

Ground deformation in Aso Volcano before and during 2014-15 eruptive activity

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Aso Volcano, one of the most active volcanoes in Japan, is located in the central part of Kyushu and consists of an elliptical caldera with a diameter of 18km in E-W and 25km in N-S, and of central cones with more than 10 volcanoes aligned in E-W direction. Among central cones, Nakadake volcano is the only active cone and its recent activity is characterized by ash and strombolian eruptions and phreatic or phreatomagmatic explosions. The last strombolian eruptions ended in the beginning of the 1990s and after that, surface activities have been restricted to the fumarolic gas and ash emission from the northernmost crater of the volcano accompanying activity of long period tremors (LPT) or very long period (VLP) events.

Aso volcanological laboratory has an observation tunnel for the precise measurement of ground deformations. The 30m-deep tunnel is located at Hondo observatory, 1km southwest from the active crater. Waterlube tiltmeters and invar-rod extensometers are working in the tunnel to monitor the ground deformation of Aso.

Since 1990s, observations using broadband seismometers at the tunnel have revealed that the source of LPT is a crack-like conduit located at depths of 1-1.5 km beneath Nakadake, with a length of 1km and width of 2.5km. It is also revealed that at this depth a pressure was located and caused long-period displacements a few minutes before phreatic eruption that occurred in 1993 and 1994.

After 21 year's dormancy, Aso volcano started magmatic eruptions in November, 2014.

During pre-eruptive stage, remarkable ground deformations were detected by the tilt meters and extensometers in September 2013, January 2014 and July 2014 associated with increase in VLP events activity. By comparing the calculated deformation assuming a Mogi source and a dyke, it is found that observed deformation could be attributed to the expansion of the crack-like conduit.

Just before the eruption that occurred on 25 Nov. 2014, we have detected a rapid extension of the radial component of the extensometers.

We also detected an expansion at a depth of 1.3km just beneath the active crater of Nakadake 2 days before successive eruptions in Jan. 2015. It is found that the located deformation source almost coincides with the location of the pressure source before the phreatic eruption in 1993 and 1994.

Keywords: Aso Volcano, Eruptive activity 2014-2015, Crustal deformation