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TROUGH IN LOW LEVEL MONSOON WESTERLIES AND ASSOCIATED RAINFALL OVER TEESTA CATCHMENT

1. The river *Teesta* is one of the major rivers of North Bengal which is always susceptible to the flash floods endangering Jalpaiguri city. As the time of concentration for the rivers of hilly region is less, forecaster has to appraise the synoptic situation and issue heavy rainfall warnings at the shortest possible time. The river *Teesta* originates in the glaciers of north Sikkim at an altitude of 6400 m. The catchment area of *Teesta* river up to Indo-Bangladesh border is about 12650 sq km, 75% of which lies in hilly region. The Teesta basin gets about 217.0 cm of rains during monsoon months. The main synoptic situations responsible for heavy rainfall over the basin are identified as : (*i*) break monsoon condition, (*ii*) the low pressure area/cyclonic circulations in the neighbourhood of west of the catchment, and (*iii*) the passage of low level trough in monoon westerlies between east Nepal hills to Assam & Meghalaya (Biswas *et al.* 1984). The high influence of the low level trough in monsoon westerlies can be appreciated by the fact that during period 1980-90, 39% occasions of heavy rainfall (areal rainfall of more than 25. 0 mm) over Teesta basin are associated with this system. The importance of this system was recognised by earlier workers (Srinivasan *et al.* 1972).

2. The trough in the low level nonsoon westerlies are mainly associated with break monsoon situation. They may form and travel as far as west Madhya Pradesh to Assam & Meghalaya. However, in the majority of the cases the system appears between east Nepal hills to Assam & Meghalaya and trevels eastwards. However, the movement is not regular. The position of the trough at 00 UTC over 25°N is determined at 900 m, 850 hPa, 2100 m and 700 hPa level by analysing available upper air data during period 1980-90. The characteristics of the rainfall recorded at 03 UTC next day over Teesta basin are studied and tabulated. As an illustration, the trough positions in low level monsoon westerlies during 4 to 9 July' 88 at 900 m, 850 hPa, 2100 m and 700 hPa with streamline analysis of 7 July '88 is shown in Fig. 1. The highest rainfall caused by this system was recorded on 8 July' 88. The isohyetal pattern of this rainstorm is shown in Fig.2.

3. During the period 1980-90, there were 35 occasions when the low level trough in monsoon westerlies was identified with available data. The average characteristics of rainfall over Teesta basin associated with this system (Table 1) indicates that the system has a strong potential of producing heavy rainfall over Teesta basin during the months July and August. The influence of the system lasts generally for the duration of 3 to 4 days. The average highest one day rainfall over Teesta basin is of the order of 34.0 mm. The heaviest rainfall will occur on any of the first two days after the appearance of the system (Table 2). From

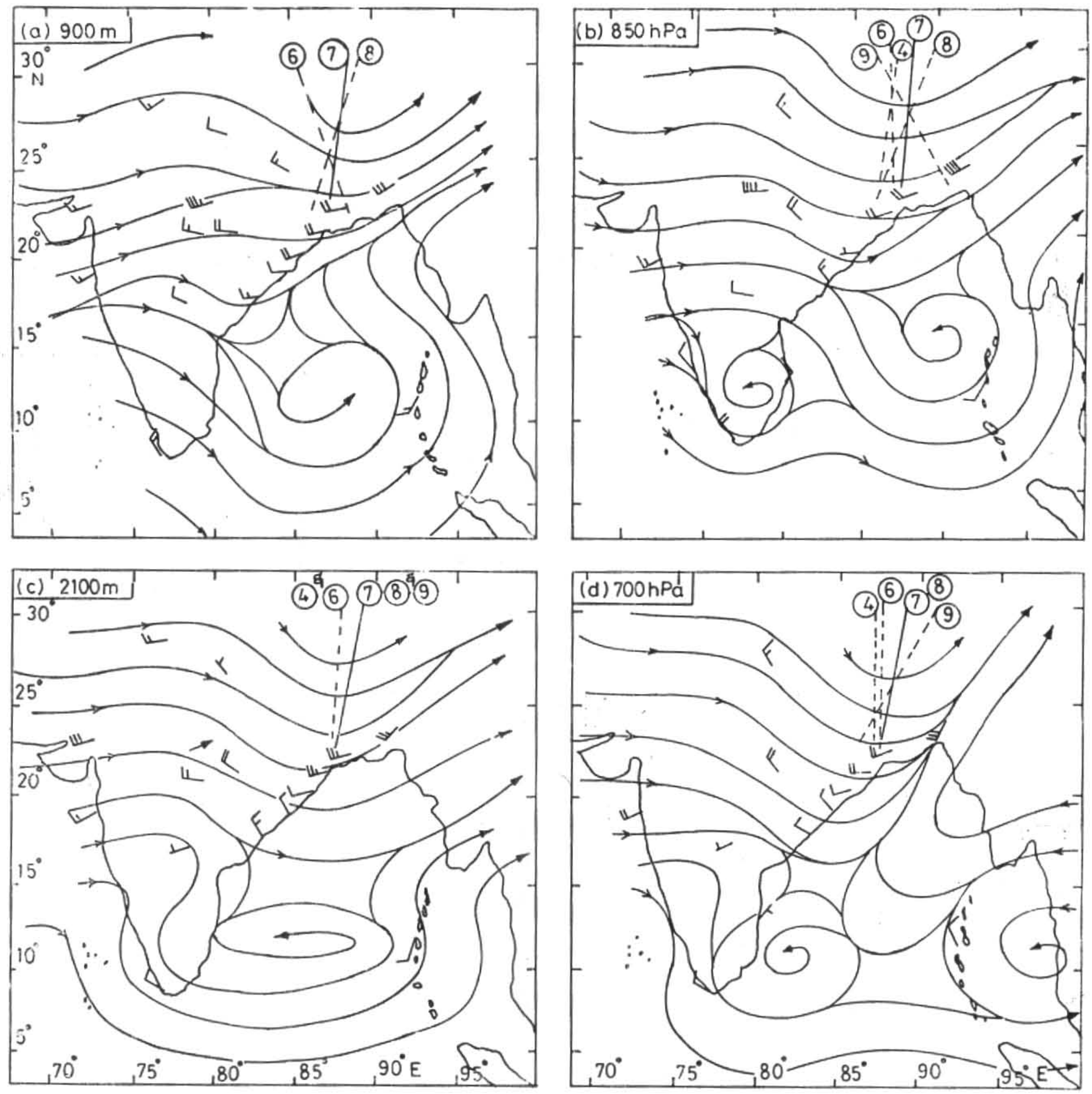

Fig. 1. Streamline analysis on July 1988 (00 UTC) and position of trough during 4-9 July 1988

TABLE 1

Main features of rainfall and associated trough in monsoon westerlies (Period : 1980-90)

	No. of occasions of trough in low level monsoon westerlies	Average duration of persistence of the system (days)	Average rainfall (mm) over Teesta catchment under the influence of the system	1-day highest rainfall: Average (mm)	1-day highest rainfall: Absolute (mm)
Jun	4	3	47.5	31.7	72.8
Jul	14	4	93.0	36.7	60.4
Aug	6	3	89.3	39.5	80.9
Sep	11	4	56.2	28.5	53.0

TABLE 2

Average rainfall for each day under the influence of the trough in low level monsoons westerlies (rainfall in terms of percentage of total rain during the passage of the system)

	Day						
	1st	2nd	3rd	4th	5th	6th	7th
Jun	32	51	15	2	—	—	—
Jul	39	31	13	10	4	3	1
Aug	37	33	23	5	2	—	—
Sep	31	45	15	4	1	4	—

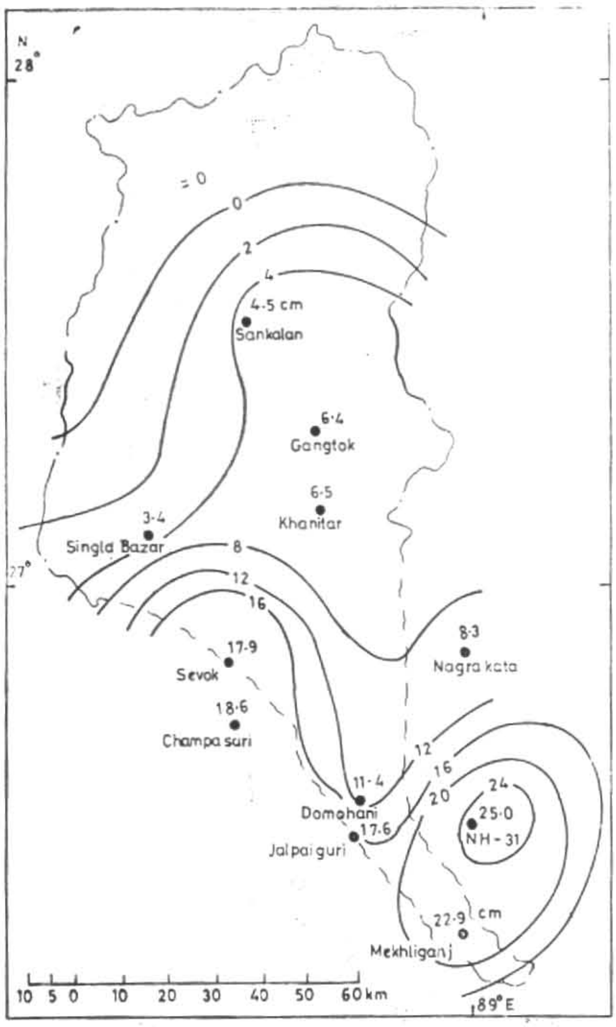

Fig. 2. Isohyetal analysis of 8 July 1988 (rainfall in cm)

TABLE 3

Frequency of one day rainfall under various ranges (mm) under the influence of the position of the system

Position of the system	Average areal one-day rainfall				
	1-10	11-25	26-50	51-75	76-100
West of 88° E	9	14	14	4	0
Between 88° E & 89° E	21	22	18	3	1
East of 89° E	7	7	4	0	0

Table 3 it may be seen that possibility of heavy rainstorm (one day average areal rainfall more than 25.0 mm), which has high potential of causing severe floods over Teesta basin, is maximum when the location of the system is west of 89°E at 25° N and the least when it is east of 89° E. From the illustrations depicted in Fig. 1 and Fig. 2 also it may be observed that heaviest rainfall was recorded on 8 July '88 when the trough position was between 88° E and 89° E at 25° N on preceding day 7 July '88. Also out of 124 occasions of the presence of this system, the system lingers west of 89° E on 106 occasions. It moves faster eastwards after crossing 89° E and becomes unimportant as far as the rainfall of the Teesta basin is concerned.

4. *Conclusions*

(*i*) The low level trough in monsoon westerlies is one of the important synoptic situations responsible for heavy rainstorms over Teesta basin.

(*ii*) The heaviest rainfall associated with this system can be expected on any of the first two days after the appearance of the system.

(*iii*) The system is more effective in producing heavy rainfall over Teesta basin during the months July and August particularly when it is west of 89° E.

(*iv*) The system may cause rainfall of the order of 70.0 mm during its passage over and in neighbourhood of Teesta catchment.

References

Biswas, B. and Bhadram, C.V.V., 1984, "A study of major rainstorm of Teesta basin", *Mausam*, **35**, 2, pp. 187-190.

Srinivasan, V., Raman, S. and Mukherjee, S., 1972, "Southwest monsoon—Typical situation over West Bengal and Assam and adjoining States", India Met. Dep. Forecasting Manual Part III-3, 6.

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