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Russian Federation State Research Center

Arctic and Antarctic Research Institute

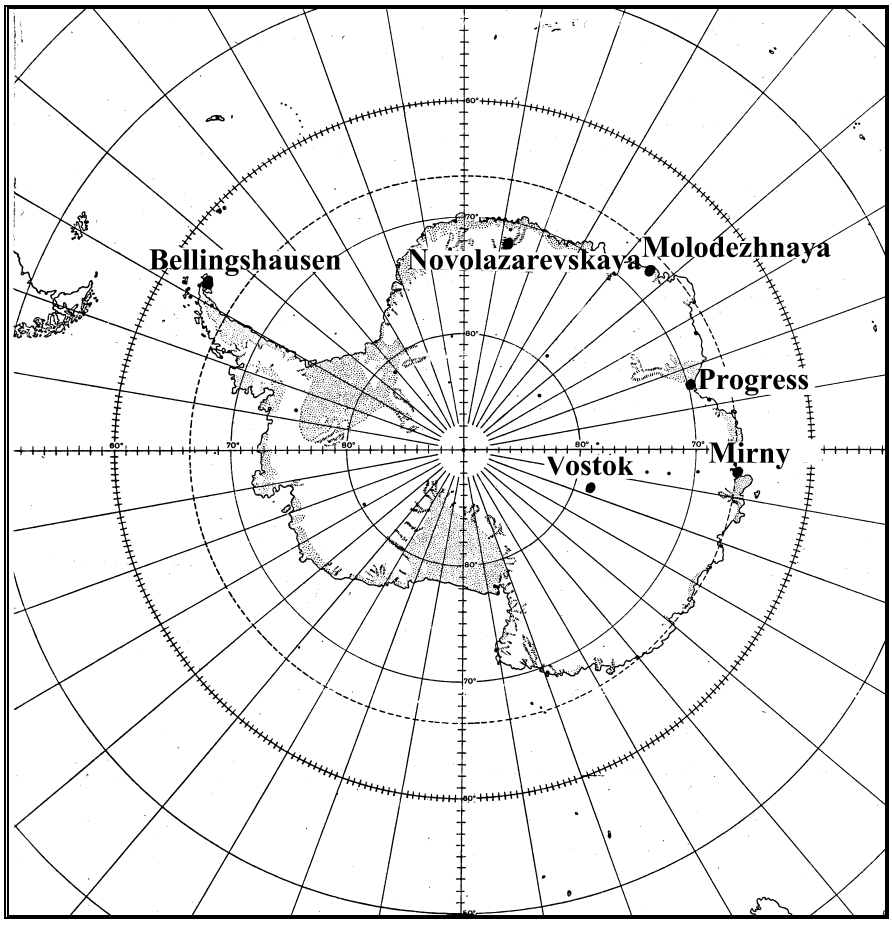
Russian Antarctic Expedition

BULLETIN

STATE OF ANTARCTIC ENVIRONMENT

Operational data of Russian Antarctic stations

January-March 2000



St. Petersburg

2000

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CONTENTS

PREFACE

The present Bulletin is based on the data that are 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 and geophysical observations at the Russian Antarctic stations for January, February and March 2000 (Section I).

As a result of reorganization undertaken by the Russian Antarctic Expedition (RAE) in compliance with the Decision of the Government of the Russian Federation No. 1113 of August 28, 1997, standard meteorological observations from the third quarter of 1999 are carried out at Mirny, Novolazarevskaya, Bellingshausen and Vostok stations.

The Progress station that was used for the last few years as a base of seasonal geological-geophysical studies will become the major center of logistics operations of the Russian Antarctic Expedition. During the period 1998-1999, permanent studies were organized at the Progress Base in cooperation with the neighboring Chinese station Zhong-Shan implementing in general the aforementioned Decision. They include coastal ice observations and the ecological monitoring program. It is planned to arrange meteorological observations under the program of the aviation meteorological station in 2001.

From February 1999, the upper-air sounding is carried out at two Russian stations - in Mirny Observatory (twice daily at 00.00 and 12.00 UT from June 1999) and at Novolazarevskaya station once a day at 00.00 UT. More frequent sounding during the periods of the International Geophysical Interval (IGI) is conducted at both stations in accordance with the International Geophysical Calendar.

The atmospheric pressure for coastal stations in the meteorological tables of this Bulletin is referenced to sea level whereas for the inland Vostok station, it is given at the station level.

The absolute anomalies (deviations from climatic averages (multiyear averages), $(f-f_{avg})$, normalized anomalies (same differences in σ_f fractions (RMS deviation of the specific parameter) $(f-f_{avg})/\ \sigma_f$) and relative anomalies f/f_{avg} are presented as the characteristics of anomalous meteorological and upper-air parameters. The latter are typically presented for the meteorological parameters that are characterized by 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 ionospheric observation programs (riometer observations and vertical ionosphere sounding (VIS)). The absolute geomagnetic field values (D, H and Z components) are presented. 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 in the tables 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 anomalous meteorological and synoptic conditions (sections II-III) and ice conditions in the Southern Ocean based on satellite data received at Bellingshausen, Novolazarevskaya and Mirny stations and observations at the coastal stations Bellingshausen, Progress and Mirny. The analysis is performed against the averages obtained from every 10-day ice reviews at the AARI Ice Regime

and Forecasting Department based on satellite imagery of the Russian Antarctic stations over the period 1971-1995 (section IV).

Section V presents a review of total ozone content (TOC) whose measurements are carried out in Mirny Observatory and at Vostok station.

The last Section VI is traditionally devoted to the RAE main events and logistics operations during these months.

Russian Antarctic stations in operation in January-March 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

JANUARY 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	981.5	995.5	956.5	-9.5	-2.8	
Air temperature, °C	-3.1	5.5	-10.9	-1.5	-1.7	
Relative humidity, %	75			4.6	1.0	
Total cloudiness (sky coverage), tenths	7.1			0.1	0.1	
Lower cloudiness(sky coverage),tenths	4.4			1.3	1.0	
Precipitation, mm	14.7			-0.8	-0.1	0.9
Mean wind speed, m/s	8.4	22		0.6	0.5	
Prevailing wind direction, deg	90					
Total radiation, MJ/m^2	840					1.0
Total ozone content, DU	0.286	0.316	0.232			

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
977	53	-3	3,9					
925	482	-5,1	5,4	92	11	93	0	0
850	1141	-8,9	5,2	87	9	84	0	0
700	2622	-16,7	5	82	4	51	0	0
500	5088	-29,7	5,6	288	1	11	0	0
400	6645	-40,1	5,1	269	2	22	0	0
300	8556	-51,2	4,5	271	4	36	0	0
200	11201	-47,8	7,5	272	7	76	0	0
150	13102	-47,2	9,6	267	8	77	0	0

100	15790	-45,8	11,7	266	9	84	0	1
70	18175	-43,5	13,1	264	7	81	0	0
50	20456	-41,1	14,8	263	5	73	1	1
30	23951	-37,2	17	207	1	24	1	1
20	26769	-33,6	19	100	2	55	1	1
10	31700	-26,7	22,1	91	8	95	2	2

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	-67	-2,3	-0,8	-1,0
700	-73	-2,3	-1,2	-1,1
500	-84	-2,0	-0,8	-0,7
400	-91	-1,9	-1,0	-1,1
300	-99	-2,0	-0,7	-0,7
200	-123	-2,2	-2,9	-2,5
150	-150	-2,7	-3,8	-4,5
100	-196	-3,6	-3,6	-3,4
70	-234	-4,0	-2,7	-2,3
50	-245	-4,2	-1,3	-1,2
30	-253	-4,0	0,5	0,5
20	-250	-3,7	1,0	0,7
10	-221	-3,0	1,0	0,4

GEOPHYSICS

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*86°27.2'W*
Horizontal component	*13999 nT*
Vertical component	*-57560 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
02	-86°22.3'	13899	-57496	-88°02.8'	13202	-58799
08	-86°12.0'	13905	-57500	-87°58.7'	13223	-58793
14	-86°29.6'	13904	-57494	-88°00.1'	13211	-58798
17	-86°14.8'	13905	-57499	-87°59.5'	13209	-58800
22	-86°06.1'	13895	-57499	-87°59.6'	13204	-58795
28	-86°27.9'	13907	-57504	-88°01.7'	13204	-58803

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
0.4830/0.1176	0.4863	0.4875	27.92/6.915	23.62	27.35

Ionospheric observations

Riometer observations			Vertical sounding		
Date	Type	A_{max} dB	Date	f0F2(00 UT), MHz	f0F2(12 UT), MHz
01	-	0.2	01	4.2	-
02	-	0.2	02	-	-
03	-	0.3	03	4.2	7.3
04	-	0.2	04	6.8	7
05	-	0.2	05	5	-
06	-	0.1	06	6.4	7
07	-	0.1	07	4	6.3
08	-	0.1	08	4	7.2
09	-	0.2	09	5.6	7
10	-	0.3	10	5	-
11	-	0.3	11	4.6	-
12	-	0.3	12	3.5	-
13	-	0.2	13	4.2	-
14	-	0.2	14	4.3	7.2
15	-	0.2	15	4.7	-
16	-	0.3	16	4.8	-
17	-	0.2	17	4.9	-

18	-	0.5	18	4.5	7
19	-	0.4	19	-	7.1
20	-	0.4	20	5	-
21	-	0.3	21	3.8	7.8
22	-	0.3	22	4.6	-
23	-	0.4	23	3.9	-
24	-	0.2	24	4	-
25	-	0.2	25	4	6.2
26	-	0.1	26	4.2	-
27	-	0.3	27	4.1	-
28	AA	0.8	28	-	-
29	AA	0.9	29	5.2	6.5
30	-	0.3	30	7	-
31	-	0.2	31	4.3	-

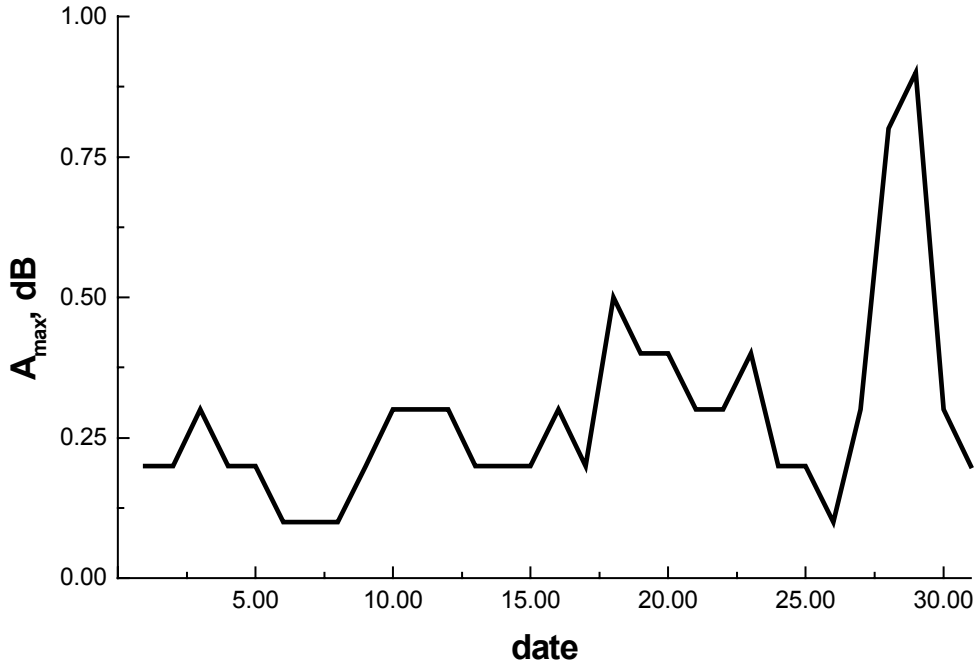

Fig. I.1. The maximum daily values of 32 MHz cosmic radiowave absorption, Mirny station, January 2000

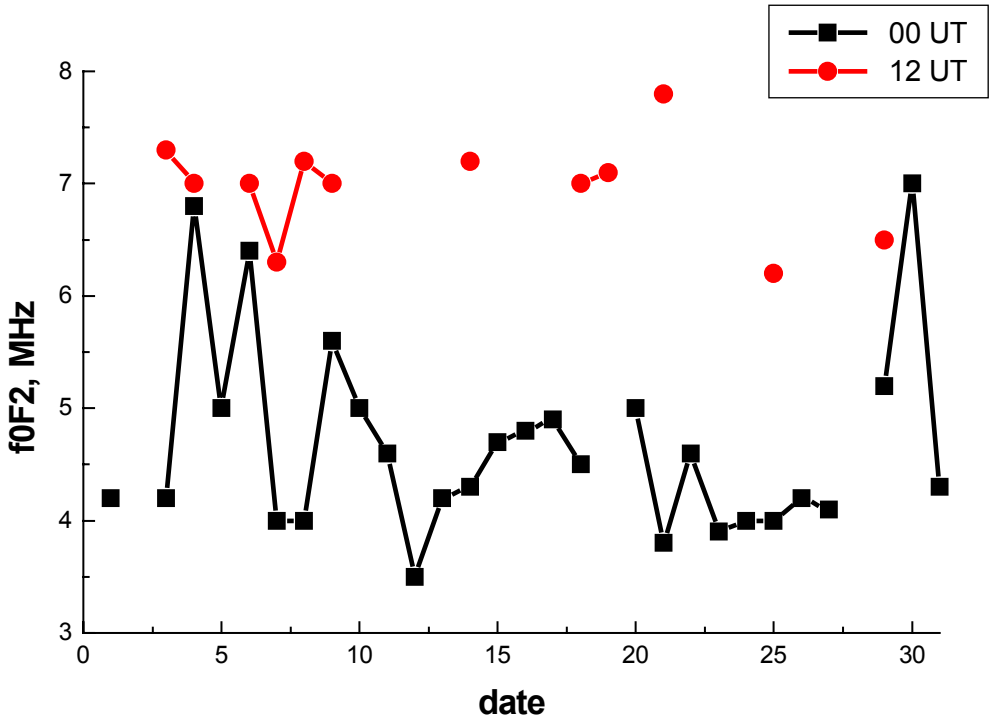

Fig.I.2 The maximum daily values of critical frequency of F2 layer (f0F2), Mirny station, January 2000.

NOVOLAZAREVSKAYA STATION

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	981.7	994.2	971.8	-9.9	-2.7	
Air temperature, °C	-1.8	4.4	-8.9	-1.4	-1.4	
Relative humidity, %	51			-6.1	-1.4	
Total cloudiness (sky coverage), tenths	6.3			0.3	0.3	
Lower cloudiness(sky coverage),tenths	1.2			-0.4	-0.4	
Precipitation, mm	2.7			-0.1	0.0	1.0
Mean wind speed, m/s	7	21		0.4	0.3	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	901					1.1

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
968	122	-2,9	7					
925	486	-4,5	6,5	107	8	97	2	3
850	1147	-9,4	5,6	99	9	93	2	3
700	2617	-19	5,3	95	8	94	2	2
500	5053	-32,9	4,5	169	2	25	2	2
400	6590	-43,2	3,8	227	3	47	2	2
300	8474	-53,8	3,4	240	5	63	2	2
200	11100	-48	6,1	265	5	82	4	4
150	13005	-46,2	8,1	271	6	81	4	4
100	15716	-42,9	10,4	266	7	78	5	6
70	18130	-40,3	12	255	8	88	8	9
50	20428	-37,9	13,7	249	6	80	12	9

30	23966	-34,5	16,2	208	5	72	20	9
20	26817	-32,3	17,8	160	3	56	20	9
10	31330	-20,8	22	142	5	31	17	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	-73	-2,1	-1,1	-1,1
700	-83	-2,2	-1,4	-1,2
500	-104	-2,2	-2,1	-1,5
400	-118	-2,2	-2,3	-1,8
300	-140	-2,4	-2,0	-1,7
200	-172	-2,8	-2,3	-1,8
150	-195	-3,1	-2,2	-2,0
100	-215	-3,4	-0,7	-0,6
70	-219	-2,8	0,3	0,2
50	-227	-3,4	1,2	1,2
30	-212	-3,5	2,7	1,9
20	-171	-2,0	2,7	1,3
10	-554	-6,8	8,5	3,7

BELLINGSHAUSEN STATION

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	981.1	995.9	965.6	-11.8	-4.5	
Air temperature, °C	1.8	6.1	-1.5	0.6	1.0	
Relative humidity, %	87			1.4	0.3	
Total cloudiness (sky coverage), tenths	8.7			-0.5	-1.0	
Lower cloudiness(sky coverage),tenths	6.6			-1.1	-1.4	
Precipitation, mm	35.5			-4.4	-0.3	0.9
Mean wind speed, m/s	6.6	20		0.2	0.3	
Prevailing wind direction, deg	270					
Total radiation, MJ/m^2	725					1.5

VOSTOK STATION

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}
Station surface level pressure, hPa	627.9	636	621.5	-6.7	-1.6	
Air temperature, °C	-33.4	-28.3	-46.7	-1.4	-0.9	
Relative humidity, %	76			3.1	2.1	
Total cloudiness (sky coverage), tenths	4.7			0.8	1.0	
Lower cloudiness(sky coverage),tenths	0.1			-0.3	-0.5	
Precipitation, mm	0.8			-0.1	-0.1	0.9
Mean wind speed, m/s	1.5	12		-3	-3.8	
Prevailing wind direction, deg	202					
Total radiation, MJ/m^2	235					0.0
Total ozone content, DU	0.235	0.261	0.212			

GEOPHYSICS[1]

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*120°39.1'W*
Horizontal component	*13408 nT*
Vertical component	*-58187 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	-120°33.7'	13411	-58320	-122°13.4'	13392	-58183
06	-120°33.9'	13415	-58322	-122°13.4'	13386	-58186
09	-120°33.6'	13410	-58321	-120°14.5'	13332	-58179
13	-120°33.2'	13409	-58324	-120°27.4'	13501	-58178
16	-120°34.7'	13414	-58324	-120°28.2'	13387	-58178
19	-120°31.7'	13416	-58318	-120°25.5'	13506	-58170
21	-120°32.4'	13417	-58321	-120°25.8'	13503	-58172
23	-120°32.5'	13422	-58320	-120°27.8'	13510	-58172
25	-120°33.6'	13418	-58320	-120°28.1'	13507	-58170
31	-120°30.2'	13420	-58319	-120°24.5'	13506	-58171

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
0.386/0.0992	0.386	0.397	0.486/0.2564	0.454	0.472

[1] [1] By the time the Bulleting was issued, data of riometer observations at Vostok for January 2000 were not completely processed and hence they are not published.

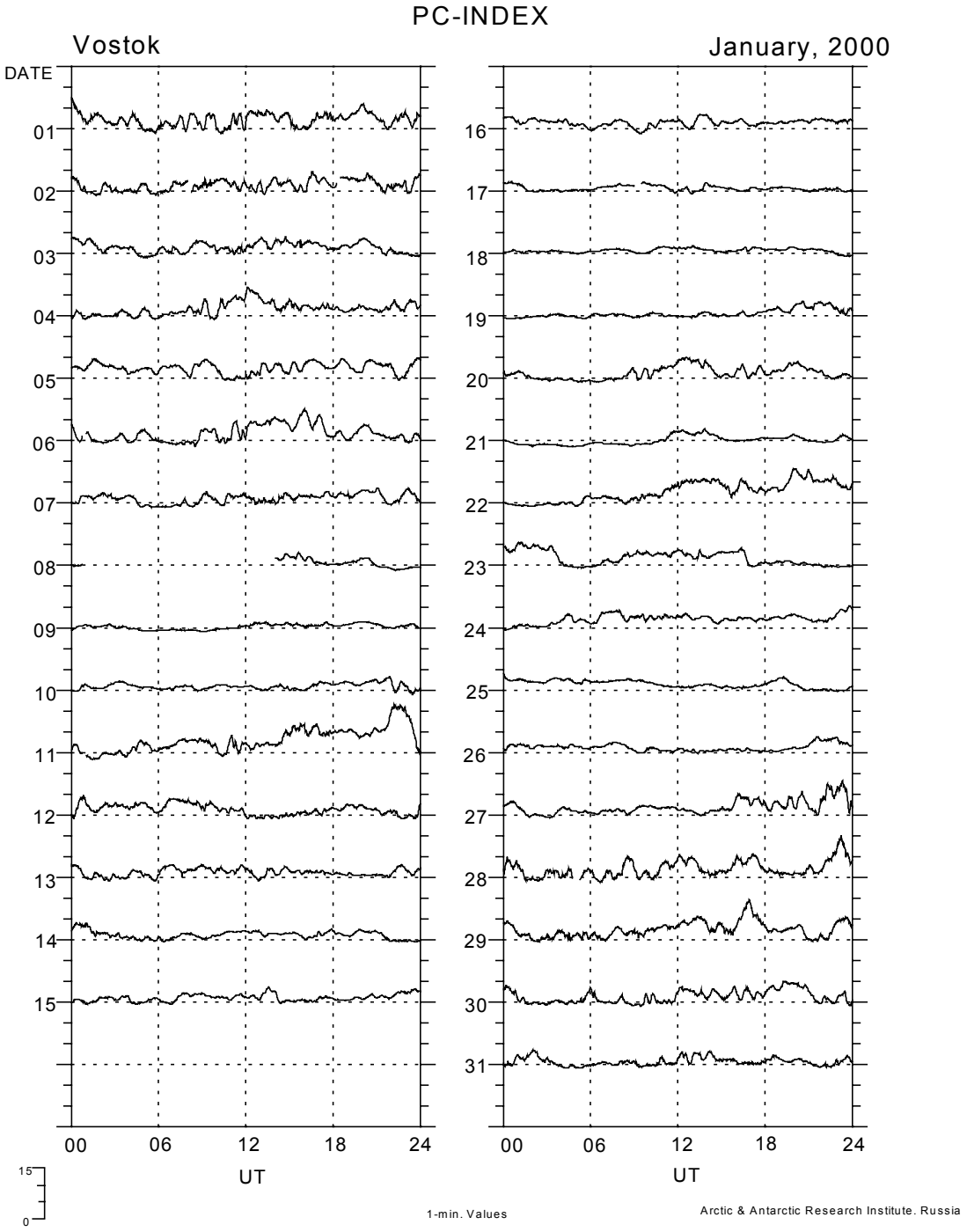
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Fig. I.3.

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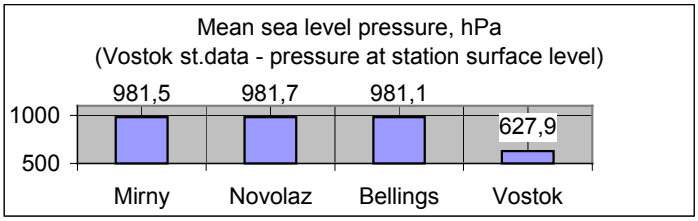
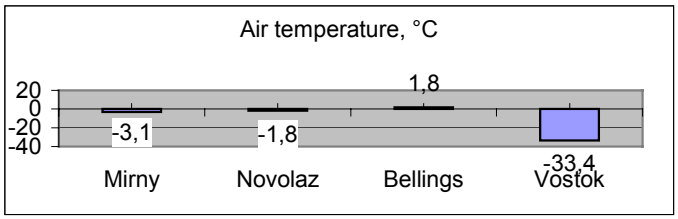
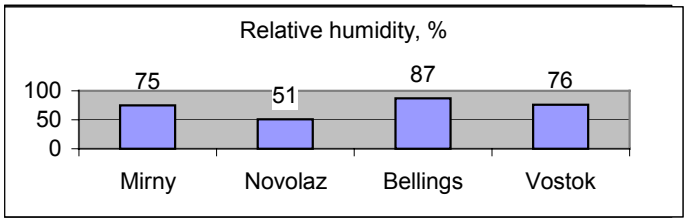


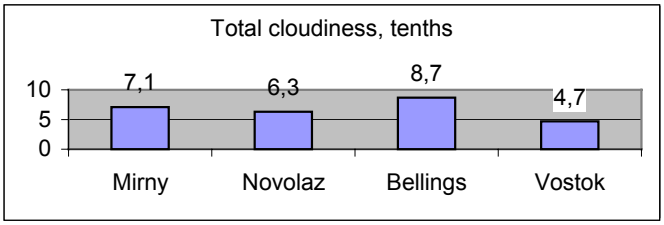
$(f-f_{avg})/\sigma_f$ -2,8 -2,7 -4,5 -1,6



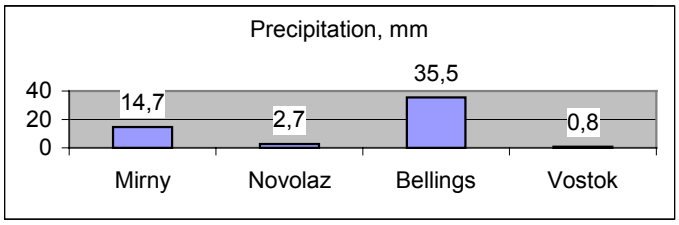
$(f-f_{avg})/\sigma_f$ -1,7 -1,4 1,0 -0,9



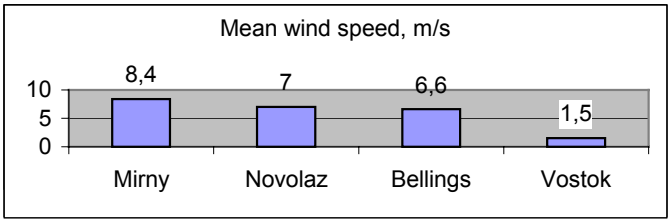
$(f-f_{avg})/\sigma_f$ 1,0 -1,4 0,3 2,1



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



f/f_{avg} 0,9 1,0 0,9 0,9



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

Fig. I.4. Comparison of monthly averages of meteorological parameters at the stations, January 2000

FEBRUARY 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	983.1	995.4	962.9	-5.5	-1.7	
Air temperature, ^{0}C	-5.6	3.9	-14.7	-0.4	-0.4	
Relative humidity, %	70			1.6	0.4	
Total cloudiness (sky coverage), tenths	6.4			-0.3	-0.5	
Lower cloudiness(sky coverage),tenths	3			0	0.0	
Precipitation, mm	8.6			-8.6	-0.5	0.5
Mean wind speed, m/s	9.9	27		0.8	0.7	
Prevailing wind direction, deg	90					
Total radiation, MJ/m^2	549					1.1
Total ozone content, DU	0.293	0.322	0.265			

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
978	53	-5,3	4,9					
925	487	-6,8	6,5	93	10	93	0	0
850	1141	-11,1	5,8	89	9	84	0	0
700	2611	-17,9	6,8	92	4	47	0	0
500	5067	-30,2	6,7	269	2	15	0	0
400	6623	-39,9	5,3	278	3	19	0	0
300	8537	-50,6	4,5	272	4	23	0	0
200	11194	-46,3	7,7	263	9	74	0	0
150	13112	-45,5	10	266	8	80	0	0
100	15818	-44,4	12	262	8	89	0	0
70	18212	-43,3	13,1	265	6	87	0	0

50	20482	-42,4	13,9	267	5	87	0	1
30	23945	-40,8	15,2	286	3	73	0	0
20	26721	-38,5	16,2	298	2	56	0	0
10	31543	-32,8	18,9	70	2	49	2	2

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	-38	-1,4	-0,7	-0,7
700	-46	-1,4	-1,1	-0,9
500	-51	-1,2	0,2	0,1
400	-51	-1,1	0,3	0,2
300	-46	-1,0	0,1	0,1
200	-65	-1,2	-1,5	-1,2
150	-74	-1,4	-1,5	-1,6
100	-92	-1,7	-0,8	-0,8
70	-95	-1,6	-0,4	-0,4
50	-99	-1,7	0,1	0,2
30	-97	-1,5	0,4	0,4
20	-88	-1,3	0,6	0,4
10	-66	-0,8	0,9	0,6

GEOPHYSICS

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*86°33.8'W*
Horizontal component	*13972 nT*
Vertical component	*-57560 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°08.5'	13903	-57496	-88°00.3'	13201	-58794
05	-86°10.5'	13905	-57498	-87°59.2'	13207	-58800
13	-86°52.1'	13930	-57690	-87°58.2'	13194	-58804
20	-86°56.3'	13884	-57814	-87°56.9'	13194	-58809
27	-86°47.4'	13971	-57599	-87°54.5'	13210	-58760
29	-86°49.0'	13922	-57769	-87°56.6'	-	-58792

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
0.4835/0.1175	0.4848	0.4835	27.96/6.911	23.66	27.41

Ionospheric observations

Riometer observations			Vertical sounding		
Date	Type	A_{max} dB	Date	f0F2(00 UT), MHz	f0F2(12 UT), MHz
01	-	0.2	01	3.8	6.8
02	-	0.2	02	4	8.9
03	-	0.2	03	4.3	7
04	-	0.3	04	4.2	7
05	-	0.1	05	4.2	8.5
06	-	0.3	06	4.3	-
07	-	0.4	07	4.3	-
08	-	0.6	08	3.8	-
09	-	0.2	09	4	-
10	-	0.3	10	4	-
11	-	0.5	11	3.5	-
12	-	0.6	12	6.6	-
13	-	0.2	13	-	-
14	-	0.4	14	-	8.4
15	-	0.2	15	3.7	6.5
16	-	0.2	16	4.2	7
17	-	0.3	17	4	7.4
18	AA	2	18	3.4	6.8
19	-	0.5	19	4	9.8

20	-	0.4	20	3.9	9.4
21	AA	0.7	21	5.8	7
22	-	0.2	22	2.5	6.7
23	-	0.1	23	-	8.4
24	-	0.2	24	3.3	-
25	-	0.4	25	-	-
26	AA	0.8	26	2.8	7
27	-	0.1	27	3.9	7
28	-	0.1	28	4.1	5.8
29	-	0.1	29	4	6.2

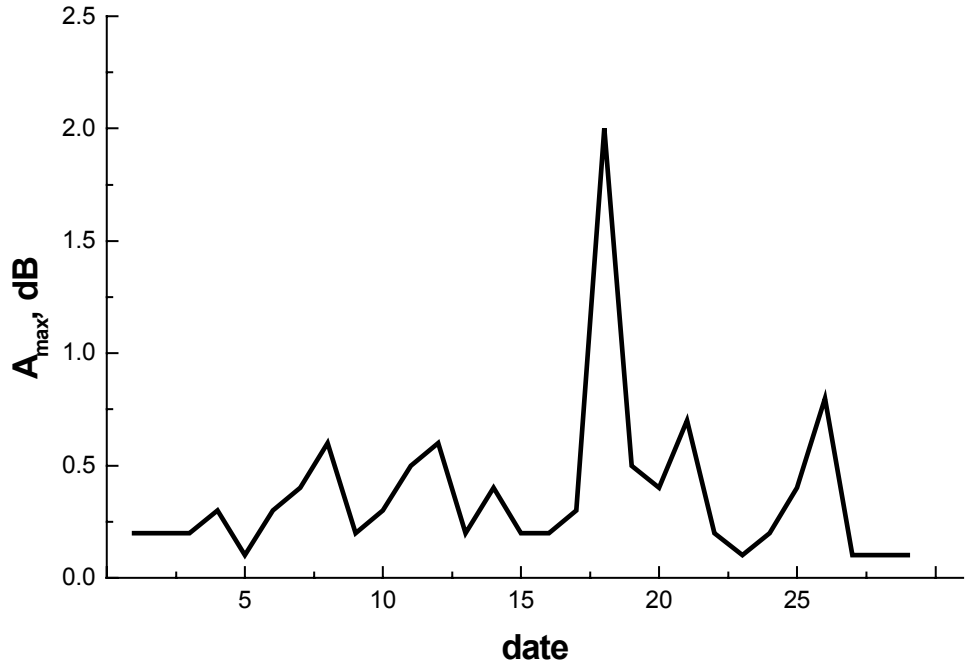


Fig. I.5. The maximum daily values of 32 MHz cosmic radiowave absorption, Mirny station, February 2000

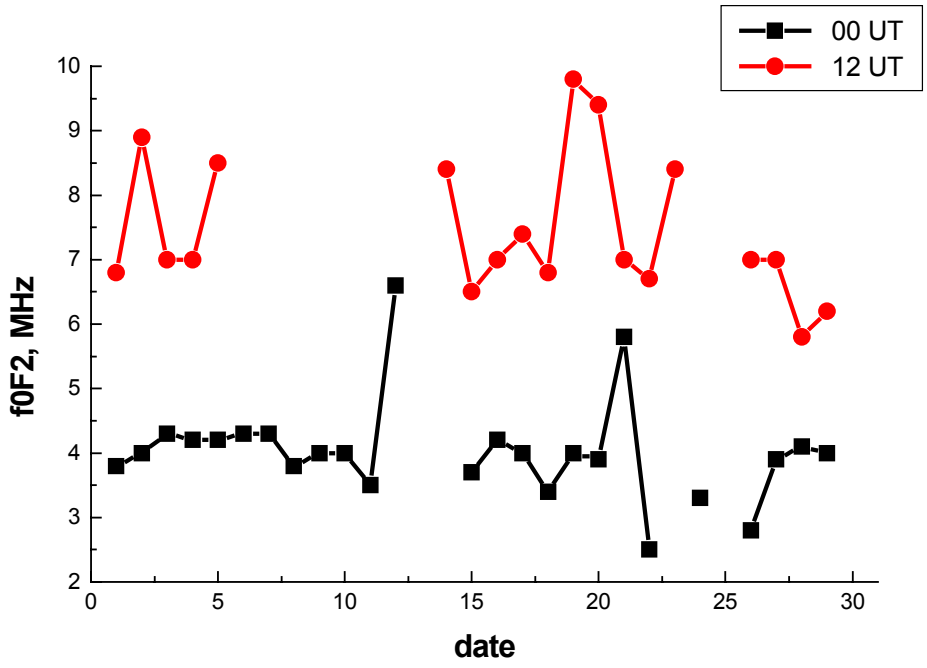


Fig.I.6. The maximum daily values of critical frequency of F2 layer (f0F2), Mirny station, February 2000.

NOVOLAZAREVSKAYA STATION

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	983.7	993.8	967.8	-5.4	-1.2	
Air temperature, ^{0}C	-4.4	3.1	-11.7	-1	-1.1	
Relative humidity, %	45			-4.4	-1.0	
Total cloudiness (sky coverage), tenths	6.3			0	0.0	
Lower cloudiness(sky coverage),tenths	0.8			-0.5	-0.7	
Precipitation, mm	2.4			0.6	0.2	1.3
Mean wind speed, m/s	8.4	31		-0.7	-0.5	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	527					1.1

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	-5,5	8,7					
925	501	-6,7	8,9	113	11	93	0	1
850	1154	-11,4	8,1	99	11	92	0	2
700	2620	-18,8	7,1	100	5	53	0	0
500	5064	-31,9	5,1	237	1	8	0	0
400	6610	-42,2	4,1	265	4	27	0	0
300	8501	-53,6	3,5	274	6	40	0	0
200	11127	-48,2	5,7	246	5	51	0	0
150	13028	-47	7,8	240	5	60	0	0
100	15719	-45,8	9,4	235	4	63	0	0
70	18102	-44,2	10,8	231	3	60	0	0
50	20360	-43,4	11,9	223	2	58	0	1
30	23816	-42,5	13	201	1	35	2	3
20	26573	-40,7	14,1	125	1	25	6	7
10	31391	-34	16,1	102	2	39	13	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	-32	-1,0	-0,7	-0,7
700	-35	-1,1	0,3	0,3
500	-35	-0,9	0,1	0,0
400	-34	-0,8	-0,3	-0,2
300	-44	-0,9	-1,5	-1,3
200	-80	-1,8	-2,9	-2,1
150	-103	-2,4	-2,5	-2,5
100	-130	-2,8	-1,9	-1,9
70	-141	-2,8	-1,0	-1,0
50	-160	-2,9	-0,7	-0,8
30	-159	-2,4	-0,4	-0,3
20	-154	-2,0	-0,4	-0,2
10	-125	-1,6	1,7	0,7

BELLINGSHAUSEN STATION

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	993.2	1010.8	978.8	3.5	1.3	
Air temperature, ^{0}C	1.9	6.6	-1.9	0.5	0.7	
Relative humidity, %	90			2.1	0.6	
Total cloudiness (sky coverage), tenths	8.7			-0.4	-0.7	
Lower cloudiness(sky coverage),tenths	7.3			-0.5	-0.6	
Precipitation, mm	40.9			-26.2	-1.3	0.6
Mean wind speed, m/s	6	20		-0.9	-1.8	
Prevailing wind direction, deg	270					
Total radiation, MJ/m^2	433					1.4

VOSTOK STATION

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}
Station surface level pressure, hPa	623.9	640	610.7	-5.8	-1.4	
Air temperature, ^0C	-45.1	-27.9	-60.5	-0.7	-0.4	
Relative humidity, %	78			6.3	3.9	
Total cloudiness (sky coverage), tenths	3.6			0	0.0	
Lower cloudiness(sky coverage),tenths	0			0	0.0	
Precipitation, mm	0.8			0	0.0	1.0
Mean wind speed, m/s	1.9	16		-3.1	-3.4	
Prevailing wind direction, deg	225					
Total radiation, MJ/m^2	633					0.0
Total ozone content, DU	0.265	0.321	0.224			

GEOPHYSICS

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*120°32.9'W*
Horizontal component	*13391 нТ*
Vertical component	*-58196 нТ*

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
08	-120°29.1'	13420	-58323	-120°24.5'	13504	-58171
13	-120°30.0'	13419	-58324	-120°25.6'	13501	-58171
19	-120°29.7'	13417	-58322	-120°24.2'	13503	-58170
25	-120°29.8'	13417	-58322	-120°25.9'	13499	-58170

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
-	-	-	0.486/0.2567	0.455	0.472

Ionospheric observations

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

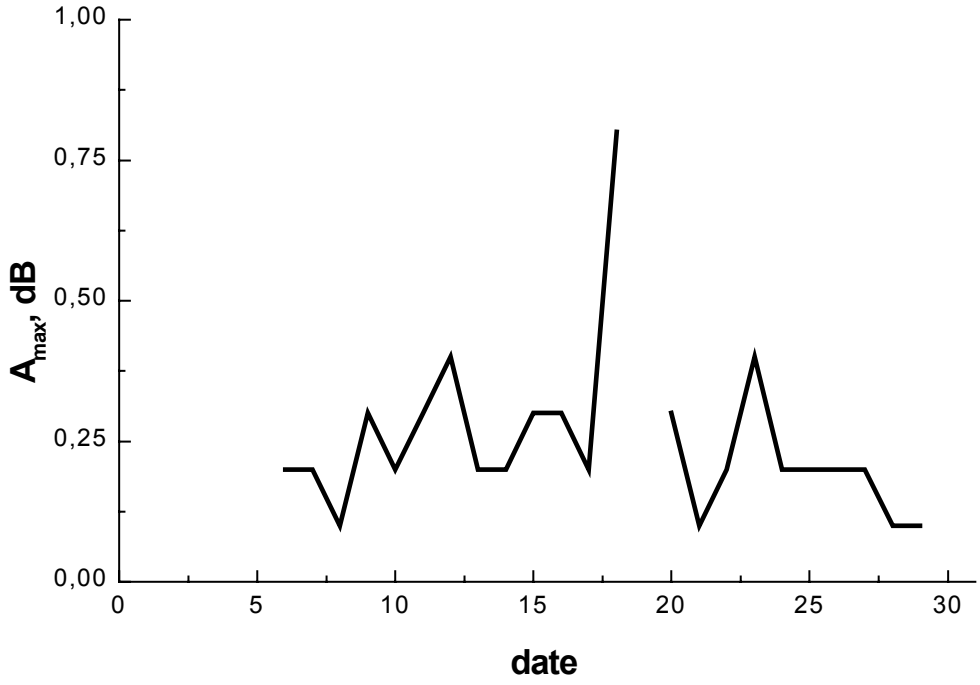
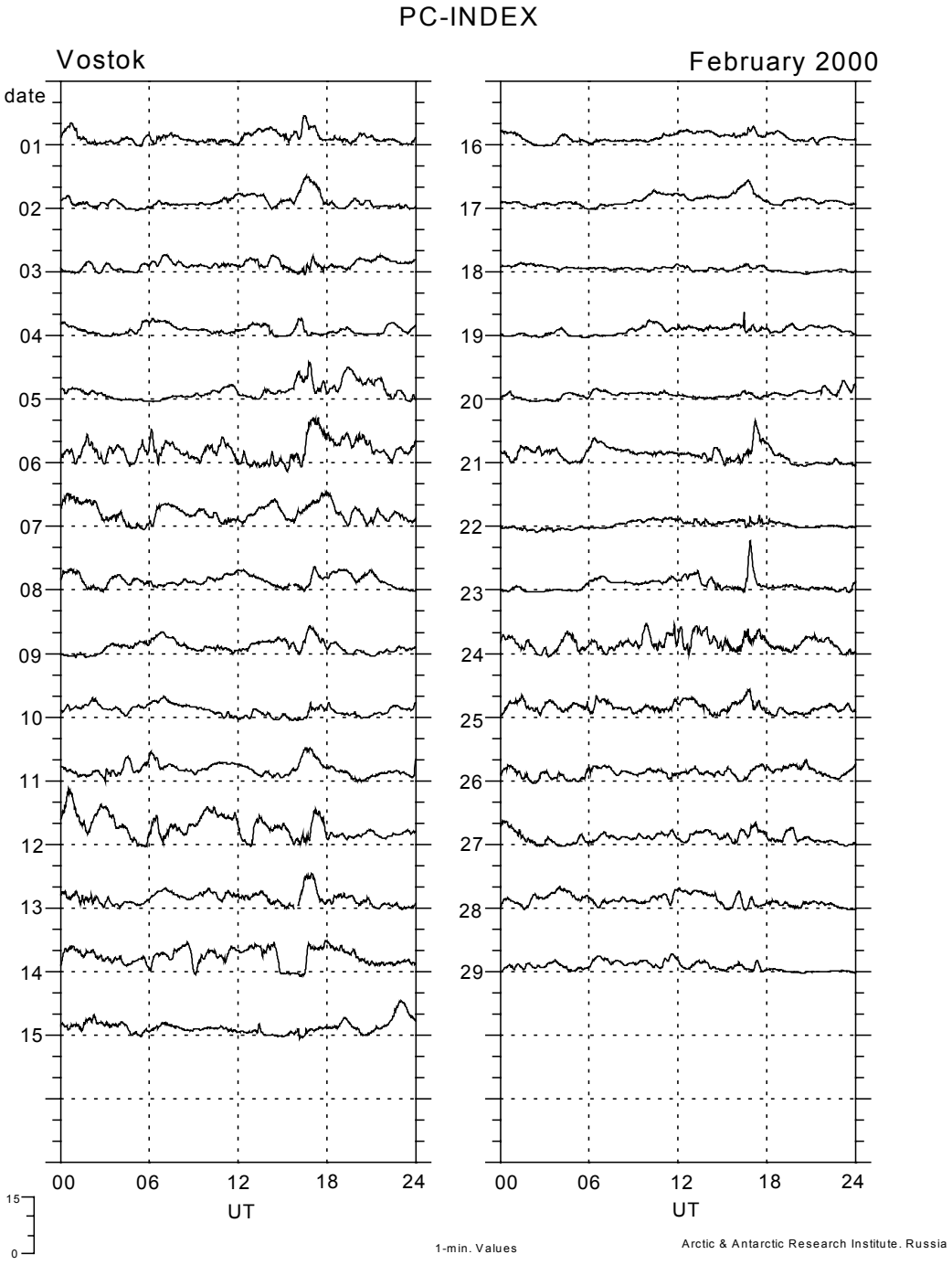


Fig. I.7. The maximum daily values of 32 MHz cosmic radiowave absorption, Vostok station, February 2000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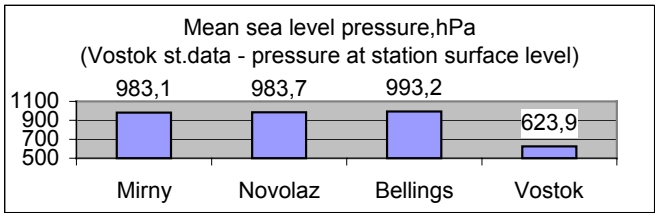
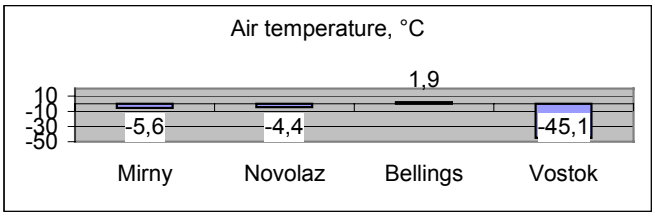
Arctic & Antarctic Research Institute. Russia

Fig. I.8.

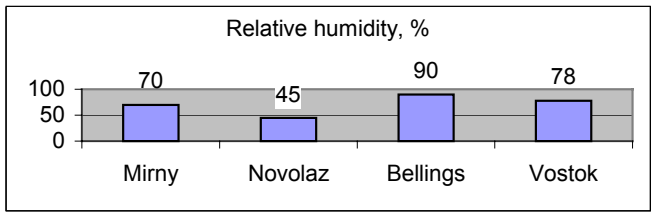
February 2000



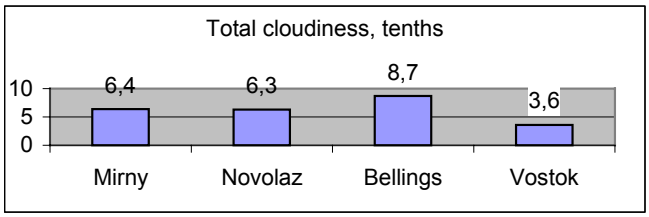
$(f-f_{avg})/\sigma_f$ -1,7 -1,2 1,3 -1,4



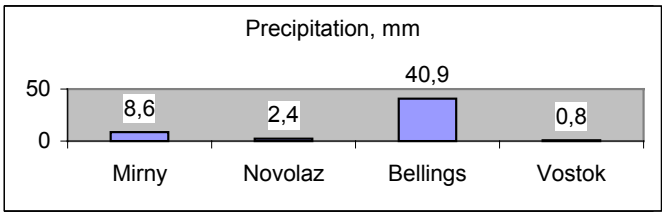
$(f-f_{avg})/\sigma_f$ -0,4 -1,1 0,7 -0,4



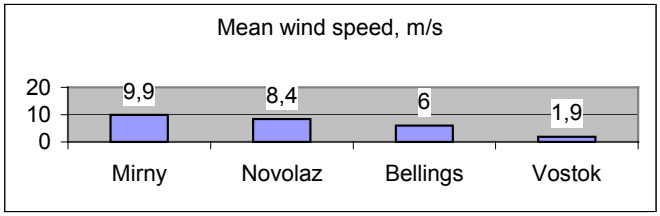
$(f-f_{avg})/\sigma_f$ 0,4 -1,0 0,6 3,9



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



f/f_{avg} 0,5 1,3 0,6 1,0



$(f-f_{avg})/\sigma_f$ 0,7 -0,5 -1,8 -3,4

Fig. I.9. Comparison of monthly averages of meteorological parameters at the stations, February 2000

MARCH 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	986.8	1000.7	964.8	-0.1	0.0	
Air temperature, ^{0}C	-11.3	-2	-17.7	-1.2	-0.8	
Relative humidity, %	68			-1.6	-0.3	
Total cloudiness (sky coverage), tenths	5.8			-0.9	-1.0	
Lower cloudiness(sky coverage),tenths	3.1			0.3	0.3	
Precipitation, mm	56.8			27.2	0.9	1.9
Mean wind speed, m/s	11.1	34		0.1	0.1	
Prevailing wind direction, deg	158					
Total radiation, MJ/m^2	322					1.1
Total ozone content, DU	0.3	0.342	0.277			

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
982	53	-12,1	4,8					
925	514	-11,6	6,5	91	9	90	1	1
850	1157	-14,6	6,5	95	7	82	1	1
700	2617	-19,5	7	116	0	5	1	1
500	5053	-32,5	5,4	267	4	45	1	1
400	6592	-42,7	4,3	268	7	55	1	1
300	8481	-54	3,7	267	11	66	1	1
200	11080	-50,7	5,6	269	12	90	1	1
150	12965	-49,5	7,4	270	12	95	2	2

100	15617	-49,5	9,1	272	11	97	3	3
70	17952	-49	10,2	275	11	98	3	3
50	20162	-48,6	10,8	276	12	99	3	3
30	23522	-47,8	11,7	282	13	98	4	4
20	26206	-45,3	12,7	284	15	97	4	5
10	30915	-39,5	15,8	278	17	96	13	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	12	0,4	-0,9	-0,8
700	8	0,2	-0,4	-0,5
500	4	0,1	0,1	0,1
400	6	0,1	-0,5	-0,4
300	-4	-0,1	-2,1	-1,6
200	-66	-1,2	-4,0	-3,4
150	-90	-1,6	-3,0	-3,6
100	-123	-2,0	-2,5	-2,9
70	-149	-2,1	-1,7	-1,8
50	-162	-2,5	-0,8	-0,8
30	-166	-2,1	-0,2	-0,2
20	-159	-1,5	1,2	0,7
10	-117	-1,1	2,4	1,2

GEOPHYSICS

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination	*86°37.5'W*
Horizontal component	*13975 nT*
Vertical component	*-57511 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°50.9'	13936	-57601	-88°03.0'	13194	-58799
10	-86°54.0'	13970	-57601	-87°58.9'	13200	-58785
14	-86°46.7'	13952	-57634	-88°00.6'	13197	-58793
20	-86°56.1'	13939	-57592	-88°00.6'	13198	-58791
24	-86°52.6'	13917	-57578	-88°00.4'	13202	-58789
28	-86°48.4'	13880	-57587	-88°04.3'	13191	-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
0.4849/0.1183	0.4822	0.4851	27.92/6.915	23.70	27.43

Ionospheric observations

Riometer observations			Vertical sounding		
Date	Type	A_{max} dB	Date	f0F2(00 UT), MHz	f0F2(12 UT), MHz
01	-	0.2	01	4.8	6.5
02	-	0.2	02	4.7	7
03	-	0.2	03	4	8.7
04	-	0.2	04	-	9.3
05	-	0.3	05	4.4	-
06	-	0.2	06	4.3	-
07	-	0.2	07	4.7	-
08	-	0.4	08	4.5	7.2
09	-	0.2	09	4.5	-
10	-	0.4	10	-	-
11	-	0.3	11	-	-
12	-	0.4	12	-	-
13	-	0.2	13	-	-
14	-	0.2	14	4.3	7.5
15	-	0.3	15	4.9	6.7
16	-	0.4	16	4.2	6.2
17	-	0.4	17	4.2	7
18	AA	0.4	18	2.8	8.9
19	-	0.3	19	4.2	-
20	-	0.3	20	4.2	8.3
21	AA	0.3	21	4.1	9
22	-	0.3	22	4.3	9

23	-	0.4	23	-	-
24	-	0.4	24	4.3	7.2
25	-	0.5	25	3	7.2
26	AA	0.3	26	-	-
27	-	0.5	27	-	-
28	-	0.4	28	4.8	-
29	AA	1	29	4.2	9
30	-	0.5	30	4.5	9
31	-	0.8	31	4.5	8.5

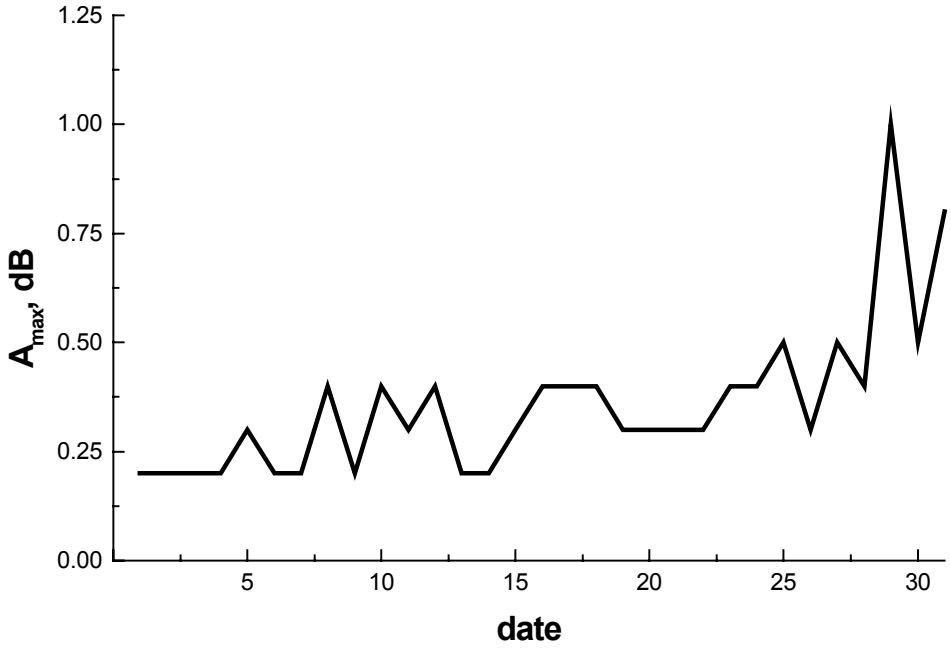


Fig. I.10. The maximum daily values of 32 MHz cosmic radiowave absorption, Mirny station, March 2000

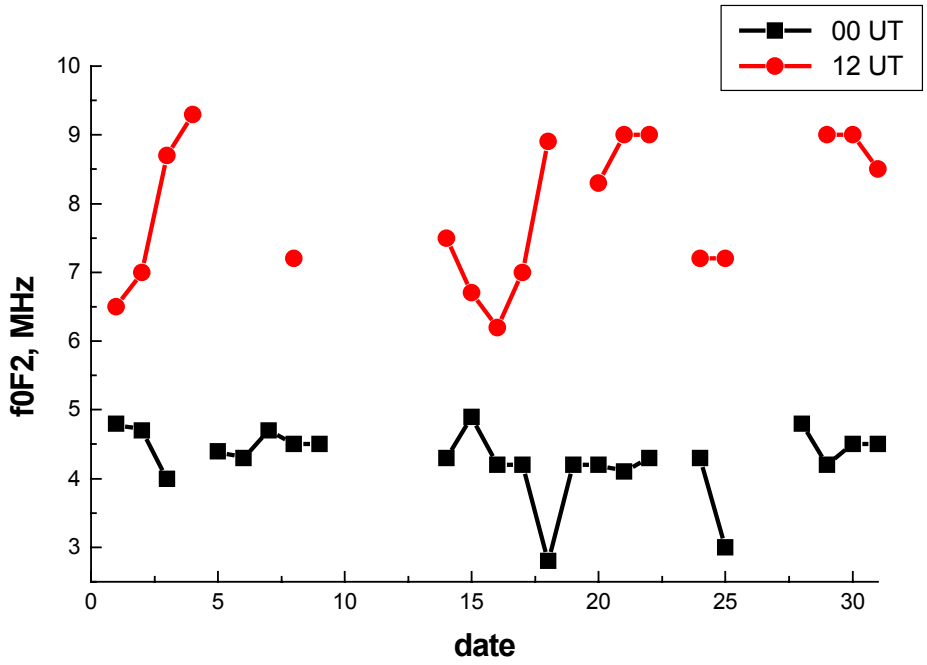


Fig.I.11. The maximum daily values of critical frequency of F2 layer (f0F2), Mirny station, March 2000.

NOVOLAZAREVSKAYA STATION

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	986.3	998.2	974.6	0.1	0.0	
Air temperature, ^{0}C	-11.4	-4.4	-18.9	-3.6	-3.3	
Relative humidity, %	47			-2.2	-0.5	
Total cloudiness (sky coverage), tenths	6.3			0	0.0	
Lower cloudiness(sky coverage),tenths	2.1			0.4	0.3	
Precipitation, mm	8.1			-0.8	0.0	0.9
Mean wind speed, m/s	9.9	27		-0.7	-0.5	
Prevailing wind direction, deg	135					
Total radiation, MJ/m^2	265					1.1

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
972	122	-11,2	8,7					
925	510	-12,8	8,3	109	13	98	0	1
850	1150	-17,2	6,6	96	12	93	0	0
700	2584	-24,5	4,9	100	4	49	0	0
500	4970	-37,5	4,9	258	4	45	0	0
400	6481	-46,9	4,6	260	8	60	0	0
300	8349	-53,1	4,1	257	10	66	0	0
200	11001	-47,6	6,9	231	9	85	0	0
150	12895	-48,4	8,3	226	9	87	1	1
100	15554	-49,9	9,5	223	9	92	1	1
70	17880	-50,7	10	221	9	92	1	1
50	20061	-51,8	10,5	225	8	94	1	1
30	23369	-52,5	11	226	7	93	3	3
20	25986	-52,2	11,5	242	7	93	3	3
10	30548	-46,9	13,2	278	8	94	12	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	-4	-0,1	-3,9	-3,7
700	-30	-0,9	-4,0	-3,5
500	-69	-1,5	-3,6	-2,1
400	-90	-1,6	-3,3	-2,0
300	-109	-1,7	0,4	0,4
200	-92	-1,5	0,5	0,4
150	-96	-1,5	-0,6	-0,8
100	-109	-1,8	-1,5	-1,4
70	-129	-2,0	-1,5	-1,3
50	-153	-2,3	-1,9	-1,4
30	-162	-1,5	-1,5	-0,6
20	-222	-2,2	-2,7	-1,1

10	-218	-1,1	-0,2	0,0

BELLINGSHAUSEN STATION

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	1001.8	1017.9	980.9	10.9	2.7	
Air temperature, ^{0}C	0.8	6.1	-4.3	0.5	0.6	
Relative humidity, %	91			3.7	1.1	
Total cloudiness (sky coverage), tenths	8.6			-0.4	-1.3	
Lower cloudiness(sky coverage),tenths	7.4			-0.4	-0.5	
Precipitation, mm	63.6			-8.6	-0.3	0.9
Mean wind speed, m/s	7.7	31		0.6	0.9	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	278					1.4

VOSTOK STATION

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}
Station surface level pressure, hPa	622	632.3	613.7	-3	-0.8	
Air temperature, ^{0}C	-60.7	-42.5	-72	-2.6	-1.2	
Relative humidity, %	31			-38.2	-17.4	
Total cloudiness (sky coverage), tenths	4.3			0.7	0.7	
Lower cloudiness(sky coverage),tenths	0			-0.1	-0.5	
Precipitation, mm	0.7			-1.5	-0.6	0.3
Mean wind speed, m/s	1.8	13		-3.7	-4.1	

Prevailing wind direction, deg	225					
Total radiation, MJ/m^2	251					0.0
Total ozone content, DU	0.222	0.285	0.184			

GEOPHYSICS

Geomagnetic observations

Mean monthly absolute geomagnetic field values

Declination *120°42.8'W*

Horizontal component *13447 nT*

Vertical component *-58208 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	-120°29.1'	13415	-58322	-120°23.6'	13500	-58168
09	-120°29.1'	13416	-58322	-120°23.9'	13500	-58168
14	-120°28.7'	13418	-58318	-120°24.0'	13502	-58163
20	-120°29.8'	13418	-58321	-120°24.4'	13504	-58168
27	-120°28.8'	13416	-58321	-120°24.1'	13504	-58168
31	-120°28.8'	13417	-58317	-120°22.6'	13510	-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
-	-	-	0.4863/0.2567	0.4547	0.4720

Ionospheric observations

Riometer observation					
date	type	A_{max}, dB	date	type	A_{max}, dB
01	-	0.5	16	AA	0.6
02	-	0.4	17	AA	0.5
03	-	0.5	18	-	0.4
04	-	0.5	19	-	0.2
05	-	0.5	20	-	0.4
06	-	0.4	21	-	0.3
07	-	0.3	22	-	0.4

08	-	0.3	23	-	0.4
09	-	0.4	24	-	0.3
10	-	0.4	25	-	0.3
11	-	0.2	26	-	0.3
12	-	0.2	27	-	0.4
13	-	0.2	28	-	0.5
14	-	0.5	29	-	0.5
15	-	0.3	30	-	0.5
			31	-	0.4

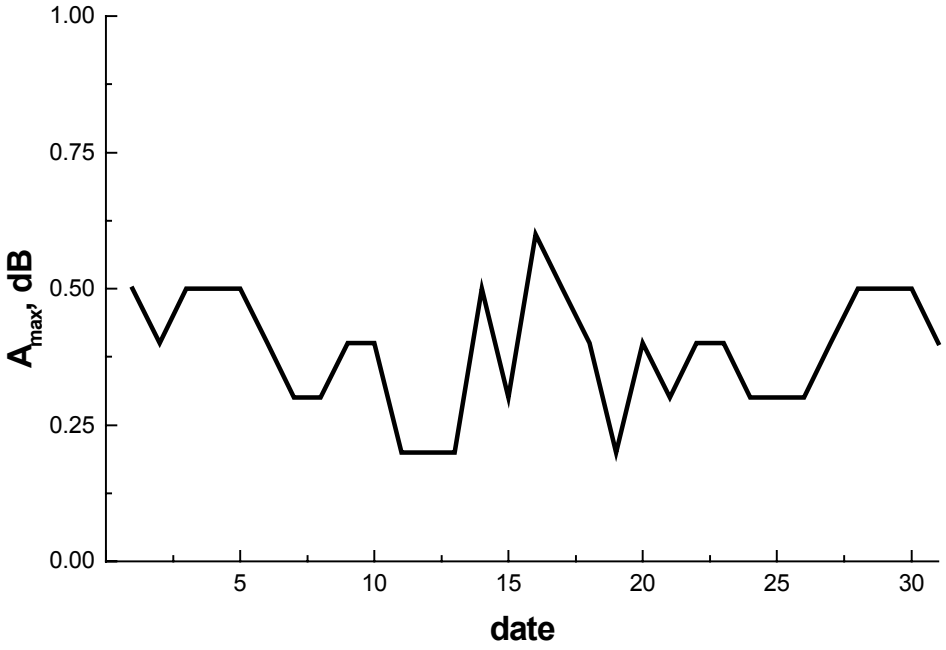
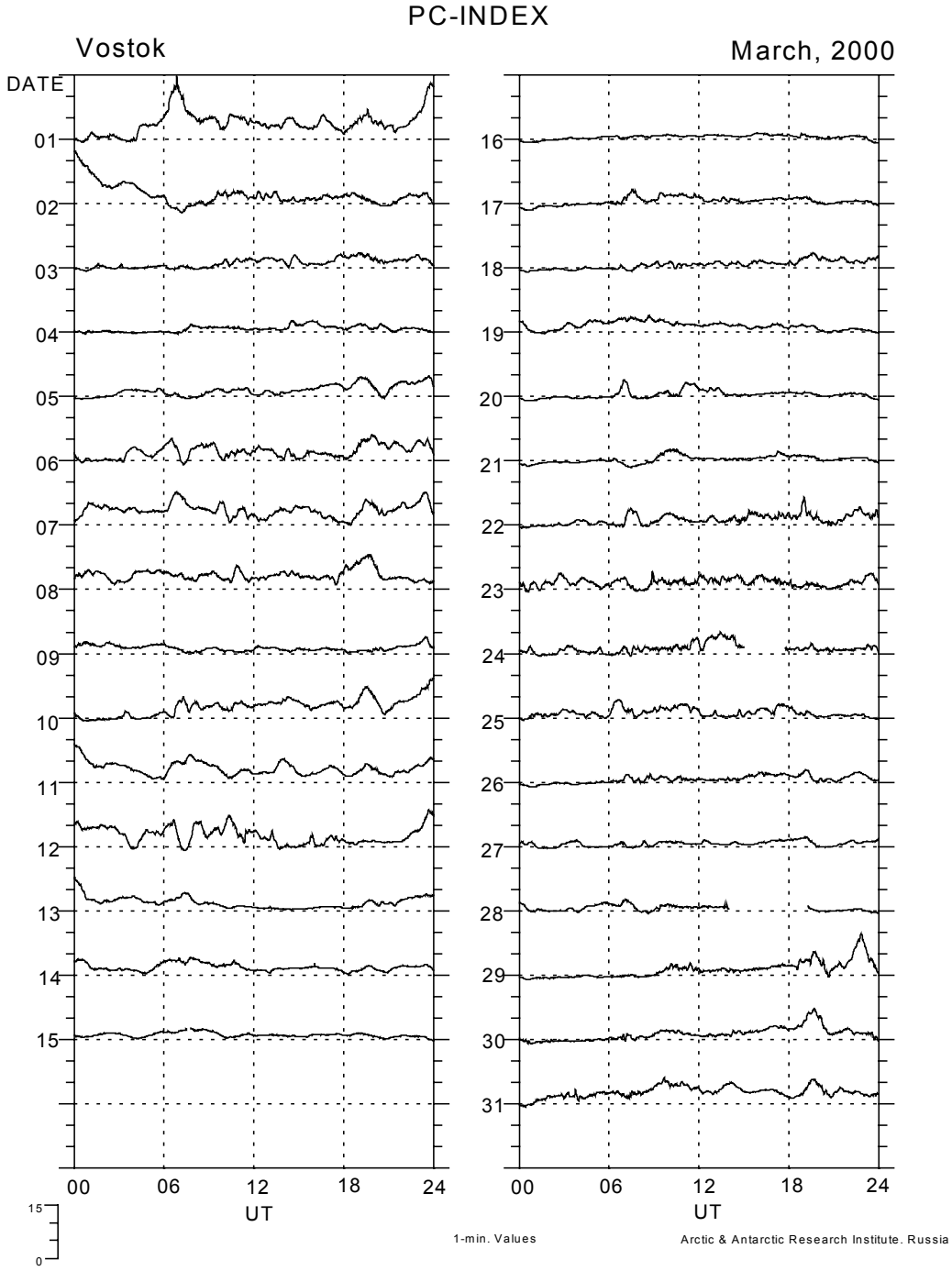


Fig. I.12. The maximum daily values of 32 MHz cosmic radiowave absorption, Vostok station, March 2000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Vostok
March, 2000
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Arctic & Antarctic Research Institute. Russia

Fig. I.13.

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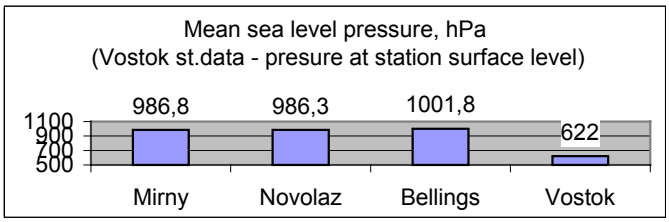
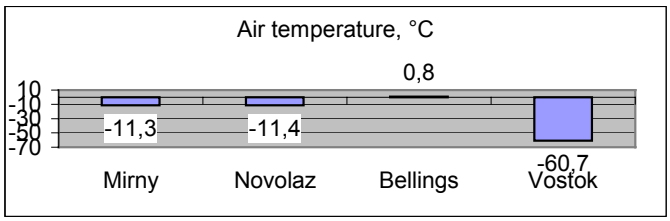
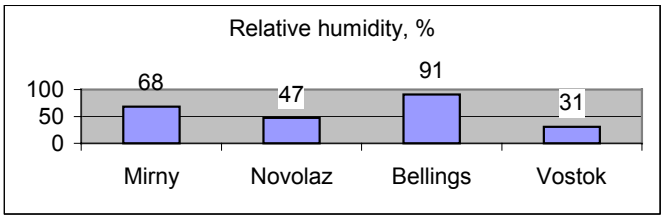


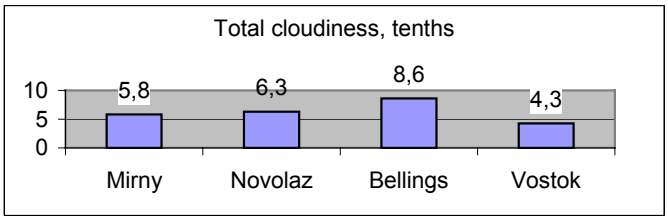
$(f-f_{avg})/\sigma_f$ 0,0 0,0 2,7 -0,8



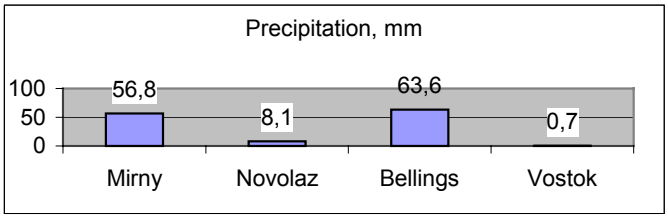
$(f-f_{avg})/\sigma_f$ -0,8 -3,3 0,6 -1,2



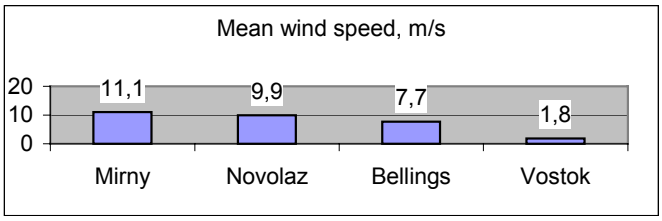
$(f-f_{avg})/\sigma_f$ -0,3 -0,5 1,1 -17,4 *



$(f-f_{avg})/\sigma_f$ -1,0 0,0 -1,3 0,7



f/f_{avg} 1,9 0,9 0,9 0,3



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

Fig. I.14. Comparison of monthly averages of meteorological parameters at the stations, March 2000

II. ANOMALOUS METEOROLOGICAL CONDITIONS AT THE RUSSIAN ANTARCTIC STATIONS IN JANUARY-MARCH 2000

During the first quarter of 2000, including the second half of the austral summer (January) and autumn (February-March), the center of the below zero air temperature anomalies in East Antarctica was preserved. Its core in January was located near Mirny. The temperature anomaly at the station comprised -1.5° C (1.7σ). A series of the below zero temperature anomalies has been observed at Mirny station in January since 1996.

In February, the intensity of the cold center slightly decreased and its core shifted towards the Weddell Sea coast. The monthly temperature averages during this month at the Russian stations were predominantly close to multiyear averages for this period being not greater than 0.3 – 0.7 σ. Only at the Novolazarevskaya station, the anomaly was -1.0° C (1.2σ).

In March, a new cold center intensification was observed in East Antarctica. The anomaly at the core of the center at Novolazarevskaya comprised -3.6° C (3.4 σ). Such a large cold anomaly at the Novolazarevskaya station in March was recorded for the first time over the entire observation period from 1961. The cold anomaly in the Polar Plateau area at the Vostok station was -2.6°C (1.2σ).

A small heat center was observed in January-March in the Antarctic Peninsula area. The air temperature anomaly at Bellingshausen station in these months was 0.6°C in January and 0.5°C in February and March.

An assessment of the tendencies of long-period changes of mean monthly temperature in these months reveals that the process of warming continued to develop in the coastal regions of West Antarctica being most pronounced in the Atlantic sector and in the Antarctic peninsula area (Figs. II.1–II.3). Warming in January at the Bellingshausen station comprised 1.3° C for the period from 1968. In March, on Queen Maude Land (Novolazarevskaya station), the temperature increase comprised 0.9°C for the period from 1961. In East Antarctica in the vicinity of Mirny station, a source of long-period temperature decrease remained (a temperature decrease from 1957 comprised 1.0° C for January and 0.6°C for March). At the inland Vostok station, the temperature trend in these months was not statistically significant.

In respect of the atmospheric pressure, the negative anomalies were predominant in January. An extensive low pressure center also covered the Polar Plateau area. The largest pressure decrease was noted in January in the vicinity of the Antarctic Peninsula (Bellingshausen station) where the anomaly comprised -11.8 hPa (4.5 σ). Such a significant negative anomaly was recorded in January for the first time over the entire observation period. New monthly averages of the atmospheric pressure minimums were also recorded in January at Novolazarevskaya and Mirny. The pressure anomalies at these stations comprised around -10 hPa (3σ).

In February, a decrease of the center of negative pressure anomalies was observed. The core of the center moved to the Polar Plateau area. At Vostok, a negative pressure anomaly comprised -5.8 hPa (1.4σ). In West Antarctica, near the Weddell Sea and the Antarctic Peninsula, a center of positive pressure anomalies formed in February. An anomaly of 3.5 hPa (1.3σ) was observed in the vicinity of the Bellingshausen station. In March, the center of positive anomalies has become stronger with the anomaly at Bellingshausen comprising 10.9 hPa (2.7σ), which was recorded for the first time over the entire observation period. At the rest of the Russian Antarctic stations, the atmospheric pressure in March was close to the multiyear average for this period. The atmospheric pressure trend at the Russian stations for these months continued to preserve a negative sign throughout the entire observation period. The only exception was a positive trend at the Bellingshausen station in February and at the Vostok station in March.

The amount of precipitation in January-March at the Russian stations was predominantly close to the multiyear average for this period. Only in March, some deviations were observed in the coastal area of East Antarctica and on Polar Plateau. Thus, abundant precipitation twice as large as the monthly multiyear average was observed in the vicinity of Mirny whereas at Vostok, the precipitation was significantly less compared to the multiyear average for this period (around 30%).

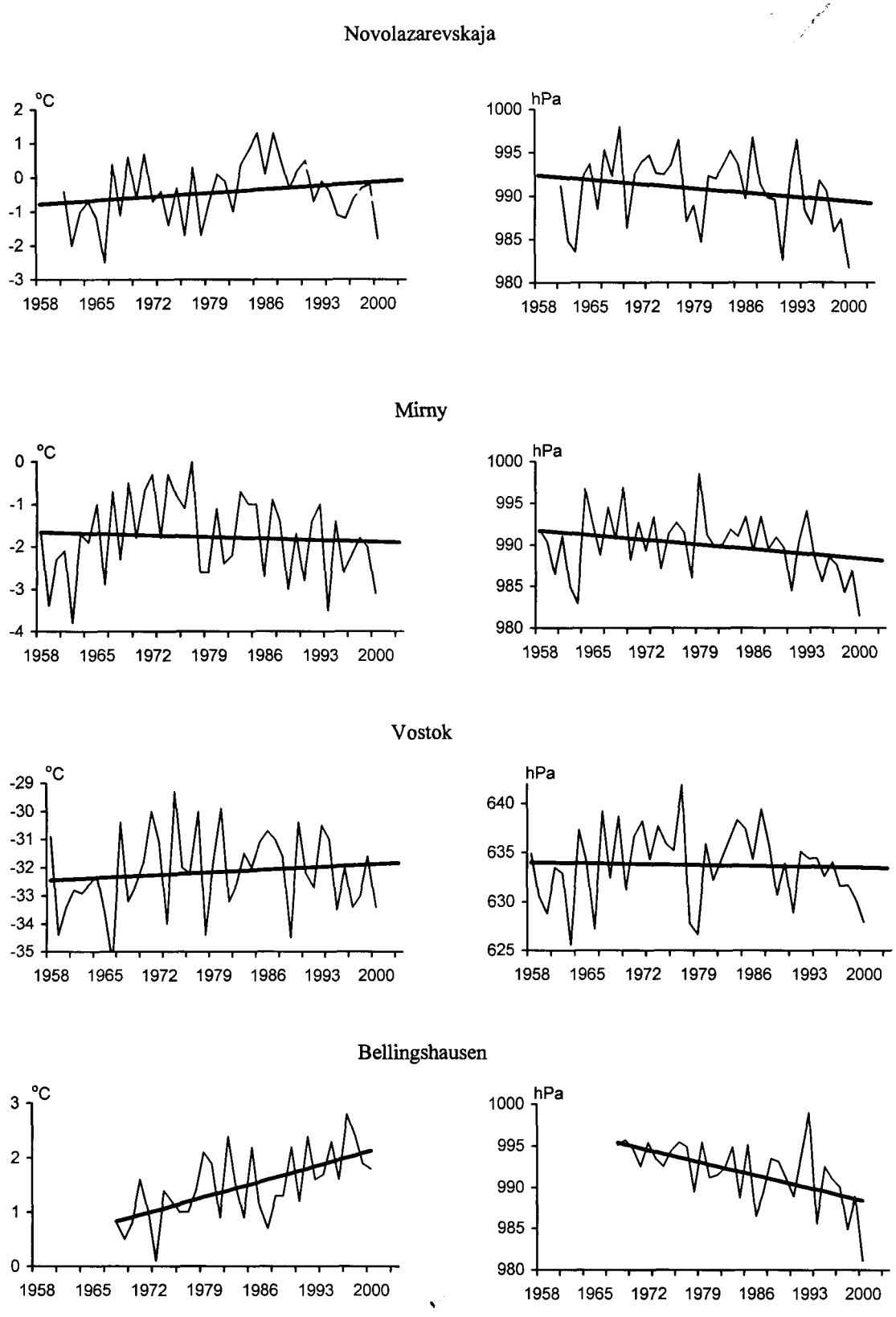


Fig.II.1. Variations of mean monthly air temperature and atmospheric pressure at the Russian Antarctic stations, January.

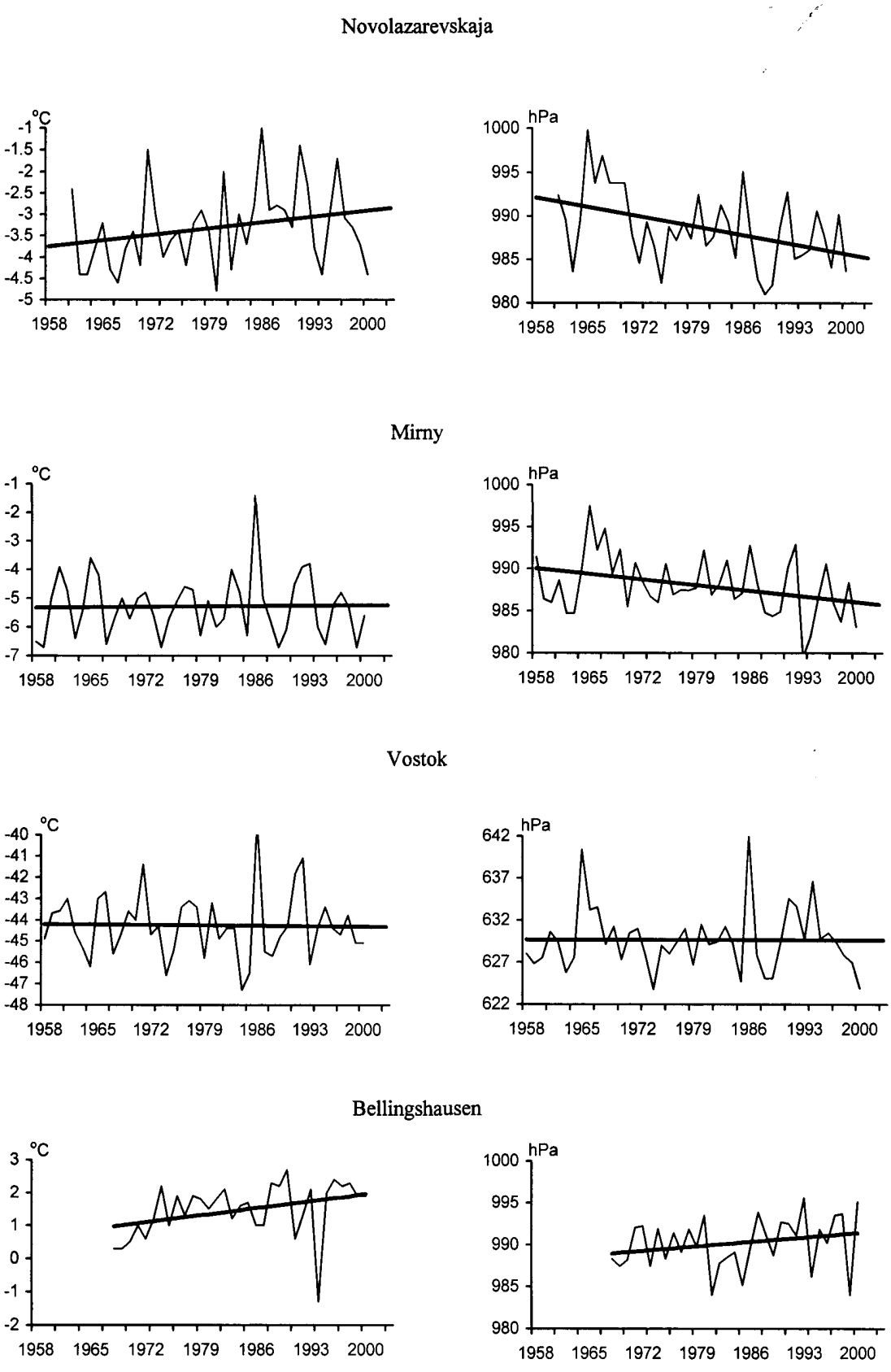


Fig.II.2. Variations of mean monthly air temperature and atmospheric pressure at the Russian Antarctic stations, February.

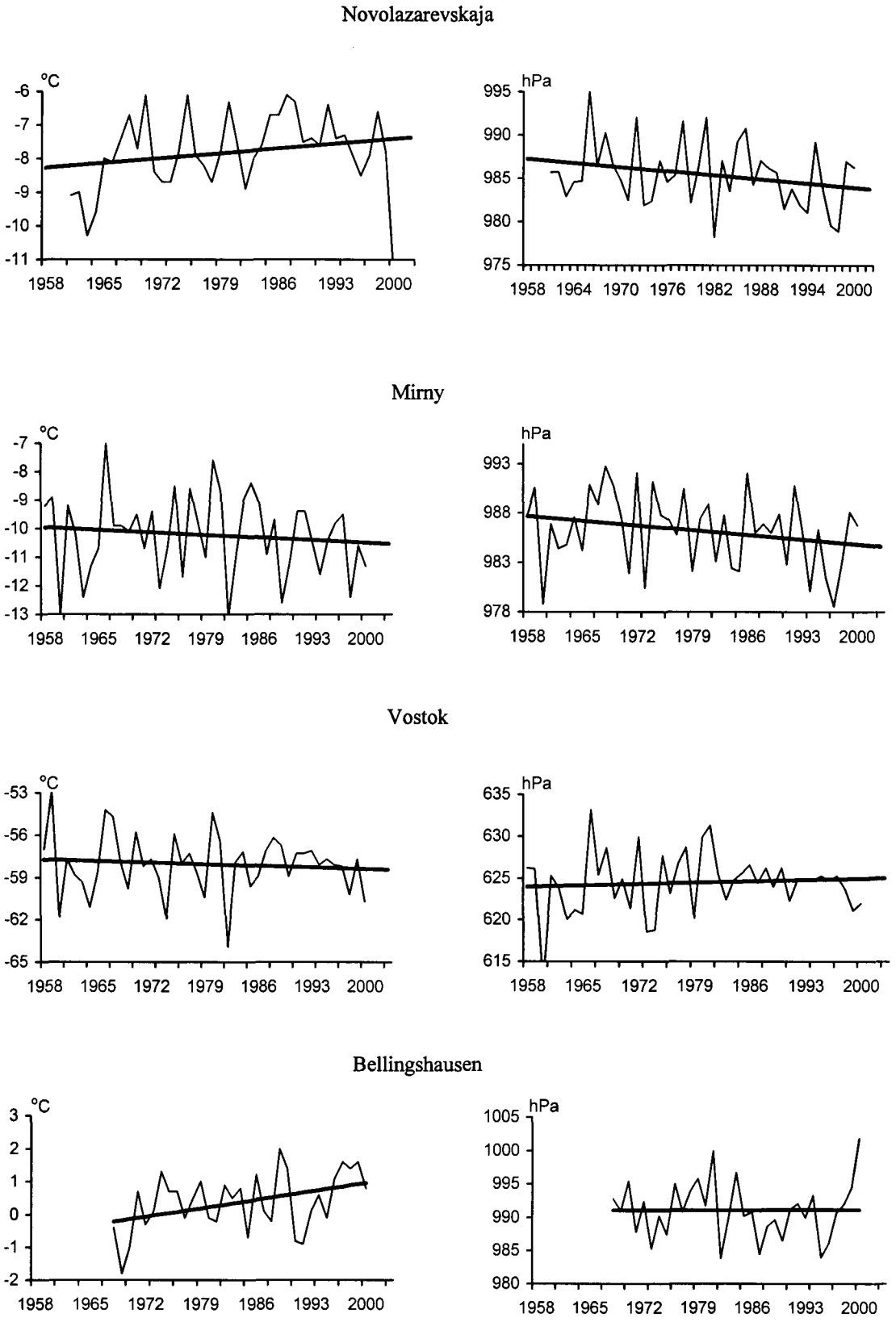


Fig.II.3. Variations of mean monthly air temperature and atmospheric pressure at the Russian Antarctic stations, March.

III. REVIEW OF THE ATMOSPHERIC PROCESSES ABOVE THE ANTARCTIC IN JANUARY-MARCH 2000

An analysis of the atmospheric processes in high and temperate latitudes of the Southern Hemisphere reveals that the increased activity of zonal circulation (Z-form) recorded during much of 1999 was also observed in January 2000. The frequency of occurrence of these processes was 19 days, which is 6 days greater than the multiyear average for this period (see Table III.1).

Table III.1

Frequency of occurrence of the atmospheric circulation forms in the Southern Hemisphere and their anomalies in January-March 2000

Month	Frequency of occurrence (days)			Anomalies (days)		
	Z	M_a	M_b	Z	M_a	M_b
January	19	10	2	6	-1	-5
February	12	10	7	-4	4	0
March	9	15	7	-8	6	2

In February, the atmospheric circulation pattern was modified. The zonal processes were observed 4 days less compared to the multiyear average while in March, the negative anomaly was 8 days. Simultaneously, the frequency of occurrence of M_a form processes increased. Thus, the character of the macroprocess transformation from January to February-March had a form $Z \rightarrow M_a + M_b$.

There are significant differences in the formation of air pressure fields in January, on the one hand and in February-March, on the other hand. In January, the cyclonicity belt and correspondingly, a zone of negative pressure anomalies covered the sub-Antarctic latitudes without discontinuities. Later on, the meridional character of the processes was manifested in the formation of blocking ridges above the Weddell, Commonwealth and Amundsen Seas in February and above the Weddell, Riiser-Larsen, Mawson and Ross Seas in March. At the western peripheries of these ridges, active cyclones exited to the mainland shore governing persistent storm weather periods with prolonged snowfall, snow storm and poor visibility. Thus, during the third 10-day period of February, a cyclone exited to Wilkes Land with frontal cloudiness extending almost up to the Vostok station. In March, persistent stormy weather with wind decrease and increase was observed above Prydz Bay and the adjoining areas of the Amery Ice Shelf. Very strong snowstorms with a visibility of less than 50 m at easterly hurricane winds raged at the Progress and Mirny stations.

The air temperature in January at the East Antarctica coast and in the southern half of the Weddell Sea was much below the average. The below zero, mean temperature anomalies comprised -1.5°C to -2.5°C from the Dumont d'Urville station eastward to Syowa station and -1.0°C to -1.5°C at the Novolazarevskaya and Hally stations. In February and March, a negative background of temperature anomalies in the indicated areas was preserved, however their values were less than 1° C being typically not greater than a multiyear average for this period.

In the stratosphere in January, in the 20-30 km heights, typical of the summer season, weak and moderate in speed easterly flows were recorded. In mid-February, the autumn circulation pattern began to modify above Mirny being completed by the end of the month. The temperature in the upper stratosphere that comprised -28° C to -39° C (at the beginning of the month) decreased to -36° C to -46° C.

In March, the modification of the hemispheric circumpolar vortex was completed. Westerly transports in the upper troposphere and stratosphere increased with their speeds beginning to be greater than 30 m/s. The temperature decrease in the stratosphere continued. In the 25-30 km heights, the temperature during the month decreased by 7 °C – 8°C.

IV. BRIEF REVIEW OF THE ICE PROCESSES IN THE SOUTHERN OCEAN FROM SATELLITE AND COASTAL OBSERVATIONS AT THE RUSSIAN ANTARCTIC STATIONS IN JANUARY-MARCH 2000

A distinguishing feature of the austral summer of 2000 is the increased regional variability of ice conditions. The regions of increased ice cover extent were adjoining the areas that were almost completely ice-cleared.

Thus, a rare situation of almost absolute ice clearance was observed in the Davis Sea. Relatively early landfast ice decay and its export in the Mirny Observatory area (Table IV.1) accompanied it.

On the contrary, a tongue of heavy ice exported from the east from behind the Cape Cheluskintsev was preserved in Prydz Bay as late as it was never observed before. This ice was partly transported to the head of the bay where it concentrated near the landfast ice edge preventing its breakup.

As a result, the landfast ice decay in the vicinity of Progress base occurred approximately one month later than on average. In the Sandenfjord Bay where a seasonal Druzhnaya-4 field base is located, the breakup of second-year landfast ice 25-30 km wide never occurred.

The Atlantic ice massif similar to the last year 1999, was slow-moving and occupied the extreme southwestern position reliably blocking the Weddell Sea coast from the tip of the Antarctic peninsula in the vicinity of the James Ross Islands to 30^{o} W (Cape Vahsel). In addition, a belt of residual drifting ice 60 to 120 miles wide was stable throughout the summer along the northeastern coast of the Weddell Sea.

In the end, after an enormous decrease in summer of 1998, the massif was actually completely reestablished with its area being only insignificantly less that its multiyear average dimensions (Table IV.2).

Table IV.1

Dates of the onset of main ice phases in the areas of Russian Antarctic stations in January-March 2000

Station (water area)		Landfast ice breakup		Ice clearance		Ice formation	
		Start	End	First	Final	First	Stable
Mirny (roadstead)	Actual	14.12. 1999	27.01	14.02	14.02	14.03	14.03
	Multiyear average	23.12	05.02	12.02	NO	11.03	12.03
Progress (Vostochnaya Bay)	Actual	03.02	20.02	NO	NO	15.02	15.02
	Multiyear average	30.12	13.01	NO	NO	16.02	17.02
Bellingshausen (Ardley Bay)	Open water from October 1, 1999						

Note: NO – phenomenon not observed

Table IV.2

Average latitude of the external northern drifting ice belt edge in the Southern Ocean based on satellite data of Novolazarevskaya and Mirny stations in February 2000

Longitude	Latitude (actual)	Latitude (multiyear average)
60 °W	64.2 ° S[1]	64.2° S [1]
50 °W	67.9 ° S	65.3 ° S
40 °W	71.2 ° S	69.3 ° S
30 °W	72.2 ° S	73.1 ° S
20 °W	71.8 ° S	72.5 ° S
10 °W	70.4 ° S	70.4 ° S
0 °	69.5 ° S	69.3 ° S
10 °E	69.3 ° S	69.3 ° S
20 °E	69.2 ° S	69.1 ° S
30 °E	68.3 ° S	68.5 ° S
40 °E	67.4 ° S	67.8 ° S
50 °E	66.7 ° S	66.3 ° S
60 °E	67.0 ° S	66.8 ° S
70 °E	66.8 ° S	67.3 ° S
80 °E	65.9 ° S	66.0 ° S
90 °E	65.5 ° S	65.5 ° S
100 °E	64.8 ° S	64.4 ° S
110 °E	65.5 ° S	65.4 ° S
120 °E	65.3 ° S	65.6 ° S
130 °E	65.2 ° S	65.4 ° S
140 °E	66.7 ° S	66.5 ° S
150 °E	65.9 ° S	65.4 ° S

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

V. TOTAL OZONE MEASUREMENTS AT THE RUSSIAN ANTARCTIC STATIONS IN JANUARY-MARCH 2000

During the first quarter of the current year, regular total ozone (TO) measurements at the Mirny and Vostok stations were continued.

Similar to the previous few years, the total ozone values in Mirny in January-March were below the averages calculated over the entire observation period. On January 5, a minimum daily TO average over the entire observation period for this month of 232 Dobson units was recorded (see Fig. V.1). The monthly average of 285 Dobson units was the second minimum value according to the rank for January (a lower value of 280 Dobson units was observed in 1974). In the first half of January, quite significant TO variations from day-to-day were observed in Mirny. The monthly TO averages during three months from November to January were very close by value (283 Dobson units in November, 282 Dobson units in December and 285 Dobson units in January) and slightly lower compared to the values observed for the few last years. By March, the total ozone in Mirny increased up to 300 Dobson units being close to the average for this month (301 Dobson units). In general, the TO level in Mirny during the first three months was quite stable.

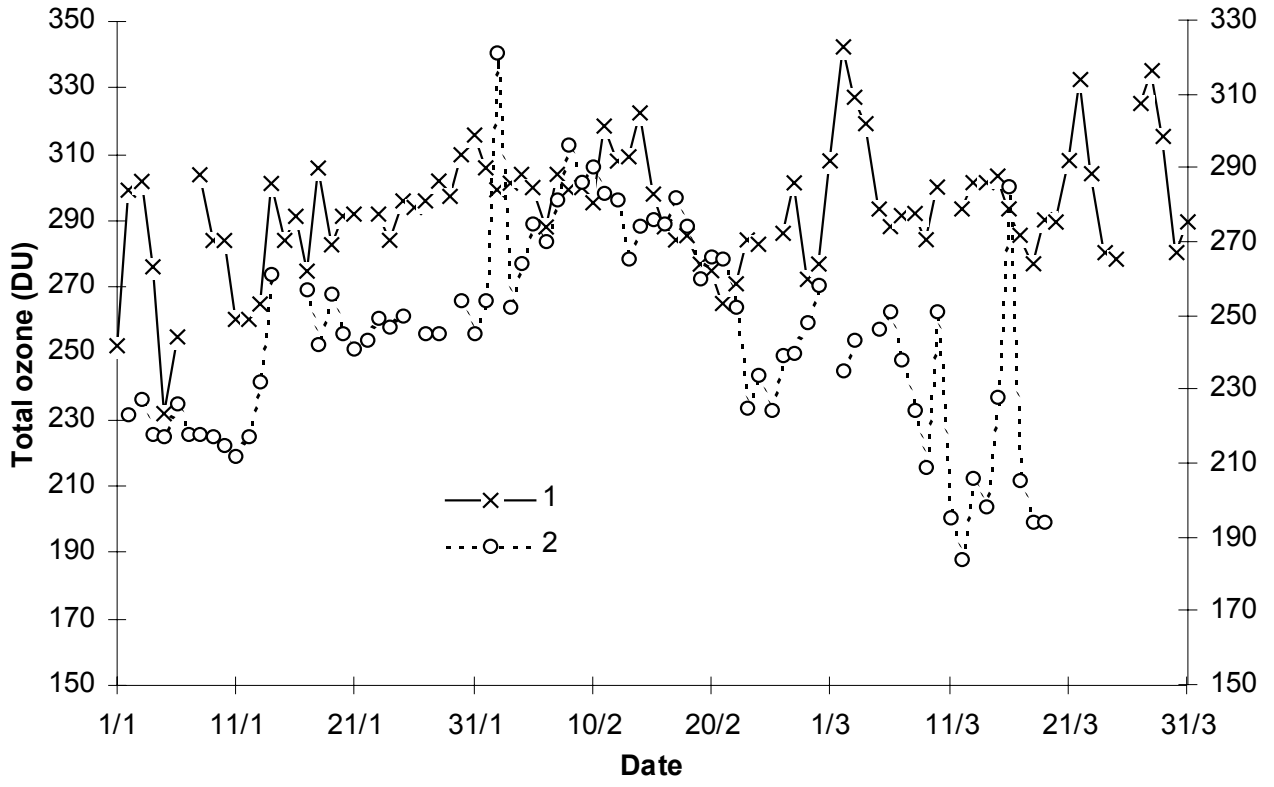


Fig. V.1. Daily total ozone averages at Mirny (1) and Vostok (2) stations in January-March 2000

The total ozone values at the Vostok station throughout the period under consideration were lower compared to Mirny. In January and February, the least daily averages of all available data for these months were observed comprising 212 Dobson units on January 11 and 224 Dobson units on February 25. The daily TO average of 235 Dobson units in January was also the least of all January values observed while the monthly average for February 2000 of 265 Dobson units is only slightly greater than the minimum value of 264 Dobson units recorded in 1999. We note that although the observations at the Vostok station have been carried out for quite a long time from 1974, they are of occasional character. Last measurements during the austral summer and autumn were undertaken in 1991.

VI. MAIN RAE EVENTS IN JANUARY-MARCH 2000

January 2, 2000	Arrival of the research expedition vessel "Akademik Fedorov" to the Druzhnaya-4 field base (Master Mikhailov M.Ye., Head of the 45th RAE Frolov I.Ye. Head of the 45th seasonal RAE Budretsky A.B.). Start of cargo operations and landing of the expedition participants. Base re-activation.
January 3, 2000	Cargo operations at the Druzhnaya-4 field base were completed. Three participants of the wintering and 13 of the seasonal team of the 45th RAE were delivered to the base with 3 tons of food supplies unloaded.
	Departure of the "Akademik Fedorov" from the Druzhnaya-4 field base area to Mirny Observatory.
January 6, 2000	Arrival of the "Akademik Fedorov" to the Mirny Observatory area. Start of cargo operations.
January 7, 2000	Start of the scientific traverse on two vehicles DT-30P from the Vostok station for radar and seismic studies in the southern area of the sub-glacial Lake Vostok. The group headed by A.N. Sheremetyev consisted of 6 people.
January 9, 2000	Cargo operations at Mirny Observatory were completed. Two people of the wintering team and four of the seasonal team were delivered to the station, 197 tons of cargo for Mirny and Vostok were unloaded and 1000 tons of diesel fuel placed to the base fuel-lubricant containers.
January 10, 2000	Departure by a regular flight from St. Petersburg to Christchurch (New Zealand) of the 45th RAE wintering and seasonal group (Vostok station) of 13 people (headed by the RAE Head Lukin V.V.)
January 14, 2000	Arrival of the "Akademik Fedorov" to the Progress Base area. Start of cargo operations for resupply of the Progress station and Druzhnaya-4 field base.
January 15, 2000	Departure of the sledge-caterpillar traverse (5 vehicles: 3 STT and 2 DT-30P) with a group of 18 people from Vostok to Mirny Observatory. The traverse head is Kornachev Ye.I.
January 17, 2000	Start of the upper-air sounding of the atmosphere by the AVK-MR3 system at the Novolazarevskaya station. Arrival of two Spanish scientists to the Bellingshausen Base.
January 24, 2000	Cargo operations for resupply of Progress station and Druzhnaya-4 field base were completed (Head of the base –Deputy Head of the 45th RAE Masolov V.N.). 36 expedition participants were delivered to the stations and 1193 tons of cargo were unloaded.
	Departure of the "Akademik Fedorov" from the area of the Progress Base to the Norwegian station Troll for resupply of the Scandinavian Antarctic Expedition.
January 26, 2000	Arrival to the Vostok station of LC-130 aircraft of the US Antarctic Program with 11 people of the 45th RAE wintering team, 2 people of the seasonal team (Lukin V.V., Poznyak A.K.), two BBC correspondents and two French investigators.
	Flight from Vostok to McMurdo of 11 participants of the 44th RAE (head of the group is Mironov S.V.).
January 28, 2000	Call of the R/V "Akademik A. Karpinsky" (Master Timerev S.N., Cruise Head Gandyukhin V.V.) to Capetown (South Africa) for resupply).
January 29, 2000	Vostok station was transferred to the 45th RAE. The wintering team of 12 people headed by Kondratyev A.V. left for wintering over.
	Flight from Vostok to McMurdo of 18 people (head of the group is Lukin V.V.).
	Arrival of the "Akademik Fedorov" to the Norwegian station Troll for taking onboard two participants of the Scandinavian Antarctic Expedition. Departure of the "Akademik Fedorov" to the Antarctic stations Aboa (Finland) and Wasa (Sweden).

January 30, 2000	Arrival of the "Akademik Fedorov" to the area of the Aboa and Wasa stations. Start of loading operations.
January 31, 2000	End of cargo operations at the Aboa and Wasa stations, embarkation of 35 participants of the Scandinavian expedition, loading of 1000 tons of cargo.
	Departure of the "Akademik Fedorov" from the area of the Antarctic stations Aboa and Wasa to Capetown (South Africa).
	Flight of the Vostok group of people (head of the group is Lukin V.V.) from the US station McMurdo to Christchurch (New Zealand).
February 1, 2000	Session of the Interagency Commission on the Arctic and the Antarctic (Moscow). Presentation of the AARI Deputy Director Danilov A.I. "Results of the 43d wintering and 44th seasonal RAE activities, plan-program of the 45th RAE".
February 4, 2000	Arrival of two Russian and 5 Italian volunteers to the Bellingshausen Base for ecological activities.
February 5, 2000	Arrival of 8 volunteers from England to the Bellingshausen base for ecological activities
February 8, 2000	Arrival to St. Petersburg of the 44th and 45th RAE wintering and seasonal team participants at Vostok station (Head of the group is Lukin V.V.).
	Arrival to Capetown (South Africa) of the "Akademik Fedorov" for ship resupply, bunkering, disembarkation of 37 participants of the Scandinavian expedition, loading of 24 tons of cargo for the Russian Antarctic stations and embarkation of 56 participants of the 45th RAE.
February 9, 2000	Departure by a regular flight from St. Petersburg to Capetown (South Africa) of the 45th RAE wintering group (56 people) for embarking the "Akademik Fedorov" (head of the group is V.N. Pomelov)
	Start of operation of the R/V "Akademik A. Karpinsky" in the range in the Cosmonauts Sea (marine geophysical studies).
February 10, 2000	Return of the sledge-caterpillar traverse Mirny-Vostok-Mirny to Mirny Observatory (9 vehicles, 18 people).
February 14, 2000	Departure from Capetown (South Africa) of the REV "Akademik Fedorov to the Antarctic. Departure of the Head of the 45th RAE Frolov I.Ye. by a regular flight from Capetown (South Africa) to St. Petersburg.
February 22, 2000	Arrival of the "Akademik Fedorov" to the Molodezhnaya Base. Start of loading operations.
February 23, 2000	End of loading operations at the Molodezhnaya Base. Embarkation of 13 people of the 45th RAE wintering group headed by the Head of the base Kiselev V.V. Loading of 122 tons of technical cargo.
	Conservation of the Molodezhnaya base for the winter period.
	Departure of the "Akademik Fedorov" from the Molodezhnaya base to the Druzhnaya-4 field base.
February 24, 2000	Departure by a regular flight from St. Petersburg of the RAE Deputy Head V.L. Martyanov to Punta Arenas (Chile) for further flight to the Bellingshausen Base.
February 26, 2000	Arrival of the "Akademik Fedorov" to the area of the Druzhnaya-4 Base for completing the seasonal activities (delivery of the second pilot of MI-8 helicopter to replace the diseased pilot).
February 27, 2000	Disembarkation of 6 persons of the seasonal team and embarkation of 5 participants of the 45th RAE who completed seasonal activities onboard the "Akademik Fedorov".
	Departure of the "Akademik Fedorov" from the Druzhnaya-4 field base to Mirny Observatory.
March 1, 2000	Arrival of the "Akademik Fedorov" to Mirny Observatory to replace the wintering team.

March 3, 2000	Change of the wintering personnel of the Mirny Observatory, 47 participants of the 44th and 45th RAE were taken onboard and 34 participants of the 45th RAE disembarked.
	Mirny Observatory transferred to the 45th RAE. A group of 41 people remained for wintering over with the head of the 45th RAE wintering team Stepanov V.M.
	Departure of the "Akademik Fedorov" from Mirny Observatory to Progress Base.
	Arrival of the RAE Deputy Head Martyanov V.L. to the Bellingshausen base by the Brazilian Air Force aircraft.
March 6, 2000	Arrival of the "Akademik Fedorov" to the area of Progress station to replace the wintering personnel of the station and for loading-unloading operations.
March 14, 2000	Departure from St. Petersburg to Ushuaia (Argentina) for embarking the M/V "Professor Multanovsky" of 3 people of the inspection group of Roshydromet (head of the group is Martyschenko V.A.) and three participants of the 45th RAE wintering team at the Bellingshausen Base (head of the group is Levando K.K.).
March 15, 2000	Completing the loading-unloading operations at the Progress station, 7 people of the 45th RAE wintering personnel disembarking and 21 participants of the 44th and 45th RAE embarking the ship, unloading of 256 tons of diesel fuel.
	Progress station transferred to the 45th RAE with 16 people remaining for wintering over with the head of the station Borzenkov S.P.
	Departure of the "Akademik Fedorov" from the Progress station to the Druzhnaya-4 field base. Completion of the scientific program over the Cosmonauts Sea area by the R/V "Akademik A. Karpinsky". The ship heads for Capetown (South Africa).
March 16, 2000	Arrival of the "Akademik Fedorov" to the area of the Druzhnaya-4 field base for loading operations and shipping of the 45th RAE seasonal participants.
March 18, 2000	Arrival of the M/V "Professor Multanovsky" (Master Kostusev S.Yu.) to the Bellingshausen Base for inspection and replacement of the base personnel.
March 20, 2000	Completing loading operations at the Druzhnaya-4 field base. Decommissioning of the base for the winter period and embarkation of 42 participants of the 44th and 45th RAE. Departure of the "Akademik Fedorov from Druzhnaya-4 base to the Cosmonauts Sea for oceanographic studies.
	Completing inspection of the Bellingshausen Base. A group of participants of the 44th and 45th RAE embarking the M/V "Professor Multanovsky".
	The Bellingshausen Base transferred to the 45th RAE with 7 people remaining for wintering over with the head of the base Levando K.K.
	Departure of the M/V "Professor Multanovsky" (cruise head Sakharov O.S.) from the Bellingshausen Base to Flissengen (Holland).
March 20 –24, 2000	Oceanographic observations onboard the research expedition vessel "Akademik Fedorov" in the Cosmonauts Sea.
March 30, 2000	Departure of the sledge-caterpillar traverse from Novolazarevskaya station to the barrier of the Lazarev Sea to meet the "Akademik Fedorov".