



Four PhD positions in Canada: High-latitude land surface-atmosphere interactions and biogeochemistry (positions are open for immediate start, and entry before May 2019 is preferred)

We are looking for four highly motivated individuals for PhD positions focusing on changes in land surface-atmosphere interactions (PhD1 and PhD2), and terrestrial-aquatic linkages (PhD 3 and PhD4) in the northwestern Canadian boreal zone where hydrological regimes undergo rapid changes due to permafrost thaw. Funding packages for these four PhD positions include four-year stipends (\$21,000/year), and travel and field expenses. Additional sources of funding include university fellowships, tuition remission (international students), and research and teaching assistantships. Total value of funding packages will depend on position and applicant, but will be generous for highly qualified applicants. Additional funding can be applied for through external sources (e.g., Natural Sciences and Engineering and Research Council of Canada).

PhD1: Land surface-atmosphere interactions near the boreal treeline. Co-supervised by Dr. Oliver Sonnentag/Université de Montréal (UdeM) and Dr. Philip Marsh/Wilfrid Laurier University (WLU) this position based in the Department of Geography and Environmental Studies at WLU in Waterloo, ON with regular visits to UdeM. The focus of this project is on high-latitude land-atmosphere interactions across the boreal treeline. The study area consists of two nearby research sites near Inuvik, NT, Havikpak Creek (sub-Arctic woodland with continuous permafrost) and Trail Valley Creek (mineral upland tundra with continuous permafrost) where eddy covariance of water and energy fluxes and ancillary measurements and detailed hydrology, permafrost and snow surveys have been made since 2013 and the early 1990s, respectively.

PhD2: Land surface-atmosphere interactions near the southern limit of permafrost. Co-supervised by Sonnentag and Dr. Jennifer Baltzer/WLU this position is based in the Département de géographie at UdeM with regular visits to WLU. The focus of this project is on a better understanding of land-atmosphere interactions by studying ecosystem-, plot- and leaf-scale measurements of carbon, water and heat fluxes made with the eddy covariance and different chamber techniques (LI-6400, LGR Ultraportable Greenhouse Gas Analyzer). The study area consists of two research sites in the Northwest Territories near the southern limit of permafrost, Scotty Creek (boreal peat landscape with sporadic permafrost) near Fort Simpson and Smith Creek (boreal peat landscape with discontinuous permafrost) near Wrigley, around 200 km north of Scotty Creek. Permafrost along the southern limit of its distribution undergoes dramatic changes in hydrological regimes due to rapid permafrost thaw. At Scotty Creek these changes lead to wetland expansion at the expense of boreal forest coverage. The project aims to expand on ongoing eddy covariance and chamber measurements at Scotty Creek in comparison to the recently instrumented Smith Creek research site. More specifically, the PhD student will examine if permafrost thaw-induced changes in land-atmosphere interactions observed at Scotty Creek can be used to project similar changes at Smith Creek as the regional climate keeps getting warmer.

PhD3: Smith Creek catchment hydrology and water quality and treatability monitoring. Co-supervised by Dr. David Olefeldt/University of Alberta (UofA) and Sonnentag, this position is based in the Department of Renewable Resource at UofA. The focus of this project is to establish a hydrological monitoring program for a number of catchments (including Smith Creek, which is the focus of PhD2 and PhD4) near Wrigley, NT, that all have large peatland complexes currently undergoing permafrost thaw and thermokarst formation. The goal is to understand controls on

contributions from different catchment water sources, and their influence on catchment solute transport and water quality, and on the downstream chemistry of terrestrially derived dissolved organic matter. Detailed analysis of the composition of dissolved organic matter will be combined with analysis of water quality from a drinking water perspective, i.e., coagulative and oxidative demand, and disinfectant by-product formation potential. Overall, this project will shed light on the impact of continued permafrost thaw on water quality from the perspective of water treatability, as well as the links between terrestrial and aquatic carbon cycling.

PhD4: Influence of permafrost thaw on peatland hydrology, peat/sediment chemistry, and carbon balance. Co-supervised by Sonnentag and Olefeldt, this position is based in the Département de géographie at UdeM. In close collaboration with PhD2 and PhD 3, the focus of this project is on a small peatland sub-catchment within the Smith Creek catchment. The goal is to establish the sub-catchment water balance and understand the hydrological functions and influence on catchment solute export from the dominating land cover types including thermokarst bogs and ponds, and forested permafrost peat plateaus. In addition, this project will include the analysis of peat and sediment profiles from peat plateaus, bogs, and ponds within the sub-catchment, including carbon, nutrient and metal contents, degree of organic matter humification, and concentration and chemical composition of the dissolved organic matter in pore-water. Overall this project will aim to gain an understanding of the potential impacts of permafrost and thermokarst formation for the peatland carbon balance and for downstream solute export.

Ideal applicants for all four PhD positions should have

- 1) a strong quantitative (including programming skills in Matlab and/or R) and technical background obtained through a Master's or Diploma degree in ecology, biogeosciences, environmental sciences, hydrology, etc.,
- 2) previous exposure to some aspects of the project (e.g., high latitude ecosystems/ecohydrology/catchment science/biogeochemistry),
- 3) (some) wilderness outdoor experience as the project requires frequent traveling to and extended stays at the sites,
- 4) the ability to work independently and effectively as part of a team setting consisting of university and government researchers and Indigenous communities, and
- 5) proficiency in English (the UdeM is a francophone research university, so knowledge of French is of great advantage but not mandatory).

Please email questions regarding the PhD positions/admission processes and application packages consisting of cover letter, curriculum vitae, an English writing sample (ideally a publication), copies of academic credentials, and names and contact information of at least two referees to:

pmarsh *at* wlu.ca (PhD1)

oliver.sonnentag *at* umontreal.ca (PhD1-PhD4)

jbaltzer *at* wlu.ca (PhD2)

olefeldt *at* ualberta.ca (PhD3 & PhD4)

The review of applications will commence immediately until the positions are filled.