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Time Series Surface Deformation using Multi-Temporal InSAR Technique at Mount Sinabung Eruption in North Sumatra, Indonesia

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Sinabung volcano in Indonesia is a part of the Pacific Ring of Fire, formed due to the subduction between the Eurasian and the Indo-Australian plate. After about 400-year dormancy, Sinabung volcano erupted on August 29, 2010 and January 4, 2014, recently. We study the surface deformation of Sinabung volcano using ALOS/PALSAR and RADARSAT-2 interferometric synthetic aperture radar (InSAR) images acquired from February 2007 to September 2013. Based on multi-temporal InSAR processing, we can generate the ground surface deformation map due to the 2010 eruption. During the 3 years before the 2010 eruption, the volcano inflated at an average rate $\sim$1.7 cm/yr with marked higher rate of 6.6 cm/year during the 6 months prior to the 2010 eruption. The inflation is constrained to the top of the volcano. Since the 2010 eruption to January 2011, the volcano has subsided for about 3 cm (or about 6 cm/yr). The observed inflation and deflation are modeled with a Mogi and Prolate spheroid source. The source of inflation is located about 0.3 – 1.3 km below sea level directly underneath the crater. On the other hand, deflation source is modeled about 0.6-1.0 km with coeruption period. The average volumetric change was about from 1.9x10-6 to -2.7x10-5 km3/yr during the eruption event using ALOS/PALSAR images. Recently, RADARSAT-2 SAR data were applied to new eruption event from September 2013 to January 2014 for frequently eruption during short time period. We interpret the inflation was due to magma accumulation at a shallow reservoir beneath the Sinabung volcano. The deflation was due to the magma withdrawal from the shallow reservoir during the eruption as well as thermo-elastic compaction of erupted material.