Assessment of climate change impact on hydrological processes based on statistical approaches

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Abstract: The changed climate could cause more frequent extreme meteorological events, and lead to exacerbated hydrological disasters such as floods or droughts. The impact assessment of climate change on hydrological processes is thus imperative before any adaptation plans are to be made. This study aimed to assess the river discharge response under climate change using the multiple statistical approaches in the Bow River Basin, Alberta, Canada. There are two major components in this study, including climate downscaling and hydrological simulation. Firstly, the large-scale predictors from Hadley Centre Coupled Model, version 3 (HadCM3) A2 scenarios were downscaled using support vector machine (SVM) to generate the local meteorological information including precipitation, minimum and maximum temperature. An integrated-multiple-steps SVM model was applied to address spatial correlations. Secondly, the downscaled weather variables were applied into a trained Bayesian neural network (BNN) model to simulate the monthly runoff. The BNN model in this step was trained by the observed local weather dataset. Based on the HadCM3 A2 emission scenario, the future variation of the river discharge was projected. The dry-/wet-spells and extreme events are examined and compared with the current condition. This study relies only on statistical methods, which are advantageous in less data demand and flexible way of usage. The main limitation is that the statistical method has to assume stationary relationships for current and future periods.

Keywords: Climate change, Statistical downscaling, SVM, BNN