Variational assimilation of screen-level temperature for the global semi-Lagrangian NWP model SL-AV

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The parametrization of land surface processes ISBA (Interaction Soil Biosphere Atmosphere) [1] was implemented in the global semi-Lagrangian finite-difference NWP model SL-AV[2]. It is known that this parametrization is highly sensible to initial data errors of soil water content. Soil variables correction scheme consistent with the parametrization was implemented in order to improve the analysis. The scheme initializes the following surface variables: surface soil temperature, deep soil temperature, surface water content and deep soil water content. One can find the detailed description of the above scheme in [3]. Its implementation for SL-AV model is presented in [4] .

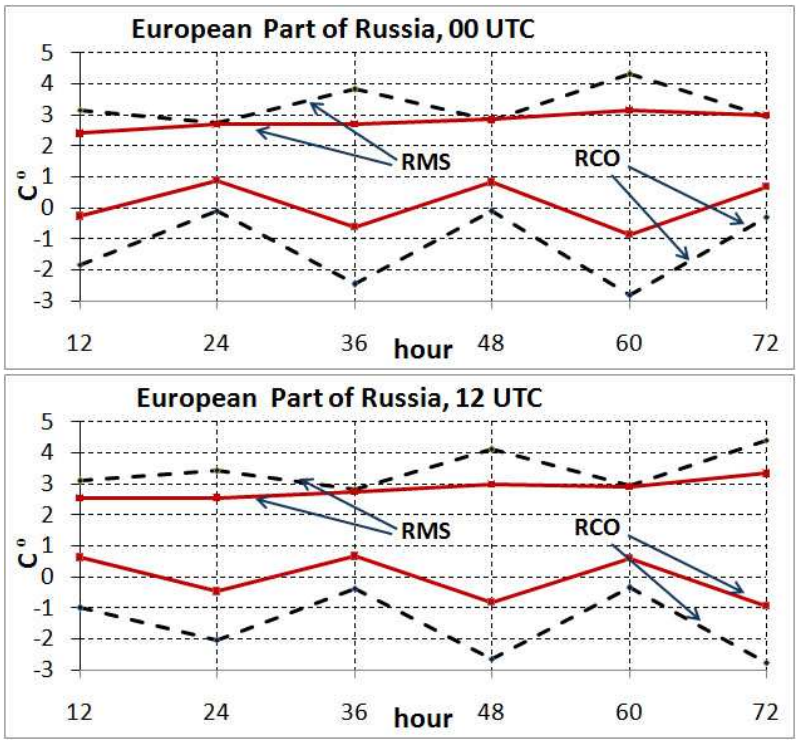

Figure 1: T_{2m} forecast errors with respect to observations. Solid lines: new analyses. Dashed lines: analyses from assimilation system of Hydrometcenter of Russia. [7]

As this scheme uses 2 meter temperature and relative humidity analysis increments, soil variables errors are influenced by screen-level analysis errors. 2D variational analysis method was implemented in order to improve screen-level temperature analysis.

Background error covariance matrix $\mathbf{B}$ is obtained using the function suggested by Tilmann Gneiting [5] with an additional term. This term takes into account orography difference between different gridpoints. 2DVAR analysis method was parallelized with OpenMP and MPI technologies.

The validation of the method was carried out in the continuous assimilation cycle. The estimates used were 2m temperature mean (RCO) and root-mean square (RMS) errors with respect

to SYNOP observations. The resolution of the model is 0.72 degrees in latitude, 0.9 degrees in longitude, 28 vertical levels. Upper-air initial fields are taken from the data assimilation system [7].

Figure 1 shows the errors of 72-hour 2-meter temperature forecast averaged for June 5-18, 2007 obtained with new analyses for soil variables, screen-level temperature and also OI relative humidity analysis [6] along with the results obtained with previously used fields from assimilation system [7]. The upper lines are root-mean square errors and the lower lines are biases. One can observe smaller screen-level temperature errors in case of using new schemes. T_{2m} forecast root-mean square error on all regions decreased on 0.6 degrees on average.

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