

Magnitude-frequency distribution of volcanic eruptions from an open conduit

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Explosive eruptions such as vulcanian, strombolian, or significant gas burst excite seismic waves. Such seismic signals, which are often called as explosion earthquakes or explosion quake, are used to quantitatively evaluate the magnitude of such volcanic explosions. In the present study, we systematically examine magnitude-frequency distributions of explosion earthquakes observed at Sakurajima and Suwanosejima volcanoes in Japan, and Semeru and Lokon volcanoes in Indonesia. We use the long-term catalog data of Sakurajima explosions for the period from 1963 to 2011, which are routinely summarized by Sakurajima Volcano Research Center (SVRC). Also, we measure the amplitudes of explosion earthquakes from continuous seismic records observed at Suwanosejima and Semeru and Lokon volcanoes in Indonesia. We measure the number of earthquakes that exceed a given amplitude, and then plot the cumulative number of earthquakes versus amplitude, as is often done for examining Ishimoto-Iida's relation, which expresses a power law distribution. However, the observed frequencies of earthquakes at the four volcanoes do not seem to fit the Ishimoto-Iida's relation. The cumulative numbers are well explained by exponential functions. This means that the magnitude of explosion earthquake at each volcano is randomly determined with an average scale.

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