Operational activities in Prague July – December 2004

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CHMI

1. OPERATIONS

1.1 The ALADIN/CE suite was switched to mean orography and modified physics on:

07/09/2004 at 12 UTC network time for the production run and at 06 UTC network time for the assimilation cycle.

The corresponding parallel test has the identification name ADN. Here below is the full modset description (roughly in decreasing order of importance):

I) Activation of the SLHD option for the horizontal diffusion processes. Most but not all of the current linear spectral horizontal diffusion process is replaced by a modulation of the strength of the damping properties of the semi-Lagrangian scheme, via the choice of the interpolation operators. The important fact is that this modulation is depending on the deformation field. This helps avoiding false small-scale developments and better structuring rightly forecast ones. There is also a positive impact on the upper-air temperature scores.

II) Use of the new version of ACRANEB (quality equivalent for the atmospheric part to that of FMR15, but without need to have an intermittent calling sequence) with all its novelties (LRMIX=.TRUE., LRPROX=.TRUE., LRSTAB=.TRUE., LRTDL=.TRUE. and LRTPP=.TRUE. with LRAUTOEV=.FALSE. and LREWS=.TRUE.).

III) Use of the random/maximum overlap for clouds instead of the random overlap (LRNUMX=.TRUE.). This change, together with the one above and the one below, brings a small but systematically positive contribution to all kinds of scores.

IV) New "mixed" version of the Xu-Randall cloudiness scheme: one comes back to the published tuning of the X-R function (QXRAL=100.), the critical humidity (HUC) profile is computed in APLPAR with a slightly different formula (3 coefficients rather than 2) and a tuning that matches the ZAMG proposal for quite lower values away from the PBL, QSSUSV is equal to 250 and a continuous function with an intercept at 0.925 replaces the QXRHX=0.99 threshold, this difference compensating the effect of the HUC decrease. All these changes roughly keep the same averaged structure of cloudiness (in mid-latitudes) but with a far less 0/1 behaviour and a slightly better vertical distribution.

V) Suppression of the envelope orography and introduction of the new drag/lift scheme with the recommended values (LNEWD=.TRUE., LGLT=.TRUE., GWDSE=0.02, GWDCD=5.4, GWDLT=1., GWDPROF=1., GWDVALI=0.5, GWDAMP, GWDBC and HOBST remaining unchanged). The pluses (better circulations and reduction of the precipitation dipole of errors, better scores at 850 hPa) and minuses (too weak 10 m winds near mountains and too strong reduction of Foehn effects, hence worse scores at the surface) of this change roughly compensate each other.

VI) Activation of the "moist gustiness" option (LRGUST=.TRUE. with RRSCALE=1.15E-04, RRGAMMA=0.8 and UTILGUST=0.125).

VII) Computation, over sea, of a roughness length for heat and moisture that, while remaining close to the one for momentum at small surface wind values, saturates far earlier for strong winds. The latter two points help getting a better simulation of the famous "Black-Sea" case.

VIII) REVGSL=15 to damp fibrillations around 0°C while keeping a still physically realistic value for this parameter (ratio of the fall speeds of rain and snow).

IX) Quasi-monotonous interpolation for specific humidity only.

X) RCIN=1 in order to prevent one convective cloud low down to un-physically trigger another one higher up across some rather deep stable and/or dry layer (and the same upside down in ACCVIMPD).

XI) A different security tuning from the ARPEGE one for the "King-Kong-butterfly" syndrome: GCSMIN=5.5E-04.

XII) Mesospheric drag like in ARPEGE.

The above mentioned set of modifications is a synthesis of the work of many people inside the ALADIN project. The decision on the operational switch was a trade off between better (PBL top temperatures, precipitations) and worse scores (bias of screen-level temperature and wind). Better results prevailed, however, as well as the conscience that where the worsening of results occurred, we very likely have to do with a case of compensating errors. That is why we shall concentrate within the forthcoming months on the screen level values of wind and temperature.

1.2 The ALADIN/CE suite was switched to the new modification concerning the inversion-layer clouds on:

20/10/2004 at 12 UTC network time for the production run and at 06 UTC network time for the assimilation cycle.

The corresponding parallel test has the identification name ADP. This modification entered the operational suite just at the beginning of the stratus season, so typical for Central Europe. It is based on the previous work of Harald Seidl and Alexander Kann. It is however a bit algorithmically improved: when a sufficiently thick inversion layer is detected, its temperature is cooled in some proportion of its vertical temperature gradient in order to re-compute the saturation profile used by the cloudiness scheme.

For the time being, there are two tuning parameters. The first one, `RPHIR`, is a minimum thickness of the inversion layer for which the scheme is activated. It was tuned to 1750 J/kg (app. 175 meters). The second one, `RPHI0`, is the length scale for the temperature vertical change to achieve the desired cooling. It was tuned to 1250 J/kg. Tuning was made for the November 2003 period where we had a couple of situations with stratus, where the reference forecast missed low-level clouds (Figure 1) compared to observations (Figure 3). We could observe a weak improvement not only regarding the amount of low-level clouds (Figure 2) but also in temperature scores. Since the scheme has a positive local feedback between cloud and inversion strength we verified that we do not obtain an excessive amount of clouds.

However it should be stressed out that this is not a final solution to the low-level clouds simulation problem. It is simply the first step in a good direction and already helpful in the operational forecast.

At the same time a new diagnostic PBL height (development of Martina Tudor) was put in service, after a set of off-line tests.

1.3 The ALADIN/CE suite forecast length was increased up to 54h on:

07/12/2004 at 12 UTC network time for the production run.

This was enabled by the availability of the ARPEGE coupling files for +51h and +54h from 06/12/2004.

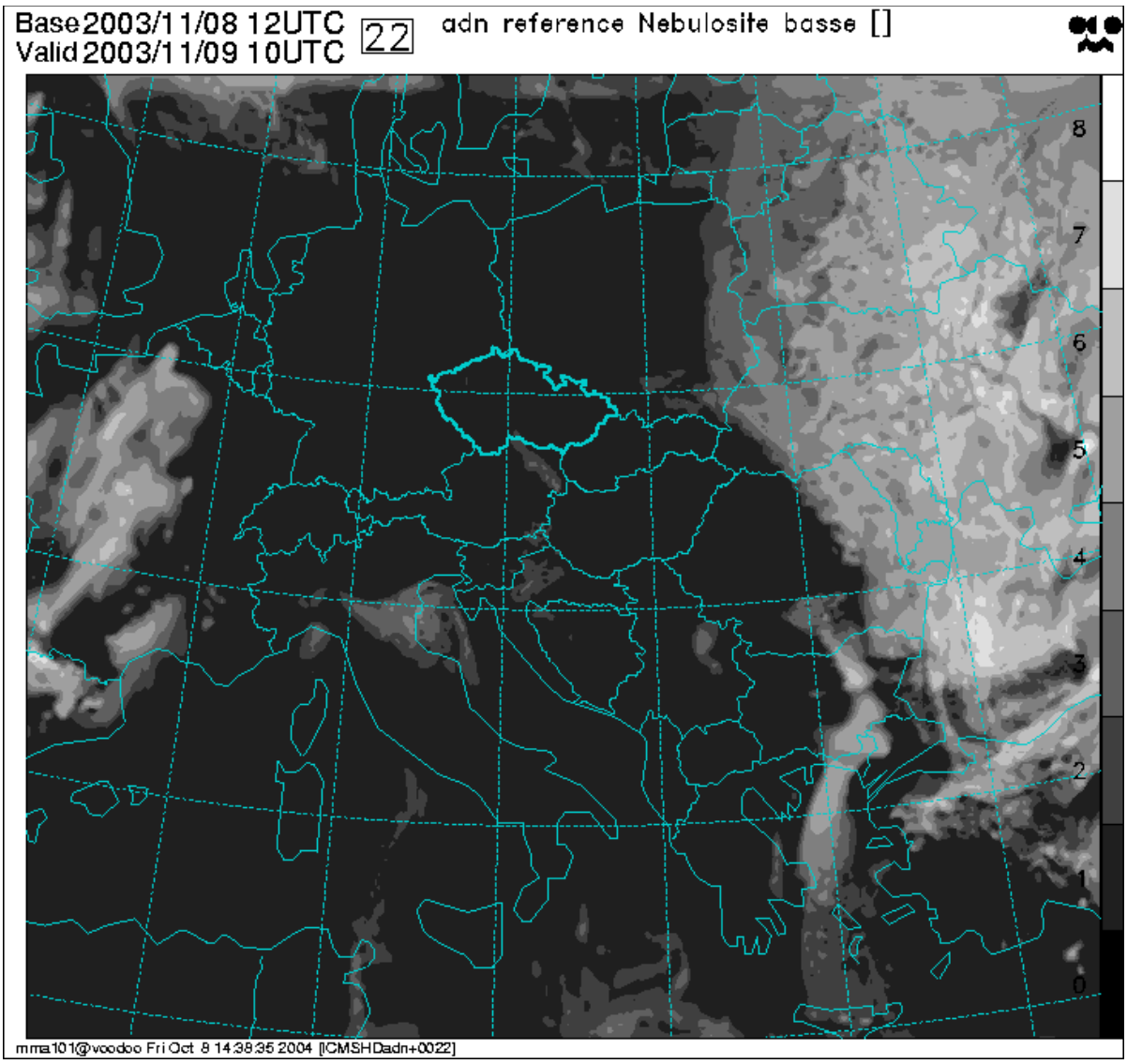

Figure 1: 22h ALADIN/CE reference forecast of low-level clouds for 9 November 2003 at 10 UT.

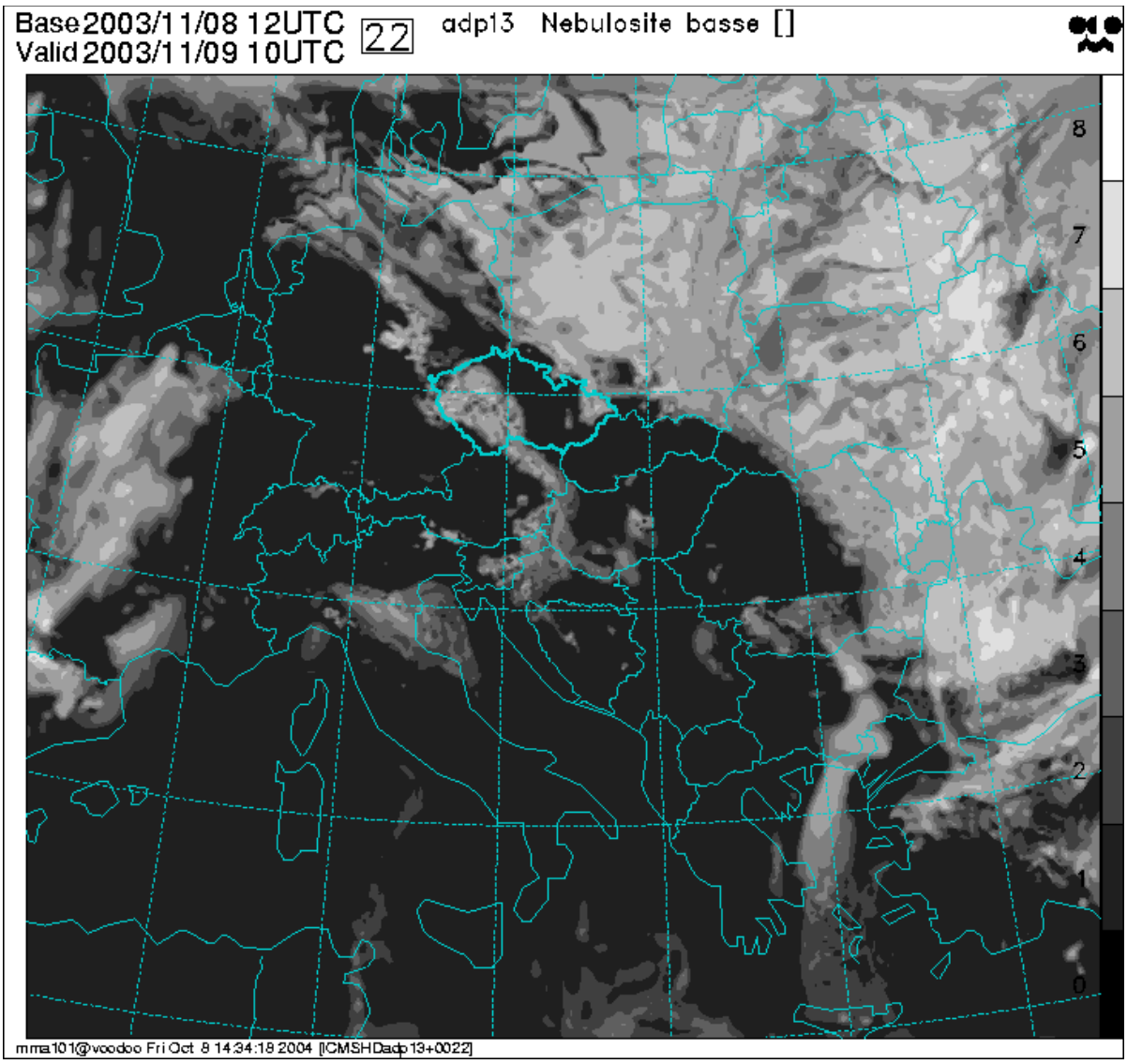

Figure 2: 22h ALADIN/CE parallel test forecast of low-level clouds for 9 November 2003 at 10 UT, including new modification to simulate inversion clouds.

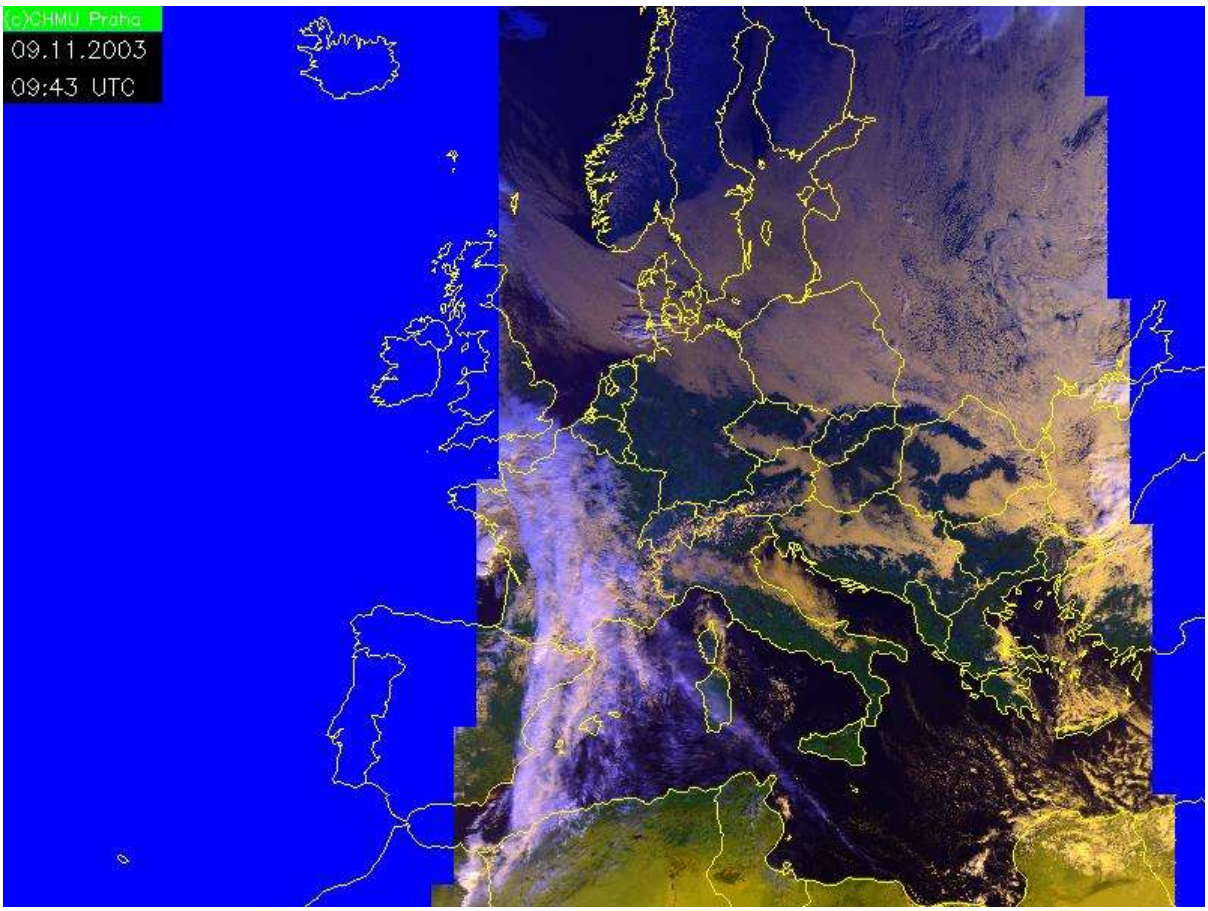

Figure 3: NOAA picture from 9 November 2003 at 9:43 UT. Yellowish color shows presence of low cloudiness.

2. PARALLEL SUITES & MAINTENANCE

The two main parallel suites, ADN and ADP, resulted in the successful operational applications. There were other less successful suites, testing an alternative Ekman spiral simulation (ADO, ADQ and ADR). These suites were declared as void since there is no plan to continue with this specific topic.

In the second half of 2004 we spent a lot of time on porting the cycle AL28T3. It was namely due to the new data-flow structure used in the model as well as new style of using the interfaces at every routine. On the other hand we managed to optimize rather well the code for the NEC-SX6 platform. For example, despite more computations, forecast runs at about the same speed as it did with the cycle AL25T1. Concerning *lancelot* (ee927) , it takes more memory (as found on VPP) but it runs almost three times faster compared to AL25T1.

We phased all the locally modified physics (content of ADN and ADP suites) to AL28T3 and we are about ready to verify this cycle in a parallel suite. Here it should be mentioned that the ADN and ADP modifications are already phased into AL29T1.

There will be no further development and/or suite on the currently operational cycle AL25T1. On the other hand we still ought to validate research configurations with AL28T3 including the ODB use.

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