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Observed changes in one-in-20 year extremes of Canadian surface air temperatures

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This study applies a recently developed GEV-tree (a tree of Generalized Extreme Value distributions) approach to a newly homogenized Canadian daily surface air temperature data set, to assess changes in temperature extremes over the last century (1910-2010) and the last 50 years (1960-2010). Changes in one-in-20 year extremes (i.e. 20-year return values, denoted as RV20yr) are estimated from the most suitable GEV distribution chosen from a GEV-tree that consists of both stationary and non-stationary (with polynomial trends) distributions. The annual extremes analyzed include the annual maxima and minima of daily minimum temperatures (TNx and TNn), and of daily maximum temperatures (TXx and TXn). Usually, the annual minima, TNn and TXn, occur in nighttime and daytime of winter, and the annual maxima, TNx and TXx, in nighttime and daytime of summer, respectively. The results show that warming is strongest in the extreme low temperatures, with a 115-station average rate of increase of about 3.5°C per century for RV20yr of TNn, and weakest in the extreme high temperatures, at about 0.5°C per century for RV20yr of TXx. The average rate of increase for RV20yr of TXn and TXn is about 1.9°C and 1.2°C per century, respectively, and about 1.5°C per century for the annual mean temperatures. The warming is stronger in winter than in summer; it is also stronger in nighttime than in daytime of the same season.