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Modelling Xanthi's earthquake activity using a two-dimensional cellular automaton

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Seismicity is an extended geophysical characteristic of Greek dominion. There are certain areas of high seismic activity, as well as, regions of low seismicity where strong earthquakes are rather rare events. Consequently, it is of great interest to study the earthquake process in Greece even for areas considered to be of low seismicity. In this paper, the study of the earthquake activity of an area at the Northeast of Greece, centred at Xanthi, Thrace, extended over a region of a scaling radius during a certain time period, is presented. A two-dimensional cellular automaton (CA) dynamic system constituted of cells-charges is proposed for the simulation of the earthquake process. The proposed model is constructed in order to simulate earthquake activity in correspondence to the quasi-static two-dimensional version of the Burridge-Knopoff spring-block model of earthquakes, as well as, to the Olami-Feder-Christensen (OFC) earthquake model. The aforementioned CA model has been calibrated based on the seismicity of the above-mentioned region, the density of the recorded events as well as the corresponding initial conditions. The 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 these co-centric circular regions. Finally, the CA model has a user-friendly interface and enables the user to change several of its parameters, in order to study various hypotheses concerning the seismicity of the region under consideration.