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The seismic cycle of the Central Apennines fault system (Italy)

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Tondi and Cello in 2003 analyzed the active seismogenic crustal-scale fault system (named the Central Apennines Fault System or CAFS) with the aim of assessing the spatial and temporal characteristics of fault development and related earthquake activity. The CAFS represents the most important tectonic element in central Italy and it extends over a large area (more than 100 km long and 40 km wide) from Colfiorito, to the north, and L'Aquila, to the south.

The main results of the work was the reconstruction of the seismic cycle of the entire active fault system for the last millennium, with the following considerations:

1. The CAFS is a multi-scalar seismogenic fault structure including strike-slip and normal/transtensional active fault segments. The cumulative distribution of fault lengths within the CAFS is expressed by the relation $N_{(\geq S)}$=aS^{-D}. The value D=1.5 of the power-law exponent suggests that the system is an immature still-growing fault structure.

2. The displacement rate of the whole system in the last 700 ka is 1.6 cm/year.

3. The two largest earthquakes recorded within the CAFS (1349–1703 A.D.) account for approximately 90% of the total seismic energy released by the system in the last millennium.

4. Given the assumption that one millennium is a time period long enough to characterize the slip pattern of the CAFS, the cumulated coseismic slip patterns can be interpreted in terms of "time-predictable" and "slip-predictable" models, and the average recurrence time for M>6.5 events is about 350 years.

5. The b value of the Gutemberg–Richter relation for CAFS-related earthquakes is 0.8; the magnitude of the maximum expected event coincides with the largest historical event.

6. The exponent of the relation between seismogenic fault length and seismic moment is 2.6; this suggests that most of the seismic events in central Italy can be considered as small earthquakes (with Mo=L^3).

After the last seismic sequences generated by some of the active faults belonging to the CAFS (L'aquila earthquake, Mw_{max}=6.3 the 6^{th} April 2009; Amatrice-Visso-Norcia earthquake, Mw_{max}=6.5 the 30^{th} October 2016), the seismic cycle that was interpreted as "time-predictable" and "slip-predictable" can be verified and discussed.

Reference:

Tondi, E., Cello, G. 2003. Spatiotemporal Evolution of the Central Apennines Fault System (Italy). Journal of Geodynamics, 36, 113-128.