

# Probabilistic Lava-Flow Risk Mapping of Mt. Etna

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Cellular Automata simulations have been performed with the model SCIARA [1] by adopting a specially-designed dice to evaluate lava-flow susceptibility at Mt. Etna. Data related to the volcano's last 400-years history has been used to forecast the number of activations, the location of future flank eruptions and the type of activations to expect in the next 100 years. Following Lupiano's approach [2], the number of activations in a given time frame has been assumed to be Poisson distributed, and the table of types and associated probabilities of future activations has been used. The probability density function for sites of future activations (sources) has been revised to disregard distance from the crater. In a single run simulating 100 years, the resulting topography has been preserved between the events, allowing us to evaluate changes in the volcano morphology for the next century. Risk scenarios and resulting topography have been generated for the next activation, for the next 50 years and for the next 100 years. In the first case, results look quite

comparable with previous forecasts obtained by using deterministic simulations on the same non-uniform grid of vents [3]. The remaining scenarios are in good agreement with previous risk studies made for the same area, particularly Duncan's [4] identification of "topographically unprotected areas". In this study, threats to major lifelines have also been analysed with reference to the time-frames considered.

## References

- [1] W. Spataro, M. V. Avolio, V. Lupiano, G. A. Trunfio, R. Rongo, D. D'Ambrosio. The latest release of the lava flows simulation model SCIARA: first application to Mt Etna (Italy) and solution of the anisotropic flow direction problem on an ideal surface. *Procedia Computer Science*, 1, 17-26, 2010.
- [2] LUPIANO, V. (2011) - Definizione di una metodologia per la creazione di mappe di rischio tramite l'utilizzo di un modello ad automi cellulari: applicazione ai flussi lavici del Monte Etna. PhD Thesis, University of Calabria (Italy).
- [3] Bongolan, V.P., Lupiano, V., D'Ambrosio, D., Rongo, R., Spataro, W. AND Iovine, G. Applying Non-Uniform Grids to Evaluating Susceptibility from Flow-type Phenomena: An Application to Mount Etna. *Proceedings of the European Geosciences Union General Assemble, APRIL 2013*.
- [4] Duncan, A.M., Chester, D.K., Guest, J.E. (1981) Mount Etna Volcano: Environmental Impact and Problems of Volcanic Prediction. *Journal of Volcanology and Geothermal Research*, 172, 288-299.