

# Working Group for Dynamics & Coupling:

*fulfilment of 2008 plan*

*February 6, 2009*

NOTIFICATION: This document is a supplement of the LACE project “Toward an operational implementation of the NH dynamics” (hereafter referred as Project) proposal and the “Research plan for the year 2008”. The topic descriptions and objectives are not explained once again here. In case of need they can be referred directly from the original documents. The listed topics have been restricted to just those supposed to be tackled according the Project during 2008 and to those for which a progress was achieved.

## Preface

Traditionally the manpower available to the model dynamics is limited. The reason for it is mainly seen due to the rather complex problematics requiring people with longer term availability to deal with a given scientific subject. Moreover to introduce newcomer into dynamics is also not a really quick procedure comparing with the other modelling areas.

The RC LACE working plan for 2008 tried to reflect this reality. The ultimate imperative for this year was then to finish all the ongoing research subjects. Like that the available manpower can be concentrated around the main issue defined by the Project: To be able to deliver at the end of 2009 the NH dynamics model core comparable with the present operational hydrostatic dynamics. Indeed some preparatory activities and preliminary studies for the Project were supposed to start in parallel during 2008 too.

Seen from the present perspective most of the tasks seem to be already finished. The only remaining non-NH subject is the design for the 3D turbulence which seems to be also of the increased interest with respect to the high resolution modelling. Here there is also a good hope to share research and coding with the physics people (possibly also from outside of the LACE community) as this subject is sort of inter-disciplinary one between physics and dynamics (or code architecture).

Contrary to the rather satisfactory progress of the ongoing tasks the start up of the NH Project was rather slower with respect what had been planned. For the moment this tendency is not considered as critical, but it has to be ensured that key researches are really fully available to the Project. The results from the optional purely research subjects (from the WP2) also indicate that one might not soon expect a substantial progress on VFE (Task 2.2) and introduction of physical tendency to  $w$  (Task 2.6) especially with the available manpower.

In order not to relay to just existing LACE manpower it is planned to offer two temporal stays through the SRNWP cooperation. Thanks to the Aladin II flat rate funds SHMU was hosting newcomer from Poland to train him for the future VFE development. Finally there is also a hope to profit from the cooperation with Meteo-France, Hirlam and ECMWF where development of NH core suitable for operational purposes becomes also a priority issue.

## 1 LACE project “Toward an operational implementation of the NH dynamics”

### Summary of means

Task	Planned deliverable	Planned means	Executed means
1.1	summer 2008	1 month	2 weeks
1.2	summer 2008	2 weeks	nothing done
2.2	continuous development	3 months (2008)	3.5 months
2.3	summer 2008	2 weeks	2 weeks

## WP1 Validation of the current NH dynamics

### 1.1 Redo academic tests with the recent version of the NH dynamics

Partially done for CY32T1, but the major testing is postponed after CY35T1 is available.

**Means:** 2 weeks on LACE stay

**People involved:** JM

### 1.2 Check the way the physics is coupled to dynamics in ICI scheme

**Means:** Nothing done for the moment.

## WP2 Additional development and validation

### 2.2 Vertical finite element discretization for NH dynamics

Not much progress. The existing code behaves differently from the testing environment. The explanation of this feature is still missing. During his stay at ZAMG JV reformulated the integral and derivative operators to be semi-invariant (their product is giving matrix with  $1+\epsilon$  on diagonal). This however was not stabilizing the unstable behavior of the code.

New potential researcher (M. Kolonko from Poland) was trained to be able to help with this important subject.

**Means:** 3.5 months

**People involved:** JV, MK, JM

### 2.3 Consistent coupling of physics to fully elastic dynamics

The work is done. The code is available (as research branch for the moment). But the results are ambiguous. Some more work is required to understand them.

**Means:** 2 weeks

**People involved:** PS

**Reference:** P. Smolikova - Implementation of the fully compressible flux conservative thermodynamic equations

## 2 Other (not only NH) dynamics

### Summary of means

Research subject	Planned means	Executed means
Improved SLHD triggering	2 months	2 months
New interpolation for sL advection	3 months	4 months
TL/AD of SLHD	3 months	done jointly with the previous item
Design for 3D turbulence scheme	1 month	2 weeks
Orographic noise	-	1 months
DFI with LSPRT	-	2 weeks

### Improved SLHD triggering

The SLHD is now ready to be triggered by purely  $p$ -level computed triggering functions (avoiding the influence of the model orography). Quite surprisingly the SLHD with pure horizontal triggering behave in a way more active (stronger) with respect to the current vertical level following habit.

To better and consistently access the numerical noise accumulated by the and of finitely resolved model spectra, the triggering function can be optionally extended by divergence.

In order to be able to directly see the impact of the horizontal diffusion to the KE spectra, a special experiment tool has been developed suppressing during the post-processing the impact of the non-physical extension zone. It gives clean test-bed to check the current SLHD tuning with respect to the varying model resolution.

**Means:** 2 months (1 month supported by LACE)

**People involved:** JM, FV

**Code implications:** New code appears in CY35T1

### **New interpolators for sL advection**

The work is finished including the TL/AD code. The first documentation is ready, the detailed one still has to come.

**Means:** 3.5 months (0.5 month supported by LACE)

**People involved:** FV, JM

**Code implications:** New code appears in CY35T1

**Reference:** J. Mašek: Changes in SLHD setup in ARPEGE/ALADIN cycle 35t1, December 2008.

### **TL/AD of SLHD**

The interpolation part is ready profiting from previous item (CY35T1). The triggering part was finished by mid January 2009 (to appear in CY35T2).

**Means:** See previous item as it is difficult to separate the two. Additionally there was 0.5 month for the triggering (the only part differing from SL data-flow).

**People involved:** FV

**Code implications:** Part entered CY35T1 the rest is just entering CY35T2.

### **Design for 3D turbulence scheme**

The theoretical work is done. It is clear now how the 3D turbulence should be designed with respect to the existing data-flow. The SLHD code offers nice possibility to treat 3D turbulence as a special case of the SLHD data-flow. The remaining issues are to code diabatism into the 3D turbulence scheme, to code triggering function and to decouple horizontal and vertical parts. The former seems to be just technical issue, the other two might implicate also some questions to be studied.

**Means:** 2 weeks of local work

**People involved:** FV, JM

### **Orographic noise**

Specific noise linked to the orography has been recognized in orographic areas of the LAM models. Some other approaches to orography generations has been tested but mostly with neutral or detrimental impact. The problem is related to the moving the "noise" from the low areas to the mountains. It seems the mountains are not the best place to store the noise. It should be either better treated or moved to areas where does no harm, like extension zone.

**Means:** 1 month of local work

**People involved:** FV, RB

### **DFI with respect to spectral treatment of temperature**

It has been found that to use DFI with the LSPRT=.T. (spectral temperature is represented by virtual one) filters out too strongly. The fix is not straight-forward. Some solutions were proposed, how to deal with this problem.

**Means:** 2 weeks of local work

**People involved:** PS

**Code implications:** none for the moment

**References:** P. Smolikova - The interaction of DFI with the option LSPRT