Geophysical Research Abstracts,
Vol. 11, EGU2009-4845, 2009
EGU General Assembly 2009

Predicting the impact of lava flows at Mount Etna by an innovative method based on Cellular Automata: Applications regarding land-use and civil defence planning

G.M. CRISCI (1,2,), M.V. AVOLIO (1,,), D. D'AMBROSIO (2,3,), S. DI GREGORIO (2,3,), G.V. LUPIANO (1,,), R. RONGO (1,2,), W. SPATARO (2,3,), B. BENHCKE (4,,), M. NERI (4,,)

(1) Dept. of Earth Sciences, University of Calabria, Italy , (2) Center of Excellence for High Performance Computing, University of Calabria, Italy, (3) Department of Mathematics University of Calabria, Italy, (4) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania, Catania, Italy (neri@ct.ingv.it, +39 095 435801), () I

Forecasting the time, character and impact of future eruptions is difficult at volcanoes with complex eruptive behaviour, such as Mount Etna, where eruptions occur from the summit and on the flanks, affecting areas distant from each other. Modern efforts for hazard evaluation and contingency planning in volcanic areas draw heavily on hazard maps and numerical simulations. The computational model here applied belongs to the SCIARA family of lava flow simulation models. In the specific case this is the SCIARA-fv release, which is considered to give the most accurate and efficient performance, given the extent (567 km2) of the study area and the great number of simulations to be carried out. The model is based on the Cellular Automata computational paradigm and, specifically, on the Macroscopic Cellular Automata approach for the modelling of spatially extended dynamic systems2.
This work addresses the problem of compiling high-detailed susceptibility maps with an elaborate approach in the numerical simulation of Etnean lava flows, based on the results of 39,300 simulations of flows erupted from a grid of 393 hypothetical vents in the eastern sector of Etna. This sector was chosen because it is densely populated and frequently affected by flank eruptions. Besides the definition of general susceptibility maps, the availability of a large number of lava flows of different eruption types, magnitudes and locations simulated for this study allows the instantaneous extraction of various scenarios on demand. For instance, in a Civil Defence oriented application, it is possible to identify all source areas of lava flows capable of affecting a given area of interest, such as a town or a major infrastructure. Indeed, this application is rapidly accomplished by querying the simulation database, by selecting the lava flows that affect the area of interest and by circumscribing their sources. Eventually, a specific category of simulation is dedicated to the assessment of protective measures, such as earth barriers, for mitigating lava invasion susceptibility in given areas. For the case if the town of Nicolosi, results show that the barrier would be necessary to effectively protect the town centre.
The methodology here described can therefore represent a substantial advance in the field of lava flows impact prediction and can also have immediate, far-reaching implications both in land-use and civil defence planning.