Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment

Assessing the quality of high resolution forecasts the HARP initiative

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The Hirlam Aladin R-based Packages (HARP) inititiative aims to improve the verification of meso-scale NWP models such as HARMONIE. Also, intercomparison and communication of results should be more convenient using a common data format and common verification tools. The code will be made freely available for use and distribution from the Hirlam `git` repository.

1. Introduction

Verification of weather parameters that have a large socio-economical impact but are highly localised is a challenging task, especially for high resolution, convection resolving models.

Some methods that try to resolve this include the use of e.g. radar data to compute Fractions Skill Scores (Roberts & Lean, 2008) and Structure, Amplitude and Location scores, (SAL, Wernli et al, 2008).

The HARP initiative tries to bundle some of these methods in a tool that is based on open source software, easily ported to various platforms and can be configured to handle any local data.

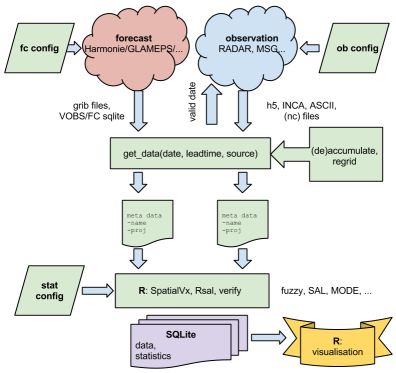

Figure 1: HARP concept

2. Framework: R, SQLite

The `R` statistics/scripting language is used as the main vehicle for the code base, as it is free, open source software, has a large and active developing community and is easy to learn, adapt and use.

Data is committed to SQLite databases, which are accessible from many (scripting) languages, and can be shared by e-mail, web or FTP.

Scripting can be done in Python, bash or any convenient scripting language.

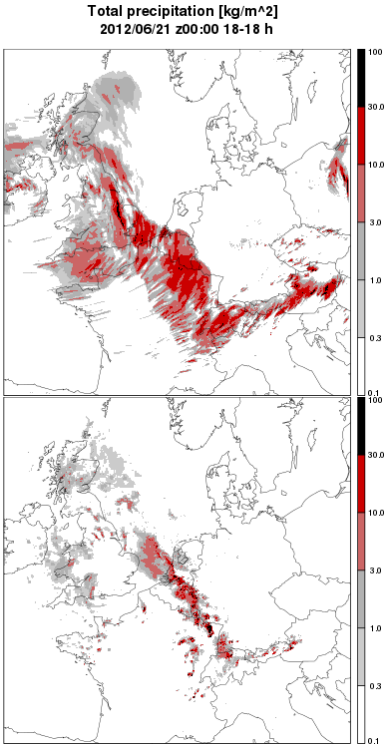

Figure 2: Sample Harmonie forecast (1h acc) and European composite radar image.

3. Data, methods

The input data that will be considered is for spatial data:

- `GRIB`: Hirlam, Aladin, Harmonie etc
- `INCA`: nowcasting analysis
- `hdf5`: standard for radar output (OPERA)

Data is subsequently regridded and masked to achieve one-to-one comparable arrays.

The verification methods used in the first version are primarily the FSS and SAL and some point-based methods. We aim to incorporate some new, experimental methods. As both `C` and `fortran` are easily integrated within `R` scripts, there is no immediate problem to include new code.

4. Preliminary results: FSS

HARMONIE vs Dutch radar

This example shows some results of a one month experiment over March 2013, where we compared two versions of Harmonie (the operational model, 8 analyses per day, 48 hour forecast on a 800 × 800 domain with a 2.5 km grid size, named `BULL`), a similar run using mode-S aircraft data in the 3D VAR analysis (named `MODES`) and hydrostatic Hirlam on a 11 km grid, 3D VAR. We use the three hour accumulated (non-calibrated) radar product to verify against.

We see a slight increase in skill in this largely dry month of Harmonie over Hirlam. Surprisingly, the mode-S data seems to deteriorate the forecast slightly for the first 12 hours leadtime.

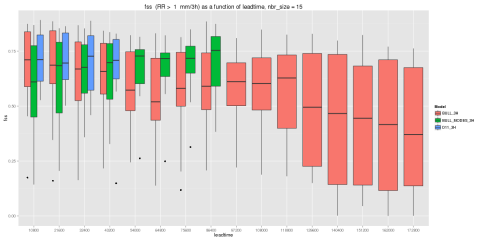

Figure 3: Fractions Skill Scores as function of leadtime (s) for Harmonie, Hirlam at KNMI

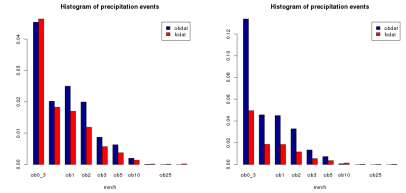

Figure 4: Histograms of 3 hour accumulated precipitation for MODES (left) vs Hirlam (right).

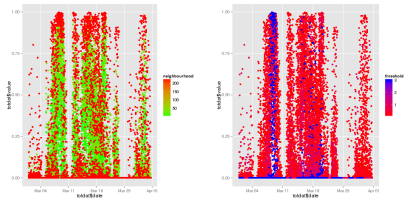

Figure 5: Time series of the FSS of the mode-S experiment coloured by area (left) and by threshold (right).

5. Discussion

HARP is under active development. A working version is available at `git@hirlam.org:Harp`.

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