Trend Analysis of Annual and Summer Rainfall of Golestan Province

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Abstract

Rainfall, as the most important climatic element is the most variable element and has a variety of area and time difference in different spatial-time scales. Due to the important role of precipitation in the determining physical and geographical characteristics of a region, it has a significant importance in natural sciences. Considering the location of Iran in arid and semiarid regions of the world, changes in rainfall amounts in water resources management issues makes it even much more important. This study was conducted to examine the annual and summer rainfall trends using 9 rain gauge stations data in Golestan province and in a 41-year period (1971-2011). The non-parametric Mann-Kendall was tested in seasonal and annual time scales. Using statistical distributions, the days with heavy and widespread summer rainfall were selected and studied. According to the results, in the 41-year period, annual rainfall in most stations showed no descending or ascending trends (i.e., static) but in Bahlake Dashli station ascending trend was observed. Descending trend in summer rainfall amounts in most stations was observed while the number of days with heavy summer rainfall was increasing. Using data geopotential levels of 500 and 850 hPa, omega 500 hPa, the average long-term geopotential 500 hPa and anomaly data from NOAA, synoptic patterns of the region of 41-year (2011-1970) and in the days with heavy and widespread rainfall were studied and compared. The results showed that the North East region of Iran, due to the changes in pressure patterns had experienced more changes than other parts of the country and July had the greatest changes in summer months. These changes lead to changes in rainfall amounts and increasing the number of days with heavy rainfalls

Keywords: Mann–Kendall, Golestan, Statistical Distribution, Precipitation trend.

Introduction

Rainfall, as the most important climatic element is the most variable element and has a variety of area and time difference in different spatial-time scales. Due to the important role of precipitation in the determining physical and geographical characteristics of a region, the element has a significant importance in natural sciences. Considering the location of Iran in arid and semiarid regions of the world, changes in rainfall amounts in water resources management issues makes it even much more important.

Data and Methodology

Regarding the increase in the frequency of recent flash floods in Golestan province, this study is conducted to examine the annual and summer rainfall trends. Using 9 rain gauge stations data in a 41-year period (1971-2011) and the non-parametric Mann-Kendall test in seasonal and annual time scales, the trends of precipitation are determined. Using statistical distributions, the days with heavy and widespread summer rainfall were selected and studied. In final step using geopotential maps of levels of 500 and 850 hPa, omega 500 hPa, the average long-term geopotential 500 hPa and anomaly data from NOAA, synoptic patterns of the region of 41-year (2011-1970) and in the days with heavy and widespread rainfall were studied and compared.

Results and Conclusion

According to the results, in the 41-year period, annual rainfall in most stations showed no descending or ascending trends (static) but in Bahlake-Dashli station ascending trend is observed. Descending trend in summer rainfall amounts in most stations is observed while number of days with heavy summer rainfall is increasing.

Studying the synoptic patterns showed that the North East region of Iran, due to the changes in pressure patterns had experienced more changes than other parts of the country. In addition, July had the greatest changes amount in comparison to other summer months. These changes lead to changes in rainfall amounts and increasing the number of days with heavy rainfalls .