

Spatial verification activities at ARPA-SIMC: first results on MesoVICT cases

Maria Stefania Tesini

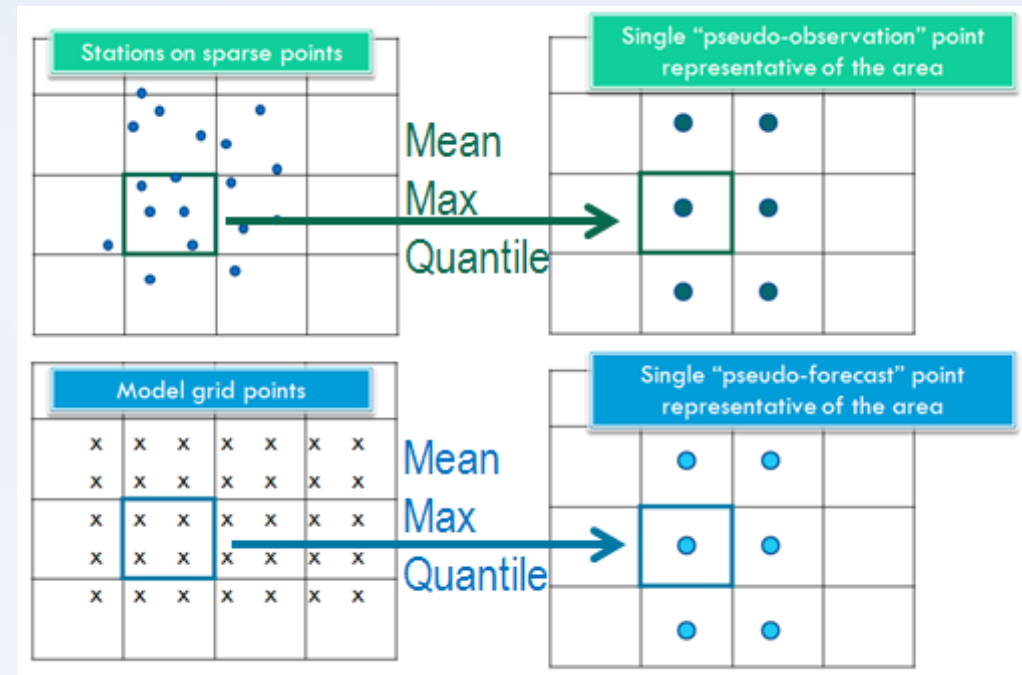
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Overview

- Initial plans (full of good intentions!)
 - Application of “DIST” methodology developed at ARPA-SIMC to MesoVict cases
 - Sensitivity study on the verification box-size using all the possible combination of the available dataset:
 - OBS: gridded VERA analysis , direct observations
 - FCS: COSMO-2, GEM-LAM, COSMO-LEPS – interpolated onto VERA-grid and in their original grid
- In practice
 - Start with precipitation of the core case (20-22 June 2007) using VERA-analysis and COSMO-2 VERA-grid interpolated data
 - Issues on the interpretation of gridded precipitation data
- Revised plans (due to time constraints)
 - Application of “DIST” to available data but sensitivity study loses the original significance because the presence of “missing data” make comparison unfair
- To be continued....

The “distributional method (DIST)”

- The verification domain is subdivided into a number of “boxes”, each of them containing a certain number of observed and forecast values.
- For each box, several parameters of the distribution of both the observed and forecast values falling in the box can be computed (mean, median, percentiles, maximum).
- Verification is then performed using a categorical approach, by comparing for each box one or more parameters of the forecast distribution against the corresponding parameters of the observed distribution, using a set of indices.



Marsigli, C., Montani, A. and Paccagnella, T. (2008), A spatial verification method applied to the evaluation of high-resolution ensemble forecasts. *Met. Apps*, 15: 125–143. doi: 10.1002/met.65

Application to MesoVict cases

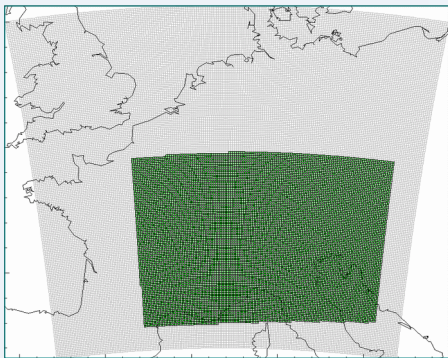
- The idea was to create boxes of different size
- for each box size perform the verification using DIST with different input data:
 - VERA gridded obs & fcst
 - Sparse points obs & models on original grid
 - Different accumulation times (1h,3h,6h)
- Compare the results and try to assess the impact of the dimension of the boxes and/or of the type of data used for the verification



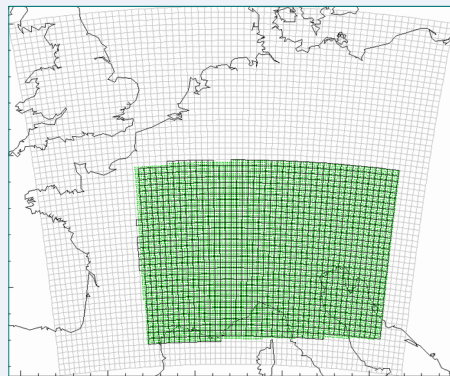
Application to the Core case

20-22/07/2007

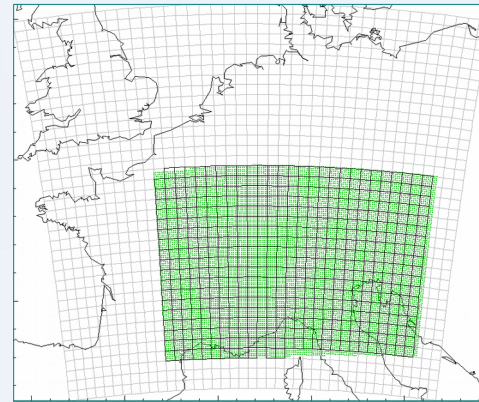
- On the **COSMO-2 domain** we create a set of boxes of different size:



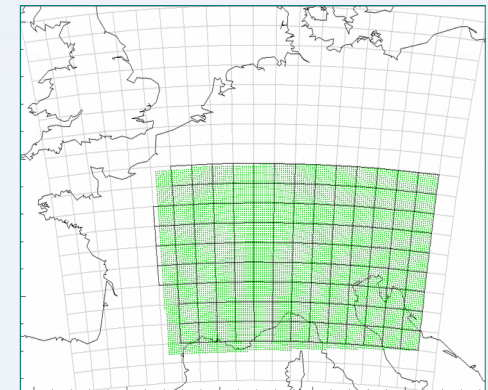
8x8 Km²
containing 1 point
(as the original
VERA grid)



24x24Km²
containing 9 points

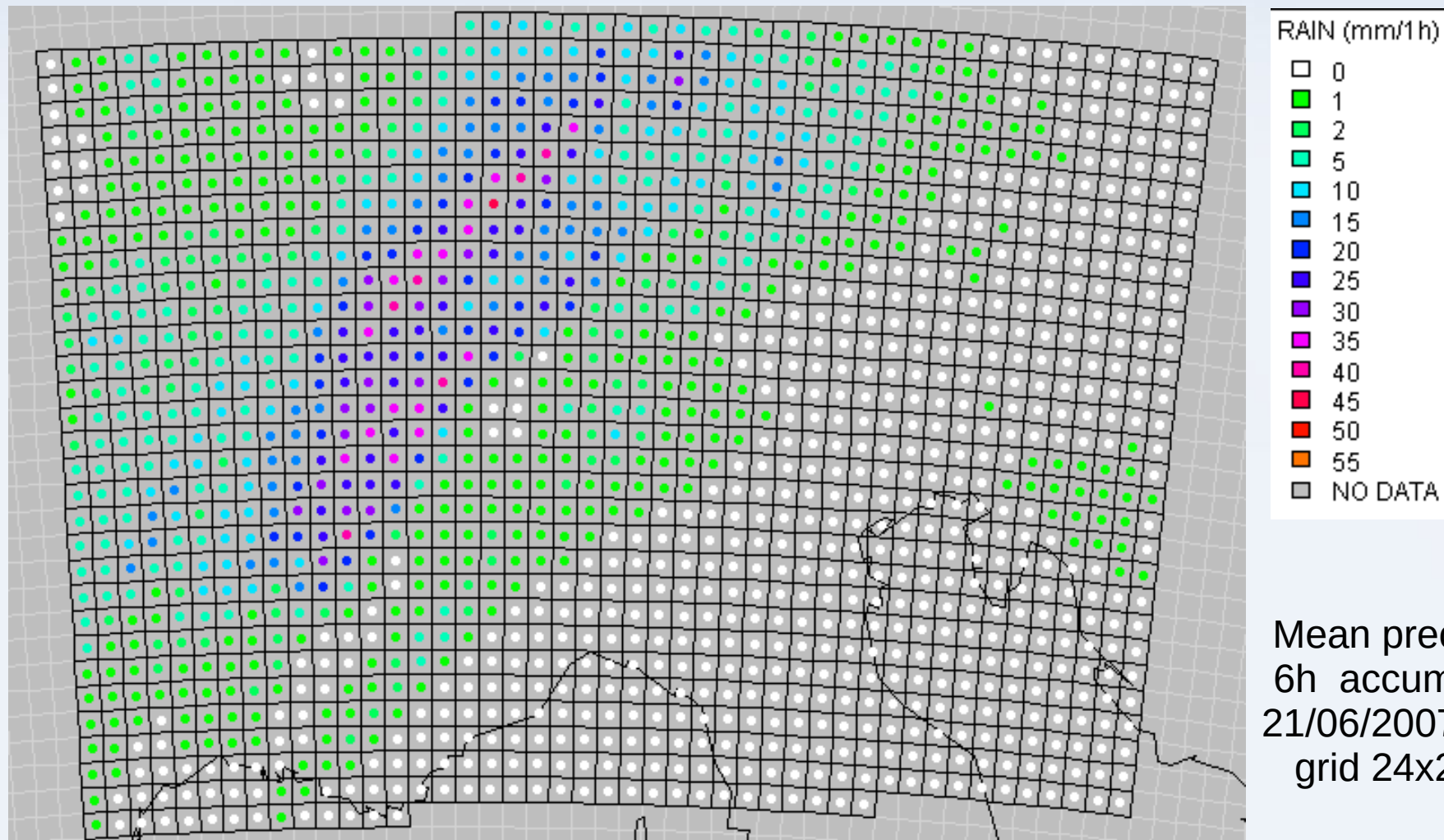


40x40 Km²
containing 25 points



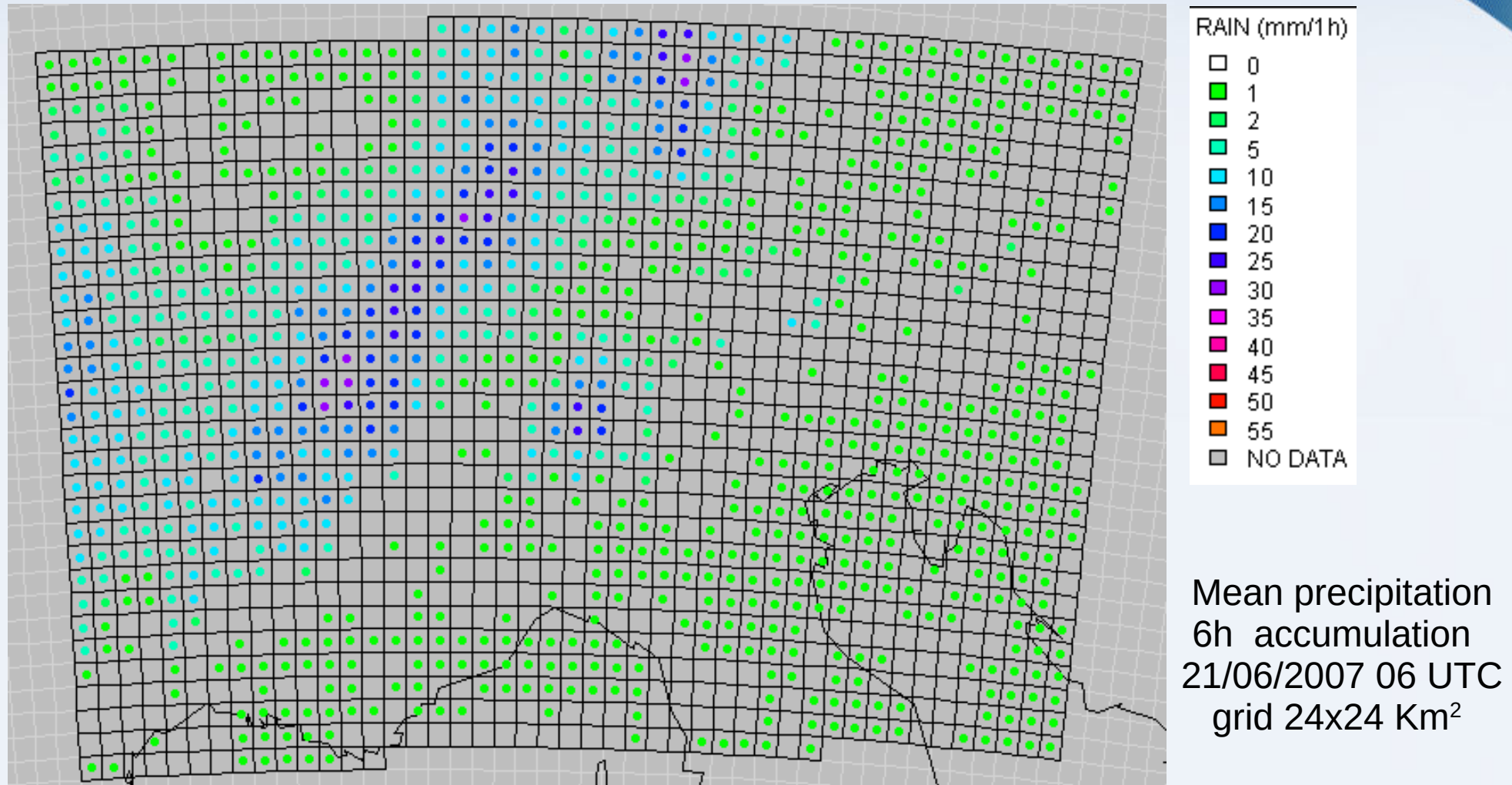
80x80 Km²
containing 100 points

Exploring the data: COSMO-2



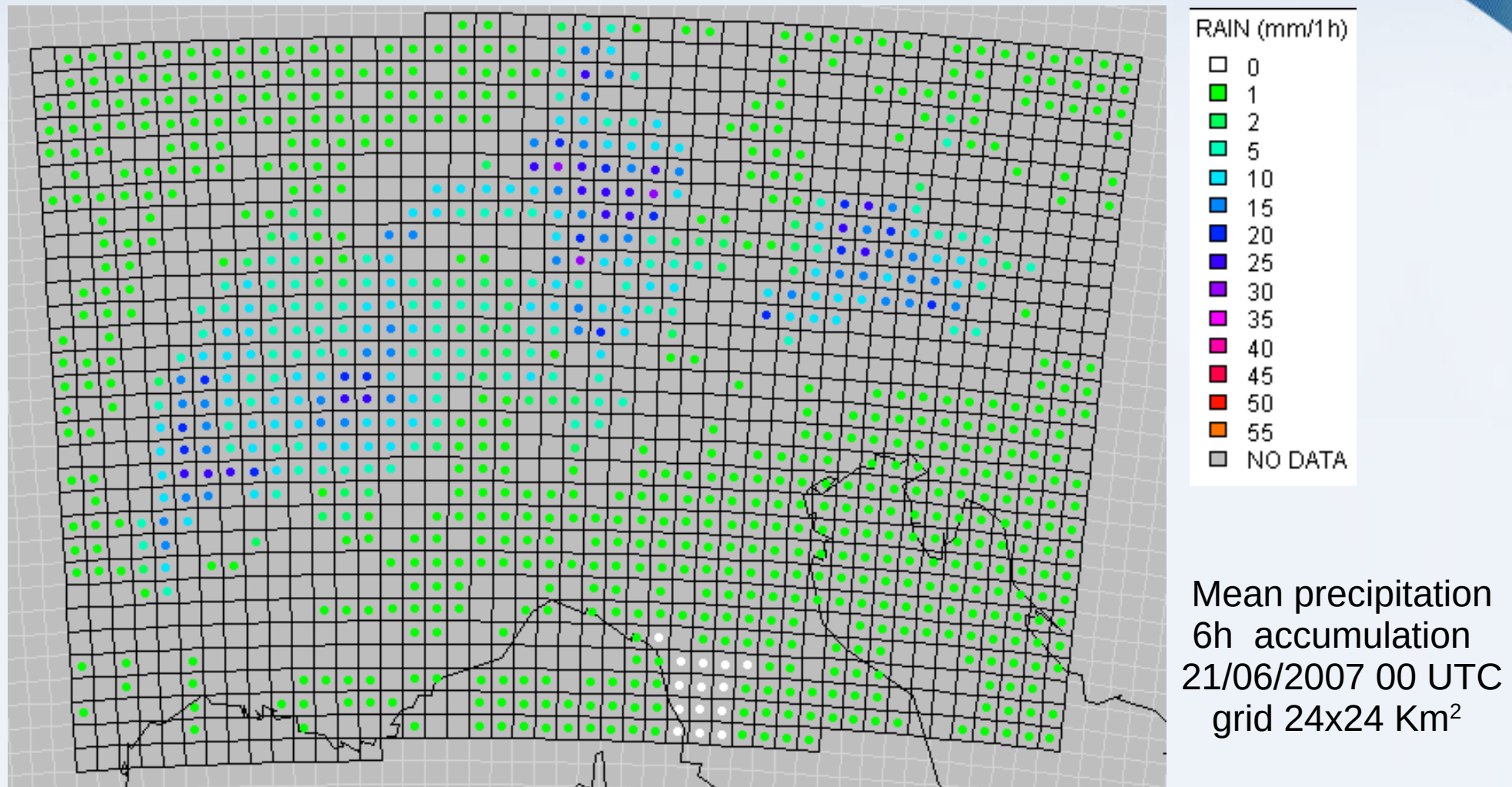
each box should contain 90% of the nominal number of point (8 pts in this case)
Some boxes at the edge of the domain were discarded, but inside they are all “full”

Exploring the data: VERA analysis



Unfortunately using VERA analysis I get a lot of missing data...
(the problem is the same also in the original grid)

Exploring the data: observation



...and the missing data are not in the same place for each time step

Am I using the data properly?



Description of VERA file format

VERA Data are saved in ASCII format on a Cartesian grid. The first 46 lines are the header and contain some necessary information for users (the important lines are **highlighted yellow**). Following the header the analysed field starts organized in 19 columns. The domain is 1664 km in W-E direction and resolution of 8 km).

File name

VERA_8km_200

gives information on:

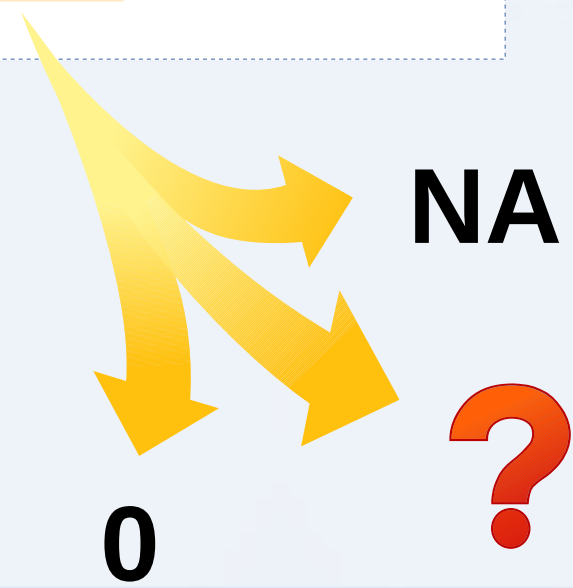
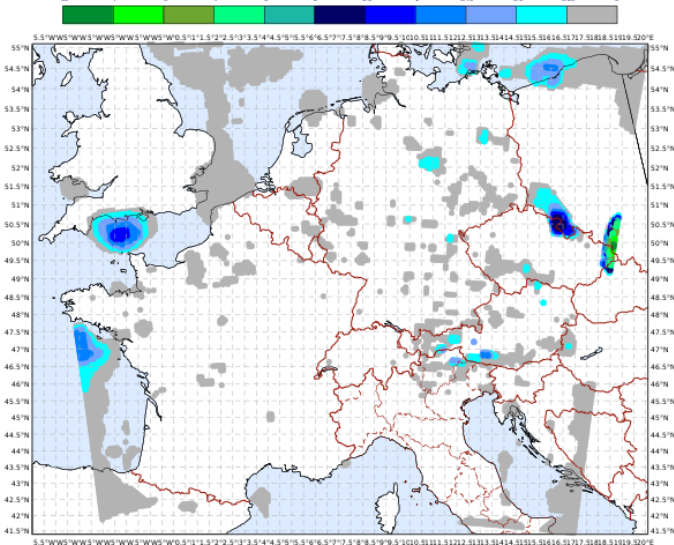
Field of analysis values:

19 columns:

```
-832.0000 -768.0000 0.0000 0.0000 -0.07 1.16 0.36 21.87 39.48  
9999.00 9999.00 1016.19 9999.00 9999.00 9999.00 9999.00 -0.05 9999.00 7.08
```

1. x - coordinate (km, distance from origin)
2. y - coordinate (km, distance from origin)
3. z - coordinate (not used)
4. t - coordinate (not used)
5. **precipitation (mm/ x hours, x hours are defined in the last line of the header and in the file name – some values may be below zero because of spline curvatures – ignore them)**
6. 10m wind u - component (m/s)
7. 10m wind v - component (m/s)

Negative value of VERA analysis precipitation 2007-06-21 17 UTC



NA

0



Am I using the data properly?



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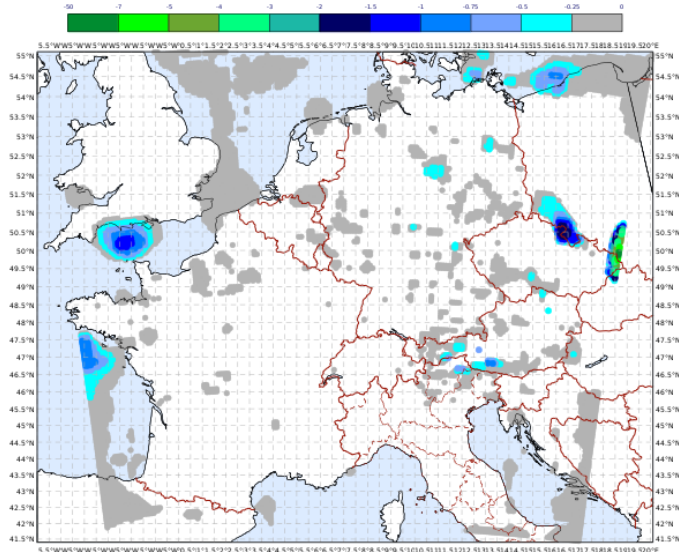
Field of analysis values:

19 columns:

```
-832.0000 -768.0000 0.0000 0.0000 -0.07 1.16 0.36 21.87 39.48  
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Negative value of VERA analysis precipitation 2007-06-21 17 UTC



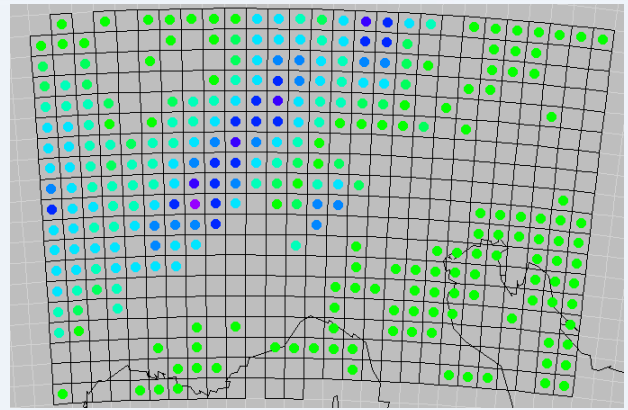
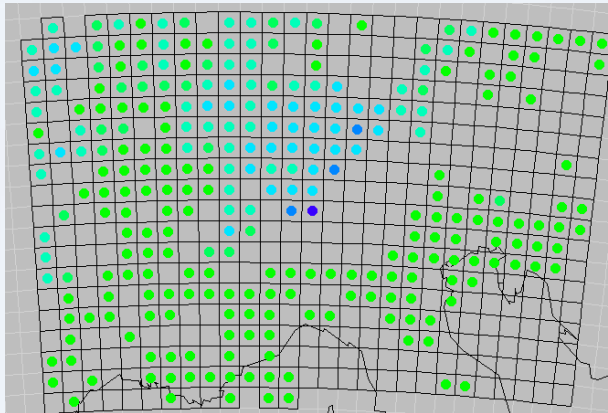
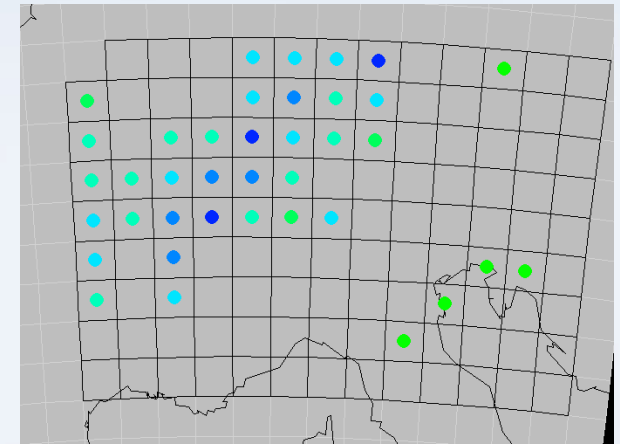
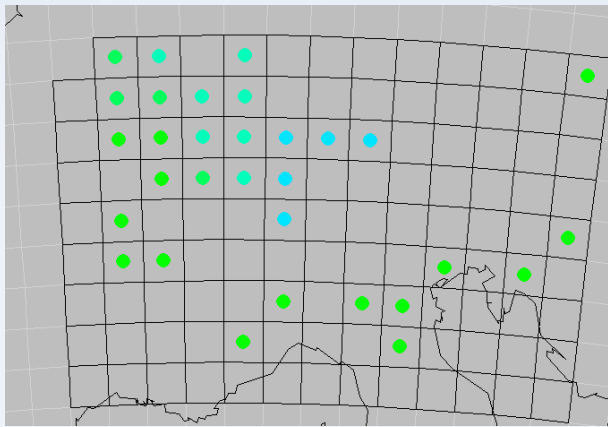
NA



This was my first choice (in terms of time!) and the rest of the work is based on this assumption

Revised plan

- Since the missing data are in different place at each time step, it is difficult to find a common verification area in order to have data for all the period and for each dimension of the box
- Nevertheless DIST can work considering time to time only the pairs of boxes where data are present.
It resembles the usual situation with sparse point data.

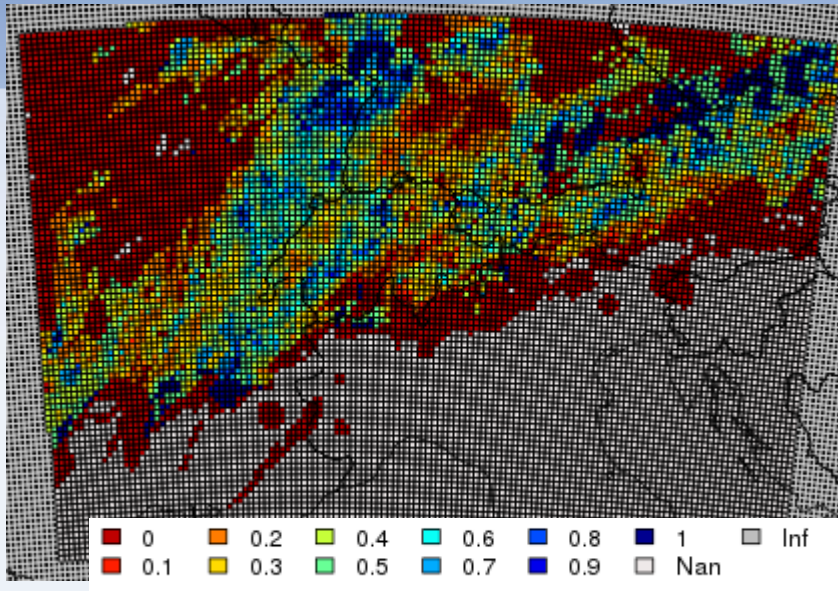


Sensitivity to box size

- Sensitivity tests lose their original importance but some general consideration can anyway be done considering the **MAXIMUM**
 - Since we are considering “at least one point value” exceeding a threshold (>0) over a specific area, the NA data are not influencing the observational dataset for this parameter of the distribution.
 - Possibly we miss some False Alarm because we are discarding some boxes with no available data, while they could be all zero
 - Different story for other parameters, such as the mean or percentiles, where the presence of zero can change significantly the value of the calculated indices

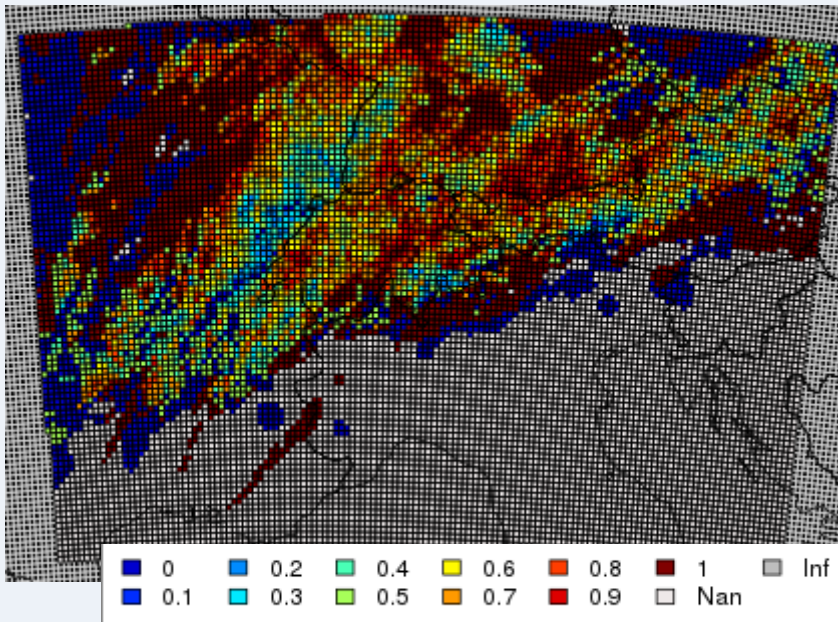
Scores are evaluated for each time step and aggregated over all the period (72 hours)

POD

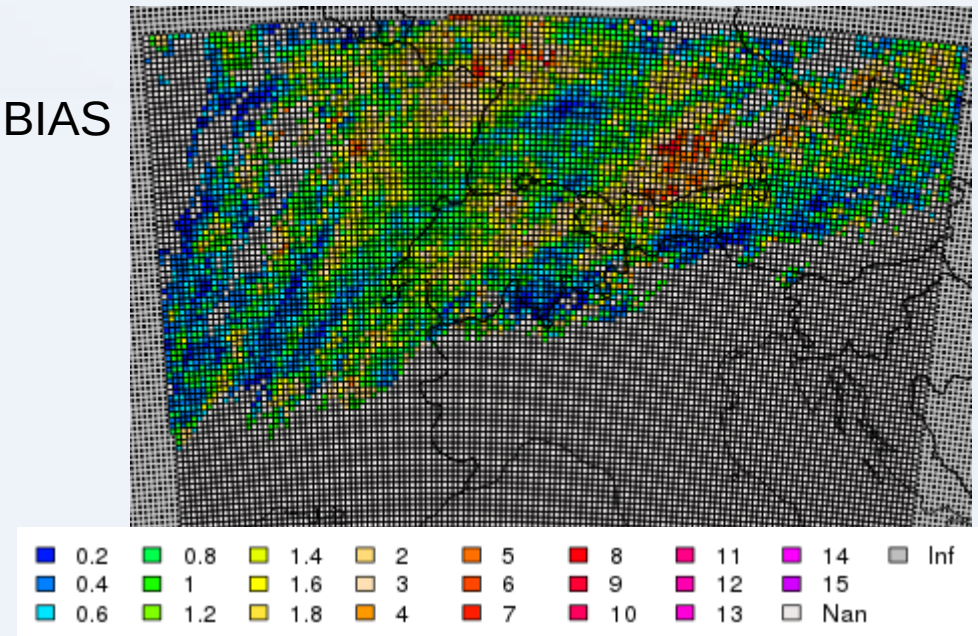


Max > 1 mm/1hour
GRID: 1 point
(original VERA grid)

FAR

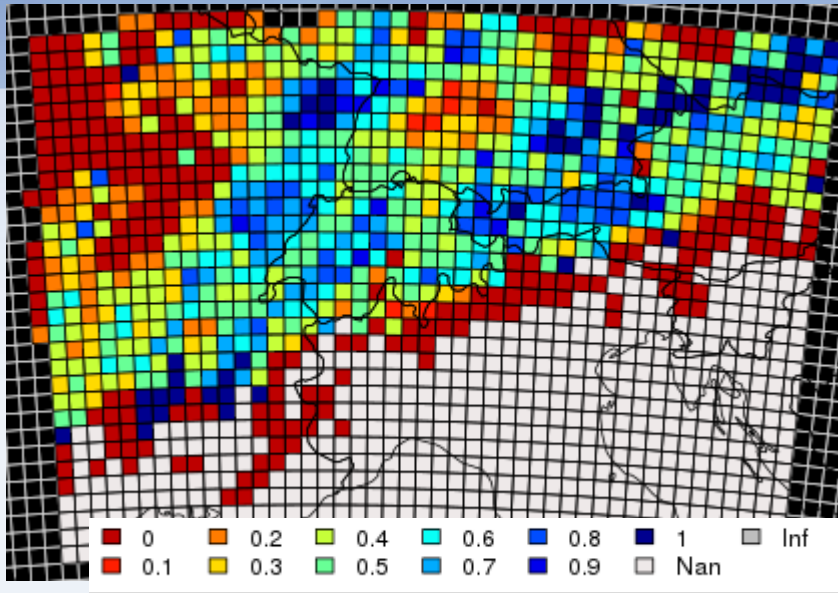


BIAS



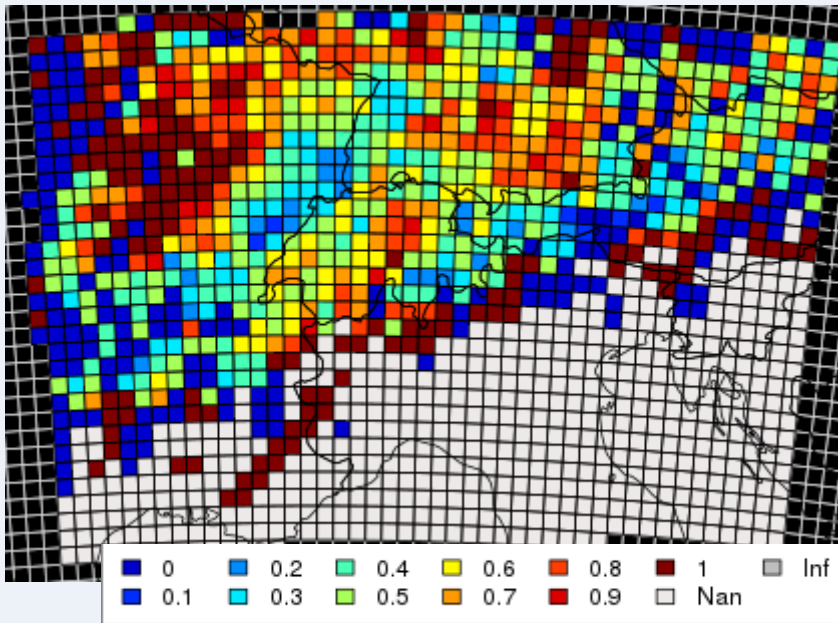
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POD

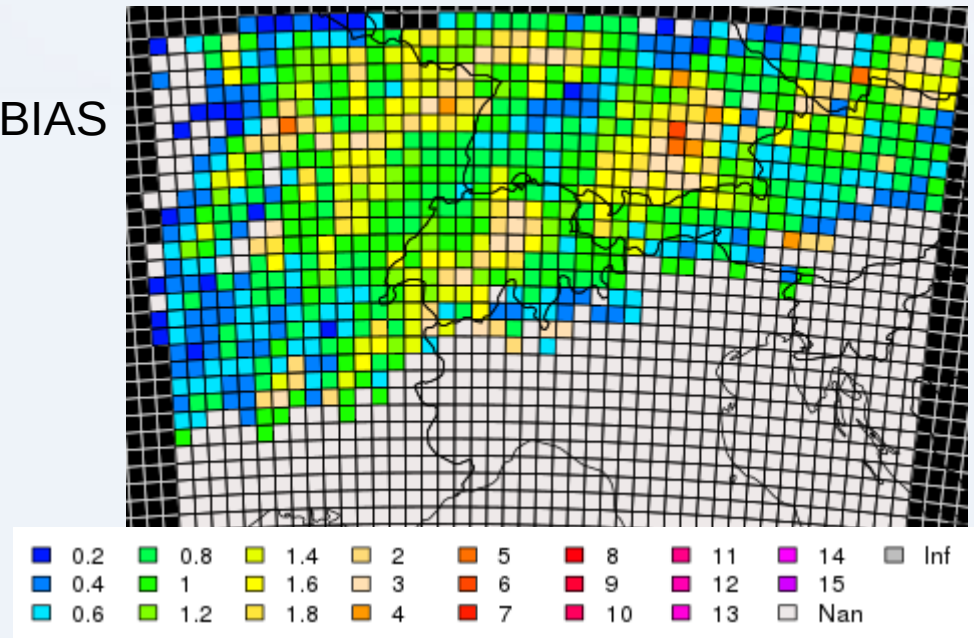


Max > 1 mm/1hour
GRID: 9 points
(24x24 Km²)

FAR

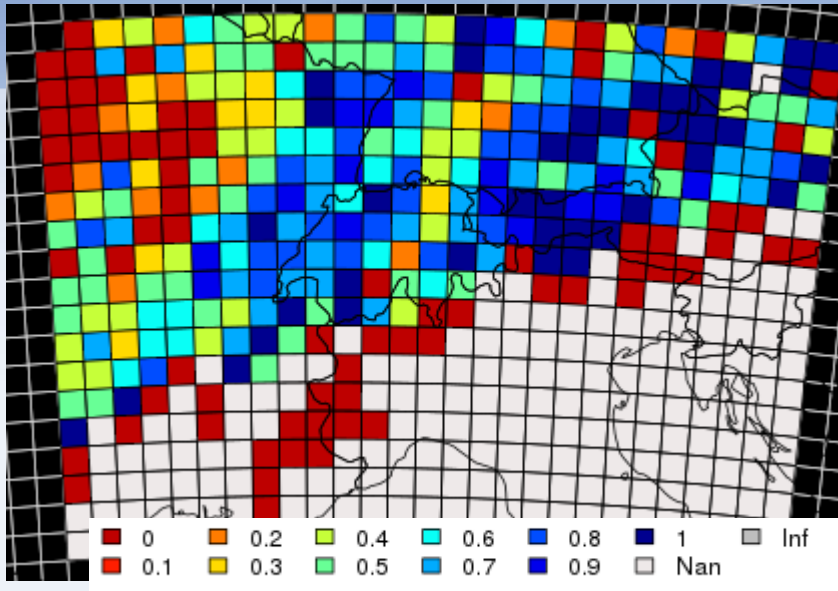


BIAS



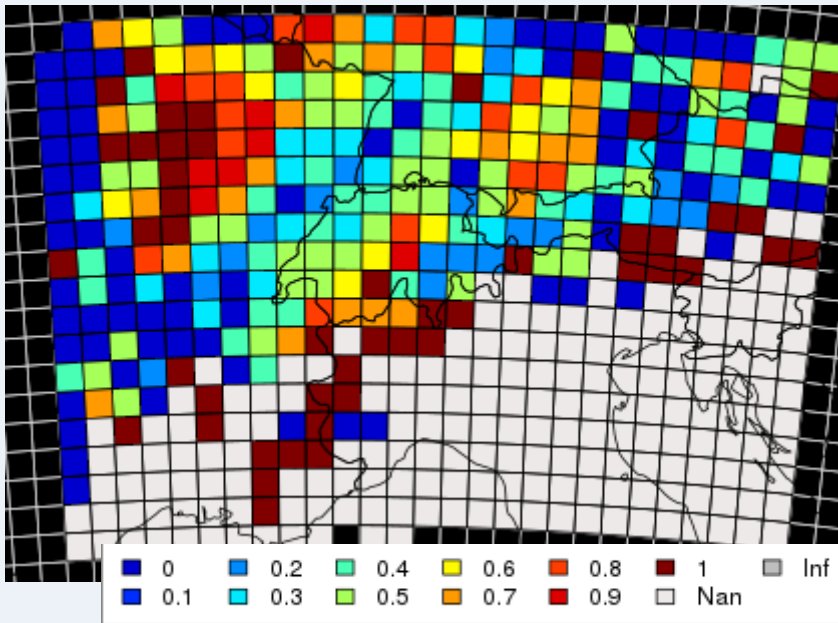
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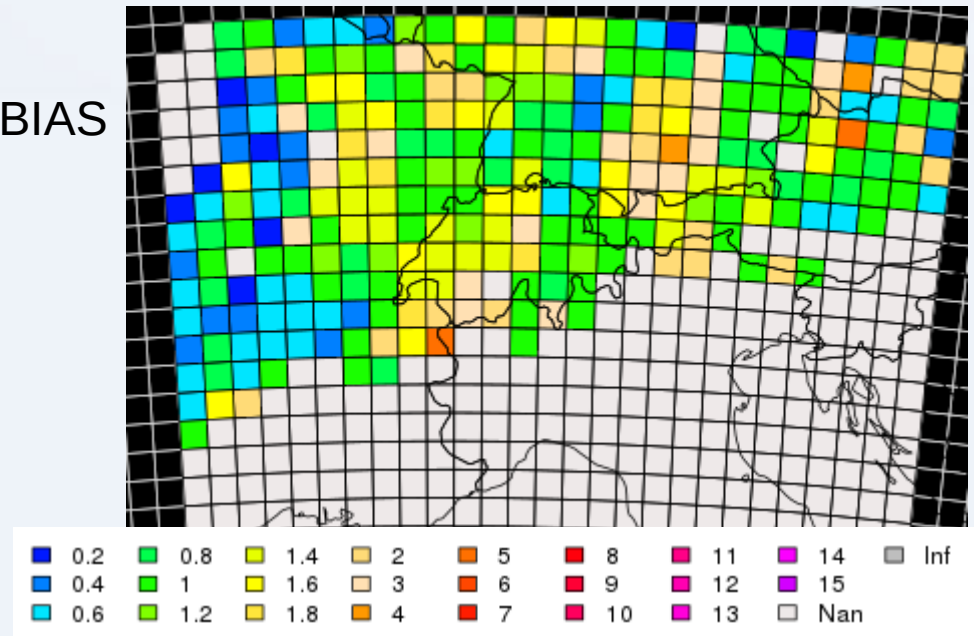


Max > 1 mm/1hour
GRID: 25 points
(40x40 Km²)

FAR

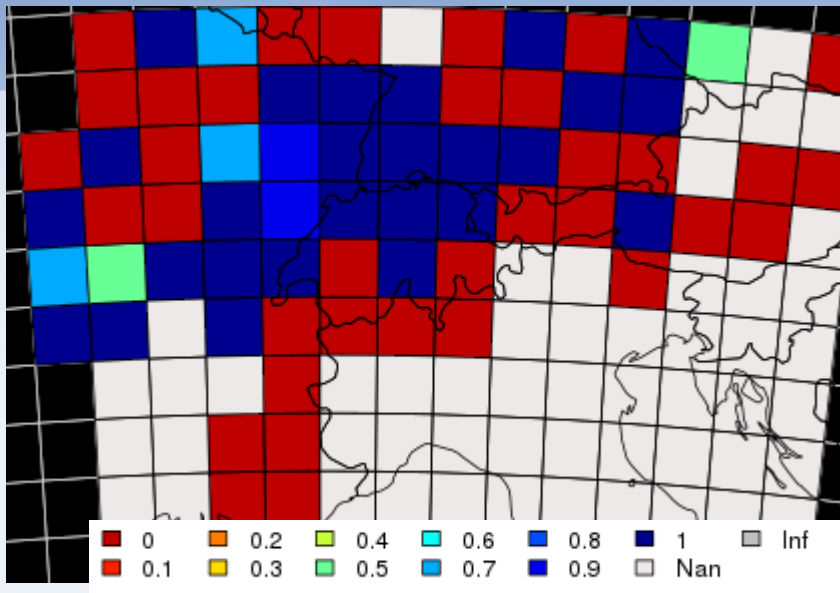


BIAS



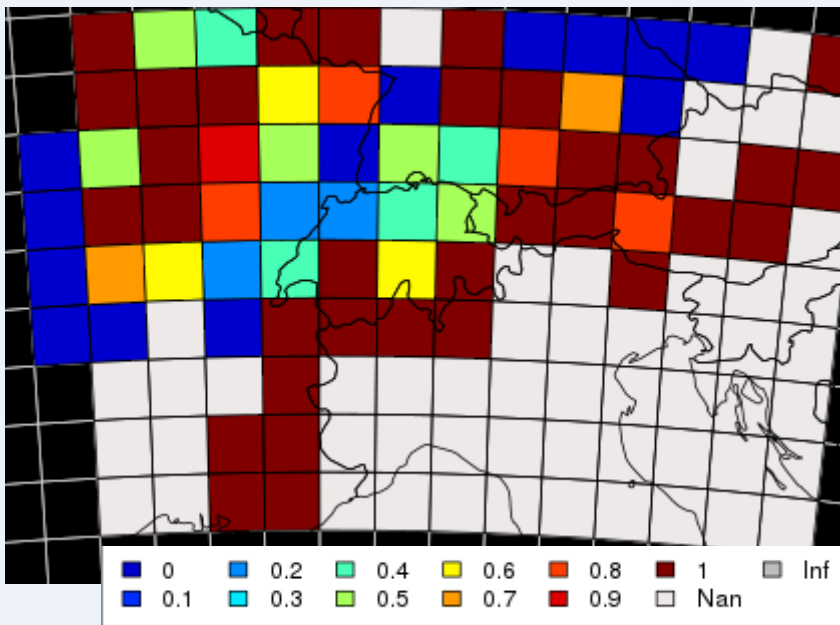
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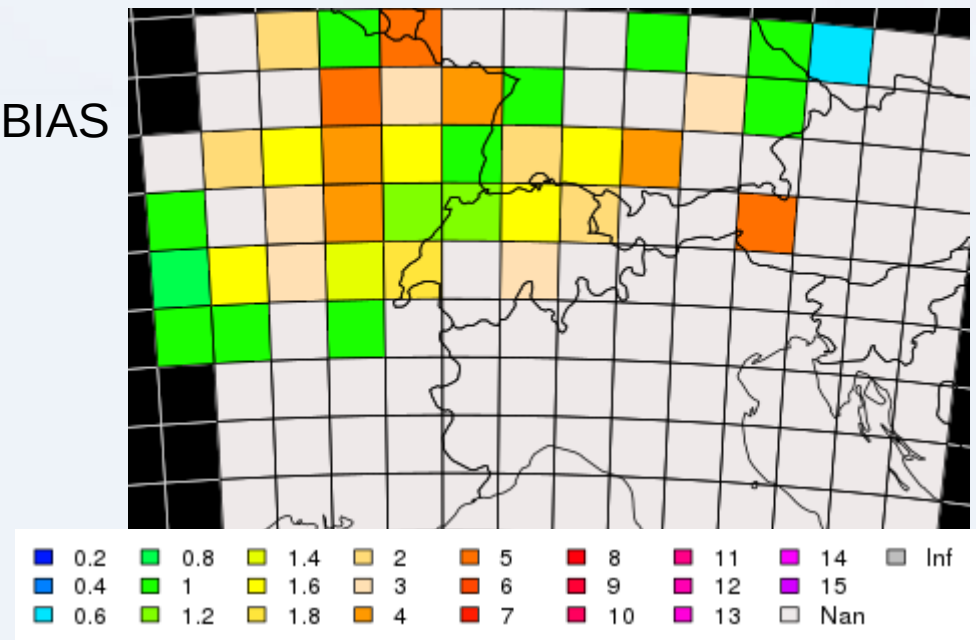


Max > 1 mm/1hour
 GRID: 100 points
 (80x80 Km²)

FAR

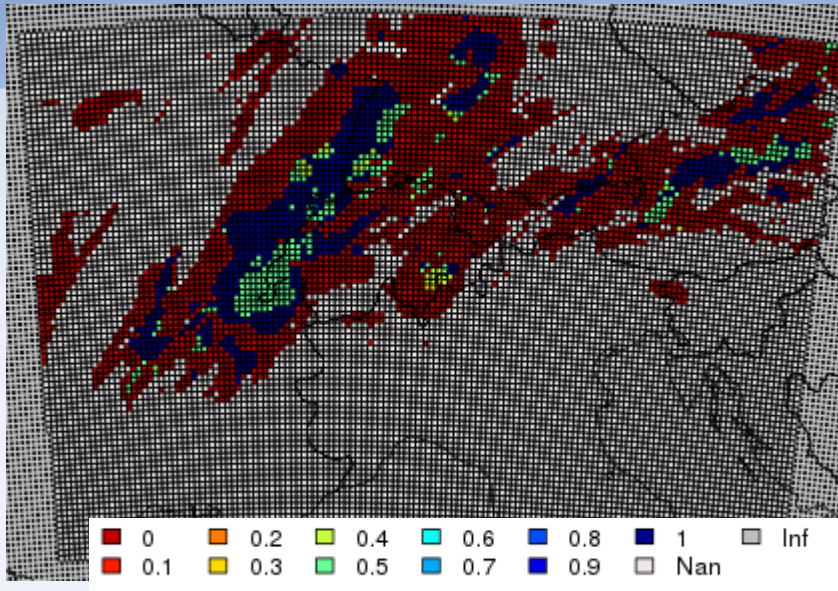


BIAS



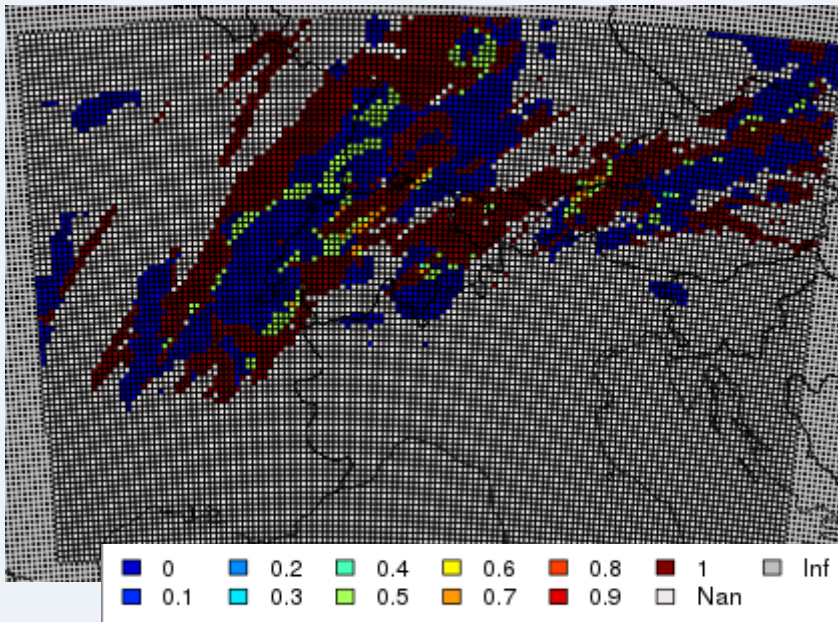
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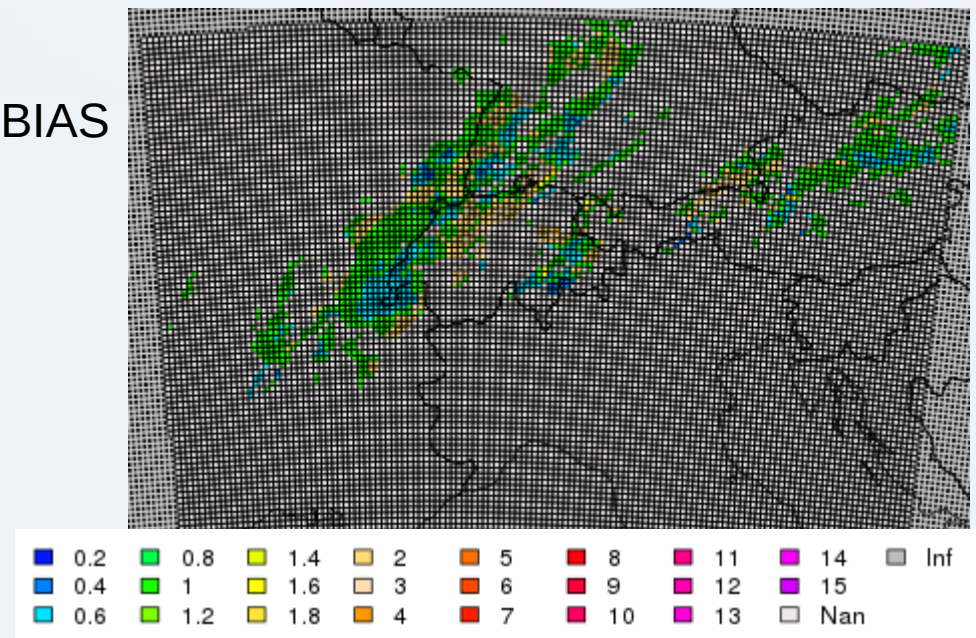


Max > 10 mm/6hour
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(original VERA grid)

FAR

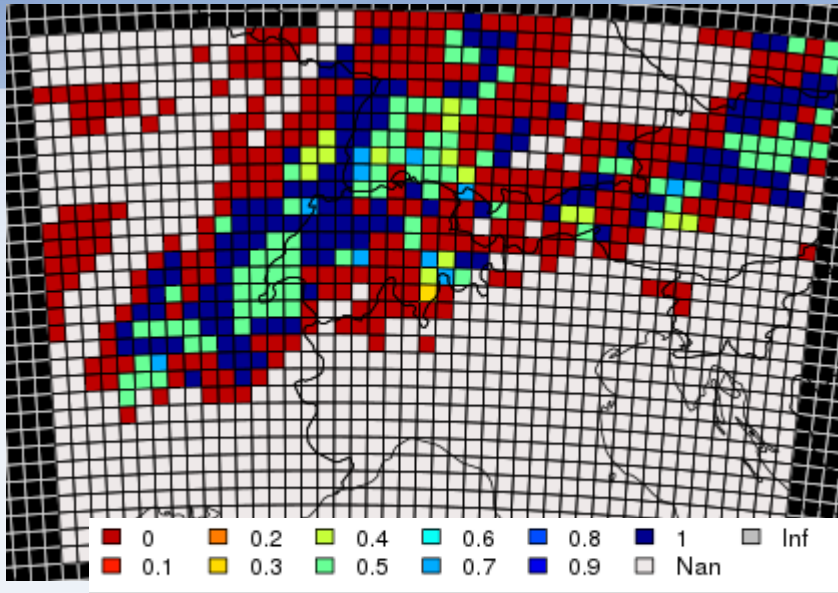


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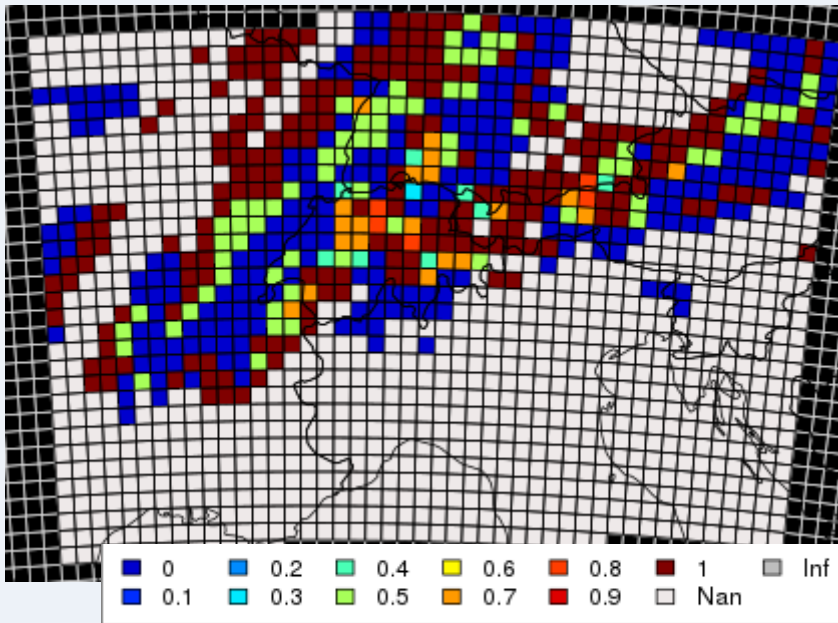
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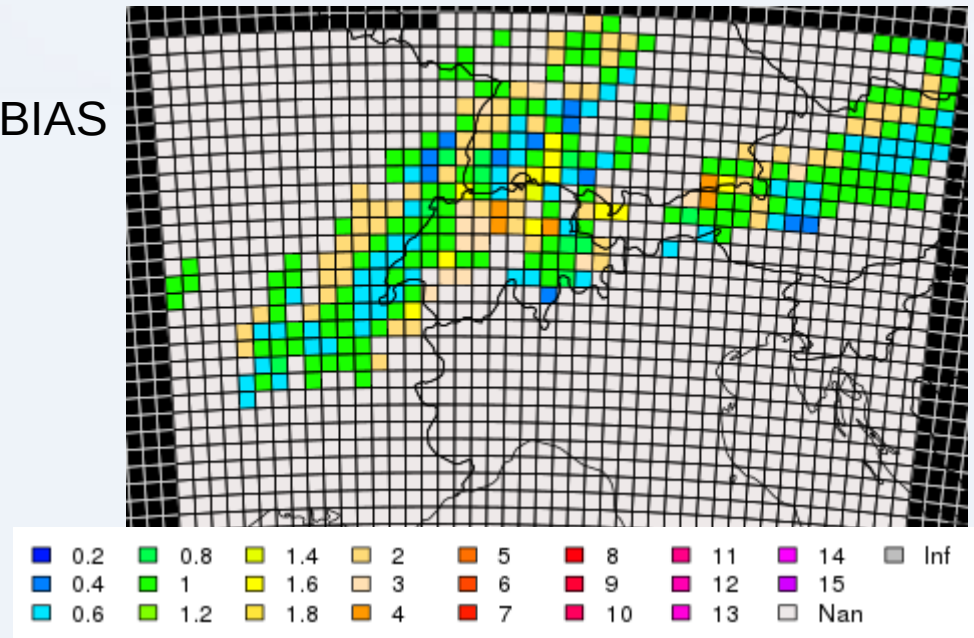


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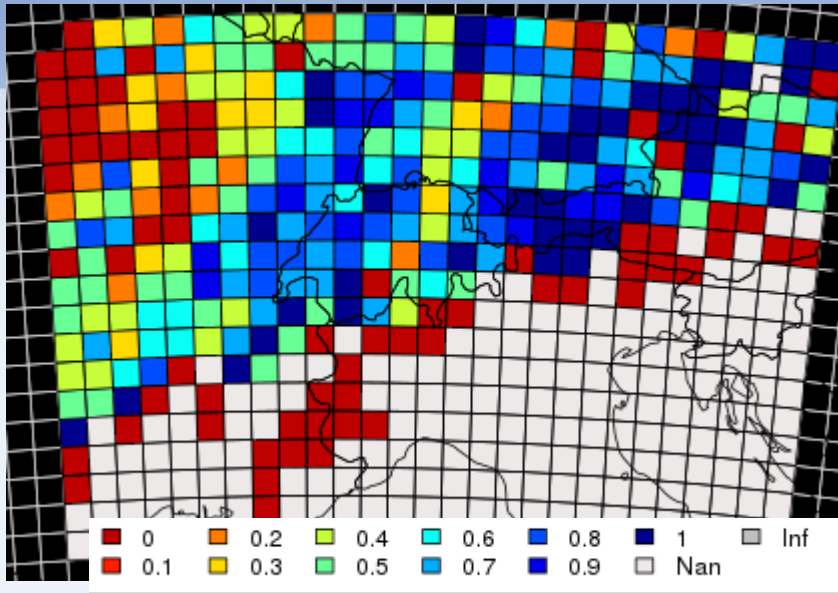


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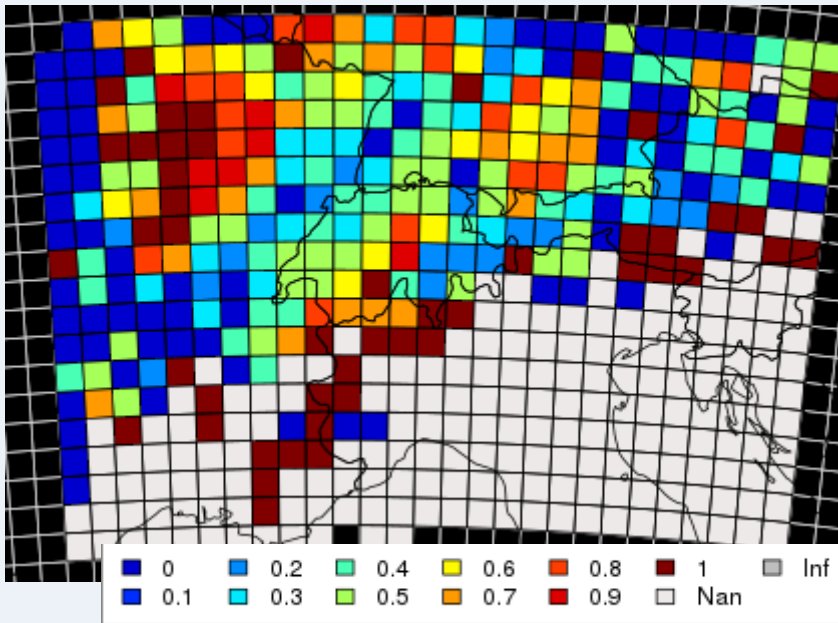
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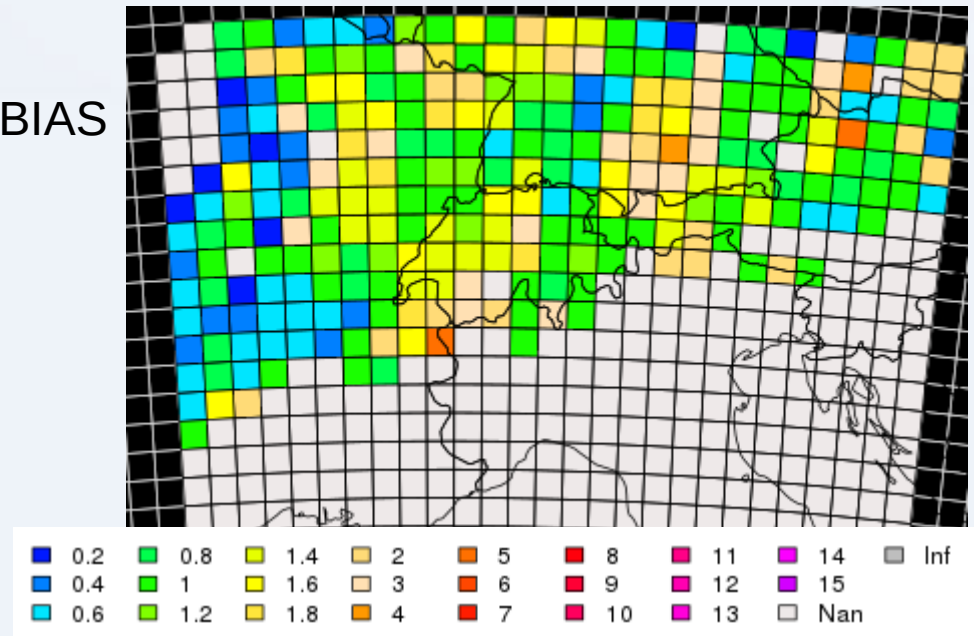


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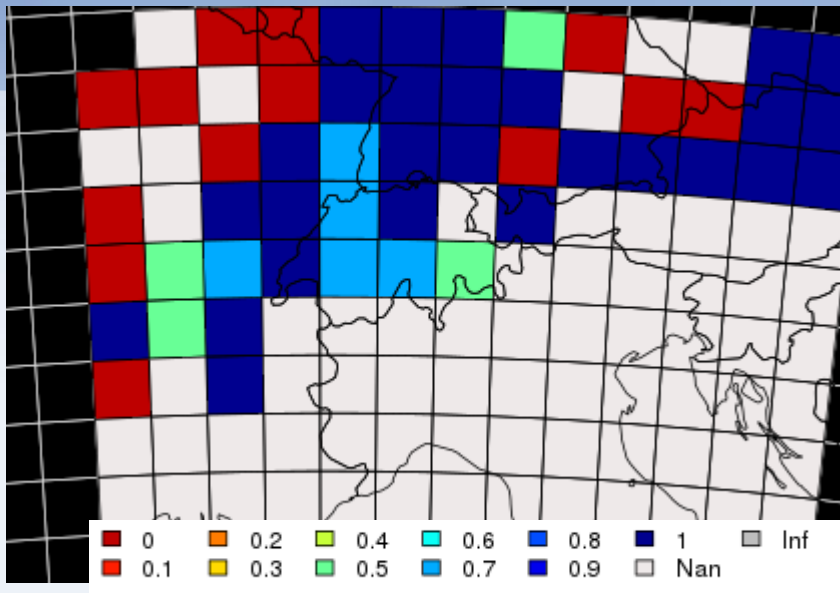


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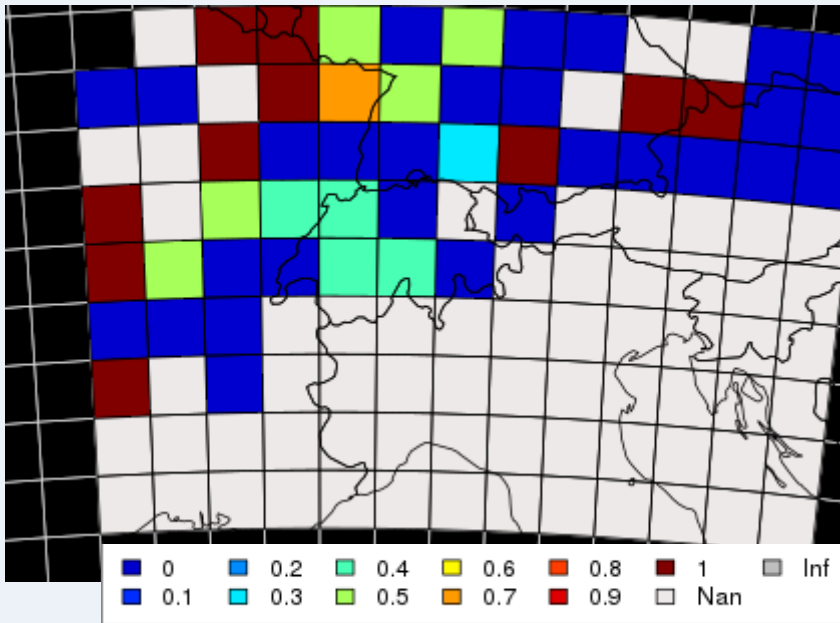
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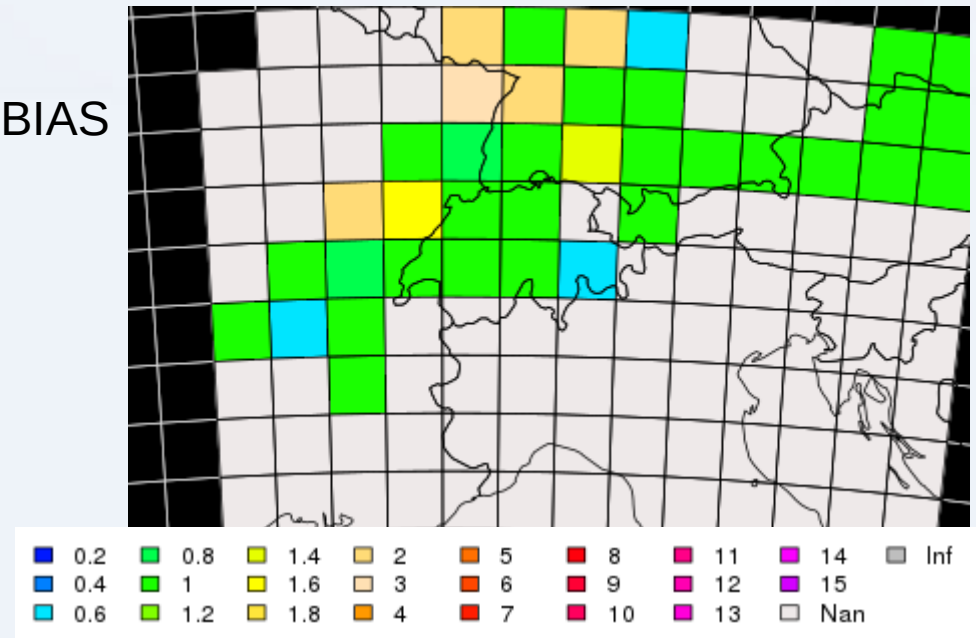


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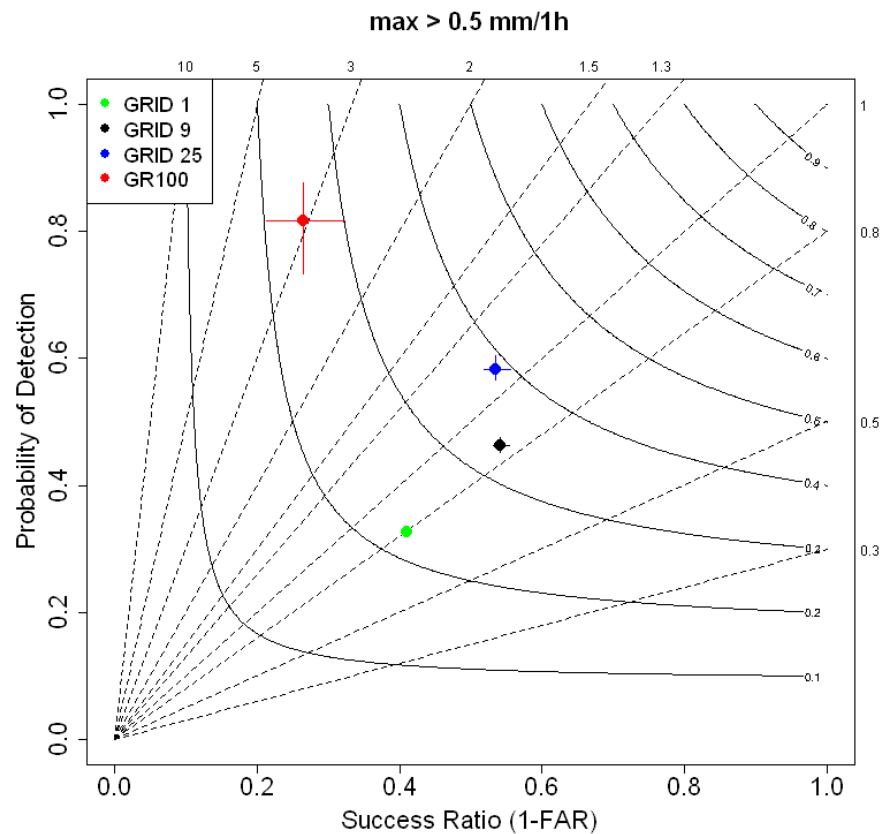
FAR



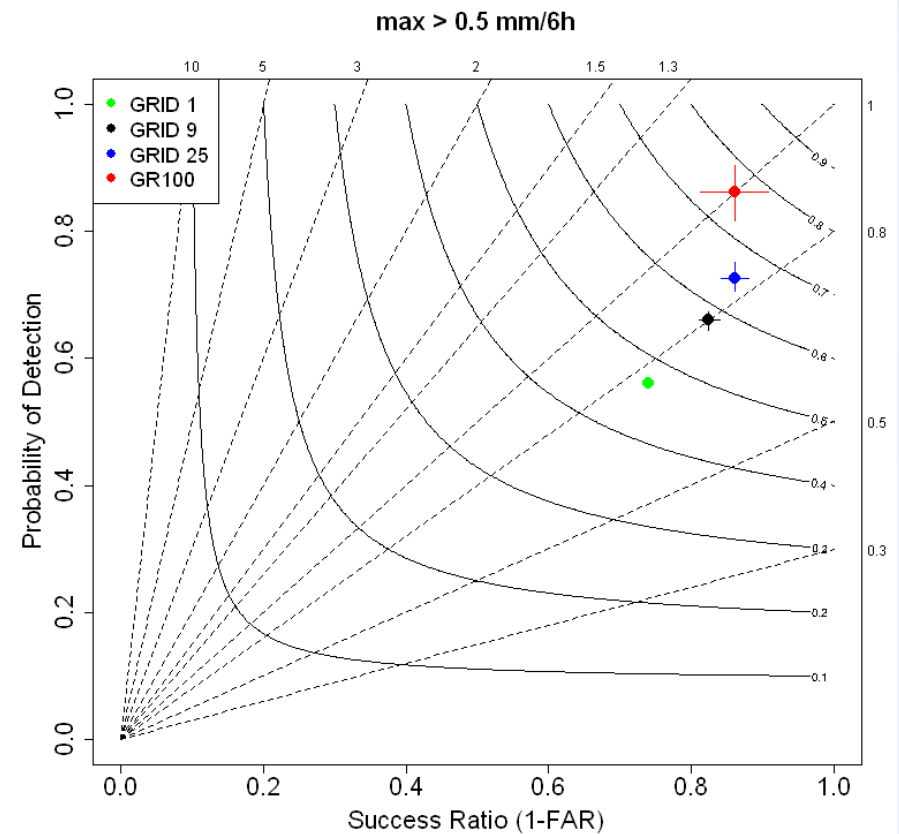
BIAS



Summarizing the scores over all the available boxes

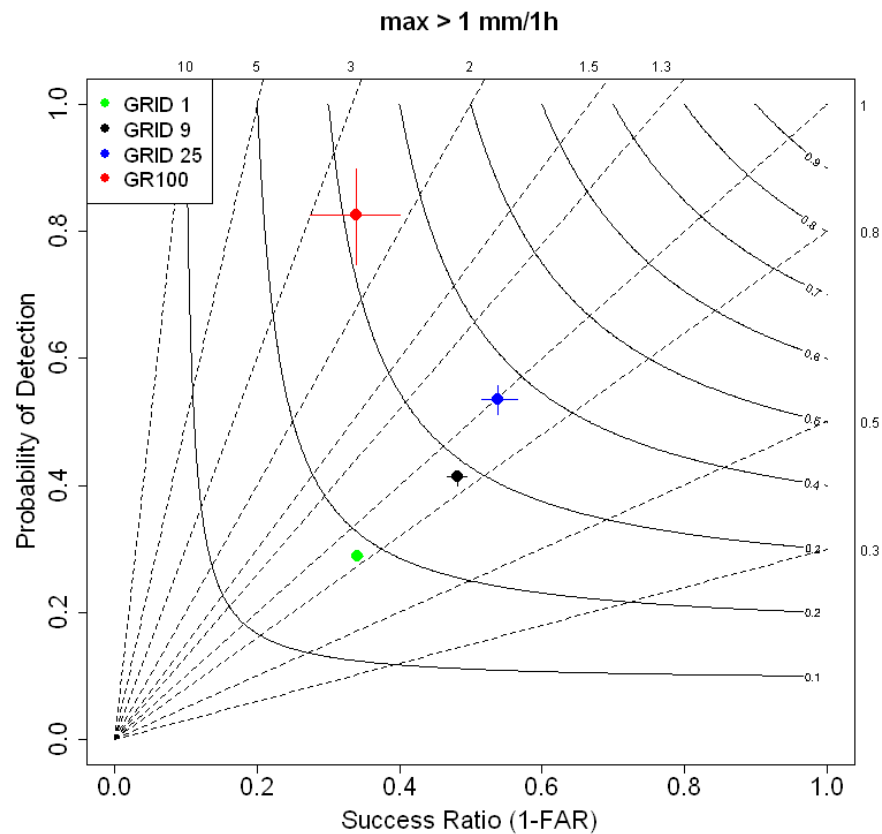


1 hour

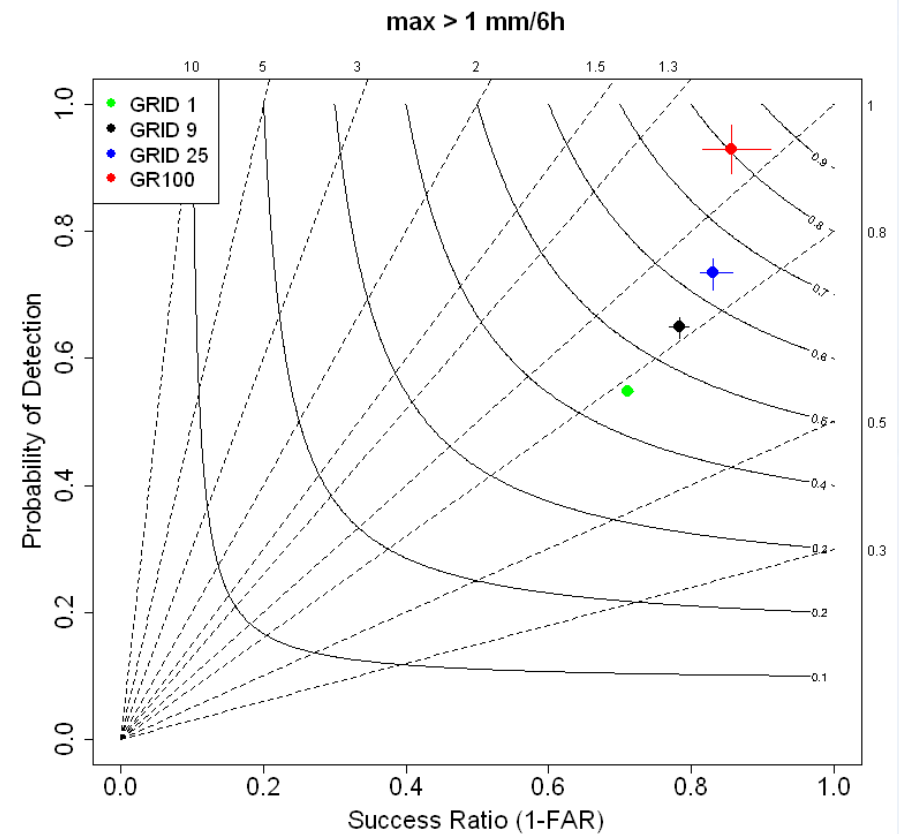


6 hours

Summarizing the scores over all the available boxes

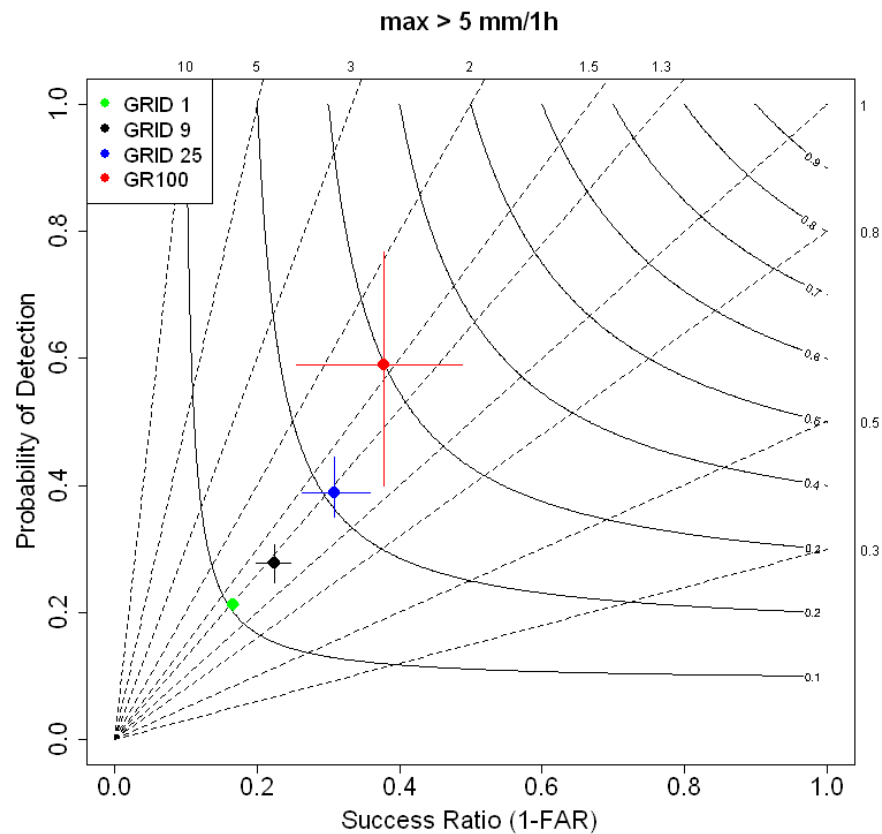


1 hour

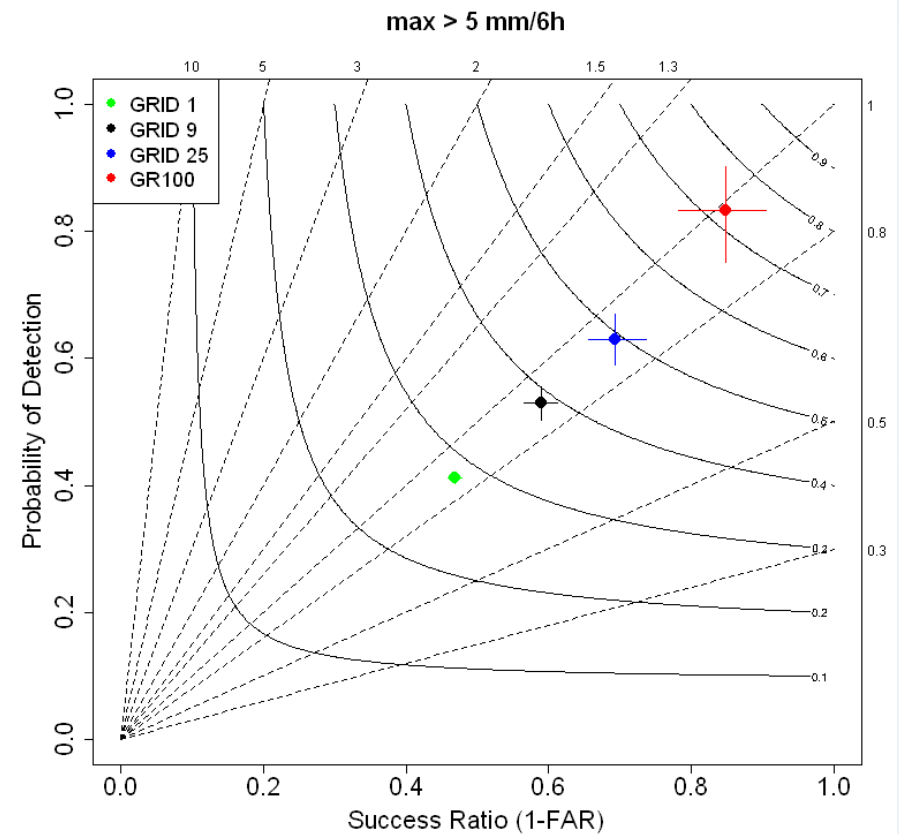


6 hours

Summarizing the scores over all the available boxes

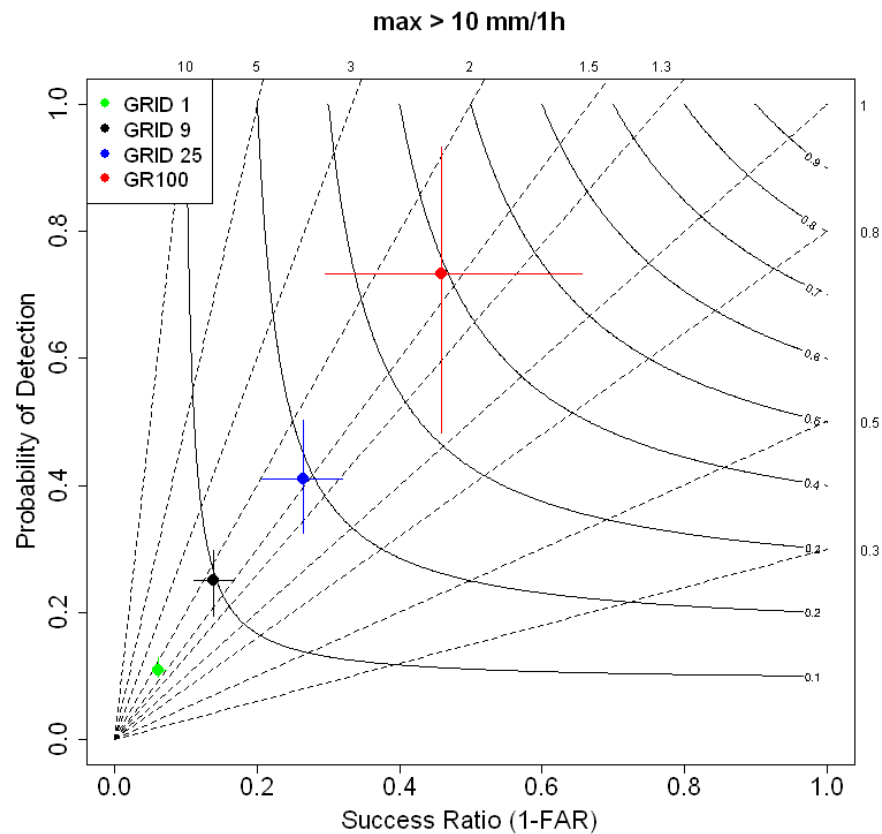


1 hour

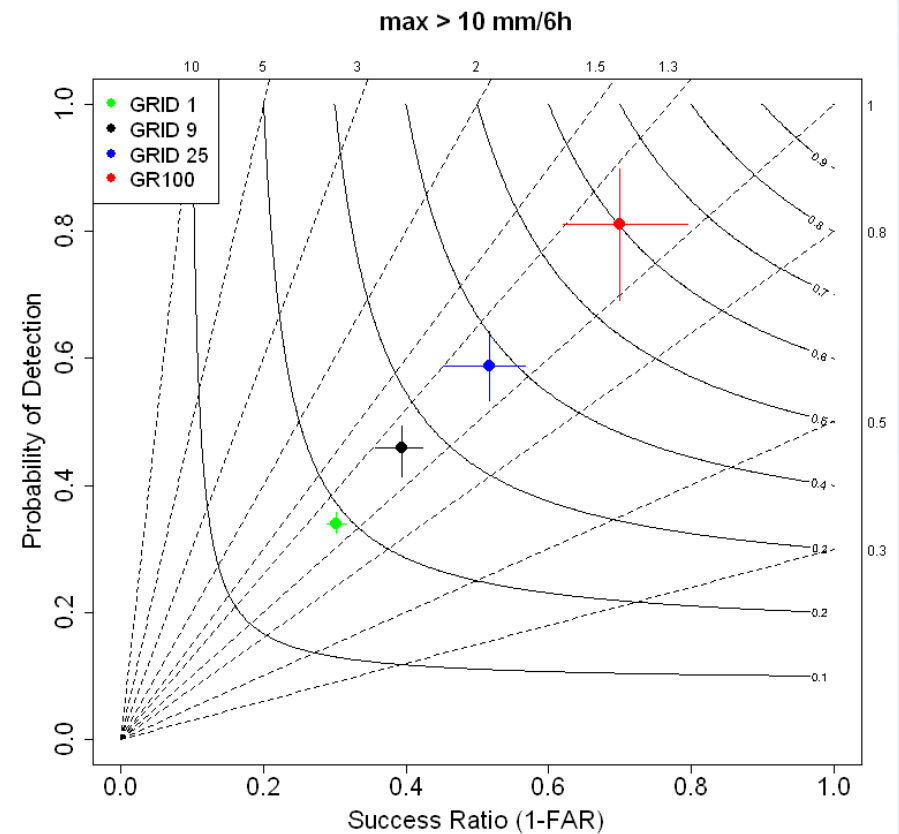


6 hours

Summarizing the scores over all the available boxes



1 hour

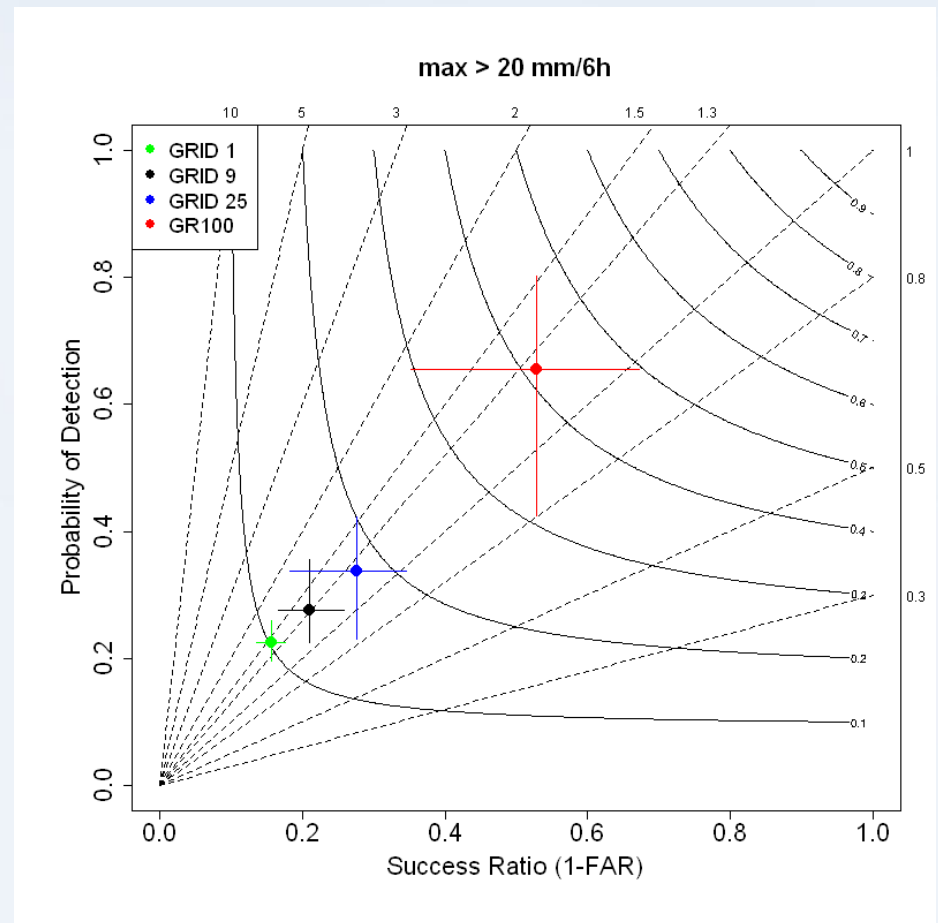


6 hours

Summarizing the scores over all the available boxes



Of course, the meaning of precipitation exceeding a particular threshold is different between 1 hour or 6 hours!



6 hours

Conclusion

- The word “conclusion” refers only to this presentation...the work is just at the beginning!
 - These preliminary results seem to confirm our experience with DIST
 - positioning errors are minimized if the considered area is larger, even if the increase of the dimension seems to produce a higher number of false alarm for very low threshold and especially in the shorter period of accumulation (1 hour)
 - More robust results can be obtained using a “full” analysis in order to make fair comparison between boxes of different size
 - Once clarified if there is the possibility to have a full VERA analysis (maybe just put 0 for negative values!), our intention is to go on with the sensitivity tests also for the mean value and other percentiles
 - Since much of the initial effort was devoted to the data ingestion, other MesoVict cases can now be taken into consideration in an easier way

THANKS FOR YOUR ATTENTION!