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Thunderstorms at Srinagar

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1. Introduction

In this paper a study has been made of the thunderstorms at Srinagar (Lat. 34°08′N, Long. 74° 45′E) during the period 1939–1953. The data have been collected from the copies of the *Monthly Weather Reports*, available at the station, and the frequencies of the thunderstorms have been briefly worked out. If on any day there were two thunderstorms these have been counted separately.

During the period thunderstorms have been found to occur only during the months, March to October. There was, however, a thunderstorm on 13 November 1944 which commenced at 0745 IST and lasted for only 5 minutes, then having been followed by a heavy rainfall with sleet and snow. This, being an exceptional case, has not been included in this general study. Out of the 8 months, May has recorded the highest number of 240 thunderstorms and October the least number of only 39 thunderstorms.

No useful record was available at the station to find the frequency of hailstorms having accompanied the thunderstorms.

2. Frequency of thunderstorms from year to year

The total number of thunderstorms during each month March to October for the years 1939 to 1953 are given in Table 1. In all 1128 thunderstorms have been recorded during the 15—year period. The highest number of 102 has occurred in 1946 and the least number of 52 in 1952. It is also seen that there were no thunderstorms in March during 1939, 1942, 1944 and 1945 and in October during 1942, 1943, 1944 and 1949. The highest monthly record of 26 thunderstorms is found in May 1941. March and October have not recorded more than 7 thunderstorms in a year except in 1953 when 10 thunderstorms were experienced during March.

3. Total number of thunderstorms on each date

The distribution of the total number of thunderstorms on each day during the months March to October is shown in Table 2.

It is seen that the highest number of 18 thunderstorms has occurred on 27 May and 13 June. There are 7 days in March and 8 days in October when there were no thunderstorms.

Except 16 April and 7 July, each date has recorded thunderstorms during 1 April to 26 September, the total number exceeding 5 being more frequent from last week of April to second week of August.

4. Precipitation during thunderstorms

The total precipitation associated with the thunderstorms in each month during 1939–1953 is given in Table 3. As no self-recording raingauge was available at the station, it is not possible to work out the actual rainfall amount having occurred during the thunderstorms. The rainfalls recorded during the periods 0300 to 1200 GMT and 1200 to 0330 GMT of the next day have been considered to have been associated with the thunderstorms occurring respectively during the above periods. For those thunderstorms which covered both the above periods, the total rainfall recorded at 0300 GMT has been considered to have accompanied the thunderstorms. Table 3

therefore, gives an approximate measure of the rainfall associated with the thunderstorms.

The total number of 1128 thunderstorms were accompanied with 140·93″ of rainfall, May having recorded 28·02″ and October 5·21″.

The highest monthly total of 4·25″ was accompanied by the 12 thunderstorms in May 1943 and the least amount of only 1 cent was accompanied with the 2 thunderstorms of October 1948.

May 1941 having recorded the highest number of 26 thunderstorms (Table 1) has recorded only 1·12″ of rainfall associated with these thunderstorms.

5. Frequency of dry thunderstorms

The number of thunderstorms which were not accompanied with any precipitation are given in Table 4.

153 thunderstorms out of 1128 were not accompanied with any precipitation. June has recorded the highest number of 41 such thunderstorms out of the total of 195 in this month during the years 1939–1953. The highest number of 17 dry thunderstorms has been recorded in 1945.

March, April, May and October have less frequency of dry thunderstorms being 8, 7, 9 and 5 per cent respectively out of the total number of thunderstorms recorded in these months.

6. Frequency of spells of thunderstorms

The frequency of thunderstorms lasting continuously for different durations is given in Table 5.

The table shows the increasing frequency of longer spells for May, June and July. The longest spells of 11 days has been recorded from 4 to 14 June 1946 and the next longest spell of 6 days has been recorded twice in May that is 24 to 29 May 1939 and 20 to 25 May 1946 and once in July from 23rd to 28th in 1945. One-day spells are most frequent, being 311 out of 523 (59 per cent). The frequency of the 2-day spells is 28 per cent and for spells lasting for more than 2 days is in all 13 per cent.

The spells of thunderstorms lasting for more than 2 days have been absent in March during the 15-year period except in 1953 when a 5-day spell was recorded from 15 to 19 March. October has recorded only one spell of more than 2 days being from 7 to 9 October 1946. During May and July spells lasting for 5 days have been absent but those lasting for 6 days have been recorded.

7. Total duration of thunderstorms during each month

The total duration of thunderstorms in each month for the 15-year period is tabulated in Table 6.

The thunderstorms during May have lasted for the longest time of 500 hours and 25 minutes, an average of 33 hours and 21 minutes for each year and those in October have lasted for 100 hours and 39 minutes. Working out the average time taken by each thunderstorms during each month we find that thunderstorms in March have lasted for the greatest average time of 2 hours and 48 minutes, in spite of not having recorded any thunderstorms for 4 years. For May which has recorded the greatest number of thunderstorms during the 15-year period, the average duration for each thunderstorm comes out to be 2 hours and 5 minutes.

The greatest monthly thunderstorm duration of 57 hours and 16 minutes has occurred in May 1949.

8. Frequency of thunderstorms within different time limits

The data of thunderstorms have been analysed with respect to their times of occurrence within certain time limits. The day has been divided into six ranges of 4 hours each commencing at 2400 IST. The thunderstorms with times of commencement in one 4-hour period and the times of cessation in the other, have been counted in all the

ranges in which they occur. This frequency of the thunderstorms within different time limits is shown in Tables 7(a) and 7(b).

The tables show that thunderstorms have the least frequency of occurrence between 2400 and 0400 IST and the greatest frequency between 1600 and 2000 IST. Out of the highest number of 498 thunderstorm occasions from 1600 to 2000 IST, the highest number of occasion of 126 has occurred in May and the least of 18 in October. 75 per cent of the total number of thunderstorms during the 15-year period have occurred between 1200 and 2400 IST. The thunderstorms between 2400 and 0800 IST are most frequent during August being 36 between 2400 to 0400 IST and 45 between 0400 to 0800 IST.

9. Acknowledgement

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TABLE 1

Frequency of thunderstorms at Srinagar during 15 years (1939—1953)

Year	March	April	May	June	July	August	September	October	Total
1939	..	10	12	12	18	13	10	3	78
40	4	8	13	10	5	11	11	2	64
41	7	17	26	12	15	8	3	2	90
42	..	7	18	15	11	11	5	..	67
43	5	8	12	9	18	10	3	..	65
44	..	11	8	13	12	19	9	..	72
45	..	8	22	14	19	16	10	3	92
46	6	18	20	23	11	12	5	7	102
47	5	9	15	17	11	17	7	3	84
48	3	12	19	18	14	18	5	2	91
49	2	11	20	14	9	4	6	..	66
50	3	6	17	7	16	15	5	3	72
51	3	13	14	15	5	11	5	5	71
52	2	4	14	6	15	5	3	3	52
53	10	5	10	10	5	12	4	6	62
Total	50	147	240	195	184	182	91	39	1128

TABLE 2

Total number of thunderstorms at Srinagar for each date during 15 years (1939 to 1953)

Date	March	April	May	June	July	August	September	October
1	..	1	8	7	6	9	6	..
2	..	4	16	7	4	11	5	4
3	..	3	4	5	4	6	5	2
4	1	2	5	9	2	10	3	1
5	..	1	2	12	3	11	5	1
6	1	11	11	7	9	5	2	..
7	..	5	6	6	..	9	2	2
8	1	2	12	5	6	9	1	1
9	1	2	2	3	5	4	3	3
10	1	4	9	7	10	8	5	..
11	1	7	6	5	4	9	3	1
12	2	3	8	11	6	8	3	1
13	..	9	11	18	8	6	1	3
14	1	5	5	11	6	8	4	1
15	4	4	5	7	6	5	4	1
16	1	..	9	5	6	6	3	2
17	4	5	5	7	5	10	4	3
18	1	5	7	9	7	2	4	2
19	4	6	7	6	7	2	2	4
20	1	4	7	3	3	3	3	1
21	1	3	4	7	13	5	1	1
22	2	2	8	4	6	1	2	..
23	1	4	9	2	5	4	4	..
24	2	6	4	1	7	5	4	1
25	3	5	12	6	6	6	1	1
26	4	5	13	1	7	7	4	1
27	2	8	18	1	5	5	..	..
28	2	7	7	9	7	1	3	1
29	6	9	5	9	7	1	3	..
30	3	15	8	5	7	3	1	..
31	..		7		7	3		1
Total	50	147	240	195	184	182	91	39

TABLE 3

Total precipitation (cents) associated with thunderstorms at Srinagar (1939 to 1953)

Year	March	April	May	June	July	August	September	October	Total
1939	*	126	75	11	123	77	34	55	501
40	46	277	150	141	37	133	129	24	937
41	132	136	112	17	296	133	10	8	844
42	*	150	256	102	180	221	79	*	988
43	92	157	425	64	167	252	20	*	1177
1944	*	119	65	201	57	272	93	*	807
45	*	103	195	76	73	52	84	49	632
46	62	181	103	175	114	93	trace	131	859
47	78	34	220	157	131	149	19	33	821
48	229	296	200	400	114	217	55	1	1512
1949	55	131	206	159	57	70	57	*	735
50	45	163	317	24	287	199	37	31	1103
51	16	238	287	292	116	276	50	125	1400
52	170	106	182	146	176	83	69	2	934
53	327	17	9	58	104	209	57	62	843
Total	1252	2234	2802	2023	2032	2436	793	521	14093

* No thunderstorm

TABLE 4

Total number of dry thunderstorms at Srinagar during 15 years (1939-1953)

Year	March	April	May	June	July	August	September	October	Total
1939	None	1	..	6	..	2	4	..	13 (17)
40	..	1	..	1	3	..	1	..	6 (9)
41	..	1	2	3	1	1	1	..	9 (10)
42	None	..	1	4	1	1	2	None	9 (13)
43	1	1	1	1	5	..	..	None	9 (14)
1944	None	..	3	3	3	4	..	..	13 (18)
45	None	2	5	3	..	5	2	..	17 (19)
46	..	1	2	3	..	5	2	..	13 (13)
47	1	1	2	2	1	1	4	..	12 (14)
48	1	..	..	5	1	3	1	..	11 (12)
1949	..	1	1	2	4	..	..	None	8 (12)
50	1	1	1	3	4	2	1	None	13 (18)
51	..	..	1	3	1	2	2	..	9 (13)
52	..	..	..	1	..	1	..	..	2 (4)
53	..	..	2	1	..	3	1	2	9 (15)
Total	4	10	21	41	24	30	21	2	153
	(8)	(7)	(9)	(21)	(13)	(16)	(23)	(5)	(14)

N.B.—(1) Dots (..) indicate no dry thunderstorm

(2) *None* indicates no thunderstorm having occurred during the period

(3) Figures in brackets indicate the percentages of the total number of thunderstorms (Refer Table 1)

TABLE 5

Frequency of the spells of thunderstorms during 15 years at Srinagar (1939 to 1953)

Month	Duration of spells in days						Remarks
	1	2	3	4	5	More than 5	
March	25 (8)	7 (5)	..	..	1 (20)	..	5-day spell from 15 to 19 March 1953
April	49 (16)	22 (15)	4 (10)	..	1 (20)	..	5-day spell from 3 to 7 April 1951
May	47 (15)	28 (19)	11 (27)	4 (25)	..	2 (40)	6-day spells from 24 to 29 May 1939 and 20 to 25 May 1946
June	41 (13)	18 (12)	11 (27)	3 (19)	2 (40)	2 (40)	11-day spell from 4 to 14 June 1946
July	49 (16)	25 (17)	3 (8)	5 (31)	..	1 (20)	6-day spell from 23 to 28 July 1945
August	51 (16)	25 (17)	4 (10)	2 (13)	1 (20)	..	5-day spell from 11 to 15 August 1944
September	31 (10)	14 (10)	6 (15)	2 (13)	..	..	4-day spell from 9 to 12 September 1939 and 17 to 20 September 1942
October	18 (6)	7 (5)	1 (3)	..	..	..	3-day spell from 7 to 9 October 1946
Total	311 *59*	146 *28*	40 *8*	16 *3*	5 *1*	5 *1*	

Bracketed figures indicate the percentage of the total No. of occasions of respective spell durations. Figures in italics indicate the percentage of total No. of occasions of all spell durations

TABLE 6

Total duration of thunderstorms during each month (1939 to 1953)

Year	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
	h m	h m	h m	h m	h m	h m	h m	h m	h m
1939	None	19 41	18 32	16 08	41 56	19 41	26 06	14 41	147 45
1940	04 07	14 50	20 48	32 07	16 39	13 00	00 33	None	112 04
1941	20 39	24 00	52 25	38 53	27 20	16 04	03 31	02 07	184 49
1942	None	20 00	38 36	27 19	26 13	28 59	12 55	None	153 02
1943	08 57	27 36	36 28	14 42	24 48	28 34	04 00	None	145 05
1944	None	28 53	05 30	27 15	20 21	55 25	13 19	00 05	160 48
1945	None	15 34	42 01	24 37	41 15	14 23	13 40	17 00	168 30
1946	08 40	39 59	51 08	40 43	27 33	24 23	08 44	17 55	217 25
1947	11 05	14 10	37 37	32 15	22 03	33 38	16 03	09 05	175 56
1948	08 56	30 35	23 51	43 03	13 49	32 50	13 25	02 00	168 29
1949	10 45	27 40	57 16	28 37	13 49	05 42	15 57	None	159 46
1950	08 15	34 10	52 38	14 08	31 13	44 48	05 15	06 01	196 28
1951	04 46	24 06	26 30	32 28	08 55	25 34	09 33	13 50	145 42
1952	07 10	19 20	27 15	20 51	29 20	06 15	07 30	01 05	118 46
1953	46 50	03 57	09 50	18 25	11 30	28 00	04 20	16 50	139 42
Total	140 20	344 31	500 25	411 33	356 49	377 16	154 51	100 39	
Average duration	2 48	2 20	2 5	2 7	1 6	2 4	1 42	2 35	

TABLE 7(a)

Frequency of thunderstorms within different time limits (IST)

Year	March						April						May						June					
	0—4	4—8	8—12	12—16	16—20	20—24	0—4	4—8	8—12	12—16	16—20	20—24	0—4	4—8	8—12	12—16	16—20	20—24	0—4	4—8	8—12	12—16	16—20	20—24
1939	—	—	—	—	—	—	—	—	2	4	7	2	1	1	1	7	3	3	—	1	—	3	8	2
1940	—	—	—	1	2	2	1	1	1	4	3	2	1	1	1	5	7	3	—	1	3	6	8	1
1941	2	1	1	—	2	3	2	2	2	2	7	4	1	1	1	10	16	6	—	1	2	4	8	3
1942	—	—	—	—	—	—	—	—	1	6	1	1	1	2	2	5	9	5	2	3	4	2	7	3
1943	1	2	1	—	2	—	1	1	—	4	6	3	1	1	2	6	10	1	1	1	2	1	5	1
1944	—	—	—	—	—	—	1	2	1	3	5	5	—	—	—	2	5	2	—	—	1	4	5	8
1945	—	—	—	—	—	—	—	—	—	2	6	2	—	1	—	6	14	8	1	2	1	6	7	1
1946	—	1	1	4	2	—	1	3	2	4	6	5	2	1	1	4	12	7	—	—	1	8	13	9
1947	—	—	1	—	3	2	—	—	—	3	7	3	1	—	1	5	7	4	3	2	4	7	4	3
1948	—	—	—	—	3	1	2	2	1	2	6	4	—	1	1	9	5	4	2	2	2	6	10	3
1949	—	1	1	1	1	1	1	2	1	5	4	3	1	—	5	5	9	7	1	2	1	9	6	2
1950	—	—	—	1	3	1	1	1	1	2	4	4	—	2	2	8	9	5	—	1	1	4	2	1
1951	—	—	—	—	3	1	—	—	—	7	9	4	2	3	1	4	7	1	2	3	1	5	3	2
1952	—	—	—	—	2	2	—	—	1	2	4	2	1	1	1	7	7	2	—	—	2	3	3	3
1953	2	3	2	3	5	2	—	—	—	2	2	1	—	—	1	5	6	1	3	2	2	3	2	1
Total	5	8	7	10	28	15	10	14	13	52	77	44	12	15	21	88	126	59	15	21	27	71	91	43

TABLE 7 (a)—*contd*

Year	July						August						September						October					
	0—4	4—8	8—12	12—16	16—20	20—24	0—4	4—8	8—12	12—16	16—20	20—24	0—4	4—8	8—12	12—16	16—20	20—24	0—4	4—8	8—12	12—16	16—20	20—24
1939	1	1	1	5	9	9	1	1	1	5	7	5	2	1	—	1	5	6	1	1	—	—	2	1
1940	—	—	—	3	2	1	1	2	—	5	3	1	1	1	—	1	8	2	—	1	—	1	—	—
1941	—	2	3	4	6	4	1	1	—	2	4	2	2	—	—	—	1	—	—	—	—	—	2	—
1942	3	3	3	4	3	1	1	2	2	3	4	4	2	1	1	1	—	1	—	—	—	—	—	—
1943	1	4	5	4	7	—	5	3	—	2	2	3	—	—	1	1	1	1	—	—	—	—	—	—
1944	1	4	1	5	2	3	8	8	—	3	5	4	1	1	—	2	4	2	—	—	—	—	—	—
1945	2	5	3	5	2	7	1	4	1	4	5	3	2	—	1	—	5	2	1	1	1	2	2	—
1946	4	5	—	—	3	3	2	3	2	2	2	4	—	—	—	1	5	1	1	1	—	1	4	3
1947	1	—	—	1	5	8	4	3	1	5	4	3	—	1	2	3	3	3	—	—	—	1	2	2
1948	1	1	—	3	5	7	1	4	3	8	5	1	—	2	—	—	1	2	—	—	—	—	1	2
1949	1	—	—	4	4	2	—	—	—	2	1	2	—	1	1	1	3	2	—	—	—	—	—	—
1950	6	6	2	3	3	2	3	5	1	5	2	5	—	—	—	2	2	2	—	—	—	1	—	2
1951	—	1	—	—	3	2	—	3	4	4	4	2	—	—	—	—	4	3	—	1	2	3	1	—
1952	2	4	4	3	1	2	3	1	—	—	1	2	—	—	—	1	3	2	—	—	—	—	2	1
1953	—	—	1	1	2	2	5	5	1	2	3	2	—	—	—	—	4	1	1	1	—	2	2	3
Total	23	36	23	45	57	53	36	45	16	52	52	43	10	8	6	13	9	30	4	6	3	11	18	14

TABLE 7 (b)

Frequency of thunderstorms within different time limits during 15 years (1939-1953)

	0 to 4	4 to 8	8 to 12	12 to 16	16 to 20	20 to 24	Total
March	5	8	7	10	28	15	73
April	10	14	13	52	77	44	210
May	12	15	21	88	126	59	321
June	15	21	27	71	91	43	268
July	23	36	23	45	57	53	237
August	36	45	16	52	52	43	244
September	10	8	6	13	49	30	116
October	4	6	3	11	18	14	56
Total	115	153	116	342	498	301	1525