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On the recurrence of large earthquakes: some insights from a model based on a realistic interacting fault system

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The statistical law for large earthquakes recurrence is still matter of debate. Although different and antithetical statistical distributions have been so far proposed, there is not a commonly accepted model yet. We argue that part of these discrepancies is possibly related to the different time behavior of "individual seismogenic structure" and "seismic regions", the latter being composed by interacting structures. Here, we set a quantitative model based on a realistic interacting fault system to investigate on this issue. We define an active fault system in Central Italy that includes causative faults of moderate to large magnitude earthquakes. The main geometric and kinematic parameters of each structure are confidently assessed. Then, we study the evolution through time of the fault system by modeling different seismogenic processes and the interaction among faults by means of co- and post-seismic stress variations. The model produces synthetic catalogs on regional and sub-regional scale, as well as earthquake catalog for each seismogenic structure. The results highlight many interesting features: (i) the regional and sub-regional synthetic seismic catalogs reproduce the main characteristics of the real historical catalog of the last centuries; (ii) the synthetic catalogs show significant long-term nonstationarity with seismic rates that vary on time scales different from the recurrence time of each fault; (iii) the statistical earthquake distribution on faults and on seismic regions are completely different. Finally, we interpret these results in terms of the physics of the process.