

Working Group for Dynamics & Coupling:

fulfilment of the 2005 plan

February 9, 2006

NOTE: this document is a supplement of the Research plan for the year 2005. Hence the topics descriptions and objectives are not explained once again here. In case of need they should be referred directly from the Research plan.

NH dynamics

Iterative schemes

Planned actions:

1. Phase and validate the 3TL Eulerian ICI scheme into CY29T2
2. Test the ICI status with DFI
3. Justify the proposed solution for SLHD with ICI scheme
4. Extend the ICI scheme for 3TL SL advection

During the CY29T2 phasing the 3TL Eulerian ICI scheme has been successfully committed to the common source by JV. Moreover he made consistent the spectral diffusion for the d prognostic variables. As also proven DFI is working without problems with ICI. The extension of the ICI for 3TL SL advection is still missing. It has to be done in a future. However this is not an important task for the operational model execution since the preferred time-stepping is based on 2TL scheme. When working on the NH diffusion chimney MV was checking the performance of SLHD when ICI is active. He found the implemented design quite good with respect of efficiency and performance.

Available reports:

- Jozef Vivoda - Three time level iterative centered implicit scheme with Eulerian advection treatment
- CY29T2 phasing report

Source code implications:

3TL Eulerian ICI available since CY29T2

Means: 2.0 person \times month (1.5 person \times month by Meteo-France maintenance funding)

Contributors: Jozef Vivoda, Miklos Vörös

Choice of additional NH prognostic variable

Planned actions:

1. Improve the performance of clear d_4 variable
2. Analyze (and possibly test) the radical approach

Due to the substantial code changes of the NH source, this topic has been postponed. The planned manpower was then devoted to the ALARO-0 action.

Bottom boundary condition

Planned actions:

1. Test the impact to the chimney when the spectral horizontal diffusion would be replaced by SLHD.
2. Implement the exact treatment of BBC using some additional spectral computation.
3. Issuing paper analyzing the chimney origin.

The main work on this topic was done by MV (cooperating with RB) during his stay at CHMI. It has been found that the existing model code already offers solution good enough to get rid of the so called diffusive chimney problem. Up to now MV and RB are still trying to further improve the already reached state. But in practice the remaining chimney is negligible with even very strong horizontal diffusion. This gives a confidence that in NWP runs it would be simply enough to use the code as it is available now.

Logically the coding of the exact and complicated treatment of BBC becomes less important.

The paper about the chimney origin is on slight progress.

Available reports:

- Jean-Francois Geleyn - New findings about the orographic 'chimney problem' in ALADIN-NH dynamical core and tentative conclusions for the code policy

Source code implications:

All to solve chimney available since CY29T1 in the public source, the NH code is constantly improving.

Means: 2.0 person \times month (1.5 person \times month by LACE funding)

Contributors: Miklos Vörös, Radmila Brožková

Stabilization and cleaning of d_4 variable

Planned actions:

1. Select the appropriate setting for ND4SYS model variable.
2. Regularize the d_4 code.
3. Implement non isothermal background temperature and acoustic temperature profiles to SI scheme.

During the NH code revision (extension to the spherical geometry - work of KY with help of RB) the ND4SYS variable was found surplus. The various code options defined by this parameter were recognized as potentially dangerous for the stability. Hence the parameter has been removed and the code corrected and unified accordingly. During her summer stay at Meteo-France RB was further optimizing the NH code. The obscured AUX structure was removed from. The X is since then treated as GMV structure (NFOTHER) and for the transformation purposes is unified with the rest of the d variable. The further effort significantly enhancing the code performance was spent on biperiodicisation of the X via coupling.

The non-isothermal profile to the SI background was coded during the August stay of JV at ZAMG. The experimental part is supposed to follow this work with intention to quantify the impact of the new SI profiles to the scheme stability.

Available reports:

- Radmila Brožková - Documentation on d4 developments in ALADIN NH (01/08/2005)
- CY30T1 phasing report
- Jozef Vivoda - Non-isothermal reference temperature profile in NH dynamics of model ALADIN (to be completed)

Source code implications:

Radmila's development available since CY30T1, Jozef's one exists as separate branch based on CY29T2.

Means: 3.0 person \times month (1 person \times month by LACE funding)

Contributors: Radmila Brožková, Jozef Vivoda

Diabatic forcing**Planned actions:**

1. Perform more various tests with both treatments.
2. Coordinate with actions organized within phys/dyn interface development.

Work is in waiting mode to be restarted once the new phys/dyn interface is available.

Theoretical studies linked to the vertical discretisation in high resolution**Planned actions:**

1. Vertical finite elements in NH.

This strategic work was lacking from the absence of an available manpower.

Other (not only NH) dynamics**SLHD****Planned actions:**

1. Introduce more flexible setup of SLHD to CY29T2
2. Tuning of SLHD.
3. Producing user's guide for the model users.
4. Perform various tests with different model configurations
5. Issuing paper about SLHD

During the CY29T2 phasing the global SLHD switch was split into a set of keys related to separate prognostic variables. The SLHD scheme has been tuned with respect to a general resolution and truncation. The proposed tuning was afterwards justified upon various domain with resolutions between 2.2 and 17 km. (However since it was behaving regularly there is a good chance that this tuning can be used even for ranges beyond this interval.) The consequent changes for the setup (new defaults and removal of one useless tunable) were prepared for the CY30T1 phasing. Since August the SLHD user's guide is available. The fundamental paper about SLHD is still in progress.

MT performed some real case tests with the SLHD in mountains. A very interesting consequence for the mountain cloudiness has been detected when using this diffusion scheme (MAP conference and ALADIN workshop).

Thanks to the conclusions from MV's work, SLHD has been tested in AROME removing significantly numerical noise there. Anyway wide expertise from the scheme behavior at the very high resolution (kilometric scale) over the mountains is still missing.

Available reports:

- CY29T2 phasing report
- Filip Váňa - Semi-Lagrangian horizontal diffusion in ALADIN/ARPEGE
- CY30T1 phasing report

- Tudor, Tutis, Drvar, Stiperski and Vana - Testing of the new SLHD scheme
ALADIN NEWSLETTER 28
- Tudor, Tutis, Drvar, Stiperski and Vana - ALADIN/HR: Testing the new semi-Lagrangian horizontal diffusion scheme
Croatian Meteorological Journal, 40, Zagreb 2005
- Tudor, Tutis, Drvar, Stiperski and Vana - Pre-operational testing of ALADIN physics
27th EWGLAM / 12th SRNEP meetings NEWSLETTER
Ljubljana: Environmental Agency of the Republic of Slovenia, 2006

Source code implications:

The recent version of SLHD available since CY29T1, since CY29T2 more flexible way of activating it, since CY30T1 universal defaults appeared in the code.

Means: 5.0 person × month

Contributors: Filip Váňa, Martina Tudor

RUBC

Planned actions:

1. Implementation to 2D vertical plane version of ALADIN
2. Merging with P/C scheme to get a stable solution
3. 2D and 3D experiments (SCANIA case)

During summer some work has been done. The scheme is ready to be coded into model, the stability has been ensured by practical test.

Means: 0.5 person × month

Contributors: Martin Janoušek

Phys/Dyn interface - stability & accuracy

Planned actions:

1. Model equations
2. Quasi-dynamical questions
3. Miscellaneous topics

The work on this transversal topic is fully harmonized with the ongoing ALARO-0 effort. Currently the topics belonging to the dynamics are less important with respect to the ones more related to the physics. Hence there is nothing to be specifically reported here. However the planned manpower (MT, AT, FV, JM) was devoted to the ongoing work (see the WG on physics fulfilment).

Case study in HR

Planned actions:

1. prepared the NH dynamical adaptation
2. compare the performances of hydrostatic and NH dynamical adaptations for selected cases

MT was performing one case to compare the NH simulation with the dyn adaptation on strong bura case. Due to the data lost the experiment will have to be repeated.

Means: 0.5 person × month

Contributors: Martina Tudor

Coupling

Ability of DFI to perform correctly for short coupling intervals

Planned actions:

1. Test the result of extrapolation of the "past" time-steps and DFI reliability for cut-off longer than offered by coupling frequency.

As checked with CY28T3 (and confirmed also by CY29T2) DFI is currently limited by the coupling frequency. When the cut-off interval is at least equal to 1.5 times coupling frequency, the model tends to read second coupling file. At this state the inconsistency between model time and the coupling time date is detected which is the reason for abort.

Available reports:

- Stjepan Ivatek-Šahdan - Status of DFI in ALADIN 28T3

Means: 0.5 person × month

Contributors: Stjepan Ivatek-Šahdan, Filip Váňa