Geophysical Research Abstracts
Vol. 14, EGU2012-2981, 2012
EGU General Assembly 2012

Spatiotemporal probability of vent opening at Mt Etna volcano (Sicily, Italy)

A. Cappello (1,2), G. Bilotta (1,2), M. Neri (1), V. Acocella (3), G. Gallo (2), and C. Del Negro (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania, (2) Dipartimento di Matematica e Informatica, Università di Catania, (3) Dipartimento di Scienze della Terra, Università RomaTre

We produced a spatiotemporal probability map of vent opening at Mt Etna, using a statistical analysis of structural features of the flank eruptions of the last 2000 years. The methodology is based on the hypothesis that the location and frequency of future events will have the same causal factors as the eruptions occurring in the past. The study is supported by a detailed knowledge of the volcano structures, including the modalities of shallow magma transfer deriving from dike and dike-fed fissure eruptions analysis on historical eruptions. The geological and structural data are converted in distinct and weighted probability density functions (PDFs), exploiting both spatial and temporal recurrence rates. The spatiotemporal probability map is obtained through a non-homogeneous Poisson process, where the expected recurrence rate per unit area is calculated as the weighted sum of the PDFs, with the weights derived from a backward/forward analysis to highlight the presence of temporal trends in the history of the volcano. The highest probability of new eruptive vents opening at Mt Etna falls within a N-S aligned area passing through the Summit Craters down to about 2000 m a.s.l. on the southern flank. Four other zones of high probability follow respectively the North-East, East-North-East, West and South Rifts, the latter reaching low altitudes ($\sim$400 m). Less susceptible areas prone to the opening of new vents were found around the faults cutting the upper portions of Mt Etna, including the western portion of the Pernicana fault system and the northern extent of the Ragalna fault system. The spatiotemporal probability map of vent opening provides detailed recurrence rates (events expected per unit area per unit time) and will hence be an important resource to predict the future timing and location of Etna eruptions. This structural-based map is the first and perhaps most important step in assessing lava flow hazards at Mt Etna, and thus represents a support tool for decision makers.