551.577.2 (541.2)

LONG TERM VARIATIONS OF THE RAINFALL AT JALPAIGURI IN NORTH BENGAL

1. Based on 80 years (1901–1980) rainfall data, the long-term variations of mean annual and seasonal rainfall have been studied for Jalpaiguri. The significant results have been brought out here.

2. From the daily rainfall data, monthly, seasonal and annual rainfall have been evaluated. In addition to long term mean, 30 years climatological and decadal averages have also been worked out for various periods during 1901–1980.

3. The study of the annual and seasonal (Jun–Sep) rainfall variations for the period 1901–1980 indicates that the highest annual (4546 mm) and seasonal (3997 mm) rainfall occurred in 1938 while lowest annual of 1864 mm and seasonal of 1676 mm occurred in 1978. The long term mean of annual and seasonal rainfall were 3276 mm and 2640 mm respectively for the 80 years rainfall series. The annual and seasonal coefficients of variation were 16.1 % and 18.2 % respectively.

4. WMO commission on climatology has recommended the use of 30 years mean (WMO 1966). In this study the rainfall series of the period 1901 to 1980 was broken into two 30 years period of 1901–1930 and 1931–1960 and a 20 years period of 1961–1980 for the available rainfall record. It was later found that, with the addition of two more non standard 30 years period of 1916–1945 and 1946–1975, more valuable features of the long term-variations appear which may help in evaluating future trend, if any.

The 30 years mean annual and seasonal rainfall for the years 1901–1930, 1916–1945, 1931–1960, 1946–1975 and a 20 years mean of 1961–1980 were obtained and their variations are shown in Fig. 1. The main features of the figure are as follows :

(*a*) The 30 years mean annual and seasonal rainfall are highest for the non-standard climatological period of 1916–1945 and were 3468 mm and 2805 mm respectively.

(*b*) There was a steep rise in the mean annual and seasonal rainfall during 1916–1945 in comparison to 80 years mean, which decreased there after continuously till 1980.

(*c*) There was a fall of about 350 mm of mean annual and 280 mm of seasonal rainfall till the period 1961–1980 since 1916–1945. The falling rate was about 80–90 mm per decade for the mean annual rainfall.

5. The mean annual rainfall of 10, 20, 30, ..., 80 years period have been obtained and same were plotted against length of record in Fig. 2. It indicates that the mean rainfall for the period 1901–1940, reached an all time high and it slightly reduced thereafter. The coefficient of variations reached 16.2% for the 80 years data base from 15.3% for the data base of 10 years. The variation of the mean annual *versus* length of record of data and their coefficient of variations are shown in Fig. 2.

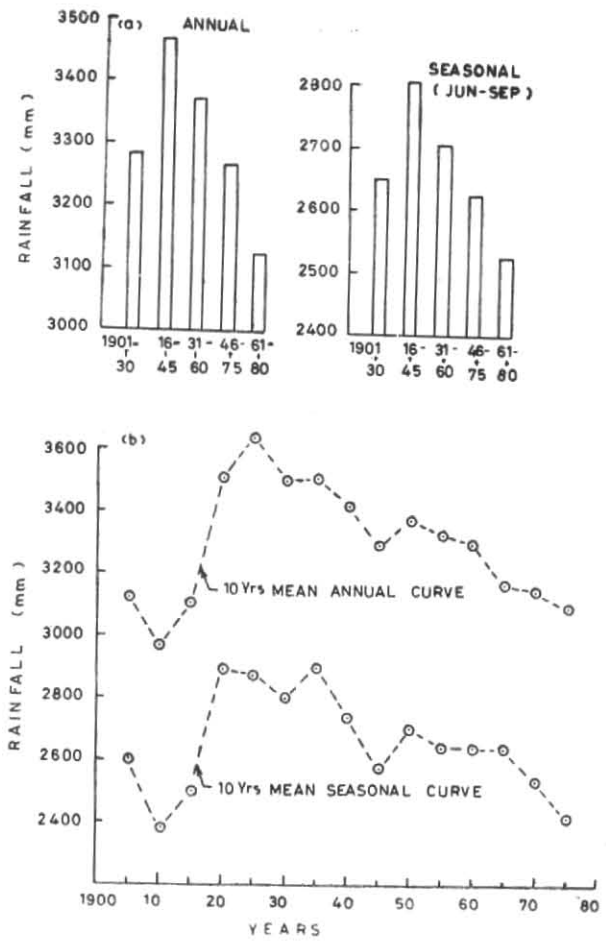

Fig. 1
(a) Histograms showing mean rainfall during different periods, (b) Mean annual and seasonal rainfall variations

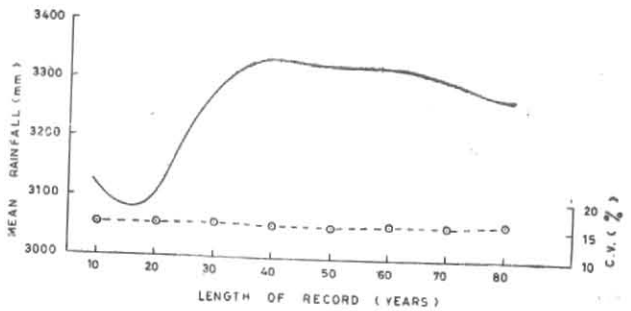

Fig. 2. Variation of mean annual *vs* length of record of data and their coefficient of variation

6. The decadal averages for annual and seasonal rainfall, their standard deviations and coefficient of variation are shown in Table 1 for standard and non-standard decades of 1901–1980. The highest mean decadal annual and seasonal rainfall of about 3631 mm and 2896 mm occurred during the decades of 1921–1930 and 1931–1940 respectively and lowest mean decadal annual of 2962 mm and seasonal rainfall of 2383 mm occurred in the same decade of 1906–1915. The highest coefficient of variation was about 22% during

TABLE 1

Statistical parameters of annual and seasonal rainfall at Jalpaiguri during various decades

Decade	Decadal mean rainfall (in mm)		Standard deviation (in mm)		C.V. %		Fisher's Z-test parameter		Crammer's test statistic t_k		Difference of decadal Annual average from long term (%)
	Annual	(Seasonal)	Annual	(Seasonal)	Annual	(Seasonal)	Annual	(Seasonal)	Annual	(Seasonal)	
1901-10	3116.4	(2601.7)	477.2	(500.5)	15.3	(19.2)	0.056	(0.084)	—1.017	(—0.267)	4.9
1906-15	2962.2	(2382.9)	402.1	(442.3)	13.6	(18.6)	0.227	(0.039)	—2.035*	(—1.820)	9.6
1911-20	3102.0	(2487.8)	511.1	(451.6)	16.5	(18.1)	0.012	(0.018)	—1.109	(—1.064)	5.3
1916-25	3504.2	(2888.1)	543.8	(356.9)	15.5	(12.3)	0.074	(0.254)	1.457	(1.749)	—7.0
1921-30	3630.8	(2867.4)	396.8	(330.5)	10.9	(11.5)	0.240	(0.330)	2.313*	(1.598)	—10.8
1926-35	3491.0	(2797.3)	336.3	(313.1)	9.6	(11.2)	0.406	(0.385)	1.370	(1.095)	—6.6
1931-40	3496.5	(2895.8)	466.0	(486.7)	13.3	(16.8)	0.079	(0.056)	1.406	(1.805)	—6.7
1936-45	3407.7	(2730.0)	496.5	(565.2)	14.6	(20.7)	0.016	(0.206)	0.823	(0.622)	—4.0
1941-50	3286.0	(2574.7)	509.5	(429.6)	15.5	(16.7)	0.009	(0.068)	0.060	(—0.455)	—0.3
1946-55	3372.4	(2705.6)	604.0	(562.9)	17.9	(20.8)	0.179	(0.202)	0.607	(0.452)	—2.9
1951-60	3327.0	(2645.4)	624.8	(572.5)	18.8	(21.6)	0.213	(0.219)	0.319	(0.034)	—1.5
1956-65	3286.9	(2645.1)	654.5	(582.8)	19.9	(22.0)	0.259	(0.236)	0.066	(0.032)	—0.3
1961-70	3163.7	(2636.9)	497.4	(482.9)	15.7	(18.3)	0.014	(0.048)	—0.714	(—0.024)	3.4
1966-75	3144.8	(2532.5)	473.2	(394.8)	15.0	(15.6)	0.064	(0.152)	—0.834	(—0.750)	4.0
1971-80	3089.2	(2413.4)	617.7	(496.6)	20.0	(20.6)	0.202	(0.076)	—1.193	(—1.598)	5.7

*Significant at 95% level

1951–1960 and 1956–1965 for the decadal average of seasonal rainfall. The significance of the decadal averages for annual and seasonal rainfall have been tested with respect to long term mean of 80 years (1901-1980) series and the result are given below :

(*i*) The Fisher's Z-test has been applied to test whether the variances of the mean decadal annual and seasonal rainfall are same or different from the long term variance of the period 1901–1980. The calculated values of Z parameters are given in Table 1 which indicate that the differences between the two variances are not significant for 5 per cent points for the annual and seasonal mean both.

(*ii*) The Crammer's test was used to test the hypothesis whether averages of decadal annual rainfall were different from the long term 80 years averages of annual rainfall. The Crammer's test statistics, t_k, have been calculated for all the decades and are shown in Table 1.

The rainfall of the decade 1921–1930 was about 11% more than the long term annual mean and the difference was significant at 95% level of significance. The rainfall of the decade 1906–1915 was about 10% less than the long term annual mean and the difference was also significant at 95% level of significance.

(*iii*) A comparison of Crammer's test statistics, t_k, of the decadal mean seasonal rainfall and of the long term seasonal mean indicate that none of the seasonal decadal mean were significant at 95% level.

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Reference

WMO, 1966, *Climatic change*, WMO Tech. Note No. 79.

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