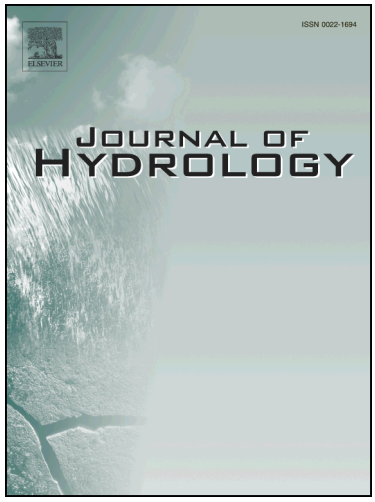

Research papers

The impact of climate change on inland waterway transport: effects of low water levels on the Mackenzie River

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The impact of climate change on inland waterway transport: effects of low water levels on the Mackenzie River

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Abstract

Potential impact of climate change on the inland waterway transport of the Mackenzie River Basin (MRB) have been investigated through simulations of the Hydrologiske Byrån avdeling för Vattenbalans (HBV) hydrological model, the HBV-light, for the baseline, 1974-2004, and future periods of 2041-2070 and 2071-2100 over the MRB driven by precipitation and air temperature data of Representative Concentration Pathways, RCP4.5 and RCP8.5 climate scenarios of 10 Global Climate Models statistically downscaled by the Pacific Climate Impacts Consortium using the Bias-Correction Spatial Disaggregation. The average onset of spring snowmelt between 2041 and 2100 is projected to occur up to two weeks earlier than the historical (1974-2004) climate. Projected warmer temperature and higher precipitation will lead to higher runoff for MRB in winter and spring, at the expense of decreased summer streamflow and water level at Fort Simpson and Arctic Red River stations partly because projected increase in evapotranspiration will offset the projected increase in precipitation. Under a warmer climate, navigation issues related to low water levels are expected to increase, e.g., under RCP8.5 at Arctic Red River station, the number of days the water level above 5 m is projected to decrease from 74 days in 1974-2000 to 42 days in the 2080s. The summer durations that water levels of MRB will be at or above 3, 4, and 5 m are projected to decrease by 2.8%-22.2%, 10.0%-34.5%, and 16.2%-43.4%, respectively, which mean navigation problems would increase because safe transit through MRB depends on its water levels.

Key Words: Mackenzie River Basin, Water level, Arctic transportation network, Impacts of Climate Change, Statistical downscaling, HBV hydrologic model