Evaluation of InSAR analysis result using pipe strain gauge data in Otari village, Nagano prefecture, Japan

*Tomoya Kiyosawa[1], Hiroshi, P. Sato[2]

1. Department of Geography, Graduate School of Science and Technology, Nihon University , 2. College of Humanities and Science, Nihon University

In order to detect landslide surface deformation, InSAR (Synthetic Aperture Radar interferometry) images were produced and interpreted in the study area of Ahara area in Otari Villege, Nagano Prefecure in Japan. The images were produced from time-series ALOS-2/PALSAR-2 data, taken from September 2014 to March 2018. More than 50 InSAR images were produced; however, at most four images gave good coherence available to interpret and detect the deformation. The one was taken on and the three were after Kamishiro Fault earthquake (M 6.7) on 22 Nov 2014. As a result of images interpretation, westwards deformation was detected up to ca. 2.5 cm and 4.5 cm along LoS (line of sight) on and after the earthquake, respectively.
To take measures against landslide disaster, Nagano Prefecture installed pipe type strain gauge in Ahara area, and the measured strain data were used to evaluate the image-detected deformation. As a result, at the slip layer of 8-m depth from the ground, the strain gauge measured 13 μST on the earthquake and it also indicated westward deformation. Empirically, strain over ca. 20,000 μST cuts electric measurement cables, and this strain is known to be equal to 2-3 cm deformation under the ground. Therefore, 13 μST is thought to be correspondent to 0.0013 cm deformation. Thus, the image-detected deformation itself was proved by the gauge-measured strain data and westward deformation direction was harmonized with the gauge-measured strain data. However, it was found that the image-detected deformation amount is 2,000 times larger than the strain gauge-calculated deformation amount.
Focusing on the deformation after the earthquake, as the observation periods of the images were not overlapped with measurement period of the strain gauge, assuming that the deformation proceeds at uniform speed in landslide body, then, both data were compared in daily mean deformation speed. The image-detected speed was calculated as 0.025-0.064 cm/day, and strain gauge-detected speed 0.000083 cm/day was calculated from 58 μST. It was found that the image-detected deformation speed is 300-780 times larger than the strain gauge-calculated speed. We think that this difference is attributed to the fact that InSAR measured the deformation not on the ground but along LoS distance and strain gauge measured the deformation not on the ground but under the ground. Furthermore, we think that the reason of more difference of the deformation amount on the earthquake than after the earthquake is that the image on the earthquake includes the deformation not only by landslide surface deformation but also crustal deformation by the earthquake.

Keywords: PALSAR-2, Landslide, InSAR

