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A study of fifty years' rainfall of Nagapattinam

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CONTENTS

		Pages
1.	Introduction	310
2.	Normal rainfall of each calendar day	310
3.	Three-day normals	311
4.	Three-day "moving" normals	311
5.	Half-monthly and monthly means and extremes of monthly totals	311
6.	Frequency of raininess of each calendar day	311
7.	Mean intensity per rainy day	311
8.	Frequencies of different 24-hour intensities	318
9.	Proportion of rain falling in different 24-hour intensities	318
10.	Frequencies of rainy spells of different lengths	318
11.	Frequencies of dry intervals of different lengths	318
12.	Spells of heavy rain	318
13.	Association of heavy falls with depressions and storms	325
14.	Variability from year to year	325
15.	Acknowledgement	325

1. Introduction

Nagapattinam is second in the series of stations selected for studies of rainfall of individual stations, the first being Madras (Ramakrishnan 1953). It is situated in the east coast of the Madras State and almost marks the southern tip of the Indian portion of the region getting the northeast monsoon, Madras representing the middle and Visakhapatnam the northern tip. Its geographical co-ordinates are 10° 46′N, 79° 53′ E, 31 ft above sea level. The observations relate to the departmental observatory, situated in the port office, the observations being taken on a part time basis by officials of the port office. The observatory was founded in 1868, with one observation daily at 0800 LT. This hour was changed to 0800 IST on 1 January 1943 and to 0830 IST on 1 March 1949. A second routine observation was added in 1930, at 1700 IST and changed to 1730 IST on 1 March 1949. The raingauge, along with other meteorological instruments was inspected from time to time by departmental officers. The series formed by the 0800 or 0830 hrs (treated as homogeneous) for the fifty years 1901-1950 are utilised for the present paper. The study follows the general pattern of the earlier paper on Madras rainfall.

The raingauge is situated in an open ground in front of the port office. Some thirty to forty yards to the east of it runs a narrow river and a further 100 yards to the east is the actual water-edge of the sea. The country around is quite plain and there are no buildings within 50 yards of the raingauge. The raingauge at Nagapattinam is much closer to the open sea than that at Madras.

2. Daily normal rainfall

2·1. The normal rainfall of each calendar day, *i.e.*, the arithmetic mean of the total rain from 0800 (or 0830) hrs of each day to 0800 (or 0830) hrs of the next day for each January 1st etc from 1901 to 1950—is given in Table 1 and shown graphically in Fig. 1.

2·2. The main rainy season can be marked out as from middle of October to first week of December. If we take 30 cents as a working

minimum, the period can be more precisely stated as from 18 October to 8 December. Only stray cases of daily normals exceeding this value occur outside this time limit. The period starts some 8 days earlier and continues till 13 January, if we set a lower standard of daily normal, *viz.*, 20 cents. The highest daily normal of 0·83″ occurs on 23 October, with the next best of 0·82″ on 9 November. 16 days in the year have a normal less than 1 cent, *i.e.*, less than 25 cents have occurred on each of those days in all the 50 years together.

3. Three-day normals

The three-day normals are given in Table 2 and represented diagrammatically in Fig. 2. The period from the 99th (22 to 24 October) to the 114th (5 to 7 December) 3-day period stands out prominently with more than 1·5″. Even 1″ is rare, almost absent, outside this range, thus making the beginning and end quite sharp. The highest 3-day normal of 2·00″ was in the 105th period (11 to 13 November) and the second of 1·99″ on the 103rd (2 to 4 November).

The lowest value, on the other hand, is 2 cents.

4. Three-day " moving " normals

The three-day "moving" totals of normals are given in Table 3 and shown pictorially in Fig. 3. The period with a minimum of 1″ starts on 20 October and extends till 9 December. The highest value of 2·05″ occurs from 31 October to 2 November, with the next best of 2·00″ from 8 to 10 November and once again from 13 to 15 November.

5. Half-monthly and monthly means and extremes of monthly totals

The half-monthly and monthly means and extremes of monthly totals are contained in Table 4 and are represented diagrammatically in Figs. 4a and 4b.

5·1. The sharp rise in the half-monthly totals from the first half to the second half of October marks the beginning and the sharp fall from the first to the second half of January the end of the main rainy season (*i.e.*, the northeast monsoon).

5·2. The ratio of the highest total of each month to its normal is also given. This value has reached a figure of 11·6 in May, a month which does not ordinarily get much rain, but may have almost a deluge when a storm passes close to the station.

5·3. Even the month with the highest normal, *viz.*, November, has had a completely rainless year, in 1949.

5·4. Two thirds (67%) of the year's rainfall occurs in the three months October to December. The other third is scattered over the remaining nine months.

5·5. March has been rainless most often, *viz.*, in 20 of the 50 years and February in 17. September and October are the only months which have never been rainless ; but the margin is quite slender.

5·6. The highest total for November, of 55″ in 1920, has considerably exceeded the normal annual total.

6. Frequency of raininess of each calendar date

6·1. For each calendar date, the number of years out of the 50 in which there was some rain is shown in Table 5 and Fig. 5. The dates which had rain 20 or more occasions have been marked out by a vertical line by their side. The main period is from 16 October to 9 December. It is significant that in the southwest monsoon months, the raininess here is much less than at Madras, whereas in the northeast monsoon season, the two stations are almost comparable.

6·2. Two-digit figures are practically absent from 14 January to end of July more than half the year, at a stretch.

7. Mean intensity per rainy day

The mean intensity* per rainy day for each calendar date, obtained by dividing the total rain that fell on the particular date in the 50 years by the number of times the date had some rain, is shown in Table 6 and Fig. 6. Intensities exceed 1″ on 22 days in the month of November. The highest intensity of 2·42″ was on 24 December.

*The expression "intensity" is used in this paper in the sense of intensity in 24-hour periods ; no observations of the actual rate of rain with time are available for the stations

TABLE 1

Daily normal rainfall (*in.*)—Nagapattinam (1901—1950)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	·19	—	·01	·08	·02	·04	·04	·14	·14	·13	·59	·36
2	·26	·02	·08	·02	—	·03	·02	·07	·04	·06	·80	·44
3	·15	·02	·02	·04	·02	·10	·08	·03	·07	·07	·51	·57
4	·14	·02	·08	·06	·05	·03	·14	·02	·20	·11	·68	·56
5	·17	·02	·01	·04	·05	·02	·03	·01	·09	·07	·68	·52
6	·18	·02	—	—	·06	·03	·10	·01	·08	·11	·56	·65
7	·18	·17	—	·01	·02	·04	·05	·06	·21	·06	·59	·40
8	·22	·15	·02	·01	·05	·02	·03	·19	·10	·14	·50	·43
9	·10	·05	·01	·04	·08	·06	·02	·06	·03	·12	·82	·20
10	·19	·03	·02	·02	·03	·07	·09	·08	·14	·23	·68	·13
11	·16	·01	—	·01	·01	·05	·02	·08	·08	·22	·45	·25
12	·26	·03	·08	·13	·06	·07	·07	·06	·21	·21	·52	·29
13	·27	·01	·01	·26	·14	·02	·08	·07	·06	·21	·67	·13
14	·03	—	·18	·21	·09	·02	·04	·09	·11	·13	·56	·13
15	·01	·02	·05	·02	·07	·04	·03	·08	·14	·29	·77	·27
16	·04	—	·02	·04	·09	·08	·04	·06	·07	·18	·48	·44
17	·05	·01	·01	·02	·13	·04	·02	·05	·15	·24	·47	·19
18	·07	·04	—	·02	·11	·02	·07	·20	·12	·31	·55	·37
19	·02	·05	·01	·02	·14	·01	·03	·19	·10	·30	·27	·25
20	·03	·09	·01	·04	·13	·07	·05	·12	·11	·20	·38	·23
21	·06	·03	·01	—	·02	·02	·02	·11	·18	·39	·41	·13
22	·03	—	·07	·05	·05	·01	·01	·12	·07	·50	·79	·14
23	·02	·06	·02	—	·05	·01	·12	·12	·07	·83	·28	·24
24	·03	·04	·01	·05	·06	—	·03	·04	·10	·50	·44	·44
25	·08	·02	—	·01	·01	·05	·05	·09	·14	·54	·79	·36
26	·08	—	·01	·03	·11	·02	·07	·02	·25	·46	·50	·13
27	·05	·04	·01	·02	·03	·02	·09	·13	·15	·58	·63	·29
28	·12	·03	·08	·01	—	·04	·08	·09	·12	·77	·47	·08
29	·05		·05	·01	·02	·07	·08	·06	·12	·36	·60	·12
30	·01		·03	—	·03	·04	·04	·08	·12	·64	·48	·21
31	·03		·03		·02		·03	·14		·66		·13

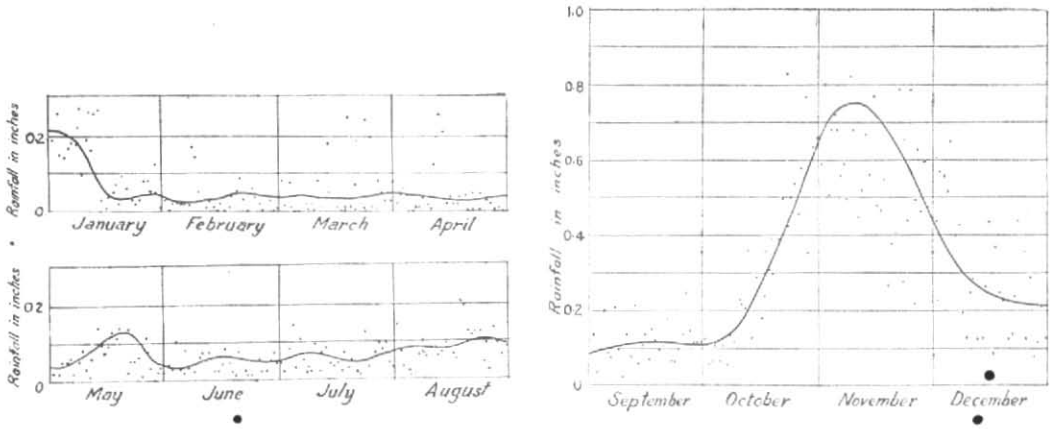

Fig. 1. Daily normal rainfall of Nagapattinam (1901—1950)

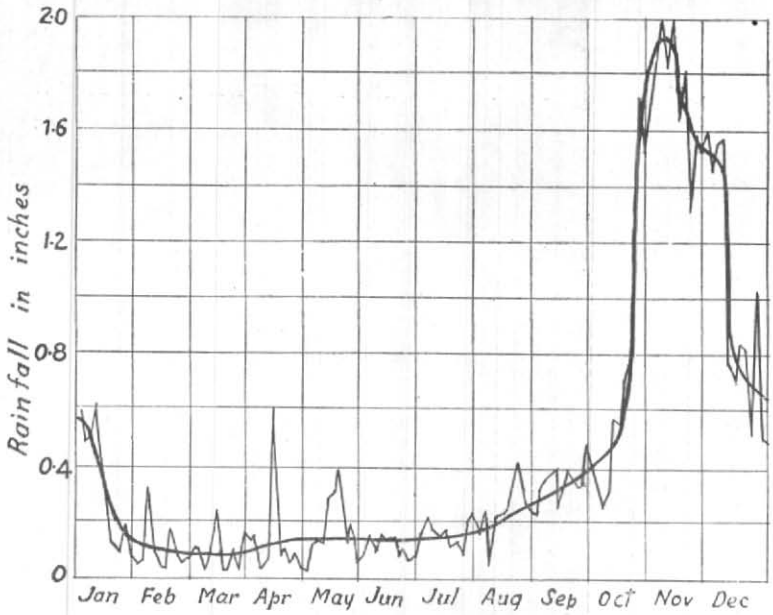

Fig. 2. Three-day normal rainfall of Nagapattinam (1901—1950)

TABLE 2

Three-day normals of rainfall—Nagapattinam (1901—1950)

	0+	10+	20+	30+	40+	50+	60+	70+	80+	90+	100+	110+	120+
1	0·60	0·05	0·11	0·13	0·02	0·09	0·15	0·15	0·23	0·39	1·71	1·60	0·50
2	0·49	0·06	0·09	0·14	0·12	0·16	0·24	0·24	0·32	0·31	1·89	1·44	0·46
3	0·50	0·34	0·03	0·02	0·13	0·09	0·18	0·04	0·36	0·25	1·99	1·55	..
4	0·61	0·09	0·10	0·07	0·12	0·15	0·14	0·22	0·39	0·31	1·83	1·57	..
5	0·31	0·04	0·24	0·60	0·29	0·14	0·17	0·22	0·25	0·57	2·00	0·76	..
6	0·16	0·03	0·03	0·08	0·29	0·14	0·11	0·24	0·38	0·55	1·64	0·67	..
7	0·11	0·18	0·03	0·10	0·38	0·07	0·12	0·31	0·36	0·71	1·81	0·84	..
8	0·08	0·09	0·10	0·05	0·12	0·10	0·08	0·42	0·33	0·81	1·29	0·81	..
9	0·21	0·06	0·02	0·09	0·18	0·06	0·20	0·28	0·32	1·72	1·58	0·50	..
10	0·08	0·07	0·16	0·04	0·05	0·08	0·24	0·24	0·49	1·50	1·51	1·04	..

NOTE—The year has been divided into 122 three-day periods and the normal of each 3-day successive period is given in the table, *e.g.*, the normal of 103rd 3-day period (2-4 November) is 1·99"

TABLE 3

Three-day moving totals of normal rainfall—Nagapattinam (1901—1950)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1—3	0·60	0·04	0·11	0·14	0·04	0·17	0·14	0·24	0·25	0·26	1·90	1·37
2—4	0·55	0·06	0·18	0·12	0·07	0·16	0·24	0·12	0·31	0·24	1·99	1·57
3—5	0·46	0·06	0·11	0·14	0·12	0·15	0·25	0·06	0·36	0·25	1·87	1·65
4—6	0·49	0·06	0·09	0·10	0·16	0·08	0·27	0·04	0·37	0·29	1·92	1·73
5—7	0·53	0·21	0·01	0·05	0·13	0·09	0·18	0·08	0·38	0·24	1·83	1·57
6—8	0·58	0·34	0·02	0·02	0·13	0·09	0·18	0·17	0·39	0·31	1·65	1·48
7—9	0·50	0·37	0·03	0·06	0·15	0·12	0·10	0·22	0·04	0·32	1·91	1·03
8—10	0·51	0·23	0·05	0·07	0·16	0·15	0·14	0·24	0·27	0·49	**2·00**	0·76
9—11	0·45	0·09	0·03	0·07	0·12	0·18	0·13	0·22	0·25	0·57	1·95	0·58
10—12	0·61	0·07	0·10	0·16	0·10	0·19	0·18	0·22	0·43	0·66	1·65	0·67
11—13	0·69	0·05	0·09	0·40	0·21	0·14	0·17	0·21	0·35	0·64	1·64	0·67
12—14	0·56	0·04	0·27	0·60	0·29	0·11	0·19	0·22	0·38	0·55	1·75	0·55
13—15	0·31	0·03	0·24	0·49	0·30	0·08	0·15	0·24	0·31	0·63	**2·00**	0·53
14—16	0·08	0·02	0·25	0·27	0·25	0·14	0·11	0·23	0·32	0·60	1·81	0·84
15—17	0·10	0·03	0·08	0·08	0·29	0·16	0·09	0·19	0·36	0·71	1·72	0·90
16—18	0·16	0·05	0·03	0·08	0·33	0·14	0·13	0·31	0·34	0·73	1·50	1·00
17—19	0·14	0·10	0·02	0·08	0·38	0·07	0·12	0·44	0·37	0·85	1·29	0·81
18—20	0·12	0·18	0·02	0·10	0·38	0·10	0·15	0·51	0·33	0·81	1·20	0·85
19—21	0·11	0·17	0·03	0·08	0·29	0·10	0·10	0·42	0·39	0·89	1·06	0·61
20—22	0·12	0·12	0·09	0·09	0·20	0·11	0·08	0·35	0·36	1·09	1·58	0·50
21—23	0·11	0·09	0·10	0·05	0·12	0·04	0·15	0·35	0·32	1·72	1·48	0·51
22—24	0·08	0·10	0·10	0·10	0·16	0·02	0·16	0·28	0·24	1·83	1·61	0·82
23—25	0·13	0·12	0·03	0·06	0·12	0·06	0·20	0·25	0·31	1·87	1·51	1·04
24—26	0·19	0·06	0·02	0·09	0·18	0·07	0·15	0·15	0·49	1·50	1·78	0·92
25—27	0·21	0·06	0·02	0·06	0·15	0·09	0·21	0·24	0·54	1·48	1·92	0·78
26—28	0·25	0·07	0·10	0·06	0·14	0·08	0·24	0·24	0·52	1·81	1·60	0·50
27—29	0·22	0·07	0·14	0·04	0·05	0·13	0·25	0·28	0·39	1·71	1·70	0·49
28—30	0·18	0·04	0·16	0·02	0·05	0·15	0·20	0·25	0·36	1·77	1·55	0·41
29—31	0·09	0·29	0·11	0·03	0·07	0·15	0·15	0·28	0·37	1·66	1·44	0·46
30—	0·04		0·14	0·02	0·09	0·10	0·21	0·36	0·31	1·89	1·28	0·53
31—	0·05		0·13		0·09		0·24	0·32		**2·05**		0·58

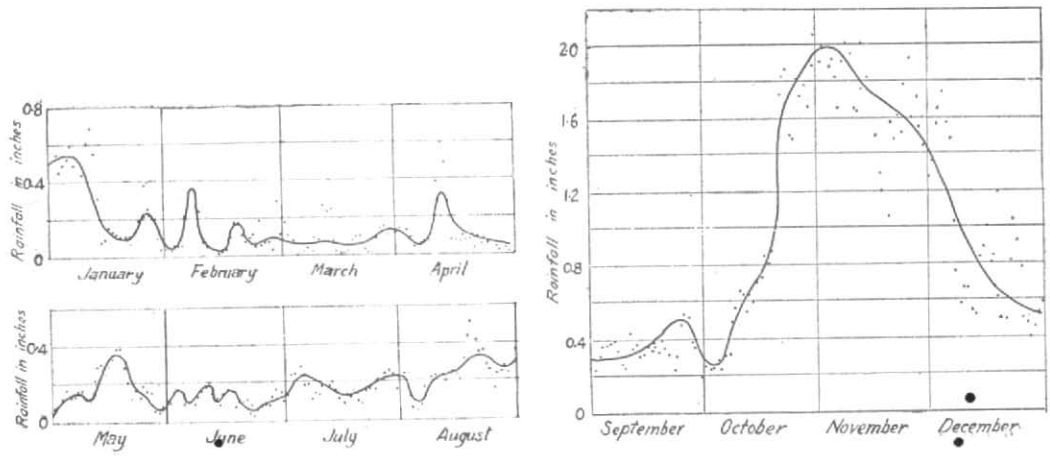

Fig. 3. Three-day moving totals of normal rainfall—Nagapattinam (1901—1950)

TABLE 4

Half-monthly* and monthly means and extremes of monthly totals of rainfall at Nagapattinam (1901—1950)

Month	Mean of 1st half month	Mean of 2nd half month	Mean of whole month	Normal of month expressed as % of annual normal	Highest monthly total	Ratio of the highest total of month to the normal	Year	Lowest monthly total	Year/s
Jan	2·51	0·71	3·26	6	22·49	6·9	1923	0·00	2
Feb	0·58	0·47	1·00	2	10·07	10·1	1938	0·00	17
Mar	0·58	0·35	0·95	2	6·12	6·5	1925	0·00	20
Apr	0·93	0·36	1·29	2	11·39	8·8	1939	0·00	11
May	0·94	0·94	1·94	4	22·55	11·6	1943	0·00	7
Jun	0·64	0·50	1·12	2	3·30	2·9	1950	0·00	2
Jul	0·85	0·76	1·65	3	8·38	5·1	1950	0·00	1924
Aug	0·95	1·52	2·51	5	7·07	2·8	1916	0·00	1948
Sep	1·69	1·82	3·44	7	15·29	4·4	1903	0·12	1925
Oct	2·14	7·03	9·46	18	34·63	3·7	1930	0·70	1918
Nov	9·41	7·55	16·96	32	54·73	3·2	1920	0·00	1949
Dec	5·40	3·56	9·20	17	33·47	3·6	1931	0·00	2

*The actual values have been adjusted, on a proportionate basis, for a 15-day period

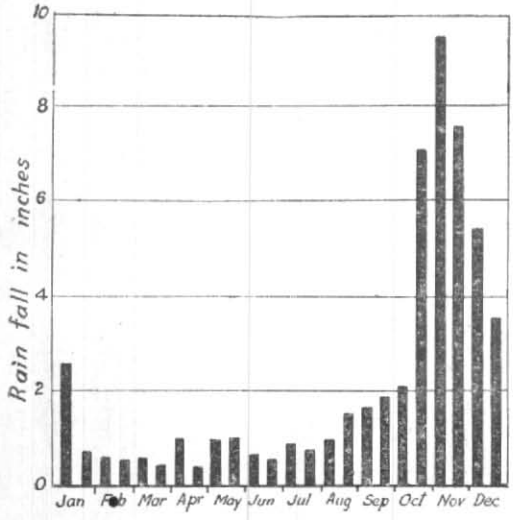

Fig. 4(a) Normal half-monthly rainfall Nagapattinam (1901—1950)

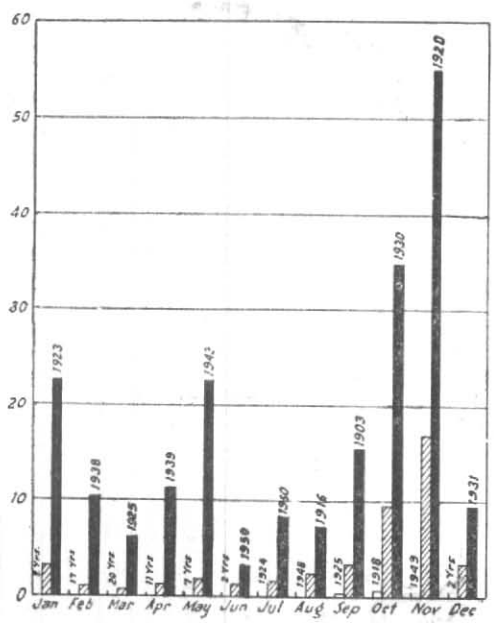

Fig. 4(b) Mean and extreme monthly totals of rainfall—Nagapattinam (1901—1950)

TABLE 5

Number of days in 50 years on which each calendar date had any rain—Nagapattinam (1901—1950)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	18	—	5	5	3	7	6	13	17	13	29	25
2	17	4	2	8	1	8	6	11	15	8	28	23
3	20	5	2	5	6	4	8	5	7	10	30	24
4	10	3	3	3	5	8	12	2	18	9	24	23
5	14	4	3	7	4	8	6	5	15	13	25	24
6	14	5	—	1	5	4	8	7	12	12	23	26
7	13	5	—	3	6	6	8	10	12	11	28	22
8	15	6	2	3	4	4	7	8	10	15	24	21
9	7	4	3	3	5	7	6	13	5	17	25	20
10	12	3	3	3	4	8	7	12	8	17	27	14
11	12	2	4	3	4	6	9	10	7	19	28	13
12	10	2	2	8	7	4	8	9	12	13	25	18
13	11	3	4	7	4	4	8	8	11	19	28	17
14	9	2	4	6	3	8	9	11	14	15	27	21
15	4	1	4	5	4	6	7	14	11	19	22	17
16	7	1	4	4	9	5	8	17	16	25	22	19
17	8	1	3	3	8	6	6	13	17	19	18	21
18	6	2	1	4	4	4	8	16	13	30	22	23
19	6	5	1	7	9	5	6	16	10	21	19	18
20	5	7	4	7	8	7	7	13	15	17	24	16
21	5	4	5	1	6	3	4	16	16	22	21	16
22	4	4	3	2	6	4	3	13	10	29	23	15
23	3	3	2	2	3	2	7	11	10	28	19	12
24	2	2	1	3	6	2	9	8	7	28	22	9
25	6	2	1	4	3	9	9	12	18	24	22	10
26	6	2	5	3	5	5	10	7	14	27	23	10
27	6	3	3	4	3	4	9	13	14	32	25	14
28	4	3	7	3	1	7	3	9	14	31	25	13
29	6		4	4	4	6	10	16	15	27	24	13
30	1		5	1	4	5	5	11	14	28	27	10
31	2		5		2		3	13		28		11

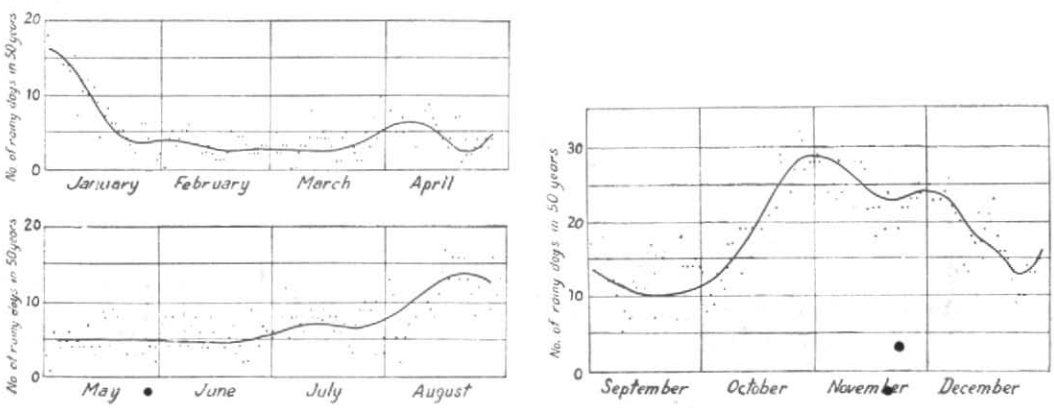

Fig. 5. Nagapattinam (1901—1950)

TABLE 6

Mean intensity per rainy day—Nagapattinam (1901—1950)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0·52	—	0·13	0·75	0·41	0·29	0·31	0·54	0·40	0·49	1·02	0·73
2	0·77	0·22	2·07	0·12	0·05	0·20	0·17	0·30	0·14	0·36	1·52	0·96
3	0·37	0·23	0·47	0·36	0·21	1·27	0·52	0·26	0·46	0·35	0·82	1·19
4	0·69	0·40	1·25	1·08	0·54	0·22	0·57	0·55	0·56	0·61	1·38	1·22
5	0·61	0·23	0·16	0·27	0·56	0·10	0·28	0·09	0·31	0·25	1·36	1·09
6	0·64	0·19	—	0·03	0·55	0·43	0·65	0·06	0·29	0·48	1·22	1·26
7	0·71	1·68	—	0·10	1·72	0·36	0·33	0·32	0·89	0·25	1·01	0·91
8	0·72	1·24	0·49	0·17	0·59	0·27	0·24	0·64	0·48	0·47	1·01	1·02
9	0·75	0·59	0·19	0·59	0·84	0·41	0·19	0·21	0·33	0·35	1·64	0·51
10	0·79	0·48	0·27	0·38	0·38	0·42	0·61	0·35	0·78	0·68	1·26	0·54
11	0·65	0·35	0·03	0·17	0·10	0·40	0·11	0·39	0·61	0·59	0·80	0·97
12	1·28	0·77	2·09	0·79	0·46	0·88	0·44	0·33	0·88	0·79	1·05	0·81
13	1·21	0·25	0·16	1·82	1·70	0·25	0·53	0·43	0·26	0·55	1·23	0·45
14	0·20	0·07	2·03	1·78	1·46	0·11	0·24	0·40	0·38	0·42	1·03	0·32
15	0·12	1·05	0·63	0·15	0·92	0·30	0·20	0·27	0·65	0·77	1·75	0·80
16	0·33	0·10	0·20	0·55	0·52	0·75	0·23	0·18	0·22	0·36	1·09	1·15
17	0·32	0·67	0·22	0·32	0·79	0·33	0·17	0·19	0·45	0·64	1·30	0·44
18	0·57	1·07	0·10	0·29	1·31	0·21	0·44	0·64	0·45	0·52	1·26	0·81
19	0·19	0·45	0·24	0·26	0·75	0·06	0·29	0·58	0·52	0·72	0·70	0·70
20	0·31	0·64	0·13	0·27	0·84	0·51	0·33	0·47	0·36	0·59	0·80	0·72
21	0·57	0·39	0·11	0·03	0·20	0·36	0·19	0·33	0·55	0·89	0·85	0·41
22	0·32	0·05	1·20	1·13	0·38	0·18	0·10	0·47	0·34	0·86	1·71	0·47
23	0·27	1·05	0·58	0·09	0·79	0·35	0·87	0·55	0·35	1·48	0·74	1·01
24	0·81	0·99	0·31	0·90	0·53	0·09	0·17	0·26	0·68	0·89	1·00	**2·42**
25	0·67	0·51	0·03	0·16	0·10	0·26	0·30	0·37	0·38	1·01	1·80	1·79
26	0·63	0·09	0·14	0·50	1·11	0·20	0·33	0·12	0·80	0·85	1·09	0·64
27	0·43	0·62	0·19	0·28	0·52	0·21	0·49	0·48	0·52	0·91	1·25	1·04
28	1·46	0·53	0·57	0·18	0·22	0·30	1·28	0·47	0·41	1·24	0·95	0·31
29	0·44		0·63	0·18	0·26	0·56	0·39	0·19	0·39	0·68	1·37	0·55
30	0·35		0·31	0·12	0·43	0·43	0·44	0·36	0·44	1·14	0·89	1·08
31	0·65		0·29		0·48		0·42	0·56		1·17		0·67

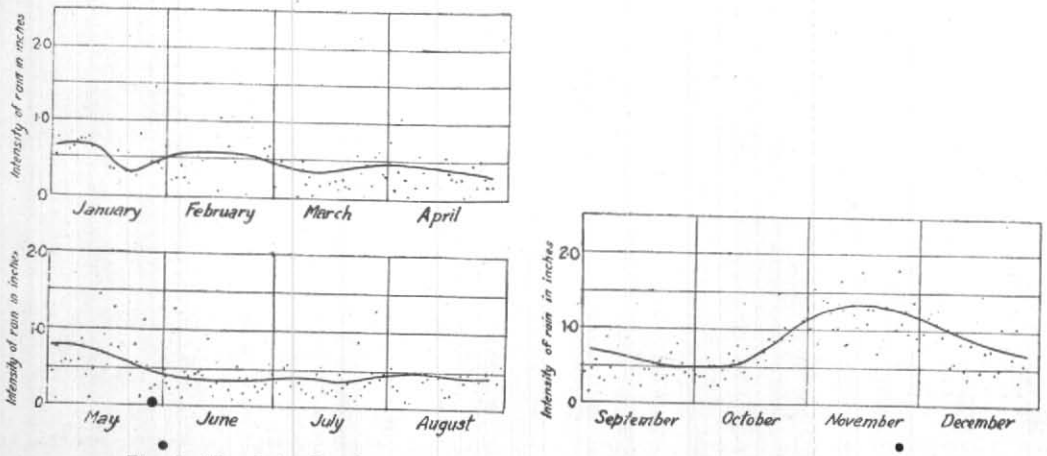

Fig. 6. Mean intensity of rain per rainy day in inches—Nagapattinam (1901-1950)

8. Frequencies of different 24-hour intensities

8·1. The numbers of occasions when rainfall with different ranges of intensity per day occurred in each of the 12 months are shown in Table 7. Figures in brackets show the frequency in each category expressed as percentages of the total number of occasions with some rain in the months. Totals for the seasons January to May, June to September and October to December are also given at the bottom of the table.

8·2. It will be seen that the first two categories between them cover about 60 per cent of the cases. In other words, on 60 per cent of the days when there is rain, it is only less than half an inch.

8·3. On the other side of the scale, there were 166 occasions exceeding 3″, in 43 of which the daily value exceeded 5″. The bulk of the last category were in November and December.

8·4. The numbers of occasions above (without the percentages) for the 12 months are also represented diagrammatically in Fig. 7.

9. Proportion of rain falling in different ranges of 24-hour intensities

9·1. The distribution of the total rain which occurred in each month in the 50 years over different 24-hour intensity ranges is shown in Table 8. The figures in brackets below the actual rainfall amounts in each category are their percentages of the total rain of the month.

9·2. The comparatively high percentages in the column more than 3″ in the months October to December will be expected. But that a high percentage of the total rain is really made up of a few heavy falls even in the months January to May will perhaps be a surprise.

9·3. The proportion of rain falling in units over 3″ per day, is comparatively least in the southwest monsoon months, June to September.

10. Frequencies of rainy spells of different lengths

The frequencies of rainy spells of different lengths are given in Table 9. The length of spell increases in steps of 1 day upto 10 days and in steps of 5 days later. A spell starting in one month and extending into the next is shown against the one in which it started. The table shows the increasing frequency of longer and longer spells in the months, October, November and December, with the peak in November, when even 7-day spells were common.

Most of the spells in June-September are of one day only. In the months February to July, spells longer than 2 consecutive days are uncommon. The longest spell was one of 18 days and occurred from 13 to 30 November 1920, a period which holds the record for heavy rainfall in other respects also (see Table 13, later). This length of the longest spell of rainy days is comparable to the one Madras had, *viz.*, of 21 days.

11. Frequencies of dry (rainless) intervals of different lengths

The frequencies of dry (rainless) intervals of different lengths are given in Table 10. The length of interval increases in stages of 4 days upto 20 days and stages of 10 days later upto 100 days. All cases above 100 days are treated as a single group. Spells of more than 50 dry days start in the months January to April. There were 3 spells longer than 100 days, the longest being of 118 days, from 26 January to 23 May in 1913.

12. Spells of heavy rain

Nagapattinam, being more or less on a par with Madras, the same criterion as for Madras was used for describing rain as heavy. However, the table were extended upto 7 days*. Thus Table 15 lists all instances of 4″ in a day, 6″ in 2 *consecutive* days, 8″ in 3 consecutive days etc ....16″ in 7 consecutive days, and gives the actual totals of the different spells. Tables 11, 12 and 13 show (*i*) the distribution of the spells of heavy rain in each category like 1 day, 2 days etc according to intensities, (*ii*) numbers of spells of each category in each month and (*iii*) the highest total with date of occurrence in each category.

*For Madras, values were given only upto 4 days

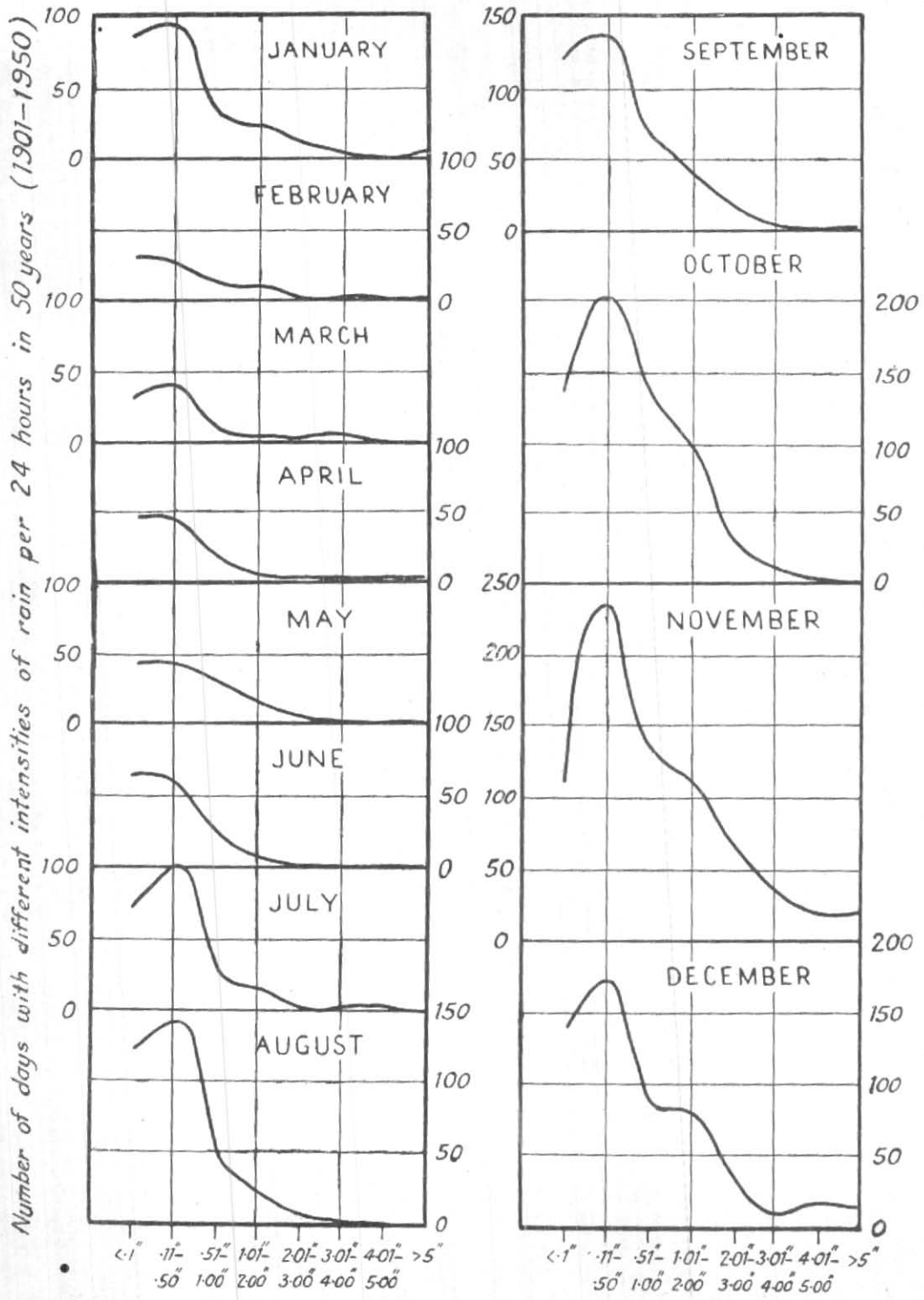

Fig. 7. Frequencies of days with different intensities—Nagapattinam (1901—1950)

TABLE 7

Distribution of rain according to intensity in 24 hours—Nagapattinam (1901—1950)

Month	0·00	Number of occasions with rainfall in one day								Total
		Less than 0·10″	0·10″ to 0·50″	0·51″ to 1·00″	1·01″ to 2·00″	2·01″ to 3·00″	3·01″ to 4·00″	4·01″ to 5·00″	Greater than 5·00″	
Jan	1287	87 (33)	96 (36)	32 (12)	27 (10)	10 (4)	7 (3)		4 (1)	263
Feb	1324	31 (35)	29 (33)	12 (14)	11 (13)	1 (1)	3 (3)	1 (1)		88
Mar	1455	33 (35)	41 (43)	9 (9)	5 (5)	2 (2)	4 (4)	1 (1)		95
Apr	1378	47 (38)	45 (37)	16 (13)	6 (5)	3 (2)	2 (1)	1 (1)	2 (1)	122
May	1404	44 (30)	45 (31)	31 (21)	15 (10)	5 (3)	4 (2)	1 (1)	2 (1)	146
Jun	1334	65 (39)	64 (39)	28 (17)	6 (4)	2 (1)	1			166
Jul	1329	75 (34)	102 (46)	25 (11)	13 (6)	3 (1)	1	2 (1)		221
Aug	1268	121 (35)	143 (42)	45 (13)	23 (7)	8 (2)	2 (1)			342
Sep	1123	121 (32)	139 (37)	62 (17)	41 (11)	13 (3)	1			377
Oct	924	133 (21)	202 (32)	138 (22)	99 (16)	29 (5)	13 (2)	8 (1)	4	626
Nov	771	110 (15)	234 (32)	132 (18)	114 (16)	65 (9)	36 (5)	18 (2)	20 (3)	729
Dec	1012	139 (26)	172 (32)	87 (16)	80 (15)	31 (6)	7	11 (2)	11 (2)	538
Jan—May	6848	242	256	100	64	21	19	4	8	714
Jun—Sep	4994	382	448	160	83	26	5	2		1106
Oct—Dec	2707	382	608	357	293	125	56	37	35	1893

Figures in brackets are percentages of number of days with rain in each category to total number of days with any rain in the month

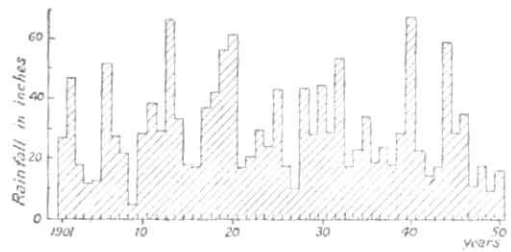

Fig. 8. Total rainfall from middle of October to middle of December—Nagapattinam (1901-1950)

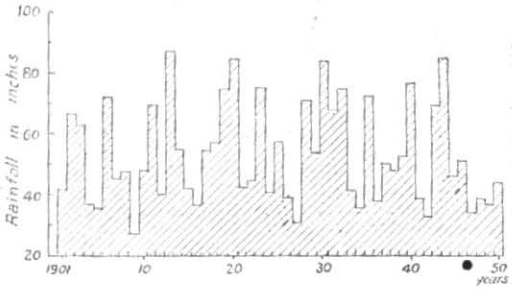

Fig. 9. Annual rainfall—Nagapattinam (1901-1950)

TABLE 8

Distribution of total rainfall over different ranges of 24-hour falls (amounts)—Nagapattinam (1901—1950)

Month	0·50″ and less	0·51″ to 1·00″	1·01″ to 1·50″	1·51″ to 2·00″	2·01″ to 2·50″	2·51″ to 3·00″	More than 3·00″	Total rain
Jan	26·3	22·4	22·8	16·0	20·6	2·7	52·3	163·1
	(16)	(14)	(14)	(10)	(13)	(2)	(32)	
Feb	7·7	8·6	10·3	5·4	..	..	18·1	50·1
	(15)	(17)	(20)	(11)			(36)	
Mar	11·1	6·1	4·7	1·7	2·1	2·6	19·2	47·5
	(23)	(13)	(10)	(3)	(5)	(5)	(40)	
Apr	11·7	12·2	4·3	5·1	..	8·0	23·0	64·3
	(18)	(19)	(7)	(8)		(12)	(36)	
May	13·6	22·5	8·7	14·0	8·7	2·6	27·1	97·2
	(14)	(23)	(9)	(14)	(9)	(3)	(28)	
Jun	18·8	20·1	4·8	5·2	2·2	2·6	3·1	56·8
	(33)	(35)	(8)	(9)	(4)	(5)	(5)	
Jul	26·8	18·2	8·2	9·9	2·5	5·2	12·2	83·0
	(32)	(22)	(10)	(12)	(3)	(6)	(15)	
Aug	40·1	32·3	22·2	8·6	8·4	10·5	6·3	128·4
	(31)	(25)	(17)	(7)	(7)	(8)	(5)	
Sep	39·3	44·3	30·9	26·3	18·2	13·8	3·1	175·9
	(22)	(25)	(17)	(15)	(10)	(8)	(2)	
Oct	57·8	99·0	77·9	59·3	30·6	44·4	112·1	481·1
	(12)	(21)	(16)	(12)	(6)	(9)	(23)	
Nov	69·3	96·2	92·0	72·3	76·1	86·0	355·9	847·8
	(8)	(11)	(11)	(9)	(9)	(10)	(42)	
Dec	50·6	61·3	53·0	61·0	34·1	46·7	153·1	459·8
	(11)	(13)	(11)	(13)	(7)	(10)	(33)	

Figures in brackets are percentages of rainfall amount in the range to total rain for the month

TABLE 9

Distribution according to length of rainy spell—Nagapattinam (1901—1950)

	Duration of spell (*days*)												Total
	1	2	3	4	5	6	7	8	9	10	11 to 15	16 to 20	No. of spells
Jan	54	29	27	3	2	4	2						121
Feb	17	12	6	3	2		1						41
Mar	27	13	5	5		1		1					52
Apr	42	15	3	6	2								68
May	67	12	5	4	2	1			1				92
Jun	101	26	3	1									131
Jul	126	30	8	1		1							166
Aug	134	38	16	12	2	3	3	1					209
Sep	119	46	23	7	7	4	1						207
Oct	77	30	22	15	12	7	8	4	1	4	15	1	196
Nov	53	31	32	21	12	11	11	1	2		8	3	185
Dec	64	49	26	11	10	9	3	4		1	1	1	179
Jan—May	207	81	46	21	8	6	3	1	1				374
	(55)	(21)	(12)	(6)	(2)	(2)							
Jun—Sep	480	140	50	21	9	8	4	1					713
	(67)	(20)	(7)	(3)									
Oct—Dec	194	110	80	47	34	27	22	9	3	5	24	5	560
	(35)	(20)	(14)	(8)	(6)	(5)	(4)	(2)		(1)	(4)	(1)	

(*i*) Longest spell : 18 days, from 13 to 30 November 1920

(*ii*) Next best : 16 days, from (1) 21 October to 5 November 1910 and (2) 4 to 19 December 1942

(*iii*) The figures in brackets are percentages

TABLE 10

Dry (rainless) intervals between rainy days—Nagapattinam (1901—1950)

Month	Duration of spells (*days*)													
	1 to 4	5 to 8	9 to 12	13 to 16	17 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100	More than 100
Jan	41	28	9	8	6	13	6	5	5	1	4	3	1	1
Feb	4	4	3	3	1	7	5	6	4			1		1
Mar	11	5	3	6	4	6	8	2		1	1			
Apr	18	12	3	5	3	14	7	4	2	1	1			
May	17	15	9	15	2	13	3	3						
Jun	43	22	17	12	9	15	2	1						
Jul	71	33	27	9	11	8	3							
Aug	104	53	20	8	6	2	2	1						
Sep	130	31	21	12	6	5	2							
Oct	119	29	22	7	1	1								
Nov	137	30	7	7		2	2	2						
Dec	112	39	21	8	4	7	1							1

Longest spell: 118 days, from 26 January to 23 May 1913

TABLE 11

Frequency of spells of heavy rain according to intensity irrespective of months of occurrence Nagapattinam (1901-1950)

Rainfall range (*inches*)	One-day spells	Two-day spells	Three-day spells	Four-day spells	Five-day spells	Six-day spells	Seven-day spells
	Frequency						
4·01—5·0	40						
5·01—6·0	20						
6·01—7·0	6	32					
7·01—8·0	4	18					
8·01—9·0	4	15	24				
9·01-10·0	2	7	19				
10·01-11·0	3	10	14	24			
11·01-12·0		3	5	15			
12·01-13·0	1	5	8	14	18		
13·01-14·0			7	4	10		
14·01-15·0	2	3	6	12	15	8	
15·01-16·0	1		2	4	8	14	
16·01-17·0		1	1	2	2	7	10
17·01-18·0		1	3	8	5	6	7
18·01-19·0		1	3	2	5	6	4
19·01-20·0		2	2	4	6	4	8
20·01-21·0			2	4	7	5	4
21·01-22·0					2	5	8
22·01-23·0					1	5	1
23·01-24·0			1			2	2
24·01-25·0				1	1	1	4
25·01-26·0				1	1	1	4
26·01-27·0					1	2	2
27·01-28·0						1	4

TABLE 12

Number of spells of heavy rain—Nagapattinam (1901—1950)

	4″ or more in 1 day	6″ or more in 2 days	8″ or more in 3 days	10″ or more in 4 days	12″ or more in 5 days	14″ or more in 6 days	16″ or more in 7 days
January	4	4	6	4	2	2	2
February	1	1	1	..	..	..	..
March	1	..	..	..	..	..	..
April	3	3	2	2	..	..	..
May	3	4	2	2	3	2	2
June	..	..	..	..	..	..	..
July	1	..	..	..	..	..	..
August	..	..	..	..	..	..	..
September	..	..	..	..	..	..	..
October	12	9	10	9	10	7	6
November	36	54	57	56	51	43	37
December	22	23	19	22	16	13	11

TABLE 13

Highest total in each category Nagapattinam (1901—1950)

Duration of spells (days)	Date	Total rainfall (*in*)
1	23-10-30	15·66
2	23-10-30 to 24-10-30	19·74
3	22-10-30 to 24-10-30	23·50
4	21-10-30 to 24-10-30	25·06
5	20-10-30 to 24-10-30	26·02
6	25-11-20 to 30-11-20	27·40
7	24-11-20 to 30-11-20	27·55

TABLE 14

Variation of Seasonal (middle of October to middle of December) and annual rainfall of Nagapattinam (1901—1950)

Year	Rainfall (*in*)		Year	Rainfall (*in*)	
	Middle of October to middle of December	Annual		Middle of October to middle of December	Annual
1901	27·22	41·96	1926	17·74	38·80
1902	47·00	66·40	1927	10·90	30·48
1903	18·29	62·21	1928	44·21	71·16
1904	11·86	36·89	1929	27·88	53·75
1905	12·24	35·78	1930	44·79	83·93
1906	51·52	72·27	1931	28·22	68·53
1907	27·81	45·11	1932	53·00	75·63
1908	47·34	47·34	1933	16·44	41·30
1909	4·56	26·49	1934	22·98	36·86
1910	27·59	47·52	1935	34·57	73·03
1911	38·47	68·65	1936	19·59	38·97
1912	29·72	40·18	1937	33·81	50·29
1913	66·50	85·79	1938	18·02	48·01
1914	33·36	54·89	1939	29·04	53·01
1915	17·63	41·58	1940	67·43	76·23
1916	17·52	36·59	1941	22·97	38·06
1917	36·76	54·57	1942	14·79	32·84
1918	41·84	56·16	1943	22·87	69·76
1919	56·22	74·61	1944	58·73	84·84
1920	61·26	84·37	1945	29·05	46·21
1921	17·08	42·28	1946	35·18	51·10
1922	20·30	44·28	1947	11·36	34·17
1923	29·99	75·18	1948	18·26	39·61
1924	24·25	40·91	1949	9·97	37·04
1925	43·70	56·45	1950	15·41	43·01

Table 13 shows that two years 1920 and 1930 carry all the records between them. There were 58 spells with 16″ or more in 7 days, 48 of them in the two months November and December. Note how the highest total in a spell rises very slowly from 3 days, 23·5″ in 3 days to 27·5″ in 7 days.

13. Association of spells of heavy rain with storms and depressions

All the dates which have figured in Table 15, are arranged in spells of consecutive days and these dates, lengths of spell and brief notes about the general weather situation which could have had a bearing on the rain of Nagapattinam are given in Table 16. The notes are only extracted from the descriptions in the printed Monthly Weather Reports or Annual Summaries and are not based on any special fresh study of the working charts of the period in question. Statements about the strengthening of the northeast monsoon and references to low pressure waves often do not contribute much to clarify the situation, but they are recorded for what they are worth. They, however, help to emphasise the fact that the rainfall is general over the area and not too local. The 63 spells of heavy rain get distributed over different types of weather situations as follows —

Strengthening of northeast monsoon	Passage of low pressure wave, or influence of weak or distant depression	Full influence of depression or storm	Other categories
24	11	23	5

To complete the picture, one has also to examine the complementary point as to how often situations of these same types did occur without producing corresponding heavy rain and also to see how far the heaviness of the rain could be correlated with the intensity or proximity of the weather influence. These are not easy to define, yet as detailed an examination as is possible seems worthwhile and the authors hope to do it separately.

4. Variability from year to year

The totals for the main rainy season, middle of October to middle of December and the whole year for each of the 50 years are given in Table 14 and shown diagrammatically in Figs. 8 and 9. The highest totals are 67·4″ for season in 1940 and 85·8″ for year in 1913 ; while the lowest are 4·6″ for the season and 26·5″ for year in 1909. Fifty years is not a long enough period to discover periodicities or secular trend. But the information in Table 14 and Figs. 8 and 9 will, the authors hope, be useful.

15. Acknowledgment

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REFERENCE

Ramakrishnan, K. P. (1953). *Ind. J. Met. Geophys.*, **4**, 2, pp. 123-144.

TABLE

Spells of heavy rain

4″ or more in 1 day			6″ or more in 2 days			8″ or more in 3 days		
Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)
								JANUARY
			1902	3—4	7·59	1902	3—5	8·06
1904	2	5·12						
1923	13	9·65	1923	12—13	16·50	1923	11—13	18·93
1923	12	6·85	1923	11—12	9·28	1923	10—12	9·70
						1923	12—14	17·25
			1923	13—14	10·40	1923	13—15	10·60
1926	28	5·18						
						1930	6—8	9·64
								FEBRUARY
1938	7	4·92	1938	7—8	8·51	1938	7—9	8·57
								MARCH
1923	23	4·98						
								APRIL
1931	14	5·97	1931	13—14	9·82	1931	13—15	9·87
			1931	14—15	6·02			
1939	13	5·54	1939	13—14	10·04	1939	13—15	10·28
1939	14	4·50						
								MAY
1930	7	6·46	1930	7—8	6·53			
			1943	12—13	7·65	1943	12—14	11·89
1943	13	5·96	1943	13—14	10·20	1943	13—15	12·75
1943	14	4·24	1943	14—15	6·79			
								JUNE
Nil								
								JULY
1916	23	4·45						
								AUGUST
Nil								
								SEPTEMBER
Nil								
								OCTOBER
1905	12	4·48						
			1908	22—23	8·66	1908	22—24	12·71
1908	23	5·76	1908	23—24	9·79	1908	23—25	11·51
1908	24	4·05						
						1913	23—25	8·67
			1913	24—25	6·61	1913	24—26	10·80
1913	25	5·26	1913	25—26	9·51	1913	25—27	10·99
1913	16	4·25						

15

in Nagapattinam (1901—1950)

10″ or more in 4 days			12″ or more in 5 days			14″ or more in 6 days			16″ or more in 7 days		
Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)
1923	10—13	19·35	1923	9—13	19·35	1923	8—13	19·35	1923	7—13	19·39
1923	12—15	17·45	1923	12—16	17·45	1923	12—17	17·45	1923	12—18	17·45
1923	13—16	10·60									
1930	6—9	11·34									
1931	13—16	10·08									
1939	13—16	10·44									
1943	12—15	14·44	1943	12—16	14·50	1943	12—17	16·10	1943	12—18	19·86
1943	13—16	12·81	1943	13—17	14·41	1943	13—18	18·17	1943	13—19	19·09
			1943	14—18	12·20						
1908	22—25	14·43	1908	22—26	14·94	1908	22—27	15·02			
1908	23—26	12·02	1908	23—27	12·10						
1913	23—26	12·92	1913	23—27	14·40	1913	23—28	14·70			
1913	24—27	12·34	1913	24—28	12·64						
1913	25—28	11·29									

TABLE

4″ or more in 1 day			6″ or more in 2 days			8″ or more in 3 days		
Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)
								OCTOBER—
1923	28	4·81	1923	27—28	8·28	1923	26—28	8·89
						1923	27—29	9·14
1930	24	4·08	1930	23—24	19·74	1930	22—24	23·50
						1930	23—25	20·36
1930	23	15·66						
1934	28	5·56	1934	27—28	6·97	1934	26—28	8·26
			1934	28—29	6·52			
1935	30	4·08						
1937	31	4·37						
			1943	25—26	6·77			
1950	19	4·02						
								NOVEMBER
1906	14	8·06	1906	13—14	11·63	1906	12—14	13·65
			1906	14—15	12·33	1906	14—16	14·43
1906	15	4·27	1906	15—16	6·37			
			1907	4—5	6·66	1907	3—5	8·02
1907	10	5·28	1907	9—10	6·65	1907	9—11	9·71
			1907	10—11	8·34	1907	10—12	8·34
			1911	20—21	6·54			
1912	17	9·18	1912	16—17	10·63	1912	15—17	10·73
						1912	16—18	14·10
			1912	17—18	12·65	1912	17—19	13·80
			1913	7—8	6·49	1913	7—9	17·23
			1913	8—9	14·58	1913	8—10	14·78
1913	9	10·74	1913	9—10	10·94	1913	9—11	10·94
1913	29	5·15	1913	28—29	8·35	1913	27—29	9·95
						1913	28—30	10·71
			1913	29—30	7·51	1913	29—1	9·51
1916	15	4·12						
1917	22	6·45	1917	21—22	8·75	1917	20—22	8·81
						1917	21—23	8·93
			1917	22—23	6·63	1917	22—24	9·58
						1917	26—28	9·48
			1917	27—28	6·65			
1918	18	14·39	1918	17—18	18·21	1918	16—18	18·31
						1918	17—19	18·44
			1918	18—19	14·62	1918	18—20	14·62

15 (*contd*)

10″ or more in 4 days			12″ or more in 5 days			14″ or more in 6 days			16″ or more in 7 days		
Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)
contd											
1923	25—28	11·69	1923	24—28	12·35						
			1923	25—29	12·55						
1930	21—24	25·06	1930	20—24	26·02	1930	19—24	26·92	1930	18—24	27·11
1930	22—25	24·12	1930	21—25	25·68	1930	20—25	26·64	1930	19—25	27·54
1930	23—26	20·38	1930	22—26	24·14	1930	21—26	25·70	1930	20—26	26·66
			1930	23—27	20·42	1930	22—27	24·18	1930	21—27	25·74
						1930	23—28	20·69	1930	22—28	24·45
									1930	23—29	24·53
1906	11—14	14·01	1906	11—15	18·28	1906	11—16	20·38	1906	11—17	20·62
1906	14—17	14·67	1906	14—18	14·67	1906	14—19	14·67			
1907	2—5	10·07									
1912	14—17	10·86	1912	14—18	14·33	1912	14—19	15·48			
1912	15—18	14·20	1912	15—19	15·35	1912	15—20	15·83	1912	15—21	16·08
1912	16—19	15·25	1912	16—20	15·73	1912	16—21	15·98	1912	16—22	16·58
1912	17—20	14·28	1912	17—21	14·53	1912	17—22	15·13			
1913	7—10	17·43	1913	7—11	17·43	1913	7—12	17·43	1913	7—13	17·43
1913	8—11	14·78	1913	8—12	14·78	1913	8—13	14·78			
1913	9—12	10·94									
1913	26—29	11·43	1913	26—30	13·79	1913	26—1	15·79	1913	26—2	18·14
1913	27—30	12·31	1913	27—1	14·31	1913	27—2	16·66	1913	27—3	16·78
1913	28—1	12·71	1913	28—2	15·06	1913	28—3	15·18	1913	28—4	21·23
1913	29—2	11·86				1913	29—4	18·03	1913	29—5	18·28
			1913	30—4	12·88						
									1917	20—26	16·77
1917	21—24	11·88	1917	21—25	13·88	1917	21—26	16·71	1917	21—27	19·86
1917	22—25	11·58	1917	22—26	14·41	1917	22—27	17·56	1917	22—28	21·06
1917	24—27	10·93	1917	24—28	14·43	1917	24—29	15·48	1917	24—30	18·48
1917	25—28	11·48	1917	25—29	12·53	1917	25—30	15·53			
1917	26—29	10·53	1917	26—30	13·53						
1917	27—30	10·70									
1918	15—18	19·49	1918	14—18	19·49	1918	13—18	19·49	1918	12—18	19·49
									1918	13—19	19·72
			1918	15—19	19·72	1918	15—20	19·72	1918	15—21	19·72
1918	16—19	18·54	1918	16—20	18·54	1918	16—21	18·54	1918	16—22	18·54
1918	17—20	18·44	1918	17—21	18·44	1918	17—22	18·44	1918	17—23	18·44
1918	18—21	14·62	1918	18—22	14·62	1918	18—23	14·62			

TABLE

4″ or more in 1 day			6″ or more in 2 days			8″ or more in 3 days		
Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)
								NOVEMBER—
			1919	1—2	11·03	1919	1—3	11·45
1919	2	8·09	1919	2—3	8·51	1919	2—4	11·19
						1920	13—15	8·85
1920	15	4·03	1920	14—15	8·20	1920	14—16	8·75
1920	25	7·60	1920	24—25	7·75	1920	23—25	8·80
1920	22	4·25						
						1920	24—26	10·23
			1920	25—26	10·08	1920	25—27	15·38
			1920	26—27	7·78	1920	26—28	12·20
1920	27	5·30	1920	27—28	9·72	1920	27—29	12·25
1920	28	4·42	1920	28—29	6·95	1920	28—30	12·02
1920	30	5·07	1920	29—30	7·60			
						1924	3—5	9·82
1924	4	4·20	1924	4—5	8·97	1924	4—6	9·50
1924	5	4·77						
1928	5	4·22	1928	4—5	8·02	1928	3—5	8·38
						1928	4—6	8·10
			1928	10—11	6·93	1928	10—12	9·19
1929	23	4·30	1929	23—24	6·20			
1930	27	4·49	1930	26—27	7·35			
1932	25	12·18	1932	24—25	17·31	1932	23—25	19·92
1932	24	5·13				1932	24—26	17·31
1933	9	4·51	1933	8—9	6·90			
1935	15	5·97	1935	14—15	7·56	1935	14—16	9·00
			1935	15—16	7·41			
1935	22	7·97	1935	21—22	8·18	1935	21—23	8·90
			1935	22—23	8·69	1935	22—24	9·41
1936	2	4·64						
1937	3	4·78	1937	2—3	6·86			
1939	7	4·75	1939	6—7	6·46	1939	6—8	9·53
			1939	7—8	7·82	1939	7—9	8·62
1939	15	5·47	1939	14—15	6·04	1939	14—16	9·58
			1939	15—16	9·01	1939	15—17	9·19
						1940	2—4	8·33
						1940	4—6	15·96
			1940	5—6	12·48	1940	5—7	13·88
1940	6	10·36	1940	6—7	11·76	1940	6—8	14·74
						1940	8—10	9·14
			1940	9—10	6·16	1940	9—11	8·80
			1940	10—11	6·45			
1944	15	7·73	1944	14—15	10·14	1944	13—15	13·06
						1944	14—16	10·65

15 (*contd*)

10″ or more in 4 days			12″ or more in 5 days			14″ or more in 6 days			16″ or more in 7 days		
Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)
contd											
1919	1—4	14·13	1919	1—5	14·88	1919	1—6	16·37	1919	1—7	16·37
1919	2—5	11·94	1919	2—6	13·43						
1920	14—17	10·08				1920	14—19	14·39	1920	14—20	16·35
1920	22—25	13·05	1920	21—25	13·24	1920	20—25	15·20	1920	19—25	17·76
									1920	20—26	17·68
						1920	21—26	15·72	1920	21—27	21·02
			1920	22—26	15·53	1920	22—27	20·83	1920	22—28	25·25
1920	23—26	11·28	1920	23—27	16·58	1920	23—28	21·00	1920	23—29	23·53
1920	24—27	15·53	1920	24—28	19·95	1920	24—29	22·48	1920	24—30	27·55
1920	25—28	19·80	1920	25—29	22·33	1920	25—30	27·40	1920	25—1	27·40
1920	26—29	14·73	1920	26—30	19·80	1920	26—1	19·80	1920	26—2	19·80
1920	27—30	17·32	1920	27—1	17·32	1920	27—2	17·32	1920	27—3	17·32
1920	28—1	12·02	1920	28—2	12·02						
			1924	1—5	13·05						
1924	2—5	11·53	1924	2—6	12·06						
1924	3—6	10·35									
1928	10—13	11·54	1928	10—14	12·95						
1932	22—25	20·75	1932	21—25	21·38	1932	20—25	22·16	1932	19—25	22·78
1932	24—27	17·31	1932	24—28	17·31	1932	24—29	17·31	1932	24—30	17·51
			1935	21—25	12·59						
1935	22—25	12·38	1935	22—26	12·46						
1937	2—5	10·06									
1939	6—9	10·33									
1940	1—4	10·47	1940	1—5	12·59	1940	1—6	22·95	1940	1—7	24·35
1940	2—5	10·45	1940	2—6	20·81	1940	2—7	22·21	1940	2—8	25·19
1940	3—6	17·56	1940	3—7	18·96	1940	3—8	21·94	1940	3—9	24·29
1940	4—7	17·36	1940	4—8	20·34	1940	4—9	22·69	1940	4—10	26·50
1940	5—8	16·86	1940	5—9	19·21	1940	5—10	23·02	1940	5—11	25·66
1940	6—9	17·09	1940	6—10	20·90	1940	6—11	23·54	1940	6—12	23·70
1940	7—10	10·54	1940	7—11	13·18						
1940	8—11	11·78									
1944	12—15	15·23	1944	11—15	15·35	1944	10—15	15·38			
			1944	12—16	15·74	1944	12—17	16·24	1944	12—18	16·76
1944	13—16	13·57	1944	13—17	14·07	1944	13—18	14·59			
1944	14—17	11·15									

TABLE

4″ or more in 1 day			6″ or more in 2 days			8″ or more in 3 days		
Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)
								NOVEMBER—
			1944	15—16	8·24	1944	15—17	8·74
1944	22	7·68	1944	21—22	10·94	1944	20—22	12·06
						1944	21—23	10·99
			1944	22—23	7·73			
1944	29	4·04						
1946	2	4·76	1946	1—2	6·24			
1948	16	5·02	1948	16—17	6·76	1948	16—18	8·28
								DECEMBER
1903	30	4·54	1903	29—30	7·49	1903	29—31	8·07
1911	6	4·95	1911	6—7	9·25	1911	5—7	9·57
1911	7	4·30						
1911	23	5·32	1911	22—23	6·86			
1911	25	8·10	1911	25—26	8·20	1911	24—26	10·80
			1911	24—25	10·70	1911	23—25	16·02
			1911	23—24	7·92	1911	22—24	9·46
						1911	25—27	8·20
1913	4	6·05	1913	3—4	6·17	1913	2—4	8·52
			1913	4—5	6·30			
1914	3	4·20						
1918	4	4·76	1918	3—4	6·11			
1919	6	4·12				1919	6—8	11·83
1919	8	6·10	1919	7—8	7·71			
						1923	14—16	13·34
1923	15	4·25	1923	15—16	12·29	1923	15—17	13·07
1923	16	8·04	1923	16—17	8·82	1923	16—18	10·14
						1931	22—24	20·38
1931	23	4·91	1931	23—24	19·35	1931	23—25	19·35
1931	24	14·44	1931	24—25	14·44	1931	24—26	14·74
						1932	1—3	12·66
			1932	2—3	12·57	1932	2—4	12·65
1932	3	10·14	1932	3—4	10·22	1932	3—5	10·28
1933	16	4·67	1933	15—16	7·40			
			1935	17—18	6·48			
1935	18	6·04	1935	18—19	7·37	1935	18—20	13·07
1935	20	5·70	1935	19—20	7·03			
1940	6	5·35	1940	5—6	7·96	1940	4—6	10·70
1941	2	5·07						
			1943	4—5	6·25			
1943	5	4·36	1943	5—6	6·02			
1948	18	4·37						

15 (*contd*)

10″ or more in 4 days			12″ or more in 5 days			14″ or more in 6 days			16″ or more in 7 days		
Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)	Year	Date	Rainfall (*in*)
contd											
1944	19—22	12·74	1944	18—22	13·26						
			1944	19—23	12·79						
1944	20—23	12·11									
1944	21—24	10·99				1944	21—26	14·68			
			1904	29—2	13·19						
1904	30—2	10·24									
						1911	22—27	17·66	1911	22—28	17·66
1911	23—26	16·12	1911	22—26	17·66	1911	21—26	18·58	1911	20—26	18·75
1911	22—25	17·56	1911	21—25	18·48	1911	20—25	18·65			
1911	21—24	10·38									
1911	24—27	10·80	1911	23—27	16·12	1911	23—28	16·12	1911	23—29	16·12
1913	1—4	10·52									
1919	5—8	12·26	1919	5—9	12·30						
1919	6—9	11·87									
									1923	12—18	16·09
						1923	13—18	16·09	1923	13—19	16·09
1923	14—17	14 12	1923	14—18	15·44	1923	14—19	15·44			
1923	15—18	14·39	1923	15—19	14·39	1923	15—20	14·39			
1923	16—19	10·14									
									1931	18—24	21·75
						1931	19—24	21·09	1931	19—25	21·09
			1931	20—24	21·06	1931	20—25	21·06	1931	20—26	21·36
1931	21—24	20·79	1931	21—25	20·79	1931	21—26	21·09	1931	21—27	21·90
1931	22—25	20·38	1931	22—26	20·68	1931	22—27	21·49	1931	22—28	21·52
1931	23—26	19·65	1931	23—27	20·46	1931	23—28	20·49	1931	23—29	20·49
1931	24—27	15·55	1931	24—28	15·58	1931	24—29	15·58			
1932	1—4	12·74	1932	1—5	12·80						
1932	2—5	12·71	1932	2—6	12·71						
1932	3—6	10·28									
1935	17—20	13·51	1935	17—21	13·67						
1935	18—21	13·23	1935	18—22	13·23						
1940	3—6	12·33	1940	3—7	12·33						
1940	4—7	10·70									

TABLE 16

The main spells of heavy rain at Nagapattinam and brief remarks about general weather situation (1901—1950)

Serial No.	Date	No. of days	Remarks
1	3-1-02 to 5-1-02	3	Strengthening of northeast monsoon
2	29-12-03 to 2-1-04	5	A depression formed in the southwest Bay off Ceylon on 27 December. Moving northwest, it crossed coast near Cuddalore on morning of 30 December and filled up rapidly
3	12-10-05	1	Shallow and ill-defined depression passed across south of peninsula between 11th and 13th
4	11-11-06 to 17-11-06	7	Strengthening of northeast monsoon
5	9-11-07 to 12-11-07	4	Low pressure in south Bay intensified on 8th and moderate to heavy rainfall continued in south Madras. By 12th depression formed to west of Andamans and stopped rainfall in south India, by diversion of moist air
6	20-11-07 to 21-11-07	2	Strengthening of northeast monsoon
7	22-10-08 to 27-10-08	6	Depression from Andaman Sea travelled across south Bay. It passed across north Ceylon and adjoining south India into Arabian Sea on 23rd
8	5-12-11 to 11-12-11	7	Strengthening of northeast monsoon
9	20-12-11 to 29-12-11	10	Strengthening of northeast monsoon
10	14-11-12 to 22-11-12	9	Disturbed weather over south Bay between Andamans and Madras for several days from 13th. A depression formed over Ceylon on 19th and moved into south Arabian Sea
11	23-10-13 to 28-10-13	6	Strengthening of northeast monsoon
12	7-11-13 to 13-11-13	7	Depression formed to east of Ceylon on 6th and moved towards Coromandel coast. Centre lay 100 miles east of Nagapattinam on 9th morning. Broke up without crossing coast by 11th night
13	26-11-13 to 5-12-13	10	Disturbance formed over north Ceylon on 28 November and filled up in situ after 2 days
14	2-12-13 to 5-12-13	4	Strengthening of northeast monsoon

TABLE 16—(*contd*)

Serial No.	Date	No. of days	Remarks
15	3-12-14	1	Strengthening of northeast monsoon
16	23-7-16	1	Weak monsoon in north India and corresponding abundant rain in peninsula
17	15-11-16	1	Strengthening of northeast monsoon
18	20-11-17 to 30-11-17	11	Strengthening of northeast monsoon
19	12-11-18 to 23-11-18	12	A depression was forming in the south Bay on 8th and 9th. On 10th morning its centre was 300 miles east of Nagapattinam. It intensified into a moderately severe cyclone and travelled northwest. By midnight of 10th centre was near Madras. Another depression formed on the 15th in southwest Bay. Centre was about 200 miles east of Pamban till 17th. It then moved north and centre was about 200 miles east of Nellore on 21st morning
20	3-12-18 to 4-12-18	2	Strengthening of northeast monsoon
21	1-11-19 to 7-11-19	7	A depression formed in south Bay on 30-31 October. On 31st morning, centre lay near 7½°N, 87°E. It crossed Madras-Nagapattinam coast early on the morning of 2 November. It passed out into the Arabian Sea near Mangalore
22	5-12-19 to 9-12-19	5	Strengthening of northeast monsoon
23	13-11-20 to 30-11-20	18	A depression formed to south of Ceylon on 20th. Its centre lay to the east of Ceylon on 21st morning, to west of Colombo on 22nd night and 23rd morning. Moved eastwards after 23rd noon and lay in the Bay on 24th morning. It then gradually weakened and disappeared by 27th. It concentrated the rainfall to an unusual extent in southeast Madras
24	7-1-23 to 18-1-23	12	A revival of monsoon occurred in south Bay and gave rise to a shallow depression to east of Ceylon on 9th. It was over Ceylon on 10th and 11th and over extreme south of peninsula on 12th and 13th. It stimulated monsoon into unusual activity
25	23-3-23	1	Strengthening of northeast monsoon
26	24-10-23 to 29-10-23	6	A depression formed about 130 miles east of Trincomalee on 27th morning. It advanced parallel to the coast line and intensified. Its centre was about 150 miles east of Nagapattinam at 20 hrs of 27th and about 120 miles southeast of Madras on 28th morning
27	12-12-23 to 20-12-23	9	A low pressure area formed in south Bay on 12th. It passed over Ceylon on 15th as a small depression which lay over the Gulf of Mannar on 16th morning. It then travelled westwards into the Arabian Sea where it developed into a small but moderately severe storm

TABLE 16—*(contd)*

Serial No.	Date	No. of days	Remarks
28	1-11-24 to 6-11-24	6	Northeast monsoon strengthened on 1st and 2nd. On 3rd rainfall decreased in Konkan, Madras, Deccan and Mysore but became heavy on south Madras coast. Conditions became unsettled in south Bay and a depression formed by 5th morning with centre 250 miles southeast of Madras. It crossed coast near Madras and weakened on 6th morning
29	28-1-26	1	A revival of northeast monsoon in Bay started on 23rd
30	4-11-28 to 6-11-28	3	Northeast monsoon active
31	10-11-28 to 14-11-28	5	Northeast monsoon active
32	23-11-29 to 24-11-29	2	Strengthening of northeast monsoon due to unsettled conditions in south Bay
33	6-1-30 to 9-1-30	4	Thunderstorm rain
34	7-5-30 to 8-5-30	2	Depression with centre 150 miles east of Hambantota formed on 5th morning. By 6th morning, it had intensified into a storm of small extent, centred near 6°N 83°E and was moving northwards. The centre was near 10°N 80°E on 7th morning. It crossed coast just to the south of Nagapattinam at 11 hrs of 7th and weakened
35	18-10-30 to 29-10-30	12	A depression was forming with central region near 8°N 86½°E on 21st morning. It intensified into a storm by 22nd evening and was centred about 80 miles east of Nagapattinam on 23rd morning. It crossed coast near Nagapattinam at 2 hrs of 24th. It weakened afterwards into a depression and passed out into the Arabian Sea by 26th
36	26-11-30 to 27-11-30	2	Deep depression centred near 9½°N 85½°E at 19 hrs of 27th. It was centred about 50 miles south of Madras on 28th morning
37	13-4-31 to 16-4-31	4	Thunderstorms associated with unsettled conditions in southwest Bay which did not reach depression stage
38	18-12-31 to 29-12-31	12	Deep depression formed near 7½°N 82½°E on 22nd morning and intensified into a storm by noon. It continued to intensify and moved northwest and centre lay near Palk Strait on 23rd morning. It was about 50 miles southeast of Nagapattinam on 23rd afternoon. It crossed coast about 20 miles south of Nagapattinam at 17 hrs of 24th and then weakened

TABLE 16—(*contd*)

Serial No.	Date	No. of days	Remarks
39	19-11-32 to 6-12-32	18	With an intensification of the seasonal trough of low pressure in the south Bay, the monsoon strengthened in south Madras on 19th and 20th. Conditions became unsettled in south Bay on 21st and a depression formed by 22nd. It intensified into a storm and was centred near 10°N 82°E on 24th morning. It passed inland near Madras early on 26th morning, weakened and passed into Arabian Sea Accentuation of seasonal trough of low pressure from 1 to 5 December
40	8-11-33 to 9-11-33	2	Low pressure wave remnant of a depression in Andaman Sea lay off south Coromandel coast on 8th and passed across south peninsula into Arabian Sea by 10th
41	15-12-33 to 16-12-33	2	A depression formed near 9°N 83°E by 12th evening. It intensified into a severe cyclone by 14th morning, crossed coast near Cuddalore on 15th evening, and lay as a depression over southeast Madras on 16th, where it filled up
42	26-10-34 to 29-10-34	4	A low pressure wave moved from southwest Bay of Bengal to southeast Arabian Sea across south Madras
43	30-10-35	1	Pronounced northeast monsoon conditions
44	21-11-35 to 26-11-35	6	Active northeast monsoon
45	17-12-35 to 22-12-35	6	Low pressure wave passed westwards across southwest Bay and Ceylon between 15th and 19th
46	2-11-36	1	Low pressure wave passed westwards from southwest Bay across south Madras into southeast Arabian Sea on 1st
47	31-10-37	1	Northeast monsoon active
48	2-11-37 to 5-11-37	4	Active northeast monsoon
49	7-2-38 to 9-2-38	3	Revival of northeast monsoon
50	13-4-39 to 16-4-39	4	A depression formed 100 miles southeast of Nagapattinam on 13th morning. It intensified into a storm by 14 hrs on 13th and crossed coast near Cuddalore by early morning of 14th. It later weakened and moved northwestwards
51	6-11-39 to 9-11-39	4	Unsettled conditions in southwest Bay, which did not reach depression stage

TABLE 16—*(contd)*

Serial No.	Date	No. of days	Remarks
52	14-11-39 to 17-11-39	4	Deep depression formed 150 miles southeast of Nagapattinam on 15th morning. It intensified into a severe cyclonic storm, crossed coast near Nagapattinam at 5 hrs of 16th and weakened
53	1-11-40 to 12-11-40	12	Unsettled conditions in southwest Bay near Ceylon moved into Arabian Sea between 1st and 3rd. There a depression developed and moved west Conditions again became unsettled in southeast Arabian Sea on 7th but did not develop
54	3-12-40 to 7-12-40	5	Northeast monsoon active
55	2-12-41	1	Deep depression was centred near 9½°N 84°E on 1st morning ; intensified into cyclonic storm and was centred near Cuddalore about midnight of 2nd
56	12-5-43 to 19-5-43	8	Depression formed about 200 miles east of Nagapattinam on 13th morning. Moved slowly westnorthwest and intensified for 3 days, with centre near 11½°N 81½°E on 16th morning. Crossed coast about 60 miles south of Madras on 18th afternoon
57	25-10-43 to 26-10-43	2	Unsettled conditions near Ceylon
58	4-12-43 to 6-12-43	3	Northeast monsoon active
59	10-11-44 to 26-11-44	17	A low pressure wave appeared over southwest Bay on 9th and 10th and disappeared. Another low pressure wave was to the east of Ceylon on 14th, and moved across extreme south of peninsula on 16th
60	29-11-44	1	A depression was centred near 10½°N 82½°E on 29th but weakened by next day
61	1-11-46 to 2-11-46	2	Depression formed near 9½°N 88½°E by 17 hrs of 31 October 1946 and was centred on 1st morning near 10°N 86°E. It deepened at night and was close to coast just south of Nagapattinam on 2nd morning. It later crossed coast and moved across peninsula to Arabian Sea
62	18-12-48	1	Strengthening of northeast monsoon associated with low pressure wave
63	19-10-50	1	A depression formed about 150 miles southeast of Madras on 17th morning and moved northwards