

## Vertical Deformation Detected by the Precise Levelling Survey after the 2015 Eruption in the Hakone volcano (2015-2017)

\*Masayuki Murase<sup>1</sup>, Hitoshi Yamashita Mori<sup>1</sup>, Yang Li<sup>1</sup>, Kaito Katano<sup>1</sup>, Masatake Harada<sup>2</sup>, Ryosuke Doke<sup>2</sup>, Kazutaka Mannen<sup>2</sup>, Yuki Abe<sup>2</sup>, Jun Takenaka<sup>5</sup>, Takeshi Matsushima<sup>3</sup>, Yoshiko Teguri<sup>3</sup>, Kazunari Uchida<sup>3</sup>, Kaori Morita<sup>3</sup>, Yuki Koga<sup>3</sup>, Manami Nakamoto<sup>3</sup>, Rintaro Miyamachi<sup>3</sup>, Misa Ichimura<sup>4</sup>

1. Department of Earth and Environmental Sciences, College of Humanities and Sciences, NIHON University, 2. Hot Springs Research Institute of Kanagawa Prefecture, 3. Faculty of Sciences, Kyushu University, 4. Graduate School of Science, Kyoto University, 5. Hot Springs Research Institute of Kanagawa Prefecture (Current affiliation: Japan Meteorological Agency)

We conducted the precise leveling surveys in the Hakone volcano in December 2015, September 2016 and December 2017, and discussed vertical deformations in the periods of after the 2015 Eruption.

The leveling routes of about 11 km with 41 benchmarks were established on the northern flank of central cone of Hakone volcano. The main route was extended from GEONET Hakone (Ninodaira) to the Togendai ropeway station. In order to improve the spatial layout of the benchmarks, a branched leveling route extended to Owakudani was established.

After the 2015 eruption (December 2015- September 2016), the subsidence of 18mm and 15mm were detected with respect to the GEONET Hakone on the Owakudani and main routes, respectively. Then, in the period between September 2016 and December 2017, the subsidence of 12mm and the uplift of 7mm were detected in the Owakudani and the main routes, respectively.

Since GEONET Hakone is too close to accept as a reference point for the vertical deformation in Hakone volcano, we used GEONET Odawara as the reference point.

The GEONET Hakone showed the subsidence of 15mm and the uplift of 8mm with respect to the GEONET Odawara in the period from December 2015 to September 2016 and the period from September 2016 to December 2017, respectively.

Although subsidence was detected in the period of after the 2015 eruption, the small uplift was detected with respect to the GEONET Odawara at main route in period from December 2015 to December 2017.

On the other hand, large subsidence of 37mm was detected with respect to GEONET Odawara at Owakudani route in the period between December 2015 and December 2017.

We need continued and careful observation of the deformation in the Hakone volcano.

Keywords: Hakone Volcano, Precise Leveling Survey, Vertical Deformation