Vertical deformation associated with the 15 August 2015 dike intrusion at Sakurajima volcano measured by leveling survey

*Keigo Yamamoto[1], Shin Yoshikawa[2], Takeshi Matsushima[3], Takahiro Ohkura[2], Akihiko Yokoo[2], Hiroyuki Inoue[2], Kazunari Uchida[3], Tadaomi Sonoda[1], Manami Nakamoto[3], Yusuke Yamashita[1], Daisuke Miki[1], Satoshi Matsumoto[3], Koki Aizawa[3], Mie Ichihara[4]

1.Disaster Prevention Research Institute, Kyoto University, 2.Graduate School of Science, Kyoto University, 3.Faculty of Sciences, Kyushu University, 4.Earthquake Research Institute, University of Tokyo

We conducted the precise leveling survey in and around Sakurajima volcano, in order to detect the vertical ground deformation associated with the dike intrusion event occurred on August 15, 2015. The leveling routes measured in this survey are about 69 km long in total, including Sakurajima coast route, Sakurajima western flank route, Sakurajima northern flank route, Kurokami route in the eastern side of this volcano and Kagoshima Bay western coast route located outside Sakurajima. These leveling routes were measured during the periods from August 16 to September 24 and on December 18, 2015, immediately after the occurrence of the intrusion event. Mean square errors of the conducted survey were achieved with a good accuracy as the range from ±0.17 to ±0.33 mm/km. From the survey data measured in Sakurajima, we calculate the relative height of each bench mark referred to the reference bench mark BM.S.17 which is located at the western coast of Sakurajima. The calculated relative heights of the bench marks are then compared with those of the previous survey conducted in November 2014 (Yamamoto et al., 2015), resulting in the relative vertical displacements of the bench marks during the period from November 2014 to August-September 2015. As to the measured data of Kagoshima Bay western coast route, the reference bench mark is taken at BM.2469 located in Kagoshima city to the west of Sakurajima, and we calculate the relative vertical displacements of the bench marks during the period from November 2013 (when the previous survey was conducted in this route) to August 2015.
The resultant displacements indicate the remarkable ground uplifts around the northern part of Sakurajima, at Arimura (to the south of craters) and at Kurokami (to the east of craters). The amount of the maximum uplift is as much as about 16.8 mm referred to BM.S.17. The obtained uplifts at Arimura and Kurokami are consistent with the vertical ground deformation expected from the dike intrusion models inferred by other researches using InSAR, GNSS, tilt and strain data associated with the August 15 event (Geospatial Information Authority of Japan, 2015; Hotta et al., 2016). The uplifts around the northern part of Sakurajima suggest the inflation of the magma reservoir beneath the northern part of Sakurajima or beneath Aira caldera, which was not simultaneous with the August 15 event.

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