Variation Characteristics of Aridity Index in the Ebinur Lake Oasis, Xinjiang: Postprint

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Abstract

Based on monthly climate data from four meteorological stations in the Ebinur Lake Oasis for the period 1960–2013, the aridity index was calculated. The results indicate: 1) The mean aridity index in the Ebinur Lake Oasis over the past 54 a is 6.97, classifying the region as arid. The aridity index exhibits a significant decreasing trend with strong persistence, at a rate of approximately $0.49 \cdot (10a)\text{-}1$ ($P<0.05$). The aridity index reaches its maximum in summer at 9.04 and its minimum in winter at only 2.20. 2) The annual aridity index in the Ebinur Lake Oasis underwent an abrupt decrease in 1985. The years when abrupt decreases occurred in summer and winter were 1991 and 1983, respectively, while no abrupt change points exist in spring and autumn. 3) The evolution of the aridity index in the Ebinur Lake Oasis shows periodic variations of 7–8 a and 20–21 a. The primary period of variation is 9 a, while the second and third periods are 21 a and 5 a, respectively. 4) The aridity index is most sensitive to changes in wind speed and has the highest relative contribution rate, while it is least sensitive to changes in sunshine duration.

Full Text

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Abstract

This paper calculates the annual and seasonal aridity index values for the Ebinur Lake Oasis in Xinjiang, China, based on measured monthly precipitation, wind speed, relative humidity, and radiation data from four meteorological stations in the oasis during the period from 1960 to 2013. Linear fitting, Mann-Kendall mutation test, wavelet analysis, and climate sensitivity coefficient test were employed. The results are as follows: (1) The average aridity index of the Ebinur Lake Oasis was 6.97 over the recent 54 years, indicating that the study area can be categorized as an arid region. The aridity index showed a significant decreasing trend at an average rate of $0.49 \cdot (10a)^{1}$ ($P < 0.05$). The average aridity index in summer was as high as 9.04, while its minimum value in winter was only 2.20. (2) The annual aridity index in the Ebinur Lake Oasis decreased sharply in 1985. Seasonally, the sharp decrease of aridity index in summer and winter occurred in 1991 and 1983, respectively; however, there was no mutation of aridity index in spring and autumn. (3) There were 7–8-year and 20–21-year periodic variations of aridity index in the Ebinur Lake Oasis over the recent 54 years. The first principal period of aridity index variation was 9 years, and the second and third periodic changes were 21 years and 5 years, respectively. (4) The aridity index in the Ebinur Lake Oasis was most sensitive to changes in wind speed; the contribution of wind speed change to the variation of aridity index was the highest, and the aridity index was not sensitive to changes in sunshine duration.

Keywords: oasis; aridity index; climate change; sensitivity coefficient; Ebinur Lake; Xinjiang

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