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Describing seismic pattern dynamics by means of Ising Cellular Automata

A. Jiménez (1,2), A. M. Posadas (3), and K. F. Tiampo (1)

(1) University of Western Ontario, Canada (ajimene@uwo.ca), (2) Fundación Ramón Areces, (3) University of Almeria, Spain (aposadas@ual.es)

After a coarsegraining of the events, both spatially and temporally, a state (active or quiescent for seismic activity) is assigned to each cell at each time step. Then, a serial of lattice configurations (patterns) is obtained. This discrete representation allows us to describe the seismic catalogs as Cellular Automata. Considering that each cell interacts only with its nearest neighbors, we can calculate the transition rules directly from these patterns. In this particular work, the transition rules are based on an Ising model scheme. By maximizing the mutual information between the past and future states we can find the model which contains a higher correlation between the patterns. To accomplish this, a grid search in time steps and number of cells is made and, finally, we derive our cellular automaton. These rules have been proven to be similar to those of an Ising scheme, by using the Iberian and Greek catalogs. More catalogs are tested in this work. Finally, the cellular automaton rules are applied to the latest pattern, and we obtain a Probabilistic Activation Map, where the probability of surpassing certain energy (equivalent to certain magnitude) in the next interval of time is shown. This is useful for seismic hazard assessment.