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Letters to the Editor

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THUNDERSTORM FORECASTING AT SRINAGAR AND ITS NEIGHBOURHOOD

1. The objective studies due Showalter's stability index, George's instability (K); Legg and Tillotson's height difference (δ) have been used as 'rough and ready' methods to predict thunderstorms over Srinagar and neighbourhood.

2. Data for this study are mainly confined to the aerological data for the months of April-September 1968, April-June 1969 and the available tephigrams of Srinagar for the months of April to September 1974. The data of Gulmarg for April-September 1974 have also been found very useful on many occasions.

3. Showalter's (1953) stability index is determined with the help of tephigrams. It is considered that a parcel of dry air is lifted from 800-mb level (Srinagar being a hill station) adiabatically to the level of saturation and then pseudo adiabatically up to 500-mb level. The temperatures obtained at 500-mb level is subtracted algebraically from the observed 500-mb temperature. The resultant negative value indicates instability while positive value shows stability of air at that time.

George's K value depends on the following factors :

(*i*) Lapse rate in the lower atmosphere, (*ii*) Moisture content in the lower layers, (*iii*) Vertical extent of the moist layer, (*iv*) Low level convergence and (*v*) Upper air divergence. An empirical relation, suggested by George (1960) to calculate K value is expressed as follows —

K = (800 mb temp. — 500 mb temp.) + (800 mb dew point) — (700 mb dew point depression).

Legg (1948) and Tillotson (1951) developed a useful relationship between millibaric height difference (δ) of the convective condensation level and freezing level to thunderstorm activity.

4. Showalter's stability index values are given in Table 1 and as judged from the tabulated data, the probability of occurrence of thunderstorm varies inversely to the Stability Index (S. I.) value. The

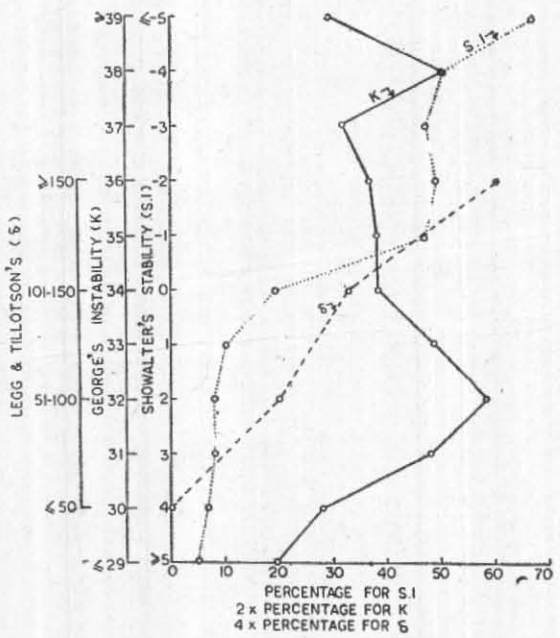

Fig. 1. The percentage of occurrence of probability of thunderstorms at Srinagar using different parameters

total number of 767 cases have been arranged into separate rows as the cases of 00 and 1200 GMT radiosonde ascents. On examining the *Monthly Meteorological Registers* of Srinagar and Gulmarg of the required period, the number of thunderstorms which occurred during next 12-15 hours have been considered in accordance to their occurrence of time and date.

From Table 1 the value of S. I. is found to be $\leqslant$—5 on 6 occasions out of 9 cases of occurrence of thunderstorm and the highest value of probability is found to be 67 per cent. On the other hand 9 occasions of thunderstorms were found, out of 362 cases, when the stability index value as $\geqslant$+5 which reveals the lowest value of probability of occurrence of thunderstorm.

It will be seen from Table 2 that the highest probability (29 per cent) of occurrence of thunderstorm falls under the K value of 32. The K value of 29 leads to greater certainty of non-occurrence of thunderstorm. Theoretically, as K value increases, the chance of occurrence of thunderstorm must increase but it is not so in practice as is evident from Fig. 1 which depicts two maxima.

TABLE 1

Showalter's Stability Index (S.I.)

	Showalter's Stability Index											Total
	⩽−5	−4	−3	−2	−1	0	+1	+2	+3	+4	⩾+5	
No. of occasions	9	12	17	33	60	43	61	77	51	42	362	767
(a)	2	7	9	20	38	29	45	49	26	21	123	369
(b)	7	5	8	13	22	14	16	28	25	21	239	398
No. of thunderstorms	6	6	8	16	28	8	6	6	4	3	9	100
(a)	0	2	1	5	8	1	1	4	2	0	3	27
(b)	6	4	7	11	20	7	5	2	2	3	6	73
Percentage	67	56	47	49	47	19	10	8	8	7	2	
(a)	0	29	11	25	21	3	2	8	7	0	2	
(b)	86	80	87	85	91	50	31	7	8	21	2	

NOTE — Figures against (a) and (b) correspond to 00 GMT and 12 GMT ascents

TABLE 2

George's Instability value *K*

	K Instability Index										Total
	⩽29	30	31	32	33	34	35	36	37	38 ⩾39	
No. of occasions	396	35	46	45	37	41	12	22	36	24 50	753
(a)	209	15	28	14	14	14	9	11	16	5 20	355
(b)	187	20	18	31	23	27	12	11	20	19 30	398
No. of thunderstorms	29	5	11	13	9	8	4	4	6	6 5	100
(a)	8	1	4	1	2	1	0	1	2	1 0	21
(b)	21	4	7	12	7	7	4	3	4	5 5	79
Percentage	7	14	24	29	24	19	19	18	16	25 10	
(a)	4	7	14	7	14	7	0	9	13	20 0	
(b)	11	20	39	39	30	30	33	27	20	26 17	

NOTE — Figures against (a) and (b) correspond to 00 GMT and 12 GMT ascents

TABLE 3

Relationship of difference of height of convection condensation level (CCL) and freezing level (FL) to frequency of occurrence of thunderstorms at Srinagar

	Class intervals of (CCL—FL) in mb				Total
	⩽50	51—100	101—150	⩾151	
No. of occurrences	19	66	83	614	782
(a)	15	57	46	253	371
(b)	4	9	37	361	411
No. of thunderstorms	0	3	7	90	100
(a)	0	3	3	15	21
(b)	0	0	4	75	79
Percentage	0	5	8	15	
(a)	0	5	7	6	
(b)	0	0	11	21	

NOTE — Figures against (a) and (b) correspond to 00 GMT and 12 GMT ascents

TABLE 4

Relationship between compound probable frequencies to S.I. & K values

S.I. =	−5	−4	−3	−2	−1	0	+1	+2	+3	+4	+5
K =	32	31	33	34	35	36	37	38	⩾39	30	⩽29
Compound probable frequencies	95	60	55	45	45	15	10	5	5	5	1

A few values of K which do not fit in may be due to the absence of favourable conditions of instability in the atmosphere at that time.

Examination of Table 3 shows the relationship between the millibaric height difference of convective condensation level (CCL) and freezing level (FL) to the frequency of occurrence of thunderstorm. This method was developed by Legg (1948) and Tillotson (1951). The present study corroborates their findings that when the difference between CCL and FL is greater, the chances of occurrence of thunderstorms are more.

The values of the compound probabilities have been shown in Table 4 after computing them by taking the values of S. I. and K simultaneously. The values of these two parameters have been plotted in the base and five times the compound-probability percentage depicted in three dimensional diagram in Fig. 2.

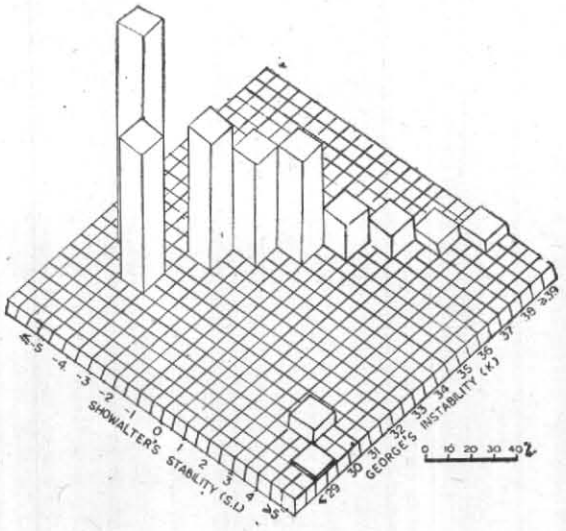

Fig. 2. Three dimensional diagram giving compound probability percentage of thunderstorms at Srinagar. Vertical axes : the heights of the parallelopiped are the functions of heights.

5. It is very clear from the Tables 1, 2 and 3 that the occurrence of thunderstorms mostly takes place in the afternoon or in the early part of night at Srinagar and its neighbourhood.

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H. C. ARYA
M. N. JATAV

Meteorological Centre, Srinagar
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