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ABNORMAL DIFFERENCES IN MINIMUM TEMPERATURES AT COLABA AND SANTACRUZ

This note studies the differences in the minimum temperatures at Colaba and Santa Cruz which are a few miles apart, during the winter months with a view to see if there are any peculiar variations in the same.

The Colaba Observatory is located at the southern tip of the Bombay Island and is closely surrounded on three sides by sea. Santa Cruz Observatory is on the mainland 12 miles to the north of Colaba and is about 2 miles inland towards the east from the sea; there are some hillocks to the east of the Observatory at a distance of 2 or 3 miles, the highest among them being 674 ft.

The differences in minimum temperatures between Colaba and Santa Cruz during the winter months (November, December, January and February) of four years 1949-53 were extracted and the monthly means together with the extreme values are given in Table 1.

TABLE 1

Month	Mean difference (m) (Colaba— Santa Cruz) °F	Extreme values of differences	
		Highest °F	Lowest °F
November	7	12	0
December	8	14	2
January	7	11	1
February	7	14	3

Colaba's minimum is on an average 7 to 8 degrees higher than Santa Cruz which can be explained by Colaba being practically on

the shore surrounded on three sides by sea while Santa Cruz is two miles inland. The comparatively less nocturnal cooling over sea is having its influence at Colaba.

Occasions on which the difference varied from the average by more than 2°F were chosen for detailed study. Such occasions numbered 94. The results of the detailed study are summarised in Table 2.

TABLE 2

Month	No. of occasions of differences greater than ($m+2^{\circ}\text{F}$)		No. of occasions of differences less than ($m-2^{\circ}\text{F}$)	
	With clear skies	With slight cloudiness*	With partially cloudy or cloudy to overcast skies	With clear skies
November	11	1	9	1
December	7	0	11	2
January	14	3	9	0
February	10	3	7	6
Percentage of total No. of occasions studied	44	7	38	11

* Mostly high clouds

Larger differences in minimum temperatures between Colaba and Santa Cruz are thus seen to occur more frequently on days when the skies are clear. With partially cloudy or overcast skies there is a greater probability for the minimum temperatures to get closer. Since the mean has been worked out taking into account both cloudy and clear skies, it should be expected that with clear skies there is a greater probability for the differences to exceed the average and with cloudy skies for the values to get closer.

The decrease in the difference between the minima at the two places on cloudy nights may be explained as follows —

Brunt (1941) has observed that when sky is covered with low cloud the net loss of heat from the ground is only about one seventh as great as the loss when the sky is cloudless. It may probably be assumed that the extent to which cloudiness reduces radiative cooling over land or sea is approximately the same. Hence, the difference in the fall in temperature at night between land and sea would be reduced on a cloudy night compared to clear conditions. It is seen that on clear nights during January the fall in temperature between the time of sunset and the attainment of minimum temperature at Santaacruz (*i.e.*, over land) is on an average 19°F, the corresponding value at Colaba (*i.e.*, over sea) being 9°F. On cloudy nights therefore, this cooling may be of the order of 1/7th or so, *i.e.*, 3°F over land and about 1°F over sea. It is thus seen that the difference between the two minimum temperatures tends to be reduced by 8°F.

The lowest temperature recorded at Colaba during the period of study was 58°F on 11 February 1950 when a cold wave was affecting Bombay. The corresponding minimum at Santaacruz was 55°F. The difference was thus only 3°F, in spite of clear skies when the greater probability was for the difference to exceed the average of 7°F. It would appear that on occasions when the stations come under the influence of a cold wave, constant flowing of colder air from land towards the coast prevents the comparatively less cooling over the sea surface having its full effect at Colaba. This process seems to be similar to the maximum temperatures at Colaba and Santaacruz tending to approach each other on occasions of heat wave. On 24 November 1951 when the sky was nearly overcast and the prevailing wind direction mainly NE, Santaacruz and Colaba recorded the same minimum temperature of 75°F. This appears to be an occasion when the decrease in radiative cooling on a cloudy night was having its maximum effect. Apart from the influence of cloudiness attempts to correlate abnormal

differences with wind direction have not been fruitful.

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REFERENCE

- Brunt, D. (1941). *Physical and Dynamical Meteorology*, p. 144.