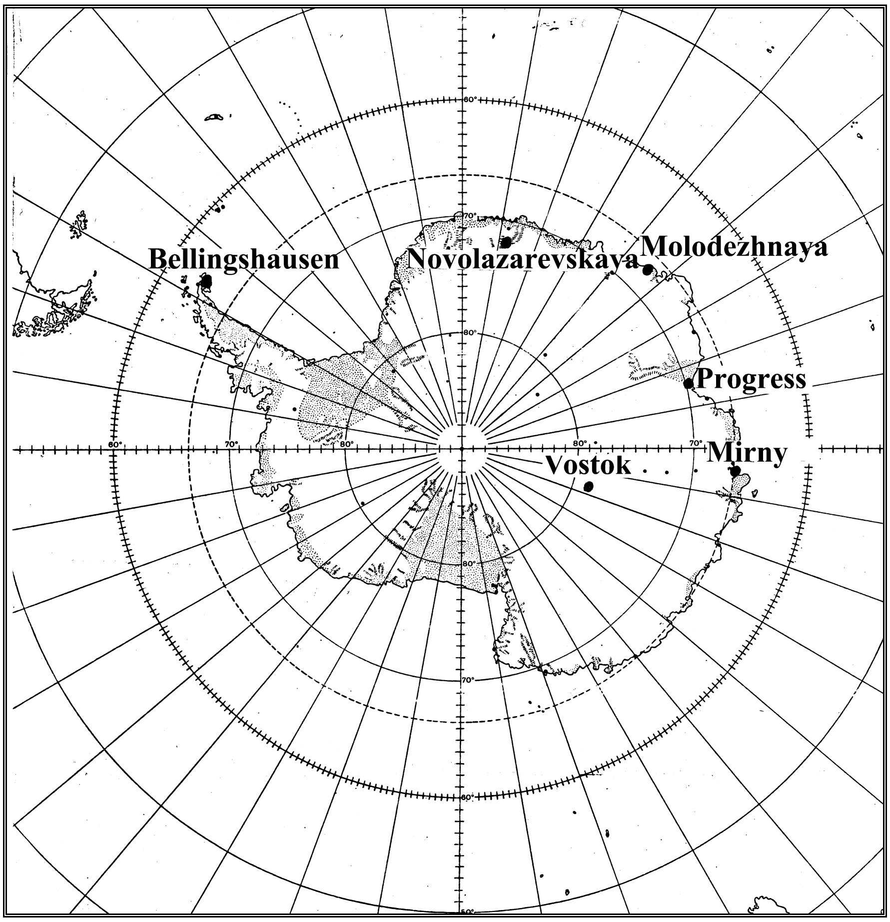
FEDERAL SERVICE OF RUSSIA FOR HYDROMETEOROLOGY AND ENVIRONMENTAL MONITORING

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

STATE OF ANTARCTIC ENVIRONMENT

Operational data of Russian Antarctic stations

October-December 2000



St. Petersburg
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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. Section I of this issue contains monthly averages and anomalies of standard meteorological and actinometric observations and upper-air sounding at the Russian Antarctic stations for the October-December 2000.

At the present time, standard meteorological observations are carried out at Mirny, Novolazarevskaya, Bellingshausen and Vostok stations. The upper-air sounding is undertaken at two Russian stations, namely, at Mirny Observatory and at Novolazarevskaya station once a day at 00.00 UT. More frequent sounding is conducted at both stations during the International Geophysical Intervals (IGI) 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, the absolute anomalies (deviations from 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 given for the meteorological parameters that are characterized by the significant variability, for example, for the monthly precipitation sums and total radiation. The statistical characteristics necessary for calculation of anomalies were derived 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 (beginning from this issue, section VI) present the results of measurements at Mirny Observatory and Vostok station under the geomagnetic and ionospheric programs (magnetic and riometer observations). Data of riometer observations are presented as plots of maximum daily values of space radio-emission absorption at the 32 MHz frequency.

The Bulletin also publishes information on the magnetic activity index (PC-index), whose calculation is made on the basis of geomagnetic observation data from Vostok station.

The Bulletin also contains brief overviews with an assessment of the anomalous state of the Antarctic environment based on actual data. 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 from observations at the coastal stations (Bellingshausen, Progress and Mirny). The anomalous character of ice conditions is assessed against the multiyear averages of the drifting ice edge location and the multiyear averages of the onset of different ice phases in the coastal areas of the Southern Ocean adjoining the Antarctic stations. The multiyear averages used were obtained at the AARI Ice Regime and Forecasting Department over the period 1971-1995.

Section V presents an overview of the total ozone (TO) level based on measurements at Mirny Observatory and at Vostok station.

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

Russian Antarctic stations in operation in 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**

1. DATA OF AEROMETEOROLOGICAL OBSERVATIONS AT THE RUSSIAN ANTARCTIC STATIONS

OCTOBER 2000

MIRNY OBSERVATORY

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

October2000

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	979,2	989,5	951,4	-2,6	-0,6	
Air temperature, °C	-16,2	-5,9	-26,1	-2,8	-1,3	
Relative humidity, %	73			4	0,7	
Total cloudiness (sky coverage), tenths	5,6			-1,2	-1,2	
Lower cloudiness(sky coverage),tenths	2,9			0,4	0,3	
Precipitation, mm	120,9			77,4	2,1	2,8
Mean wind speed, m/s	9,5	28		-1,1	-0,7	
Prevailing wind direction, deg	90					
Total radiation, MJ/m^2	508			-2,4	-0,1	1,0
Total ozone content, DU	40	95	76			

*- No observations were done

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

October 2000

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
973	53	-17,7	3,9					
925	429	-17	5,1	92	10	93	0	1
850	1060	-19,6	4,4	88	6	62	0	2
700	2489	-24,5	5,8	319	1	15	0	1
500	4868	-39,4	5,5	289	6	48	0	0
400	6363	-49,4	5,1	289	8	54	0	0
300	8203	-58,6	4,9	283	10	62	0	0
200	10730	-60,8	5,3	279	14	84	0	0
150	12520	-60,6	5,7	281	19	91	1	1
100	15069	-54,9	6,7	282	30	95	1	2
70	17401	-44	9,1	285	45	96	2	2
50	19711	-33,9	12,3	286	54	96	2	4
30	23331	-26,9	16,4	290	53	98	5	5
20	26253	-27	17,9	293	46	98	8	8
10	31247	-27,6	19,2	301	34	95	11	9

Anomalies of standard isobaric surface heights and temperature

October 2000

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	-34	-1,1	-2,4	-1,6
700	-48	-1,4	-2,1	-1,8
500	-76	-1,8	-2,9	-1,9
400	-93	-1,8	-2,8	-1,8
300	-109	-1,8	-0,4	-0,3
200	-86	-1,2	3,7	1,7
150	-57	-0,7	3,2	1,0
100	-9	-0,1	5,8	1,2
70	85	0,5	12,3	2,0

50	231	1,1	17,9	2,7
30	487	1,6	17,9	2,7
20	604	1,6	11,9	1,9
10	782	1,9	3,1	0,7

NOVOLAZAREVSKAYA STATION

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

October 2000

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	979,3	993,2	954,1	-4,8	-1,1	
Air temperature, °C	-13,1	-6	-24,3	-0,5	-0,3	
Relative humidity, %	49			-2,6	-0,4	
Total cloudiness (sky coverage), tenths	7			1,4	1,4	
Lower cloudiness(sky coverage),tenths	2,1			1,5	2,1	
Precipitation, mm	11,2			-17,8	-0,5	0,4
Mean wind speed, m/s	10,6	29		0,6	0,4	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	438			-19,0	-0,5	1,0

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

October 2000

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
965	122	-13,7	9,1					
925	449	-14,6	8	108	14	98	1	2
850	1083	-19,3	6,9	96	13	94	1	2
700	2502	-26,4	4,9	92	6	66	1	1
500	4867	-40,9	4,1	335	1	15	1	1
400	6352	-51	3,8	299	3	41	1	1
300	8175	-61,9	3,5	284	6	53	1	1
200	10628	-69,4	3,3	276	9	77	1	1
150	12331	-72,3	3,3	276	10	85	1	1
100	14693	-75,6	3,2	281	13	90	1	1
70	16750	-76,1	3,3	286	16	93	2	2
50	18690	-73,7	3,6	288	20	94	4	4
30	21755	-60,6	4,6	298	27	95	4	4
20	24366	-47,6	7,4	301	30	95	4	4
10	29132	-27,5	13,6	312	39	94	7	9

Anomalies of standard isobaric surface heights and temperature

October 2000

P, hPa	$H\text{-}H_{avg}$, m	$(H\text{-}H_{avg})/\sigma_H$	$T\text{-}T_{avg}$, °C	$(T\text{-}T_{avg})/\sigma_T$
850	-31	-0,8	-0,8	-0,6
700	-38	-0,9	-0,8	-0,5
500	-54	-1,0	-2,2	-1,1
400	-69	-1,1	-2,4	-1,5
300	-88	-1,3	-1,6	-1,3
200	-99	-1,4	-0,2	-0,1
150	-115	-1,4	-1,7	-0,8
100	-155	-1,7	-5,0	-1,5
70	-224	-2,0	-7,1	-1,9
50	-320	-2,2	-7,4	-1,6
30	-421	-1,9	-1,4	-0,2
20	-415	-1,4	3,5	0,5
10	-316	-0,7	10,6	1,2

BELLINGSHAUSEN STATION

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

October 2000

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	988,8	1019,2	954,7	-1,0	-0,2	
Air temperature, °C	-2,1	2,9	-8	0,5	0,5	
Relative humidity, %	89			0,8	0,3	
Total cloudiness (sky coverage), tenths	9,5			0,5	1,3	
Lower cloudiness(sky coverage),tenths	8,2			0,2	0,3	
Precipitation, mm	43,9			-5,7	-0,4	0,9
Mean wind speed, m/s	7,9	17		-0,1	-0,1	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	394			-9,8	-0,3	1,0

VOSTOK STATION

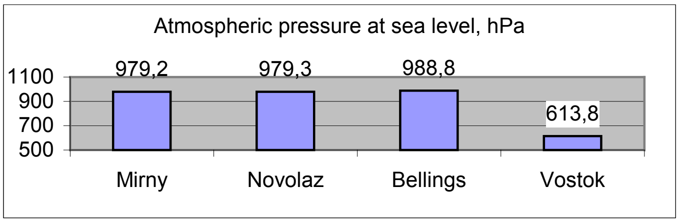
Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f_{avg})

October2000

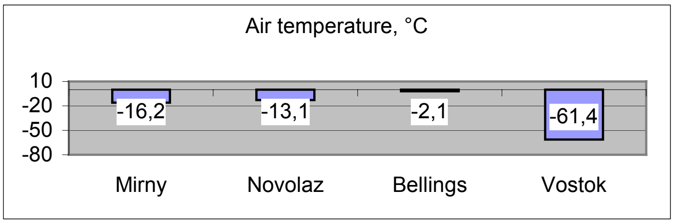
Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_f$	Relative anomaly f/f_{avg}
Station surface level pressure, hPa	613,8	623,6	605,5	-5,6	-1,2	
Air temperature, °C	-61,4	-47,2	-72,9	-4,4	-2,8	
Relative humidity, %	46			-24,5	-5,6	
Total cloudiness (sky coverage), tenths	4,1			-0,3	-0,3	
Lower cloudiness(sky coverage),tenths	0			0	0,0	
Precipitation, mm	1,7			-0,2	-0,1	0,9
Mean wind speed, m/s	4,9	13		-0,6	-0,5	
Prevailing wind direction, deg	225					
Total radiation, MJ/m^2	472			13,2	0,6	1,0
Total ozone content, DU	215	272	159			

*- No observations were done

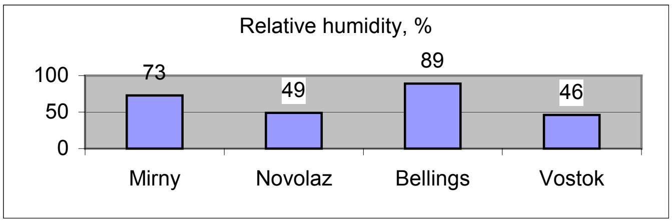
O c t o b e r 2000



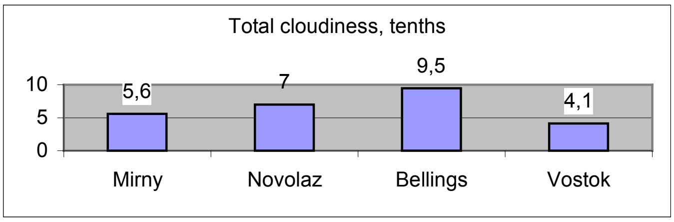
$(f-f_{avg})/\sigma_f$ -0,6 -1,1 -0,2 -1,2



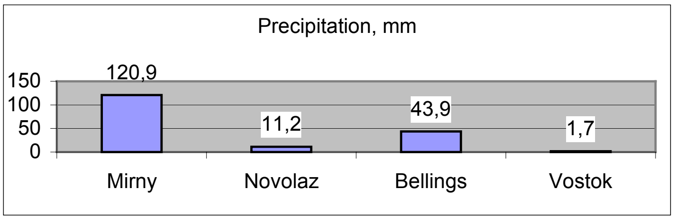
$(f-f_{avg})/\sigma_f$ -1,3 -0,3 0,5 -2,8



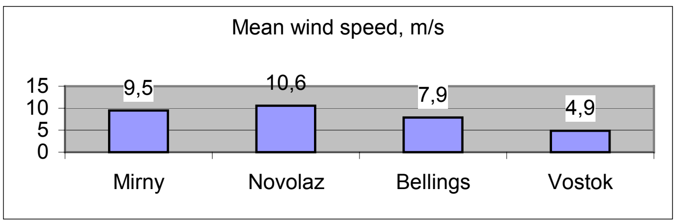
$(f-f_{avg})/\sigma_f$ 0,7 -0,4 0,3 -5,6



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



f/f_{avg} 2,8 0,4 0,9 0,9



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

Fig. 1.1. Comparison of monthly averages of meteorological parameters at the stations, October 2000.

NOVEMBER 2000

MIRNY OBSERVATORY

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

November 2000

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	1006,7	968,2	0,5	0,1	
Air temperature, ^{0}C	-5,5	1,9	-17,2	1,8	1,3	
Relative humidity, %	85			17,2	4,8	
Total cloudiness (sky coverage), tenths	7,7			1,3	1,9	
Lower cloudiness(sky coverage),tenths	5,2			2,6	2,2	
Precipitation, mm	197,2			163,8	5,9	5,9
Mean wind speed, m/s	11,6	27		1,8	1,5	
Prevailing wind direction, deg	90					
Total radiation, MJ/m^2	707			-66,5	-1,2	0,9
Total ozone content, DU	306	366	243			

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

November 2000

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	-6,8	2,8					
925	516	-7,9	4,6	88	15	95	1	1
850	1168	-11,9	3,6	84	13	92	1	1
700	2637	-18,1	5,4	78	10	86	1	1
500	5079	-32,9	5,4	67	11	81	1	1
400	6615	-43	4,6	59	11	74	1	1
300	8498	-55,4	4,4	46	9	58	1	1
200	11052	-58,6	5,3	360	6	59	1	1
150	12860	-58,3	6,1	326	8	78	1	1
100	15418	-56,3	6,9	321	14	87	1	1
70	17725	-49,2	8,4	322	19	91	2	2
50	19950	-39,4	10,9	329	24	93	3	3
30	23489	-30,1	14,7	341	23	93	5	7
20	26392	-27,2	16,6	347	22	93	9	9
10	31461	-26,1	18,6	20	15	90	12	9

Anomalies of standard isobaric surface heights and temperature

November 2000

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	20	0,6	0,6	0,6
700	24	0,7	0,9	0,7
500	26	0,5	-0,2	-0,1
400	25	0,4	-0,1	-0,1
300	17	0,3	-1,2	-0,8
200	-8	-0,1	-3,1	-1,0
150	-43	-0,4	-5,4	-1,4
100	-132	-0,9	-8,6	-2,0
70	-206	-1,1	-6,1	-1,7
50	-264	-1,3	0,2	0,1
30	-253	-1,2	5,1	1,8
20	-189	-0,9	5,3	1,7
10	-36	-0,2	2,8	0,7

NOVOLAZAREVSKAYA STATION

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

November 2000

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	989,3	999,2	975	3,5	0,9	
Air temperature, ^{0}C	-5,3	2,7	-14,8	0,6	0,5	
Relative humidity, %	51			-2,3	-0,5	
Total cloudiness (sky coverage), tenths	7,6			1,3	1,2	
Lower cloudiness(sky coverage),tenths	1,3			0,3	0,4	
Precipitation, mm	7,5			-0,5	0,0	0,9
Mean wind speed, m/s	11,1	31		1,7	0,9	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	676			-53,0	-1,1	0,9

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

November 2000

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
974	122	-6	8,1					
925	535	-7,9	6,8	105	13	97	2	2
850	1185	-12,9	5,5	96	15	98	2	3
700	2637	-22	4,4	91	12	91	2	2
500	5051	-35,5	4,1	61	4	48	2	2
400	6570	-46,4	3,2	39	3	32	2	2
300	8422	-59	2,7	3	3	26	2	2
200	10916	-64	2,9	313	3	30	2	3
150	12690	-64,2	3,3	301	3	43	4	4
100	15168	-63,7	3,8	293	4	48	4	5
70	17376	-58,2	4,7	279	4	43	4	4
50	19578	-47,8	6,6	259	3	32	6	6
30	23088	-33,9	12,7	146	5	41	7	7
20	25974	-26,3	16,4	129	9	66	7	7
10	31117	-20,5	21	112	11	80	10	9

Anomalies of standard isobaric surface heights and temperature

November 2000

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	34	1,1	0,1	0,1
700	30	0,9	-0,3	-0,3
500	28	0,7	-0,6	-0,5
400	22	0,5	-1,4	-1,2
300	4	0,1	-2,2	-1,9
200	-27	-0,4	-2,4	-0,8
150	-41	-0,5	-4,2	-1,0
100	-119	-0,9	-7,9	-1,4
70	-208	-1,1	-7,1	-1,3
50	-216	-0,9	-1,2	-0,2
30	-159	-0,5	5,5	1,4
20	-54	-0,2	7,8	1,9
10	142	0,4	6,1	1,2

BELLINGSHAUSEN STATION

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

November 2000

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	994	1011	971,3	6,4	1,2	
Air temperature, ^{0}C	-1,4	1,6	-10,4	-0,2	-0,3	
Relative humidity, %	87			-0,6	-0,2	
Total cloudiness (sky coverage), tenths	8,5			-0,7	-1,8	
Lower cloudiness(sky coverage),tenths	6,5			-1,5	-1,7	
Precipitation, mm	27,5			-20,9	-1,1	0,6
Mean wind speed, m/s	5,5	15		-1,5	-1,7	
Prevailing wind direction, deg	360					
Total radiation, MJ/m^2	523			-16,1	-0,5	1,0

VOSTOK STATION

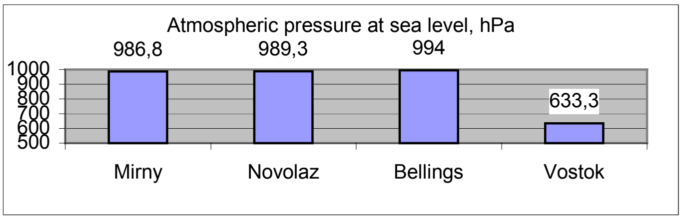
Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f_{avg})

November 2000

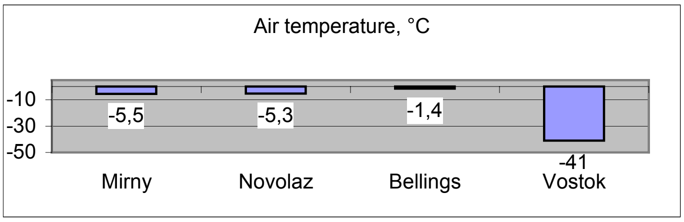
Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_f$	Relative anomaly f/f_{avg}
Station surface level pressure, hPa	633,3	646,3	607,6	7,6	1,6	
Air temperature, ^{0}C	-41	-25,6	-58,4	2,1	1,4	
Relative humidity, %	51			-20,9	-5,0	
Total cloudiness (sky coverage), tenths	3,2			-0,1	-0,1	
Lower cloudiness(sky coverage),tenths	0			0	0,0	
Precipitation, mm	0,4			-0,5	-0,7	0,4
Mean wind speed, m/s	6	11		0,8	0,9	
Prevailing wind direction, deg	202					
Total radiation, MJ/m^2	921			-12,8	-0,4	1,0
Total ozone content, DU	285	321	207			

*- No observations were done

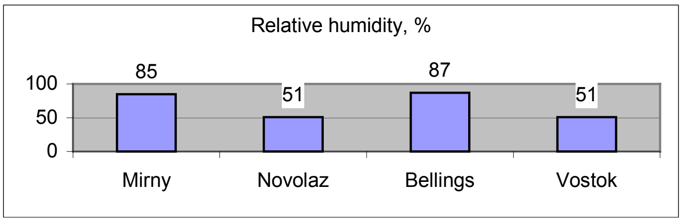
N o v e m b e r 2000



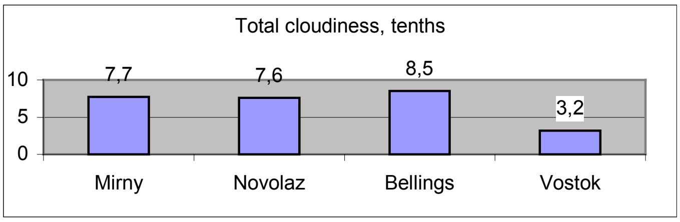
$(f-f_{avg})/\sigma_f$ 0,1 0,9 1,2 1,6



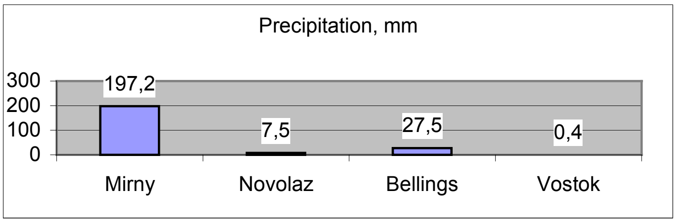
$(f-f_{avg})/\sigma_f$ 1,3 0,5 -0,3 1,4



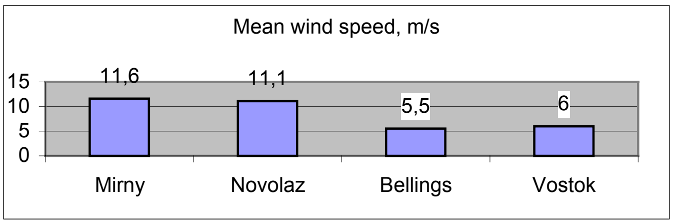
$(f-f_{avg})/\sigma_f$ 4,8 -0,5 -0,2 -5,0



$(f-f_{avg})/\sigma_f$ 1,9 1,2 -1,8 -0,1



f/f_{avg} 5,9 0,9 0,6 0,4



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

Fig. 1.2. Comparison of monthly averages of meteorological parameters at the stations, November 2000.

DECEMBER 2000

MIRNY OBSERVATORY

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

December 2000

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	994	1010,2	981,3	4,3	1,1	
Air temperature, ^{0}C	-2,6	4,5	-10,4	-0,1	-0,1	
Relative humidity, %	77			6,3	1,5	
Total cloudiness (sky coverage), tenths	5,6			-1,3	-1,3	
Lower cloudiness(sky coverage),tenths	2,6			-0,4	-0,4	
Precipitation, mm	7,8			-17,4	-0,8	0,3
Mean wind speed, m/s	7,9	21		-0,6	-0,5	
Prevailing wind direction, deg	90					
Total radiation, MJ/m^2	945			1,9	0,0	1,0
Total ozone content, DU	312	342	279			

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

December 2000

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
989	53	-3	4,1					
925	580	-5,4	5,8	90	10	96	0	0
850	1238	-9,5	4,9	89	9	91	0	0
700	2717	-16,2	7,1	85	5	76	0	0
500	5187	-29,3	6,9	231	1	13	0	0
400	6750	-38,8	6	237	4	38	0	0
300	8672	-50	5,2	231	5	45	0	0
200	11323	-47,4	7,7	255	2	35	0	0
150	13232	-45,7	9,8	263	1	22	0	1
100	15944	-43,7	11,6	63	1	6	1	1
70	18351	-41,5	13,3	69	2	64	1	1
50	20637	-40	14,6	85	4	90	2	2
30	24144	-37,2	16,1	83	8	97	3	5
20	26966	-33,9	17,7	85	10	99	7	7
10	31890	-26,6	21,2	86	14	99	9	9

Anomalies of standard isobaric surface heights and temperature

December 2000

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	44	1,4	-0,6	-0,8
700	40	1,1	0,2	0,2
500	43	1,0	0,7	0,5
400	48	0,9	1,2	1,0
300	57	1,0	1,4	1,1
200	65	1,0	0,1	0,1
150	64	0,9	-0,5	-0,2
100	54	0,7	-1,1	-0,6
70	32	0,3	-0,8	-0,6
50	32	0,3	-0,8	-0,6
30	18	0,2	-0,8	-0,5
20	15	0,2	-0,3	-0,1
10	33	0,3	1,5	0,6

NOVOLAZAREVSKAYA STATION

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

December 2000

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	994,7	1006	983,3	4,4	0,9	
Air temperature, ^{0}C	-1,6	4,5	-9,6	-0,7	-0,9	
Relative humidity, %	59			1,2	0,3	
Total cloudiness (sky coverage), tenths	6,3			0	0,0	
Lower cloudiness(sky coverage),tenths	2			0,5	0,6	
Precipitation, mm	0,9			-6,7	-0,5	0,1
Mean wind speed, m/s	5,2	18		-2,2	-1,3	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	956			48,0	0,7	1,1

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

December 2000

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
980	122	-1,4	6,6					
925	587	-5	6	101	7	93	0	0
850	1245	-10	5,1	97	8	94	0	0
700	2712	-20,4	3,6	99	9	92	0	0
500	5134	-33,9	5	106	3	45	0	0
400	6667	-43,6	4,6	164	2	19	0	0
300	8559	-51,6	4,4	217	3	30	0	0
200	11211	-47,3	7,2	325	0	4	0	0
150	13121	-45,4	9	31	1	20	0	0
100	15842	-42,4	11	53	3	65	0	0
70	18266	-39,9	12,7	64	5	90	0	0
50	20574	-38,3	13,9	68	6	91	0	0
30	24103	-36	15,5	77	8	93	0	0
20	26933	-33,2	16,8	79	9	95	0	0
10	31861	-26,2	18,9	86	10	97	3	3

Anomalies of standard isobaric surface heights and temperature

December 2000

P, hPa	$H-H_{avg}$, m	$(H-H_{avg})/\sigma_H$	$T-T_{avg}$, °C	$(T-T_{avg})/\sigma_T$
850	40	0,9	-1,2	-1,4
700	31	0,6	-2,1	-1,8
500	3	0,1	-2,4	-1,5
400	-11	-0,2	-2,0	-1,4
300	-21	-0,3	1,0	0,8
200	10	0,1	2,3	0,7
150	25	0,3	1,3	0,4
100	45	0,4	0,5	0,2
70	56	0,4	0,6	0,3
50	51	0,4	-0,1	-0,1
30	34	0,3	-0,7	-0,3
20	41	0,3	-0,5	-0,2
10	40	0,3	1,9	0,6

BELLINGSHAUSEN STATION

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

December 2000

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	988,3	1003,6	968	-3,1	-0,6	
Air temperature, ^{0}C	0,1	3,8	-2,7	-0,3	-0,6	
Relative humidity, %	86			-1,5	-0,4	
Total cloudiness (sky coverage), tenths	9,5			0,4	1,0	
Lower cloudiness(sky coverage),tenths	7,4			-0,5	-0,7	
Precipitation, mm	63,7			14,6	0,9	1,3
Mean wind speed, m/s	6,7	17		0,1	0,1	
Prevailing wind direction, deg	112					
Total radiation, MJ/m^2	555			-24,7	-0,6	1,0

VOSTOK STATION

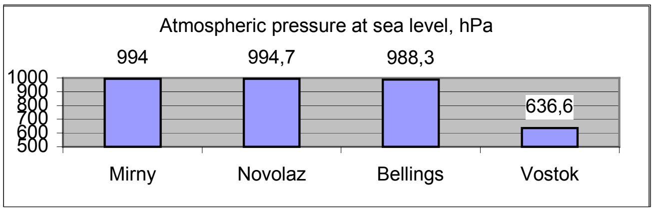
Monthly averages of meteorological parameters (f) and their deviations from multiyear averages (f_{avg})

December 2000

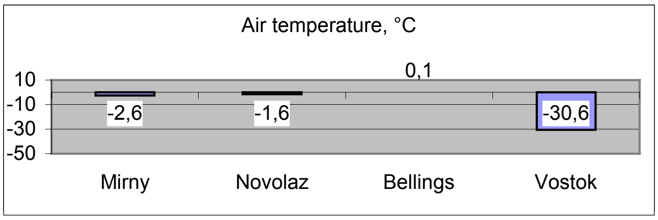
Parameter	$f_{mon.avg}$	f_{max}	f_{min}	Anomaly $f-f_{avg}$	Normalized anomaly $(f-f_{avg})/\sigma_f$	Relative anomaly f/f_{avg}
Station surface level pressure, hPa	636,6	646	628,8	2,8	0,7	
Air temperature, ^{0}C	-30,6	-23,8	-38,3	1,3	0,8	
Relative humidity, %	62			-10,4	-2,3	
Total cloudiness (sky coverage), tenths	2,2			-1	-1,0	
Lower cloudiness(sky coverage),tenths	0,1			-0,1	-0,5	
Precipitation, mm	0,2			-0,4	-0,4	0,3
Mean wind speed, m/s	4,4	8		-0,1	-0,1	
Prevailing wind direction, deg	180					
Total radiation, MJ/m^2	1296			63,5	1,6	1,1
Total ozone content, DU	*					

*- No observations were done

D e c e m b e r 2000



$(f-f_{avg})/\sigma_f$ 1,1 0,9 -0,6 0,7



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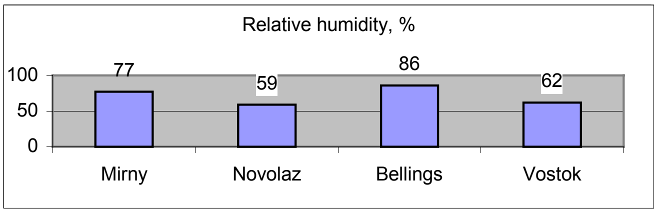
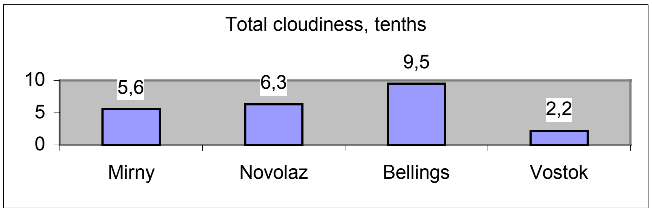
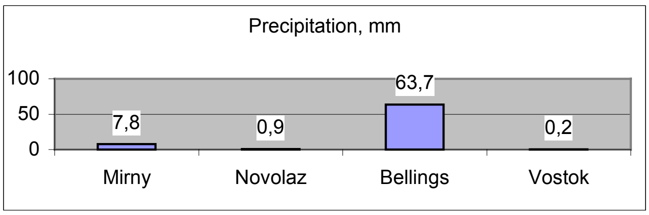


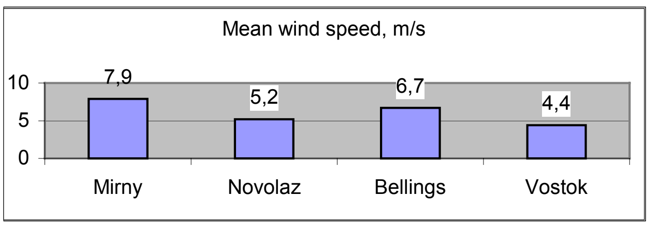
$(f-f_{avg})/\sigma_f$ 1,5 0,3 -0,4 -2,3



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



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



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

Fig. 1.3. Comparison of monthly averages of meteorological parameters at the stations, December 2000.

II. ANOMALOUS METEOROLOGICAL CONDITIONS IN ANTARCTICA IN OCTOBER-DECEMBER 2000

During the last quarter of 2000, the air temperature above Antarctica was characterized by the dominance of the below zero anomalies in October and above zero anomalies in November-December. For illustration, the anomalies of mean monthly temperature at the Russian and foreign permanent stations are presented in Fig. II.1. (http://www.ncdc.noaa.gov/ol/climatedata.html:http://www.nerc-bas.ac.uk/icd/gjma/temps.html).

One can see that in October, the anomalies were below zero practically over the entire territory of Antarctica except for the Antarctic Peninsula with the minimum values of -4.4° C (-2.8σ) at Vostok station and -4.4° C (-1.6σ) at Halley-Bay stations.

Unlike October, the above zero air temperature anomalies prevailed in November-December in Antarctica being most significant in November. In December, the above zero anomalies were recorded predominantly in the inland areas. At Vostok station, the temperature anomaly comprised +2.1° C (+1.4σ) in November and +1.3° C (+0.8σ) in December.

The atmospheric pressure (Fig. II.2) in October over much of Antarctica was lower in comparison with the multiyear average, which is in agreement with the intense development of the cyclonic activity in this month (see section III). In November-December, the positive pressure anomalies prevailed since the processes of anticyclogenesis were predominant again.

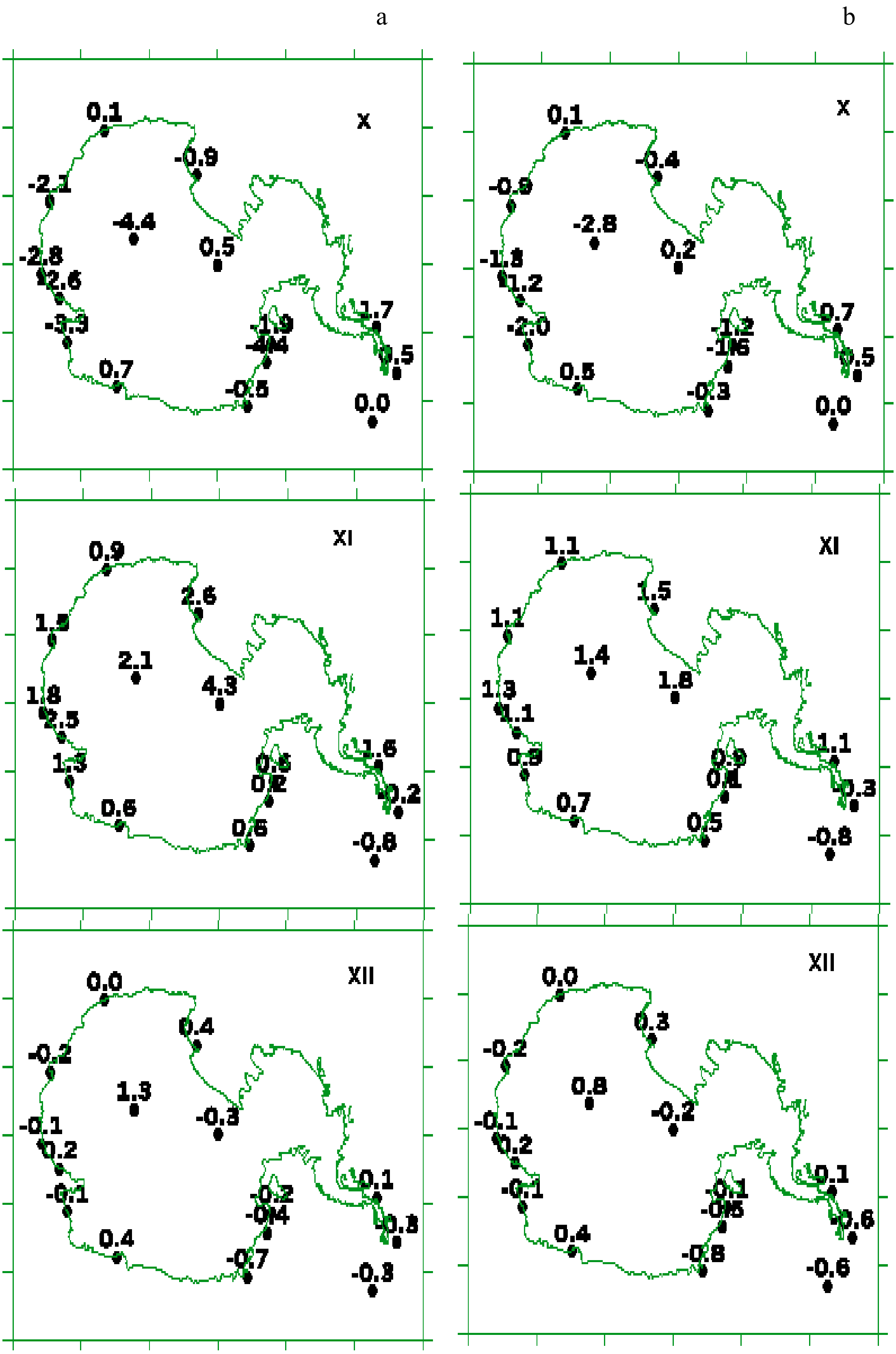


Fig.II.1. Absolute anomalies (a) and normalized anomalies (b) of surface air temperature in October (X), November (XI), and December (XII) 2000 from data of stationary meteorological stations in the South Pole area.

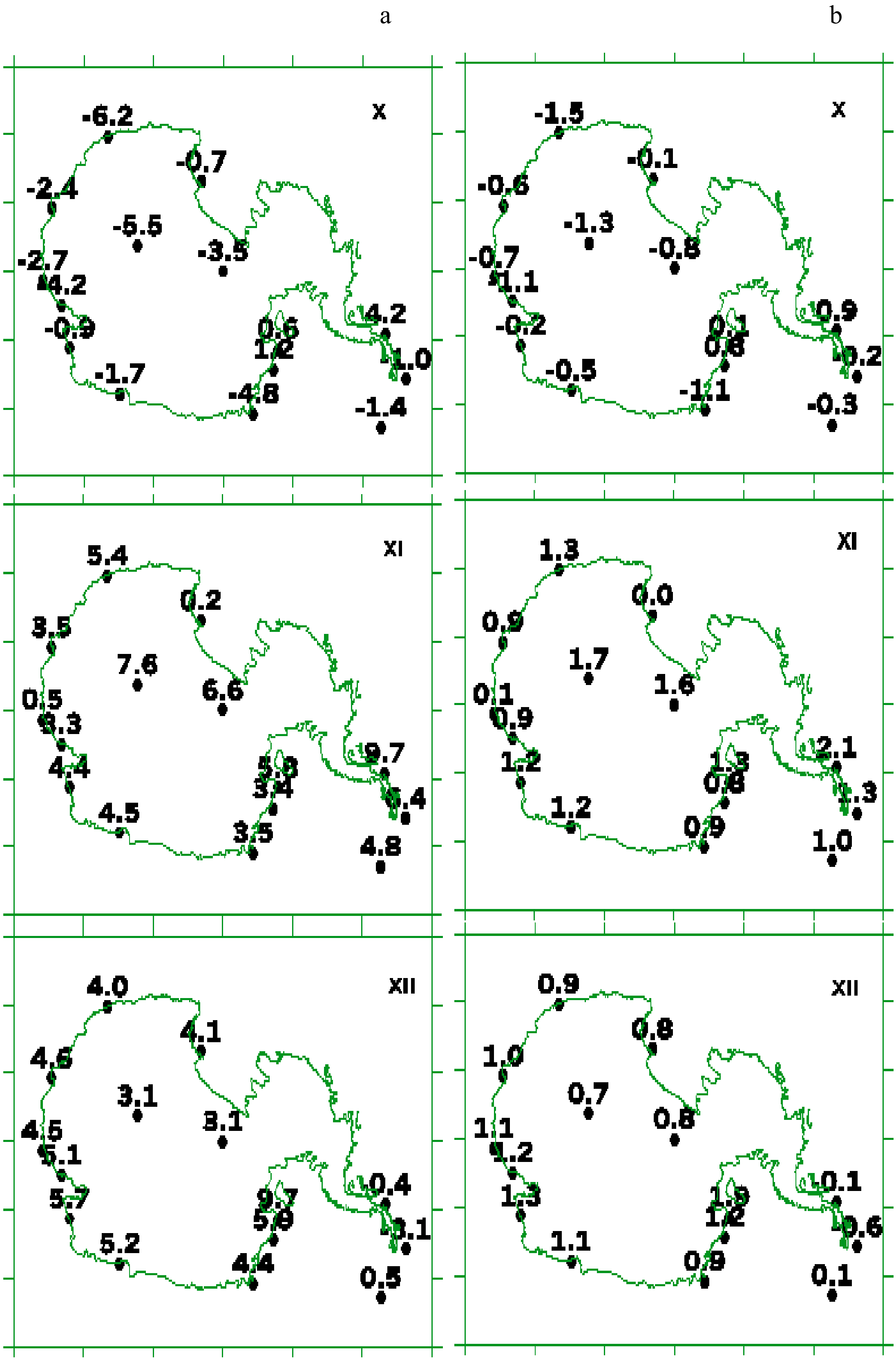


Fig. II.2. . Absolute anomalies (a) and normalized anomalies (b) of atmospheric pressure in October (X), November (XI), and December (XII) 2000 from data of stationary meteorological stations in the South Pole area.

The recorded monthly sums of precipitation at Bellingshausen, Novolazarevskaya and Vostok stations during the period October-December 2000 were close to a multiyear average whereas at Mirny in October they were almost 3-times and in November 5-times as great as the multiyear average. In fact, storm weather with strong snowfalls and

drifting snow was frequently observed in these months at Mirny, however, one can believe with a greater probability that precipitation was blown to a precipitation gage and the measurement data are in need of correction.

In respect of the air temperature regime in 2000, one can note in general that during the first three months (the second half of the Antarctic summer and autumn) a center of the below zero anomalies was preserved in East Antarctica whose core in January was located near Mirny station. The temperature anomaly in Mirny in January comprised -1.5° C (-1.7σ). In March, there was a new intensification of the below zero anomalies in East Antarctica. Thus, at Novolazarevskaya station, the anomaly comprised -3.6° C (-3.3σ), and in the Polar Plateau area at Vostok station, it was -2.6° C (-1.2σ).

On the Antarctic Peninsula, the temperature in January-March was higher compared to a multiyear average.

The second quarter of 2000 – autumn and the beginning of winter in the Southern Hemisphere, was characterized by the decreased below zero temperature anomalies in East Antarctica and the increased (especially in June) above zero temperature anomalies on the Antarctic Peninsula. At Bellingshausen station, the above zero anomaly in April, May and June comprised 1.4σ, 1.4σ and 1.8σ, respectively. In June, the above zero anomaly was also observed at Novolazarevskaya (1σ) and even at the inland Vostok station (1.8σ), which is attributed to deep cyclones penetrating far southward and warm air masses spreading from lower latitudes.

By September, the above zero anomalies have spread virtually over the entire mainland territory except for the northern part of the Antarctic Peninsula. Two intense heat centers were noted. The core of one of them was in the coastal zone of the Indian sector of East Antarctica (the temperature anomaly in Mirny comprised +4.4° C (1.7σ). The core of the other one of up to 2.0° C was above the Weddell Sea and the coastal areas of the Atlantic sector of Antarctica.

The aforementioned dominance of the above zero temperature anomalies was also observed in general over the continent during November 2000. In December at most Russian stations except for Vostok, the temperature was close to a multiyear average.

The annual temperature and atmospheric pressure variations at the Russian stations in 2000 in comparison with the multiyear averages for the period 1961-1990 (Fig. II.3) indicate that

1) there is a significant difference between the conditions of West Antarctica (Bellingshausen station) where the temperature from January to July was much higher than normally, and the meteorological conditions of East Antarctica (Mirny, Novolazarevskaya and Vostok stations) where the temperature was lower than normally in most months of the year;

2) the year 2000 is distinguished by a large number (more than 1.5σ)of mean monthly temperature deviations from a multiyear average. For example, in March and May at Novolazarevskaya station, the below zero anomalies comprised -3.6° C (-3.3σ) and -3.4° C (-1.5σ). At Mirny station, the anomaly in January was -1.5° C (-1.7σ) and at Vostok station, the anomaly in October comprised -4.4° C (-2.8σ). Large above zero temperature anomalies were observed in June at Bellingshausen station (3.5° C (1.8σ) and at Vostok (5.1° C (1.8σ) and in September at Mirny station (4.4° C (1.7σ);

3) significant negative anomalies are noted in the annual variations of atmospheric pressure in January at all Russian stations. At Bellingshausen station, the observed value was the least for the entire series beginning from 1968. In East Antarctica, the pressure anomalies in January at Novolazarevskaya, Mirny and Vostok stations comprised –2.7σ, -2.8σ and –1.6σ, respectively. In the area of the Antarctic Peninsula and in other months of 2000, large pressure anomalies were more frequent but the sign was already positive. Thus, at Bellingshausen, the values of normalized anomalies in March, July and September were equal to 2.7σ, 1.8σ and 3.1σ.

The interannual temperature and pressure variations at the Russian Antarctic stations for October-December are illustrated in Fig. II.4-II.6.

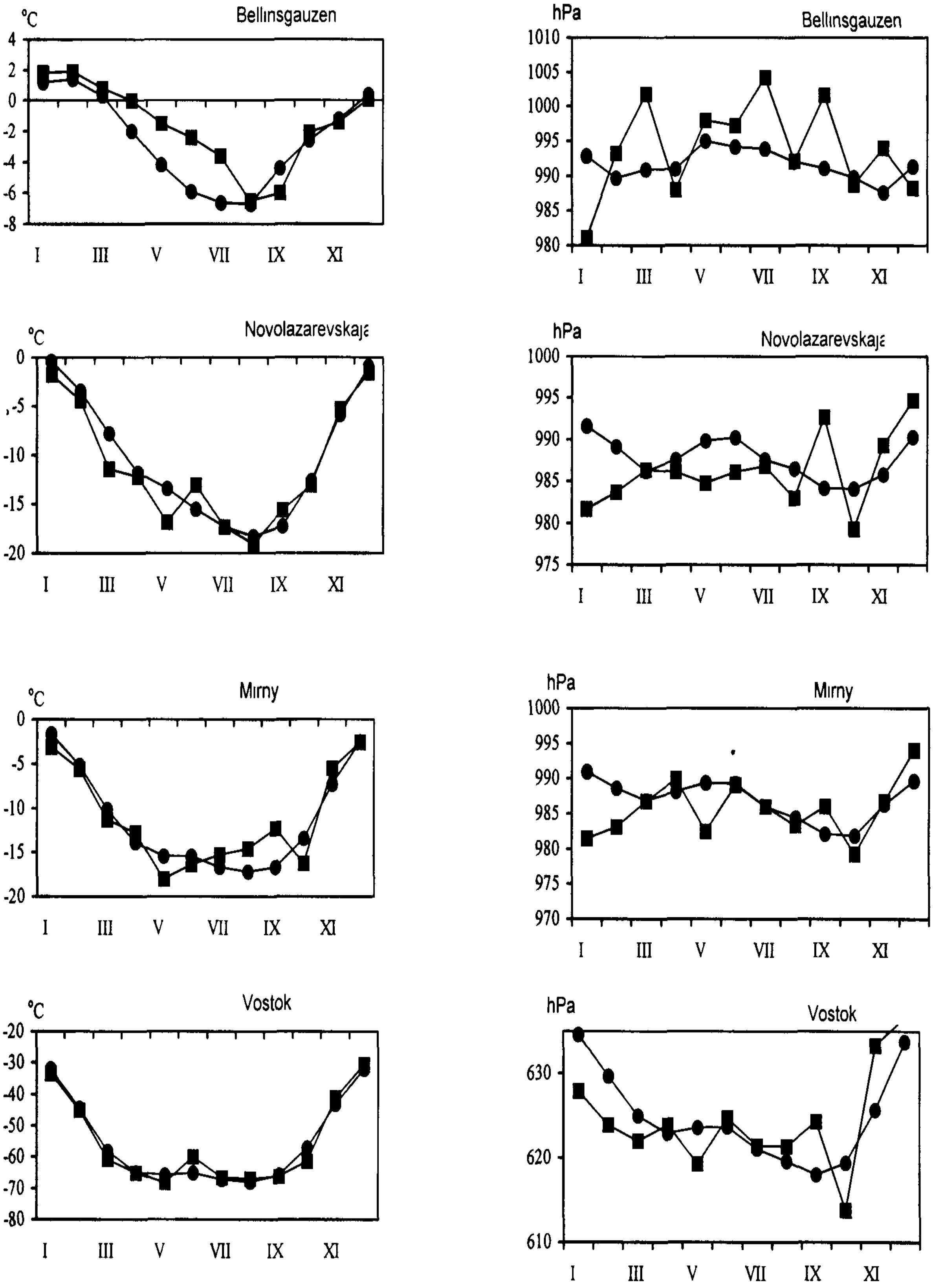
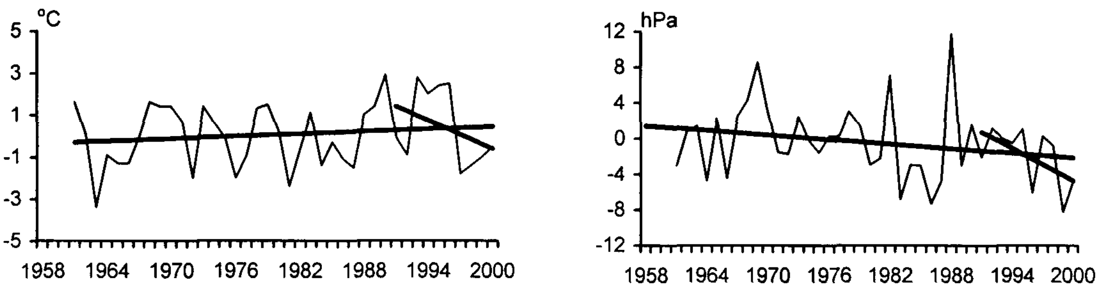
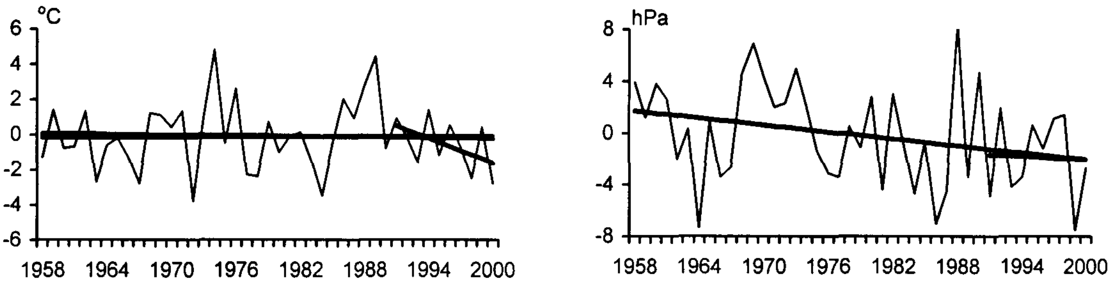


Fig.II.3. Annual variations of monthly pressure and monthly air temperature averages in 2000.
■ - 2000, ● - multiyear averages in 1961-1990.

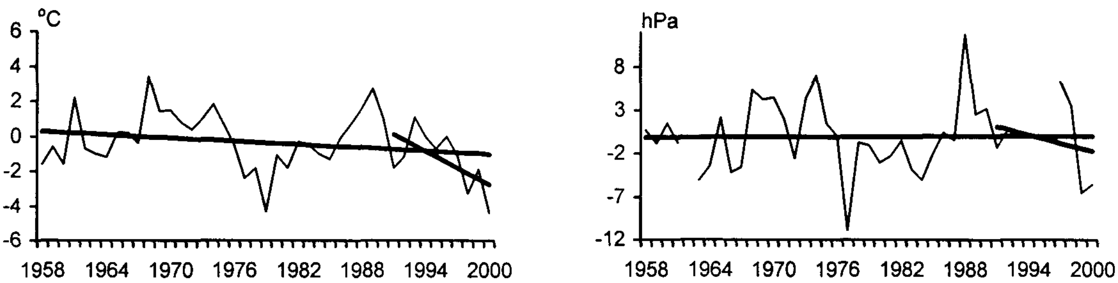
Novolazarevskaja



Mirny



Vostok



Bellinsgauzen

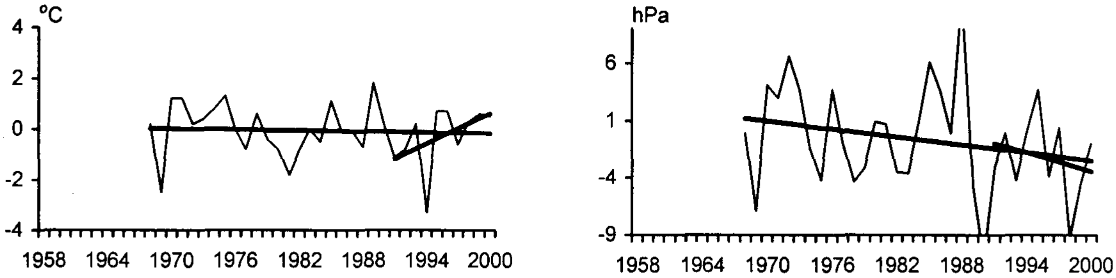
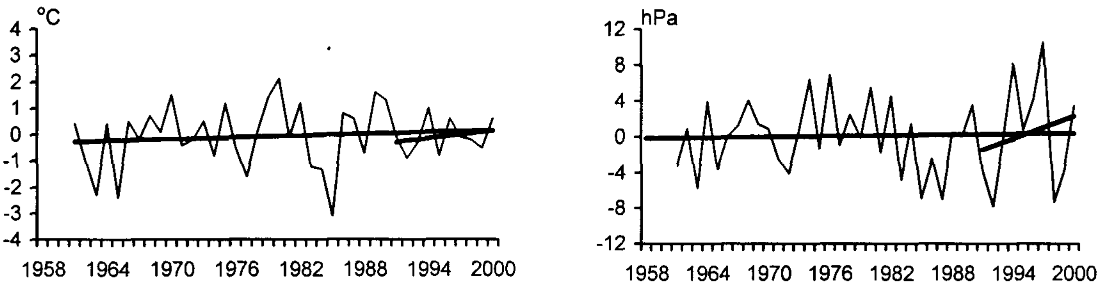
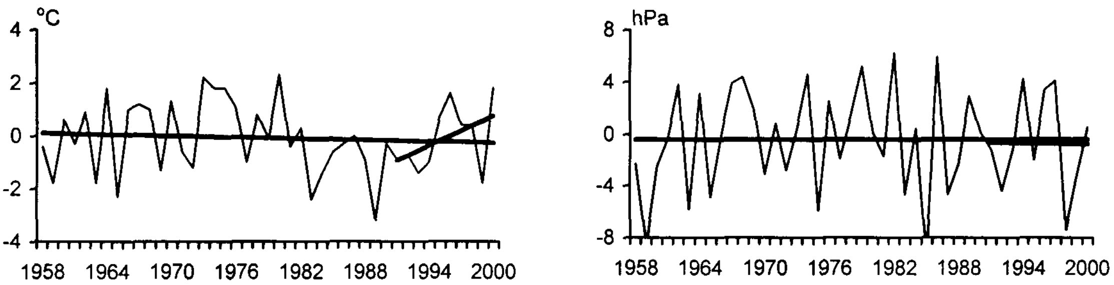


Fig. II.4. Interannual variations of air temperature and atmospheric pressure anomalies at the Russian Antarctic stations. October.

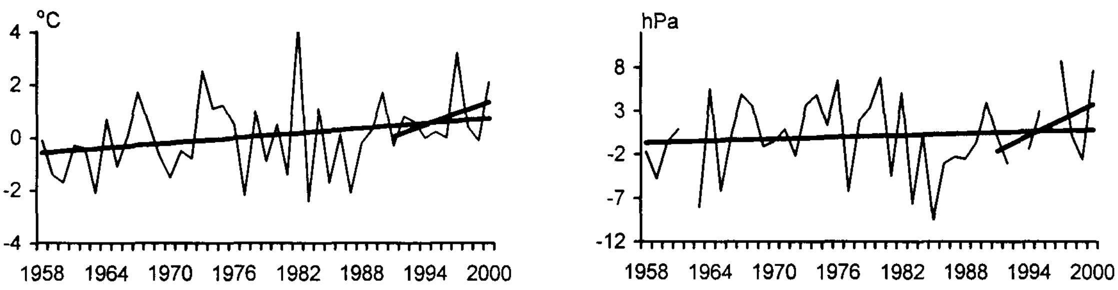
Novolazarevskaja



Mirny



Vostok



Bellinsgauzen

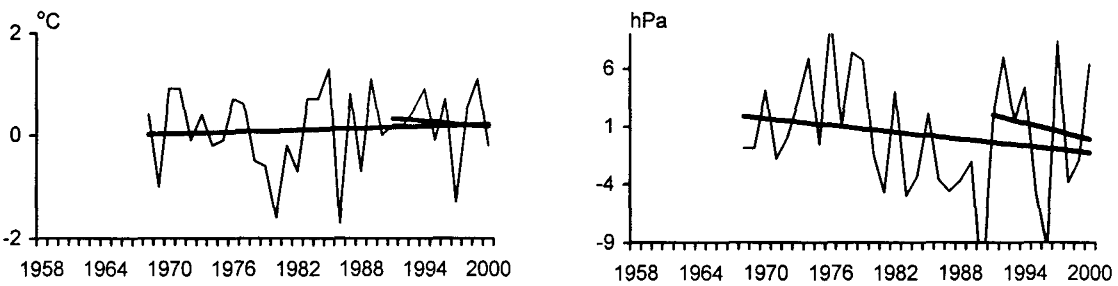


Fig. II.5. Interannual variations of air temperature and atmospheric pressure anomalies at the Russian Antarctic stations. November.

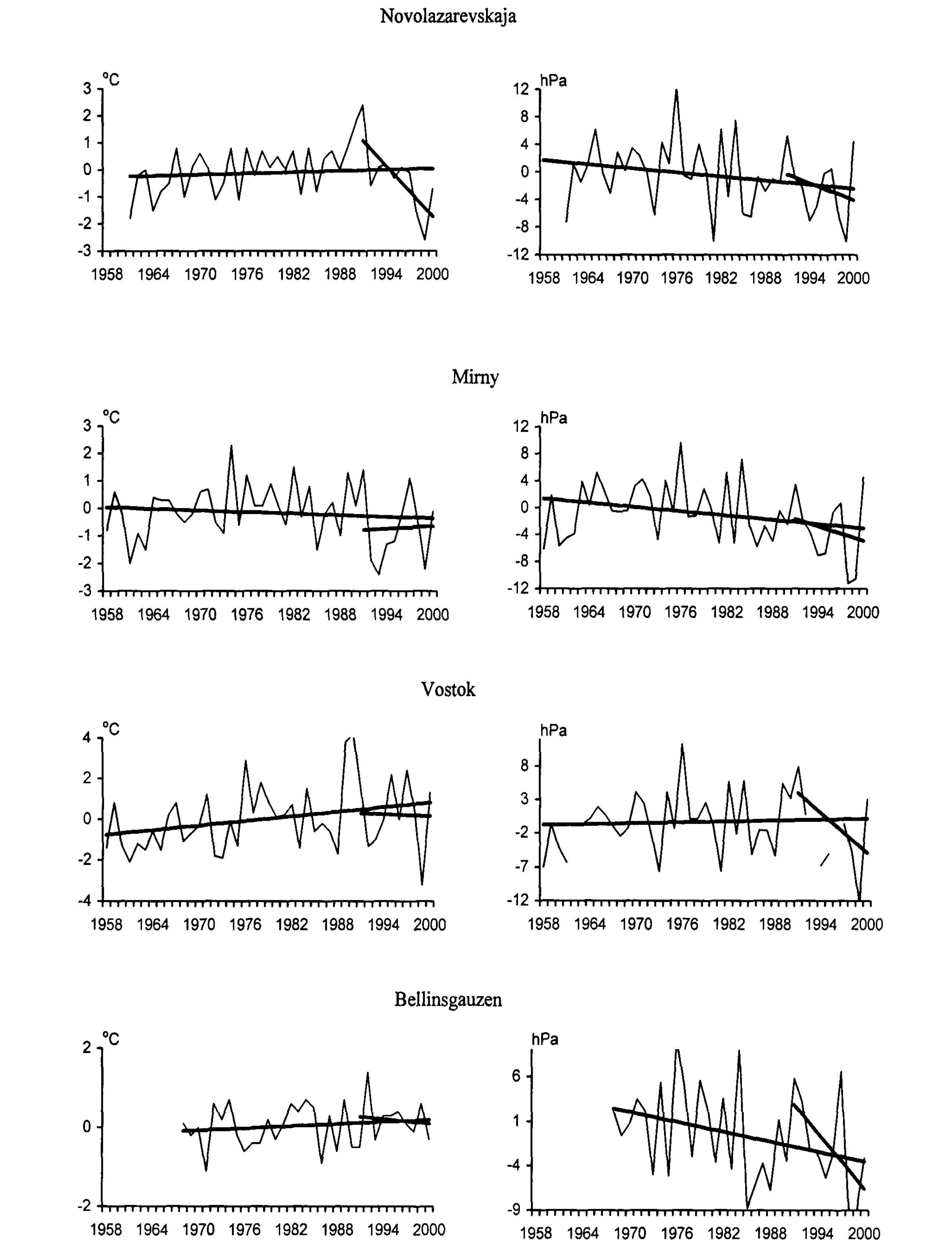


Fig.II.6.Interannual variations of air temperature and atmospheric pressure anomalies at the Russian Antarctic stations. December.

An assessment of the temperature linear trend parameters over the period 1957-2000 for October-December (Table II.1) does not reveal the statistically significant changes. One can only point that for October the trend is positive at Novolazarevskaya station while at the other three stations, it is negative. At the Bellingshausen station the trend in

November-December is positive. At Vostok, the trend in October-November is insignificant. Only in December, a statistically significant positive trend is observed. The temperature increase here over the period 1957-2000 comprised 1.7° C/44.

Table II.1

Linear trend parameters of mean monthly surface air temperature

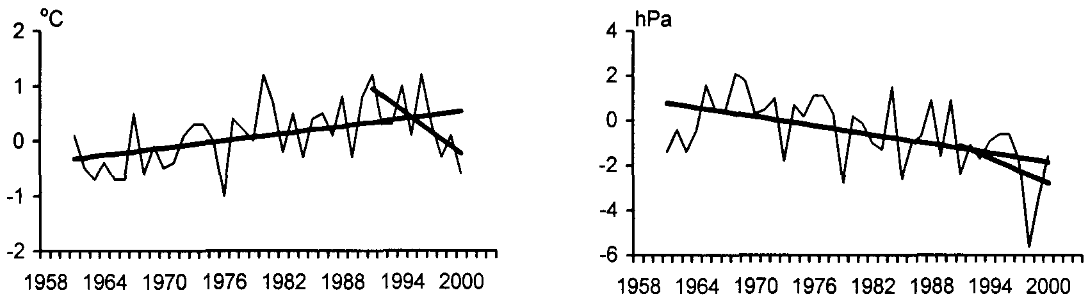
Stations		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Novolazarevskaya	°C/10 yr	0.190	0.202	0.195	0.232	-0.124	0.235	0.793	0.281	0.425	0.274	0.001	0.106	0.200
(1961 – 2000)	D,%	25	25	20	14	6	12	34	14	24	19	8	13	36
	P,%	–	–	–	–	–	–	95	–	–	–	–	–	95
Mirny	°C/10 yr	-0.11	0.00	-0.14	-0.24	-0.48	0.33	0.00	0.24	0.45	-0.00	-0.00	-0.00	-0.00
(1956 – 2000)	D,%	15	0	13	15	24	19	4	10	22	5	8	12	1
	P,%	–	–	–	–	–	–	–	–	–	–	–	–	–
Vostok	°C/10 yr	0.12	-0.00	-0.14	-0.19	-0.36	0.11	-0.19	0.17	-0.22	-0.31	0.31	0.38	-0.00
(1958 – 2000)	D,%	11	2	9	11	19	5	8	6	9	24	28	31	5
	P,%	–	–	–	–	–	–	–	–	–	–	90	95	–
Bellingshausen	°C/10 yr	0.38	0.36	0.35	0.42	0.73	0.82	0.27	0.62	-0.32	-0.06	0.00	0.01	0.30
(1968 – 2000)	D,%	59	55	40	28	33	37	8	26	17	6	7	16	36
	P,%	99	99	95	–	90	95	–	–	–	–	–	–	95
1991-2000 гг.														
Novolazarevskaya	°C/10 yr	–1.2	–1.8	–2.6	–1.5	–3.9	0.8	–2.0	–0.4	0.9	–2.2	0.5	–3.1	–1.3
	D,%	69	51	56	27	48	15	26	7	13	36	21	67	65
	P,%	95	–	90	–	–	–	–	–	–	–	–	95	95
Mirny	°C/10 yr	-0.88	–1.93	–1.70	–2.00	0.20	–1.15	–0.57	0.69	4.13	–2.32	1.86	0.16	–0.24
	D,%	32	58	50	27	4	15	6	9	47	49	45	4	9
	P,%	–	90	–	–	–	–	–	–	–	–	–	–	–
Vostok	°C/10 yr	–1.29	–2.92	–3.00	–4.27	–3.50	1.78	–4.91	–1.30	–0.28	–3.21	1.44	–0.13	–1.81
	D,%	37	57	74	58	56	22	40	17	4	60	39	2	62
	P,%	–	90	95	90	90	–	–	–	–	90	–	–	95
Bellingshausen	°C/10 yr	0.30	1.27	2.49	2.78	7.27	6.81	4.42	–0.36	–4.12	2.00	–0.19	–0.20	1.85
	D,%	21	65	83	72	83	80	40	5	62	48	8	11	68
	P,%	–	95	95	95	99	95	–	–	90	–	–	–	95

Note: First line is the linear trend coefficient;
D - dispersion explained by the linear trend;
P – level of significance (given if it exceeds 90%, 95% or 99 % by the Student's criterion).

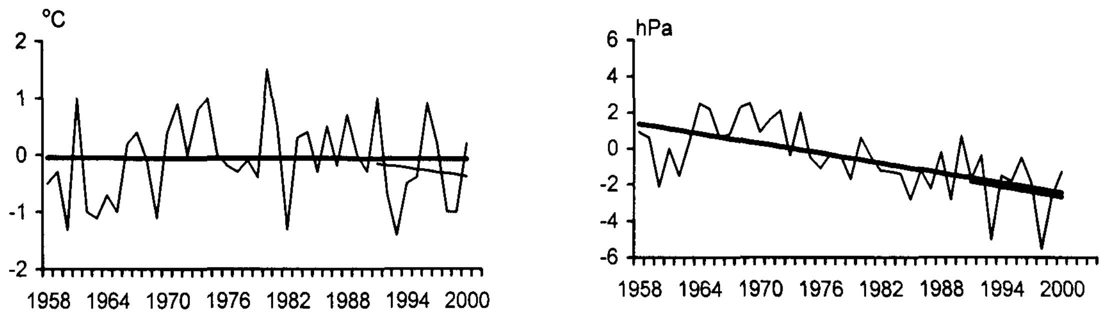
As to the other months of the year, one can see from data of Table II.1 that large statistically significant temperature changes at the coastal stations refer to the winter period. Thus, a temperature increase was 2.7°C/33 years for June at Bellingshausen station and 2.9°C/40 years for July at Novolazarevskaya station.

However, an assessment of the linear trends for all months of the year for the last decade displays a statistically significant negative trend for the summer months (December-January) at Novolazarevskaya station and a positive trend for February-June at Bellingshausen station. In spite of the peculiarities of the last decade and the differences for the individual months of the year, the mean annual temperature at both stations has a statistically significant positive trend in general over the period 1957-2000. The mean annual temperature increase as can be seen in Fig. II.7 and from data of Table II.1 comprised 1.2° C/33 years (from 1968) at Bellingshausen station and 0.9° C/40 years (from 1961) at Novolazarevskaya station. At Mirny and Vostok stations, the statistically significant trend of mean annual temperature for the entire observation period is insignificant. Thus, the available data can indicate with a specific degree of probability only a warming event in West Antarctica.

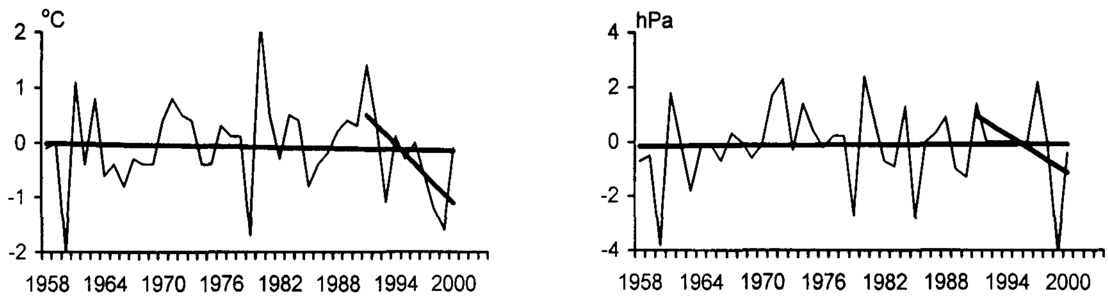
Novolazarevskaja



Mirny



Vostok



Bellinsgauzen

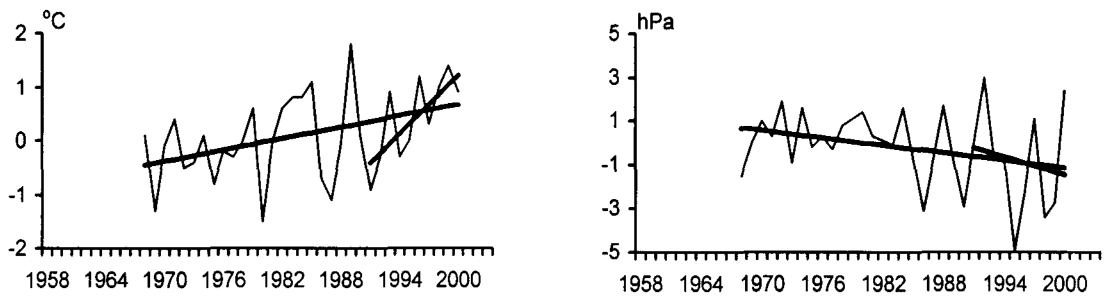


Fig. II.7. Interannual variations of anomalies of annual temperature and atmospheric pressure averages.

III. REVIEW OF THE ATMOSPHERIC PROCESSES ABOVE THE ANTARCTIC IN OCTOBER-DECEMBER 2000

An analysis of development of the atmospheric processes at temperate and high latitudes of the Southern Hemisphere indicates that the character of atmospheric circulation has changed in October. Unlike the previous months when the meridional circulation of predominantly M_a form prevailed /1, 2 and 3/, an active development of zonal circulation was observed in October (Table III.1). The resulting disturbance of the interlatitudinal air exchange has governed the formation of the center of the below zero temperature anomalies above East Antarctica including the inland areas. The background atmospheric pressure was decreased at this.

In November, the meridional processes have started to dominate again, especially the M_a circulation form. One can note the development of the Australian high pressure ridge that obstructed the motion of cyclones along the Marion and Kerguelen trajectories. The cyclones often persisted above the Davis and Mawson Seas while their frontal divides sometimes penetrated deep inland bringing snowfalls and drifting snow. Due to the development of the ridges of the Highs, the atmospheric pressure above East Antarctica was typically slightly higher than a multiyear average or close to it. The meridional export of air masses to high latitudes has determined the dominance of the above zero temperature anomalies over much of the Antarctic continent. The spring stratospheric modification has been practically completed at the end of the month.

In December, the mean monthly atmospheric pressure above a considerable portion of the South Polar area was higher than a multiyear average, which can be related to the slightly more northern trajectories of the Lows. The air temperature above much of Antarctica was close to a multiyear average.

Table III.1

Frequency of occurrence of the atmospheric circulation forms in the Southern Hemisphere and their anomalies in October-December 2000.

Month	Frequency of occurrence (days)			Anomalies (days)		
	Z	M_a	M_b	Z	M_a	M_b
October	17	8	6	4	-3	-1
November	8	15	7	-7	4	3
December	16	8	7	2	-4	2

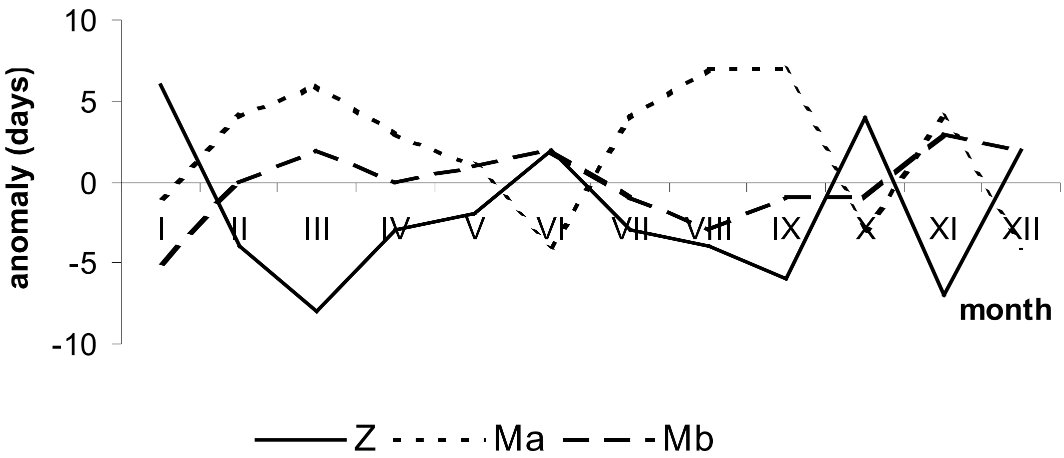


Fig. III.1. Variations of the anomalies of atmospheric circulation forms in the Southern Hemisphere in 2000.

Considering the peculiarities of atmospheric macroprocesses above the temperate and high latitudes of the Southern Hemisphere in 2000 in general, the dominance of meridional character following a more active zonal character in late 1999-early 2000 is noted. However, by the end of 2000, a tendency for a higher frequency of occurrence of zonal processes and a significant decrease of the frequency of M_a form has appeared (Fig. III.1). From

month-to-month, there was a displacement of the areas of dominance of northerly and southerly air flows, governing a change in the areas of the below and above zero temperature anomalies over the Antarctic Seas and the adjoining coastal territories.

The fields of pressure anomalies were of a meridional character in most months. Of interest is a significant positive anomaly of about +10 hPa in July above the inland areas of East Antarctica and about +13 hPa in September above the Antarctic Peninsula.

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.
3. Ryzhakov L.Yu., Savitsky G.B. and Ryabkov G.Ye. Seasonal motion features of pressure formations in the Southern Hemisphere at typical atmospheric macroprocesses. – SAE Proceedings, 1990, Vol. 87, p. 70-74.

IV. BRIEF OVERVIEW OF ICE PROCESSES IN THE SOUTHERN OCEAN IN 2000 FROM SATELLITE DATA AND COASTAL OBSERVATIONS AT THE RUSSIAN ANTARCTIC STATIONS

The ice conditions in the marginal Antarctic Seas in early 2000 during the summertime were of a complicated character. In January-February, the areas with an increased ice cover extent were adjacent to the water areas that were almost completely ice cleared. For example, in Prydz Bay, there was an unusually persistent tongue of heavy ice exported from the east from behind the Cheluskintsev Peninsula. This ice was partly brought to the head of the bay where it concentrated near the landfast ice edge preventing its breakup. Thus, the landfast ice in the vicinity of Progress station was destroyed approximately one month later compared to a multiyear average (Table IV.1), whereas in Sandefjord Bay where the seasonal field Druzhnaya-4 Base is located, the second-year landfast ice 25-30 km in width was not broken up at all.

Simultaneously in the Davis Sea, a rare situation of its virtually complete ice clearance was observed. It was accompanied with a relatively early breakup and export of landfast ice in the area of Mirny Observatory.

The Atlantic ice massif was of low mobility occupying the south-westernmost location obstructing the approach to the Weddell Sea coast from the Atlantic Peninsula tip to 30° W (Cape Vahsel).

In autumn, the significant differences between the regions in respect of the ice cover extent were also preserved.

The Atlantic massif core between 30-60° W still underwent no significant changes for a long time. Its northern boundary reached the South Orkneys Islands only in late June. However, the area of the so-called Weddell Polynya between 20° W and 20° E was rapidly covered with ice in May. The area of its extent has significantly exceeded a multiyear average (Table IV.2).

At the same time, in spite of the increased residual ice cover extent of the Cosmonauts and Commonwealth Seas, the ice belt expanded here very slowly. Even by late June, the ice edge in the longitudinal sector 40° E-60° E remained near 65° S. On the contrary, the ice cover extent in the Davis Sea has reached a multiyear average as early as in May. Even a more pronounced change of the decreased summer ice cover extent to the increased autumn one was observed in the area of the Mawson-D'Urville Seas.

According to data of Mirny and Progress stations, a late establishment of landfast ice was recorded in the coastal zone due to frequent breakups (Table IV.1) but with its subsequent rapid growth by thickness (Table IV. 3).

In winter, the general tendency for a decreased expansion of the ice cover was clearly pronounced. As a result in September, when the Antarctic circumpolar belt of drifting ice usually achieves its maximum size, it was everywhere less developed compared to a multiyear average (Table IV.2).

In respect of the decreased winter development of ice processes, an example of the area of South Shetland Islands is quite illustrative. According to observations of the Scientific Bellingshausen base, the duration of the ice period from the time of stable ice formation until a complete ice clearance of Ardley Bay was only one month, while in mean multiyear data, it comprises 4-5 months (Table IV.1).

However, in the areas of Progress station and Mirny Observatory, the landfast ice growth until the onset of spring melting in November continued extremely intensely (Table IV.3). This has determined an excess of 10 and 30 cm, on average, respectively over the landfast ice thickness here recorded last year. It is also noted that there is an almost constant snow absence (Table IV.4) on landfast ice in Vostochnaya Bay (Prydz Bay, Progress station).

In October and especially in November, there was a sharp increase in the dynamics of the circumpolar belt of drifting ice. It was accompanied with its active separation and diverging. During this period, a breakup of the marginal segments of landfast ice and intense development of recurring polynyas began. Especially large polynyas were observed in the Weddell and Cosmonauts Seas, in Prydz Bay and in the Dumont D'Urville Sea.

As a result, in December (Fig. IV.1), the increased background ice cover extent was observed predominantly in the Scotia Sea following from continued ice export from the Atlantic massif core to the northeast towards the South Orkneys and Sandwich Islands. Over the rest of the water area, the location of the northern ice edge was close to the norm or was even much more southward (in the Cosmonauts Sea). By the end of the month, the central part of the Commonwealth Sea between 65° E and 75° E as well as the Dumont-D'Urville Sea between 139° E and 145° E have become unusually early ice-free.

Table IV.1

Dates of the main ice phases in the areas of Russian Antarctic stations in 2000

Station (water body)		Landfast ice breakup		Ice clearance		Ice formation		Landfast ice formation		Freeze up	
		Start	Final	First	Final	First	Stable	First	Stable	First	Final
Mirny (roadstead)	Actual	14.12.1999	27.01	14.02	14.02	14.03	14.03	29.03	24.04	04.05	04.05
	Multiyear average	23.12	05.02	12.02	NO	11.03	12.03	30.03	02.04	14.04	17.04
Progress (Vostochnaya Bay)	Actual	03.02	16.02	NO	NO	19.02	19.02	18.03	18.03	05.04	05.04
	Multiyear average	30.12	13.01	NO	NO	16.02	17.02	06.03	08.03	26.03	26.03
Bellingshausen (Ardley Bay)	Actual	29.08	17.09	18.09	18.09	25.06	19.08	23.07	NO	25.08	NO
	Multiyear average	10.09	09.10	12.10	05.11	09.05	08.06	11.06	13.06	03.07	07.07

Note: [1] NO – phenomenon not observed.

Table IV.2

Landfast ice thickness (cm) in the areas of Russian Antarctic stations from profile measurement data in 2000

Station		Months											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Mirny	Actual					77	91	113	132	147	156	167	166
	Multiyear average				46	67	84	101	119	137	152	156	149
Progress	Actual			34	63	90[1]	105[1]	144	155	163	166	144	

Note:[1] from measurements at a constant point.

Table IV.3

Snow depth (cm) on landfast ice in the areas of Russian Antarctic stations from profile measurement data in 2000

Station		Months											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Mirny	Actual					26	15	18	37	24	14	30	17
Progress	Actual			0	3	7[1]	0[1]	6	0	0	0	0	

Note:[1] from measurements at a constant point

Table IV.4

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

Longitude	February		May		September		December	
	Actual ice edge location	Multiyear ice edge location average	Actual ice edge location	Multiyear ice edge location average	Actual ice edge location	Multiyear ice edge location average	Actual ice edge location	Multiyear ice edge location average
60° W	64.2°S [1]	64.2°S [1]	64.2°S [1]	63.1°S				
50° W	67.9	65.3	62.4	60.5	60.9°S	59.9°S	59.4°S	62.6°S
40° W	71.2	69.3	63.8	61.2	58.9	58.1	59.1	61.4
30° W	72.2	73.1	63.3	62.6	58.8	57.0	58.2	62.9
20° W	71.8	72.5	63.4	64.6	59.9	56.9	60.9	64.1
10° W	70.4	70.4	62.1	66.2	58.6	56.6	63.8	64.1
0°	69.5	69.3	64.7	66.8	55.8	55.9	63.5	64.4
10° E	69.3	69.3	63.5	66.3	56.3	55.3	62.8	64.3
20° E	69.2	69.1	63.6	66.2	55.3	56.6	64.9	64.1
30° E	68.3	68.5	65.0	66.4	60.7	58.7	66.0	63.6
40° E	67.4	67.8	65.6	66.2	60.6	59.1	66.8	62.8
50° E	66.7	66.3	65.5	64.8	60.8	59.1	64.4	64.0
60° E	67.0	66.8	64.2	63.6	60.3	59.3	64.8	64.3
70° E	66.8	67.3	64.9	63.0	59.7	59.1	64.2	64.2
80° E	65.9	66.0	64.4	63.4	59.4	58.3	63.8	64.9
90° E	65.5	65.5	63.8	63.3	61.2	59.5	64.2	64.8
100° E	64.8	64.4	63.5	62.9	61.6	59.9	62.8	62.8
110° E	65.5	65.4	62.6	63.5	63.2	60.6	64.1	64.0
120° E	65.3	65.6	62.5	63.8	63.8	61.3	65.2	64.3
130° E	65.2	65.4	63.5	64.0	63.9	61.9	64.8	64.2
140° E	66.7 [1]	66.5	63.6	63.9	63.6	62.3	66.7 [1]	64.9
150° E	65.9 °S	65.4 °S	62.3°S	63.6	62.2	62.0	64.9	64.8
160° E				62.1	62.1	64.6	64.5	
170° E				62.2	62.9	65.6	66.1	
180° E				62.3°S	63.8°S	66.1°S	67.8°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.

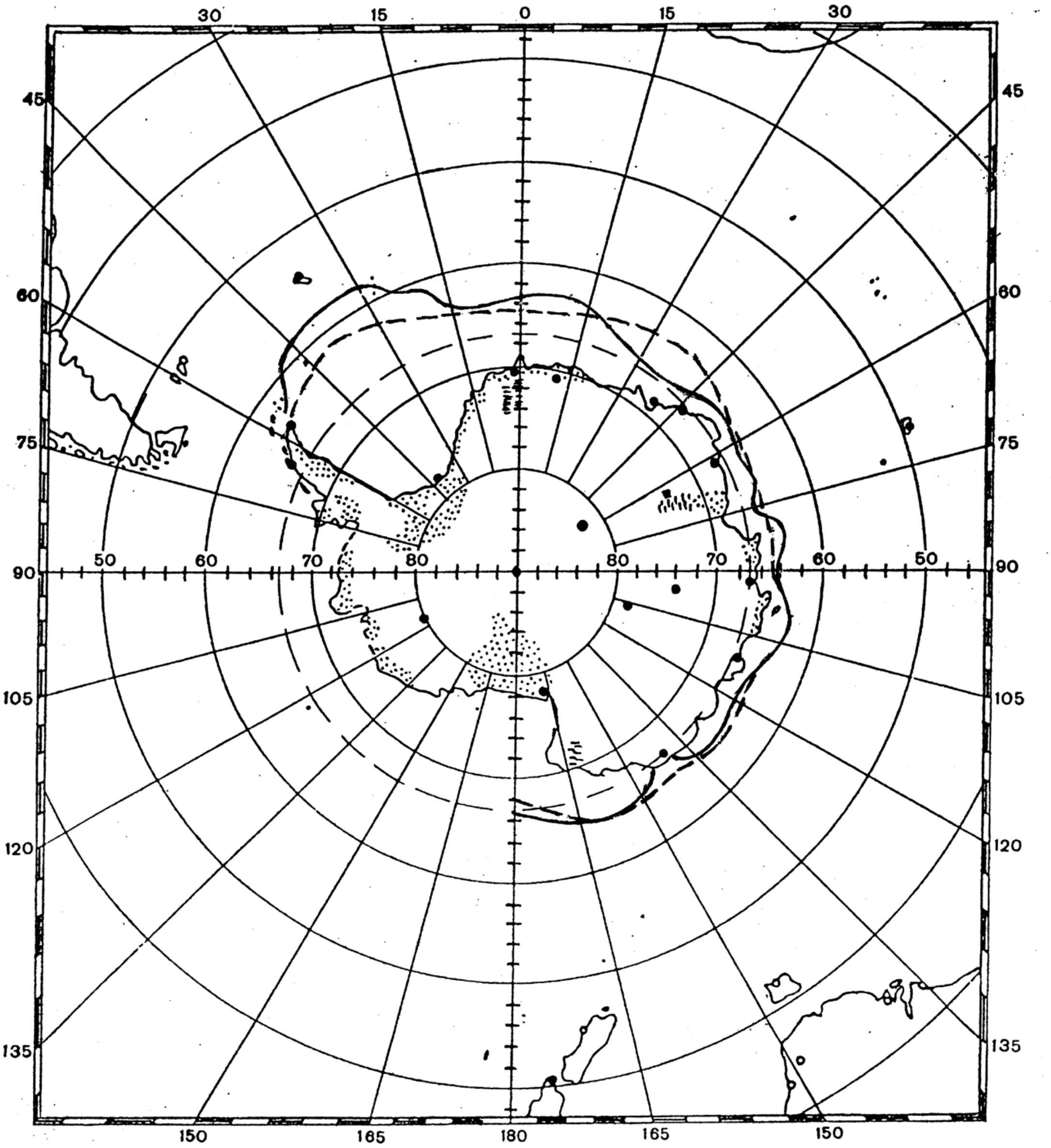


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Fig. IV.1. Actual (1) and mean multiyear (2) position of the external northern drifting ice edge in the Southern Ocean in December 2000.

Symbols:

1 ▬▬ actual; 2 - - - norm (multiyear average).

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

In 2000, the total ozone (TO) measurements were undertaken using M-24 ozone meter at Mirny and Vostok stations. Annual variations of daily TO values for these stations are presented in Fig. V.1.

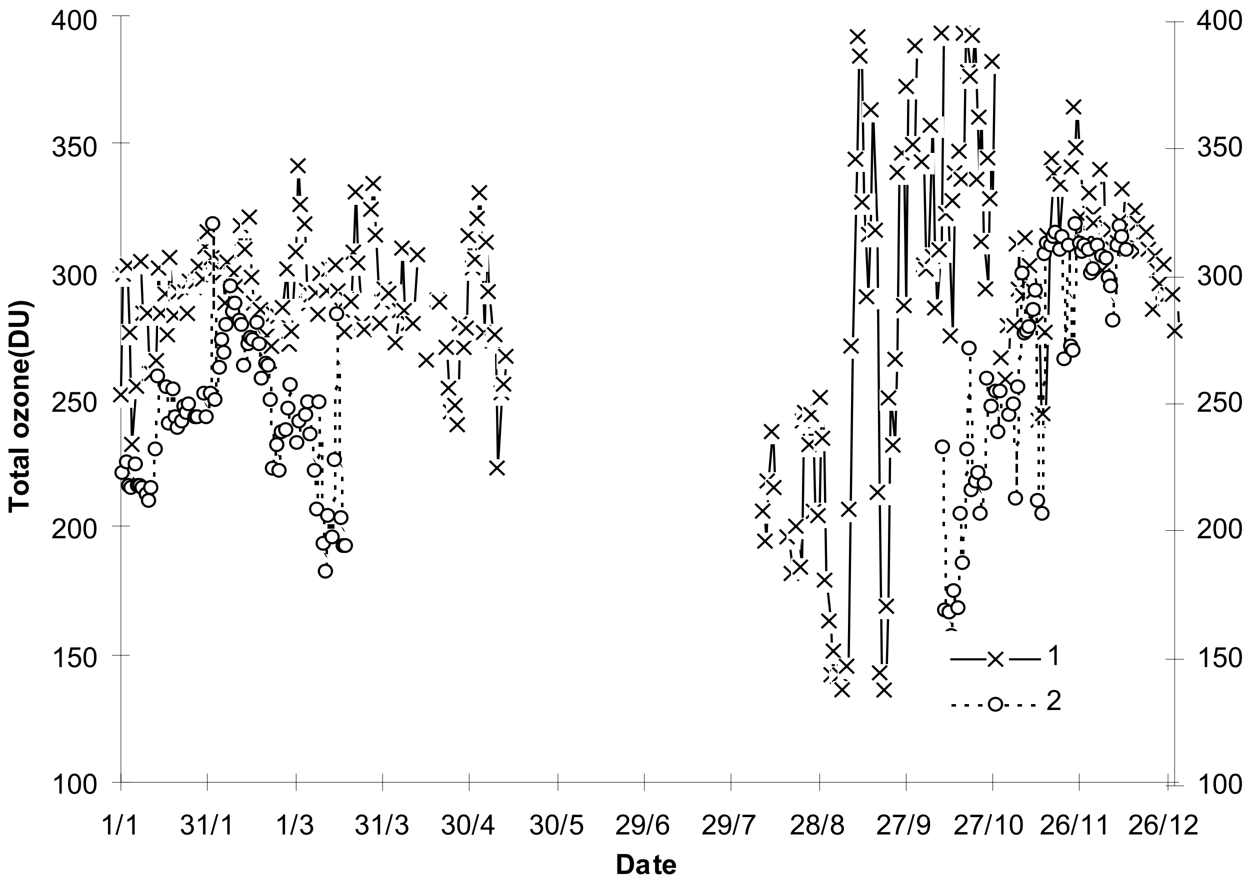


Fig. V.1. Daily total ozone averages at Mirny (1) and Vostok (2) stations in 2000.

The absolute values of total ozone and the character of its change in the annual variations at these stations differ significantly, which is connected as noted in the previous issues of the Bulletins, with the geographical location of the stations relative to the circumpolar vortex center. The daily total ozone variability at Mirny is much higher than at Vostok, especially in spring during the period of destruction of the winter stratospheric vortex. This can be attributed to a peripheral location of Mirny relative to the center of the circumpolar vortex, and correspondingly, to a larger probability of the inflow to this Antarctic area of the air masses rich in ozone from temperate latitudes.

The lowest daily TO averages during the season under consideration at Mirny were recorded on September 7 and 21 equaling 137 Dobson units. The lowest value of 159 Dobson units at Vostok was observed on October 14 (the observations at Vostok have started after the polar night only on October 10). Thus, in September, the second by rank total ozone minimum was observed in Mirny over the entire history of ozone measurements at this station (a minimum of 127 Dobson units was recorded on September 2, 1994). At Vostok station, due to the low Sun's height, the observations could not be performed at this time.

Data of TO measurements in September in Mirny confirm the reports of the USA and Japanese investigators about the "ozone hole" observed above Antarctica at this time. It was of a very large extent with an area of 28.4 million km^2 on September 5 according to satellite data. During September, sharp ozone oscillations occurred between 137 Dobson units at the beginning and end of the month to 393 Dobson units on September 12. According to the analysis of the circulation processes, there was an anomalously developed meridional feature above Antarctica in September with a stable export of air masses of temperate latitudes towards the eastern coast that was most intense in the Indian Ocean sector. This could in turn cause an inflow of the richer in ozone air masses from the north.

The least monthly TO average in Mirny in 2000 was observed in August (see Fig. V.2). It comprised 218 Dobson units, which was the second by rank minimum value for August in Mirny. In January, the second by rank minimum monthly average for this month was also recorded that was equal to 285 Dobson units. Monthly TO averages in May and October were the highest for these months over the entire observation period beginning from 1974. The monthly TO average in October (341 Dobson units) was much higher than in September (248 Dobson units) and higher

than TO values in October for all last years. One can also note the decreased amplitude of day-to-day TO oscillations in October compared to September, which is probably related to the modified circulation processes from the dominating meridional forms to zonal ones and to the decreased interlatitudinal air exchange. In November, the amplitude of day-to-day TO oscillations as well as its monthly average have decreased even more, which can be attributed to the practically completed seasonal modification of the circumpolar vortex.

At Vostok station, the daily and monthly TO averages were lower than in Mirny almost throughout the entire year. The minimum monthly average was recorded in October and comprised 215 Dobson units. Both in October and November, the TO monthly averages at Vostok were much higher than the values observed here for the last two years. Data for December are not commented here since the results of measurements reported from Antarctica are doubtful and require an additional analysis.

The entire period of TO observations at Mirny Observatory beginning from 1974 is characterized by a tendency for its decreasing values by about 10% in summer and autumn compared to the mid-1970s (the trends calculated for these seasons are insignificant) and by 25-30% in spring (see Fig. V.3). There are significant total ozone fluctuations from year-to-year at this, which can be explained by the changes in the configuration of the decreased pressure area forming in winter over Antarctica and specific features of its destruction in spring. In this respect, the year 1988 is still noticeable when the destruction of the stratospheric vortex occurred very early in spring without causing the TO decrease. As a result, the values of the latter were at the level of values observed in the 1970s.

During this season, the TO values in spring were even slightly higher than in the last several years although as noted above there were significant variations during September and the extremely low daily averages of 137 Dobson units for Mirny were observed twice.

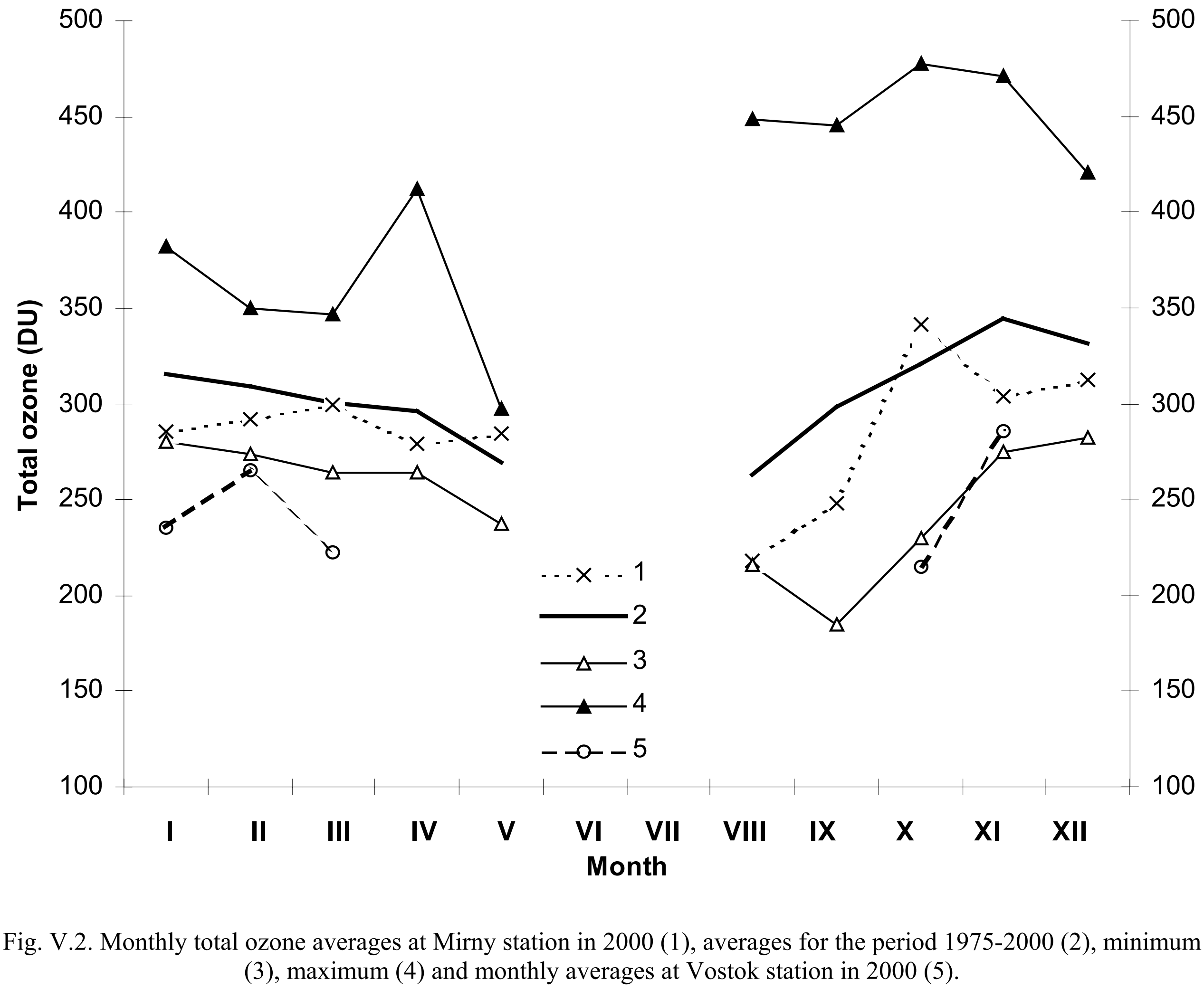


Fig. V.2. Monthly total ozone averages at Mirny station in 2000 (1), averages for the period 1975-2000 (2), minimum (3), maximum (4) and monthly averages at Vostok station in 2000 (5).

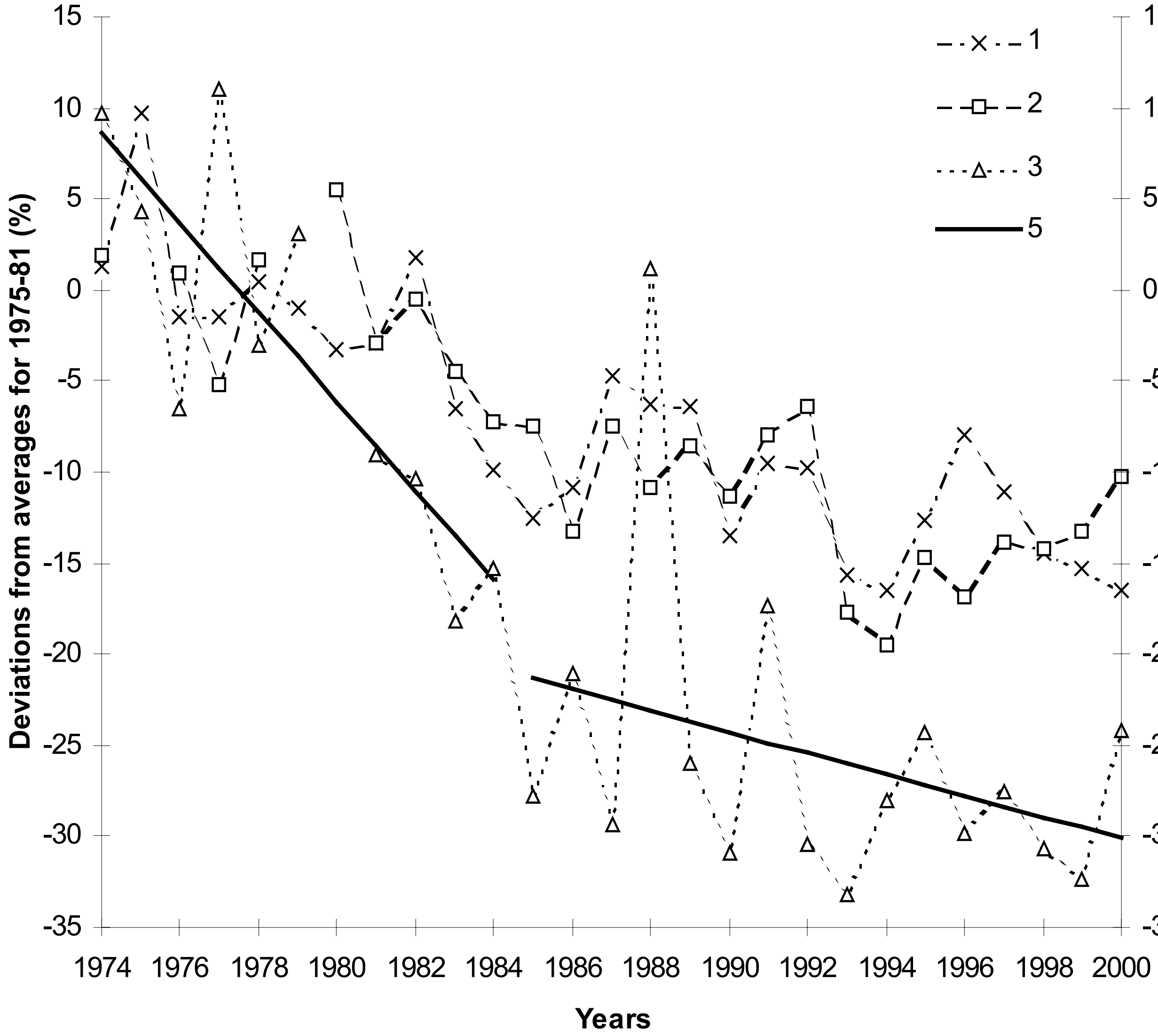


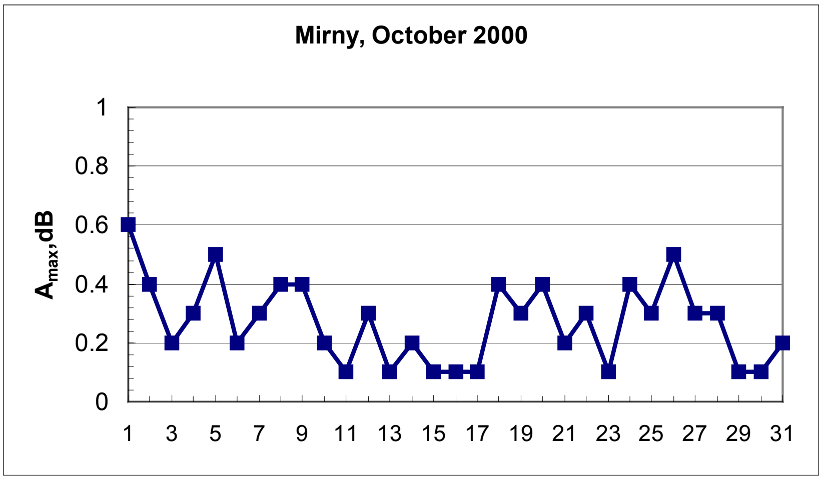
Fig. V.3. Normalized TO deviations at Mirny station for summer (1), autumn (2) and spring (3); linear trends of TO changes for spring (4).

VI. GEOPHYSICAL OBSERVATIONS AT RUSSIAN ANTARCTIC STATIONS IN 2000
DATA OF ONGOING OBSERVATIONS

MIRNY OBSERVATORY

Mean monthly absolute geomagnetic field values

	October	*November*	*December*
Declination	*86°45.3'W*	*86°52.0'W*	*86°35.9'W*
Horizontal component	*13977 nT*	*13965 nT*	*13975 nT*
Vertical component	*-57552 nT*	*-57519 nT*	*-57531 nT*



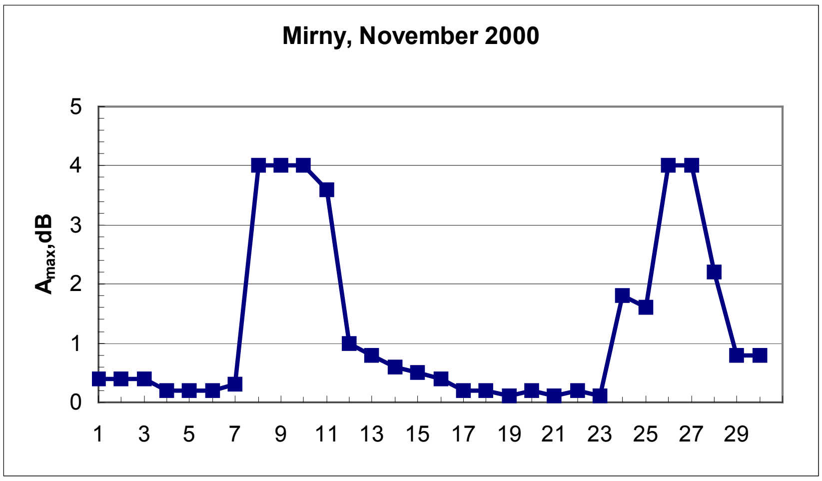


Fig. VI.1. Maximum daily space radio-emission absorption at the 32 MHz frequency from riometer observations in Mirny Observatory.

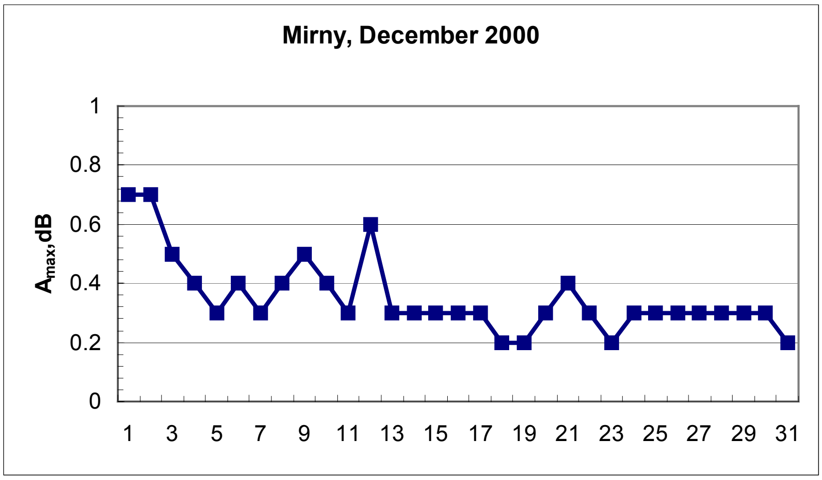
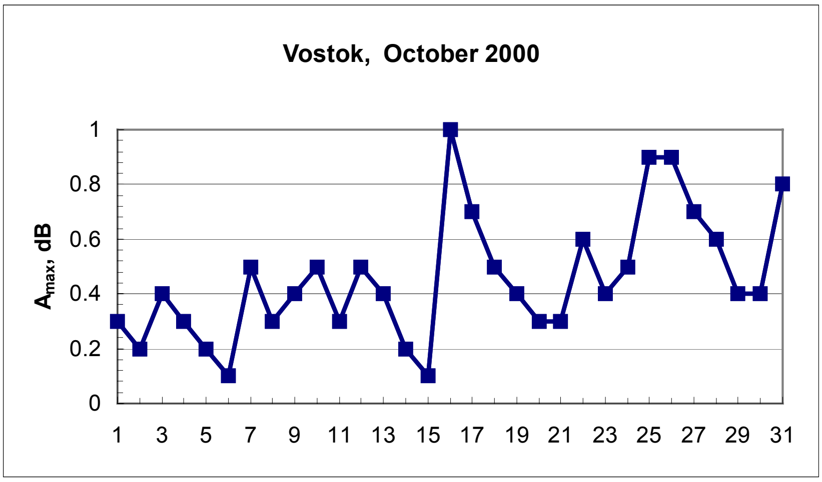


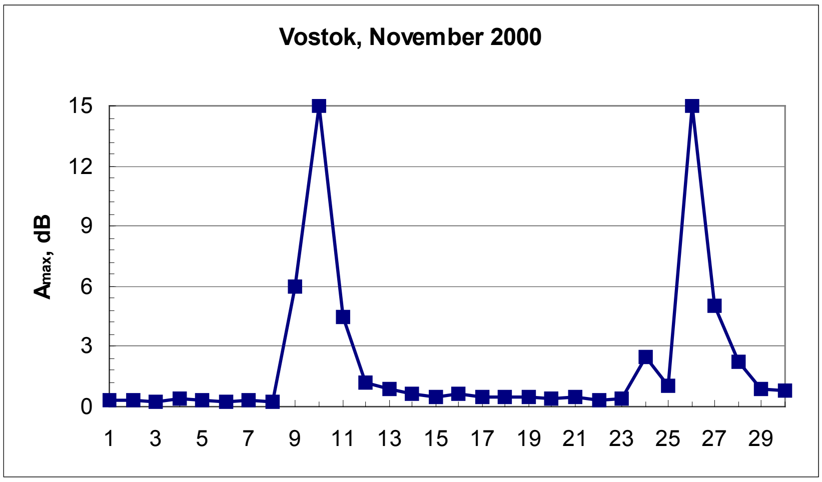
Fig. VI.1 (continued) Maximum daily space radio-emission absorption at the 32 MHz frequency from riometer observations in Mirny Observatory.

VOSTOK STATION

Mean monthly absolute geomagnetic field values

	October	November	December
Declination	*120°37.5'W*	*120°44.2'W*	*120°50.1'W*
Horizontal component	*13436 nT*	*13459 nT*	*13438 nT*
Vertical component	*-58192 nT*	*-58106 nT*	*-58151 nT*





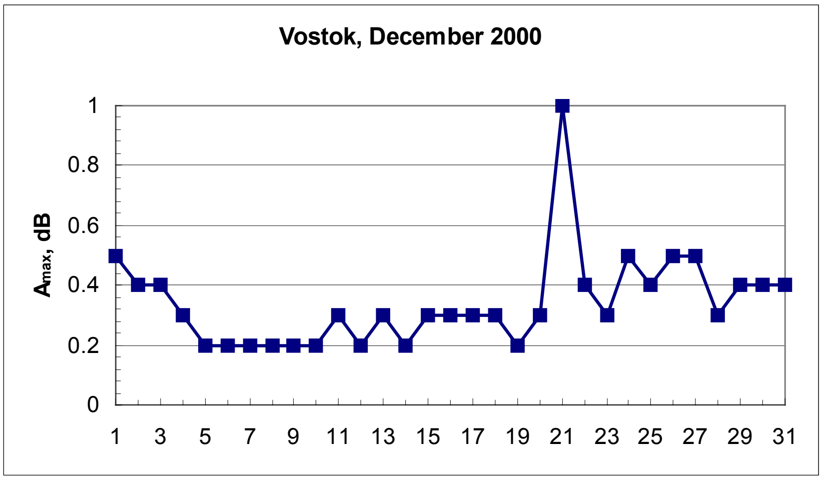
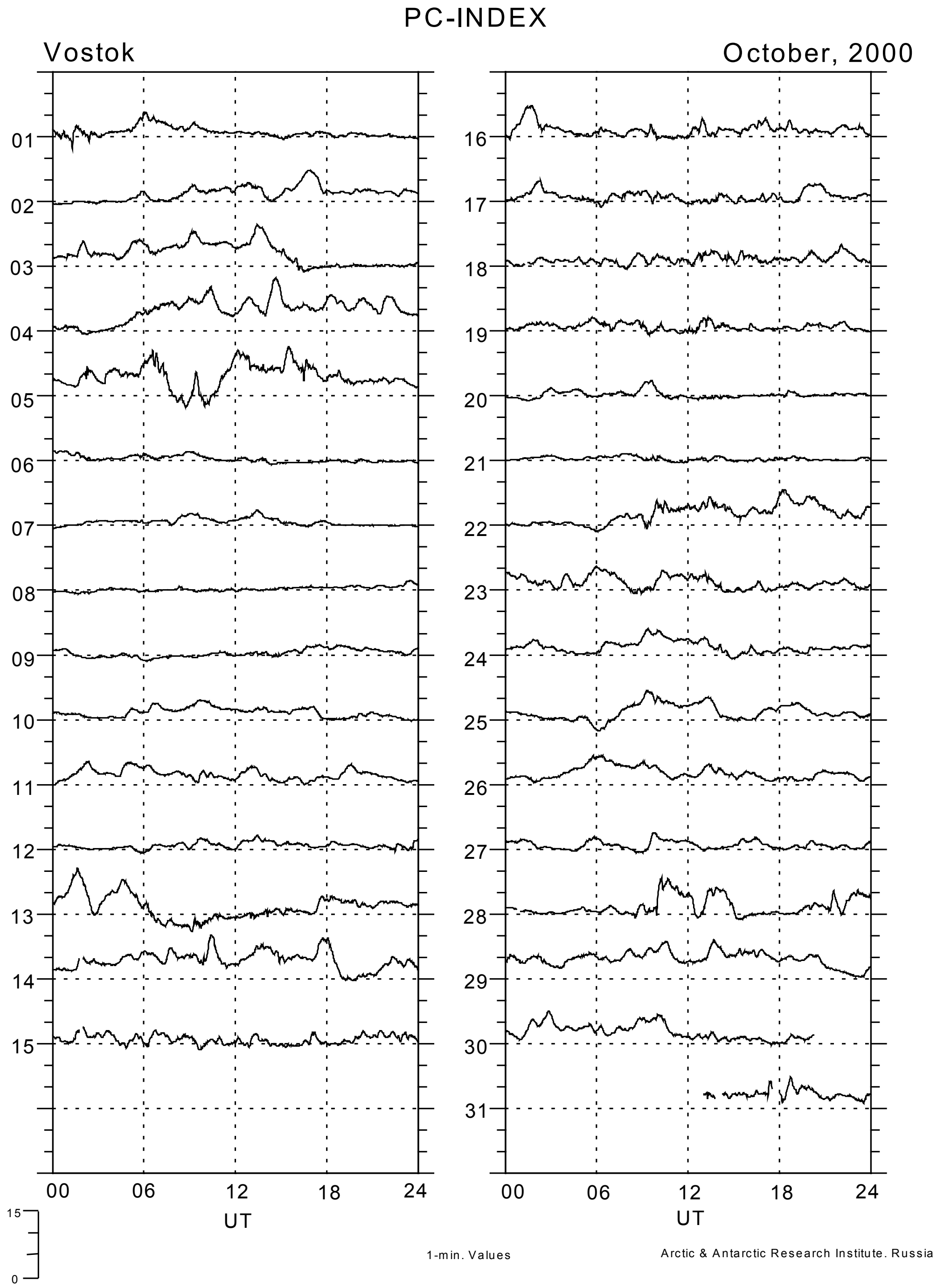


Fig. VI.2 Maximum daily space radio-emission absorption at the 32 MHz frequency from riometer observations at Vostok station.


PC-INDEX
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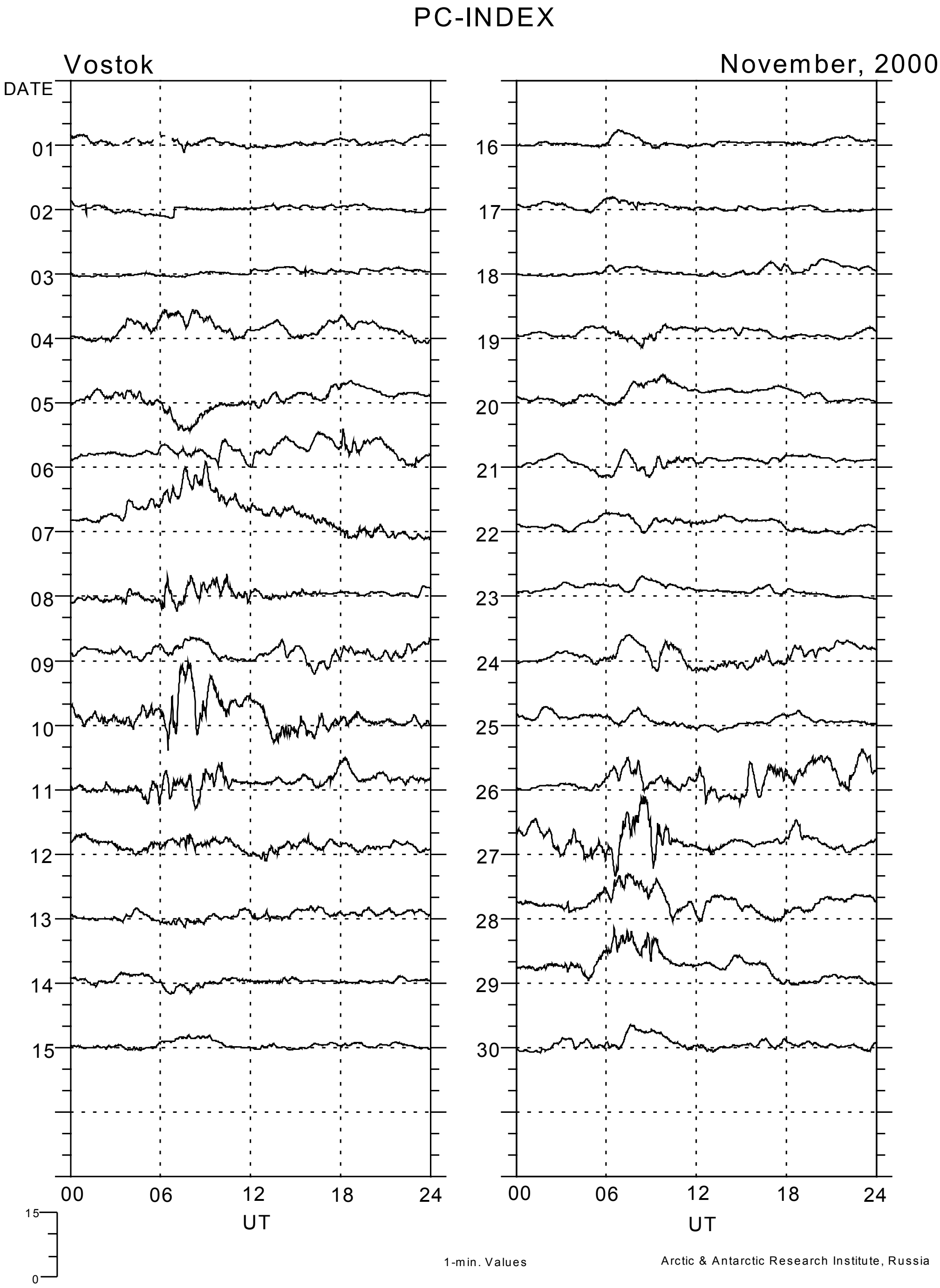
1-min. Values
Arctic & Antarctic Research Institute. Russia

Fig. VI.3.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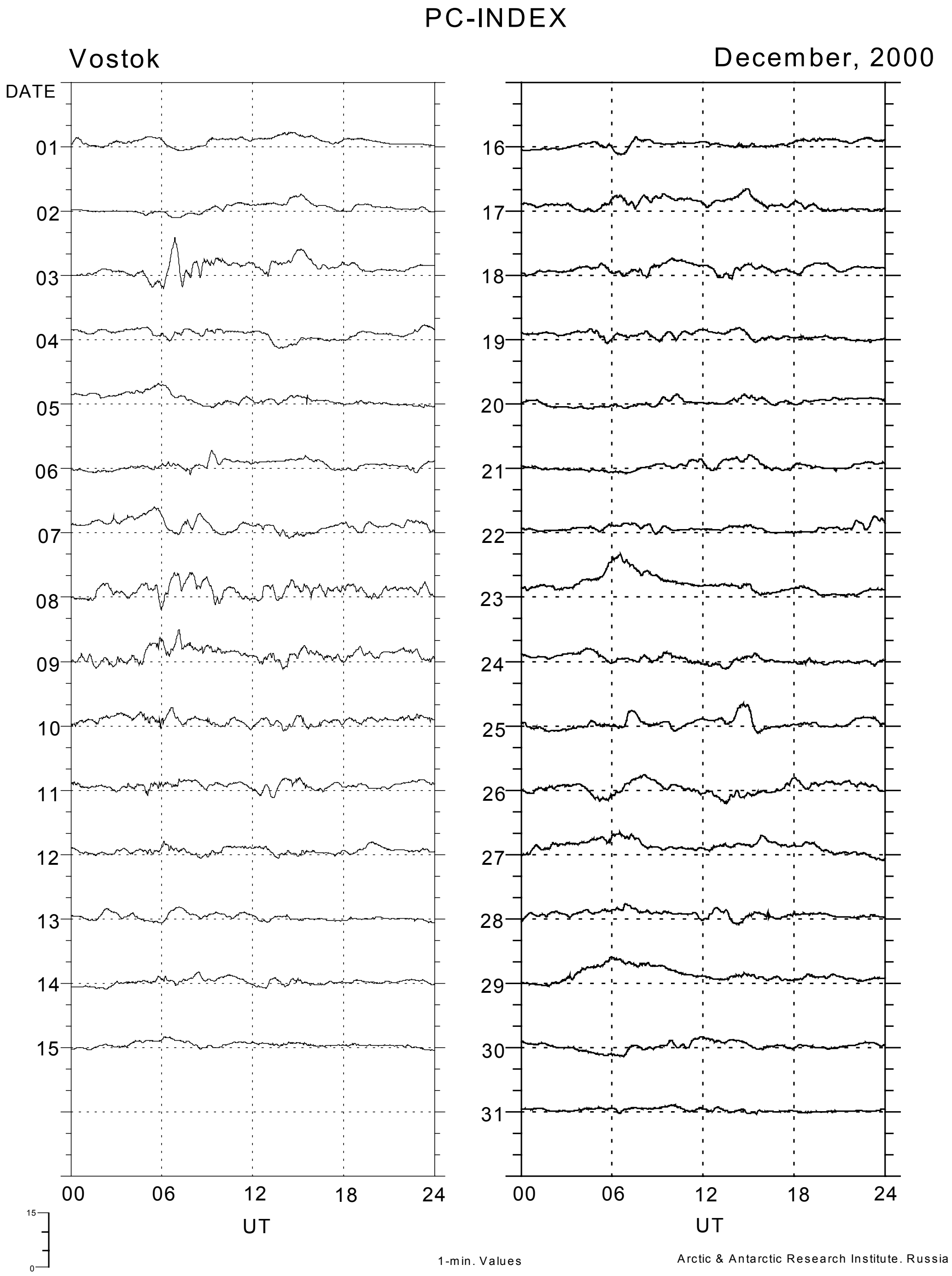
Arctic & Antarctic Research Institute, Russia

Fig. VI.4.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Arctic & Antarctic Research Institute. Russia

Fig. VI.5.

VII GEOPHISICAL OBSERVATIONS AT RUSSIAN ANTARCTIC STATIONS IN 2000

Diagnostics of the magnetosphere state from data on magnetic activity in the near-pole area: PC-index

V.A. Gizler, R.Yu. Lukyanova, I.V. Moskvin and O.A. Troshichev

Introduction

It is known that the magnetic activity in the polar cap is determined during the non-substorm periods by the changes in the solar wind parameters. As shown by the statistical studies, there is an almost linear relation between the vertical B_z component of the interplanetary magnetic field (IMF) and the amplitude of magnetic disturbances associated with a two-cell convection pattern DP2. At the station located in the vicinity of the pole, the DP-disturbances will be determined at all local time hours by the antisolar convection flux in a two-cell pattern. In view of this, it was proposed [Troshichev et al., 1988] to use data of the station situated in the vicinity of the geomagnetic pole to calculate the magnetic activity index PC that could be considered as an indicator of magnetic activity driven by the IMF B_z component. An obvious advantage of the PC-index is that it can be obtained only from data of one station, which reduces to a minimum the process of data collection and processing.

The results of the corresponding analysis based on the data of Vostok station (invariant latitude of –83.3°, local magnetic noon at 13.00 UT) will be described below.

Method of analysis

The F amplitude of magnetic disturbances in the South Pole Cap related to a two-cell DP2 convection pattern is determined by the following expressions:

$$F = \Delta H \sin\psi + \Delta D \cos\psi \qquad (1)$$

$$\psi = \lambda + D + UT^0 + \varphi \qquad (2)$$

where ΔH and ΔD are deviations of H and D components of the geomagnetic field from the quiet level; UT is universal time expressed in degrees (1 h UT = 15, 12 h UT =180, etc.); D is the average declination at the station (for Vostok, D =-119); λ is geographical longitude and φ is the angle between the direction of antisolar convection and the noon-midnight meridian.

As initial data, the 1 minute averaged magnetic perturbation values at Vostok station and data on solar wind parameters from IMP-8 satellite during the 1977-1980 period were used.

The F-correlation with the following parameters was considered:

$$F = \alpha_1 \cdot B_Z + K_1 \qquad (3)$$

$$F = \alpha_2 \cdot v \cdot B_Z + K_2 \qquad (4)$$

$$F = \alpha_3 \cdot v \cdot B_S + K_3 \qquad (5)$$

$$F = \alpha_4 \cdot E_m + K_4 \qquad (6)$$

$$F = \alpha_5 \cdot \varepsilon + K_5 \qquad (7)$$

Here, $E_m = v \cdot B_t \cdot \mathrm{Sin}^2\theta/2 = v \cdot (B_Z^2 + B_Y^2)^{1/2} \cdot \mathrm{Sin}\theta/2$ presents an electric reconnection field penetrating to the magnetosphere at its interaction with solar wind, ε is the Akasofu energy parameter; v is the solar wind speed; B_Z is any vertical and B_Y is only the southern IMF component.

Since the polar ionosphere conductivity strongly depends on the time of the year and of the day, data were divided into three seasons (summer, equinox and winter) and the regression analysis was performed for each UT h of each season separately. Having derived the regression coefficients α_i and K_i, we can diagnose a B_Z IMF component or other solar wind parameters according to expressions (3)-(7).

Results of the regression analysis

In order to estimate the optimal delay time of the ground response to the change in the solar wind parameters, the correlation coefficients between F and different IMF parameters in the right-hand side of expressions (3) and (7)

were calculated for different $\Delta\tau$ varying from 0 to 60 min. The most typical delay time was the time at which the correlation coefficient averaged over a day achieved its maximum value.

For all IMF parameters, the correlation was maximum at the time delay $\Delta\tau$ = 20-25 min. The correlation coefficients increase by 0.06-0.10 at the transfer from $\Delta\tau$ =0 to $\Delta\tau$ =20 min. The lowest correlation for ε-Akasofu parameter is the highest for the E_m electrical field.

Since as shown by the analysis, the magnetic activity in polar caps has the best correlation with the electrical reconnection field $E_m = v \cdot B_t \cdot Sin^2\theta/2 = v \cdot (B_Z^2 + B_Y^2)^{1/2} \cdot Sin\theta/2$, we shall use this parameter for diagnostics of the magnetosphere state.

An analysis of dependence of F on E_m was conducted for three data series: for negative values of B_Z (B_Z <-1 nT), for B_Z >1 nT and for all values of B_Z. Fig. VI.6 shows the corresponding correlation coefficients of F and E_m values of the IMF for the summer season of Vostok station. One can see that at positive values of B_Z , the correlation coefficient sharply exceeds the level of 0.5 and the data are characterized by a large dispersion. This is probably connected with the fact that at B_Z >0, the current system in the polar cap responses more effectively to a B_Y component of the IMF than to B_Z.

However, the correlation coefficients obtained at using all B_Z values turn out to be similar to the coefficients obtained for a data set of B_Z < -1 nT. This means that the connection between F and the electrical reconnection field E_m in the polar cap can be considered without taking into account the sign of the B_Z component.

The consideration of the daily variation of parameters describing a linear relation between the F values and E_m at different signs of the azimuthal IMF component B_Y > 0 and B_Y < 0 has revealed that in spite of a specific difference in the results at different B_Y signs, the B_Y effect is of the second order infinitesimal.

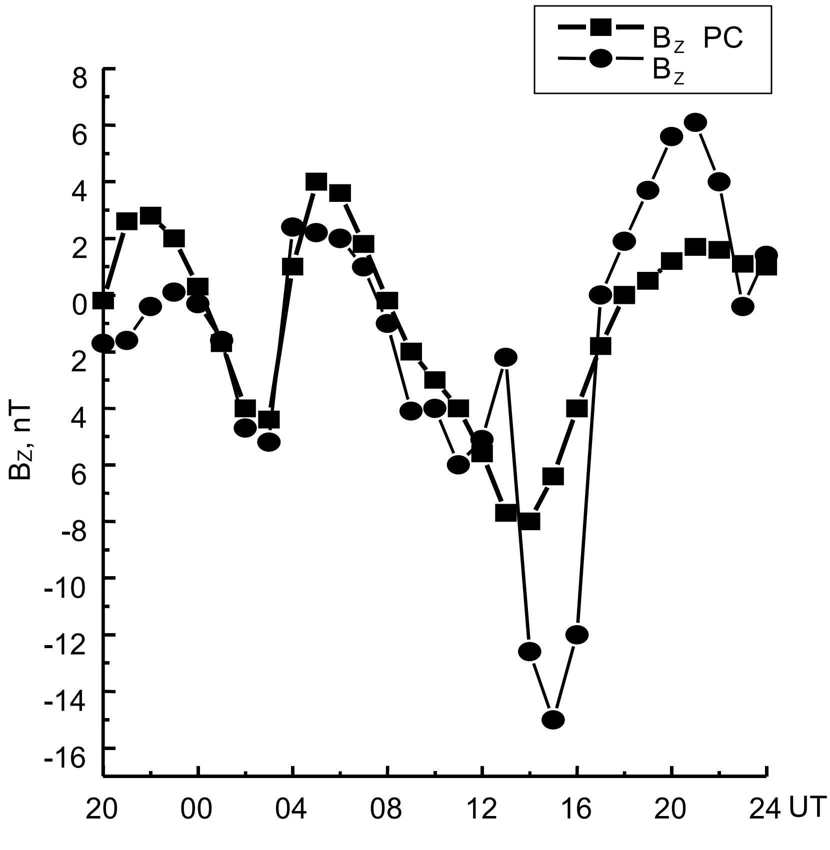

Fig. VI.6. PC B_Z from data of Vostok station and real vertical IMF component values for December 24-25, 1978.

Magnetic activity index in the polar cap

It is obvious that the magnetic activity index obtained from data of only one near-pole station should be corrected for daily and seasonal changes of activity. With this aim, the PC-index is determined as follows. PC=F/α where for normalizing the F value, the regression coefficient $\alpha(\equiv\alpha_4)$ is used according to expressions (1) –(2) and (5) with the optimal values of angle φ. Although the angle φ changes with the change of sign of B_Y, however, as shown by calculations, the correlation coefficient remains almost unchanged within the interval of angles $\Delta\varphi \approx 40^o$, which is typically greater than the difference in φ values at different signs of B_Y.

In the summertime at B_Z >0, one often observes the reversed convection in the polar cap caused by a system of field-aligned NBZ currents and such currents should obviously influence the PC-index. This will be manifested in the form of negative PC-index values. Although such situations are really encountered, it should still be stressed that he PC-index cannot be a good indicator of the force of these currents since at B_Z > 0, the effects of other sources begin to play an increasingly greater role.

Determination of the vertical IMF component from data of Vostok station

A solar plasma flux moving with a speed of 300-700 km/s recorded by satellite at a distance of several Earth's radiuses reaches the surface of the magnetosphere in 10-15 minutes. Since the information "release" is made by satellite at the strictly specific moments of time and processing of this information requires time, it becomes obvious that the direct measurements exclude a possibility for an operational receiving of the IMF parameters. From this viewpoint, the PC-index is a simple and incomparably cheaper method of diagnostics of the IMF parameters in real time.

Fig. VI.6 presents as an example, two B_Z curves: a real one based on IMF data and a curve obtained from the Vostok data with the use of the PC-index. A good agreement is evident especially at negative B_Z. To check the effectiveness of the index obtained, a correlation of PC B_Z with the magnetic activity at Molodezhnaya station (Φ' = -66.8^o, Λ' =77.4^o) and at Novolazarevskaya station (Φ'= -62.6^o, Λ' = 51.0^o) for the period January-March and November-December 1983 is considered [Gizler et al., 1989]. This period corresponds to the summer season in the Antarctic. The UT (or MLT) intervals that correspond to the night sector of longitudes at the stations were considered. It was assumed that at these very hours, Molodezhnaya was at the center of polar lights zone, and in the event of a substorm, it would be by all means recorded by magnetometers of the station. The Novolazarevskaya station is located in the same longitudinal sector but in the subauroral zone.

During the study period, in 79 (of 108) cases considered, the substorm began to develop at Molodezhnaya and in some cases at Novolazarevskaya following the turn southward of the calculated from Vostok data PC B_Z (sometimes in 15 min and more). It was noted that the PC B_Z is ahead of the magnetic disturbances in the auroral zone only before the start of substorms, i.e. in the periods, which are preceded by the development of DP2 system. Further field variations (in the course of a substorm) at Molodezhnaya and Vostok should obviously occur practically simultaneously. In fact, in this case, the magnetic instruments of Vostok record the magnetic field of the auroral electrojet (or a distant field of field-aligned currents generating this electrojet), rather than DP2 or DP3 disturbances. In the course of a substorm (after 03 h), the disturbances at Molodezhnaya and Vostok occur virtually simultaneously, i.e. the PC B_Z does not already give information about the interplanetary field but indicates geomagnetic field variations during a substorm.

The results of the analysis based on data of Molodezhnaya and Novolazarevskaya indicate that the obtained B_Z of PC-index shows sufficiently well the real situation in the geomagnetic field in the polar lights zone and the subauroral zone. It can along with the PC E_m be applied for diagnostics of disturbances in high-latitudinal areas.

Conclusion

An analysis of the interrelation between all known magnetic activity indexes has shown that the PC-index responds in the best way to the change of interplanetary characteristics.

Based on the magnetic data of Vostok station, the PC-index for the previous years was calculated for 1977-1991 and its catalogue for this period was published in 1994 at the National Geophysical Data Center (Boulder). At present, the PC-index is included as the main ground parameter to the operational reviews of geophysical situation.

An important advantage of the PC-index is that it can be calculated operationally based on data of only one near-pole Vostok station in Antarctica (or Tule in Greenland). Thus, it is at present the only index diagnosing the general state of the magnetosphere that can be obtained in real time. The main problem of organizing the communication system (satellite channels) allowing the transmission of this index in real time from Antarctica to the solar-geophysical service of Russia has been practically resolved now.

References

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2. Gizler V.A., Bunyak A.Kh., Troshichev O.A. Diagnostics of geomagnetic perturbation from data of Antarctic near-pole stations: magnetic PC-index. // Proceedings of the AARI. L.: Gidrometeoizdat, 1989. V. 412. P. 92-106.

State of the geomagnetic field and ionosphere above the Antarctic in 2000

The magnetic perturbation in 2000 has achieved the maximum phase for the given solar activity cycle following solar activity changes. In 2000, 23 world magnetic storms were observed with an amplitude of D_{st} variations of more than 50 nT, the strongest of them being the storms of April 7 (312 nT), and July 15 (more than 250 nT) and August 12 (more than 250 nT).

In the South Polar area, the magnetic disturbances – substorms occurred periodically in 2000. The observations of magnetic activity at Vostok (PC- and K-index records) at Vostok station indicate that the strong substorms occurred on January 12, February 6, 12 and 24, April 7, May 2 and 24, June 8, 23 and 26, July 14-15, August 12, September 17-18, October 5 and 14, November 9-12 and 27-29 and December 8-10 and 25-27. The substorms of July 15, August 12 and September 17-18 can be referred to a rank of extreme intense polar magnetic perturbations. Fig. VI.7 presents the annual variations of mean daily values of magnetic activity (K_{avg}) for Vostok station in 2000.

The flare activity of the Sun was accompanied with intrusion of high-energy solar protons to the upper atmosphere of the Antarctic. The effects of these intrusions, the so-called polar cap absorption (PCA) phenomena were recorded by riometers at Mirny and Vostok stations. The most significant PCA were observed on April 4-6, July 14-18 and September 12-18 (Fig. VI.8).

March and April 2000 were the most magneto-calm period in the Antarctic.

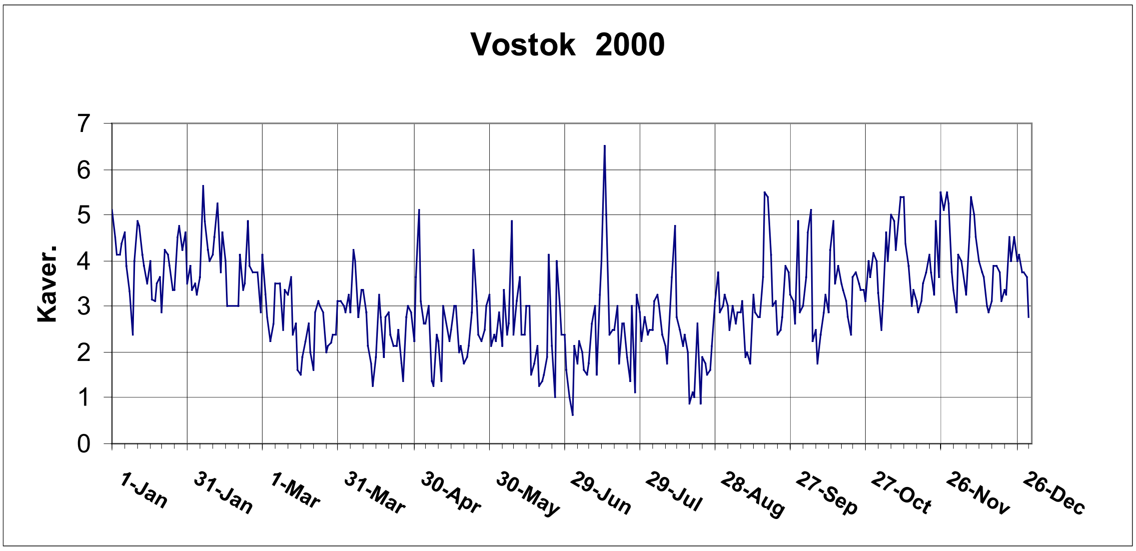

Fig. VI.7. Annual variations of magnetic activity at Vostok station.

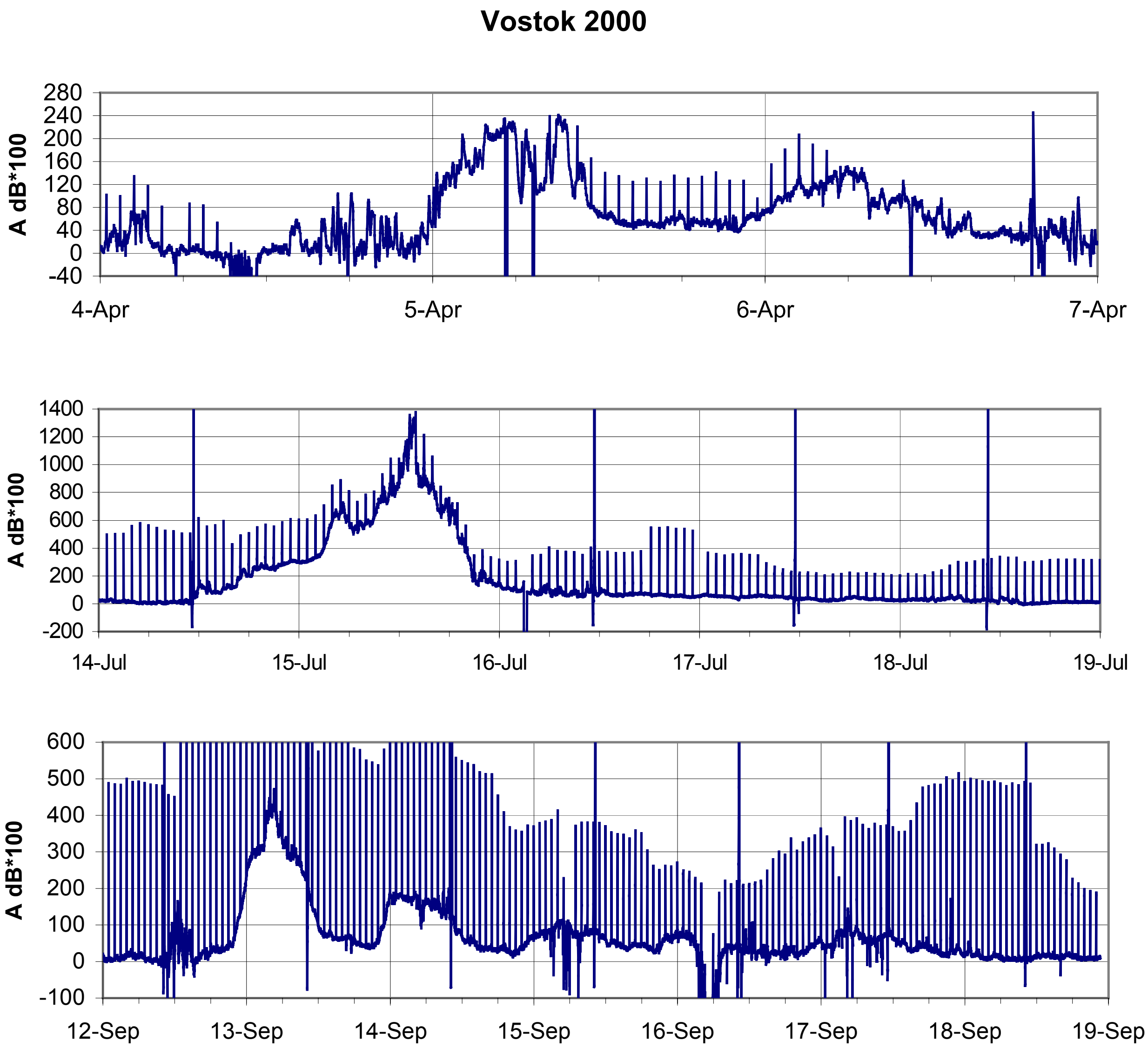

Fig. VI.8. Most intense PCA phenomena recorded by 32 MHz riometer at Vostok station in 2000.

VII. MAIN EVENTS OF RAE ACTIVITY IN OCTOBER-DECEMBER 2000

October 3, 2000	Air flight from St. Petersburg to Amsterdam (Netherlands) of the Head of the Bellingshausen field base Sakharov O.S. for embarkation onboard the M/V “Professor Multanovsky” in port Flissingen.
October 4, 2000	Arrival of the Head of the Bellingshausen field base Sakharov O.S. onboard the M/V “Professor Multanovsky”
October 5, 2000	Departure of the 46th RAE seasonal group (headed by Osipov V.V., Head of the nature-protection team) by bus from St. Petersburg to Flissingen. for embarkation onboard the M/V “Professor Multanovsky”
October 7, 2000	Arrival of the 46th RAE seasonal group of the Bellingshausen field base of 13 people headed by Osipov V.V., Head of the nature-protection team, onboard the M/V “Professor Multanovsky”
October 10, 2000	Departure of the sledge-caterpillar traverse from Mirny Observatory to Vostok station (15 people and 12 truck tractors) headed by Yemichev N.V. Start of the cruise of the M/V “Professor Multanovsky” from port Flissingen (Captain Kostusev S.Yu., Head of the cruise – Sakharov O.S.).
October 13, 2000	Arrival of the R/V/ “Akademik Fedorov” to St. Petersburg from the Arctic cruise.
October 16-18, 2000	Expert Meeting on World Weather Watch Operational Arrangements in the Antarctic under the World Meteorological Organization (Geneva, Switzerland). Roshydromet was represented by the RAE Head Martyanov V.L. and Head of the State Company “Morsvyaz” Zhernovetsky F.V.
October 25, 2000	Visit of polar explorers from Davis station (Australia) to Progress station.
November 12, 2000	Arrival of the M/V “Professor Multanovsky” to roadstead of the Bellingshausen field base. Landing of 16 people of the seasonal group of the Bellingshausen field base headed by Sakharov O.S., Head of the field base. Unloading of 100 t of diesel fuel and 8 t of cargo of the Russian Antarctic Expedition.
November 13, 2000	Departure of the M/V “Professor Multanovsky” from the roadstead of the Bellingshausen field base to port Ushuaia (Argentina).
November 15, 2000	Flight from St. Petersburg to Christchurch (New Zealand) of the group of 11 people of the wintering and seasonal teams of Vostok station headed by the Team Head Sheremetyev A.N. Shmarin A.V. passing his functional duties to Sakharov O.S. Cargo operations, hydrological studies.
November 24, 2000	Landing at Vostok of first aircraft from McMurdo station that has delivered 5 t of fuel.
December 1, 2000	Arrival to Vostok station by airplane from McMurdo station of the 46th wintering and seasonal teams of 11 people headed by Sheremetyev A.N., scientific equipment and fresh food products were delivered.
December 2, 2000	Arrival of the sledge-caterpillar traverse of 7 truck tractors to Vostok station
December 10, 2000	End of depth measurements by hydrologists of Mirny Observatory in the vicinity of Tokarev Island.
December 12, 2000	Start from Vostok station of the scientific traverse headed by Sheremetyev A.N. for investigating the subglacial lake Vostok. The group consists of 5 people in one DT-30P vehicle.
December 16, 2000	Start of the sledge-caterpillar traverse for diesel fuel from Novolazarevskaya station headed by Zakhavatov P.V. to the ship unloading site. The group consists of 5 people in 5 vehicles.