

Stability Index and Thunderstorm forecasting at Delhi

N. SESHADRI

Meteorological Office, New Delhi

(Received 23 January 1961)

1. Introduction

There has always been a great need for a simple method which can provide a quick check on the possibility of a thunderstorm—one of the greatest hazards to aviation. As an aid to forecasting of thunderstorms many predictors have been indicated. The stability index formulated by Showalter (1953) is one among them; some of the other predictors are the mean of relative humidities at standard pressure levels between 850 and 500 mb, and the Gardner-Scherhag instability index.

2. Study

In this paper the importance of the two predictors, namely, the Showalter's index and the mean of R. H. at pressure levels between 850 and 500 mb with respect to the thunderstorms at Delhi has been examined with the help of tephigrams of Delhi for March to May, 1958 and 1959. The conclusions drawn are then applied to the thunderstorm days of the same season, March to May during 1960, to test their utility.

The stability index and corresponding mean R.H. on each day for both 00 and 12 GMT radiosonde soundings have been plotted in Figs. 1 and 2 respectively. From the monthly meteorological registers the cases of thunderstorm occurrences at and after the time of the soundings and those of non-occurrences have been separated.

3. Results

From Fig. 1 (March to May 1959) and Fig. 2 (March to May 1958) it is seen that there had been only two thunderstorm occurrences out of a total number of 115 cases in Fig. 1 and 3 occurrences out of a total of 117 cases in Fig. 2, in the region of positive stability index. The mean percentage of occurrence of thunderstorms for this region is 7 per cent, which means that this is mainly a preferred region of non-occurrences. Even these very few occurrences had been confined to the region where the stability index is $< +2$ and M.R.H. 30 per cent. In the region of the negative stability index, the thunderstorm occurrences had been mainly confined to the area, where $S.I. \leq -1$ and $M.R.H. \geq 30$ per cent (A in Figs. 1 and 2). The mean percentage of occurrence of thunderstorms in this region being 56, it indicates that this is a preferred region for such occurrence. Further examination of this region in Figs. 1 and 2 reveals that when $S.I. \leq -4$ and $M.R.H. \geq 45$ per cent the average percentage of occurrence was 78.1 which shows that the limiting values of the predictors in this region are very significant.

Even in the region where S.I. is negative, mainly there had been no occurrences where the M.R.H. was 20 per cent. On the days when S.I. is greater than $+4$ or more, there had been no thunderstorm irrespective of the M.R.H. value and in the S.I.

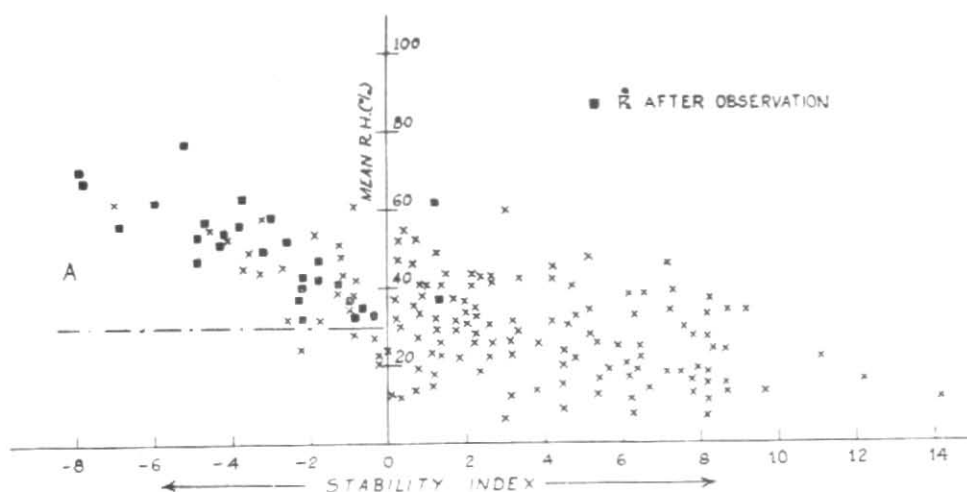


Fig. 1. New Delhi, 0000 Z, March to May 1959

TABLE 1
1200 GMT Ascent

Stability Index	Mean Relative Humidity (%)	Total No. of occasions	No. of occurrences	Percentage	Total No. of occasions	No. of occurrences	Percentage	Weighted percentage
-4 to -8	45	14	10	71.4	5	4	80	78.1
	30-45	Nil	Nil	..	4	1	25	25
	30	Nil	Nil	..	3	Nil	..	..
0 to -4	45	15	6	40	9	6	66.7	53.4
	30-45	17	10	60	17	8	47.0	54.2
	30	6	Nil	..	13	Nil	Nil	Nil
0 to +4	45	8	1	12.5	3	Nil	..	12.5
	30-45	26	1	3.8	29	3	10.4	8.75
	30	26	Nil	..	29	Nil	..	..
+4 to +8 or more	45	2	Nil	..	1	Nil	..	..
	30-45	16	Nil	..	9	Nil	..	..
	30	39	Nil	..	46	Nil	..	..
Total		169			168			

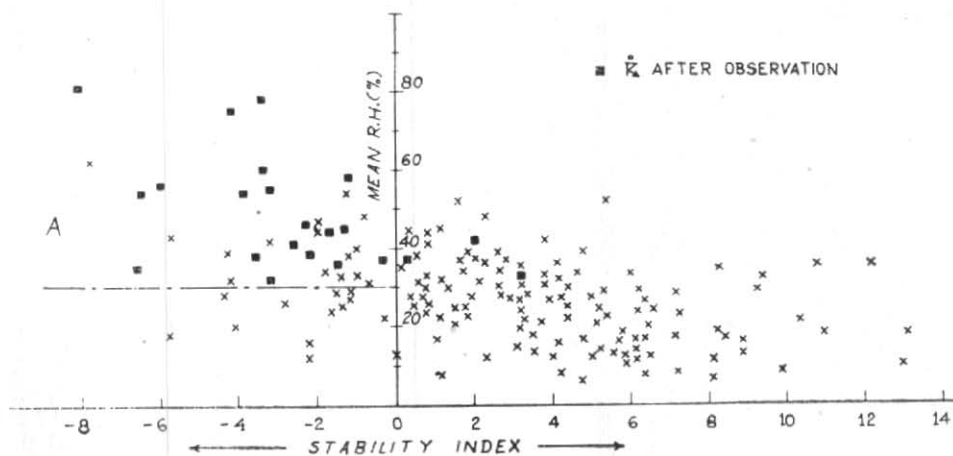


Fig. 2. New Delhi, 1200 Z, March to May 1958

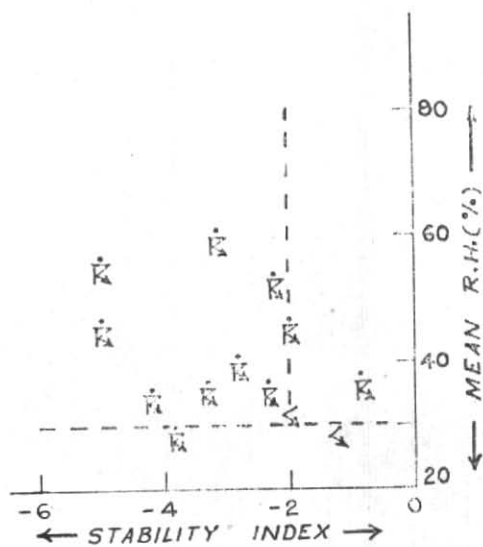


Fig. 3. New Delhi, March to May 1960

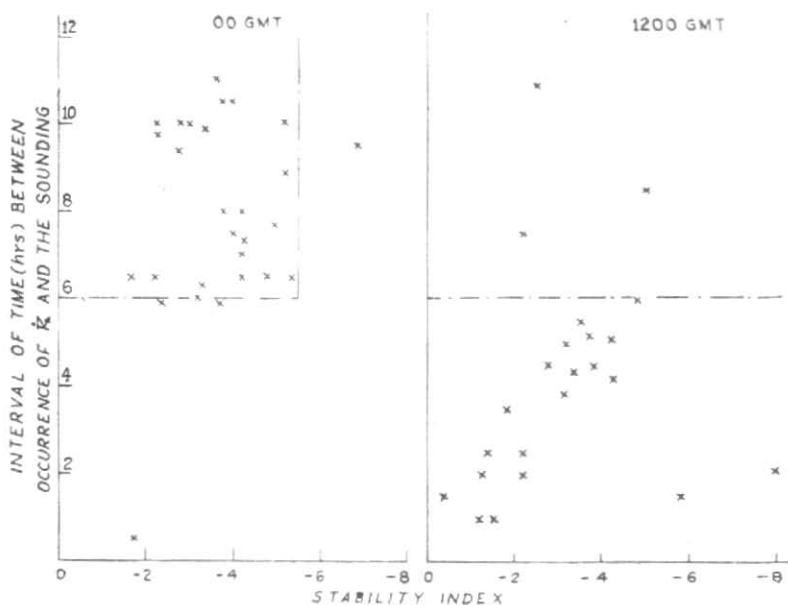


Fig. 4. New Delhi, March to May 1958, 1959

region 0 to +4 mainly there had been no occurrence when M.R.H. was < 30 per cent.

The detailed analysis for the various regions in Figs. 1 and 2 with weighted mean percentage of occurrences are given in Table 1. Fig. 3 represents the S.I. against M.R.H. on the thunderstorm days in 1960 during the same period. The occurrences had been confined only to a region with the S.I. ≤ -2 and M.R.H. ≥ 30 per cent. Out of a total of 13 cases of thunderstorm, 9 occurrences had been in this region. This agrees with the earlier conclusions.

Fig. 4 shows the distribution of S.I. vs the interval of time between the occurrence

of thunderstorm and the sounding separately plotted for 00 and 12 GMT. It is seen from this figure that the occurrence of thunderstorm had been mostly between 6 and 10 hours after the 00 GMT soundings, whereas in the case of 12 GMT soundings the occurrences had been mostly between 2 to 6 hours after the observation. This gives a clue for day to day work in thunderstorm forecasting of Delhi, namely, that on occasions whenever negative stability index and favourable R.H. conditions are evidenced in either the 00 or 12 GMT soundings, thunderstorm can be reasonably expected to occur between 6 to 10 hours after the ascent in the case of 00 GMT sounding and within 6 hours after the ascent in the case of 12 GMT sounding.

REFERENCE

Showalter, A. K.

1953 *Bull. Amer. met. Soc.*, 34, 6, p. 250.