Possible Impact of Climate Change on Future Extreme Precipitation Events of Southern Alberta

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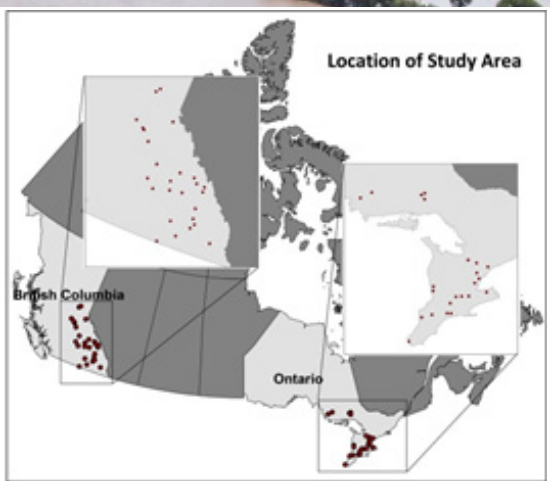
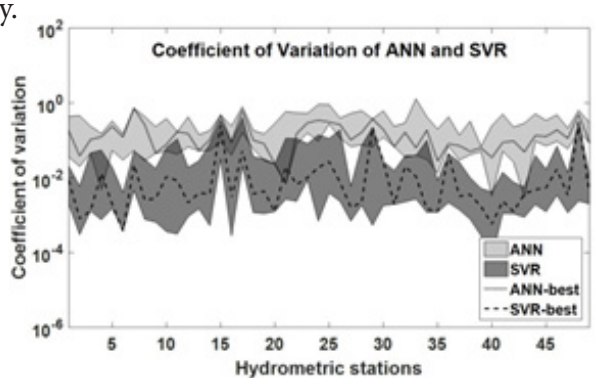
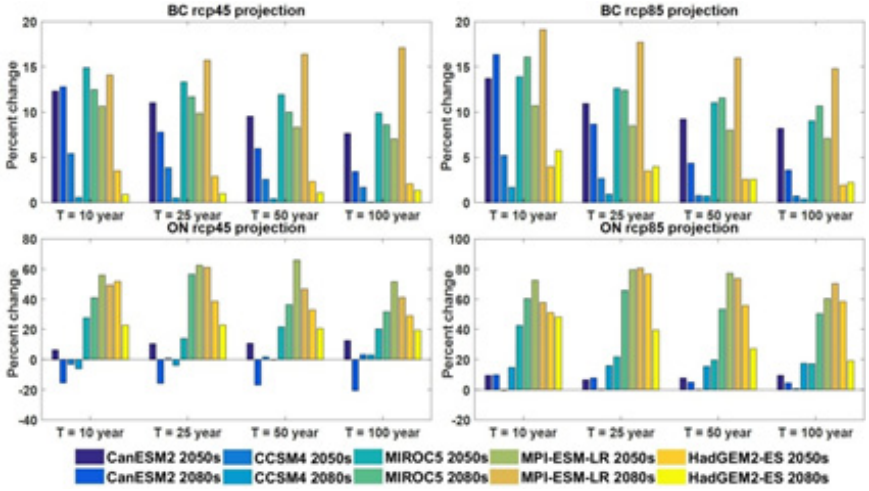
Research Summary

Regional Flood Frequency Analysis (RFFA) are statistical methods that are widely used to estimate flood quantiles of catchments with limited streamflow data. In addition, sometimes only a limited number of stations with complete dataset are available from hydrologically similar, surrounding catchments to estimate the flood quantile of certain ungauged sites. Besides traditional regression based RFFA methods, recent applications of machine learning algorithms such as the artificial neural network (ANN) have shown encouraging results in regional flood quantile estimations. In this study, another novel machine learning technique, Support Vector Regression (SVR), was used to develop an RFFA model to estimate regional flood quantiles for two study areas, one with 26 catchments located in southeastern British Columbia (BC) and another with 23 catchments located in southern Ontario (ON), Canada. The SVR-RFFA model for both study sites was developed from 13 sets of physiographic and climatic predictors for the historical period. The Ef (Nash Sutcliffe coefficient) and R2 of the SVR-RFFA model was about 0.7 when estimating flood quantiles of 10, 25, 50 and 100 year return periods which indicate satisfactory model performance in both study areas. With a fairly limited amount of data available to train the RFFA models, the SVR-RFFA model was also found to perform better than an ANN based RFFA model, and with significantly lower median CV (coefficient of variation) of the estimated flood quantiles. The SVR-RFFA model was then used to project changes in flood quantiles over the two study areas under the impact of climate change using the RCP4.5 and RCP8.5 climate projections of five CMIP5 GCMs (Global Climate Models) for the 2041-2100 period. The results suggest that due to an increase in the mean annual precipitation, and rainfall of a given return period, the flood quantile is projected to increase by about 7% for the southeastern BC and 29% for southern ON region in the mid- and late 21st century.







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