

## **Roles of groundwater processes in the evolution of complex landscape of discontinuous permafrost**

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The Hay River Lowland in the Northwest Territories is a 140,000 km<sup>2</sup> region of discontinuous and sporadic permafrost with a high density of peatlands. The landcover consists of permafrost plateaus, channel fens, and ombrotrophic flat bogs, occurring as a complex mosaic of patches. The permafrost is contained within peat-covered permafrost plateaus that rise 1-2 m above the surrounding fens and bogs. The region is experiencing a rapid warming over the past several decades, and large-scale (e.g. 50 km grids), vertical energy transfer models suggest a pole-ward shift of the discontinuous permafrost zone in the future. At the Scotty Creek research basin in the Hay River Lowland, recent field-based and remote sensing observations indicate a rapid lateral thawing of permafrost and deepening of the active layer. It is expected that the lateral transfer of subsurface energy is at least partially responsible for thawing, but the relative roles of conductive transfer and advective transfer mediated by groundwater processes is not well understood. Field observation of differential thawing of the active layer also indicates the presence of strong feedback mechanism mediated by groundwater. We will use two- and three-dimensional numerical models of subsurface water and heat transfer to examine the magnitude of subsurface heat fluxes and test the feasibility of various hypotheses regarding the lateral thawing of permafrost including: 1) the circulation of warm water around permafrost plateau "island" has a significant effect on lateral thawing, 2) variable saturation of peat affects the spatial distribution of permafrost thaw rates, 3) a small depression in permafrost plateau grows into a wetland as a result of groundwater-feedback process and eventually merge into larger, interconnected wetlands and 4) the amplitude of seasonal air temperature fluctuation affects the permafrost geometry and the pathway of groundwater flow.

Oral presentation

**Hydrology - Cold Regions Processes**