Estimation method for snow-depth distribution at Midagahara Plateau, Toyama, using time-lapse photography

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The snow in the cold regions is the important water resources. The data of snow depth by AMeDAS are effective to estimate the effect of climate change on the water resources in Japan, and it is not sufficient to estimate the amount of snow in a mountainous region of sparsely distributed AMeDAS. Live cameras have been installed by Tateyama Kurobe Kanko along Tateyama Kurobe Alpine Route. In this study to establish an estimation method for snow-depth distribution using time-lapse photography, we observed the height of the tree exposed from the snow surface and we estimated the snow depth distribution.

The target area is Midagahara Plateau, Toyama. The target period is from April to June when the snow was disappeared in the whole area of Midagahara Plateau. During the target period, the live camera data were saved every day. The target trees (Abies mariesii) to estimate the snow depth were decided. We measured the exposed height of each tree from the snow surface by in-situ observation using a laser range finder. Based on the exposed height of each tree, the image data of the live camera were analyzed and the snow depth of the noon every day was estimated.

We could firstly obtain time-series data of the snow depth and our data suggested that the snow depth changed suddenly in places due to a lift up of the branches. Though the snow depth was different on each tree site at the initial stage of the snow melting season, the snow seemed to disappear at any tree sites (except one tree site) with the same timing. The cause of the early melting away of snow at the one tree site is that the area is composed of densely tall trees and the snowmelt is promoted by a radiation and turbulence fluxes. The cause of the same timing of melting away of snow at the other tree sites is that when the ground surface covered patchily with snow appears, it is easy to be able to melt rapidly the snow around the exposed ground surface because the albedo of the ground surface is lower than that of the snow surface (air temperature becomes higher).

Second, the amount of snowmelt by a degree-day method using a degree-day factor obtained by the previous study was underestimate in comparison with a snow-surface reduced method. Since trees grow in Midagahara Plateau, it is assumed that one of the factors is that trees promote snow melting.

Finally, when we analyzed the exposed height of trees at a distance of above 400 meters from the live camera under a scale of below 1cm per one pixel, the image of the live camera became indistinct. We could confirm the limit of snow depth change using live cameras.

Keywords: snow depth, time-lapse photography, estimation method