

Altitudinal Distribution of Snow Water Equivalent in the Tuul River Basin, Mongolia, 2002-2006

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Introduction

Numerous attempts have been made by researchers to investigate the snow water equivalent in mountains (e.g. Yamada, 1982; Kondo and Yamazaki, 1990; Ohta, 1994; Matsuyama, 1998). It has been widely recognized that the snow water equivalent of mountains is much than that of plains, and the snow water equivalent depends on season and region.

In order to investigate the altitudinal distribution of snow water equivalent in the Tuul river basin, Mongolia, the snow survey was carried out in each February from 2002 to 2006.

Observation site and methods

The Tuul river basin is located to the northeast of Ulaanbaatar, and the altitudinal difference in the basin is roughly 1400 m with the highest peak of 2799 m.

The snow depth was measured using a snow stick. The total snowpack weight was measured using a cylindrical snow sampler with 0.005-m² area. The total snow density was calculated from the measured snow depth and the measured total snowpack weight. The snow water equivalent was estimated from the measured snow depth and the calculated total snow density. The altitude was measured using a handy type GPS (GARMIN).

Results and discussion

It was confirmed that the south face of mountains in the Tuul river basin was less snow and grasses or stones were exposed. The snow type of the upper snowpack was composed of new snow or lightly compacted snow, and that of the lower snowpack was composed of depth hoar.

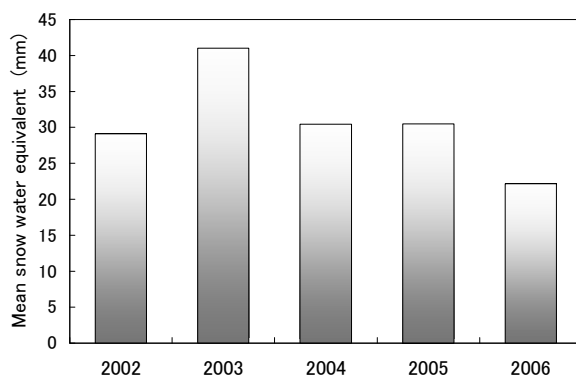


Fig. 1 Mean snow water equivalents in the Tuul river basin for five years.

The snow water equivalents in the Tuul river basin were ranging from 3 to 102 mm with the maximum in February, 2004, and with the minimum in February, 2006. The mean snow water equivalents in the Tuul river basin were 41 mm in 2003 and 29-30 mm in 2002, 2004 and 2005, as shown in Fig.1. The mean snow water equivalent in the Tuul river basin in 2006 was 22 mm, and was lower in comparison with the past four years by about 10 mm (30 %) on average.

To investigate the altitudinal dependence of snow water equivalent in the Tuul river basin, a linear equation as a function of altitude was fitted as

$$SWE = aH + b$$

where *SWE* is the snow water equivalent in the Tuul river basin, *a* is the increase ratio of snow water equivalent due to altitude, *H* is the altitude, and *b* is a constant.

The increase ratios of snow water equivalent due to altitude were 0.042 to 0.104 mm/m within an altitudinal difference of 775 m. The snow water equivalent increased slightly with an increase in altitude. The maximum increase ratio was obtained in 2006.

Matsuyama (1998) reviewed the previous snow surveys conducted in mountainous regions in Japan to these ratios, and the increase ratios ranged mostly from 0.1 to 1 mm/m. It was found that the increase ratios obtained in the Tuul river basin, Mongolia, were smaller by an order of magnitude in comparison with the results reported in various mountainous regions in Japan. The altitudinal distribution of snow water equivalent is mainly related to snowfall and snowmelt processes. Since the snow survey in this study was carried out in the coldest period, it is probably that the difference of the snowfall process is attributed to the increase ratios.

The increase ratios of snow water equivalent in the Tuul river basin, Mongolia, will be applicable to obtain gridded snow distribution data in the Tuul river basin, Mongolia.

Conclusion

The snow survey in the Tuul river basin, Mongolia, was carried out in each February from 2002 to 2006. The snow water equivalent in 2006 was lower in comparison with the past four years by about 30 % (10 mm) on average. The altitudinal dependence of snow water equivalent was confirmed. The

increase ratios of snow water equivalent due to altitude were 0.042-0.104 mm/m. These were smaller by an order of magnitude in comparison with the results reported in various mountainous regions in Japan.

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