Tilt and strain change before and after the explosion at Minami-dake, Sakurajima, in 2017

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A deformation source associated with each eruption at Sakurajima have been estimated beneath Minami-dake [Ishihara, 1990; Iguchi et al., 2013]. Deformation sources for mid-long-term magma intrusion event were estimated beneath Aira caldera, Kita-dake and Minami-dake; and the deformation source beneath Kita-dake was found to act as a buffer of mid-long eruptive activity at Sakurajima [Hotta et al., 2016].

On November 13, 2017, an explosion with an infrasound occurred at Minami-dake at 22:07. Ground deformation was accompanied and kept for approximately five hours. For the period of 22:07–22:10 (period I), a large strain change at Arimura observation tunnel, which is the nearest tilt/strain station from Minami-dake crater and operated by Ministry of Land Infrastructure, Transport and Tourism, was detected whereas no significant change in tilt/strain was detected at other tilt/strain stations. For the period of 22:10–22:50 (period II), tilt/strain change was detected at all tilt/strain stations associated with violent eruptive activity. At around 23:00, style of eruption shifted from Vulcanian to Strombolian. For the period of 22:50–3:00 of the next day (period III), a pattern of tilt change at Japan Meteoritical Agency (JMA)-A station, which located on western area of Sakurajima, and tilt/strain gradually stopped.

We modeled the detected tilt/strain change using a finite spherical source model [McTigue, 1987]. Because of the poor constraint of the radius of the source, we assumed the radius of the source as 20 m for period I and 200 m for periods II and III. A shallow deflation source was located at a depth of 0.1 km above sea level beneath Minami-dake for period I. A deeper deflation source was located at a depth of 5.9 km below sea level beneath Minami-dake for period II. Then, a deflation source was located at a depth of 5.9 km below sea level beneath Kita-dake for period III. Deformation sources beneath Minami-dake for periods I and II are corresponding to the deformation sources previously found for each eruption at Sakurajima. Meanwhile, the deformation source beneath Kita-dake for period III is corresponding to the deformation source beneath Kita-dake which was found during mid-long eruptive activity. Each eruption at Sakurajima revealed to cause deflation of not only Minami-dake source but also Kita-dake one, which considered to repeat inflation/deflation during mid-long eruptive activity at Sakurajima. Temporal development of deflation accompanied by the eruption on November 13, 2017, will be revealed in our future study.

Keywords: Sakurajima Volcano, Explosion at Minami-dake, Ground deformation, Tilt and strain

