Ground Deformation at Usu volcano, obtained from SAR interferometric analysis using ALOS (PALSAR) data

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Introduction: Usu volcano, which is located at the southern edge of Toya caldera in Hokkaido, is one of the most active volcano in Japan. It is widely known that a clear precursory seismic activity and ground deformation just before an eruption. In contrast, there is little seismicity after the eruptive activities, but the volcano deflates steadily. Terrestrial observations have shown contractional deformation at the western flank of Mt. Usu, called Nishiyama and Kompira where the 2000 eruption occurred, and at a lava dome locating the summit area after the 1977-78 eruption. ALOS, launched in January 2006, has L-band sensor (PALSAR) and the sensor has much advantage to extract crustal deformation with conducting a interferometric approach. The satellite has taken many scenes for Usu volcano, so that it is expected that the spatial extent of the abovementioned contractional deformation that have not observed by terrestrial observation can be detected. I report the result of SAR interferometric analysis for Usu volcano.

Analysis: We conducted a differential interferometirc approach using pair of images that have a perpendicular baseline less than 2 km. Among them, I report the results using 3 images of ascending orbit (401-840), captured on 20 July 2007, 4 September 2007, and 20 October 2007, and 2 images of descending orbit (55-2270), captured on 23 July 2006 and 27 October 2007, in which nice interferometry images are created. For ascending data, the short observation intervals are disadvantage to detect small ground deformation we consider, so that we here stacked 3 interferometry images to improve the signal-to-noise ratio. In this approach, we assume that the deformation rate is constant through the analysis period. We use 10m mesh DEM which was measured after the 2000 eruption by GSI.

Result: The interferometry images clearly show the deformation at the summit area of Usu and around Nishiyama with the direction that goes away from the satellite, namely contractional deformation. The notable point of the result is that in both the images the largest contraction is identified at the summit area rather than at the Nishiyama region where the newest eruption occurred in 2000. The magnitudes of slant range changes are estimated to be approximately 10 and 5 cm/yr in the ascending and descending orbits, respectively, with reference around Zenko-ji. On the other hand, at Nishiyama region, the magnitude is approximately a half of the summit area. A small contractional deformation is identified with about 2 cm/yr at also Showa-shinzan which is a lava dome formed during 1943-45. It may be possible that the detected slant range change is not atmospheric noise but true signal because similar deformations are obtained from multiple images commonly.

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