Synoptic Analysis of Khorasan Razavi Droughts

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Introduction

Drought is one of the climate risks that has made Iran to be one of the 10 countries subject to drought. Scientific knowledge about this phenomenon is necessary in order to plan, manage and confront with problems resulting from drought. Considering the spatial extent and climate variability of Iran, all climates of this country are prone to drought. Due to the fact that Khorasan Razavi province is located in dry and half-dry climate region, and due to frequent droughts in recent years, as well as the dire condition of water resources, this province has been chosen as the studied region.

Precipitation less than average annual precipitation and unequal distribution of rainfall in a region is called drought. This natural phenomena roots in inherent variability of climate system and general cycle of weather. Extent and frequency of drought during the time shows distinct patterns , to recognise these patterns is the purpose of this paper.

Material and Methods

The objective of this study is to identify synoptic patterns of occurrence of drought in Khorasan Razavi province. For this reason, from all of the synoptic aerology stations in this province, 10 stations from those which had enough statistical data were chosen and for the sake of performing this research, statistical data of precipitation for 9 months of a year up to 2007 has been studied. In order to have statistical analysis of data, we used Excel, SPSS software and SPI index, Also for drawing maps we utilized GIS, Surfer and Grads software.

In this study for identifying droughts ,SPI index in a three dry specified months-period was used. Among dry months , pervasive drought in the region 17 drought phenomena was identified in Khorasn razavi.

In order to identify synoptical patterns that leads to drought and to reach these patterns for each dry month in different years data of 17 months of high level of geo-potential meter of earth surface and voracity of this period was extracted from NCEP/NCAR site. For recognising and making Matrix ,the area between degree of 10 to 70 northern latitude and degree of -10 to 80 eastern longitude was studied.

This matrix consists of 925 cells that for the sake of reducing and coherence of the data, and also for identifying causes of drought, we used principal component analysis. Therefore, for the sake of categorising atmospheric circulation patterns, we got use of S array. Results showed that

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5 principal components were covering more than 95 percent of the variance. The first element includes 44 percent of the variance.

Table 1: Distribution of total variance and non total variance factors.

Elements	Variance	Total Variance
1	44/426	44/426
2	24/186	68/612
3	10/037	78/648
4	9/910	88/559
5	6/730	95/288

Results and Discussion

Considering the spatial extent and climate variability of Iran, all climates of this country are prone to drought. Widespread droughts are controlled by four pressure patterns in Khorasan razavi. These main centers which have been identified are as the following: high pressure Subtropical, hood on the Mediterranean Sea, Siberian High-Pressure, North Ridge of the Caspian Sea.

Whenever High pressure of subtropical increases especially in cold period of the year, North Atlantic Oscillation (NAO) will occur in positive phase and this high pressure will be stretching towards upper orbit of 38. Due to the fact that it encompasses Iran territories such as Khorasan razavi, mild winter with a Trolley weather which creates Virulence air flow in Khorasan Razavi, provides drought in this region.

Findings of this study showed that high-pressure behaviour of subtropical, no formation of west winds' hood on the Mediterranean Sea, as well as formation of Polar Front in Upward circuit has led to air stability and no transfer of humidity to the studied region and has provided suitable conditions for drought to occur in mentioned months. This study can be used to identify atmospheric circulation patterns and to forecast those patterns that help face this climatic event (drought) in a better way.

Conclusion

The findings of this research indicated that western wind manner and (North Atlantic Oscillation) NAO performance, no formation of Mediterranean hood and also formation of polar front in high latitude have caused no transportation of humidity and weather stability in study area. When in cold period of the year high pressure Subtropical advances, it increases the temperature of the normal and enhances the humidity capacity to which finally may lead to drought due to decrease in humidity.

Key Words :droughts, Khorasan Razavi ,precipitation, atmospheric patterns, main components analysis.

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