



## Cold Region Engineering Modelling, Characterization, Observations and Testing

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### 8A - Vulnerability of Cold-Region Infrastructure to Permafrost Degradation in a Changing Climate

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Globally, permafrost is thawing due to amplified climate warming in cold regions. Permafrost thaw substantially reduces load-bearing capacity of soil and induces differential settlements, leading to potentially catastrophic situations for buildings, pipelines, and roads, as well as increased maintenance costs and reduced lifespans. Nearly 70% of infrastructure built on permafrost is located in areas of high hazard potential. Additionally, construction practices often change or damage vegetation and replace the natural surficial cover with engineered materials such as gravel, sand, and/or asphalt. These surface disturbances result in accelerated permafrost thaw, which is often irreversible. Furthermore, permafrost degradation and talik formation affect the thermal, hydrological, and biogeochemical processes at and below the land surface.

This session is intended as a forum for current research on monitoring and modelling thermal, hydrological, and geotechnical responses of infrastructure built on permafrost to climate change. It addresses (1) investigation of the thermal state of permafrost; (2) recent and upcoming advances in permafrost modelling, including algorithm types, model uncertainties, soil parametrizations, numerical and physical benchmark cases, and land-surface-atmosphere interactions; (3) coupling processes of water, energy, and solute transport through the disturbed ground surface, and their interacting effects on long-term stability of infrastructure, such as permafrost thaw, talik formation, preferential flow; (4) development of mitigation techniques aimed to increase infrastructure resilience against permafrost thawing impacts.

We invite contributions based on laboratory experiments, field observations, or physical and numerical modelling, which advance the characterization, understanding, and models' predictive capacity of cryohydrological processes beneath cold-region infrastructure in a changing climate.

**Keywords:** Climate Change, Thawing Permafrost, Cold-Region Infrastructure, Changing Environmental Conditions

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