Operational suites at CHMI

January – June 2004

1. Evolution of the ALADIN/CE application.

The ALADIN/CE suite was switched to 9 km mesh-size and 43 vertical levels on 13/01/2004 at 12 UT network time for the production run and at 06 UT network time for the blending cycle.

The corresponding parallel test has the identification name ADA. Beside the increased grid-point space resolution, a linear grid is used as well. The increased spectral resolution required a specific tuning of the horizontal diffusion coefficients, where we found the same set-up as used in ALADIN/France, where the linear grid is used, too. The effect of higher resolution was tested in the suite ACN showing weak improvements of the most of the scores. Then a modified Xu-Randall cloudiness scheme was added, and tested by the suite ADA. General results of the ACN and ADA suites were already reported in the previous Newsletter.

Since the problem of the low-level cloudiness was specifically addressed by the modified Xu-Randall scheme, a few words should be mentioned here. Till this operational switch the old cloudiness scheme and old tuning of the radiation scheme were kept in use, since the results of the COCONUT physics version seemed even worse in winter. With the additional modification of the Xu-Randall scheme there was a hope to increase the amount of low-level clouds and thus to correct a too cold bias of the screen-level temperature. The modification allowed a cloud presence at a bit lower relative humidity threshold accompanied by a security avoiding the super-saturation. Indeed, the tests made in winter periods showed the required tendency but mainly due to the effect of increasing amount of points with 100% cloudiness cover. This feature is already present in the COCONUT physics version itself and the modification did not change it really. Intermediate clouds were mostly replaced by either clear sky or a full cloud cover. Although the screen-temperature scores got better in winter, it was then due to a bad reason of the binary-like clouds distribution. Further work on the cloudiness scheme was therefore strongly motivated and some results are described below.

2. Parallel Suites

The following parallel tests were launched to assess the impact of different modifications:

- **Suite ADD** : this was a short suite to validate a new compiler release. The results were slightly different, very likely due to some optimization features in the code of the physics. In debug mode both compiler versions give identical results. In addition, we found that a choice of the semi-Lagrangian or Eulerian set-up within the e927 jobs has some impact on the results. It is due to the different truncation of the map factor. The impact on results is of course weak but some attention has to be paid to keep consistent choices in the testing procedures.

- **Suite ADE** : test of the future ALADIN/MFSTEP configuration. A special setup of ALADIN for the MFSTEP project was described in the previous Newsletter. As a next step, the configuration should comprise the SLHD diffusion, the abandon of the envelope orography compensated by the introduction of a new version of the gravity wave drag and orographic lift parameterizations. There are improvements of the radiation scheme as well. This future configuration was thus pre-tested on the ALADIN/CE domain. It showed better scores in the upper-air temperature and wind. On the other hand there is a colder bias of the screen level temperature and too weak screen level wind. The geopotential score has a characteristic change of the bias and pending the situation, it is translated either to an improvement or a worsening of the score. To analyze this scores' response other suites were launched, testing individual ingredients of the ADE suite.

- **Suite ADF** : the SLHD was switched off in the test. The purpose was to see whether there was not an accumulation effect of SLHD compared to the ADE test. This hypothesis was found negative.

- **Suite ADG**: it was a repeat of the ADE suite with still retuned gravity wave drag and orographic lift parameterizations. The screen level scores of temperature and wind remained almost the same, although the tuning corresponded rather well to the values derived from the theory.

- ✔ **Suites ADH, ADI, ADJ** : these tests are the complementary ones to the ADE and ADG ones. The goal was to perform cross-tests of the impact made by SLHD scheme and new gravity wave drag scheme. We found that SLHD has similar effects as the drag; we concluded that a specific study of the SLHD scheme in presence of mountains should be undertaken. Very likely the ALPIA experimental framework shall be chosen for this benchmarking.

- ✔ **Suite ADK** : this test is based on the ADG one, where the cloudiness scheme was slightly revisited and retuned, regarding the curve of the critical relative humidity to diagnose clouds. The Xu-Randall limitation formula is rewritten, using a tangent hyperbolic function, allowing an easier tuning. Quite important change is in putting the switch LRNUMX=.TRUE., activating the computation of the random maximum of clouds. This change helped to get-rid of the binary-like clouds distribution and to reintroduce a reasonable amount of intermediate clouds. Suite ADK provided improved results with respect to ADG suite, surely in terms of the geopotential score and bit in terms of the screen-level temperature score.

- ✔ **Suite ADL** : here a small retouch of the critical humidity function was made, still having a small positive impact compared to ADK.

- ✔ **Suite ADM** : based on ADL, more consistent but also more expensive computations are activated in the radiation scheme. Another small improvement of the scores follows.

- ✔ **Suite ADN** : there is a last retouch of the cloudiness scheme, providing probably the best trade-off with the current formulation; therefore this configuration will be likely introduced into the operational use.

   The results of parallel tests may be consulted on the following pages :
   www.chmi.cz/meteo/ov/lace/aladin_lace/partests/

3. ALADIN/MFSTEP configuration

   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.

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