

CELLULAR AUTOMATA SIMULATIONS OF LAVA FLOWS FOR THE DETERMINATION OF VOLCANIC RISK AREAS

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One of the innumerable problems of sustainable development is the determination of risk zones in inhabited areas threatened by destructive phenomena as lava flows, landslides, lahars and so on. SCIARA (Smart Cellular Interactive Automata for modeling the Rheology of Aetnean lava flows, to be read as “shea’rah”), was a first two-dimensional CA model developed for the simulation of lava flows. First versions of SCIARA were tested on the 1986/87 Etnean eruption and the last phase of the 1991/93 Etnean one. Furthermore, more sophisticated versions have been validated on other real lava flows of Mount Etna and of Reunion Island. The comparison between the real and simulated events is satisfying within limits to forecast the surface covered by the lava. This model is well working within limits of its features, it permits: a) many vents and flows; b) automatic morphology updating; c) mechanisms to manage flows at different temperatures; d) flows at very different temperatures are not more mixed. Results of the validation phase of SCIARA allowed us to apply the model for studying risk conditions of the towns of Nicolosi, Pedara and S. Alfio, threatened by Etna. Coupling statistical methods and simulations of a large number of probable events permitted to individuate many critical conditions, whose occurring involves a direct danger toward selected areas. This study has permitted to evidence the existence of a “weak” zone where the building of appropriate defense constructions could represent a valid protection instrument.