REGIONAL VARIATIONS IN THE SEASONALITY OF PRECIPITATION IN BANGLADESH

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Markham's vector method, by which the theme of precipitation seasonality in Bangladesh has been investigated in this paper, makes possible a direct comparison of seasonality at various places. It also helps in the description of the climate of a place and has some value in defining climatic change. The seasonality index obtained by this method and the degree of seasonality are directly correlated, higher value indicating greater seasonality. The period of seasonal concentration is indicated by the direction of the vector resultant. The results of the analysis show that there is a gradual increase in seasonality of precipitation from the northeast of Bangladesh, where it is the lowest, towards the northwest, the southwest and the southeast. Clearly, the number of rainy months (i.e., those having at least 1/12 of the mean annual rainfall) decreases in these directions. The eastern part of Northeast Bangladesh belongs to June-July rainfall regime, whereas, Northwest Bangladesh belongs to the July-August regime and the rest of the country is markedly dominated by the July regime.

INTRODUCTION

The term 'Seasonality of Precipitation' refers to the tendency for a place to have more rainfall in certain months than in others. As it is natural for a monsoon land like Bangladesh to possess the characteristic of pronounced seasonality of precipitation, it appears worthwhile to analyse this aspect of its precipitation climatology. The conventional method used for this purpose is the bar graph representing the mean monthly rainfall data of a place by separate bars. Although this cartographic technique does provide a most convenient way of comparing the rainfall data of the twelve months of a year and, thus, of assessing precipitation seasonality of a place, it does not permit any direct comparison of seasonality at various places.

Markham (1970) has developed a quantitative technique for measuring precipitation seasonality—a technique which is based on the concept of vector in modern algebra. The vector analysis suggested by him provides an index of seasonality for every place, thus making possible a direct comparison of seasonality at various places. Moreover, the index helps in the description of the climate of a region or place and has some value in defining climatic change, since "changes in seasonal distribution of precipitation are probably as important as changes in absolute amount (Markham 1970). The aim of the present author in this paper is to apply Markham's technique in the context of Bangladesh.

METHOD OF ANALYSIS

Monthly rainfall of a place can be represented by a vector, the amount of rainfall being the magnitude and the time of its occurrence being the direction of the vec-

tor. Markham's vector method of calculating the Index of Seasonality of Precipitation at a place adopts the following procedure : concentric circles are drawn to scale to represent the amount of rainfall; the circles are proportionately divided into 12 sectors representing the twelve months of a year; the mean monthly rainfall data of a place are plotted in the respective sectors as twelve monthly vectors; these are, then, added vectorially in order to obtain what is described as the Vector Resultant of the place. The length of the Vector Resultant is converted in terms of the amount of rainfall for the purpose of being used in the following formula which gives the Index of Seasonality of Precipitation:

$$ISP = VR \times 100/AR$$

where ISP is the Index of Seasonality of Precipitation, VR is the Vector Resultant converted in terms of the amount of rainfall and AR is the Mean Annual Rainfall.

The Index of Seasonality is thus obtained in percentage and its value ranges from 0 to 100. The value 0 indicates that the seasonal distribution of rainfall of the place concerned is uniform, i.e., all the months have equal rainfall during a year, whereas the value 100 indicates that all rainfall during a year occurs in one single month. The index and the degree of seasonality are directly correlated, higher value indicating greater seasonality. The period of seasonal concentration is indicated by the direction of the Vector Resultant.

Results of Analysis

The rainfall normals (India Met. Dept. 1953) based on observations extending over twenty to seventy years have been used in the calculation of the indices of seasonality of precipitation for the observatories in Bangladesh. The results thus obtained are presented in Table I.

Table I

Observatories	Indices of Seasonality of Precipitation (in per cent)	Directions of Vector Resultants indicating Rainfall Regimes (in degrees)
Barisal	59.73	198 (July)
Bogra	62.18	200 (July)
Brahmanbaria	52.97	185 (June-July)
Chittagong	61.34	200 (July)
Comilla	58.32	190 (July)
Cox's Bazar	69.95	197 (July)
Dinajpur	66.84	204 (July-August)
Faridpur	56.34	190 (July)
Jessore	57.29	194 (July)
Khulna	60.43	193 (July)
Mymensingh	57.99	193 (July)
Narayanganj	56.91	189 (July)
Noakhali	63.04	201 (July)
Pabna	59.43	195 (July)
Satkhira	60.46	195 (July)
Srimangal	53.37	182 (June-July)

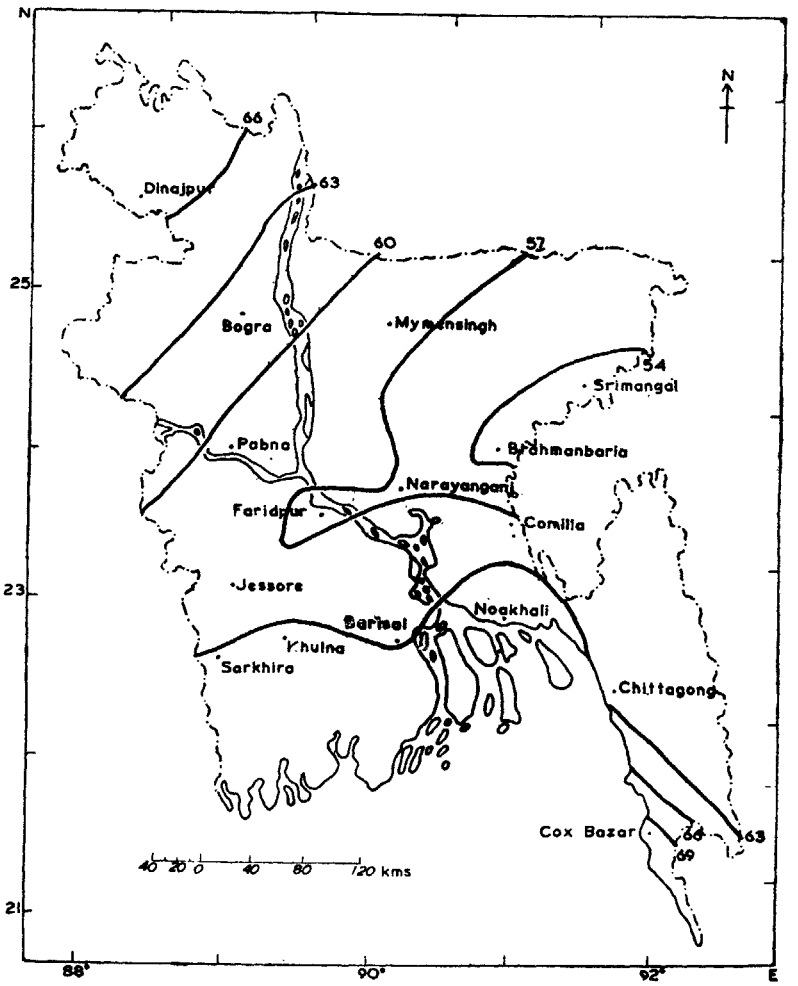

FIG. 1. Regional pattern of precipitation seasonality.

Table I contains data regarding the degree (col. 2) and the period (col. 3) of seasonal concentration of precipitation. The data in col. 2 above have been cartographically analysed in Fig. 1 which brings out clearly the pattern of the spatial variation in precipitation seasonality in Bangladesh. The lowest seasonality occurs in the northeast, from where there is a gradual increase in seasonality towards the northwest, the southwest and the southeast. Clearly, the number of rainy months (i.e., those having at least 1/12 of the mean annual rainfall) decreases in these directions. As evidenced from the spacing of isopleths showing the precipitation seasonality (Fig. 1), the rate of change in seasonality is steepest in the southeast, specially in Chittagong and Chittagong Hill Tracts, whereas it is moderate in the northwest (Rajshahi, Dinajpur, Bogra, Rangpur and parts of Pabna and Nasirabad-Quaidabad districts) and gentle in rest of the country. The frequencies of the indices of seasonality of precipitation have been plotted in Fig. 2, which demonstrates that 6 out of 16 weather stations have frequencies of seasonality from 58 to 62 per cent.

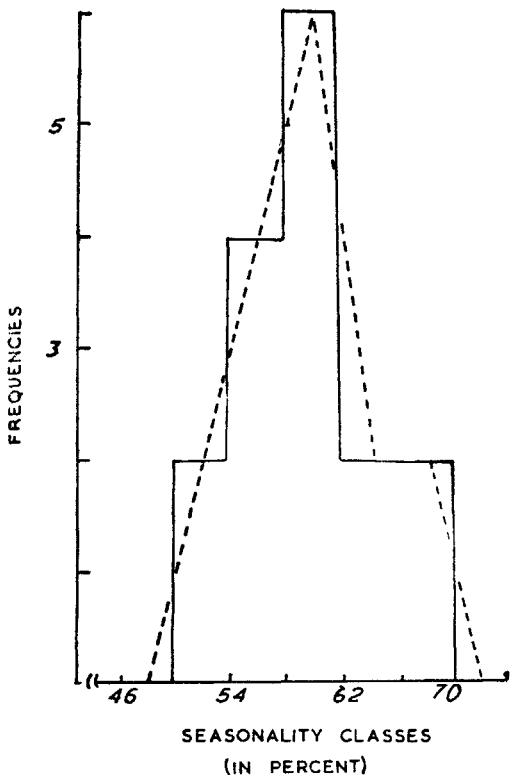

FIG. 2. Frequency polygon and histogram showing frequency distribution of Precipitation Seasonality Index.

The rainfall regimes, "include a sector of 45° or 1/8 of a year and thus overlap about a week in adjacent months" (Markham, 1970). The Vector Resultant of a weather station falling between 172° and 187°, thus, shows that the station belongs to the June–July regime, whereas those falling between 187° and 202°, and 202° and 217° belong to July and July–August regimes respectively. The whole of Bangladesh on this basis has these three rainfall regimes. The easternpart of Northeast Bangladesh (parts of Sylhet, Dacca, Comilla and Nasirabad-Quaidabad districts) are dominated by the June–July regime of rainfall, whereas Northwest Bangladesh (Dinajpur and parts of Rangpur and Rajshahi districts) belongs to the rainfall regime of July–August. In the remaining parts of the country, the precipitation seasonality markedly occurs in July.

Two types of rainfall incidence are distinguished in Bangladesh on the basis of the occurrence of rainy months (Johnson 1969). Barring the northeastern part of the country, Bangladesh belongs to the Bengal Type of Rainfall Incidence, characterised by substantial rains beginning early and the rainy season extending from May to September. On the other hand, Northeast Bangladesh belongs to the Assam Type of Rainfall Incidence, characterised by still earlier rains and a longer rainy season of 6 months from April to September. The rainfall occuring during April and May

is caused by pre-monsoon thunderstorms, whereas that occuring during June-September is due to the southwest monsoon.

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REFERENCES

Markham, Charles, G. (1970). Seasonality of precipitation in the United States. *Ann. Assoc. Am. Geographers*, **60**, 3.

India Met. Dept. (1953). *Climatological Tables of Observatories in India.*

Johnson, B.L.C.(1969). *South Asia.* Heinemann Educational Books Ltd., London, pp. 23–24.