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AN UNUSUAL BEHAVIOUR OF SURFACE TEMPERATURE DURING THE NIGHT OF 21/22 JANUARY 1987 AT PATNA

Accurate forecasting of surface temperature is of importance to aviation. When it happens to be minimum temperature in winter or maximum temperature in summer it acquires an additional significance because of its importance to agriculture and general public. Thus unusual behaviour of mercury, during night hours in winter is of great interest to meteorologists. An unusual behaviour of mercury occured during the night of 21/22 January 1987 when temperature rose by 4.5°C between 0000 and 0400 IST at Patna airport. The fall of night temperature between 2000 and 2300 IST was 5.4°C recorded on 21st January.

The surface wind was light during day time of 21st and 22nd and calm throughout the night. The sky was almost overcast with stratus clouds throughout the day hours on 21st. The sky started clearing at about 1730 IST and became clear at about 2100 IST. By midnight the state of sky again changed. The sky was overcast a little after midnight of 21st and this state continued till the mid-day of 22nd. Table 1 shows the summary of current weather observations from 1720 IST on 21st to 0920 IST on 22nd. Fig. 1 shows the relevant thermogram. The fall of temperature of 5.4°C between 2000 and 2300 IST is quite normal as sky was clear during the period. But the rise in temperature of 4.5° C between 0000 and 0400 IST was unusual. Overcast clouding with low cloud at the most may stop the fall in surface temperature. It cannot raise the surface temperature during night.

TABLE 1

Current weather observations at Patna 21/22 January 1987

Time (IST)	Wind direction (°)	Speed (kt)	Temp. (0°C)	Dew point (0°C)	Cloud	
					Total amount (Octa)	Height (m)
1720	300	02	14.2	11.2	7	240
1820	320	02	14.0	11.4	7	240
1920	320	02	13.2	10.9	6	240
2020	000	00	12.6	11.4	3	240
2120	000	00	11.4	10.2	0	—
2220	000	00	10.0	08.8	0	—
2320	000	00	08.6	07.3	0	—
0020	000	00	09.2	08.0	4	240
0120	000	00	09.8	07.7	8	240
0220	000	00	11.4	10.2	8	240
0320	000	00	11.8	09.8	8	240
0420	000	00	12.2	09.9	8	240
0520	000	00	12.2	09.9	8	240
0620	000	00	12.2	09.9	8	240
0720	290	02	12.2	09.9	8	240
0820	VRB	02	12.0	10.1	8	240
0920	320	02	12.0	10.1	8	240

On 22 January 1987 the minimum temperature recorded was 7.7° C.

The relevance of the following four plausible causes for the rise of temperature during the night of 21st is discussed below :

(*i*) *Advection of heat from above* — Such cases of rising of surface temperature during night have been reported by Dayakishan (1979). For this process to work the surface wind should be strong and lapse rate should be much below the dry adiabatic lapse rate. As indicated by the upper air soundings (Fig. 2) there was inversion at 1200 IST on 21 January 1987 between surface and 930 hPa level which must have increased with surface cooling from 2000 to 2330 IST making it a very favourable case of thermal advection from above. But the wind was calm and, therefore, this process must not have been at work. The isothermal layer between surface and 700 hPa level at 0530 IST on 22 January (Fig. 2) also indicates that the turbulence was absent. Turbulence would have caused dry adiabatic lapse rate below the cloud base during night.

(*ii*) *Horizontal advection of temperature* — With wind being calm at the surface, the upper wind at the lower levels being light and hardly any temperature gradient over the region any significant horizontal advection of temperature is ruled out.

(*iii*) *Radiation from the cloud base* — This process will cause rise in surface temperature if cloud base temperature is higher than the surface temperature. With the temperature 12° C at 850 hPa level at 1730 IST and minimum temperature falling to 7.7° C, this process might have been at work during the period when the sky became cloudy during the later part of the night. Isothermal layer at 12° C from surface up to 850 hPa level with mild thermal inversion upwards suggests the heating of the layer below the cloud base due to radiation from the cloud layer.

(*iv*) *Sinking of the air* — Subsidence of air can occur due to divergence resulting in adiabatic warming but its contribution cannot be assessed with data of a single station. However, presented in Fig. 2 is the relevant tephigram.

Considering the different plausible causes for the rise in surface temperature, it may be concluded that

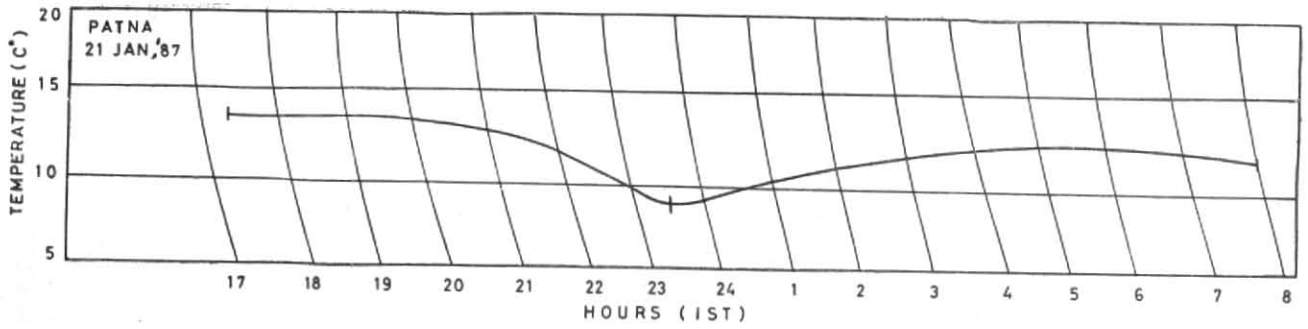

Fig. 1. Thermogram of Patna on 21 January 1987

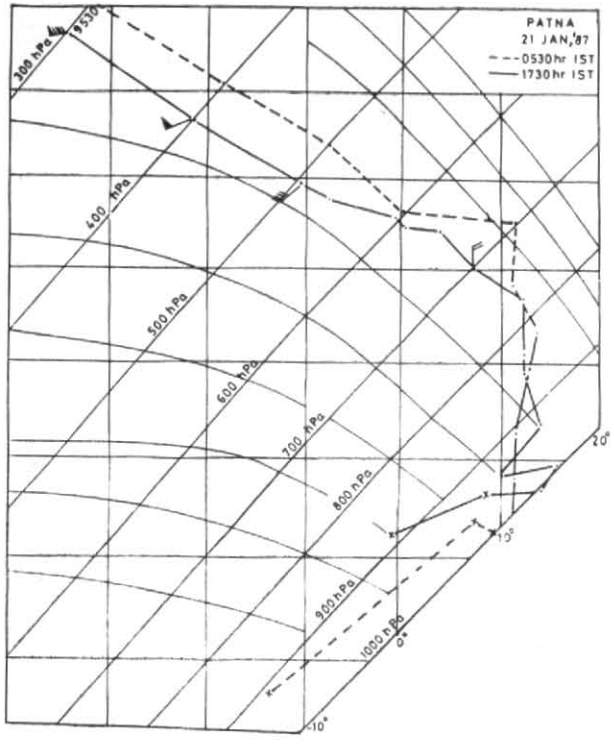

Fig. 2. Tephigram of Patna at 1730 IST and 0530 IST on 21 January 1987

some subsidence and radiation from the base of the low cloud had caused the unusual rise of surface temperature during early hours of 22 January 1987.

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Reference

Dayakishan, 1979, *Vayu Mandal*, **9**, pp. 11-15.

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