Report on research activities in Prague

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1. ALADIN/MFSTEP configuration

Since ALADIN/MFSTEP has been a very costly application, we explored ways to reduce it once the Target Observation Period was accomplished. Since the atmospheric forcing from ALADIN was used exclusively by oceanographers' groups working on the Western part of the Mediterranean basin, we negotiated limits of a new post-processing domain called West Sea. These limits turned out to be still out of reach, in case we would like to merge the MFSTEP and CE domains (it was seriously considered an option and discussed within LACE, due to its impact on the common telecommunication domain). For this reason we had to keep the two applications separated. First the post-processing domain was switched to the West Sea on 29 June 2005, while the change of the integration domain should happen in early July 2005.

Thanks to the validation of surface fluxes we have discovered a problem with ALADIN latent heat flux over the sea surface, where ALADIN had a non-negligible bias. Thus we retuned the Charnock formulae gustiness term to get rid of the latent heat flux bias (the saturation of moisture and heat flux is reached earlier). Now the values are fine both for weak and strong winds.

1.1 Optimisation and cleaning of ALADIN NH

The pseudo vertical divergence denoted as d_4 represents till now the most stable option for the vertical-velocity based prognostic variable choice in the ALADIN NH dynamical core. It is defined as:

$$d_4 = d_3 + X$$

where d_3 is the vertical part (corresponding to $\partial w/\partial z$) and X is the horizontal wind-shear part of the total 3D divergence as computed in the η-coordinate system:

$$X = \frac{\partial V}{\partial \Phi} \cdot \nabla \Phi$$

While the evolution of d_3 is computed as usual, the evolution of X is approximated by a first-order scheme (see the documentation on ALADIN NH for more details). When the d_4 variable was implemented into ALADIN NH for the first time, it was convenient to explore several plausible solutions as regards the treatment of the X part (ND4SYS option in the code). It was also decided to bi-periodicise X tendency at every time-step. These solutions were suitable for research but costly. In addition, the ND4SYS variants were not respecting the exact diagnostic relationship $d_4 = d_3 + X$ at every (x, y, η, t) and were re-using the first-order explicit estimates of X in the following time-step. This had an impact on the stability, pending which option of ND4SYS was used for which domain and meteorological situation. Therefore it was decided to retain the exact diagnostics of X whenever possible and to optimise the code of d_4. We established a plan of this work in three steps: i) removal of option ND4SYS while respecting the diagnostic definition of X, ii) to include the spectral transforms of X in the same call as for the rest of prognostic variables while iii) removing the biperiodic extension of X at every time-step and ensuring it by the lateral coupling.

Work on the recoding of the X pseudo-variable as part of d_4 started in June and is supposed to be completed by the end of July 2005 and should enter cycle 30T1.

1.2 Set-up of SLHD

Although the SLHD scheme is implemented successfully in ALADIN/CE operational suite, its general setup for any horizontal resolution and domain size was not yet ready. In the late spring this missing piece of work was completed by Filip Váňa. Therefore we have now the setup rules and tunings for the SLHD scheme. The technical note explaining the basic properties of the SLHD as well as the recommended tunings as function of the resolution and wave-length is under redaction

and should be completed before the end of summer holidays.

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