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Comparison between scaling law and nonparametric Bayesian estimate for the recurrence time of strong earthquakes

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According to the unified scaling theory the probability distribution function of the recurrence time ΔT is a scaled version of a base function and the average value of ΔT can be used as a scale parameter for the distribution. The base function must belong to the scale family of distributions: tested on different catalogues and for different scale levels, for Corral (2005) the (truncated) generalized gamma distribution is the best model, for German (2006) the Weibull distribution. The scaling approach should overcome the difficulty of estimating distribution functions over small areas but theorical limitations and partial instability of the estimated distributions have been pointed out in the literature.

Our aim is to analyze the recurrence time of strong earthquakes that occurred in the Italian territory. To satisfy the hypotheses of independence and identical distribution we have evaluated the times between events that occurred in each area of the Database of Individual Seismogenic Sources and then we have gathered them by eight tectonically coherent regions, each of them dominated by a well characterized geodynamic process.

To solve problems like: paucity of data, presence of outliers and uncertainty in the choice of the functional expression for the distribution of Δt, we have followed a nonparametric approach (Rotondi (2009)) in which: (a) the maximum flexibility is obtained by assuming that the probability distribution is a random function belonging to a large function space, distributed as a stochastic process; (b) nonparametric estimation method is robust when the data contain outliers; (c) Bayesian methodology allows to exploit different information sources so that the model fitting may be good also to scarce samples.

We have compared the hazard rates evaluated through the parametric and nonparametric approach.

References

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