THE OPERATIONAL WEB-BASED PRESENTATION OF THE RF UPPER-AIR NETWORK PERFORMANCE MONITORING

A. Kats, A. Naumov, A. Ivanov

Central Aerological Observatory, Roshydromet
3 Pervomaiskaya Street, Dolgoprudny, 141700, Russian Federation
Tel.: +(7 095) 408 6677, Fax:+(7 095) 576 3327
E-mail: caoaero@mail.ru

ABSTRACT

It is presented and discussed the very first experience of regular (on the quarterly basis) publication in Web miscellaneous results of the Russian Federation (RF) upper-air network performance monitoring, covering different aspects of its operation: equipment modernization, data quality and availability, achieved height, regularity of observations. Performance marks are presented either for level of particular stations, territorial bodies of Roshydromet – Regional Administrations for Hydrometeorology and Environmental Monitoring of Roshydromet and for the whole RF network. The 1st version of quarterly updated monitoring page has started since 2004 at http://caometeo.no-ip.org/monitor/monitorres.htm. Some annual results for the year 2004 are presented here.

Web-based presentation proved itself as a cost-effective and efficient tool for providing operative feed-back to upper-air network from a national upper-data quality monitoring system.

In early 90-s under conditions of economic difficulties of the FSU countries it was urgently necessary to concentrate efforts on maintaining in working order and even preservation of upper-air network. Such activity is impossible without comprehensive information about state of network.

Therefore Central Aerological Observatory, as Roshydromet leading centre for upper-air observations, with participation of the Hydrometeorological Centre of Russia (Dr. A.N.Bagrov at al.), Main Computer Centre and Main Radio-Meteorological Centre of Roshydromet, started in 1993 organization and implementation of the national monitoring system of upper-air network operation complementary to the ECMWF (WMO CBS Lead Centres on radiosonde data quality) monitoring, enabling timely preventive and remedial actions on maintaining proper upper-air data quality and performance of upper-air network. After feasibility study since 1994 CAO under financial support of Roshydromet started an official experimental operation of monitoring system, and since 1995 - routine operation.

Source information enters to CAO everyday from the Main Computing Centre data bases as well as directly from the National meteorological telecommunication network and comprises for the FSU and neighbouring countries upper-air stations:

- 00 and 12 UTC de-coded radiosounding results from parts A, B, C and D of **TEMP** messages;
- results of upper-air data complex quality control on standard pressure levels /1/, performed operationally by the Hydrometeorological Centre of Russia data assimilation system;
- geopotential and wind first-guess (FG) field, based on 12-h forecast /2/, for several standard pressure levels, interpolated to the station's locations;
- **NIL** messages, compiled according extended national code form, encoding information on reasons of absence for each missed radiosonde observation, such as routine maintenance, lack of consumables, failure of ground equipment, absence of energy, severe weather conditions and so on.

Data are collected and processed on conventional PC which so far allows to store and analyse data bases for the whole period of operation. Different aspects of upper-air network operation under monitoring include fulfilment of program of observations, reasons of stations downtime, completeness and quality of observations. Developed software allows generation in operational mode different kinds of monthly, quarterly and annual reports for stations, regional administrations and member states of the Intergovernmental Council for Hydrometeorology of the Commonwealth of Independent States, e.g.:

- detailed monthly list of soundings and reasons of observations absence;
- statistics of program of observations fulfillment for 00 and 12 UTC and both terms;
- statistics of soundings heights;
- reasons of failure of observations statistics;
- rejected data statistics;
- (OB-FG) geopotential and wind statistics and their distributions and lists of suspected stations for geopotential and wind observations (followinging to recommendations of /3/).

Analysis of monitoring results as well as direct mutual exchange by monitoring statistics and intercomparison with ECMWF, UK Met Office and JMA proved us in skill of statistics, based on the Hydrometeorological Centre of Russia FG, to reflect the real upper-air data quality. An example of such assessment is given on Figure 1.1 - Figure 1.4 where presented are correlation between ECMWF (taken from supported by the UK Met Office radiosonde team EUMETNET radiosonde web site http://www.metoffice.com/research/interproj/radiosonde/reports/index.html) and Hydrometeorological Centre of Russia quarterly monitoring statistics for the year 2000: 00 and 12 UTC (OB-FG) geopotential bias and standard deviation. Despite of some apparent particular inconsistencies•, a general agreement is evident, especially for stations with larger systematic and random deviations, i.e. for cases of the most practical significance.

The national monitoring system was successfully operated for quite a long period but its output (more or less extensive tables and reports) had rather limited distribution: monthly results were presented regularly to Roshydromet only, and limited information entered regional administrations just in emergency urgent cases (data quality problems with particular soundings or suspected operation). And only once per year annual CAO survey of RF network operation with monitoring results reached all interested bodies.

Recent progress in telecommunications made it possible to bring to public pictorial information on monitoring results in much more timely way using Internet. Almost all regional administrations have an access to Internet and about 60 upper-air stations have PC in their ground systems, i.e. they potentially are able to have off-line access to these materials.

There were developed rather plain HTML templates suitable for presentations of quarterly and annual results. Original software was developed to create maps, suitable for displaying and publishing to Web miscellaneous performance indicators for the whole network. To keep brevity, names and indices of upper-air stations are displayed using tooltips, which are displayed by browser when the users mouse pauses over the station symbol.

The very first experience with publication of annual results for the year 2003 met a good responses and in 2004 it was started regular quarterly publications. The starting page (in Russian) of the CAO upper-air network monitoring is located at http://caometeo.no-ip.org/monitor/monitorres.htm. English version at the moment of preparation of this paper was available only for the annual results of the year 2004 at http://caometeo.no-ip.org/monitor/2004/index2004e.htm.

For the illustration of published results and forms of their presentation is given as an example the information presented for the year 2004.

• Some systematic inconsistency in standard deviations results from different procedure of quarterly averaging, other cases are worth of separate investigation

The first page "Network configuration and observational program" presents actual configuration of sounding equipment by the end of the period under report and program of observations actual for the reporting period (Figure 2.1 - Figure 2.2).

Next page "Data availability" reflects overall percentage of observational program fulfillment for each station, quarterly distribution of stations amount by average daily number (for 00 and 12 UTC and for both times) of ascents and quarterly distribution of average daily number of ascents (Figure 3.1 - Figure 3.3).

"Data quality marks" presents network maps and diagrams with distribution of stations for the average heights of soundings, weighted (following procedure /3/) root-mean-square 'OB-FG' geopotential differences in 1000-100 hPa layer, root-mean-square 'OB-FG' wind vector differences in 850-100 hPa layer (Figure 4.1 - Figure 4.6).

To some extent the present work was simulated by ideas, implemented by USA NWS in the National Upper-air Station Performance Ranking Program /4/. However, the Russian upper-air network is rather bulky to have all stations ranked in a compact way. The Roshydromet manage hydrometeorological service throughout the country via its territorial bodies - Regional Administration for.Hydrometeorology and Environmental Monitoring (Russian acronym is UGMS). To stimulate an interest and responsibility of regional administrations to manage and control operation upper-air station, situated on their territory, on the page "Regional administrations (UGMS) ranking" average results of above mentioned statistics for regional administrations are presented ordered according to their values (Figure 5.1 - Figure 5.5).

And the final page "The results of the RF upper-air network performance monitoring" presents a summary table• with numerical presentation of annual results for each station, regional administration and the whole network (Table 1).

The monitoring system itself should be re-designed in 2005 in connection with modernization of computers park and of Main Computer Centre and relevant changes in technology of the Hydrometeorological Centre of Russia. These changes must result in use FG, based on 6-h forecast, with all levels up to and some levels above 100 hPa, temperature FG, quality control flags, reflecting reasons for data rejection, raw TEMP messages with time of their parts receiving, direct FTP-access to source information instead of dial-up line. Therefore the amount of results to be published on regular basis is expected to substantial extension, first and foremost, in favor of monthly publications and trend representations.

Regular publication in Internet even such limited amount of information about performance the Russian upper-air network got a keen interest from stuff of regional administrations, dealing with maintenance and control of upper-air stations, upper-air stations themselves and even from manufacturer of upper-air equipment. The Russian upper-air network nowadays meets new but positive challenges: in year 2005 two-times sounding must re-start on the whole network and new-generation MARL radars started recently to displace obsolete Meteorites. The national monitoring system and operational dissemination of its results are expected to support and manage these events.

References:

1. O.A. Alduchov, 1983. Meteorologia i Gydrologia [Soviet Meteorology and Hydrology], No. 12.

2. A.N. Bagrov, 1990. Meteorologia i Gydrologia [Soviet Meteorology and Hydrology], No. 2.

3. WMO No.485, 1992. Manual on the Global Data-Processing System, Edition 1992. Volume I - Global Aspects. Attachment II.10 Procedures and formats for the exchange of monitoring results

4. C. Bower, W. Blackmore, 2000. USA National Weather Service Radiosonde Upper Air Excellence Award Program. INSTRUMENTS AND OBSERVING METHODS. REPORT No. 74 (WMO/TD - No. 1028). Papers Presented at the WMO Technical Conference on Meteorological and Environmental Instruments and Methods of Observation (TECO-2000), Beijing, China, 23 - 27 October 2000.

• Station symbols on each map on the previous pages are linked to the corresponding row of the summary table

Figures:

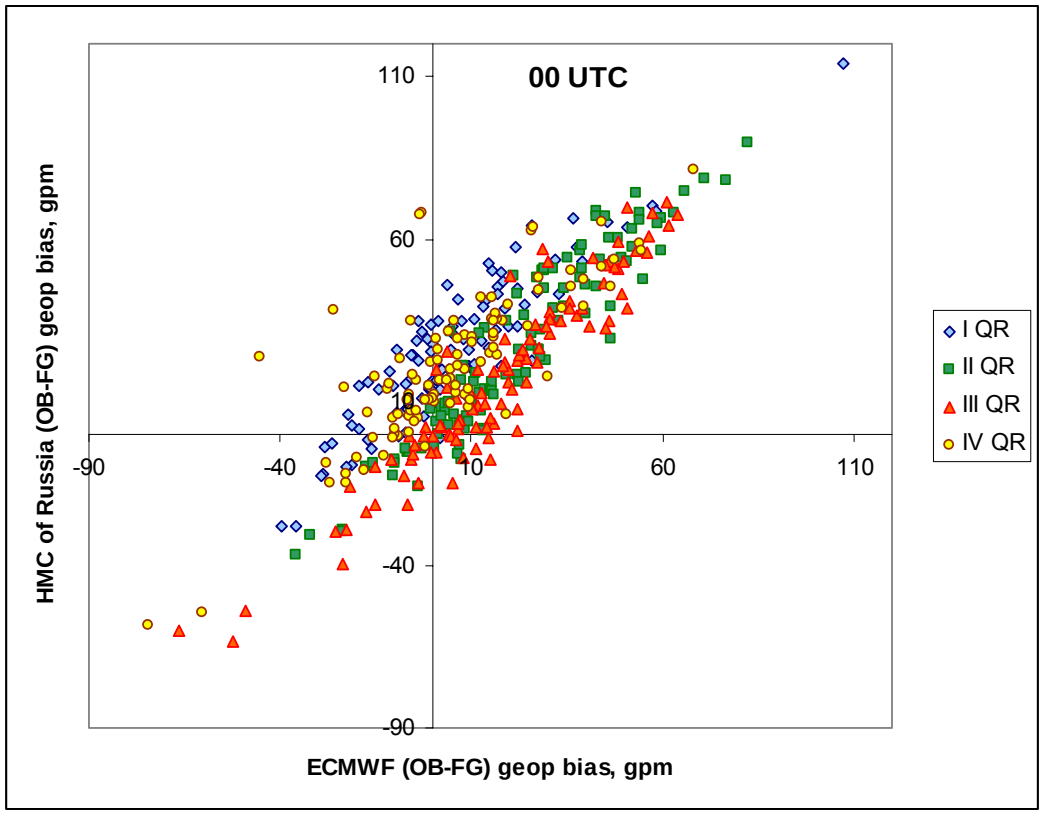

Figure 1.1. Comparison of ECMWF and Hydrometeorological Centre of Russia quarterly monitoring statistics for the year 2000: 00 UTC (OB-FG) geopotential bias.

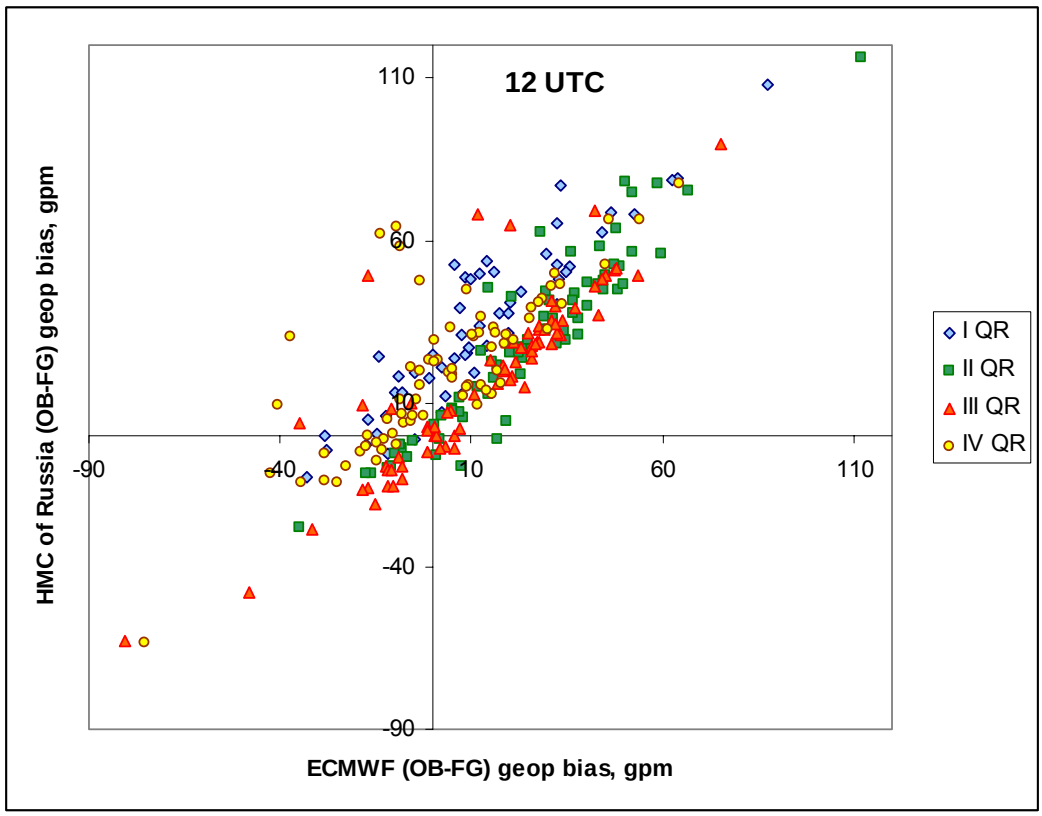

Figure 1.2. Comparison of ECMWF and Hydrometeorological Centre of Russia quarterly monitoring statistics for the year 2000: 12 UTC (OB-FG) geopotential bias.

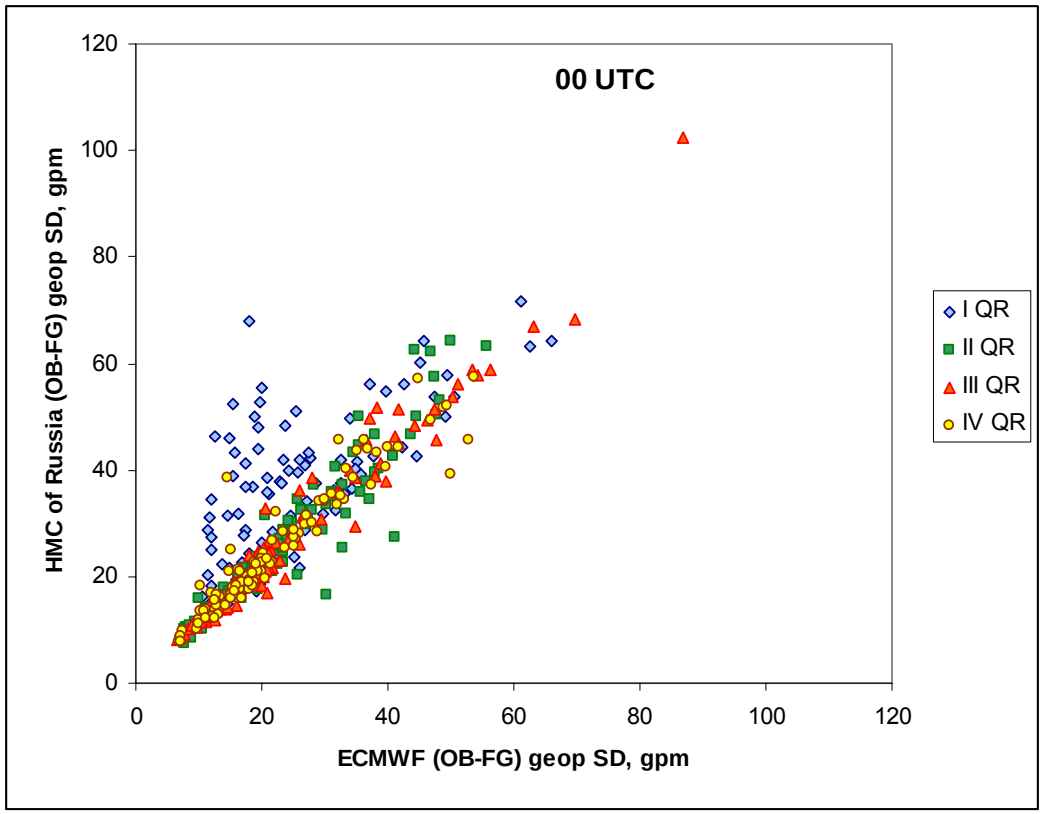

Figure 1.3. Comparison of ECMWF and Hydrometeorological Centre of Russia quarterly monitoring statistics for the year 2000: 00 UTC (OB-FG) geopotential standard deviation.

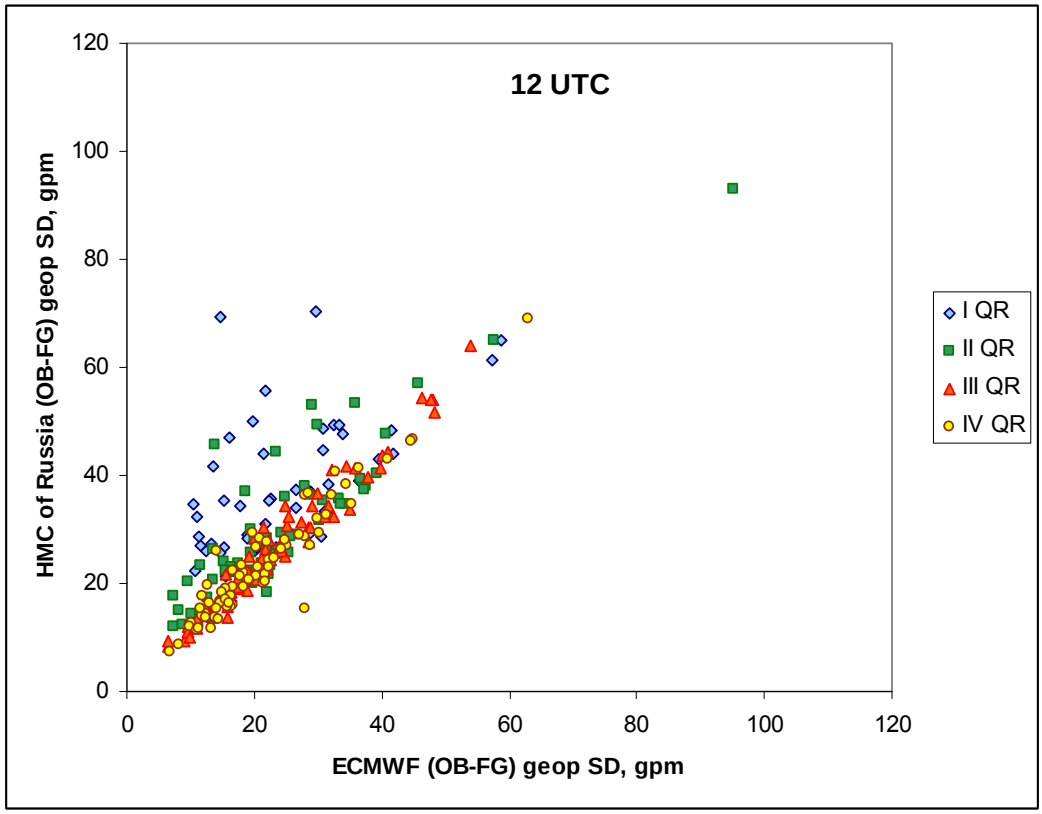

Figure 1.4. Comparison of ECMWF and Hydrometeorological Centre of Russia quarterly monitoring statistics for the year 2000: 12 UTC (OB-FG) geopotential standard deviation.

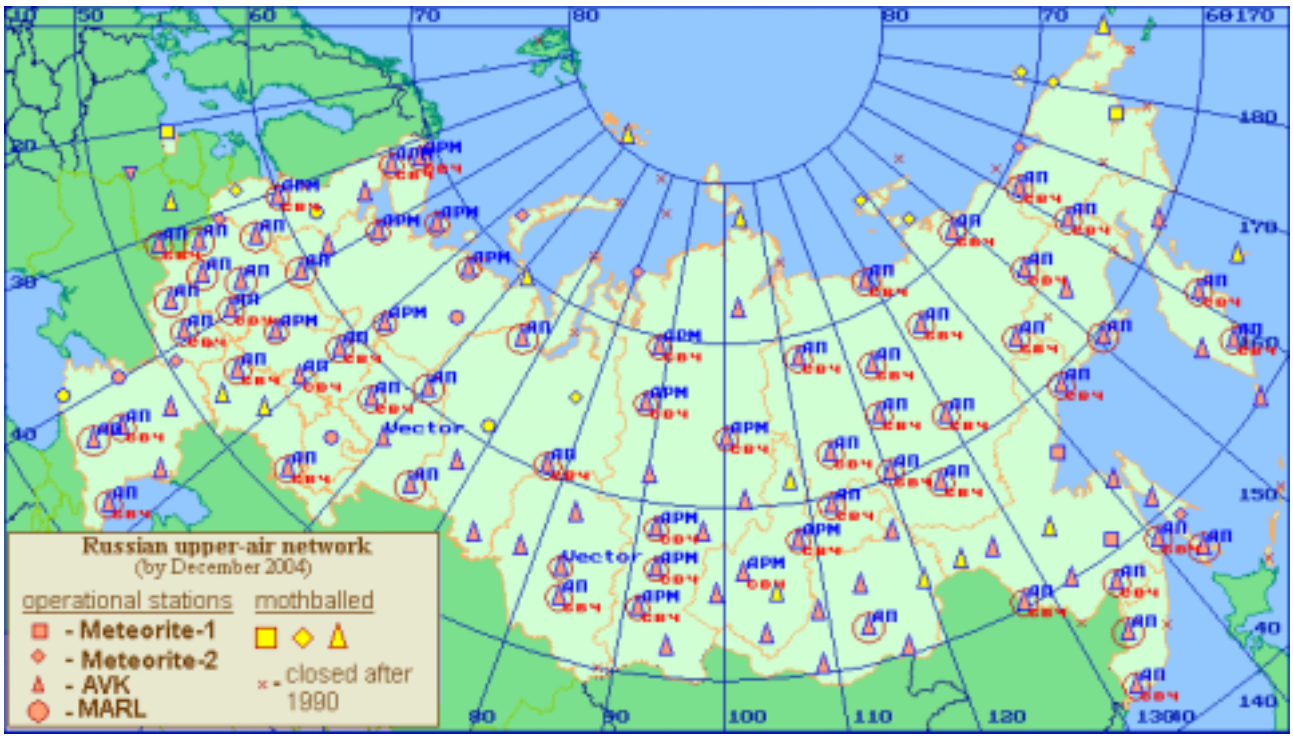

Figure 2.1. Russian upper-air network equipment (by December 2004): "СВЧ" - new solid-state microwave modules installed, which have displaced non-durable electro-vacuum devices, "АП" and "АРМ" – new PC-based data processing systems installed, which have displaced unreliable hardwired microcomputers

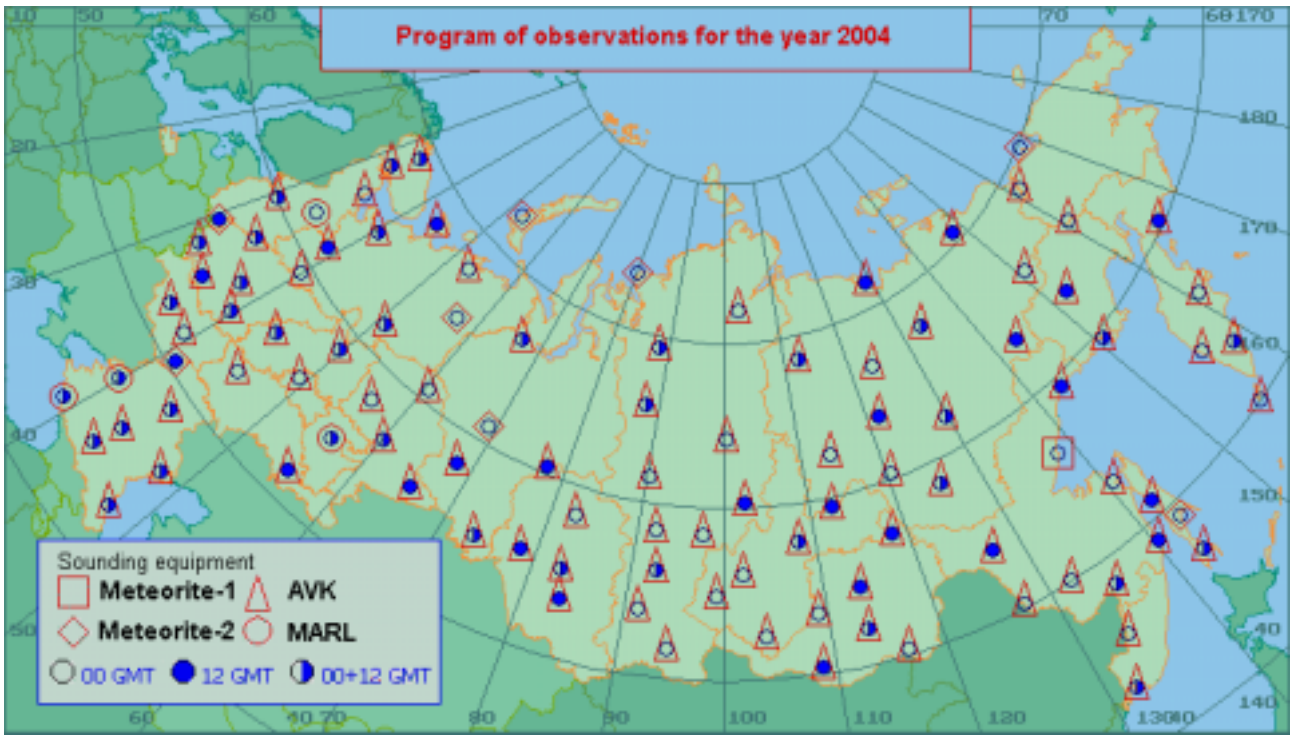

Figure 2.2. Observational program of Russian upper-air network for the year 2004.

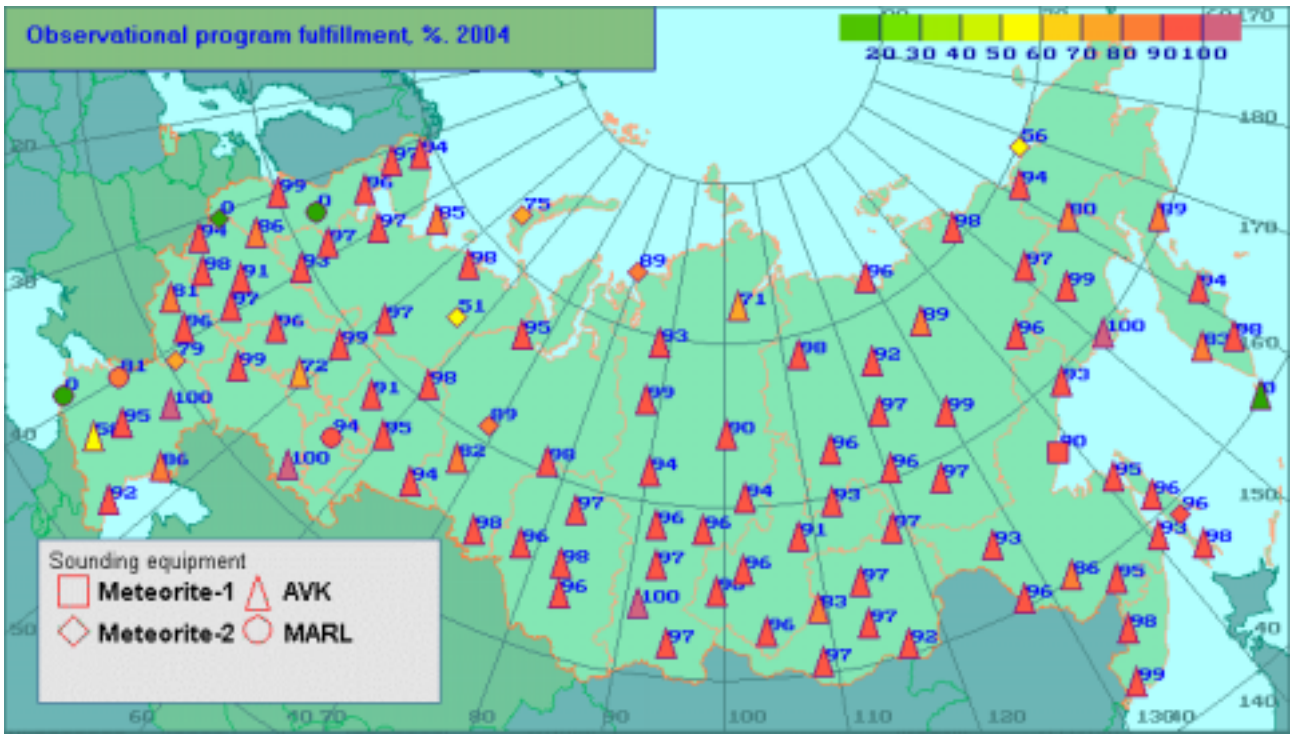

Figure 3.1. Percentage of observational program fulfillment for the year 2004.

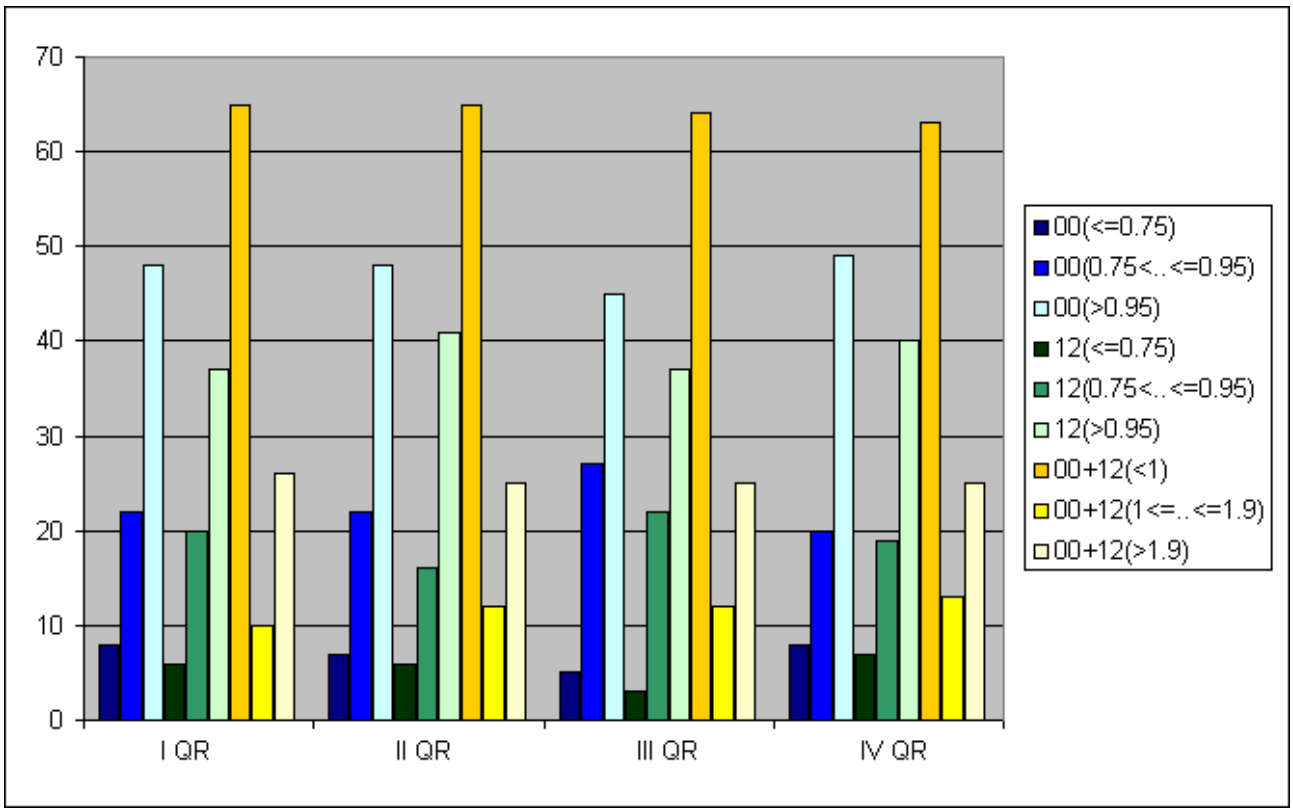

Figure 3.2. Distribution of stations amount by average number of ascents (00, 12 UTC and daily) - by the quarter. 2004.

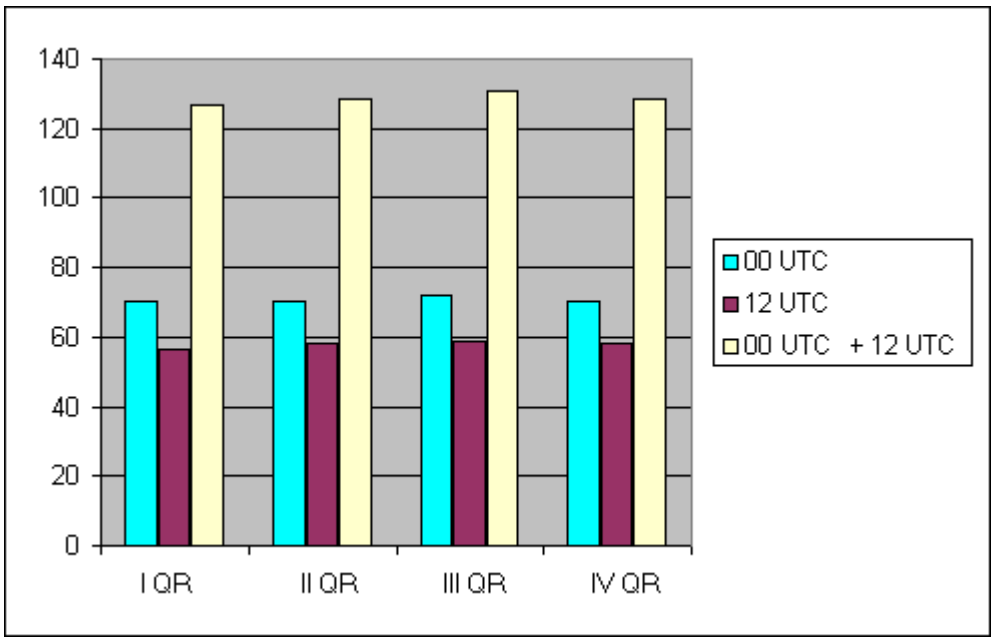

Figure 3.3. Daily amount of ascents - by the quarter. 2004.

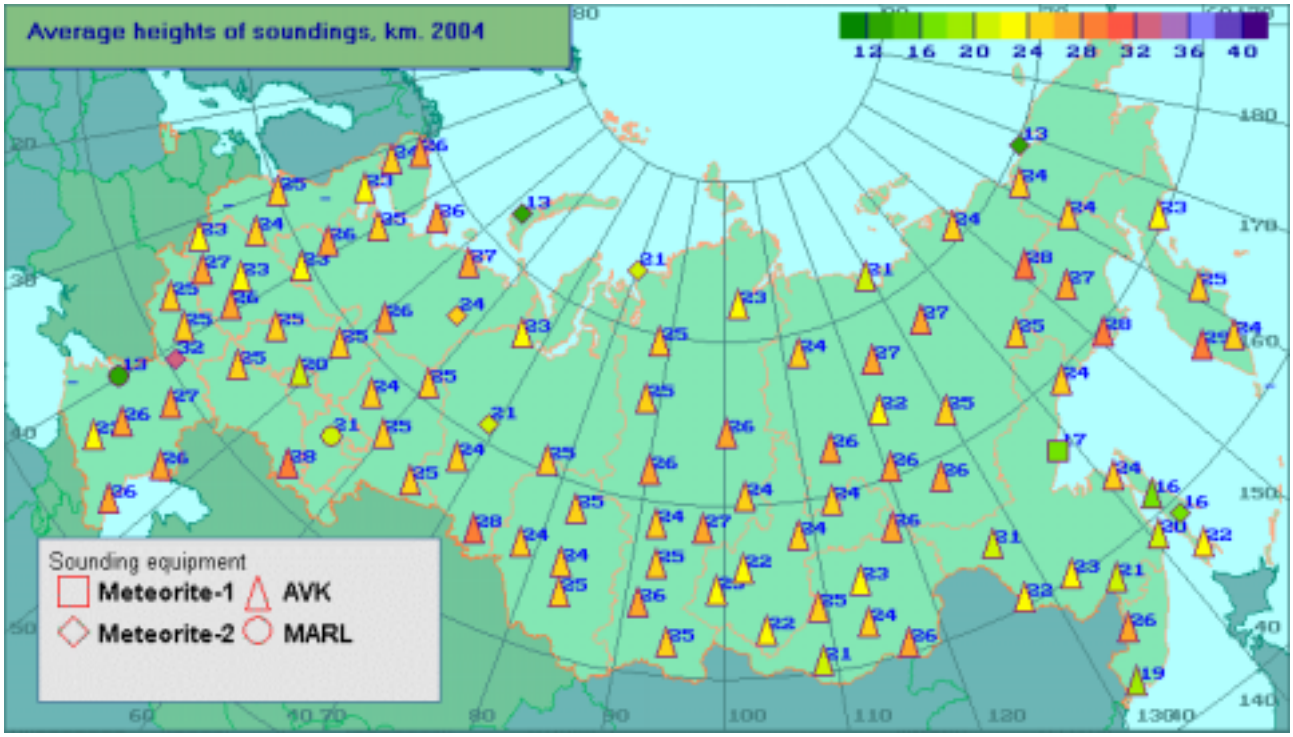

Figure 4.1. Average heights of soundings.

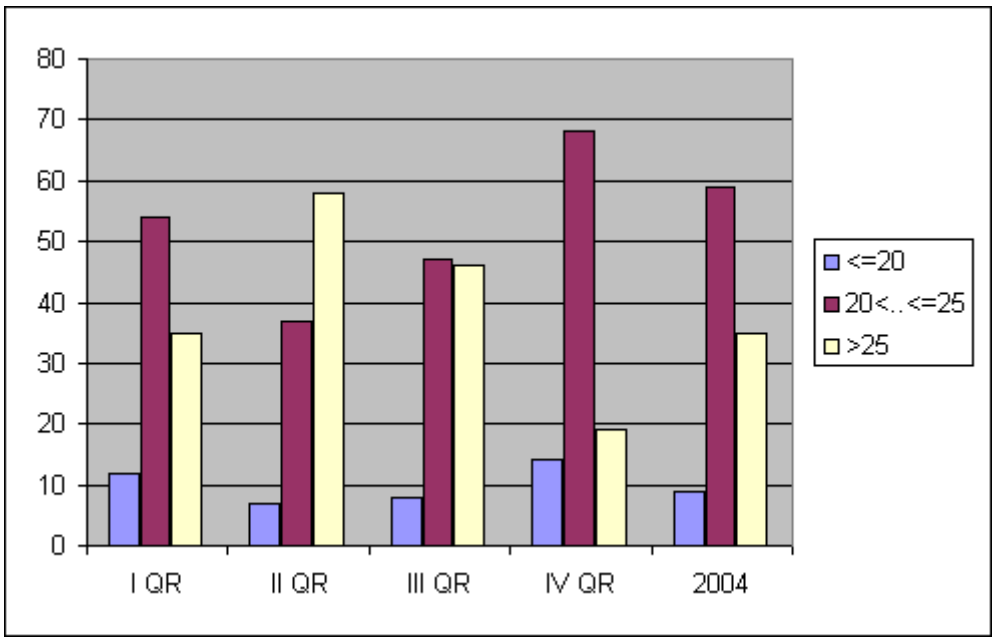

Figure 4.2. Distribution of stations amount by average heights of soundings, km. 2004.

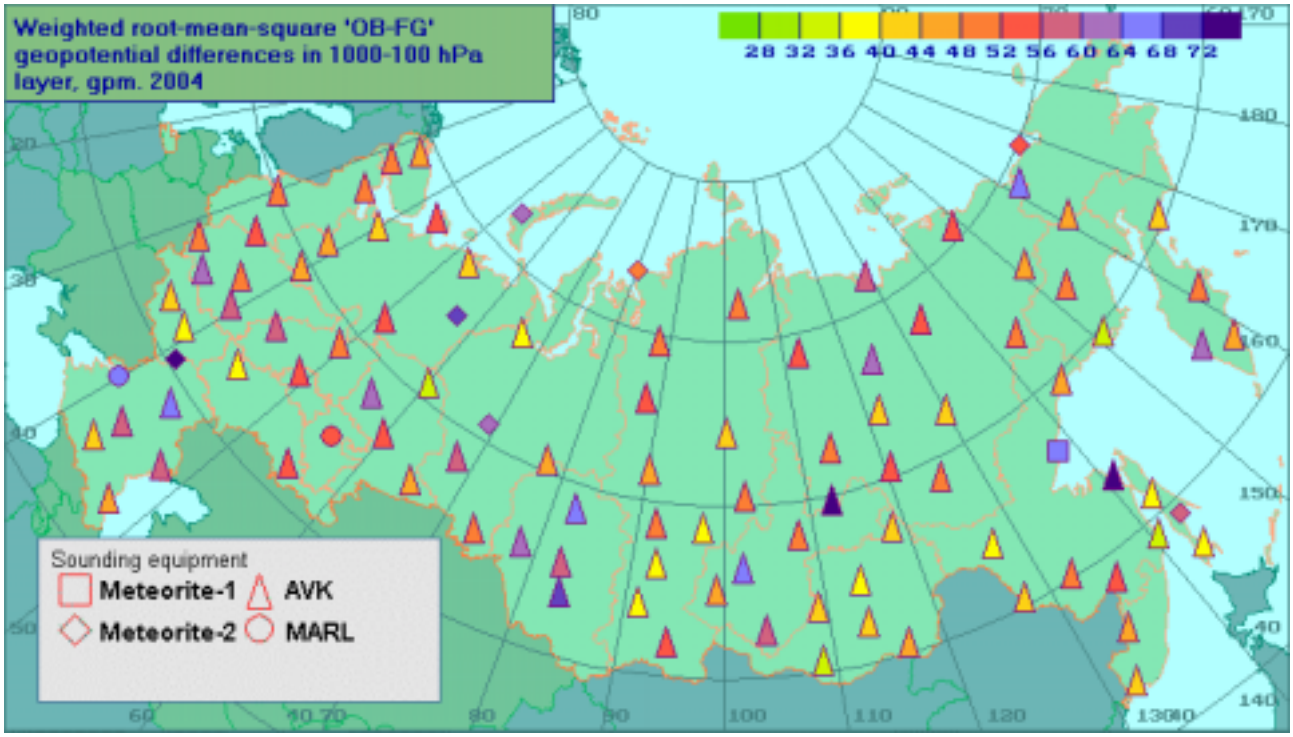

Figure 4.3. Weighted root-mean-square 'OB-FG' geopotential differences in 1000-100 hPa layer

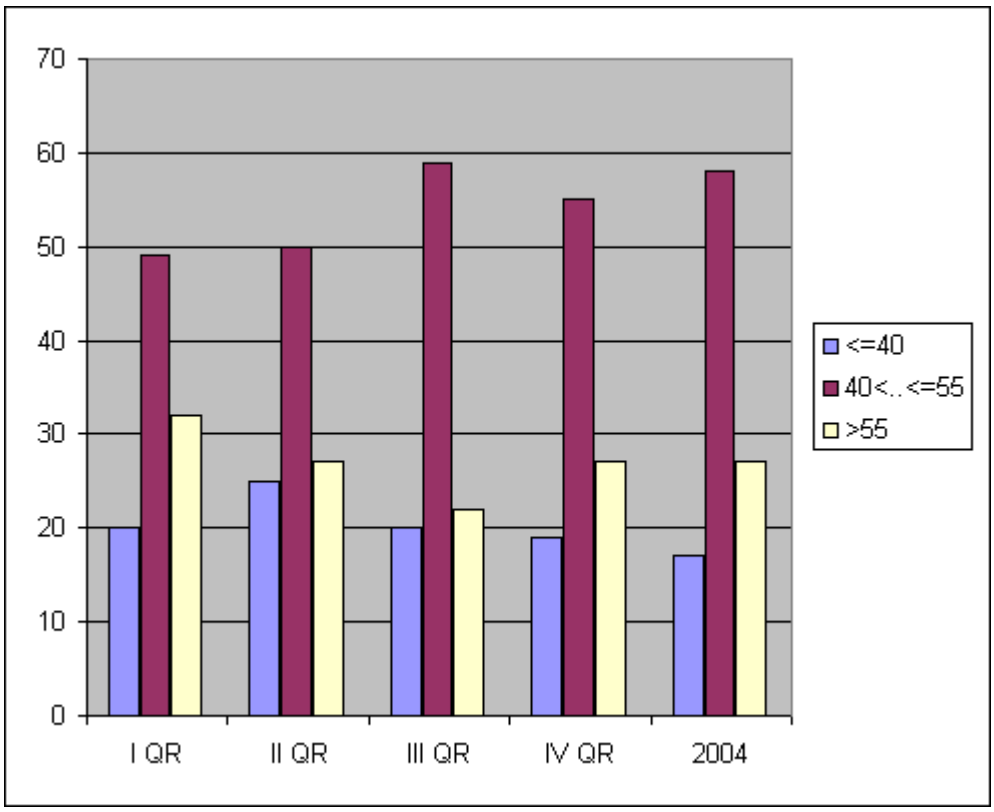

Figure 4.4. Distribution of stations amount by weighted root-mean-square 'OB-FG' geopotential differences, gpm. 2004.

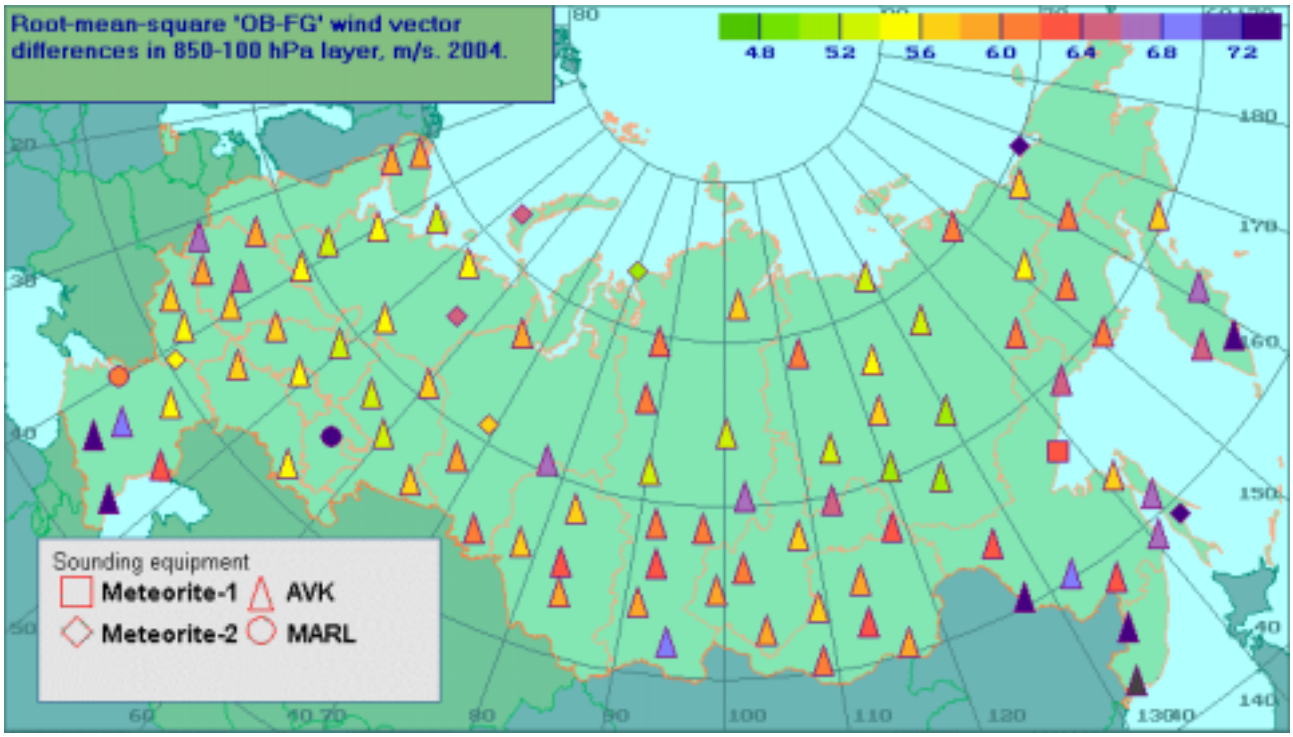

Figure 4.5. Root-mean-square 'OB-FG' wind vector differences in 850-100 hPa layer.

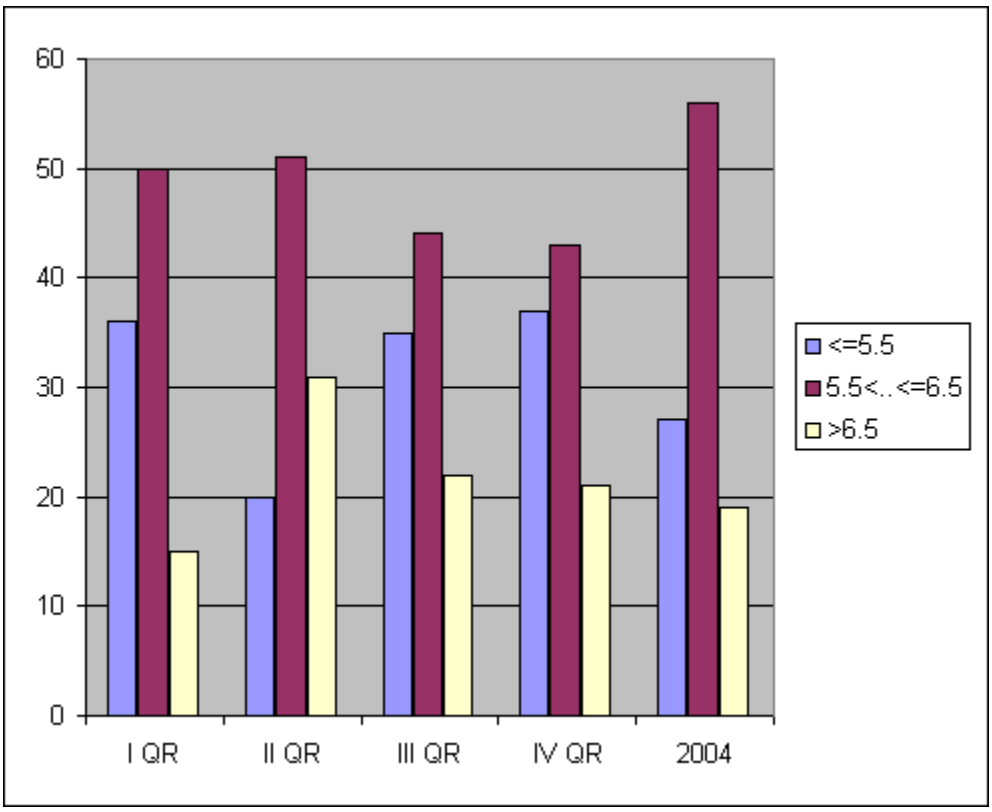

Figure 4.6. Distribution of stations amount by root-mean-square 'OB-FG' wind vector differences, m/s.2004.

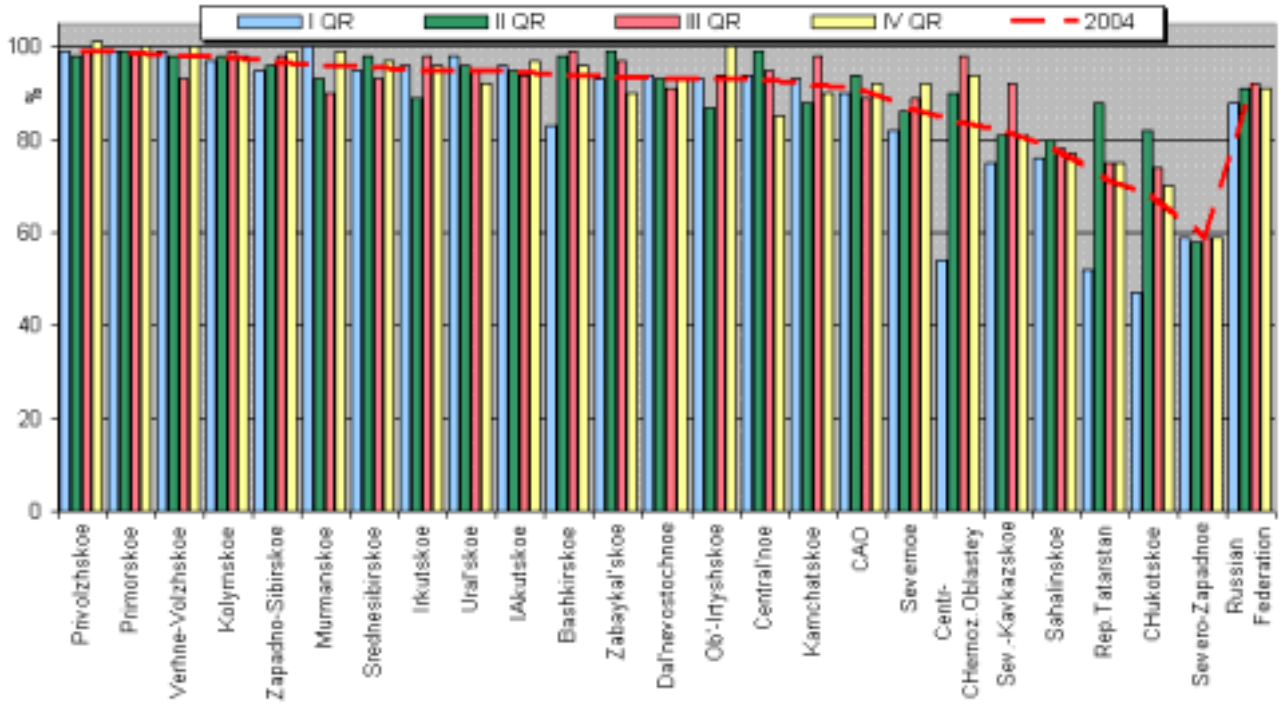

Figure 5.1. Regional administrations ranking: by upper-air observational program fulfillment.

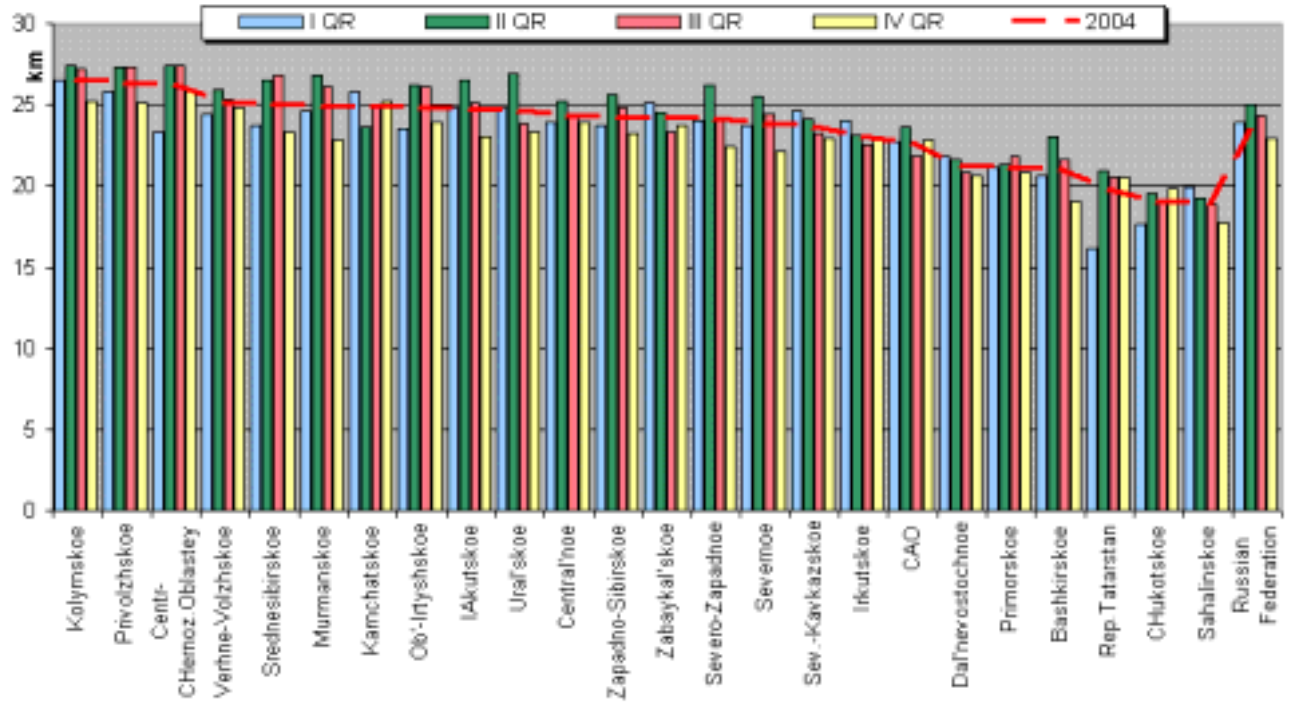

Figure 5.1. Regional administrations ranking: by upper-air observational program fulfillment.
.2. Regional administrations ranking: by average heights of soundings.

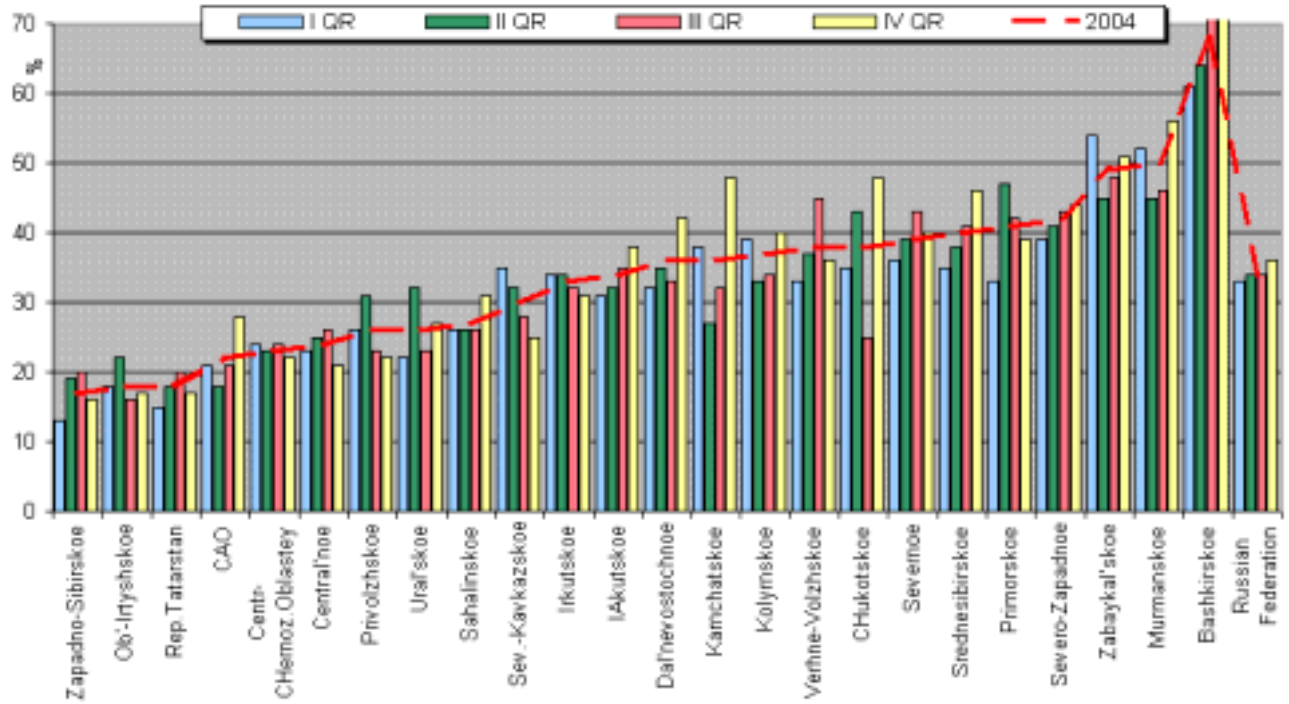

Figure 5.3. Regional administrations ranking: by percentage of soundings with rejected data.

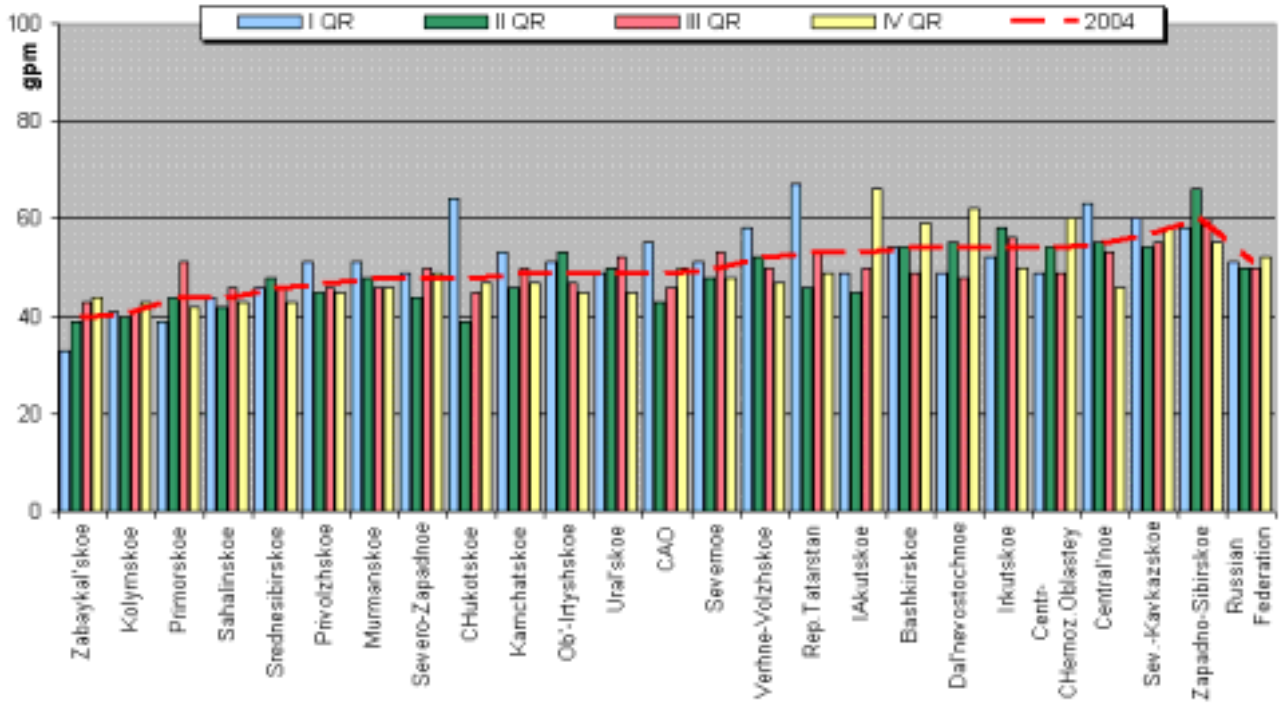

Figure 5.4. Regional administrations ranking: by weighted root-mean-square 'OB-FG' geopotential differences in 1000-100 hPa layer.

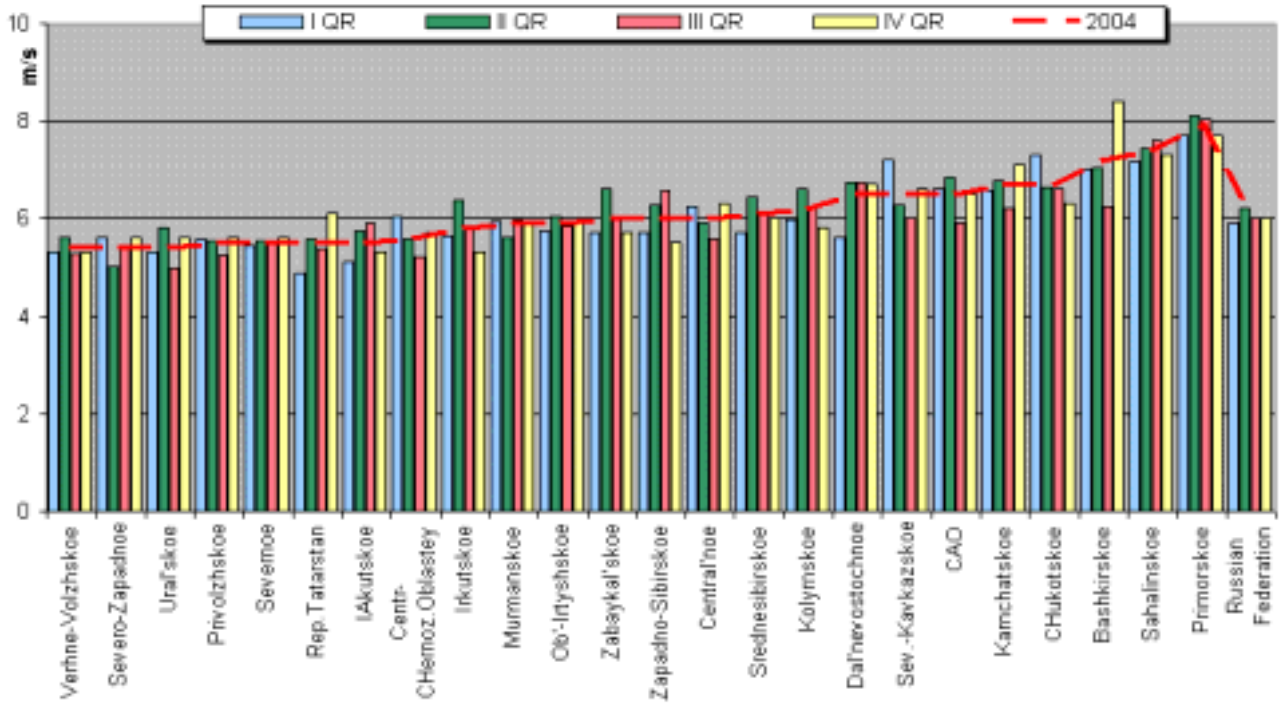

Figure 5.5. Regional administration ranking: by Root-mean-square 'OB-FG' wind vector differences in 850-100 hPa layer.

Table 1 Summary results of the RF upper-air network performance monitoring in the year 2004.

Stations/Regional administrations	a1	a2	a	b	b1	c1	c2	c3	c	d	e	f	g	h
Ufa	99	89	94	46	21.1	1	5	6	68	-	+	+	54	7.2
Bashkirskoe UGMS/ 1	**99**	**89**	**94**	**46**	**21.1**	**1**	**5**	**6**	**68**	**0**	**1**	**1**	**54**	**7.2**
Kirov	99	99	99	26	24.8	2	3	1	20	-	-	-	48	5.2
Nizhniy Novgorod	96	96	96	23	25.4	2	2	2	56	-	-	-	56	5.6
Verhne-Volzhskoe UGMS/ 2	**97**	**98**	**98**	**25**	**25.1**	**2**	**2**	**2**	**38**	**0**	**0**	**0**	**52**	**5.4**
Aian	90	-	90	85	17.2	0	1	3	30	-	-	-	65	6.2
Zeia	-	93	93	47	21	1	1	2	35	-	-	-	39	6.2
Nikolaevsk	94	-	95	31	23.7	1	4	3	39	+	-	-	84	5.6
Blagoveshensk	95	-	96	37	22.4	1	1	3	38	-	+	+	42	7.4
Sutur	85	-	86	35	22.9	2	2	4	55	-	+	-	50	6.9
Habarovsk	96	95	95	44	21.4	0	0	2	27	-	+	-	52	6.2
Sovetskaia Gavan'	-	93	93	56	19.8	0	1	4	36	-	+	-	34	6.7
Dal'nevostochnoe UGMS/ 7	**92**	**95**	**93**	**45**	**21.2**	**1**	**1**	**3**	**36**	**1**	**4**	**1**	**54**	**6.5**
CHara	-	97	97	22	25.9	1	2	4	50	+	-	-	41	6.2
Bagdarin	-	97	97	33	23.2	1	1	3	35	-	-	-	37	5.9
Ust'-Barguzin	83	-	83	24	25.3	2	2	5	59	-	-	-	40	5.7
CHita	97	97	97	31	23.7	1	1	5	55	+	-	-	40	6.2
Krasnyy CHikoy	-	97	97	44	21.4	1	1	4	42	-	-	-	35	6
Borzia	92	-	92	21	26.2	2	2	3	50	-	-	-	46	5.8
Zabaykal'skoe UGMS/ 6	**91**	**97**	**94**	**29**	**24.2**	**1**	**1**	**4**	**49**	**2**	**0**	**0**	**40**	**6**
Aleksandrovskoe	-	98	98	26	24.7	0	0	1	16	-	-	-	44	6.6
Kolpashevo	96	-	97	26	24.7	0	1	1	19	-	-	-	65	5.7
Barabinsk	-	96	96	28	24.4	0	1	1	12	-	-	-	63	5.6
Novosibirsk	99	97	98	30	23.9	0	1	1	15	-	-	-	57	6.2
Barnaul	-	96	96	27	24.5	1	1	2	25	-	-	-	70	5.8
Zapadno-Sibirskoe UGMS/ 5	**98**	**97**	**97**	**28**	**24.3**	**0**	**1**	**1**	**17**	**0**	**0**	**0**	**60**	**6**
Nizhneudinsk	98	-	98	33	23.3	1	1	3	35	-	-	-	44	5.8
Kirensk	91	92	91	29	24	0	1	2	31	-	-	-	49	5.6
Bratsk	96	-	96	38	22.3	0	0	3	31	-	-	-	66	6
Angarsk	96	-	96	39	22.2	1	0	3	36	-	-	-	58	5.9
Irkutskoe UGMS/ 4	**95**	**92**	**95**	**34**	**23.1**	**0**	**1**	**3**	**33**	**0**	**0**	**0**	**54**	**5.8**
Korf	-	89	89	34	23.1	0	1	2	23	-	-	-	40	5.7
Kliuchi	94	-	94	24	25.2	1	1	3	34	-	-	-	48	6.6
Sobolevo	83	-	83	13	29.3	2	2	4	53	-	-	-	63	6.4
Petropavlovsk	96	99	98	31	23.7	0	1	3	36	-	-	-	47	7.2
Kamchatskoe UGMS/ 4	**91**	**94**	**92**	**26**	**24.9**	**1**	**1**	**3**	**36**	**0**	**0**	**0**	**49**	**6.7**
Seymchan	-	99	99	19	26.8	3	3	3	43	-	-	-	51	6
Magadan	100	100	100	17	27.6	0	1	3	36	-	-	-	32	6.1
Ohotsk	-	93	93	29	24.1	0	1	3	30	-	-	-	47	6.5
Kolymskoe UGMS/ 3	**100**	**98**	**98**	**20**	**26.6**	**1**	**1**	**3**	**37**	**0**	**0**	**0**	**41**	**6.2**
Murmansk	95	94	94	21	26.1	3	3	2	50	+	-	-	46	5.8
Kandalaksha	97	97	97	29	24	3	3	2	50	-	-	-	50	5.9
Murmanskoe UGMS/ 2	**96**	**95**	**96**	**25**	**25**	**3**	**3**	**2**	**50**	**1**	**0**	**0**	**48**	**5.9**
Salehard	96	95	95	33	23.2	0	0	1	17	-	-	-	39	5.8
Hanty-Mansiysk	89	-	89	49	20.8	1	3	1	28	-	-	-	62	5.7
Tobol'sk	-	82	82	30	23.8	1	1	1	20	-	-	-	59	5.8
Omsk	98	98	98	16	27.8	0	0	1	17	-	-	-	51	6
Ob'-Irtyshskoe UGMS/ 4	**95**	**91**	**93**	**26**	**24.9**	**0**	**1**	**1**	**18**	**0**	**0**	**0**	**49**	**5.9**
Penza	99	-	99	24	25.2	0	2	2	27	-	-	-	39	5.6

Stations/Regional administrations	a1	a2	a	b	b1	c1	c2	c3	c	d	e	f	g	h
Orenburg	-	99	100	17	27.5	0	1	2	24	-	-	-	53	5.4
Privolzhskoe UGMS/ 2	**99**	**99**	**99**	**20**	**26.4**	**0**	**1**	**2**	**26**	**0**	**0**	**0**	**47**	**5.5**
Dal'nerechensk	98	-	98	22	25.9	0	0	3	35	-	+	-	45	7.6
Sad-gorod	99	99	99	64	19	1	1	5	43	-	+	-	43	8.1
Primorskoe UGMS/ 2	**99**	**100**	**99**	**45**	**21.2**	**1**	**1**	**4**	**41**	**0**	**2**	**0**	**44**	**7.9**
Aleksandrovsk	-	94	96	102	16	0	1	3	28	-	+	-	39	6.7
Poronaysk	96	-	96	102	16	1	1	3	31	-	-	-	57	7.4
IUzhno-Sahalinsk	97	99	98	42	21.7	0	0	3	25	-	+	-	38	7.7
Severo-Kuril'sk	0	-	0	-	-	-	-	-	-	-	-	-	-	-
Sahalinskoe UGMS/ 4	**65**	**96**	**78**	**65**	**18.9**	**0**	**1**	**3**	**27**	**0**	**2**	**0**	**44**	**7.4**
O.Dikson	89	-	89	46	21.2	2	3	1	19	+	-	-	49	5.1
Malye Karmakuly	75	-	75	157	13.3	1	1	1	15	-	-	-	63	6.4
Hatanga	71	-	71	35	22.9	1	1	1	17	-	-	-	51	5.7
SHoyna	-	85	85	22	25.9	2	1	2	48	-	-	-	55	5.2
Arhangel'sk	97	97	97	26	24.7	0	1	2	51	-	-	-	41	5.4
Kargopol'	-	97	97	22	26	1	2	1	27	-	-	-	44	5.2
Nar'ian-Mar	98	-	98	18	27.3	1	2	2	52	-	-	-	43	5.5
Pechora	51	-	51	28	24.3	2	4	4	44	+	-	-	68	6.5
Syktyvkar	96	97	97	23	25.6	5	5	2	57	+	-	-	55	5.5
Vologda	93	-	93	35	22.8	1	3	1	24	-	-	-	45	5.5
Severnoe UGMS/10	**84**	**94**	**87**	**30**	**23.9**	**2**	**2**	**2**	**39**	**3**	**0**	**0**	**50**	**5.5**
Kem'	96	-	96	34	23.1	2	3	1	27	-	-	-	48	5.2
Petrozavodsk	0	-	0	-	-	-	-	-	-	-	-	-	-	-
Voeykovo	100	99	99	26	24.7	0	1	2	49	-	-	-	48	5.5
Velikie Luki	-	0	0	-	-	-	-	-	-	-	-	-	-	-
Severo-Zapadnoe UGMS/ 4	**65**	**49**	**59**	**29**	**24.2**	**1**	**1**	**1**	**42**	**0**	**0**	**0**	**48**	**5.4**
Volgograd	99	100	100	17	27.4	0	1	2	23	-	-	-	66	5.4
Rostov-na-Donu	87	75	81	169	12.8	1	2	4	30	-	+	-	64	6
Divnoe	96	94	95	23	25.6	0	1	2	27	-	+	-	56	6.8
Astrahan'	87	84	86	21	26.3	0	1	2	26	-	-	-	57	6.2
Tuapse	0	0	0	-	-	-	-	-	-	-	-	-	-	-
MinVody	58	58	58	36	22.6	0	0	4	41	-	+	-	43	7.6
Mahachkala	93	92	92	22	25.8	0	1	4	38	-	+	-	47	7.4
Sev.-Kavkazskoe UGMS/ 7	**83**	**81**	**82**	**31**	**23.7**	**0**	**1**	**3**	**30**	**0**	**4**	**0**	**57**	**6.5**
Noril'sk	93	94	93	27	24.6	0	1	2	30	-	-	-	49	6.1
Turuhansk	99	99	99	26	24.7	0	1	1	34	-	-	-	52	6
Bor	94	-	94	22	25.9	0	1	1	20	-	-	-	44	5.3
Tura	90	-	90	23	25.6	2	2	2	43	-	-	-	43	5.3
Vanavara	-	94	94	29	24.2	1	2	2	33	-	-	+	49	6.6
Eniseysk	96	-	96	30	23.8	0	2	2	42	-	-	-	50	6
Boguchany	96	-	96	19	27	1	2	2	33	-	-	-	39	6
Emel'ianovo	98	97	97	25	25	1	1	3	55	-	-	-	37	6.3
Hakasskaia	100	-	100	20	26.3	1	1	4	56	-	-	-	39	5.8
Kyzyl	97	-	97	26	24.7	3	5	4	55	-	-	-	52	6.9
Srednesibirskoe UGMS/10	**96**	**96**	**96**	**25**	**25.1**	**1**	**1**	**2**	**40**	**0**	**0**	**1**	**46**	**6.1**
Kazan'	72	-	72	56	19.8	1	2	1	18	-	-	-	53	5.5
Rep.Tatarstan/ 1	**72**	**-**	**72**	**56**	**19.8**	**1**	**2**	**1**	**18**	**0**	**0**	**0**	**53**	**5.5**
Ivdel'	98	-	98	26	24.9	0	1	2	23	-	-	-	33	5.7
Perm'	91	-	91	30	23.8	2	2	2	32	+	-	-	63	5.2
Verhnee Dubrovo	95	96	95	25	24.9	1	1	2	25	-	-	-	52	5.3

Stations/Regional administrations	a1	a2	a	b	b1	c1	c2	c3	c	d	e	f	g	h
Kurgan	-	94	94	25	25	0	1	2	25	-	-	-	45	5.7
Ural'skoe UGMS/ 4	**95**	**95**	**95**	**26**	**24.7**	**1**	**1**	**2**	**26**	**1**	**0**	**0**	**49**	**5.4**
Moskva	99	84	91	36	22.7	3	3	1	22	-	+	-	49	6.5
CAO/ 1	**99**	**84**	**91**	**36**	**22.7**	**3**	**3**	**1**	**22**	**0**	**1**	**0**	**49**	**6.5**
Bologoe	87	86	86	30	23.8	3	3	2	29	-	-	-	55	5.8
Riazan'	98	97	97	23	25.7	3	3	1	22	+	-	-	56	5.7
Smolensk	93	94	94	37	22.5	1	1	1	20	-	-	-	49	6.6
Suhinichi	-	98	98	19	26.7	3	3	2	26	-	-	-	61	5.8
Central'noe UGMS/ 4	**93**	**93**	**93**	**28**	**24.4**	**2**	**2**	**2**	**24**	**1**	**0**	**0**	**55**	**6**
Kursk	97	65	81	26	24.8	3	3	2	26	+	-	-	42	5.7
Voronezh	96	-	96	27	24.5	0	0	1	16	-	-	-	36	5.4
Kalach	-	79	79	9	31.6	2	2	1	26	+	-	-	81	5.5
Centr-CHernoz.Oblastey UGMS/ 3	**96**	**72**	**84**	**20**	**26.3**	**2**	**2**	**1**	**23**	**2**	**0**	**0**	**54**	**5.6**
O.Ayon	56	-	56	161	13.2	2	2	3	33	-	-	-	52	7.7
Omolon	79	-	80	31	23.6	1	2	3	43	-	-	-	45	6
CHukotskoe UGMS/ 2	**68**	**-**	**68**	**63**	**19.1**	**2**	**2**	**3**	**38**	**0**	**0**	**0**	**48**	**6.7**
Tiksi	-	96	96	50	20.5	4	3	1	21	+	-	-	58	5.2
CHokurdah	-	98	98	27	24.4	1	1	1	13	+	-	-	52	6
Olenek	96	99	98	31	23.7	1	2	2	26	-	-	-	55	6
Verhoiansk	89	89	89	20	26.5	1	1	2	31	+	-	-	52	5.3
ZHigansk	92	-	92	20	26.6	2	3	1	24	+	-	-	62	5.5
Viliuysk	-	97	97	38	22.3	1	1	2	29	-	-	-	43	5.7
Oymiakon	-	90	96	26	24.7	4	5	4	88	-	-	-	48	6.1
Mirnyy	96	-	96	21	26	1	1	2	28	-	-	-	48	5.2
Olekminsk	96	-	96	22	25.8	2	2	2	27	+	-	-	52	5
IAkutsk	98	99	99	26	24.7	2	2	2	27	+	-	-	43	5
CHerskiy	94	-	94	30	23.8	1	2	1	23	+	-	-	66	5.6
Zyrianka	97	-	97	17	27.7	1	1	2	24	-	-	+	44	5.4
Vitim	-	93	93	31	23.7	12	13	3	50	+	+	-	81	6.5
Aldan	97	97	97	22	25.9	1	1	4	57	-	-	-	48	5.1
IAkutskoe UGMS/14	**96**	**95**	**95**	**26**	**24.8**	**2**	**2**	**2**	**34**	**8**	**1**	**1**	**53**	**5.5**
Russian Federation/106	**90**	**91**	**91**	**29**	**24**	**1**	**2**	**2**	**34**	**19**	**15**	**4**	**51**	**6.1**

a- Percentage of observational program fulfillment,
a1,a2 - 00 and 12 UTC
b- Average height of soundings hPa,
b1 - km
c- Percentage of soundings with rejected data,
c1 - Percentage of rejected temperature
c2 - Percentage of rejected geopotential
c3 - Percentage of rejected wind
d- suspected stations (geopotential heigh)
e- suspected stations (wind)
f- suspected stations (wind direction)
g- Weighted root-mean-square 'OB-FG' geopotential differences in 1000-100 hPa layer, gpm
h- Root-mean-square 'OB-FG' wind vector differences in 850-100 hPa layer, m/s