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Strong lateral variation of ground temperature revealed by a large network of boreholes in the Slave Geological Province of Canada

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The Slave Geological Province is a key region in the Canadian North. Its tundra areas form a large and resource-rich landscape in which comparably few systematic permafrost observations exist. Because the region contains layers of ice-rich till, the ground is susceptible to subsidence during thaw. Consequently, possible impacts of permafrost thawing on infrastructure and the natural environment motivate baseline investigations and simulation studies. In this context, the spatial variation of ground temperatures is relevant: How well can we extrapolate from one or few locations of observation? How well can we describe permafrost characteristics with coarse-grid (e.g., 50 km) models assuming relatively homogenous conditions?

In July 2015, an observation network of more than 40 plots was installed to monitor ground thermal regime and to detect surface subsidence. Plots are within few tens of meters to few tens of kilometers from each other and were chosen to represent a distinct combination of surficial geology, vegetation, drainage conditions, and snow accumulation. In each plot (15 m x 15 m), temperatures are recorded in a borehole as well as about 10 cm deep at four locations. Data on surface and subsurface properties has been recorded as well.

In September 2016, data was downloaded from the loggers and the conditions of the instruments were described. This contribution presents the first year of temperature data. In the annual averages, it reveals more than 7ºC lateral variation between plots as well as within-plot variations of more than 2.5ºC. This underscores the need for carefully designing measurement campaigns and methods when aiming to test coarse-scale permafrost simulations, even in gentle topography. The data resulting from this observational network will be made available publicly in the near future.