Geophysical Research Abstracts
Vol. 15, EGU2013-11458, 2013
EGU General Assembly 2013

Modeling the statistical behaviour of volcanic eruptions using a cellular automaton

Laura Sanchez (1) and Robert Shcherbakov (1,2)

(1) University of Western Ontario, Earth Sciences, London, Canada (lsanche@uwo.ca), (2) University of Western Onario, Physics and Astronomy, London, Canada (rshcherb@uwo.ca)

Volcanic eruptions are a complex dynamical system characterized by non-trivial temporal correlations. Understanding the processes involved in magma ascent within the crust as well as the interactions between magma and crust and the failure mechanism that leads to an eruption are crucial in order to develop better hazard assessment techniques. In a previous study, we showed that the interevent time distributions of volcanic eruptions are characterized by a universal behavior, independent of the type of volcanism and geographical location. The distribution for eruptions with a large interevent time seems to deviate from the simple Poisson statistics.
In order to investigate the interactions between the magma and the host rock within the crust, we developed a cellular automaton model which mimics those interactions at the microscopic level. The results from a preliminary analysis presented at the AGU fall meeting 2012 showed a good agreement between the model results and the world eruption data. We observe 2 regimes of eruptions that could be representative of close and open conduits systems.
Here, we explore the capabilities of the model on larger lattice sizes and longer time intervals. We consider two different fracture profiles within the crust. (1)- Only the vertical fractures directly under the eruption point are considered in the eruption; (2)- the entire fracture network (vertical and horizontal) under the eruption point is considered in the eruption. We also introduce different particle types: magma and dissolved gas, in order to take into account the explosivity of eruptions. We then perform a statistical analysis to compare the model results with the world eruption data. This model allows us to describe the dynamics of complex magma interactions using a minimum number of parameters.