

Convective activity associated with Jet Stream

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ABSTRACT. Synoptic situations and weather associated with the passage of a jet stream over the central and northern parts of the country between 8 and 14 March 1962 were examined. Thunderstorm activity was pronounced in the right entrance and in the left exit sectors of the jet stream where superposition of high level divergence over lower level convergent areas could be assumed.

1. Introduction

In a study of premonsoon thunderstorms over Gangetic West Bengal, Koteswaram and Srinivasan (1958) have shown that the important condition for convective activity is the superposition of high level divergence over lower level convergent areas. Further high level divergence has been shown to be confined to the right entrance and to the left exit portions of the Jet. In this context, the low and high level synoptic situations and the associated weather between 8 and 14 March 1962 were examined.

2. Weather during period 8 to 14 March 1962

During this week, local or scattered thundershowers were reported from Assam on six days, from Bay Islands, Orissa, east Madhya Pradesh and Vidarbha on three days each, and from Gangetic West Bengal, west Uttar Pradesh, Jammu and Kashmir and Madhya Maharashtra on one day each. Isolated light thundershowers were also reported from Jammu and Kashmir, hills of Uttar Pradesh, Marathwada, north Madhya Maharashtra and Bihar Plateau on one day each. However, on 10 and 13 March 1962, the activity was pronounced and confined to specific areas only.

Newspapers reported severe hail storms accompanied with heavy showers and violent squalls, causing considerable damage to rabi and mango crops in Waraseoni,

Balaghat, Dongargarh and neighbouring places in southeast Madhya Pradesh on 11th and 12th and to wheat crop in the interior villages of Seoni district on 12th and 13th. Nagpur airport experienced series of squalls between 1600 and 1700 IST on 12 March 1962, when the wind speed reached a maximum of 64 km per hour.

3. Low level synoptic situations

During this period, the seasonal anticyclonic circulation was well marked over the central or north Bay of Bengal. The associated moist southerlies at lower levels, penetrated into the central parts of the country and neighbouring areas. Further a low pressure area on the sea level chart with associated upper air circulation extending upto 1500 m. a.s.l. lay over Vidarbha and adjoining areas at 0830 IST on 8 March 1962. On the following day, it was diffuse at the surface but a well marked upper air cyclonic circulation extending upto 1500 m. a.s.l. was observed over those areas. Subsequently the lower level flow pattern changed and a trough in the easterlies extending upto 1500 m. a.s.l. lay over Vidarbha and adjoining areas at 0530 IST on 12 March 1962. It also became unimportant on the following day.

4. High level flow

Information regarding the height, the direction and the maximum speed of the

TABLE 1

Table of maximum wind of 100 knots and more during the period 8 to 14 March 1962

Date	0000 GMT				1200 GMT			
	Station	Height (km)	Direction (deg.)	Speed (kt)	Station	Height (km)	Direction (deg.)	Speed (kt)
8-3-62	Karachi	10.50	260	150	Allahabad	10.45	270	101
	New Delhi	10.87	270	122	Ahmedabad	10.76	260	106
					New Delhi	11.62	270	114
9-3-62	Ahmedabad	10.81	270	101	Ahmedabad	09.16	280	101
	Nagpur	10.38	270	101	Nagpur	10.99	280	104
	Visakhapatnam	13.50	280	104	Gauhati	09.21	270	104
10-3-62	Allahabad	11.60	280	128	Allahabad	10.60	280	132
	Ahmedabad	09.16	280	120	Ahmedabad	10.66	280	132
	Calcutta	10.81	270	109	Jodhpur	12.20	270	118
	New Delhi	10.60	280	111	New Delhi	12.16	280	136
	Nagpur	10.40	280	116				
11-3-62	Ahmedabad	12.21	260	131	Ahmedabad	11.21	260	102
	Nagpur	11.21	260	101	Nagpur	12.45	270	115
	New Delhi	11.50	270	113	Calcutta	09.36	260	114
	Gauhati	09.78	280	100	Gauhati	09.23	270	113
					Bahraich	11.78	270	104
Bombay	10.89	260	118					
12-3-62	Calcutta	09.81	260	125	Bhagalpur	10.11	260	132
	Gauhati	09.86	270	119				
	Nagpur	10.65	250	112				
13-3-62	Gauhati	10.31	260	132	Gauhati	10.91	260	121
					Imphal	10.50	250	116
14-3-62	Calcutta	12.46	250	125				

jet stream when it is 100 knots or more is given in Table 1.

It is seen that Ahmedabad and Allahabad reported 120 and 128 knots respectively on the morning of 10 March 1962 when New Delhi also reported 111 knots. But in the afternoon all these stations reported more than 130 knots. Ahmedabad reported 131 knots on the following morning also. Calcutta reported 125 knots on the morning of 12th and 14th. Bhagalpur reported 132 knots on the morning of 12th, while Gauhati reported 132/121 knots on 13th morning/evening. Thus it is seen that, during this week, a westerly jet stream with a maximum speed of more than 130 knots passed over the central and northern parts of the country from west to east, generally between 10 and 12-km levels.

5. Analysis and Conclusion

Weather on 10 March 1962 and analysis— On 10 March 1962, local or scattered rain or thundershowers were reported from north-east Madhya Pradesh, Orissa, Gangetic West Bengal and Kerala with isolated falls in Bihar Plateau, Chandbali reporting 7 cm of rain, Cuttack and Keonjhar 5 cm each, Angul and Punalur 2 cm each, and Balasore and Sandheads 1 cm each.

At 00 GMT on 9 March 1962 upper air cyclonic circulation in the lower level westerlies, well marked at 900 m. a.s.l. (shown in Fig. 1) and extending also upto 1500 m. a.s.l., lay over Vidarbha and adjoining areas of Telengana and Madhya Pradesh, with associated trough line extending to Orissa and Gangetic West Bengal also. This circulation is favourable for convergence

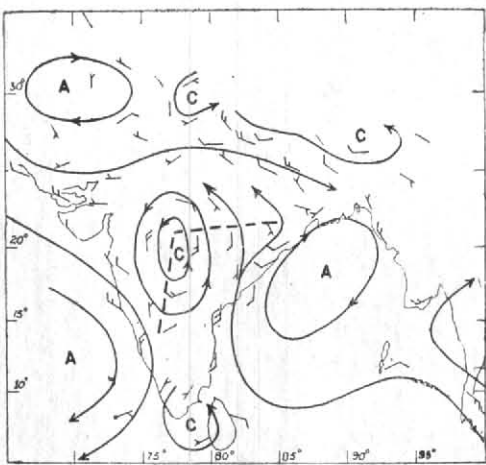


Fig. 1. 900 m a.s.l. winds and stream line flow pattern at 0000 GMT on 9 March 1962
 - - - - Trough line, — Stream line
 A—Anticyclonic, C—Cyclonic

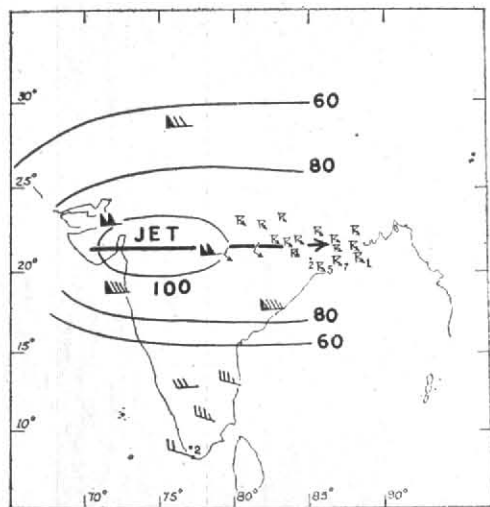


Fig. 2. 10.5 km a.s.l. winds at 0000 GMT on 9 March 1962
 — Isotachs, wind speed in knots. Rainfall (cm) and weather symbols refer to 24-hour ending 0830 IST on 10 March 1962

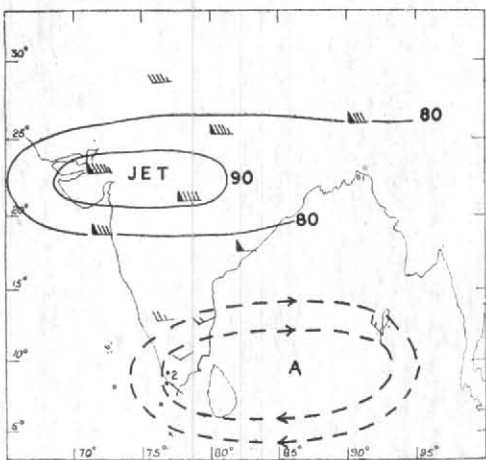


Fig. 3. 9.0 km a.s.l. winds at 0000 GMT on 9 March 1962
 — Isotachs, wind speed in knots
 - - - - Stream line, A—Anticyclonic

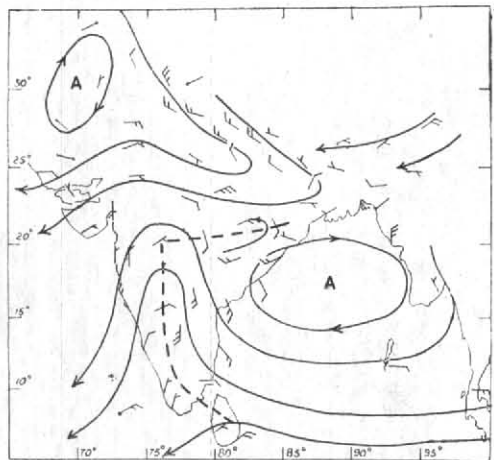


Fig. 4. 900 m. a.s.l. winds and stream line flow pattern at 0000 GMT on 12 March 1962
 - - - - Trough line, — Stream line
 A—Anticyclonic

over these areas. The southerly components supply moisture also. The high level flow pattern at 10.5 km a.s.l. at the same hour of the same date (shown in Fig. 2) is favourable for divergence over northeast Madhya Pradesh, Gangetic West Bengal and Orissa because they form the left exit sector of the jet stream.

Thus superposition of high level divergence over lower level convergent areas may be assumed over northeast Madhya Pradesh, Gangetic West Bengal and Orissa where thundershowers may be expected but not so over the rest of the areas where high level divergence cannot be assumed. This assumption is found to be correct

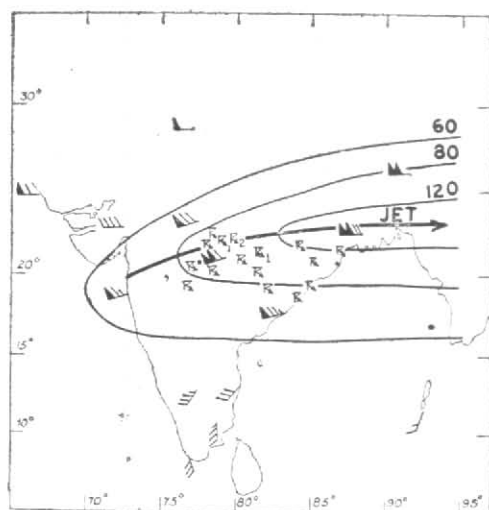


Fig. 5. 10-5 km a.s.l. winds at 0000 GMT on 12 March 1962

— Isotachs, wind speed in knots
 Rainfall (in cm) and weather symbols refer to 24-hours ending at 0830 IST on 13 March 1962

as seen by the weather that occurred during the succeeding 24 hours, indicated in Fig. 2.

Local rain over Kerala reported on 10 March 1962 may also be explained as due to the superposition of high level divergence associated with the anticyclonic vortex in weak winds over Kerala at 9.0 km a.s.l. (shown in Fig. 3) over the lower level convergence associated with the feeble cyclonic circulation over the same area indicated in Fig. 1.

Weather on 13 March 1962 and analysis—
 On 13 March 1962 local or scattered rain

or thundershowers were reported from south Madhya Pradesh, Vidarbha and Orissa while isolated shower was also reported from Marathwada, Seoni reporting 2 cm of rain and Raipur and Chhindwara 1 cm each.

At 00 GMT on 12 March 1962 an upper air trough in the lower level easterlies, well marked at 900 m. a.s.l. (shown in Fig. 4) and extending also upto 1500 m. a.s.l., lay over south Madhya Pradesh, Vidarbha and neighbouring areas. Hence lower level convergence over these areas may be assumed. The southerlies again supply the necessary moisture. From the flow pattern of winds at 10.5 km a.s.l. at the same hour on the same date (shown in Fig. 5), high level divergence over these areas may also be assumed since they form the right entrance sector of the jet stream.

Thus superposition of high level divergence over lower level convergent areas may be assumed over Vidarbha and neighbouring areas where thundershowers did occur as seen by the weather that occurred during the succeeding 24 hours, as indicated in Fig. 4.

Conclusion—Since light isolated thundershowers were reported on other days of the week also, it is concluded that pronounced and significant thunderstorm activity associated with the jet stream is confined to the right entrance and to the left exit sectors when lower level conditions were favourable for convergence and supply of moisture.

REFERENCE

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