Long term trends of fuzzy-verification results

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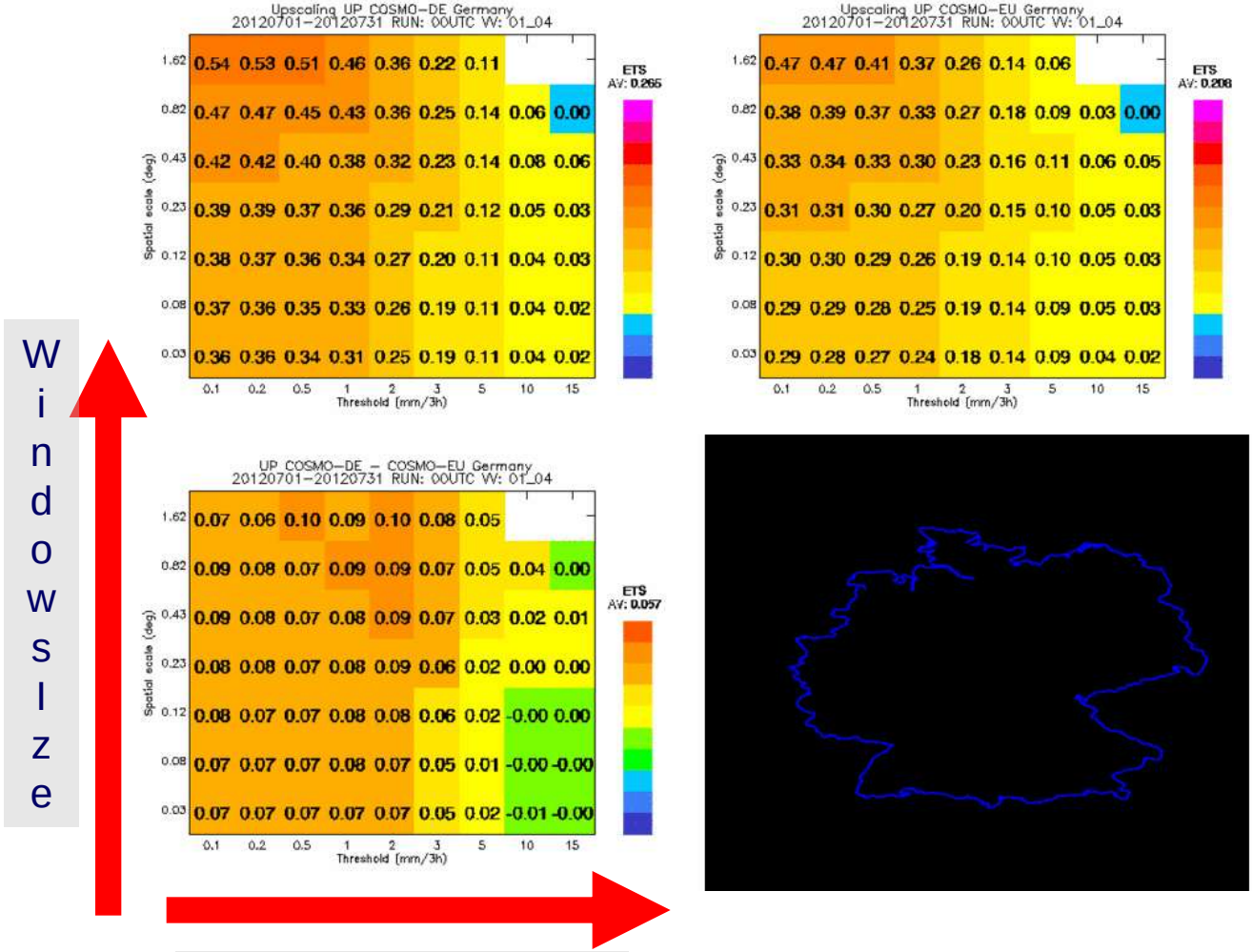
Presentation of “fuzzy”-verification results

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

- **Look at windows with different sizes in space (and/or in time)**
- **Calculate results that are typical for this window size**



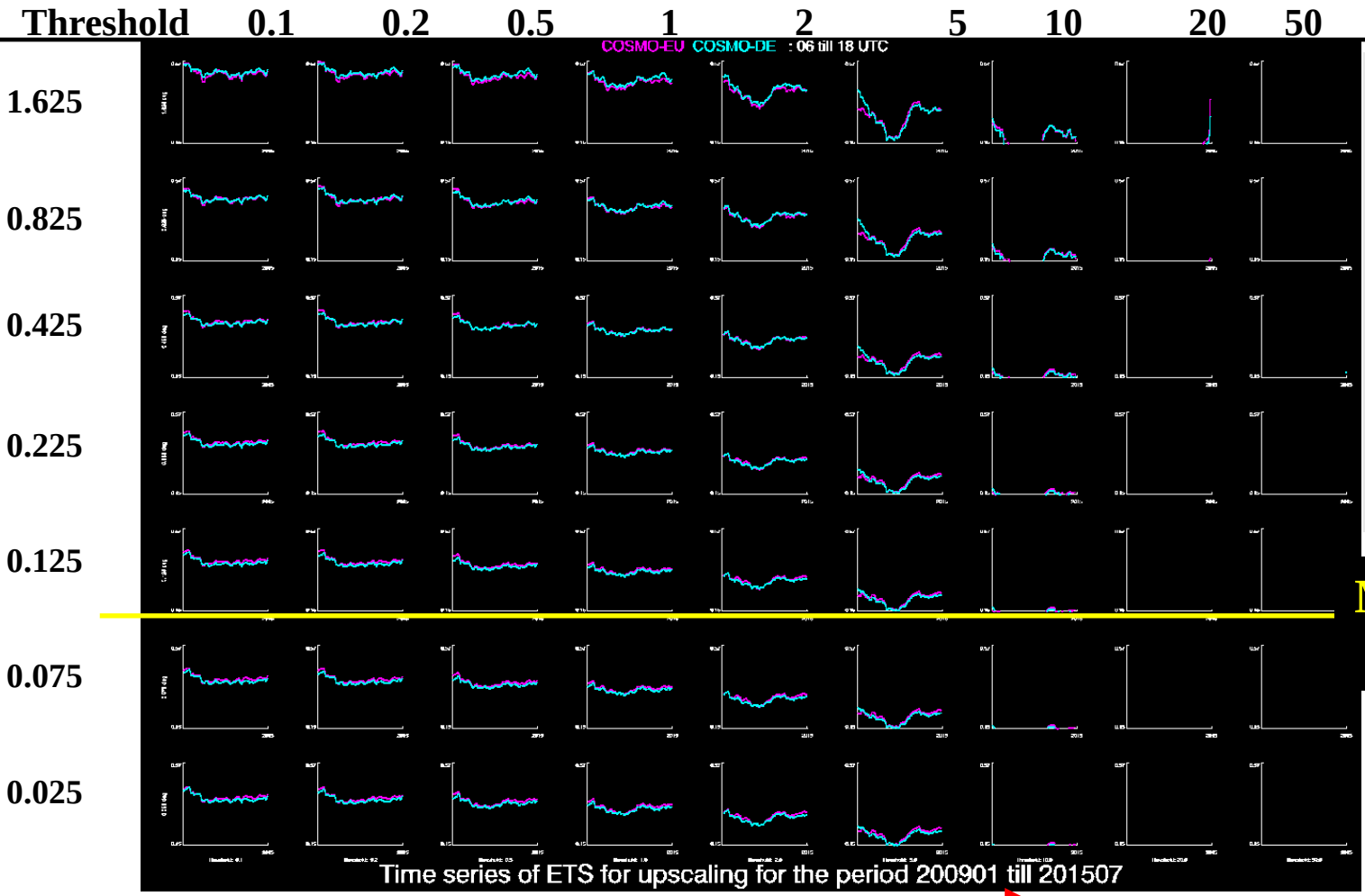
Overview

Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD

- **Data sources**
  - ***Precipitation forecasts of german COSMO-models and GME (with March 2015 ICON)***
  - ***Precipitation observations from radar data***
  - ***Interpolation of all model data to the grid of COSMO-DE (nearest neighbour)***
- **Method of calculations**
  - ***Getting ETS for upscaling fractions skill score as monthly values from fuzzy verification***
  - ***No averaging over daily values but calculation of scores from the contingency tables of the whole month***
  - ***Calculation of running means of the results over one year***
  - ***Presentation of mean values and mean averages***
- **Gridsizes and thresholds**
  - ***Grid from 0.025 (resolution of COSMO-DE) to 1.625 (0.025, 0.075, 0.125, 0.225, 0.425, 0.825, 1.625)***
  - ***Thresholds: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 mm (12h) $^{-1}$ or (24h) $^{-1}$***

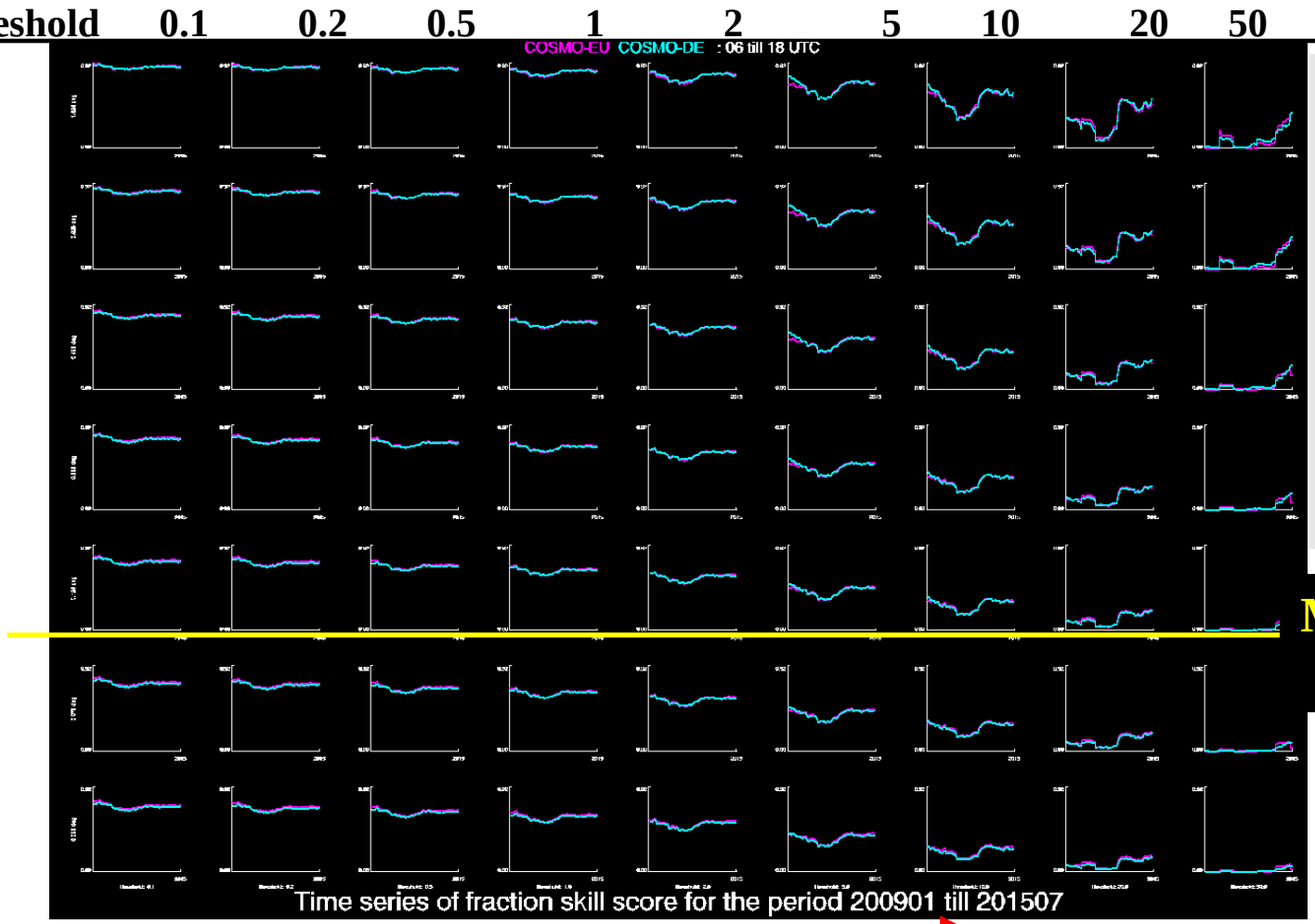
Comparison of COSMO-EU to COSMO-DE – upscaling ETS (values)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



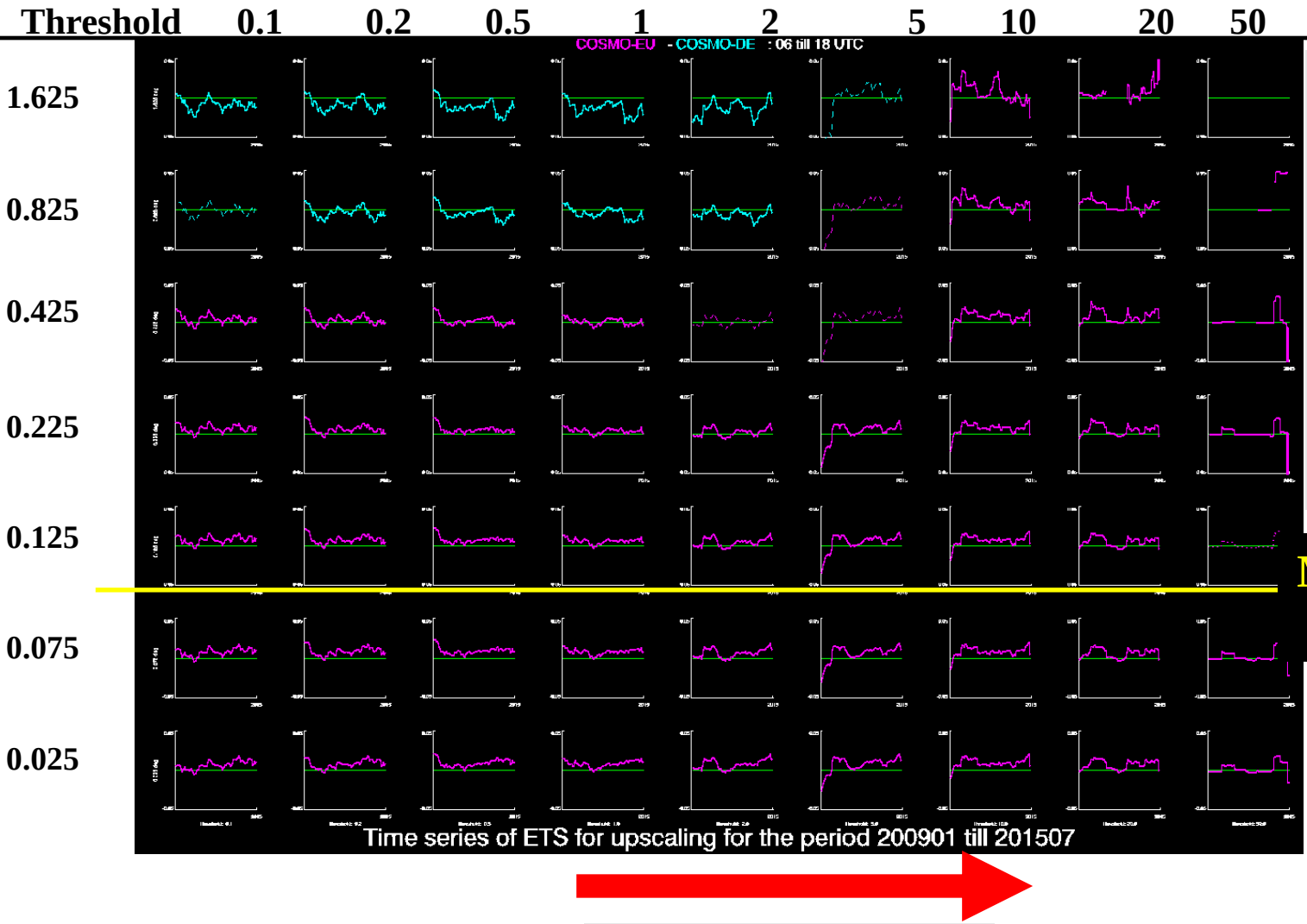
Comparison of COSMO-EU to COSMO-DE – FSS (values)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



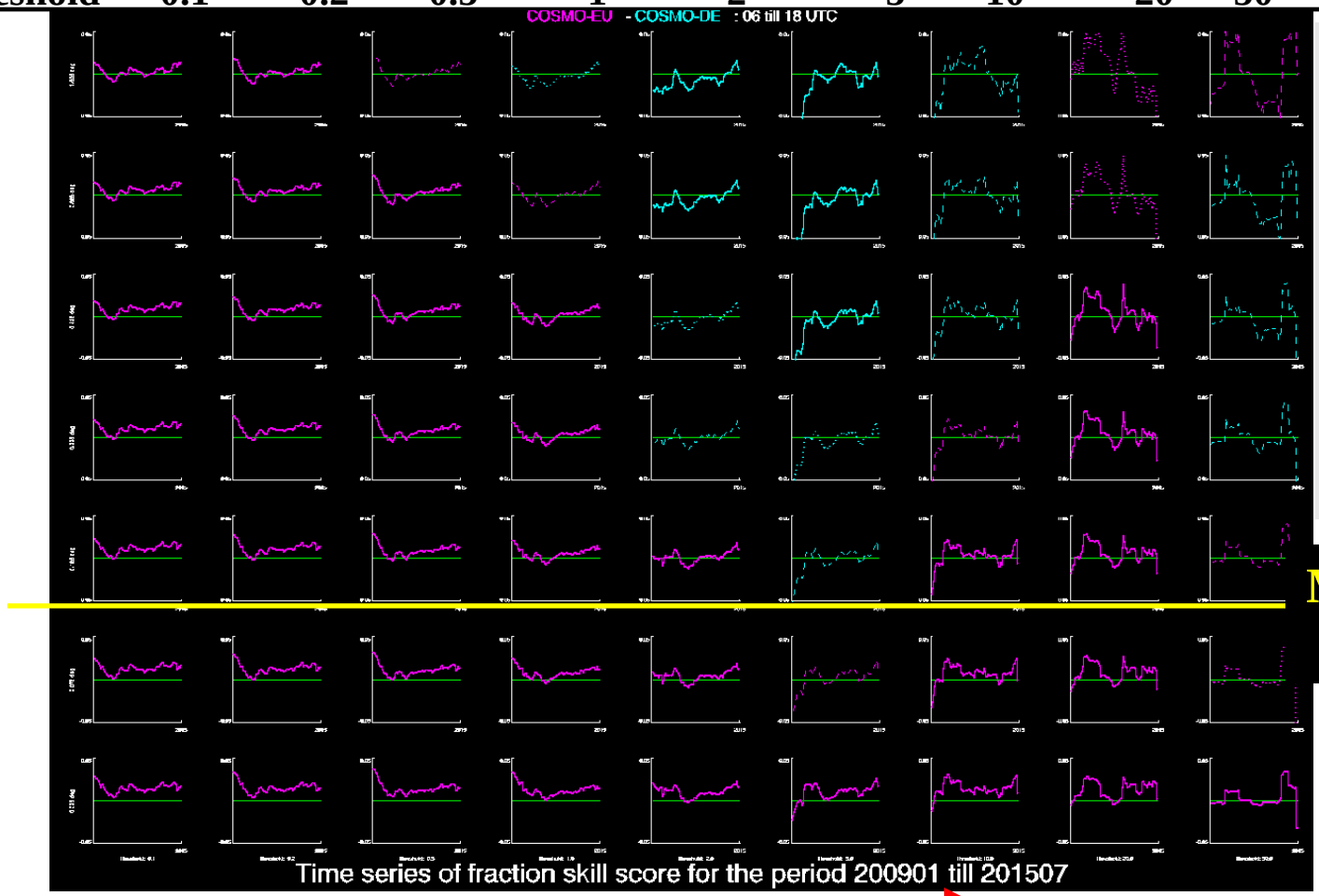
Comparison of COSMO-EU to COSMO-DE – upscaling ETS (differences)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Comparison of COSMO-EU to COSMO-DE – FSS (differences)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



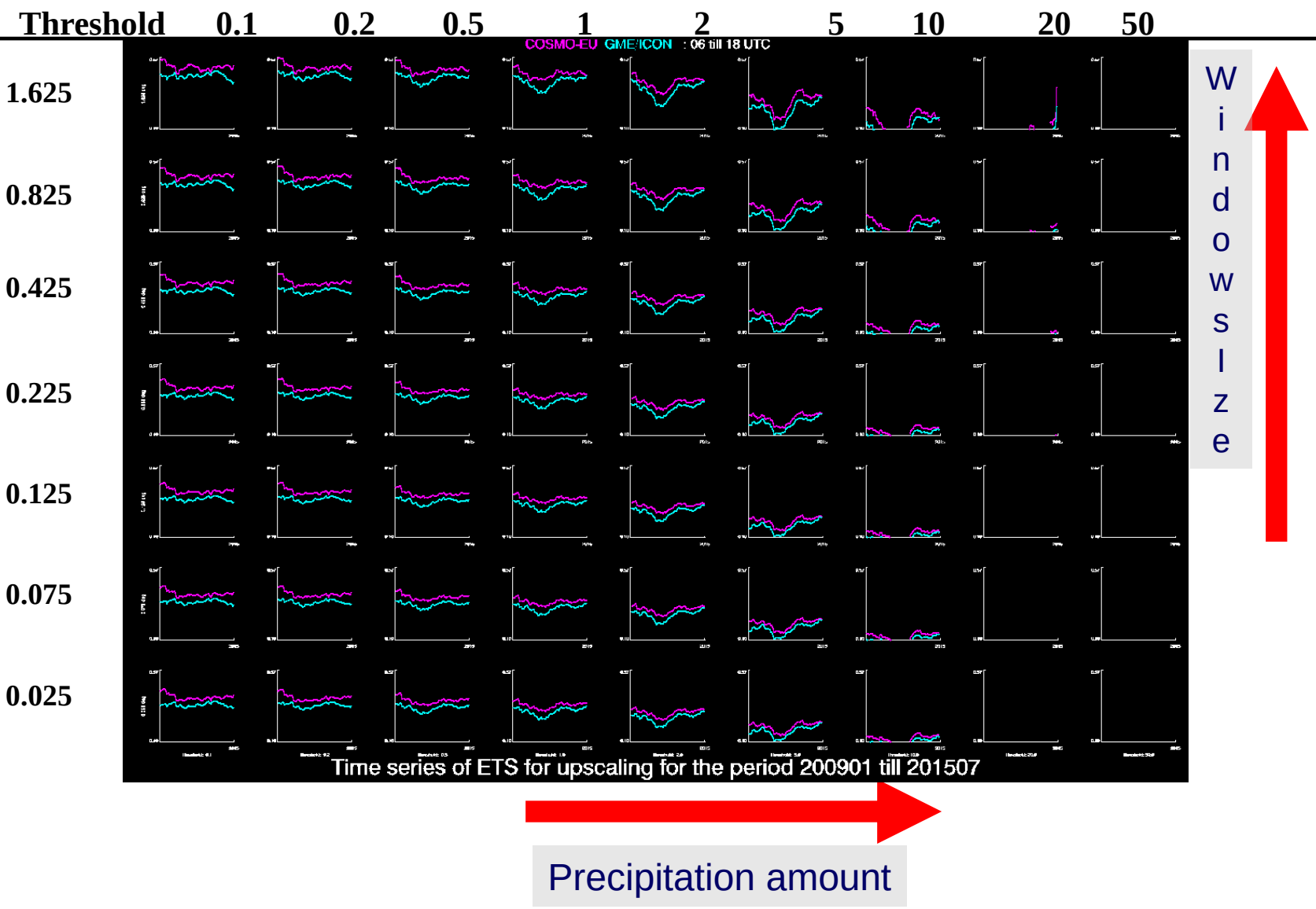
Windowsize

Mesh width of COSMO-EU

Precipitation amount

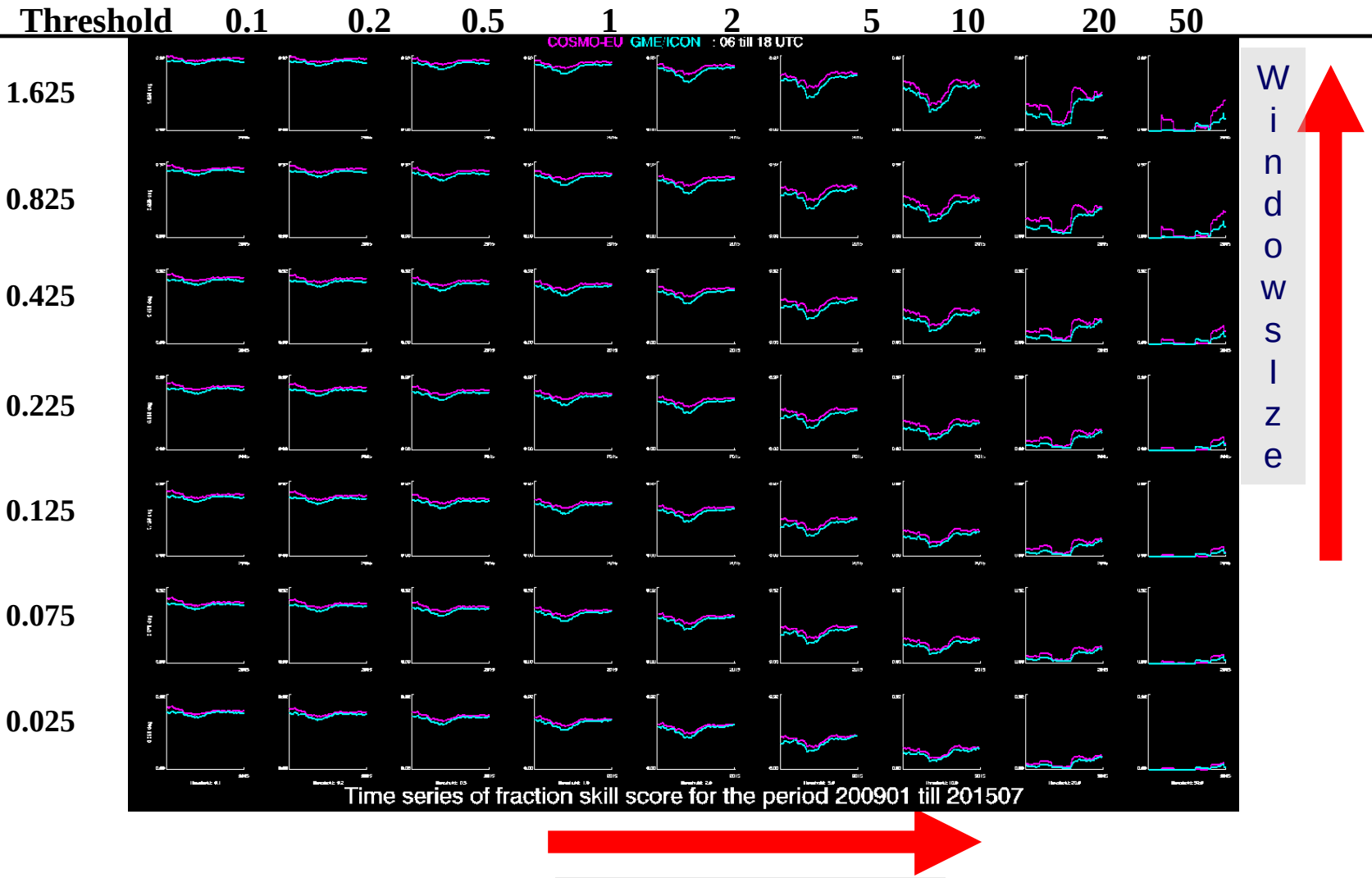
Comparison of COSMO-EU to GME/ICON – upscaling ETS (values vv: 06-18)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



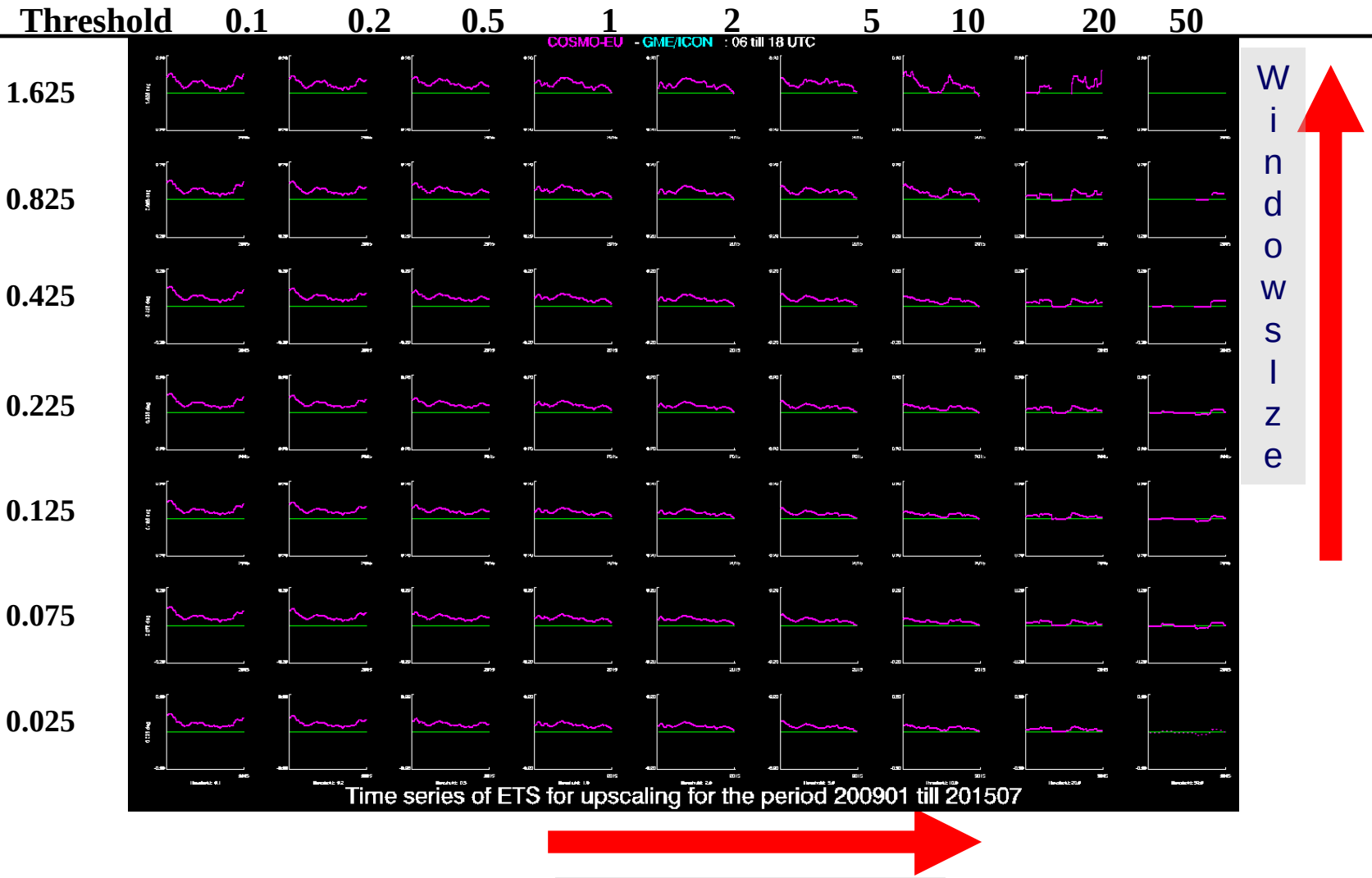
Comparison of COSMO-EU to GME/ICON – FSS (values vv: 06-18)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



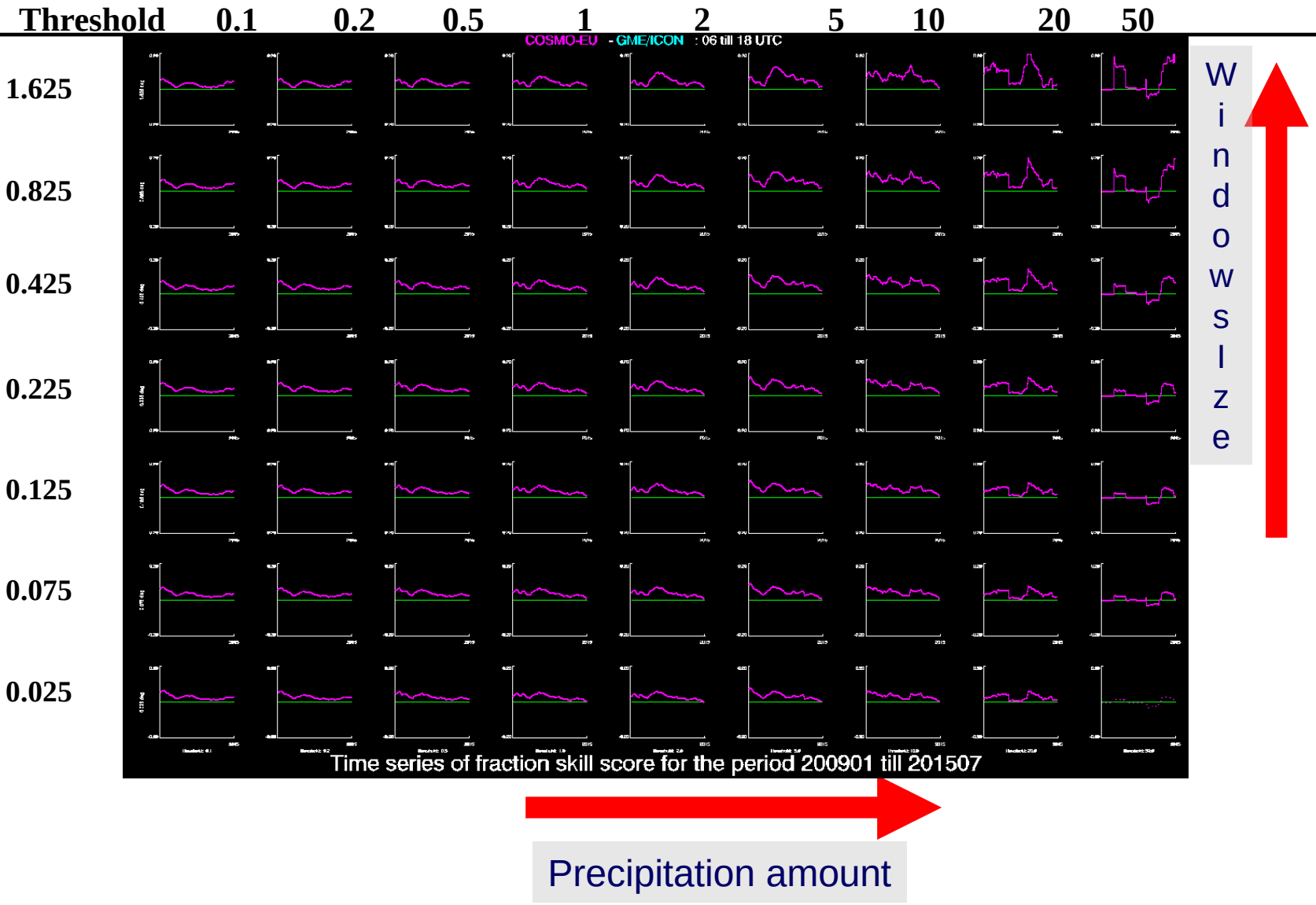
Comparison of COSMO-EU to GME/ICON – upscaling ETS (differences vv: 06-18)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



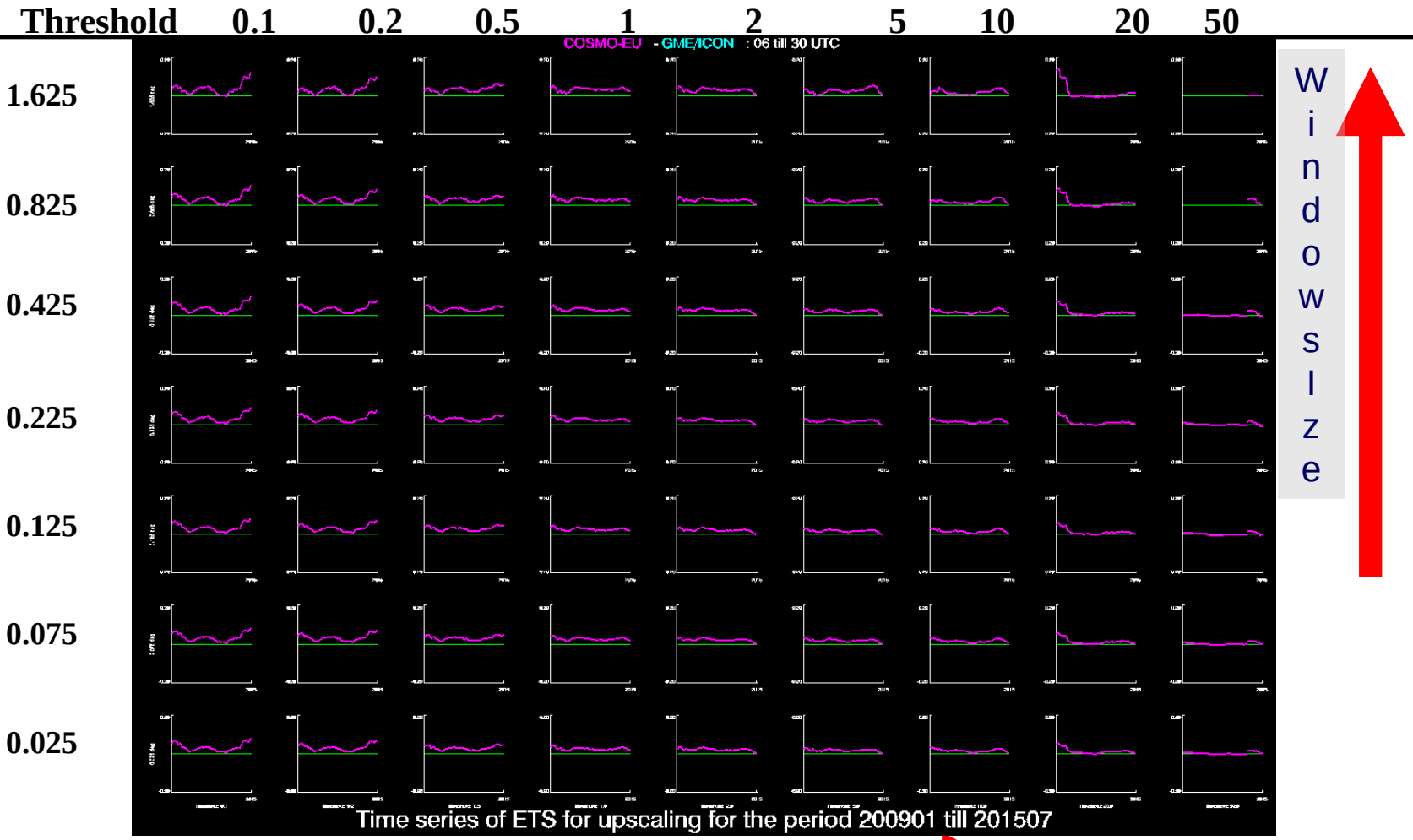
Comparison of COSMO-EU to GME/ICON – FSS (differences vv: 06-18)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



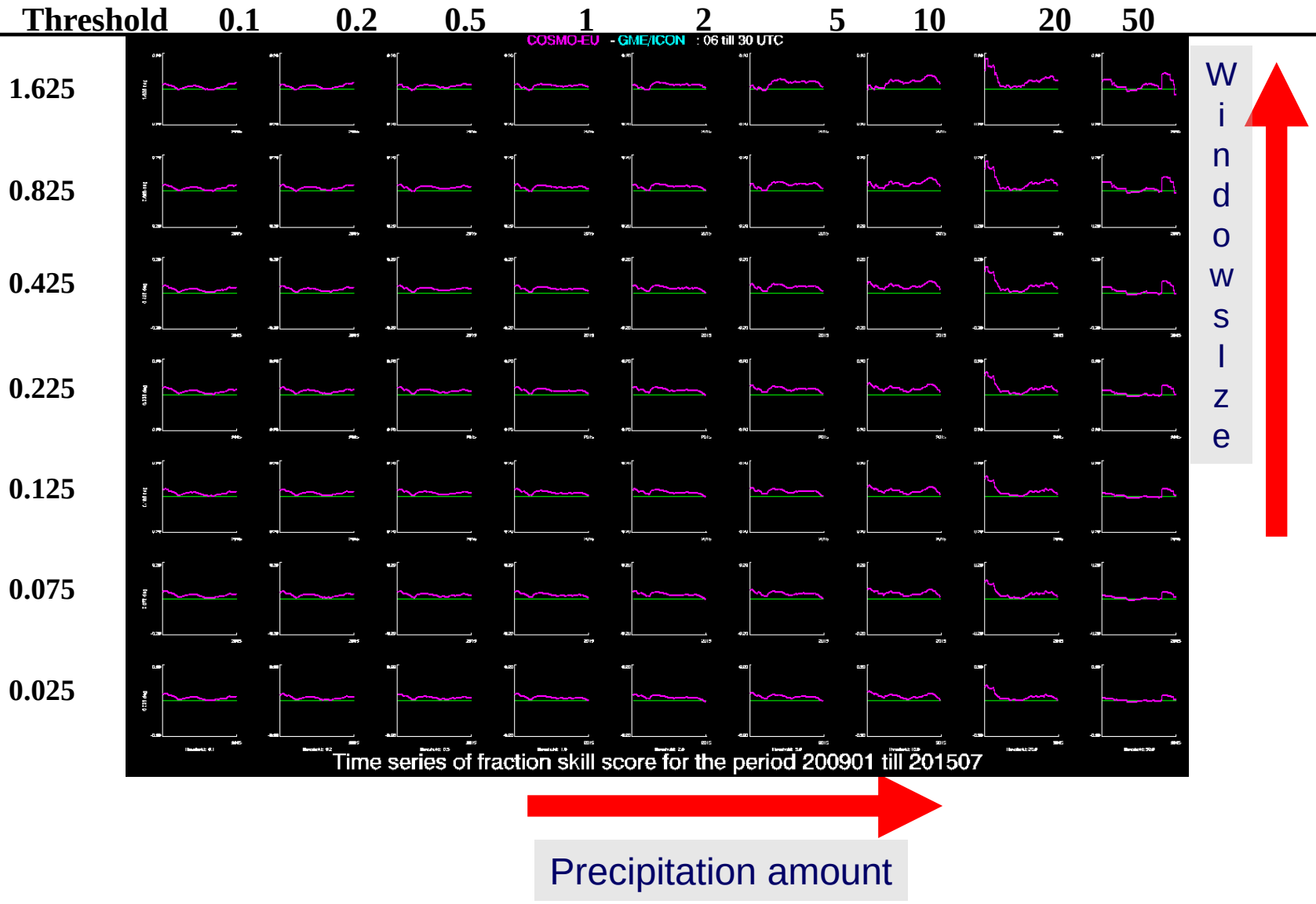
Comparison of COSMO-EU to GME/ICON – upscaling ETS (differences vv:06-30)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Comparison of COSMO-EU to GME/ICON – FSS (differences vv:06-30)

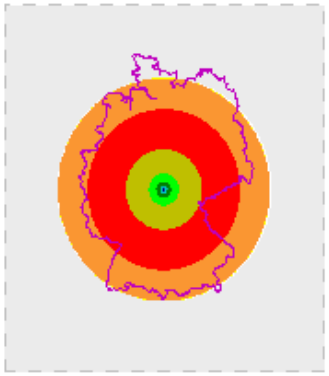
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



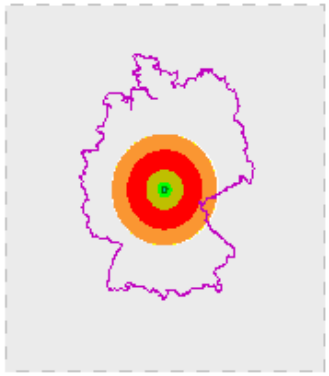
FUZZY-scores: What do they mean? Synthetic situation 1: large scale precipitation with differerent amplitude, shape and phase errors

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

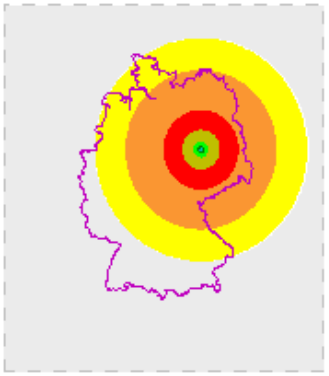
double amplitude N(RR): 61502
AV: 0.45 MA:101.0 STD: 1.22



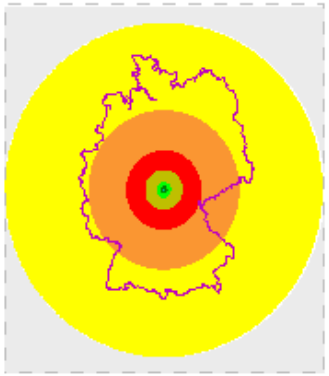
half radius N(RR): 15360
AV: 0.11 MA: 50.0 STD: 0.70



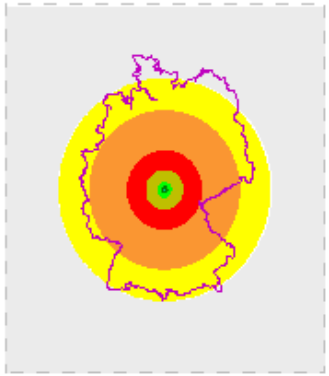
phase shift N(RR): 61502
AV: 0.22 MA: 50.0 STD: 0.94



larger radius N(RR): 138446
AV: 0.34 MA: 50.0 STD: 0.81



OBSERVATION N(RR): 61502
AV: 0.22 MA: 50.0 STD: 0.94



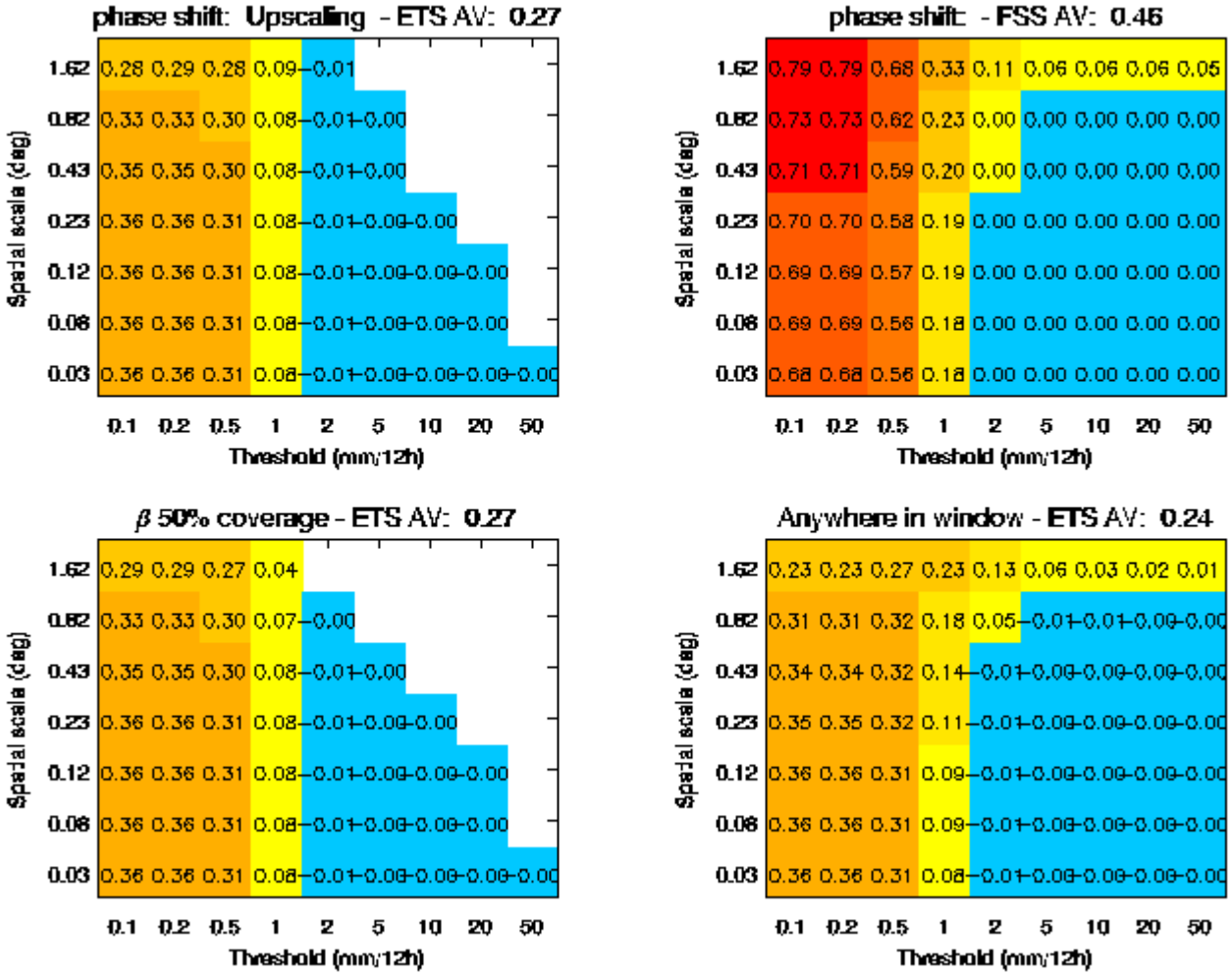
Mod Thr	MODEL 1	MODEL 2	MODEL 3	MODEL 4	
0.0	1.00	0.25	1.00	2.25	
0.5	1.96	0.49	1.00	1.00	
1.0	4.09	1.00	1.00	1.00	
2.0	4.13	1.00	1.00	1.00	
5.0	4.20	1.00	1.00	1.00	FBI
10.0	4.71	1.00	1.00	1.00	
20.0	3.29	1.00	1.00	1.00	
50.0	9.00	1.00	1.00	1.00	
100.0	---	---	---	---	
0.0	100.00	18.53	36.43	18.64	
0.5	41.60	44.54	31.07	100.00	
1.0	21.28	100.00	7.88	100.00	
2.0	23.43	100.00	−0.50	100.00	
5.0	23.69	100.00	−0.08	100.00	ETS
10.0	21.20	100.00	−0.02	100.00	
20.0	30.43	100.00	−0.01	100.00	
50.0	11.11	100.00	−0.00	100.00	
100.0	---	---	---	---	

No random effect

Plot time: 11.08.2015 13:05:25 MESZ

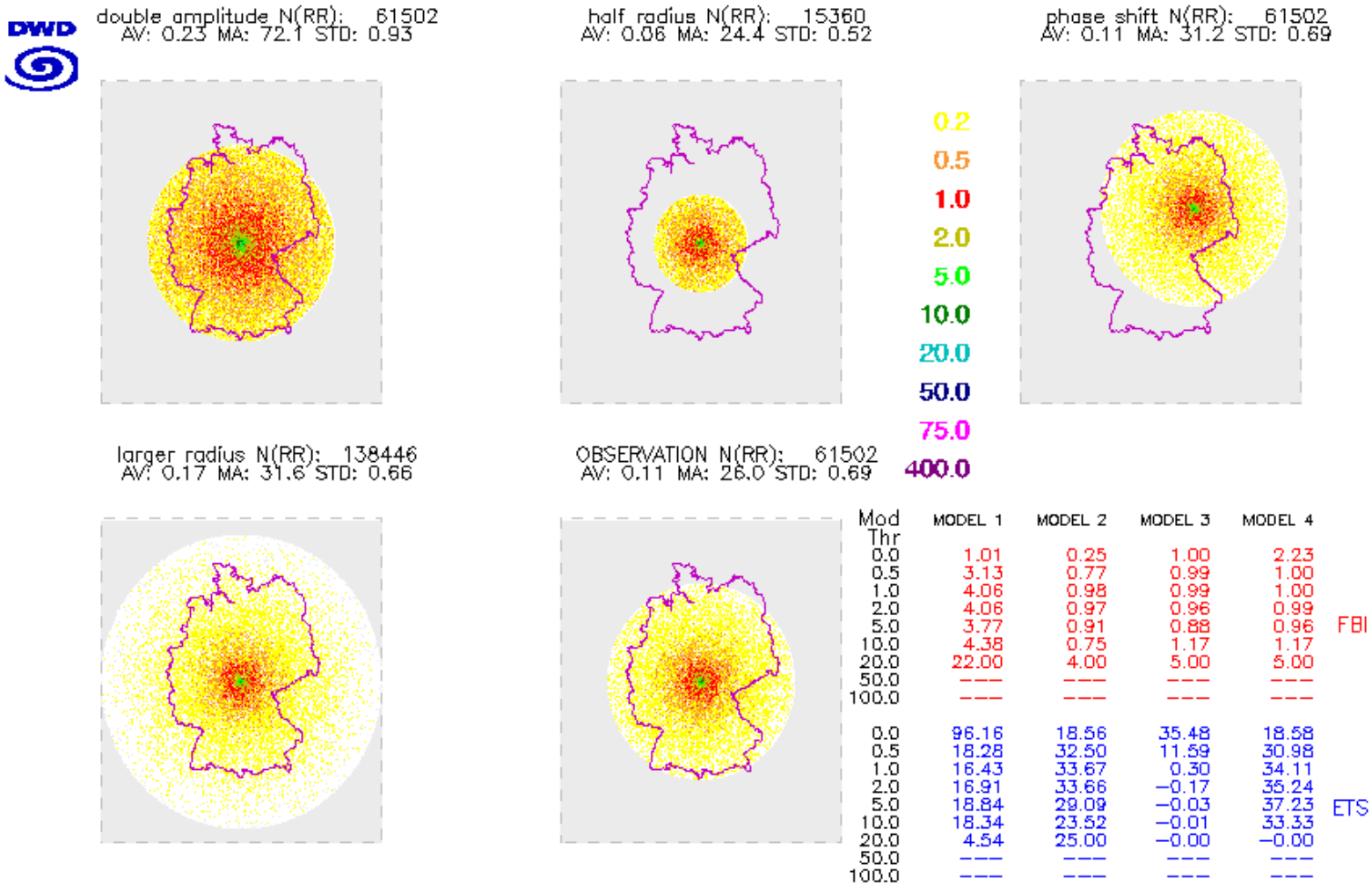
FUZZY-scores: What do they mean? Synthetic situation 1: large scale precipitation with differerent amplitude, shape and phase errors, Upscaling ETS, FSS, 50% coverage ETS and anywhere ETS

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



FUZZY-scores: What do they mean? Synthetic situation 2: large scale precipitation with differerent amplitude, shape and phase errors, randomly disturbed values with 0 < RN < 1

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



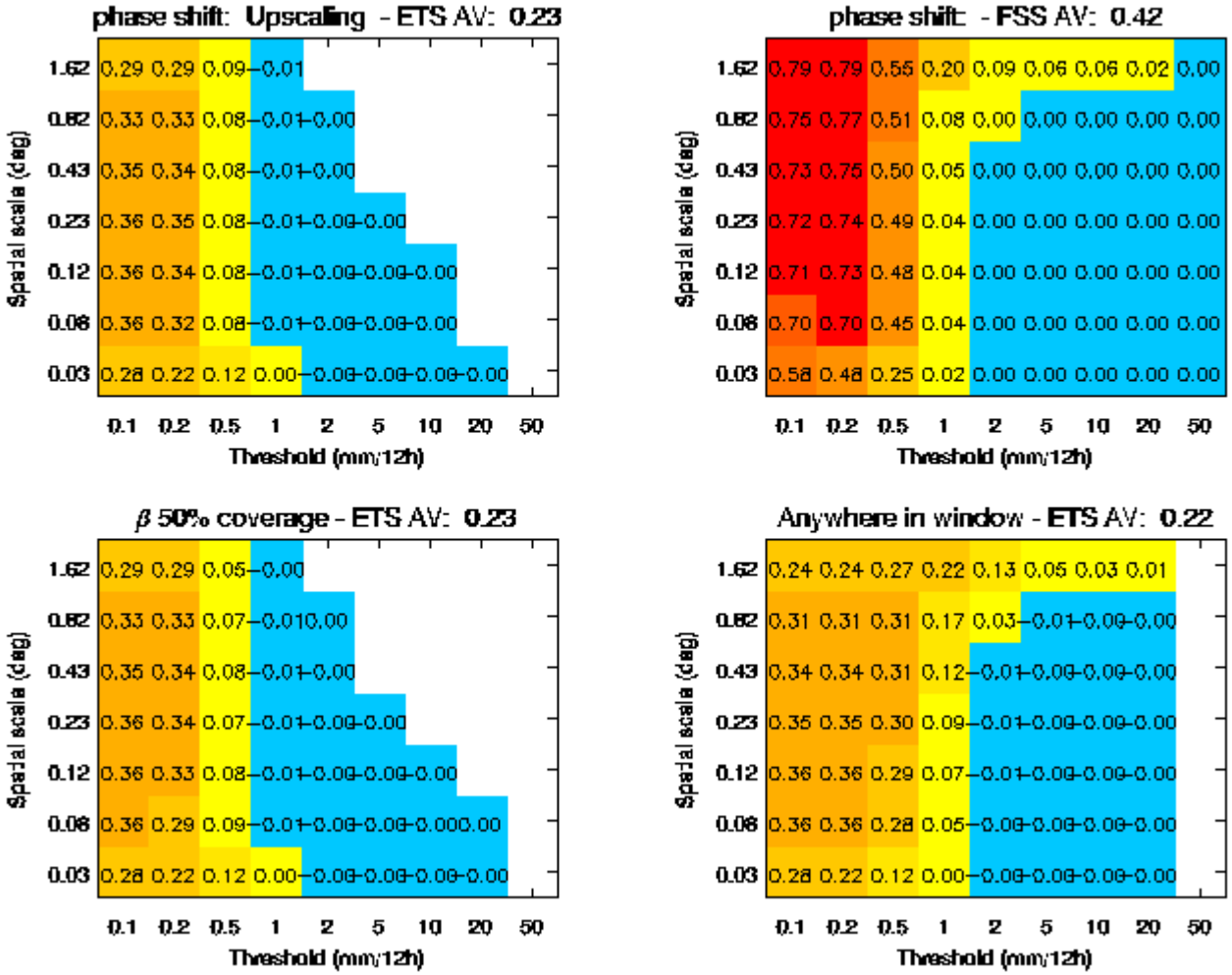
Mod Thr	MODEL 1	MODEL 2	MODEL 3	MODEL 4	
0.0	1.01	0.25	1.00	2.23	
0.5	3.13	0.77	0.99	1.00	
1.0	4.06	0.98	0.99	1.00	
2.0	4.06	0.97	0.96	0.99	
5.0	3.77	0.91	0.88	0.96	FBI
10.0	4.38	0.75	1.17	1.17	
20.0	22.00	4.00	5.00	5.00	
50.0	---	---	---	---	
100.0	---	---	---	---	
0.0	96.16	18.56	35.48	18.58	
0.5	18.28	32.50	11.59	30.98	
1.0	16.43	33.67	0.30	34.11	
2.0	16.91	33.66	−0.17	35.24	
5.0	18.84	29.09	−0.03	37.23	ETS
10.0	18.34	23.52	−0.01	33.33	
20.0	4.54	25.00	−0.00	−0.00	
50.0	---	---	---	---	
100.0	---	---	---	---	

Random effect - values are multiplied with random numbers between 0. and 1.

Plot time: 11.08.2015 13:06:16 MESZ

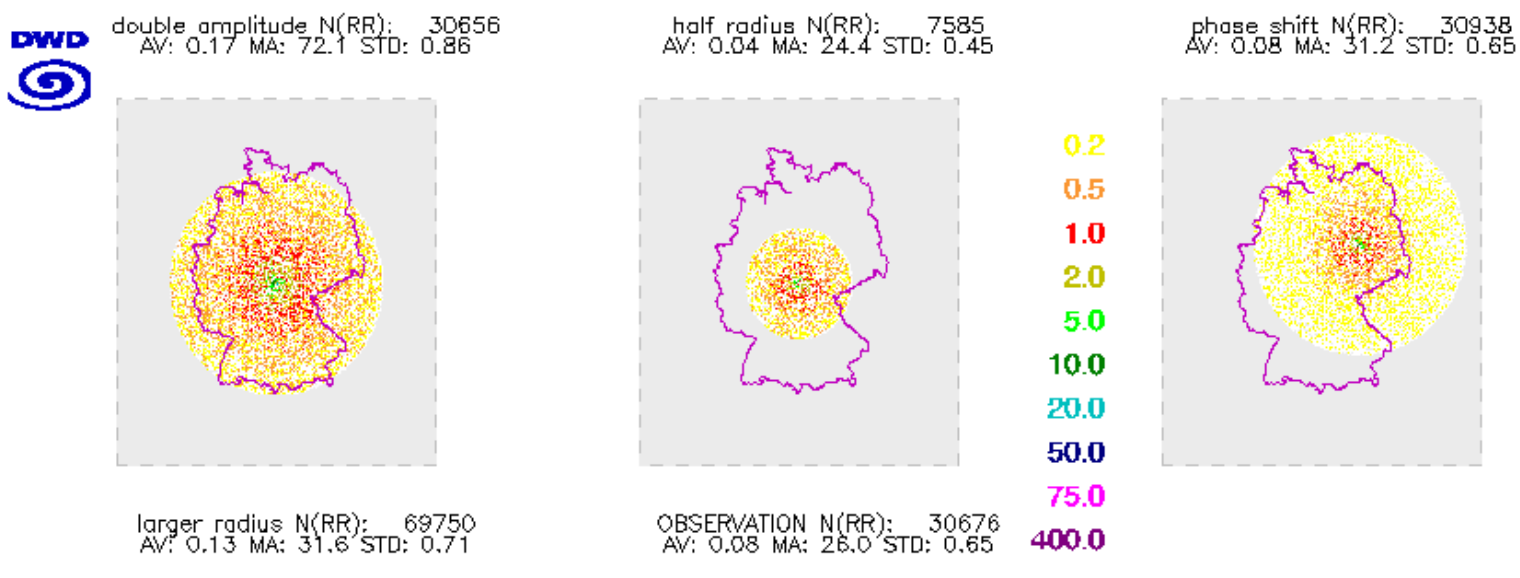
FUZZY-scores: What do they mean? Synthetic situation 2: large scale precipitation with differerent amplitude, shape and phase errors, Upscaling ETS, FSS, 50% coverage ETS and anywhere ETS

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



FUZZY-scores: What do they mean? Synthetic situation 3: large scale precipitation with differerent amplitude, shape and phase errors, randomly disturbed values with 0.5 < RN < 1

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



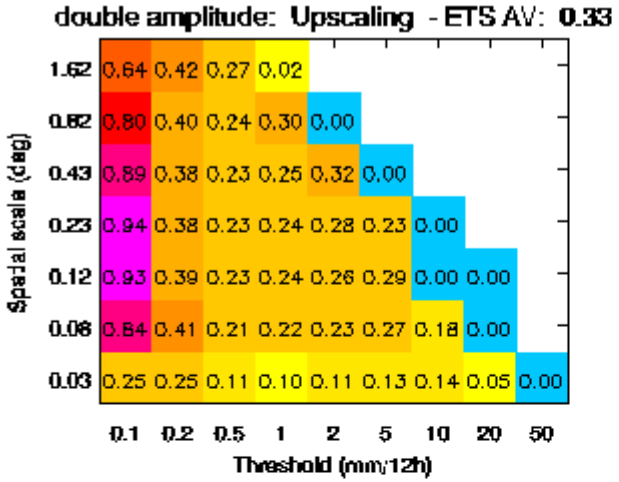
Mod Thr	MODEL 1	MODEL 2	MODEL 3	MODEL 4	
0.0	1.00	0.25	1.01	2.27	
0.5	2.98	0.73	0.99	1.00	
1.0	4.04	0.96	0.98	1.00	
2.0	4.08	0.98	0.97	1.01	
5.0	3.78	0.88	0.88	0.96	FBI
10.0	4.67	0.71	1.10	1.24	
20.0	21.00	4.00	5.00	5.00	
50.0	---	---	---	---	
100.0	---	---	---	---	
0.0	25.22	7.89	12.09	5.95	
0.5	10.53	22.41	9.45	22.23	
1.0	9.87	24.66	0.52	25.17	
2.0	10.80	24.62	−0.15	25.16	
5.0	12.62	20.92	−0.02	25.65	ETS
10.0	14.41	16.12	−0.01	23.68	
20.0	4.76	25.00	−0.00	−0.00	
50.0	---	---	---	---	
100.0	---	---	---	---	

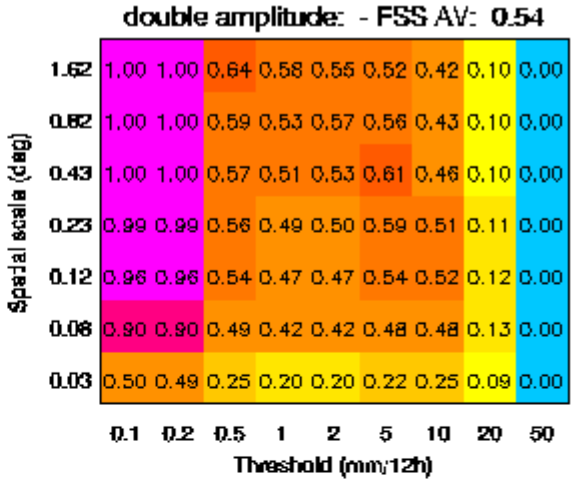
Random effect - values are multiplied with random numbers between 0. and 1.
For random numbers below 0.5 zero is assumed as factor.

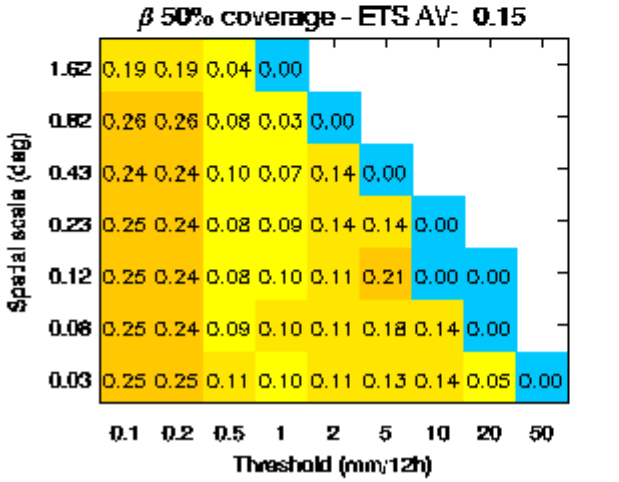
Plot time: 11.08.2015 13:07:09 MESZ

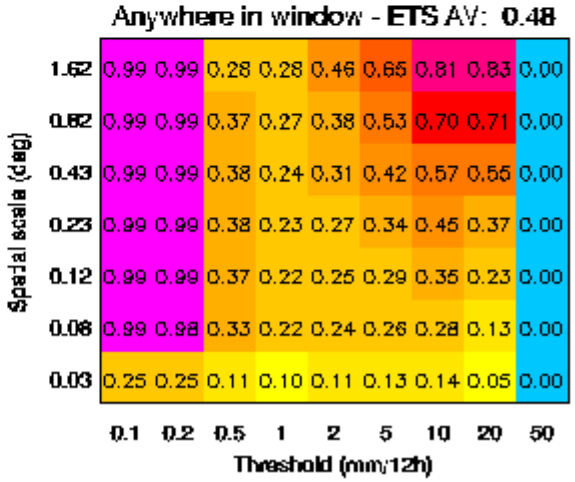
FUZZY-scores: What do they mean? Synthetic situation 3: large scale precipitation with differerent amplitude, shape and phase errors, Upscaling ETS, FSS, 50% coverage ETS and anywhere ETS

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



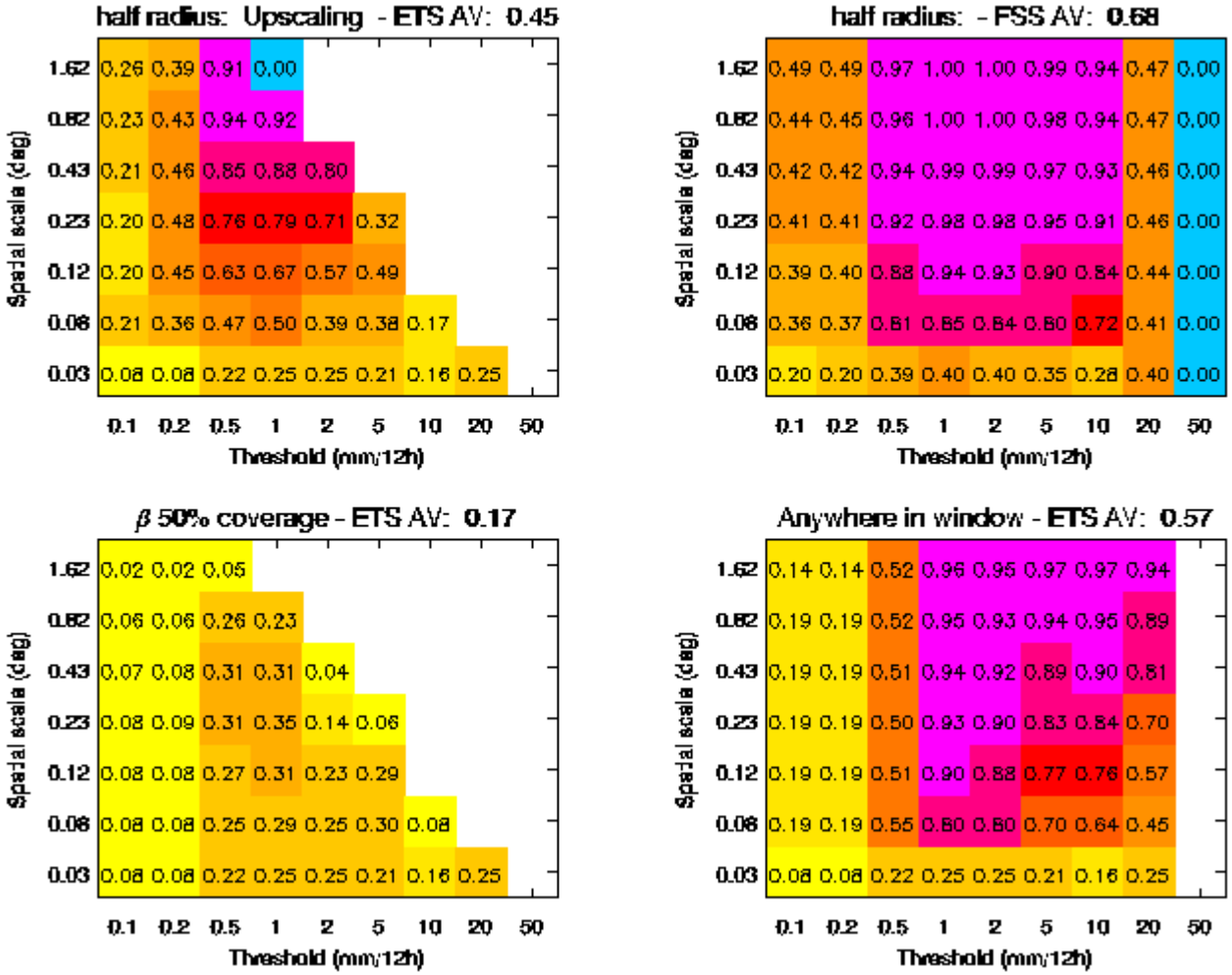






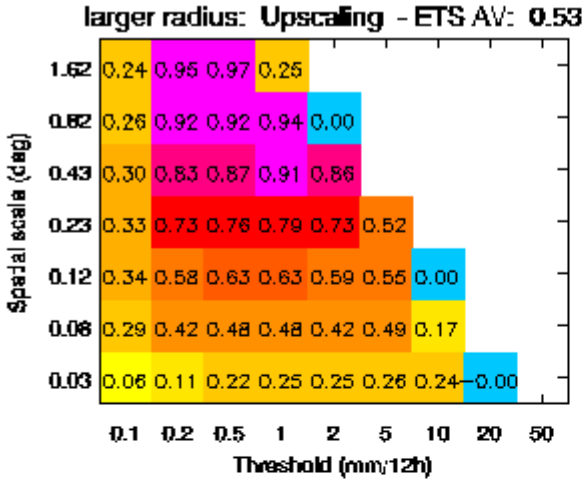
FUZZY-scores: What do they mean? Synthetic situation 3: large scale precipitation with differerent amplitude, shape and phase errors, Upscaling ETS, FSS, 50% coverage ETS and anywhere ETS

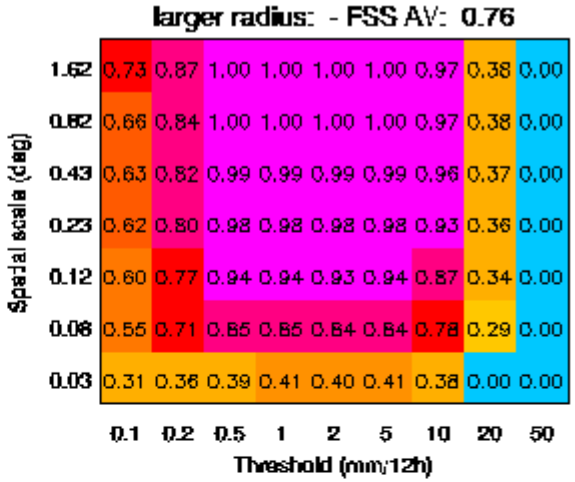
Deutscher Wetterdienst
Wetter und Klima aus einer Hand

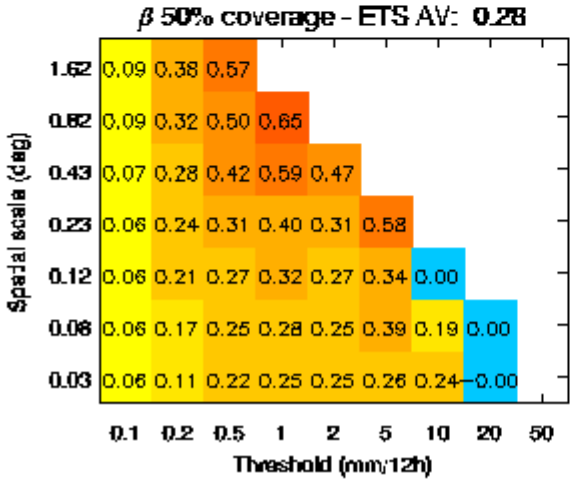


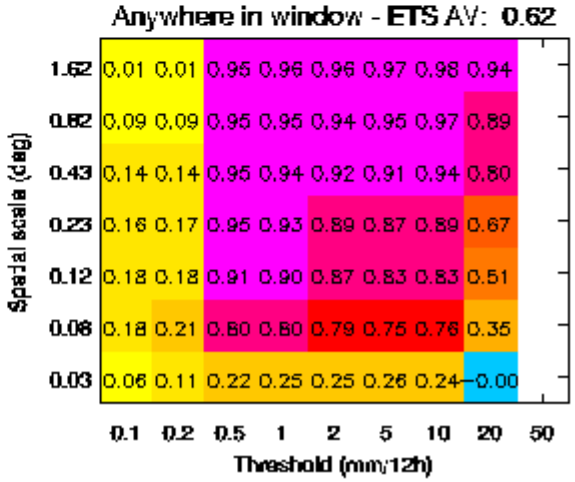
FUZZY-scores: What do they mean? Synthetic situation 3: large scale precipitation with differerent amplitude, shape and phase errors, Upscaling ETS, FSS, 50% coverage ETS and anywhere ETS

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



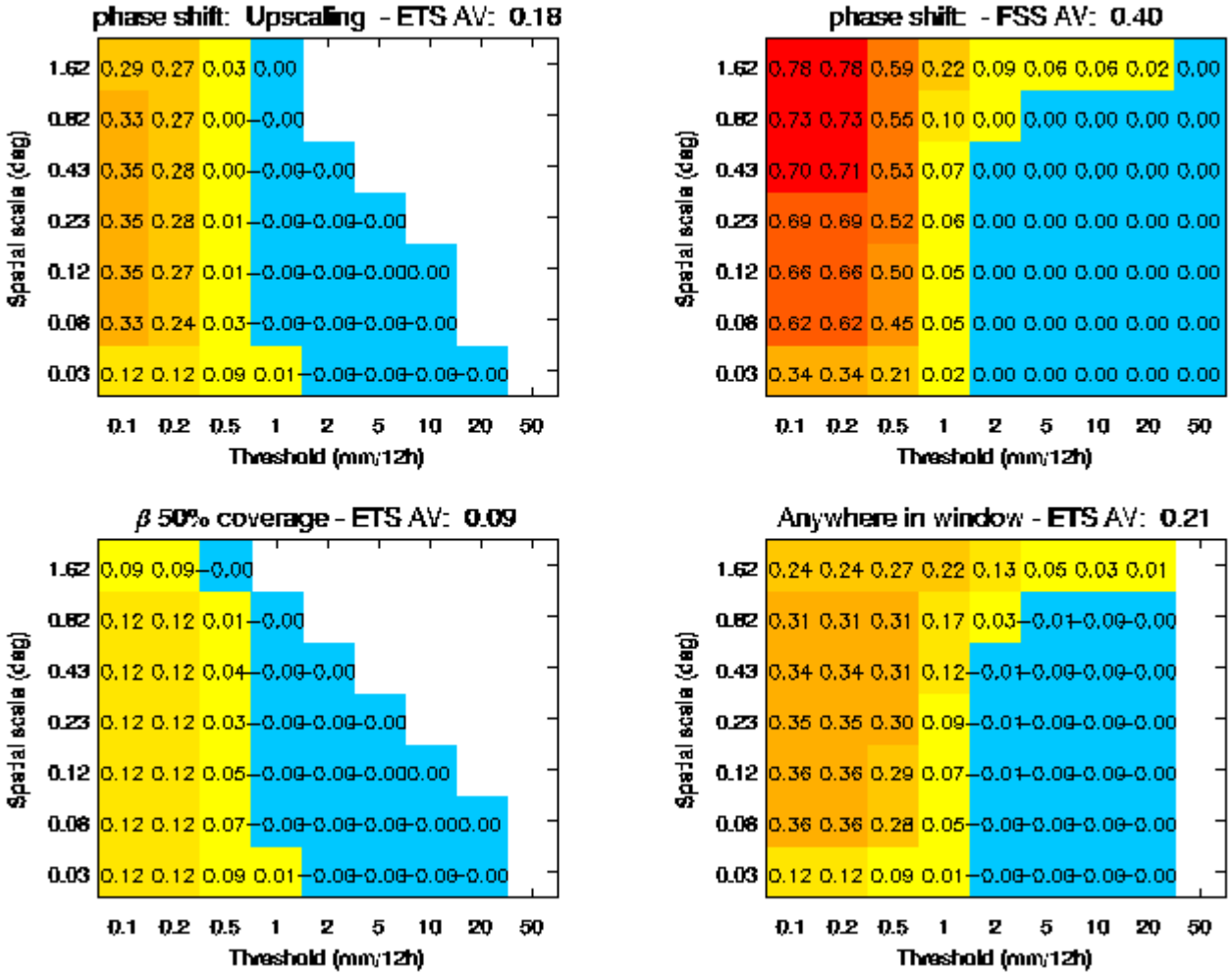






FUZZY-scores: What do they mean? Synthetic situation 3: large scale precipitation with differerent amplitude, shape and phase errors, Upscaling ETS, FSS, 50% coverage ETS and anywhere ETS

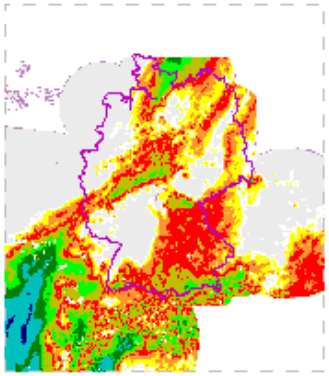
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



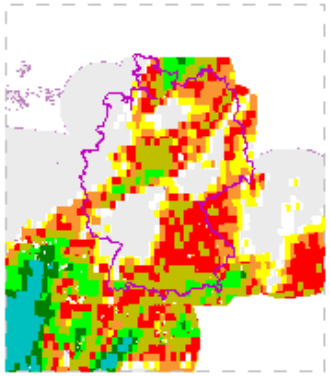
Comparison of precipitation one forecast COSMO-EU to ICON against radar data – a problem for ICON?

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

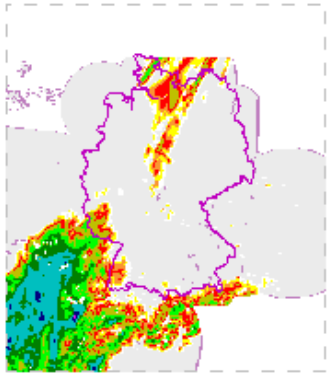
ICON–EU N(RR): 101181
AV: 2.00 MA: 66.7 STD: 1.64



ICON–GL N(RR): 102542
AV: 2.11 MA: 46.8 STD: 1.70

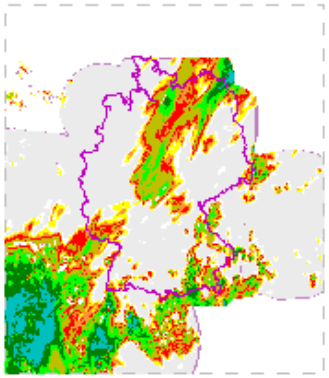


COSMO–EU N(RR): 51001
AV: 2.02 MA:106.9 STD: 1.64



0.2
0.5
1.0
2.0
5.0
10.0
20.0
50.0
75.0
400.0

RADAR N(RR): 76085
AV: 1.95 MA: 65.3 STD: 1.72



Mod Thr	ICONO	ICONR	COSMO–EU	
0.0	1.32	1.33	0.66	FBI
0.5	1.33	1.43	0.68	
1.0	1.17	1.33	0.69	
2.0	0.90	1.04	0.70	
5.0	0.76	0.83	0.85	
10.0	0.74	0.75	1.03	
20.0	1.16	1.20	1.55	
50.0	38.18	0	34.82	
100.0	---	---	---	
0.0	27.72	25.69	32.58	ETS
0.5	27.99	29.16	38.67	
1.0	29.49	27.68	37.97	
2.0	32.19	30.93	36.42	
5.0	30.68	32.12	36.51	
10.0	35.54	36.29	34.52	
20.0	24.49	22.88	21.22	
50.0	–0.01	0.00	–0.01	
100.0	---	---	---	

Forecasts of precipitation Start: 08.08.2015 00 UTC VV=30-06

Plot time: 10.08.2015 19:42:16 UTC

Comparison of COSMO-EU to GME/ICON –

ETS upscaling and FSS (values vv:06-30)

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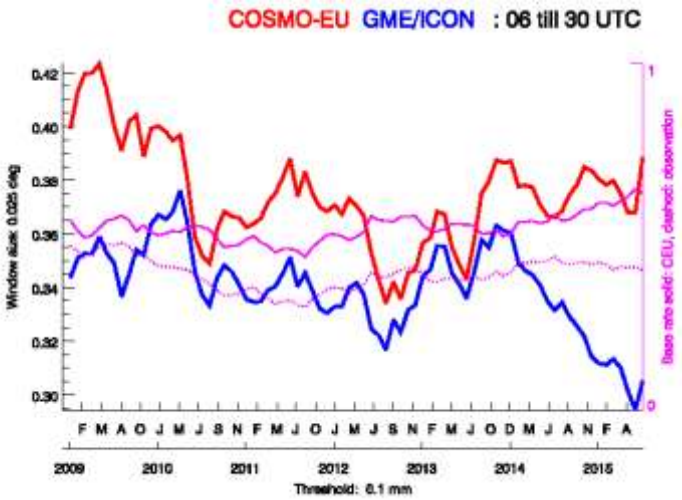
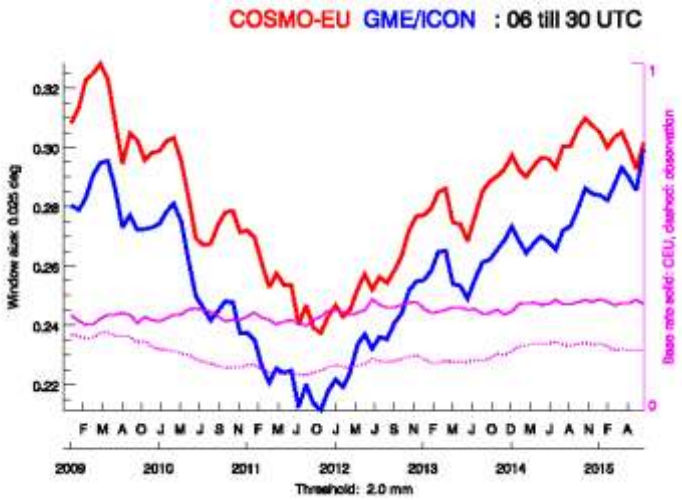
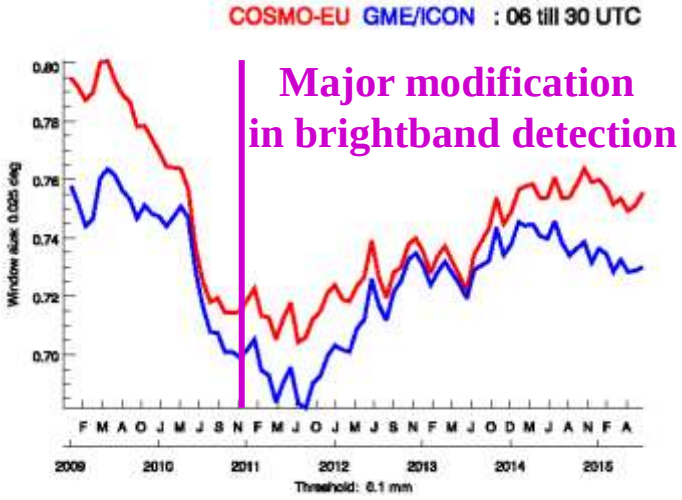
Wetter und Klima aus einer Hand



Time series of ETS for upscaling for the period 200901 till 201507



Time series of ETS for upscaling for the period 200901 till 201507



Time series of fraction skill score for the period 200901 till 201507

Time series of fraction skill score for the period 200901 till 201507

Summary

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DWD

- **COSMO-EU against GME/ICON**
  - ***In general precipitation forecasts of COSMO-EU have a better quality than those of GME – as it could be expected!***
- **COSMO-EU against COSMO-DE**
  - ***The differernces of forecast quality are dependend on the window size and the precipitation amount***
    - ***For small window sizes a mean value as it is given by the downsclaed COSMO-EU forecasts lead to better results than the forecasts od COSMO-DE.***
    - ***This means that for the scale of COSMO-DE grid no real predictability can be registered although in single cases amazingly results can be got.***
    - ***Depending on the chosen score forecasts of COSMO-DE show better quality compared to COSMO-EU for window sizes larger than 0.425 ^{O} and for precipitation amounts lower than 2 mm/12h (ETS upscaling) and window sizes larger than 0.125 ^{O} and precipitation amounts over 2 mm/12h***
- **ETS upscaling against FSS**
  - ***Because of the different characteristics of upscaling procedure (evaluation of mean values over a grid cell) and FSS (roughly spoken: evaluation of th number of occurences in a grid cell under consideration) differences in the results have to occur and can be interpreted using the properties of the scores.***

Thank you for your attention!