Fram Strait Cruise Report

24th August – 13th September 2014

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Scientific Participants

Physical and chemical oceanography

1. Paul Dodd, NPI (Cruise leader, CTD/tracers, ADCP)
2. Laura de Steur, NPI, (CTD, ADCP)
3. Dimitry Divine, NPI, (Stereo camera system, CTD)
4. Malin Johansson, Chalmers University (CTD)
5. Mats Granskog, NPI, (CTD/tracers)
6. Alexy Pavlov, NPI, (CTD/tracers)
7. Cecilia Perralta Ferriz, APL/UW (CTD)
8. Piotr Kowalczuk, IOP, (Optics)
9. Anna Raczkowska, IOP (Optics)

Sea ice

10. Sebastian Gerland (Sea ice)
11. Jennifer King (Sea ice)

Technical

12. Kristen Fossan, NPI (Moorings)
13. Are Bjørdal, NPI (Moorings, Miljødata)
14. Marius Bratrein, NPI (EM-Bird)

Helicopter team

15. Jostein, Airlift (Pilot)
16. Arild, Airlift (Helicopter technician)

Figure 1: *Scientific participants of the complete cruise: a: Anna Raczkowska, b: Are Bjørdal, c: Alexy Pavlov, d: Cecilia Perralta Ferriz, e: Dimitry Divine, f: Jennifer King, g: Kristen Fossan, h: Laura de Steur, i: Malin Johansson, k: Marius Bratrein, l: Paul Dodd, m: Piotr Kowalczuk, n: Sebastian Gerland.:*

Cruise Outline

Since 1997 NPI has maintained an array of oceanographic moorings in the East Greenland Current at Fram Strait. This array has provided a long time series of observations with which to monitor the outflow from the Arctic Ocean. The main purpose of the 2014 Fram Strait cruise was to recover and redeploy the mooring array. All six NPI moorings were recovered, although all instrumentation on the easternmost mooring (F18-9) was lost during the deployment, probably due to contact with an iceberg.

F18 could not be redeployed as planned in 2014, due to the lost instrumentation. The other 5 standard moorings (F11, F12, F13, F14 and F17) were de-deployed as planned. An additional mooring (F13B) was deployed for the first time in 2014. Large automatic water samplers (which may increase mooring push-down in strong currents) and surface ice-cats (which could interfere with ice profiling sonar) will now be deployed at F13B to ensure that these recent additions to the mooring array do not compromise the quality of data collected at long term observations sites.

NPI has completed annual sections of CTD and conservative tracer measurements along 78°50'N since 1997. The zonal extent of sections varies from year to year, but the region between the 0 and W 010° (which includes the main outflow from the Arctic Ocean) has been sampled in every year. During the 2014 Fram Strait cruise a CTD section was completed between W 010° 30 and E 009°. Samples were collected for analysis of $\delta^{18}O$, nutrient, coloured dissolved organic matter (CDOM), dissolved organic carbon-13 ($DO^{13}C$), dissolved inorganic carbon (DIC), total alkalinity (A_T), Iodide, Iodate and ^{129}I samples at most stations along the section.

A second CTD and tracer section was completed across the Norske Trough between N 77° 48', W 017° 30' and N78° 24', W 014 on the East Greenland Shelf. This section was an exact repeat of a similar section completed in 2013. The primary purpose of this section is to study the circulation of warm Altantic water within the Belgica - Norske - Westwind trough system. Atlantic water in the trough system is thought to cross the shelf before reaching the Greenland coast, where it interacts with the floating glacier tongues through basal melting.

Ice conditions were favourable along the 78°50'N section and the Norske trough section; wide leads, generally open drift ice and a predominance of small ice floes allowed the moored array to be recovered in good time and mostly during daylight hours. However very dense ice was encountered around F11 during the first recovery attempt, which made recovery impossible. The mooring was recovered a day later during a second attempt when the ice was more open.

3 CTD profiles were collected immediately in front of Nioghalvfjerdsbræ and one from beneath the floating ice tongue of Nioghalvfjerdsbræ. These sites were accessed by helicopter and CTD profiles were collected by drilling holes in sea ice to deploy X-CTD probes, and in one case a small RBR CTD. Tracer samples were not collected at these stations due to time constraints and the difficulty of drilling large diameter holes though ice.

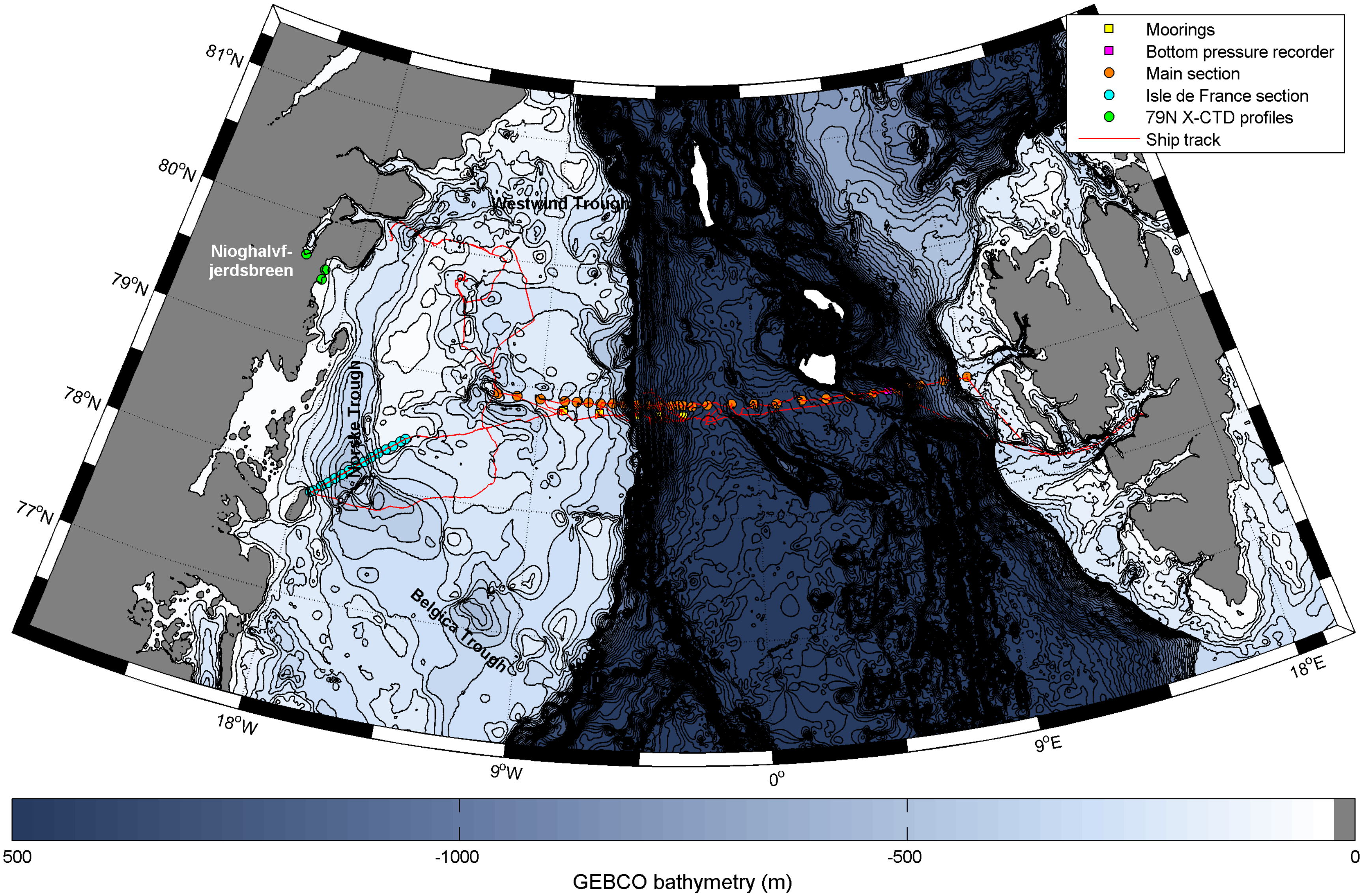


__Figure 2.__ Chart showing the locations of major activities during the FS2014. Yellow squares indicate mooring positions; orange and cyan circles indicate CTD, LADCP and tracer stations; Green circles indicate helicopter accessed X-CTD stations. Bathymetric contours are drawn at 100m intervals. The ship track is shown in red.

Sailing Log

Date	**Activity** (all times UTC)
Sunday 24 August 2014	*Loading, mobilization and departure* **10:30** Departed Longyearbyen **11:00** Safety meeting *Sailing to first CTD station* **20:40:** CTD station 1 **22:26:** CTD station 2 **23:38:** CTD station 3
Monday 25 August 2014	*Completing CTDs along main section in a westerly direction. Exceptionally calm weather (0.5-1.0 m wave height).* **02:06:** CTD station 4 **04:17:** CTD station 5 **06:16:** CTD station 6 **08:57** Uploading data from BPR at 005 W using acoustic modem. **10:00** Problems with data link, upload aborted. **11:31:** CTD station 7 **14:03** Second attempt to upload data from BPR at 005 W. Unsuccessful. Aborted after 30 mins. **16:39:** CTD station 8 **20:04:** CTD station 9 **23:18:** CTD station 10
Tuesday 26 August 2014	*Continuing main CTD section westwards* **04:21: CTD station 11** **05:00** Met first ice **08:00: CTD station 12** **19:16: CTD station 13** **09:48 – 09:57** Attempted Helicopter EM-Bird flight. Aborted. **17:21 – 19:00** Helicopter EM-Bird flight **21:47 – 22:49** Sea ice station 001 with MOB boat + 5 pax.
Wednesday 27 August 2014	*Continuing main CTD section westwards* **06:48:** CTD station 14 **13:15:** CTD station 15 **15:29:** CTD station 16 **18:00:** CTD station 17 **19:19:** CTD station 18 **21:54:** CTD station 19 **17:50-20:35** Sea ice station 002 with basket + 3 pax.

Thursday 28 August 2014	**01:43:** CTD station 20 **06:45** F11 located on echo sounder (floatation at 300 m) **07:30** Abort F11 recovery due to a lack of open water **12:30** F12 located using hydrophone. Acoustic range 1950 m **14:02** F12 released at acoustic range of 1944 m *F12 surfaces under ice and cannot be seen on the surface. Release location marked on ice with paint. Working to locate acoustic release under the ice using acoustic range measurements. Then braking ice to try and reveal the mooring.* **16:38** Top section of F12 on grappling hook. **18:40** Top section of F12 on deck **19:05** bottom section of F12 on grappling hook. **19:10** bottom section of F12 on deck **20:07 – 21:40** helicopter flight with 4 people **20:20:** CTD station 21
Friday 29 August 2014	**06:20** F11 rapidly located on echo sounder using position determined on 28/8. 50m and 300m floatation visible. **06:31** F11 released **08:25** F11 on deck **08:37:** CTD station 22 **12:45 – 14:30** EM-bird flight **16:00** F13 located on echo sounder (50 m floatation) **17:05 – 17:25** Assessing drift of ice in small lead (257º, 0.6 kts) **17:25** F13 Recovery aborted due to lack of suitable opening and poor visibility. **19:19:** CTD station 23 **22:37:** CTD station 24
Saturday 30 August 2014	**00:04:** CTD station 25 **02:38:** CTD station 26 **05:55** F14 located on echo sounder (50 m flotation) **06:03** F14 released, spotted on surface immediately. **06:20** F14 on deck **06:41:** CTD station 27 **07:14 – 08:55** Helicopter EM-Bird flight **11:40 – 14:36** Ice station, 6 persons (local time?) **16.15** F13 released **17:25** F13 on deck **17:51 -19:55** helicopter with 4 people **17:52:** CTD station 28 **21:41 – 21:55:** helicopter flight with 4 people **21.57-22:00:** helicopter flight with 4 people **21:58:** CTD station 29

Sunday 31 August 2014	**00:11:** CTD station 30 **01:30:** CTD station 31 **03:48:** CTD station 32 **06:18:** F17 released **06:30:** F17 on deck (partially lost) **07:41:** CTD station 33 **08:45:** F18 released **09:55:** F17 on deck **10:00:** take off 10:17 landed **11:42:** CTD station 34 **13:58:** CTD station 35 **18:30 – 20:15** ice station (3 persons) **21:55 - 00:00** ice station (6 persons)
Monday 1 September 2014	**03:29-03:40:** Helicopter flight with 2 pax, **03:42-03:50:** Helicopter flight with 2 pax, **03:52-04:02:** Helicopter take off with 5 pax **12:20-14:20** Helicopter EM-bird flight 4 pax **14:44-14:50** Helicopter flight 3 pax **17:40:** Helicopter take off for 79N glacier front work with 5 pax
Tuesday 2 September 2014	*Waiting by fast ice during 79N glacier helicopter work*
Wednesday 3 September 2014	*Sailing to Dijmphna sund* **03:55** *Helicopter on board* Sailing to Isle de France section
Thursday 4 September 2014	*Isle de France section* **14:05:** CTD station 36 **15:41:** CTD station 37 **16:54:** CTD station 38 **19:00:** CTD station 39 **20:25:** CTD station 40 **21:28:** CTD station 41 **22:29:** CTD station 42 **23:53:** CTD station 43
Friday 5 September 2014	*Isle de France section, sailing to deploy F17* **01:05:** CTD station 44 **02:04:** CTD station 45 **03:00:** CTD station 46 **04:18:** CTD station 47 **05:12:** CTD station 48 **05:58:** CTD station 49 **06:44:** CTD station 50 **07:18:** CTD station 51 **21:35:** F17 Deployed

Saturday 6 September 2014	**06:15** - Sea ice station, 7 persons **12:59:** F14 Deployed **18:46:** CTD station 52 **19:23:** F13B Deployed
Sunday 7 September 2014	**15:37:** F13 Deployed **18:25: CTD** station 53
Monday 8 September 2014	**12:34:** CTD station 54 **14:02:** F12 Deployed
Tuesday 9 September 2014	**14:23** F11 Deployed
Wednesday 10 September 2014	*Attempting locate and recover F10 (All day)*
Thursday 11 September 2014	*Continued attempting locate and recover F10* **14:00** Ceased trying to recover F10 in difficult ice conditions. *Attempting locate and recover F9* **14:22** Released F9 **16:43** F9 on deck *Sailing to Longyearbyen*
Friday 12 September 2014	*Sailing to Longyearbyen* **06:00- 07:00** Third (and final) attempt to upload data from BPR at 005 W. Unsuccessful. Aborted after 1 hour. *Continued sailing to Longyearbyen* **18:39** Arrival in Longyearbyen (Bykaia)
Saturday 13 September 2014	*Packing and unloading (All day)*
Sunday 14 September 2014	*Continued unloading* **14:45** Most participants depart on SK4425

CTD Measurements

The CTD used as an SBE911+ unit. Niskin bottles were closed using the bottle fire command within the Sea-Bird acquisition software so that a .bl file was created for each deployment when bottles were fired.

NMEA time and position information was fed to the acquisition computer and added to each scan line of the data files. Cast starting times were automatically added to the header of all data files.

A paper log sheet was completed at each CTD station. Log sheets list the depths at which bottles were fired and the samples taken from each bottle. Times and positions manually recorded on log sheets are indented as a backup in the case of a problem with the data acquisition, not a replacement for logged time and position data.

CTD Package Configuration

- Primary temperature sensor serial number **4052** was used for the entire cruise
- Secondary temperature sensor serial number **2400** was used for the entire cruise

- Primary conductivity sensor serial number **2056** was used for the entire cruise
- Secondary conductivity sensor serial number **3742** was used for the entire cruise

- Digiquartz pressure sensor serial number **0972** was used for the entire cruise

Station Locations

CTD stations were organized along two sections.

1. **Main Section:** An east-west section along the Fram Strait mooring array line at 78º 50 N, which is repeated annually. Figure 4 shows the data collected along the Main repeated section.

2. **Norske Trough Section:** A high-resolution (7 km spacing) southwest-northeast section across the NorskeTrough on the East Greenland continental shelf. This section begins at the tip of Isle de France and crosses crossing the complete trough. Figure 5 shows the data collected along the Norske Trough section.

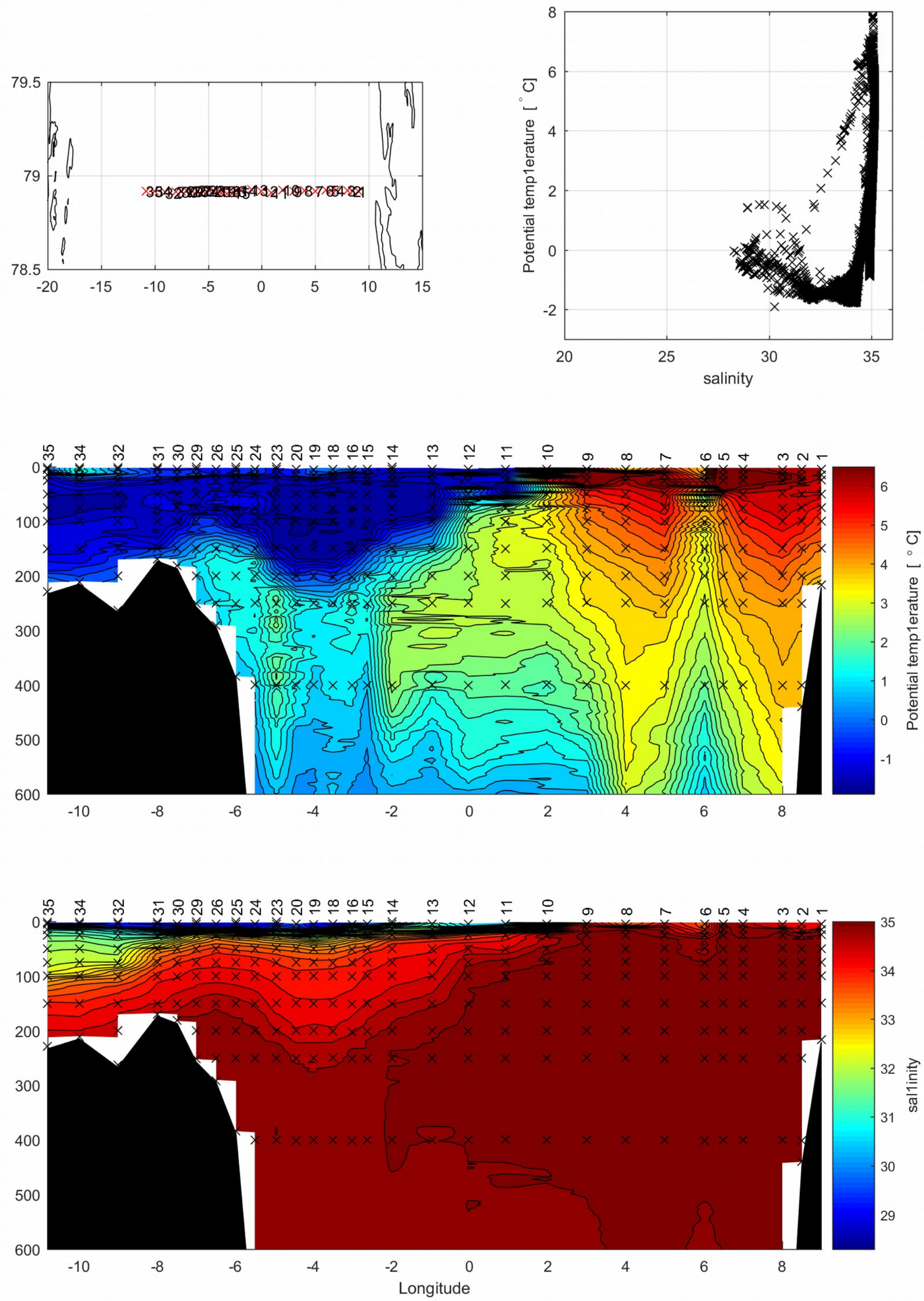


Figure 4: *Map showing the location of CTD stations along the main section (top left panel); Measurements from the primary temperature and salinity sensors in θ-S space (tope left panel); and sections of potential temperature, salinity and density (lower 3 panels respectively). Station locations are indicated by dotted lines in sections. Station numbers are plotted above sections.*

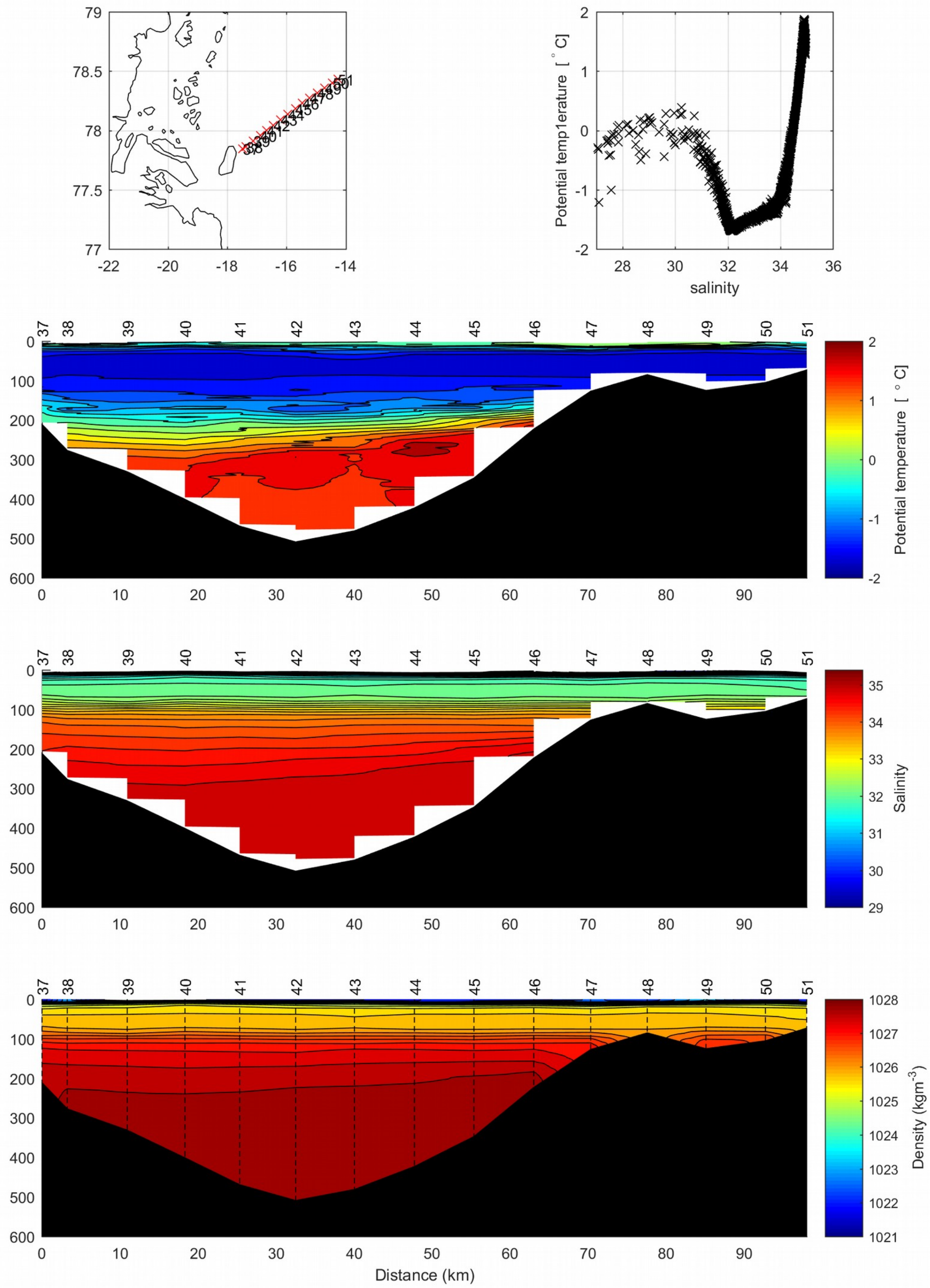


Figure 5: *Map showing the location of CTD stations along the Norske Trough section (top left panel); Measurements from the primary temperature and salinity sensors in θ-S space (tope left panel); and sections of potential temperature, salinity and density (lower 3 panels respectively). Station locations are indicated by dotted lines in sections. Station numbers are plotted above sections.*

Sensor Calibration

Water samples for laboratory salinity measurement were collected at most CTD stations. At stations where tracer samples were collected, salinity samples were collected at standard depths of 5, 15, 25, 50, 75, 100, 150, 200 and 300 dbar, plus two samples from the bottom of the water column. At stations where tracer samples were not collected, samples for salinity measurement were collected from deep parts of the water column where the salinity gradient was shallow. Deep regions provide the best data for conductivity sensor calibration as the water trapped in the Niskin bottles is most similar to that sampled by the CTD.

Salinity samples were analysed on broad Lance using a Guildline Portasal portable salinometer which was standardised after every 24 measurements using IAPSO P-series standard seawater.

Comparison of laboratory salinity measurements and CTD-salinity measurements revealed an offset of < 0.001 psu for the primary sensor group (Figure 6). The offset between the primary sensor group and the laboratory measurements very large, however, the offset is constant with changing pressure (Figure 7) and in time (Figure 8). Similarly large offsets have been encounters on previous Fram Strait cruises. The standard deviation of measurements is with an acceptable range for a pumped CTD system at 0.005 psu.

Comparison of laboratory salinity measurements and CTD-salinity measurements revealed an offset of around -0.002 practical salinity units for the secondary sensor group (Figure 6). An offset of this magnitude is typical for the type of sensors used during the cruise. The standard deviation of measurements is with an acceptable range for a pumped CTD system at 0.002 psu for both sensor groups

Both sensor groups remained stable during the cruise and had similar standard deviations, when compared to laboratory salinity measurements. However, the first sensor group seems to have the most accurate measurements.

No provisional calibration offset will be applied to the CTD data. A final calibration will be performed when post-deployment calibration data are available for the sensors used during the cruise.

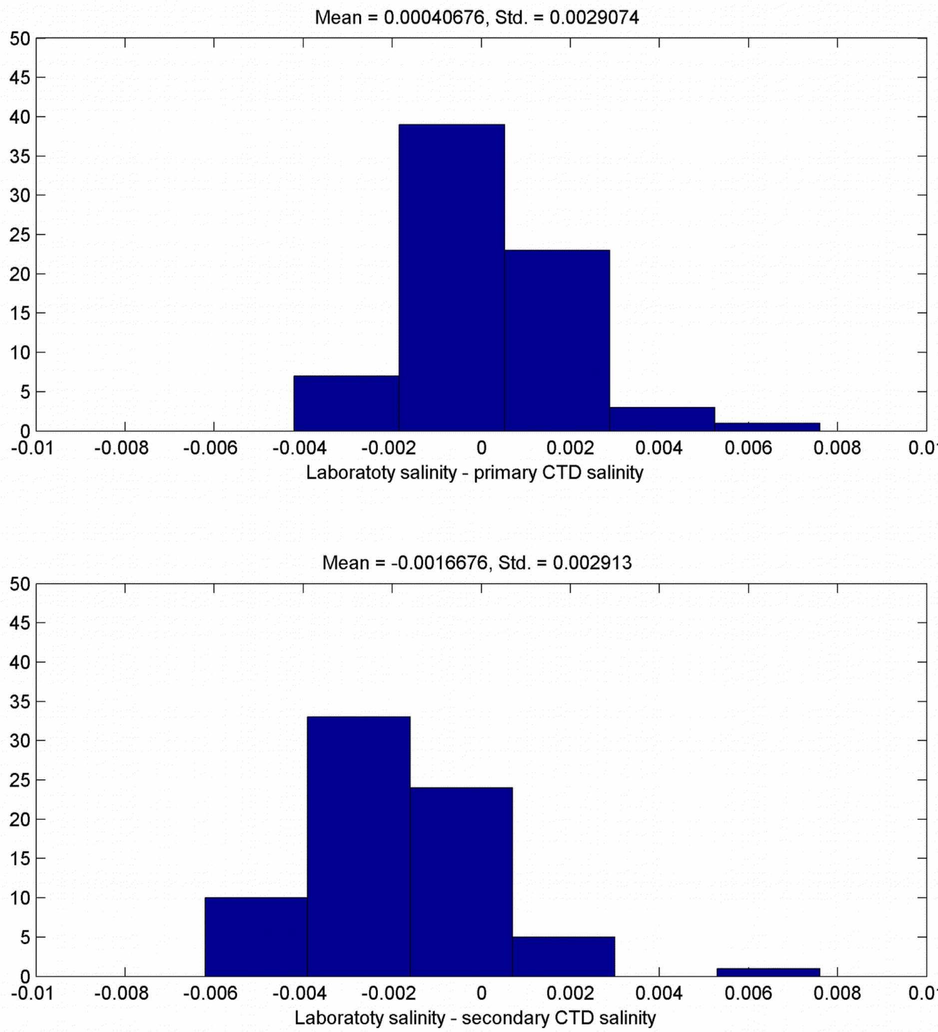


Figure 6: *Histograms showing the difference between laboratory salinity measurements and the primary (left hand panel) and secondary (right hand panel) sensor groups on the CTD. Only points deeper than 400 m are considered.*

Helicopter CTD Stations

A helicopter operation was planned to investigate the hydrographic properties of the water column immediately in front of Nioghalfvjerdsbræ. Due to time and the limited constraints profiles were obtained using X-CTD profilers launched though holes drilled in sea ice, using an ice corer. The ice corer was used in place of an auger to minimize the amount of cuttings and slush left in the hole, which could affect the fall rate of the X-CTD probe. The operation was modelled on similar helicopter CTD surveys performed in Fram Strait in 2007 (4 operations, occupying 15 sites) and 2008 (12 operations, occupying 29 sites). The 2014 Fram Strait operation used the same type of helicopter (AS350), as was used in 2007 and 2008, the flight distances, number of out-landings per flight, duration of planned out-landings, and number and experience of scientists involved was similar. In terms of data collection the 2014 operation was a success with good CTD profiles being collected at 4 of the 5 sites visted

Stations were laid out using a Radarsat II image of 30/8 (figure 7). This was the most recent image available before the operation. Four stations were placed on areas of level ice, located a safe distance from the front of the floating ice tongue (figure 1, yellow points). Two more stations were located in a rift in the floating ice tongue, the bottom of which was covered by sea ice (figure 7, pink points). The stations in the rift were visited by scientists from the Woods Hole Oceanographic Instiution (WHOI) in 2009 during a similar helicopter operation. Scientists from WHOI provided detailed information about their operation that enabled us to precisely identify the same rift on a Radarsat II image immediately before the operation. Precise lat\lon co-ordinates for all stations were obtained by clicking on the Radarsat II image in the QGIS mapping software.

At the beginning of the operation R/V Lance was located at the edge of a large area of multi-year fast ice close to 79° 30’N, 013° 00’W. R/V Lance was moving towards Dijmphna Sound before the operation began. The team on board the helicopter expected R/V Lance to continue moving towards Dijmphna Sound during the helicopter operation.

Movement of R/V Lance towards Dijmphna Sound was an important part of the safety plan. If the visibility deteriorated, the helicopter would wait for R/V Lance to reach Dijmphna Sound and then fly along the Greenland coast to reach R/V Lance in Dijmphna Sound. Flying back to R/V Lance along the Greenland coast where the mountains of Greenland are visible would be possible even in quite poor conditions and the Greenland coast would provide numerous safe landing sites along the route should conditions become unsuitable for flying over open water.

A detailed plan (including an annotated Radarsat II image and a printed list of station positions) was discussed with the pilot during the afternoon of 1/9. A copy of the annotated radarsat II image (figure 7) and printed list of station positions given to the officer on the bridge at the start of the operation.

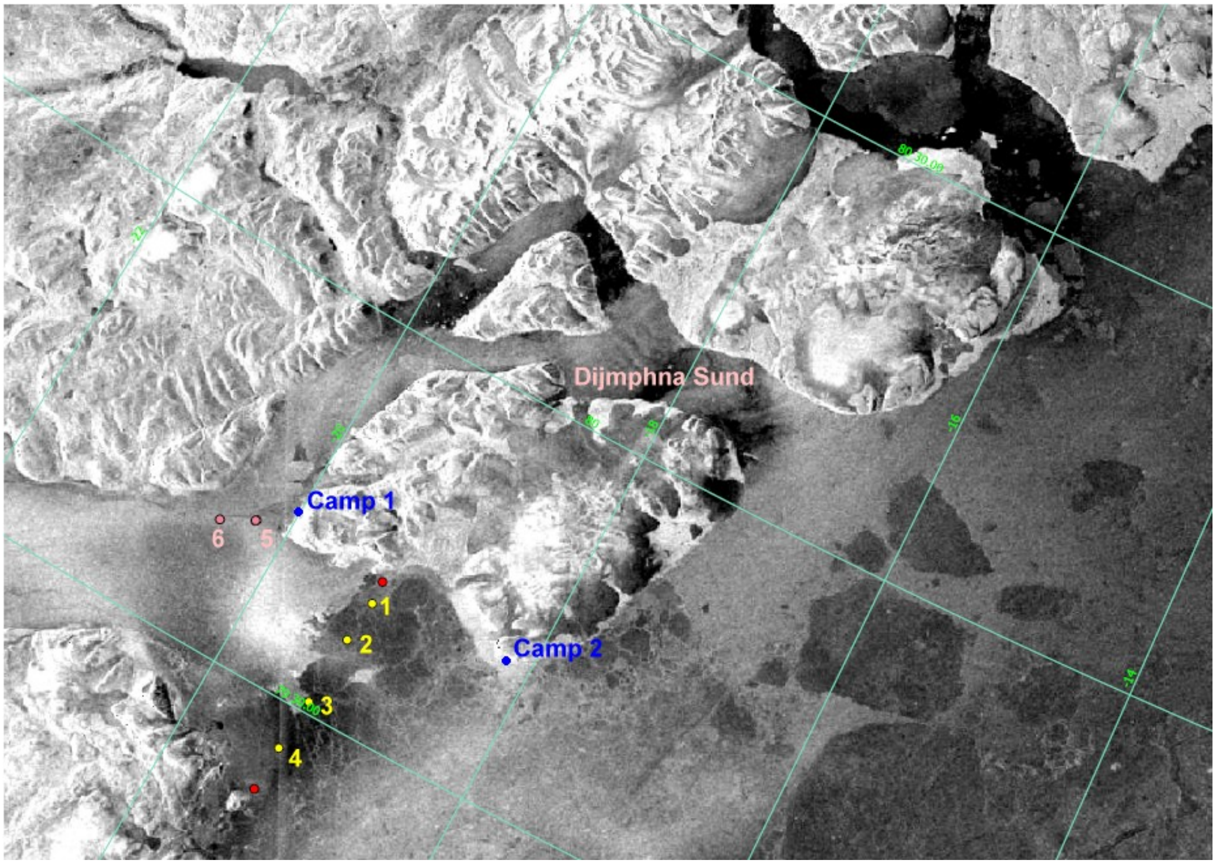


Figure 7: Radarsat II image showing the main activities during the operation. Yellow Points: planned CTD stations 1-4. Pink points: Planned CTD stations 5-6. Blue points: fist and second waiting places.

The operation initially proceeded as planned with profiles being collected at the 1st, 2nd and 3rd stations. However, the pilot declined to proceed to the 4th planned station due to poor visibility so this station was skipped and the next landings were at the 5th and 6th planned stations in the glacial rift. Work at the 5th planned station went according to plan, but the 6th station had to be aborted due to deteriorating visibility.

After leaving the 6th planned station the helicopter attempted to return to R/V Lance but was unable to complete the planned flight due to fog and instead landed at the camp 1 (figure 7). After waiting overnight a second attempt was made to return to the ship, but this was also aborted due to fog and the helicopter returned to Greenland landing at camp 2 (figure 7). After waiting 12 hours at the second campsite flying conditions had still not improved and R/V Lance began to move towards Dijmphna sound, where it would be easier to reach by helicopter. In the early hours of the following morning R/V Lance reached a location close to camp 2 and the helicopter was able to return to the ship. The movements of R/V Lance's and the helicopter during the operation are summarized in the table below.

Time (UTC)	Helicopter Position	R / V Lance Position	Comment
17:40 1/9	R/V Lance	79° 45’ N 013° 00’ W	Take-off from RV Lance
19:04 1/9	79° 39.784’ N 019° 17.320’ W	79° 45’ N 013° 00’ W	Helicopter at 1st planned CTD station
Ca. 19:10 1/9	79° 39.784’ N 019° 17.320’ W	79° 45’ N 013° 00’ W	Lance informs the helicopter that the ship has become engulfed in fog. At this point it is not possible to return to R/V Lance.
19:43 1/9	79° 39.588’ N 019° 15.446’ W	79° 45’ N 013° 00’ W	Helicopter at 2nd planned CTD station
20:20 1/9	79° 31.609’ N 019° 17.948’ W	79° 45’ N 013° 00’ W	Helicopter at 3rd planned CTD station
21:10 1/9	79° 41.310’ N 020° 16.262’ W	79° 45’ N 013° 00’ W	Helicopter at 5th planned CTD station
21:59 1/9	79° 40.139’ N 020° 26.897’ W	79° 45’ N 013° 00’ W	Helicopter at 6th planned CTD station
Ca. 22:30 1/9	79° 45’ N 020° 00’ W	79° 45’ N 013° 00’ W	Helicopter at 1st camp (on land)
09:45 2/9	79° 45’ N 018° 00’ W	9° 36’ N 012° 53’ W	Helicopter arrives at 2nd camp (on land) after attempting to fly to R/V Lance.
10:00 2/9	79° 45’ N 020° 00’ W	79° 36’ N 012° 53’ W	R/V Lance begins to move south along the fast ice edge (in the opposite direction to that planned and expected by the helicopter team). The captain is moving to minimise the straight-line distance between R/V Lance and the helicopter.
22:00 2/9	79° 45’ N 018° 00’ W	80° 01’ N 012° 28’ W	**Lance begins to move towards Dijmphna sound as in contingency plan**
Ca. 03:00 3/9	79° 45’ N 018° 00’ W	80° 06’ N 018° 20’ W	R/V Lance arrives in Dijmphna sound.
03:33 3/9	R/V Lance	80° 06’ N 018° 20’ W	Landing on R/V Lance in Dijmupha sound.

The operation broadly followed the original plan and then the contingency plan when the helicopter encountered fog during CTD station 6. R/V Lance’s movement departed slightly from the contingency plan. Rather than moving directly to Dijmphna Sound as planned, R/V Lance first moved south along the edge of the fast ice, before changing direction and sailing towards Dijmphna Sound, arriving about 24 hours later than planned. The reason for this deviation from the plan was that the captain felt R/V Lance risked being trapped in dense sea ice if it moved towards Dijmphna Sound.

Tracer Sampling

Overview: Water samples were collected at standard pressures of 5, 15, 25, 50, 75, 100, 150, 200, 250, 400 dbar and at the bottom of each cast.
Samples were collected in the following order:

1. pH & Total alkalinity
2. CDOM (Filtered)
3. DOC (Filtered)
4. Nutrients
5. $\delta^{18}O$
6. Iodide / Iodate
7. Salinity
8. ^{129}I
9. Particulate light absorption

Laboratory salinity analysis: Samples for laboratory salinity analysis were collected from all Niskin bottles. When the surface of the water column is strongly stratified, the salinity of water trapped in Niskin bottles can be significantly different from that measured by the conductivity sensor at the bottom of the CTD package, which is approximately 1 meter deeper then the top of the Niskin bottles. Independent laboratory salinity measurements give salinity measurements which correspond exactly to the other tracer measurements made from Niskin bottles. Laboratory measurements were made with a Guildline Portasal 8400b salinometer, which was standardized every 24 samples using P-series seawater supplied by OSIL.

Oxygen isotope ratio analysis and dissolved nutrient analysis: Samples for $\delta^{18}O$ isotope ratio analysis and dissolved nutrient analysis were collected at the locations listed in appendices 1 and 2. Note that samples for $\delta^{18}O$ and dissolved nutrients were always collected concurrently.

Coloured dissolved organic matter (CDOM): Samples for CDOM analysis were collected at the locations listed in appendix 3. Samples for $\delta^{18}O$ isotope ratio analysis and dissolved nutrient analysis were always collected when CDOM samples were collected.

Total alkalinity and dissolved inorganic carbon (A_T & DIC): Samples total alkalinity and dissolved inorganic carbon analysis were collected at the locations listed in appendix 4. Samples for $\delta^{18}O$ isotope ratio analysis and dissolved nutrient analysis were always collected when Total Alkalinity and Dissolved Inorganic Carbon samples were collected.

Iodide / Iodate: Samples total alkalinity and dissolved inorganic carbon analysis were collected at the locations listed in appendix 5. Samples for Iodide / Iodate were collected at a limited number of stations chosen so as to sample inflowing Atlantic water entering the Arctic Ocean as well as recirculating and return Atlantic water passing out of the Arctic Ocean.

^{129}I: Samples ^{129}I analysis were collected at the locations listed in appendix 6. Samples for ^{129}I were collected at a limited number of stations chosen so as to sample inflowing Atlantic water entering the Arctic Ocean aswell as reciruclating and return Atlantic water passing out of the Arctic Ocean. Due to the high cost of ^{129}I analyses, samples for ^{129}I were only collected at selected depths.

Niskin bottle operations: The rubber bands which hold the Niskin bottles closed were in good condition at the beginning on the cruise and only one bottle required attention during the cruise. The rubber band that holds the lids closed had become slack. All taps, values and rubber seals on Niskin bottles remained in good working order throughout the cruise however, the o-rings around the bottle taps are in poor condition and should be replaced soon.

Tracer samples of sea ice: Ice cores for tracer analysis were collected at most sea ice stations. Cores were collected in triplicate so as to allow some assessment of the variability of properties at each site sampled. Loose surface snow was removed before coring. Cores were stored in air-tight buckets and melted within 48 hours of collection, after which the melt water was sub-sampled. Cores were handled with latex or nitrile gloves and an all-plastic syringe was used to extract water from buckets for CDOM sampling. Figure 7b shows the location of sites where ice cores for tracer analysis were collected.

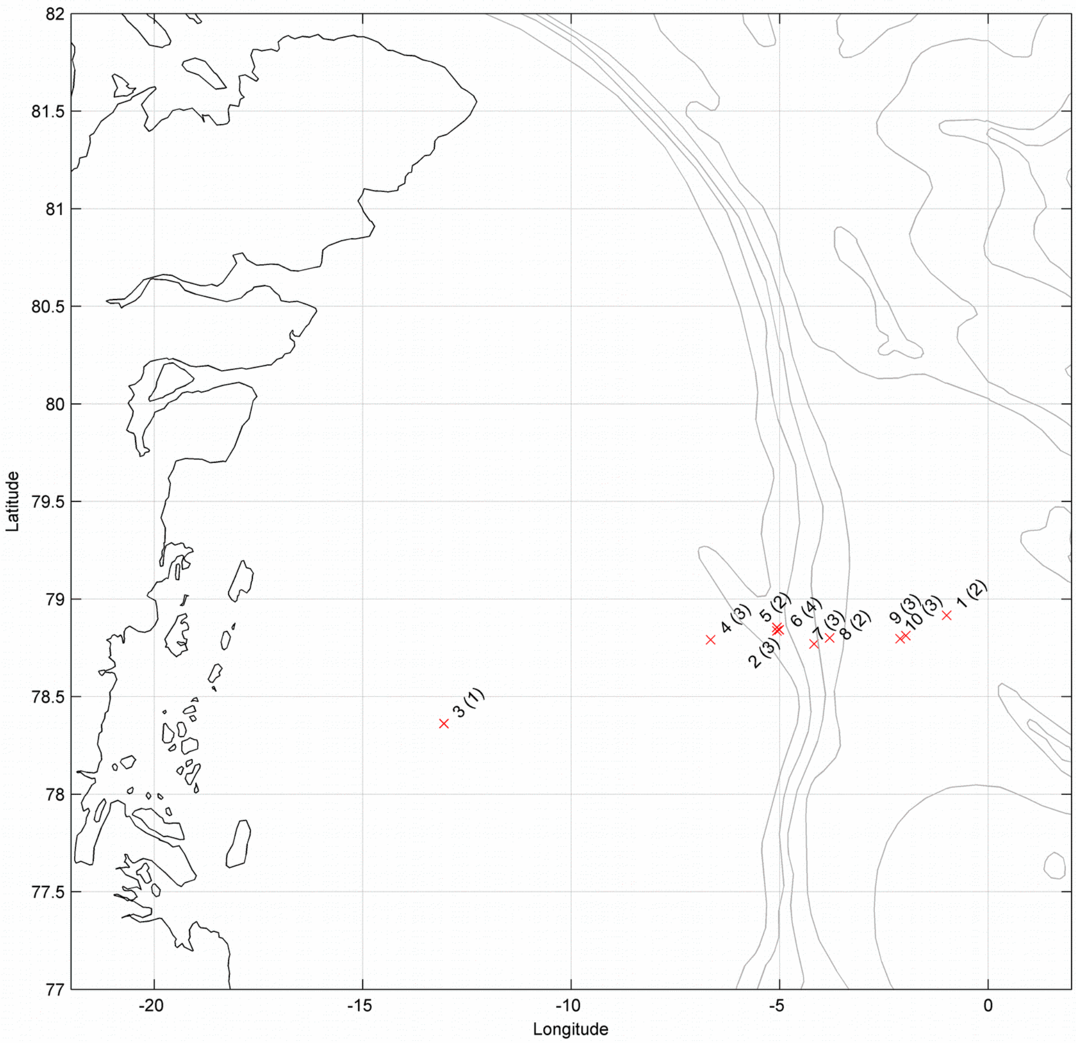


Figure **7b**: Locations of sea ice floes (or regions of thin ice) where cores were collected for tracer analysis. The number of cores collected from at each site is shown in brackets.

Lowered ADCP Measurements

An RDI Workhorse Sentinel lowered ADCP (LADCP) was deployed from the CTD rosette in a downward looking orientation at all CTD stations. Different configuration parameters were used in 2014 to those which have been on all Fram Strait cruises since 2008. The reason for the change was that the LADCP had received a firm-ware update which made some of the commands in the older script obsolete. (The LADCP could not be started using the scripts using from 2008-2013).

The ADCP was always deployed with the following script. However, the script was edited to change the name of the date file before each deployment. LADCP data file names match raw CTD data filenames from the same cast.

```
CR1
WM15
; !!! RENAME FILE NAME BELOW:
RN L001_
LZ030,220
CF11111
EA0
EB0
ED0
ES35
EX11111
EZ1111101
WB0
WD111100000
WF176
WN14
WP1
WS800
WV175
SM1
SA001
SI0
SW75
TE00:00:01.00
TP00:01.00
CK
CS
;
;Instrument         = Workhorse Sentinel
;Frequency          = 307200
;Water Profile      = YES
;Bottom Track       = NO
;High Res. Modes    = NO
;High Rate Pinging  = NO
;Shallow Bottom Mode= NO
;Wave Gauge         = NO
;Lowered ADCP       = YES
;Ice Track          = NO
;Surface Track      = NO
;Beam angle         = 20
;Temperature        = 5.00
;Deployment hours   = 12.00
;Battery packs      = 1
;Automatic TP       = YES
;Memory size [MB]   = 256
;Saved Screen       = 1
;
;Consequences generated by PlanADCP version 2.06:
;First cell range   = 10.11 m
;Last cell range    = 114.11 m
;Max range          = 116.10 m
;Standard deviation = 1.73 cm/s
;Ensemble size      = 521 bytes
```

```
;Storage required   = 21.46 MB (22507200 bytes)
;Power usage        = 43.18 Wh
;Battery usage      < 0.1
;
; WARNINGS AND CAUTIONS:
; WM15 feature has to be installed has to be installed in Workhorse to use selected option.
; Advanced settings have been changed.
```

Clock Synchronisation

Repeatedly adjusting the LADCP clock leads to sudden jumps in the LADCP clock drift. During fs2014 we tracked the clock drift relative to GPS time so that it may be corrected later by applying a correction. Table 1 lists LADCP clock checks

GPS time (UTC)	**Lowered ADCP (UTC)**
14/08/24,17:13:05	14/08/24,17:13:05 (Synchronised)
14/08/29,20:41:10	14/08/29,20:41:07 (ADCP 3 seconds slow
14/08/29,20:45:00	14/08/29,20:44:57 (ADCP 3 seconds slow
14/09/04,13:07:00	14/09/04,13:06:56 (ADCP 4 seconds slow
14/09/05,07:31:00	14/09/05,07:30:56 (ADCP 4 seconds slow

Table 1: *LADCP clock synchronisation and drift information.*

LADCP Operations

The LADCP unit did not present any problems during the cruise. The battery installed at the beginning of the cruise did not require replacement.

Vessel-Mounted ADCP Measurements

The vessel mounted ADCP was deployed using the S_300B4 configuration script designed by Pierre Jarracrd (4 metre bin size, standard range parameters, bottom tracking mode on). The same configuration was used for the duration of the cruise. The precise configuration can be determined from examination of the deployment script (below). Bottom tracking pings were sent during complete cruise. Sending bottom tracking pings in deep water is ineffective and slightly reduces the amount of good data water column data collected, but this approach avoids the situation where nobody remembers to turn on bottom tracking when the ship enters shallow water. During Fram Strait cruises we are principally interested in vessel mounted ADCP data collected in shallow water.

```
BEGIN RDI CONFIGURATION FILE (L300B4.CFG)

COMMUNICATIONS
{
ADCP         ( ON   COM2 38400 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
ENSOUT       ( OFF  COM4 9600 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
NAV          ( ON   COM1 9600 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
REFOUT       ( OFF  COM4 4800 N 8 2 ) [ Port Baud Parity Databits Stopbits ]
EXTERNAL     ( ON   COM3 9600 N 8 1 ) [ Port Baud Parity Databits Stopbits ]
}

ENSEMBLE OUT
{
ENS CHOICE   ( N N N N N N N N )  [ Vel Corr Int %Gd Status Leader BTrack Nav ]
ENS OPTIONS  (BOTTOM   1   8   1   8 )  [ Ref First Last Start End ]
}

ADCP HARDWARE
{
Firmware       ( 5.46 )
Angle          (      30 )
Frequency      (     150 )
System         (    BEAM )
Mode           (       4 )
Orientation    (    DOWN )
Pattern        ( CONCAVE )
}

DIRECT COMMANDS
{
WS400
WF200
BX4000
WN064
WD111100000
WP00001
BP001
WM4
TP000010
BM4
TE00000050
EZ0000001
EP0
ER0
EH0
WB2
}

RECORDING
{
Deployment ( OAER )
Drive 1    (   C  )
Drive 2    (   C  )
ADCP       ( YES )
Average    ( YES )
Navigation ( YES )
}
```

```
CALIBRATION
{
ADCP depth                 (    6.00 m      )
Heading / Magnetic offset  (   0.00      0.00 deg )
Transducer misalignment    (    0.00 deg    )
Intensity scale            (    0.43 dB/cts )
Absorption                 (   0.039 dB/m   )
Salinity                   (    35.0 ppt    )
Speed of sound correction  (   NO   1500.0  )
Pitch & roll compensation  (     YES        )
Tilt Misalignment          (    0.00 deg    )
Pitch_Offset               (    0.000 deg    )
Roll_Offset                (    0.000 deg    )
Top discharge estimate     (    CONSTANT    )
Bottom discharge estimate  (    CONSTANT    )
Power curve exponent       (      0.1667   )
}

PROCESSING
{
Average every ( 300.00 s )
Depth sounder (  NO )
Refout_info (   1   8  30.00  1.000 0      1) [bins:1st last, limit, weight, format, delaysec]
External_formats  ( N N Y N )  [ HDT HDG RDID RDIE ]
External_decode   ( Y Y Y  N ) [ heading pitch roll temp ]
}

GRAPHICS
{
Units        ( SI )
Velocity Reference (    NONE    )
East_Velocity      ( -100.0  100.0  cm/s )
North_Velocity     ( -100.0  100.0  cm/s )
Vert_Velocity      ( -100.0  100.0  cm/s )
Error_Velocity     ( -100.0  100.0  cm/s )
Depth              (      1     61   bin )
Intensity          (      0    200     dB)
Discharge          (  -1000   1000  m3/s )
East_Track         ( -107681 1191414     m )
North_Track        ( -300000 1357285     m )
Ship track         (  5 bin  100.0  cm/s )
Proj_Velocity      ( -100.0  100.0  cm/s )
Proj_Angle         (    0.0  deg from N )
Bad_Below_Bottom   (   NO  )
Line1              (                                                  )
Line2              (                                                  )
}

HISTORY
{
SOFTWARE       ( BB-TRANSECT )
Version        ( 2.72 )
}

END RDI CONFIGURATION FILE
```

Remote Access Water Samplers

Recovery & Sampling

Three remote access water samplers were recovered during the FS2014, one from F17 and two from F13. Serial number MLl12239-02 was not deployed from 2012-2013 so was not recovered. MLl12239-02 was held in storage at NPI in Tromsø.

- Serial number MLl12239-01 was deployed at 120 m depth on mooring F17. Microcat serial number 3995 was attached to MLl12239-01

- Serial number MLl12239-02 was deployed at 60 m depth on Mooring F17. Seacat serial number 7253 was attached to MLl12239-02. This sampler did not perform well during the deployment and many bags contained no (or only very little) sample fluid even though no problem was apparent with the bag or the connecting tubing.

- Serial number ML12852-02 was deployed at 68 m depth on mooring F13. Seacat serial number 7212 was attached to ML12852-02.

Samples for Salinity, $\delta^{18}O$, dissolved nutrients, CDOM and total alkalinity were collected from all three samplers. All bags contained 0.07 g of HgCl2 dissolved in 1 ml of filtered low nutrient seawater (salinity ~35) provided by OSIL.

Bags were removed from samplers in the Heated CTD tent. Bag taps were closed before bags were removed from the samplers. Immediately after removal, bags were labelled, subsampled and then connected to a salinometer for laboratory salinity determination

Sample numbers and bag weights were recorded on paper log sheets.

Preparation and Deployment

No remote access water samplers were deployed during FS2014 due to problems with the sample bags supplied by McLane. During the cruise the bags were tested and most found to leak from around the tap at the mouth of the bag. Samples stores in leaking bags would not be suitable for analysis.

After more than 4 years of continuous deployment the water samplers need to be serviced before redeployment. The gear pumps are showing signs or corrosion and maybe not be reliable.

Mooring Operations

Six moorings were recovered, and six new moorings were redeployed. The configuration of the recovered moorings is listed in Table 2 and the configuration of the deployed moorings is listed in Table 3. The recovered moorings are illustrated in Figures 8 to 13 and deployed moorings are illustrated in Figures 14 to 19**.**

Performance of moored instruments

SBE37 / SBE16: All SBE37-MicroCATs and SBE16-SeaCATs had performed very well throughout the deployment 2013-2014 with zero sensor or battery failures.

ADCPs: The upward looking ADCP (SN 16831) at 52 m on F13 had performed for only one month, likely due to battery failure. All other ADCPs had functioned well throughout the whole year.

RCMs: RCM8 (SN 10069) at 2459 m on F11 stopped measuring current speed mid November 2013. All other RCMs had worked well with respect to velocity and direction during the whole deployment year. All T sensors delivered good data, however with slightly worse accuracy than the SBE37. The P sensors on most RCMs however deliver very coarse resolution data: P data on RCM with SN 1049 was acceptable, all others basically show a very coarse resolution of 2, 5 db, 10 db (delta function). Therefore it is recommended to not use the P sensor data, but that of the SBE37 which is usually 3 m above it.

IPSs: Two IPSs with SN 51063 and SN 51064 malfunctioned for unknown reasons: SN 51063 on F12 did work for one month but then stopped (possibly battery failure). SN 51064 on F14 had not worked at all for any time of the deployment. This latter IPS had a new type of memory card, and when it was changed to a different one and when a new battery was inserted during FS2014 this IPS did work again during a short test, however, it was decided to not redeploy it. Instead both IPS will be send back to the company for inspection.

IceCAT: The newly installed IceCAT (SBE37-MicroCAT + Icebox with conductive modem) on F17 to obtain data higher in the water column had performed very well for 9 months of the deployment year. On June 3rd, 2014 the MicroCAT and float were ripped off at the weak link (as supposed to when the strain from ice drag becomes too large). All the data up to that date was stored in the IceBox which was mounted on the RAS water sampler at 55 m depth. This has proven that the IceCAT set up works very well and that it is possible to obtain temperature and salinity data closer to the surface (in this case it was at ~22 m depth) than with the ordinary mooring set up where the uppermost instrument is usually at 55 m depth. It should be kept in mind that dependent on the settings of SBE37-MicroCAT and Icebox the samples obtained with the Icebox are one-hour averages and we do not retrieve each sample of the SBE37-MicroCAT which sampled every 15 minutes). For the new deployment year with IceCATs on F17 and F13b we set both the SBE37-MicroCAT to sample every 30 minutes and have the Icebox inquire for data every 30 minutes with a 5 to15 minute delay with respect to the SBE37-MicroCAT.

DL7 CT-string: Unfortunately the DL7 string was lost. The kevlar was broken about 20-40 above the release. This was mostly likely due to collision with an ice berg keel.

Mooring	Position	Depth (m)	Date and time (UTC)	Instrument	Serial #	Instrument depth (m)
F11-15	N 78° 48.4100', W 002° 58.0500'	2470	Deployed: 01 September 2013 01:15 Recovered: 29 August 2014 10:25	IPS	51062	54
				SBE37	7054	56
				ADCP	17461	60
				SBE37	3996	299
				RCM9	1049	303
				SBE37	7061	1553
				RCM11	538	1556
				SBE37	8226	2456
				RCM8	**10069**	**2459**
				AR861	499	2463
F12-15	N 78° 47.6720' W 003° 57.8600'	1881 (1873)	Deployed: 10 September 2013 21:36 Recovered: 28 August 2014 16:38	**IPS**	**51063**	**81 (124)**
				SBE37	7055	83 (126)
				ADCP	17462	88 (130)
				SBE37	3994	354 (353)
				RCM9	836	356 (1517)
				SBE37	10295	1562 (1556)
				RCM11	556	1565 (1559)
				SBE37	8227	1867 (1859)
				RCM11	117	1870 (1862)
				AR861	500	1874 (1866)
F13-15	N 78° 50.0378', W 004° 59.5912'	1012	Deployed: 08 September 2013 15:21 Recovered: 30 August 2014 16:15	IPS	1047	47
				SBE37	7059	49
				ADCP	**16831**	**53**
				SBE16	7212	68
				RAS	12852-02	68
				AURAL	TBC	76
				SBE16	7339	147
				SBE37	7060	247
				RCM9	1326	250
				SBE37	10294	1000
				RCM11	345	1003
				AR861	743	1008
F14-15	N 78° 49.0115', W 006° 31.0877'	266	Deployed: 07 September 2013 15:26 Recovered: 30 August 2014	**IPS**	**51064**	**58**
				SBE37	7058	62
				ADCP	16876	66
				SBE37	7057	257
				RCM9	1325	260
				AR861	568	264
F17-10	N 78° 50.6103', W 008° 08.4930'	225	Deployed: 06 September 2013 21:28 Recovered: 31 August 2014 06:18	**SBE37-IM**	**10793**	**25**
				SBE16	7253	57
				ICEBOX	N/A	57
				RAS	12239-02	58
				ADCP	7636	109
				RAS	12239-01	113
				SBE37	3995	113
				AR661	501	222
F18-9	N 78° 48.3092', 008° 04.6912'	217	Deployed: 07 September 2013 00:31 Recovered: 31 August 2014 08:28	**DL7 (LOST)**	**1632**	**57-107**
				AR861	553	217

Table 1: *Moorings recovered during FS2014. Red = Lost Instrument, Green = Instrument lost, but data stored in logger, Blue = Malfunctioning Instrument . Depths of instruments on F12 are corrected relative to last year's table according the pressures measured by the SBE37-MicroCATS.*

Mooring	Position	Depth (m)	Date and time (LOCAL)	Instrument	Serial #	Instrument depth (m)
F11-16	N 78° 49.179, W 003° 02.685' **Check all time/date from logbook**	2447	Deployed: 09 September 2014 14:23 **Check all time/ date from logbook**	IPS SBE37 ADCP SBE37 RCM9 SBE37 RCM11 SBE37 RCM8 AR861	51062 3490 17461 4702 1324 3552 494 8821 10071 287	51 53 57 274 280 1530 1533 2433 2436 2438
F12-16	N 78°49.158' W 004° 01.423'	1832	Deployed: 08 September 2014 14:02	IPS SBE37 ADCP SBE37 RCM9 SBE37 RCM11 SBE37 RCM11 AR861	51063 3489 17462 4837 884 3554 235 8822 228 182	55 57 61 274 277 1477 1480 1820 1823 1825
F13-16	N 78° 50.133', W 005° 00.241'	1015	Deployed: 07 September 2014 15:37	IPS SBE37 ADCP RCM9 AURAL SBE37 SBE37 RCM9 SBE37 RCM11 AR861	1047 7056 16831 1175 N/A 12232 3993 1327 3551 561 053	51 53 58 60 77 147 247 250 1000 1003 1005
F13B-1	N 78° 50.167', W 005° 31.040'	517	Deployed: 06 September 2014 19:28	SBE37-IM ICEBOX SBE37 SBE37 ADCP SBE37 AR661	11435 N/A 12234 12233 707 10295 291	27 54 55 104 106 206 510
F14-16	N 78° 48.859', W 006° 30.058'	271	Deployed: 06 September 2014 12:59	IPS SBE37 ADCP SBE37 RCM9 AR861	51064 3492 16876 3992 1046 409	58 62 66 257 260 264
F17-11	N 78° 50.381', W 008° 07.530'	225	Deployed: 05 September 2014 21:35	SBE37-IM SBE16 ICEBOX SBE37 ADCP SBE16 SBE37 AR661	11434 6693 N/A 2962 7636 6694 7062 110	25 53 54 80 105 109 213 218

Table 2: Moorings deployed during FS2014. F18 was not deployed since we did not have a second DL7 string with us (since it was borrowed to AWI this year), therefore two extra SBE37 Microcats were added to F17 to obtain larger coverage in the vertical as we had on F18. F13B is a new mooring with the purpose of obtaining salinity data closer to the surface with an IceCAT and larger vertical resolution in the upper 200 m of the water column in the EGC.

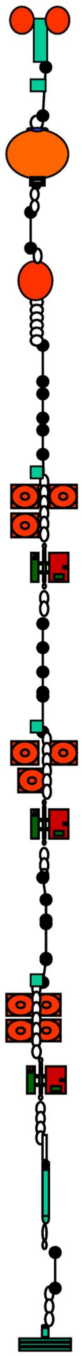
Summary of deployed moorings

	Time (UTC)	Date (UTC)	Latitude	Longitude	Drift (SOG)	Drift (COG)	Echo (m)	Sound velocity
F17	19:31:48	05 Sep 14	78° 50.387’ N	008° 07.520’ W	0.6 kts	181°	225	1450.7
F14	10:56:27	06 Sep 14	78° 48.861’ N	006° 30.087’ W	0.5 kts	175°	270	1449.0
F13b	17:25:00	06 Sep 14	78° 50.169’ N	005° 31.049’ W	0.3 kts	85°	517	1449.0
F13	13:53:50	07 Sep 14	78° 50.134’ N	005° 00.236’ W	0.4 kts	39°	1016	1458.7
F12	11:59:05	08 Sep 14	78° 49.154’ N	004° 01.435’ W	0.7 kts	222°	1832	1450.7
F11	12:23	09 Sep 14	78° 49.179’ N	003° 02.685’ W	0.2 kts	181°	2447	1450.7

Rigg F11-15 78 48,41N

Satt ut 1 SEP 2013 kl 01:13 002 58,05W

Tatt opp AUG kl



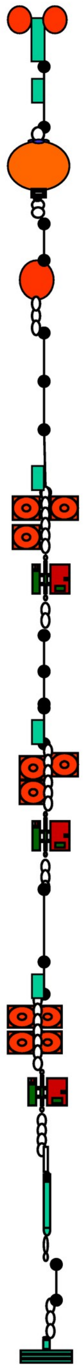
			Dyp:	Fra bunn:	Ut:
IPS	SNR. 51062		54	2416	23:43
SBE37	SNR. 7054		56	2414	23:43
5 m Kevlar					
ADCP300	SNR: 17461		60	2410	23:43
1 m Kjetting galvanisert					
10 m Kevlar					
Stålkule 37 McLane			72	2398	
1 m Kjetting galvanisert					
100 m Kevlar					
50 m Kevlar					
20 m Kevlar					
50 m Kevlar					
5 m Kevlar					
SBE37	SNR. 3996		299	2171	22:54
3 Glasskuler					
2 m Kjetting galvanisert					
RCM9	SNR.1049		303	2167	22:54
0,5 m Kjetting galv					
200 m Kevlar K					
500 m Kevlar K					
500 m Kevlar					
40 + 10 m Kevlar					
SBE37	SNR. 7061		1553	917	22:18
3 Glasskuler					
2 m Kjetting galvanisert					
RCM11	SNR.538		1556	914	22:18
0,5 m Kjetting galv					
500 m Kevlar K					
200 m Kevlar					
200 m Kevlar					
SBE37	SNR. 8226		2456	14	21:48
4 Glasskuler					
2 m Kjetting galvanisert					
RCM8	SNR.10069		2459	11	21:48
0,5 m Kjetting rustfri					
Svivel					
AR861	SNR. 499	Pinger på: Pinger av: Release: Release m/ping:			
5 m Kevlar					
2 m Kjetting galvanisert					
ANKER 1190/(960) kg			2470	0	

Figure 8: *Recovered mooring F11 15*

Rigg F12-15 78 47,672N

Settes ut 10 SEP 2013 kl 13:20 003 57,860W

Tatt opp AUG 20 kl



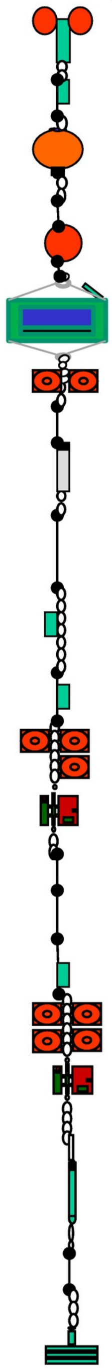
			Dyp:	Fra bunn:	Ut:
IPS	SNR. 51063		124	1749	11:26
SBE37	SNR.7055		126	1747	11:26
5 m Kevlar					
ADCP300	SNR: 17462		130	1743	11:26
0,5m Kjetting galvanisert					
10 m Kevlar					
Stålkule 37			142	1731	
1 m Kjetting galvanisert					
10 m Kevlar					
200 m Kevlar					
SBE37	SNR.3994		353	1520	11:22
3 Glasskuler					
2 m Kjetting galvanisert					
RCM9	SNR. 836???		356	1517	11:22
0,5 m Kjetting galv					
500 m Kevlar					
500 m Kevlar					
200 m Kevlar					
SBE37	SNR.10295		1556	317	11:03
3 Glasskuler					
2 m Kjetting galvanisert					
RCM11	SNR.556		1559	314	11:03
0,5 m Kjetting galv					
200 m Kevlar					
100 m Kevlar					
SBE37	SNR. 8227		1859	14	10:54
4 Glasskuler					
2 m Kjetting galvanisert					
RCM11	SNR.117		1862	11	10:54
0,5 m Kjetting rustfri					
Svivel					
AR861	SNR. 500	Pinger på: Pinger av: Release Release m/ping:			
5 m Kevlar					
2 m Kjetting galvanisert					
ANKER 1170/(940) kg			1873 (1833)	0	

Figure 9. *Recovered mooring F12-15.*

Rigg F13-15 78 50.038N

Settes ut 8 SEP 2013, kl 17:20 004 59.591W

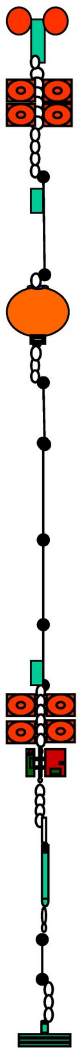
Tatt opp AUG 201 kl :00



			Dyp:	Fra bunn:	Ned i vann:
IPS4	SNR. 1047		47	968	15:14
SBE37	SNR: 7059		49	966	15:14
5 m Kevlar					
ADCP300	SNR: 16831		53	962	15:14
0,5 m Kjetting galv					
10 m Kevlar					
Stålkule 37			65	950	
2 m Kevlar					
SBE16	SNR. 7212		68	947	15:00
Vannhenter					
1,5 m Kjetting galv.					
2 Glasskuler					
5 m Kevlar					
Hvallydopptaker			76	939	15:00
0,5 m Kjetting galv.					
50 + 20 m Kevlar					
SBE16	SNR. 7339		147	868	14:40
1 m Kjetting galv.					
100 m Kevlar					
SBE37	SNR.7060		247	768	14:33
3 Glasskuler					
2 m Kjetting galv.					
RCM9	SNR.1326		250	765	14:33
0,5 m Kjetting galv					
500 m Kevlar K					
100 + 50 m Kevlar					
50 +10 + 40 m Kevlar					
SBE37	SNR.10294		1000	15	14:13
4 Glasskuler					
2 m Kjetting galv.					
RCM11	SNR. 345		1003	12	14:13
0,5 m Kjetting rustfri					
Svivel					
AR861	SNR. 743	Ping på: Ping av: Release: Release m/ping:			
5 m Kevlar					
2 m Kjetting galvanisert					
ANKER	1130/(900) kg		1015	0	

Figure 10: *Recovered mooring F13-15*

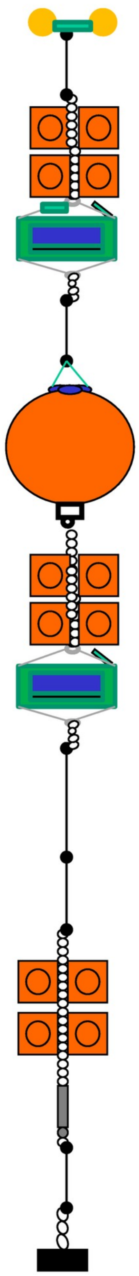
Rigg F14-15 — Satt ut 7 SEP 2013 , kl 15:27 — 78 49.012N 006 31,087W



			Dyp:	Fra bunn:	Ned i vann:
IPS	SNR. 51064		58	213	15:22
4 Glasskuler					
2 m Kjetting galv.					
SBE37	SNR: 7058		62	209	15:22
5 m Kevlar					
ADCP 300	SNR: 16876		66	205	15:20
1 m Kjetting Galv.					
0,5 m Kjetting Galv.					
40 m Kevlar					
100 m Kevlar					
50 m Kevlar					
SBE37	SNR.7057		257	14	15:14
4 Glasskuler					
2 m Kjetting Galv.					
RCM9	SNR. 1325		260	11	15:14
Svivel					
AR861	SNR. 568	Arm: Range: Ping on:			
5 m Kevlar					
2 m Kjetting					
ANKER 900/(720) kg			271	0	

***Figure 11**. Recovered mooring F14-15.*

Rigg F17-10 78 50.610 N
Satt ut 6 SEP 2013 , kl 21:28 008 08.493W



			Dyp:	Fra bunn:	Ut:
ICECat	SNR.		29	200	21:26
25 m Wire					
Weak link					
2 m Kjetting galv.					
4 Glasskuler					
SBE16	SNR.7253		57	172	21:26
ICECAT Modem					
Vannhenter			58	171	21:26
50 m Kevlar					
ADCP	SNR.7636		109	120	21:19
2 m Kjetting galv.					
4 Glasskuler					
SBE37	SNR.3993		113	116	21:19
Vannhenter			113	116	21:19
100 m Kevlar					
5 m Kevlar					
2 m Kjetting galv.					
4 GLASSKULER			219	10	21:10
AR661	SNR. 501	Ping on:			
		Release:			
		Arm:			
5 m Kevlar.					
2 m Kjetting galv.					
ANKER	780/(620)kg		229	0	

***Figure 12:**. Recovered mooring F17-10.*

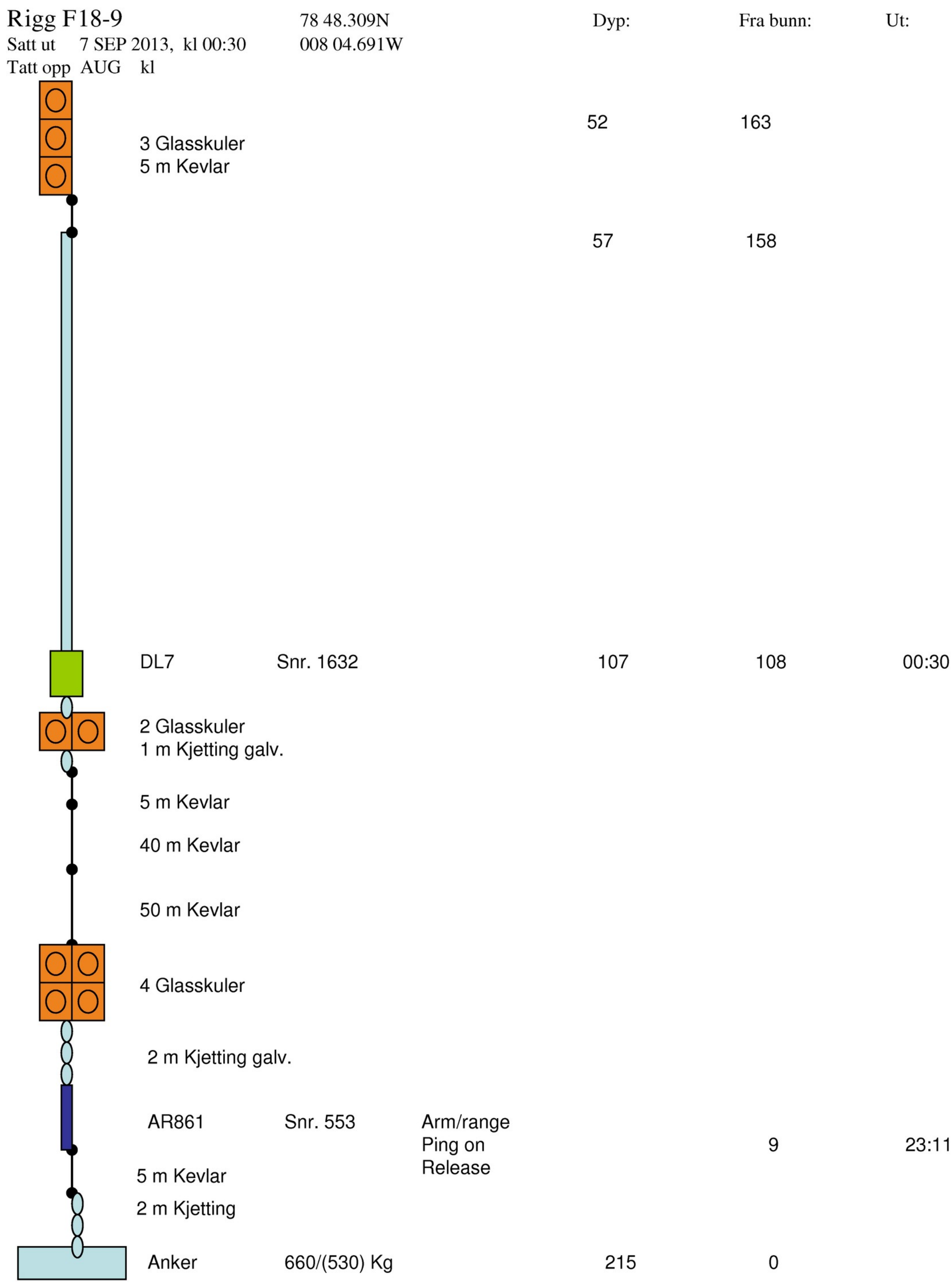
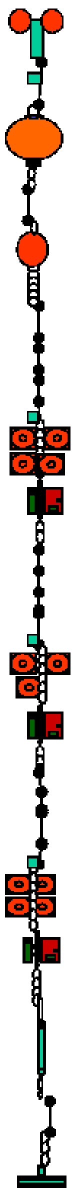


***Figure 13:**. Recovered mooring F18-9.*

Rigg F11-16 78 48,2N
Satt ut 9 SEP 2014 kl 12:30 003 04,7W
Tatt opp AUG kl



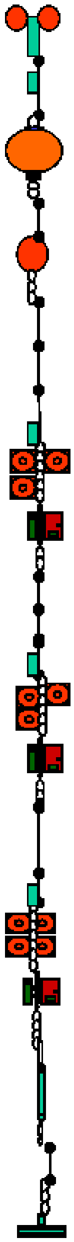
		Dyp:	Fra bunn:	Ut:
IPS	SNR. 51062	53	2395	12:00
SBE37	SNR. 3490	55	2393	12:00
5 m Kevlar				
ADCP300	SNR: 17461	59	2389	12:20
1 m Kjetting galvanisert				
10 m Kevlar				
Stålkule 37 McLane		71	2377	
1,5 m Kjetting galvanisert				
100 m Kevlar				
50 m Kevlar				
50 m Kevlar				
5 m Kevlar				
SBE37	SNR. 4702	278	2170	12:07
4 Glasskuler (gule)				
2 m Kjetting galvanisert				
RCM9	SNR.1324	282	2166	12:07
0,5 m Kjetting galv				
200 m Kevlar K				
500 m Kevlar K				
500 m Kevlar				
50 m Kevlar				
SBE37	SNR. 3552	1532	916	11:38
3 Glasskuler (2 oransje + 1 gul)				
2 m Kjetting galvanisert				
RCM11	SNR.494	1535	913	11:38
0,5 m Kjetting galv				
500 m Kevlar K				
200 m Kevlar				
200 m Kevlar				
SBE37	SNR. 8821	2435	13	11:20
4 Glasskuler (gule)				
2 m Kjetting galvanisert				
RCM8	SNR.10071	2438	10	11:20
0,5 m Kjetting rustfri				
Svivel				
AR861	SNR. 287	Finger på: Finger av: Release: Release m/ping:		
3,5 m Kevlar				
3 m Kjetting galvanisert				
ANKER 1230/(980) kg		2448	0	

Figure 14: *Deployed mooring F11-16*

Rigg F12-16 78 49,154N

Settes ut 8 SEP 2014 kl 12:00 004 01,435W

Tatt opp AUG 20 kl



			Dyp:	Fra bunn:	Ut:
IPS	SNR. 51167		53	1780	11:55
SBE37	SNR.3489		55	1778	11:55
5 m Kevlar					
ADCP300	SNR: 17462		59	1774	11:55
0,5m Kjetting galvanisert					
10 m Kevlar					
Stålkule 37	SNR. 596		69	1764	
1,5 m Kjetting galvanisert					
200 m Kevlar					
SBE37	SNR.4837		270	1563	11:42
3 Glasskuler					
2 m Kjetting galvanisert					
RCM9	SNR. 884		273	1560	11:42
0,5 m Kjetting galv					
500 m Kevlar					
500 m Kevlar					
200 m Kevlar					
SBE37	SNR.3554		1473	360	11:21
3 Glasskuler					
2 m Kjetting galvanisert					
RCM11	SNR.235		1480	353	11:21
0,5 m Kjetting galv					
200 m Kevlar					
100 m Kevlar					
40 m Kevlar					
SBE37	SNR. 8822		1820	13	11:10
4 Glasskuler					
2 m Kjetting galvanisert					
RCM11	SNR.228		1823	10	11:10
0,5 m Kjetting rustfri					
Svivel					
AR861	SNR. 182	Pinger på: Pinger av: Release Release m/ping:			
3,5 m Kevlar					
3 m Kjetting galvanisert					
ANKER 1190/(960) kg			1833	0	

Figure 15: *Deployed mooring F12-16*

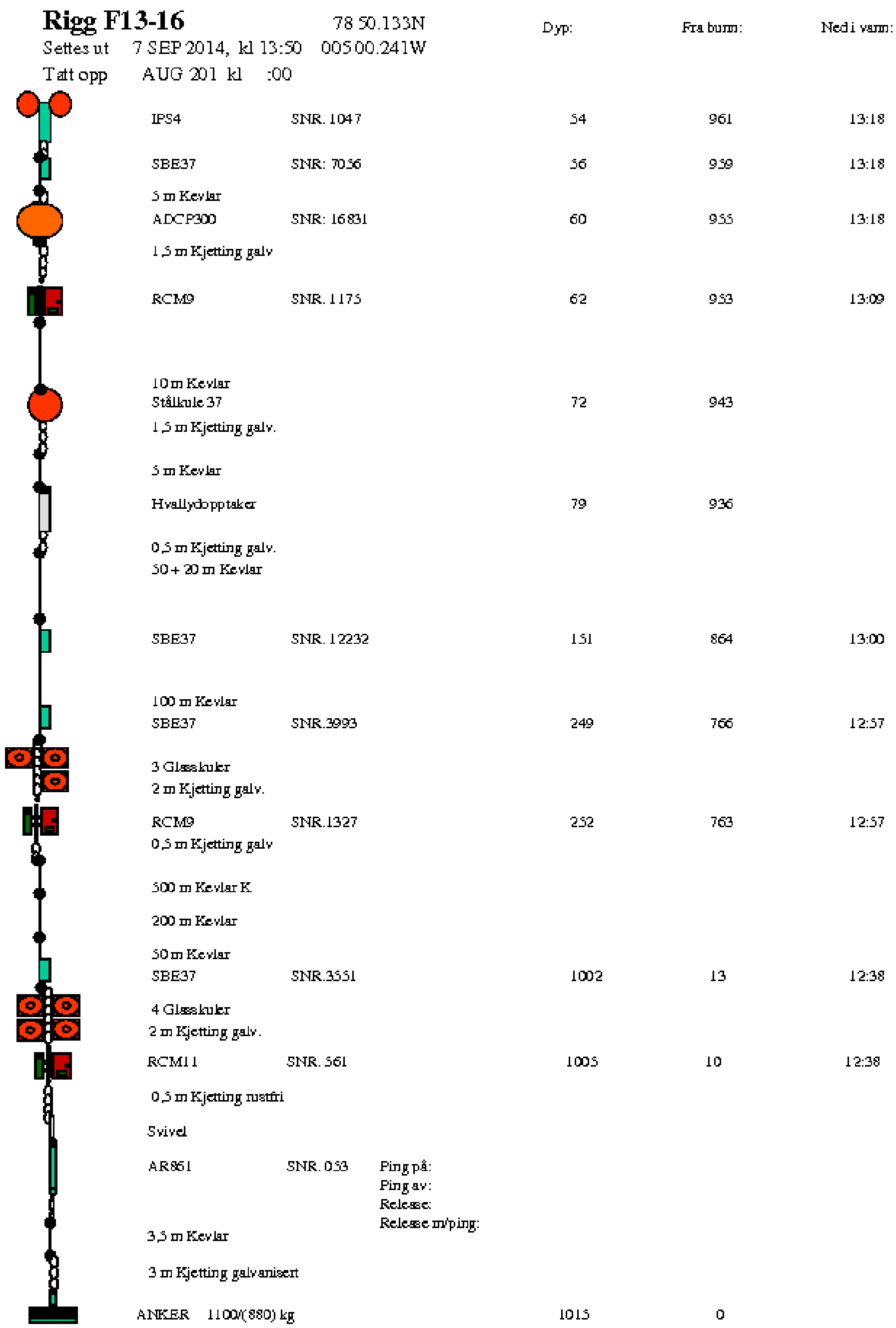
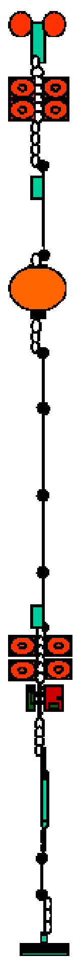


Figure 16: *Deployed mooring F13-16*

Rigg F14-16 78 48,85N
Satt ut 6 SEP 2014 , kl 11:56 006 30,09W

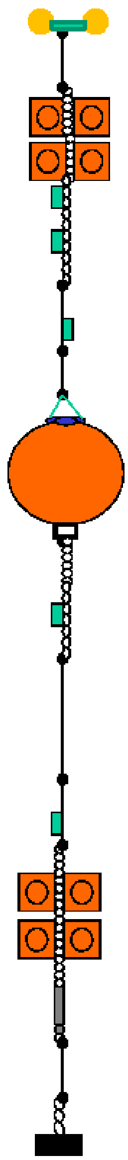


			Dyp:	Fra bunn:	Ned i vann:
IPS	SNR. 51127		58	213	11:40
4 Glasskuler					
2 m Kjetting galv.					
SBE37	SNR: 3492		62	209	11:40
5 m Kevlar					
ADCP300	SNR: 16876		66	205	11:40
1 m Kjetting Galv.					
0,5 m Kjetting Galv.					
40 m Kevlar					
100 m Kevlar					
50 m Kevlar					
SBE37	SNR.3992		258	13	11:30
4 Glasskuler					
2 m Kjetting Galv.					
RCM9	SNR. 1046		261	10	11:30
Svivel					
AR861	SNR. 409	Arm: Range: Ping on:			
3,5 m Kevlar					
2,5 m Kjetting					
ANKER 925(740) kg			271	0	

Figure 17: *Deployed mooring F14-16*

Rigg F17-11 78 50.610 N   Dyp: Fra bunn: Ut:

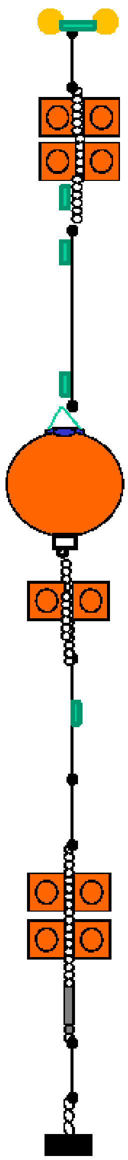
Satt ut SEP 2014 , kl 21:28   008 08.493 W



			Dyp:	Fra bunn:	Ut:
ICECat	SNR. 11434		27	198	21:26
25 m Wire Weak link					
3 m Kjetting galv. 4 Glasskuler					
ICECAT Modem					
SBE16	SNR.6693		55	170	21:26
40 m Kevlar					
SBE37	SNR.2962		95	130	21:19
10 m Kevlar					
ADCP	SNR.7636		106	119	21:19
2 m Kjetting galv.					
SBE16	SNR.6694		108	117	21:19
100 m Kevlar					
5 m Kevlar					
SBE37	SNR.7062		213	12	21:19
2 m Kjetting galv.					
4 GLASSKULER			210	10	21:10
AR661	SNR. 110	Ping on: Release:			
5 m Kevlar.					
2 m Kjetting galv.					
ANKER	770/(620)kg		225	0	

Figure 18: *Deployed mooring F17-11*

Rigg F13B-1 78 50.17 N
Satt ut 6 SEP 2014 , kl 17:30 006 31.06W



			Dyp:	Fra bunn:	Ut:
ICECat	SNR. 11435		26	490	17:25
25 m Wire Weak link					
3 m Kjetting galv. 4 Glasskuler					
ICECat modem					
SBE37	SNR. 12234		54	462	17:16
50 m Kevlar					
SBE37	SNR. 12233		102	414	17:06
ADCP	SNR 707		103	413	17:06
1 m Kjetting galv.					
2 Glasskuler					
200 m Kevlar					
SBE37	SNR. 10295		205	311	16:54
200 m Kevlar					
2 m Kjetting galv.					
4 GLASSKULER			506		16:45
AR661	SNR. 291	Range: Release:			
5 m Kevlar.					
2 m Kjetting galv.					
ANKER	770/(620)kg		516	0	

Figure 19: *Deployed mooring F13B-1*