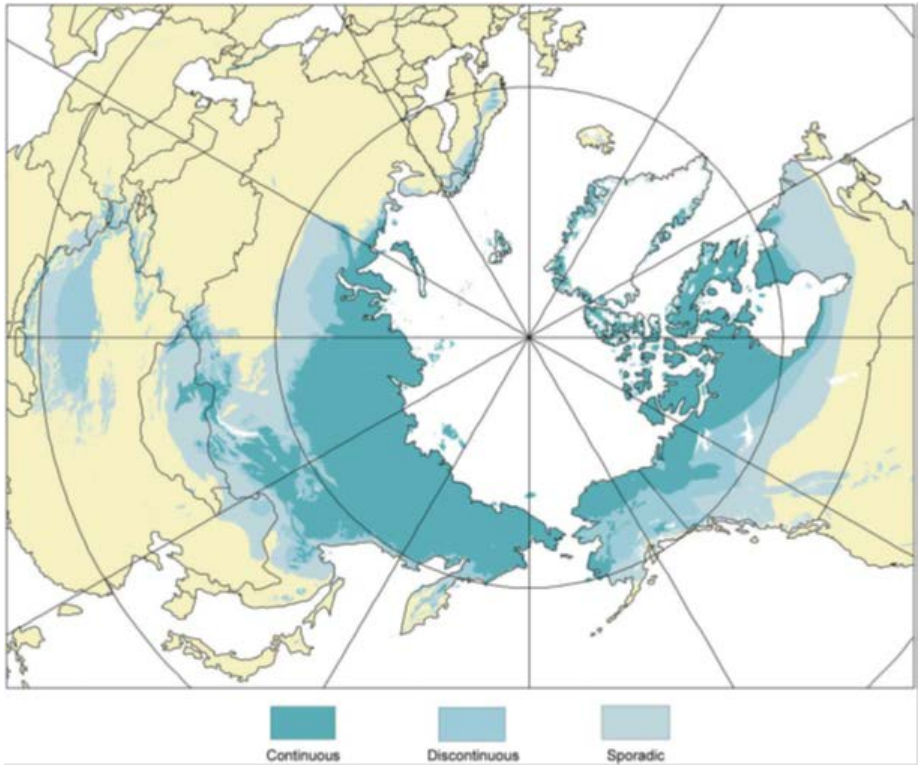
Geotechnical Implications of Climate Change

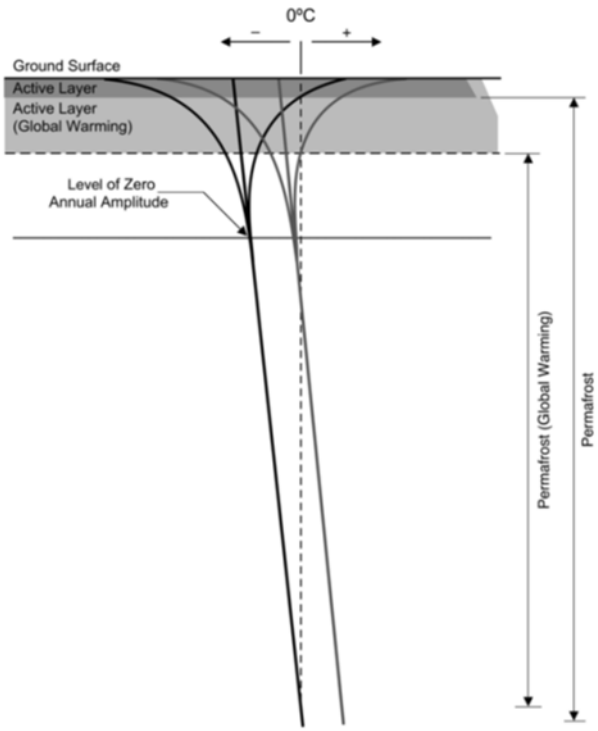
Global temperatures have increased during the last century, and according to climate change scenarios the increase will continue further into the future (IPCC, 2007). In Canada, the mean ground temperature is expected to increase by 2-4°C during this century, which follows a general trend of increase in air temperature for the permafrost areas in the north (Romanovsky et al., 2010). This increase in global temperature, however, can potentially have substantial impacts on the environment, water supply, mining activities and oil and gas exploration because of the greatly enhanced potential for geo-hazards such as landslides, permafrost thaw and deformation of foundations and pipelines.



Permafrost zonation in the Northern Hemisphere (Brown et al. , 1998)

The purpose of this research is to investigate the impact of incremental temperature increase on the mechanical behaviour of frozen soil, stability of embankment, bearing capacity and settlement of both shallow and pile foundations, and to explore potential mitigation solutions.

Considering the fact that extensive areas of permafrost in the cold regions already experience temperatures nearing 0°C, even a small temperature rise of one or two degrees over a century would eventually have widespread effects.



Temperature profile in permafrost

The insight and knowledge gained through this research will lead to improved foundation and embankment designs that will provide long-term sustainable development.

The controlled laboratory tests used in this research examine (i) the effect of incremental temperature increase (from -4 to 0°C) on strength characteristics of various frozen soils ranging from clay to gravel, (ii) the effect of temperature increase on bearing capacity of shallow and pile foundations in permafrost, and (iii) the effect of controlling parameters such as unfrozen water content, soil salinity and additives on the performance of these materials under simulated field conditions.