CONSORTIUM FOR SMALL SCALE MODELING

COSMO

C2I Priority Project

Status of the transition from COSMO to ICON at Arpa Piemonte

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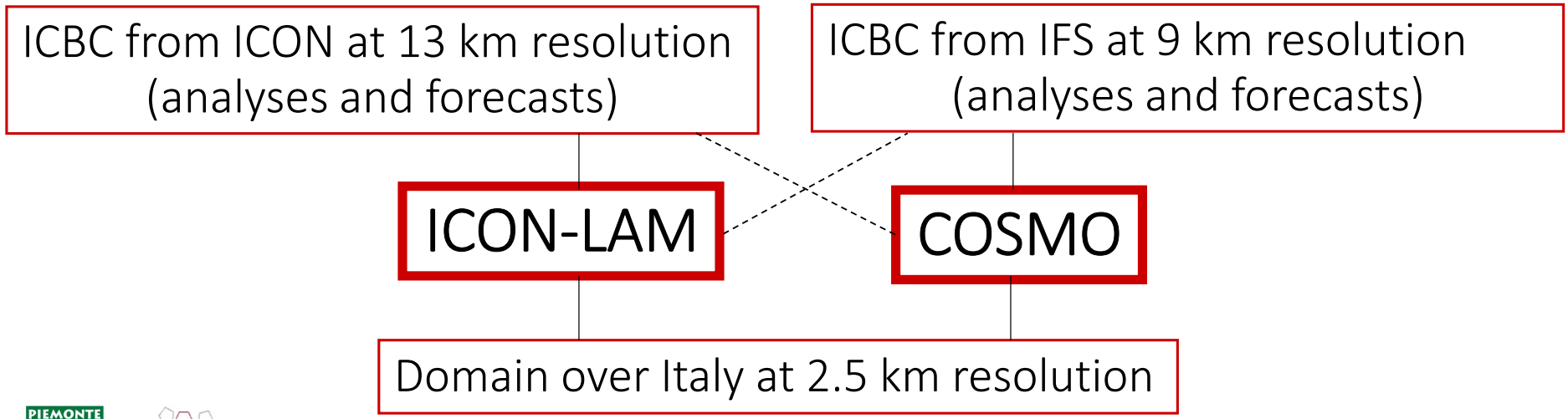
PIEMONTE Arpa Agenzia Regionale per la Protezione Ambientale

Sistema Nazionale per la Protezione dell'Ambiente

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

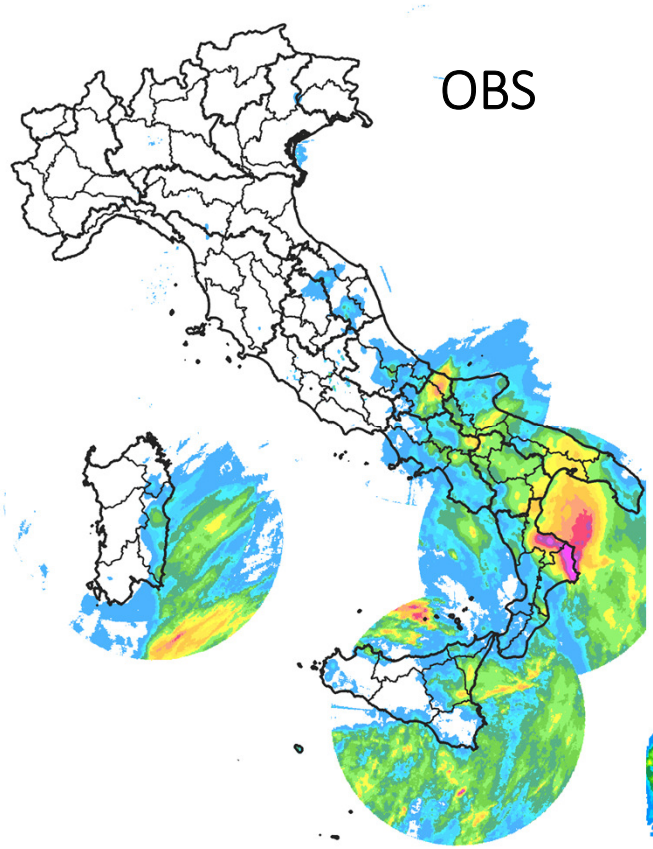
Phase 2: Basic Forecasting System

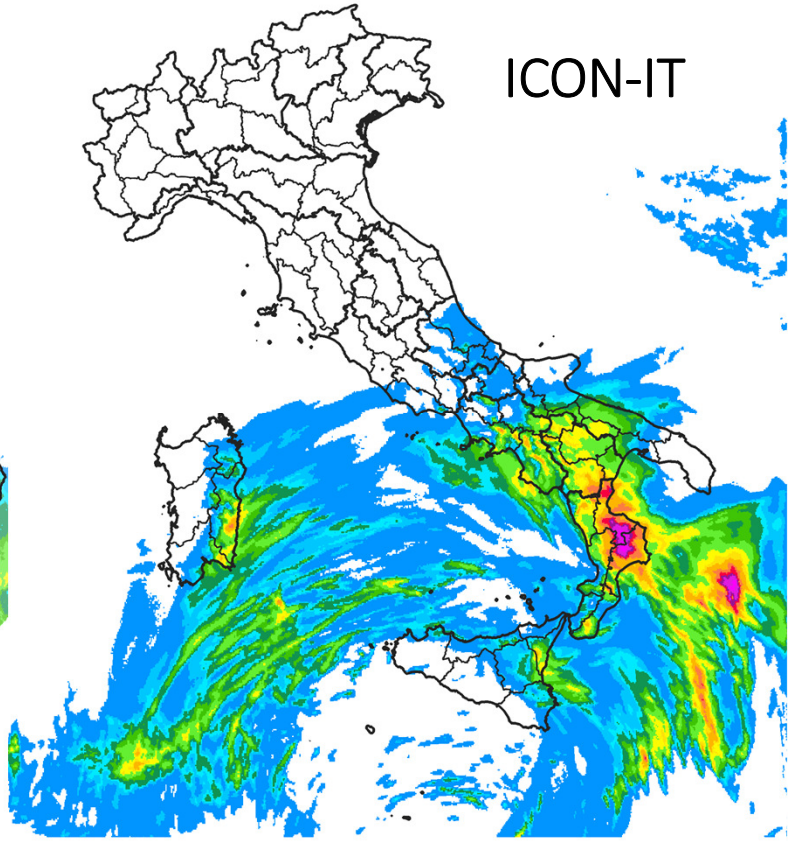
Considering limited capacities of the HPC systems at Arpa Piemonte, only **deterministic forecast** of case studies is foreseen within this project. We performed deterministic ICON-LAM (and COSMO) re-analysis and forecast without data assimilation of past extreme events in order to assess the added value of ICON-LAM compared to the COSMO model in case of severe weather situations.

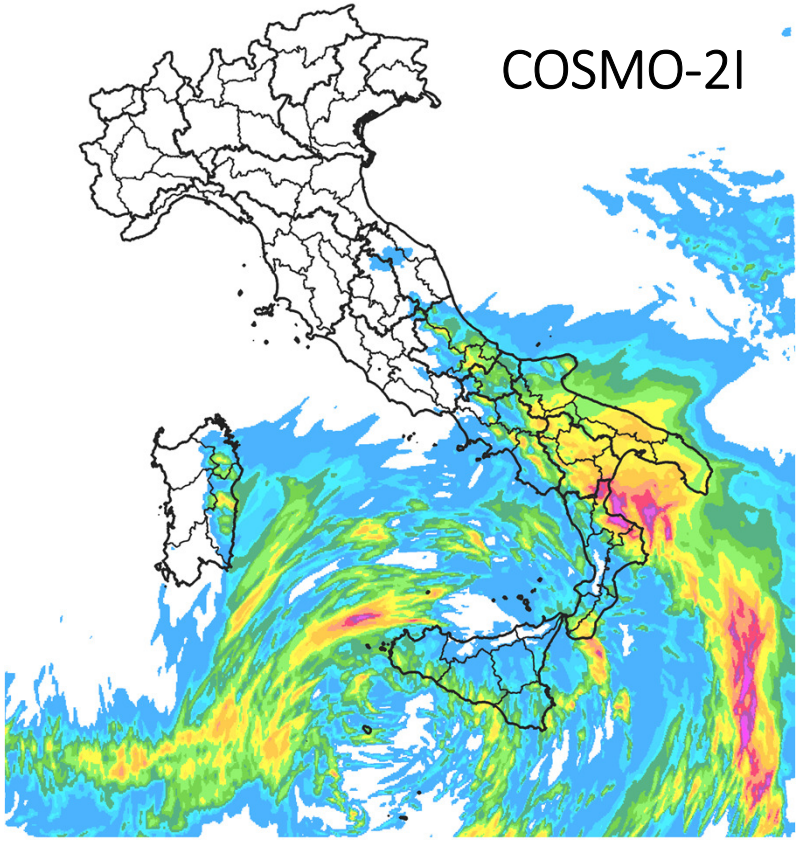


Phase 2:
deterministic run

21-22 November 2020, flood over Calabria region







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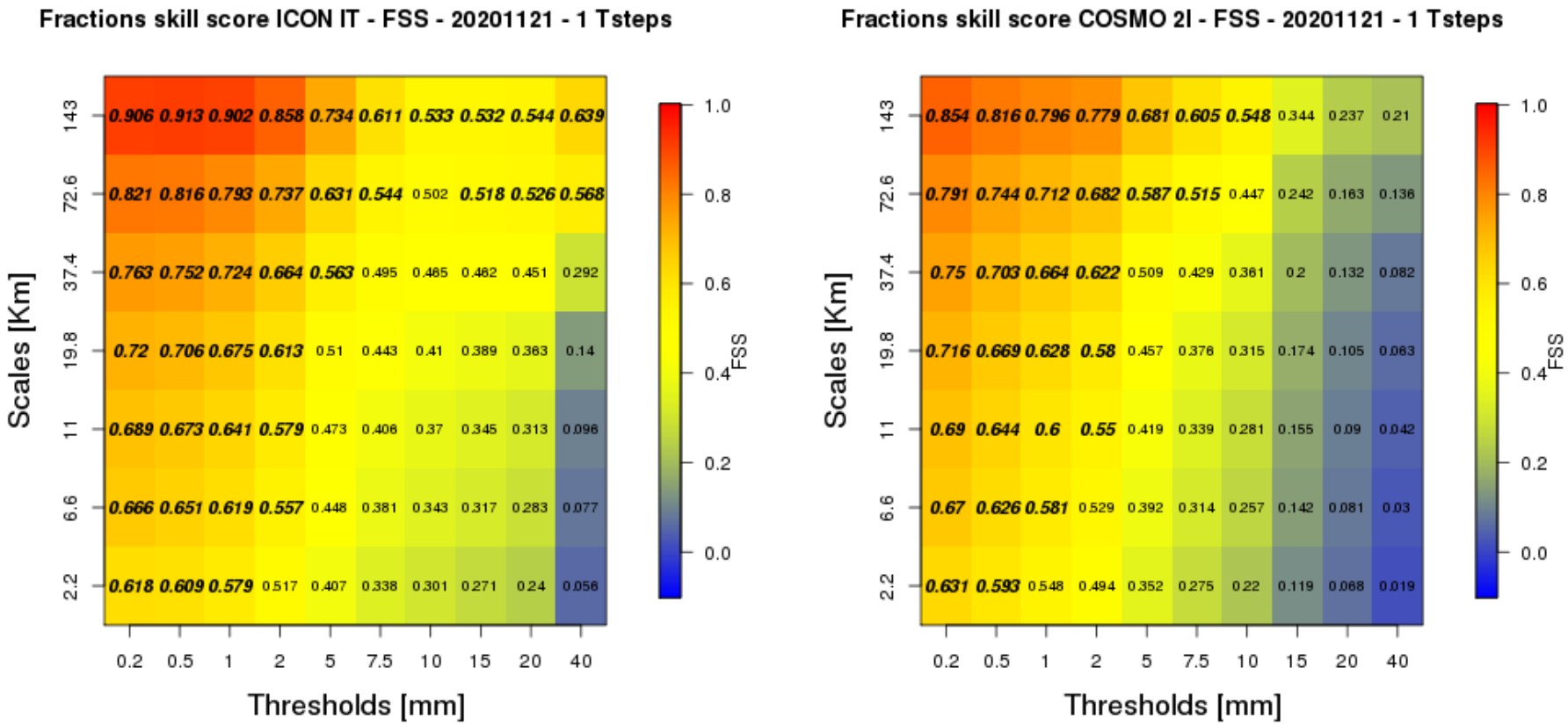
Phase 2:
Fuzzy verification

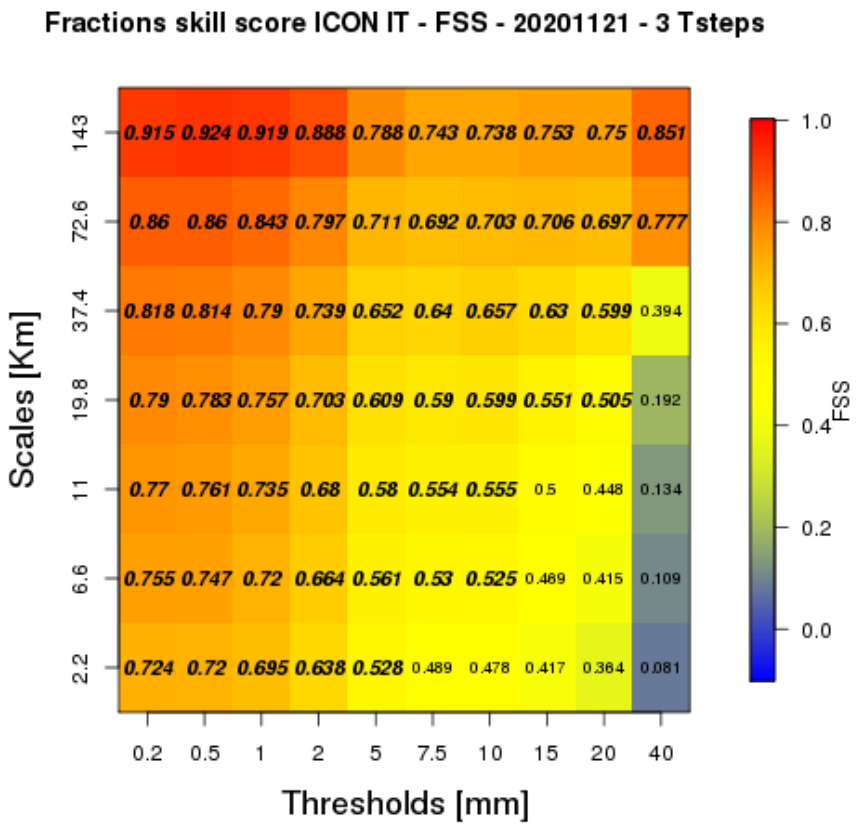
21-22 November 2020, flood over Calabria region

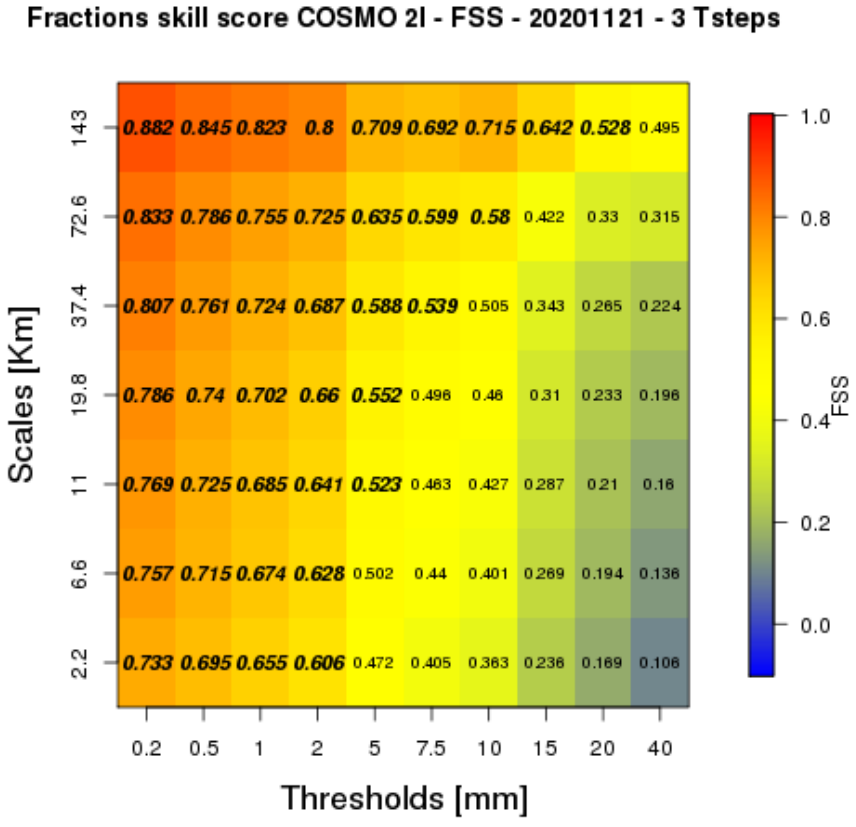


ICON-IT: better scores for all the thresholds
Useful scale at 2.2 km for 5 mm/3h and at 143 km for 40 mm/3h

Phase 2:
Fuzzy verification

21-22 November 2020, flood over Calabria region

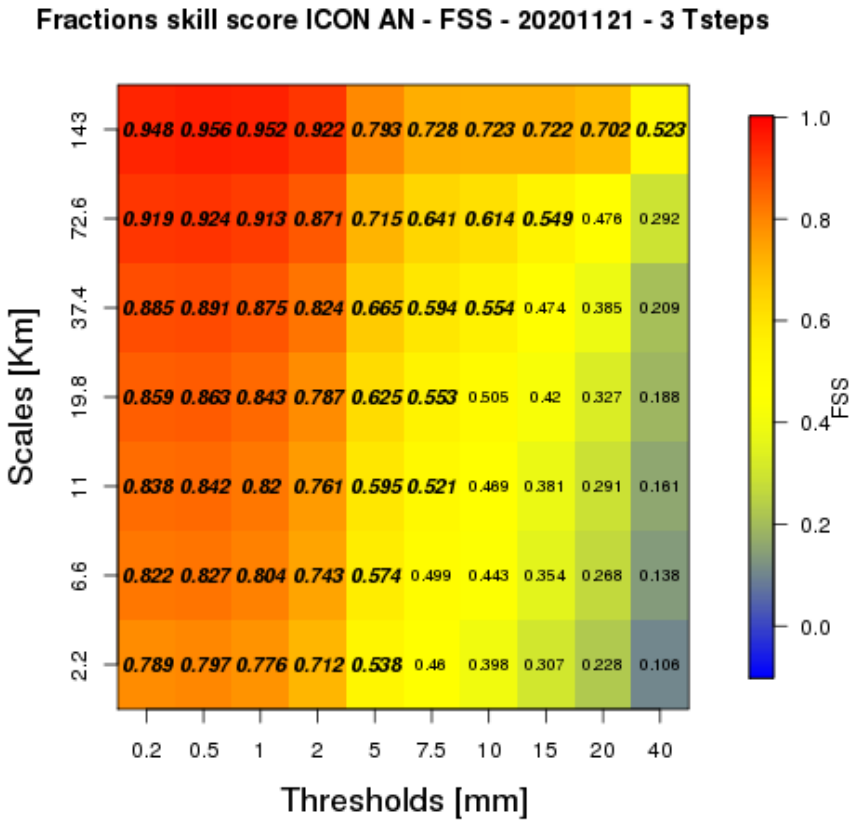


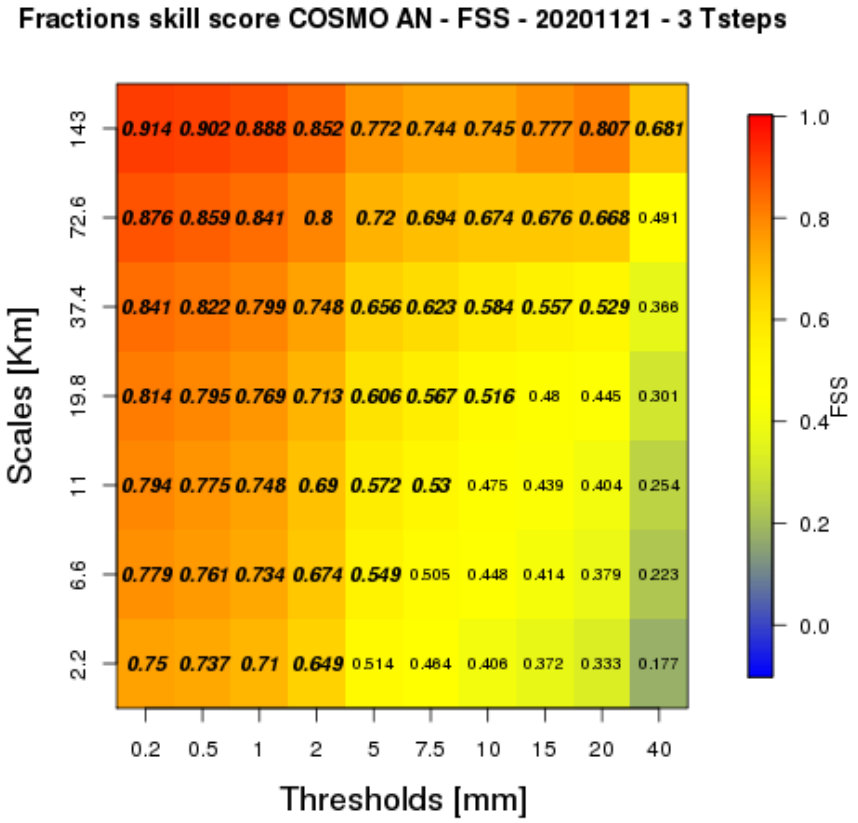


Improvements for both the models
ICON-IT: better scores for all the thresholds

Phase 2:
3D Fuzzy verification

✓ **Run AN**: ICON/COSMO re-analysis at 2.2 km resolution since 20201121 00 UTC to 20201123 00 UTC with BCs every 1h/6h – No data assimilation





COSMO slightly better than ICON for medium thresholds (10-20 mm/3h)

Phase 3: Deterministic Forecasting System Including Data Assimilation

In collaboration with COMET, we performed some verification of ICON-IT:

✓ some results are presented in the "Verification of ICON in Limited Area Mode at COSMO National Meteorological Services" report, March 2021

✓ .. and other results with the bug fixed ICON-IT version* are presented in the next slides: fuzzy techniqueand performance diagrams

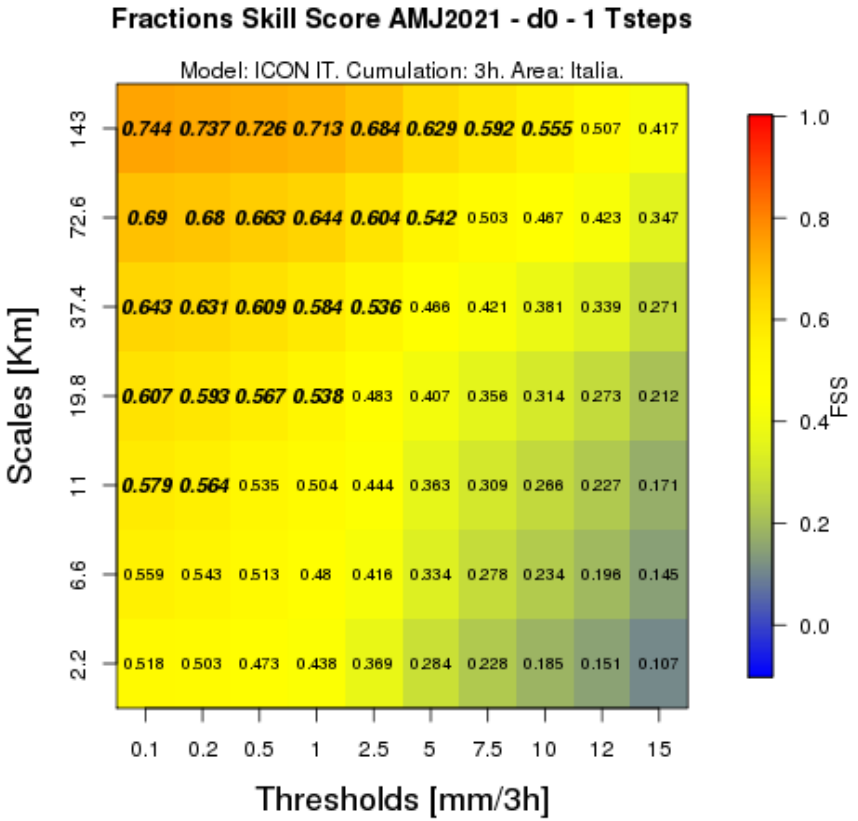
BUG!

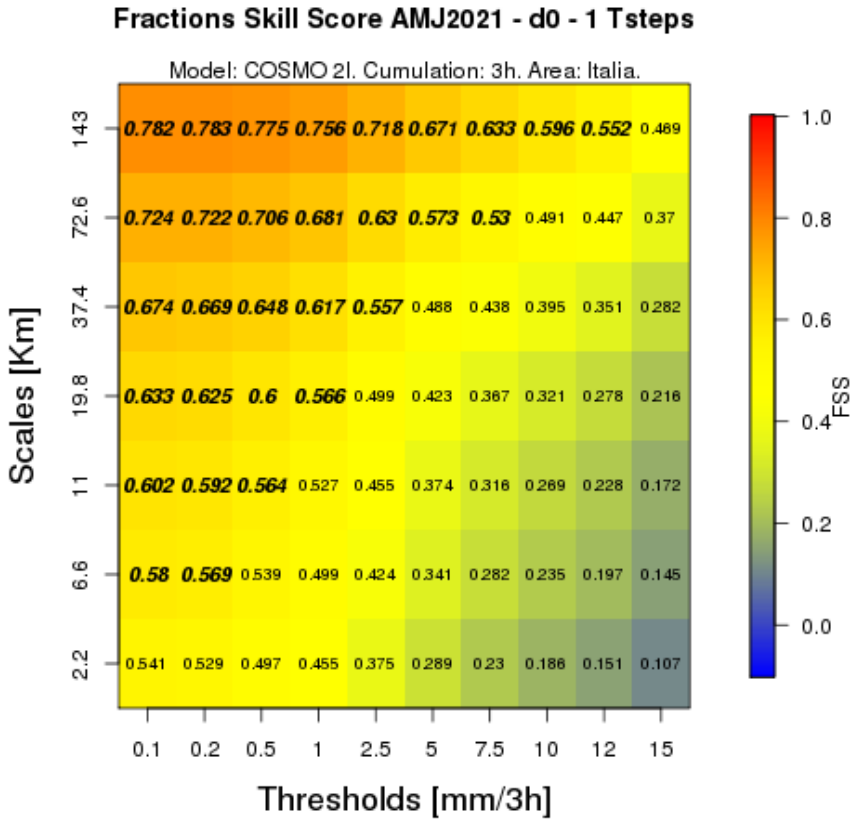
* released on 3 February 2021

N.B. On 12 April 2021 COMET changed the namelist (box_liq / box_liq_asy for low cloud) and the grid (R19B7)

Phase 3:
Fuzzy verification – D0

12 April 2021 – 30 June (bug fixed version, new namelist and grid)

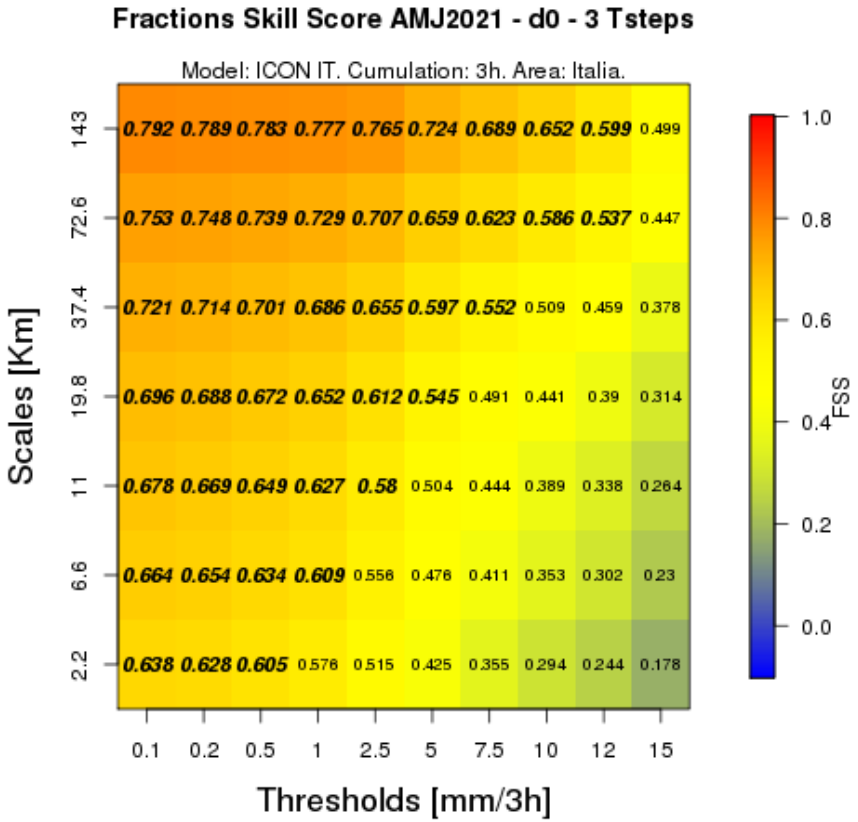


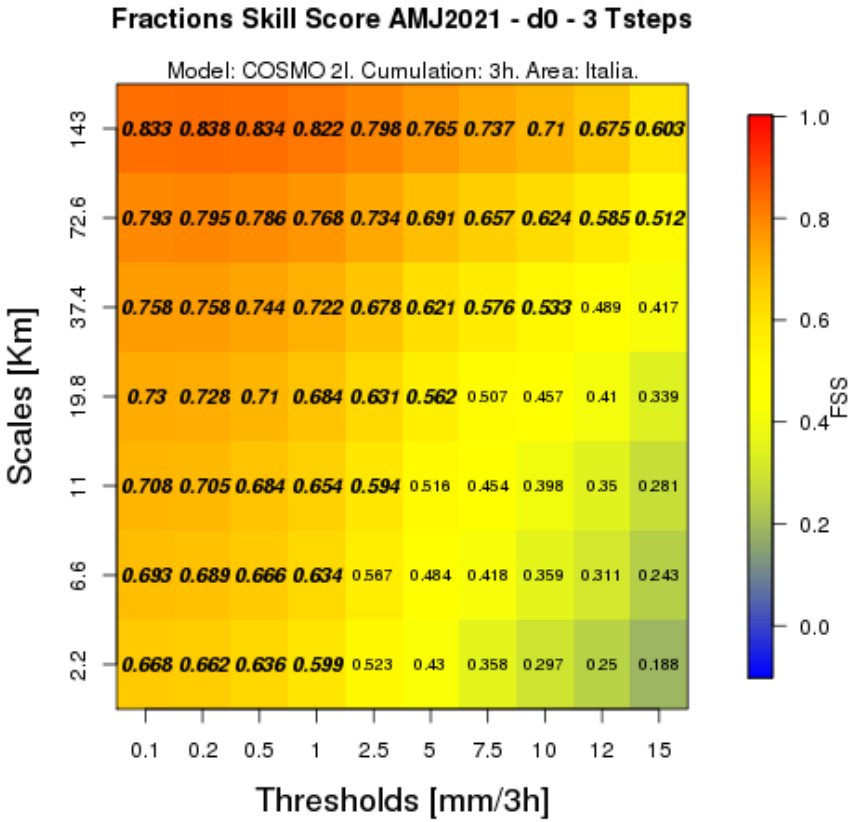


COSMO-2I: better scores for low and high thresholds
Useful scale at 6.6 km for 0.1 mm/3h and at 143 km for 12 mm/3h

Phase 3:
3D Fuzzy verification – D0

12 April 2021 – 30 June (bug fixed version, new namelist and grid)

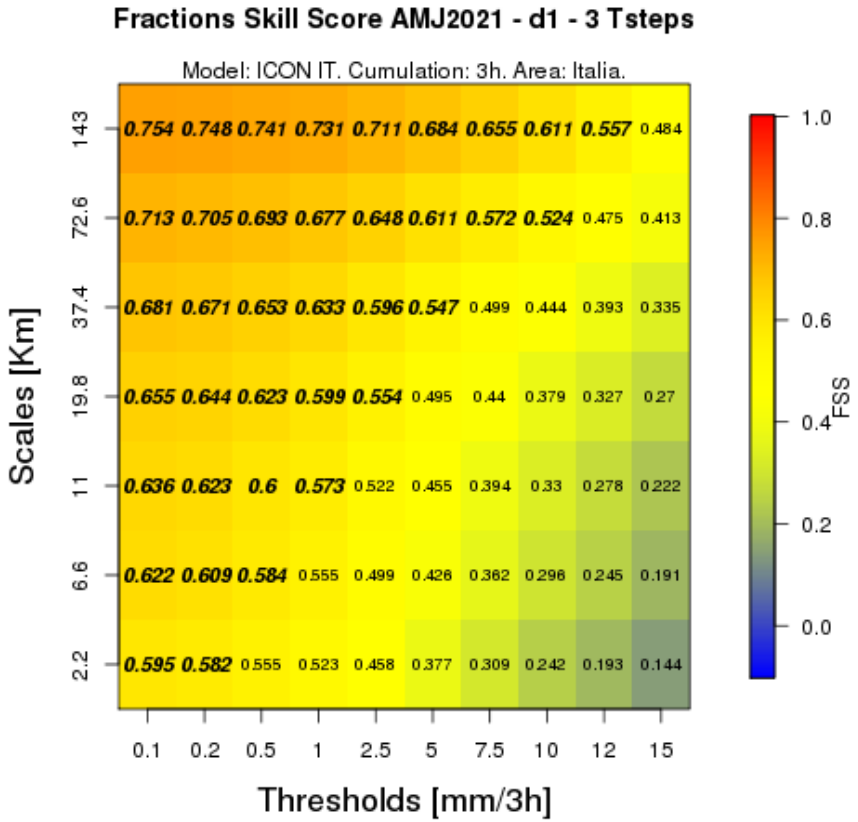


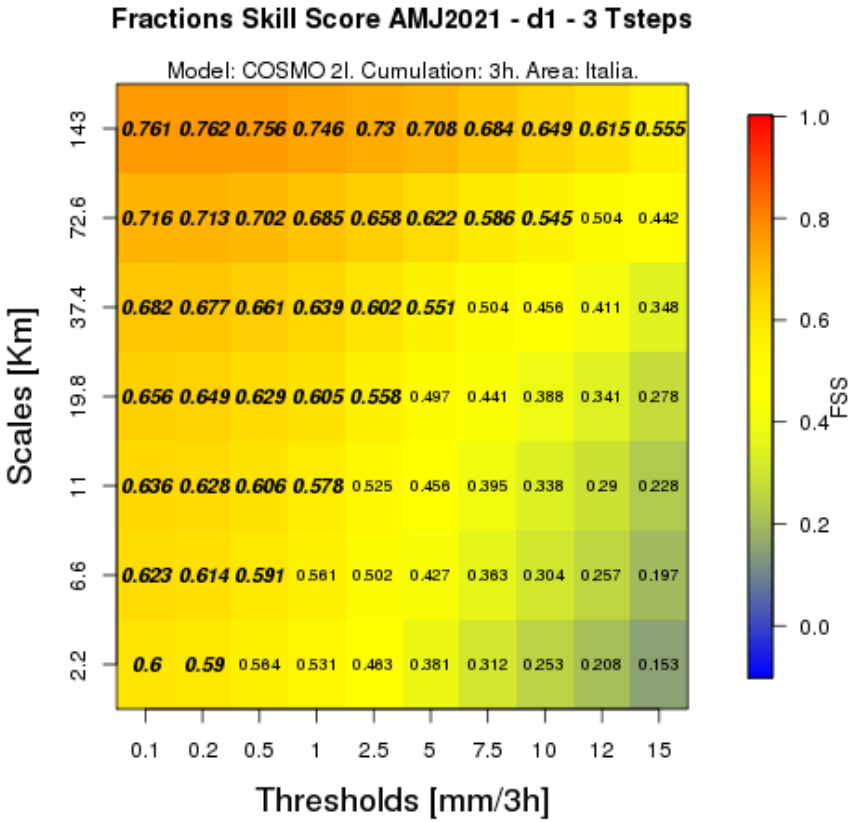


COSMO-2I: better scores for very low and very high thresholds
Useful scale at 2.2 km for 0.1 mm/3h and at 143 km for 15 mm/3h

Phase 3:
3D Fuzzy verification – D1

12 April 2021 – 30 June (bug fixed version, new namelist and grid)





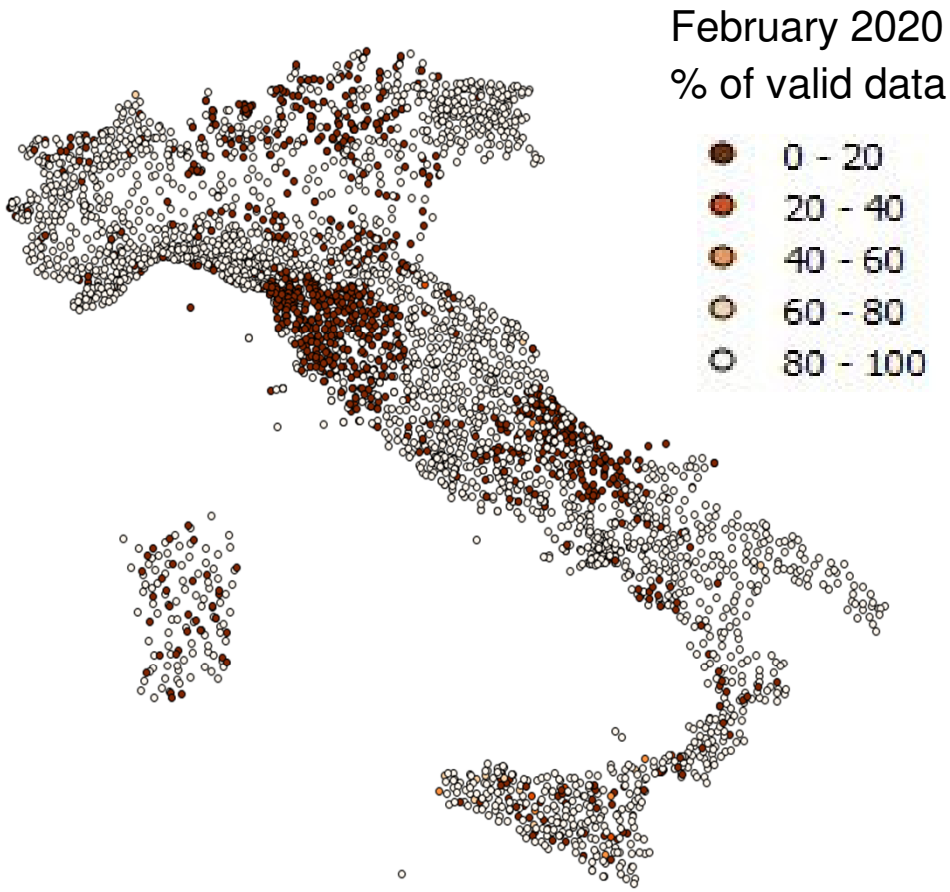
Worst perfomance for the second 24 hours of forecast (D1)
No significant difference between the models

Phase 3:
Performance Diagram

Precipitation- high resolution network → problems with the data: dataset not stable in time, data not always reliable.

Period of verification:

June and July 2021



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Phase 3:
Performance Diagram

Meteo-hydro alert system: 70 alert areas for civil protection purposes

$$FOR_{MAX}=MAX(for)_i$$

$$OBS_{MAX}=MAX(obs)_i$$

$$\overline{FOR} = \frac{1}{N}\sum^{N}(for)_i$$

$$\overline{OBS} = \frac{1}{K}\sum^{K}(obs)_i$$

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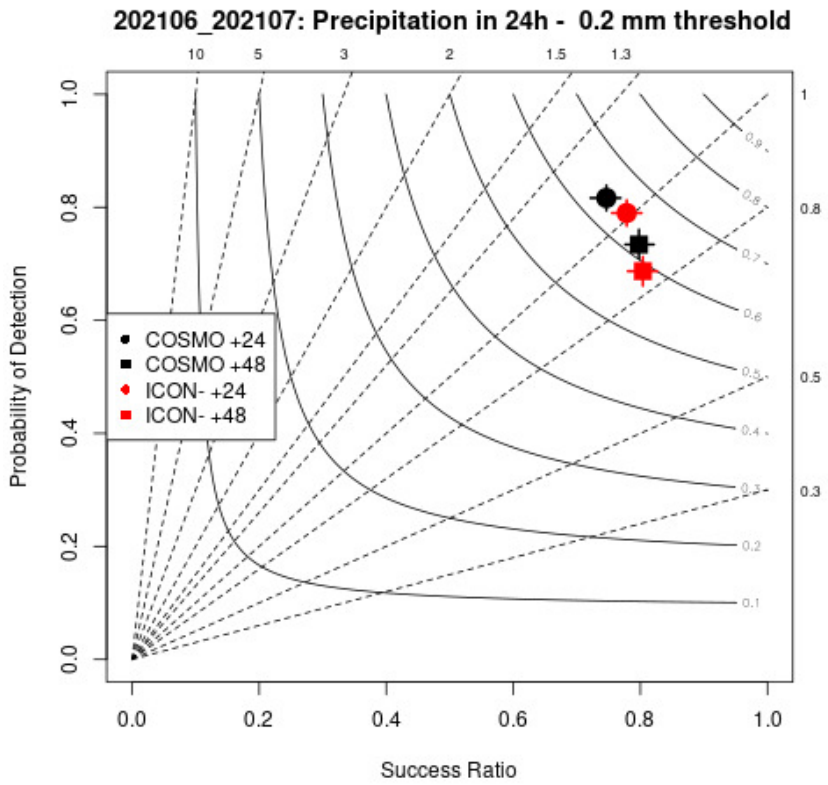
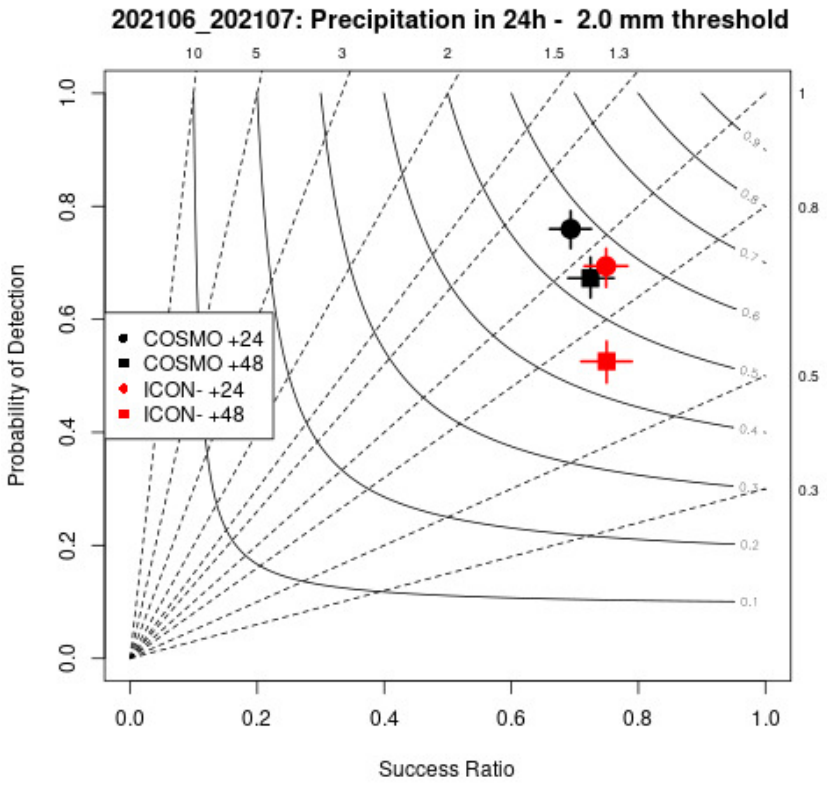
Performance diagram: 24h prec cumulated averaged over alert areas

First 24h ICON is better, not for the second 24h



ICON underestimates



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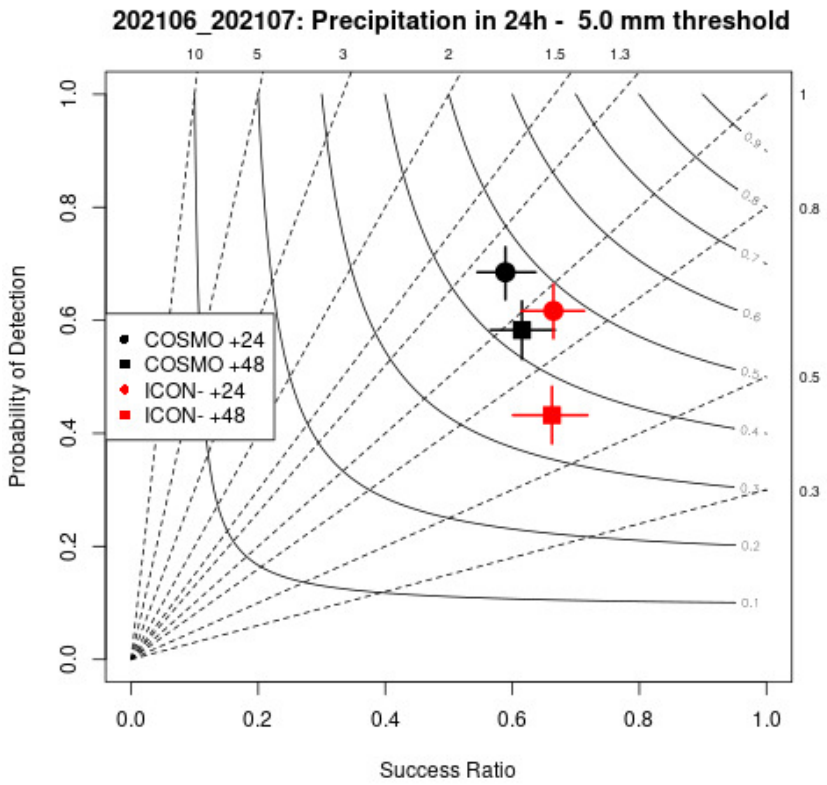
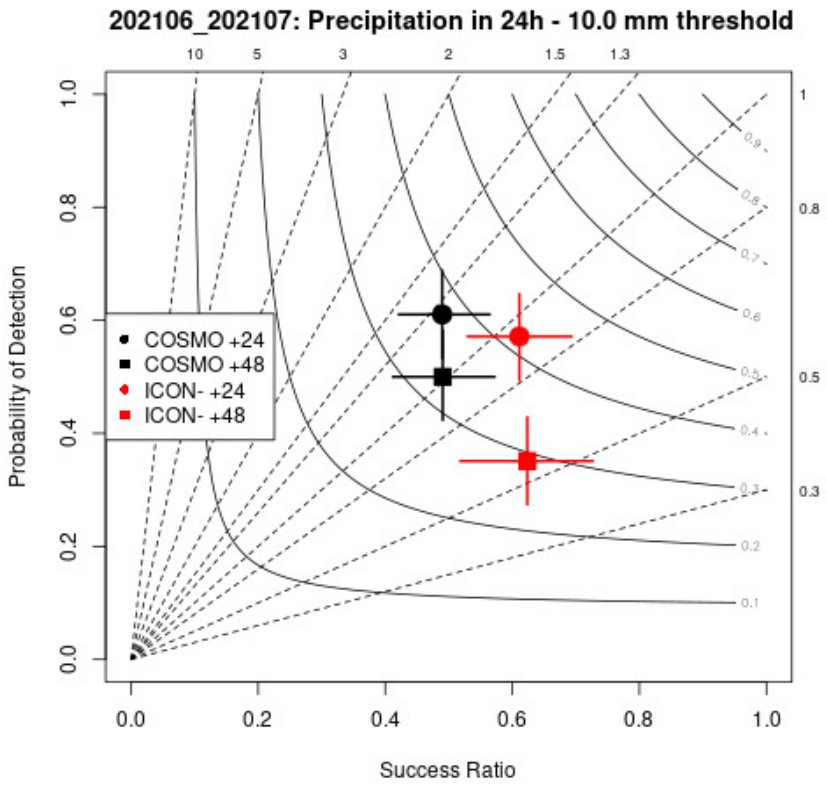
Performance diagram: 24h prec cumulated averaged over alert areas

First 24h ICON is better, not for the second 24h



First 24h ICON is better, not for the second 24h



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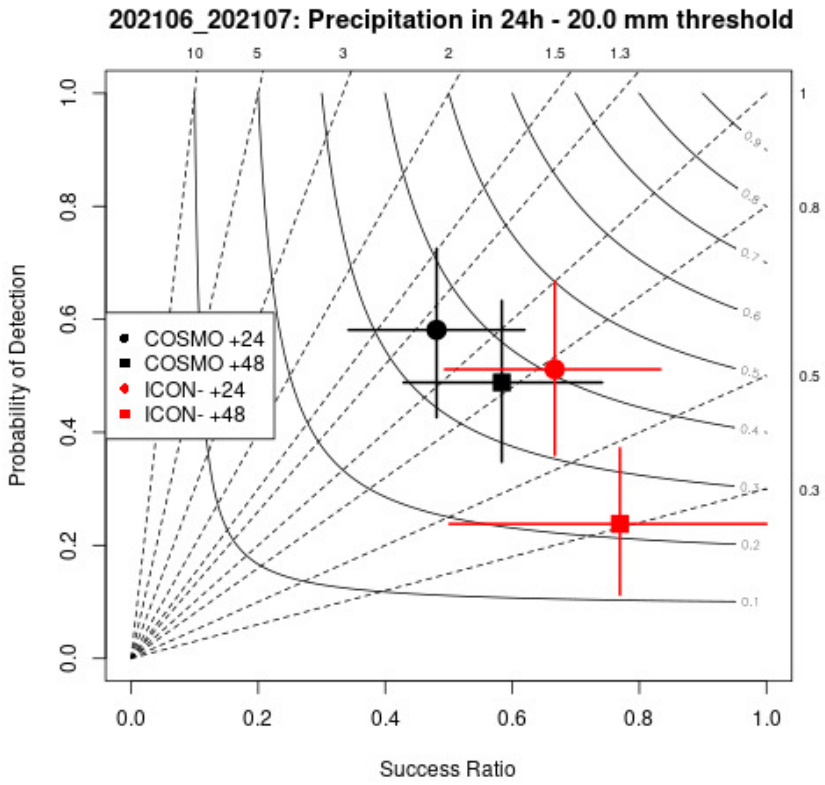
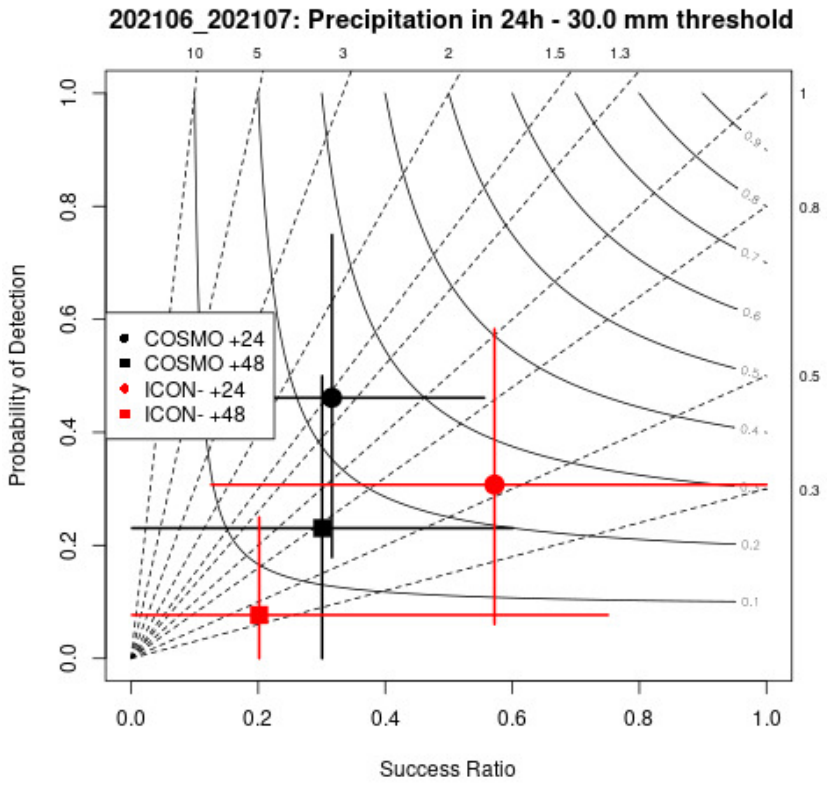
Performance diagram: 24h prec cumulated averaged over alert areas

ICON underestimates



ICON underestimates



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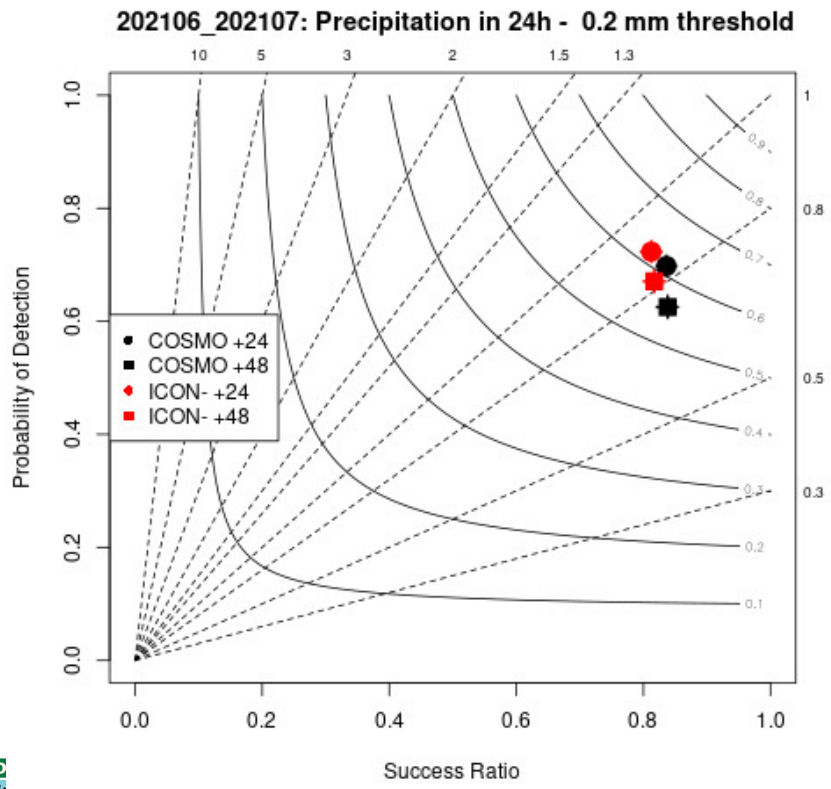
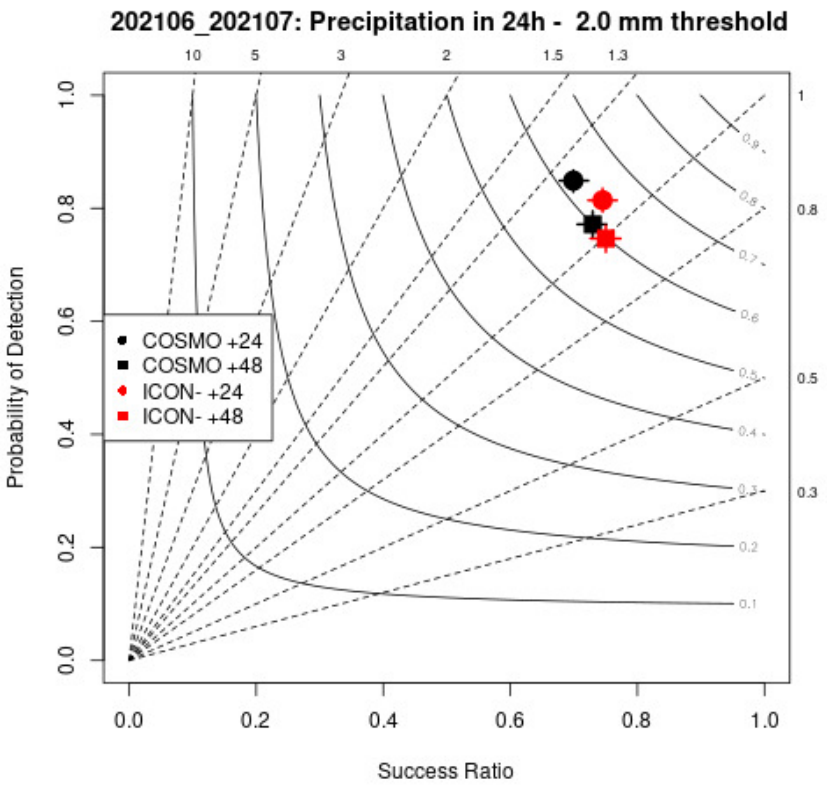
Performance diagram: 24h maximum prec over alert areas

ICON is slightly better



ICON is slightly better



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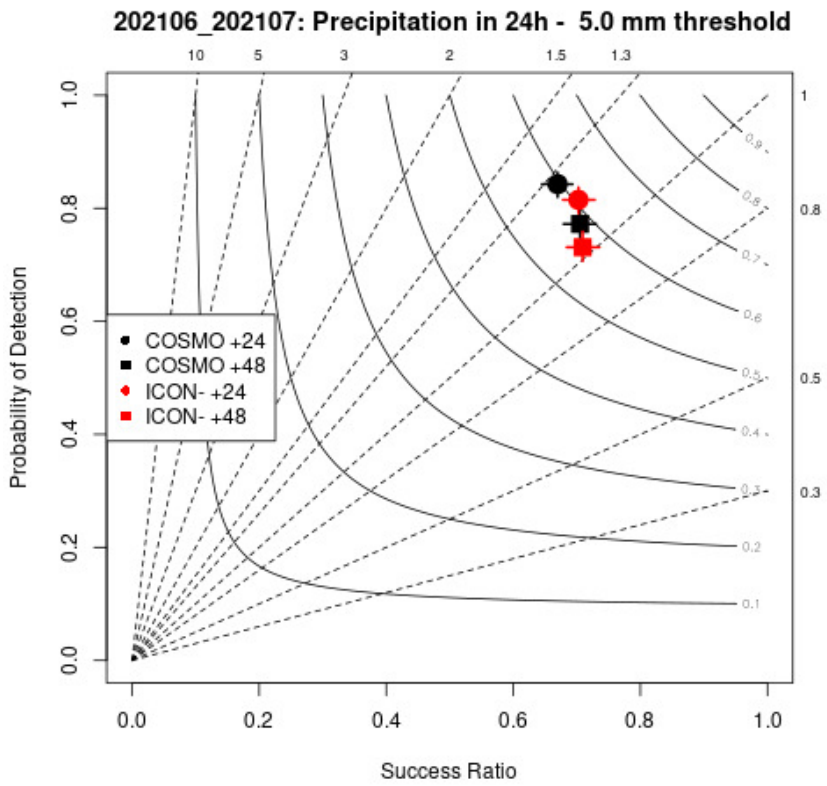
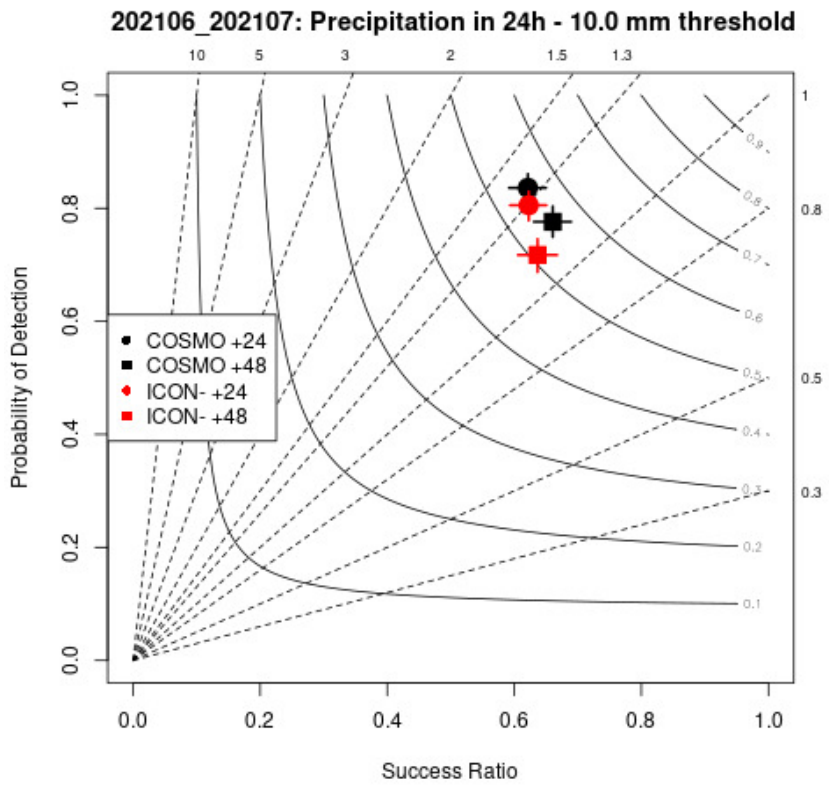
Performance diagram: 24h maximum prec over alert areas

ICON is slightly better

No improvement for ICON





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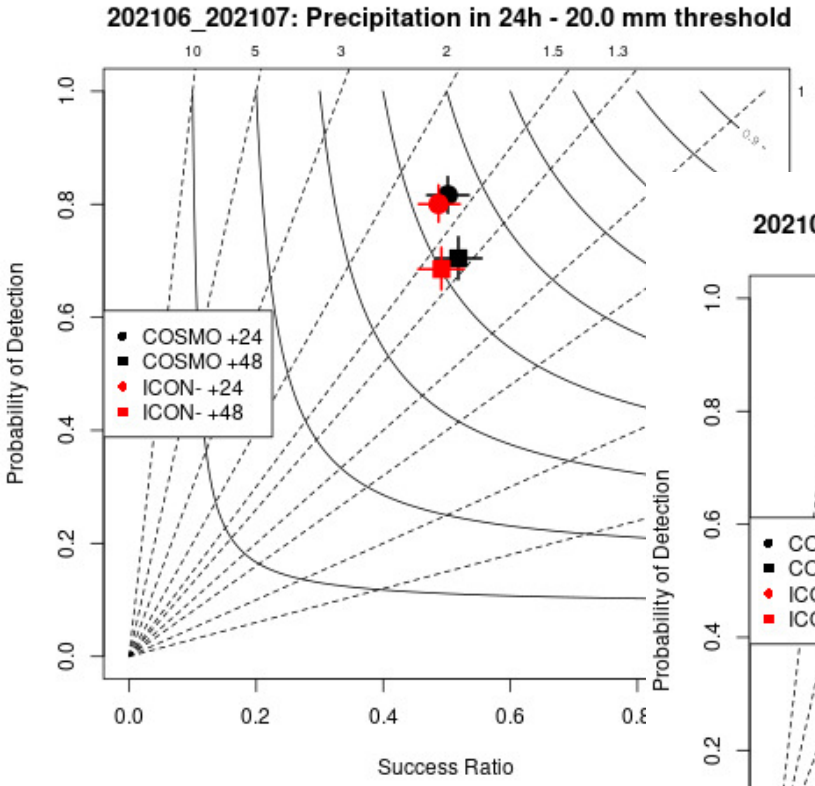
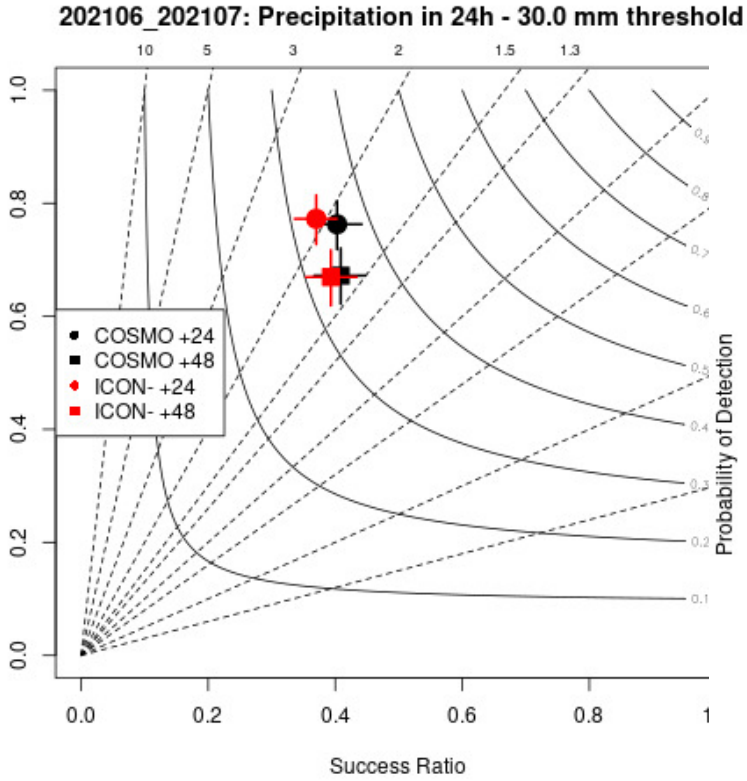
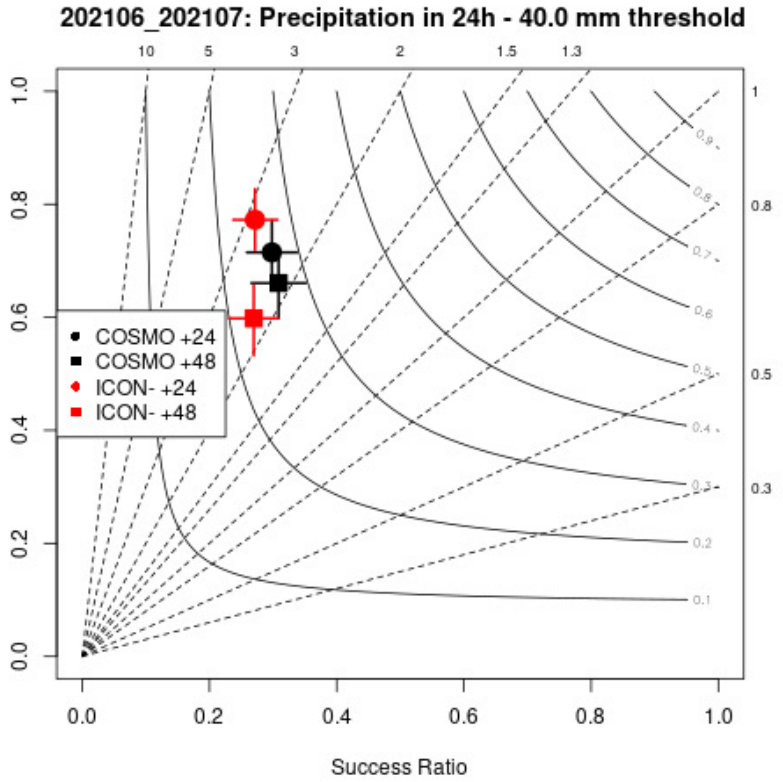
Performance diagram: 24h maximum prec over alert areas



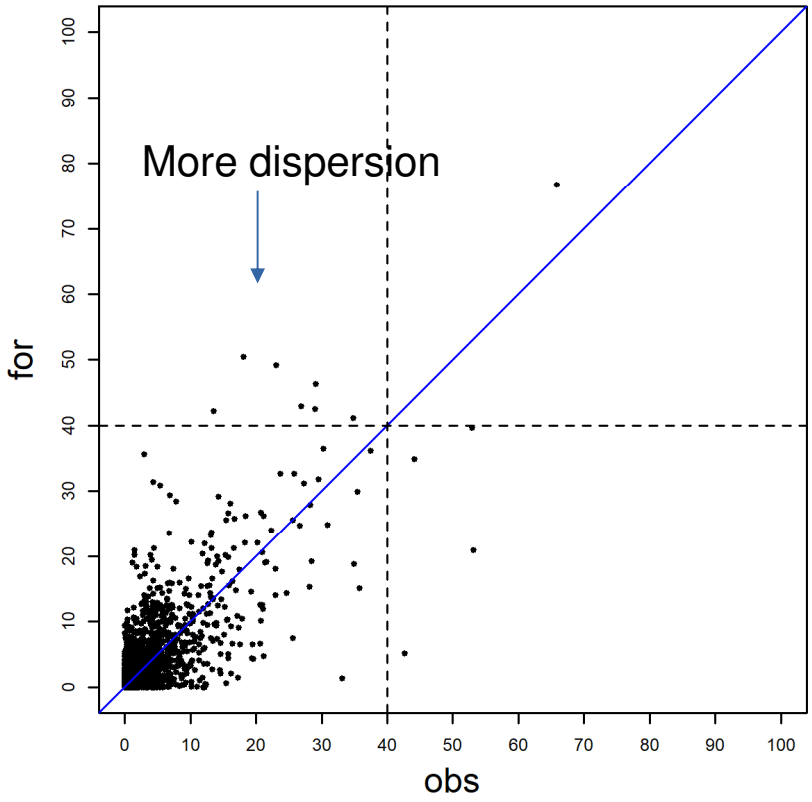




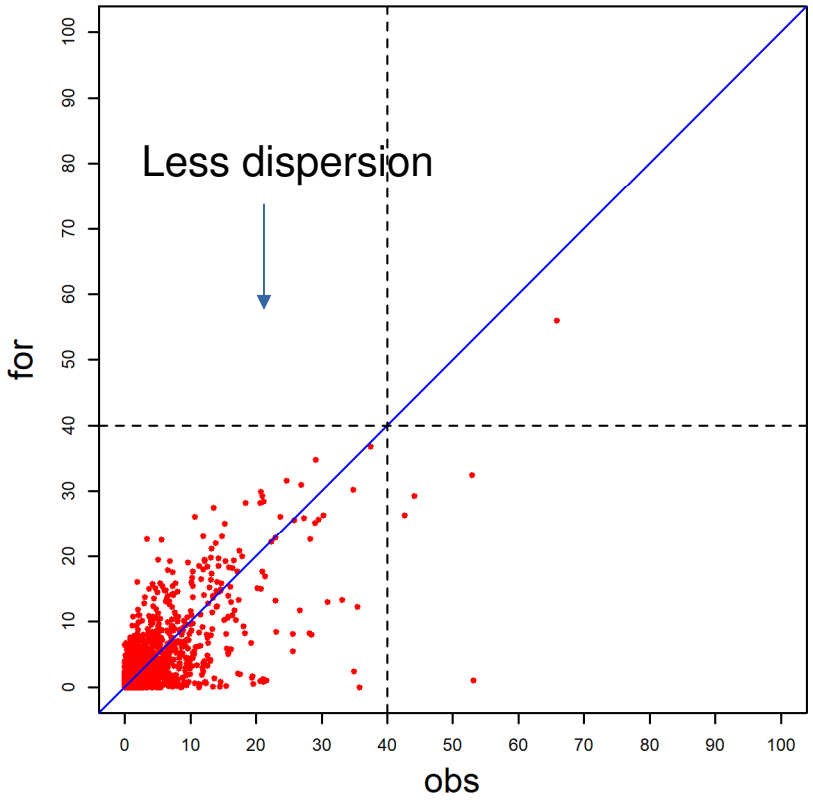
No improvement for ICON, slightly better COSMO

Scatterplot: first 24h prec cumulated averaged over alert areas

June-July '21 COSMO-2I +00/+24



June-July '21 ICON-IT +00/+24



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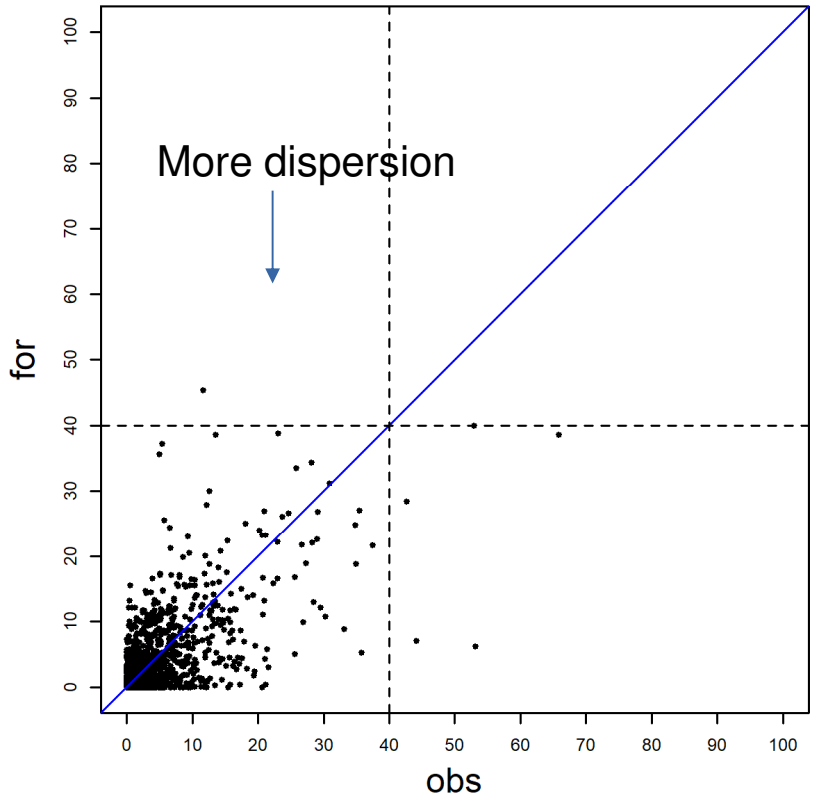
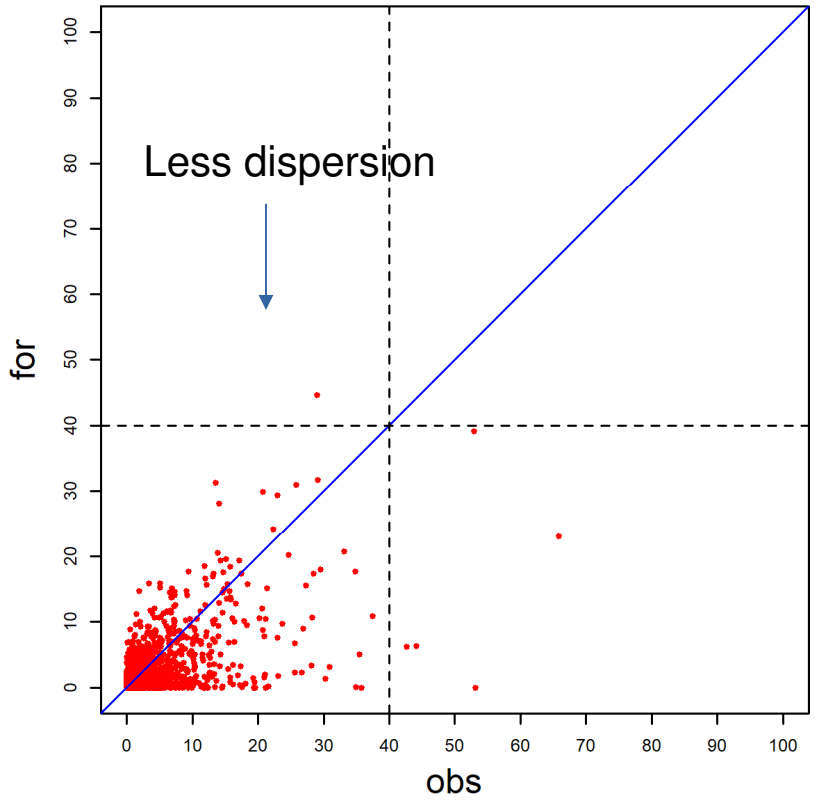
Scatterplot: second 24h prec cumulated averaged over alert areas

June-July '21 COSMO-2I +24/+48



June-July '21 ICON-IT +24/+48



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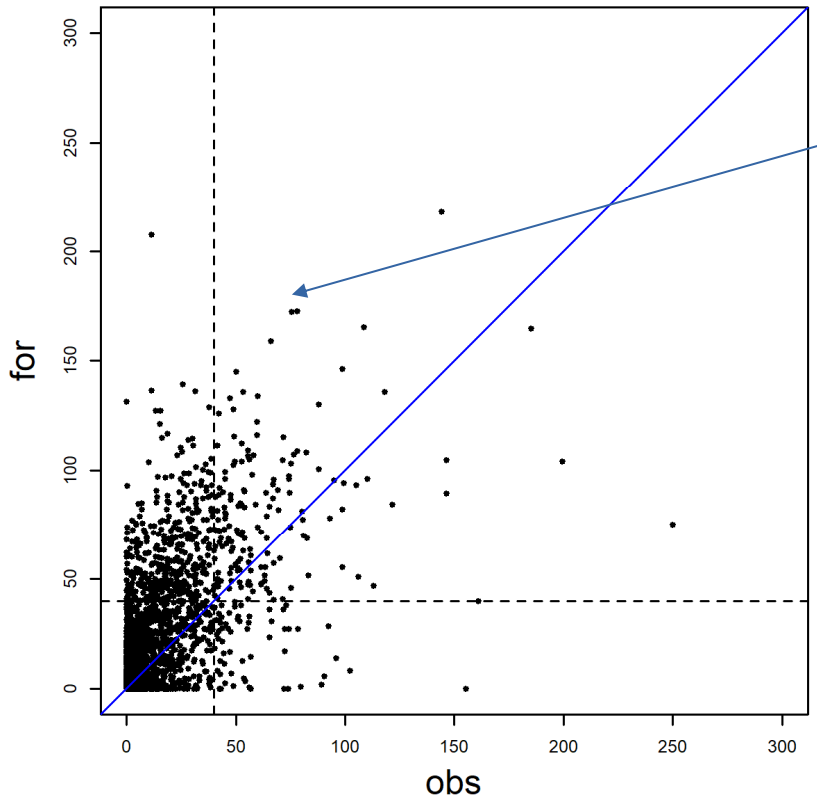
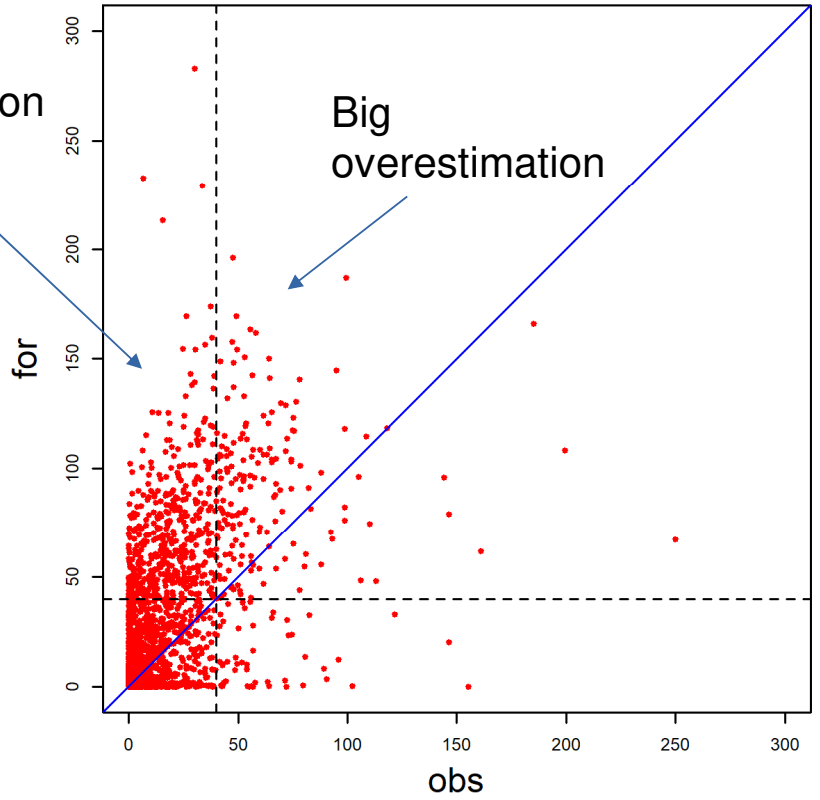
Scatterplot: first 24h maximum prec over alert areas

June-July '21 COSMO-2I +00/+24



Overestimation

June-July '21 ICON-IT +00/+24



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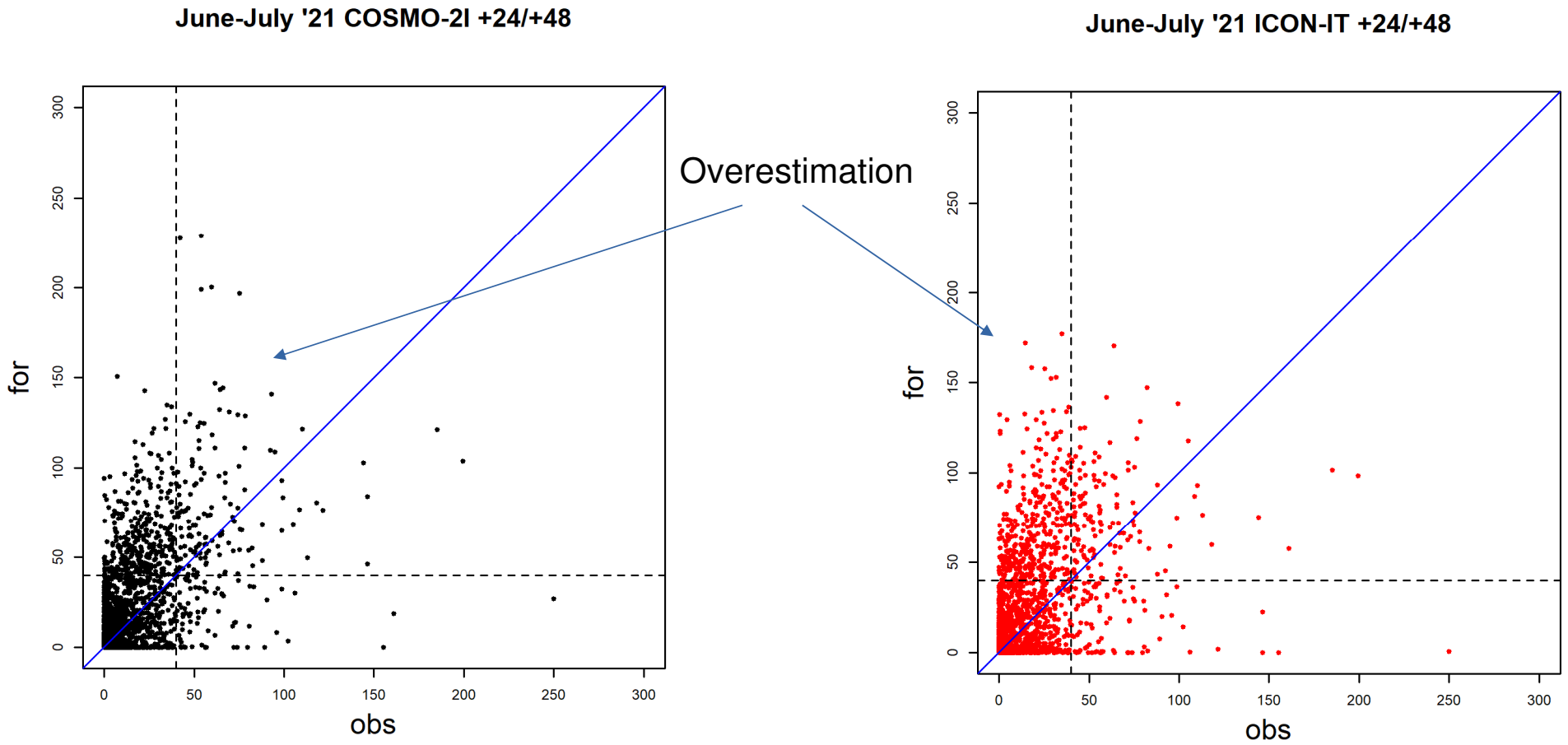
Scatterplot: second 24h maximum prec over alert areas



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Conclusions

No clear added value of ICON-IT with regard to precipitation but these are preliminary results to draft a unique conclusion: longer period should be verified

Different case studies will be considered: test by changing ICON-LAM parametrization schemes and ICBC are planned in order to calibrate the model

Verification on other variables than precipitation (T2m, RH2m, U10m, pressure, etc..) is planned

Phase 3: survey

Since **June 2021** ICON-IT is available to forecasting department of Arpa Piemonte thanks to COMET.
Results of the survey are definitely **preliminary**:

- short period
- few forecasters attended (summer, habit,..)

1.The overall ICON-LAM model guidance is estimated good and useful
2. There is an added value of ICON-LAM for predicting precipitation during thunderstorms and frontal precipitation
3. Maximum precipitation forecasts are often too high!!