551.553.21 : 551.515.4 (541.23)

DISCRIMINATION BETWEEN PRE-MONSOON THUNDERSTORM AND NON-THUNDERSTORM DAYS AT DUMDUM(CALCUTTA)

1. In recent times several works (Md. A.M. Choudhary *et al.* 1996, Ghosh *et al.* 1997 & Ghosh *et al.* 1998) has come out based on RS/RW data of Dumdum(Calcutta Airport) to identify the distinctive features of thunderstorm and non-thunderstorm days over Calcutta. But all these works are based on standard pressure level data. In the present work 50 hPa interval data have been utilized to examine the distinctive features. 0000 UTC RS/RW data of Dumdum from surface upto 500 hPa level have been utilized to evaluate three parameters namely, $(\theta_{es}-\theta_e)$, convective instability $(\partial\theta_e/\partial Z)$ and vertical shear $(\partial V/\partial Z)$ of resultant horizontal wind. Here θ_{es},θ_e and Z

TABLE 1

Confidence interval 90 % for the thermodynamic parameter ($\theta_{es}-\theta_e$) in °K at Dumdum (Calcutta)

Level (hPa)	Thunderstorm days	Non-thunderstorm days
1000-950	$6.59<\mu<9.82$	$7.36<\mu<9.82$
950-900	$13.08<\mu<20.14$	$17.20<\mu<24.77$
900-850	$21.26<\mu<29.04$	$24.30<\mu<31.30$
850-800	$25.49<\mu<31.83$	$26.02<\mu<31.54$
800-750	$23.86<\mu<28.60$	$22.60<\mu<26.92$
750-700	$19.25<\mu<23.11$	$18.69<\mu<21.95$
700-650	$14.97<\mu<17.87$	$15.11<\mu<17.69$
650-600	$9.66<\mu<12.12$	$10.36<\mu<12.72$
600-550	$6.91<\mu<9.35$	$6.50<\mu<08.88$
550-500	$2.17<\mu<5.55$	$5.88<\mu<11.52$

μ denotes mean value of the parameter

TABLE 2

Confidence interval 90 % for convective instability in °K/m at Dumdum (Calcutta)

Level (hPa)	Thunderstorm days	Non-thunderstorm days
1000-950	$-11.20\times10^{-3}<\mu<1.00\times10^{-3}$	$-12.45\times10^{-3}<\mu<-3.15\times10^{-3}$
950-900	$-15.00\times10^{-3}<\mu<-7.30\times10^{-3}$	$-10.42\times10^{-3}<\mu<-4.18\times10^{-3}$
900-850)	$-13.12\times10^{-3}<\mu<-5.38\times10^{-3}$	$-12.37\times10^{-3}<\mu<-7.27\times10^{-3}$
850-800	$-12.06\times10^{-3}<\mu<-5.64\times10^{-3}$	$-6.85\times10^{-3}<\mu<-1.91\times10^{-3}$
800-750)	$-5.17\times10^{-3}<\mu<-0.19\times10^{-3}$	$-6.92\times10^{-3}<\mu<-2.92\times10^{-3}$
750-700	$-36.6\times10^{-3}<\mu<-32.4\times10^{-3}$	$-19.71\times10^{-3}<\mu<-17.89\times10^{-3}$
700-650	$-1.43\times10^{-3}<\mu<0.23\times10^{-3}$	$-1.96\times10^{-3}<\mu<0.12\times10^{-3}$
650-600	$-14.5\times10^{-3}<\mu<-13.54\times10^{-3}$	$-2.61\times10^{-3}<\mu<0.73\times10^{-3}$
600-550	$-2.10\times10^{-3}<\mu<0.62\times10^{-3}$	$-3.64\times10^{-3}<\mu<0.78\times10^{-3}$
550-500	$2.44\times10^{-3}<\mu<10.66\times10^{-3}$	$0.53\times10^{-3}<\mu<2.15\times10^{-3}$

μ denotes mean value of the parameter

stand respectively for saturation equivalent potential temperature, equivalent potential temperature and vertical height in meters. Importance of these parameters in connection with thunderstorm development is already discussed in the literature (Betts, 1974) and the method of evaluation of θ_{es} and θ_e is already available (Bolton, 1980).

2. In this work 1985 and 1986 pre-monsoon days data for the month March, April and May are considered. During these two years 51 thunderstorm days are reported at Calcutta (Dumdum). Fair-weather (non-thunderstorm)

TABLE 3

Confidence interval 90 % for vertical shear in per sec at Dumdum (Calcutta)

Level (hPa)	Thunderstorm days	Non-thunderstorm days
1000-950	$1.95\times10^{-3}<\mu<3.85\times10^{-3}$	$2.40\times10^{-3}<\mu<4.38\times10^{-3}$
950-900	$-0.33\times10^{-3}<\mu<0.65\times10^{-3}$	$-0.22\times10^{-3}<\mu<0.96\times10^{-3}$
900-850	$-1.20\times10^{-3}<\mu<-0.24\times10^{-3}$	$-0.63\times10^{-3}<\mu<0.27\times10^{-3}$
850-800	$-0.03\times10^{-3}<\mu<1.25\times10^{-3}$	$-0.37\times10^{-3}<\mu<0.63\times10^{-3}$
800-750	$1.11\times10^{-3}<\mu<2.41\times10^{-3}$	$0.59\times10^{-3}<\mu<1.59\times10^{-3}$
750-700	$0.88\times10^{-3}<\mu<1.86\times10^{-3}$	$0.56\times10^{-3}<\mu<1.72\times10^{-3}$
700-650	$1.19\times10^{-3}<\mu<2.21\times10^{-3}$	$1.52\times10^{-3}<\mu<2.68\times10^{-3}$
650-600	$0.97\times10^{-3}<\mu<1.87\times10^{-3}$	$0.84\times10^{-3}<\mu<1.86\times10^{-3}$
600-550	$0.43\times10^{-3}<\mu<2.57\times10^{-3}$	$0.43\times10^{-3}<\mu<1.87\times10^{-3}$
550-500	$-1.50\times10^{-3}<\mu<0.52\times10^{-3}$	$-0.54\times10^{-3}<\mu<1.66\times10^{-3}$

μ denotes mean value of the parameter

days are considered only around thunderstorm days. In the present study 50 such non-thunderstorm days are taken into account. In the evaluation of convective instability or vertical shear, the difference between two consecutive 50 hPa level data is being evaluated and the corresponding value is attributed to the lower level. 90% Confidence Interval (C.I.) for each parameter and for each level upto 500 hPa is constructed using student-t-probability (Fischer, 1973) for 51 thunderstorm days and 50 non-thunderstorm days.

3. Tables 1, 2 and 3 present 90 % Confidence Interval for ($\theta_{es}-\theta_e$), convective instability and vertical shear of resultant horizontal wind for thunderstorm and non-thunderstorm days. It is obvious from Table 1 that ($\theta_{es}-\theta_e$) 90% C.I. value at 550 hPa level completely separates out for thunderstorm and non-thunderstorm days. On the other hand Table 2 shows that 90 % C.I. value for convective instability completely separates out for those two situations at three levels namely, 750 hPa, 650 hPa and 550 hPa levels. From Table 3, it is apparent that no such separation exists for vertical shear.

4. One can in general conclude that mid-tropospheric moisture level and above boundary layer to mid-tropospheric convective instability are important for thunderstorm or non-thunderstorm situations later in the day from morning RS/RW observations. However, to predict with 90 % confidence the possibility of thunderstorm development later in the day, observation of ($\theta_{es}-\theta_e$) at 550 hPa level, $\partial\theta/\partial Z$ at 750 hPa, 650 hPa and 550 hPa levels are significant. It seems in case of parameterization for thunderstorm and non-thunderstorm

days these layers with the corresponding parameters will play significant role.

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SEEMA SHARMA

Regional Meteorological Centre,
4, Duel Avenue, Alipore
Calcutta – 700 027, India

U.K.DE

Environmental Science Programme
Jadavpur University
Calcutta – 700 032, India

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