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Simulating the 1984 Mt. Ontake Debris Avalanche through a Cellular Automata Model

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Cellular Automata (*CA*) represent an alternative approach to differential equations to model and simulate complex fluid-dynamical systems, whose evolution depends on local interactions among their constituent parts. Debris flows are such a type of systems.

The CA-model SCIDDICA has recently been improved for simulating fast-moving debris flows. It was first developed for modeling slow-moving flow-like landslides, and after some modifications, for the simulation of the 1984 Mt. Ontake (Japan) debris avalanche, with good results [1]. The study case is quite unusual: it was triggered by an earthquake, following a period of heavy rainfalls. It moved for 9 km along the Denjo river, at about 20–26 m/s, descending a relief of 1625 m. The anomalous spreading out and speed can be explained by the water saturated ground.

New releases of the model were developed in order to better capture the features of complex debris flows, in cases where erosion assumes a key role. Simulations of the 1998 Sarno (Italia) debris flows confirmed improvements of the model [2,3]. Afterwards, genetic algorithms were also adopted for calibrating the model parameters, even within a parallel computing environment [4].

The latest release of SCIDDICA has been applied to the 1984 Mt. Ontake case of study. Results demonstrated a significant improvement with respect to previous releases. After proper calibration, the model could be applied for forecasting purposes, for simulating scenarios of debris flow activation, and for evaluating the consequences of eventual remedial works along the flow path.

Keywords: debris flow; cellular automata; modeling; simulation; hazard zonation.

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