

A NOTE ON THE BEHAVIOUR OF RADIOSONDE BALLOONS DURING RAIN

1. During daily routine radiosonde flights at Poona with the F-type radio-meteorographs, interesting observations were made on two consecutive days (6 and 7 October 1950) while it was raining at the time of the flights. On both these days, the radiosonde balloon was found to go up and down a number of times between two definite levels. A description of the important features of these observations and the reasons for the same are given below.

2. Rain started at Poona on 6 October 1950 at 1715 IST and continued steadily till about midnight. During this time, a total of 0.26 inch of rain fell. On 7 October 1950, rain started at 1600 IST, and a continuous steady fall occurred till 0030 IST. The rainfall charts for the above days are shown in Fig. 1. The intensity of rainfall during the flight on 6 October 1950 was only about 7 cents per hour, while that on the 7th was more than double this rate, *viz.*, 17 cents per hour. One feature of the weather was that there was no thunder or lightning observed on both the days.

3. On 6 October 1950, the radiosonde balloon was released at 1927 IST. Signals were received for the first 20 minutes when

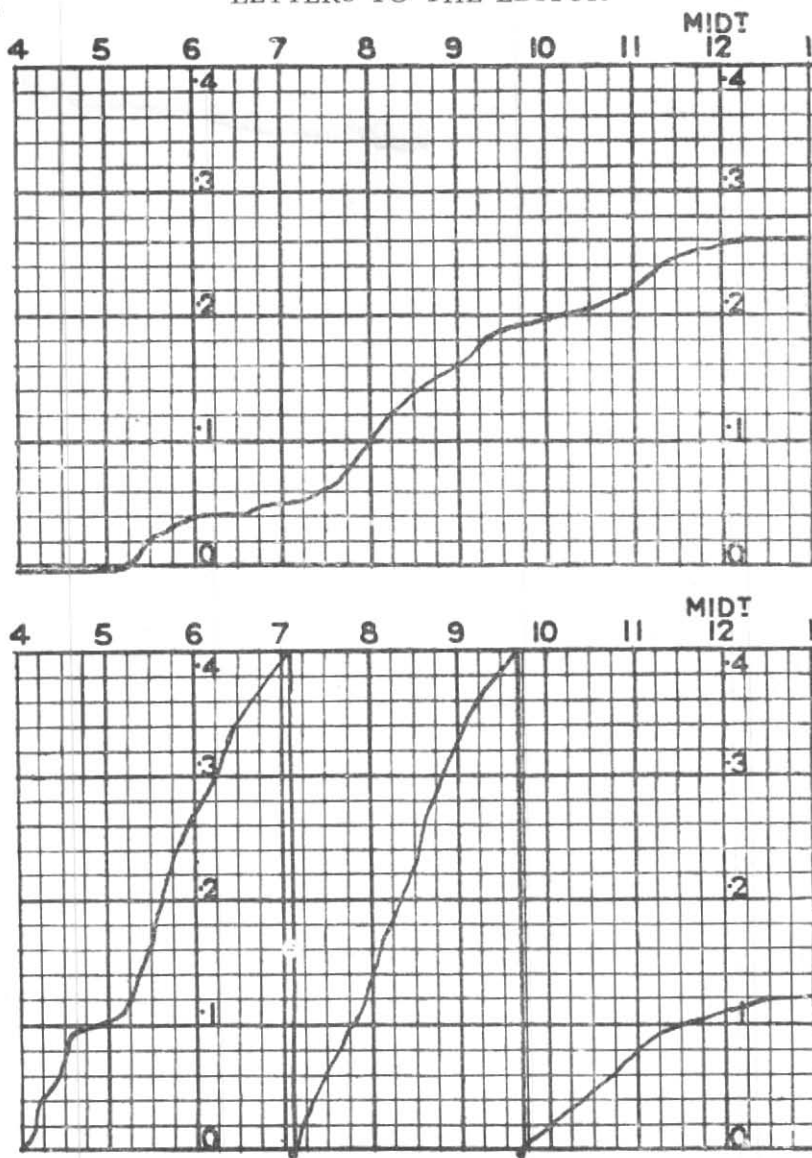


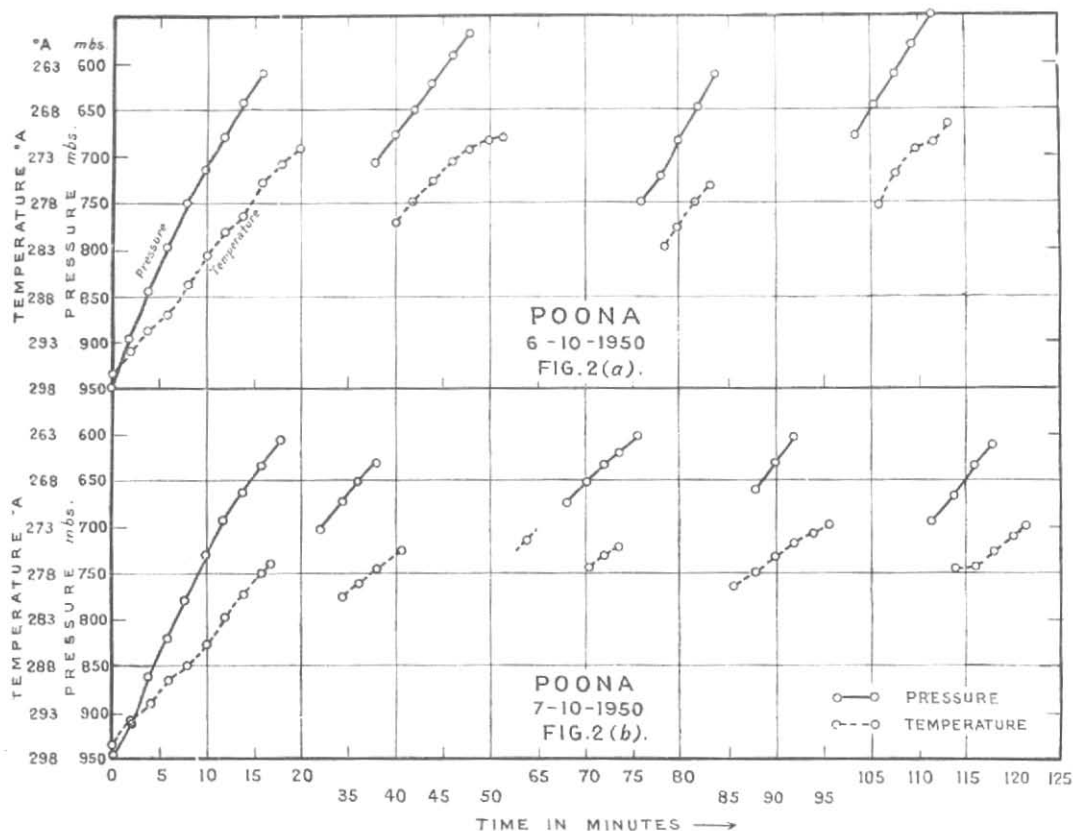
Fig. 1

they stopped; they started again after 17 minutes and continued for about 15 minutes when they again stopped. Altogether three periods of silence were observed on this day.

When the signals were plotted in the usual way, it was observed that the signals stopped in the region between 600 and 550 mb levels where the air temperature was 0°C or a few degrees less. When the signals restarted, the balloon was found to have descended to a lower level and to be in the region between 750 and 700 mb. The

exact times at which the signals stopped and restarted and the corresponding pressures and temperatures are shown in Fig. 2(a). Similar values for the flight on 7 October 1950 are shown in Fig. 2(b).

In the F-type radiosonde, the fan which operates the switching mechanism can rotate only if there is a resultant wind from above; if the meteorograph descends due to the balloon bursting or due to the decrease in the free lift, the fan will cease rotating. The fan will, however, continue to rotate, if the balloon is forced down



due to a strong vertical current*. From the observations of temperature at the time of descent of the balloon and its ascent, it definitely appears that the movement of the balloon in the atmosphere was influenced due to the accumulation of snow or frozen water. The balloon which is thus loaded begins to descend when the net free lift is more than balanced by the weight of the snow collected on the balloon. This descent continues until enough snow melts at the lower level to allow the balloon to ascend again. An approximate value for the lower limit of the amount of snow necessary to start the balloon to descend must be about 1400 gm which was the net free lift of the balloon.

The differences between the two days which are significant are—

(1) The slightly lower level and higher temperatures reached in general on the second day than on the first,

(2) The larger number (six) of ascents

on the second day compared to four on the first in about the same period (114 minutes on the 6th and 121 minutes on 7 October),

(3) The shorter period of descent (on the average 13 minutes per descent) on the second day compared to the corresponding period (16½ minutes) on the first day.

These features can be understood if we remember that the rain was more intense on the second day compared to the first. As a result of this, accumulation of unmelted snow started even at a lower level than on the previous day. The levels at which the balloon started ascending after the melting of the snow was almost the same on both the days; the small variations observed in this level must have been due to the variations in the amount of snow collected on the balloon.

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*An instance when an ascent was made during a thunderstorm and the balloon was forced down due to both vertical downward currents and due to the decrease in free lift on account of accumulation of snow, has been described in detail in a note under publication by S.P. Venkiteswaran and A.R.B. Tilakan