Estimation of surface displacement around Kuju volcano before and after the 2016 Kumamoto earthquake using SAR interferometry

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The 2016 Kumamoto earthquake occurred from Kumamoto prefecture to Oita prefecture along the Beppu-Shimabara graben. Kuju volcano is one of active volcanoes, which lies in the center of the Beppu-Shimabara graben, and even now volcanic fume is observed.
In this study, we estimated surface displacement around Kuju volcano before and after the 2016 Kumamoto earthquake using differential SAR interferometry (DInSAR) and SAR interferometry time-series analysis. We applied DInSAR analysis to SAR data acquired soon after the 2016 Kumamoto earthquake: ALOS2/PALSAR-2 images acquired at April 18 and June 13 2016 on an ascending orbit (path 23, frame 2950). On the other hand, we used Small Baseline Subset (SBAS) analysis, one of InSAR time-series analysis, for estimating spatio-temporal pattern of surface displacement before and after the Kumamoto earthquake. We used 6 PALSAR-2 data acquired from August 2014 to February 2016 on an ascending orbit (path 130, frame 650), and 13 PALSAR-2 data acquired from June 2016 to October 2016 on a descending orbit (path 23, frame 2950).
As a result of DInSAR analysis, we estimated surface displacement toward line-of-sight direction with about 4cm at Mt. Iwou, about 3cm in Mt. Kuju and about 2cm around the Hatchobaru geothermal field. Considering that the displacement occurred at almost all of Kuju volcano, and no significant seismicity has been observed, we interpreted that thermal fluid or magma at deeper than 5km depth have influenced the surface displacement.
SBAS analysis revealed surface displacement showing both upward and downward pattern at Mt. Iwou and Mt. Kuju before and after the 2016 Kumamoto earthquake. Despite the similarity of displacement pattern, we could not find clear correlation between the displacements before and after the earthquake. Moreover, we estimated a liner subsidence rate of about 14~16 mm/year around the Hatchobaru geothermal field.
Although it is better to apply further analysis to larger number of SAR data for clarifying changes in surface displacement pattern.

Keywords: InSAR, DInSAR, SBAS Analysis, Kumamoto earthquake, Kuju volcano, ALOS2/PALSAR2

