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ALOS2-PALSAR2 Interferometry on snow covered mountaneous area in Hokkaido: Tokachi-dake Volcano and Vicinity

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A repeat pass interferometery using spaceborne L-band synthetic-aperture radar provides a good coherency even on a vegetated area. It has already become an indispensable geodetic tool to detect spatial distribution of crustal deformation. However, if the earth surface is covered by snow at a cold district covered, we suffer from loss of coherence mainly caused by the change of reflection conditions due to a snowpack.

A relatively large dielectric constant of dry snow brings changes of the microwave propagation velocity and traveling distance. Nevertheless, details of a phase change by snowpack were left untouched, because the basic coherence was considered to be lost when the earth surface is covered by snow or ice.

ALOS2 satellite was launched by Japanese space agency, JAXA in May, 2014. This is a satellite dedicated solely for SAR mission. It is equipped with PALSAR2 which is the next generation L band sensor. Various improvements have been implemented in this satellite. As a result it is expected to provide high coherency for repeat pass InSAR for different areas on the glove. If an observation for snow covered target is also becomes possible, it is a significant step forward for facilitation of a geodetic monitoring in winter over a volcano season where the terrestrial access is very limited.

To validate such possibility several InSAR analyses were carried out using PALSAR2 data acquired on August 14, December 4, the 18, 2014, and January 15, 2015. The target area includes Tokachidake and Taisetsu volcanic chains.

Relatively good coherence was obtained for the pair spanning December 4 and 18 despite a heavy snow fall experienced one day before the second acquisition. This indicates a possibility that a good coherence is achievable for a snow covered target, if the other conditions are favorable. It is noteworthy that the coherence was also maintained around volcano summit where the ground is mostly composed with lava and breccia and almost no vegetation is found. This is an encouraging finding for the achievement of geodetic monitoring around vents and craters of volcanoes located in cold region with similar setting. On the other hand, some interesting phase patterns having correlation with land characteristics (forest, cultivated field, and city, etc.) are found on flat regions. Those might suggest that the phase change caused by snowpack depends on bouncing mechanisms of microwave. In the presentation, more details of those findings will be covered.

The PALSAR2 data used here were acquired and provided by JAXA through the Working Group for special study on application of satellite remote sensing technology for volcanic monitoring, organized under the umbrella of the Coordinating Committee for Prediction of Volcanic Eruption.

Keywords: crustal deformation, InSAR, remote sensing, satellite, volcano, snowpack