Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

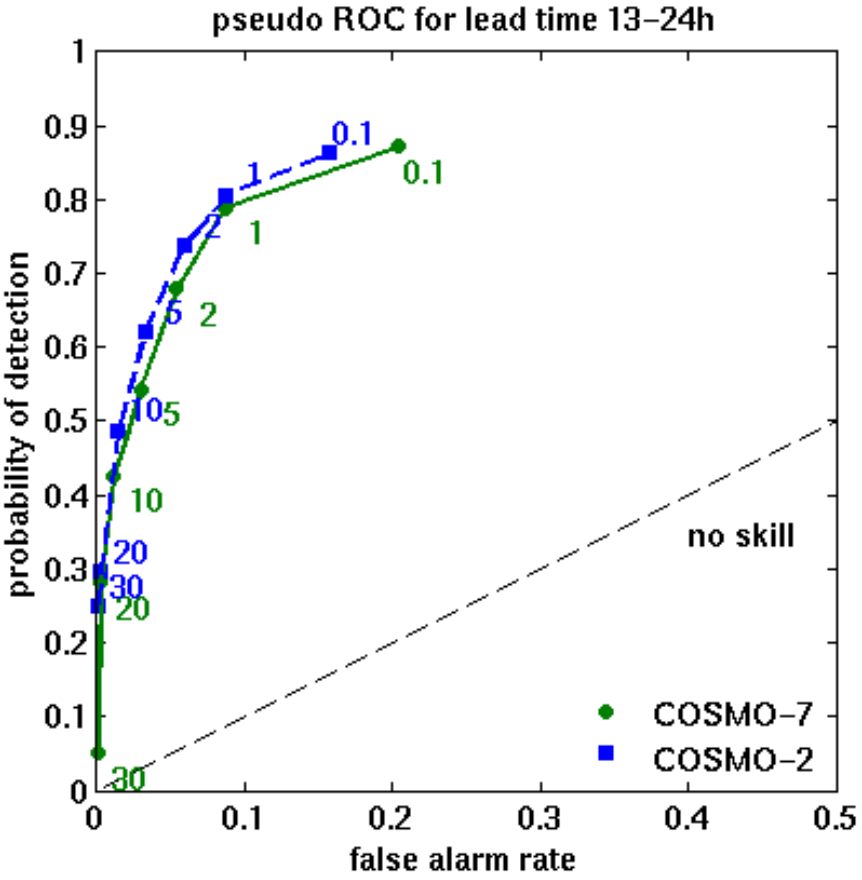
Slides of COSMO-activities in verification in 2011

compiled by Francis Schubiger (MeteoSwiss)

Summaryof activities

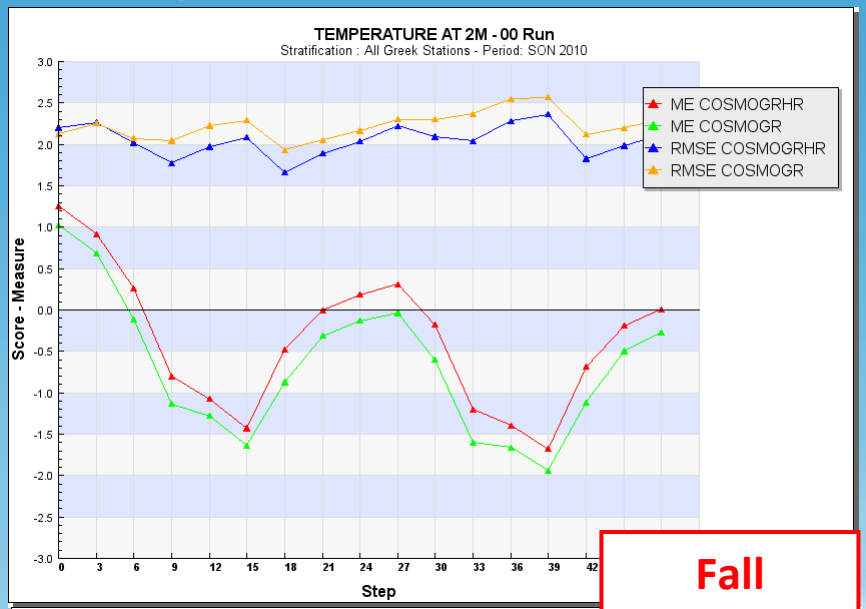
- Common verification software VERSUS:
  - common plots
  - conditional verification
  - weather type dependant verification
- Comparison of COSMO-models: 7km vs 2-3km
- Neighborhood verification:
  - MeteoSwiss, also with extension to „fuzzy in time“
  - DWD
- Precipitation verification over Italy with different COSMO-models (CNMCA, ARPA-Piemonte, ARPA-SIM)
- Bootstrapping: using different methods to estimate statistical differences between model errors (DWD)

Precipitation (12h-sums +12 to +24h): Spring 2011 over Switzerland (SYNOP's) COSMO-7 & COSMO-2

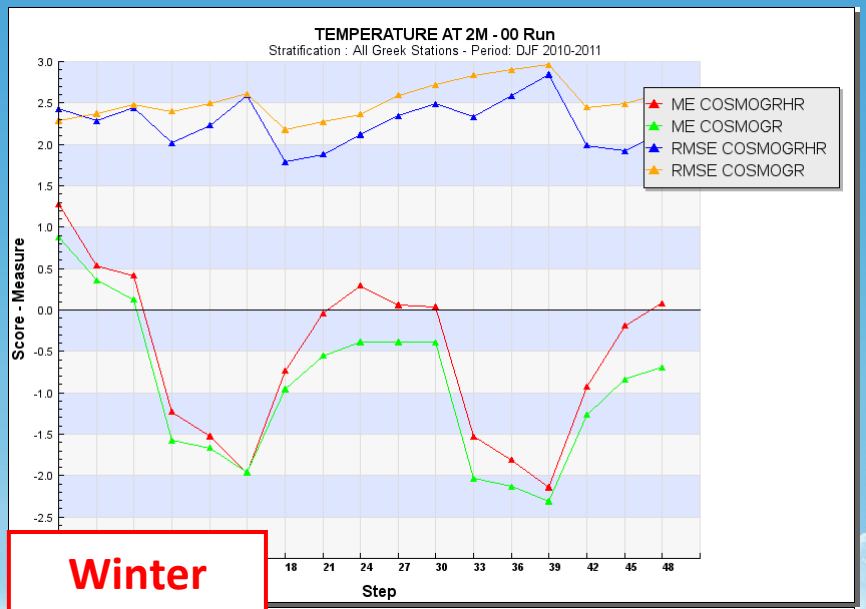


for both models
mean over 9 gridpoints for each station

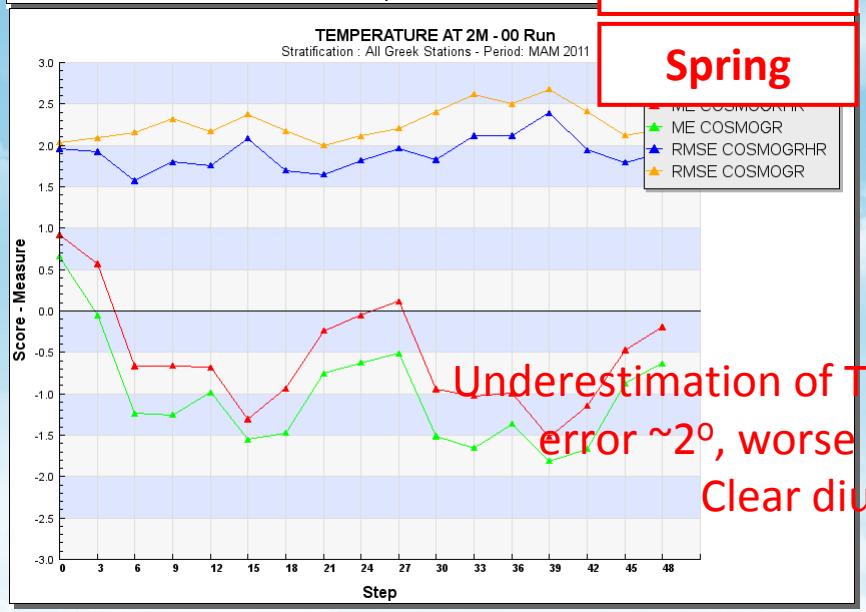
Temp 2m - 7km vs 3km



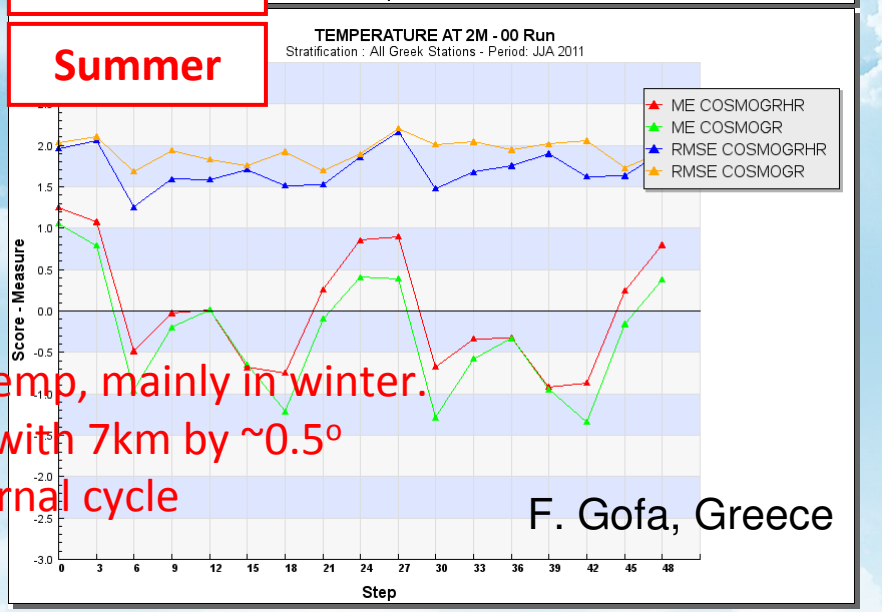
Fall



Winter



Spring



Summer

Underestimation of Temp, mainly in winter.
error ~2º, worse with 7km by ~0.5º
Clear diurnal cycle

F. Gofa, Greece

Neighborhood verification for precipitation at MeteoSwiss

results for 2010

3h accumulated precipitation sums
over the domain of the swiss radar composit

models: COSMO-2 and COSMO-7

for all 8 daily forecast runs, precipitation sums from +3 to +6h

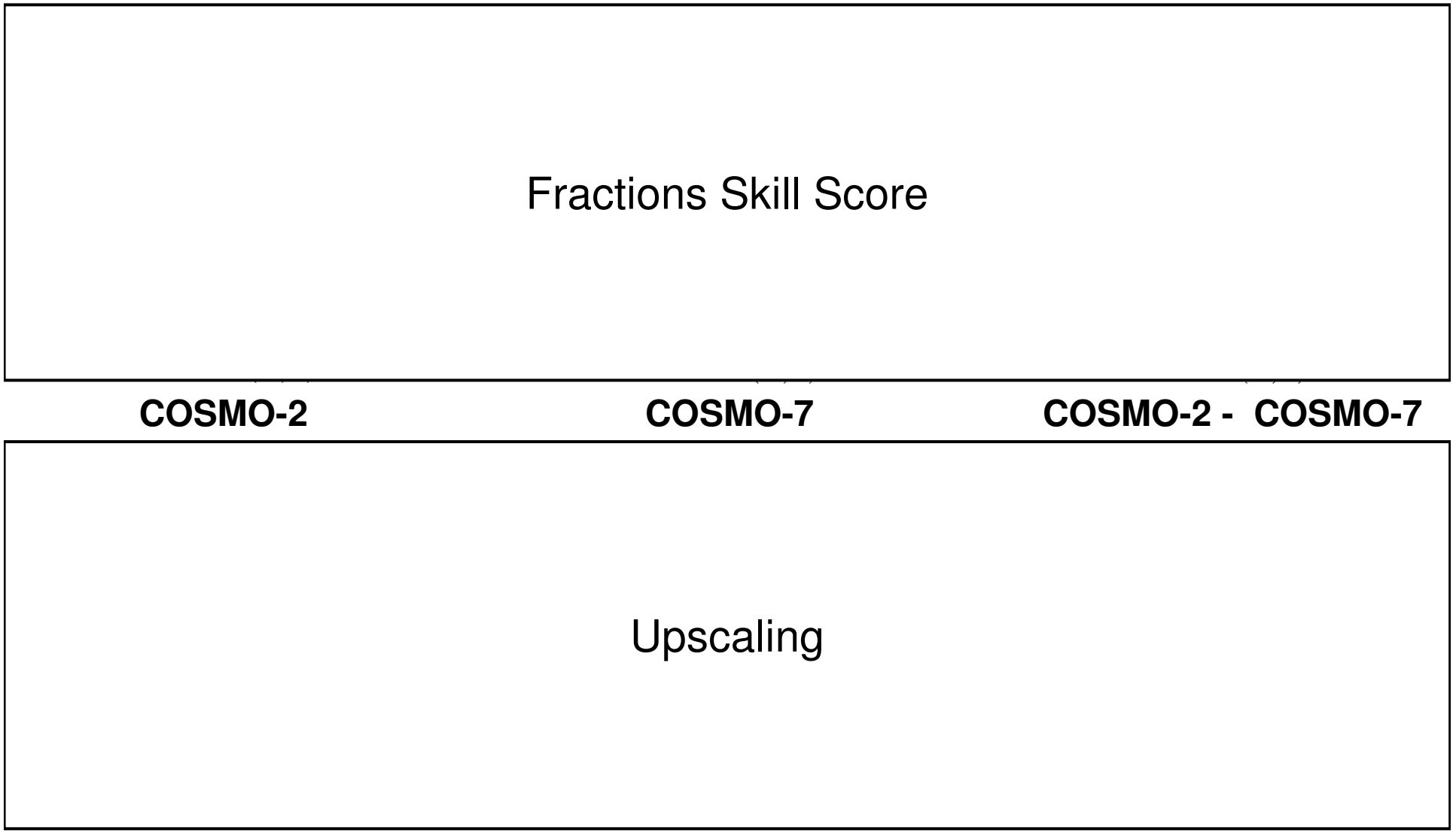
observation

precipitation estimates of the swiss radar composit

in case of a missing value, the full date will not be evaluated

Extension of the spatial window with a window in time:
-> „fuzzy in time“ : volume (dx * dy * dt)

Neighbourhood Verification, January–December 2010
3h sums (+3 ..+6h) Fractions Skill Score (top) and Upscaling (bottom)



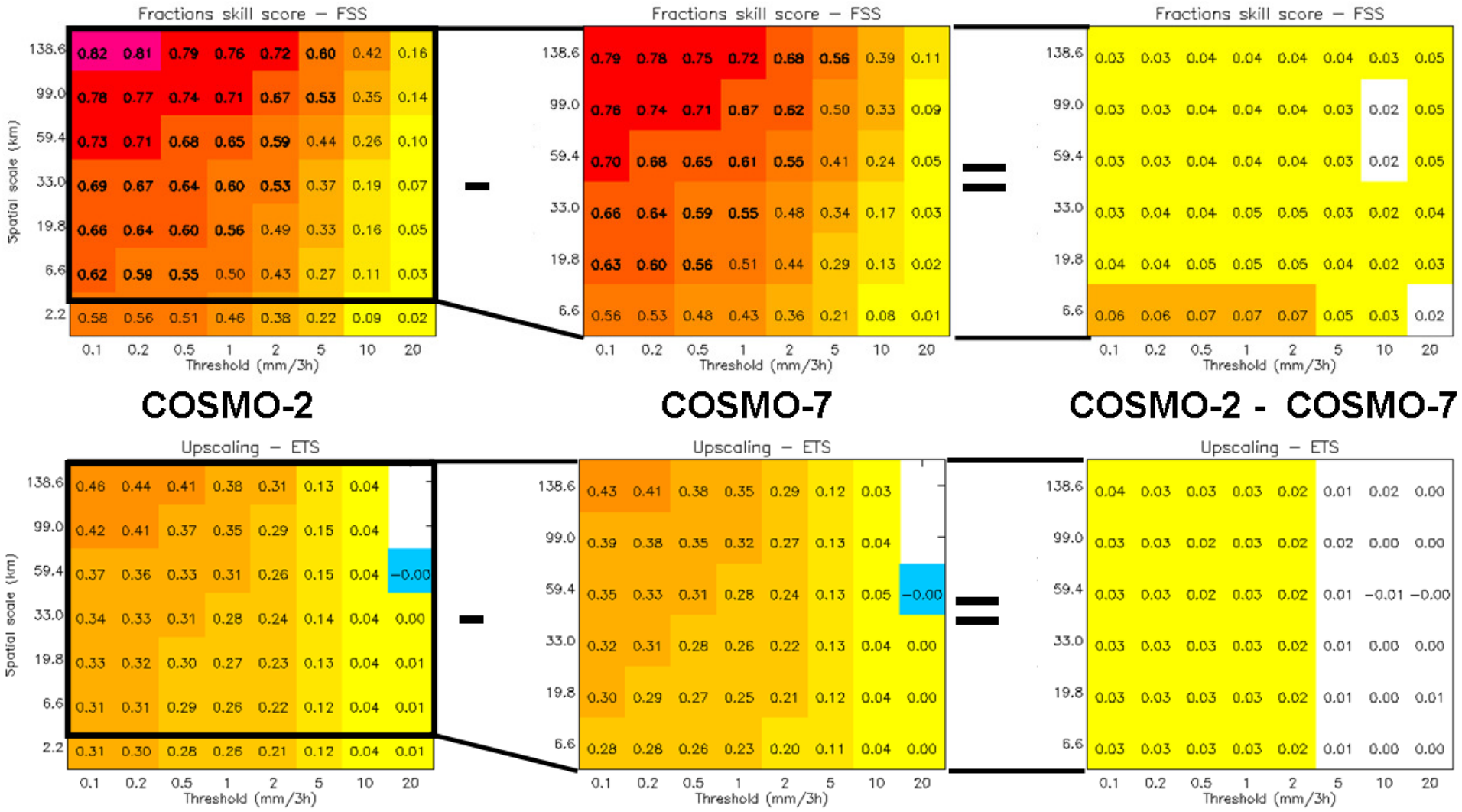
COSMO-2 **COSMO-7** **COSMO-2 - COSMO-7**

bad good

COSMO-7 better COSMO-2 better

T. Weusthoff
MeteoSwiss

Neighbourhood Verification, January–December 2010
3h sums (+3 ..+6h) Fractions Skill Score (top) and Upscaling (bottom)



COSMO-2 **COSMO-7** **COSMO-2 - COSMO-7**

bad good

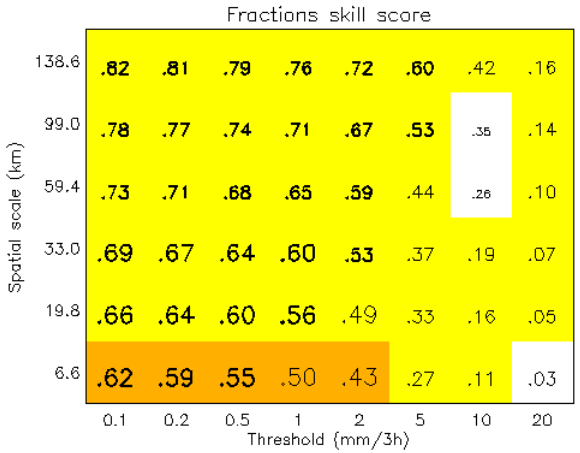
COSMO-7 better COSMO-2 better

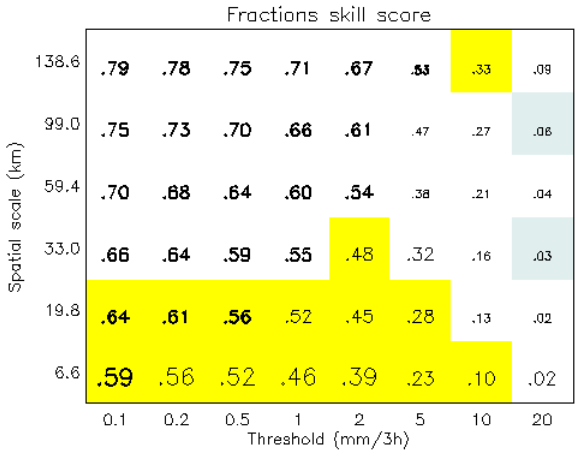
T. Weusthoff
MeteoSwiss

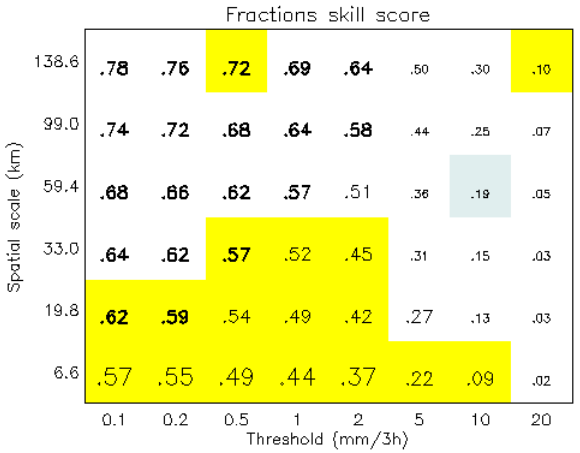
Dependency of the lead time

+3 bis +6h | +12 bis +15h | +21 bis +24h

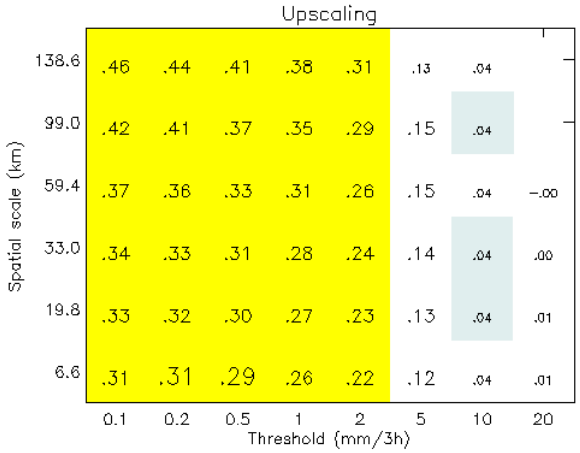
Fractions Skill Score

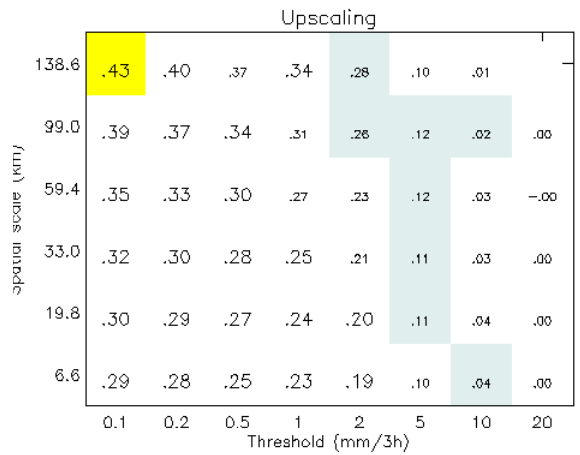


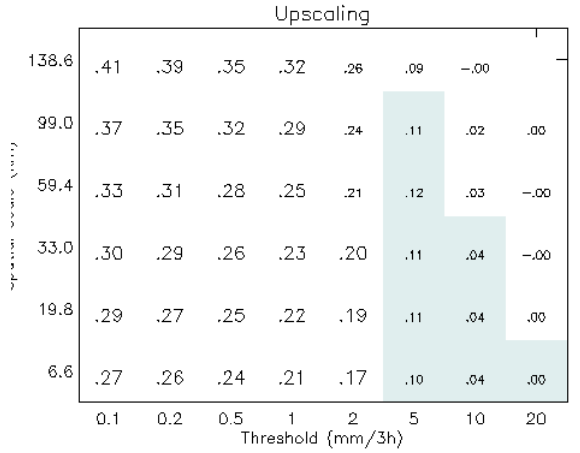




Upscaling - ETS







COSMO-7 better COSMO-2 better

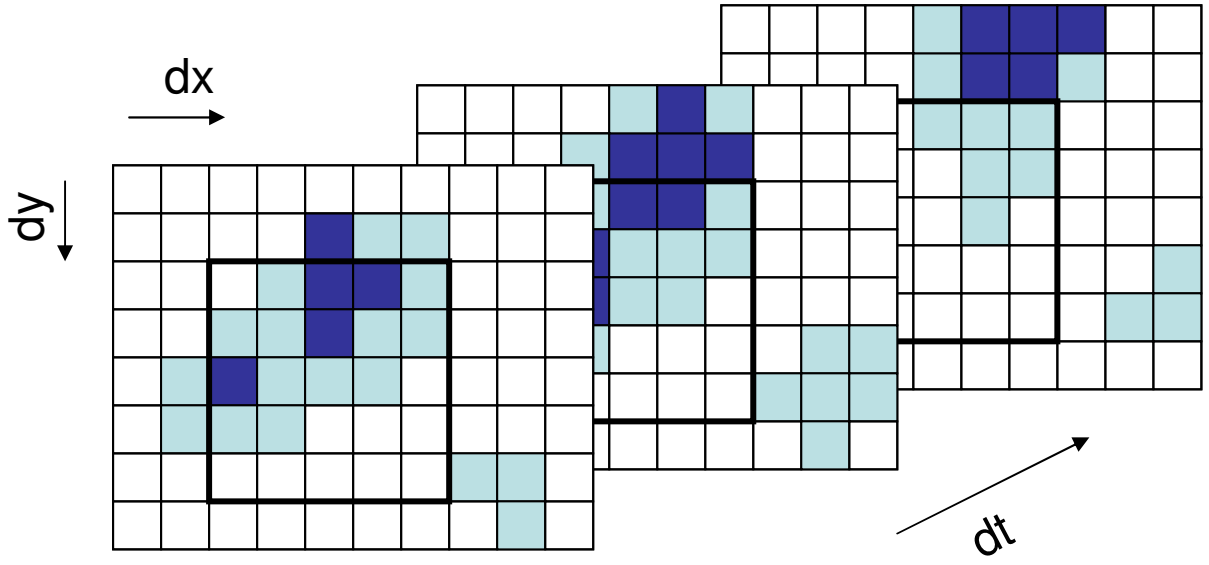
T. Weusthoff, MeteoSwiss

Summary neighbourhood Verifikation precipitation in 2010 @ MeteoSwiss

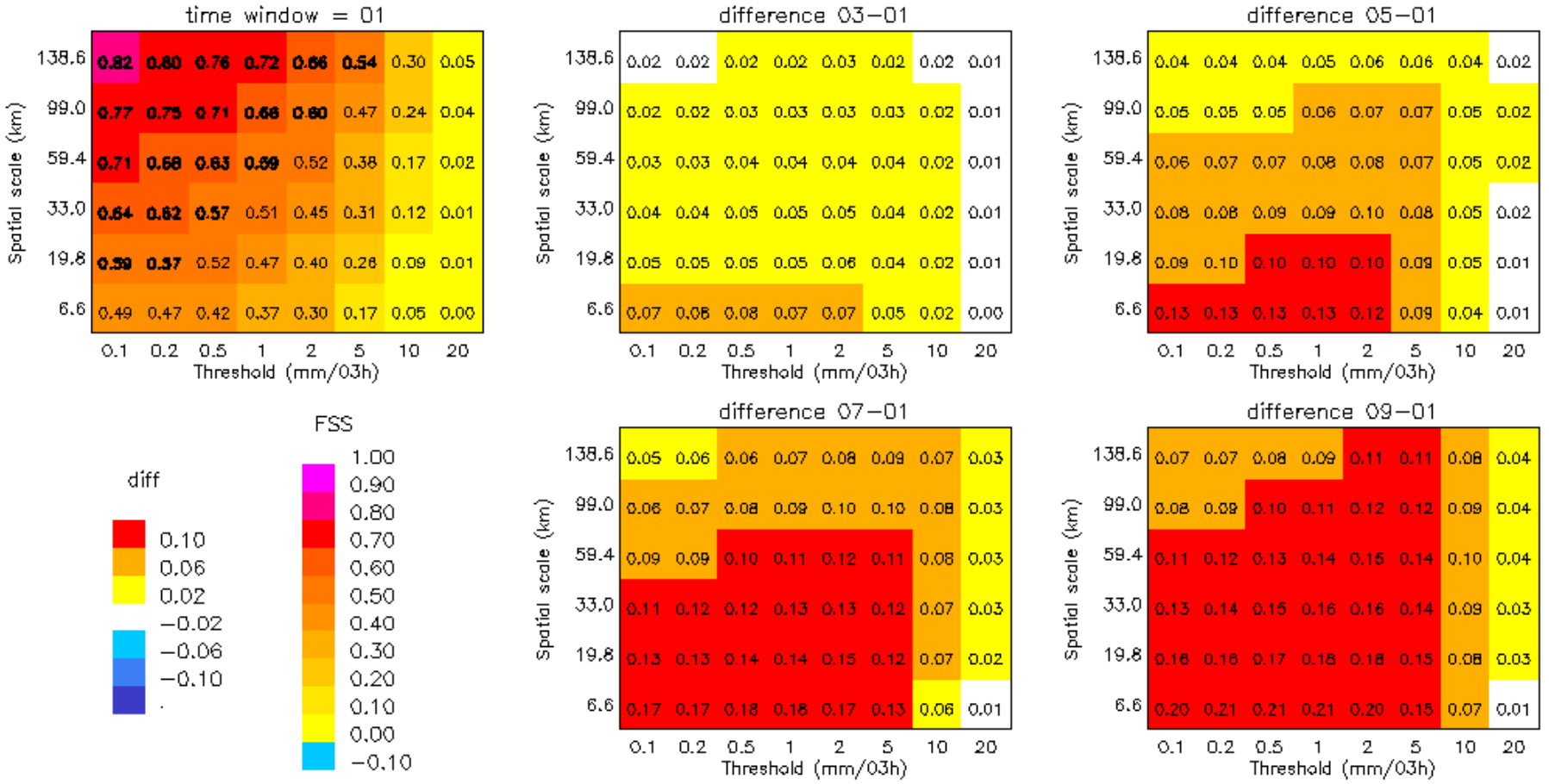
- COSMO-2 better than COSMO-7 on all scales, differences become less with increasing leadtime
- good forecast of the spatial structure on higher scales
- The skill of the models varies for different weather types and the differences between COSMO-2 and COSMO-7 varies also:
  - best skill: Autumn and Spring, south to northwest weather types
  - greatest difference COSMO-2 minus COSMO-7: Summer and Winter, north- and east types, convective cases

3. „Fuzzy in Time“

- Extension of the spatial window with a window in time
  → **volume (dx * dy * dt)**
- Evaluation of the forecasts in this volume
- Time-window ntm = [1h,3h,5h,7h,9h]



FSS for different time-windows
COSMO-7, July 2010



Summary „fuzzy in time“

- FSS increases on all scales with increasing time-window
  - greatest effect for small spatical scales
  - lowest effect for high threshods

- Both models show a similar increase
  - difference COSMO-2 minus COSMO-7 stays equal, resp. becomes littler for high time-windows

- For Upscaling the influence of a time tolerance is relatively low und restricted on low thresholds (→ effect of the avergaing)

→ Application of time-windows on the gridscale would make sense; simultaneous application with space tolerance brings no great change

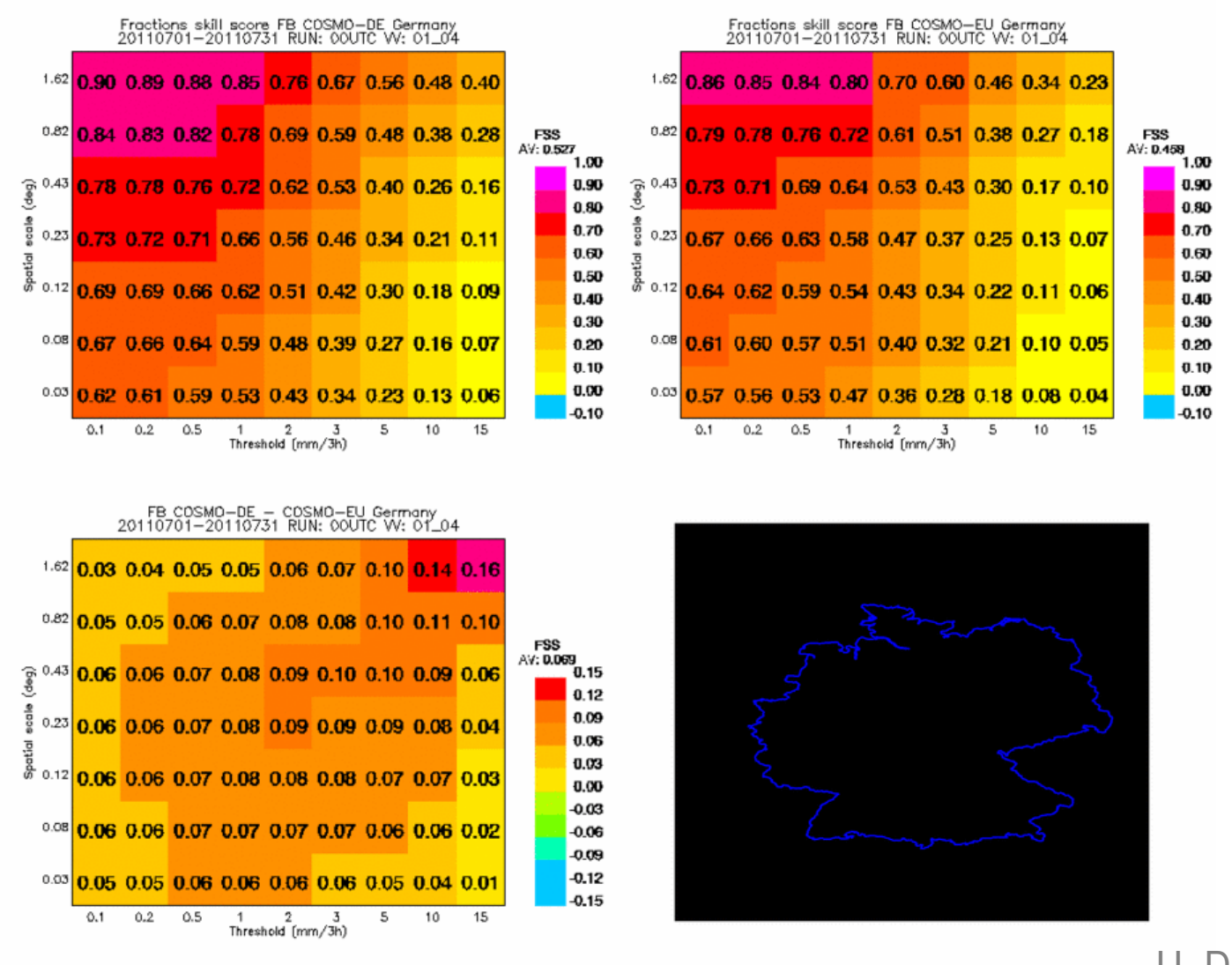
Configuration of precipitation verification with FUZZY-methods

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

- **Up to May 2011:**
  - Observation data: Radar data prepared by assimilation scheme
  - Model data: GME-, CEU- and CDE-GRIBS interpolated to CDE-grid (nearest gridpoint)
  - Run: 00 UTC
  - Forecast times: GME, CEU: 06-18, 06-30, CDE: 06-18 hours
  - Verification area: part of CDE that is covered by radar data
- **Since May 2011:**
  - Observation data as before, modell data: CEU- and CDE-GRIBS interpolated to CDE-grid (nearest gridpoint)
  - Run: 00, 03, 06, 09, 12, 15, 18, 21
  - Forecast times: 01-04, 03-06, 06-12, 12-15, 15-18, 18-21 hours
  - Verification areas : CDE, Northern part of Germany, Southern part of Germany, North-Western part of Germany, North-Eastern part of Germany , South-Western part of Germany, South-Eastern part of Germany

Some examples :
FSS July 2011, Run: 00 UTC, forecast time 01-04 hours

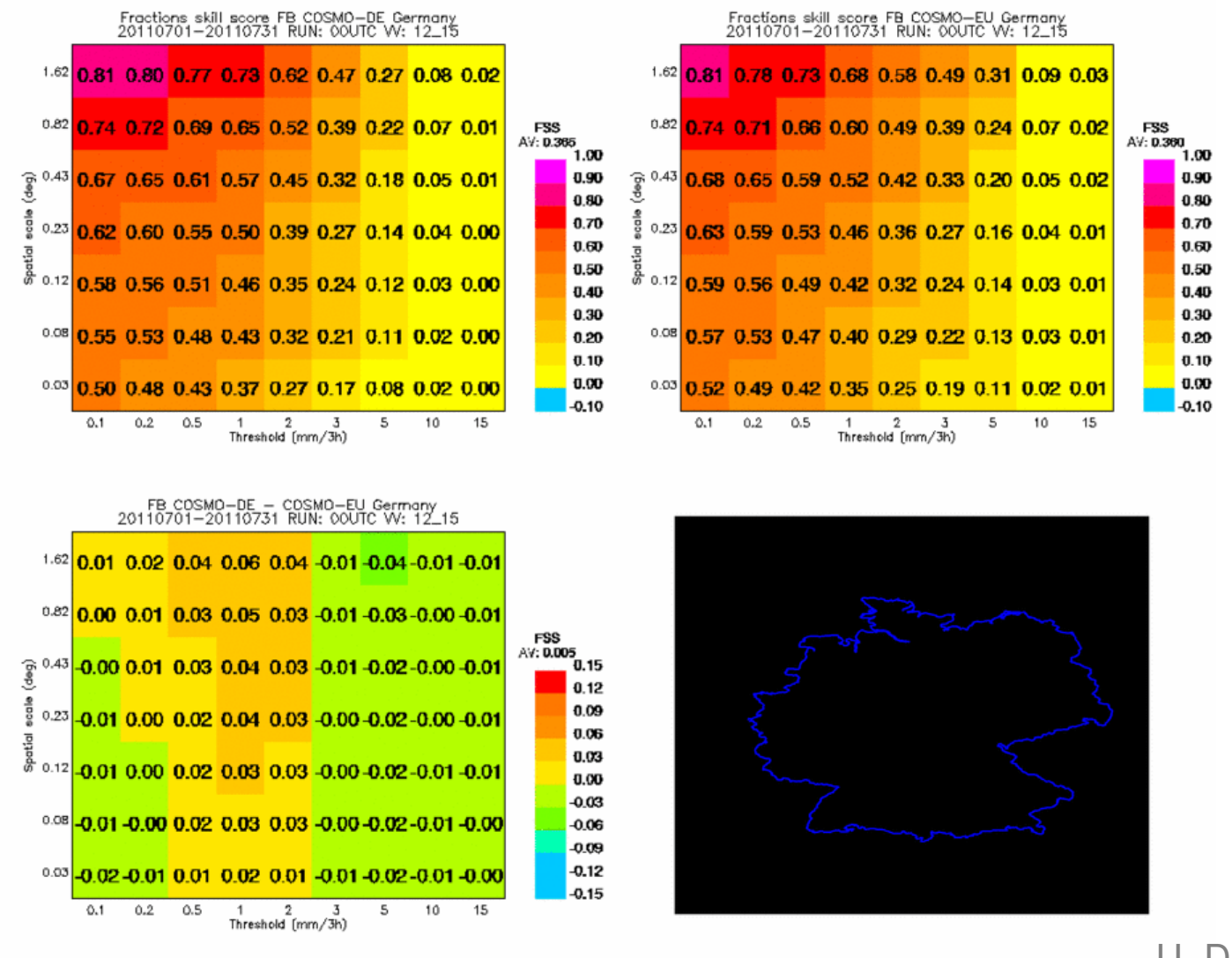
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



U. Damrath, DWD

Some examples :
FSS July 2011, Run: 00 UTC, forecast time 12-15 hours

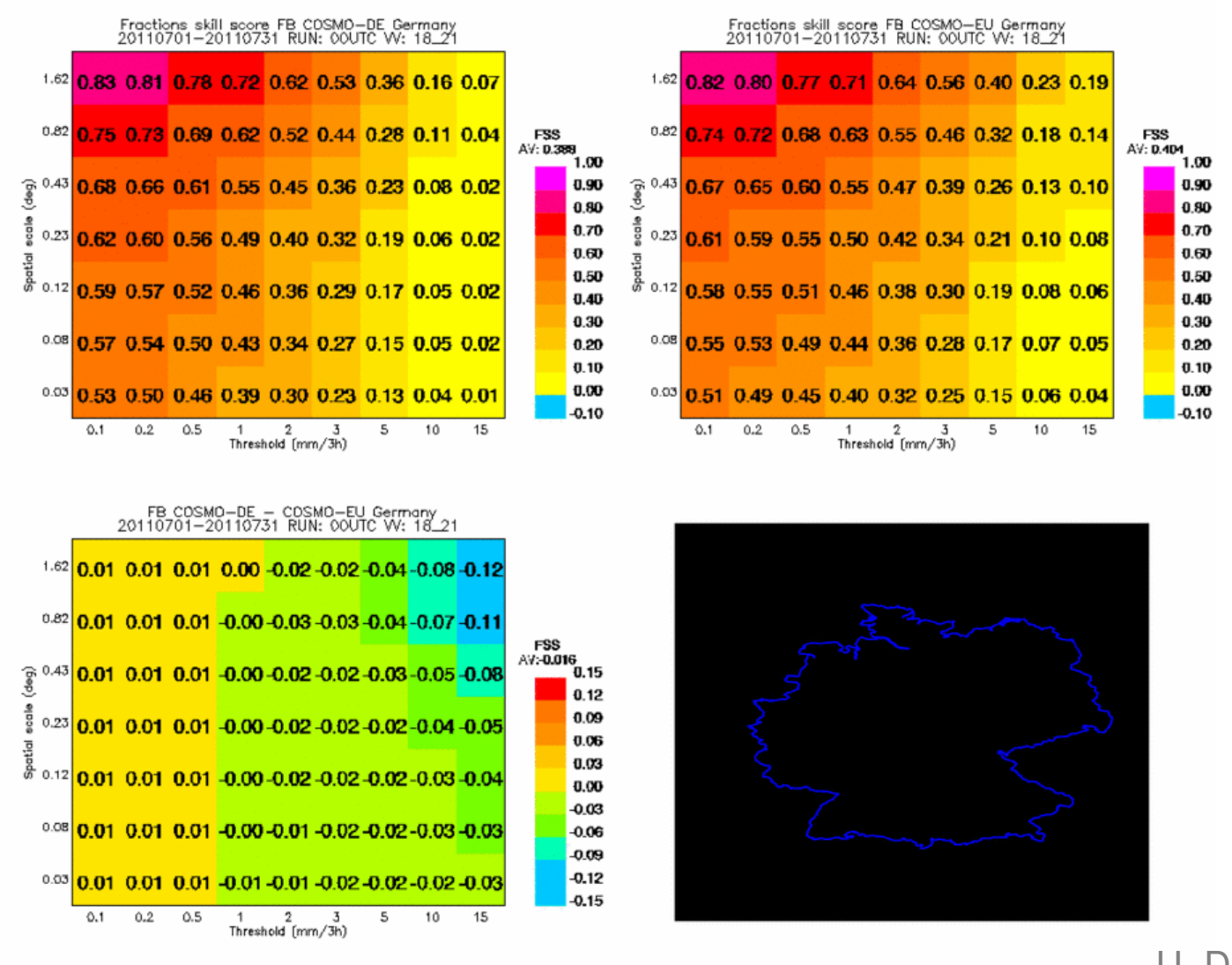
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



U. Damrath, DWD

Some examples :
FSS July 2011, Run: 00 UTC, forecast time 18-21 hours

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



U. Damrath, DWD

Summary concerning Fuzzy-Verification

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

- The application of Fuzzy-verification for 3h-intervals allows a more detailed insight on the differences between the quality of precipitation forecast of CDE and CEU.
- The results got by MeteoSwiss could be reproduces at least in a qualitative way.
- Fractions Skill Score and ETS upscaling give for special cases notable different results. But the aggregated results are relatively good correlated.
- The effect of LHN is especially for the whole region of Germany and for runs between sun rise and sun set relatively clear pronounced.
- Also for parts of Germany this can be stated – but not with the same degree as for the whole region.
- For some forecast intervals the effect of threee hour old boundary values of the CEU can be seen.

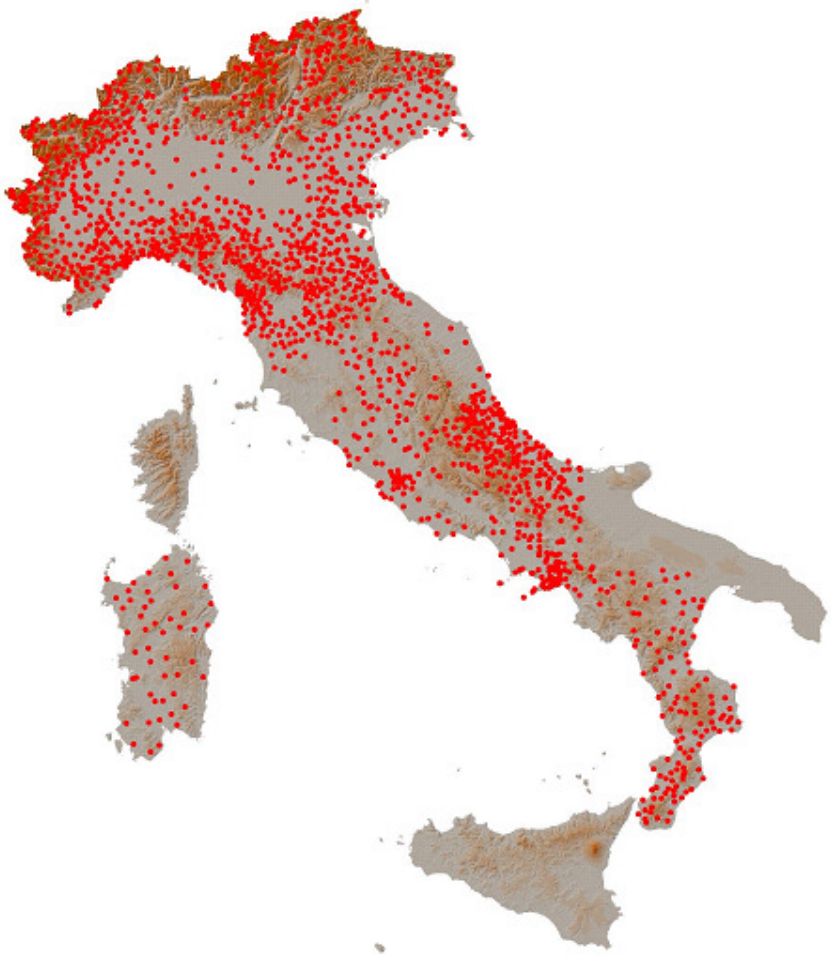
Precipitation verification comparison the several COSMO-Model versions

(Elena Oberto, Massimo Milelli - ARPA Piemonte)

QPF verification of the 4 model versions at 7 km res. (**COSMO-I7, COSMO-7, COSMO-EU, COSMO-ME**) with the 2 model versions at 2.8 km res. (**COSMO-I2, COSMO-IT**) and **ECMWF**

Specifications:

- Dataset: high resolution network of rain gauges coming from COSMO dataset and Civil Protection Department → 1300 stations
- Method: 24h/6h averaged cumulated precipitation value over 90 meteo-hydrological basins
- Model selection: run 00UTC, D+1, D+2



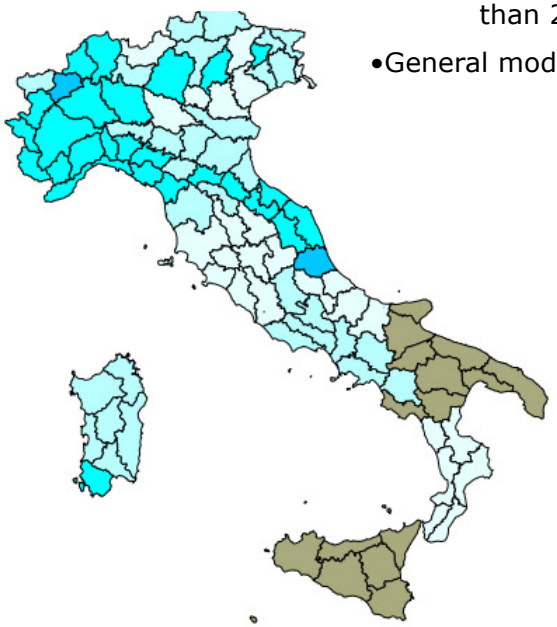
RELATIVE ERROR spring 2011

Cosmo-I7

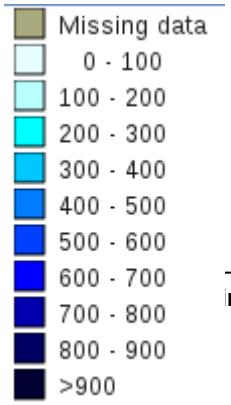
Cosmo-ME

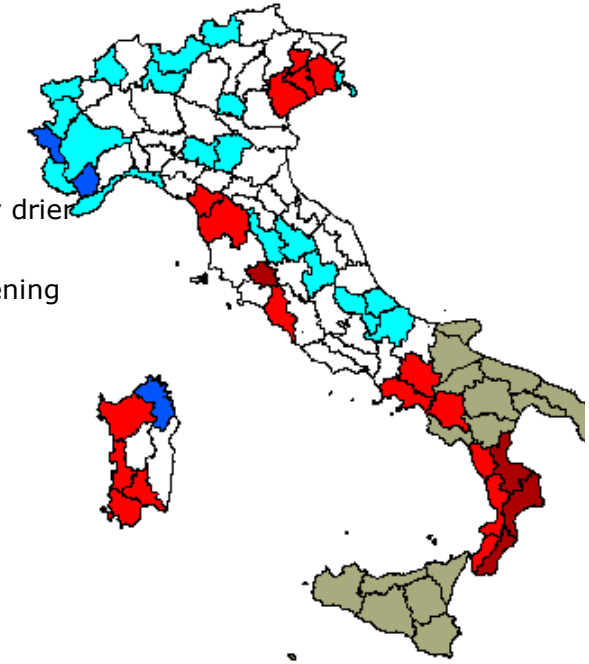
Cumulated obs. Prec.

- Spring 2011 definitely drier than 2010
- General model worsening

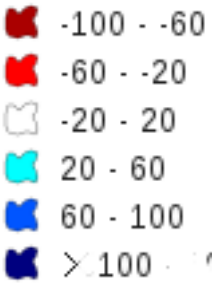


Cumulated seasonal precipitation (mm)

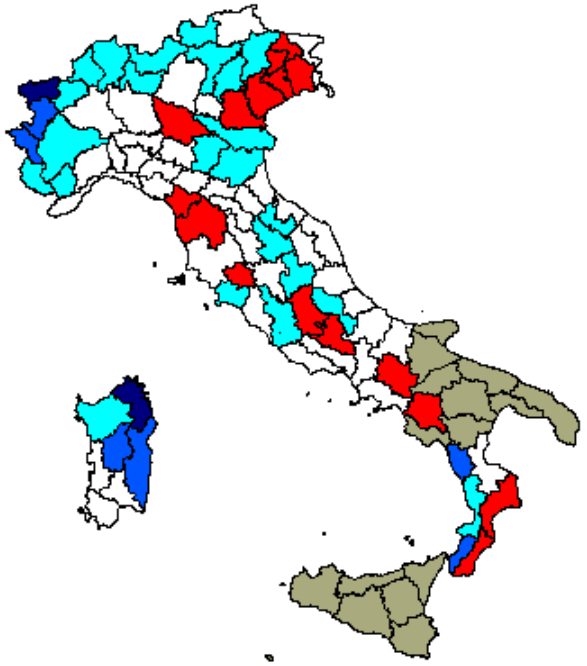


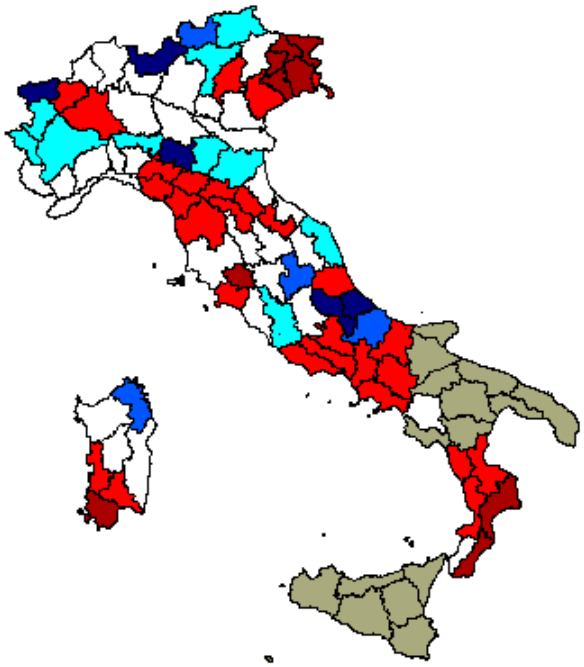


Rel Err= (for-obs)/obs %



Ecmwf



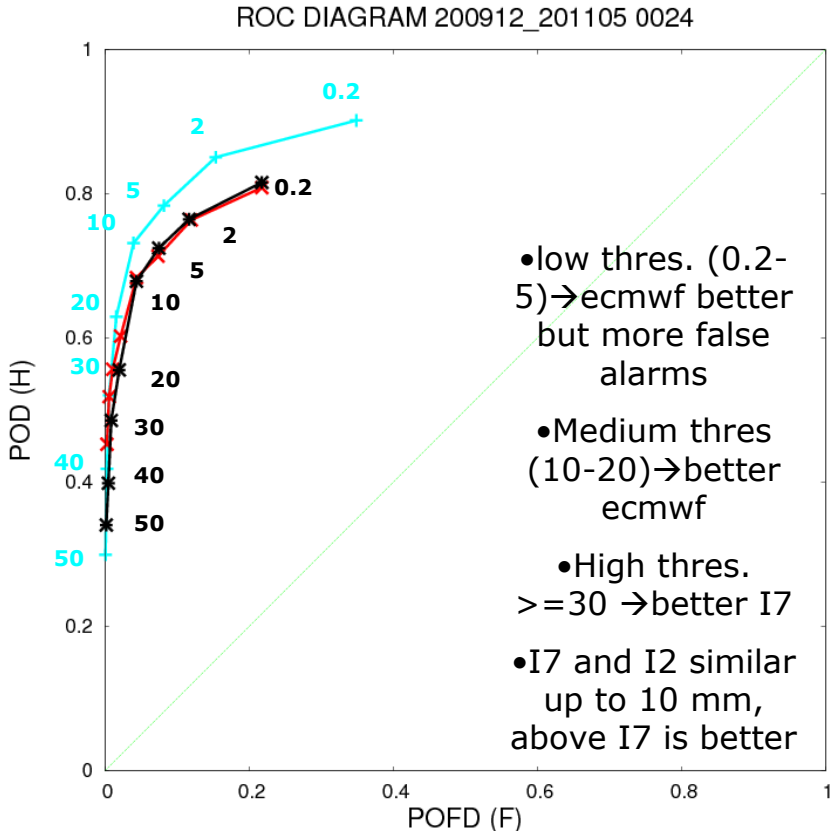


n COSMO in the year 2010

extreme dependency score → investigate the performance of an NWP model for rare events

Stephenson et al. Introduce the extreme dependency score (EDS) as a good alternative to standard scores for verification of rare events.

	Event observed yes	Event observed no	Total
Forecast yes	A	b	$a + b$
Forecast no	c	d	$c + d$
Total	$a + c$	$b+d$	$n= a + b + c + d$



•low thres. (0.2-5)→ecmwf better but more false alarms

•Medium thres (10-20)→better ecmwf

•High thres. >=30 →better I7

•I7 and I2 similar up to 10 mm, above I7 is better

Driving model comparison: ECMWF/COSMO-I7/COSMO-I2

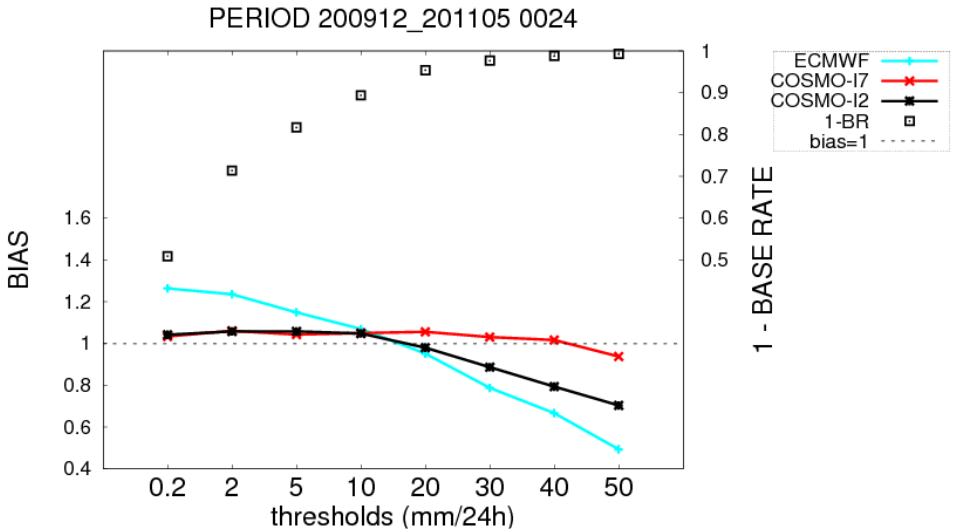
FIRST 24H

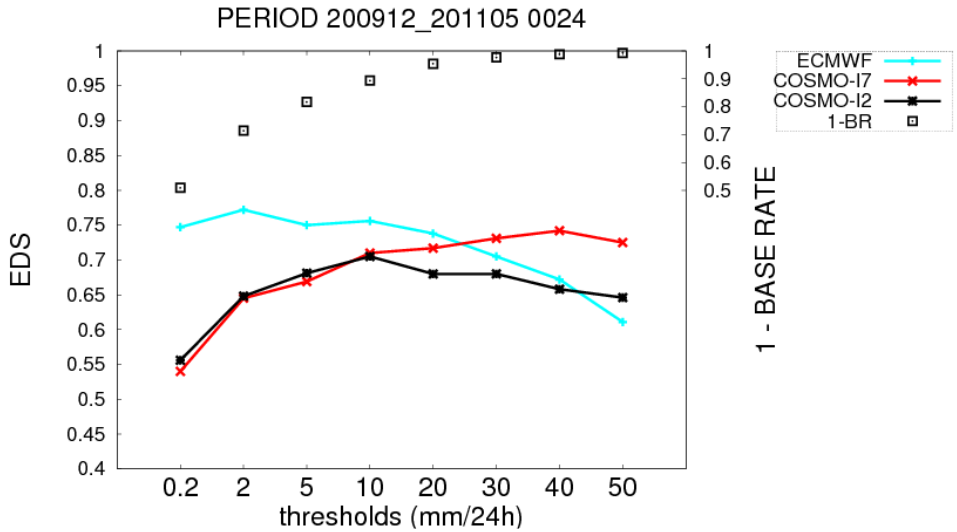
•BIAS: ecmwf overestimates for low thres., underestimates for high thres.

•BIAS: I7 and I2 similar up to 10mm, above I7 is better

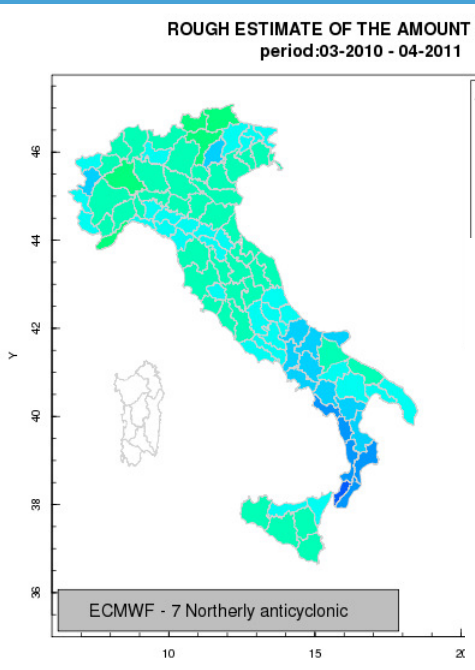
•EDS: the best is ecmwf up to 20mm. Above the best is cosmo-I7

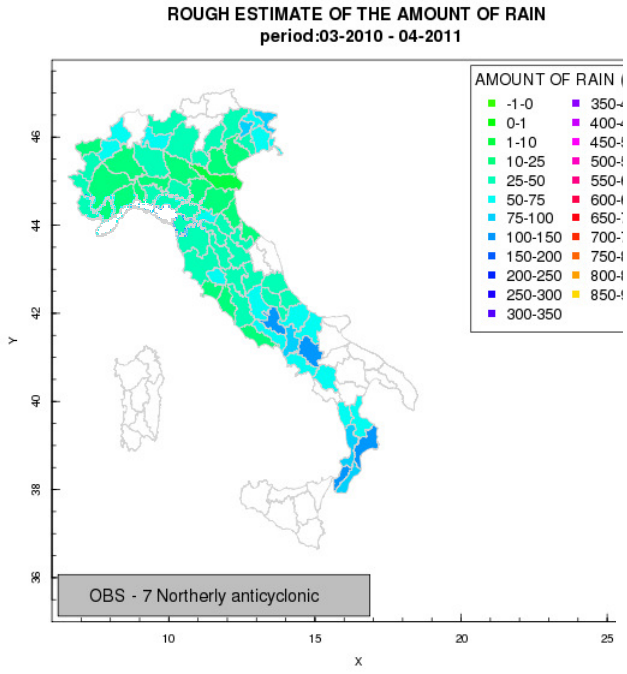
E. Oberto, ARPA-Piemonte

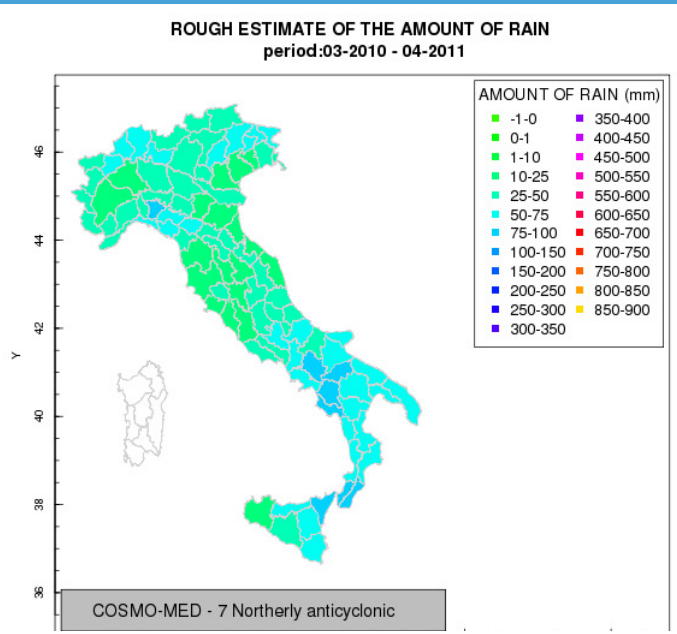


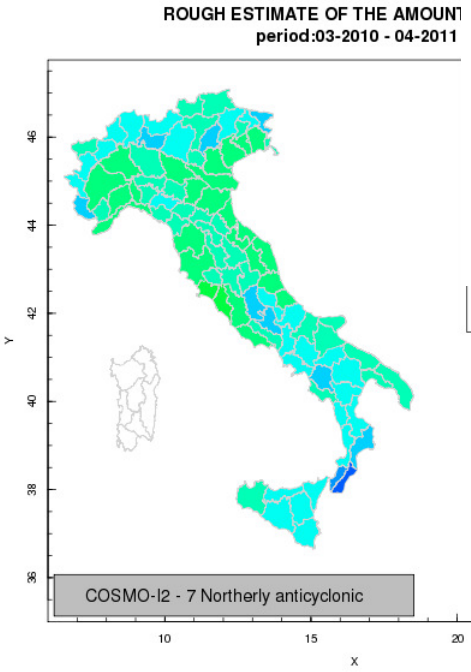


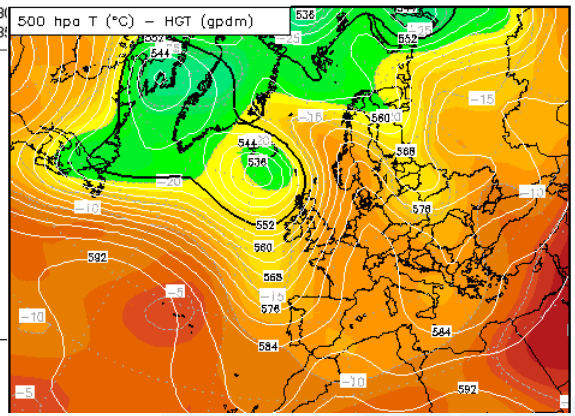
7-Northerly anticyclonic

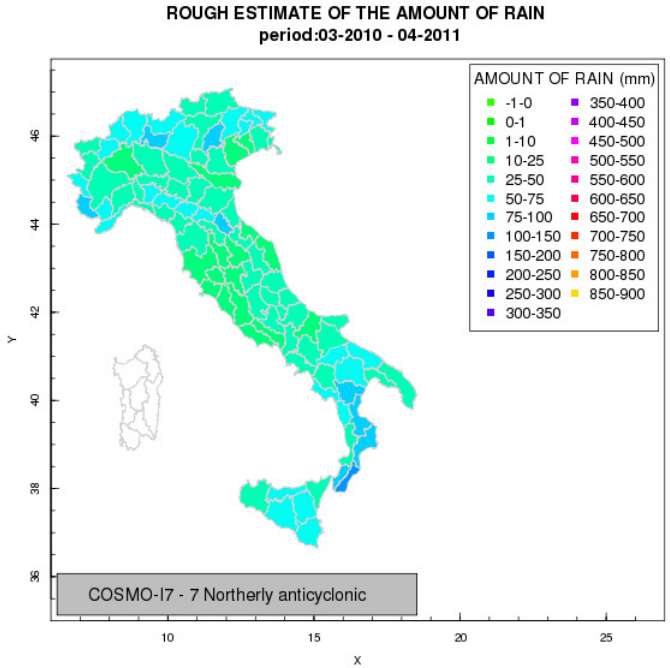






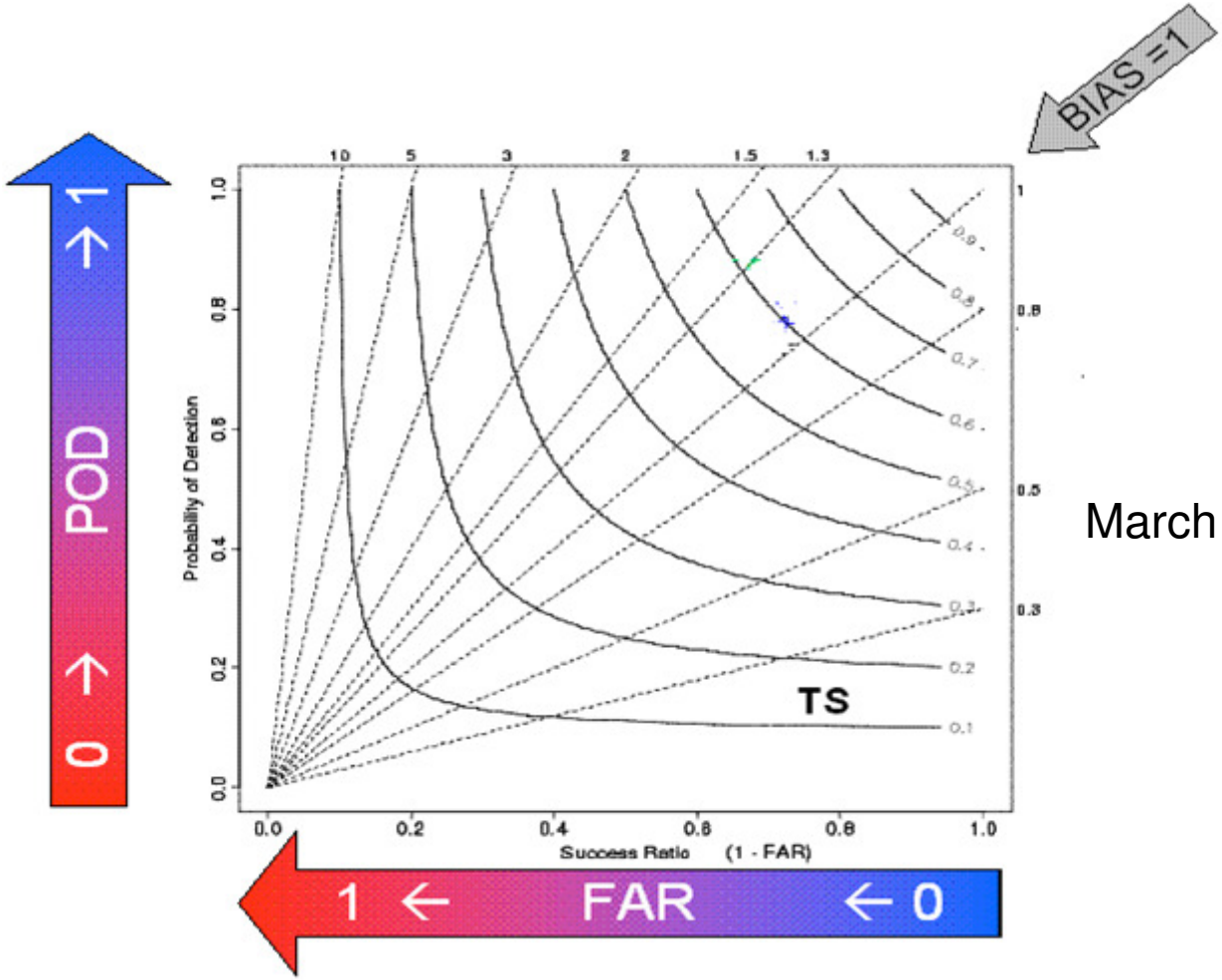






Raspanti (CNMCA), Tesini (ARPA-SIM)

PERFORMANCE DIAGRAM

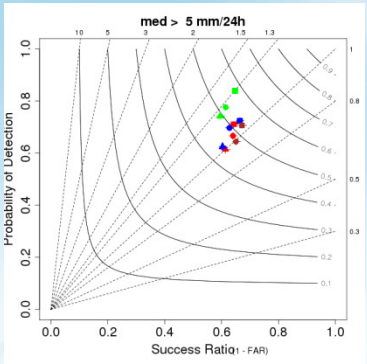


Period
March 2010 - April 2011

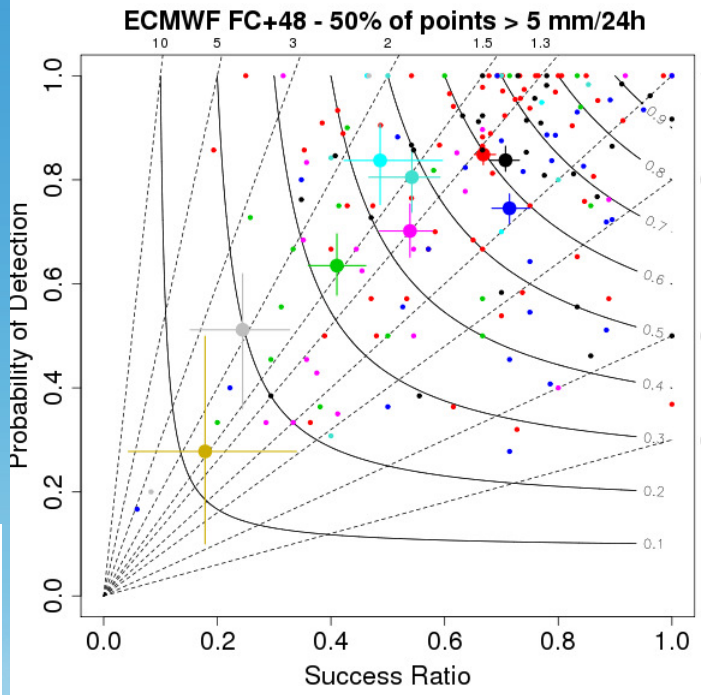
Small dots = daily scores

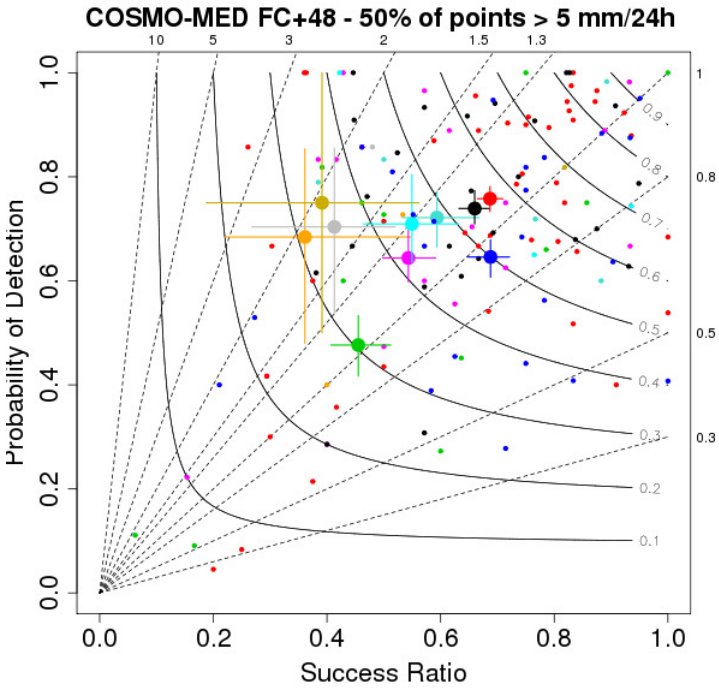
Big dots = scores over the days in each category

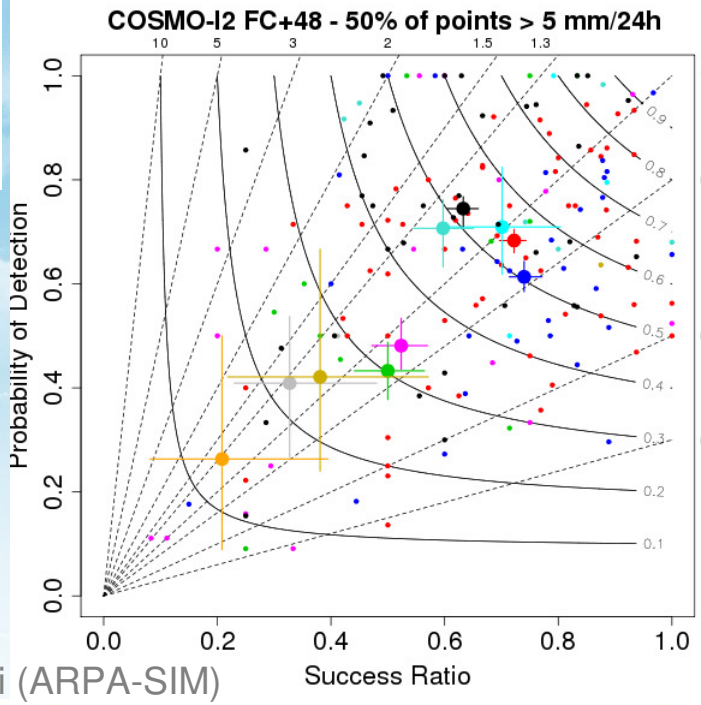
- 1 Zonal Westerly anticyclonic
- 2 Zonal Westerly cyclonic
- 3 Easterly
- 4 Meridional cyclonic
- 5 Meridional anticyclonic
- 6 Northerly cyclonic
- 7 Northerly anticyclonic
- 8 Central Mediterranean High
- 9 Central Mediterranean Ridge
- 10 Central Mediteranean Low
- 11 Central Mediterranean Trough

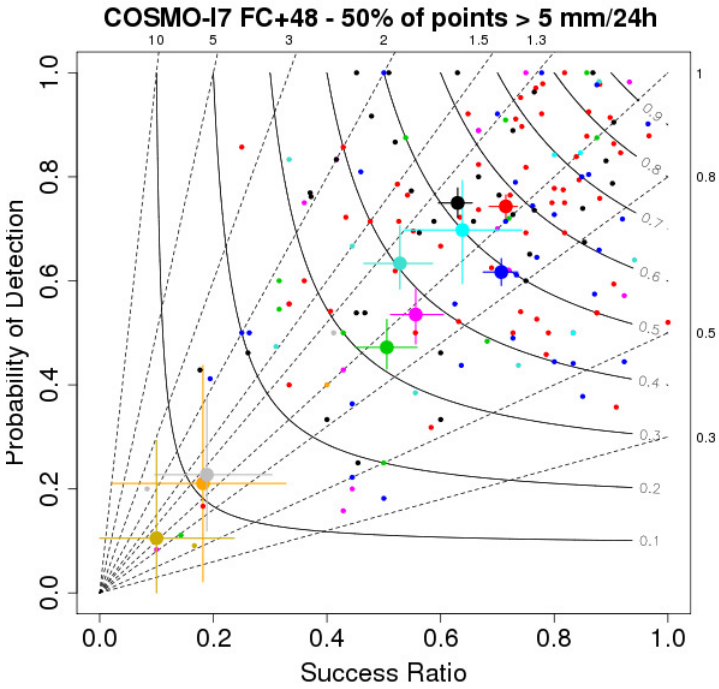


All cases



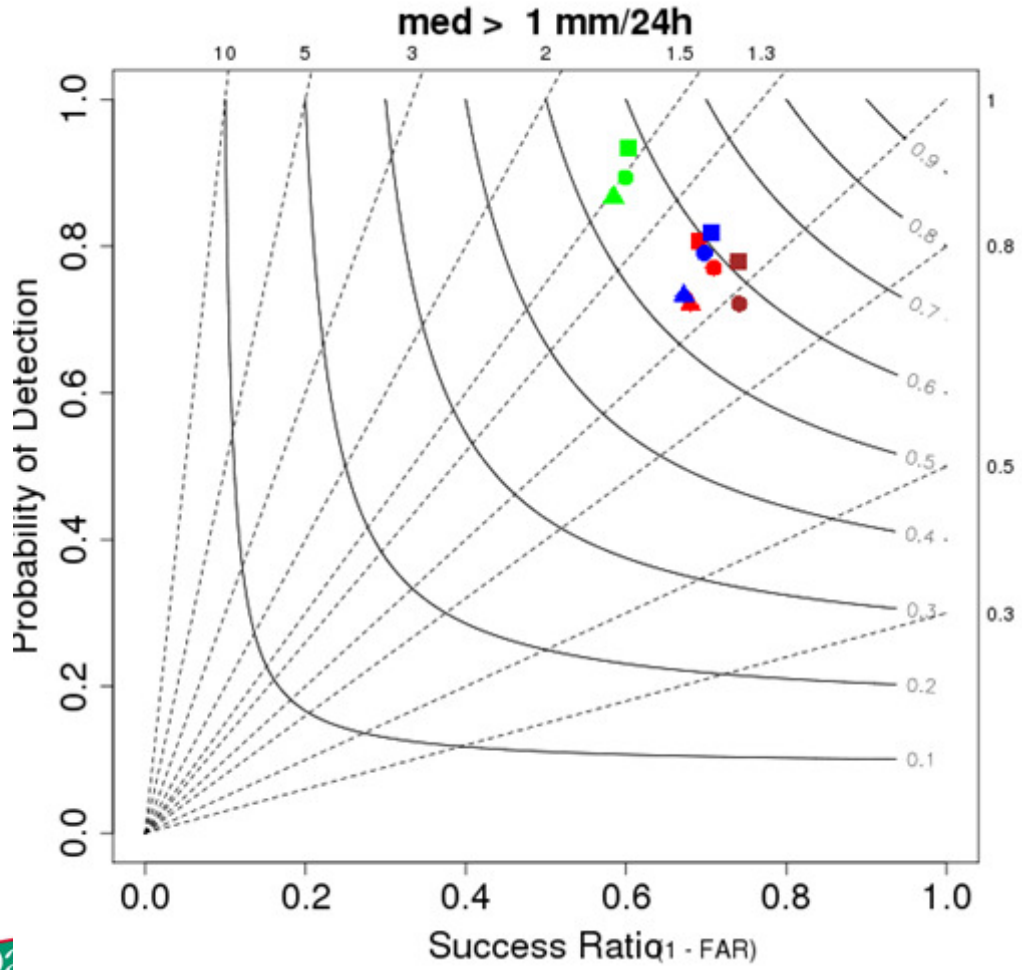






Raspanti (CNMCA), Tesini (ARPA-SIM)

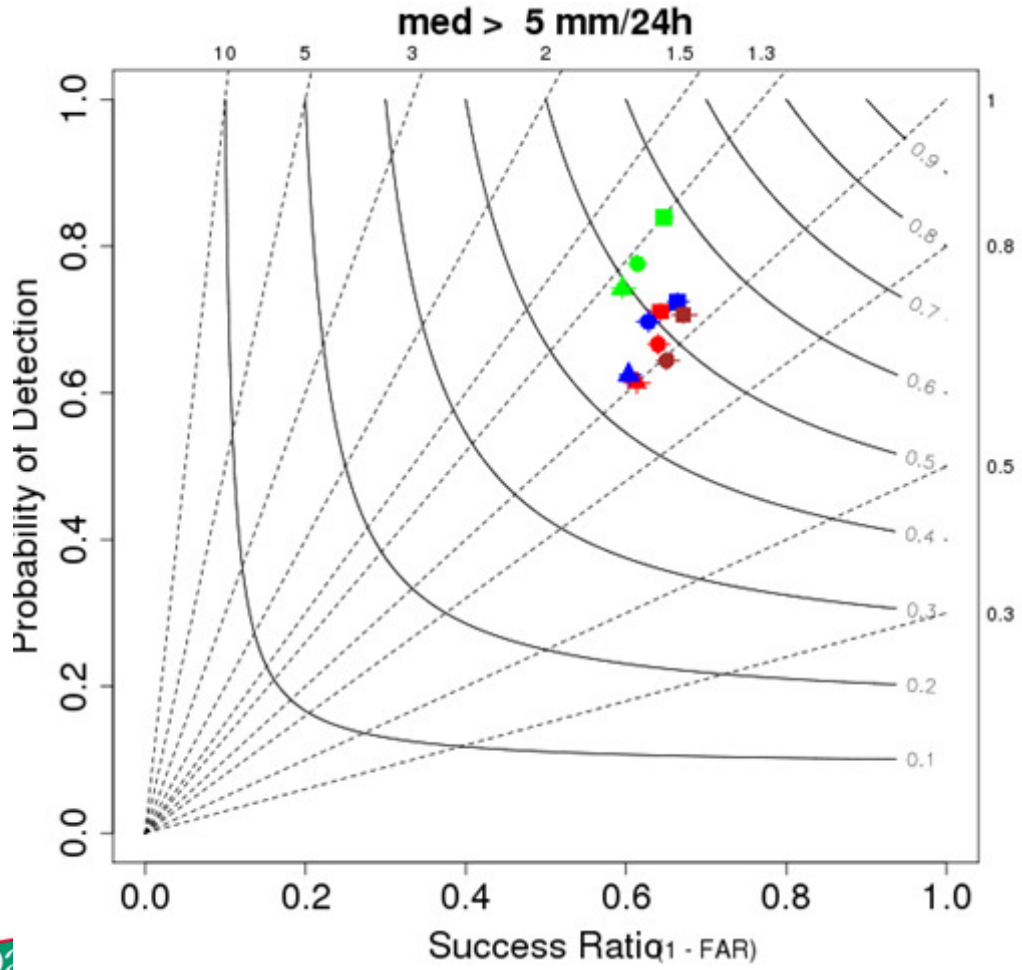
50% of points (median) > 1 mm/24h



- COSMO-I2_00 - fc + 24
- COSMO-I2_00 - fc + 48
- COSMO-I7_00 - fc + 24
- COSMO-I7_00 - fc + 48
- COSMO-I7_00 - fc + 72
- COSMO-MED_00 - fc + 24
- COSMO-MED_00 - fc + 48
- COSMO-MED_00 - fc + 72
- ECMWF_00 - fc + 24
- ECMWF_00 - fc + 48
- ECMWF_00 - fc + 72

Raspanti (CNMCA), Tesini (ARPA-SIM)

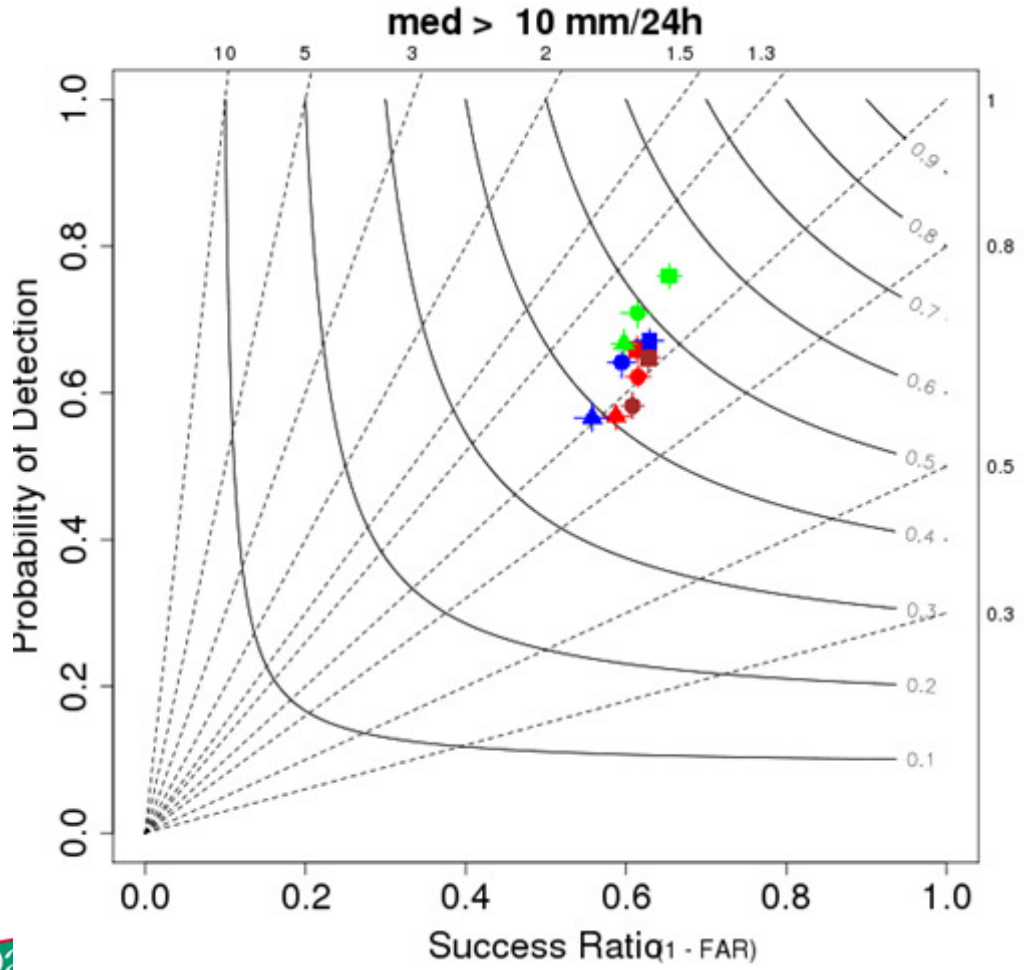
50% of points (median) > 5 mm/24h



- COSMO-I2_00 - fc + 24
- COSMO-I2_00 - fc + 48
- COSMO-I7_00 - fc + 24
- COSMO-I7_00 - fc + 48
- COSMO-I7_00 - fc + 72
- COSMO-MED_00 - fc + 24
- COSMO-MED_00 - fc + 48
- COSMO-MED_00 - fc + 72
- ECMWF_00 - fc + 24
- ECMWF_00 - fc + 48
- ECMWF_00 - fc + 72

Raspanti (CNMCA), Tesini (ARPA-SIM)

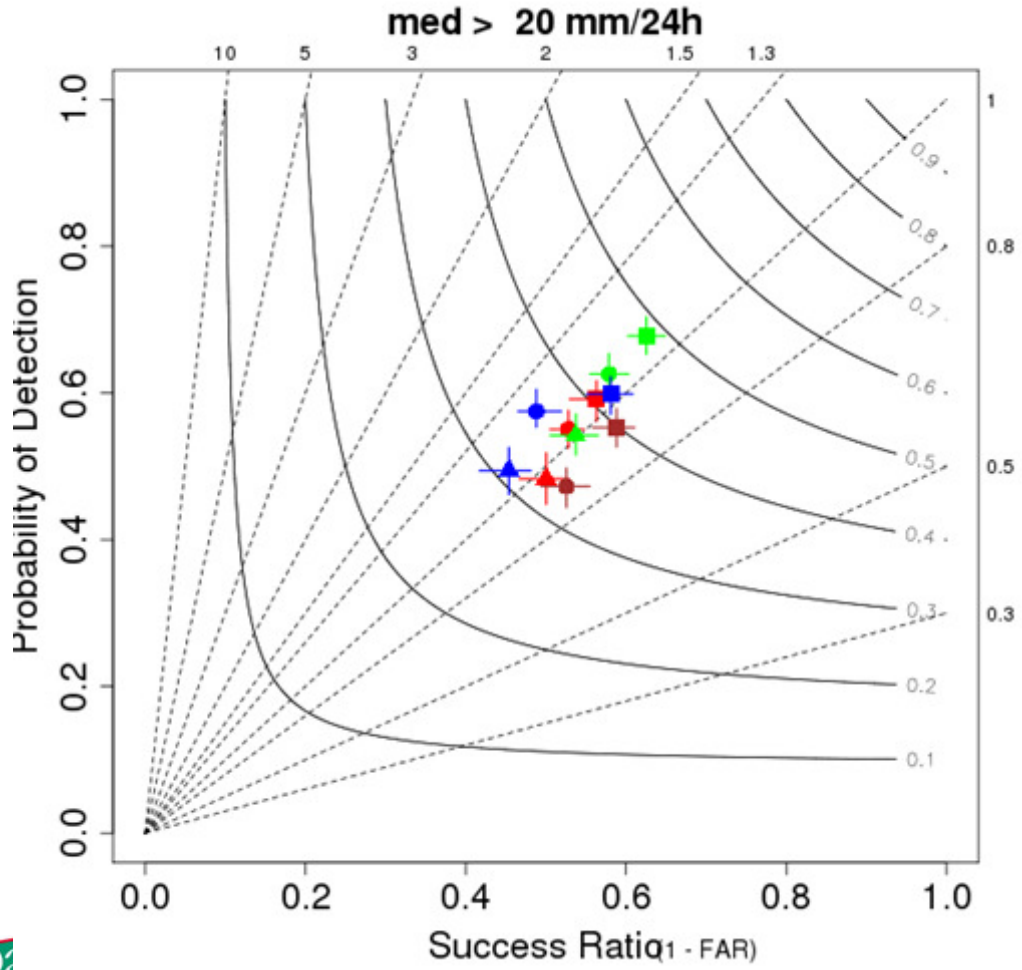
50% of points (median) > 10 mm/24h



- COSMO-I2_00 - fc + 24
- COSMO-I2_00 - fc + 48
- COSMO-I7_00 - fc + 24
- COSMO-I7_00 - fc + 48
- COSMO-I7_00 - fc + 72
- COSMO-MED_00 - fc + 24
- COSMO-MED_00 - fc + 48
- COSMO-MED_00 - fc + 72
- ECMWF_00 - fc + 24
- ECMWF_00 - fc + 48
- ECMWF_00 - fc + 72

Raspanti (CNMCA), Tesini (ARPA-SIM)

50% of points (median) > 20 mm/24h



- COSMO-I2_00 - fc + 24
- COSMO-I2_00 - fc + 48
- COSMO-I7_00 - fc + 24
- COSMO-I7_00 - fc + 48
- COSMO-I7_00 - fc + 72
- COSMO-MED_00 - fc + 24
- COSMO-MED_00 - fc + 48
- COSMO-MED_00 - fc + 72
- ECMWF_00 - fc + 24
- ECMWF_00 - fc + 48
- ECMWF_00 - fc + 72

Raspanti (CNMCA), Tesini (ARPA-SIM)