WMO TECHNICAL REPORT
ON THE DEVELOPMENT OF GLOBAL DATA-PROCESSING AND NUMERICAL WEATHER PREDICTION SYSTEM FOR 2012

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1. SUMMARY OF HIGHLIGHTS

In 2012, MM5 numerical weather prediction model calculations became operational on a computing complex comprised of a single server. The WRF-ARW model was configured to carry out calculations for the territory of Belarus.

2. EQUIPMENT IN USE

The MM5 mesoscale model calculations are performed on a computing complex comprised of one server (with two four-core Intel E5540 (Nehalem) processors and 12 GB of RAM) with the capacity of 0.1 Tf.

An HP Blade System c7000 supercomputer became operational with its peak performance of 3.5 Tf. Each of the nodes has 23.5Gb of RAM.

3. DATA AND PRODUCTS FROM GTS IN USE

Average number of messages (statistics per day):

- SYNOP – 9802
- SHIP – 3813
- TEMP – 2292
- PILOT – 540
- SATEM – 2695
- BATHY – 5404
- AMDAR – 3594
- AIREP – 9816
- GRIB – 18259
- BUFR – 10504

4. FORECASTING SYSTEM

4.1 General Forecasting System Structure

Forecast calculations are performed using the Russian-Belarusian model (author: V.Losev, RF HMC) and the MM5 model; the prepared forecast fields are processed in GRIB code and other formats downloaded from the Internet via FTP and received through the communication channels. Pressure field forecasts are verified on the main isobaric surfaces using the regional model, as well as the forecasts of temperature and rainfall for the regional centres of the Republic of Belarus. All the processed forecast data are available at the forecaster automated workstation (AWS).

4.2 Medium-Range Forecasting System (4-10 days)

Forecast data are being issued operationally in the GRIB code on the basis of the UK MetOffice UM model for the 108x162 node grid with the resolution of 0.833° x 0.556°, with the lead time of 144 hours, at 6-hour intervals for the reference times of 00, 12 UTC. The following surface data are being processed: temperature, precipitation, pressure, wind velocity components, relative and specific humidity, and wind gusts. GMT software is used for the visualization of surface pressure and precipitation. The interpolated values for the points in the Republic of Belarus are recorded in the database. For regional centres, forecast temperature and precipitation data from the RF HMC centre with the lead time of 120 hours are also processed.

4.3 Short-Range Forecasting System (0-72 hours)

Forecast calculations are based on two following models:

- the Regional Model (author: V.Losev, RF HMC) – for input data at 00, 12 UTC. Calculation is carried out for a rectangular grid on the stereographic projection map with the horizontal grid length of 75 km for the first version and 50 km for the second one. The grid covers the territory of the Atlantic, Europe and parts of Asia (8400x6900 km). The model uses a coordinate system with 20 sigma levels and 113x93 horizontal nodes with the 48-hour lead-time. Objective analysis is used in the GRIB code from RF HMC transmitting centre. At the grid borders, the forecast values are adjusted every 12 hours on the basis of the Global Spectral Medium-Range Forecast Model for the Northern Hemisphere (T85L31, RF HMC). The pressure field forecast verification is carried out on the main isobaric surfaces. Output: surface pressure, precipitation, geopotential field, wind speed components at 13 standard isobaric surfaces of 1000, 925, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50 hPa. Surface pressure and

precipitation are visualized at one-hour intervals using the SURFER software;

- MM5 Model – for input data at 00 UTC. Calculation is carried out for a rectangular 73x73 node grid on the stereographic projection map with the horizontal grid length of 45 km and the lead time of 48 hours. The GMT (Generic Mapping Tools) generic mapping tool has been configured to visualize the model output forecast fields at three-hour intervals. The values of the meteorological parameters for RB points were obtained by bilinear interpolation of the forecast fields in accordance with the MM5 numerical model projection and grid. The visualization system in the form of maps, tables and graphs was integrated into the existing general methodology of forecast data processing and presentation.

Numeric model forecast data are used to calculate the TTI instability criterion and the thunder storms using the Reshetov method for the meteorological support of the Minsk aerodrome; namely, the wind calculation within the 600m range, the calculation of icing and turbulence, as well as the representation of temperature and wind by flight levels.

5. VERIFICATION OF PROGNOSTIC PRODUCTS

The table below shows the root mean square error (RMSE) values for the pressure field forecasts based on the regional area model:

63° N., 5° W. 66° N., 40° E.
44° N., 9° E. 45° N., 33° E.

Lead time, h	**Ps.l.**	**H850**	**H700**	**H500**	**H300**	**H200**
36	3.82	2.61	2.51	2.56	3.21	3.44
48	4.75	3.63	3.42	3.53	4.66	4.34

6. PLANS FOR THE FUTURE

Experimental calculations using the HP Blade System c7000 supercomputer for the WRF-ARW regional non-hydrostatic hydrodynamic model forecasts with nested grids, taking into account the specified geophysical characteristics of the territory of Belarus. Preparation of detailed numerical weather forecasts. Development of software tools for severe weather forecasting.

8. REFERENCES

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