

Unusually heavy rain in parts of northwest India on 30 June 1981

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(Received 2 February 1982)

सार — इस लेख में नई दिल्ली, हरियाणा के कुछ भागों तथा पश्चिमी उत्तर प्रदेश के मैदानों में 30 जून 1981 को हुई असाधारण भारी वर्षा का अध्ययन किया गया है। 30 जून 1981 की सुबह 08.30 बजे समाप्त होने वाले 24 घण्टों में रोहतक, आगरा तथा नई दिल्ली (पालम) में अलग-अलग 30, 26 तथा 22 सें.मी. वर्षा रिकार्ड की गई। नई दिल्ली, पटियाला, ग्वालियर, जोधपुर तथा लखनऊ में लिये रेडियोसोन्डे आरोहणों के विश्लेषणों से पता चलता है कि इस भारी वर्षा का कारण इन क्षेत्रों तथा इनके आस-पास के क्षेत्रों में उपलब्ध प्रचुर नमी के साथ संबंध है। ऊर्ध्वधर गति के लिये निम्नस्तरीय अभिसरणों द्वारा ट्रिगर प्रदान किया गया। यह अभिसरण मौसमी द्रोणी से जो भली-भांति अंकित किया गया था और जिसका अक्ष समुद्रतलीय चार्ट पर 29 जून को अमृतसर, दिल्ली, लखनऊ तथा गया पर से गुजरा, से संबंध था।

ABSTRACT. The unusually heavy rain which occurred in New Delhi and parts of Haryana and of the plains of west Uttar Pradesh on 30 June 1981 has been studied in this paper. Rohtak, Agra and New Delhi (Palam) recorded 30, 26 and 22 cm of rain respectively during the 24 hours ending at 0830 I.S.T. on 30 June 1981. New Delhi (Safdarjung) recorded 19 cm. The heavy rainfall has been associated with availability of moisture in abundance over and near these areas as deduced from the analysis of radiosonde ascents taken at New Delhi, Patiala, Gwalior, Jodhpur and Lucknow. The trigger for the vertical motion was provided by the low level convergence associated with the seasonal trough which was well-marked and whose axis on sea level chart passed through Amritsar, Delhi, Lucknow and Gaya on 29 June.

1. Introduction

A depression formed in the north Bay of Bengal in the morning of 20 June 1981 with centre at about 200 km to the southsoutheast of Calcutta. Intensifying into a deep depression in the same evening and moving northwestwards it crossed West Bengal coast in the morning of 21st. Later moving westnorthwestwards through north Orissa-Bihar plateau and east Madhya Pradesh as a deep depression it lay in the morning of 24th as a depression near Jabalpur. Weakening further into a well-marked low it lay on 25th over northwest Madhya Pradesh and adjoining areas of southwest Uttar Pradesh and east Rajasthan and persisted there also on 26th. It weakened and merged with the seasonal trough on 27th when southwest monsoon in its northward progress covered Gujarat, east Rajasthan, Haryana and eastern parts of Himachal Pradesh.

On 28th a western disturbance appeared over east Afghanistan and adjoining north Pakistan which moving eastwards lay over north Pakistan and ad-

joining Jammu & Kashmir on 30th. Under its influence the seasonal low became well marked favouring the advance of southwest monsoon into Punjab, rest of Himachal Pradesh and Jammu & Kashmir on 30th.

The significant amounts of rainfall recorded on 30 June 1981 in parts of northwest India are : Rohtak 30 cm, Agra 26 cm, Gurgaon 26 cm. Rohtak, Agra and Gurgaon had the highest ever rainfall recorded at these stations in 24 hours during the month of June while at New Delhi (Safdarjung) it was the second highest rainfall in a day in the month of June, the highest rainfall being 23.6 cm on 28 June 1936.

Enough precipitable water and dynamic factors like ascending currents at a place are the main causes of heavy rain. Mukherji (1969) had shown that during the southwest monsoon season over Gangetic West Bengal the value of mixing ratio of air at 3 km level (700 mb) serves to provide an additional criterion for forecasting day to day rainfall in the absence of any prominent meteorological situation such as a depression

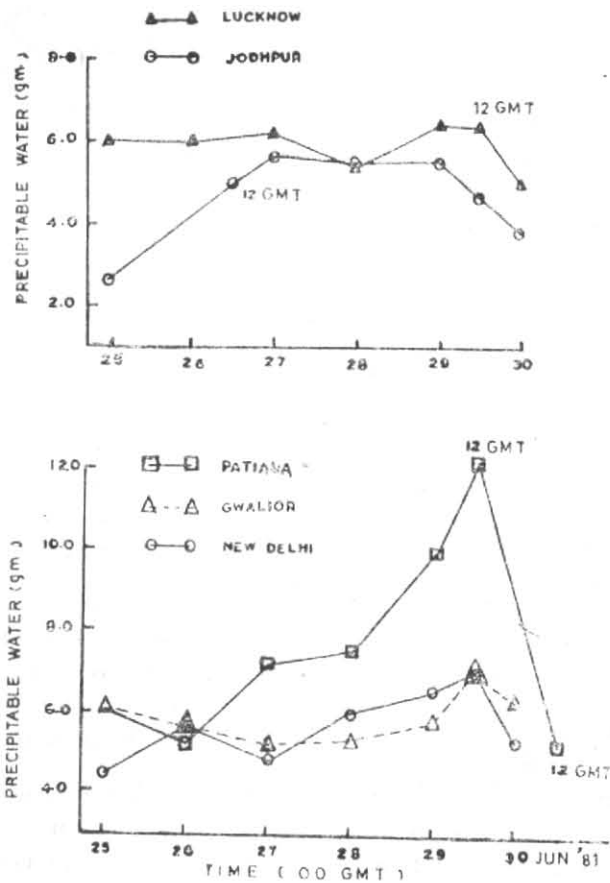
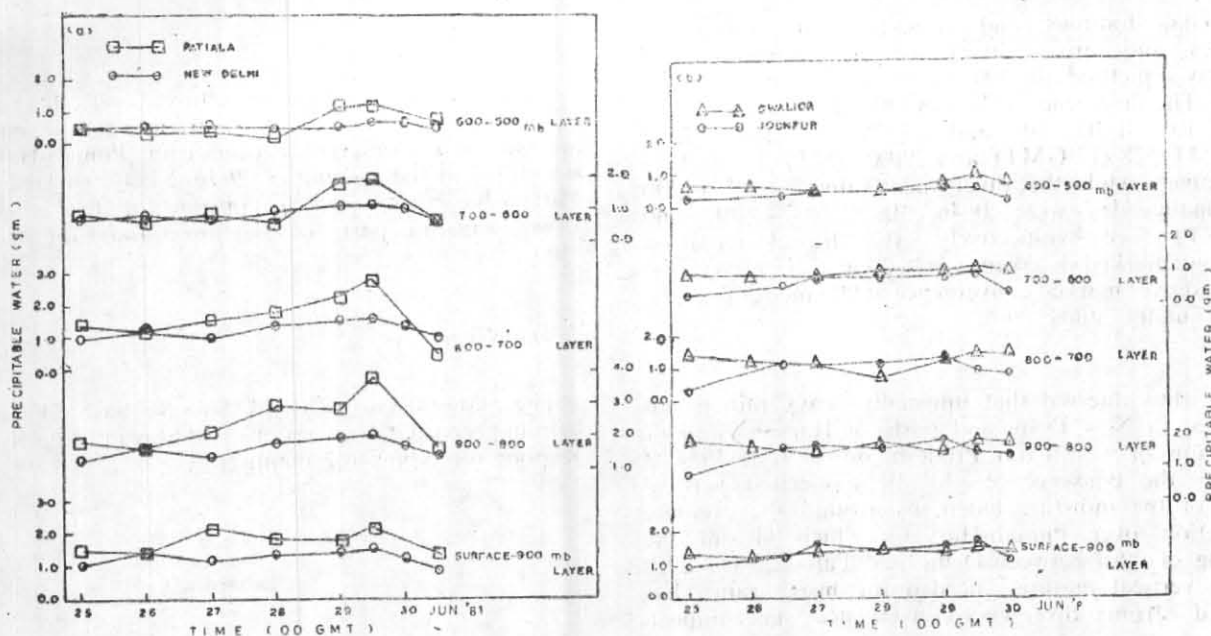


Fig. 1. Day to day variation of precipitable water (surface to 500 mb level) over New Delhi, Jodhpur, Gwalior, Patiala and Lucknow from 25 to 30 June 1981



Figs. 2(a & b). Day to day variation of precipitable water layerwise over (a) New Delhi & Patiala and (b) Jodhpur & Gwalior from 25 to 30 June 1981 (00 GMT)

affecting the region. The probability of occurrence of rain is the highest on days with high water vapour content at 3 km level and the largest percentage of rainless days is associated with low moisture content at that level. Also the occurrence of moderate to heavy rainfall seems to be associated with significant variations in the moisture values at 700 mb level.

In the present study we have discussed the day to day variation in precipitable water content from surface to 500 mb level over Jodhpur, New Delhi, Patiala, Gwalior and Lucknow during the period 25 to 30 June 1981 and found that there was a significant increase in the precipitable water content on 29th evening which we attribute as contributory to unusually heavy rain in parts of northwest India on 30 June.

2. Data used and method of computation

The upper air data from the radiosonde ascents taken at Jodhpur, New Delhi, Gwalior, Patiala and Lucknow were used for the calculation of precipitable water at these stations from surface to 500 mb level for the period 25 to 30 June 1981. Fig. 1 gives this day to day variation of precipitable water over these stations. Figs. 2 (a) and 2(b) represent the variation of precipitable water in various layers, viz., surface to 900 mb, 900-800, 800-700, 700-600 and 600-500 mb for New Delhi, Patiala, Gwalior and Jodhpur for the above period. There was no significant increase in the precipitable water content at Lucknow.

The values of humidity mixing ratio ' ω ' were evaluated from the tephigrams for the surface as well as the isobaric levels of 900, 850, 800, 700, 600 and 500 mb. Mean humidity mixing ratio $\bar{\omega}$ between two consecutive isoba-

ric levels was then worked out. From it the mean specific humidity was calculated by using the relation :

$$q = \bar{\omega} / (1 + \bar{\omega})$$

The precipitable water was then worked out from the

usual formula $W = \frac{1}{g} \int q dp$ which may be taken as

$\Delta W = \bar{q} \Delta p / g$ c.c. for the atmospheric layer between two consecutive isobaric levels p_1 and p_2 . ($\Delta p = p_1 - p_2$), \bar{q} represents the mean specific humidity of the atmospheric layer. The unit of precipitable water is cubic centimetre and as the density of water is unity, the unit of precipitable water may be taken as gram also.

3. Discussion

As the monsoon was in advancing phase between 27th and 30th increased moisture incursions towards northwest India including the Western Himalayas were likely.

However, it will be seen from Fig. 1 that precipitable water increased over Rajasthan (Jodhpur) from 25th to 27th and then maintaining a plateau upto 29th decreased sharply on 30th.

But the gradual increase in precipitable water content from 27th onwards upto 29th evening over Gwalior, Delhi and Patiala is clear, being spectacular at Patiala. This is also seen in day to day variation of precipitable water layerwise as shown in Figs. 2(a) and 2(b).

Patiala, Jodhpur and Lucknow are taken as vertices and area divergence is calculated by Bellamy's method at 900 metres a.s.l. and 9.0 km a.s.l. The divergence values at 900 metres a.s.l. were 0.98×10^{-5} , 1.03×10^{-5} and $-1.29 \times 10^{-5} \text{ sec}^{-1}$ on 27 (00 GMT), 28 (12 GMT) and 29(00 GMT) June 1981 respectively while the divergence values at 9.0 km a.s.l. on these days were -0.46×10^{-5} , -0.77×10^{-5} and $1.18 \times 10^{-5} \text{ sec}^{-1}$ respectively. It is thus clear that on 29 June marked divergence at 9.0 km a.s.l. was superimposed over marked convergence at 900 metres over the region under study.

It is thus inferred that unusually heavy rain which occurred in New Delhi and parts of Haryana and of the plains of west Uttar Pradesh on 30 June 1981 is due to the convergence and the associated vertical uplift of the moisture laden air around the cyclonic circulation over Punjab-Haryana which lay in the evening of 29th between Delhi and Patiala. On 29th strong vertical motions, needed for heavy rains, has resulted from divergence/convergence super-imposition.

4. Conclusion

Strong vertical motion resulting from divergence/convergence super-imposition in moisture-laden air around the cyclonic circulation over Punjab-Haryana which lay in the evening of 29 June between Delhi and Patiala has been found responsible for the unusually heavy rain in parts of northwest India on 30 June 1981.

Acknowledgement

The authors wish to thank Shri Subhash Chand for help in preparing the diagrams and Shri Pradeep Kumar Kapoor for typing the manuscript.

Reference

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