Weather forecasting of meteorological variables for Moscow and Moscow Region

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The Dynamical Weather Forecasting System (DWFS) operated at the Hydrometeorological Research Centre of Russia [1,2,3]. Its outputs are the short-range 48-h predictions of:

- surface meteorological variables (temperature, humidity, and wind velocity);
- cloud amount and precipitation rates; and
- vertical profiles of wind, temperature, and turbulence characteristics in the 2 km layer .

The skill of DWFS we demonstrate here by verification statistics of its improvement over the persistence (forecast error- FE and persistence error – PE) [4] . The corresponding data on temperature, precipitation, and wind predictions for Moscow in 2001 are given in Table which reproduces the mean absolute forecast error of daily minimum and daily maximum temperatures ($\delta T_{\min}$, $\delta T_{\max}$; °C), 12-h precipitation amount (δP_r , mm), and wind speed (δV, m·s^{-1}). We demonstrate the improvement of our weather forecasts over persistence, because there are no currently available another objective short-range weather forecasting techniques for Moscow, which we could compare our forecasts with. Operational forecasts calculated from operational database for 17 Russian cities around Moscow demonstrate about the same skill as shown in Table for Moscow.

	δT_{min}	δT_{max}	δP_r			δV			
	Projection (h)								
	0-36		00-12	12-24	24-36	12	24	36	48
FE	1.7	2.0	1.4	1.5	1.8	1.5	1.7	1.8	1.9
PE	2.7	2.8	2.7	2.3	2.6	2.0	1.8	2.4	2.2

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A description is provided of basic concepts, prediction techniques, and performance of a system for operational short-range forecasting of meteorological variables and weather patterns at the Russian Hydrometeorological Research Centre. The basic principle of the system lies in reconstruction of both synoptic-scale and mesoscale weather patterns from the output product of a large-scale prediction model by means of the ABL model algorithms and locally-adapted parameterizations of the radiative heating effects on the near-surface air temperature variation as well as of some other physics. The system provides quite realistic 48 h guidance of weather patterns for cities in Russia and for a limited area encompassing Russia, Eastern Europe, and neighbouring regions. Detailed prediction for different parts of the city of Moscow and its suburbs is provided as well.

As it is shown, DWFS has considerable operational effectiveness. Further improvements and developments being partly in progress now are:

- improvement of the air humidity prediction through implementation of a simplified land surface hydrology model;
- implementation of a moist convection model for prediction of convective precipitation to replace the currently used semi-empirical technique;
- parameterized treatment of the impact of atmospheric fronts upon the evolution of meteorological variables in the boundaru layer and free atmosphere;
- development of optimal parameterizations for treatment of dynamical and thermal characteristics and radiative balance of the underlying surface to account for spetial features of the builtup areas in various parts of a large city; and
- development and implementation of parameterized treatment of the anthropogenic heating impacts to improve the technique of detailed weather forecasting for a large city.

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