New neighborhood-based contingency tables

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ALADIN/HIRLAM Workshop
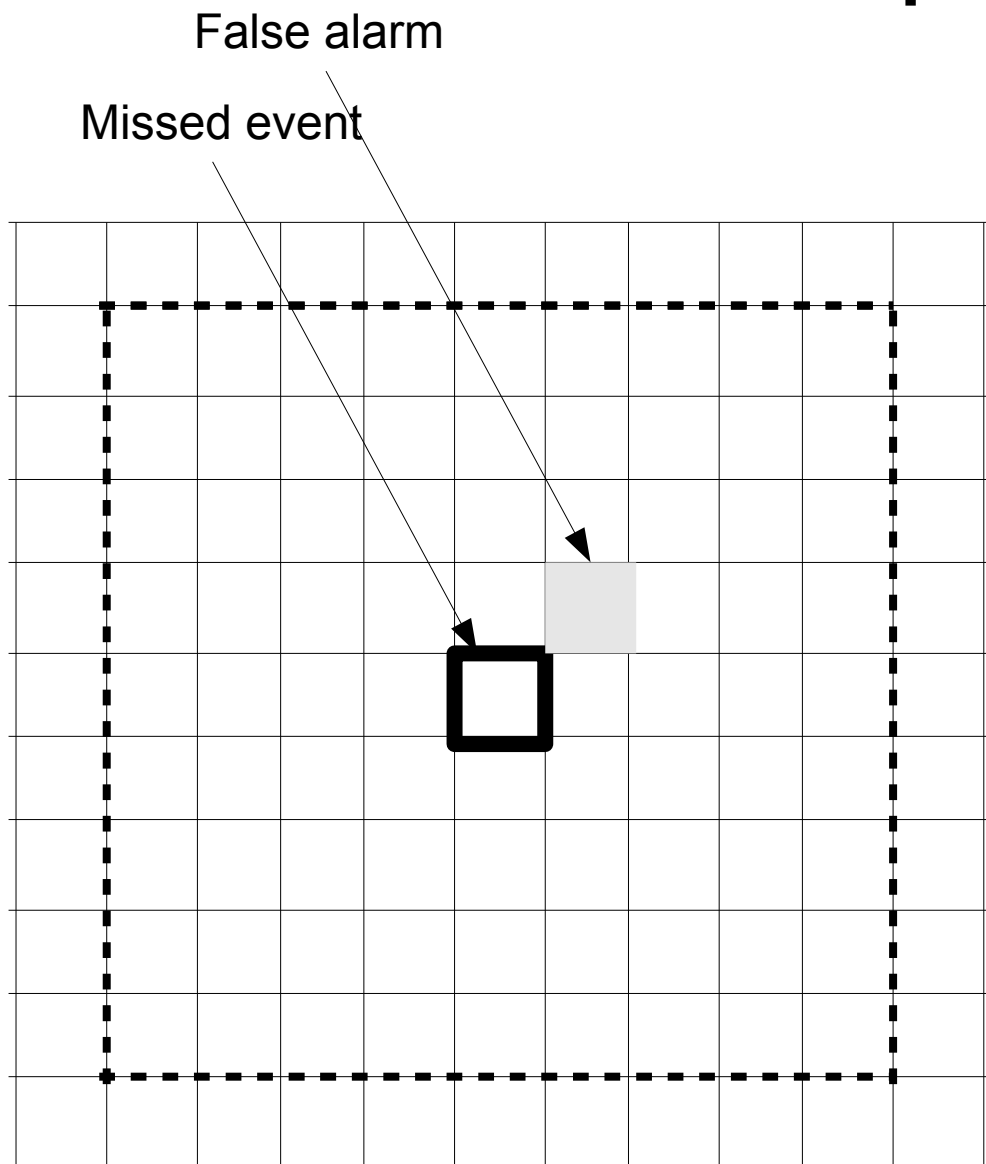18/04/2018

Table of contingency for binary events

Observed event   Y   N

Forecast event

Y
$$\begin{pmatrix} Hits & False\,alarms \\ Misses & Correct\,rejections \end{pmatrix}$$
N

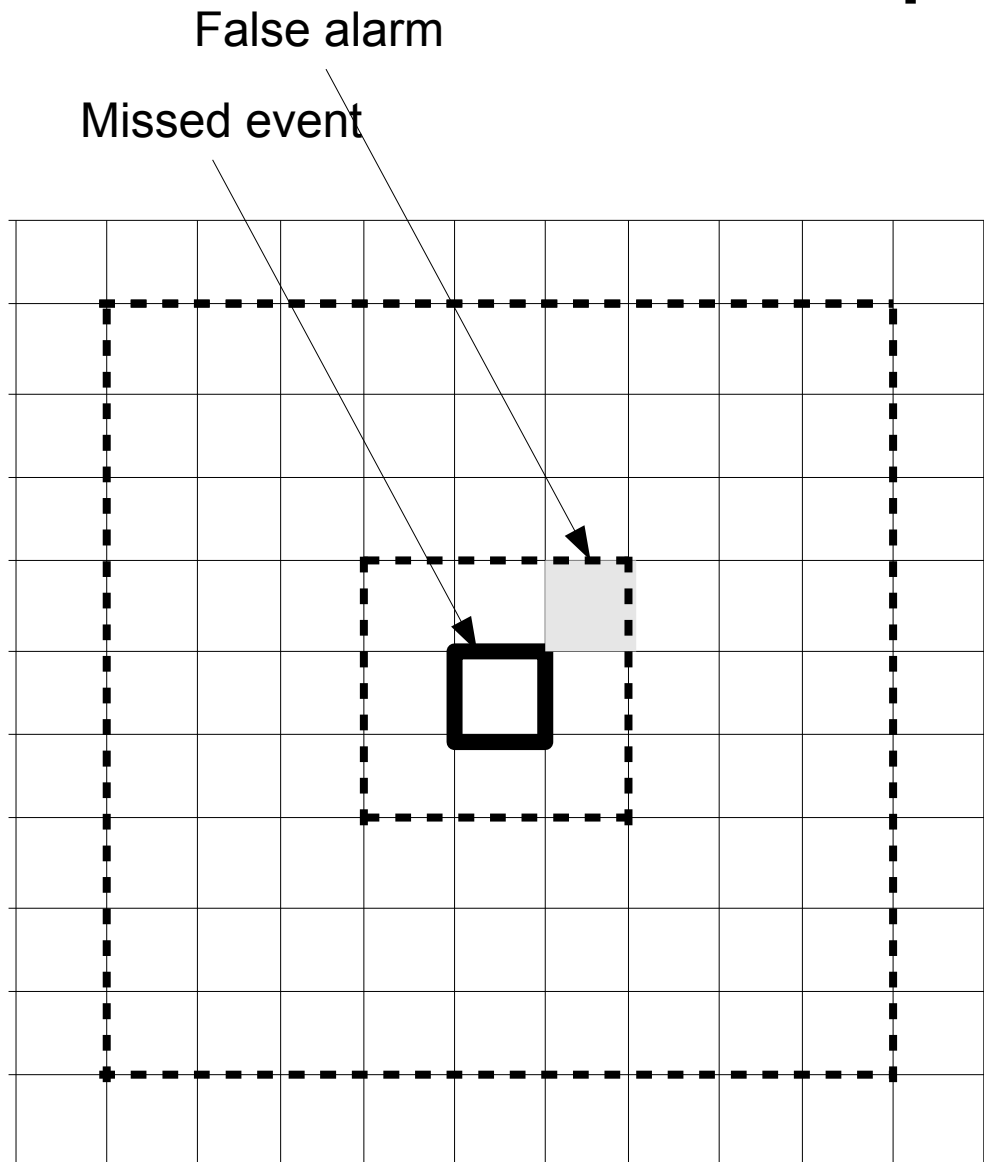Many scores are deduced from this table

The double penalty problem

False alarm

Missed event

$$\begin{pmatrix} 0 & 0 \\ 1 & 80 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 79 \end{pmatrix}$$

The double penalty problem

False alarm

Missed event

Frequency=1/9 for observed
and forecast events

Frequency Brier Score

$$FBS = \frac{1}{N_t N_s} \sum_{i=1}^{N_t} \sum_{j=1}^{N_s} \left(\nu_f(i,j) - \nu_o(i,j) \right)^2 ,$$

Fraction Skill Score (Roberts and Lean 2008)

$$FSS = 1 - \frac{FBS}{\frac{1}{N_t N_s} \sum_{i=1}^{N_t} \sum_{j=1}^{N_s} \left(\nu_f^2 + \nu_o^2 \right)} .$$
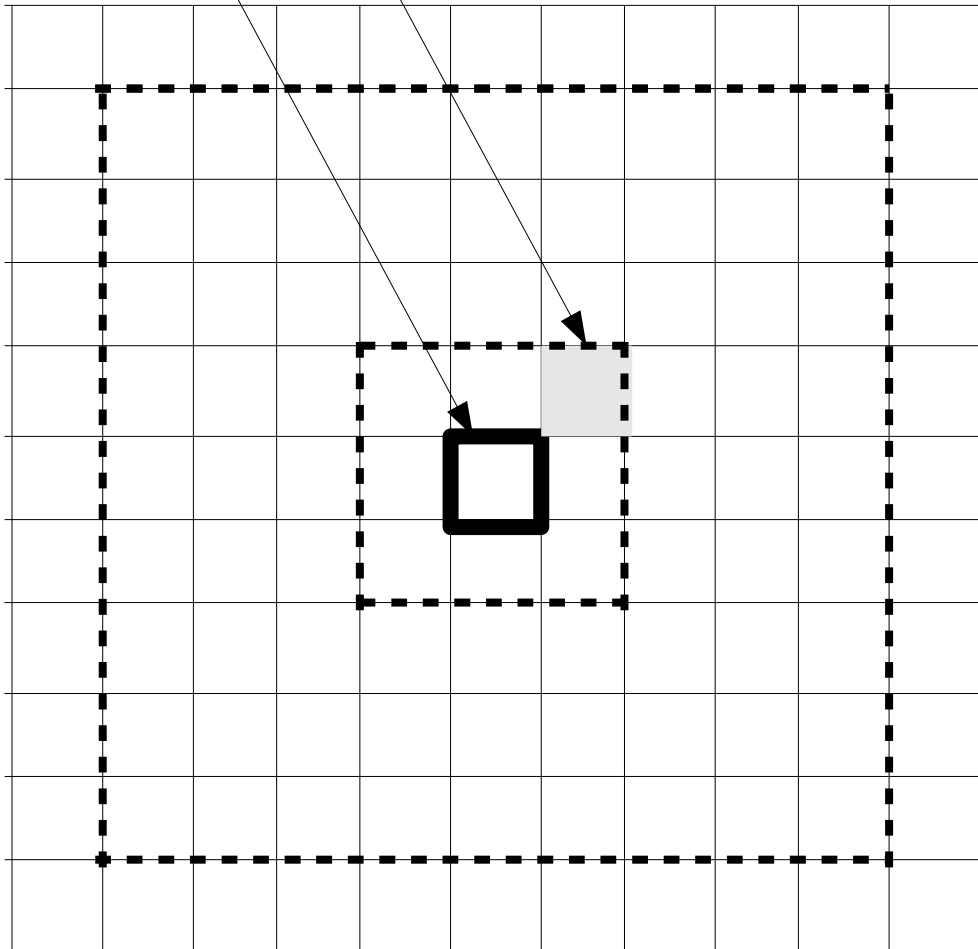
Summary

- 2 neighborhood-based tables of contingency

- Application to QPF of ARPEGE and AROME

- Conclusion

The neighborhood maximum (Sobash etal 2011, Schwartz 2017)

False alarm

Missed event

« The event is observed at the central point »
 is replaced by
« The event is observed one or more times
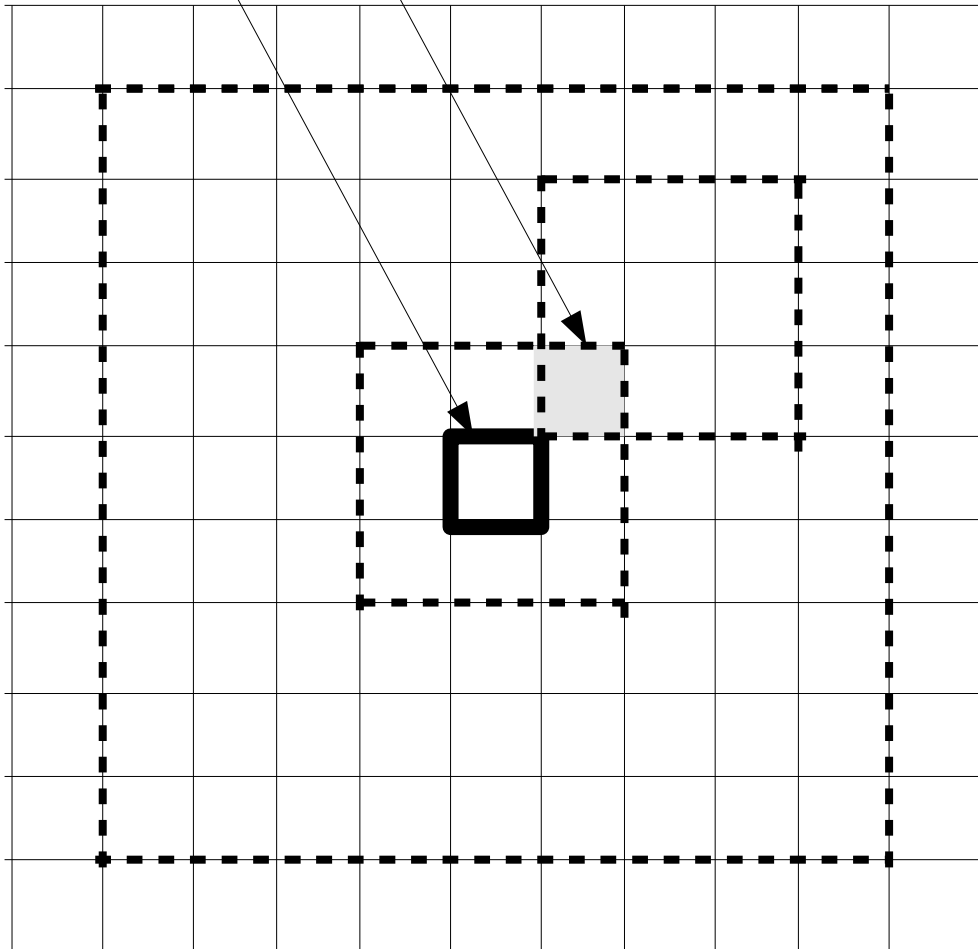 in the neighborhood »

« The event is not forecast at the central point »
 is replaced by
« The event is forecast one or more times
 in the neighborhood »

« The missed event at the central point »
 is replaced by
« one hit in the neighborhood »

The Table of contingency is filled with these
 transformed events by moving the
 neighborhood windows all along the verification
 domain

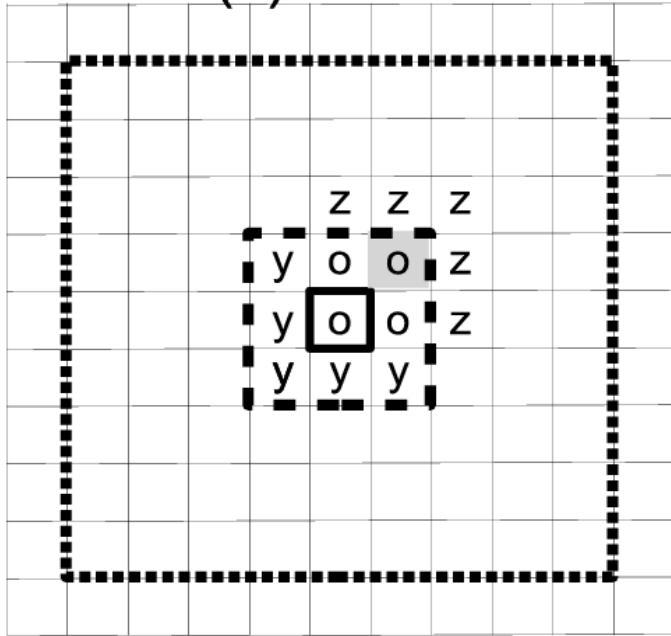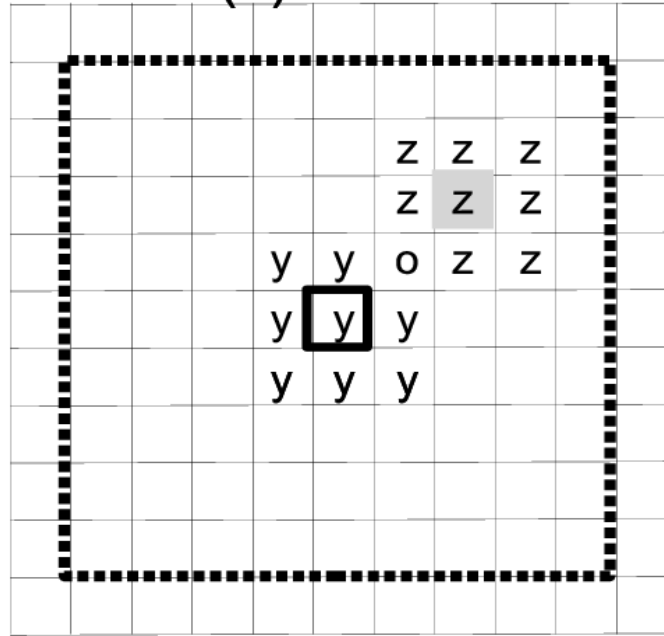# The errors association (Stein and Stoop 2018)

False alarm

Missed event

« Pairs of one false alarm and one missed event are replaced by pairs of one hit and one correct rejection in the neighborhood»

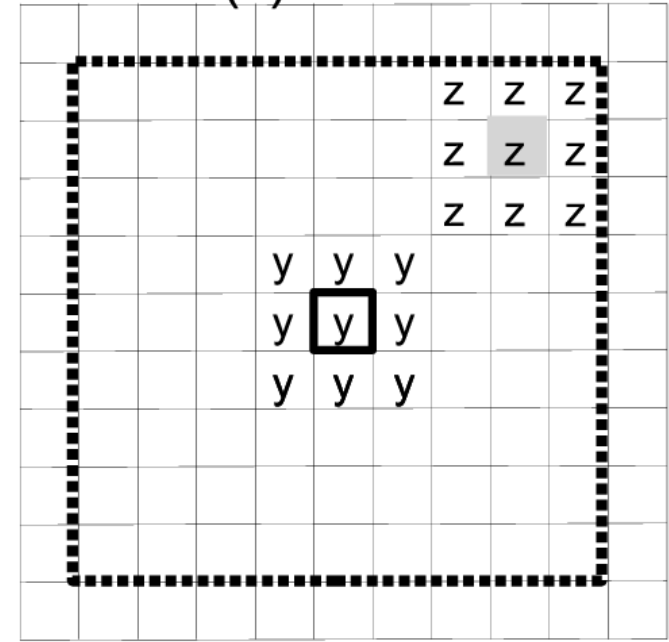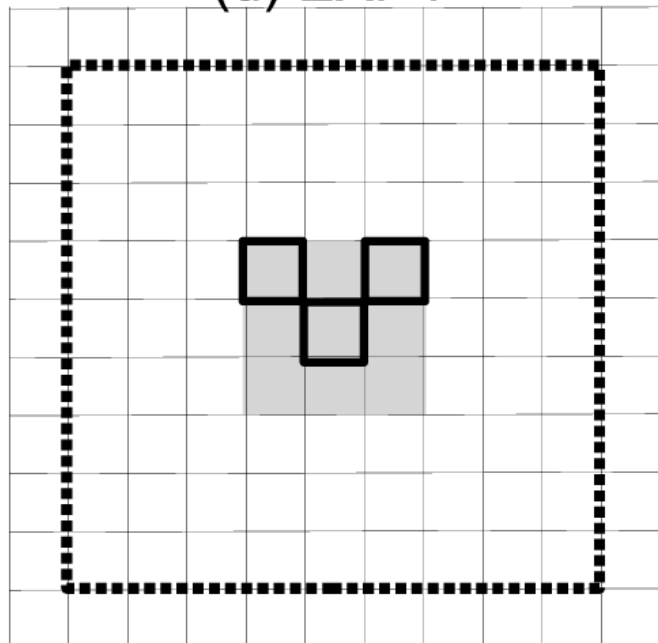The Table of contingency is filled by moving the neighborhood window all along the verification domain

$$\begin{pmatrix} 0.44 & 0.56 \\ 0.56 & 79.44 \end{pmatrix}$$

$$\begin{pmatrix} 0.11 & 0.89 \\ 0.89 & 79.11 \end{pmatrix} .$$

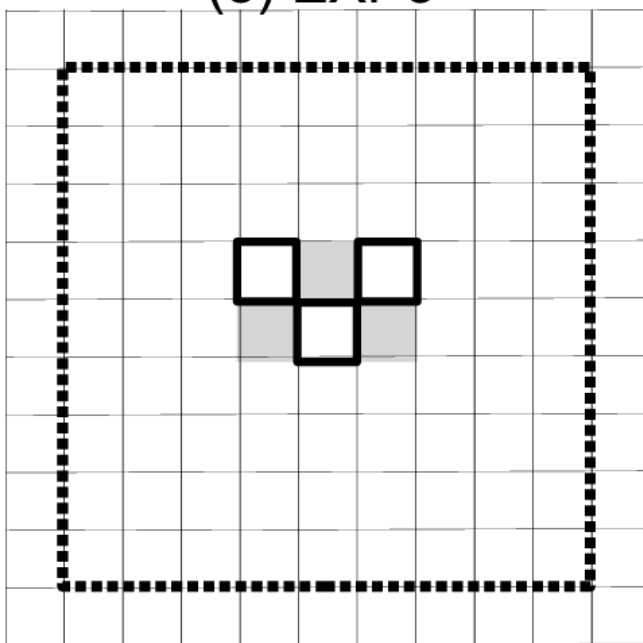$$\begin{pmatrix} 0 & 1 \\ 1 & 79 \end{pmatrix} .$$

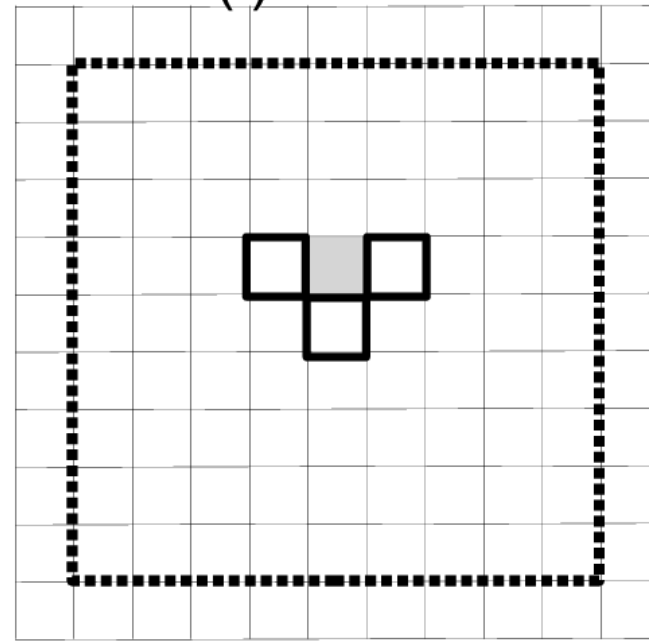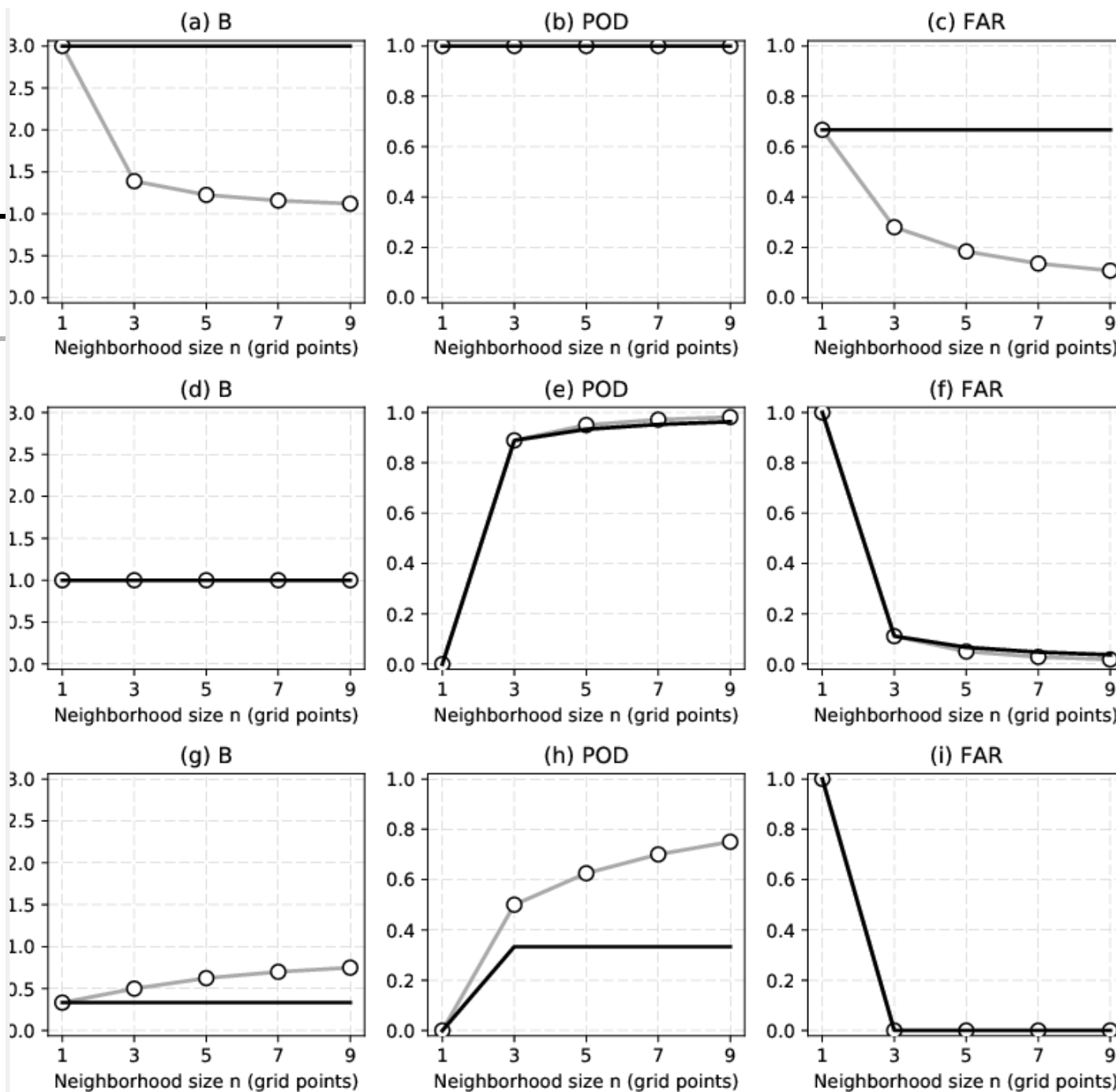Both methods give the same results

(d) EXP4   (e) EXP5   (f) EXP6

$B=3$ $B=1$ $B=1/3$

Comparison of basic scores for the 2 neighborhood based contingency tables
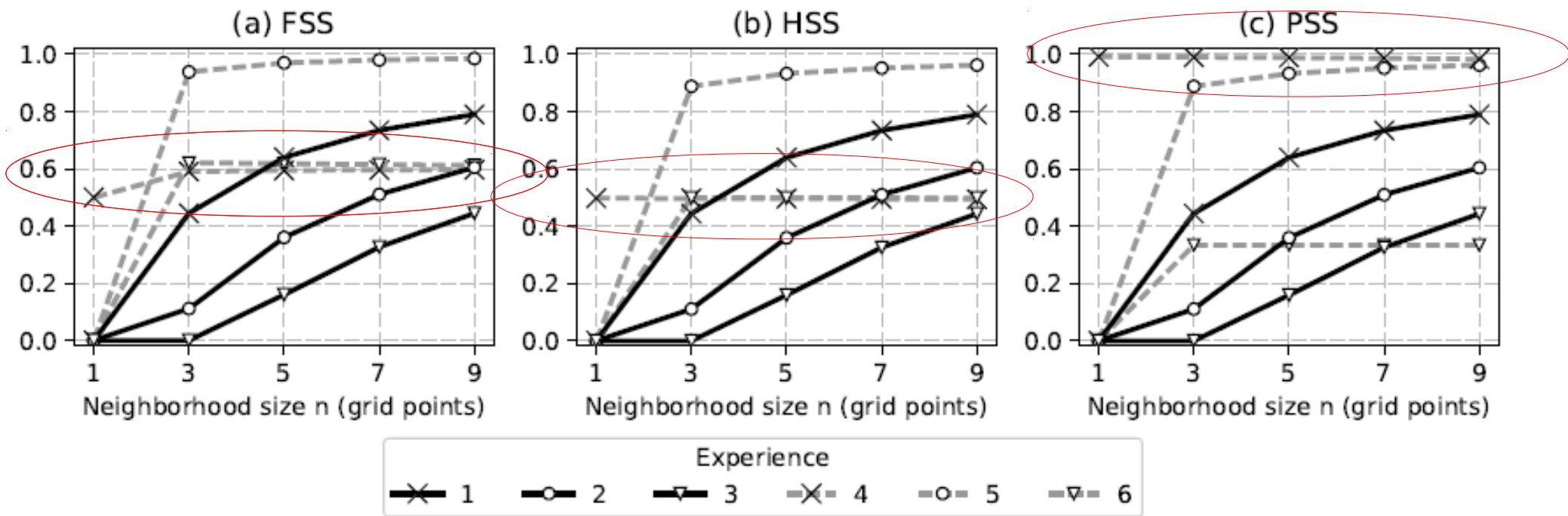
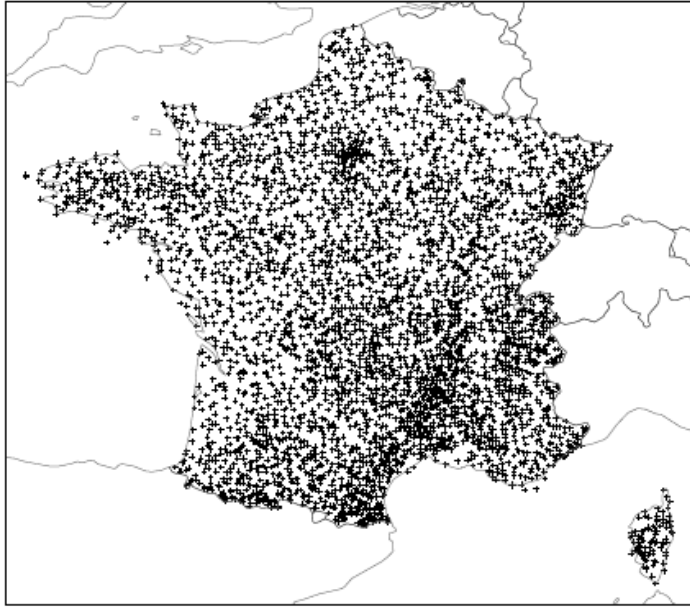# Comparison of synthetic scores from our neighborhood based contingency tables and FSS
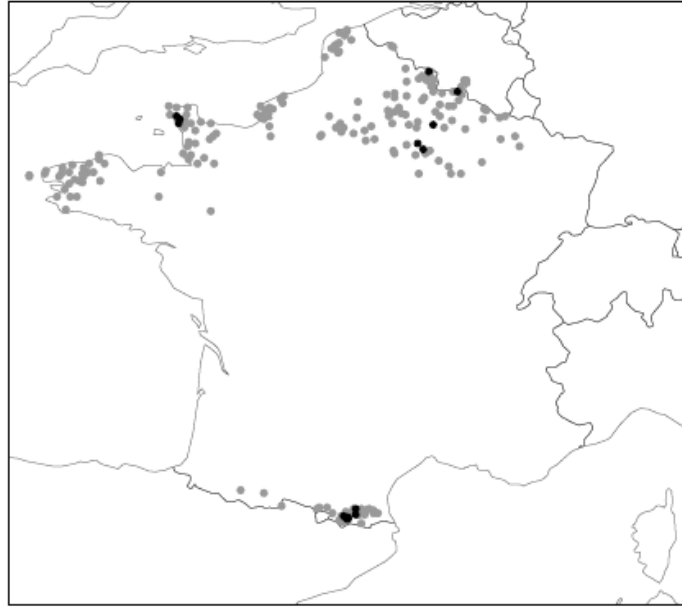
Summary

- 2 neighborhood-based tables of contingency
- **Application to QPF of ARPEGE and AROME**
- Conclusion

Accumulated precipitations greater than or equal to 2mm (▢) and 10mm (■) during the 26 June 2016
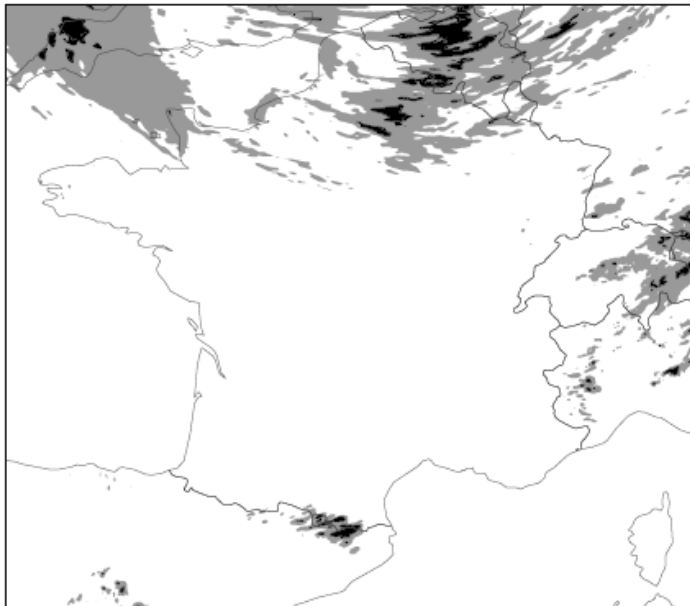

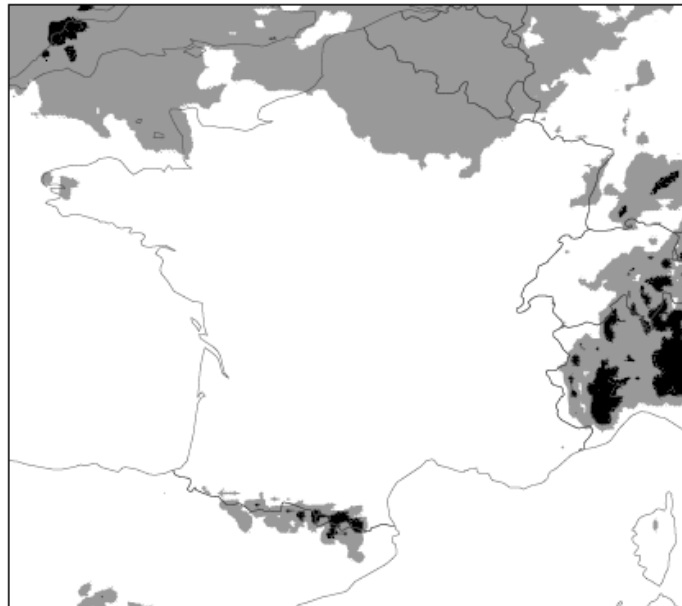(a) French climatological network

(b) Observations

(c) AROME

(d) ARPEGE

ARPEGE :Global Model using A stretched horizontal mesh from 7,5 to 36 km.

AROME : N-H LAM I using 1,3 km horizontal mesh, nested in ARPEGE

# Scores as a function of the neighborhood size in grid-points on a single day: 26 June 2016

(a) B

(b) POD

(c) FAR

(d) FSS

(e) HSS

(f) PSS

neighborhood size n (grid points)

Model/threshold

—— AROME 2.0mm/day   —O— AROME 10.0mm/day   - - - ARPEGE 2.0mm/day   - -O- - ARPEGE 10.0mm/day

Scores as a function of the neighborhood size for ARPEGE (⸺) and AROME (⸺) for daily accumulated precipation greater than 0.5 (⸺) 5 (----) and 50 (· ·) mm from the 01/09/2015 until the 31/08/2016
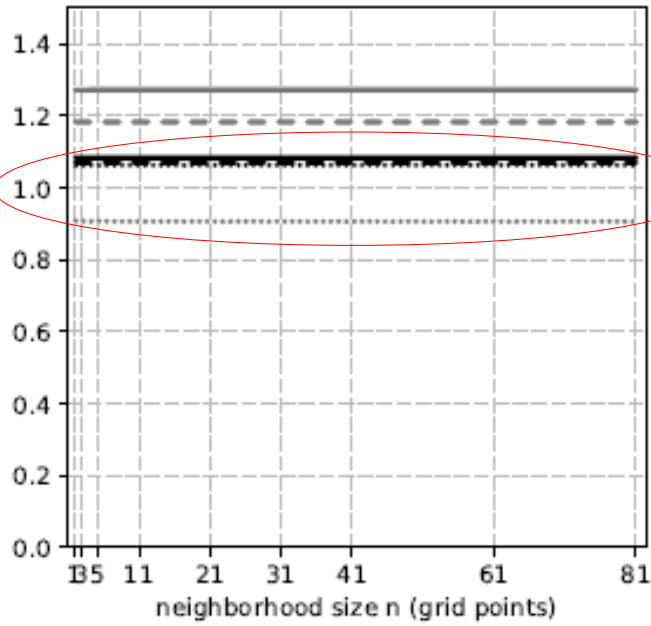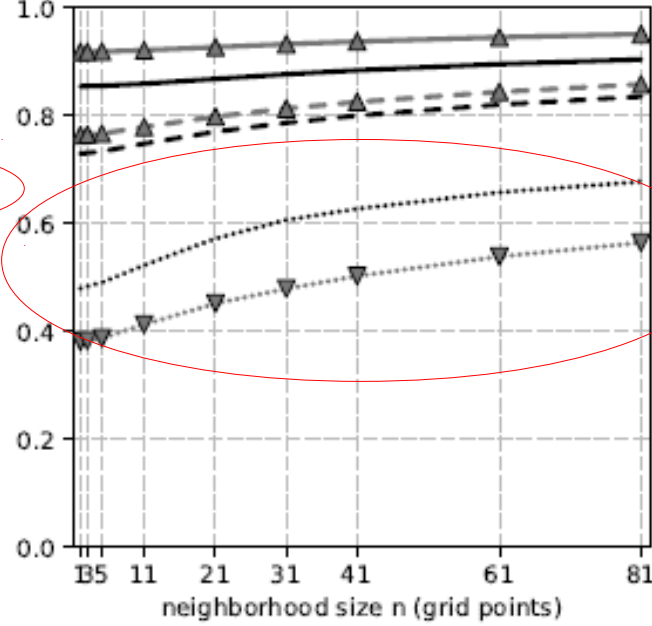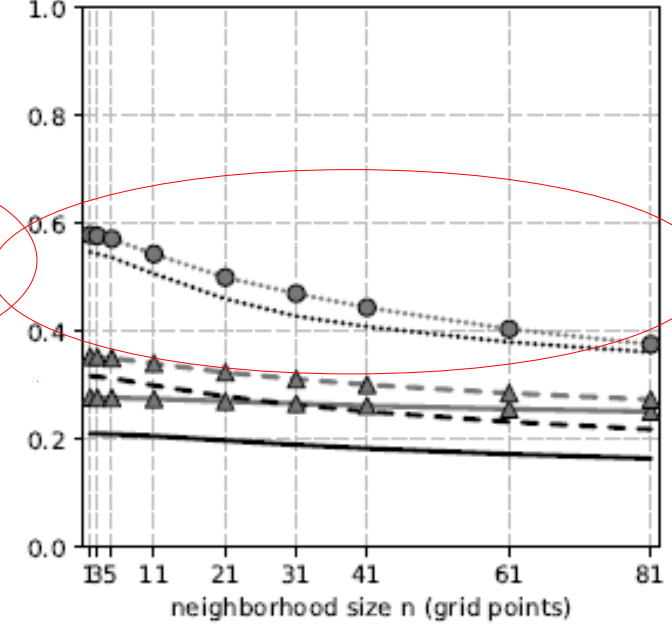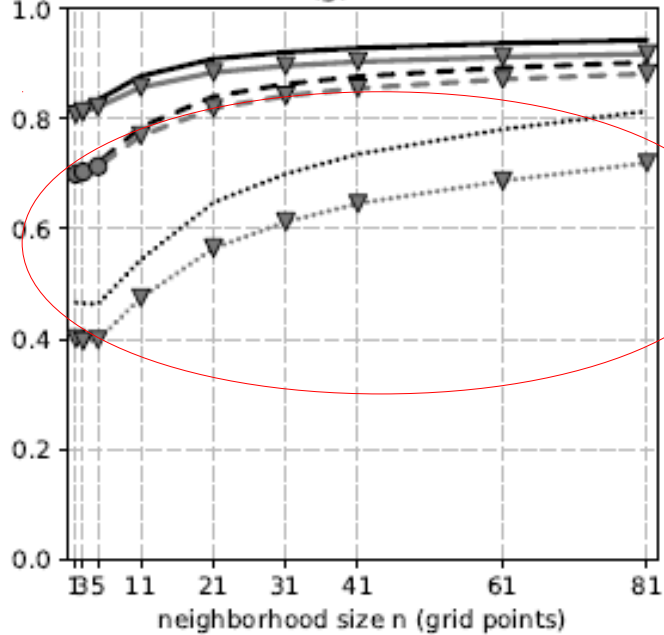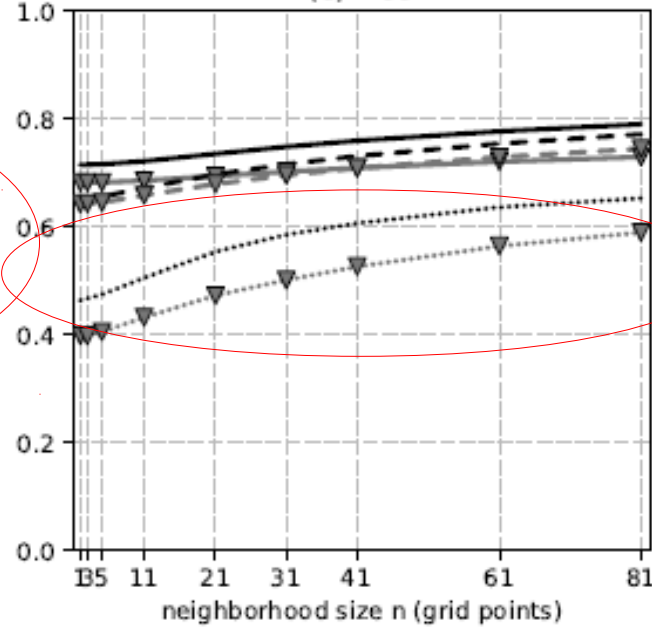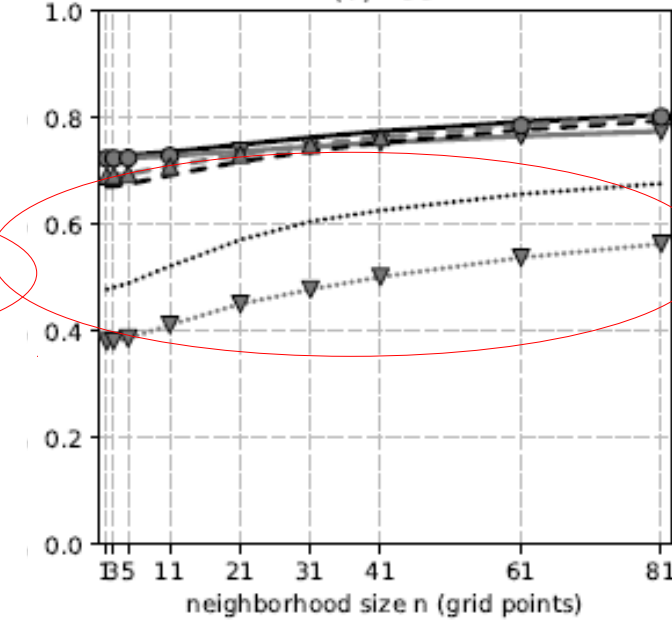
Conclusion

- A new way of populating tables of contingency has been presented. It uses the errors' association by pairs in the neigborhood.

- It respects the frequency Bias and allows the discussion of the influence of neighborhood on basic scores POD and FAR.

- It gives synthetic scores equitable or not which complement FSS

- Generalisation to categorical forecast is available

- Generalisation to high resolution EPS is in progress