Geophysical Research Abstracts
Vol. 18, EGU2016-10786, 2016
EGU General Assembly 2016

Lake-river and lake-atmosphere interactions in a changing climate over Northeast Canada

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Lakes influence the regional climate and hydrology in a number of ways and therefore they should be represented in climate models in a realistic manner. Lack of representation of lakes in models can lead to errors in simulated energy and water fluxes, for lake-rich regions. This study focuses on the assessment of the impact of climate change on lakes and hydrology as well as on the influence of lakes on projected changes to regional climate and surface hydrology, particularly streamflows, for Northeast Canada. To this end, transient climate change simulations spanning the 1950–2100 period are performed, with and without lakes, with the fifth generation of the Canadian Regional Climate Model (CRCM5), driven by the Canadian Earth System Model (CanESM2) at the lateral boundaries for Representative Concentration Pathway 8.5.
Comparison of projected changes from the CRCM5 simulations with and without lakes suggest that lakes attenuate projected increases to 2-m air temperature in all seasons, almost everywhere in the study domain, with maximum decreases of the order of 2°C occurring during winter. As for streamflows, results suggest projected increases for winter and spring and decreases during summer. Comparison of the projected changes suggests that lakes attenuate the projected increases in streamflows in spring due to the storage effect of lakes, and also attenuate the projected decreases in streamflows in summer in future climate due to the gradual release of the excess water stored in the lakes during spring. This study, thus demonstrates the impact of lakes on projected changes to the regional climate and hydrology for the study region using a single regional modelling system.