

Radar observations of monsoon precipitation

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ABSTRACT. Radar observations of monsoon rain over Poona on the lee-side of the Western Ghats have frequently shown the presence of 'melting bands'. On the windward side on the west coast however, the rain echoes generally appear much below the freezing level. The paper describes an unusual observation of a 'melting band' noticed at Alibag on the west coast of the peninsula during the southwest monsoon.

1. Introduction

Monsoon precipitation along the west coast of India is known for its heavy rainfall, generally accepted to be from 'warm' clouds at temperatures above freezing point. Radar studies of monsoon rain over Poona on the other hand, have very often shown the presence of the melting band during steady rain suggesting the origin of precipitation to be from above the freezing level. Earlier workers (Mani and Venkiteshwaran 1961 a, Gupta, Mani and Venkiteshwaran 1955, 1961) have explained this as an orographic feature arising from the location of Poona on the lee-side of the Western Ghats. The present paper describes a rather unusual observation of the melting band noticed on the west coast at Alibag to the windward side of the mountains during the southwest monsoon.

2. Observations of monsoon rain

The results of radar observations of rain made at Poona since 1953 using a 9.1 cm airborne radar type SCR 717 C have been presented by earlier workers (Mani and Venkiteshwaran 1961 a, 1961 b, Gupta, Mani and Venkiteshwaran 1955, 1961). The echoes observed have been roughly classified as belonging to two types: one, associated with rain cells of comparatively short duration of less than an hour and the other associated with steady rain lasting four or five hours. The two are easily distinguishable in their formation, movement and dissipation—the first generally appearing well below the freezing level moving in from the west over the station and rapidly disappearing to the east. All of them seem to form generally at the same level. The second type observed during steady continuous rain show the presence of "bright band" throughout the period of the precipitation. In all these cases the upper winds at the levels embedding the rain cells were found to be westerly, 30–40 knots. The bright band appeared at a height of about 4.8 km a.s.l.

To study the nature of the monsoon precipitation on either side of the Western Ghats and to make radar observations from a number of places on either side of the mountain ranges, the radar was mounted on a truck with antenna, R. F. unit and modulator, fitted in a separate steel cabinet that could be rolled out on a platform to facilitate scanning. A petrol generator, on a trailer, supplied necessary power. The antenna was mounted so that the sky could be scanned from horizon to horizon through the zenith giving a vertical cross-section about the radar site.

3. Observations at Alibag

Figs. 1 (a) to 1 (d) show a series of conventional monsoon echoes obtained at Alibag on the west coast 100 km west of Poona on the windward side of the mountain on 30 July 1961. The radar antenna was scanning from WSW through zenith to ENE. A complete sequence is shown of a rain cell moving in fairly fast at about 20 km/hr from WSW, coming over the station and crossing to ENE where it dissipated. At 1712 IST the rain cell was first detected at about $2\frac{1}{2}$ miles WSW of the station; the station had no rain till 1717 hrs, when a light drizzle started, becoming heavy at 1722 hrs. It was still raining at the station when the cell crossed and finally dissipated at 1733 hrs. The characteristic is quite similar to the first type often observed at Poona, and associated with rain cells of comparatively short duration and extent.

Figs. 2 (a) to 2 (f) show a very unusual characteristic of the southwest monsoon at Alibag as detected by the radar on 29 July 1961. With the direction of scanning maintained the same, Fig. 2(a) was taken at 1342 IST when it was raining heavily and shows rain echoes mainly to the WSW of station. At 1352 hrs the echoes intensified on either side of the station and a faint 'bright band', at a height of 4.4 km a.s.l. was noticed. It persisted for a few minutes; by 1357 hrs the band had become quite faint and was not easily detectable. The



(a) 1712 IST



(b) 1717 IST



(c) 1726 IST



(d) 1733 IST

Fig. 1. Radar echoes of typical monsoon rain at Alibag on 30 July 1961

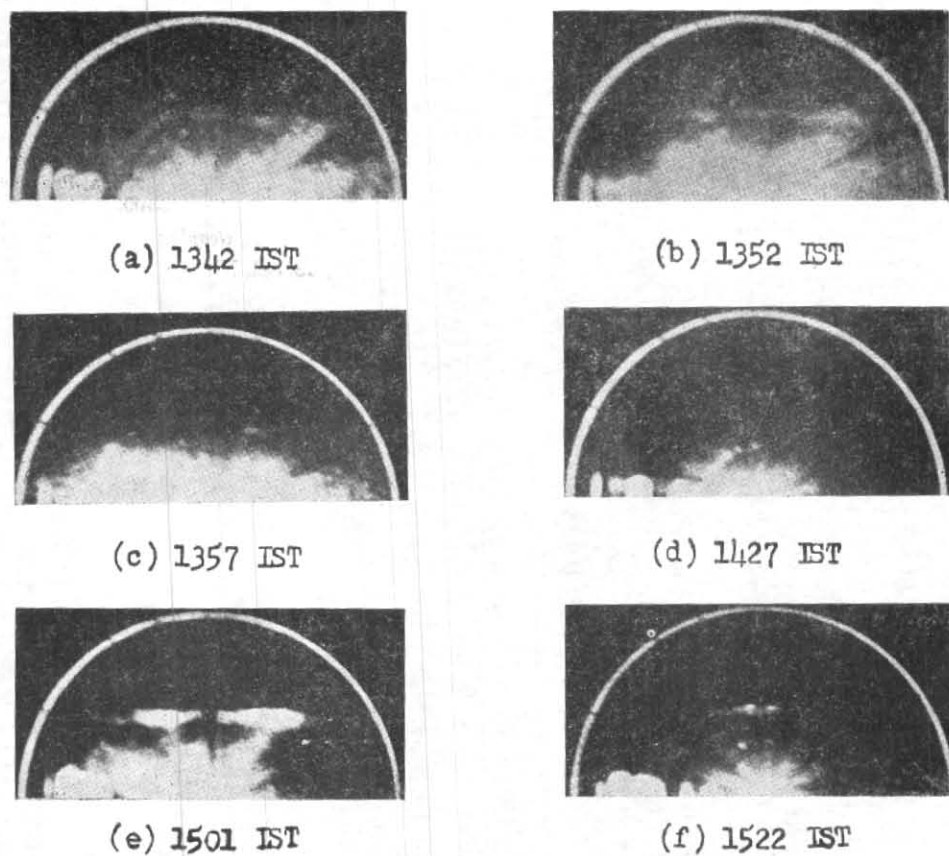


Fig. 2. Melting band in monsoon rain at Alibag on 29 July 1961

(Range marker:—5 nautical miles)

echoes generally dissipated by 1427 hrs. At 1500 hrs the rain was still light to moderate and though there had not been any apparent change in the nature of precipitation, a 'bright band' suddenly appeared at 1501 hrs—Fig. 2 (f). It persisted till 1545 hrs and was not noticed again during the rest of the period of observation at Alibag that day, though a number of rain cells passed over Alibag.

The rainfall on 29 July 1961 from 0830 to 1730

hrs was 62 mm and on 30 July 1961 during the same period was only 6.3 mm. The upper winds at 4.5 km were light westerly, 7 knots.

4. Discussion of results

Pisharoty (1962) has explained the frequent occurrence of the melting band over Poona on the basis of Scorer's lee wave theory. The melting band noticed in monsoon precipitation on the windward side of the mountain presumably occurs when the upper winds are weak and the monsoon circulation less pronounced.

REFERENCES

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