Regional Cooperation for Limited Area Modeling in Central Europe

LACE
nwp central europe

Status of LAM-EPS development in LACE

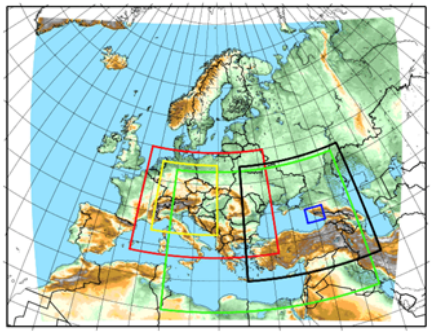
Theresa Schellander-Gorgas, ZAMG; with contributions of Florian Weidle, Mihaly Szucs, Martin Bellus, Simona Tascu, Yong Wang, Christoph Wittmann

DHMZ SHMU OMSZ ZAMG ROMANIA ANM

Overview of EPS in LACE

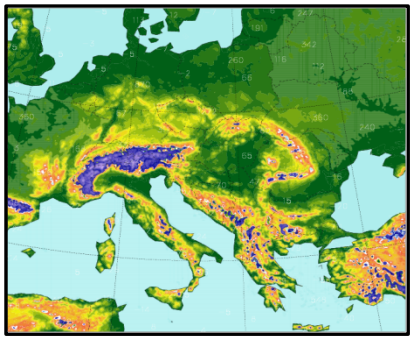
ALADIN-LAEF

- 11km version operational at ECMWF-HPC since 7/2013
- Visibile improvement of new LAEF compared to old 18km version
- Features: 16 members, ECMWF-EPS coupling, Surface EDA (OI), Breeding/Blending, Multi-physics scheme, TIGGE-LAM



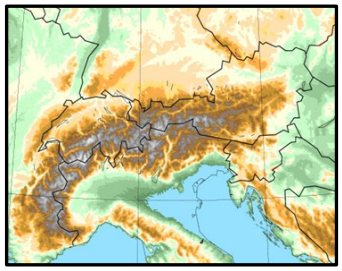
ALARO-HUNEPS

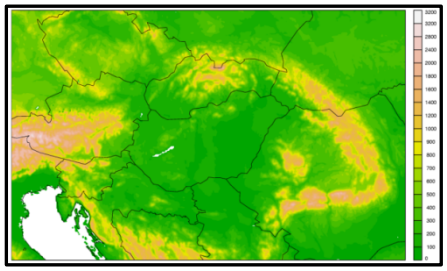
- 8km resolution, 11 members, downscaling of PEARP, TIGGE-LAM



AROME-EPS development (Hungary and Austria)

- Downscaling experiments (ECMWF High-Res/Low-Res, PEARP, ALADIN-LAEF)
- EDA:
  - Centralized AROME-DA
  - Ens 3D-VAR
- SPPT



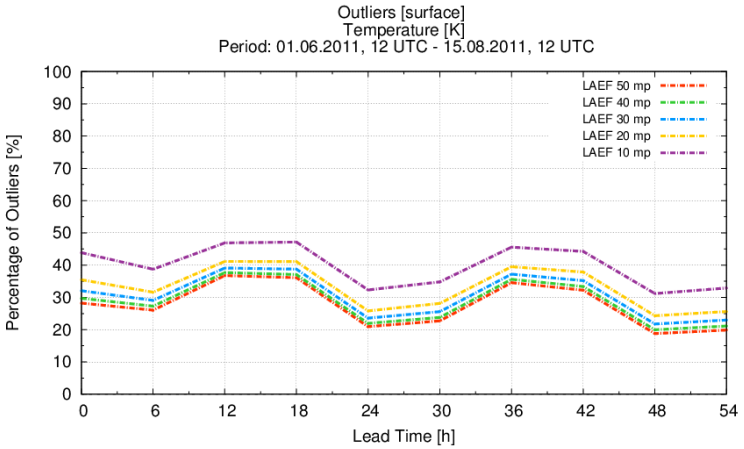


ALADIN-LAEF ensemble size (M. Bellus)

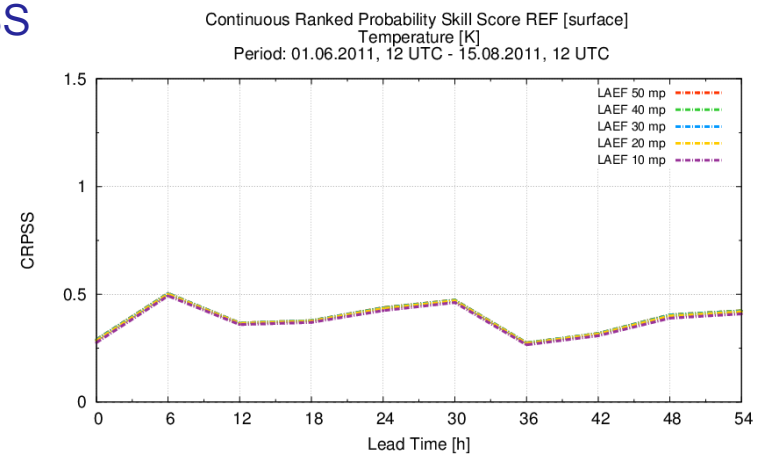
Experiments with 50 ensemble members:

- Coupled with 50 ECMWF global EPS members
- Verification for subsets of 10, 20, 30, 40, 50 members
- Two experiments:
  - without multiphysics, but: with breeding/blending and surface assimilation of perturbed T2M and RH2M
  - Same as above, but with multiphysics: 10 selected configurations, repeated 5x for 50 members

Outliers T2M

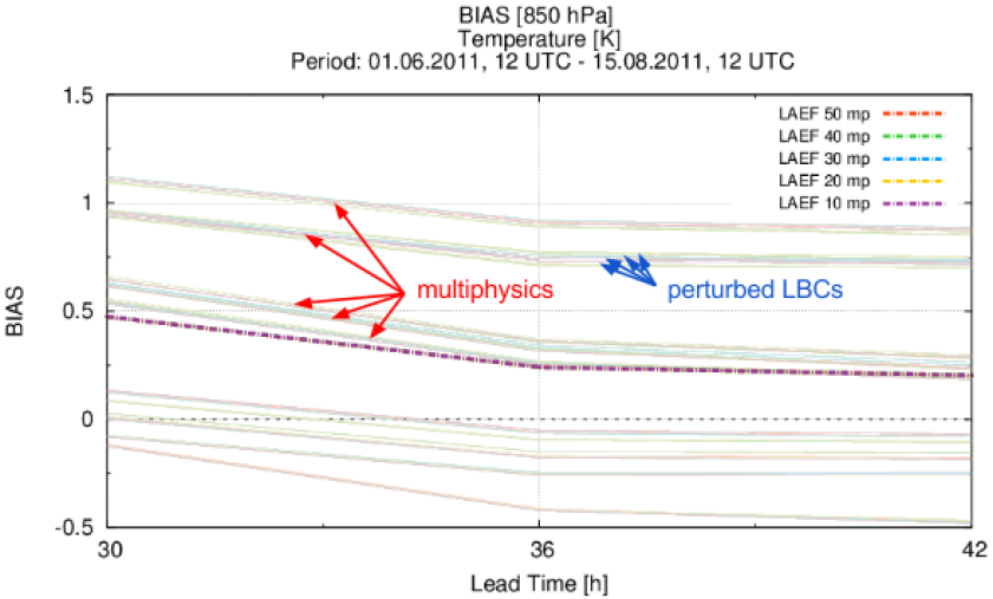


CRPSS T2M

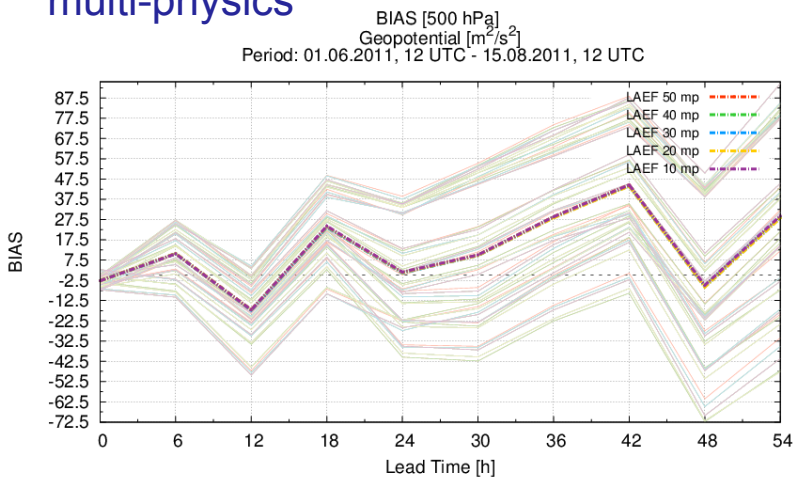


ALADIN-LAEF ensemble size (M. Bellus)

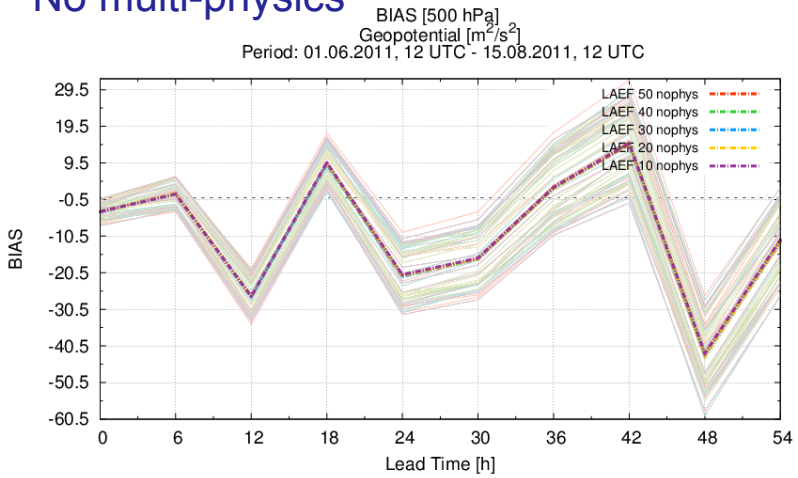
- No impact of ensemble size on bias
- Influence of LBCs is smaller than of LBCs and multiphysics
- clustering according to physics configuration



multi-physics



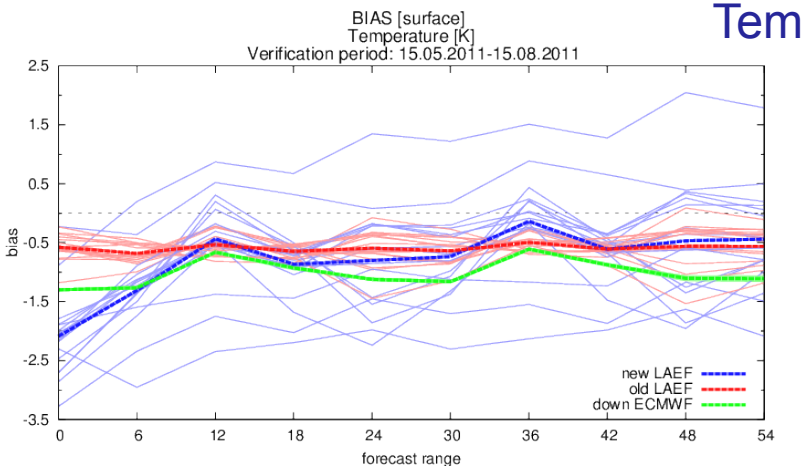
No multi-physics

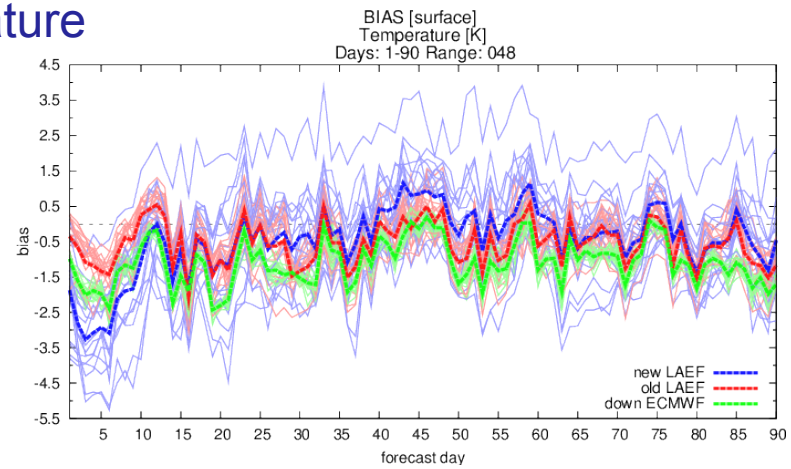


ALADIN-LAEF multi-physics (M. Bellus, S. Tascu)

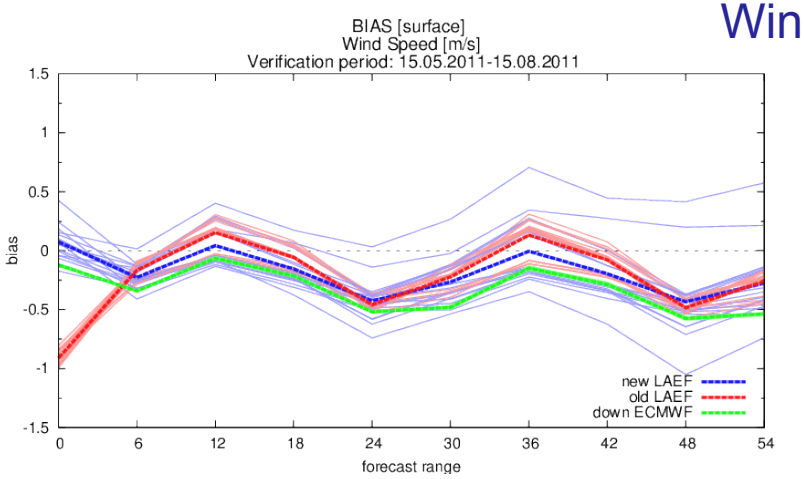
Unequal performance of individual members:

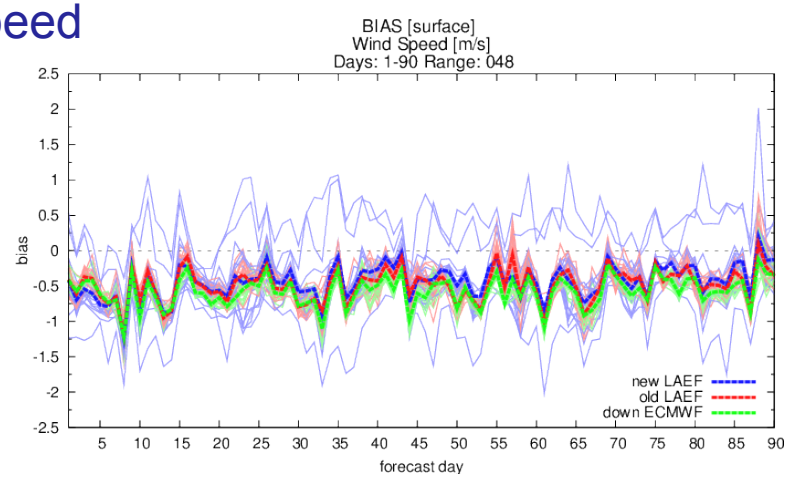
Temperature





Wind speed

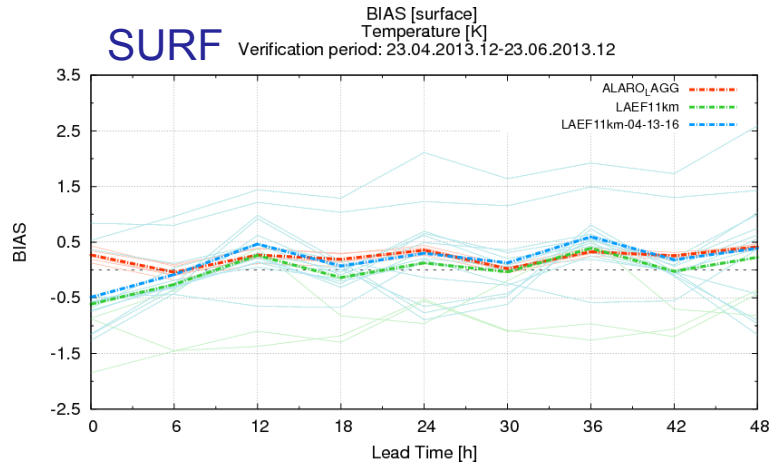




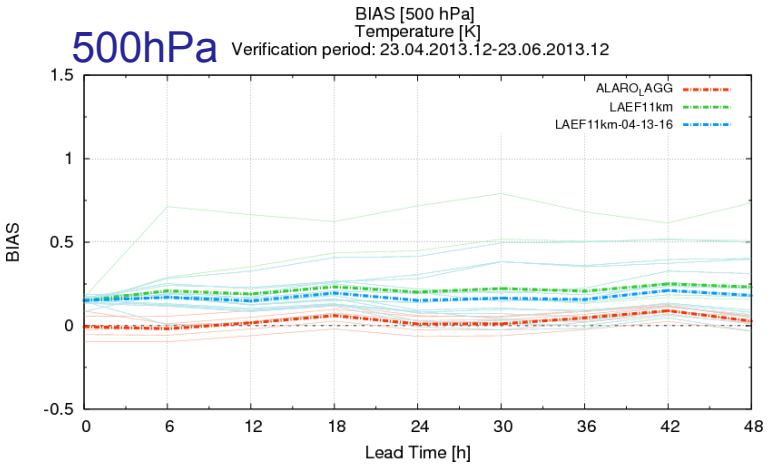
ALADIN-LAEF multi-physics (M. Bellus, S. Tascu)

Verification without blacklisted members (4, 13, 16): slight deterioration at the surface slight improvement for 500hPa

SURF

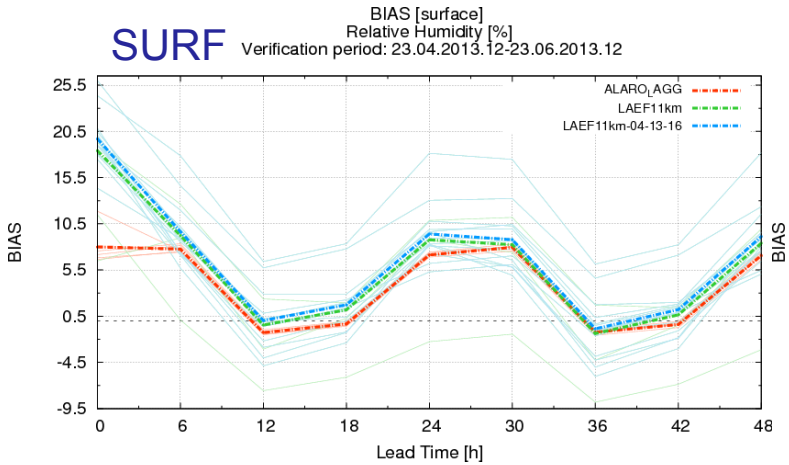


500hPa

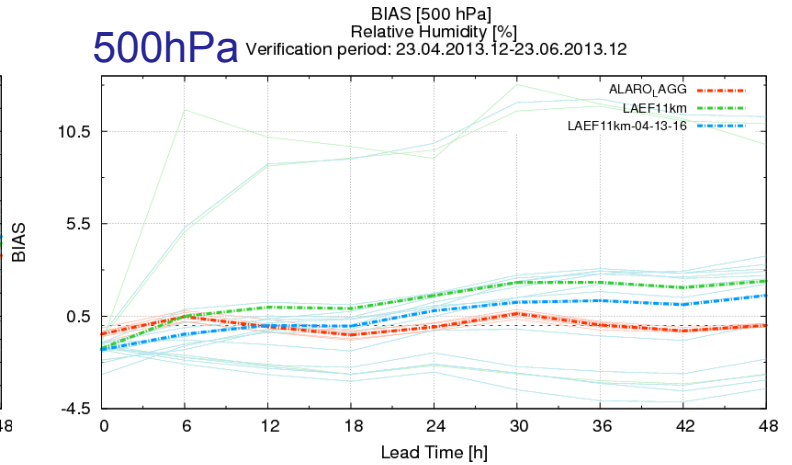


Temperature

SURF



500hPa

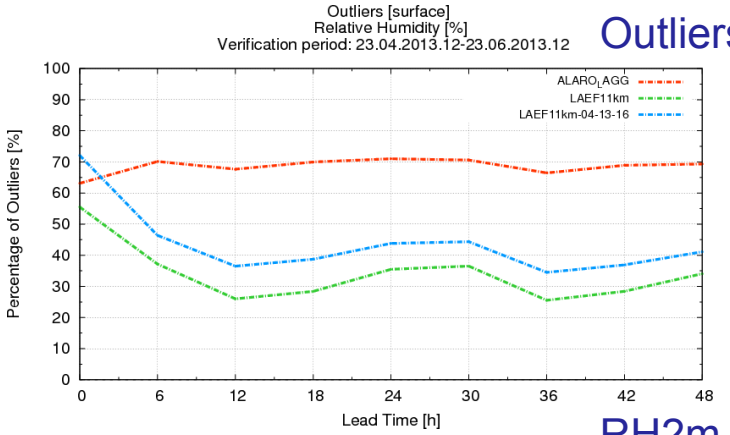


Rel. Humidity

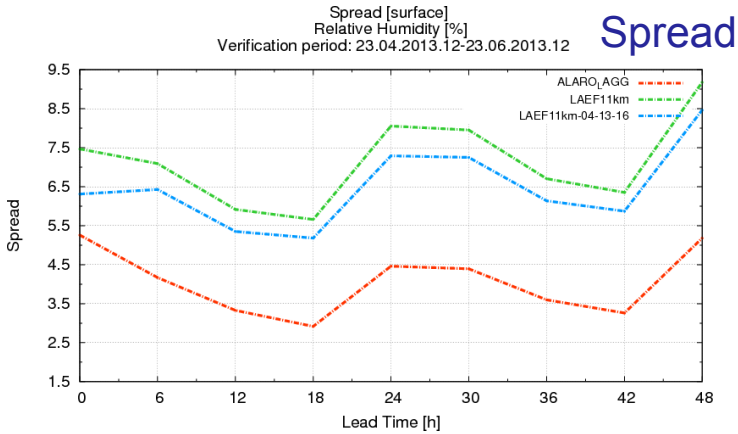
ALADIN-LAEF multi-physics (M. Bellus, S. Tascu)

Without blacklisted members 4, 13, 16:
More outliers, less spread

RH2m Outliers

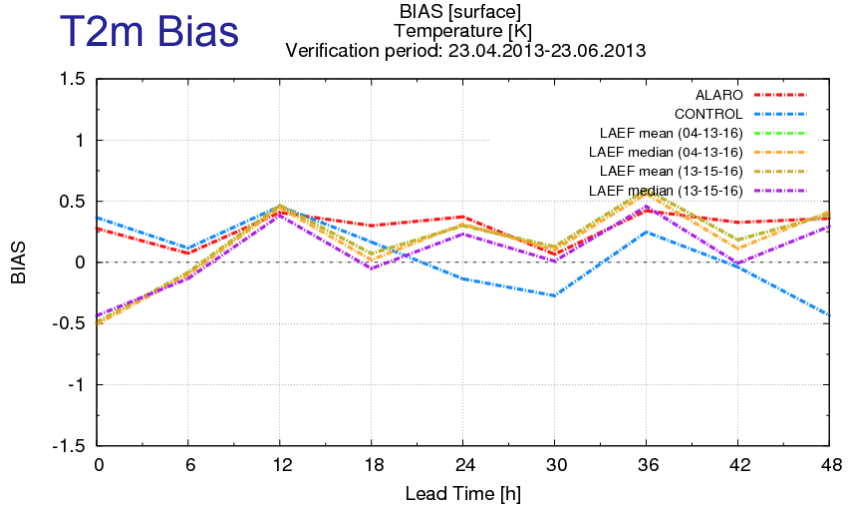


RH2m Spread



Other combination of blacklisted members: Small differences

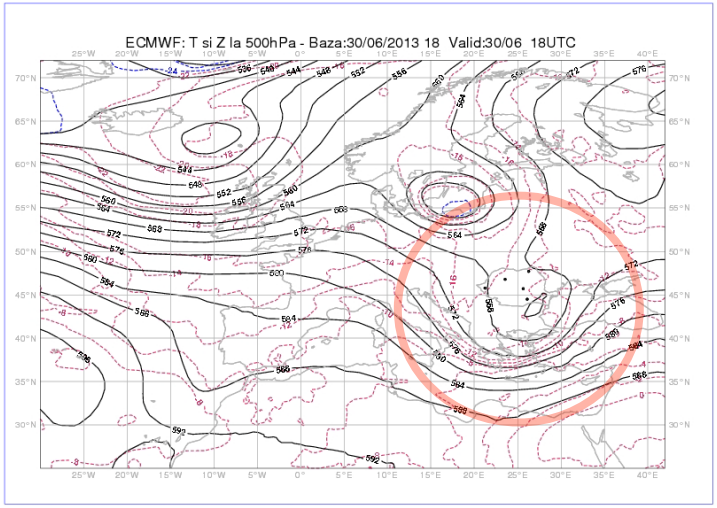
T2m Bias



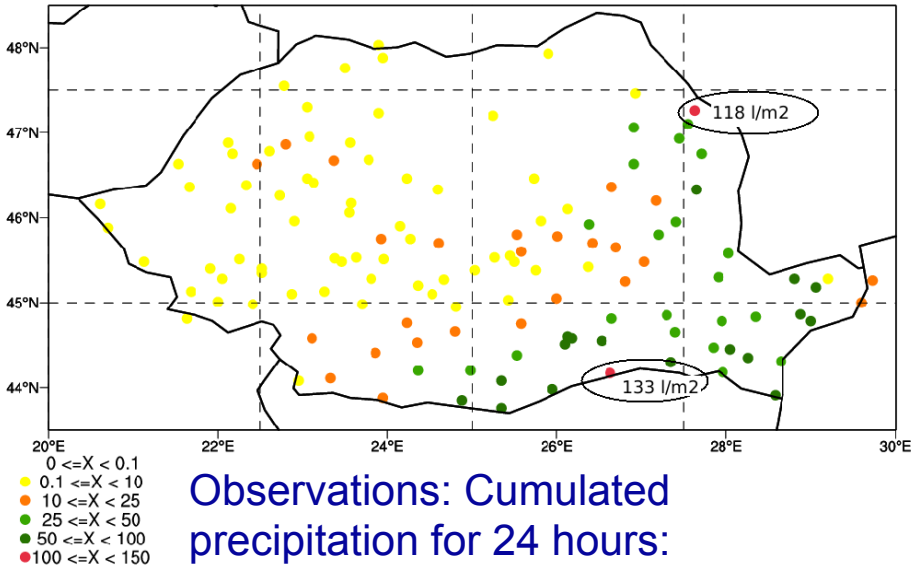
Further development:

Combine reduced multi-physics (a few stable members) with stochastic methods (SPPT, stoch. soil physics)

ALADIN-LAEF Romanian case study (Romanian Team)



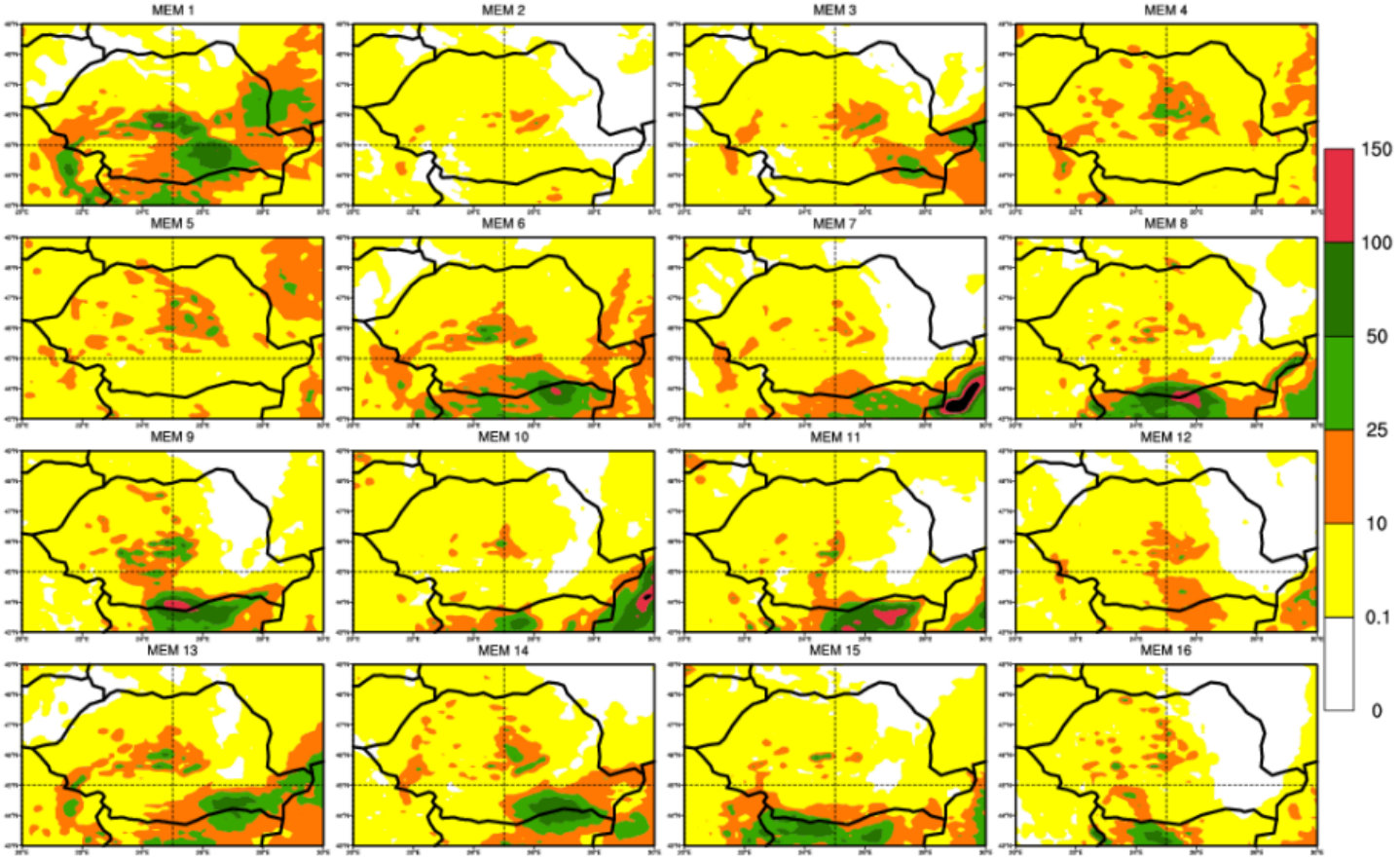
ECMWF analysis: 30.06.2013, 18 UTC
T500 and H500



Observations: Cumulated precipitation for 24 hours: 30-06-2013, 06 UTC – 01-07-2013, 06 UTC

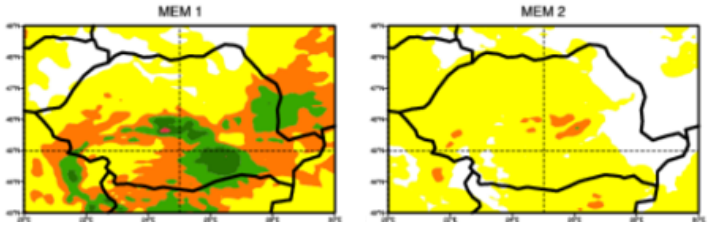
ALADIN-LAEF Romanian case study (Romanian Team)

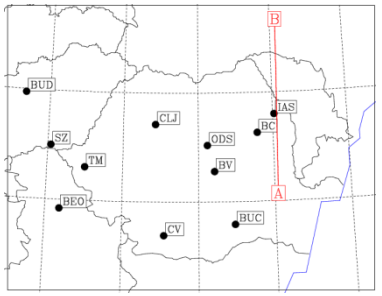
29-06-2013, 00 UTC + 54h
24h accumulated precipitation stamps



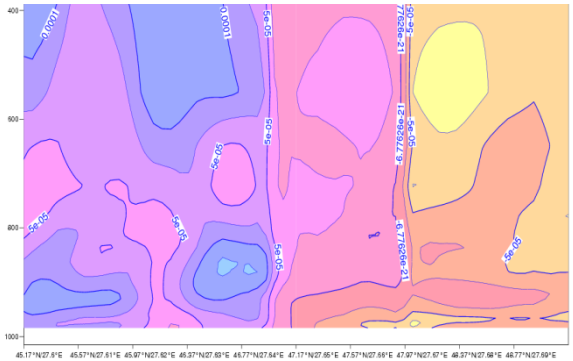
ALADIN-LAEF Romanian case study (Romanian Team)

Cross-section:
South (left) to North (right)
29-06-2013, 00 UTC + 54h

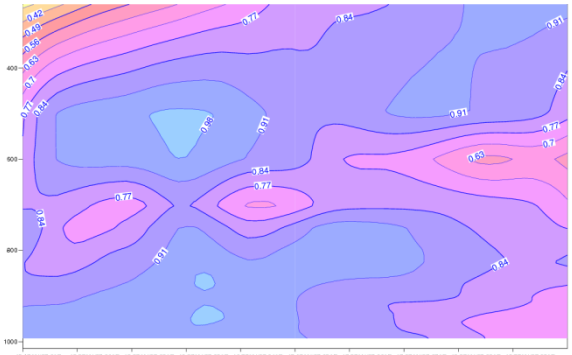




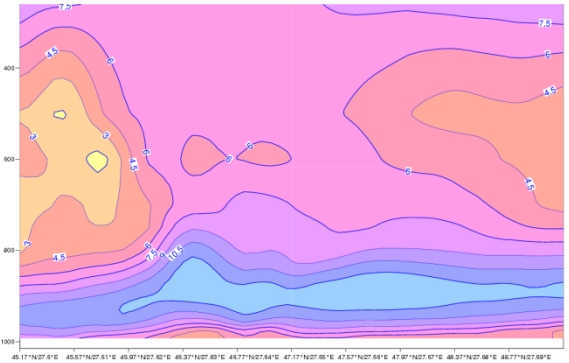
PV



Rel. Hum



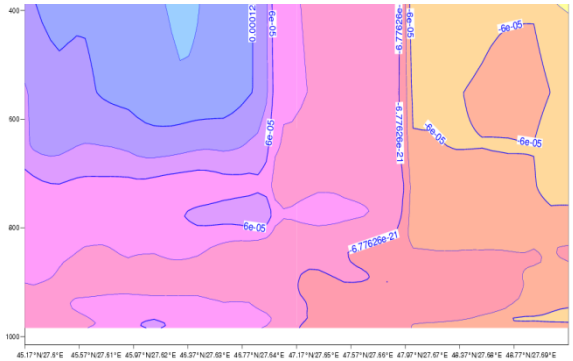
Wind



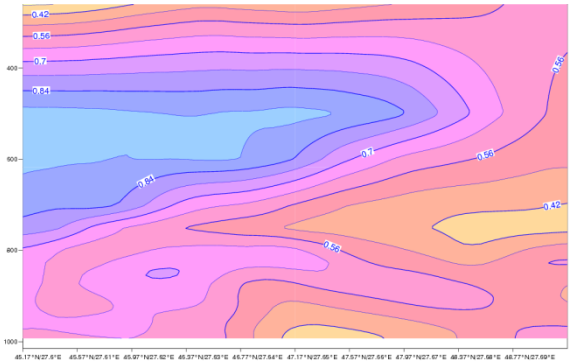
Mem 1

Mem 2

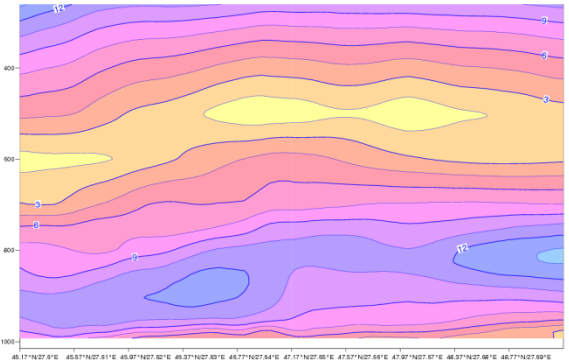
PV



Rel. Hum

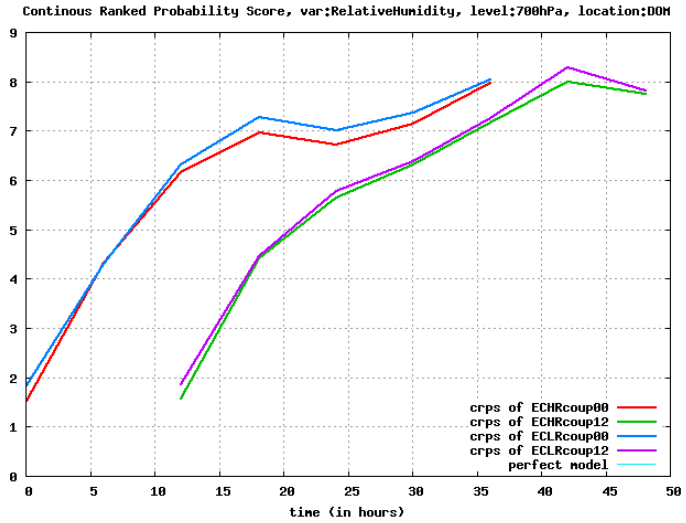


Wind

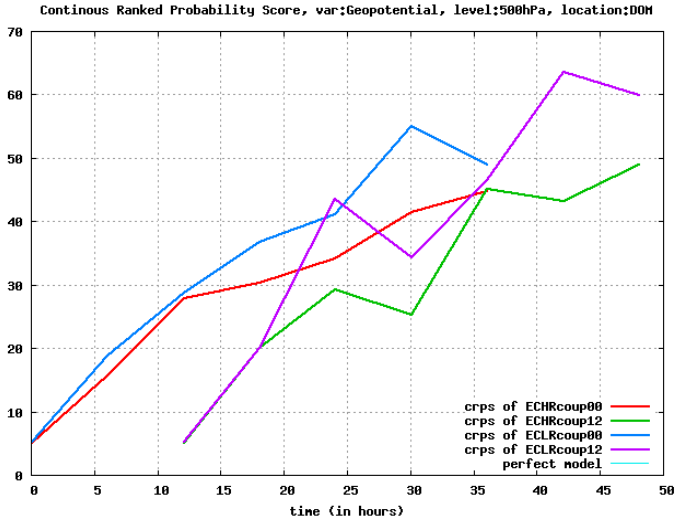


AROME-EPS – High/low-res ECMWF coupling (M. Szucs)

- LBCs – T1279 (~16km), 20 members provided by ECMWF to EPS community for 3 periods.
- Winter period (26.12.2011 – 8.1.2012) was evaluated
- Downscaling compared for HR-LBCs versus LR-LBCs (T639, ~32km)
- Positive impact is bigger for upper levels and smaller for lower levels and near surface



CRPS
RH 700hPa

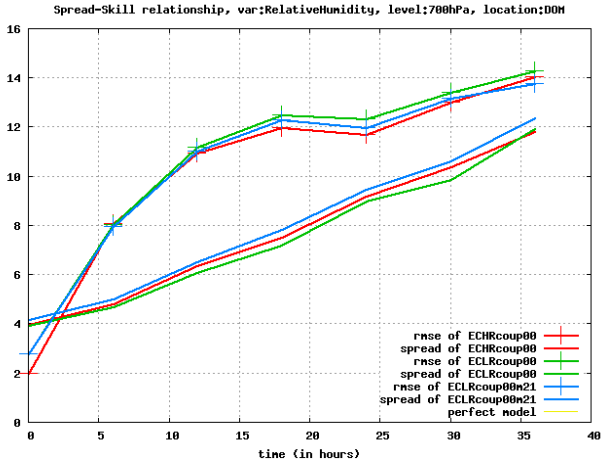


CRPS
Geopot.
500hPa

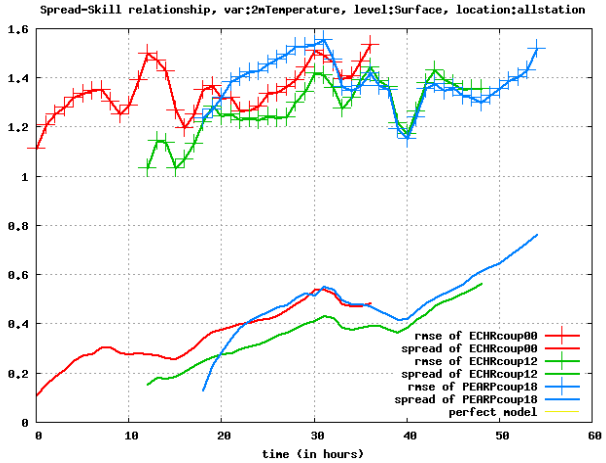
AROME-EPS – High/low-res ECMWF coupling (M. Szucs)

Impact of HR-LBCs is comparable to impact of higher number of LR-LBCs

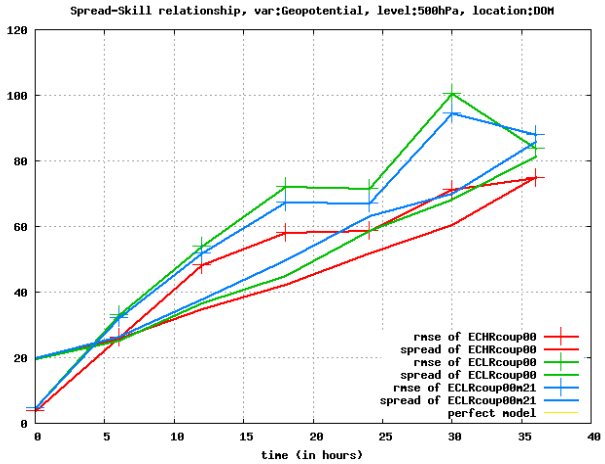
ECMWF-HR coupling vers. PEARP coupling



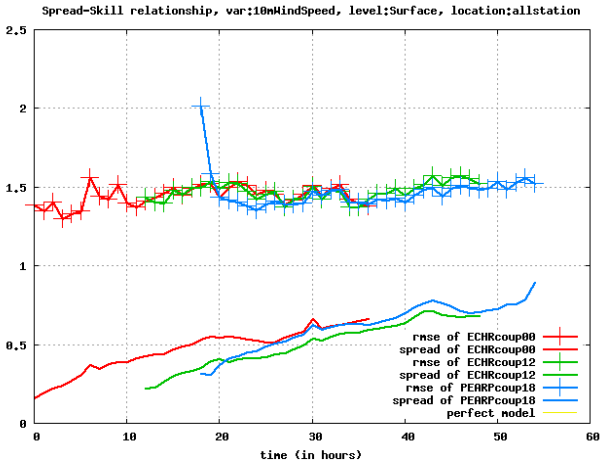
Spread-Skill RH 700hPa



Spread-Skill T2M



Spread-Skill Geopot. 500hPa



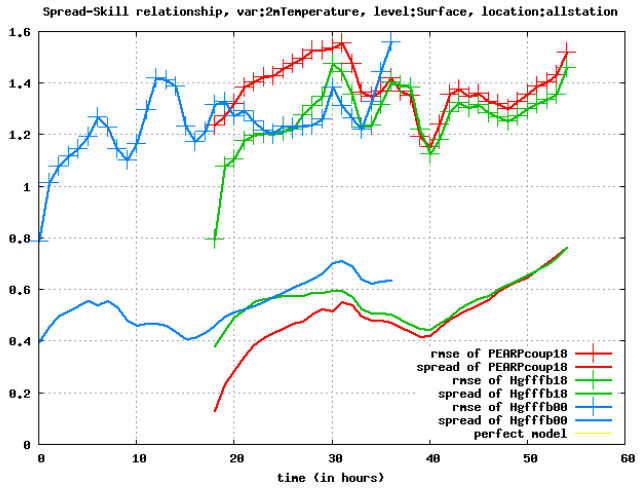
Spread-Skill Wind10M

AROME-EPS TEST of EDA-Suite (M. Szucs)

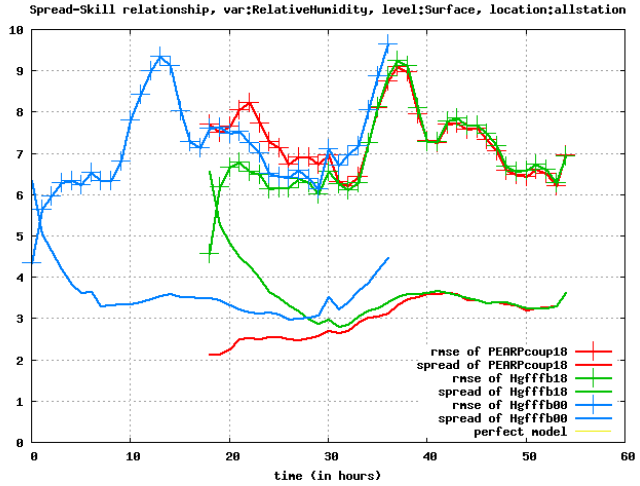
- Set-up of ensemble 3DVAR for upper levels
- PEARP LBCs (10+1 members)
  - 00 UTC run: 6h lag
  - 18 UTC run: 24h lag
- Assimilation of perturbed observations - conventional data only (OPLACE & ZAMG archive)
- 3h assimilation cycle
- Test for winter period (26.12.2011-8.1.2012, 2 days spin-up)

Results

- Visible improvement for surface (more than for upper levels) for the first 3-12 hours
- Additional spread at the beginning which decreases with time



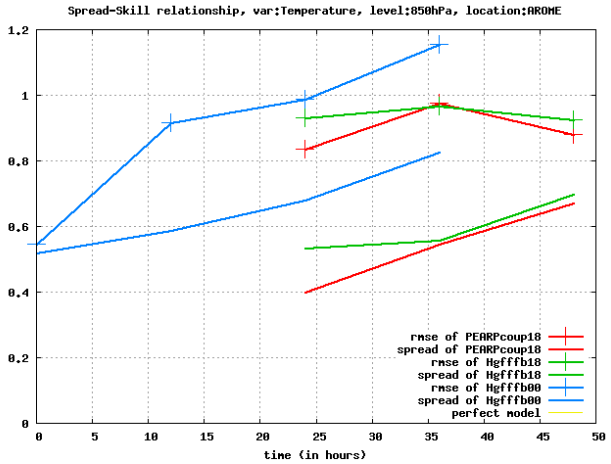
Spread-Skill T2M



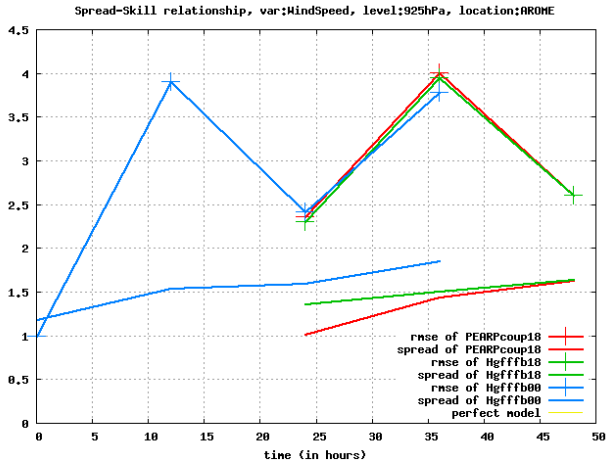
Spread-Skill RH2M

AROME-EPS TEST of EDA-Suite (M. Szucs)

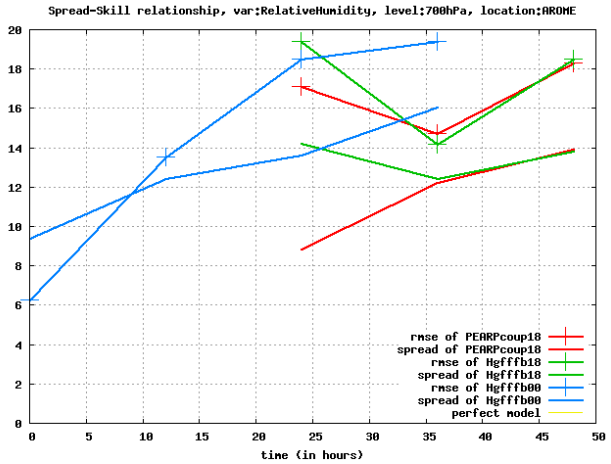
Results for upper levels: Advantage of short-time lagged coupling



Spread-Skill T850hPa



Spread-Skill Wind speed 925hPa



Spread-Skill RH700hPa

Future tasks:

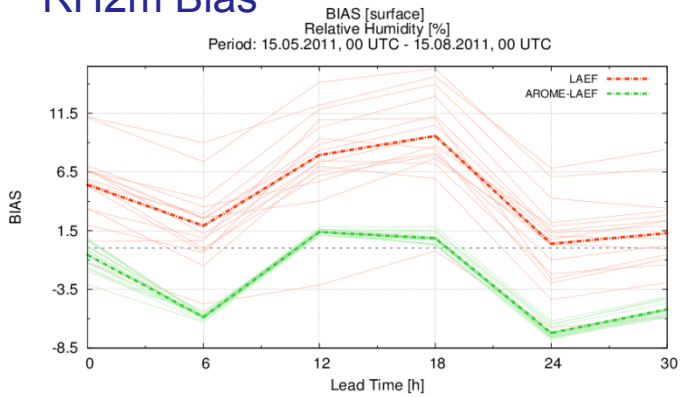
- Find more optimal perturbations
- Combination with other perturbation methods (e.g. physics)

AROME-EPS LAEF-downscaling (T. Schellander-Gorgas)

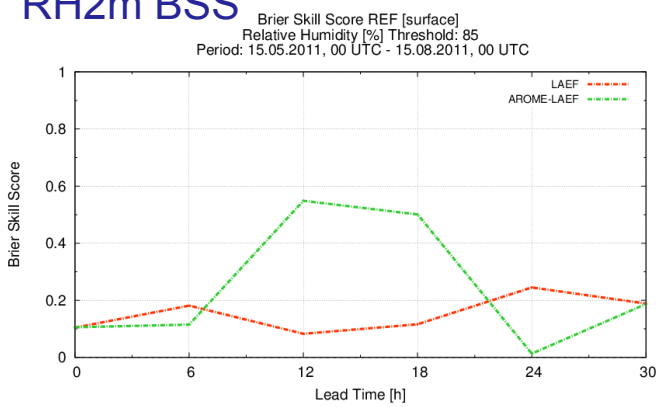
3-months downscaling experiment with ALADIN-LAEF coupling files

- Period: 15.5.2011-15.8.2011
- 3-hourly coupling
- +30h lead time

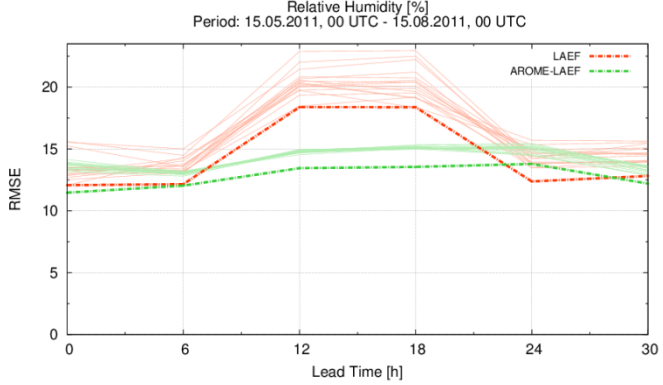
RH2m Bias



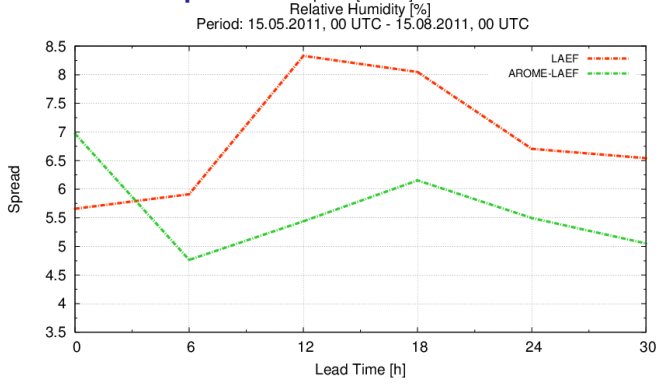
RH2m BSS



RH2m RMSE



RH2m Spread



Results

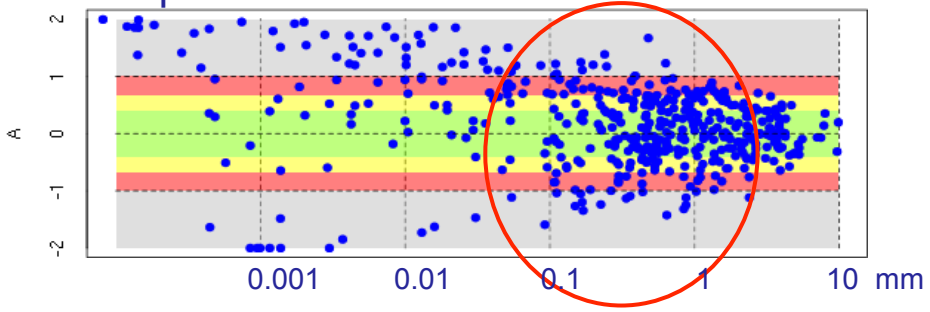
- Visible improvements for MSLP, partial for RH2m, T2m, Wind, precipitation
- Improved Biases + RMSE
- Larger percentage of outliers
- Smaller spread

AROME-EPS LAEF-downscaling (T. Schellander-Gorgas)

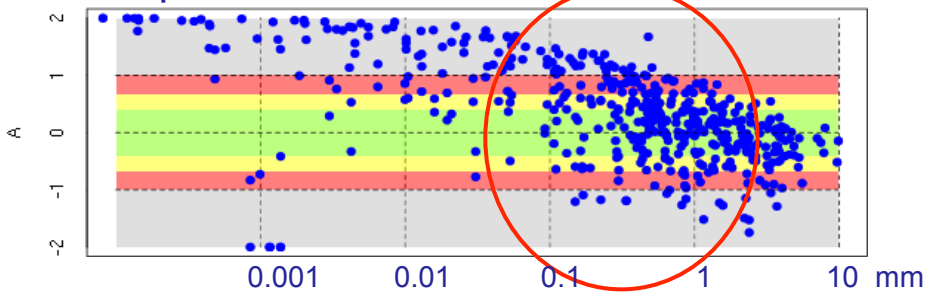
Precipitation results with SAL (RR-6h, Austrian INCA domain)

- Improvement of Amplitude Score – less over-estimation during the day
- Improvement for light rain events, equal for intense rain

A-component AROME-EPS

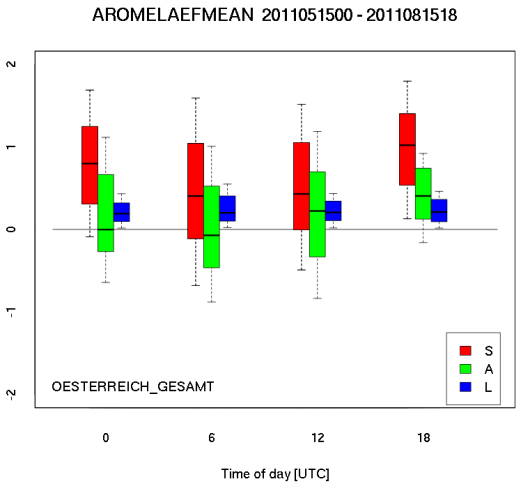


A-component LAEF

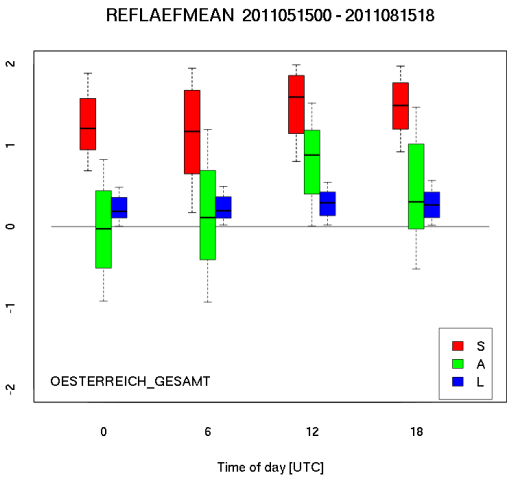


Factor: 1.5 2 3

AROME-EPS



LAEF



Outlook

ALADIN-LAEF

- Proceed to 5km resolution
- Multiphysics + SPPT + Stochastic soil physics
- Ens-3DVAR

AROME-EPS

- Further evaluation of downscaling experiments
- EDA for upper levels AND surface
- SPPT (continued) and multi-physics

Thank you for your attention!