Fram Strait September 2004 Cruise on R/V Lance

Cruise report

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Jürgen Holfort
Sebastian Gerland
Richard Hall

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1. General information

The 2004 Fram Strait cruise was performed in the period 31/8-19/9 2004 on R/V Lance. The purpose of the cruise was to maintain the NPI mooring array in the western Fram Strait and to acquire CTD and ADCP data at the standard monitoring lines, plus performing in situ sea ice work in the vicinity of the moored upward looking sonars. The main monitoring lines run across the Fram Strait along the 78° 50’ parallel, along the Fram Strait along the 0° meridian, and across the two branches of Atlantic Water where the West Spitsbergen Current splits at the Yermak Plateau.

In addition the purpose was to deploy the first NABOS mooring northeast of Svalbard. A hydrographic section should also be performed across the branch of Atlantic Water at the site of this mooring.

Scientific cruise participants:
Edmond Hansen, NPI (cruise leader, oceanography, data responsible)
Jürgen Holfort, NPI (oceanography)
Kristen Fossan, NPI (oceanography, technician)
Terje Brinck Løyning, NPI (oceanography)
Vladimir Ivanov, IARC (oceanography, NABOS representative)
Sebastian Gerland, NPI (sea ice)
Richard Hall, NPI (sea ice, IceCam)

Lance captain was Frits Johansen.

2. Cruise activity log

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity (UTC time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tue 31/8</td>
<td>0400 departure LYB to Billefjorden/Brucebyen for field equipment pickup. 1125 RADNOR water sampling outside Adventfjorden. 1130 steaming toward F11-6.</td>
</tr>
<tr>
<td>Fri 3/9</td>
<td>0800 arrival F19-1. Ice cover to dense, can not release. Sea ice work. 1200 retrying F19-1 recovery. Mooring under very large ice floe, can not release. CTD no 13-14.</td>
</tr>
<tr>
<td>Date</td>
<td>Activity</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Sun 5/9</td>
<td>Bad weather, not possible to work on deck, to much wind for CTDs because of fast drift of ship and ice. Waiting. 1500: Trying to do CTDs westward, but reaches the fast ice edge after one station. Can not penetrate further. CTD no 16.</td>
</tr>
<tr>
<td>Wed 8/9</td>
<td>Assembling F13-7 (deep mooring with tube and iceberg protecting cone around ULS, very time consuming). 1745 deploying F13-7 at N 78°50.700’ W 005°00.926’, depth 1028 m. CTD no 21-27.</td>
</tr>
<tr>
<td>Thu 9/9</td>
<td>1210 deploying F12-7 at N 78°49.765’ W 004°01.528’, depth 1855 m. Assembling F11-7. Sea ice work. 1850 deploying F11-7 at N 78°49.917’ W 003°15.415’, depth 2378 m. CTD no 28-30.</td>
</tr>
<tr>
<td>Fri 10/9</td>
<td>CTDs toward Ny-Ålesund. CTD no 31-40.</td>
</tr>
<tr>
<td>Sun 12/9</td>
<td>2000 arrival first M4 CTD station. CTD section and depth survey. CTD no 51-54.</td>
</tr>
<tr>
<td>Mon 13/9</td>
<td>CTD no 55-58, finishing section. 1145 deploying NABOS M4 mooring at N 81°33.761’ E 030°55.391’depth 1012 m. Steaming toward Yermak plateau.</td>
</tr>
<tr>
<td>Tue 14/9</td>
<td>1000 arrival Virgohamna. Dismantling equipment and tools from mooring work while in lee, packing. 1610 starting on the Yermak plateau sections. CTD no 59-63.</td>
</tr>
<tr>
<td>Wed 15/9</td>
<td>CTD no 54-73.</td>
</tr>
<tr>
<td>Thu 16/9</td>
<td>CTD no 74-79. 2030 starting steaming toward Tromsø</td>
</tr>
<tr>
<td>Fri 17/9</td>
<td>Steaming toward Tromsø</td>
</tr>
<tr>
<td>Sat 18/9</td>
<td>Steaming toward Tromsø</td>
</tr>
<tr>
<td>Sun 19/9</td>
<td>0900 arrival Tromsø</td>
</tr>
</tbody>
</table>

Table 1. Cruise log.
3. Moorings

3.1 Recovered moorings
Mooring F11-6, F13-6, F14-6, F17-1 and F19-1 were recovered in good shape. The upper two
thirds of F12-6 were lost, while all of F18-1 was gone.

The details of the recovered moorings are summarized in Table 2. Lost instruments are
highlighted with a red font. A visual impression and overview of the setup of the recovered
moorings is given in Appendix 1, where drawings of the mooring configurations are provided.

Table 2: Recovered moorings (deployed in 2003)

<table>
<thead>
<tr>
<th>Mooring</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Water depth (m)</th>
<th>Date and time of deployment</th>
<th>Instrument type</th>
<th>Serial number</th>
<th>Instrument depth (m)</th>
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<tbody>
<tr>
<td>F11-6</td>
<td>78° 49.921 N</td>
<td>03° 16.077 W</td>
<td>2376</td>
<td>14.09.2003 15:40</td>
<td>ES300 SBE16 RCM9</td>
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<td></td>
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<td>2365</td>
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<td>F12-6</td>
<td>78° 49.770 N</td>
<td>04° 02.868 W</td>
<td>1841</td>
<td>14.09.2003 10:50</td>
<td>ES300 SBE37 RCM7</td>
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<td>RCM7 RCM11 RCM8S</td>
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<td>11625</td>
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<td>F13-6</td>
<td>78° 50.728 N</td>
<td>05° 00.994 W</td>
<td>980</td>
<td>13.09.2003 16:00</td>
<td>ES300 SBE37 RCM7</td>
<td>51</td>
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<td>F17-1</td>
<td>(FnyA) 78° 49.818 N</td>
<td>08° 59.251 W</td>
<td>238</td>
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<td>122</td>
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<td>F18-1</td>
<td>(FnyB) 78° 49.953 N</td>
<td>08° 54.146 W</td>
<td>246</td>
<td>11.09.2003 14:40</td>
<td>SBE37 SBE37</td>
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<td>SBE37 SBE37</td>
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<tr>
<td>F19-1</td>
<td>78° 49.821 N</td>
<td>12° 29.876 W</td>
<td>189</td>
<td>11.09.2003 05:00</td>
<td>SBE37 SBE37 AWI releaser</td>
<td>2967</td>
<td>Upper</td>
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<td></td>
<td></td>
<td>2942</td>
<td>Lower</td>
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<td></td>
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<td>207</td>
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</tbody>
</table>

As in the years 2002 and 2003, moorings were fully or partially lost. F12-6 was a relatively
deep mooring on 1841 meters depth, see illustration in Appendix 1. F18-1 was a test tube

1 Lost instrument
2 Joint IfM Hamburg/NPI/AWI tube mooring. The mooring is not illustrated in the appendix with mooring
drawings, but contains a microcat in the upper and lower end of the tube
with only two microcats inside, and is also illustrated in Appendix 1. On F12-6 only the releaser and lowest RCM was intact, along with the lowest flotation. The losses and approximate costs are summarized in the following list:

- 1 ES300 270,000 NOK
- 3 SBE37 150,000 NOK
- 3 RCM 300,000 NOK
- 1 Releaser 80,000 NOK
- Kevlar ropes 80,000 NOK
- Flotation 70,000 NOK

This sums up to 800,000 NOK, a substantial amount for this project. The exact reasons for the losses are impossible to point at, but iceberg collisions and/or corrosion are two likely candidates. Corrosion on stainless steel parts have increasingly become a problem, although the providers ensure that they deliver products of top quality. Heavily corroded shackles have been observed even on some of the recovered moorings. We speculate that the material contains impurities, leading to very aggressive corrosion at the location of the impurity. The issue has been raised with the local provider, and alternatives must be sought.

### 3.2 Deployed moorings

Seven new ASOF-N moorings were deployed to replace the recovered ones. F11-7 to F14-7 were deployed over the EGC and continental shelf break, using the setup that has been used since the start of VEINS in 1997. In addition a second year of observations on the shelf was initiated, by deploying F17-2, F18-2 and F19-2. F17-2 is only an ADCP measuring the currents to combine with TS measurements performed by the tube mooring F18-2 close by. F19-2 is a tube mooring with a RDCP600 below the tube. The mooring details are provided in Table 3, and graphically illustrated in Appendix 2.

In addition a NABOS mooring was deployed in the boundary current northeast of Svalbard, mooring M4. The details and drawings of this mooring are given along with the ASOF-N moorings in the tables and appendices. For further information about NABOS and the M4 mooring, consult NABOS websites and publications.

<table>
<thead>
<tr>
<th>Mooring</th>
<th>Latitude Longitude</th>
<th>Water depth (m)</th>
<th>Date and time of deployment</th>
<th>Instrument type</th>
<th>Serial number</th>
<th>Nominal instrument depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F11-7</td>
<td>78° 49.917 N 03° 15.415 W</td>
<td>2378</td>
<td>09.09.2004 18:50 UTC</td>
<td>ES300 RDCP600 SBE37 RCM9 RCM11 RCM8 AR861</td>
<td>55 28 3554 1175 117 10069 287</td>
<td>60 65 261 1465 2368 2371</td>
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<tr>
<td>F12-7</td>
<td>78° 49.765 N 04° 01.528 W</td>
<td>1855</td>
<td>09.09.2004 12:10 UTC</td>
<td>ES300 DCM12 SBE37 RCM7 RCM7 RCM11 RCM11 AR861</td>
<td>48 190 3553 12643 12464 372 377 288</td>
<td>66 66 71 75 338 1541 1845 1848</td>
</tr>
<tr>
<td></td>
<td>Latitude</td>
<td>Longitude</td>
<td>Date</td>
<td>Time</td>
<td>Instrument</td>
<td>Temperature</td>
</tr>
<tr>
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<td>----------------</td>
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<td>F13-7</td>
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<td>XT6000</td>
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</table>

4. CTD work
79 CTD stations were taken. All CTD stations are plotted in figure 1. A complete CTD station list is enclosed in appendix 3. The measurements were taken with a Seabird SBE9 CTD with an SBE11+ deck unit. The temperature and conductivity sensors came directly from calibration. There were no problems with the equipment during the cruise. One to three salinity samples were taken on each station for calibration purposes.
5. Vessel mounted ADCP
The VM ADCP was kept running throughout the cruise, with configuration files adjusted according to shallow/deep and underway/on station conditions. No processing or analysis of the data was performed during the cruise.
Appendix 1: Drawings of recovered and lost moorings

**Rigg F11-6**

Settes ut 14 SEP 2003 15:40  
78 49,921N 003 16,077W

<table>
<thead>
<tr>
<th>Name</th>
<th>SNR.</th>
<th>Depth</th>
<th>Release m/ping</th>
<th>Dyp:</th>
<th>Fra bunn:</th>
<th>Ut:</th>
</tr>
</thead>
<tbody>
<tr>
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<td>SNR.19</td>
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<td>2311</td>
<td>13:21</td>
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<td>DCM12</td>
<td>SNR.190</td>
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<td>SNR.23050</td>
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<td>Kevlar</td>
<td>SNR.</td>
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</tr>
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<td>Svivel</td>
<td>SNR.596</td>
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<td>Stålkule 37</td>
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<td>1 m Kjetting rustfri</td>
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<td>SEACAT</td>
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</tr>
<tr>
<td>3 Glasskuler</td>
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<tr>
<td>4 m Kjetting galvanisert</td>
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<td>2 m Kjetting rustfri</td>
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<td>ANKER</td>
<td>1110/(860) kg</td>
<td>2376</td>
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ES300 SNR. 52
Microcat SNR.2963
5 m Kevlar
Stålkule 37 SNR.602
2 m Kjetting rustfri
RCM7 SNR.11854
0,5 m Kjetting rustfri
40 m Kevlar
200 m Kevlar

3 Glasskuler
3 m Kjetting galvanisert
RCM7 SNR10349
0,5 m Kjetting rustfri
500 m Kevlar
500 m Kevlar
200 m Kevlar

2 Glasskuler
2 m Kjetting rustfri
RCM11 SNR. 234
0,5 m Kjetting rustfri
200 m Kevlar
100 m Kevlar

4 Glasskuler
2 m Kjetting rustfri
RCM8S SNR.11625
0,5 m Kjetting rustfri
Svivel

AR861 SNR. 182
Ping på: 04AF + 0447
Ping av: 04AF + 0448
Release: 04AF + 0455
Release m/ping: 04AF + 0456

7 m Kjetting
ANKER 1110@(960) kg 1841 0
Rigg F13-6
Satt ut 13 SEP 2003, 16:04

FS300  SNR. 51  47  977  14:04
DCM12  SNR.17  47  977  14:04
Microcat  SNR. 2962
Kevlar  5 m
Stålkule 37  SNR.Mc.lane
Svivel 2 m Kjøtting
RCM7  SNR.7718  57  965  14:04
50 m Kevlar
100 m Kevlar
10 m Kevlar
5 m Kevlar
4 Glasskuler
RCM11  SNR.235  227  795  13:38
500 m Kevlar
200 m Kevlar
10 m Kevlar
20 m Kevlar
40 m Kevlar
10 m Kevlar
4 Glasskuler
RCM8  SNR. 12733  1014  8  13:16
Svivel
AR661  SNR.30  Int Range:  9270
Release:  9279
5 m Kevlar
ANKER  1020/(900) kg  1022  0
Rigg F17-1 (FnyA)
Satt ut 11 SEP 2003, 12:21
78 49.818N Dyp: 78 49.818N
008 59.251W Fra bunn: 008 59.251W
Ned i vann: 008 59.251W

ADCP SNR.727 122 110
100 m Kevlar

10 m Kevlar

4 GLASSKULER 10 222

AR661 SNR. 110 Int Range: 6151 eller 6125
Release: 6152 eller 6126

ANKER 630/(520)kg 0
Toppen av denne riggen ble i farten montert opp ned slik at Microcat'en ble øverst og ikke slik nederst figuren viser og der den skulle ha vært.
Appendix 2: Drawings of deployed moorings

Rigg F11-7
78 49,917N
Satt ut 9 SEP 2004, 18:50
003 15,415W

Dyp: | Fra bunnt: | Ut:
--- | --- | ---
60 | 2307 | 18:40
65 | 2312 | 18:40

ES100
RCGP 600
Kevlar 5 m
SBE37
Stålkule 37

0.5 m Kjetting rustfri
40 m Kevlar
40 m Kevlar
100 m Kevlar
10 m Kevlar

3 Glasskuler
3 m Kjetting galvanisert
RCM9
SNR.1175

0.5 m Kjetting rustfri
200 m Kevlar
500 m Kevlar
500 m Kevlar

3 Glasskuler
3 m Kjetting galvanisert
RCM11
SNR.117

0.5 m Kjetting rustfri
500 m Kevlar
200 m Kevlar
200 m Kevlar

4 Glasskuler
3 m Kjetting galvanisert
RCM8
SNR.10669

0.5 m Kjetting rustfri
Svivel

AR861
SNR. 287
Ping på: 1412 + 1447
Ping av: 1412 + 1448
Release: 1412 + 1455
Release m/ping: 1412 + 1456

5 m Kevlar
2 m Kjetting galvanisert

ANKER 1110/(960) kg
2378 0
Rigg F12-7  78 49,765N  Dyp:  Fra bunn:  Ned i vann:
Satt ut  9 SEP 2004  004 01.528W

ES300  SNR. 48  66  1769  11:45
DCM12  SNR. 190
SBE37  SNR. 3553  71  1774  11:45
5 m Kevlar
Stålkule 37  SNR.605
2 m Kjetting galvanisert

RCM7  SNR.12643  75  1770  11:45
0,5 m Kjetting rustfri
40 m Kevlar
200 m Kevlar
20 m Kevlar

3 Glasskuler
3 m Kjetting galvanisert
RCM7  SNR.12464  338  1517  11:30
0,5 m Kjetting rustfri
500 m Kevlar
500 m Kevlar
200 m Kevlar

3 Glasskuler
3 m Kjetting galvanisert
RCM11  SNR. 372  1541  314  11:02
0,5 m Kjetting rustfri
200 m Kevlar
100 m Kevlar

4 Glasskuler
5 m Kevlar

RCM11  SNR. 377  1845  10  10:53
0,5 m Kjetting rustfri

Svivel
AR861  SNR. 288  Ping på:  1413 + 1447
Ping av:  1413 + 1448
Release:  1413 + 1455
5 m Kevlar
Release m/ping:  1413 + 1456

2 m Kjetting galvanisert

ANKER  1110@960) kg  1855  0

Rigg F12-7  78 49,765N  Dyp:  Fra bunn:  Ned i vann:
Satt ut  9 SEP 2004  004 01.528W

ES300  SNR. 48  66  1769  11:45
DCM12  SNR. 190
SBE37  SNR. 3553  71  1774  11:45
5 m Kevlar
Stålkule 37  SNR.605
2 m Kjetting galvanisert

RCM7  SNR.12643  75  1770  11:45
0,5 m Kjetting rustfri
40 m Kevlar
200 m Kevlar
20 m Kevlar

3 Glasskuler
3 m Kjetting galvanisert
RCM7  SNR.12464  338  1517  11:30
0,5 m Kjetting rustfri
500 m Kevlar
500 m Kevlar
200 m Kevlar

3 Glasskuler
3 m Kjetting galvanisert
RCM11  SNR. 372  1541  314  11:02
0,5 m Kjetting rustfri
200 m Kevlar
100 m Kevlar

4 Glasskuler
5 m Kevlar

RCM11  SNR. 377  1845  10  10:53
0,5 m Kjetting rustfri

Svivel
AR861  SNR. 288  Ping på:  1413 + 1447
Ping av:  1413 + 1448
Release:  1413 + 1455
5 m Kevlar
Release m/ping:  1413 + 1456

2 m Kjetting galvanisert

ANKER  1110@960) kg  1855  0
**Rigg F13-7**

Settes ut 8 SEP 2004, 16:04

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<th>Dyp:</th>
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Plastmør: 18 m

Kevlar: 5 m
Stålkule: 37
Svivel

0,5 m Kjetting rustfri
50 m Kevlar
100 m Kevlar
10 m Kevlar
5 m Kevlar

4 Glasskuler
3 m Kjetting Galv.

RCM7 | SNR. 11059 | 245 | 783 | 17:00

0,5 m Kjetting rustfri
500 m Kevlar
200 m Kevlar
50 m Kevlar
10 m Kevlar
10 m Kevlar

4 Glasskuler
3 m Kjetting Galv.

RCM11 | SNR. 384 | 1018 | 10 | 16:38

0,5 m Kjetting rustfri

Svivel

AR661 | SNR.577 | Int Range: 4A11 Release: 4A12

5 m Kevlar
2 m Kjetting galvanisert

ANKER 1020/(900) kg: 1028 0
Rigg F14-7
Satt ut 7 SEP 2004, 17:25

78 48,992N 006 26,834W

Dyp:  233  17:25
Fra bunnt:  51
Ned i vann:

ES300
ARGOS  SNR. 17
SNR. 23050  ID 041
DCM12
SNR.17

5 M Kevlar

SBE37  SNR: 2158
56  228  17:25

4 Glasskuler
3 m Kjetting Galv.

RCM9  SNR. 836
60  224  17:25

0,5 m Kjetting rustfri

10 m Kevlar

200 m Kevlar

4 Glasskuler
3 m Kjetting Galv.

RCM9  SNR. 1049
274  10  16:52

Svivel

AR661  SNR. 290  Int Range:
Release:  C343
C344

5 m Kevlar

2 m Kjetting

ANKER  640/(530) kg
284  0
### Rigg F17-2

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- **ANKER**: 630/(520)kg
- **SNR.291**: 10
- **SNR.727**: 112
- **SNR.727**: 103
- **AR661**: 3 m Kjetting galv.
- **4 GLASSKULER**: 10
- **630/(520)kg**: 0
- **215**

---

100 m Kevlar
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Satt ut 6 SEP 2004, 09:50

78 49.832N 012 30.074W

Dyp: Fra bunn: Ned i vann:

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| Svivel 1,5 m Tau |

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| 5 m Kjetting galvanisert |

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