

## Snow patches of Japanese Alps last until late autumn 2013 and their past variations

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Variations in glaciers are visible indicators of climate change, especially in mountain region. In Japan, snow patch can be an alternate indicator since glaciers, long years, were not recognized in the Japanese Alps. One characteristic of the Japanese Alps is their extensive distribution of snow patch last until late autumn. A snow patch inventory for this mountain is urgently required, not only for monitoring snow patch variations but also to evaluate water reservoir in the region. Limited number of studies has attempted to complete snow patch atlas in Japan. As a step in this direction, the author has produced an inventory of snow patch lasts before winter 2013 at the entire area of the Japanese Alps. This study addresses the results of snow patch mapping 2013.

The work of compiling a perennial snow patch inventory for the Japanese Alps initially involved oblique aerial photographs taken from a charter flight throughout the Japanese Alps. These photographs were interpreted using a stereoscope. The photographs were taken on 7th and 10th October 2013. The planimetric outline of each perennial snow patch was manually delimited and drawn on 1:25 000 scale topographical maps and successfully compiled the complete set of snow patch inventory of the Japanese Alps in 2013. Then inventory of 2013 thus compiled reveals 579 snow patches with a total surface area of 3.66 km<sup>2</sup>. The year 2013 distribution was much extensive rather than that of usual years. The lowest snow patch termini appeared at the altitude of 1070 m on Mt. Inu of the northern Japanese Alps and the southernmost was 35° 40' 30.5" at Mt. Kita of the southern Japanese Alps. The largest one was the area of 0.184km<sup>2</sup> on Mt. Karamatsu of the Northern Japanese Alps. Ca. 80% of them locate east-facing slopes, where leeward side against winter prevailing NW wind. Latitudinal profile of the terminus altitudes of snow patches shows northward gradients. Winter northwesterly blown from the Siberian High, collecting vapor from warm current on the Sea of Japan, bring orographic heavy snowfall to the northern part of the Japanese Alps. Thereafter, peculiar snow patch distribution last before winter is likely to be a ruling by maldistribution of snowfall in winter.

In the same area, the inventory of 1976/77, compiled by the vertical aerial photograph interpretation, counts 264 with the area of 2.48 km<sup>2</sup>. Major distribution concentrated in Mts. Tsurugi and Tateyama, central part of the Northern Japanese Alps. The total area in this mountains were 0.78, 0.77, 0.58, 0.84 km<sup>2</sup> in 1969, 1977, 2009, and 2013, respectively. Snowfall amount in winter and the snow patch area fluctuate largely year-by-year. However, the area fluctuation limits within a range of 30% the total area.

Keywords: Year 2013, Perennial snow patch, Japanese Alps, Snow patch inventory, Aerial photograph