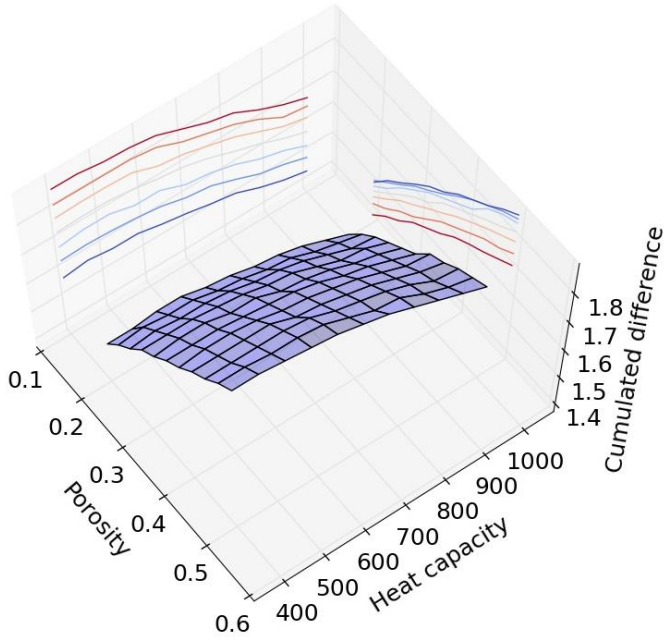
Supplementary file for: Pannetier R. & Frampton A. 2016. Air warming trends linked to permafrost warming in the sub-Arctic catchment of Tarfala, Sweden. *Polar Research 35*. Correspondence: Romain Pannetier, Stockholm University, Department of Physical Geography, Svante Arrhenius väg 8, SE-106 91 Stockholm, Sweden. E-mail address: romain.pannetier@natgeo.su.se.

The sensitivity of the model performance to thermal conductivity and porosity values was investigated (Supplementary Fig. S1). This parameter exploration shows that a lower cumulative total residual (summing the absolute difference between simulated and modelled values over depth and time) could be obtained with higher heat capacity (and hence implicitly a higher thermal conductivity) and/or larger porosity. Despite lower residuals, such simulation cases typically perform poorly with regard to other key qualitative aspect of the temperature record. For instance, the zero-degree curtain observed in the active layer nearly disappears for small porosity values. Further, the "response surface" in Supplementary Fig. S1 lacks local extrema, and hence the smallest differences are to be found on the edges of the surface, corresponding to the extremes of the value ranges used for the parameters. These ranges are selected based on what can be considered realistic for the material types encountered at the site. These tested alternative parametrisation values are therefore not considered improvements to the overall model performance. In order to obtain general improvements in simulated subsurface temperatures while maintaining other qualitative aspects of the model performance intact, it seems likely that a more complex model design and additional processes not considered here, such as a vadoze zone in the active layer, may need to be included.



Supplementary Fig. 1. Response surface of model performance as a function of porosity and specific heat (with constant diffusivity). The response variable is the absolute difference of model simulation with data, integrated over time and depth $\int_{2000}^{2011}\int_{-100}^{0}|\Delta T|dz\,dt$ $(10^5 \cdot K \cdot m \cdot d)$.