ONE Planet Doctoral Training Partnership

Natural Environment Research Council

Project title: Where is the permafrost? High-resolution 3D mapping of ground ice in the Canadian Arctic

Ref: OP2472

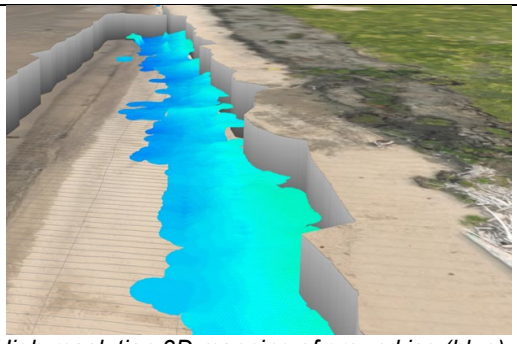
Keywords: ground ice, permafrost, geophysics, Ground Penetrating Radar

One Planet Research Theme:
Climate & Climate Change ☒ | Earth System Processes ☒ | Anthropocene ☐ | Environmental Informatics ☒

Lead Supervisor: Dr Craig Warren, Northumbria University

Key Research Gaps and Questions:

- Can geophysical methods, such as Ground Penetrating Radar (GPR) and passive seismic be used to create 3D subsurface maps of ground ice in Arctic coastal regions?
- How does the extent and thickness of the ground ice change according to different permafrost environments, e.g. cliffs, dunes, and pingo ice?



High-resolution 3D mapping of ground ice (blue) using Ground Penetrating Radar data

Project Description:
Permafrost degradation and thawing is an important indicator of climate change that impacts the geomorphology, eco-systems, and infrastructure of the Canadian Arctic. Ground ice is a common constituent of permafrost and a key driver of permafrost thawing. However, the formation of ground ice is complex, and its origins and distribution are unpredictable and poorly understood, e.g. over short distances volumetric ice content can vary from near zero to pure ice with little change visible on the ground surface.

This research project will use data from two complementary geophysical tools – Ground Penetrating Radar (GPR) and passive seismic – to map the spatial and temporal variation of ground ice at three different coastal locations in the Canadian Arctic. You will process and analyse densely acquired GPR data to create, for the first time, high-resolution three-dimensional maps showing the spatial distributions of ground ice. Passive seismic and ground truth data will augment and verify GPR measurements, and you will carry out numerical modelling, using the open-source software gprMax (www.gprmax.com), to enable detailed interpretation of the GPR data and reveal the structure and composition of the ground ice.

The outcomes from this project will provide new knowledge on permafrost and ground ice geomorphology, as well as inform engineering design decisions, where ground ice distribution is important for new construction and maintenance of existing infrastructure in the Canadian Arctic. You will have the opportunity to link your research into the CINUK (https://www.cinuk.org/) project – *Nuna: Changing ground conditions, Community resilience, technological solutions* – as well as the National Research Council (NRC) Canada, who are researching engineering solutions to mitigate permafrost thawing.

Prerequisites: The is project would suit applicants with a background in fields such as geophysics, remote sensing, or environmental sciences with skills in (or the desire to learn) numerical modelling, data processing and simulation. For more information, please contact Dr Craig Warren (craig.warren@northumbria.ac.uk).

Newcastle University

Northumbria University NEWCASTLE


Newcastle
University


Northumbria
University
NEWCASTLE