Tilt changes associated with volcanic tremors observed in Ohachi of Kirishima volcanoes from December 2003 to January 2004

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1. Introduction

The MRI started the repeated GPS and geomagnetic survey around Shimoedake and Ohachi of the Kirishima volcanoes in August 2001. The continuous GPS observation at 5 stations using the 1 frequency type GPS and continuous geomagnetic observation at 3 stations were installed, and the ground tilt observation was started at 3 stations in November 2003. This paper discusses the tilt changes associated with the volcanic tremors observed in Ohachi Volcano from December 2003 to January 2004.

2. Tilt observation in Kirishima volcanoes

The ground tilt observation was started by using Pinnacle's borehole type tiltmeter at 3 stations in November 2003 (Shinmoe: 4.4km N28W away from Ohachi crater, 1.1km N29E away from Shinmoedake crater. Araso: 1.3km S24W away from Ohachi crater. Yunono: 4.2km W10N away from Ohachi crater). The resolution of this sensor is 1nrad and the dynamic range is +/-10 degrees by an automatic leveling mechanism. The observation well is a PVC pipe of 75mm diameter hold together with concrete into the drilling hole of 15cm diameter and 12m depth. The tiltmeter is installing in this inside, and it is being fixed by the silica sand of a uniform grain size. The solar battery and satellite portable phone are used for telemetry at Shinmoe and Araso stations. A telephone line and the commercial power supply are used at Yunono station. Tilt data sampled by 10 second were collected at MRI. The drift of tilt data at Araso is small and the step is not caused by earthquake. The earth tide and distant earthquakes are well recorded at all stations.

3. Tilt changes associated with volcanic tremors

The volcanic tremors were observed at the stations near Ohachi at 11h14m JST on 12 December, at 11h20m JST on 15 December, 2003 and at 06h36m JST on 3 January, 2004, and the new fumaroles were confirmed (Volcanic Observation and Information Center, Fukuoka DMO and Kagoshima LMO/JMA, in this assembly). The duration of the volcanic tremors are 40 minutes, 5 minutes, and 55 minutes, respectively. The amplitude are 14.2, 10.8, and 29.9micro-meters/sec. The tilt changes associated with the volcanic tremors were observed at Araso, the changes showed downward tilt in the radial direction to Ohachi crater. From that the direction of tilt change was the subsidence of Ohachi crater (new fumaroles) and that the stones and mud were emitted from the new fumaroles on 12 December, it is supposed that the deflation occurred by the pressure decrease by discharging the material from the new fumaroles. The depth of the decompression source is estimated as shallower than 2km. The volume change on 12 December is estimated as 2000m^3 for 2km depth, as 700m^3 for 1km depth. The duration of this changes are 9 minutes, 4.5 minutes, and 2.5 minutes, and amplitudes of tremors are 0.045, 0.014, and 0.032 microradian, respectively. The behaviors of tilt change are similar. However, the relation between tremor and tilt change is not simple. For example, the tilt change of the first event is the biggest, while the amplitude of 3rd event is largest.

4. Concluding remarks

Ohachi of Kirishima volcanoes frequently erupted during the period from 1880 to 1923, and the non-eruptive stage, except some seismic events, continued afterwards. Shinmoedake was active in this period. Yasui and Nagatomo (1961) said that the volcanic activity of Shinmoedake and that of Ohachi occurred alternatively in the period of several tens years. The volcanic tremors were observed at Ohachi, since 26 October, 2001, it may be showing that a new active stage opened at Ohachi.

Reference

Yasui H. and Nagatomo Y. (1961) An investigation of the history of volcanic activity of Kirishima volcanoes. Sokkou Jihou, 28, 32-42 (in Japanese).