

AN UNUSUAL SOUTHEASTWARD MOVEMENT OF A WESTERN DISTURBANCE IN DECEMBER 1974

1. In this note the development of an induced low, rather a powerful one, over southwest Rajasthan and adjoining Pakistan in the end of December 1974, which resulted in considerable rainfall over northwest India, has been reported.

2. On the morning of 30 December 1974 there was no weather system in the lower troposphere anywhere near India. This is corroborated by the NOAA-4 Satellite picture of 30th. There was only a trough in the westerlies at 300 mb with its axis along 53°E north of 37°N . But there was a general fall of pressure over the country, the maximum being 3 to 4 mb over west Rajasthan. By the evening of 30th a western disturbance developed over north Pakistan as a feeble upper air cyclonic circulation/trough between 2.1 and 4.5 km asl. There was also a feeble sea level trough extending into south Rajasthan.

On 31st morning the westerly trough was lying with its axis along 63°E . Under its influence an induced low developed over southwest Rajasthan with associated cyclonic circulation extending upto 900 m asl. The pressures were still falling over Rajasthan suggesting that the induced low may intensify further. At 0600 GMT some cloudiness started over extreme west Rajasthan. By the evening the induced low became well marked and lay over central Rajasthan and one or two west Rajasthan stations reported light rainfall. The trough in the westerlies lay along 40°N , 70°E to 28°N , 74°E having a northnorthwest-southsoutheast orientation as shown in Fig.1. The main western disturbance lay over north Pakistan and adjoining Jammu & Kashmir and Qazigund in Kashmir reported light snowfall. While 24-hr pressure

changes over northwest Rajasthan were of the order of *minus* 4 mb, short duration pressure changes were positive in west Rajasthan. The weather over Delhi rapidly deteriorated from mainly clear skies during late evening to overcast skies and rain from about 1500 GMT.

On the morning of 1 January 1975, the trough in the westerlies moved to 76°E . The western disturbance moved southeastwards and lay over Punjab and adjoining areas. The induced low also moved southeastwards from central Rajasthan to southwest Uttar Pradesh and adjoining northwest Madhya Pradesh. While Jammu & Kashmir had very little weather, Haryana had widespread rain and Himachal Pradesh and Uttar Pradesh hills widespread rain or snow. By 1st evening, the western disturbance was moving eastwards across Western Himalayas and the induced low moved further southeastwards to northeast Madhya Pradesh.

3. Due to fall of pressure over west Rajasthan on 30 December, a trough of low pressure developed there. This got further intensified on 31st morning, under the influence of a westerly trough along 63°E . Due to further pressure fall and the eastward movement of the westerly trough, the induced low intensified by 31st evening into a well marked low, probably a depression. The westerly trough not only shifted eastwards from 63°E to 70°E but also extended southwards upto 28°N . This was responsible for the intensification of the induced low. It is interesting to note that while Jammu & Kashmir did not get any significant precipitation in association with the main western disturbance on 31 December and 1 January 1975, Himachal Pradesh and Uttar Pradesh hills had fairly widespread to widespread rain or snow on these two days. This is due to the western disturbance moving southeastwards to Punjab and neighbourhood, after having intensified under the

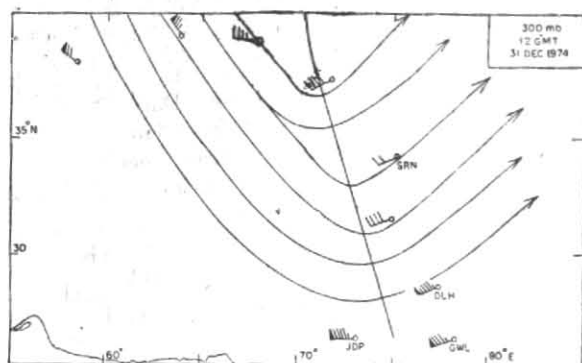


Fig. 1. Position of western trough at 300 mb on 31 December 1974 (12 GMT)

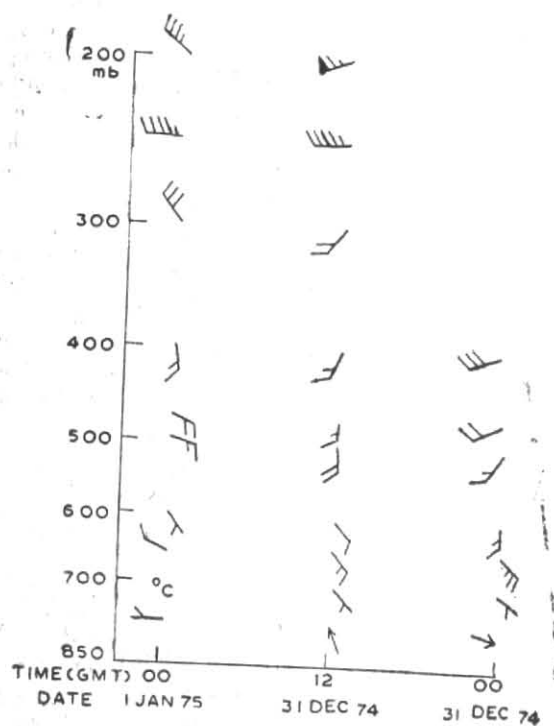


Fig. 2. Vertical time-section of winds over Srinagar

influence of the westerly trough. The low level and the high level systems had the necessary west-

ward displacement (Haltiner and Martin 1957; Ghosh and Veeraraghavan 1975). Because of the southeasterly movement, Jammu & Kashmir was not much affected. That the system moved definitely southeastwards is borne out by the vertical time-section of Srinagar (Fig. 2). It can be seen that from 1200 GMT of 31 December to 00 GMT of 1 January 1975, the winds between 600 and 400 mb continually backed. For example, at 500 mb the wind changed from $180^\circ/21$ kt to $100^\circ/13$ kt indicating southeastward movement of the system which was solely responsible for non-occurrence of precipitation over Jammu & Kashmir. It is seen from Fig. 1 that the trough is oriented in north-northwest-south-southeast direction with winds to the west of the trough being northwesterlies. Thus the low level system was under the influence of the overlying northwesterlies which resulted in the southeastward movement of the system from 31 December to 1 January 1975.

The authors wish to emphasize that large displacement of the order of about 10° between the sea level system and the upper level wave is necessary for the intensification of the system. For example, on the morning of 1 January 1975 the westerly trough was along 76°E and the low level system over southwest Uttar Pradesh and adjoining northwest Madhya Pradesh. Further intensification of the low level system did not take place as the trough had come closer and did not provide the necessary large westward displacement.

The study also reveals that over an area of continued pressure fall for 1 to 2 days in December, conditions become favourable for the formation of a low level system.

An examination of the data of the last 25 years indicates that there was no instance in which Jammu & Kashmir went practically dry whereas the other areas of northwest India had widespread precipitation. This is due to the *in situ* development of the feeble western disturbance over Indo-Pakistan area and its southeastward movement. This is probably the first case in which the unusual southeastward movement of a western disturbance and an induced low has been documented.

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