551.557.2 : 551.578.7

COMPUTATION OF CONVERGENCE IN A HAILSTORM SITUATION

In recent years various workers[1—6] have tried to measure horizontal velocity convergence at different levels of the atmosphere. With a view to study the nature of convergence in various synoptic situations in India, the author calculated convergence patterns in a number of cases including a western disturbance and a tropical storm. The results of comparison between the calculated convergence and the weather experienced have been encouraging. An interesting situation is presented below ; a fuller account of this study will be discussed in a subsequent paper.

A shallow 'low' had appeared over Saurashtra on the evening of 23 November 1947. It weakened into a trough of low pressure with discontinuity line on the surface running from Bhavnagar to Neemuch at 0800 I.S.T. on the 24th. It remained practically stationary till 0800 I.S.T. of the next day. In the upper air, southerlies or southeasterlies prevailed over south Gujarat since the morning of the 20th upto 7000 ft. These winds had brought in a good amount of moisture.

Cumulonimbus clouds were visible from Ahmedabad Airfield at 1600 I.S.T. of the 24th with distant precipitation in sight. Clouds grew and at about 2300 I.S.T. Ahmedabad experienced a severe thunderstorm which lasted for six hours with almost non-stop thunder and lightning, accompanied by rain and hail. By 0800 I.S.T. on the 25th, it was seen that only Ahmedabad had recorded 3 inches of rain and other neighbouring observatories did not report any precipitation except Bhavnagar which experienced slight drizzle in the night with an insignificant amount of precipitation and Brijnagar which experienced a dry thunderstorm at 1800 I.S.T. of the previous day.

With a view to see how far the method of calculation of convergence from u, v isopleths can account for such a localised phenomenon, divergence charts for levels 3000, 5000, 10,000 and 15,000 ft. above sea level were prepared. The wind reported by each station at 1600 I.S.T. on the 24th November 1947 was resolved into its components u

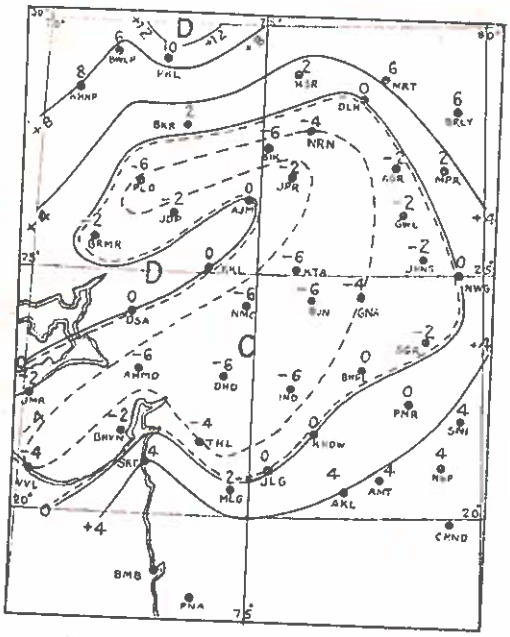

Fig. 1. Divergence at 3000 ft.
(1 Unit = 10^{-5} Sec $^{-1}$)

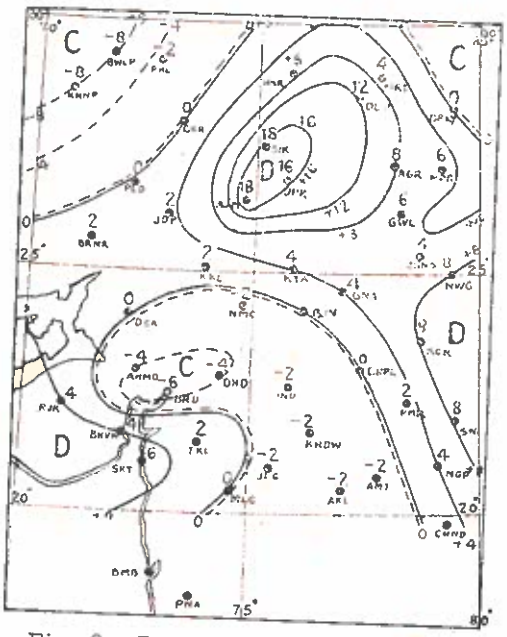

Fig. 3. Divergence at 10,000 ft.
(1 Unit=10^{-5} Sec $^{-1}$)

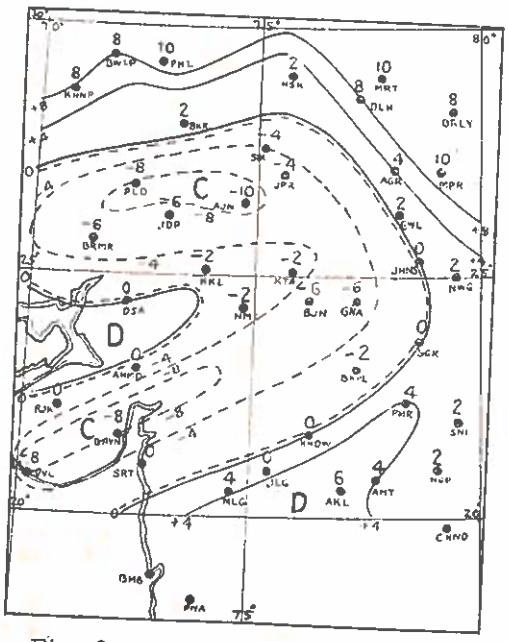

Fig. 2. Divergence at 5000 ft.
(1 Unit= 10^{-5} Sec $^{-1}$)

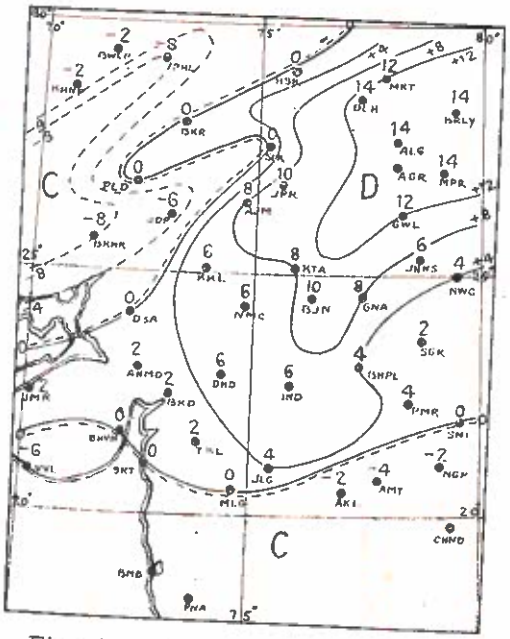

Fig. 4. Divergence at 15,000 ft.
(1 Unit=10^{-5}Sec $^{-1}$)

and v (u is measured from west to east and v from south to north) and isopleths of u, v were drawn at an interval of 2 knots on $1:10^7$ scale I. Met. D. charts. Distances δx and δy between two successive isopleths were measured in millimetres. $\frac{\delta u}{\delta x}$ was calculated for several points and also $\frac{\delta v}{\delta y}$ for the same points. The algebraic sum $\frac{\delta u}{\delta x} + \frac{\delta v}{\delta y}$ gives the divergence at a point. Charts prepared from data as published in the Indian Daily Weather Reports are given in Figs. 1 to 4.

It will be seen from the divergence charts that at 3000 and 5000 ft. levels, there are two areas of maximum convergence, one roughly along the line from Veraval to Brijnagar (let us call it area A) and the other from Phalodi to Sikar (say area B). At 10,000 ft. B has lost its convergence and can be said to be an area of non-divergence near Phalodi but of strong divergence near the other end. Area A still maintains maximum convergence near Ahmedabad-Baroda-Dohad but has developed some divergence near Kotah. Picture at 15,000 ft. reveals divergence over area A, weak near Baroda and strong near Kotah. B is practically an area of non-divergence at Sikar and convergence at the Phalodi end. This picture of the convergence area concentrating about Ahmedabad agrees with the nature of the weather near Ahmedabad. The Phalodi-Sikar sector, however, was free from any weather. This can be attributed to the dry continental nature of airmass over Phalodi whereas in Ahmedabad area there was plenty of moisture fed by southerly winds.

It may be mentioned here that the divergence patterns obtained in the vicinity of high ground are vitiated by peaks extending above the level of the charts and thus causing a break in the continuity of flow. But since the conclusions drawn pertain to an area of flat country around Ahmedabad, this factor will not be of much importance.

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