About the numerical modeling of snow avalanches in the Russian Arctic

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Every year numerous avalanches of different types and volumes occur in mountain regions in the Russian Arctic, where seasonal snow cover is one of the most important components of the environment, making continuous development of hazard management strategies through research and experience highly relevant. Numerical modeling of snow avalanches is the most important step of the large-scale avalanche hazard assessment in the unpopulated regions without historical records providing data about the avalanche dynamics: runout distances and impact pressures. However most state-of-the-art two-dimensional avalanche dynamics models have never been calibrated in the Arctic regions.

The Khibiny Mountains region at Kola Peninsula is an exception among other Arctic mountain regions because of the available most well-documented longest avalanche database in Russia. The accurate information (including maps with avalanche outlines) from powder and wet snow avalanches, extreme rare and the frequent small ones has been being collected from 1930's by the local mining avalanche warning service. This database was digitized and put to the detailed GIS with more than 80 years of observations for certain avalanche tracks. GIS was used to analyze the initial conditions of avalanches and numerical models input parameters as well as to compare measured parameters with model results.

The two-dimensional Swiss numerical avalanche dynamics model RAMMS was used to back-calculate more than 50 well documented avalanche events recorded in the Khibiny Mountains with volumes from 2, 000 up to 167,000 m^3. As a result, most of observed avalanches were back-calculated. While RAMMS was calibrated for large avalanches (> 60, 000 m^3) in Switzerland it produced realistic results with modified friction values in completely different conditions in the Khibini Mountains. We confirmed that the friction values (μ and ξ) may be

taken from the upper altitude limit «above 1500 m.a.s.l.» of the table recommended for Switzerland (RAMMS User Manual, 2017) for simulations in the Khibini Mountains (highest point is 1200,6 m). A high level of correspondence of observed and simulated run-out distances, deposition heights, flow channels and flow widths was found for avalanches with medium (25 – 60,000 m^3) and large (> 60,000 m^3) volumes in such a way.

Back-calculation of avalanches in the unchanged avalanche track (Mt. Ukspor) as well as in the same track after the construction of mitigation structures (two catching dams) were performed using 5-m resolution “historical” DEM with no mitigation structures as well as recently obtained DEM including them. While it is not recommended to apply RAMMS for simulating avalanches over dams lying perpendicular to the flow, in this case the RAMMS reproduced the observed avalanches behavior.

The long-term experience and received results from the Khibiny Mountains should be accounted during the numerical avalanche modeling in other mountain regions in the Russian Arctic.

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Ratios of methane and its homologues in the lakes of central Yamal as indicator of methane origin

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In our study of Central Yamal lakes, we analyzed the distribution of dissolved methane and volatile hydrocarbon gases composition. Comparison of methane and other hydrocarbon gases concentration, particularly ethylene, allows concluding the nature of the methane source.

Sampling of water was carried out from both bottom and surface water layers. Hydrocarbon gases composition was determined by conventional gas chromatography using GC2014 with flame ionization detector (FID).

Methane concentration in the studied samples varies from 7,24 to 61,04 ppm. Distribution of methane values is characterized by left-side asymmetry, which indicates the heterogeneity of the selection and, thus, may point at several sources of methane enrichment.

Concentrations of C2+ compounds are low and their sum ranges from 0,04 to 0,39 ppm with average value 0,06 ppm. However, distribution of the total