# Hirlam at INM. Plans for the next future.

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1. Introduction.

Hirlam became INM operational model for numerical weather prediction in 1995. First operational version was 2.4. Version 4.6.2, which is the one we run now, came into operations in December, the 9th 1999 at 12 UTC.

We didn't change integration areas and vertical resolution from the very beginning. We run two different horizontal resolutions, OPR with 0.5 deg. latxlon and HIR with 0.2 deg. latxlon. Both versions have 31 vertical levels.

In the figures below we can see integration areas for both operational versions.
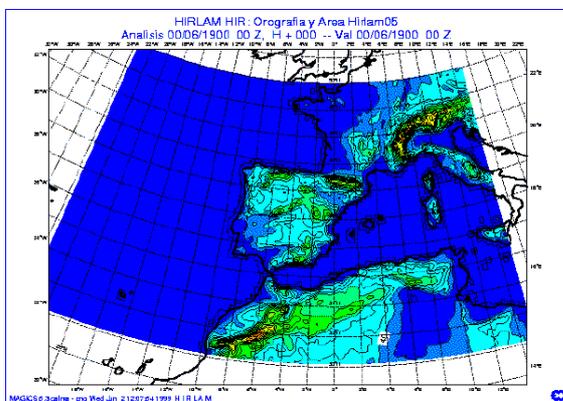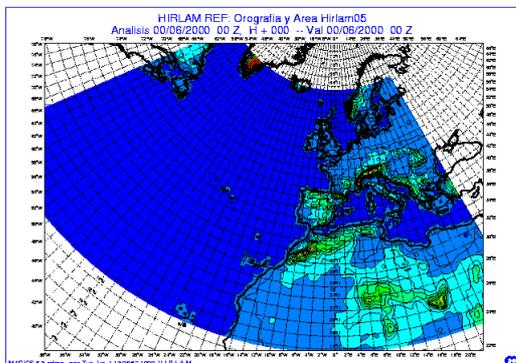
As usual we use ECMWF model for OPR boundaries and OPR files for HIR

boundaries. We also refresh Hirlam first guess when new BC arrives from the centre. We repeat analysis using new first guess before start the new integration of the model.

Our present computer for HPC is a Cray C94 that started operations in 1992 and it is the main limitation to increase the resolution and the version of Hirlam we use for operational forecast.

This year INM will make public the ITT for our new HPC system. There will be two phases, the first one in middle 2002 and the second one at the beginning of 2004. We're looking for 100 Gf sustained with Hirlam, to have that we have plans for make the benchmark with Hirlam 5.x and also with a version of ECMWF forecast model (T511L60).

Of course our new operational versions of Hirlam are computer dependent. But the know what we'd like to have in terms of horizontal and vertical resolutions.

2. Plans for deterministic forecasts.

The idea is to increase both vertical and horizontal resolutions and to keep the same integration areas. Then OPR will have 0.15 deg. latxlon (726x335 gridpoints) and 60 vertical levels (more resolution at the PBL). We'll do 72 hours forecast at main synoptic hours, let say 00, 06, 12 and 18 UTC. Semilagrangian dynamics and new physics will be part of the system. We also have plans for use 3DVAR. The figure below
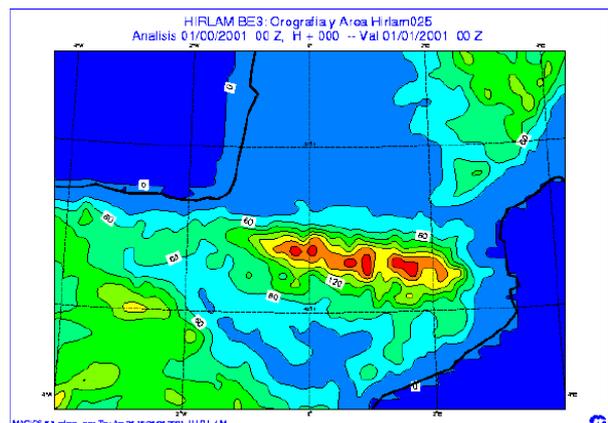
shows the orography of the new OPR around the Pyrenees.

Higher resolution version (HIR) will have the same number of gridpoints (726x335) and 60 vertical levels. As the integration area will be the same, horizontal resolution will be 0.05 deg. latxlon. Forecast up to 36 hours at the main synoptic hours (00, 06, 12 and 18 UTC). We also try Semilagrangian dynamics and 3DVAR, however we don't know yet if we'll be able to manage such characteristics at that very high resolution. The figure below shows Pyrenees orography of the new version.

HIRLAM BE5: Orografia y Area Hirlam025
Analisis 01/01/2001 00 Z, H + 000 -- Val 01/01/2001 00 Z
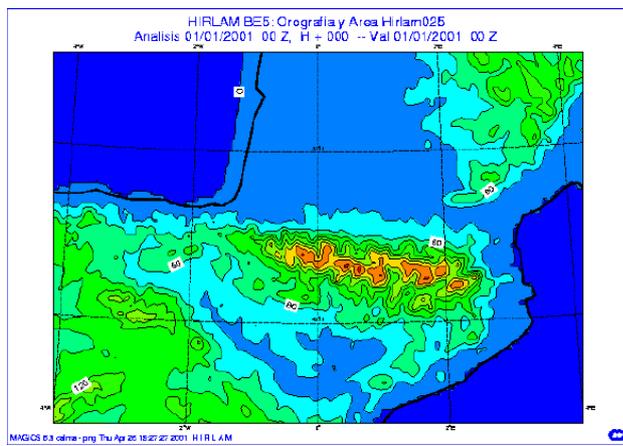
Of course, we have to test these new versions in order to assess that Hirlam performs well enough at such very high resolutions.

3. Parallel tests.

The new versions of Hirlam we have plans that become operational when the new computer arrives are very expensive at the ECMWF computers (because Hirlam code is basically scalar) and we're not able to run parallel test there.

To know if we are able to improve Hirlam increasing the horizontal resolution we made a parallel test between our present operational resolution (0.5 deg.) and a higher of 0.25 deg. Eleven days of 48 hours forecasts were running at VPP700 (at 00, 06, 12 and 18).

SMS represents the lower resolution experiment and S2G the higher one. Test went from 2000050700 to 2000051818.

Summarising, we can get better scores in low levels. Following you can see some

parameters like Sea Level Pressure, 2 meter temperature and 10 meters wind. Dash lines represent S2G results and solid ones SMS.
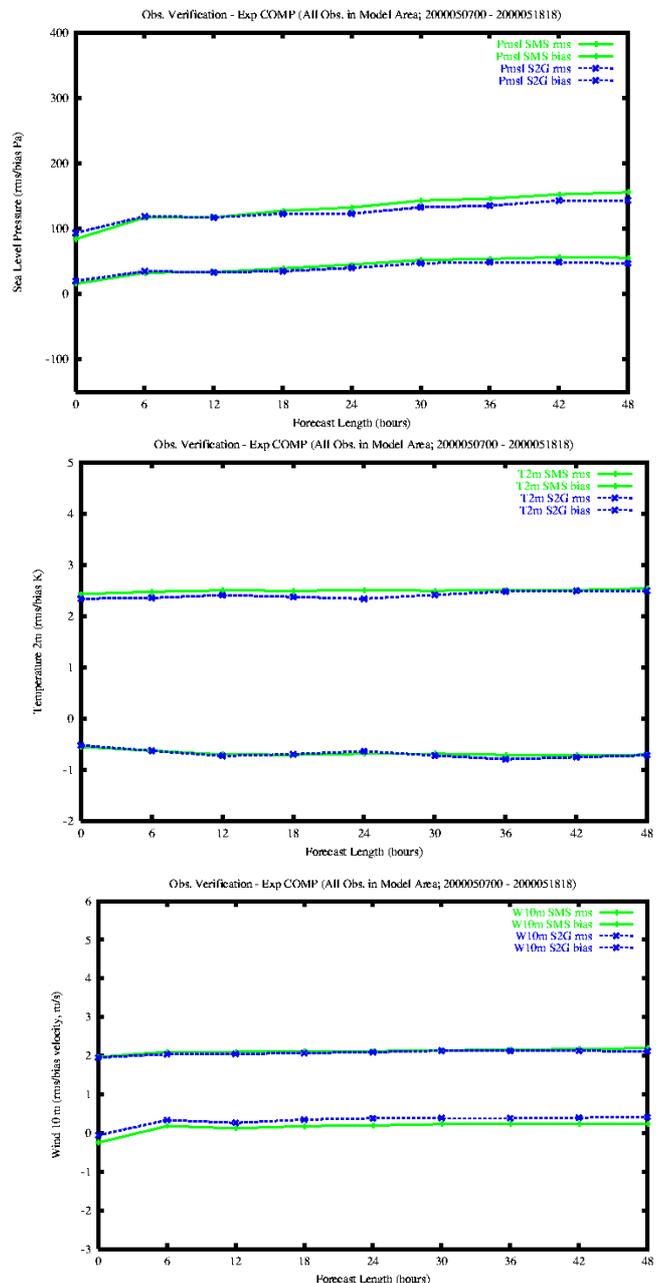
We obtain also some degradation in the upper level scores.

4. Short Range EPS.

According to a recent paper by Eugenia Kalnay and collaborators published in Monthly Weather Review (Hou et al. 2001) Short Range Ensemble Prediction System (SREPS) is better achieved mixing different models than using perturbed analysis and

the same model. Results from the SAMEX'98 experiment support this multimodel approach.

From the point of view of an operational SREPS basic research is needed and, of course, implementation will be close related with results of such research.

But according to our ITT for the new HPC, at the beginning of 2004 we will be able to run a SREPS. We plan to run 25 members every three hours (all synoptic hours) and define the EPS as the last 100 members. Integration area will be again the one we have with our present OPR. Horizontal resolution will be about 0.25 deg. latxlon and 31 vertical levels. Runs will go up to 72 hours forecast.

5. Schedule.

According to INM ITT, first step of the new computer will be installed in the last quarter of 2002 and the second one will be operational at the beginning of 2004.

Then we hope that we will be able to manage Hirlam to have new deterministic forecast versions operational in the first quarter of 2003 and a first setup of the SREPS at the beginning of 2005.

6. Operational forecast tool.

One of the main goal in operational prediction at INM is the wish to have forecast in different languages. INM, MeteoFrance, the Austrian Met Service (ZAMG) and the Belgian Met Institute (IRM) participated in a EU project called Multimeteo. The goal of the project was to automatically produce written forecasts in Spanish, French, German, English and Dutch, with the aim that such kind of predictions were as similar as possible the ones written by human forecasters of each institute. INM increase the capabilities of Multimeteo to include the other official languages of Spain, Gallego, Catalan and Euskera.

Input data for Multimeteo are obtained from a numerical model (Hirlam in case of INM) and interpolated to the sites where Multimeteo is going to be applied (provinces, Spanish cities, European cities, etc.).

Of course, everything can be done automatically but INM likes to use Multimeteo in real operations and then human forecasters should be able to correct the model wherever they think the model is wrong in some sense. Then a graphical tool to modify the input matrix is needed.

INM together with the French company Lexiquest develop Modigraph, that is the tool to modify the forecast matrix taken from Hirlam. In the figure below we show the main window of Modigraph.
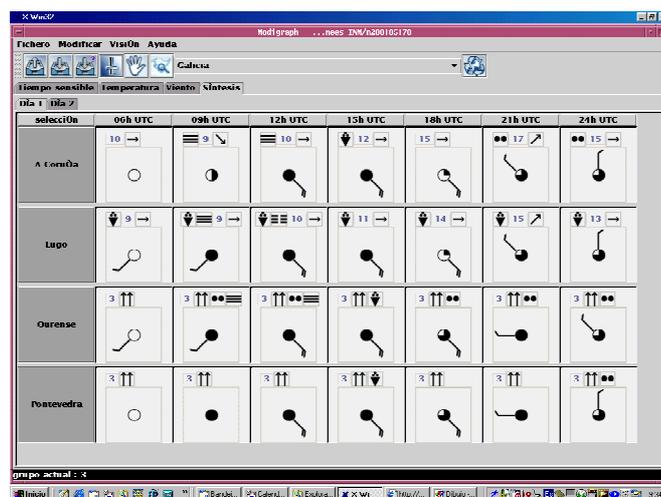
In this figure you can see weather for four Spanish provinces every three hours. The forecaster is able to modify one parameter or few of them easily in order to have the forecast he likes.

After the modification Multimeteo is able to generate automatically all the weather forecast in eight languages.

7. References.

Hou D., Kalnay, E. & Drogemeier, K. (2001). "Objective Verification of the SAMEX'98 Ensemble Forecasts". Mon. Wea. Rev.,*129*,73-91.