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Flash flood warning methods: how to evaluate them? An application in the French Southern Alps using the AIGA warning method and different rainfall input data.

Dimitri Defrance¹, Pierre Javelle¹, Patrick Arnaud¹, Vazken Andreassian², Emmanuel Moreau³, and Patrice Meriaux⁴.

(1) Cemagref, GR RHAX, Aix-en-Provence, France, (2) Cemagref, UR HBAN, Antony, France, (3) NOVIMET, Guyancourt, France, (4) Cemagref, GR OHAX, Aix-en-Provence, France

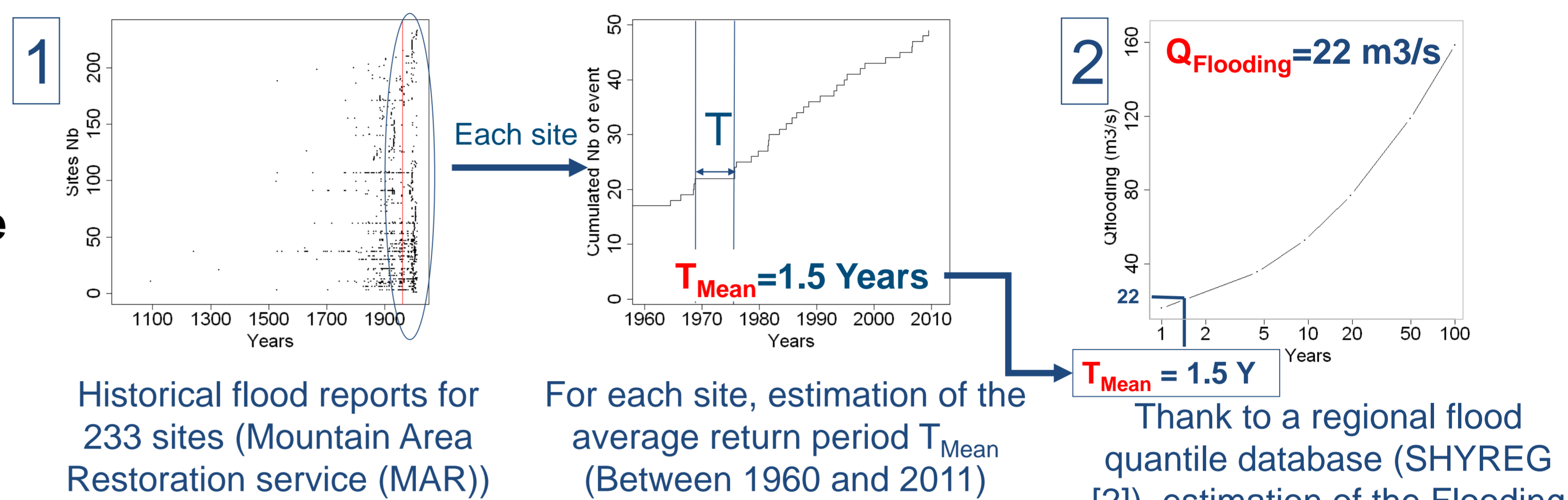
Contact: dimitri.defrance@cemagref.fr



> Objectives

- ▶ To deliver flash flood warning on ungauged bassins.
- ▶ To assess the Interest of historical 'flood reports' to determinate the 'alert' discharge (bankfull) on small ungauged catchments.
- ▶ To assess the interest of X-Band Doppler radar rainfall in mountain areas.

> Methodology



3

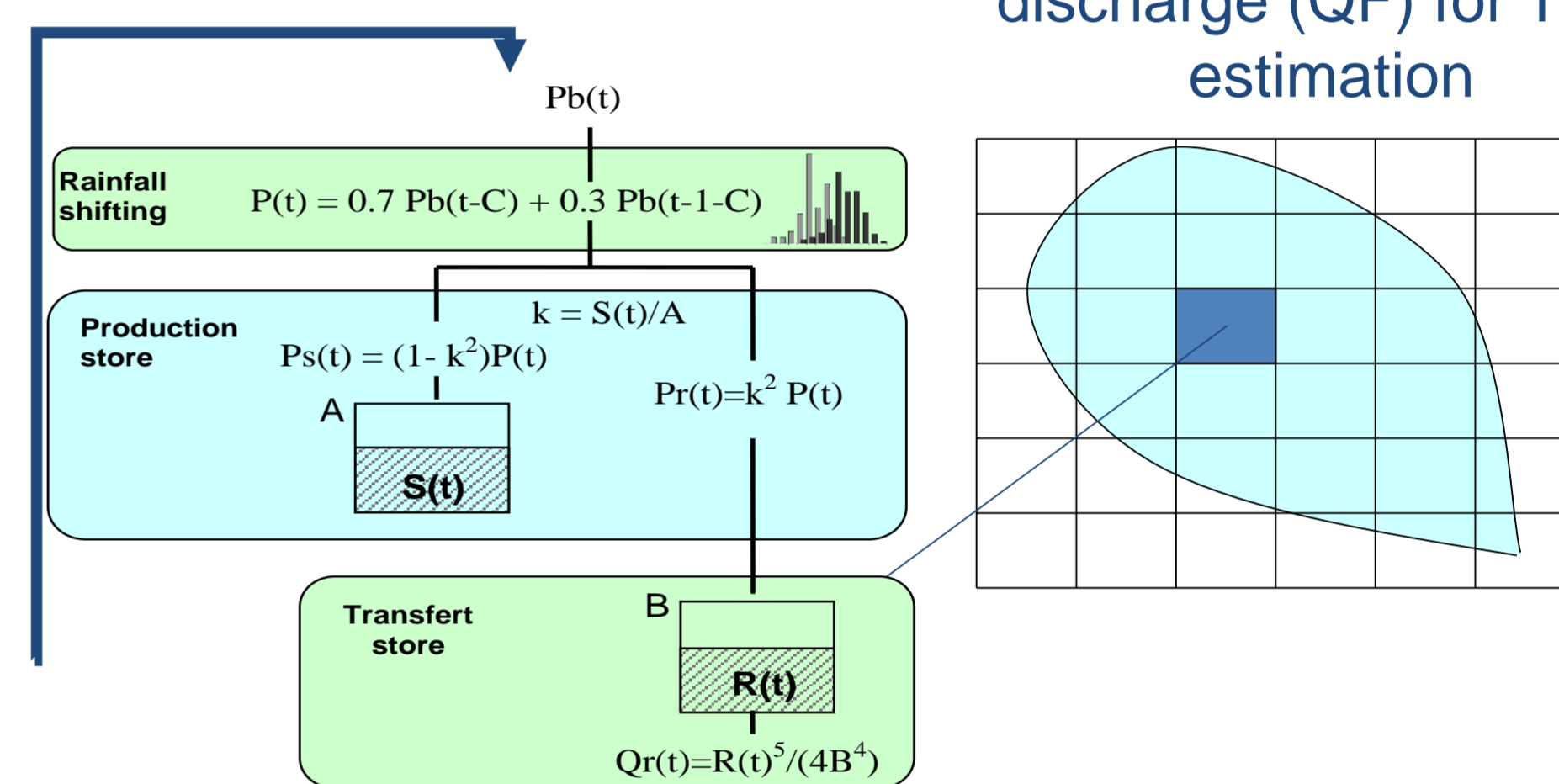


▶ Focus on the 2009-2011 period with a « pseudo-continuous » simulation using:

2 years of X-band Doppler dual polarized radar rainfall estimates

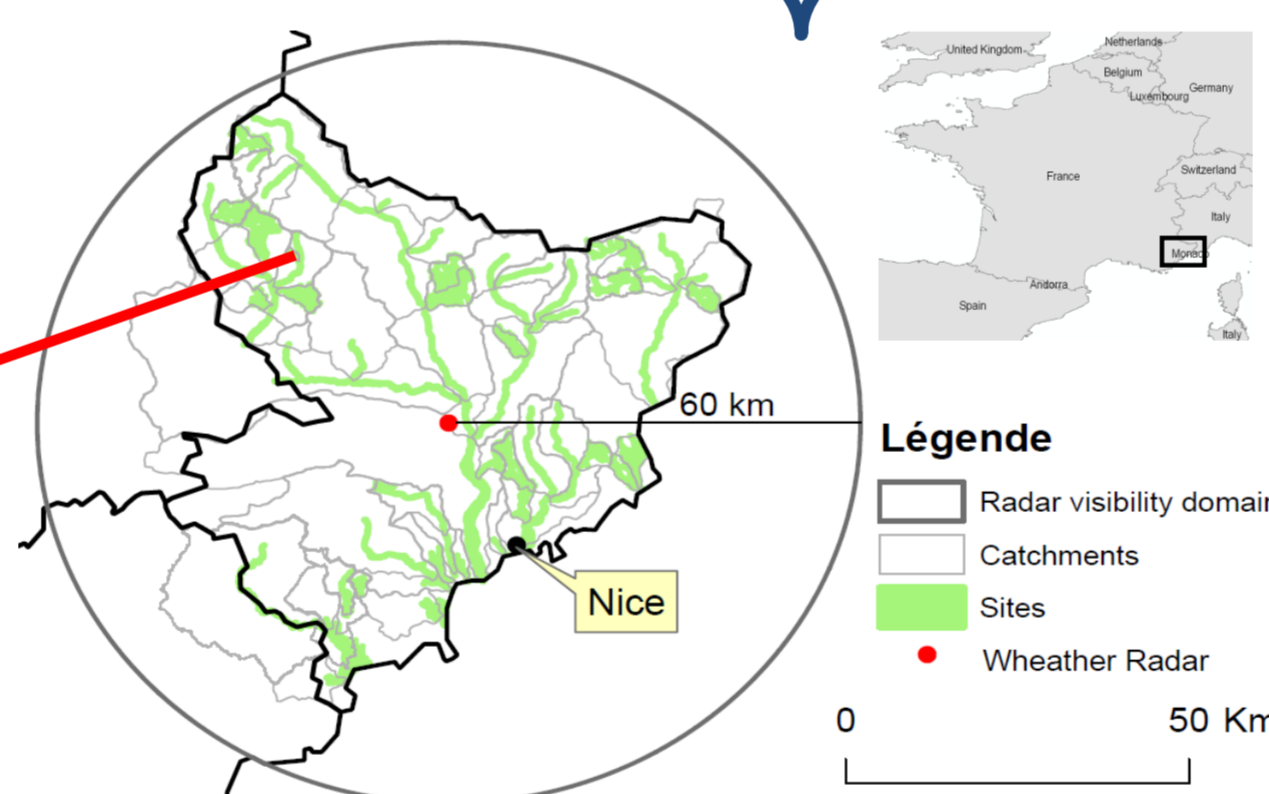
64 events defined according to a rainfall threshold (10 mm/day) thus allowing to take into account all the historical events of the Mountain Area Restoration service

“Realtime” discharge simulation using a simple hourly event-based distributed model (GRdist model[1])



4

Flood report

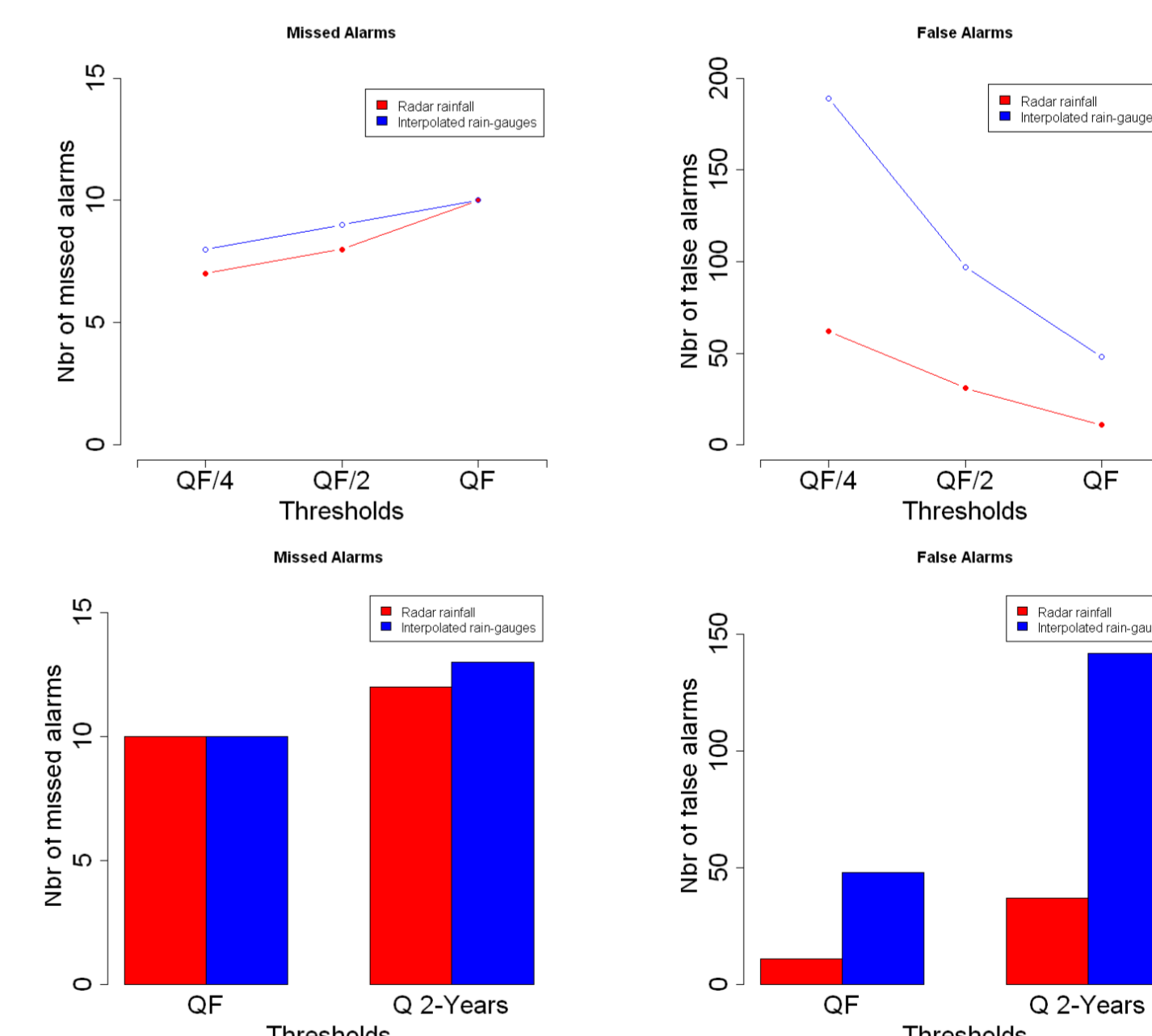


Performance evaluation by comparing Observed Alert (sites damages) and Model Alert (Calculated $Q > QF$) for recent events (2009-2011) in “Alpes Maritimes”, South-eastern France on ungauged catchment outlets. An alert is counted when calculated discharge exceeds a thresholds given

> Performance & evaluation

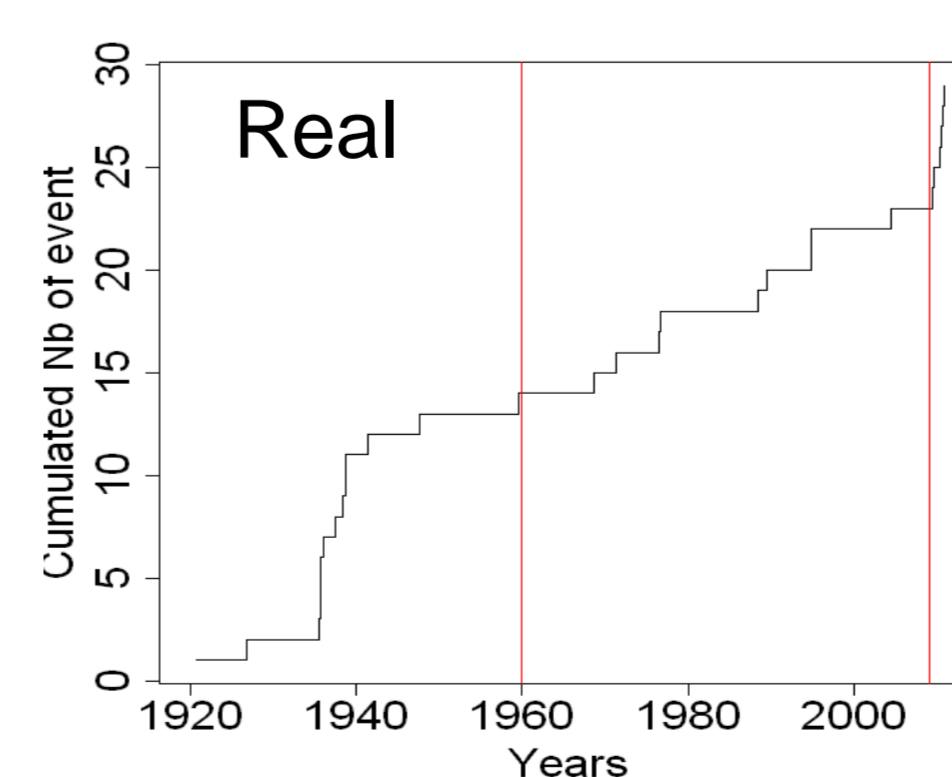
- ▶ Evaluating « False » and « Missed » alarms over the 2009-2011 period (14 flood reports)
- ▶ Using 2 different thresholds:
 - either QF (and QF/2, QF/4) defined by the above methodology
 - either 2-year flood Carpenter et al. (1999) [3] who suggest that a 2-year flood is a reasonable threshold to use for flood warnings at ungauged locations given that the flood flow associated with damage or hazard is often a little higher than bankfull flow.

- ▶ High threshold = More missed alarm
- ▶ High threshold = less false alarm
- ▶ Results are better with X-band radar rainfall
- ▶ ‘QF’ thresholds give better results than the classical 2-year threshold with less missed alarm and less false alarms
- ▶ Rainfall input importance is reduced with the QF use



> Discussion

- ▶ Our results were obtained:
 - with a limited length of the radar rainfall data which does not provide a sufficient number of flood alerts (only 14 flood reports),
 - in a small geographical area (4300 km²) thus limiting the number of catchments.
- ▶ The rainfall precision is problematic in mountains areas → others rainfall data must be used to try and improve the estimation of rainfall
- ▶ Experimental return period of QF depends on the period beginning.



▶ Observation of stationary problems at several sites (e.g. Real), whose reasons have to be checked: problems in sites monitoring or lack of stationary due to natural cycles.

▶ Depending on the starting date, return period changes of T_{MEAN} :

- $T_{Mean} = 5.6$ Years for starting date 1960
- $T_{Mean} = 0.34$ Year for starting date 2009

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Research in Hydrology Research Unit – Centre d'Aix-en-Provence

[1] Javelle, P., Fouchier, C., Arnaud, P., Lavabre, J., Flash flood warning at ungauged locations using radar rainfall and antecedent soil moisture estimations, Journal of Hydrology (2010), doi: 10.1016/j.jhydrol.2010.03.032

[2] Lavabre, J., C. Fouchier, et al. (2003). "SHYREG: une méthode pour l'estimation régionale des débits de crue. Application aux régions méditerranéennes françaises." Ingénieries 97-111

[3] Carpenter, T. M., J. A. Sperslage, et al. (1999). "National threshold runoff estimation utilizing GIS in support of operational flash flood warning systems." Journal of Hydrology 224(1-2): 21-44

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