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Multi-Temporal Ground Deformation Monitoring for Mt. Agung, Indonesia Using Persistent Scatterer Interferometry

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Persistent Scatterer Interferometric Synthetic Aperture Radar (PSInSAR) is an effective method to measure ground deformation in a large area, with improvements on decorrelation and noise resistance against conventional Differential Interferometric Synthetic Aperture Radar (DInSAR) analysis. In this study, PSInSAR was applied to analyze multi-temporal ground deformation for Mt. Agung located in Bali, Indonesia, which is an active volcano showing a great potential of eruption since September, 2017. The phreatic eruption of Mt. Agung began on Nov. 21, 2017, while the magmatic eruption, which brings fresh lava to the surface, began on Nov. 25, 2017. In order to understand the multi-temporal, from pre-eruption to post-eruption, ground deformations of the volcano, 17 Sentinel-1 SAR images between June to December, 2017 were collected for analysis. A total of 16 pairs of interferograms were generated with InSAR analysis using the SNAP software developed by the European Space Agency (ESA). During the InSAR processing, 1 arc-second SRTM DEM was used to calculate the phase caused by topography and a set of interferograms related by ground deformation was obtained. Then, PSInSAR analysis was carried out using the Stanford Method for Persistent Scatterers (StaMPS) InSAR implementation. According to the generated PSInSAR results, an uplift velocity about 15 mm/month around the crater, along line of sight (LOS) direction over Mt. Agung, is measured. Furthermore, the volcano activity traces could also be revealed by PS time series, which provide detailed information from pre-eruption, co-eruption, to post-eruption, illustrating the activeness of Mt. Agung, and help researchers and decision makers understand the active cycle of the volcano.