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Analysis of regional climate projections of extreme precipitation and temperatures by using an Extreme Value Theory non-stationary model

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Future climate projections of extreme events can help forewarn society from high-impact events and develop better adaptation strategies. Extreme Value Theory (EVT) provides a well established and robust framework to analyze the behaviour of extreme weather events for the present climate and future projections. In this study a non-stationary model for Generalized Extreme Value (GEV) distributions is used to analyze the trend of the distributions of extreme precipitation and temperatures, in the context of a changing climate.

The analysis is performed for climate projections of the Canadian Regional Climate Model (CRCM version 4.2) driven by two members (#4,#5) of the Canadian Coupled Global Climate Model (CGCM version 3.1), over North America. Annual extremes of 24h accumulated precipitation and daily minimum and maximum temperatures are analyzed. Significant positive trends for the location parameter of the GEV distribution are found, indicating an expected increase in extreme value intensities. The scale parameter of the GEV distribution reveals that the variability of precipitation extremes exhibits also an increase, whereas the variability for temperature extremes decreases. The shape of the GEV distributions seems not to vary significantly. In some regions, extreme temperatures exhibit an increase significantly larger than that for the seasonal average temperatures.

The extreme temperature trends have been tested for three different behaviours : linear, parabolic and logistic, the latter representing an abrupt change between present and future equilibrium states. Simulations driven by the CGCM#5 exhibit predominantly linear trends, whereas simulations driven by the CGCM#4 exhibit predominantly parabolic trends. Logistic trends occur sometimes in the CRCM simulations driven by the CGCM#5, and reveal some peculiar behaviours for specific regions.

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