Realtime estimation of eruption size using high-frequency seismic waves: empirical relations to predict eruption height from the seismic source amplitude of eruption tremor

*Azusa Mori[1], Hiroyuki Kumagai[1]

1. Nagoya University Environmental Studies

We studied the relationship between the eruption plume height and the high-frequency seismic amplitude of eruption tremor to explore the possibility to estimate eruption size in realtime. We estimated the source amplitudes (A_s) of eruption tremors using high-frequency (5-10 Hz) seismic amplitudes. We analyzed eruption tremors at Kirishima volcano in Japan and Tungurahua volcano in Ecuador. We found that the maximum eruption plume heights (H) during individual eruption tremors at these volcanoes were proportional to 0.21 power of A_s. We also compared time-series data of plume heights for the sub-plinian eruptions at Kirishima volcano in January 2011 with A_s values in corresponding time windows. The estimated relation between H and A_s was not represented by the power law relation when H is less than 6 km, and H becomes zero when A_s is less than a certain value. Based on these results, we proposed the empirical relations to predict the eruption plume height depending on the value of A_s. If we assume that the eruption volumetric flow rate is equal to the seismic source volume rate, the proposed relations can be reasonably explained with the physical process of plume rise. Our results suggest that the plume height can be predicted by the seismic source amplitude in realtime, which would contribute to improve eruption monitoring.

