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A new quantitative method to measure and document snow profiles independent of observers

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Abstract

Different layers in snow profiles are distinguished by a distinctive set of features, most of them aquired by manual and visual inspection and following the rules of the international guidelines. These methods rely, with the exception of the ramm-sonde hardness, on the capabilites of the observer. The variation between observers is difficult to quantify, especially because no independent method existed to compare to. The difficulties arise because grain shape is often in a transitional state between shapes defined in the classification, grain size focuses on the largest grains, and hand hardness uses a decreasing area in cross-section with increasing hardness (from knife to fist) requiring a homogenous layer at least the height of the penetrator. To measure the properties of snow profiles in an observer independent way, we combined three methods: high-resolution penetrometry, near-infrared photography and surface sections from cast samples. High-resolution penetrometry was done with the SnowMicroPen. The SnowMicroPen measures penetration resistance acting on a 5 mm diameter tip with a spatial frequency of 4 micrometer. Textural properties and layer hardness can be extracted from the signal. Digital near-infrared photography (NIP) is sensitive to grain-size. The high horizontal and vertical resolution of about 1 mm documents the distribution of grain size on snow profiles with a dimension of about 1 m width, and unlimited depth by combining subsequent photographs. Surface sections document objectively grain size and shape. By co-registering the samples with the near-infrared photographs and penetration signals as well as classical profile descriptions the information of these sources can be compared. Using this new method we are ably to produce an observer independent classification of snow profiles. The method can be used to compare real to simulated snow packs with a method which is not biased and where a standardized algorithm can be used. These methods also enable to detect spatial variability of layers.

Poster presentation preferred
Topic: snow, weather, terrain