Letters To The Editor

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HEAVY RAINFALL OVER DELHI DURING 20–21 JULY 1958 AND THE ASSOCIATED VERTICAL CURRENTS

Delhi had a deluge by way of a very heavy downpour of rain during 20-21 July 1958.* Many houses, kharif crops and public properties were destroyed and 8 human lives lost due to this rainfall. Communications and public utility services also became disrupted for many days. In the low lying areas over the city, many high ways were water-logged and the level of the water went upto 30 ft near Minto Road Bridge, which was very nearly submerged under water.

In this note an attempt has been made to examine the meteorological situation under which this heavy downpour occurred over Delhi. The vertical currents associated with the heavy rainfall on 21 July 1958 have also been estimated.

On the 1730 IST surface isobaric chart of 19 July 1958 an elongated low pressure area appeared over east Uttar Pradesh and the adjoining areas of north Madhya Pradesh and Bihar. This low pressure area was associated with an upper air cyclonic circulation over Uttar Pradesh and the neighbouring areas of the plains of Punjab upto 3·0 km a.s.l. On this day, thundershowers occurred over Delhi in the afternoon and the rainfall recorded at Delhi (Safdarjung) was 3·3 cm during 24 hours ending 0830 IST of 20 July.

The 0830 IST surface isobaric chart of 20 July 1958 showed that the low pressure area on the 19th had concentrated over west Uttar Pradesh and neighbourhood, but the associated upper air circulation was not as well marked as on 19 July. Another low pressure area also developed over West Pakistan on this day.

At 1730 IST of 20th, the low pressure area over west Uttar Pradesh and neighbourhood further concentrated into a very small low pressure area lying about 150 miles southsoutheast of Delhi, and the corresponding pressure change (—2 mb) was associated with a small concentrated upper air cyclonic circulation just over Delhi and neighbourhood upto 4·5 km a.s.l.

On this day, continuous light to heavy rain took place throughout the day and night. The rainfall recorded at Delhi was 26·6 cm during the 24 hours ending 0830 IST of 21 July.

The 0830 IST surface isobaric chart of 21 July showed that the low over west Uttar Pradesh and neighbourhood on the 20th had moved away northwestwards, and lay over the plains of the Punjab and neighbourhood. The corresponding pressure change (—2 mb) was also slightly more diffuse than on the 20th. This was associated with an upper air low over the plains of the Punjab and neighbourhood upto 3·0 km a.s.l.

Continuous moderate to heavy rain fell from 0230 to 0630 IST of 21 July. The S.R. raingauge record is reproduced in Fig. 1. The intensity of the rainfall was 2·8″ to 3·3″ (7·1 to 8·4 cm) per hour during this period (Fig. 2). The raingauge in the observatory at Lodi Road, New Delhi recorded 26·6 cm (10·48″) of rainfall during the 24 hours ending 0830 IST on this day. The rainfall at the following neighbouring stations during the 24 hours ending 0830 IST of this date is given below—

Delhi University	22·5 cm (9·0″)
Palam Airport	10·4 cm (4·1″)
Okhla	23·1 cm (9·1″)
Pusa Institute	20·5 cm (8·1″)

*A note on the subject has been published in Vol. 9 No. 4, p. 386

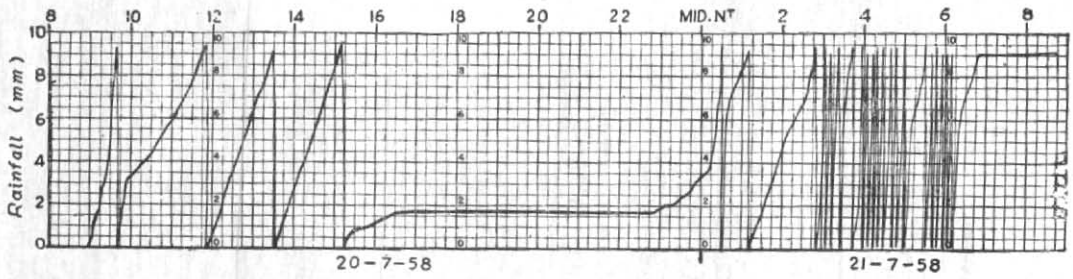

Fig. 1

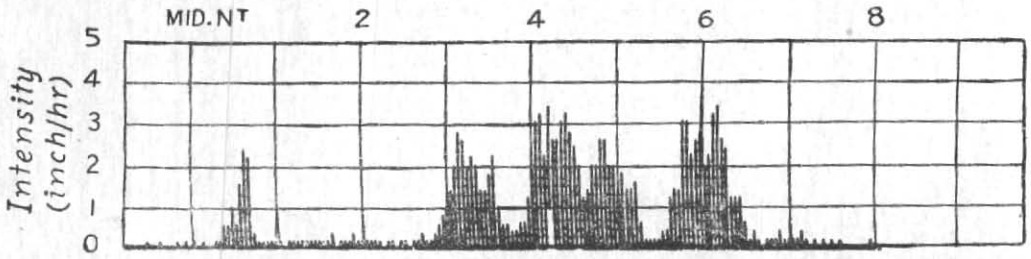

Fig. 2

It may be assumed that the above heavy downpour over Delhi in the early morning hours on 21 July was due to the following factors—

(*a*) The low pressure area over the plains of the Punjab and neighbourhood concentrated over a very small area near Delhi. The associated upper air cyclonic circulation was also concentrated over Delhi and neighbourhood upto 4·5 km a.s.l.

(*b*) The low pressure area over West Pakistan helped to bring a considerably moist current over Delhi from the Arabian Sea. Possibly Delhi lay in a marked convergence zone during the period between 20 and 21 July.

It is difficult to state with accuracy what area round Delhi was affected by this heavy rainfall in the early morning hours of 21 July while Safdarjung and Lodi Road recorded the heaviest fall between 0230 to 0630 IST of 21 July, Palam at a distance of only 3-4 miles from Safdarjung recorded only 10 cm (4 inches) of rain during the same period. This phenomenon could only be explained by the fact that the exceptional heavy rainfall over some parts of Delhi was in no small measure due to individual cloud-bursts. While rapid variation of rainfall over comparatively small distances is not unknown, the unusually steep gradient of isohyets in this case was a feature of great interest.

Intensity of precipitation during heavy rain and the associated vertical currents—It is known (Sil 1950) that a saturated vertical column of 100 dynamic metres thickness, ascending with a velocity of v_z m. sec^{-1} would give the following rate of precipitation—

$$P_{100} = 3{\cdot}6 \times 10^9 \times \left[\frac{1 + C_p \dfrac{dT}{dQ}}{\alpha L}\right] v_z$$

where, C_p is the specific heat of moist air, L is the latent heat of condensation, α is the specific volume of saturated air and Q is the dynamic height.

TABLE 1

	Vertical currents (m. sec^{-1})	
	Mean	Maximum
1st spell	1·3	2·4
2nd spell	2·2	3·4
3rd spell	2·4	3·4

The precipitation from the entire vertical column may thus be expressed in the following simple form—

$$P = \Sigma r v_z$$

where, $r = 3{\cdot}6 \times 10^9 \times \dfrac{1 + C_p \dfrac{dT}{dQ}}{\alpha L}$

for each layer of 100 dynamic metres thickness. Thus it is seen that P is a function of v_z.

From the radiosonde ascent at 1730 IST on 20 July which was the latest ascent available before the heavy downpour in the early morning of 21 July the values of r were obtained. The values of P could be obtained from the rainfall intensity record (Fig. 2), the values of v_z could be subsequently computed as has been done by Sil (1950).

It is found that the heavy downpour in the early morning of 21 July consists of two showers. The first shower gives mean vertical current as 1·2 m. sec^{-1} and maximum vertical current as 2·4 m. sec^{-1}. The second shower consists of three spells which give mean and maximum vertical currents as shown in Table 1.

The high vertical currents of 3·4 m. sec^{-1} and the corresponding intensity of 8·9 cm hr^{-1} (3·5″ hr^{-1}) and the fact that the rainfall recorded was in fairly well-defined spells, lend support to the belief that the rainfall was mainly convective—from individual cloud bursts—from clouds with large moisture content and vertical currents.

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REFERENCES

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