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Return periods of large earthquakes and their coefficient of variations constrained with paleoseismological data: examples from central Italy

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Over the last 10 years several papers have been published showing the Holocene seismic slip history of seismogenic normal faults in the Mediterranean, mainly modelled using in situ-produced 36Cl cosmogenic nuclide on limestone fault scarps. Limestone fault scarp exhumation events can be dated with that method and are correlated to large earthquakes or to clusters of moderate events associated with surface ruptures (Schlagenhauf et al. 2010). In this work we use the data published in central Italy (Benedetti et al. 2013). The reconstructed seismic history on various faults allows generating a large number of synthetic earthquake catalogues with the age of each event randomly varying within their uncertainties. The computed synthetic catalogues are then used to extract the mean recurrence times (Tmean), defined as the recurrence intervals between similar-sized, maximum expected earthquakes from the seismogenic sources, and the coefficient of variation (CV), given by the standard deviation over the Tmean. We repeat the experiment with the same approach, but including the available paleoseimological data derived from trenching. Finally, using the Tmean and CV values, together with the time of the last earthquake on each source, we evaluated the time-dependent BPT probabilities of a maximum earthquake in the next 50 years, and we compared them with the Poisson probabilities.
The results suggest non-random processes occurring in the release of the strain accumulated on faults, probably related to fault interactions, and apparent synchronization. The conclusions will help better understand the processes controlling the earthquake occurrences and will improve the fault-based probabilistic seismic hazard models in Central Italy.

References

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