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 5, 190°, 1019 hPa, $T_A = 18.6$ °C, fine, $T_w = 18.6$ °C, $S = 34.23$ psu

- ↓ **20:43 – 20:54 Station GN016 (Haddock Bank):**
Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides. 10-fold determination of oxygen.
W&S: Bft. 3, 210°, 1019 hPa, $T_A = 17.8$ °C, obscured sky, $T_w = 17.0.0$ °C, $S = 34.46$ psu.

Friday, August 30th, 2019

- ↓ **02:26 – 02:42 Station GN009S (Outer Silver Pit):**
Clean-CTD profile with rosette sampler salinity.
W&S: Bft. 4, 220°, 1018 hPa, $T_A = 17.2$ °C, obscured sky, $T_w = 17.2.0$ °C, $S = 34.64$ psu.
- ↓ **06:39 – 06:48 Station GN017 (east of Flamborough Head):**
Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 6, 220°, 1017 hPa, $T_A = 16.4$ °C, cloudy, $T_w = 15.9$ °C, $S = 34.34$ psu.
The position of bottle S-ID181011 and S-ID181006 in the rosette sampler frame was exchanged.
- ↓ **09:26 – 09:37 Station GN017A:**
Secchi depth and Clean-CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 4-5, 200°, 1017 hPa, $T_A = 17.1$ °C, cloudy, $T_w = 14.8$ °C, $S = 34.25$ psu
- ↓ **12:42 – 12:54 Station GN017S:**
Secchi depth and Clean-CTD profile with rosette sampler for nutrients and salinity. 10-fold determination of chlorophyll.
W&S: Bft. 4-5, 210°, 1015 hPa, $T_A = 18.6$ °C, cloudy, $T_w = 15.7$ °C, $S = 34.00$ psu.
- ↓ **16:45 – 16:56 Station GN018A:**
Secchi depth and Clean-CTD profile with rosette sampler salinity. Water samples for artificial nuclides.
W&S: no wind data, 1013 hPa, $T_A = 18.1$ °C, cloudy, $T_w = 14.6$ °C, $S = 34.26$ psu.
- ↓ **19:12 – 19:29 Station GN018 (Baymans Hole):**
Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 220°, 1013 hPa, $T_A = 17.9$ °C, cloudy, $T_w = 16.9$ °C, $S = 34.54$ psu.
- ↓ **22:59 – 23:13 Station GN018S (Bruceys Garden):**
Clean-CTD profile with rosette sampler for salinity.
W&S: Bft. 5, 210°, 1013 hPa, $T_A = 18.6$ °C, obscured sky, $T_w = 17.2$ °C, $S = 34.62$ psu.

Saturday, August 31st, 2019

- ↓ **02:43 – 02:56 Station GN019 (Doggerbank):**
Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: no wind data, 1026 hPa, $T_A = 17.7$ °C, obscured sky, $T_w = 17.0$ °C, $S = 34.61$ psu.

- ↓ **06:18 – 06:28 Station GN019S:**
 Secchi depth and Clean-CTD profile with rosette sampler for salinity.
W&S: Bft. 5-6, 190°, 1011 hPa, $T_A = 17.7$ °C, partly cloudy, $T_w = 17.3$ °C, $S = 34.67$ psu.
- ↓ **09:44 – 10:05 Station GN020 (east of Doggerbank):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 6-7, 210°, 1011 hPa, $T_A = 18.6$ °C, partly cloudy, $T_w = 17.4$ °C, $S = 34.69$ psu.
- ↓ **13:40 – 13:53 Station GN021/AWZW2 (Nordschillgrund):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 4-5, 170°, 1009 hPa, $T_A = 20.2$ °C, partly cloudy, $T_w = 17.9$ °C, $S = 34.65$ psu.
- ↓ **18:19 – 20:14 Station GN022 (Weiße Bank):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
 4 × 500-l-sampler for flushing and filling of two 600 liter containers with sea water low in nutrients.
W&S: Bft. 3, 180°, 1008 hPa, $T_A = 20.1$ °C, obscured sky, $T_w = 18.9$ °C, $S = 34.55$ psu.
- ↓ **22:50 – 23:05 Station GN022A:**
 Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1008 hPa, $T_A = 18.4$ °C, obscured sky, $T_w = 19.5$ °C, $S = 33.64$ psu.
 Bottle S-ID181009 had contact to the ship's side, thus drain cock was damaged. It was replaced by bottle S-ID181010.

Sunday, September 1st, 2019

- ↓ **01:01 – 01:09 Station GN023:**
 Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1007 hPa, $T_A = 18.1$ °C, obscured sky, $T_w = 18.9$ °C, $S = 33.31$ psu.
- ↓ **03:09 – 03:20 Station GN024:**
 Clean-CTD profile with rosette sampler for nutrients, metals, and salinity.
W&S: Bft. 3, 250°, 1007 hPa, $T_A = 18.3$ °C, obscured sky, $T_w = 19.6$ °C, $S = 32.08$ psu.
- ↓ **04:49 – 05:02 Station GN025 (west of Sylt):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 6, 3100°, 1007 hPa, $T_A = 18.6$ °C, partly cloudy, $T_w = 19.9$ °C, $S = 31.37$ psu.

- ↓ **13:05 – 13:16 Station GN026 (west of Lyngvik):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 3, 260°, 1011 hPa, $T_A = 17.7$ °C, cloudy, $T_w = 18.7$ °C, $S = 32.96$ psu.
- ↓ **16:33 – 16:42 Station GN026A:**
 Secchi depth and Clean-CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 270°, 1012 hPa, partly cloudy, $T_A = 17.1$ °C, $T_w = 18.1$ °C, $S = 34.18$ psu.
- ↓ **20:47 – 20:57 Station GN027:**
 Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1013 hPa, $T_A = 15.9$ °C, obscured sky, $T_w = 17.5$ °C, $S = 34.76$ psu.

Monday, September 2nd, 2019

- ↓ **01:01 – 01:13 Station GN028:**
 Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1015 hPa, $T_A = 15.5$ °C, obscured sky, $T_w = 17.1$ °C, $S = 34.88$ psu.
- ↓ **04:56 – 05:08 Station GN028S:**
 Clean-CTD profile with rosette sampler for salinity.
W&S: Bft. 3-4, 300°, 1017 hPa, $T_A = 14.6$ °C, partly cloudy, $T_w = 16.9$ °C, $S = 34.89$ psu.
- ↓ **08:40 – 08:54 Station GN029:**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 240°, 1018 hPa, $T_A = 17.0$ °C, partly cloudy, $T_w = 16.6$ °C, $S = 34.90$ psu.
- ↓ **03:02 – 03:19 Station GN030:**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 4-5, 230°, 1017 hPa, $T_A = 15.7$ °C, partly cloudy, $T_w = 16.4$ °C, $S = 34.80$ psu.
- ↓ **16:33 – 16:46 Station GN031:**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 6-7, 230°, 1013 hPa, $T_A = 15.0$ °C, overcast, rain, $T_w = 16.5$ °C, $S = 34.70$ psu.
- ↓ **21:57 – 22:14 Station GN032:**
 Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1012 hPa, $T_A = 12.2$ °C, obscured sky, $T_w = 15.2$ °C, $S = 34.69$ psu.

Tuesday, September 3rd, 2019

- ↓ **02:18 – 02:36 Station GN033 (east of Firth of Forth):**
Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1014 hPa, $T_A = 14.8$ °C, obscured sky, $T_w = 14.0$ °C, $S = 34.63$ psu.
- ↓ **05:03 – 05:17 Station GN033A:**
Secchi depth and Clean-CTD salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 250°, 1014 hPa, $T_A = 14.6$ °C, partly cloudy, $T_w = 13.4$ °C, $S = 34.88$ psu.
- ↓ **08:24 – 08:36 Station GN033S (Marr Bank):**
Secchi depth and Clean-CTD profile with rosette sampler for salinity.
W&S: Bft. 3, 130°, 1016 hPa, $T_A = 13.2$ °C cloudy, $T_w = 12.4$ °C, $S = 34.64$ psu.

The bottom sampler could not be closed because it was connected to the wrong release hook.
- ↓ **11:10 – 11:23 Station GN034A:**
Secchi depth and Clean-CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 160°, 1015 hPa, $T_A = 13.4$ °C, cloudy, $T_w = 12.6$ °C, $S = 34.70$ psu.
- ↓ **13:33 – 13:47 Station GN034 (Aberdeen Bank):**
Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides. 10-fold determination of alkalinity.
W&S: Bft. 4, 140°, 1014 hPa, $T_A = 14.0$ °C, cloudy, $T_w = 13.3$ °C, $S = 34.69$ psu.
- ↓ **17:34 – 17:47 Station GN034S:**
Secchi depth and Clean-CTD profile with rosette sampler for salinity.
W&S: Bft. 4, 200°, 1012 hPa, $T_A = 14.5$ °C, cloudy, $T_w = 13.6$ °C, $S = 34.91$ psu.
- ↓ **21:36 – 21:56 Station GN035 (Coal Pitt):**
Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 220°, 1010 hPa, $T_A = 15.0$ °C, obscured sky, $T_w = 14.2$ °C, $S = 34.87$ psu.

Wednesday, September 4th, 2019

- ↓ **01:18 – 01:33 Station GN035S:**
Clean-CTD profile with rosette sampler for salinity.
W&S: No wind data, 1008 hPa, $T_A = 15.1$ °C, obscured sky, $T_w = 15.9$ °C, $S = 34.78$ psu.
- ↓ **05:02 – 05:16 Station GN036:**
Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 4-5, 220°, 1005 hPa, $T_A = 15.8$ °C, cloudy, $T_w = 16.1$ °C, $S = 34.77$ psu.

- ↓ **10:26 – 10:39 Station GN037 (Große Fischerbank):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: Bft. 5, 250°, 1003 hPa, $T_A = 16.2$ °C, cloudy, $T_w = 16.1$ °C, $S = 34.77$ psu.
- ↓ **13:48 – 13:58 Station GN038 (Kleine Fischerbank):**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1004 hPa, $T_A = 16.0$ °C, partly cloudy, $T_w = 16.7$ °C, $S = 34.73$ psu.
16:00: Bft 5, 300°, strong swell.
- ↓ **17:05 – 17:21 Station GN038A:**
 Secchi depth and Clean-CTD profile with rosette sampler for nutrients, metals, and salinity. Water samples for artificial nuclides.
W&S: No wind data, 1004 hPa, $T_A = 16.0$ °C, partly cloudy, $T_w = 16.7$ °C, $S = 34.76$ psu.
 Problems occurred with data transmission between CTD and deck unit. Checked all plug connectors. Test on deck OK, will make a final check on next station.
- ↓ **20:34 – 21:07 Station GN039 (east of Jyske Rev):**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 4, 280°, 1004 hPa, $T_A = 15.3$ °C, obscured sky, $T_w = 17.2$ °C, $S = 34.34$ psu.
 One cable of the Clean-CTD was defect, changed to CTD S1.
- ↓ **23:34 – 23:47 Station GN039S:**
 CTD profile with rosette sampler salinity.
W&S: No wind data, 1004 hPa, $T_A = 14.9$ °C, obscured sky, $T_w = 16.5$ °C, $S = 31.69$ psu.

Thursday, September 5th, 2019

- ↓ **02:56 – 03:23 Station GN801:**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 36, 280°, 1003 hPa, $T_A = 13.8$ °C, obscured sky, $T_w = 17.0$ °C, $S = 34.36$ psu.
- ↓ **06:16 – 06:52 Station GN802:**
 Secchi depth and CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 4, 240°, 1002 hPa, $T_A = 13.8$ °C, partly cloudy, $T_w = 16.5$ °C, $S = 30.54$ psu.
- ↓ **10:31 – 11:15 Station GN803:**
 Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 5, 310°, 1002 hPa, $T_A = 13.1$ °C, partly cloudy, $T_w = 16.6$ °C, $S = 30.29$ psu.

Test of Clean-CTD failed, changed to CTD S1 for the remaining stations. We exchanged pH-senor and fluorometer from CTD S6 to CTD S1.

- ↓ **13:00 – 13:23 Station GN804:**
Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 6, 270°, 1003 hPa, $T_A = 14.8$ °C, partly cloudy, $T_w = 17.1$ °C, $S = 31.39$ psu.

Waypoint for entry in Swedish waters: 57° 40'N; 11° 10'E.

- ↓ **15:23 – 15:51 Station GN805:**
Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 5, 280°, 1005 hPa, $T_A = 16.6$ °C, partly cloudy, $T_w = 17.1$ °C, $S = 30.56$ psu.

Friday, September 6th, 2019

- ↓ **23:59 – 00:47 Station GN807:**
Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 4, 270°, 1010 hPa, $T_A = 14.1$ °C, obscured sky, $T_w = 16.6$ °C, $S = 30.78$ psu.

- ↓ **04:59 – 09:59 Station GN808:**
Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 4, 260°, 1012 hPa, $T_A = 13.1$ °C, cloudy, $T_w = 16.2$ °C, $S = 29.81$ psu.

Taking three 270 liter samples for the determination of artificial nuclides at 39, 97, and 262 m depth.

- ↓ **15:36 – 16:22 Station GN040 (Skagerrak):**
Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: No wind data, 1008 hPa, $T_A = 15.0$ °C, partly cloudy, $T_w = 16.8$ °C, $S = 28.64$ psu.

- ↓ **20:46 – 21:12 Station GN040S:**
CTD profile with rosette sampler for salinity.
W&S: No wind data, 1008 hPa, $T_A = 14.9$ °C, obscured sky, $T_w = 16.3$ °C, $S = 33.00$ psu.

Saturday, September 7th, 2019

- ↓ **00:39 – 01:16 Station GN041 (west of Lindesnes):**
CTD profile with rosette sampler for salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 2, 310°, 1009 hPa, $T_A = 14.7$ °C, obscured sky, $T_w = 16.3$ °C, $S = 31.66$ psu.

- ↓ **04:49 – 05:21 Station GN042 (Eigersundbank):**
 Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: No wind data, 1011 hPa, $T_A = 13.9\text{ }^\circ\text{C}$, partly cloudy, $T_w = 15.9\text{ }^\circ\text{C}$, $S = 31.66$ psu.
07:30: Bft 6-7, 340° , strong swell.
- ↓ **09:53 – 10:30 Station GN042S:**
 CTD profile with rosette sampler for salinity.
W&S: No wind data, 1016 hPa, $T_A = 14.3\text{ }^\circ\text{C}$, partly cloudy, $T_w = 14.3\text{ }^\circ\text{C}$, $S = 34.92$ psu.
- ↓ **14:30 – 15:00 Station GN043 (Lingbank East):**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 5-6, 350° , 1020 hPa, $T_A = 13.8\text{ }^\circ\text{C}$, partly cloudy, $T_w = 14.3\text{ }^\circ\text{C}$, $S = 34.88$ psu.
- ↓ **20:32 – 21:02 Station GN044 (Lingbank West):**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: No wind data, 1024 hPa, $T_A = 12.3\text{ }^\circ\text{C}$, obscured sky, $T_w = 13.7\text{ }^\circ\text{C}$, $S = 35.05$ psu.

Sunday, September 8th, 2019

- ↓ **01:14 – 01:28 Station GN044S (Witch Ground):**
 CTD profile with rosette sampler for salinity.
W&S: Bft. 2, 340° , 1025 hPa, $T_A = 11.6\text{ }^\circ\text{C}$, obscured sky, $T_w = 13.4\text{ }^\circ\text{C}$, $S = 35.12$ psu.
- ↓ **05:25 – 05:55 Station GN045 (east of South Bank):**
 Secchi depth and CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 1, 210° , 1025 hPa, $T_A = 10.2\text{ }^\circ\text{C}$, fine, $T_w = 12.4\text{ }^\circ\text{C}$, $S = 35.19$ psu.
W&S 07:40; Bft 4, 170° , fine.
 Between GN045 and GN045 we filled two 600 liter containers with surface seawater for the calibration lab.
- ↓ **08:54 – 09:07 Station GN045A (West Bank):**
 Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: No wind dat, 1023 hPa, $T_A = 11.8\text{ }^\circ\text{C}$, fine, $T_w = 12.1\text{ }^\circ\text{C}$, $S = 34.97$ psu.
- ↓ **12:00 – 12:11 Station GN045B (east of Pentland Firth):**
 Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 180° , 1021 hPa, $T_A = 14.3\text{ }^\circ\text{C}$, fine, $T_w = 12.8\text{ }^\circ\text{C}$, $S = 34.79$ psu.

- ↓ **17:08 – 17:19 Station GN057A (east of Pentland Firth):**
 Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 160°, 1015 hPa, $T_A = 14.3$ °C, cloudy, $T_w = 13.3$ °C, $S = 34.49$ psu.
- ↓ **20:39 – 21:10 Station GN056 (Cape Wrath):**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 3, 160°, 1013 hPa, $T_A = 14.5$ °C, obscured sky, $T_w = 13.3$ °C, $S = 34.58$ psu.

Monday, September 9th, 2019

- ↓ **00:27 – 00:42 Station GN056C (North Minch):**
 CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 5, 200°, 1010 hPa, $T_A = 13.9$ °C, obscured sky, $T_w = 13.0$ °C, $S = 34.49$ psu.
- ↓ **03:06 – 03:32 Station GN064 (Shiant East Bank):**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: No wind data, 1008 hPa, $T_A = 13.5$ °C, overcast, $T_w = 13.1$ °C, $S = 34.48$ psu.
- ↓ **05:34 – 05:47 Station GN056B (Sulisker Bank South):**
 Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 5-6, 350°, 1008 hPa, $T_A = 12.8$ °C, overcast, rain, $T_w = 13.6$ °C, $S = 34.76$ psu.
- 13:00 W&S:** Bft. 4, 0°, 1010 hPa, overcast, $T_A = 12.6$ °C.
- 15:00 W&S:** Bft. 2-3, 0°, 1011 hPa, overcast, $T_A = 12.7$ °C.
- ↓ **16:28 – 17:47 Station GN065 (Færoe Bank Channel):**
 Secchi depth and CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 2, 330°, 1011 hPa, $T_A = 12.2$ °C, partly cloudy, $T_w = 12.1$ °C, $S = 35.22$ psu.
- ↓ **20:44 – 21:33 Station GN055:**
 CTD profile with rosette sampler for nutrients, and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 2, 320°, 1014 hPa, $T_A = 11.8$ °C, overcast, $T_w = 12.5$ °C, $S = 35.18$ psu.

Tuesday, September 10th, 2019

- ↓ **00:36 – 00:49 Station GN054S:**
 CTD profile with rosette sampler for salinity.
W&S: Bft. 4, 310°, 1014 hPa, $T_A = 12.0$ °C, obscured sky, $T_w = 12.8$ °C, $S = 35.14$ psu.

- ↓ **04:12 – 04:43 Station GN054 (Otter Bank):**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 3, 300°, 1014 hPa, $T_A = 11.7$ °C, partly cloudy, $T_w = 12.7$ °C, $S = 34.91$ psu.
- ↓ **07:30 – 07:42 Station GN053B (Foula Bank):**
 Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 3, 300°, 1014 hPa, $T_A = 11.8$ °C, partly cloudy, $T_w = 11.8$ °C, $S = 35.12$ psu.
- ↓ **09:59 – 10:10 Station GN053A (Sumburgh Head):**
 Secchi depth and CTD profile with rosette sampler for salinity. Water samples for artificial nuclides.
W&S: Bft. 4, 290°, 1014 hPa, $T_A = 12.2$ °C, cloudy, $T_w = 11.9$ °C, $S = 35.16$ psu.
- We are seeking shelter from ex-hurricane Dorian in the Voe of Cullingsbergh at the east coast of Bressay, Shetland (60° 10.1927'N; 001°03.7017' W).
- 17:30 W&S:** Bft 5-6 from the south in the sheltered bay.

Wednesday, September 11th, 2019

- 05:15 W&S:** Bft. 5-6, gusts up to 7, 240°, 994 hPa, cloudy.
- 10:30 W&S:** Bft. 5-6, gusts up to 7, 260°, 996 hPa, cloudy.
- 14:00** Leaving the Voe of Cullingsbergh and heading to GN0053.
W&S: Bft. 5-6, 250°, 1000 hPa, $T_A = 13.5$ °C, partly cloudy.
- ↓ **16:32 – 16:59 Station GN053 (E-lich Shetlands):**
 Secchi depth and CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 7, 270°, 1002 hPa, $T_A = 13.9$ °C, partly cloudy, $T_w = 12.7$ °C, $S = 35.17$ psu.
- ↓ **20:45 – 21:03 Station GN052S (Forty Mile Ground):**
 CTD profile with rosette sampler for salinity.
W&S: Bft. 5-6, 270°, 1006 hPa, $T_A = 12.5$ °C, obscured sky, $T_w = 12.9$ °C, $S = 35.12$ psu.

Thursday, September 12th, 2019

- ↓ **00:55 – 01:23 Station GN052 (Bergen Bank):**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 5, 260°, 1008 hPa, $T_A = 13.2$ °C, obscured sky, $T_w = 13.5$ °C, $S = 34.71$ psu.
- ↓ **05:15 – 05:46 Station GN051S:**
 Secchi depth and CTD profile with rosette sampler for salinity.
W&S: Bft. 5, 250°, 1010 hPa, $T_A = 13.0$ °C, cloudy, $T_w = 13.1$ °C, $S = 34.90$ psu.

- ↓ **09:23 – 10:05 Station GN051 (west of Selbjørnsfjord):**
 Secchi depth and CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: No wind data, 1013 hPa, $T_A = 13.7\text{ °C}$, overcast, $T_w = 15.6\text{ °C}$, $S = 31.21\text{ psu}$.
- ↓ **13:41 – 13:58 Station GN050S:**
 Secchi depth and CTD profile with rosette sampler for salinity.
W&S: No wind data, 1015 hPa, $T_A = 14.6\text{ °C}$, overcast, $T_w = 15.6\text{ °C}$, $S = 31.79\text{ psu}$.
- ↓ **17:38 – 18:24 Station GN050 (Utsira Loch):**
 Secchi depth and CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: No wind data, 1015 hPa, $T_A = 14.1\text{ °C}$, partly cloudy, $T_w = 15.3\text{ °C}$, $S = 31.87\text{ psu}$.
- ↓ **21:33 – 21:58 Station GN049S:**
 CTD profile with rosette sampler for salinity.
W&S: Bft. 5, 300°, 1017 hPa, $T_A = 14.2\text{ °C}$, obscured sky, $T_w = 15.3\text{ °C}$, $S = 31.67\text{ psu}$.

Friday, September 13th, 2019

- ↓ **01:46 – 02:22 Station GN049 (Utsira Grund):**
 CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: No wind data, 1020 hPa, $T_A = 13.5\text{ °C}$, obscured sky, $T_w = 13.7\text{ °C}$, $S = 34.53\text{ psu}$.
- 05:00 W&S:** Bft. 5, 270°, 1022 hPa, $T_A = 13.1\text{ °C}$, partly cloudy.
- ↓ **07:10 – 07:21 Station GN048S:**
 Secchi depth and CTD profile with rosette sampler salinity.
W&S: Bft. 6, 290°, 1024 hPa, $T_A = 14.3\text{ °C}$, partly cloudy, $T_w = 13.2\text{ °C}$, $S = 35.03\text{ psu}$.
- 10:45 W&S:** Bft. 7, 270°, 1027 hPa, $T_A = 13.3\text{ °C}$, partly cloudy.
- ↓ **13:20 – 13:49 Station GN048:**
 Secchi depth and CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 7, 270°, 1027 hPa, $T_A = 14.1\text{ °C}$, fine, $T_w = 13.1\text{ °C}$, $S = 35.04\text{ psu}$.
- 17:00 W&S:** Bft. 4-5, 270°, 1028 hPa, $T_A = 13.9\text{ °C}$, partly cloudy.
- ↓ **18:50 – 19:20 Station GN047 (Fladengrund Rinne):**
 Clean-CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides. MERCOS-sampler for metals.
W&S: Bft. 4, 270°, 1029 hPa, $T_A = 13.4\text{ °C}$, partly cloudy, $T_w = 13.0\text{ °C}$, $S = 35.13\text{ psu}$.

Saturday, September 14th, 2019

- ↓ **00:34 – 01:23 Station GN046:**
CTD profile with rosette sampler for nutrients and salinity. Water samples for artificial nuclides, MERCOS-sampler for metals.
W&S: Bft. 5, 250°, 1027 hPa, $T_A = 12.6$ °C, obscured sky, $T_w = 12.2$ °C, $S = 35.06$ psu.
- ↓ **03:04 – 03:19 Station GN046A:**
CTD profile with rosette sampler for salinity and water samples for artificial nuclides.
W&S: Bft. 6, 250°, 1025 hPa, $T_A = 13.0$ °C, overcast, $T_w = 12.5$ °C, $S = 34.94$ psu.
- 03:20** Heading for Bremerhaven.
- 05:15 W&S:** Bft. 4-5, 220°, 1024 hPa, $T_A = 12.7$ °C, cloudy.
- 09:30 W&S:** Bft. 5-6, 200°, 1021 hPa, $T_A = 11.9$ °C, overcast.
- 10:40 W&S:** Bft. 6-7, gusts up to 8, 200°, 1019 hPa, $T_A = 12.4$ °C, overcast, rain.
- 16:45 W&S:** Bft. 6, gusts up to 8, 200°, 1014 hPa, $T_A = 14.2$ °C, overcast, rain.
- Final processing of the last water samples for RA and nutrients

Sunday, September 15th, 2019

- 04:45 W&S:** Bft. 5-6, 300°, 1015 hPa, $T_A = 14.8$ °C, overcast, rain.
- 09:45 W&S:** Bft. 5-6, 300°, 1018 hPa, $T_A = 14.6$ °C, overcast.
- 12:30 W&S:** Bft. 5-6, 300°, 1019 hPa, $T_A = 14.7$ °C, overcast.
- 15:00 W&S:** Bft. 6, 310°, 1020 hPa, $T_A = 14.7$ °C, overcast.
- 17:15 W&S:** Bft. 4-6, 310°, 1019 hPa, $T_A = 14.7$ °C, cloudy.

Monday, September 16th, 2019

- 04:00** Pilot on board.
- 05:15 W&S:** Bft. 4, 320°, 1019 hPa, $T_A = 14.8$ °C, partly cloudy.
- 08:30** Arrival at BREDO Dry Dock, Bremerhaven
- 15:00** Post Cruise Conference

Tuesday, September 17th, 2019

- 07:00** De-mobilization with local crane.
- 11:00** Departure for Hamburg by bus.

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 (bottle files) 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 psu² 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 2019 with positive monthly anomalies between 1.0 and 1.3 K between January and April (see Table 2 and Fig. 5) and moderate anomalies between 0.5 and 0.7 K from May to July. During the first week of August the seasonal cycle reached its maximum of 17.0 °C, followed by a 1 K drop during the subsequent two weeks. During the first week of the survey SST increased slightly to 16.3 °C and decreased to 14.7 °C until the end of the survey.

SST averaged 16.7 °C in August and remained at 1.6 K above normal. During the survey the North Sea had an averaged SST of 15.5 °C.

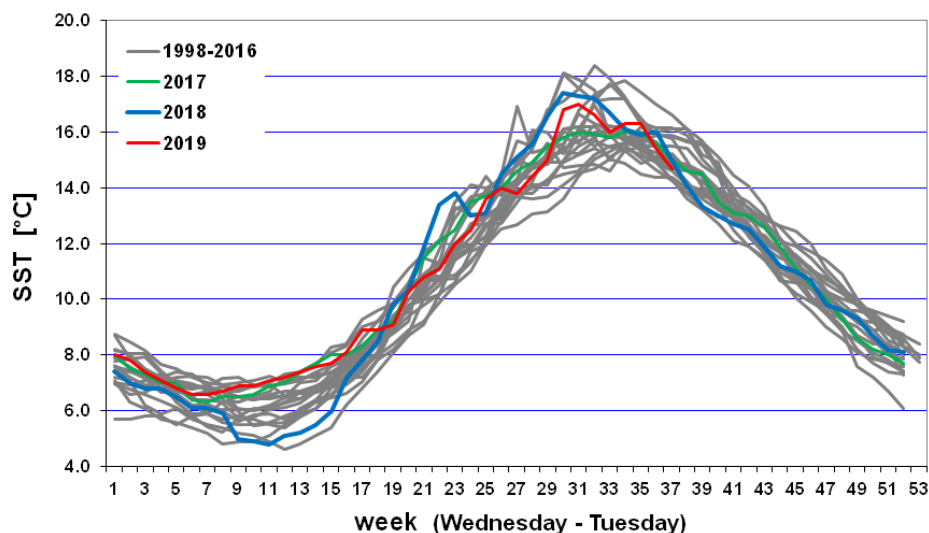


Fig. 5: Weekly area averaged North Sea SST January 1998 – 17.09.2019

² psu = practical salinity units

Table 2: Monthly North Sea area-averaged SSTs and SST anomalies in 2019
(Reference period 1971-1993)

| 2019 | Jan | Feb | Mar | Apr | May | June | Jul | Aug | Sep |
|------|-----|-----|-----|-----|-----|------|------|------|------|
| °C | 7.6 | 6.7 | 7.0 | 7.9 | 9.6 | 12.6 | 15.0 | 17.6 | 14.8 |
| K | 1.0 | 1.0 | 1.3 | 1.2 | 0.5 | 0.6 | 0.7 | 1.6 | 1.1 |

Temperature

Due to an unusual high intensity of solar radiation during the first days of the cruise, there was a moderate temperature stratification along the zonal (east-west) 54° N section. This section is normally completely vertically mixed due to tidal mixing and low water depths. The same was observed along the shallow eastern part of the 55° N section. The deeper western part of the 55° N section and all sections up to 60° N showed 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. In the Norwegian Trench the thermocline had deepens to about 100 m. The temperature difference between surface and bottom temperature was greater 10 K at the deep stations in the Skagerrak and about 8 K in the central North Sea.

Salinity

As in the previous year, there was a relative narrow inflow of Atlantic Water ($S > 35$ psu) over the East Shetland Shelf and the Fair Isle Channel in the surface layer which was also visible on the 59° N section but not on southern sections. In the bottom layer a broad inflow over the entire northern sections down to 58°N was observed reaching southward with a small tip to 56° N. At the southern connection between North Sea and Atlantic, the eastern approach to the Strait of Dover, a small tongue of Atlantic Water was detected in both layers extending north-eastward up to Station GN010 west off Den Helder. 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.



Fig. 6: Choppy waters (© H. Klein)

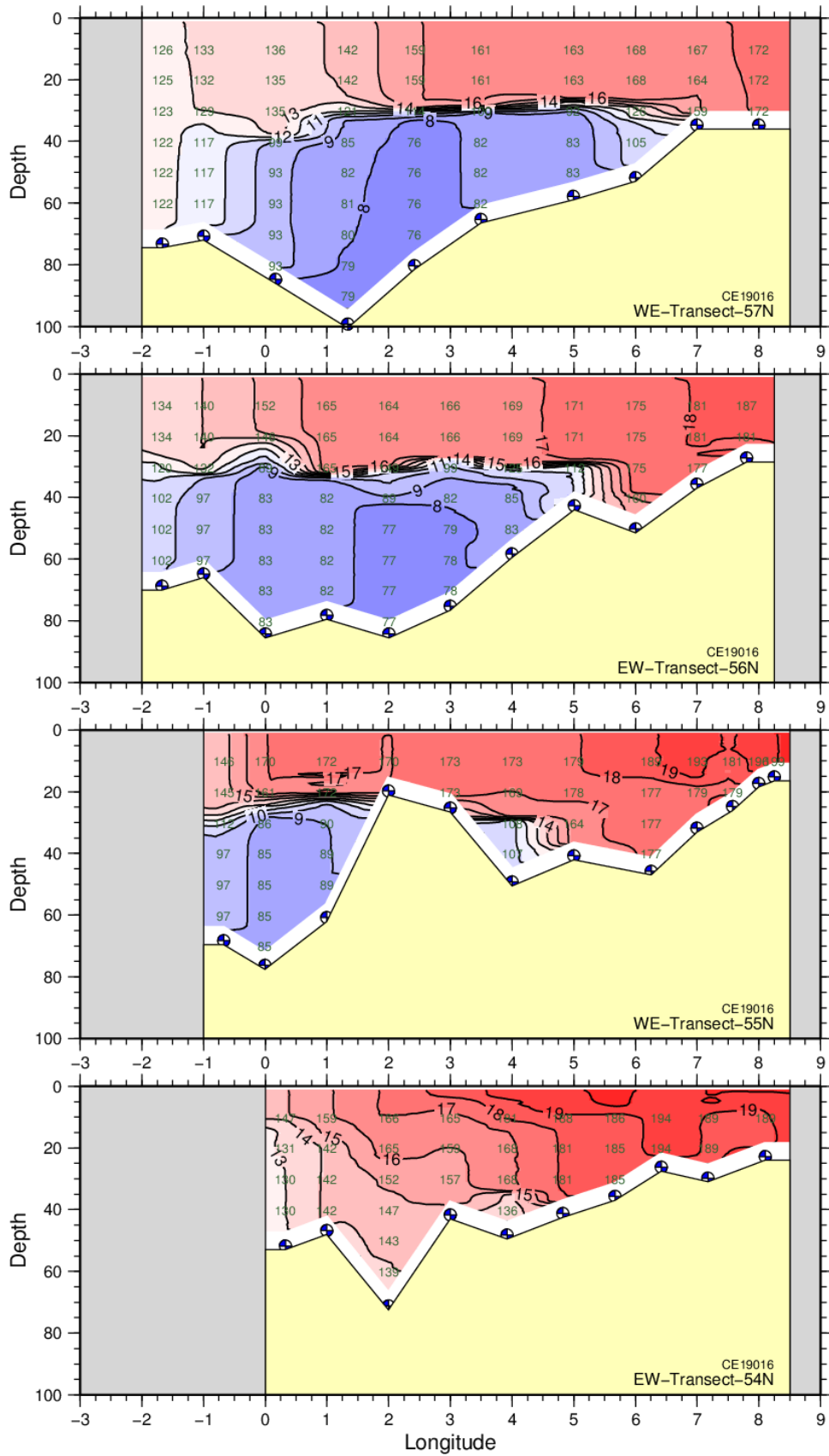


Fig. 7: Vertical temperature distribution along the 54°, 55°, 56°, and 57°N sections basing on CTD raw data. The numbers in the section give temperatures $\times 10$ for selected data points.

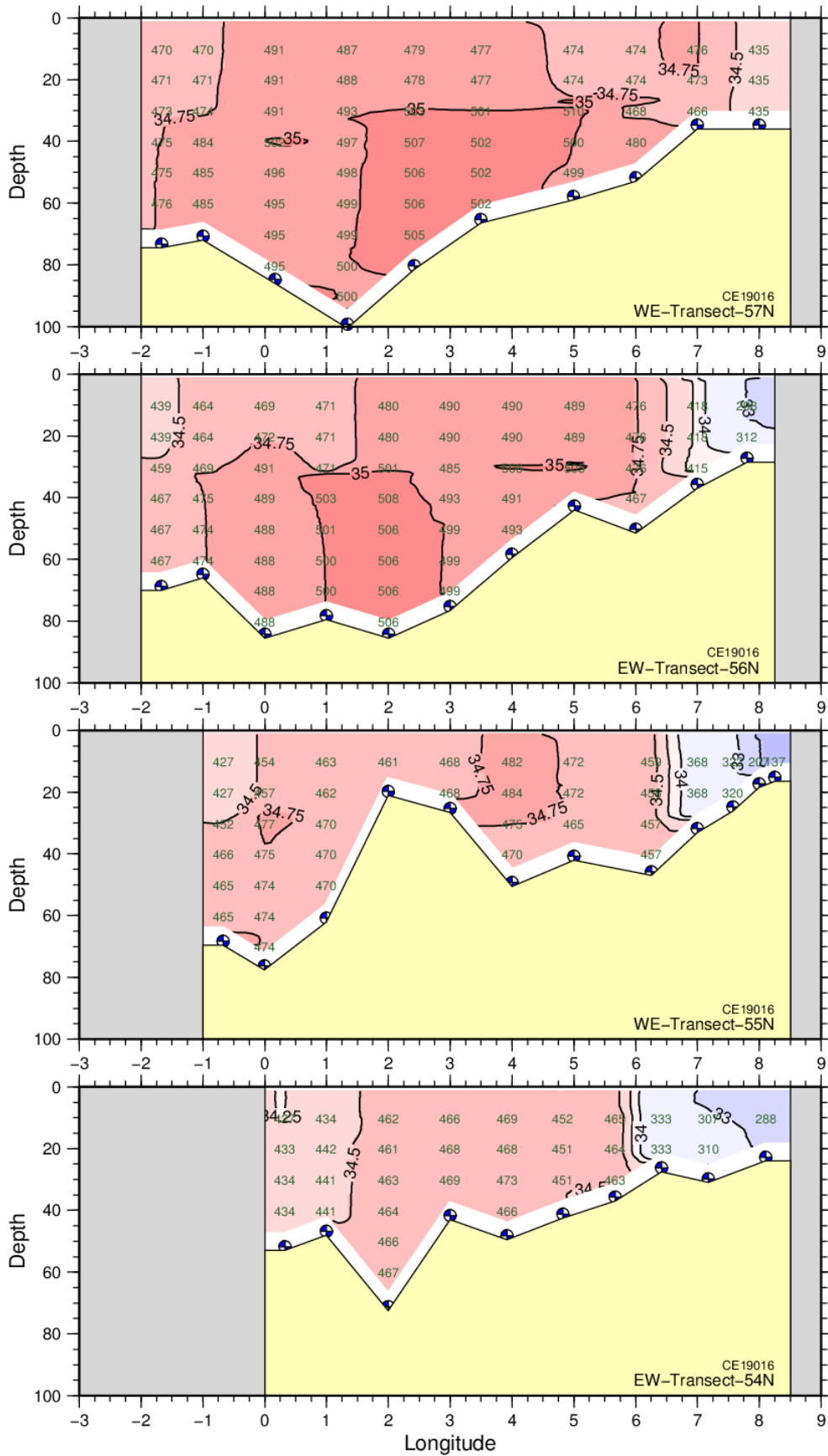


Fig. 8: Vertical salinity distribution along the 54°, 55°, 56°, and 57°N sections basing on CTD raw data. The numbers in the section give (salinities × 100) - 3000 for selected data points.

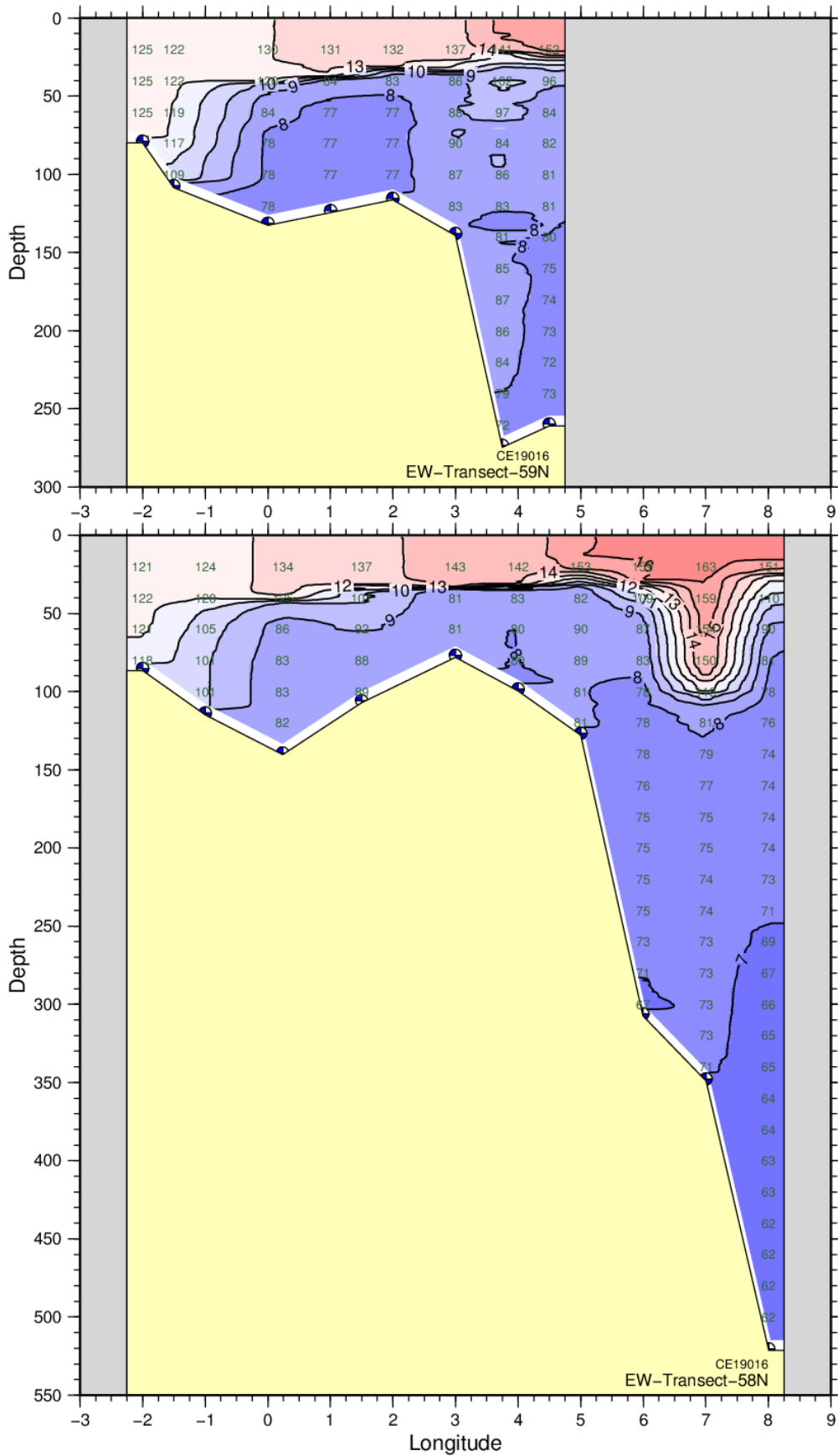


Fig. 9: Vertical temperature distribution along the 58° and 59°N sections basing on CTD raw data. The numbers in the section give temperatures $\times 10$ for selected data points.

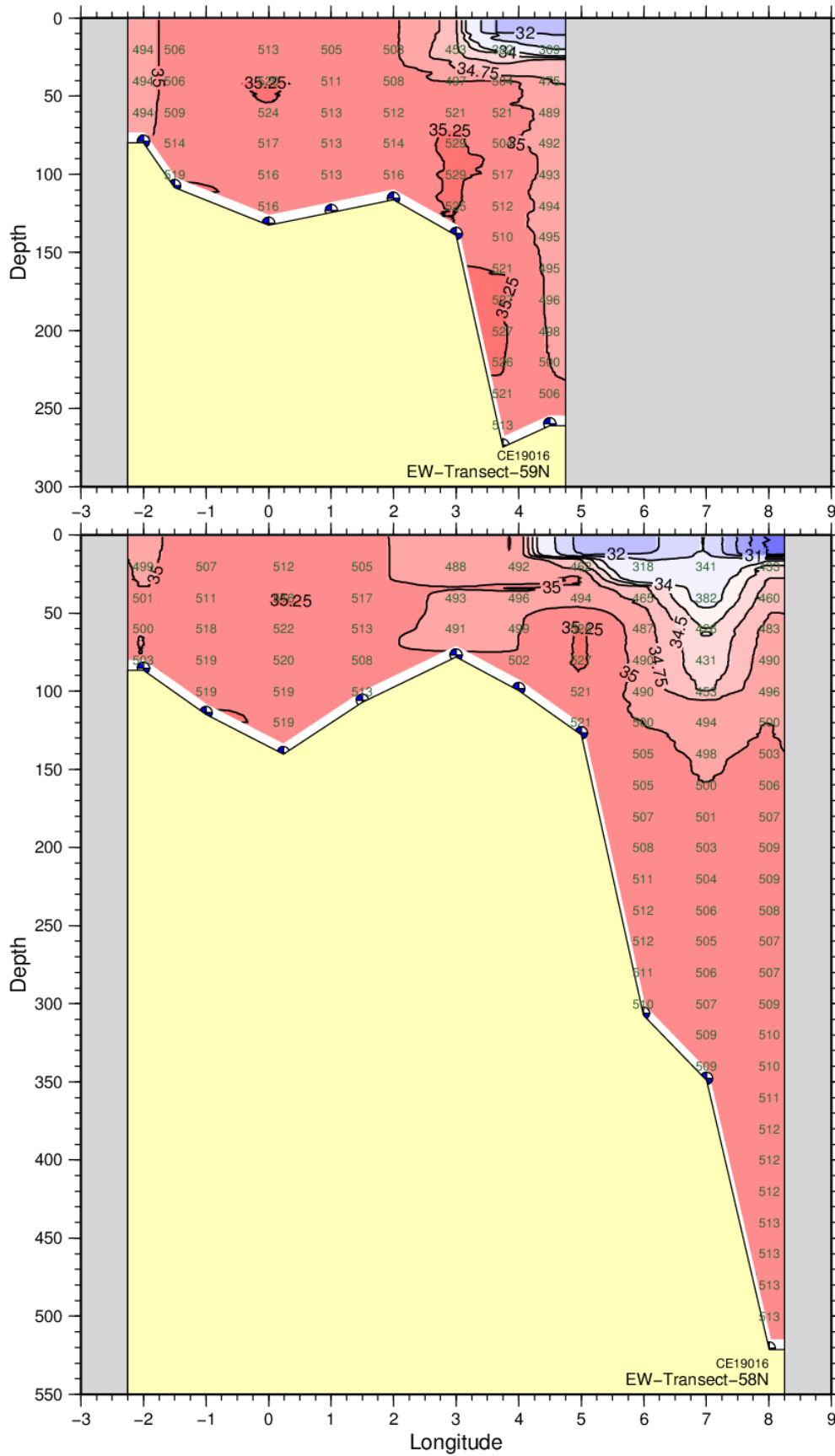


Fig. 10: Vertical salinity distribution along the 58° and 59°N sections basing on CTD raw data. The numbers in the section give (salinities \times 100) - 3000 for selected data points.

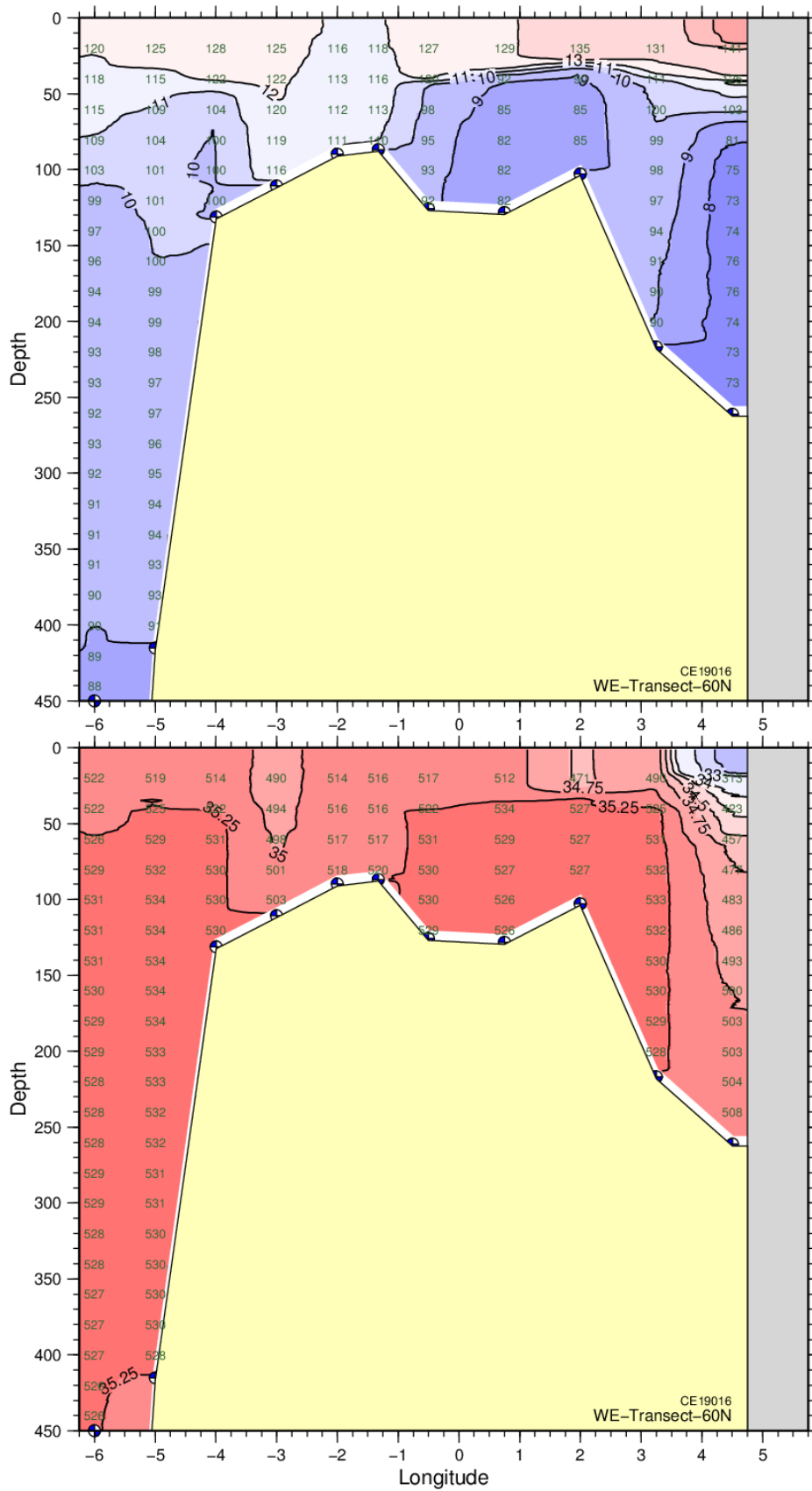


Fig. 11: Vertical temperature (top) and salinity (bottom) distribution along the 60°N section basing on CTD raw data. The numbers in the section give the temperatures $\times 10$ and (salinities $\times 100$) - 3000 for selected data points.

Acknowledgement

All participants accomplished a big amount of work in a good temper and made the North Sea Summer Survey 2019 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 all enjoyed the last nine summer cruises onboard Celtic Explorer and felt “home away from home”.

Holger Klein

Hamburg, September 2019

Appendix 1: List of samples

| | |
|--------------------------------------|---|
| CTD-profiles with rosette: | 100 stations |
| Secchi depth: | 50 stations (daylight stations only) |
| Salinity: | 281 samples |
| Total Alkalinity: | 150 samples incl. 10fold determination |
| Oxygen: | 242 samples incl. 10fold determination |
| pH-value: | 150 samples incl. 10fold determination |
| Chlorophyll: | 81 samples incl. 10fold determination |
| Total-N | 36 samples |
| Total-P | 36 samples |
| Radioactivity (artificial nuclides): | 80 stations 39 samples à 2 35-l-drums strontium-90 (pure) 30 samples à 1-l-bottles tritium (pure) 52 samples à 100 l transuranic elements (concentrated) 83 samples à 150 l caesium-137 (concentrated) |
| Trace metals: | 65 stations, 260 samples |

Appendix 2: Surface and bottom temperatures and salinities

The following tables are based on CTD bottle file raw data.

| Station ID | Secchi depth [m] | water depth [m] | T _{sur} [°C] | T _{bot} [°C] | T _{sur} - T _{bot} [K] | thermo-cline depth [m] | S _{sur} [psu] | S _{bot} [psu] | S _{bot} - S _{sur} [psu] |
|------------|------------------|-----------------|-----------------------|-----------------------|---|------------------------|------------------------|------------------------|---|
| GN003 | 4.0 | 23 | 19.3 | 18.9 | 0.4 | — | 32.90 | 32.97 | 0.07 |
| GN003A | 8.0 | 30 | 20.0 | 18.9 | 1.1 | — | 32.90 | 33.10 | 0.20 |
| GN007 | — | 27 | 19.8 | 19.4 | 0.4 | — | 33.29 | 33.32 | 0.03 |
| GN007A | — | 36 | 20.1 | 18.5 | 1.6 | 7 | 34.58 | 34.63 | 0.05 |
| GN008 | — | 42 | 19.8 | 18.1 | 1.7 | 8 | 34.49 | 34.51 | 0.02 |
| GN008S | — | 46 | 19.2 | 13.6 | 5.6 | 33 | 34.67 | 34.65 | -0.02 |
| GN009 | 18.5 | 41 | 17.5 | 15.6 | 1.9 | 18 | 34.66 | 34.69 | 0.03 |
| GN009A | 6.5 | 28 | 18.8 | 18.5 | 0.3 | — | 34.42 | 34.44 | 0.02 |
| GN010 | 10.0 | 30 | 19.1 | 19.1 | 0.0 | — | 35.14 | 35.14 | 0.00 |
| GN011 | — | 19 | 19.6 | 19.6 | 0.0 | — | 32.54 | 33.10 | 0.56 |
| GN012 | — | 25 | 19.9 | 19.9 | 0.0 | — | 34.50 | 34.51 | 0.01 |
| GN013 | 10.0 | 36 | 19.1 | 19.1 | 0.0 | — | 35.03 | 35.04 | 0.01 |
| GN014 | 3.5 | 31 | 18.6 | 18.5 | 0.1 | — | 35.12 | 35.12 | 0.00 |
| GN015 | 5.0 | 46 | 19.1 | — | — | — | 34.70 | — | — |
| GN015B | 2.5 | 40 | 18.6 | 18.6 | 0.0 | — | 34.23 | 34.22 | -0.01 |
| GN016 | — | 31 | 17.0 | 17.0 | 0.0 | — | 34.46 | 34.46 | 0.00 |
| GN009S | — | 71 | 17.2 | 13.8 | 3.4 | 30 | 34.64 | 34.67 | 0.03 |
| GN017 | 7.5 | 47 | 15.9 | 14.2 | 1.7 | 15 | 34.34 | 34.41 | 0.07 |
| GN017A | 10.5 | 52 | 14.8 | 12.9 | 1.9 | 12 | 34.25 | 34.34 | 0.09 |
| GN017S | 9.5 | 61 | 15.7 | 10.5 | 5.2 | 18 | 34.00 | 34.58 | 0.58 |
| GN018A | >8.0 | 68 | 14.6 | 9.7 | 4.9 | 22 | 34.26 | 34.65 | 0.39 |
| GN018 | — | 75 | 16.9 | 8.5 | 8.4 | 23 | 34.54 | 34.74 | 0.20 |
| GN018S | — | 62 | 17.2 | 8.9 | 8.3 | 23 | 34.62 | 34.69 | 0.07 |
| GN019 | — | 29 | 17.0 | 17.0 | 0.0 | — | 34.61 | 34.61 | 0.00 |
| GN019S | 10.5 | 25 | 17.3 | 17.3 | 0.0 | — | 34.67 | 34.67 | 0.00 |
| GN020 | 14.0 | 48 | 17.4 | 10.7 | 6.7 | 28 | 34.69 | 34.81 | 0.12 |
| GN021 | 14.5 | 41 | 17.9 | 16.4 | 1.5 | 22 | 34.72 | 34.65 | -0.07 |
| GN022 | 10.0 | 44 | 18.9 | 17.6 | 1.3 | 16 | 34.55 | 34.57 | 0.02 |
| GN022A | — | 32 | 19.5 | 17.9 | 1.6 | 17 | 33.64 | 33.68 | 0.04 |
| GN023 | — | 26 | 18.9 | 17.9 | 1.0 | 7 | 33.31 | 33.20 | -0.11 |
| GN024 | — | 18 | 19.6 | 19.5 | 0.1 | — | 32.08 | 32.03 | -0.05 |
| GN025 | 3,5 | 14 | 19.9 | 19.9 | 0.0 | — | 31.37 | 31.37 | 0.00 |
| GN026 | 7.5 | 29 | 18.7 | 17.7 | 1.0 | 18 | 32.96 | 33.24 | 0.28 |
| GN026A | 10.0 | 35 | 18.1 | 17.2 | 0.9 | 27 | 34.18 | 34.10 | -0.08 |
| GN027 | — | 49 | 17.5 | 15.6 | 1.9 | 35 | 34.76 | 34.63 | -0.13 |
| GN028 | — | 43 | 17.1 | 11.0 | 6.1 | 27 | 34.88 | 34.96 | 0.08 |
| GN020S | — | 58 | 16.9 | 8.2 | 8.7 | 32 | 34.89 | 34.93 | 0.04 |
| GN029 | 25.5 | 74 | 16.6 | 7.8 | 8.8 | 30 | 34.90 | 34.99 | 0.09 |
| GN030 | 13.5 | 86 | 16.4 | 7.7 | 8.7 | 35 | 34.80 | 35.06 | 0.26 |
| GN031 | 9.0 | 78 | 16.5 | 8.2 | 8.3 | 32 | 34.70 | 35.00 | 0.30 |
| GN032 | — | 84 | 15.2 | 8.3 | 6.9 | 25 | 34.69 | 34.80 | 0.11 |
| GN033 | — | 66 | 14.0 | 9.7 | 4.3 | 30 | 34.63 | 34.74 | 0.11 |
| GN033A | 9.0 | 69 | 13.4 | 10.1 | 3.3 | 25 | 34.38 | 34.67 | 0.29 |
| GN033S | 13.0 | 50 | 12.4 | 12.4 | 0.0 | — | 34.64 | 34.64 | 0.00 |
| GN034A | >9.5 | 23 | 12.6 | 12.2 | 0.4 | — | 34.70 | 34.75 | 0.05 |
| GN034 | 10.5 | 70 | 13.3 | 11.6 | 1.7 | 33 | 34.69 | 34.85 | 0.16 |
| GN34S | 9.5 | 86 | 13.6 | 9.3 | 4.3 | 37 | 34.91 | 34.95 | 0.04 |
| GN035 | — | 99 | 14.4 | 7.8 | 6.6 | 32 | 34.87 | 35.00 | 0.13 |
| GN035S | — | 81 | 15.9 | 7.6 | 8.3 | 30 | 34.78 | 35.05 | 0.27 |
| GN036 | — | 65 | 16.1 | 8.2 | 7.9 | 30 | 34.77 | 35.02 | 0.25 |
| GN037 | 13.0 | 58 | 16.3 | 8.3 | 8.0 | 27 | 34.74 | 34.99 | 0.25 |

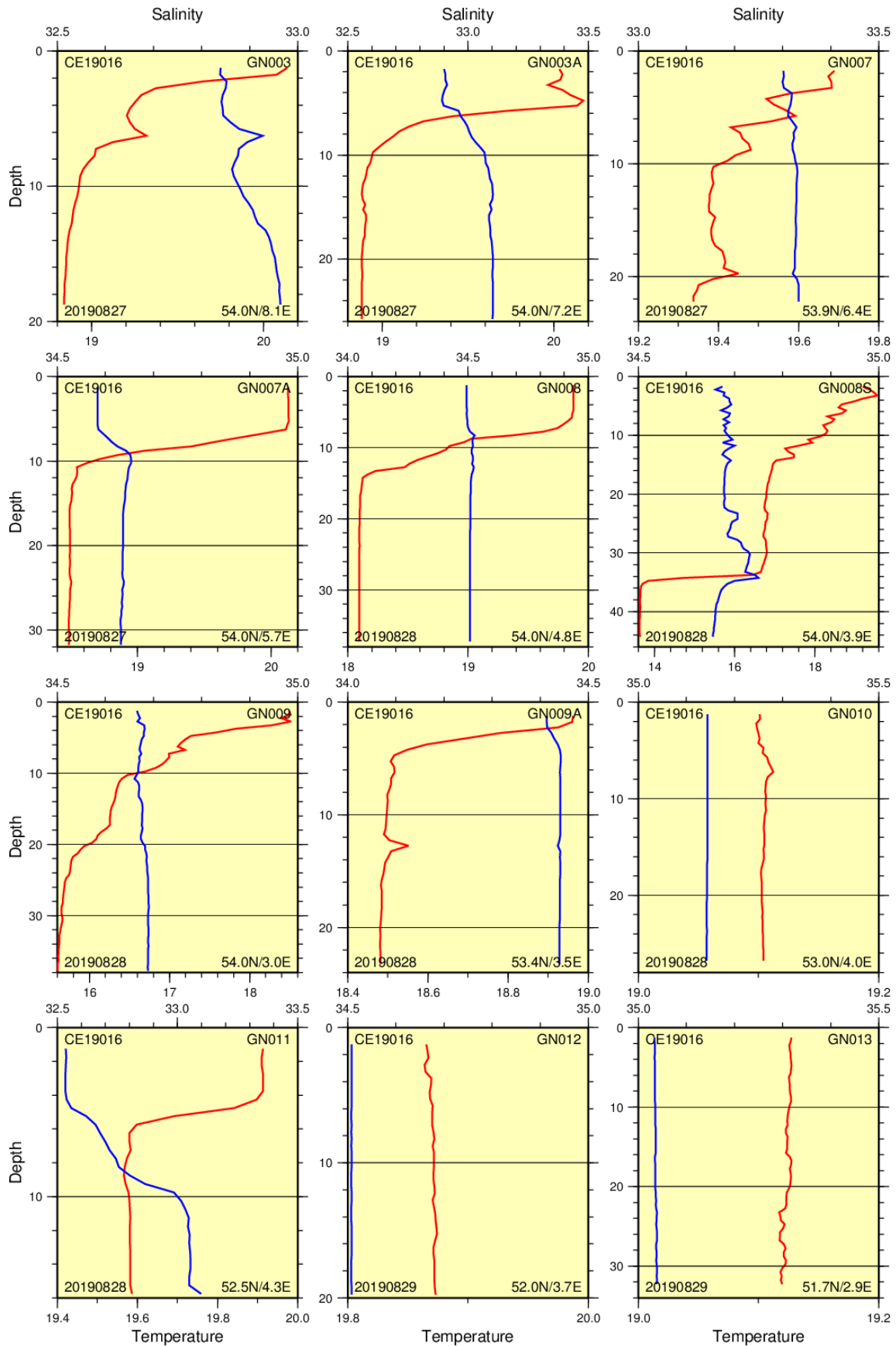
| Station ID | Secchi depth [m] | water depth [m] | T _{sur} [°C] | T _{bot} [°C] | T _{sur} - T _{bot} [K] | thermo-cline depth [m] | S _{sur} [psu] | S _{bot} [psu] | S _{bot} - S _{sur} [psu] |
|------------|------------------|-----------------|-----------------------|-----------------------|---|------------------------|------------------------|------------------------|---|
| GN038 | 11.0 | 53 | 16.7 | 10.4 | 6.3 | 30 | 34.73 | 34.80 | 0.07 |
| GN038A | 12.0 | 34 | 16.7 | 15.9 | 0.8 | — | 34.76 | 34.66 | -0.10 |
| GN039 | — | 34 | 17.2 | 17.2 | 0.0 | — | 34.34 | 34.35 | 0.01 |
| GN039S | — | 91 | 16.5 | 8.6 | 7.9 | 38 | 31.69 | 34.87 | 3.18 |
| GN801 | — | 29 | 17.0 | 17.0 | 0.0 | — | 34.36 | 34.36 | 0.00 |
| GN802 | 4.5 | 217 | 16.5 | 7.9 | 8.6 | 38 | 30.54 | 35.14 | 4.60 |
| GN803 | 9.0 | 125 | 16.6 | 8.2 | 8.4 | 50 | 30.29 | 34.92 | 4.63 |
| GN804 | 5.5 | 23 | 17.1 | 17.5 | -0.4 | — | 31.39 | 32.81 | 1.42 |
| GN805 | 6.0 | 88 | 17.1 | 13.3 | 3.8 | 65 | 30.56 | 33.85 | 3.29 |
| GN807 | — | 536 | 16.6 | 6.2 | 10.4 | 10 | 30.78 | 35.13 | 4.35 |
| GN808 | 9.5 | 680 | 16.2 | 6.1 | 10.1 | 10 | 29.81 | 35.13 | 5.32 |
| GN040 | 7.0 | 523 | 16.8 | 6.2 | 10.6 | 25 | 28.64 | 35.13 | 6.49 |
| GN040S | — | 350 | 16.3 | 7.1 | 9.2 | 100 | 33.00 | 35.09 | 2.09 |
| GN041 | — | 310 | 16.3 | 6.7 | 9.6 | 50 | 31.66 | 35.09 | 3.43 |
| GN042 | 8.5 | 128 | 15.9 | 8.1 | 7.8 | 30 | 31.66 | 35.21 | 3.55 |
| GN042S | — | 99 | 14.3 | 7.8 | 6.5 | 33 | 34.92 | 35.09 | 0.17 |
| GN043 | — | 77 | 14.3 | 8.1 | 6.2 | 33 | 34.88 | 34.91 | 0.03 |
| GN044 | — | 105 | 13.7 | 8.9 | 4.8 | 30 | 35.05 | 35.13 | 0.08 |
| GN44S | — | 139 | 13.4 | 8.2 | 5.2 | 40 | 35.12 | 35.19 | 0.07 |
| GN045 | 11.5 | 115 | 12.4 | 10.1 | 2.3 | 45 | 35.07 | 35.19 | 0.12 |
| GN045A | 13.0 | 85 | 12.1 | 11.8 | 0.3 | — | 34.97 | 35.03 | 0.06 |
| GN045B | 13.0 | 72 | 12.8 | 12.4 | 0.4 | — | 34.79 | 34.94 | 0.15 |
| GN057A | 14.0 | 79 | 13.3 | 13.0 | 0.3 | — | 34.49 | 34.64 | 0.15 |
| GN056 | — | 86 | 13.3 | 13.0 | 0.3 | — | 34.58 | 34.63 | 0.05 |
| GN056C | — | 109 | 13.0 | 12.1 | 0.9 | — | 34.49 | 34.60 | 0.11 |
| GN064 | — | 65 | 13.1 | 13.2 | 0.1 | — | 34.48 | 34.49 | 0.01 |
| GN056B | 15.5 | 119 | 13.6 | 10.6 | 3.0 | 75 | 34.76 | 34.98 | 0.22 |
| GN065 | 12.0 | 1064 | 12.1 | -0.6 | 12.7 | 580 | 35.22 | 34.91 | -0.31 |
| GN055 | — | 410 | 12.5 | 9.1 | 3.4 | (33) | 35.18 | 35.28 | 0.10 |
| GN054S | — | 129 | 12.8 | 10.0 | 2.8 | 45 | 35.14 | 35.30 | 0.16 |
| GN054 | — | 111 | 12.7 | 11.5 | 1.2 | — | 34.91 | 35.04 | 0.13 |
| GN053B | 14.0 | 88 | 11.8 | 11.1 | 0.7 | — | 35.12 | 35.18 | 0.06 |
| GN053A | 13.0 | 86 | 11.9 | 10.0 | 1.9 | — | 35.16 | 35.20 | 0.04 |
| GN053 | 11.0 | 127 | 12.7 | 9.2 | 3.5 | 33 | 35.17 | 35.29 | 0.12 |
| GN052S | — | 126 | 12.9 | 8.2 | 4.7 | 33 | 35.12 | 35.25 | 0.13 |
| GN052 | — | 104 | 14.5 | 8.5 | 6.0 | 30 | 34.71 | 35.27 | 0.56 |
| GN051S | 7.5 | 217 | 13.1 | 8.9 | 4.2 | 30 | 34.90 | 35.28 | 0.38 |
| GN051 | 8.0 | 261 | 15.6 | 7.3 | 8.3 | ~50 | 31.21 | 35.09 | 3.88 |
| GN050S | 10.5 | 266 | 15.6 | 7.3 | 8.3 | ~50 | 31.79 | 35.10 | 3.31 |
| GN050 | 9.0 | 259 | 15.3 | 7.3 | 8.0 | 30 | 31.87 | 35.11 | 3.24 |
| GN049S | — | 273 | 15.3 | 7.2 | 8.1 | 20 | 31.67 | 35.13 | 3.46 |
| GN049 | — | 138 | 13.7 | 8.0 | 5.7 | 33 | 34.53 | 35.25 | 0.72 |
| GN048S | 13.0 | 114 | 13.2 | 7.7 | 5.5 | 33 | 35.03 | 35.16 | 0.13 |
| GN048 | 9.5 | 125 | 13.1 | 7.4 | 5.7 | 38 | 35.04 | 35.13 | 0.09 |
| GN047 | — | 130 | 13.0 | 7.8 | 5.2 | 40 | 35.13 | 35.16 | 0.03 |
| GN046 | — | 107 | 12.2 | 10.9 | 1.3 | 85 | 35.06 | 35.18 | 0.12 |
| GN046A | — | 78 | 12.5 | 12.5 | 0.0 | — | 34.94 | 34.94 | 0.00 |

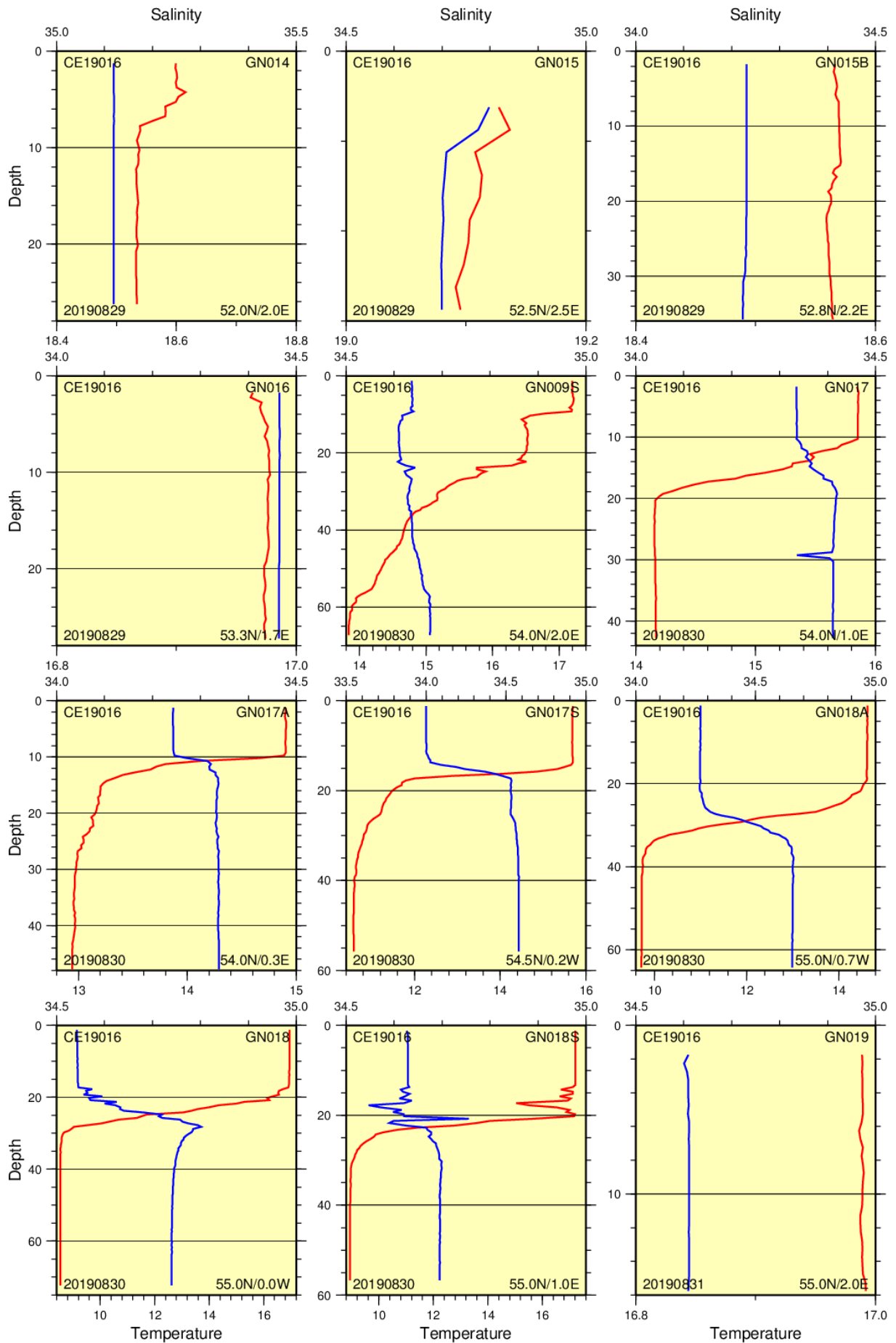
T_{sur}, T_{bot}: surface (5 m) and bottom temperature.

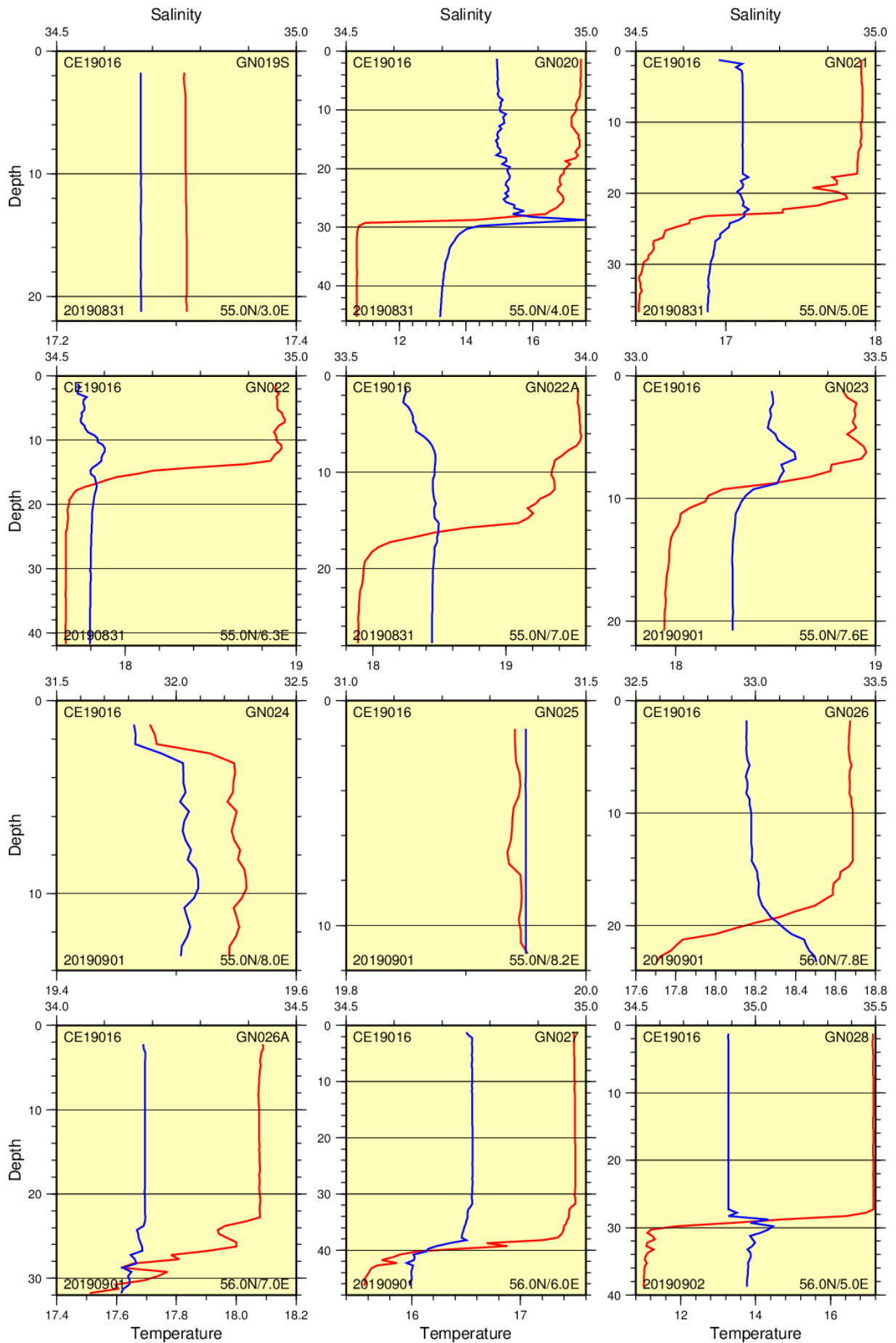
S_{sur}, S_{bot}: surface and bottom salinity. Blue: Coastal Water ≤34 psu, red: Atlantic Water ≥35 psu.

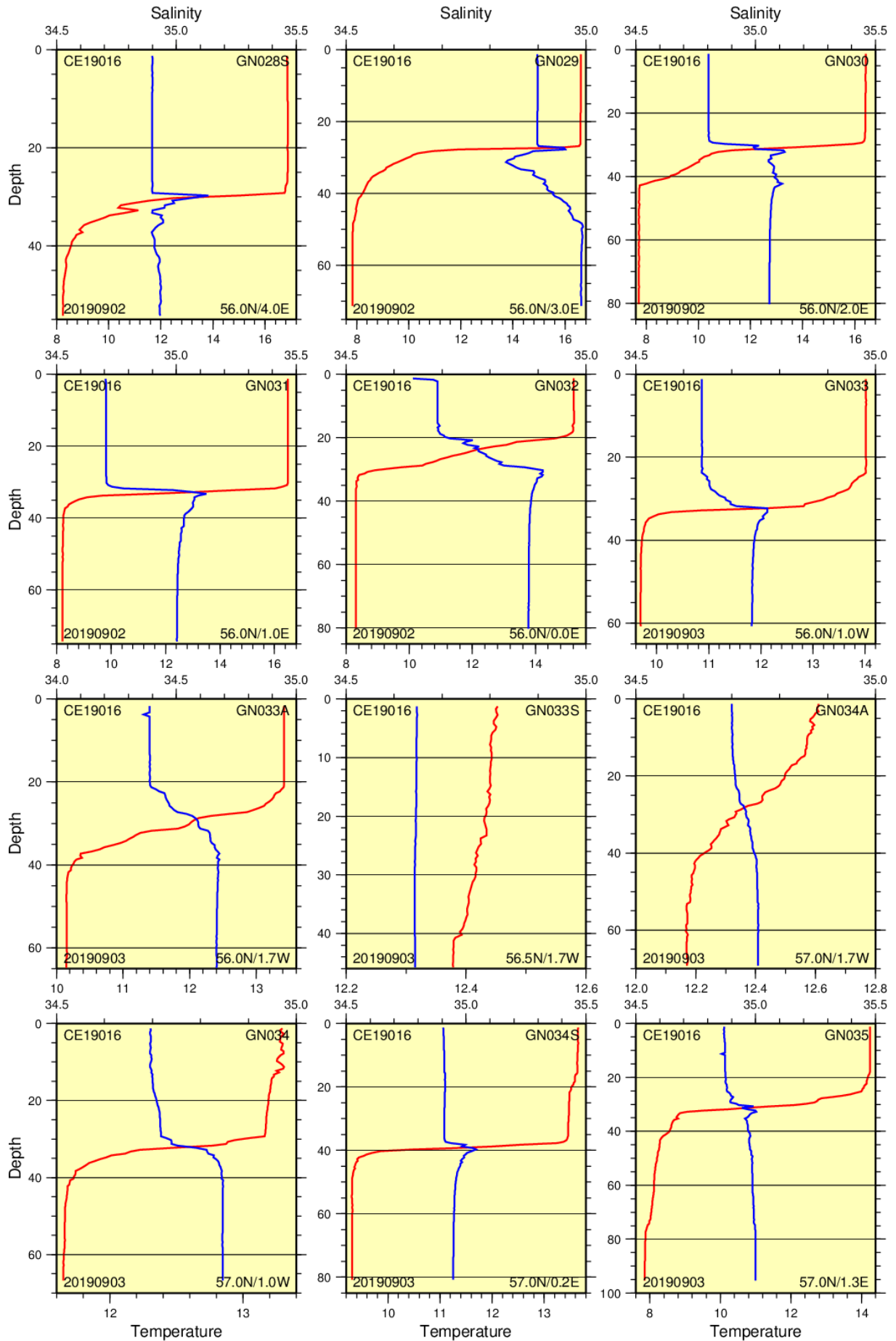
Appendix 3: T and S profiles, all stations

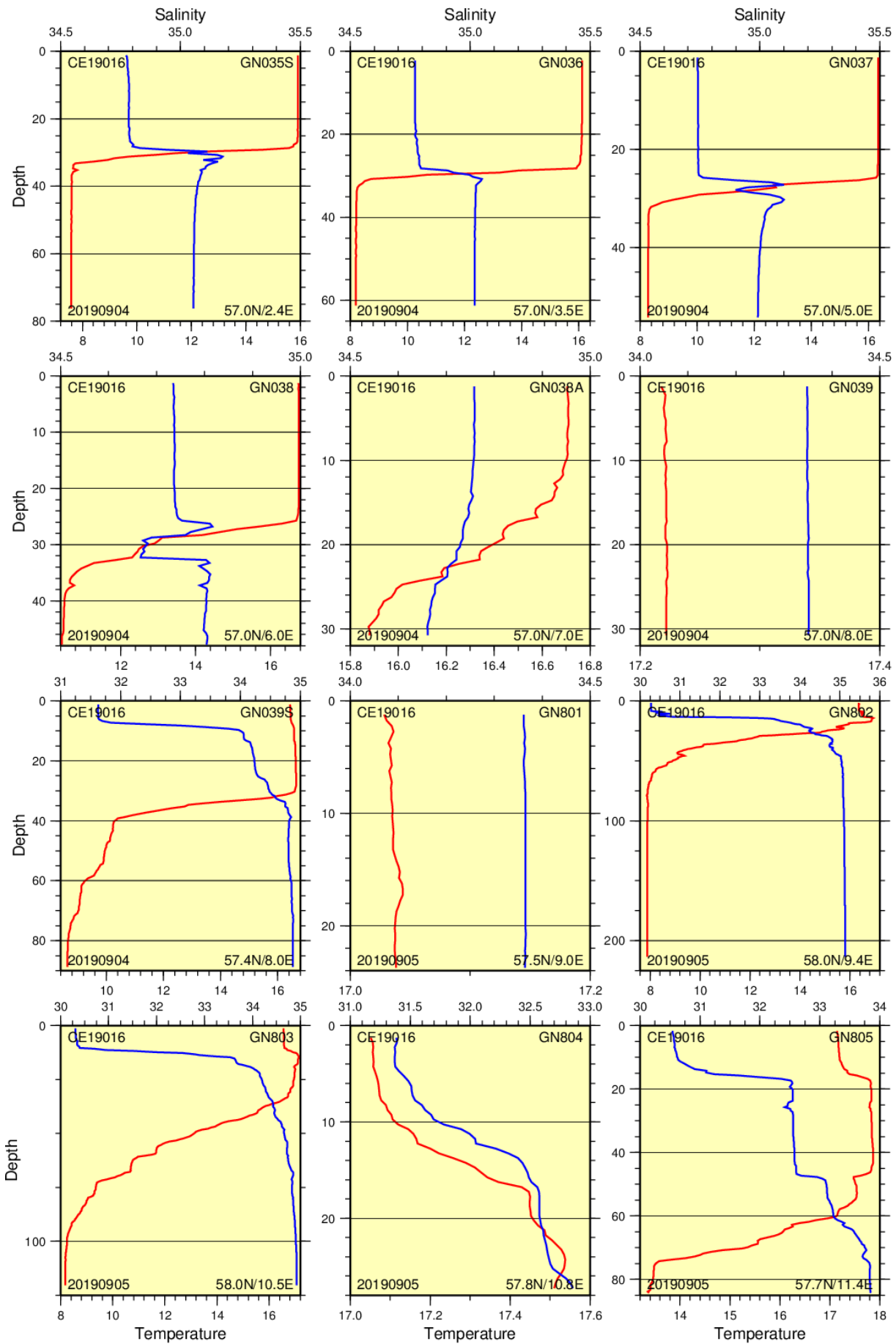
The following temperature and salinity profiles are based on CTD raw data.

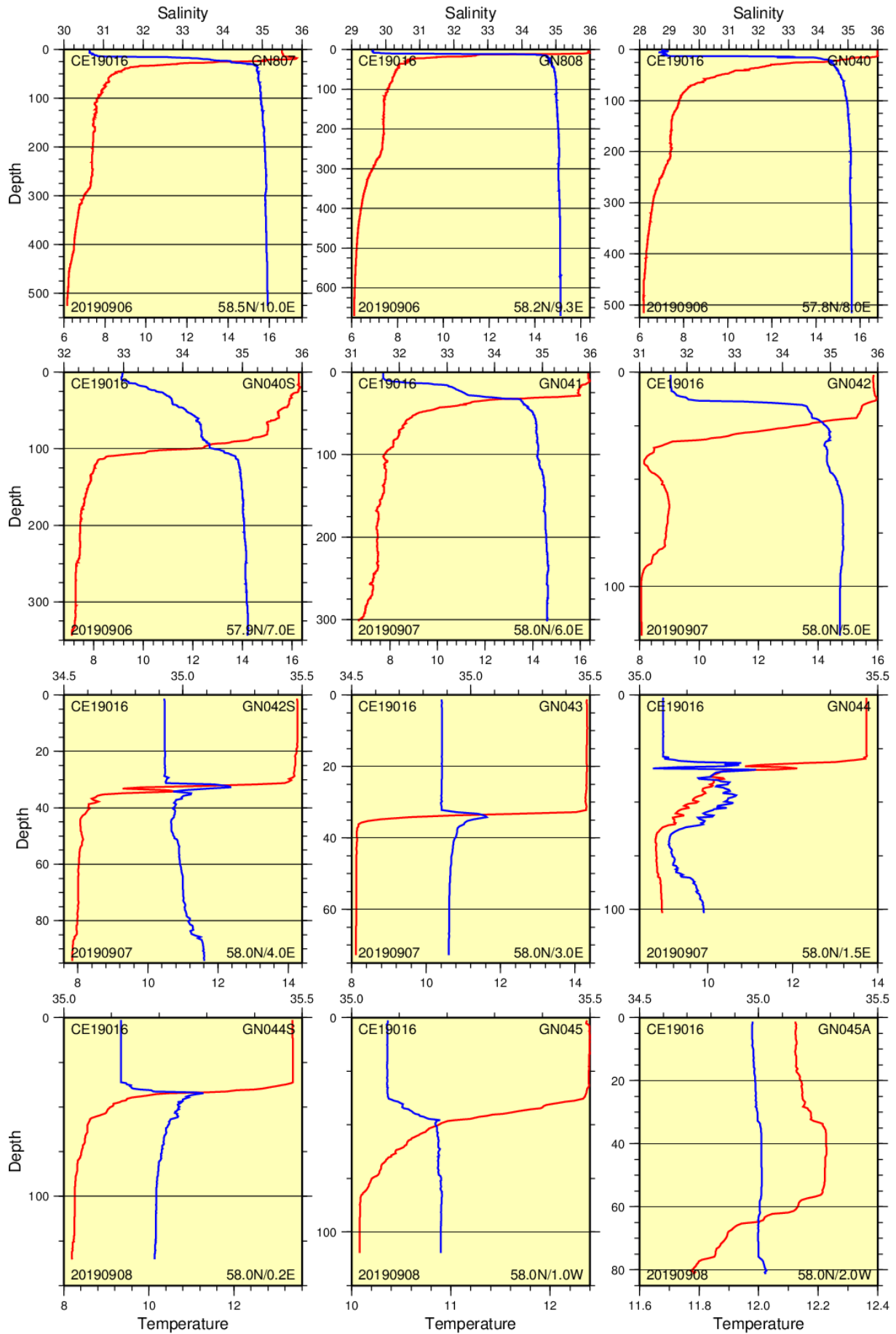


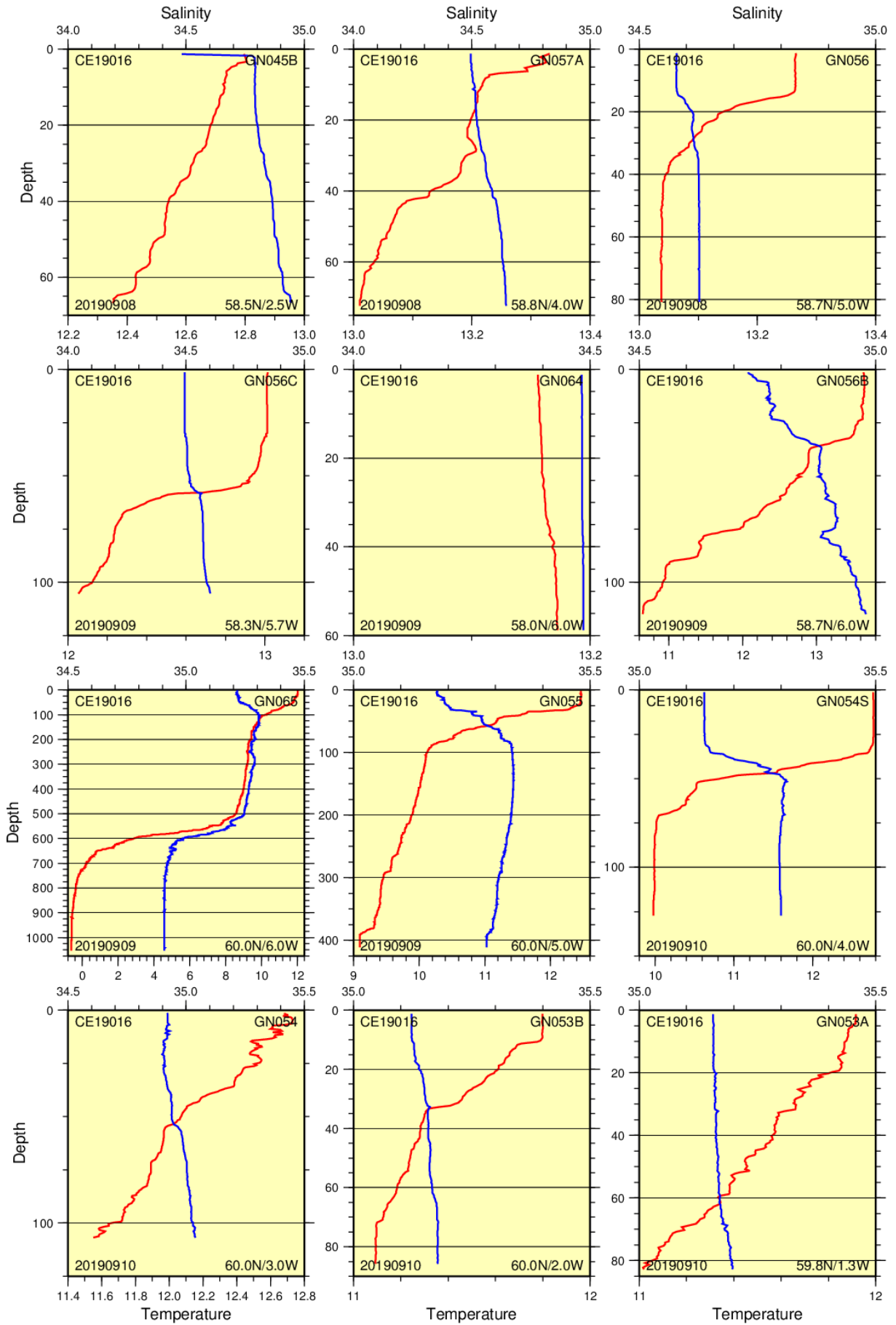


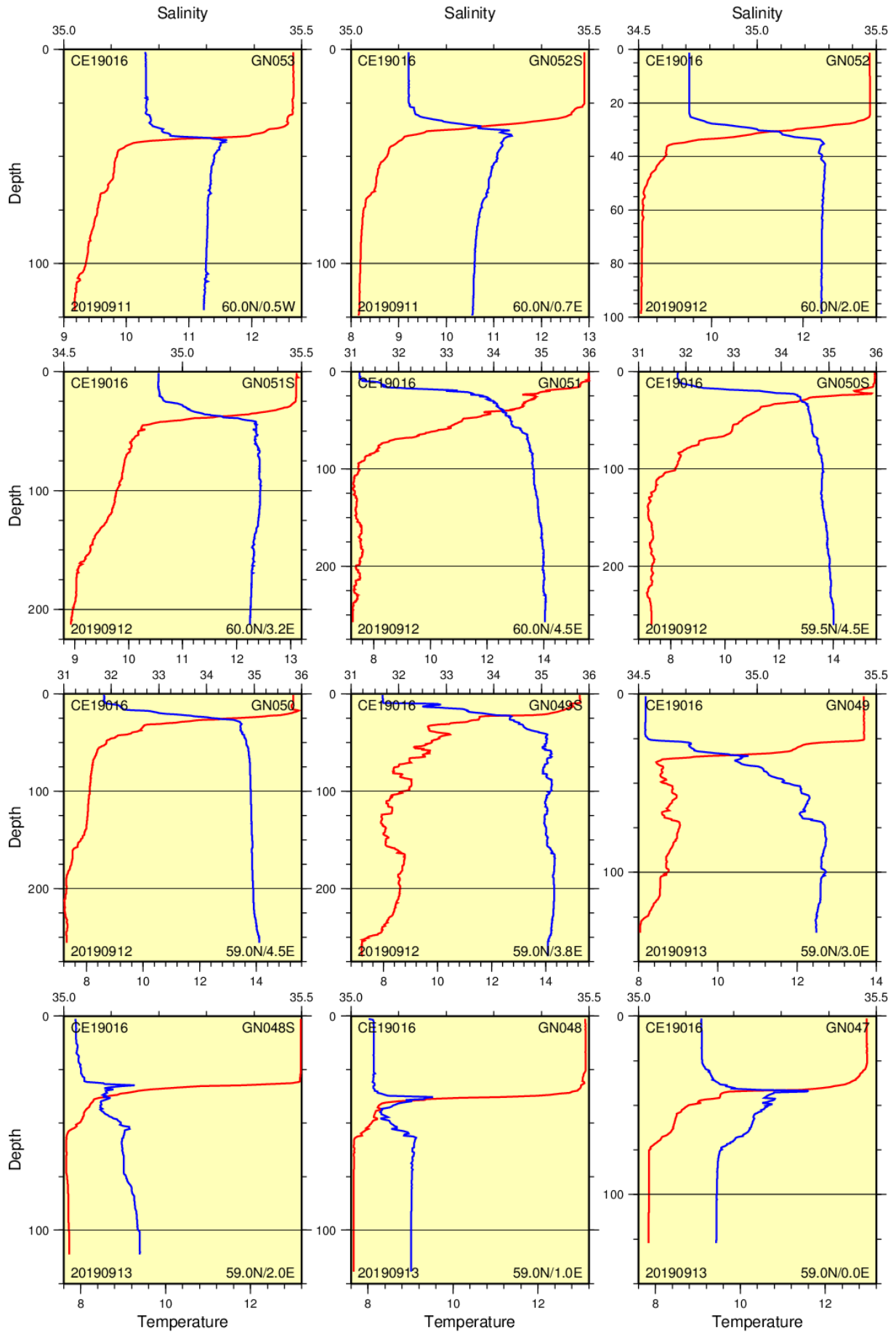


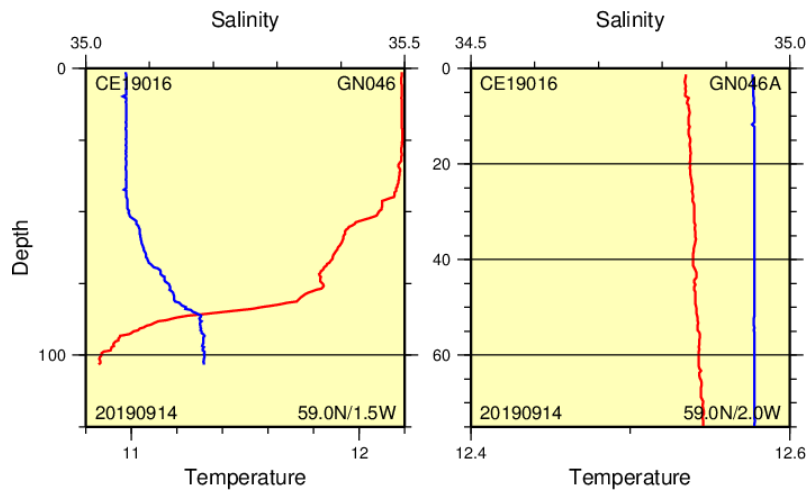






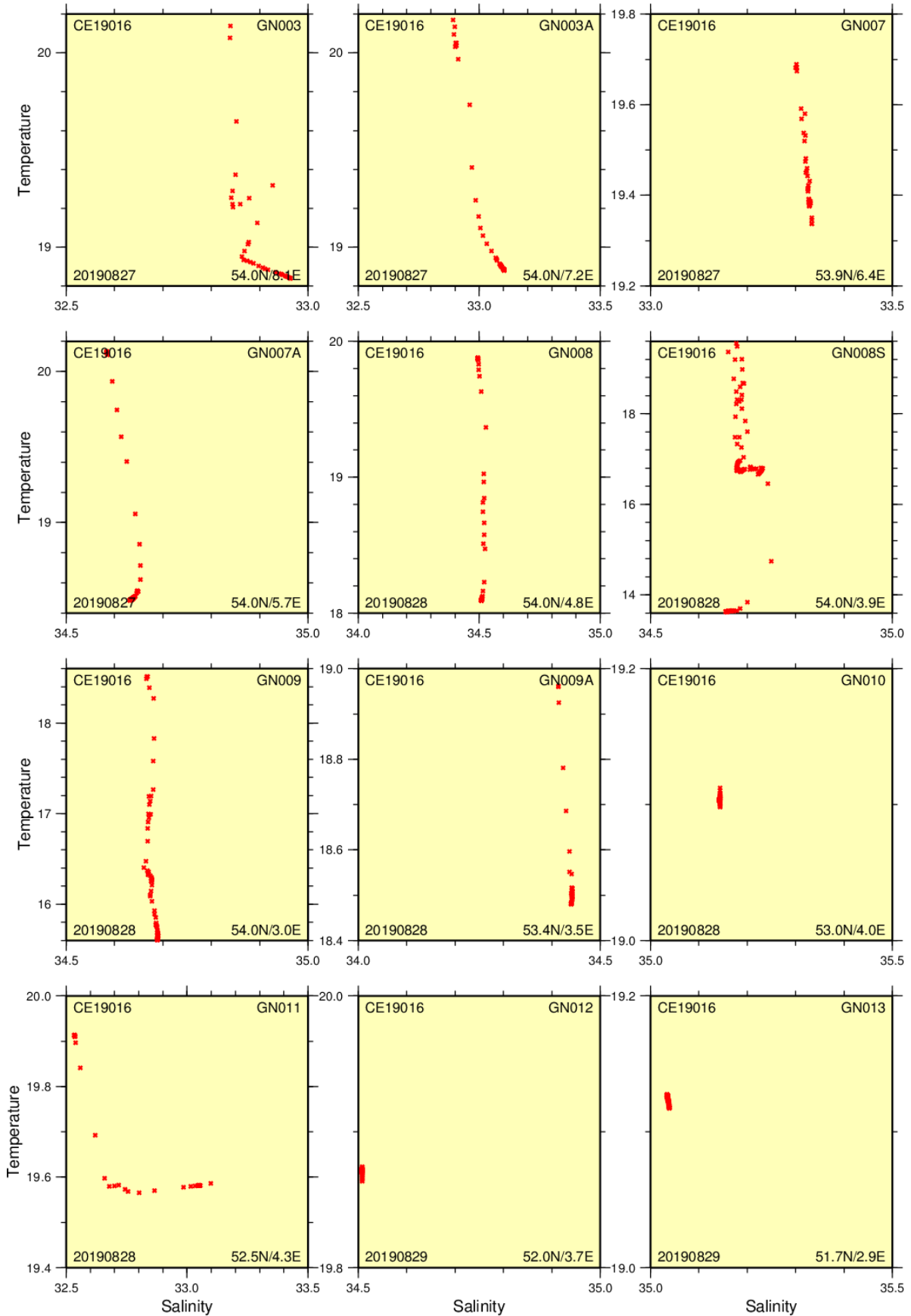


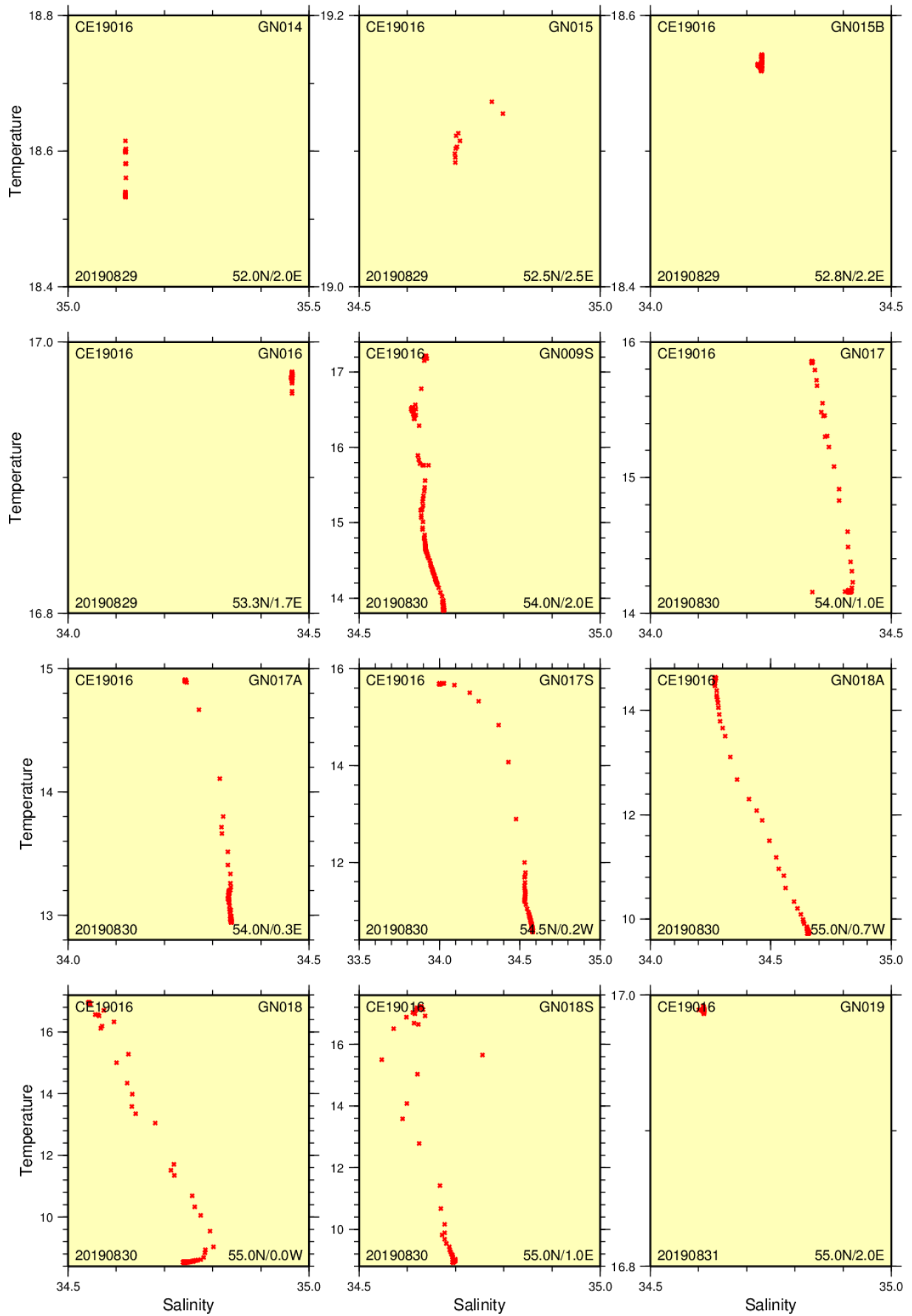


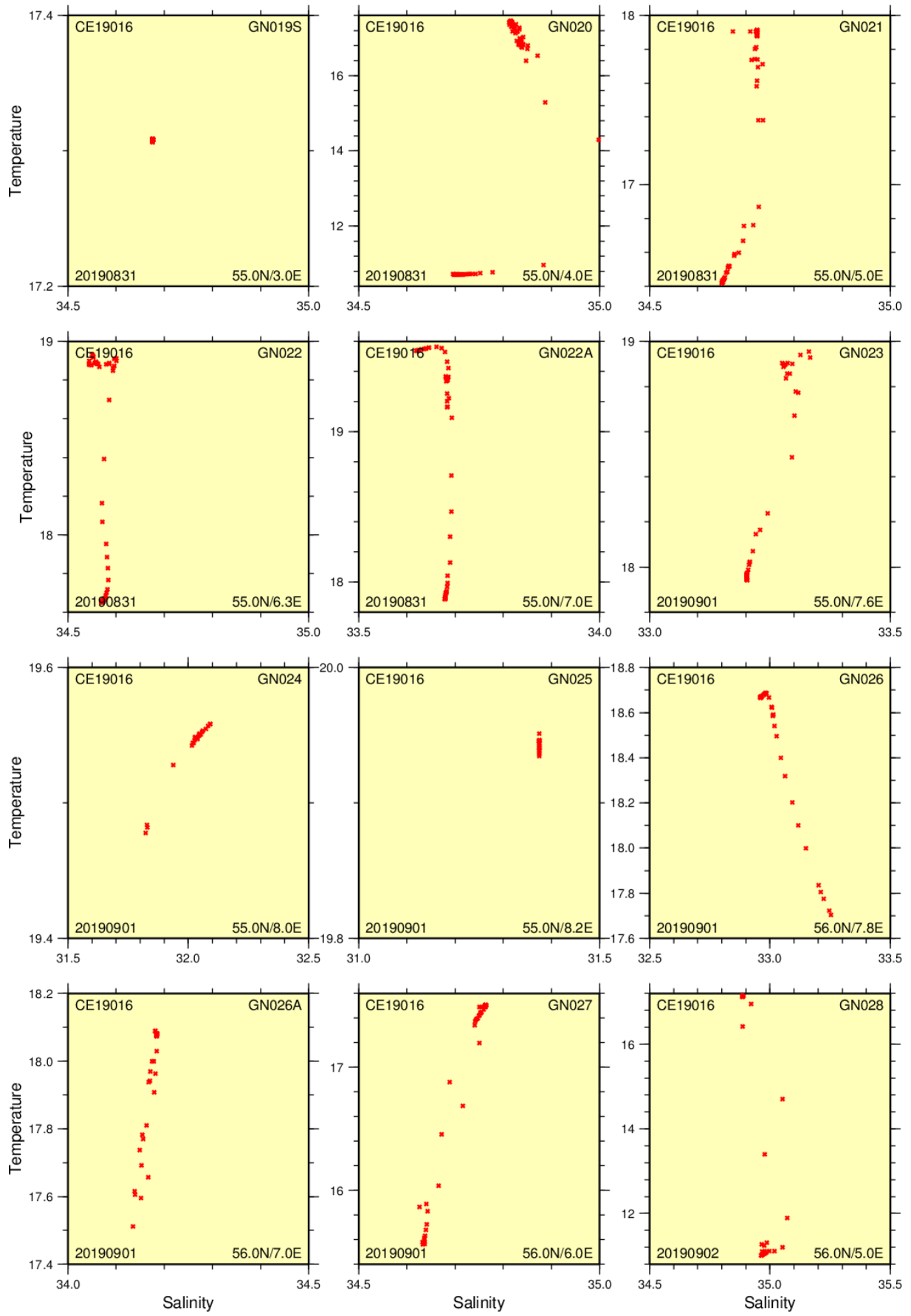


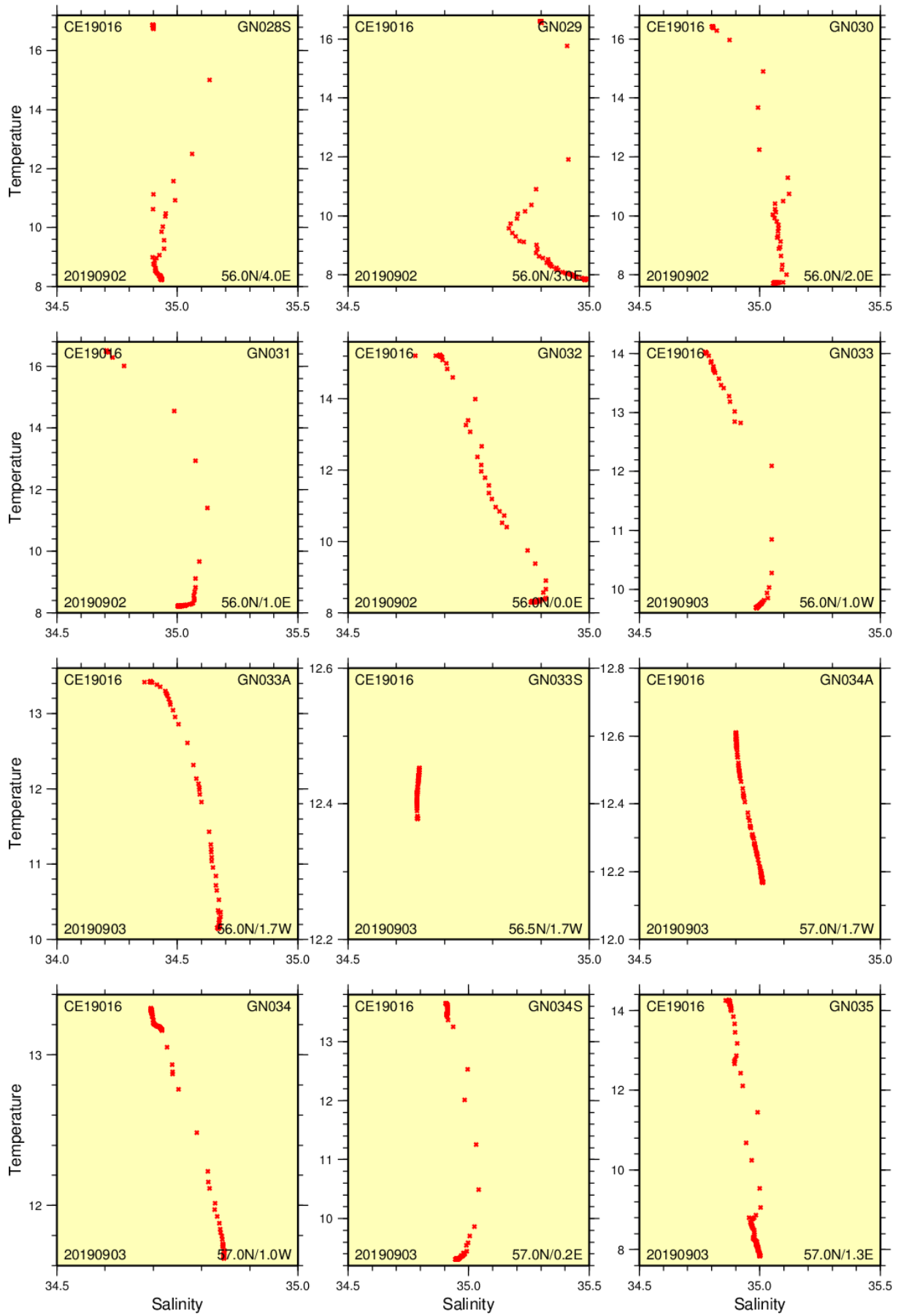
Appendix 4: T/S diagrams, all stations

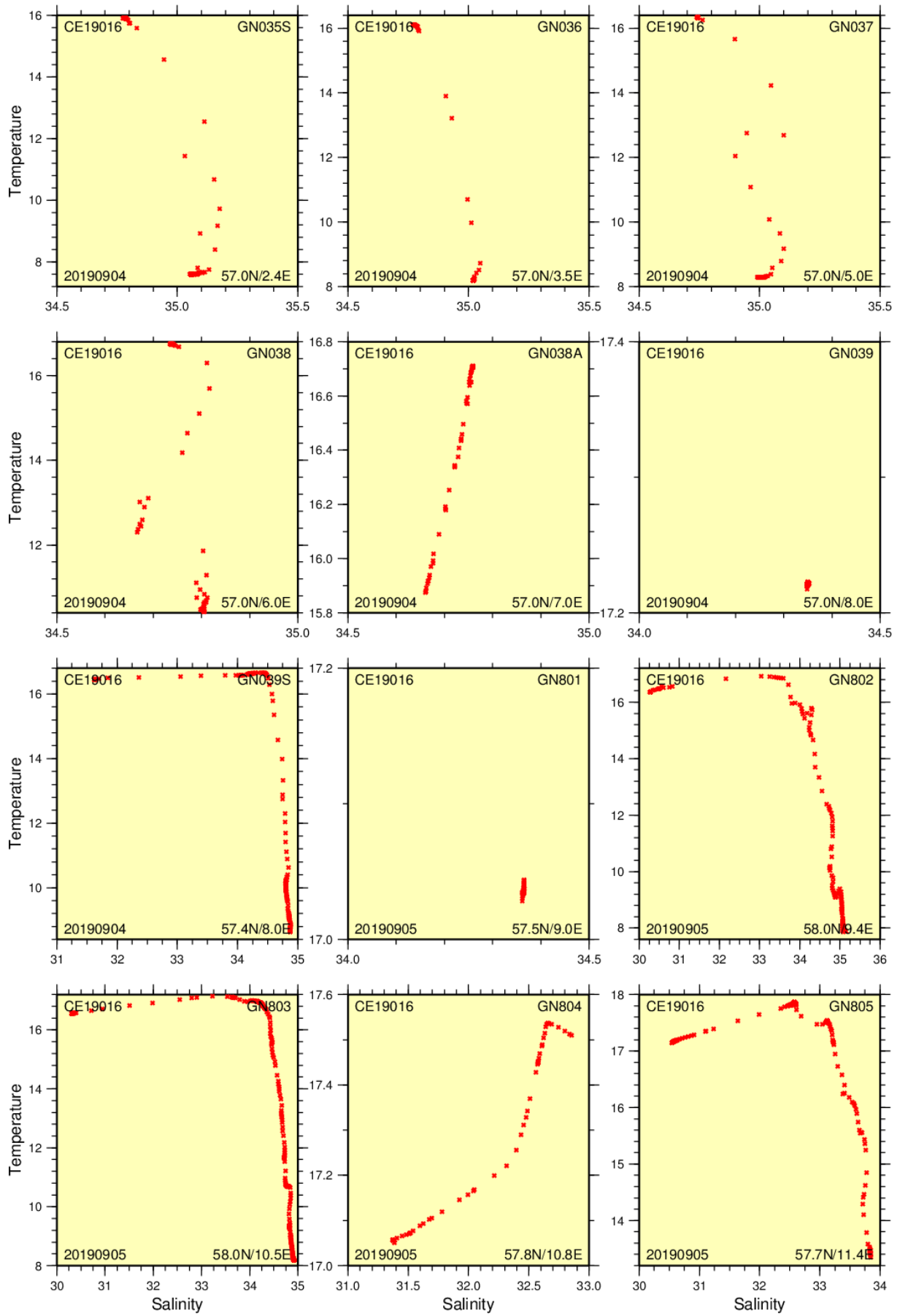
The following diagrams are based on CTD raw data.

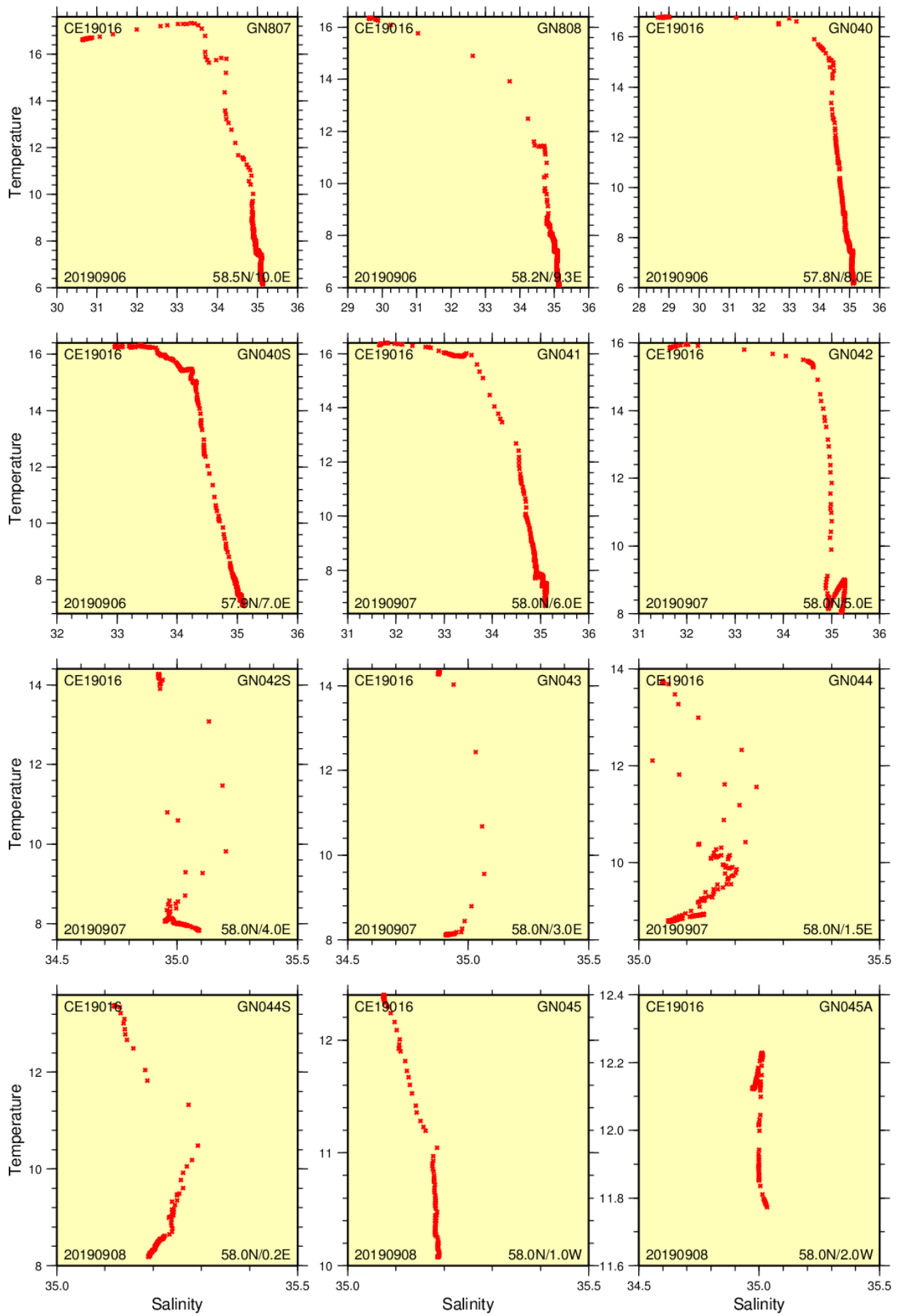


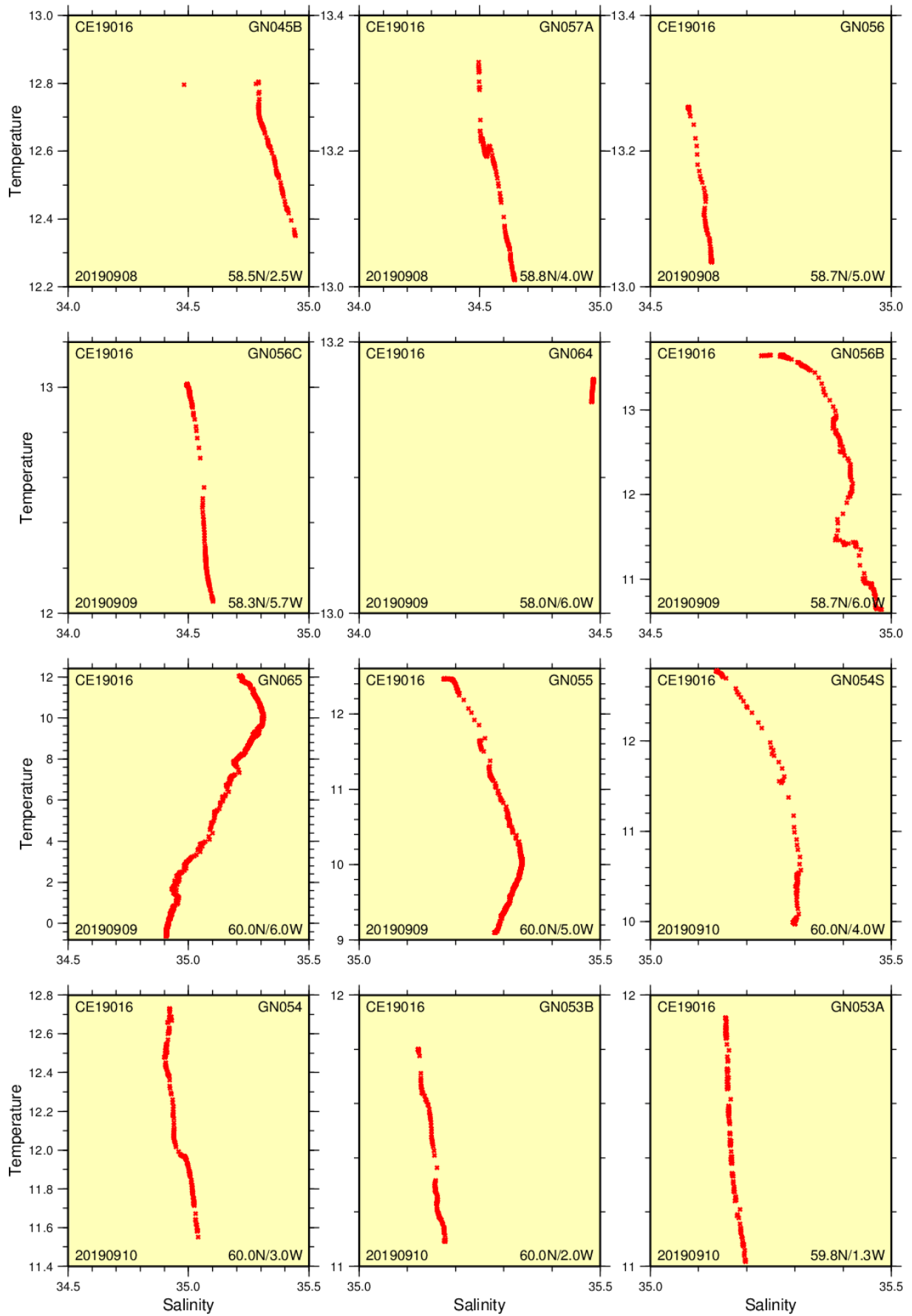


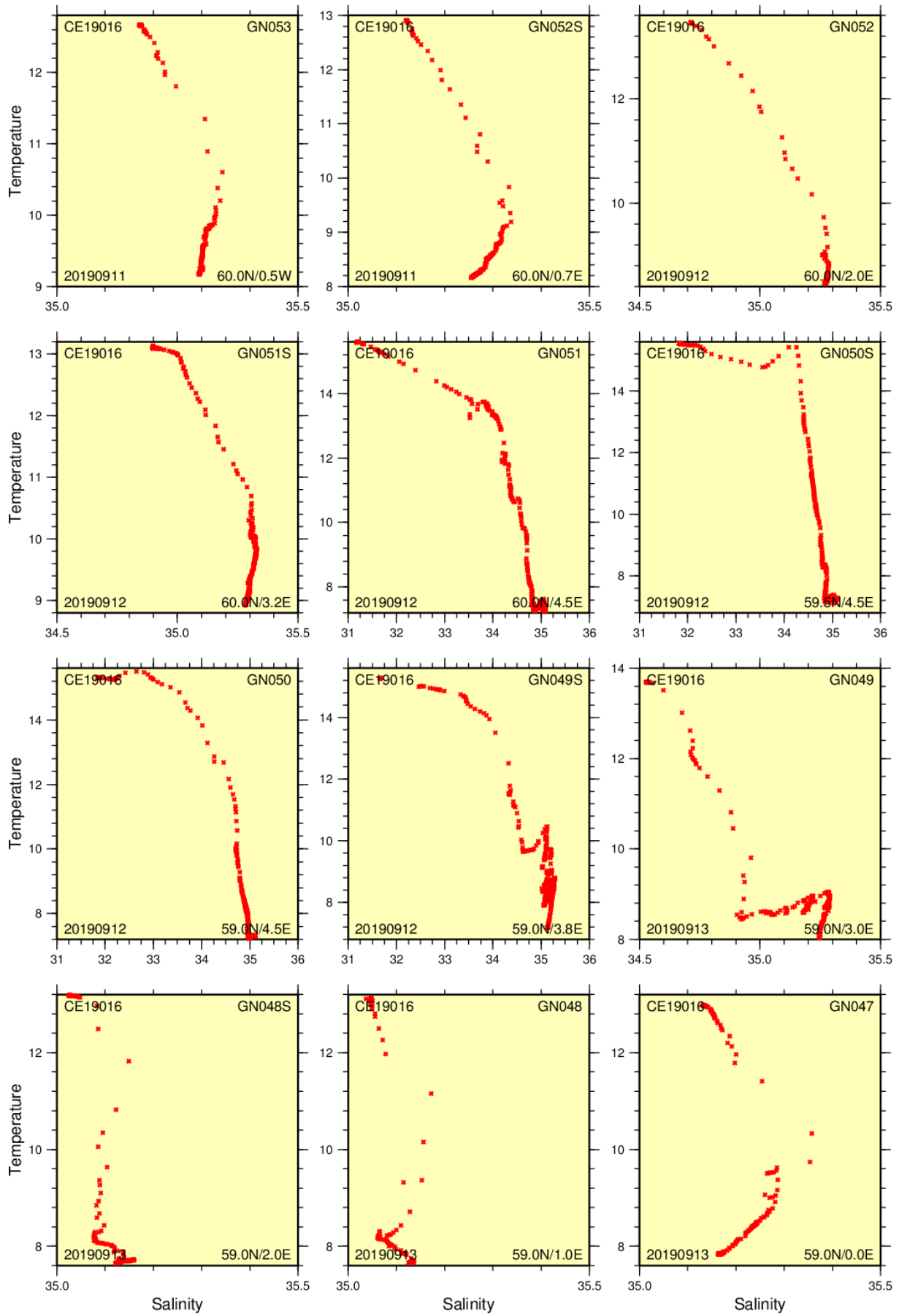


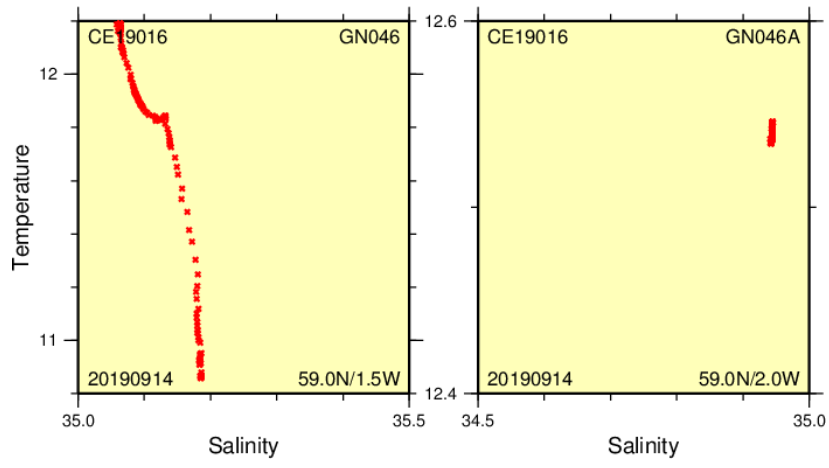












Appendix 5: Station List

Positions are taken at the beginning of station work!

Radioactivity: Cs = Caesium-137; Sr = Strontium-90; Tu = transuranic elements (Pu, Am, Cm); H3 = Tritium

Water depth corrected for draft (5 m)! bo = bottom

| station name | latitude | longitude | water depth [m] | water sampling & CTD [m] | Secchi depth [m] | radio-activity | trace metals [m] | nutrients [m] | Bedford ID 195nnn | date [dd.mm.yy] | time [UTC] |
|----------------|--------------|---------------|-----------------|--------------------------|------------------|----------------|------------------|---------------|-------------------|-----------------|---------------|
| STADE | 53° 37.19' N | 009° 32.70' E | 17 | — | — | Cs, Tu | 10 | — | 001 | 27.08.19 | 07:55 – 08:09 |
| MEDEM | 53° 52.98' N | 008° 43.04' E | 14 | — | — | Cs, Tu | 10 | — | 002 | 27.08.19 | 11:49 – 12:03 |
| GN003 ELBE1 | 54° 00.18' N | 008° 06.42' E | 23 | bo, 10, 5 | 4.0 | Cs, Tu | 10 | bo, 5 | 003-005 | 27.08.19 | 13:53 – 14:10 |
| GN003A | 54° 00.15' N | 007° 10.35' E | 30 | bo, 10, 5 | 8.0 | Cs, Tu | 10 | bo, 5 | 006-008 | 27.08.19 | 17:39 – 17:51 |
| GN007 | 53° 55.70' N | 006° 25.27' E | 27 | bo, 10, 2x5 | — | Cs, Tu | 10 | bo, 5 | 009-011 | 27.08.19 | 20:54 – 21:10 |
| GN007A | 53° 59.98' N | 005° 40.03' E | 36 | bo, 5 | — | Cs, Sr, H3, Tu | — | — | 012-013 | 27.08.19 | 23:43 – 23:59 |
| GN008 | 54° 00.01' N | 004° 49.62' E | 43 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 014-016 | 28.08.19 | 02:50 – 03:08 |
| GN008S | 53° 59.98' N | 003° 55.14' E | 46 | bo, 5 | — | — | — | bo, 5 | 017-018 | 28.08.19 | 06:53 – 07:02 |
| GN009 | 54° 00.00' N | 002° 59.93' E | 41 | bo, 10, 5 | 18.5 | Cs, Sr, H3, Tu | 10 | bo, 5 | 019-021 | 28.08.19 | 10:17 – 10:45 |
| GN009A | 53° 25.20' N | 003° 29.95' E | 28 | bo, 5 | 6.5 | Cs | — | — | 022-023 | 28.08.19 | 14:55 – 15:15 |
| GN010 | 52° 59.87' N | 003° 59.83' E | 30 | bo, 10, 5 | 10.0 | Cs, Sr, H3, Tu | 10 | bo, 5 | 024-026 | 28.08.19 | 18:09 – 18:19 |
| GN011 | 52° 30.99' N | 004° 19.14' E | 19 | bo, 7x12 | — | Cs | 12 | bo, 12 | 027-034 | 28.08.19 | 21:38 – 21:46 |
| GN012 | 51° 59.93' N | 003° 43.79' E | 25 | bo, 10, 5 | — | Cs, Sr, H3, Tu | 10 | bo, 5 | 035-037 | 29.08.19 | 02:40 – 02:54 |
| GN013 | 51° 41.91' N | 002° 51.54' E | 36 | bo, 10, 5 | 10.0 | Cs, Sr, H3, Tu | 10 | bo, 5 | 038-040 | 29.08.19 | 06:50 – 07:02 |
| GN014 | 52° 00.14' N | 001° 59.95' E | 31 | bo, 10, 5 | 3.5 | Cs, Sr, H3, Tu | — | bo, 5 | 041-043 | 29.08.19 | 10:52 – 11:10 |
| GN015 | 52° 29.96' N | 002° 30.25' E | 46 | 5 | 5.0 | Cs | 5 | 5 | 044-045 | 29.08.19 | 14:05 – 14:17 |
| GN015B | 52° 49.79' N | 002° 10.07' E | 40 | bo, 5 | 2.5 | Cs | — | — | 046-047 | 29.08.19 | 16:31 – 16:43 |
| GN016 | 53° 19.82' N | 001° 40.20' E | 31 | bo, 6x10, 5 | — | Cs, Sr, H3, Tu | 10 | bo, 5 | 048-055 | 29.08.19 | 20:43 – 20:54 |
| GN009S | 53° 59.92' N | 001° 59.96' E | 71 | bo, 5 | — | — | — | — | 056-057 | 30.08.19 | 02:26 – 02:42 |
| GN017 | 53° 59.98' N | 001° 00.06' E | 47 | bo, 10, 5 | 7.5 | Cs | — | bo, 5 | 058-060 | 30.08.19 | 06:39 – 06:48 |
| GN017A | 54° 00.12' N | 000° 19.63' E | 52 | bo, 5 | 10.5 | Cs, Sr, H3, Tu | — | — | 061-062 | 30.08.19 | 09:26 – 09:37 |
| GN017S | 54° 30.18' N | 000° 10.09' W | 61 | bo, 5x10, 5 | 9.5 | — | — | 10 | 063-069 | 30.08.19 | 12:42 – 12:54 |
| GN018A | 54° 59.89' N | 000° 40.31' W | 68 | bo, 5 | >8.5 | Cs | — | — | 070-071 | 30.08.19 | 16:45 – 16:56 |
| GN018 | 55° 00.01' N | 000° 00.07' W | 75 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 072-074 | 30.08.19 | 19:12 – 19:29 |
| GN018S | 54° 59.95' N | 000° 59.91' E | 62 | bo, 5 | — | — | — | — | 075-076 | 30.08.19 | 22:59 – 23:13 |
| GN019 | 54° 59.91' N | 002° 00.08' E | 29 | bo, 10, 5 | — | Cs/Tu | 10 | bo, 5 | 077-079 | 31.08.19 | 02:43 – 02:56 |
| GN019S | 55° 00.00' N | 003° 00.08' E | 25 | bo, 5 | — | — | — | — | 080-081 | 31.08.19 | 06:18 – 06:28 |
| GN020 | 55° 00.07' N | 004° 00.16' E | 48 | bo, 10, 5 | 14.0 | Cs | 10 | bo, 5 | 082-084 | 31.08.19 | 09:44 – 10:05 |
| GN021 AWZW2 | 54° 59.89' N | 005° 00.16' E | 41 | bo, 10, 5 | 14.5 | Cs | — | bo, 5 | 085-087 | 31.08.19 | 13:40 – 13:53 |

| station name | latitude | longitude | water depth [m] | water sampling & CTD [m] | Secchi-depth [m] | radio-activity | trace metals [m] | nutrients [m] | Bedford ID 195nnn | date dd.mm.yy | time [UTC] |
|--------------|--------------|---------------|-----------------|------------------------------------|------------------|----------------|------------------|---------------|-------------------|---------------|---------------|
| GN022 | 54° 59.96' N | 006° 15.31' E | 44 | bo, 10, 5 2x500 l for nutrients | 10.5 | Cs | 10 | bo, 5 | 088-090 | 31.08.19 | 18:19 – 20:14 |
| GN022A | 55° 00.01' N | 006° 59.85' E | 32 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 091-093 | 31.08.19 | 22:50 – 23:04 |
| GN023 | 54° 59.90' N | 007° 34.49' E | 26 | bo, 10, 5 | — | Cs/Tu | 5 | bo, 5 | 094-096 | 01.09.19 | 01:01 – 01:09 |
| GN024 | 55° 00.00' N | 008° 00.02' E | 18 | bo, 10, 5 | — | — | 10 | bo, 5 | 097-099 | 01.09.19 | 03:09 – 03:20 |
| GN025 | 54° 59.95' N | 008° 14.76' E | 13 | bo, 10, 5 | 3.5 | Cs/Tu | 10 | bo, 5 | 100-102 | 01.09.19 | 04:49 – 05:01 |
| GN026 | 56° 00.05' N | 007° 48.01' E | 29 | bo, 10, 5 | 7.5 | Cs, Sr, H3, Tu | 10 | bo, 5 | 103-105 | 01.09.19 | 13:05 – 13:16 |
| GN026A | 56° 00.00' N | 006° 59.83' E | 35 | bo, 5 | — | Cs, Sr, H3, Tu | — | — | 106-107 | 01.09.19 | 16:33 – 16:42 |
| GN027 | 56° 00.00' N | 005° 59.99' E | 49 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 108-010 | 01.09.19 | 20:47 – 20:57 |
| GN028 | 56° 00.01' N | 005° 00.42' E | 43 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 111-113 | 02.09.19 | 01:01 – 01:13 |
| GN028S | 56° 00.01' N | 003° 59.92' E | 58 | bo, 5 | — | — | — | — | 114-115 | 02.09.19 | 04:56 – 05:08 |
| GN029 | 56° 00.00' N | 002° 59.99' E | 74 | bo, 10, 5 | 25.5 | Cs/Tu | 10 | bo, 5 | 116-118 | 02.09.19 | 08:40 – 08:54 |
| GN030 | 56° 00.10' N | 002° 00.16' E | 86 | bo, 10, 5 | 13.5 | Cs | 10 | bo, 5 | 119-121 | 02.09.19 | 12:27 – 12:41 |
| GN031 | 55° 59.95' N | 001° 00.08' E | 78 | bo, 10, 5 | 9.0 | Cs | 10 | bo, 5 | 122-124 | 02.09.19 | 16:33 – 16:46 |
| GN032 | 56° 00.06' N | 000° 00.05' E | 84 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 125-127 | 02.09.19 | 21:57 – 22:14 |
| GN033 | 55° 59.95' N | 001° 00.03' W | 66 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 128-130 | 03.09.19 | 02:18 – 02:36 |
| GN033A | 55° 59.99' N | 001° 40.29' W | 69 | bo, 5 | 9.0 | Cs, Sr, H3, Tu | — | — | 131-132 | 03.09.19 | 05:03 – 05:17 |
| GN033S | 56° 30.02' N | 001° 40.18' W | 50 | bo, 5 | — | — | — | — | 133 | 03.09.19 | 08:24 – 08:36 |
| GN034A | 57° 00.00' N | 001° 40.08' W | 23 | bo, 5 | — | Cs, Sr, H3, Tu | — | — | 134-135 | 03.09.19 | 11:10 – 11:23 |
| GN034 | 56° 59.91' N | 000° 59.58' W | 70 | bo, 6x10, 5 | 10.5 | Cs | 10 | bo, 10, 5 | 136-143 | 03.09.19 | 13:33 – 13:47 |
| GN034S | 56° 59.87' N | 000° 10.15' E | 86 | bo, 5 | — | — | — | bo, 5 | 144-145 | 03.09.19 | 17:34 – 17:47 |
| GN035 | 56° 59.86' N | 001° 20.20' E | 99 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 146-148 | 03.09.19 | 21:36 – 21:52 |
| GN035S | 57° 00.12' N | 002° 25.05' E | 81 | bo, 5 | — | — | — | bo, 5 | 149-150 | 04.09.19 | 01:18 – 01:33 |
| GN036 | 56° 59.80' N | 003° 29.95' E | 65 | bo, 10, 5 | — | Cs, Sr, H3, Tu | 10 | bo, 5 | 151-153 | 04.09.19 | 05:02 – 05:16 |
| GN037 | 57° 00.13' N | 004° 59.83' E | 58 | bo, 10, 5 | 13.0 | Cs | — | bo, 5 | 154-156 | 04.09.19 | 10:26 – 10:39 |
| GN038 | 56° 59.89' N | 006° 00.09' E | 53 | bo, 10, 5 | 11.0 | Cs | — | bo, 5 | 157-159 | 04.09.19 | 13:48 – 13:58 |
| GN038A | 56° 59.92' N | 006° 59.73' E | 34 | bo, 10, 5 | 12.0 | Cs/Sr/H3/Tu | 3x10 | — | 160-162 | 04.09.19 | 17:05 – 17:21 |
| GN039 | 57° 00.02' N | 008° 00.03' E | 34 | bo, 10, 5 | — | Cs/Sr/H3/Tu | 10 | bo, 5 | 163-165 | 04.09.19 | 20:34 – 21:07 |
| GN039S | 57° 25.15' N | 007° 59.92' E | 91 | bo, 5 | — | — | — | — | 166-167 | 04.09.19 | 23:34 – 23:47 |
| GN801 | 57° 30.15' N | 009° 00.04' E | 29 | bo, 10, 5 | — | Cs, Sr, H3, Tu | 10 | — | 168-170 | 05.09.19 | 02:56 – 03:23 |
| GN802 | 57° 57.00' N | 009° 25.24' E | 217 | bo, 10, 5 | 4.5 | Cs, Sr, H3, Tu | 10 | — | 171-173 | 05.09.19 | 06:16 – 06:52 |
| GN803 | 57° 59.92' N | 010° 29.83' E | 125 | bo, 10, 5 | 9.0 | Cs, Sr, H3, Tu | 10 | — | 174-176 | 05.09.19 | 10:31 – 11:15 |
| GN804 | 57° 45.00' N | 010° 46.11' E | 23 | bo, 10, 5 | 5.5 | Cs, Sr, H3, Tu | 10 | — | 177-179 | 05.09.19 | 13:00 – 13:23 |
| GN805 | 57° 40.19' N | 011° 25.14' E | 88 | bo, 10, 5 | 6.0 | Cs, Sr, H3, Tu | 10 | — | 180-182 | 05.09.19 | 15:23 – 15:51 |
| GN807 | 58° 29.78' N | 009° 59.81' E | 536 | bo, 10, 5 | — | Cs, Sr, H3, Tu | 10 | — | 183-185 | 05.09.19 | 23:59 – 00:47 |

| station name | latitude | longitude | water depth [m] | water sampling & CTD [m] | Secchi-depth [m] | radio-activity | trace metals [m] | nutrients [m] | Bedford ID 195nnn | date dd.mm.yy | time [UTC] |
|--------------|--------------|---------------|-----------------|--|------------------|----------------|------------------|---------------|-------------------|---------------|---------------|
| GN808 | 58° 13.21' N | 009° 19.84' E | 680 | bo, 8, 5. 270 l sampler: 39, 97, 262 | — | Cs, Sr, H3, Tu | 10 | — | 186-188 | 06.09.19 | 04:59 – 09:59 |
| GN040 | 57° 49.86' N | 008° 00.33' E | 523 | bo, 10, 5 | 7.0 | Cs, Sr, H3, Tu | 10 | bo, 5 | 189-191 | 06.09.19 | 15:36 – 16:33 |
| GN040S | 57° 55.19' N | 007° 00.09' E | 350 | bo, 5 | — | — | — | bo, 5 | 192-193 | 06.09.19 | 20:46 – 21:11 |
| GN041 | 57° 59.98' N | 005° 59.67' E | 310 | bo, 10, 5 | — | Cs, Sr, H3, Tu | 10 | bo, 5 | 194-196 | 06.09.19 | 00:39 – 01:16 |
| GN042 | 58° 00.05' N | 005° 00.05' E | 128 | bo, 10, 5 | 8.5 | Cs | 10 | bo, 5 | 197-199 | 07.09.19 | 04:49 – 05:21 |
| GN042S | 58° 00.03' N | 004° 00.20' E | 99 | bo, 5 | — | — | — | bo, 5 | 200-201 | 07.09.19 | 09:53 – 10:30 |
| GN043 | 57° 59.99' N | 003° 00.09' E | 77 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 202-204 | 07.09.19 | 14:30 – 15:00 |
| GN044 | 57° 59.98' N | 001° 29.94' E | 105 | bo, 10, 5 | — | Cs, Sr, H3, Tu | 10 | bo, 5 | 105-207 | 07.09.19 | 20:32 – 21:02 |
| GN044S | 58° 00.15' N | 000° 14.42' E | 138 | bo, 5 | — | — | — | bo, 5 | 208-209 | 08.09.19 | 01:14 – 01:28 |
| GN045 | 57° 59.97' N | 001° 00.02' W | 115 | bo, 10, 5 | 11.5 | Cs, Sr, H3, Tu | 10 | bo, 5 | 210-212 | 08.09.19 | 05:25 – 05:55 |
| GN045A | 57° 59.96' N | 001° 59.97' W | 85 | bo, 5 | 13.0 | Cs, Sr, H3, Tu | — | — | 213-214 | 08.09.19 | 08:54 – 09:07 |
| GN045B | 58° 29.98' N | 002° 30.16' W | 72 | bo, 5 | 13.0 | Cs, Sr, H3, Tu | — | — | 215-216 | 08.09.19 | 12:00 – 12:11 |
| GN057A | 58° 45.05' N | 003° 59.94' W | 79 | bo, 5 | 14.0 | Cs | — | — | 217-218 | 08.09.19 | 17:08 – 17:19 |
| GN056 | 58° 44.97' N | 004° 59.95' W | 86 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 219-221 | 08.09.19 | 20:39 – 21:21 |
| GN056C | 58° 19.94' N | 005° 40.16' W | 109 | bo, 5 | — | Cs/Tu | — | — | 222-223 | 09.09.19 | 00:27 – 00:42 |
| GN064 | 57° 59.96' N | 006° 00.03' W | 65 | bo, 10, 5 | — | Cs, Sr, H3, Tu | 10 | bo, 5 | 224-226 | 09.09.19 | 03:06 – 03:32 |
| GN056B | 58° 44.93' N | 005° 59.99' W | 119 | bo, 5 | — | Cs, Sr, H3, Tu | — | bo, 5 | 227-228 | 09.09.19 | 07:55 – 08:08 |
| GN065 | 59° 59.96' N | 005° 59.99' W | 1064 | bo, 1000, 900, 10, 5 | 12.0 | Cs, Sr, H3, Tu | 10 | bo, 5 | 229-233 | 09.09.19 | 16:28 – 17:47 |
| GN055 | 59° 59.99' N | 004° 59.99' W | 410 | bo, 10, 5 | — | Cs/Tu | 10 | bo, 5 | 234-236 | 09.09.19 | 20:44 – 21:33 |
| GN054S | 59° 59.99' N | 003° 59.68' W | 128 | bo, 5 | — | — | — | bo, 5 | 237-238 | 10.09.19 | 00:36 – 00:49 |
| GN054 | 59° 59.89' N | 003° 00.13' W | 111 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 239-241 | 10.09.19 | 04:12 – 04:43 |
| GN053B | 59° 59.91' N | 002° 00.26' W | 88 | bo, 5 | 14.4 | Cs | — | bo, 5 | 242-243 | 10.09.19 | 07:30 – 07:42 |
| GN053A | 59° 47.95' N | 001° 19.71' W | 86 | bo, 5 | 13.0 | Cs | — | bo, 5 | 244-245 | 10.09.19 | 09:59 – 10:10 |
| GN053 | 60° 00.01' N | 000° 30.17' W | 127 | bo, 10, 5 | 11.0 | Cs, Sr, H3, Tu | 10 | bo, 5 | 246-248 | 11.09.19 | 16:32 – 16:59 |
| GN052S | 59° 59.93' N | 000° 44.93' E | 126 | bo, 5 | — | — | — | bo, 5 | 249-250 | 11.09.19 | 20:45 – 21:03 |
| GN052 | 60° 00.15' N | 001° 59.86' E | 104 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 251-253 | 12.09.19 | 00:55 – 01:23 |
| GN051S | 59° 59.93' N | 003° 14.95' E | 217 | bo, 5 | 7.5 | — | — | bo, 5 | 254-255 | 12.09.19 | 05:15 – 05:46 |
| GN051 | 60° 00.04' N | 004° 30.08' E | 261 | bo, 10, 5 | 8.0 | Cs, Sr, H3, Tu | 10 | bo, 5 | 256-258 | 12.09.19 | 09:23 – 10:05 |
| GN050S | 59° 30.19' N | 004° 29.88' E | 266 | bo, 5 | 10.5 | — | — | bo, 5 | 259-260 | 12.09.19 | 13:41 – 13:58 |
| GN050 | 59° 00.07' N | 004° 30.05' E | 259 | bo, 10, 5 | 9.0 | Cs, Sr, H3, Tu | 10 | bo, 5 | 261-263 | 12.09.19 | 17:38 – 18:24 |
| GN049S | 58° 59.99' N | 003° 45.04' E | 273 | bo, 5 | — | — | — | bo, 5 | 264-265 | 12.09.19 | 21:33 – 21:58 |
| GN049 | 58° 59.98' N | 003° 00.22' E | 138 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 266-268 | 13.09.19 | 01:46 – 02:22 |
| GN048S | 59° 00.00' N | 002° 00.05' E | 114 | bo, 5 | — | — | — | bo, 5 | 269-270 | 13.09.19 | 07:10 – 07:21 |
| GN048 | 58° 59.93' N | 001° 00.22' E | 125 | bo, 10, 5 | 9.5 | Cs, Sr, H3, Tu | 10 | bo, 5 | 271-273 | 13.09.19 | 13:20 – 13:49 |
| GN047 | 59° 00.01' N | 000° 00.04' E | 130 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 274-276 | 13.09.19 | 18:50 – 19:20 |

| station name | latitude | longitude | water depth [m] | water sampling & CTD [m] | Secchi-depth [m] | radio-activity | trace metals [m] | nutrients [m] | Bedford ID 195nnn | date dd.mm.yy | time [UTC] |
|---------------|--------------|---------------|-----------------|--------------------------|------------------|----------------|------------------|---------------|-------------------|---------------|---------------|
| GN046 | 58° 59.95' N | 001° 30.11' W | 107 | bo, 10, 5 | — | Cs | 10 | bo, 5 | 277-279 | 14.09.19 | 00:57 – 01:23 |
| GN046A | 59° 00.02' N | 001° 59.89' W | 78 | bo, 5 | — | Cs, Sr, H3, Tu | — | — | 280-281 | 14.09.18 | 03:04 – 03:19 |