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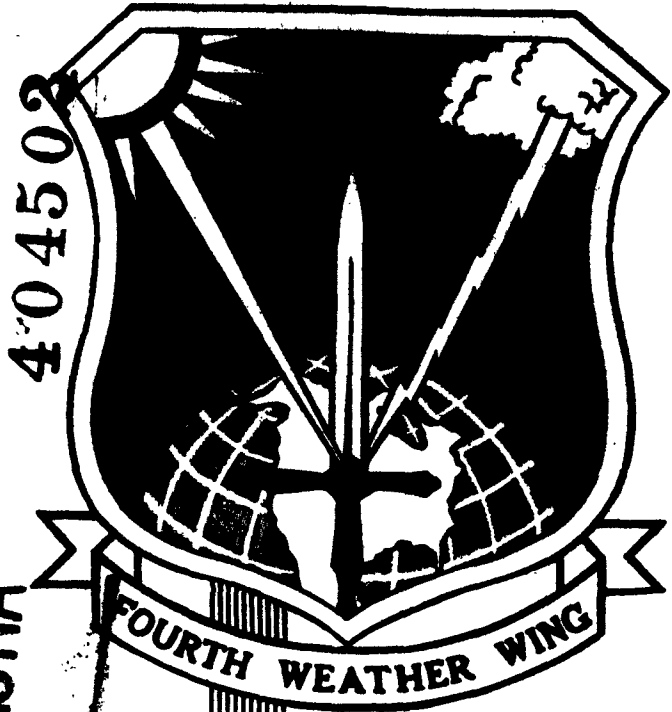
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Technical Paper 63-5  
 AN OBJECTIVE AID FOR FORECASTING  
 STRONG AND GUSTY SURFACE WINDS



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AN OBJECTIVE AID FOR FORECASTING  
STRONG AND GUSTY SURFACE WINDS

at

Grand Forks AFB, N. Dakota

May 1963

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## INTRODUCTION

Forecasting the occurrence of operationally critical values of strong surface winds with accompanying gusts presents a major problem at Grand Forks AFB, N. Dakota. This investigation was conducted to develop an objective aid for forecasting such critical values.

## THE PROBLEM

The problem concerns the forecasting of strong surface winds with gusts equal to or greater than 30 knots during the months of October through April. These winds are broken down into two categories - Those with a northerly component, i.e., those from the WNW clockwise thru N to ENE inclusive, and those with a southerly component, i.e., those from the ESE clockwise thru S to WSW inclusive. Very few strong winds occur from either due W or due E and if so, they are taken care of by either one of the procedures which follow. One of the major problems that presents itself during these strong winds is the reduced visibilities caused by blowing snow and dust (see comments).

1. Observation times from which forecasts are made: 0600 LST, 1200 LST, 1800 LST, and 2400 LST.

2. Valid time of forecast: 2 to 6 hours following each forecast.

## PERIOD OF DATA AND ANALYSIS CONDUCTED

The data sample used in this study included the months October through April, 1956 through 1960. The criteria to be met and the attached diagrams are self-explanatory and their use is discussed under "Procedure."

## EVALUATION OF THE SYSTEM

Thirteen randomly chosen months were set aside for use as an independent sample. The following contingency tables show the performance of the technique as measured on both the dependent and independent data:

Dependent data - (winds with northerly components)

		<u>FORECAST</u>		
		Occurrences	Nonoccurrences	Total
Observed	Occurrences	101	16	117
	Nonoccurrences	16	955	971
	TOTAL	117	971	1088
Skill Score	.88			
Percent	97			

Dependent data - (winds with southerly components)

		<u>FORECAST</u>		
		Occurrences	Nonoccurrences	Total
	Occurrences	40	10	50
Observed	Nonoccurrences	1	1013	1014
	TOTAL	41	1023	1064
Skill Score	.87			
Percent Correct	99			

Independent data - (winds with southerly components)

		27	7	34
		8	738	746
		35	745	780
Skill Score	.77			
Percent Correct	98			

COMMENTS

1. In addition to the danger to aircraft due to strong and gusty surface winds, there is the additional problem of low visibilities that often occurs as a result of these strong winds. It behooves the forecaster to know the condition of the surrounding terrain in order to determine whether blowing snow or blowing dust will be a significant part of his forecast.

2. For winds with northerly components, approximately 60 cases out of a total of 214 produced reduced visibilities due to blowing snow or blowing dust. For winds with southerly components, approximately 20 cases out of 80 produced similar conditions.

3. In order to prepare properly an objective method of this type, it is necessary to work with an exact statement of the problem. This must contain definitely established meteorological and time limits. However, the final product is not so sensitive that it will always cut on and off exactly within the limits specified. We observed on several occasions that the method gave "near misses" which were sufficiently close to be of value to the operational forecast. Information, other than that evidenced by a

statistical verification, can be obtained through the forecaster's interpretation of the results of this type of study; i.e., it is recommended that the main role of this objective aid be that of a guide and that it be modified by the forecaster in those cases where he has information other than that used by the technique.

FORECAST CHECKLIST

Date \_\_\_\_\_

Data Required

- (a) GFA (Malmstrom) sea level pressure \_\_\_\_\_
- (b) GFK (Grand Forks) sea level pressure \_\_\_\_\_
- (c) FSD (Sioux Falls) sea level pressure \_\_\_\_\_
- (d) MOT (Minot) sea level pressure \_\_\_\_\_
- (e) WG (Winnipeg) sea level pressure \_\_\_\_\_
- (f) (GFA - GFK) pp \_\_\_\_\_
- (g) (FSD - GFA) pp \_\_\_\_\_
- (h) (MOT - GFK) pp \_\_\_\_\_
- (i) (GFK - MOT) pp \_\_\_\_\_
- (j) (FSD - WG ) pp \_\_\_\_\_

Procedure for winds from WNW clockwise thru ENE

The steps in the following procedures are sequential and must be followed in the order listed.

Step No.

- 1. If (GFA -GFK) pp  $\geq$  0.0 mbs, forecast "no" and stop \_\_\_\_\_
- 2. If (FSD - GFA) pp  $\geq$  0.0 mbs, forecast "no" and stop \_\_\_\_\_
- 3. If (GFA - GFK)  $>$  + 18.5 mbs, forecast "yes" and stop \_\_\_\_\_
- 4. If (MOT - GFK)  $>$  + 5.0 mbs forecast "yes" and stop \_\_\_\_\_
- 5. If (MDT - GFK)  $\geq$  + 2.5 mbs forecast "no" and stop \_\_\_\_\_
- 6. If none of the above criteria are satisfied, use Diagram I. If case falls in areas marked "A", forecast "yes" and if in areas marked "B", forecast "no" \_\_\_\_\_

Procedure for winds from ESE clockwise thru WSW

Step No.

1. If (GFA - GFK)  $pp \gg + 4.0$  mb, forecast "no" and stop \_\_\_\_\_

2. If (FSD - GFA)  $pp \gg + 7.0$  mb, forecast "no" and stop \_\_\_\_\_

3. If (GFK - MDT)  $pp \ll + 5.0$  mb, forecast "no" and stop \_\_\_\_\_

4. If none of the above criteria are satisfied, use Diagram II.  
If case falls in area marked "C," forecast "yes," if in area marked "D,"  
forecast "no."

NOTE: If critical winds (northerly components) are present at time of observation, there is an 80% probability that they will persist for 4 hours or more. For winds with a southerly component, there is a 50% probability that they will persist for 4 hours or more.



(FSD - GFA) PP (in Mbs)

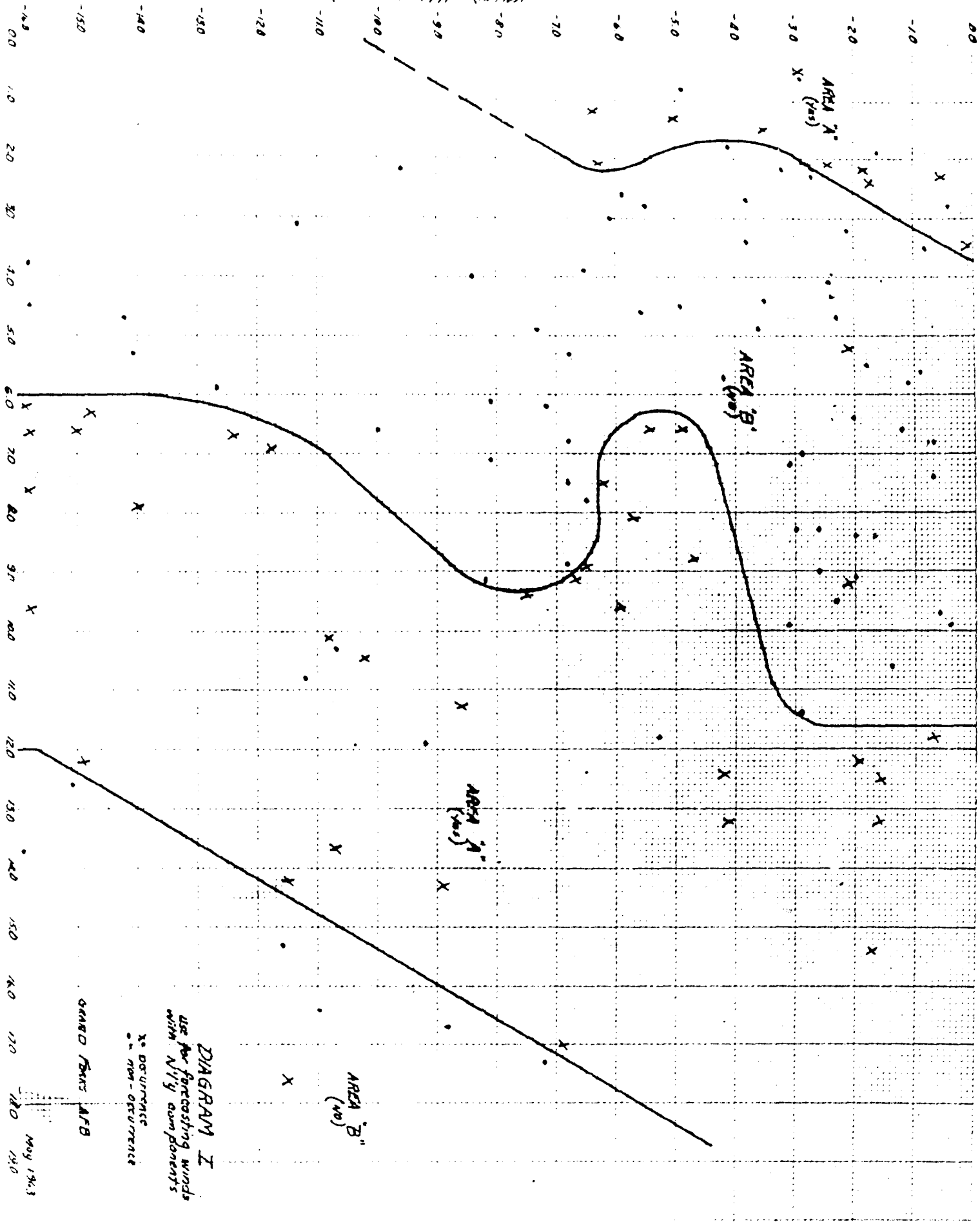


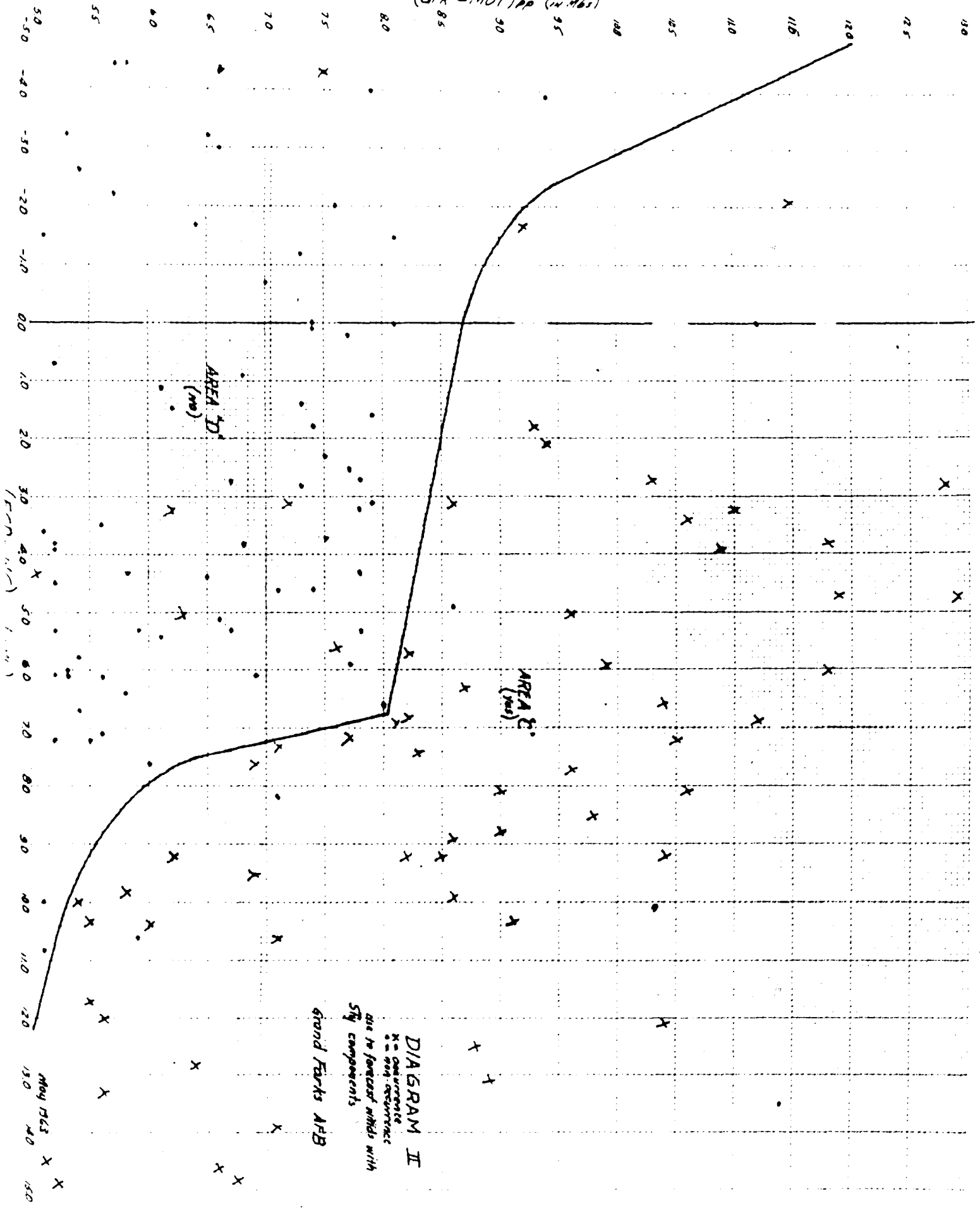
DIAGRAM I  
USE FOR FORECASTING WINDS  
WITH N/ly COMPONENTS

x = OCCURRENCE  
• = NON-OCCURRENCE

STANDARD FORMS AIRB

MAY 1943

(GFK - MOT) PP (in lbs)



**DIAGRAM II**  
 x = occurrence  
 • = non occurrence  
 due to forecast errors with  
 STY components  
 Grand Forks AFB

May 1965