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Source process of small volcanic explosions as inferred from tilt records: Shinmoe-dake, Kuchierabu-jima, and Ontake-san

NISHIMURA, Takeshi[1*]

[1]Geophysics, Science, Tohoku Univ.

Small phreatic explosions occurred at Shinmoe-dake in May 2011 and Ontake-san in September 2014 and phreatomagmatic explosion at Kuchierabu-jima in August 2014 were observed by tilt meters installed at a few kilometers from the active crater of the volcanoes. Temporal characteristics of the tilt motions during these small explosions are characterized by initial uplifts toward the active craters followed by exponential decays indicating deflations of the volcano. The temporal changes of the exponential decays are compared with predictions from an eruption model assuming pseudo ideal gas flow through a narrow conduit from a chamber (Nishimura, 1998). The comparisons indicates that the observed characteristic are well explained by the prediction. This strongly suggests that the processes of these small explosions process is simply expressed by a pressure relaxation due to the withdrawal of ideal gas stored beneath a volcano. The relaxation times, which are related to the cross sectional area of the conduit, chamber volume, initial velocity of the ejecta and specific heat of the ideal gas, are estimated to be about 3 min. for Shinmoe-dake and Ontake-san and 20 s for Kuchierabu-jima, respectively.

Keywords: phreatic explosion, tilt, volcano deformation, small explosion, phreatomagmatic explosion