New developments on the homogenization of Canadian daily temperature data

Lucie A. Vincent and Xiaolan L. Wang

Climate Research Division, Science and Technology Branch, Environment Canada, Toronto, Canada

Long-term and homogenized surface air temperature datasets had been prepared for the analysis of climate trends in Canada (Vincent and Gullett 1999). Non-climatic steps due to instruments relocation/changes and changes in observing procedures were identified in the annual mean of the daily maximum and minimum temperatures using a technique based on regression models (Vincent 1998). Monthly adjustments were derived from the regression models and daily adjustments were obtained from an interpolation procedure using the monthly adjustments (Vincent et al. 2002).

Recently, new statistical tests have been developed to improve the power of detecting changepoints in climatological data time series. The penalized maximal t (PMT) test (Wang et al. 2007) and the penalized maximal F (PMF) test (Wang 2008b) were developed to take into account the position of each changepoint in order to minimize the effect of unequal and small sample size. A software package RHtestsV3 (Wang and Feng 2009) has also been developed to implement these tests to homogenize climate data series. A recursive procedure was developed to estimate the annual cycle, linear trend, and lag-1 autocorrelation of the base series in tandem, so that the effect of lag-1 autocorrelation is accounted for in the tests. A Quantile Matching (QM) algorithm (Wang 2009) was also developed for adjusting Gaussian daily data so that the empirical distributions of all segments of the detrended series match each other.

The RHtestsV3 package was used to prepare a second generation of homogenized temperatures in Canada. Both the PMT test and the PMF test were applied to detect shifts in monthly mean temperature series. Reference series was used in conducting a PMT test. Whenever possible, the main causes of the shifts were retrieved through historical evidence such as the station inspection reports. Finally, the QM algorithm was used to adjust the daily temperature series for the artificial shifts identified from the respective monthly mean series. These procedures were applied to homogenize daily maximum and minimum temperatures recorded at 336 stations across Canada.

During the presentation, the procedures will be summarized and their application will be illustrated throughout the provision of selected examples.

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