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能登半島における測地学的手法を用いた地すべり変動の検出
Detection of Landslide displacement by Geodetic techniques at the Noto Peninsula

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Natural disasters represented by earthquake, flood, and tsunami have occurred frequently in Japan. Landslides caused by earthquakes and/or heavy rains have caused great damages in many areas in Japan. Sliding of landslide moves slowly and continuously in general. Elucidation of the characteristic of spatio-temporal movement of landslide is important to understand the mechanism of landslide and to evaluate the assessment of its risk.

In this study, we estimated landslide displacements by geodetic techniques and analyzed the characteristic of landslide movement with ground surface observations at Wajima City, Ishikawa Prefecture, in the Noto Peninsula. We conducted GPS observations of the landslide during July 2014 to March 2015, and detected ground surface displacements from a change in the positions of the GPS sites. We also conducted SAR (synthetic aperture radar) analyses of InSAR (SAR interferometory) and PS-InSAR (persistent scatterer SAR interferometry) using 10 ALOS/PALSAR images acquired from December 2006 to October 2010. Furthermore, we used the ground data observation records of the borehole extensometers obtained by the Ishikawa Prefecture from 2008 to the present. We examined a landslide history of the analyzed area by tracking a topographic map published in 1970 and 5 m DEM released by GSI (Geospatial Information Authority of Japan) recently.

The InSAR analysis reveals landslide displacements of several tens cm/year in the area of 500 m x 500 m and horizontal displacements of 0.6-1.0 cm/year are estimated from GPS. The magnitudes and directions of the landslide displacements are coincident with the monitoring result of the borehole measurements and previous researches. We estimate the average rate of the landslide displacements of 0.5-0.8 m/year from the tracking topographical characteristics using the topographic data. These observations confirm that the landslides in the analyzed area have been active in recent years and suggest that active landslides in the past forms distinct scarp terrains and causes the past disasters written in historical materials.

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