

Influence of distant monsoon lows on weather over Jodhpur

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Round the seasonal low over West Pakistan during the southwest monsoon period, there are broadly three zones of air circulation—the innermost zone of dry air, the second zone of comparatively moist air and the third zone of very moist monsoon air. The soundings or radiosonde data of Quetta, Karachi and Hyderabad (Dn), lying in the three zones, will bring out the contrasts of the air in the different zones. The temperature and humidity characteristics for these stations for July have been worked out by Roy (1946). The mean values of the relative humidity at different heights for July are reproduced in Table 1 for ready reference.

The low relative humidity at Quetta at all the levels right from the lowest level shows the prevalence of the deep layer of tropical continental (*Tc*) air in the first zone. Similarly, the high relative humidity at Hyderabad (Dn) at all the levels exhibits the presence, in depth, of the contrasting maritime equatorial (*Em*) air in the third zone. The high relative humidity at the lowest levels at Karachi with lower humidity higher up shows the transitional zone (second zone) with a shallow layer of *Em* air at the lower level with *Tc* air higher up. Jodhpur is generally in the second zone during the monsoon period, unless the third zone is brought over it with the movement of some lows.

2. Places in the third zone can have rainfall even in the absence of any prominent weather producing agent, but presence of a

prominent weather producing agent is necessary for the occurrence of rain in the other two zones. Strengthening of the winds in the monsoon zone, for example, may cause precipitation over the third zone, but the increased winds and associated increased turbulence over Jodhpur give only low stratus clouds with practically no rain.

3. The tephigrams of Jodhpur often show a layer of inversion at 5000/6000 feet or higher up in the monsoon season. Thus the conditions are not normally favourable for the upward ascent of air. Moderate to strong southwest to west'ly winds may continuously blow over Jodhpur for many days during the monsoon period without producing any rain or thundershower. During the whole month of July 1955 for example, southwest to west'ly winds blew over Jodhpur, and there was no rain or thundershower on any of the days in the month.

4. Thus the strengthening of the southwest to west'ly flow in the monsoon period is not a favourable condition for Jodhpur to have rain or thundershower. It is rather the weakening or interruption to this flow which causes rain or thundershower over this place. This interruption may be caused in one or two cases due to appearance of low over Sind-Kathiawar area, but is mostly caused by the lows moving westnorthwestwards from the Bay of Bengal or inland areas. These bring in the easterly current causing a convergence with the westerly current near Jodhpur and thunderstorm-shower results in the process.

TABLE 1
Mean relative humidity at different heights for July

Station	Height (km)	Relative humidity (%)
Quetta	2	39
	2.5	36
	3	30
	4	30
	5	—
Karachi	0.5	82
	1	78
	1.5	60
	2	49
	2.5	49
	3	50
Hyderabad (Deccan)	1	79
	1.5	82
	2	86
	2.5	78
	3	78
	4	77
	5	80

5. Rain or thundershower generally occurs over Jodhpur, when the low lies on or near the line passing eastsoutheastwards from Jodhpur, and the low has a tendency of movement towards westnorthwest because these provide favourable conditions for the development of convergence of the air masses in the neighbourhood of Jodhpur as the trough line associated with the low shifts over the neighbourhood of Jodhpur in such cases. If the position of the low is far off from this line, as it happens when it is over northern Uttar Pradesh or the Punjab (I), or if the movement of the low is much different from westnorthwest direction, as it occurs at the time of recurving, the low ceases to have weather producing effect on Jodhpur.

6. Sometimes, the low from the Bay of Bengal may continue to move westnorthwestwards for a number of days and come over Sind or merge nearby into the seasonal low maintaining till that stage the monsoon air over Jodhpur and upper wind discontinuity near it and thus cause rain or thundershower over Jodhpur on a number of successive days, starting from the stage when the

low is quite far off on the eastern side of Jodhpur and continuing till it is near Jodhpur and also when it has moved west of Jodhpur. Thus, the weather over Jodhpur during the monsoon period can be affected by the low when it is nearer Jodhpur as well as when it is far away from Jodhpur. The occurrence of the weather when the low is nearer Jodhpur is a well known feature which does not require elaboration. The occurrence of the weather when the low is far off from Jodhpur merits consideration, and it is a very useful consideration from the point of correctly forecasting the weather over Jodhpur.

7. It is generally observed that when the low from the Bay of Bengal comes over northeast Madhya Pradesh and neighbourhood during the monsoon season, thundershower occurs at Jodhpur. Even from such a distance of 700/800 miles, the low together with its westnorthwestwards movement exerts influence in the invasion of the easterly air towards Jodhpur, and thundershower, occurring in the process, is generally seen to come over Jodhpur from the eastern side.

8. To show how the weather over Jodhpur is affected when the low from the Bay of Bengal moves over northeast Madhya Pradesh and neighbourhood, some illustrations covering practically a full monsoon season are given below. The orientation of the associated upper air trough line and the pressure changes at Jodhpur are also indicated.

- (i) On 27 June 1955, conditions were markedly unsettled in the north Bay of Bengal where a depression was forming. The depression moved westnorthwestwards and lay as a low over south Chota Nagpur, north Orissa and adjoining northeast Madhya Pradesh on the morning of the 28th. Thunderstorm with rain occurred at Jodhpur in the afternoon of 28th and 29th, recording rainfall of 0.04 and 0.32 inch respectively. The trough line or the upper wind discontinuity

at 1.5 km above the mean sea level ran more or less southeast to northwest through Jharsuguda, Pendra, Fatehpur and Bareilly on the morning of the 27th and was away from Jodhpur. It, however, shifted southwestwards and passed through Angul, Umaria, Jhansi and Sikar on the morning of the 28th, tending to move towards Jodhpur. Jodhpur had a pressure fall of 2.3 mb during the 24 hours ending at 0830 IST on the 27th and a small rise of pressure of 0.7 mb on 28th.

- (ii) During the month of July 1955, no rainfall was recorded at Jodhpur and it is also seen that no depression or low moved over northeast Madhya Pradesh and neighbourhood from the Bay of Bengal during the month. There were, however, stationary or eastward moving land lows or depressions over east Uttar Pradesh on a number of days and these had no rain producing effect over Jodhpur.
- (iii) On 27 August 1955, a depression from the Bay of Bengal was crossing the coast near Gopalpur in the morning. The depression lay over south Orissa and adjoining east Madhya Pradesh on the morning of the 28th. Jodhpur had thunder-shower in the afternoon of the 28th. Jodhpur had a fall of pressure of 0.8 mb on the 27th and a rise of pressure of 0.5 mb on the 28th. The upper wind discontinuity at 1.5 km passed near Jodhpur both on 27th and 28th. Thundershower, however, occurred at Jodhpur in the afternoon of the latter date when the depression moved over the eastern parts of east Madhya Pradesh.
- (iv) A cyclonic storm from the Bay of Bengal was crossing coast close to

Balasore on the morning of 3 September 1955, and was weakening into a deep depression. It lay as a deep depression over northeast Madhya Pradesh on the morning of the 4th. Jodhpur, however, had a rise of pressure of 3 mb on the 3rd and a further rise of 2 mb on the 4th. The upper wind discontinuity at 1.5 km was oriented more or less southeast to northwest through Jharsuguda, Pendra, Jhansi and Jaipur on the 3rd and ran westnorthwestwards through Pendra to Jodhpur on the 4th. Thundershower was recorded at Jodhpur in the afternoon of the 4th. Jodhpur, which was showing a decreasing trend in rainfall by the 3rd due to dissipation of an earlier disturbance, began to show an increasing trend in rainfall again from the 4th afternoon. Conditions were again markedly unsettled in the west central Bay of Bengal on 8 September 1955, and resulted in a low pressure area over south Orissa and adjoining Madhya Pradesh on the 9th morning. Thunderstorm with one inch of rain was recorded at Jodhpur in the afternoon of the 9th. Jodhpur recorded rainfall till 12th due to the effect of this low. Thereafter dry spell continued over Jodhpur for eleven or twelve days till a depression from the Bay was over northwest Madhya Pradesh on the morning of 23 September 1955; Jodhpur, after the spell of dry weather, had again thunderstorm with 0.37 inch of rain in the afternoon of the 29th.

9. The above facts illustrate how pronounced is the inter-relation of the weather over Jodhpur with the movement of a monsoon low from the Bay of Bengal over northeast Madhya Pradesh and neighbourhood.

10. So far as the effect on weather over Jodhpur is concerned, there is some diffe-

rence between a low moving over northeast Madhya Pradesh and neighbourhood from the Bay of Bengal and a low directly appearing over northeast Madhya Pradesh and neighbourhood. The former has mostly a tendency of westnorthwestward movement which contributes to the realisation of weather over Jodhpur, whereas, the latter may or may not have tendency of such a movement. In some cases, the low directly appearing over northeast Madhya Pradesh and neighbourhood may shift westnorthwestwards and behave like a low coming from the Bay of Bengal and produce weather over Jodhpur, while in some other cases, it may remain stationary or shift northeastwards, without producing any weather over Jodhpur. In the latter cases the trough line from northeast Madhya Pradesh runs north or northeast instead of westnorthwest.

11. It may also be worth mentioning here that when the rainfall occurs at Jodhpur in the afternoon or evening, it is almost invariably accompanied with thunder even in the monsoon period, whereas, if it occurs at

other times, it may or may not be accompanied with thunder. When the low moving westnorthwestwards is nearer Jodhpur, rainfall may occur at any time of the day or night and may or may not be accompanied with thunder. But, when the rainfall is caused by the influence of the distant low coming from the Bay of Bengal over northeast Madhya Pradesh and neighbourhood, it occurs in the afternoon or evening and is accompanied with thunder. This is a useful knowledge for forecasting the time of occurrence and the type of weather.

12. It would be seen from the foregoing paragraphs that from the point of view of forecasting the weather over Jodhpur, the movement of the low from the Bay of Bengal into northeast Madhya Pradesh and neighbourhood during the monsoon season and the orientation of the associated trough lines in the lower troposphere in the neighbourhood of Jodhpur are noteworthy features, as they have well marked influence on the weather over Jodhpur in spite of the large intervening distance of the low from Jodhpur.

REFERENCE

Roy, A. K.

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India met. Dep. Tech. Note, 16.
