

Report of Management Group visit to INM, 9-10 March 2006

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On March 9 and 10, the new HIRLAM management group (Jeanette Onvlee, Nils Gustafsson, Dale Barker, Bent Hansen Sass, Sander Tijm and Xiaohua Yang) made its first member institute visit to INM. The visit started with a set of presentations of the management group members to INM HIRLAM and operational staff on the recently made scientific plan for HIRLAM-A and the work plan for 2006. Jeanette first gave a general overview of the plans, after which the project leaders described the plans and priorities in their respective areas.

After this, the INM NWP staff highlighted their research activities in a series of presentations. Bartolome Orfila began by describing the structure of INM in general, and of the NWP research group in particular. An important development for INM is that in the near future it will become an agency, not so closely controlled by the ministry. This is likely to enhance the flexibility of the organization a lot, in particular with respect to administration and budgetary matters. The NWP group consists of three sections: data assimilation, then led by Alberto Cansado; the models group, led by Isabel Martinez; and predictability and seasonal forecasting, led by Jose Antonio Garcia-Moya.

Next, Alberto Cansado described his study of near-surface wind observations from masts, and their impact in assimilation. Wind mast data are important in Spain for e.g. the wind energy industry and for high-wind forecasts for high-speed trains on mountain overpasses. With careful quality control and white-listing of the observations, a slight positive impact on the model analysis can be obtained (see also the report of Cansado and Navascues elsewhere in this newsletter).

Carlos Geijo showed results for short-wave irradiance fields that he has derived from HIRLAM and validated against pyranometer observations. This research was initiated because of the potential interest of this product for the solar energy industry. The model irradiance fields showed a positive bias, indicating that the atmosphere of the model is too transparent. Carlos showed one situation of large irradiance errors in the Duero valley. Presumably this is due to the poor representation of fog and low clouds in the area. Also, the day-to-day variability in the irradiance appears to be overestimated by HIRLAM.

Bartolome pointed out the existence of the CIBA observation tower in Valladolid. INM has access to these data, and Ana Morata has been collecting and processing them. The management group concurred that these tower data are interesting for validation of the boundary layer behaviour of HIRLAM, and agreed to arrange the inclusion of the CIBA mast data in the present RCR monitoring and verification, next to Sodankyla and Cabauw. Ana Morata will work on this in cooperation with FMI staff.

Isabel Martinez presented her activities in the ALADIN non-hydrostatic dynamics. She has been developing a Mercator map factor, which is required for NH-ALADIN to run accurately on larger grids. Isabel described the derivation of the map factor and its impact for various grid sizes. Her initial analytical tests show good results, but more extensive experiments will be required before this work can be implemented in the ALADIN system.

Gema Morales presented results of the ocean model which she has been mostly working with until now. Recently she has begun to gain experience with HIRLAM under Isabel's guidance.

Javier Calvo described experiments that he had done with the Kain-Fritsch Rasch-Kristjansson (KF-RK) scheme. He has experienced some problems with the stability of the KF-RK scheme. It is unclear to what extent this is related to the specific computer architecture and hardware configuration used. The reproducibility of the KF-RK code on various platforms in any case is a matter of concern and something that deserves to be tested more extensively. Javier points out that this will impact on the proposed comparison between KF-RK and STRACO. An effort to improve the stability and portability of the KF-RK scheme is needed in order to allow a fair comparison with the STRACO scheme.

Javier then raised the issue of the single column model, pointing out that he has written documentation for it, and that this should be made available on Hexnet. Xiaohua requested Javier to send him this documentation, and has afterwards arranged for it to be published on Hexnet.

Jose Antonio, Daniel Santos and Carlos Santos presented the multi-model, multi-boundary (MUMMUB) EPS system which is in use at INM, primarily for hydrological and severe weather forecasting. The MUMMUB approach was chosen for very pragmatic reasons, namely to achieve operational ensemble probabilistic forecasts which are reliable and have sufficient ensemble spread. However, the system is time-consuming to set up and maintain, as it requires expertise and maintenance of a variety of models. At that time, the MUMMUB system was based on four global models providing boundaries and initial conditions for five regional models.

Jose Antonio emphasized that quite a lot of effort had been spent in determining the optimal setup and calibration of the system. For example, care had to be taken to include models of comparable quality. He presented verification results, showing a more realistic, wider spread than the original single-model EPS system at INM. Now that the system has been set up, the emphasis in INM's predictability efforts has been shifting towards visualization and verification of the EPS results. For presentation of the EPS output, a system has been developed based on Metview, in close cooperation with ECMWF; this visualisation package will be extended further in a number of ways. INM has just started experimenting with applying Bayesian Model Averaging (BMA) techniques, as this is one of the most promising methods to optimize the calibration and performance of multi-model ensembles. Jeanette pointed out that HIRLAM staff at KNMI have also begun to gain experience with BMA, and suggested that the two groups should share experiences and coordinate their efforts.

Both the MUMMUB set-up, and the lessons to be learned from it for a HIRLAM short-range ensemble system, were discussed at length. The management group was impressed by the effort undertaken by INM to set up this complex system, and by the flexible and extensive visualisation tools developed for it. The system setup and post-processing at INM contains several components which the management group considered to be highly relevant for a HIRLAM ensemble system configuration. Also, the multi-model system can be used as a quite demanding benchmark test to compare a HIRLAM-based ensemble system against.

Within Spain there is a strong demand for seasonal forecasting, primarily for hydrological purposes. To provide such forecasts, INM performs dynamical downscaling of ECMWF seasonal ensemble forecasts with HIRLAM, and then applies statistical post-processing in order to make forecasts for all Spanish municipalities (on a scale of several km). A statistical post-processing and visualization system, called PROMETEO, has been developed for this purpose by the University of Cantabria, using analog techniques. Bartolome Orfila demonstrated the web-based PROMETEO user interface, (see www.meteo.unicam.es) and showed some verification results for precipitation and snow forecasts. The quality of the local probabilistic forecasts produced in this way, which is presented in terms of e.g. ROC curves and reliability diagrams, appeared to be surprisingly good, and the manner of presentation is attractive.

An extensive discussion was held on the experiences of users with HIRLAM, and on user needs. When asked what were the most relevant weaknesses of the model, Jose Antonio pointed out that the biggest impediment for using HIRLAM in Spain is simply the fact that the system and its data are not very accessible to users. Many commercial service providers and universities in Spain are strongly attracted to the combination of the MM5 model and free NCEP/AVN data, which are easy to download and can be implemented quickly. In contrast, the HIRLAM system is difficult to obtain, complicated to install, and not very well documented. This is a hindrance for a fruitful cooperation of the HIRLAM programme with e.g. university researchers. Jose Antonio therefore urged the management group to give high priority to: 1) easy availability to users of both the HIRLAM model itself and the data to run it with, 2) increasing the user friendliness of the model, and 3) improved support and documentation. Issues 2) and 3) are explicitly included in the HIRLAM-A plans. Issue 1) has many data policy aspects, and will require further thought.

Wind is an important forecast parameter in Spain, used for e.g. the wind energy industry and warnings for the high-speed train network. Javier showed several cases in which HIRLAM wind forecasts gave rise to problems. The winds appear to suffer from two bias problems: strong winds are underestimated over Spain, and low winds in stable night time situations are overestimated. Sander suggested that the high-wind bias is probably related to orography, as this bias has been

noted in other places with steep orography (Norway), but appears to be absent over e.g. Denmark and the Netherlands. This should be investigated further. The solution for the stable night-time problems is sought in adaptations to the turbulence scheme. In this respect, the spectral turbulence scheme with which Yevgeni Atlaskin is experimenting, may be of particular interest.

The correct analysis of extra-tropical hurricanes is also an area of attention. Javier showed results from forecasts of severe precipitation and wind for hurricane Delta for the Canary Islands. ECMWF and HIRLAM forecasts were used to predict the hurricane track and arrival time, while operational forecasts for the Canary Islands locally were made using HIRLAM and high-resolution MM5 model data. When analyzing the outcome of the Delta case, the US National Hurricane Center and ECMWF differed in opinion of what the actual path of the hurricane had been; nevertheless, it was clear that neither the path and arrival time of the hurricane nor the intensity of the local precipitation associated with it were forecasted well by HIRLAM in advance. This appeared to be mainly an analysis problem. The performance of the HIRLAM analysis in this case can likely be improved by using more satellite observations in the data assimilation, and by blending in ECMWF analyses, such as has been introduced in Reference system 7.0. Nils also pointed out the potential advantages of using 4D-VAR in this case, and the need to adapt to structure functions of scales finer than 200km to bring out the small scale features of the developing hurricane. He proposed to rerun the Delta case with the latest model version including several newer options (4D-VAR, ECMWF blending, adapted structure functions, etc). This is now being done by Jana Sanchez.

At present, INM is using HIRLAM version 6.1. The management group remarked that some of the operational performance problems identified by INM may be alleviated by introducing a more recent version of the Reference System. This led to a discussion on the efforts required to keep up with the (significant) changes that the Reference System has undergone in recent years. Jose Antonio argued that it is a burden for local system managers to keep track of these changes, and he therefore pleaded for a more conservative attitude towards the management of, and tools used in, the Reference System. In defense of the most recent changes in the Reference System revision tools, Xiaohua argued that these are actually aimed primarily at making the HIRLAM system easier to maintain and install. Also, the recently formed system group is able to provide support to local HIRLAM system managers in setting up new operational versions.

Sander Tijm raised the issue of a more comprehensive common HIRLAM post-processing package. He suggested a number of possible post-processing products, and asked for INM's interest in these products as routine output of the model. Products such as wind gusts, short-wave irradiances, CAPE, Tmin, and Tmax were considered useful, as well as model simulations of remote sensing images. It was suggested to make more use of tile output for specific land type fractions. Wind gusts can be derived by a number of methods. It was noted that Javier Calvo has been comparing several approaches, and this experience can be used to select one method.

Jose Antonio raised the question if the management group intends to reconsider the issue of the model output format: maintain ASIMOF, or move to standard WMO or ECMWF GRIB. This is not only relevant for discussions on future operational cooperation between HIRLAM countries, but is also something which should be considered together with the management of ALADIN; the present difference in output format between the two consortia is a clear hindrance for common activities in validation and verification.

The management group visit to INM was concluded by a short visit to the computer room.

The management group was favourably impressed by the activities of the INM HIRLAM group. The accomplishments in the field of predictability are particularly noteworthy, but also in the research on use of observations and the model physics and dynamics there have been solid achievements. The recent departures of experienced staff has been difficult for the group, and care will need to be taken in the training of new young staff, particularly in the area of soil modelling and assimilation. Steps are being taken to ensure that this will be done in the near future.