

HIRLAM workshop on HIRVDA background error statistics Norrköping 2003-12-17 to 2003-12-19

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1. Objective of the workshop

To improve the knowledge about background error statistics for HIRLAM variational data assimilation within the HIRLAM community through direct work with the statistics software, through inspection and discussion of the output from this software and through single observation experiments with derived statistics files. Besides this practical work with the statistics software, there was also time allocated to some talks on background error statistics.

2. General remarks

A very valuable contribution to the workshop was due to the presence of Loïk Berre from Meteo-France, who developed a major part of the hirvda background error related software. During the workshop he gave a presentation and also practical support related to HIRLAM background error programs. It was very good as well to have such many HIRLAM participant, representing different expertices and practical experiences. Also Nedjelka Zagar from MISU in Stockholm and local SMHI participants provided valuable input.

The workshop got more people interested and started in the Jb topic, both on understanding and on practical work. It was also a good oppotunity to exchange information including data, codes and scripts. The experimental work was alternated with presentations of related research work. Some problems were identified and real work got started.

Important outcomes of the meeting were also discussions and coordination of HIRLAM working plans. It was agreed among the participants that more workshops of the same kind should be arranged in the future.

3. Urgent work after the workshop

There will be a number of urgent follows up efforts resulting from the workshop:

- Create and distribute a tar file with the latest updates for programs and scripts (Krisitian).
- Find reasons behind a noise problem noticed in the background error statistics when generating it from Swedish HIRLAM x data.

- Try other (e.g. DMI) dataset to confirm the source of the noise (Kristian and Bjarne) and investigate whether there are problems with the statistics software.
- Investigate the need of filtering?
- Finish the new structure function calculations using both smhi data and dmi data (Nils, Martin, Kristian and Bjarne)
- Try simobs with old and new structure functions (All)
- Try simobs in fgat and 4dvar environment (Hans and Nils)
- Try BGOS software (All)

4. Plans for background error statistics

The discussion was useful for identifying priorities with respect to background error statistics for the HIRLAM-6 2004 work plan. In addition to the urgent issues mentioned above, some points that were discussed are:

- New moisture variable for hirvda.
- A comparison different Jb formulations should be carried out.
- Investigate the pilot rejection problems related to the index experiment. (Magnus, Oct)
- One should consider generation of structure functions using the index field.
- Continue the work with ensemble structure function (Martin).

5. Participants

Loik Berre, Meteo France
 Magnus Lindskog, SMHI
 Nils Gustafsson, SMHI
 Martin Ridal, SMHI
 Per Dahlgren, SMHI
 Tomas Landelius, SMHI
 Nedjeljka Zagar, MISU
 Ole Vignes, met.no
 Xiang-Yu Huang, DMI
 Kristian Mogensen, DMI
 Bjarne Amstrup, DMI
 Beatriz Navacues, INM
 Sigurdur Thorsteinsson, IMO
 Toon Moene, KNMI
 Han The, KNMI

6. Notes from the workshop

Wednesday 17 December 2003

10.00 - 12.00 Presentations

Introduction - Nils Gustafsson

Statistics for the HIRVDA analytical and statistical balance background constraints: algorithms, software modules and scripts - Loik Berre

Scripts for graphical display of derived background error statistics - Ole Vignes

Some comments on background error statistics derived from SMHI HIRLAM x data - Sigurdur Thorsteinsson

13.00 -17.00 Work in subgroups with support from Loik Berre

Subgroups:

- 1) Sigurdur Thorsteinsson, Xiang-Yu Huang and Per Dahlgren
- 2) Ole Vignes, Nils Gustafsson, Toon Moene and Tomas Landelius
- 3) Bjarne Amstrup, Han The, Magnus Lindskog and Nedjeljka Brovic
- 4) Kristian Mogensen, Beatriz Navascues and Martin Ridal

Each group was assigned with one month HIRLAM-X data to compute structure functions using both analytical and statistical approaches.

Thursday 18 December 2003

09.00 - 10.00 Discussion of results from work in the subgroups

10.00 - 11.00 Continued work in subgroups

11.00 - 12.00 Presentations:

Experiences from INM with the HIRVDA analytical and statistical balance background constraints - Beatriz Navascues

Status of the HIRVDA sigma_b index field - Nils Gustafsson

Software and script for simulated (single) observation experiments - Kristian Mogensen

13.00 - 16.00 Continued work in subgroups

16.00 - 17.00 Discussions of results from work in the subgroups

17.00 - 19.00 Continued work in the subgroups

Friday 19 December 2003

09.00 - 11.00 Presentations

Online estimation of background error statistics and use of an Eady index field in HIRVDA - Magnus Lindskog

Background error statistics in Aladin 3D-Var and plans for the AROME project - Loik Berre

Theory and practical use of the software for background errors in observation space (BGOS) - Nils Gustafsson

HIRVDA priorities and HIRLAM-6 2004 working plan - Xiang-Yu Huang

A background error constraint for tropical assimilation - Nedjeljka Brovic

10.00 - 12.00 Continued work in subgroups

13.00 - 15.00 Final Discussions

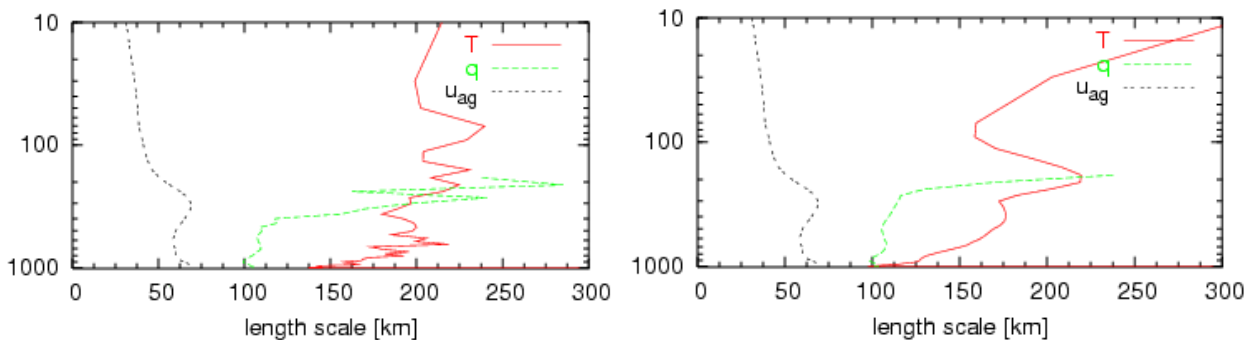
Results from the work in the subgroups

Conclusions for the future work

7. Comment written after the workshop

After the workshop I have tried to investigate the reasons for the noisy forecast difference statistics, obtained from the calculations during the workshop. One likely problem candidate is the extrapolation of forecast differences into the extension zone that is carried out in order to obtain a periodic variation in both horizontal dimensions. This is needed, since the forecast difference statistics are presently based on a spectral representation. In particular, since the forecast fields are quite noisy in lateral boundary relaxation zone (ongoing adjustments), it seemed to me possible that strong (unrealistic) gradients in this relaxation zone could be amplified through the extrapolation into the extension zone. In fact a GRIB truncation of 0.1 K in temperature could contribute to a further amplification of the noisy extrapolation.

In order to test this idea I simply put the forecast differences to zero in the boundary relaxation zone (the code was there already, but active only for the ageostrophic wind components). This has the effect that all extrapolated values in the extension zone will be zero. The result can be seen in the figures below, which show the vertical variation of the derived length-scales for temperature (T), specific humidity (q) and ageostrophic wind (u_{ag}), before (left) and after (right) my modification. The noisy lengthscales for T and q have a much smoother vertical variation after the modification.



The technique for extrapolation to the extension zone used for forecast difference statistics (used as background error statistics in 3D-Var) needs to be considered a bit further. If such an extrapolation is used, also the size of the extension zone will influence the derived length scales, and this is of course a bit arbitrary. Maybe the best solution is to force the forecast differences to be zero in the extension zone, and to take this into account via a re-scaling of the derived forecast difference standard deviations.

Nils Gustafsson