**The influence of climate change on permafrost and river discharge in the Mackenzie River Basin**

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Continental high altitudes and latitudes are predicted to continue warming at higher rates than the global average, with great implications for coupled cryosphere-hydrological systems. Feedbacks are generally complex and depend on a multitude of factors, including changes to precipitation intensity, timing, and phase, as well as soil composition and hydraulic and thermal properties. The Mackenzie River Basin (MRB) is the largest in Canada and is underlain by permafrost for much of its extent. In this study, the MESH hydrological land surface model was set up over the MRB, from the Columbia Icefields to the Arctic Ocean, forced with bias-corrected downscaled RCM forcings and parameterized with deep soil profile (to 50 m) and organic soil, to simulate permafrost dynamics. Some parameters were then fine-tuned to reproduce the spatial distribution of permafrost occurrence provided by several gridded datasets, and the model was validated using site-based active layer depth or soil temperature observations. The model was partially calibrated against streamflow observations in selected sub-basins. The resulting high-fidelity model was then used to simulate both the hydrology and permafrost dynamics in the basin under the RCP8.5 climate change scenario. The results show alarming rates of permafrost thaw, to the extent that most of the basin will be permafrost-free by the 2080s. Streamflow hydrographs show shifts to earlier and higher peaks in response to projected increases in precipitation and temperature. Baseflow discharges are projected to increase, partly due to improved connectivity because of permafrost thaw and partly due to increased precipitation.