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Modelling Pyroclastic flows by Cellular Automata: an application to the 1991 Pinatubo eruption

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Computer simulation of pyroclastic flows represents an important goal in order to minimise the hazard, associated to the phenomenon. Models adopting differential equations ruling complex non-linear systems such as pyroclastic flows, are very complex and need numerical methods for approximate solutions of real cases.

Cellular Automata (CA) [1] are based on a regular division of the space in cells, each one embedding an identical finite automata (*fa*), whose input is given by the states of neighbouring cells; *fa* have an identical transition function, which is simultaneously applied to each cell. A CA model for pyroclastic flows, PYR, generated by collapsing volcanic columns, is presented. The model is derived by an empirical approach by Di Gregorio and Serra [2] for modelling and simulating complex natural phenomena and applied successfully in the past to real natural phenomena such as lava and debris flows. The objective of the work is to simulate numerically real events and to test that main phenomenological conditions appear correctly in the simulations. The model is very simple, but it is able to capture the three-dimensional evolution of the phenomenon. The model has been tested on the 1991 Mt. Pinatubo eruption in the Philippines. The results of the simulations are satisfying, if the comparison between real and simulated event is performed, considering the area involved by the event and the thickness of the deposit. The model exploitation could thus be very important in order to assess pyroclastic flow hazard in inhabited areas.

Keywords: Cellular Automata; Modelling; Simulation; Pyroclastic flows.

References

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