ALADIN Group Report : 2004-2005

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1. ALADIN-HIRLAM : a close cooperation did start !

New MoUs are under finalization for both consortia, which explicitly consider the new "code collaboration" between the two groups. There are to be signed, as well as a common agreement, within the end of the year. In the meantime, scientists are identifying common objectives and research topics. Work started in April with data assimilation, with discussions besides the WMO meeting in Prague, resumed in June besides the ALADIN workshop in Bratislava, and was pursued all along summer 2005 with the drafting of a common research plan to be finalized in October. In fact, cooperation didn' twait, and there have been many common scientific workshops, training actions, meetings organized or scheduled since the beginning of 2005.

Besides, an extensive evaluation of ALADIN is performed by the *mesoscale* HIRLAM group since summer 2004, using the *hirald* setup at ECMWF or local implementations (at DMI and SMHI mainly). *hirald* provides a common environment for running ALADIN, to both HIRLAM and ALADIN partners, with up-to-date libraries and an increasing number of configurations, far to be complete however. The first experiments used the 3 ALADIN domains shown in Figure 1, and daily runs are performed with the 11 km model since July 2005, with initial and lateral boundary conditions from HIRLAM-C22, and comparisons to HIRLAM-E11 (SMHI). Maps and diagnostics are available at : http://www.smhi.se/sgn0106/if/hirald/WebgraF/OPER/index.html . Sensitivity experiments were also performed at high resolution. Developments have been undertaken to couple ALADIN to HIRLAM, and to make the HIRLAM physical package available in the ARPEGE/ALADIN/AROME framework.

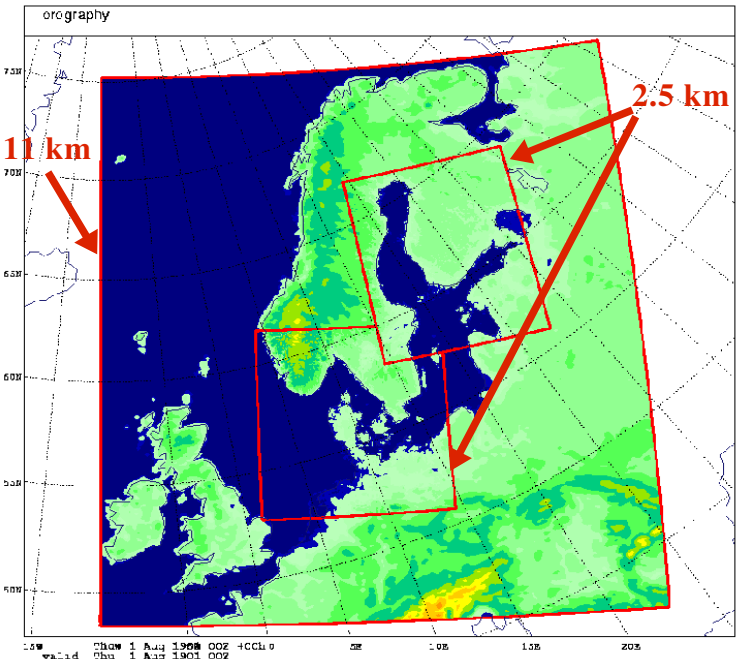

Figure 1 : HIRLAM domains available via *hirald*

2. Operational challenges

Main events

Two ALADIN 3d-var assimilation suites became operational recently : in Hungary in spring, in France during summer. They differ both in Jb (reference background error statistics) and Jo (using "standard" observations at higher resolution versus using new types of observations).

A prototype version of ALADIN-Algérie is running daily since September 22nd, setup by 3 scientists trained on ALADIN in June : an efficient team !

Summer challenge

All summer was necessary to collect a complete set of informations on the ALADIN operational applications, in order to prepare a common update. There are now at least 60 domains used in operations : 8 for the transmission of coupling data from ARPEGE or ALADIN-France, 20 for the reference forecasts (see Fig. 2), 14 for local high-resolution dynamical adaptation of low-level wind and precipitations, 18 for post-processing (including the interface to downstream models). The size of the main domains ranges from ~ 900 km x 900 km for the Romanian and Bulgarian models to 6300 km x 9700 km for ALADIN-NORAF, while very high resolution applications cover distances from 150 to 700 km.

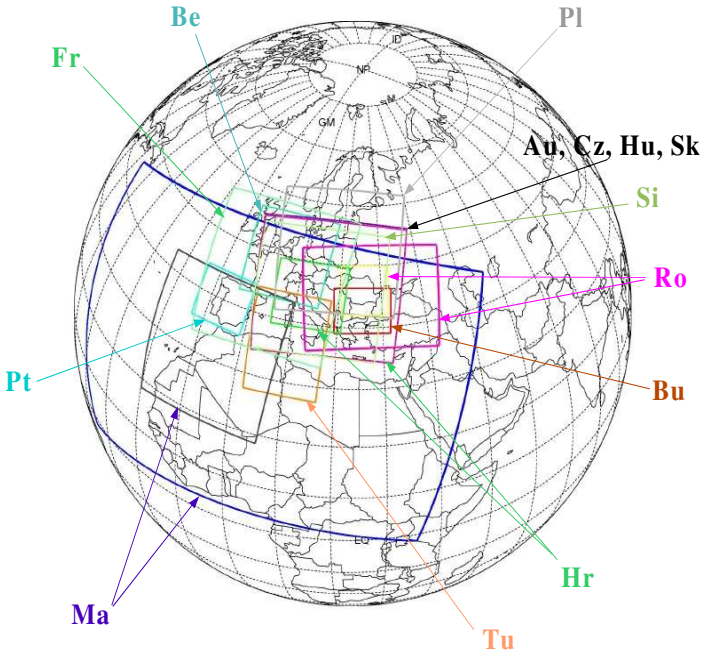

Figure 2 : Main operational ALADIN domains

Diversity lies also in horizontal resolution, from 7 to 31 km for synoptic forecast (2-3 km for local adaptation), in vertical discretization, with now 6 different grids used in operations (see Fig. 3), in choices for dynamics (linear versus quadratic spectral truncation, horizontal diffusion), for physics (envelope orography or not, radiation scheme, parametrization of cloudiness, etc ...), data assimilation, post-processing, ... : a big step since beginning ! Unluckily the dispersion keeps wide also for model versions, despite efforts.

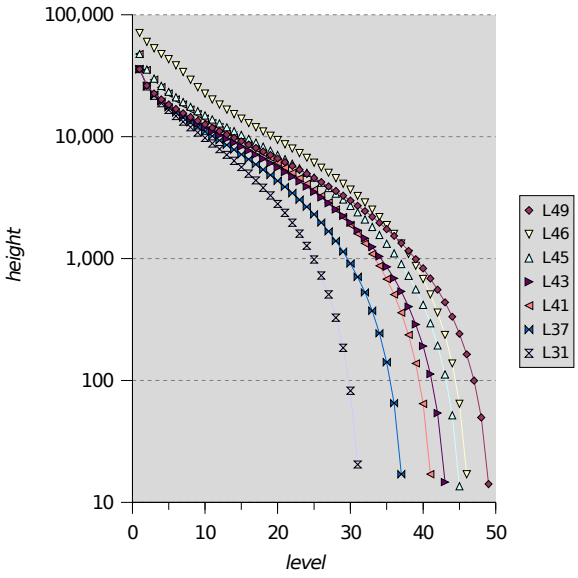

Figure 3 : ALADIN (pre)operational vertical grids

Autumn challenge

The task to face now is the quasi-simultaneous update of all the corresponding files, as concerns surface characteristics, file format, geometry description, and available fields.

3. Research : an overview of progress, problems and plans

Background

This year was marked by an intensification of the decentralization of research and of cross-exchanges with HIRLAM, but was still poisoned by "misunderstandings", as along the previous one. And research did suffer from this, especially in some sensitive domains.

Coupling

The main problem addressed is the implementation of transparent lateral boundary conditions in a spectral model. This is not an easy task at all in ALADIN, with difficulties arising from the presence of an extension zone. These led to even question the Machenhauer approach, and consider searching for an alternative solution for biperiodization.

Besides, a few studies addressed the nesting and initialization strategy, when going to higher resolution and to more sophistication in models. More effort is clearly required in this domain, too much left aside for the while.

Physics

The situation in this domain is best represented by a "?". There was progress indeed, but partners had to face several rather drastic changes of strategy, and significant divergences in interest.

LEPS

Work did start, with several approaches addressed by several teams, mainly Hungary, Austria and Morocco. However more coordination is required.

Data assimilation

A first important step has been reached, with the operational implementation of two 3d-var assimilation suites. Some improvements are already scheduled, through :

- combination with spectral blending : either "blendvar", i.e. "external" explicit or dfi-blending of the ALADIN first guess with the ARPEGE analysis before 3d-var (in test in Hungary and Morocco) or variational blending, i.e. using the so-called Jk cost-function to restore the largest scales towards the global model.

- implementation of data assimilation for soil and surface variables, before or after the setup of an "upperair" assimilation : based on optimal interpolation as in ARPEGE, with retuning of the statistical model for higher resolution (already under test in Czech Republic, with a positive impact).

- introduction of new observations : GPS and maybe radar data.

For the "longer" term, the following issues are considered : time-dimension (shorter assimilation cycles, comparison between frequent analyses and 3d-FGAT), the "HIRLAM challenge", i.e. building together an ALADIN 4d-var, combination between EPS and data assimilation, ...

An efficient and flexible toolbox !

To be able to effectively combine all the available options (see Fig. 4), a careful design of interfaces is required. Along the last year, work focussed on equations, in order to define a general physics-dynamics interface and common diagnostics, and on the interfaces with an externalized surface module (based on Best's approach).

4. Towards very high resolution

There are already several operational applications running, for years, at an horizontal resolution of 2-3 km, mainly for the dynamical adaptation of wind to orography (based on the work of Mark Zagar). Slovenia was the ALADIN pioneer in this domain.

Besides, many sensitivity studies at high resolution were performed along the last year, using either ALADIN or AROME (the difference is only in the physical package) : impact of hydrostatic versus non-hydrostatic dynamics, of coupling (coupling model, coupling or not some fields, ...), of initial conditions, of horizontal diffusion, etc...

The AROME prototype is running daily from June 2005, up to 24 h, on a sub-domain of ALADIN-France (600 km x 600 km), with initial and lateral boundary conditions from ALADIN. Horizontal resolution is 2.5 km, time-step 60 s, and the vertical grid is the same as in ARPEGE. Some fields are available on the ALADIN web site (output

every 3h, at the same resolution as for ALADIN-France, i.e. ~10 km). This experiment will enable people to get more familiar with the model, and to better detect its strengths and weaknesses. To end with, let's recall the dedicated training course, to be held in Romania, at the end of November (21-25).

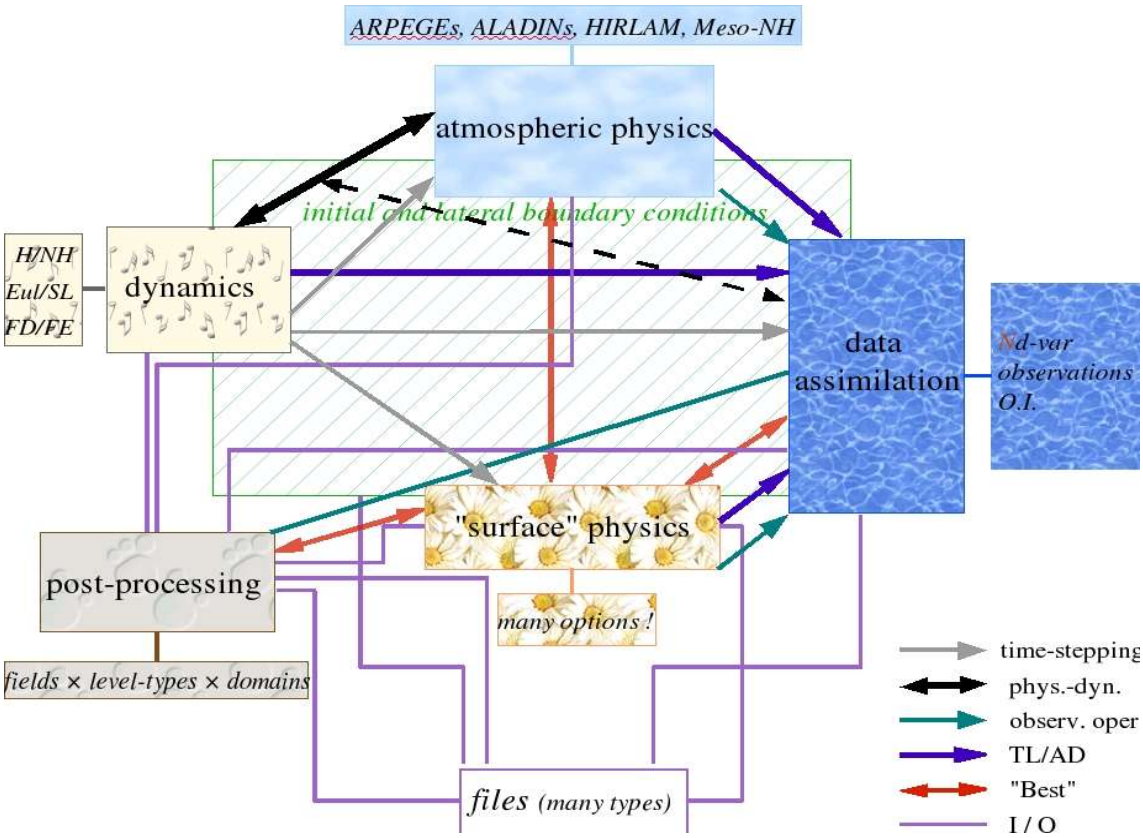

Figure 4 : Examples of tools *(internal or external, in fact "sub-toolboxes")* of the toolbox and of interfaces