VAST: past year improvements and statistics

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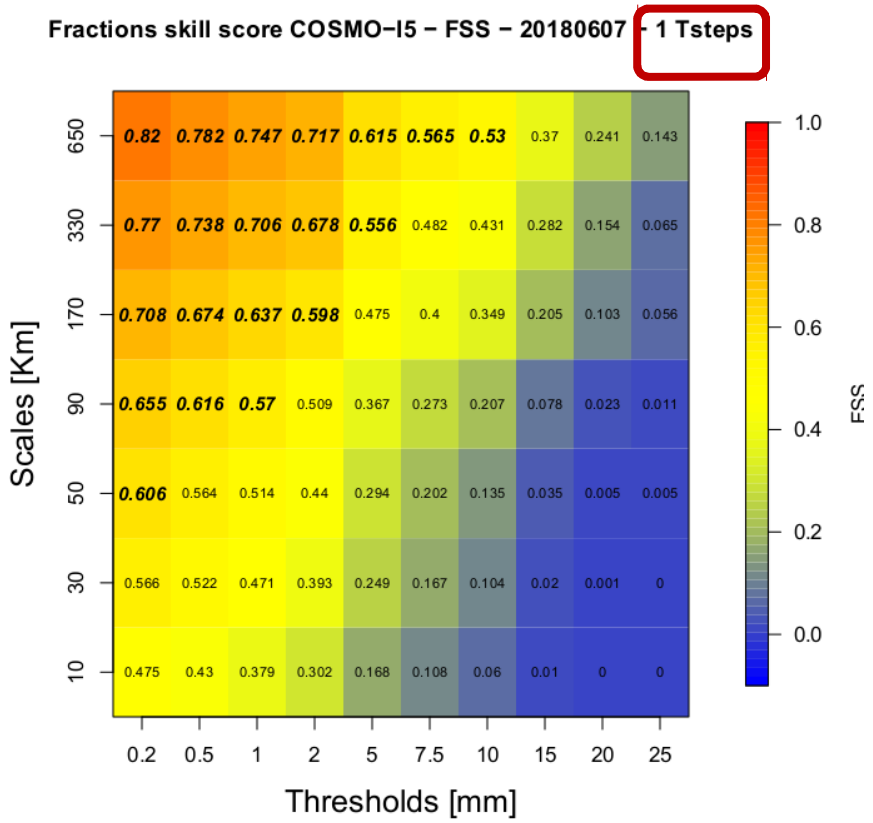
Content of the presentation

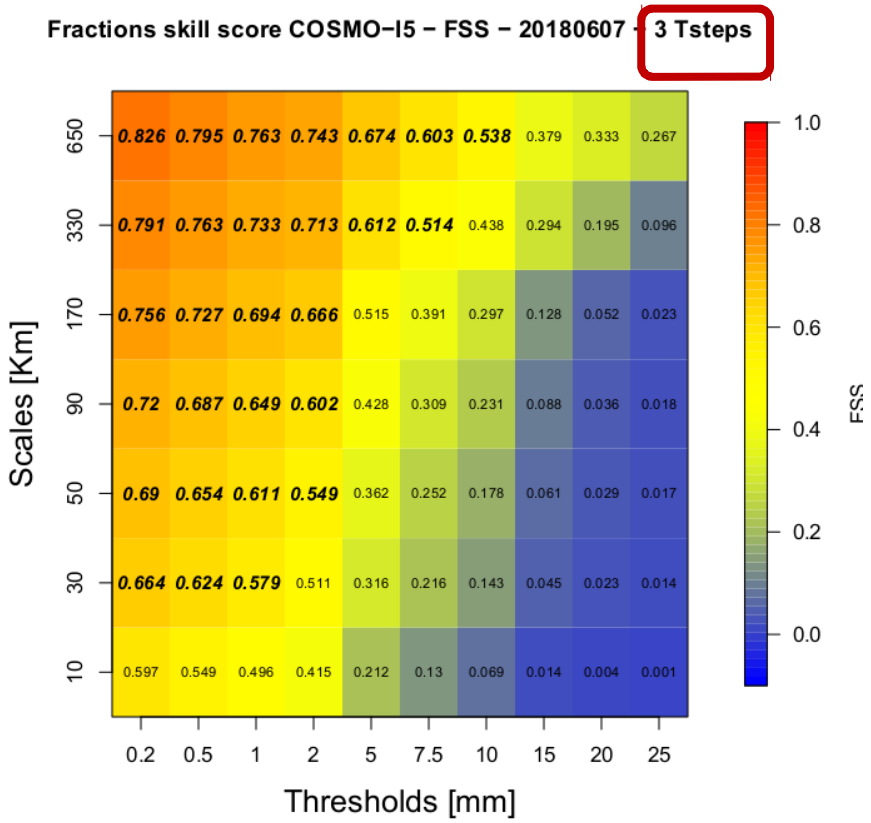
- VAST improvements: timesteps
- Statistical analysis of the FSS for COSMO I5, COSMO 2I and COSMO I2 for the months of June and July 2018.
- Comparison among the models
- Comparison between D0 and D1
- Comparison between 1 and 3 timesteps
- Comparison between COSMO 2I and COSMO I2 at their own resolution (1 timestep)

VAST improvements: 1 vs 3 timesteps

- Implemented in VAST version 2.0 beta
- The user has the possibility to produce the verification using more than one observation/forecast timestep
- At the moment all the timesteps must be available (no time gaps in data)
  - If not, wrong scores will be produced
- The number of timesteps used for the verification can be set in «input_fuzzy.nml», variable «n_timesteps»
  - The value must be an odd number:
    - 1 => only current timestep (2D verification, same as previous VAST versions)
    - 3 => previous one, current, following one
    - 5 => previous two, current, following two
    - …
  - ATTENTION: the higher the number, the slower the process!

Example: 1 vs 3 timesteps (2018/06/07 COSMO I5 D0)





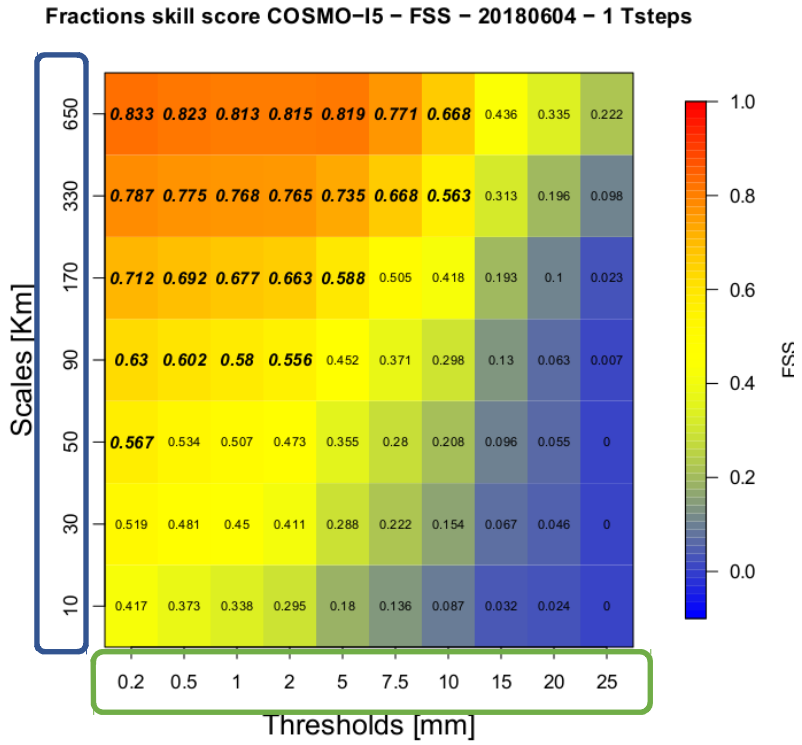
VAST statistics – June/July 2018

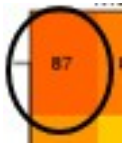
- Uses data coming from the fuzzy verification of numerical weather prediction models used by Arpa Piemonte to produce operative forecast
- INPUT data:
  - Forecast: COSMO I5, COSMO 2I, COSMO I2
  - Observation: Italian radar composite estimated precipitation (source: Department of Civil Protection)
- Days with convective precipitation, at least one Civil Protection alert and radar/model data availability
- Used fuzzy verification outputs: FSS, FAR, POD

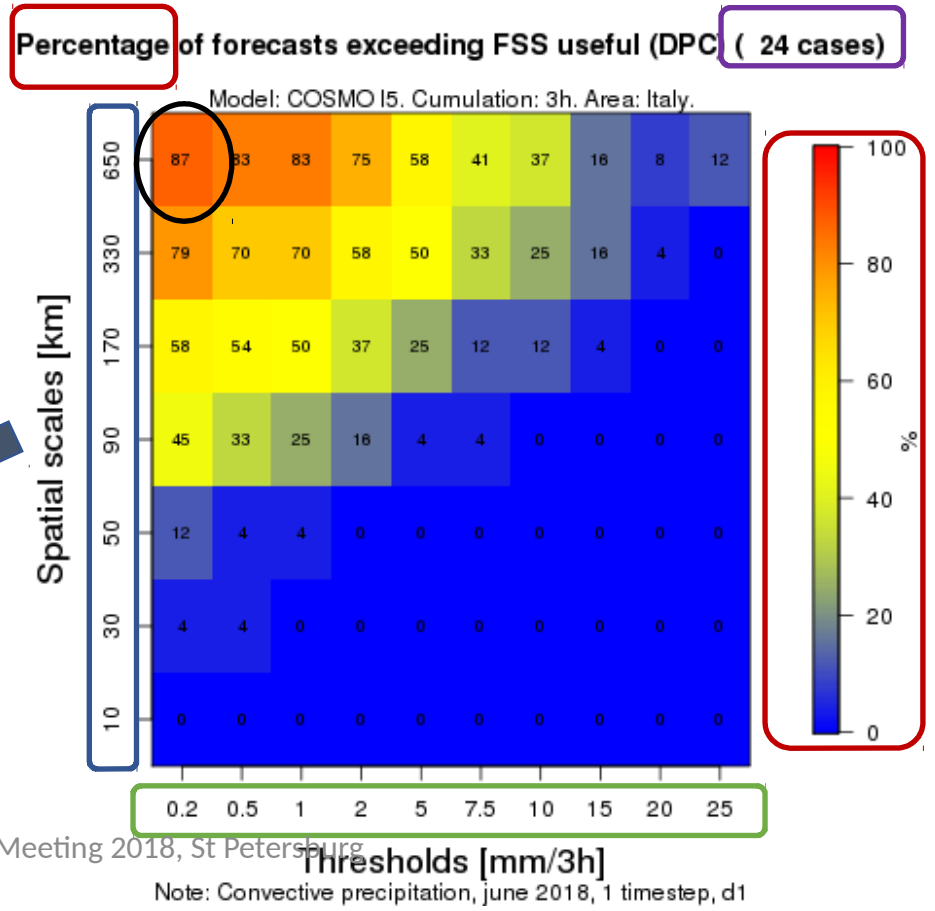
Methodology - FSS

- The starting point is the typical VAST FSS output
- The statistical FSS results shown in the presentation are calculated from the single FSS plot
- For each threshold/spatial scale the value the following percentage has been calculated:

$$\% = \left(\frac{FSS_{useful}}{number\ of\ cases} \right) * 100$$



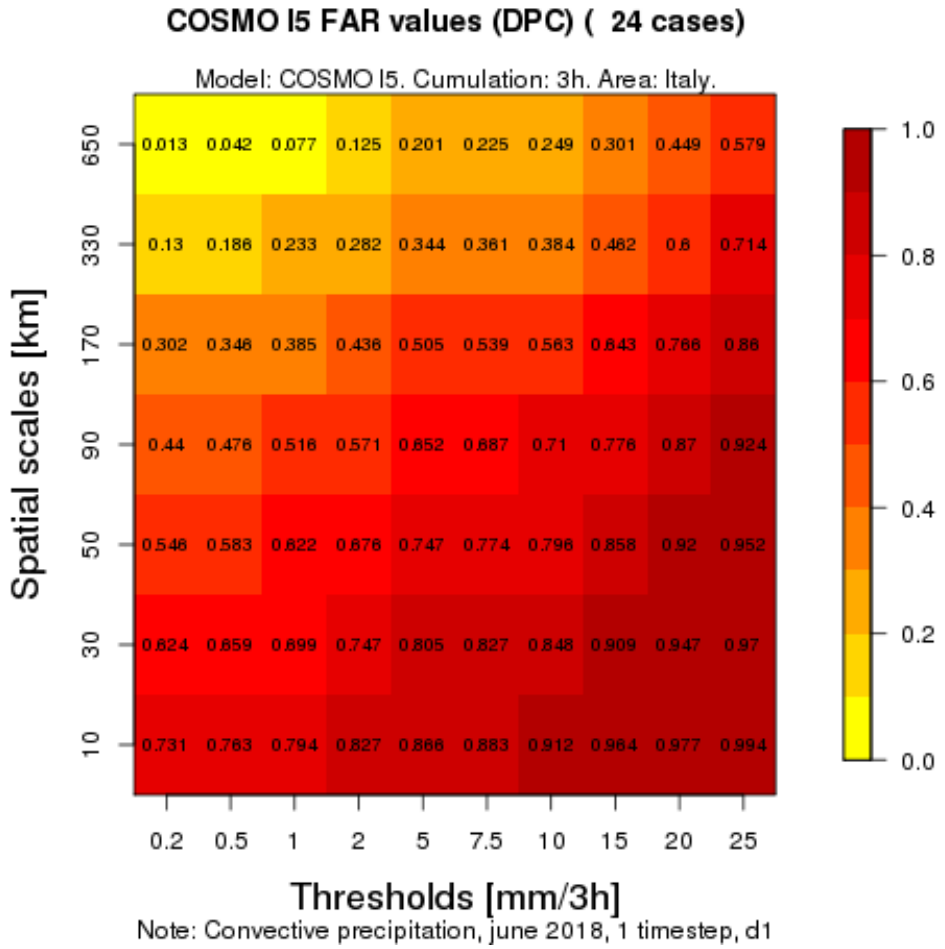




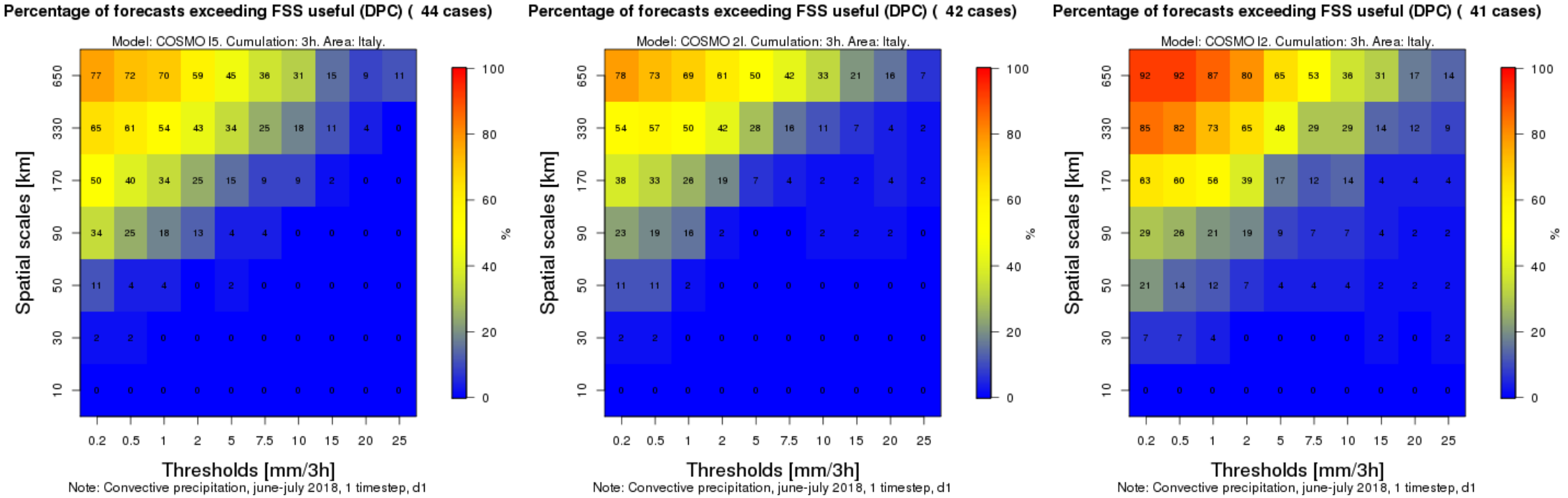
- Same spatial scales and thresholds as «single case» FSS
- Up right corner: number of cases
- Color scale: percentage
- %FSS_{useful} for spatial scale 650x650 km, precipitation exceeding 0.2 mm/3h

Methodology - POD and FAR

- For both POD and FAR a contingency table has been created containing data from all the case studies
- Same spatial scales and precipitation thresholds as single case study plots
- Each number indicates the FAR (or POD) calculated over all the case studies for that spatial scale and precipitation exceeding that threshold.

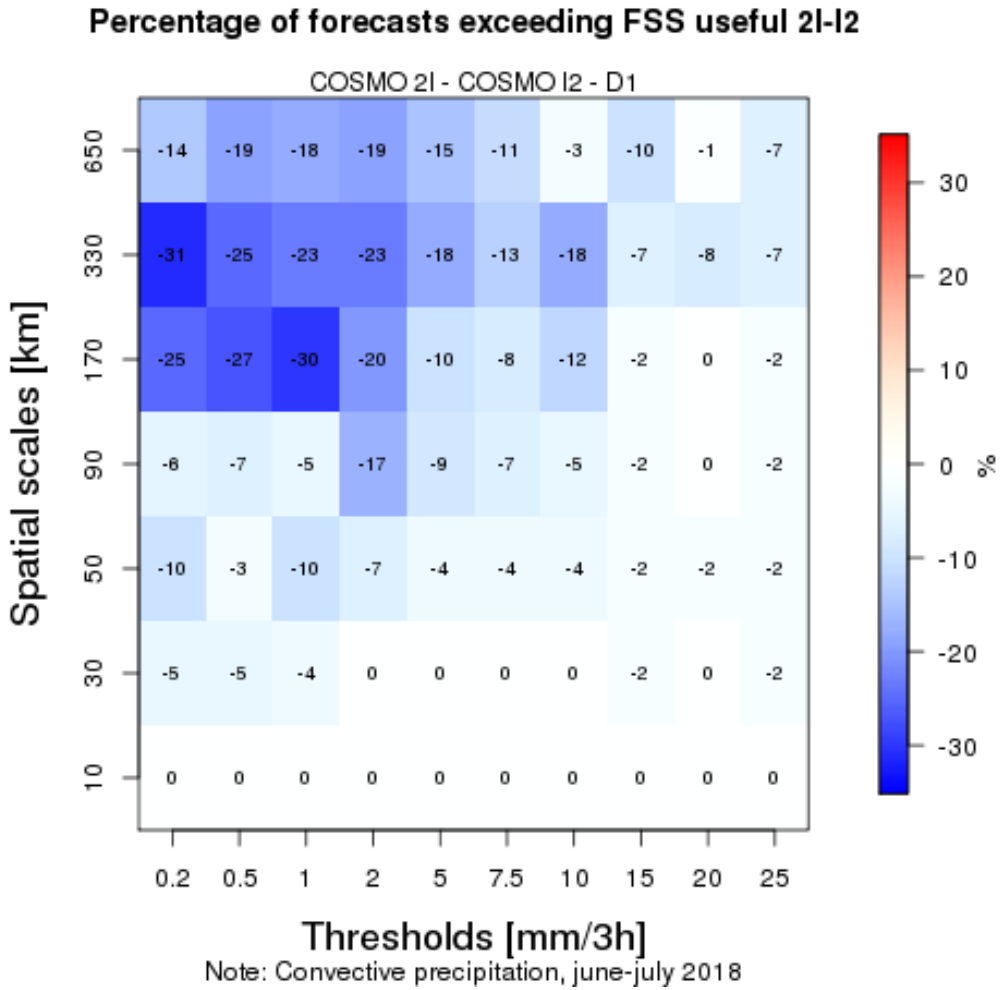


JJ 2018 – D1 – 1 timestep – 10x10km grid

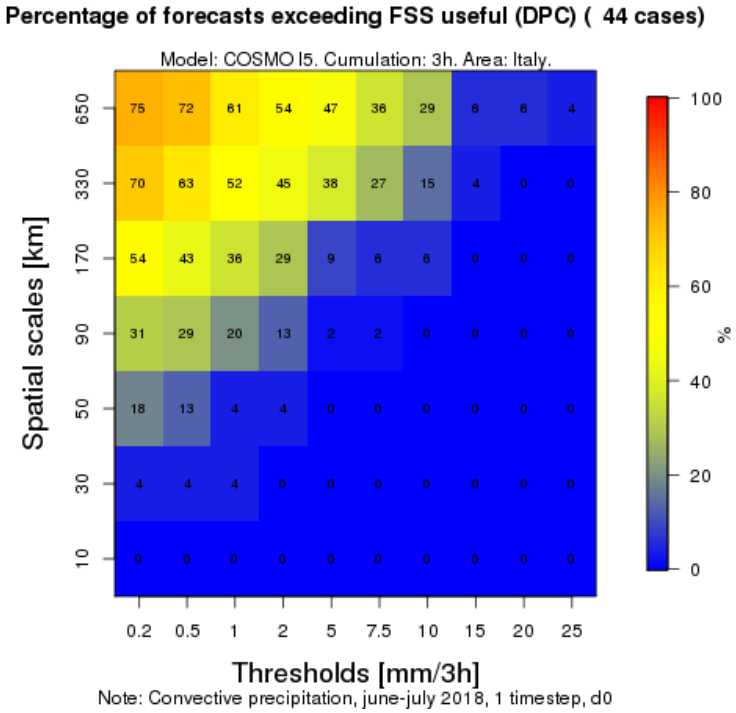


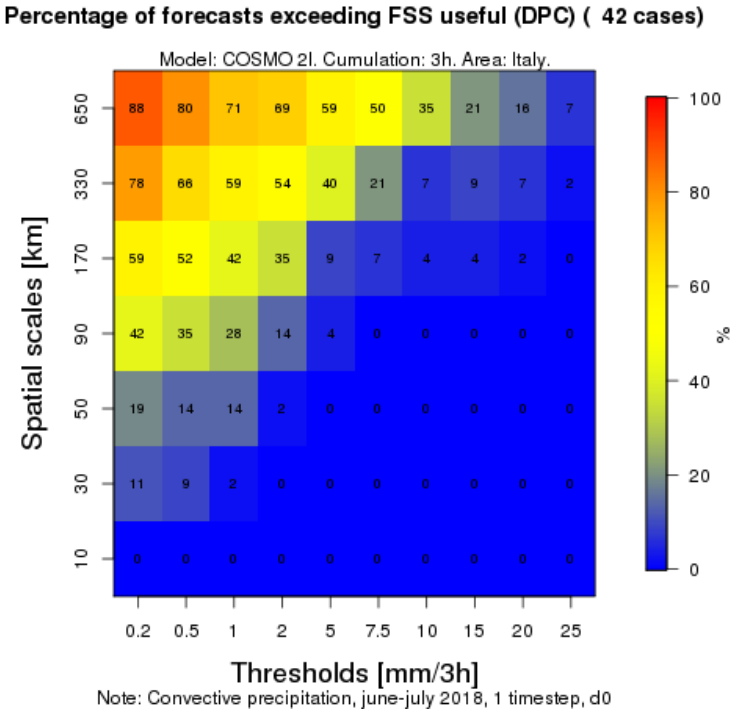
Best performances for COSMO I2 for all spatial scales and all precipitation thresholds .
Very similar performance for COSMO I5 and COSMO 2I.

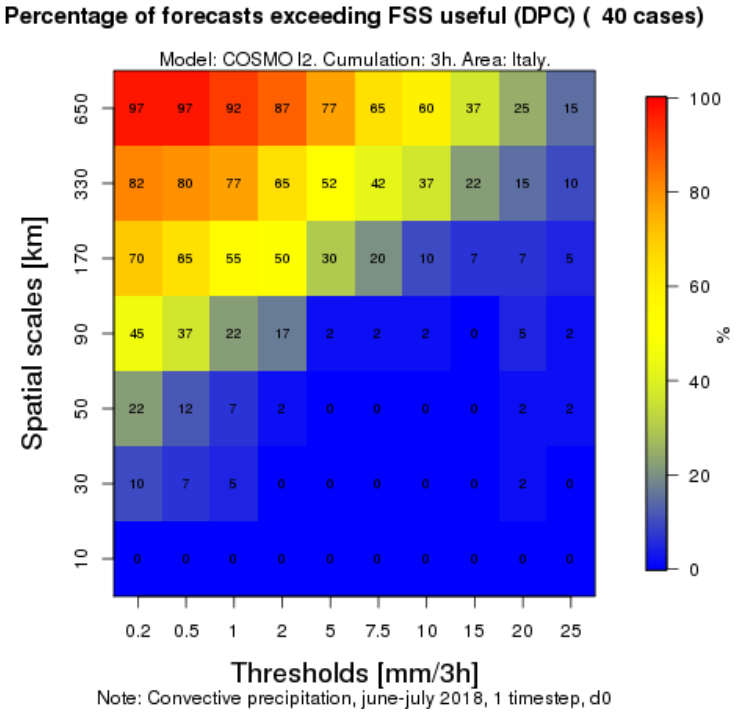
JJ 2018 – D1 – (COSMO 2I – COSMO I2) – 10x10km grid



JJ 2018 – D0 – 1 timestep – 10x10km grid

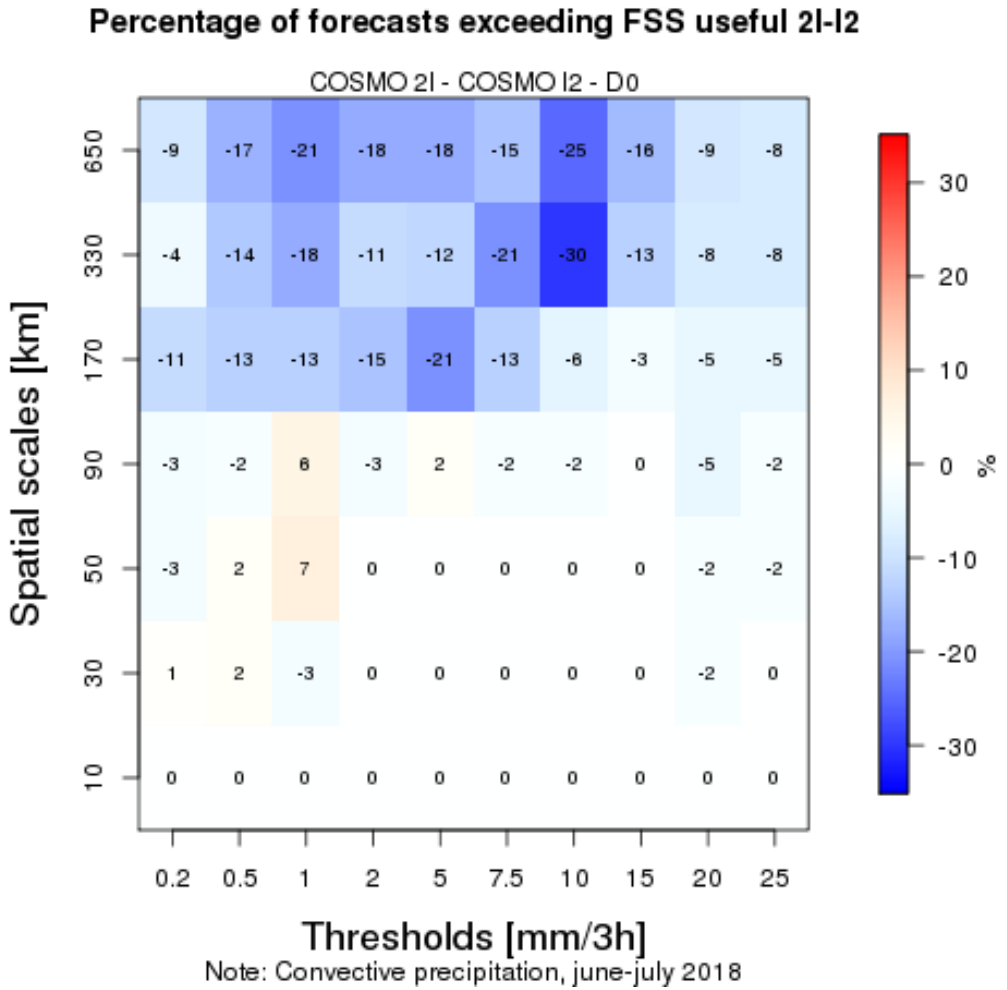






Best performances for COSMO I2 for almost all spatial scales and precipitation thresholds.
Worst performance for COSMO I5 (all scales, all thresholds).

JJ 2018 – D0 – (COSMO 2I – COSMO I2) – 10x10km grid



Three timesteps

- The following plots reproduce the same results shown before, but with a 3D approach
- The verification is based on a 3D box containing all the grid points falling in the selected area for the current time step, the previous one and the following one.
- If the results are very different from the previous ones the verification may enhance a difficulty for the models to correctly locate the the precipitation in space or time.
- 1 VS 3 timestep comparison is shown

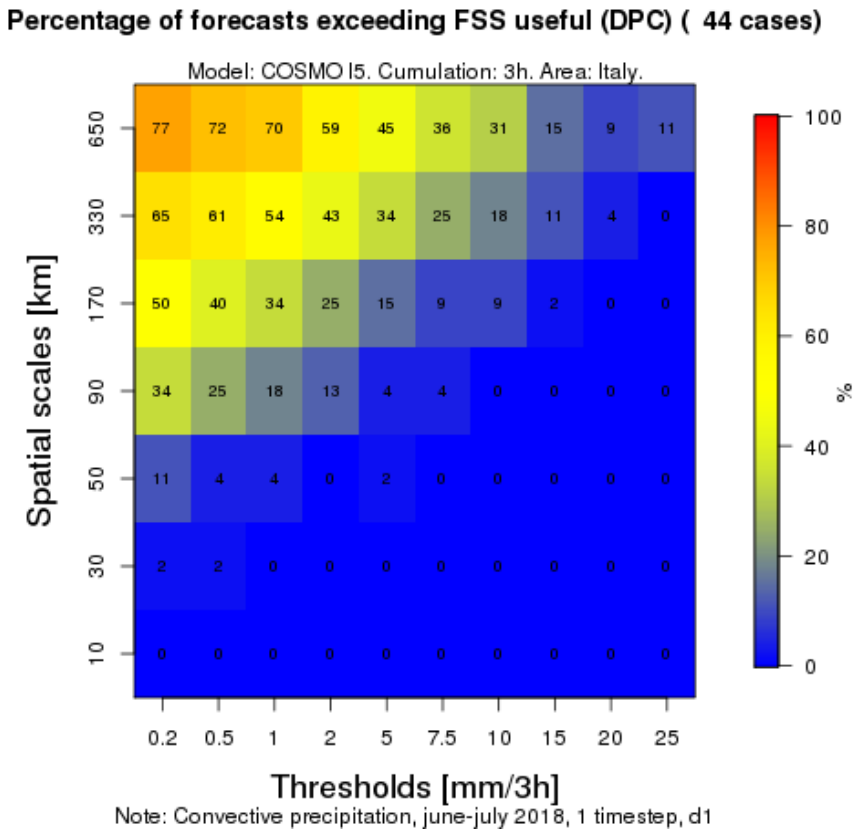
How to read 3 timesteps – 1 timestep comparison

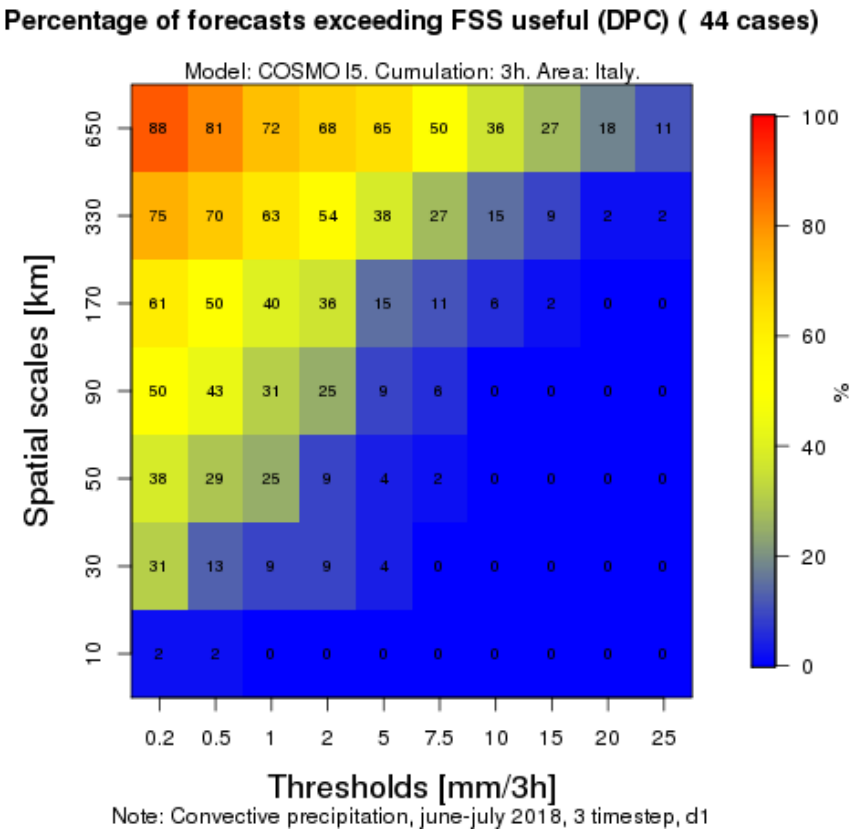
- 2D (1 timestep) good, 3D (3 timesteps) good: Good space/time location
- 3D better than 2D: Bad time location
- 2D better than 3D: Bad spatial location/different spatial extension.
- 2D bad, 3D bad: Bad space/time location

USUAL BEHAVIOUR

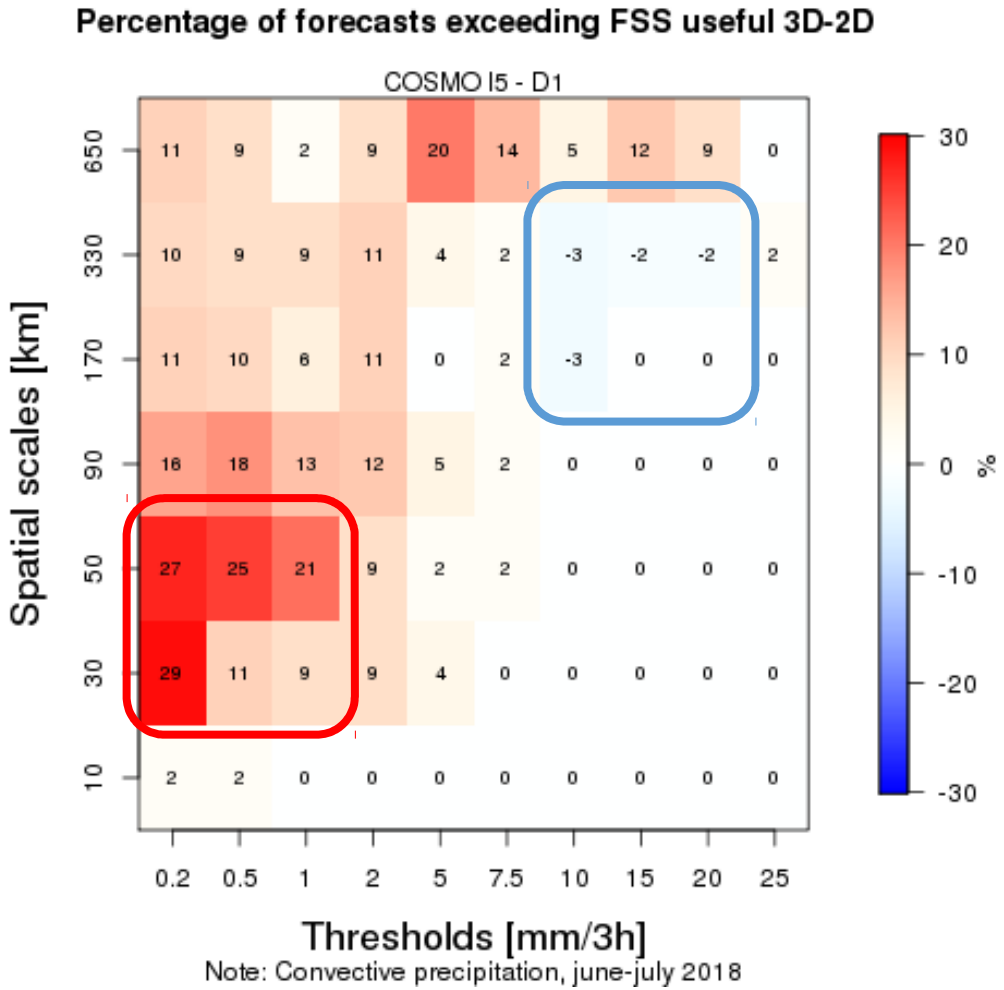
- 3D generally better for low to medium precipitation thresholds at all spatial scales
- 3D generally better for very large spatial scales for all thresholds
- 2D may be better for medium spatial scales/medium-high thresholds

JJ 2018 – D1 – 1 vs 3 timesteps – COSMO I5

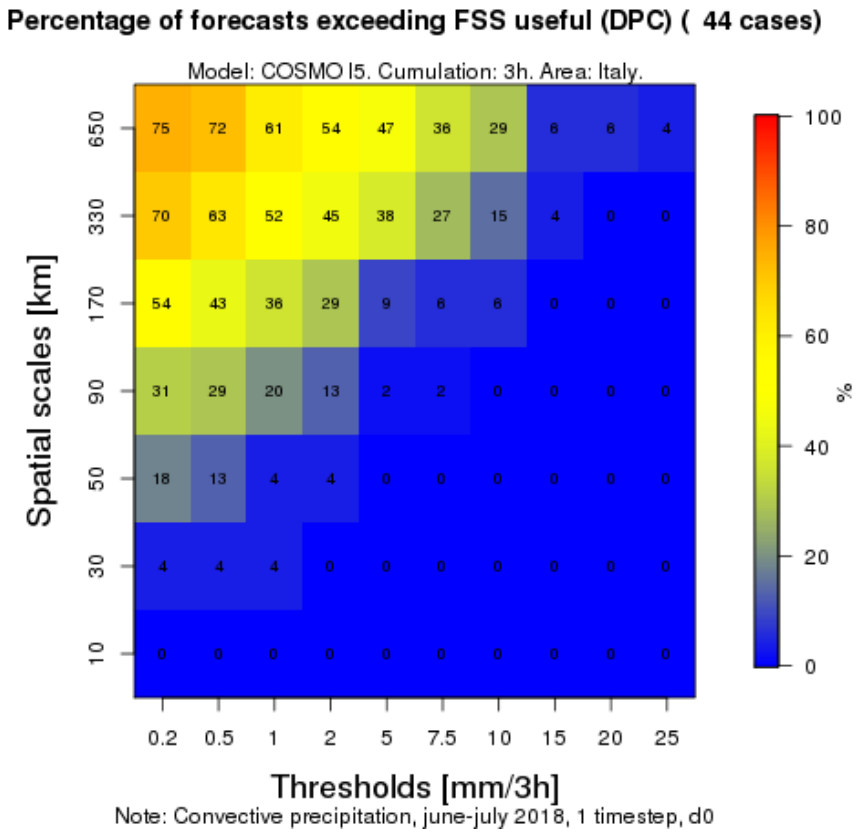


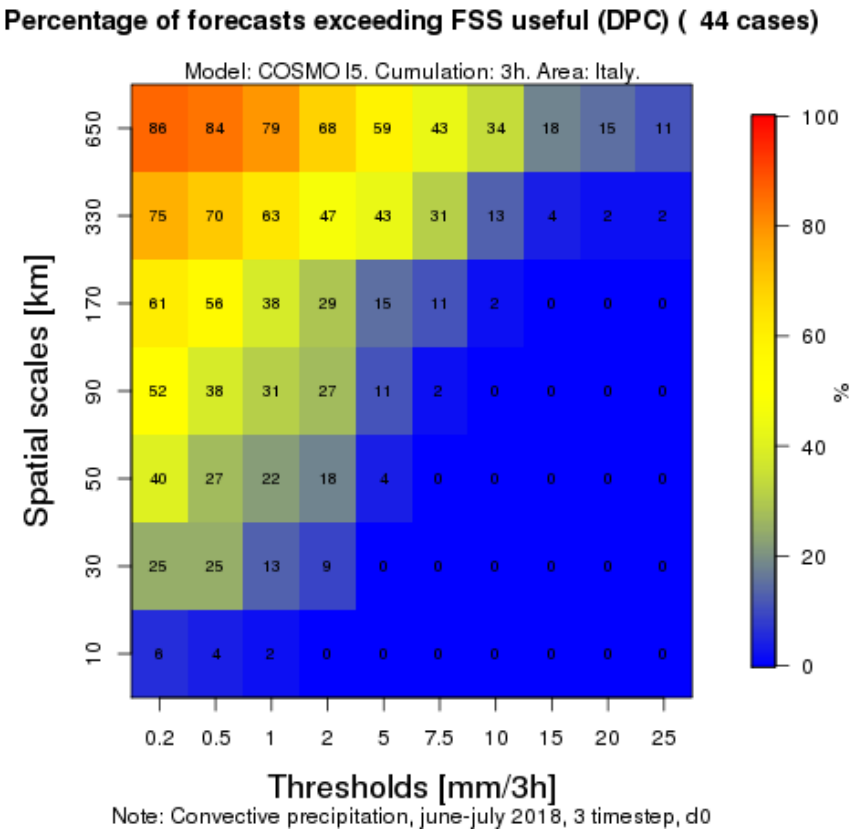


JJ 2018 – D1 – (3-1) timesteps – COSMO I5

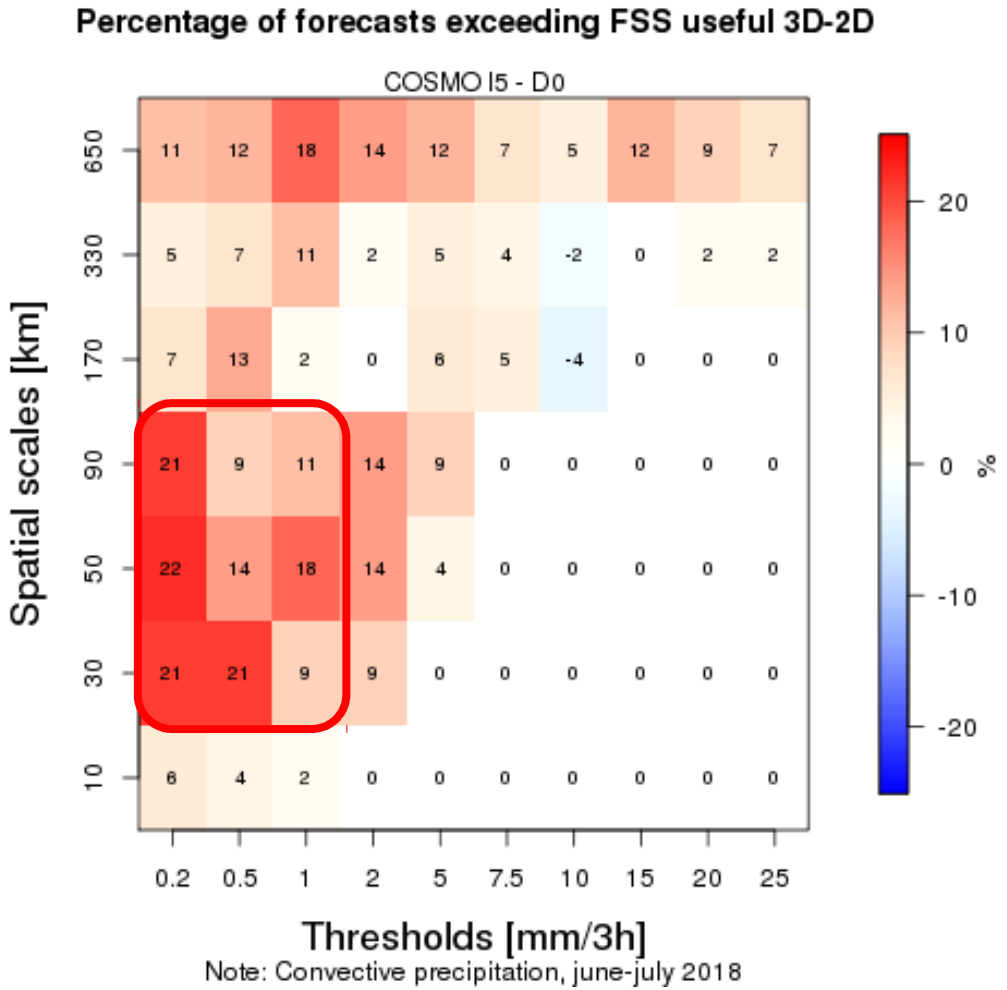


JJ 2018 – D0 – 1 vs 3 timesteps – COSMO I5

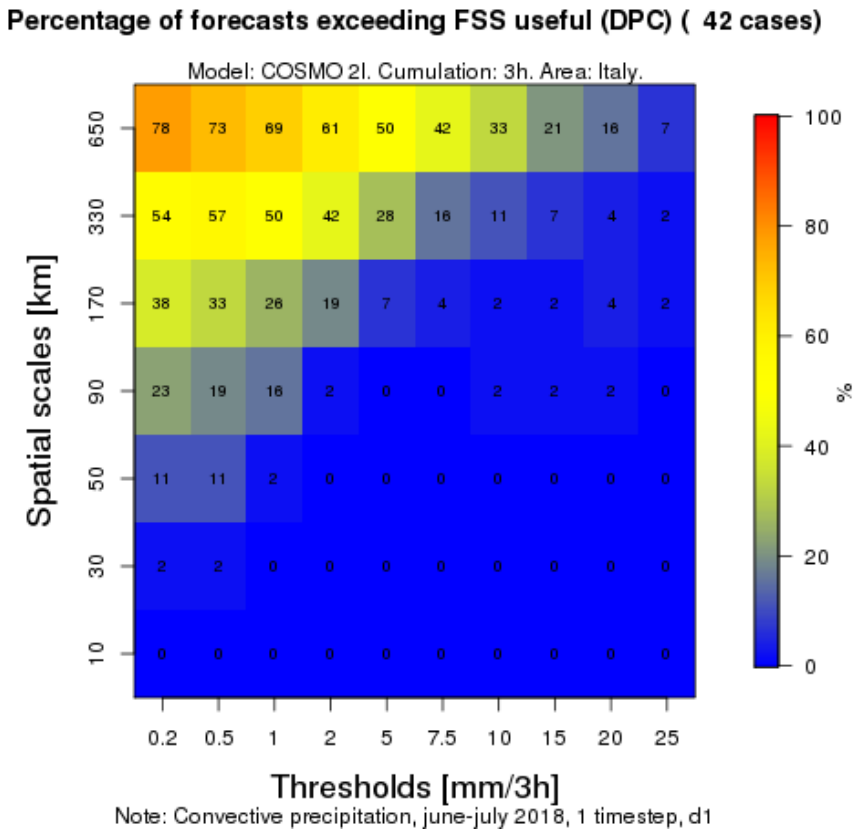


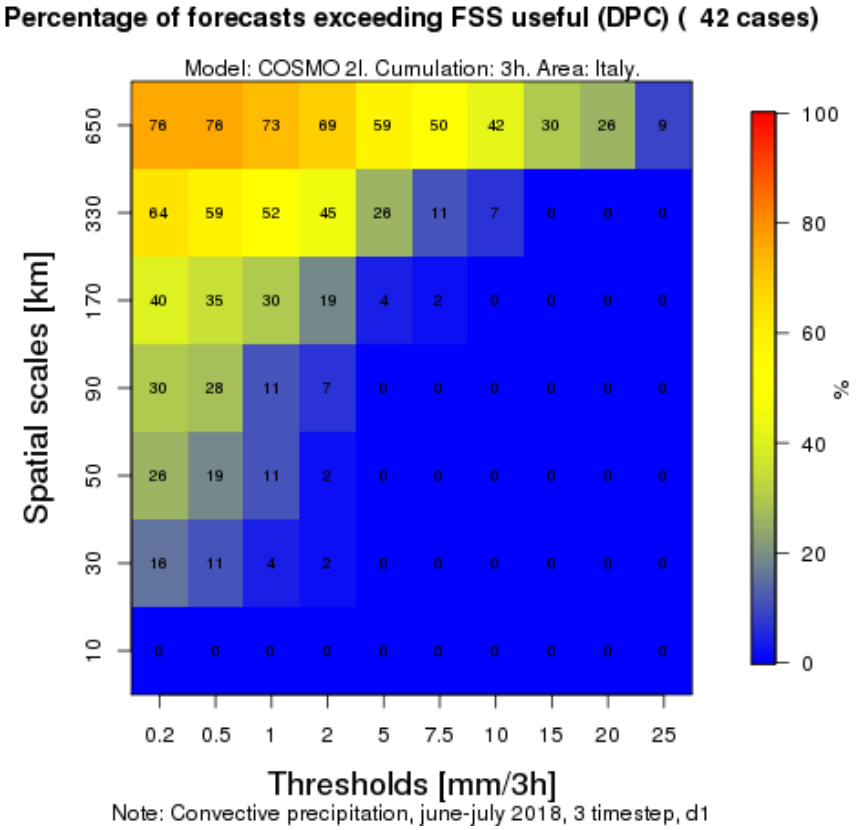


JJ 2018 – D0 – (3-1) timesteps – COSMO I5

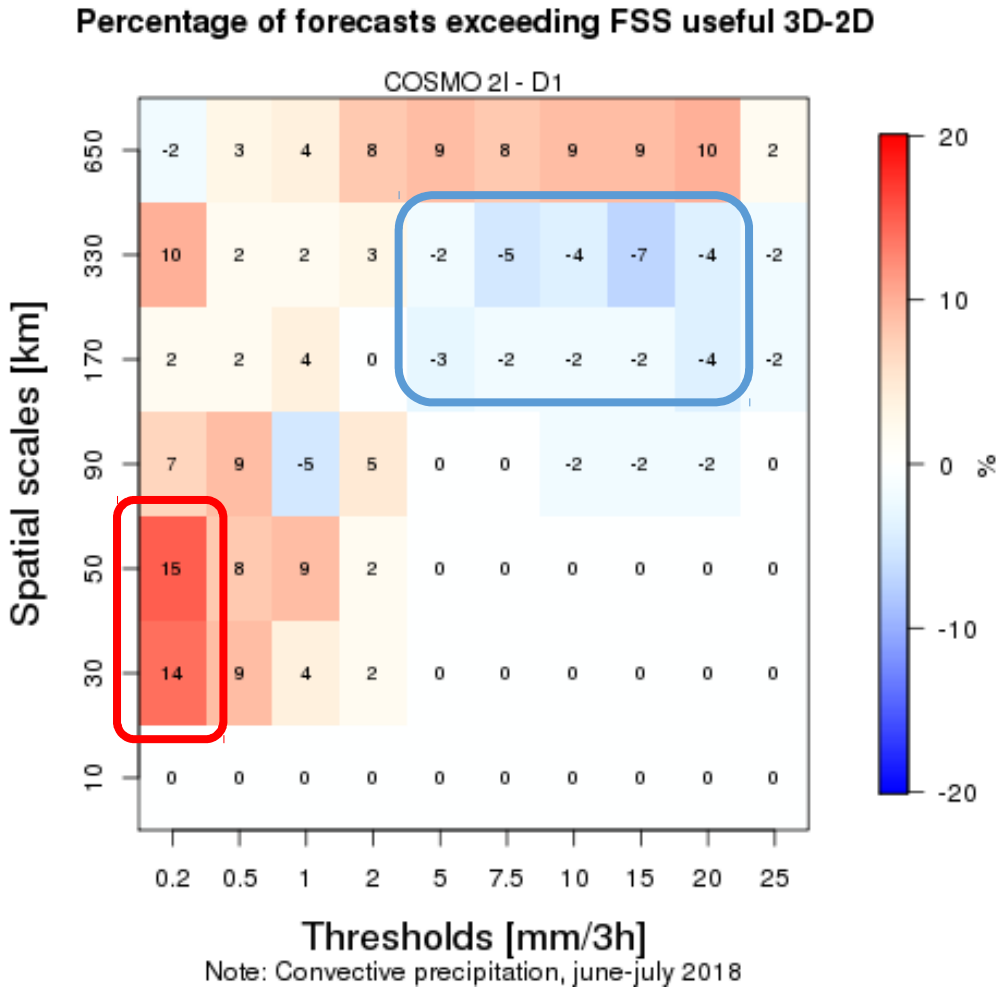


JJ 2018 – D1 – 1 vs 3 timesteps – COSMO 2I

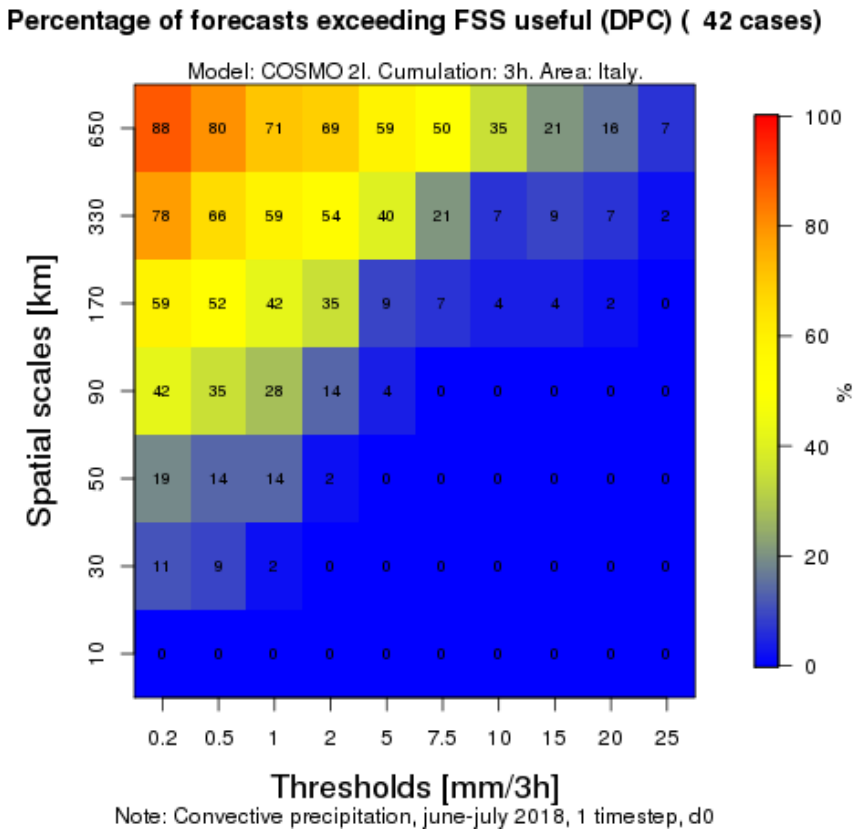


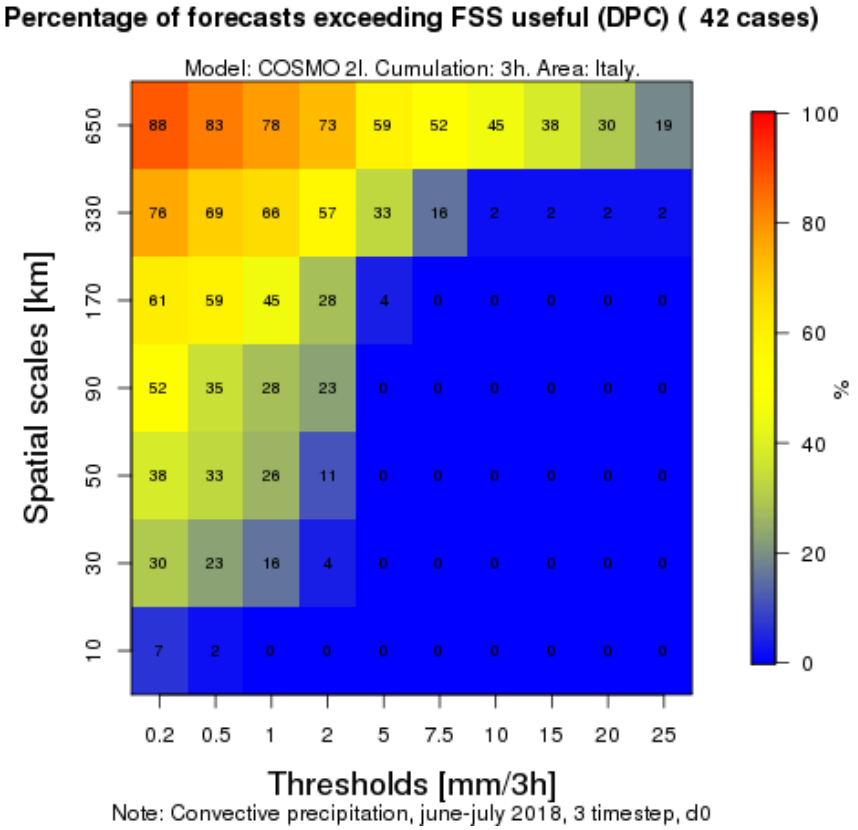


JJ 2018 – D1 – (3-1) timesteps – COSMO 2I

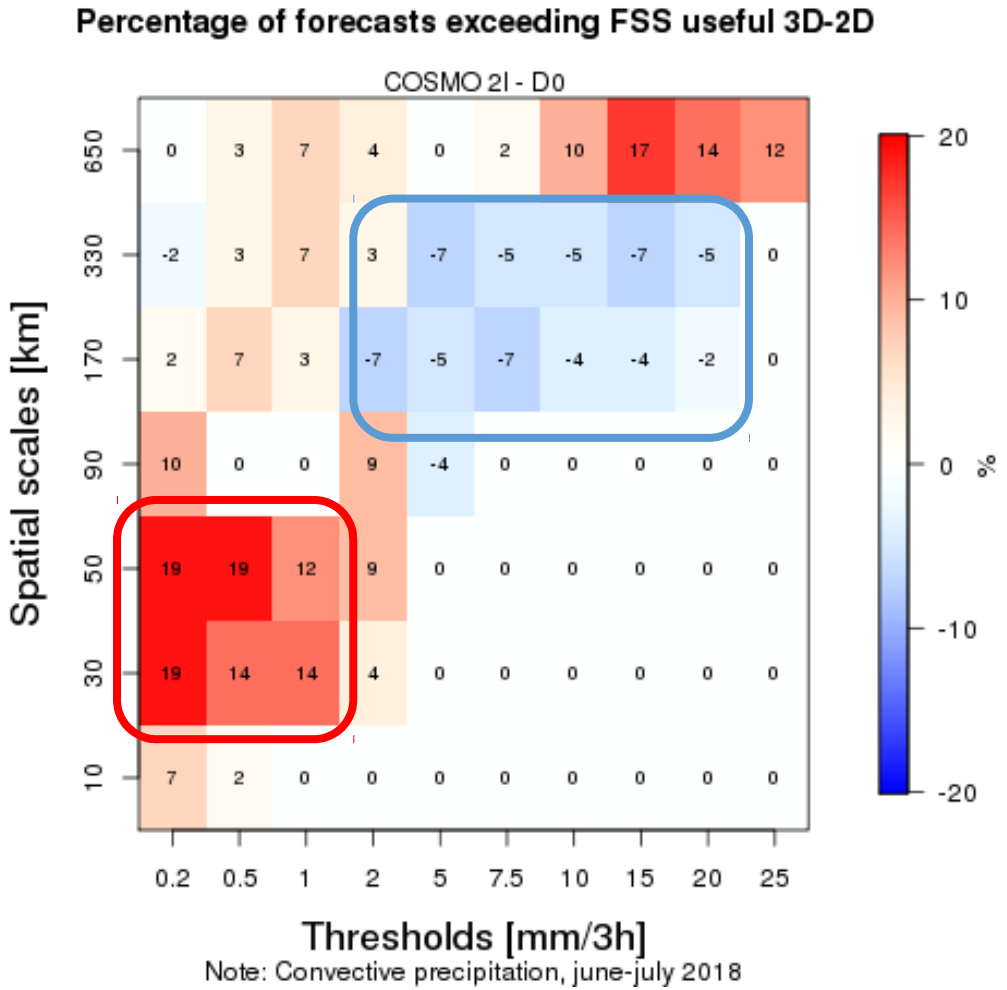


JJ 2018 – D0 – 1 vs 3 timesteps – COSMO 2I

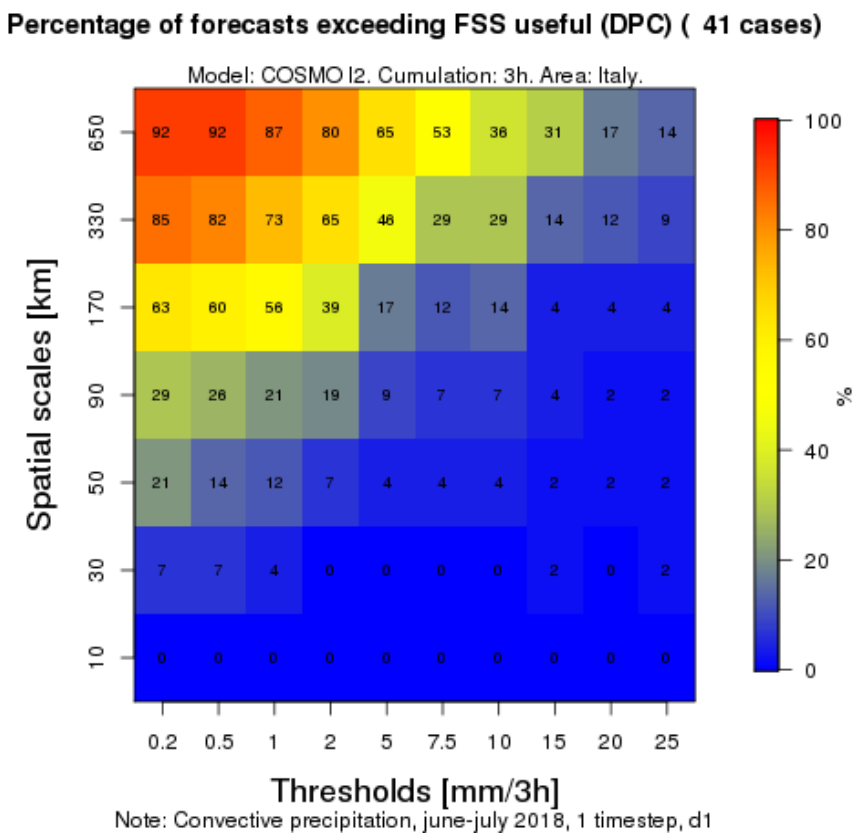


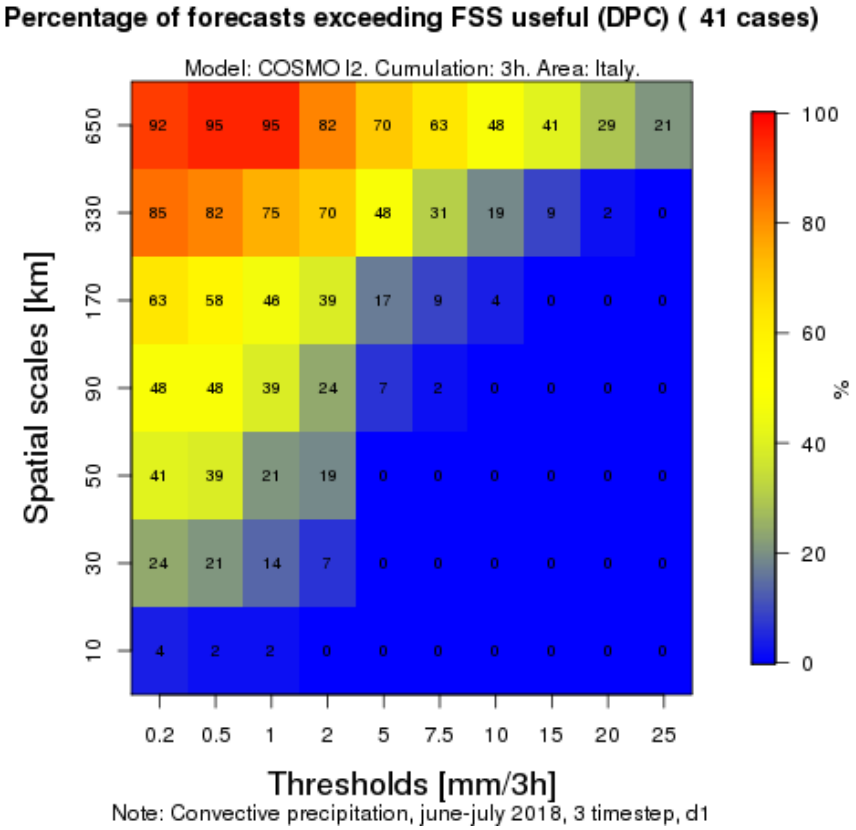


JJ 2018 – D0 – (3-1) timesteps – COSMO 2I

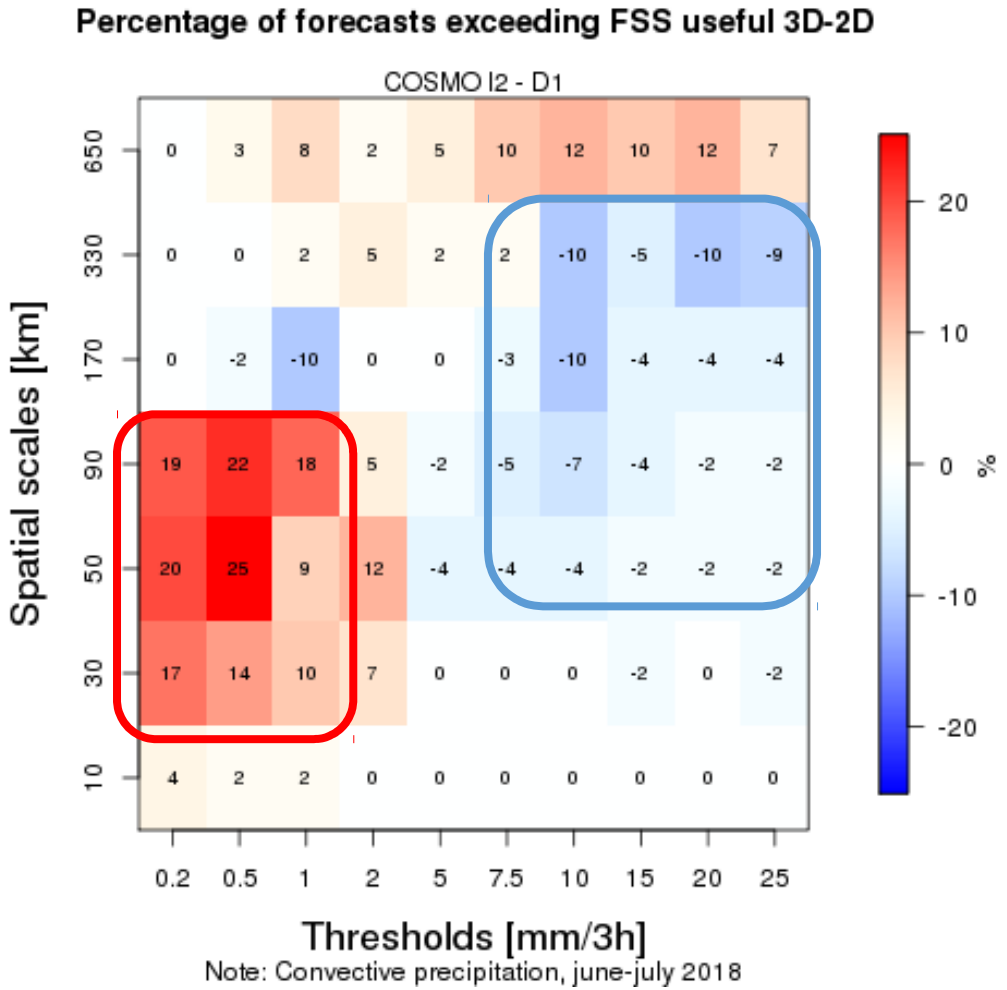


JJ 2018 – D1 – 1 vs 3 timesteps – COSMO I2

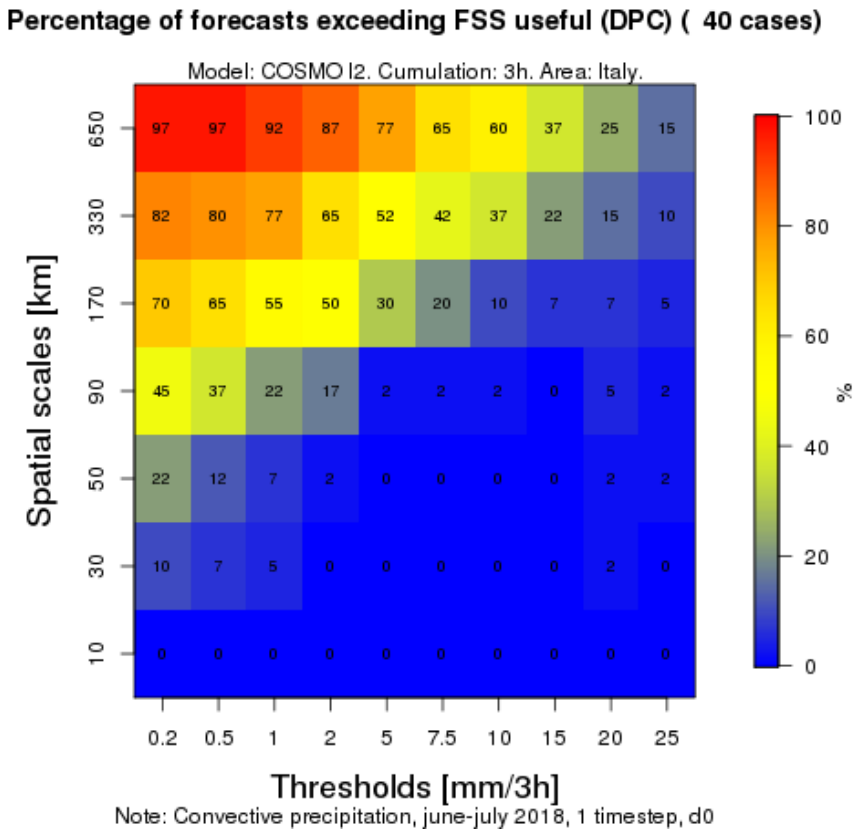


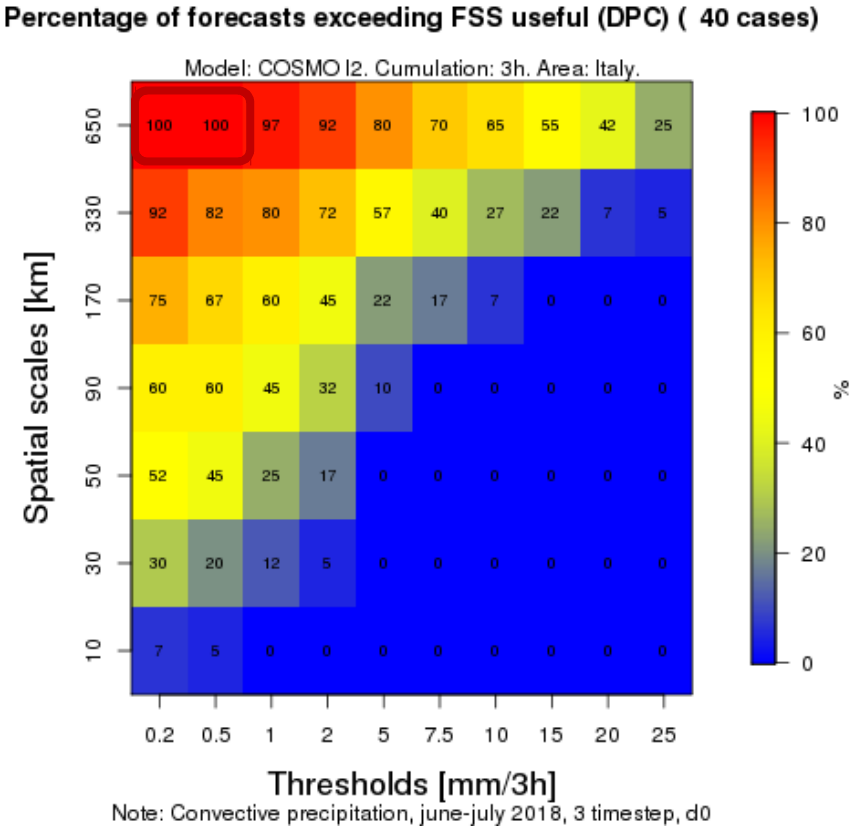


JJ 2018 – D1 – (3-1) timesteps – COSMO I2

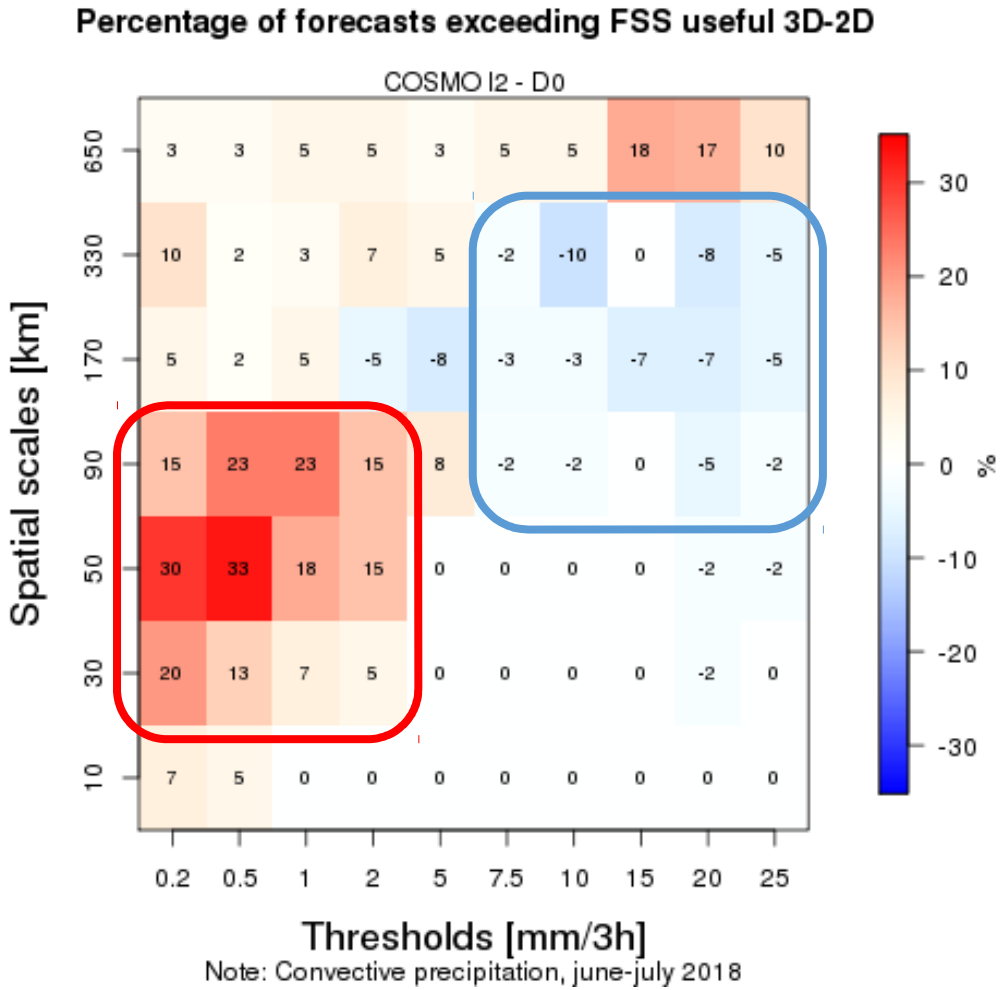


JJ 2018 – D0 – 1 vs 3 timesteps – COSMO I2





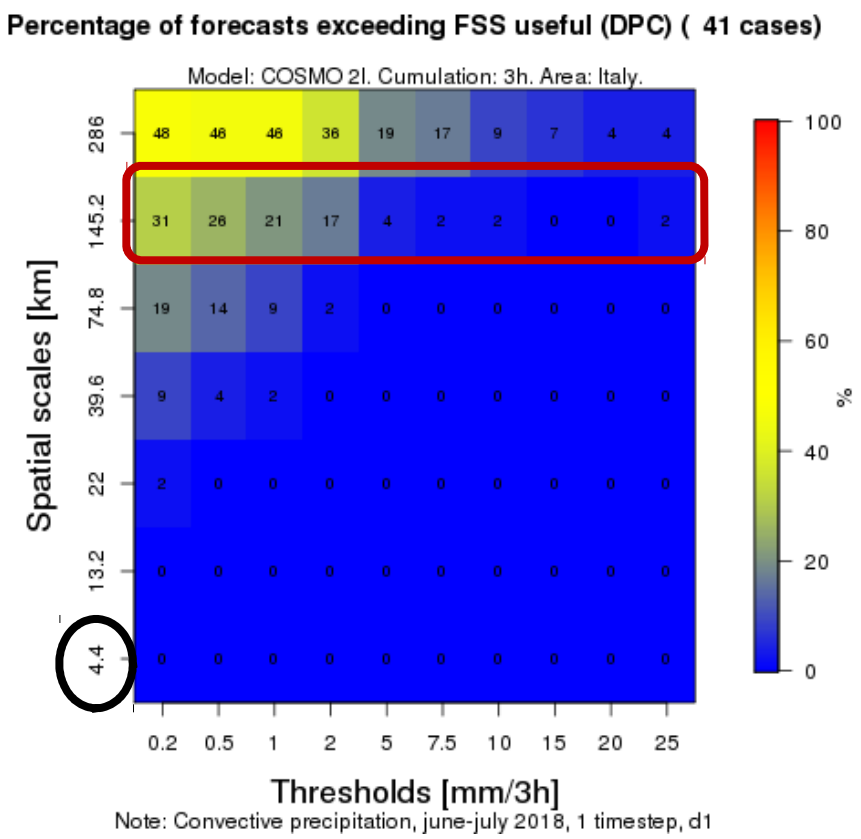
JJ 2018 – D0 – (3-1) timesteps – COSMO I2

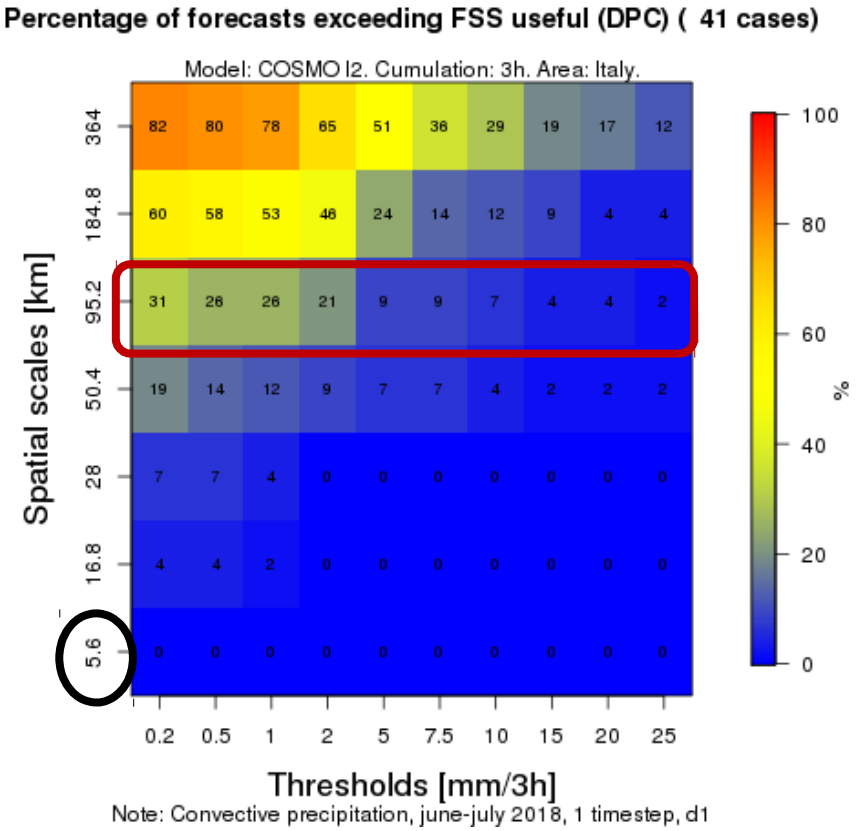


COSMO 2I VS COSMO I2

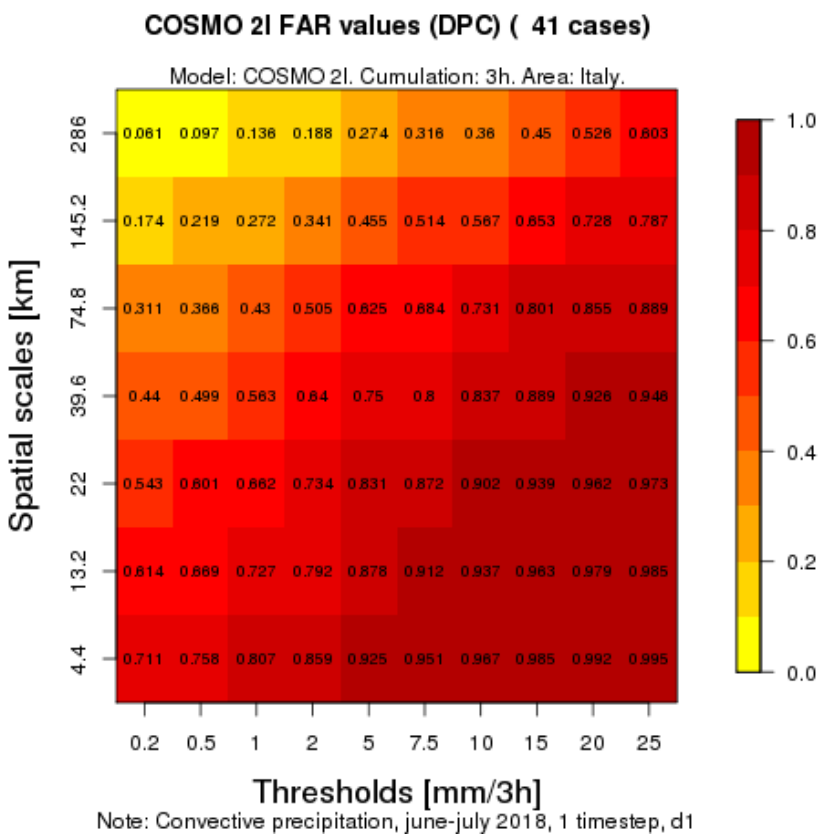
- Grid step -> two times the horizontal resolution of each model
- Plot spatial scales are different
- Precipitation thresholds are the same
- Only 2D verification plots are shown
- FSS, FAR and POD are shown for D1 and D0

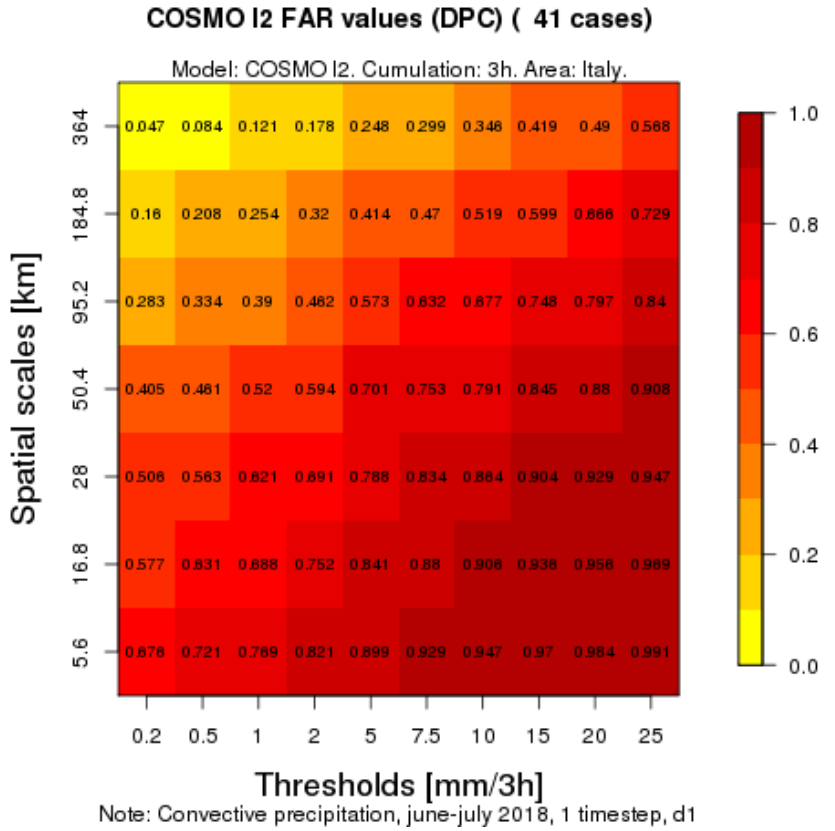
JJ 2018 – D1 – 1 timestep – 2Xmodel resolution



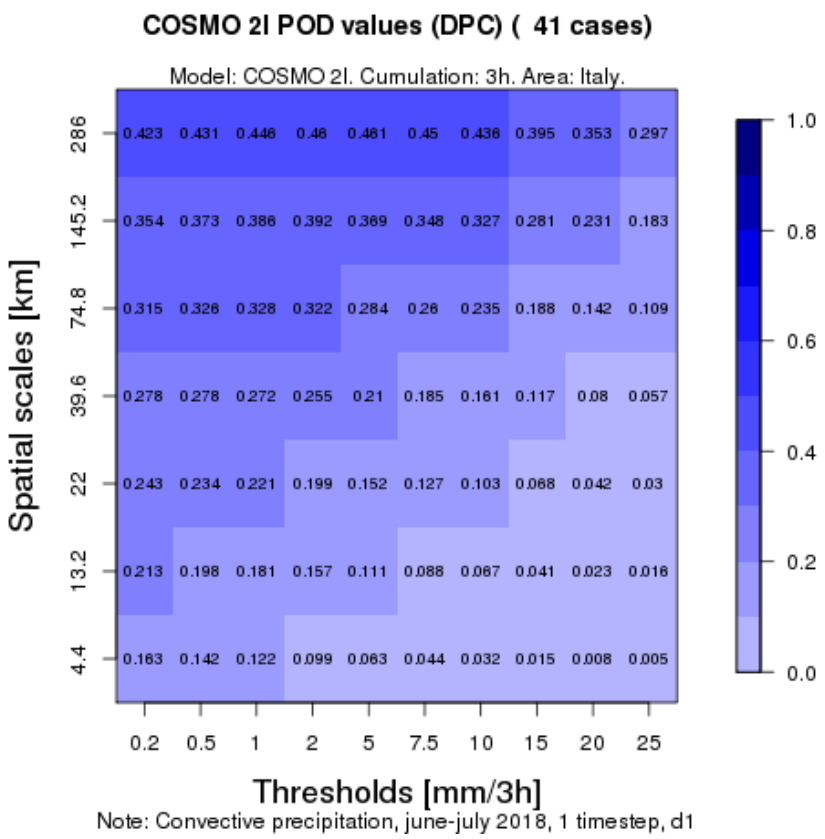


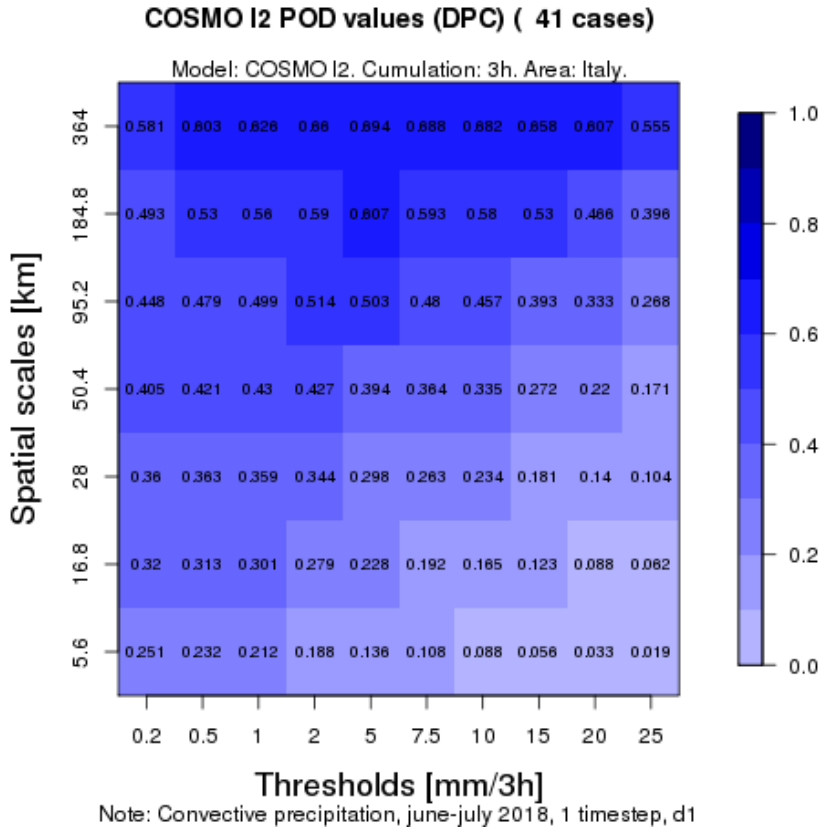
JJ 2018 – D1 – 1 timestep – 2Xmodel resolution



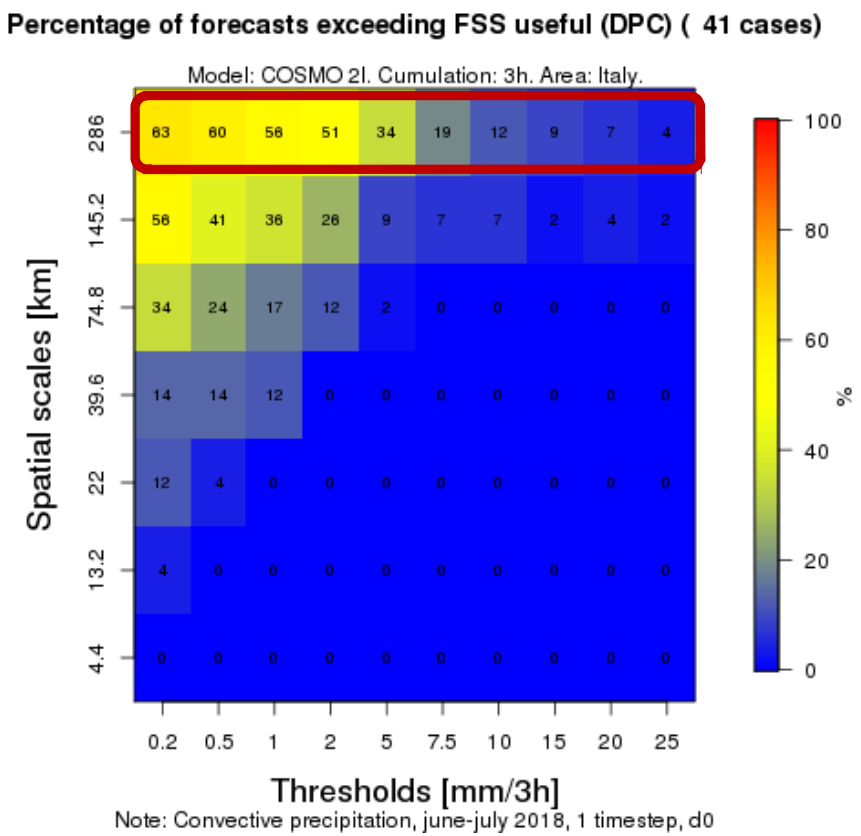


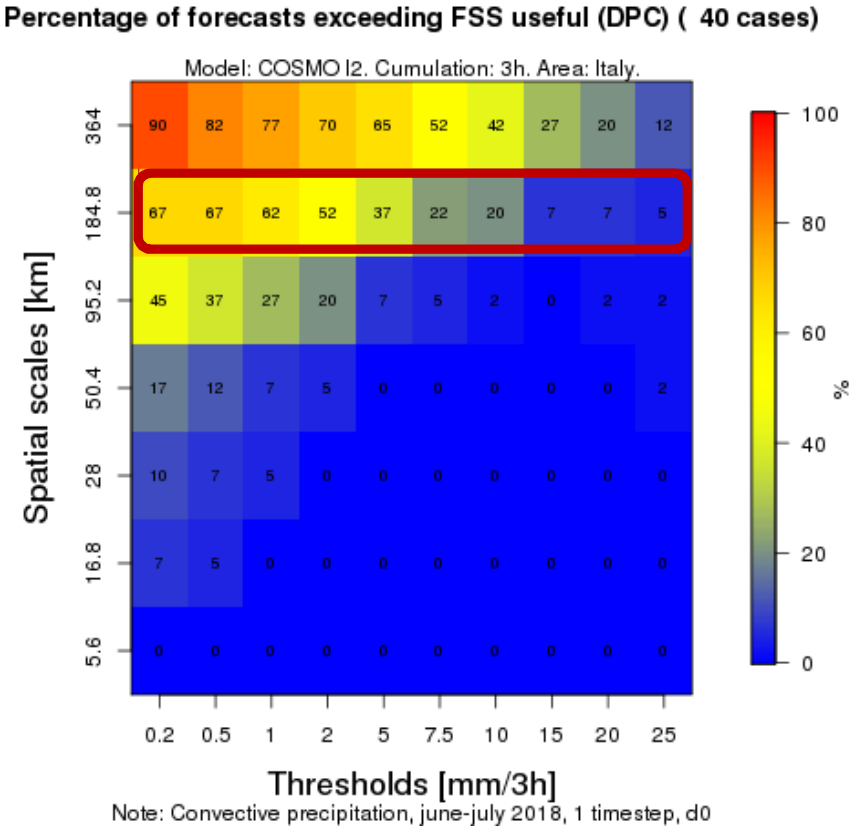
JJ 2018 – D1 – 1 timestep – 2Xmodel resolution



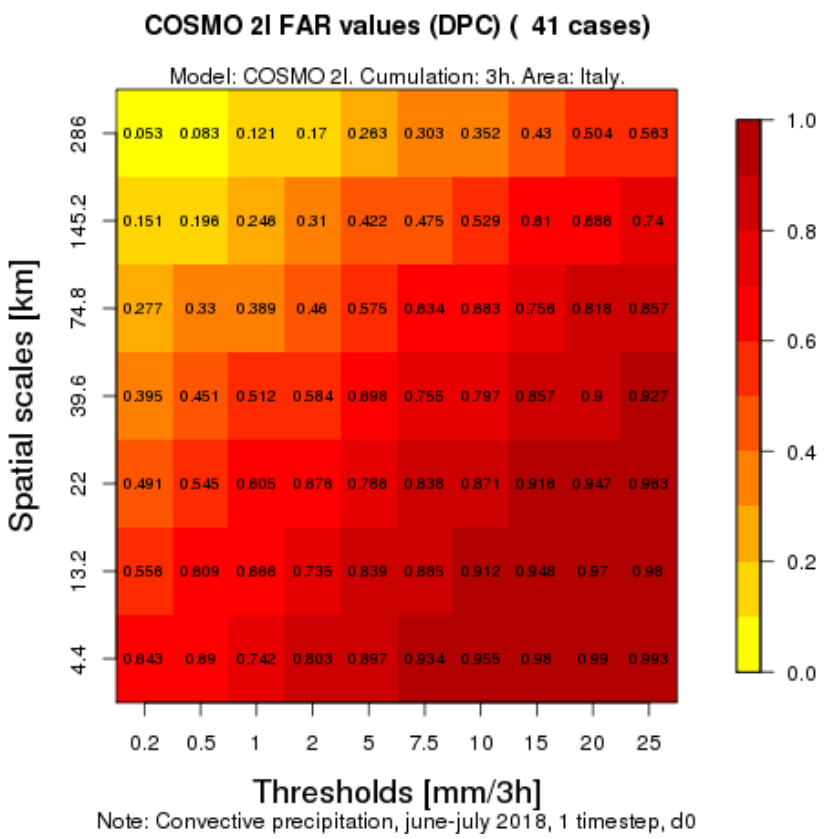


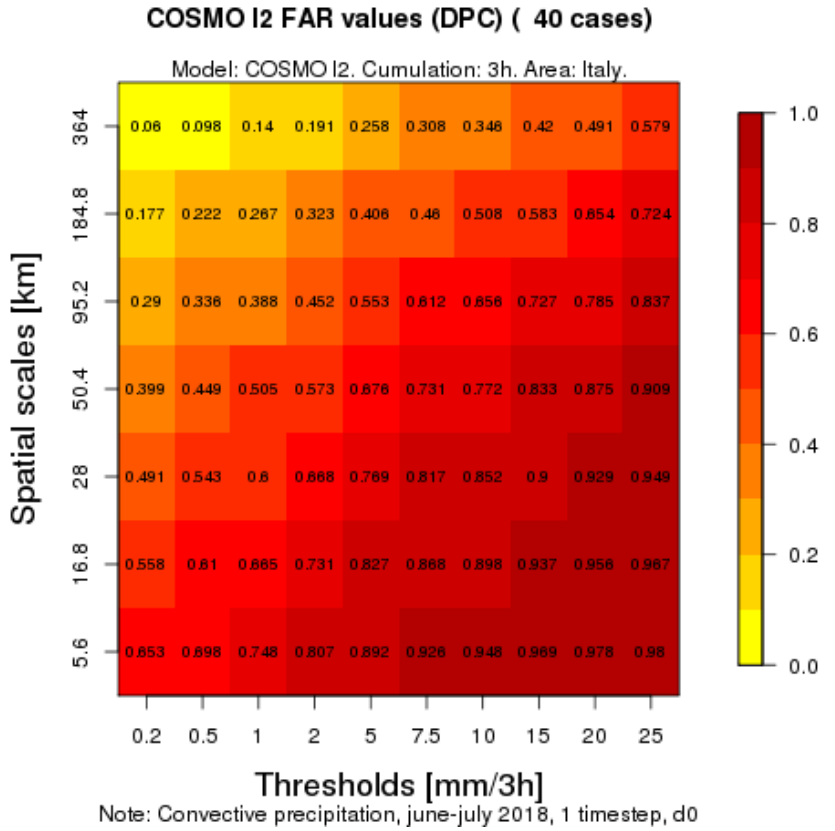
JJ 2018 – D0 – 1 timestep – 2Xmodel resolution



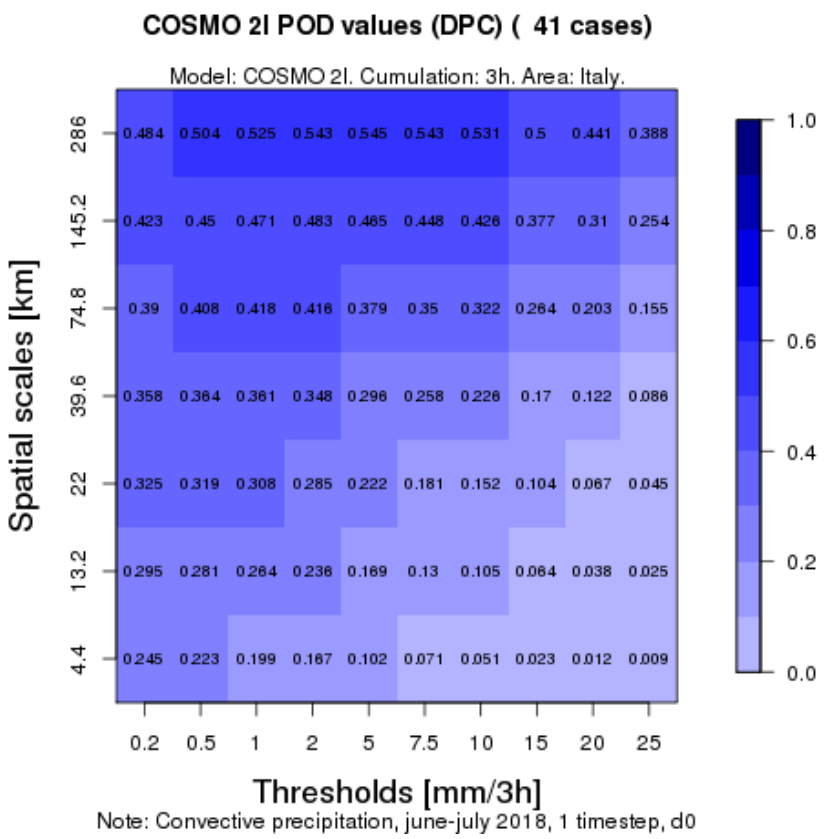


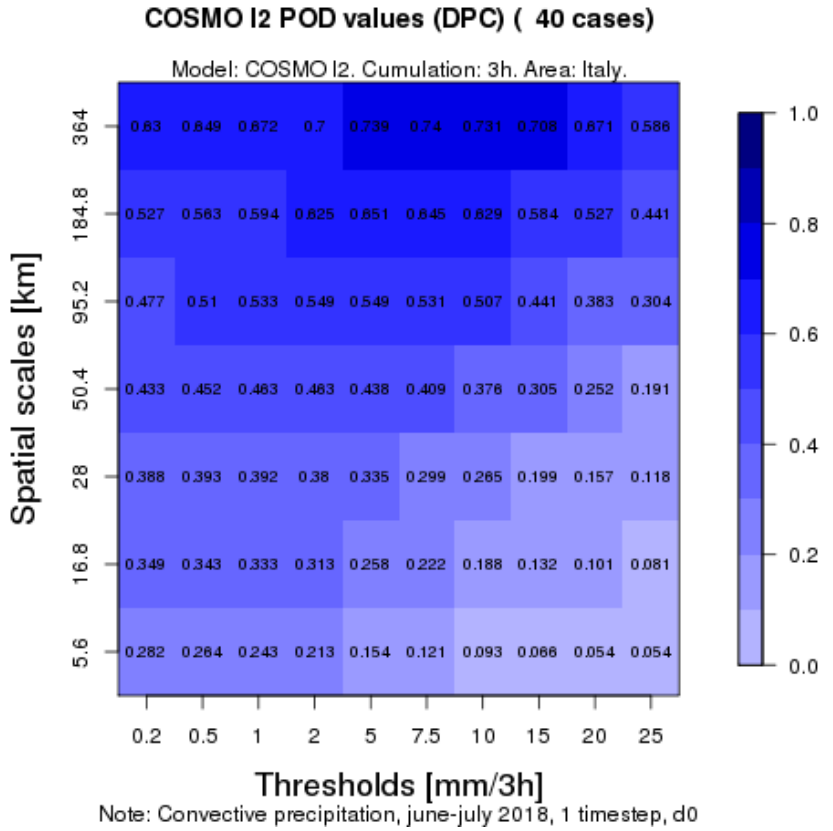
JJ 2018 – D0 – 1 timestep – 2Xmodel resolution





JJ 2018 – D0 – 1 timestep – 2Xmodel resolution





Conclusions

- 3 MODEL COMPARISON:
  - D1: COSMO I2 always the best
  - D0: COSMO I2 almost always the best (COSMO 2I better for a few plot pixels)
- 2D VS 3D:
  - 2D better for middle high spatial scales and thresholds
  - 3D better anywhere else, especially for low middle spatial scales and low thresholds
- COSMO I2 VS COSMO 2I
  - COSMO I2 always better
  - COSMO 2I is less capable to produce precipitation

THANK YOU FOR YOUR ATTENTION!

Please email me for every doubt you may have about the presentation:

naima.vela@arpa.piemonte.it

...And as you can see I’m already studying hard with my assistant to give you more updates next year!