

## **Introduction – All Staff meeting 2002.**

This HIRLAM Newsletter No 41 contains the write-ups from the All Staff Meeting at DMI in Copenhagen 3-5 April 2002. As always there were many interesting presentations from the staff members. The discussions were organised as separate sessions this year and a lot of things were aired. Issues for a continuation Project were presented and discussed. This introduction summarises the points made in the talks, the discussions and presentations and discussions from the working groups. In addition, this issue contains the write-up of the talk by Elias Holm at the Data Assimilation Workshop in Helsinki in January 2002.

The meeting was opened by Lars Prahm, The Director of DMI. He reviewed the history of the HIRLAM Project(s), since the first one was set up in Copenhagen in 1985. Initially DMI ran a LAM developed from the ECMWF model and modified in Sweden with 75 km resolution. The first HIRLAM model became operational in 1990. In the 1990s there was a fast scientific development and resolution increased and other models needed HIRLAM data. DMI regards HIRLAM as an efficient collaboration and congratulated for the developments, particularly the new analysis. The Project Leader then reviewed the status of the activities in the sub-projects and the priorities.

### **Operational activities**

The Danish operational developments were reviewed by Bent Hansen Sass. In common with all the other implementations, they had introduced the ECMWF frames with 3 hourly boundaries. Data assimilation with 3D-VAR is now activated on all models except the 0.05 HIRLAM-D. The convection scheme has been developed and there have been developments of diagnostic quantities. DMI maintains an on-line, public, documentation on the web. There will be upgrades of the advection of humidity and cloud water in April, implementation on the new NEC SX-6 for July and other new developments in October.

Kalle Eerola described the Finnish operational activities. Much was the same as the year before, but for lake Ladoga, SSTs of the Gulf of Finland were used instead of the lake climates. A two-way wave model was implemented. The OI analysis was updated to use SHMEM and AMDAR introduced. A “spring” modification lowering evaporation is in use. The version 5.1.4 and 3D-VAR will be implemented on the IBM p690.

Dominique Giard gave an overview of the French system(s). There are now a large number of models run operationally. A new un-stretched tropical model has been put in operation. There are several ALADIN models run, targeted for different areas. There have been a number of physics and data assimilation updates during the year and vertical resolution has increased.

Ray McGrath described the Irish new system on their IBM SP RS-6000. 3D-VAR was implemented and resolution increased to 15 km. They had some problems when not using the consistent orography for the boundary files. There have been some improvements of PMSL and the T2m biases are almost gone. Feedback files are generated every hour and used by climate and marine meteorologists, so observations and the assimilation get scrutinised.

Ben Wichers Schreur reviewed the Dutch developments. Their new SUN 10k had become operational on 5 March with an increased resolution to  $0.2^\circ$ . The 10m wind bias increased but the T2m was reduced. NLDYNVD had to be introduced since otherwise there was noise. With the increased resolution the forecasters experience more jumpiness, but within the uncertainties of the model. The initialisation increments are seen to be large.

Ole Vignes talked about the Norwegian system. They had moved to the SGI 3800 in December with 5.0.5 but 2.6 physics. They run HIRLAM 50 out to 60 hours on 220 nodes and it takes 12 minutes including analysis. Reanalyses are still done, but may not be so relevant anymore with the frames. They will try to implement the 5.1.4 version with ISBA and also try to couple the HIRLAM 10 directly with the ECMWF frames.

The Spanish activities were reviewed by José Antonio García-Moya. They are waiting for a new computer, although the execution time had been reduced on the C90 to 65% by use of the SHMEM versions. The new computer will run Short Range EPS and probably a  $0.15^\circ$  and 50-60 level version out to 72h plus a  $0.05^\circ$ .

The Swedish operations were described by Lars Meuller. The SGI 3800 is used as the main operational system. 5.0.0 and 2.7 physics are used. 3D-VAR was introduced last June. The NCS computer centre will be significantly upgraded and use of Linux clusters will be investigated. A 4x2 PE will be built and set up very soon for testing with HIRLAM. The new model versions are tested in the HIRLAM-X project with ISBA and Kain-Fritsch. The near surface biases of temperature and humidity are very much improved.

## **Data assimilation**

Bent Hansen Sass has developed a nudging scheme using 3D-cloud analyses and surface analysis for extended nowcasting. In 1D-simulations with weak forcing it seems to maintain a significant impact up to 18 hours. Claus Petersen showed a 3D test with good impact on cloud amount.

Nils Gustafsson gave an overview of the background error formulation in HIRVDA and the new development of a horizontal index field describing the variation of background errors. Xiang-Yu Huang gave an account of the 4D-VAR developments in HIRLAM. Recently new progress was made and three periods have been tested at 47 km with 1/3 grid in the minimisation. The overall impact is neutral. The costs of the various options were compared. The adiabatic or Buizza physics could be run at a cost roughly 6x 3D-VAR. Bjarne Amstrup reviewed the parallel assimilation with ATOVS at DMI. Cloud and land contamination and bias correction have been updated. The observation error matrix is now diagonal and for March a positive impact was shown. It is considered ready for operational implementation. Dominique Giard gave an account of some pathological behaviour of the MF multi-incremental 4D-VAR. Too much change of humidity had occurred, particularly at low resolution, due to pressure data. The most efficient way to eliminate it was to set  $R_v=R_d$ . Also the system will become less incremental (with semi-Lagrangian in the minimisation).

## **Discussion on operational matters AND data assimilation and HIRLAM-6 scenarios.**

The use of other (non-researchers) meteorologists for diagnosing or monitoring HIRLAM is very valuable. The problem of the correct orography with the ECMWF boundaries can be avoided by always including the orography in the dissemination. There was some discussion about whether there should be a recommended resolution for HIRLAM or not. It was generally agreed that a 20 km resolution should now be the recommended (and Reference) resolution. Also the number of levels should be at least 40. (But the lowest model level should not be closer than the 30 m used so far, since it impacts on the stability).

Some post-processing methods should be thought of when going higher than 10 km, since a probabilistic approach is needed at higher resolutions.

( -- It was strongly pointed out that the support for the operational models and applications took increasingly more of the HIRLAM researchers' time and too little is available for HIRLAM research. --)

Several staff questioned the nudging approach. Previous extended attempts at SMHI were not really successful. It is probably due to that the 3D-structure of the cloud fields is very difficult to estimate and does not normally agree with the model one. Still, it is probably a useful nowcasting tool and can be used for diagnosing model errors. The prospects of 4D-VAR solving the spin-up problems were then discussed. It has not yet been so successful due to the difficulty of the physics. The spin-up in the model itself makes it difficult with a too short 4D-VAR window, whereas on the other hand the linearisation works better for a short window and has been showed in the US for the meso-scale. Increased resolution and structure functions will matter. The coupling of the surface analysis and the upper air has not really been talked about. It is possible in HIRVDA to do it since the tools are there. Still, the scales and structure functions are very different.

The Project leader reviewed the strategy for HIRLAM, as discussed in the HAC and printed in NL40 and further discussed in the Helsinki Workshop. Some comments on the scetch of the merits of LAM compared to global models were made, where it appeared that LAM's become worse than the global model after some time. This effect is in that case due to improper LBC treatment and likely to be exaggerated as shown and was disputed. A questionnaire has been sent out to member institutes detailing most of the possible objective, scope and activities and organisation of the Project. A question was asked about the likely resolution of ECMWF in the future and if that was high enough for HIRLAM to use their physics. It is likely to be a significant gap between the scales (e.g. 20 for ECMWF, 10 or higher for HIRLAM). Another comment was that with the limited resources we have, we should not try to do everything but target certain issues.

## **Model Physics**

Geert Lenderink reviewed the latest changes to CBR. The conservative version is now in 5.1.4 and he has made a further re-tuning for stable waves. For low level clouds a moist version is needed and it is easy, from the turbulence scheme's point of view, to mix moist variables. It is more the re-distribution to normal variables and interaction with other schemes which are the problems. Further he showed a matching of the stability functions to surface similarity which worked very well.

Laura Rontu reviewed the work which started in 2000 on the MSO parameterisation. The MF scheme was introduced but the impact was small and there was not much drag. Further tuning has been done and it has been run with the new CBR and the MSO does impact with flow blocking to a large degree, but the turbulence gives correspondingly less drag. Ernesto

Rodriguez showed results from seasonal ISBA assimilations for two periods of 5-6 months each. The improvements of the 2m humidity and temperature biases were confirmed. The apparent remaining biases were to a large degree caused by a lack of vertical interpolations in the verification package. Simo Järvenoja showed his latest runs of his three test periods with ISBA on the Finnish 0.2° area but run at ECMWF. The improvements of the biases are also here very good and all periods are better or equal than without ISBA. An extra benefit is that now the surface analysis can be used for field verification. The earlier temperature biases (negative) near the surface also reached up to 925 hPa, but are now almost gone. The low level cloud erroneous inversion is now seen to be eliminated. ISBA gave a bit more cloud and rain in the summer case. It was pointed out that from innovation vector statistics one can find out which tile each station belongs to.

Niels Woetman Nielsen talked about estimation of SSTs from AVHRR and showed nice impacts in coastal regions. Another application of satellite data in the SAT-MAP-CLIM project is to estimate  $z_0$  from land classifications of very high resolution. Javier Calvo showed results from using the Emanuel convection scheme. It gave more convective precipitation than Kain-Fritsh but has no convective clouds. Erik Bazile gave an account of the progress with a functional boxes. There were some problems when the ice phase was included but now the cloud fields look much smoother, except a few problems around 0°.

Colin Jones talked about the shallow convection in Kain-Fritsh and long wave radiation interaction. The shallow convection cloud fraction has so far been missing, but it accounts for some 20% of the diurnal cycle in LW radiation. A parameterisation for that has been included and agrees well with LES, although the detrainment and entrainment individually are too large, their ratio is about right. Sander Tijm showed some results comparing KF with Straco. The distribution is better, with less events of very small rainfall and extending the distribution in to very large ones. Issues are with the optimisation of the code and spin-up effects in combination with the DFI initialisation. The model seems to increase in activity with range and overpredict wind.

Laura Rontu reviewed the orographic effects in HIRLAM. In the PYREX comparisons most models underestimated the blocking but overestimated waves. It seems the models need large surface friction. The MSO parameterisation nor the turbulence do enough on so there may be a need for a super-gridscale orographic drag parameterisation.

## Working Groups

- I. Physics time discretisation.
  1. One issue concerns the code cleaning. COMMONs should be cleaned so that the same constant only is defined in one place and with one COMMON per process.
  2. Sub-time stepping is not necessary anymore in PHYS. Historical only. Remove.
  3. CBR constraints. The mixing is implicit whereas the stability computations are explicit.
  4. The time stepping should be the same for turbulence and Kain-Fritsch.
  5. There is some double counting of turbulence and convection, but everybody was not quite in agreement.

6. The calling sequence should be: Surface before turbulence, all heterogeneous fluxes inside surface routines, then turbulence together with convection, cloud fraction before radiation, radiation explicit.
7. Avoid routines like QNEGAT that do vertical re-arranging. Use conservative schemes instead.
8. Implement the revision to the physics/dynamics coupling, FG predictor and average along SL trajectory.

Comments were about PHYS routines in F90 and whether the staggering-de-staggering should be done in this way.

## II. Preparation for system overhaul.

1. The overhaul will almost certainly entail re-writing F77 into F90 and using SRNWP standards is useful. MPP programming is necessary.
2. The Bourne/Korn shell writing should be replaced by Perl or Python. The former is more known whereas the latter is easier to learn.
3. There will be problems to find the staff for this work. As much cooperation as possible should be searched.
4. A common GUI for NWP would be good.
5. The codes should be written with portability in mind.
6. Files formats should also be chosen for portability. GRIB is not very portable. Maybe HDF5 is. ODB and FDB from ECMWF are possible. The interface to files should be a clean “call write”.
7. Obsoperators can be exchanged provided the interface is standardised.

Comments were about the feasibility of a GUI. The maintenance might need a local Guru in each institute. This might be overcome by having the GUI maintained centrally. Furthermore, there should be access to the script system as well. The resources are estimated to be 0.25x4 man-years for design of interfaces, code 0.5x4, portability 0.5x4 and user interfaces 2x2 man-years.

## III. Mountain effects in HIRLAM and NH model

1. There is a problem with the surface fluxes to understand. They are almost insensitive to  $z_0$  (except if=0). The windspeed at 10 m is of course affected, but not the surface momentum fluxes. Check low level ageostrophic wind or try other turbulence schemes.
2. The climate generation should separate between scales for turbulence (smallest) , for MSO 2-10 km, resolved scales above  $3 \Delta x$ .
3. Another approach from Wood is to try orographic turbulence.
4. Complete the MSO parameterisation implementation. Even though the overall effect together with turbulence is very small on momentum, the processes are different and MSO does not work on temperature, so there should be internal differences with MSO included. MF can help by running same cases if same resolution and area agreed and compare budgets.
5. The NH model will be ported to 5.2 and should not be a big problem.
6. One needs to go higher than 5 km for seeing NH effects. 2-3 km or even 1. Convection cases should be studied.
7. The initialisation effects and needs will be investigated. The NH model needs mass balance. The DFI cut-off may be tuned.

8. The pressure used in the physics is the reference one. It is not known if this a problem or not. The sensitivity can be checked, but a change means quite a lot of work.
9. The reversing if the vertical velocity recurrence formula in DYN to be investigated.

## **Model dynamics**

Aidan McDonald reviewed the latest results of testing the different LBCs using a host model at low and high resolution and a guest (inner) model at high resolution. There is a strong need to initialise the boundaries. The characteristics scheme does improve on the Davies' scheme. There were some points raised about the usefulness of LAMs. Apart from dynamic adaptation to e.g. orography and L/S mask, there is a different dynamics at higher resolution with e.g. sharper effects.

Aarne Männik talked about the situation with the NH model. The SI schem is stable and the model is ported to 5.0.0. A re-implementation of the parallel design has been done at a meeting at SMHI in February. It is ported to SHMEM to run faster. A SISL scheme is being developed. 1 km test will be done. The physics at high resolution is an urgent question. It is not suitable as it is. Per Undén showed how the values of the vertical coordinates had been derived through polynomial fits. The lowest model level had been kept at 30 m. The motivation for this is a) to have some blending height above the heterogeneous surface scheme and b) to have a better stability for the surface fluxes in the physics (and in general a better stability through thicker layers).

## **Embedding**

Ray McGrath described the new nested hourly system in Ireland. It uses nearby data only and 3D-VAR. The question is if it is better for nowcasting than something else. Ray showed a case where it did give quite poor synoptic forecast, as other available models. Dag Bjørge showed results from the Norwegian quasi-operational tests during 2000. Due to worse T2m and 10m winds the 5.0 could only be implemented with 2.6 physics. The frames from ECMWF were shown to have positive impact but only very small.

## **Discussion on model physics and issues from the working groups.**

In the KF comparisons it should be clarified which STRACO version to use, as the beta-release did not contain the latest developments. There were recommendations to take a strategic decision for which scheme to use and then work on that rather than test against the existing one. The MG maintained that that strategic decision has been taken and is in the Plan. Testing is in order to eliminate any implementation errors as the Reference has evolved. There was some concern that stratus clouds are not represented in KF. There were discussions about implementing the new scheme as a beta-release and then let each member decide for themselves if to use it. The MG maintained that the scheme can only be (active) in the beta-release if it is likely that it can become Reference subsequently. If, on the other hand, is only an option, it will not be tested by default, and cannot be guaranteed to be maintained and work correctly. The advantage of putting it in a beta-release is that many can test it.

The use of ECMWF physics was discussed a number of times during the meeting. In general it is not thought to be appropriate for HIRLAM due the resolution. It was not thought that their convection scheme was appropriate at all even though the radiation scheme is very good but far too expensive. The effort to implement other physics schemes is also significant and underestimated by e.g. the HAC. It is however not an issue any more if we don't own all our codes, as commercial sales of HIRLAM codes is not an issue. The developments of new schemes must be done in collaboration as we have too few staff. Physics for the meso scale should be a priority and how to actually switch off convection. We need guidance from the HAC how to do all the things that we are supposed to do and on the priorities.

## **Discussion on model dynamics.**

The EPS for limited area and short range was questioned. Inger-Lise Frogner has however seen significant improvements of running HIRLAM from ECMWF TEPS. The physics is the most important reason for uncertainties and for heavy precipitation events. In general the high resolution will need some sampling and probability forecasts.

The physics needs to be developed for the NH model at 2km.

The complications of the staggering-un-staggering of wind components was questioned. We should instead keep everything un-staggered except for the dynamics where it is needed. (This is if you use an inverse of the staggering rather than the un-staggering which is not an inverse operator.)

The quality and the lack of impact of the frames is disappointing. One possibility is that the BC short cut-off 3D-VAR forecasts are not that much better than the older main runs. The Project Leader will approach ECMWF for verification and monitoring figures. The other possibility is that in most cases there is little sensitivity.

The orography should be filtered, and at least to  $3\Delta x$  since the dynamics is inaccurate. The emergence of Gibb's waves may be a problem or if they are accepted (could or should be handled by post-processing).

Shape preserving advection schemes are recommended.

We should consider the spectral model. It does not seem to be more expensive although at very high resolution there may be questions. The frames approach does however not go with the spectral model (nor the NH model, PL's comment).

There was rather too little time to discuss the dynamics (and even less for systems).

## **Embedding (cont).**

Kai Sattler gave a talk about a mini-ensemble forecasting experiment for the European flood forecasting system for the Piemonte event in November 1994. Significant improvements in amounts and also some in locations were shown when running high resolution ensembles with HIRLAM. Ben Wichers Schreur reviewed the results of the verification questionnaire returns where most preferred a separate visualisation from the computation. The new outputs are in readable formats and it is possible to average and slice the outputs. It is planned to introduce a data base with a web interface.

Colin Jones reviewed the background for doing the climate change simulations at the Rossby Centre. Model developments have been verified against current climate. Long runs compare

well with precipitation climatologies. There is too much radiative cooling in the mid troposphere related to the formulation of emissivity.

Carl Fortelius showed high resolution simulations with Kain-Fritsch and the NH HIRLAM by Sami Niemelä. The NH model is smoother and STRACO has a lot more cloudiness than KF and KF has more intense events. Simo Järvenoja showed the results of using two-way wave model coupling at FMI (as also described in NL40). It results in somewhat lower wind speeds. Mikhail Sofiev showed results of inverse modelling to trace emissions. The model includes several processes and the results can be quite sensitive.

Ole Vignes has developed the HGS I/O server of Jan Boerhout (NL39) further to generalise it to MPI and other platforms. It is implemented under directives, so it is optional. Some parallelisation strategies were described. Kristian Mogensen reviewed HIRVDA developments. The code has been ported to IBM SP and Linux. It uses optionally both OpenMP and MPI, a two-level strategy. The observation handling has been updated and it is possible to enter some data directly into the variational code. Gerhard Cats discussed the issues for the overhaul and the European cooperation on NWP systems. The SMS type organisation of the Reference system into several families is a new feature in HIRLAM, but before the complications were hidden in the sometimes complicated scripts. We are likely to stay with SMS or something similar. It is doubtful that we can go for a gradual transition to a re-designed system since e.g. the data structures affect everything.

The Project Leader wrapped the meeting up with going through and briefly discussing the most likely scenarios and activities in HIRLAM-6. There was some concern aired about the large number of activities in relation to the available staff.

### **Recent meetings**

- HIRLAM MG visit to Met Eireann and MGM , 27 February - 1 March 2002, Dublin.
- HIRLAM All Staff Meeting, 3-5 April 2002, DMI, Copenhagen.
- HIRLAM Council Follow-on project meeting, 9 April, Porto, Portugal.
- HIRLAM Advisory Committee Meeting, 26 April 2002, Reykjavik.

### **Forthcoming meetings**

- SRNWP Workshop on NWP system design, 13-15 May, Météo-France, Toulouse.
- HIRLAM-5 Council Meeting No. 6, 26 June, Reading.
- INM workshop on EPS, 3-4 October 2002, INM, Madrid.
- EWGLAM/SRNWP meeting, 7-10 October, KNMI, De Bilt.
- HIRLAM workshop on Mesoscale modelling, 14-16 October 2002, Met Eireann, Dublin.

**Per Undén, 30 April 2002.**

AGENDA

# HIRLAM All-Staff Meeting, 2002

## DMI

Copenhagen, 3-5 April, 2002 Version 2002-03-19

Wednesday, 3 April

### **09:00-09:30. Welcome and Introduction**

#### **Opening of the Meeting**

- Opening and role of HIRLAM in Denmark. *Lars Prahm*, General Director of DMI
- Introduction and current status of HIRLAM-5: *Per Undén*, Project Leader.
- Practical Arrangements for the Meeting: *Kristian Mogensen*.

#### **Operational Implementations. Chair: Gerard Cats**

- 09:30-09:45. Annual report of DMI's operational activities : *Bent Hansen Sass*.
- 09:45-10:00. Operational HIRLAM at FMI : *Kalle Eerola*.
- 10:00-10:15. Report on operational implementations at Meteo-France since the last HIRLAM All-staff Meeting : *Dominique Giard*.
- 10:15-10:30. Operational activities at Met Eireann : *Ray McGrath*.
- 10:30-10:50. *Coffee-break*
- 10:50-11:05. Operational system and plans at KNMI : *Ben Wichers Schreur*.
- 11:05-11:20. Operational HIRLAM at the Norwegian Meteorological Institute : *Ole Vignes*.
- 11:25-11:40. Operational news at INM, Plans for the coming year. *José Antonio García-Moya*.
- 11:40-11:55. SMHI operational system : *Lars Meuller*.

#### **Data Assimilation. Chair: Heikki Järvinen**

- 11:55-12:15. Preliminary results from a nudging scheme for HIRLAM intended for very short range forecasts of cloud related parameters : *Bent Hansen Sass and Claus Petersen*.
- 12:15-12:30. A short note on the horizontal variation of the background error formulation in 3D-VAR : *Nils Gustafsson*.

### **12:30-13:30. Lunch**

- 13:30-13:50. 4D-VAR developments, feasibility study and case study : *Xiang-Yu Huang, Xiaohua Yang, Nils Gustafsson, Kristian Mogensen and Magnus Lindskog.*
- 13:50-14:05. Status of ATOVS assimilation at DMI : *Bjarne Amstrup.*
- 14:05-14:25. Problems and progress within the operational 4D-VAR assimilation at Météo-France : *Dominique Giard.*
- 14:25-14:45. Discussion on Operational Matters.
- 14:45-15:05. *Coffee-break*
- 15:05-15:25. Discussion on Data Assimilation.
- 15:25-15:50. HIRLAM-6 scenarios : *Per Undén.*
  - Strategy
  - Priorities and allocation of staff
  - How to organise the work
- 15:50-16:20. First Discussion on HIRLAM-6 scenarios.

### **Model Physics. Chair: *Bent Hansen Sass***

- 16:20-16:50. Recent developments and future turbulence research in HIRLAM. (Conservative formulation, moist turbulence scheme and the time stepping issue) : *Geert Lenderink.*
- 16:50-17:10. Parameterization of mesoscale orography effects in HIRLAM : *Laura Rontu and Kai Sattler.*

**Evening: 18:00. Dinner hosted by DMI. Rest. Cassiopeia, Tycho Brahe Planetarium, near Vesterbro Stn.**

Thursday 4 April

- 09:00-09:40. Seasonal assimilation experiments and some new results in the Nordic region with the new surface package : *Ernesto Rodríguez, Beatriz Navascués, Juan José Ayuso and Simo Järvenoja*. Part I : Ernesto Rodríguez, part II : Simo Järvenoja.
- 09:40-10:00. SAT-MAP-CLIM: A pilot project about use in NWP of surface parameters derived from satellite measurements : *Niels Woetmann Nielsen*.
- 10:00-10:20. The Emanuel convection scheme : *Javier Calvo*.
- 10:20-10:40. Progress and problems in the Functional Boxes : *Eric Bazile*.
- 10:40-11:00. *Coffee-break*
- 11:00-11:20. Kain-Fritsch in Hirlam and 22 km version : *Sander Tijn*.
- 11:20-11:40. The representation of shallow convection and shallow convective cloud fraction in HIRLAM : *Colin Jones*.
- 11:40-12:00. Orography effects in fine resolution HIRLAM - items for discussion : *Laura Rontu*.

### **Working Groups Session I .**

A: Physics time discretisation. B : Preparation for System Overhaul C: Mountain effects in HIRLAM and NH model

12:00-12:30. Working groups.

**12:30-13:30. Lunch**

### **Working Groups Session II .**

- 13:30-14:30. Working groups.  
  
A: Physics time discretisation. B : Preparation for System Overhaul C: Mountain effects in HIRLAM and NH model
- 14:30-14:50. Discussion on Physics in general, referring to the talks.
- 14:50-15:50. Presentations by working groups and identification of issues to discuss :  
*Chair: Per Undén*
  - 14.50 Physics time discretisation
  - 15.10 System
  - 15.30 Mountain
- 15:50-16:10. *Coffee-break*

## **Model Dynamics. Chair: Ernesto Rodríguez**

- 16:10-16:30. Lateral boundary conditions: a progress report : *Aidan McDonald*.
- 16:30-16:50. Current situation with the NH HIRLAM : *Aarne Männik*.
- 16:50-17:05. Note on definitions of 40/50 model levels : *Per Undén*.

Friday, 5 April.

## **Embedding. Chair: Aidan McDonald**

- 09:00-09:15. The new nested system at Met Éireann (preliminary) : *Ray McGrath*.
- 09:15-09:35. A comparison of different HIRLAM versions : *Dag Bjørge*.
- 09:35-10:30. Discussion on issues from the Working Groups.

## **Synoptics and verifications and cooperation**

- 10:30-10:50. *Coffee-break*
- 10:50-11:10. Discussion on Model Dynamics.
- 11:10-11:30. A mini ensemble experiment of a historical heavy rain event : *Kai Sattler*.
- 11:30-11:50. Verification : *Ben Wichers Schreur*.
- 11:50-12:10. The Rossby Centre Climate Model Version 2. A verification of the model climatology and interannual variability against observations : *Colin Jones*.
- 12:10-12:30. Simulation of a summertime frontal system under hydrostatic and non-hydrostatic dynamics : *Carl Fortelius and Sami Niemelä*.

### **12:30-13:30. Lunch**

- 13:30-13:50. Coupled atmosphere-wave model at FMI : *Simo Järvenoja*.
- 13:50-14:10. Real time solution of forward and inverse air pollution problems with a numerical dispersion model based on short-term weather forecasts : *Mikhail Sofiev*

## **System**

- 14:10-14:30. Asynchronous I/O in HIRLAM : *Ole Vignes*.
- 14:30-14:50. Recent technical developments and plans for HIRVDA : *Kristian Mogensen*.
- 14:50-15:10. System: European cooperation and other issues : *Gerard Cats*.
- 15:10-15:30. *Coffee-break*

## **15:30-16:00. General Matters and wrap up. Project Leader**

- 15:30-15:45. Final Discussion on HIRLAM-6 scenarios.

- 15.45 Meeting Programme for 2002 (Project Leader)
- 15.50 General views on the organisation of the meeting. (Staff).
- 15.55 Any Other Matters.

**16:00. *Close of Meeting.***

List of Participants

Sigurdur Thorsteinsson, Vedurstofa Islands  
 Per Undén, SMHI  
 Geert Lenderink, KNMI  
 Sander Tijm, KNMI  
 Ben Wichers Schreur, KNMI  
 Gerard Cats, KNMI  
 Ole Vignes, NMI  
 Dag Bjørge, NMI  
 Inger-Lise Frogner, NMI  
 Vibeke Wauters Thyness, NMI  
 Dominique Giard, Météo-France  
 Eric Bazile, Météo-France  
 Ray McGrath, IMS  
 Aidan McDonald, IMS  
 Ernesto Rodríguez, INM  
 José Antonio García-Moya, INM  
 Javier Calvo, INM  
 Isabel Martínez, INM  
 Heikki Järvinen, FMI  
 Kalle Eerola, FMI  
 Simo Järvenoja, FMI  
 Laura Rontu, FMI  
 Carl Fortelius, FMI  
 Mikhail Sofiev, FMI  
 Aarne Männik, Tartu University  
 Nils Gustafsson, SMHI  
 Colin Jones, SMHI  
 Lars Mueller, SMHI  
 Kristian Mogensen, DMI  
 Kai Sattler, DMI  
 Xiang-Yu Huang, DMI  
 Xiaohua Yang, DMI  
 Bent Hansen Sass, DMI  
 Niels Woetmann Nielsen, DMI  
 Leif Laursen, DMI  
 Bjarne Amstrup, DMI  
 Claus Petersen, DMI

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