Incontro su Geoscienze e Rischi Naturali
Potenza 4-5 Marzo 2009

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Modelli statistici di eventi sismici
e faglie sismogenetiche

No, i terremoti
non si possono prevedere

La statistica giusta è meglio dell'ignoranza,
ma quella sbagliata è molto peggio!

Processi a singola realizzazione e
variabili ordinali non-metriche

Bisognerebbe avere un catalogo lungo almeno 4 volte il periodo di previsione

La sismologia strumentale copre un periodo molto corto

Si aggiungono dati storici, archeologici e geologici

macrosismologia, archeosismologia, paleosismologia (Pangloss et al, 1759)

Bulletin of the Seismological Society of America, Vol. 98, No. 6, pp. 2652–2664, December 2008, doi: 10.1785/0120080077

Comparison of Probabilistic Seismic Hazard Estimates in Italy

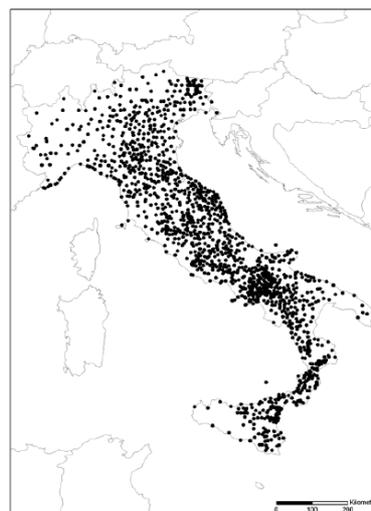by Marco Mucciarelli, Dario Albarello, and Vera D'Amico

ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

Mappa di pericolosità sismica del territorio nazionale
(riferimento: Ordinanza PCM del 28 aprile 2006 n.3519, All 1b)
espressa in termini di accelerazione massima del suolo
con probabilità di eccedenza del 10% in 50 anni
riferita a suoli rigidi (Vs₃₀ > 800 m/s; cat.A, punto 3.2.1 del D.M. 14.09.2005)

< 0.025 g
0.025 - 0.050
0.050 - 0.075
0.075 - 0.100
0.100 - 0.125
0.125 - 0.150
0.150 - 0.175
0.175 - 0.200
0.200 - 0.225
0.225 - 0.250
0.250 - 0.275
0.275 - 0.300

Le sigle individuano isole per le quali è necessaria una valutazione ad hoc
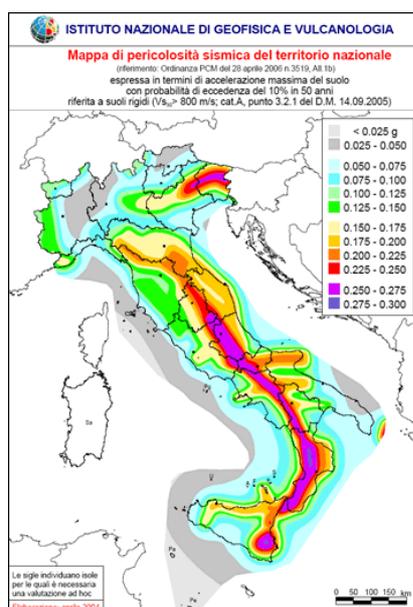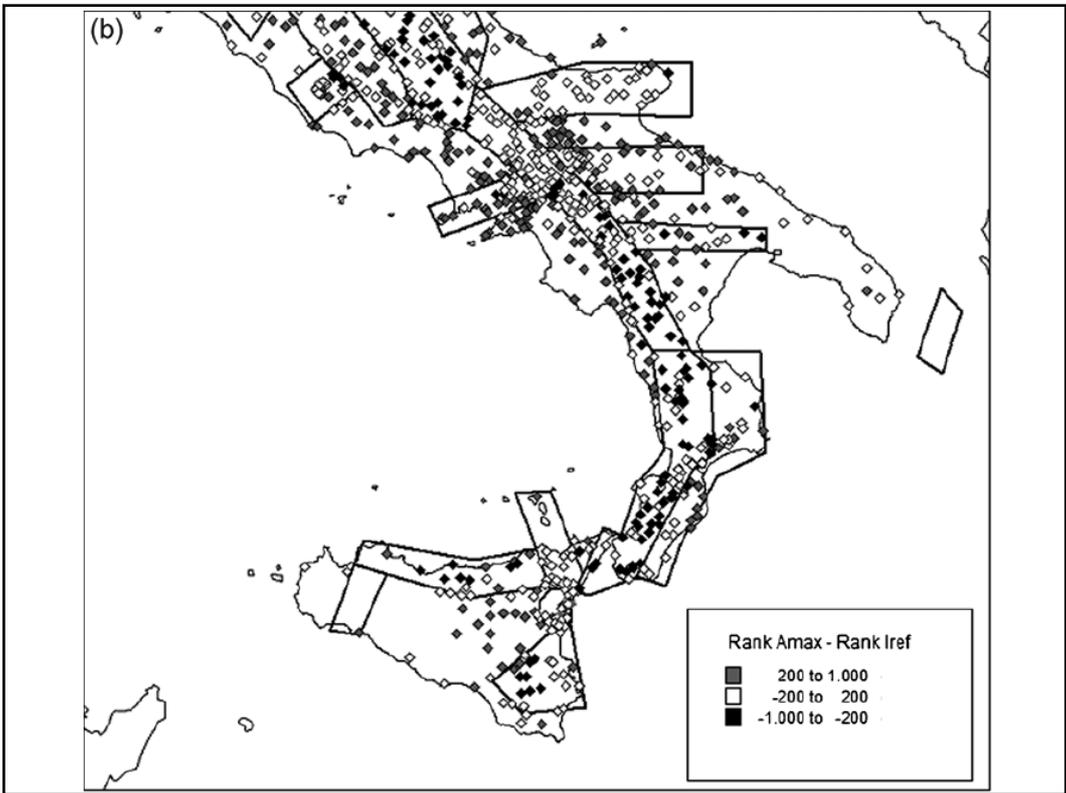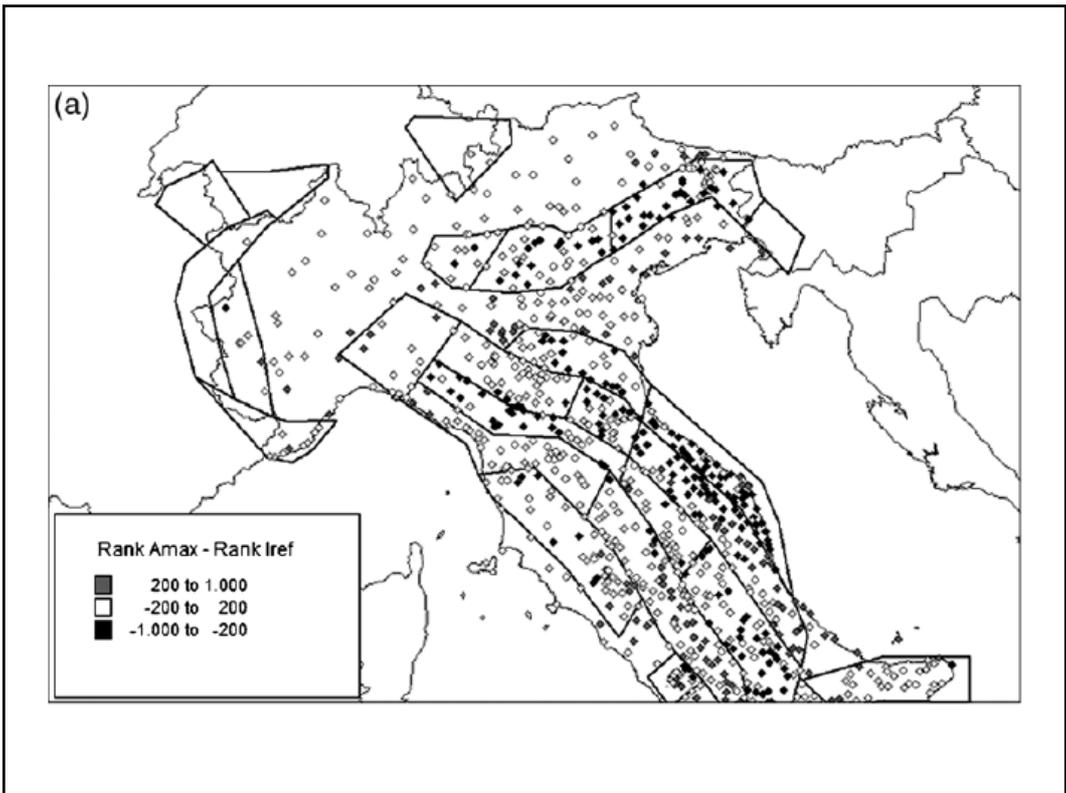Elaborazione: aprile 2004

Figure 1. Location of sites where the hazard estimates provided by the standard and site approaches have been compared. At all these sites, documentation relative to the effects of at least 10 earthquakes is available (Stucchi *et al.*, 2007).
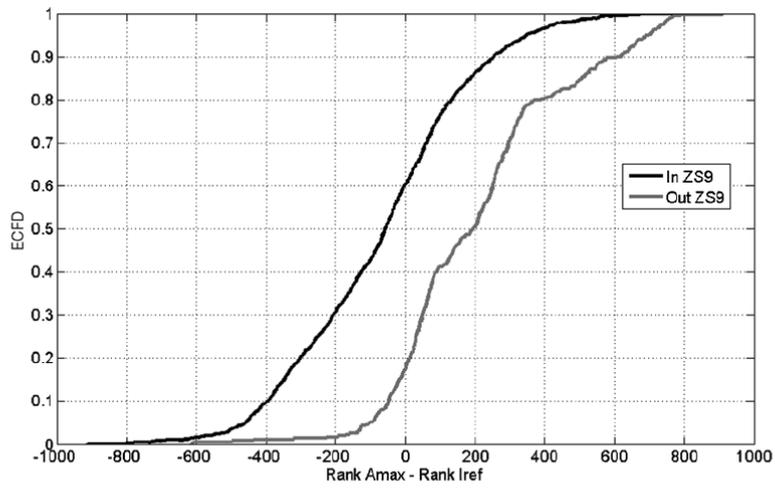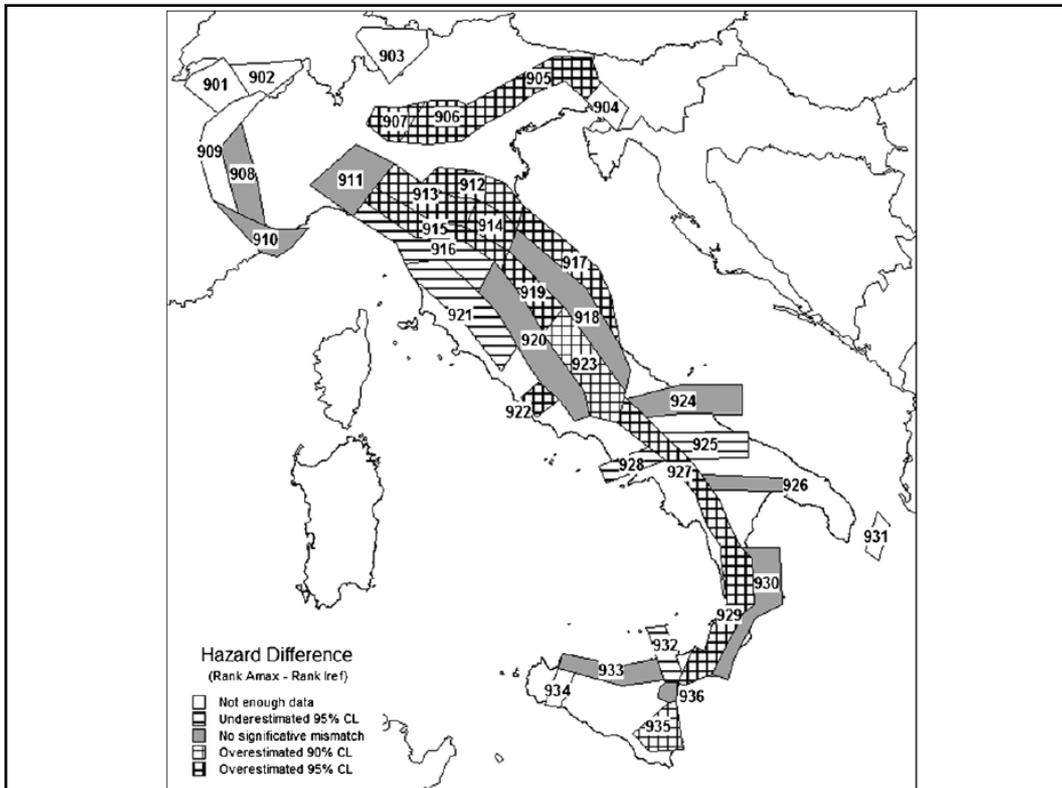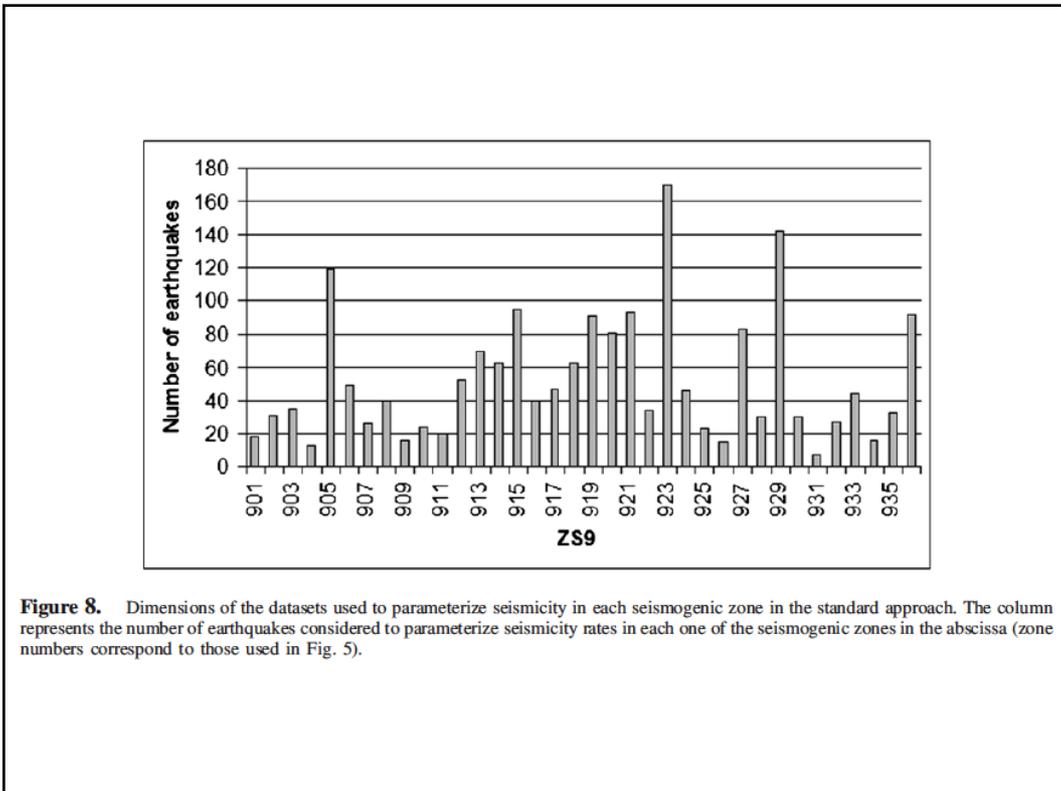
(a)

Rank Amax - Rank Iref

200 to 1.000
-200 to 200
-1.000 to -200

(b)

Rank Amax - Rank Iref

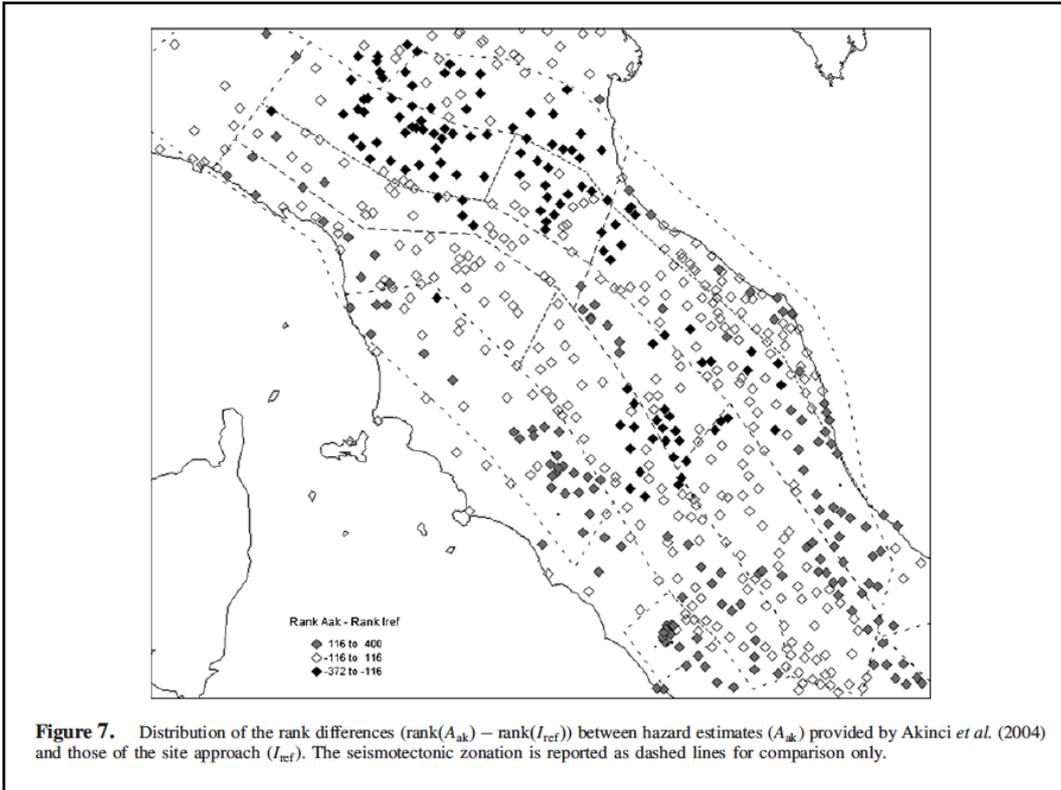200 to 1.000
-200 to 200
-1.000 to -200

Figure 4. Cumulative frequency distribution of HD values relative to sites located inside or outside of the ZS9 seismogenic zones considered in the standard PSHA.

4

Figure 7. Distribution of the rank differences (rank(A_{ak}) − rank(I_{ref})) between hazard estimates (A_{ak}) provided by Akinci *et al.* (2004) and those of the site approach (I_{ref}). The seismotectonic zonation is reported as dashed lines for comparison only.

Figure 8. Dimensions of the datasets used to parameterize seismicity in each seismogenic zone in the standard approach. The column represents the number of earthquakes considered to parameterize seismicity rates in each one of the seismogenic zones in the abscissa (zone numbers correspond to those used in Fig. 5).

Magnitude distribution of linear morphogenic earthquakes in the Mediterranean region: insights from palaeoseismological and historical data
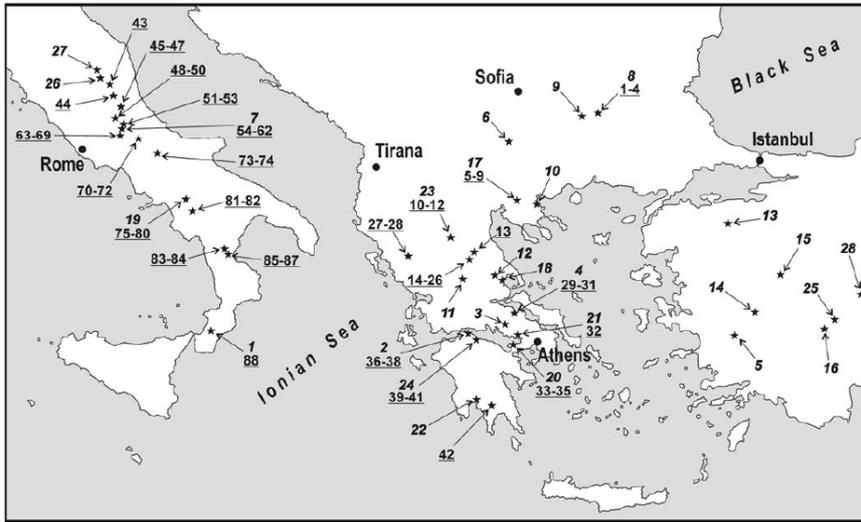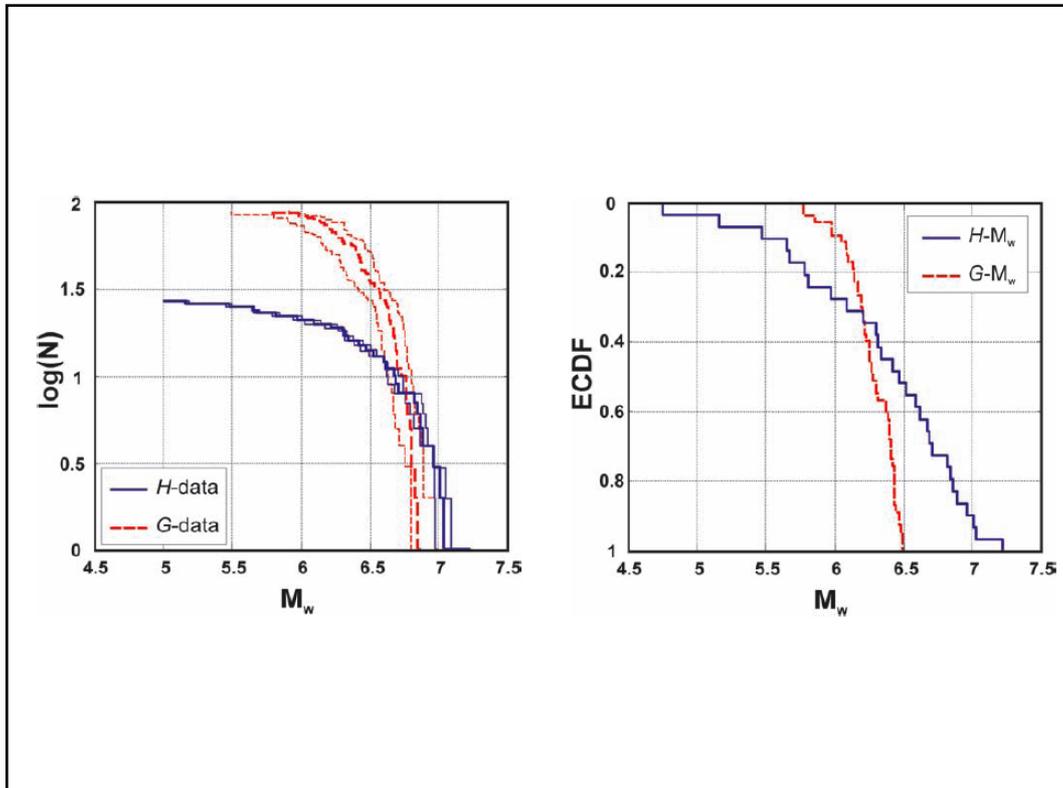
R. Caputo,[1] M. Mucciarelli[2] and S. Pavlides[3]

Figure 1. Location map of the investigated Aegean-type faults and associated linear morphogenic earthquakes. Numbers in italics plus bold refer to *H*-catalogue (Table 1), while numbers underlined to *G*-catalogue (Table 2).
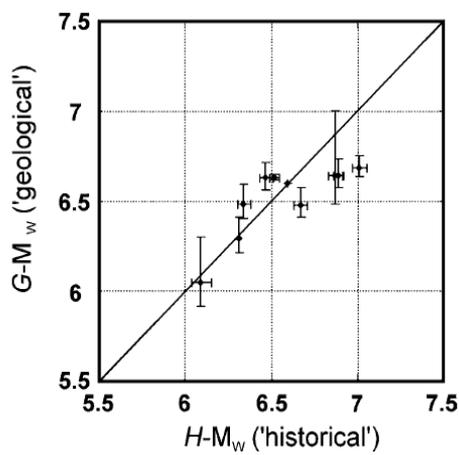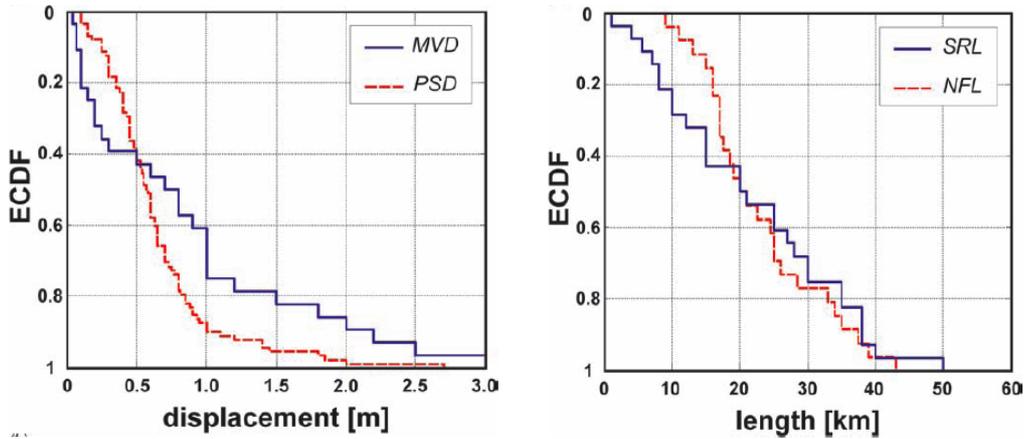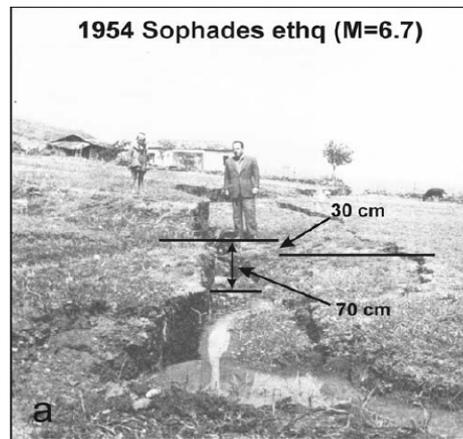
Mo=μAD=μ(L.W)D

Figure 7. Comparison of the M_w calculated for 10 linear morphogenic events included in both H-catalogue and G-catalogue (Tables 1 and 2, respectively).

In our opinion, the two investigation methods should be combined. Indeed, for the larger linear morphogenic earthquakes ($M > 6.5$) the geological approach (G-catalogue) is not strongly affected by misinterpretation of the vertical displacement that might adversely affect the historical data. As a consequence, the G-catalogue provides more reasonable truncation magnitudes than the H-catalogue. In contrast, the H-catalogue seems to be more complete in the interval up to $M = 6.5$, where the palaeoseismological studies are still far from completeness. Moreover, in the range 5.5–6.5, the geological approach (G-catalogue) likely provides a higher seismic hazard due to the bias introduced by considering the entire fault length (NFL)

**Natural Hazards
and Earth
System Sciences**

A test for checking earthquake aperiodicity estimates from small samples

M. Mucciarelli
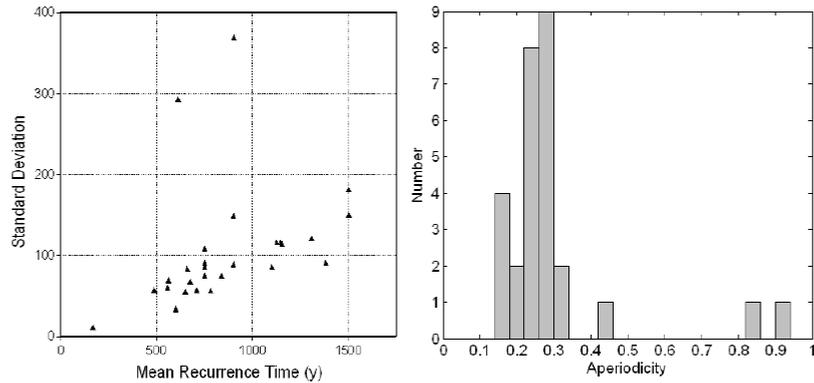
Fig. 1. The distribution of σ versus μ (left) and the histogram of α (right) for 28 seismogenic sources in Central Italy, according with Pace et al. (2006).
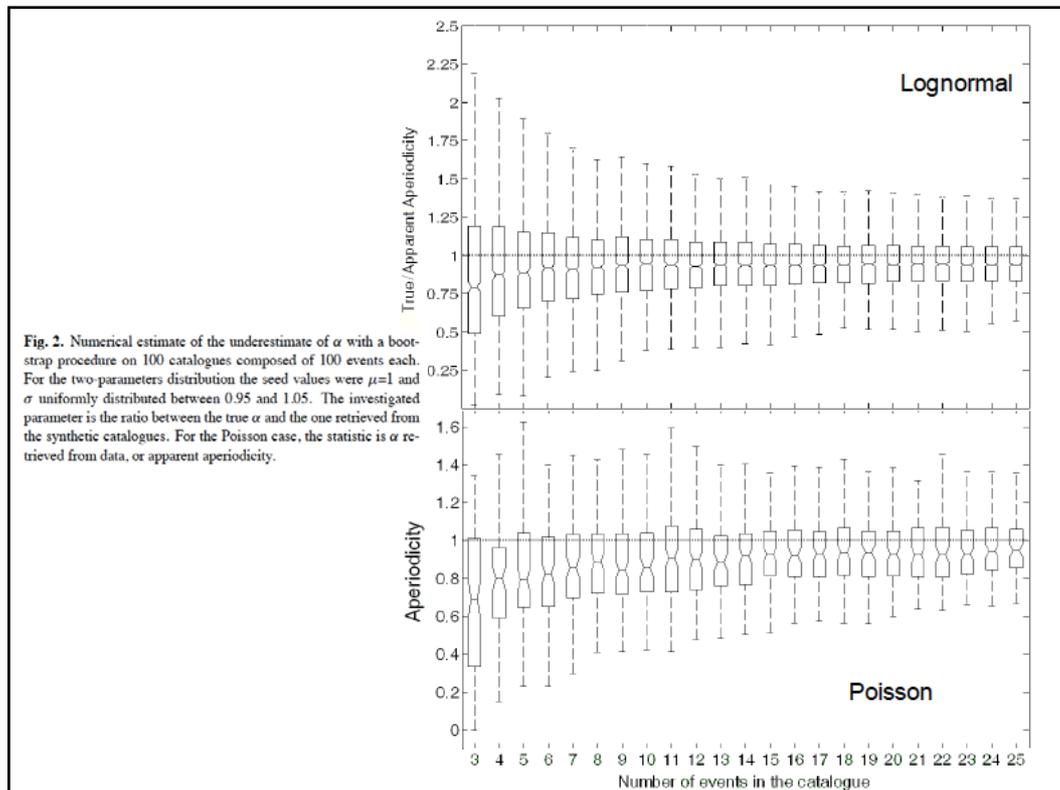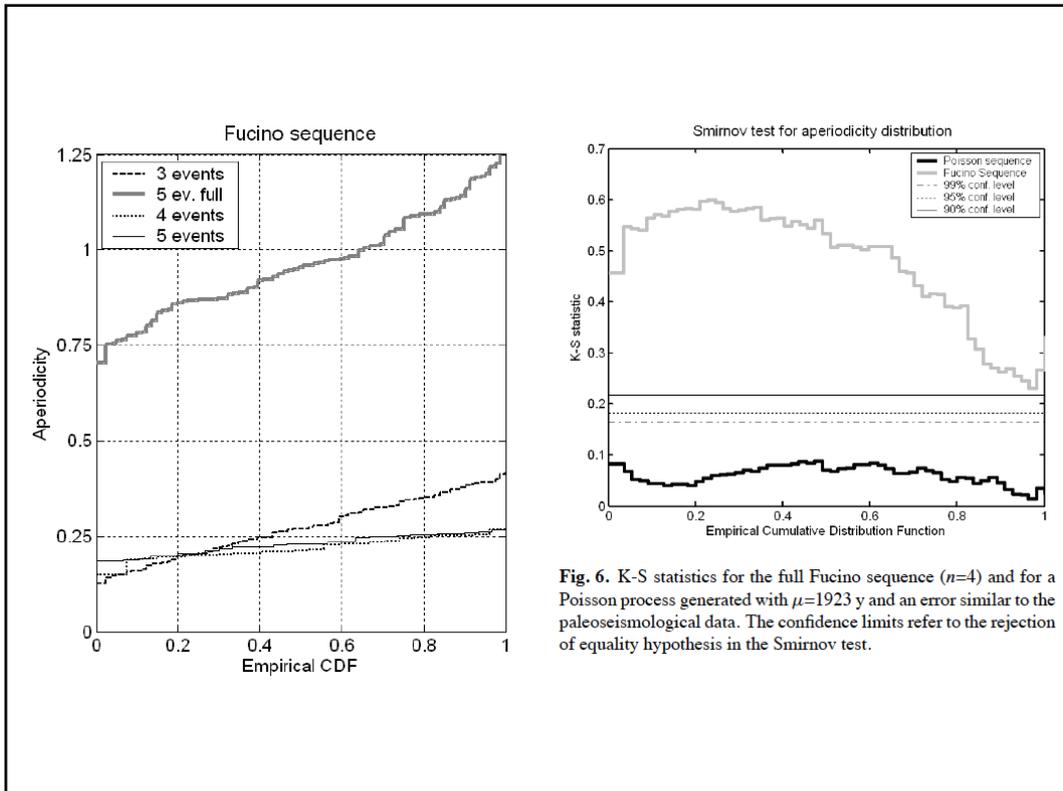

Fig. 2. Numerical estimate of the underestimate of α with a boot-strap procedure on 100 catalogues composed of 100 events each. For the two-parameters distribution the seed values were $\mu=1$ and σ uniformly distributed between 0.95 and 1.05. The investigated parameter is the ratio between the true α and the one retrieved from the synthetic catalogues. For the Poisson case, the statistic is α retrieved from data, or apparent aperiodicity.
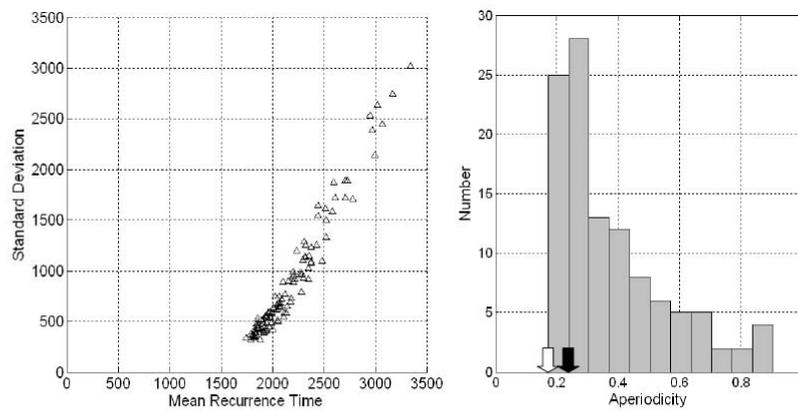
Fig. 3. Bootstrap procedure simulating 100.000 realizations of two Poisson processes having μ estimated from the Fucino data ($\mu=1498$) and from the most recent events of the Pallet Creek sequence ($\mu=120$). For the Pallet Creek data set the comparison is also with or without the request for exact matching of the sequence (less restrictive, exact Poissonian condition; see text for details).

Fig. 6. K-S statistics for the full Fucino sequence ($n=4$) and for a Poisson process generated with $\mu=1923$ y and an error similar to the paleoseismological data. The confidence limits refer to the rejection of equality hypothesis in the Smirnov test.

Fig. 7. The distribution of σ versus μ and the histogram of α obtained for the Fucino sequence with 100.000 trials. The black arrow marks the α obtained for the Fucino fault by Pace et al. (2006), while the white one is the α estimated directly from the data given by Galadini and Galli (1999).