Postprint: Experimental Analysis of Snow Cover Area Estimation and Canopy Snow Water Equivalent Interception in Tian Shan Spruce Forests

Authors: Wang Yifan, Xie Ling, very smooth, Liu Suhong, Maryam Mamut, Mirzat Imin, Abduweli Abdukrem

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Abstract

Snow water equivalent is an important indicator that can intuitively reflect the amount of water resources in snow cover. Accurately and comprehensively obtaining information on snow water equivalent intercepted by Tianshan spruce canopies is of great significance for improving the calculation accuracy of water resources in the Tianshan region. This study takes Tianshan spruce seedlings as the research object and conducts snowfall interception experiments through simulated snowfall. Using a digital camera to obtain the snow cover area of spruce and a high-precision balance to measure the mass of snow water intercepted on the canopy, thereby establishing the relationship between snow cover area and snow water equivalent for spruce seedlings. Experimental results show that for multiple spruce seedlings under multiple simulated snowfall events, the fitting curve between snow water equivalent intercepted by the canopy and snow cover area obtained from vertically downward digital photography tends to be consistent, and the fitting regression equation satisfies y=21.235x^2-1.457x (R^2=0.9925). Through multiple simulated snowfall experiments on spruce, this study constructs a model relating spruce snow cover area to canopy-intercepted snow water equivalent, proposes a scientific method for more accurately estimating canopy-intercepted snow water equivalent using snow cover area, and provides a high-precision estimation model for snowfall interception by Tianshan spruce canopies and their snow water equivalent.

Full Text

Preamble

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Authors and Affiliations

WANG Yi-fan[1], XIE Ling[1,3], CHANG Shun-li[1], LIU Su-hong[1,2], Mariam Mamuti[1], Mirzati Yimin[1], Abdowli Abdukrmu[1]

[1] College of Resources and Environmental Sciences, Xinjiang University, Urumqi 830046, Xinjiang, China
[2] Department of Geography, Beijing Normal University, Beijing 100875, China
[3] College of Environment and Resources, Guangxi Normal University, Guilin 541004, Guangxi, China

Abstract

Snow water equivalent is an important indicator that directly reflects the amount of snow water resources. Accurate and comprehensive acquisition of snow water equivalent data intercepted by the Tianshan spruce canopy is of considerable significance for improving the calculation accuracy of water resources in the Tianshan region. In this study, experiments were conducted to investigate snow interception by spruce using simulated snowfall and Tianshan spruce saplings. The snow-covered area of the spruce was obtained using a camera, and the mass of canopy interception water was measured using a high-precision balance, thereby establishing the relationship between snow-covered area and snow water equivalent. Experimental results show that the fitted curves between the snow water equivalent of spruce canopy interception and the snow-covered area of spruce, obtained via vertically downward digital photography, exhibit good consistency across multiple saplings and several simulated snowfall events; the fitted regression equation is $y = 21.235x^2 - 1.457x$ ($R^2 = 0.9925$). Through repeated simulations of the spruce snowfall experiment, models for snow-covered area and snow water equivalent of spruce canopy interception were obtained. Accordingly, a scientific method for estimating the snow water equivalent of spruce canopy interception based on snow-covered area has been proposed, providing a high-precision estimation model for intercepted snowfall and snow water equivalent in Tianshan spruce canopies.

Keywords: Tianshan spruce; sapling; simulated snowfall; snow cover area; digital photo; snow water equivalent; estimation model

Note: Figure translations are in progress. See original paper for figures.