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### TYPICAL CONFIGURATIONS OF MONSOON TROUGH AT 850 MB AND ASSOCIATED RAINFALL PATTERNS

1. It is well-known that the distribution of the rainfall over the central and north India is closely linked with the position of the monsoon trough. A more southerly position of the monsoon trough gives good rainfall activity over the central parts of the country and the north Peninsula while a northerly position of the trough leads to 'break' in the monsoon. A quantitative estimate of the rainfall *vis-a-vis* the orientation of the monsoon trough has not been made so far.

The daily mean rainfall values have been computed for  $2\frac{1}{2}^\circ$  latitude and longitude grids over India north of Lat.  $20^\circ\text{N}$  and the remaining parts of Maharashtra for the month of July for a 5-year period in the near past (1969 and 1972 to 1975) and plotted over the 850 mb chart corresponding to 00 GMT of the previous day. Thiruvengadathan (1964), in his study of the spells of strong and weak monsoon over Konkan finds that the association between rainfall and monsoon trough is most marked at the latter's position at 700 mb. Since there was some ambiguity in fixing the position of the monsoon trough at 700 mb due to paucity of upper wind data mostly, pibal at that level, the authors had to study the rainfall pattern in relation to the axis of the monsoon trough at 850 mb.

2. Charts pertaining to a few typical positions of the monsoon trough have been grouped together. For each group, the mean vectorial winds for all upper wind stations and the mean rainfall for  $2\frac{1}{2}^\circ$  grid squares have been computed. These are shown in Fig. 1. The positions of the trough are also marked. Fig. 2 shows the rainfall as percentage of normal. Regions having scanty rainfall, *i.e.*, 40 per cent or less of normal rainfall are left blank, regions with deficient rainfall, *i.e.*, actual rainfall between 40 and 80 per cent of normal have been dotted, areas of normal rainfall (80 to 120 per cent of normal) are hatched and regions of above normal rainfall (*i.e.*, more than 120 per cent of normal) are double hatched.

Figs. 1(a) and 2(a) give the rainfall pattern when the monsoon trough is very much to the south of its normal position. Heavy rainfall occurs near and to the south of the trough. There is very little rainfall to the north of  $25^\circ\text{N}$  with scanty rainfall between  $75^\circ$  and  $90^\circ\text{E}$ . Small cyclonic circulations may be embedded in the monsoon trough. The daily charts show very heavy rain in the southwest sector of these circulations.

Another typical pattern during the monsoon is a cyclonic circulation over the north Bay with a trough running nearly along  $88^\circ\text{E}$  (Figs. 1b and 2b.) Very heavy rains occur to the west of the centre of the circulation and extend to about 500 km. The rainfall, however, falls rapidly further west and is scanty west of  $80^\circ\text{E}$ .

When the monsoon trough lies close to the foot of the Himalayas, the rainfall amounts over the central parts of the country and north Peninsula decrease considerably. It is generally believed that on such occasions, rainfall is heavy along the Himalayas. This does not occur always.

Figs. 1(c) and 2(c) show the mean rainfall patterns when the monsoon trough is close to the hills and the rainfall activity is poor over most parts of the country including the regions near the Himalayas. Weather is dry over large parts of the country. The rainfall is normal over Assam and deficient in West Bengal and adjoining areas along the western Himalayas and the Konkan and scanty or nil over the rest of the country.

Figs. 1(d) and 2(d) show the mean rainfall patterns when the axis of the trough runs close to the hills with good rainfall activity along the Himalayas. The Himalayas and regions close to them get excess of rain while the remaining parts of northeast India, Uttar Pradesh, Punjab and Haryana get nearly normal rain. It may be seen that the rainfall amounts are considerably higher to the east of  $75^\circ\text{E}$  in Fig. 2(d) as compared to Fig. 2(c).

An examination of the charts for the individual days coming under the group shows that the rainfall is not heavy all along the hills. Heavy rain with 'break' monsoon conditions generally occurs in association with the passage of westerly troughs along the Himalayas. Depending upon the position of the trough, the western, central or eastern Himalayas gets heavy rains. Since, however, westerly troughs occur in quick succession during 'breaks', we may find, at times, rainfall both along the western and the eastern Himalayas though they are due to two different systems.

3. The following conclusions can be drawn from the study :

- (i) Moderate to heavy rainfall occurs generally around the axis of the monsoon trough.
- (ii) When the monsoon trough is much to the south of the normal position, the regions to the north of  $25^\circ\text{N}$  get very little rain. Very heavy rain in the southwest sector

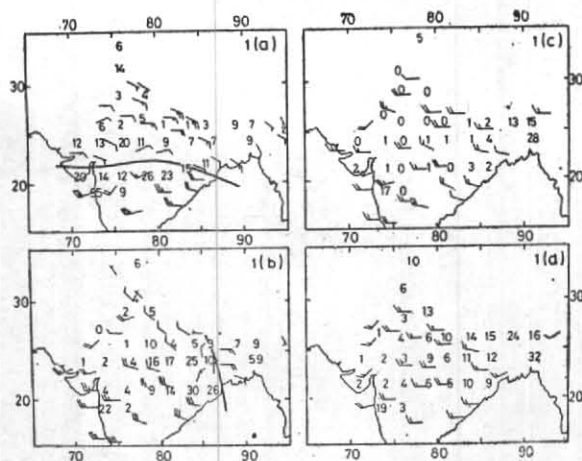


Fig. 1. Rainfall pattern (actual amount in cm) associated with various positions of monsoon trough

is associated with depressions, lows or upper air cyclonic circulations.

- (iii) With a cyclonic circulation over the north Bay and the axis along about  $88^{\circ}\text{E}$ , heavy rain occurs for about 500 km to the west of the centre of the circulation. The rainfall decreases rapidly westwards and becomes scanty west of about  $80^{\circ}\text{E}$ .
- (iv) When the axis of the monsoon trough runs close to the hills, there is a considerable decrease in the rains over the central parts of the country. Heavy rainfall

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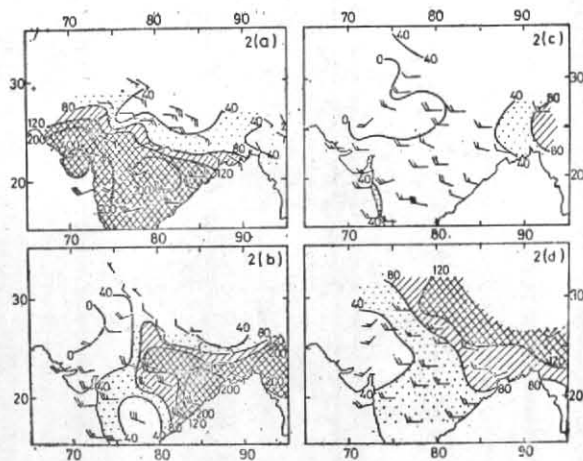


Fig. 2. Rainfall pattern (percentage of normal) associated with various positions of monsoon trough

occurs along the Himalayas in association with the passage of troughs in westerlies. They give moderate to good rainfall over Haryana, the plains of the Punjab and of Uttar Pradesh and in northeast India. In the absence of the troughs in westerlies, rainfall activity is poor even along the foot of the Himalayas.

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A. THIRUVENGADATHAN  
C. V. V. S. RAO\*  
S. S. IYER

#### REFERENCE