Geophysical Research Abstracts
Vol. 18, EGU2016-8117, 2016
EGU General Assembly 2016

Evaluation of eruptive energy of a pyroclastic deposit applying fractal geometry to fragment size distributions

Joali Paredes Marino (1), Daniele Morgavi (1), Mauro Di Vito (2), Sandro de Vita (2), Fabio Sansivero (2), and Diego Perugini (1)

(1) Department of Physics and Geology, University of Perugia, Piazza Università, 06100 Perugia, Italy. (joali.paredes@studenti.unipg.it), (2) Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Vesuviano, Via Diocleziano 328, 80124 Napoli, Italy

Fractal fragmentation theory has been applied to characterize the particle size distribution of pyroclastic deposits generated by volcanic explosions. Recent works have demonstrated that fractal dimension on grain size distributions can be used as a proxy for estimating the energy associated with volcanic eruptions. In this work we seek to establish a preliminary analytical protocol that can be applied to better characterize volcanic fall deposits and derive the potential energy for fragmentation that was stored in the magma prior/during an explosive eruption. The methodology is based on two different techniques for determining the grain-size distribution of the pyroclastic samples: 1) dry manual sieving (particles larger than 297μm), and 2) automatic grain size analysis via a CamSizer-P4® device, the latter measure the distribution of projected area, obtaining a cumulative distribution based on volume fraction for particles up to 30mm. Size distribution data have been analyzed by applying the fractal fragmentation theory estimating the value of Df, i.e. the fractal dimension of fragmentation. In order to test our protocol we studied the Cretaio eruption, Ischia island, Italy. Results indicate that size distributions of pyroclastic fall deposits follow a fractal law, indicating that the fragmentation process of these deposits reflects a scale-invariant fragmentation mechanism. Matching the results from manual and automated techniques allows us to obtain a value of the “fragmentation energy” from the explosive eruptive events that generate the Cretaio deposits. We highlight the importance of these results, based on fractal statistics, as an additional volcanological tool for addressing volcanic risk based on the analyses of grain size distributions of natural pyroclastic deposits.

Keywords: eruptive energy, fractal dimension of fragmentation, pyroclastic fallout.