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TORGNY VINJE AND VLADIMIR VOLKOV, (EDITORS)

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CRUISE REPORT FROM KAREX-94
R/V "IVAN PETROV"

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1. INTRODUCTION.

Torgny Vinje, Vladimir Volkov, Vasilyi Kuznetzov

The studies of KAREX-94 onboard the RV "Ivan Petrov" continue and develop AARI`s investigations in the adjacent seas of the Arctic Ocean. These studies include the comprehensive monitoring of the Arctic seas in summer related to the range of AARI`s scientific research programs. Moreover, these studies are in the framework of scientific topics started by NPI and AARI. The expedition goal is to continue and considerably enlarge the Russian-Norwegian Oceanographic Program (RUSNOP) which have been performed within 1988-92 as the Soviet-Norwegian Oceanographic Program (SNOP). It means the geographic enlargement since the object under study is the Eastern Barents sea and Kara sea with its gulfs and straits as well as disciplinary one that is study of water and ground pollution, use of remote sensing and hydrophysical modelling. The main idea of the program is to study the key characteristics of oceanographic regime (including water dynamics) influencing to the transport and transfer of pollutants. In this way the goals of RUSNOP are equal to ones of the long-term international project "Arctic Climate System Study" (ACSYS) of World Climate Research Program which was planned to begin in 1994, and can provide national programs under international "Arctic Monitoring and Assessment Program" (AMAP) founded by the arctic countries.
The KAREX was performed in accordance with the Agreement between Norwegian Polar institute, Arctic and Antarctic Research Institute and Regional Centre "Arctic Monitoring" (Russia).

The KAREX-94 was comprehensive. It included observations of hydrophysical and hydrochemical water parameters, degree of water pollution, ground pollution, hydrobiological observations of benthos, actynometric and hydrooptical observations, studies of sea ice including the remote sensing methods.

In general, the expedition performed 144 oceanographic stations recording temperature, salinity and density in the Kara sea with vertical interval of 0.1 m. The records of dissolved oxygen, silicon and phosphates at standard levels are available for 124 stations. The water and ground samples for pollution study under AMAP are available for 63 stations. At 100 stations the hydrooptical observations have been performed.

The special attention while the sea survey was payed to the Gulf of Yenisey, Obskaya Guba and Baidaratskaya Guba and North-eastern part, ice edge regions.

The ice situation was relatively favorable. The free water occupied the major part, probably it opened by the call of the ship to the regions ice-covered before.

The distribution of the key hydrological characteristics in the summer of 1994 was close to the multi-year one when the river water distributes by eastern type. Taking into account the temperature and salinity distribution on the surface, we can conclude that the river discharge was lower than usually. The zonal character of the field of surface temperature of the Kara sea suggests the prime warm up by solar radiation. The influence of the Barents sea water can be slightly seen in the distribution of thermohaline characteristics of the surface layer of Kara sea. The enhanced water salinity background in the Northern Kara sea makes favorable conditions for the development of winter convection.

The optical characteristics mainly depend on availability of mineral suspensions and their distribution by density gradients in the Kara sea.

2. SEA ICE AND REMOTE SENSING.

A.Grigoriev, R.Korsnes

To determine the real ice situation in the Kara sea during the joint Russian-Norwegian expedition, the Satellite Data Systems inc.Model ESC-102 was used. The system contains of: two-run spiral antenna receiving in 137.40-137.85 MHz, digital transferrer and EGA computer for storage and reflection of the images received. The receiving antenna was installed at the left board of finding deck, and the other equipment - in the rudder house of the R/V "Ivan Petrov". From 19.08 to 8.10.94 the reception from satellites "Meteor", "NOAA-11" and "NOAA-12" was carried out 3-4 turns a day, and in favorable weather - 6 turns of "NOAA" a day. The images were handled by means of the software developed in the Department of Improvement of Ice Information Systems (DIIIS) of AARI, which was used to distinguish zones of different ice concentration.

Beside the data obtained by Model ESC-102 and visual ice observations, the information in CONTUR-telegrams form sent from the Centre of Ice and Hydrometeorological Information (CIHI) of AARI was used to complete the analysis of ice situation. These telegrams were received onboard the "Ivan Petrov" through the Hydrometeorological Service of Arkhangelsk. Then they were put into the computer by means of software FS-1500 developed in DIIIS. The telegram passed through the initial syntactic control was processed by the software CONTUR which allows one to have the ice chart on the display, and then print it in any scale. During the cruise two telegrams in CONTUR were received from CIHI AARI for 12-16.08.94 and 19-24.08.94 (Fig.2.1,2.2). Using the ice charts obtained, satellite images and the data of synoptic charts the correction of the working plans could be made. Ice conditions during the cruise (Fig.2.3 a, b,c).
Conclusively, during the cruise 64 turns of "Meteor" satellite and 200 of "NOAA" were received.

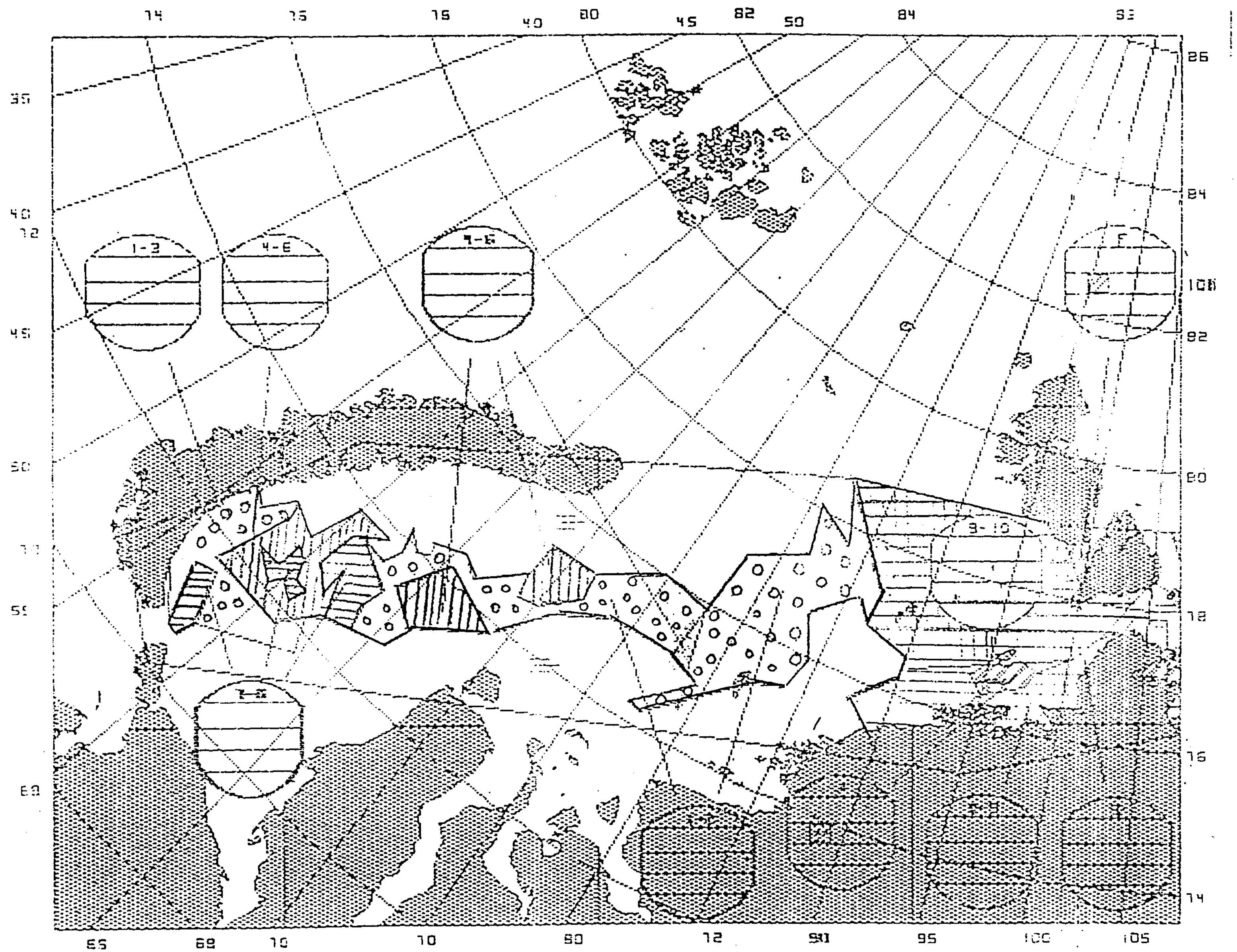


Fig.2.1 Ice condetions according to the sattelite images for 12 - 16.08.94 (received from the Center of the ice and Hydrometeorological Information, AARI).

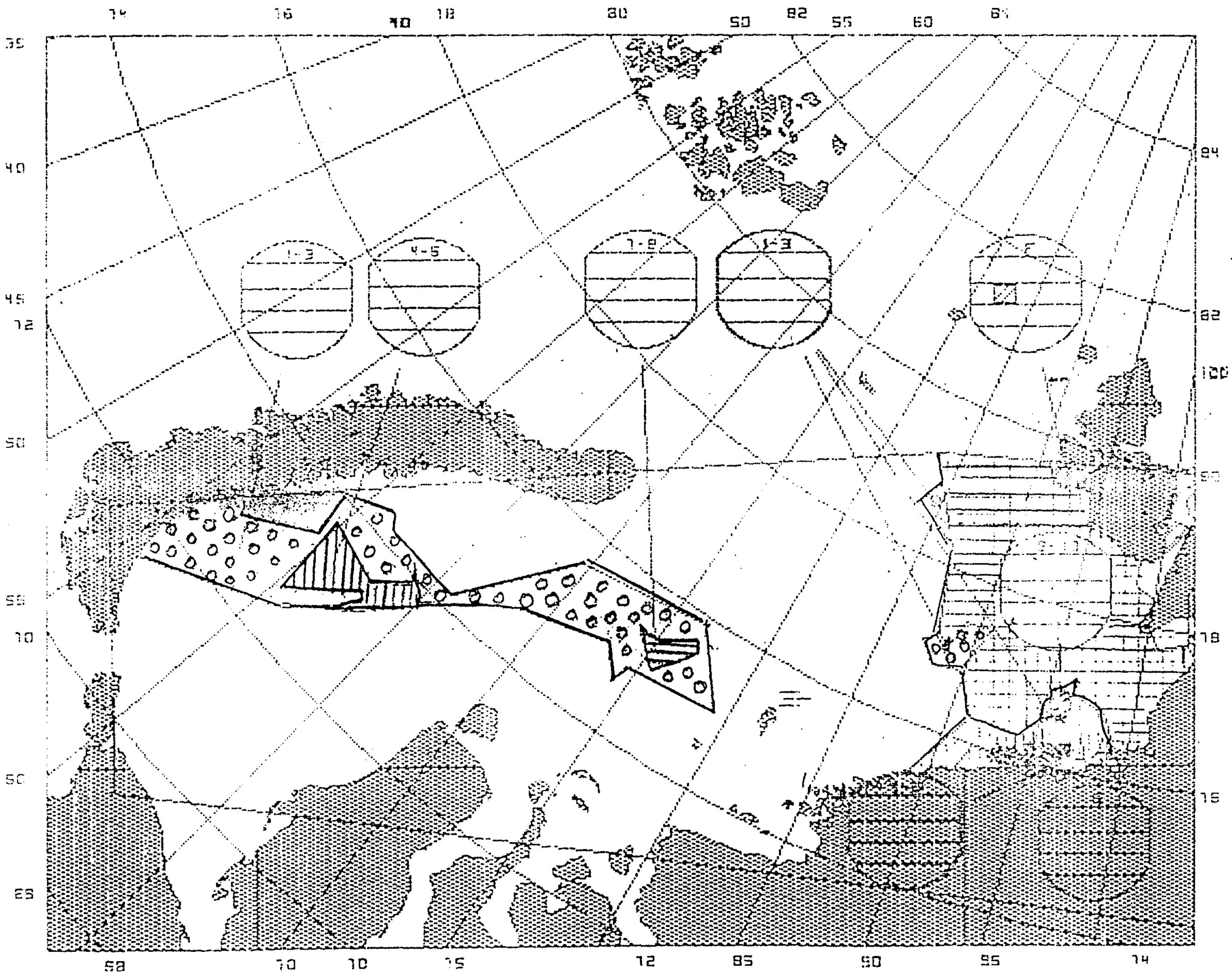


Fig.2.2 Ice condetions according to the sattelite images for 19 - 24.08.94
(received from the Center of the ice and Hydrometeorological Information, AARI).

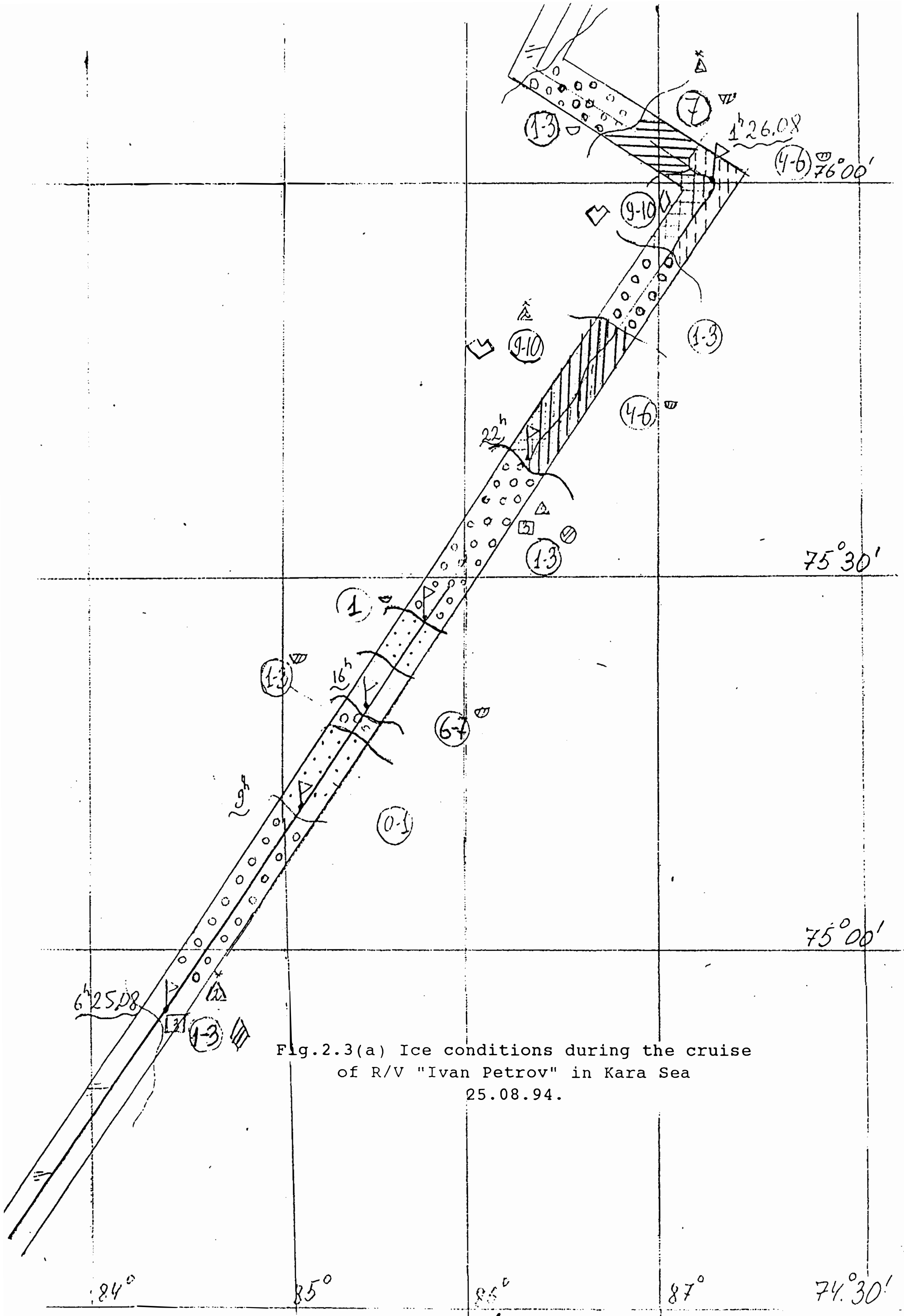


Fig.2.3(a) Ice conditions during the cruise of R/V "Ivan Petrov" in Kara Sea 25.08.94.

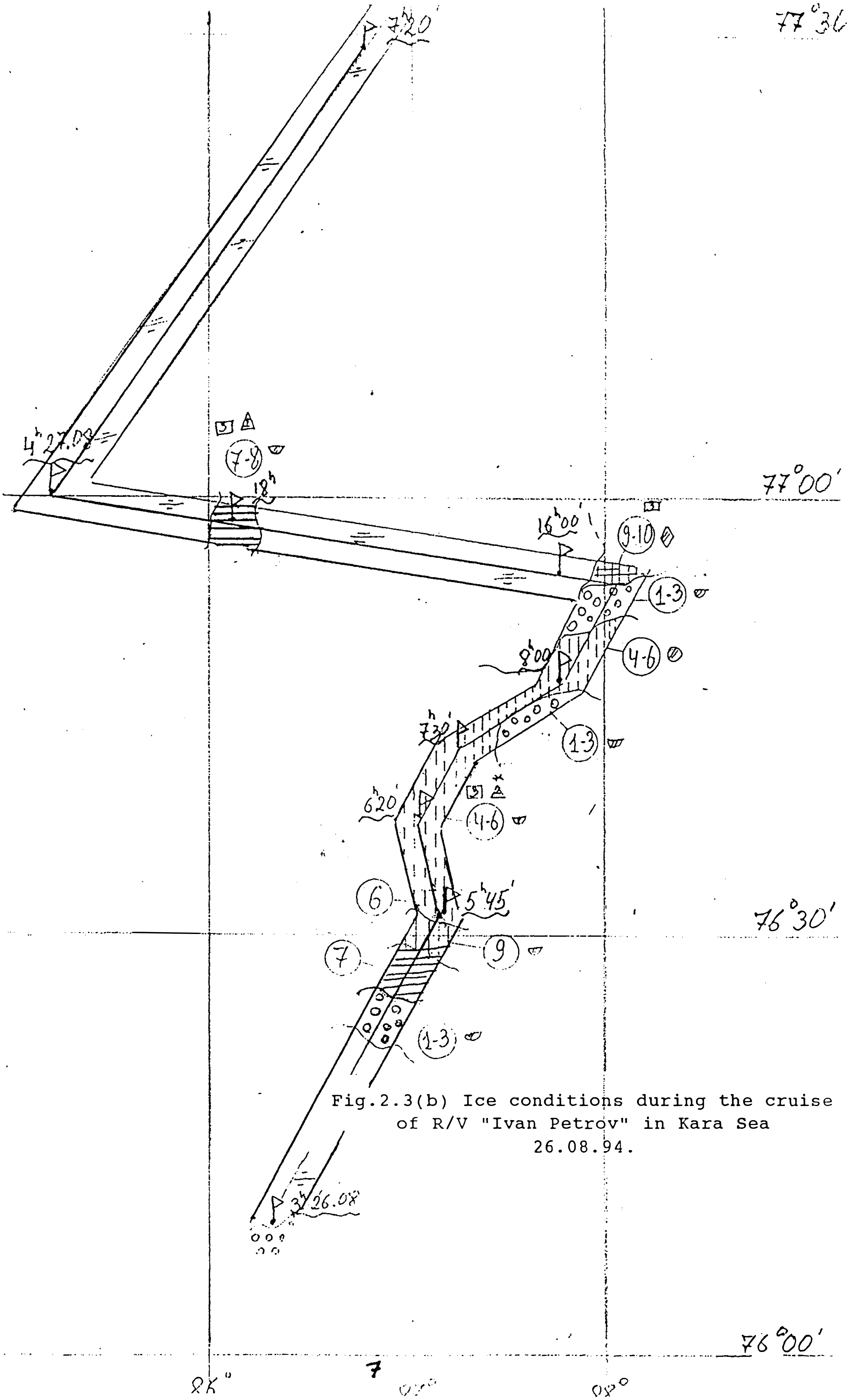


Fig.2.3(b) Ice conditions during the cruise of R/V "Ivan Petrov" in Kara Sea 26.08.94.

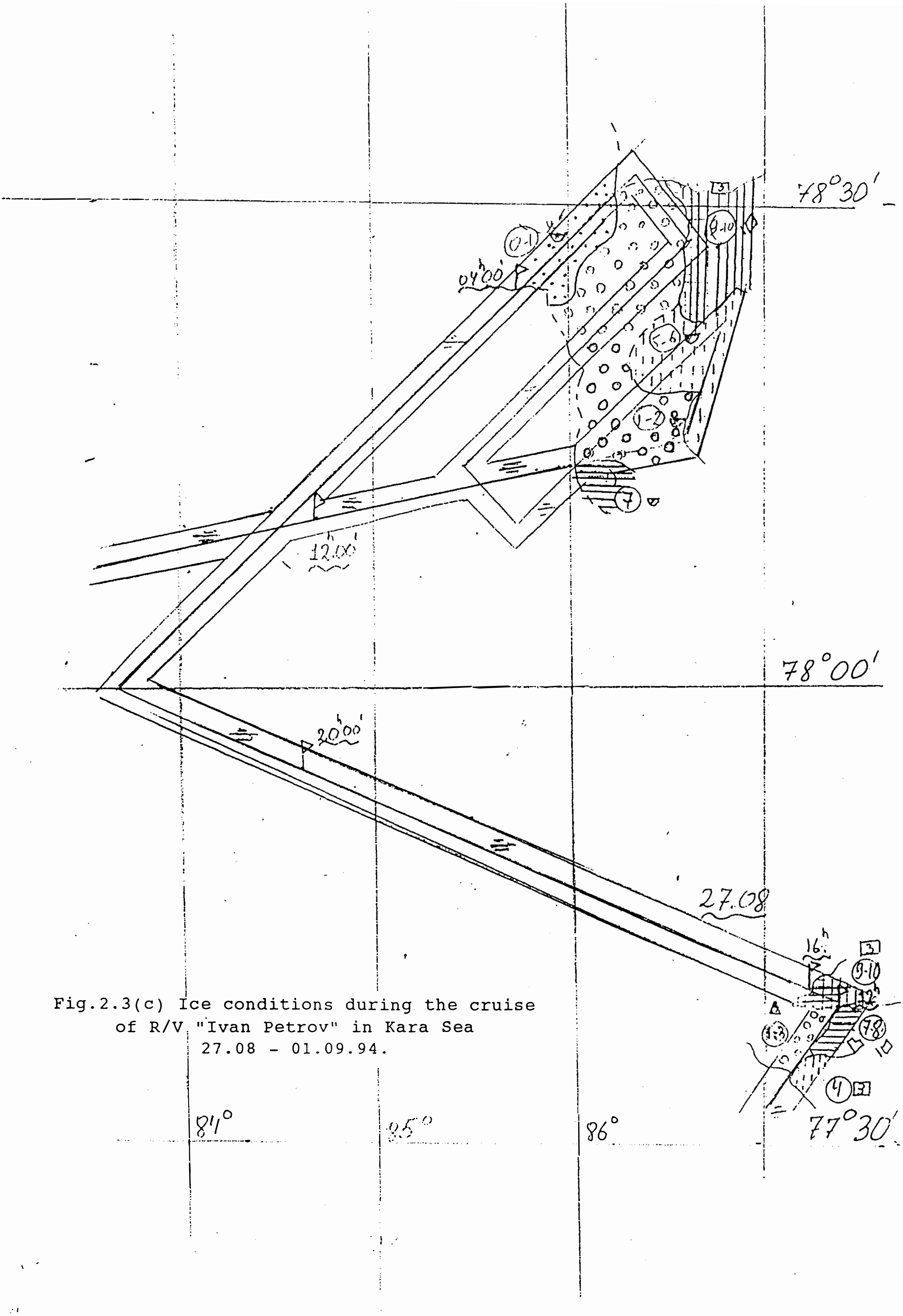


Fig.2.3(c) Ice conditions during the cruise of R/V "Ivan Petrov" in Kara Sea 27.08 - 01.09.94.

3. Ice and meteorological conditions during the cruise

A. Grigoryev, T. Vinje, V. Volkov

A. Grigoryev, T. Vinje, V. Volkov Ice conditions during the expedition to the Kara Sea were favourable for navigation.

Ice cover extent in August-September was less than mean multiyear one. Ice massif zones were clearly defined, the edge of the Severozemel'sky massif passed roughly along the Dikson meridian being clearly defined on satellite images. Ice situation during the work period off the Severozemel'sky ice massif is presented in (Fig. 2.1,2.2).

First drifting ice of 1-3/10 concentration was observed on 25.08.94 at 6h 30min of the ship time at 74 50'N and 84 20'E. The ship was moving in the NE direction and by the beginning of 26.08.94 reached a point of 76 N and 87 30'E where ice concentration was already 4-6/10. By 15 h the R/V "Ivan Petrov" performing hydrological studies en route reached 76 50' N and 88 05'E where she encountered very close ice of 9-10/10. Then turning to NNW and after 4h on 27.08 again to NE the "Ivan Petrov" having passed open ice of 1-2/10, was again blocked by drifting ice of 9/10 at 77 40'N and 87 20'E. A number of hydrological studies were conducted over the area of 78 10'-78 30'N and 85 30'-87 50'E in ice of 1-2/10 and sometimes up to 5-6/10 in concentration.
It should be noted that during the period from 25.08 to 1.09.94 drifting ice encountered by the R/V "Ivan Petrov" represented small floes and ice cake and sometimes medium floes. By age categories it was first-year ice and its thickness reached 3 m and more.
The meteorological conditions during the cruise were as follows. The images of the Model ESC-102 system, as well as daily synoptic charts reported from the Hydrometeorological Centers of Dikson, Amderma and Arkhangelsk by means of a fax machine installed at the radiocommunication cabin of the R/V "Ivan Petrov" provided information on the processes in the atmosphere over the Kara Sea during the expedition. Most characteristic data on wind strength and direction are given in (Table. 3.1).

During the cruise the weather was formed under the influence of the cyclones passing in the south-eastern direction. However, on some days when cyclonic activity decreased, the weather was governed by a small gradient extensive depression with many centers. For example, a cyclon with a center at 63 N and 60 E on 19.08.94 was shifting along 63 parallel and by 21.08.94 reached 80 N and ceased to exist. During navigation near the ice edge in the vicinity of 85 meridian the studies were carried out at sufficiently weak southerly winds. From 1.09.94 the cyclon with a center at 80 N 65 E was shifting quite slowly to the south-east and by 10.09.94 its center was observed at 71 N and 74 E (Fig.3.1) then its influence on the weather formation over the Kara Sea ceased. It was replaced by an anticyclone

with a center at 70 N and 40 E on 9 September which with a shift eastward was destroying and by 11.09.94 its center was recorded at 72 N and 70 E.
An extensive cyclone which was formed with a center at 70 N 20 E on 11.09.94, disintegrated into a number of smaller cyclones whose centers were located in the meridional direction. One of them having shifted by 14.09 with a center at 70 N and 59 E, preserved its location up to 16.09 (Fig.3.2).
Then on 21.09 a frontal zone is observed at the synoptic charts passing from NW to SE over the whole Kara Sea.
An extensive cyclone noted on 24.09 with a center at 72 N and 62 E governed weather conditions for quite a long time in the region under study up to 30.09 when its center shifted to 72 N and 70 E.
Then the character of the weather was greatly influenced by a vast cyclone with a center at 83 N 70 E on 5.10. From 6.10 to 10.10 the isobars at synoptic charts (the Kara Sea region to the east of Novaya Zemlya) were situated in parallel to latitudes at a surface pressure gradient directed southward (Fig. 3.3).

Table 3.1

Mean everyday wind.

Date	φ	λ	ν	α	Date	φ	λ	ν	α
21.08	69°,5	57°,0	7,7	8°	16.09	72°,0	59°,0	4,0	240°
22.08	73°,0	67°,0	3,7	43°	17.09	70°,5	59°,2	6,5	130°
23.08	74°,0	73°,2	11,0	46°	18.09	70°,0	61°,0	3,0	90°
24.08	74°,0	80°,0	8,4	35°	19.09	70°,0	61°,2	9,0	290°
25.08	75°,5	86°,0	2.0	0°	20.09	68°,5	69°,0	13,3	250°
26.08	77°,0	88°,0	6,2	225°	21.09	69°,3	1°,8	1,8	2°
27.08	77°,5	87°,2	8,8	200°	22.09	69°,0	6°,3	6,3	200°
28.08	78°,5	86°,5	0,0	0°	23.09	69°,5	6°,1	6,1	135°
29.08	78°,2	86°,0	6,8	155°	24.09	70°,5	5°,8	5,8	250°
30.08	76°,3	75°,0	5,8	280°	25.09	69°,5	5°,5	5,5	245°
31.08	75°,0	73°,0	13,0	195°	26.09	69°,5	12°,0	12,0	85°
01.09	76°,0	79°,0	2,5	325°	27.09	69°,5	6°,0	6,0	45°
02.09	75°,0	86°,5	16,0	350°	28.09	69°,5	3°,0	3,0	120°
03.09	75°,0	80°,0	8,2	250°	29.09	68°,3	10°,0	10,0	190°
04.09	73°,0	73°,5	7,3	240°	30.09	68°,2	14°,6	14,6	225°
05.09	71°,5	72°,0	11,5	3°	01.10	67°,4	9°,0	9,0	255°
06.09	69°,0	74°,0	1,5	0°	02.10	67°,4	10°,0	10,0	235°
07.09	70°,4	73°,5	14,7	90°	03.10	67°,4	11°,1	11,1	225°
08.09	71°,3	73°,0	15,3	0°	04.10	68°,1	12°,5	12,5	190°
09.09	71°,3	73°,0	15,3	0°	05.10	69°,2	13°,7	13,7	190°
10.09	73°,0	74°,2	6,0	0°	06.10	69°,1	17°,7	17,7	250°
11.09	73°,0	80°,2	3,3	245°	07.10	69°,1	18°,8	18,8	230°
12.09	72°,2	81°,0	3,0	330°	08.10	69°,1	12°,1	12,1	84°
13.09	73°,5	79°,5	10,0	175°	09.10	69°,3	16°,0	16,0	290°
14.09	74°,0	74°,0	10,0	135°	10.10	69°,4	11°,0	11,0	290°
15.09	75°,0	67°,0	3,0	70°	11.10	69°,2	14°,0	14,0	215°

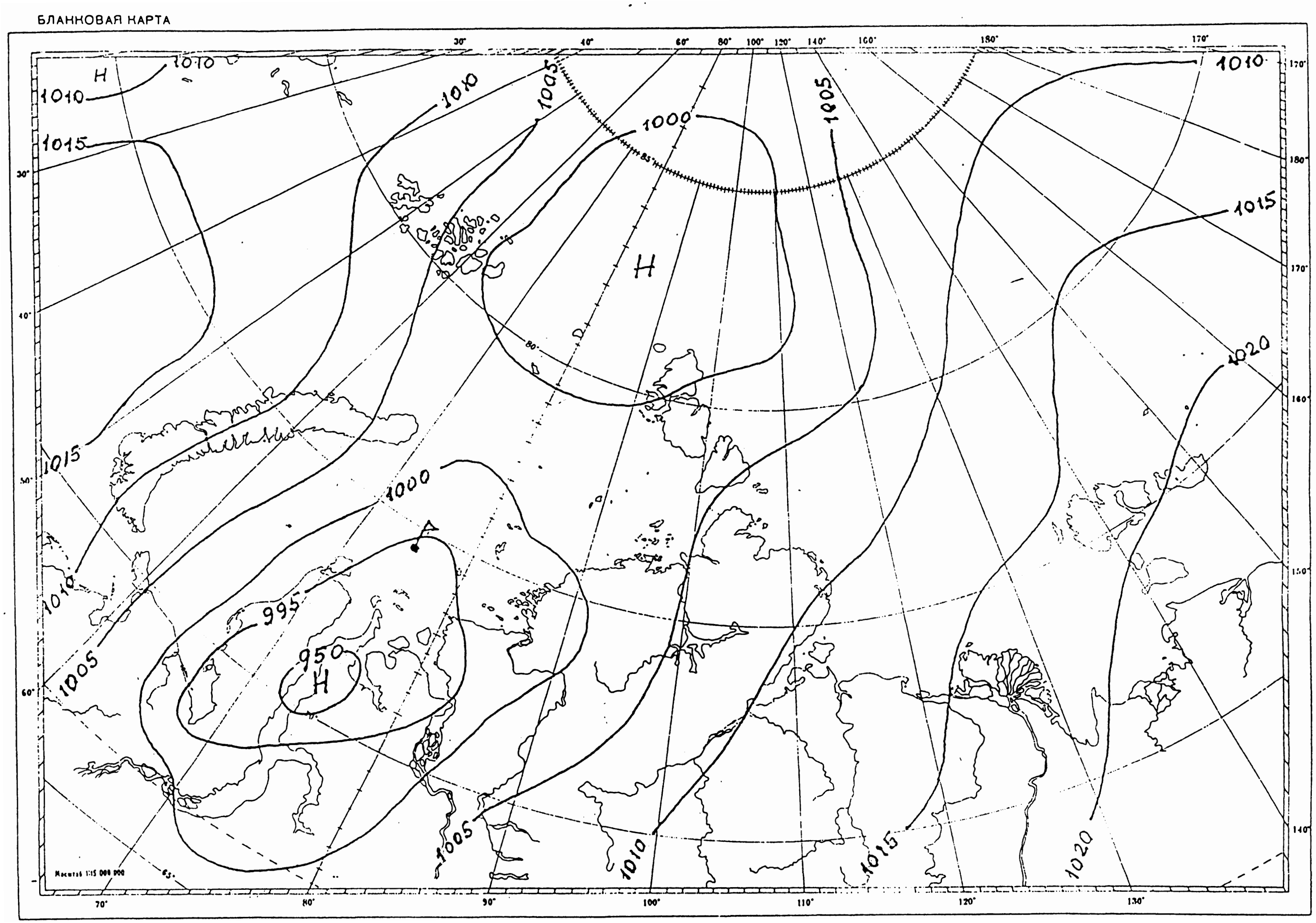


Fig.3.1 Synoptic circulation in the work area of the "KAREX-94" expedition for 10.09.94

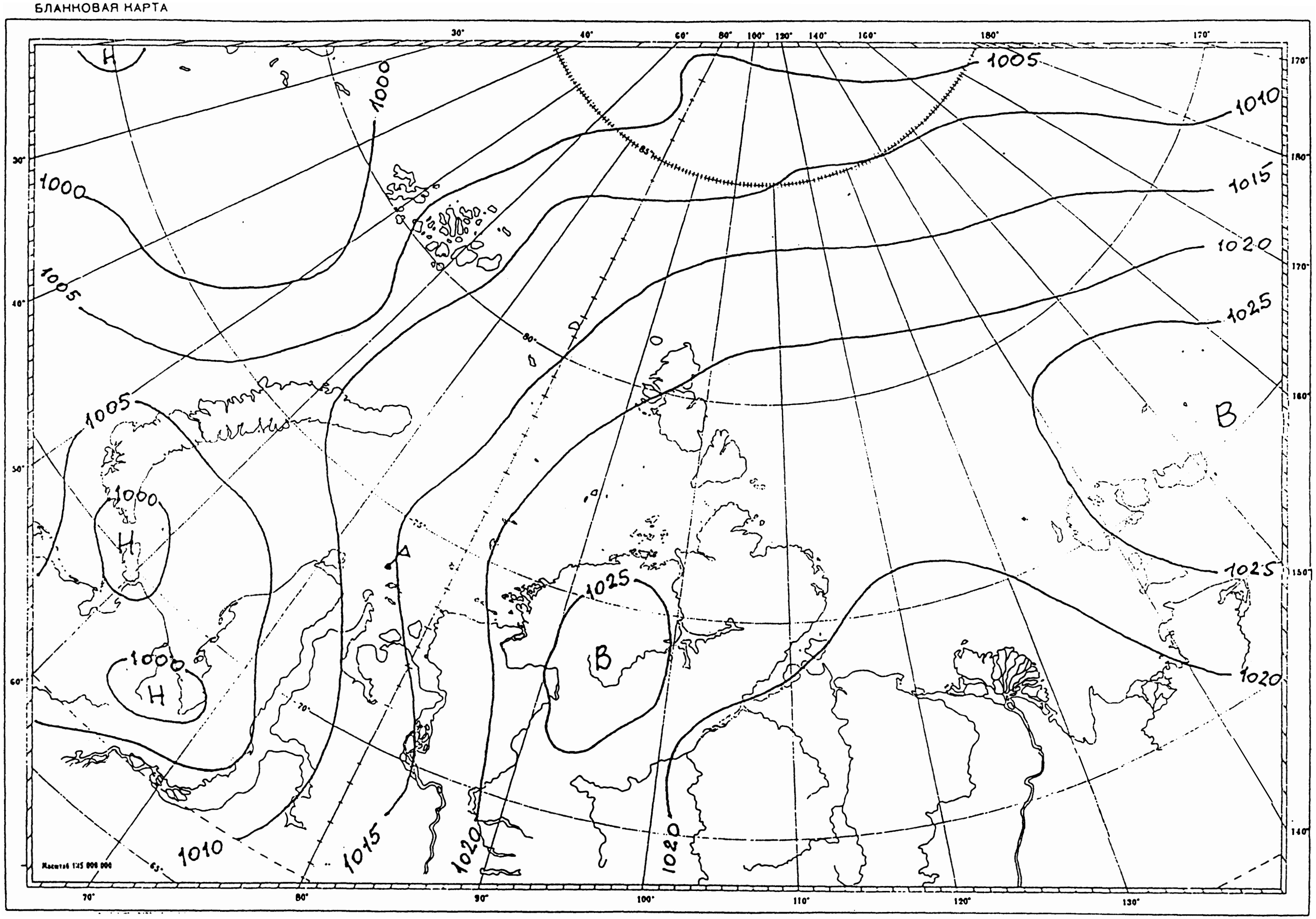


Fig.3.2 Synoptic circulation in the work area of the "KAREX-94" expedition for 14.09.94

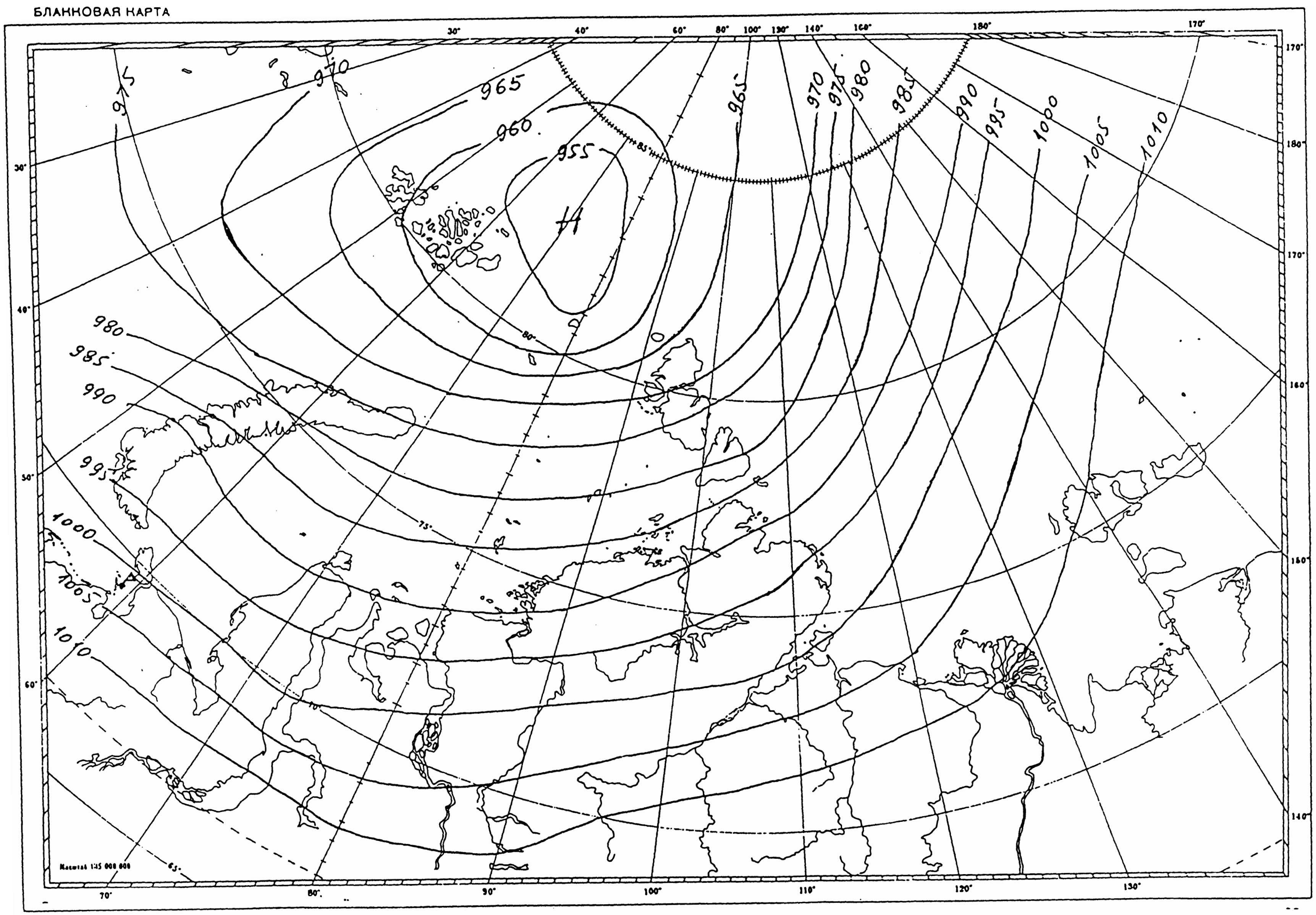


Fig.3.3 Synoptic circulation in the work area of the "KAREX-94" expedition for 06.10.94

4. CTD OBSERVATIONS IN THE KARA SEA (OTS-1500)

V.Kuznetsov, S.Kuzmin, E.Nygaard, P.Pavlov,
L.Pisarevskaya, V.Zhukov

The deep water observations of the water temperature with hydrochemical sampling were carried out during 18.08 - 04.10.1994.
The order of deep water observations was the following:
1. Check of the CTD-sound (OTS-1500) in the White sea - 1 st.
2. Deployment of SM in the area of river water outflow of Obskaya Guba, here again the work with CTD-sound - 1 st.
3. Deployment of second mooring station (MS) in the area of water outflow of Gulf of Yenisey along the Dikson meridian, here again work with CTD-sound - 2 st.
4. Going from MS deployment point to the Svedrup Island region and further to Baranov Island - 3 st.
5. Going towards north-east and then to Northern Kara sea in order to meet the ice edge, incidental performance of several stations along 77 and 78 N - 6 st.
6. Mesofield near ice edge - 18 st.
7. Cross line stations at the sections along 78, 77, 76 and partly 75 N and the section Zhelaniya Cape - Mikhailova Peninsula - 20 st.
8. Survey of Obskaya Guba - 22 st.
9. Going to the deployment point of second MS - 1 st.
10. Taking off of MS, here again work with CTD-sound - 1 st.
11. Survey of Gulf od Yenisey - 15 st.
12. Section Dikson - Bely Island , then section along 74 N and partly, stations along 75 N - 18 st.
13. Going to the Southern Kara sea along the 60-miles zone of Novaya Zemlya, one station at each section along 73, 72, 71 N - 3 st.
14. Section Kara Gate - 3 st.
15. Second stage of expedition, survey of Baidaratskaya Guba - 19 st.
16. Stations along sections 70 and 71 N - 10 st.

After finishing works along 70 and 71 N the ship went to Amderma where a part of scientific staff disembarked, and just coming hydrooptist embarked. Then the ship went to Naryan-Mar where bunkered and stayed few time due to the storm. On 03.10 the ship came out of Naryan-Mar, went to the Pechora sea towards Murmansk. Due to the storm (wind speed 25-30 m/s) and following time shortage there was no opportunity to perform the other sections in the Kara sea (along 72, 73 N), and ones planned in the Barents sea. During storm the last expedition station was carried out in the Pechora sea. On 11.10 the ship lied out in the Kola Gulf without call to Murmansk. The Norwegian equipment was unloaded there. On 13.10 the ship went to Arkhangelsk and reach it on 15.10.

The temperature and salinity observations by means of the OTS-1500 CTD took place at all the stations. See the General Table (Annex B) .The observations was carried out by the scheme of stations (Fig. 4.1,4.2) proposed in the Expedition

Program. The samples were taken at standard levels (for the Kara sea: 0, 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 100, 125, 150, (175), 200, 250, 400, 500) with interval not more than 0.25 m. Water samples were

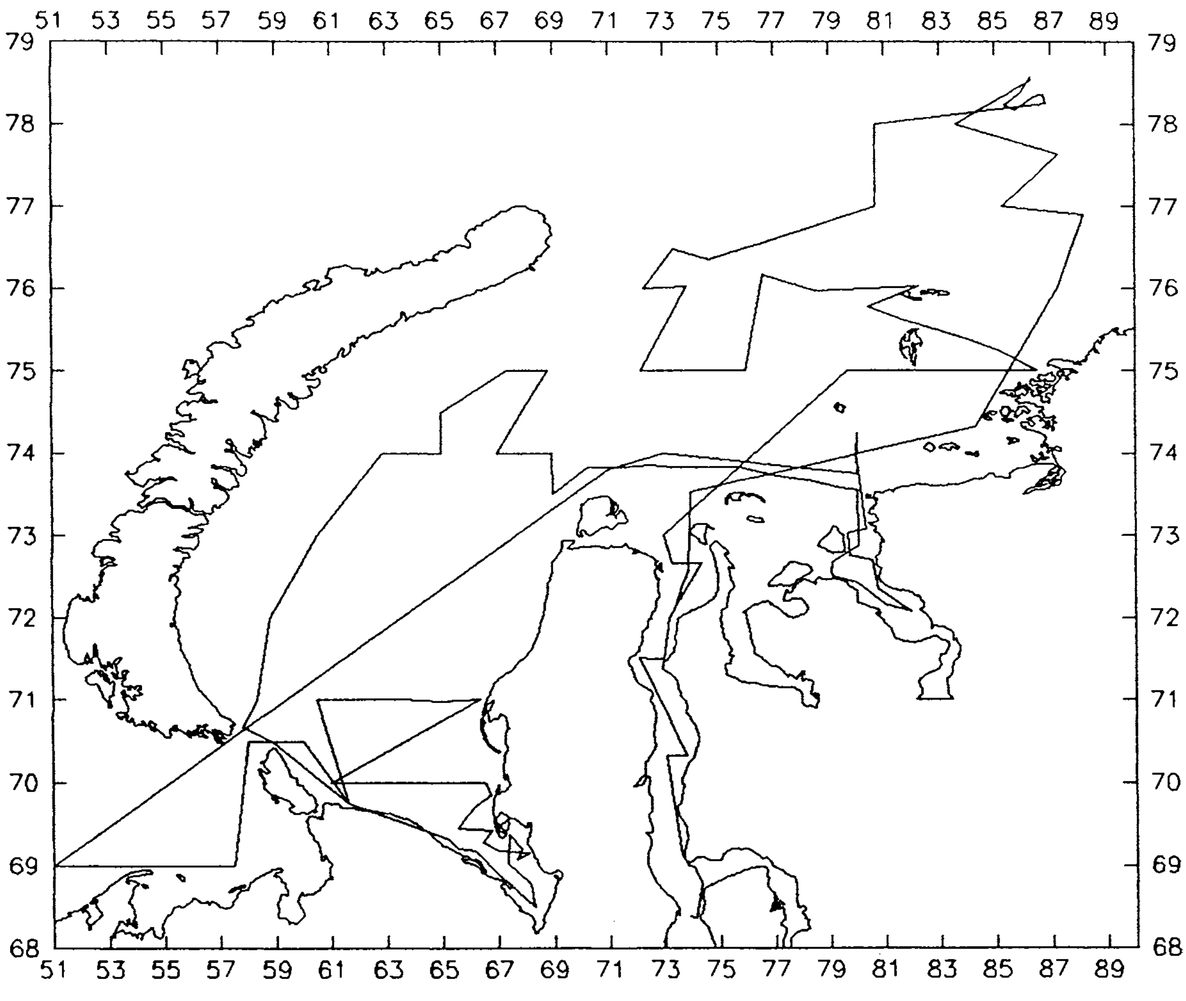


Fig. 4.1 The itinery of " Ivan Petrov " during cruise in the august / october.
Kara sea (22.08-12.10.94).

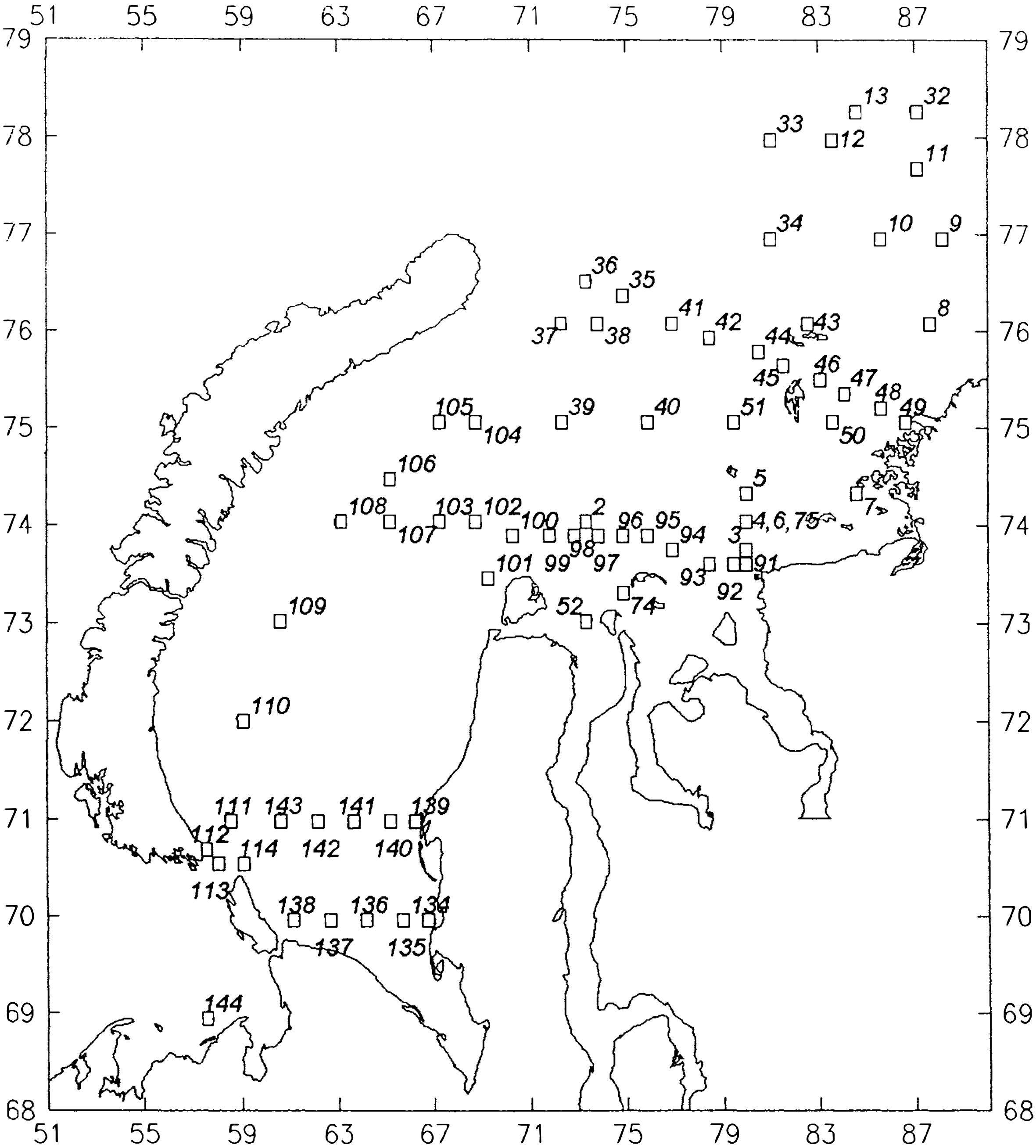


Fig. 4.2 Position of stations during cruise on the R/ V " Ivan Petrov " in august / october. Kara sea (22.08-04.10.94).

collected with a General Oceanics Rosette with 12 2 1/2 liters Niskin bottles. Water samples were collected for analysis of salinity, heavy metals, oxygen, helium, tritium, $\delta^{18}O$ sland organic contents.
The mini-winch was enclosed to the sound, however, it was not used in the cruise. The usual ship winch with a cable was used. In the beginning of the cruise the lower stand of bottle rosette was damaged due to careless handling of electrohydraulic winch. However,

winch. However, the ship mechanics managed to change that detail that allowed us not to interrupt CTD measurements. In general, CTD "OTS-1500" had a stable quality during the whole cruise. The bottle rosette also had no troubles, but by the end of the cruise several bottles had to be removed due to their tightness changed to the worse (the springs and elastics of bolt device grew weak).

A pre-cruise calibration of the OTS-1500 CTD was carried out at Geophysical Institute in Bergen. The results were in good agreement with the accuracy for the OTS-1500 CTD given in table 4.1.

Sensor	Principle	range	accuracy	resolution	time const.
Temperature	Pt 100	-2..38°C	± 0.01°C	0.001°C	160 ms
conductivity	7-pole-cell	0..60 mS/cm	± 0.01mS/cm	0.001 mS/cm	100 ms
Pressure	piezo-resistive	as required	± 0.25 % fs	0.025 dbar	20 ms

Table 4. 1 Specifications for the sensors of the OTS-1500 CTD.

During the cruise water samples were collected for calibration of the conductivity cell and the water samples will be analyzed at Geophysical Institute in Bergen .

All the oceanographic data obtained were preliminarly handled and reviewed. On the basis of these data the plots and schemes for the main hydrological characteristics such as: vertical temperature, salinity and density distribution, and T-S curves for each hydrological station, were plotted. Furthermore, the schemes of vertical distribution of temperature, salinity and density for all zonal sections and several sections of the field were plotted. The number of standard and additional sections in Baidaratskaya Guba, Obskaya Guba and Gulf of Yenisey were carried out. Additionally, the square schemes of distribution of temperature, salinity and density for levels 0, 5, 10, 15, 20, 25, 50 and 75 were carried out .
Distribution of temperature and salinity on the serface (Fig. 4. 3 - 4.8)

The ice situation during the expedition allowed us to operate in the central and north-eastern Kara sea. However, the ice massif removed of Novaya Zemlya and extending from the West to the East, delayed our work. During operations in the north of the Kara sea the mesofield was done near the ice edge region (Fig.4.9) . The surface temperature was variating within -0.2 C0 - -1.7 C0 (Fig.4.10) .The typical reduction of temperature was observed in the north. If we look to the sections of the field under study, we see that the temperature slightly changes from surface to bottom. Most likely the surface arctic water mass transformed in an explicit form prevails here. The salinity here is less conservative. Particularly, it is pronounced at sections 2 and 3 where are the deepest areas of the field (Fig.4.11-4.14). In bottom layers the transformed waters of the Arctic Basin are observed (probably, being under influence of the atlantic waters) with increased salinity of about 34.5 0/00. As for the other regions, the surface arctic waters also were transformed due to various factors such as the influence of Ob and Yenisey discharge and advection of adjacent regions. It is important that the distribution of temperature and salinity in the surface layer was influenced not only by river discharge and advection but also solar radiation and ice melting processes.

The maximal surface temperatures were observed near the wester coast of Yamal and in the region of Baidaratskaya Guba (south-west Kara sea). (Fig. 4.7). In the region of river water input the

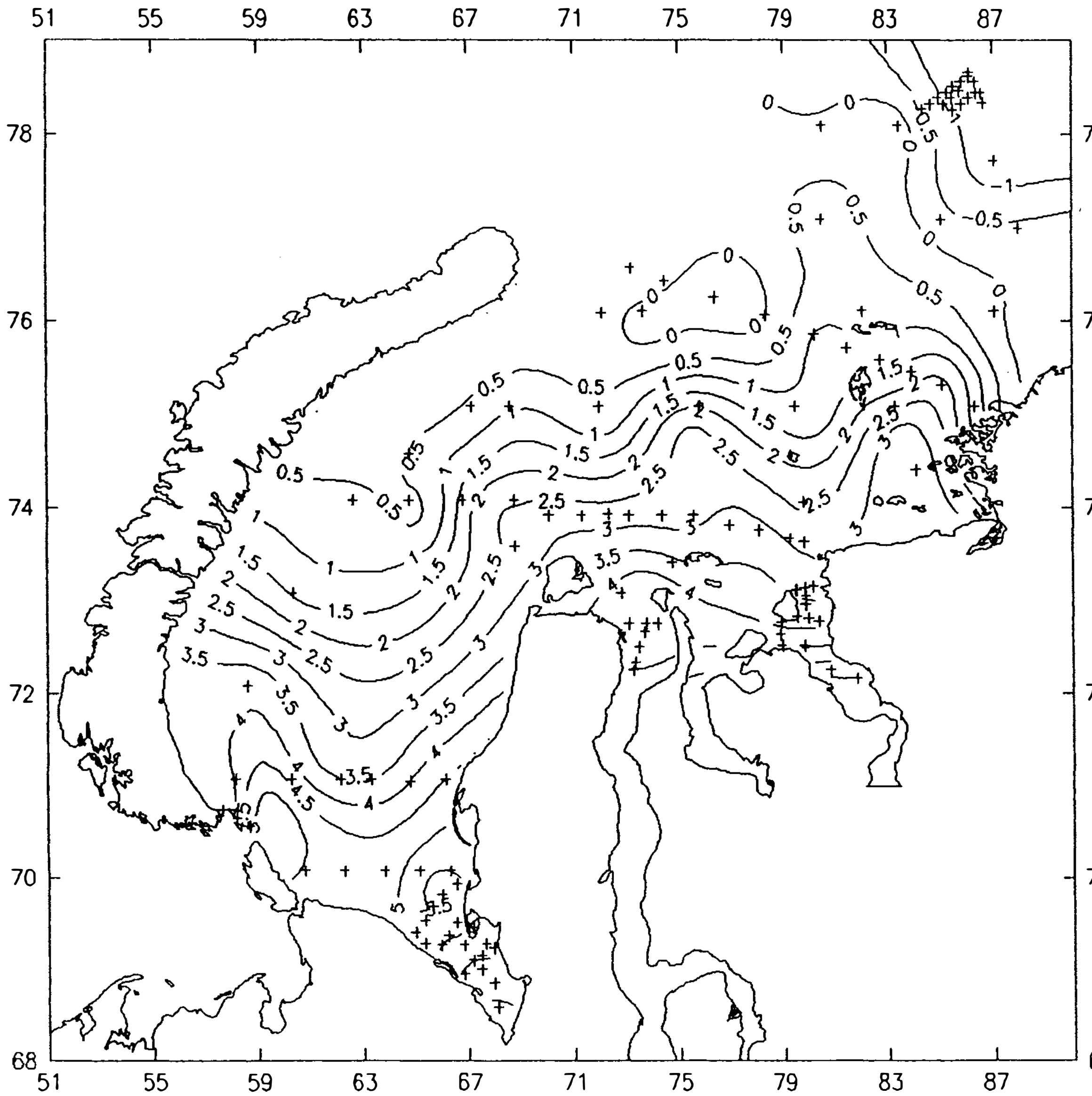


Fig. 4.3 Temperature of surface water in august / october. Kara sea (22.08-04.10.94).

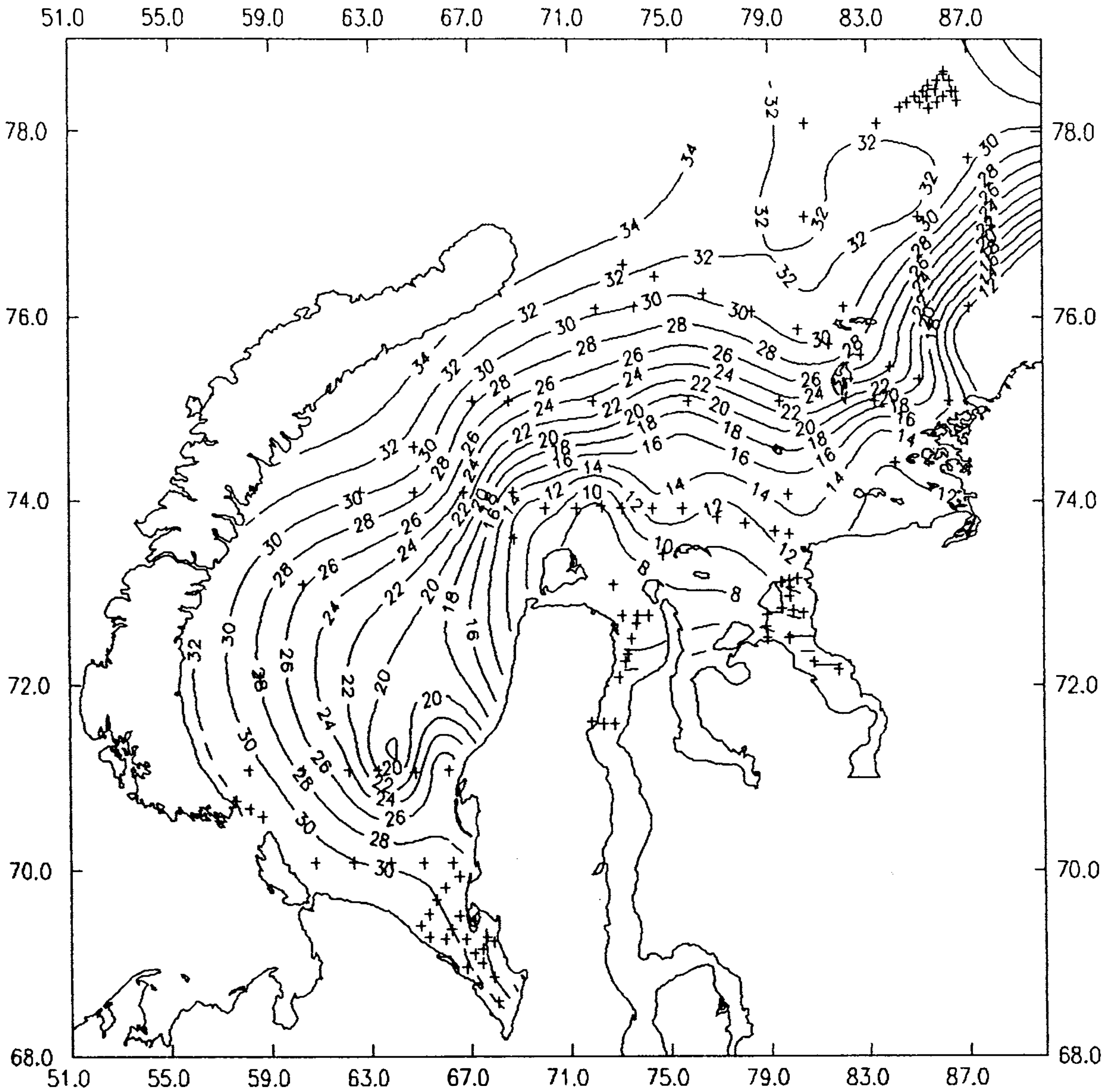


Fig. 4.4 Salinity of surface water in august / october . Kara sea (22.08- 04.10.94)

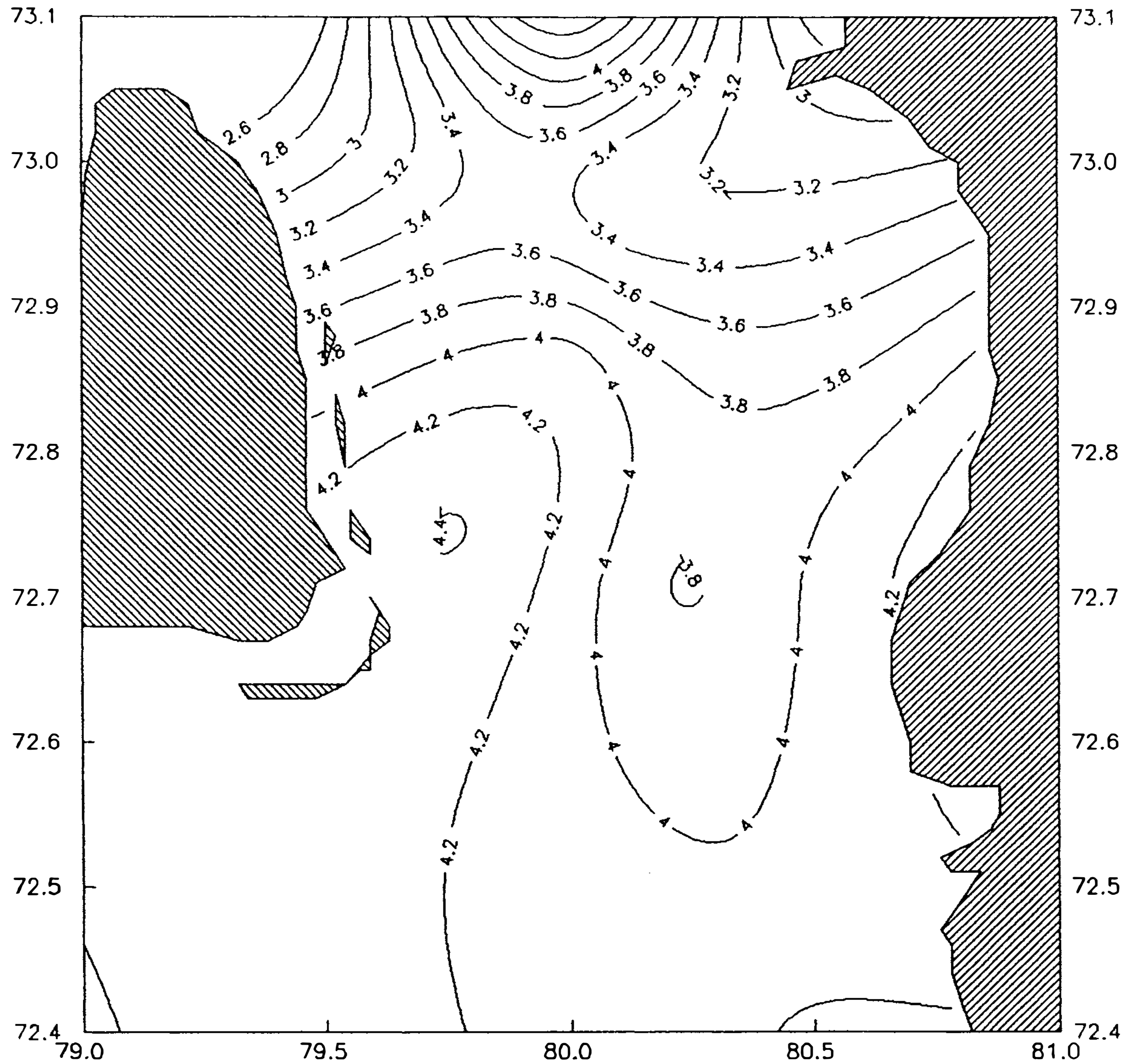


Fig. 4.5 Temperature of surface water in the Enisey bay (11.09-13.09.94) .

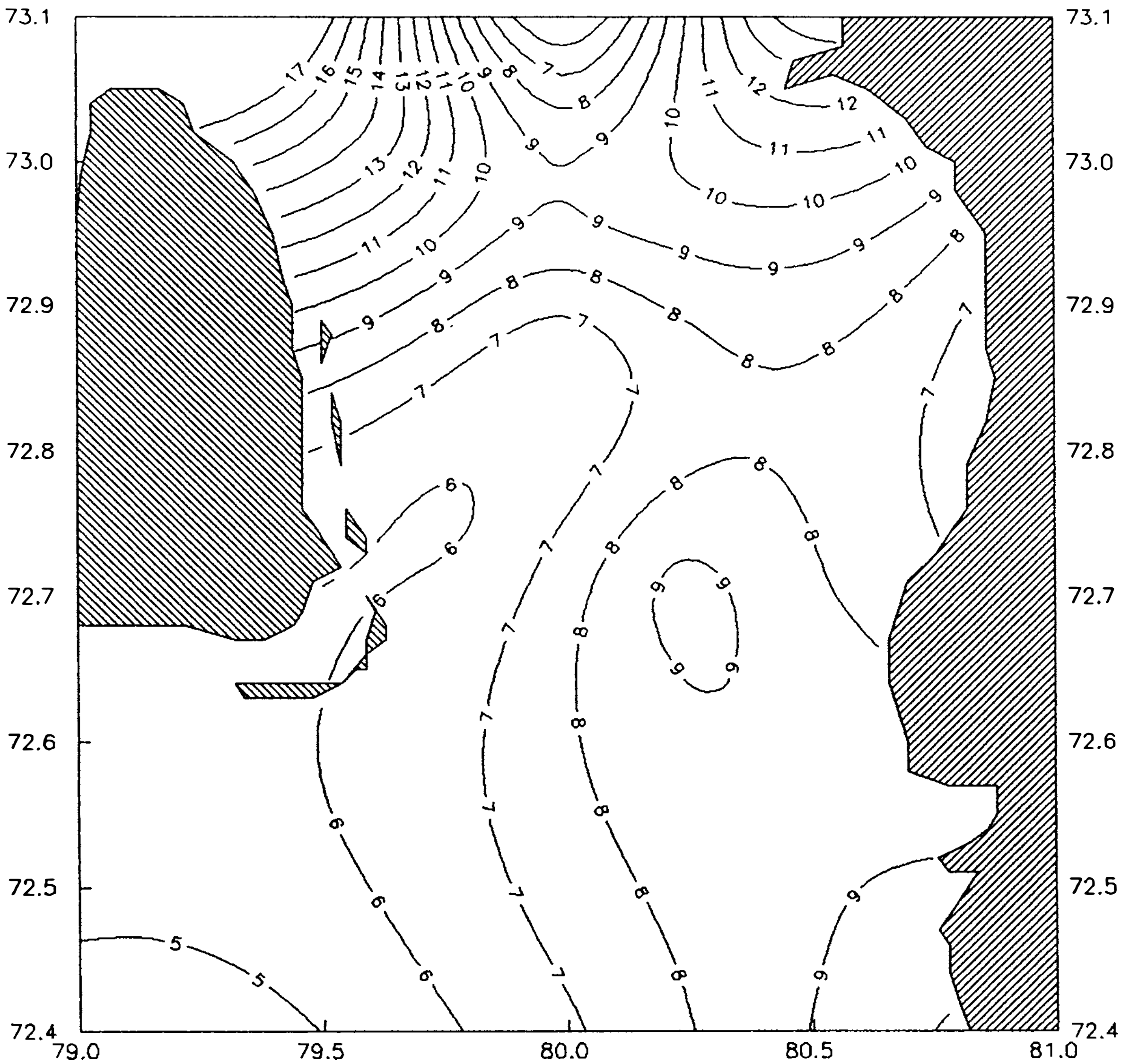


Fig. 4.6 Salinity of surface water in the Enisey bay (11.09-13.09.94).

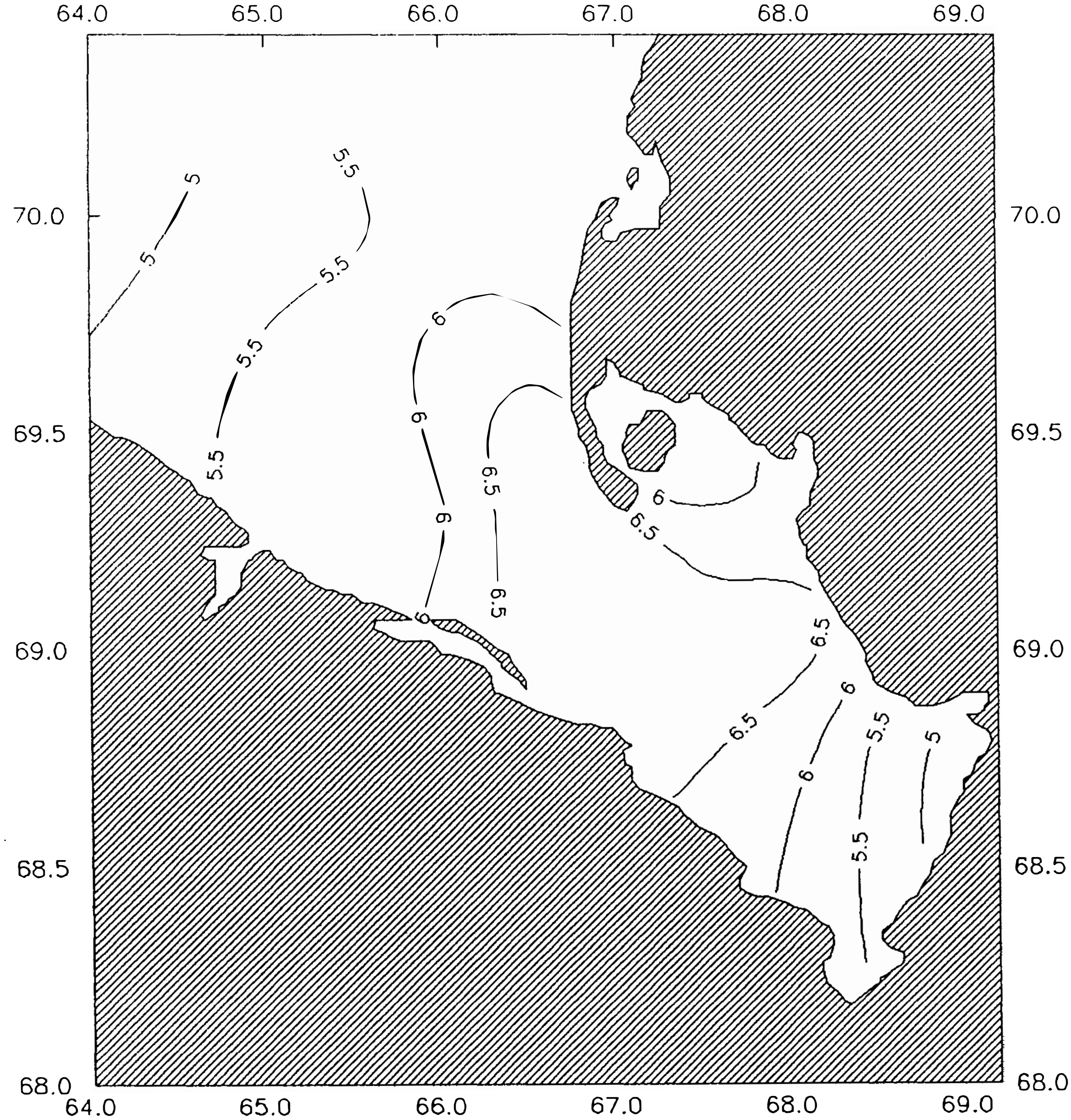


Fig. 4.7 Temperature of surface water in the Baidaratskaya Guba. (19.09 -23.09.94)

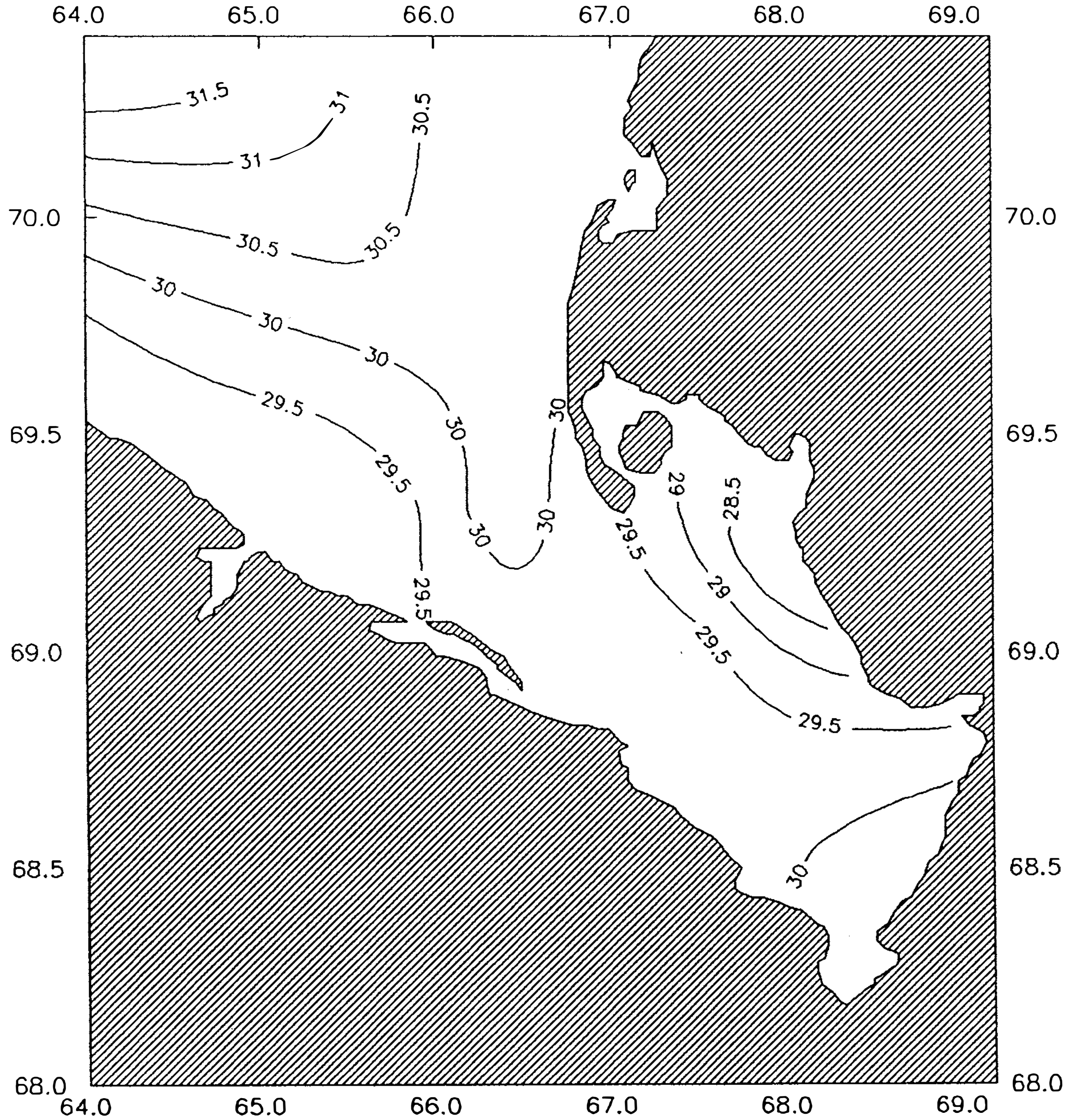


Fig. 4.8 Salinity of surface water in the Baidaratskaya Guba. (19.09-23.09.94).

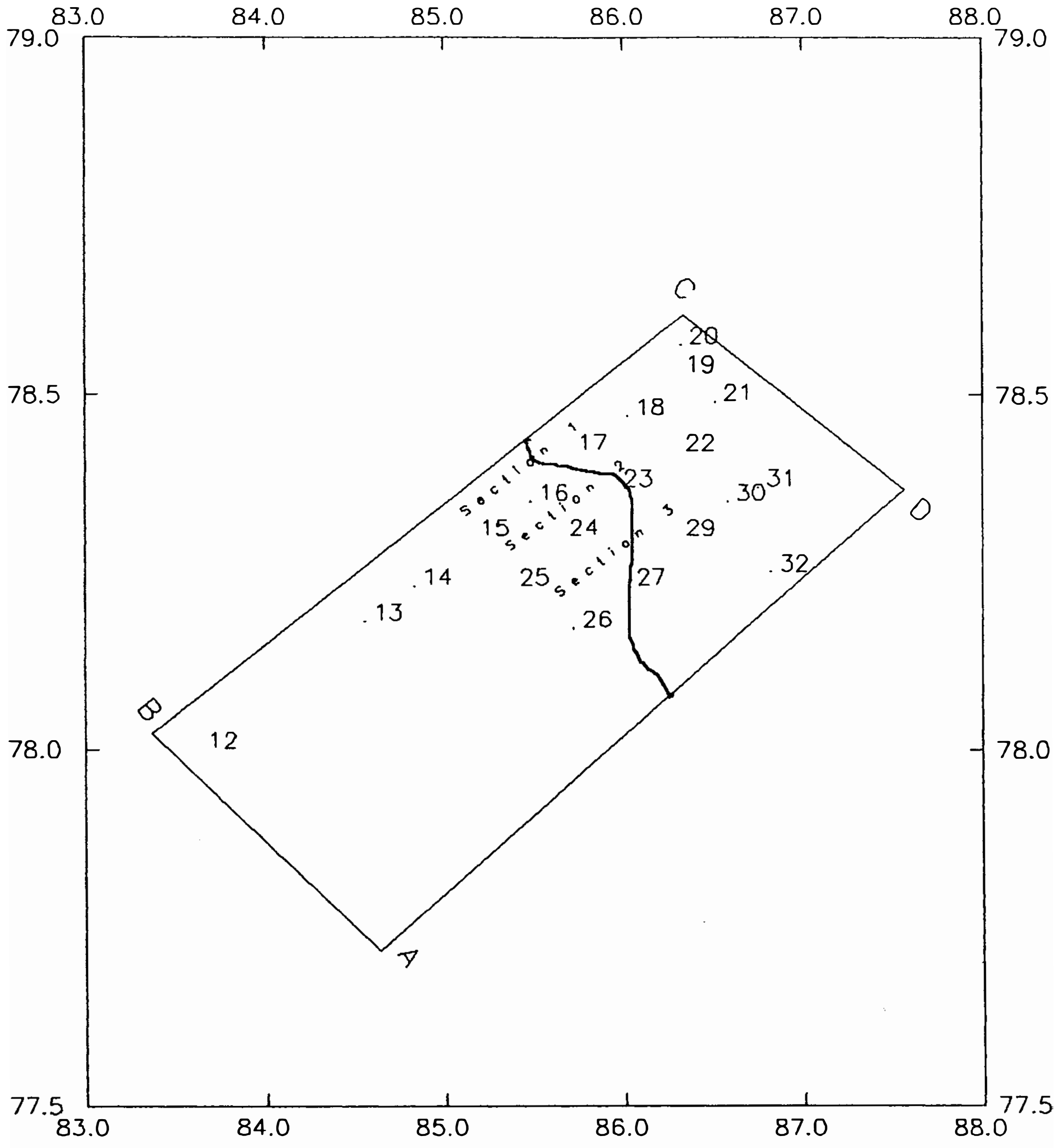


Fig. 4.9 Position of oceanographic stations, sections and ice boder on the POLIGON in the near-edge zone. Kara sea (27.08 - 28.08.94). _____ position of ice boder.

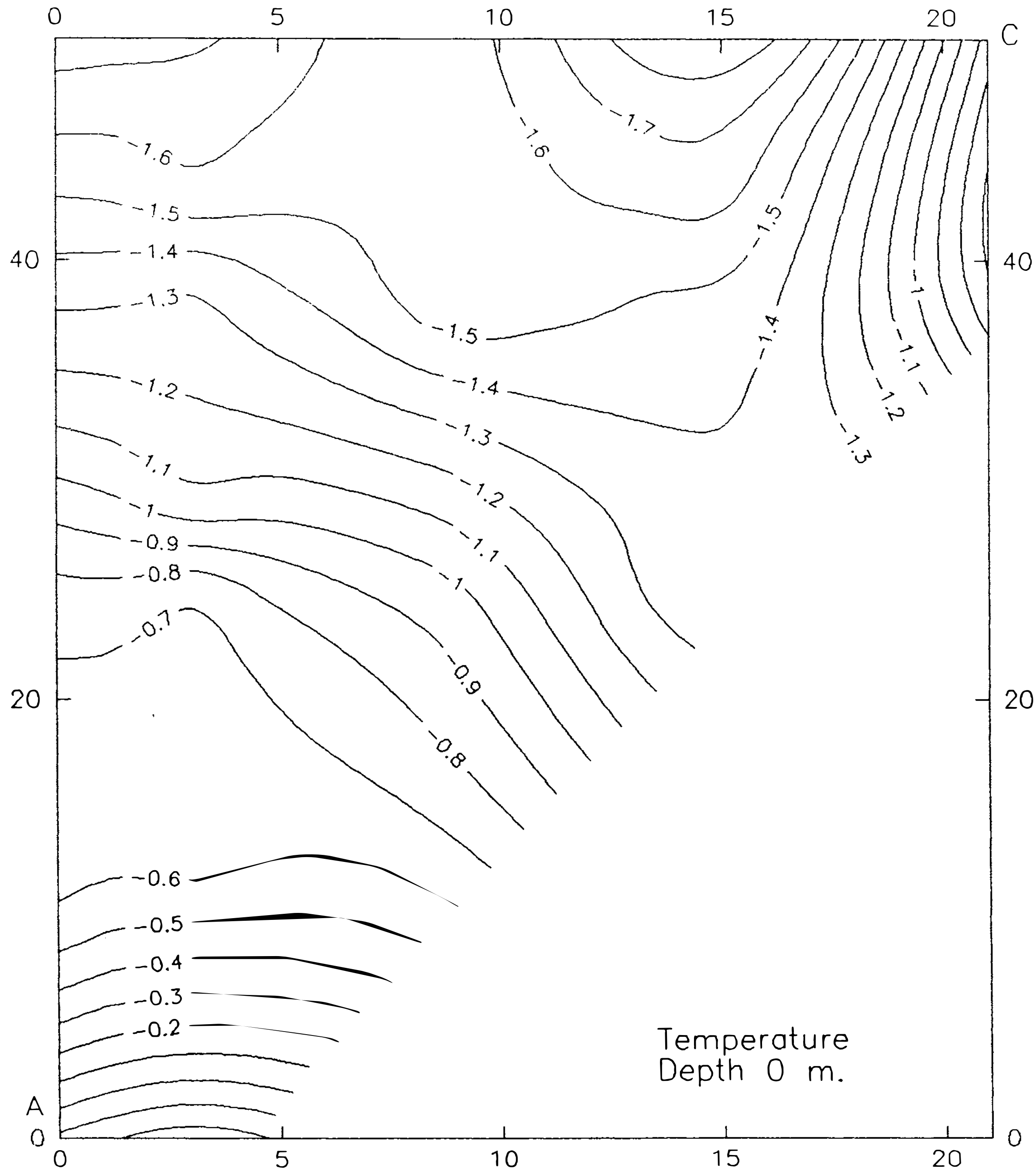


Fig. 4. 10 Temperature of surface water on the POLIGON in the near-edge zone.
Kara sea (27.08-28.08.94).

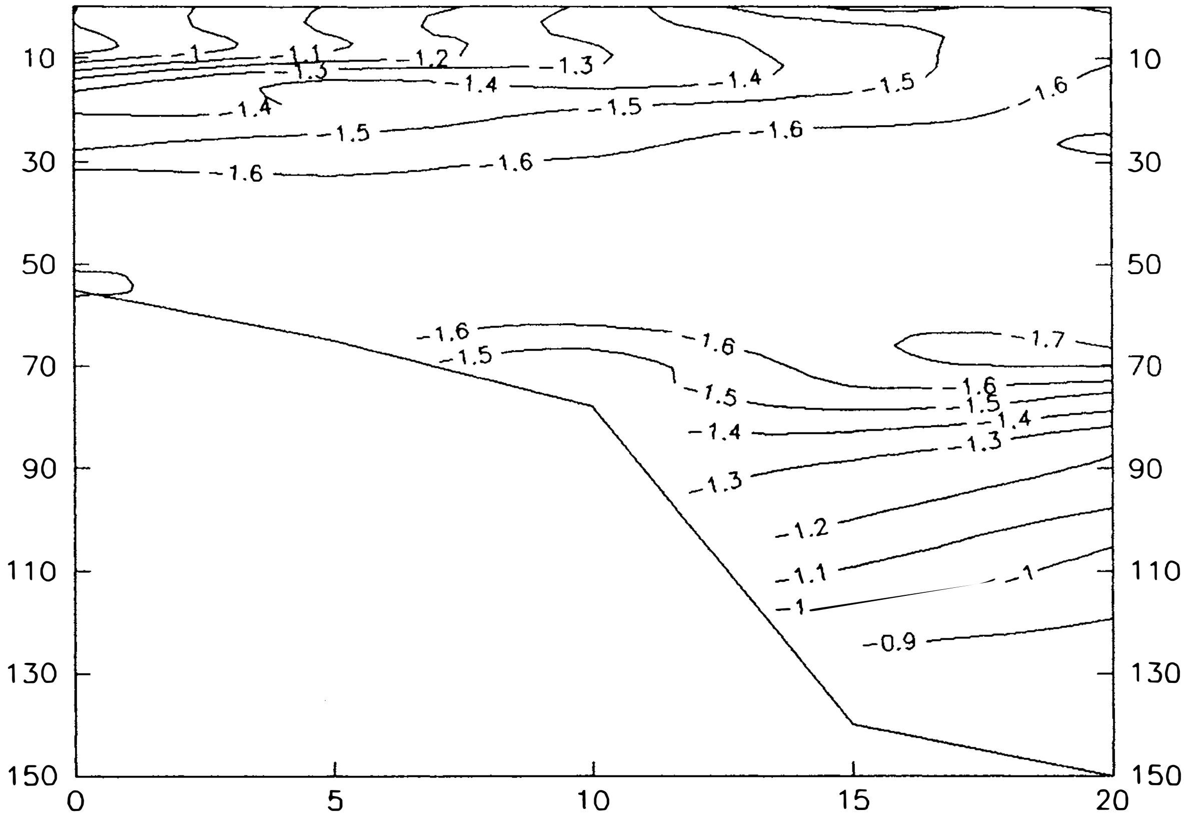


Fig. 4. 11 Distribution of temperature on the the section **2** across the POLIGON in the near-edge zone. Kara sea (27.08-28.08.94).

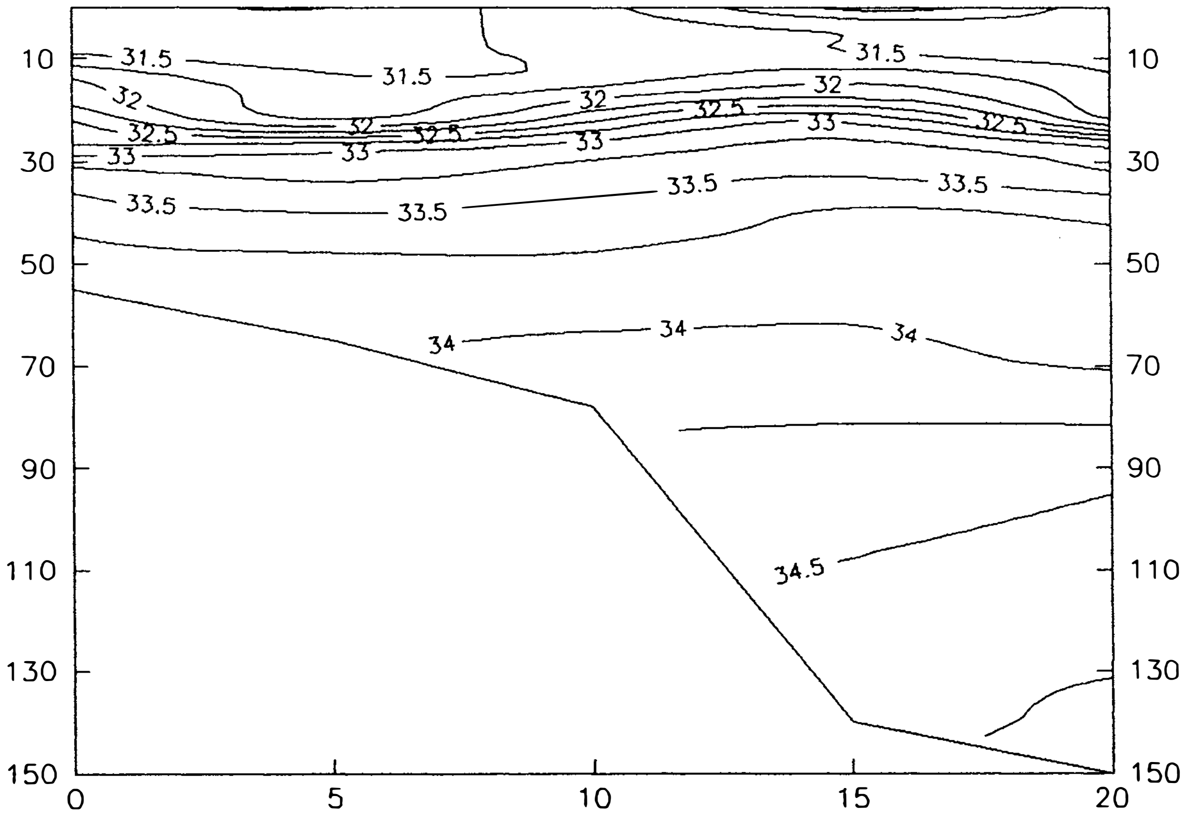


Fig. 4. 12 Distribution of salinity on the the section **2** across the POLIGON in the near-edge zone. Kara sea (27.08-28.08.94).

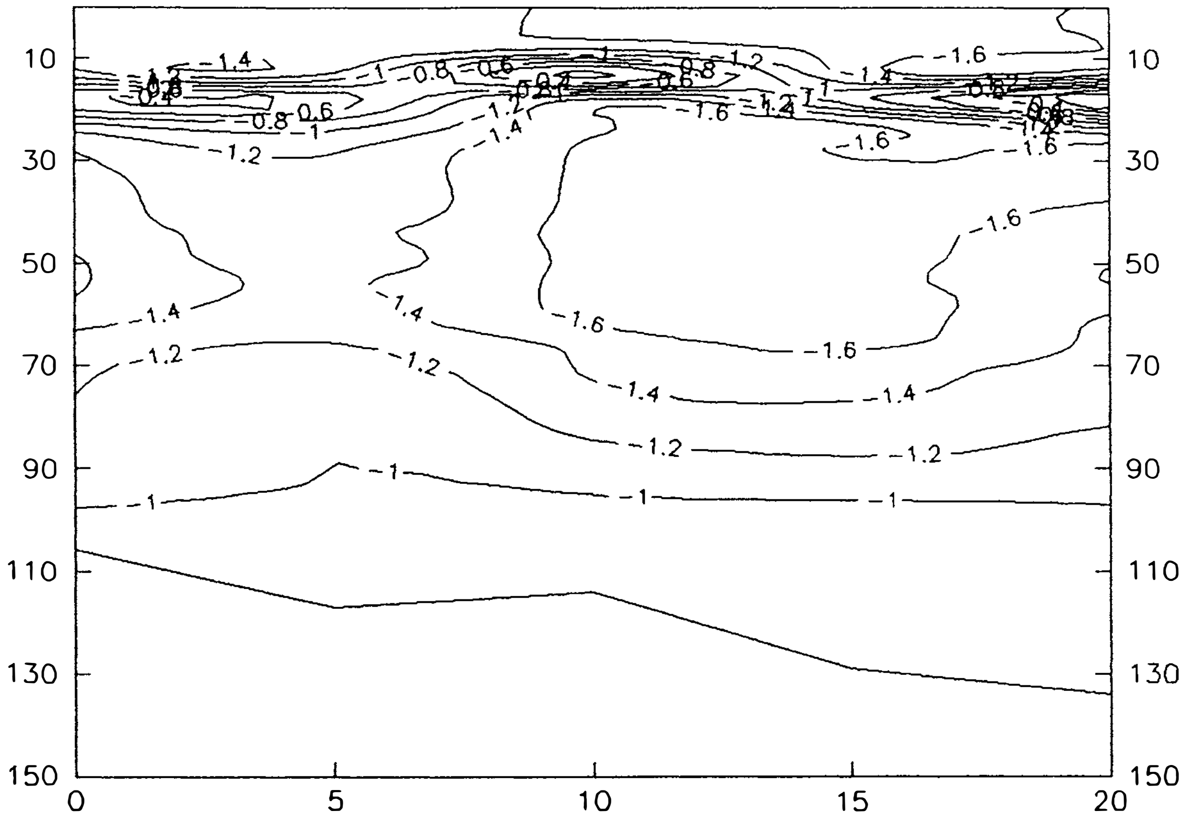


Fig. 4. 13 Distribution of temperature on the the section 3 across the POLIGON in the near-edge zone. Kara sea (27.08-28.08.94).

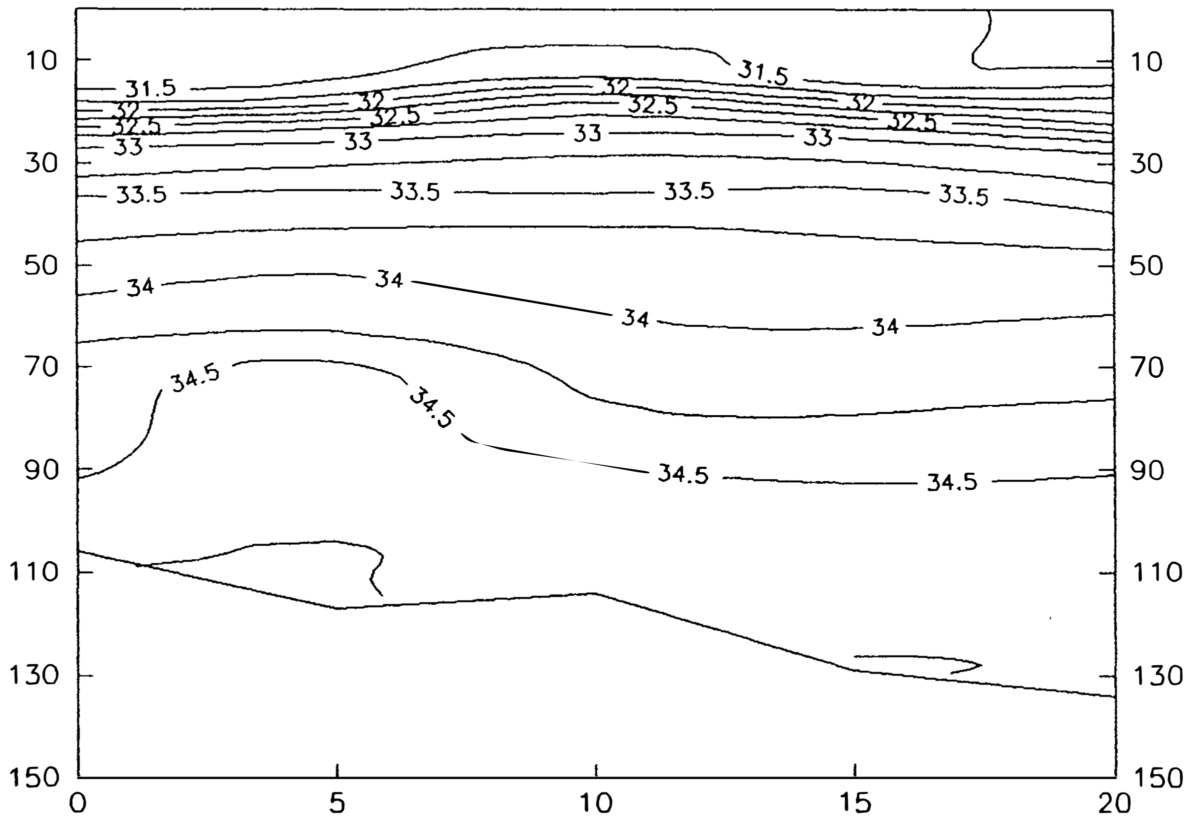


Fig. 4. 14 Distribution of salinity on the the section 3
across the POLIGON in the near-edge zone.
Kara sea (27.08-28.08.94).

water temperature was also increased up to 3.0 - 4.5 C0. The lowest temperature - to -1.0 C was observed near the ice edge and in the above mentioned ice massif.

The maximal salinity was observed near the Zhelaniya Cape, the increasing was observed near the Kara straits and in the centre and north-east of the Kara sea. Conversely, in the mouth area of Ob and Yenisey the salinity was the lowest.

The analysis of the vertical distribution of temperature on the sections allow us to distinguish the thermocline layer with gradients of 0.2-0.4 grade/m, maximum 0.7 grade/m which is located at the depth of 10-25 m and has the thickness of 10-15 m. The maximal values of gradient were observed on the sections in Obskaya Guba and Gulf of Yenisey. The increased gradients for temperature were also observed on the section Kara Gate. The lower border of thermocline is interpreted to be isotherm - 1.2 C0.

The halocline, as a rule, coincides with thermocline. Its gradients in the open sea are about 0.1 - 0.2 0/00 per m. In the Obskaya Guba and Gulf of Yenisey the gradients are higher (0.8 - 0.4 0/00 per m. The maximal 6 0/00 is observed in the Gulf of

Yenisey. The isogaline 33 0/00 can be taken as the low border of halocline (Fig. 4.16,17;4.19,20). The layer of density race formed by thermohalocline is the impediment for the water mixing and border between the surface fresh water and water formed by winter convection having emperature low to the freezing.

In the western part of zonal sections over the Novaya Zemlya Through and eastward there was no features of atlantic water. At the north-west the moderate inflow of the surface barents water took place in the over-pycnocline layer. Probably, it was due to influence of north-west winds enforced in late September and occurring during the whole October. Along the section 71'N the layer of transformed barents water with the temperature more than 1.5 C and salinity more than 33.5 0/00 held.The thickness of that layer was up to 80 m.

Russian and norwegian specialists consider the data obtained in the Gulf of Yenisey and Obskaya Guba as the most interesting. Let us learn the sections in the frontal zones, area of fresh water outflow of the Gulf of Yenisey and Obskaya Guba (Fig. 4.15-4.20).

At the longitudinal and cross sections in the Gulf of Yenisey the outflow of the main fresh water mass occurs in the upper layer (0-8 m) along the left coastline. Probably, it is due to the bottom orography of this region . The upper border of halocline is 8 meters. The gradients in halocline are considerable (3-4 0/00 with the maximum near 17th station of 5 0/00). The halocline thickness is 4-5 m. The maximal salinity near bottom is 29 0/00.

The gradients in halocline in Obskaya Guba are lower (1-1.2 0/00 per m) when maximum is 1.5 0/00 per m. Contrary to the Gulf of Yenisey, the outflow of fresh water here is right-side that is also considerably dealt with bottom orography . The halocline thickness here is 3-4 m. The upper border is 11 m. The maximal salinity is 28 0/00.

The water exchange with the Barents sea through Kara Gate is mutual. Rounding the Menshikova Cape, surface kara water inflow into the Strait, along the Vaigach more salt barents water inflow into the Kara sea. However, it is important that the water exchange was moderate, probably, due to prevailing south and north-western wind during the entire observational period.

The distribution of the Ob and Yenisey discharge was of the eastern type. The volume of river discharge was considerably smaller compared to previous years.

Conclusively, one should note that the distribution of the main hydrological characteristics in this year was generally in agreement with the multi-average ones.

Further, we expect to carry out more detailed analysis of the data obtained during the cruise using computers.

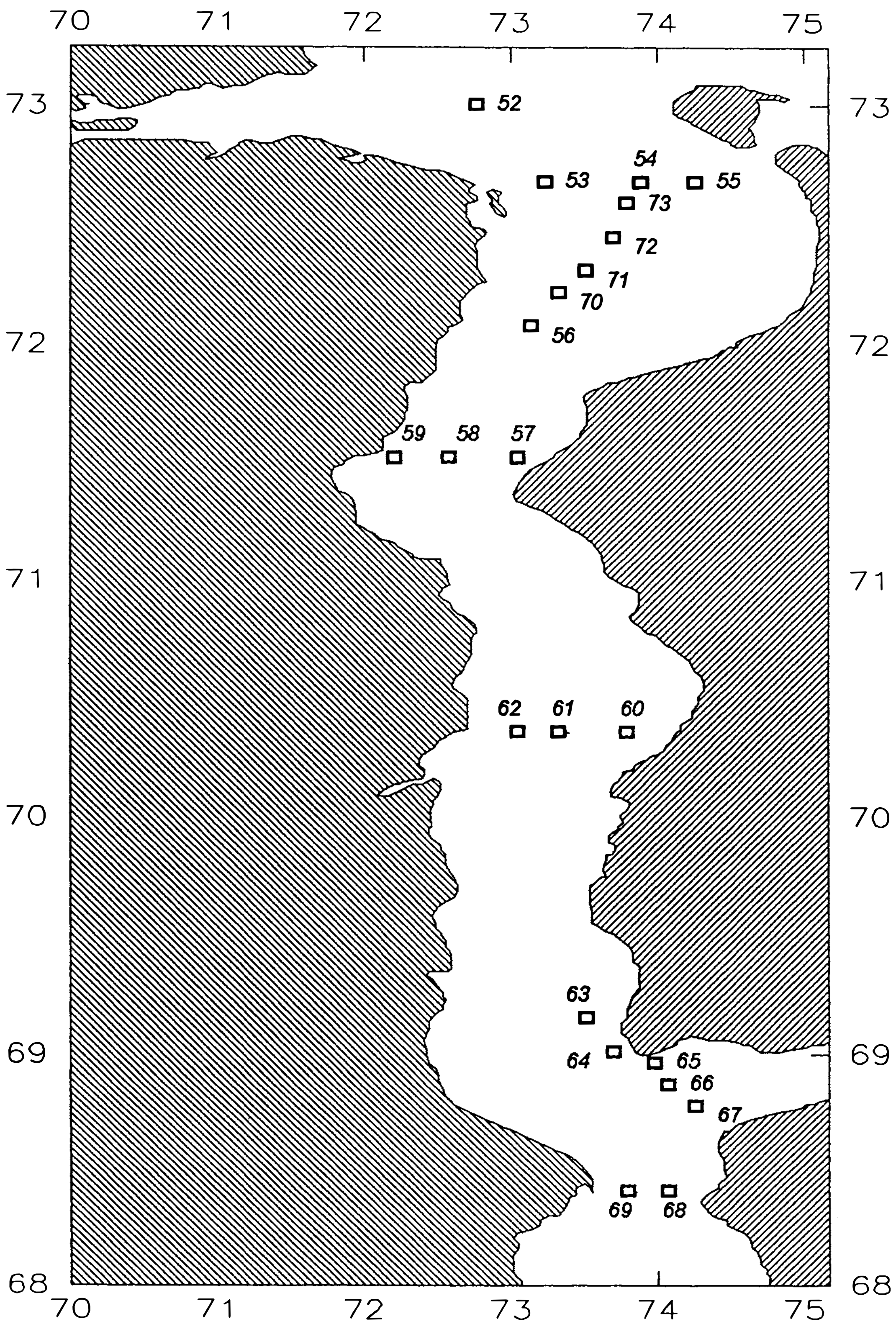


Fig. 4. 15 Position s of the oceanographic stations in the Ob bay. Ob bay (09.09.94).

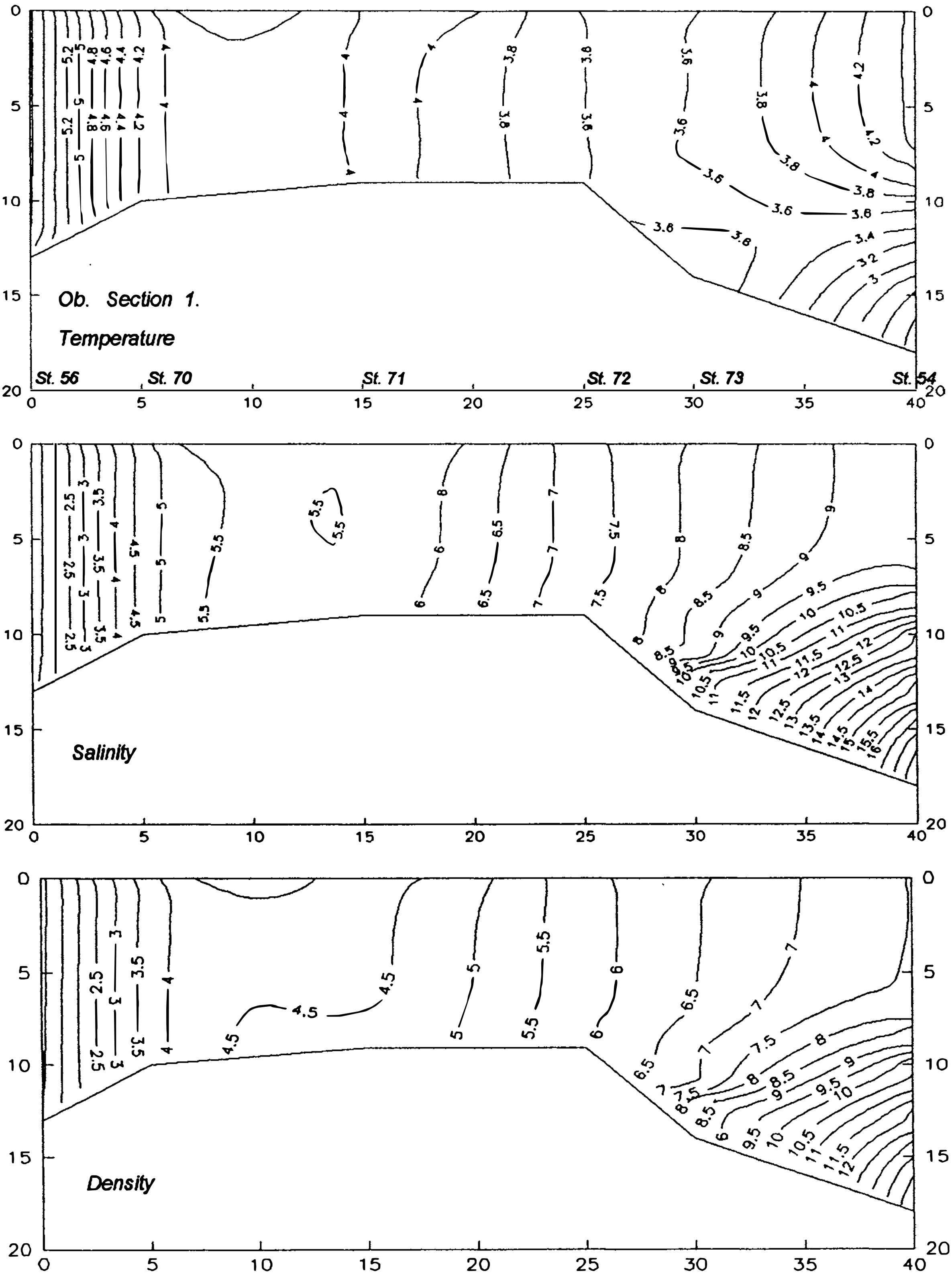


Fig. 4.16 Distribution of temperature, salinity and density on the section along frontal zone in the Ob bay. Ob bay (09.09.94).

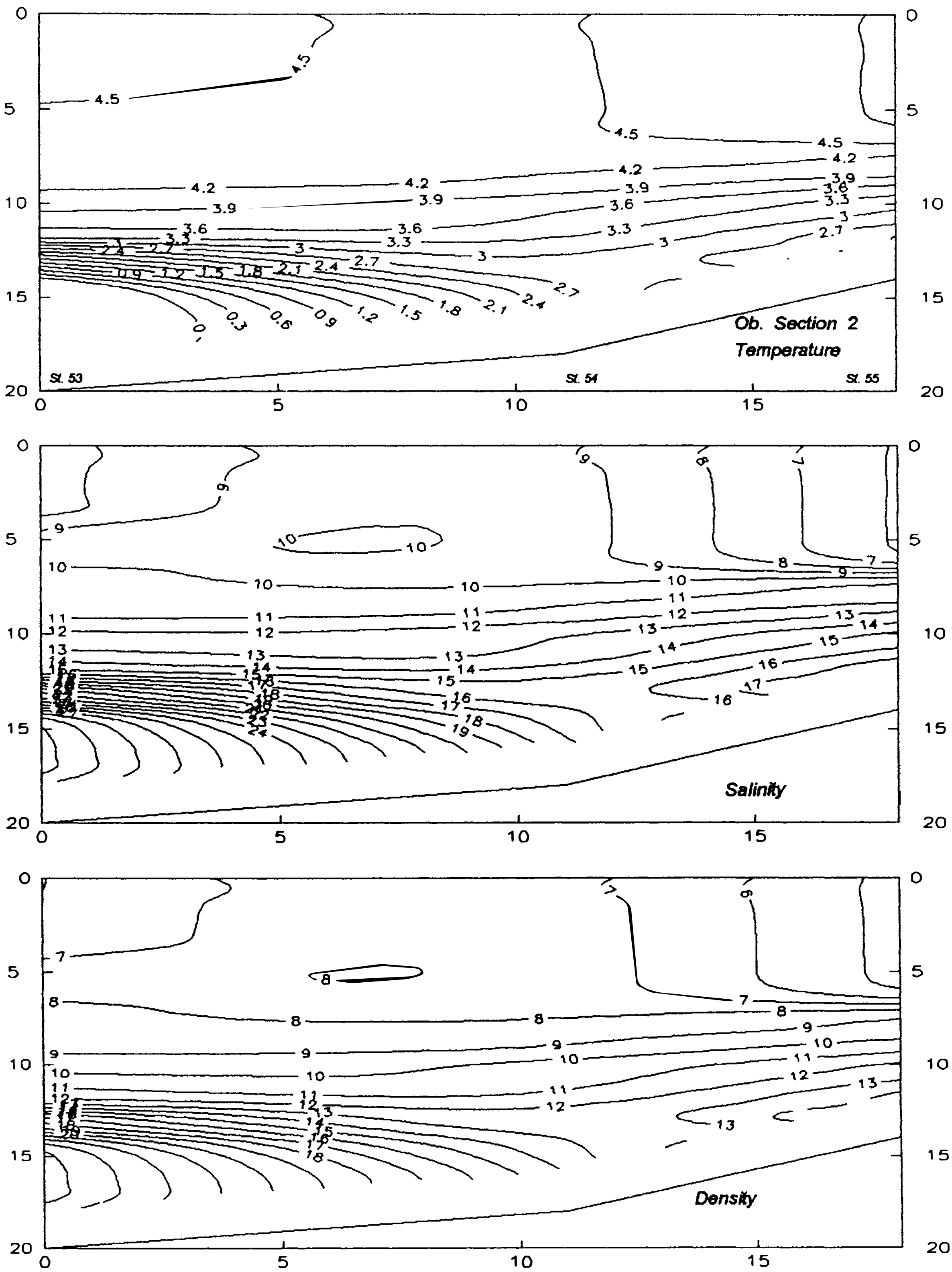


Fig. 4.17 Distribution of temperature, salinity and density on the section across frontal zone in the Ob Bay. (04.09.94).

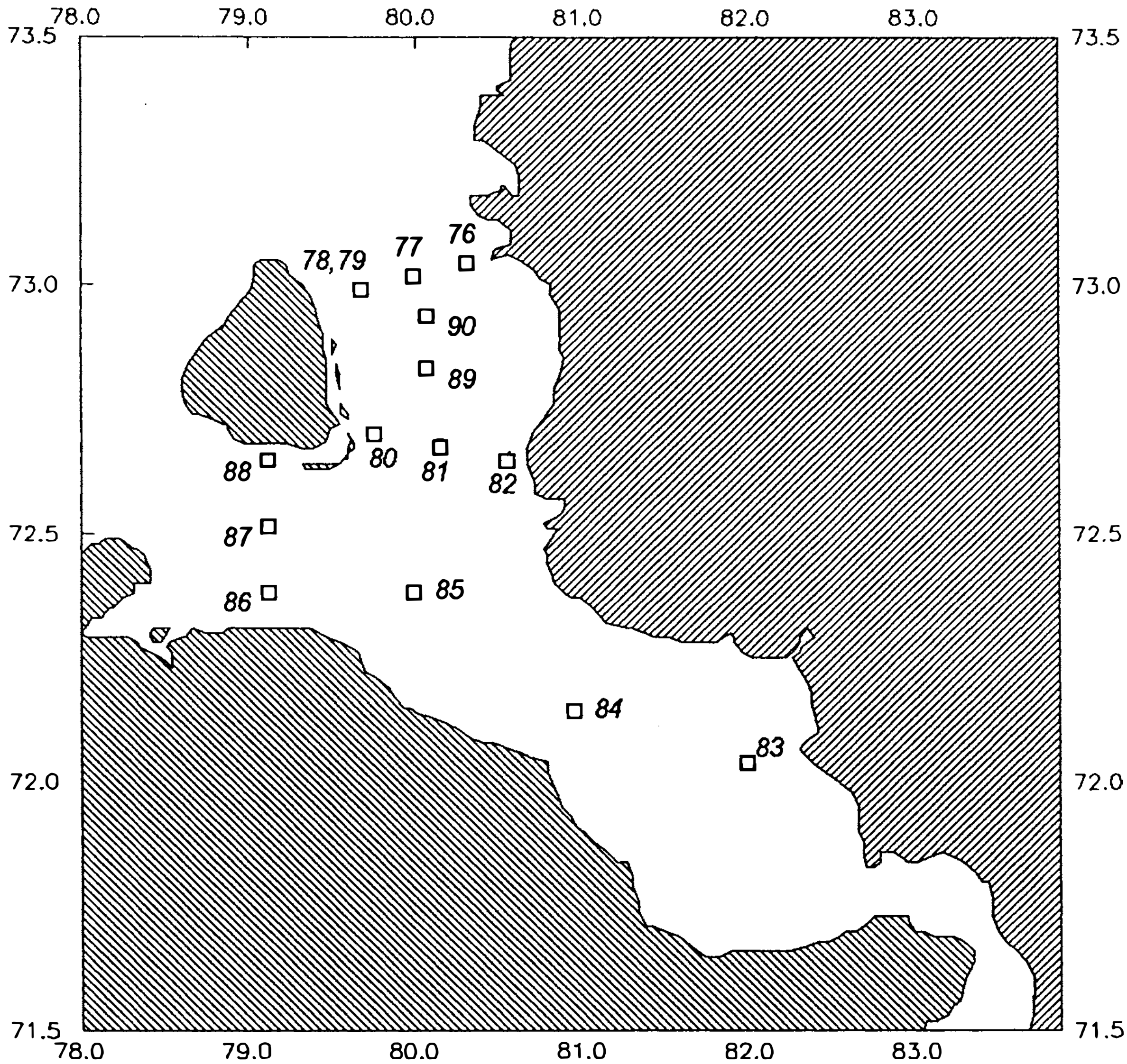


Fig. 4.18 Positions of stations in the Enisey bay. Enisey bay (11.09.94).

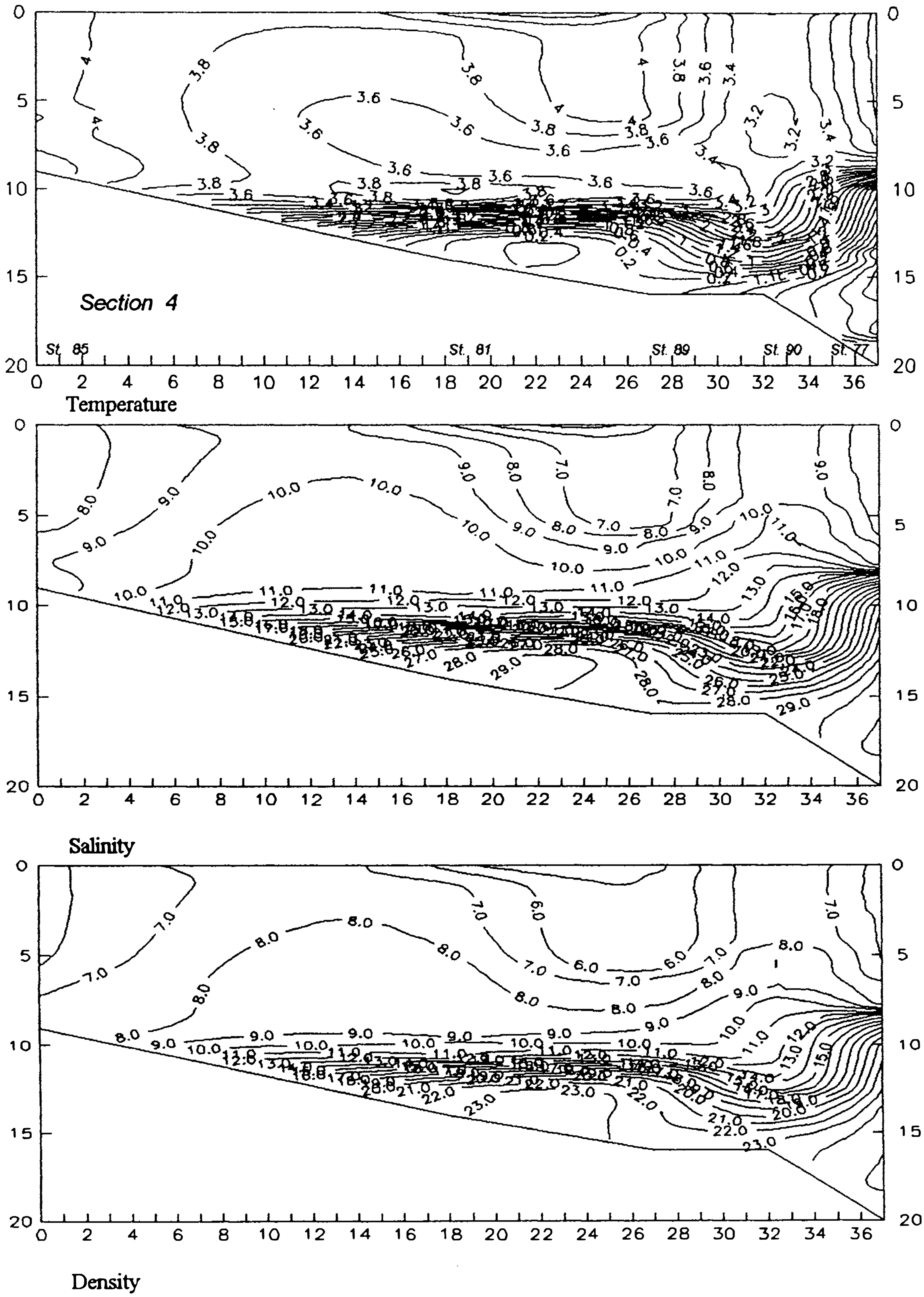
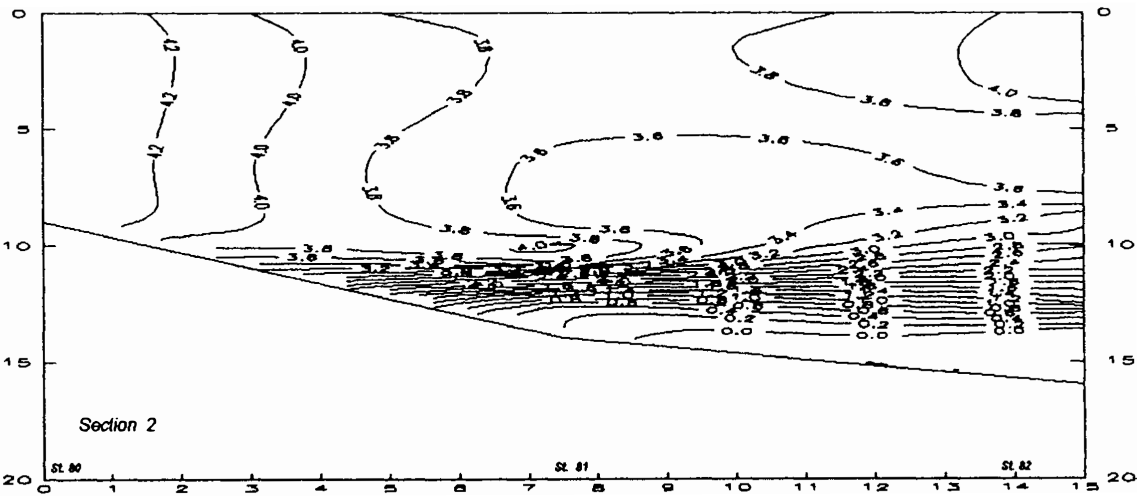
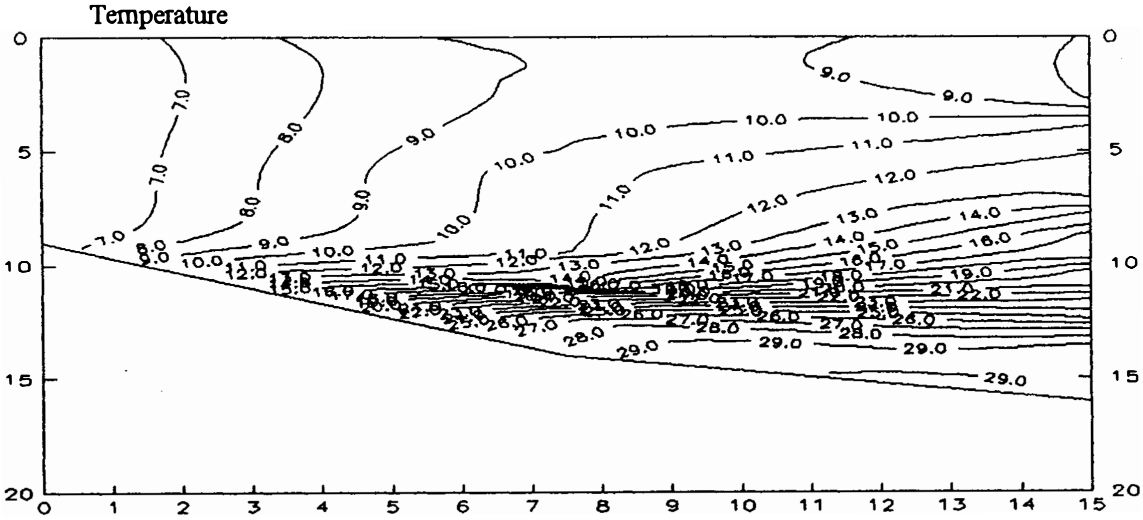


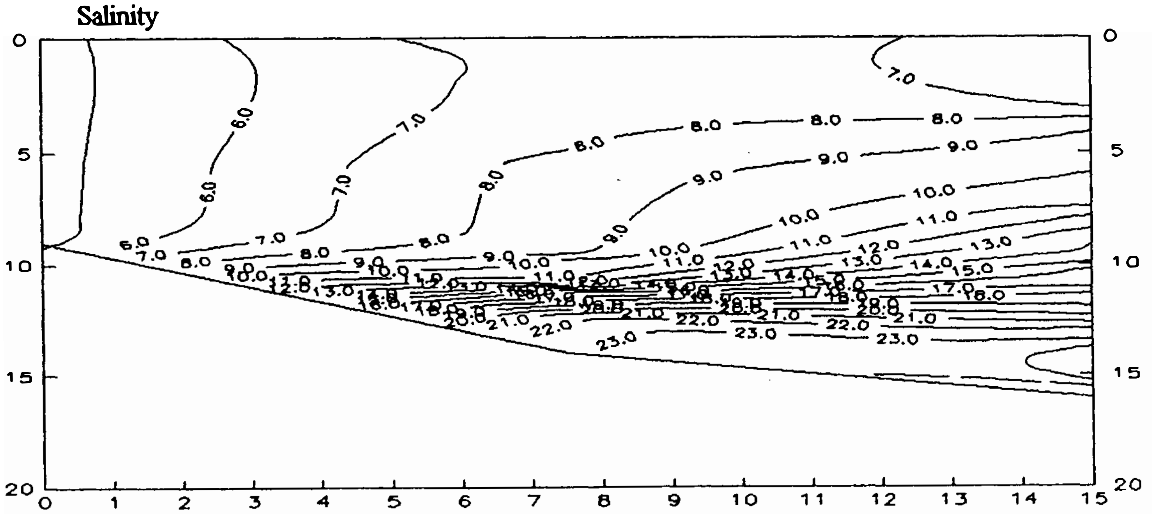
Fig. 4.19 Distribution of temperature, salinity and density on the section along frontal zone in the Enisey bay. Enisey bay (11.09-13.09.94).



Temperature



Salinity



Density

Fig. 4.20 Distribution of temperature, salinity and density on the section across frontal zone in the Enisey bay. Enisey bay (11.09.94).

5. CTD-measurements in vicinity of a drifting floeberg.

L.G.Pisarevskaya, E.Nygaard

Motivation

The motivation for this work is to get a better understanding of the water motion near a melting ice wall.

Observations

The unique situation of careful approaching to a free-drifting floeberg amidst the ice floes in extremely calm weather conditions was used to obtain 3 CTD stations. The studied floeberg consisted of heavily ridged multiyear ice, its length being about 12 meters, its freeboard about 4-5 meters height with its keel going down to about 15-20 meters depth. The air bubble content in the floeberg was roughly estimated by comparing with ice samples taken from another similar floeberg some hours later during an ice station and was about 6 % by volume.

When the distance from the ship's bow to the floeberg was about 10-15 meters the first CTD-probe lowering (station 29a, Fig.5.1) started , so that the ship's propeller could not affect the measurements while the ship was very slowly moving forward. When the probe reached a depth of 60 meters the measurements were stopped due to the expected floeberg approaching. The ship moved back and the CTD-probe was lifted (station 29b)at the distance supposed to be about 50 meters. Then the ship moving back was turned aside to keep a 100 meters distance to the floeberg, and one more station (29, Fig.5. 2)

was done to be considered as the far-field.

Far-field station 29 showed a quasi-homogeneous layer from the surface to 9 meters depth with a temperature of -1.42 C and a salinity of 31.4 ppt. Underneath there was a well-defined warm water layer with the temperature reaching in maximum 0.18 C and high gradients to mark its upper (1.08 C/m) and lower (0.57 C/m) borders. This warm layer could be traced along the whole transect (stations 26,27,28,29,30 and 31). Under the warm layer there was a cold (-1.5 C) and salt (32.7 ppt) layer that stretched to the bottom.

Results

Measurements revealed general warming of the water column close to the floeberg (stations 29a and 29b)due to the upwelled warm water that was mixed with the melt water to make the corresponding salinity values lower as compared to the station 29. Superimposed on the warming there were intrusions of cold melt water into warm water layer and of warm upwelled water mixed with the melt water into the cold ambient at the higher depths at the closest distance (station 29a). They were tranformed into step structure at the station 29b. There the very upper part of the surface layer definitly showed warmer, saltier and thus denser water upwelled.

Summary

1. The scale of the layers seems to correspond well to the one predicted from laboratory measurements of intrusions to spread into the stratified fluid : the measured thickness were 3.1, 2.1, 2.4 and 3.4 m as compared with 3.4 m derived from the ambient water stratification.

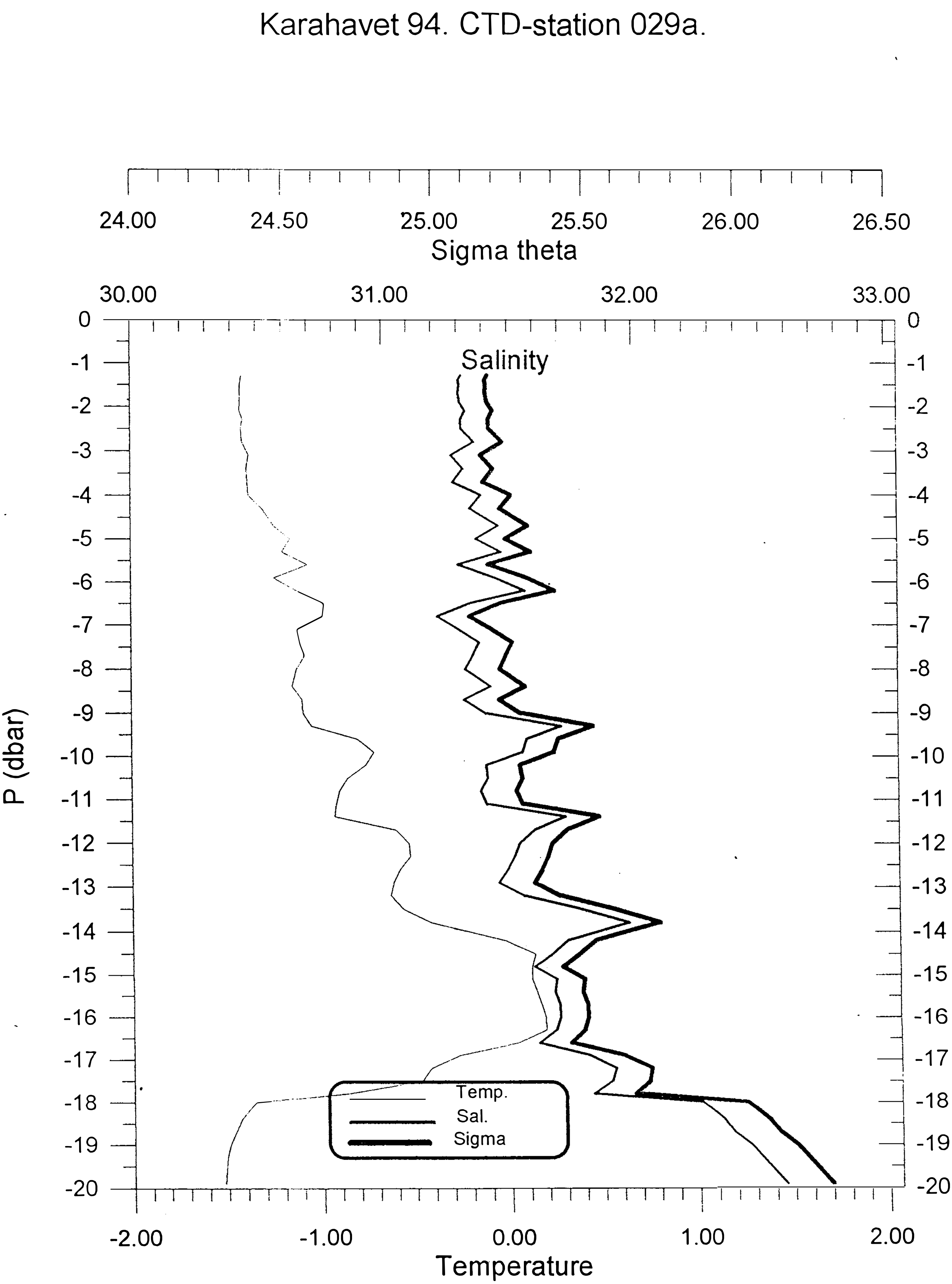


Fig. 5.1 Temperature, salinity and potential density profiles
near the floeberg at the distance of 15 meters (down), station 29a.
Kara sea (28.08.94)

Karahavet 94. CTD-station 029

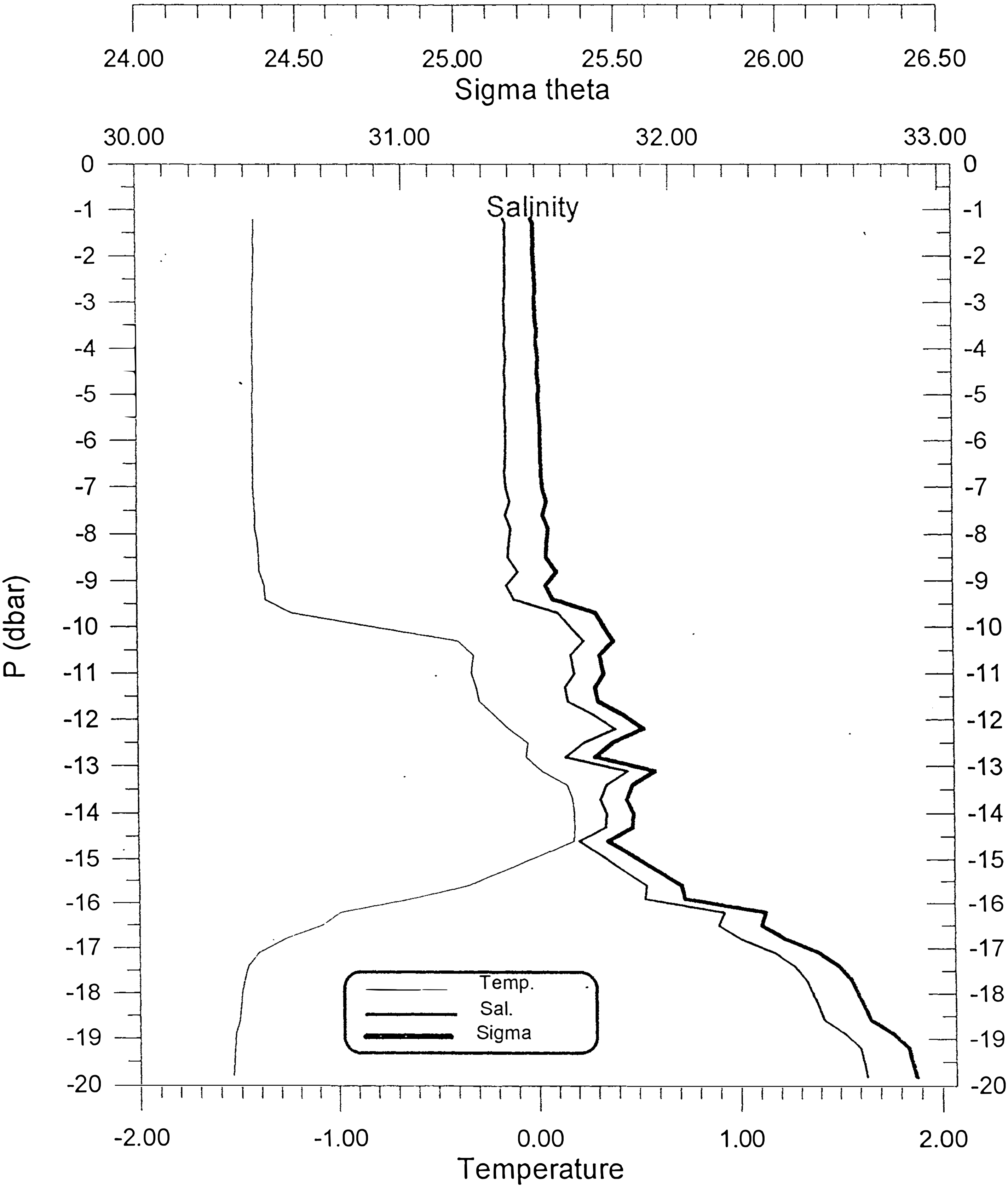


Fig. 5.2 Temperature, salinity and potential density profiles near the floeberg at the distance of 100 meters, station 29. Kara sea (28.08.94).

2. The distance where all the disturbances vanish was very small (less than 100 m) in the extremely calm weather conditions, the layers could be perfectly traced only in the raw data, so now it seems quite understandable why all the previous investigators failed to

detect these layers near the drifting icebergs at the distances greater than 1 cable and much rougher seas.
3. Definite temperature rize speaks in favour of warm "deep" water upwelling. It seems that the entrainment with the releasing air bubbles can explain better the observed warmer and saltier water appearence at the surface level, as compared with the entrainment only with the melt water from ice as proposed by Steve Neshyba in 1977.
4. Deflection of the lower boundary of the warm intrusion layer seems to be connected with the very slow ship motion and probable internal wave generation rather than with the whole circulation pattern and pecularities of measurement process.
In whole, this investigation near a floeberg in the absence of icebergs pleased us with the interesting and unexpected results. We are really grateful to the ship's crew for the offered opportunity of these measurements.

6. WORK AT THE MOORINGS

Kuznetsov V, Nygaard E.

In order to obtain the information on the current structure in different regions of the Kara sea, their influence to the thermohaline processes and water exchange with the adjacent areas of the sea, two points were chosen to deploy moorings equipped with current, temperature and electrical conductivity meters. The moorings were deployed near the mouth of Ob and Yenisey within the area of river discharge influence. It is important to follow the prevailing fluxes in the subsurface layer of transformed river water and bottom one of the sea water. The relative positions of moorings will allow us to calculate the tidal current characteristics. That information will provide the linkages between these regions and general water circulation of the Kara sea and we could add the results of mathematical modelling with natural data. The point northward of Gulf of Yenisey is the bench mark. The range of current observations from 8 moorings is available for a few years.

We choose the submerged mooring (SM) with surface signal buoy. The coordinates of the points of deployment: 74 00 N, 73 00 E and 74 00 N, 80 00 E. The expected depth is about 30 meters. The locations of the moorings are shown in Figure 4.2. Table 6.1 gives information about the moorings, their position, time of deployment, depth etc. The current measurements were carried out with Aanderaa RCM-7's.

Mooring	Instr. nr.	position	time out	hours	Echo	depth
NPI-94-K1	11493	73 59.84N 73 00.13E	22/8-94 23.20	——	32	13
NPI-94-K1	11476	73 59.84N 73 00.13E	22/8-94 23.20	——	32	30
NPI-94-K2	11059	73 59.65N 79 59.91E	24/8-94 10.40	422	34	11
NPI-94-K2	11475	73 59.65N 79 59.91E	24/8-94 10.40	422	34	32

Table 6.1 Information about the moorings in the Kara Sea. (Instr. nr.: RCM7 number, Position: Longitude latitude, time out: Time of deployment, hours: Period in sea in hours, Echo: Echo depth in meters and depth: measuring depth)

Before the deployment of both SMs the bottom echo sounding was carried out. The cross lines of sounding had a 1 mile cross shape. There was no considerable bottom inclinations. The depth in the points of SM deployment was 32 and 34 meters. First of all, the anchor was recoiled then the oceanographic station was carried out, the levels of instruments deployment was confirmed and the station was taken away. In advance, the SM rigging was put on the big winch drum located at the ship forecastle. Then the station was mounted and put out of the ship by means of the left anchor davit with wide bloque. The instruments (RCM7 at two levels two at a time) and one buoy were attached in "breaking off" of the buoy line (rope of 8 mm diameter and length of 5 and 10 meters) which was attached to the set of two buoys. The signal buoys was attached by means of the buoy line made of chain as well. Figure 6.1 shows the mooring NPI-94-K2. The scheme of NPI-94-K1 is equal to the present one. While mounting the part of station in "breaking off" the load transmitted to the nylon rope with spring hook. The parts of buoy line had a garnishment with splices to transmit the load. The cargo "frog" of 250 kg was used as SM's anchor. Each station buoy consisted of two plastic floating parts of 350 mm diameter of "VINY" type. The signal plastic pear-shape buoy had the maximal diameter of 400 mm and maximal height of 450 mm. The pelican hook was used to cast the station off.

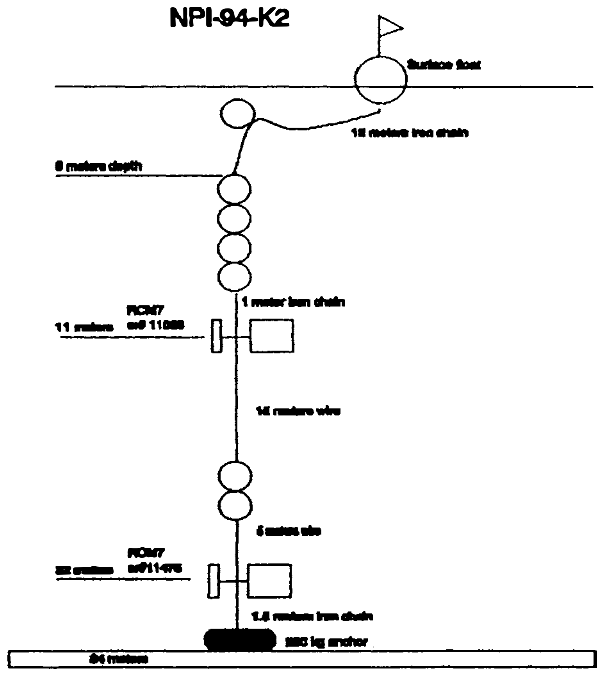


Fig. 6.1 Mooring NPI-94-K2

Unfortunately the iron chain to the surface float was cut by the ship's propeller at mooring NPI-94-K1after deployment. We tried to lift it up in order to recover the signal buoy but after about 12 hours of dredging without retrieving the mooring it was decided to come back next year with better equipment for dredging and try to recover the mooring then. Unfortunately, there was no the acoustic disengager in the mooring set, that would make considerably better its search and lifting.

The SM-2 was lifted 18 days after its deployment. It was lifted up by means of big cable winch of forecastle and left anchor davit. All the mooring set had working condition. The mooring operated during 17 full days and 13 hours. The interval of environmental observations was 10 minutes. The 2532 observational cycles are available for each level. The table 6.1 shows the results of SM-2 operations.

The following can be concluded after the analysis of the data obtained (Fig.6.2 - 6.7).

We can distinguish two types of water masses in the area of deployment: transformed brackish water of river discharge forming the upper homogenous layer and Kara sea water laying lower than pycnocline, formed by winter convection.

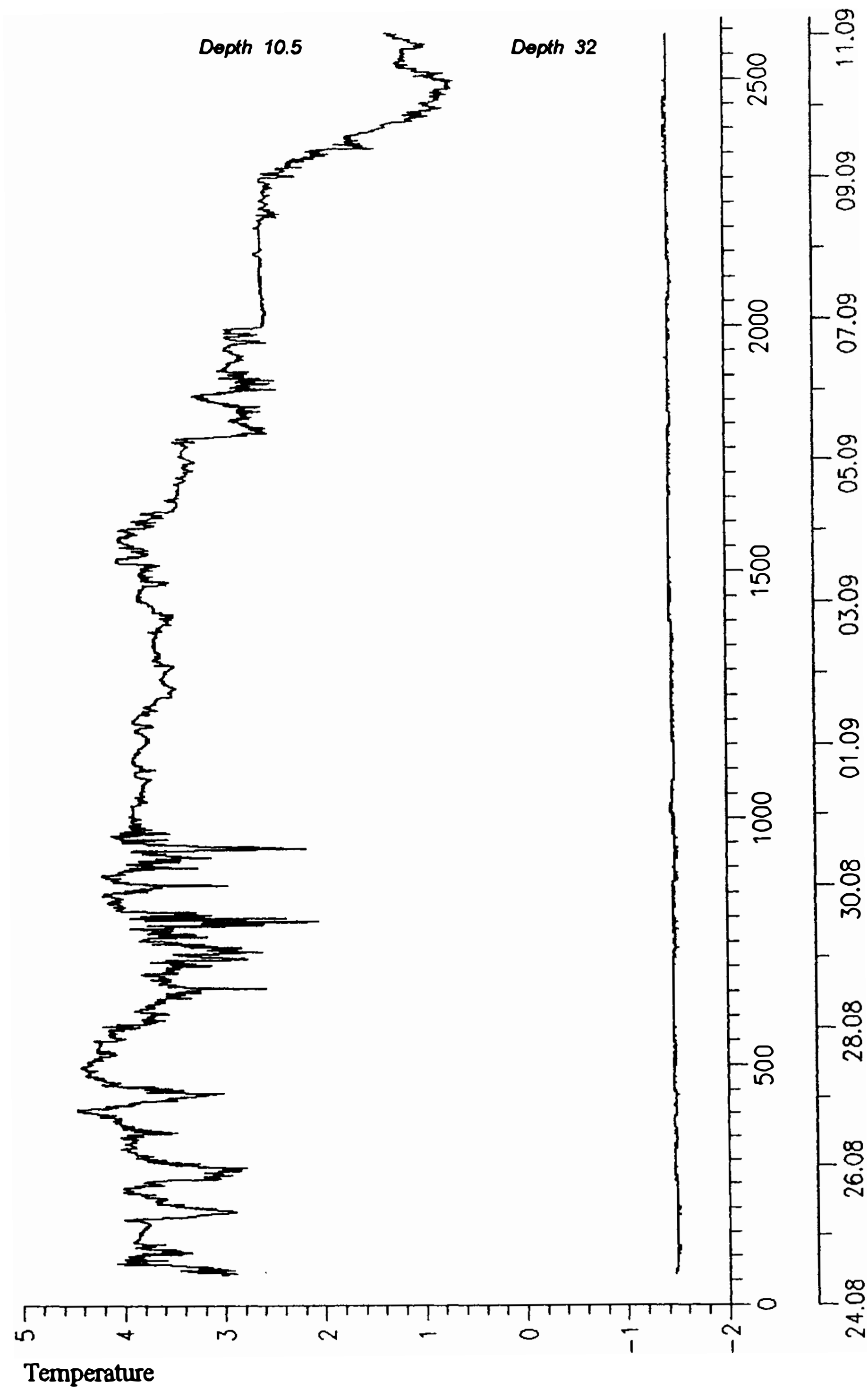


Fig. 6.2 Plots of temperature values at NPI-94-K2 levels 10.5 and 30 m. Kara sea (24.08 - 11.09.94)

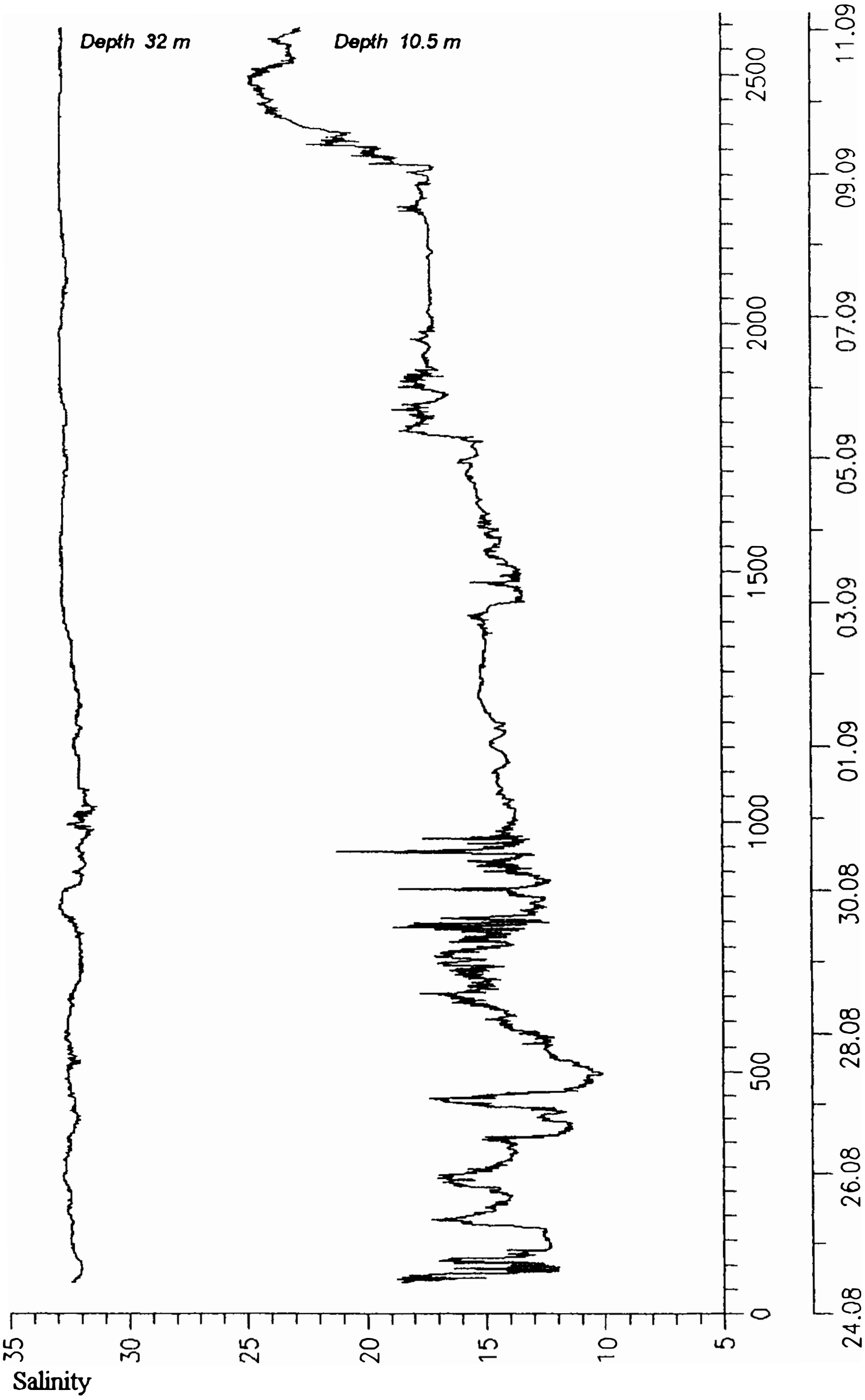


Fig. 6. 3 Plots of salinity values at NPI-94-K2
levels 10.5 and 30 m . Kara sea (24.08 - 11.09.94)

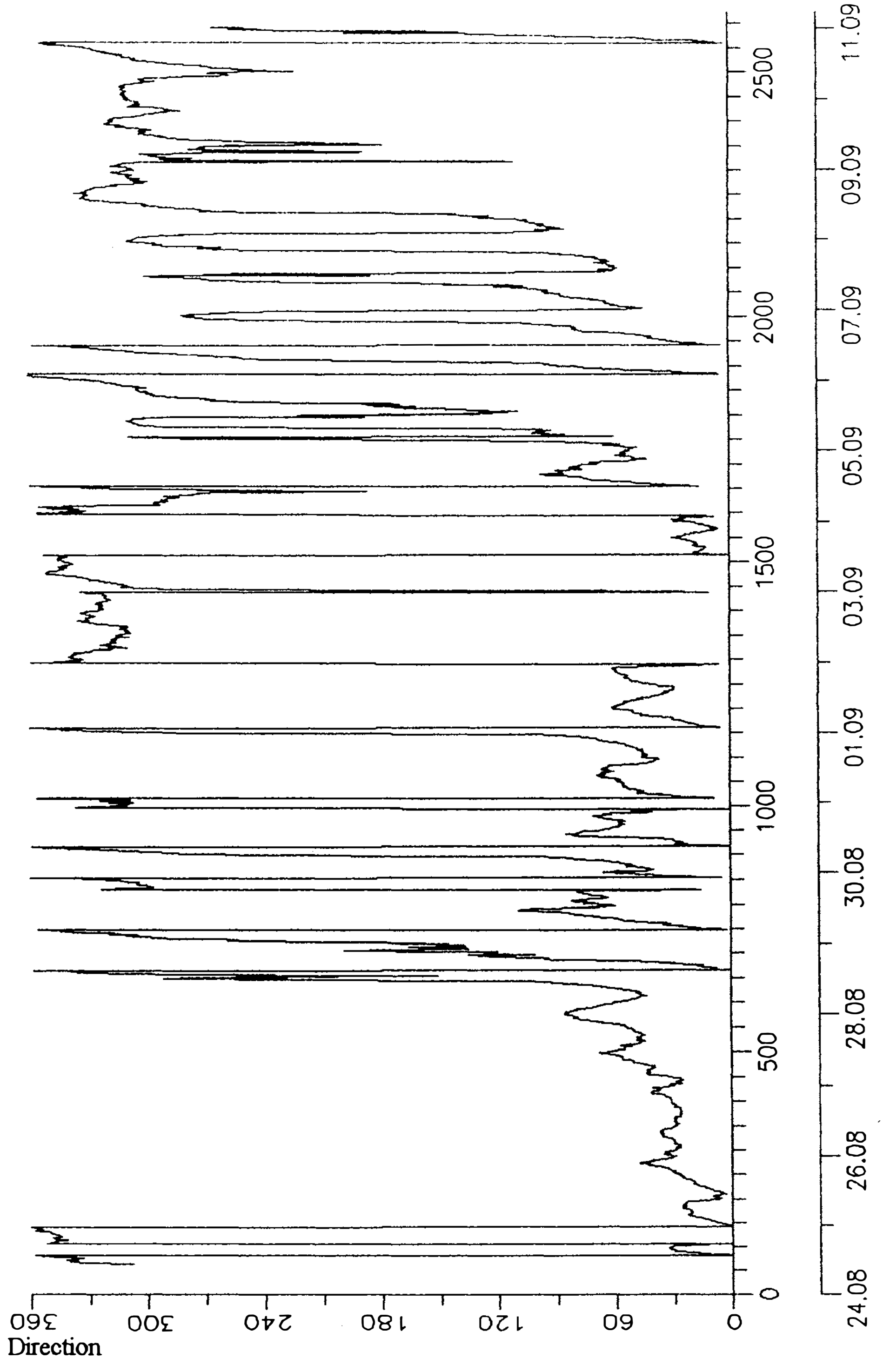


Fig. 6. 4 Plots of current vector at NPI-94-K2
level 10.5 m . Kara sea (24.08 - 11.09.94)

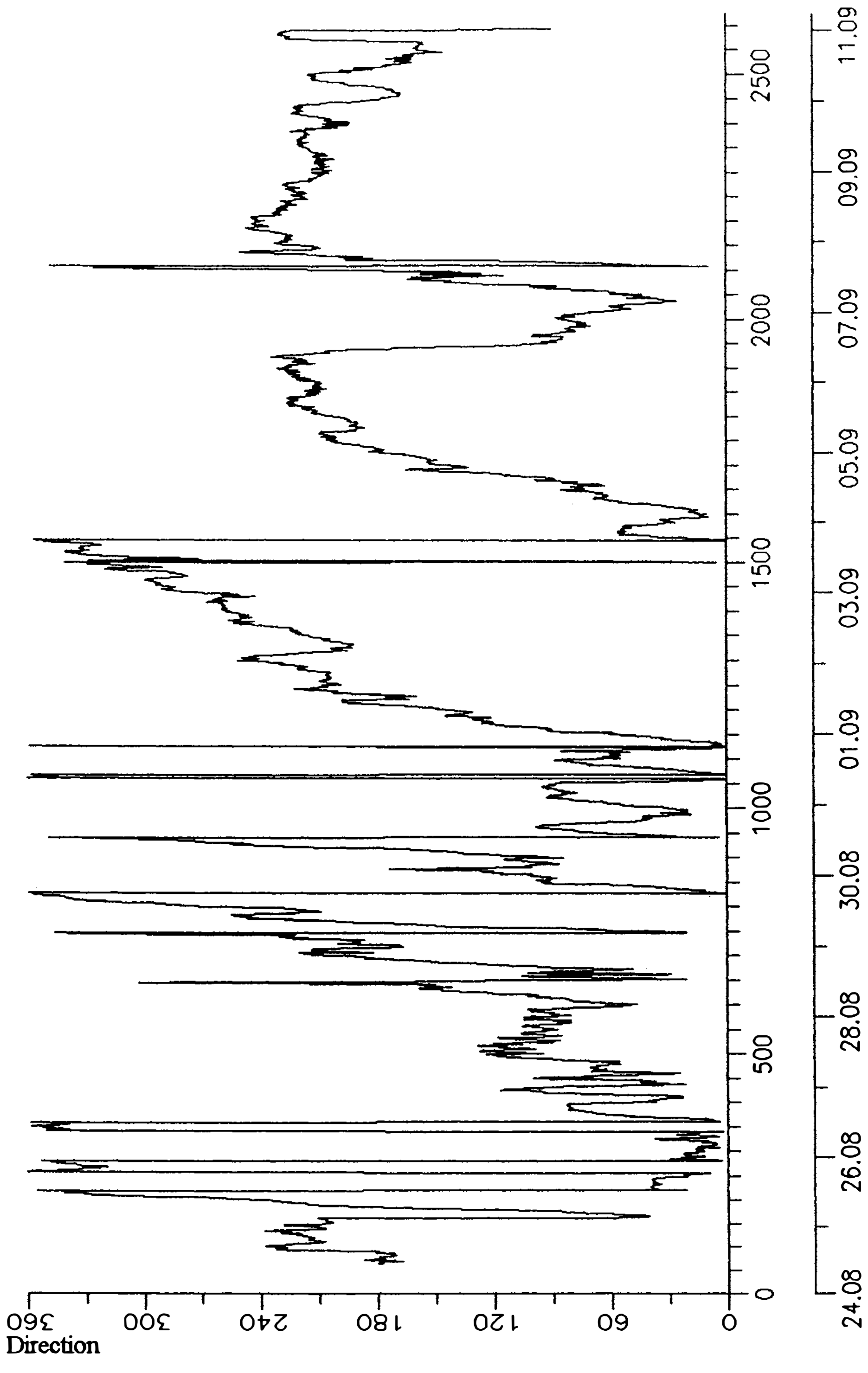


Fig. 6. 5 Plots of current vector direction at NPI-94-K2
level 30 m . Kara sea (24.08 - 11.09.94)

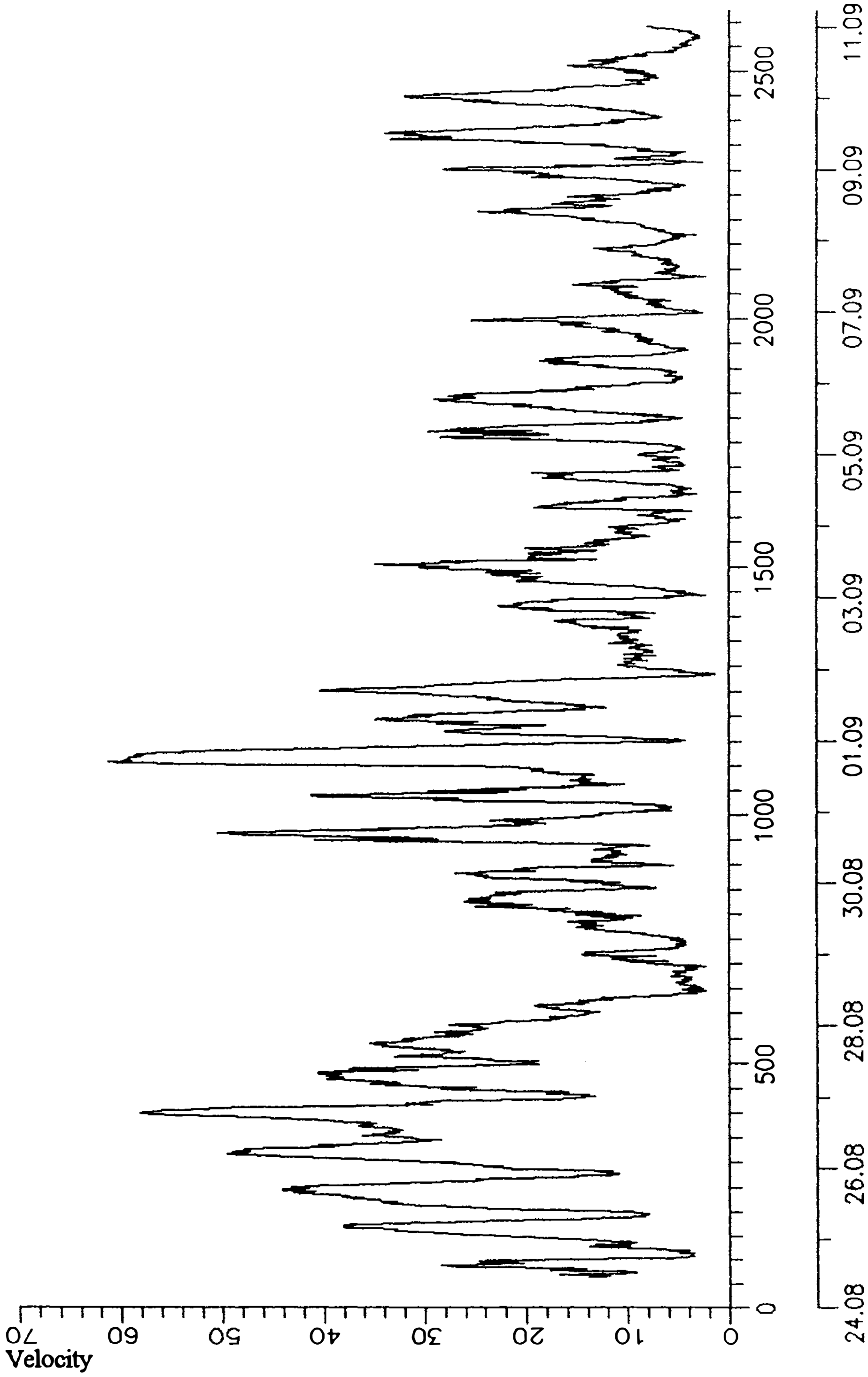


Fig. 6.6 Plots of modules of current velocity at NPI-94-K2 level 10.5 m. Kara sea (24.08 - 11.09.94)

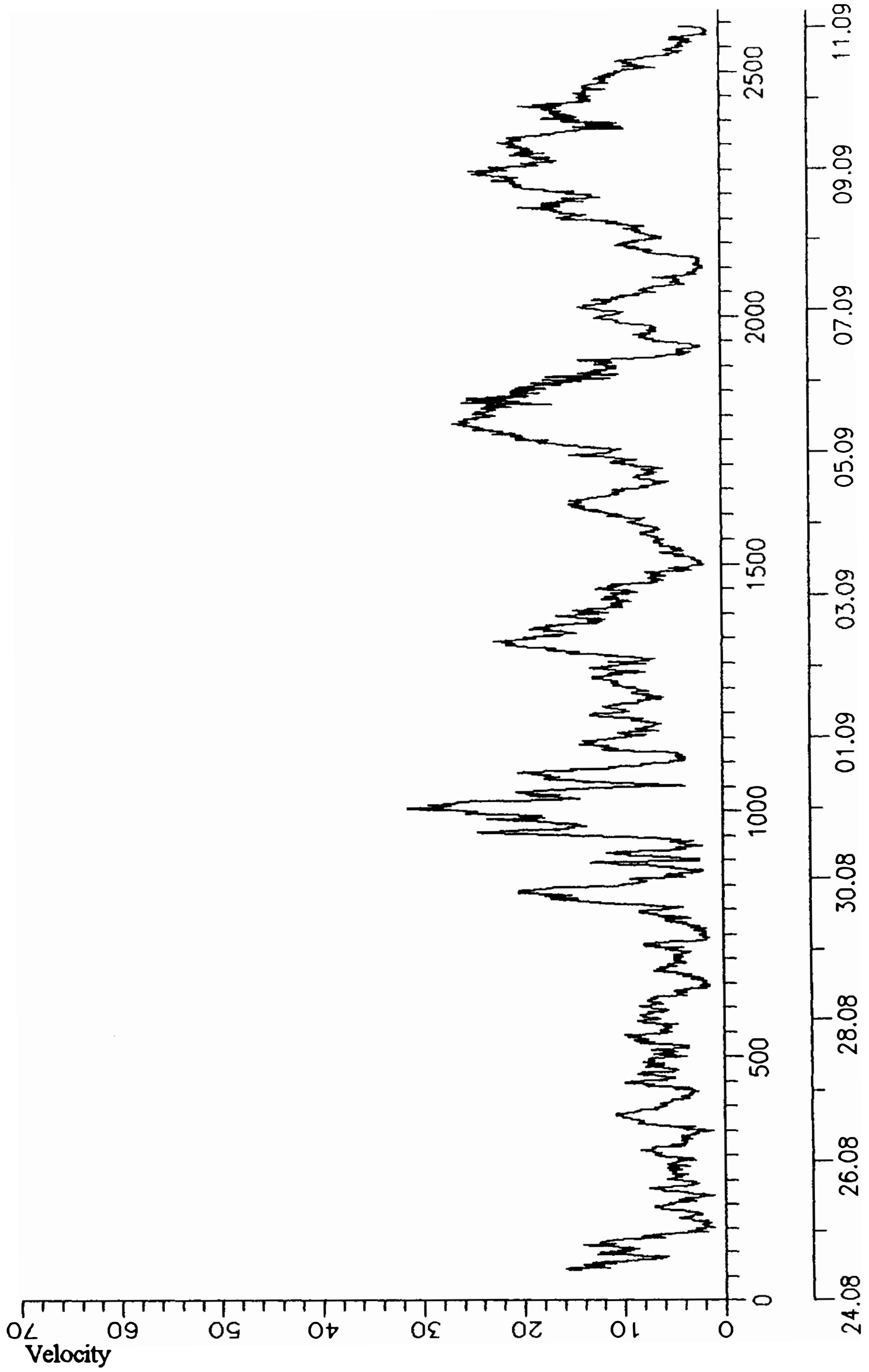


Fig. 6.7 Plots of modules of current velocity at NPI-94-K2 level 30 m. Kara sea (24.08 - 11.09.94)

The analysis of the temporal variability of the parameters under study allows us to distinguish two periods in SM1s operations: the first one - 28.08 - 31.08 and the second one - 1.09 - 11.09. During the first period in the surface layer the northern and north-eastern fluxes prevailed, the maximal winds were just northern ones, that is the discharge and eastern water transfer prevailed. The semidiurnal tidal component was typic for this process. When this component was equal to the discharge stream, the vectors were 60 cm/s. In the bottom layer during this period the eastern and south-eastern fluxes prevailed. The variability of velocity and stream direction shows the existence of semidiurnal tidal component. The temperature and salinity of the bottom layer variate a little only. In the surface layer the temperature and salinity fluctuate semidiurnaly, and there is a probable guess about the internal waves at the upper border of pycnocline which covers the level of the upper device.

During the second period, the surface layer is influenced by wind, northern and north-eastern wind. The current velocity decreases with northern component, and the share of southern component increases in the current direction. The temperature and salinity have the 3-days cycle. In the bottom layer the variations of velocity and current direction have the 3-days cycle with moderate semidiurnal fluctuations. The temperature and salinity are stable.

Consequently, in the region of mouth of Yenisey in the period under study there was clearly defined eastern water transfer of continental discharge in the upper layer and advection of Kara sea water towards the continent in the bottom layer. Also the tidal and synoptic fluctuations covering the surface as well as bottom layers took place. By the last year data for the same period, the eastern transfer did not observed, but the advection of the Kara sea water was held.

We would like to propose that during the mooring deployment in the next year, it is needed to provide SM with acoustic disengagers of cable of OCEANO type.

7. MONITORING OF POLLUTION LEVELS AND ICE HYDROCHEMICAL INDICATORS.

S.Vlasov, M.Chigak, A.Vikdorovich

According to the cruise program the main goal of hydrochemical team KAREX-94 was to obtain the information about the pollution levels in the surface and bottom waters, bottom sediments, benthos and atmospheric precipitation, and the main hydrochemical characteristics of the Kara sea and inflowing river`s mouths.

Consequently, the expedition goals include determination of concentration of dissolved oxygen, dissolved silicic acid and phosphates at standard hydrological levels, sea water sampling for salinity, content of non-organic compounds of nitrogen and phosphorus, dissolved silicates,oxygen and other mineral components at standard levels, sampling and extracting concentration of surface and bottom water samples to determine volganochlorine compounds, oil hydrocarbon, polyaromatic polycyclic hydrocarbons, heavy metals and phenols at the General State Sistem for Observation (GSSO) stations included into the Russian part of AMAP, bottom sediments sampling to determine chlororganic compounds, oil hydrocarbon, polyaromatic polycyclic hydrocarbons, heavy metals and radionuclides at GSSO stations (AMAP), zooand phyto-benthos sampling and conservation to determine chlororganic compounds, heavy metals and radionuclides at GSSO stations (AMAP), atmospheric aerosol and precipitation sampling to determine chlororganic compounds, oil hydrocarbon, polyaromatic polycyclic hydrocarbons and heavy metals.
The hydrochemical team of KAREX-94 consisted of 4 persons (see Annex A).

Methods and devices

The sea water sampling at standard hydrological levels was carried out by means of sound-bottle "General Oceanic". The pressure meter CTD OTS-1500 controlled the going into level. The surface water sampling was carried out by TWS-3 and SWS-4 systems designed and produced in the Russian Centre "Monitoring of Arctic". The bottom water was sampled by means of TTWS-3 system produced in the Russian Centre "Monitoring of Arctic" as well. It was hanged on the capron rope with titanium adapter to the ship winch cable.

The bottom sediments sampling was carried out by pneumatic sampler DG-008 (State Enterprise Sevmorgeologia, St.Petersburg). The benthos was sampled by Van Vinnes grapple dredger provided by Norwegian side.

The atmospheric aerosol sampling was carried out to the fiber-filters (PVC) by means of aerosol aspirator PAB (Scientific Venture "Taifun", Obninsk). Atmospheric aerosols were sampled by means of "Cyclon" system as well. It was installed at the bearing ship deck. In that case aerosol samples were washed with distilled water and extracted.

The determination of dissolved oxygen was performed by modified Winklair`s method.

The titration was carried out by means of automatic burette.
The phosphates were determined by modified Morphy and Reily method.
The silicium was determined by Mullin and Reily method with blue complex with ascorbic acid as deoxidizer. The optical density of solutions for silicium and phosphorus was measured by means of spectrophotometer SF-46 (Optical Mechanic Venture LOMO, St.Petersburg).

Results

During the expedition the following varieties were determined: dissolved oxygen at 551 level of 128 hydrological stations, dissolved silicic acid at 734 levels of 129 stations, phosphate at 775 levels of 129 stations (see Annex B,C)

The bottom sediments were sampled at 56 stations GSSO, in particular, at 3 stations a big volume was collected for intercalibration with Norwegian Institute Akvaplan-Niva, and at 24 stations ground samples were collected to determine lythodynamic characteristics.
The zoo- and phyto-benthos samples were collected at 18 stations GSSO, 22 samples of different species of benthic flora and fauna were taken.

The sampling and extracting concentration of sea water to determine pollutants content were carried out:
oil hydrocarbons - 90 samples, including 28 bottom ones; polyaromatic polycyclic hydrocarbons - 84 samples, including
25 bottom ones; chlororganic compounds - 90 samples, including 28 bottom ones; heavy metals - 92 samples, including 26 bottom ones; phenols - 65 samples, including 23 bottom ones. The 11 daily samples of atmospheric aerosols were collected
to PVC filters. Also 3 daily aerosol samples by means of "Cyclon" system were collected. Those samples were extracted for determination of chlororganic compounds, oil hydrocarbon, polyaromatic polycyclic hydrocarbons and heavy metals.
At 60 stations water sampling at standard hydrological levels was carried out to determine biogenic elements and mineral components.
All the samples and concentrates obtained were sent to the laboratory of analytic chemistry of Russian Centre "Monitoring of Arctic" to be further handled.
During the expedition the extended field tests of new sampling instruments of TTWS-3 system, dredger DG-008, aerosol aspirator PAB.
New sampling and laboratory equipment kept very high quality in field conditions. The test results and experience of its use allow us to develop recommendations for further improvement of new instruments for sea pollution studies.

8. Contaminants in suspended particles, bottom sediments, drifting ice and organisms, analysis of benthic fauna

S.Cochrane, K.-F.Fredriksen, T.Vinje

Sabine Cochrane and Kurt-Roger Fredriksen from Akvaplan-niva, Tromsø, Norway, has participated in the scientific cruise KAREX-94 to the Kara Sea and the estuaries of Ob and Yenisey. The cruise was part of the Russian-Norwegian oceanographic programme (RusNoP). RusNoP is a co-operation between the Arctic and Antarctic Research Institute (AARI) and the Norwegian Polar Institute (NPI).

The expedition was carried out on the RV *Ivan Petrov* of AARI. The cruise started from Archangels on August 12th 1994, and ended in Amderma on September 19th 1994.

Objectives

The overall objectives of Akvaplan-niva were to carry out environmental base line studies of the Kara Sea and the estuaries of Ob and Yenisey, as well as to study the transport of sediments and contaminants in the Eastern Kara Sea. The studies were carried out according to recommendations given by Arctic Monitoring and Assessment Programme (AMAP) and the results will contribute to the Quality Status Report of AMAP. During the cruise, sampling was carried out for the following purposes:

- Sediment chemistry, study of persistent organic compounds, metals and radionuclides, grain size distribution and content of organic carbon and nitrogen in the surface sediments (0-1 cm)
- Sediment profile core for studies of the process of sedimentation and historical levels of contaminants. These studies included Pb-210 dating and stratigraphic analyses of the cores.
- Benthic macrofauna and microfauna (foraminifera), community structure analysis and distribution of species.
- Suspended particle matter (SPM) in water for analyses of metals, total organic content and total nitrogen in surface layer, in water with maximum sediment concentration (above the picnocline) and in bottom water.
- Contaminants in drifting "dirty"sea ice, particulary in melting ponds.
- Contaminants in selected organisms.
- Intercalibration of analyses of contaminants in sediment and SPM, both in the field and in the laboratory, see tabl. 8.1.

In close contact with NPI, Akvaplan-niva will organize the analyses of contaminants in suspended particle matter in water (SPM), sediment, sea ice and organisms. Akvaplan-niva will also carry out diversity and community studies of benthic fauna. NPI together with AARI, carried out comprehensive oceanographic, water transport and ice studies.

The following Norwegian institutes will participate in the laboratory analyses of contaminants:

- Norwegian Institute for Water Research (NIVA)
- Norwegian State Radiation Agency
- Norwegian College of Agriculture
- Unilab Analyse
- GeoGruppen

Sampling equipment

Akvaplan-niva brought the necessary scientific equipment for the sampling programme.
The sampling equipment used by Akvaplan-niva was deployed from the stern deck, using a winch and the ship's 10 mm wire. A meter wheel was used to determine the amount of wire paid out.

The van Veen grab

A 40 kg van Veen grab with a surface sampling area of 0.1 m^2 was used. Where appropriate, additional weights of 30 or 40 kg were used according to the sediment type encountered. The grab had hinged and lockable inspection flaps with a mesh diameter of 0.5 mm. These were covered by additional rubber flaps, allowing water to pass freely through the grab during descent through the water column, to minimise the pressure wave below the instrument, which can 'blow off' the top surface of the sediment during sampling. On ascent, the rubber flaps are closed to minimise water turbulence inside the grab. As a further precaution against sediment loss during sampling, the winch speed was slowed for the last metres of descent.

The Niemesto corer.

This corer collects samples from soft bottom sediments. The sediment is collected with an open PVC-tube with an inner diameter of 50 mm and a total length of 80 cm. The core is loaded with weights to ensure the necessary penetration.

Niskin water bottles

The water bottles were connected to a rosette containing 12 bottles on the CTD-instrument. While lowering the rosette the CTD-measurements were registrated on the computer, and while raising the rosette to the surface, water was obtained from the bottom layer, just above the pycnocline and from the surface layer.

Sampling programme

A total of 69 stations were sampled for studies of contaminants. These includes 49 stations for suspended particle matter (SPM) in water, 40 stations for sediment surface samples, 6 stations for sediment core samples, 3 stations (8 ice floes) for sediment particle in ice and 6 stations for analyses of contaminants in organisms. Samples for studies of distribution and diversity of benthic macro fauna were obtained from 15 stations, and benthic microfauna (foraminifera) from 38 stations.

Contaminants in sediment samples from sea floor
Sediment surface samples (top 0-1 cm) were obtained by van Veen grab at 40 stations. On 6 of these stations sediment cores were obtained using a Niemesto gravity corer.
Both the corer and the grab samples were subjected to careful quality control before being accepted. Cores without clear water above the sediment surface, and cores where surface water and particles drained downwards along the tube wall, were rejected, as well as grabs where the sediment surface was disturbed. The surface water of grab samples were carefully drained with thin tubes through the inspection flaps on the top of the grab, after which the samples for different analyses were collected.

The gravity corer had to be deployed 12 times on each station to obtain sufficient material for the different analyses. Sections from three cores were pooled and used for the analyses of total hydrocarbons (THC) and polyaromatic hydrocarbons (PAH). similarly three cores were used for the analyses of 13 components of polychlorinated biphenyls and pesticides (PCB), and three for analyses of metals (Cd, Pb, Hg, Ni, Zn, Cr), total carbon/nitrogen and grain size. Single cores were used for analyses of radionuclides, for Pb-210 dating and for stratigraphic analyses.
SPM samples
Samples were taken at three water depths at a total of 49 stations. Of these, 20 were taken from the north eastern Kara Sea and Arctic basin, 25 samples were taken from the estuaries of Ob and Yenisey, and 4 samples from western Kara Sea.

Contaminants in sediment, ice and water samples from "dirty ice" floes
Sediment samples were taken from 8 ice floes. Sediment for analyses of metals, PcB, Pah/THC and radionucleides were sampled from melting ponds on "dirty ice" floes. SPM samples were taken from melting ponds and from ice cores on 8 ice floes.

Benthic fauna
Macrofauna
Five replicates from a total of 15 stations were sampled using the 0.1 m^2 van Veen grab, for studies of macrobenthic infaunal communities.

Microfauna
Samples for analysis of benthic foraminifera communities were taken from 38 stations from the upper 0-1 cm of the sediment surface, using the van Veen grab. The samples were preserved in a 96% ethanol solution stained with Bengal Rose vital stain.

Intercalibration of analyses of contaminants in sediment and SPM in water.
A programme for intercalibration of both field methods and laboratory analyses was undertaken. Samples for intercalibration of sediment analyses were taken at three stations, where extra samples for metal and persistent organic compounds were

taken from the van Veen grab and given to the Russian scientists. Similar samples were sampled by the Russian scientists from their grab and given to Akvaplan-niva.

Two bulk sediment samples were taken from two grabs for homogenisation at a Norwegian laboratory. Sub sediment samples will later be distributed to the laboratories included in the intercalibration. Norwegian and Russian scientists took samples for SPM in water from the same Niskin bottles on most of the stations. Intercalibration of the analyses will be carried out on selected number of stations.

TABLE 8.1

Akvaplan-niva sampling programme for contaminants in water, sediments and organisms, and for benthic fauna community studies.

CTD sampling on all stations by NPI and AARI.

Station no	Lattitude north	Longitude east	Depth (m)	Type of sampling	Equipment	Date time (UTC)	Surface sediment / length of core	Location
1	64° 50,85	40° 16,50	5	SPM-water/filtered	Niskin (1,)	18.8.94 08.40		Dvina estuary
3	73° 45,00	80° 01,11	36	SPM-water/frozen	Niskin (1,2,3)	24.8.94 02.30		North of Dikson I.
4	74° 00,14	79° 59,26	34	SPM-water/frozen	Niskin (1,2)	24.8.94 05.00		North of Dikson I.
7 7b	74° 19,77 74° 20,43	84° 17,40 84° 20,04	19 58	SPM-water/filtered Contam. surf.sed. Benthic fauna Foraminifera	Niskin (1,2,3) Grab (2) Grab (5) Grab	24.8.94 18.15	Silty clay	Pyasina bay
8	76° 00,42	87° 16,24	43	SPM-water/filtered	Niskin (1,,3)	25.8.94 19.10		East of Nordenskiold Archipelago
9	76° 54,20	88° 10,74	51	SPM-water/filtered	Niskin (1,3)	25.8.94 05.40		Slozhny I.
Ice st no 1	76° 52,34	87° 58,26		SPM water/frozen Contam. sediment	Ice floe no. 1 Ice floe no. 2	26.8.94 10.00	Clean ice Dirty ice	Slozhny I.
10	76° 59,88	85° 15,14	57	SPM-water/filtered Contam. surf.sed. Contam. strat. sed Benthic fauna Foraminifera	Niskin (1,2,3) Grab (2) core (12) Grab (5) Grab	26.8.94 15.50	Brownish silty clay Core length: 18-22 cm	West of Slozhny I.
11	77° 38,05	87° 14,77	107	SPM-water/filtered Contam. surf.sed. Foraminifera	Niskin (1) Grab (2) Grab	27.8.94 05.00	Dark brown silt	West of Isachenko I.
Ice st no 2	77 38,77	87 25,49		SPM water/frozen Contam. sediment	Ice floe no. 3 Ice floe no. 4 Ice floe no. 5	27.8.94 09.00	Dirty ice	West of Isachenko I.
12	77° 59,65	83° 37,86	120	SPM-water/filtered Contam. surf.sed. Foraminifera	Niskin (1) Grab (2) Grab	27.8.94 17.00	Dark brown silt	Northeast of Uyedinyeiniy I.
20	78° 33,52	86° 18,60	154	SPM-water/filter	Niskin (1, 2)	28.8.94 03.20		South of Krasnaya Armina Strait
31	78° 21,33	86° 44,72	141	SPM-water/filter	Niskin (1, 2, 3)	28.8.94 17.25		"
32	78° 15,25 78° 15,88	86° 48,58 86° 51,33	145	SPM-water/filtered Contam. surf.sed. Contam. strat. sed Benthic fauna Foraminifera	Niskin (1,2,3) Grab (2) core (12) Grab (5) Grab	28.8.94 19.20	Brownish silty clay Core length: 13-29 cm	South of Krasnaya Armina Strait
Ice st no 3	78° 15,98	86° 26,17		SPM-water/Frozen Contam. sediment Contam. sediment	Ice floe no. 6 Ice floe no. 7 Ice floe no. 8	29.8.94 08.00	Clean ice Dirty ice Dirty ice	South of Krasnaya Armina Strait
35	76° 20,89 76° 22,48	74° 42,12 74° 39,81	101	Contam. sediment Foraminifera	Grab (2) Grab	30.8.94 08.25	Brownish silt	Northeast of Novaya Zemlya

Station no	Lattitude north	Longitude east	Depth (m)	Type of sampling	Equipment	Date Time (UTC)	Surface sediment / length of core	Location
36	76° 28,64 76° 29,96	73° 24,66 73° 26,66	104	Contam. surf.sed. Foraminifera	Grab (2) Grab	30.8.94 11.50	Brownish silt	Northeast of Novaya Zemlya (NZ)
37	76° 00,02	72° 18,42	170	SPM-water/filter	Niskin (1,2,3)	30.8.94 16.45		East of northern NZ
39	74° 59,64	72° 11,75	27	SPM-water/filtered Contam. surf.sed. Benthic fauna Foraminifera	Niskin (1,2,3) Grab (2) Grab (5) Grab	31.8.94 05.15	Brownish silty sand	North of Yamal p.
40	74° 59,63	76° 00,21	42	SPM-water/filtered Contam. surf.sed.	Niskin (1,2,3) Grab (2)	31.8.94 12.20	Brownish silt	North of Yamal p.
41	76° 09,78	76° 36,20	64	SPM-water/filtered Contam. sediment Benthic fauna Foraminifera	Niskin (1,2,3) Grab (2) Grab (5) Grab	31.8.94 21.50	Brownish silt	East of northern NZ
44	75° 45,92	80° 24,16	41	SPM-water/filtered Contam. surf.sed. Benthic fauna Foraminifera	Niskin (1) Grab (2) Grab (5) Grab	1.9.94 13.40	Brownish sandy silt	West of Izverstyi TSIK I.
46	75° 30,27	82° 55,23	46	Contam. surf.sed. Foraminifera	Grab (2) Grab	1.9.94 14.20	Brownish clayey silt	North of Sidorov I.
48	75° 14,48	85° 16,43	44	SPM-water/filtered Contam. surf.sed. Foraminifera	Niskin (1) Grab (2) Grab	1.9.94 23.40	Brownish clayey silt	West of Scott-Hansen I.
50	74° 59,95	83° 30,00		SPM-water/filtered Contam. surf.sed. Foraminifera	Niskin (1) Grab (2) Grab		Brownish silt	East of Arkticheskogo Instituta I.
51	75° 00,01	79° 40,40	39	SPM-water/filtered Contam. surf.sed. Benthic fauna Foraminifera	Niskin (1,2,3) Grab (2) Grab (5) Grab	3.9.94 06.10	Light brownish clayey silt	west of Arkticheskogo Instituta I.
54	72° 40,09	73° 58,01	18	Contam. surf.sed. Benthic fauna Foraminifera	Grab (2) Grab (5) Grab	4.9.94 08.35	Light brownish clayey silt	Obskaya Guba
55	72° 40,38	74° 23,77	14	SPM-water/frozen Contam. surf.sed.	Niskin (1,2) Grab (2)	4.9.94 10.54	Light brownish clayey silt	"
56	72° 00,20	73° 11,57	13	SPM-water/frozen Contam. surf.sed. Foraminifera	Niskin (1) Grab (2) Grab	4.9.94 21.40	Brownish clayey silt	"
57	71° 30,04	75° 02,04	10	SPM-water/frozen	Niskin (1)	5.9.94 01.20		"
58	71° 30,16	72° 34,88	14	SPM-water/frozen Contam. surf.sed. Benthic fauna Foraminifera	Niskin (1) Grab (2) Grab (5) Grab	5.9.94 02.40	Brownish clayey sandy silt	"
59	71° 30,87	76° 06,08	7,5	SPM-water/frozen	Niskin (1)	5.9.94 04.55		"
60	70° 20,12	73° 50,14	12	SPM-water/frozen	Niskin (1)	5.9.94 13.05		"
61	70° 20,39	77° 26,34	12	SPM-water/frozen Contam. surf.sed. Contam. strat. sed Benthic fauna	Niskin (1) Grab (2) Core (12) Grab (5)	5.9.94 14.04	Light brownish clayey silt Core length: 31-50 cm	"
62	70° 20,74	73° 05,66	13	SPM-water/frozen	Niskin (1)	5.9.94 19.58		"
63	69° 08,03	73° 38,08	12	SPM-water/frozen Contam. surf.sed. Foraminifera	Niskin (1,2) Grab (2) Grab	6.9.94 03.24	Light brownish clayey silt	"
65	68° 59,02	74° 03,55	10	SPM-water/frozen Contam. surf.sed. Benthic fauna Foraminifera	Niskin (1,2) Grab (2) Grab (5) Grab	6.9.94 07.52	Light brownish clayey silt	"

Station no	Lattitude north	Longitude east	Depth (m)	Type of sampling	Equipment	Date Time (UTC)	Surface sediment / length of core	Location
66	68° 53,08	74° 10,88	10	SPM-water/frozen Contam. surf.sed.	Niskin (1,2) Grab (2)	6.9.94 09.54	Light brownish clayey silt	"
67	68° 46,92	74° 19,93	10	SPM-water/frozen	Niskin (1,3)	6.9.94 11.40		"
69	68° 22,92	73° 52,96	15	SPM-water/frozen Contam. surf.sed.	Niskin (1,3) Grab (2)	6.9.94 15.48	Light brownish /olive clayey silt	"
74	73° 20,52	74° 59,22	12	Contam. surf.sed. Foraminifera	Grab (2) Grab	10.9.94 12.01	Brownish sand	North of Obskaya Guba
76	73° 03,91	80° 20,95	21	SPM-water/frozen	Niskin (1,2)	11.9.94 05.52		"
77	73° 02,95	80° 00,65	21	SPM-water/frozen Contam. strat.sed. Foraminifera	Niskin (1,2,3) Core (12) Grab (1)	11.9.94 07.58	Light brown clayey silt Core length: 70-62 cm	Jenisei Zaliv
80	72° 45,00	79° 43,73	9	SPM-water/frozen Contam. surf.sed. Foraminifera	Niskin (1,2) Grab (2) Grab	11.9.94 15.20	Brownish sand	Jenisei Zaliv
81	72° 44,13	80° 11,08	14	SPM-water/frozen Contam. surf.sed. Foraminifera Stratigraphy	Niskin (1,2) Core (10) Core (2) Core (1)	11.9.94 16.30	Light brown clayey silt 65 cm core	Jenisei Zaliv
82	72° 42,21	80° 35,18	16	SPM-water/frozen	Niskin (1,2)	11.9.94 19.10		Jenisei Zaliv
83	72° 05,97	82° 00,14	7,5	SPM-water/frozen Contam. surf.sed. Benthic macro fauna Foraminifera	Niskin (1) Grab (2) Grab (5) Grab	12.9.94 01.00	Brownish sandy silt	Jenisei Zaliv
84	72° 10,00	81° 00,00	11	SPM-water/frozen Contam. strat.sed. Foraminifera/grain size	Niskin (1,3) Core (12) Core (4)	12.9.94 05.00	Brownish clayey silt Core length: 41-52 cm	Jenisei Zaliv
85	72° 26,01	80° 01,21	9	SPM-water/frozen Contam. surf.sed. Benthic macro fauna Foraminifera	Niskin (1,3) Grab (2) Grab (5) Grab	12.9.94 11.50	Brownish clayey silt	Jenisei Zaliv
86	72° 26,00	79° 09,00	7,5	SPM-water/frozen	Niskin (1,2)	12.9.94 18.30		Jenisei Zaliv
87	72° 33,24	79° 05,72	9	SPM-water/frozen Contam. surf.sed. Foraminifera	Niskin (1,2) Grab (2) Grab	12.9.94 19.40	Brownish silt	Jenisei Zaliv
91	73° 33,00 73° 34,81	80° 02,32 80° 02,67	37	SPM-water/frozen Contam. surf.sed. Foraminifera	Niskin (1,2) Grab (2) Grab	13.9.94 04.50	Brownish silt	Dickson
93	73° 39,76 73° 39,86	78° 17,39 78° 19,49	14	SPM-water/frozen Contam. surf.sed. Foraminifera	Niskin (1,2) Grab (2) Grab	13.9.94 08.45	Brownish clayey silt/sand	North of Ostrov Sibiryakova
96	73° 50,52 73° 50,67	74° 33,79 74° 33,90	15	SPM-water/frozen Contam. surf.sed. Foraminifera	Niskin (1,2) Grab (2) Grab	13.9.94 16.35	Brownish silty sand	North of Obskaya Guba
97	73° 49,65	73° 20,34	26	SPM-water/frozen	Niskin (1,2)	13.9.94 19.05		North of Obskaya Guba
100	73° 50,10 73° 51,04	70° 16,10 70° 17,46	20	Contam. surf.sed. Foraminifera	Grab (2) Grab	14.9.94 03.30	Olive brown sandy silt	North of Ostrov Belyy
102	74° 00,06	68° 58,53	17	SPM-water/frozen Contam. surf.sed. Foraminifera	Niskin (1,2) Grab (2) Grab	14.9.94 10.00	Brownish silty sand	Northwest of Ostrov Belyy
104	75° 00,08 75° 02,68	68° 49,26 68° 51,35	83	Contam. surf.sed. Foraminifera	Grab (2) Grab	14.9.94 20.45	Brownish silt	North western Kara Sea

Station no	Latitude north	Longitude east	Depth (m)	Type of sampling	Equipment	Date Time (UTC)	Surface sediment / length of core	Location
105	74° 59,89	67° 20,46	185	SPM-water/filtered	Niskin (1,2,3)	14.9.94 01.40		North western Kara Sea
106	74° 36,08 74° 36,10	65° 00,04 64° 56,57	77	Contam. surf.sed. Foraminifera	Grab (2) Grab	15.9.94 07.35	Brownish silt	North western Kara Sea
107	73° 59,97 73° 58,47	65° 00,33 65° 00,82	197 170	Contam. surf.sed. Foraminifera	Grab (2) Grab	15.9.94 11.48	Dark brown clayey silt	North west of Yamal
109	73° 00,01 73° 00,40	60° 32,07 60° 31,66	113 100	Contam. surf.sed. Foraminifera	Grab (2) Grab	16.9.94 01.25	Dark brown silt	South western Kara Sea
110	71° 59,94 71° 59,48	58° 47,67 58° 46,91	88	Contam. surf.sed. Foraminifera	Grab (2) Grab	16.9.94 09.40	Brown clayey silt	South western Kara Sea
111	70° 59,92 70° 58,44	58° 20,02 58° 32,11	236	SPM-water/filtered Contam. strat.sed. Contam. surf. sed Benthic macro fauna Foraminifera	Niskin (1,3) Core (12) Grab (2) Grab (5) Grab	16.9.94 15.10	Brown clayey silt Core length: 36-54 cm	North of Kara Gate
113	70° 34,67	58° 23,27	140	SPM-water/filtered	Niskin (1,2,3)	17.9.94 02.35		Kara Gate
end of leg one								

NOTES FOR THE TABLE :

- The Niemesto gravity corer was used with a inner tube diameter of 50 mm. The van Veen grab used had a sampling area of 0.1 m^2.
- One possition is given for stations where sampling was carried out from an ancored vessel. Several possitions are given where the vessel was drifting during sampling. The positions for start and finish of station are given in the table.
- Hydrographic profiles were obtained by CTD-instrument at all stations.
- Stations where only CTD-sampling were carried out, are not reported in this table.
- Samples for intercalibration of sediment analyses have been carried out on station no. 32, 48 and 83.
- In addition to stations given in table, samples of organisms were taken from 4 land stations and one ice station situated in Eastern Kara Sea, Obskaya Guba and Ygorski Shar.
- All positions are given by the satellite navigation system of the vessel.
- All dates and times are given in Greenwich time (GMT)
- Niskin (1,2,3): Water samples taken by Niskin water bottles at the following depths - 1: surface layer, 2: picnocline or max concentration, 3: bottom water.
- Contam. surf.sed.: Abbrevated from contaminants in surface sediments (0-1 cm).
- Contam. strat.sed.: Abbrevated from contaminants in stratigraphic samples (cores)
- Grab (5): Sample taken by van Veen grab deployed 5 times.
- core (12): Sample taken by Niemesto corer deployed 12 times.

Contaminants in organisms

A total of 9 sea birds (table 8.2) were collected and frozen. Tissues from the breast musculature and selected internal organs will be analysed for contaminants and a visual analysis of stomach content will be carried out.

16 specimens of fish were also collected. Myotomal muscle tissue and the livers were dissected out and frozen for later analysis. Otolith analysis will be carried out to determine the age of the fish. Where possible, stomach content analysis will be carried out to determine the type of prey organisms taken.

Table 8.2
Sampling of organisms for for analyses of contaminants

Date	Latitude north	Longitude east	Geographic area	Organism	Labelled	Equipment
27.8.94			Ice station no 2 close to Slozhny Island.	"Havhest"	Bird 1	On the ice shotgun
29.8.94			Ice station no 2 south of Krasnaya Amina strait	"Sea gull"	Bird 2	On the ice shotgun
02.9.94			Mikhaelova penisula		Fish 1	Coastal station, caught by net
04.9.94			Shokal'skogo Island, Ob	Omul	Fish 2	Coastal station, shotgun
10.9.94			Shokal'skogo Island, Ob	Diffrent birds	Bird 3, 4, 5, 6, 7, 8	Coastal station, shotgun
10.9.94			Shokal'skogo Island, Ob	Diffrent fish	Fish 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	Coastal station, shotgun
18.9.94			Ygorski shar (Khabarovo)	Diffrent fish	Fish 14, 15, 16	Coastal station, caught by net
18.9.94			Ygorski shar (Khabarovo)	Duck	Bird 9	Coastal station, shotgun

Possisjoner på landstasjoner mangler/feil - input fra Torgny Vinje

RV "IVAN PETROV" 18th september 1994.
Kurt-Roger Fredriksen and Sabine Cochrane

9. OPTICAL MEASUREMENTS.

D. Pavlikov, I.Popov, V. Matyushenko, V. Demchenko

Variability of optical characteristics of sea water is mainly governed by hydrodynamic and biological processes, that is why data on the distribution of these characteristics can be used for an analysis of different dynamic processes in the ocean. Optical characteristics of sea water are governed by different components of suspended and dissolved substances. In most cases one can identify specific optical characteristics governed by some optically active sea water component.

The main aim of the optical team during the KAREX-94 expedition was to study spatial variability of the attenuation coefficient of light in sea water. Also measurements of sea spectral brightness coefficient were carried out.

The information on sea water transparency (attenuation index is inversely proportional to transparency) is used to fulfil many objectives: calculation of illumination coefficients at different levels, estimates of bioproductivity of the areas, ecological control of the works connected with dredging and ground removal, in particular, for construction of oil drilling platforms, use of water of reduced transparency as a tracer in water dynamics studies, operation and development of underwater TV equipment.

The spectrum type of the sea brightness coefficient informs about the concentration of chlorophyll and the sea water absorption coefficient. At the present time the methods are known which allow the determination of phytoplankton by the so called chlorophill gap in the spectrum of sea brightness coefficient. Also, a comparison of sea brightness coefficient spectrum recorded at a height of several meters from sea surface with the spectra of the own ocean radiation spectra obtained from satellities, will possibly provide interesting results required for an analysis of satellite information.

Instruments and equipment

Transparency meter "Kvant-3" is an instrument to measure the light attenuation index in sea water in the regime of sounding:
- wave operating length 530 nm - measuring range 0.1 - 3.0 m - absolute measurement error not more than 0.01 m - constant of the measurement time 0.02 s - optical basis 460 mm - depth of submerging up to 150 m - instrument weight 36 kg 2. Sea spectral brightness coefficient meter "Rometer". - measurement range, relative units 0.01-10.00 - spectral range λ, nm 400-700 - spectral resolution $\Delta\ \lambda$, nm 2-5 - frequency of scanning of brightness and exposure channels, kHz 4 - scanning time by the spectrum, C 15

Installation of equipment The recording equipment and computers for data procession

were accomodated in the meteorological laboratory at the life-boat deck of the left board in the central part of the ship. The cables from the winches and instruments installed on the deck passed along the upper deck to the laboratory through the illuminator.
The "Rometer" instrument was installed at the bow of the ship at a special horizontal site at a 5 m height from sea surface. The cable winch of the transparency meter "Kvant-3" was mounted on the life-boat deck of the right board of the stern of the ship. The instrument was lowered by means of the hydraulic crane with a winch operation radius of 2.5 m.

Methods of measurments

The transparency meter "Kvant-3" measures the index of light attenuation in water (ε_0) by means of comparing the intensity of two light beams. The first beam passing inside the instrument is called the basic beam and provides information about the optical density of the atmosphere inside the instrument. The second beam goes out through the illuminator outside the instrument limits and passes a distance in water equal to a double length of the optical base and reflecting from the mirror returns to the instrument.The difference in intensity of the light fluxes of the first (X_0) and second (X) beams contains information on the sea water attenuation index. The light attenuation index in sea water (ε_0) is calculated according to the following formula:

$$\varepsilon_0 = \left[\frac{Xon}{Xon - X} \right] - \ln \left[\frac{Xon}{Xon - Xo} \right] + \ln [1.07] ,$$

where Xon - a minimum possible intensity of the second beam (upper boundary of the dynamic range of the instrument), ln (1.07) - correction for refraction of the light flux at the boundary glass-water.
The meter of sea brightness coefficient "Rometer" is designed for measuring spectral density of the brightness of solar radiation outgoing from the sea and reflected from its surface (Bm), radiation brightness of the sky in zenith (Bn) and illumination of sea surface (ε_0) in a spectral range of 400-700 nm. The sea spectral brightness coefficient $\rho(\lambda)$ is expressed through the values measured by the following formula:

$$\rho(\lambda) = \pi(Bm - RBn) + \varepsilon_0,$$

where R=0.02 - Frenel coefficient of radiation reflection from sea surface at a normal incidence. At the stations there were carried out a single sounding by transparency meter down to a depth of 150 m or to the bottom and repeated measurements by "Rometer" if weather conditions permitted. The "Rometer" measurements require high illumination and uniform sky brightness (continous uniform cloud or completely cloud-free sky), small wave and sufficiently high water transparency. Thus, the "Rometer" is not suitable for operation in gulfs.

Repeated measurements are necessary for a statistical filtration of the wave effects, ship pitch and roll, specks of light, etc.

Brief characteristics of the studies During the KAREX-94 expedition there were carried out 100 soundings by the transparency meter "Kvant-3" and 30 determinations of the spectral sea brightness coefficient by the "Rometer". The sounding points were uniformely distributed over the network of hydrological stations, the gaps were caused by the misfunction of the equipment and stormy weather. The points of measurements by "Rometer" were identified depending on the instrument being ready for work and weather conditions. It should be noted that the instrument is designed for operation on board much larger ships, as compared with the R/V "Ivan Petrov". The most suitable time of operation is a period from June to August.

Results

Preliminary analysis of hydrological data Transparency of sea water is mainly governed by the presence of biological and mineral suspended matter. It follows from the results of the studies of bioproductivity of the Kara Sea that a small amount of phyto- and zooplankton cannot strongly affect water transparency. Mineral suspensions transported by the continental outflow and entrapped from the bottom during storms in the shallow sea zone are considered to be a decisive factor for the formation of background values and spatial distribution of the light attenuation index in the Kara Sea water.

In the region of the ice edge in the north-eastern and northern Kara Sea sea water is relatively transparent, the vertical and horizontal distributions of the light attenuation coefficient do not have high gradients. In the upper layer in the pycnocline region layers with a reduced transparency several meters thick are observed.

At the stations occupied in the vicinity of the Izvestiya TSIK islands and in the eastern part of the transect along 74 N an increase of mean values of the light attenuation coefficient and a large irregularity of its vertical profile are observed. The layers with enhanced turbidity usually correspond to the layers of increased density gradient. Such type of vertical distribution of the light attenuation coefficient characterizes the regions with a significant influence of the river run-off.

In the Ob' Gulf and the Yenisey Bay vertical profiles of the light attenuation coefficient clearly illustrate the process of mutual penetration and mixing of more transparent sea water and water of the river run-off. On the whole, water of the Yenisey Bay is more transparent than that of the Ob' Gulf, where water turbidity exceeded the dynamic range of the instrument.

In the Baidaratskaya Gulf a spatial distribution of the light attenuation coefficient corresponds to a greater extent, to bottom topography and is partly modified by the dynamics of the surface water layer.

In the western Kara Sea water transparency increases from south to north, in the region of the Kara Gate strait a decrease in mean water transparency is observed.

On the whole, water transparency of the Kara Sea increases from south to north and from east to west, from the coast to the ice edge. Vertical profile of the light attenuation coefficient usually contains layers of reduced transparency in the subsurface and near bottom layers.

An analysis of spectral brightness coefficient data will be performed after the end of the expedition. The General table of opticals observatins duiring cruise (Annex D).

10. BALANCE MEASUREMENTS OF SHORT-WAVE RADIATION ON THE SEA SURFACE AND UNDER IT AND IN THE SEA ICE PUDDLES.

O.Myakoshin, A.Bezgreshnov

Heat exchange processes between sea and atmosphere in the Arctic Basin govern in many respects to the thermic and dynamic regime, and considerably affects to the climate of the whole Northern Hemisphere. The inflow and outflow of short-wave radiation into the high layers of the Arctic Basin seas are the main component of the heat balance of the arctic seas.

The available estimations of the flows of short-wave radiation in the Arctic were made on the base of the small number of natural observations. To extend the available information on the heat exchange processes between the sea surface and atmosphere, their influence to the ice massif formation, and to determine the absorption of short-wave radiation in the ice and fractures, the underwater actynometric studies were included into the KAREX-94.

The over- and underwater pyranometers were used for measurements. These devices were produced by the special order and are the test specimens. The underwater pyranometer has the hermetic corp and two transducers (up- and downward) that allows one to measure not only the separate components of the short-wave flow in the near-surface layer but also the balance in general. The overwater pyranometer had the single transducer. The range of sensibility of transducers is within 0.3-3.0 mcm. The micro ampermeter having the accuracy of 1 mcA was used. Then, the values of short-wave radiation flows were calculated in Wt/m2, using the sensibility of transducer (66 Omkv/(Wt/m2) and resistance.

The measurements were carried out at oceanographic stations mainly in favorable conditions: during the light time and small (< 3 balls) disturbance. The measurements of underwater pyranometer were obtained from surface to depth where the transducer signal attenuated (with middle light and 8-12 m transparency) with the interval of 0.5-1 m. The data of overwater meter were obtained in the beginning and finish of work.

Furthermore, the radiation measurements were carried out during landings to the drifting ice, in puddles. It was due to the special role of puddles in the arctic heat exchange. The flows of short-wave radiation over the surface were observed in different points of the puddle three times each one. The underwater measurements were carried out at different levels with the interval of 20 sm. Also we described the ice sheet, puddle and meteoinformation as it was done onboard the ship.

Totalty, during the cruise the 33 oceanographic stations were fulfilled (including 15 ones to 10 m depth) and observations were made at 3 drifting ice sheets (in puddles).
The estimation of the impact of puddle`s pollution to the amount of outgoing radiation is the important result.
In general, the data obtained allow us to determine the influence of various factors (cloudiness, disturbance etc.) to the short-wave radiation balance in the sub-surface layer of the Arctic seas and over the surface, and to check the charts of distribution of its components as well.

Preliminary revising of the cruise data on the income of short-wave radiation to the sub-surface layer of the sea and the graphs we can indicate the following peculiarities.
The radiation flow with depth occurs by expotential law, and it is the clearest while cloudiness absence (Fig.10.1). From surface to 0.5 m the drastic decrease of radiation (about two times) is observed. Then, the decrease slows down with depth and at 8-10 m it becomes tens times lower (compared to the surface).

Furthermore, the comparison of the graphs of observations carried out with different surface lightness, shows that the difference in the amount of incoming radiation is considerable at the surface and at fact disappears at 8-10 m.

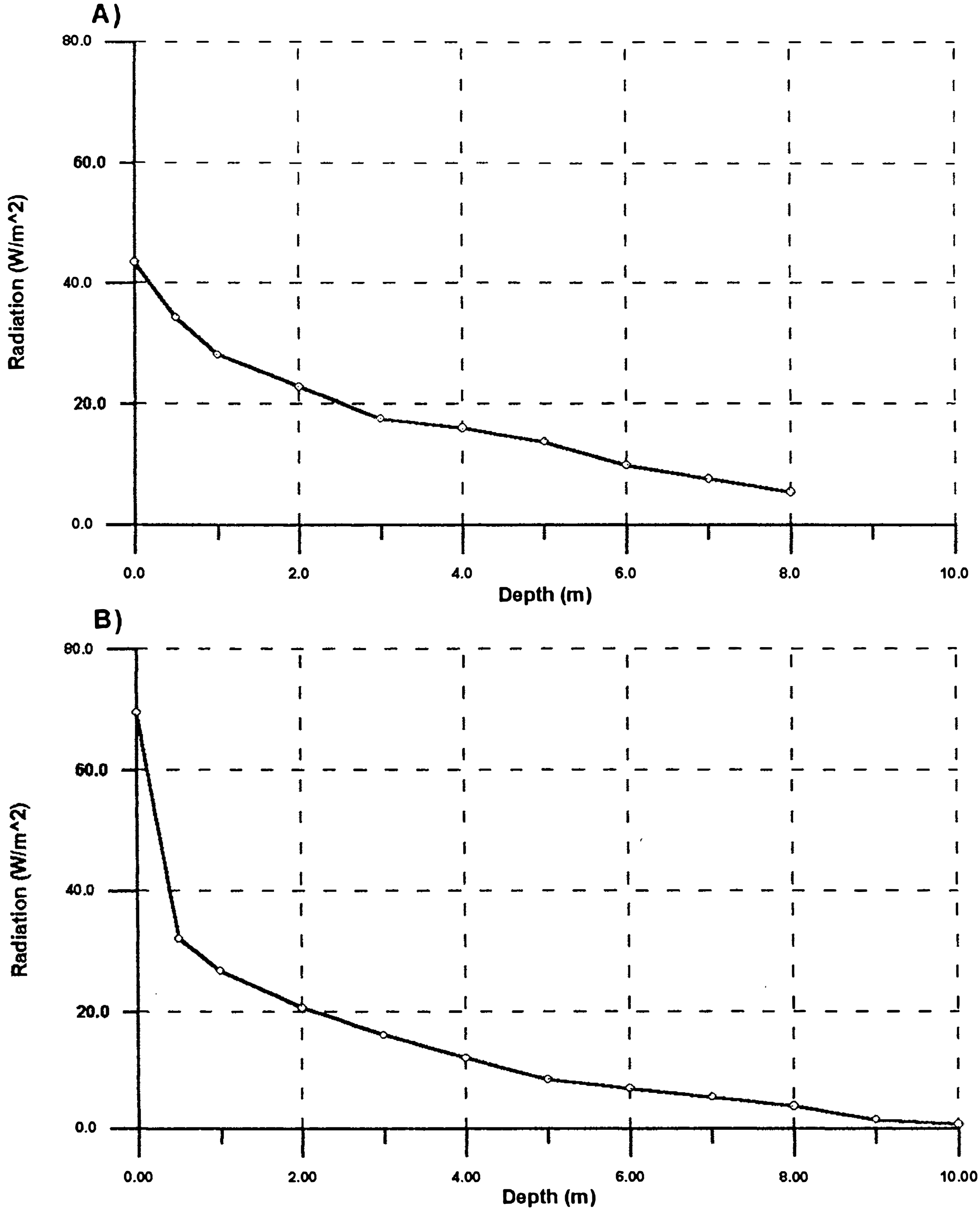


Fig. 10.1 Distribution of oncoming short-wave radiation in the upper layer of Kara sea in september 1994, with clouds (a) and without clouds (b).

11. CONCLUSION .

T.Vinje, V.Volkov

The success of the marine arctic expedition mainly depends on ice and meteorological conditions which are difficult to be forecasted quite accurately. Therefore, KAREX-94 was planned on the base of some maximal program indicating the first priority regions. All program corrections were made taking into account the real weather and ice conditions. The regions of first priority were Obskaya Guba, Gulf of Yenisey, Baidaratskaya Guba and ice edge area in the north-eastern Kara sea. During the first part of the expedition the weather was quite favorable but the second one was held in fall storms, and several stations in the centre of south-western Kara sea were not carried out.
Nevertheless, the first priority studies are carried out completely.
In the future, it seems reasonable to begin the expedition 2-3 weeks earlier when meteorological conditions use to be more stable.

ANNEX A

Participants and affiliation :

1. Volkov Vladimir	scientific expedition leader, oceanography	AARI	Leg I
2. Kuznetsov Vasiliy	cruise leader, oceanography	AARI	
3. Zhukov Vladislav	deputy expedition leader, oceanography	AARI	Leg II
4. Kuzmin Sergey	head of oceanography group	AARI	
5. Pavlov Pavel	oceanography	AARI	
6. Pisarevskaya Ludmila	oceanography	AARI	
7. Vlasov Sergey	head of chemical group	RCMA	Leg I
8. Vikdorovich Alexey	marine chemistry	RCMA	Leg I
9. Chigak Maxim	marine chemistry	RCMA	Leg I
10. Vershinin Alexander	marine biology	RCMA	Leg I
11. Grigoryev Andrey	ice observation	AARI	
12. Pavlikov Dmitriy	head of optical group	AARI	
13. Demchenko Vadim	marine optics	AARI	
14. Matyushenko Vladimir	marine optics	AARI / IEPN	
15. Miakoshin Oleg	oceanography, short-wave radiation	AARI	Leg I
16. Bezgreshnov Andrey	oceanography, short-wave radiation	AARI	Leg II
17. Igor Popov	marine optics	AARI	Leg II
18. Vinje Torgny	sea ice, remote sensing,, oceanography	NP	Leg I
19. Hokedal Jo	oceanography, sea ice, marine optic	NP	
20. Korsnes Reinart	sea ice, remote sensing	NP	Leg I
21. Nygaard Einar	oceanography, moorings	NP	Leg I
22. Fredriksen Kurt-Roger	marine geology	NP/APN	Leg I
23. Cochran Sabine	marin biology	NP/APN	Leg I

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ANNEX B

The General table of observations by CTD OTS-1500

Stations No	AMAP Stations No	Position		Depth	last horizont	Time	Date	CTD	Chemistry		
		Latitude	Longetude						O_2	Si	PO_4
1	2	3	4	5	6	7	8	9	10	11	12
001		64 50.9	40 16.5	10	5	08.40	18.08	+	-	-	-
002		73 59.8	73 00.4	31	31	22.05	22.08	+	-	+	+
003		73 45.0	80 01.1	36	26	02.30	24.08	+	+	+	+
004		74 00.1	79 59.5	34	33	04.55	24.08	+	+	+	+
005	59	74 14.9	79 59.5	35	33	07.10	24.08	+	+	+	+
006		74 00.0	80 01.3	35	33	09.50	24.08	+	-	-	-
007	61	74 19.8	84 17.1	19	17	18.15	24.08	+	+	+	+
008	120	76 00.2	87 16.3	43	41	19.10	25.08	+	+	+	+
009		76 54.4	88 13.2	51	51	05.40	26.08	+	+	+	+
010	118	76 59.9	85 15.1	57	56	15.50	26.08	+	+	+	+
011		77 38.1	87 14.8	107	104	05.00	27.08	+	+	+	+
012		78 00.1	83 39.8	120	115	17.00	27.08	+	+	+	+
013		78 10.4	84 33.8	87	84	20.25	27.08	+	+	+	+
014		78 14.0	84 50.5	57	53	21.30	27.08	+	+	-	+
015		78 17.4	85 08.8	57	56	22.20	27.08	+	+	-	+
016		78 20.9	85 28.3	49	46	23.05	27.08	+	+		+
017		78 24.5	85 42.2	72	68	23.50	27.08	+	+	-	+
018		78 27.9	86 00.6	52	50	01.25	28.08	+	+	-	+
019		78 32.0	86 17.7	90	87	02.35	28.08	+	+	-	+
020	300	78 33.5	86 18.6	154	150	03.20	28.08	+	+	+	+
021		78 27.9	86 32.3	165	160	06.25	28.08	+	+	-	+
022		78 34.0	86 17.7	143	140	09.00	28.08	+	+	-	+
023		78 21.5	85 56.6	81	78	10.10	28.08	+	+	-	+
024		78 18.1	85 38.9	67	64	11.04	28.08	+	+	-	+
025		78 13.7	85 21.7	57	56	12.05	28.08	+	+	-	+
026		78 09.4	85 42.6	108	106	12.55	28.08	+	+	-	+
027		78 14.0	86 00.9	123	118	14.05	28.08	+	+	-	+
028		78 14.0	86 00.9	123	114	14.20	28.08	+	-	-	-
029		78 17.3	86 17.8	121	114	15.25	28.08	+	+	-	+
030		78 20.9	86 35.2	134	129	16.45	28.08	+	+	-	+
031		78 21.3	86 44.7	141	134	17.35	28.08	+	+	-	+
032		78 15.6	86 49.1	145	137	19.20	28.08	+	+	+	+
033		78 00.3	80 39.6	146	141	12.35	29.08	+	+	+	+
034		76 59.4	80 39.7	76	75	22.50	29.08	+	+	+	+
035		76 21.5	74 40.7	101	90	08.25	30.08	+	+	+	+
036		76 29.8	73 26.2	104	98	11.45	30.08	+	+	+	+
037	110	76 00.0	78 18.4	150	139	16.25	30.08	+	+	+	+
038		76 01.1	73 53.0	107	88	21.50	30.08	+	+	+	+
039	111	74 59.6	72 11.8	27	26	05.15	31.08	+	+	+	+
040		74 59.6	76 00.2	42	36	12.20	31.08	+	+	+	+

Stations No	AMAP Stations No	Position		Depth	last horizont	Time	Date	CTD	Chemistry		
		Latitude	Longetude						O_2	Si	PO_4
1	2	3	4	5	6	7	8	9	10	11	12
041	113	76 09.8	76 36.2	64	61	21.50	31.08	+	+	+	+
042		75 58.0	78 32.7	63	54	03.34	01.09	+	+	+	+
043		76 00.7	82 15.1	24	22	09.22	01.09	+	+	+	+
044		75 46 1	80 24.5	41	39	13.40	01.09	+	+	+	+
045		75 38.9	81 39.0	47	41	16.00	01.09	+	+	+	+
046		75 29.7	82 55.2	46	41	18.20	01.09	+	+	+	+
047		75 22.4	84 06.8	37	34	21.20	01.09	+	+	+	+
048	63	75 14.5	85 16.4	44	42	23.40	01.09	+	+	+	+
049		75 00.0	86 20.0	35	30	05.50	02.09	+	+	+	+
050	60	75 00.0	83.30.0	48	44	22.00	02.09	+	+	+	+
051	116	75 00.0	79 40.4	39	36	06.10	02.09	+	+	+	+
052	0-1	73 00.0	73 00.0	26	22	03.30	04.09	+	+	+	+
053	0-2	72 40.0	73 20.0	21	16	06.35	04.09	+	+	+	+
054	0-3	72 40.1	73 58.0	18	16	08.35	04.09	+	+	+	+
055	0-4	72 40.4	74 23.8	14	13	10.50	04.09	+	+	+	+
056	0-5	72 00.2	73 11.6	13	11	21.40	04.09	+	+	+	+
057	0-6	71 30.0	73 02.0	10	8	01.20	05.09	+	+	+	+
058	0-7	71 30.2	72 34.9	14	11	02.40	05.09	+	+	+	+
059	0-8	71 30.9	72 06.1	7	4	04.55	05.09	+	+	+	+
060	0-9	70 20.1	73 50.1	12	10	13.05	05.09	+	+	+	+
061	0-10	70 20.4	73 26.3	12	10	14.04	05.09	+	+	+	+
062	0-11	70 20.7	73 05.7	13	5	20.05	05.09	+	+	+	+
063		69 08.0	73 38.1	12	10	03.25	06.09	+	+	+	+
064	0-12	68 54.9	73 52.8	10	8	06.20	06.09	+	+	+	+
065	0-13	68 59.0	74 03.3	10	8	07.52	06.09	+	+	+	+
066	0-14	68 53.0	74 10.7	10	9	09.54	06.09	+	+	+	+
067	0-15	68 46.9	74 19.9	10	9	11.40	06.09	+	+	+	+
068	0-16	68 22.0	74 08.0	7	6	14.30	06.09	+	+	+	+
069	0-17	68 22.9	73 51.2	15	14	15.48	06.09	+	+	+	+
070		72 09.9	73 28.3	10	9	19.00	09.09	+	-	-	-
071		72 15.2	73 34.0	9	8	19.45	09.09	+	-	-	-
072		72 24.9	73 42.7	9	8	20.50	09.09	+	-	-	-
073		72 35.1	73 55.1	14	14	22.15	09.09	+	-	-	-
074	49	73 20.3	74 58.2	12	10	12.05	10.09	+	+	+	+
075		73 59.3	79 59.3	32	30	23.10	10.09	+	-	-	-
076	E-1	73 03.9	80 21.0	21	18	05.50	11.09	+	+	+	+
077	E-2	73 03.0	80 00.4	21	18	07.58	11.09	+	+	+	+
078	E-3	73 02.1	79 43.0	18	16	13.05	11.09	+	+	+	+
079		73 01.6	79 41.0	19	17	13.30	11.09	+	+	+	+
080		72 45.0	79 43.7	9	8	15.20	11.09	+	+	+	+
081	E-4	72 44.1	80 11.1	14	14	16.30	11.09	+	+	+	+
082		72 42.2	80 35.2	16	15	19.10	11.09	+	+	+	+

Stations No	AMAP Stations No	Position		Depth	last horizont	Time	Date	CTD	Chemistry		
		Latitude	Longetude						O_2	Si	PO_4
1	2	3	4	5	6	7	8	9	10	11	12
083	E-5	72 05.9	82.00.1	8	6	01.00	12.09	+	+	+	+
084	E-6	72 10.0	81 00.2	11	10	05.00	12.09	+	+	+	+
085	E-7	72 25.8	80 01.9	9	8	11.50	12.09	+	+	+	+
086		72 26.0	80 01.2	8	7	18.26	12.09	+	+	+	+
087	E-8	72 33.2	79 05.7	9	8	19.50	12.09	+	+	+	+
088		72 41.1	74 07.0	7	6	21.30	12.09	+	+	+	+
089		72 53.1	80 03.0	16	15	00.55	13.09	+	-	-	-
090		72 58.0	80 04.1	16	15	01.50	13.09	+	-	-	-
091		73 33.0	80 02.3	38	36	04.50	13.09	+	+	+	+
092		73 35.0	79 27.2	28	27	06.30	13.09	+	+	+	+
093	58	73 39.8	78 17.4	14	13	08.45	13.09	+	+	+	+
094		73 43.6	77 07.9	19	18	11.50	13.09	+	+	+	+
095		73 50.0	75 46.2	17	17	14.40	13.09	+	+	+	+
096		73 50.3	74 33.8	15	15	16.35	13.09	+	+	+	+
097	112	73 49.6	73 20.3	26	26	19.05	13.09	+	+	+	+
098		73 50.0	72 27.0	21	25	21.40	13.09	+	+	+	+
099		73 50.0	71 30.5	17	17	01.15	14.09	+	+	+	+
100		73 50.1	70 16.1	20	18	03.30	14.09	+	+	+	+
101		73 30.4	69 00.2	20	17	07.05	14.09	+	+	+	+
102	109	74 00.7	69 00.8	17	17	10.00	14.09	+	+	+	+
103		74 00.1	67 00.2	86	83	14.15	14.09	+	+	+	+
104		75 00.1	68 49.3	83	81	20.45	14.09	+	+	+	+
105	107	76 00.0	67 20.5	185	181	01.40	15.09	+	+	+	+
106		74 36.1	65 00.0	77	67	07.35	15.09	+	+	+	+
107		74 00.0	65 0.3	200	194	11.48	15.09	+	+	+	+
108		74 00.1	62 52.7	175	171	18.20	15.09	+	+	+	+
109	105	73.00.0	60 32.1	113	109	01.25	16.09	+	+	+	+
110		71 59.9	58 47.7	88	82	09.30	16.09	+	+	+	+
111		70 59.9	58 20.0	236	227	15.10	16.09	+	+	+	+
112		70 39.9	57 49.4	48	46	01.15	17.09	+	+	+	+
113	25	70 34.7	58 23.3	140	134	02.35	17.09	+	+	+	+
114		70 30.1	58 52.4	40	45	04.35	17.09	+	+	+	+
115	B-1	69 18.8	65 09.8	13	11	20.05	19.09	+	+	+	+
116		69 12.0	65 30.9	8	8	21.55	19.09	+	+	+	+
117	B-2	69 10.5	66 09.6	15	14	00.20	20.09	+	+	+	+
118	B-3	68 51.9	67 01.8	9	9	03.28	20.09	+	+	+	+
119	B-4	68 30.0	68 18.3	10	9	07.45	20.09	+	+	+	+
120	B-5	68 45.7	68 09.0	13	12	10.27	20.09	+	+	+	+
121	B-6	68 55.0	67 39.9	13	12	12.40	20.09	+	+	+	+
122	B-7	69 01.1	67 20.7	19	19	14.25	20.09	+	+	+	+
123	B-8	69 21.5	67 22.6	9	9	00.37	21.09	+	+	+	+
124	B-9	69 12.1	67 51.3	13	11	08.35	21.09	+	+	+	+
125	B-10	69 04.0	67 39.5	16	15	10.15	21.09	+	+	+	+
126	B-11	69 09.1	68.07.6	8	8	12.00	21.09	+	+	+	+
127	B-12	69 11.0	67 00.3	24	23	15.25	21.09	+	+	+	+

ations No	AMAP Stations No	Position		Depth	last horizont	Time	Date	CTD	Chemistry		
		Lituade	Longetude						O_2	Si	PO_4
1	2	3	4	5	6	7	8	9	10	11	12
128	B-13	69 17.1	66 26.8	23	22	18.23	21.09	+	+	+	+
129	B-14	69 26.0	66 44.5	16	15	20.06	21.09	+	+	+	+
130	B-15	69 27.1	65 30.7	24	24	06.30	22.09	+	+	+	+
131	B-16	69 36.0	65 49.9	25	24	08.30	22.09	+	+	+	+
132	B-17	69 43.9	66 10.2	19	18	10.00	22.09	+	+	+	+
133	B-18	69 50.8	66 45.1	9	9	12.20	22.09	+	+	+	+
134		69 59.7	66 29.8	15	14	07.00	23.09	+	+	+	+
135		69 59.2	65 20.2	37	36	09.27	23.09	+	+	+	+
136		69 59.5	64 00.2	138	136	12.13	23.09	+	-	-	-
137		69 59.8	62 29.9	138	139	16.02	23.09	+	-	-	-
138		69 59.9	60 58.8	200	191	20.06	23.09	+	-	-	-
139		70 59.9	66 20.6	17	16	07.45	24.09	+	-	-	-
140		70 59.0	65 00.2	38	38	10.20	24.09	+	-	-	-
141		70 59.8	63 29.9	155	151	13.21	24.09	+	-	-	-
142		71.00.0	60 20.4	147	148	15.55	24.09	+	-	-	-
143		71.00.0	67 20.4	132	131	19.26	24.09	+	-	-	-
144		69.00.0	57 30.1	15	14	18.17	4.10	+	-	-	-

ANNEX C

The General table of actionometrics, chemicals and ice observations.

Stations No	Actino-metry	Ice	AMAP Chemistry				
			Water	Bottom sediments	Benthos	Salinity	Nuclean chemistry
001	-	-	-	-	-	-	-
002	-	-	-	-	-	+	-
003	-	-	-	-	-	+	-
004	+	-	-	-	-	+	-
005	+	-	I	I	-	+	-
006	+	-	-	-	-	-	-
007	-	-	I	I	-	+	-
008	-	-	I	I	-	+	-
009	-	-	-	-	-	+	-
010	+	+	II	I	+	+	-
011	-	-	-	-	-	+	-
012	-	+	-	-	-	+	+
013	-	-	-	-	-	+	-
014	-	-	-	-	-	+	-
015	-	-	-	-	-	+	-
016	-	-	-	-	-	+	-
017	-	-	-	-	-	+	-
018	-	+	-	-	-	+	-
019	-	+	-	-	-	+	-
020	-	+	II	-	-	+	-
021	+	+	-	-	-	+	-
022	+	+	-	-	-	+	-
023	-	+	-	-	-	+	-
024	-	+	-	-	-	+	-
025	-	+	-	-	-	+	-
026	-	+	-	-	-	+	-
027	-	+	-	-	-	+	-
028	-	+	-	-	-	-	-
029	-	+	-	-	-	+	-
030	-	+	-	-	-	+	-
031	-	+	-	-	-	+	-
032	-	+	II	-	-	+	-
033	-	-	-	-	-	+	-
034	-	-	-	-	-	+	-
035	-	-	-	-	-	+	-
036	-	-	-	-	-	+	-
037	-	-	II	I	-	+	-
038	-	-	-	-	-	-	-
039	-	-	II	I	+	+	-

Stations No	Actino-metry	Ice	AMAP Chemistry				
			Water	Bottom sediments	Benthos	Salinity	Nuclean chemistry
040	+	-	-	-	-	+	-
041	-	-	II	I	+	+	-
042	+	+	-	-	-	+	-
043	+	-	-	-	-	+	+
044	+	-	-	-	-	+	-
045	-	-	-	-	-	+	-
046	-	-	-	-	-	-	-
047	-	-	-	-	-	+	-
048	-	-	I	I	+	+	-
049	-	-	-	-	-	+	-
050	-	-	I	I	+	-	-
051	+	-	II	I	+	+	-
052	-	-	I	I	+	+	-
053	-	-	I	I	-	-	-
054	+	-	I	I	-	+	-
055	+	-	I	I	-	-	-
056	-	-	I	I	-	-	-
057	-	-	I	I	-	-	-
058	-	-	I	I	-	-	-
059	-	-	I	I	-	-	-
060	-	-	I	I	-	-	-
061	-	-	I	I	-	-	-
062	-	-	I	I	-	-	-
063	+	-	-	-	-	-	-
064	-	-	I	I	-	-	-
065	+	-	I	I	-	-	-
066	+	-	I	I	-	-	-
067	-	-	I	I	-	-	-
068	-	-	I	I	-	-	-
069	-	-	I	I	-	-	-
070	-	-	-	-	-	-	-
071	-	-	-	-	-	-	-
072	-	-	-	-	-	-	-
073	-	-	-	-	-	-	-
074	+	-	I	I	+	-	-
075	-	-	-	-	-	+	-
076	+	-	I	I	-	-	-
077	+	-	I	I	-	-	-
078	-	-	I	I	-	-	-
079	-	-	I	-	-	-	-
080	-	-	-	-	-	-	-
081	-	-	I	I	-	-	-
082	-	-	-	-	-	-	-
083	-	-	I	I	-	-	-
084	+	-	I	I	-	-	-
085	-	-	I	I	-	-	-

Stations No	Actino-metry	Ice	AMAP Chemistry				
			Water	Bottom sediments	Benthos	Salinity	Nuclean chemistry
086	-	-	-	-	-	-	-
087	-	-	I	I	-	-	-
088	-	-	-	-	-	-	-
089	-	-	-	-	-	-	-
090	-	-	-	-	-	-	-
091	-	-	-	-	-	-	-
092	-	-	-	-	-	-	-
093	-	-	I	I	+	-	-
094	-	-	-	-	-	-	+
095	-	-	-	-	-	-	-
096	-	-	-	-	-	-	-
097	-	-	II	I	-	-	-
098	-	-	-	-	-	+	-
099	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-
101	-	-	-	-	-	-	-
102	-	-	II	I	-	+	-
103	-	-	-	-	-	+	-
104	-	-	-	-	-	+	-
105	-	-	II	I	+	+	+
106	-	-	-	-	-	+	-
107	+	-	-	-	-	+	-
108	-	-	-	-	-	+	-
109	-	-	II	I	-	+	+
110	+	-	-	-	-	+	-
111	-	-	-	-	-	+	-
112	-	-	-	-	-	+	+
113	-	-	II	-	-	+	-
114	+	-	-	-	-	-	-
115	-	-	I	I	-	-	-
116	-	-	-	-	-	-	-
117	-	-	I	I	+	-	-
118	-	-	I	I	-	-	-
119	+	-	I	I	+	-	-
120	+	-	I	I	+	-	-
121	+	-	I	I	-	-	-
122	-	-	I	I	+	-	-
123	-	-	I	I	-	-	-
124	+	-	I	I	+	-	-
125	+	-	I	I	-	-	-
126	+	-	I	I	-	-	-
127	-	-	I	I	+	-	-
128	-	-	I	I	-	-	-
129	-	-	I	I	-	-	-
130	-	-	I	I	-	-	-
131	+	-	I	I	+	-	-
132	+	-	I	I	+	-	-

Stations No	Actino-metry	Ice	AMAP Chemistry				
			Water	Bottom sediments	Benthos	Salinity	Nuclean chemistry
133	-	-	I	I	-	-	-
134	-	-	-	-	-	-	-
135	+	-	-	-	-	-	-
136	-	-	-	-	-	-	-
137	-	-	-	-	-	-	-
138	+	-	-	-	-	-	-
139	-	-	-	-	-	-	-
140	-	-	-	-	-	-	-
141	-	-	-	-	-	-	-
142	+	-	-	-	-	-	-
143	-	-	-	-	-	-	-
144	-	-	-	-	-	-	-

NOTES FOR THE TABLE:

Chemistry

Water - I komplex : Si, O_2, PO_4 , Σ P, NH_4 , NO_2, NO_3 , ΣN, pH,
P - phenols,
RN - radionucleads,
HM - hard metals,
POC - persistent organic compounds,
OH - oil hidrocarbones,
PPH - poliaromatics , policyclics hidrocarbones,
D - detergents;

II komplex : Si, O_2 , PO_4,
POC - persistent organic compounds,
OH - oil hidrocarbones,
HM - hard metals,
PPH - poliaromatics , policyclics hidrocarbones.
RN - radionucleads.

ANNEX D

The General table of opticals observations.

Stations No	LAI	SRSC	SI
1	2	3	4
001	-	-	-
002	-	-	-
003	+	-	-
004	+	-	-
005	+	-	-
006	+	-	-
007	+	-	-
008	+	-	-
009	+	-	+
010	+	-	-
011	+	-	+
012	+	-	-
013	-	-	-
014	-	-	-
015	-	-	-
016	-	-	-
017	-	-	-
018	-	-	-
019	-	-	-
020	-	-	-
021	-	-	+
022	-	-	-
023	-	-	-
024	-	-	-
025	-	-	-
026	-	-	-
027	-	-	-
028	-	-	-
029	-	-	-
030	-	-	-
031	-	-	-
032	+	-	-
033	+	-	-
034	+	-	-
035	+	-	-
036	+	-	-
037	+	-	-
038	+	-	-
039	+	-	-
040	+	-	-

Stations No	LAI	SRSC	SI
1	2	3	4
041	+	-	-
042	-	-	-
043	+	-	+
044	+	-	-
045	+	-	-
046	+	-	-
047	+	-	-
048	-	-	-
049	-	-	-
050	+	-	-
051	+	-	-
052	+	-	-
053	+	-	-
054	+	-	-
055	+	-	-
056	+	-	-
057	-	-	-
058	-	-	-
059	-	-	-
060	-	-	-
061	-	-	-
062	-	-	-
063	-	-	+
064	-	-	+
065	-	-	-
066	-	-	+
067	-	-	-
068	-	-	-
069	-	-	-
070	-	-	-
071	-	-	-
072	-	-	-
073	-	-	-
074	-	-	-
075	-	-	-
076	+	-	-
077	+	-	+
078	+	-	-
079	+	-	-
080	+	-	-
081	+	-	-
082	+	-	-
083	+	+	+
084	+	-	+
085	+	-	+
086	+	-	-
087	+	-	-
088	+	-	-

Stations No	LAI	SRSC	SI
1	2	3	4
089	+	-	-
090	+	-	-
091	+	-	-
092	+	+	-
093	+	-	-
094	+	-	-
095	+	-	-
096	+	-	-
097	+	-	-
098	+	-	-
099	+	-	-
100	+	-	-
101	+	+	-
102	+	-	-
103	+	-	-
104	+	-	-
105	+	-	-
106	+	-	-
107	+	+	-
108	+	-	-
109	+	-	+
110	+	+	-
111	+	-	-
112	+	-	-
113	+	-	-
114	+	-	-
115	+	-	-
116	+	-	-
117	+	-	-
118	+	+	-
119	+	+	-
120	+	+	-
121	+	-	-
122	+	-	-
123	+	+	-
124	+	+	-
125	+	+	-
126	+	+	-
127	+	-	-
128	+	-	-
129	+	+	-
130	+	+	-
131	+	+	-
132	+	-	-
133	+	+	-
134	+	+	-

Stations No	LAI	SRSC	SI
1	2	3	4
135	+	-	-
136	+	-	-
137	+	-	-
138	+	+	-
139	+	-	-
140	+	+	-
141	+	+	-
142	+	+	-
143	+	+	-
144	+	-	-

NOTES FOR THE TABLE:

LAI - light attenuation index
SRSC - sea radience spectral coefficient
SI - spectral irradience

ANNEX I

EXPEDITION MAIL

The Russian firm "GeoGrafica" printed 500 envelopes especially for KAREX-94 held in the framework of the Russian-Norwegian Oceanographic Program (RUSNOP). Also, the stamp RUSNOP-94 was made and major part of envelopes was stamped with an R/V "Ivan Petrov"'s official stamp.
The expedition mail and private mail of participants was sent in those envelopes during stays and calls of the R/V "Ivan Petrov" (Arkhangelsk, Naryan-Mar, Amderma and from St.Petersburg (Russia), Oslo and Tromsoe (Norway).

ANNEX F

Affirmed by:
A.G.Zhirnov Captain of the r/v "IVAN PETROV" ....

ACT

23 August 1994 Kara sea
This document is issued in three copies, in Russian and English.

This hereby confirms that on the 22nd of August, a mooring rig with attached current measuring apparatus was laid in the Kara Sea. This was carried out during the course of the Russian-Norwegian scientific expedition, from the rerearch vessel "IVAN PETROV" (Northern Territorial Department of ROSGIDROMET, Arkhangelsk). the geographical position of the mooring was 73 59.8 North, 73 00.2 East, and the water depth was 32 meters. This mooring (scheme attached) consistedof 2 RCM-7 instruments of Norwegian manufacture, 3 buoys consising of 2 floats each, i.e. a total of 6 floats, each of 35 cm's diameter),together with 1 signal buoy for the sea surface and 35 cm diameter buoy ro support the hanging signal-bioy rope.
The ship was anchored prior to setting the mooring> The mooring was laid from the port(left) side. There was a north-easterly wind, with a speed of 8 meters per second and the wave height was 1 meter. There was a strong surface current, persumed to be due to tidal influence. During the final stage of setting the mooring, after releasing the signal buoy and commencing anchor lifting , the stern of the ship swung sharply to the left. as a result the surface buoy was forced under the ship's hull, where it was severed by free-rotating propeller, and sank instantaneously.
Analysis of the situation shows that the mooring was in operation when deployed. Attempts were made to lift the mooring by trawling with the help of a stern winch and to replace the sygnal buoy. However, due to detyeriorating weather conditions (the wind speed rose to 10 meters per second and wave heights also increased) it was decided to leave the working without the sygnal buoy and to try and recover it during the coming 1995 expedition, using sonar techniques to assist location.

Thus, the following equipment was left at this mooring site No 1:

2 RCM-7 measuring instruments 3 supporting buoys 1 sygnal buoy 1 additional float

These items are a part of the equipment taken into Russia by the Norwegian Polar Institute (Oslo), for joint work with Russian scientists.
The technical plans for mooring no.1 are attached as a separate appendix.

Chief of the expedition KAREX-94 V.A.Volkov.............
Chief of the Norwegian scientific team T.Vinje................
Chief of the cruise V.L.Kuznetsov...........
Norwegian moorin specialist E. Nygaard..............