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# Some facts about monsoon onset dates over Kerala and Bombay

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सार — इस लेख में केरल और बम्बई में दक्षिणपश्चिम मानसून के आरम्भ की तारीखों के लिए एक नवीनतम सूची प्रस्तुत की गई है। इन तारीखों पर सांख्यिकीय विश्लेषण किया गया है। इनमें उत्पन्न कुछ विसंगतियों की चर्चा की गई है।

ABSTRACT. In the present article an updated list for the onset dates of the southwest monsoon over Kerala and Bombay is presented. Statistieal analysis has been done on these dates. Some discrepancies encountered are pointed out.

## 1. Introduction

Much has been discussed about the importance of onset dates of the southwest monsoon over India. The need for realistic approach and adequate considerations while documenting the onset dates for various places in India was emphasized by various workers (Ananthakrishnan *et al.* 1967, Mooley and Appa Rao 1970, Raman 1974, Subbaramayya and Bhanukumar 1978).

Diagrams giving isopleths of the normal dates of onset and withdrawal of the monsoon rains over India and adjacent areas have been published by India Meteorological Department (IMD 1943). These are based on normal pentad (5-day) rainfall at a large number of stations distributed over entire area. The onset date at any station is taken as middle date of pentad in which a "characteristic monsoon rise in rainfall" is noticed. The withdrawal date corresponds to a "characteristic fall" in rainfall curve. The diagrams are obtained by plotting the individual dates on maps and drawing isolines. These diagrams which were prepared over 40 years ago are still in use in the IMD. They give a broad picture of the onset and withdrawal phases of monsoon and provide a datum for the study of these phases of monsoon in individual year.

While dealing with agricultural planning over small areas, these onset dates encountered serious limitations and the conventional pentad rainfall was unable to furnish the details of spatial variation of the mean onset dates over Indian region in particular over the interior parts of the country. The spells of light or moderate rain experienced at the beginning of the monsoon are not necessarily characterised by a sharp rise. Thus, the criteria for onset of monsoon used in preparing these charts is not unique and realistic (Raman 1974).

The onset of southwest monsoon over the extreme tip of the Indian Peninsula and its northward progress across the country is of considerable interest, since agricultural planning and economy of India are closely linked with the southwest monsoon. Ananthakrishnan *et al.* (1967) realised the need for fixing objective criteria to define the onset dates over Kerala and suggested certain empirical criteria. Examination of the criteria suggested by these research workers has shown that for declaring the onset of monsoon rains over Kerala and over other parts of country there is no single, realistic and definite criteria. The fixation of the date of onset, therefore, becomes rather subjective. In the present article an updated list of onset dates over Kerala and Bombay collected from the IMD records is presented. These onset dates are then subjected to some statistical analysis. We do not propose to put forth any criteria for deciding onset dates nor do we propose to look into the causes of an early or late monsoon in this article.

## 2. Data

Eighty four years (1901-84) of onset dates over Kerala and Bombay have been utilised in the present study.

(*i*) The dates of onset of monsoon over Kerala for the period 1901-68, published in the IMD *Weather Reports* and documented by Ananthakrishnan *et al.* (1968) have been used. The onset dates over Kerala from 1969 onwards have been collected from *monsoon rainfall summaries* published by the India Meteorological Department every year.

(*ii*) The dates of onset of monsoon over Bombay for the period 1901-71 (published in IMD

TABLE 1(a)

**Onset dates of southwest monsoon over Kerala (1901-1984)**

| Year | Date | Year | Date | Year | Date | Year | Date |
|---|---|---|---|---|---|---|---|
| 1901 | J-07 | 1922 | M-31 | 1943 | M-29 | 1964 | J-06 |
| 1902 | J-06 | 1923 | J-11 | 1944 | J-03 | 1965 | M-26 |
| 1903 | J-12 | 1924 | J-02 | 1945 | J-05 | 1966 | J-01 |
| 1904 | J-02 | 1925 | M-27 | 1946 | M-29 | 1967 | J-09 |
| 1905 | J-10 | 1926 | J-06 | 1947 | J-03 | 1968 | J-08 |
| 1906 | J-13 | 1927 | M-27 | 1948 | J-11 | 1969 | M-17 |
| 1907 | J-08 | 1928 | J-03 | 1949 | M-23 | 1970 | M-26 |
| 1908 | J-11 | 1929 | M-29 | 1950 | M-27 | 1971 | M-27 |
| 1909 | J-02 | 1930 | J-08 | 1951 | M-31 | 1972 | J-18 |
| 1910 | J-02 | 1931 | J-04 | 1952 | M-20 | 1973 | J-04 |
| 1911 | J-06 | 1932 | J-02 | 1953 | J-07 | 1974 | M-27 |
| 1912 | J-08 | 1933 | M-22 | 1954 | M-31 | 1975 | M-31 |
| 1913 | J-02 | 1934 | J-08 | 1955 | M-29 | 1976 | M-31 |
| 1914 | J-04 | 1935 | J-12 | 1956 | M-21 | 1977 | M-31 |
| 1915 | J-15 | 1936 | M-19 | 1957 | J-01 | 1978 | M-28 |
| 1916 | J-02 | 1937 | J-04 | 1958 | J-14 | 1979 | J-11 |
| 1917 | M-31 | 1938 | M-26 | 1959 | M-31 | 1980 | J-01 |
| 1918 | M-11 | 1939 | J-05 | 1960 | M-14 | 1981 | M-30 |
| 1919 | J-03 | 1940 | J-14 | 1961 | M-18 | 1982 | M-30 |
| 1920 | J-03 | 1941 | M-23 | 1962 | M-17 | 1983 | J-13 |
| 1921 | J-02 | 1942 | J-10 | 1963 | M-31 | 1984 | J-01 |

The month is indicated as M (May) or J (June).

TABLE 1 (b)

**Onset dates of southwest monsoon over Bombay (1901-84)**

| Year | Date | Year | Date | Year | Date | Year | Date |
|---|---|---|---|---|---|---|---|
| 1901 | J-06 | 1922 | J-01 | 1943 | J-08 | 1964 | J-12 |
| 1902 | J-10 | 1923 | J-12 | 1944 | J-12 | 1965 | J-15 |
| 1903 | J-12 | 1924 | J-12 | 1945 | J-07 | 1966 | J-12 |
| 1904 | J-07 | 1925 | M-28 | 1946 | J-08 | 1967 | J-15 |
| 1905 | J-25 | 1926 | J-10 | 1947 | J-10 | 1968 | J-14 |
| 1906 | J-06 | 1927 | J-11 | 1948 | J-13 | 1969 | J-05 |
| 1907 | J-11 | 1928 | J-09 | 1949 | M-31 | 1970 | J-02 |
| 1908 | J-12 | 1929 | J-02 | 1950 | J-10 | 1971 | M-29 |
| 1909 | J-08 | 1930 | J-09 | 1951 | J-12 | 1972 | J-21 |
| 1910 | J-04 | 1931 | J-13 | 1952 | J-06 | 1973 | J-08 |
| 1911 | J-05 | 1932 | J-16 | 1953 | J-13 | 1974 | J-18 |
| 1912 | J-13 | 1933 | J-01 | 1954 | J-07 | 1975 | J-17 |
| 1913 | J-08 | 1934 | J-13 | 1955 | J-11 | 1976 | J-03 |
| 1914 | J-13 | 1935 | J-13 | 1956 | J-19 | 1977 | J-16 |
| 1915 | J-17 | 1936 | J-04 | 1957 | J-21 | 1978 | J-09 |
| 1916 | J-01 | 1937 | J-12 | 1958 | J-19 | 1979 | J-19 |
| 1917 | J-04 | 1938 | J-02 | 1959 | J-25 | 1980 | J-07 |
| 1918 | M-24 | 1939 | J-09 | 1960 | J-12 | 1981 | J-23 |
| 1919 | J-06 | 1940 | J-17 | 1961 | J-10 | 1982 | J-17 |
| 1920 | J-07 | 1941 | J-05 | 1962 | M-29 | 1983 | J-19 |
| 1921 | J-09 | 1942 | J-13 | 1963 | J-06 | 1984 | J-08 |

The month is indicated as M (May) or J (June).

TABLES 2 (a & b)

**Frequency distribution of onset dates based on 84 years (1901-84)**

**(a) For Kerala onset**

| May 11-15 | May 16-10 | May 21-25 | May 26-30 | May-June 31-4 | June 5-9 | June 10-14 | June 15-19 | Total |
|---|---|---|---|---|---|---|---|---|
| 2 | 5 | 4 | 15 | 30 | 14 | 12 | 2 | 84 |

**(b) For Bombay onset**

| May 24-28 | May-June 29-2 | June 3-7 | June 8-12 | June 13-17 | June 18-22 | June 23-27 | Total |
|---|---|---|---|---|---|---|---|
| 2 | 10 | 17 | 29 | 17 | 6 | 3 | 84 |

TABLE 3

**Frequency distribution of simultaneous occurrence of early, normal, late onset dates over Kerala and Bombay**

| | | Bombay: Early | Normal | Late | Total |
|---|---|---|---|---|---|
| Kerala | Early | 5 (6%) | 6 (7%) | 0 | 11(13%) |
| | Normal | 7 (8%) | 48(57%) | 4(5%) | 59(70%) |
| | Late | 0 | 9 (11%) | 5(6%) | 14(17%) |
| | Total | 12(14%) | 63(75%) | 9(11%) | 84 |

TABLE 4

**Frequency distribution of the difference of onset dates between Kerala (K) and Bombay (B) : (K—B)**

| 0 days or less | 1-2 days | 3-7 days | 8-10 days | 11-15 days | 16-20 days | 21-25 days | 26-30 days | Total |
|---|---|---|---|---|---|---|---|---|
| 5 | 11 | 32 | 11 | 10 | 9 | 5 | 1 | 84 |

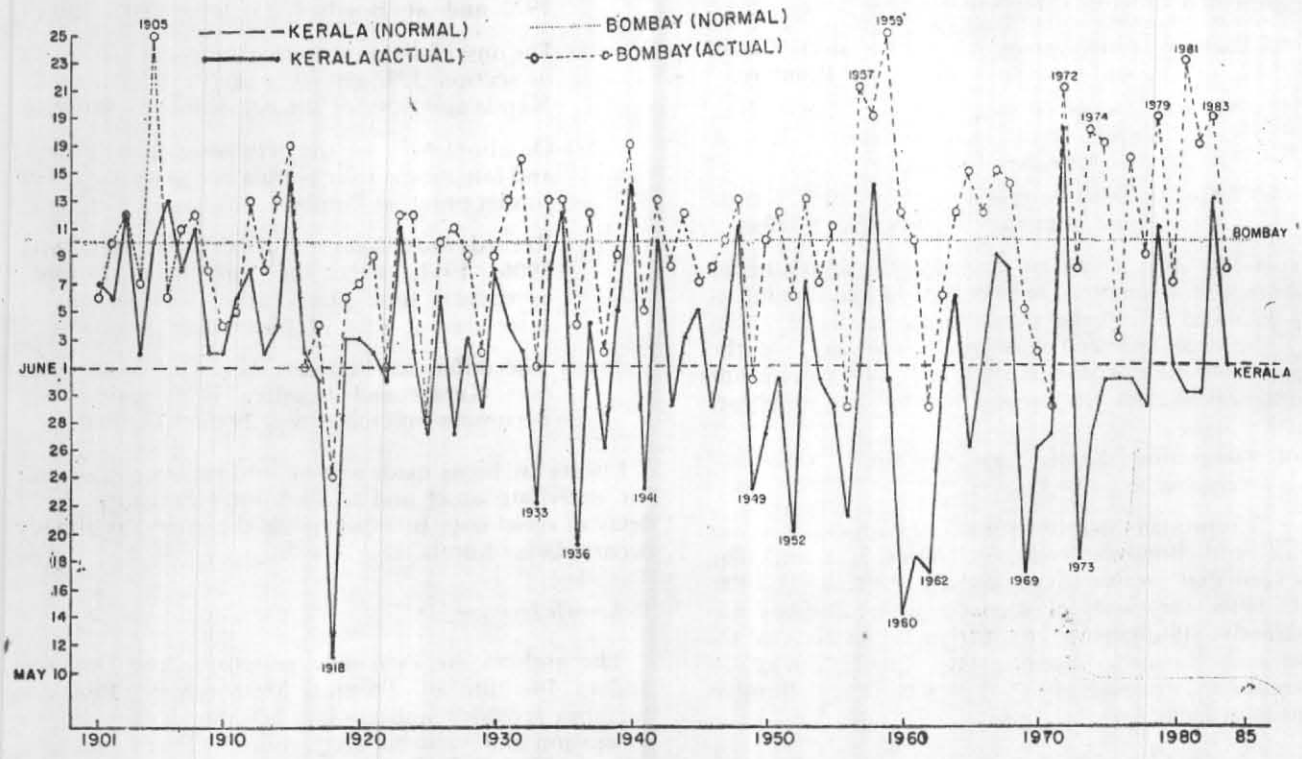


FIG 1 ONSET DATES OVER KERALA AND BOMBAY (1901-1984)

Fig. 1

Weather Reports) and documented by Srinivasan *et al.* (1972) are used. From 1972 onwards the dates have been extracted from the *Indian Daily Weather Reports*.

## 3. Results

### 3.1. *Kerala*

The dates of onset of southwest monsoon over Kerala during the period 1901-84 are given in Table 1(a).

Analysis of this data reveals the following :

(*i*) The mean onset date over Kerala is 1 June, with a standard deviation of 7 days.

(*ii*) The earliest onset occurred on 11 May (1918) and the latest on 18 June (1972).

(*iii*) Table 2 (a) shows the frequency distribution of Kerala onset dates in 5-day intervals starting from 11 May. Taking onset dates prior to 26 May as early onset dates, 26 May to 9 June as normal onset dates (Ca. $\pm$ one standard deviation from the mean onset date of 1 June) and after 9 June as late onset dates, it is seen that on 11 occasions (13%) the monsoon onset was early, on 59 occasions (70%) monsoon onset was normal and on 14 occasions (17%) monsoon onset was late.

### 3.2. *Bombay*

The dates of onset of monsoon over Bombay during the period 1901-84 are given in Table 1 (b). This table brings out the following :

(*i*) The mean onset date over Bombay is 10 June, with a standard deviation of 8 days.

(*ii*) The earliest onset over Bombay has been on 24 May (1918) and latest on 25 June (1905, 1959).

(*iii*) Table 2 (b) shows the frequency distribution of Bombay onset dates in 5-day intervals starting from 24 May. Taking onset dates prior to 3 June as early onset dates, 3 June to 17 June as normal onset dates (Ca.$\pm$ one standard deviation from the mean onset date 10 June) and after 17 June as late onset dates, we find that on 12 occasions (14%) the monsoon was early, on 63 occasions (75%) the onset date was normal and on 9 occasions (11%) the onset date was late.

A closer examination of Tables 2 (a) & (b) show that onset dates have a somewhat skew distribution with a longer tail to the left of the mean date.

### 3.3. *Kerala and Bombay*

To study the simultaneous occurrence of an early normal or late onset over Kerala and Bombay a fre-

quency table is prepared (Table 3) by considering the following three different categories :

(*i*) Early : Onset prior to 26 May over Kerala and prior to 3 June over Bombay.

(*ii*) Normal : Onset between 26 May and 9 June over Kerala and between 3 June & 17 June over Bombay.

(*iii*) Late : Onset later than 9 June over Kerala and later than 17 June over Bombay.

From the table it can be seen that the simultaneous occurrence of an onset event over Kerala and Bombay is early on about 6% of the occasions, normal on about 75% the occasions and late on about 6% of the occasions. In other words on about 69% of the occasions the onset events over Kerala and Bombay are in phase.

### 3.4. *Onset over Kerala and Bombay : Some discrepancies*

Fig. 1 represents diagramatically the onset dates over Kerala and Bombay listed in Tables 1(a) and 1(b). It is seen that on five occasions, *viz.*, 1901, 1903, 1906, 1911, 1916, the onset of monsoon over Bombay was apparently simultaneous or earlier compared to the onset over Kerala. The frequency distribution of the difference in the onset dates over Kerala and Bombay is given in Table 4.

### 3.5. *Difference of days between Kerala and Bombay onset*

With the normal date of onset over Kerala as 1 June and over Bombay as 10 June, the difference is 10 days. It can be seen from Table 4 that on 59 occasions (71%) the difference between onset days of Kerala and Bombay is less than 10 days. A prolonged delay exceeding 20 days of onset over Bombay, when onset over Kerala had already taken place, occurred on 6 occasions (7%) with maximum difference of 29 days in 1960 and of 25 days in 1959. It may be of interest to examine the causes of such prolonged delay of onset over Bombay after it has set in over Kerala. No such attempt is made in this particular article.

## 4. Conclusions

From the analysis of 84 years (1901-84) of onset dates for Kerala and Bombay, following broad conclusions can be drawn :

(*i*) The mean onset dates for Kerala and Bombay are 1 June and 10 June respectively with a standard deviation of 7 and 8 days respectively. These dates are the same as those in the IMD diagram prepared in 1943. This shows that as long term averages these dates are stable for different data samples, if the samples are not too small.

(*ii*) The earliest onset over Kerala was 11 May 1918 and at Bombay 24 May 1918.

(*iii*) The latest onset over Kerala was on 18 June 1972 and at Bombay 25 June 1905, 1959.

(*iv*) The onset falls in the normal category, as defined in section 3.3, on 70% of the occasions for Kerala and 75% of the occasions for Bombay.

(*v*) On about 69% of the occasions, early, normal and late onsets over Kerala are associated with similar onsets at Bombay.

(*vi*) Records show that on five occasions, 1901, 1903, 1906, 1911, 1916 the onset over Bombay apparently took place earlier than or on the same day as that of onset over Kerala.

(*vii*) The difference between the mean onset dates over Kerala and Bombay is 10 days. The maximum difference was 29 days in 1960.

Efforts are being made to look into factors responsible for early/late onset and to look into the causes for a delay of onset over Bombay, when the event has already occurred over Kerala.

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