VARIATIONS OF MONSOON RAINFALL IN FLOOD YEARS OVER INDIA DURING 1940-90

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Abstract

Daily precipitation data of the monsoon season during (1940-90) is presented. A test of significance at 5% level was carried out using Student 't' distribution. Stations, qualifying the significance test are considered here. As observed, flood occurs mainly due to the tropical disturbances, like monsoon depressions, cyclonic storms, low pressure systems (monsoon lows) passing from the neighboring seas i.e. Bay of Bengal and Arabian seas. Empirical Orthogonal Analysis (EOF) analysis was used to find out the nature of rainfall distribution patterns in flood years. This technique thus identifies the spatial and temporal patterns characteristics of possible physical significance.

1.Introduction

A detailed statistical analysis of the monsoon rainfall (1940-90) has been carried out in the present study. Mooley and Parthasarthy (1984) and Parthasarathy et al., (1987) have prepared the series for the period (1871-1988) from 306 well-distributed stations. In the study carried out by Parthasarathy et al., (1987), the criteria for identification of flood over subdivision was adopted as the percentage of rainfall departure from normal value. Parthasarathy et.al. (1990) have used the rainfall data set for the period 1951-80 (June to September) to understand the circulation parameters. Bhalme and Mooley (1980) used monthly mean percentage departure rainfall data for the period (1891-1975). Ramaswamy (1987) has shown various meteorological aspects, which cause flood situations in the country, while Sikka (2000) has shown different aspects responsible for floods year situations in the country.

2. Rainfall Data

Daily precipitation data (in cms.) of the monsoon season (June to September) for the period 1940 to 1990 from 68 Indian stations is considered in this study. Only those stations, with no missing data on a daily basis have been used. This data has been taken from the India Meteorological Department (I.M.D.) Pune, India.

3. Data Analysis and Computing Procedure

In the present study, the data of 68 stations spread over a period of 51 years (1940-1990) has been used. This study has been extended into flood years of Monsoon rainfall over India. Following Parthasarthy et. al., (1988) Flood year has been defined as ($\bar{R}$+S), where $\bar{R}$ is the seasonal mean rainfall of 51 years period of the country as a whole and S is the standard deviation. It is noticed that 11-year period falls into the category of flood years respectively.

11 flood years existed over India. Further correlation of seasonal rainfall for each year with the rainfall for each of the sixty-eight stations was calculated. The correlation of individual station rainfall with all India seasonal rainfall is carried out to identity the homogeneity associated with the nature of rainfall activity of individual stations, along with the rainfall character of all India seasonal rainfall. Empirical Orthogonal Function (EOF) is used to describe the characteristics of the meteorological data of certain synoptic climatologically events.

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4. Results and Discussions

The rainfall distribution data has been analysed for only four typical flood years i.e. 1970,1973, 1975, 1983. It has been observed that significant variations occur in the rainfall amount over regions covering Orissa and North East Madhya Pradesh. Additionally, during the flood years, isohyets of 120 cms. encompass a large area over North-East Madhya Pradesh and adjoining Orissa regions. It has been found that the average number of low-pressure system / low-pressure system days during flood years are 18.73 and 4.64 respectively. This could be due to large numbers of low-pressure area/systems, depressions, which form in the Bay and across Orissa coast and move across Northeast Madhya Pradesh. Therefore, it is felt that large numbers of low pressure areas or depression forming over the Bay and moving inlands during South west monsoon season are responsible for the flood like situation in the country.

The first principal component concerning the flood years for significantly correlated stations explains 46% of the variance. It is noticed that most parts of the country are dominated by a positive value of the first component and the maximum positive values are concentrated over North West India and also over North East Madhya Pradesh, Bengal & Orissa.

5. Conclusions

Important findings of the present study revolve around a deeper understanding of the Indian Monsoon from several key considerations. Like, the controlling factor of the variability of the summer monsoon rainfall appears to be depression/low pressure area in the Bay of Bengal. These explanations seem to be important, due to a great deal of both climatic and geographical variability. No less important is the inference drawn from the EOF analysis that in the flood years of the monsoon rainfall, some typical synoptic patterns such as monsoon depressions/low occurs, but lows play a more important role as compared to the monsoon depression.

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