

Some features of the Rainfall over a belt in the Madras State*

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(Received 28 February 1952)

ABSTRACT. A study is made of the post-monsoon rainfall over a belt of Madras State, where some Community Development Blocks are located, using the daily values of rainfall recorded during the years 1948 to 1957. The special features of the rainfall as regards spatial distribution and intensity are discussed.

1. Introduction

Experience gained during the last few years in the issue of weather warnings for Community Development Blocks has brought to the forefront difficulties of forecasting weather over small areas. Density of reporting observatory stations necessary for a proper appraisal of the occurrence of rainfall over selected localities has been worked out by Rai Sircar and Hariharan (1954) and Hariharan (1956). Density of reporting stations required is so high that it will be difficult to arrange for reporting from such a close network of stations. To issue weather forecasts for small areas like the Community Development Blocks with no observatory nearby, it will be found useful to have an idea of any special characteristics that exist in the rainfall distribution over the areas where such blocks are located. This study is about the rainfall of the post-monsoon season over a small belt in the Madras State where some Community Development Blocks are located.

2. The Belt

The belt selected for the study comprises the area bounded by lines joining (1) Madras and Vellore on the north, (2) Vellore, Kallakurchi and Tiruchirapally on the west, (3) Tiruchirapally and Nagapattinam on the south and (4) Nagapattinam, Cuddalore and

Madras on the east. At all the stations mentioned above, there are India Meteorological Department observatories. There are some Community Development Blocks in this belt, out of which six blocks having State rain-gauge located nearby have been selected for this study. These blocks are (1) Polur, (2) Tiruvannamalai, (3) Panrutti, (4) Kurinjipadi, (5) Chidambaram and (6) Shyali. Locations of the six India Meteorological Department observatories and the six State rain-gauges are shown in Fig. 1. The Community Development Blocks of Polur and Tiruvannamalai are comparatively in the interior, while Shyali and Chidambaram are near the coast. Panrutti and Kurinjipadi are a little away from the coast.

The belt under study consists mostly of flat land. On the western edge of the belt, there are three ranges of hills namely Javadi Hills, Shevaroy Hills and Pachaimalai Hills. The observatories of Vellore and Kallakurchi and the rain-gauges of Polur and Tiruvannamalai are located in areas where there are hills nearby.

3. The Data

The post-monsoon season, when Madras State gets the highest rainfall, has been taken up for this study. Data used are the daily rainfall values of the six observatories and

*This study was undertaken in the Community Project Section of Main Meteorological Office, Madras under the guidance of Shri V. C. Bedekar, Meteorologist and Shri Y. P. Rao, Regional Director

the six rain gauge stations referred to above for the months of October, November and December of the ten years 1948-57 published in the *Daily Rainfall recorded in the Madras Presidency/State*. Of the two observatories at Madras, data of Nungambakkam have been used in this study.

During the ten-year period considered, the average post-monsoon rainfall over the belt considering the rainfall of the six observatories was normal in 3 years and deficit in the remaining 7 years. The years 1949 and 1957 had the extreme rainfall of the period being 34 and 102 per cent respectively of the normal.

4. Discussions

4.1. *Spatial rainfall distribution*—Table 1 gives the total number of days of different classes of rainfall distribution over the belt (bounded by the six India Meteorological Department observatories) and over a portion of the belt (bounded by the six Community Development Blocks) during the post-monsoon seasons studied. Rainfall distribution is classified dry if no station reported rain, scattered if less than 1/3 of the stations reported rain, local if 1/3 or more but less than 2/3 of the stations reported rain, fairly widespread if 2/3 or more but not all the stations reported rain, and widespread if all the stations reported rain.

Considering the rainfall distribution over the belt, it was dry on the average on 43 days and had widespread rain on 4 days in the post-monsoon season, these two together accounting for nearly half of the period. Rainfall distribution 'local' was on the average 18 days, 'scattered' on 15 days and 'fairly widespread' on 12 days in the season. Monthwise values (not given in the table) showed that the number of days when the belt was dry increased progressively from October to December. Days of widespread rain were nearly the same in October and November and half this value in December. Other classes of rainfall generally decreased from October to December, December values being half or less of October values.

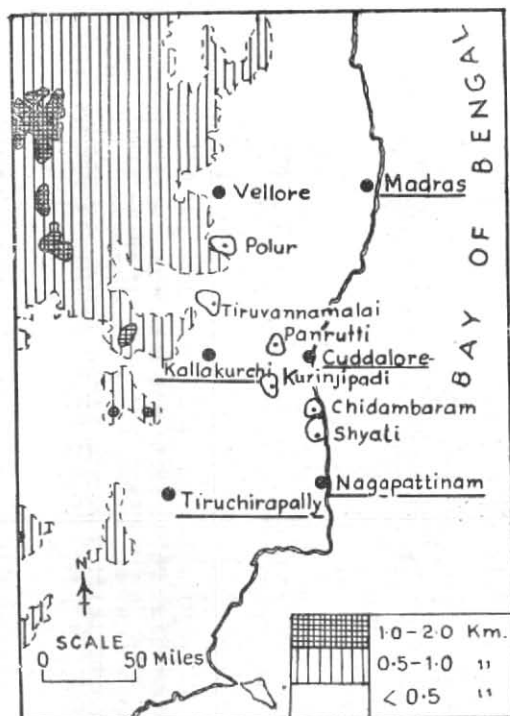


Fig. 1. The belt showing the location of I. Met. D. observatories and Community Development Blocks

The six Community Development Blocks covered only a small portion of this belt. This portion of the belt had more dry days but lesser number of days of 'scattered', 'local' and 'fairly widespread' rainfall than the belt. Number of days of 'widespread rainfall' was nearly the same both over the belt and the portion of it.

4.2. *Rain days at each block*—Number of days when rainfall occurred at each Community Development Block corresponding to the different classes of rainfall distribution over the belt is given in Table 2.

Total number of rain days at the Community Development Blocks of Polur, Tiruvannamalai, Kurinjipadi and Panrutti is more or less of the same order (177 to 192), while that of Chidambaram and Shyali is greater by about 25 per cent. This greater number of rain days of the latter two stations might be due to the fact that their location is nearer the coast.

TABLE 1

Spatial rainfall distribution over the belt and a portion of it during post-monsoon seasons (1948—1957)

Class of rainfall distribution	Rainfall distribution over the belt based on the data of six observatories	Rainfall distribution over the portion of the belt based on the data of six raingauges	Difference
	(No. of days)	(No. of days)	
Dry	428	495	67
Scattered	147	111	36
Local	185	162	23
Fairly widespread	118	109	9
Widespread	42	43	1

TABLE 2

Rain days at each Community Development Block corresponding to the different classes of rainfall distribution over the belt

Rainfall distribution over the belt based on the six observatories	No. of days	No. of days when rain fell at the Community Development Blocks							
		Polur	Tiruvannamalai	Kurinjipadi	Painrutti	Chidambaram	Shyali	Lowest %	Highest %
Dry	428	6	12	7	7	6	11	1	3
Scattered	147	25	19	14	14	32	40	10	27
Local	185	51	50	51	59	91	92	27	50
Fairly widespread	118	61	64	68	74	85	83	52	72
Widespread	42	36	39	37	38	40	36	86	95
Total	920	179	184	177	192	254	262		

TABLE 3

Average number of rain days at the interior blocks and the coastal blocks for the different classes of rainfall distribution over the belt

Rainfall distribution over the belt based on the six observatories	Average No. of rain days at a block taking into account all the six blocks	Average No. of rain days at a block taking into account the interior blocks only	Average No. of rain days at a block taking into account the coastal blocks only
	%	%	%
Dry (428 days)	2	2	2
Scattered (147 days)	16	12	24
Local (185 days)	36	29	50
Fairly widespread (118 days)	61	57	72
Widespread (42 days)	90	89	90

Considering these two blocks (Chidambaram and Shyali) as coastal and the other four blocks as interior blocks, average number of rain days has been worked out separately for the coastal and interior blocks and given in Table 3.

When the belt was dry, occurrences of rain at individual blocks were negligible being on the average 2 per cent. When the belt had fairly widespread or widespread rain, the average number of occurrence of rain at a block was 61 and 90 per cent respectively. In the case of widespread rainfall over the belt, rain-occurrence at a block was slightly less than the average when the interior blocks alone were considered and 1/5 more than the average when the coastal blocks alone were considered. On occasions, when rainfall distribution over the belt is expected to be fairly widespread or widespread, justification therefore exists for the issue of rainfall warnings to all the blocks.

When the belt had rainfall distribution scattered, average number of rain days at a block was 12 per cent when interior blocks alone were considered and 24 per cent when

coastal blocks alone were considered and 16 per cent when all the blocks were considered. Similarly when the belt had local rainfall, these percentages were nearly double being 29, 50 and 36 per cent respectively. These percentages (16 and 36 per cent) also represent the percentages of realised forecasts at each block, if on such occasions warnings are issued to all the blocks. These are very low values. If rainfall distribution over the belt can be forecasted correctly say only on 80 per cent occasions, then the percentage of realised forecasts at each block will also be correspondingly less. When rainfall distribution expected over the belt is scattered or local, warnings therefore have to be issued on a selective basis.

4.3. *Amount of rain (in 24 hours) at individual stations*—Number of days with rain within specified amounts is given for each station in Table 4.

Average number of days when a station had no rain or less than 10 cents of rain considering all the 12 stations was 70 in the season; individual values varying between 63.5 and 74.5. In the months of November

TABLE 4
Number of days with rain within specified amounts, post-monsoon seasons 1948-1957

Amount of rainfall (in)	Months	Number of days											
		I. Met. D. observatories						State raingauges					
		Madras	Cuddalore	Nagapattinam	Vellore	Kallakuruchi	Tiruchirappalli	Polur	Tiruvannamalai	Kurinjiipadi	Panrutti	Chidambaram	Shyali
0.00—0.09	{ Oct Nov Dec Season	206 225 267 698	211 215 257 683	211 186 238 635	209 246 270 725	210 243 275 728	213 218 268 699	211 245 289 745	216 240 282 738	234 231 278 743	222 240 269 731	213 205 248 666	226 196 240 662
0.10—0.49	{ Oct Nov Dec Season	54 31 26 111	50 32 27 109	52 42 34 128	61 25 25 111	60 31 17 108	54 55 27 136	44 34 10 88	43 34 16 93	23 25 7 55	39 24 22 85	57 44 31 132	41 48 34 123
0.50—0.99	{ Oct Nov Dec Season	22 18 7 47	25 26 8 59	26 33 14 73	22 19 7 48	26 10 9 45	17 13 8 38	26 9 3 38	24 15 3 42	22 20 11 53	23 21 7 51	19 21 12 52	24 22 17 63
1.00—1.99	{ Oct Nov Dec Season	20 17 7 44	14 14 9 37	11 26 15 52	12 8 6 26	8 13 5 26	15 10 3 23	18 7 7 32	18 6 5 29	25 13 5 43	16 9 4 29	13 18 10 41	16 20 9 45
2.00—2.99	{ Oct Nov Dec Season	4 4 2 10	5 7 4 16	4 8 2 14	6 2 1 9	4 2 3 9	8 4 2 14	8 4 .. 12	5 2 1 8	3 6 4 13	6 4 5 15	6 6 2 14	.. 6 6 12
3.00—3.49	{ Oct Nov Dec Season	1 1 2 2	3 2 3 8 0	1 .. 1 2 2 2	2 1 1 4	1 2 3 6	1 1 1 3	2 3 1 6	.. 1 2 3	1 2 .. 3
3.50 and more	{ Oct Nov Dec Season	3 5 1 9	5 6 3 14	3 3 4 10 1 1	1 1 .. 2	3 3	1 1	3 1 .. 4	2 4 4 10	2 .. 1 3	2 5 5 12	2 6 4 12

and December, interior stations had more such days than coastal stations. These days generally increased from October to December excepting at Nagapattinam, Chidambaram and Shyali where they were slightly less in November than in October.

Days with rainfall between 10 cents and $\frac{1}{2}$ " were 11, with rainfall between $\frac{1}{2}$ " and 1" were 5, with rainfall between 1" and 2" were 4 and with rainfall between 2" and 3" were 1 on the average at a station in the season.

Days, when rainfall was 3" and above were on the average 1 each at a station in the season. Number of such days of heavy rain was 1.8 at Nagapattinam, 1.6 at Cuddalore and 1.5 each at Chidambaram and Shyali. Such days were comparatively less at Vellore, Kallakurchi, Polur and Tiruchirapally being 0.1, 0.4 and 0.5 respectively. If heavy rainfall warnings are issued in respect of the belt on the average say on 7 occasions in this season, the percentage of realised forecasts at a station of the belt will vary from 1 to 26 per cent.

Occasions when heavy rain (3" or more) fell at 2 to 3 stations, 4 to 5 stations and 6 stations of the belt on the same day were on the average 0.5, 0.3 and 0.2 respectively in the season. During the ten post-monsoon

seasons studied, there was one occasion each when heavy rain fell on the same day at 7 stations and 10 stations of the belt.

Heavy rain fell at one or more stations of the belt on three consecutive days on 2 occasions, and on two consecutive days on 10 occasions during the whole period studied.

5. Conclusion

The data studied were of ten post-monsoon seasons, out of which seven were seasons of deficit rainfall and three of normal rainfall. In this season on the average a station in the belt gets no rain or rain up to 9 cents on 70 days, rain between 10 cents and 49 cents on 11 days, between 50 cents and 99 cents on 5 days, between 100 cents and 199 cents on 4 days, between 200 cents and 299 cents on 1 day and rain 300 cents or more on 1 day. Occurrence of heavy rain (300 cents or more) at one or more stations of the belt on two consecutive days and three consecutive days has been 1.0 and 0.2 respectively in the season. The belt experiences spells of good rain generally in association with (i) disturbances in the southwest Bay of Bengal and also on occasions in the East Arabian Sea, and (ii) passage of low pressure areas/waves across the south peninsula.

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