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A study of high level wind tendency during premonsoon months in relation to time of onset of southwest monsoon in India

N. C. RAI SIRCAR and C. D. PATIL

Regional Meteorological Centre, Bombay

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ABSTRACT. Instances of unusually early or late arrival of the southwest monsoon over the whole country or a large part thereof during the 15-year period 1943-57 have been studied with reference to the high level wind changes during the corresponding premonsoon months. The rapid weakening of the mean westerly components of the prevailing winds during April appear to be associated with early monsoon while their strengthening with late monsoon. Some typical cases are illustrated and discussed in the note. These may be of interest to a forecaster who has to make a long range forecast regarding the probable time of arrival of the monsoon in a particular year.

1. Introduction

Venkiteshwaran (1950) made a detailed study of the winds at 10 km and above over India and adjoining areas. The following are the main seasonal features of the flow patterns in the above levels. In winter months, the winds are generally westerly over the entire country, the strength increasing from about 10-20 m/s in the neighbourhood of latitude 10°N to about 40-50 m/s in the neighbourhood of latitude 25°N. With the advent of monsoon, there is a complete reversal of the whole wind system in the above levels. Easterly winds generally prevail over the entire country to the south of Lat. 30°N. These easterlies are more marked during July and August when the monsoon usually shows its maximum activity. The transition from westerlies to easterlies and from easterlies to westerlies takes place during the premonsoon and postmonsoon months respectively, when the wind system is relatively light. From the above features one can reasonably expect that if during the premonsoon months of a particular year the high level prevailing westerlies weaken rapidly, this should normally indicate an early onset of the easterlies, bringing early monsoon in that year. Similarly, if the westerlies show signs of considerable strengthening, this should signify late arrival of the monsoon. No well marked changes should lead to nearly timely monsoon. These aspects have been examined in this note.

2. Analysis of high level wind data of premonsoon months

The levels selected for this study were 20,000 and 30,000 feet. The afternoon pibal data have been used since these flights are usually longer than the other flights. Stations from which observations were not received at least for three days in a fortnight have not been considered since such few observations may not indicate the correct trends.

The day-to-day wind vector data of each station were resolved into E-W and N-S components. The average values of E-W components were worked out for the periods 1-15 April, 16-30 April, 1-16 May and 16-31 May. The average E-W component for a particular fortnight was then subtracted from that for the next fortnight. The E-W wind change vectors were thus determined for the periods 1-30 April, 16 April-16 May and 1-31 May and plotted.

It was seen from the above charts that the distinctive features associated with early monsoon and late monsoon years were more marked at 30,000-ft level and in the charts for April (1st-30th) and, therefore, only such charts have been included in the note. In May, the easterly wind changes generally dominated in most years.

3. Discussion of wind change charts

(*a*) *An instance of early monsoon throughout the country* (*1956*)—In the year 1956, the Peninsula, NE India and the central parts were under the sway of the monsoon by as early as the beginning of June. It extended into the Punjab and east Rajasthan in the fourth week of June and into the rest of the country by the end of the month. Thus, the monsoon prevailed over the entire country about 10-15 days ahead of the normal time.

The wind tendency chart for 30,000 ft for April is shown in Fig. 1. It will be seen that there was a general weakening of the prevailing westerly winds practically throughout the country. Thus the weakening of the high level westerly winds in April was associated with early monsoon over the country that year.

(*b*) *An instance of late monsoon over most parts of the country* (*1957*)—The monsoon advanced into most parts of the country 10-15 days after the normal time. The Arabian Sea branch extended into north Konkan and Maharashtra on 22 June and into Gujarat and SE Rajasthan in the last week of June. The Bay branch advanced into Assam on 21 June and into the Punjab on 9 July. The monsoon prevailed over Jammu, Kashmir and west Rajasthan towards the middle of this month (July).

The wind change pattern in April of the above year is shown in Fig. 2. It is seen that there was a strengthening of westerly components of the winds over most parts of the country and the monsoon too was late.

(*c*) *An instance of late monsoon in the south Peninsula but nearly timely monsoon elsewhere* (*1944*)—The southwest monsoon appeared in the Indian seas as a feeble current towards the end of May, *i.e.*, about 7 or 8 days after the usual time. Till the end of the first week of June the current continued to be weak. It extended into the south Peninsula in the next week. Thereafter its northward advance was quite rapid. The Arabian Sea branch advanced into the north Konkan on 14 June and into the central parts and east Rajasthan by the 17th. The Bay branch extended into Bihar and Uttar Pradesh by the 20th. By the first week of July monsoon got itself established over the whole country.

The wind change chart relating to the above year is shown in Fig. 3. It is seen that the wind change vectors were westerly over the south Peninsula and the monsoon was also late over that area. The wind changes were easterly elsewhere and the northward progress of the monsoon was also rapid over the same region.

(*d*) *An instance of early monsoon in the Peninsula but late monsoon in other parts* (*1949*)—The monsoon extended into the Malabar coast on 23 May and into the north Konkan by the end of the month, *i.e.*, about 8-10 days before the usual time. The Bay branch got itself established over NE India only on 30 June, about two weeks after the normal time. The monsoon extended into west Uttar Pradesh, north Madhya Bharat and east Rajasthan on 7 July and into the rest of India during the next week. Thus the monsoon was late in the regions outside the Peninsula by about 10 or 15 days.

The chart relating to the above year is shown in Fig. 4. It will be seen that the wind change vectors were easterly and fairly strong over the Peninsula and the monsoon too actually arrived there early. On the other hand, wind changes were westerly and fairly strong over the rest of the country, and the

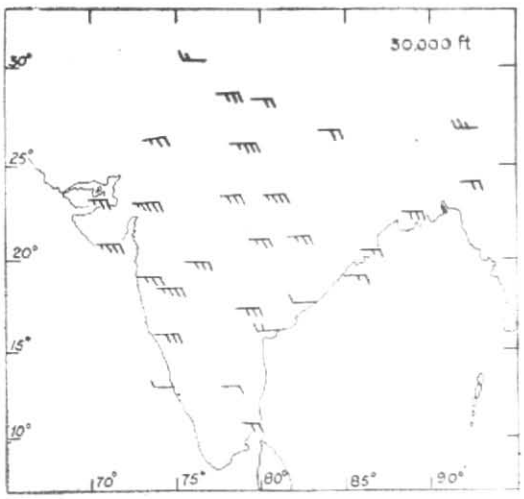

Fig. 1. Early monsoon over the country in 1956

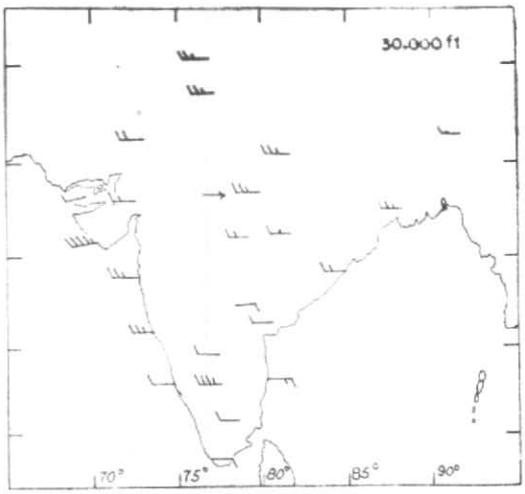

Fig. 2. Late monsoon over most parts of the country in 1957

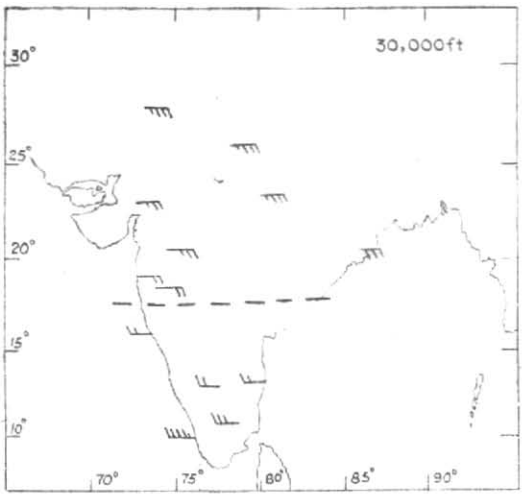

Fig. 3. Late monsoon in the south Peninsula but nearly timely monsoon elsewhere in 1944

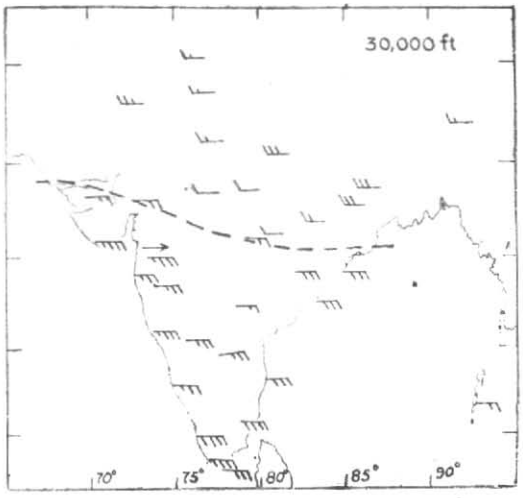

Fig. 4. Early monsoon in the Peninsula but late monsoon elsewhere in 1949

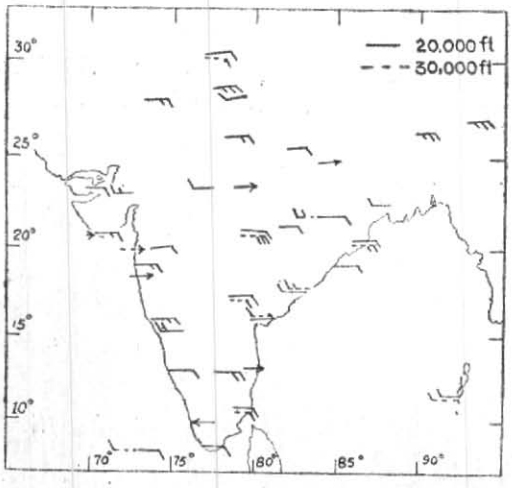

Fig. 5. Nearly timely monsoon over the country in 1947

northward progress of the monsoon also was slow in the same region.

(*e*) *An instance of timely monsoon over the country* (*1947*)—The Arabian Sea branch of the monsoon advanced into the Comorin area on 20 May and extended into south Konkan on 4 June—at about the usual time. The Bay branch advanced into Bengal and Chota Nagpur in the second week of June, *i.e.*, within a couple of days from normal date. The monsoon established itself over the central parts of the country and Uttar Pradesh by the fourth week. During the first week of the next month (*i.e.*, July) it extended into the remaining parts. Thus, the monsoon was nearly timely over the country.

The high level wind tendency chart for April of the above year is shown in Fig. 5. The data for 30,000 ft are meagre and therefore the wind changes at 20,000 ft are also shown in the same diagram. It is seen that the wind changes were generally light and both easterly and westerly. The monsoon too, actually arrived over the country at about the normal time.

4. Conclusions

As the number of cases of unusually early or late arrival of the monsoon over the country are few, it is desirable that a study of this kind is based on a large number of years. The idea brought out by the instances discussed in the note, namely, early or late arrival of the monsoon is associated with weakening or strengthening of the westerly components of winds at high levels in April, deserves further examination when more high level wind data are available in future.

5. Acknowledgement

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