

TSP NORWAY – Thermal borehole monitoring of permafrost in northern Norway

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INTRODUCTION

The Norwegian funded IPY project 'Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost in Norway and Svalbard', (TSP NORWAY) is a part of the international IPY full project 'Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost (TSP)'.

TSP will obtain a "snapshot" of the permafrost environments as a benchmark against which to assess past and future changes by making standardized temperature measurements in existing and new boreholes throughout the World's permafrost regions. The ultimate payoff is long-term and will serve as validation of current models and understanding of how permafrost conditions are reacting to climate change.

Permafrost distribution in the north Atlantic area is strongly climatically controlled, mainly by the North Atlantic Drift, providing much less permafrost than in any other high latitude terrestrial region on the Northern Hemisphere. The extent of permafrost in the north Atlantic area is, however, not mapped, and it is therefore important to delimitate and assess the thermal state of permafrost.

The main objective of TSP NORWAY is to measure and model the permafrost distribution in northern Norway and Svalbard, including its thermal state, thickness and influence on periglacial landscape-forming processes. The current knowledge on the extent and the thermal conditions of permafrost in northern Norway is scarce. Thawing of permafrost in Norway may lead to subsidence of the ground surface, having a impact on e.g. infrastructure and on the stability of mountain slopes.

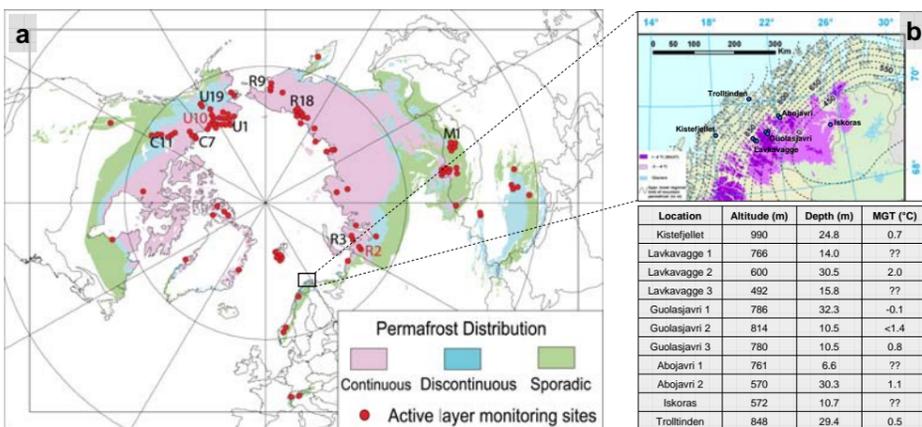


Figure 1. (a) Permafrost distribution on the northern hemisphere and locations of selected sites in the Circumpolar Active Layer Monitoring (CALM) program (Lemke et al. 2007, CALM). (b) Location of the TSP-borehole sites in Northern-Norway. The map show MAAT below -3°C derived from gridded temperature maps compiled by Tveito et al. (2000). The contour lines show the lower elevation limit of MAAT = -3°C for the area. The calculations follow the principles outlined in Etzelmüller et al. 2007. Key info found in the table, including the first estimate of mean ground temperature (MGT) near the bottom of the boreholes.

BOREHOLE THERMAL MONITORING

Nine 7-31 m deep boreholes were drilled in bedrock in northern Norway in August and September 2007. In addition two boreholes were drilled in September 2004. In three of the boreholes, a measurement setup with 15-20 thermistors connected to dataloggers, with data recording every six hours, were installed. The other six boreholes were instrumented with miniature temperature dataloggers at selected depths. All boreholes were cased. Periodic recalibration of the installed thermistors is possible and the holes remain accessible for other probes in future. In addition, a series of miniature temperature data loggers were installed for monitoring surface and air temperatures at selected sites. This presentation summarizes first results of this activity.



Figure 2. Drill site Iskoras, the most continental site in the TSP-project.

FIRST RESULTS



Figure 3. (a) Drilling of Guolasjavri 1 borehole, September 2004. (b) Temperature profile from Guolasjavri 1 borehole, recorded 12.09.2005 (Isaksen et al. in prep). Maximum thaw depth is near 7 m.

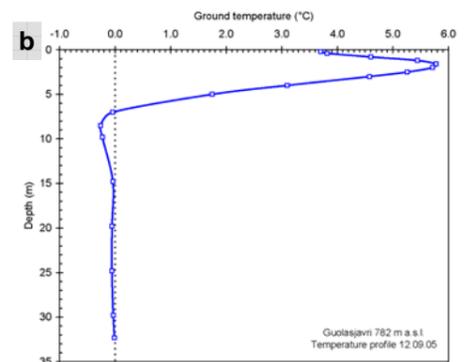


Figure 4. (a) Drilling of Lavkavagge 1 borehole, August 2007. (b) Temperature profile from Lavkavagge 1 borehole, recorded 07.09.2007. Seasonal frost reach a depth of more than 8 m.

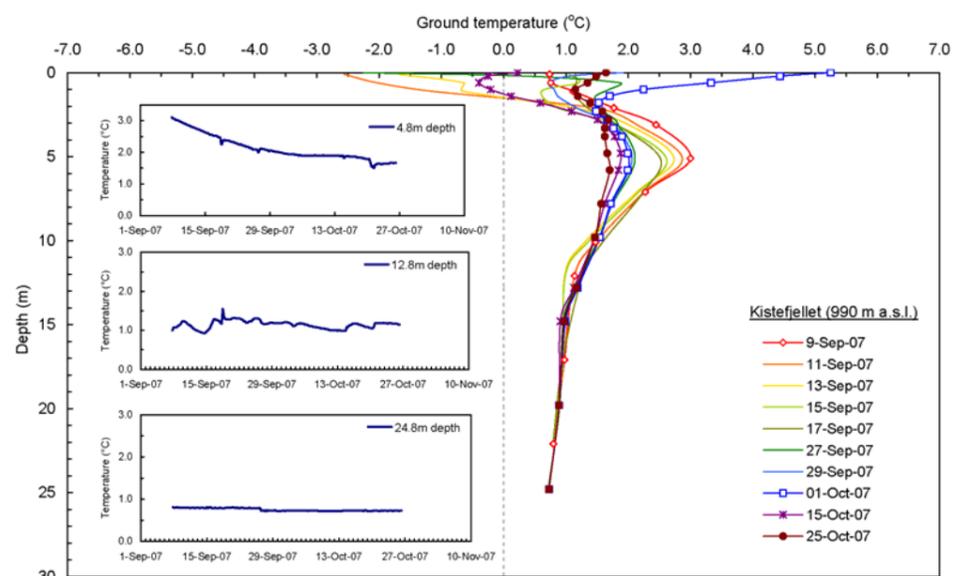
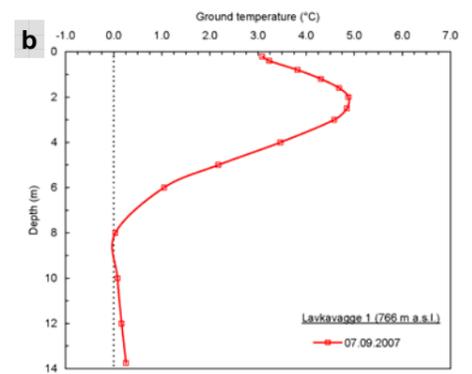


Figure 5. Temperature-depth profiles and three selected temperature series from the most maritime site Kistefjellet (990 m a.s.l.), which were drilled and instrumented in August-September 2007.

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