"**An evaluation of the 3D-FGAT scheme for the ALADIN/Hungary model**"

(Results obtained during the LACE stay at the Hungarian Meteorological Service)
steluta.vasiliu@meteo.inmh.ro

An intermediate step from the 3D-Var to the 4D-Var data assimilation scheme is the so-called three-dimensional First Guess at the Appropriate Time (3D-FGAT). In the 3D-Var system, the observations are collected within an observations window (± 1.5 or ± 3 hours around the analysis time, called cut-off) and assumed to be valid at the analysis time. The innovations (observations - background) are computed using a short-range forecast valid at the analysis time. As the name indicates, in the 3D-FGAT scheme, the observations are taken into account at their accurate time and compared with the first guess at the appropriate time. The assimilation window is divided into **n** observation windows (generally each one of 1 hour) and for each observation window, the differences between the observations and the forecast states, valid at the observation time, are computed. The innovations are assumed to be constant in time and remain stationary within the observation window. Excepting the evaluation of the innovations, 3D-FGAT follows the same algorithm as 3D-Var. The 3D-FGAT scheme for the ALADIN model estimates the 3D-FGAT analysis at the beginning of the assimilation (when the first-guess is valid) and not at the middle of the assimilation window (as for the 3D-Var scheme). Thus, even if the same observations are used along the assimilation window (of 6 hours) the 3D-FGAT analysis is valid with 3h before the one evaluated by the 3d-Var scheme.

The experiments have been performed using the cycle 28t3 of the ALADIN/Hungary model (with 12 km horizontal resolution), taking into account the observations available at the Hungarian Meteorological Service (SYNOP, TEMP, SATOB, WIND PROFILE, AIREP, satellite radiance).

At the beginning single observation experiments were carried out, using only one observation of the temperature field. It was shown the isotropic shape of the temperature increment (both for the surface observation and for the 500 mb measurement), which confirmed that the 3D-FGAT scheme is applied correctly.

The second set of experiments consists in performing an assimilation cycle during 11.05.2005 – 21.05.2005. The results of the 48h integration of the model, using as initial condition the 3d-Var analysis, respectively the 51h integration (due to the 3h difference between the valid time of the analyses), with 3D-FGAT analysis as initial condition, were compared both with the observations (from the surface) and with the ARPEGE analyses (based on the VERAL procedure). The verification scores did not show an improvement in the first 12h forecasts, when the 3D-FGAT scheme was used. Afterwards, the scores become neutral. An explanation of this poor evolution can be that for the same moment of time, as example for 00 UTC, the 3d-Var analysis and 3h forecast obtained with the 3D-FGAT scheme were compared with observations. It is known already from the 3d-Var experiments, that the analysis of the model is improved, but after 6h integration, the improvement is decreased significantly.

In these conditions, the third set of experiments was performed, similar with the previous one (and carried out in the same period), but for which the assimilation window was decreased till ±1.5 hours around the analysis time. Thus, the results of the 48h integration of the model (using the 3d-Var and 3D-FGAT analyses as initial conditions) were evaluated at the same moment of time. A significant improvement (comparing the two assimilation cycles with the 3D-FGAT scheme) was noticed when the assimilation window was reduced.

A case study (with significant amount of precipitation measured over Hungary) was investigated. The forecasts have shown the main features of the precipitation field.

These experiments represent a first evaluation of the 3D-FGAT scheme for the ALADIN/Hungary model. Further it follows to increase the observation number during the assimilation cycle, and other case studies to be carried out for establishing the performance of this assimilation scheme.

More details about the experiments and the results will be available in the RC LACE Internal Report.