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ANALYSIS OF DAILY RAINFALL OF COIMBATORE

1. It is of interest to study the daily rainfall distribution alongwith the monthly and seasonal distribution. Such an information is of relevance to the efficient management of water resource, agricultural operations, preparation of cropping pattern etc. The technique of analysing the daily rainfall data provides much insight into the characteristics of rainfall distribution and also involves the identification of association between the cumulated percentages of rain amount (x) and rainy days (y).

1.1. Such a study for 10 regions, using 5 years' daily rainfall data, was made in Argentina by Olascoaga (1950) who reported that a single Normalised Rainfall Curve (NRC) drawn from daily rainfall of any one region gave a satisfactory representation for the rainfall distribution of the other rainfall regions. Similar results were reported by Rai Sircar (1955) from a study of raingauges around Delhi, Calcutta, Bangalore and Thiruchirapalli. However, Wexler (1967) and Cobb (1968) reported that a single distribution curve did not gave a satisfactory representation of the rainfall of other stations. Similar view was also expressed by Ananthakrishnan and Soman (1989) for India. Considering the above studies, an attempt has been made to study the daily rainfall variation for Coimbatore, Tamil Nadu, India.

2. The present study deals with daily rainfall distribution of Coimbatore and Tamil Nadu. Daily rainfall data for 33 years, from 1960 to 1992, were collected from the meteorological observatory raingauge, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore. For each month, the daily rainfall amount was arranged in ascending order for 33 years to compute cumulated percentage of rain amount and rain days and were plotted in a graph. Thus the normalised rainfall curves for four seasons, *viz.*, cold weather period (January and February), hot weather period (March-May), southwest monsoon (June-September) and northeast monsoon (October-December) were drawn and presented in Fig. 1. The rainfall variability analysis was carried out for the four seasons as indicated by Soman & Krishnakumar (1990), Budhar *et al.* (1991) and Swaminathan *et al.* (1991) and presented in Table 1. Eleven year block analysis was also done as detailed hereunder. First block consisted of rainfall data from 1960 to 1970. While the second and third blocks were from 1971 to 1981 and 1982 to 1992 respectively. The coefficient of variation (CV) was worked out for the blocks and presented in Table 2. Since the rain amounts contributed by days with less than 2.5 mm/day were also taken into account for calculating the total seasonal rainfall, a matrix was formed using three states of rainfall, namely,

(i) rainless day (no rain),

TABLE 1

Statistical parameters of rainfall series of Coimbatore

Season	No. of rainfall days	Mean rainfall/ rain day (mm)	Standard deviation (σ)	Coefficient of variation (CV) (%)	Significant days*/ rainfall		Percentage of rainy days
					Days (%)	Rainfall (%)	
CWP (Jan & Feb)	2.27	7.43	10.02	134.86	36.00	83.92	53.33
HWP (Mar-May)	13.91	9.22	12.63	136.98	30.06	76.64	65.14
SWM (Jun-Sep)	36.27	5.09	8.10	159.13	29.32	87.71	45.78
NEM (Oct-Dec)	27.42	12.65	17.81	147.92	29.17	87.31	59.44
Annual (Jan-Dec)	79.88	8.47	12.16	146.32	30.79	81.22	43.78

* Days with rainfall more than average.

TABLE 2

Eleven-year variation of seasonal rainfall during latest 33 years

Parameter	CWP (Jan-Feb)	HWP (Mar-May)	SWM (Jun-Sep)	NEM Oct-Dec)	Annual (Jan-Dec)
		Block I (1960-1970)			
Mean seasonal rainfall (mm)	12.65	125.51	168.96	287.93	595.05
S.D.	12.74	56.68	79.97	105.69	162.80
C.V.	100.72	45.16	47.33	36.71	27.36
		Block II (1971-1981)			
Mean seasonal rainfall (mm)	15.0	142.65	208.42	402.34	768.40
S.D.	36.08	65.47	63.61	217.86	272.41
C.V.	240.52	45.90	30.52	54.15	35.45
		Block III (1982-1992)			
Mean seasonal rainfall (mm)	22.18	116.36	180.52	299.18	618.25
S.D.	26.57	58.74	57.22	134.06	120.95
C.V.	119.79	50.48	31.70	44.81	19.56

(*ii*) rain day (rainfall between 0.1 and 2.49 mm), and

(*iii*) rainy day (rainfall $\geqslant$ 2.5 mm) and presented in Table 3.

3. It is observed from Fig. 1 that for all the four seasons of study; the drawn NRC behaved for quadratic function. This indicated that there was a similar behaviour of daily rainfall in all the seasons. Olascoaga (1950) found that a single NRC gave a satisfactory representation of the rainfall distribution of ten rainfall regions of Argentina. Similar to the above finding, even though the data of Coimbatore raingauge station was not compared with other centre. However, in Coimbatore station, uniform curve pattern was observed for the four standard seasons. The nature of the NRC is uniquely determined by the coefficient of variation of the rainfall series (Soman & Krishnakumar 1990 and Ananthakrishnan & Soman 1989). Since the CV of the rainfall of four seasons did not vary greatly as furnished in Table 1, the NRC for all the four seasons also behaved similarly.

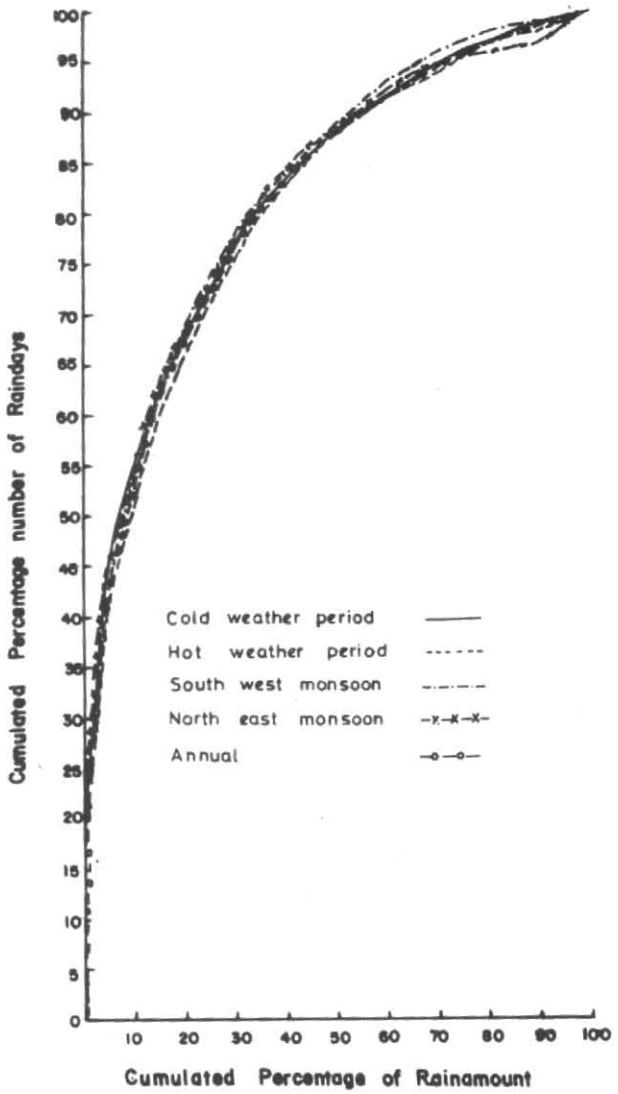

Fig. 1. Normalised rainfall curves of Coimbatore for four seasons

3.1. Further, in all the four seasons 50% of the total rainfall contribution accrued from 90% due to rain fall days (rain and rainy days). The balance 10% of rainfall days accounted for another 50% of rain amount. This trend was unique for all the four seasons of study without any marked difference. The reason being, a large number of rainfall days in a season was of low intensity contributing only a small fraction to the seasonal total, whereas a few days of high rain intensity contributed substantially higher amount. This is evident from Table 1, that around 30% of days with significant rainfall (rainfall $\geqslant$ seasonal mean) contributed 75-85% of seasonal rain amount, whereas the remaining 70% contributed only 25-15% of rain amount.

3.2. The highest percentage of rainy days (days with $\geqslant$ 2.5 mm rainfall) was observed for hot weather

TABLE 3

Transition probabilities of three states of monthly and seasonal rainfall at Coimbatore

Month and season	Rainless day (Rld) followed by			Rain day (Rd) followed by			Rainy day (Ryd) followed by		
	Rld	Rd	Ryd	Rld	Rd	Ryd	Rld	Rd	Ryd
Jan	97.0	1.37	1.16	77.77	5.5	16.66	52.38	19.05	28.57
Feb	97.12	1.38	1.50	55.55	22.22	22.22	77.77	16.66	5.55
Mar	96.13	2.32	2.84	88.23	5.88	11.76	54.05	13.51	32.43
Apr	85.32	5.21	9.47	71.64	16.42	11.94	66.98	11.32	21.70
May	81.27	5.72	13.00	70.66	10.66	18.66	64.47	13.82	21.71
Jun	84.80	9.55	5.64	46.66	31.52	21.82	30.97	34.51	34.51
Jul	73.26	14.80	8.93	48.44	29.16	22.40	30.54	22.75	46.71
Aug	83.60	10.00	6.40	56.16	24.66	19.18	42.85	28.57	28.57
Sep	79.36	9.38	11.26	54.03	22.58	23.39	42.57	26.35	31.08
Oct	73.66	8.60	17.73	45.38	16.81	37.82	35.52	16.55	47.93
Nov	81.47	7.96	10.56	57.14	14.28	28.52	33.16	22.80	44.04
Dec	90.57	5.40	3.83	47.38	19.72	32.39	42.71	14.58	42.71
CWP (Jan-Feb)	97.51	1.30	1.19	63.88	13.88	22.22	60.98	17.07	21.95
HWP (Mar-May)	85.62	4.13	7.85	69.93	13.07	16.99	65.72	11.66	22.61
SWM (Jun-Sep)	80.81	11.20	7.98	51.72	26.72	21.56	36.48	28.33	35.19
NEM (Oct-Dec)	81.96	7.32	10.71	49.97	16.94	32.91	37.13	17.98	44.89
Annual (Jan-Dec)	80.13	11.36	8.76	57.21	13.15	28.71	43.14	28.57	28.57

period (HWP) but the total number of rainy days were comparatively lesser for HWP over the two monsoon seasons (Table 1).

3.3 In cold weather period (CWP), though the co-efficient of variation of second and third block is higher over the first block (Table 2) the actual rainfall amount was in increasing trend.

3.4. In HWP the recorded rainfall was found to increase from first to second block, and then decreased in the third block, but the CV was found increasing. In both southwest (SW) and northeast (NE) monsoon the rainfall was found to decrease in the third block (1982-1992) over second block (1971-1981). It is of interest to note that when the SW and NE monsoon seasonal rainfall were in decreasing trend the off-season CWP rainfall was in the increasing trend, indicating a shift in rainfall quantity from seasons to CWP. Hence a micro level seasonal adjustment was observed in rainfall quantity. This needs further indepth study within annual rainfall distribution.

4. In general, the possibility trend between rainless day followed by rainless day, with that of rain day and rainy day was not uniform with advancement in months from January to December (Table 3). Similar variations were observed for rain day and rainy day followed by rainless day, rain day and rainy day. However, if the comparison is made between rainless day followed by rainless day, rain day followed by rainless day and rainy day followed by rainless day the trend was in decreasing order. Interestingly, increasing probability trend was observed for rainless day followed by rain day, rain day followed by rain day and rainy day followed by rain day. Similar pattern was observed for rainless day followed by rainy day, rain day followed by rainy day and rainy day followed by rainy day. Seasonal probability also behave similarly.

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