

Reference System Status June 2003

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Main changes since November 2002

The current official release is version 6.1.0; the latest β -release is version 6.1.1. Since the previous Newsletter, number 42, November 2002, which describes version 5.2.2, the following changes have been implemented:

- Version 6.0 (10 March 2003) is the first official HIRLAM release where the 3D variational data assimilation scheme replaces the optimum interpolation method for synoptic scale extra-tropical model configurations.
- Version 6.1 (3 April 2003) is essentially the same as 6.0, but running on ECMWF's IBM instead of Fujitsu.
- Version 6.1.1 (β -release) introduces revisions to the convection and turbulence schemes, a modified Raymond filter for orography, revisions to the soil scheme and a modified algorithm for the generation of climate files with global coverage and usable for resolutions down to 2.5°. It also corrects a nasty error in the climate generation system, which has its origin in version 5.2.2.

The modification in the convection scheme (STRACO) improves the model produced precipitation in general, in particular for convective situations. It is also intended to improve the vertical distribution of heating and moistening. The modifications in the turbulence scheme (CBR) increase mixing of momentum in vertically stable situations and thus maintain higher TKE values in stable conditions.

A new explicit treatment of the effect of soil moisture freezing and thawing in the soil scheme (ISBA) has been implemented. Its effect is described by Parodi *et al.* (this issue).

- Several coding errors were corrected:
 - In 5.2.3, an error in the surface analysis scheme, if applied in 3-hour cycles, was corrected.
 - In 6.0, the climate data files were corrected. However, the software to use these new files still contained an error, which was not corrected until 6.1.1.
 - Also in 6.0, the temperature limits for the occurrence of sea ice were corrected.
 - An error in the SYNOP redundancy check was corrected, again in 6.0.

Detailed description of the changes

Version 5.2.3 (25 November 2002)

Ray McGrath discovered that in case of 3-hours analysis cycles, the surface parameter scheme did not find the history of soil variables. Beatriz Navascues wrote:

As a consequence the soil moisture analysis increments will be higher and will present a diurnal cycle. This feature will happen in mid latitudes and in

summer time (when vegetation coverage is high enough, the soil moisture is far below saturation and then soil moisture analysis is active).

The solution is to run 6-hours cycles for the surface parameter analysis scheme, irrespective of the cycle length of the upper air analysis.

Version 6.0.0 (10 March 2003)

This is the approved, official, release of 3DVAR as the reference data assimilation scheme. Meteorologically, hence, 6.0.0 is to a large extent equal to 5.2.3. Yet, a number of coding errors had to be corrected, some with meteorological impact:

- *New land-use data in the climate generation system.*
Han The provided new data sets, which were introduced into the reference system at ECMWF on 18 February 2003. The older files have been kept, so if you insist on using erroneous files, you still can. For this, the script `Climate` was changed. If `CLIMATE_VERSION` is set to 5.2.3 it will access the wrong files. (Note that a coding error in the software to process the new files lead to wrong climate fields; this error was corrected in 6.1.1).
- *Too much sea-ice in the surface parameter analysis scheme.*
A coding error in the test whether a point was near the coast or inland led to treat open sea as coastal, in the application of the temperature limits for sea-ice.
- *SYNOP redundancy check in parallel implementations:*
Kristian Mogensen corrected a bug in the SYNOP redundancy check in the HIRVDA code, which resulted in incorrect counting when the data is collected from all processors.
- *Accumulation of budgets, and postprocessing.*
With the introduction of ISBA, several inconsistencies in budget accumulation and postprocessing were introduced. Laura Rontu corrected a number of them (if not all).
- *Several technical changes.*
These affect efficiency (e.g. asynchronous IO, treatment of lateral boundary files, streamlining of the verification package); or they improve the user interface. A few correct errors in particular configurations, e.g. when running a self-nested system.

Version 6.1.0 (3 April 2003)

This (official) version was introduced merely to make sure that the default system (which is the latest official release) at ECMWF would run on the IBM, and not attempt to run on a Fujitsu. Some changes (e.g. to remove syntax errors discovered by the IBM compiler) may be useful for other configurations.

Version 6.1.1 (2 June 2003)

- *Revisions to STRACO.*
Bent Hansen Sass wrote: Modification of the previous scheme (1999) has the primary purpose of improving the model produced precipitation in general, in particular for convective situations. It is also intended to improve the vertical distribution of heating and moistening.

- *Revisions to CBR.*
Colin Jones wrote: The turbulence modifications increase mixing of momentum in vertically stable situations and thus maintain higher TKE values in stable conditions. This results in an improved overall dynamical structure of the model atmosphere. The RMS errors of MSLP, and geopotential height are reduced, biases in MSLP and free tropospheric wind speeds are also generally reduced. There is a slightly increased positive (hence worse - GC) bias in 10m-wind speed as a consequence of increased (downward) momentum mixing.
- *Revised subgrid-scale orography.*
Kai Sattler wrote: The new algorithm for determination of sub-grid orographic roughness $z0_oro$ includes a dependency on the grid spacing. This means that $z0_oro$ over mountainous areas will decrease when the grid resolution is increased. The impact on the meteorological results is expected to be minor on 20-25 km grids. On grids with higher resolution, the meteorological impact is expected to be modest. However, 10m-wind is affected over mountainous regions.
- *Raymond filter for orography.*
The orography is passed through a Raymond filter before it is used by the rest of the climate generation system and the HIRLAM forecasting system. After the Raymond filter, the grid points where the orography changed sign (including 0) due to the filter, the orography is reset to its original value, to avoid non-zero orography over sea and to preserve the shape of the Dead Sea (and some other areas below sea level).
Colin Jones wrote: The primary impact is disappearance of 2-delta x forcing of waves from the surface over orography. These are treated wholly incorrectly in semi-Lagrangian advection. If they are present one sees large (numerical) bulls-eyes in precipitation over mountain regions, this is clearly improved with smoothed orography.
- *Revised saturation pressure.*
Carl Fortelius wrote: The modification acts to reduce the saturation deficit driving the surface latent heat flux at temperatures below the freezing point, and removes a spurious equilibrium between a water cloud and the snow cover. The expected impact is a reduction of the winter-time surface latent heat flux and boundary layer relative humidity and cloudiness.
- *Several code improvements, bug corrections, etc.*