

Project description for MSc students - Characterising permafrost landscapes in sub-arctic environments

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Introduction

Project types

Permafrost temperatures have been reported to increase in the arctic and sub-arctic environments. Mean annual air temperatures in the regions north of 65°N have increased by about 2 - 3 °C since the 1950s. At the north-ernmost part of Sweden in the Abisko area, data from the boreholes show that the ground temperature in the upper and lower part have increased by 0.4°C to 1°C between 1980 and 2002. Persistent high temperatures result in permafrost degradation. Thawing permafrost affects the physical, chemical, and biological processes within this environment.

Permafrost is frozen soil where the ground temperatures remain at or below 0°C for two or more consecutive years. The permafrost thaws and freezes seasonally due to the influx of heat energy from the ground surface. The thawing process generates an active layer above the permafrost. The groundwater from this active layer is called supra-permafrost water. The properties of near-surface permafrost can be determined by field and lab experiments. The results from the experiments provide the necessary input data to conduct numerical studies that could capture the evolution of permafrost in the future.

The main goal of the project is to conduct a characterization study of permafrost mounds at Abisko, Sweden. The pedological, thermal, and hydraulic properties of permafrost are to be determined.

The project will also include a fully funded 10-15 days research stay at the Abisko scientific research station, Sweden. The students can opt to take it up as an interdisciplinary project topic or a master thesis topic. It can also be offered as a HiWi job for one month during the fieldwork campaign (September 2023). The workload will be accordingly modified based on the type of project. The project work will be built upon the research work conducted last year.

Do you find the topic interesting? Do you like doing fieldwork? Would you like to engage in interdisciplinary research work? Then write us an email along with your Resume/CV.



Research Questions

- What is the existing status of permafrost related measurements?
- What are the typical subsurface properties of permafrost that is required as input to numerical models and how can we measure them?
- What are the methods to determine hydraulic conductivity?
- What are the statistical techniques that can be employed to determine relationships between the pedological, thermal and hydraulic properties of the soil?

Beneficial Skills

- Driving license in the EU.
- Background knowledge Hydrogeology.
- Field and lab work experience is favourable but not mandatory.

Figure 1:Abisko field campaign 2022 - Measurement of thermal parameters using the TEM-POS device.



References

Contact Information

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- Institute of Fluid Mechanics and Environmental Physics in Civil Engineering

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[2] M. Johansson, J. Åkerman, F. Keuper, T. R. Christensen, H. Lantuit, and T. V. Callaghan. Past and present permafrost temperatures in the abisko area: Redrilling of boreholes. *Ambio*, 40(6):558–565, 2011.