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Multicellular thundercloud and interesting surface weather phenomena at Meenambakkam airfield on 15 July 1965

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ABSTRACT . A good example of the multicellular nature of a thundercloud as revealed by the interesting surface weather features over Meenambakkam airfield on 15 July 1965 is presented in this paper.

1. Introduction

According to Byers and Braham, a thunderstorm was usually multicellular consisting of a group of cells or units of convective circulation having similar properties and characteristics and capable of analysis as a class of convection phenomena. The detailed observations during the Thunderstorm Project (Byers and Braham 1949) permitted also the identification and study of those individual cells or units. The surface weather phenomena, *namely*, precipitation, high gusty winds, temperature — relative humidity discontinuity etc, which were features of the individual cell, were found to repeat themselves with a definite distinct minimum of weather elements marking the zone between the successive cells.

The above facts were well illustrated in the study of the surface weather features that prevailed over Meenambakkam airfield in the evening on 15 July 1965.

2. Surface wind fluctuations

The rapid fluctuations in the surface wind speed during the period 1612 to 1735 hours (Fig. 1) reflected the complex structure of the thundercloud, the downdrafts of which manifested themselves by four periods of high gusty winds.

Four downdrafts in quick succession with three squalls in about an hour were rather unusual phenomena. During the period of 17 years from 1949 to date there were only two earlier occasions in which three squalls were recorded at Meenambakkam in one day, the first in May 1952 and the second in August 1954, each occurring within a period of four hours.

3. Temperature — Relative Humidity variations

The variations in the surface temperature and relative humidity (Fig. 2) showing four well defined stages corresponding to the four gusty periods corroborated the passage of four downdrafts. The temperature fall from 35·0 to 24·6° C in well marked steps separated by short periods of steady or slight rise in temperature and the relative humidity increase from 36 to 84·5 per cent faithfully responding to the temperature variations were very interesting records. It was found by Byers and Braham that sharp and well defined temperature — relative humidity discontinuity occurred at stations near the core of a thunderstorm cell.

4. Rainfall pattern

During the above period rainfall also occurred in four separate spells in association with the passage of each downdraft (Fig. 3). Very little rainfall in the first two spells may be explained as being due to rapid evaporation of rain drops while falling through environment whose relative humidity had increased to only 65 per cent. Last two spells recorded 0·7 mm of rain. Byers and Braham had stated that short periods of little rainfall amounts were indications that the station was not in the path of the centre of the cell but was to the rear or lateral edge with respect to each passing cell.

5. Pressure rise

The barograph trace (Fig. 4) during that period showed steady pressure till 1630 hours and later pressure rose sharply by 2·7 mb in three stages till 1730 hours after which the fall was gradual, the return settling period lasting till about 2000 hours. Byers and Braham had found the trace of the pressure dome to occur at stations beneath the radar echo of a thundercloud, not far away from the cell centre.

Details of the surface weather features associated with the four downdrafts could also be seen in Table 1.

6. Radarscope observations

At 1630 hours the nearest radar echo (Fig. 5) was observed in the northern sector covering a radial distance of about 3 to 8 miles from the station. The first gust heralding a period of gusty winds and

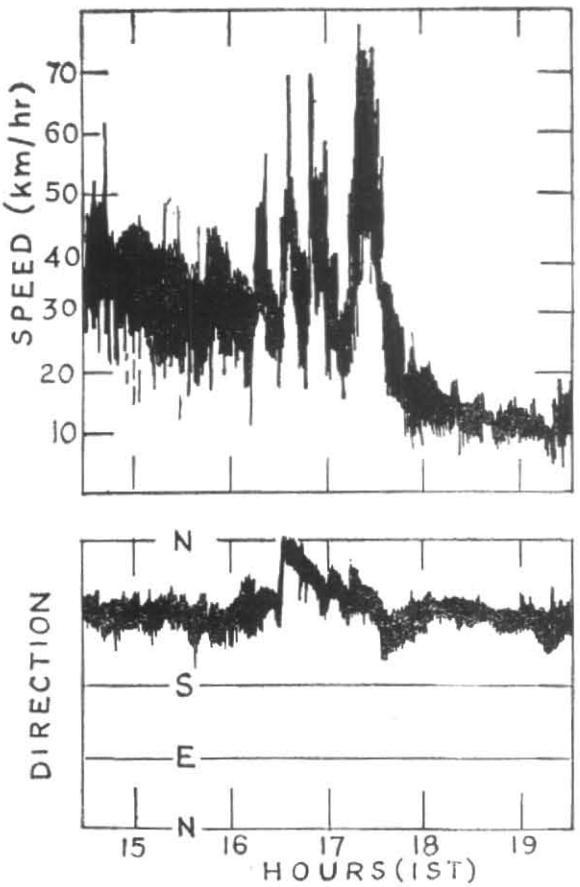

Fig. 1. A portion of the record of wind direction and speed at Meenambakkam airfield on 15 July 1965

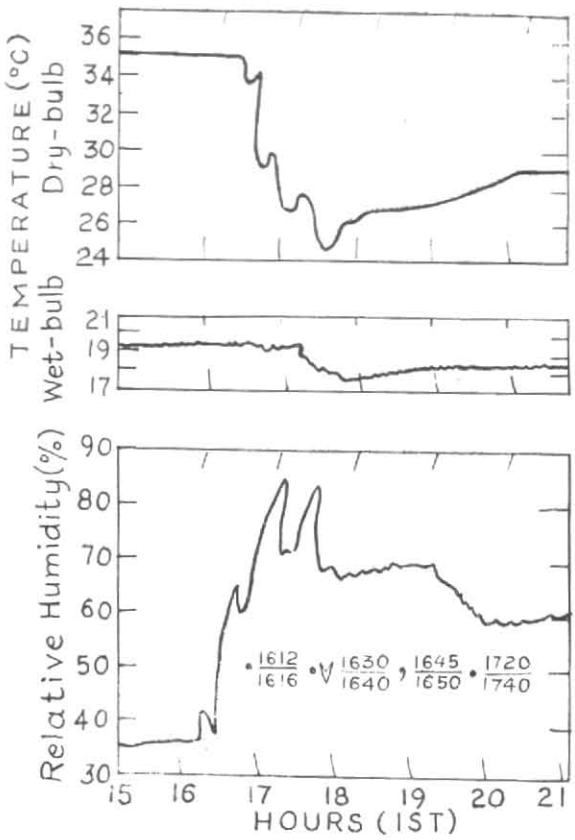

Fig. 2. A section of the thermograph and hygrograph record at Meenambakkam Observatory on 15 July 1965. These traces show the sharp temperature fall and the increase in relative humidity in four well defined stages

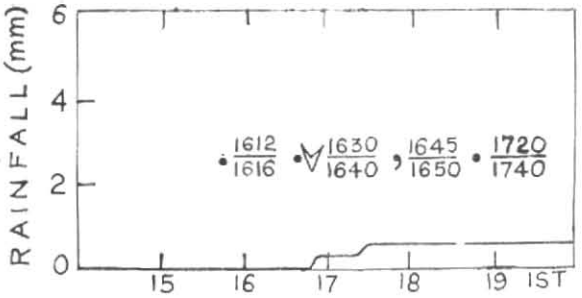

Fig. 3. A portion of the hyetograph at Meenambakkam airfield on 15 July 1965

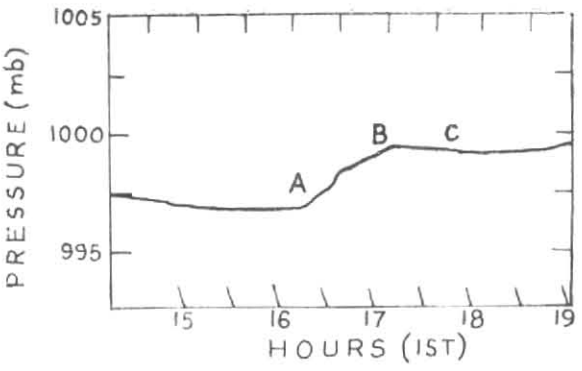

Fig 4. A portion of the microbarograph record at Meenambakkam airfield on 15 July 1965. Points A,B,C delineate the pressure dome, and BC represent the beginning of the 'return settling' period

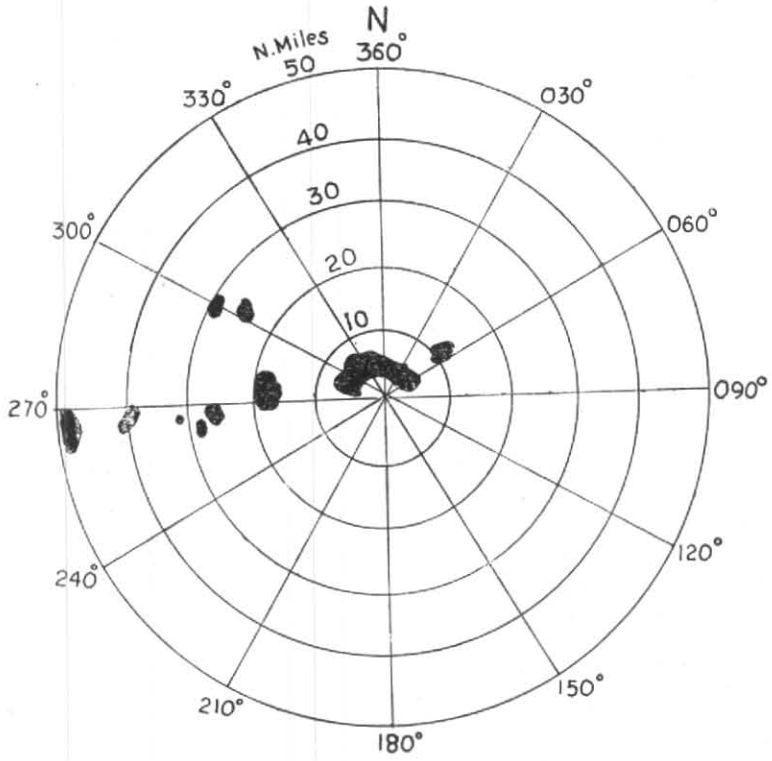

Fig. 5. A schematic drawing of PPI' scope showing the actual radar echoes at 1630 IST on 15 July 1965 at Meenambakkam airfield

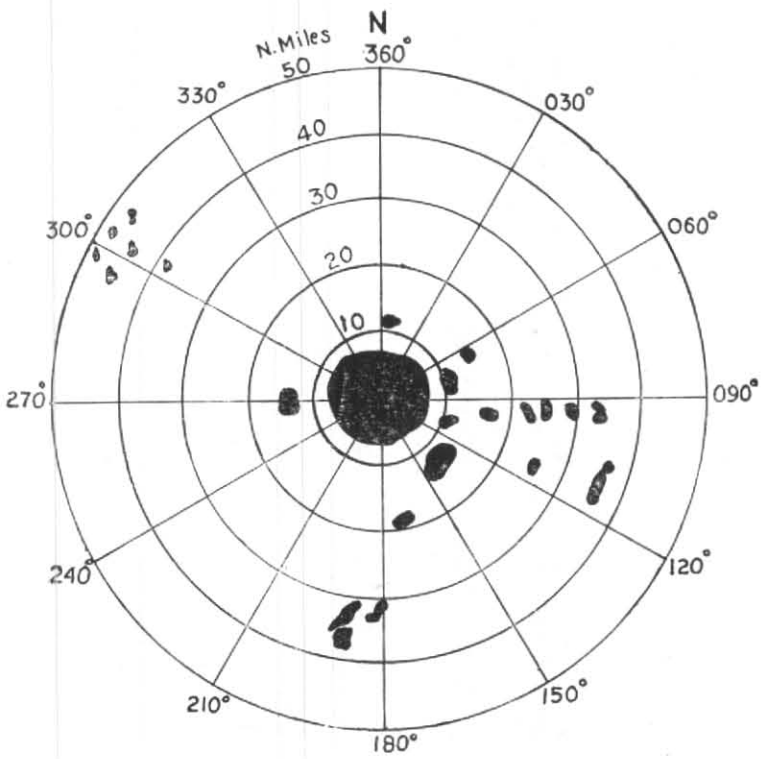

Fig. 6. A schematic drawing of PPI' scope showing the actual radar echoes at 1730 IST on 15 July 1965 at Meenambakkam airfield

TABLE 1

Downdraft	Time (IST) From	Time (IST) To	Peak gusts (kmph)	Temp. drop (°C)	Relative humidity increase (%)	Pressure rise (mb)	Rainfall (mm)
First	1612	1630	57	1·2	5·6	Nil	Little
Second	1630	1647	74	5·2	26·7	0·7	Little
Third	1647	1708	70,59	2·8	24·5	1·0	0·4
Fourth	1708	1735	79,75,74	2·8	12·5	1·0	0·3

the arrival of colder air could be associated with a cell of that thundercloud. At 1730 hours a radar echo (Fig. 6) was over the station covering an area of about 7 miles radius around it. It was assumed that the thundercloud observed near the station at 1630 hours had moved over it by that time. During that period three squalls passed over the station in quick succession. They were evidently the cold downdrafts from three separate cells. The sudden drop in wind speed between 1732 and 1735 hours marking the cessation of squally period was a characteristic feature of the passage of the rear of a cell. There was no echo over the station at 1830 hours.

7. Conclusion

It was concluded that four cold downdrafts of four individual cells of a multicellular cloud passed over the station between 1612 and 1735 hours, resulting in the repetition of the surface weather features with distinct minimum of weather elements between successive cells.

REFERENCE

Byers, H. R. and Braham, R. R. 1949 The Thunderstorm, pp. 17-77.