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Towards a TTOP ground temperature model for mountain terrain in central-eastern Norway

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Mountain permafrost distribution and temperature are on a regional scale controlled by air temperature. On the local scale, microclimatic factors such as snow depth and ground materials become increasingly important. Especially block fields have been shown to favour permafrost occurrence. In Norway, there is at present no model on mountain permafrost distribution taking such site-specific factors into consideration. Therefore, we have tested the regional Canadian TTOP-model in the mountains Sølen and Elgåhogna, central-eastern Norway. The TTOP-model uses seasonal n-factors (nt and nf) and air temperature to model the mean annual ground-surface temperature (MAGST), and a ratio of thawed to frozen thermal conductivity to model the average temperature at the top of the permafrost or at the bottom of the seasonally frozen layer (TTOP).

Site-specific factors have been included in the model through parameterization of the n-factors. Due to limited information on the subsurface component of the model, only MAGST can be modelled at present. The model has been evaluated against an existing permafrost distribution model based on BTS (Bottom Temperature of winter Snow) and geophysical soundings.

Model runs for the 1961-1990 period, the Little Ice Age and year 2050 will be presented. The model can also be used to explore the limits at which permafrost exists, and critical values on snow depth, solar radiation and thermal conductivity ratio restraining negative MAGST and thus permafrost will be presented.