Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Developments of COSMO-DE-EPS since the operational start in 2012

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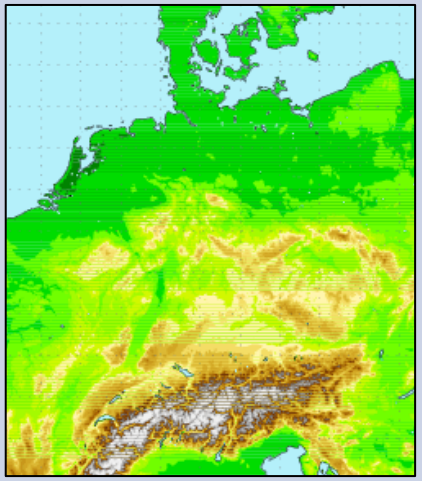
Outline

1. Current state
2. Perturbed coefficients for minimum diffusion
3. Upgrade to 40 members
4. Summary

1. Current state
2. Perturbed coefficients for minimum diffusion
3. Upgrade to 40 members
4. Summary

operational set-up

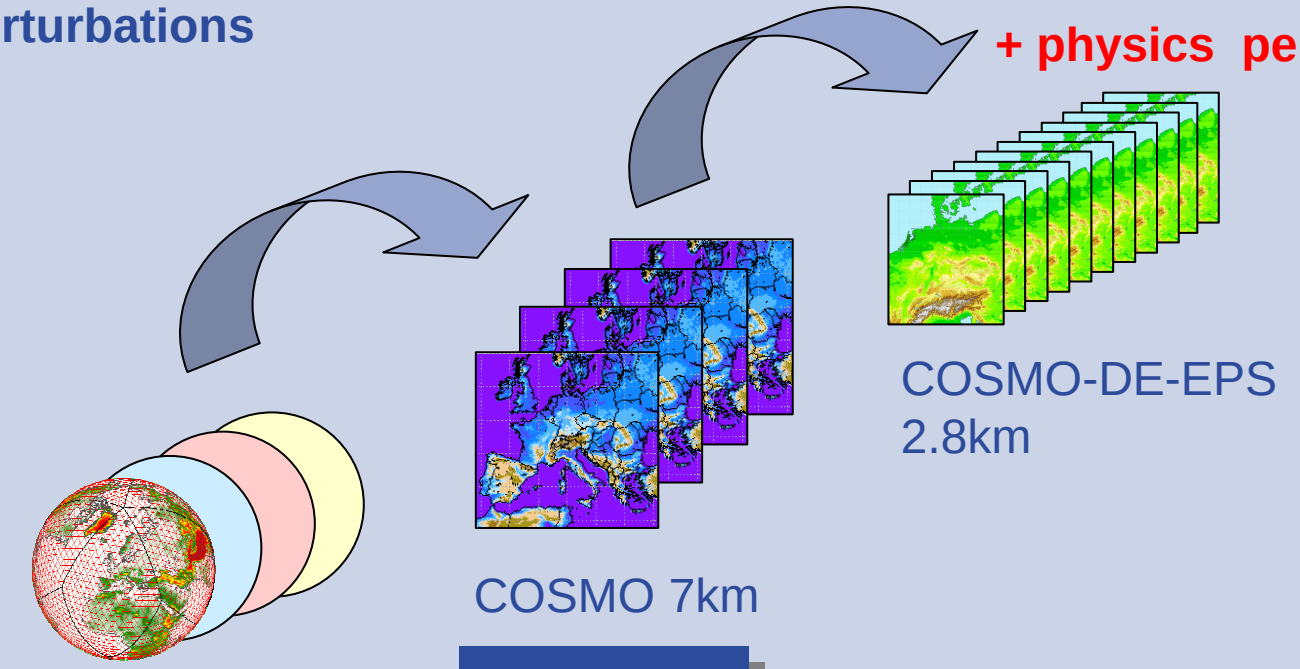
- ➔ 20 members
- ➔ grid size: 2.8 km
  convection-permitting
- ➔ lead time: 0-21 hours,
  8 starts per day
  (00, 03, 06,... UTC)



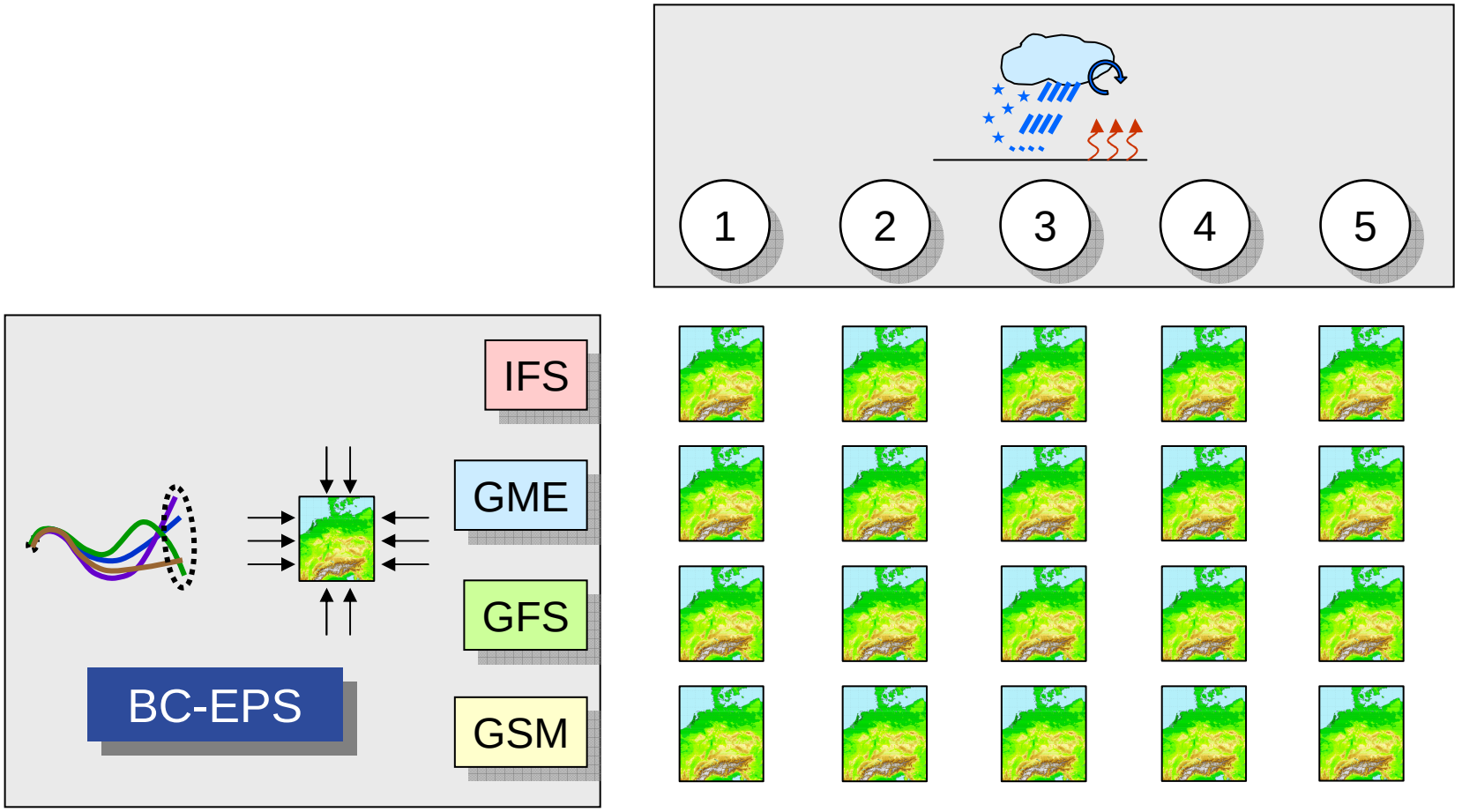
model domain

Generation of EPS members

BC-EPS for boundary and initial perturbations

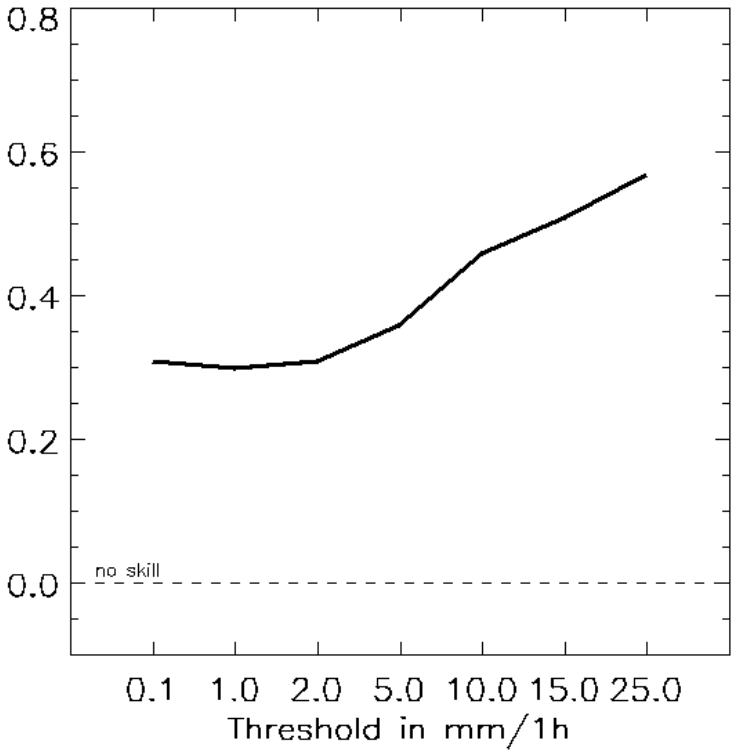


The 20 members of COSMO-DE-EPS

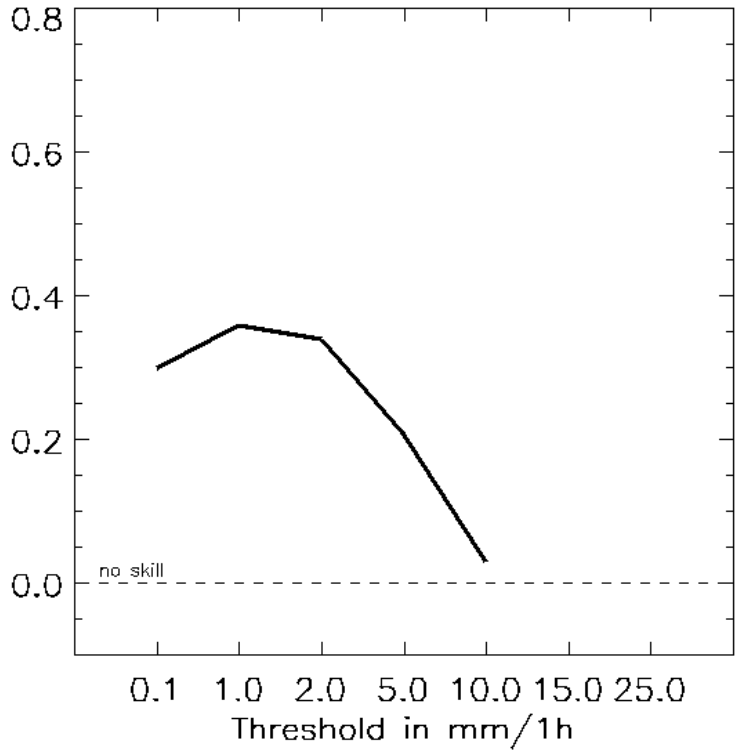


Brier Skill Score (reference: deterministic run of COSMO-DE)

summer 2012



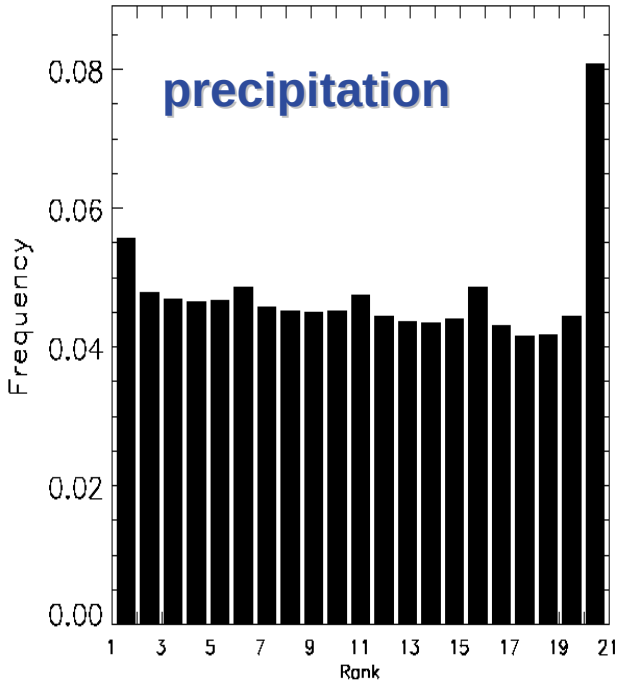
winter 2012



Thresh.	Num. of cases
0.1	>1.000.000
1.0	>1.000.000
2.0	>1.000.000
5.0	>100.000
10.0	17817

Rank histogram

summer 2012

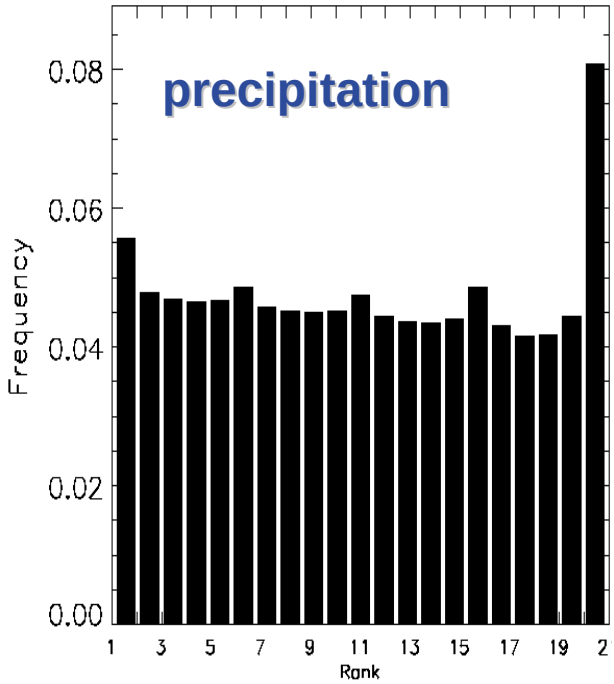


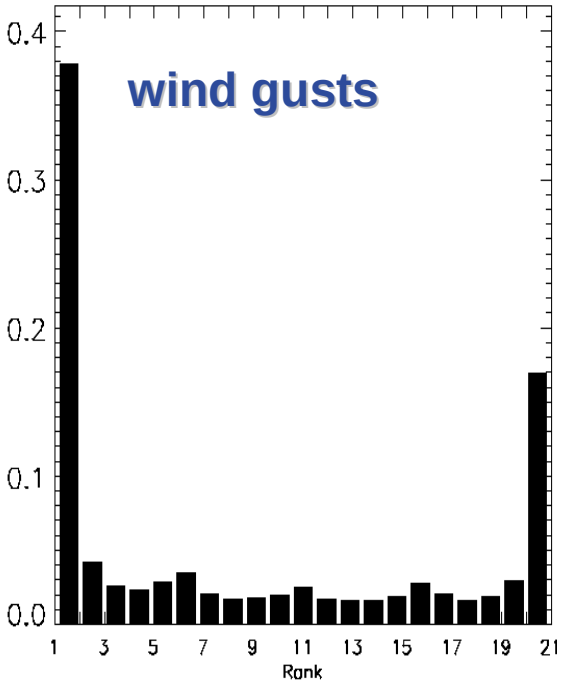
COSMO-DE-EPS
not calibrated or post-processed

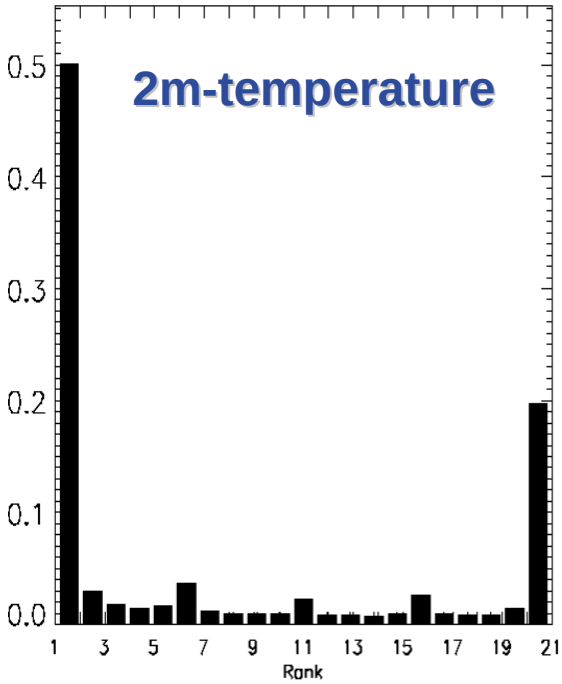
observations:
rain-gauge adjusted radar

Rank histogram

summer 2012



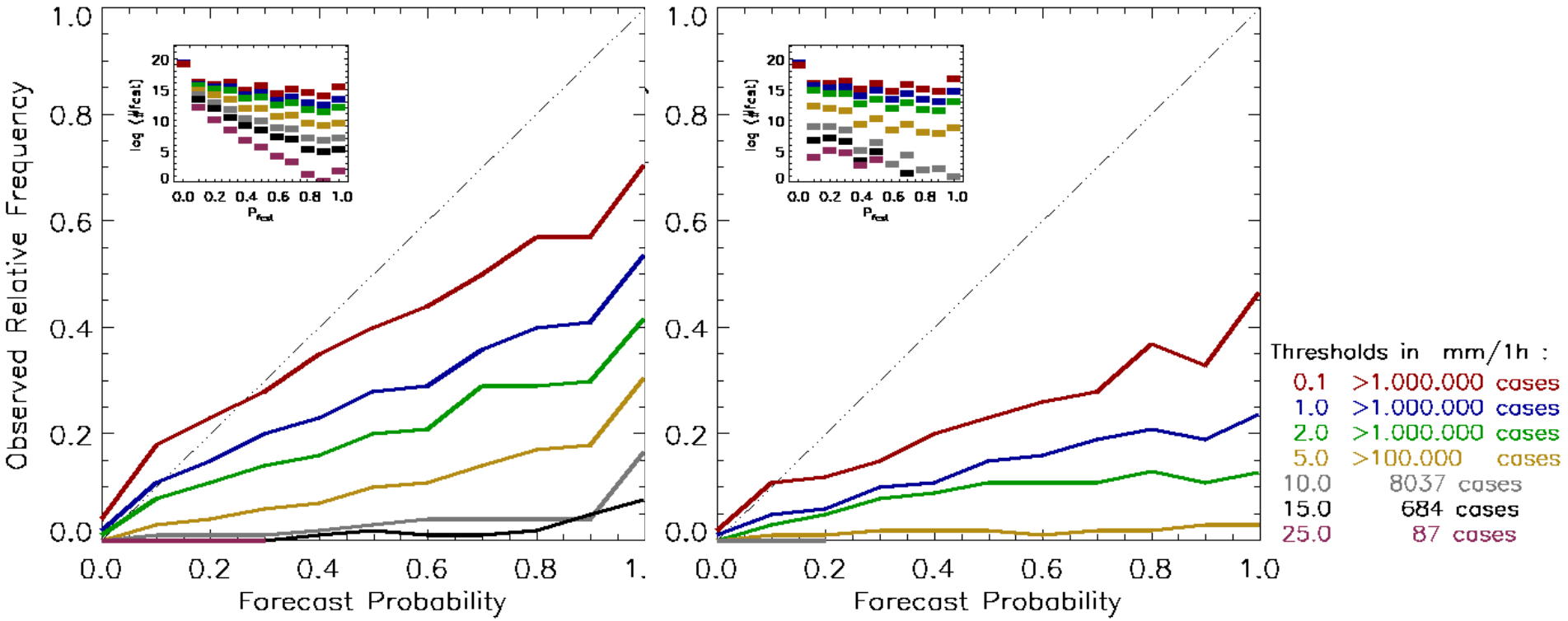




Reliability diagram

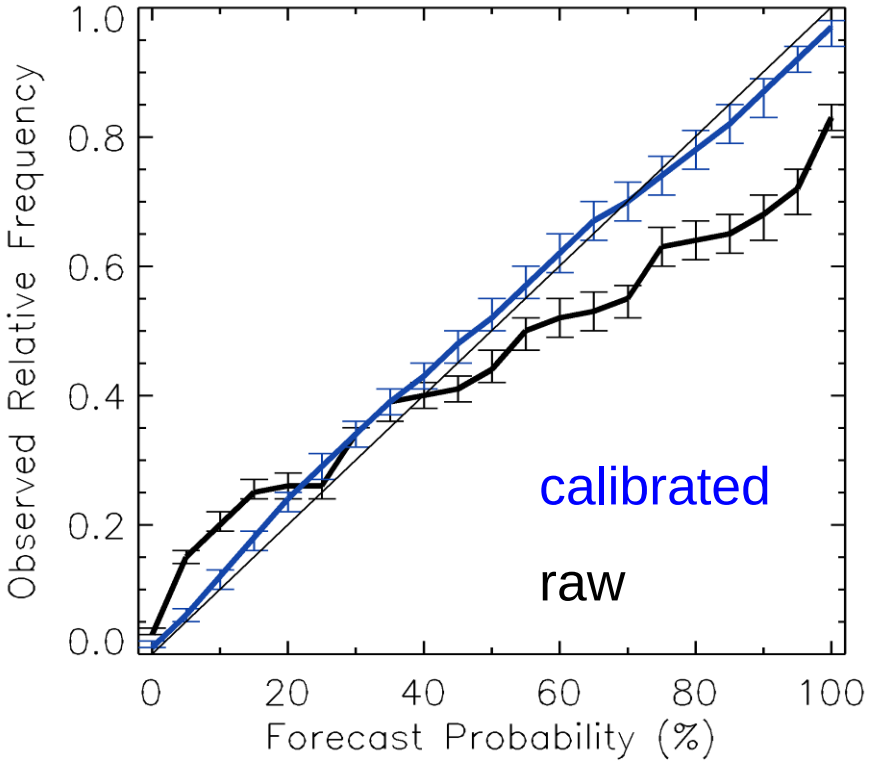
summer 2012

winter 2012

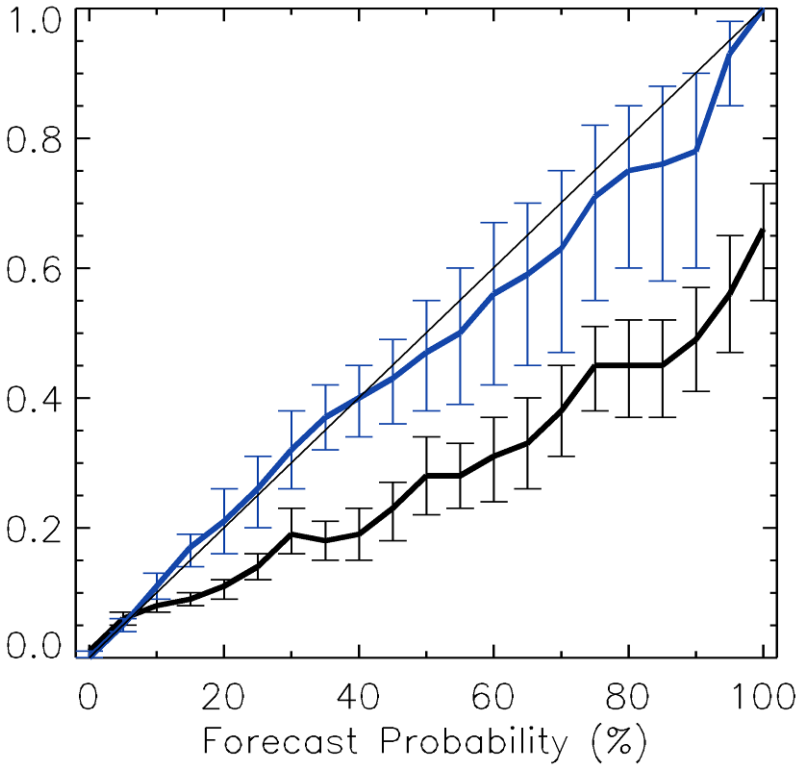


Reliability diagram after calibration

1mm/6h



10mm/6h



(Ben Bouallègue, Z., 2013)

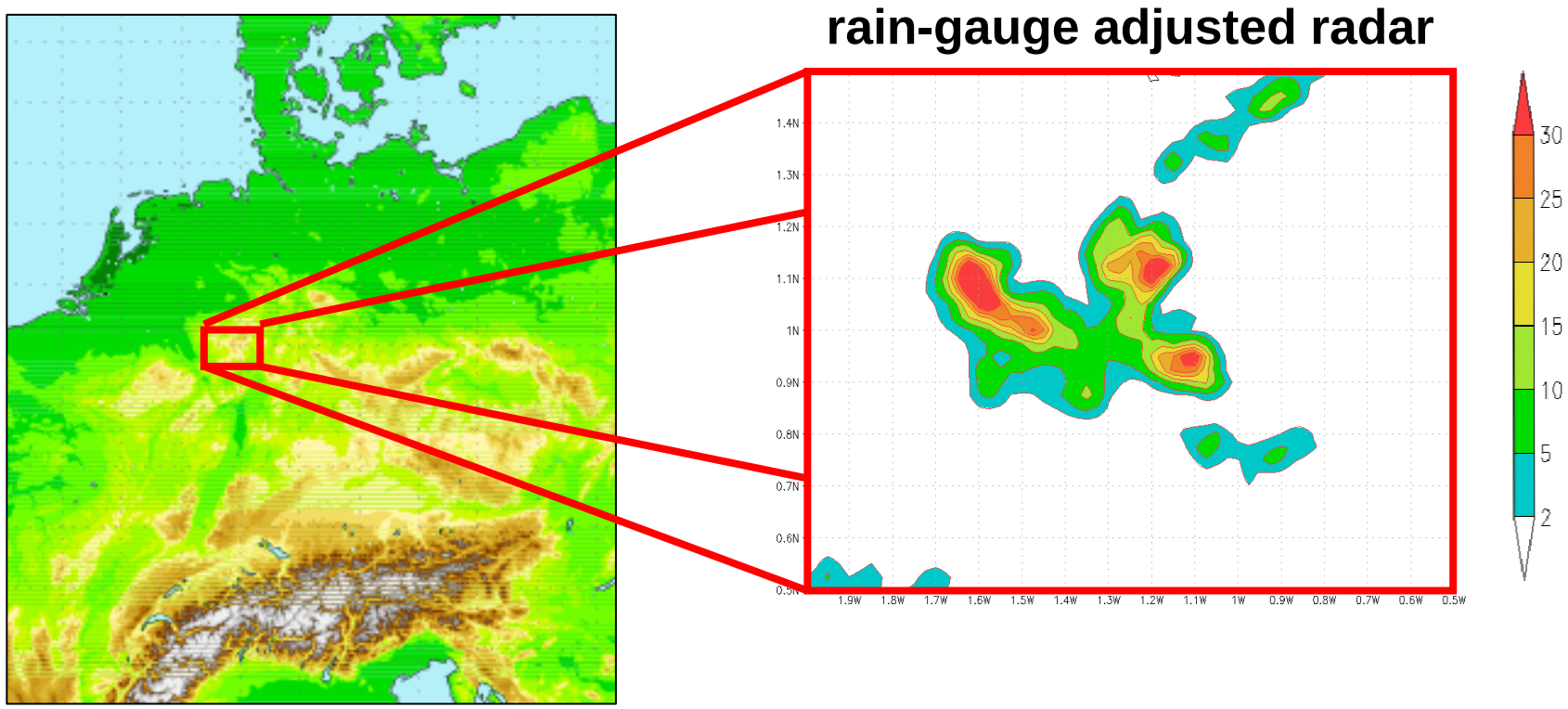
Main results from operational phase (20 members)

probabilistic verification (for periods of several months)

- ➔ probabilities perform better than deterministic “yes/no”
- ➔ particularly for high precipitation thresholds in summer
- ➔ drawback: underdispersion

  (esp. for wind gusts and 2m-temperature)

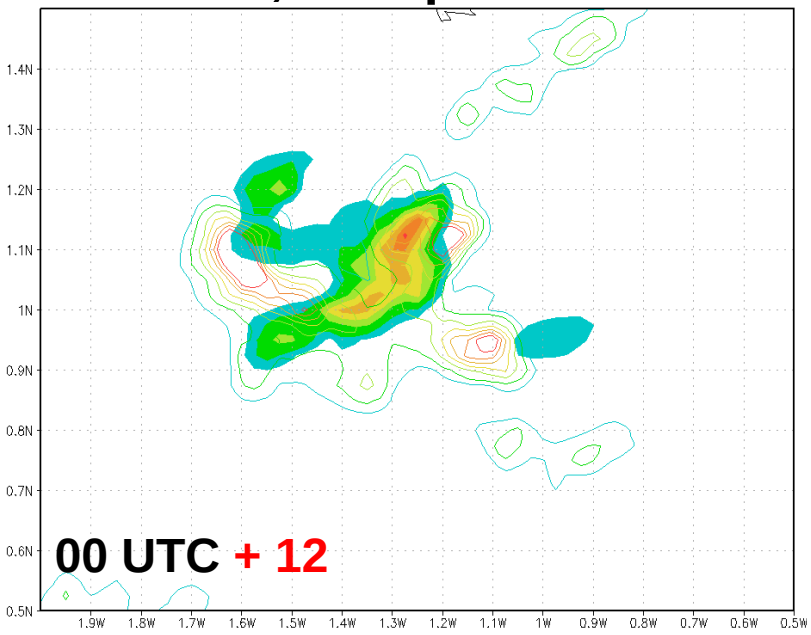
Case study of 23rd May 2012, 12 UTC

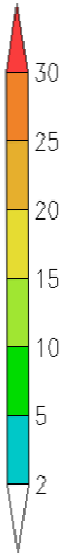


Case study of 23rd May 2012

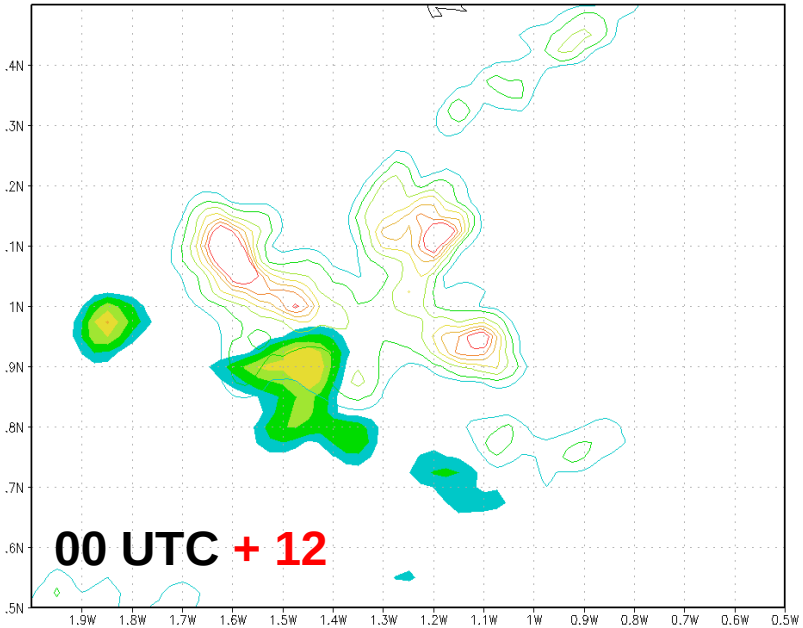
hourly precipitation 11-12UTC

EPS, 90%-percentile





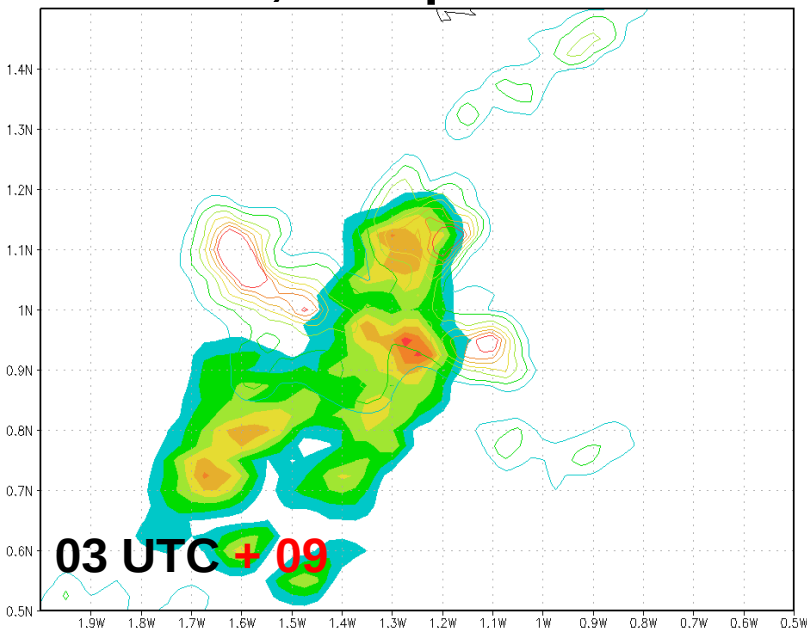
deterministic

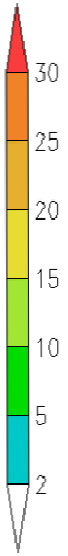


Case study of 23rd May 2012

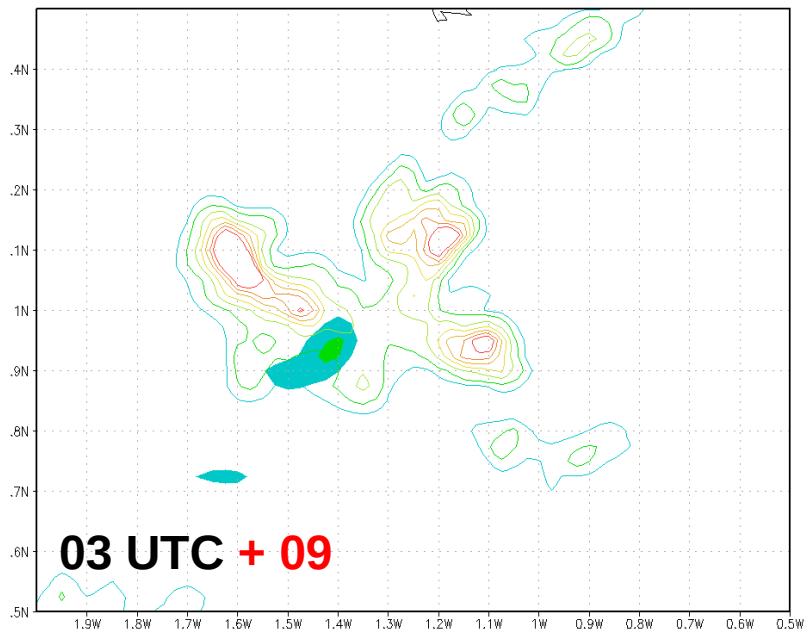
hourly precipitation 11-12UTC

EPS, 90%-percentile





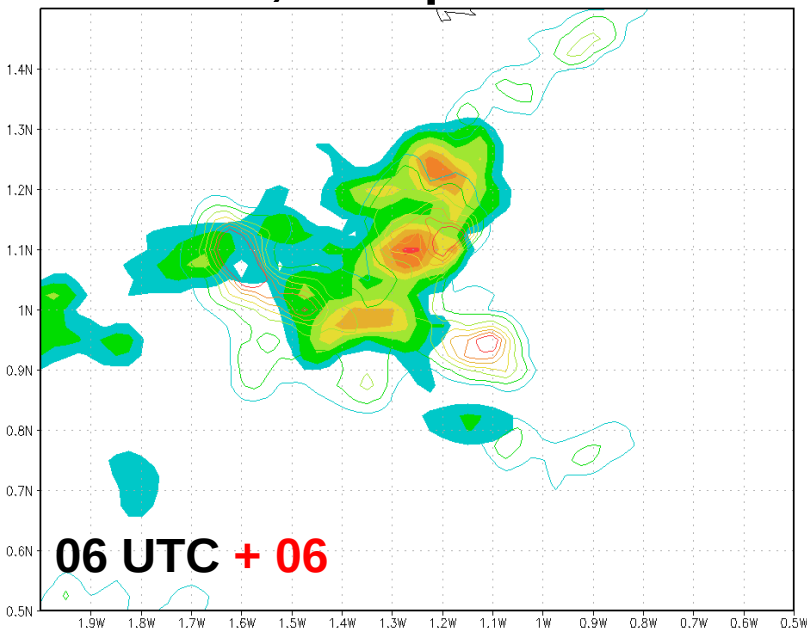
deterministic

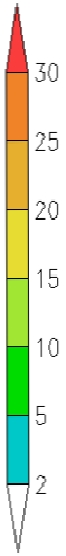


Case study of 23rd May 2012

hourly precipitation 11-12UTC

EPS, 90%-percentile





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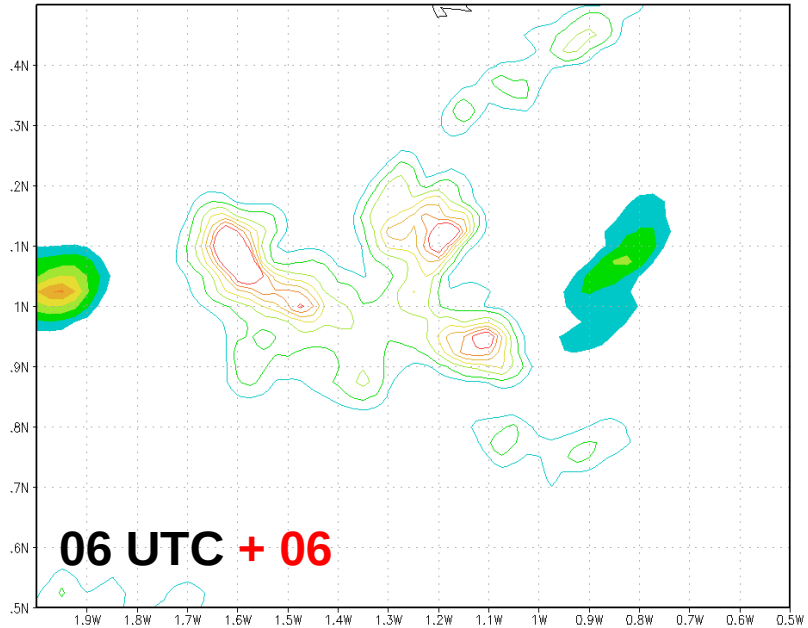
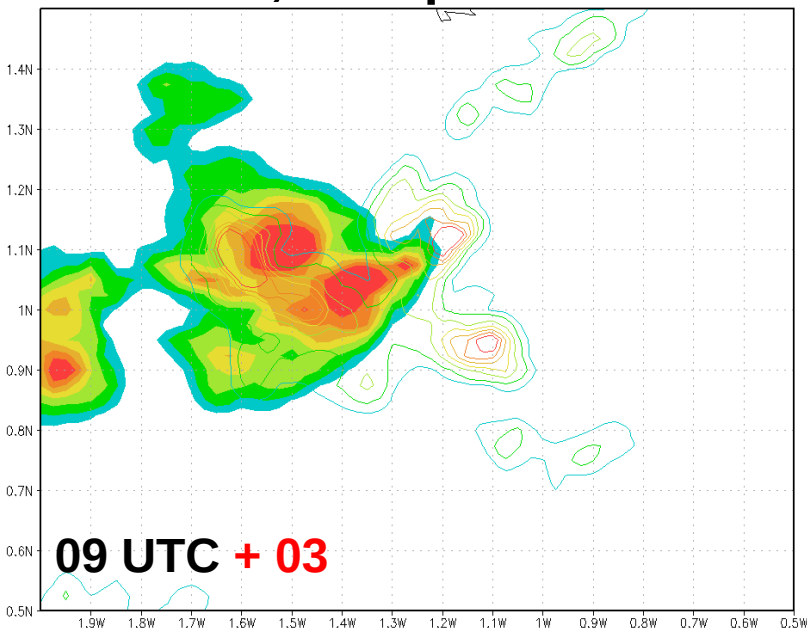
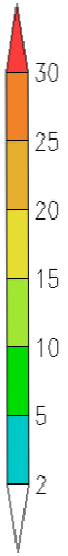


Case study of 23rd May 2012

hourly precipitation 11-12UTC

EPS, 90%-percentile





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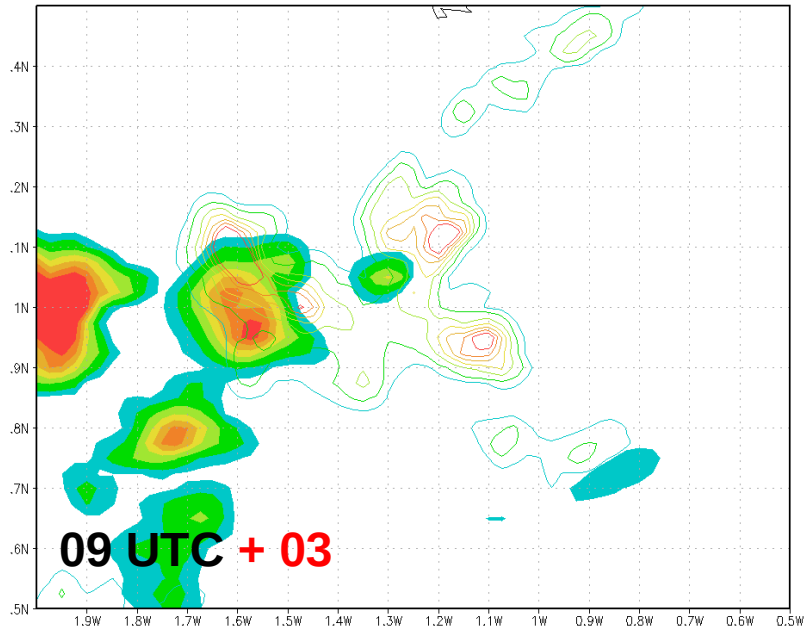


Main results from operational phase (20 members)

evaluation by forecasters (case studies):

- ➔ additional benefit for precipitation forecasts
- ➔ provides early signals for severe weather
- ➔ most beneficial for convective precipitation in summer
- ➔ reduced jumpiness between consecutive runs

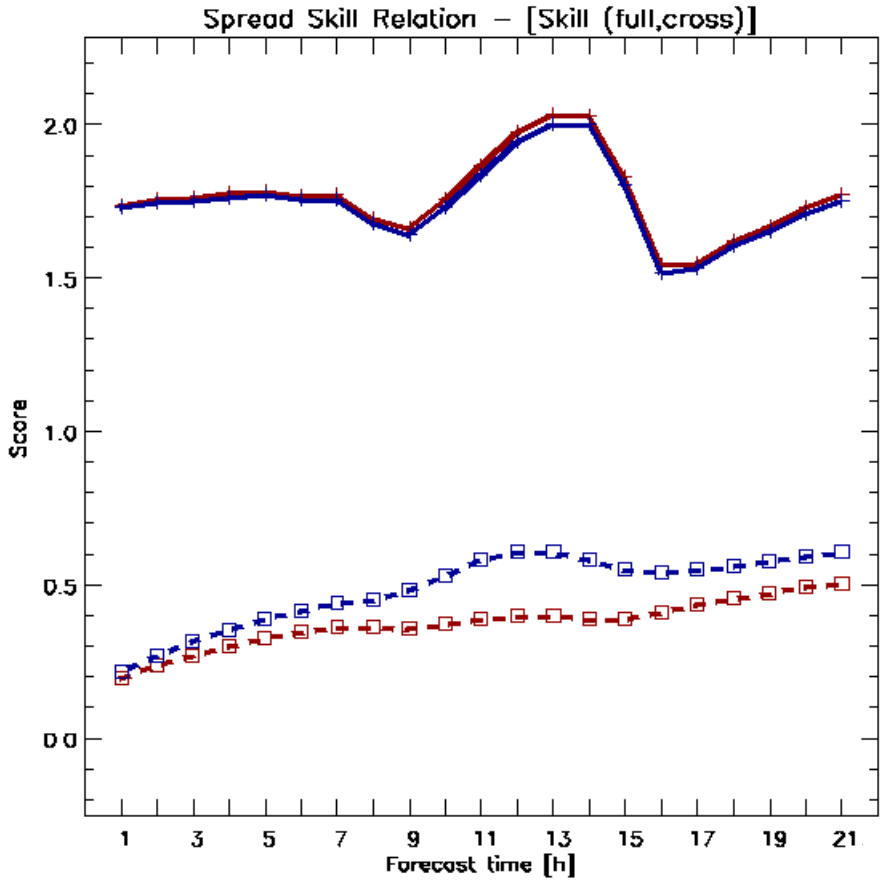
1. Current state
2. Perturbed coefficients for minimum diffusion
3. Upgrade to 40 members
4. Summary

Perturbed coefficients for minimum diffusion

(heat and momentum *tkhmin, tkmmin*)

- (modified) operational setup + perturbation of tkhmin, tkmmin Range:
  [0.2 ,0.5, 0.8]
  4 members 0.5,
  8 members 0.2,
  8 members 0.8 (of 20 members)
- Test period: November 2011, 00 UTC runs
- compared with reference COSMO-DE-EPS

Spread Skill Relation for 2m-temperature



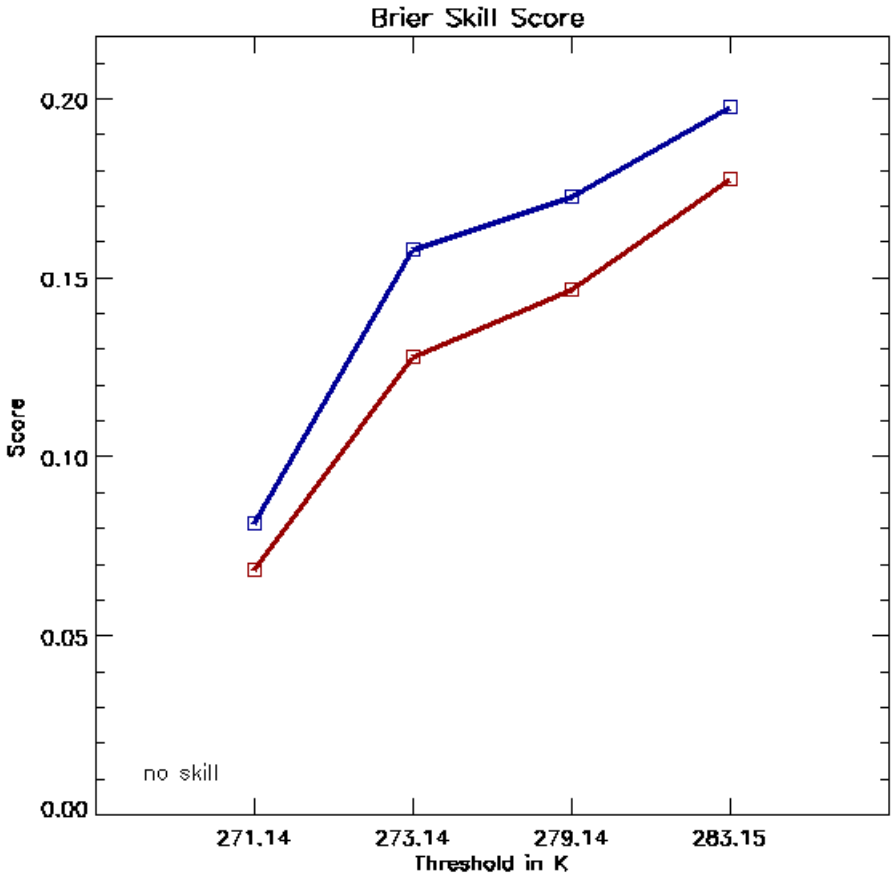
perturbed

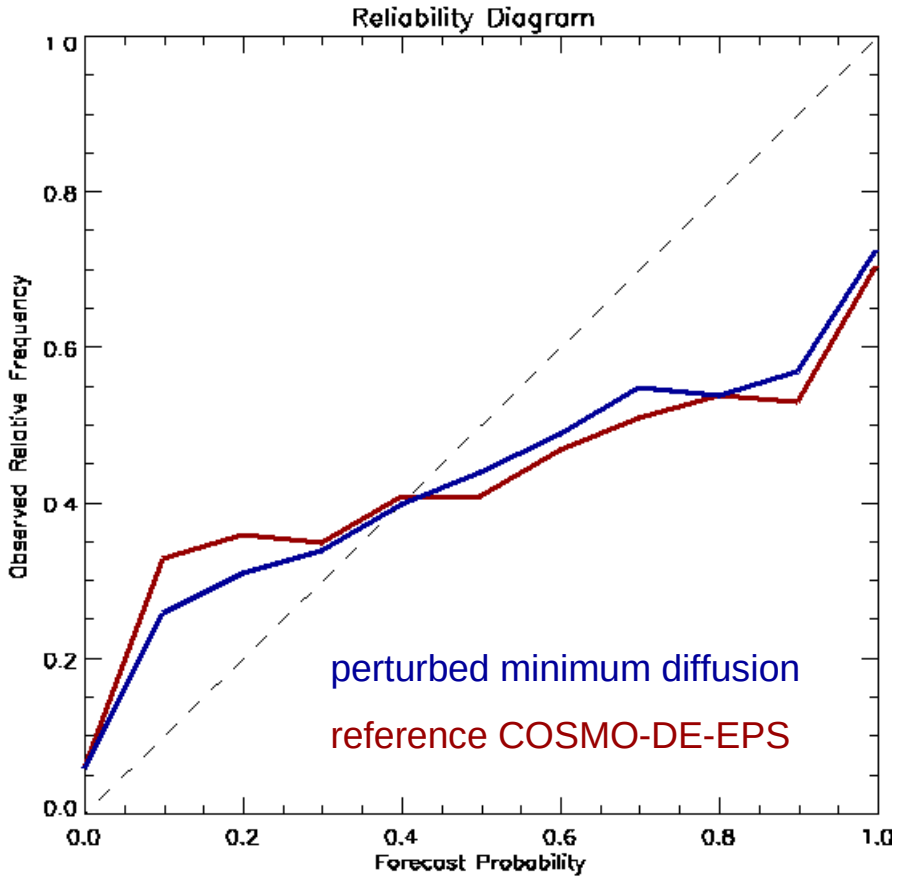
minimum diffusion

reference

COSMO-DE-EPS

Brier Skill Score and Reliability diagram for 2m-temperature





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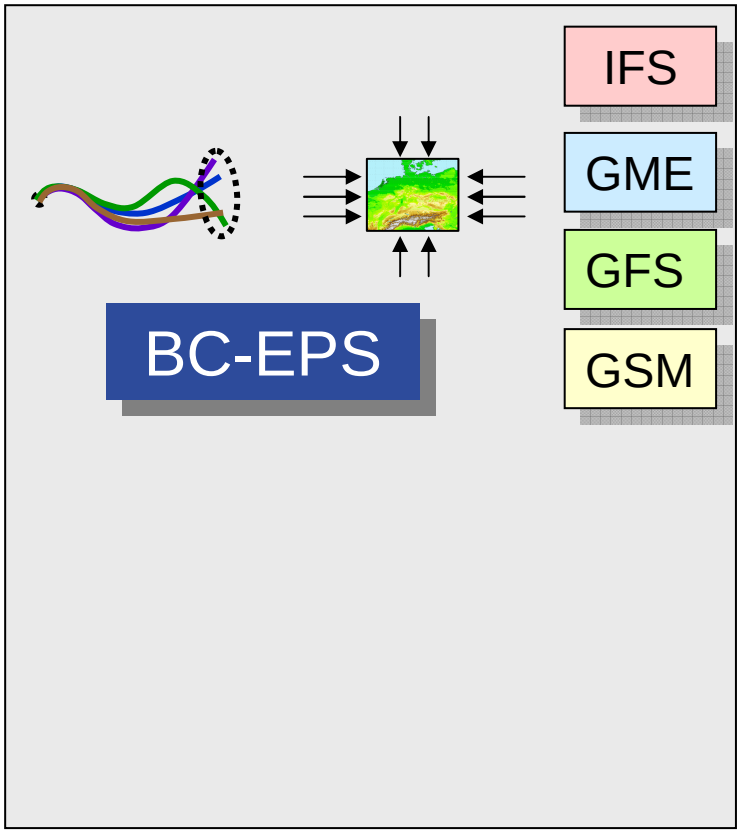
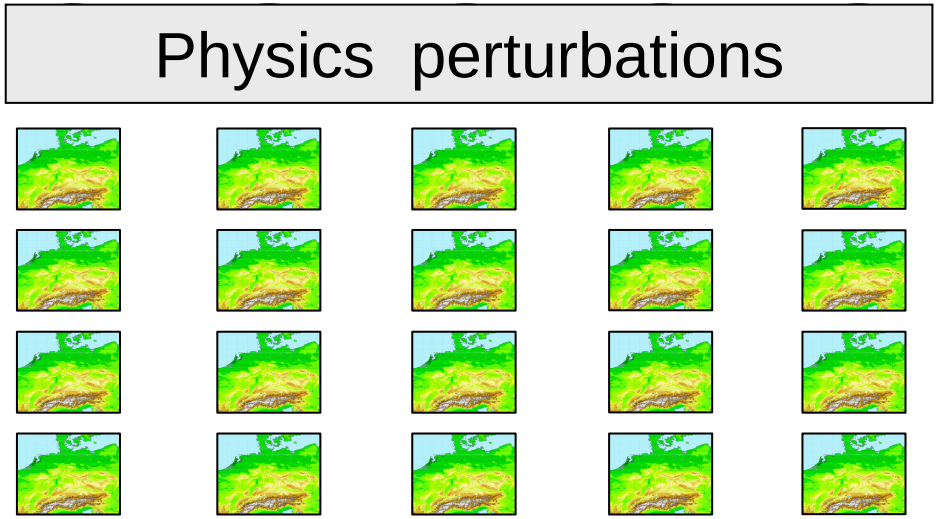
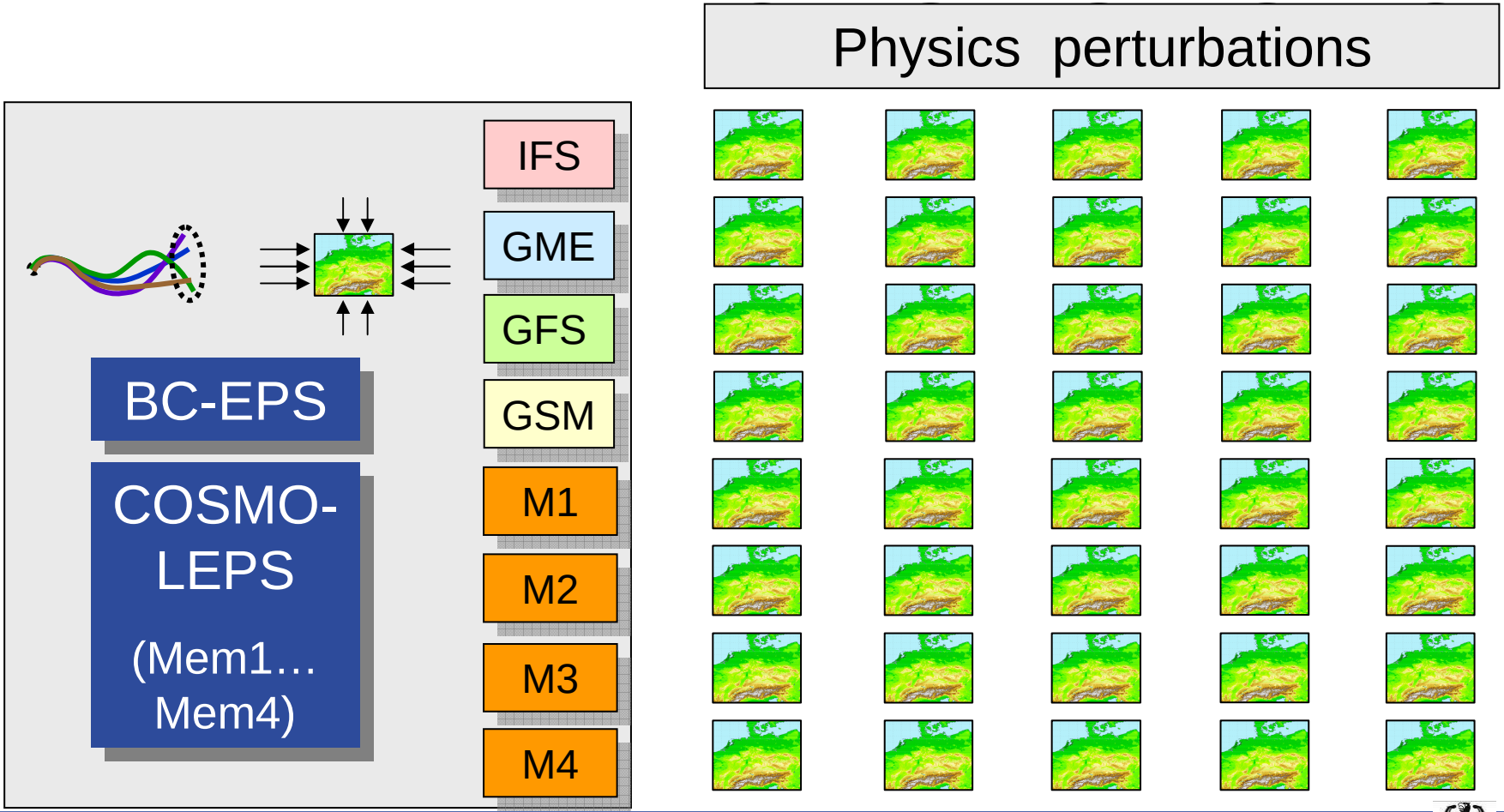
Upgrade to 40 members





Upgrade to 40 members



Upgrade to 40 members

RESULTS:

Adding 4 COSMO-LEPS members as IC and BC leads to mixed results

➔ improvement for precipitation

➔ neutral for wind gusts

➔ less skill for 2m-temperature forecasts

due to COSMO-LEPS in Winter 2011/12

➔ separation between BC-EPS and

COSMO-LEPS single member RMSE

(cold bias) in Winter 2011/12

Upgrade to 40 members

RESULTS:

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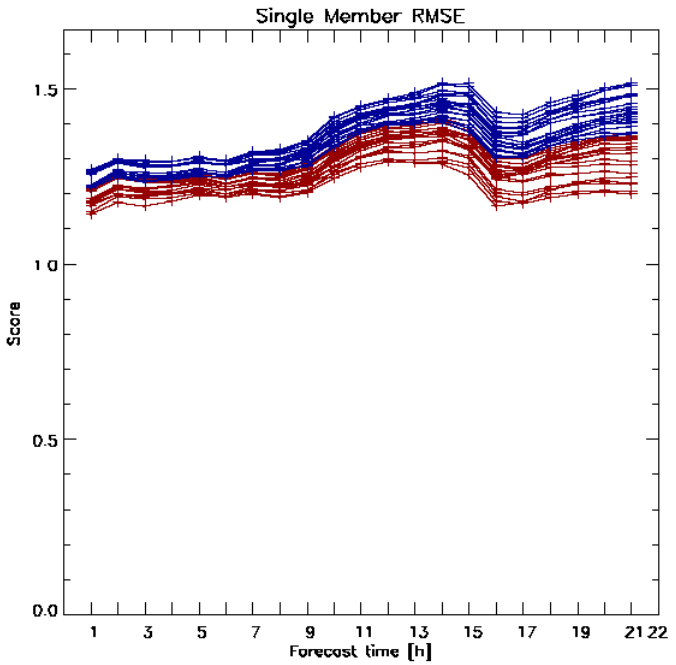


Summary

Skillful quantitative precipitation forecasts in summer/winter 2012

Challenge: *strong under-dispersiveness of wind gusts and 2m-temperature*

- additional perturbation of the coefficients for minimum diffusion leads to more spread in the 2m-temperature

- adding 4 LEPS members as BC leads to an improvement for precipitation, but also to a separation between BC-EPS and COSMO-LEPS single member RMSE

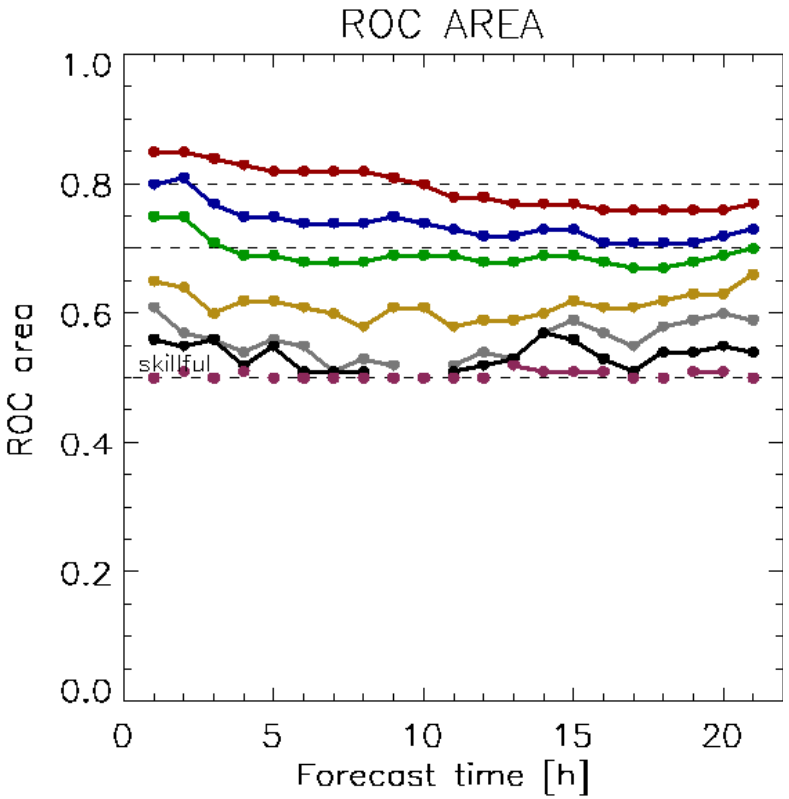
➔ has to be further investigated…

Thank You !

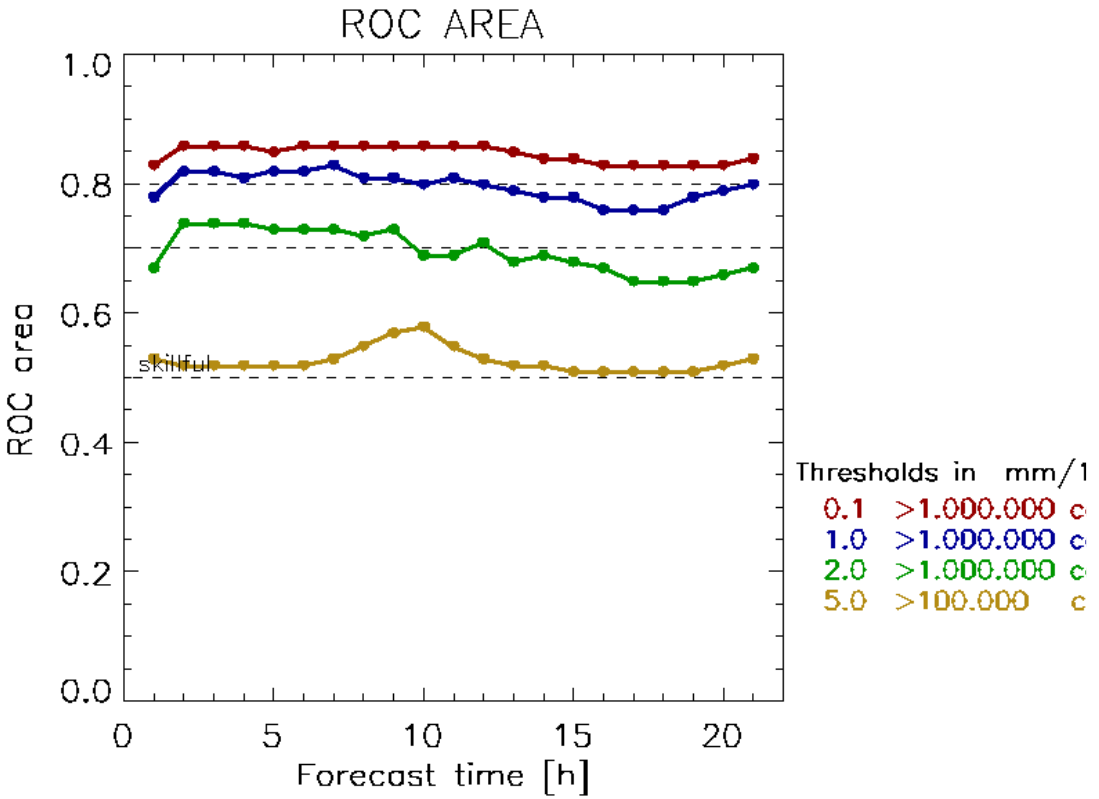
Questions ?

Roc area

summer 2012

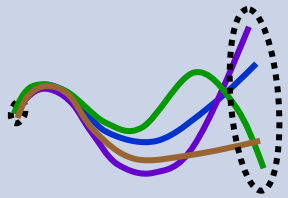
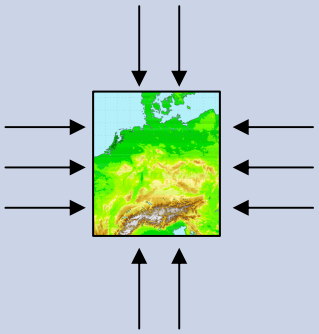
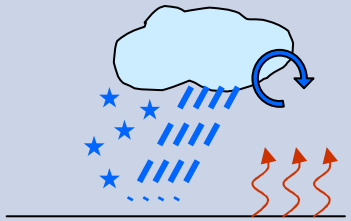


winter 2012

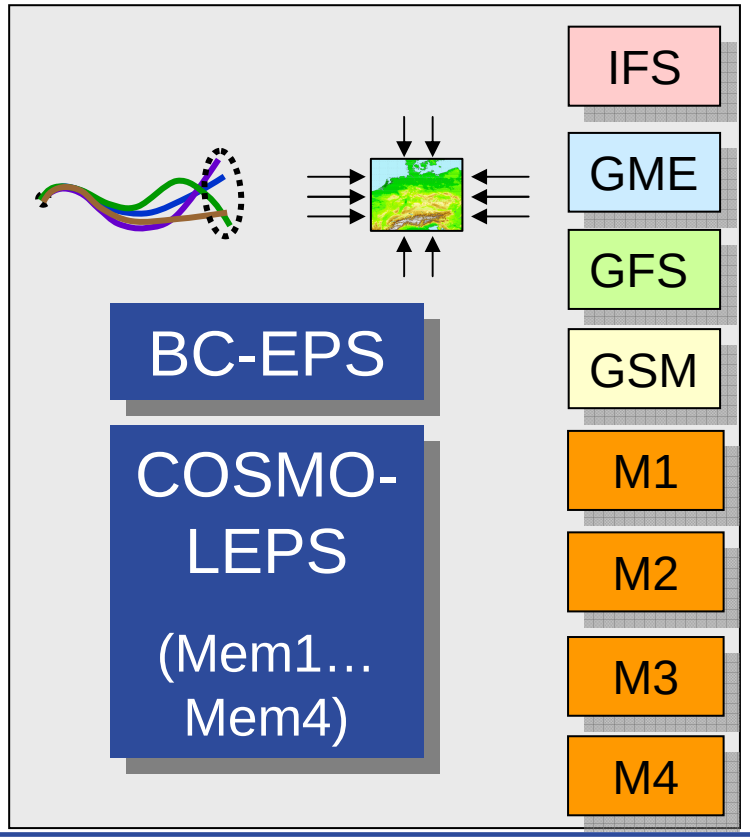


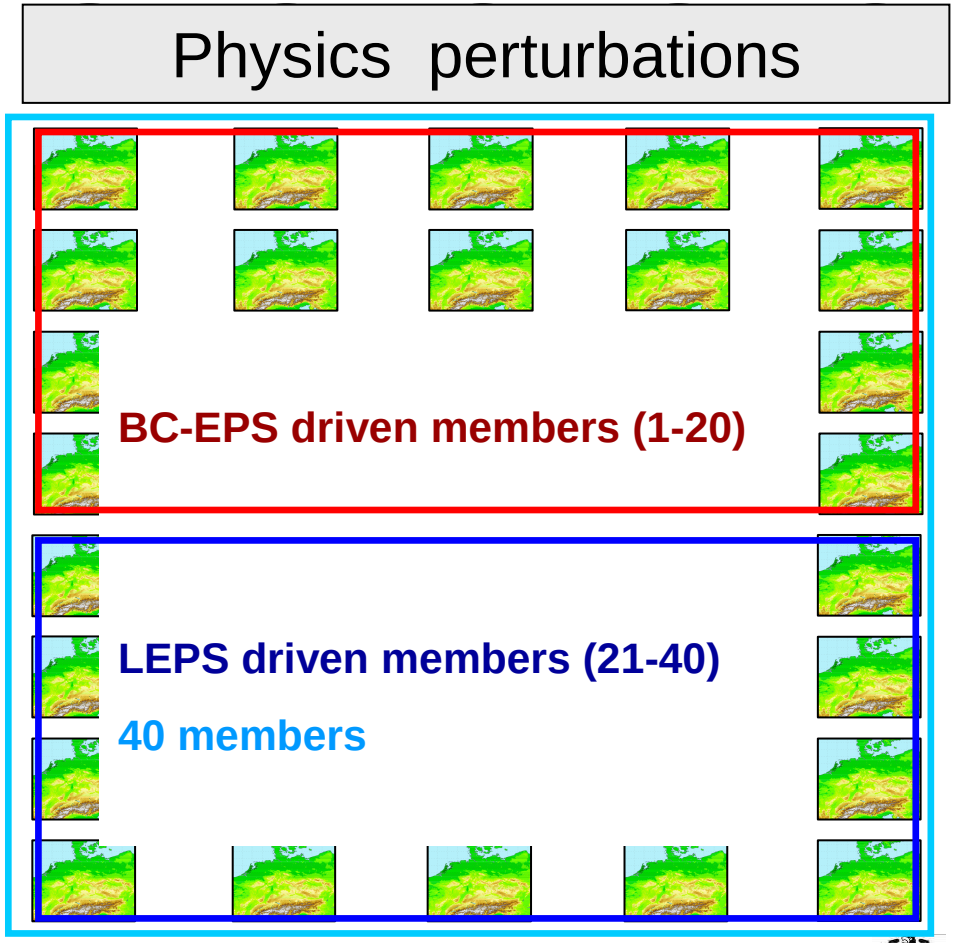
Generation of EPS members

representing uncertainty in

initial conditions	boundary conditions	model physics
		

Upgrade to 40 members





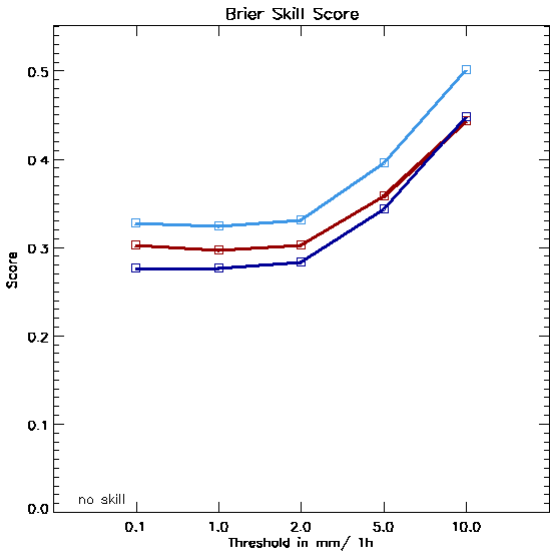
Brier Skill Score - summer 2012

40 members

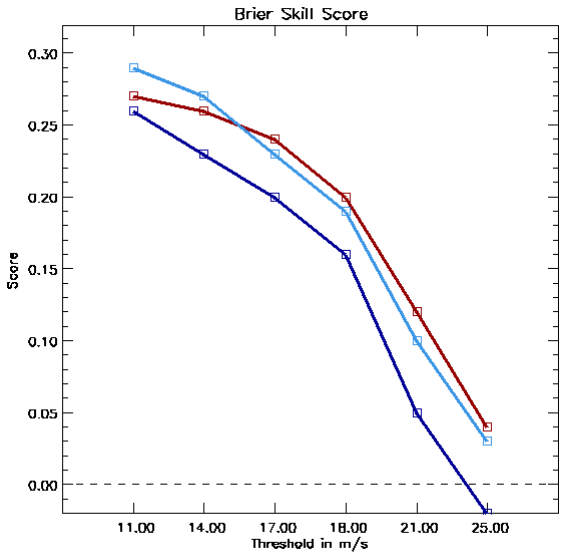
BC-EPS driven members (1-20)

LEPS driven members (21-40)

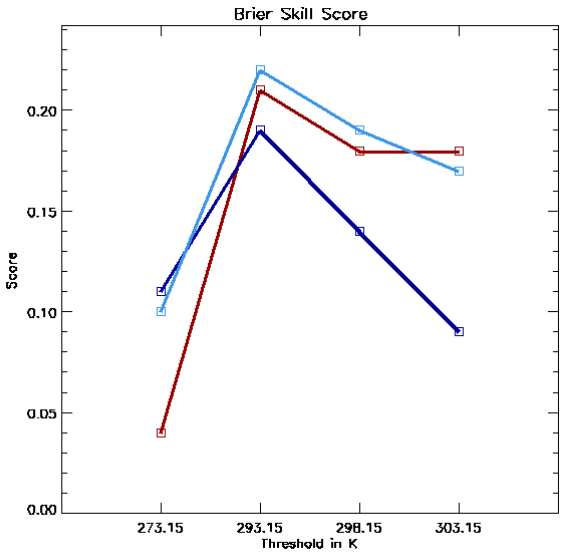
precipitation



wind gustes



temperature



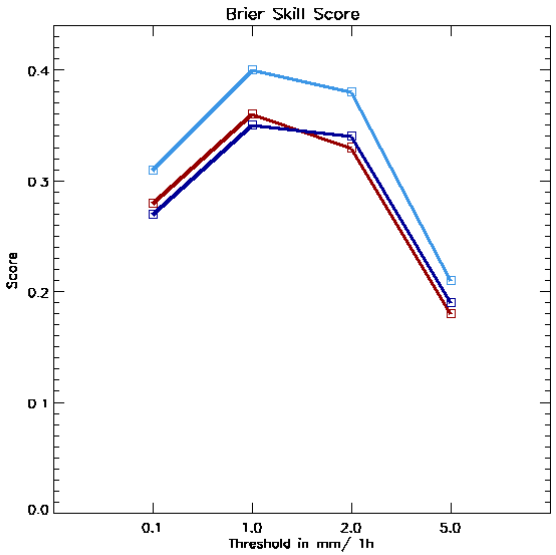
Brier Skill Score - winter 2011/12

40 members

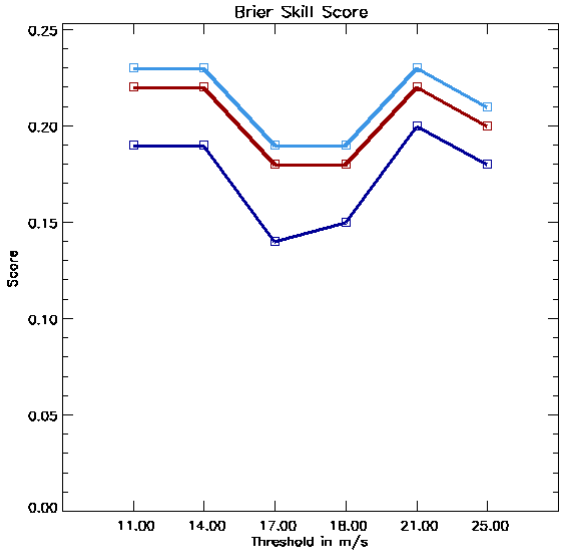
BC-EPS driven members (1-20)

LEPS driven members (21-40)

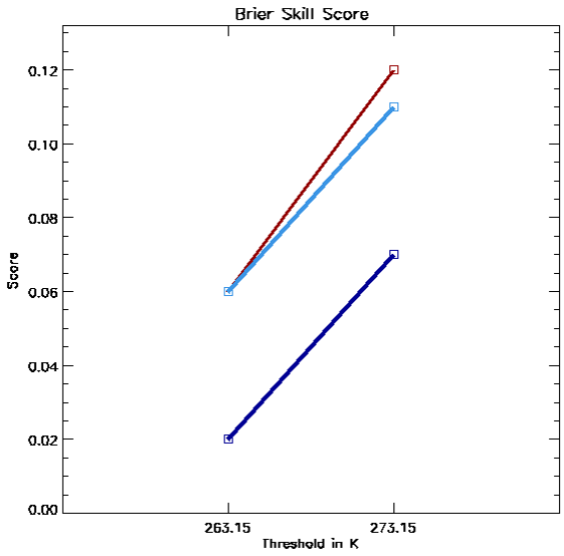
precipitation



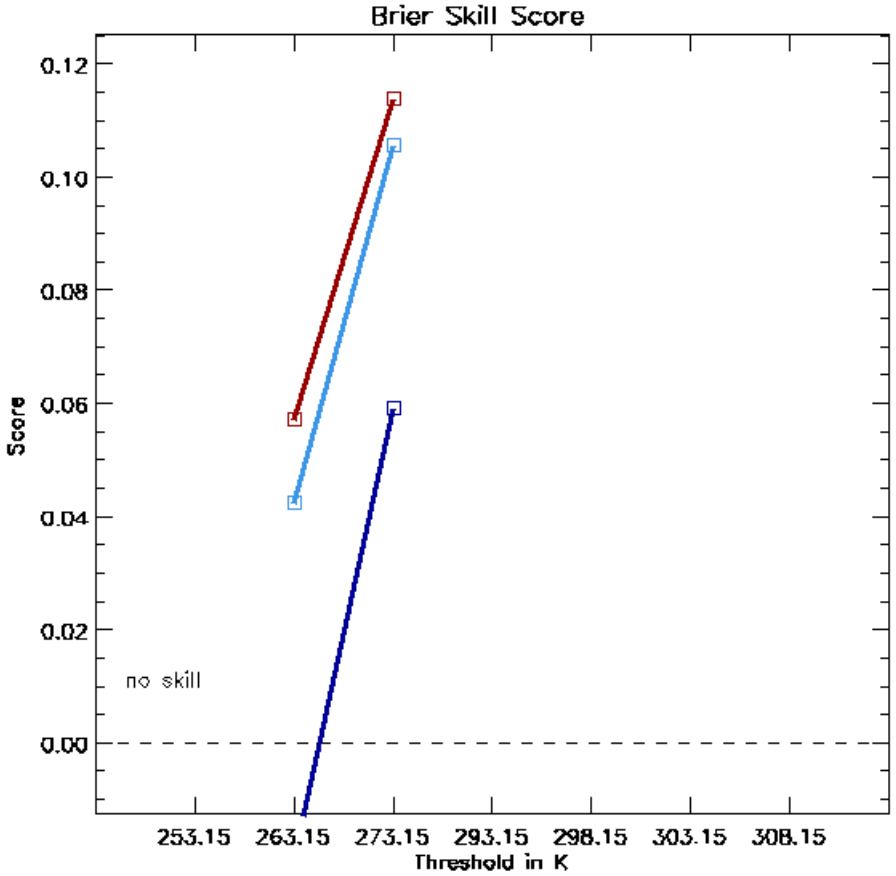
wind gustes

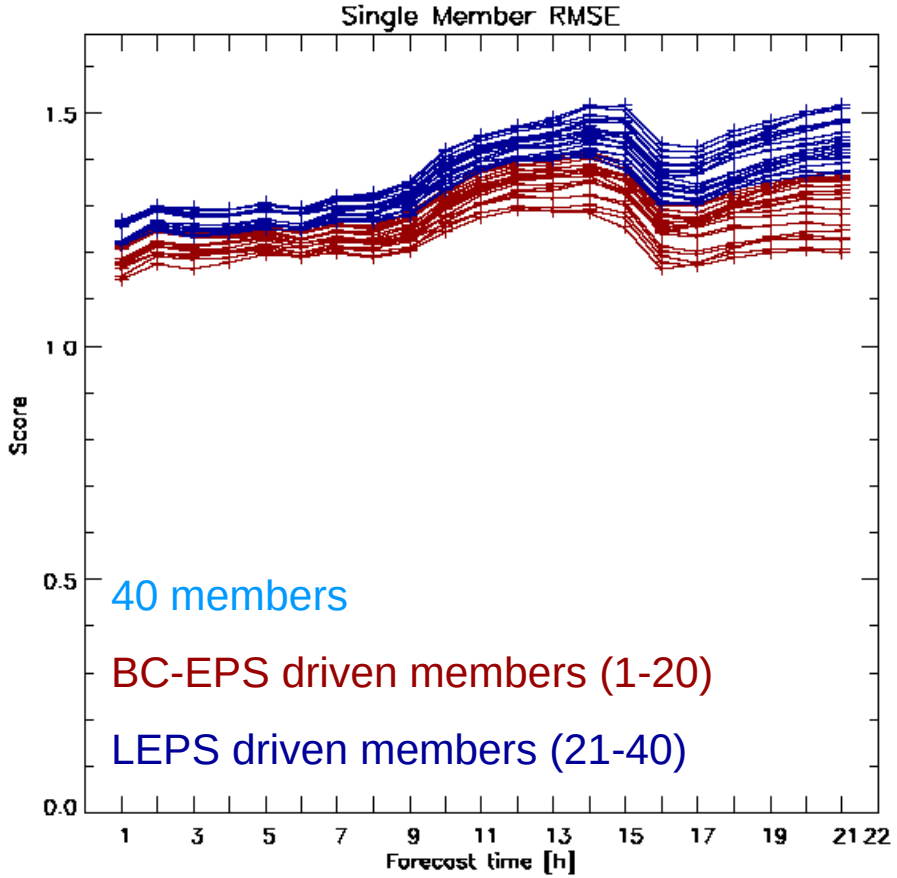


temperature

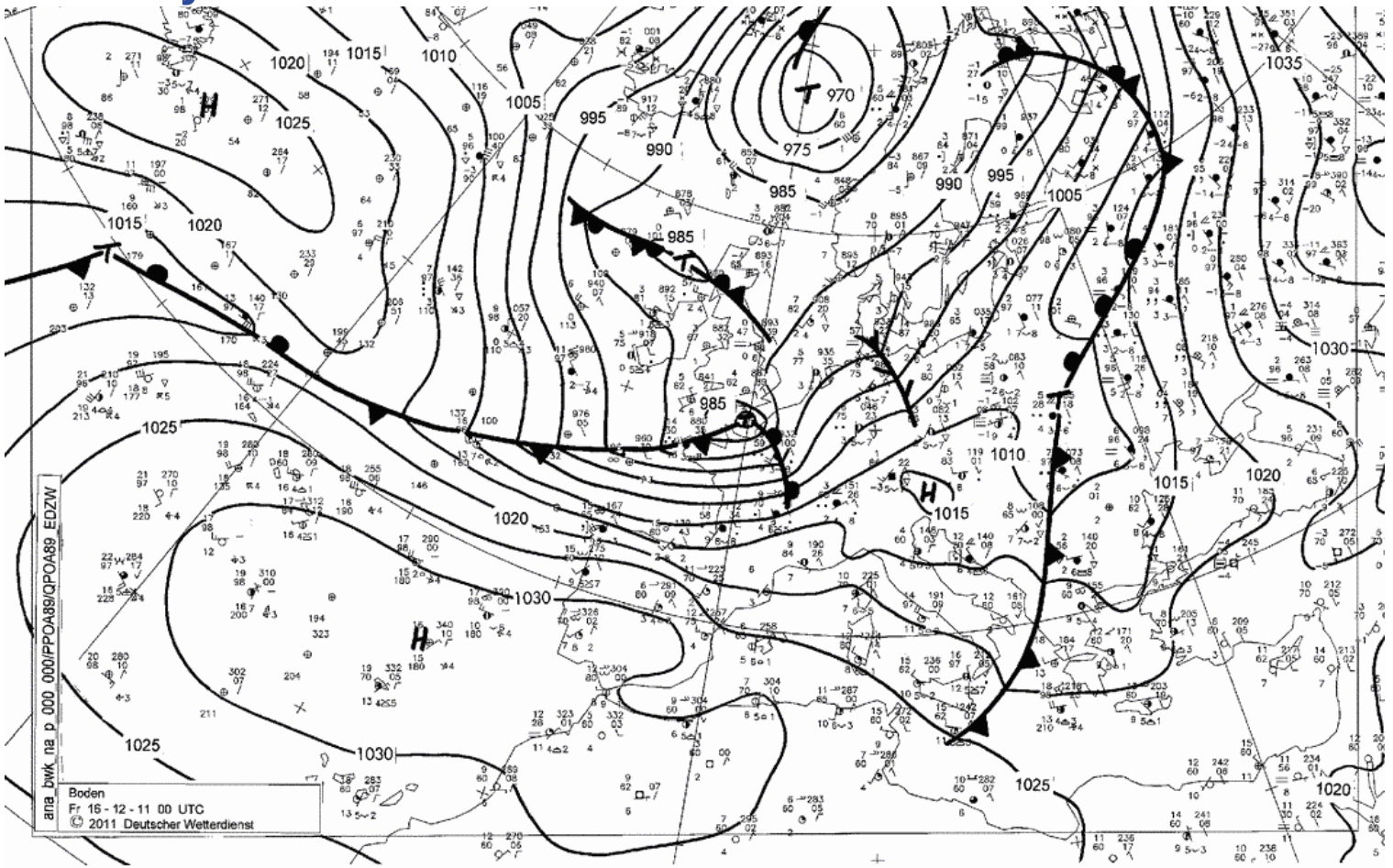


Single Member RMSE for 2m-temperature

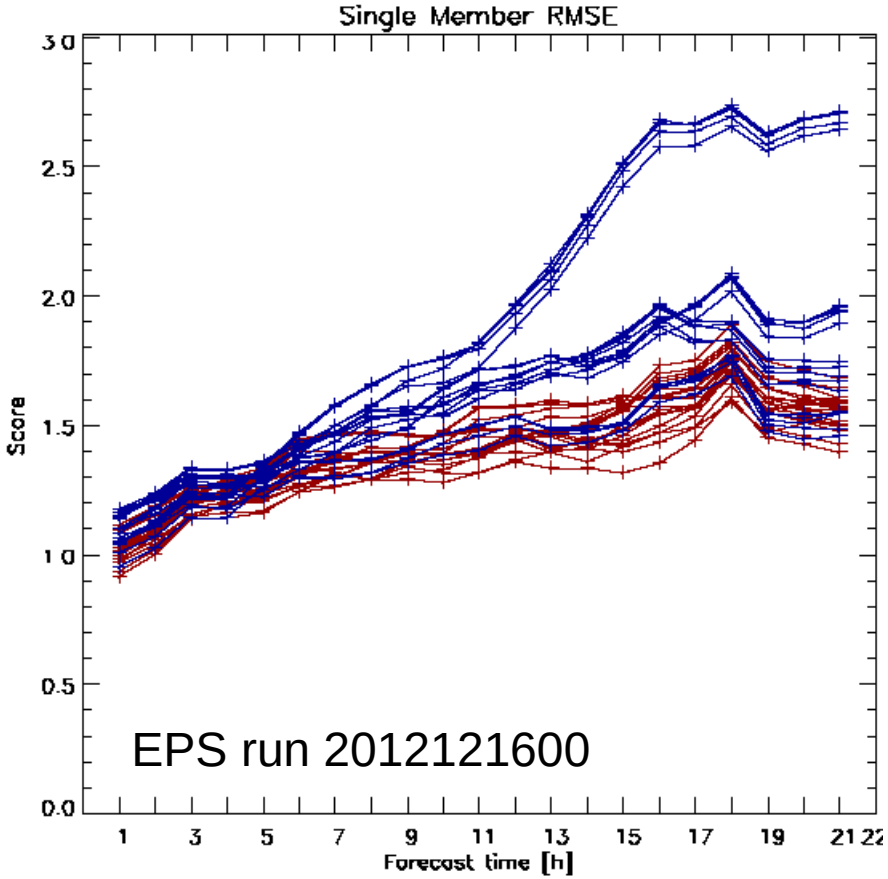


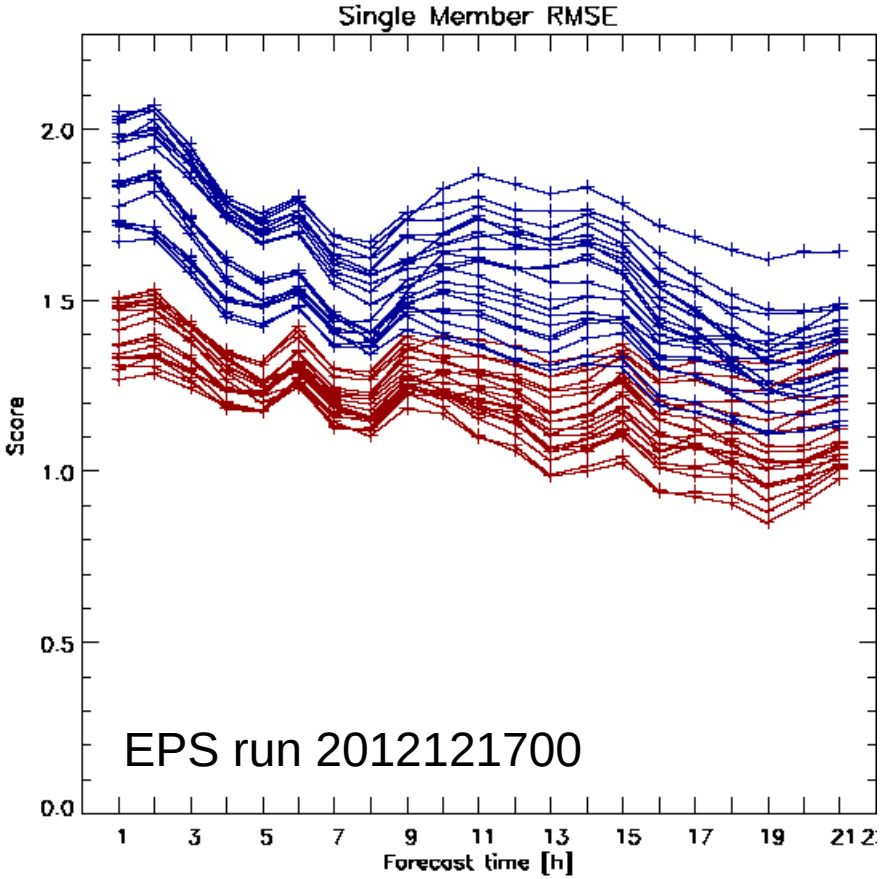


Case study of 16th December 2011

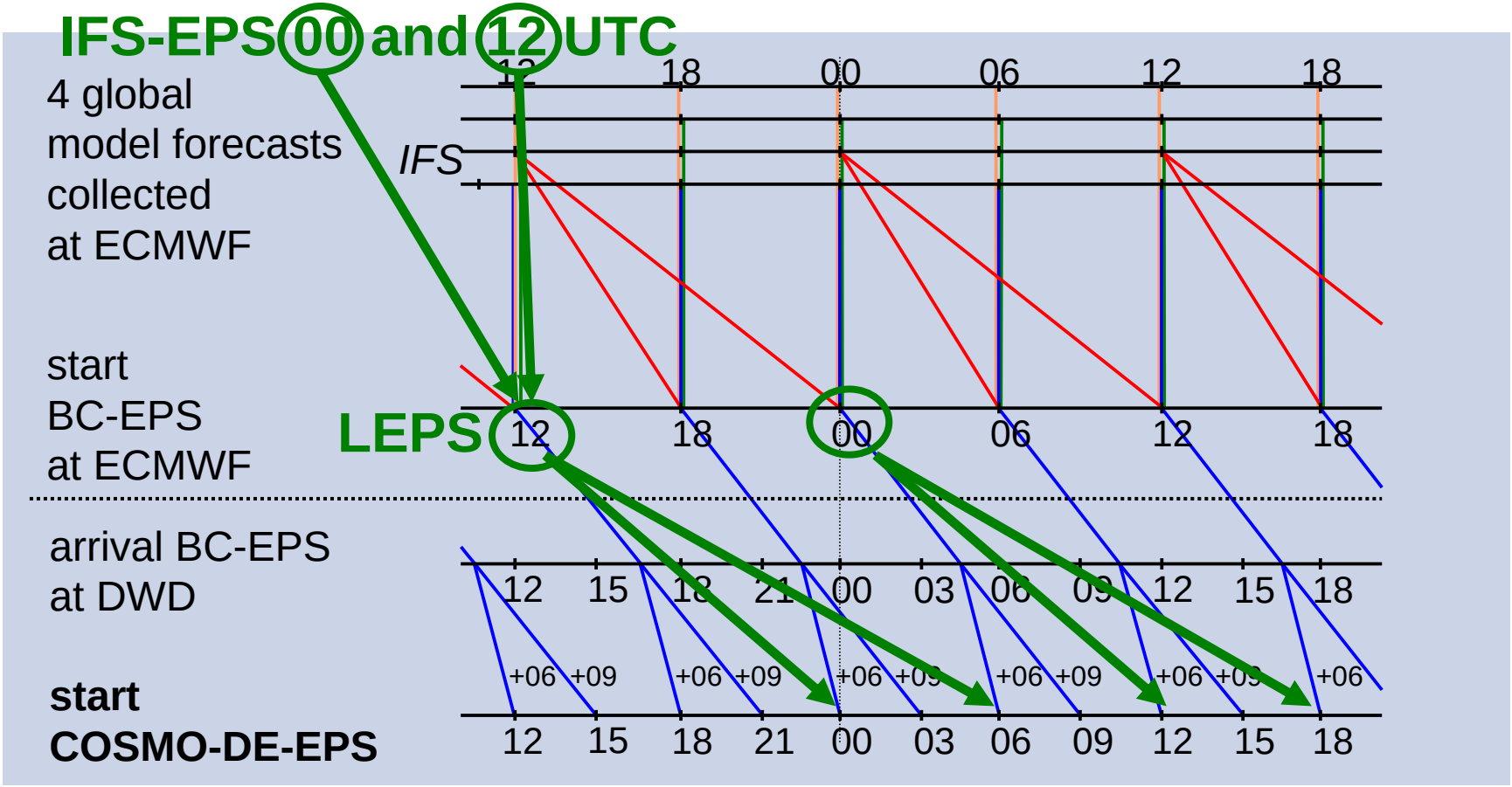


Case study of 16th December 2011





COSMO-DE-EPS


IFS-EPS 00 and 12 UTC
4 global model forecasts collected at ECMWF
start BC-EPS at ECMWF
arrival BC-EPS at DWD
start COSMO-DE-EPS
IFS
LEPS
12 18 00 06 12 18
12 15 18 21 00 03 06 09 12 15 18
+06 +09
+06