Spatiotemporal Variation Characteristics of Temperature in Northern Xinjiang from 1961 to 2014 (Postprint)

Authors: Tan Jiao, Ding Jianli, Zhang Junyong, Wu Pengfei, Ding Jianli

Date: 2018-09-03T00:00:00+00:00

Abstract

Using monthly mean temperature data from 41 meteorological stations in Northern Xinjiang (hereinafter referred to as Northern Xinjiang) from 1961 to 2014, this study analyzes annual and seasonal temperature changes in the Northern Xinjiang region employing methods such as linear tendency rate, moving average, ArcGIS-based mixed interpolation, cumulative anomaly analysis, Mann-Kendall mutation test, and Matlab-based Morlet wavelet analysis. The results show: Annual and seasonal mean temperatures in the Northern Xinjiang region have experienced multiple cold-warm fluctuations, all showing a significant warming trend. Among them, annual and spring, summer, and autumn temperatures have warmed significantly since the 1990s, while winter temperatures have warmed significantly since the 1980s. The annual mean temperature tendency rate in the Northern Xinjiang region is 0.35 ℃• (10a) -1, with larger warming amplitude mainly in the Junggar Basin, Tacheng area, and Fuyun. Annual and four-season mean temperatures in the Northern Xinjiang region have all undergone mutations. Among them, mutations in annual, spring, summer, and autumn mean temperatures occurred mainly in the 1990s, while winter temperature mutation occurred mainly in the late 1970s. The annual mean temperature in the Northern Xinjiang region exhibits a primary period of 27 a and a secondary period of 14 a over the recent 54 a, with alternating cold and warm periods, and the periodic manifestation is region-wide.

Full Text

Preamble

Journal: Arid Zone Research (ChinaXiv 合作期刊)
DOI: doi:10.13866/j.azr.2018.05.23

Title

Spatiotemporal Variation of Temperature in North Xinjiang during the Period of 1961–2014

Authors

TAN Jiao[12], DING Jian-li[12], ZHANG Jun-yong[12], WU Peng-fei[3]

Affiliations

[1]Key Laboratory of Wisdom City and Environmental Modeling of Ministry of Education, Xinjiang University, Urumqi 830046, Xinjiang, China
[2]Key Laboratory of Oasis Ecology of Ministry of Education, Urumqi 830046, Xinjiang, China
[3]Urumqi Meteorological Satellite Ground Station, Urumqi 830011, Xinjiang, China

Abstract

In this study, monthly average temperature data from 41 meteorological stations in north Xinjiang during the period from 1961 to 2014 were used to analyze annual and seasonal abrupt temperature changes. The methods applied included linear trend analysis, moving average, three-dimensional quadratic trend surface simulation based on GIS, cumulative anomaly analysis, Mann-Kendall test, and Morlet wavelet analysis based on Matlab. The main results are as follows: (1) The average annual and seasonal temperatures in north Xinjiang were characterized by several cold and warm fluctuations; however, the average temperature showed a statistically significant increasing trend since the 1990s, except in winter. (2) The increase in average annual temperature in north Xinjiang was $0.35℃ \cdot (10a)^{1}$, with significant temperature increases occurring in the Junggar Basin, Tacheng, and north Fuyun County. (3) Abrupt changes occurred in both seasonal and annual average temperatures in north Xinjiang. The abrupt changes in average annual, spring, summer, and autumn temperatures occurred mainly in the late 1990s, while those in average winter temperature occurred mainly in the late 1970s. (4) There was a 27-year main period and a 14-year sub-period in the changes of annual and seasonal temperature in north Xinjiang from 1961 to 2014, with global high-low temperature alternations.

Keywords

temperature variation; regional difference; abrupt change; wavelet analysis; north Xinjiang

References

[9] Liu Bo, Feng Jinming, Ma Zhuguo, et al. Characteristics of climate changes in Xinjiang from 1960 to 2005[J]. Climatic & Environmental Research, 2009,

14(4): 414-426.

[10] Yin Jianhong, Xu Yuyang. Analysis of precipitation in Northern Xinjiang during 1953–2008[J]. Journal of Water Resources & Water Engineering, 2010, 21(4): 130-134.

[12] Zhang Jiabao, Shi Yuguang. Study on Climate Change and Short-term Climate Prediction in Xinjiang[M]. Beijing: China Meteorological Press, 2002.

[19] Wei Fengying. Modern Technology of Statistics, Diagnosis and Forecast for Climate[M]. Beijing: China Meteorological Press, 2007: 42-113.

[20] Shen Wei. Trend analysis of precipitation in Northern Xinjiang during 1953–2008[J]. Journal of Water Resources & Water Engineering, 2010, 21(4): 130-134.

[21] Li Jinglin, Zhang Shanqing, Pu Zongchao, et al. Spatiotemporal variation of seasonal and annual air temperature in Xinjiang during 1961–2010[J]. Arid Land Geography, 2013, 36(2): 228-237.

[22] Peng Yunfeng, Xie Yifang, et al. Long-term trend of temperature, precipitation and relative humidity in the Northern and Southern regions of Xinjiang from 1955 to 2012[J]. Research of Soil and Water Conservation, 2015, 22(2): 270-277.

[25] Zhang Yanwei, Ge Quansheng, Jiang Fengqing, et al. Evolution characteristics of extreme high and low temperature events in the Qinling Mountains[J]. Scientia Geographica Sinica, 2016, 36(2): 296-302.

[26] Liu Changming, Zhang Dan. Temporal and spatial change analysis of the sensitivity of potential evapotranspiration to meteorological influencing factors in China[J]. Acta Geographica Sinica, 2011, 66(5): 579-588.

[28] Guo Chunxia, Li Zhongkui, Zhu Yunqiang, et al. Application of local regression kriging in mean annual air temperature estimation[J]. Journal of Capital Normal University (Natural Science Edition), 2016, 37(6): 85-92.

[29] Hu Yicheng, Yao Zuoxin, Qin Rongmao, et al. Study on spatial interpolation of mean temperature based on KBSI model in Xinjiang[J]. Desert and Oasis Meteorology, 2016, 10(3): 66-71.

[30] Ding Yihui, Zhang Jin, Xu Ying, et al. Evolution and Forecast of Climatic System[M]. Beijing: China Meteorological Press, 2003: 51-64.

Note: Figure translations are in progress. See original paper for figures.