

Snowpack spatial and temporal variability assessment using SMP high-resolution penetrometer

Anton Komarov, Yuriy Seliverstov, Sergey Sokratov, and Pavel Grebennikov

Lomonosov Moscow State University, Geography, Moscow, Russian Federation (ankom9@gmail.com)

This research is focused on study of spatial and temporal variability of structure and characteristics of snowpack, quick identification of layers based on hardness and dispersion values received from snow micro penetrometer (SMP). We also discuss the detection of weak layers and definition of their parameters in non-alpine terrain. As long as it is the first SMP tool available in Russia, our intent is to test it in different climate and weather conditions. During two separate snowpack studies in plain and mountain landscapes, we derived density and grain size profiles by comparing snow density and grain size from snowpits and SMP measurements.

The first case study was MSU meteorological observatory test site in Moscow. SMP data was obtained by 6 consecutive measurements along 10 m transects with a horizontal resolution of approximately 50 cm. The detailed description of snowpack structure, density, grain size, air and snow temperature was also performed. By comparing this information, the detailed scheme of snowpack evolution was created. The second case study was in Khibiny mountains. One 10-meter-long transect was made. SMP, density, grain size and snow temperature data was obtained with horizontal resolution of approximately 50 cm. The high-definition profile of snowpack density variation was acquired using received data.

The analysis of data reveals high spatial and temporal variability in snow density and layer structure in both horizontal and vertical dimensions. It indicates that the spatial variability is exhibiting similar spatial patterns as surface topology. This suggests a strong influence from such factors as wind and liquid water pressure on the temporal and spatial evolution of snow structure. It was also defined, that spatial variation of snowpack characteristics is substantial even within homogeneous plain landscape, while in high-latitude mountain regions it grows significantly.