

Status of the Reference System

Xiaohua Yang

Recent HIRLAM releases

The current official Hirlam system release is version 7.0, released on May 2, 2006. According to the agreement between the HIRLAM programme and the Finnish Meteorological Institute, the official release of Hirlam 7.0 coincides with the upgrade of FMI's operational NWP suite, the RCR (Regular Cycle Run of the Reference Hirlam). Technically, RCR version 7.0 at FMI is based on Hirlam version 6.4.4, but the meteorological features of version 6.4.4 are equivalent to those of 7.0.

Prior to the official release of 7.0, two technical releases have been made in the past two months. On March 9, 2006, HIRLAM 7.0 beta 1 was released. This release is the first of its kind in the HIRLAM-A program after the adoption of a new release numbering scheme, in which the release numbering has been designed to reflect more clearly the status of the release: an unstable version of release for beta testing, as a release candidate or bug-fix; or an official, stable version suitable for operational use. 7.0 beta 1 is a technical beta release with as its main feature the replacement of the CVS revision control system by its upgrade, Subversion. A Hirlam Subversion repository has been established on HIRLAM's system server at DMI. Subversion is to some extent an upgrade of CVS, therefore bearing many similarities with CVS. On the other hand, for normal HIRLAM developers, the implied change due to the upgrade of the revision control system is considered to be minimal.

On April 18 2006, HIRLAM 7.0rc 1 was released, as the release candidate for the official version, 7.0. The main technical feature of this release is the removal of the revision control feature from the standard script-set. This is a first step toward a more rational use of the revision control feature in the HIRLAM system. The change increases the portability of the HIRLAM system, due to the fact that there are now several alternative options for users to access the HIRLAM source code.

Hirlam 7.0

Hirlam 7.0 has been released on 2 May 2006. Compared to the previous official release 6.4, the main features that are of meteorological significances are as follows:

- A modified model coupling. A re-forecast procedure has been introduced, following practices used in DMI, met.no and KNMI. The purpose of the re-forecast procedure in the HIRLAM synoptic-scale operational system is to utilize late-arriving, high quality ECMWF analyses and forecasts to improve short-range forecasts for the previous cycle, so as to improve the quality of the background fields, especially in terms of representation of large scale features;
- A reduction of scaling for the specified background error statistics so that effectively less weight is given to observation in 3D-VAR minimization;
- Assimilation of ATOVS AMSU-A data;
- Revisions to stomatal resistance, and a revised leaf area index with seasonal dependence;
- Other technical changes. Among them, the changes needed to adjust to the increased vertical resolution in the ECMWF model.

In addition, version 7.0 contains a series of important code and script improvements and bug fixes for the 4D-VAR scenario, so that 4D-VAR assimilation scheme now becomes a realistic option, albeit non-default.

From the meteorological point of view, a validation study of versions after 6.4.4 for two winter months, Dec 2005 and Jan 2006, and two summer months, July and Aug 2005, conducted at ECMWF, has demonstrated a clear advantage, in terms of root-mean-square scores of almost all key parameters, when compared to the equivalent results for 6.4.1 (the de facto official release 6.4). At FMI, a real-time, pre-operational RCR beta-suite based on 6.4.4 has been running and monitored daily since March 2, 2006. The verification of this beta-suite compares favourably against the operational suite based on 6.4. This is particularly obvious in field verification of surface pressure forecasts. Note that the performance gain of the FMI-RCR with the new suite is partially to be attributed to a corrected optimization setting for the FMI HPC platform.

Outstanding problems, bugs

- On ECMWF-ecgate, the start-up compilation sometimes crashes but it normally manages again after more tries. This is believed to be associated with the Fortran compilers at the ECMWF-IBM platforms.
- There is an apparent forecast module reproducibility problem, which shows up in various aspects. It has been observed that model results vary, to various degrees, depending on the hardware platform, the selected optimization level, the number of PEs, domain decomposition, etc. Users are encouraged to report problems and share experiences on the developers forum dev@hirlam.org. For operational centers, it is highly recommended to perform a platform equivalency test between the reference ECMWF-IBM platform and the local super-computer platform, and between various configurations on local platforms. Please also share your results with the community.

Plans for Reference System releases in 2006

A series of beta releases for HIRLAM 7.1 is prepared following the official launch of 7.0. The official launch of 7.1 is targeted for the second half of 2006 (November). The main components to be considered will be, (in the order of assumed priorities):

- Configuration: Increased model resolution in both horizontal and vertical, (0.15 degree and 60 levels);
- Physics: Revised snow and forest scheme
- Physics: Tuned turbulence and condensation schemes in connection with introduction of moist CBR
- Assimilation: 6 h assimilation interval
- Assimilation: Statistical balance structure functions for 4D-VAR and 3D-VAR
- Assimilation: Sea ice and SST analysis using OSI-SAF data
- Observation data use: Quikscat; AMV wind; surface SYNOP data (10 m wind (whitelist) + 2m RH)
- Physics: Recoded physics
- Assimilation: 4D-VAR, upon a positive meteorological validation and technical feasibility evaluation.

Note that some of the above candidates are still under development and not all of them may be ready by the targeted time of release. A decision can be made at the earliest after the summer.

Recent news in the System and Applications Area

- **Investigation of RCR quality, platform equivalency, code reproducibility.** The quality of the RCR has been on top of the agenda from the start of the HIRLAM-A. Recent parallel

studies revealed a significant gap between the meteorological quality of the RCR and several member service operational models, in terms of averaged observation and field verification scores. The deficiencies of the FMI-RCR suite using HIRLAM 6.4 became especially apparent when the obvious inequivalency of the RCR results on the FMI-SGI platform and on the ECMWF-IBM platform was detected. Further dedicated investigations suggest a strong sensitivity of the forecast code on the optimization options used at the FMI-SGI ALTIX1 platform, but also in general some code reproducibility problems in several aspects. The investigation of these aspects is ongoing. An active participation by staff at member services in this investigation will be highly desirable.

- **hirlam.org.** A top-level internet domain, hirlam.org, has been acquired. The move has been taken both for convenience of use and for increasing the visibility of the HIRLAM programme. It is planned to be used as the official internet address for applications such as the official HIRLAM web site www.hirlam.org (unlimited access), the HexNet (<https://www.hirlam.org>), mailing list, etc.
- **the HIRLAM system wiki webpage system.** "wiki" means 'fast, fast webpage' and it is a special kind of webpage featuring easy and simple editing function, and it is especially desirable for a software project like HIRLAM to engage as many as possible the staffs to contribute to the web-content. Currently, the HIRLAM wiki page is mainly designed for usage in system area, in connection with the setup of the Subversion repository.
- **HIRLAM mailing lists.** A web-based mailing list facility has been set up on HIRLAM's new server at DMI. The primary purpose of the mailing lists is for ease of communication and archiving. The facility currently consists of a number of easy-to-remember mailing aliases such as announce@hirlam.org (for programme news and announcements), operational@hirlam.org (for discussion issues on operational models), or dev@hirlam.org (for discussing issues related to HIRLAM releases).
- **Recent hot topics in HIRLAM mailing lists.**
 - <https://hirlam.org/pipermail/operational>
 - Characteristics of the monthly averaged surface pressure bias in several HIRLAM operational centers
 - Use of bufr-format E-AMDAR data in operational suites
 - (In-)adequacy of using reduced vertical resolution from the ECMWF BC analysis and boundary
 - Risk of long spin-up at cool-start in data assimilation cycling
 - <https://hirlam.org/pipermail/dev>
 - Equivalency of running reference HIRLAM on ECMWF/HPCD(IBM) and on FMI (SGI)
 - Risk/Reliability of using high optimization level with HIRLAM forecast model in some platforms