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Study on climate change in the source region of the Yangtze River from 1957 to 2010

K. Qian, J. Lv, X. Wang, and L. Wan
China university of Geosciences in beijing, Beijing, China (qiankaizhu@126.com)

In recent years, especially after 1980s, climate has changed more extremely and abnormally in the source region of the Yangtze River. As a typical sensitive area of climate change, the study of climatic factors variance has become more important to reveal their regulations as precipitation (P), temperature (T) and actual evapotranspiration (ETa). By consideration of more fine description of time series, the wavelet method had been employed as the final way to analyze the observed meteorological data from 1957 to 2010. The data are from the meteorological stations as Tuotuohe, Wudaoliang, Qumalai and Yushu, which these stations distribute equally and their data can cover the whole region. After the experiment of many mother function wavelets, the Morlet wavelet was chosen to study the climate change in the source region. Combining with the Morlet wavelet transform (MWT), it had been used to decompose factors into various periods and trend, which the four meteorological stations have different periods and trend. Furthermore, it exist distinct periods and trends between precipitation and temperature without obvious relation. However, the periods and trend of actual evapotranspiration can be almost explained by the regularity of precipitation and temperature. The detailed periods of each station can be shown as follows: (1) In the station of Tuotuohe, the precipitation has periods of 4 years, 8 years, 29-30 years and 43 years. The temperature has periods of 15-16 years, 29-30 years and 43 years. The actual evapotranspiration has periods of 4 years, 8 years, 18 years, 29-30 years and 43 years. (2) In the station of Wudaoliang, the precipitation has periods of 4 years, 8 years, and 43 years. The temperature has periods of 4 years, 8 years, 15-16 years and 29-30 years. The actual evapotranspiration has periods of 5-6 years, 16-17 years and 43 years. (3) In the station of Qumalai, the precipitation has periods of 4-5 years and 20-30 years. The temperature has periods of 15-16 years, 29-30 years and 43 years. The actual evapotranspiration has periods of 4 years, 8 years and 43 years. (4) In the station of Yushu, the precipitation has periods of 4 years, 8 years, 22 years and 42-43 years. The temperature has periods of 15-16 years and 43 years. The actual evapotranspiration has periods of 4 years, 7-8 years, 15-16 years, 29-30 years and 43 years. In addition, referring to the SLOPE method, the slope values of precipitation, temperature and actual evapotranspiration had been calculated and drawn into contours in the entire source region scope. And it can represent the whole situation of the climatic change in different area from 1957 to 2010. According the contours, it can infer that the precipitation had an increase of 55.52 mm, with a temperature increase of 1.67 degrees Celsius and an actual evapotranspiration increase of 25.03 mm. According to analysis, it can infer that the whole source region almost has been driven into warm-wet state with increasing temperature and precipitation, only except the southeast area with warm-arid trend.