Homogenization of Chinese Daily Surface Air Temperatures

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Extreme climate events have large potential of impacts on the society and economy. However, analysis of long-term changes in climate extremes need to use homogeneous time series of high resolution climatic data (e.g., daily or sub-daily), to diminish non-climatic influences. Thus, more and more attention has been drawn to the development of high quality daily climatic data.

Since both temporal and spatial variations are much larger in daily data than in the corresponding monthly or annual data, it is important and yet more difficult to choose a reference series for homogenization of daily data. We tested and compared different methods to select reference series. The reference series that leads to the best match of detected changepoints with metadata information is selected and used to perform homogeneity test for data time series from stations within the grid box. Specifically, we divided the whole country into 2.5-by-2.5 degree lat-long grid boxes. The time series of the averages of observations at all stations in each grid box was considered to be the series representing the climatic variations/changes in each grid box. We calculated the correlation coefficient of annual data series at each station with the average series of annual data in each grid box, and chose the five stations of highest correlations. Then, we obtained the daily difference series between each chosen station and the average series in each grid box, and applied the PMTred method to test the homogeneity of the daily difference series, We chose the homogeneous station as the reference station for testing inhomogeneities in other station's series in the grid box, using the PMTred method. In addition to testing the daily series, we also tested the corresponding annual and monthly series. We adjusted for change points that are identified in both daily and monthly/annual series and also supported by metadata.

Daily maximum and minimum temperatures recorded at 822 Chinese stations were tested in this study. The results show that site relocations are the main source of inhomogeneity. The impacts of inhomogeneities on the estimates of climate trends and extremes were assessed. The resulting daily data set is also compared with a previous version of homogenized temperature data set.