Crustal deformation and pressure source estimation of Miyakejima volcano obtained from GNSS campaign observation (2013-2019)

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Miyakejima is an active volcano located about 180 km south of Tokyo, and since the 20th century it erupted at intervals of about 20 years (1940, 1962, 1983, and 2000). Fukui et al. (2015) conducted GNSS campaign observations and estimated the pressure source of Miyakejima from 2011 to 2013. In this research, using the crustal deformation of Miyakejima observed from 2013 to 2019, we estimate the position of the pressure source and the volume change, and discuss the temporal change of the pressure source of Miyakejima after the 2000 eruption.

We conducted GNSS campaign observations at about 15 reference points arranged so as to be distributed almost evenly throughout Miyakejima in September 2013, 2015, 2016 and 2019. We used the data obtained from this GNSS campaign observation and the data for the same period of continuous observation points established by the Geospatial Information Authority of Japan and JMA. In order to analyze the obtained data, the coordinate value of the observation point for each year was obtained using RTKLIBver.2.4.2 software (Takasu et al., 2007). Estimating the horizontal displacement for each period from the position, a radial displacement was observed around the southwestern part of Miyakejima in any period.

The pressure source was estimated based on horizontal displacement from 2013 to 2019. The optimum value of the variation was obtained by using MaGCAP-V software (Meteorological Research Institute, 2008) for analyzing crustal activity for volcano. As a result, one spherical pressure source was estimated at about 4 km southwest from the summit crater of Miyakejima and 10 km deep below sea level, and this positions was almost the same as those of deep pressure sources obtained by Nishimura et al. (2002) based on the leveling and GNSS survey results before the 2000 eruption. The changes in the sill and dike pressure sources just below the crater pointed out by Fukui et al. could not be detected during this period, and the depth of the deeper spherical pressure source was estimated to be 3 km shallower than Fukui’ s estimate. It was also found that the spherical pressure source continued to inflate at about 1.7×10^{7} m^3/yr from 2013 to 2019. The volume accumulated between the 1983 and 2000 eruptions is estimated to be about 1.7×10^{8} m^3 by Nishimura et al.. On the other hand, from this study, the Geographical Survey Institute (2010) and Fukui et al., the amount of accumulation during the 2000-2019 exceeded 2.6×10^{8} m^3, indicating that it is not surprising that an eruption will occur in the near future.

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