

Main synoptic conditions over India and neighbourhood during a period of 40 days before onset of monsoon 1979

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(Received 25 September 1979)

ABSTRACT. The position of lows, highs, troughs and ridges have been studied in the lower and upper troposphere with respect to their normal positions during the 40 days period before the onset of monsoon in 1979. The unfavourable effects of some of these features have also been studied in respect of the onset on monsoon during 1979.

1. Introduction

In this paper some of the main synoptic conditions prevailing over the Indian subcontinent and neighbourhood before the onset of the summer monsoon are explained in relation to their normal features.

The normal synoptic conditions have been taken from the *Meteorological Atlas of the International Indian Ocean Expedition*, Vol. II: upper air (Ramage and Raman 1972).

For the explanation purpose, a 'Quick Look' data is compiled for the Indian subcontinent. But we hope that the figures themselves may be a valuable data source for the scientists interested in synoptic situations of summer monsoon.

2. Actual synoptic conditions in the month of May and first ten days of June

2.1. Main synoptic conditions on the first of May

From Fig.1 (surface chart 0000 GMT of 1 May 1979) it is seen that the thermal low over India was located rather in a northerly position with a closed centre (1002 mb) over west central parts of Pakistan. From this low pressure cell, a trough extended to latitude of 22°N over the southeastern parts of Pakistan and northern parts of Arabian Sea. Another trough extended from the central parts of Nepal and northeastern parts of India southwards to 19°N.

An important unfavourable condition which appeared in association with the summer monsoon was a deep westerly trough from the north-west of Afghanistan around 61°E across the Arabian sea southwards on 500 mb (Fig. 2) and on 200 mb level (Fig. 3), it was more pronounced and extended to equator.

The position of subtropical ridge over 300 mb level (Fig. 2), as compared with its normal position of the month of May which over India, Arabian Sea, and the Bay of Bengal, lies around 15°N, was located a little south specially, over the eastern parts of the Bay of Bengal and western part of Arabian Sea where it was located around the latitude of 10°N.

The subtropical ridge on 200 mb which over India, Arabian Sea and the Bay of Bengal lies around 15°N in the normal was on the first of May, located much south (over the southern parts of the Bay of Bengal around 5°N and from 80°E slopping toward the equator to 60°E).

On 1 May 1979 at 200 mb level a trough was also seen over the central parts of the Bay of Bengal which was not favourable for establishment of easterlies at this level.

As a result, on the first of May 1979 the Indian subcontinent, Arabian Sea and the Bay of Bengal were under the effect of subtropical western troughs. Therefore it seems that cool

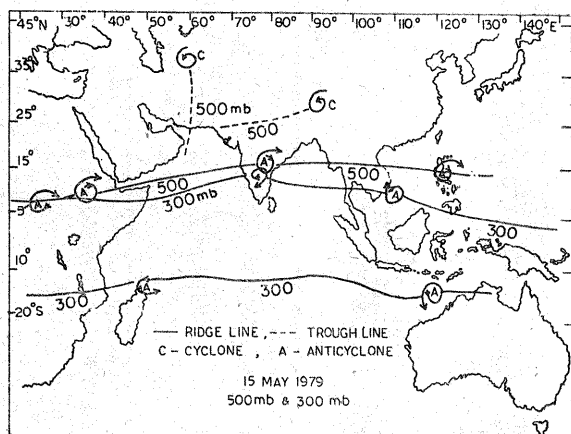


Fig. 1.

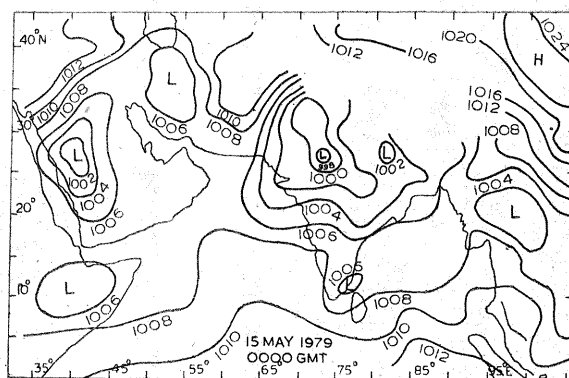


Fig. 2.

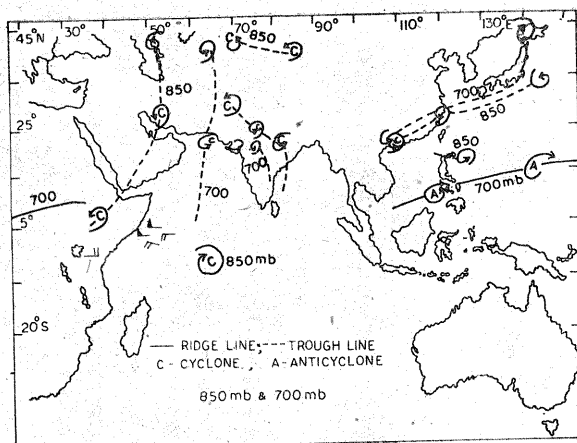


Fig. 3.

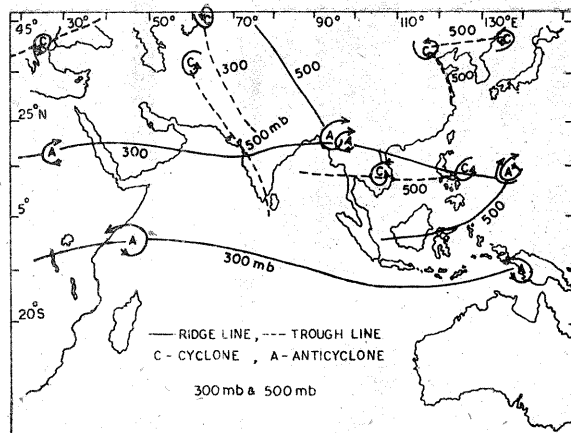


Fig. 4.

air from the northern latitudes prevailed from the surface upto 200 mb level over the above mentioned regions. This delayed the establishment of westerlies or southwesterlies semipermanent winds over Arabian Sea in lower levels and easterlies in upper levels.

2.2. Main synoptic conditions on 15 May 1979

From the surface chart of 0000 GMT, 15 May 1979 (Fig. 2) it is seen that the thermal low over the northern and central parts of India and over Pakistan was somewhat deeper and occupied larger area as compared to the normal conditions of the thermal low on the first of May. Another low centre was seen over Saudi Arabia with closed isobars which was not seen on the first of May. But westerly troughs on 850 mb and 700 mb levels over the eastern parts of Saudi Arabia southwards to 7°N, and over the Arabian Sea, west of 65°E, southwards to 5°N (Fig. 3) were the unfavourable conditions

for the establishment of semipermanent westerlies or southwesterlies over the Arabian Sea for some time. The westerly trough on 500 mb level (Fig. 4) which was extending from a cyclone centre about 37°N, 60°E in a direction north-west to nearly southeast upto 5°N was another unfavourable condition for the appearance of semipermanent westerlies or southwesterlies over the Arabian Sea.

300 mb subtropical ridge (Fig. 4) on 15 May is located a little north of the normal position and the 200 mb and 100 mb (Fig. 5) subtropical ridge on 15 May was located near about the normal position for the month of May. But the presence of westerly troughs at 300, 200 and 100 mb was an indication for movement of these ridges southwards.

Consequently, due to upper tropospheric flow, even the subtropical ridges were located northwards or at the normal positions there was no hope for the monsoon onset for some time after 15 May.

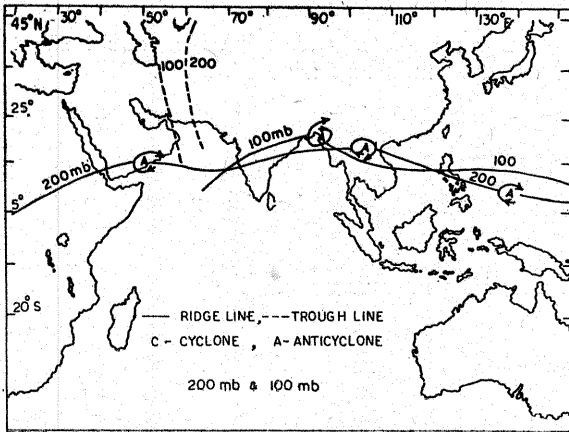


Fig. 5.

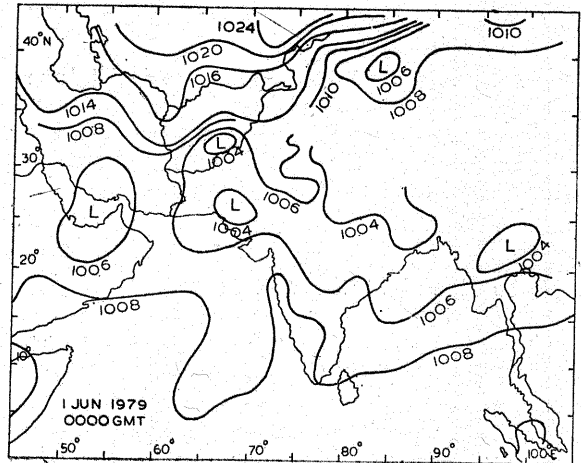


Fig. 6.

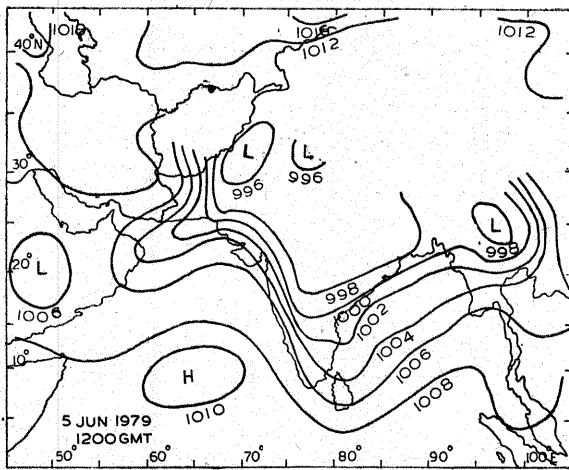


Fig. 7.

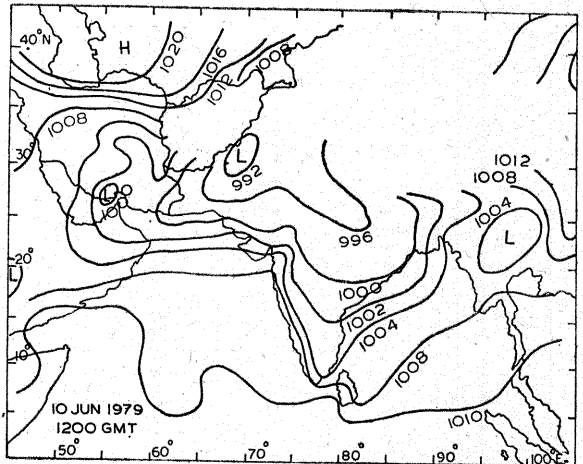


Fig. 8.

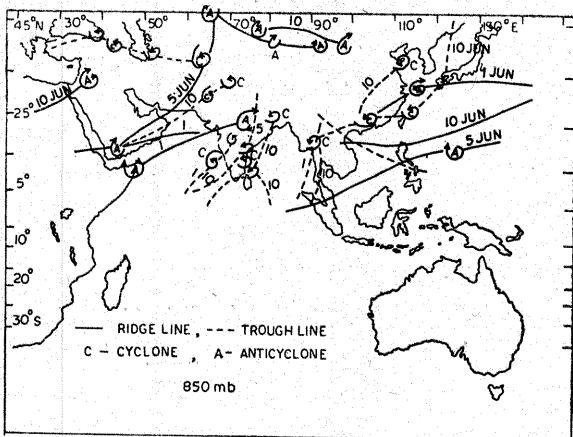


Fig. 9. Actual synoptical conditions of 1, 5, & 10 June 1979 at 850 mb

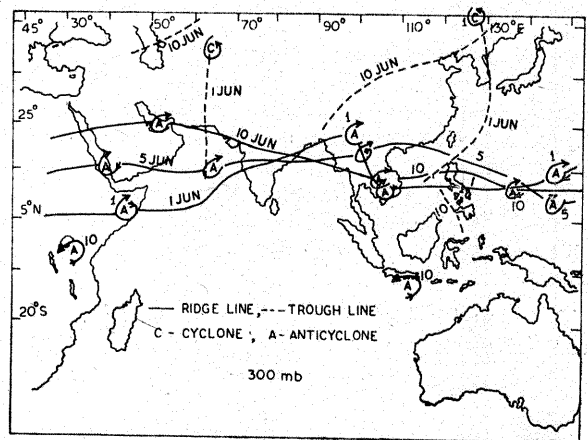


Fig. 10. Actual synoptical conditions of 1, 5 & 10 June, 1979 at 300 mb

2.3. Main synoptic conditions during 1-10 June 1979

From the surface chart of 0000 GMT of 1 June 1979 (Fig. 6) it is seen that there were small closed low pressure cells with centres over south east of Pakistan (1004 mb), central part of Burma (1004 mb) and Persian Gulf.

Important features on the surface chart were the presence of low pressure cells centred at 38°N, 85°E and at the eastern part of Afghanistan.

The last two pressure cells were connected with a deep westerly trough. It seems that a cold front in this trough and these two pressure cells represent waves on it. The precipitation which occurred at places of Afghanistan and the cloudy weather over the northwestern parts of India confirmed this fact. The high pressure area which was located behind the cold front showed that the trough wall moved in the southeasterly direction.

Consequently, synoptic situations, even in the first week of June was unfavourable for the onset of monsoon.

Referring to the surface chart of 1200 GMT of 5 June 1979 (Fig. 7), it seems that the thermal low was well organized over the northern parts of Indian Subcontinent, with the trough extending from the northeast of Pakistan to the western parts of Arabian Sea upto about 12° N. A part of this trough was over ocean and not on Mekran Coast. This suggested shifting of trough southwards due to cold invasion over Afghanistan and Baluchistan which was obstructing the onset of monsoon.

Considering the surface chart of 1200 GMT of 10 June 1979 (Fig. 8), we see that the thermal low over the northern parts of India was well organized and a west to east trough was located from the northeast of Saudi Arabia, southeastern parts of Pakistan, north of India to the northeastern parts of the Bay of Bengal.

On the 850 mb level (Fig. 9), a trough extended from the northwest of the Bay of Bengal to the north of Sri Lanka which thereafter divided into two branches, one towards the southeast of Arabian Sea and another towards the southwest of Bay of Bengal. A westerly trough extended in a northeast to southwest direction from the north of Iran to the southeast of Saudi Arabia.

The trough which on the 850 mb was located over the western part of Bay of Bengal, was

also seen on 500 mb level. But above 500 mb there was no westerly trough which could effect the onset of monsoon after 10 June.

Considering the subtropical ridge, it was seen that from 1 to 10 June at 300 mb level (Fig. 10), especially over Arabian Sea, it shifted northwards near 25°N, *i.e.*, its normal position for the month of June. But over the northern parts of India it was located 3° to 5° latitude south of its normal position.

The 200 mb and 100 mb subtropical ridges from the 1 to 10 June had interesting movement, that is, on 200 mb level the subtropical ridge from the first of June to 5 June shifted north of normal position (over Arabian Sea and India) but from 5 to 10 June it again moved south to a nearly normal position.

Over Arabian Sea and India the subtropical ridge at 100 mb level shifted from the 1 June to 5 June, southward much to the normal position and from 5 to 10 June, it shifted upto nearly a normal position.

As a result, the upper tropospheric conditions from 1 to 5 June, which were not favourable for establishment of semipermanent westerlies or southwesterlies over the Arabian Sea, changed from the 5 to 10 June, favouring of monsoon onset.

3. Conclusion

The passing of westerly troughs in the lower and mid troposphere which were extending southwards into the Arabian Sea and over the Indian Subcontinent from the first of May till the end of first week of June may be considered the main unfavourable condition for delay in advance of monsoon by the normal date.

Acknowledgements

The authors are thankful to Dr. P. K. Das, Director General of Meteorology (India) for providing necessary facilities for working at SMOC, Bombay, Calcutta and Delhi.

The authors are grateful to Mr. M. C. Sinha for reading the paper and giving useful advice.

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