SHORTER CONTRIBUTIONS

A PRELIMINARY REPORT ON AN OBJECTIVE METHOD OF FORECASTING MINIMUM CONDITIONS AT LEIGH CREEK, SOUTH AUSTRALIA

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(Manuscript received 9th December, 1954)

1. INTRODUCTION

Terminal forecasting for Leigh Creek presents considerable difficulty because circumstances denying the operational use of the airfield are not solely related to meteorological phenomena, but are strongly affected by the uncontrolled burning of tailings at nearby coal dumps. The contribution due to the combustion products of the tailings is a variable factor, at least when combustion is spontaneous, is impossible to anticipate.

Investigations suggest that the problem of terminal forecasting may be resolved into:

(a) a separation of the occasions of sub-minimum conditions due to the products of combustion,

(b) a generalised correlation between the presence or absence of burning, as such, and the deterioration of ceiling and/or visibility, and

(c) the forecasting of low stratus.

This preliminary report is concerned with the meteorological aspects of the terminal forecasting problem, and because a rather similar difficulty exists at Woomera and because the required data for the investigation are available only from that station, a method has been developed using Woomera observations. Pilot balloon observations at 1600Z, and surface data (temperatures and dew points) for 1700Z have been used to forecast the 2300Z cloud and visibility. The hour 2300Z has been chosen since it is the nearest synoptic hour to 0735 C.S.T. (i.e. 2205Z), the scheduled time of landing of the northbound aircraft through Leigh Creek.

2. METHOD OF INVESTIGATION

The minimum conditions for day landings at Leigh Creek has been adopted, namely, more than 4/8ths cloud, base 700 feet or less, and/or visibility 2 miles or less, and the orthodox technique of successive scattergram analyses used.

For the first analysis the parameters taken were 3,000 feet wind direction and speed, the procedure being to plot against the end point of each wind vector (i.e. 1700Z value) the cloud and visibility conditions prevailing at 2300Z, i.e. whether above or below the minimum level specified above.

In the second analysis the parameters chosen were air temperature against dew point depression - again the plot being of 2300Z cloud and visibility conditions against 1700Z temperature values.

3. RESULTS

When the first analysis, i.e. the 3,000 feet wind hodograph scatter diagram was completed, it was found possible to sub-divide it into three areas, A, B and C, area A containing the greatest concentration of occurrences of sub-minimum conditions, a lesser concentration in area B, whilst area C was almost free. This is illustrated in figure 1. The allocation of the occurrences and non-occurrences for the period 1950-1954 (April to September) - 854 observations - was as follows:

Area	Occurrence	Non-occurrence	Total
A	17	110	127
B	5	47	52
C	10	665	675
	32	822	854

This result shows the effect of taking into consideration air mass source, general stability or instability of the air mass as roughly indicated by speed and direction at 3,000 feet.

The second process takes into account temperature and dew point depression, and enables sub-division of the observations in area A into areas D and E, those of B into F and G and those of C into H and I with results as below, and illustrated in figures 2, 3 and 4.

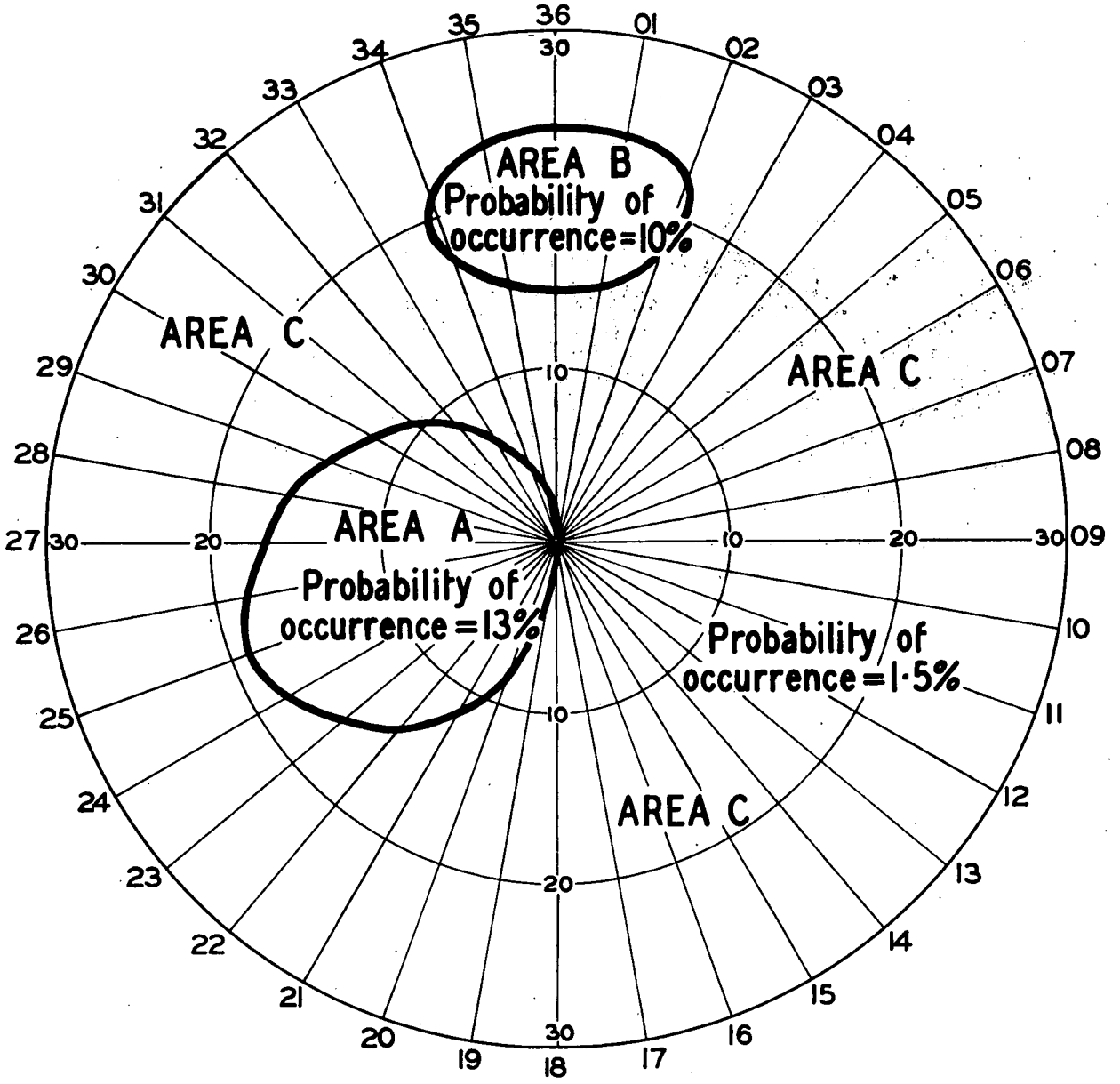


FIGURE 1. Indicating the probability of the occurrence of sub-minimum conditions at 2300Z in relation to the 3000ft. wind vector at 1600Z.

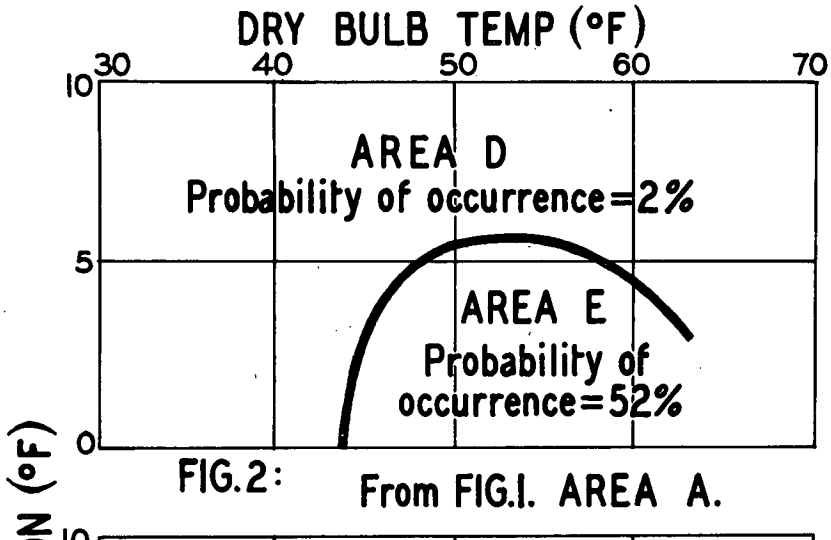


FIG. 2: From FIG. I. AREA A.

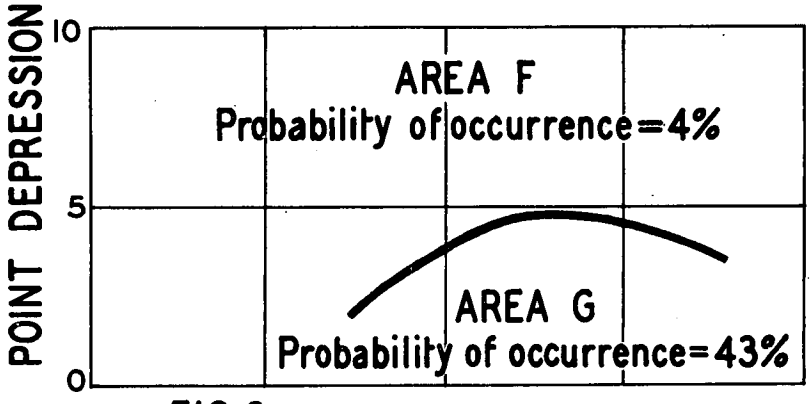


FIG. 3: From FIG. I. AREA B.

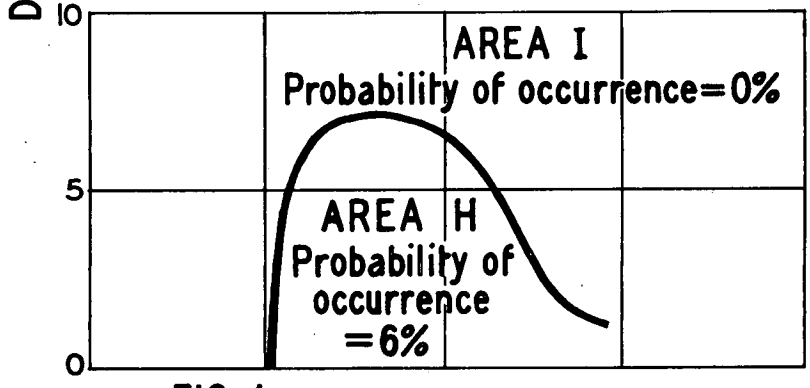
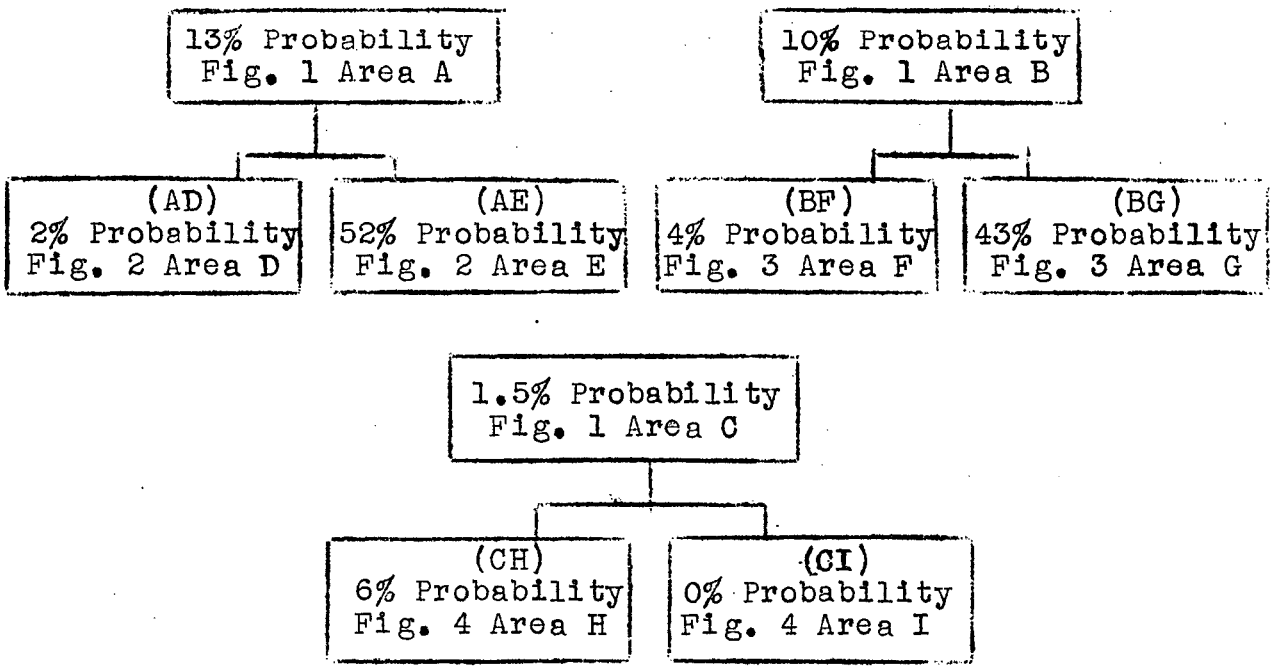


FIG. 4: From FIG. I. AREA C.

FIGURES 2-4. Indicating the results obtained by plotting the observations in the separate areas of FIG. I. according to the dry bulb and dew point depression observed at 1700 Z.

Area	Occurrence	Non-Occurrence	Total	
D	2	96	98	127
E	15	14	29	
F	2	43	45	52
G	3	4	7	
H	10	162	172	675
I	0	503	503	

These results may be represented thus -



It is apparent that only those observations which fall into the classification (AE) 52% Probability or (BG) 43% would result in a positive forecast.

It should be noted that if the 3,000 ft. wind is calm the plot is considered to fall into area C.

The method has been checked with good results on past records at Leigh Creek by using Woomera 1600Z upper wind and 1700Z and 2000Z temperatures for 2000Z and 2300Z forecasts respectively.

4. CONCLUSIONS

Four diagrams have been prepared (figures 1 to 4) from which it is possible to assess the probability of cloud and visibility conditions falling below the minimum acceptable for aircraft landings by day at Leigh Creek Airport.

The predictors used are the 3000 feet wind direction and speed as observed at 1600Z and the surface temperature and dew point as observed at 1700Z. From these a positive forecast, i.e. that cloud and visibility condition will be below the acceptable minimum at 2300Z can be made when the 1600Z 3000 feet wind vector falls in Area A of figure 1, and the 1700Z dry bulb temperature when plotted against the dew point depression falls in Area E of figure 2; and again when the 1600Z 3000 feet wind vector falls in Area B of figure 1 and the 1700Z dry bulb temperature versus dew point depression plot falls in Area G of figure 3.