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Snowmelt monitoring of alpine zone in Japan by using time-lapse cameras

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The vulnerability of alpine ecosystems to climate change and the necessity to conduct monitoring in the alpine zone have been recognized worldwide. The Japanese Alps is characterized by extremely heavy snowfall, and snowmelt is a key factor for the growth of alpine vegetation. The Center for Global Environmental Research (CGER) at the National Institute for Environmental Studies has, therefore, launched long-term monitoring of snowmelt and ecosystems in the Japanese alpine zone since 2011 by using automated digital time-lapse cameras and aerial photographs.

In this study, a new method for monitoring alpine zones by digital cameras was developed in order to detect yearly change of snow-cover areas at high temporal and spatial resolutions. We used images from cameras that have been installed at mountain lodges in the northern Japanese Alps (at elevations around 2350-3100 m) and at around Mt. Rishiri in Hokkaido. RGB digital numbers were derived from each pixel within the images. The snow-cover and snow-free pixels were statistically classified by analysis of variance of gray-level histograms. In this discriminate analysis method, a flexible threshold was determined for each image to maximize the between-class variance.

The detected distributions of the snowmelt dates showed site-specific characteristics and yearly variations. Finally, we produced ortho-rectified maps of snowmelt dates over North Alps areas and Mt. Rishiri.

Keywords: RGB digital number, ortho-rectify, discriminate analysis method

Fig. 1   Monitoring sites location map