Graduate opportunities for the three PhD positions described below, earliest start in September 2014.

== Topic 1: Topography and permafrost thaw ==

The expected outcome of this project is a set of well-characterised and tested methods for quantifying and interpreting topographic change resulting from permafrost thaw. This is important because subsurface ice loss affects a significant part of the globally exposed land surface but cannot adequately be characterized by ground temperature measurements alone. The methods developed are intended for routine use in the built and natural environment, and should help to establish baseline data in remote monitoring locations. The principle tool for this will be terrestrial laser scanning, focusing on accuracy over rough or otherwise difficult surfaces (e.g., moss), repeatability, and characterization of vegetation cover. New instruments for this will be acquired in Fall 2014. Suitable complementary methods for scaling (DInSAR, airborne laser scanning) and interpretation (modelling, measuring time series of heave/settlement) will be decided during the first year of the project. Besides method development, this project is expected to result in field measurements providing an accurate insight into the ice loss at selected sites.

The ideal candidate is a curious and driven person with strong communication and interpersonal skills. You should be motivated to work in a multi-disciplinary environment, and to develop both field measurement and computational analysis. You should have a Masters level degree in a relevant area, e.g., Geodesy, Geomatics, Computer Science, Mathematics, Physics, Geography, Engineering, or Earth Sciences. Programming skills and experience with GIS are important assets. You have a very good standard of written and spoken English and are experienced and comfortable in scientific writing. Personal skills and certifications in areas such as wilderness travel or mountaineering as are very welcome.

== Topic 2: Subsurface properties and permafrost thaw ==

The expected outcome of this project is a method that allows for efficient measurement of liquid water and ice content in permafrost and in laboratory experiments. This is important as close to 0ºC, heat gain in frozen soil is manifested more in changes to its composition than in temperature. As most commercial TDR instruments are difficult to install in boreholes, the principle instrument of this project will employ ring electrodes. The applicability of a prototype field sensor will be tested and its calibration and usability will be supported by laboratory measurements of dielectric properties of frozen soil, and possibly other laboratory measurements and experiments. A corresponding laboratory is in renovation and the required instruments will be acquired in Fall 2014. With more and more of the global permafrost area entering a state of thaw, the importance of methods for quantifying this hidden thaw will increase rapidly, both for the monitoring of environmental change and for early detection of structural integrity changes around infrastructure.

The ideal candidate is a curious and driven person with strong communication and interpersonal skills. You should be motivated to work in a multi-disciplinary environment, and to develop both field measurement and computational analysis. You should have a Masters level degree in a relevant area, e.g., Soil Science, Soil Physics, Hydrology, Computer Science, Mathematics, Physics, Geography, Engineering, or Earth Sciences. Programming skills and experience with maintaining field/laboratory instruments are important assets. You have a very good standard of written and spoken English and are experienced and comfortable in scientific writing. Personal skills and certifications in areas such as wilderness travel or mountaineering as are very welcome.

== Topic 3: Simulating permafrost thaw ==

The expected outcome of this project is an improved simulation of permafrost and permafrost changes with emphasis on quantifying subsurface ice loss. This is important for (a) the adequate interpretation of permafrost measurements, especially for reconciling measurements of temperature, ice loss, and subsidence; and (b) for simulating the state and change of heterogeneous permafrost landscapes. Especially issues related to model testing, scale, and uncertainty will be important. This work will build on existing Open Source simulation code, access to high-performance computing resources is available.

The ideal candidate is a curious and driven person with strong communication and interpersonal skills. You should be motivated to work in a multi-disciplinary environment, and to complement the development of computational tools with fieldwork in the Arctic. You should have a Masters level degree in a relevant area, e.g., Atmospheric Science, Meteorology, Hydrology, Geomatics, Computer Science, Mathematics, Physics, Geography, Engineering, or Earth Sciences. Programming skills and experience with computational research are important assets. You have a very good standard of written and spoken English and are experienced and comfortable in scientific writing. Personal skills and certifications in areas such as wilderness travel or mountaineering as are very welcome.

== Academic environment and education offered ==

These positions will be part of a research group established with the new Canada Research Chair in Climate Change Impacts/Adaptation in Northern Canada at Carleton University; infrastructure is supported by a recent Canada Foundation for Innovation grant. A broad range of partnerships – on campus, in Canada and internationally – exist and can offer specialised support, academic exchange, and industry interaction. The successful candidate(s) will interface with relevant industries and government agencies during their theses.

The Department of Geography and Environmental Studies has a long history of permafrost research and several research groups specialize in differing aspects of the cryosphere and

Northern research. This is complimented by a strong program in Geomatics offering GIS and remote sensing, as well as a growing focus on collaborative research in the North that is shared by many other departments across campus.

Carleton is a comprehensive University offering a broad range of teaching and research in Natural Sciences, Engineering, and Arts/Humanities. Located in Ottawa, the capital of Canada, researchers and students profit from the proximity to many government research institutions, e.g., differing branches of Environment Canada or the Canadian National Research Council. The proximity of Ottawa University adds yet another layer of opportunity.

The successful candidate(s) will join the PhD program of the Department of Geography and Environmental Studies (http://www.carleton.ca/geography/geography/graduate/doctoral-program/) and a personalized curriculum will be developed within the first year. In exceptional cases, supervision in a differing department may be negotiated.

== Funding ==

Funding for PhD students at Carleton is a combination of differing sources that include research assistantships though a project, a teaching assistantship, and sometimes scholarships offered by the Department and University. Details, especially w.r.t visa for foreign students, need to be worked out case-by-case; we will make sure that the successful candidate has a competitive overall income, and provide training and support for obtaining high-profile scholarships. If the successful candidate is subject to higher tuition fees as a foreign national, the difference to tuition fees for Canadians will additionally be covered.

== Application ==

Please send (a) a letter of motivation; (b) curriculum vitae; (c) transcripts; and (d) a writing sample such as an article, essay, or thesis. In your letter of motivation, explain why you are the right candidate for one of these topics, and why this particular topic and Carleton University would be the right choice for you. Explain why you choose to pursue a PhD.

Email your application as one PDF file to Stephan Gruber (stephan.gruber@carleton.ca). Mass applications failing to address the projects outlined here in their letter of motivation will receive no reply.

== Selection process ==

Your submission will be acknowledged by email within one week of receipt. Reviews of applications will commence on July 10, 2014. You will be notified you before August 1, 2014 whether we invite you for an interview by Skype. We intend to fill two of these positions by September 2014; positions will remain open until a suitable candidate is found. If selected for one of these positions, you will have to make a formal application to http://graduate.carleton.ca for enrolment.

If you require further information, contact Stephan Gruber (stephan.gruber@carleton.ca).

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Stephan Gruber (stephan.gruber@carleton.ca)

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Model sensitivity http://dx.doi.org/10.5194/gmd-6-1319-2013

Frost weathering http://dx.doi.org/10.5194/gi-1-155-2012

Subgrid simulation http://dx.doi.org/10.5194/gmd-5-1245-2012

Snow & iButtons http://dx.doi.org/10.5194/tc-6-1127-2012

Frost cracking http://dx.doi.org/10.1016/j.epsl.2012.06.014