

LETTERS

551.576.11 : 551.577.37

CLOUD BURST DURING SOUTH WEST MONSOON SEASON AT TIRUCHIRAPALLI, TAMIL NADU

1. Cloud bursts are devastating weather phenomena representing highly concentrated rainfall over a small area lasting for a short time. They lead to flash floods / landslides, house collapses, dislocation of traffic and human casualties. Though the exact mechanism of these systems is not yet perfectly understood, research bibliography suggests that they are manifestations of intense vortices on small scale (Das, 1988).

Cloud bursts are common in the hilly areas and causes severe damage. Bhan *et al.* (2004) have studied the cloud burst events in Himachal Pradesh (H.P.) occurred during southwest (SW) monsoon season. Rauf (1978) highlighted the cloud burst event on 10 June 1976 at Chittagong, Bangla Desh occurred at the onset of SW monsoon due to the formation of a micro low at the tip of the monsoon trough. Puniah *et al.* (1974) described heavy rainfall over Kolkata during the cloud burst on 29 July 1971. Kulandaivelu (1996) also described impact of cloud burst on downstream areas leading to land slides.

2. Cloud burst events also occurred at many places in Tamil Nadu during northeast (NE) monsoon season and at Nilgiri hill areas during SW monsoon season leading to the land slides and disruption of the vehicular traffic. Tiruchirapalli, being the interior district of Tamil Nadu and located in rain shadow region records some times heavy rainfall of the order of 8 – 10 cm in 24 hrs during break monsoon period when the monsoon trough lies in the foot hills of Himalayas. On 20th July 2008, Tiruchirapalli city and airport experienced unusual very heavy rainfall. The highest intensity of rainfall occurred in one hour/60 mts duration was very significant and more than 120 mm rainfall recorded at the air port and more than 150 mm reported at the Tiruchirapalli town observatory in an hour. The event has been analysed using synoptic observations, METAR/SPECI, Dines Pressure Tube (DPT) Anemograph records. Self Recording Rain Gauge (SRRG) chart and Pilot Balloon Observations (PBO) of Tiruchirapalli airport, the DWR products from Chennai and analysed weather charts from ACWC Chennai are used.

3. During SW Monsoon period (June - September) and pre-monsoon months of April & May, the

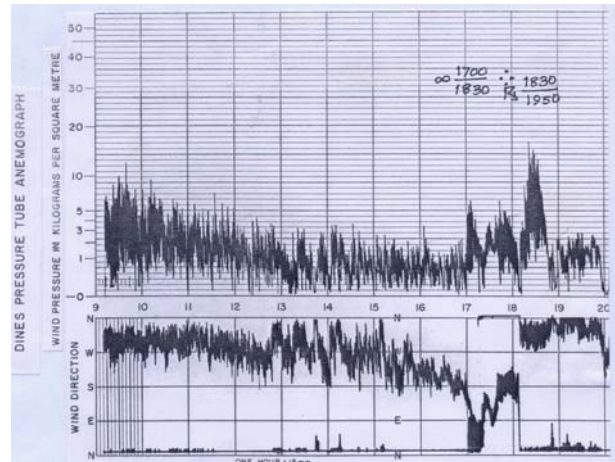


Fig. 1. DPT (Dines Pressure Tube) Anemograph showing the variations of wind before and during cloud burst at Tiruchirapalli airport on 20 July 2008

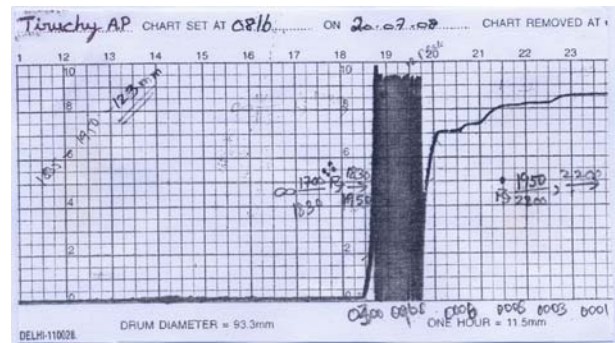


Fig. 2. Hyetograph showing the very heavy rainfall during cloud burst event at Tiruchirapalli airport on 20 July 2008

highest intensity of rainfall in one hour / 60 mts recorded at Tiruchirapalli airport since 1980 has been analysed from the Hyetograph of the station. Before 20 July 2008, the highest intensity of 92.5 mm rainfall in one hour has been recorded between 21.20 and 22.20 hrs (IST) on 06 September 1988 (the total rainfall was 98.7 mm at airport and 103.4 mm at Tiruchirapalli Town in 24 hrs). On 20 July 2008, this record has broken as it recorded very high intensity of 120.0 mm rainfall in 60 mts between 1845 and 1945 hrs (IST) at Tiruchirapalli airport (Rainfall of 135.0 mm at airport and 161.2 mm at Tiruchirapalli Town reported in 24 hrs ending 0830 (IST) on 21 July 2008. Another high intensity event (90.0 mm in 60 mts) has also been recorded between 1945 and 2045 hrs (IST) on 26 August 2008.

DWR CHENNAI IMAGES (PPI-Z) ON 20TH JULY, 2008

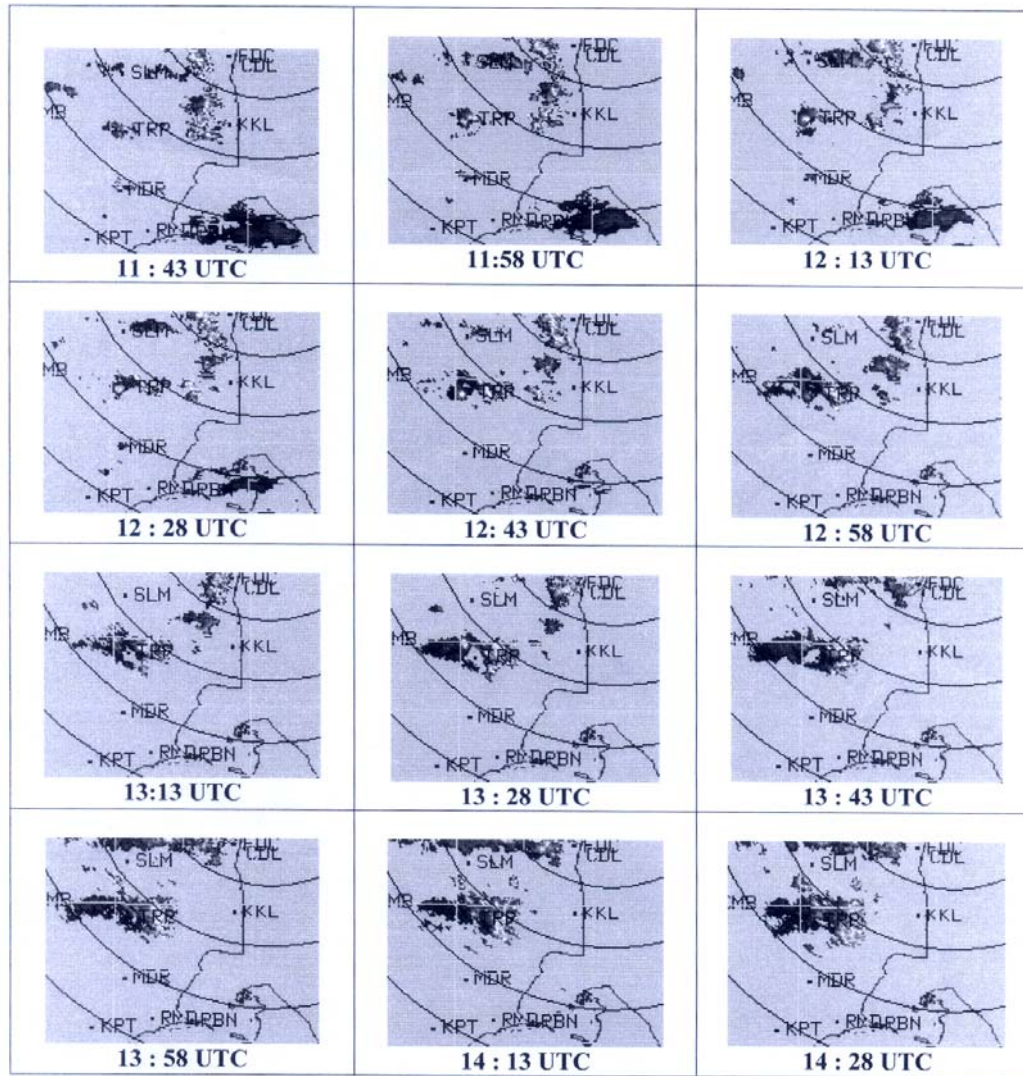


Fig. 3. Radar (DWR Chennai) images showing genesis, development, movement and decay of thunder clouds over Tiruchirapalli (TRP) and its neighbourhood on 20 July 2008

4. While analyzing DPT anemograph (Fig. 1), the strong surface wind varying between 10 and 16 kts from west-northwest (WNW) direction prevailed in the morning which is normal wind during southwest monsoon season at Tiruchirapalli. The medium clouds in the morning slowly dissipated and sky became clear from 0900 hours (IST). Scattered cumulus (Cu) clouds developed after 1100 hrs (IST). The wind remained nearly steady from southwest (SW) direction with speed of 05 knots. At 1700 hrs, the wind suddenly backed to northeast

(NE) with increasing average wind speed from 5 kts to 10 kts and gusting to 17 knots. The sky became mainly cloudy with dark low clouds of Sc, Cu and few octa of Cb (Cumulonimbus) at 1700 hrs (IST). The wind changed its direction from northeasterly to southeasterly from 1740 hrs (IST) onwards. At 1810 hrs (IST), the direction suddenly changed to northwesterly from southerly. This shows a sudden downdraft from the Cb cell in NW direction from airport. At 1830 hrs (IST), thundershower has been reported in Tiruchirapalli airport as well as

Tiruchirapalli town which is about 4 km in north-northwest (NNW) direction from the airport. The surface wind from NW'ly direction was of the order of 20 kts with gusts exceeding 30 kts. At 1845 hrs (IST) the strength of the wind weakened to 5 – 8 kts from north to north-northwest direction.

We can compare the DPT anemograph of Fig. 1 with hyetograph chart shown in Fig. 2. Even though the rainfall recorder shows the precipitation since 1830 hrs the very heavy rainfall only occurred 15 minutes after the commencement of Thunder storm (TS). Very heavy downpour occurred for one hour only between 1845 and 1945 hrs (IST). During this one hour, the city observatory at Tiruchirapalli Corporation office Compound recorded the highest rainfall of 161 mm while the airport received rainfall of 135 mm. Practically the rainfall ceased at 1950 hrs and only very light rain/drizzle with TS continued till mid-night on 20 July 2008. Due to this sudden heavy downpour, the Tiruchirapalli city roads were flooded. The public were stranded between 1830 and 2000 hrs (IST) in the city. The traffic in the city was heavily affected. The railway under bridge (sub-way) near Palakkarai railway station was filled with rain water and a city bus was also submerged while crossing that sub-way.

5. After perusal of upper air chart of 0000 UTC on 20 July 2008, one could see an anticyclone over northern parts of Tamil Nadu and neighbourhood right from 2.1 km above mean sea level (a.m.s.l.) pumping the moisture from Bay of Bengal towards Tiruchirapalli. In the lower tropospheric level upto 0.9 km a.m.s.l. a trough in the westerlies could be seen over extreme south peninsula. On perusal of 0300 UTC surface chart one could see a trough on the sea level extending from Vidarbha to Gulf of Mannar across coastal Tamil Nadu. Tiruchirapalli reported WNW'ly 12 kts and Cuddalore & Chennai were SW'ly clearly showing the trough could be passing closure to Tiruchirapalli.

6. Radar observations of CDR Karaikal and DWR Chennai have been considered for analyzing the development and movement of clouds over Tiruchirapalli and neighbourhood on 20 July 2008. CDR Karaikal (KKL), about 150 km east of Tiruchirapalli did not report any significant cloud echo at 0900 UTC observation on 20 July 2008 and there was no 1200 UTC observation reported/taken. Hence, DWR Chennai data which is more than 300 km away from Tiruchirapalli was the only alternative to analyze the thunderstorm development at Tiruchirapalli and its neighbourhood. Fig. 3 shows the DWR product (PPI-Z) from 1143 UTC onwards upto 1428 UTC observation in series on 20 July 2008. The vertical type of clouds like Cu and Cb were seen initially at 1143 UTC towards west of Tiruchirapalli. It developed

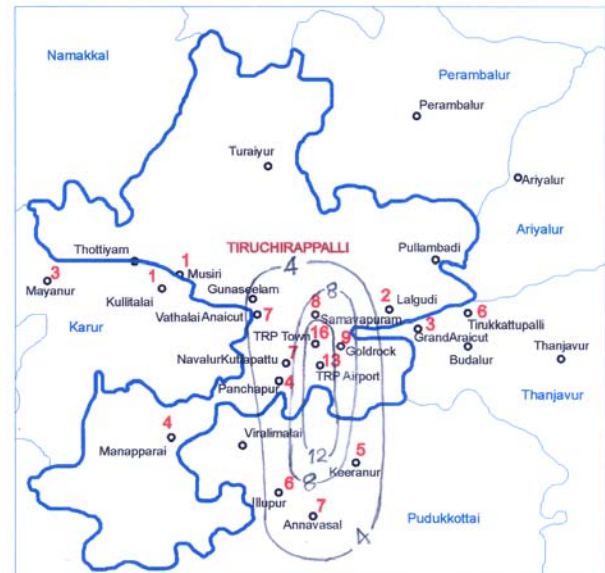


Fig. 4. Isohyetal chart shows 24 hour rainfall (cm) over various places around the radius of 20-25 km from Tiruchirapalli town on 21st July 2008

further as large two strong Cb cells in northern side and one more strong Cb cell in the western side very close to Tiruchirapalli town. These echoes were seen in the successive observations of DWR images also till 1428 UTC. A line of strong Cb cells could be seen in NW to SE direction across Tiruchirapalli Town in 1228 UTC and 1243 UTC images. The approximate height of Cb clouds would be between 12-15 kms.

7. Fig. 4 shows isohyetal chart for the 24 hours rainfall ending of 0830 hrs (IST) on 21 July 2008 in many important places in Tiruchirapalli district and nearby district with in 20-25 km radius from Tiruchirapalli town. The rainfall map shows the centre of the heavy rainfall is north of airport and south of Rock Fort hill. The strong convective activity in NNW of airport caused more very heavy rainfall in the city than the airport. Heavy rainfall also occurred within the radius of 10 km from the centre of the Tiruchirapalli city (The cyclonic circulation in the lower atmosphere over Tiruchirapalli and neighborhood with intense insulation caused the development of larger thunderstorm cells over a small area).

8. The authors thank to unknown referee for his valuable comments and suggestion to improve this letter.

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E. KULANDAIVELU
M. SOUNDARARAJ*
M. V. GUHAN

Regional Meteorological Centre, Chennai-6.
**Meteorological Office, Airport, Tiruchirapalli.*
(Received 5 November 2008, Modified 4 August 2010)
e mail : metmds@snl.com
