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An automatic hybrid three-dimensional spatiotemporal model for earthquake activity by the dissociation of seismic data

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Physical processes in the earth's lithosphere compose a nonlinear complex system. Earthquake generation is part of this process. Till now, several computational geophysical models have been proposed in order to tackle complex problems associated with proper interpretation of the available seismicity information and the understanding of triggering mechanisms. In this study, an automatic, hybrid, 3-d cellular automaton model evolved both in space and time is proposed for the modelling of earthquake activity. The proposed model is further calibrated with the usage of reverse engineering in its attempt to close the loop from data collection to initial hypothesis model formation and revision. More specifically, the CA rules and the rest of the CA parameters are derived by the dissociation of real seismic data of the region under consideration as it was spatiotemporally evolved. As a result, our model not only successfully copes with the volume of provided data but could also realize the first stage of a perspective, real-time, efficient system for hazard evaluation and mapping of regional, dangerous phenomena. Moreover, the corresponding simulation results are found in good quantitative and qualitative agreement with the Gutenberg–Richter (GR) scaling relations emerged by the use of the recorded data over the under study geographical regions mainly located in Greece territory.