ALADIN/LACE Research and Development on Predictability in 2006

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Works have been done in 2006 for

Research Areas:

- Dealing with uncertainties in analysis
- Dealing with uncertainties in LBC
- Dealing with uncertainties in model physics
- Dynamical downscaling
- EPS post-processing
- Common EPS verification
- Development of ALADIN-LAEF

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Overview of EPS research in LACE countries

- Austria: Breeding, ETKF, ET, Blending, downscaling, LBC perturbation, physics perturbation and bias correction
- Croatia: ECMWF EPS downscaling
- Czech: ARPEGE EPS downscaling, ALADIN SV
- Hungary: ECMWF EPS downscaling, ARPEGE target SV, ALADIN SV
- Romania: from 1.1.2007 LACE member

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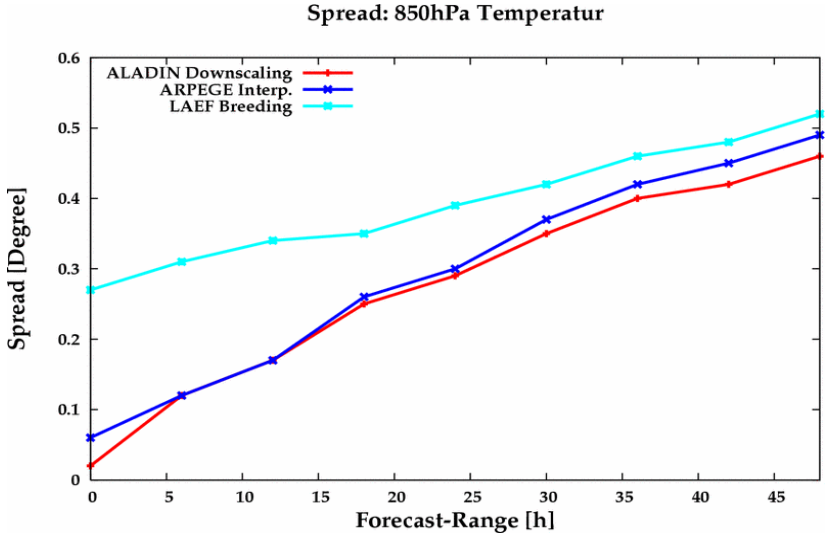
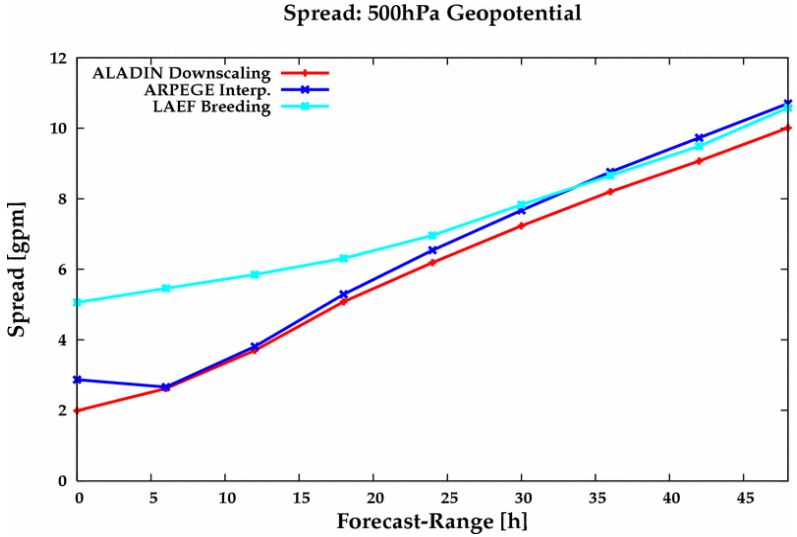
Dealing with uncertainties in analysis

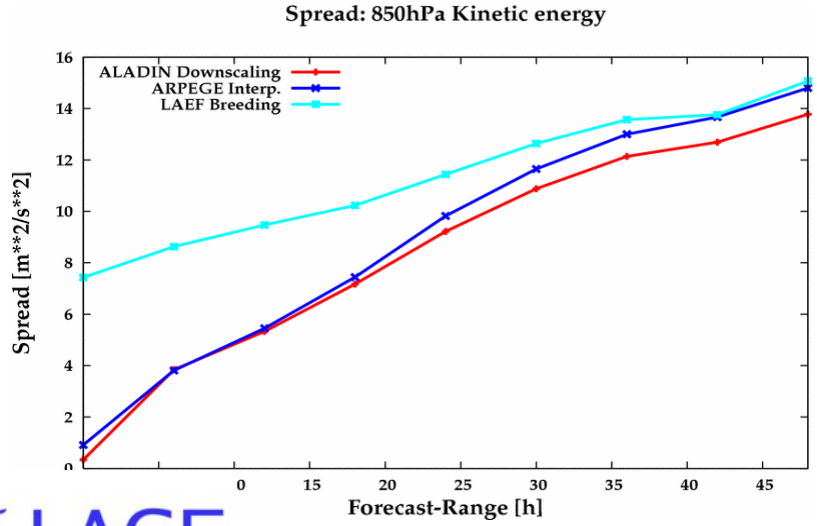
- **Breeding**

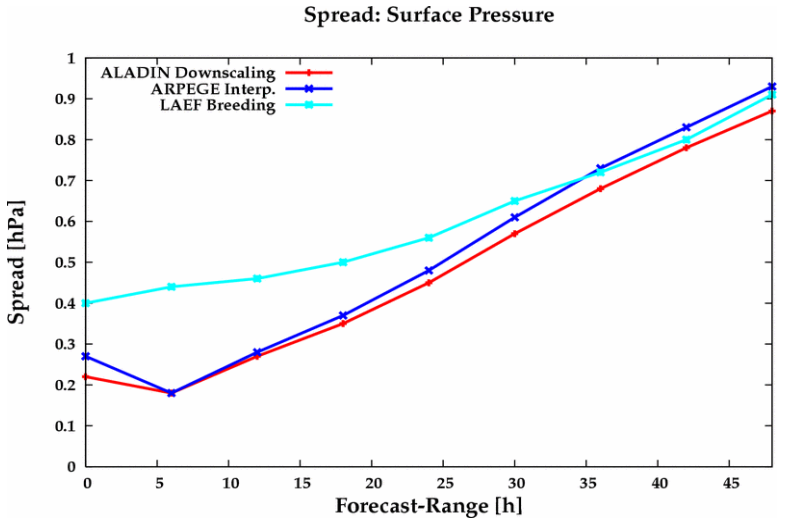
Status: Effort on testing rescaling factor and breeding cycles. A one-month test which makes the verification meaningful were carried out with 10 members Breeding.

Downscaling vs. Breeding









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Dealing with uncertainties in analysis

- **ETKF + spherical simplex transformation:**

Status: a one-month test for 10 members ETKF has been carried out. A preliminary comparison between ETKF with Breeding and ET has been done. The inflation method used in the experiment is the similar one used as in Breeding. The innovation inflation technique was not tested for this one-month test. Only some case studies were done with this innovation inflation technique.

- **ET + spherical simplex transformation:**

Status: Same as ETKF, a one-month test for 10 members ET has been carried out. A preliminary comparison between ET with Breeding and ETKF has been done.

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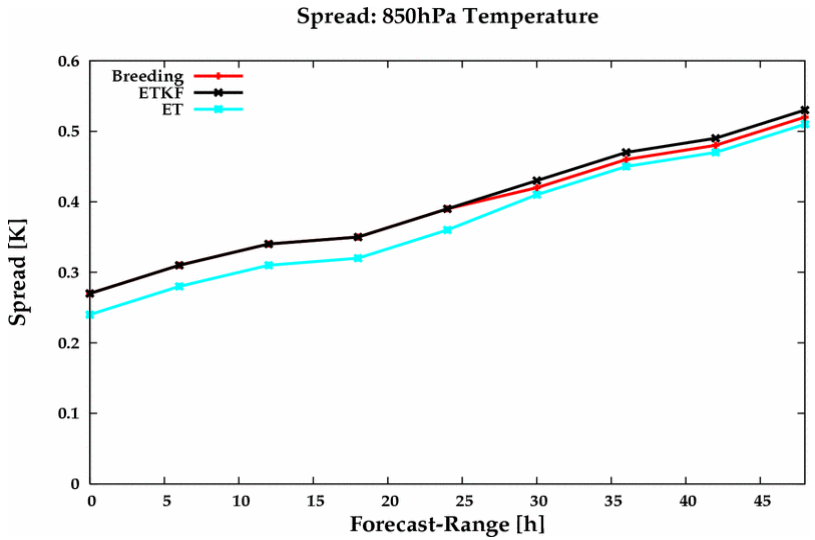
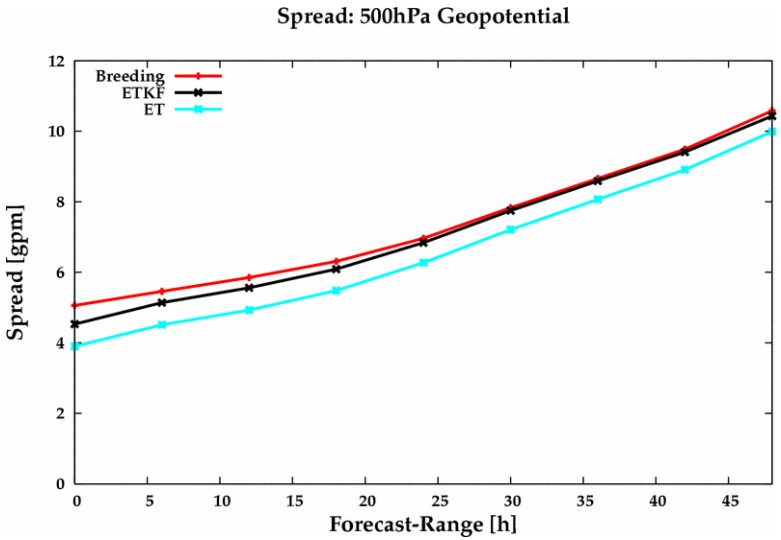
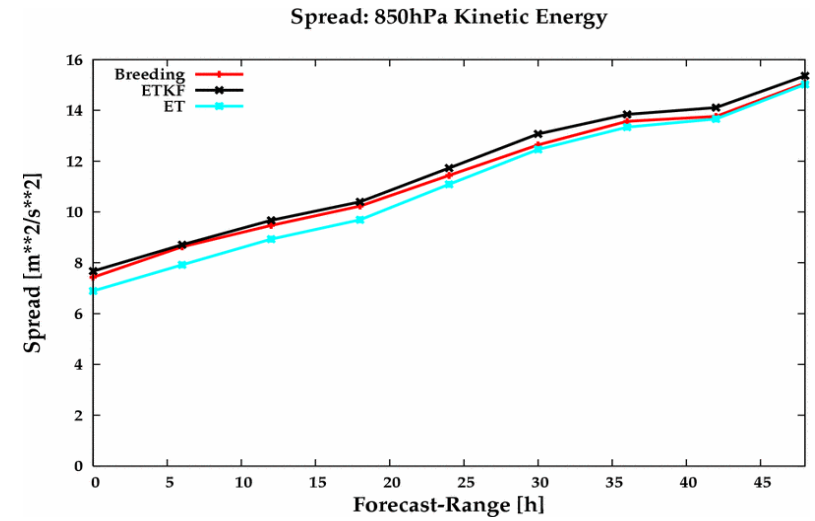
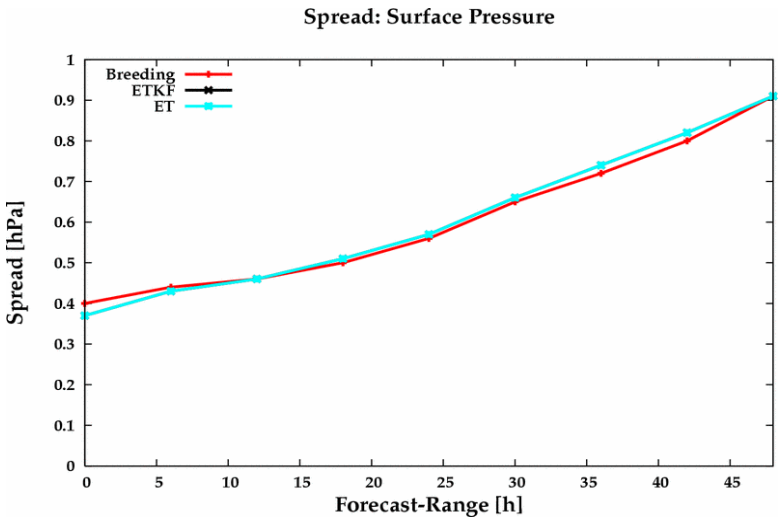
ET, ETKF and Breeding

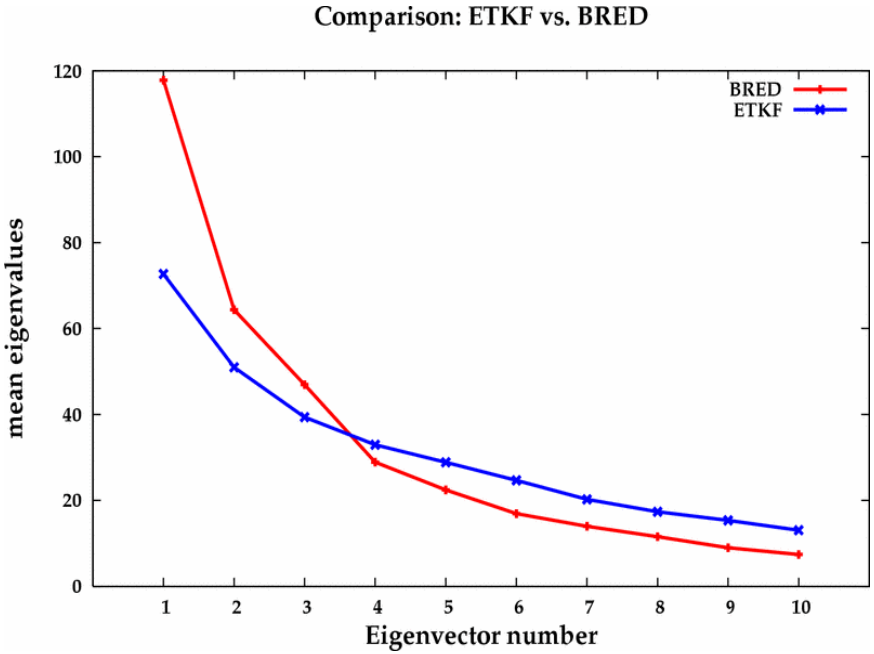


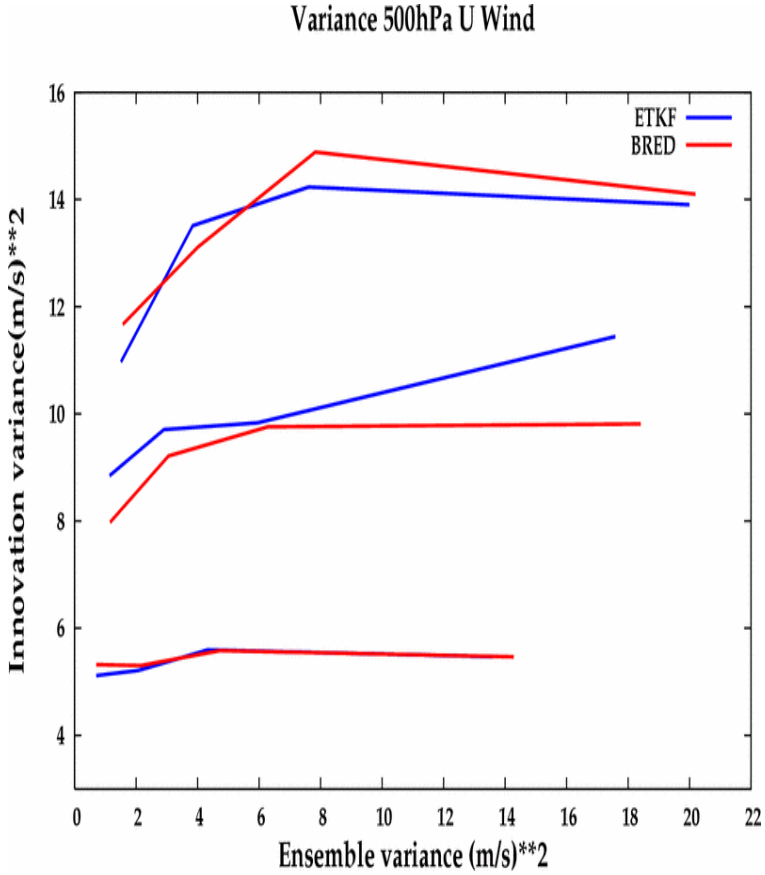






ETKF vs. Breeding





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Dealing with uncertainties in analysis

- **ALADIN native Singular Vector (Edit and Horanyi):**

Status: Research with ALADIN SV has been started in 2006 at Budapest. As a first step conf 401, 501 and finally 601 was used and tested. Speed of the convergence (during the singular vector computation), as well as CPU time and memory usage was analyzed. These are quite important issues, since the number of iterations performed determines the accuracy of the computed singular values/vectors. The first results with the ALADIN singular vectors were presented in the ALADIN HIRLAM LAMEPS workshop in Vienna in November, 2006. More details are available from the poster

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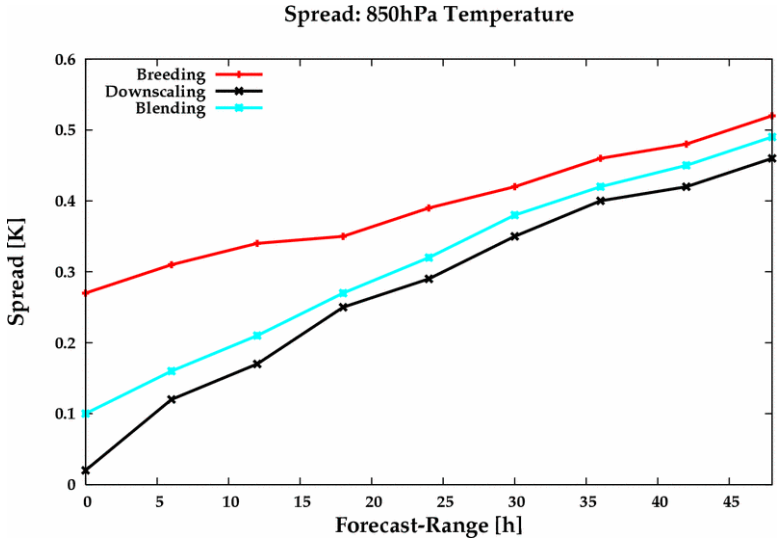
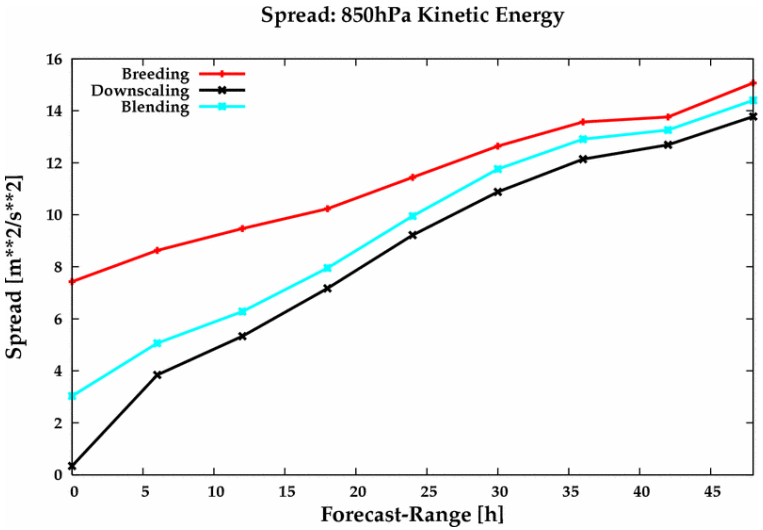
Dealing with uncertainties in analysis

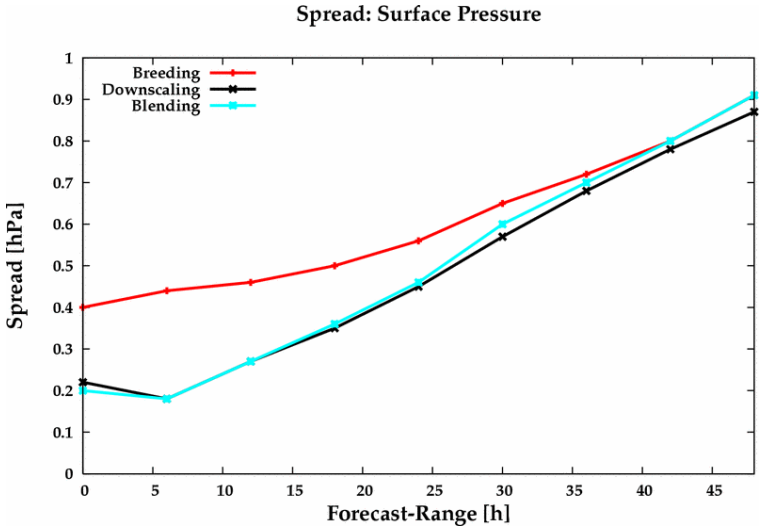
- **Blending ARPEGE PEARP and ALADIN Breeding:**

Status: implemented, first test has been done. More tunnig with Breeding are needed.

Blending vs. Breeding and downscaling







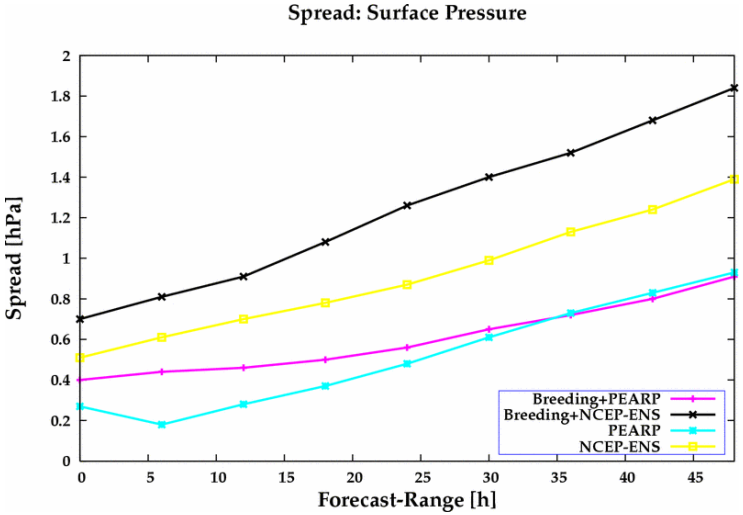
Dealing with uncertainties in LBC

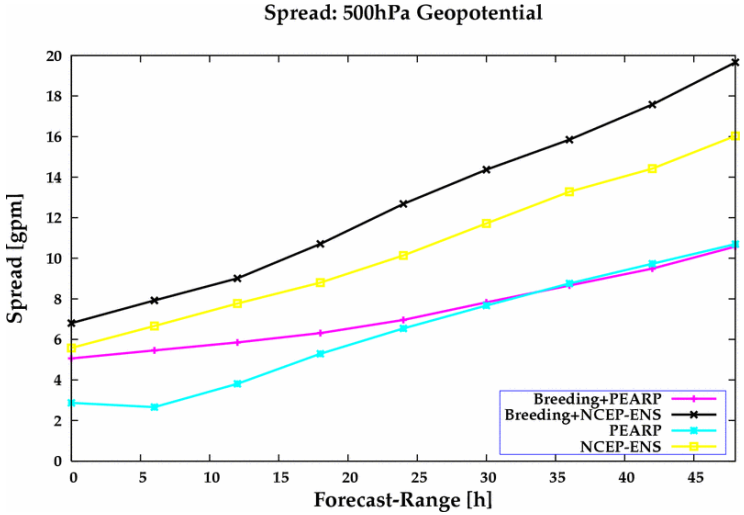
- **Impact of inconsistent LBC and IC perturbation**

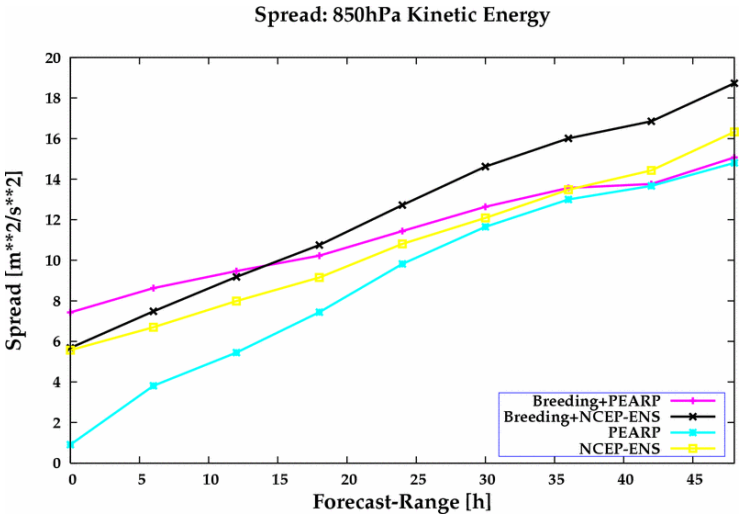
ALADIN Breeding coupled with NCEP EPS system and ARPEGE SV EPS system

Status: finished partly, more experiments are needed.

Coupling with SV vs. Breeding: Spread

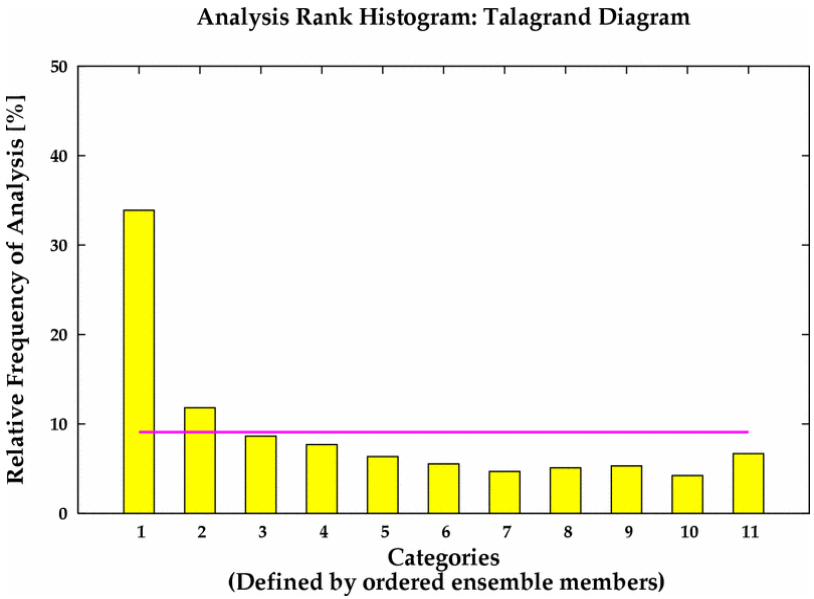


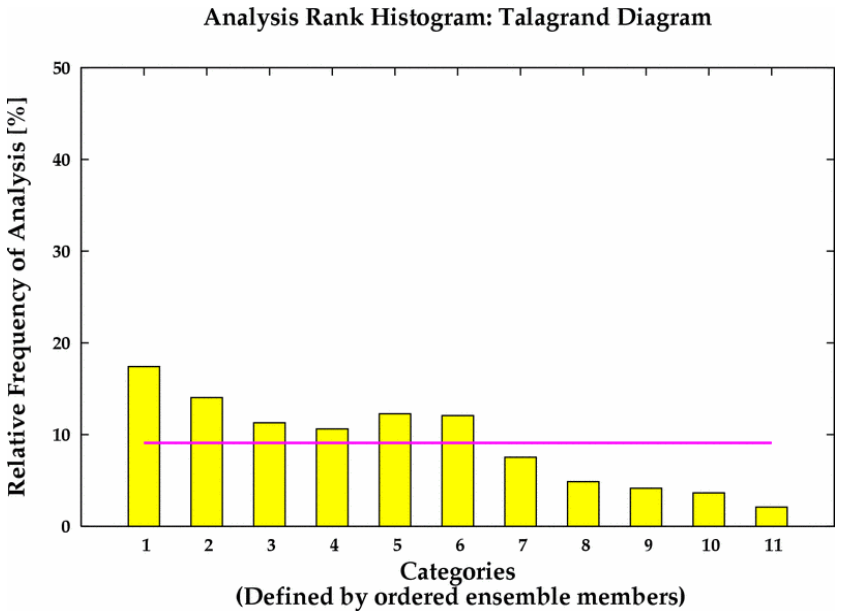




Spread of *Surface Pressure* (top left), *Geopotential* (top right) and *Kinetic Energy* (bottom left) as a function of forecast range. Experiments: Breeding coupled with PEARP (purple), Breeding coupled with NCEP-ENS (black), PEARP members (light blue), NCEP-ENS (yellow). Breeding coupled with NCEP-ENS perturbed LBC show much larger spread, partly due to the spread of the coupling model itself, partly due to a combination with Breeding within LAEF.

Coupling with SV and Breeding: Talagrand Diagram

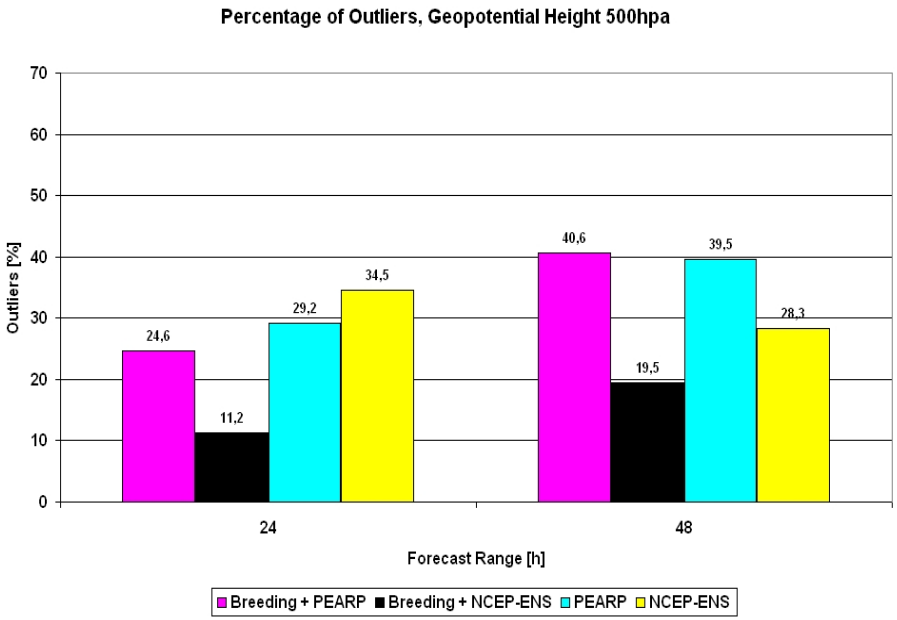




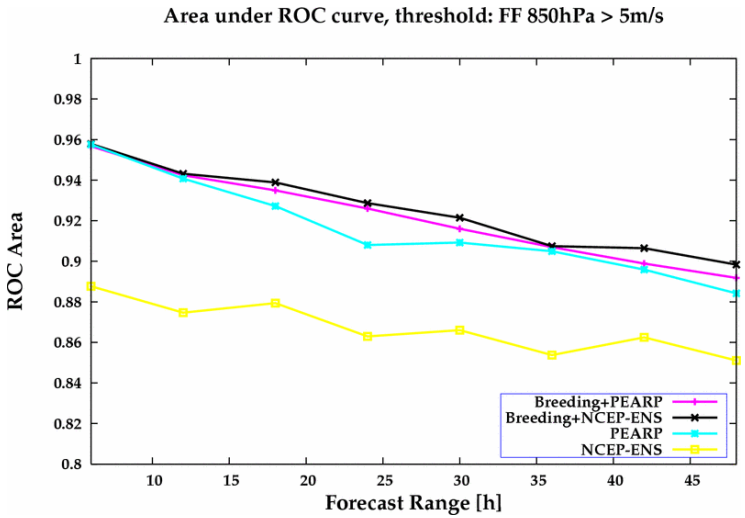
Talagrand Diagram: *Geopotential* 500hPa + 48h, Breeding experiment coupled with ***PEARP*** members. Large ensemble high bias (higher than expected frequency for low observations).

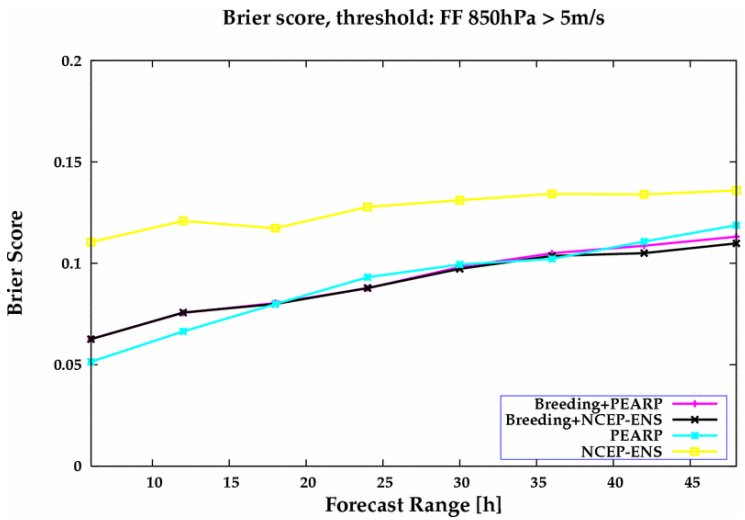
Talagrand Diagram: *Geopotential* 500hPa + 48h, Breeding experiment coupled with ***NCEP*** members. Ensemble high bias, but less pronounced.

Coupling with SV vs. Breeding: Outliers, ROC, Brier



Outliers: *Geopotential* 500hPa +24h and +48h, Breeding experiment coupled with ***PEARP*** members (purple) vs. coupled with ***NCEP*** members (black). Frequency of outliers is halvened for Breeding + NCEP-ENS.





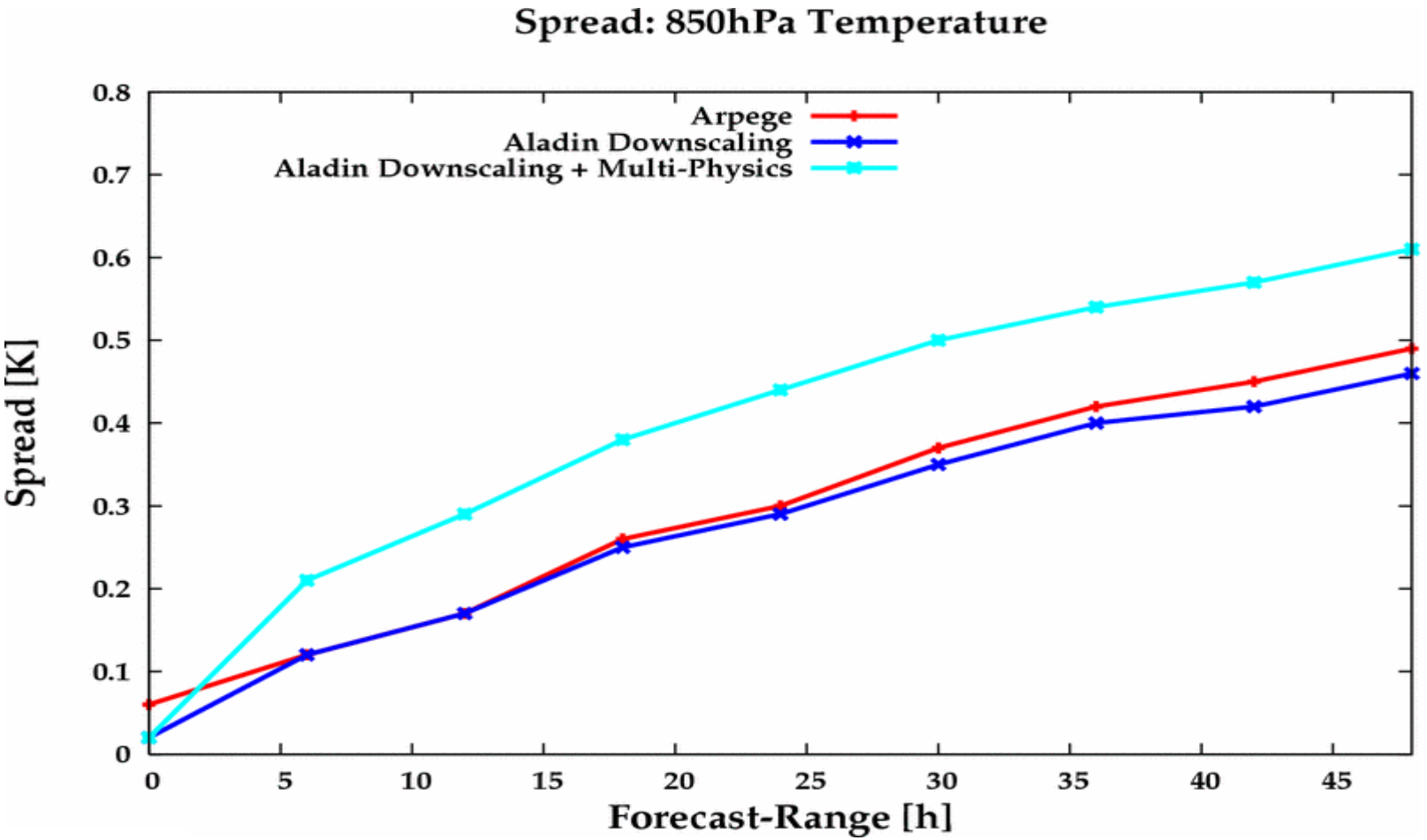
Dealing with uncertainties in physics

- **Multi-physics parameterization:**

  11 combinations of different physics parameterizations and tunings in ALADIN have been chosen for downscaling the PEARP members schemes of Lopez, Bougeault, Kain-Fritsch etc....

  Status: finished partly

Results of multi-physics option



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Dynamical downscaling

- **Downscaling of ECMWF EPS**

The ECMWF EPS provides the perturbation both in initial condition and lateral boundary condition

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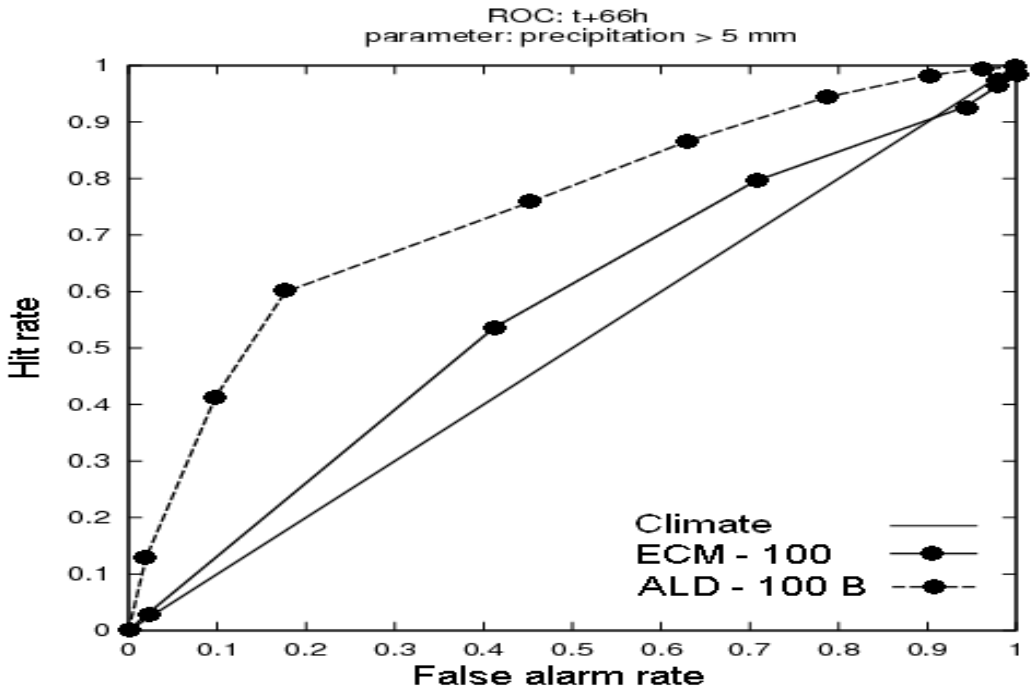
ECMWF EPS downscaling: case study, HU



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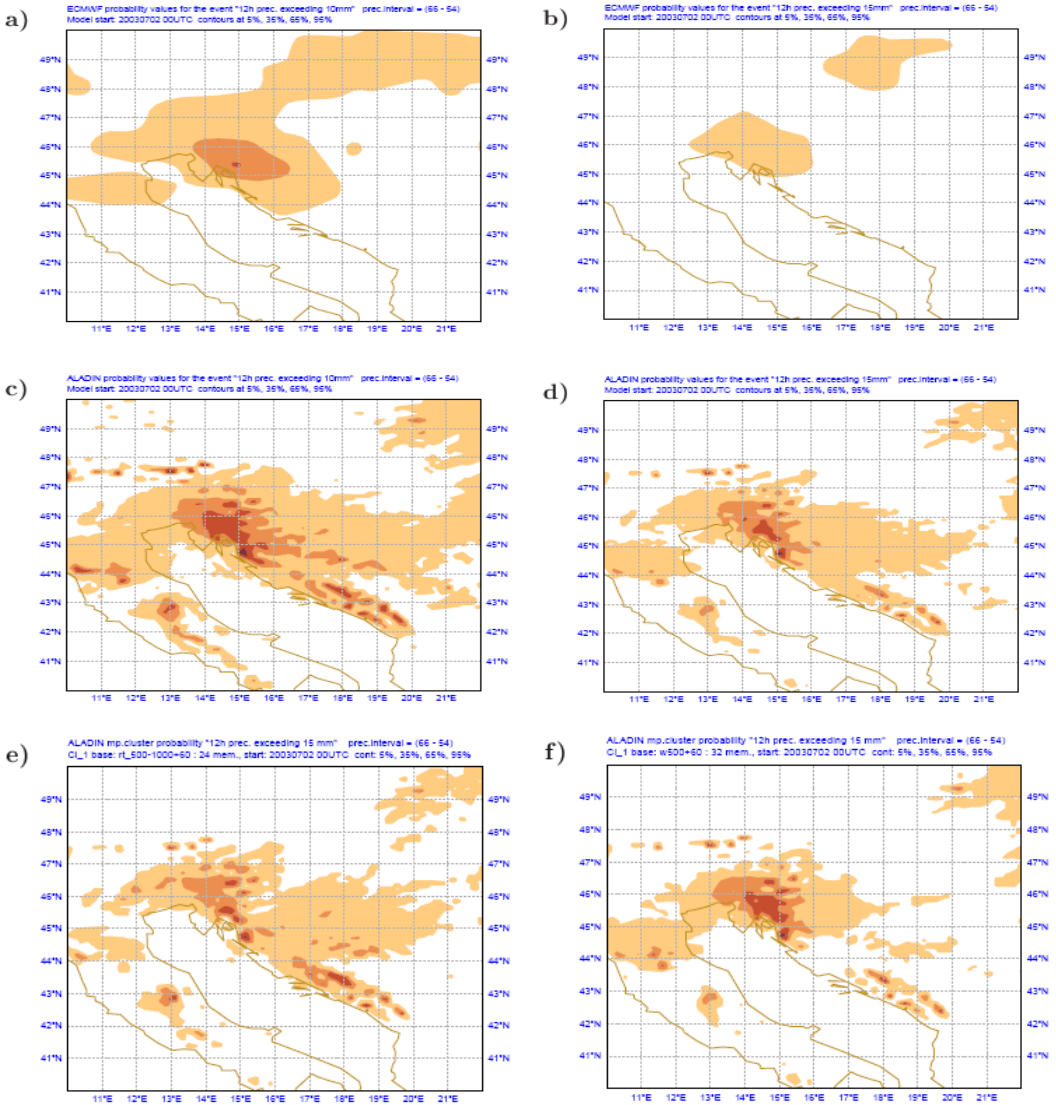
Experiments with clustering: case studies CRO



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Development of ALADIN-LAEF

The first ALADIN LAMEPS system in pre-operational mode since 19 March 2007.

The first version of LAEF is the dynamical downscaling of ECMWF EPS. 22 members, 2 runs per day.....

The details will be presented by Alexander Kann.

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- **Downscaling of ARPEGE EPS**

Status: Works have been done in HU,CZ and AT.

In HU, experiments with different optimisation time and target domain in ARPEGE EPS and then ALADIN downscaling are done. More details by E. Hagel and A. Horanyi.

In CZ, to investigating the performance, in particular the more added value of the downscaling of ARPEGE EPS. Cases studies, especially those related with big problem with precipitation forecast in ALADIN, are under way to be investigated. Details can be found in the poster of Richard Mladek.

EPS post-processing

- **Bias correction**

  developing a statistical method for correcting the bias in LAEF forecast.

  Status: code implemented.

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Common EPS verification

- **Verification**

  developing a common verification package for LACE research and development on prdictability

Status: The common verification package has been developed for verifying the upper air parameters. The scores, like Talagrand diagram, Brier Score and skill score, ROC etc have been implemented.

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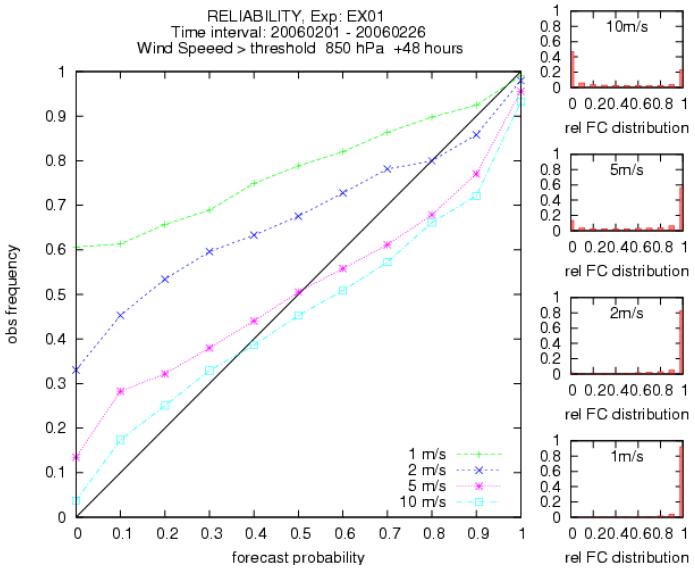
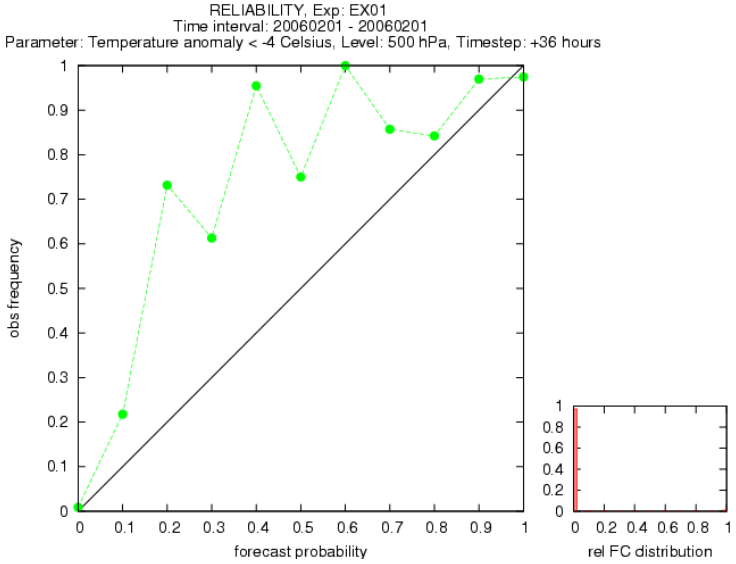
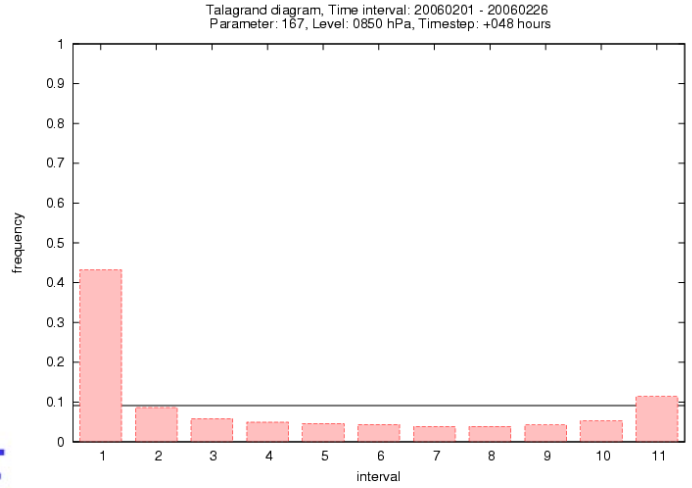
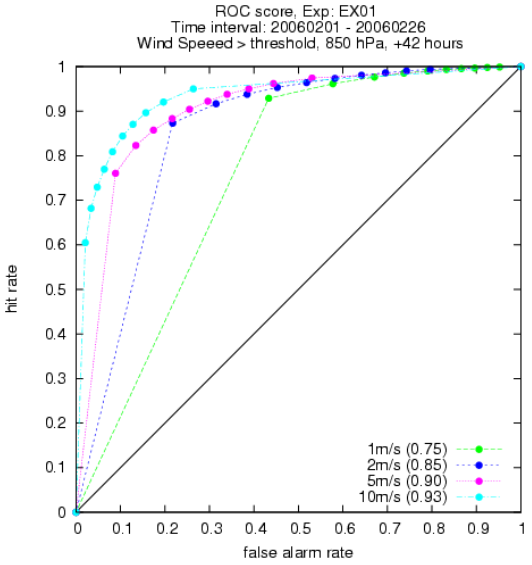
Common EPS verification: examples









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The details of LAEF will be presented by Alexander Kann.

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International Collaboration

- **Participation on GLAMEPS**

  LACE contribution: Austria, Croatia, Czech, Hungary, Romania

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International Collaboration

- **ZAMG/Meteo-France's Participation on B08RDP of WMO/WWRP**

  Beijing 2008 Olympics Mesoscale Ensemble Prediction Research and Demonstration Project

  ALADIN-LAEF will be used for regional EPS action with resolution 15km, 37 levels: August 2007 for Test and in August 2008 for Olympic game

  AROME will be used for meso-scale EPS with very high resolution 2-4km.

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International Collaboration

MAP D-Phase

Mesoscale Alpine Program (MAP) D-PHASE: ***D****emonstration of* ***P****robabilistic* ***H****ydrological and* ***A****tmospheric* ***S****imulation of flood* ***E****vents in the Alpine region*

A WMO/WWRP Forecast Demonstration Project

ALADIN-LAEF and ALADIN-Austria will be used for the participation on the MAP D-Phase

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Conclusions

The first ALADIN LAMEPS applictaion ALADIN-LAEF is running pre-operationally.

- Works on the investigation of methods like Blending, Breeding, ET, ETKF and SV are on the „good“ way.
- Coupling with different global EPS systems shows that LBC perturbation is very essential for LAMEPS.
- Physics perturbation has quite large influence on the performance of LAEF.
- More investigations will be continued for Blending, SV, downscaling, etc. works on improvment of LAEF, development of verification and participation of international cooperations.

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Acknowledgements

Thanks to all the LACE and ALADIN colleagues, who have made contribution to the common work of LACE on predictability, in particular, M. Bellus, E. Hagel, R. Mladek, S. Ivatek-Sahdan, S. Kertesz, S. Tascu, E. Bazile, F. Bouyssel, J. Nicolau and so on.

I am also grateful for the support of the colleagues in the NWP team at ZAMG. Also the colleagues in the EPS teams at NCEP, CMA, NOAA, NRL are acknowledged.

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