Fram Strait with RV Lance
28.8.2005 - 17.9.2005

Cruise Report

Jürgen Holfort
Harvey Goodwin
Angelica Renner

Norwegian Polar Institut

Planned activities

The purpose of the cruise was to recover and redeploy the NPI mooring array in the western Fram Strait, and to perform the annual CTD sections. The moorings and CTD sections are part of the ASOF programme, presently funded by NPI and the EU project ASOF-N. In addition the NPI sea ice group performed sea ice work during the first cruise leg, mostly focusing on ice thickness measurements. A NABOS mooring should be recovered and redeployed north-east of Svalbard in collaboration with IARC Fairbanks. On the way back to Tromsø three French sound source moorings should be recovered. The cruise is scheduled to starts in Longyearbyen on Sunday 28/8, and end in Tromsø Saturday 17/9, a total of 21 days at sea.

Scientific participants

Jürgen Holfort, NPI, chief scientist
Kristen Fossan, NPI
Harvey Goodwin, NPI (first leg)
Angelica Renner, NPI (first leg)
Vladmir Ivanov, IARC
Alexander Smirnov, AARI

Overview

Lance left Longyearbyen August 28 around noon.. The first mooring could be recovered the day after and shortly thereafter we encountered the first ice. The ice cover was larger and denser then anticipated, this made progress slower and therefore only the main CTD section, along about 78N55, could be taken in Fram Strait. It was possible to reach all mooring positions in Fram Strait, although not always on the first attempt. Sometimes the ice situation did not allow for mooring recovery, less for dredging. Mooring losses were large and not all moorings could be redeployed. Only the ice work gained from the ice situation, as more station then planned could be done.
On the second leg the ice did not allowed to reach the mooring M4 position, although it was attempted on two days. Due to the ice also the planned CTD transect across the Atlantic Water pathways north of Svalbard could not be done. The focus of the CTD work was therefore changed to the region east of Svalbard, supplementing the CTD survey made on the previous cruise. The recovery of the three sound sources during the last two days of the cruise did not pose any difficulties. Lance arrived Tromsø Saturday, September 17.
An day by day cruise itinerary can be found in appendix 1.

Mooring work

In respect to the mooring work this cruise was very unlucky, as only three out of the eight northern moorings could be recovered (table 1 and appendix 2). Moorings F12, F13, F18 and F19 could not be recovered and moorings F18 and F19 not redeployed. In our papers F18 had the wrong position, so that in the place were we searched and tried to release the mooring nothing could be found. The error was noticed to late (8.9) to get to the right position and also the notice send to Polarstern came to late, as they had gone past that position. Polarstern searched for F19 and could not find the mooring, so it is clearly lost. Although tried on two days, the NABOS mooring could not be reached due to heavy ice. The pure instrument losses from the NPI moorings (in parenthesis approximate cost per unit in NOK) are two ES300 (270000), six RCMs (100000), four releaser (80000) , one DCM (100000), two RDCP600 (100000) and three, respective five if we include F18, Microcats (50000). This sums up to about 2 million NOK, and this number is even without including Flotation, Kevlar rope, etc..

In the newly deployed moorings (table2 and appendix 2) not every mooring from F11 to F14 could be equipped with an upward looking sonar for ice thickness measurements due to the lack of instruments. As none of the tubes was recovered and there were not enough flotation for a new tube, F18 and F19 could not be deployed this year. Therefore one of the Microcats planned for the tubes were moved onto the newly deployed F17 mooring.

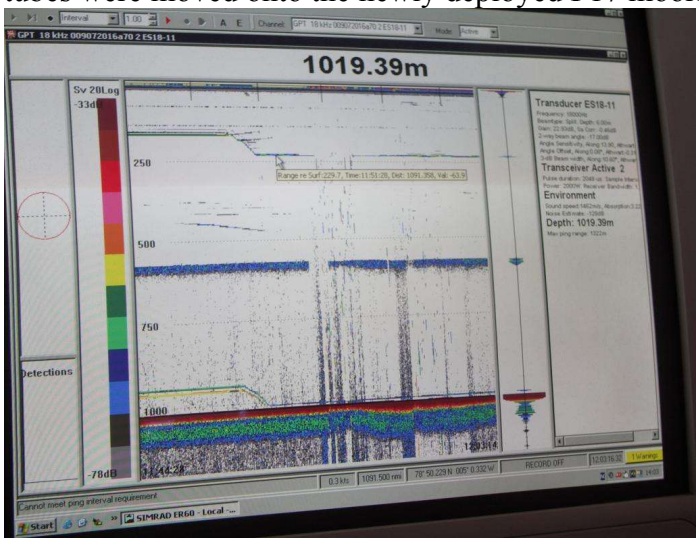


Figure 1Echo sounder screen after deployment of F13 showing the echoes of two instrument packages.

If ice conditions allowed before recovery and after deployment it was tried to locate the mooring with the echo sounder. Before recovery no mooring could be located definitively on the echo sounder, as most were probably also not there. From the experiences after deployment the following conclusion could be drawn:
-the best return signal was seen from the flotation package with the releaser just over the bottom. The main echo sounder showed no clear signal of the upper instruments but on the echo sounder for shallow regions located near the bridge sometimes also the upper instrument / flotation packages could be seen.
-at shallow depths the signal is quite clear, but the horizontal distance from the echo sounder to the mooring has to be quite small (20m or less) as else the footprint of the echo sounder does not catches the mooring.
-at intermediate depths (1000m) the signal from the lowermost flotation can also be seen at larger horizontal distances from the mooring, as due to the larger distance the foot print is also larger.
-at depths larger then 1500m no signal was seen on the echo sounder. A reason can be that the flotation package is to small compared to the large foot print at these depths, so the return signal is to week and within the noise.

The sound sources in the south, just outside of Tromsø, were recovered without problems.

Table 1Information of moorings scheduled for recovery.

Mooring	Latitude Longitude	Water depth (m)	Date and time of deployment and **recovery**	Instrument type	Serial number	Instrument depth (m)
F11-7	78° 49.917 N 03° 15.415 W	2360	09.09.04 19:40-20:50 **29.08.05** **8:20-9:35**	ES300 RDCP600 SBE16 RCM7 RCM11 RCM8	55 28 3554 1175 117 10069	60 60 65 261 1465 2368
F12-7	78° 49.765 N 04° 01.528 W	1829	09.09.04 12:35-14:10 NO RECOVERY	ES300 DCM12 SBE37 RCM7 RCM7 RCM11 RCM11	45 190 3553 12643 12464 372 377	66 66 71 75 338 1541 1845
F13-7[1]	78° 50.700 N 05° 00.926 W	980	09.09.04 18:30-19:45 NO RECOVERY	ES300 RDCP600 SBE37 RCM7 RCM11	54 LOST 29 LOST 3489 (lost) 11059 384	52 52 56 245 1018
F14-7	78° 48.992 N 06° 26.834 W	282	09.09.04 18:45-19:25 **30.08.05** **20:34-20:45**	ES300 DCM12 SBE16 RCM9 RCM9	54 17 2158 836 1049	51 51 56 60 274
F17-2	78° 49.888 N 07° 59.274 W	215	07.09.04 13:12 **31.08.05** **5:55-6:10**	ADCP	727	112
F18-2[2]	!!WRONG!! 78° 49.818 N 08° 59.251 W RIGHT: 78° 49.981 N 08° 04.646 W	225	07.09.04 12:02 NO RECOVERY	SBE37 SBE37	3490 3491	21 62
F19-2[3]	78° 49.832 N 12° 30.074 W	193	06.09.04 11:48 NO RECOVERY	SBE37 SBE37 RDCP600	3492 2445 26	22 63 69
Nabos	81° 33.761 N 30° 55.391 E	1012	13.09.04 NO RECOVERY	RCM 9 SBE37 SBE37 SBE37 SBE37 SBE37 RCM9	1149 3380 3441 3647 3524 3638 1147	62 64 105 214 442 1000 1002
Sound1	72° 10.506 N 14° 53.543 E	1021	22.06.05 **15.09.05**	S-Source	14	570
Sound2	70° 59.040 N 11° 49.321 E	2481	21.06.05 **16.09.05**	S-Source	02	548
Sound3	70° 21.509 N 17° 03.444 E	1020	21.06.05 **16.09.05**	S-Source	01	569

[1] With iceberg protection, but the upper part with the protecting tube, including the microcat, was found January 2005 on Island.
[2] Tube only
[3] Tube and RDCP600 setup

Table 2: Information of deployed moorings

Mooring	Latitude Longitude	Water depth (m)	Date and time of deployment	Instrument type	Serial number	Instrument depth (m)
F11-8	78N49.94 03W15.47	2365	06.09.05 12:30-14:00	ES300 RDCP600 SBE16 RCM7 RCM11 RCM8		60 60 65 261 1465 2368
F12-8	78N49.615 04W00.767	1853	05.09.05 17:30-21:10	DCM12 SBE37 RCM7 RCM7 RCM11 RCM11		66 71 75 338 1541 1845
F13-8	78N50.213 05W00.093	1018	04.09.05 13:10-13:46	ES300 RDCP600 SBE37 RCM7 RCM11		52 52 56 245 1018
F14-8	78N49.002 06W26.561	285	03.09.05 15:40-16:14	ES300 DCM12 SBE16 RCM9 RCM9		51 51 56 60 274
F17-8	78N49.893 07W59.237	197	03.09.05 6:49-6:54	ADCP SBE16		112

Mooring data

A first inspection of the data from the recovered instruments showed no mayor problems, all instruments seem to have worked over the whole year of deployment.

CTD

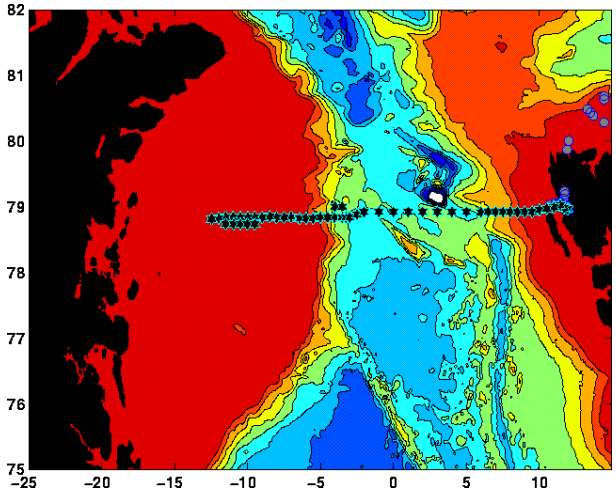
The CTD used was a Seabird 911+ model, now being in use for several years on the Fram Strait cruise and also used on the cruise before. On station the header data was filled in and the acquisition started while the CTD was still on deck. After putting the CTD into the water at about 2 to 4m depth (depending on weather and sea state).it was waited until the pump started and values looked reasonable before beginning with the downcast. The downcast was stopped when the bottom alarm went off, meaning about 6-7m above the bottom. Water samples were taken on the upcast, while the winch was stopped. CTD acquisition was stopped when the CTD was on deck again.

The pre- and post-profile pressure offset was estimated from the data and then the data of the beginning of the cast, which is unusable in temperature and conductivity because the pump is still not running, was deleted. CTD values at the time of bottle closing were determined from the upcast data, using the times in which the CTD velocity was almost zero. For the determination of the final CTD profile the upcast data was not used. The remaining downcast data was despiked using a medianfilter, a time constant mismatch correction and cell thermal mass correction applied. The data was then monotonized and averaged onto 1 dbar values.

The pressure offset of the CTD before and after the profile was about -0.3 dbar and this value was used to correct all profiles. The effect of this correction on the salinity is minimal (less then 0.0002 PSU). Salinity samples were taken on most stations but as they will be processed only later on shore no conductivity correction can be determined at this moment.

First Leg

Due to the heavy ice conditions and the priority of the mooring work just the standard 79N section and some stations north and south of it could be taken in Fram Strait. The standard section consists of station (from west to east) 15-4, 21-24, 26,25, 29-49 and 54-50. At three nominal position 2 stations were taken, one on the westward, the other on the eastward part of the transect. The three station pairs are 1 and 30; 2 and 24; and 3 and 21. The stations 16 to 20 make a short transect on the East Greenland Shelf at about 78N44 and stations 27 and 28 are located north of the main section at 79N.



The temperature difference section to 2004 show in the region of the Atlantic Water eddy like structures but no apparent warming or cooling. So the warming noticed from 2003 to 2004 did not proceeded further, but the temperature also did not fell back to 2003 levels, compared to 2003 both 2004 and 2005 show warmer Atlantic Water. On the western side we see that the water on the shelf is cooler and fresher in 2005 then in 2004, but that east of the East Greenland front the water is warmer and more saline. This could also to a certain part explain the larger amount of ice found this year west of the EGF. If the warmer rAW penetrate onto the shelf it acts, through vertical, possibly

tidal induced mixing, as an additional heat source for ice melting. This heat was absent in 2005 and therefore the ice cover was larger.

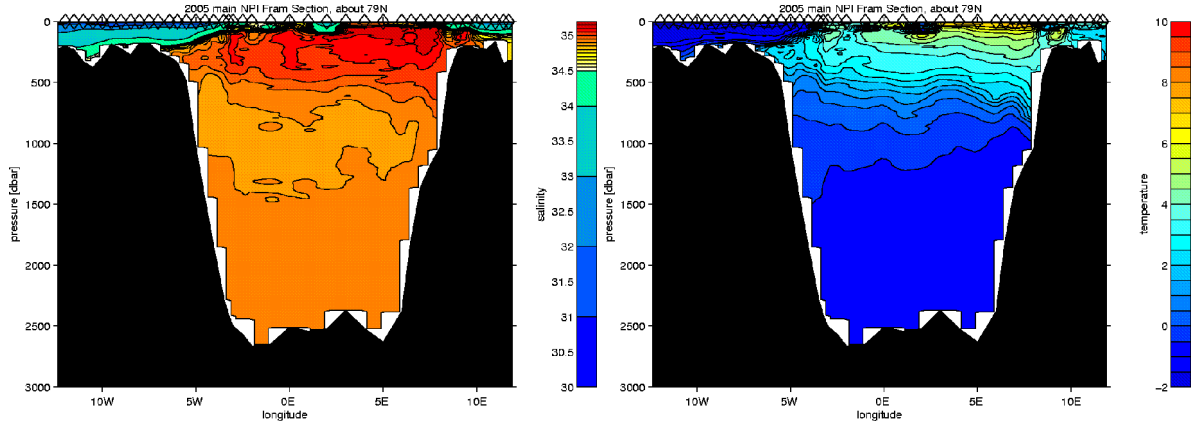


Figure 3Salinity and temperature section along about 79ºN.Markers at the top denote station positions.

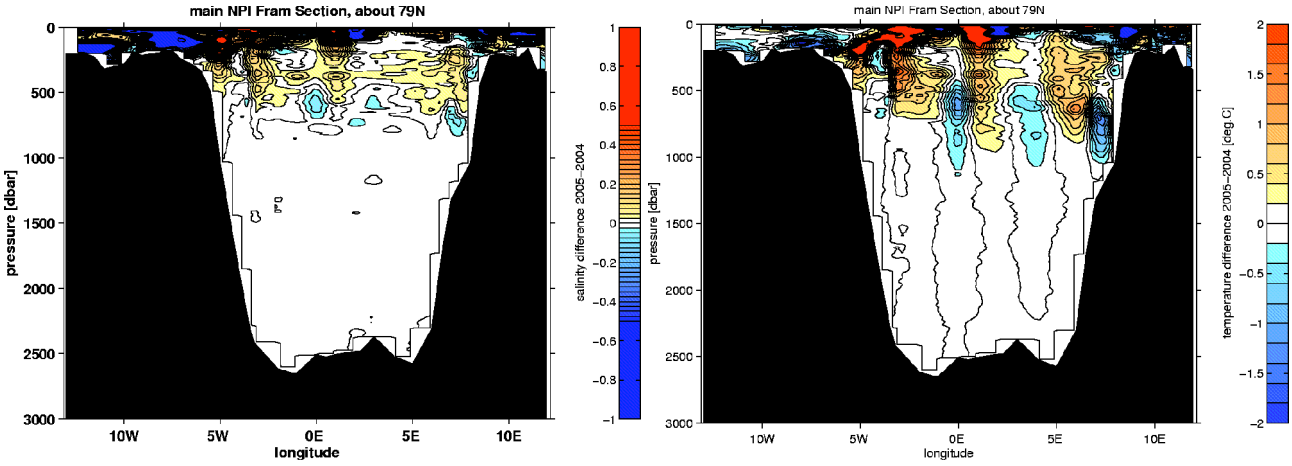


Figure 4Salinity and temperature differences along 79ºN between 2005 and 2004.

Second Leg

As after the attempts to reach the NABOS mooring there was not enough time to return to Fram Strait and carry out CTD work there, it was decided to take some CTD sections from the most northeasterly point reached towards Hopen to supplement the CTD stations taken in this region on the previous Lance cruise (chief scientist Nalan Koc).

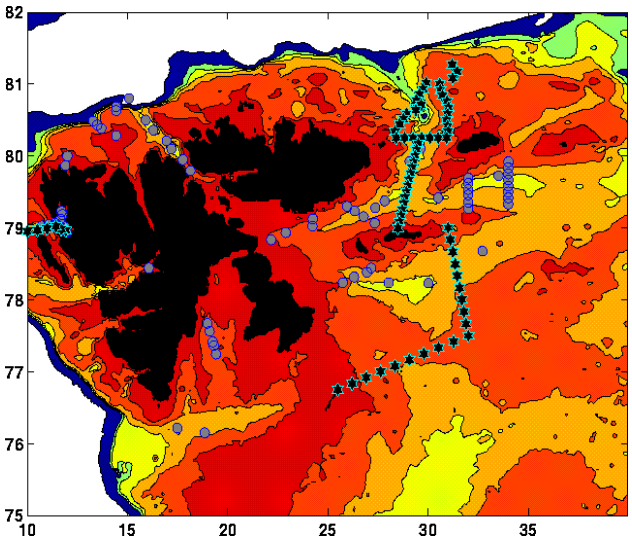


Figure 5CTD stations east of Svalbard from Framstredet cruise (hexagons) and from the previous cruise (circles).

A first conclusion from these section (see below) is that the Atlantic water found in the deeper parts east of Svalbard flows into this region from the south (east of Hopen), respective from the east in the part north of Kong Karls Land and not from the north through the passage between Nordauslandet and Kvitøya.

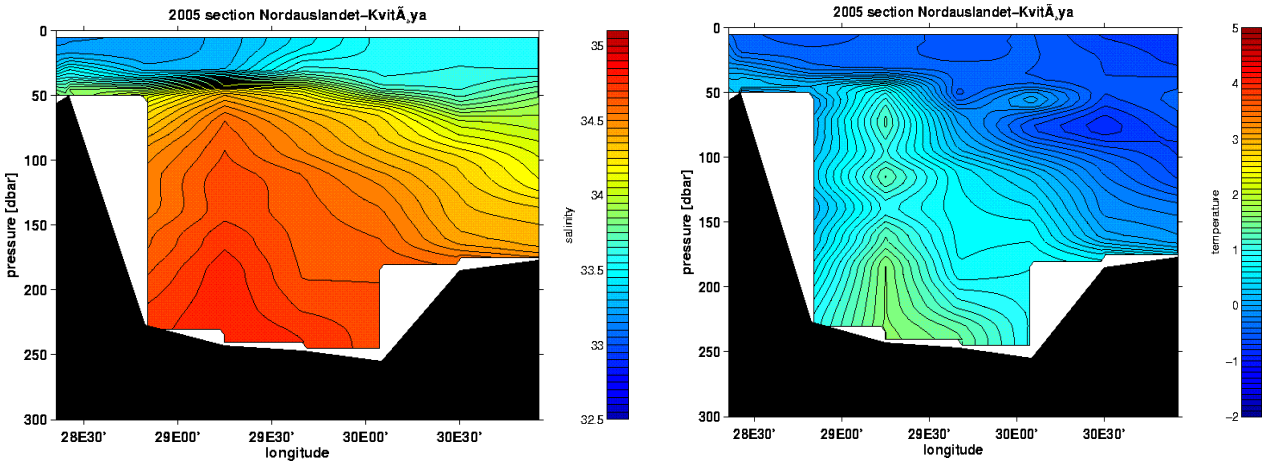


Figure 6Salinity and temperature section between Nordaustlandet and Kvitøya

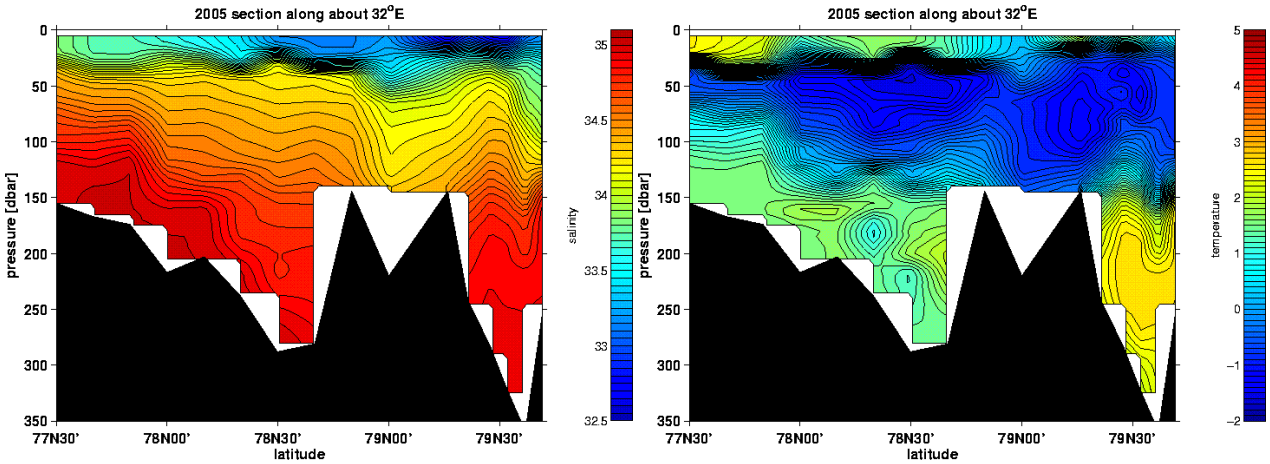


Figure 7Salinity and temperature section along about 32°E

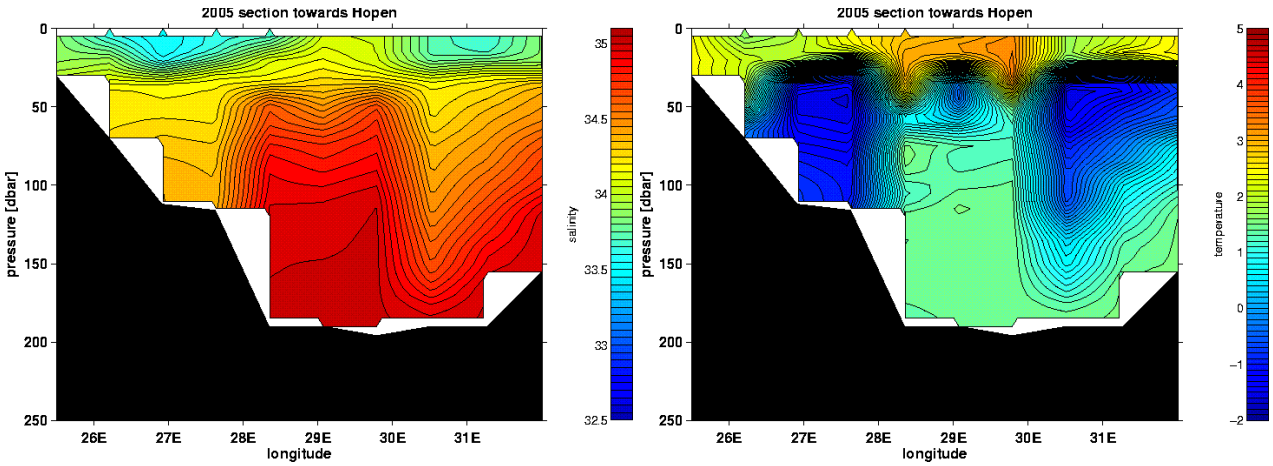


Figure 8Salinity and temperature section from the end of the 32ºE section towards Hopen (at the left).

ADCP

After having left Longyearbyen the vessel mounted ADCP was turned on. As sometimes the acquisition stopped, which was not noted immediately, for some transects no ADCP data is available. Within ice covered regions, we expect larger noise and erroneous measurements due to the often abrupt movements of the ship when hitting ice.

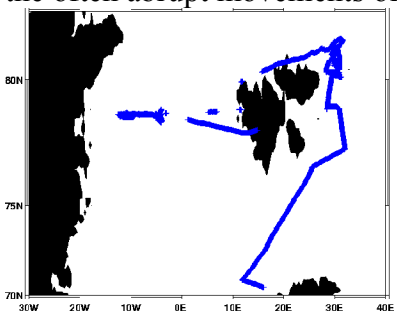


Figure 9Position of ADCP measurements

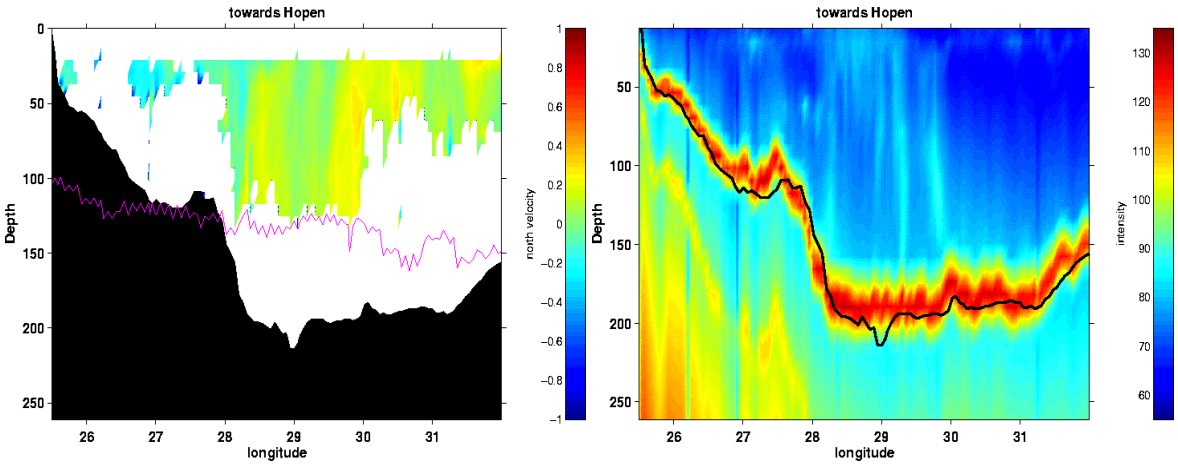


Figure 10Northward velocity and beam 1 intensity form the VMadcp on the transect towards Hopen. The Bathymetry in the velocity section and the black line in the intensities are from the GEBCO 1 minute topography.

Although the backscatter intensities of the bottom are large enough to be discernible to depths larger then 250m, the backscatter in the water column is at the most times only sufficient to calculate velocities until about 100m depth. As up till now only a very simple quality control was used to flag bad velocities, some suspicious velocities can still be seen in the sections and perhaps some good velocities were flagged out.

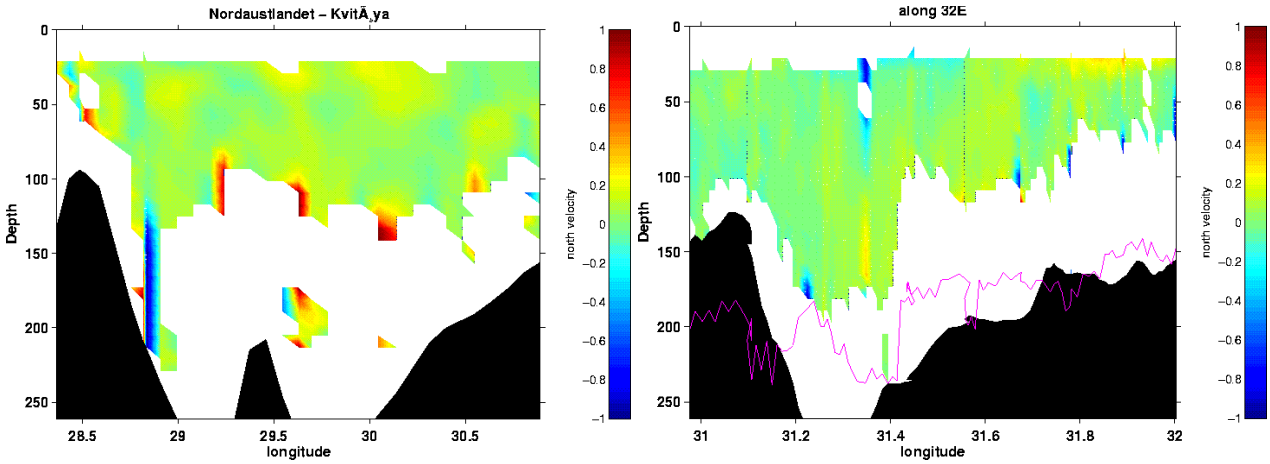


Figure 11Velocity sections from VMadcp. Northward velocity between Nordaustlandet and Kvitøya (left) and eastward velocity along approximately 32E.

Sea Ice work

Field operators: Harvey Goodwin and Angelika Renner, both NPI.
Project: Surface properties and thickness of multi-year sea ice in the Fram Strait for calibration/validation of CryoSat (PI: Sebastian Gerland, NPI)

IceCam

An IceCam is permanently installed onboard Lance. The camera is mounted on the bridge looking to the the starboard side. Images are recorded every 5 minutes together with weather station data (air temperature, wind speed and direction, relative humidity, water temperature), GPS-position, time, pitch and roll.

Figure 12IceCam observations

Ice Stations

A total of 12 stations were taken. At each station the following data were recorded:

- GPS position and time (at start and end)
- Ice thickness (using an electromagnetic device (Geonics EM31) and drillings)
- Snow thickness and physical properties
- Air and water temperature
- Water sample (except at Station FS05-L01)

Additionally ice cores (L02, L05, L09) were drilled and optical measurements (L03, L04, L07) were performed at three stations each.

Station no.	Date	Latitude (start)	Longitude (start)	Additional work
FS05-L01	29.08.05	78°40' N	04°30.3' W	
FS05-L02	30.08.05	78°47.518' N	05°01.072' W	Ice core
FS05-L03	30.08.05	78°50.722' N	07°04.591' W	Optics
FS05-L04	31.08.05	78°50.142' N	09°06.219' W	Optics
FS05-L05	31.08.05	78°50.804' N	09°46.205' W	Ice core
FS05-L06	01.09.05	78°49.627' N	12°30.861' W	
FS05-L07	01.09.05	78°47.269' N	11°47.273' W	Optics
FS05-L08	02.09.05	78°43.925' N	09°32.304' W	
FS05-L09	02.09.05	78°49.589' N	09°01.363' W	Ice core
FS05-L10	03.09.05	78°48.102' N	05°28.811' W	
FS05-L11	04.09.05	78°49.595' N	05°02.061' W	
FS05-L12	04.09.05	78°49.927' N	04°58.110' W	

Table 3 Station number, date, position and comment on additional work for all ice stations.

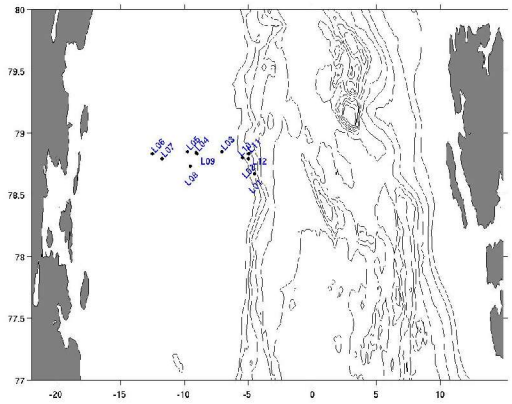


Figure 13Position of ice stations

Ice thickness measurements

Ice floes were chosen as large as possible and of average thickness to avoid heavily ridged ice. Access was either directly from Lance or by Zodiac.
Profiles were 40-110m in length. Thickness was measured using a Geonics EM31 every five meter along the profile together with snow thickness. At at least three points along each profile ice thickness drilling was performed and ice thickness and freeboard recorded.

Figure 14Ice thickness measurement with the Geonics EM31

Snow properties

At a site representative for the ice floe physical snow properties were recorded considering the following parameters:

- Snow description (grain type, average grain size, hardness, photography)
- Snow temperature (where possible)
- Snow density (where possible)
- Snow moisture with a LEAS moisture sensor (where possible)

Figure 15Snow pit

At two stations (L02 and L10) snow samples were taken for snow salinity measurements.

Water temperature and salinity

Water temperature was measured from the side of the floe during an ice station, and samples taken for salinity measurements back in Tromsø.

Air temperature

Air temperature was recorded at 1m above surface at each station.

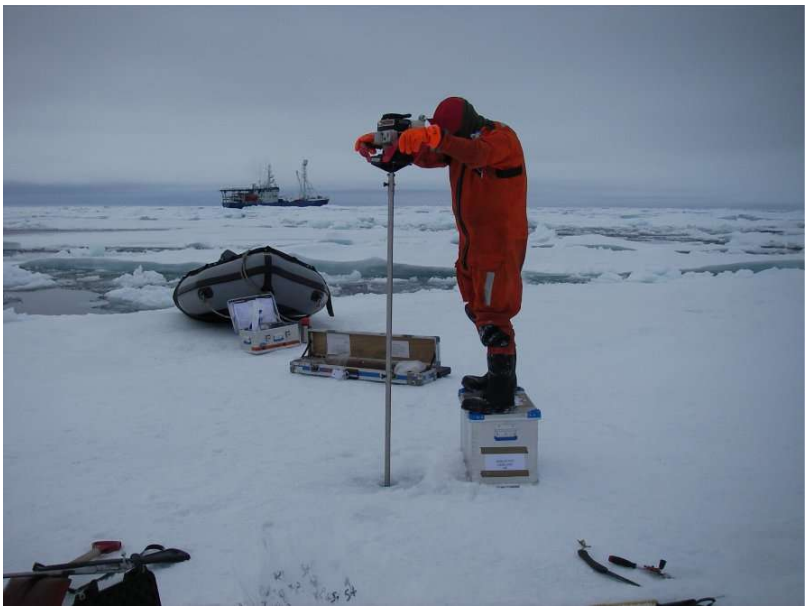


Figure 16Ice core drilling

Ice cores

A total of three ice cores were drilled. The core was photographed and its length together with a general description recorded. At approx. every 10 cm temperature was measured by drilling a hole with a hand drill in the core and inserting the temperature probe. To avoid temperature changes this was done section for section.

Figure 17Ice core section

For salinity measurements the core was cut into approx. 10cm sections, bagged and labeled and stored frozen onboard Lance for shipping to Tromsø.

Optical measurements

Figure 18Optical measurements over a melt pond

At three stations irradiance measurements were performed in order to measure albedo of different surfaces. To record changes in solar radiation due to changing cloud cover spectra were taken pointing upwards first, then downwards and upwards again. At all three stations measurements were done over snow, at stations FS05-L04 and FS05-L07 reflectance was also recorded over melt ponds. For the measurements, a TriOS Ramses VIS spectrometer was used, covering a wavelength range from 320 to 950 nm.

Bird observations

Birds were observed during the whole cruise and at the ice stations L03 and L09.

Water samples

2 x 50 liter surface water samples were taken with a bucket from the side of the ship for analysis of technetium-99 radionuclides in Tromsø within the NFR project “RADNOR”, a collaboration with the Norwegian Radiation Protection Authority (NRPA). The first sample was taken on the 30.08.2005 at 78º50’N 05º00' W, the second on the 08.09.2005 at 78º55’N 08º30’W.

date	station	gps start		gps stop		EM31 (profile length in m)	snow pit	thickness drillings (no.)	coring	spectro-metry	water sample	snow sample	bird obser-vations
		N	W	N	W								
29/08/05	FS05-L01	78°40'	04°30.3'	78°38.7'	04°32.8'	x (40)	x	x (3)					
30/08/05	FS05-L02	78°47.518'	05°01.072'	78°45.6’	05°09.9’	x (70)	x	x (3)	x		x	x	
30/08/05	FS05-L03	78°50.722'	07°04.591'	78°51.133'	07°13.899'	x (50)	x	x (3)		x	x		x
31/08/05	FS05-L04	78°50.142'	09°06.219'	78°50.708'	09°12.419'	x (50)	x	x (3)		x	x		
31/08/05	FS05-L05	78°50.804'	09°46.205'	78°49.243'	09°48.982'	x (70)	x	x (3)	x		x		
01/09/05	FS05-L06	78°49.627'	12°30.861'	78°49.112'	12°29.646'	x (70)	x	x (3)			x		
01/09/05	FS05-L07	78°47.269'	11°47.273'	78°46.949'	11°44.850'	x (60)	x	x (3)		x	x		
02/09/05	FS05-L08	78°43.925'	09°32.304'	78°43.893'	09°33.549'	x (50)	x	x (3)			x		
02/09/05	FS05-L09	78°49.589'	09°01.363'	78°49.174'	09°12.244'	x (60)	x	x (4)	x		x		x
03/09/05	FS05-L10	78°48.102'	05°28.811'	78°47.083'	05°26.253'	x (50)	x	x (4)			x	x	
04/09/05	FS05-L11	78°49.595'	05°02.061'	78°49.365'	04°59.825'	x (70)	x	x (3)			x		
04/09/05	FS05-L12	78°49.927'	04°58.110'	78°49.474'	04°56.058'	x (110)	x	x (4)			x		

Table 4Date,station number, gps positions and start and end, activities performed at station

Appendix 1: Cruise itinerary

28.8

At 12:30 we left Longyearbyen, after the ships crew went voting at the sysselsmann office and went steaming towards the position of mooring F11.

29.8

In the morning we arrived at mooring position F11. The releaser could not be heard, but responded and the mooring was recovered successfully. After the recovery we started the CTD section. Shortly after we encountered heavy ice and at 14:30 we were near, but not on, position F12 but there was to much ice for mooring recovery.

30.8

In the morning at position F13, so response from the releaser and to much ice to to release the mooring without hearing it, more so because at least the upper part is known to be missing. In the evening recovery of F14. We had to wait some hours before releasing the mooring (releaser could be located) because we had to wait for a large enough opening in the ice to pass over the mooring.

31.8

In the morning recovery of mooring F17 without problems. After reaching the position of F18 no response was got from the releaser. As there was enough open water we did send the release signal, but the mooring did not surface. We then started to search in the drift direction to search for the mooring and the hear for the releaser (as it the whole mooring could also have been dragged to such a position by an iceberg.), but were not successfully. We continued the CTD section towards F19.

1.9

After encountering heavy ice on the way, in the late morning we reached mooring position F19 and also the westernmost point of the CTD section. At the site at least 80% ice coverage and very thick ice floes (generally thicker then 4-5m, some more then 10m thick. As last years many iceberg to the north of the site (mostly grounded). But some also to the south and at almost the mooring latitude (those floating). No contact was possible with the releaser of F19. As good as possible in this ice conditions, we tried to find the mooring with the echo sounder. We saw some signals that could have been reflections from the tube, but no clear signal. As recovery was not possible in such a situation, we made no attempt to release the mooring. As we had also only 5 tube segments and 30 flotations (about 60 kg of uplift) we also could not deploy a new one. After an ice station we left for mooring position F18 along a short CTD transect along 78N44.

2.9

During the whole day very high ice cover, just a little bit better for some hours during midday. In the afternoon we reached mooring position F18 but ice cover was to large to drag for the mooring.

3.9

Reached position F17 and deployed the mooring, then headed towards F14 and deployed it in the afternoon. Starting at F14 going eastward we resumed the CTD work on the main Fram Strait section.

4.9

Very high ice in the morning, almost 100% as the small leads between floes were covered with new ice. Floes itself have and estimated 1-2m thickness. Due to this conditions there was no possibility to release or dredge for mooring F13, but the new F13 could be deployed after making a larger opening in the ice with the ship. The next hours after mooring deployment the ice cover was so high (>98%) that the ship made almost no progress, but mainly drifted south-southwestward with the ice. At 22:00 hours the wind had increased and the tide had changed and the ice became more open, so that better progress was possible.

5.9

During the early morning again heavy ice, but the situation got better and later we reached the ice edge south of F12. After some hours of steaming we reached position F12, which was ice free. F12 could not be seen on the echo sounder nor could the releaser be heard. The release signal was sent, but no mooring surfaced. Dredging for the mooring was also unsuccessful. In the evening the new F12 mooring was deployed. After this the CTD work was continued.

6.9

Around noon we met Polarstern, who had deployed their last mooring and was on her way to the Greenland coast. Three people were picked up with the Helicopter from Polarstern for a visit, while one person was visiting Lance. It was agreed that if Polarstern finds favorable ice conditions at F19 they will try to recover the mooring. During the Polarstern visit F11 was deployed. Afterwards the CTD transect towards Ny Ålesund was continued.

7.9

All day taking CTD casts on the transect towards Ny Ålesund.

8.9

The work on the CTD transect continues. Shortly before arriving Ny Ålesund, we saw a walrus on a beach on Prins Karls Forlandet. At 15:30we arrived to Ny Ålesund. Harvey and Angelica left the ship, as no ice work is planned the next leg. There was also some unloading and loading of cargo. Edmond mailed to inform us we probably had the wrong position for F18, I checked in the ship log of last year and he is right. I then send a notice to Polarstern if they could also pick up this mooring at the correct position, although they probable had passed it already. Departure from Ny Ålesund was at 24:00.

9.9

The five last CTD of the 79N section were taken and then we started to steam towards the NABOS mooring position. The route passed through Smeerenburg Fjorden, where we met Jan Mayen. After passing Nordkapp, we encountered first ice in the evening.

10.9

The morning begins with low visibility and ice cover with large open spaces. The wind is strong (8 Beaufort) but due to the ice and the wind direction (northwesterly winds) the sea is quite calm. During the morning the wind decreases. The ice conditions are large ice flows, at times quite ridged, separated by open water. The leads that are comfortably wide for Lance are mostly in east-west direction but to the north the leads are getting smaller or disappear. Therefore not much progress to the north is done. After noon we decided to make first the CTD section towards Kvitøya and then try tomorrow again to reach the mooring position.

11.9

At about 1:00 o'clock in the morning the last CTD on the section towards Kvitøya was taken and we again turned north to try to reach the mooring. There was ice almost all the way to Kvitøya, which in respect to the sea state was good, as in the morning the mean wind speed reached 27 m/s, in gusts over 30m/s. But due to the presence of ice the sea was relatively calm. In the afternoon, with still 38 nm to go to the NABOS mooring it was decided that due to the minimal possibility to reach the mooring it should not be tried to proceed further towards the mooring. At this moment the ice floes were large (often >1km) and ridged, so Lance could not break through them and the only open lead was in southerly direction. In the other directions only small pieces of open water could be distinguished. Even with an very optimistic assumption of 2 knots, it would take 19 hours to reach the position, with some waiting for a clear area over the mooring and a way back lasting at least the same amount of time, we would need more time then is still left.
After this decision a CTD transect towards Storøya was started, followed by a section towards Kvitøya.

12.9

In the morning the section towards Kvitøya was finished and the monument to Andree, Strindberg and Frænkel on Kvitøya was visited. Then a CTD section towards Kong-Karls land was done.

13.9

We continued the CTD work, first to southeasterly, then to southwesterly direction towards Hopen.

14.9

The CTD work was finished early in the morning. After Breakfast we paid a visit to the meteorological station on Hopen. At 12:00 we left for the first sound source mooring to be recovered, with a planned arrival time the 15th in the late afternoon.

15.9

After about 30 hours of steaming, the northernmost sound source mooring was reached at about 16:30 and recovered within an hour. Later in the evening a double profile 600m CTD station was done to test the calibration of another pair of temperature/conductivity sensors.

16.9

At 6:00 o'clock in the mooring the southwestern sound source mooring was reached and recovered. The last sound source mooring was reached at about 18:00 and recovered.

17.9

Arrival Tromsø at 8:00, first to refuel, then to unload. Finish of cruise.

Appendix 2: Short notes about mooring recovery and deployment.

Recovery F11, 29.8

8:20 UTC released
8:42 first pick up
8:44 ES300,RDCP, SBE in
8:54 RCM9,1175 in
9:18 RCM in
9:35 RCM,Releaser in

Recovery F14, 30.8

20:34 released
20:45 on deck

Recovery F17, 31.8

5:55 UTC released
6:07 ADCP on deck
6:10 all on bord.

Deployment F17, 3.9

6:49 UTC begin deployment 78N48.849, 7W59.165, 198m
6:54 UTC released, **Final position: 78N49.893 7W59.237, 197m**
Got some pictures of the echo sounder while putting the mooring out. Afterwards we tried to pass over the mooring position. At 50m distance no sign of the mooring on the echo sounder. A signal could be seen in a distance of 20m, but then quite strong. The upper flotation was seen better on the forward echo sounder then on the main echo sounder.
ADCP 727, 90m rope with 1 microcat just under the ADCP (3m?, as there is also some chain just below the ADCP), 4 flotations and releaser AR861 (ARM=146e, Ping arm+1447, release arm+1755, pinger off arm+1448, release with pinger arm+1456).

Deployment F14, 3.9

15:40 UTC in position
15:42 anchor weight out 78N49.008,6W26.575
15:57 first instrument pack out; 78N48.990, 6W26.408
16:06 second instrument pack out, 78N48.995, 6W26.431
16:10 last pack out
16:14 release, **Final position: 78N49.002, 6W26.561, 285m**
Afterwards passed over the mooring and saw clear signal of it on the echo sounder, as long as being quite close to the actual position.

Deployment F13, 4.9

13:10 start of deployment
13:xx first pack out 78N50.388, 5W00.138, 1024m
13:29 second pack out 78N50.304, 5W00.147, 1021m
13:46 released, **Final position: 78N50.213 5W00.093, 1018m**
Afterwards passed over the mooring and saw clear signal of it on the echo sounder. Best and the furthest away the signal from the bottom pack (due widening of the echo beam at larger distances?).

Deployment F12, 5.9

17:26 weight in water, 78N51.050, 3W57.001, 1928m
17:35 1st pack, 78N50.898, 3W57.164,1925m
17:43 2nd pack, 78N50.748, 3W57.407, 1919m
18:04 3rd pack, 78N50.364, 3W57.858, 1906m
18:23 last pack, 1894m, then dragging the mooring to the right depth
18:38 position 78N49.954, 3W59.137, 1879m
18:47 position 78N49.886, 3W59.969, 1868m
21:08 released mooring, **Final position: 78N49.615, 4W00.767, 1853m**

Deployment F11, 6.9

12:25 begin deployment
13:52 end deployment, **Final position: 78N49.94, 3W15.47, 2365m**