

RADAR ECHO PATTERN DURING THE ONSET PHASE OF SOUTHWEST MONSOON OVER GANGETIC WEST BENGAL

Southwest monsoon is the principal rainy season (June to September) that gives about 75% of the annual total rainfall over Gangetic West Bengal (GWB). The normal "date of onset" over GWB is 8 June. The changes in radar echo patterns over GWB, utilising data for 1978-88, during the onset phase of monsoon have been studied. Taking a period of 15 days as the onset phase, variations in top heights of radar echoes in respect of 7 days prior to the date of onset, on the date of onset and 7 days after the onset has also been discussed and the salient features noted.

2. The actual dates of onset and the direction from which it approached GWB have been shown in Table 1. The onset was delay in all cases during the period under study, excepting 1984. The southwest monsoon generally advances over GWB from the east and sometimes from the southeast. Out of these eleven occasions it covered the whole area of GWB within 24 hours on five occasions and within 25 to 48 hours on four occasions. Only on two occasions it took more than 48 hours to cover the area.

3. The 1-day average number of radar echoes with top heights 6 km or more is maximum after the date of onset (Fig. 1). But for Cb (cumulonimbus) cells with heights 8 km or more, the number becomes maximum prior to the date of onset. A day before the date of onset gets about 32% more echoes than that of a day after the onset when their top heights are 10 km or more.

TABLE 1

Dates of onset of SW monsoon over GWB during the years 1978-88, direction from which it advanced and time taken to cover the whole area

Year	Date of onset	Direction	Time taken to cover the area (Hrs)
1978	21 June	Southeast	>48
1979	24 June	Southeast	<24
1980	10 June	East	25-48
1981	20 June	East	<24
1982	15 June	East	<24
1983	27 June	Southeast	25-48
1984	08 June	East	<24
1985	15 June	East	>48
1986	19 June	East	<24
1987	09 June	East	25-48
1988	09 June	East	25-48

This shows that the Cb cells formed before the dates of onset are of pre-monsoon type (Biswas & Gupta 1989) though the entire period under observation falls in the month of June. But the number of Cb cells with top exceeding 6 km remains minimum on the date of onset. The reason may be due to "high rise in 5-day average rainfall" before declaring the date of onset and much of the energy is spent during the first four days of the 5-day period.

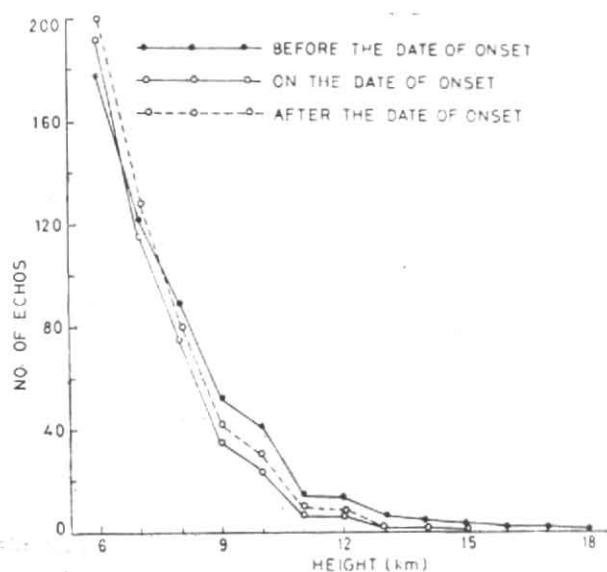


Fig. 1. 1-day average (1978-88) of radar echoes with top height 6 km or more during the onset phase of SW monsoon over GWB

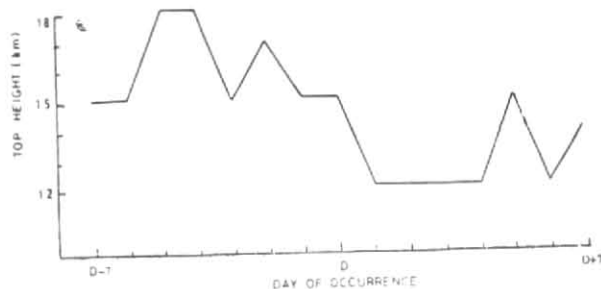


Fig. 2. Highest Cb cells top developed over GWB during the 15-day period of onset of SW monsoon in the year 1978-88

4. Fig. 2 shows the highest top heights of Cb cells developed during the 15-day period ($D - 7$ to $D + 7$) of onset in the years 1978-88. The Cb cells with top heights 15 km or more may form over GWB prior to the date of onset of monsoon. But the heights generally becomes less than 15 km after the onset.

5. The Cb cells (scattered plot) with top heights 12 km or more developed during 7 days before onset (B), on the date of onset (D) and during 7 days after onset (A) are shown separately in Fig. 3. The high density of Cb cells are found more over the northeastern, central and southwestern parts of GWB before the date of onset. Similar Cb cells activities are also reported over the western areas on the date of onset and in the southeastern parts after the onset. Intense convection (IC) takes place at the meeting zones of dry and warm air from west/northwest with the moist southerly air flow from the Bay of Bengal before the onset and along the line indicating the limit up to which monsoon has advanced, on the day of onset. On the other hand, after the onset, the development of Cb cells may take place within the monsoon air (air mass type) under favourable conditions soon after the current enters land areas. Intense convection, in this case, may take place along the coastal areas under the influence of monsoon disturbances.

6. The radar echoes of convective clouds over GWB are observed as scattered or broken line type before the advance of the monsoon currents over the area. With the advance of the monsoon currents, radar echoes are developed mainly in a scattered or isolated way over the area. Sometimes echoes are formed in a broken lines pattern over the leading edge of the advancing monsoon currents. But the height attained by these cells does not exceed 6-8 km in most of the observations. On many occasions the heights are even less than 6 km. The scattered or isolated convective clouds with not very high tops cause thunderstorms and heavy showers at times. During the advancing phase of the monsoon, a station falling on its way experiences 5 to 10 spells of precipitation, drizzle to shower, mainly of passing type (*i.e.*, short lived) and sometimes continues for a few hours and generally accompanied with thunder.

7. Conclusions

- (i) The advance of SW monsoon over GWB generally takes place from east to west.
- (ii) The radar echoes prior to the date of onset of SW monsoon over GWB are of pre-monsoon type even in the month of June.

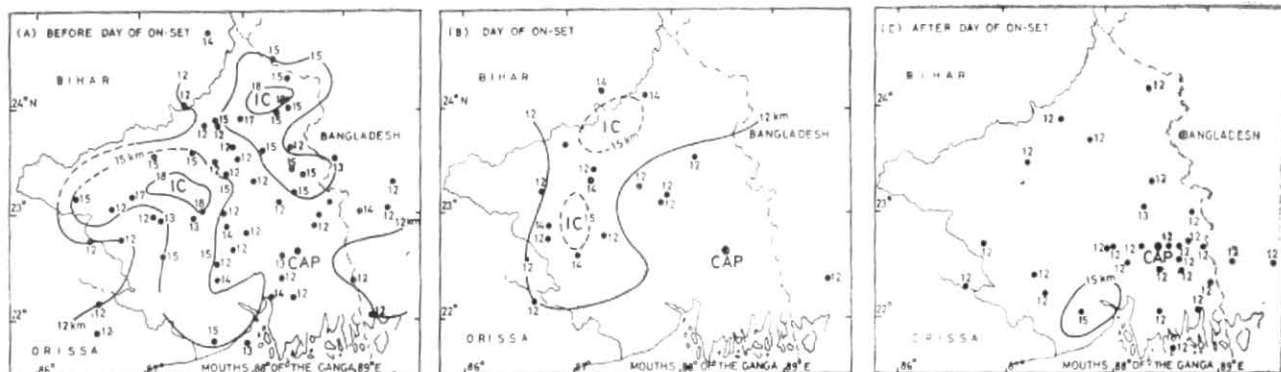


Fig. 3. A scattered plot of Cb cells with top height 12 km and more developed over and around GWB

- (iii) The convective clouds associated with the advancing monsoon currents over GWB generally form in a scattered or isolated pattern and sometimes in broken line pattern with top heights ranging between 6 to 8 km in most of the cases.
- (iv) Development of high Cb cells are more in the northeastern, central and southwestern areas of GWB before the date of onset, while it is more in the western areas on the date of onset and in the southeastern areas after that.
- (v) A station falling in the way of advancing monsoon currents experiences 5 to 10 spells

of precipitation in 24 hours, occasionally accompanied with thunder.

Reference

- Biswas, B. and Gupta, K., 1989, "Heights of Cb clouds around Calcutta Airport—Diurnal and seasonal variations", *Mausam*, 40, 2, pp. 169-174.

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