Mesoscale ensemble prediction system using the nonhydrostatic atmospheric model COSMO-RU

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Ensemble description

The nonhydrostatic mesoscale atmospheric model COSMO-RU [4, 5] is a version of the COSMO model [3] for European territory of Russia.

In recent years, technological progress has made the mesoscale ensemble weather forecasting possible. Systems for mesoscale ensemble weather prediction already work in United States, Canada and some European countries. Mesoscale ensemble forecasting using COSMO model has become one of the COSMO consortium Perspective Projects [1, 2].

We use the COSMO-RU model with 14 km grid step. The model grid for this version has 350×310 grid points at 40 vertical levels.

Successful experiments on building ensembles by perturbing COSMO mesoscale model physical parameterizations are already made in Italy, Greece and Switzerland [1]. The difference of this work is the use of different numerical schemes implemented in the model too.

Freezing rain case in Moscow, 25–26 December 2010

Intensive freezing rain in Moscow region on 25-26 December 2010 caused damage of trees, electric lines and constructions due to large mass of glazing ice formed during this time. This case is interesting for ensemble forecast test because of usually low predictability of such phenomena.

The ensemble used in this study contains 28 ensemble members using the leapfrog and 2 different second-order Runge-Kutta numerical schemes, Tiedtke and Kain-Fritsch convection parameterization schemes and perturbations of parameters for the length scale of sub-scale surface thermal patterns over land and the scaling factor for the thickness of the laminar boundary layer for heat.

Fig. 1 shows the 0°C isotherm spaghetti plot on the zonal vertical profile at 6:00 GMT 12/26/2010 according to the 66-hour ensemble forecast. The red vertical line shows the position of Moscow. We can see that even for such a long forecast term our ensemble shows rather large probability for appearance of warm (with temperature greater then 0°C) air flow above the cold near-surface air. This temperature distribution is one of main weather conditions making the freezing rain possible, so it can be an important symptom of freezing rain cases when forecasted.

It should be noted that this ensemble forecast also shows rather large probability of snow and rain in the region at the moment shown. This allows us to see the possibility of freezing rain at this moment. So we can see that our ensemble can predict such phenomena in near 3 days advance.

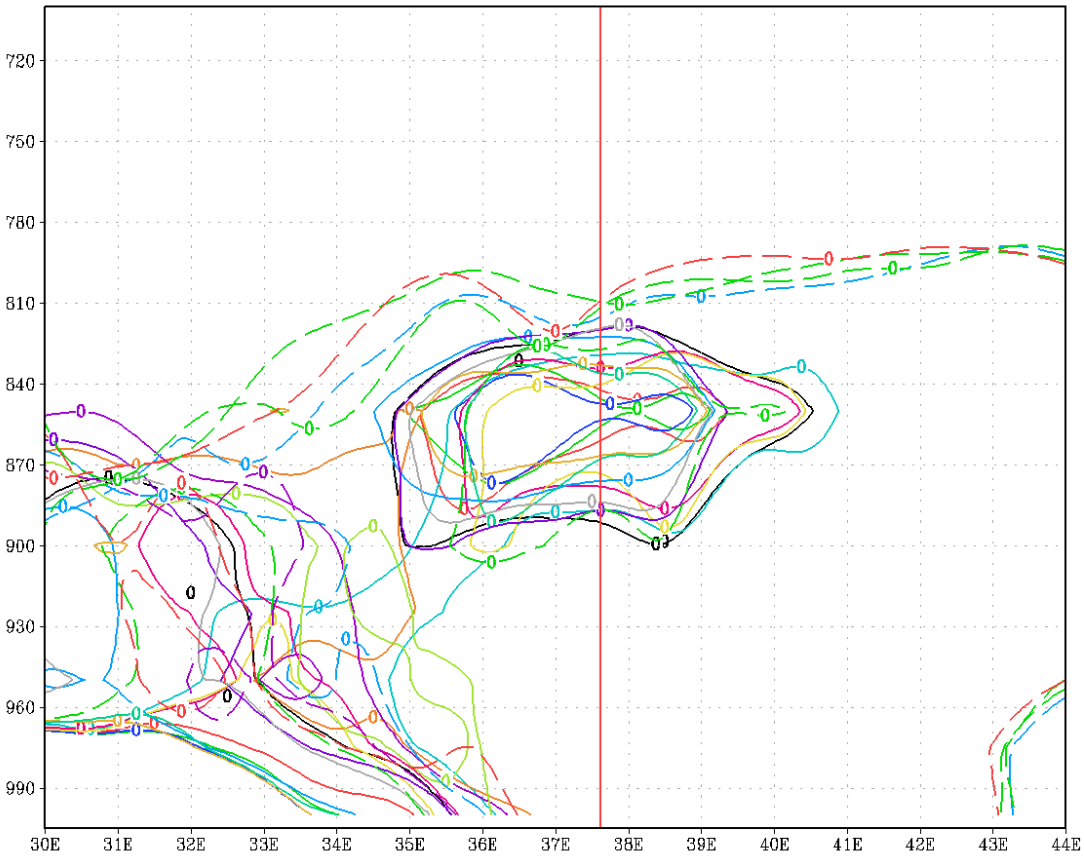

Fig. 1. 0°C isotherm spaghetti plot on the zonal vertical profile at 6:00 GMT 12/26/2010 according to the 66-hour ensemble forecast. The vertical coordinate is shown in pressure levels. The red vertical line shows the position of Moscow.

References

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