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Extended Abstract

Analysis of the Probability Distribution for the Annual Precipitation in the Golestan Province

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Introduction

Some characters of the time series probability distribution are described by the shape and the scale parameters. These parameters show the skewness and the kurtosis of the probability distribution. Suitable fitting of the probability distribution on the climatic elements, e.g. precipitation, can estimate the related scale and shape parameters.

Objectives

Probability distributions of precipitation have been studied by many experts. Ben-Gai et al. (1998) depicted the spatial pattern of the probability distribution pattern in the occupied land based on the shape and the scale parameters of Gamma distribution. Aksoy (2000) used two parametric Gamma distributions in hydrological analysis. Husak et al (2004) fitted Gamma distribution on monthly precipitation to analyse African droughts. Suhaila and Jemain (2007) used exponential distribution for daily precipitation of Penin Sular Malaysia.

The main objective of this study is the spatial analysis of the probability distribution of the annual precipitation and their shape and scale parameters. Different probability distributions are compared in this paper to fit Golestan province's precipitation.

Data

In this study, 51 stations have been selected to represent the best possible coverage of the Golestan province. The rainfall data from the national Meteorological Organization and the Ministry of Energy are used. The stations were selected based on the data quality and the period of the records which varied between 17 and 43 years.

Methodology

Most of the statistical distributions contain two parameters called the scale and the shape parameter. These can show symmetrical and disparity of the data distribution.

Fitting a theoretical distribution to the rainfall totals makes it easy to estimate the frequency of the rainfall amounts. In this paper the total monthly average of the precipitation is used for probability distribution analyses. The results have then been generalized for the annual scale. All possible statistical distributions have been fitted to the monthly data from all stations and the fitting goodness has been tested. The best fitted has been chosen to find the probability distribution parameters. Finally the geostatic methods were used to project the results on the map.

Results and Discussion

Spatial factors such as elevation (h), latitude (φ), and longitude (λ) are highly associated with the spatial variation of precipitation (R). The following equation can explain this relationship:

$$R=7133.401+35.088\,\lambda-526.026\,\varphi-0.069h \qquad (1)$$

During the dry season (April to September), the exponential and half normal distribution is fitted to precipitation while during the wet months (October to

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March) Gamma distribution is the best fit. The spatial distribution of the shape and the scale produced gyrostatically is presented in figure 1.

This figure shows random spatial distribution of the shape parameter while the scale parameter follows a trend. It is less in the northern part and increases toward the southern part of the province. Based on these parameters the 25 and 75 percentiles used as the drought and the wet indices, indicate that during the extreme events of precipitation, spatial variation becomes bigger.

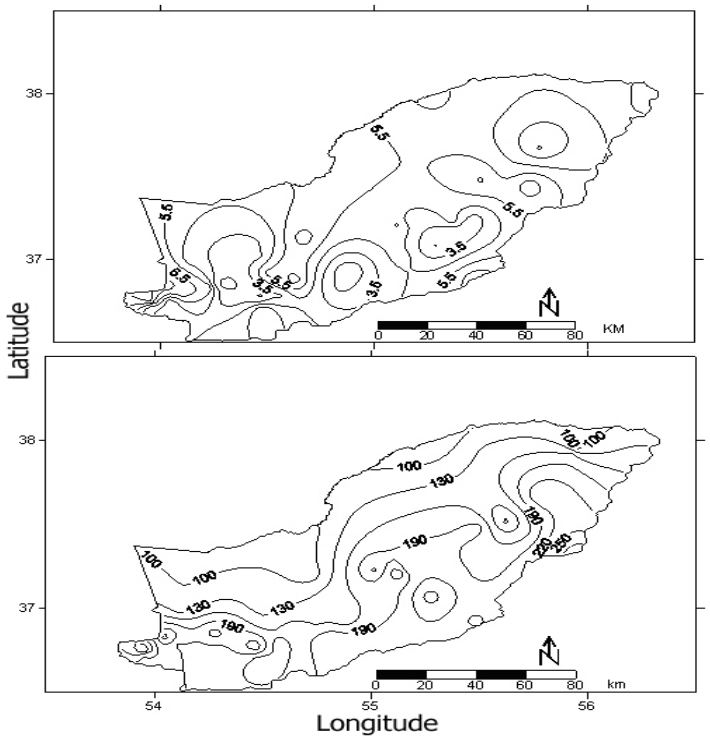

Figure 1: Spatial distribution of the shape (above) and the scale (below) parameter for the Golestan province

Conclusion

Golestan province experiences it's lowest and highest amount of precipitation in the northern and southern mountainous parts, respectively. Elevation is the most important factor in the spatial variation of precipitation.

The shape parameter shows that in the regions with high precipitation, skewness is smaller. The precipitation in such regions is thus mostly regular and moderate. In dry regions the precipitation tends to be irregular and intense.
The scale parameter also increases by the precipitation amount. In other words, areas with more frequent precipitation events experience elevated values in precipitation. The extreme events in precipitation are more probable in the south of the province.

***Keywords*:** Scale Parameter, Shape Parameter, Probability Distribution, Precipitation, Golestan Province

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