

Development of snow-depth map using ALOS-2

*Hiroto Nagai¹, Tomohiro Watanabe¹, Takeo Tadono¹, Takeshi Motohka¹

1. Japan Aerospace Exploration Agency

Concentration of heavy snow fall is concerned related to recent climate change (Kawase et al. 2016). In order to prevent social confusion caused by hazardous snow fall, snow depth measurement by means of satellite-based synthetic aperture radar (SAR) is one of possible ways in addition to in-situ snow depth measurement. However microwave reflection is strongly influenced by land cover condition. In this study, therefore, we aim to estimate snow depth from a L-band SAR with consideration of seasonal land cover change on paddy fields, that contributes for a following discussion for operational use.

A study site is defined at paddy fields around Nagaoka, Niigata prefecture, Japan (Fig. 1a), where snow depth reaches up to several meters which is deeper in the mountain side than the plain side. The Phased Array type L-band Synthetic Aperture Radar (PALSAR-2) observed this site on Mar 1, 2016 (snow covered) as well as non-snow seasons with water surface (2015/6/23, 2016/6/7, 2017/6/6) and with land surface (2014/11/11, 2015/11/24, 2016/11/8, 2017/11/7). The non-snow data was averaged at each month of Jun and Nov. In-situ measurement of snow depth was carried out on Feb 26, 2016 at eight points in the site.

The measured snow depths are positively correlated with the differences of PALSAR-2 backscatter amplitude between snow-covered season and non-snow seasons (Fig. 1b). Comparing with those in Jun, little difference of backscatter amplitude is found at the points of snow depth closer to 0 cm, whereas deeply snow-covered points denoted larger microwave reflection than non-snow season. Comparing with those in Nov, lower amplitude difference is found at the points of snow depth closer to 0 cm, whereas deeply snow-covered points denoted closer values. In the in-situ survey we confirmed that the snow-ground interface had muddy condition suggesting snow melting in all points. That possibly caused similar microwave reflection between little snow-covered condition with melting surface in Mar. and fully water-filled condition in Jun. In contrast no-water condition in Nov. has similar microwave reflection to deeply snow-covered condition with melting bottom rather than little snow-covered condition, due to volumetric scattering.

Keywords: SAR, Snow depth, Nagaoka

