

An investigation of Afro-Eurasia precipitation anomalies in relation to climate change

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Abstract

Changes in precipitation will be one of the most critical factors determining the overall impact of climate change. Spatial-temporal variations in rainfall affected runoff, soil moisture, and underground water reserves. The analysis of precipitation trend is important in climate-change studies for planning and effective water resource management. In this study, long-term annual and seasonal trends of Precipitation were identified for region 15° W to 135° E over period of 1982-2016 Using CHIRPS precipitation data. The statistical significance of trends is assessed by the Mann-Kendall test. Our target in this research is to investigate the trend of precipitation and to know how it changes during the study period.

Introduction

Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems. Evidence of observed climate change impacts is strongest and most comprehensive for natural systems. In many regions, changing precipitation or melting snow and ice are altering hydrological systems, affecting water resources in terms of quantity and quality. Changes in precipitation will not be uniform. The high latitudes and the equatorial Pacific are likely to experience an increase in annual mean precipitation under the RCP8.5 scenario. In many mid-latitude and subtropical dry regions, mean precipitation will likely decrease, while in many mid-latitude wet regions, mean precipitation will likely increase under the RCP8.5 scenario[1, 2] Space and time variability analysis of regional precipitation is crucial for water resource management, at a regional level, and for numerous environmental and socio-economic systems, particularly for the agricultural sector. The variability of the precipitation field depends on

many factors, including the thermodynamic structure of the atmosphere, the orography and the interaction with the large-scale atmospheric circulation[3]. Kampata et al (2008), Chaouche et al (2010) and Xu, et al (2010) are some examples of the researchers who have investigated precipitation trends in different areas [4-6]. Therefore, our target in this research is to investigate the trend of precipitation and to know how it changes during the period.

Material and methods

To study the long-term annual and seasonal trends of precipitation and determine the anomalies in the Afro-Eurasia region, daily mean precipitation data were obtained from the CHIRPS¹ reanalysis archive[7]. All fields have a spatial resolution of 0.5° latitude × 0.5° longitude. A trend is a significant change over time exhibited by a random variable, detectable by statistical parametric and non-parametric procedures

Mann-Kendall test for trend

Mann-Kendall test is a statistical test widely used in analysis of trend in climatological time series. There are two advantages of using this test. First, it is a nonparametric test and does not require the data to be normally distributed. Second, the test has low sensitivity to abrupt breaks due to inhomogeneous time series. According to this test, the null hypothesis H_0 assumes that there is no trend (the data is independent and randomly ordered) and this is tested against the alternative hypothesis H_1 , which assumes that there is a trend. Mann-Kendall test is a nonparametric test for identifying trends in time-series data. This test assumes that there exist only one data values for a time period. When multiple data points exist for a single time period, the median value will be used.

¹ Climate Hazards Group InfraRed Precipitation with Station data