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Generalized Cantor sets and seismicity in natural time

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It has been demonstrated that[1] natural time χ [2,3] has the capability to distinguish the two origins of self-similarity, i.e., the process memory and the process increments *infinite* variance. Seismicity is an example[1] that exhibits both these origins. Moreover, the variance $\kappa_1 \left(\equiv \langle \chi^2 \rangle - \langle \chi \rangle^2 \right)$ of natural time has been proposed[4] as an order parameter for seismicity. The scaled distributions of κ_1 of the worldwide seismicity as well as that of San Andreas fault system and Japan fall on the same (universal) curve, which exhibits, over almost five orders of magnitude, features similar[4] to those in other non-equilibrium critical systems (e.g., three dimensional turbulent flow). The effect of the process increments infinite variance in seismicity can be visualized by employing generalized Cantor sets (multiplicative cascades) in natural time: the most probable value of the variance κ_1 is explicitly related with the parameter *b*of the Gutenberg-Richter law for randomly shuffled earthquake data[5]. In addition, the presence of temporal and magnitude correlations in the original earthquake data can also be identified using natural time[5]. The magnitude correlations are larger for closer in time earthquakes, if the maximum inter-occurrence time varies from half a day to 1 min. This result, since may be due to aftershock sequences that are always present in earthquake catalogues, may be useful for aftershock hazard assessment.

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