Deflation source after the September 2014 eruption of Ontake Volcano, Japan detected by ALOS2/PAlSAR2 InSAR

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1. Introduction
On September 27th, a phreatic eruption occurred at Mt.Ontake, located on the border between Gifu and Nagano prefectures, central Japan. Preceding this event, the number of VT earthquakes gradually increased from early September, and their source was approaching ground surface during the final 10 minutes before the eruption. Simultaneously, the tilt meter located on the southeast flank recorded a rapid change suggesting inflation of the edifice. The eruption started on new eruptive fissures formed in Jigokudani, where there are many fumaroles and fissures formed in 1977. These activities then exponentially declined.
Multiple observations during the event suggest formation of co-eruptive crack just beneath Jigokudani area. Analysis of VLP event just before the eruption suggested that co-eruptive small crack opened at the depth of 300-1000m beneath the newly former fissures, and its orientation was approximately east-west (Maeda et al.,2015). ALOS2-InSAR detected co-eruptive ground deformation, revealing that co-eruptive crack aligned along new fissures extends vertically downward from 100m to 1400m (GSI, 2015). On the other hand, deflation around Jigokudani area after the eruption is confirmed by ALSO2 InSAR. The goal of this study is to reveal the source causing the deflation and its relationship to pressure sources during pre and co eruptive stages of 2014 eruption.
2. Data and Results
We processed 3 scenes of ALOS-2 data and computed 3 interferograms spanning 2014/10/03-2015/06/12 (8 month), 2014/10/03-2015/11/13 (13 month), 2015/06/12-2015/11/13 (5 month), respectively. All the interferograms were made from ascending and right looking observations having the same offnadir angle (32.4°). Coherency of those interferograms is very good. We used RINC 0.36version developed by Dr. Taku Ozawa at NIED.
In all the interferograms we detected LOS increase in the area of 2km×1km around Jigokudani. The distance changes in LOS direction mean subsidence, and its maximum values are respectively 45cm in 13month, 30cm in 8 month, and 12cm in 5 month. To estimate the source parameters causing the deformation, we carried out an inversion using Mogi model, which assumes point source buried in an elastic half-space. The depth of estimated sources is consistently about 400m beneath Jigokudani area. The volume changes are respectively $3.7\times10^5m^3$ in 13 month, $2.4\times10^5m^3$ in 8 month, $1.1\times10^5m^3$ in 5 month.
3. Discussions and future challenges
The deflating source estimated in this study are consistently located about 400m below the surface. GNSS campaign observation from August 2005 to May 2007 detected local ground deformation near the summit of Ontake, and revealed that an inflating source was located about 1km under the area of new fissures. Although the depth of these sources location is not same, the horizontal location of the inflating source detected by GNSS is near the south edge of the deflating source in this study. Moreover, InSAR time-series analysis using ALOS-1 data from 2007 to 2010 revealed that there were displacements meaning inflation near the summit of Ontake and its speed was about 1cm/yr. To discuss the relation between these sources, it is necessary for us to track time-dependent ground deformation in detail and to relocate the source in this study with more precise method, i.e. finite element method, considering the topographic effect to the observed displacements.
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Keywords: Ontake, phreatic eruption, volcano deformation

