FEDERAL SERVICE OF RUSSIA FOR HYDROMETEOROLOGY
AND ENVIRONMENTAL MONITORING

Russian Federation State Research Center
Arctic and Antarctic Research Institute
Russian Antarctic Expedition

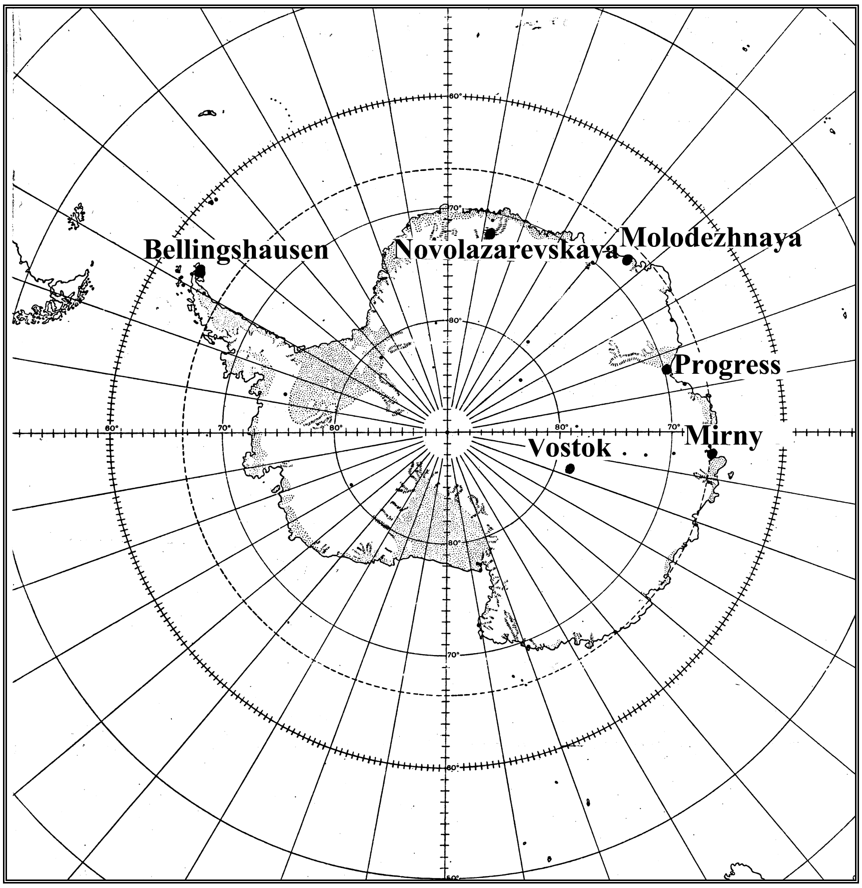
BULLETIN

STATE OF ANTARCTIC ENVIRONMENT

Operational data of Russian Antarctic stations

April-June 2000

Edited by V.V. Lukin



St. Petersburg
2000

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CONTENTS

PREFACE

The Bulletin is prepared on the basis of data reported from the Russian Antarctic stations in the on-line mode via the communication channels. This issue contains monthly averages of standard meteorological and actinometric observations, upper-air sounding as well as geophysical observations at the Russian Antarctic stations for April, May and June 2000 (Section I).

Standard meteorological observations are currently carried out at Mirny, Novolazarevskaya , Bellingshausen and Vostok stations. Coastal ice observations and a program of ecological monitoring are undertaken at the Progress station. This station serves as a base of Russian geological-geophysical studies and will become the main center of the logistics operations of the Russian Antarctic Expedition (RAE) in the future.

The upper-air sounding is carried out at two Russian stations - at Mirny Observatory and at Novolazarevskaya station once a day at 00.00 UT. More frequent sounding during the International Geophysical Intervals (IGI) is conducted at both stations in accordance with the International Geophysical Calendar.

In the meteorological tables, the atmospheric pressure for the coastal stations is referenced to sea level whereas for the inland Vostok station located at a height of almost 3500 m, it is given at the station level.

As characteristics of the anomalous meteorological and upper-air parameters, absolute anomalies (deviations from climatic averages (multiyear averages), $(f-f_{avg})$, normalized anomalies (same differences in σ_f fractions - $(f-f_{avg})/\sigma_f$) and relative anomalies f/f_{avg} are presented. The latter are typically presented for the meteorological parameters that are characterized by a significant variability, for example, for the monthly precipitation sums and total radiation. The statistical characteristics necessary for calculating the anomalies were obtained at the AARI Department of Meteorology for the period 1961-1990 as recommended by the World Meteorological Organization.

The geophysical observation data published in the Bulletin are collected at Vostok and Mirny stations under the geomagnetic and ionosphere programs (magnetic observations, riometer observations and vertical ionosphere sounding (VIS)). The absolute geomagnetic field values (D, H and Z components) are presented in the tables. The declination is western at both stations (D_w) with a negative Z-component. Based on the results of riometer observations, the daily maximum radiowave absorption is given in decibels (at the 32 MHz riometer operating frequency). The conventional designations denote the “presence of auroral absorption” (AA) and the “polar cap absorption” (PCA) event. Based on the results of vertical ionosphere sounding, daily f0 critical frequencies in the F2 layer for 00 UT and 12 UT are given. The Bulletin publishes information on the magnetic activity index (PC-index), whose calculation is included to the geomagnetic observation program at Vostok station.

In addition to observation data, the Bulletin contains brief overviews with an assessment of the anomalous state of the Antarctic environment from data of the Russian stations. Sections II and III are devoted to meteorological and synoptic conditions. The analysis of ice conditions in the Southern Ocean (Section IV) is performed using satellite data received at the Bellingshausen, Novolazarevskaya and Mirny stations and observations at the coastal stations (Bellingshausen, Progress and Mirny). The anomalous character of ice conditions is assessed against the average multiyear data on the drifting ice edge location and the average multiyear data on the onset of different ice phases in the coastal areas of the Antarctic stations. The information used was obtained at the AARI Ice Regime and Forecasting Department based on satellite imagery of the Russian Antarctic stations over the period 1971-1995.

Section V presents an overview of total ozone (TO) measurements at the Mirny Observatory (no TO observations were undertaken at Vostok in April-May due to the onset of polar night).

In May 2000, the research expedition vessel of the Russian Antarctic Expedition "Akademik Fedorov" returned to St. Petersburg from the Antarctic, which made it possible to publish some additional full-scale data obtained during the 44th wintering and 45th seasonal RAE. These materials are presented in Sections VI and VII. Section VI describes coastal oceanographic studies in the vicinity of Mirny Observatory (measurements of sea level oscillations and sea water temperature and salinity). Section VII sets forth the results of oceanographic studies in the eastern Cosmonauts Sea during the 45th RAE (2000) from board the "Akademik Fedorov".

The last Section VIII is traditionally devoted to the main directions and events of logistics activity of RAE during the period under consideration.

Russian Antarctic stations in operation in April-June 2000

MIRNY OBSERVATORY

STATION SYNOPTIC INDEX	**89592**
METEOROLOGICAL SITE HEIGHT ABOVE SEA LEVEL	**39.9 m**
GEOGRAPHICAL COORDINATES	**φ = 66°33′ S; λ = 93°01′ E**
GEOMAGNETIC COORDINATES	**Φ = -76.8°; Δ = 151.1°**
BEGINNING AND END OF POLAR DAY	**7 December – 5 January**
BEGINNING AND END OF POLAR NIGHT	**No**

NOVOLAZAREVSKAYA STATION

STATION SYNOPTIC INDEX	**89512**
METEOROLOGICAL SITE HEIGHT ABOVE SEA LEVEL	**119 m**
GEOGRAPHICAL COORDINATES	**φ = 70°46′ S; λ = 11°50′ E**
BEGINNING AND END OF POLAR DAY	**15 November - 28 January**
BEGINNING AND END OF POLAR NIGHT	**21 May - 23 July**

BELLINGSHAUSEN STATION

STATION SYNOPTIC INDEX	**89050**
METEOROLOGICAL SITE HEIGHT ABOVE SEA LEVEL	**14.3 m**
GEOGRAPHICAL COORDINATES	**φ = 62°12′ S; λ = 58°56′ W**
BEGINNING AND END OF POLAR DAY	**No**
BEGINNING AND END OF POLAR NIGHT	**No**

VOSTOK STATION

STATION SYNOPTIC INDEX	**89606**
METEOROLOGICAL SITE HEIGHT ABOVE SEA LEVEL	**3488 m**
GEOGRAPHICAL COORDINATES	**φ = 78°27′ S; λ = 106°52′ E**
GEOMAGNETIC COORDINATES	**Φ = -89.3°; Δ = 139.5°**
BEGINNING AND END OF POLAR DAY	**21 October - 21 February**
BEGINNING AND END OF POLAR NIGHT	**23 April - 21 August**

PROGRESS STATION

METEOROLOGICAL SITE HEIGHT ABOVE SEA LEVEL	**64 m**
GEOGRAPHICAL COORDINATES	**φ = 69°23′ S; λ = 76°23′ E**
BEGINNING AND END OF POLAR DAY	**21 November – 21 January**
BEGINNING AND END OF POLAR NIGHT	**28 May - 16 July**

I. OBSERVATION DATA AT THE RUSSIAN ANTARCTIC STATIONS

APRIL 2000

MIRNY OBSERVATORY

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages ($f-f_{avg}$)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_f$…	Relative anomaly f/f_{avg}
Sea level pressure, hPa	989,9	1008,7	967,1	1,7	0,5	
Air temperature, °C	-12,8	-4,6	-24,3	1,1	0,6	
Relative humidity, %	78			5,7	1,2	
Total cloudiness (sky coverage), tenths	6,2			-0,5	-0,6	
Lower cloudiness(sky coverage),tenths	4,5			1,5	1,3	
Precipitation, mm	118,3			78,8	2,4	3,0
Mean wind speed, m/s	14,5	33		2,1	1,6	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	84					0,8
Total ozone content, DU	278	315	241			

*- No observations were done

Results of aerological atmospheric sounding (from CLIMAT-TEMP messages)

Isobaric surface, P, hPa	Isobaric surface height, H m	Temperature, T °C	Dew point deficit, D °C	Resulting wind direction, deg	Resulting wind speed, m/s	Wind stability parameter	Number of days without temperature data	Number of days without wind data
985	53	-13,3	3,5					
925	532	-13,9	5,3	91	18	99	2	2
850	1171	-15,7	5	82	14	93	2	2
700	2624	-20,3	4,7	61	7	58	2	2
500	5056	-33	4,5	19	5	37	2	2
400	6592	-43,1	4,4	358	4	29	2	2
300	8480	-54,5	4,2	328	6	37	2	2
200	11055	-55,2	4,9	283	10	72	2	2

150	12895	-54,9	5,7	271	13	87	2	2
100	15471	-56,4	6,3	271	15	91	3	4
70	17716	-58,4	6,4	270	18	93	4	4
50	19830	-59,7	6,9	270	21	95	5	5
30	23006	-61,2	7,2	269	26	97	6	7
20	25342	-58,1	7,1	270	30	96	10	9

Anomalies of standard isobaric surface heights and temperature

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	27	1,0	0,48	0,3
700	27	0,9	0,26	0,3
500	33	0,8	1,3	0,9
400	40	0,8	0,97	0,6
300	53	0,8	0,13	0,1
200	21	0,4	-3,27	-2,4
150	-6	-0,1	-2,85	-2,4
100	-36	-0,4	-2,74	-2,4
70	-83	-1,1	-3	-2,5
50	-108	-1,1	-2,98	-2,1
30	-176	-1,5	-3,4	-1,9
20	-386	-2,5	-0,49	-0,2

Geophysics

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination *86°40.5'W*

Horizontal component *13986 nT*

Vertical component *-57532 nT*

Baseline values of the main and backup stations

Date	Main station			Backup station		
	D_w	H, nT	Z, nT	D_w	H, nT	Z, nT
01	-86°28.3'	13936	-57454	-87°59.6'	13208	-58791
08	-86°27.6'	13938	-57475	-87°59.3'	13199	-58804
13	-86°26.7'	13950	-57487	-87°59.0'	13200	-58806
18	-86°27.5'	13929	-57463	-88°00.8'	13191	-58804
23	-86°26.9'	13941	-57442	-88°00.9'	13192	-58800

30	-86°28.1'	13936	-57458	-88°00.0'	13199	-58796

Average variometer sensitivity

Main station, nT/mV			Backup station, nT/mm		
D_w, nT/mV; min/mV	H, nT/mV	Z, nT/mV	D_w, nT/mm; min/mV	H, nT/mm	Z, nT/mm
0.4853/0.1179	0.4829	0.4847	27.91/6.913	23.65	27.41

Ionospheric observations

Riometer observations			Vertical sounding		
Date	Type	A_{max} dB	Date	f0F2(00 UT), MHz	f0F2(12 UT), MHz
01	-	0.3	01	4.2	7
02	-	0.2	02	-	6.8
03	AA	0.4	03	4	9
04	AA	0.4	04	6.8	-
05	PCA	2.2	05	4.5	-
06	PCA	1.1	06	-	8.5
07	-	0.6	07	3.2	-
08	-	0.8	08	-	9
09	AA	0.6	09	6.5	8
10	-	0.4	10	4	7.2
11	-	0.6	11	4	9.5
12	-	0.4	12	3.4	7.5
13	-	0.4	13	-	6.3
14	-	0.6	14	3.5	7.7
15	-	0.7	15	4.8	9
16	-	0.4	16	4.4	4.2
17	-	0.3	17	3.7	7.8
18	-	0.2	18	4	8.7
19	-	0.3	19	4	8.3
20	-	0.3	20	4.2	4.8
21	-	0.4	21	-	-
22	-	0.2	22	4.9	8
23	-	0.4	23	4.3	8.7
24	AA	1.1	24	4.2	-
25	-	0.2	25	3	7.8
26	-	0.3	26	4.3	8.5
27	AA	1	27	4.6	8.8

28	-	0.2	28	4.9	7.3
29	-	0.3	29	2.9	8.5
30	-	0.3	30	3.9	4

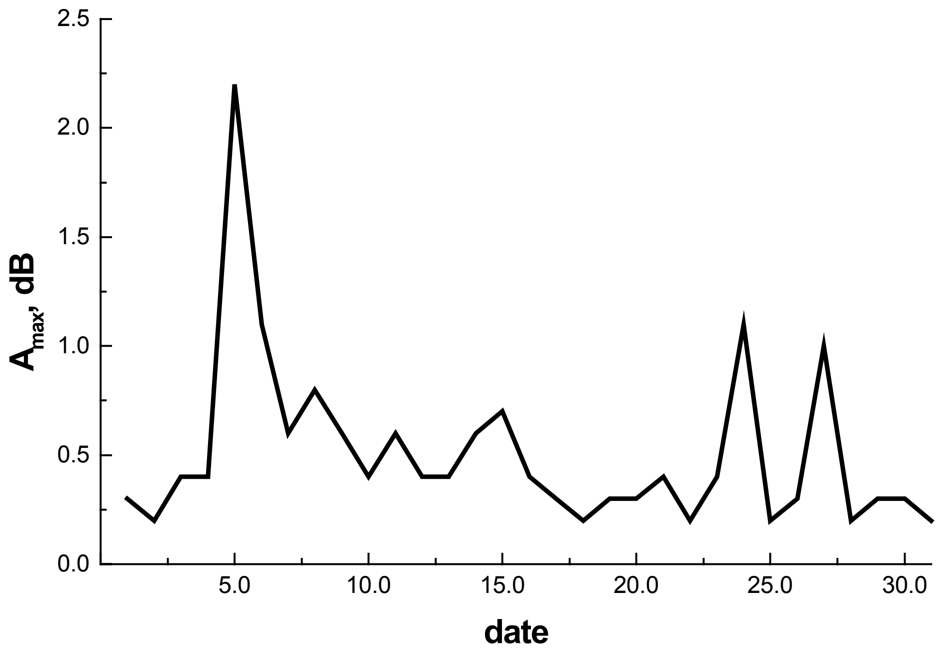


Fig. I.1. The maximum daily values of 32 MHz cosmic radiowave absorption, Mirny station, April 2000.

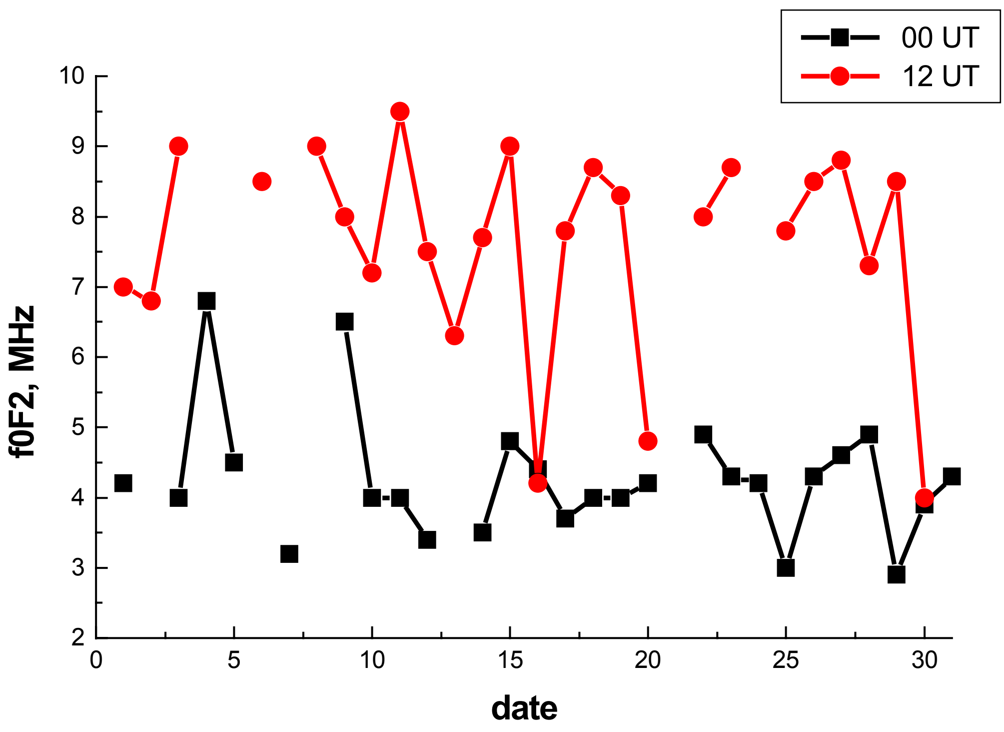


Fig.I.2. The maximum daily values of critical frequency of F2 layer (f0F2), Mirny station, April 2000.

NOVOLAZAREVSKAYA STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_{f}$…	Relative anomaly f/f_{avg}
Sea level pressure, hPa	986,1	1003,8	959,5	-1,5	-0,4	
Air temperature, °C	-12,2	-4,4	-19,4	-0,4	-0,2	
Relative humidity, %	44			-4	-0,9	
Total cloudiness (sky coverage), tenths	5,3			-0,2	-0,2	
Lower cloudiness(sky coverage),tenths	2,2			1	1,3	
Precipitation, mm	10,1			-5,4	-0,2	0,7
Mean wind speed, m/s	12,4	32		1,5	0,8	
Prevailing wind direction, deg	135					
Total radiation, MJ/m^2	67					0,9

Results of aerological atmospheric sounding (from CLIMAT-TEMP messages)

Isobaric surface, P, hPa	Isobaric surface height, H m	Temperature, T °C	Dew point deficit, D °C	Resulting wind direction, deg	Resulting wind speed, m/s	Wind stability parameter	Number of days without temperature data	Number of days without wind data
971	122	-12,3	8,8					
925	499	-12,8	8,8	116	14	97	0	0
850	1137	-17,6	7,1	97	12	94	0	0
700	2569	-24,4	5	98	4	56	0	0
500	4964	-36,8	5,6	257	2	19	0	0
400	6477	-46,7	4,5	259	4	37	0	0
300	8337	-56,4	4	261	7	49	0	0
200	10921	-53,4	5,5	264	10	85	0	0
150	12774	-54,1	6,3	263	11	90	1	1
100	15359	-56,3	7	264	12	95	1	1
70	17611	-58,7	7,4	262	15	96	4	4

50	19706	-61,1	7,3	264	18	96	5	5
30	22852	-63,5	7,3	263	23	97	8	8
20	25335	-64,3	7,3	265	27	97	10	9
10	29576	-63,2	7,9	262	30	97	15	9

Anomalies of standard isobaric surface heights and temperature

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	-11	-0,3	-1,46	-1,1
700	-21	-0,6	-1,77	-1,4
500	-33	-0,8	-0,83	-0,6
400	-37	-0,8	-0,84	-0,7
300	-47	-0,9	-0,49	-0,4
200	-49	-1,0	-0,22	-0,1
150	-49	-1,0	-0,6	-0,4
100	-61	-1,0	-0,75	-0,6
70	-74	-1,1	-1,06	-0,8
50	-94	-1,3	-1,38	-1,0
30	-132	-1,5	-1,94	-1,2
20	-182	-1,5	-2,88	-1,4
10	-180	-0,9	-3,3	-1,0

BELLINGSHAUSEN STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_f$…	Relative anomaly f/f_{avg}
Sea level pressure, hPa	988	1002,9	961,1	-3	-0,7	
Air temperature, °C	0	3,2	-7,7	2	1,4	
Relative humidity, %	88			1,2	0,4	
Total cloudiness (sky coverage), tenths	9			0	0,0	
Lower cloudiness(sky coverage),tenths	7,4			-0,4	-0,4	
Precipitation, mm	53			-14,2	-0,8	0,8

Mean wind speed, m/s	8	23		0,4	0,4	
Prevailing wind direction, deg	315					
Total radiation, MJ/m^2	106					1,2

VOSTOK STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_{f}$…	Relative anomaly f/f_{avg}
Station surface level pressure, hPa	623,9	635,8	611	1	0,3	
Air temperature, °C	-65	-53,9	-76,4	-0,1	0,0	
Relative humidity, %	38			-30,1	-6,1	
Total cloudiness (sky coverage), tenths	3,6			0,5	0,6	
Lower cloudiness(sky coverage),tenths	0			0	0,0	
Precipitation, mm	0,4			-2,3	-1,4	0,1
Mean wind speed, m/s	1,8	14		-3,9	-3,5	
Prevailing wind direction, deg	244					
Total radiation, MJ/m^2	21					0,0
Total ozone content, DU	*					

*- No observations were done

Geophysics

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*120°38.1'W*
Horizontal component	*13454 nT*
Vertical component	*-58210 nT*

Baseline values of the main and backup stations

Date	Main station			Backup station		
	D_w	H, nT	Z, nT	D_w	H, nT	Z, nT
06	-120°29.8'	13420	-58319	-120°25.2'	13509	-58169
11	-120°28.7'	13419	-58319	-120°24.7'	13506	-58168
16	-120°28.4'	13418	-58318	-120°23.9'	13506	-58167
22	-120°28.6'	13418	-58318	-120°24.0'	13507	-58168
28	-120°29.1'	13418	-58317	-120°25.2'	13507	-58168

Average variometer sensitivity

Main station			Backup station		
D_W, nT/mV	H, nT/mV	Z, nT/mV	D_W, nT/mm	H, nT/mm	Z, nT/mm
0.387/0.0987	0.386	0.391	0.4858/0.2555	0.4552	0.4718

Ionospheric observations

Riometer observation					
date	type	A_{max}, dB	date	type	A_{max}, dB
01	-	0.4	16	AA	0.8
02	-	0.4	17	-	0.1
03	-	0.5	18	-	0.3
04	-	0.5	19	-	0.5
05	PCA	2	20	-	0.3
06	PCA	1.4	21	-	0.3
07	-	0.4	22	-	0.3
08	-	0.3	23	-	0.2
09	-	0.5	24	-	0.2
10	-	0.6	25	-	0.1
11	-	0.5	26	-	0.2
12	-	0.6	27	-	0.3
13	AA	0.8	28	-	0.4
14	-	0.3	29	-	0.3
15	AA	0.8	30	-	0.3

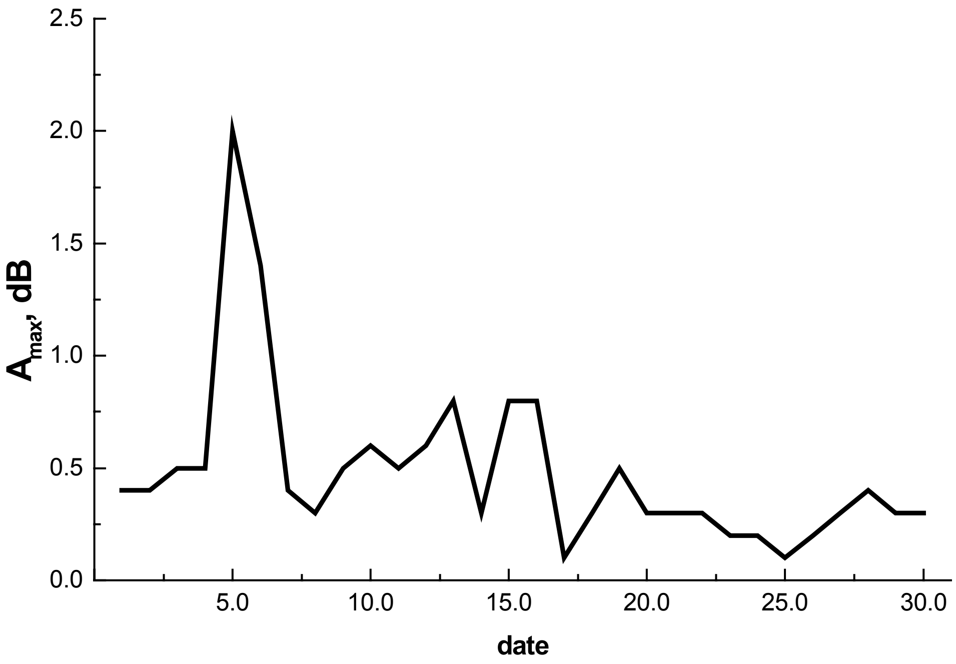
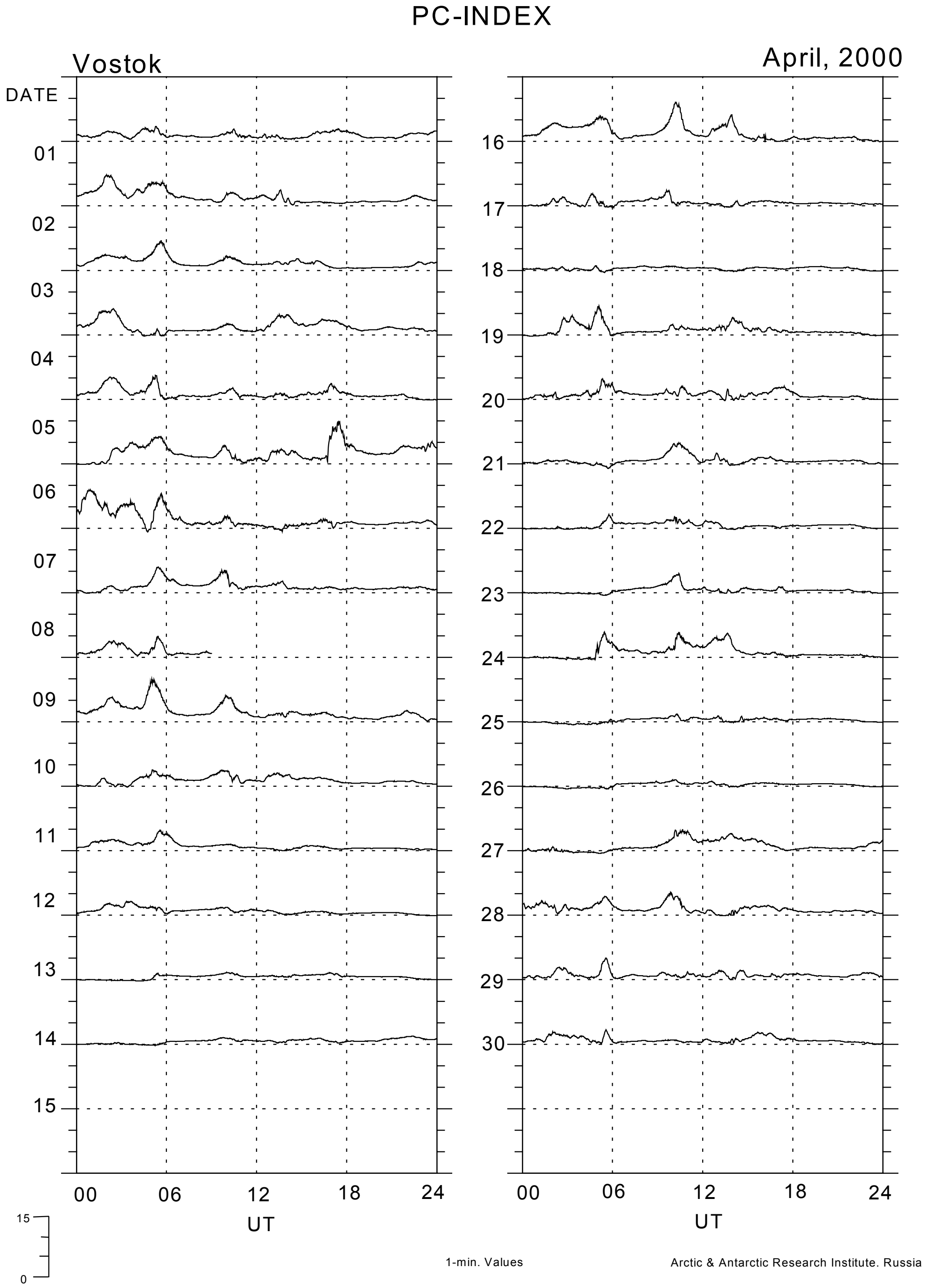


Fig. I.3. The maximum daily values of 32 MHz cosmic radiowave absorption, Vostok station, April 2000.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Vostok
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Fig. I.4.

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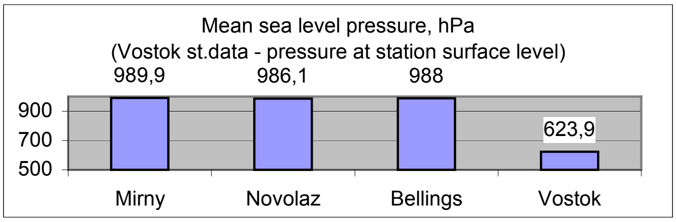
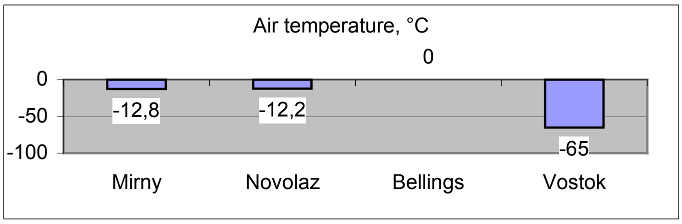
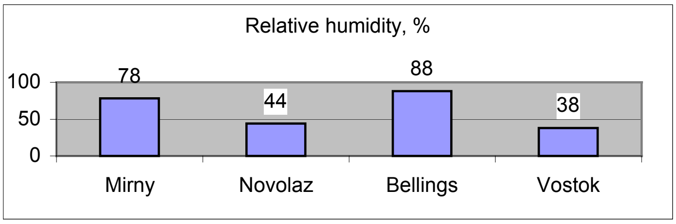


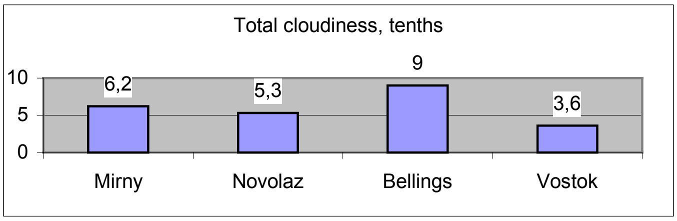
$(f-f_{avg})/\sigma_f$ 0,5 -0,4 -0,7 0,3



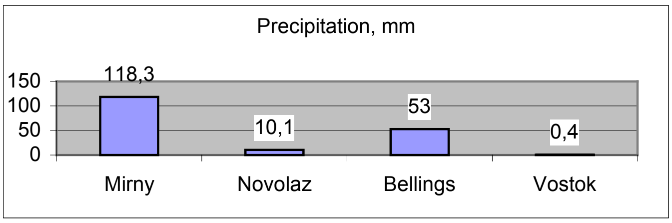
$(f-f_{avg})/\sigma_f$ 0,6 -0,2 1,4 0,0



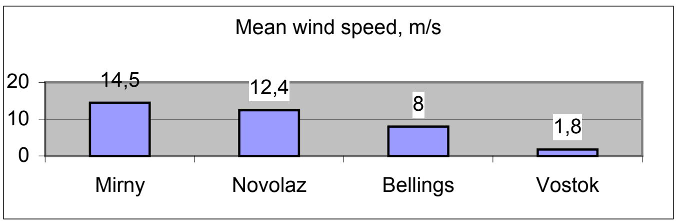
$(f-f_{avg})/\sigma_f$ 1,2 -0,9 0,4 -6,1 *



$(f-f_{avg})/\sigma_f$ -0,6 -0,2 0,0 0,6



f/f_{avg} 3,0 0,7 0,8 0,1



$(f-f_{avg})/\sigma_f$ 1,6 0,8 0,4 -3,5

Fig. I.5. Comparison of monthly averages of meteorological parameters at the stations, April 2000.

MAY 2000

MIRNY OBSERVATORY

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_f$...	Relative anomaly f/f_{avg}
Sea level pressure , hPa	982,5	1011,5	961,8	-6,9	-1,3	
Air temperature, ^{0}C	-18	-4,6	-29,4	-2,6	-1,0	
Relative humidity, %	75			0,8	0,1	
Total cloudiness (sky coverage), tenths	5,2			-1,4	-1,6	
Lower cloudiness(sky coverage),tenths	2,4			-0,8	-0,5	
Precipitation, mm	137,4			87,4	2,1	2,7
Mean wind speed, m/s	13,3	42		0,4	0,3	
Prevailing wind direction, deg	158					
Total radiation, MJ/m^2	18					0,8
Total ozone content, DU	284	332	224			

Results of aerological atmospheric sounding (from CLIMAT-TEMP messages)

Isobaric surface, P, hPa	Isobaric surface height, H m	Temperature, T ^{0}C	Dew point deficit, D ^{0}C	Resulting wind direction, deg	Resulting wind speed, m/s	Wind stability parameter	Number of days without temperature data	Number of days without wind data
976	53	-18,5	4,1					
925	456	-18	5,3	93	12	92	1	1
850	1085	-20,2	4,8	93	10	79	1	1
700	2518	-22,8	5,4	128	1	8	1	1
500	4917	-37,3	5,1	266	5	37	1	1
400	6423	-47,6	4,6	271	9	53	1	1
300	8277	-57,6	4,3	266	13	65	1	1
200	10819	-59,2	4,8	265	17	84	1	1
150	12619	-59,9	5,2	263	20	91	1	2

100	15121	-63,7	5,3	266	24	93	3	3
70	17290	-67,1	5,3	266	28	95	3	3
50	19311	-69	5,3	268	32	96	3	3
30	22348	-70,9	5,7	270	37	96	9	9
20	24830	-70	5,8	271	41	98	14	9

Anomalies of standard isobaric surface heights and temperature

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	-61	-1,4	-2,74	-1,6
700	-76	-1,6	-1,34	-0,9
500	-90	-1,5	-1,85	-0,9
400	-108	-1,5	-2,27	-1,3
300	-121	-1,5	-1,25	-1,1
200	-135	-1,6	-1,57	-0,8
150	-150	-1,6	-2,2	-1,2
100	-190	-1,7	-3,43	-1,6
70	-225	-1,6	-4,37	-1,8
50	-279	-1,9	-4,22	-1,6
30	-330	-1,7	-3,97	-1,4
20	-316	-1,3	-2,67	-0,9

Geophysics

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*86°42.5'W*
Horizontal component	*13945 nT*
Vertical component	*-57528 nT*

Baseline values of the main and backup stations

Date	Main station			Backup station		
	D_w	H, nT	Z, nT	D_w	H, nT	Z, nT
04	-86°27.4'	13941	-57486	-87°58.8'	13196	-58808
09	-86°27.5'	13939	-57455	-88°00.7'	13191	-58806
13	-86°25.8'	13934	-57464	-88°01.1'	13195	-58804
19	-86°27.6'	13929	-57475	-88°00.7'	13189	-58808
26	-86°28.5'	13900	-57447	-88°00.2'	13188	-58811
31	-86°28.2'	13943	-57471	-88°00.5'	13196	-58796

Average variometer sensitivity

Main station, nT/mV			Backup station, nT/mm		
D_w, nT/mV; min/mV	H, nT/mV	Z, nT/mV	D_w, nT/mm; min/mV	H, nT/mm	Z, nT/mm
0.4835/0.1185	0.4813	0.4808	27.90/6.912	23.59	27.28

Ionospheric observations

Riometer observations			Vertical sounding		
Date	Type	A_{max} dB	Date	f0F2(00 UT), MHz	f0F2(12 UT), MHz
01	AA	0.6	01	3.9	4
02	AA	0.8	02	4.2	-
03	AA	0.4	03	2.8	4.8
04	-	0.4	04	-	4.7
05	AA	0.5	05	-	-
06	AA	0.6	06	-	-
07	-	0.4	07	-	-
08	-	0.2	08	-	-
09	-	0.4	09	3.1	7.5
10	-	0.2	10	3	4.5
11	-	0.2	11	4	8.5
12	PCA	0.8	12	-	4.6
13	-	0.2	13	4.2	4.7
14	-	0.3	14	-	4.2
15	-	0.4	15	3.9	-
16	AA	0.6	16	3.2	4.4
17	AA	0.6	17	-	-
18	PCA	1	18	-	-
19	AA	0.4	19	3.7	9

20	-	0.2	20	-	8.5
21	-	0.2	21	4.1	7.6
22	-	0.3	22	3.9	4.2
23	AA	0.2	23	-	3.8
24	-	0.4	24	2.8	-
25	AA	0.4	25	2.7	9
26	-	0.3	26	4.8	9.2
27	-	0.3	27	-	9
28	-	0.2	28	4.6	5.1
29	-	0.2	29	2.8	4.8
30	-	0.1	30	-	5.2
31	-	0.1	31	-	4.9

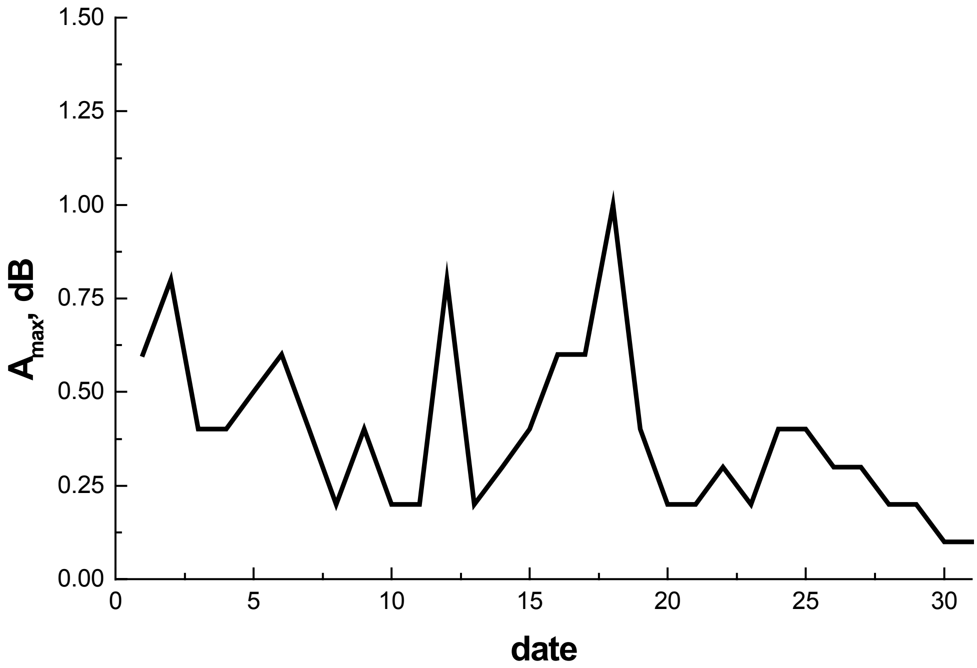


Fig. I.6. The maximum daily values of 32 MHz cosmic radiowave absorption, Mirny station, May 2000.

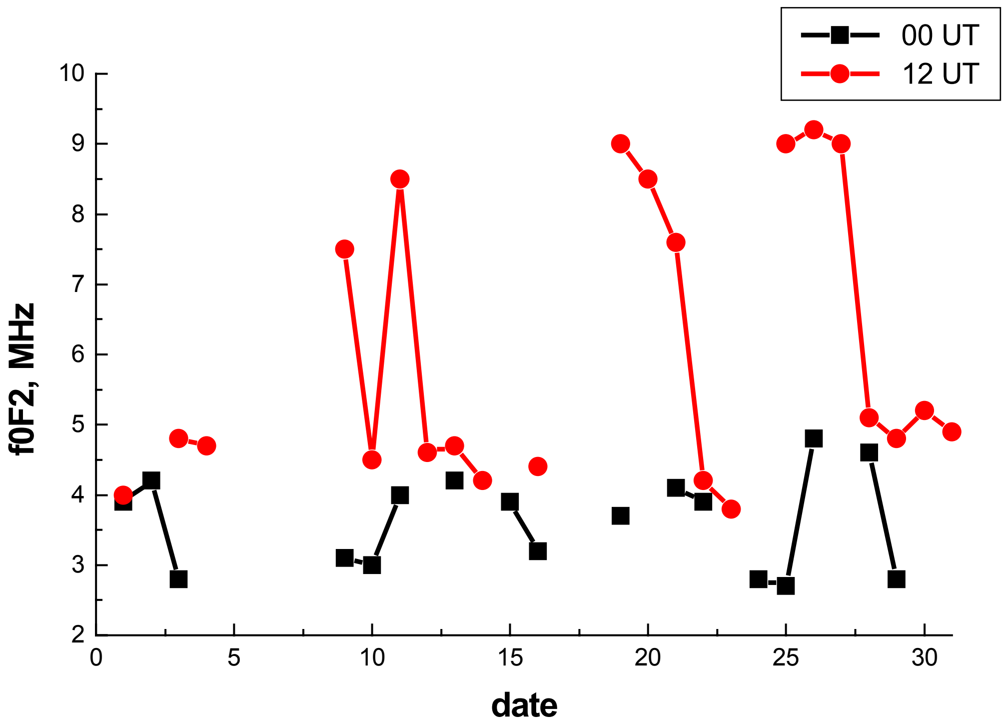


Fig.I.7. The maximum daily values of critical frequency of F2 layer (f0F2), Mirny station, May 2000.

NOVOLAZAREVSKAYA STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_f$…	Relative anomaly f/f_{avg}
Sea level pressure , hPa	984,8	1010,2	967,7	-5	-0,9	
Air temperature, ^{0}C	-16,8	-3	-30,6	-3,4	-1,5	
Relative humidity, %	41			-8,4	-1,5	
Total cloudiness (sky coverage), tenths	4,2			-1,7	-1,4	
Lower cloudiness(sky coverage),tenths	0,3			-1,1	-1,0	
Precipitation, mm	7,5			-16	-0,6	0,3
Mean wind speed, m/s	9,6	38		-1,5	-0,7	
Prevailing wind direction, deg	135					
Total radiation, MJ/m^2	4					0,8

Results of aerological atmospheric sounding (from CLIMAT-TEMP messages)

Isobaric surface, P, hPa	Isobaric surface height, H m	Temperature, T ^{0}C	Dew point deficit, D ^{0}C	Resulting wind direction, deg	Resulting wind speed, m/s	Wind stability parameter	Number of days without temperature data	Number of days without wind data
970	122	-16,8	10,4					
925	498	-17,4	8,3	114	13	92	1	1
850	1120	-19	8,8	100	11	90	1	1
700	2547	-24,9	7,2	113	5	59	1	1
500	4939	-37,4	5,3	222	6	55	1	2
400	6446	-47,4	4,8	229	10	69	1	2
300	8302	-57,6	4,3	240	11	60	1	1
200	10824	-62	4,7	250	14	79	1	1
150	12600	-62,6	5	247	15	89	1	2
100	15086	-66	5,1	254	17	92	4	4
70	17234	-69	5	254	21	93	4	4
50	19230	-71,9	5,1	258	24	93	4	4
30	22222	-75	5,1	261	29	93	5	6
20	24563	-76	4,9	265	34	95	6	9
10	28558	-73,8	5,7	16				

Anomalies of standard isobaric surface heights and temperature

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	-41	-0,8	-1,37	-0,8
700	-51	-1,0	-1,07	-0,6
500	-57	-0,8	0,14	0,1
400	-54	-0,7	0,1	0,1
300	-43	-0,6	0,64	0,5
200	-55	-0,6	-1,51	-0,9
150	-67	-0,8	-1,45	-0,9
100	-79	-0,9	-1,57	-0,9
70	-100	-1,0	-1,6	-0,9
50	-118	-1,1	-1,85	-0,9
30	-152	-1,1	-2,9	-1,2
20	-177	-0,8	-3,14	-1,3
10	-305	-1,3	-2,3	-0,8

BELLINGSHAUSEN STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f\text{-}f_{avg}$	Normalized anomaly $(f\text{-}f_{avg})/\sigma_{f}$…	Relative anomaly f/f_{avg}
Sea level pressure , hPa	998	1032,5	965,9	3	0,6	
Air temperature, ^{0}C	-1,5	2,4	-8,8	2,7	1,4	
Relative humidity, %	91			3,9	1,1	
Total cloudiness (sky coverage), tenths	8,8			0,1	0,2	
Lower cloudiness(sky coverage),tenths	7,5			-0,1	-0,1	
Precipitation, mm	36,8			-26,3	-1,6	0,6
Mean wind speed, m/s	6,8	22		-0,8	-0,6	
Prevailing wind direction, deg	315					
Total radiation, MJ/m^2	34					1,0

VOSTOK STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f\text{-}f_{avg}$	Normalized anomaly $(f\text{-}f_{avg})/\sigma_{f}$…	Relative anomaly f/f_{avg}
Station surface level pressure, hPa	619,3	644,9	608	-4,3	-0,8	
Air temperature, ^{0}C	-68,2	-49,8	-77,8	-2,4	-0,9	
Relative humidity, %	47			-21,1	-4,2	
Total cloudiness (sky coverage), tenths	4,5			1,6	1,3	
Lower cloudiness(sky coverage),tenths	0			0	0,0	
Precipitation, mm	2			-1	-0,4	0,7
Mean wind speed, m/s	5	13		-0,6	-0,6	
Prevailing wind direction, deg	202					
Total radiation, MJ/m^2	0					0,0
Total ozone content, DU	*					

*- No observations were done

Geophysics

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*120°39.95'W*
Horizontal component	*13453 nT*
Vertical component	*-58213 nT*

Baseline values of the main and backup stations

Date	Main station			Backup station		
	D_w	H, nT	Z, nT	D_w	H, nT	Z, nT
04	-120°29.2'	13421	-58318	-120°25.5'	13509	-58167
08	-120°28.5'	13416	-58317	-120°24.2'	13508	-58168
15	-120°27.0'	13415	-58316	-120°22.7'	13508	-58167
20	-120°31.1'	13416	-58316	-120°27.0'	13508	-58167
25	-120°32.5'	13416	-58315	-120°28.8'	13507	-58166
31	-120°27.3'	13416	-58316	-120°22.7'	13509	-58167

Average variometer sensitivity

Main station			Backup station		
D_W, nT/mV	H, nT/mV	Z, nT/mV	D_W, nT/mm	H, nT/mm	Z, nT/mm
0.372/0.0951	0.379	0.388	0.4874/0.2555	0.4549	0.4721

Ionospheric observations

Riometer observation					
date	type	A_{max}, dB	date	type	A_{max}, dB
01	-	0.5	16	-	0.4
02	-	0.4	17	-	0.3
03	-	0.3	18	-	0.4
04	-	0.2	19	-	0.3
05	-	0.2	20	-	0.2
06	-	0.4	21	-	0.3
07	-	0.3	22	-	0.4
08	-	0.2	23	-	0.3
09	-	0.4	24	-	0.1
10	-	0.3	25	-	0.5
11	-	0.2	26	-	0.5

12	-	0.4	27	-	0.5
13	-	0.1	28	-	0.5
14	-	0.2	29	-	0.1
15	-	0.3	30	-	0.3
			31	-	0.2

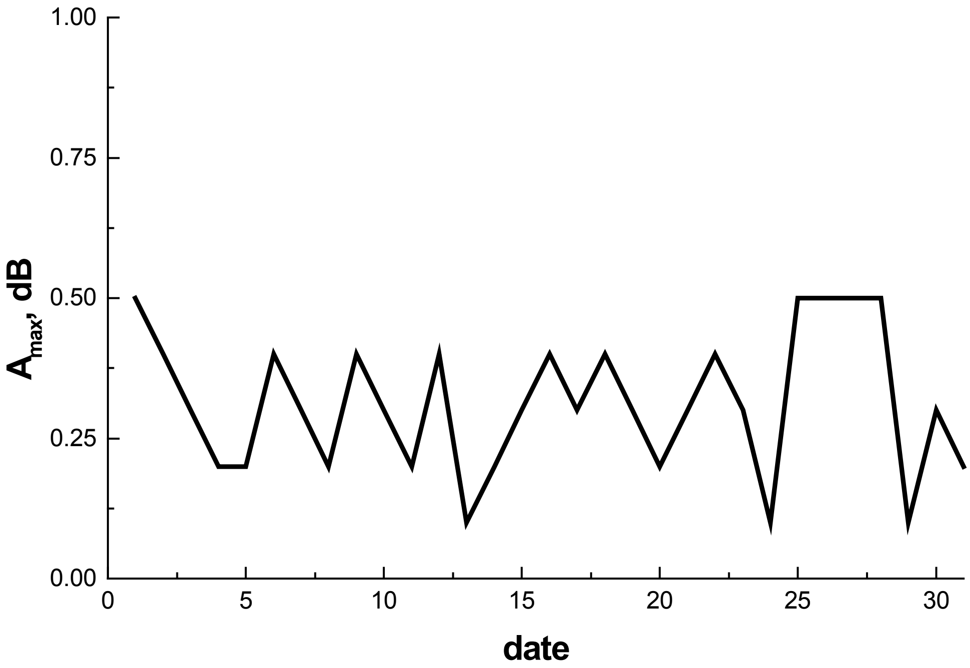
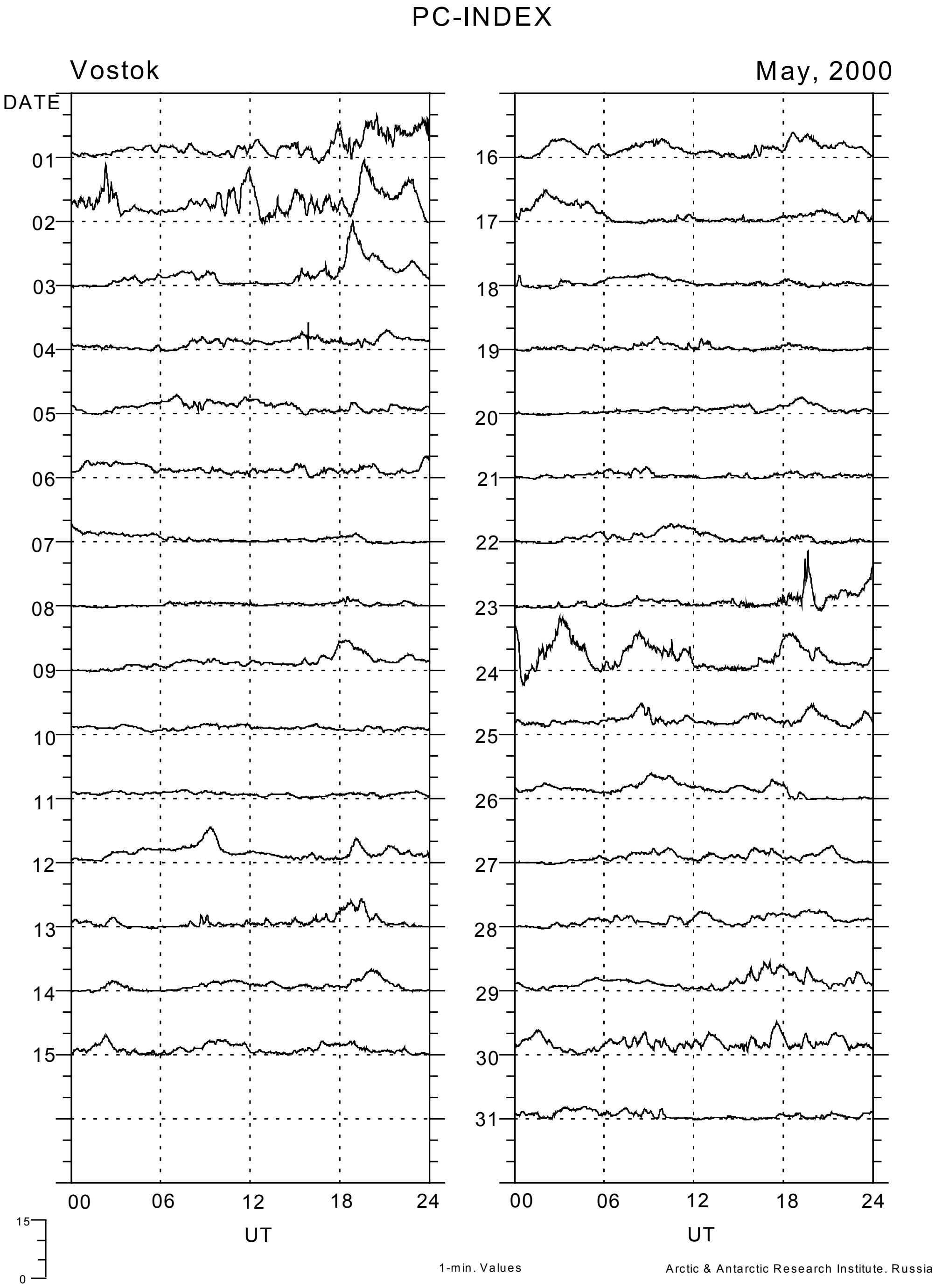


Fig. I.8. The maximum daily values of 32 MHz cosmic radiowave absorption, Vostok station, May 2000.


PC-INDEX
Vostok
May, 2000
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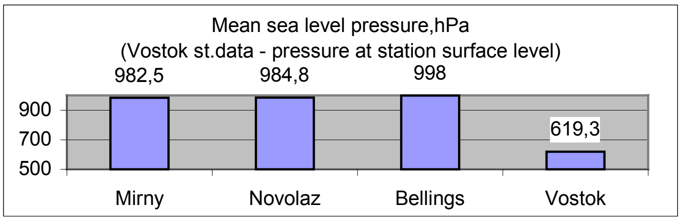
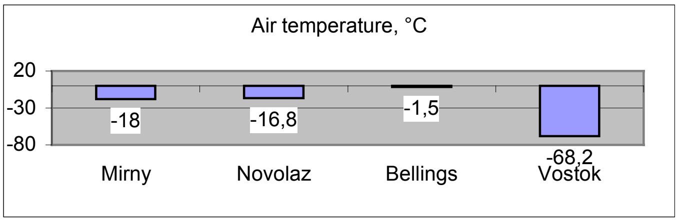
1-min. Values
Arctic & Antarctic Research Institute. Russia

Fig. I.9.

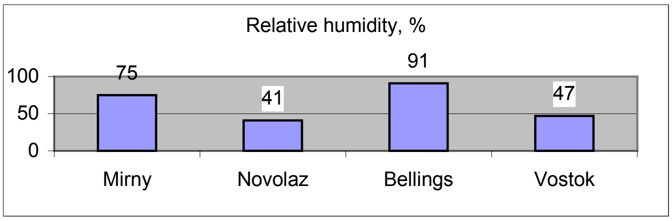
May 2000



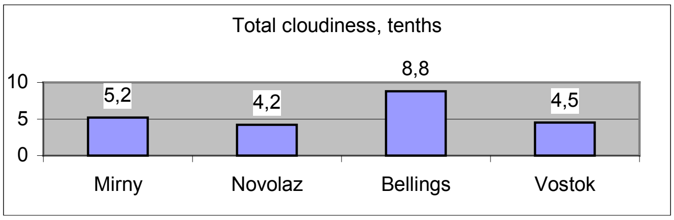
$(f-f_{avg})/\sigma_f$ -1,3 -0,9 0,6 -0,8



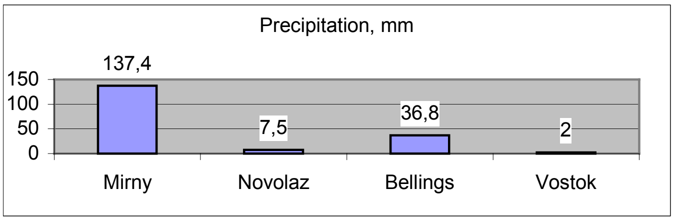
$(f-f_{avg})/\sigma_f$ -1,0 -1,5 1,4 -0,9



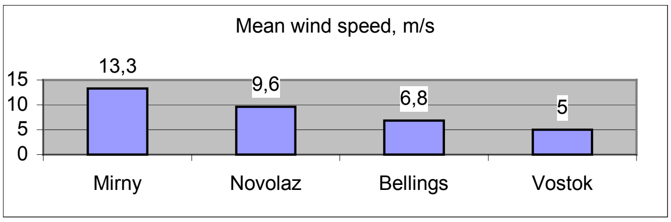
$(f-f_{avg})/\sigma_f$ 0,1 -1,5 1,1 -4,2 *



$(f-f_{avg})/\sigma_f$ -1,6 -1,4 0,2 1,3



f/f_{avg} 2,7 0,3 0,6 0,7



$(f-f_{avg})/\sigma_f$ 0,3 -0,7 -0,6 -0,6

Fig. I.10. Comparison of monthly averages of meteorological parameters at the stations, May 2000

JUNE 2000

MIRNY OBSERVATORY

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_{f...}$	Relative anomaly f/f_{avg}
Sea level pressure , hPa	989,1	1002,1	966,6	-0,2	0,0	
Air temperature, ^{0}C	-16,4	-6,5	-25,5	-1	-0,5	
Relative humidity, %	73			-2,3	-0,4	
Total cloudiness (sky coverage), tenths	4,4			-2,3	-1,9	
Lower cloudiness(sky coverage),tenths	1,3			-1,9	-1,6	
Precipitation, mm	54,3			-18,4	-0,4	0,7
Mean wind speed, m/s	12,5	38		-0,5	-0,3	
Prevailing wind direction, deg	135					
Total radiation, MJ/m^2	3					0,7
Total ozone content, DU						

Results of aerological atmospheric sounding (from CLIMAT-TEMP messages)

Isobaric surface, P, hPa	Isobaric surface height, H m	Temperature, T ^{0}C	Dew point deficit, D ^{0}C	Resulting wind direction, deg	Resulting wind speed, m/s	Wind stability parameter	Number of days without temperature data	Number of days without wind data
983	53	-16,8	4,1					
925	509	-15,9	6,2	91	12	98	0	0
850	1142	-18,7	6,1	90	11	93	0	0
700	2589	-20,5	6,9	87	3	42	0	0
500	5017	-33,1	8,3	205	4	33	0	0
400	6553	-42,9	7,6	220	8	48	0	0
300	8434	-56,6	6,5	227	11	55	0	0
200	10922	-68	5,7	247	13	72	0	0
150	12650	-68,2	5,8	259	14	85	0	0

100	15064	-71,7	5,8	267	19	91	0	1
70	17155	-74,6	5,8	270	23	92	1	2
50	19119	-76,8	6	273	28	94	3	4
30	22020	-79,8	5,6	279	37	96	9	9
20	24365	-79,6	0	0	0	0	20	0

Anomalies of standard isobaric surface heights and temperature

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	2	0,1	-0,87	-0,6
700	6	0,2	1,66	1,4
500	24	0,5	3,78	2,4
400	47	0,8	4,08	2,9
300	76	1,1	1,95	1,8
200	59	0,8	-4,41	-2,5
150	21	0,3	-4,22	-2,6
100	-28	-0,3	-4,46	-2,5
70	-71	-0,6	-4,33	-2,0
50	-102	-0,8	-4,31	-1,7
30	-219	-1,2	-5,25	-1,7
20	-292	-1,3	-4,65	-1,5

Geophysics

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination *86°45.1'W*

Horizontal component *13976 nT*

Vertical component *-57532 nT*

Baseline values of the main and backup stations

Date	Main station			Backup station		
	D_w	H, nT	Z, nT	D_w	H, nT	Z, nT
03	-86°27.1'	13947	-57438	-88°02.5'	13202	-58816
06	-86°28.3'	13912	-57450	-88°01.5'	13194	-58820

12	-86°26.8'	13952	-57435	-88°01.3'	13219	-58811
17	-86°27.4'	13983	-57468	-87°59.9'	13197	-58820
22	-86°28.4'	13951	-57466	-87°59.5'	13189	-58826
29	-86°28.4'	13946	-57453	-88°01.3'	13204	-58817

Average variometer sensitivity

Main station, nT/mV			Backup station, nT/mm		
D_w, nT/mV; min/mV	H, nT/mV	Z, nT/mV	D_w, nT/mm; min/mV	H, nT/mm	Z, nT/mm
0.4814/0.1180	0.4809	0.4816	27.91/6.911	23.57	27.25

Ionospheric observations

Riometer observations			Vertical sounding		
Date	Type	A_{max} dB	Date	f0F2(00 UT), MHz	f0F2(12 UT), MHz
01	-	0.4	01	4.3	8.6
02	-	0.2	02	-	7.2
03	-	0.4	03	3.7	-
04	-	0.4	04	-	9.2
05	-	0.2	05	3.2	3.5
06	-	0.2	06	3	5.5
07	AA	0.6	07	4.2	5.2
08	PCA	2	08	4.8	-
09	PCA	1	09	-	-
10	PCA	0.8	10	-	4
11	PCA	0.8	11	2.8	-
12	PCA	0.6	12	3.8	7.5
13	-	0.4	13	-	7.3
14	-	0.4	14	-	7.1
15	-	0.1	15	-	-
16	-	0.2	16	-	-
17	-	0.4	17	-	-
18	-	0.5	18	-	-
19	-	0.3	19	-	-
20	-	0.2	20	-	-
21	-	0.3	21	-	-
22	-	0.2	22	-	-
23	-	0.3	23	-	-
24	-	0.1	24	-	-

25	PCA	0.8	25	-	-
26	PCA	1	26	-	-
27	PCA	1	27	-	-
28	PCA	0.9	28	-	-
29	PCA	0.8	29	-	-
30	-	0.3	30	-	-

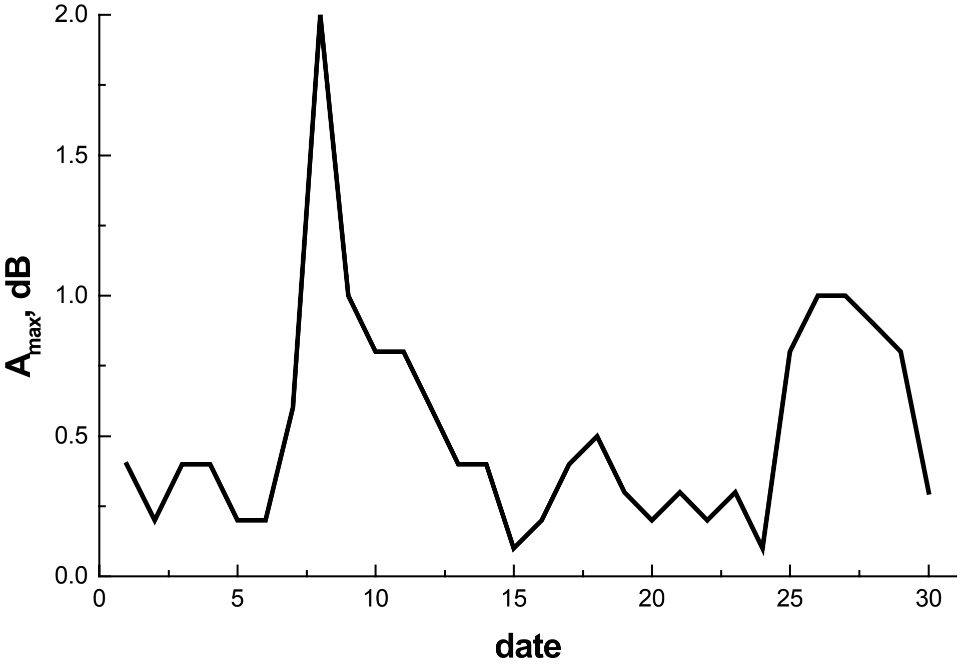


Fig. I.11. The maximum daily values of 32 MHz cosmic radiowave absorption, Mirny station, June 2000.

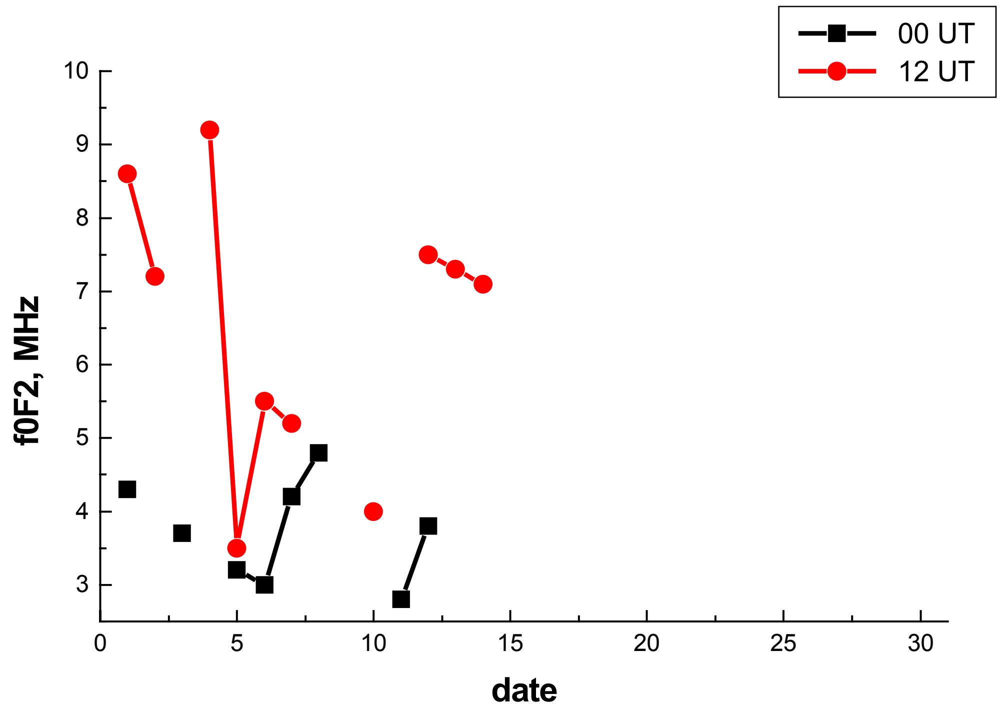


Fig.I.12 The maximum daily values of critical frequency of F2 layer (f0F2), Mirny station, June 2000.

NOVOLAZAREVSKAYA STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_f$…	Relative anomaly f/f_{avg}
Sea level pressure , hPa	986,1	1004,7	973,2	-4,1	-0,9	
Air temperature, ^{0}C	-13,1	-5,4	-25,8	2,4	1,0	
Relative humidity, %	39			-12,4	-2,1	
Total cloudiness (sky coverage), tenths	6,9			1,3	1,1	
Lower cloudiness(sky coverage),tenths	1,5			0,3	0,3	
Precipitation, mm	2,6			-26,6	-0,6	0,1
Mean wind speed, m/s	12	35		0,8	0,3	
Prevailing wind direction, deg	135					
Total radiation, MJ/m^2	0					0,0

Results of aerological atmospheric sounding (from CLIMAT-TEMP messages)

Isobaric surface, P, hPa	Isobaric surface height, H m	Temperature, T ^{0}C	Dew point deficit, D ^{0}C	Resulting wind direction, deg	Resulting wind speed, m/s	Wind stability parameter	Number of days without temperature data	Number of days without wind data
970	122	-13	10,6					
925	495	-13,6	9,4	111	16	97	0	0
850	1131	-18	7,9	98	15	95	0	0
700	2560	-25	5,5	92	8	79	0	0
500	4940	-39	5,6	80	2	21	0	0
400	6436	-49,2	4,9	337	1	5	0	0
300	8272	-60,9	4,2	297	2	16	0	0
200	10734	-67,9	3,9	285	4	35	0	0
150	12457	-69,7	4	285	5	55	0	0
100	14845	-74,6	3,8	280	9	84	0	0
70	16895	-78,7	3,8	273	13	94	0	0
50	18797	-81,6	3,6	271	17	96	0	1
30	21630	-84	3,5	272	24	97	2	2
20	23877	-83,7	3,6	270	28	97	4	6
10	27914	-78,3	4,3	0	0	0	16	0

Anomalies of standard isobaric surface heights and temperature

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	-26	-0,7	1,48	0,9
700	-22	-0,5	0,44	0,3
500	-23	-0,5	-0,18	-0,1
400	-26	-0,4	-0,28	-0,2
300	-28	-0,4	-0,45	-0,3
200	-37	-0,5	-0,89	-0,5
150	-47	-0,6	-1,73	-1,0
100	-77	-0,9	-2,61	-1,5
70	-95	-1,0	-2,29	-1,0
50	-144	-1,2	-2,97	-1,4
30	-241	-1,6	-3,12	-1,2
20	-303	-1,7	-3,07	-1,1

10	-303	-0,8	-0,8	-0,2

BELLINGSHAUSEN STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_{f}$…	Relative anomaly f/f_{avg}
Sea level pressure , hPa	997,2	1016,3	973,1	3	0,5	
Air temperature, ^{0}C	-2,4	3,5	-10,2	3,5	1,8	
Relative humidity, %	89			1,8	0,5	
Total cloudiness (sky coverage), tenths	8,9			0,3	0,5	
Lower cloudiness(sky coverage),tenths	8,2			0,9	1,0	
Precipitation, mm	20,7			-29,6	-1,1	0,4
Mean wind speed, m/s	7,7	25		0	0,0	
Prevailing wind direction, deg	292					
Total radiation, MJ/m^2	14					1,1

VOSTOK STATION

Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f-favg)

Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_{f}$…	Relative anomaly f/f_{avg}
Station surface level pressure, hPa	624,8	641,2	610,8	1,1	0,2	
Air temperature, ^{0}C	-59,9	-42,6	-73,9	5,1	1,8	
Relative humidity, %	69			0,3	0,1	
Total cloudiness (sky coverage), tenths	1,8			-1,1	-1,1	
Lower cloudiness(sky coverage),tenths	0			0	0,0	
Precipitation, mm	0,8			-2,2	-1,0	0,3

Mean wind speed, m/s	4,8	18		-0,9	-1,1	
Prevailing wind direction, deg	158					
Total radiation, MJ/m^2	0					0,0
Total ozone content, DU	*					

*- No observations were done

Geophysics

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*120°39.1'W*
Horizontal component	*13473 nT*
Vertical component	*-58204 nT*

Baseline values of the main and backup stations

Date	Main station			Backup station		
	D_w	H, nT	Z, nT	D_w	H, nT	Z, nT
06	-120°26.7'	13417	-58317	-120°22.8'	13508	-58163
14	-120°27.8'	13416	-58316	-120°23.8'	13509	-58164
19	-120°27.6'	13415	-58314	-120°22.9'	13508	-58162
24	-120°26.2'	13411	-58313	-120°21.7'	13503	-58160
29	-120°28.5'	13414	-58317	-120°24.3'	13507	-58164

Average variometer sensitivity

Main station			Backup station		
D_W, nT/mV	H, nT/mV	Z, nT/mV	D_W, nT/mm	H, nT/mm	Z, nT/mm
0.375/0.0956	0.374	0.393	0.4875/0.2550	0.4558	0.4706

Ionospheric observations

Riometer observation					
date	type	A_{max}, dB	date	type	A_{max}, dB
01	-	0.2	16	-	0.3
02	-	0.2	17	-	0.3
03	-	0.2	18	-	0.3
04	-	0.3	19	-	0.3
05	-	0.2	20	-	0.3
06	-	0.3	21	-	0.2

07	-	0.3	22	-	0.3
08	-	0.2	23	-	0.2
09	-	0.4	24	-	0.1
10	-	0.2	25	-	0.2
11	-	0.3	26	-	0.3
12	-	0.3	27	-	0.3
13	-	0.3	28	-	0.3
14	-	0.3	29	-	0.2
15	-	0.3	30	-	0.3

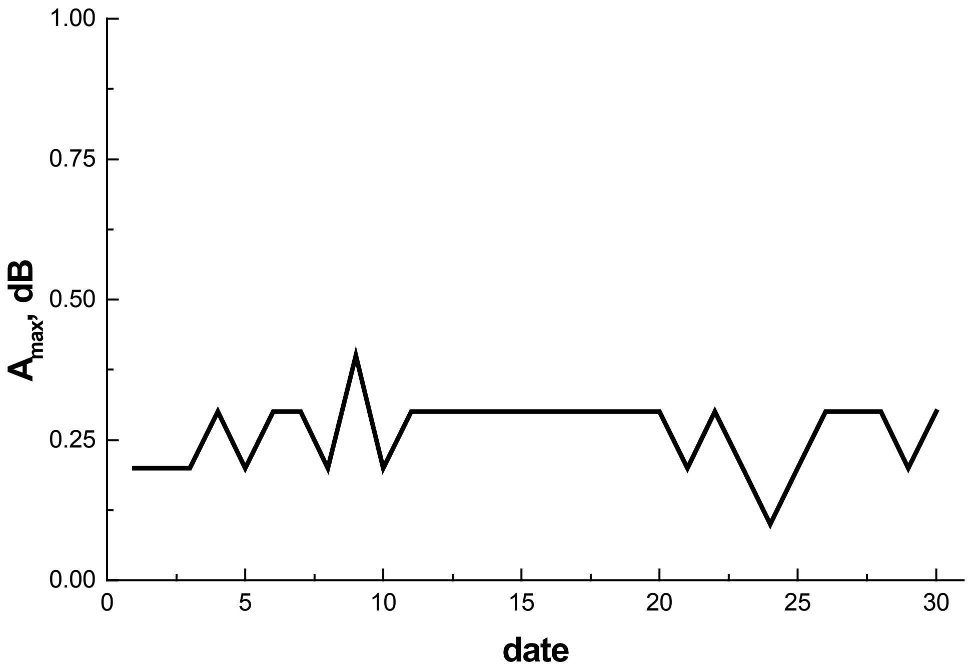


Fig. I.13. The maximum daily values of 32 MHz cosmic radiowave absorption, Vostok station, June 2000.

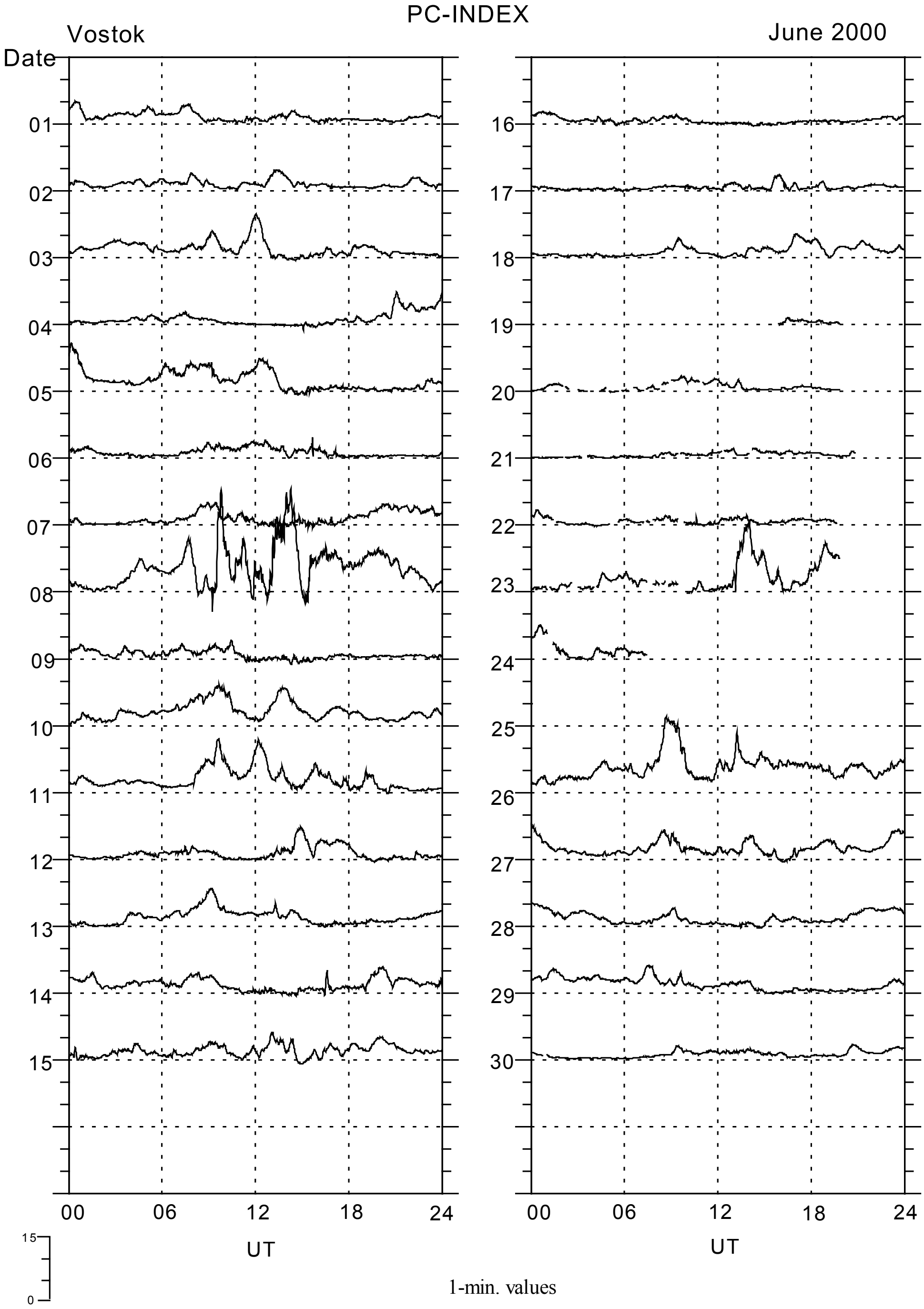

PC-INDEX
Vostok
June 2000
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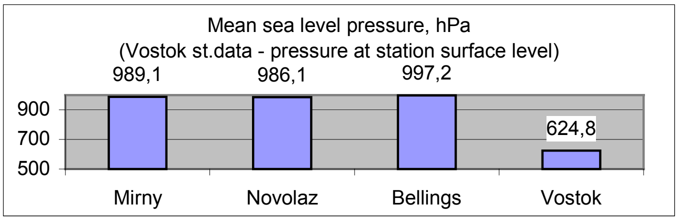
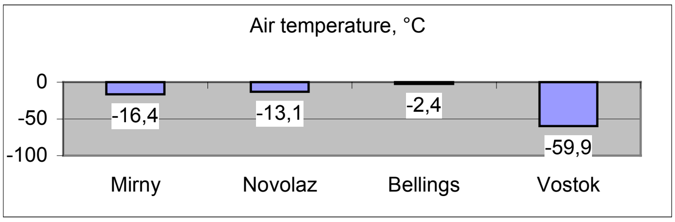
Fig. I.14.

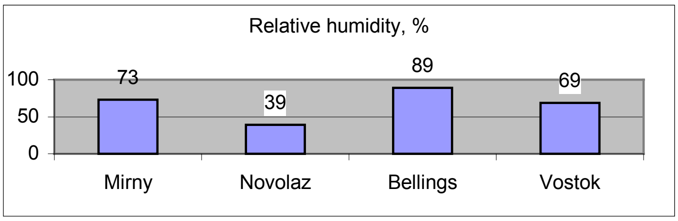
June 2000



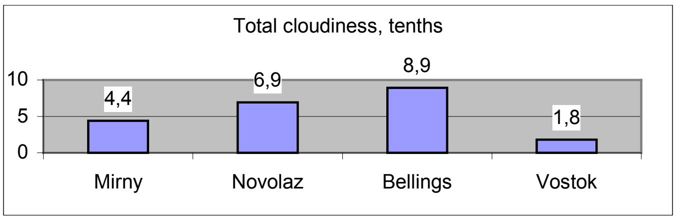
$(f-f_{avg})/\sigma_f$ 0,0 -0,9 0,5 0,2



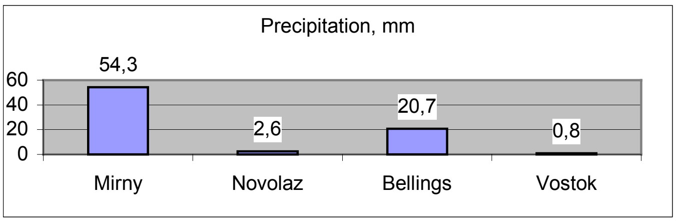
$(f-f_{avg})/\sigma_f$ -0,5 1,0 1,8 1,8



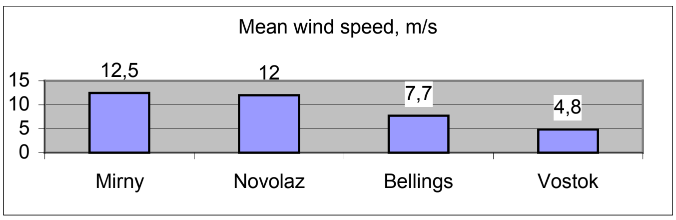
$(f-f_{avg})/\sigma_f$ -0,4 -2,1 0,5 0,1



$(f-f_{avg})/\sigma_f$ -1,9 1,1 0,5 -1,1



f/f_{avg} 0,7 0,1 0,4 0,3



$(f-f_{avg})/\sigma_f$ -0,3 0,3 0,0 -1,1

Fig. I.15. Comparison of monthly averages of meteorological parameters at the stations, June 2000.

II. ANOMALOUS METEOROLOGICAL CONDITIONS AT THE RUSSIAN ANTARCTIC STATIONS IN APRIL-JUNE 2000

The period April to June 2000 – autumn and early winter in the Southern Hemisphere is characterized by the decrease of below zero temperature anomalies in East Antarctica and the increase, especially in June of above zero anomalies on Antarctic peninsula. At the Bellingshausen station, a positive anomaly comprised 1.4σ, 1.4σ and 1.8σ in April, May and June, respectively. In June, a positive anomaly was also observed at the Novolazarevskaya station (1σ) and at the inland Vostok station (1.8σ), which is attributed to the penetration of deep cyclones far to the south and to spreading of warm air masses from lower latitudes. In the interannual temperature variations, June 2000 was second at Vostok and third at Bellingshausen by the rank of warm years.
The temperature series of June at all Russian stations over the entire observation period indicate a warming most expressed at Bellingshausen. As can be seen from data in Table II.1 and Fig. II.3, the June temperature at this station from 1968 to 2000 increased by 2.7^{0}C with the largest positive trend occurring during the last decade. However, at Mirny, the temperature trend in June is negative for the last decade.

In April 2000, a small positive temperature anomaly (0.6σ) was observed at Mirny. The average temperature in May and June in Mirny was below the multiyear average (-1.0σ and -0.5σ).

The temperature trend over the entire observation period at the Russian stations except for Bellingshausen was negative for May. In April, at the stations in East Antarctica (Mirny, Vostok) the trend is negative while at Bellingshausen and Novolazarevskaya it is positive.
Table II.1

Parameters of the linear trend of mean monthly surface air temperature and atmospheric pressure

Station	1958-2000						1991-2000					
	April		May		June		April		May		June	
	B_{xy}	D	B_{xy}	D	B_{xy}	D	B_{xy}	D	B_{xy}	D	B_{xy}	D
Air temperature												
Bellingshausen	0.44	29.6	0.72	32.5	0.82	36.4	2.75	71.1	7.13	82.6	6.75	80.9
Novolazarevskaya	0.22	14.3	-0.27	14.8	0.38	19.8	-1.47	22.5	-2.99	45.9	0.81	14.0
Mirny	-0.09	5.5	-0.46	22.4	0.35	19.1	-1.95	26.9	0.20	4.5	-1.15	14.7
Vostok	-0.20	11.5	-0.38	19.3	0.13	05.6	-4.27	57.6	-3.50	56.5	1.78	21.9
Atmospheric pressure												
Bellingshausen	0.50	11.9	0.63	11.8	0.08	01.3	-6.35	48.6	3.35	20.9	-0.16	01.2
Novolazarevskaya	-0.85	25.5	-1.45	31.4	0.05	01.4	-6.52	55.8	-5.87	60.2	-7.09	45.1
Mirny	-0.69	24.0	-1.93	47.1	-1.19	29.1	-3.82	25.4	-6.11	41.2	0.07	0.6
Vostok	-0.28	10.6	-0.69	17.9	0.51	14.0	-5.99	43.1	-5.90	53.3	-1.05	08.9

The atmospheric pressure at the Russian stations during April-June is close to the multiyear average, on average. However, in May due to intense cyclonic activity, the pressure anomalies at Mirny, Novolazarevskaya and Vostok are negative comprising -1.3σ, -0.9σ and 0.8σ, respectively. Of interest is a negative pressure trend at all three stations both for the observation period in general and especially during the last decade.

Precipitation during the months in question is non-uniformly distributed. Significant precipitation (almost 3 times as high as the monthly average) was observed in April and May at Mirny station, which is connected with a passage and persistence of deep cyclones with strong snowfalls and snow storms in the Davis Sea area.

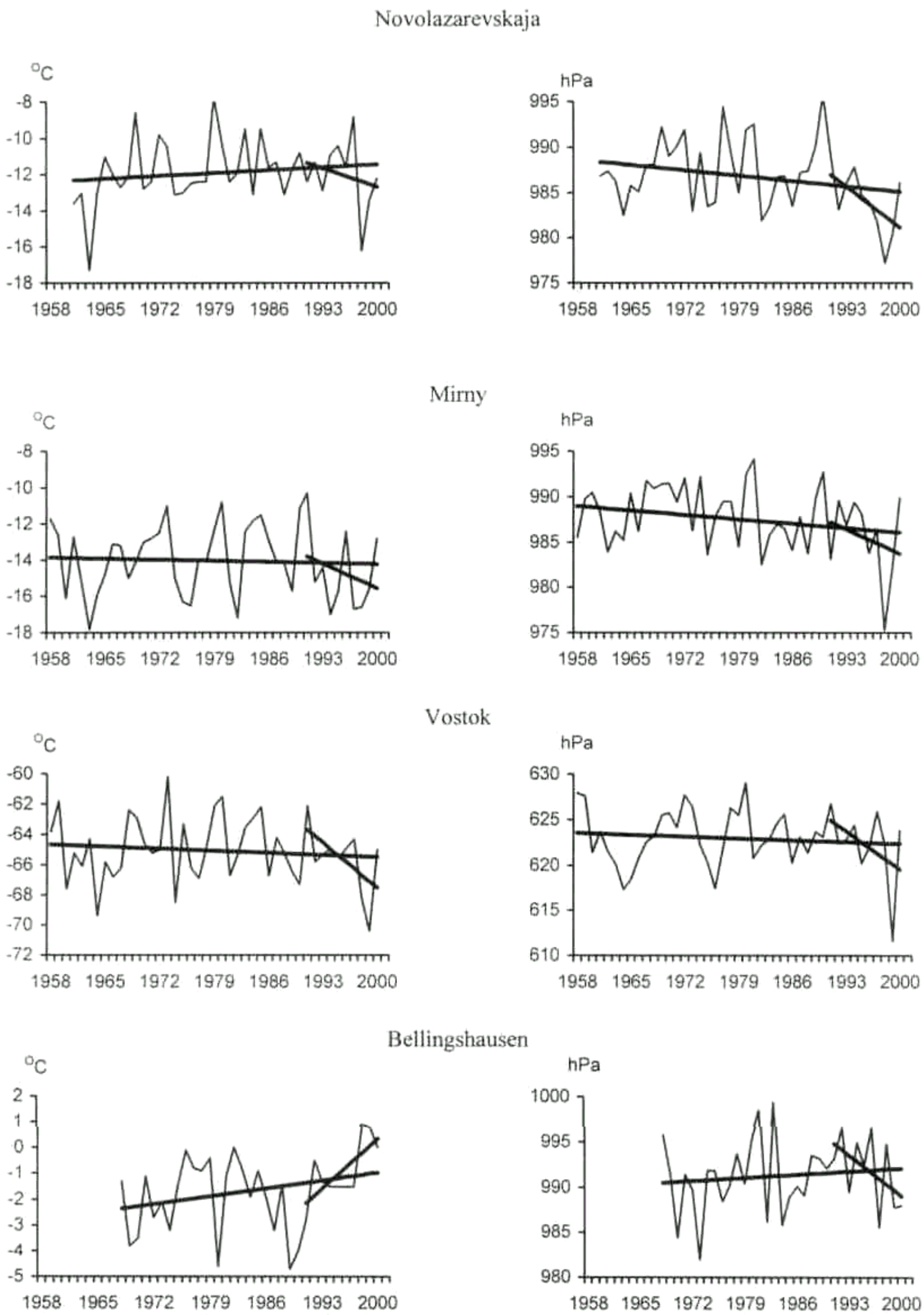


Fig.II.1 Variation of mean monthly air temperature and atmospheric pressure at the Russian Antarctic stations, April.

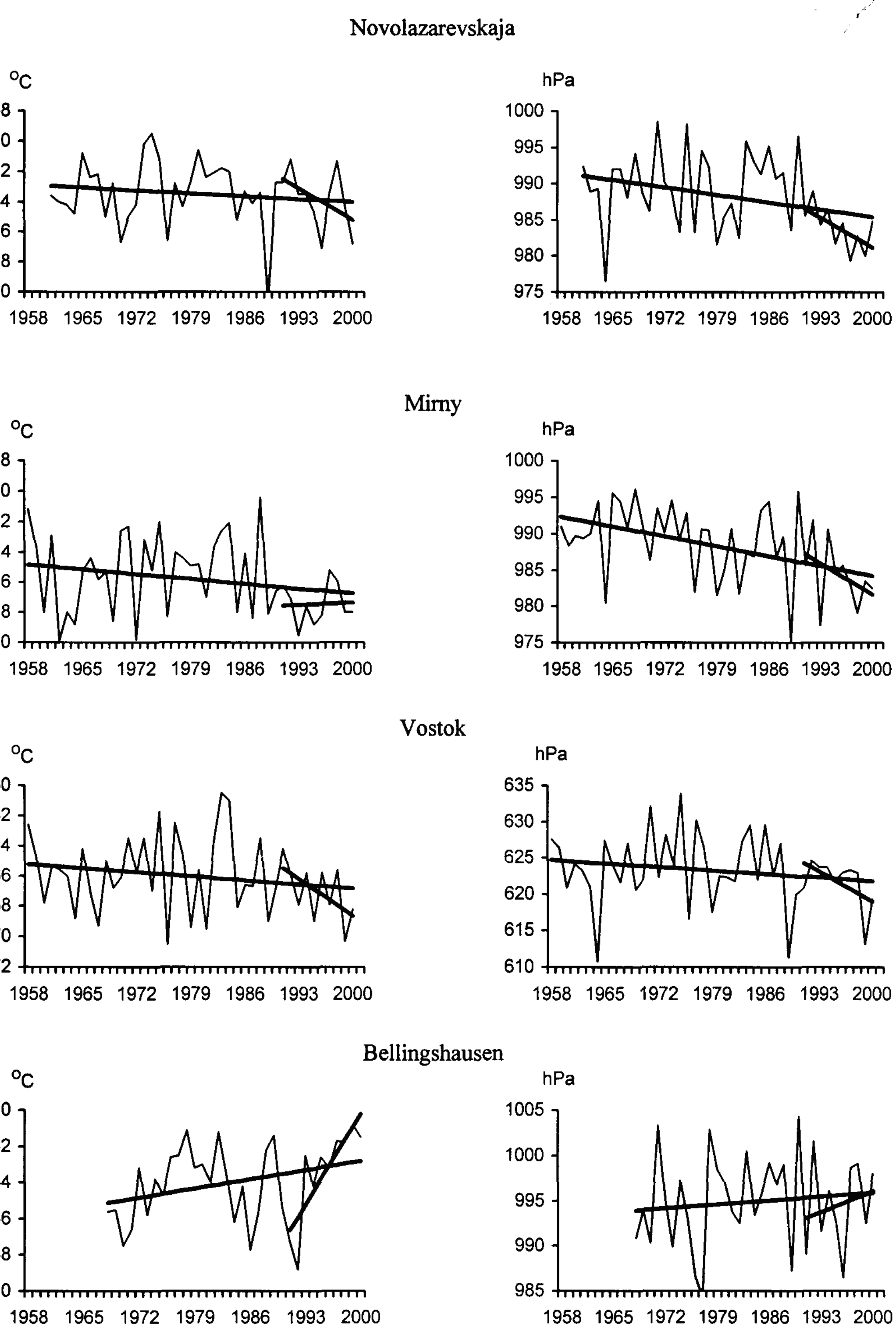


Fig.II.2. Variation of mean monthly air temperature and atmospheric pressure at the Russian Antarctic stations, May.

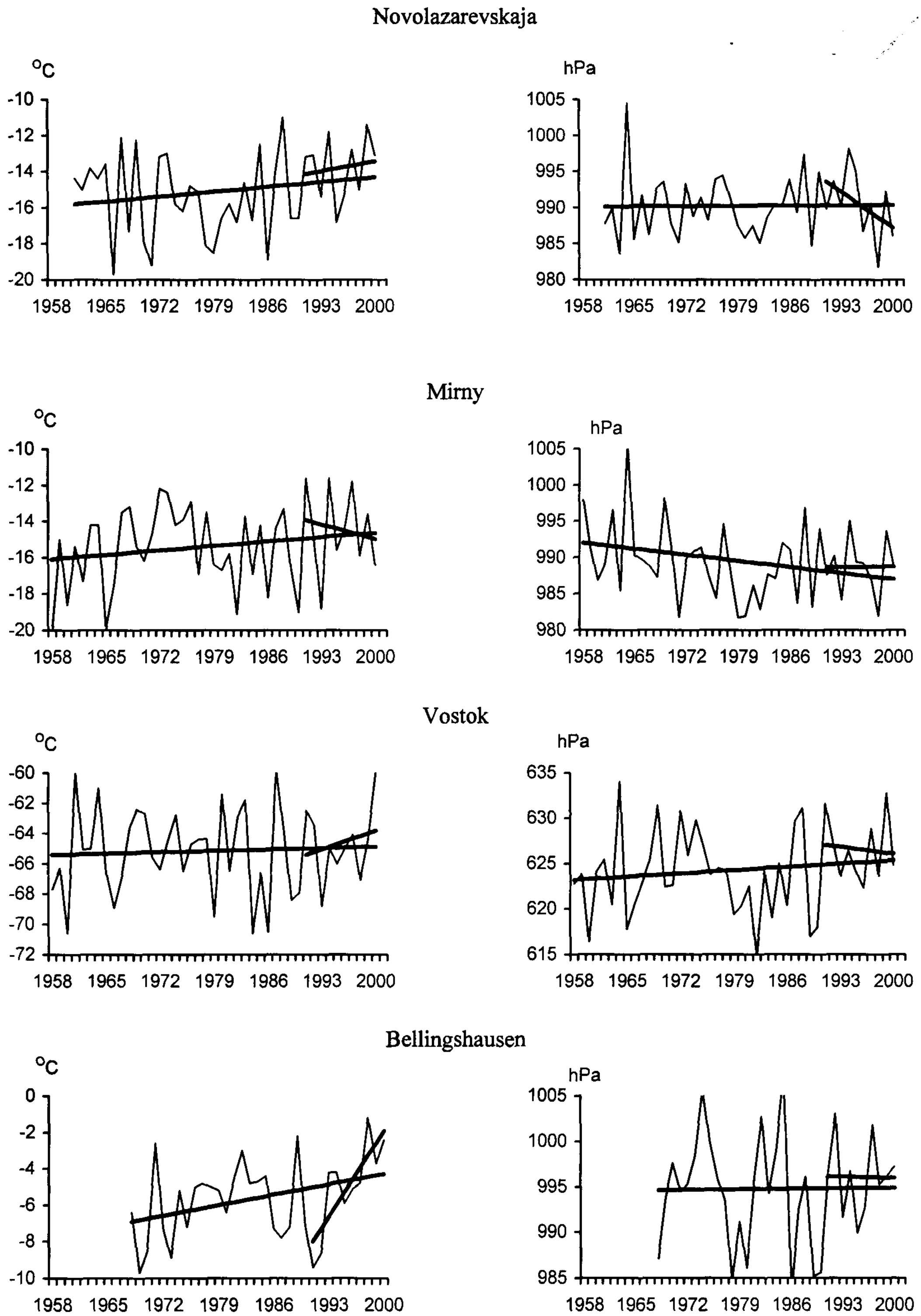


Fig.II.3. Variations of mean monthly air tempetature and atmospheric pressure at the Russian Antarctic stations, June.

III. REVIEW OF ATMOSPHERIC PROCESSES ABOVE THE ANTARCTIC IN APRIL-JUNE 2000

By analyzing the atmospheric processes of the Southern Hemisphere based on daily synoptic and mean monthly charts of atmospheric pressure and temperature at the weather bureau of Mirny Observatory and at the AARI Department of Long Range Meteorological Forecasting, it was possible to determine the frequency of occurrence of the major circulation forms /1, 2/ for April, May and June 2000 and calculate their anomalies as departures from multiyear means for 1964-1993 (Table III.1).

As can be seen from data in the table, the transfer from the increased zonal circulation activity (Z form) in late 1999 and in January 2000 to prevailing meridional forms M_a and M_b in February and March 2000 was also developed in April-June. In fact, the number of days with the meridional processes in April and May is more than 3 times as large as the number of days with the zonal form of circulation. The situation has slightly changed in June when the frequency of occurrence of zonal processes was two days greater compared with the multiyear average for this period.

Table III.1

Frequency of occurrence of atmospheric circulation forms in the Southern Hemisphere and their anomalies in April-June 2000

Month	Frequency of occurrence (days)			Anomalies (days)		
	Z	M_a	M_b	Z	M_a	M_b
April	8	14	8	-3	3	0
May	6	15	10	-2	1	1
June	10	11	9	2	-4	2

The development of the upper-level tropospheric ridges in April, especially during the second and third 10-day periods occurred above the central part of the Atlantic and Indian sectors of the Southern Ocean and above the eastern part of the Pacific sector. Deep cyclones moved along the western periphery of these ridges exiting to the Antarctic coast governing a persistent stormy weather in the Commonwealth, Davis, Mawson and Ross Seas. Some cyclones penetrated sufficiently far south of the continent. Active cyclogenesis above the Davis Sea during the second 10-day period of April was a cause of frequent stormy weather in the coastal areas with strong snowfalls and snow storms at the wind of up to 25-30 m/s. Abundant precipitation fell out in Mirny while the average 10-day air temperature was 4-7^{o}C higher compared to the multiyear average.

In May, the dominance of meridional circulation form was combined with short but intense zonal processes. The anomalous development of the continental High was of special importance determining significant temperature contrasts in the lower troposphere in coastal areas and a periodical deterioration of weather conditions.

In the second half of May, the Atlantic and West Australian upper-level tropospheric ridges developed. A stable zone of intense cyclogenesis formed above the Indian sector of the Southern Ocean. The deep cyclones moving along the South African and Kerguelen trajectories were most active. They often persisted above the southern areas of the Commonwealth, Davis and Mawson Seas contributing to the onset of prolonged stormy weather. This is particularly typical of the Pravda shore area (Mirny station), where a combination of the cyclonic conditions with the catabatic wind resulted in frequent and extremely strong drifting snow. In May in Mirny, the number of storm days was twice as large compared to the multiyear average. A rare phenomenon was observed on May 26– a frequent change in the wind direction from SSE to NNE at the speed ranging between 5-10 m/s to 30-35 m/s. The wind increase was accompanied by a strong drifting snow at the visibility of less than 50 m.

In June, there was an almost equal number of days with the processes of three main circulation forms. The frequency of occurrence of the processes of zonal and M_b forms was slightly higher than

normally while that of the processes of M_a form was lower since the latter were often transformed to the M_b form processes. The outflow of the warm moist air masses to the coast of East Antarctica was more rare. The mean monthly temperature in the Mirny area was 1-2^o C below the multiyear average with a smaller number of days with snowfalls and storm wind. A strong snowstorm at the easterly wind of 25-30 m/s was observed only once at the end of the month.

The circulation conditions in the coastal areas of the Weddell and Lazarev Seas in June were characterized by frequent deep cyclones exiting along the South American and Falkland trajectories. Active cyclones exiting along the East Australian and New Zealand trajectories to the D'Urville and Ross Seas in some cases advanced southward to the continental Antarctic areas.

References:

1. Dydina L.A., Rabtsevich S.V., Ryzhakov L.Yu., Savitsky G.B. Atmospheric circulation forms in the Southern Hemisphere. – AARI Proceedings, 1976, V. 330, p. 5-16.
2. Ryzhakov L.Yu. Some characteristics of the anomalous development of atmospheric circulation forms in the Southern Hemisphere at the cold time of the year. – AARI Proceedings, 1976, V. 330, p. 17-29.

IV. BRIEF OVERVIEW OF ICE PROCESSES IN THE SOUTHERN OCEAN IN APRIL-JUNE 2000

During the austral autumn of 2000, similar to the preceding period, the significant differences between the Southern Ocean areas were preserved in respect of their ice extent (Fig. IV.1, Table IV.1).
The core of the Atlantic ice massif (between 30^o and 60^o W) was still of low mobility. Its northern boundary similar to the previous year reached the South Orkney Islands only in late June with a simultaneous old ice export from the Weddell Sea westward to Bransfield Strait. Such a delay of one month and a half, on average, in the development of the massif resulted in particular in a later onset of ice formation in the Ardley Bay area in the vicinity of the Bellingshausen Base (Table IV.2). However, in spite of a low mobile core of the Atlantic massif, the entire Weddell polynya area (20^o W – 20^o E) was rapidly covered with ice, probably due to the increased secondary export branch of ice advection from the coastal zone northward in the vicinity of 20^o W. The ice extent area was significantly greater than normally (Table IV.1).

The compensation character of the development of hydrometeorological processes in the South Polar area that was also manifested in the seasonal change of the sign of ice anomalies, was especially pronounced in the marginal seas of the Indian Ocean sector.

Thus, in spite of the increased residual ice extent in the Cosmonauts and Commonwealth Seas in late summer, the expansion of the ice band in autumn was here extremely slow. Even in late June, the ice edge in the longitudinal sector of 40-60^o E remained near 65^o S. On the contrary, the ice extent of the Davis Sea reached the multiyear average already in May, although an extremely rare situation of complete ice clearance of this basin was observed in summer. An even more pronounced change of the decreased ice extent in summer to the increased one in autumn occurred in the area of the Mawson - D'Urville Seas.

At the same time, according to the data from Mirny and Progress stations, the landfast ice formation in the coastal zone (Table IV.2) was late due to frequent breakups but with subsequent rapid growth in thickness at a relatively small snow cover (Table IV.3 and IV.4).

Table IV.1

Latitudinal location of the external northern drifting ice edge in the Southern Ocean based on satellite data of Novolazarevskaya and Mirny stations in May 2000

Meridians	Actual	Multiyear average
60^o W	64.2^o S[1]	63.1^o S
50^o W	62.4^o S	60.5^o S
40^o W	63.8^o S	61.2^o S
30^o W	63.3^o S	62.6^o S
20^o W	63.4^o S	64.6^o S
10^o W	62.1^o S	66.2^o S
0^o	64.7^o S	66.8^o S
10^o E	63.5^o S	66.3^o S
20^o E	63.6^o S	66.2^o S
30^o E	65.0^o S	66.4^o S
40^o E	65.6^o S	66.2^o S
50^o E	65.5^o S	64.8^o S
60^o E	64.2^o S	63.6^o S
70^o E	64.9°S	63.0^o S

80° E	64.4°S	63.4° S
90° E	63.8°S	63.3° S
100° E	63.5°S	62.9° S
110° E	62.6°S	63.5° S
120° E	62.5°S	63.8° S
130° E	63.5°S	64.0° S
140° E	63.6°S	63.9° S
150° E	62.3°S	63.6° S

Note: [1] – clear, no ice – instead of the ice edge position, latitude of the Antarctic coast point is given at its crossover with the corresponding meridian.

Table IV.2

Dates of the onset of main ice phases in the areas of Russian Antarctic stations in April-June 2000

Station (water area)		Ice formation		Landfast ice formation		Freeze-up	
		First	Stable	First	Stable	First	Final
Mirny (roadstead)	Actual	14.03	14.03	29.03	24.04	04.05	04.05
	Multiyear average	11.03	12.03	30.03	02.04	14.04	17.04
Progress (Vostochnaya Bay)	Actual	19.02	19.02	18.03	18.03	05.04	05.04
	Multiyear average	16.02	17.02	06.03	08.03	26.03	26.03
Bellingshausen (Ardley Bay)	Actual	25.06	NO	NO	NO	NO	NO
	Multiyear average	09.05	08.06	11.06	13.06	03.07	07.07

Note: NO – Not observed

Table IV.3

Landfast ice thickness in the areas of Russian Antarctic stations from profile measurement data in April-June 2000

Station		Months		
		IV	V	VI
Mirny	Actual	-	77	91
	Multiyear average	46	67	84
Progress	Actual	63	90[1]	105[1]

Note: 1 – from measurement data at a constant point

Table IV.4

Snow depth on landfast ice in the areas of Russian Antarctic stations from profile measurement data in April-May 2000

Station	Months		
	IV	V	VI
Mirny		26	15
Progress	3	7[1]	0[1]

Note: 1 – from measurement data at a constant point

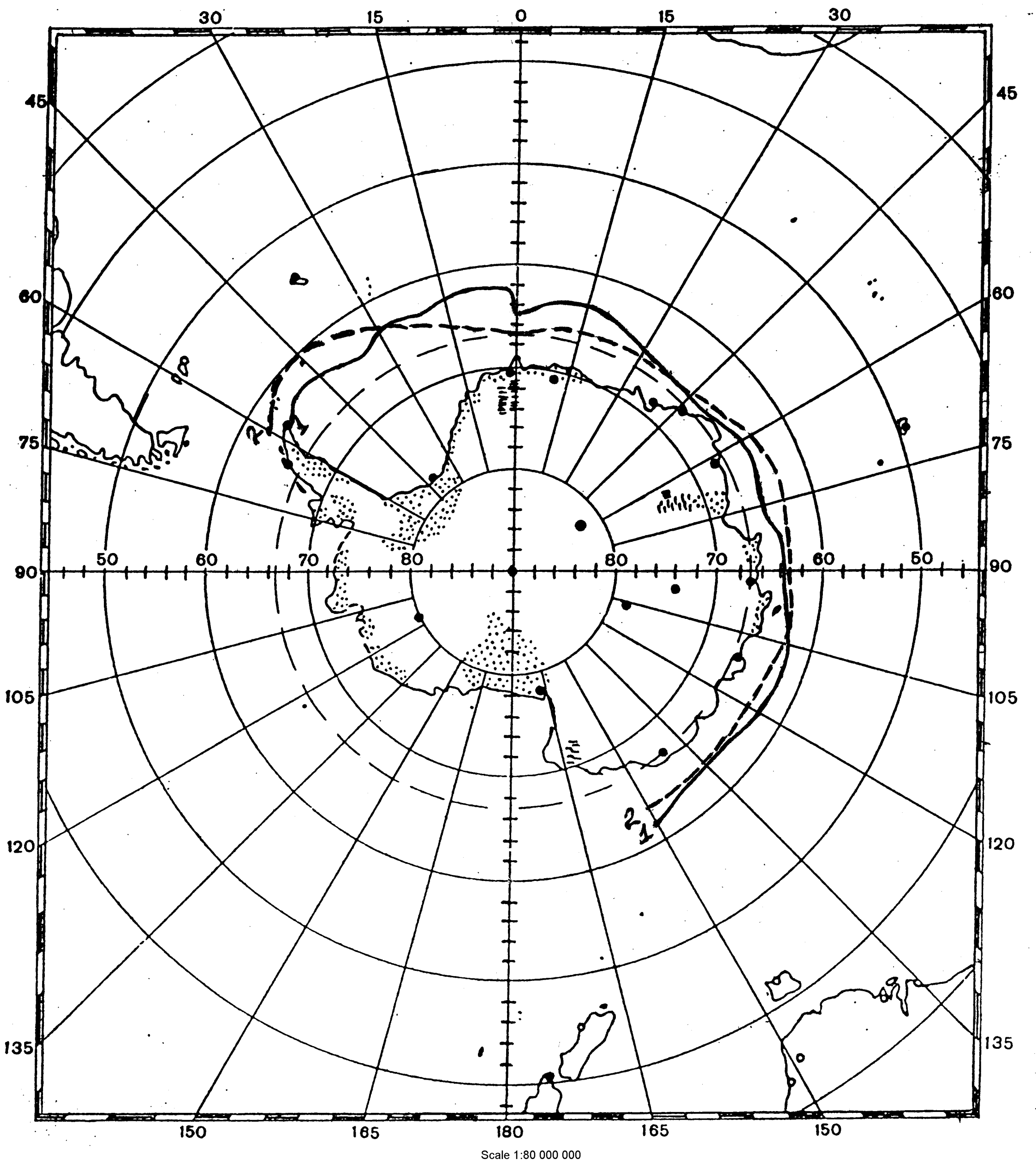


Fig. IV.1. Actual (1) and mean multiyear (2) position of the external northern drifting ice edge in the Southern Ocean in May 2000

Conventional designations: 1 – actual; 2 – multiyear average for this period

V. TOTAL OZONE MEASUREMENTS AT MIRNY OBSERVATORY IN APRIL-JUNE 2000

The total ozone measurements were made in April-May 2000 only at Mirny Observatory, since there was already polar night at Vostok station. The observations at Mirny lasted until May 13.

The monthly averages of total ozone in April and May were close by value comprising 279 and 284 Dobson units, respectively, i.e. remained approximately at the same level for the last few years. However, the character of their changes during the study period was not constant. Thus, whereas in April, the total ozone values were stable remaining at the same level, in early May, the ozone content began to decrease, which is illustrated in Figure V.1.

Fig. V.1. Daily averages of total ozone at Mirny Observatory in April-May 2000.

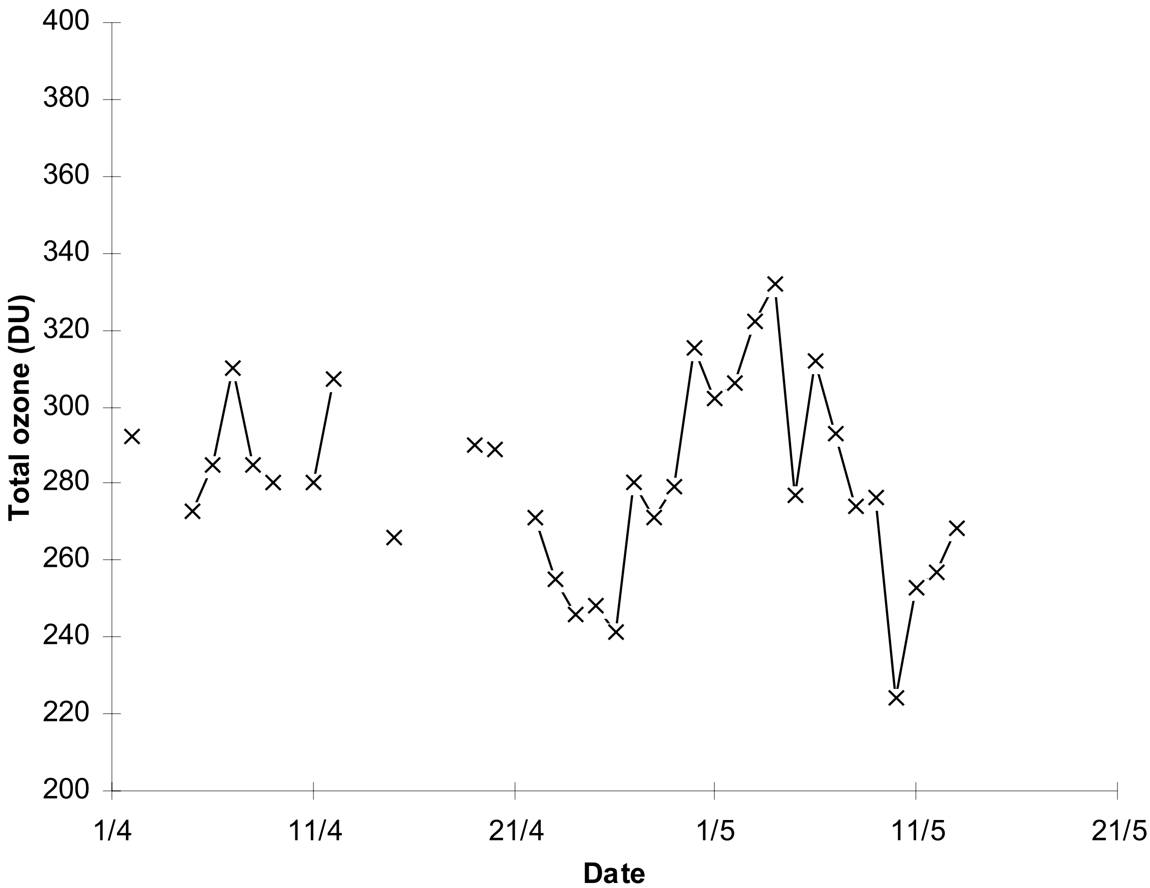


Fig. V.1. Daily averages of total ozone at Mirny Observatory in April-May 2000.

VI. COASTAL OCEANOGRAPHIC STUDIES AT MIRNY OBSERVATORY

Coastal oceanographic observations in the Mirny Observatory area began from the first national Antarctic expeditions. They included occupation of deep water hydrological stations and measurements of currents and sea level oscillations from landfast ice. The observations were typically undertaken to survey the hydrometeorological conditions of the station area being unsystematic. The hydrological observations from landfast ice area closely connected with the state of the latter. The average multiyear date of the onset of breakup in the vicinity of Mirny is December 23 with the onset of stable ice formation on March 12.

In this area, work is possible during 8-9 months on average. Weather conditions present a serious obstacle to conduct hydrological observations using standard methods. This fact as well as the absence of a long-term ocean state monitoring program in the coastal zone and of modern equipment and instruments resulted in a long break in this research. Sea level observations in the Mirny area were performed last time in January 1970. Regular observations were resumed here in accordance with the action plan to fulfil the subprogram “Study and Research of the Antarctic” of the Federal Program “Global Ocean”, Direction 3 – “Monitoring of the Antarctic Environment”.

The place of the tide gauge deployment was selected during the 44th seasonal RAE. This is a small underwater rock cliff in the zone of the coastal scarp. With the arrival of the 44th RAE seasonal and wintering personnel to Mirny, the sea level oscillation meter “Priliv” manufactured at the AARI was deployed in June 1999 near Mabus Point. Its technical data are

as follows:

Deployment depth	up to 24 m,
Sea level oscillation measurement error at the 0 to 5 m range	2 cm,
Temperature measurement range	between –10^o C to +30^o C,
Temperature measurement error	0.1^o C.

The tide gauge was connected to PC by cable through the interface block located at the heated hut onshore. Thus, the instrument set up on June 27, operated for 205 days and was recovered on January 18, 2000 after the end of the power supply block replacement life. A continuous computer record of water level oscillations and temperature comprised 4938 hours. By the present time, this is the longest period of continuous sea level record ever obtained in Mirny.

The level was reduced to the water gauge datum, for which a mark of the temporary reference point No. 1 + 500 cm was assumed . For referencing the “Priliv” observation data, two series of sea level observations (in July and January) were made using a staff with the readout by the reference point level. A constant coefficient of data referencing to the water gauge datum was 849 cm. A schematic of the tide gauge deployment is presented in Fig. VI.1.

After a preliminary data processing, an average sea level over the observation period was obtained relative to the water gauge datum of 502 cm. This signifies a discrepancy with the geodetic system datum of Mirny Observatory of 2 cm, which is less than the permissible error of the water gauge leveling system.. Thus, from the 1950s the mean sea level mark in the Mirny area has not changed. The maximum level rise of 704 cm above the gauge datum with the minimum of 394 cm was recorded in November 1999. The average extreme amplitude comprised 214 cm over the observation period with the extreme level amplitude within a day of 310 cm being observed on November 25, 1999.

It was possible to continue sea level observations during the open water period at the Mirny roadstead after the power supply block was replaced. The administration of the research expedition

vessel "Akademik Fedorov" did not provide the corresponding floating craft to deploy a tide gauge. It was deployed only after a strong landfast ice formed in early May 2000.

Sea level variations in the vicinity of Mirny are presented in Fig. VI.2. An initial analysis of this information allows us to consider the character of tidal oscillations as being mixed. Irregular semi-diurnal tides predominate. The heights of adjoining high and adjoining low waters differ significantly (with a syzygy of more than 1 m). In July and August, tidal variations corresponded completely to fortnight inequalities connected with lunar phases. In September-December, the prevailing factor influencing the tide value was probably a fortnight inequality connected with lunar and solar declinations. The maximum heights of high water were 2-5 days delayed relative to syzygies falling on the periods of the maximum lunar declinations, i.e. there were "tropic tides". In January, the first fortnight inequality was again predominant with the high water maximum falling on the syzygy. The maximum tide was recorded on November 25, 1999 on the second day after the syzygy at the largest lunar declination comprising 3.10 m. The by-month statistical characteristics of sea level oscillations are given in Table VI.1. Note some minor feature in the tidal regime in July-October. The irregular semi-diurnal tides in one or two days after the Moon's first quarter phase passed to a period of two-four days to the regular diurnal tides 70-100 cm high.

After a long break, the sea water temperature and salinity observations at a constant point and at the hydrological transect (through Ob' Strait) offshore Mirny station were continued. The studies were performed from landfast ice during the period August to September 1999. In addition to observations every 10 days using Nansen bottles from August 3,1999 to December 15, 1999, the temporal variability of sea water temperature was recorded on an hourly basis at 5 levels by means of the thermistor chain "RGFPT". The technical data of the instrument are as follows:

Submergence depth	not more than 130 m,
Submergence depth by levels	120, 50, 25, 10 and 0.5 m,
Temperature measurement range	between -2^{o} C to $+28^{o}$ C,
Absolute temperature measurement error range	not greater than $\pm 0.01^{o}$ C.

The data obtained indicate the dominance of winter shelf water in the Mirny station coastal area of the Davis Sea with a temperature ranging from -1.74^{o}C to -1.95^{o}C and salinity from 33.72 ppt to 34.40 ppt. A sharp salinity-density stratification was observed. Based on the salinity observations at the hydrological transect we can suggest that there was a constant water exchange through the southern deep transect part of the study area with subglacial water of the Shackleton Ice Shelf. The water dynamics was mainly influenced by sea level tidal oscillations. The temperature at a constant point was very conservative. The by-layer distribution was constant with the minimum at a 10 m level and the maximum temperatures at 50 and 120 m. The temperature oscillations in the layers over the entire period ranged between 0.02^{o} C to 0.05^{o} C. Daily oscillations in the layers within 0.01^{o}C were typical being probably due to the tidal currents. Thus, the coastal hydrological observations at Mirny Observatory were resumed after a long break. Of special interest among them appear to be the thermistor chain observations allowing us to gain understanding about the shelf water formation processes during the winter period.

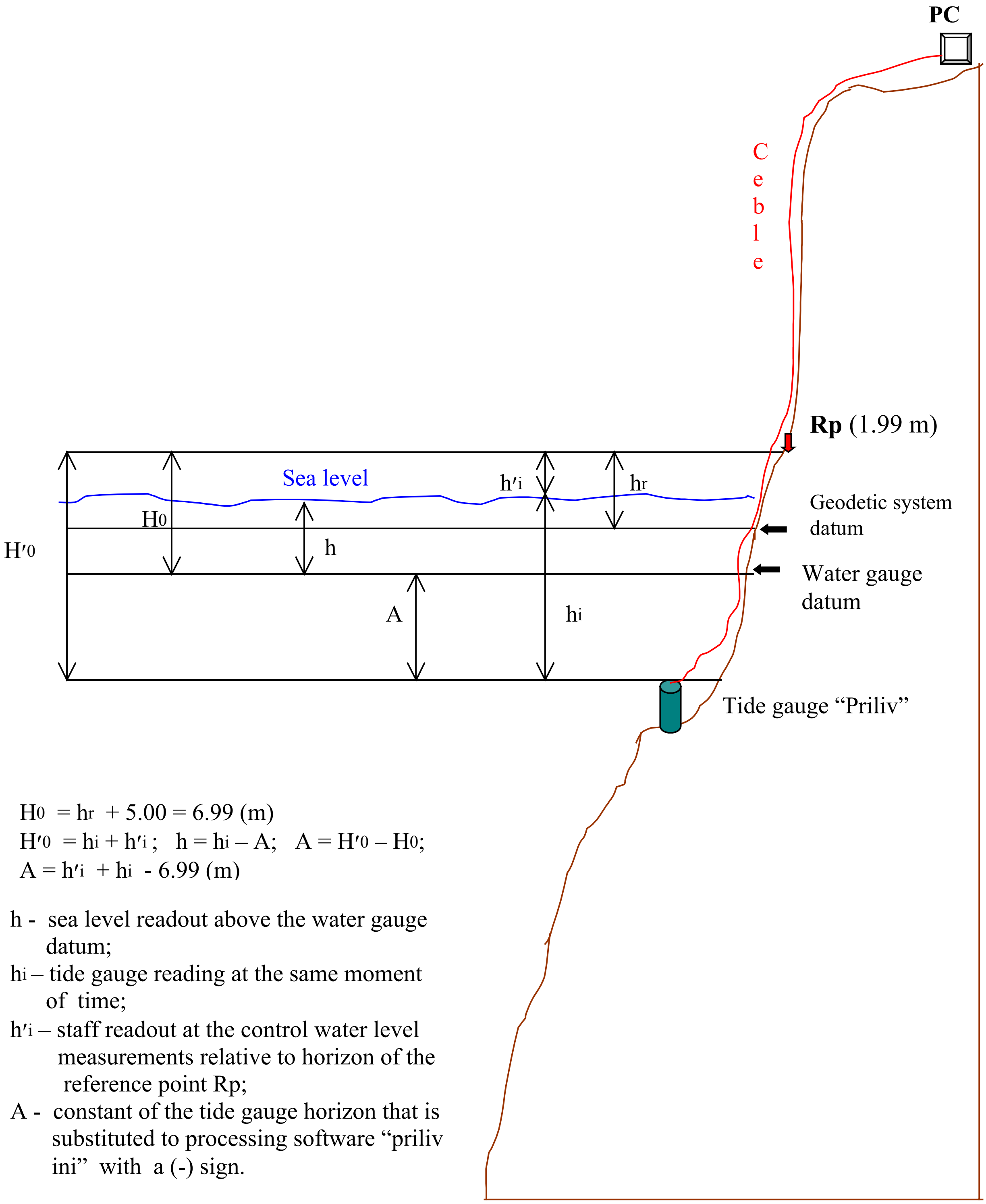
Table VI.1

Statistical characteristics of sea level oscillations in the vicinity of Mirny Observatory during the period June 1999 to January 2000

	$Hi_{avg.}$,cm	hi_{min},cm	hi_{max},cm	$H_{avg.}$,cm	h_{min},cm	h_{max},cm
June	1352	1272	1458	503	428	609
July	1354	1266	1466	504	417	617
August	1351	1283	1454	502	434	605
September	1349	1260	1449	500	411	600
October	1349	1251	1470	500	402	621
November	1349	1243	1553	500	394	704
December	1347	1253	1487	498	404	638
January	1373	1298	1487	509	429	638
Mean	1353	1266	1478	502	415	629

In total for 4886 hours of "Priliv" operation

	Level from the instrument (h_i), cm	Level from the water gauge datum (h), cm	Temperature, ^{o} C
Max	1553	704	-1.44
Min	1243	394	-1.71
Mean	1350.59	501.59	-1.609



$H_0 = h_r + 5.00 = 6.99$ (m)

$H'_0 = h_i + h'_i$; $h = h_i - A$; $A = H'_0 - H_0$;

$A = h'_i + h_i - 6.99$ (m)

h - sea level readout above the water gauge datum;

h_i – tide gauge reading at the same moment of time;

h'_i – staff readout at the control water level measurements relative to horizon of the reference point Rp;

A - constant of the tide gauge horizon that is substituted to processing software “priliv ini” with a (-) sign.

Fig. VI.1. Schematic of deployment of the tide gauge “Priliv” and the main water gauge horizons .

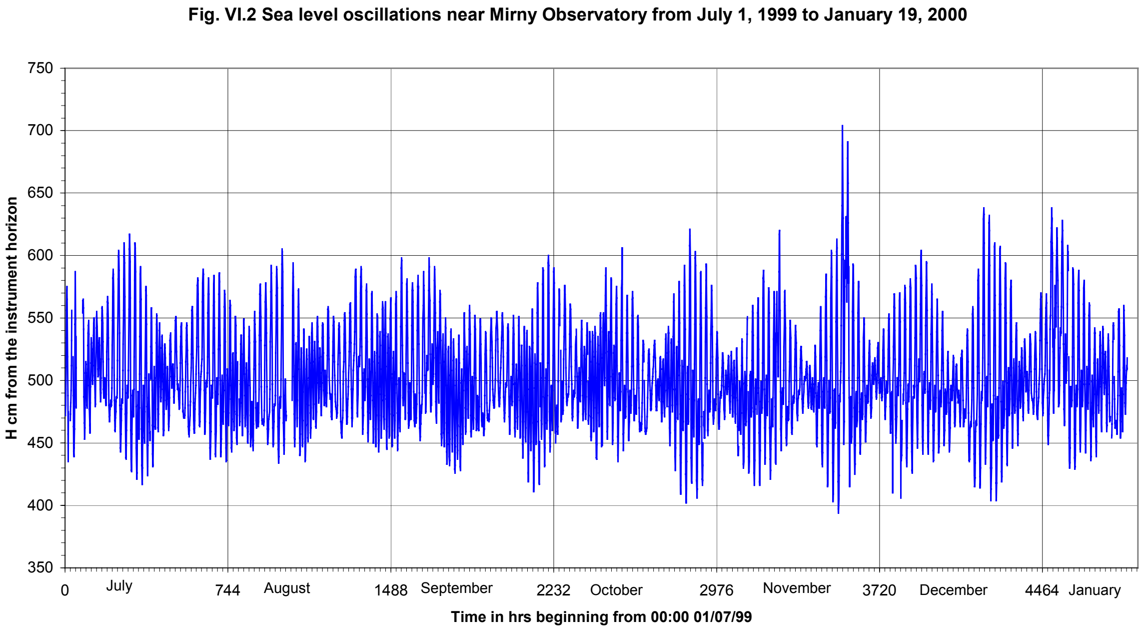


Fig. VI.2 Sea level oscillations near Mirny Observatory from July 1, 1999 to January 19, 2000

VII OCEANOGRAPHIC STUDIES DURING THE 45TH RAE

The main aim of oceanographic studies during the period of the 45th RAE was to investigate the structure of the Antarctic Slope Front (ASF) in the eastern area of the Cosmonaut Sea. During the period March 23-27, 25 hydrographical stations were made from board the research and support vessel "Akademik Fedorov" that comprised three quasi-meridional transects located along meridians 41^o E, 43^o E and 45^o E (Fig. VII.1). All transects begin on the shelf near the shelf break (at depths less than 500 m), cross the continental slope and reach the deep ocean area (with depths of more than 3000 m). The stations at the depths of up to 3000 m were made down to the bottom and in the deep ocean area up to a depth of 1500 m. The distance between the stations comprises 2-10 km in the shelf break area and the upper part of the continental slope and up to 50 km north of the Antarctic Slope Front. At each deepwater hydrological station, sea water temperature and dissolved oxygen and silicon concentrations were observed.

As a result of observations made, a detailed understanding of the structure (primarily thermal) of the Antarctic Slope Front (ASF) in this area was obtained for the first time, which was provided both by small distances between the stations at the transects in the upper part of the continental slope and the capability of the ship to operate under relatively complicated ice conditions. Up to now there were extremely few oceanographic sections made across the ASF with such a high spatial resolution necessary for the adequate reflection of the front structure in the Southern Ocean.

The observation data indicate that the ASF is well pronounced primarily at the deep water level with high gradients of oceanographic characteristics. The distribution of characteristics at the transects reflects a complicated structure of water circulation in the area of the Cosmonauts Sea continental slope where the flow of the Antarctic Circumpolar Current and the Southern branch of the large-scale cyclonic gyre of the Cosmonauts Sea interact. Deep convection is well pronounced in the ASF area reaching a depth of 500-700 m. Fine structure reflects active processes of the horizontal exchange in the ASF area between waters of deep sea area and the shelf and the continental slope resulting in particular in active transformation and ventilation of warm circumpolar deep waters. The distribution of characteristics at the northern transect part along 45^o E (Fig. VII.2) confirms the important role of the ocean in the formation of the known recurring polynya of the Cosmonauts Sea revealed before both in the data of satellite observations and directly in the 1999 observations from board the "Akademik Fedorov".

The observation results will serve as a good basis for forming a strategy of further in-situ studies of the most important element of the Antarctic water structure – Antarctic Slope Front.

“Akademik Fedorov” sections. March 2000.

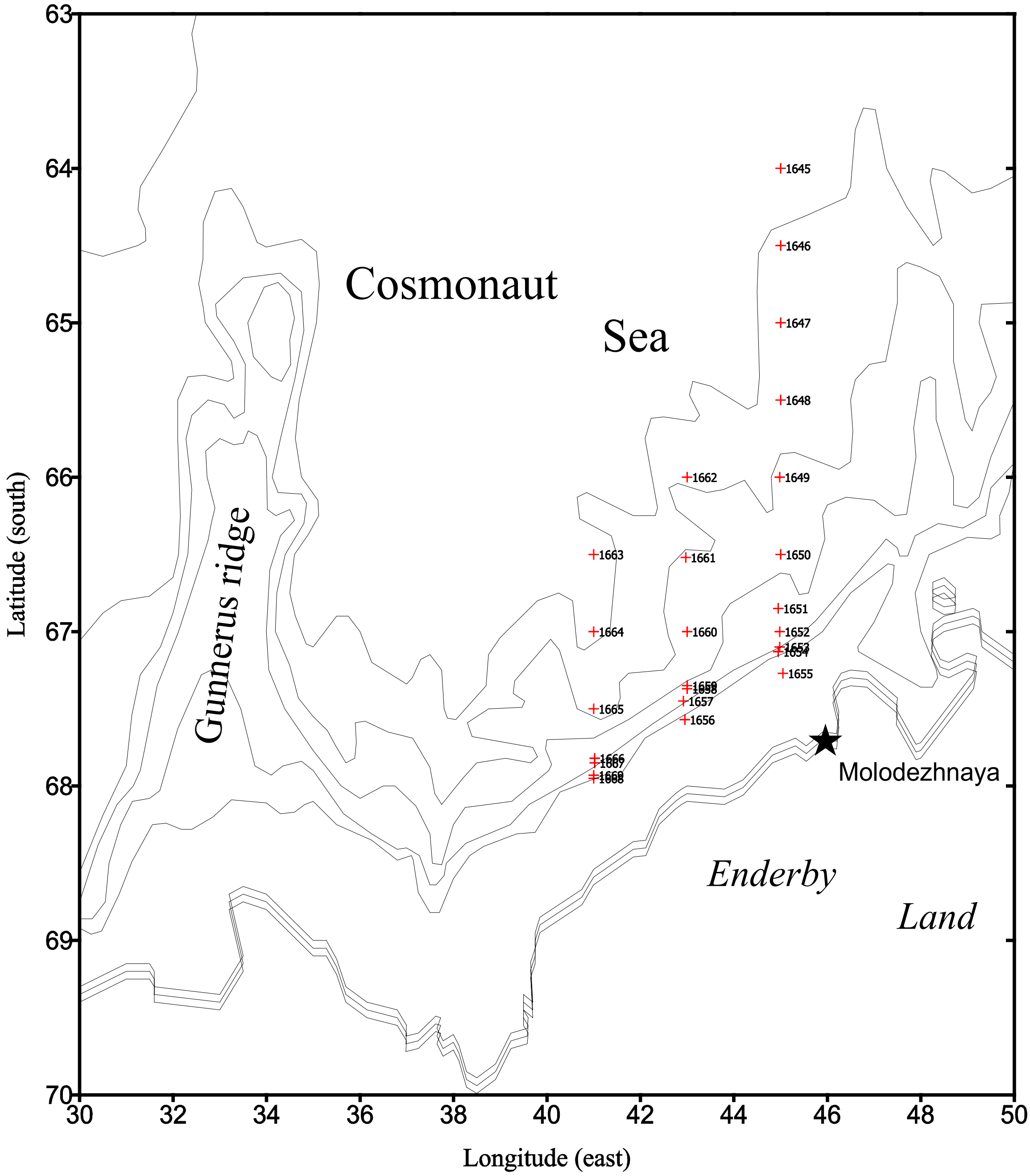


Fig. VII.1 Schematic of the location of oceanographic stations occupied from board the “Akademik Fedorov”.

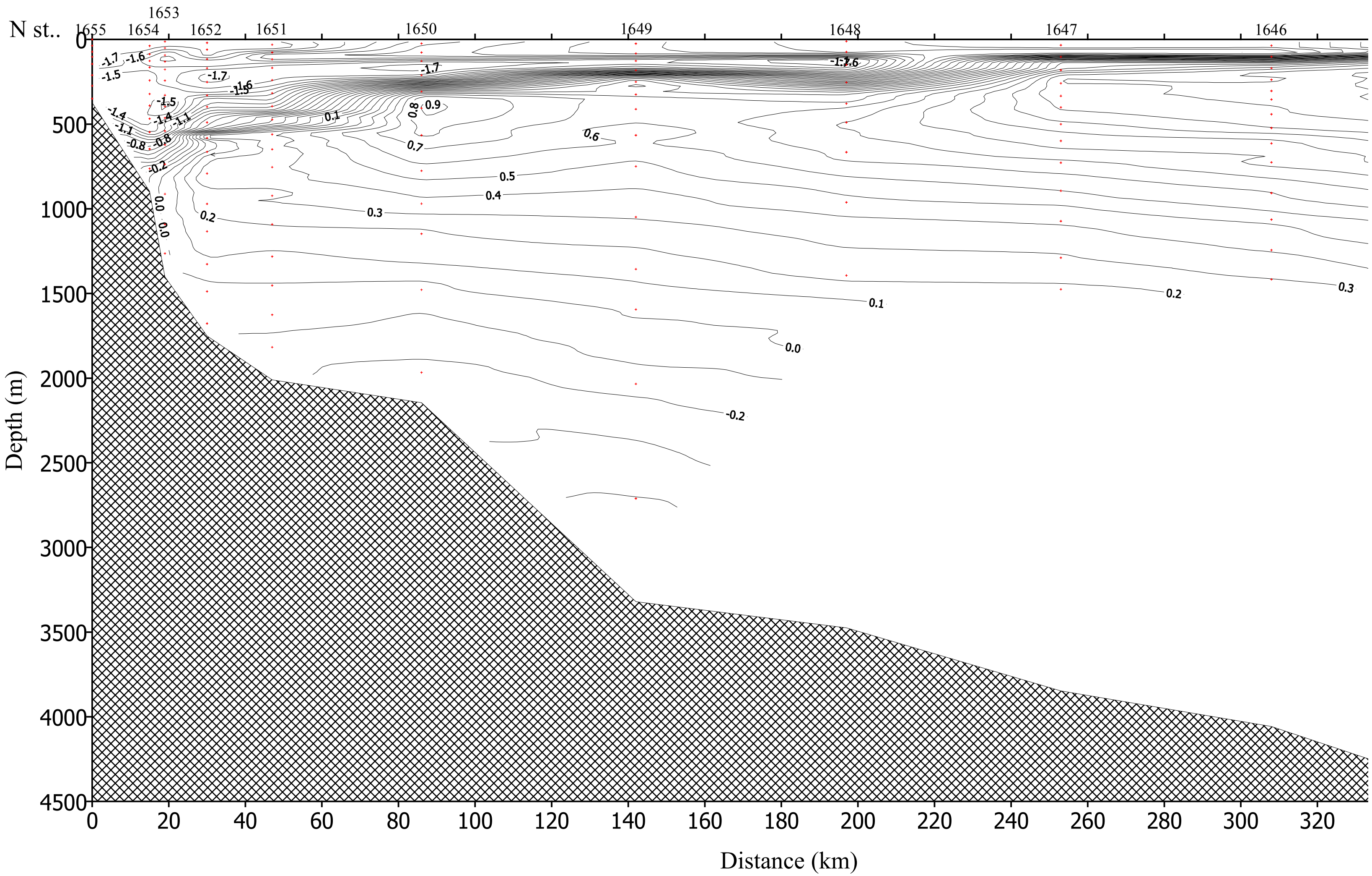


Fig. VII.2. Distribution of potential temperature (^{o}C) at the transect along 45^{0} E.

VIII. MAIN EVENTS OF THE 45TH RAE IN APRIL-JUNE 2000

April 1, 2000	Participation of Levando K.K., Head of the Bellingshausen Base in the official meeting of Ricardo Lagos, President of the Republic of Chile who arrived to the Chilean stations "Presidente Eduardo Frei".
April 4, 2000	Arrival of the research expedition vessel "Akademik Fedorov" to the unloading area of Novolazarevskaya station. Start of cargo operations.
April 6, 2000	Departure of the "Akademik Fedorov" for Capetown (South Africa). During the period of cargo operations, three 45th wintering personnel participants were shipped to Novolazarevskaya station and 8 participants in the seasonal activities of the 4th RAE were taken onboard. Twenty people remained at the station for wintering (together with people who arrived earlier) with the station Head Pugachev Ye. N.
April 12, 2000	Return of the sledge-caterpillar train from the unloading site of the "Akademik Fedorov" at the Lazarev Sea barrier to the Novolazarevskaya station. The train delivered part of diesel fuel, frost-resistant food supplies and general cargo.
April 14, 2000	Arrival of the "Akademik Fedorov" to Capetown (South Africa) for ship resupply and shipping by aircraft part of the expedition personnel.
April 17, 2000	Departure of the "Akademik Fedorov" from Capetown to Bremerhafen (Germany). Flight from Capetown to Russia of 26 participants of the 44th and 45th RAE.
April 22, 2000	Continuation of analogue magnetic observations at Novolazarevskaya station.
April 27, 2000	Start of operation of the digital magnetic variation station "Geomet" at Novolazarevskaya Base.
May 3, 2000	Arrival of the R/V "Akademik Aleksander Karpincky" to St. Petersburg (Captain Timerev S.N., Cruise Head Gandyukhin V.V.).
May 6, 2000	Arrival of the "Akademik Fedorov to Bremerhafen (Germany) for ship resupply and bunkering.
May 7, 2000	Departure of the sledge-caterpillar train from Novolazarevskaya to the Lazarev Sea barrier to the station cargo unloading site for refueling.
May 10, 2000	Return of the sledge-caterpillar train with diesel fuel to Novolazarevskaya station. The Polish polar explorer (Arctowski station) is put to hospital at Bellingshausen station for further shipment for treatment.
May 11, 2000	Departure of the "Akademik Fedorov" from Bremerhafen (Germany) to St. Petersburg.
May 15, 2000	Arrival of the "Akademik Fedorov" to St. Petersburg (Captain Mikhailov M.Ye., Head of the 45th seasonal RAE Budretsky A.B.)
May 17, 2000	Start of unloading the RAE research expedition equipment from the "Akademik Fedorov". Flight of the diseased polar explorer from "March" airport by Brazilian airplane to the hospital in Punta-Arenas (Chile).
May 25, 2000	End of unloading the RAE research-expedition equipment. The "Akademik Fedorov" is placed to the dry dock of the Kanonersky ship repair plant for preventive measures and repair of the hull and superstructure.
June 1, 2000	Next departure of the sledge-caterpillar train from Novolazarevskaya to the Lazarev Sea barrier to the station cargo unloading site for refueling.
June 12, 2000	Return of the sledge-caterpillar train with diesel fuel to Novolazarevskaya.

June 13, 2000	Continuation of level observations with a tide gauge “Priliv” at Mirny Observatory near Mabus Point in connection with stable formation of landfast ice.
June 16, 2000	Departure of the Head of Bellingshausen station Levando K.K. to Punta-Arenas (Chile) for further flight to Russia due to the need of acute treatment. Designation of meteorologist Shmarin A.V. as Acting Head of the Base. Completion of preventive and repair work of the hull and superstructure of the “Akademik Fedorov” at the Kanonersky ship repair plant.
June 20, 2000	Arrival of the diseased Head of Bellingshausen Base Levando K.K. to Russia.
June 22, 2000	Congratulation of President of the Russian Federation Putin V.V. of Antarctic polar explorers with the Antarctic winter middle on the winter solstice day.
June 27, 2000	Departure of the “Akademik Fedorov” from St. Petersburg to Bremerhafen (Germany) for repair and preventive work of the ship power plant and ship machinery.