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Incorporating spatial variability of hydrological response into flood warning system based on rainfall thresholds

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1 Thresholds from inverse simulation

2 Initial condition

AnnAGNPS model (Bingner & Theurer, 2005).

3 Case studies

River Arno - 15 sections

Area: 151 – 4267 km²

Upper Po - 40 sections
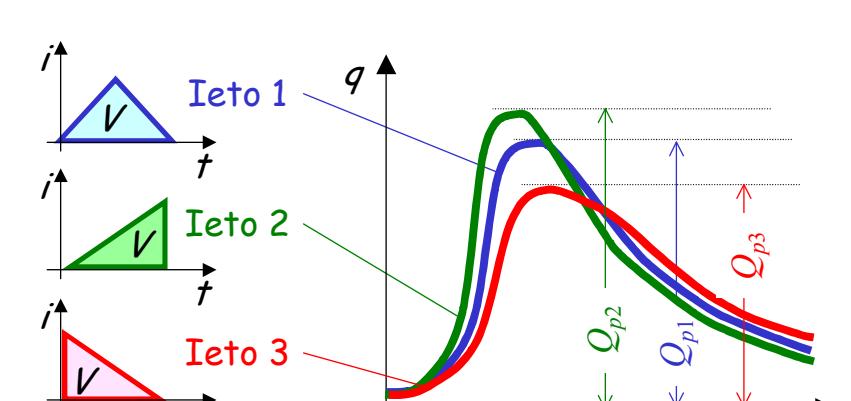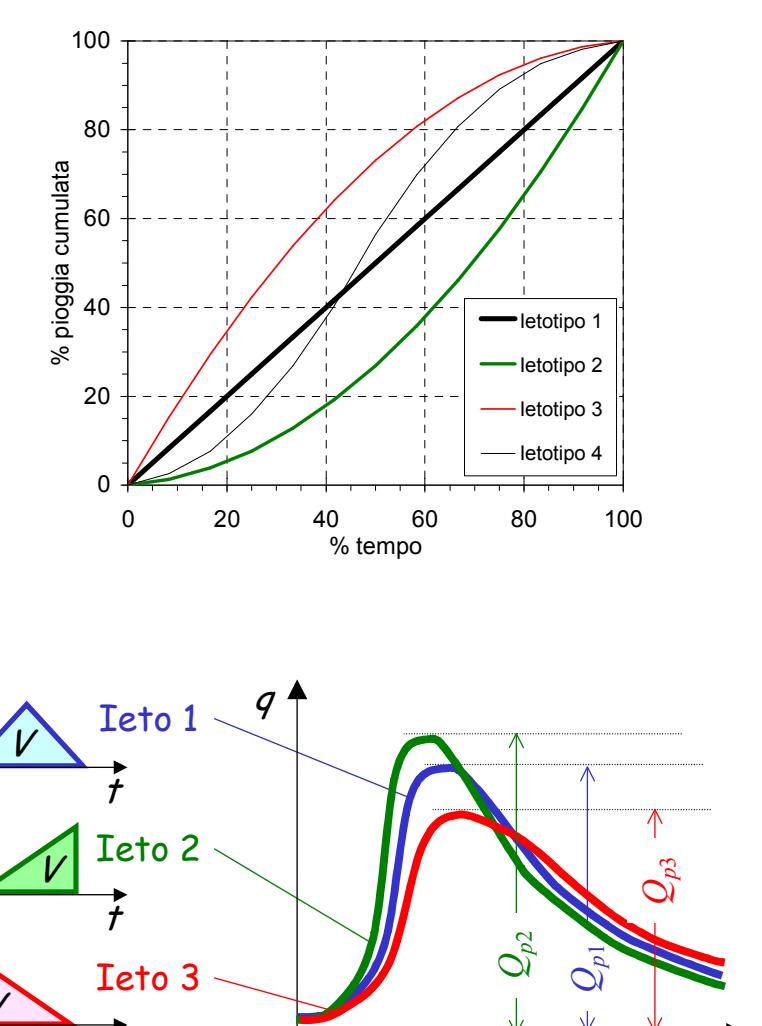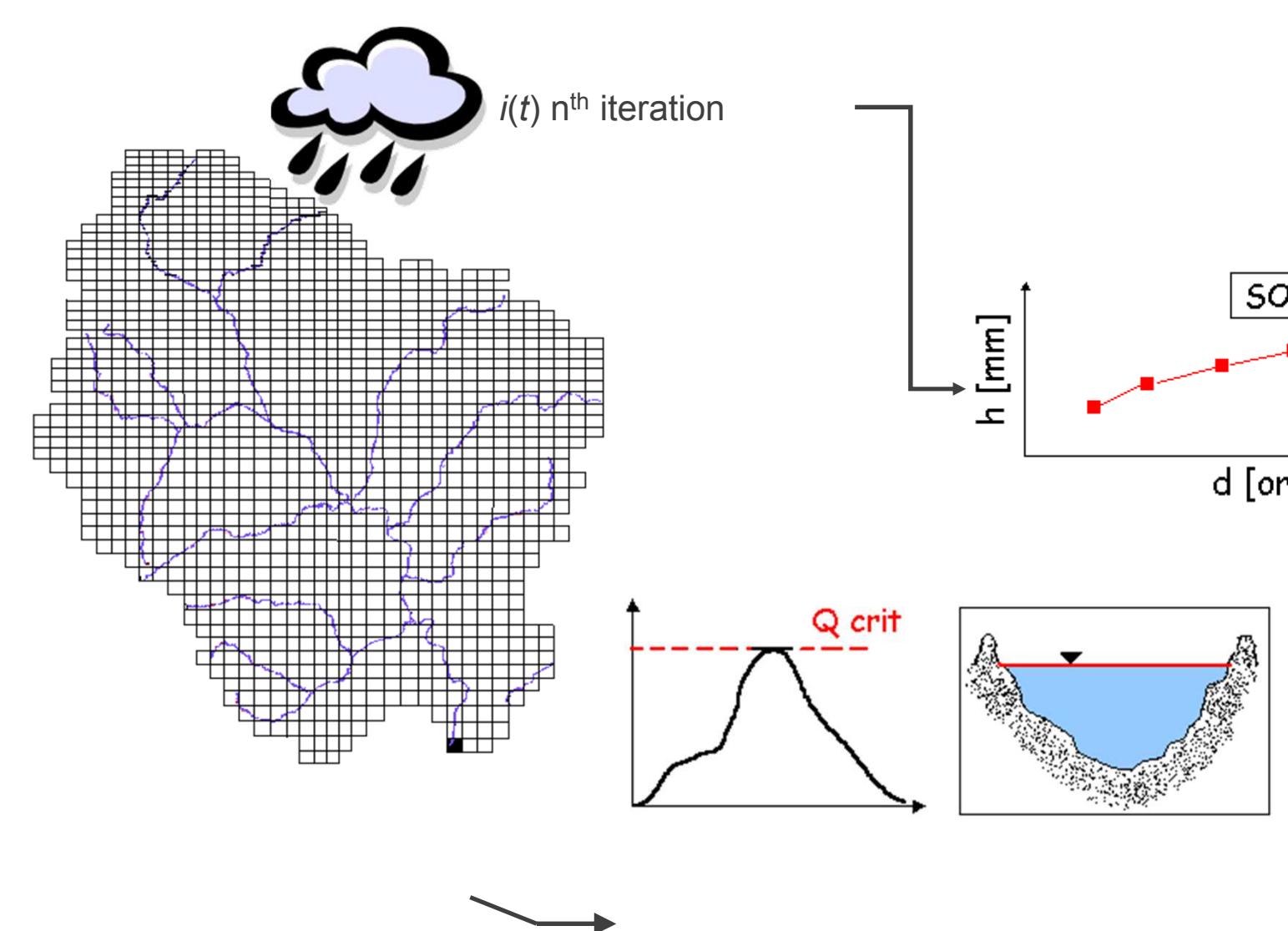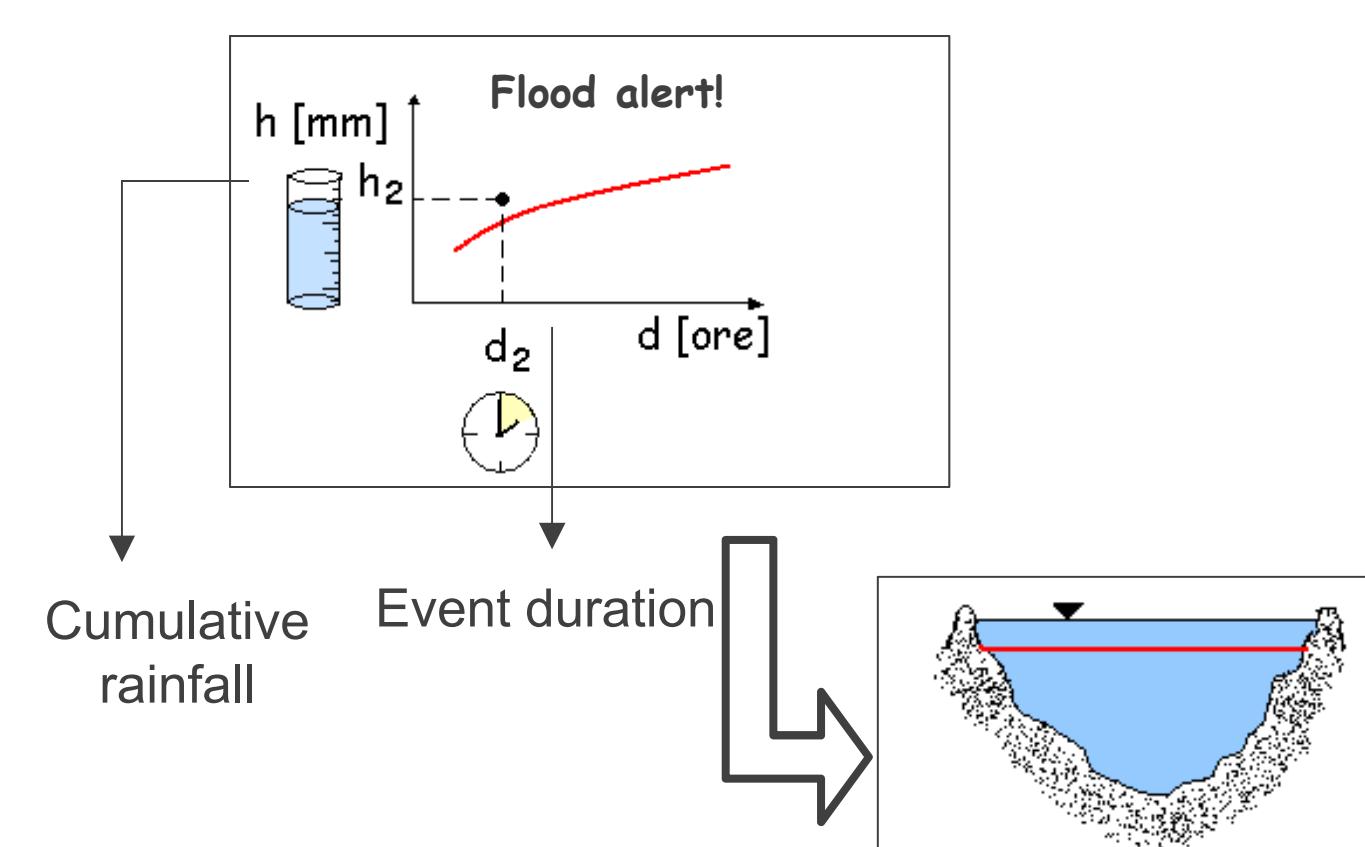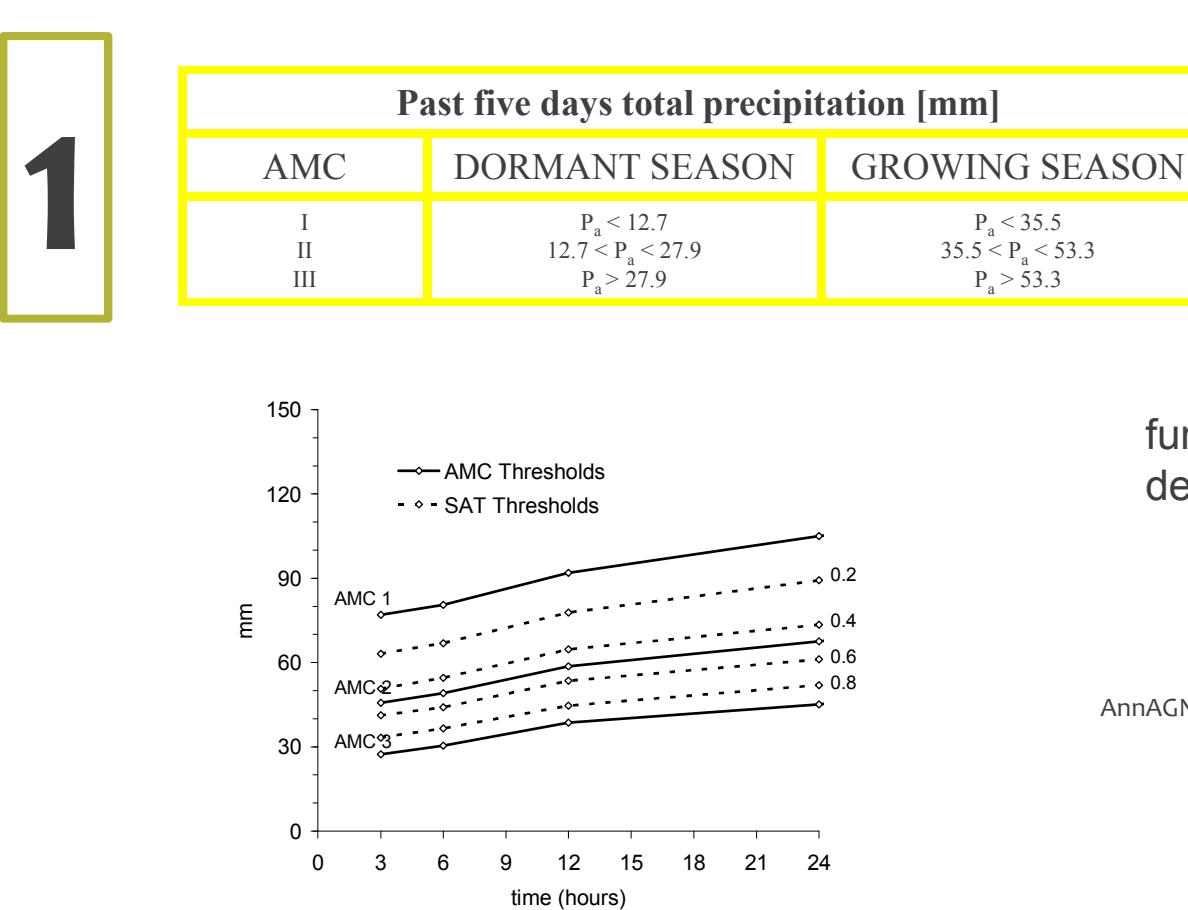
4 Reliability analysis

Based on contingency table, period 1992 – 2002, observed rainfall and discharge

(1) a **hit**, if an event occurred and the warning was provided (h is the number of hits);
(2) a **false alarm**, if an event did not occur but the warning was provided (f is the number of false alarms);
(3) a **miss**, if an event occurred but the warning was not provided (m is the number of misses);
(4) a **correct rejection**, if an event did not occur and the warning was not provided (c is the number of correct rejections);
(5) a **delayed hit**, if an event occurred and a warning was provided later (d is the number of delayed hits)

Outcome	River section: Nave di Rosano	Subbiano	Pontassieve	S. Piero a Ponti	Poggio a Caiano
Hit (h)	2	4	0	1	
False alarm (f)	1	3	1	1	0
Miss (m)	1	1	1	0	0
Correct reject. (c)	8	9	15	3	11
Delayed hit (d)	0	2	2	0	0
Total (n)	12	17	23	4	12

Index	Nave di Rosano	Subbiano	Pontassieve	S. Piero a Ponti	Poggio a Caiano	
POD	0.667	0.667	0.800	-	1	Probability of detection h/(h + m)
FAR	0.111	0.250	0.063	0.250	0	False alarm rate f/(f + c)
CSI	0.615	0.545	0.759	-	1	Crit. Suc. I. 1/[1/(1 – FAR) + (1/POD) – 1]
SS	0.556	0.417	0.738	-	1	Skill Score. POD – FAR
CPI	0.833	(0.647)	(0.826)	0.750	1	Correct performance index (c + h)/n
		0.765	0.913			
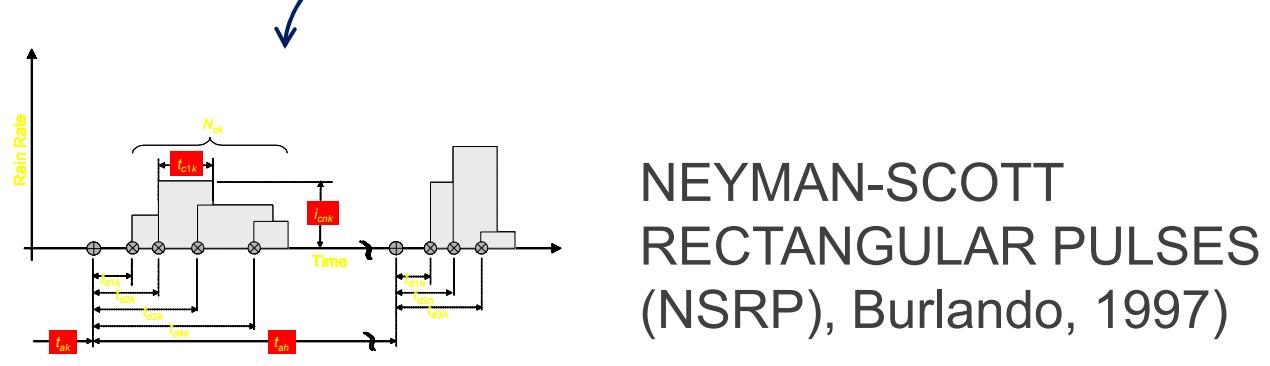
NEYMAN-SCOTT RECTANGULAR PULSES (NSRP), Burlando, 1997)

Based on contingency table, 500 years synthetic data

Outcome	River section: Nave di Rosano	Subbiano	Pontassieve	S. Piero a Ponti	Poggio a Caiano
Hit (h)	164	224	289	90	33
False alarm (f)	24	47	53	24	1
Miss (m)	34	59	41	29	11
Correct reject. (c)	201	295	425	116	153
Delayed hit (d)	9	10	5	4	1
Total (n)	432	635	813	263	199

Index	Nave di Rosano	Subbiano	Pontassieve	S. Piero a Ponti	Poggio a Caiano
POD	0.828	0.792	0.876	0.756	0.750
FAR	0.107	0.137	0.111	0.171	0.006
CSI	0.754	0.703	0.790	0.654	0.746
SS	0.722	0.654	0.765	0.585	0.744
CPI	0.845	0.817	0.878	0.783	0.935

Rainfall threshold

POD	0.74
FAR	0.54
CSI	0.37
CPI	0.74

Hydrological model

POD	0.76
FAR	0.47
CSI	0.45
CPI	0.80
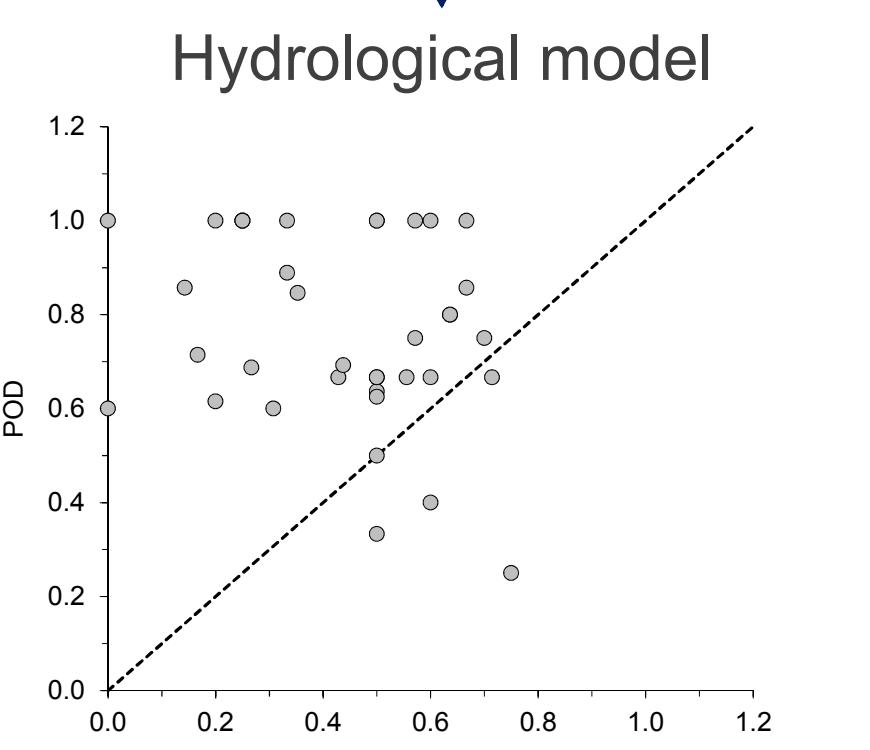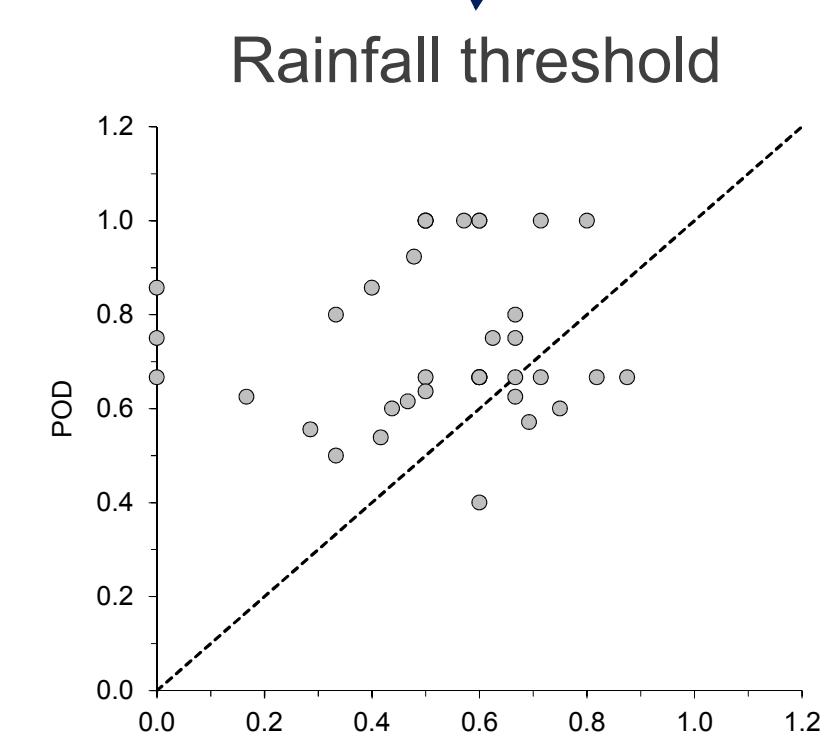
5 Real time operation
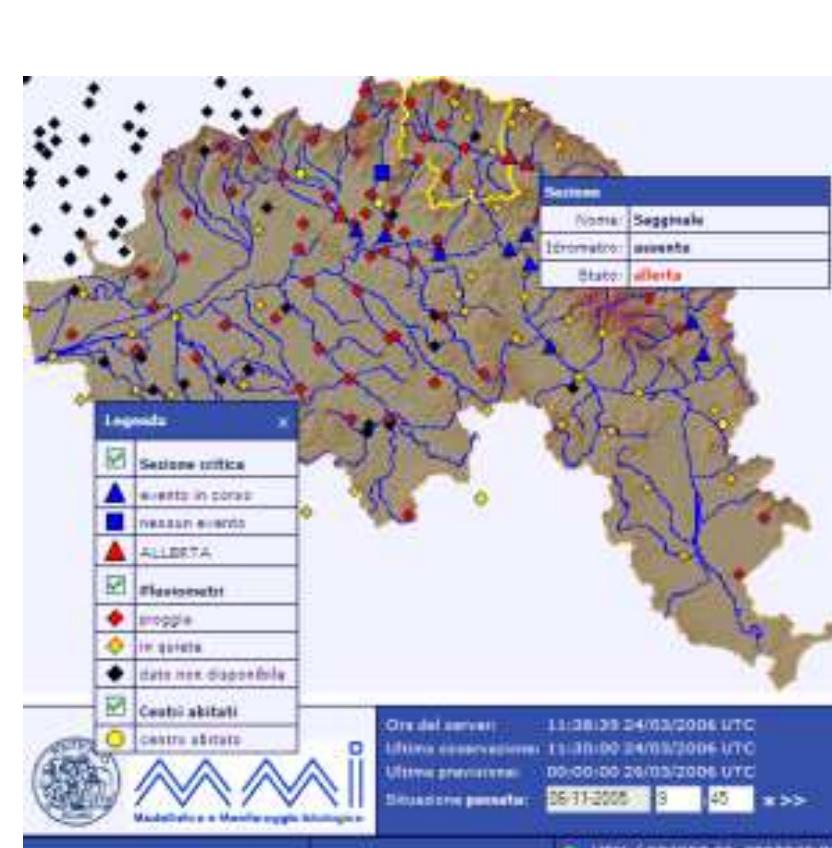
MIMI
Meteo Hydrological Integrated Model

6 References

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