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Condition for water infiltration in snowy highland marshes based on ALOS/PALSAR data analysis

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We have been studying how to monitor the hydrological environment of snowy highland marshes by using remote sensing. The data from L-band radar PALSAR (The Phased Array type L-band Synthetic Aperture Radar) onboard ALOS (Advanced Land Observing Satellite "DAICHI"), a Japanese satellite, has potentials to observe the marshes under the snow layer. The microwave radar measures the back- scattered signals and works in all weathers. The microwave generally reaches the subsurface layer, so the returned signal includes information about soil moisture as well as surface roughness. We analyze the data from PALSAR and try to retrieve the hydrological information in highland marshes through the year.

Based on our analysis of PALSAR/ALOS data, we lastly reported that the Oze highland marsh, extending across the 4 prefectures (Fukushima, Gumma, Niigata and Tochigi), keeps a largest amount of liquid water body in midwinter, however, no such case seems to happen in Kiritappu and Sarobetsu marshes both locating at Hokkaido. All 3 marshes are covered with snow layer in winter. The peak of water content in Oze is observed in midwinter and not in early spring. We concluded that the observed water body in Oze marsh is not meltwater but would be the liquid water squeezed out from the peat bed by the load of heavy snow. In the other 2 marshes of Kiritappu and Sarobets, the thickness of the snow layer and/or peat layer (which is a reservoir of water) seems not enough.

In this presentation, we show our new analysis about Tashiroyama, Uryunuma and Midagahara marshes, locating at Fukushima, Hokkaido and Toyama prefectures, respectively. All 3 marshes are highland marshes where it snows in every winter. We examined whether the water infiltration out of the peat layer could be observed in these highland marshes based on the PALSAR/ALOS data. In both Tashiroyama marsh and Uryunuma marsh, water infiltration was observed during midwinter. In Midagahara marsh, on the other hand, no infiltration of water was observed. We discuss the condition for water infiltration in its correlation with peat depth and snow depth. We propose that water infiltration in highland marshes is caused when the following two conditions are met: 1) layer $>$2m for the thickness of peat bed and 2) snow cover $>$2-3m.

Keywords: PALSAR, hydrology, remote sensing, highland marsh, snow, peat bed