

# Status of the Reference System

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## 1 Recent HIRLAM releases and status of the reference RCR

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On September 2, 2008, the latest official HIRLAM forecast system, Hirlam-7.2, is released, featuring 4D-VAR upper air data assimilation scheme. 7.2 also adopts the Kain-Fritsch Rasch-Kristjansson condensation scheme and tuning in the vertical diffusion scheme (including removal of turning of the surface stress vector by several alternative methods). In addition, there are changes in data assimilation, such as an update in the ATOVS data assimilation module and the implementation of RTTOV-8 library for satellite data assimilation, updates in background error statistics data both for screening and for minimization; and an update of the bias correction data.

Several code updates were carried out for trial versions of the Hirlam-7.2 during the extensive pre-operational tests and validations on both ECMWF and FMI computer platforms. Validation results with 7.2 have demonstrated an overall improvement in forecast quality compared to previous versions, such as a general and persistent reduction of the random errors of the surface pressure and in upper-air fields. The biggest improvement is found in the relative humidity, for which the earlier large wet bias near the jet stream level is gone, and the dry bias of the lower troposphere is reduced. Systematic changes in the weather parameters tend to be small. The new version gives a little lower night-time wind speeds, thus reducing to some extent the long-lasting positive bias. By contrast, although precipitation forecasts are improved in terms of standard deviation, the frequency of weak rainfall occurrence is clearly overestimated in Hirlam 7.2. This weakness is a target for improvement in the forthcoming version, Hirlam-7.3.

## 2 Development of the HIRLAM meso-scale forecast system HARMONIE

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On June 19, 2008, the latest HARMONIE “reference” system, 33h1, is released. The system is based on IFS/ALADIN Cycle 33t1 with HIRLAM extensions, mostly in scripts and utilities. Harmonie 33h1 enables surface and upper air data assimilation for a few selected model domains at typical “synoptic” resolution. A HIRLAM-RCR equivalent domain as defined with polar stereographic projection, is also included, enabling future parallel studies between HIRLAM and HARMONIE systems.

With 33h1, the framework for a complete meso-scale HARMONIE forecast system is taking shape. The system includes source codes, scripts, common utilities and documentation. Among them, the mini-SMS script controls full NWP suite for build, data preparation, analysis and forecast cycling, post-processing and archiving.

Currently, user instruction and other system documentation are mainly available in the form of an online wiki on [hirlam.org](http://hirlam.org).

It shall be emphasized that, in contrast to the reference HIRLAM system, the present reference HARMONIE is still at a quite preliminary stage. It is felt that the definition of a reference HARMONIE configuration will remain a challenge for the foreseeable future. With HARMONIE, we face many “degree of freedoms” about model domains, resolution, boundary coupling models and strategies, different options in data assimilation, surface coupling, dynamics, and last but not least, physical parameterisations. Due to an overall lack of experiences with most of the HARMONIE components (data assimilation, boundary coupling, surface coupling, dynamics, physics etc.), our ability to evaluate and tune a certain HARMONIE system version is still quite much limited. Therefore, it is of great importance that the HARMONIE community continues to keep a tight cooperation in the common research and development efforts, including sharing of operational experiences and monitoring information.

***Reference system upgrade plans***

Hirlam 7.3 is in preparation and targeted for release early 2009. Hirlam 7.3 is to feature

- Assimilation of observation data from more satellites (NOAA17/18/Metop) with AMSU-A over sea and ice, AMSU-B/MHS over sea, Seawinds, and Meteosat AMV-wind, OSI-SAF SST and ice;
- Updates in the Rasch-Kristjansson parameterisation scheme using SMHI adaptation of the CAM3 code, which has been shown to overcome previous KFRK over-prediction for small precipitation events;
- Several code optimisations to improve on computational efficiency of 4D-VAR minimisation. This includes separate configuration of extension zone in 4D-VAR for Jb term and for adjoint and tangent linear codes, removal of redundant FFT computations with nonlinear trajectories and improvement on 4D-VAR minimisation scalability by the introduction of the OpenMP option and “halo zone on demand” in Semi-Lagrangian swapping;
- Some additions and improvements on technical aspects (including items on system overhaul), and for non-default components.

An alpha version will be tagged within short, to provide the development community the system basis for evaluation and validation. It is unclear, at the current stage, whether the ongoing work in newsnow development branch would enable an introduction of the modified surface parameterisation scheme into Hirlam-7.3.

For the meso-scale forecast system, releases of Harmonie-35h1 is scheduled before the end of year. 35h1 will among others, include the previously missing component (PGD) to build climate data related to HARMONIE surface scheme using SURFEX, making the HARMONIE system an complete one for a single computer platform.