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FORECASTING BLOWING DUST AT GEORGE AFB, CALIFORNIA

BY

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March 1963

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1. PURPOSE. To forecast the occurrence of Blowing Dust at George AFB, assuring a two hour lead time.

2. GENERAL. The main factors in causing Blowing Dust at George AFB are the combination of steady wind speed and gusts, with steady wind speed as the main factor. When the steady wind speed reaches its critical value the loose dust lying on the desert floor will be lifted to a height sufficient to restrict the visibility. These values are, 17 knots for a Northerly wind, 26 knots for a Southerly wind, and 25 knots for a Westerly wind. The critical value increases to 30 knots during the months April through September for a Southerly wind, and from June through September for a Westerly wind. This is a result of the "baking action" of the desert floor by the sun and the increase in desert foliage. Gusts alone without a sufficiently strong steady wind, will only lift the dust a few feet above the ground, it will then settle on the lee side of the brush. After the dust has been lifted by the steady wind the gusts lift larger quantities of dust into the atmosphere and force it to greater heights. The principal source regions for Blowing Dust are; the area in the vicinity of the mouth of Cajon Pass (to the South), the dry lake beds and mesa between George AFB and Palmdale (to the West), and the Mojave River Valley (to the North). The main difficulty in forecasting Blowing Dust at George AFB is whether the main body of dust will be carried through George AFB or on the outer perimeters. With a South wind, the air is funnelled through Cajon Pass and "fanned out" over the desert, while the center of the stream moves Northward through Apple Valley. The predominate dust layer travels with the main stream, with George AFB lying on the outer fringes. Blowing Dust is not a problem during the summer months with a South wind, except when associated with Thunderstorms.

3. PARAMETERS:

- a. Steady wind speed.
- b. Peak gust.
- c. Wind direction.
- d. Number of days since precipitation last occurred.

4. EXCEPTIONS:

- a. Blowing Dust will not occur for four consecutive days following an occurrence of dust, except when there is a significant change in the wind direction.
- b. Precipitation for five consecutive hours or a sufficient amount to cause runoff in the last 14 days will eliminate the possibility of Blowing Dust for steady winds less than 30 knots.

5. PROCEDURES:

- a. Southerly wind (140°-180° Magnetic).
 - (1) If plot falls in area A, forecast 2 miles visibility temporarily $\frac{1}{4}$ mile.
 - (2) If plot falls in area B, forecast 5 miles visibility temporarily 3 miles.

(3) If plot falls in area D, forecast 5 miles visibility or more.

b. Westerly wind (230°-280° Magnetic).

(1) If plot falls in area A, forecast 1 mile visibility temporarily $\frac{1}{4}$ mile.

(a) If precipitation has fallen in last seven days forecast minimum visibility 2 miles.

(2) If plot falls in area B, forecast 3 miles visibility temporarily $\frac{1}{2}$ mile.

(a) For speeds 28-30 knots forecast 2 miles visibility temporarily $\frac{1}{4}$ mile if peak gusts will be 40 knots or more.

(3) If plot falls in area D, forecast 5 miles visibility or more.

c. Northerly wind (320°-030° Magnetic).

(1) If plot falls in area A, forecast 3 miles visibility temporarily $\frac{1}{4}$ mile.

(2) If plot falls in area B, forecast 3 miles visibility temporarily $\frac{1}{2}$ mile.

(3) If plot falls in area C, forecast 5 miles visibility temporarily 3 miles.

(4) If plot falls in area D, forecast 5 miles visibility or more.

d. Easterly winds (050-110° Magnetic). Blowing Dust does not occur when the wind direction is from East Northeast through Southeast.

e. Timing:

(1) Blowing Dust with a Northerly wind has mean duration of 40 minutes.

(2) Blowing Dust with a Westerly wind usually lasts 2 to 3 hours. The dust starts rising between 1200 and 1500L and settles by 2000L in most cases (see Atch 4). A few cases have been observed during the morning hours.

(3) Blowing Dust with a Southerly wind has no distinct starting period, but generally lasts one hour or less, and ends by 1600L (see Atch 4). Isolated cases have occurred late at night (2300-0300L).

(4) Minimum visibility occurs at the time of the maximum gust with an average duration of 15 minutes. The visibility will then begin to improve, becoming 7 miles or more within 1 to 2 hours.

6. SKILL SCORES. The dependent data was collected from the years 1958 through 1961, the test years from 1 January 62 to 3 March 63. All cases of 30 knot gusts or greater were used in this study, and any occurrence of Blowing Dust was also used. When the visibility was restricted by a combination of Haze and Blowing Dust I considered these cases not applicable, as it is not known which was the reducing factor, all cases occurred with relatively light

winds. In computing the skill score if the prevailing visibility was 7 miles or more, but the visibility in one or more quadrants was restricted to the value for that area, I counted that case as a hit. This was done because of the funneling effect of the terrain and because the point of observation has been in three separate locations in the last three years. If the point falls in area B with a steady Westerly wind of 28 to 30 knots, and the gust is 40 knots or greater the minimum visibility will be less than $\frac{1}{2}$ mile. This is not statistically significant due to the lack of occurrences. The same is true for Blowing Dust when associated with a Northerly wind. The following contingency tables show the results of both dependent and test years.

a. Forecasting the occurrence of Blowing Dust restricting the visibility to less than 5 miles (see Attachment #3).

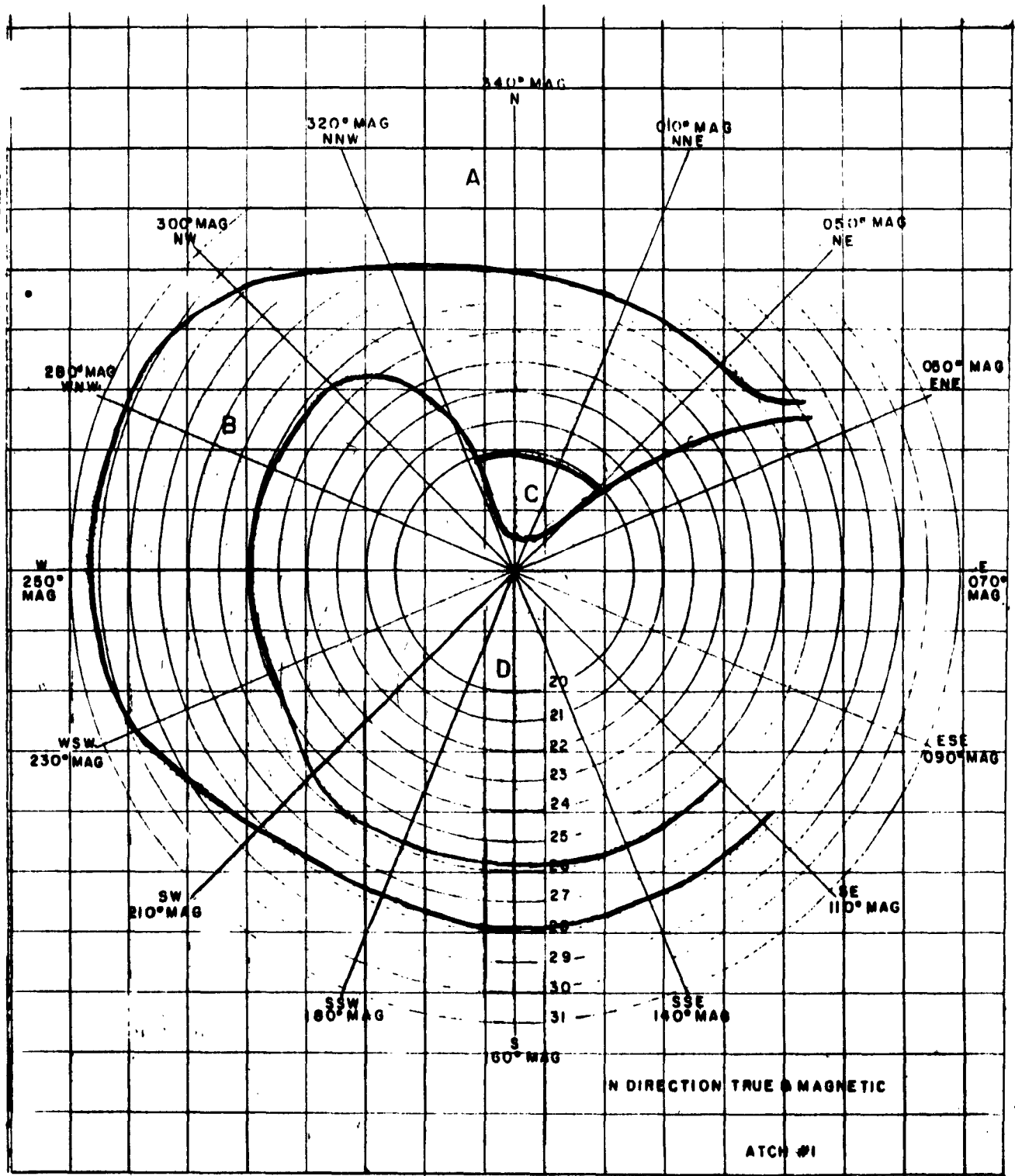
b. Forecasting the occurrence of Blowing Dust restricting the visibility in increments that are operationally significant (see Attachment #2-3).

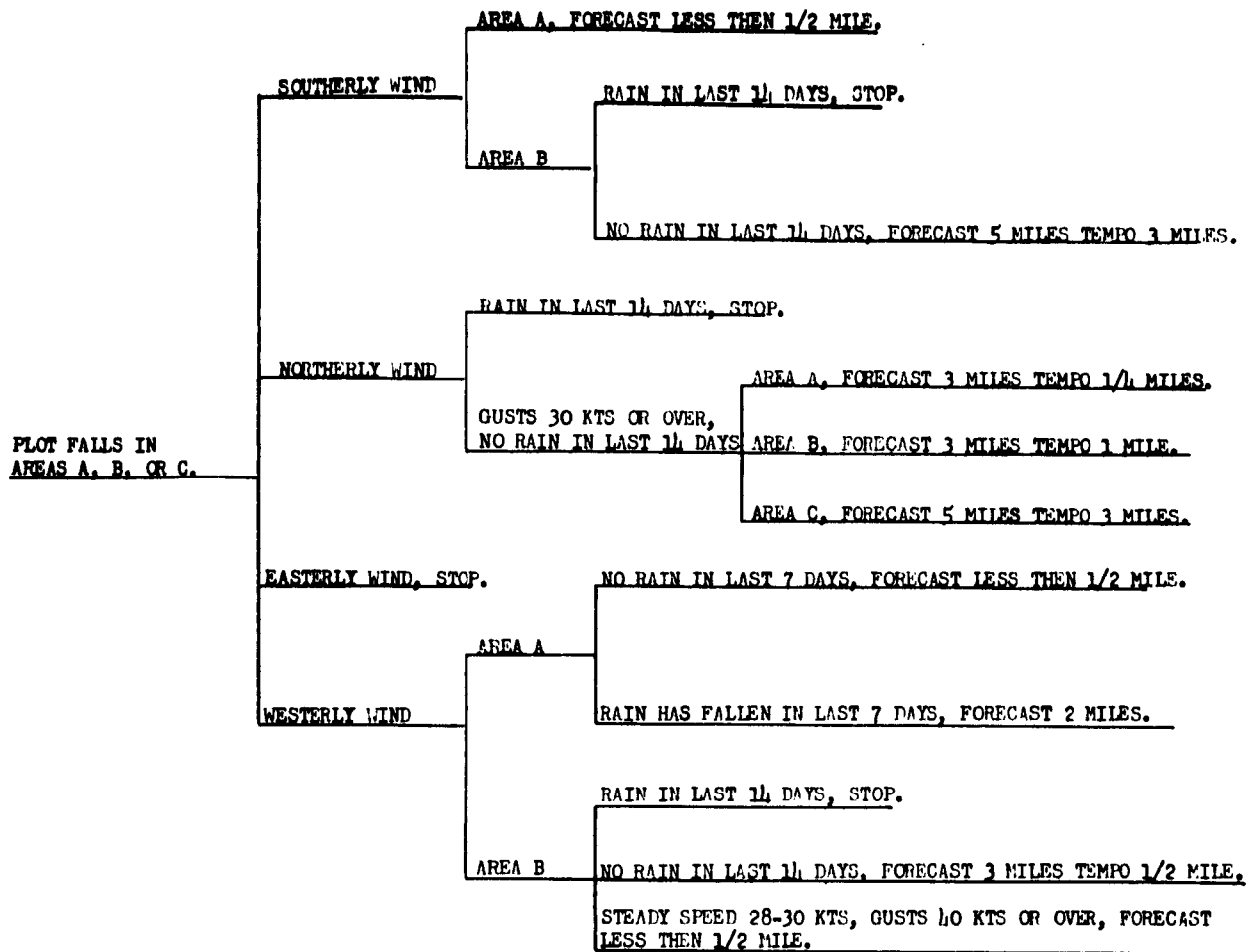
7. CONCLUSION. The main limitation in using this study for forecasting Blowing Dust is the accurate forecast of the steady wind speed. Forecasting of the wind direction is not considered a problem. Generally the wind direction for a Blowing Dust producing system is established by 1000L except for a Westerly wind for which it is usually established by 0800L. Blowing Dust when associated with a Thunderstorm was not considered in this study. A separate study should be constructed for this phenomenon, using different predictors. The few Blowing Dust occurrences associated with a Thunderstorm which we have on record indicate a correlation between the intensity of the Thunderstorm, the direction of its movement, and the occurrence of Blowing Dust.

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5 Atch.

1. Scatter Diagram
2. Flow Chart
3. Contingency Tables
4. Start-End Table
5. Area Map





CONTINGENCY TABLES

1. TEST YEAR, JAN 62-MAR 63.
FCST VSBY LESS THEN 5 MILES.
SKILL SCORE= .86

		FORECAST		TOTAL
		YES	NO	
OBSERVED	YES	7	2	9
	NO	0	66	66
TOTAL		7	68	75

2. TEST YEAR, JAN 62-MAR 63.
FCST VSBY BY INCREMENTS.
SKILL SCORE= .81

		FORECAST			TOTAL
		< 1/2	3 T. 1/2	≥ 5	
OBSERVED	< 1/2	4	0	0	4
	3 T. 1/2	1	3	2	6
OBSERVED	≥ 5	0	0	65	65
	TOTAL	5	3	67	75

		FORECAST			TOTAL
		< 1/2	3 T. 1/2	≥ 5	
OBSERVED	< 1/2	3	0	1	4
	3 T. 1/2	1	15	3	19
OBSERVED	≥ 5	0	1	156	157
	TOTAL	4	16	160	180

3. DEPENDENT YEARS JAN 58-DEC 61.
FCST VSBY BY INCREMENTS.
SKILL SCORE= .846

BLOWING DUST START AND END TIMES BY OCCURRENCE
(1 JAN 1958-3 MAR 1963)

SOUTHERLY WIND (110-180 DEGREES MAGNETIC)

HOUR	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-00
START				8	5	2,9	3	6	1	4,7							
END					8	5	2,9	3,6		1,4	7						

WESTERLY WIND (230-280 DEGREES MAGNETIC)

HOUR	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-00
START					9	10,18,22	12,14	1,5,6 27	4,7,8 14,20 23,24,26	15,17,21	19,16,26		3,25	2			28,29
END							18	1	4,7,11 14,20 22	9,12,19	8,23,27	13,21	3	14,17,24	2,5,10 16		4,5,25 28,29

ATCH # 4

A: SOURCE REGION SOUTH
B: SOURCE REGION WEST
C: SOURCE REGION NORTH
/ : SOUTHERLY WIND FLOW

