[JJ] Evening Poster | S (Solid Earth Sciences) | S-VC Volcanology

[S-VC41]Active Volcanism

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Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
This session discusses various aspects of active volcanisms including, but not limited to, recent and historical eruptions, various phenomena associated with the volcanic activities, underground structures of the volcanoes, and developments of new instruments based on geophysical, geochemical, geological, and multidiscipline approaches. We also welcome studies on understanding and predicting the transitions of the eruptive activities from observational, theoretical, and experimental approaches.

[SVC41-P08]Explosion energy of Moto Shirane eruption estimated from the news movies

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Keywords:Kusatsu Shirane, Phreatic eruption, eruption energy

Based on the analysis of broadcasted news movies, explosion energy of the Moto-Shirane eruption on 23rd January was estimated using the method by Ohba et al. (2003). The initial explosion at the summit of the Kagami-Ike North Cone captured by NHK and FUJI TV was funnel-shaped, indicating that the explosion source was very shallow (< 10 m). Compared with the geomorphology captured in the movie, the explosion cloud was estimated as c. 200 m in height, and accordingly, the explosion energy was estimated as 1.5 x 10^{11} J. According to the experiments by Goto et al. (2002), an explosion with this energy leaves a crater with a diameter of 30 m. A Taiwanese skier captured the successive explosions from another crater in the western base of the cone. The explosions spouted vertically elongated jets which correspond to a scaled explosion depth of 0.004 m/J$^{1/3}$. The movies provided the information of the crater location, distance from the photographer, and the heights of the clouds (60 - 100 m). The energy of individual explosion ranged from 10^8 to 10^9 J in order. Although the exact total number of explosions cannot be estimated from the movie, the number of explosions can be assumed as in order of 10^2, because the explosions occurred roughly once a second in the movie and the duration of the eruption was less than five minutes. As a result, the total energy discharged from this crater is in order of 10^{11} J supposedly. The first explosion at the summit was exceptionally big, and the following explosions were two to three orders smaller in energy. The total energy of the following successive small explosions was close to that of the initial explosion (order of 10^{11} J). Assumed the total energy of entire eruption was 10^{12} J, mass of water that has equivalent thermodynamic energy of vaporization is 5 x 10^5 kg (assumed the enthalpy of vaporization is 2000 kJ/kg). The water volume is as small as a sphere with a diameter of 10 m. Assumed high-temperature volcanic gas (assumed as high-T steam here) mixed with cold groundwater at 0.5 MPa (c. 50m in hydrostatic depth) to create high-T steam to explode, the thermodynamic energy of 10^{12} J is obtained by mixing between 300 – 380 tons of cold water and a larger amount of volcanic gas. The estimated volume of volcanic gas ranges from 800 to 10000 tons, depending on the initial temperatures of volcanic gas and the resultant steam.