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## A CONVECTIVE TURBULENCE THEORY OF THUNDERSTORMS—VERIFICATION OF

1. Ramalingam (1960) in his 'Convective Turbulence Theory of Thunderstorms' has suggested that the critical condition given by the expression—

$$(\log P_1 / P_0) / (\log \theta_0 / \theta_1)$$

should exceed the value 19 for thunderstorms to occur, where $P_0$ is the value of pressure in millibars at the ground and $P_1$ is the pressure at 500 or 600-mb level. $\theta_0$ and $\theta_1$ are the corresponding potential temperatures in degrees Absolute. According to the above theory, the breakdown in the equilibrium of the air, which is necessary for thunderstorm activity, should occur if the value of the above expression exceeds 19.

In order to confirm the validity of the above critical condition, an attempt has been made to study the occasions when Dum Dum airport experienced squalls (Nor'-westers) during the pre-monsoon season (April-May) of 1962.

2. The values of the critical number along with the other salient features are shown in Table 1. The values of the index have been calculated from the 00 and 12 GMT radiosonde ascents made at Dum Dum airport. As the surface pressure of Dum Dum during the above months is slightly more than 1000 mb, for the sake of uniformity the value of $P_0$ has been taken as 1000 mb. The values of the index have been calculated for $P_1$ corresponding to 600-mb and also for 500-mb levels. The values of $\theta_0$ and $\theta_1$ have been calculated from the actual values of temperature at the time of the radiosonde ascent. Maheshwari (1961) in his communication has calculated the value of the index $\theta_0$ corresponding to the maximum temperature attained and assumed that there should not be any appreciable change in the value of temperature at 500-mb level ($\theta_1$) since the morning radiosonde ascent. The above assumption does not seem to be valid, as can be seen from Table 1, because the values

**TABLE 1**

| Date 1962 | Time of occurrence of surface squall (IST) | Time of radiosonde ascent (GMT) | $(\log P_1/P_0) / (\log \theta_0/\theta_1)$ corresponding to $P_0=1000$ mb and | |
|---|---|---|---|---|
| | | | $P_1=500$ mb | $P_1=600$ mb |
| April | | | | |
| 1 | 2307 | 00 | 9·6 | 9·5 |
| | | 12 | 13·2 | 14·4 |
| 6 | 1935 | 00 | 7·1 | 9·2 |
| | | 12 | 16·0 | 15·8 |
| 11 | 1450 | 00 | 10·0 | 10·1 |
| | | 12 | 10·7 | 12·8 |
| 12 | 1720 | 00 | 9·3 | 8·9 |
| | | 12 | 10·7 | 12·3 |
| 15 | 1740 | 00 | 9·4 | 10·1 |
| | | 12 | 14·3 | 19·0 |
| 20 | 1620 | 02 | 10·0 | 13·0 |
| | | 12 | 10·2 | 9·0 |
| 22 | 1740 | 00 | 11·7 | 11·1 |
| | | 12 | 9·7 | 11·4 |
| 29 | 0900 | 00 | 10·5 | 10·4 |
| | | 12 | 7·4 | 7·1 |
| May | | | | |
| 2 | 1720 and 2000 | 00 | 11·0 | 8·6 |
| | | 12 | 8·2 | 9·1 |
| 4 | 2020 | 00 | 9·6 | 9·5 |
| | | 12 | 12·9 | 10·8 |
| 11 | 1810 | 00 | 9·7 | 11·7 |
| | | 12 | 9·3 | 10·0 |
| 26 | 1757 | 00 | 9·7 | 8·4 |
| | | 12 | 8·8 | 12·2 |

of temperature at $\theta_1$ level at 00 and 12 GMT ascents have been found to vary considerably. This point has, however, been stated by Maheshwari in the later part of his communication.

3. It can be seen from the table that on only one occasion (15 April 1962) out of 12 occasions under study, the value of the index came as high as 19. On all other occasions, the value is less than the critical number suggested by Ramalingam.

4. Examination of a few random cases of the remaining occasions during the premonsoon season (when there was no thunderstorm activity), has revealed that the value of the index is generally of the order of 10 to 12. Maheshwari, in his study for the northern Indian stations (*viz.*, New Delhi, Amritsar, Allahabad and Jodhpur) for the period March to June 1960 based on 00 GMT radiosonde ascents, has found that on about 26 per cent occasions the index exceeded 19 when actually thundery conditions/thunderstorms occurred, while on 59 per cent of the days in the premonsoon months the value of the index exceeded the critical value 19. But in our present case, the value of the index on the extreme cases when violent thunderstorm activity leading to surface squalls occurred, is generally much less than 19. It thus appears that the above convective theory fails to predict the occurrence of thunderstorms in the Gangetic valley of West Bengal. It is however worth mentioning that the ideal condition, *viz.*, a direct

vertical ascent of the radiosonde instrument, could not be attained at the time of the radiosonde ascents because the wind was not absolutely calm.

It is felt that if the above theory is suitably modified by giving due consideration to the humidity in the lower levels, it might prove to be useful.

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