Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Advanced representation of sources of forecast uncertainty in COSMO-DE-EPS

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COSMO / CLM / ICON / ART User Seminar 2017

Predictability and Ensemble Systems

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developers of KENDA, ICON-EPS, ICON-EDA, verification

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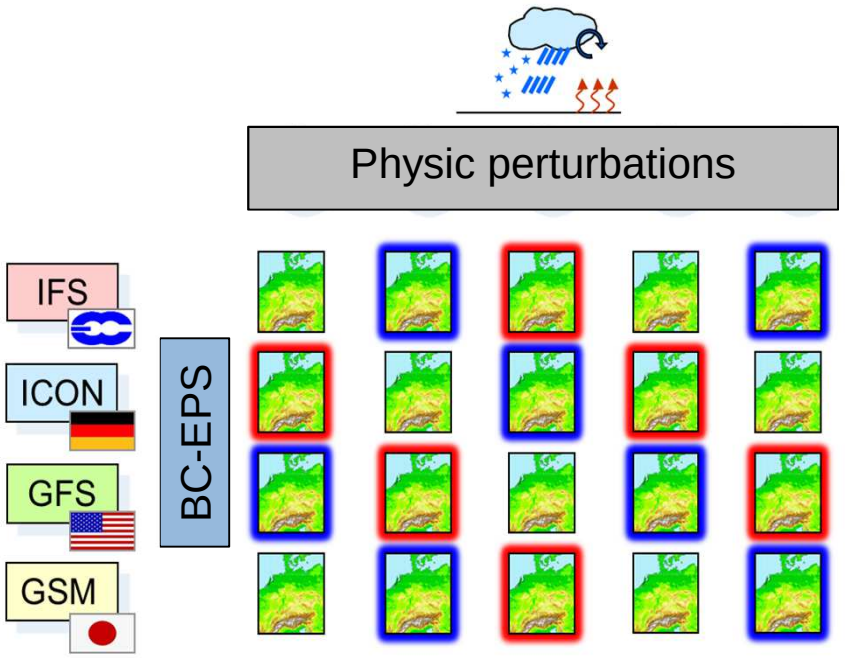
Outline

- COSMO-DE-EPS - the operational state
- Improvements in COSMO-DE-EPS
- Results

COSMO-DE-EPS - the operational state

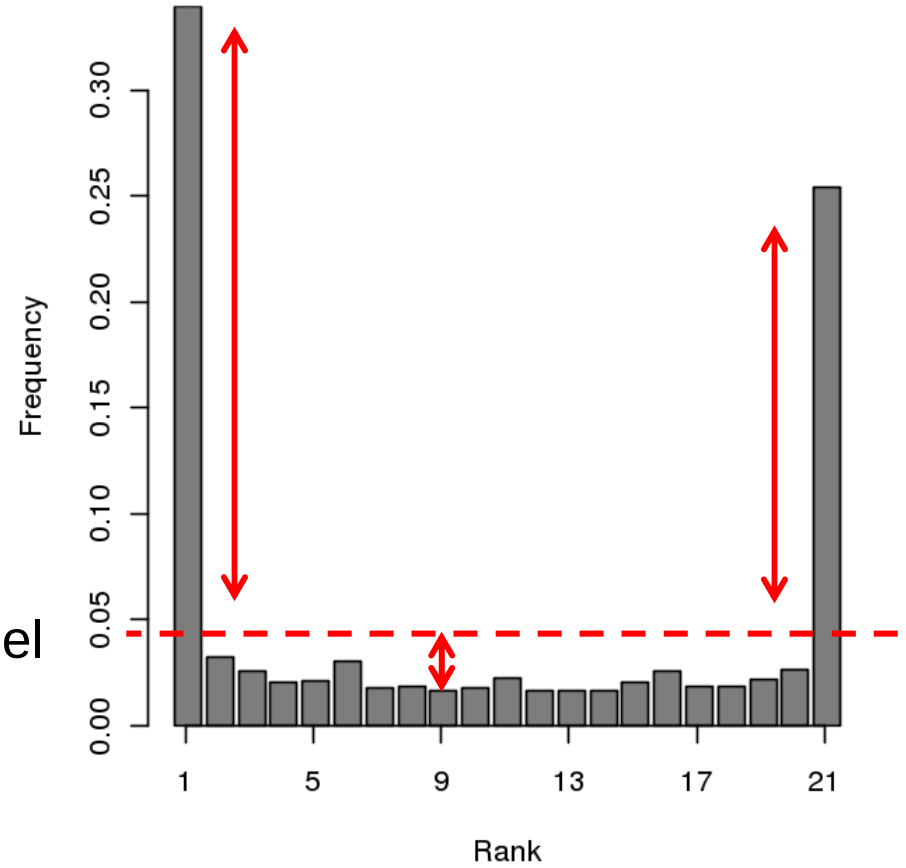
- 2.8km horizontal resolution
- 50 vertical levels
- 20 members
- 27h forecast range
- 4 global models
- Fixed physic perturbations
- BC-EPS as boundary and initial perturbations
- Soil moisture perturbation



COSMO-DE-EPS concept

Motivation

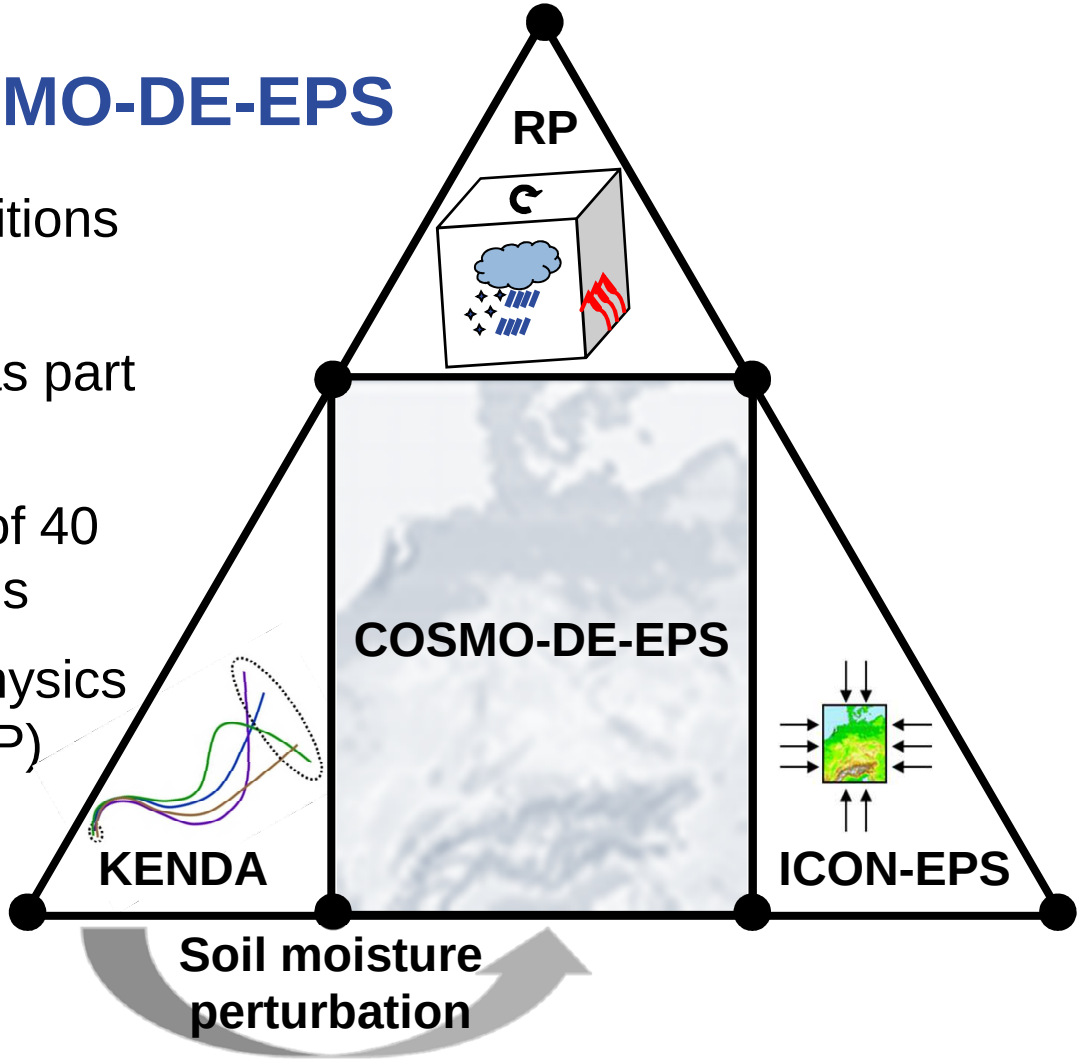
- Increasing the spread of the ensemble and improving e.g. reliability and resolution as well
- Improving the IC by using an ensemble Kalman filter to generate perturbations based on statistically-dynamically sound methods
- ICON-EPS provides a sample of high-quality BCs based on one model and it is more feasible in operations then the multi-model BC-EPS



T2M routine from 26.07.-25.08.2016
00 UTC run

Improvements in COSMO-DE-EPS

- KENDA as EPS initial conditions 1-20 of 40 members
- Soil moisture perturbation as part of KENDA
- ICON-EPS members 1-20 of 40 used as boundary conditions
- Randomised selection of physics parameter perturbations (RP)



COSMO-DE-EPS changed concept

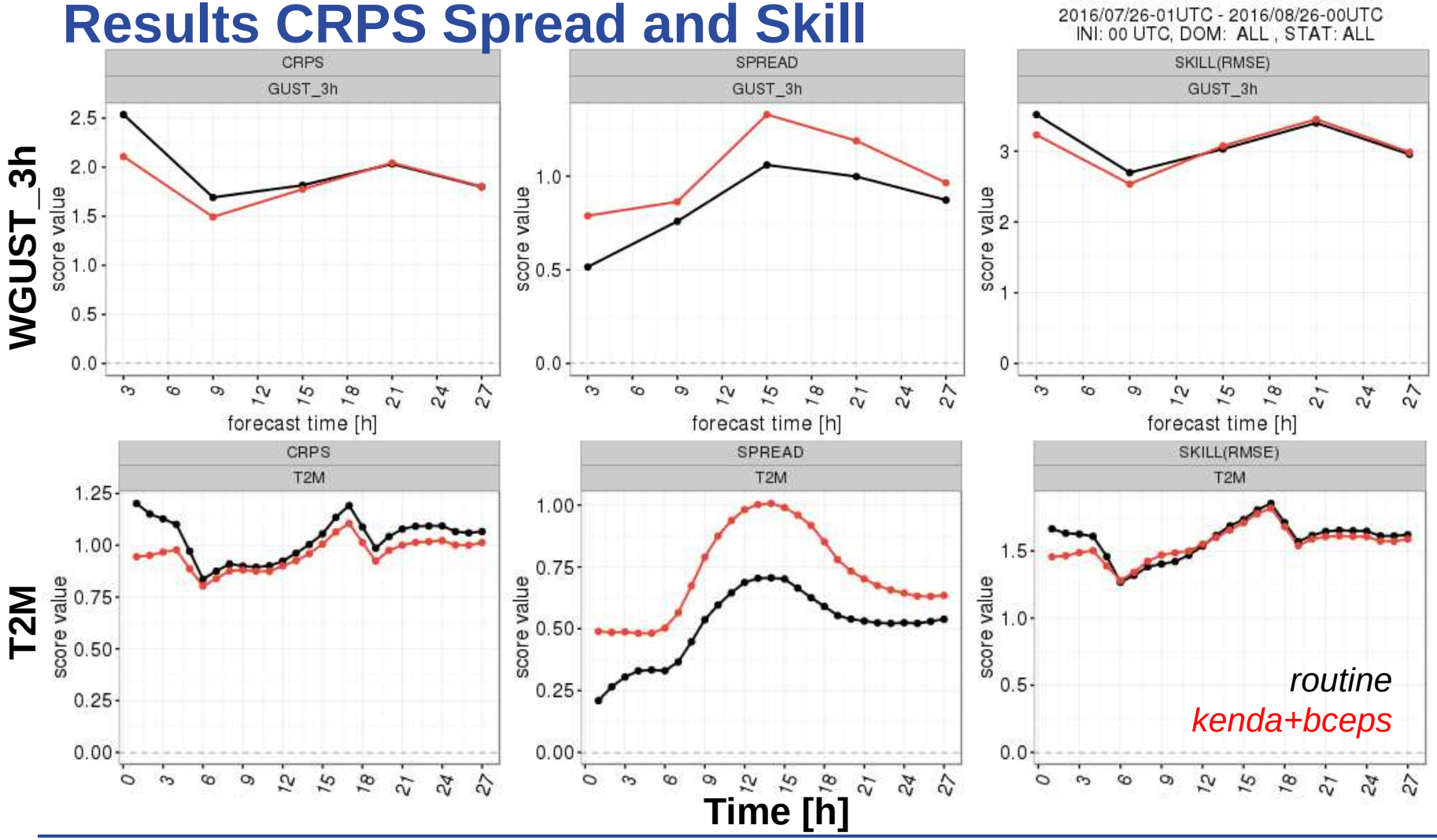
Improvements in COSMO-DE-EPS – the RP

- Randomised selection of the physics parameter perturbation for COSMO-DE-EPS
- The values of the parameters are not random (2-3 different values for each of the 12 parameters) [see table]
- Each parameter gets perturbed for 50% of the members of each ensemble run and stays fixed over the forecast range

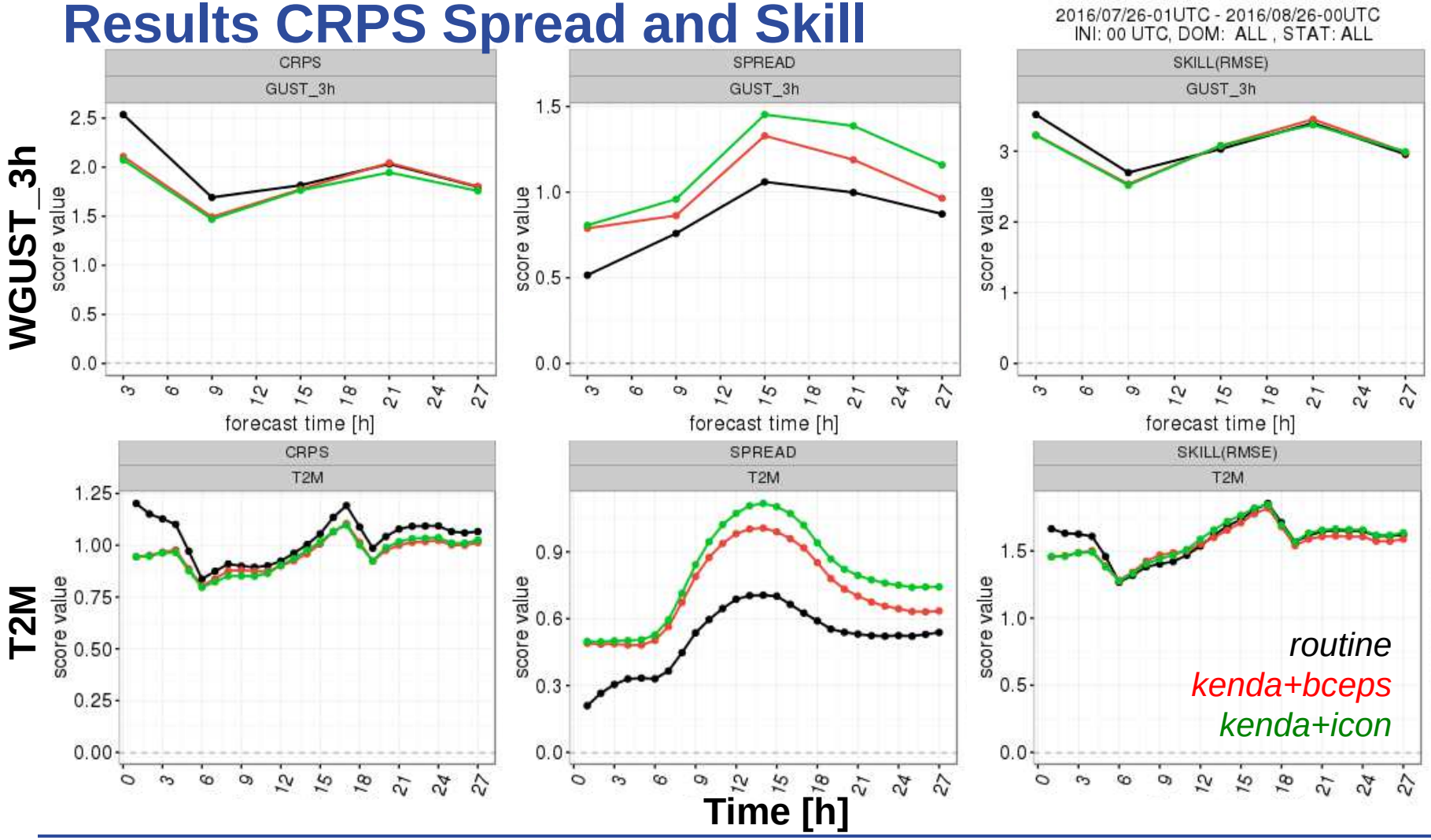
New perturbations (easier to implement with the RP)

a_stab	c_diff	radqi_ fact	radqc_ Fact	thick_ sc	rlam_ heat	entr_sc	q_crit	tur_len	tkh min	tkm min	lhn_coef
0	0.2	0.5	0.5	25000	1	0.0003	1.6	150	0.4	0.4	1
1	0.1	0.9	0.9	10000	10	0.002	4	500	0.7	0.7	0.5
	10			30000	0.1				0.2	0.2	

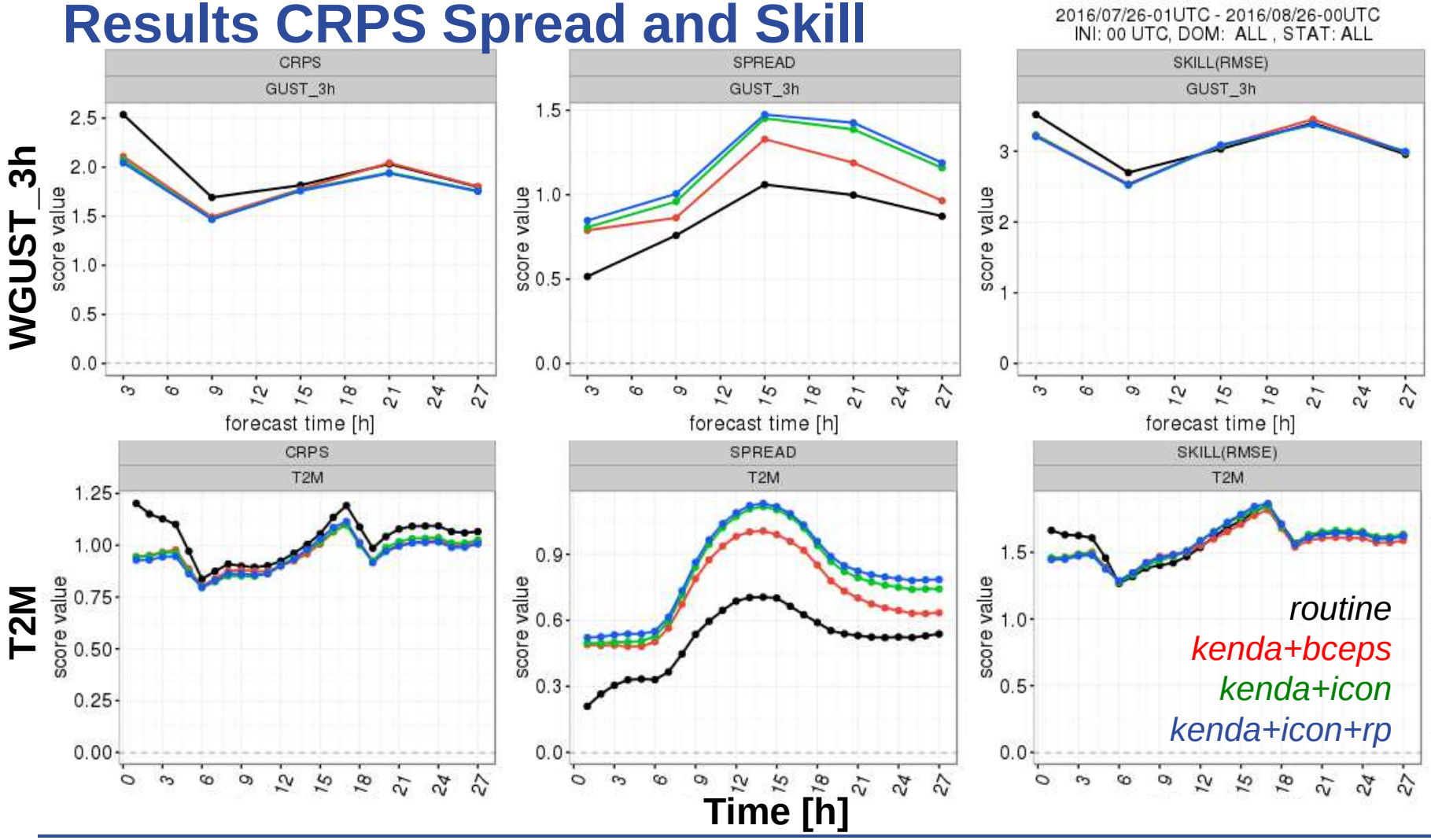
Results CRPS Spread and Skill



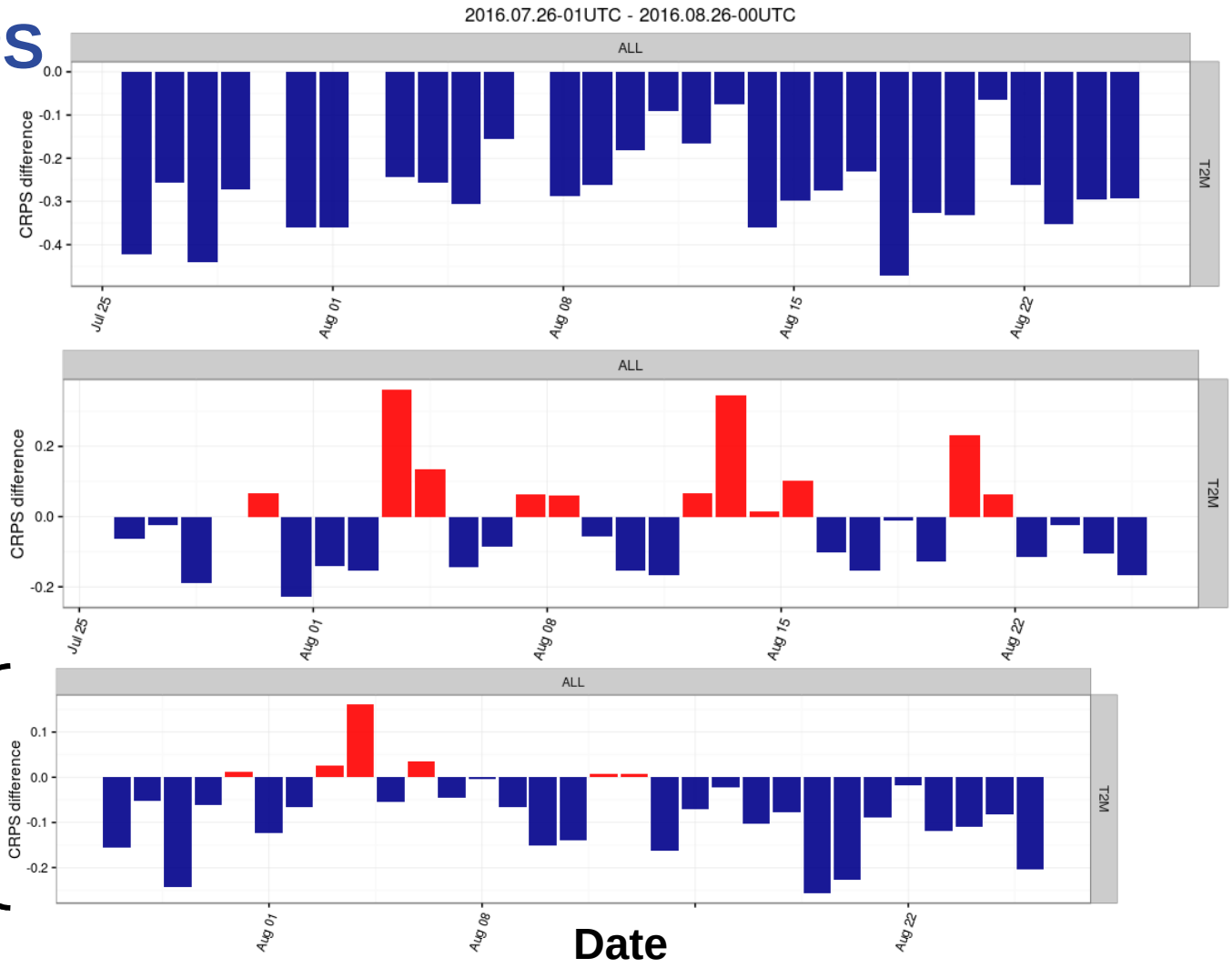
Results CRPS Spread and Skill



Results CRPS Spread and Skill



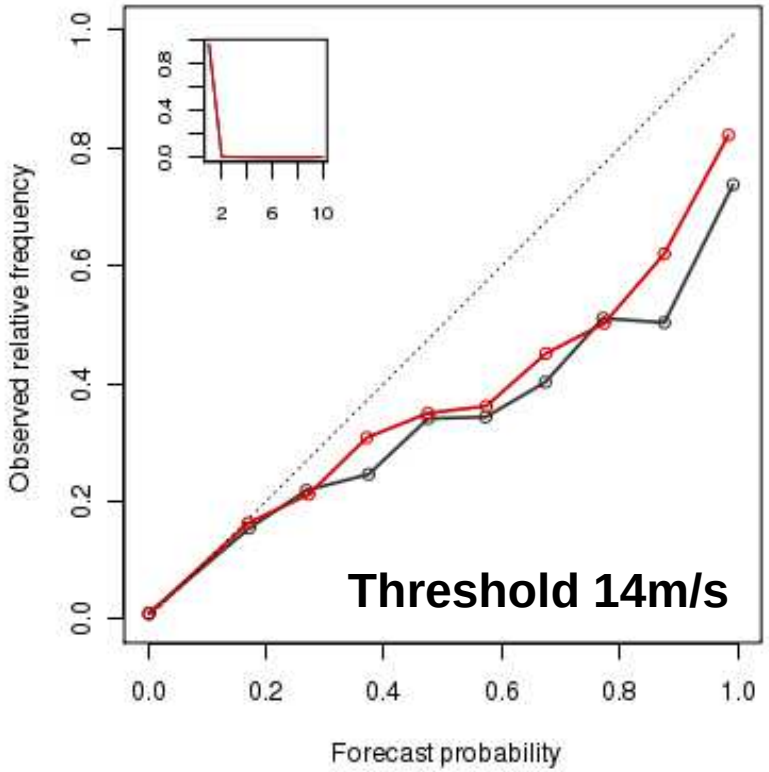
Results CRPS

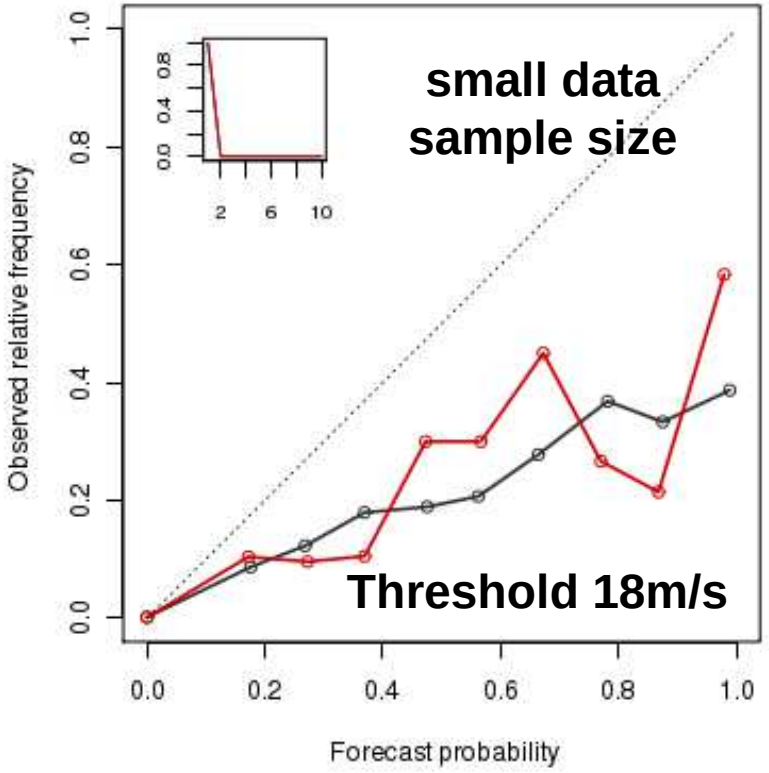


CRPS difference of KENDA-ICON-RP minus routine for T2M from 26.07.-26.08.2016 as 00 UTC run at lead time 1, 12 and 24

at night time it performs better again

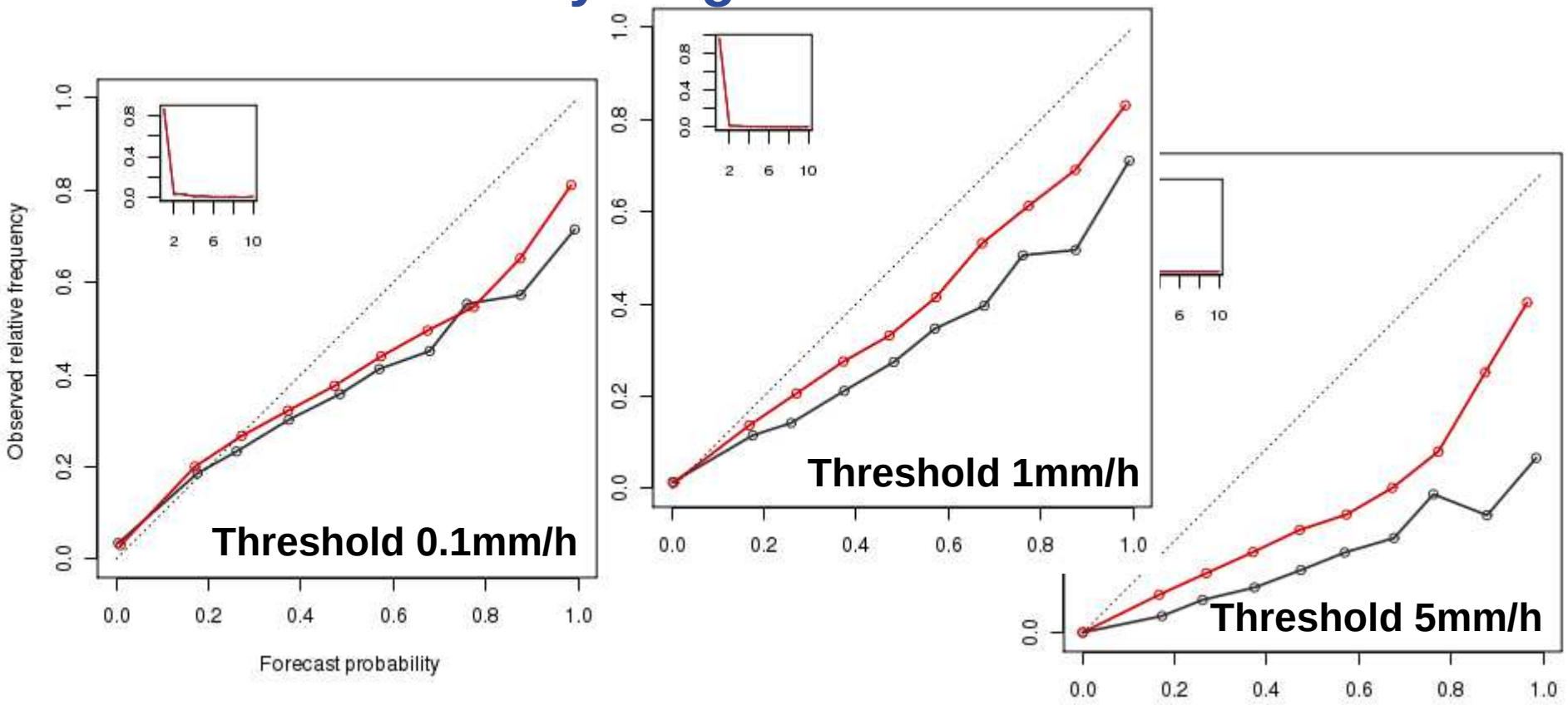
Results – Reliability diagram





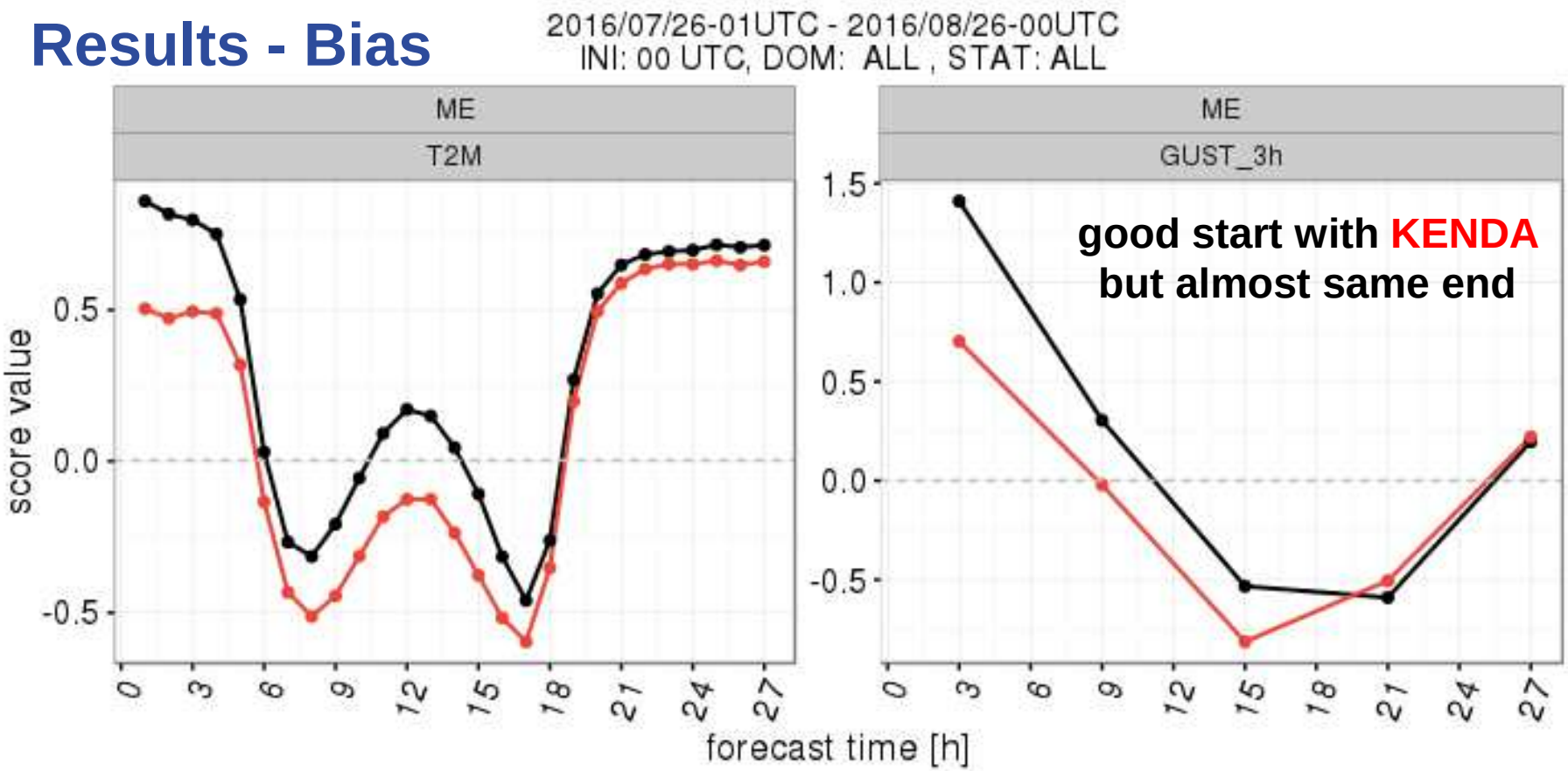
WGUST routine (black) and kenda+icon+rp (red) from 26.07.-25.08.2016
as 00 UTC run for the threshold values 14 and 18m/s

Results – Reliability diagram



PREC routine (black) and kenda+icon+rp (red) from 26.07.-25.08.2016 as 00 UTC run for the threshold values 0.1, 1 and 5mm/h

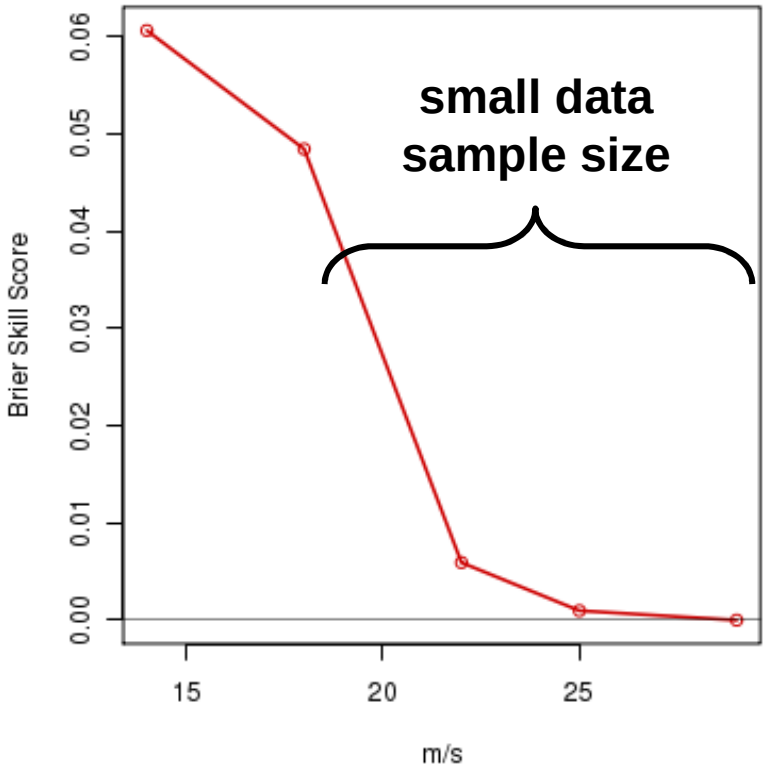
Results - Bias



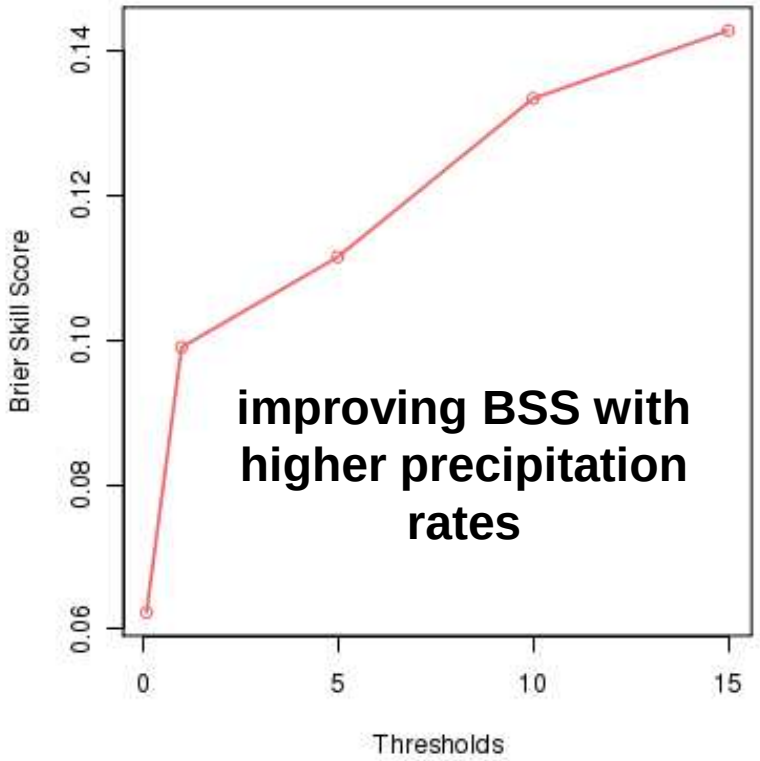
T2M routine (black) and kenda+icon+rp (red) from 26.07.-25.08.2016 as 00 UTC run

WGUST_3h routine (black) and kenda+icon+rp (red) from 26.07.-25.08.2016 as 00 UTC run

Results – Brier skill score

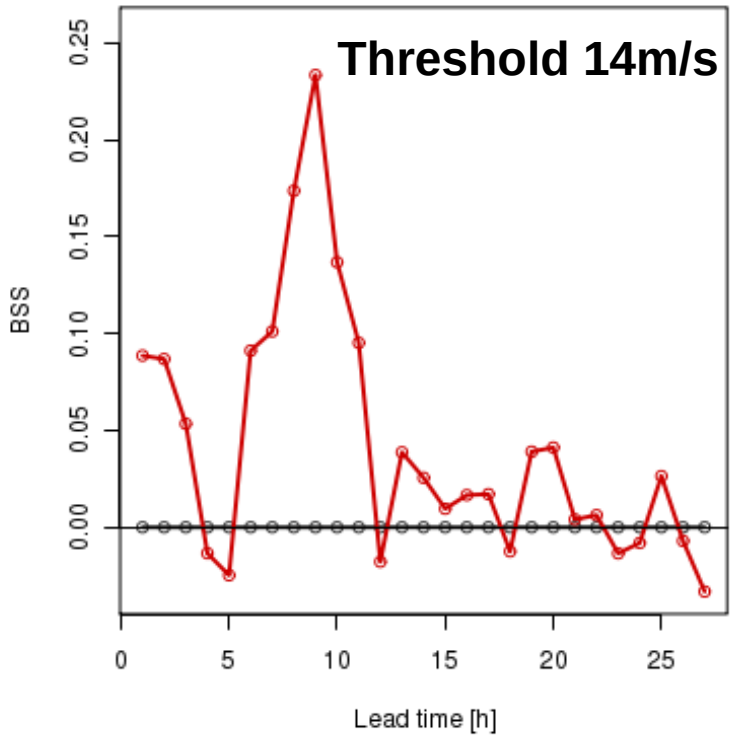


WGUST kenda+icon+rp vs. routine from 26.07.-25.08.2016 as 00 UTC run

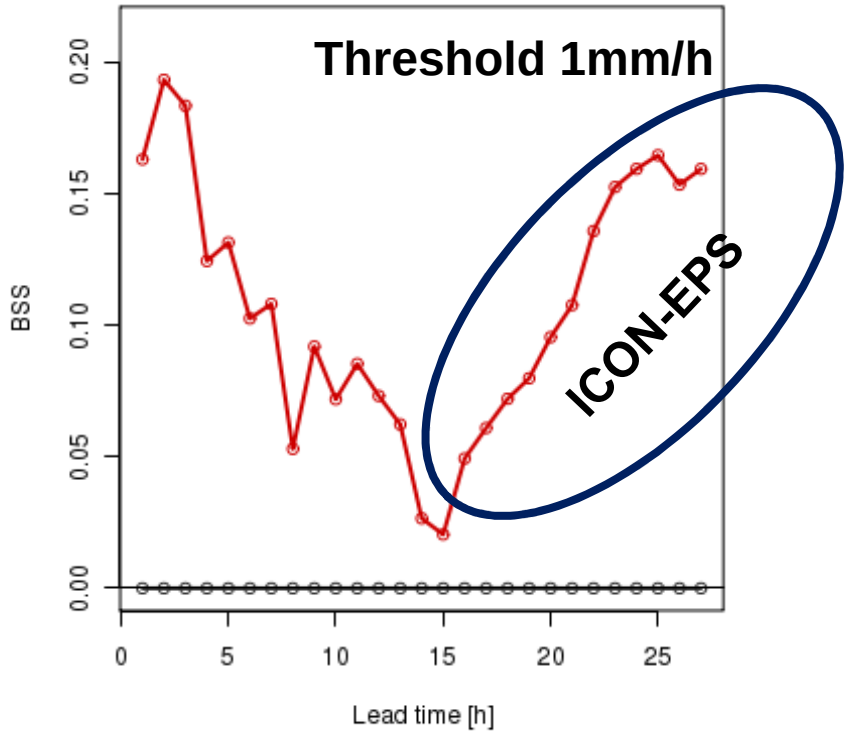


PREC kenda+icon+rp vs. routine from 26.07.-25.08.2016 as 00 UTC run

Results – Brier skill score behaviour over time

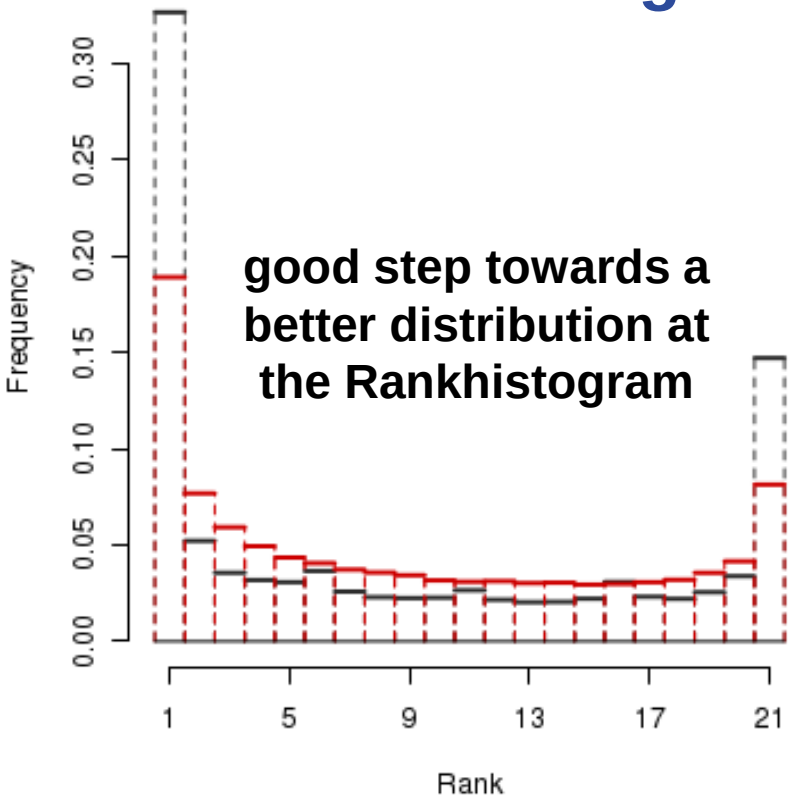


WGUST kenda+icon+rp vs. routine from 26.07.-25.08.2016 as 00 UTC run at 14m/s threshold



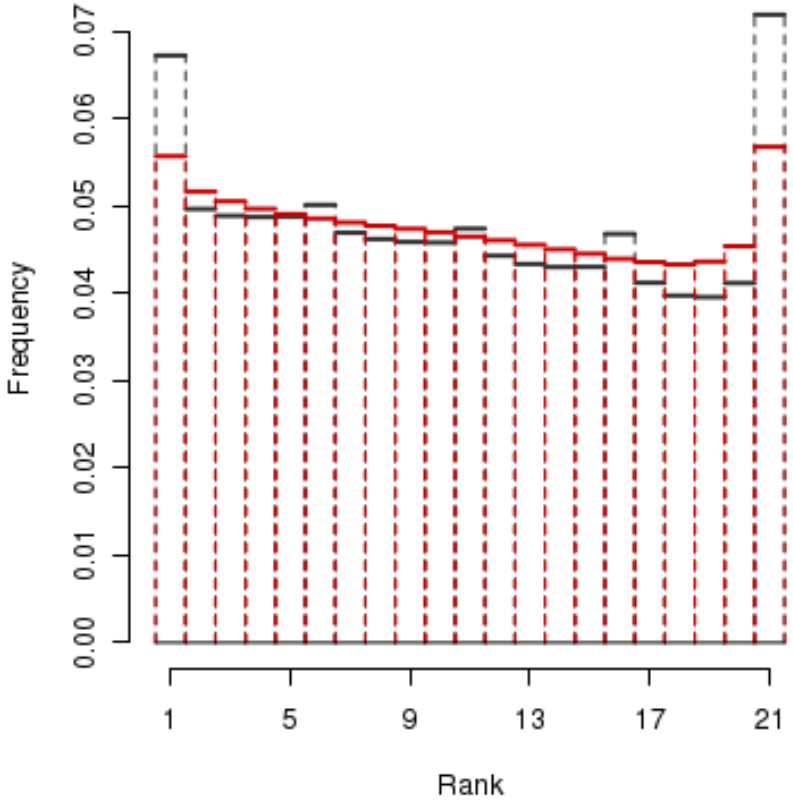
PREC kenda+icon+rp vs. routine from 26.07.-25.08.2016 as 00 UTC run at 1mm/h threshold

Results - Rankhistogram



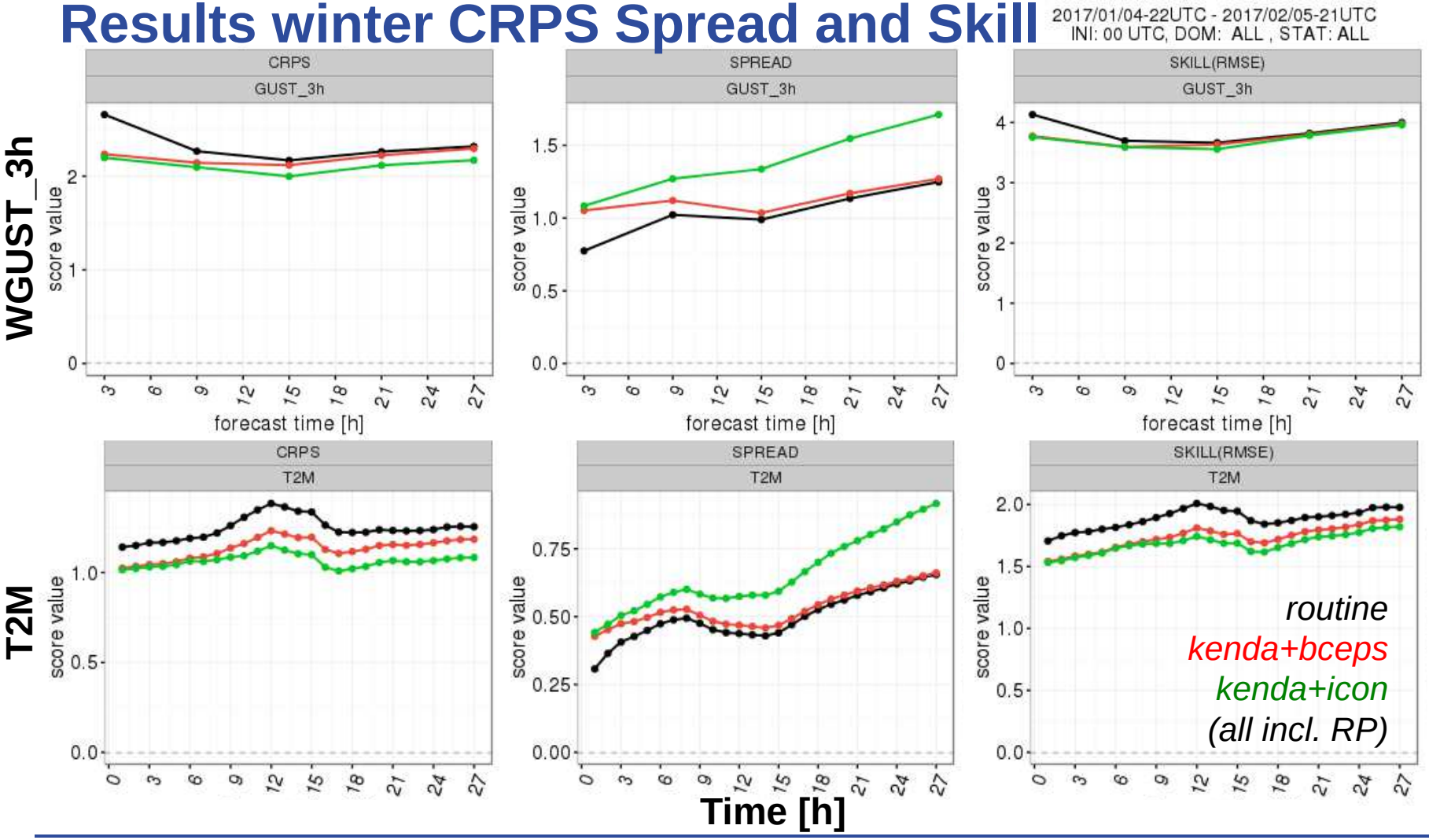
good step towards a better distribution at the Rankhistogram

WGUST routine (black) and kenda+icon+rp (red) from 26.07.-25.08.2016 as 00 UTC run

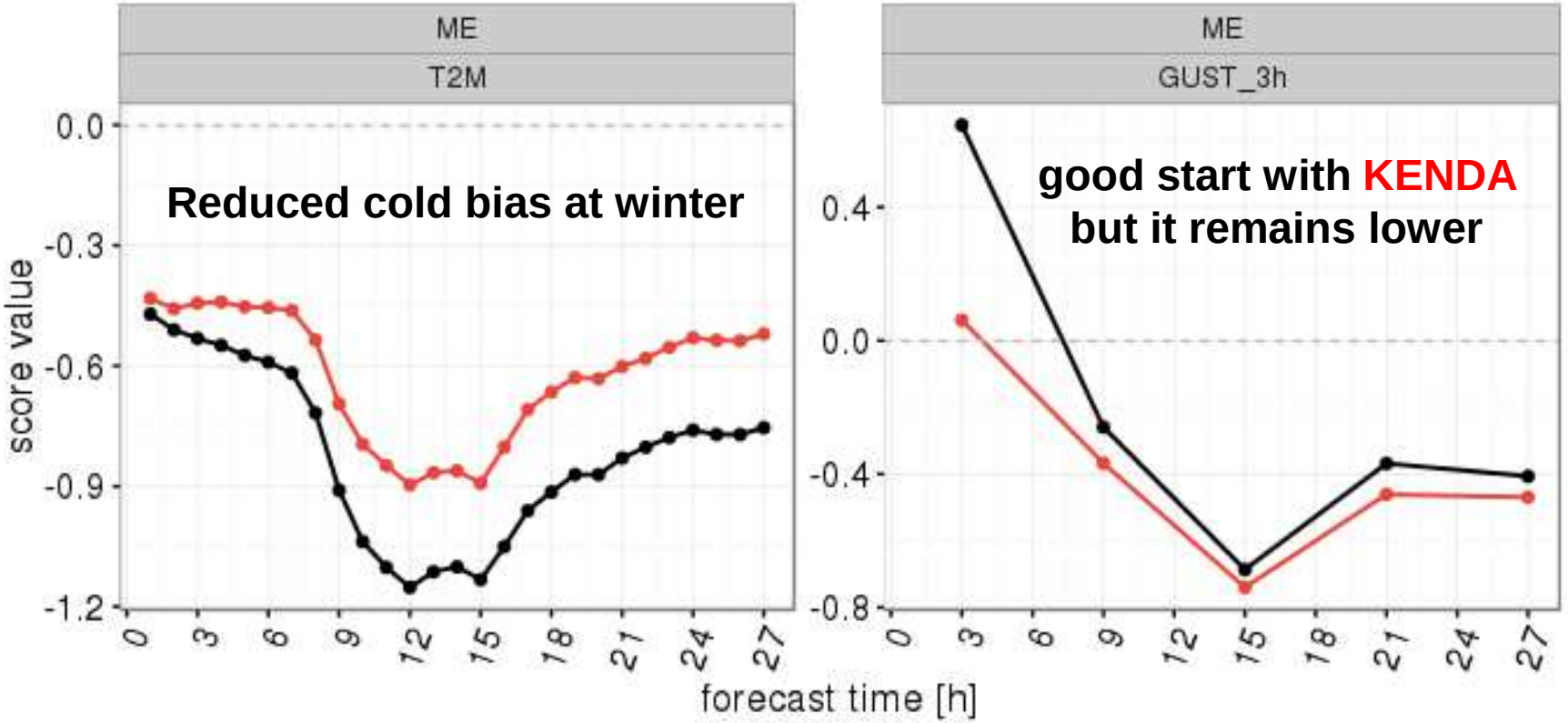


PREC routine (black) and kenda+icon+rp (red) from 26.07.-25.08.2016 as 00 UTC run

Results winter CRPS Spread and Skill



Results winter bias



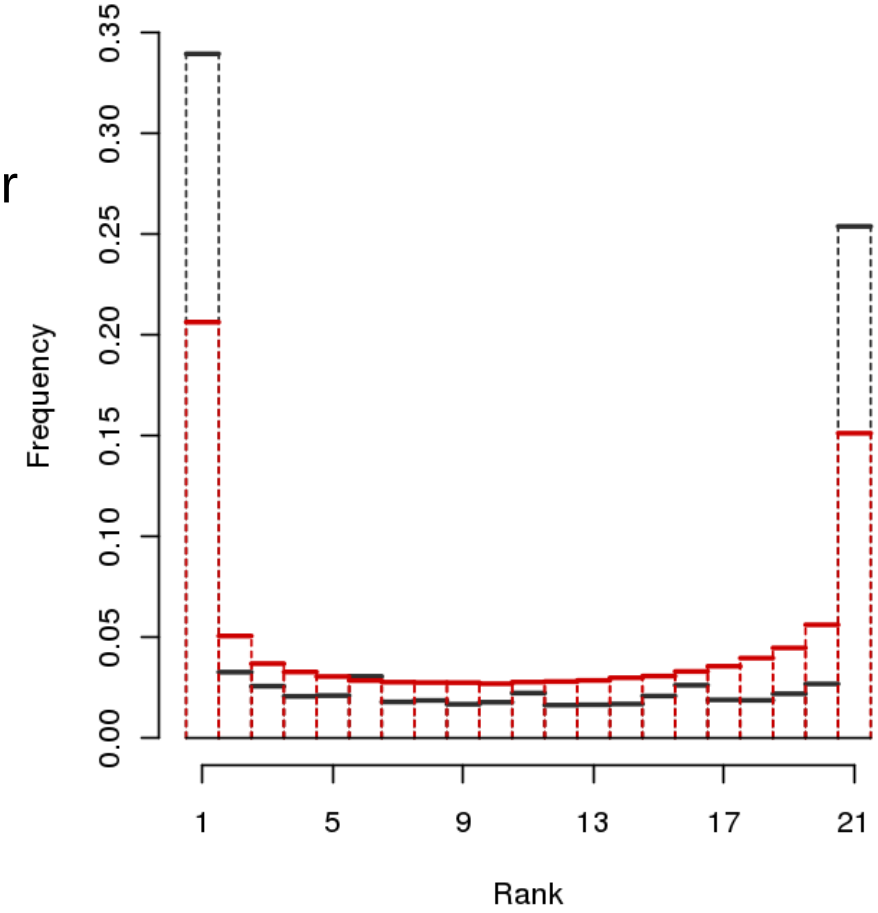
T2M routine+rp (black) and kenda+icon+rp (red) from 04.01.-05.02.2017 as 00 UTC run

WGUST_3h routine+rp (black) and kenda+icon+rp (red) from 04.01.-05.02.2017 as 00 UTC run

Conclusion

- Improvement in almost all scores for summer and winter
- KENDA shows large improvement for initial conditions and the benefit remains often for the whole run
- ICON-EPS shows positive effect at higher lead times
- RP has a small but overall positive effect and might become of special interest for weather extremes

- Coming soon to routine (21.03.2017)



T2M routine (black) and kenda+icon+rp (red) from 26.07.-25.08.2016 as 00 UTC run

Thank You for the attention

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Time for questions