

Adaptation of the PSU/NCAR MM5 for high-resolution weather prediction over Russia

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The Penn State/NCAR mesoscale model MM5v3.6 has been adapted for high-resolution numerical weather prediction and computer benchmarking at the Main Computer Center (MCC) of the Hydrometeorological Service of Russia (Roshydromet). Initial and lateral boundary conditions for the developed system are being specified from the synoptic-scale numerical three-dimensional analyses and predictions available from the Hydrometcentre of Russia (HMC) and the National Center for Environmental Prediction (NCEP), USA. An automatic weather prediction system has been designed to allow realization of the all standard stages of the data processing and weather prediction with the MM5 both on the distributed memory and the distributed shared memory computers. No objective analysis computations are performed. Efficiency of the developed MM5-based system has been tested on the Itanium 2 Altix 3700, Origin 2000 Silicon Graphics and Xeon-2 computers. Three model versions (Table 1, I-III) have been configured with the aim of the experimental 72-hr weather prediction over Europe and Central part of European Russia (centered over Moscow). An example of a pattern with the results of the T850/H850 72 hr prediction initiated at 00:00 UTC June 4, 2004 is given in Figure 1. Results of the MM5 benchmarking on the Altix 3700 machine are presented in Table 2.

Future plans of work include detailed evaluation of the accuracy of the model predictions and the determination of its optimal configuration for the weather prediction over Russia.

Partial support has been provided by RFFI grants 03-05-64312, 04-05-64151 and INTAS project 03-51-5296.

Table 1. Configuration of the MM5 model versions at the HMC/MCC Russia

Experimental Version	I (Altix/Origin)	II (Xeon4)	III (Altix)
Num of levels	37	27	37
Num domains	4	2	27
Horiz. Res.	45/15/5/1 km	54/18 km	1x90/3x30/21x10km
Pressure at model top	70 hPa	70 hPa	70 km
Domain interaction	One-way	One-way	One-way
Init./boundary data	NCEP, USA	HMC, Russia	NCEP, USA
FDDA	No	No	No
Expl. Moisture	Simple ice	Simple ice	Simple ice
Cumulus scheme	G/G/0/0 (G=Grell)	G/G (B-M=Betts-Miller)	B-M/K-F/G (K-F=Kain-Fritch)
Shallow conv.	No	No	No

PBL scheme	Eta M-Y	MRF	Eta M-Y
Radiation	RRTM	Cloud	RRTM
Land surface	NOAH	Multi-layer Soil temp.	NOAH
Effects of monthly snow albedo	Yes	No	Yes

Table 1 (cont)

**Table 2. Benchmark estimations for 48-hr prediction with the MM5
(version III, Tabl. 1) on the SGI Altix 3700 (1.5 GHz/ 6.MB processors)**

N.domains/resolution	N. grid points	N. of processors	Time (min)
1 (90 km)	85x100 points	16 processors	6 min
1 (30 km)	148x121	28	5 min 48 s
1 (30 km)	103x73	16	5 min 55 s
1 (30 km)	124x73	16	5 min 21 s
21 (10 km)	52 x 52	6	18 min x 21
21 (10 km)	52 x 52	60	3 min x 21

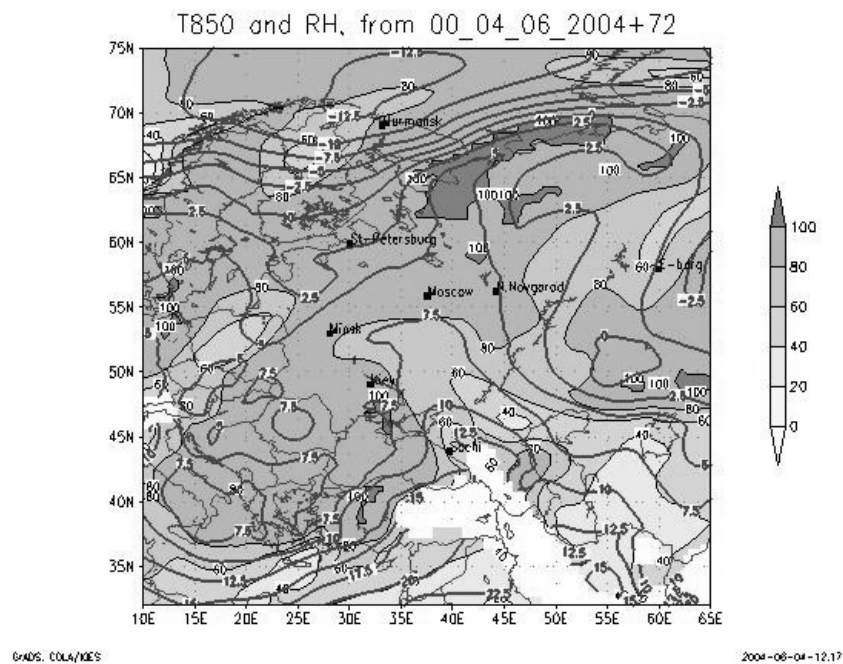


Figure 1: 72-hr forecast of the air temperature and relative humidity at 850 hPa