Ground thermal variability and landscape dynamics in a northern Swedish permafrost peatland

A. Britta K. Sannel[1]

[1]Department of Physical Geography and Bolin Centre for Climate Research, Stockholm University, Sweden

AGU General Assembly, Online

4-8 May 2020

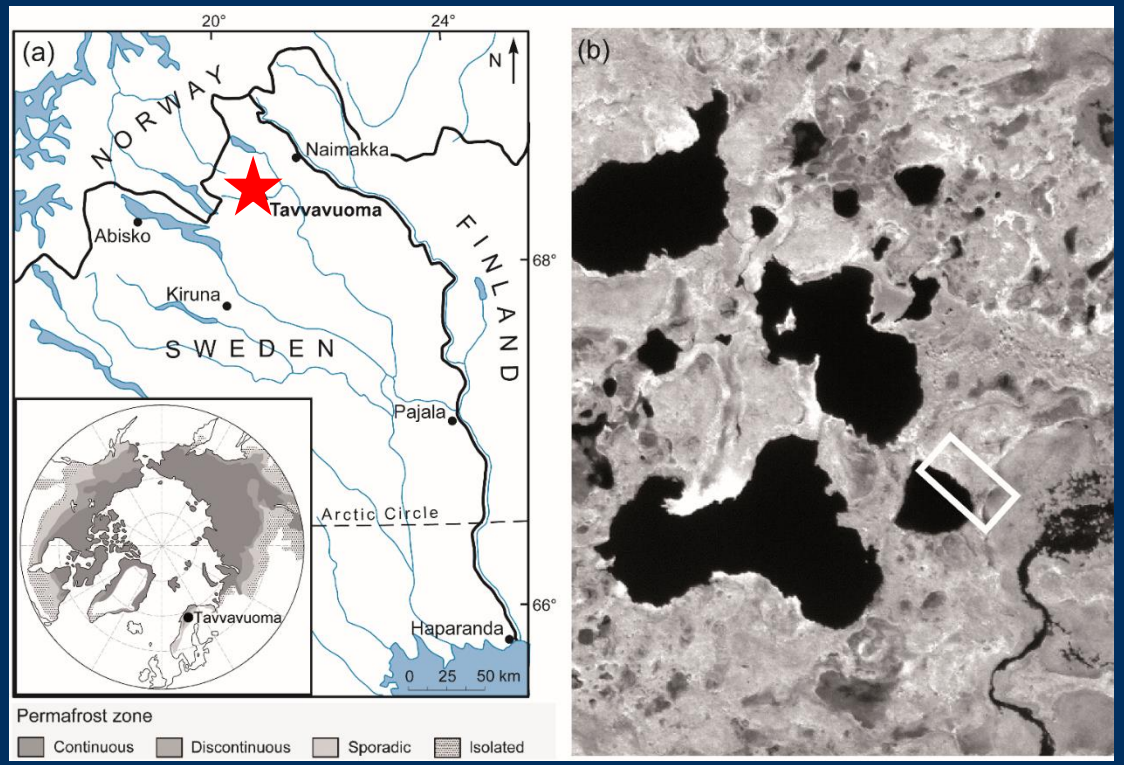
Objectives

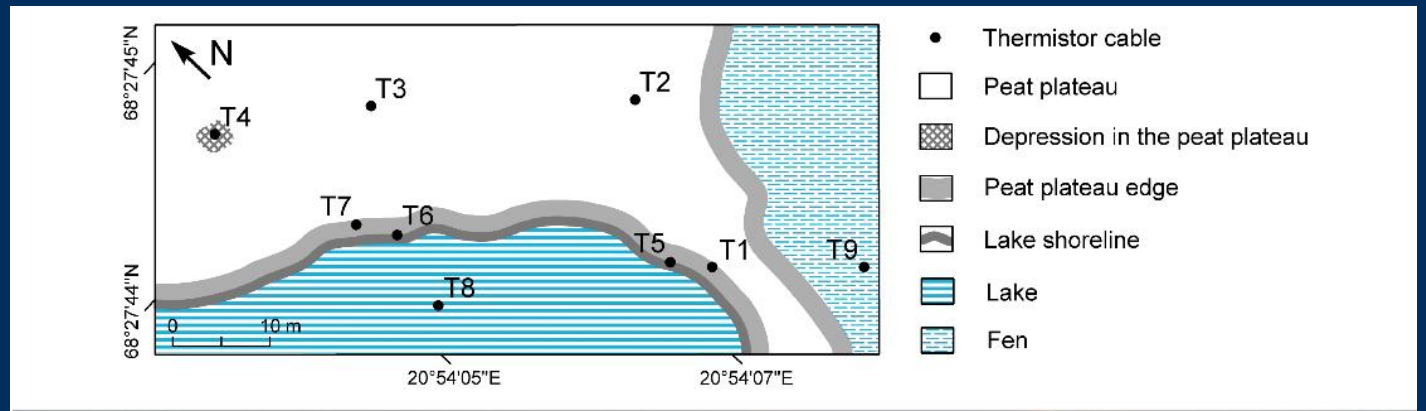
To increase our knowledge of small-scale spatial ground thermal variability within subarctic peat plateau landscapes

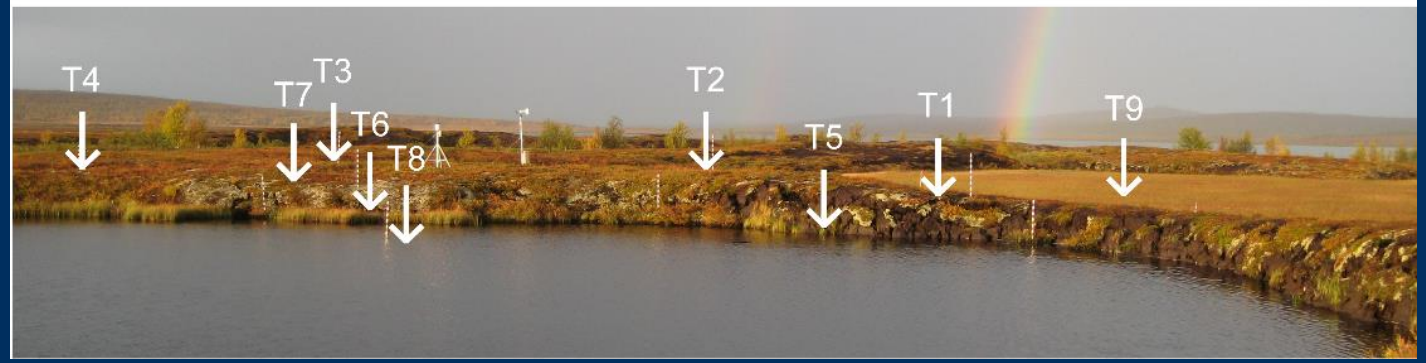
To discuss potential drivers of ground thermal regimes in different landscape units

The study site in Tavvavuoma (68°28’N, 20°54’E, 555 m a.s.l.)

MAAT -2.1 °C, and mean annual precipitation 461 mm (2006-2013)







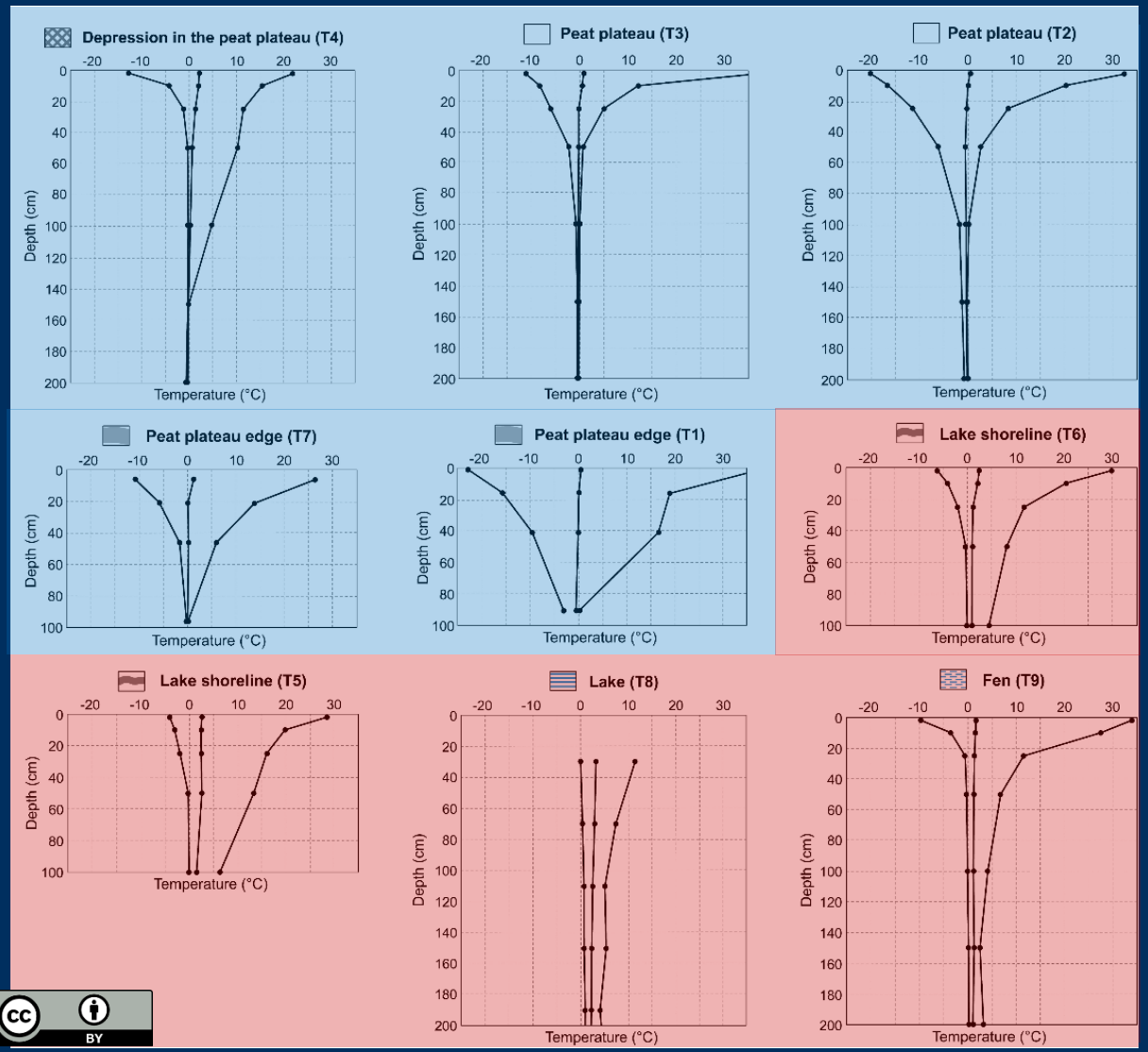
Monitoring of ground temperature (1-2 m depth), active layer depth and snow depth in six different landscape units

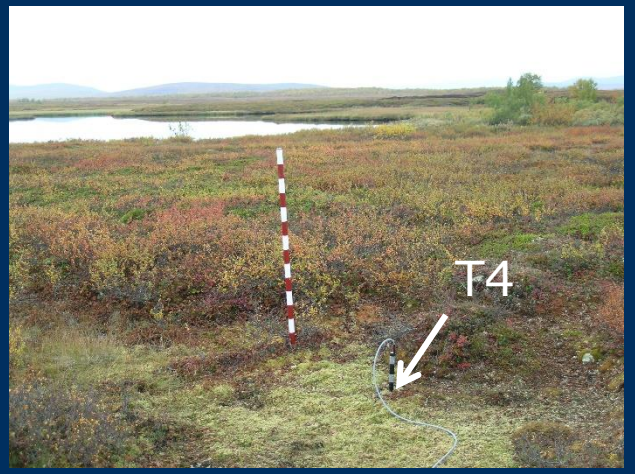
Sannel, 2020, *Permafrost and Periglacial Processes*

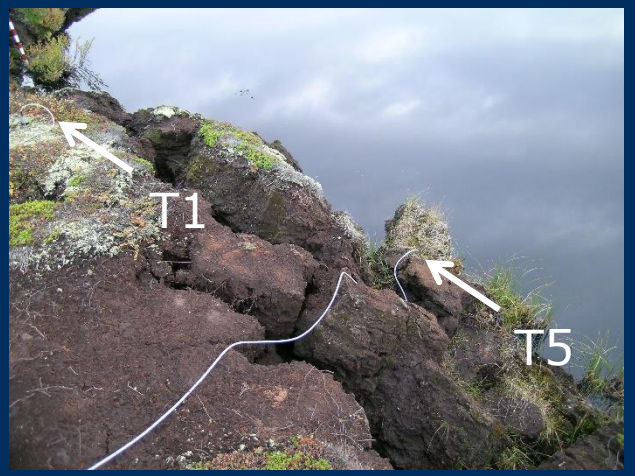
Ground temperature

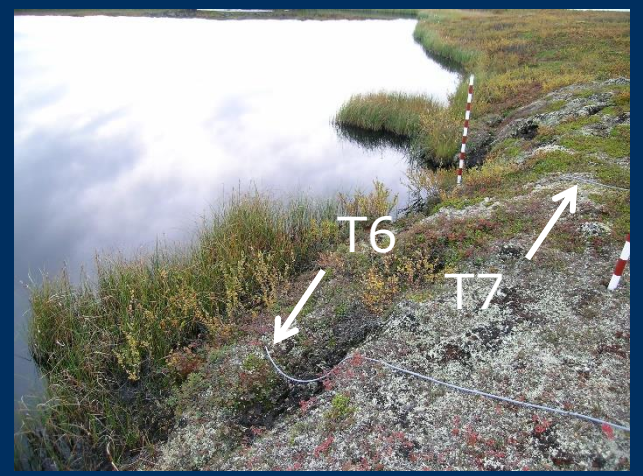
Permafrost

Non-permafrost/talik







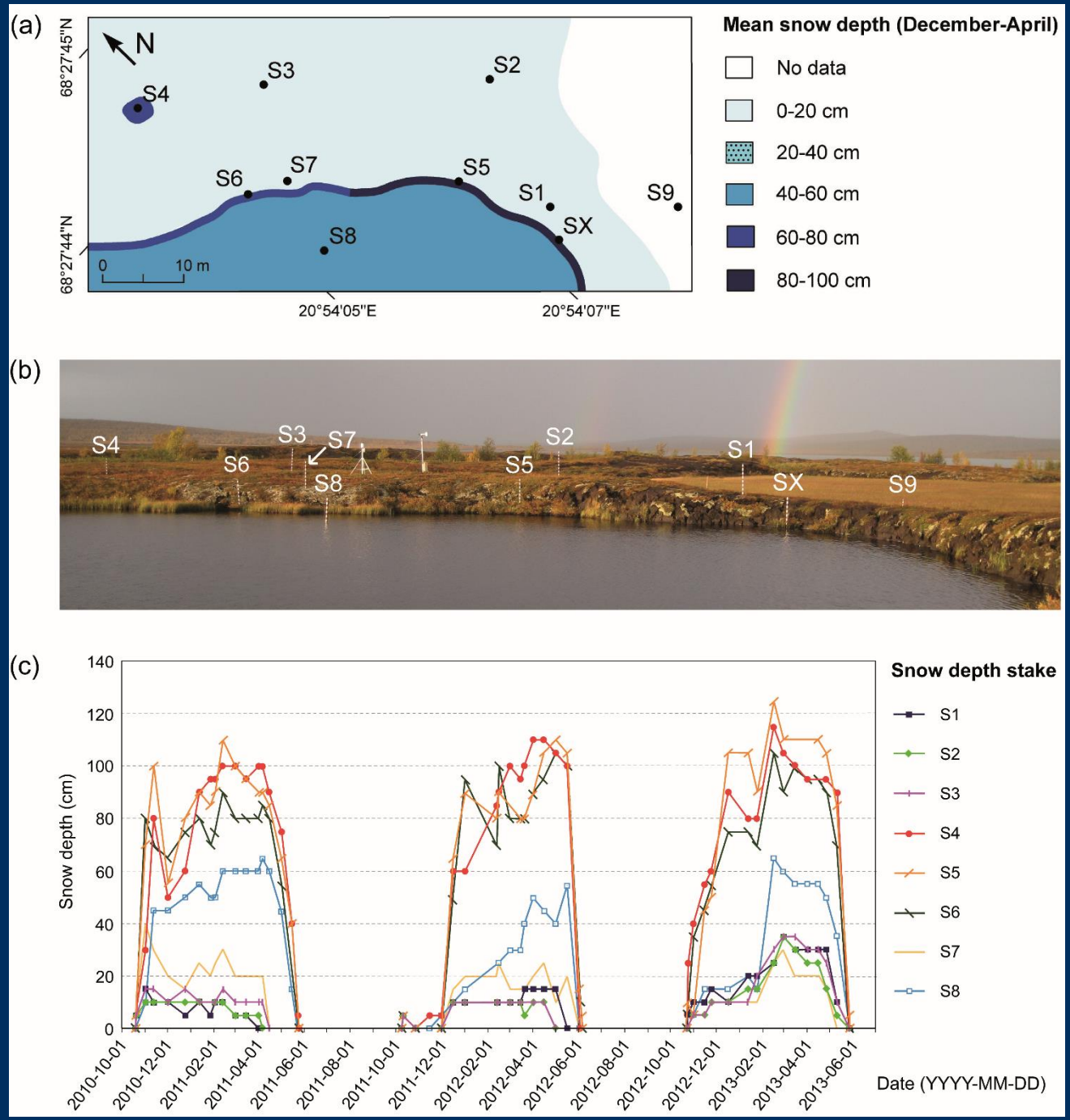


Sannel, 2020, *Permafrost and Periglacial Processes*

Snow depth

There is a significant correlation between mean Dec-April snow depth and MAGT at 1 m depth at T1-T7

Spearman's rho=0.9727 (*p*-value=0.0016)



Sannel, 2020, *Permafrost and Periglacial Processes*

The depression in the peat plateau has:

A deeper mean Dec-April snow depth (60 cm) compared to the peat plateau landscape unit (p.p.)

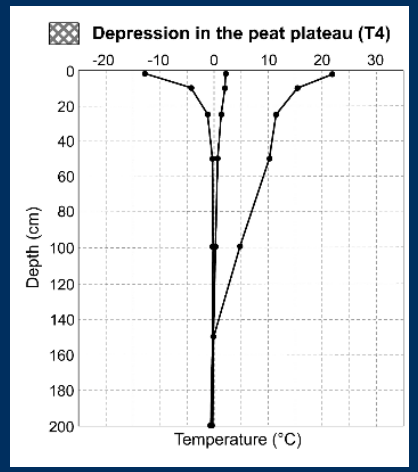
The same MAGT at 2 m depth (-0.3 °C) as the p.p.

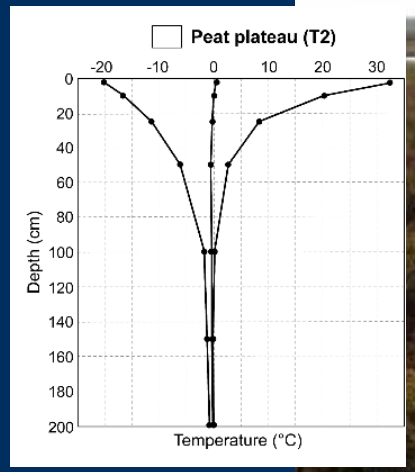
>7 °C warmer maximum ground temperature at 0.5 m depth compared to the p.p.

A >50 cm deeper (100-150 cm) active layer depth compared to the p.p.

Been subject to ground subsidence (2005-2019)

Shifted from *Sphagnum* to *Cyperaceae* dominated vegetation





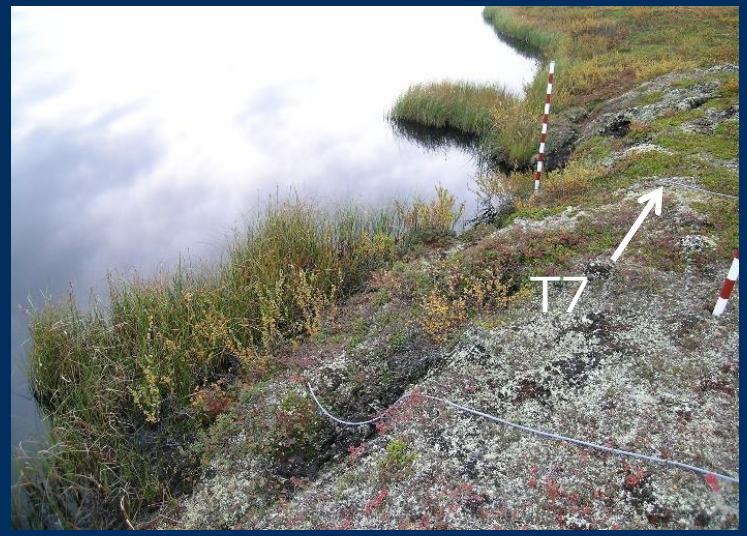
Sannel, 2020, *Permafrost and Periglacial Processes*

At the peat plateau edge:

The mean Dec-April snow cover is the same as in the central peat plateau (<20 cm)

The active layer depth is greater (>69 cm) compared to in the central parts, suggesting that the permafrost has started to thaw

Extensive block erosion and ground collapse has taken place where the edge is steep (2006-2018)



Sannel, 2020, *Permafrost and Periglacial Processes*

Conclusions

Small-scale landscape morphology has a major impact on ground thermal variability in peat plateau complexes

In Tavvavuoma permafrost is present in all three peat plateau landscape units, where the mean Dec-April snow depth mostly is shallow (<20 cm). Taliks are present along lake shorelines, in lakes and fens, where the mean Dec-April snow cover is >40 cm

Snow depth is an important controlling factor for the local ground thermal regime

Sannel, 2020, *Permafrost and Periglacial Processes*