

Zentralanstalt für Meteorologie und Geodynamik



Status of ALADIN-LAEF

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Weidle, Jian Tang, Fan Xia and many more

Outline

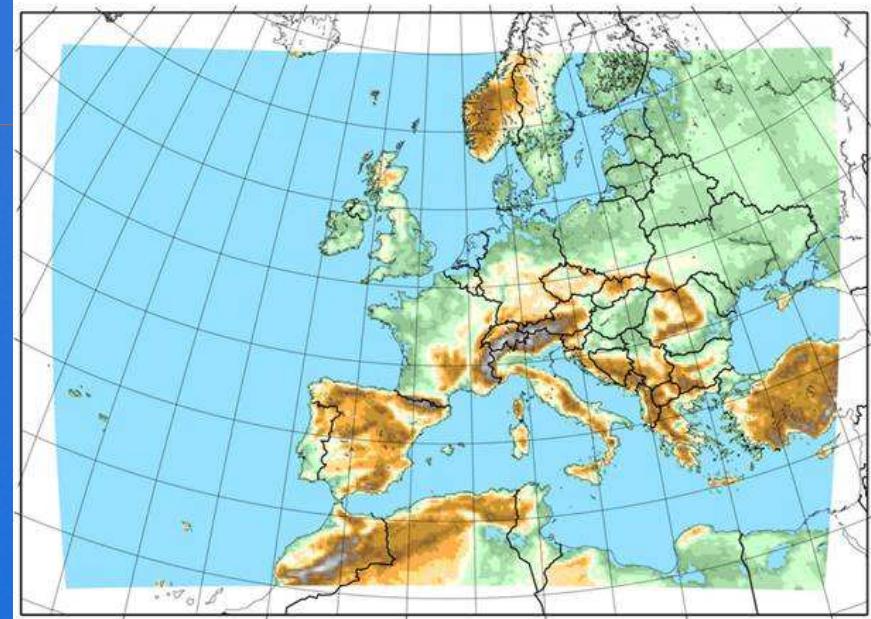
- ALADIN-LAEF operational configuration
- ALADIN-LAEF upgrade with new features:
 - Ensemble land surface data assimilation
 - Stochastic perturbation in the surface physics
 - Revised Multi-physics
 - Higher horizontal and vertical resolution
- Summary



Operational setup of ALADIN-LAEF

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
Coupling-Update	6h

ALADIN-LAEF Domain & Topography



Model core: **ALADIN**

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

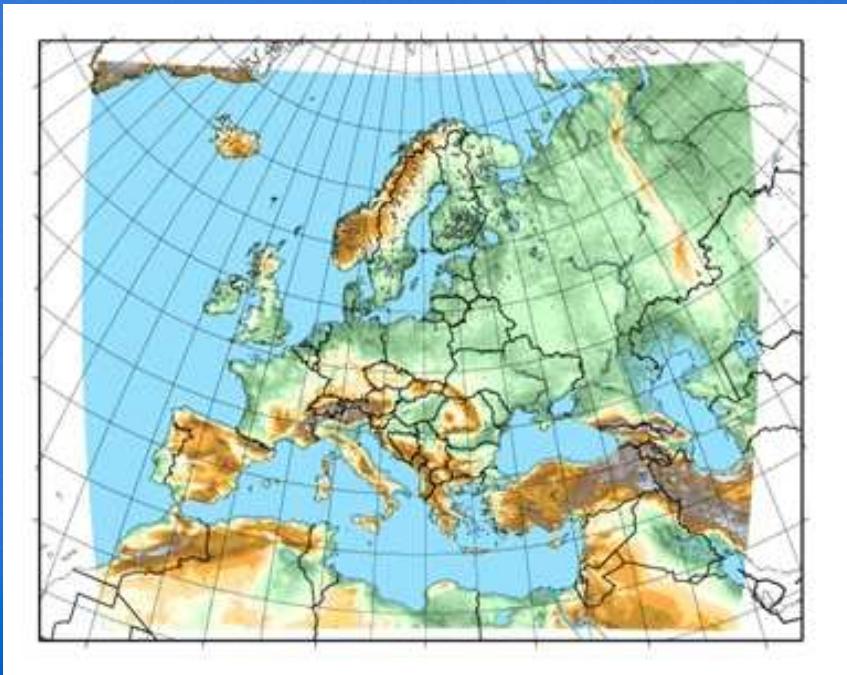
Surface perturbation:
Non-Cycling surface Breeding

Model perturbation: **multi-physics**



ALADIN-LAEF upgrade

- Blending for IC perturbation
- Revised multiphysics
- Ensemble land surface data assimilation
- Stochastic surface physics

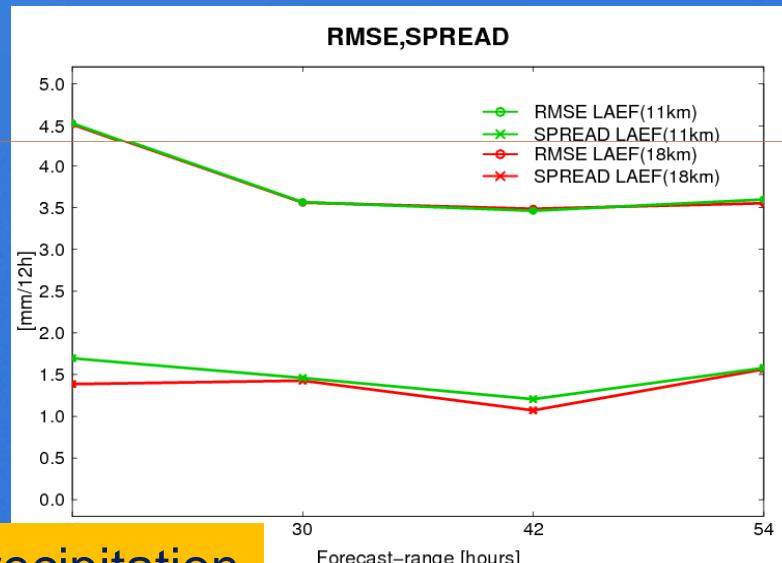


Ensemble size	16+1
Horizontal resolution	10.9 km
Vertical resolution	45 levels
Runs/Day	2 (00, 12 UTC)
Forecast range	72 h
Output-Frequency	1h
Model time step	450s
Coupling-Model (time-lagged)	<i>ECMWF-EPS</i> <i>(first 16 members)</i>
Coupling-Update	6h

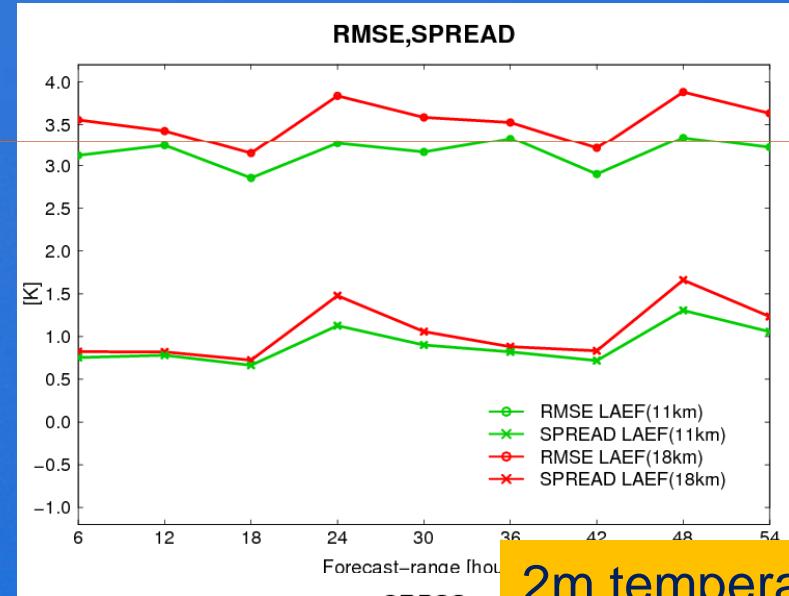


Impact of resolution: 18km vs. 11km

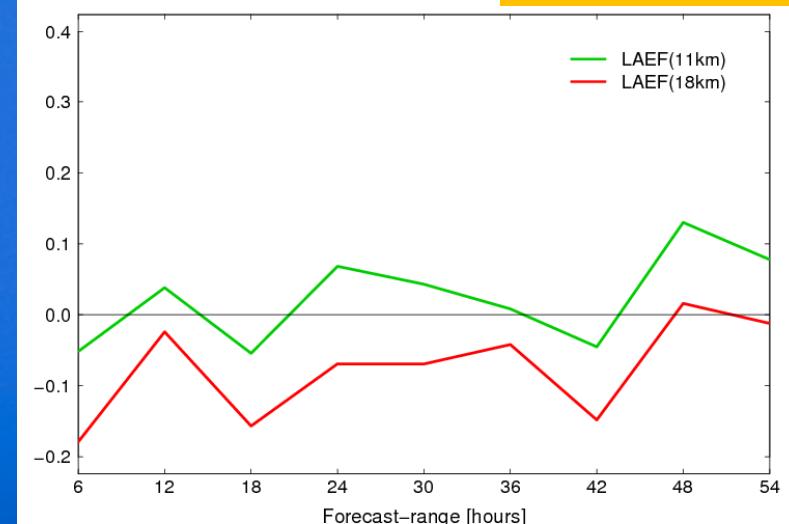
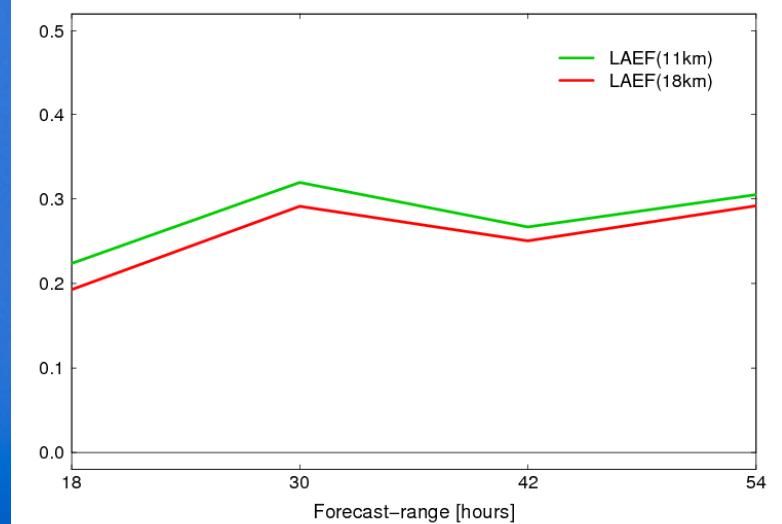
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Precipitation

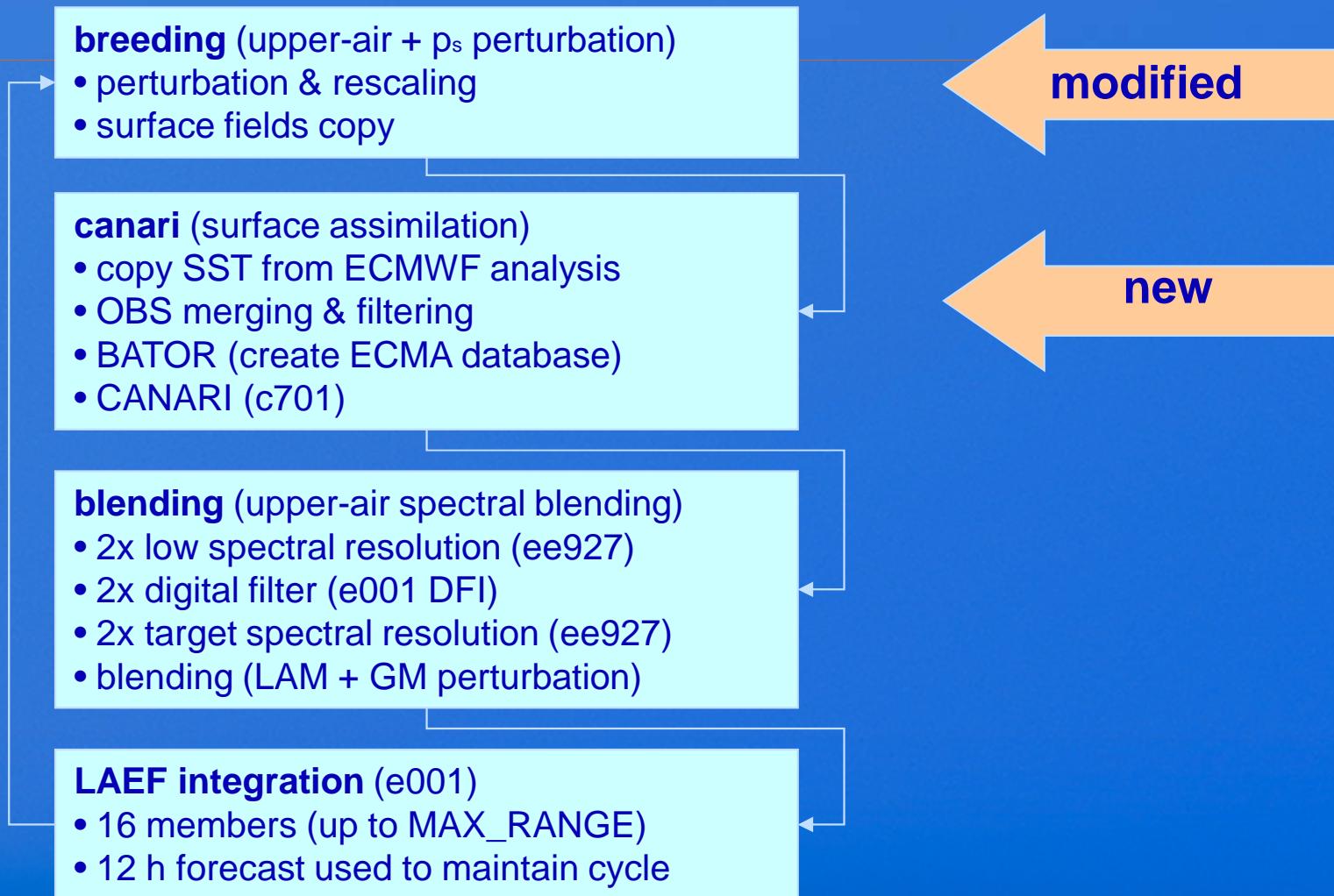


2m temperature



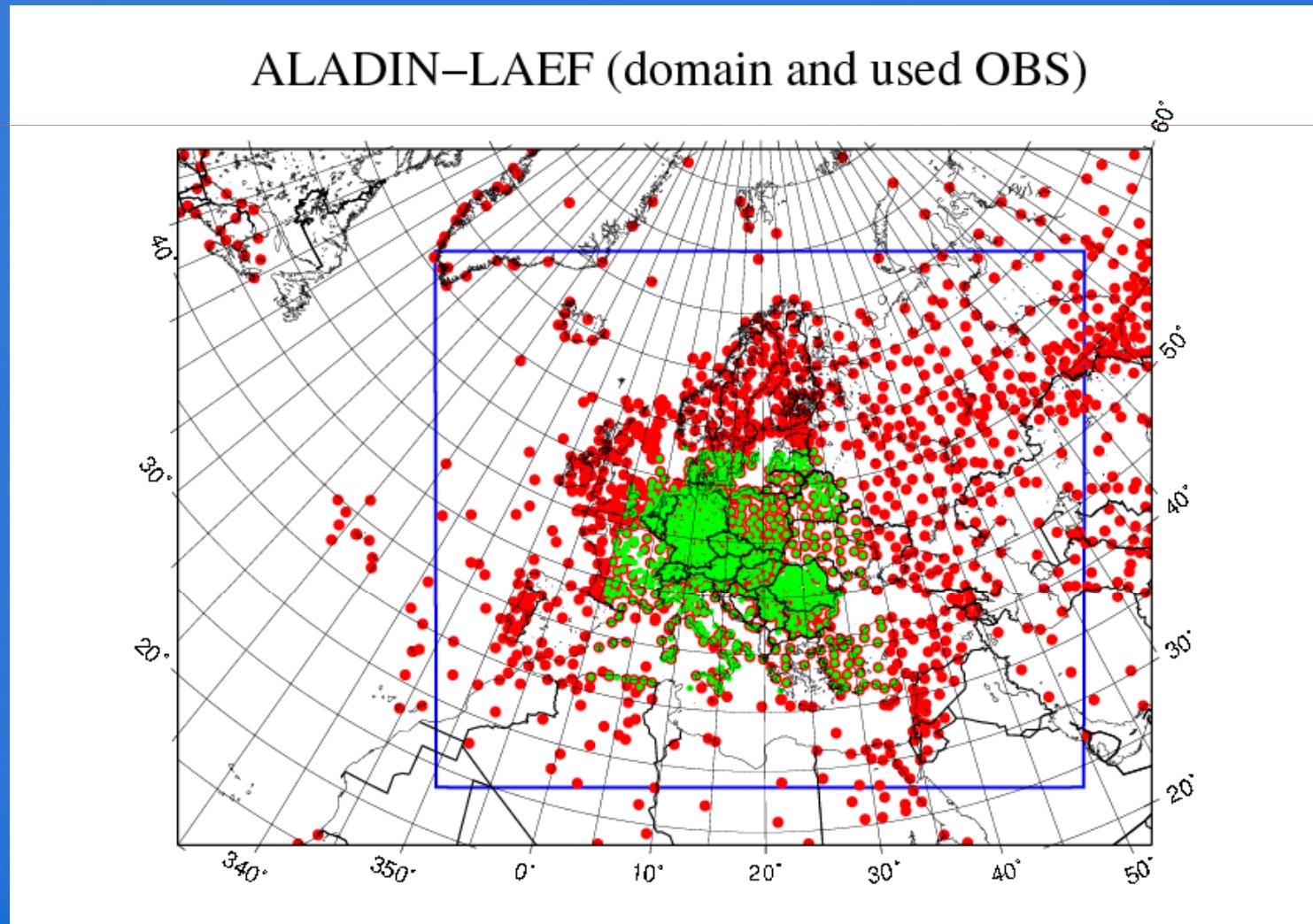
LAEF IC perturbation: atmosphere and land surface (breeding-canari-blending cycle)

(Präsentation)
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Ensemble surface DA: observation coverage

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New LAEF domain covered by OPLACE (red dots) and “local” AT SYNOP observations (green dots)

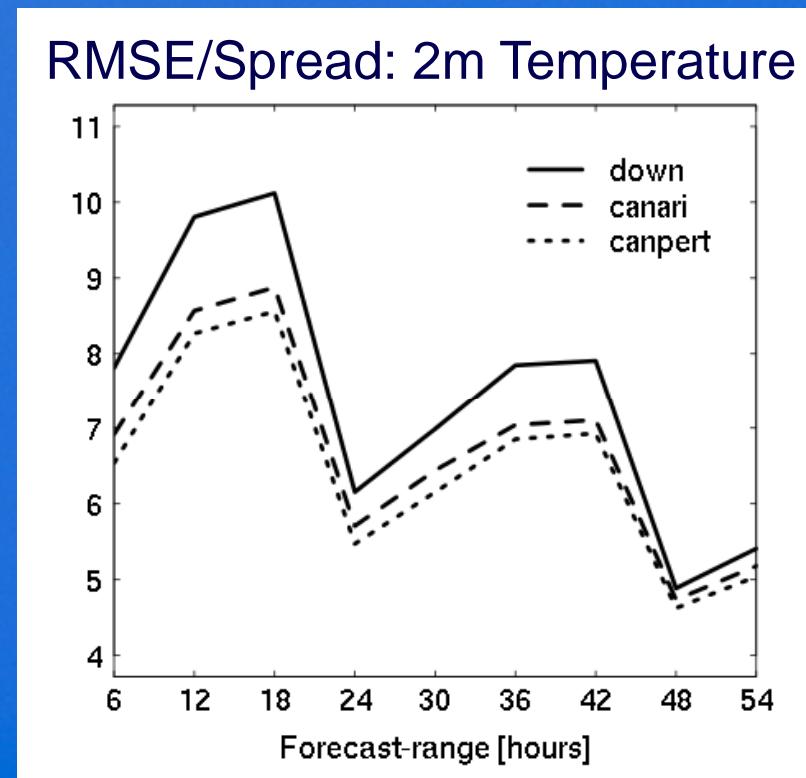
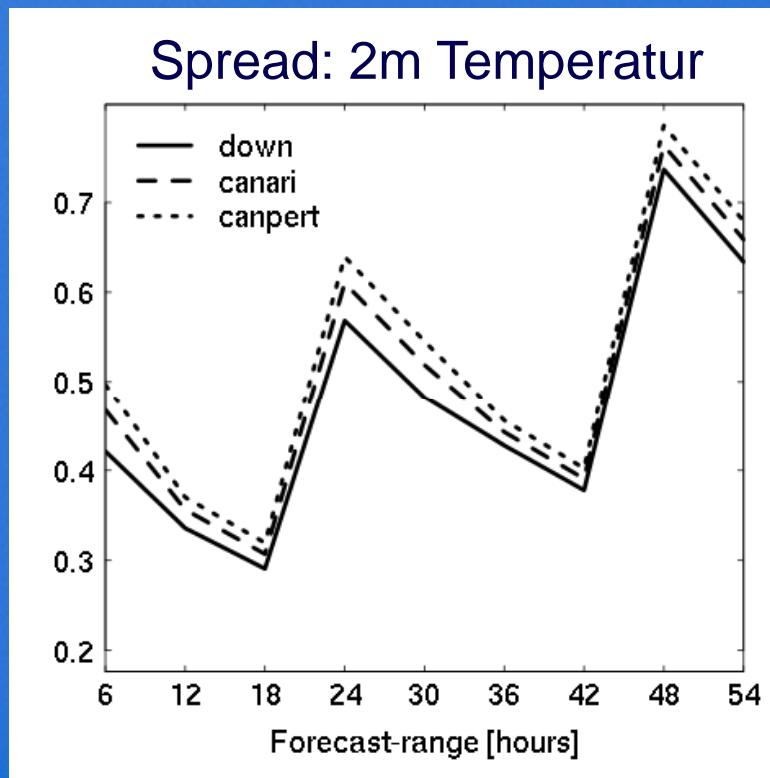


Verification of ensemble land surface assimilation

Down (Reference): Downscaling of ECMWF-EPS with ARPEGE surface -> All members start with same surface, no multiphysics

Canari: Surface assimilation in ALADIN-LAEF (OI)

Canpert: Surface assimilation with perturbed observations



Verification period: 15/05/2011 – 15/08/2011, only 12 UTC runs
1215 synop stations are used

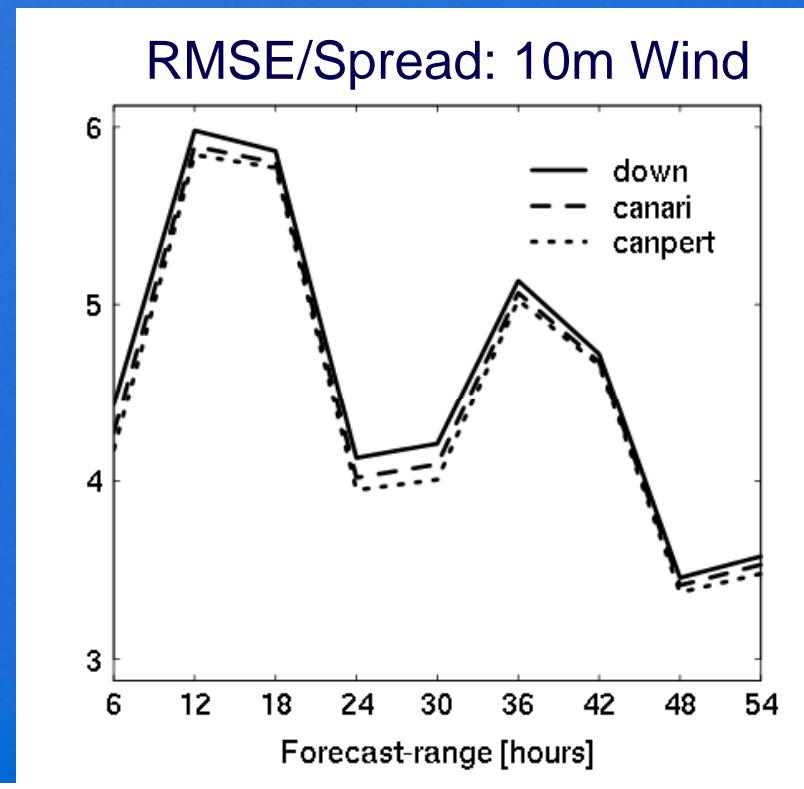
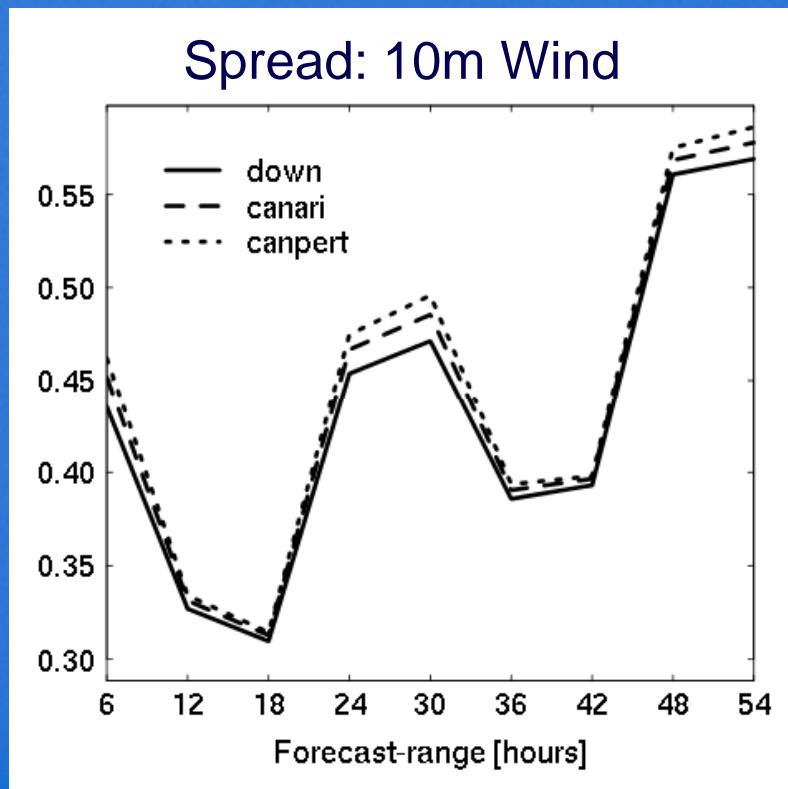


Verification of surface data assimilation in ALADIN-LAEF

Down (Reference): Downscaling of ECMWF-EPS with ARPEGE surface -> All members start with same surface, no multiphysics

Canari: Surface assimilation in ALADIN-LAEF (OI)

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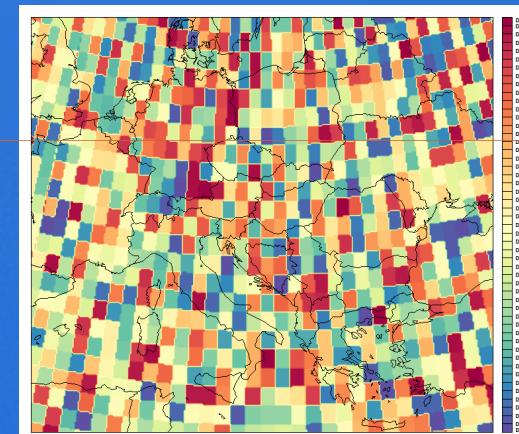
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Stochastic perturbed land surface physics

Stochastic perturbation of variables
in ALADIN surface scheme (ISBA)
using:

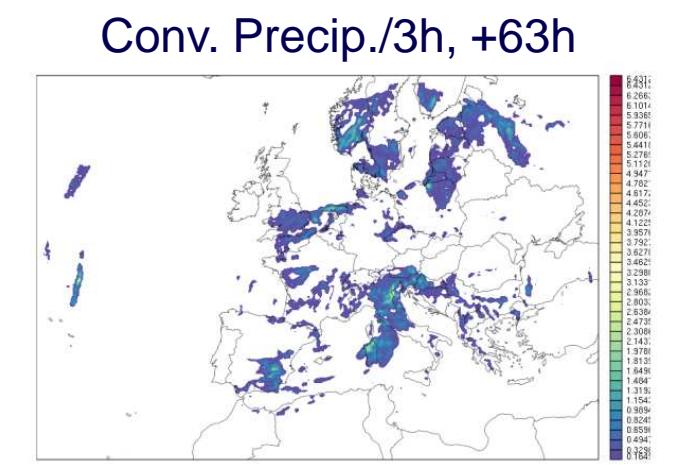
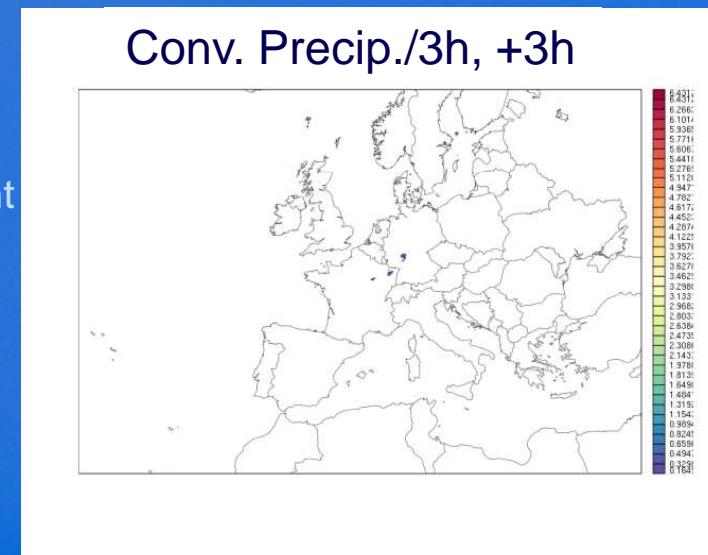
$$X_p = (1+r)X_c,$$

r: random number [-0.5,0.5],
 X_c the unperturbed tendency



Perturbed variables:

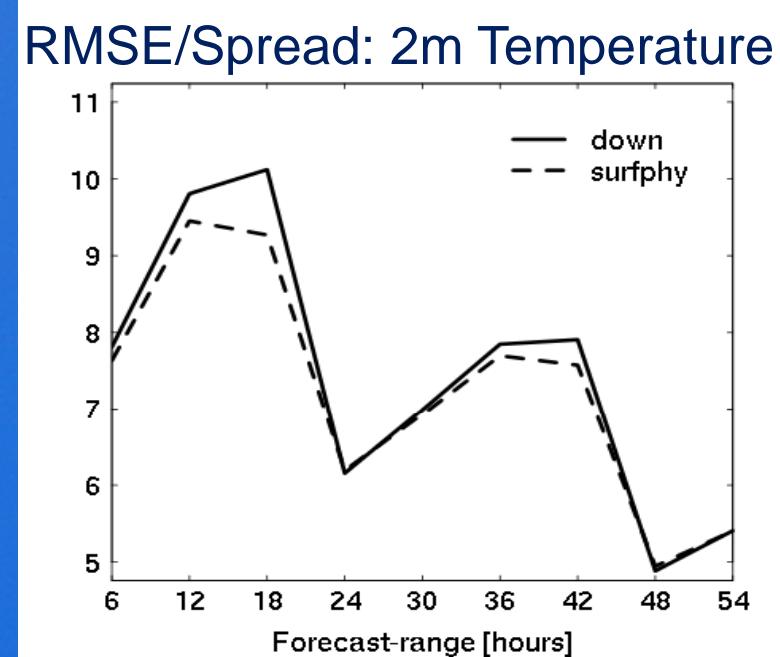
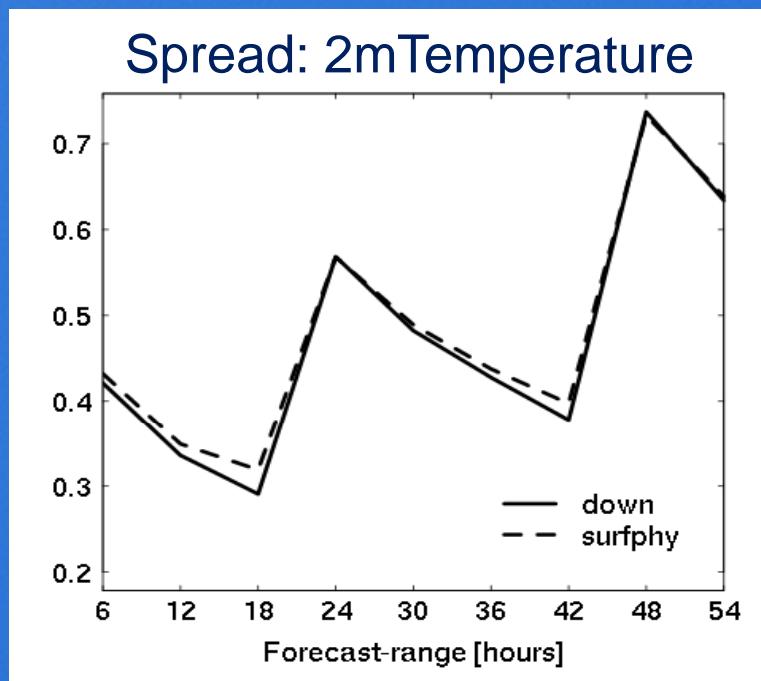
- Mean soil temperature
- Total liquid soil water content
- Total frozen soil water cont.
- Snow reservoir water cont.
- Superficial liquid soil water
- Superficial frozen soil water
- Interception water contents
- Snowalbedo
- Snowdensity



Verification of perturbed surface physics

down (Reference): Downscaling of ECMWF-EPS with ARPEGE surface -> All members start with same surface, no multiphysics

surfphy: same as down but with active SPPT-scheme



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Revised Multi-Physics

Focus on:

-) gridscale microphysics (Condensation, Autoconversion, Sedimentation,...)
 - 5 different setups with variable tuning/options
-) subscale precipitation (Convection)
 - 2 schemes (+ variable tuning/options)
-) Radiation
 - 2 schemes (+ variable tuning/options)
-) Gusts and Screening Level Diagnostic
 - 5 schemes (gusts) and variable tuning/options)
-) ...



Revised Multi-Physics

NAMELIST	MICROPHY SICS	TUNING	DEEP CONV.	TUNING	SHALLOW CONV.	TUNING	RADIATION	TUNING	TURBULEN CE	TUNING	GUST DIAG.	TUNING	SCREENING LEVEL	TUNING	DIAG.
MP01	ALARO-XR		3MT		JFG87		JFG05		JFG06		RAFTUR		NSCRE0		
MP02	ALARO-XR	M3H	3MT	D2L, D3H	JFG87		JFG05	R1H, R3H, R4T	JFG06		RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP03	ALARO-XR	M1L, M2L, M3L	3MT	D2H, D3L	JFG87		JFG05	R1L, R3L, R4T	JFG06		RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP04	ALARO-XR	M3L	3MT	D2H, D3L	JFG87		JFG05	R1L, R3L, R4T	JFG06		RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP05	ALARO-XR	M1H, M2H, M3L	3MT	D2H, D3L	JFG87		JFG05	R1L, R3L, R4T	JFG06		RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP06	ALARO-SM		3MT		JFG87		JFG05	R4F	JFG06	T2H, T3L	RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP07	ALARO-SM		3MT	D5T	JFG87		JFG05	R4T	JFG06	T2L, T3H	RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP08	LOPEZ		BG		KFB		ECMWF		CBR		RAFTKE		NSCRE0		
MP09	LOPEZ		BG	D1T	KFB		ECMWF		CBR		RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP10	LOPEZ		BG		KFB		ECMWF		CBR		RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP11	LOPEZ		BG	D1T	KFB	S1	ECMWF		CBR		RAFTUR/RA FTKE/RAFB		NSCRE0/NS CRE1/NSCR		
MP12	KESSLER		BG		JFG87		JFG05		LOUIS		RAFTUR		NSCRE0		
MP13	KESSLER		BG		JFG87		JFG05		JFG06		RAFTUR/RAFTK E/RAFBRA		NSCRE0/NSCRE 1/NSCRE2		
MP14	ALARO-RK		3MT		JFG87		JFG05		JFG06		RAFTUR		NSCRE0		
MP15	LOPEZ		BG		KFB		ECMWF		CBR		RAFTUR/RAFTK E/RAFBRA		NSCRE0/NSCRE 1/NSCRE2		
MP16	ALARO-XR		3MT		JFG87		JFG05		JFG06		RAFTUR/RAFTK E/RAFBRA		NSCRE0/NSCRE 1/NSCRE2		

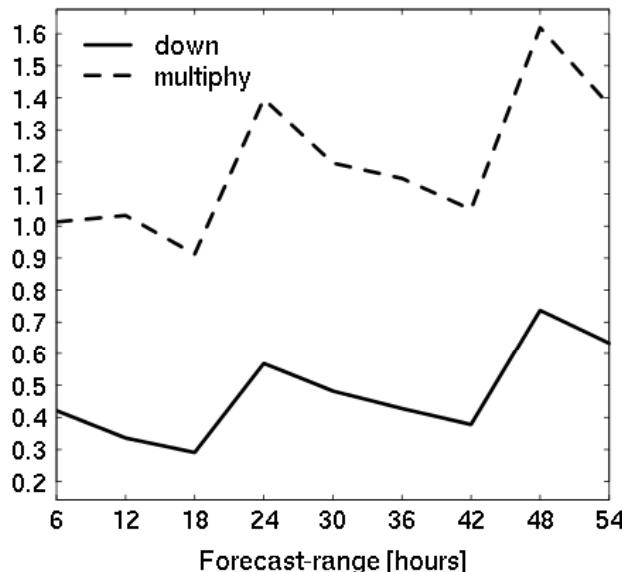


Revised Multiphysics

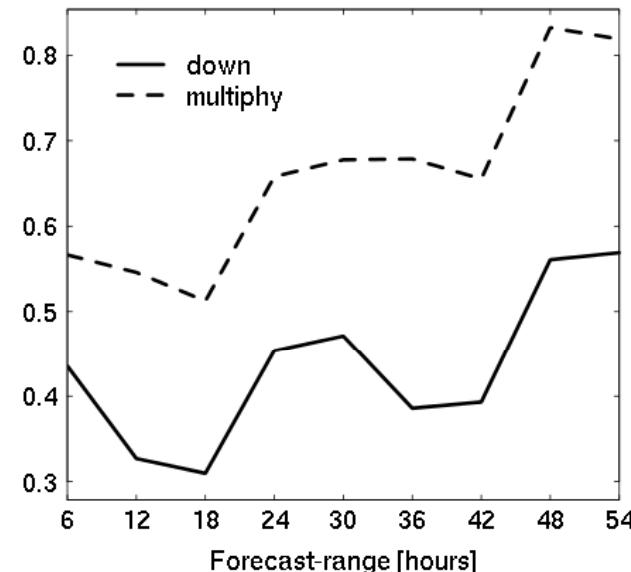
down (Reference): Downscaling of ECMWF-EPS with ARPEGE surface -> All members start with same surface, no multi-physics

multiphy: same as down but with revised multiphysics

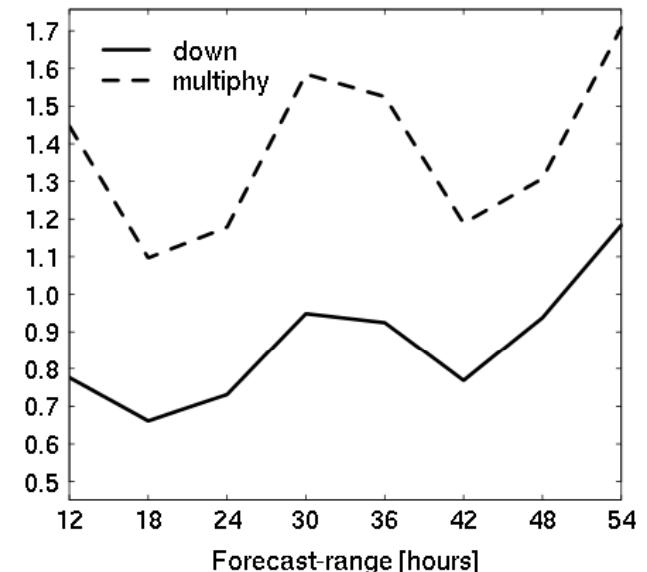
Spread: 2mTemperature



Spread: 10m Wind



Spread: RR/12h



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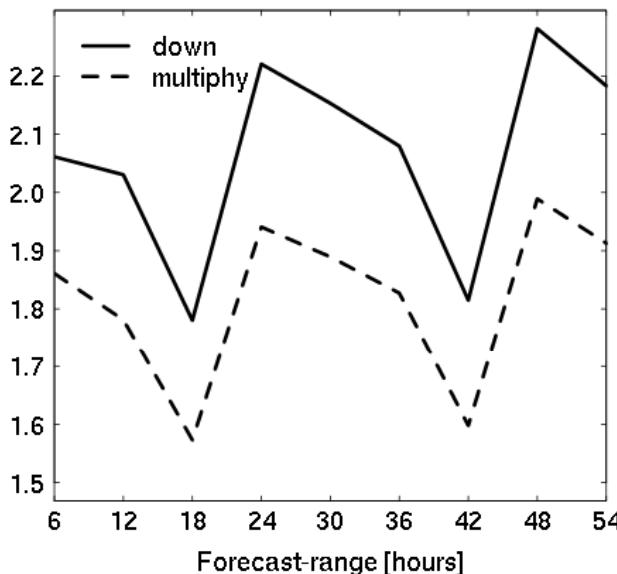


Revised Multi-physics

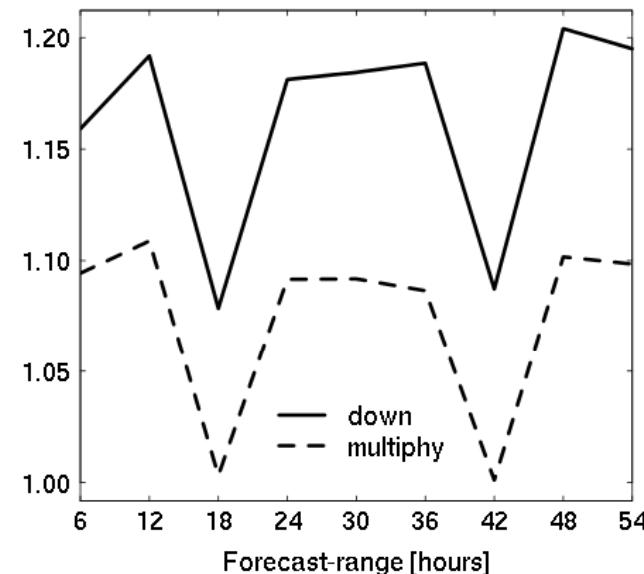
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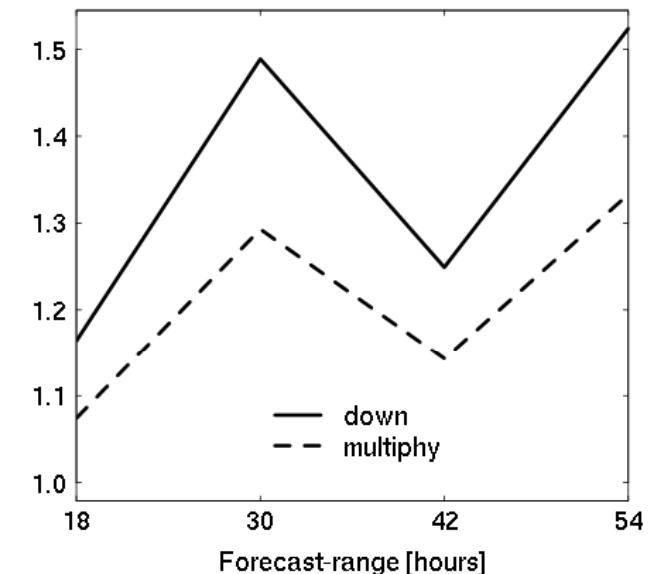
CRPS: 2mTemperature



CRPS: 10m Wind



CRPS: RR/12h

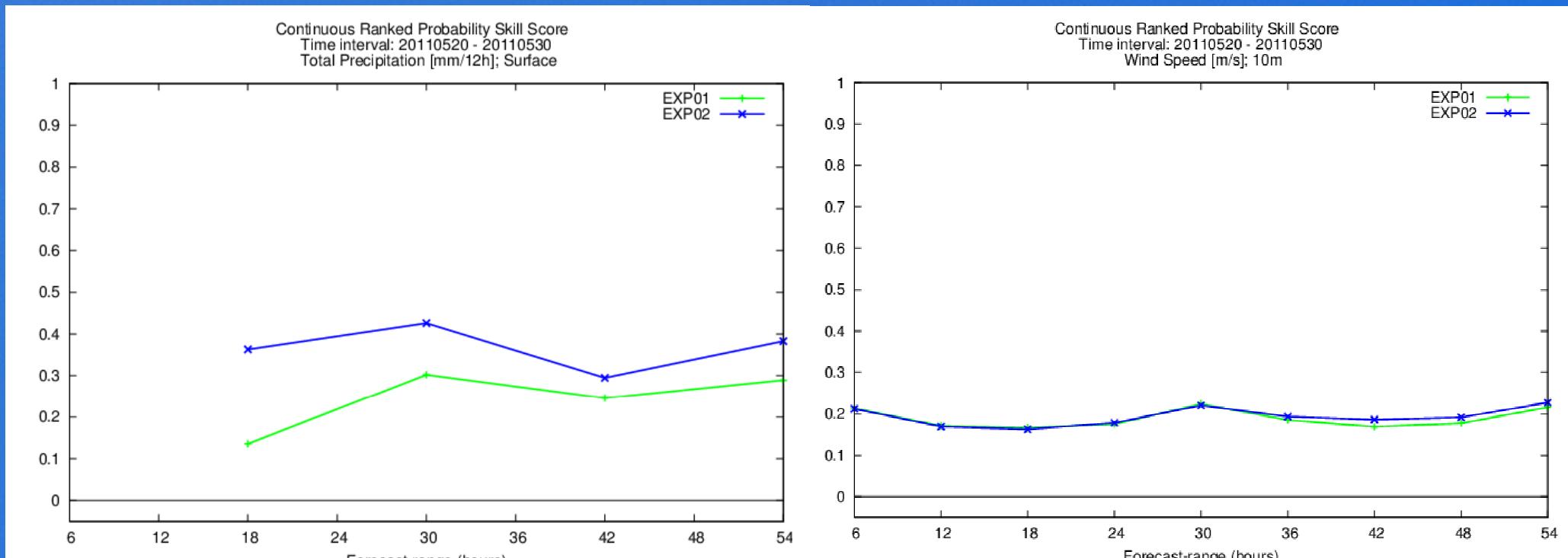


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Impact of the optimized multi-physics

(Präsentation)
24.10.2012 Folie 16



Precipitation

10m Wind



Summary

- Preparation work for upgraded version of ALADIN-LAEF
- Positive to neutral results have been archived:
 - Towards to higher resolution
 - Optimizing multi-physics
 - Taking more error sources into account for IC perturbation.
 - Introducing surface stochastic physics
- Incorporation of new modules in operational ALADIN-LAEF setup – not yet done



Upcoming plans

As soon as new HPC at ECMWF is available (mid of October):

- Migration of upgraded version of ALADIN-LAEF on new hpc
- Combination of new/revised components with operational ALADIN-LAEF configuration
 - > Use of revised Multiphysics, Incorporation of surface assimilation in NCSB scheme to generate initial perturbations of surface fields
- Validation of full upgraded version of ALADIN-LAEF vs. operational ALADIN-LAEF



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Thank you !!!

