Crustal deformation around the Kirishima Volcano Group detected by GNSS and SAR observation

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Since July 2017, GNSS Earth Observation Network (GEONET) maintained by Geospatial Information Authority of Japan (GSI) has observed elongation at the baseline surrounding the Kirishima volcano group. Similar crustal deformation has been observed before the Shinmoe-dake eruption in 2011, and it is estimated that magma accumulation was progressing at about 6 to 7 km northwest of the Shinmoe-dake (e.g. Kobayashi et al., 2012). Detailed investigation of crustal deformation of the Kirishima volcano group is important in grasping the situation of volcanic activity. In this research, we investigated the crustal deformation of the Kirishima volcano group including Shinmoe-dake using GNSS observation and ALOS-2 (Daichi 2) SAR data analysis.

To comprehend the crustal deformation around the volcanoes in detail, GSI analysis data from the GNSS continuous observation stations installed near the volcano by the Japan Meteorological Agency (JMA) and the National Research Institute for Earth Science and Disaster Prevention (NIED) using the integrate analysis developed by Hatanaka, (2012) to obtain solutions consistent with GEONET F3 solutions. In this study, we investigated crustal deformation of the Kirishima volcano group in detail using the analysis result. As a result, it became clear that from July 2017 crustal movements occurred that expands the Kirishima volcano group including Shinmoe-dake (Fig. 1). The center of expansion is generally located in the northwestern part of Shinmoe-dake, uplift is also observed near the center.

In order to grasp the crustal deformation around the Kirishima volcano group spatially in detail, we performed InSAR time series analysis using ALOS-2 (Daichi 2) data. We used the right looking data from ascending orbit (path 131) and descending orbit (path 23), 21 scenes of ascending data from September 30, 2014 to October 10, 2017, and 32 scenes of descending data from 9 February to 18 September 2017. Analysis results of ascending and descending orbit were obtained, we carried out 2.5-dimensional analysis (Fujiwara et al., 2000) using these results. As a result of the analysis, not only sedimentation and shrinkage inside the Shinmuke-dake crater but also uplift of maximum 5 mm / yr or more in the range of about 2 km diameter around the crater, horizontal expansion of more than 10 mm / yr were clearly captured. In addition, local uplift of up to 10 mm / yr or more was detected on the western slope of the crater. In addition, the local expansion in the Iwo-yama is captured, and the uplift rate is at most 20 mm / yr or more.

As also revealed by GNSS observation, crustal deformation is observed widely around the Kirishima volcano group. We will estimate the source model from the crustal deformation detected by GNSS considered to be related to magma accumulation.

Keywords: Kirishima volcano group, Shinmoe-dake, crustal deformation, GNSS, SAR