RV LANCE Cruise Report

18th May – 04th June 2005

Hydrography and Ice Observations in the Fram Strait

Report prepared by: Vladimir Pavlov, Harvey Goodwin, Jürgen Holfort, Kristen Fossan, Olga Pavlova, Marzena Kaczmarska and Roman Vlasenkov

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List of Participants

Cruise Leader

Vladimir Pavlov

Norsk Polarinstitutt
Tromsø, Norway
pavlov@npolar.no

Scientists:

Harvey Goodwin

Norsk Polarinstitutt
Tromsø, Norway
goodwin@npolar.no

Jürgen Holfort

Norsk Polarinstitutt
Tromsø, Norway
holfort@npolar.no

Olga Pavlova

Norsk Polarinstitutt
Tromsø, Norway
olga@npolar.no

Marzena Kaczmarska

Norsk Polarinstitutt
Tromsø, Norway
marzena.kaczmarska@npolar.no

Engineer

Kristen Fossan

Norsk Polarinstitutt
Tromsø
kfossan@npolar.no

PhD student

Roman Vlasenkov

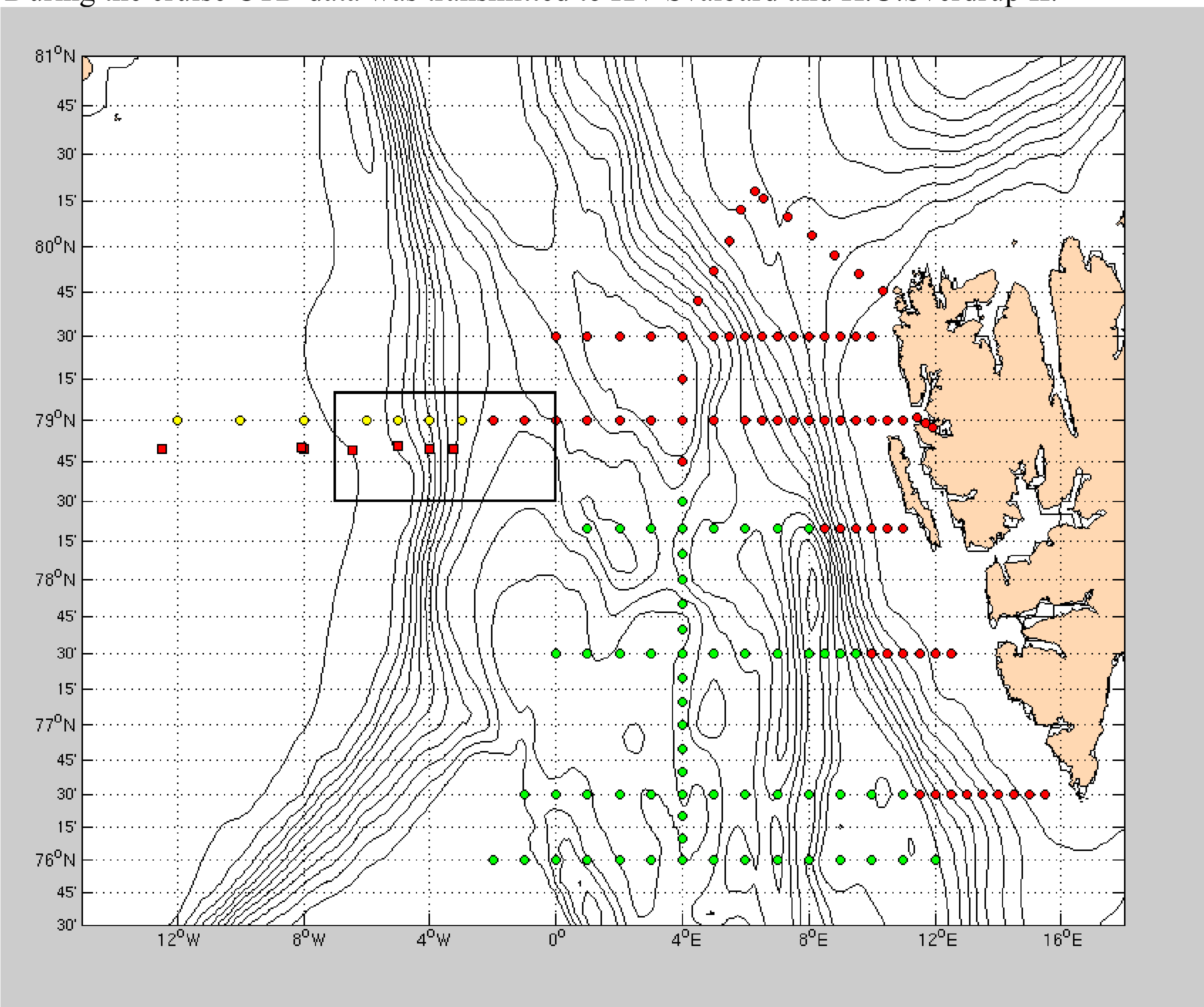
Arctic and Antarctic Research Institute
St.Petersburg, Russia
vlasenkov@list.ru

Work performed, data acquired

Our survey of the Fram Strait continues the annual NP hydrographic observation and monitoring of ice in this region.

The locations of the profiles were at the positions of the stations performed in grid survey of FRAM2005 expedition plan (see Fig.1). The Lance CTD stations were a mixture of near full depth (3500 m) and shallower depth (100m) stations.

Additional stations extending this grid were also performed (Transect 7: Sts. 51-59) as well as CTD stations near ice stations. All data were acquired using a 'Seabird 911 plus' fitted with a Seabird, pressure, temperature, conductivity cell and pump. The CTD was installed at the bottom of a CTD frame which included a carousal water sampler above it. Water samples for salinity calibration were obtained at most stations (See Table 1 for full listing). The ADCP records were obtained throughout the cruise.
During the cruise CTD data was transmitted to KV Svalbard and H.U.Sverdrup II.



Red circles:	Lance CTD stations
Green circles:	H. U. Sverdrup II CTD stations
Yellow circles:	Helicopter CTD stations from KV Svalbard
Red squares:	NPI moorings
Black rectangle:	Likely operating area of KV Svalbard, depending on sea ice conditions.

10 ice stations were visited. 6 in the MIZ near 79°N and between 0°W and 2°W, and 4 stations in the MIZ northwest of Svalbard at approximately 80°N. The main aim of the ice

station work was to obtain data regarding ice thickness from representative large ice floes in the Fram Strait. In addition temperature and salinity samples were taken along with physical properties of the snow cover.

Lance is also equipped with an automatic weather station which records meteorological parameters and digital photographs every 5 minutes which are used to calculate sea ice concentration. Navigational parameters are also recorded in parallel.

To aid our operational efficiency ice charts and satellite imagery were obtained daily via email.

At each CTD station Sekki disk observations of relative seawater transparency was carried out.

Cruise track and station positions

Below is a map showing the location of all CTD and Ice stations performed during the cruise.

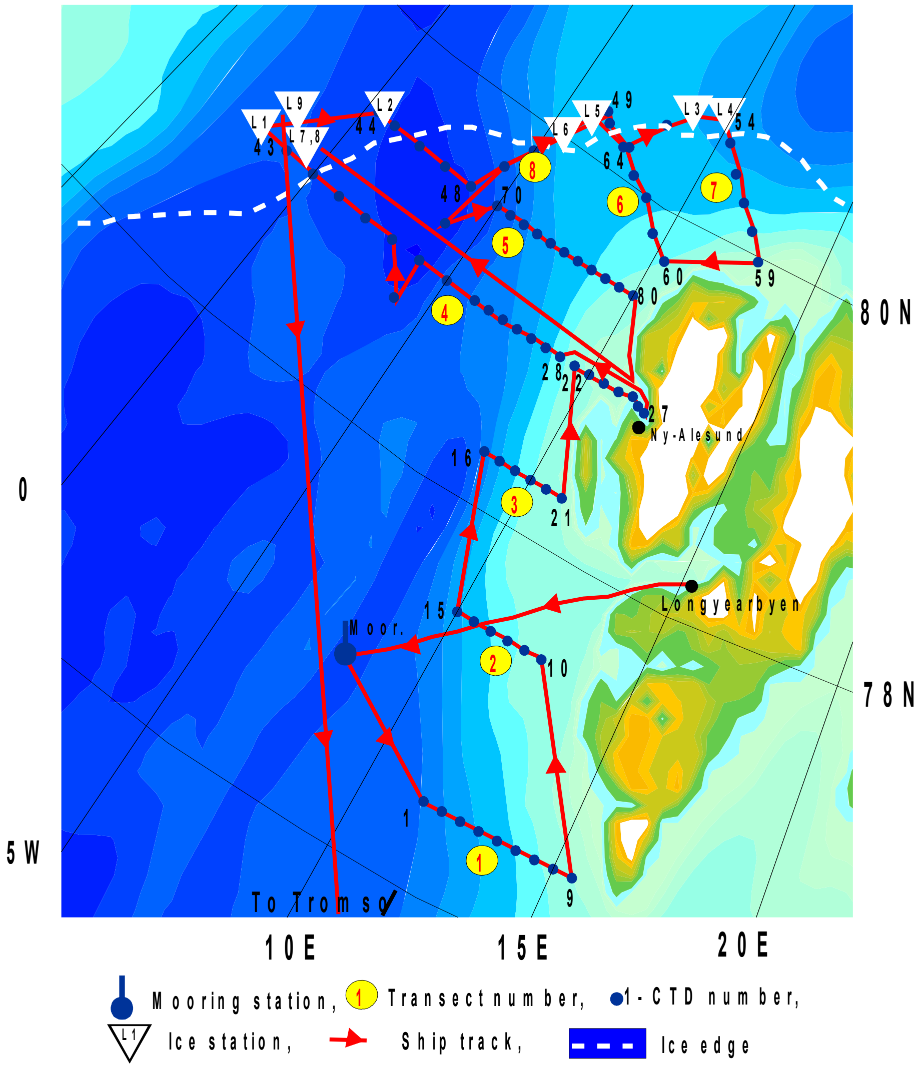


Fig.2 Cruise track and station positions

Mooring search

In the beginning of the cruise, on 19th May at 11:00, the successful recovery of the University Pierre et Marie Curie mooring station was undertaken. The mooring was deployed in 2003. The depth and position are noted in table below.

Date	Depth	Lat.	Long.
2003	2662	76 58.463N	008 04.516E

CTD Work

CTD data Acquisition

In order to obtain 'round the clock' CTD data the scientific personnel was divided into two groups. Team 1 (Vladimir, Kristen and Roman) performed the 6 to 12 shift whilst Team 2 (Jürgen and Olga) ran the 12 – 6 shift. In the calm weather the swinging of the CTD was not a problem. When the weather was bad an extra person from the crew or Harvey or Roman helped Team 2 with this procedure and we are indebted to them for their help.

Once in the water the logging was initiated using SeaSave the Seabird data acquisition software. The salinity and temperature values were monitored until they were stable and then the CTD was lowered at about 1m/s. Water samples were 'fired' on the upcast.

At the end of a station the CTD was taken back on deck, wheeled into the shelter where it could be fastened to the ship before 'Lance' headed to the next station. After which the data was downloaded, changed to ASCII using Data Conversion (DatConv) on the SBE data processing software. The resultant CNV file was used for plotting of TS vertical profiles and transects. At this stage no other processing was performed to the data.

Grid survey

The main thrust of the cruise was to characterise the oceanographic properties of the Eastern part of the Fram Strait. In particular it was to identify and survey features of the West Spitsbergen Current. In order to identify the Atlantic water masses there were performed 8 transects through the West Spitsbergen Current (Fig.2). The CTD data from these transects (Fig. 3-10) allowed us to identify pathways of the Atlantic waters and reconstruct the main branches of the West Spitsbergen Current (Fig. 11). In the core the temperature is changing from 5.1-5.2 at latitudes 76 30N - 77N to 3.4-4.3 at the latitudes 80N-80 30N. At the latitude 79 30N the branching of the West Spitsbergen Current occurs. Eastern branch turns over Svalbard trough Yermak Plateau along isobaths 500 m and its western branch follows to the north.

Figures 12-22 shows vertical profiles of the potential temperature and salinity at the stations in the branches of the West Spitsbergen Current.

Table. 1 Water sampling and Station information

Stn Number	Stn. Num. FRAM-2005 plan (Fig. 1)	Date	Time	Latitude	Longitude	Pressure	Temperature	Salinity	Bottles	Comment
1	9	19/05/05	19:25	76 29.95	011 30.00E	2000 100.8	-0.857 -4.0578	34.4069 35.1213	1 2	Start of grid
2	8	19/05/05	21:55	76 29.92	011 59.86E	1896 248	-0.8615 3.3448	34.9062 35.0390	3 4	
3	7	20/05/05	01:00	76 30.00	012 30.00E	1737	-0.872	34.907	5	
4	6	20/05/05	10:55	76 30.00	012 59.68E	1554 899	-0.881 -0.686	34.907 34.900	6 7	
5	5	20/05/05	12:50	76 29.987	013 30.20E	1268 103.4	-0.877 4.925	34.907 34.142	8 9	
6	4	20/05/05	13:20	76 30.07	014 00.50E	743.5 192	0.16 4.486	34.913 35.098	10 11	
7	3	20/05/05	15:05	76 29.94	014 29.82E	245.6	2.933	34.971	12	
8	2	20/05/05	16:26	76 29.94	014 59.53E	169.8 53.4	1.3680 1.6516	34.8491 34.7533	13 14	
9	1	20/05/05	18:06	76 30.00	015 29.80E	138.7 21.1	1.6544 -1.3350	34.8420 34.0802	15 16	
10	10	21/05/05	04:30	77 29.90	012 29.90E	92.3	1.9465	34.8021	17	
11	11	21/05/05	05:30	77 29.90	011 59.90E	135.5	3.4147	34.9863	18	
12	12	21/05/05	06:40	77 29.90	011 30.00E	257.6 32.4	3.6727 4.0735	35.0198 34.9962	19 20	
13	13	21/05/05	07:55	77 29.90	010 59.90E	798.4	1.6860	34.9611	21	
14	14	21/05/05	09:30	77 30.00	010 30.00E	1207 34.5	-0.872 5.101	34.907 35.139	22 23	
15	15	21/05/05	11:30	77 29.97	009 59.96E	1530 50	-0.871 5.197	34.907 35.150	24 25	
16	21	21/05/05	18:45	78 20.00	008 29.70E	1798 502.7	-0.853 3.0995	34.9069 35.2033	26 27	
17	20	21/05/05	21:05	78 20.00	008 59.90E	1196.3 301.8	-0.8304 3.4592	34.9064 35.0815	28 29	

18	19	21/05/05	22:40	78 19.94	009 29.98E	384 8	3.530 1.18	35.037 34.562	30 31	
19	18	21/05/05	23:40	78 20.00	010 00.41E	200 7	3.406 -0.007	34.978 34.269	32 33	
20	17	22/05/05	00:40	78 20.06	010 30.20E					Did not fire
21	16	22/05/05	01:22	78 20.01	011 00.20E	14	-1.000	34.060	34	
22	28	22/05/05	05:40	79 00.00	009 29.90E	193.3 17.4	3.4096 -0.8147	35.0169 34.1767	35 36	
23	27	22/05/05	06:35	79 00.00	010 00.30E	252.8	3.0499	34.9532	37	
24	26	22/05/05	07:30	79 00.00	010 30.00E	262.7	1.5875	34.7727	38	
25	25	22/05/05	8:30	79 00.00	011 00.00E	262.3	3.1881	34.9637	39	
26	24	22/05/05	09:40	78 58.9	011 41.96E	313	1.540	34.7712	40	
27	23	22/05/05	10:23	78 57.60	011 56.30E	337	1.470	30.761	41	
28	29	22/05/05	17:50	79 00.00	008 59.70E	196.4	3.5387	35.0088	42	
29	30	22/05/05	18:45	79 00.00	008 29.80E	457.2	3.2762	35.0322	43	
30	31	22/05/05	19:50	79 00.00	007 59.8E	1053 236.6	-0.8730 3.2166	34.9064 35.0579	44 45	
31	32	22/05/05	21:20	79 00.00	007 29.70E	1204.9 262	-0.8492 3.208	34.9069 35.072	46 47	
32	33	22/05/05	23:00	79 00.00	006 59.98E	1215 10	-0.879 1.565	34.907 34.677	48 49	
33	34	23/05/05	00:25	79 00.06	006 29.60E	1418 120	-0.869 4.510	32.907 35.098	50 51	
34	35	23/05/05	01:55	79 00.02	005 59.99E	1843 236	-0.846 3.378	34.907 35.003	52 53	
35	36	23/05/05	04:10	79 00.00	005 00.10E	2404.3 741.2	-0.7815 0.0492	34.9196 34.9003	54 55	
36	37	23/05/05	06:55	79 00.00	004 00.00E	2583 753	-0.7613 0.3427	34.9212 34.9129	56 57	
37	22	23/05/05	10:00	78 45.00	004 00.50E	2314 11	-0.778 3.425	34.923 35.004	58 59	
38	38	23/05/05	13:45	79 00.05	002 59.95E	1440 11	-0.773 3.639	34.921 35.007	60 61	
39	39	23/05/05	16:30	79 00.00	001 59.50E	2296.5 795.5	-0.7904 -0.2088	34.9130 34.8978	62 none	 Did not fire
40	40	23/05/05	19:30	79 00.00	000 59.30E	2500	-0.8178	34.9118	63	

						602	0.5632	34.9230	64	
41	41	23/05/05	22:15	79 00.20	000 01.00W	2578 10	-0.777 -1.517	34.917 33.916	65 66	
42	42	24/05/05	01:20	79 00.08	000 59.80W	2635 11	-0.784 -1.735	34.426 33.855	67 none	 Did not fire
43	43	24/05/05	08:45	78 59.06	001 58.30W	2604.5 8	-0.7490 -1.681	34.9233 33.792	68 69	Ice station F05-L01
44	61	25/05/05	00:35	79 31.10	000 21.30E	600				Did not fire. Ice station F05-L02
45	60	25/05/05	05:10	79 30.00	001 00.60E	3102.6 648.5	-0.7204 0.6877	34.9250 34.9057	70 71	
46	59	25/05/05	08:25	79 30.00	002 00.00E	2365.7 804	-0.7625 0.1053	34.9165 34.8940	none none	Problem with bottles
47	58	25/05/05	11:15	79 29.95	003 00.01E	3533 9	-0.678 -1.19	34.925 33.978	72 none	 Did not fire
48	57	25/05/05	15:10	79 29.96	003 59.96E	3153 898.6	-0.7138 -0.070	34.9227 34.8963	73 74	
49	72	26/05/05	22:30	80 16.90	006 18.00E	556 107	1.917 3.424	34.995 34.981	none 75	Problem with bottles
50	71	27/05/05	00:10	80 14.00	006 32.60E	553 5	2.113 1.392	35.005 34.577	76 77	
51	New	27/05/05	02:35	80 10.30	007 30.70E	620	0.478	34.925	none	Problem with bottles
52	New	27/05/05	04:45	80 23.60	008 12.00E	755	-0.2135	34.9089	78	
53	New	27/05/05	06:55	80 31.70	008 53.70E	1232.1 199.5	-0.5748 2.4471	34.9053 34.9711	79 80	Ice station F05-L03
54	New	27/05/05	14:40	80 35.90	009 46.70E	1112 8.5	-0.629 -1.499	34.905 33.941	none 81	Problem with bottle Ice station F05-L04
55	New	27/05/05	21:30	80 29.60	010 22.00E	769.9	-0.1604	34.9096	82	
56	New	27/05/05	23:10	80 22.25	011 02.30E	491 8	2.3000 0.696	35.000 34.565	83 84	
57	New	28/05/05	00:30	80 14.80	011 43.10E	174 8	3.163 0.224	34.953 34.535	85 86	
58	New	28/05/05	01:40	80 07.40	012 22.50E	183 12	2.921 -0.284	34.936 34.468	87 88	
59	New	28/05/05	02:45	80 00.04	013 00.30E	185 8	2.236 0.309	34.841 34.551	89 90	
60	63	28/05/05	06:30	79 45.00	010 20.20E	107.1	3.527	35.0154	91	

61	64	28/05/05	07:45	79 51.00	009 34.60E	450.1 138.3	1.5695 3.9154	34.9755 35.0202	92 93	
62	66	28/05/05	09:15	79 56.90	008 50.20E	469	0.5573	34.9252	94	
63	68	28/05/05	10:40	80 03.60	008 06.80E	499	2.0750	35.003	95	
64	69	28/05/05	12:10	80 09.60	007 20.70E	541 8	2.058 1.214	35.003 34.555	96 97	
65	70	28/05/05	17:00	80 12.10	005 58.50E	665	0.5361	34.9380	98	Ice station F05-L05
66	67	28/05/05	23:50	80 01.70	005 29.50E	952	-0.8320	34.907	99	Ice station F05-L06
67	65	29/05/05	03:55	79 54.40	004 59.20E	1419 317	-0.8543 3.5151	34.9071 35.0719	100 101	
68	62	29/05/05	06:20	79 42.00	004 29.70E	2941 631.5	-0.7385 0.9005	34.9256 34.9304	102 103	
69	45	29/05/05	10:50	79 15.30	004 00.40E	2741 11.5	-0.7470 3.9380	34.9230 35.0830	104 105	
70	56	29/05/05	14:50	79 20.00	004 59.60E	2725 600	-0.7480 2.6525	34.9240 35.0325	106 107	
71	55	29/05/05	17:10	79 30.00	005 30.00E	2427 451.6	-0.8028 3.3147	34.9206 35.0853	108 109	
72	54	29/05/05	19:20	79 30.20	006 00.10E	1859.4 360.1	-0.8393 3.4240	34.9080 35.0679	110 111	
73	53	29/05/05	21:00	79 30.00	006 30.30E	1379.2 500	-0.8535 3.1728	34.9075 35.0678	112 113	
74	52	29/05/05	22:30	79 30.00	007 00.30E	1095 12	-0.7740 2.5820	34.9060 34.8360	114 115	
75	51	29/05/05	23:50	79 30.05	007 30.40E	860 10	-0.6800 2.3550	34.9050 34.7360	116 117	
76	50	30/05/05	01:05	79 30.00	007 59.50E	599 10	2.5900 2.2390	35.0300 34.7120	118 119	Too noise
77	49	30/05/05	02:10	79 30.00	008 30.10E	278 10	3.0370 0.5240	35.0610 35.5090	120 121	
78	48	30/05/05	03:07	79 30.05	009 00.06E	153 8	2.8040 0.6680	35.0450 34.5520	122 123	
79	47	30/05/05	03:55	79 30.00	009 30.10E	128 11	3.235 -0.257	35.0450 34.3770	124 125	
80	46	30/05/05	04:40	79 30.00	010 00.10E	74.6	1.2621	34.6854	126	
81	44	30/06/05	08:00	79 01.20	011 25.80E	336	2.4711	34.8903	127	
82	New	31/05/05	07:20	78 59.00	000 44.00W	2598	-0.7576	34.9226	128	Ice station F05-L07

83	New	31/05/05	11:40	79 04.60	001 22.91W	1000	-0.2955	34.9014	none	Problem with bottle. Ice station F05-L08
84	New	01/06/05	07:10	78 58.50	001 58.70W	1002	-0.2071	34.8974	129	Ice station F05-L09

Temperature and salinity distribution at the transects through the West Spitsbergen Current

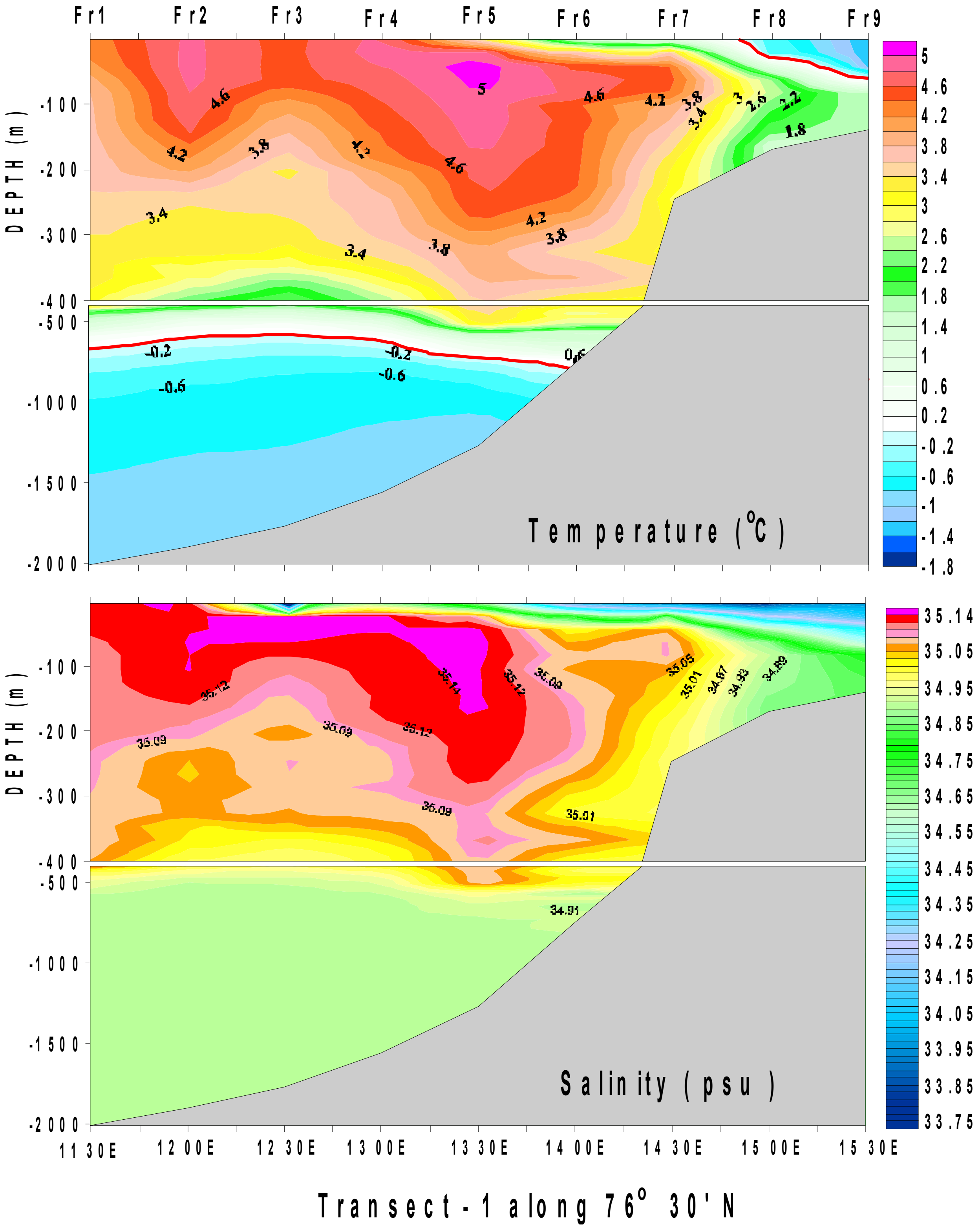


Fig. 3 Temperature and salinity distribution at Transect 1 (transect location is shown in Fig. 2)

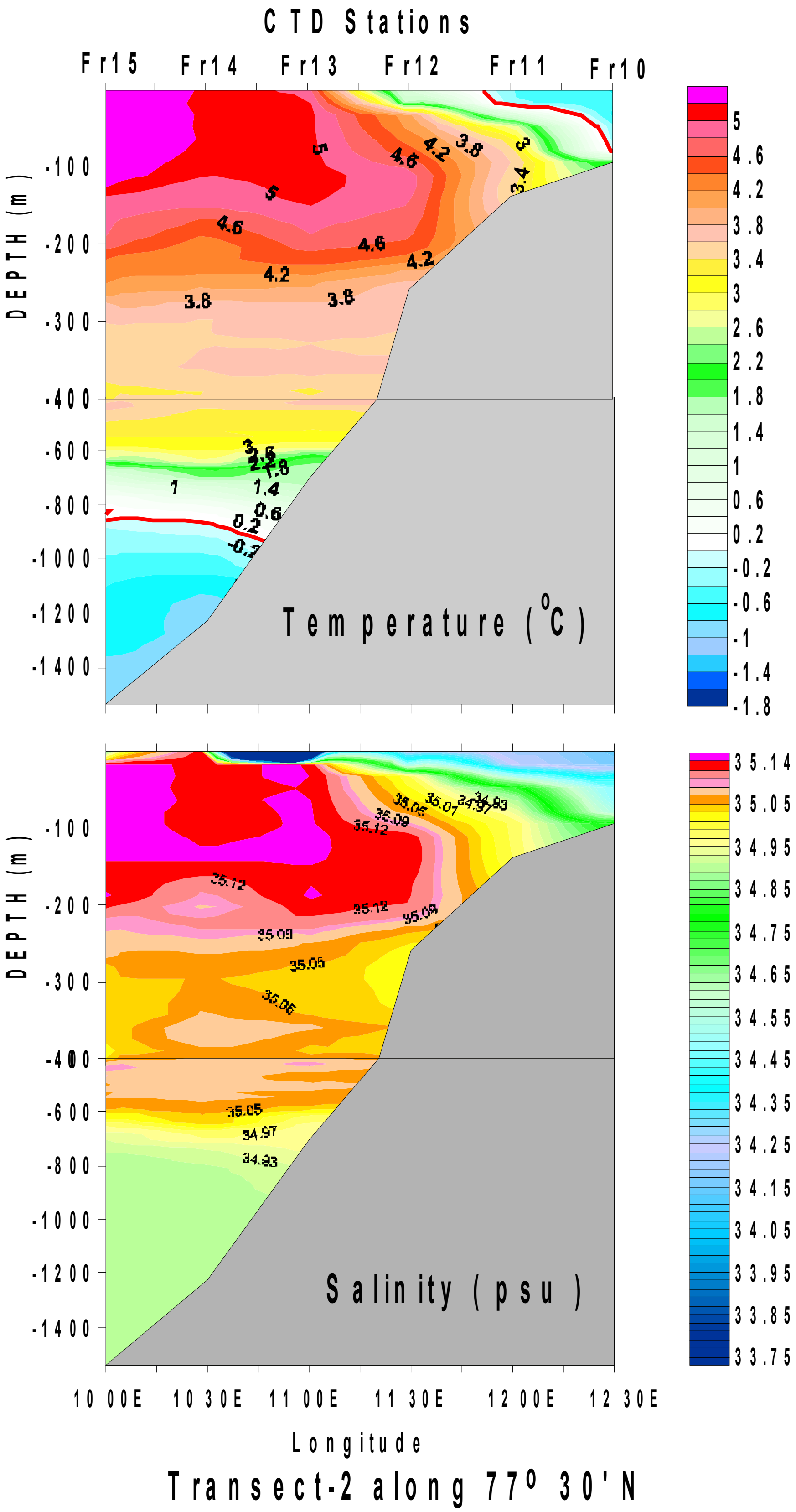


Fig. 4 Temperature and salinity distribution at Transect 2 (transect location is shown in Fig. 2)

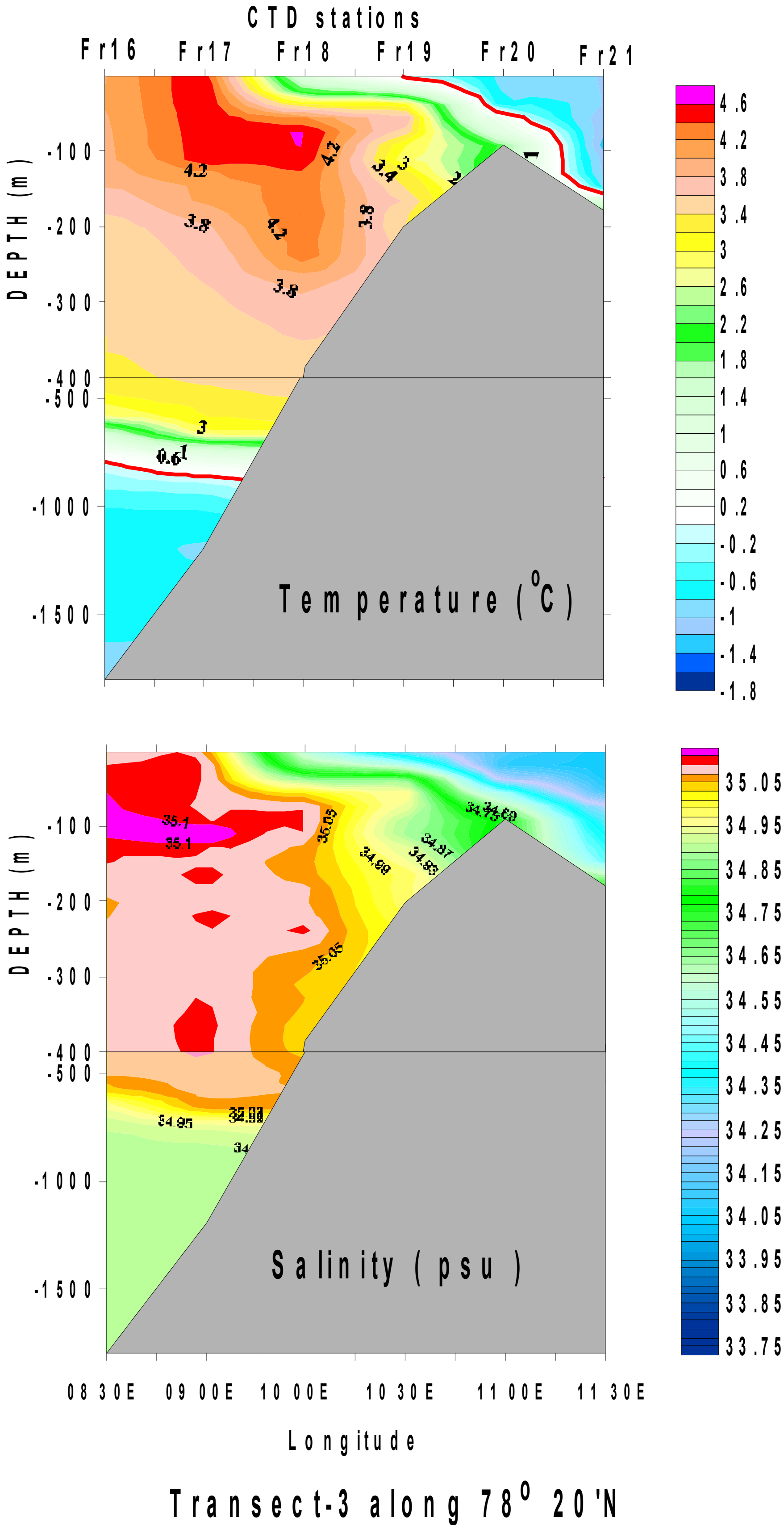


Fig. 5 Temperature and salinity distribution at Transect 3 (transect location is shown in Fig. 2)

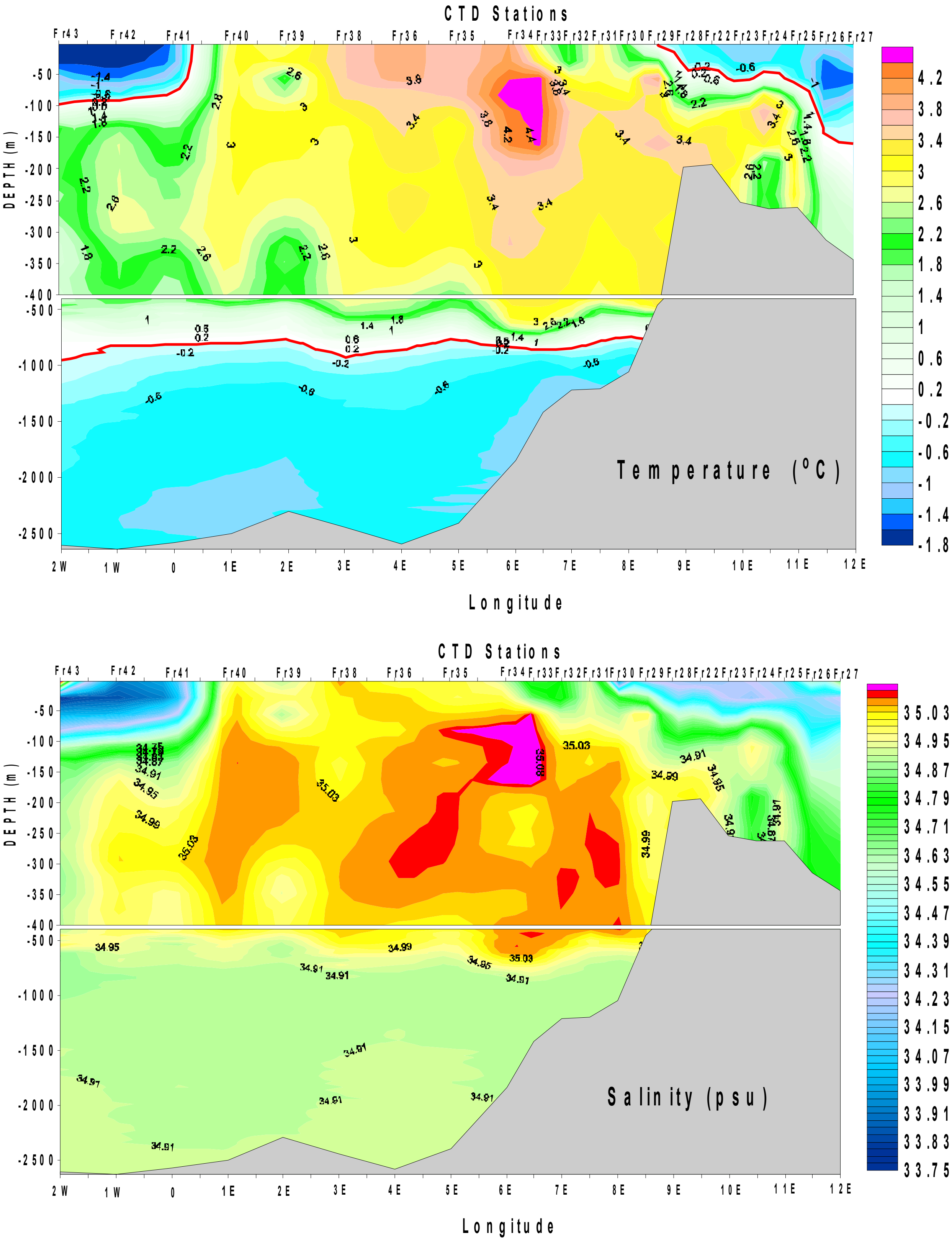


Fig. 6 Temperature (upper panel) and salinity (bottom panel) distribution at Transect 4 (transect location is shown in Fig. 2)

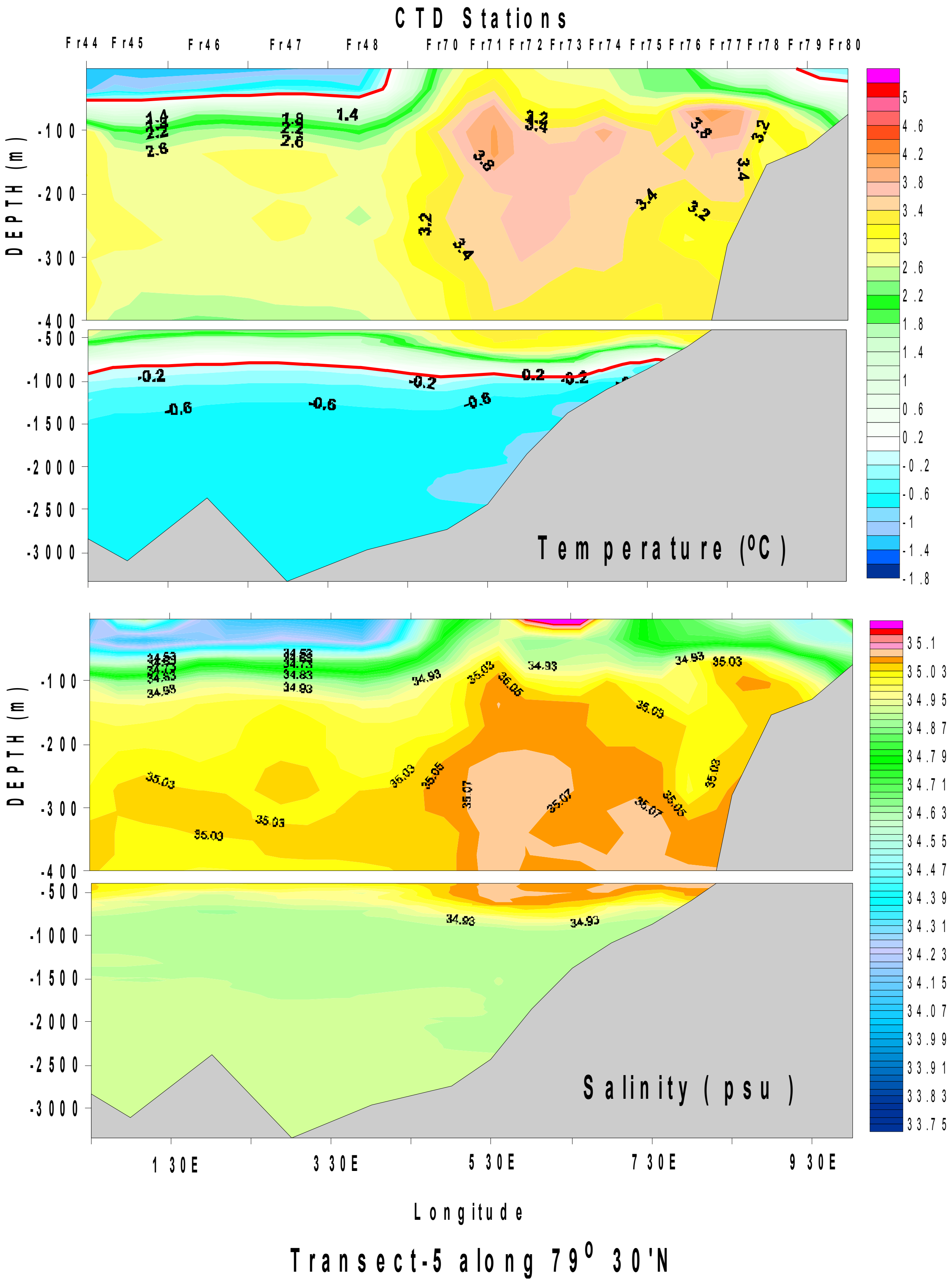


Fig. 7 Temperature and salinity distribution at Transect 5 (transect location is shown in Fig. 2)

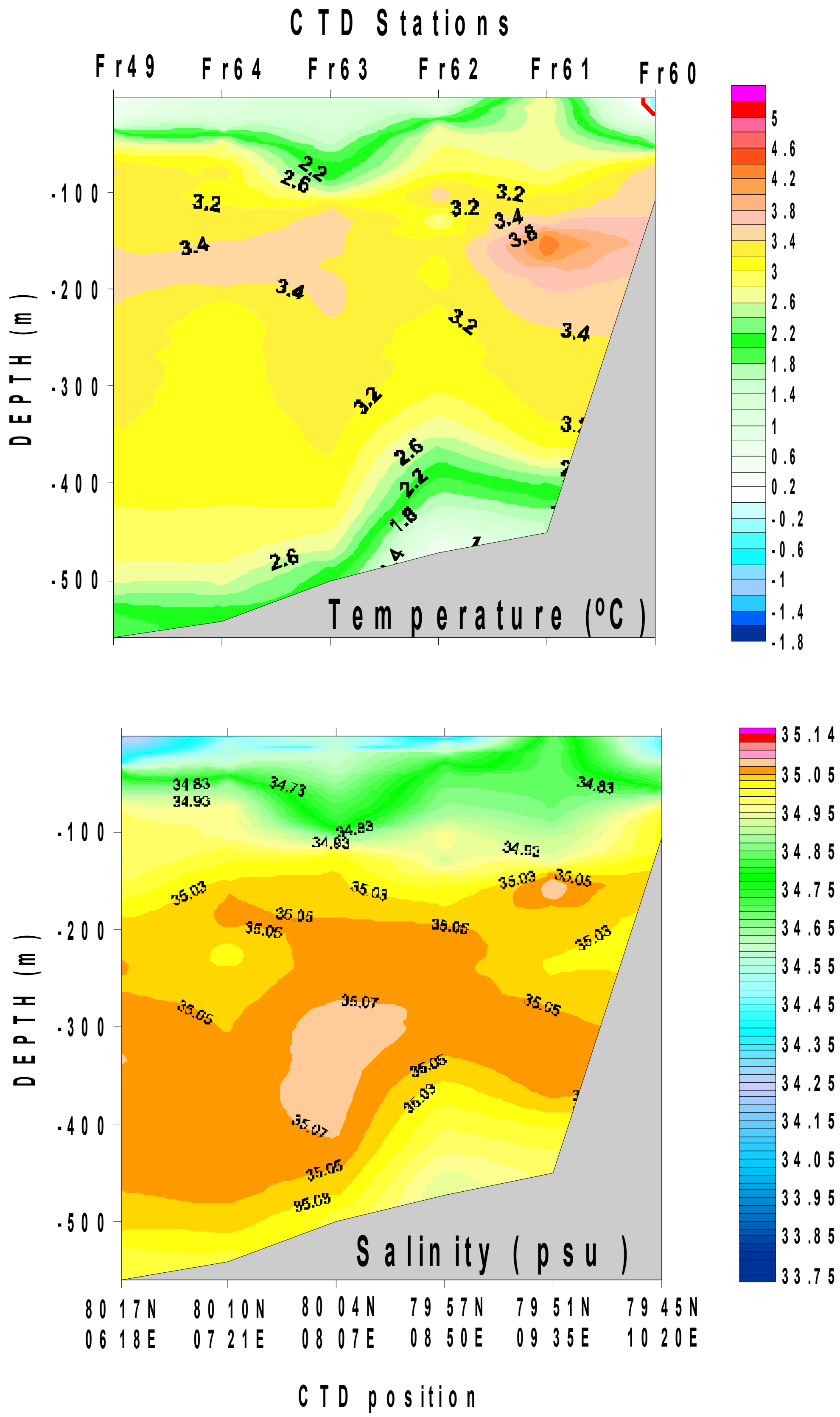


Fig. 8 Temperature and salinity distribution at Transect 6 (transect location is shown in Fig. 2)

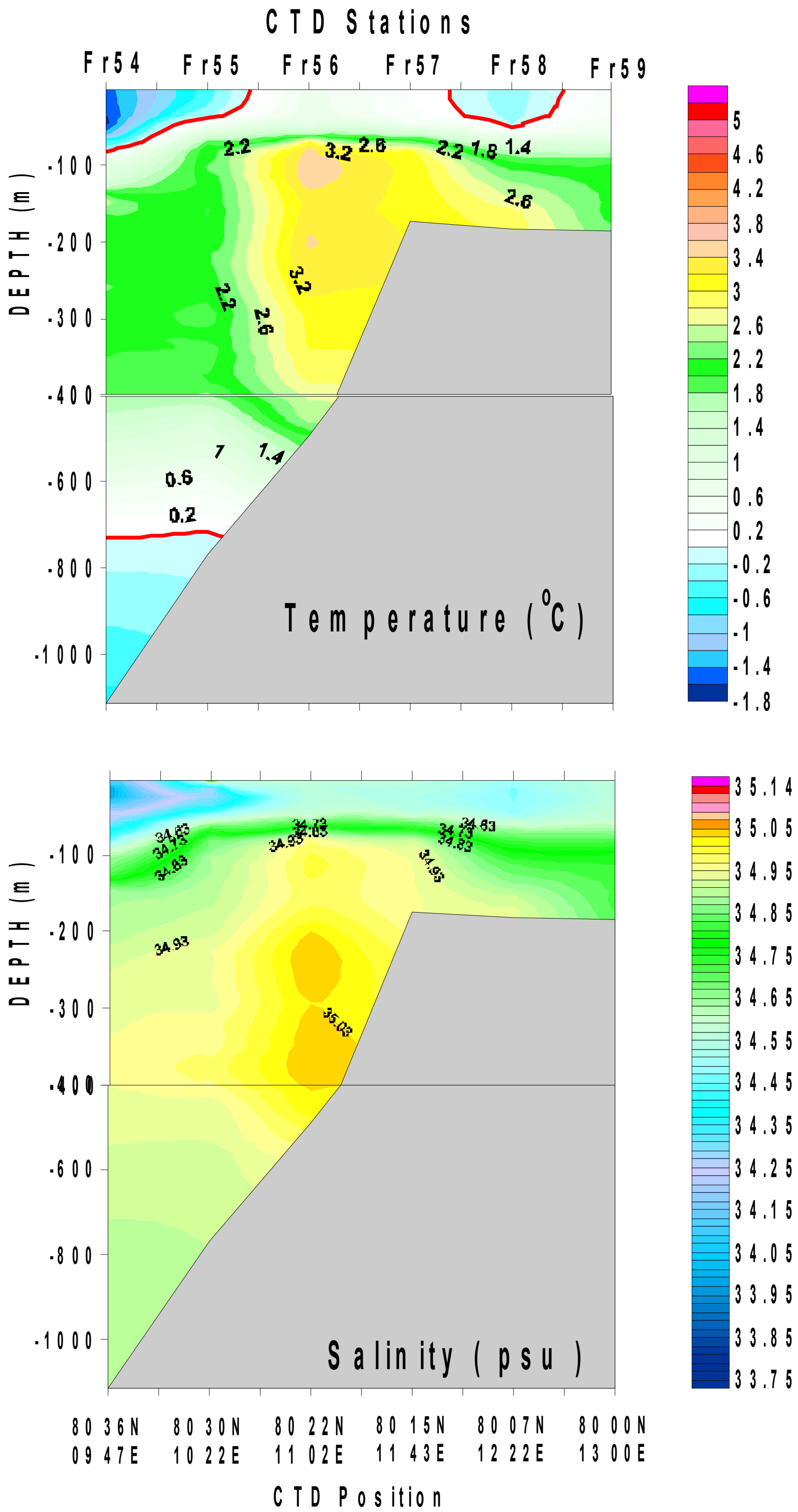


Fig. 9 Temperature and salinity distribution at Transect 7 (transect location is shown in Fig. 2)

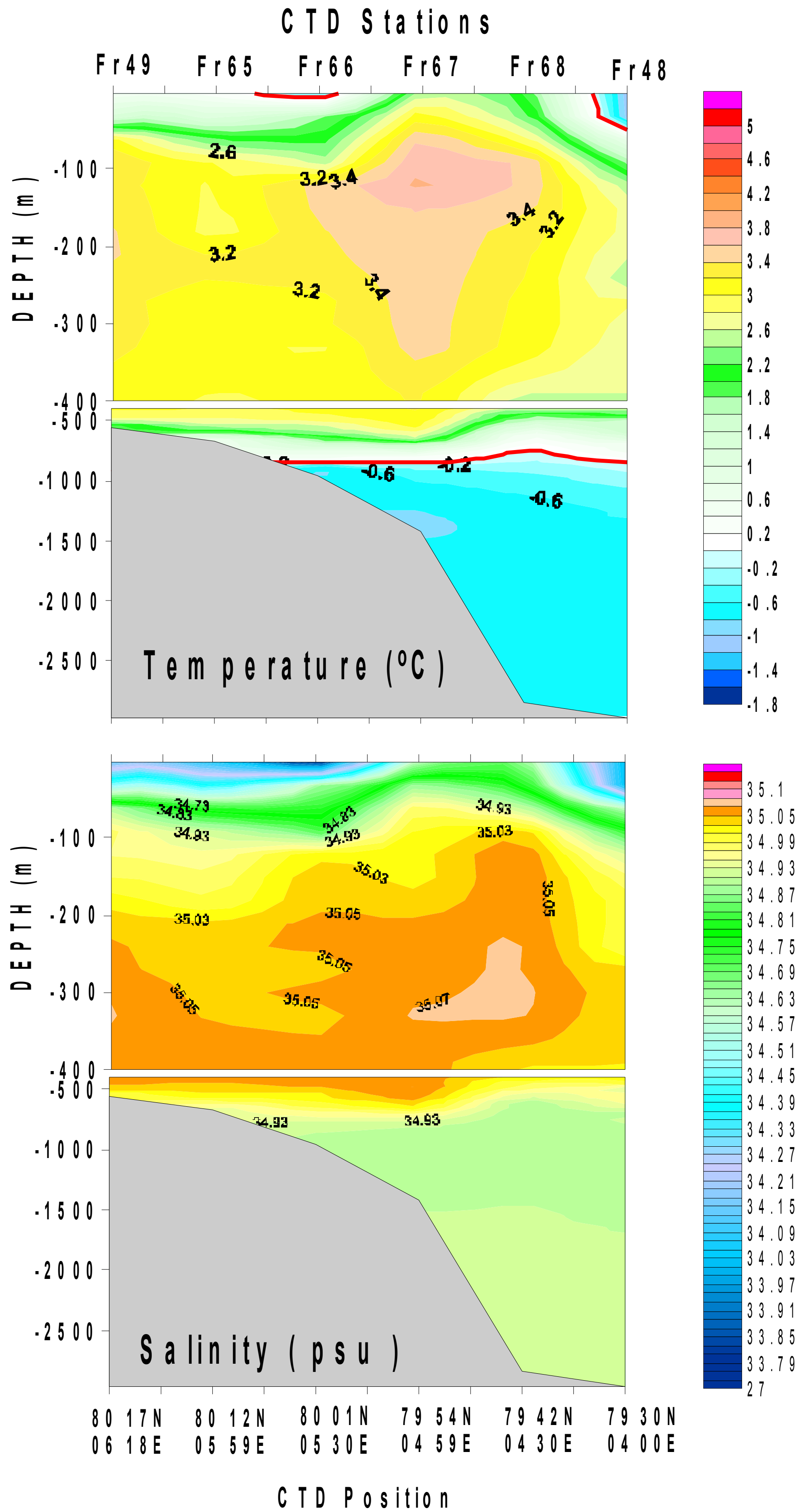


Fig. 10 Temperature and salinity distribution at Transect 8 (transect location is shown in Fig. 2)

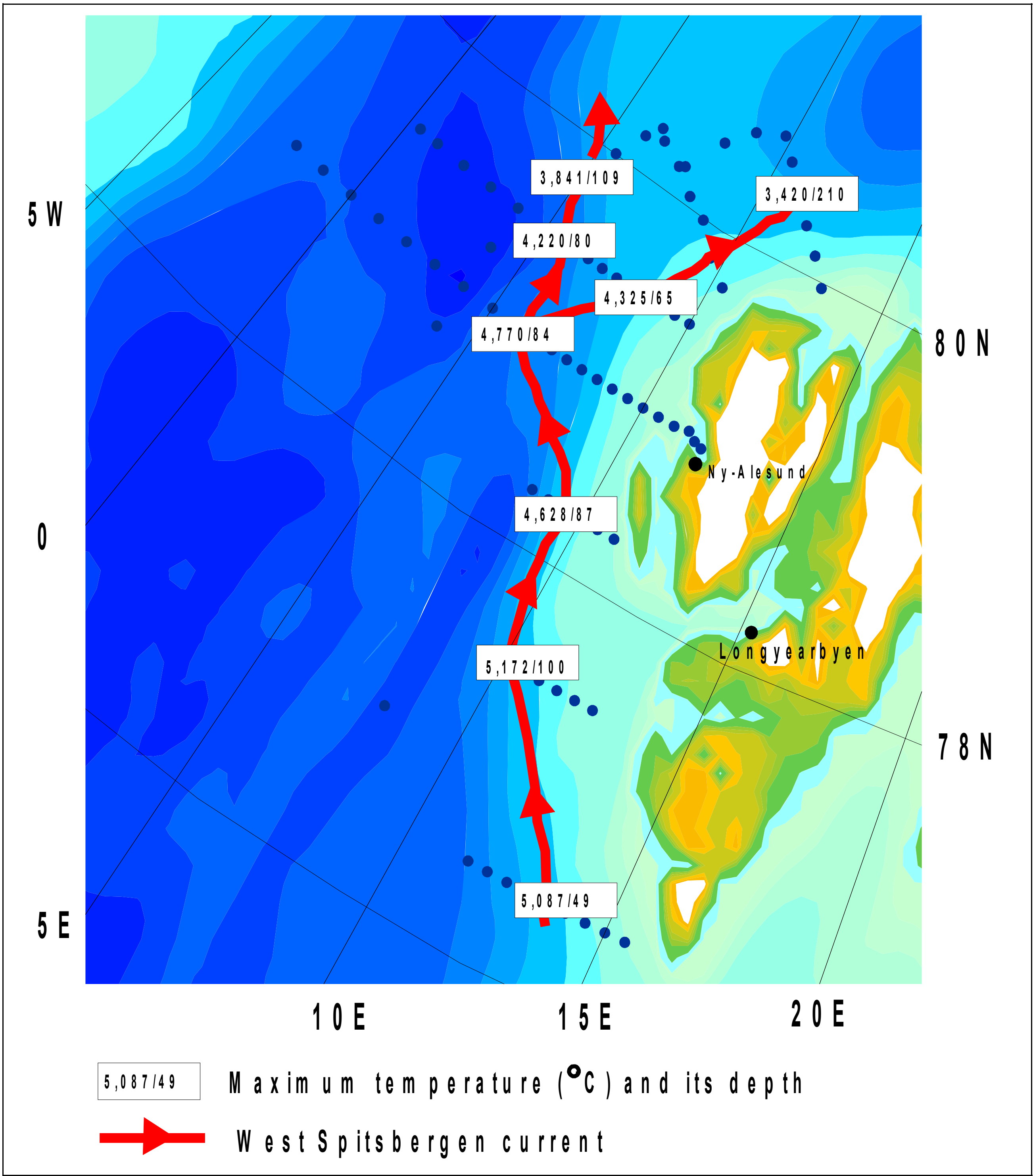


Fig. 11 Reconstructed location of the main branches of the West Spitsbergen Current

Vertical profiles of potential temperature and salinity at the stations in the branches of the West Spitsbergen Current

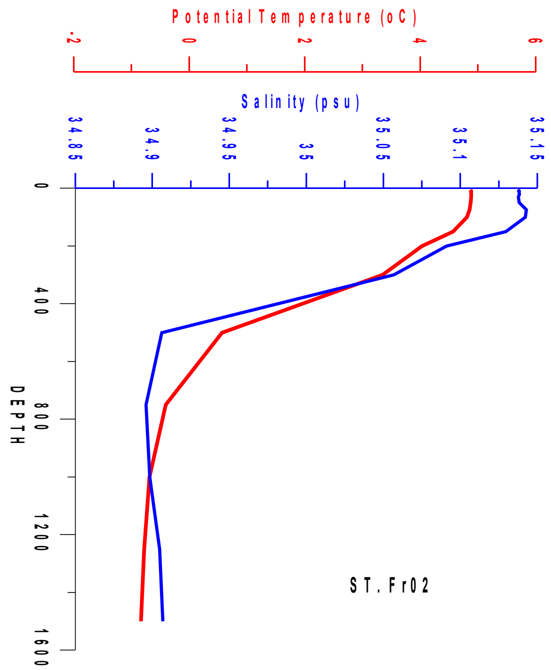


Fig. 12 Potential temperature and salinity profiles at the standard levels (Station number Fr02, Transect 1)

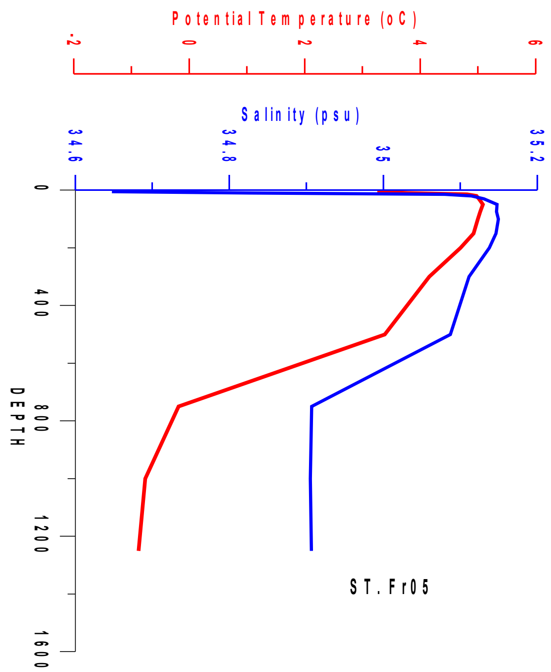


Fig. 13 Potential temperature and salinity profiles at the standard levels (Station number Fr05, Transect 1)

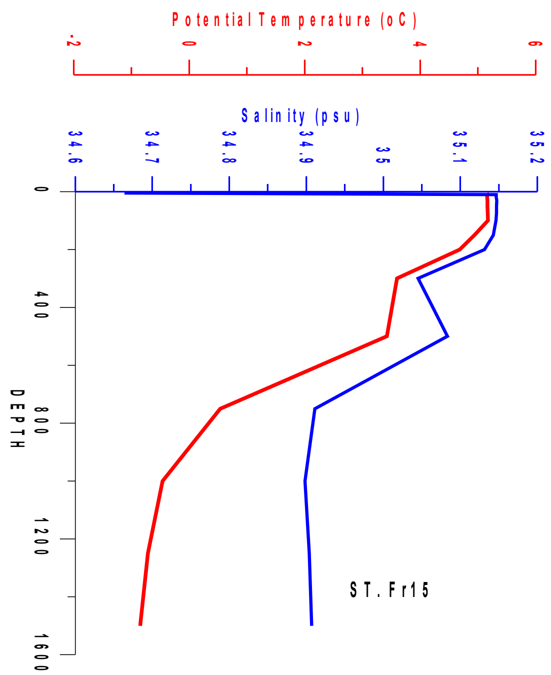


Fig. 14 Potential temperature and salinity profiles at the standard levels (Station number Fr15, Transect 2)

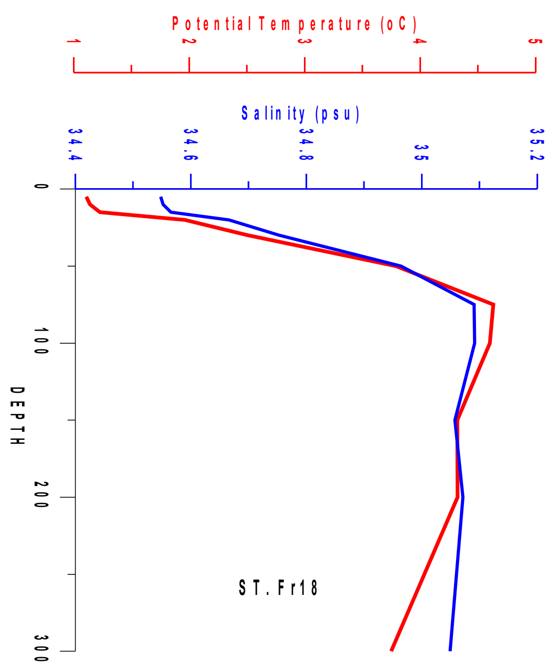


Fig. 15 Potential temperature and salinity profiles at the standard levels (Station number Fr18, Transect 3)

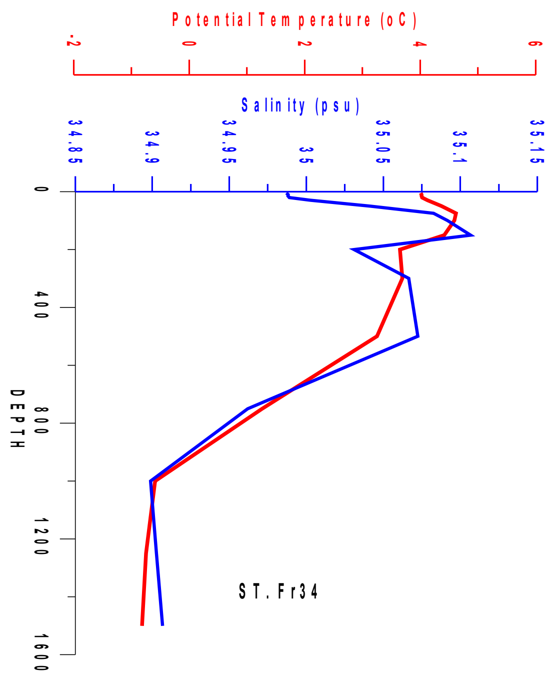


Fig. 16 Potential temperature and salinity profiles at the standard levels (Station number Fr34, Transect 4)

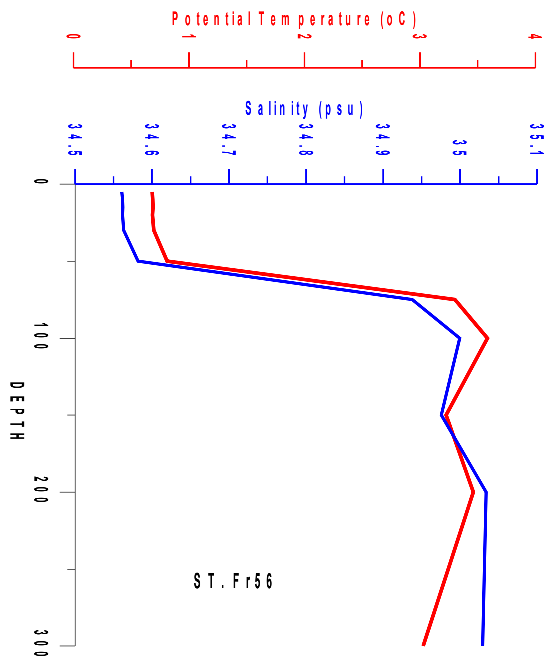


Fig. 17 Potential temperature and salinity profiles at the standard levels (Station number Fr56, Transect 7)

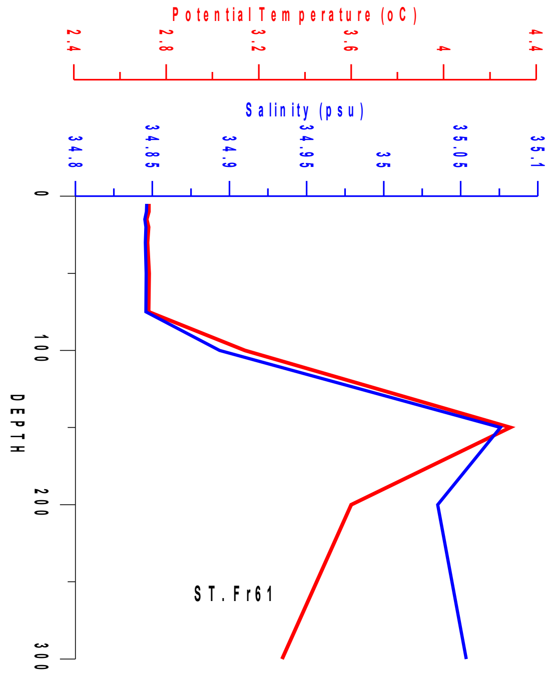


Fig. 18 Potential temperature and salinity profiles at the standard levels (Station number Fr61, Transect 6)

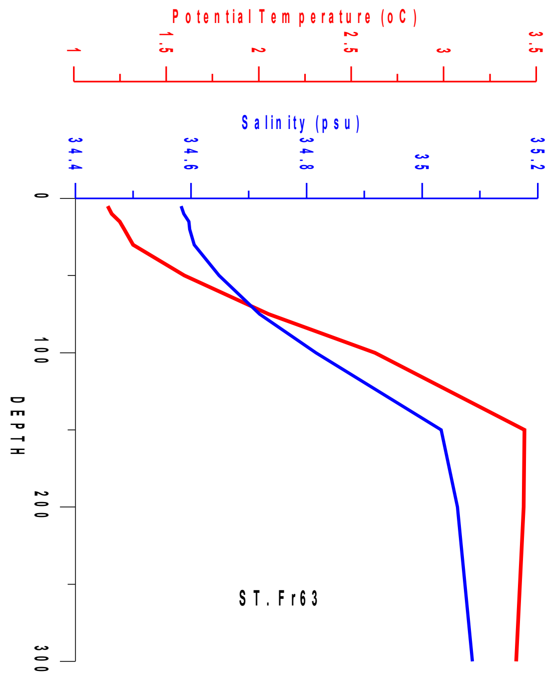


Fig. 19 Potential temperature and salinity profiles at the standard levels (Station number Fr63, Transect 6)

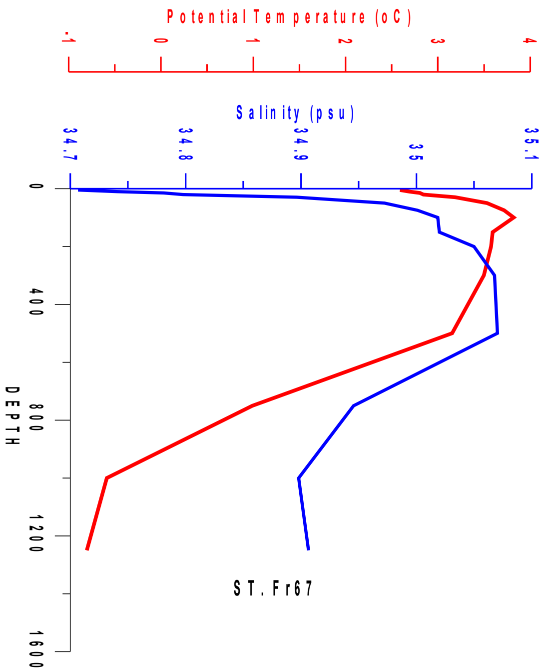


Fig. 20 Potential temperature and salinity profiles at the standard levels (Station number Fr67, Transect 8)

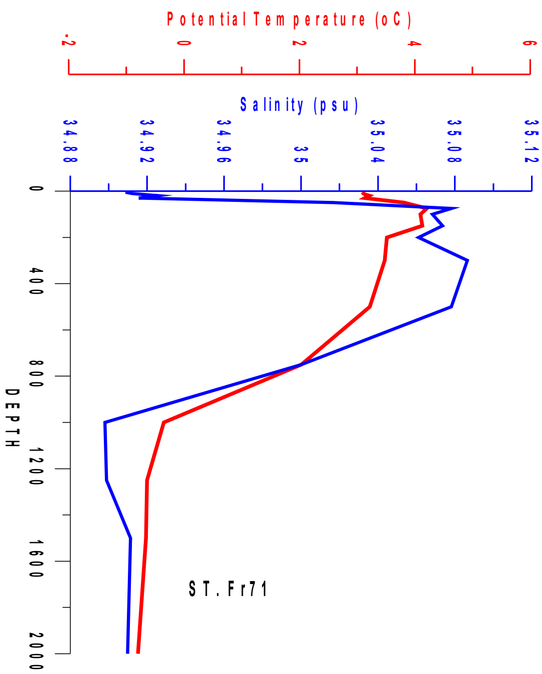


Fig. 21 Potential temperature and salinity profiles at the standard levels (Station number Fr71, Transect 5)

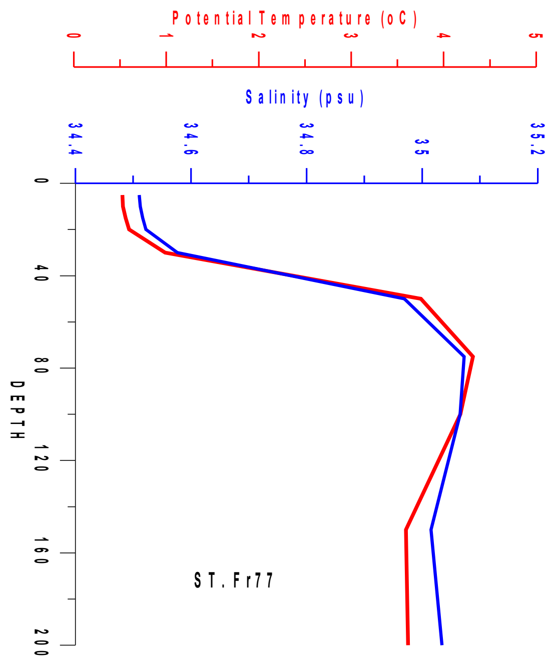


Fig. 22 Potential temperature and salinity profiles at the standard levels (Station number Fr77, Transect 5)

Some comparisons between Lance CTD observations and historical hydrography in the Fram Strait

Our primary focus is on the section along 79ºN as this is a regular section surveyed by the September cruises in recent years and it also covers the largest part of the basin. An important task of these comparisons is the differentiation between seasonal and longer term changes. To see what part of the observed changes is due to seasonal variations we will compare the changes from September 2004 to May 2005 with changes from September 1998 to May 1999 and look for similarities. Both September cruises were done while servicing the NPI mooring array in the East Greenland current, the May 1999 cruise was a VEINS cruise (data from the VEINS CD-ROM).

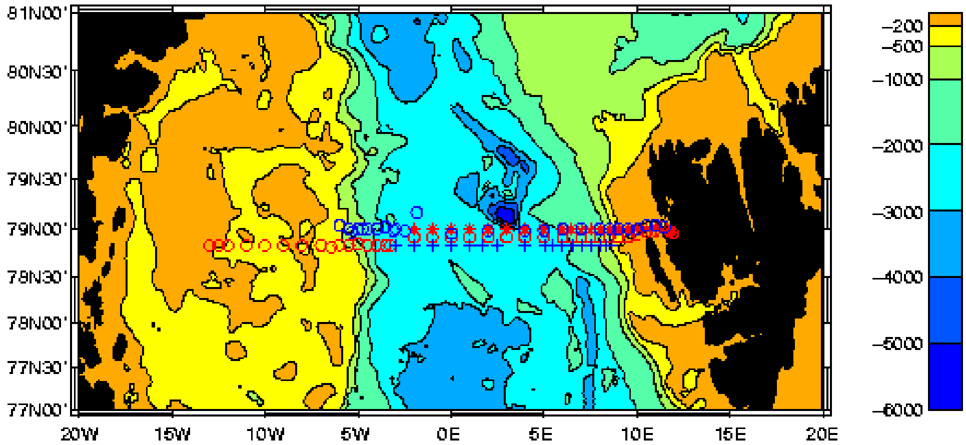


Fig.23: Positions of the CTD stations used in the comparison.

The individual sections were first interpolated onto a regular longitude-pressure grid (irrespective of latitude) and these grids were then used for the comparison. The latitudinal difference between sections is at most 10 minutes (Fig.23), the errors due to this separation should be small. As the difference sections (Fig.24) are quite noisy due to frontal shifts and eddy activity, means of different hydrographic regions were calculated. The 79ºN section was divided into three regions, a shelf region (east of 9ºE), the West-Spitsbergen current (3ºE-9ºE) and the mid Fram Strait (west of 3ºE till about 2ºW).

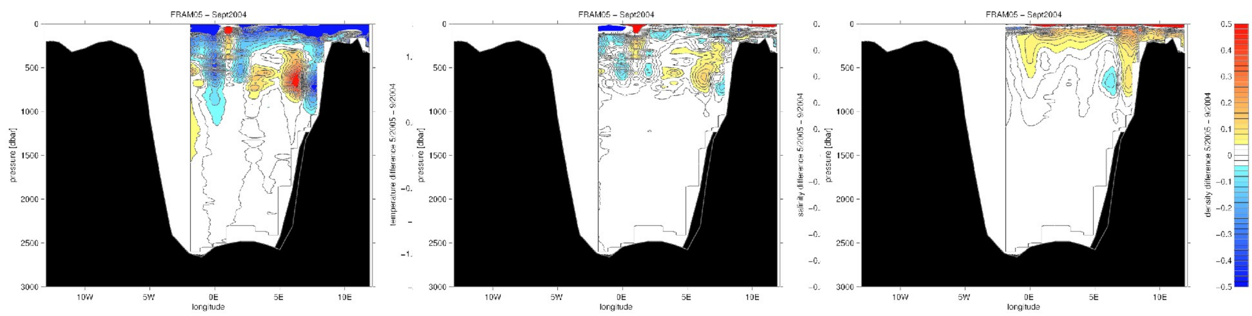


Fig.24 Sections of the differences between May 05 and September 04 in temperature, salinity and density (from left to right). Red colours indicate higher values in May 05, blue values values that are lower in May 05 then in September 04.

In all regions the uppermost water column (till about 50m) has higher salinities than in September (Fig.25). The middle of the Fram Strait has a pronounced decrease in salinity. This can be attributed to an eastward shift of the East Greenland front, which brings the cold and less saline Polar Water (PW) into regions up to 0ºW. As expected the surface waters are colder in May then in September, this cooling reaches depths of about 300 m in the West Spitsbergen region and 700m in the middle Fram Strait region (Fig.26). Associated with this cooling is an increase in density. The largest density increase is found at the surface due to the combined effect of cooling and higher salinities.

At mid-depths (400-800m) the warm AW is further east in May then in September, leading to colder waters in May at the continental slope and warmer waters further east. The mean temperature is higher in May east of 3ºW and colder west of 3ºW. The total change is small. The salinity signal corresponds to the temperature signal.

The deep waters (1800-2400m) are warmer (0.02) and less saline (-0.01) in May than in September.

The deepest waters near the bottom show negligible salinity changes, an increase in temperature in the West-Spitsbergen current region and none in the middle region.

Many features of the 2005-2004 comparison can also be found in the 1999-1998 differences, and therefore are probably mostly signs of the seasonal cycle. The two strongest of these features are the colder and more saline upper waters and the warmer and more saline waters at mid-depths in the West-Spitsbergen current.

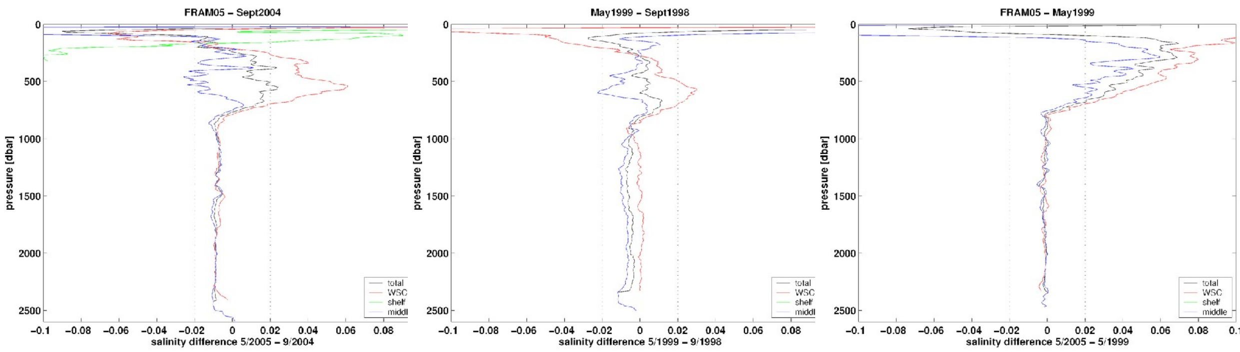


Fig.25 Salinity differences in the 79ºN regions between May 05 and September 04 (left), May 99 and September 98 (middle) and between May 05 and May 99 (right).

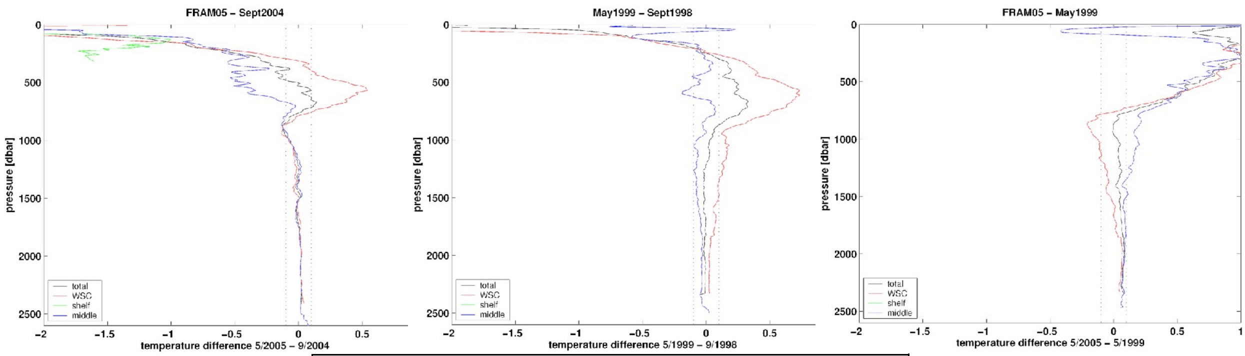


Fig.26 Temperature diff... nd September 04 (left), May 99 and September 9... right).

Comparing the May mea... g warming reaching more than 1ºC at depths of mo... vith a salinity increase. Comparing the maximum ... with previous measurements in this are... s high (4.77ºC) in 2005. Just twice, in 1984 and 1... were observed here in these months.

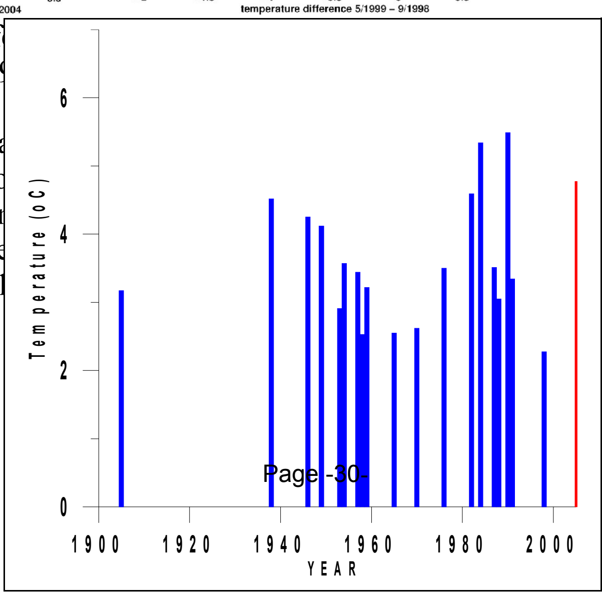


Fig. 27 Maximal temperature in the core of the West Spitsbergen Current at latitude 79ºN in this cruise (red bar) and in previous years (blue bars)

ADCP Data

The ADCP recorded data throughout the cruise. The ADCP is a broadband 150kHz type and was set to 8m bins and an averaging interval of 300 seconds. The attained vertical range was about 200m. Just a first data check was made onboard. Along the 79ºN section (Fig.XX) two regions of larger northward velocity are apparent. The first at about 6ºW can be associated with the main core of the AW and the second region at about 8ºW is situated near the shelf break and the front between warm and saline AW and cold and fresh shelf water. The later is also visible at 78º 20'N at about 9ºW.

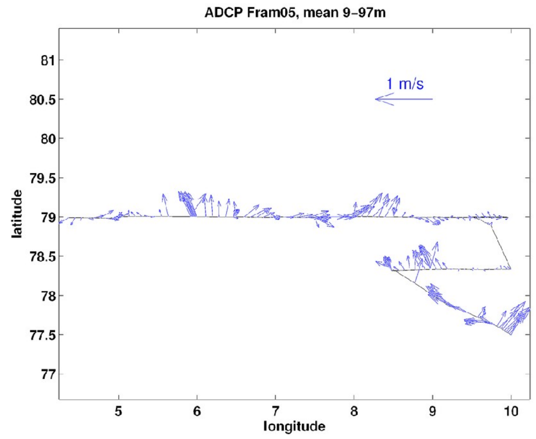


Fig. 28 Near surface velocities (9-97m) from the vessel mounted ADCP.

Sea Ice Work

IceCam ice observations

An IceCam is permanently installed onboard Lance and is set to record an image every 5 minutes via a web camera mounted on the bridge and looking to the starboard side. In addition GPS, time, pitch and roll are recorded. This data can later be analysed to give ice concentration.

Ice Stations

A total of 10 stations were taken, 6 full stations and 4 short stations. At each station the minimum work done was an ice thickness profile, and snow properties. For short stations the salinity and ice core temperature were dropped when time was limited.
The aim was to record the following data for each full station.

- GPS position and time (start and end position of the ice floe to record ice drift)
- Ice thickness
- Snow thickness and physical properties
- Ice cores – length, stratigraphy, temperature, photo
- Air and water temperature
- Salinity
- Water samples

Station no.	Date	Latitude	Longitude	
F05-L01	24.05.2005	78°59.837'N	01°59.792'W	Full
F05-L02	24.05.2005	79°32.007'N	00°27.54'E	Short
F05-L03	27.05.2005	80°32.252'N	08°45.552'E	Full
F05-L04	27.05.2005	80°37.494'N	09°47.050'E	Full
F05-L05	28.05.2005	80°12.070'N	05°58.121'E	Full
F05-L06	29.05.2005	80°01.649'N	05°29.709'E	Short
F05-L07	31.05.2005	78°58.873'N	00°42.512'W	Full
F05-L08	31.05.2005	79°04.478'N	01°24.068'W	Full
F05-L09	01.06.2005	78°58.384'N	01°57.935'W	Medium
F05-L10	01.06.2005	78°57.432'N	02°05.997'W	Medium

Ice thickness drilling

Floes were chosen as large as possible and were accessed either directly from Lance or by Zodiac. Thickness profiles 50-100m in length were measured with profiling every 10m. We used a Covacs thickness drill. Together with ice thickness we also recorded snow cover thickness and freeboard.

Snow properties

Physical snow properties were recorded at every station. The site chosen for the snow pit was selected as representative for the floe.
The following parameters were recorded

- Snow description:
  - Snow type
  - Avg, min, max grain diameter
  - Hardness test
  - Draw / photograph stratigraphy profile
- Snow temperature every 2-5cm (depending on snow pack thickness and layering)
- Snow density – no. of samples depending on the snow thickness
- Salinity measurements every 10cm in the snow pack at stations where ice core salinity is measured

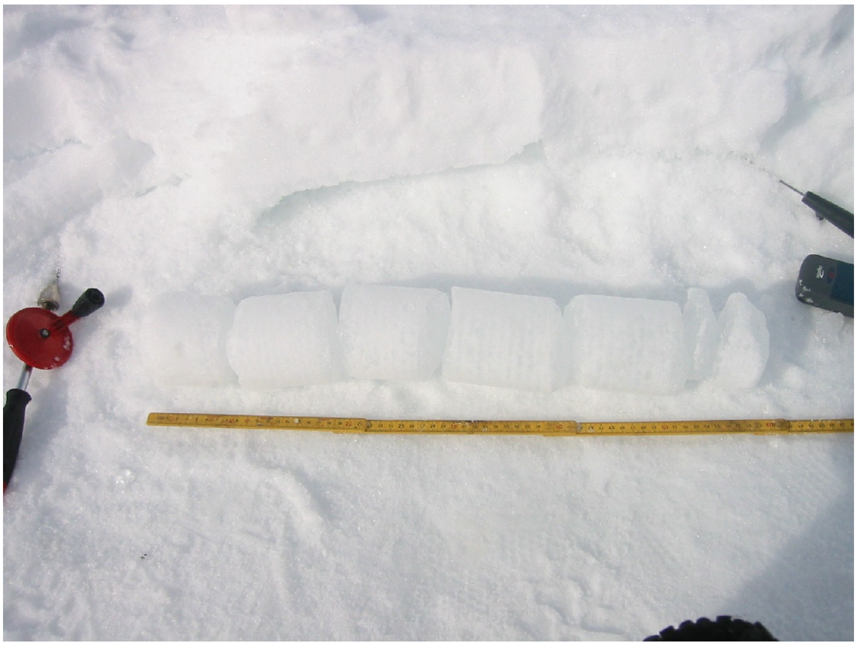
Water temperature

Water temperature was taken from the side of the floe if possible. Sometimes the ice station corresponded with a CTD station and therefore both temperature and salinity measurements can be obtained from this data

Air temperature

Air temperature was recorded at 1m above the surface in the body shadow

Ice Cores



8 ice cores were drilled at stations 1, 3, 4, 5, 7, 8, 9, and 10 in level ice of average thickness. The core was photographed and the total length recorded. The temperature approximately every 10cm was measured by drilling a hole with a hand drill in the core and inserting the temperature probe. This was done quickly section for section to avoid temp changes. The stratigraphy of the core was noted and peculiarities marked such as sediment or algae were recorded

To measure salinity along sections of the ice core we cut the core into ca. 7-10cm sections and then bagged and labelled each section. Onboard Lance the samples were melted and bottled so that salinity could be measured in Tromsø. No salinity samples were taken for cores 9 and 10.

Traces of green algae were found in core 7.

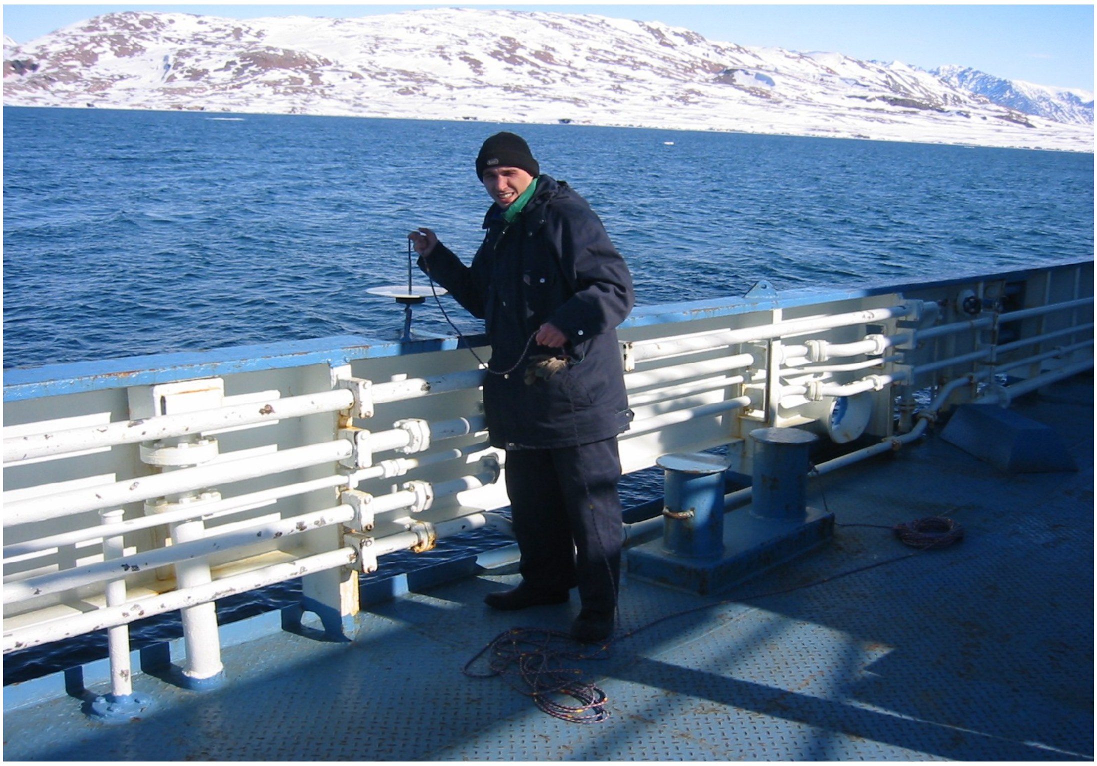
Water samples

2 x 50 liter samples were taken with a bucket from the side of the ship for analysis in Tromsø for traces of radionuclides.

1. West Spitsbergen current off Kongsfjorden N79deg 00', E08deg 30'
    - Date: 22.05.2005
    - Time: 20:30
2. N80deg 16.9', E06deg 18'
    - Date: 27.05.2005
    - Time: 00:45
    - Sea ice 1st year, 10m floes, 0.5m thick, 20cm snow cover

Measurements of the relative seawater transparency

Long before the beginning of precise instrumental observations, simple optical observations of seawater visibility depth through a white so-called Sekki disk (see picture below) were used.



Sekki disc view

The transparency characterises properties of the physical environment to loosen electromagnetic radiation in the optical range. The spatial and temporal allocation of optical properties of seawater is defined by the allocation of a dissolved organic material and suspended sediments concentration. In the open sea these are defined by the concentration of organic and non-organic material, water dynamics and turbulence. The last two factors are responsible for the transport and distribution of this material. Shore and shelf erosion, along with river discharge provide the major contribution to the optical properties of seawater.

During the Lance cruise 40 relative seawater transparencies were taken. Station positions and transparency value are listed in the Table 2 and shown in Fig 29.

Table 2 Station positions and value of the relative seawater transparency

№	Date	Time (GMT)	Longitude	Latitude	Depth, m
1	20.05.2005	11:15	12,5968 E	76,3000 N	16
2	20.05.2005	13:50	14,0050 E	76,3007 N	12
3	20.05.2005	15:15	14,2982 E	76,2994 N	11,5
4	20.05.2005	16:35	14,5499 E	76,2994 N	6,5
5	20.05.2005	18:10	15,2980 E	76,3000 N	6,5
6	22.05.2005	06:40	10,0030 E	79,0000 N	8
7	22.05.2005	07:30	10,3000 E	79,0000 N	7,5
8	22.05.2005	08:30	11,0000 E	79,0000 N	10,5
9	22.05.2005	09:40	11,4196 E	78,5890 N	7,5
10	22.05.2005	10:20	11,5630 E	78,5760 N	7,5

11	24.05.2005	08:45	01,5830 E	78,5990 N	12
12	24.05.2005	23:45	00,2534 E	79,3168 N	7
13	25.05.2005	08:35	02,0000 E	79,3000 N	12,5
14	25.05.2005	11:20	03,0001 E	79,2995 N	11
15	27.05.2005	09:00	08,4611 E	80,3245 N	5,5
16	27.05.2005	14:40	09,4670 E	80,3590 N	6
17	27.05.2005	16:50	09,4857 E	80,3758 N	5,5
18	27.05.2005	21:30	10,2200 E	80,2960 N	6,5
19	27.05.2005	23:10	11,0230 E	80,2225 N	7
20	28.05.2005	00:30	11,4310 E	80,1480 N	6,5
21	28.05.2005	01:40	12,2250 E	80,0740 N	7
22	28.05.2005	02:50	13,0030 E	80,0004 N	7,5
23	28.05.2005	06:30	10,2020 E	79,4500 N	9
24	28.05.2005	07:45	09,3460 E	79,5100 N	9
25	28.05.2005	09:15	08,5020 E	79,5690 N	7
26	28.05.2005	10:40	08,0680 E	80,0360 N	7
27	28.05.2005	12:15	07,2070 E	80,0960 N	6,5
28	28.05.2005	17:15	05,5850 E	80,1210 N	8
29	29.05.2005	03:55	04,5920 E	79,5240 N	8
30	29.05.2005	06:20	04,2970 E	79,4200 N	7,5
31	29.05.2005	19:30	06,0010 E	79,3020 N	7,5
32	29.05.2005	21:10	06,3030 E	79,3000 N	7
33	29.05.2005	22:35	07,0030 E	79,3000 N	7
34	29.05.2005	23:55	07,3040 E	79,3005 N	7
35	30.05.2005	01:10	07,5950 E	79,3000 N	6,5
36	30.05.2005	03:55	09,3010 E	79,3000 N	10
37	30.05.2005	04:45	10,0010 E	79,3000 N	11,5
38	30.05.2005	08:05	11,2580 E	79,0120 N	9
39	31.05.2005	9:50	0,4400 W	78,5900 N	7,5
40	31.05.2005	11:20	1,2291 W	79,0460 N	7

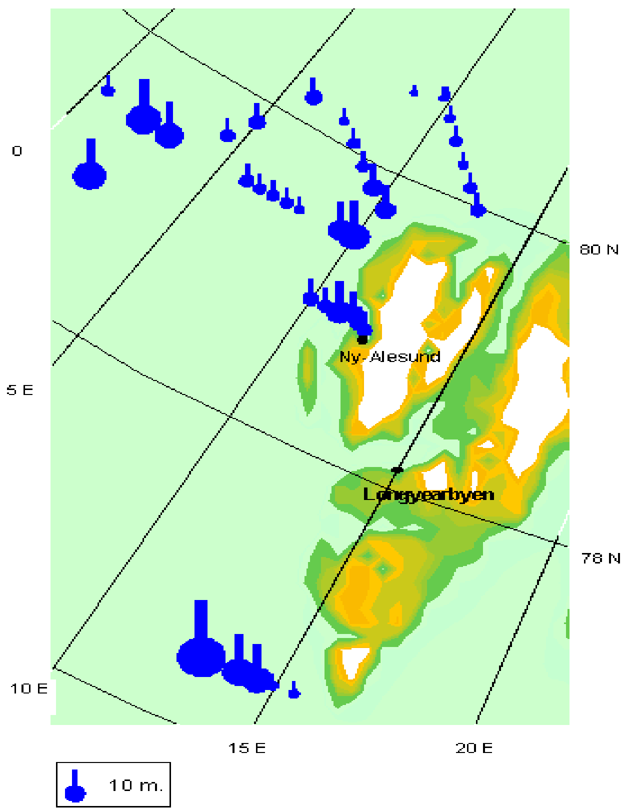
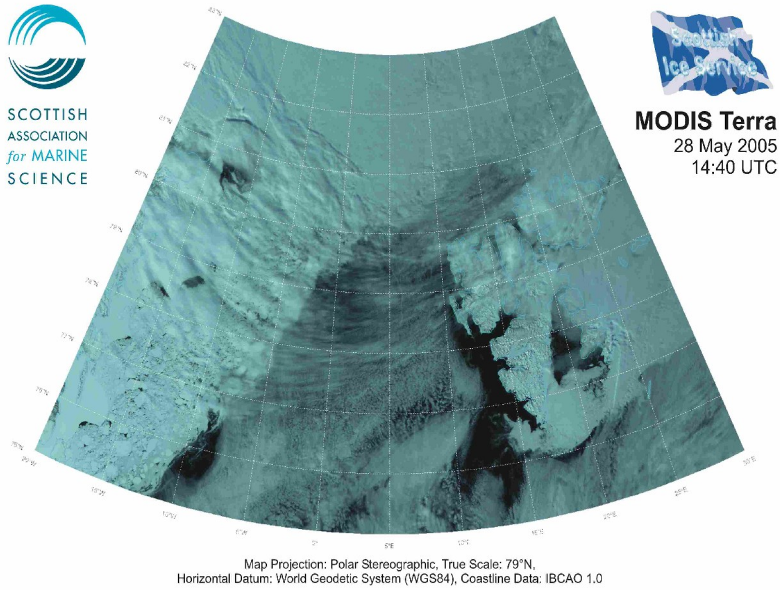
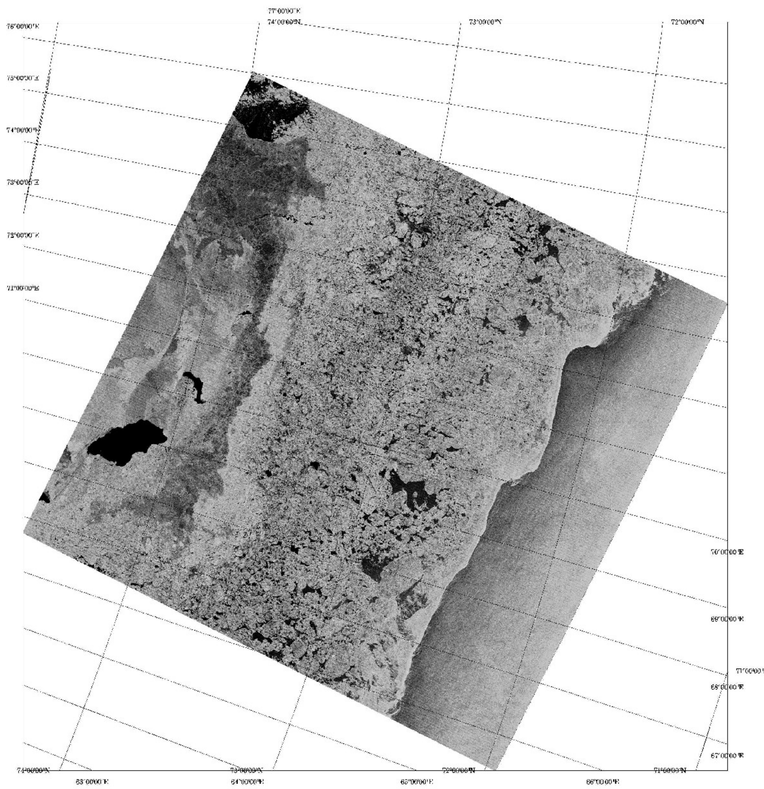


Fig. 29 Relative seawater transparency distribution.

Satellite imagery

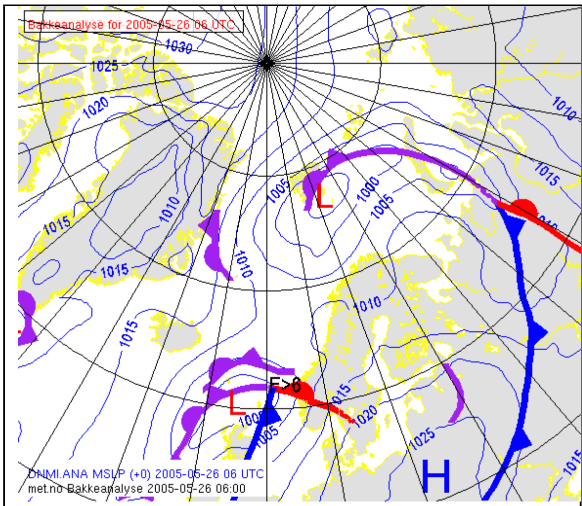
Processed MODIS satellite images were received daily from Nick Hughs from SAMS and were a useful tool for the daily operation of the cruise. Met.no provided daily ice charts useful for anticipating encounters with the sea ice edge and for planning ice stations. In addition we received Radarsat and Envisat high resolution SAR imagery for the area of operation. These were not available daily for the particular area Lance was operating in but were extremely useful for assessing ice conditions when entering the marginal ice zone. The SAR imagery was processed by Mohamed Keyse at NP

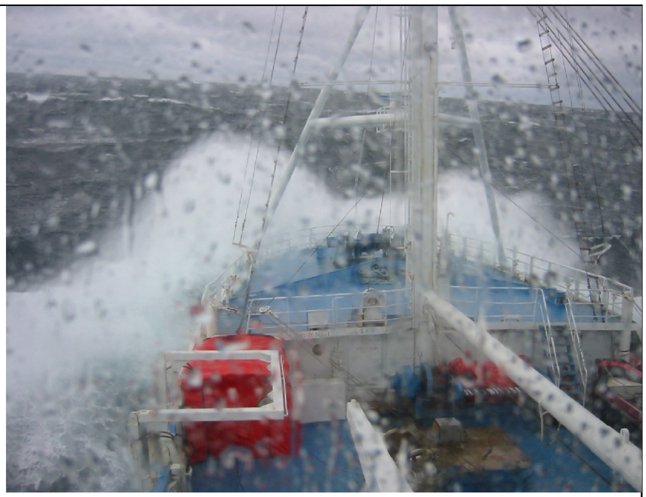




Meteorology

An automatic weather station is installed on Lance and logs data continuously. The system records air temperature, sea water temperature, humidity, wind speed and direction, and air pressure. During a period of bad weather we received synoptic weather forecast charts from met.no which helped in planning the next phase of the cruise. These charts would have been beneficial on a daily basis and should be acquired on future cruises.





Acknowledgements

We are very grateful for the excellent support and the splendid seamanship of the captain, officers and crew of Lance. Their professional conduct and willingness to help made this cruise extremely successful. In fact without their help we could not have accomplished our mission.