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Meteoritic dust and rainfall

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सार – तमिलनाडु 1957 से 1978 तक की अवधि के 18 स्टेशनों के तथा 1926 से 1975 तक के 5 स्टेशनों के वर्षा के आंकड़ों का विशलेषण कर यह पता लगाया गया है कि वर्षा, उल्का धूलि से किसी प्रकार से संम्बद्ध रही या नहीं।

ABSTRACT. Rainfall data of 18 stations in Tamilnadu for the period 1957 to 1978 and five stations for the period 1926 to 1975 were analysed to find whether or not there is any association between the meteoric dust and rainfall.

1. Introduction

Bowen (1953) analysed the rainfall data of certain stations in Australia for the month of January and concluded that the recurrence of heavy rainfall on certain calendar days is associated with meteoritic dusts. For this country Dhar (1954) arrived at almost the same results after analysing the rainfall data of two stations, *viz*, Madras and Pamban. However, divergent views were expressed on the acceptability of the meteoritic dust hypothesis by several investigators such as Swinbank (1954), Martyn (1954) and Bhalotra (1956). In the present note, rainfall data of 23 stations of Tamilnadu and neighbourhood have been examined in relation to the meteoric showers.

2. Data

The daily rainfall data of five stations, Madras, Nagapattinam, Trichirapalli, Salem and Trivandrum for the months from August to November for the 50-year period (1926-1975) have been considered in the present study. In order to confirm the results, the rainfall data of eighteen other stations, [Kancheepuram, Vellore, Tirupathur (NA), Cuddalore, Kallakurichi, Tanjore, Pudukottai, Pamban, Sivaganga, Srivilliputhur, Madurai, Dindigul, Trichendur, Palayamkottai, Kanyakumri, Coimbatore, Erode and Oothacamund] well distributed over Tamilnadu for the period of 22 years (1957-1978) have been studied for the same four months. The data were collected from the *Daily Weather Reports* published by the India Meteorological Department.

3. Analysis

3.1. *Raw data analysis*

The average rainfall of the calendar days have been found out for the 50-year period and 22-year period separately. It has been graphically represented in Fig. 1 (a) for the five stations and in Fig. 1(b) for the eighteen stations for the months from August to November. These curves show several rainfall peaks out of which real ones have to be identified from those resulting from random fluctuations. The dates of rainfall peaks which are related to the meteor streams are provided in the Tables 1 and 2 for the two sets of stations. The time difference in days between the rainfall peak and the date of meteor shower is given in the last column of the tables. To delineate the rainfall peaks due to random fluctuations, the five-day moving average method has been used.

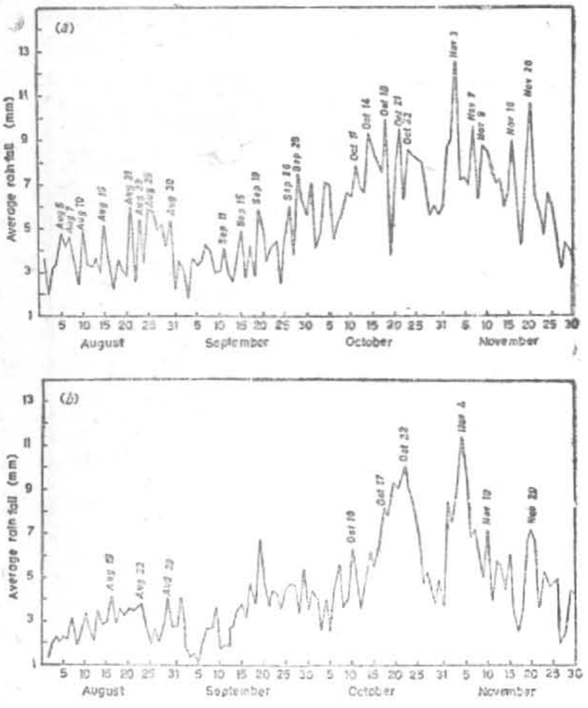

Fig. 1. (a&b). The mean rainfall curve of the months from August to November for (a) 5 stations for the period from 1926 to 1975 and (b) 18 stations from 1957-1978

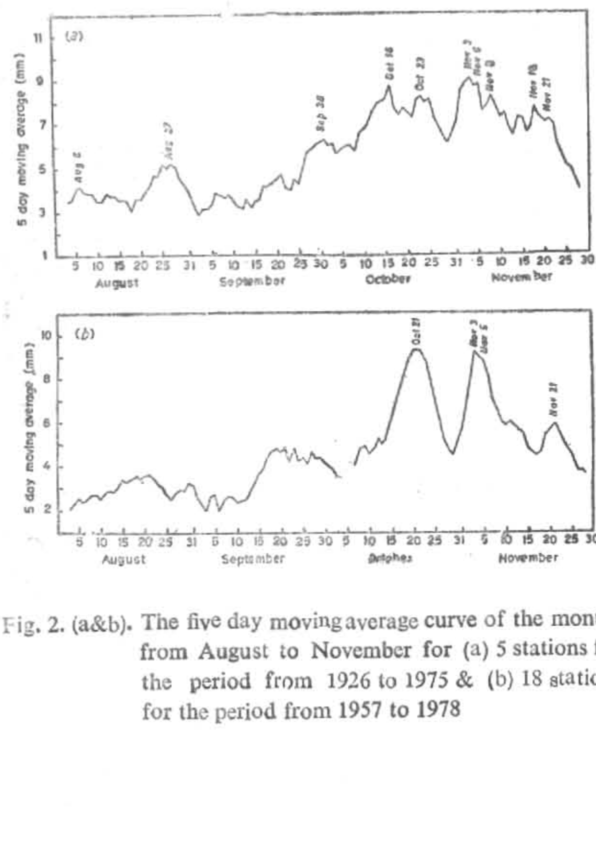

Fig. 2. (a&b). The five day moving average curve of the months from August to November for (a) 5 stations for the period from 1926 to 1975 & (b) 18 stations for the period from 1957 to 1978

TABLE 1

Dates of meteor showers and rainfall peaks for 5 stations

Meteor shower	Date of meteor shower	Date of rainfall peak	Difference (days)
β Taurids	2 Jul	5 Aug	34
γ Geminids	12	10	29
θ Aurigids	25	25	31
δ Aquarids	28	30	33
Perseids	10-14 Aug	11-15 Sep	—
Sculptorids	9 Sep	11 Oct	32
γ Pegasids	17	18	31
α Aurigids	22	21	29
Giacobinids	9 Oct	7 Nov	29
Orionids	20-23	20	30

TABLE 2

Dates of meteor showers and rainfall peaks for 18 stations

Meteor shower	Date of meteor shower	Date of rainfall peak	Difference (days)
θ Aurigids	25 July	23 Aug	29
δ Aquarids	28	29	32
Perseids	10-14 Aug	12-29 Sep	—
Sculptorids	9 Sep	10 Oct	31
γ Pegasids	17	17	30
α Aurigids	22	22	30
Giacobinids	9 Oct	10 Nov	32
Orionids	20-23	20	30

According to Srirama Rao and Lokanadham (1964), the employment of five day moving average would give a better grouping of peaks than the three day moving average. The five day moving average values are presented in Fig. 2 (a&b). The five day moving average of five stations in Fig. 2(a) presents peaks on 6, 27 August; 30 September, 16, 23 October and 3, 5, 8, 18, 21 November. It

TABLE 3

Student *t*-distribution table for 5 stations and 18 stations

Number of stations	Date of rainfall peak	$\bar{x}$ (mm)	μ (mm)	S (mm)	n	$t=\left\|\frac{\bar{x}-\mu}{S}\right\|\sqrt{n}$
5	Aug 6	4.17	3.93	0.58	5	0.93
	Aug 27	5.22	3.93	0.69	5	4.20
	Sept 30	6.08	4.00	1.31	5	3.55
	Oct 16	8.67	6.98	0.93	5	4.07
	Oct 23	8.21	6.98	1.16	5	2.38
	Nov 3	8.98	6.82	2.16	5	2.23
	Nov 5	8.73	6.82	2.39	5	1.78
	Nov 8	8.05	6.82	1.72	5	1.61
	Nov 18	7.73	6.82	2.38	5	0.85
	Nov 21	7.1[illegible]	6.82	2.29	5	0.27
18	Oct 21	9.35	5.84	0.42	5	18.62
	Nov 3	9.17	5.80	1.36	5	5.52
	Nov 5	8.79	5.80	1.77	5	3.78
	Nov 21	5.93	5.80	1.41	5	0.20

NOTE : $\bar{x} = 5$ - day mean; μ=monthly mean; S=Standard deviation

has been ovserved that the peaks on 5, 25 August; 28 September, 18, 21 October, 7,16, 20 November of Fig. 1(a) have been shifted to 6, 27 August, 30 September, 16, 23 October, 8, 18, 21 November respectively in Fig. 2 (a). Similarly the peaks on 22 October and 4, 20 November of Fig. 1 (b) have been shifted to 21 October and 3, 21 November respectively in Fig. 2(b). Perhaps the shift in peak dates may be due to the moving average technique used. Out of these peaks, the peaks on 6 August, 5, 8, 18 and 21 November are insignificant when student *t*-distribution is applied. In the case of eighteen stations, Fig. 2 (b) presents peaks on 21 October and 3, 5, 21 November. The peaks on 21 October and 3 November are significant at 1 per cent level whereas the peak on 5 November is significant at 2 per cent level.

4. Discussion

The majority of the peaks displayed by the curves [*see* Fig. 2 (a & b] are on certain days after 30± 2 days of the major meteor streams as stipulated by Bowen's (1953) meteor hypothesis. The peaks are not exceptionally distinct from other peaks as those of Bowen (1953). Out of ten peaks shown in Fig. 2(a). which appear even after smoothening process has been applied, only the peaks on 27 August and 16 October are significant at 1 per cent level. The peak on 30 September is significant at 2 per cent level (Table 3). But there is no meteor shower to account for the peak on 30 September. All other peaks are insignificant. Eventhough the peaks on 3, 5 November are prominent [Fig. 2(a), they are not significant as per *t*-test. It is seen from Table 3 that the peaks on 21 October and 3 November of Fig. 2(b) are significant at 1 per cent level. The peak on 5 November is significant at 2 per cent level. The highly prominent peak on 21 October corresponds to the meteor shower α-Aurigids. But there is no meteor shower to account for the peaks on 3, 5 November as in the case of 30 September of Fig. 2(a). The peak on 21 November must be very prominent if it corresponds to intensive shower of Orionids. But it is evident from the Table 3 that the peak on 21 November is not significant even at 5 per cent level as per *t*-distribution.

Prominent peaks are exhibited only in the months of October and November. During these two months Tamilnadu region gets good rainfall. During this season the cumulative effect of localized cyclones may contribute to the singularities on certain days (Suseela Reddy and Ramana Murty 1976). The authors also examined the cyclone reports for the period of study. Considerable number of days of Bay depressions and cyclones fall around the days of the observed singularities in the months of October and November.

5. Conclusions

In the present study the raw data curves, Fig. 1 (a & b) show prominent peaks on dates corresponding to meteor shower with 30-day lag along with some other peaks which are not at all related to any meteoric shower. Then the five-day moving average method has been used to eliminate random fluctuations. Only a small number of peaks are significant statistically. The significant peaks also appear only in the months of October and November during which period the region gets good rainfall due to northeast monsoon, Bay [depressions and cyclonic storms. Therefore, with the help of the present analysis, a strong case cannot be made in support of meteor hypothesis.

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