Ongoing Research and Development on ALADIN-LAEF

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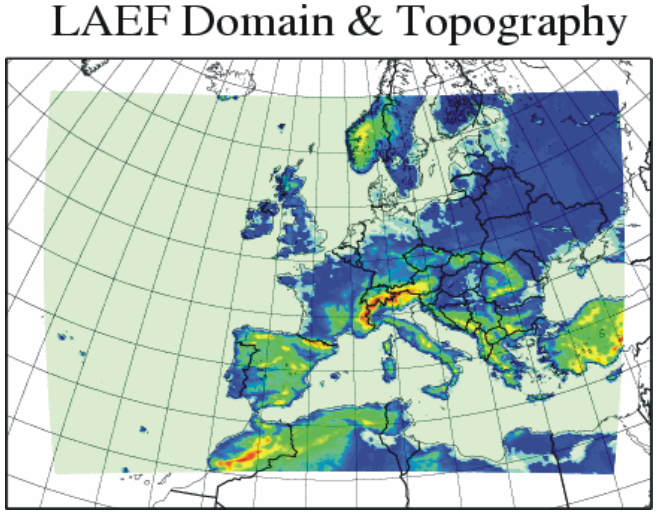
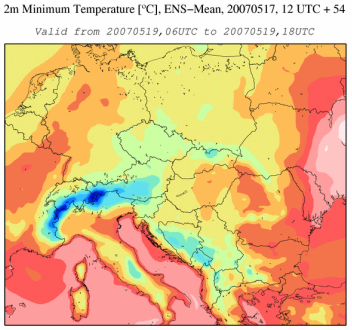
With contribution from Bellus, Wittmann, Kann, Ivatek-Sahdan, Tascu, Mladek, Hagel, etc.

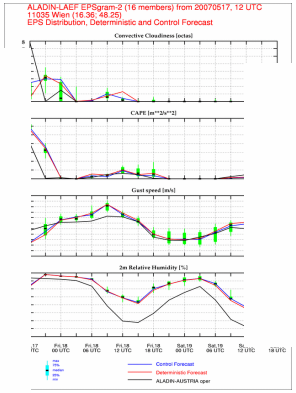
LAEF pre-operations

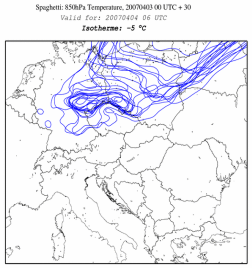
ALADIN-LAEF: Since Mar. 2007 in pre-operation

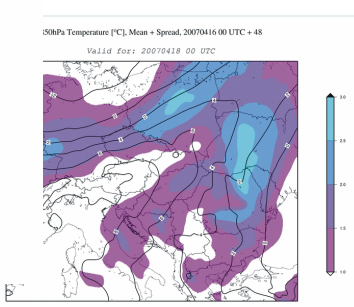
- Dynamical downscaling of ECMWF EPS
- Coupling 16 perturbed ECMWF-EPS members
- Simple post-calibration (NCEP method)
- 18km horizontal, 37 levels, 60h fcst
- 2 runs at 00 and 12 UTC
- Products on LACE Webpage for partners

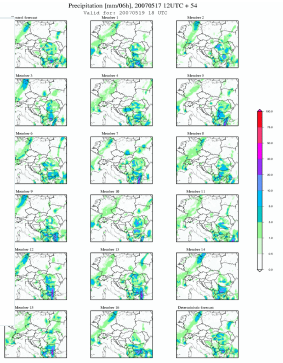




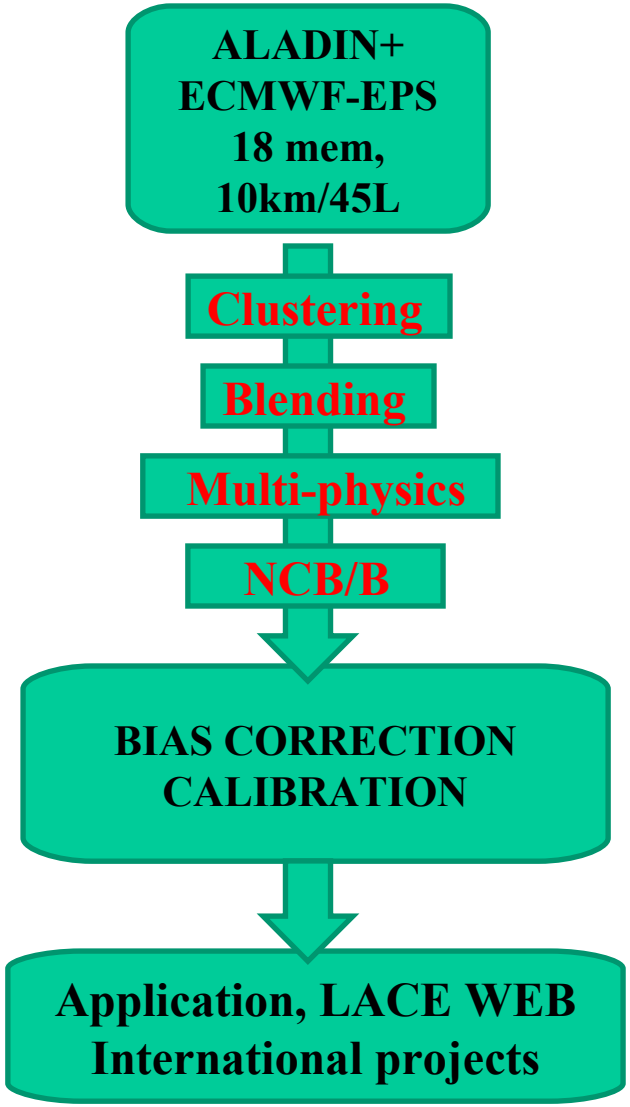








LAEF: R&D Focuses



- Clustering: RM ECMWF EPS member

Perturbation generation:

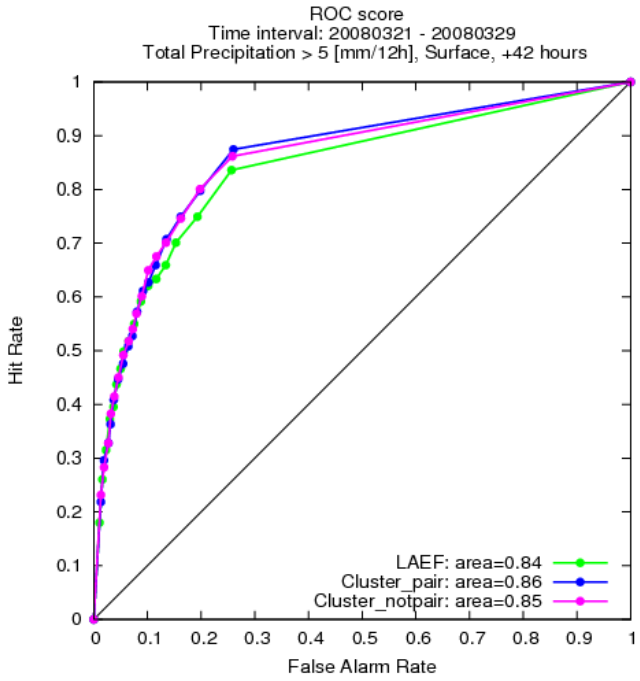
- Analysis: Blending
- Model: Multi-physis
- Surface: Non Cycling Blending/Breeding

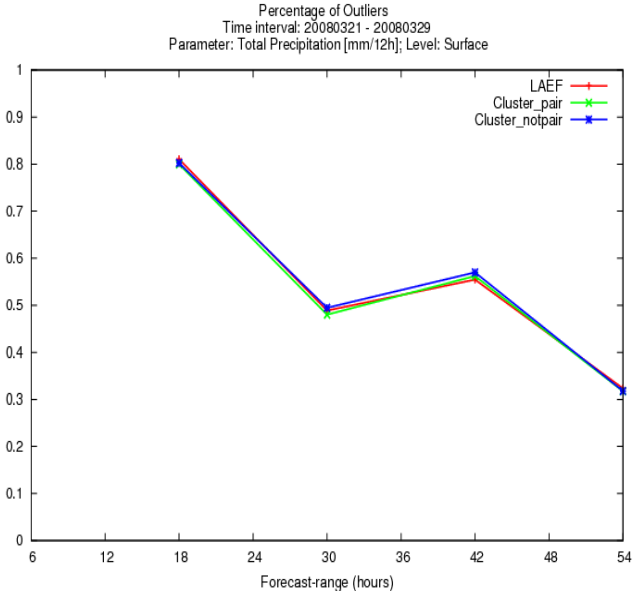
Post-processing:

- Bias correction: Analog & Kalman-type
- Calibration: NGR_T2m, LR_preci.
- Verification: EPS Verification package

Results: Clustering

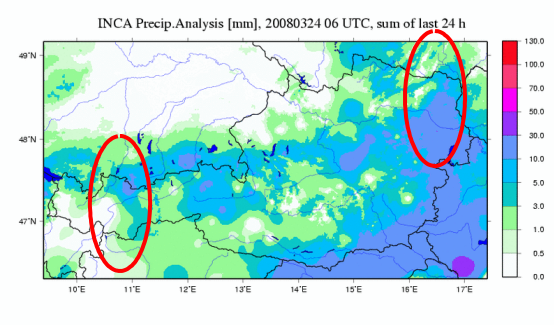
- no clustering
- clustering
- clustering-pairs

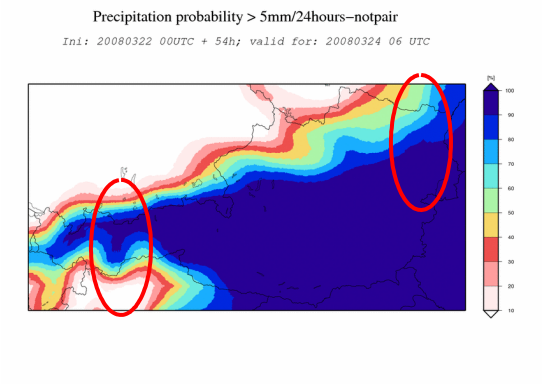




Results: Clustering

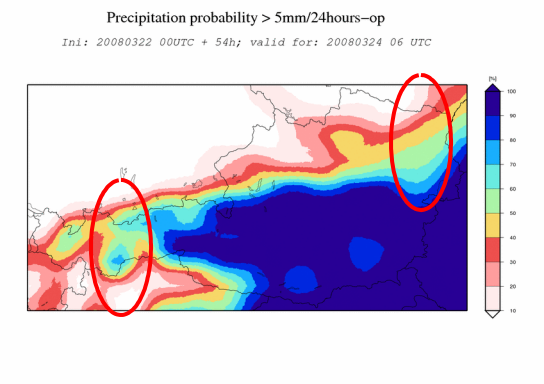
INCA

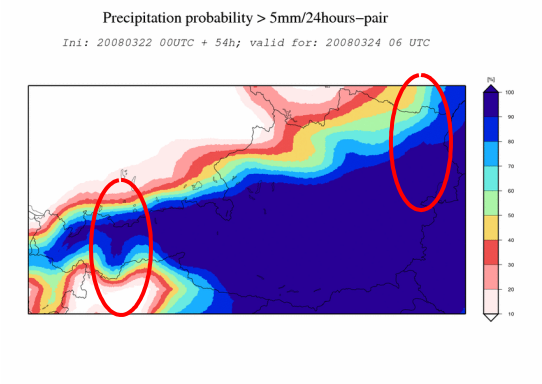




clustering

no clustering





clustering pairs

Blending technique

BLENDING GLOBAL SV WITH LAEF BREEDING

To combine the large-scale uncertainty from ECMWF SV with the small-scale uncertainty generated by Breeding in LAEF.

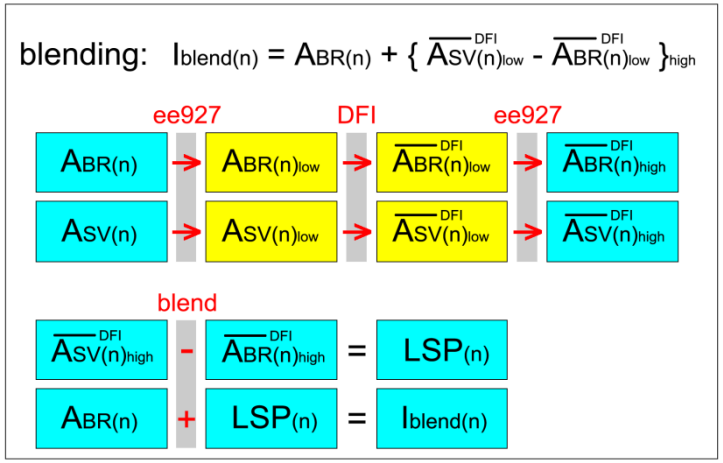
It is expected that

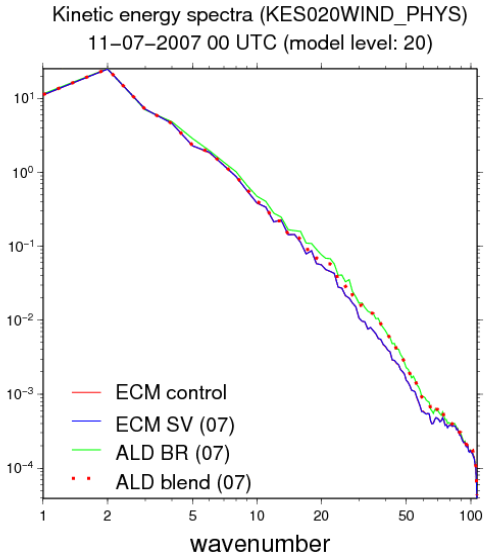
1). reducing the inconsistency between global and limited area EPS.

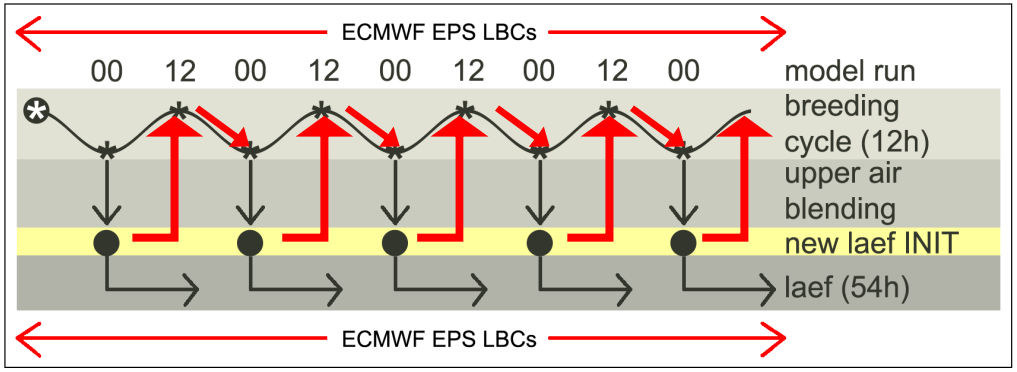
2). combining the future uncertainty generated by SV and the uncertainty in the past generated by Breeding.

Hypothesis: the small-scale part of IC uncertainty from LAM Bred vector is more realistic than interpolation of gloabl EPS members.

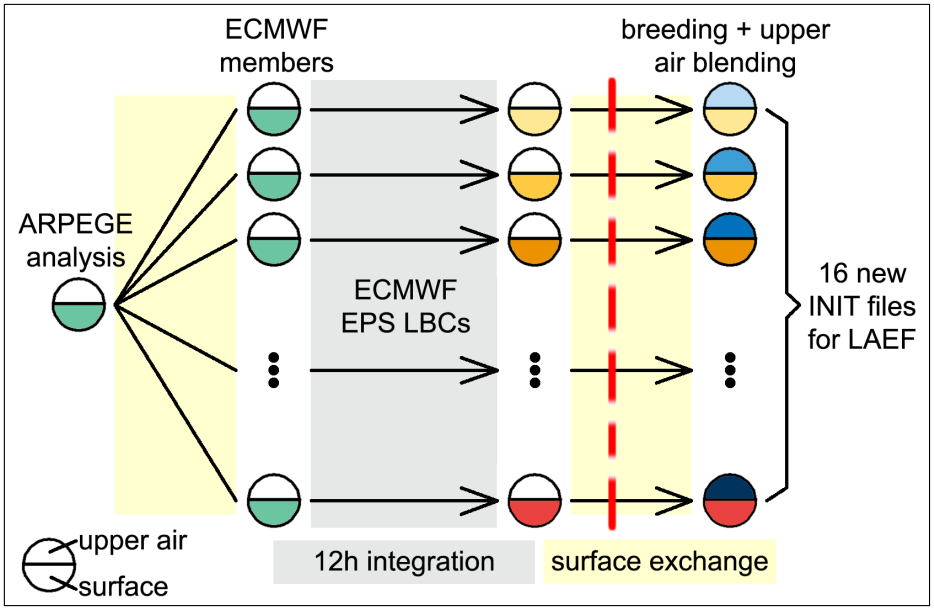
Blending technique





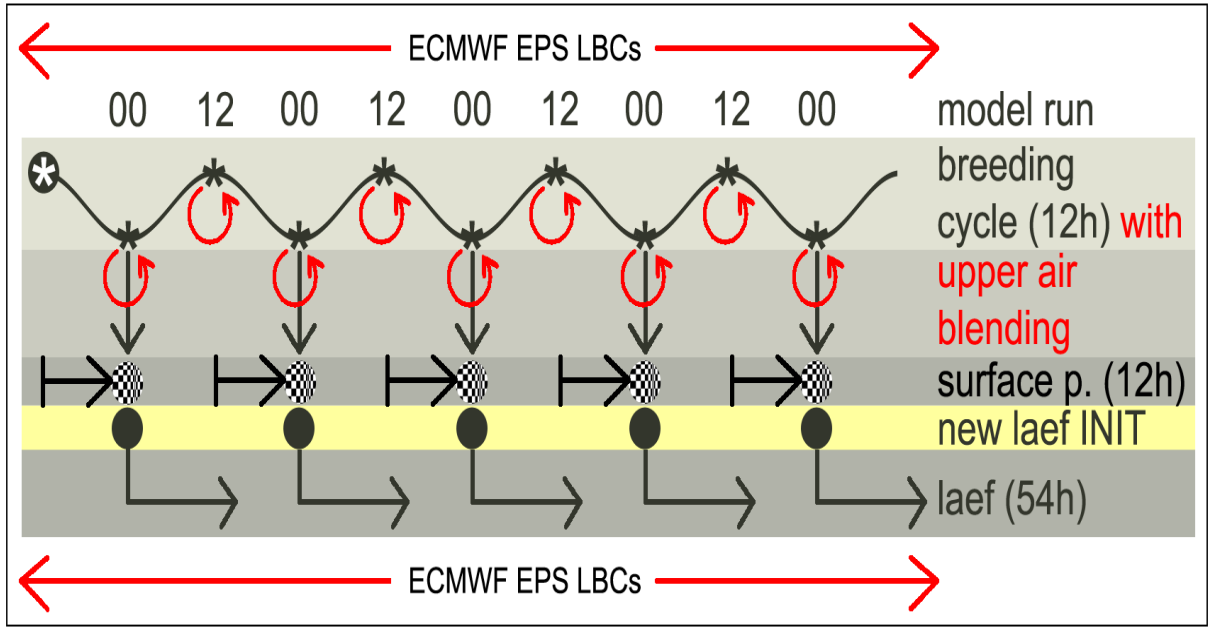


Non Cycling Blending/Breeding (NCB/B)

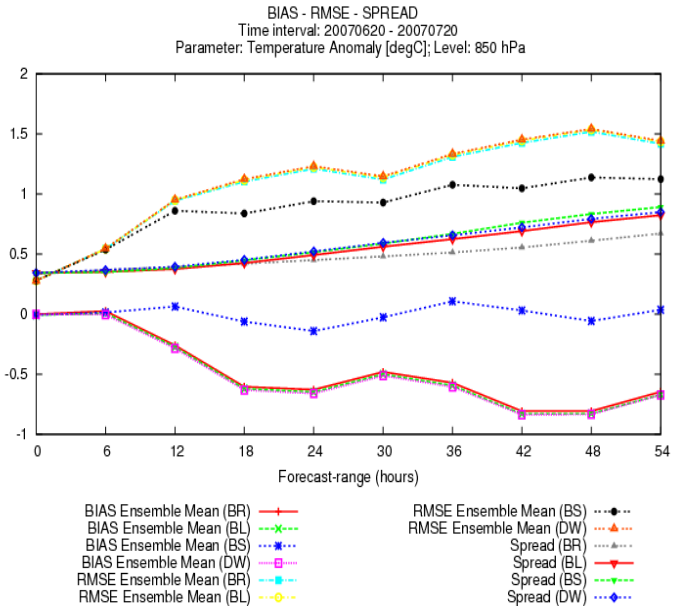


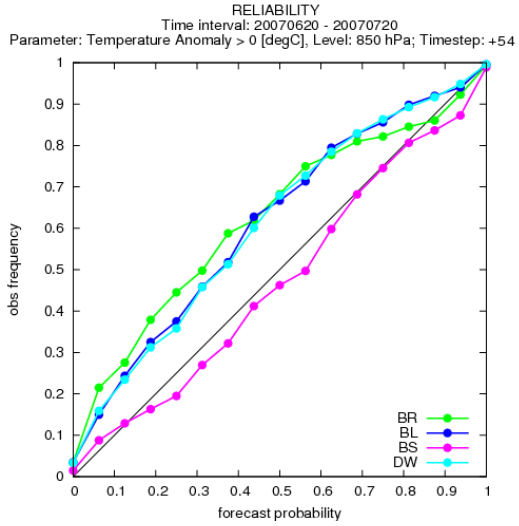
Generation of surface perturbation: short range surface forecasts driven by perturbed atmosphere forcing are used for blending or breeding on the surface analysis.

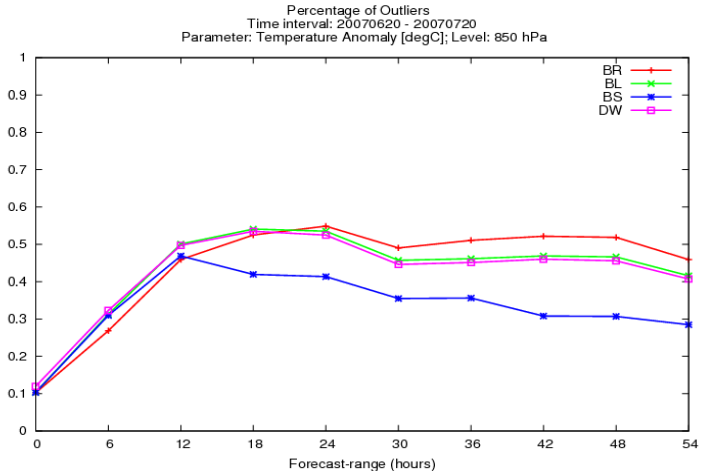
Blending+NCB/B



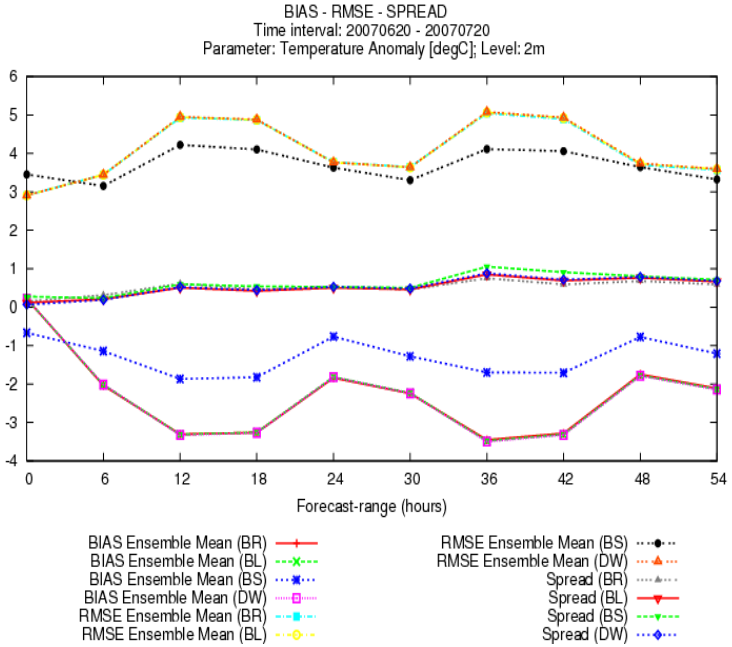
Blending+NCB/B: upper air

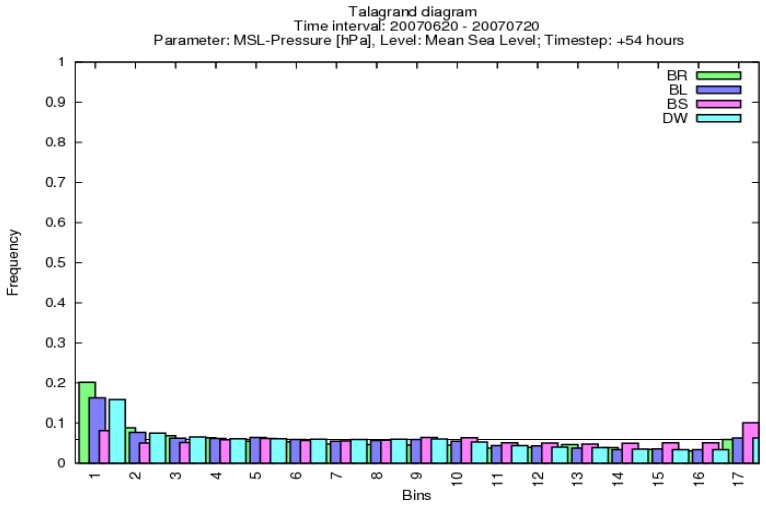






Blending+NCB/B: surface



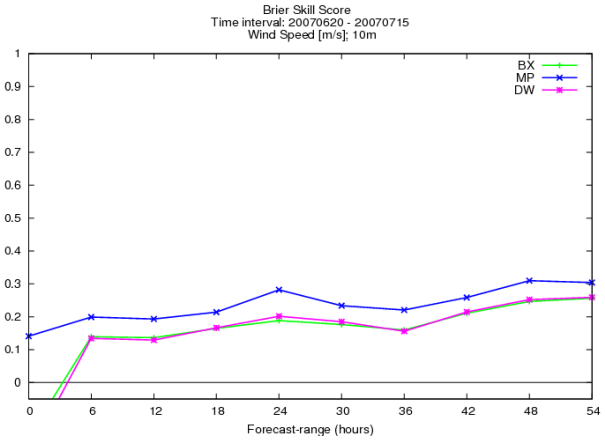


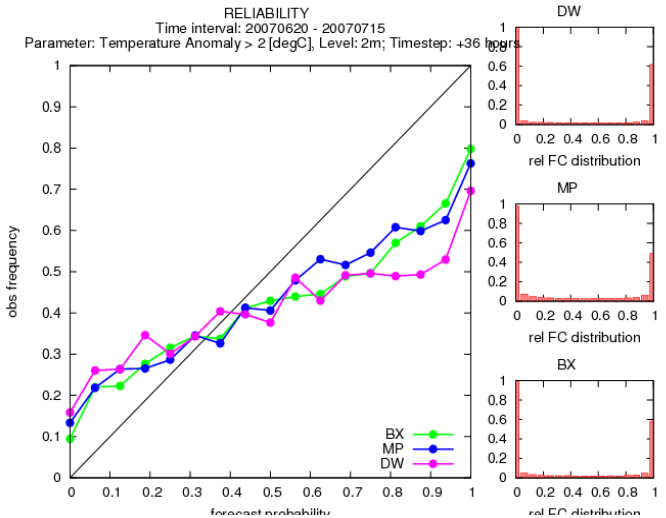
Multi-physics design

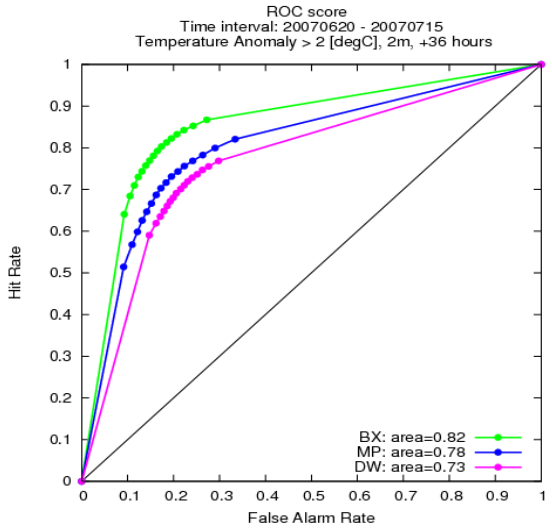
16 model physics options are used for dealing with the model uncertainty:

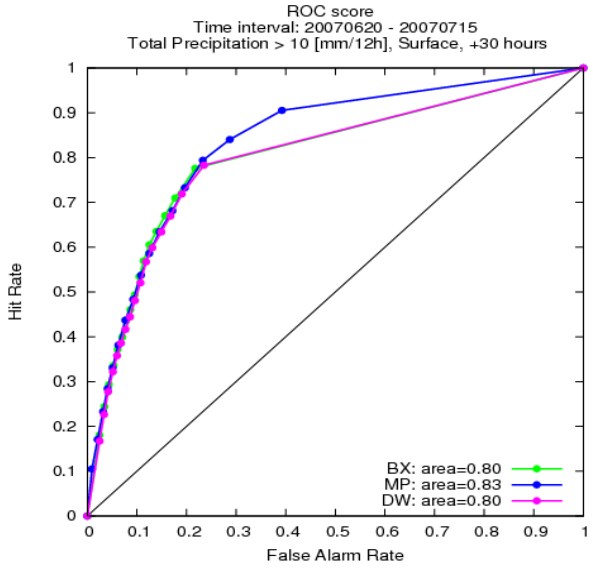
ALARO no 3MT, Lopez microphysics, Hirlam physics, prognostic TKE, AROME shallow convection, moisture convergence and CAPE closure, Kessler type scheme for large scale precipitation, tuning of the mixing length, entrainment rate, and the computation of the cloud base.

Multi-physics: surface

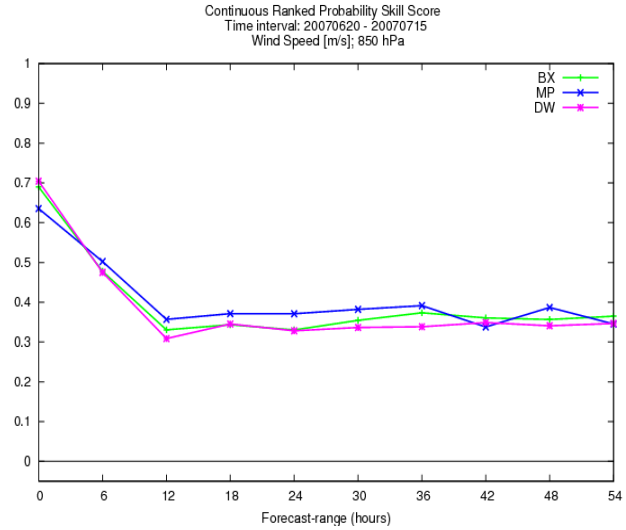


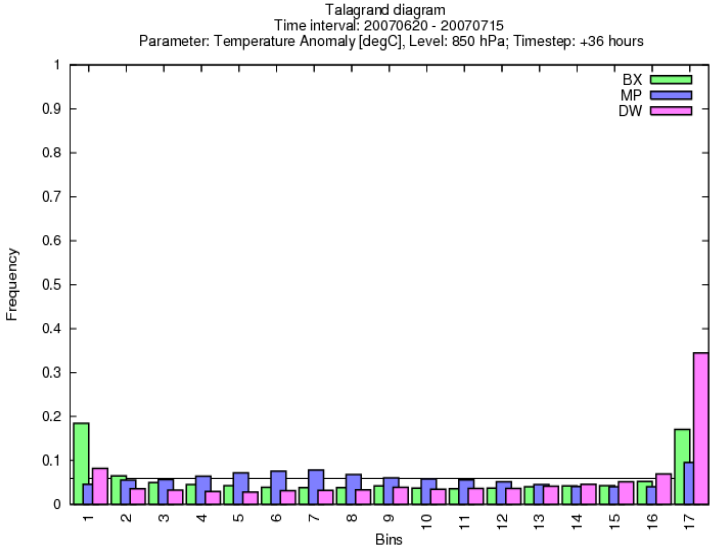


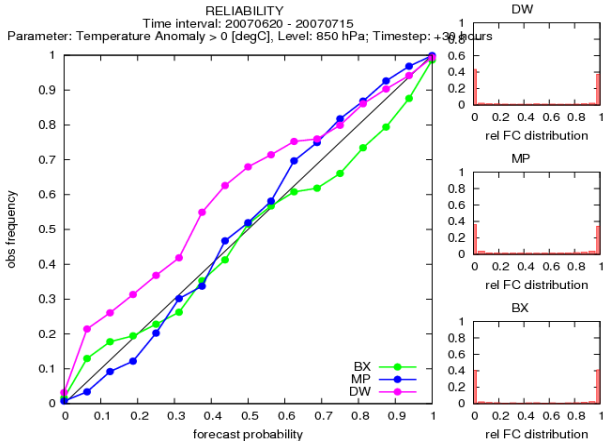


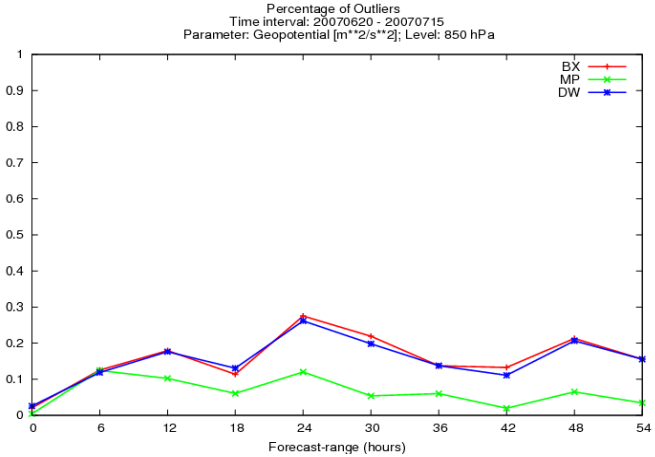


Multi-physics: upper air

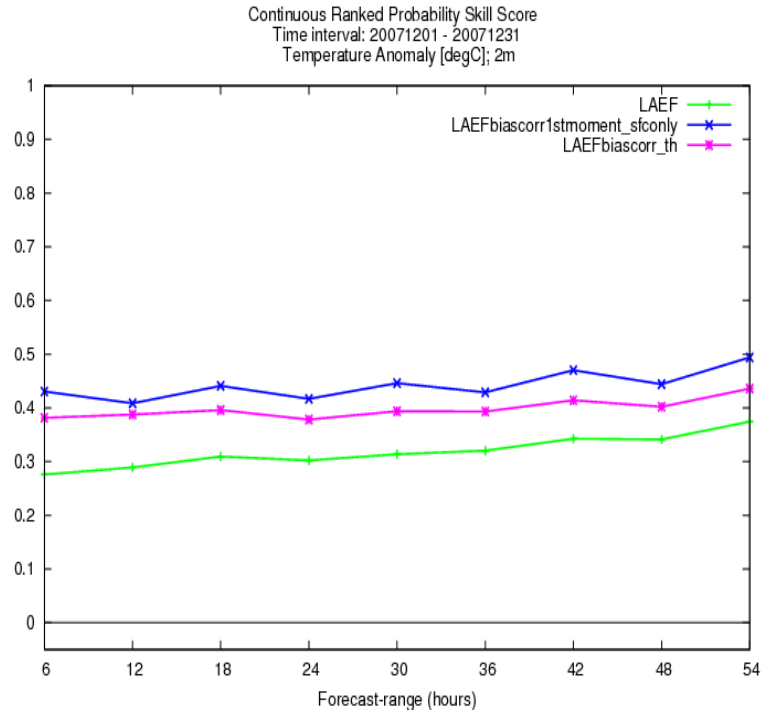






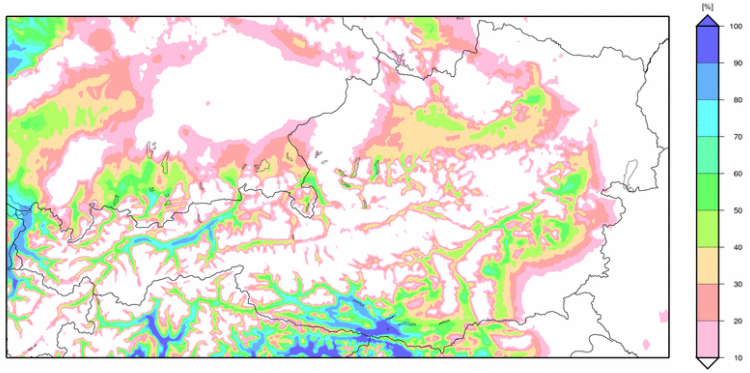


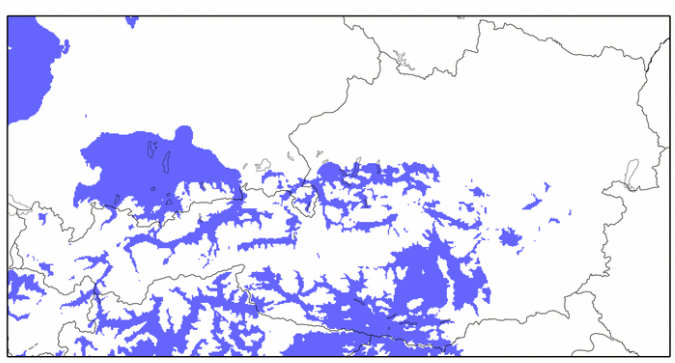
Bias correction: Kalman-type & Analog

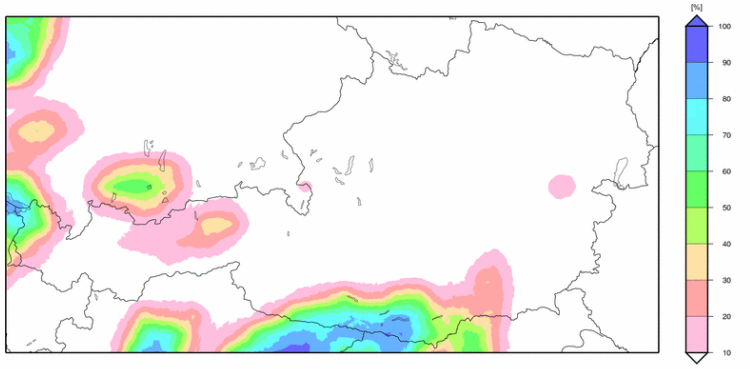


More details by the presentation of A. Kann!

Post-calibration: NGR for T2m







More details by the presentation of A. Kann!

Common EPS verification package

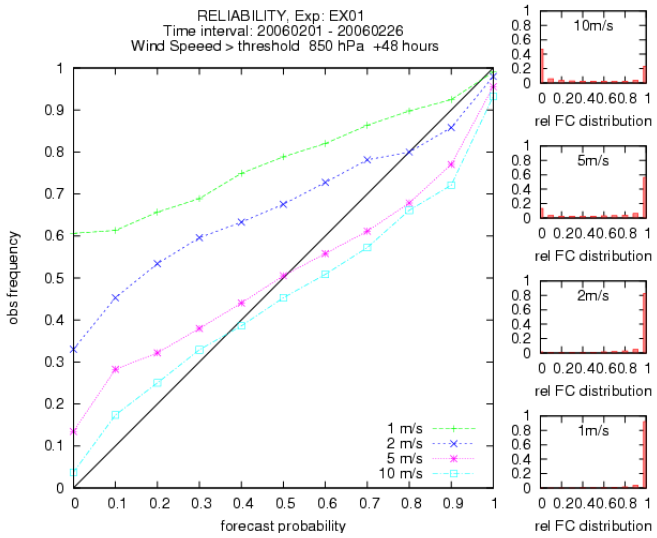
Requirements: To develop a simple, easy-use, flexible, portable and state-of-the-art verification tool for EPS.

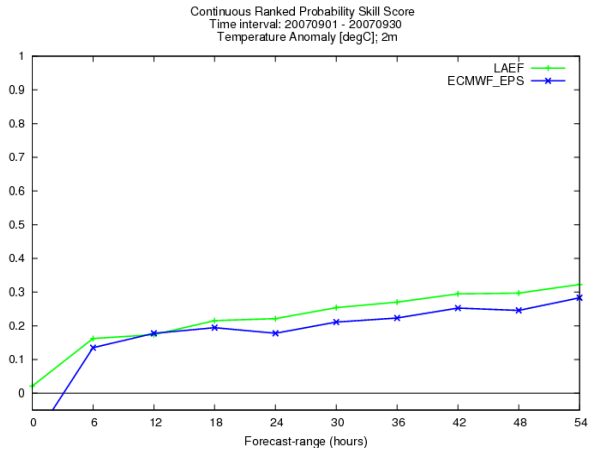
Software	Shell-Scripts, FORTRAN 90, graphics: gnuplot
Question of „TRUTH“	Surface: SYNOP Upper air: Analyses (ECMWF or ARPEGE)
Data format of forecasts/analysis	GRIB I
Data format of SYNOP obs	ASCII
Surface parameters to be verified	T2m, 10m Wind, RR, RH2m, and pressure
Upper air parameters to be verified	T, U,V, H, RH
Matching forecasts and observations	Verification performs at the observation location. Forecasts are interpolated to station, except for RR, it is to use the value of the nearest grid point.

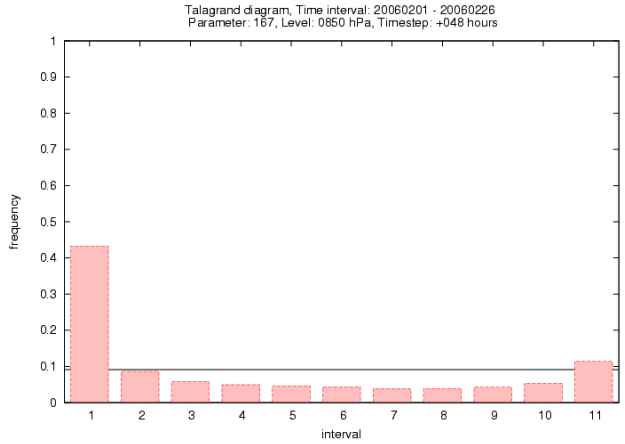
Features:

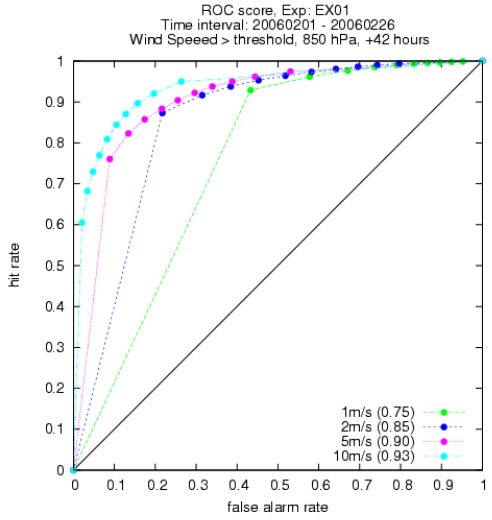
- ✓ Flexibility in data format (ascii, grib), modular design, freeware only
- ✓ Modular design, namelist controlled, freedom in the settings.
- ✓ Results in graphic plots included.
- ✓ Choice for different references for skill scores

Common EPS verification: examples









Conclusions and Plan

R&D on LAEF are being carried on:

- ✓ Small but positive impact with clustering
- ✓ Clear improvment with blending and NCB/B
- ✓ Useful results with multi-physics
- ✓ Encouraging demonsration by post-calibration
- ✓ Easy use tool: EPS verification package

Plan in the next future:

- ➢ Implementation into the operations
- ➢ Tuning on blending and NCB/B
- ➢ Optimization on multi-physics
- ➢ Continuing study on post-calibration, e.g. RR

Acknowledgment

Thanks very much to all the ALADIN Colleagues, who has contributed the ALADIN LAEF work.

Thanks also the COSMO colleagues for help with EPS clustering, e.g. Paccagnella, Montani, Marsigli and so on.

Thanks also the HIRLAM colleagues, who has helped the ALADIN Hirlam physics, in particular, XiaohuaYang and Bjarne Stig Andersen.