Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SVC48-20 Room:104 Time:May 20 09:15-09:30

Tilt motion and volcanic tremor during lava-effusive stage in the 2011 Shinome-dake eruption

Rintaro Kamata[1*], Takeo Minoru[1]

[1]Earthquake Research Institute, The University of Tokyo

Introduction

Observations such as tilt motions and tremors are important in considering magma behavior. Tilt motions observed near a crater may represent pressure change in conduit and tremors observed near a crater may be generated by volcanic fluid (gas, magma, water) in conduit. In order to reveal dynamics of eruptions, various observations such as tilt motions and volcanic earthquakes have been observed around volcanoes. In this research, we focused on tilt motions and tremors during lava-effusive stage in the 2011 Sinmoe-dake eruptions and revealed the character of them.

A series of eruptions at Shinmoe-dake

The Shinmoe-dake volcano started a magmatic eruption at 15:29 (JST) on 26 January 2011. Three sub-Plinian eruptions occurred between 26 and 27 January 2011, followed by two Vulcanian eruptions at 02:05 and at 12:48 on 28 January 2011. Midmorning on 28 January 2011, a small magma dome emerged from the center of the summit crater, progressively increasing in volume. After 1 February 2011, Vulcanian eruptions occurred frequently. Later, volcanic activity has continued during the year 2011 at least.

In this research, we focused on a lava-effusive stage (28-31 January). In this stage, deflation-inflation cycles of tilt motions with a typical period of one hour were observed at stations near by the summit of Shinmoe-dake (Maehara 2012). We also observed volcanic tremors related to deflation-inflation tilt motions. Only when the tilt motions were lower than the threshold, tremors occurred.

The frequency structure of tremors

The frequency structure of tremors differed in deflation stage from in inflation stage. In frequency domain under 2Hz, tremors are dominated by two frequencies (about 1Hz and about 1.5Hz) during deflation stage, but are dominated by a frequency (about 1.2Hz) during inflation stage. In frequency domain over 2Hz, the intensity of frequency structure in inflation stage is much smaller than in deflation stage only on 31 January.

Pressure source exciting tilt motions

We estimated the depth of pressure source exciting tilt motions by using the ratio of tilt amplitude recorded at two stations, under the assumption that pressure source generating deflation-inflation cycles was located under the center of crater and cylindrical pressure source. Then, we estimated pressure change dP which could generate tilt motions comparable to observation.

When the centroidal depth of pressure source was located at 600m above sea-level, the point sources extending 250m from 475m to 725m above sea-level could explain the observed ratio. In this case, at most a few MPa pressure change dP could generate tilt motions comparable to observation.

Keywords: lava effusion, tilt, tremor