Geophysical Research Abstracts
Vol. 17, EGU2015-3966, 2015
EGU General Assembly 2015

Simulated thaw development of a peat plateau-bog complex in a discontinuous permafrost region, Northwest Territories, Canada

Barret Kurylyk (1), Masaki Hayashi (1), William Quinton (2), and Clifford Voss (3)

(1) Department of Geoscience, University of Calgary, Calgary, AB, Canada (barret.kurylyk@ucalgary.ca and hayashi@ucalgary.ca), (2) Cold Regions Research Centre, Wilfrid Laurier University, Waterloo, ON, Canada (wquinton@wlu.ca), (3) National Research Program, United States Geological Survey, Menlo Park, CA, USA (cvoss@usgs.gov)

Air temperatures at high latitudes have increased at rates that exceed globally averaged trends, and this warming has produced rapid permafrost degradation in many areas. In discontinuous permafrost regions of the Taiga Plains of northwestern Canada, past climate warming has created a complex landscape mosaic of fully thawed bogs/fens and remnant peat plateaus underlain by thin permafrost. The thawing of peat plateaus can alter the landscape hydrologic connectivity by creating pathways to efficiently convey water from bogs to nearby rivers and lakes. Extensive monitoring of the thermal regime of a peat plateau-bog complex in the Scotty Creek watershed (61.3° N, 121.3° W), Northwest Territories, Canada has identified rapid permafrost degradation in the past decade. In addition, satellite images indicate major landscape evolution due to permafrost thaw since 1970, and these changes have resulted in increased discharge at the watershed outlet. These long term comprehensive data facilitate the numerical modeling of idealized permafrost environments based on observed data. The objective of this research project is to elucidate fundamental processes that contribute to multi-dimensional permafrost thaw and associated hydrological changes in discontinuous permafrost regions.

The thaw evolution in this peat plateau-bog complex is simulated using SUTRA, a numerical groundwater flow and coupled heat transport model that has been modified to include dynamic freeze-thaw processes. To accommodate complex surface processes, measured climate data from 1900-2010 are used to drive a separate soil-vegetation-atmosphere energy transfer model. Near-surface temperatures produced by the vertical transfer model for the peat plateau and bog are applied as the upper thermal boundary conditions for the multi-dimensional subsurface heat transport simulations in SUTRA (1900-2010). The simulated thaw development of this peat plateau will be compared to satellite imagery to assess the ability of this sequential modeling approach to reproduce observed permafrost degradation.