Scientific and Technical Activities in Prague

Period: 1st January 2004 – 30th June 2004

1. ALADIN/MFSTEP configuration (M. Derkova, J.-F. Geleyn, R. Brozkova)

As described in the previous Newsletter, a special configuration of ALADIN was prepared to provide the forecasts of surface fluxes for the near real time atmospheric forcing of ocean and shelf models. The computational domain covers near Atlantic Ocean, the whole Mediterranean Sea and Black Sea. This activity belongs to the European project MFSTEP, financially supported by the European Commission.

Since February 2004, a MFSTEP suite is computed regularly for the pre-TOP (Target Observation Period in the Mediterranean Sea) results validation, since April it is fully under the operational constraints and supervision. The suite runs in a blending assimilation mode with one production forecast up to 120 h every Wednesday.

Since the products from ALADIN/MFSTEP should satisfy a bit different needs than it is the case of classical meteorological forecasts, an important part of the work on this configuration was devoted to the improvements of the fluxes above the sea surface.

One important modification is the introduction of the selective semi-Lagrangian horizontal diffusion (SLHD), which proved to cure too intensive cyclogenesis, in all such cases tested up to now. The SLHD scheme was still slightly improved and retuned to allow its first operational use (F. Vana).

The second important modification is the abandon of the envelope orography, compensated by the new version of the gravity wave drag and orographic lift schemes (J.-F. Geleyn, B. Catry, R. Mladek). Normally, this modification should improve the fluxes in the coastal areas with high mountains.

The third package of modifications concerns the cloudiness and radiation scheme. From the scientific validation period of MFSTEP computed for January 2003 we learned that in the COCONUT (or modified COCONUT) cloudiness version there is a too high albedo of the clouds; together with the binary-like clouds distribution this leads to almost zero solar flux in presence of clouds. Normally, the solar flux should not be lower than about 100 W/m^2 in daylight. It was then quite necessary to look for a better formulation of the cloudiness scheme and checking its feedbacks with the radiation scheme. A new formula of the Xu–Randall scheme was proposed, allowing easier tuning. As proposed by T. Haiden, the shape of the critical relative humidity curve was modified to provide a better fit to the observations. The new critical humidity formula has now two “HUCOE” tuning coefficients to obtain the desired profile. It was also discovered, a bit by chance, that taking into account the random clouds maximum (key LRNUMX for the “acraneb” radiation scheme) is very important when using the Xu-Randall cloudiness diagnostics. Finally a tuning was made by looking to the solar flux values, clouds distribution, and scores.

All these three major changes need still to pass a last set of validation tests. They should however enter the reference MFSTEP suite before 1st September 2004, when the TOP period starts.

As it can be easily concluded, these modifications are beneficial for the nominal ALADIN applications as well, not only for oceanographers. They were tested in the ALADIN/CE configuration at first, also due to the reduced cost compared to the MFSTEP setup. The final tuning is included in the parallel suite ADN, as shortly mentioned above, topped by the latest improvements of the “acraneb” radiation scheme. However, there are still two problems on which future work should focus. The first problem is still the insufficient amount of low-level winter stratus. From the tests recently made we concluded that another piece of the cloudiness scheme would have to be added to answer this problem. The second issue is a weak bias of the screen-level wind, where we think that the turbulent momentum flux needs a retuning with respect to the one used up to now in presence of the envelope orography.

2. MAP reanalysis : downscaling with ALADIN (S. Ivateks-Sahdan)

The MAP IOP cases provide an excellent benchmark for the mesoscale modelling. Therefore it was decided to provide to the ALADIN community a set of files downscaled from the re-analysis of the MAP IOP period made by ECMWF. As the first set, there will be results obtained from the blending assimilation cycle to reduce the model spin-up, which could be used further on for either simple higher resolution forecasts or mesoscale reanalysis with ALADIN.

A special MAP domain was created for this purpose; in fact it is a bit shorten MFSTEP domain in longitude. A set of procedures was put in place and first validation started by including also the SLHD scheme and switching from the envelope to the mean orography, having new gravity wave drag and orographic lift schemes (it did not contain yet the last cloudiness and radiation scheme versions and tunings).

For the preliminary validation two moist IOP cases were chosen and scores of the blending assimilation cycle were computed for 20 days against observations and compared to the scores of the coupling data (coarser resolution). We found an important diurnal cycle present in the scores of the screen-level parameters for all compared datasets. ALADIN assimilation scores are systematically better than those of the coupling data except for the guess computed from the evening (18h UT) analysis. By consequence, midnight analysis is affected by a bit stronger bias in temperature and wind, coming from the mesoscale guess. It is very likely that when the vertical stratification becomes stable, the ALADIN physics is not yet optimally tuned for the use of the mean orography, new drag and lift scheme and feedback with the SLHD scheme in mountains. Despite this weakness, the current MAP downscaling configuration provides a solid start for future experiments.

3. SLHD Diffusion Scheme (F. Vana)

As it becomes obvious from the previous text, there will soon be the first operational application of the SLHD scheme. For this purpose, the necessary modifications were cleanly phased into the 25T1 local library and to the cycle 28T1 library reference. Some small improvements were made for the choice of the interpolators, including splines. A small bug was corrected to enable the SLHD scheme work stably within the backward integrations in the digital filter sessions. Future validation will be made for optimizing the scheme in presence of mountains and for the non-hydrostatic variables. To find robust tuning rules when changing the horizontal resolution is also a part of the “to do” list.

4. Bottom Boundary Condition – Problem of the semi-Lagrangian Chimneys (R. Brozkova)

While the cure of the so-called chimney problem present in the semi-Lagrangian advection (ALADIN NH) was found and successfully implemented, a linear analysis of the problem was made in order to explain the chimney creation. The analysis shows that the current default discretization scheme used to evaluate the surface vertical acceleration is not consistent with the kinematic rule for the surface vertical wind. This is, however, not very surprising result since both methods removing the chimney problem were based on the restoration of the kinematic rule validity within the computations of the surface vertical wind tendency. In addition, the analysis shows that for short trajectories, the chimney error is proportional to the third derivative of the orography. A complete documentation of the problem, including practical demonstration, is on the way.

5. Verif-Pack tools with ODB (A. Trojakova, F. Meszaros)

Quite an important piece of work is devoted to the adaptation of the verification tools to the latest library cycle and usage of the ODB system. It concerns also the format of the observations archive, ensuring the compatibility of the used information, including the observation quality flags.

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