

## Report on HIRLAM management group visit to MetEireann, 31 May - 1 June 2007

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On 31 May and 1 June, the HIRLAM management group visited MetEireann. From the side of MetEireann, the following people were present: Ray McGrath, Jim Hamilton, Eoin Whelan, Eoin Sherlock, Laura McElwain, and Willemien Phelan. Participants from ICHEC (the Irish Centre for High-End Computing) were J.-C. Desplat, Alastair McKinstry and Honore Tapamo.

First, Ray McGrath gave an overview of the staffing situation at MetEireann and its expected development. Eoin Whelan, presently working on implementing and testing HIRLAM version 7.0, is expected to be the main MetEireann contributor to future HIRLAM work. Eoin Sherlock and Laura McElwain are primarily involved in developing applications and post-processing of the model, such as the road ice model. Another staff member is expected to be attracted to work on regional climate modelling; it will be attempted to achieve as much as possible synergy of this work with HIRLAM research. An important new impuls has been provided by the cooperation with ICHEC. An upgrade of the operational HIRLAM model to version 7.0, to be run on ICHEC machines, is underway. In the upgrading process, issues of code reproducibility and model performance have come up which the group would like to take up with the MG. For the future, MetEireann has the ambition to engage itself more in the assimilation of a wider range of observations: ATOVS, GPS, scatterometer, the new Irish radars, and GPS data. The intention is also to implement and evaluate the performance of 4D-VAR, and to set up an Irish HARMONIE model. Another aim is to improve “nowcasting” with a short cutoff time version of HIRLAM.

Jeanette asked to what extent MetEireann is interested in increasing its probabilistic short-range forecasting capability, and if it is willing to join in the GLAMEPS distributed production phase. Ray responded that in the field of probabilistic forecasting, MetEireann feels that it cannot really contribute to research activities, but it will probably be possible to participate in the pre-operational distributed production of GLAMEPS (on the basis of computational resources from ICHEC for research).

Next, J.-C. Desplat described the ICHEC organization and its ambitions, both in general and with respect to the cooperation with MetEireann. ICHEC started as (and still is) a PI project (running from December 2004 – December 2008), funded by the national research council and supported by all Irish Universities. The aim of ICHEC is to establish a more permanent status as national computing infrastructure, sustainable by a diversification of funding streams. In the next five years, they would like to achieve “steady state” services, staffing and activities.

ICHEC has a diversity of hardware available; the machine being used for HIRLAM is a 948 cpu pc-cluster with 20Tb memory (Walton). Desplat stresses that the collaboration with MetEireann is a true cooperation, not a service. ICHEC is interested in participating in research on climate modelling and on HARMONIE (Honore Tapamo and Alastair McKinstry, respectively, freed for this for 0.5 fte each). For the operational HIRLAM runs, a service level agreement has been signed with MetEireann. Backup facilities are offered via an Itanium-2 machine; implementation on this machine has suffered from some problems encountered in the handling of EMOSlib, BUFR, and large stack sizes.

Alastair McKinstry is now attempting to install HARMONIE, using the Cy31 code available from the HIRLAM repository, and is having some difficulties there because of the lack of documentation. The MG advises him to get in touch with Toon Moene (who is installing HARMONIE cy32 from scratch at KNMI) and Ulf Andrae. It may be advantageous to arrange a visit of Alastair to SMHI (a lot of experience with the HARMONIE system and tools), KNMI (also working on a HARMONIE installation from scratch) or Meteo-France.

ICHEC has been in touch with the organizers of EC-Earth (Wilco Hazeleger, KNMI) to see what contributions they can make to this project in the form of activities of Honore Tapamo. Wilco Hazeleger has responded with some suggestions for ICHEC involvement: portability, I/O efficiency and code cleaning of the EC-earth code. This will be worked out further.

Jim Hamilton then presented some of the developments around the operational HIRLAM model. The present model is run on HIRLAM version 5.0. An upgrade to version 7.0 is being prepared. The model covers a 15km-resolution Atlantic domain, with a 5km model nested within it. In the new model, northern and western boundaries are being moved outwards with repsetc to the present model. HIRLAM data are used as input for a wave and ocean/storm surge model, a MOS-based road ice model and other postprocessing tools using MOS techniques.

In the process of upgrading, some problems have been encountered of memory overflow with HIRLAM 6.3.7 and 6.4 and using mini-SMS. As there was felt to be no need for the graphical user interface (GUI) of miniSMS under operational circumstances, it was decided to do operational runs without the mini-SMS GUI (using crontab). Jim asked if running without GUI could be made a standard option in the mini-SMS script. Xiaohua replied that the miniSMS GUI can be switched off optionally. In fact, operational runs in other HIRLAM countries usually do not use the GUI either. However, he remarked that when the GUI can be realized via a web client (this extension has been developed already, but not yet been introduced in the HIRLAM repository), then the mini-SMS GUI should be considered as an interesting and useful for operators.

Jim also noted that when MetEireann had to change the WMO center ID, he needed to change many HIRLAM files in order to achieve this; could this be simplified? Additionally, he remarked that, when faced with to change the model number and grid model, it would be nice to have a model number which could be based somehow on filename.

After the transition of HIRLAM 5.0 to 7.0 at MetEireann, maintaining the number of vertical levels at 31, better verification scores were obtained. When going from 31 to 60 levels in the ICHEC system, however, scores got significantly worse. MetEireann was not certain what caused this behaviour.

Eoin Whelan then presented the “good, the reasonable and the ugly” of his verification of HIRLAM 7.0 scores in more detail. The good was that T2m rms and bias have significantly improved.

Compared to this improvement, pmsl and u10 have made less progress. In interpreting this, it should be noted that in the version tested by Eoin, neither IDFI nor LSMIX are being used at the moment. A bug was found in the surface analysis (hard-coding of the number of levels) and removed.

The forecast model turned out not to be reproducible using NPROCX=NPROCY=8, but does give meteorologically sensible output. The differences between model runs occur at isolated points in the maximum winds high in the atmosphere. The upper air analysis using 60 levels is bad, showing a drift in the uppermost levels; the model is able to recover later during the forecast, however. Xiaohua suggested that one possible cause of this behaviour may lie in inappropriate background error structure functions. MetEireann applied analytical balance structure functions, which have been derived by interpolation from 31 to 60 levels. Xiaohua proposed that Eoin should use statistical balance structure functions, either derived for 60 levels for MetEireann, or taken from RCR version 7.1; this should reduce the upper air problems. The next morning Eoin showed an outcome of a test with RCR structure functions, which indeed resulted in a significantly improved behaviour in the upper atmosphere.

Xiaohua asked if Eoin has tried to establish if the code is reproducible at ECMWF or not. If the same problem occurs on that machine, then a larger group of people can investigate the problem. Also, he asked if it was possible for Jacob Weisman Poulsen to be allowed access to the ICHEC machine.

Jeanette asked why MetEireann has elected not to use the IDFI and LSMIX options in version 7.0, as these two features have been shown to have significant beneficial impact. Ray McGrath answered that technical problems and complications foreseen with the relatively complicated LSMIX scripts were the main reasons for not immediately using these options; but it is intended to start testing their potential impact in the near future.

Alastair McKinstry briefly presented information on the performance of HIRLAM on the ICHEC Walton machine. On the new Itanium architecture, memory allocation could present problems. By dynamical allocation of memory use, efficiency could probably be increased a lot. The forecast model at present has a 60% efficiency on Walton. Thus, there appears to be some scope for improvement by MPI tuning of the HIRLAM code.

Eoin Sherlock and Willemien Phelan described some of the main MetEireann applications using HIRLAM information as input: the Irish WAM wave model, the ROMS storm surge model, and the foot and mouth disease model. The quality of the former two depends quite sensitively on the accuracy of HIRLAM wind forecasts. The quality of both HIRLAM input and wave and storm surge forecasts is however relatively difficult to assess objectively, due to the scarcity of available sea surface observations in the Irish coastal and marine forecasting areas.

Aidan McDonald unfortunately could not be present at the meeting due to illness. There was a brief discussion on the priorities of his work for the next year, and the ways in which the months remaining before his retirement (expected around summer 2008) could be used to optimal effect. See also section 2, dynamics.

The possible future contributions of other members of the MetEireann/ICHEC team to HIRLAM were also reviewed. Eoin Whelan is expected to be the main MetEireann staff member contributing to HIRLAM. During 2007, he will be largely involved with (pre-)operational activities: preparing and testing the new HIRLAM and HARMONIE model suites. For 2008 and later he is interested to become more involved in boundary layer or data assimilation activities. The management group indicates that mesoscale surface and radar data assimilation are two areas where strengthening of the available expertise is highly desirable. MetEireann is also interested in work on GPS. In any case, it seems advisable to involve Eoin in the coherent observation impact studies for the Atlantic, and also to send him on a visit to e.g. DMI, where he can learn about basic data assimilation experimental setups and tools, and e.g. also learn how to derive local bias correction for an important data source such as AMSU.

Contributions on aspects of portability and numerical stability and efficiency can be made by Alastair McKinstry of ICHEC. On a longer term, there may be possibilities for MetEireann to find staff who could work on coupling of atmospheric and ocean models.

Finally, the management group was invited to visit the forecasting room. Here the forecasters presented their (negative) experiences with the short-comings of the present operational HIRLAM model (version 5.0). Their main criticisms were the inaccuracy of temperature and pmsl forecasts, the poor description of clouds, the existence of unrealistic low-level precipitation, and run-to-run inconsistencies. The management group explained some of the activities undertaken to relieve these well-known problems, and described some of the improvements that the forecasters may expect from the new model version which is being implemented at ICHEC.

The management group was gratified to see the fresh impetus given to HIRLAM activities at MetEireann by the new staff members and the cooperation agreement with ICHEC, and appreciated the opportunity to discuss recent developments and future possibilities with the enthusiastic members of the new MetEireann-ICHEC team. They were grateful for the hospitality offered by MetEireann and their efforts to arrange this meeting in a pleasant and relaxed atmosphere.