

Introduction and general report from All Staff Meeting 2003.

First of all, an apology for not **printing** a Newsletter at the advertised time, in February. There were only three contributions at the time, and I did not think it was warranted to go through the process for relatively few pages. The reason for few contributions at the time were probably due to quite a lot of work being published elsewhere, either in the Dublin Workshop on Mesoscale modelling Report or in the Technical Reports.

As a temporary measure the three articles from February (or before) were provided on HeXNeT, as in particular the change to the boundary relaxation coming out of the Dublin workshop (MC2 method) was of immediate interest. Those articles appear now in this Newsletter, of course, as we still find the hardcopy medium very worth while. In this context, I would like to complement all staff who make contributions for the high quality of the articles. The resulting publications are of high quality and valued by many recipients, both within the HIRLAM community and outside. This was stated most recently at the HIRLAM Advisory Committee meeting in Dublin, by Météo-France.

This HIRLAM Newsletter No 43 first contains the articles that have been submitted before the All Staff Meeting, and then the, as always, numerous and detailed write-ups of the presentations at the All Staff Meeting on Hanasaari, outside Helsinki, 31 March - 2 April.

The meeting was hosted and organised by FMI at this excellent cultural centre on quite a small island just off the city border (but the main westward motorway passes this island, so no shortage of connections). As you see on the cover picture, it was very bright weather as often in the Nordic spring, but it was much colder than it looks, due to a strong and cold NW flow after a cyclone passage. The programme contains many interesting and relevant talks and the time was not enough to go into as much details as one often would like. This Newsletter contains write-ups of those talks in often more detail than was possible to present with the time-constraints of the meeting. I think you will find many additional details in the subjects that you are particularly interested in.

The meeting was attended by 44 participants, see the list enclosed at end of this introduction. Mikko Alestalo, Director of Meteorological Research at FMI, opened the meeting. FMI has many international cooperations and the neighbouring countries of Russia and Estonia are also involved as HIRLAM users or developers. HIRLAM is important to FMI and the quality of the temperature forecasts has been a problem in HIRLAM-5. The developments during that project seemed to have improved much of those, but still there is a pronounced problem over snow surfaces remaining also in the new surface scheme. The diurnal cycle is not predicted very much under many such conditions due to too much evaporation from the snow and high atmospheric humidity.

After that Simo Järvenoja gave a historical recollection of FMI's HIRLAM activities. He covered the pre-history to HIRLAM, the HIRLAM Projects and FMI's HIRLAM operations from 1990. The 2m temperature is an important forecasting parameter and there have been various deficiencies in the system. Some of these difficulties remain, and in particular the one just mentioned, when the temperature falls below -20. Still, in terms of general verification measures there has been a downward trend towards reduced errors during the time of FMI operations.

Operational activities

The Danish operational developments were reported by Kristian Mogensen. In April 2002 an upstream advection of q , TKE and CLW was introduced but was later in the year rescinded. The introduction of the new NEC SX-6 computer has been the focus of many activities and last September the operational DMI HIRLAM went operational on one node with minimum changes. In December AMSU-A ATOVS became operational. 40 levels and STRACO changes were introduced as well. There are now four long runs per day and the short cut-off is 1h 40 min. The SX-6 now has eight nodes (7 with 8 PEs) with a peak rate of 480 GFLOP, 15 x faster than the previous computer. The aim is to use the Reference system on all the nodes, but currently the parallelisation does not give good enough scaling with several nodes.

The FMI system was described by Kalle Eerola. In December the T3E service terminated and since then they have been running stably on the IBM. The intention was to introduce an 0.18° version for the whole Atlantic Area, but there were problems mainly due to the boundary treatment in the Reference. (The solution was found after the Dublin Workshop as mentioned earlier. Please see separate articles). They chose instead an 0.3° model for the whole area and this was run in parallel and with the ISBA version 5.1.4. This model with 3D-VAR is now operational, but as a consequence, the old 0.4 and 0.2° systems are still run and with the old Reference system. The IBM eServer cluster1600 has 16 nodes of 32 PEs, of which FMI uses one. They plan to introduce a 15-20 km resolution again, with the MC2 boundary treatment. Both Simo and Kalle have shown a particular sort of noise problem, but at larger scales than the grid-scale, and more needs to be understood about this.

Dominique Giard gave an account of the Météo-France models and the developments. ARPEGE is run in stretched mode, for the French use, and in non-stretched mode for the Tropics. ALADIN-France is run at 9.5 km. A number of physics updates have been introduced and AMSU-A raw radiances are used.

Ben Wichers Schreur gave an account of the operational developments at KNMI. The large area is still using 22 km, and there is a nested smaller area at 11 km as well. Quikscat are assimilated separately in a late run, for validation. The problems in operations have been related to STRACO and extreme rainfalls. Modification of the lateral entrainment helped. There is a physical downscaling using high resolution physiography. Ben showed results that the 22 km model with 5.0.6 verifies better than the earlier version which had coarser resolution as well. They are implementing 6.0 with changes of the initialisation (see separate talk).

The met.no operations have changed significantly after very extensive testing and parallel runs. The Reference 5.2.3/6.0 is now operational at 0.2° resolution for the large area. The 10 and 5 km nested versions are run as well, except that the 10 km one is nested with ECMWF boundaries. ATOVS are used and FGAT activated. Verifications show a nice improvement first going to 6.0 and then by increasing resolution (from 0.5 to 0.2°). Optimisations have been made for the SIG 3800 and 190 PEs are used for the model. Tests have been performed at 0.03° .

At INM has the new CRAY SV1 been installed with 16 PEs as a first of a series of installations leading to 270 GF peak in 2004-2005 with X1. Operations have been transferred to the SV1 with the old configuration and now the Reference 6.0 and resolution increase will be introduced. The resolution will be 0.15° for the large area with a nested 0.05° and 50-60 levels. Furthermore, a lot of effort is going to be put on Short Range EPS. High resolution surface analyses are performed for diagnostic reasons.

Lars Meuller described the SMHI developments. Most things have changed - new HIRLAM version, new computers, 40 levels, new fileserver, miniSMS and application updates. The version is 5.1.4 plus Kain-Fritsch and a soil freezing fix. Operations is on a Linux cluster with SGI as a backup. ATOVS and VAD radar winds are going through in passive mode. Apart from using those in active mode, the resolution for the large area will be doubled to 0.2° .

Data assimilation

Dominique Giard informed about J_b developments at Météo-France. Apart from the lagged J_b formulation, there has been work on ensemble assimilation with perturbed analyses. Variances and spectra are estimated and attempts to model covariances in block-diagonal form or with wavelets, may provide possibilities for geographical variation. Also a bi-periodic representation is worked on, to avoid the necessity of large extension zones for small areas.

Xiang-Yu Huang showed the results from assimilation of European Wind Profilers over a whole month. The number of stations is fairly limited, over central Europe only, and some of the stations are of very high quality, whereas some others are poor and have a high rejection rate. The impact is very marginally positive.

Martin Ridal talked about assimilation of the plentiful GPS ground stations measuring wet delay. Bias correction is essential. Data are collected and processed in real time at SMHI. The MODIS instrument provides high horizontal resolution but also vertically integrated moisture over land. Here retrieved data are assimilated and without quality control. When above cloud retrievals are available, then there will also be some information in the vertical.

Kristian Mogensen has made an impact study of assimilating MODIS wind retrievals. They are made over 3 images with 100 min in between. There are a lot of data and in the Polar region (only), which is the attraction, complementing the SATOB winds. The impact was slightly negative in this trial.

Stefan Gollvik described his work on introducing the ice fraction analysis bases on the Ocean-Sea Ice SAF product. Super obs are used and the successive correction in surfana.

Then Tomas Wilhelmsson described the WRF software design. This was scheduled here only to be before the Working groups the following day. He described the layers and the parallelisation strategy. Of particular interest was the use of CASE tools. A registry file is built and from that a lot of code is generated automatically.

Model Physics

Hannu Savijärvi gave his thoughts about modifications to the radiation scheme for the meso-scale. The HIRLAM scheme is simple and cheap; the short wave part is quite OK, but the long wave is simple but clumsy to work with. There are mainly random variations due to higher resolution and much can be averaged, if random. The snow albedo is important to improve and depends on time of day and wetness and trees impact. A slope angle can be introduced by increasing the diffuse part of the radiation.

Laura Ronto talked about hers and Simo's work on validating the radiation modifications for some CO₂ and ozone effects by Räisänen and also a small bug fix for the earlier modification of the effective cloud droplet radius. Also a new radiation interface to ISBA (tiles to aggregate and vice versa) has been written and tested as well. The first test showed unexpected large impacts and this was due to a bug and they had to be re-run. Laura also had some views on the climate system and the need for finer resolution. Some discussion ensued and it is possible to make the current system to provide files down to 2.5 km. Below that, a new approach has to be followed. The files become enormous, or the concept of global coverage has to be given up.

First talk on the Tuesday morning was by Bent Hansen Sass who described a new formulation of the convective cloud cover in STRACO. It is based on a PDF, but of a special shape, different from stratiform cloud cover.

Javier Calvo compared cloud cover results from HIRLAM STRACO and KF and showed results in the EUROCS cases and especially showed the diurnal cycle for stratocumulus cover and LW radiation. A more sophisticated cloud scheme is needed, a moist conservative turbulence scheme and cloud top entrainment.

Colin Jones then reviewed recent developments to the Kain-Fritsch scheme. The single column tests are important to isolate effects. The original very simple cloud cover formulation in Rash-Kristjansson has been replaced with a formulation by Albrecht and with the modification it doesn't rain out as before.

Carl Fortelius showed important results with ISBA over snow cover. The heat balance is unrealistic due to large latent heat flux from the snow. A particular and clear part of the problem is the esat table, which uses a mixture of saturation over water and ice, as in clouds, which is inappropriate for snow/ice. A modification to over ice reduced the moisture flux by 0.3 mm/day, thus roughly halved. It improves the too warm bias by a degree or so and gives less cloud.

Eric Bazile reviewed the Météo-France physics modifications. They involved shallow convection, changes to convective and resolved precipitation, cloud cover and the snow scheme. The vertical diffusion has been modified to be more implicit and a long standing noise problem has been solved. The Kain-Fritsch scheme has been run in ALADIN and tested for the 2002 floodings and combined with other modifications.

Ernesto Rodriguez described the recent developments on soil freezing/thawing, comparing the tuned implicit Viterbo approach with the new (in HIRLAM) explicit approach following Bazile and MF. The explicit scheme is better and both schemes are much improved compared with the original ISBA in the Reference.

Stefan Gollvik gave a status report of his new snow scheme with ISBA. It has an additional fraction and an extra soil layer with heat conduction. The forest tile is not affected. Water is handled in the snow. At the time of the ASM it was being tested with assimilation.

Ben Wichers Schreur talked about the work at KNMI on the moist CBR scheme (mainly by Sander Tijm). The current scheme has too little mixing and follows a dry adiabat even in clouds, so it is not good for Sc. The moist scheme has a mixing based on θ_l . This works well at high vertical resolution, but at more modest ones (like less than 100 levels), cloud top entrainment needs to be parameterised.

Further developments to the CBR scheme were described by Colin Jones. There is a feedback between the TKE equation and the stable length scale so that both tend to become very small. There are justifications to parameterise additional effects (sub-grid scale shear and non-linear averaging) in the length scale formulation for very stable layers. This improves basically all verifications except that the 10 m wind becomes a bit too strong. A solution to this is worked on.

Eric Bazile explained some principles for the physics dynamics coupling in AROME, which was currently designed. They distinguish between three sorts of processes: thermodynamic adjustments, evolution equations, and 3D-1D effects, e.g. if 3D turbulence effects included. The first term is cheap and can go be done twice, at the start before the other processed, and then at the end after NL dynamics.

Working Groups Session

The points below summarise the presentations from the groups and the plenary discussion.

A. Surface fluxes and turbulence.

1. We need explicit treatment of snow. The correction to esat over snow surfaces should be implemented as soon as possible. The surface roughness should be assessed.
2. We need to understand more about z_0 for momentum and temperature. A global tuning is desirable.
3. Test cases are very important. Profiles and data from Sodankylä and Cabauw to be used. The stable modifications from Zilitinkevich to be tested. Land use data have a feedback and will impact the results.
4. z_0 may need to be retuned with the introduction of GWD/SSO.

B. System overhaul.

1. The actions are as described in the Work Plan 2003.
2. Working groups have been identified in parallelisation and for physics interface. The resources are however low.
3. The goal for the physics is have clear code.
4. Fortran standards should be set and adhered to, but not possible with external routines.
5. New utilities may be a problem in local installation and support. Judicious use and HIRLAM support for the ones chosen in needed.

6. Gradual re-write of scripts. There may be some reluctance to move away from simple Bourne shells to perl or python, but these tools are well known and enjoyed by younger people with university background. Thus, it will be counterproductive to resist using new tools.
7. The Working groups shall make a design paper for the plan and choices in the overhaul.
8. Other groups, MF, ECMWF, etc. to be considered and common choices made.

C. NH Dynamics and LBC

1. The Eulerian SI NH HIRLAM model has been installed in Finland, Sweden and Norway, but the testing is limited. The most severe conditions and highest resolution have been used in Norway and problems seen. The manpower for going further has not been available. The first thing to find out is to separate the adiabatic performance from what happens when the physics is active.
2. In the Estonian Met Institute will there be a quasi-operational run with the NH model.
3. Norway will do further tests and compare with MM5 and Met Office model.
4. The need for reasonable physics is the overriding problem at the moment. This is a priority in HIRLAM and such a package will become available.
5. For the LBCs, there are planned activities to improve the current scheme in 2003-04.
6. The new scheme is following the plan and will be extended to 3D. There are no free parameters as e.g. in the current Davies scheme.
7. Implications for 4D-VAR very important to consider.
8. The NH model needs to be analysed for the new scheme.

Model dynamics

Aidan McDonald talked about his recent developments. The new transparent scheme has been extended to also allow for advection speeds higher than the gravity speed. Orography has successfully been included. He has introduced proper boundary conditions for the SI solver and there is surprisingly large effect in the interior. The scheme will be extended to 3D and horizontal diffusion is to be handled as well.

Simo Järvenoja showed the problems with the boundary scheme and physics interaction when they tried their intended 0.18° area and had blowups over high orography in the boundary. The MC2 treatment solved this completely and parallel tests showed the impact to be good. Now, the 0.3° area has been introduced instead and he showed scores from parallel tests. In the winter with active periods, the MSL bias and RMS were worse with the new Reference and the temperature as well in the cold period. It is different in the spring and then the 2m temperature is much better. The low level inversion does not seem to be there any more.

Rein Room described the progress with the NH model. He briefly described the semi-Lagrangian advection with its extrapolation and an explicit interpolation step. It is not yet stable at large time steps and there seems to be some reflection problems. Aarne Männik then showed results from tests with the normal SI or explicit Eulerian version. The intercomparisons with MF showed more damping in HIRLAM, but the model had to be 3D in

the HIRLAM case, whereas MF had 2D versions. He also showed low resolution 22 km runs comparing with the FMI ENO and particularly the SI NH runs developed some spurious cyclones. He and Sami had tested with and without convection and found precipitation patterns worse without the convection.

Ben Wichers Schreur described the problems and imbalance that is created by the adiabatic backward step in TDFI. It leaves some pressure oscillations and pressure perturbations. It affects the spin-up as well. By only running forward (launching) the problems are largely removed, with the only disadvantage of losing the 0h initialised analysis.

Simo then came back and described the details of the tests with the MC2 boundary treatment. There is no difference in scores and the precipitation is suppressed in the boundary zone. Some discussion ensued on whether to relax liquid water, which is currently not done with this modification. It is probably not crucial but is desirable in a nested HIRLAM.

Han The described and discussed developments in the climate system. There will be new data bases coming and it should be easy to introduce new ones. There are many limitations in the present climate system. There are many hardcoded features and fields are overwritten or overruled if there were no such model parameters coming from the climate files. Each field is a separate variable and argument lists are long and efficiency not good. There is a mixture of really constant fields (e.g. L/S mask) and others, which are prognostic, like soil water and might be replaced during the analysis. The land use classes should be translated to index arrays. It was also suggested that tiling should be introduced at the level of the climate system.

Jose Antonio showed some results from the INM short range EPS with Scaled Lagged Average Forecasting. The analysis was perturbed with +/- the forecasts increments from the 4 times before (24h). Verifications showed that the spread was not enough. There are many other ways to create perturbations, which will be tried.

Near the end of the meeting, Ben Wichers Scheur again gave a presentation, this time about the HIRLAM re-runs (by Toon Moene) of the 1 February 1953 flooding disaster in the Netherlands. Good forecasts could be made 24 and 36 hours in advance. Radiosondes were by far the most important observations. Then Katherin Kourzeneva informed about the HIRLAM modelling in St Petersburg. They are interested in sensitivities. Documentation and even more detailed than currently available is much in demand. They are also involved in turbulence and dynamical modelling and a training Workshop on stable boundary layer is planned together with FMI.

Recent meetings

- HIRLAM-5 Council Meeting No. 8, 4 December, ECMWF, Reading.
- HIRLAM All Staff Meeting, 31 March - 2 April, Hanasaari, Espoo, Finland.
- HIRLAM Advisory Committee Meeting, 24-25 April 2003, Dublin.

Forthcoming meetings

- HIRLAM MG visit to met.no, 26-27 May 2003.

- HIRLAM-6 Council Meeting No. 1, 10 June, Copenhagen.
- HIRLAM MG visit to INM, end of September, INM, Madrid.
- EWGLAM/SRNWP meeting, 6-9 October, Lisboa.

Per Undén, 8 May 2003

Recent news

The HIRLAM Council has approved the agreement with FMI to become the lead centre for the Regular Cycle with the Reference system (RCR). I am very pleased that first FMI took this initiative and that the agreement that we worked out during my visit at FMI in May was accepted.

FMI will thus run the Reference system operationally, after comprehensive testing of the relevant beta-release and a parallel run at FMI. The Reference release is then approved in agreement between the MG and FMI.

The RCR is the operational run at FMI and will receive full operational attention and the products will be put on the HeXNeT server accessible to all HIRLAM members in near real time. A wealth of real time monitoring as well as monthly verification and diagnostics will be produced and put on HeXNeT. The existing archives at ECMWF will also be continued.

In this context, please also check out the new HeXNeT web on the new server at <https://hirlam.knmi.nl/knmi/index.html>. The layout is all new and much more modern. It should be easier to find e.g. documents and reports and there are new features, e.g. a calendar that you can update. Certified users in the institutes can also update the contents, as e.g. I now do. This speeds up publication and save time.

Per Undén, 12 June 2003

AGENDA

HIRLAM All-Staff Meeting, 2003

Cultural Centre, Hanasaari, Espoo, Finland

31 March - 2 April, 2003. Version 2003-03-29

Monday, 31 March

09:00-09:45. Welcome and Introduction

Opening of the Meeting

- Opening and role of HIRLAM in Finland. *Mikko Alestalo*, Director of Meteorological Research, FMI
- Introduction and current status of HIRLAM-6: *Per Undén*, Project Leader.
- Practical Arrangements for the Meeting: *Carl Fortelius*.
- 09:20. 13 Years of HIRLAM operations at FMI: *Simo Järvenoja* 20 mins

Operational Implementations. Chair: Gerard Cats

- 09:45. Annual report of DMI's operational activities : *Kristian Mogensen*. 15 mins
- 10:05. Operational HIRLAM at FMI : *Kalle Eerola*. 15 mins
- 10:25. Report on operational status at Météo-France : *Dominique Giard*. 15 mins

10:40-11:00. Coffee-break

- 11:00. Operational activities at Met Eireann : *Ray McGrath*. 15 mins
- 11:15. Operational system and plans at KNMI : *Ben Wichers Schreur*. 15 mins
- 11:30. Operational HIRLAM progress at met.no : *Ole Vignes*. 15 mins
- 11:50. Operational news at INM, Plans for the coming year. *José Antonio García-Moya*. 15 mins
- 12:10-12:25. SMHI operational events : *Lars Meuller*. 15 mins

12:30-13:30. Lunch

Data Assimilation. Chair: Heikki Järvinen

- 13:30. Further developments of Jb at Météo-France : *Dominique Giard*. 15 mins
- 13:50 European Wind Profiler assimilation : *Xiang-Yu Huang and Magnus Lindskog*. 15 mins
- 14:10. Assimilation of new moisture measurements from MODIS and ground based GPS : *Martin Ridal*. 15 mins
- 14:30. Assimilation of MODIS winds : *Kristian Mogensen*. 15 mins
- 14:50. Ice fraction data from the Ocean-Sea Ice SAF and the SST analysis: *Stefan Gollvik*. 5 mins
- 15:00 WRF structure and system design in HIRLAM : *Tomas Wilhelmsson* 15 mins

15:20-15:40. Coffee-break

Model Physics. Chair: Ben Wichers Schreur

- 15:40. Radiation in the small mesoscale models - what can be done ? *Hannu Savijärvi*. 20 mins
- 16:05. Radiation updates testing and diagnostics : *Laura Rontu and Simo Järvenoja*. 20 mins
- 16:30-16:40. A Climate System proposal : *Laura Rontu*. 10 mins
- 16:45-17:05. Demo of using mini-SMS and running HIRLAM : *Gerard Cats*. 20 mins

After session group meeting : Mini-workshop on Regular Run monitoring.

Tuesday 1 April

Model Physics (cont.). Chair: Ben Wichers Schreur

- 09:00. Enhanced formulation of convective cloud cover including illustrations from results of 1-D international test cases : *Bent Hansen Sass*. 15 mins
- 09:20. Representation of clouds in the HIRLAM model. Results from the EUROCS project : *Javier Calvo*. 20 mins
- 09:45. Recent developments of the K-F convection scheme : *Colin Jones*. 15 mins
- 10:05. On the heat balance of snow cover surfaces in HIRLAM 5.1.4 : *Carl Fortelius*. 15 mins
- 10:20. Recent physics modifications and results with the Bechtold KF : *Eric Bazile*. 20 mins

10:45-11:05. Coffee-break

- 11:05-11:25. Surface modelling: soil freezing and thawing, snow formulation and related problems in the Nordic region and 1-D simulations : *Ernesto Rodríguez*. 20 mins

Working Groups Session.

Preliminary or suggested titles:

A: Surface fluxes and turbulence. B : Preparation for System Overhaul C: NH model and LBC

- 11:30-12:30. Working groups.

12:30-13:30. Lunch

Model Physics (cont. II). Chair: Bent Hansen Sass

- 13:30. The new snow scheme in ISBA : *Stefan Gollvik*. 10 mins
- 13:45 Developments and results of moist CBR : *Sander Tijm and Ben Wichers Schreur*. 20 mins
- 14:10 Stable extensions to CBR : *Colin Jones*. 20 mins
- 14:35 Principles for the physics/dynamics interface in AROME : *Eric Bazile*. 15 mins

14:55-15:40. Presentations by working groups and discussion : Chair: Per Undén

- 14.55 Surface fluxes and turbulence

- 15.10 System overhaul
- 15.25 NH Dynamics and LBC

15:40-16:00. Coffee-break

Model Dynamics. Chair: Colin Jones

- 16:00. Lateral boundary conditions : *Aidan McDonald*. 20 mins
- 16:25-16.50. Experiences from pre-operational HIRLAM 5.1.4 runs at FMI : *Simo Järvenoja*. 25 mins

Conference Dinner

- 19:00 The Conference Dinner at the restaurant [Svenska Klubben](#)

Wednesday, 2 April.

Model Dynamics (cont). Chair: Colin Jones

- 09:00. Semi-Lagrangian, semi-implicit non-hydrostatic dynamical core for HIRLAM : *Rein Rõõm and Aarne Männik*. 20 mins
- 09:25. More tests and experience with the non-hydrostatic HIRLAM : *Aarne Männik and Sami Niemelä*. 20 mins
- 09:50. Work on the spin-up problem : *Ben Wichers Schreur*. 20 mins
- 10:15. Testing of the MC2 boundary treatment in HIRLAM : *Simo Järvenoja*. 15 mins

10:30-10:50. Coffee-break

Embedding. Chair: Xiang-Yu Huang

Synoptics and verifications and general

- 10:50. Climate system and ISBA : *Han The*. 20 mins
- 11:10. First results of INM SREPS. SLAF approach : *José Antonio García-Moya*. 15 mins
- 11:30. Re-run of the February 1st 1953 storm over the Netherlands : *Toon Moene and Ben Wichers Schreur*. 20 mins
- 11:55. Numerical modelling and HIRLAM in the Russian State Hydrometeorological University : *Katherin Kourzeneva*. 15 mins

12:15-12:30. General Matters and wrap up. Project Leader

- 12.15 Meeting Programme for 2003 (Project Leader)
- 12.20 General views on the organisation of the meeting. (Staff).
- 12.25 Any Other Matters.

12:30. Close of Meeting.

12:30-13:30. Lunch

List of participants

- 1 Eric Bazile, Meteo-France, CNRM/GMAP/PRO
 - 2 Javier Calvo, Instituto Nacional de Meteorología
 - 3 Gerard Cats, KNMI
 - 4 Per Dahlgren, SMHI
 - 5 Kalle Eerola, FMI
 - 6 Reima Eresmaa, FMI
 - 7 Carl Fortelius, Finnish Meteorological Institute
 - 8 Jose A. Garcia-Moya, Instituto Nacional de Meteorología
 - 9 Dominique Giard, Meteo-France, CNRM/GMAP/PRO
 - 10 Stefan Gollvik, SMHI
 - 11 Colin Jones, Rossby Centre/SMHI
 - 12 Simo Järvenoja, FMI
 - 13 Heikki Järvinen, FMI
 - 14 Marko Kaasik, University of Tartu
 - 15 Mikko Alestalo, FMI
 - 16 Markku Kangas, FMI
 - 17 Janne Kotro, FMI
 - 18 Katherin Kourzeneva, Russian State Hydrometeorological University
 - 19 Magnus Lindskog, SMHI
 - 20 Andres Luhamaa, University of Tartu
 - 21 Peter Lönnberg -
 - 22 Ivar Ansper, EMHI
 - 23 Aidan McDonald, Irish Meteorological Service
 - 24 Lars Mueller, SMHI
 - 25 Kristian Mogensen, Danish Meteorological Institute
 - 26 Aarne Männik, University of Tartu
 - 27 Sami Niemelä, University of Helsinki
 - 28 Martin Ridal, SMHI
 - 29 Ernesto Rodriguez, Instituto Nacional de Meteorología
 - 30 Laura Rontu, FMI
 - 31 Rein Rõõm, University of Tartu
 - 32 Kirsti Salonen, FMI
 - 33 Bent Hansen, Sass Danish Meteorological Institute
 - 34 Hannu Savijärvi, University of Helsinki
 - 35 Ben Wichers Schreur, Koninklijk Nederlands Meteorologisch Instituut
 - 36 Anastasia Senkova, Russian State Hydrometeorological University
 - 37 Pilvi Siljamo, FMI
 - 38 Han The, KNMI
 - 39 Priit Tisler, FMI
 - 40 Frank Tveter, Norwegian Meteorological Institute
 - 41 Per Undén, SMHI
 - 42 Ole Vignes, Norwegian Meteorological Institute
 - 43 Tomas Wilhelmsson, SMHI
 - 44 Hans Xiang-Yu Huang, Danish Meteorological Institute
-