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FORECASTING THE ONSET OF SOUTHWEST MONSOON OVER KERALA

1. The purpose of the present note is to show the association of onset of southwest monsoon with the 50 mb zonal winds at Singapore, an equatorial station and thereby suggest a method of forecasting (long range) the onset of monsoon over Kerala.

2. The monthly mean zonal wind, temperature and dynamic height of lower stratospheric levels (*i.e.*, 100, 50 and 30 mb levels) of near equatorial stations, *viz.*, Singapore, Bogota, Malakal and Lima were collected from 'monthly climatic data for the world' for the period 1964 to 1975. The dates of onset of southwest monsoon over Kerala were collected from the IDWR, WWR and MWR published by IMD for the period 1921 to 1975 (which comprises the above period 1964 to 1975). These dates were also obtained from the method suggested by Daniel *et al.* (1972) and compared with the above dates and found little difference between these two types of dates. Therefore, using the method of Daniel *et al.* (1972) the dates of onset for 1901 to 1921 were computed (as, for this period the dates are not available in IDWR). These dates for 1901 to 1975 are plotted along with the 10-year moving averages to see the trend in the dates of onset (Fig. 2). These dates were also subjected to power spectrum analysis of Blackman and Tukey (1958).

3.1. *Trend analysis of dates of onset over Kerala*— The trend suggests a cyclic variation with a period of about 54 years. The median date of these data points were taken as the normal date of onset of southwest monsoon over Kerala (*i.e.*, 31 May). It is seen from Fig. 2 that the trend is below normal from about 1900 to 1926, above normal from 1927 to 1953 and again below normal from 1954 onwards. To complete the cycle, the below normal trend will be upto 1980, and 1981 onwards the above normal trend will start. It is seen from the spectrum analysis that 2.5-2.7 year cycle is significant at 95 per cent level.

3.2. *Singapore 50 mb level zonal winds vs date of onset over Kerala* — The lower stratospheric data (as mentioned above in section 2) plottings were compared with the dates of onset over Kerala and it is found that the Singapore winds of 50 mb level has consistent relation with the dates of onset of southwest monsoon over Kerala. Fig. 1 represents the monthly mean zonal winds at 50 mb level from 1964 to 1975 with extrapolated winds upto 1978 and backwards upto 1961. It is seen from this diagram that when the winds were easterlies at 50 mb in the month of May, the onset will be late (*i.e.*, on or after 31 May) in that year and when the winds are westerlies the onset will be early (*i.e.*, before 31 May) in that year. The table shown below indicates the number of occasions the winds are easterlies or westerlies in the month of May and correspondingly the number of occasions the onset is late or early.

Onset of winds in May	No. of occasions	
	Early (E)	Late(L)
Westerlies (+)	9	0
Easterlies (—)	0	3

In the period examined, there were 3 occasions of the late onset and on all these 3 occasions winds were easterlies and the remaining 9 occasions westerlies and correspondingly the onset was early.

3.3. *Date of onset forecast* — The winds at 50 mb level over Singapore are very systematic. In the case of westerly regime, it is always—12 months and 24 months and the easterly regime, it is always—12 months and—6 months (Fig. 1). Therefore, the westerly regime which has started from June 1975 will continue upto May 1976. Westerlies in the month of May indicates that the date of onset of monsoon over Kerala will be early (*i.e.*, before 31 May) this year. The trend analysis of dates of onset also show early onset this year (Fig. 2). If the westerly regime extends beyond June in 1976 (at 50 mb level the zonal winds change their sign + to — or—to + before July) then in 1977 the winds are likely to be easterlies in the month of May (as the westerly regime is 24 months) and correspondingly the date of onset can be expected to be late (*i.e.*, on or after 31 May) in 1977. Similarly, in 1978 the winds are likely to be westerlies in the month of May (as the easterly regime is — 12 months) and correspondingly the date of onset can be expected to be early in 1978.

Similarly, the winds are extrapolated backwards from 1964 to 1961 and the corresponding wind regimes and dates of onset are also presented in Fig. 1. To satisfy the condition that the westerly regime is — 12 months and 24 months, in 1963 the easterly regime has to change to westerly regime in June 1963. The easterly regime in May 1963 suggests the late onset in 1963. The observed date of onset (31 May) supports this. Then, taking the easterly regime 12 months and when one goes back to 1962, in May 1962 the wind regime has to be westerlies and associated onset should be early. The observed date of onset

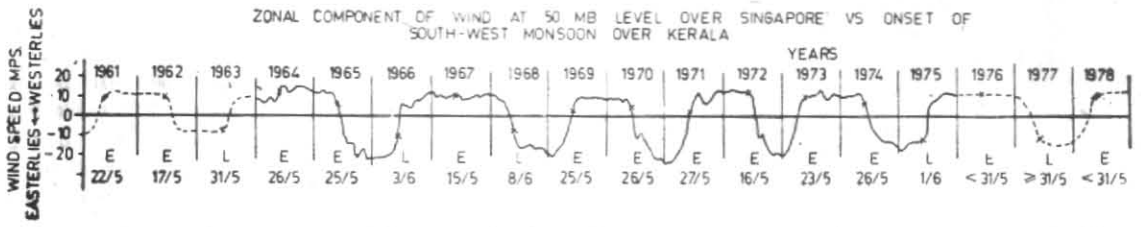

Fig. 1. Zonal component of wind at 50 mb level over Singapore *vs* onset of southwest monsoon over Kerala

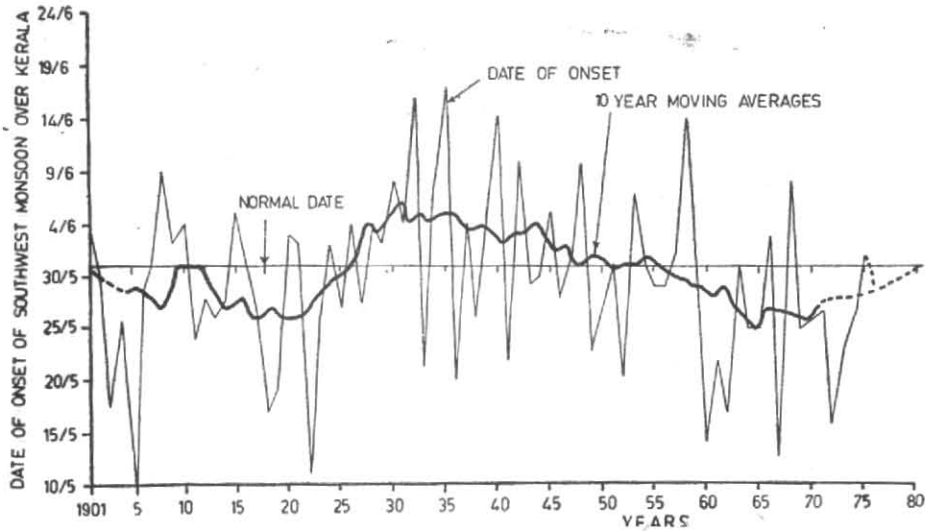

Fig. 2. Annual march of dates of onset of southwest monsoon over Kerala (1901-1975) ....extrapolated

(17 May) supports this. Similarly, the winds in May 1961 should be westerlies and the associated onset should be early. The observed date of onset (22 May) also supports this. Therefore, following the systematic trend of 50 mb winds and knowing the winds in March/April, it may be possible to predict the wind regime in May and thereby the onset of southwest monsoon over Kerala.

3.4. *Advance of monsoon* — The advance of monsoon over the entire country after setting in over Kerala follows a complicated way, *i.e.*, there were years when the advance of the monsoon over the entire country has taken place in a very short period (20 days), *viz.*, years 1931, 38, 41, 49, 53, 58 etc or long period (45 days), *viz.*, years 1924, 43, 50, 52, 62, 63, 65, 67 etc. It is also seen in some years (1933, 48, 69 etc) that the advance took place rapidly upto some region and then slowed down considerably. The rapid advance is associated with systems moving in the seas from south to north etc and the delayed advance is due to western disturbances moving west to east over north India after setting in of the monsoon over south.

4. This method has been tested for 1964 to 1975. A forecast has also been made for 3 years each, after 1975 and before 1964. The forecasts were found correct for the 3 years before 1964. The trend analysis of dates of onset of southwest monsoon over Kerala for 1901 to 1975 shows as a 54-year periodicity.

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