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RAINFALL IN RELATION TO LOWER AND UPPER TROPOSPHERIC WINDS AND TEMPERATURES OVER MADRAS DURING SOUTHWEST MONSOON SEASON

A study of the relation between the upper winds and temperatures over Madras at different standard isobaric levels and the rainfall recorded during the subsequent 24-hour period over the same place during the southwest monsoon period has been attempted in this note.

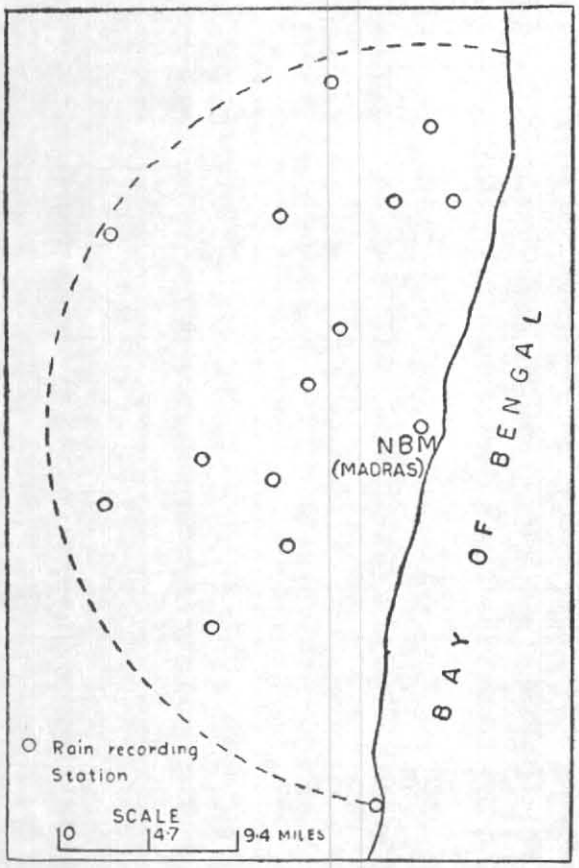

Fig. 1. Location of rain recording stations within a radius of 20 miles around Madras city

The rainfall figures reported by the 15 rain recording stations within a radius of 20 miles around Madras city during the monsoon months June—September for the year 1959—1963 have been utilised. The locations of these stations are shown in Fig. 1. The mean daily rainfall figures of the fifteen stations for each day during the above period were computed and these figures were taken to represent the mean rainfall over the area for that day. Daily values of the upper air temperatures and winds at the standard isobaric levels at 00Z for each day of the above period were also collected. The zonal component of the wind at each level was then computed.

Analysis and Discussion of data—The upper air parameters, *viz.*, the zonal components of upper winds and temperatures were tabulated against the 24 hours average rainfall ending 0830 IST of the following day for each standard isobaric level. The distributions of average rainfall in relation to the zonal components of upper winds at 10-kt class intervals for the standard isobaric levels 850-200 mb were worked out. These are given in Table 1. These are also shown graphically in Fig. 2 in which the average rainfall is plotted as ordinates and wind speed ranges as abscissae for each level. An examination of Table 1 and Fig. 2 brings out the following salient features—

(1) The rainfall increases if the low level westerlies decrease in strength,

(2) If easterlies prevail in the lower level, strengthening of these is associated with an increase in rainfall,

(3) Increase in the strength of high level easterlies is indicative of a decrease in the 24-hour rainfall.

The distributions of rainfall in relation to the upper air temperatures were also worked out as in the case of zonal winds. These are indicated in Table 2 and Fig. 3.

An examination of Table 2 and Fig. 3 reveals that—

An increase in temperature at 850-mb level above 20°C shows a decrease in the rainfall recorded during the subsequent 24 hours, whereas upto about 20° C fluctuations in temperature do not appear to have any significant effect on the rainfall. Similarly at 700-mb level upto about 12°C fluctuation in temperature cause no significant variation in the rainfall whereas it decreases with increase in temperature beyond this limit. The variations of temperatures at 500 mb and above do not appear to have any

TABLE 1

Average rainfall in relation to zonal wind components at various levels

Zonal component range (knots)	Average rainfall (cm) at pressure levels				
	850 mb	700 mb	500 mb	300 mb	200 mb
—41 to —50	1·3	1·3	—	—	—
—31 to —40	2·0	1·5	2·3	—	—
—21 to —30	4·1	3·5	3·7	—	—
—11 to —20	3·7	3·1	3·1	3·5	—
— 1 to —10	3·6	4·1	3·6	2·9	0
0 to 10	1·9	3·2	3·0	3·8	1·9
11 to 20	4·0	3·3	4·2	3·0	2·8
21 to 30	5·5	7·6	3·7	3·8	4·4
31 to 40	—	—	18·7	3·7	4·0
41 to 50	—	—	—	0·3	3·6
51 to 60	—	—	—	0·6	2·9
61 to 70	—	—	—	—	2·0
71 to 80	—	—	—	—	0

TABLE 2

Average rainfall in relation to variation in upper air temperatures

800 mb		700 mb		500 mb		300 mb		200 mb	
TT (°C) exceeding	Average rain (cm)	TT (°C) exceeding	Average rain (cm)	TT (°C) exceeding	Average rain (cm)	TT (°C) exceeding	Average rain (cm)	TT (°C) exceeding	Average rain (cm)
14	3·4	4	3·5	—14	3·4	—40	3·3	—70	3·3
16	3·3	6	3·5	—12	3·4	—38	3·3	—66	3·4
18	3·2	8	3·5	—10	3·5	—36	3·4	—62	3·4
20	3·1	10	3·3	—8	3·5	—34	3·1	—58	3·3
22	1·5	12	3·1	—6	3·3	—32	3·2	—54	3·2
24	0·5	14	0·9	—4	3·1	—30	3·1	—50	3·1
				—2	3·0	—28	2·3	—46	2·6

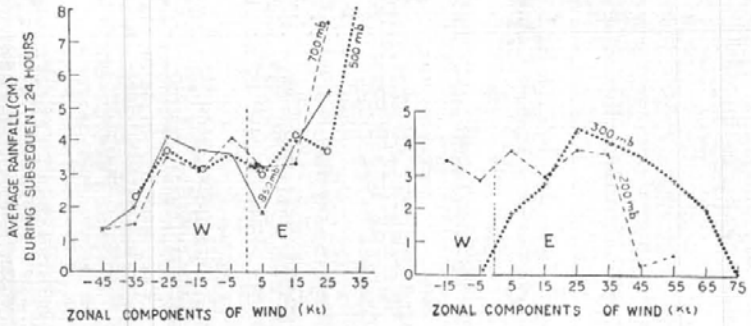

Fig. 2

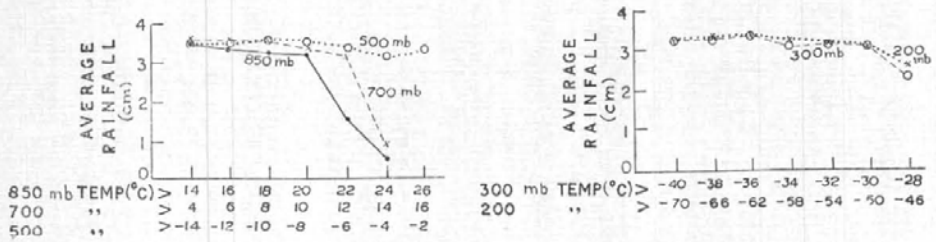

Fig. 3

significant effect on the subsequent 24-hour rainfall, showing thereby that the thermal structure of the atmosphere above the mid-troposphere does not have any effect on the rainfall recorded. In the lower troposphere, the decrease in rainfall noticed on occasions when there is an increase in temperature beyond certain critical values mentioned above may be due to warm air advection at these levels making the air layers thereby comparatively more stable.

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