551.578.1 : 551.577.37 : 551.541(54)

Study of heavy rainfall associated with low pressure microcells over northeast India

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ABSTRACT. Low pressure vortices of small extent or microcells of low pressure are sometimes embedded in the large scale circulation of the lower levels of the atmosphere. These can be located on the surface isobaric charts plotted on a large scale map by drawing isobars at intervals of 1·0 or 0·5 mb. It is seen that location and movement of these vortices sometimes influence distribution of rainfall over small areas. The spots of heavier rainfall tend to move near to the microcells of low pressure. A meso-scale network of observing stations is necessary for precise location of these cells and for study of their movements and influence on rainfall distribution. Results of studies with available observations on some typical days of the monsoon season in 1961 are presented in this paper.

1. Introduction

During the monsoon, it is common practice to associate the heavier rainfall with the axis and depth of the monsoon trough, the strength of the monsoon current and the existence of high level upper air troughs. These, however, indicate a potential field of rainfall distribution over a wide area but fixing the exact small areas over which comparatively heavier falls would actually occur becomes a difficult problem. Rai Sircar and Hariharan (1954) and Hariharan (1956) had shown that adequate appraisal of the rainfall features on a particular day of even a small area within 50 miles of a station is not often possible on the basis of the rainfall report from the station alone. Rainfall from a closer network would be helpful in the assessment of the distribution of rainfall over small areas.

George (1956) had observed the existence of significant vortices which made noteworthy contribution towards rainfall along the west coast of India during the monsoon season. The monsoon current is in a continuous state of flux and continuous formation and dissipation of significant vortices are expected not only due to the existence of the Ghats but also anywhere in the large scale circulation in the atmosphere. These elementary vortices of small extent or microcells of low pressure appearing on the surface isobaric chart may behave analogous to bubble depression in which case one should expect that the band of heavier rainfall distribution should shift near to these cells. The present study is an attempt to detect the existence of low pressure microcells and examine the areas of comparatively heavier rainfall in relation to these cells utilising the data available in our daily synoptic charts.

2. Individual cases studied

6 June 1961 (Fig. 1)—There is one microcell in the area bounded by Balasore, Midnapore, Bankura, Jamshedpur and Chaibasa, one between Dhanbad and Hazaribagh, one near Comilla and another between Daltonganj and Arrah. The one between Dhanbad and Hazaribagh appears to be more pronounced. Rainfall reported next day at 0830 IST was—Balasore 1 cm, Midnapore 2 cm, Bankura 2 cm, Jamshedpur 6 cm, Chaibasa 1 cm, Hazaribagh 15 cm, Ranchi 6 cm, Dhanbad 3 cm, Asansol 1 cm, Jamui 3 cm, Daltonganj 2 cm, Dehri 1 cm, Arrah 1 cm, Comilla 2 cm and Agartala 3 cm.

10 June 1961 (Fig. 2)—There is one microcell between Asansol and Sriniketan, one between Midnapore and Calcutta and another near Jessore. These three microcells are contiguous and fall within the area bounded by Calcutta, Jessore, Krishnagar, Berhampore, Naya Dumka, Asansol, Midnapore and Calcutta. The rainfall reported next day was—Midnapore 10 cm, Calcutta 8 cm, Jessore 7 cm, Krishnagar 6 cm, Burdwan 12 cm, Sriniketan 3 cm, Berhampore 6 cm, Naya Dumka 4 cm, Dhanbad 5 cm, Asansol 5 cm and Puri 1 cm. It is of interest that although there was a shallow depression on this chart centred near Ranchi the distribution of the band of heavy rain was away from the centre of this depression, but was mostly close to the microcells mentioned above. Due to insufficient data isobars could not be drawn with confidence beyond the line of 965·5 mb but the shape of the isobar (965·5 mb) suggests the existence of a microcell near Jharsuguda which reported 20 cm of rain next day.

Similar cases were noticed on the following dates—5-6-61, 11-7-61, 12-7-61, 31-7-61, 4-8-61

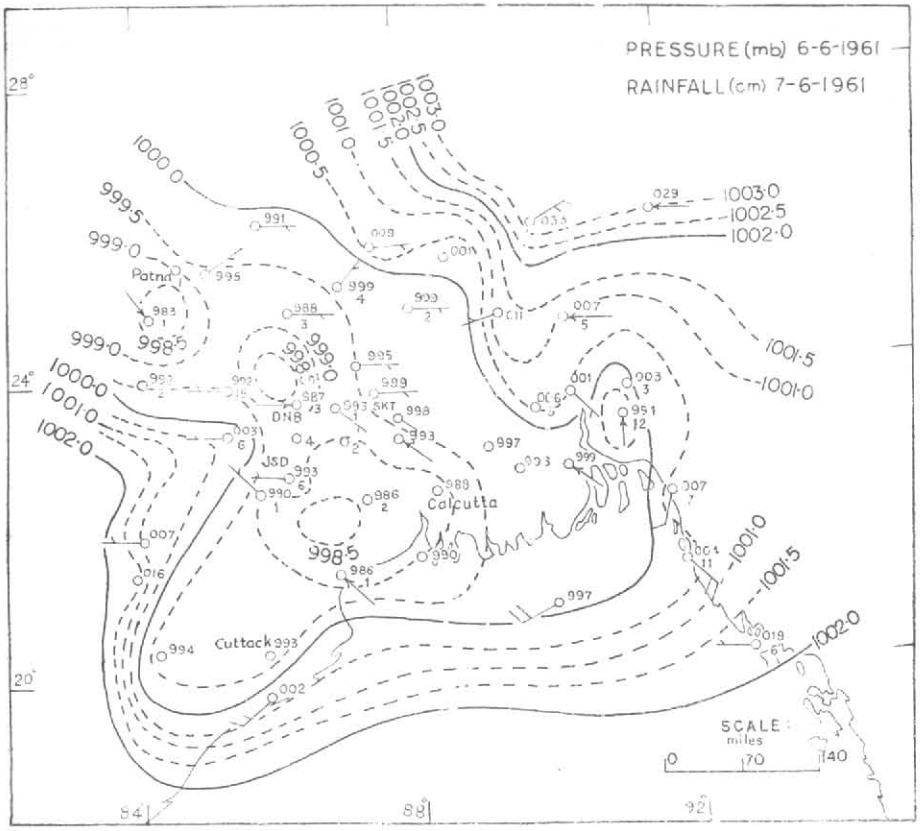
PRESSURE (mb) 6-6-1961
RAINFALL (cm) 7-6-1961
28°
24°
20°
84°
88°
92°
Patna
Calcutta
Cuttack
DNB
JSD
SKT
1003·0
1002·5
1002·0
1001·5
1001·0
1000·0
999·5
999·0
998·5
SCALE
miles
0
70
140

Fig. 1

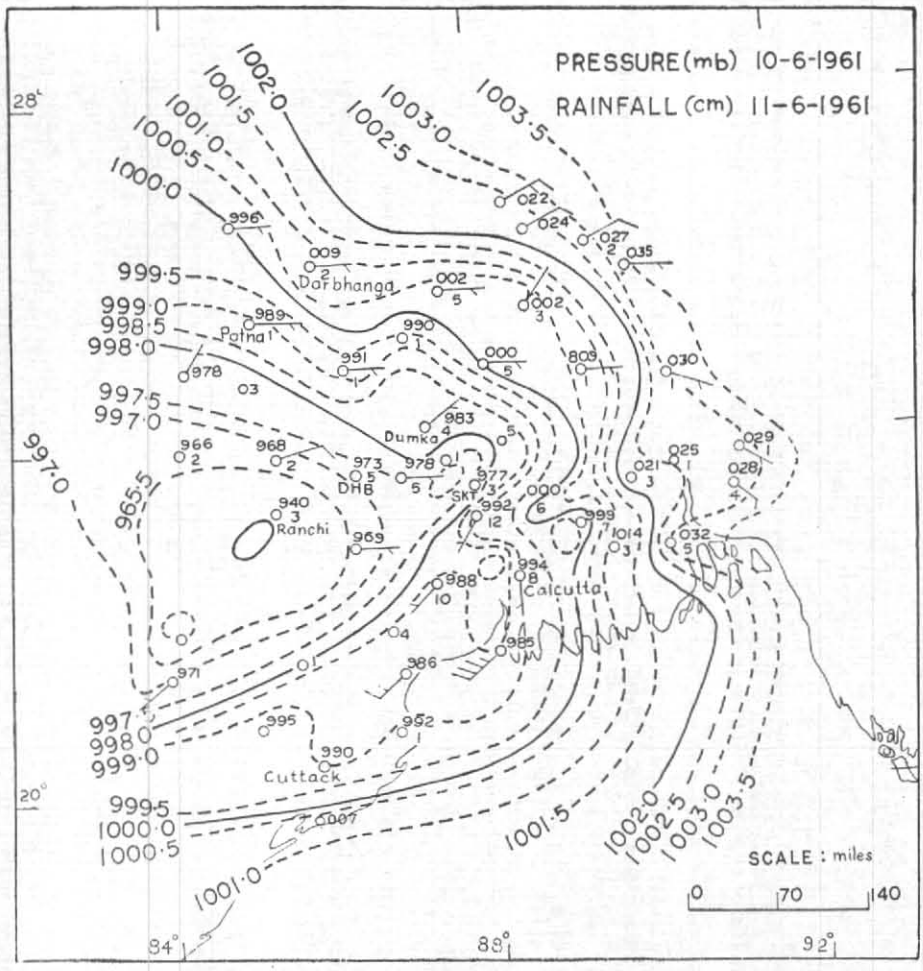

Fig. 2

and 5-8-61 (Charts for 5 June, 11 and 31 July and 4 and 5 August have not been reproduced).

In order to examine the movement and accentuation or dissipation of the cells during the next 24 hours for the above dates, a reference was made to subsequent synoptic charts. In the case of the cell near Bankura on 12 July (Fig. 3), it was noticed that the cell accentuated on the 1730 IST chart, moved northwestwards and disappeared at 0830 IST of 14 July. In other cases the cells moved west or northwestwards and decreased in numbers and increased in size suggesting dissipation of the smaller cells within the next 24 hours.

3. Conclusion

From an examination of the charts mentioned above, it appears that elementary microcells of low pressure exist as separate cells distributed in the large scale circulation of the atmosphere. Further, it seems that existence of these low pressure cells can be detected on surface isobaric charts even if isobars are drawn at intervals of 1 mb, which can be easily done with the available network of observations and accuracy of pressure data. These minute cells probably constitute active centres which induce localised heavy rain. Improvement of network of observing stations should permit a more precise identification of these cells, and study of their movement and life history. Such meso-scale study of surface isobaric charts may provide very useful clue for forecasting precipitation pattern in greater detail not only during monsoon but in other seasons also.

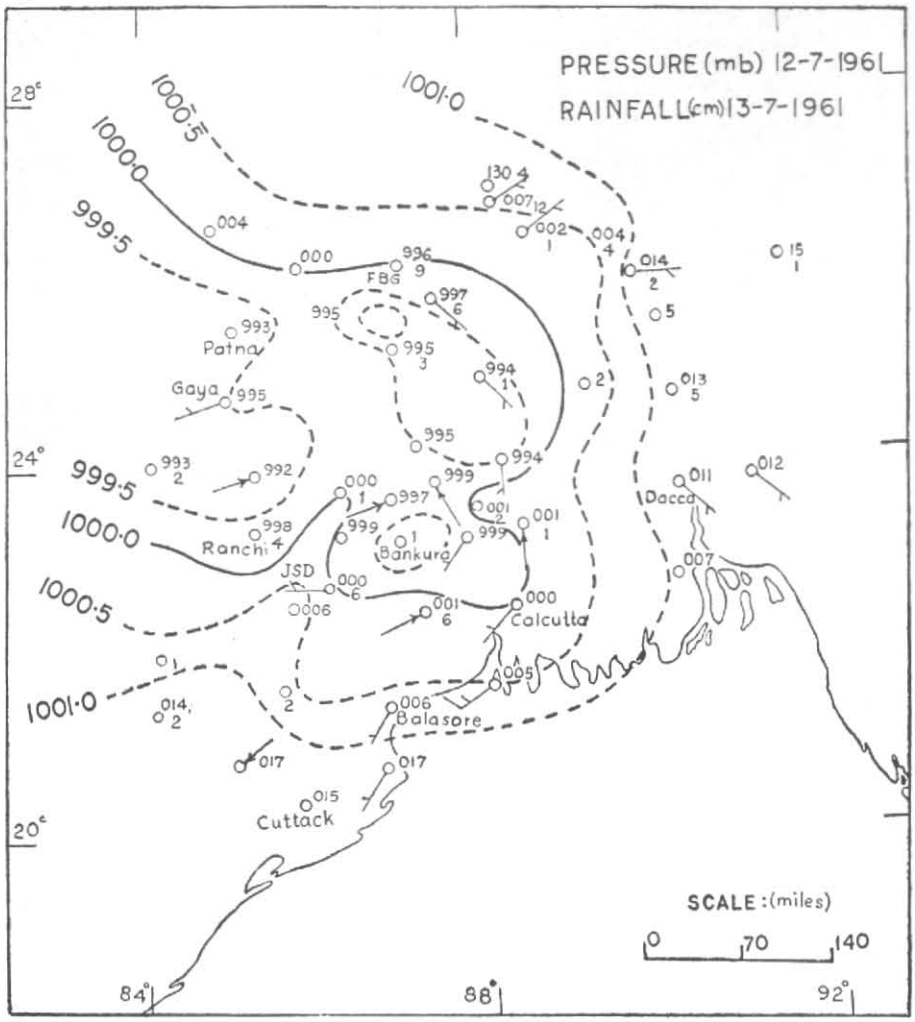

Fig. 3

4. Acknowledgement

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