

Letters to the Editor

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CASE STUDY OF A HEAT WAVE OVER KASHMIR DIVISION

On 28 June 1978 Srinagar recorded maximum temperature of 37.8°C which equalled the record of 27 June 1946. This maximum temperature record was 8°C above normal. On this day, other stations in the valley viz., Gulmarg and Qazigund also recorded maximum temperatures with departure from normal $+5$ and $+6^{\circ}\text{C}$ respectively. The minimum temperatures were also 6°C above normal. The temperatures dropped after 29 June 1978. On 28 June 1978 heat wave was declared over Kashmir division. A case study of the heat wave has been made.

From the study of synoptic charts for the period 22 June to 29 June 1978, it is seen that western disturbances were moving across the state in the form of upper air troughs and circulations.

Under the influence of these western disturbances Jammu division of the State received fairly widespread rain or thundershowers on 26, 27 and 29 June, isolated to scattered rain or thundershowers on 28 June. Kashmir division had mainly dry weather on 26th, 28th and fairly widespread rain or thundershowers on 29th and isolated on 27 June.

To investigate the causes leading to the heat wave, upper air soundings of Srinagar were examined in detail. It was observed from the upper air soundings that strong westerly wind at 500 mb and above weakened and became light northerlies upto 250 mb. At 200 mb. the winds became light southerly/southeasterlies. On 28th and 29th the winds were light northwesterlies to westerly. The wind pattern also suggested that on 28 and 29 a ridge passed over Kashmir division.

To study the thermal structure of the atmosphere, 24 hour change of temperature in vertical is presented in Table 1.

It is seen from the Table 1, that on 25th and 26th there was warming in all the levels. On 27th there was warming on surface to 400 mb, except at 600 mb and at 300 mb and above where cooling was observed. On 28th this warming up was accompanied with depletion of moisture. The dew point depression on 28th was 2 to 4°C as compared to 27th. On 29th there was cold air advection accompanied with lesser order depletion of the moisture as compared to 28th.

M. C. Queen and Cadesman Pope (1957) have shown that there exists a correlation between the heat wave with the thickness of air mass, between 1,000 and 500 mb levels. This relation is tested for the present case with some modifications.

Since Srinagar is situated at 1586 meters above msl 850 mb is taken as surface level hence 850-500 mb thickness nad its departure from the normal is examined for the period under study.

It was observed that :

- (i) at 00 GMT the 500 mb surface levels were increasing from 23 June onwards. At 12 GMT the 500 mb surface levels were increasing from 25 June onwards. This increasing tendency was also seen at 850 mb levels.
- (ii) on 24th onwards at 00 and 12 GMT the 500-850 mb thickness was above normal.

This suggests that a ridge possessing warm characteristics should have prevailed over Kashmir division during this period.

The lapse rate prevailing in the atmosphere on 27th to 29th was computed and it was observed that the mean lapse rate in the atmosphere on 28 and 29 June within the layer,

TABLE 1
Thermal Structure of the Atmosphere over Srinagar during 22 to 29 June 1978

Mb Level/ Date	24-hour Thermal Advection							Stability index		24-hour Moisture Advection				
	Sur- face	700	600	500	400	300	250	200	K	SI	Surface	700	600	500
22	-2.0	-1.0	0.8	2.6	3.8	5.2	8.8	11.0	32	-2	-1.0	4.0	1.6	-3.4
23	2.0	1.6	1.0	0.6	0.2	2.8	-1.4	-1.6	39	-7	3.0	1.6	1.6	-3.4
24	1.0	1.6	1.8	-0.2	-1.8	-5.2	-2.2	-1.2	38	-4	0	2.6	2.2	6.8
25	0.0	2.4	3.2	5.1	9.8	7.0	6.4	4.8	39	-6	0	3.5	0.2	-1.9
26	2.0	-1.8	2.2	4.0	0.2	3.6	2.6	2.8	37	-1.5	0	0.2	-1.8	1.0
27	1.0	0.2	-4.8	4.0	2.8	-6.0	-6.7	-6.8	40	-3	3	3.0	4.8	6.0
28	1.0	-1.4	2.6	1.0	2.0	0.2	2.0	2.6	39	2	-2.0	-3.5	-2.0	-4.0
29	-1.0	-2.8	-3.6	-4.9	-4.6	-4.0	-5.2	-4.6	34	-6	0	-2.3	-1.3	-7.4

surface to 700 mb was 8.2 and 10.1° C/km. This high lapse rate suggested that on these days warming up of the atmosphere must have taken place upto considerable depth. On 28th in particular the atmosphere being warm and dry (Table 1) as compared to 29th the rise in temperature was higher. On 29th high lapse rate accompanied with moisture resulted in thunderstorm in the afternoon and the rise in temperatures was arrested after the value of 36.7°C.

As is well known the duration of sunshine is directly related to the heating effects of the atmosphere. The duration of sunshine over Srinagar for the period 22 June to 29 June 1978 was examined. The examination of the duration of bright sunshine over Srinagar revealed that the duration was more on 24th, 25th and 26th as compared to 28th. In spite of lesser order of duration of bright sunshine on 28th, the maximum temperature touched the highest value of 37.8°C, this can be explained due to the fact that on other days there was moisture advection instead of moisture depletion (Table 1).

Conclusions

From the above discussion it is seen that:

- (i) The Kashmir division of Jammu and Kashmir State can have heat wave

conditions when the Jammu division is having premonsoon thunderstorms.

- (ii) This type of heat wave forms in situ and dissipates there itself without migration to other division.

The conditions leading to the occurrence of heat wave is :

- (1) Light westerly or northwesterly winds *i.e.* presence of a ridge.
- (2) Warming up of various layers together with moisture depletion.
- (3) Increase in the 850 and 500 mb surface heights and that the thickness in the layers 850-500 mb should be above normal at 00 and 12 GMT prevailing for 3-4 days prior to the days of heat wave.
- (4) The lapse rate in the atmosphere to be high enough to result in warming up of the atmosphere upto the considerable depth.
- (5) The duration of bright sunshine should be sufficient during preceding days accompanied with moisture depletion.

Reference

Forecasting Manual, 1974, FMU Rep No. IV-6 Heat and Cold Waves in India.

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