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Persistence of the movement of the tropical cyclones/depressions in the Bay of Bengal during the premonsoon and post monsoon periods

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(*Received 10 December 1965*)

ABSTRACT. An examination of the tracks of cyclonic storms/depressions in the Bay of Bengal during the premonsoon and post monsoon periods (April-May and October-December respectively) for the years 1891 to 1960 was made with reference to the characteristic of their direction of movements. The sea area was divided into 2½ degree squares for this study. The cyclonic disturbances in each of the 2½ degree squares were classified into three categories, *viz.*, (1) clockwise curvature, a, (2) anticlockwise curvature, b and (3) persistent type, c. The relative percentage frequencies of the above types a, b and c in each of the 2½ degree squares for the months April-May and October-December were found out and isolines of the percentage frequencies at 20 per cent intervals were drawn on the diagrams.

1. Introduction

Every year, a good number of depressions and storms form in the Bay of Bengal and affect the various parts of India, Pakistan and Burma. A correct prediction of the speed and direction of movement of such disturbances over the sea areas is very important for the issue of warnings against heavy rainfall and gales in coastal districts well in advance. Forecasts of movement of the disturbances are usually based on the reports received from ships, but such reports are often very meagre. Climatological information on the speed and movement is, therefore, often found to be very important for the above purpose, when sufficient data are not available from ships. On an averge, 13 disturbances develop in the Bay of Bengal every year. Of these, 10 per cent form in the premonsoon season (April and May), 56 per cent in the monsoon season (June, July, August and September) and the rest in the post monsoon season (October, November and December). The winter season (January, February and March) is practically free from the incidence of such disturbances. In the monsoon season these form in the north Bay of Bengal and generally move in a westnorthwesterly direction. In early June, a few may, however, form at lower latitudes and recurve and cross Pakistan and Burma coasts. On the other hand, the disturbances in the premonsoon and post monsoon seasons may develop in different regions of the Bay of Bengal and move in various directions. The tracks of many of these disturbances undergo recurvature and there are certain regions where the occurrence of such recurvature is frequent. Charts showing areas in which a disturbance usually follows a nearly straight track and also the areas where the path is liable to recurvature clockwise or anticlockwise, may be useful particularly to those forecasters who are yet to gain sufficient experience in the work. With this object in view, the present study has been undertaken by the authors and it relates to the premonsoon and post monsoon seasons when it is more difficult to predict the movement of such disturbances.

For the purpose of the present study, the whole Bay of Bengal has been divided into 2½ degree lat.–long. squares. The curvatures of the tracks inside each 2½ degree square for the premonsoon and post monsoon seasons during the years 1891 to 1960 have been examined monthwise. When the curvature was within $\pm$ 10 degree (positive for clockwise and negative for anticlockwise curvature), the movement has been considered as persistent. The percentage frequencies of persistent movement, clockwise movement and anticlockwise movement, were then determined for each square and plotted at the centre of the square on the different sets of charts and isolines drawn. These isolines mark out the areas favourable for persistent motion and recurvature clockwise or anticlockwise.

2. Discussion of the charts

(*a*) *Premonsoon season*

Figs. 1(a) and 1(b) represent the charts for April showing percentage frequencies of disturbances where track deviated by (a) more than 10 degrees in clockwise direction and (b) more than 10 degrees in the anticlockwise direction. Fig. 1(c) represents cases where deviation was less than or equal to 10 degrees clockwise or anticlockwise direction. It is seen from these charts that the probability of persistent movement is very high in the south and north Bay of Bengal and also in the south Andaman Sea.

The chances of the disturbances in the central Bay or north Andaman Sea to continue to move in the same or nearly the same direction or to undergo a deviation in the clockwise direction

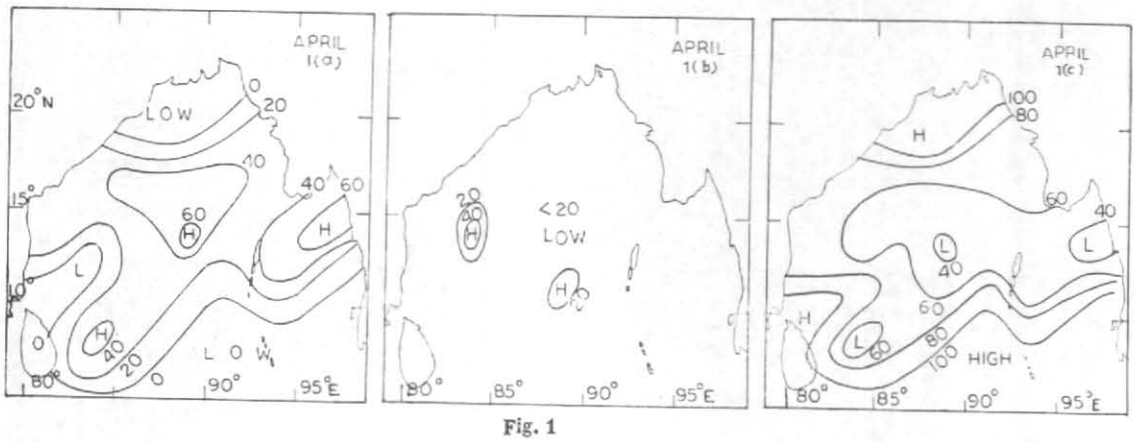

Fig. 1

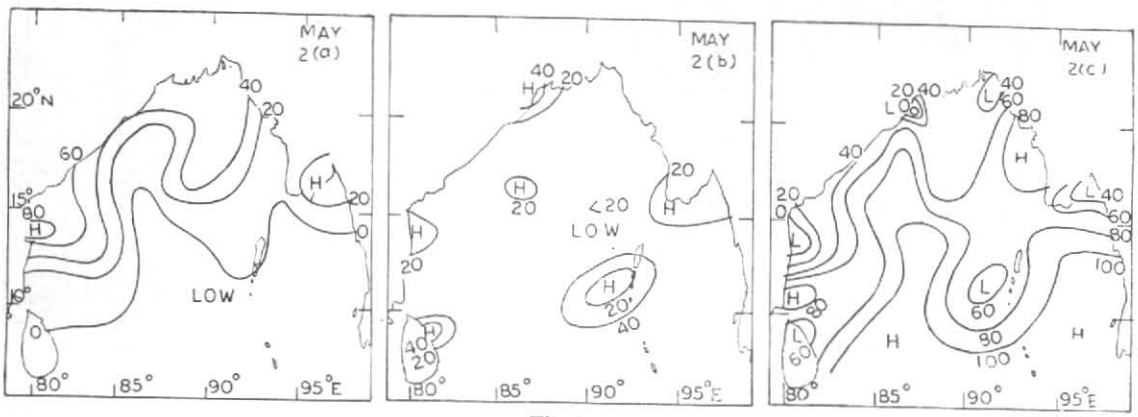

Fig. 2

Figs. 1 and 2. Isolines of percentage chance of movement of cyclonic storms/depressions in the Bay of Bengal

Figs. 1(a) and 2(a) — Movement of cyclonic storms/depressions where tracks deviated within the 2½ degree square by more than 10 degrees in clockwise direction

Figs. 1(b) and 2(b) — Movement of cyclonic storms/depressions where tracks deviated within the 2½ degree square by more than 10 degrees in anticlockwise direction

Figs. 1(c) and 2(c) — Movement of cyclonic storms/depressions where tracks deviated within the 2½ degree square within ± 10 degrees in clockwise or anticlockwise direction

is nearly 50 : 50. The instances of deviation in the anticlockwise direction are absent in most parts of the area. In this month, the disturbances usually develop in the east central Bay and adjoining southeast Bay and Andaman Sea and initially move in a northwesterly direction (Rai Sircar 1958). Many of them recurve towards northeast in the central Bay itself and continue to move in the same direction across the north Bay.

The area where storms and depressions form in the month of May practically covers the whole Bay, the incidence being relatively high in the north Bay and in the south Bay north of Lat. 9°N and the adjoining areas of central Bay and of the Andaman Sea (Rai Sircar 1958). It is seen from Fig. 2(c) that the number of cases of persistent movement is generally very high in southwest Bay, Andaman Sea and in small area of central part of central Bay and about 50 per cent over most of the rest areas. North Bay and adjoining parts of east central Bay are favourable areas where curvature in the clockwise direction may take place (Fig. 2a). Fig. 2(b) shows some cases of deviation in anticlockwise direction in southeast Bay and also in southwest Bay off Ceylon.

(b) Post monsoon season

It is seen from Fig. 3(c) that the frequency of persistent movement is high all over the Bay, although it is generally more in the south Bay and the Andaman Sea. As in the month of May, a disturbance may develop at any place in the Bay in the month of October. In these two months, the I.T.C.Z. moves northwards and southwards respectively across the Bay and this accounts for the scattered nature of their place of formation (Rai Sircar 1958). Initially, the disturbances usually

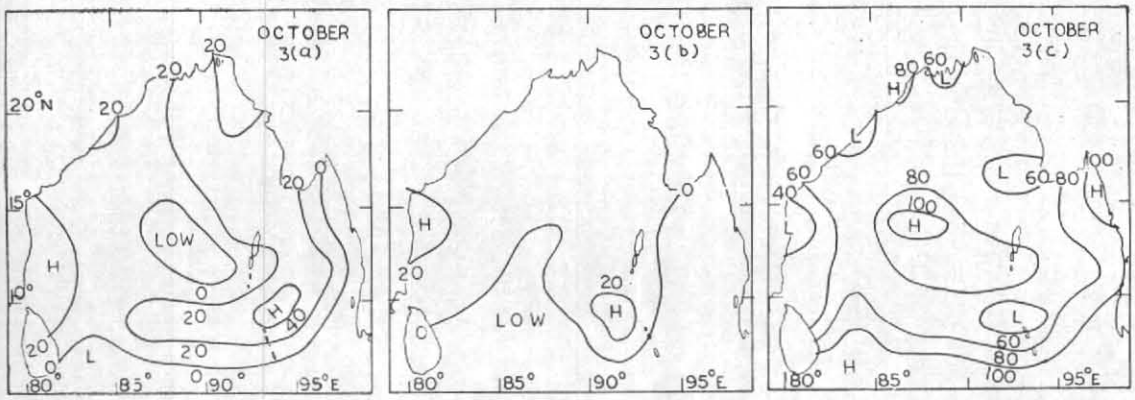

Fig. 3

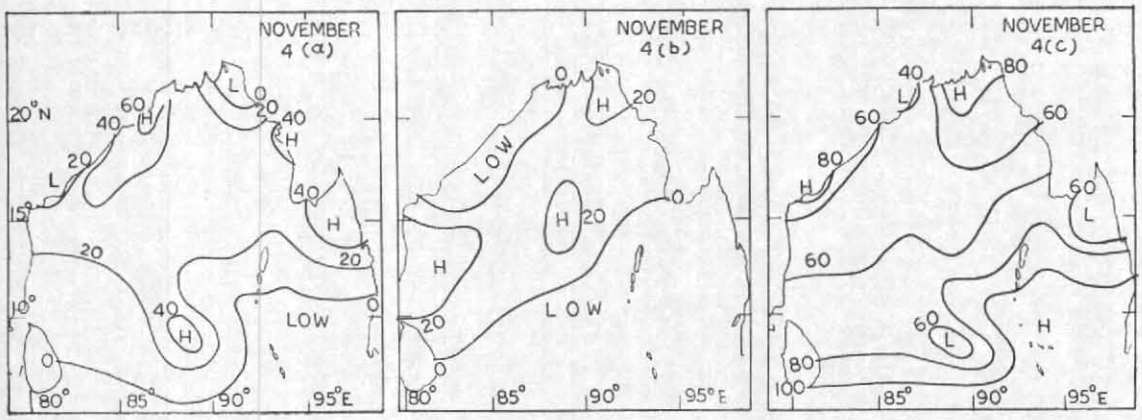

Fig.4

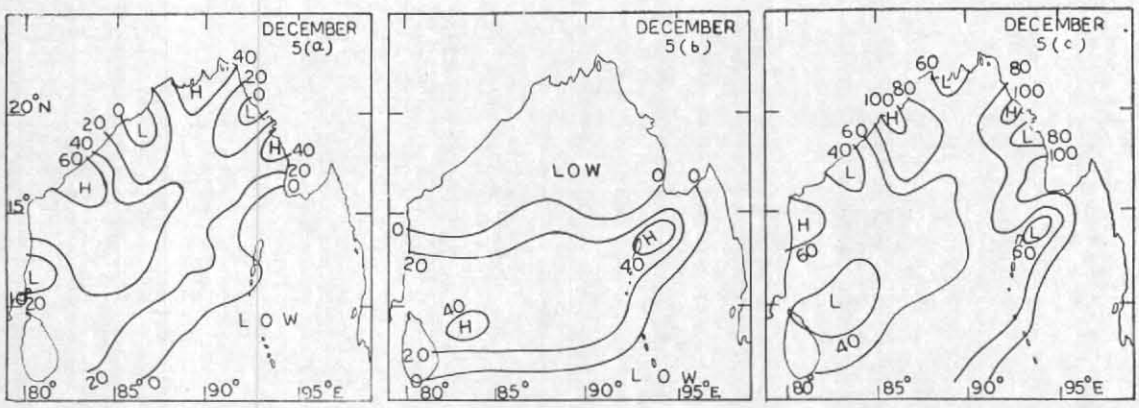

Fig. 5

Figs. 3—5. Isolines of percentage chance of movement of cyclonic storms/depressions in the Bay of Bengal

Figs. 3(a), 4(a), 5(a) — Movement of cyclonic storms/depressions where tracks deviated within the $2\frac{1}{2}$ degree square by more than 10 degrees in clockwise direction

Figs. 3(b), 4(b), 5(b) — Movement of cyclonic storms/depressions where tracks deviated within the $2\frac{1}{2}$ degree square by more than 10 degrees in anticlockwise direction

Figs. 3(c), 4(c), 5(c) — Movement of cyclonic storms/depressions where tracks deviated within the $2\frac{1}{2}$ degree square within $\pm$ 10 degrees in clockwise or anticlockwise direction

move northwestwards and later recurve towards north or northeast. Cases of curvature of the tracks in the clockwise direction are practically absent in the southern parts of south Bay and also in the central parts of the central Bay. Such curvature takes place on about 15 to 30 per cent occasions in the remaining areas. There are also some cases of anticlockwise deviation all over the Bay north of Lat. 8°N (Fig. 3 b).

The south Bay is the most favourable zone for the formation of disturbances in November and December respectively. In November, the tendency for anticlockwise curvature is noticed more in the west central Bay and is practically absent in Andaman Sea and the extreme south Bay (Fig. 4b). It may be noticed that quite a number of disturbances recurve towards southwest in the sea area off Madras coast (Fig. 4b). The central Bay is the main area where a November disturbance undergoes a turning towards northeast (Fig. 4a). The December disturbances show more or less the same features as those to the November disturbances. Northeasterly recurvature takes place mainly in the central Bay and is absent in Andaman Sea and southeast Bay. The turning towards southwest generally occurs in south Bay and is absent in north Bay.

3. Acknowledgement

The authors wish to express their thanks to all the members of the Research Section for their assistance in compiling data and preparation of charts.

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