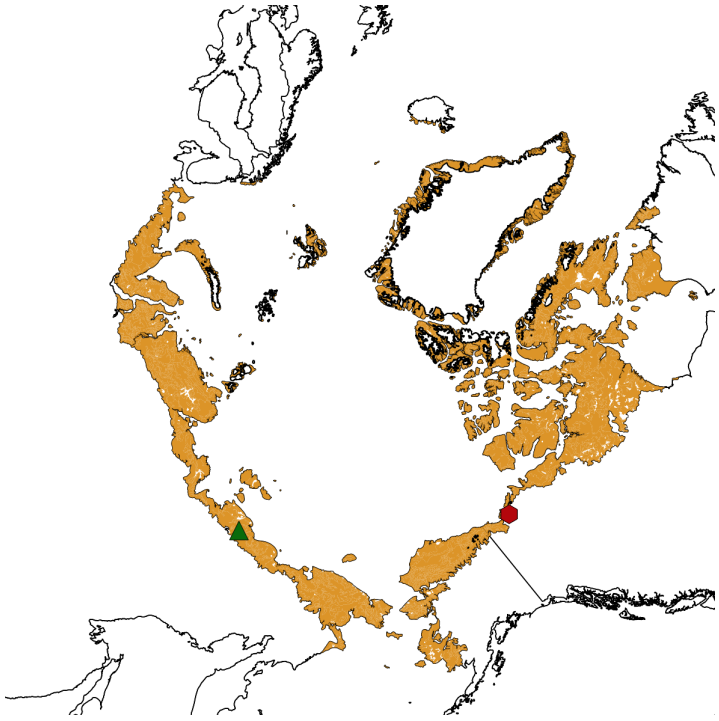
Der Einfluss verschiedener Vegetationstypen auf Oberflächentemperaturen und Auftautiefen

Inge Grünberg und Julia Boike

01.12.2018

Study sites



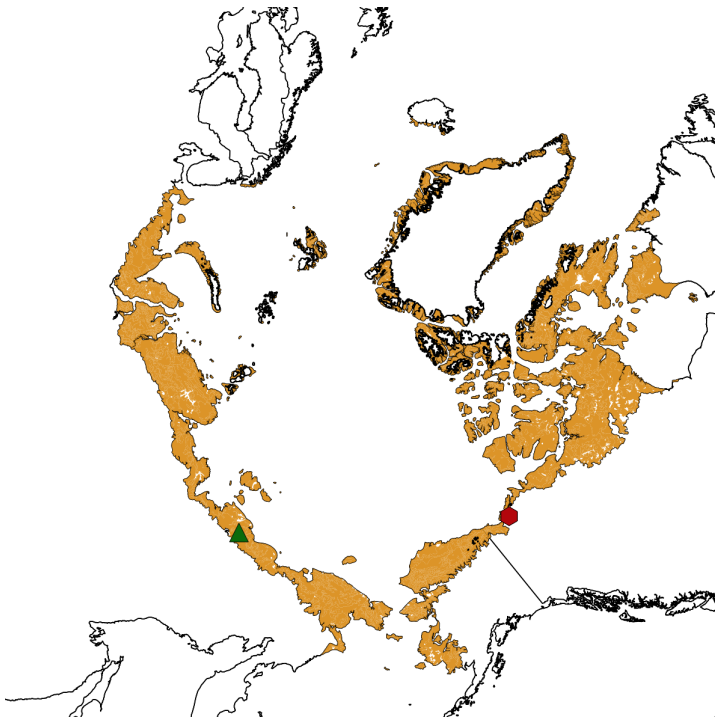
Data from Walker et al. (2005)

Kytalyk

- North-East Siberia
- Low Arctic
- Annual temperature: −13 °C
- Active layer thickness: 15–55 cm
- Permafrost depth: 400–600 m

Romanovskii et al. (2004); van Huissteden et al. (2005); van der Molen et al. (2007)

Study sites



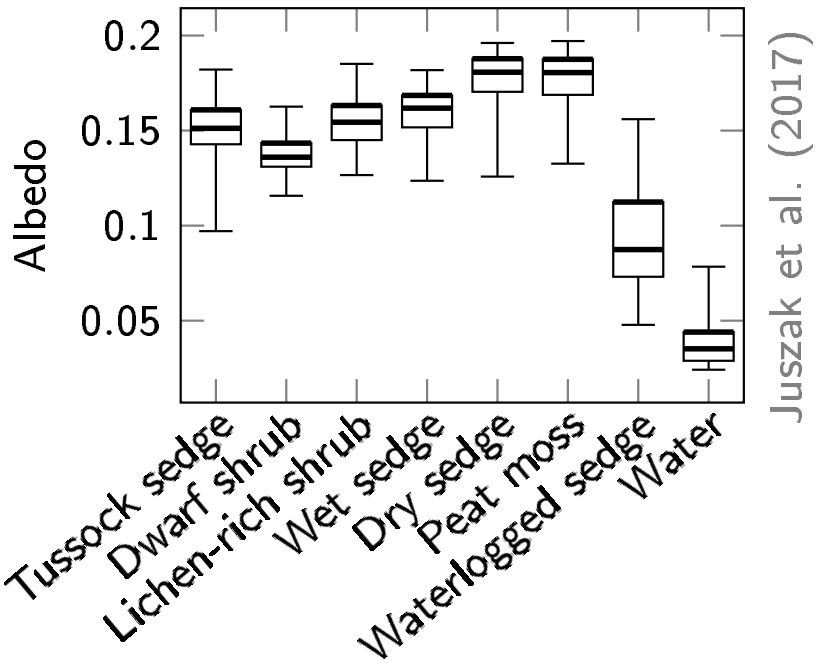
Data from Walker et al. (2005)

Trail Valley Creek

- North-West Canada
- Low Arctic, tree line
- Active layer thickness: 25–100 cm
- Permafrost depth: 100–150 m

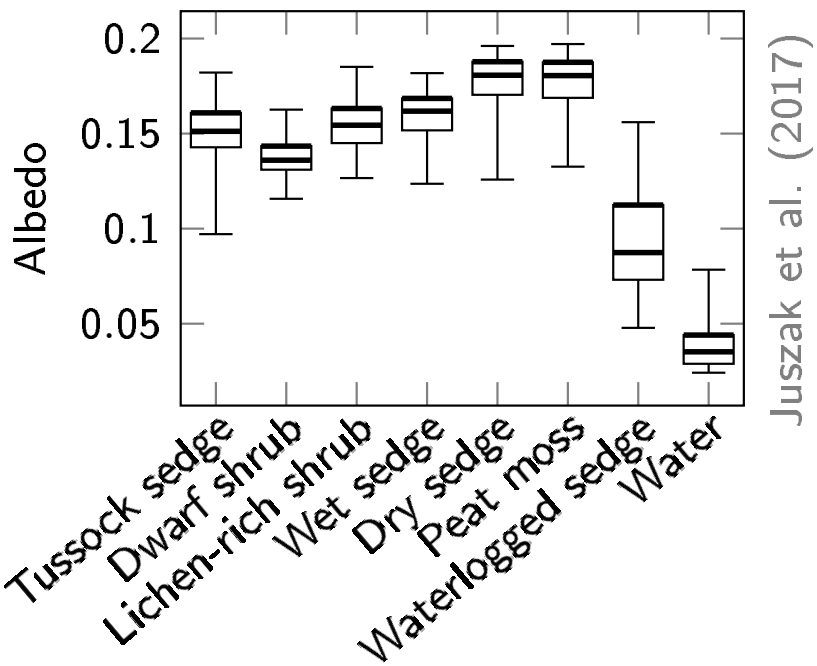
Marsh et al. (2008)

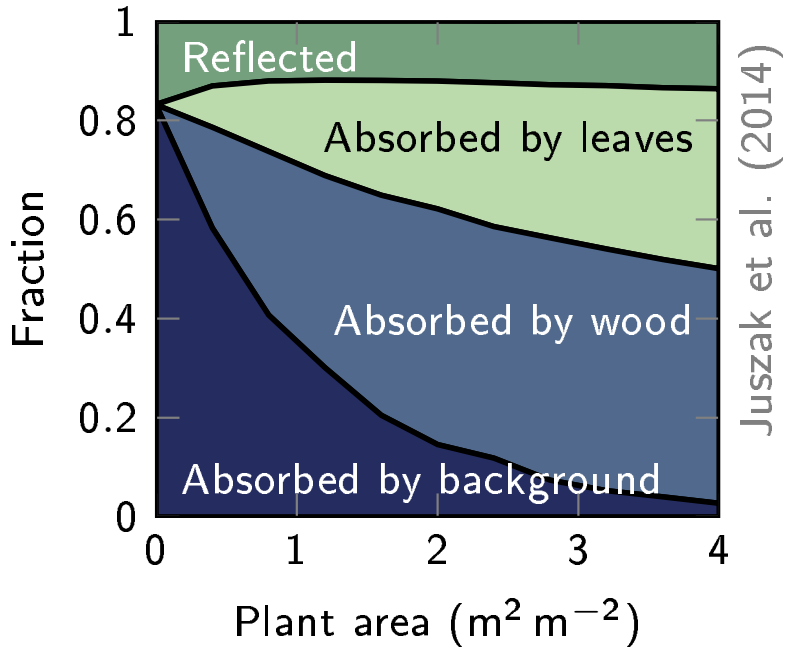
Modelling results from Kytalyk: Vegetation – climate relationship



- Vegetation type affects all radiation budget components
- High spatial variability

Modelling results from Kytalyk: Vegetation – climate relationship

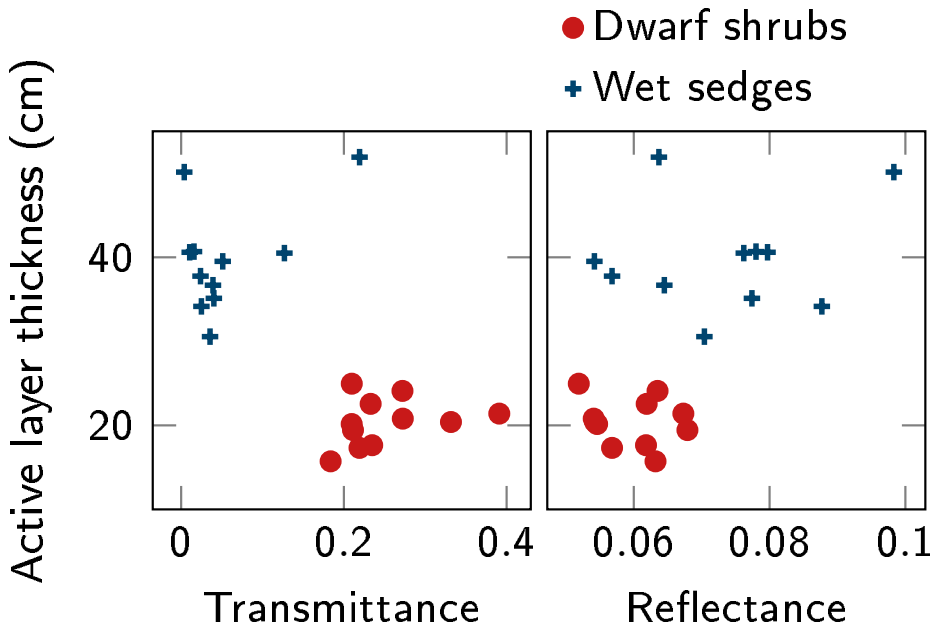




- Vegetation type affects all radiation budget components
- High spatial variability

- Vegetation density affects energy partitioning
- Wood plays a major part

Field measurements in Kytalyk: Climate – permafrost relationship



- Systematic difference between vegetation types
- No relationship within a single type
- Other drivers may be more important
- Soil moisture, snow, & evapotranspiration

Field measurements in Trail Valley Creek

- Covering different vegetation types
- Survey in thaw slumps

Field measurements in Trail Valley Creek

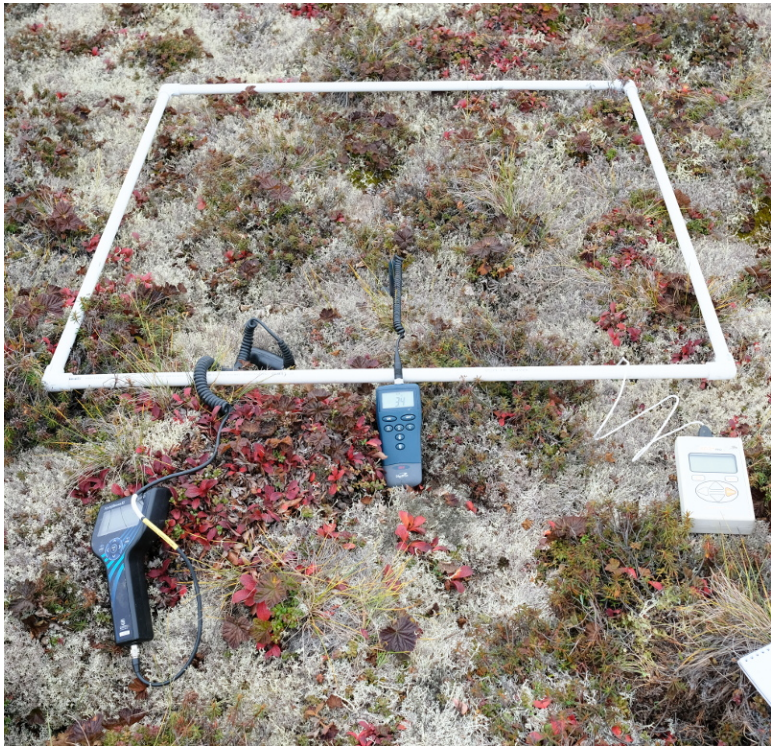
- Vegetation: species, height

Field measurements in Trail Valley Creek

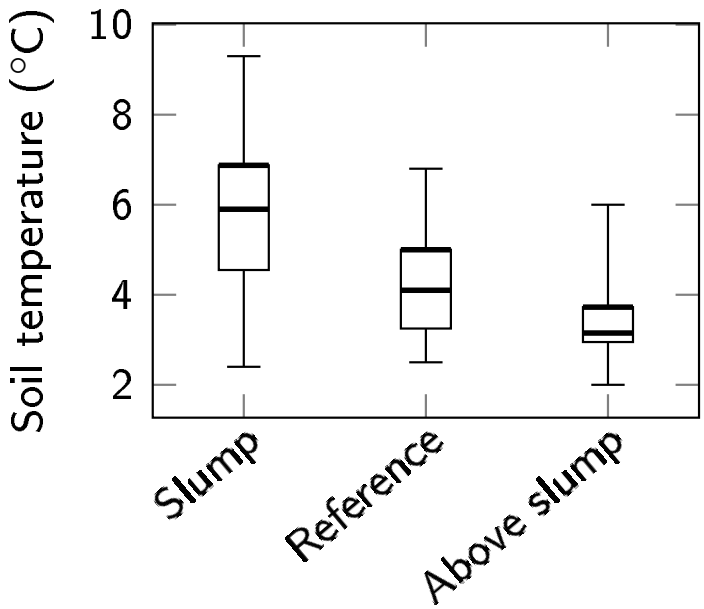
- Vegetation: species, height
- Climate: radiation, surface temperature

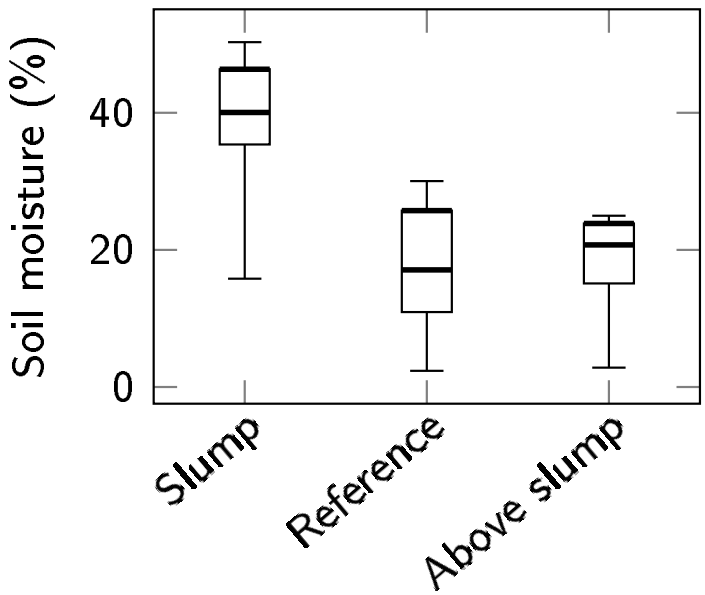
Field measurements in Trail Valley Creek

- Vegetation: species, height
- Climate: radiation, surface temperature
- Soil: thaw depth, thermal properties, temperature, heat flux



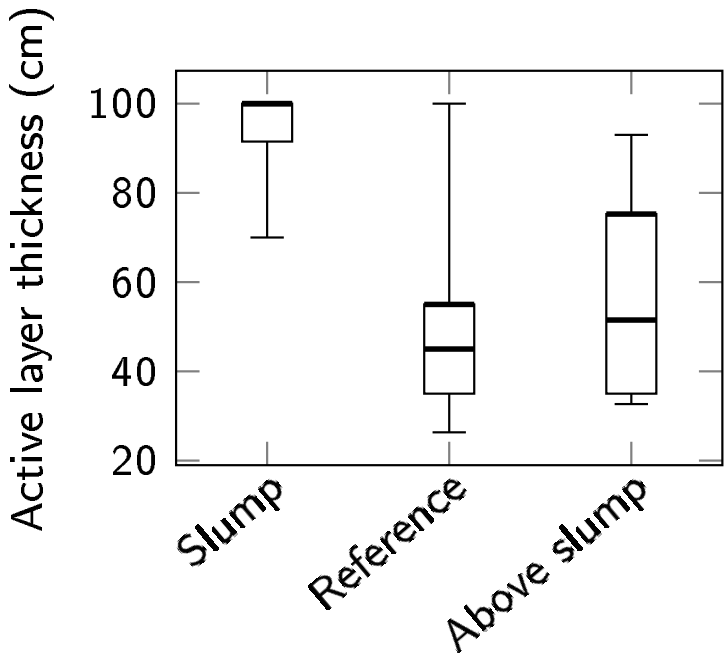
Field measurements in Trail Valley Creek: Thaw slump characteristics





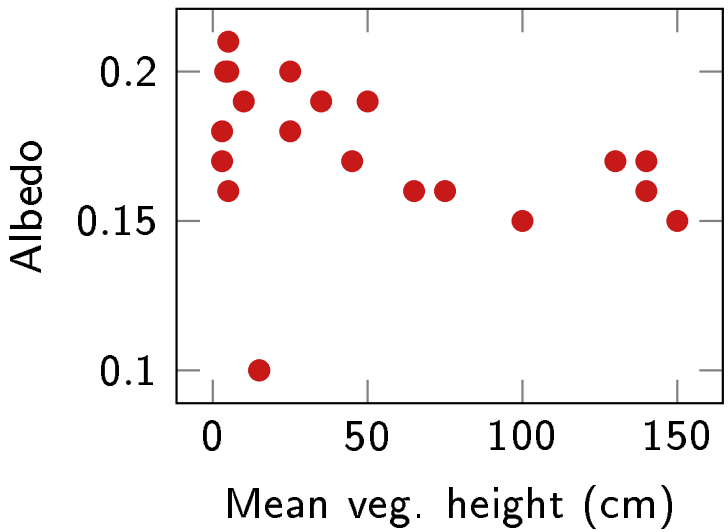
- Slumps are wet and warm

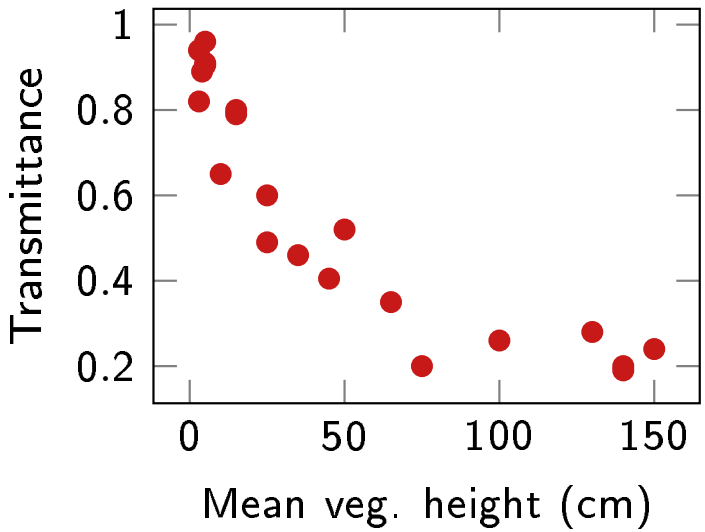
Field measurements in Trail Valley Creek: Thaw slump characteristics



- Slumps thaw

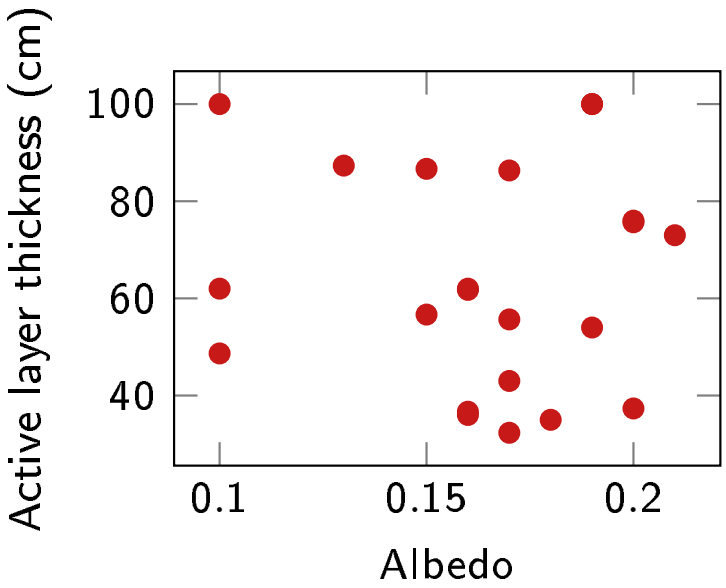
Field measurements in Trail Valley Creek: Vegetation – climate relationship

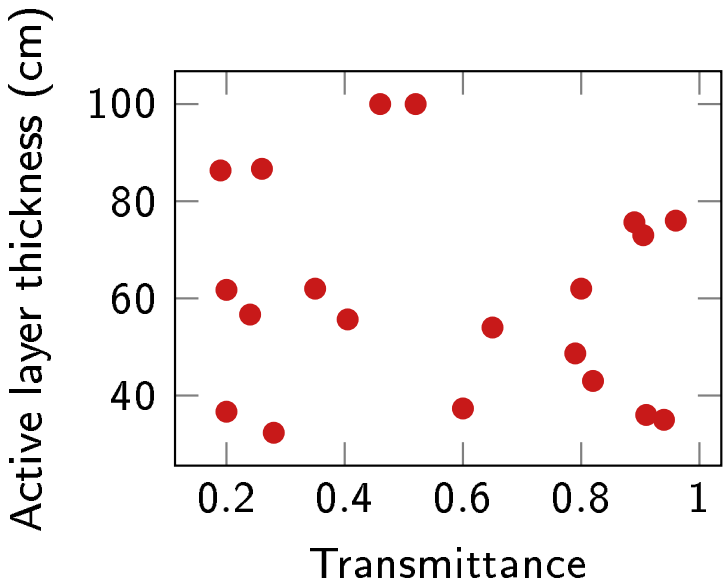




- Lowest albedo at water logged conditions
- Vegetation shades the soil

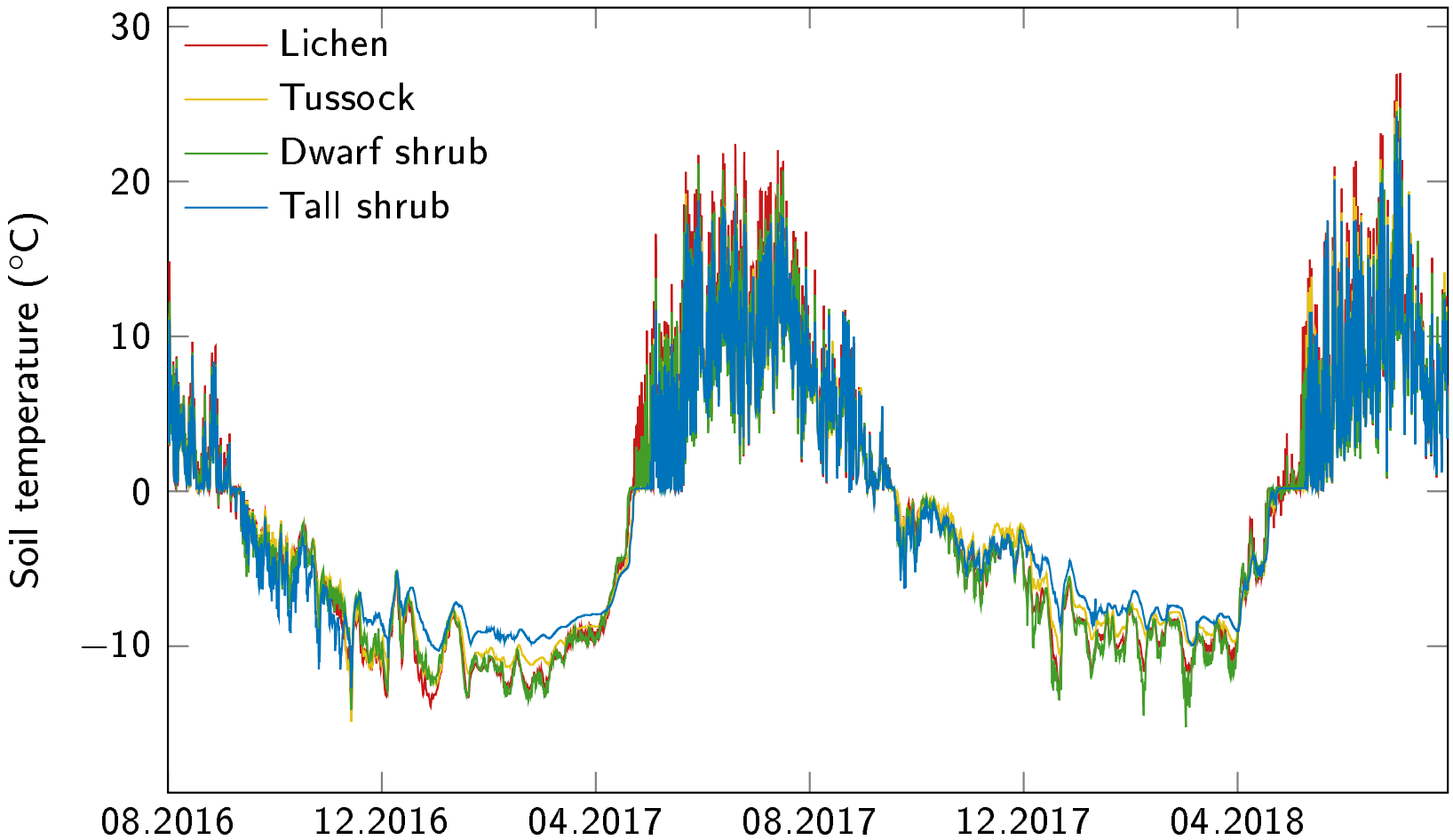
Field measurements in Trail Valley Creek: Climate – permafrost relationship



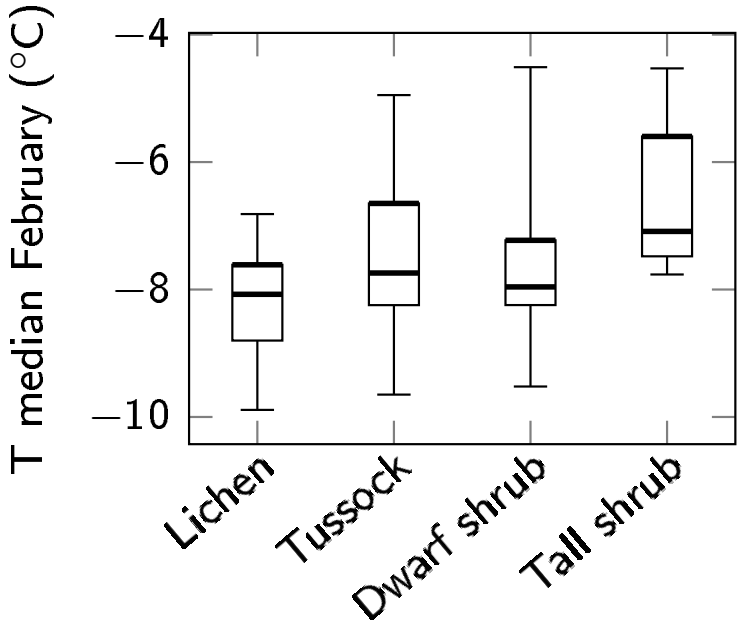


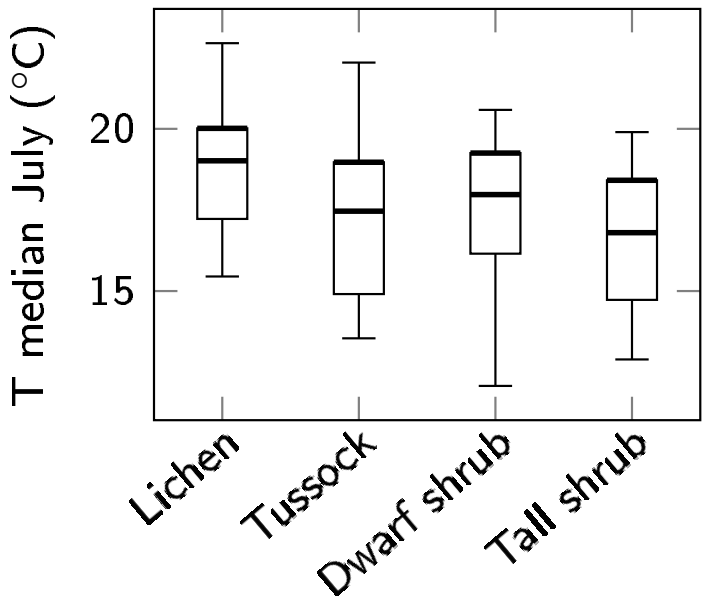
- Apparently no connection
- Confirms the (no-)result from Kytalyk

Field measurements in Trail Valley Creek: Soil surface temperature



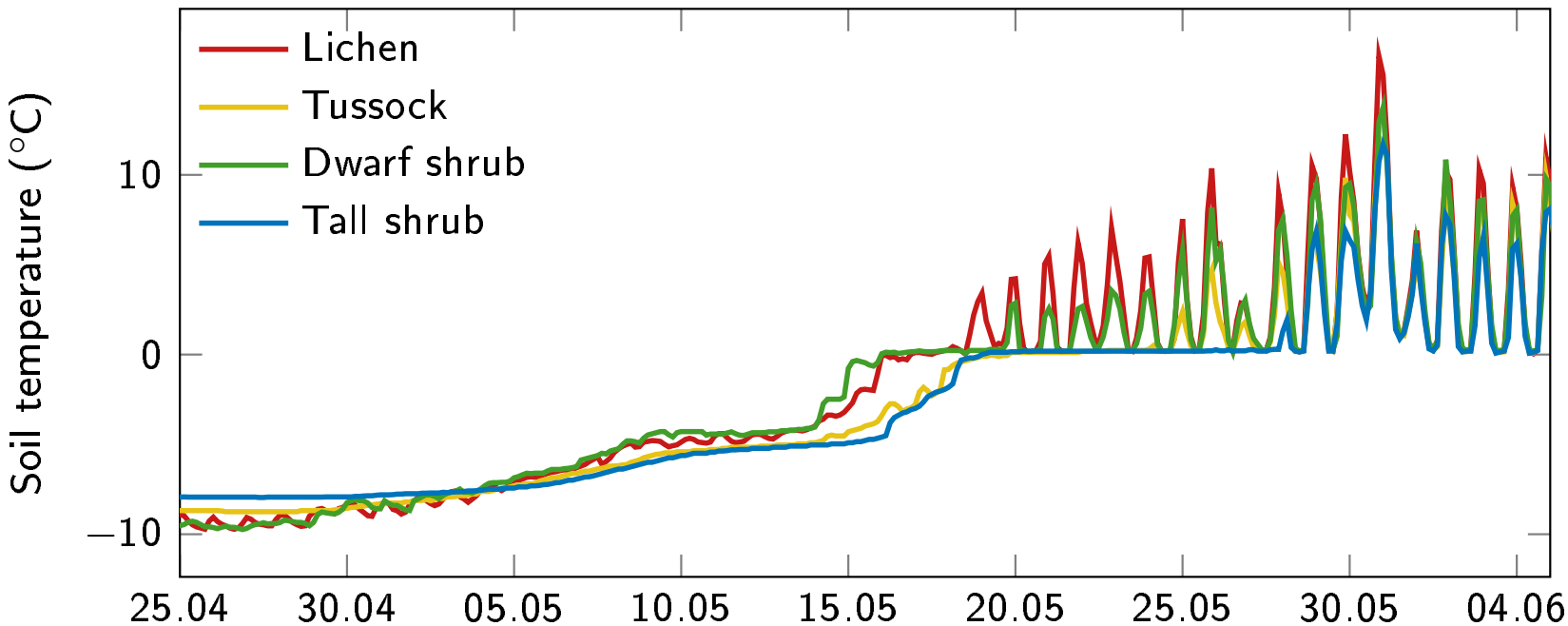
Field measurements in Trail Valley Creek: Soil surface temperature





- Tall shrub soil is warmest in winter and coldest in summer
- Lichen tundra has the strongest annual (and diel) variation

Field measurements in Trail Valley Creek: Soil surface temperature



- Tall shrubs collect snow
- Lichen and dwarf shrub tundra are similar

Thanks to

- Julia Boike
- MOSES team: Stephan Lange, Bill Cable
- TVC team: Phil Marsh
- University of Zurich: Gabriela Schaepman-Strub, Maitane Iturrate-Garcia

Literature

van Huissteden, J., et al. (2005), *Journal of Geophysical Research: Biogeosciences*, 110(G2): G02002.

Juszak, I., et al. (2014), *Remote Sensing of Environment*, 153: 79–89.

Juszak, I., et al. (2017), *Remote Sensing of Environment*, 193: 86–102.

Marsh, P., et al. (2008), *Snowmelt Processes and Runoff at the Arctic Treeline: Ten Years of MAGS Research*, 97–123, Springer Berlin Heidelberg, Berlin, Heidelberg.

van der Molen, M. K., et al. (2007), *Biogeosciences*, 4(6): 985–1003.

Romanovskii, N. N., et al. (2004), *Quaternary Science Reviews*, 23(11–13): 1359–1369.

Walker, D. A., et al. (2005), *Journal of Vegetation Science*, 16(3): 267–282.