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Crustal deformation around 62-II crater of Tokachidake Volcano, central Hokkaido Japan, depicted by InSAR of AlOS/PALSAR

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Mt. Tokachi is an active volcano with an altitude of about 2077 m, located almost at the center of the Mt. Tokachi volcano group which aligns along northeast to southwest trend in the central Hokkaido. Since the beginning of the 20th century Mt. Tokachi has been repeating eruptions in 1926, 1962, and 1988-89 with an approximate recurrence period of 30 years. In the north-northwest part of Mt. Tokachi there are number of craters, i.e., Nokogiridake crater, Ground crater, Suribachi crater, Kita-mukai crater, Tyuoh crater, and 62-II crater. Among them the 62-II crater was formed by the eruption in 1962 and also used by eruption in 1988-1989. GPS observations by Japan metrological agency and others revealed that an inflation around this crater is on-going. In this paper, we present ALOS/PALSAR interferomety results depicting deformation of crustal deformations of Tokachi volcano.

We used ALOS/PALSAR data taken during the period from 2006 to 2010. A total of 38 scenes (20 from ascending and 18 from descending orbits) were available for the analysis. From these raw data, we constructed interferogramas for the pairs whose orbit baseline lengths are reasonably short and temporal baseline is sufficiently long. Firstly we examined only nterferograms with the highest quality. From the first analysis we excluded interferotrams where the paired observations were carried out to the snow covered ground and/or ones having large noises caused by the atomosphere. Those errors are caused by the heterogeneous microwave propagation through the ionosphere and troposphere. An example of such high-quality data was taken with the pair on June 30, 2008 and October 3, 2009. We can recognize a localized phase change pattern around 62-II crater, suggesting an localized inflation around the crater which is in good agreement with the GPS results.

Then we stacked relatively good interferograms with small noises scattering over the observed region. In many cases those noises are in good correlation of the trend of the rugged topography of the mountainous region suggesting existence of propagation heterogeneity in the data, which expected to be of random nature. The stacked interferogram also depicts a localized phase change around 62-II crater which is in good agreement with the highest quality interferograms as well as GPS data. We do not find any other significant fringes (phase changes) around the other craters. By fitting of Mogi model for our InSAR results, a source was estimated below the 62-II crater at the depth of about 1 km.

In this study, whole InSAR processing was performed using SIGMA-SAR by Dr. Masanobu Shimada of JAXA-EROC. We used 10m-mesh Digital Elevation Model compiled by the Geospatial Information Authority of Japan (GSI). PALSAR level 1.0 data were provided from the Earthquake and Volcano Working Groups as well as PIXEL (PALSAR Interferometry Consortium to Study our Evolving Land surface) under a cooperative research contract with JAXA (Japan Aerospace Exploration Agency). The ownership of PALSAR data belongs to METI (Ministry of Economy, Trade and Industry) and JAXA.

Keywords: InSAR, Crustal Deformation, Tokachidake, ALOS, PALSAR, Volcano