Landslide movement at Mt. Onneobetsu-dake detected by InSAR

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Landslide is an important process for landscape evolution. Also, to reveal landslide characteristics is very important from the view point of disaster mitigation.

Shiretoko Peninsular is one of the most intensive landslide areas in Hokkaido, where large-scale landslide topographies have been detected by analyses of aerial photographs (Ito, 1994; 1996). In this study, we clarify current movements of such known landslides in Shiretoko Peninsular and examine temporal variation of the landslide movements by interferometric synthetic aperture radar (InSAR) analysis.

Japan has launched three L-band SAR satellites (JERS-1, ALOS, ALOS-2) during 15 years, with which we have accumulated a large amount of SAR images. Due to its long wavelength, we can detect surface movements under dense forests without any ground station, which is advantageous to study distal areas like Shiretoko Peninsular.

Firstly, to grasp overall activity of these landslide topographies in Shiretoko, we created seven independent interferograms of JERS-1, ALOS, and ALOS-2 with good condition for interferometry. As a result, we detected up to +4.3 cm length change in the line-of-sight (LOS) direction in ALOS-2 ascending interferogram with timespan of 9 months. This length increase coincides with a known landslide topography reported by previous studies (Ito 1994; 1996). The landscape topography stretches about 4.5 km to the southeast from landslide scarp at the summit of Mt. Onnebestudake. The InSAR signal indicates large displacements especially at the middle to lower portion of the colluvial deposit, where pressure ridges have been reported (Ito 1994; 1996). Above mentioned observations indicate that the length change detected by InSAR reflects current landslide movement. The LOS change was also detected by six other interferograms at the same location, at the peak rate ranging from +0.8 cm/yr to +5.6 cm/yr for ascending orbit, and from -1.8 cm/yr to -2.9 cm/yr for descending orbit, respectively. Thus, we clarified continuous movements of the landslide at southeast flank of Mt. Onnebetsudake for more than 20 years (from 1993 to 2015).

Next, to reveal time evolution of the landslide movement at the southeast of Mt. Onnebetsdake, we created sixteen interferograms using ALOS and ALOS-2 data acquired from ascending and descending orbits. The sixteen interferograms consist of four long time-span (~3 yr) interferograms and twelve short (~1yr) timespan interferograms. The latter separates each long time-span interferogram into three successive periods. The results indicates the landslide movements for both ALOS and ALOS-2 data, which means continuous movements of the landslide from 2007 to 2010 and 2011 to 2014, respectively. For ALOS-2 interferograms, the LOS change was detected for all the short time-span interferograms spanning 1 year. The LOS velocity of the landslide reaches 3~5 cm/yr at the maximumm. On the other hand, the LOS velocity observed from ALOS data (both ascending and descending orbits) was slower than that of ALOS-2, which means that the velocity of the landslide movements may be changing with time.

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