Report from the HIRLAM Management Group Visit to met.no 26-27 May 2003.

Introduction.

In the programme of regular visits to member institutes, the HIRLAM MG spent these two days at the Research Department of the Norwegian institute. The first day was used for presentations and demonstrations of HIRLAM related work. The Management Group held its own MGM(5) the following day (see separate Report on HEXNET), but there was also a discussion session with the met.no Research management (see separate report on HEXNET).

Presentation by the Management Group.

The Project Leader and the three Area Leaders spent an hour and a half on presenting certain parts of the plan and recent progress. Per Undén talked about the priorities and motivations in the HIRLAM Memorandum of Understanding and then the main points of the Scientific Plan. The work on the NH model is particularly difficult, both from the point of resources and the way forward. There is not enough resources to make the complete overhaul as envisaged, rather will it be directed to the most important areas. A novel development is the detailed proposal for the lead centre on the Regular Cycle with the Reference system (RCR) at FMI, just negotiated between the Project Leader and FMI. This will focus the attention on the Reference system and will provide near real time products for monitoring.
Heikki Järvinen reviewed the priorities for the Observation usage. First, one should not forget that the utilisation of conventional data can be improved (e.g. better selection or more data that are not yet used). For the data that are used one needs to tune the system. For non-conventional data, the priorities are on implementation in the Reference system of scatterometer, AMSU-A and Doppler radar wind data. With the implementation goes self contained package support for monitoring, data selection and tuning instructions. Monitoring results should be exchanged. Radar data are of high (horizontal) resolution (for radial winds) and are important for quickly developing systems. Superobservations are used from the radial winds. The radial winds are taken at low elevations to reduce influence of vertical velocities. The VAD technique give on the other hand a vertical resolution but are averaged over a larger horizontal area. Work in the area has been to take into account the broadening effect of the beam with distance and also the refractivity through Snells law,
Xiang-Yu Huang reviewed the Data Assimilation algorithmic part. First, there is only a low level of activity in the 3D/4D-VAR development. There are refinements to 3D-VAR on their way.
Most of the person months are actually in the surface assimilation part. At INM new structure functions have been derived for the 2m analysis and good impact found. The snow OI analysis has been developed. Furthermore, the 2D-Variational soil analysis from Météo-France has been implemented.
Hans then went into some aspects of the 3D/4D-VAR (upper-air) analysis. There is work on tuning the B (background error) matrix. QC aspects will have to be considered. The NMC method will be superseded by an ensemble assimilation method. The index field will be implemented. The humidity background constraint is difficult because of the non-Gaussian distribution. The work of Elias Holm at ECMWF will be followed. 4D-VAR will be possible to run about twice as fast with the semi-Lagrangian code. On the other hand, in the future more advanced physics will be used. The (multi-) incremental method will also be implemented.
Colin Jones described recent developments of the CBR turbulence scheme. In the stable regime the length scale is depending on the TKE itself and stability. The dissipation is also depending on the length scale, so the TKE can quickly fall to very low values. Colin described the evidence for both internal gravity waves and non-linear effects of averaging local instabilities not accounted for. Parameterisation for these two effects, mainly for momentum is added in the stable regime and counteracts to some degree the rapid decrease of TKE with high stability. The effects improve the verifications in the free atmosphere and reduce the bias of pressure significantly. The only slight negative effect is a little increase of the positive postprocessed 10 m wind bias. (This may be due to other problems, e.g. the value of the roughness length.)

Also the moist version of CBR is now available. It provides a moist adiabatic profile when saturated and gives less drizzle.

Presentations by met.no Research staff.

The main HIRLAM areas of research at met.no were then presented.

Finite volume calculation of vertical velocity in HIRLAM by Astrid Holstad.

It has been observed for a long time that the vertical velocities at 10 km resolution over e.g. Norway have been large and show strong variations. Ivar and Astrid have investigated the possible reasons and alternative ways of computation. The Reference method is sensitive to errors in the pressure gradient which accumulate through vertical integration. Nor is the method mass-conservative. By using a transformed variable, the continuity equation can be integrated using finite volumes. In order to arrive at a monotone scheme, a non-linear representation (Koren upwind) is used. Still the method is not more expensive than the Reference and the results look hopeful. (The calculations shown displayed vertical velocities not very different from the Reference, except in a few places).

Transparent boundary conditions for a simplified 3D-model by Ivar Lie.

The HIRLAM work for transparent B.C. is currently done following two complementary approaches. Both solve the same problem and the eigenvalues are the characteristics of the hyperbolic system. The mathematical principle is to prescribe at inflow, but not at outflow. The B.C. are solved through augmenting the equations and using a soft constraint and finite volume approach. A simplified 3D-system will be used for demonstration. The implementation will be with finding the characteristics through iterative solvers. A real problem, here as in all B.C. work, are the corners, where it is not at all obvious what to use.

ATOVS activities at met.no by Harald Schyberg.

The ATOVS usage over ice is under development. Use of HIRS data has been developed, and this work has been done largely by Vibeke Wauters Thyness. The use of locally received data and the EARS (retransmission) data has been worked on by Frank Tveter.
HIRS data have been extracted through AAPP. Cloud detection is done with the French MAIA package. Data are used over ocean only. RTTOV-7 was needed because of IR emissitivity included. The bias correction was adopted and the interface to HIRVDA. The moisture channels 10-12 are the interesting ones, since the temperature ones are somewhat redundant (with AMSU-A). The problem is that only cloud free or almost cloud free pixels can be used, as otherwise the errors are to large. An impact study with up to 20% cloudiness for data selection was performed, but the impact was very small. It was commented that perhaps dedicated verification methods would have to be used to show impact e.g. of short range (background) forecasts and over the oceans.
Other developments are in the IOMASA project with AMSU-A over ice and in collaboration with SMHI, DMI and other institutions. The Artic area is of interest because of lack of other data. The ice edge information from the Ocean Sea ice SAF will be used. First year and multi-year ice are important to distinguish due to different emissitivity.

Limited Area EPS with HIRLAM by Inger-Lise Frogner.

Targeted EPS (TEPS) had to be re-run at ECMWF, for the particular area of interest. 20 ensembles at 0.25° were run. Perturbed HIRLAM analyses are used for initial data and perturbed forecast data are used for the boundaries. Normal TEPS and evolved TEPS (including the evolved singular vectors) are compared, but the results have only been preliminarily analysed. Earlier results showed advantage for TEPS with HIRLAM for particularly high precipitation amounts. A case study for 25/9 1999 verifying against superobs from ECMWF showed advantage for LAMEPS. For October 2002, 9 days were run. The evolved singular vectors increase the spread and LAMEPS was better for the high precipitation amounts (but not for the low ones).

Status for QuikScat winds at met.no by Frank Tveter.

Two months of impact studies were done and one November 2001 showed positive impact whereas January 2002 was neutral. The impact is dominated by a few events. Plans are to use the non-quadratic cost function in outer loops of 3D-VAR and quadratic in the inner. A further impact study will be done and the two cost functions compared (their result is anyhow quite similar. The data are received with a 2-3 hours delay from NESDIS. The 100 km SAF products take only minutes to derive.

Operational experiences at met.no by Ole Vignes.

The large area uses 20 km resolution and 10 and 5 km models are run as well. The 10 km model used ECMWF boundaries instead of HIRLAM and this was reported to have positive effects. The model is practically 6.0.0 HIRVDA is to be updated to the latest. The asynchronous I/O is not operational yet, due to stability. Recent tests show stability but also less of time gain (computer OS more efficient?). The surface analysis was not particularly fast; OpenMP is inserted in some places and the SST switched off. The DIANA system allows visualisation of all fields and observations in many different ways and details. The soil freezing problem clearly showed up in Germany (on 27 March). The ground otherwise heats very quickly and latent heat fluxes seem large, but it is not clear that it is that unrealistic.
A separate demonstration was given later of the DIANA system, and it was shown to be very fast and versatile tool and it had recently been extended to research use and suits many purposes of monitoring and trouble shooting (apart from the normal operational production tools for general and aviation forecasting). Ole also showed a data base application for the ACMA files. All observation details from the last 6-7 months are in one data base and it is very fast to search and display observations, departures, flags and usage etc. It turned out on this occasion that PILOTs also reported off-time as TEMPs and should probably have the same non-FGAT treatment as TEMPs.

Experience from the cooperation with the UK Met Office on mesoscale modelling by Dag Bjørge.

The agreement was made in May 2002 between the two directors and is quite general and with a review in 2005. The UM should be run over southern Norway at 3 km with boundaries from the EuroLAM at the Met Office. There have been problems to receive these boundaries and so far only one case has been run. Currently boundaries from HIRLAM are adapted to the UM. The case shown had large wind direction differences compared with the 10 km HIRLAM, which looked similar to observations, but also large precipitation due to the large convergence.

Use of HIRLAM in ocean forecasts by Harald Engedahl.

A number of ocean models are run operationally, for a large area over the whole Artic at 20 km, and for smaller areas at 4 km. The Arctic area is planned to be run at 4 km. HIRLAM data are driving these models, but also ECMWF is interfaced, for longer runs. There is also a 300 m model for the Oslo fjord. The main product is the sea level forecast, but also particle tracks and search and rescue are important.

Ocean Sea Ice SAF products by Lars-Anders Berivik and Steinar Eastwood.

The SAF products are ice cover and SST and also fluxes of LW and SW radiation. The data used are SSM/I, QuikScat and NOAA16 and 17 AVHRR. SSTs are derived every 12h. Only cloudfree areas are available and no background used. The resolution is 12 km and the cloudmask is the one from the NWC SAF at SMHI. The ice edge is different because of the SSM/I data giving coverage each time.
Some impressive maps of SST and vortices were shown. The navigation error is up to 10 km. Large lakes also appear. In the future the AMSR instrument may be used.

General.

The MG thanked all the speakers for preparing and presenting their work and for the interesting results. There are a number of important areas worked on at met.no which are of priority to the Project.

Per Undén
4 June 2003