Detailed Features of Snow Cover Structure on Hansbreen (Svalbard) in period 2008-2019 based on Radio-Echo Sounding

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ABSTRACT

Snow cover monitoring on Hansbreen (SW Svalbard) by ground-penetrating radar (GPR) is one of the longest and the most comprehensive on Svalbard. Snow depth is frequently the only feature derived from high-frequency radio-echo sounding. In this study, also physical characteristics of snow cover structure have been analyzed. We demonstrate that based on GPR data and a single snow pit, it is possible to extrapolate the detailed characteristics of snow cover to the entire accumulation zone. Layers determined on the GPR profiles are validated by assigning them attributes from snow pit analysis.

Field studies were carried out on at the end of the accumulation seasons 2008 – 2019. The snow cover stratification and their spatiotemporal changes show the relations to the parameters such as shape, size, hardness, and density. The predominant type of snow in specific seasons and their cause have been shown, and the snow water equivalent (SWE) have been calculated. Obtained results were combined with meteorological data from an automatic weather station installed on Hansbeen and by the Polish Polar Station in Hornsund. It enabled referring to temperature gradients, sequences of thaws, refreezing, and rain-on-snow episodes that favour forming the melt-freeze crusts within snow layers. The influence of hard layers on snow metamorphism and the density/SWE has been discussed. The method used in this study may improve the calculation of winter mass balance and contribute to hydrological models.

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