



Study on characteristics of snow depth distribution in mountainous regions in Hokkaido, Japan by airborne laser scanning

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In mountainous regions, seasonal snow accumulation is affected by complex interactions between climate, topography and vegetation. Few studies have reported the characteristics of snow depth distribution in mountainous regions by airborne laser scanning (LiDAR) in Japan. To date, the characteristics of snow depth distribution in mountainous regions have not been understood well in Japan.

In this study, airborne laser scanning was conducted in the Taisetsu Mountains in Hokkaido, Japan in March 2017, approximately at the time of the local maximum of the seasonal snow accumulation. The 5m resolution digital elevation model (DEM) of snow surface was created and the snow depths were calculated by subtracting the values in the DEM of the ground surface from those in the DEM of the snow surface. The target range for airborne laser scanning (30km²) was divided on a catchment scale into 4 zones, the windward slope in forests, the leeward slope in forests, the windward slope in alpine and the leeward slope in alpine, and relationships between snow depth and topography in each zone were analyzed.

The characteristics of snow depth distribution in the forests and that in the alpine were clearly different and greater spatial heterogeneity was found in snow depth in alpine.

In the forests, the linear relationships between elevation and snow depth were found on both the windward and the leeward slope. The amount of snow accumulation on the windward slope was greater than that on the leeward slope and snow depth on the windward slope was greater than that on the leeward slope at the same elevation because of the blocking effect of the catchment boundary ridge.

For the alpine, overground-openness, an indicator to quantify how far a target point is above or below the surrounding surface, was introduced and the linear relationships between overground-openness of the ground surface and snow depth were found on both the windward and the leeward slope. This linear relationships indicate that areas with heavy snow cover are distributed in valleys and that with light cover are distributed on ridges. In contrast to the forests, significant difference in the characteristics of snow depth distribution between the windward slope and the leeward slope was not observed. But great snow depths, might be difficult to reproduce with the linear relationship, were found at the steep topography in the leeward slope.

In this study, simple relationships between snow depth and topography in mountainous regions in Japan, easy to introduce into the practical use such as water resource management, were clarified.