What are the added values of LAMEPS?

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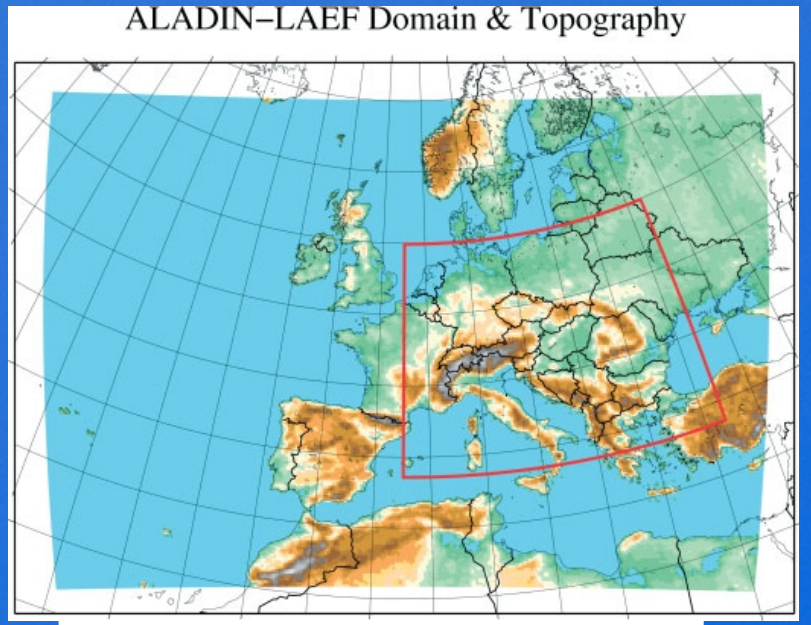
Outline

To justify the high computational costs of a LAMEPS, it has to be shown that LAMEPS fulfills the following requirements:

- **Provide a more-added value to a global EPS**
  - Probabilistic verification of ALADIN-LAEF vs. ECMWF-EPS
- **Adding value to the high resolution deterministic model counterpart**
  - Probabilistic verification of ALADIN-LAEF vs. Time-lagged EPS from ALADIN-AUSTRIA
  - Probabilistic verification of ALADIN-LAEF with ALADIN-AUSTRIA as reference model for skill scores
- **Conclusions**

LAEF - domain and setup

Ensemble size	16+1
Horizontal resolution	18 km
Vertical resolution	37 levels
Runs/Day	2 (00, 12 UTC)
Forecast range	60h
Output-Frequency	1h
Model time step	720s
Coupling-Model (time-lagged)	*ECMWF-EPS (SV Vectors)*
Coupling-Update	6h



Model core: **ALADIN**

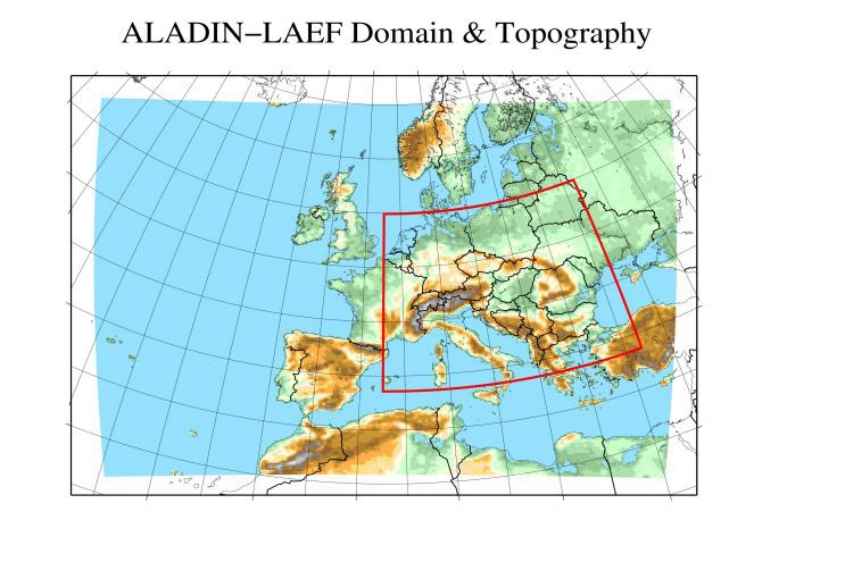
Atmosphere perturbation: **Blending ALADIN Bred + ECMWF SV**

Surface perturbation: **Non-Cycling surface Breeding**

Model perturbation: **multi-physics**

Experimental setup

- Verification period: 15.6.2007 – 20.8.2007
- Only 00 UTC runs are verified
- Surface parameter are verified against appr. 1200 Synop-stations
- Upper air parameter are verified against ECMWF-analysis



Does ALADIN-LAEF provide more added-value to ECMWF-EPS?

ALADIN-LAEF vs. ECMWF-EPS

	ALADIN-LAEF	ECMWF-EPS
Resolution	18km; 37 levels	TL 399; 62 levels
Ensemble size	16 member	50 member
Model	ALADIN	ECMWF IFS

ALADIN-LAEF vs. ECMWF-EPS

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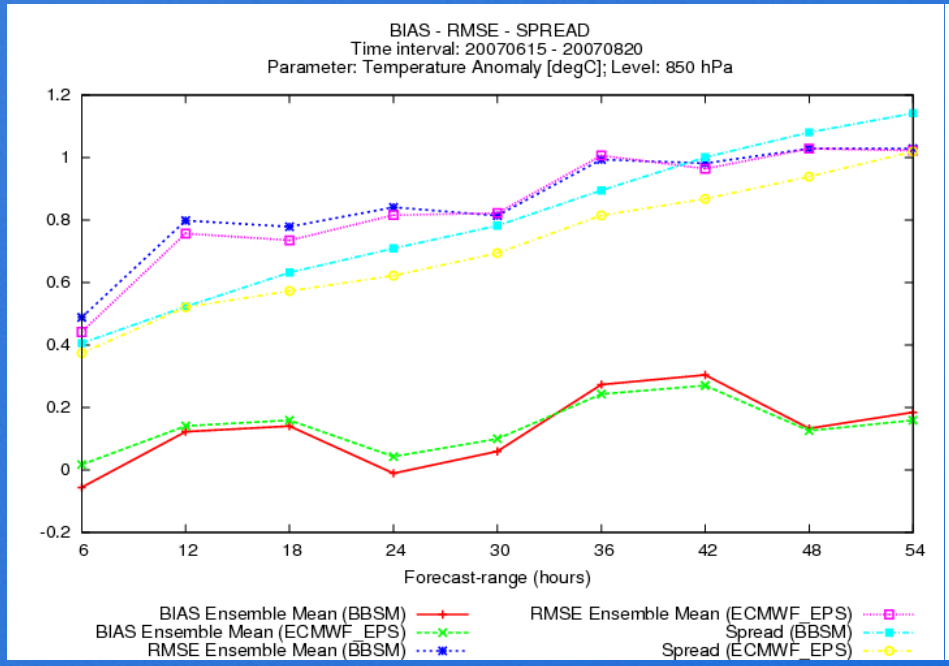
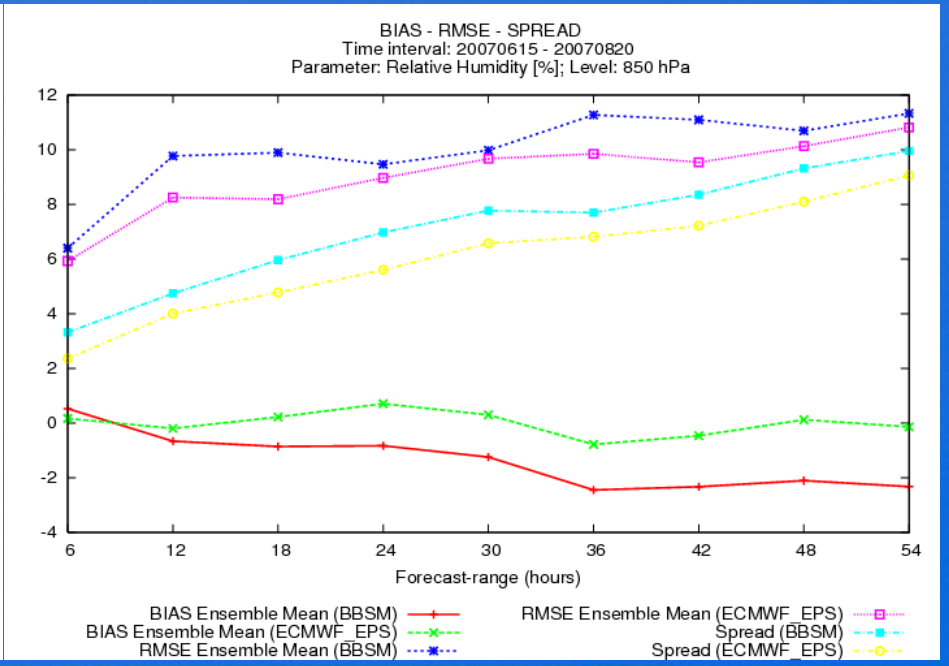
Upper air fields: SPREAD and BIAS/RMSE of ensemble mean

Temperature at 850 hPa



Relative humidity at 850 hPa

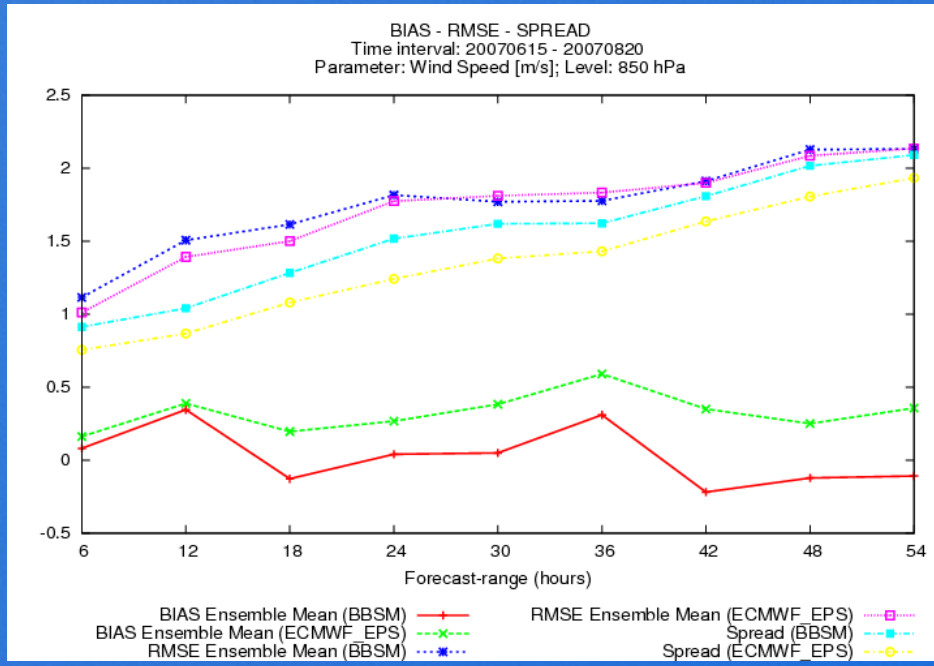


Slightly higher Spread and RMSE in ALADIN-LAEF (BBSM) compared to ECMWF-EPS

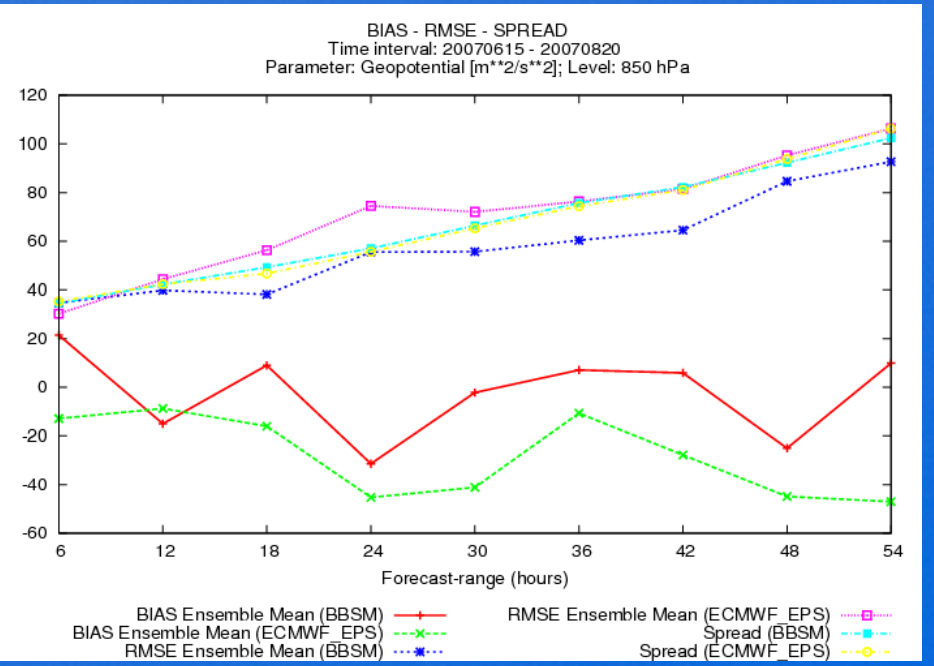
ALADIN-LAEF vs. ECMWF-EPS

Upper air fields: SPREAD and BIAS/RMSE of ensemble mean

Wind Speed at 850 hPa



Geopotential at 850 hPa

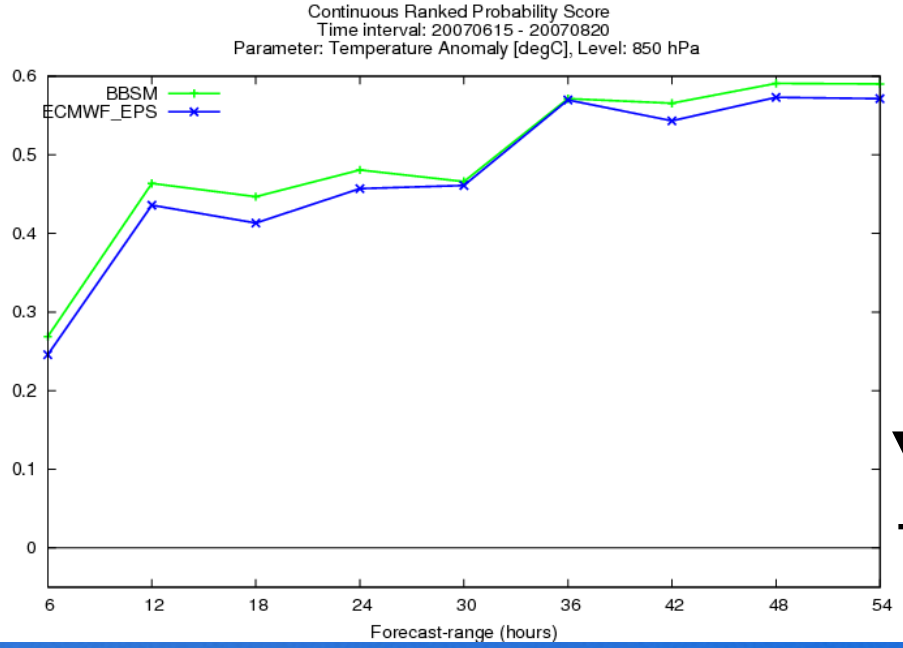


Wind: Slightly higher Spread and similar RMSE in ALADIN-LAEF compared to ECMWF-EPS
Geopotential: Too much Spread in ALADIN-LAEF (overdispersive)

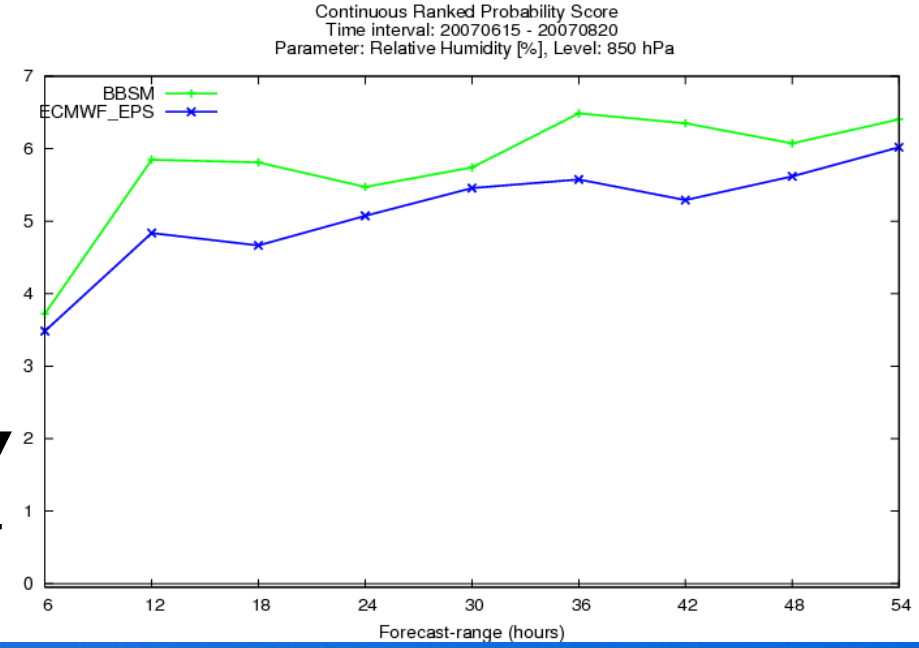
ALADIN-LAEF vs. ECMWF-EPS

Upper air fields: Continuous Ranked Probability Score

Temperature at 850 hPa



Relative humidity at 850 hPa



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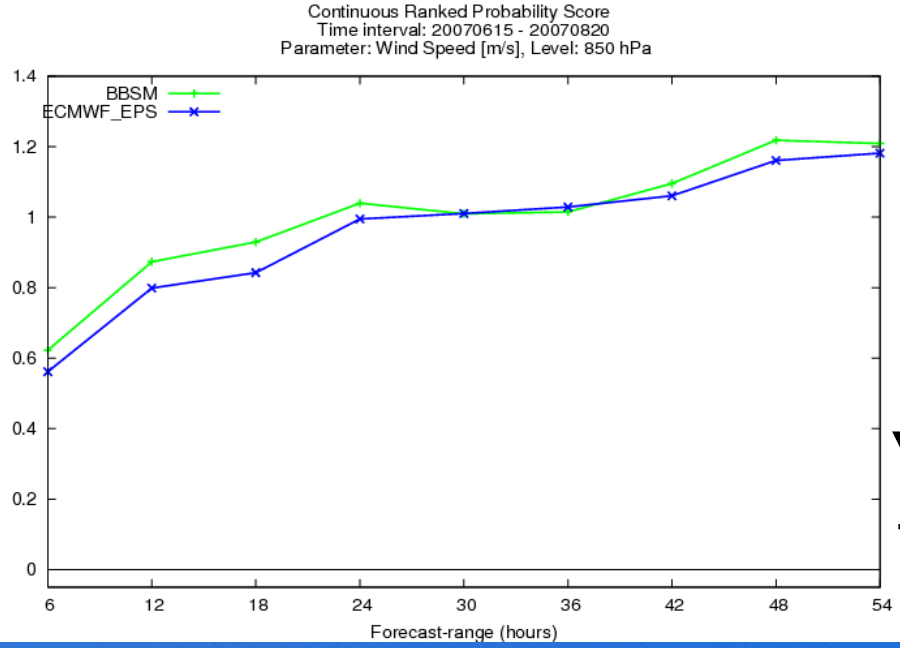
ECMWF-EPS outperforms ALADIN-LAEF for both parameter

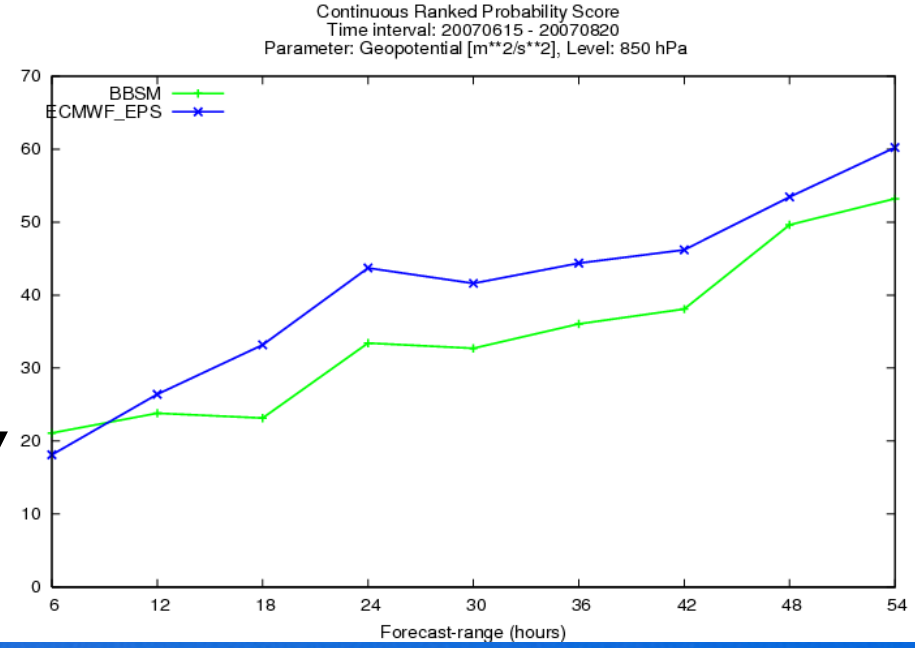
ALADIN-LAEF vs. ECMWF-EPS

Upper air fields: Continuous Ranked Probability Score

Wind Speed at 850 hPa



Geopotential at 850 hPa



Wind: ECMWF-EPS outperforms ALADIN-LAEF
Geopotential: ALADIN-LAEF performs better than ECMWF-EPS

ALADIN-LAEF vs. ECMWF-EPS

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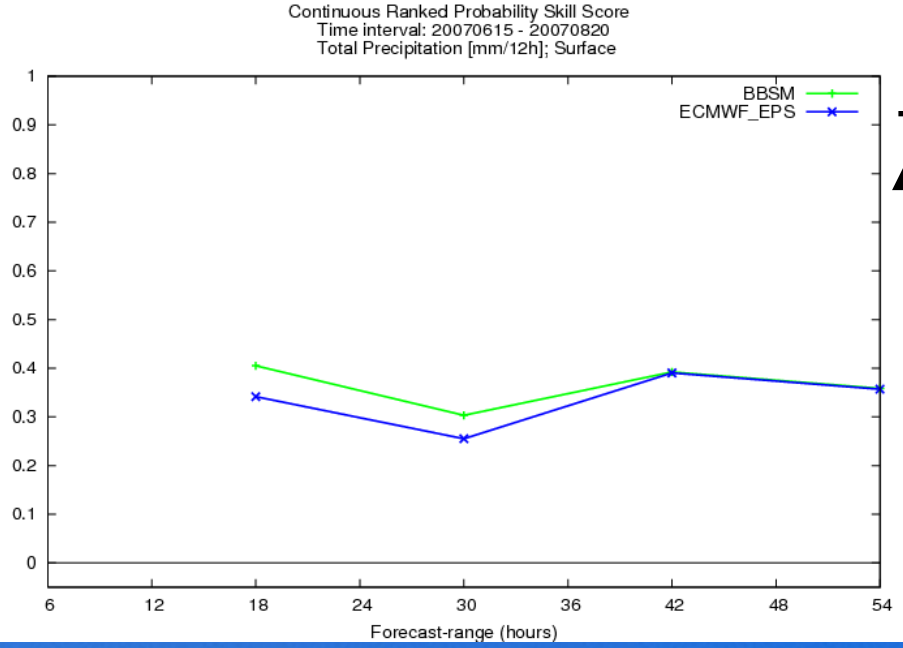
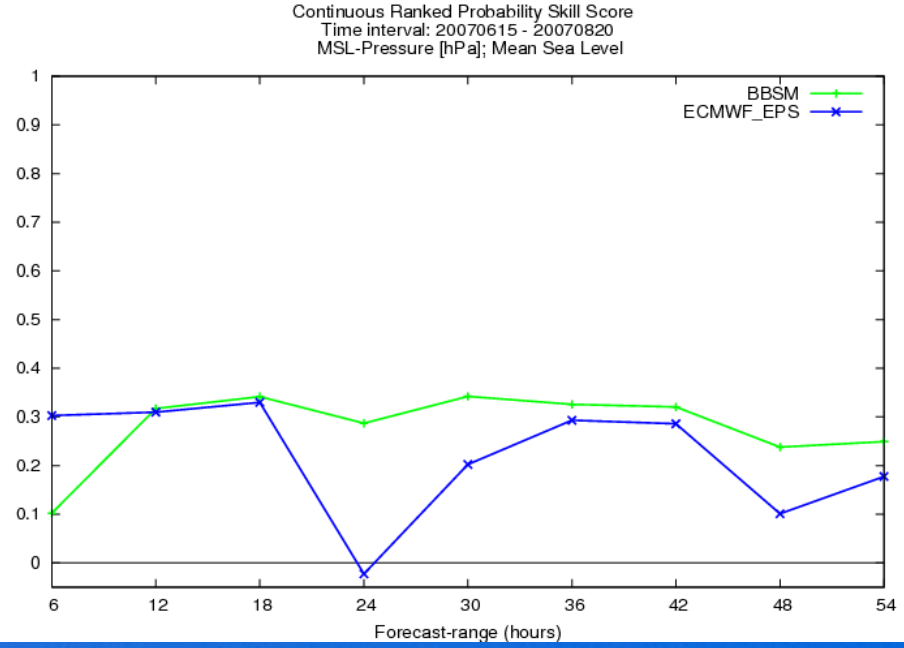
Surface parameter: Continuous Ranked Probability Skill Score
(Reference: ALADIN-AUSTRIA)

Precipitation



Mean Sea Level Pressure



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ALADIN-LAEF more skilfull than ECMWF-EPS in both parameter
Both Ensemble systems add value to the deterministic model

ALADIN-LAEF vs. ECMWF-EPS

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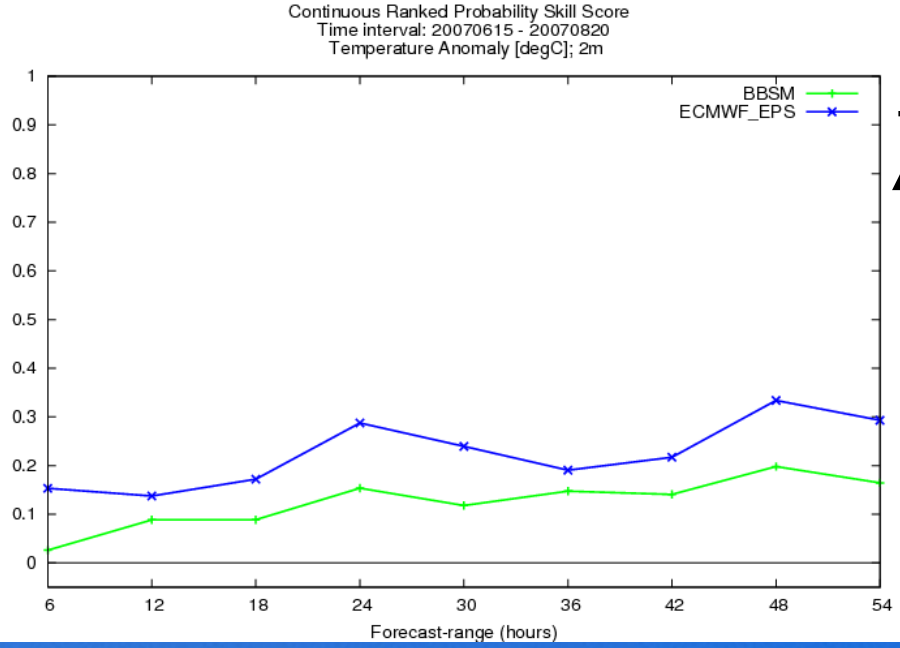
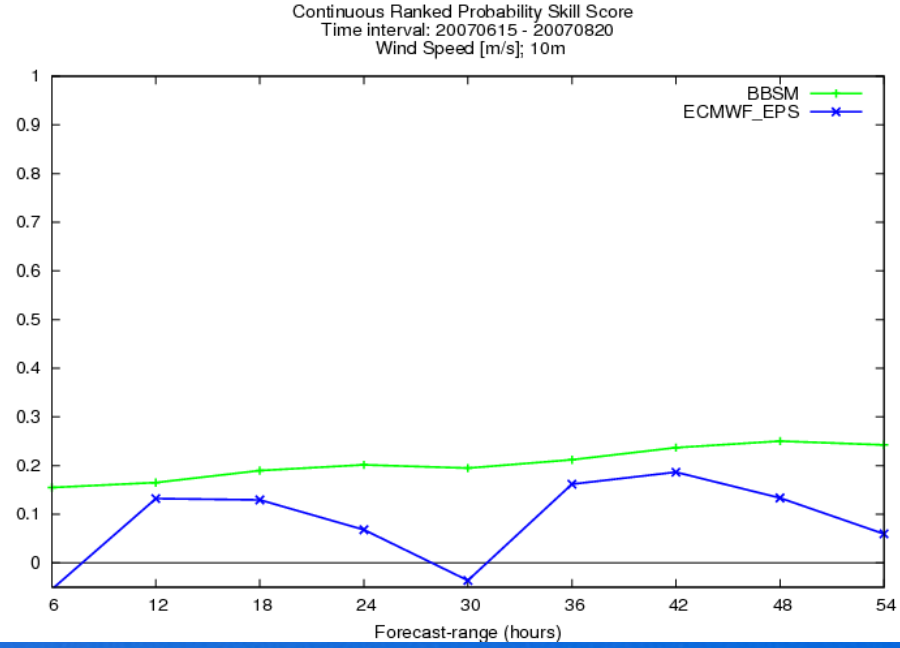
Surface parameter: Continuous Ranked Probability Skill Score
(Reference: ALADIN-AUSTRIA)

2m Temperature



10m Wind Speed



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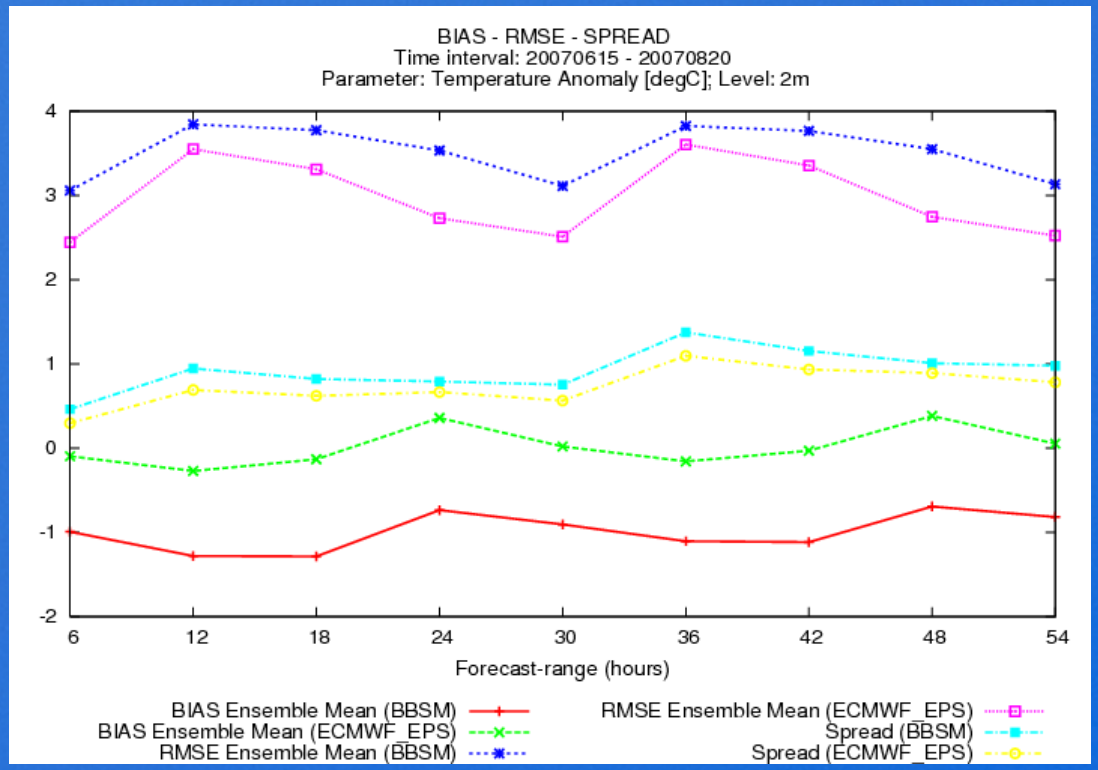
2m Temperature: ECMWF-EPS clearly better than ALADIN-LAEF
10m Wind: ALADIN-LAEF outperforms ECMWF-EPS

ALADIN-LAEF vs. ECMWF-EPS

Why performs 2m Temperature in ALADIN-LAEF poorer than ECMWF-EPS?

BIAS-RMSE-SPREAD of 2m Temperature

Cold BIAS!!!



Cold BIAS in ALADIN-LAEF 2m Temperature -> increased RMSE

Due to inconsistencies in soil moisture and soil temperature between ECMWF and ALADIN

Does ALADIN-LAEF provide more added-value to ECMWF-EPS?

- Upper air variables: ALADIN-LAEF performs similar to ECMWF-EPS
- Surface parameter: ALADIN-LAEF outperforms ECMWF-EPS except for 2m temperature

Outline

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  - Probabilistic verification of ALADIN-LAEF vs. ECMWF-EPS

- **Adding value to the high resolution deterministic model counterpart?**
  - Probabilisitc verification of ALADIN-LAEF vs. Time-lagged EPS from ALADIN-AUSTRIA
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ALADIN-LAEF vs. Lagged ALADIN-AUSTRIA EPS

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	ALADIN-LAEF	ALADIN-AUSTRIA
Resolution	18km; 37 levels	9.6km; 60 levels
Ensemble size	16 member	5 member
Model	ALADIN	ALADIN

00 UTC:	00	06	12	18	24	30	36	42	48	54	60	66	72
06 UTC:		00	06	12	18	24	30	36	42	48	54	60	66
12 UTC:			00	06	12	18	24	30	36	42	48	54	60
18 UTC:				00	06	12	18	24	30	36	42	48	54
00 UTC:					00	06	12	18	24	30	36	42	48

Comparison of 00 UTC runs up to 48h forecasts

ALADIN-LAEF vs. Lagged ALADIN-AUSTRIA EPS

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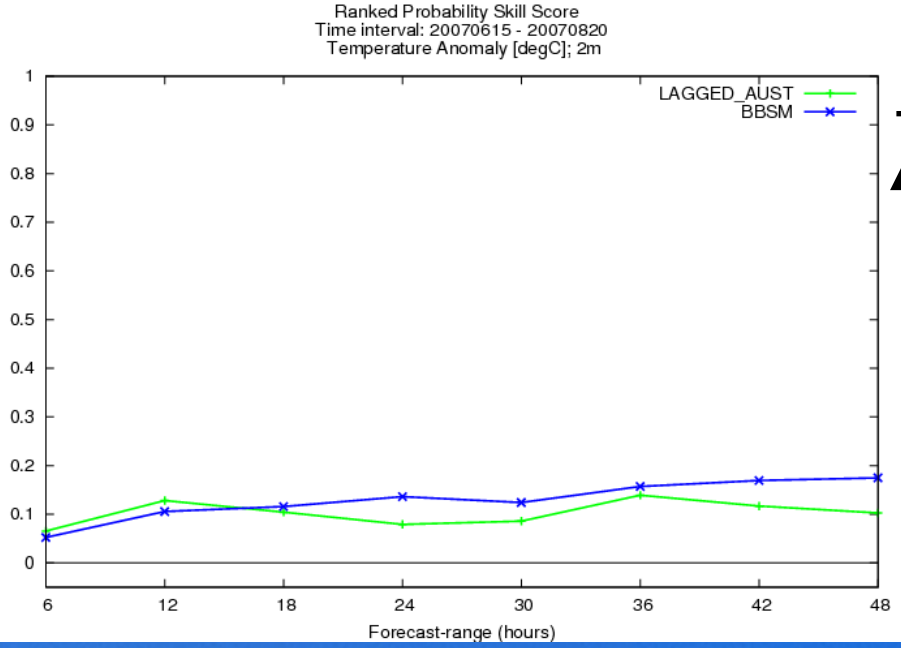
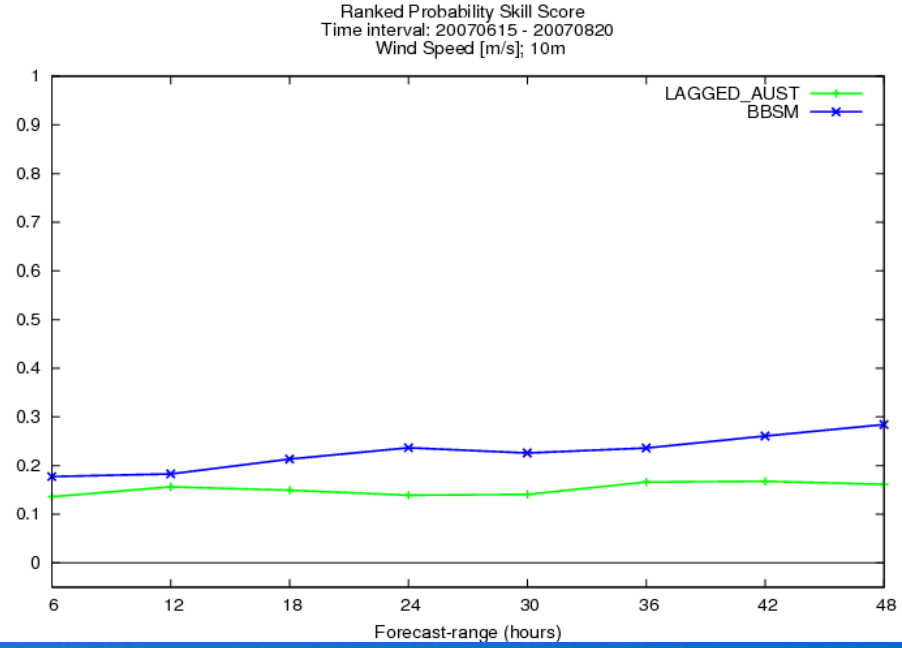
Surface parameter: Ranked Probability Skill Score

(Reference: ALADIN-AUSTRIA)

2m Temperature



10m Wind Speed



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Both ensembles add value to the deterministic model

ALADIN-LAEF outperforms the lagged ALADIN-AUSTRIA ensemble

ALADIN-LAEF vs. Lagged ALADIN-AUSTRIA EPS

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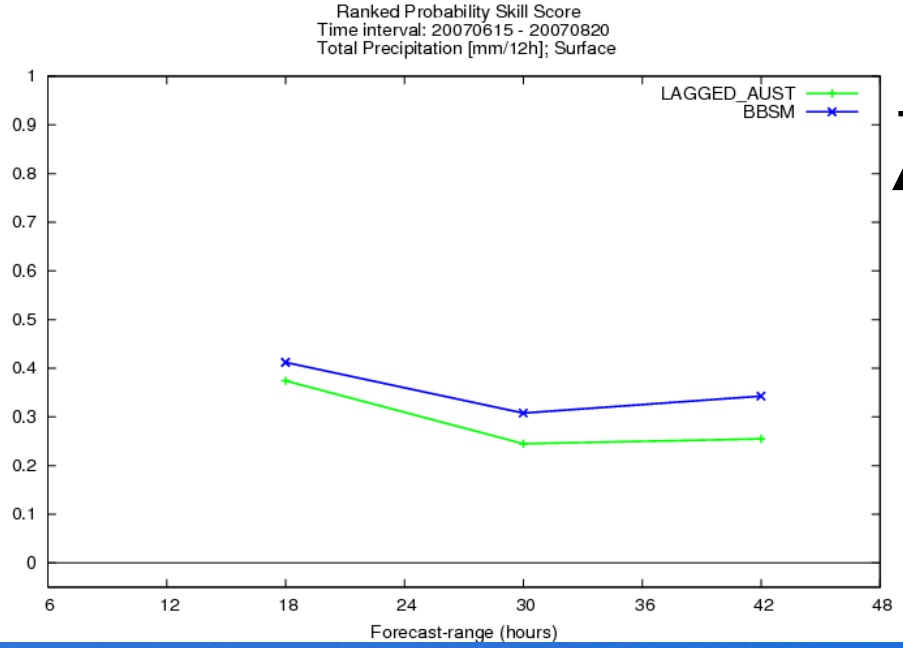
Surface parameter: Ranked Probability Skill Score
(Reference: ALADIN-AUSTRIA)

Precipitation



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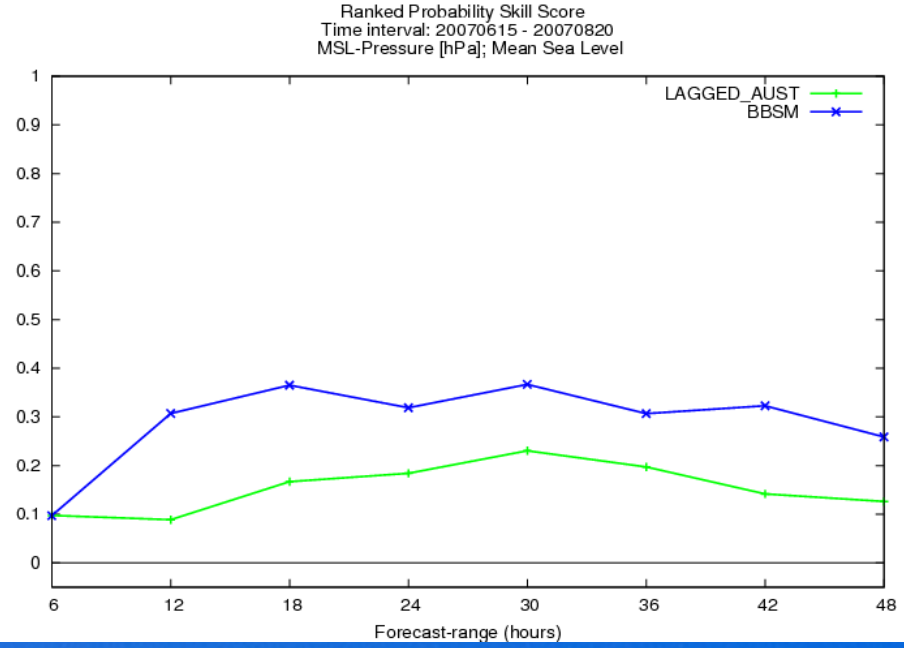

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Both ensembles add value to the deterministic model
ALADIN-LAEF outperforms the lagged ALADIN-AUSTRIA ensemble

Conclusions

Verification of ALADIN-LAEF vs. ECMWF-EPS:

- ALADIN-LAEF more skilfull for surface parameter except 2m temperature. This is due to inconsistencies in the surface schemes of ECMWF and ALADIN which lead to cold BIAS in ALADIN-LAEF
- For upper air fields ALADIN-LAEF performs similar to ECMWF-EPS
- ALADIN-LAEF provides more added value to ALADIN-AUSTRIA

Verification of ALADIN-LAEF vs. Time-lagged ALADIN-AUSTRIA:

- ALADIN-LAEF clearly outperforms an ensemble created from the high resolution deterministic model ALADIN-AUSTRIA

Outlook

In 2009 and 2010 major upgrades of the ECMWF-EPS were implemented

- Revised stochastic physics scheme
- Increase of horizontal resolution from 50 km to 32 km
- Ensemble Data Assimilation Scheme to provide initial perturbations

-> Verification has to be repeated with upgraded ECMWF-EPS