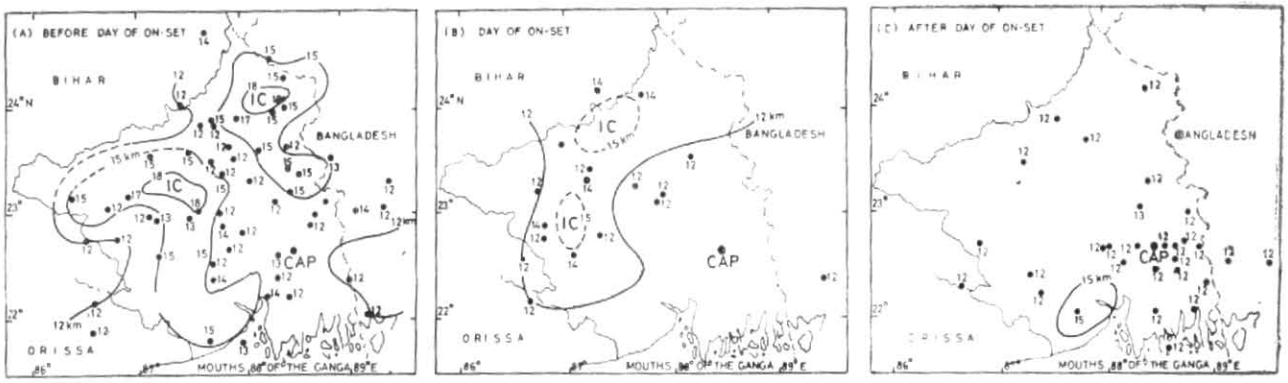

Fig. 3. A scattered plot of Cb cells with top height 12 km and more developed over and around GWB

(*iii*) The convective clouds associated with the advancing monsoon currents over GWB generally form in a scattered or isolated pattern and sometimes in broken line pattern with top heights ranging between 6 to 8 km in most of the cases.

(*iv*) Development of high Cb cells are more in the northeastern, central and southwestern areas of GWB before the date of onset, while it is more in the western areas on the date of onset and in the southeastern areas after that.

(*v*) A station falling in the way of advancing monsoon currents experiences 5 to 10 spells of precipitation in 24 hours, occasionally accompanied with thunder.

Reference

Biswas, B. and Gupta, K., 1989, "Heights of Cb clouds around Calcutta Airport—Diurnal and seasonal variations", *Mausam*, **40, 2,** pp. 169-174.

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A CLIMATOLOGICAL STUDY OF THUNDERSTORMS AT LUCKNOW AIRPORT

Thunderstorm is one of the important aviation hazards to aviation activities. Statistical knowledge of its occurrence at different times and months in a year is helpful to a forecaster. Vishvanathan & Faria (1962) and Krishnamurthy (1965) studied the climatic characteristics of thunderstorms for Bombay and Poona respectively. Similar climatological features of thunderstorms at Lucknow have been presented here using 10 years data.

2. The data for the period 1975-1985 excepting 1980 have been obtained from the current weather registers of Lucknow. Monthwise, yearwise frequencies of actual number of thunderstorms in different months and years have been shown in Table 1. Three hourly diurnal frequency distribution and duration of thunderstorms have been presented in Tables 2 and 3.

3. Thunderstorms develop from the cumulonimbus clouds. Table 1 gives the actual distribution of thunderstorms. During 10 years period total of 626 thunderstorms have been found. The occurrence of more than one thunderstorm in a day is more common during monsoon months.

4. From Table 2 in which the frequency distribution of time of commencement of thunderstorm have been shown, it is seen that the occurrence is maximum in 0900-1200 UTC respectively. In remaining periods frequencies are found to vary between 46 and 50. The average per year and percentage occurrence in each three hourly interval can be seen in Table 3.

5. Table 3 gives an idea of the duration of thunderstorms activity in relation to its time of occurrence. During the 10 years period, it is found that most of the thunderstorms are of duration less than three and 3-6 hours. About 60% of the thunderstorms are of

TABLE 1

Distribution of number of thunderstorms

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1975	4	3	6	—	4	8	17	5	7	4	—	—	58
1976	—	—	—	3	7	10	23	13	4	—	—	1	61
1977	—	2	—	10	11	3	19	13	8	—	—	1	66
1978	4	3	12	6	—	16	12	15	12	—	1	—	81
1979	1	4	3	2	4	6	11	2	6	—	2	1	42
1981	1	2	3	1	12	6	19	6	3	—	—	2	55
1982	1	3	6	4	4	7	11	27	5	4	—	—	72
1983	—	1	1	5	8	9	10	14	14	7	—	1	70
1984	—	3	—	11	1	12	10	15	5	—	—	1	59
1985	2	—	1	3	3	8	10	11	17	6	—	1	62
Total	14	21	32	45	54	85	142	121	81	21	3	7	626
Average	1.4	2.1	3.2	4.5	5.4	8.5	14.2	12.1	8.1	2.1	0.3	0.7	62.6
Per cent	2.2	3.3	5.1	7.1	8.6	13.5	22.6	19.3	12.9	3.3	0.4	1.1	—

TABLE 2

Frequency distribution of time of commencement of thunderstorm

Month	Time (UTC) of commencement of thunderstorms								
	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	Total
Jan	4	4	1	1	1	2	—	2	15
Feb	7	2	3	3	1	3	2	—	21
Mar	5	3	4	4	6	5	4	1	32
Apr	9	6	4	5	4	6	5	6	45
May	13	1	8	10	6	2	8	6	54
Jun	15	4	12	24	7	1	6	16	85
Jul	16	12	30	30	25	12	9	8	142
Aug	12	5	26	38	22	8	7	3	121
Sep	11	4	22	18	11	7	5	3	81
Oct	1	4	4	5	2	2	1	2	21
Nov	—	—	1	—	1	—	1	—	3
Dec	—	1	—	—	3	—	2	1	7
Total	93	46	114	138	89	48	50	48	626
Average	9.3	4.6	11.4	13.8	8.9	4.8	5.0	4.8	62.6
Per cent	14.8	7.3	18.2	22.0	14.2	7.6	7.9	7.6	—

TABLE 3

Frequency of time of commencement of thunderstorm activity and duration

Month	Duration (Hours)	Time (UTC) of commencement of thunderstorm activity								
		0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	Total
Jan	0-3	2	2	—	1	1	1	—	2	9
	3-6	2	2	—	—	—	—	—	—	4
	6-9	—	—	—	—	—	1	—	—	1
Feb	0-3	4	1	3	2	1	1	—	—	12
	3-6	3	1	—	—	—	1	2	—	7
	6-9	—	—	—	1	—	—	—	—	1
	9-12	—	—	—	—	1	—	—	—	1
Mar	0-3	3	2	4	3	2	2	3	1	20
	3-6	1	1	—	—	1	3	1	—	7
	6-9	1	—	—	—	1	—	—	—	2
	9-12	—	—	—	1	1	—	—	—	2
	>12	—	—	—	—	1	—	—	—	1
Apr	0-3	7	4	3	2	2	4	5	6	33
	3-6	2	2	1	3	1	1	—	—	10
	6-9	—	—	—	—	—	1	—	—	1
	9-12	—	—	—	—	1	—	—	—	1
	>12	—	—	—	—	—	—	—	—	—
May	0-3	7	1	4	6	3	1	4	5	31
	3-6	4	—	3	2	2	1	3	1	16
	6-9	1	—	—	—	1	—	1	—	3
	9-12	1	—	1	1	—	—	—	—	3
	>12	—	—	—	1	—	—	—	—	1
Jun	0-3	9	2	6	13	4	1	4	11	50
	3-6	5	1	5	7	2	—	2	5	27
	6-9	1	1	—	1	1	—	—	—	4
	9-12	—	—	1	3	—	—	—	—	4
Jul	0-3	9	3	12	21	14	3	4	5	71
	3-6	7	5	12	2	4	8	5	3	46
	6-9	—	—	2	5	4	1	—	—	12
	9-12	—	1	2	2	2	—	—	—	7
	>12	—	3	2	—	1	—	—	—	6
Aug	0-3	9	2	14	30	15	6	3	3	82
	3-6	3	2	8	3	4	2	4	—	26
	6-6	—	1	3	3	2	—	—	—	9
	9-12	—	—	1	1	1	—	—	—	3
	>12	—	—	—	1	—	—	—	—	1
Sep	0-3	7	1	14	12	5	4	2	3	48
	3-6	1	2	6	3	4	3	3	—	22
	6-9	1	—	1	—	2	—	—	—	4
	9-12	1	1	1	2	—	—	—	—	5
	>12	1	—	—	1	—	—	—	—	2
Oct	0-3	1	1	2	4	1	—	1	2	12
	3-6	—	2	2	1	1	2	—	—	8
	6-9	—	—	—	—	—	—	—	—	—
	9-12	—	—	—	—	—	—	—	—	—
	>12	—	1	—	—	—	—	—	—	1
Nov	0-3	—	—	—	—	—	1	—	—	1
	3-6	—	—	—	1	1	—	—	—	2
Dec	0-3	—	1	—	—	2	—	2	1	6
	3-6	—	—	—	—	—	—	—	—	—
	6-9	—	—	—	—	1	—	—	—	1

duration less than 3-hr and 30% lie between 3 & 6 hours duration and remaining 10% are found in the ranges more than 6 hours. Thunderstorms of duration more than 12 hours are mostly found during monsoon months.

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References

Krishnamurthy, V., 1965, "A statistical study of thunderstorms over Poona, *Indian J. Met. Geophys.*, **16**, 3, pp. 484-487.

Vishvanathan, T.R. and Faria, S.F., 1962, "A climatological study of thunderstorms at Bombay Airport, *Indian J. Met. Geophys.*, **13**, 3, pp. 377-382.

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