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Extract

Totally 36 icebergs were observed during the survey in the area between Hopen and Kong Karls Land. The majority of these icebergs were small and trapped in the landfast ice at Kong Karls Land. 4 Argos buoys were deployed, two on floating icebergs and two on grounded ones. The ice conditions were characterized by thin to medium first year ice. The amount of multi-year ice was negligible.

	Key words – English	Key words – Norwegian
Group 1	Environment	Miljø
Group 2	Ice	Is
Key words selected by author(s)	Barents Sea	Barentshavet
	Iceberg	Isfjell

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NOMENCLATURE

Ice reporting codes

CODE	TERMINOLOGY
BB	Bergy bit
C	Crack
CDPI	Consolidated pack ice
CPI	Close Pack Ice, 70%-90% ice
F	Floe
	* small (30-100 m across) * medium (100-500 m) * large (500 m - 2 km) * vast (2 - 10 km) * giant (over 10 km)
FI	Fast ice
FL	Flaw lead
G	Growler
GL	Glacier
HI	Hummocked ice
IB	Iceberg
IE	Ice edge
IF	Ice front
IS	Ice shelf
L	Lead
LAND	Land
LI	Level ice
NI	New ice
OPI	Open pack ice, 40%-60% ice
OW	Open water
R	Ridge
RI	Rafted ice
TB	Tabular berg
VCPI	Very close pack ice, close to 100% ice
VOPI	Very open pack ice, 10%-30% ice
YI	Young ice
FYI	First-year ice
SYI	Second-year ice
MYI	Multi-year ice
IC	Ice concentration
PI	Pancake ice

1. INTRODUCTION

In 1988 the Lisencees on the Norwegian Continental Shelf north of 62^0 latitude (OKN) started the Ice Data Acquisition Program (IDAP). Since then the Norwegian Polar Research Institute (NP) and SINTEF Norwegian Hydrotechnical Laboratory (SINTEF NHL) have carried out a buoy deployment project every year as a part of IDAP.

The activities within this project are carried out according to guidelines from the IDAP Committee through MOBIL Exploration Norway Inc., and this cruise report gives a preliminary description of the survey in the Barents Sea from 8 March to 19 March 1991. The objective of the IDAP 91 Vessel Deployment Project is to obtain data on iceberg movement through the deployment of 10 ARGOS buoys on selected icebergs in the Barents Sea south of N79^0 and in particular in the region between Kong Karls Land and Hopen. Additional data to be obtained should include:

- iceberg length, width and height along with estimated position of all icebergs encountered
- multi-year ice floe dimensions and estimated position
- general ice conditions along the vessel track

If time and buoy deployment activities allowed, iceberg temperature data to a depth of 10 m as well as iceberg underwater profiles were to be obtained.

The plan was to take the R/V LANCE north around E30^0 as far as we could reach towards Kong Karls Land and to use the Bell 212 helicopter on board to search regions further north.

Prior to the survey IDAP carried out two aerial reconnaissance flights in the area of investigation with a fixed wing aircraft from Longyearbyen. The objectives were to obtain data on the locations of icebergs and to find the best route for the ship through the ice field.

The field work was carried out by 9 expedition members including personnel from the Institutes, IDAP oil companies together with invited representatives from FORUT and Norwegian Petroleum Directorate (Appendix C). Like the previous years the expedition vessel was R/V LANCE from the Norwegian Hydrographic Services. The Captain was Jan Olsen. The helicopter operated from the vessel was a Bell 212 from Lufttransport with Dagfinn Robertsen as pilot.

The vessel started from Tromsø 8 March 1991 and returned to Tromsø on 19 March 1991. Totally 8 days were spent in the ice, 4 of these days the helicopter was grounded due to low visibility.

The number of icebergs encountered during the survey was small, though we observed more icebergs compared to last year's survey in the same area. Similar to last year, most of the icebergs were observed in the area around Kong Karls Land. Totally four buoys were deployed. Two more candidate icebergs for buoy deployment were identified when a low-pressure area southeast of the vessel gave prevailing northeastly winds with snow showers. The low visibility grounded the helicopter for nearly four days and no more buoys were deployed.

The other buoys will be deployed later this year.

2. FIELD OPERATIONS

2.1. Activities day by day

As mentioned earlier the first ice was encountered in the afternoon 9 March at N74°30' E24°35'. From this position we set course north-east, and the next day we had two ice reconnaissance missions, mission #1 and #2, see Figures 4.2 and 4.3. With very good visibility a considerable area was covered during these two flights, and two candidate icebergs for buoy deployment were observed. In the meantime we observed a small iceberg from the ship, entered it and performed Iceberg Station 1.

Before breakfast on 11 March we were at N77°00' E30°10'. We had advanced only 10 n.miles during the night. Two helicopter missions were carried out also this day, mission #3 was ice reconnaissance east and north to 78° latitude, on mission #4 we deployed PTTs 7085 and 7086 on icebergs 2 and 3 respectively. The air temperature had dropped below -20°C and gave rapid ice formation which made it more difficult for the vessel to navigate through the ice. At the end of the day the captain therefore had a nearly 1 hour flight to find the best way to navigate further north. At 0930 PM we stopped for the night at N77°13' E32°14'.

On 12 March helicopter mission #5 covered the area to Kong Karls Land and east to E33°. About 15 icebergs were located during this mission, all at Kongsøya and Abeløya. On mission #6 the same day we deployed PTT 7088 on iceberg #15 at Abeløya. The iceberg was grounded, and there was active ridging towards the berg during the deployment. After deployment we planned to fly ice reconnaissance directly to Hopen. On this leg we observed a big tabular iceberg south of Svenskøya. Due to a lot of head wind we had to change plans and go to LANCE to refuel before going to Hopen. We stopped for the night at N77°39' E32°07'. During the following night we drifted a few n.miles south, and we never got any further north than this with the ship.

On 13 March mission #8 went to Abeløya again where we deployed PTT 7089 on iceberg #10 about 3 n.miles south of the iceberg carrying PTT

7088. This berg was also grounded, and the FORUT representative obtained a 4" core which was brought back to the LANCE. After deployment we headed towards Svenskøya to locate the candidate iceberg from the previous day. We observed 12 new icebergs on this day, most of them in landfast ice at Kongsøya and Tirpitzøya. Iceberg #27 was big and had a maximum freeboard of about 30 m, but it was not considered a candidate since it appeared to be grounded in landfast ice. Only about 2 n.miles further south we observed iceberg #28 which was floating. We planned a mission later the same day to deploy a buoy on this iceberg, but when returning to LANCE the visibility went down, and the helicopter was grounded for the next three days.

During these three days a very stable low pressure area southeast of us gave a constant NE wind from 20 to 50 knots with snow showers and drifting snow which reduced the visibility. To navigate through the ice field under such conditions is difficult, relying only on the radar to find passages. We were partly drifting with the ice, partly navigating towards west. From late 15 March we were beset for about 18 hours until we cleared some of the ice alongside the ship. In the afternoon on 16 March we were beset again and had to remove some ice to get loose. At this time we had started to navigate towards open water east of Hopen.

On 17 March we had visibility to fly again, and mission #9 went to Svenskøya to deploy at least one buoy. Iceberg #28 had drifted and could not be relocated. The helicopter was doing ice reconnaissance towards Stonebreen, but the visibility was not good enough, and the mission continued to Longyear. On the way back to the ship the helicopter came via Tusenøyene and stopped at Hopen to refuel. West of Hopen iceberg #36 was observed, but this berg was too small for a buoy deployment. LANCE reached the open water at N76^{0}29' E29^{0}51' on the afternoon and sailed along the ice edge about 1 hour while waiting for the helicopter to return. During this hour we observed probably several hundred seals along the very distinct ice edge. The ship was back in Tromsø at 0600 on Tuesday 19 March 1991 after 11 days.

The FORUT representative carried out a number of ice floe stations to sample cores and classify the ice. A brief description of this field work is presented in Appendix D.

2.2. Track of vessel

On our way to the area of investigation between Hopen and Kong Karls Land the first waypoint was at N75°00' E25°00' to check which ice map was more correct, the DNMI map or the SSMI map, see Section 3.1.

After having encountered the ice edge at N74°30' E24°35' at 1830 on 9 March, the course was set towards N77°00' E31°00' where the ice conditions along E31°00' during the ice reconnaissance flight prior to the survey seemed to be most favourable for navigation towards Kong Karls Land. The intent was to reach the thin ice area at the southern side of Kong Karls Land, then go west towards Stonebreen and south on the western side of Hopen.

The ship's track is presented in Figure 2.1, and we can see that the vessel came as far as N77°35' E31°54'. At this time the temperature was -29°C, the ice was growing very rapidly and the vessel was not able to advance further north. Leads and refrozen leads were mostly going in east-west direction, some in northwest - southeast direction, but with northeasterly strong winds it was considered unwise to head further west along these leads.

The next few days the ship was mostly drifting with the ice in a southwesterly direction until it was time to start moving out of the ice towards southeast. On our last day in the ice the visibility was good enough to fly and the helicopter had a mission to Svenskøya to deploy a buoy on an identified iceberg. This iceberg had drifted into an area with reduced visibility and the helicopter had to return without deploying the buoy.

The ship reached the ice edge at N76°29' E29°51' in the afternoon on 17 March.

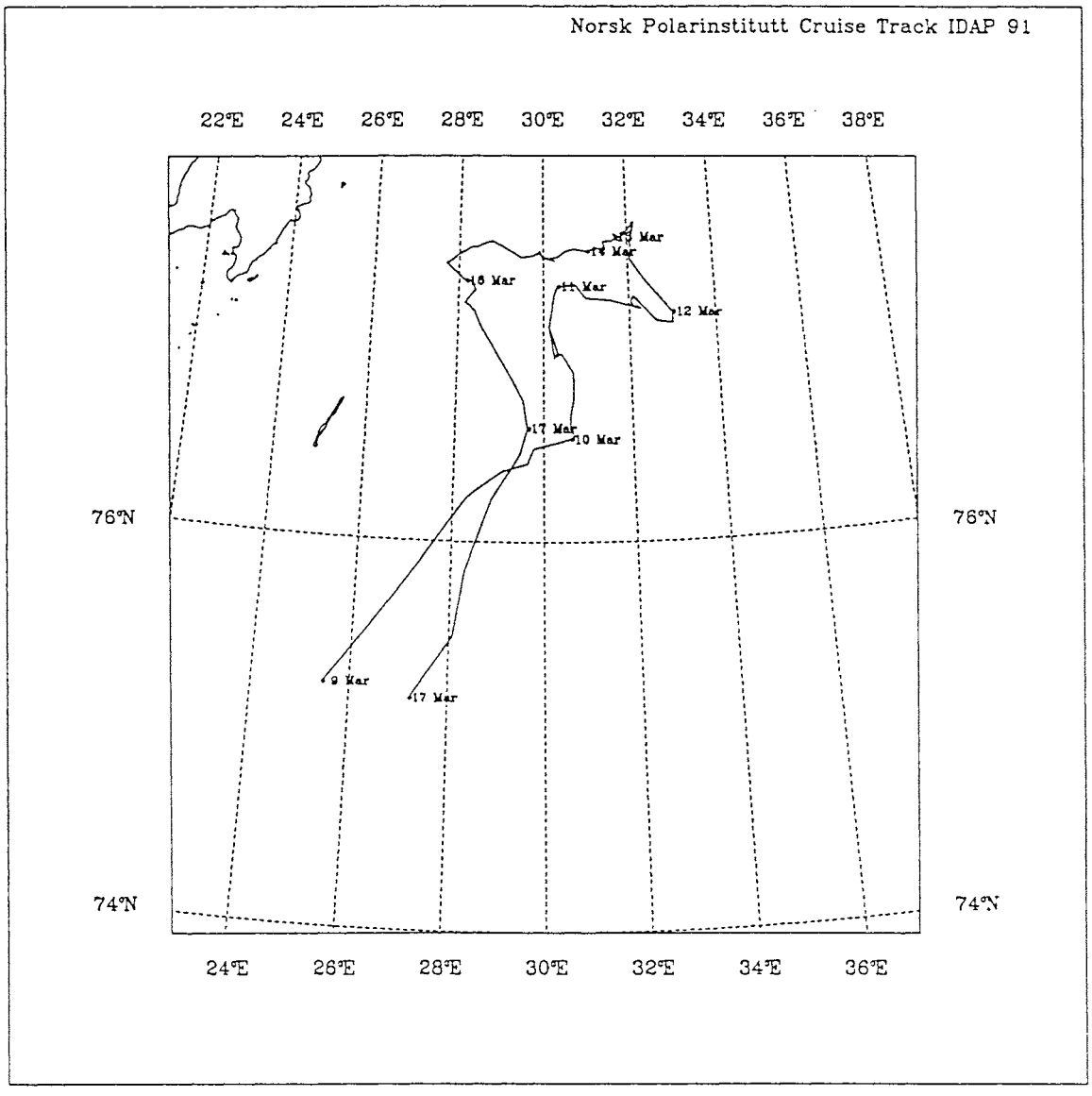

Figure 2.1. Track of the vessel.

2.3. Helicopter missions

Totally 9 helicopter missions were carried out during the expedition, see Table 2.1. During the three days from mission #8 to mission #9 helicopter operations were hindered by low visibility. Tracks of the helicopter missions are shown in Figures 2.2 - 2.9, except mission #7 which went to Hopen and back to the ship. Figure 2.10 shows all the tracks in one plot.

Table 2.1. Helicopter missions during IDAP91 Vessel Deployment.

MISSION #	DATE	MAIN OBJECTIVE
1	10 March	Ice reconnaissance towards Hopen and north to 78° latitude
2	10 March	Ice reconnaissance east towards 35° longitude
3	11 March	Ice reconnaissance east and north to 78° latitude
4	11 March	Deploy PTT 7085 and PTT 7086
5	12 March	Ice reconnaissance to Kong Karls Land and eastwards
6	12 March	Deploy PTT 7088 at Abeløya and ice reconnaissance towards Hopen
7	12 March	Ferry to Hopen
8	13 March	Deploy PTT 7089 at Abeløya and ice reconnaissance towards Svenskøya
9	17 March	Deploy PTT 1794 at Svenskøya, ice reconnaissance Stonebreen, ferry to Longyearbyen

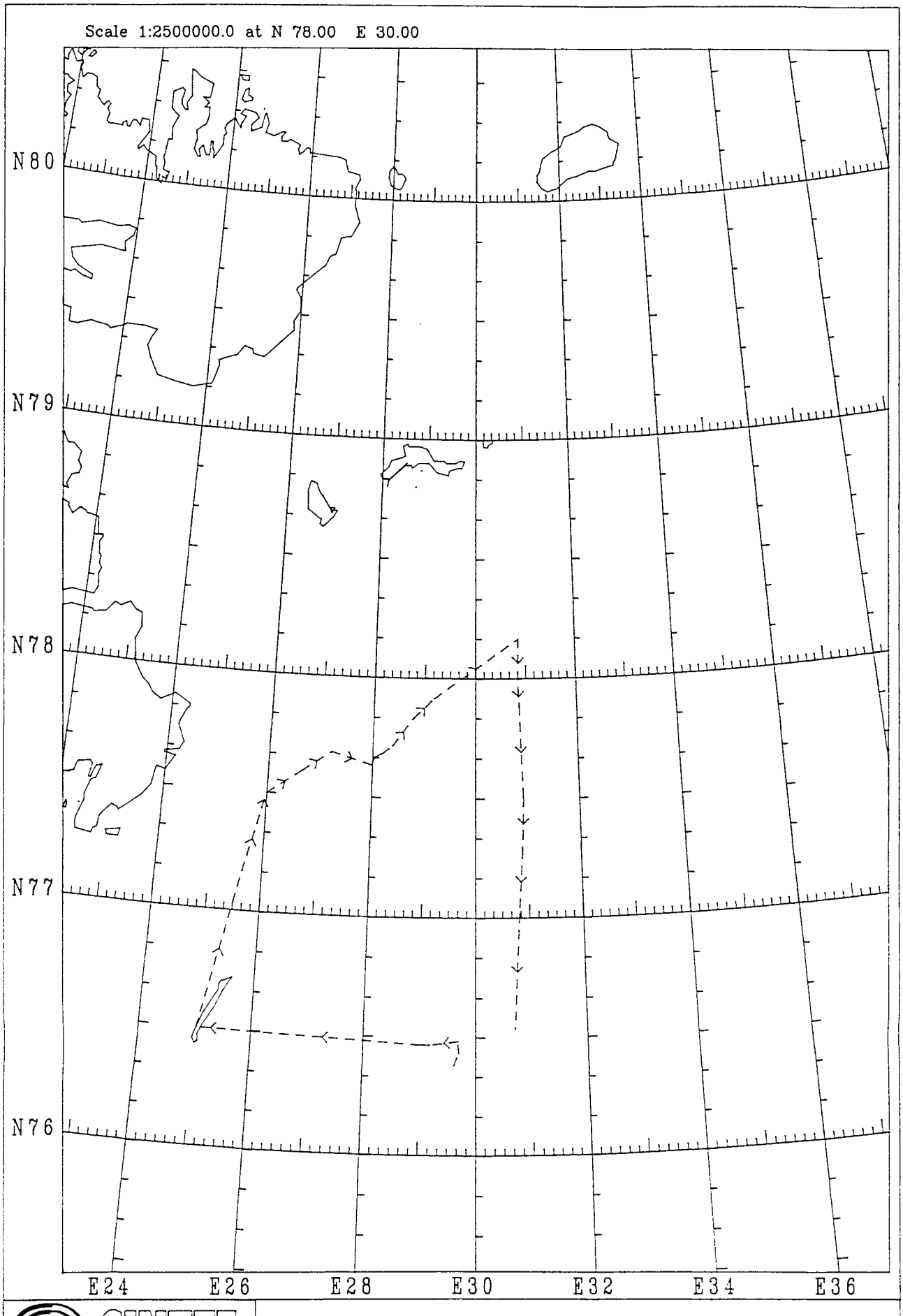

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Figure 2.2. Helicopter mission #1, 10 March 1991.

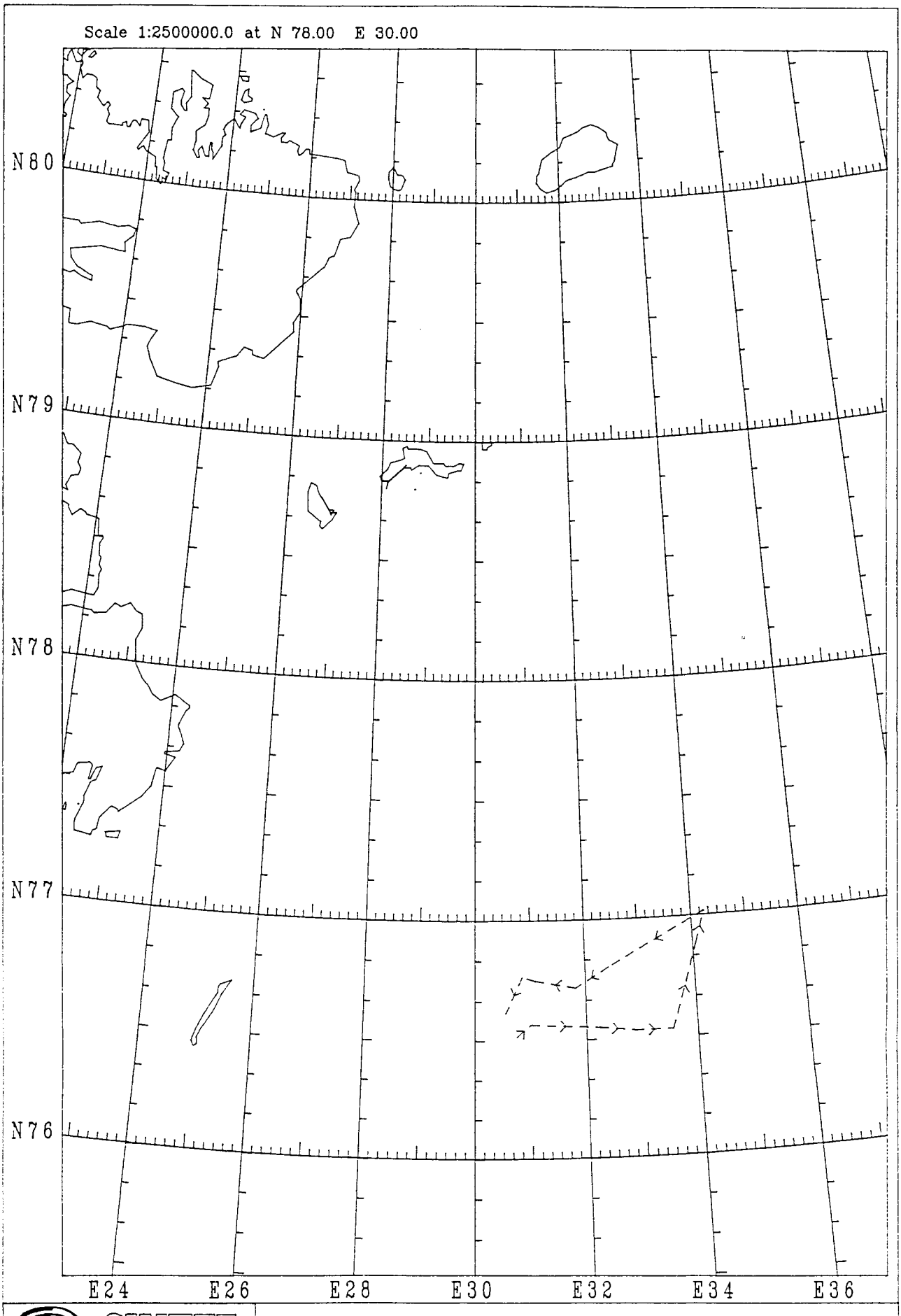

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Figure 2.3. Helicopter mission #2, 10 March 1991.

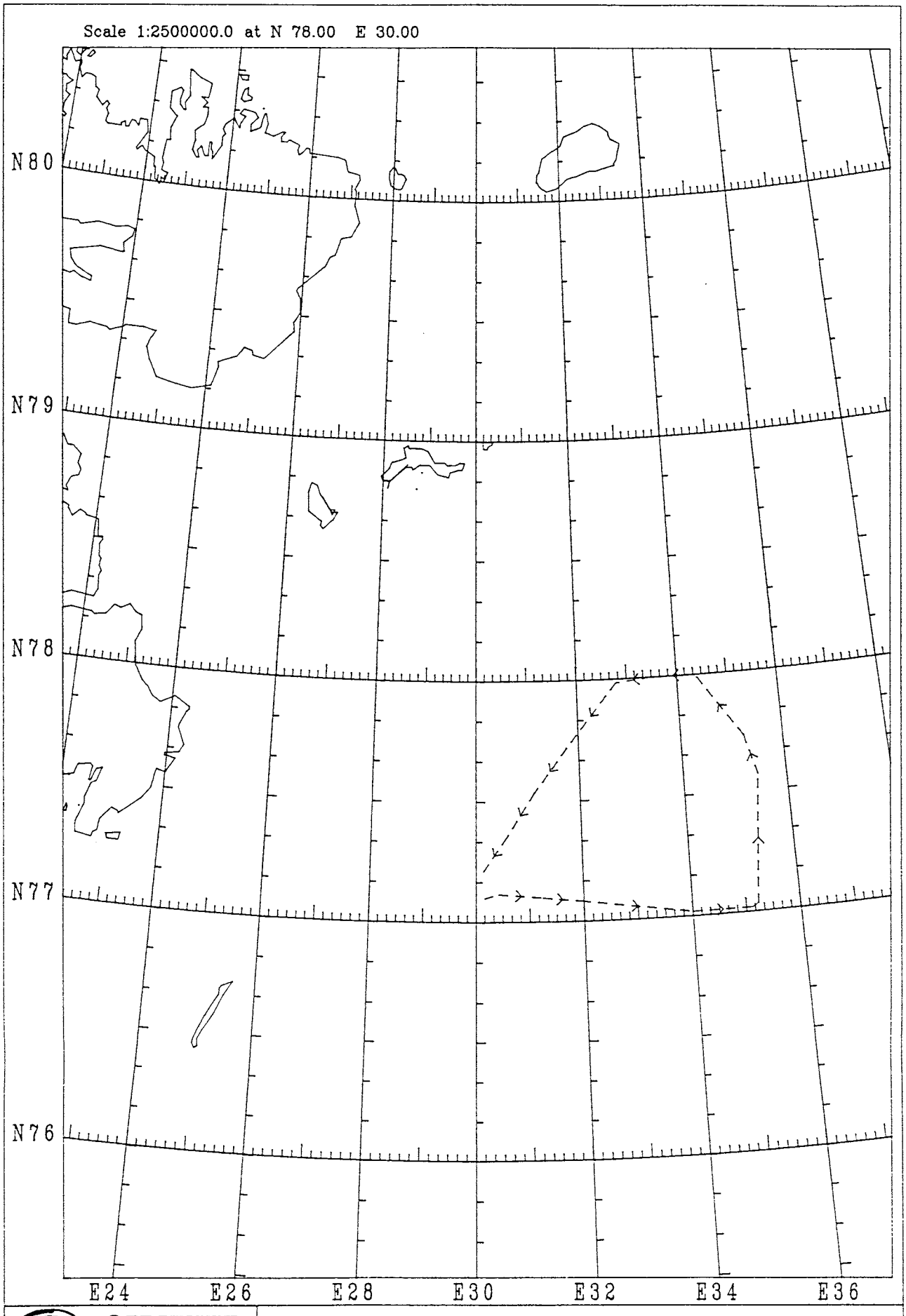

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Figure 2.4. Helicopter mission #3, 11 March 1991.

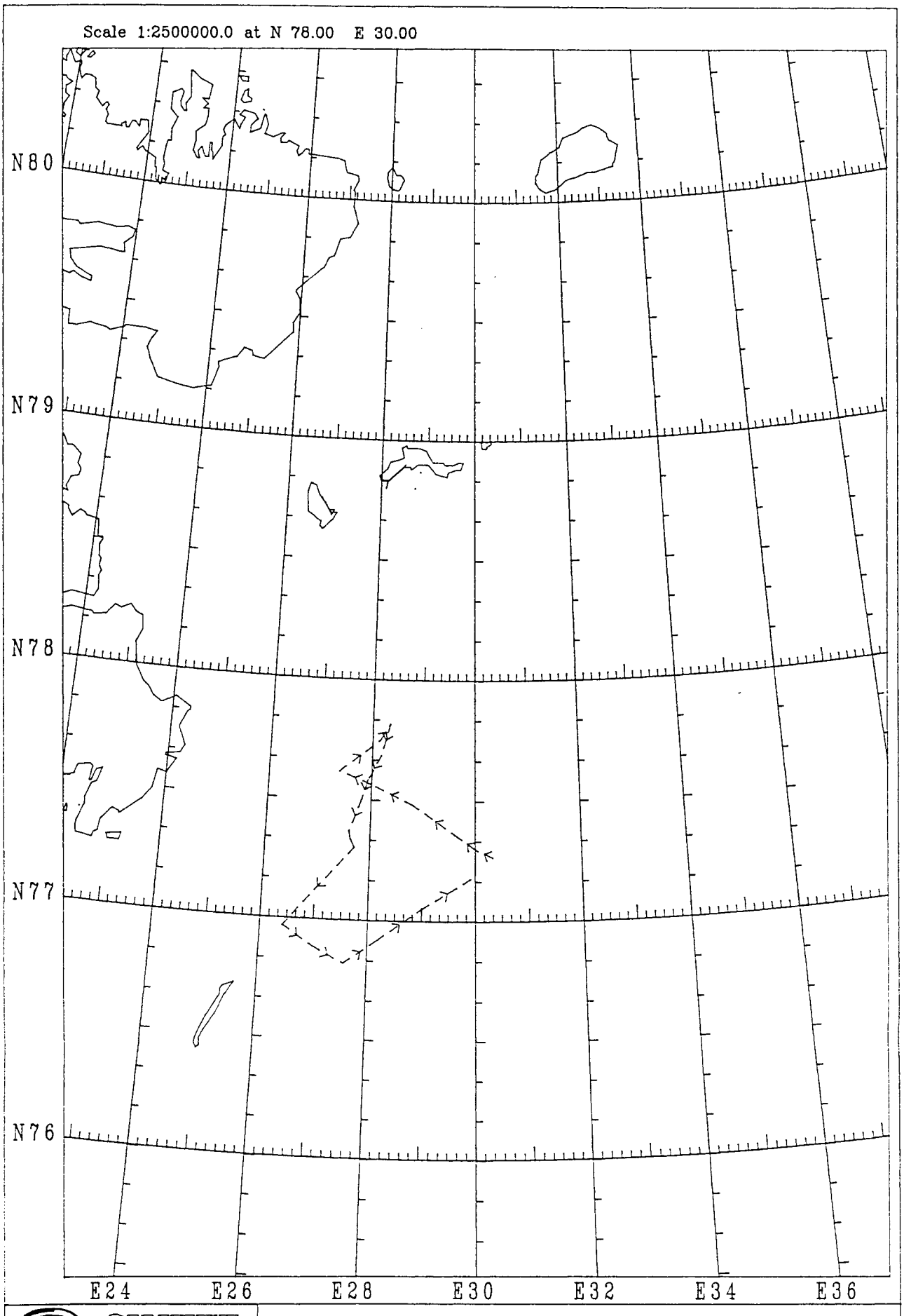

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Figure 2.5. Helicopter mission #4, 11 March 1991.

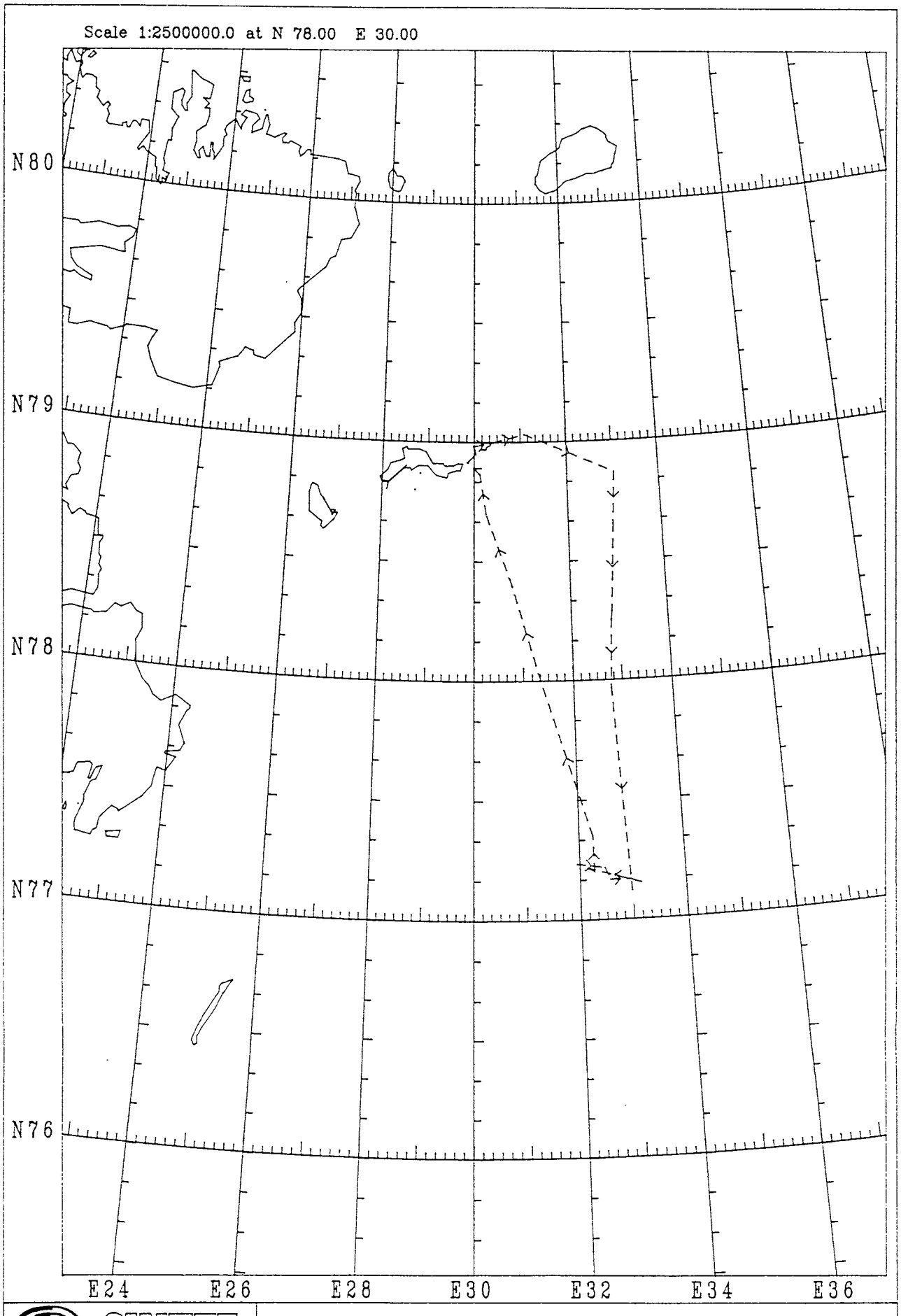

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Figure 2.6. Helicopter mission #5, 12 March 1991.

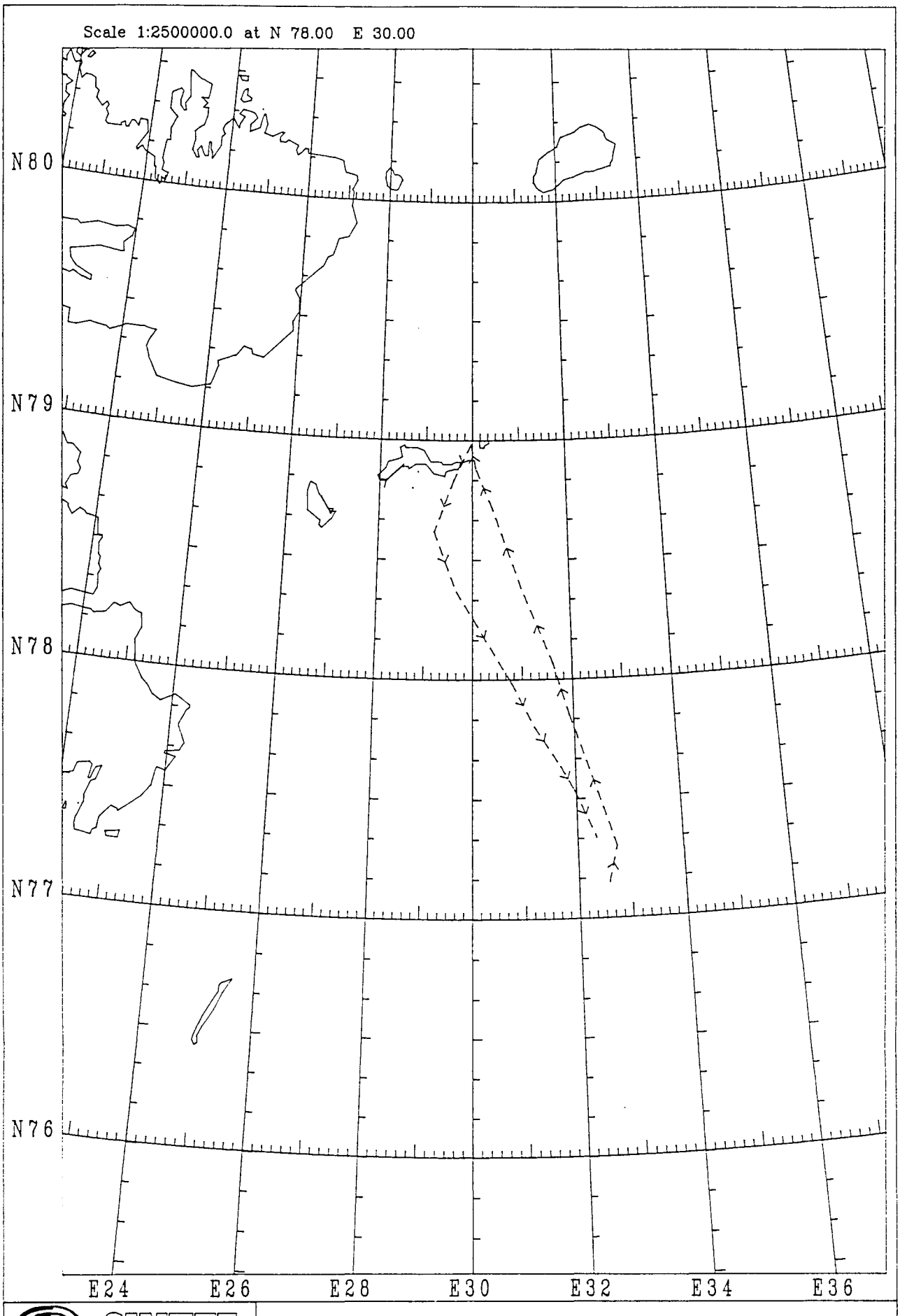

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Figure 2.7. Helicopter mission #6, 12 March 1991.

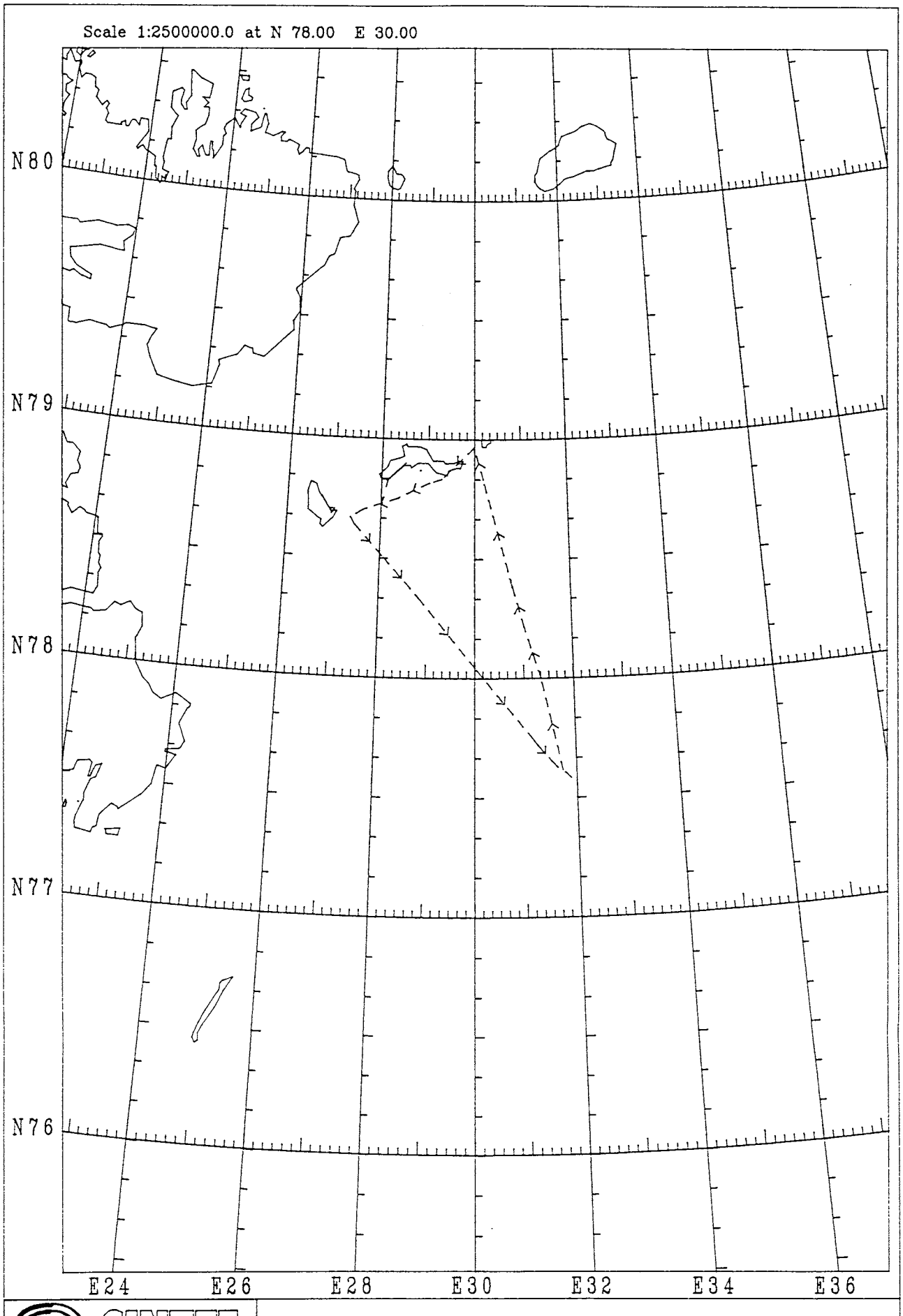

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Figure 2.8. Helicopter mission #8, 13 March 1991.

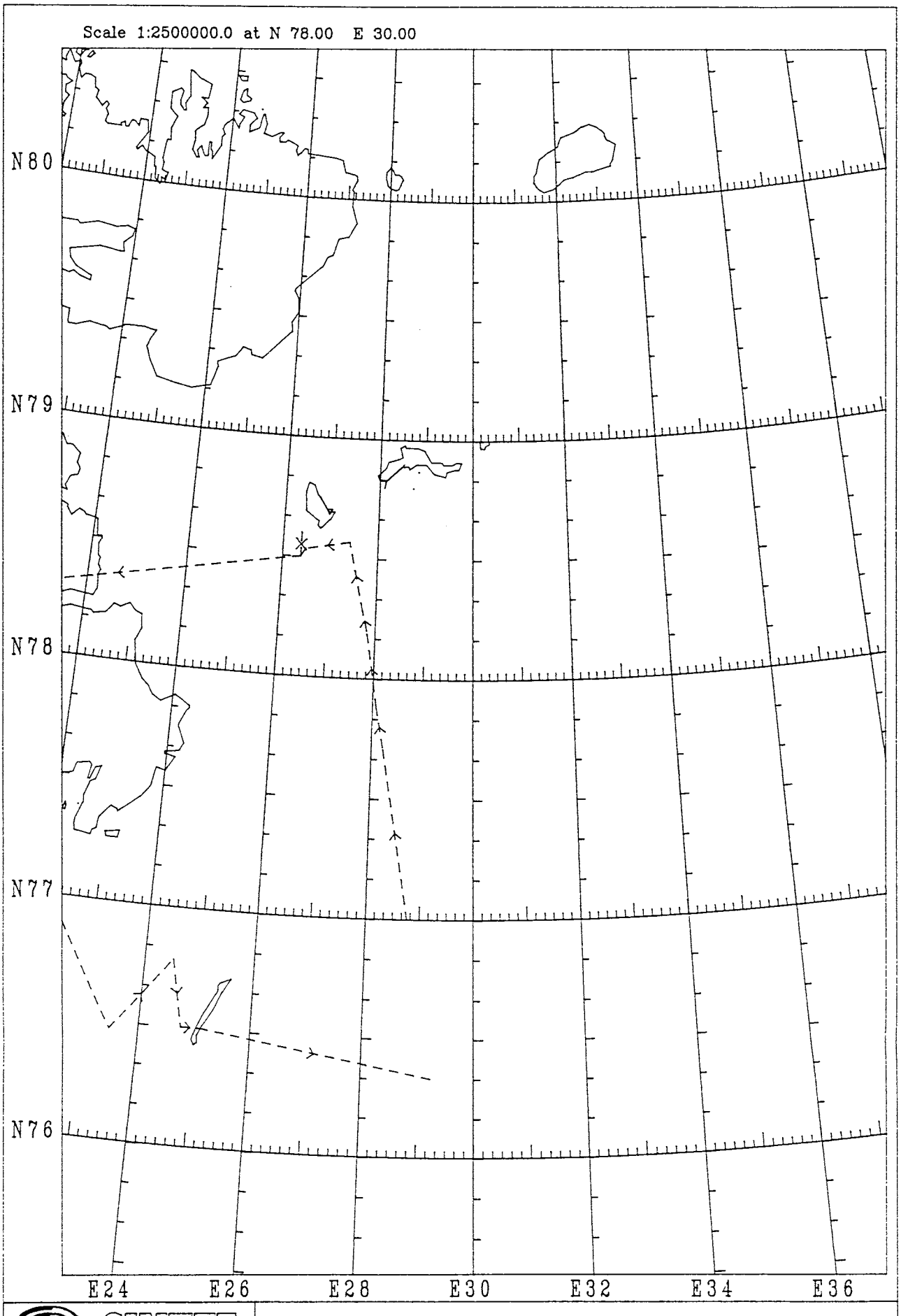

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Figure 2.9. Helicopter mission #9, 17 March 1991.

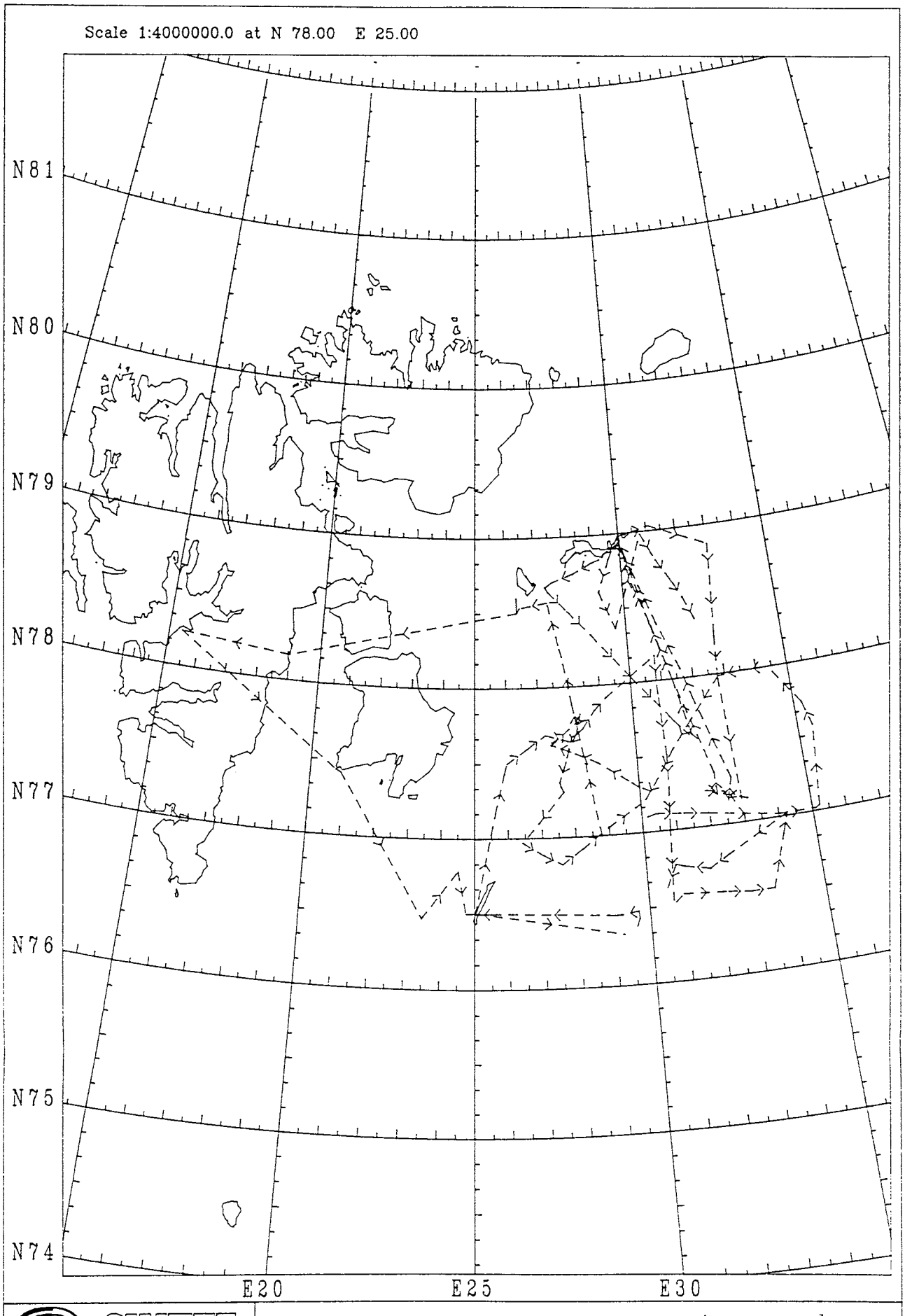

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Figure 2.10. Tracks of all ice reconnaissance and deployment missions with the helicopter during the expedition.

3. ICE CONDITIONS

3.1. Ice conditions prior to the survey

There was very low ice production in the Barents Sea during the winter season 1990/91 prior to the survey. The maximum ice thickness at Hopen reported by the DNMI ice maps was 20 cm, and most of the time the ice edge was far north. As shown in Figure 3.1 the DNMI ice map issued 4 March 1991 reported the ice edge from Tusenøyane, via Hopen and straigth east. SSM/I maps from 4 March worked out by the Cress Microwave Group at York University in Canada reported a very different ice edge in the western part of the Barents Sea, see Figure 3.2.

3.2. Ice conditions during the survey

Ice observations were obtained along the ship's track and during all helicopter missions. The first ice we encountered on our way north was pancake ice. As we moved further north, the ice field along the ship's track consisted mostly of small to medium first-year ice floes, 20 - 100 m diameter, thickness of level ice generally in the range 30 - 80 cm. Maximum ice thickness measured at ice stations was 1.3 m except for floes that had been subject to rafting. At one ice station the floe was rafted, and the ice thickness was 2.1 m. The amount of multi-year ice was very small.

Large areas of open water were observed south of Kong Karls Land during the reconnaissance flight prior to the survey. With low temperatures and rapid ice formation during the navigation north, the LANCE was not able to advance further than N77^{0}39'. Still the ice thickness was only 30 - 60 cm in the area. When flying north on 13 March, a lot of ridges had formed since the day before. These ridges consisted of ice 30 - 60 cm with a sail height about 1 m. At the same time the ice field appeared more or less continuous from N77^0 and north.

SSM/I data were obtained twice during our stay in the ice. These data helped the navigation, but would have been more useful if we were able to receive this information by fax onboard the ship.

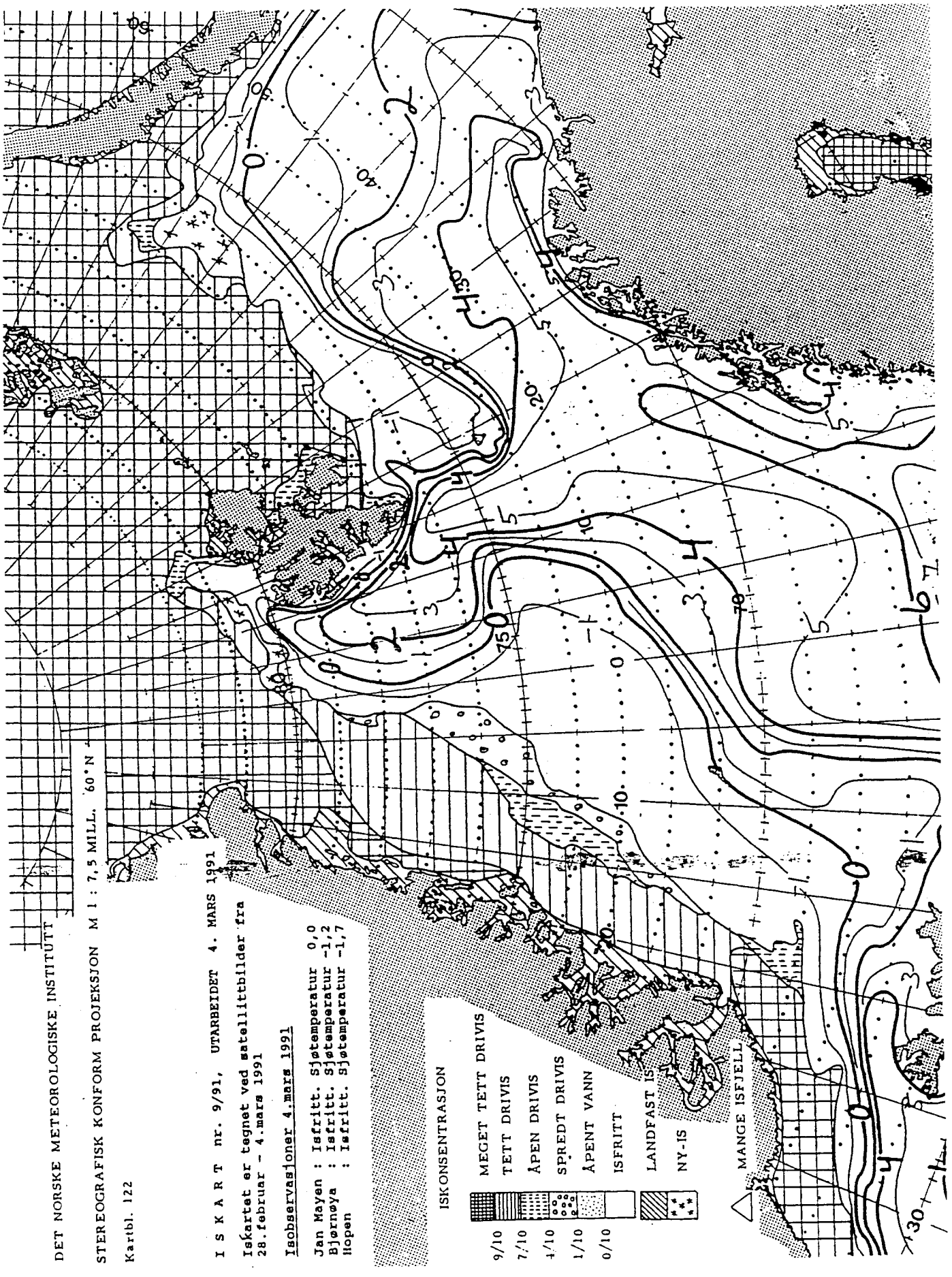

Figure 3.1. DNMI ice map issued 4 March 1991.

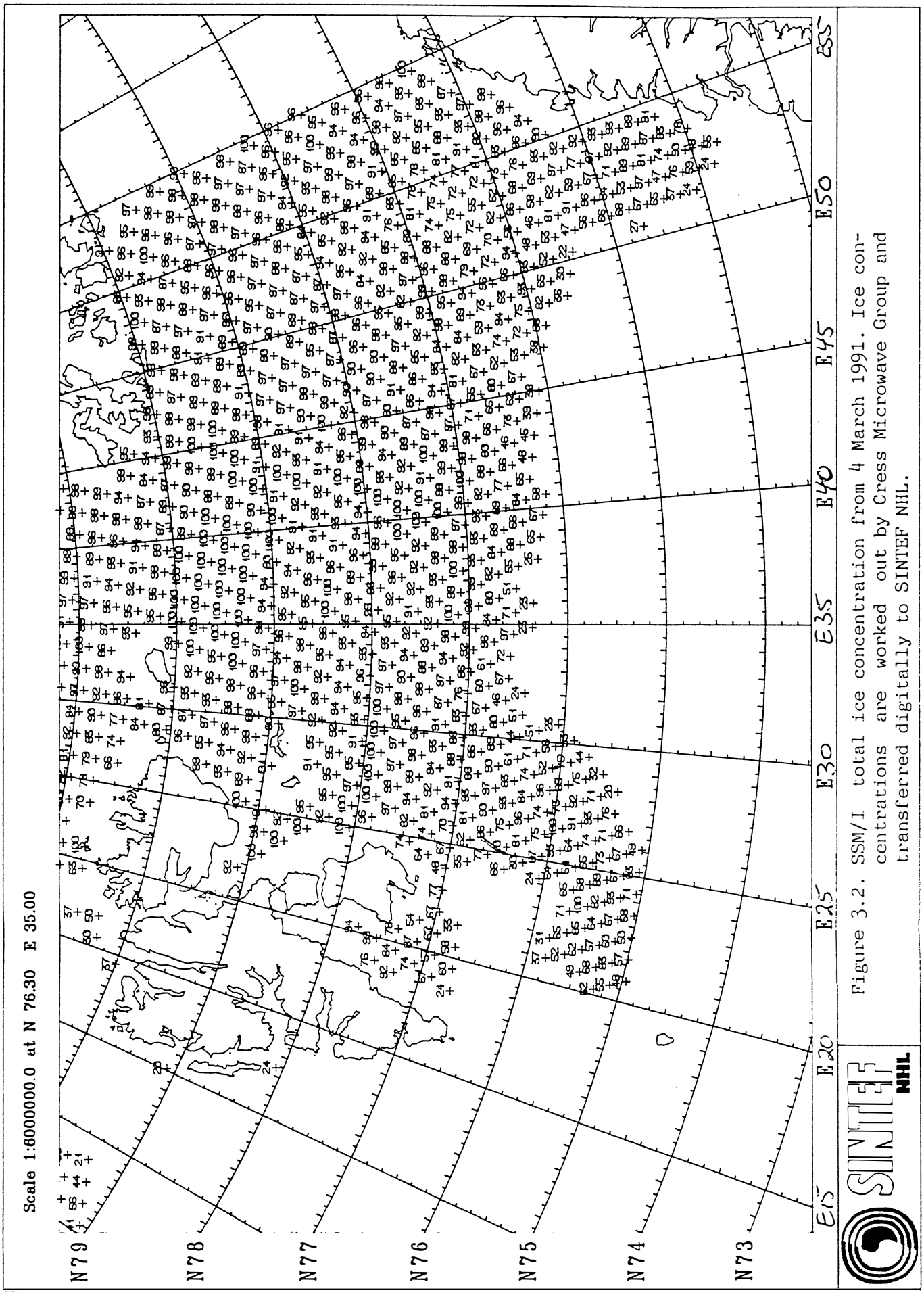

Figure 3.2. SSM/I total ice concentration from 4 March 1991. Ice concentrations are worked out by Cress Microwave Group and transferred digitally to SINTEF NHL.

4. ICEBERGS

4.1. Iceberg observations

Totally 36 icebergs were observed during the survey, nearly all from the helicopter. The icebergs are listed in Table 4.1 where all multiple observations have been removed. The positions are plotted in Figure 4.1, and we can see that most of the icebergs were located at Kong Karls Land.

The number of iceberg observations is more than 50 % greater than during the April 1990 IDAP field campaign in the same area, but a lot of the icebergs are small and grounded in landfast ice.

4.2. Iceberg stations

Figures 4.2 - 4.6 show the main characteristics of the icebergs visited during the 5 iceberg stations. Station 1 proved to be the only iceberg entered from the ship during the survey. Here we obtained a temperature profile to 6 m depth, but at such an early stage we were eager to move further north, hence we did not stop for any underwater sonar profiling of the iceberg. The other icebergs were entered by helicopter. At these stations we had only short stops to deploy Argos buoys.

Table 4.1. Icebergs observed during the survey.

ICEBERG OBSERVATIONS

Iceberg #	Position N deg.min	Position E deg.min	Mission #	Max. height (m)	Max. length (m)	Max. width (m)	Shape	Water depth (m)	Comments
1	76.32	30.42		10	30	15	W	250	IB station 1
2	77.38	27.59	1,4	25/10	300	140	T	120	PTT 7085, IB st. 2
3	77.50	28.47	1,4	10	110	60-70	T	250	PTT 7086, IB st. 3
4	77.30	27.48	4	8	40	30		160	
5	77.18	27.42	4	8	60	40	T	200	
6	77.22	27.35	4				Irreg.	200	Small
7	78.52	30.07	5,6	8	75	50	T,tilted	100	
8	78.55	30.15	5	7	40	35	T	50	
9	79.00	30.25	5	8	80	50	T,tilted	20	
10	78.56	29.59	5,8	15	200	80	T	20	PTT 7089, IB st. 5
11	78.55	29.53	5					30	
12	78.59	29.50	5					80	
13	78.57	30.02	5					50	
14	78.58	29.58	5	10	60	50	T	50	
15	78.59	29.59	5,6	7-15	150	110	T,tilted	100	PTT 7088, IB st. 4
16	79.00	30.25	5					10	
17	78.51	29.27	5,8	5	20	20		10	In landfast ice
18	78.51	29.32	5,8	8-10	30	30	T	20	In landfast ice
19	78.52	29.36	5,8					20	Small, in landfast ice
20	78.52	29.40	5,8	10	50	20	T	10	In landfast ice
21	78.56	29.33	5,8				P	50	Small, in landfast ice
22	78.44	28.27	8					70	Small, in landfast ice
23	78.44	28.27	8					70	Small, in landfast ice
24	78.44	28.27	8					70	Small, in landfast ice
25	78.44	28.27	8					70	Small, in landfast ice
26	78.45	28.20	8					70	Small, in landfast ice
27	78.40	27.21	8	30	100	90	T,tilted	110	Grounded, in landfast ice
28	78.38	27.27	8	8-10	120-150			130	
29	78.47	27.50	8					50	Small, in landfast ice
30	78.47	27.55	8					50	Small, in landfast ice
31	78.47	28.00	8					50	Small, in landfast ice
32	78.47	28.05	8					50	Small, in landfast ice
33	78.47	28.10	8					50	Small, in landfast ice
34	78.37	26.30	9				T,tilted	45	Small, in landfast ice
35	78.37	26.25	9	7-8	40	40	P	45	In landfast ice
36	76.35	24.45	9	8	20	15	P	20	In landfast ice

W: weathered T: tabular P: pinnacle

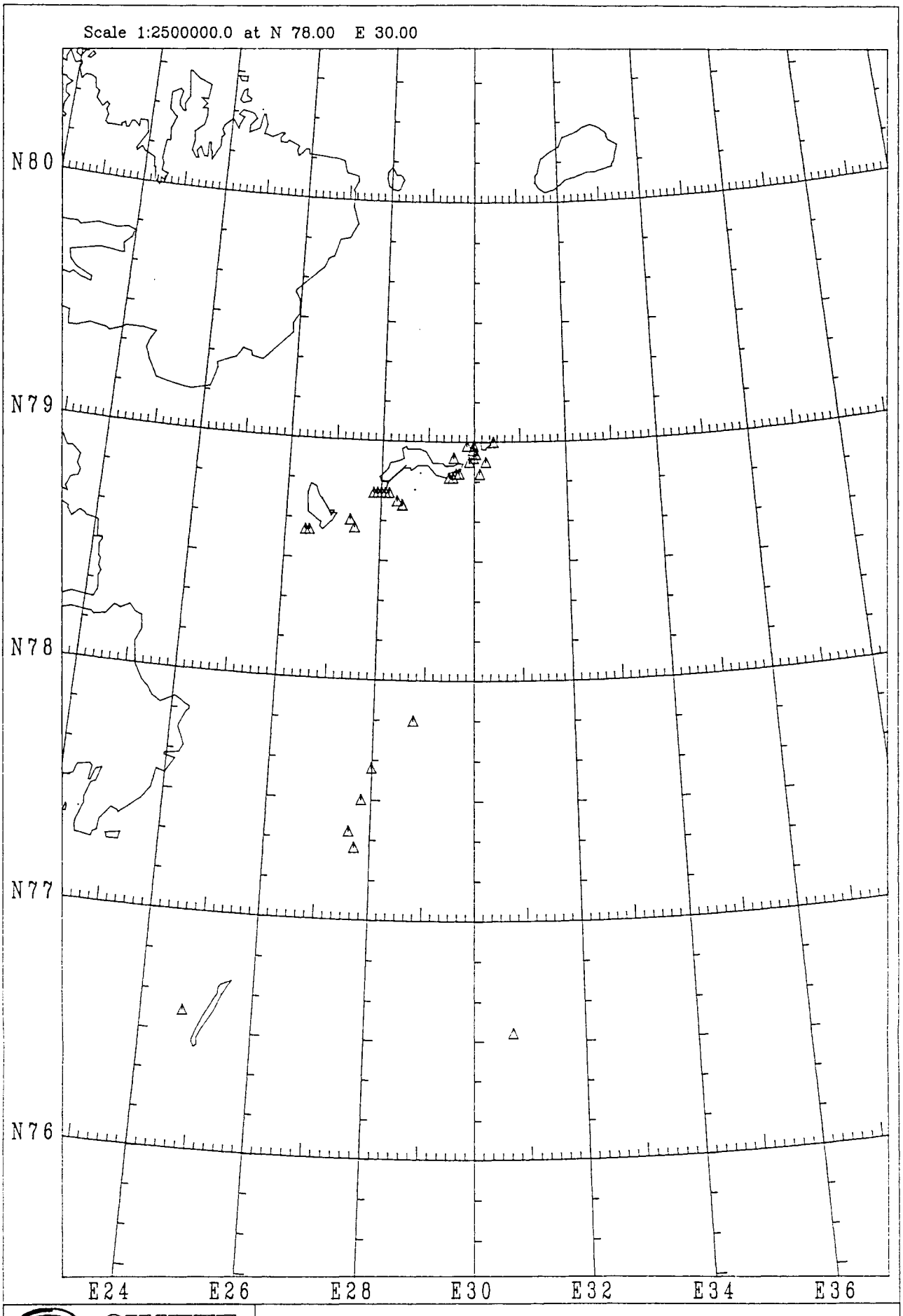

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Figure 4.1. Icebergs observed during the survey.

ICEBERG STATION 1

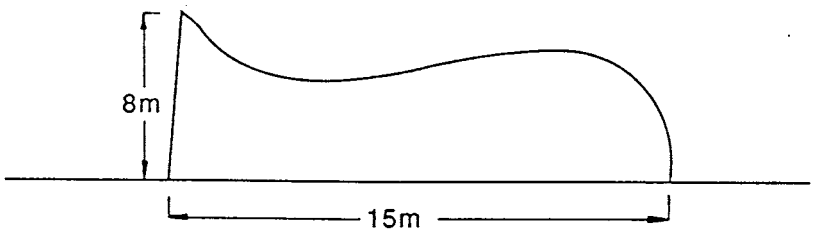
Iceberg #	1
PTT	
Date	10-mar-1991
Time	14:00
Latitude	76.32
Longitude	30.42
Length	30
Width	15
Freeboard	8
Snow cover	0.03
Water depth	300
Air temp.	
Snow temp.	

Comments:
(photo)

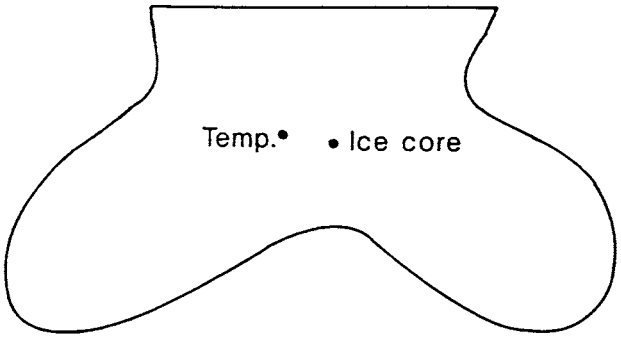
Only 2-3 cm of light snow, drill site is possibly the previous keel of the iceberg.

Shallow cores were sampled by the FORUT representative.

Profile

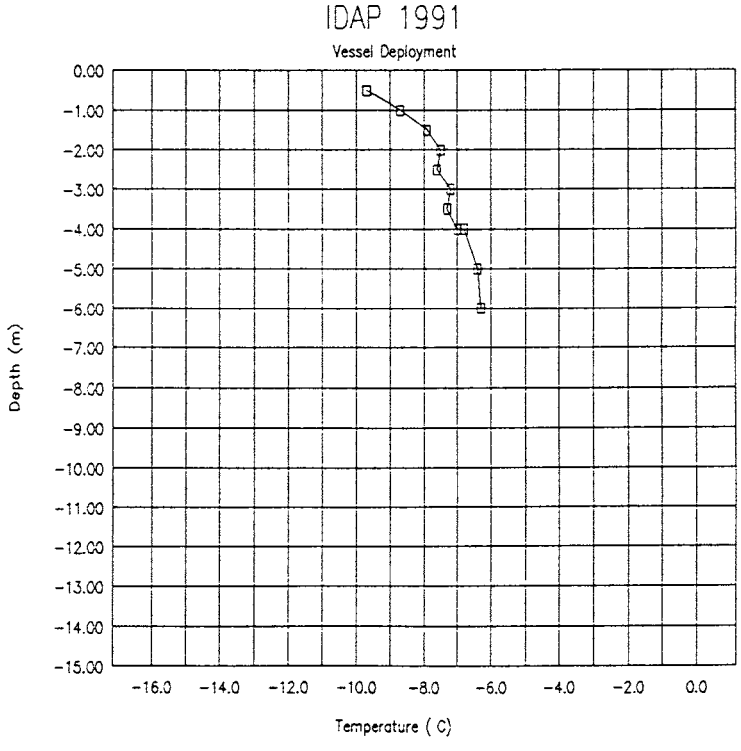


Sketch



Depth	Sensor	Temperature
-0.5	1	-9.7
-1.0	1	-8.7
-1.5	2	-7.9
-2.0	1	-7.5
-2.5	2	-7.6
-3.0	1	-7.2
-3.5	2	-7.3
-4.0	1	-7
-4.0	2	-6.8
-5.0	1	-6.4
-6.0	2	-6.3

Temperature profile



Temperatures measured from 3 drill holes: H1,H1,H2,H1,H3,H2,H1,H3,H2,H1,H3
Temperature measurements stopped at 6.0 m due to water in temperature holes.

Figure 4.2. Icebergs Station 1, 10 March 1991.

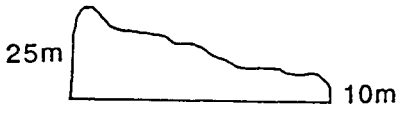
ICEBERG STATION 2

Iceberg #	2
PTT	7085
Date	11-mar-1991
Time	13:30
Latitude	77.37
Longitude	27.22
Length	300
Width	140
Freeboard	25
Snow cover	0.30
Water depth	120
Air temp.	-18
Snow temp.	

Comments:
(photo)

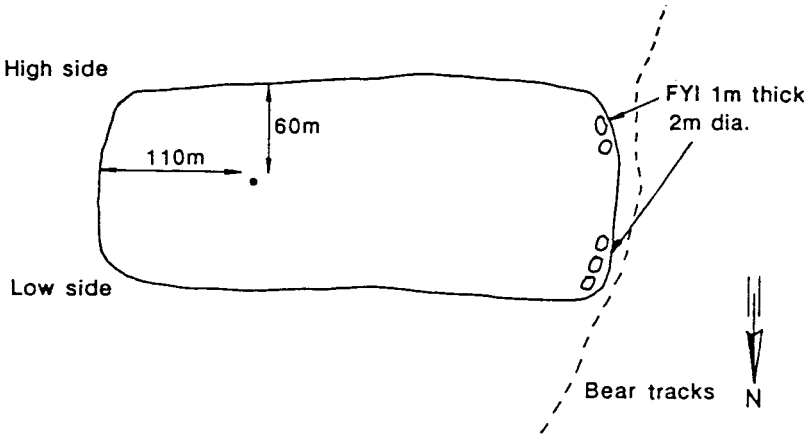
Hmin = 10 m
Sea ice on top,
2 m wide,
1 m thick

Profile



Surface had many bumbs on it and was uneven.

Sketch



Depth	Temperature

Temperature profile

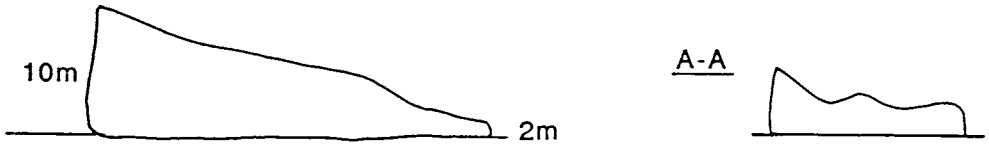
Figure 4.3. Icebergs Station 2, 11 March 1991.

ICEBERG STATION 3

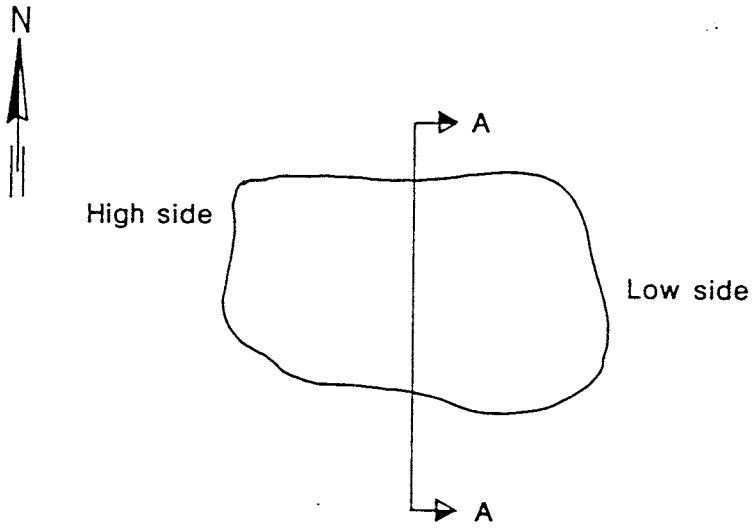
Iceberg #	3
PTT	7086
Date	11-mar-1991
Time	14:15
Latitude	77.49
Longitude	28.20
Length	110
Width	60
Freeboard	10
Snow cover	0.01-0.03
Water depth	250
Air temp.	-18
Snow temp.	

Comments:
(photo)

Profile



Sketch



Depth	Temperature

Temperature profile

Figure 4.4. Icebergs Station 3, 11 March 1991.

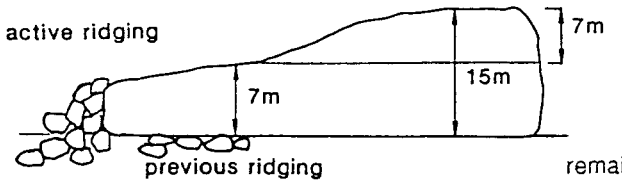
ICEBERG STATION 4

Iceberg #	15
PTT	7088
Date	12-mar-1991
Time	15:00
Latitude	78.59
Longitude	29.58
Length	150
Width	110
Freeboard	7-15
Snow cover	0.05-0.10
Water depth	
Air temp.	
Snow temp.	

Comments:

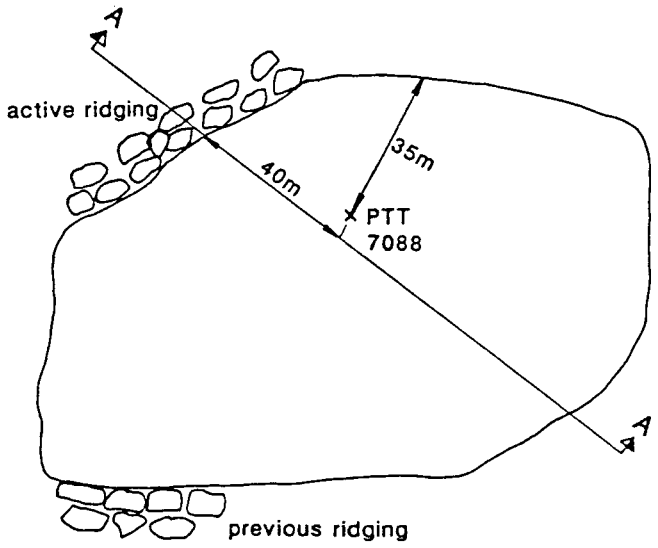
Iceberg grounded with severe ridging towards one edge. Evidence of prev. ridging on other edge. Sailheight of old ridge 2 m higher than the freeboard (ca 7-10 m).

Profile



remains of previous ridging at the edge

Sketch



Depth	Temperature

Temperature profile

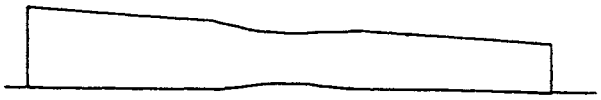
Figure 4.5. Icebergs Station 4, 12 March 1991.

ICEBERG STATION 5

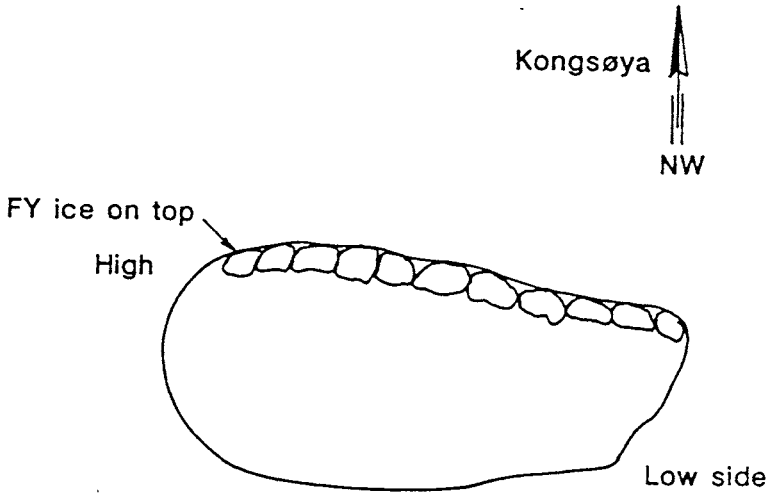
Iceberg #	10
PTT	7089
Date	13-mar-1991
Time	10:30
Latitude	78.56
Longitude	29.59
Length	200
Width	80
Freeboard	6-15
Snow cover	0.10
Water depth	
Air temp.	-28°C
Snow temp.	

Comments:
(photo)

Profile



Sketch



The whole surface of the berg was uneven like a mogul field for downhill skiing with 0.5 m from top to bottom.

Depth	Temperature

Temperature profile

Figure 4.6 Iceberg Station 5, 13 March 1991

APPENDIX A: HELICOPTER MISSIONS

FLIGHT PLAN

Mission: 1	Objectives: Ice reconnaissance
Date: 10-mar-1991	
Start time: 10:00	

FLIGHT ROUTE

Waypoints	North	East	Distance	Comments
WP1				LANCE at 10:00
WP2	76.30	25.00	60	Hopen Radio
WP3	77.30	26.00	60	
WP4	78.10	31.00	76	
WP5	77.00	31.00	60	
WP6	76.30	30.00	30	LANCE
WP7				
WP8				
WP9				
WP10				
	Total distance		286	

Personell:	Name		Function
1	Stig Løvås		/responsible
2	Haldor Haldorsen		
3	Johannes Haaland		
4	Leif Madsen		
5			

Comments:

FIELD OBSERVATION DATA BASE Mission: 1 Date: 10-mar-1991 Number of records: 44.00 Crew: S.M. Løvås, H. Haldorsen, J. Haaland, L. Madsen

		Obs. position					ICEBERGS								ICE CONDITIONS					
							Distance		Feature position		Size (m)				Water	Ice concentration			Floe size (m)		Comments
Number	Time	Latitude	Longitude	Visib. (nm)	Altitude (ft)	Speed (knts)	Dist.	Dir.	Latitude	Longitude	Height	Length	Width	Shape	depth	Total	MY	FY	Average	Max	
1	10:10			25																	Take off, LANCE
2	10:14																		0.5–1.0	5	
3	10:15	76.23	29.37		500	95															Passing LANCE
4	10:20	76.26	29.42		600	95															
5	10:23	76.29	29.41																		Thin ice + small floes
6	10:27	76.28	29.11																		Thin ice + new ice
7	10:28	76.28	29.00													10		10			Small floes
8	10:32																				Lead
9	10:46															10	0–1	9–10		20	Some thicker floes
10	10:49																				Some OW
11	10:53																		5	20	
12	11:00	76.30	25.32																		Some rigded ice floes
13	11:05	76.30	25.01																		Landed Hopen Radio
14	12:26																				Take off, Hopen
15	12:29																				Crossing to West
																					side of Hopen.
16	12:30																				OW + grease ice
17	12:35				2000	90															New ice + FYI
18	12:40															7		7			
19	12:46				1500																OW to NW
20	12:55	77.10	25.38																		Lead
21	12:58			3	800																
22	12:59			10	500																
23	13:03			20												10		10	5	20	
24	13:06	77.26	25.55		350	100															
25	13:09	77.30	26.00																		WP3
26	13:11				800																
27	13:13				400																Crossing frozen lead
28	13:17	77.36	26.39																		
29	13:20				500											10		10	10	40	VCPI
30	13:23	77.41	27.12																		IB to E, turning

FIELD OBSERVATION DATA BASE Mission: 1 Date: 10-mar-1991 Number of records: 44.00 Crew: S.M. Løvås, H. Haldorsen, J. Haaland, L. Madsen

							ICEBERGS									ICE CONDITIONS					
		Obs. position		Visib.	Altitude	Speed	Distance		Feature position		Size (m)				Water	Ice concentration			Floe size (m)		Comments
Number	Time	Latitude	Longitude	(nm)	(ft)	(knts)	Dist.	Dir.	Latitude	Longitude	Height	Length	Width	Shape	depth	Total	MY	FY	Average	Max	
31	13:30	77.38	27.59				0	0	77.38	27.59	25/10	300	140	T							IB #2
32	13:33	77.40	28.02				10	3													IB #5
33	13:35	77.41	28.11				10	3													IB #4
34	13:37	77.43	28.23																		Thin ice, VCPI
35	13:44	77.50	28.47				0	0	77.50	28.47	10	110	60	T							IB #3
36	13:50	77.55	29.11													10		7			3/10 new ice
37	14:09	78.10	30.51	800	100																WP4
38	14:16	77.58	30.50																		Rigded ice floes
39	14:19	77.53	30.51																		
40	14:27			1500																	
41	14:32	77.30	30.55																		
42	14:40	77.17	30.53																		
43	14:49	77.01	30.48																		WP5
44	15:07	76.32	30.42																		Landed LANCE

FLIGHT PLAN

Mission: 2	Objectives: Ice reconnaissance
Date: 10-mar-1991	
Start time: 15:30	

FLIGHT ROUTE

Waypoints	North	East	Distance	Comments
WP1	76.32	30.42		LANCE
WP2	76.30	35.00	53	
WP3	77.30	35.00	60	
WP4			85	LANCE
WP5				
WP6				
WP7				
WP8				
WP9				
WP10				
	Total distance		198	

Personell:	Name		Function
1	Walter Spring		/responsible
2	Hans Jensen		
3	Anton Kjelaas		
4	Gudmund Kleiven		
5			

Comments:

FIELD OBSERVATION DATA BASE Mission: 2 Date: 10-mar-1991 Number of records: 12.00 Crew: H. Jensen, W. Spring, A. Kjelaas, G. Kleiven

							ICEBERGS									ICE CONDITIONS					
		Obs. position		Visib.	Altitude	Speed	Distance		Feature position		Size (m)				Water	Ice concentration			Floe size (m)		Comments
Number	Time	Latitude	Longitude	(nm)	(ft)	(knts)	Dist.	Dir.	Latitude	Longitude	Height	Length	Width	Shape	depth	Total	MY	FY	Average	Max	
1	15:45	76.31																			Take off, LANCE
2	15:51	76.34	31.00	20	500	95										9		5	5–10	30	4/10 YI, Lead E-W with NI
3	16:05	76.33	32.15	10–15	500	95										10		5	10	30	5/10 YI Sun below horizon, difficult to observe
4	16:12	76.32	32.53	10	500	100										10		6	10	30	4/10 YI, Photo: Ice cond.
5	16:20	76.32	33.34	<10	500	100										10		6			4/10 YI, GI pattern is E-W Turns N due to light conditions
6	16:34	76.53	34.04	5	500	100															
7	16:40	77.01	34.15	3–5	300	100										10		6	10	30	Back to LANCE, too dark 4/10 YI, Nearly no NI Some thicker floes
8	16:55	76.48	32.26	3–4	300	100															
9	17:00	76.43	31.49	3	300	100										10		6	10	40–50	4/10 YI, Goes due W, GI floes are biggest
10	17:05	76.45	31.05																		
11	17:07	76.46	30.51	2–3																	Goes towards LANCE
12	17:14	76.37	30.33																		LANCE

FLIGHT PLAN

Mission: 3	Objectives: Ice reconnaissance
Date: 11-mar-1991	
Start time: 08:30	

FLIGHT ROUTE

Waypoints	North	East	Distance	Comments
WP1	77.01	30.11		LANCE
WP2	77.00	35.00	65	
WP3	77.10	36.00	7	
WP4	78.00	35.00	60	
WP5	78.00	33.00	13	
WP6	77.15	30.00	68	LANCE
WP7				
WP8				
WP9				
WP10				
	Total distance		213	

Personell:	Name	Function
1	Bjørn Erlingsson	/responsible
2	Knut Hoseth	
3	Johannes Haaland	
4	Haldor Haldorsen	
5		

Comments:

FIELD OBSERVATION DATA BASE Mission: 3 Date: 11-mar-1991 Number of records: 16.00 Crew: B. Erlingsson, K. Hoseth, J. Haaland, H. Haldorsen

		Obs. position					ICEBERGS								ICE CONDITIONS					
							Distance		Feature position		Size (m)				Ice concentration			Floe size (m)		Comments
Number	Time	Latitude	Longitude	Visib. (nm)	Altitude (ft)	Speed (knts)	Dist.	Dir.	Latitude	Longitude	Height	Length	Width	Shape	Water depth	Total	MY	FY	Average	Max	
1	08:50	77.06	30.10	10		87										10		10			Take off, LANCE
																					Leads E-W
2	09:00	77.07	30.26	20												10		10	2-20		4/10 NI, refrozen
3	09:10	77.06	31.15	20	800	80										10		10			Open lead N-S
4	09:20	77.05	31.58	20		80										10		10	2-30		Large openings N-S
5	09:40	77.01	34.01	25	800	80										10		10			Large open leads,
																					some newly refrozen
6	09:50	77.01	35.07	25	800	80															WP2
7	10:00	77.02	35.14													10					WP3
8	10:05	77.34	35.27	25	900	100															Varying proportion of
																					refrozen leads and FY
																10		6-8			2-4/10 refrozen
																					openings
9	10:20	77.44	35.14	25-30	900	100										10		10	50	300	Large ice floes,
																					New openings N-S,
																					Old openings NE-SW
10	10:30	78.00	34.22	20	900	117										10		10	200	1000	2/10 NI
11	10:40	78.00	33.30	25	900	118										10		8	200	2000	Openings N-S and
																					NW-SE
12	10:45	77.59	32.47	25	900	110										10		9	200	2000	WP5
13	10:55	77.43	31.46	25	900	111										10		9	50	200	Some rubble fields
14	11:00	77.32	31.07	25	900	112										10		8	30	100	Opening E-W
15	11:10	77.21	30.35	25	900	112										10		8	50	200	Goes towards LANCE
16	11:15	77.12	30.07	25		112										10		6	50	200	LANCE

FLIGHT PLAN

Mission: 4	Objectives: Deploy 2 Argos buoys
Date: 11-mar-1991	
Start time: 13:30	

FLIGHT ROUTE

Waypoints	North	East	Distance	Comments
WP1	77.14	30.08		LANCE
WP2	77.38	27.59	38	Iceberg # 2
WP3	77.50	28.47	18	Iceberg # 3
WP4	77.00	27.30	53	
WP5	77.20	30.08	36	LANCE
WP6				
WP7				
WP8				
WP9				
WP10				
	Total distance		145	

Personell:	Name		Function
1	Walter Spring		/responsible
2	Hans Jensen		
3	Anton Kjelaas		
4	Gudmund Kleiven		
5			

Comments:

FIELD OBSERVATION DATA BASE Mission: 4 Date: 11-mar-1991 Number of records: 20.00 Crew: H. Jensen, W. Spring, A. Kjelaas, G. Kleiven

							ICEBERGS									ICE CONDITIONS					
		Obs. position		Visib.	Altitude	Speed	Distance		Feature position		Size (m)				Water	Ice concentration			Floe size (m)		Comments
Number	Time	Latitude	Longitude	(nm)	(ft)	(knts)	Dist.	Dir.	Latitude	Longitude	Height	Length	Width	Shape	depth	Total	MY	FY	Average	Max	
1	12:53	77.16	30.20																		Take off, LANCE
2	12:57	77.18	30.00	20	500	90										10		9-10	30-40	100	Some rubble piles
3	13:00	77.21	29.41	20	500	90															Thicker ice, 2 nm E
																					lighter ice cond.
																					for navigation.
4	13:08	77.29	28.48				10-15	11								10		10			IB #2, refrozen floes
																					Some thicker
																					rubble piles.
5	13:14	77.34	27.58				2	3			2-3	15				10					More continous
																					ice field.
6	13:50	77.37	27.22				0	0	77.32	27.22	25/10	300	140	T		10					IB #2, PTT 7085,
																					finished deployment,
7	14:03	77.45	28.09	15	600	100										10					Refrozen ice,
																					consist of floes
																					hundreds of metres
																					Approaching IB #3
8	14:32	77.49	28.20	15	450	100	0	0	77.49	28.20											IB #3, PTT 7086,
																					finished deployment
9	14:38	77.41	28.10	10-15	500	100										10				cont.	Little GI left
10	14:42	77.35	27.55																		
11		77.30	27.48				0	0	77.30	27.48	8	40	30			10			>10	cont.	IB #4, refrozen floes
12	14:52	77.22	27.35				0	0	77.22	27.35											Small IB
13	14:53	77.20	27.37													10		9-10	30	100	Lighter ice cond.,
																					smaller refrozen
																					floes
14		77.18	27.42	10	500	90					8	60	40	T		10	3-5		20-30	cont.	IB #5, refrozen,
																					FB = 20-30 cm
15	15:10	76.58	26.25	10	500	90													30-40		Refrozen
16	15:18	76.53	27.00	15	550	100										10	3	7	5-40	cont.	Thick old ice has
																					larger floe size
																					Goes towards LANCE
17	15:24	76.49	27.34	15	550	100										10	4	6	20		Leads going E-W
18	15:32	76.55	28.11															4	30		Passes BB.
19	15:41	77.03	29.00	10-15	600	100												9-10	20	cont.	Thinner ice
																					mostly
20	15:53	77.11	29.58	10	550													9			LANCE

			2/10 New ice
			Large openings
7	20-40	100	2/10 New ice

FLIGHT PLAN

Mission: 7	Objectives: Ferry to Hopen
Date: 12-mar-1991	
Start time: 16:10	

FLIGHT ROUTE

Waypoints	North	East	Distance	Comments
WP1	77.20	32.22		LANCE
WP2	76.30	25.01	85	Hopen Radio
WP3	77.30	32.10	90	LANCE
WP4				
WP5				
WP6				
WP7				
WP8				
WP9				
WP10				
	Total distance		175	

Personell:	Name		Function
1	Anton Kjelaas		/responsible
2	Gudmund Kleiven		
3	Knut Hoseth		
4	Leif Madsen		
5			

Comments:

FLIGHT PLAN

Mission: 8	Objectives: Deploy PTT 7089, and ice reconnaissance Kong Karls Land
Date: 13-mar-1991	
Start time: 08:30	

FLIGHT ROUTE

Waypoints	North	East	Distance	Comments
WP1	77.35	31.54		LANCE
WP2	78.59	29.29	88	Iceberg # 10
WP3	78.34	26.50	46	Iceberg S of Svensk¢ya
WP4	77.38	31.54	88	LANCE
WP5				
WP6				
WP7				
WP8				
WP9				
WP10				
	Total distance		222	

Personell:	Name		Function
1	Walter Spring		/responsible
2	Hans Jensen		
3	Knut Hoseth		
4	Leif Madsen		
5			

Comments:

FIELD OBSERVATION DATA BASE Mission: 8 Date: 13-mar-1991 Number of records: 24.00 Crew: H. Jensen, K. Hoseth, L. Madsen, W. Spring

							ICEBERGS									ICE CONDITIONS					
		Obs. position		Visib.	Altitude	Speed	Distance		Feature position		Size (m)				Water	Ice concentration			Floe size (m)		Comments
Number	Time	Latitude	Longitude	(nm)	(ft)	(knts)	Dist.	Dir.	Latitude	Longitude	Height	Length	Width	Shape	depth	Total	MY	FY	Average	Max	
1	09:02	77.35	31.54																		Take off, LANCE
2	09:14	77.37	31.44	10	500	100										9-10		9-10		cont.	Leads and NI
3	09:25	78.00	31.20	10-15	500	100										10					
4	09:34	78.13	31.01	10-15	500	100										10				cont.	Some light grey ice
																					Ridges formed
																					yesterday.
5	09:48	78.23	30.47	10-15	500	100										10				cont.	No newly frozen
																					leads here.
6	10:00	78.50	30.11	5-10	500	100										8				3000	
7	10:40	78.56	29.59				0	0	78.56	29.59	6-15	200	80	T							IB #10, PTT 7089
8	10:44						0	0			8-10	30	30	T							IB #18, in landfast
																					ice < 1 nm from KKL
9	10:46	78.50	29.17				0.1	9			8-10	<50									IB #19,20 inside
							0.2	9			8-10	<50									landfast ice.
10	10:48	78.49	29.01	10	800	100										10					Landfast ice
																					0.5 nm to right
11	10:53	78.45	28.20	10	1000	100															
12	10:54	78.45	28.21	10																	IB #22-25 to left.
																					All frozen within
																					landfast ice. Ridges
																					and rubble piles
																					nearby, also
																					several BB.
																					1 small IB #26
																					to right.
13	11:02	78.42	27.37	10	700	100															1 IB towards
																					Svensk¢ya.
14	11:10	78.40	27.21	10	600	90	0	0			30	100	90								IB #27
15	11:11	78.38	27.27	10	600	90	0.5	9			8-10	120-150		T		9-10				cont.	IB # 28, some leads,
																					some GI, Most of
																					the ice is thicker
																					than at the ship

FIELD OBSERVATION DATA BASE Mission: 8 Date: 13-mar-1991 Number of records: 24.00 Crew: H. Jensen, K. Hoseth, L. Madsen, W. Spring

							ICEBERGS									ICE CONDITIONS					
		Obs. position		Visib.	Altitude	Speed	Distance		Feature position		Size (m)				Water	Ice concentration			Floe size (m)		Comments
Number	Time	Latitude	Longitude	(nm)	(ft)	(knts)	Dist.	Dir.	Latitude	Longitude	Height	Length	Width	Shape	depth	Total	MY	FY	Average	Max	
16	11:24	78.30	28.05													10				cont.	
17	11:28	78.20	28.50													10					200 m wide lead going West.
18	11:38	78.02	30.02	10												10				cont.	Passing lead going West.
19	11:44																				Lead going West as far as we can see.
20	11:48	77.45	31.08	5	1100	100										10				cont.	
21	11:49	77.43	31.15																		Lead with wide band of GI on both sides.
22	11:52	77.39	31.31	2												10					
23	11:53	77.37	31.40	2																	
24	11:56																				Landed LANCE

FLIGHT PLAN

Mission: 9 Date: 17-mar-1991 Start time: 09:45	Objectives: Deploy PTT 1793 and 1794, and ice reconnaissance Stonebreen. Ferry Anton Kjelaas to Longyearbyen.

FLIGHT ROUTE

Waypoints	North	East	Distance	Comments
WP1	77.35	31.54		LANCE
WP2	78.34	26.50	88	Iceberg S of Svensk¢ya
WP3	78.05	24.30	41	
WP4	78.14	15.27	41	Longyearbyen
WP5	78.05	24.30		
WP6	77.30	25.15	30	
WP7	77.35	31.54	82	LANCE
WP8				
WP9				
WP10				
	Total distance			

Personell:	Name		Function
1	Bj¢rn Erlingsson		/responsible
2	Anton Kjelaas		
3	Gudmund Kleiven		
4			
5			

Comments:

FIELD OBSERVATION DATA BASE Mission: 9 Date: 17-mar-1991 Number of records: 26.00 Crew: B. Erlingsson, G. Kleiven, A. Kjelaas (to Longyearbyen)

		Obs. position					ICEBERGS								ICE CONDITIONS					
							Distance		Feature position		Size (m)					Ice concentration			Floe size (m)		Comments
Number	Time	Latitude	Longitude	Visib. (nm)	Altitude (ft)	Speed (knts)	Dist.	Dir.	Latitude	Longitude	Height	Length	Width	Shape	Water depth	Total	MY	FY	Average	Max	
1	09:52	77.00	28.46																		Take off, LANCE
2	09:55			15	3500	100												7	200	1000	Large openings EW
3	10:10			15														8			1/10 refrozen leads
4	10:25	77.43	28.13	15														9			Leads EW
5	10:30	77.53	28.04	10	3500	100												9			1/10 newly frozen ice ridging, leads NW-SE
6	10:40	78.12	27.49	5	3500	100												10	200	1000	3/10 newly frozen ice
7	10:45	78.17	27.43															10			Ridging, new Ice with openings Large areas of newly frozen
8	10:50	78.34	27.24	9-10					78.37	26.30				T,tilted				10	40	400	Ridging, 2 small IB in
							9	5-6	78.37	26.25	7-8	40	40	P							landfast ice on west coast of Svenskøya
9	11:02	78.32	26.29	5																	
10	11:06	78.30	26.23	7																	
11	11:15	78.36	26.23	4																	
12	11:16	78.30	26.23															10	1500	cont.	lot of ridging
13	11:19																				heading Longyear
14	11:30																				On track to LYR
15	12:01	78.10	18.58		9000	100	10-30														5 IB in Storfjorden
16	12:40																				In Longyearbyen
17	14:40																				Take off, LYR
18	15:25	77.26	20.46		500	100															
19		77.25	20.55																		Poor visibility and snow showers at LANCE. Go for Hopen
20	15:45																				Tusenøyane
21	15:55	76.52	23.29															8	400	2000	
22	16:05	76.47	24.31															7	100	1500	Diverging Ice field
23		76.30	24.45						76.35	24.45	8	40	15	P							Small IB, grounded in landfast ice
24	16:15	76.30	25.05																		Landed at Hopen
25	17:55	76.30	25.05																		Take off, Hopen
26	18:00	76.20	29.14																		Landed LANCE at Ice edge

APPENDIX B: ICE OBSERVATIONS FROM LANCE

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 9-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	18:30	74.30	24.35				5-6	0	0		0.5		Ice edge, pancake
2	19:15	74.40	24.36	20			3				0.5		Patches of ice
3	21:20	75.05	25.05				7-8	0	0	0.5			Pancakes
													Heading for N77.00, E31.00

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 10-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	06:10	76.10	28.06			8	10			1	cont.	0.2 m	Pancakes, freezing together. Since last night the same type of ice has been thicker
													for a while. Speed was down to 4 knots with same prop. trust.
													Polar bear on ice 1 nm ahead. Moving easily in this ice.
2	06:27	76.12	28.12										Photo
3	08:19	76.21	28.54	20			9-10	9-10					7-8/10 pancake ice. Go more east following narrow lead.
4	09:19	76.23	29.27	20		8-9	9-10				10	0.5-0.6 m	2 photos, Steering east along YI field.
5	10:45	76.24	29.37	20			10		10	10	30		Started after stop for helicopter start + ice floe station: 2.1 m thickness, rafted FYI
													FB: 13 cm + 20-30 cm snow.
													Helicopter reported lighter ice cond. 5 nm N. 1 photo (5)
6	12:38	76.30	30.11	20		6.5	10		9				1/10 YI, 1 Photo (6)
7		76.32	30.32										Iceberg station 1 on IB #1 (L 30m,W 15m,H 8m)
8	21:35	76.50	30.36			3.8	10		7	10	30	0.3-0.4 m	3/10 YI.

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 11-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	07:00	77.00	30.10	2-3			10		10	10	30	0.5 m	4/10 Grey Ice
2	08:46	77.06	30.08	10-15			10		10	10-15	30		Refrozen, grey ice in between
3	08:48												Lift off Mission # 3, 1 photo
4	09:43	77.07	30.05	15-20	-18		10		10	15-20	100		Difficult ice conditions for the vessel. Photo.
													More rubbled ice field.
5	11:35	77.13	30.09	15-20			10		10	20	80	0.8 m	Refrozen
6	17:34	77.17	31.00	3-5			9-10						Sailing East along lead to come North. Skipper has been up in
													the helicopter for a spotting flight.
7	21:28	77.13	32.14										Stop for the night. Lead is in direction SE.

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 12-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	06:57	77.17	31.54				9-10						Moving East in lead. LANCE drifted a few nm West during the night.
2	09:33	77.11	32.20	10		9.4	9						Sailing SE to a N-S lead 600 m.
3	10:31	77.08	32.38	10-15			10			20-30	cont.		Stop for a short ice station. Photos.
4	16:33	77.20	32.17	5			9-10						Going W and NW in lead. Lighter ice cond. to the North, reported by helicopter.
5	16:56	77.22	32.14	5	-18	4-7	10		10	30-40	cont.	0.2-0.5 m	Air temp. increasing. Now in lead going NW.
6	19:31	77.33	32.06	dark			10		10	30-40	cont.	0.3-0.5 m	Refrozen. Moving NE towards a lead going N or NW.
7	22:06	77.39	32.07	dark									Stopped for the night. Drifting 0.6 knots and 213 degrees.

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 13-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	07:11	77.35	31.54	8-10	-29		10			40-60	cont.	0.3-0.5 m	New ridges.
2	15:00	77.34	31.43	0								0.6 m	No visibility for flying. Ice station.

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 14-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	07:17	77.32	31.37	1	-21		10						Wind speed is 13 knots from NE.
													Blue sky towards sun, but not flying conditions yet.
2	09:16	77.32	31.28	<1			10						Asked to move LANCE a little further north to get into better visibility.
													Now steering 180 degrees.
3	16:31	77.30	30.46	0									Wind is reducing (30-37 knots from East), has been over 50 knots.

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 15-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	07:06	77.30	29.54	3-5	-12		10				cont.	0.2-0.6 m	The snow has been drifting and made it difficult to see the Ice pattern.
													Wind speed 15 knots NE. We plan the trip to Svensk¢ya to deploy buoy.
2	11:26	77.28	29.44	0	-6								Wind speed 33 knots from E, snow drifting.
3	13:52	77.28	29.34	1			10		10		cont.		New ridges formed today.
													Trying to move towards N77.15 E28.00
4	14:27											0.2-0.7 m	Ridge from 20 cm ice has formed today close to the ship.
5	16:04	77.30	29.20	2			10		6-7				3-4/10 YI. Had to go NW to find thinner ice. Now sailing in YI
													covered with snow. Speed 8-9 knots towards 300 deg.
6	17:29	77.32	28.41	1			10						Beset. Ridges. Stop for night.
7	22:24	77.31	28.26										Still beset.

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 16-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	06:22	77.30	28.07	0	-16								Wind speed 30 knots from NNE. Still beset.
2	09:33	77.28	27.54	0									Drifting SW straight line.
3	14:11	77.25	27.58	0.2	-17								We were on the ice and sawed some Ice. At 1200 we managed to get loose.
													Now wind speed 33 knots from NE.
4	16.44	77.21	28.18										Difficult to get any further.
5	23:17	77.15	28.15		-17								Have been stucked for some time and got loose. Snowing. Wind 21 knots from NE.

FIELD OBSERVATION DATA BASE Mission: LANCE Date: 17-mar-1991 Observer: Hans Jensen

Number	Time	Obs. position Latitude	Longitude	Visib. (nm)	Air temp. (deg. C)	Speed (knts)	ICE CONDITIONS Ice concentration Total	MY	FY	Floe size (m) Average	Max	Thickness	Comments
1	07:27	77.07	28.35	2	-15		10					0.2-0.3 m	Wind speed 20 knots from NE. We have been moving all night. 3-4 photos.
													Openings in the Ice here and there. A few ridges.
2	09:53	77.00	28.46	2			10						Helicopter left for Svensk¢ya and Longyearbyen a few minutes ago.
													Travelling in lead 140 degrees.
3	10:34	76.47	29.23	2-3			10					0.4 m	Polynias here and there. About 40 cm Ice thickness.
4	13:38	76.41	29.35	1			10					0.2-0.3 m	Low visibility to NE. Going 220 degrees to stay in reasonable visibility
													for the helicopter to arrive. Ice is packed together.
5	15:45	76.31	29.51	1			10				20	0.2-0.3 m	Freeboard: 0-20 cm. Close to ice edge. 1 deg. pitch. 1/2 of the Ice cover
													is brash ice. Meeting some bigger swells here and there.
6	16:04	76.29	29.51										Ice edge. Turning SW to follow the ice edge and get the helicopter on board again.
													Snow showers. Ice edge very distinct. Ice edge direction is 230 deg.
7	17:06	76.20	29.14										Goes 310 deg from here into the ice to receive the helicopter from Hopen.
													A lot of seals at the ice edge + 3 polar bears.
8	18:05												Helicopter has arrived and we are heading for Troms¢.

APPENDIX C: EXPEDITION MEMBERS

NAME	AFFILIATION
Bjørn Erlingsson	NP
Haldor Haldorsen	Statoil
Knut A. Hoseth	FORUT
Johannes Haaland	Total
Hans Jensen	SINTEF NHL (cruise leader)
Anton Kjelaas	Saga Petroleum
Gudmund Kleiven	Norsk Hydro
Stig M. Løvås	SINTEF NHL
Leif Madsen	NPD
Walter Spring	Mobil (Chairman)

APPENDIX D: ICE PHYSICS MEASUREMENTS (FORUT)

General:

Research scientist Knut Aune Hoseth at FORUT's Department of Structural Engineering and Materials Technology performed ice physics measurements during IDAP 1991. Measurements conducted during the experiment were similar to those conducted during last year's IDAP program.

IDAP 1991 took place in the northwestern parts of the Barents Sea in the period from March 8 to March 19, 1991. The ice edge was reached at 74°52' N and 24°40' E on March 9, whereas the ship moved out of the ice and into open water at 76°21' N and 29°16' E on March 16. Tests were performed at a total number of 10 stations, at which 8 were first-year ice and two were icebergs.

Test program:

The test program consisted of both in-situ measurements and laboratory measurements. In addition to measurements performed during the expedition, ice cores from 9 out of 10 stations were transported to the ice testing laboratory. The cores will be stored here for future testing.

In-situ measurements included a description of ice conditions, snow and ice thicknesses and ice temperatures. The test program performed onboard the ship included measurements of density, salinity, brine volume, air pore sizes, grain types and grain sizes.

Results:

This year's ice conditions in the Barents Sea were characterized by thin first-year ice. It was not observed any multi-year ice along the shiptrack or from the helicopter. The area covered was limited by the ice edge (south), 24 °E (west), 32-35 °E (east) and 79 °N (north). The nonexistence of multi-year ice indicates no ice drift from the polar basin and into the area during this year's winter season.

Eight first-year floes were tested. During tests sizes varying from 10 x 10 m to 40 x 40 m and ice thicknesses ranging from 0,4 m to 1,3 m were identified. FORUT's representative estimated ice thicknesses from the ship as well. Based on in-situ measurements and ship observations, the maximum ice thicknesses appeared to be less than 1,3 - 1,4 m for floes that had not been subjected to rafting. The floe at station no 1 was rafted, and the ice thickness of this floe was 2,1 m.

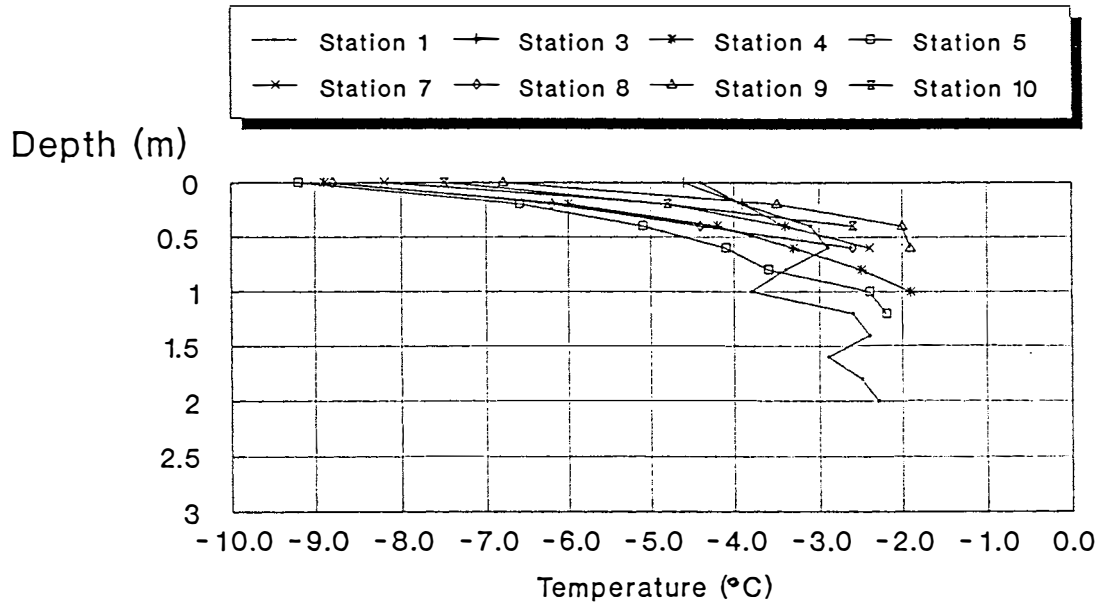


Fig 1 Ice temperatures for first-year ice.

The air temperatures ranged from -30 °C to -7 °C at the time when FORUT's test programme was performed. In combination with strong wind (up to 50 knots), this lead to relatively low temperatures in the top sections of the tested floes. Ice temperature profiles for the tested first-year floes are illustrated in Fig 1. As can be observed from this diagram, ice temperatures increase with increasing depth. Ice temperatures range from -9,2 °C at the top surface to -1,9 °C near the bottom surface. The corresponding values for the two tested icebergs were in the interval -19,6 °C to -11,3 °C.

Measured density values are presented in Fig 2. Densities varied between 804,2 kg/m^3 and 908,5 kg/m^3. The lowest density values appear near the top surface.