MODELLING SPECIFIC STREAM POWER AND ASSOCIATED CHANNEL MORPHOLOGIES USING DIFFERENTIAL SCALING OF SLOPE GENERALISATION TECHNIQUES

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Channel morphology is influenced by channel form, slope and bed characteristics which depend on sediment supply in a looped feedback of processes. However, urbanization and extensive anthropogenic activity often interrupt the continuity of water and sediment flow, resulting in fundamental alterations to geomorphology of a river system. In glacially conditioned regions, channel morphology is further influenced when glacial deposits determine the type and availability of sediment, impacting post-glacial fluvial adjustments. These geomorphic responses have motivated research to improve our understanding of changing channel form to safeguard the public against potential hazards. Effective watershed management requires analysis of landscape response to changing environmental conditions at a catchment scale that quantifies and predicts the spatial variability of fluvial processes, based on landscape linkages. Variations can be analyzed and assessed using empirically derived relationships. This study uses a detailed slope-area analysis to model specific stream power for the Duffins Creek basin in southern Ontario. Duffins Creek is a small, low relief, watershed that embodies the surficial geology and multiple landforms of Quaternary glaciations, and is subject to significant variations in stream energy. Differential scaling of slope generalization techniques are used to assess specific stream power and associated channel morphologies. A single-pass moving window is used to smooth a Digital Elevation Model (DEM) derived slope. The key objective of slope generalisation is to determine a longitudinal channel profile that exposes local variation, while maintaining general channel characteristics representative of fluvial processes at reach scale. Results suggest a 2.00 km moving average of DEM derived slope values provides a channel slope that best represents reach-averaged channel adjustments in the watershed. Although most reaches are adjusted, the longitudinal profile suggests glacial materials influence bedload composition and bank strength yielding more variable channel morphologies at the watershed scale.

Biography

Pamela Tetford (MSc 2017, University of Toronto) is a PhD student in the Department of Geography at the University of Toronto. Her research interests are on the spatial analysis of geomorphic processes using a GIS framework, with special interest in the impact of urbanization on soil and stream erosion.