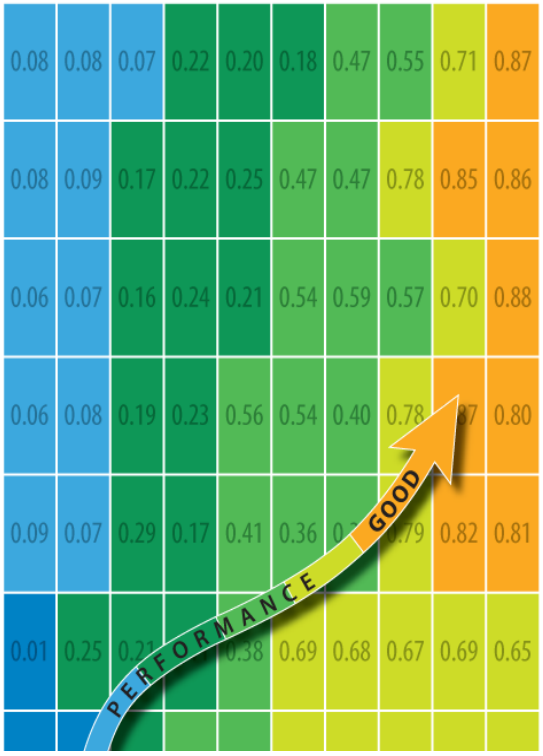
4th International Verification Methods Workshop

THE USE OF TRADITIONAL AND SPATIAL APPROACHES FOR THE VERIFICATION OF RAINFALL FORECAST OF A CONVECTIVE EVENT NEAR TO BARCELONA (SPAIN)



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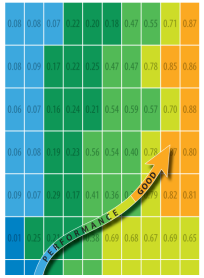
Helsinki, June 10th, 2009



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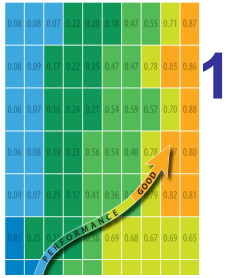


1. Which verification questions do we want to answer?

a) Question → Did the model reproduce the occurrence of the event ?

b) Attributes →
- Intensity
- Extension
- Location

c) Methods
statistics/measures/graphics →

Visual verification

Traditional approach:
POD, FAR, BIAS, PC

Spatial verification:
FSS, upscaling

2. Description of the event

Convective precipitation event in Catalonia (NE Iberian Pensinsula), on October 3rd 2008, afternoon.

Several storms developed inland and moved to the coast where they reached the maximum of activity, producing **heavy rainfall** and **hail** over the northern coast of Barcelona province.

Verification

6-hour lead-time MM5 (12 km) precipitation forecast

observed precipitation estimated by the radar network of the Catalan Meteorological Service.

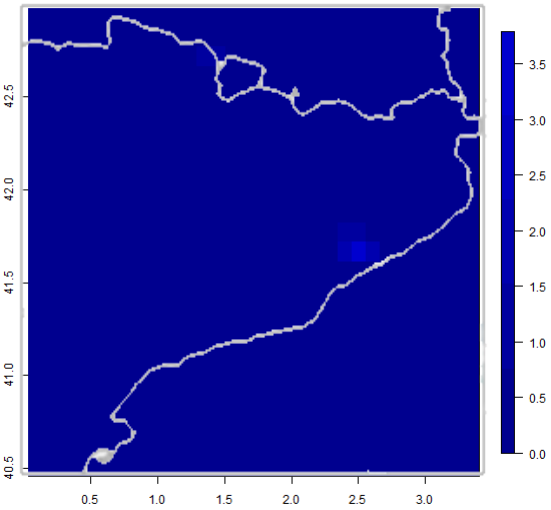
(Poster #30)

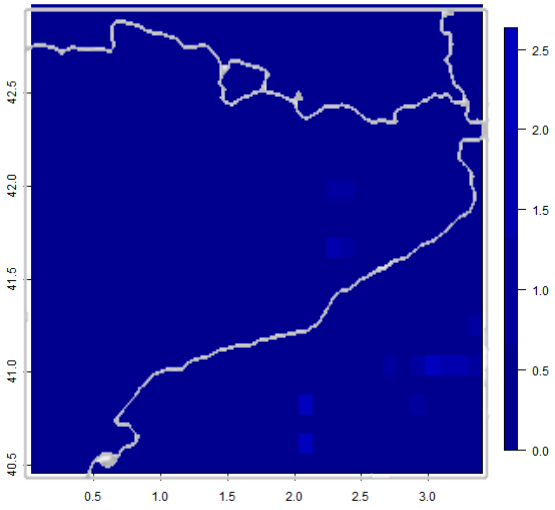
3. Visual verification (I)

MM5

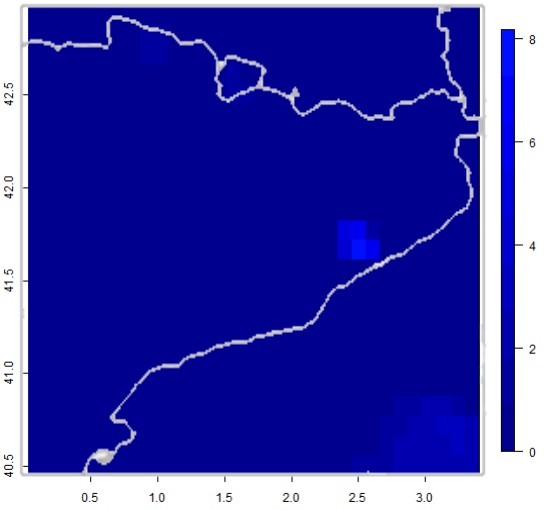
RADAR

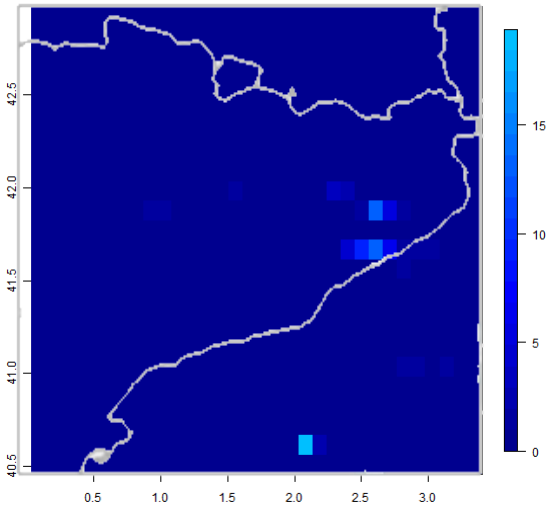
12 – 13 Z





13 – 14 Z

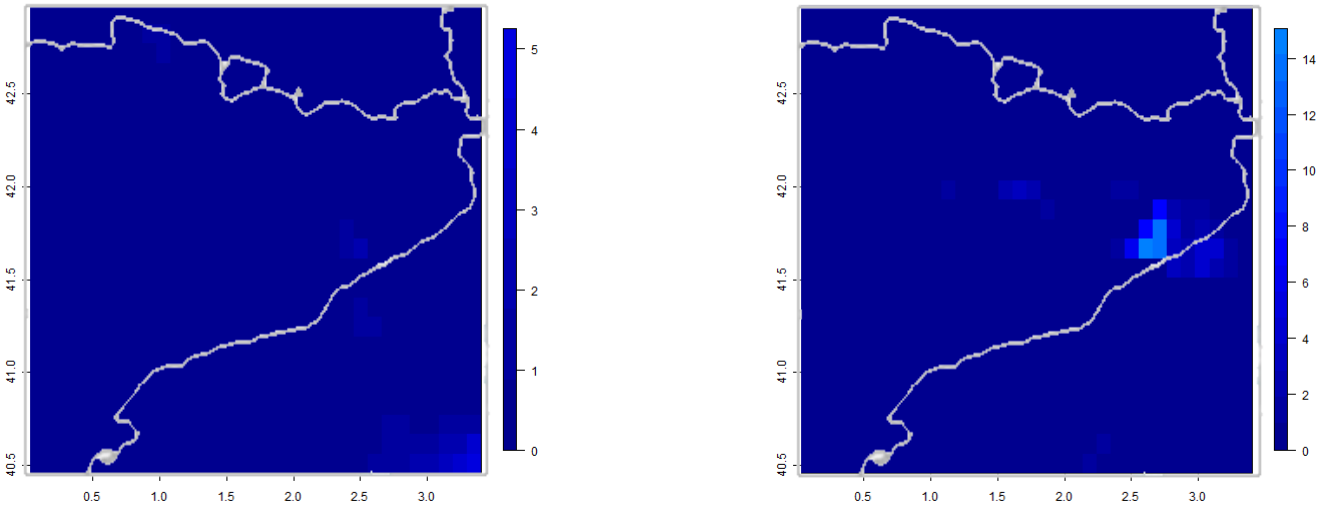




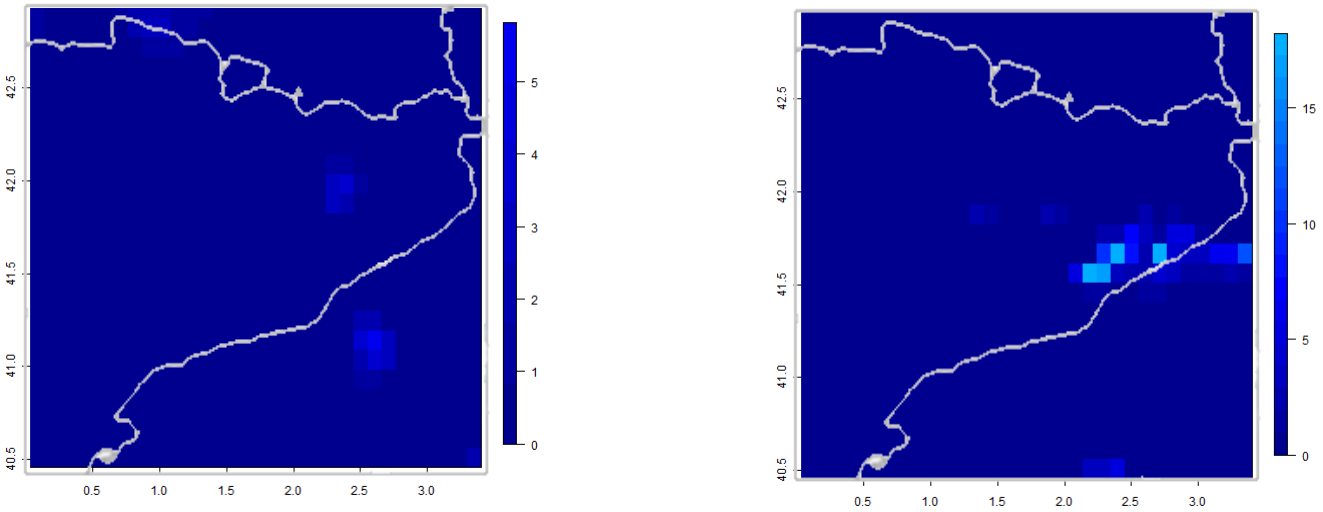
3. Visual verification (I)

MM5 **RADAR**

14 – 15 Z



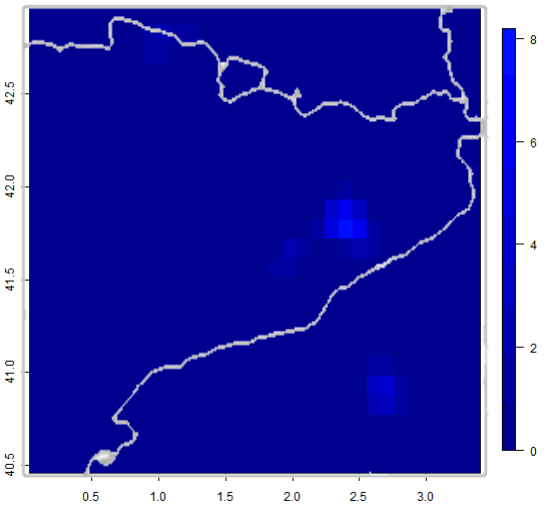
15 – 16 Z

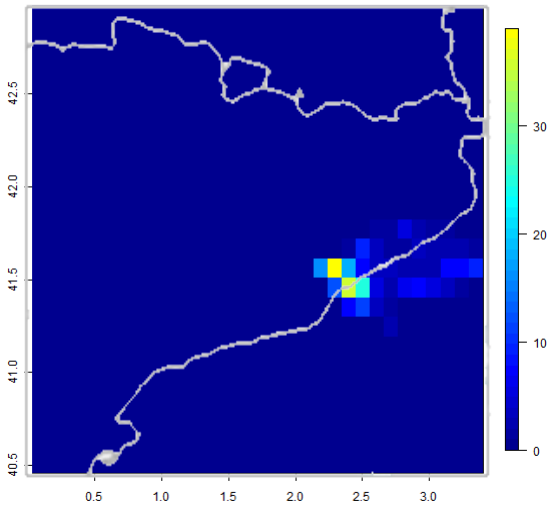


3. Visual verification (I)

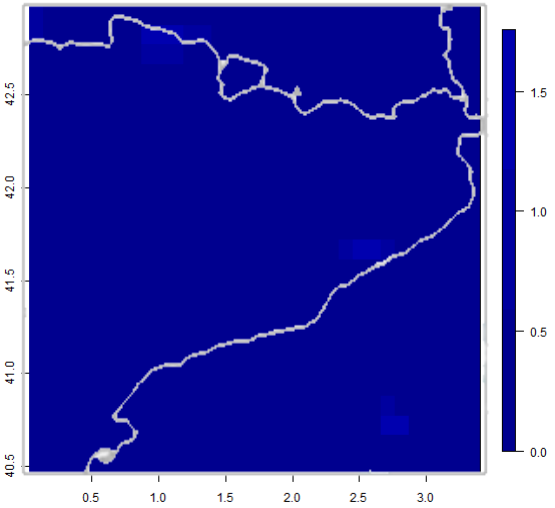
MM5 **RADAR**

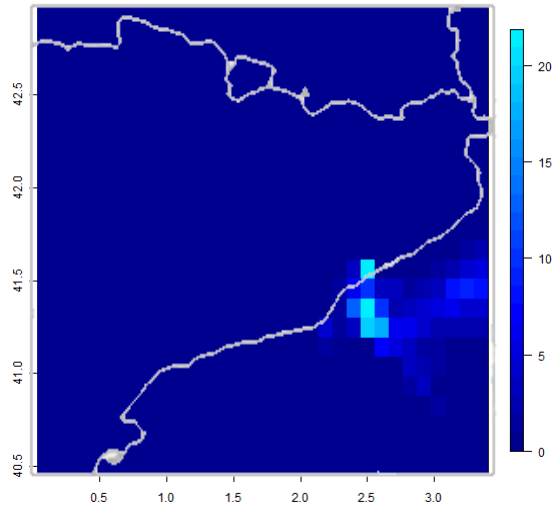
16 – 17 Z





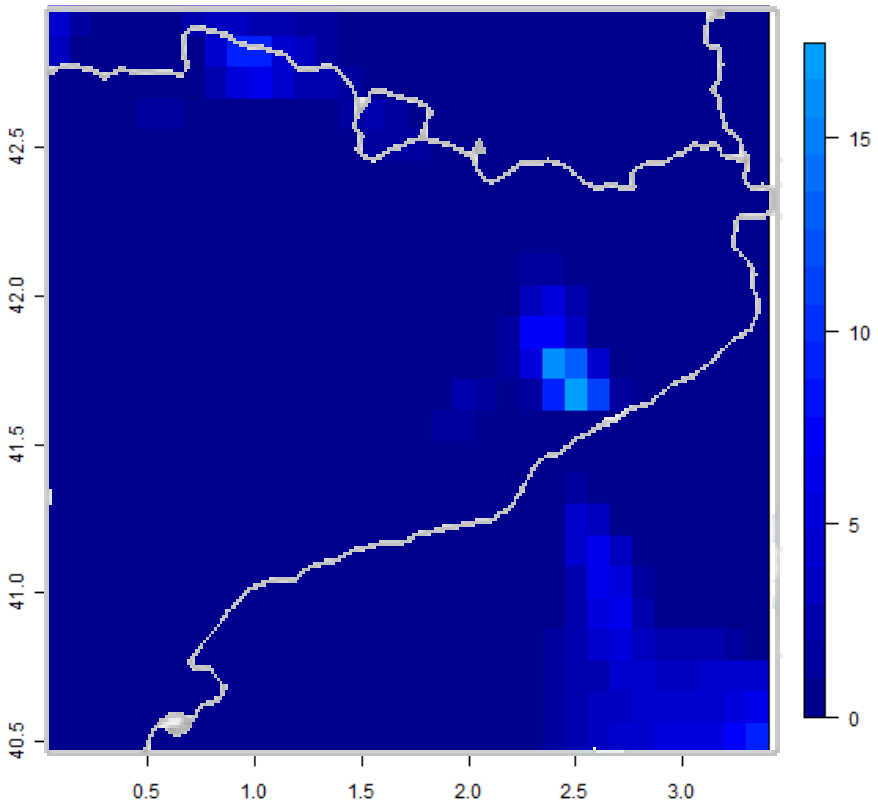
17 – 18 Z

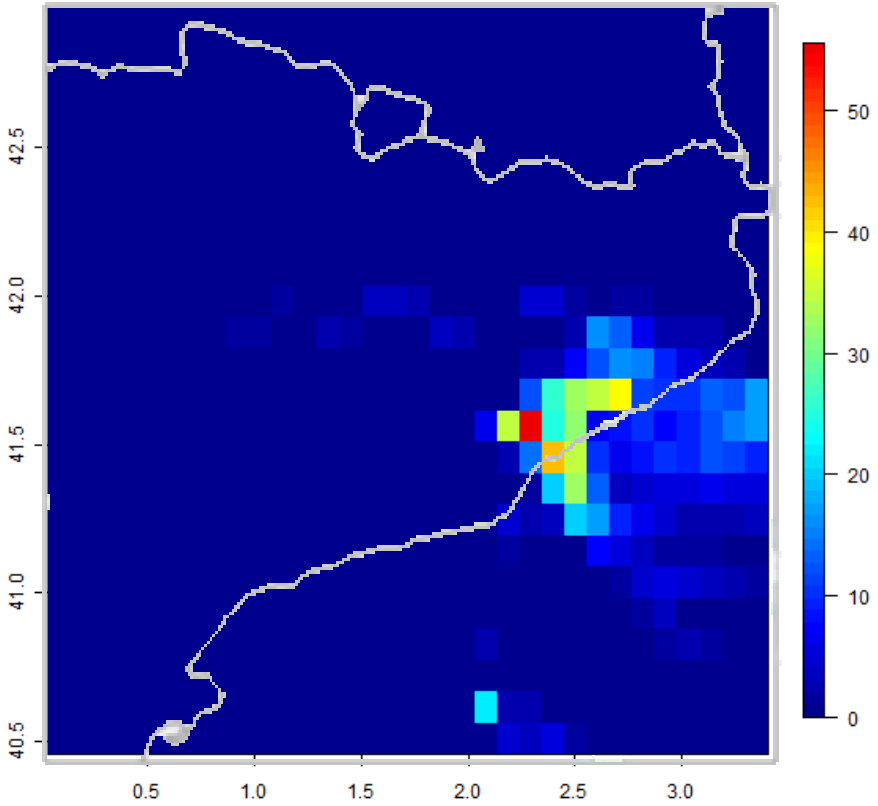


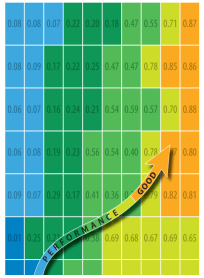


3. Visual verification (II)

MM5 **12 - 18 Z** **RADAR**







4. The traditional approach (I)

The dataset available “suggests” the adoption of the contingency table approach obtained varying the thresholds in accumulated rain

Event forecast	Event observed		
	Yes	No	Marginal total
Yes	a	b	a + b
No	c	d	c + d
Marginal total	a + c	b + d	a + b + c + d = n

$$H = POD = \frac{a}{(a+c)}$$

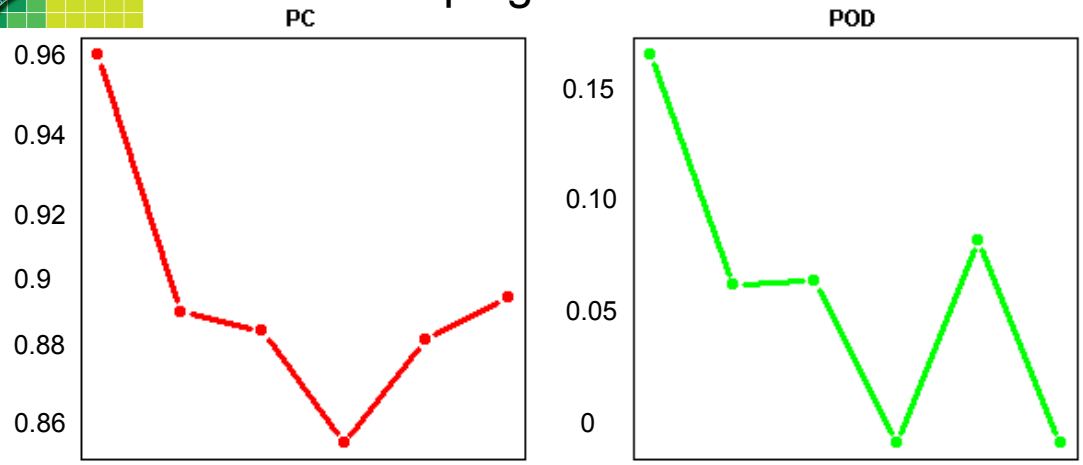
$$FAR = \frac{b}{(a+b)}$$

$$PC = \frac{(a+d)}{n}$$

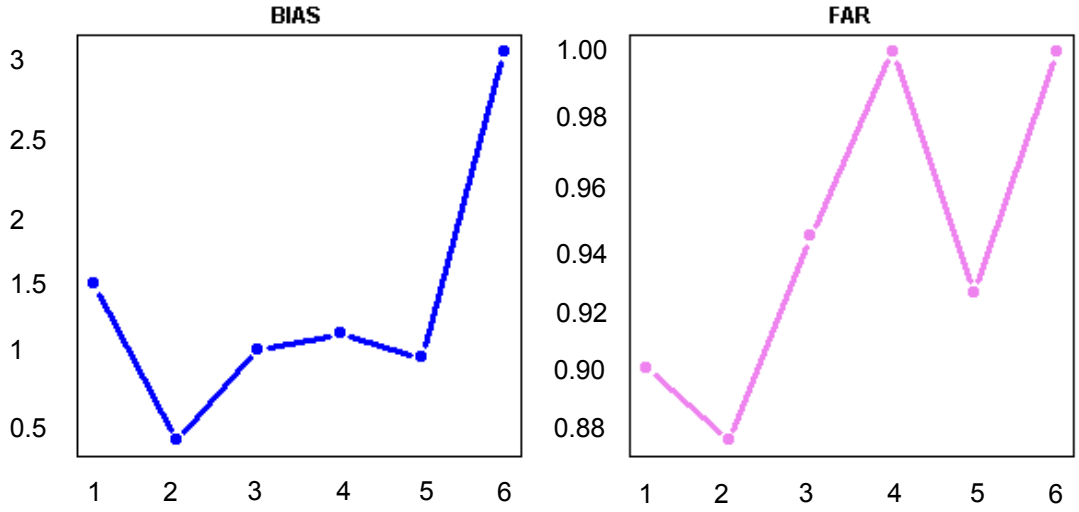
$$FBI = B = \frac{(a+b)}{(a+c)}$$

4. The traditional approach (II)

Point-to-point verification has been produced over the domain, keeping a threshold of 0.5 mm



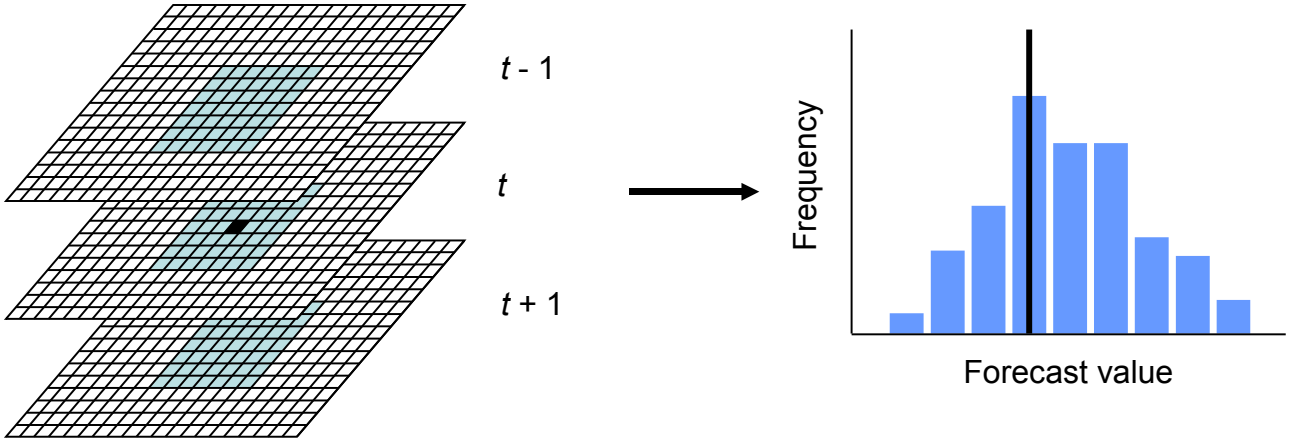
The results appear quite poor along the time range of the forecast



There's a disagreement between the eyeball and this more quantitative approach

5. Spatial verification (I)

The next step of the verification process is the application of spatial methods



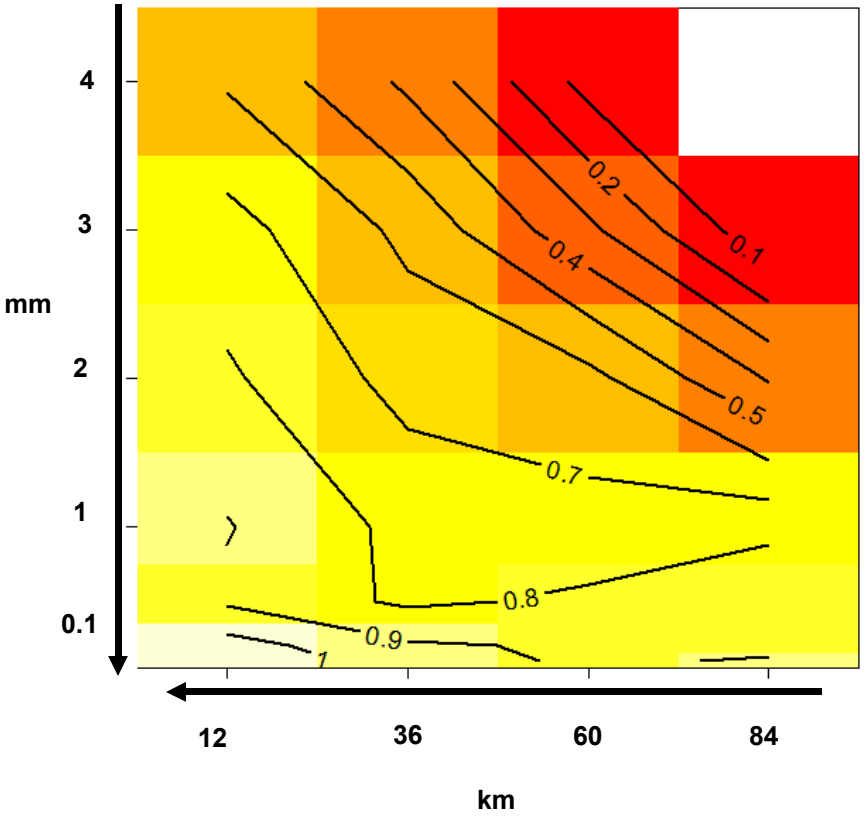
The neighborhood method provides the averaging of forecast and observation to successively larger grid resolutions (upscaling), the rain threshold being increased, too, using the usual categorical predictand metric.

This method allows to relate the best categorical scores to the more convenient grid resolution and threshold, giving some value to a forecast otherwise “traditionally” unsatisfactory

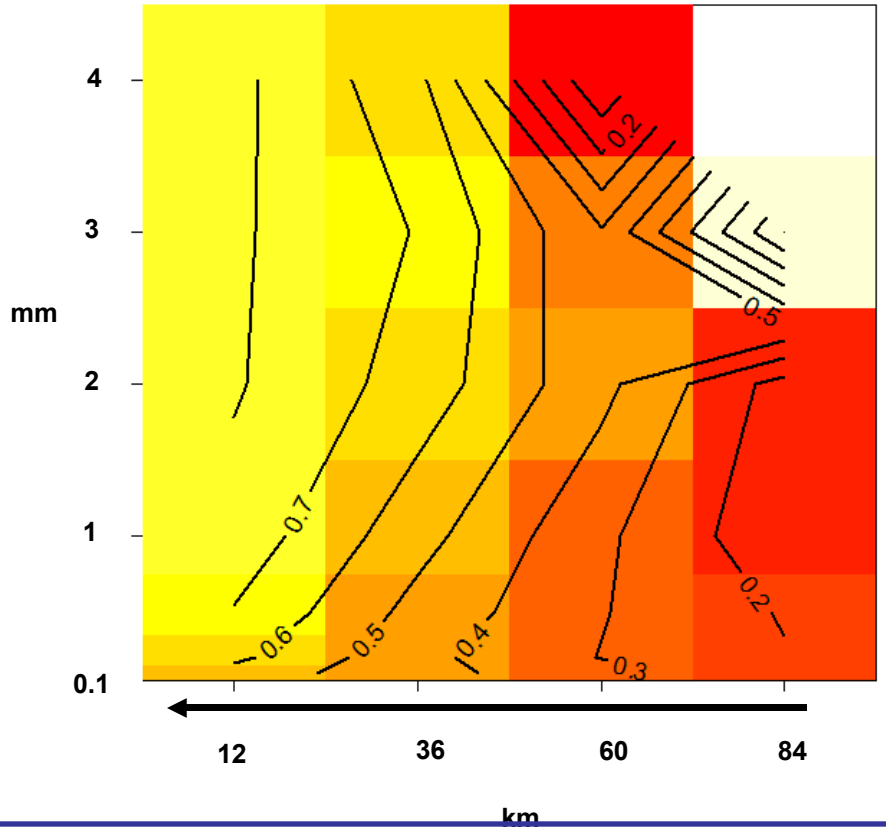
5. Spatial verification (II)

The application of this method has been made on an aggregated sample with accumulated rainfall over 6 hours

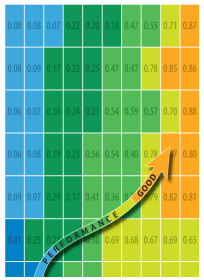
BIAS

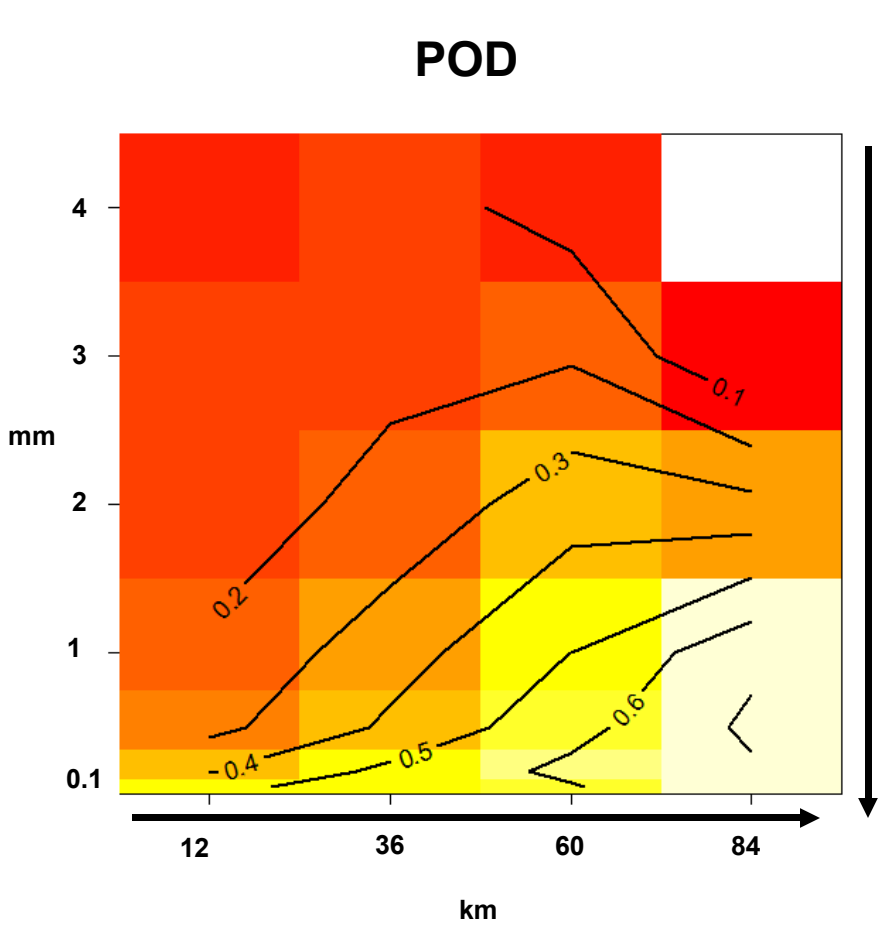


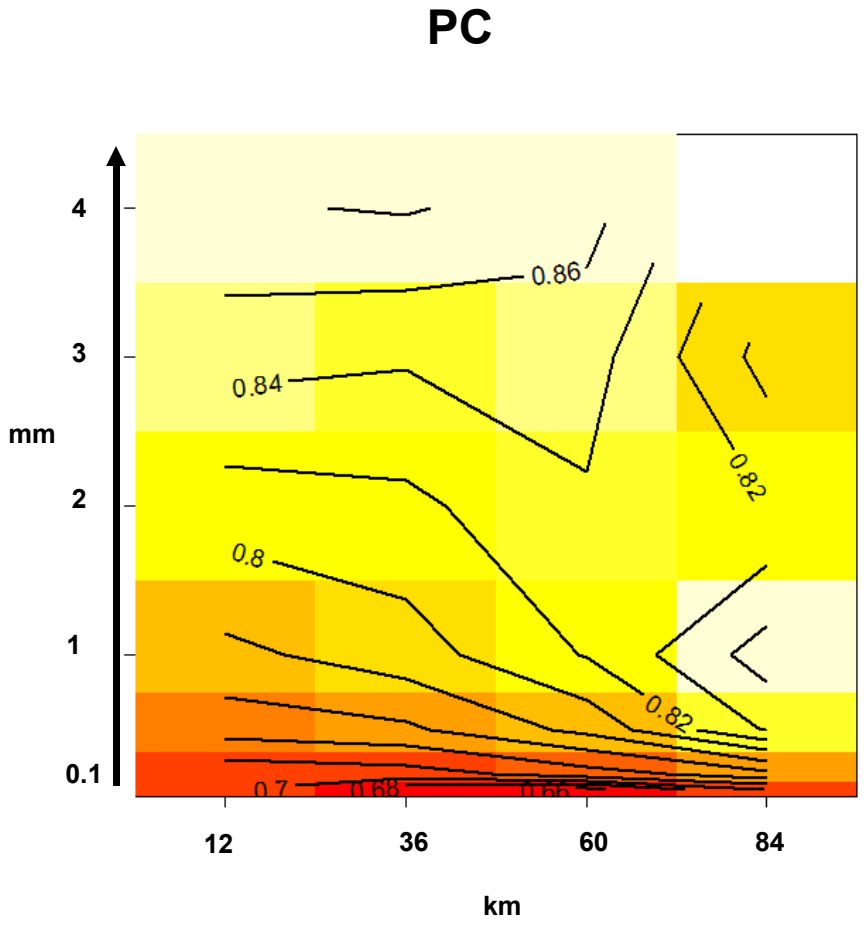
FAR

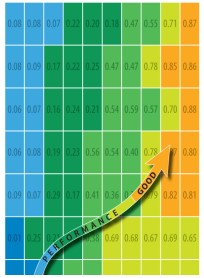


5. Spatial verification (III)





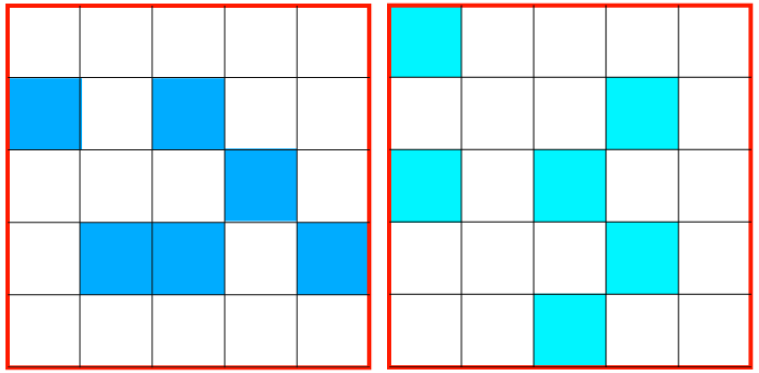




5. Spatial verification (IV)

The last verification step aims to search the smallest neighbourhood size that can provide sufficiently accurate forecasts:
the **Fractions Skill Score**

$$\mathrm{FSS} = 1 - \frac{\frac{1}{N}\sum_{i=1}^{N}(P_{fcst} - P_{obs})^2}{\frac{1}{N}\sum_{i=1}^{N}P_{fcst}^{\,2} + \frac{1}{N}\sum_{i=1}^{N}P_{obs}^{\,2}}$$

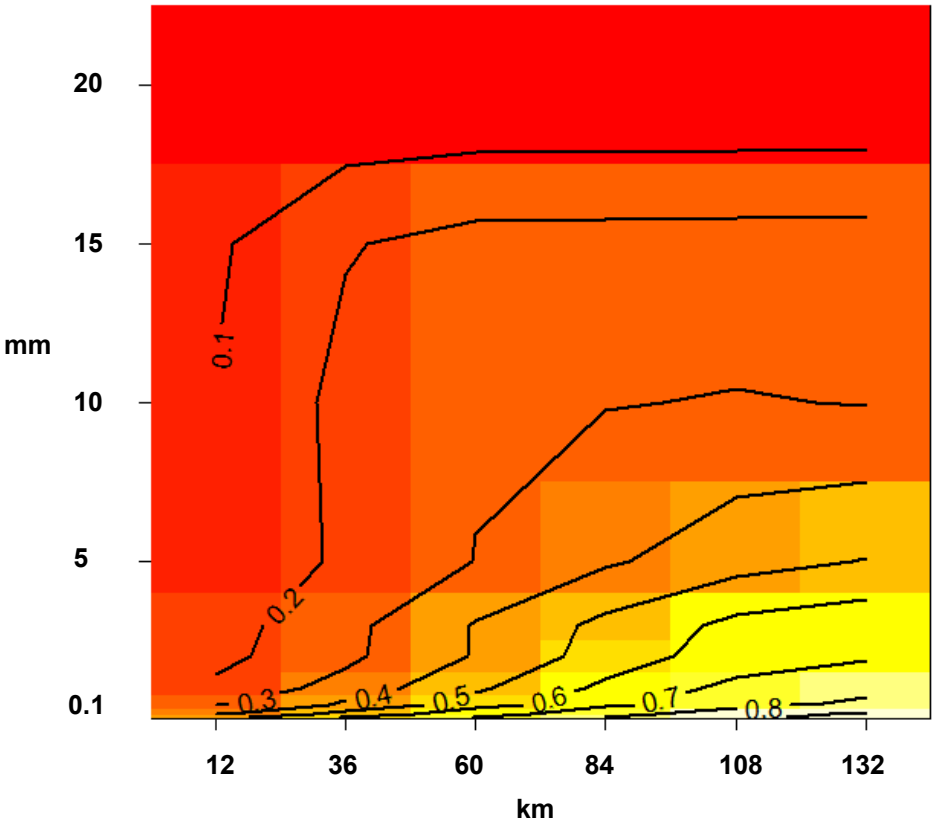


observed forecast

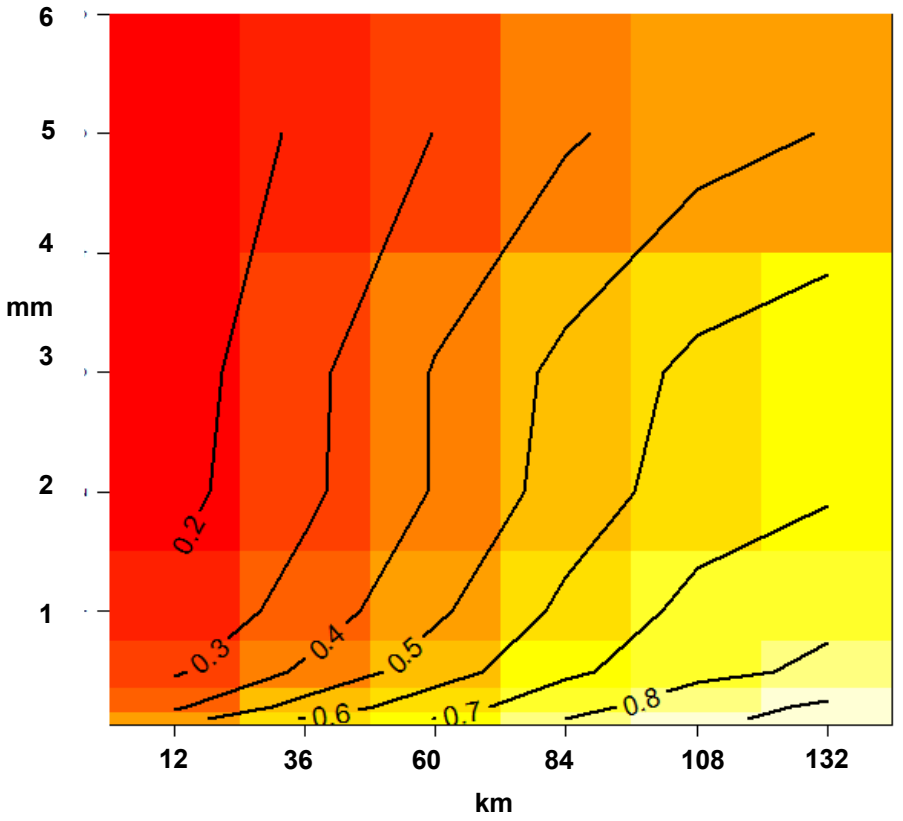
Compare forecast fractions with observed fractions (radar) in a *probabilistic* way over different sized neighbourhoods

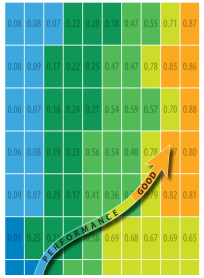
5. Spatial verification (V)

FSS



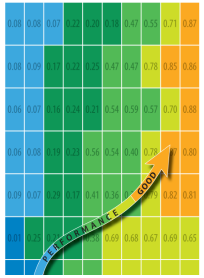
FSS - zoomed





6. Summary

- √ We have considered a dataset comparing radar estimated rainfall and a high resolution model QPF in a convective case
- √ We have applied the traditional categorical metric underlining the intrinsic limits of a “point-to-point” verification approach
- √ We have applied a more advanced spatial field verification discovering the capability of such method to extract value from a “low-score” forecast
- √ We have found out some peculiar behaviors of the categorical attributes and scores in varying resolution and rain thresholds



Aknowledgements: Tutorial teachers and organizers.

Thank you for your attention !!

Grazie !

Gràcies !

Takk !