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Future climate projections of extreme precipitation and temperature distributions by using an Extreme Value Theory non-stationary model

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Extreme weather events can cause large damages and losses, and have high societal and economical impacts. Climate model integrations predict increases in both frequency and intensity of extreme events under enhanced greenhouse conditions. Better understanding of the capabilities of climate models in representing the present climate extremes, joint with the analysis of the future climate projections for extreme events, can help to forewarn society from future high-impact events, and possibly better develop adaptation strategies.

Extreme Value Theory (EVT) provides a well established and robust framework to analyse the behaviour of extreme weather events for the present climate and future projections. In this study a non-stationary model for Generalised Extreme Value (GEV) distributions is used to analyse the trend of the distributions of extreme precipitation and temperatures, in the context of a changing climate. The analysis is performed for the climate projections of the Canadian Regional Climate Model (CRCM), under a SRES A2 emission scenario, for annual, seasonal and monthly extremes, for 12 regions characterised by different climatologies over the North American domain. Significant positive trends for the location of the distributions are found in most regions, indicating an expected increase in extreme value intensities, whereas the scale (variability) and shape (tail values) of the extreme distributions seem not to vary significantly.

Extreme events, such as intense convective precipitation, are often associated to small-scale features. The enhanced resolution of Regional Climate Models enables to better represent such extreme events, with respect to Global Climate Models. However the resolution of these models is sometimes still too coarse to reproduce realistic extremes. To address this representativeness issue, statistical downscaling of the CRCM projections is performed. The downscaling relation is obtained by comparing the GEV distributions for the CRCM extremes to those for observed extremes, in the present climate. As expected, the greatest correction factors are associated to location and scale of the distributions of precipitation extremes.