Report on HIRLAM management group visit to KNMI 9-10 January 2007

Jeanette Onvlee

Discussions with KNMI management:

From KNMI the following people were present: Gerrit Burgers (head weather research), Koos Verbeek (head product and process innovation), Fons van Loy (head operations), Reinout Boers (Climate research, head regional climate modelling), Bert van den Oord (head research information and observation technology), and Pier Siebesma (researcher). Fons van Loy was available only during part of the meeting, because of weather alert conditions.

Jeanette gives an overview of the goals, organization and plans of the HIRLAM-A programme. Gerrit Burgers (head research) then describes the weather research division at KNMI, and their main activities in relation to HIRLAM. High priority issues for the Dutch HIRLAM group are in particular the local implementation of a mesoscale HARMONIE version over the Netherlands, the continued development of mesoscale physics parametrizations, and participation in the HIRLAM short-range ensemble research activities. He ends with a series of questions on how the management group expects the non-hydrostatic HARMONIE and hydrostatic HIRLAM systems, and the relation with the ALADIN consortium to evolve. These are largely answered during the discussions later on during the meeting.

Two new divisions which have been formed in the recent reorganization of KNMI (November 2006) are the “product and process innovation (PPI)” and ”R&D information and observation technology (RIOT)” divisions. Koos Verbeek (head PPI division) presents the goals and organization of the PPI team, which is intended to bridge the gap between research and operational applications. Bert van den Oord (head RIOT division) suggests a number of areas in which people from his division could meaningfully contribute to HIRLAM, and this is then discussed in more detail. The HIRLAM management group indicates the great need for informatics expertise in many HIRLAM system activities. Increased computational efficiency and improved tools and methods for code development and quality control are goals towards which the RIOT group could perhaps contribute. In the latter context Bert asks if written requirements exist for the HIRLAM system, similar to the requirements documents that are written for e.g. the NWP SAF software. This is something that the management group should take under consideration.

Finally, Pier Siebesma presents the status of the joint KNMI/ECMWF/AROME activities on the development of an eddy diffusivity mass flux scheme suitable for use at mesoscales. The scheme is now close to the stage of implementation in a test version and extensive validation. Pier is wondering on how this implementation can best be arranged in a consistent manner for all parties involved, and asks how ALADIN, AROME and HIRLAM have agreed to organize and inform each other on code changes like this. Who is finally responsible for which code goes into the IFS system? This triggers an extensive discussion on the relations between ALADIN, AROME, HARMONIE and HIRLAM code and code management. The bottom line of the discussion is that we do not yet have a fully consistent and transparent way of code changement between the three groups, we are still finding our way there. In the mean time, the management group clearly should spend efforts in communicating frequently with the staff and member institutes on how the processes around, and responsibilities for, code management work and evolve.

Discussions with user representatives:

Present: Ton Donker (external relations manager), Frank Kroonenberg (duty forecaster), Rob Groenland (duty forecaster), Robert Mureau (developer)

Ton Donker gives an overview of the main external users of HIRLAM data, and the trends in their demands and needs. Most external users hail from government institutions, commercial weather bureaus or research institutes. Donker criticizes HIRLAM's licensing policy, which makes HIRLAM products relatively difficult to access and expensive. At KNMI, the tendency has been to increasingly offer general data product packages to users, rather than tailored products; this keeps data handling costs for the users at affordable levels. Nevertheless, HIRLAM faces a stiff competition from free model data from the US; usually these data are of lower quality, but for many commercial users (e.g. the weather presentation on Dutch television) the data price is a decisive factor. There is a growing demand for short-range probabilistic forecasts, and also for dedicated postprocessing (in particular downscaling) of HIRLAM as input for decision support systems. The representations of clouds is at present a weak point of the model, users would like to see improvements there.

Frank Kroonenberg relates the experiences of KNMI's duty forecasters with HIRLAM. The model's performance has greatly improved in recent years, and this has clearly increased the confidence that the forecasters attach to its products. In particular in cases of extreme weather they have learned to trust the outcome of the model. The description of stratus clouds in the lower boundary layer has clearly improved. A remaining problem is that thick stratocumulus in the model does not always disappear as quickly as it should. Also, although the model description of convective precipitation has improved, the model tends to over-predict precipitation amounts. HIRLAM post-processing products which are highly appreciated by the duty forecasters are vertical cross-sections, pseudo-satellite and pseudo-radar images, and pseudo-temps. At present, such products are created outside of the model; it will be relevant to include them in the internal HIRLAM post-processing (would save on maintenance costs).

The PM asks the KNMI staff what their priorities would be for improvements or extensions of the model. They unanimously assign first priority to the construction of a short-range EPS forecast system (24-36h ahead), as soon as possible. There is a strong demand for such probabilistic forecasts from both duty forecasters and external users, who in recent years have learned to use and appreciate this type of uncertainty information. Trond then describes the GLAMEPS plans and the timing, and explains that a distributed HIRLAM EPS system indeed is of high priority, but cannot realistically be expected to become available before 2008. Robert Mureau raises the matter of the resolution of the HIRLAM EPS versus the number of ensemble runs per day. There is no straightforward answer that can be given for this issue, which remains to be settled this year.

The KNMI user representatives welcome the opportunity of meeting with the HIRLAM management like this. They suggest, however, that in addition an international HIRLAM users meeting would be motivating and useful.

Discussions with KNMI staff

The HIRLAM project leaders each give a brief presentation on the status of the activities within their project, and the plans for the near future. Interspersed between these talks, there are presentations of KNMI researchers on both HIRLAM activities and related issues:

Ad Stoffelen describes the validation of Seawinds/Quikscat and the ongoing preparations for the more advanced ASCAT. Comparison of Quikscat data against HIRLAM and ECMWF analyses show that HIRLAM boundary layer wind direction are less in agreement with Quikscat than ECMWF; Ad

suggests that this apparent HIRLAM bias could be due to the tuning of the stress vector which is done within HIRLAM in order to improve the pmsl behaviour. For ASCAT, it now appears that with early retransmission delivery times of < 30m can be managed, so these data will certainly be available timely enough for HIRLAM. Ad participates in one of the expert groups which are now deliberating on the instrumentation for a post-EPS mission. He briefly mentions the concerns for an operational follow-up for ADM/Aeolis (>2012), as such an instrument does not fit on operational satellites such as METOP.

Bart van den Hurk describes the sequence of EU projects that he has been involved in, aiming at the development of a land surface data assimilation capability. In the ELDAS project, offline 2D-VAR soil moisture assimilation schemes have been developed and tested. In the follow-up project GEOLAND, a more extensive description of the carbon cycle was achieved, involving the assimilation of e.g. leaf area index (LAI), and including a more sophisticated modelling of biological components and photosynthesis aspects in the land surface model. At the moment, a proposal is in preparation for a second follow-up, GEOLAND2. In GEOLAND2, the focus will be on the construction of a demonstration system, which can ingest relevant surface observations like soil moisture and LAI, and show the impact of assimilation of these data in an NWP model. The aim is to use for this purpose an offline surface assimilation scheme with a two-week assimilation window. Bart has been involved in the initial phases of the GEOLAND-2 proposal, but now this has been taken over by Han The and Sander Tijm.

John de Vries presents his work on the assimilation of Seawinds/Quikscat observations. He has made adaptations to the screening of the data (removal of land and sea ice contamination), and been tuning the variational quality control. His experience is that rejections in the middle part of the Quikscat swath usually occur close to dynamical systems, so should be treated with care. Rejection rates typically are 2-3%, except for the central part of the swath, where they increase up to 8%. The impact of the Quikscat data on the HIRLAM analysis are generally positive over the ocean, but sometimes negative over land. The impact on HIRLAM forecasts is neutral for short lead times, and becomes slightly negative beyond +18h. At high wind speeds, there is a systematic difference between Seawinds and HIRLAM wind speeds. John is now performing experiments over longer periods and case studies, and is working on the implementation of Quikscat assimilation in the HIRLAM beta-suite.

Wim de Rooy describes some of the deficiencies in the present cloud scheme, which have led him to make adaptations in the description of detrainment. In his formulation, detrainment is sensitive to both cloud layer height and environmental conditions. Tests of the performance of the adapted cloud scheme against the STRACO and KF-RK schemes show that the new scheme gives better results.

Gerard Cats and his new post-doc, Bastiaan Jonkheid, have recently begun work on lateral boundary conditions (LBC). They aim to search for a formulation of the NH dynamical equations which express the LBC explicitly (complementary to the transparent LBC approach of Aidan McDonald). Also, Gerard would like to study the feasibility of applying McDonalds method in a spectral framework. Mariano wishes to discuss these plans in more detail in the coming meeting of the dynamics staff in Madrid.

Gert-Jan Marseille presents simulation experiments that he has carried out for the ADM/AEOLIS mission. ADM is expected to be launched in October 2008. The instrument produces 3D wind information, in the form of averages over 50km-wide bins along a 200km wide track. Observation system simulation experiments (OSSE's) for ADM are being prepared by NCEP; Gert-Jan has been working on a different simulation approach (SOSE), which is more tailored to simulate specific (extreme) events. He describes some SOSE results for ADM.

Iwan Holleman, recently appointed as the programme manager of the EUMETNET OPERA program, sketches the main developments within OPERA, and their plans for the new program OPERA-2. The

highest priorities for OPERA for the coming years are to increase the availability of radar data (including full volume data), and to improve the homogeneity and quality control of radar data throughout Europe. An OPERA data hub has been set up at the MetOffice. The timely processing and distribution of volume data is an issue which is now being addressed. Iwan asks if HIRLAM is interested in having the OPERA European radar composite (see e.g. www.meteox.com) available for validation purposes? If so, they can request a (free) license for these data (deadline: 31 March).
Nils raises the problems encountered by HIRLAM staff working on assimilation of radar winds, in the ways in which data from different radars need to be processed before they can be assimilated. For some radars, for example, wind information is not properly de-aliased on-site. Nils asks whether it would be wise for HIRLAM to develop its own common radar preprocessing software, and if so, what should be contained in it. Iwan replies that dealiasing can better be done on-site for each individual radar; actually most European radars are already using adequate algorithms for that purpose, and those that do not (e.g. Finland) are expected to follow suit soon. Superobbing and thinning of data could be done either centrally by OPERA, or within HIRLAM itself. The latter is probably the most flexible.

Geert Lenderink describes the 30-year downscaling runs he has made with the KNMI regional climate model RACMO. RACMO is based on the HIRLAM semi-Lagrangian dynamical core (version 5.6), and ECMWF physics (cy23) with some modifications (mostly soil). He has run the model at 6 and 12km resolution, with both observed (satellite) and climatological SST values at the bottom boundary. The choice of SST made a clear difference in the outcome of the simulations. The model generally produces strong precipitation over sea and the IJsselmeer, but it rains out too quickly in coastal regions, i.e. the rain does not penetrate far enough inland. Extreme precipitation is underestimated.

Frans Alkemade shows some of the experiments which he has done with the Bayesian Model Averaging algorithm on the PEPS ensemble. Jan Barkmeijer outlines his work on deriving HIRLAM singular vectors, and some of the complications which he has encountered there with the tangent linear model used in the HIRLAM 4D-VAR. Trond Iversen is highly interested in the work of both Frans and Jan, which he expects to be very useful in the context of the development and calibration of GLAMEPS.

Finally, Henk Eskes describes the plans of coupling HIRLAM to the atmospheric chemistry models that are being developed in his group. KNMI disposes of two air chemistry models: the French model Chimere, and the Dutch model LOTOS/EUROS. Chimere is more detailed in its vertical description, LOTOS/EUROS is an Eulerian transport model which contains more relevant aerosol (inactive) components. It is intended to first realize a simple one-way coupling: use HIRLAM-11km (and later the higher resolution HARMONIE) as input to Chimere and/or LOTOS/EUROS, and validate the forecasts of the chemical model to air quality observations.
The HIRLAM management group notes that there are similar efforts ongoing in other HIRLAM countries (e.g. FMI, met.no), and asks if the KNMI staff involved is in touch with scientists in those institutes. That is not the case. The management group will take it upon itself to bring the researchers involved together, to learn from each others' experiences and to determine a coherent action plan.

At the close of the meeting, the management group thanks KNMI for its hospitality, and expresses its gratitude for having been given ample opportunity for discussions and exchanges of views with KNMI HIRLAM staff, management and user representatives. The meeting has been both informative and fruitful. The management group has much appreciated the work presented by KNMI staff; several follow-up actions will be arranged to ensure that these activities are optimally integrated into the HIRLAM plans.