Geophysical Research Abstracts
Vol. 12, EGU2010-8729-1, 2010
EGU General Assembly 2010

Using in-field and remote sensing techniques for the monitoring of small-scale permafrost decline in Northern Quebec

Inga May (1), Jun Su Kim (2), Kati Spannraft (1), Ralf Ludwig (1), Irena Hajnsek (2), Monique Bernier (3), and Michel Allard (4)

(1) University of Munich, Department of Geography, Munich, Germany (i.may@iggf.geo.uni-muenchen.de, +49- (0)89-2180-6675), (2) Microwaves and Radar Institute, German Aerospace Center, Germany, (3) INRS-ETE, Québec, Canada, (4) Université Laval, Québec, Canada

Permafrost-affected soils represent about 45% of Canadian arctic and subarctic regions. Under the recently recorded changed climate conditions, the areas located in the discontinuous permafrost zones are likely to belong to the most impacted environments. Degradations of Palsas and lithalsas as being the most distinct permafrost landforms as well as an extension of wetlands have been observe during the past decades by several research teams all over the northern Arctic. These alterations, caused by longer an warmer thawing periods, are expected to become more and more frequent in the future. The effects on human beings and on the surrounding sensitive ecosystems are presumed to be momentous and of high relevance. Hence, there is a high demand for new techniques that are able to detect, and possibly even predict, the behavior of the permafrost within a changing environment.

The presented study is part of an international research collaboration between LMU, INRS and UL within the framework of ArcticNet. The project intends to develop a monitoring system strongly based on remote sensing imagery and GIS-based data analysis, using a test site located in northern Quebec (Umiujaq, 56°33' N, 76°33' W). It shall be investigated to which extent the interpretation of satellite imagery is feasible to partially substitute costly and difficult geophysical point measurements, and to provide spatial knowledge about the major factors that control permafrost dynamics and ecosystem change. In a first step, these factors, mainly expected to be determined from changes in topography, vegetation cover and snow cover, are identified and validated by means of several consecutive ground truthing initiatives supporting the analysis of multi-sensoral time series of remotely sensed information. Both sources are used to generate and feed different concepts for modeling permafrost dynamics by ways of parameter retrieval and data assimilation.

On this poster, the outcomes of the first project year (2009) are highlighted. The main focus during this year was to figure out whether small-scale topographical changes caused by seasonal thawing and freezing processes, are detectable by means of SAR-interferometry. For this purpose, repeat passes of interferometric products were computed from the multi-temporal image pairs of Germany's X-band SAR sensor TerraSar-X. These are then compared with in-situ measurements surveyed by high precision differential GPS, taken during the field measurements in April and August of 2009. Thus, the first methodological research question is to prove that the results from the interferogram analysis correspond to the findings of field surveys.

The results are promising as topographical changes could be observed with the D-GPS as well as on the interferograms. Due to the amount of factors influencing the remote sensed data, the analysis of the information contained in the data in order to make quantitative statements still remains an effort. Nevertheless it is very likely that, after further investigation to fully understand the radar-signal, this procedure is indeed reliable and efficient, and may be applied to a long-term and interannual assessment of permafrost dynamics in the sub-arctic.