RUSSIAN FEDERATION

RUSSIAN FEDERAL SERVICE FOR HYDROMETEOROLOGY AND ENVIRONMENTAL MONITORING

WWW TECHNICAL REPORT ON THE GDPS FOR 2002

Country: **Russian Federation** **Centre:** **WMC/RSMC Moscow**

1. Highlights of the year

Development of the NWP systems for running on CRAY Y-MP 8E computer

1.1. The operational global spectral T85L31 model for 10-day forecasting has continued to run. The global data assimilation system based on the spectral T40L15 model has continued to run.

1.2. The skill scores of near-surface characteristics (temperature, wind, sea level pressure) produced by the global spectral T85L31 model have been substantially improved. The output products of the global T85L31 model have been extended.

1.3. The land surface temperature field based on SYNOP observations has been added to the global 3D multivariate objective analysis scheme.

2.-6. No substantial changes have been made in the equipment in operational use, the data received from GTS, the data input system, the data quality control system, and the monitoring of the observing system.

7. Forecasting system

In 2002 output products of the global spectral T85L31 model were issued twice a day with 84 and 240 h term of forecast for 00 and 12 UTC, respectively. The outputs (geopotential heights, temperature, and wind at 15 standard pressure levels up to 10 hPa; relative humidity up to 300 hPa; mean sea level pressure and precipitation) are available on the GTS and Internet in GRID and GRIB-code forms with 2.5×2.5° and 1.25×1.25° resolutions. Digital facsimile charts (in T4 code form) of the mean sea level pressure, 500 hPa geopotential height, 850 hPa temperature, and 850 (700) hPa relative humidity in winter (summer) for the Northern Hemisphere and Europe are also available on the GTS.

The list of outputs of the T85L31 model available on the Internet in GRID code with 1.25×1.25° resolution was considerably extended in 2002. Now it includes many weather elements (surface characteristics, precipitation, cloud cover) with lead time for up to 5 days.

8. Verification of prognostic products

8.1. HMC global medium-range spectral T85L31 model; 00 UTC and 12 UTC initial data

8.1.1. Mean sea level pressure

Forecast range	*RMSE* (hPa)		Anomaly correlation		S1	
(hours)	00 UTC	12 UTC	00 UTC	12 UTC	00 UTC	12 UTC
24	2,39	2,33	0,96	0,96	39,4	38,7
48	3,62	3,6	0,91	0,92	49,1	48,4
72	4,91	4,9	0,83	0,84	59,0	58,1
96		6,22		0,75		66,5
120		7,42		0,64		73,5
144		8,45		0,54		78,6
168		9,28		0,45		82,4
192		9,98		0,37		85,3
216		10,46		0,31		87,4
240		10,86		0,26		89,1

8.1.2. 500 hPa height

Forecast range	*RMSE* (m)		Anomaly correlation		S1	
(hours)	00 UTC	12 UTC	00 UTC	12 UTC	00 UTC	12 UTC
24	18,17	18,16	0,98	0,98	22,5	22,6
48	32,50	32,28	0,95	0,95	32,5	32,6
72	45,91	45,31	0,88	0,88	41,3	41,4
96		64,08		0,8		49,5
120		79,02		0,69		56,2
144		92,64		0,58		61,8
168		105,54		0,47		66,4
192		114,68		0,38		69,8
216		121,65		0,31		72,2
240		128,11		0,24		74,3

8.1.3. 250 hPa height

Forecast range	*RMSE* (m)		Anomaly correlation		S1	
(hours)	00 UTC	12 UTC	00 UTC	12 UTC	00 UTC	12 UTC
24	24,06	23,92	0,98	0,98	19,4	19,4
48	43,23	43,17	0,95	0,95	28,4	28,2
72	64,13	64,08	0,89	0,89	36,3	36,2
96		87,02		0,80		43,7
120		108,77		0,70		50,2
144		127,16		0,60		55,3
168		147,24		0,49		59,8
192		161,43		0,40		62,9
216		172,78		0,33		65,1
240		183,35		0,26		67,3

8.1.4. 500 hPa temperature

Forecast range	*RMSE* (K)		Anomaly correlation	
(hours)	00 UTC	12 UTC	00 UTC	12 UTC
24	1,24	1,25	0,94	0,95
48	1,86	1,85	0,89	0,89
72	2,49	2,49	0,80	0,80
96		3,17		0,69
120		3,76		0,58
144		4,23		0,48
168		4,75		0,39
192		5,10		0,31
216		5,36		0,26
240		5,62		0,19

8.1.5. 250 hPa temperature

Forecast range	*RMSE* (K)		Anomaly correlation	
(hours)	00 UTC	12 UTC	00 UTC	12 UTC
24	1,67	1,58	0,90	0,90
48	2,24	2,14	0,80	0,80
72	2,70	2,66	0,69	0,69
96		3,06		0,58
120		3,42		0,47
144		3,65		0,39
168		3,88		0,32
192		4,05		0,27
216		4,23		0,22
240		4,39		0,18

8.1.6. 500 hPa wind

Forecast range	***MEAN SPEED ERROR (m/s)***		RMSEV (m/s)	
(hours)	00 UTC	12 UTC	00 UTC	12 UTC
24	-0,76	-0,79	5,48	5,48
48	-0,99	-0,97	7,44	7,45
72	-1,00	-0,99	9,42	9,43
96		-0,98		11,33
120		-0,98		13,01
144		-0,97		14,47
168		-0,98		15,64
192		-0,98		16,48
216		-1,00		17,05
240		-0,99		17,53

8.1.7. 250 hPa wind

Forecast range	*MEAN SPEED ERROR (m/s)*		RMSEV (m/s)	
(hours)	00 UTC	12 UTC	00 UTC	12 UTC
24	-1,83	-1,84	7,68	7,69
48	-2,04	-2,04	10,52	10,61
72	-1,94	-1,95	13,22	13,31
96		-1,89		15,97
120		-1,88		18,32
144		-1,87		20,31
168		-1,89		22,00
192		-1,89		23,26
216		-1,89		24,15
240		-1,87		24,94

8.2 Limited-area finite-difference 11-level p-model with 150-km horizontal resolution.

	Mean sea level pressure			925 hPa			500 hPa		
	TC×100	RMSE (hPa)	S1	TC×100	RMSE (m)	S1	TC×100	RMSE (m)	S1
24 h	91	2,3	35	91	16,0	30	93	21,1	24
36 h	88	3,1	44	89	22,2	38	92	29,4	30

Notes to 8.1, 8.2:

The average verification scores for the Northern Hemisphere over 2002 were calculated against HMC objective analyses following the standardized procedure recommended by the WMO.
The verification scores for the limited-area model were calculated against aerological observations over central and eastern Europe.

RMSE is the root-mean-square error of forecast;
RMSEV is the root-mean-square error of wind velocity;
TC is the tendency correlation;
S1 is the skill score of the gradient forecast.

9. <u>Plans for the future (2003-2004)</u>

9.1 Preparation for the implementation of the new version of the global data assimilation system based on the spectral T85L31 model.

9.2 Preparation for the operational use of a new T169L31 version of the global spectral model.

9.3 Implementation of the 30-level regional σ-model with 75 km horizontal resolution.

Country: Russian Federation **Centre: RSMC Novosibirsk**

1. HIGHLIGHTS OF THE YEAR

1.1 The work has been carried out on transfer of the systems: forecasting, the processing of operational information and products received from GTS to computer CRAY-EL and PCs due to the upgrading of the data processing centre (DPC) RSMC Novosibirsk.
1.2 The observational data assimilation system for Northern Hemisphere (DAS-NH), the data base of which is used in numerical weather prediction models has been put into operation.
1.3 Archival meteorological observation data of Urals-Siberian region has been transferred from MT to CD-disks.
1.4 The introduction of computing technology for preparation and transmission of observation data of the hydrometeorological stations for the territory of Altai region continued.

2. EQUIPMENT USED BY CENTRE

2.1 Soft ware-hard ware complex MTS is functioning in the HUB Novosibirsk. Collection of the hydrometeorological information from the the hydrometeorological stations of the three subjects of the Russian Federation - the territories of the activity of the Western – Siberian Territorial Hydrometeorological Service (Novosibirskaya,
Kemerovskaya districts, Altai region) is carried out on computer networks.
2.2 In the Data Processing Centre there are computer CRAY EL, COMPAREX, GIS – METEO system, etc.

3. GTS DATA AND PRODUCTS USED

3.1 The observational data and processed information: SYNOP, SHIP, TEMP, PILOT, CLIMAT, SATEM, SAREP, SATOB, BUOY, ROCOB, GRID, GRIB.
3.2 Graphical information (prognostic weather charts and baric topography) from London, Moscow, Khabarovsk.

4. DATA INPUT SYSTEM

Data input system is automated. Digital data input or output from the Computer is carried out directly from or into the telecommunication channels. The inter computer data exchange inside the Processing centre is also carried out.

5. QUALITY CONTROL SYSTEM

Quality control system meets the requirements of the operational practice of the hydrometeorological provision.

6. OBSERVATION SYSTEM MONITORING

6.1 The operational monitoring of the observation data for reports SYNOP, TEMP is carried out on the national level for the stations of the Western Siberian, Obj- Irtish, Irkutsk, Middle-Siberian Territorial Hydrometeorological Services and Republic Mongolia.
6.2 Non operational monitoring of the observation data is carried out daily on the regional level for the reports: SYNOP, TEMP, CLIMAT TEMP for the territory for RA II including Mongolia, mutually agreed non operational monitoring of observation passing through GTS is carried out from the 1st up to 15 October.

7. FORECASTING SYSTEM

7.1 SCHEDULE FOR SYSTEM OPERATION

7.1.1 The RSMC operates:

- Operational system of numerical short-range forecasting “Region”. The maximum lead-time of forecasts used in the Centre is 60 h, for the products disseminated through the GTS—48 h (for 12.00 mGt on computer COMPAREX);
- Hemispheric spectral model T 40 L 15 (up 3 days) developed by the Hydrometeorological Centre of Russia (run for 00 and 12 00 mGt on the computer CRAY-LE);
- Local-climatic, local-stationary, regression models for forecast of mean-monthly air temperature and precipitation anomalies;

7.2 MEAN-RANGE FORECASTING SYSTEM

7.2.3 NUMERICAL FORECAST PRODUCTS

For short- medium range forecasting in Western-Siberian Territorial HMS as basic models are used forecasts of baric- thermal fields (AT-500, P, AT-850) ECMRWF (Reading) for 24-144h with daily resolution and RSMC (Bracknel) up to 72 h with half daily resolution.

7.2.4 OPERATIONAL TECHNIQUES OF NWP PRODUCTS APPLICATION

Operational automated calculations of medium- range forecast are based on the methods developed in the Siberian Scientific Research Hydrometeorological Institute (SRHMI) and used both PP and MOS concepts. At present in the operational mode for the Urals-Siberian region the following meteorological elements and weather phenomena are calculated:

- extreme air temperature (for 1-6 days, pentad,, decade);
- half-daily precipitation amount (for 1- 5 days);
- light, prevailing and strong wind (for 1 – 5 days);
- frosts (for 1- 5 days);
- drifting snow (for 1- 5 days);
- cloud cover in tenth (for 1 – 5 days);

7.3 Short –Range Forecasting System (0-72 hours) “ Region”.

7.3.1 Data assimilation, objective analysis and initialization:

- assimilation cycle: discrete, in 03 hours data are attracted for the hours of observations 00 and 12 Mgt respectively , data cut off time in 1-3 hours;
- method of analysis: optimal interpolation;
- analyzed variables: geopotential of isobaric heights, temperature and dew point deficit on isobaric surfaces;
- the first guess: data of the nearest forecast of NMC, received through telecommunication channels in GRID code;
- coverage: data are attracted from the territory in the limits of the Northern Hemisphere, the grid point (66x34) analysis field covers the territory 40 N – 80 N,
40 E – 146,6 E;
- horizontal resolution: on latitude 1,66°, on longitude 1.25°;
- vertical resolution: (levels): 1000, 850, 700, 500, 400, 300, 250, 200, 150, 100 hPa
- initialization: non-linear on normal modes for a model on limited area.

7.3.3 Numerical Weather Forecast Products

Output products of system “Region” are provided in the operational practice in the following volume:

- surface field forecasts;
- forecasts of geopotential, temperature, wind, dew point deficit at 925, 850, 700, 500 hPa levels;
- wind and temperature forecasts for aviation at 300, 200 hPa levels;
- vertical current forecasts at 850, 700, 500 hPa levels;
- medium wind forecasts at the layer of 0-12 km.

7.3.4 Operative methods of NWP products application

System “Region"s data is used for the calculation of meteorological elements forecasts and weather phenomena for the Urals-Siberian region.

7.6 LONG-RANGE FORECASTS (from 30 days up to 2 years)

7.6.2.1 Local-climatic model intended for nonstationary assessment in regard to mathematical expectation of hydrometeorological processes with the help of piecewise functions;

7.6.2.2 Local stationary model—auto regression model intended for nonstationary assessment by auto covariant function of hydrometeorological processes.

7.6.2.3 Model with automated selection of prehistory—regression model allowing in automatic mode to select the most informative predictors and on their basis to construct the equations of regression minimizing average risk assessment.

7.6.2.4 Complex (integrated) consecutive model combining in single complex local-climatic, local-stationary model and the model with automatic selection of prehistory where each of the models fulfill its function with the consecutive results transfer to each other.

7.6.4 on the basis of above mentioned model the following long-range forecasts are calculated:
- mean-monthly air temperature anomaly forecast (2 times a year);
- monthly precipitation amount anomaly forecast (2 times a year);
- mean decade air temperature anomaly forecast (2 times a year).

8. VERIFICATION OF PROGNOSTIC PRODUCTS

Root-mean-square error of the “Region” operational scheme used for numerical weather prediction for the period January-October 2002 is shown in table 1.

Table 1

Root-mean-square error of operational numerical model “Region” for 1-X for January-October 2002

Term of forecast	Geopotential	Error
24 h	H-500	2.2
36 h	H-500	2,9
48 h	H-500	3,8
60 h	H-500	4,6

9. PLANS FOR THE FUTURE

In 2003 it is planned to continue work on the improvement of the new technological line of short-range hydrodynamic weather forecast with high spatial resolution (about 60 km) in the part of physical parametrizations in the boundary layer of the atmosphere and technological components connected with the processing of the coming actual and prognostic information.

Country: Russian Federation Centre: RSMC Khabarovsk

1. HIGHLIGHTS OF THE YEAR

For upgrading MODELL system of short- range regional forecast of the field meteorological elements:
- Conversion technology of prognostic fields in GRIB code—regional has been developed;
- Operative decoding technology and prognostic fields visualization has been prepared;

- Operative technology of calculation of semidiurnal and diurnal precipitation amount in the forecasting localities with regard to the time zones has been developed.

2. EQUIPMENT USED BY CENTRE

2.1 Automated data receiving service

For data collection from the Hydrometeorological Stations Network and its inputting into the Message Switching System (MSS); facsimile charts receiving and transmission; reception, processing, dissemination and control of data arriving at MSS the following equipment is used:

- ACER ALTOS- 1200;
- ACER POWER- 6100;
- Asynchronous Multiport Card CYCLOM 16- YeP/DB25(PC), 16 ports RS- 232, extermal SM;
- RACK Multicon;
- Network Router CISCO 2511 Series Access Server;
- modem NTU- 128SA/V.24;
  AINET- T336CX/V.34;
  MT 2834L;
- SCO Open server R5.0.5

2.4 Technical facilities for satellite data receiving and processing:
T-ris; MP- 1200; MP- 4000; TECNAVIA.

3. GST DATA AND PRODUCTS USED

The average number of messages a day

Type of data	SATEM	TEMP	SYNOP	TEMP-SHIP	PILOT	KN15
Arriving	5400	1700	5100	220	0	200
Used	5400	1700	5100	220	0	200

Meteorological Centers Products

Code	Centre	Arriving	Used
GRID	Washington	60	60
	ECMRWF (Reading)	24	24
	Moscow	174	174
GRIB	Bracknell STUVWX	229	229
	ECMRWF (Reading)	21	21
Facsimile chats	Tokyo	310	310

4. DATA INPUT SYSTEM

No changes (automated).

5. DATA QUALITY CONTROL SYSTEM

Automated message rejection with violations of the Manual in Codes’ requirements; visual review of the rejected messages and introduction of corrections in coding if it is possible. Controlled data for PA-II enter the GSET.

6. OBSERVATION SYSTEM MONITORING

No changes

7. PROGNOSTIC SYSTEMS

No changes

7.2 Mean-range prognostic system (4- 10 days)
7.2.4 ECMRWF' products in GRID code is used.

7.3 Short- range prognostic system (0- 48 h)—no changes.

7.3.4 Operative methods of NWP products application.
Semidiurnal and diurnal precipitation amount in the forecasting localities according to the given list.

8. EVALUATION OF THE QUALITY OF OPERATIONAL FORECASTS
Geopotential—without substantial changes.
Wind Velocity Components—without substantial changes.

9. PLANS FOR THE FUTURE (2003- 2004)
Testing and introduction of a new model version for short- range weather forecast in σ- coordinate system. Technology modification and data assimilation system.