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CENTRAL REGION TECHNICAL ATTACHMENT 93-02

THE TYPES AND INTENSITIES OF WEATHER PRODUCED BY THUNDERSTORMS AT WILLISTON, NORTH DAKOTA

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1. Introduction

The Intern Terminal Forecast Program is a beneficial training program for the Meteorologist Intern. When forecasting thunderstorms in my practice terminals, more often than not, they would turn out to be overly pessimistic with regard to ceiling and visibility. This result challenged me to study aviation weather due to thunderstorms at Williston, North Dakota.

This paper serves as a guide to the aviation forecaster by showing the TYPES and INTENSITIES of weather that thunderstorms produce at Williston. These TYPES and INTENSITIES will be broken down into meaningful categories to show exactly what type of weather is common and what type is not so common.

2. Data and Approach

The data used in this study included every thunderstorm that was recorded at the National Weather Service Office at Williston from January 1988 through November 1992. This includes five severe weather seasons. All totaled, 256 thunderstorms were recorded during that time frame. The data source was Surface Aviation Observations, and included both the MF1-10A and 10B forms.

Every thunderstorm that was recorded during the data period was investigated with respect to five categories and each category was then broken down. The categories and breakdown were as follows:

(1) CEILING	(a) LIFR and IFR	(b) MVFR	(c) VFR	
(2) VISIBILITY	(a) LIFR and IFR	(b) MVFR	(c) VFR	
(3) RAIN	(a) no rain	(b) RW-	(c) RW	(d) RW+
(4) HAIL	(a) no hail	(b) non-severehail	(c) severe hail	
(5) WIND	(a) <30 knots	(b) 30 to <50 knots	(c) severe wind	

3. Results

Figures 1A through 1C deal with CEILING HEIGHTS. It is obvious that the vast majority of thunderstorms that moved through Williston produced VFR ceilings, less than 13 percent produced lower than VFR ceilings. Figure 1C goes a step further and breaks down the number of thunderstorms and ceiling conditions produced, into months of occurrence. Notice that the greatest number of thunderstorms occurred in the month of July, with August and June close behind. Although the months of September and October produced few thunderstorms, note the relatively high percentage that produced less than VFR ceilings.

Figures 2A through 2C deal with VISIBILITIES. Just as the vast majority of thunderstorms at Williston produced VFR ceilings, so too did the vast majority produce VFR visibilities. Note in Figure 2C that few thunderstorms occurred in September and October, but that a relatively high percentage of those produced less than VFR visibilities.

Figure 3 deals with RAIN intensity. The vast majority of thunderstorms produced light rain showers. Figure 4 shows the size categories of HAIL, if any, produced. Most thunderstorms did not produce hail, but of those that did, only one produced severe hail.

Finally, Figure 5 addresses the WIND component. An interesting finding here was that nearly 81 percent of the thunderstorms produced a wind gust of at least 30 knots.

4. Discussion

An important assumption was that five years of data would be representative of thunderstorm produced conditions at Williston. This, of course, may or may not be true. It must be kept in mind that the data used in this study is point data and that the results may or may not be representative of thunderstorm produced conditions over a larger area, say northwest North Dakota. However, the results are similar to those determined by May (1989) for thunderstorms at Bismarck, North Dakota.

5. Conclusions

This study was done to determine the types and intensities of weather that thunderstorms produce at Williston. It has been shown that the majority produce: VFR ceilings, VFR visibilities, light rain showers, and no hail. At the same time, nearly 81 percent produced wind gusts of at least 30 knots. This percent-

age, although high, is reasonable for this area in light of the great number of high based thunderstorms that move through here. Few thunderstorms occurred in the months of September and October, but when they did a relatively high percentage produced less than VFR conditions.

With respect to severe thunderstorms, a total of five occurred in the period examined in this paper. All five were severe with respect to wind criteria, while only one of the five met severe hail criteria. Chances are that if a thunderstorm is going to be severe at Williston, it will be due to the wind and not the hail.

6. Acknowledgements

A special thank you goes out to Patrick W. Allard, OIC ISN, for his support, while I researched and prepared this paper. A special thanks also to Richard L. Van Ess, Lead Forecaster at Bismarck, for his suggestions and review of the rough draft. Finally, special thanks to James R. Fors, DMIC Bismarck, for his review of this paper, and for answering all of my many questions. Thanks also to Jim for converting this work into WordPerfect.

7. References

May, Richard C., 1989: Forecasting Thunderstorms For Aviation, Central Region Applied Research Paper 3-7.

FIGURE 1A
CEILING HEIGHTS

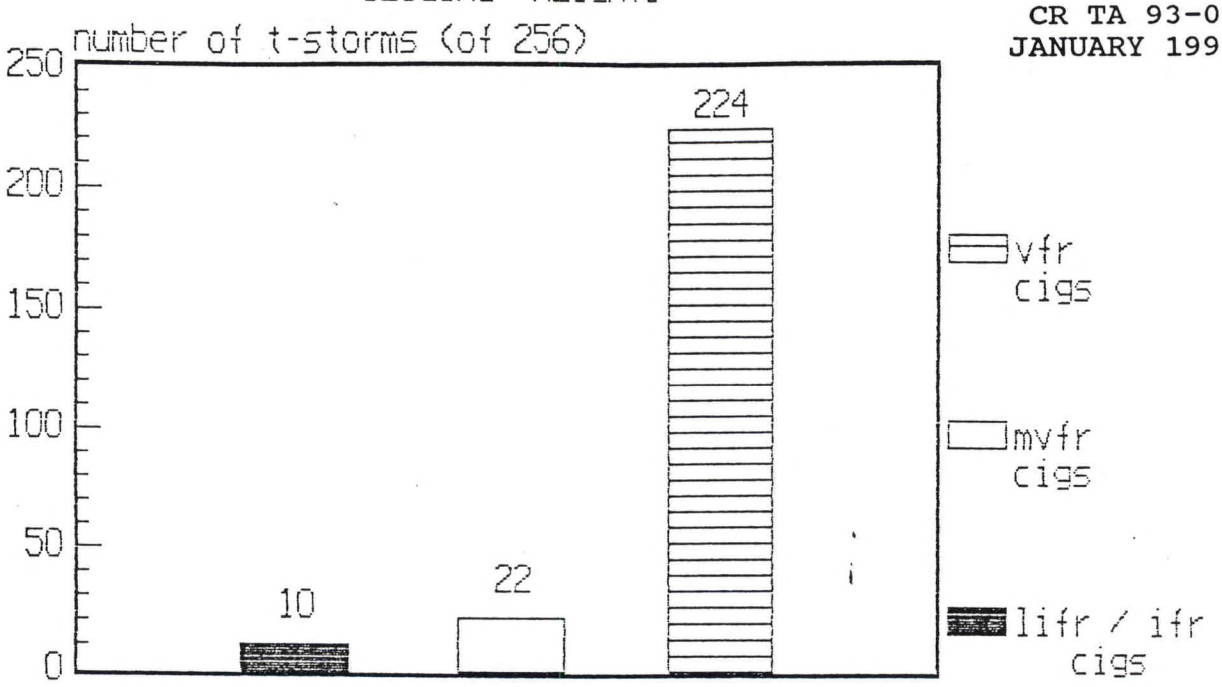

FIGURE 1B
CEILING HEIGHTS
(as a percentage)

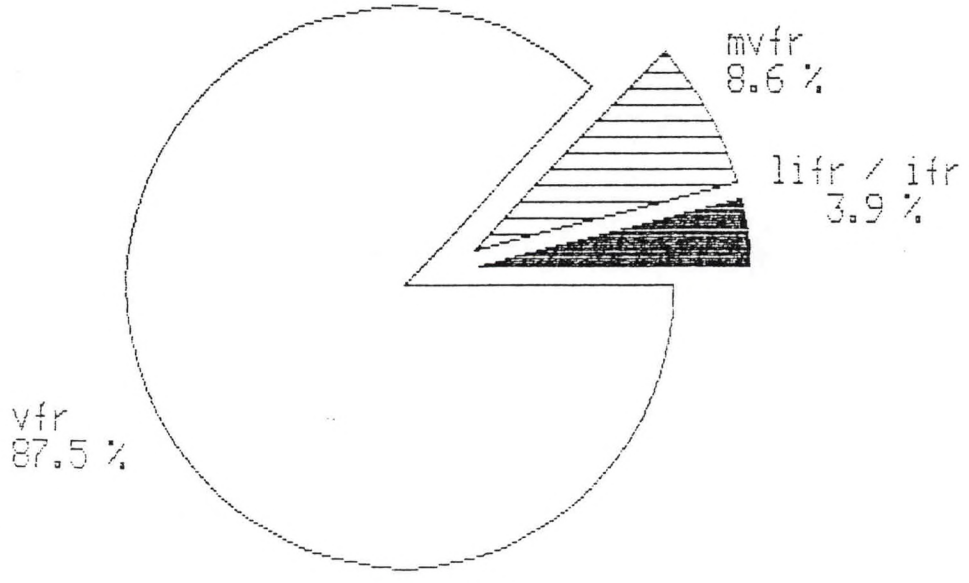

FIGURE 1C
TOTAL NUMBER OF THUNDERSTORMS VERSUS
THOSE PRODUCING LESS THAN VFR
CEILINGS

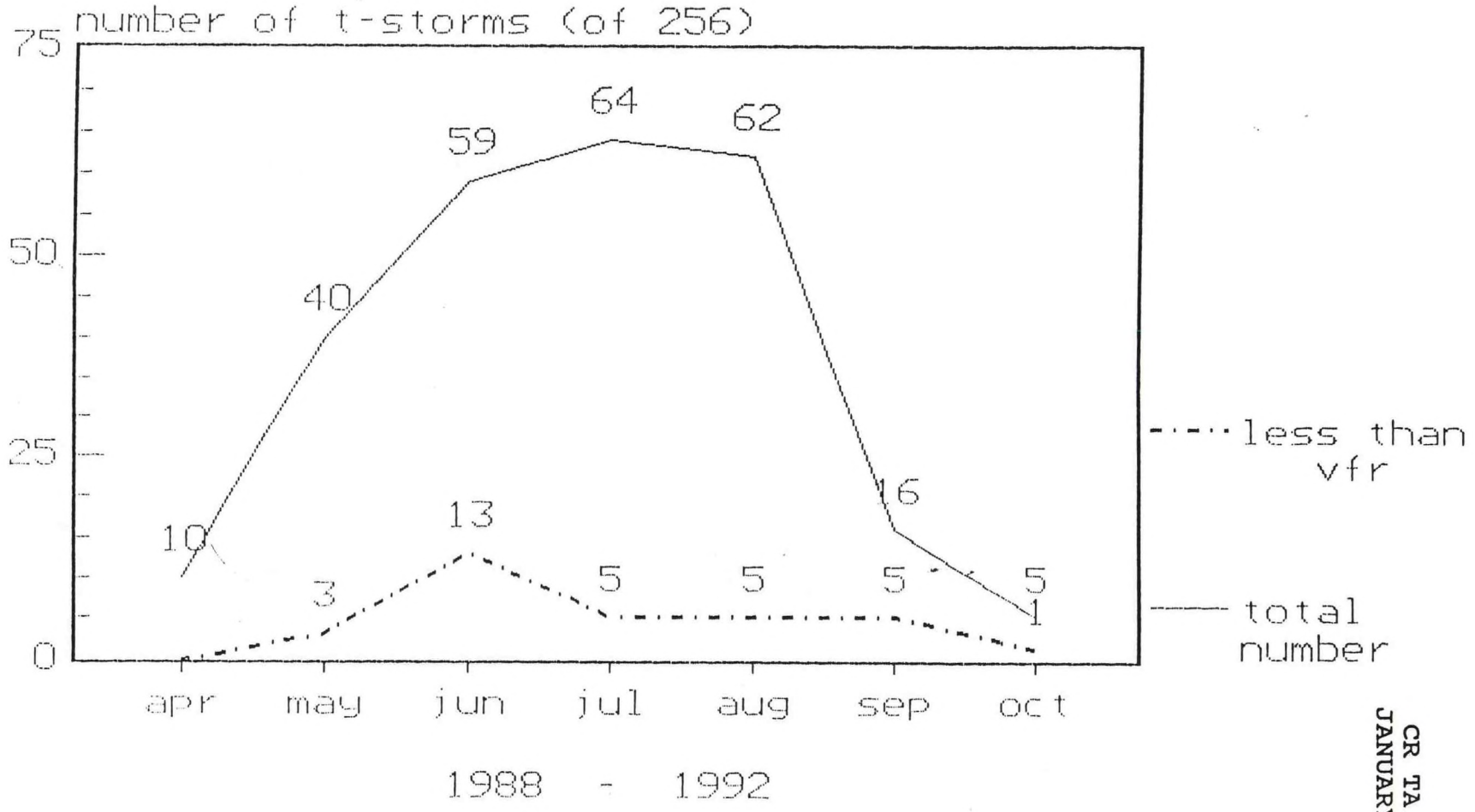

FIGURE 2A
VISIBILITIES

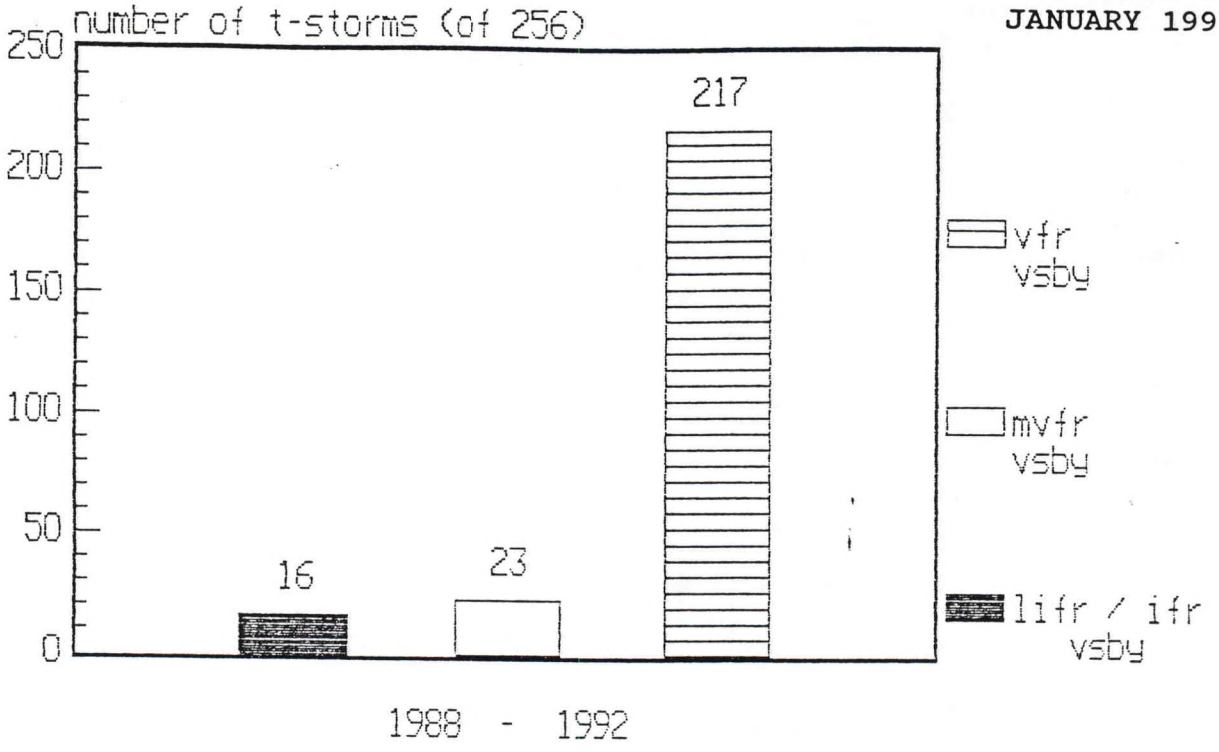

FIGURE 2B
VISIBILITIES
(as a percentage)

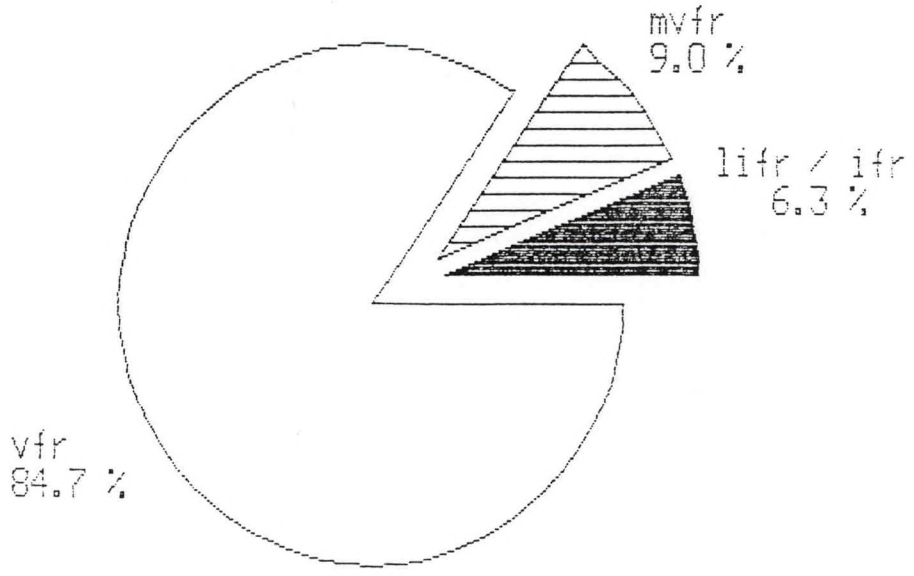

FIGURE 2C
TOTAL NUMBER OF THUNDERSTORMS VERSUS
THOSE PRODUCING LESS THAN VFR
VISIBILITIES

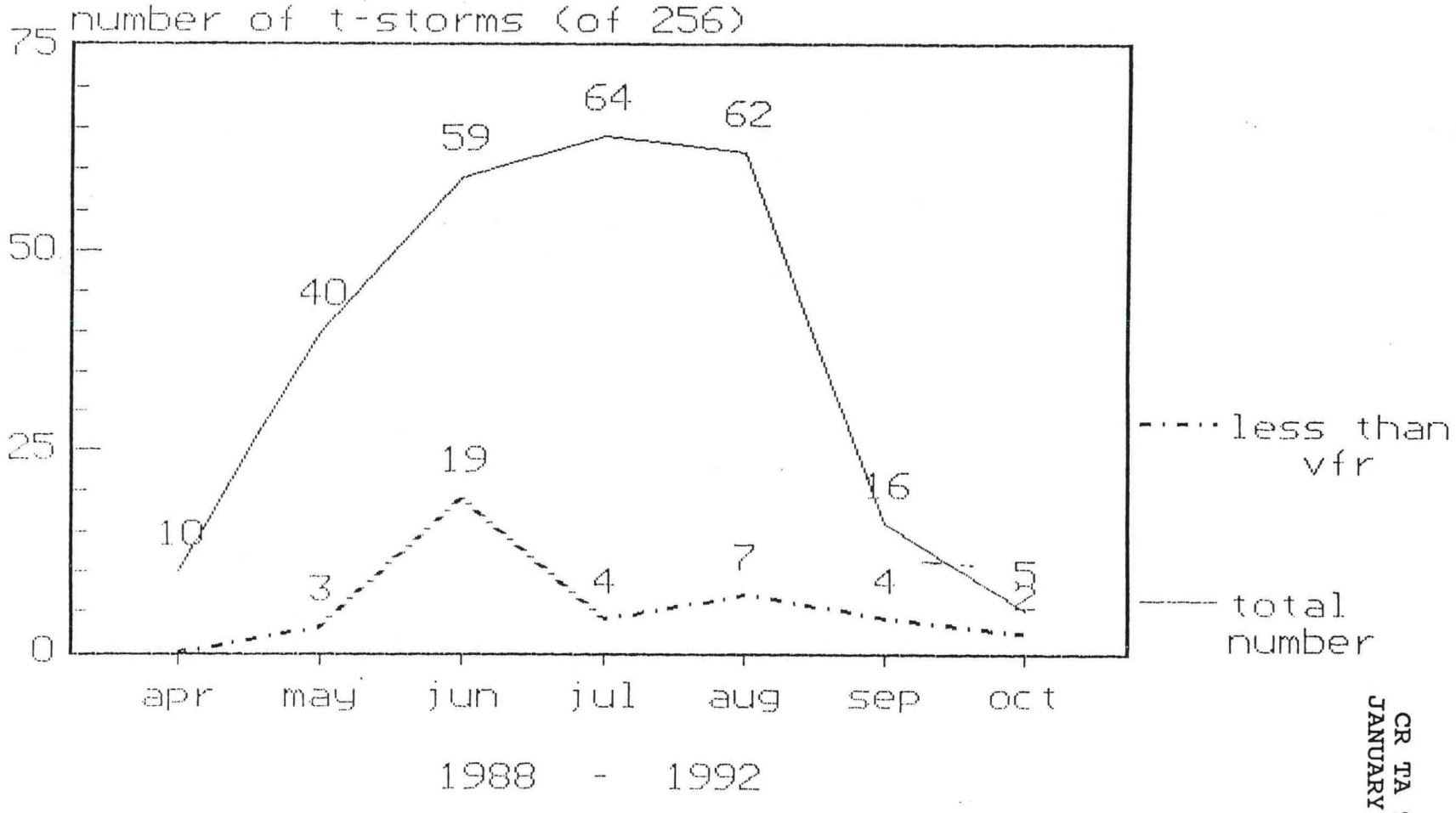

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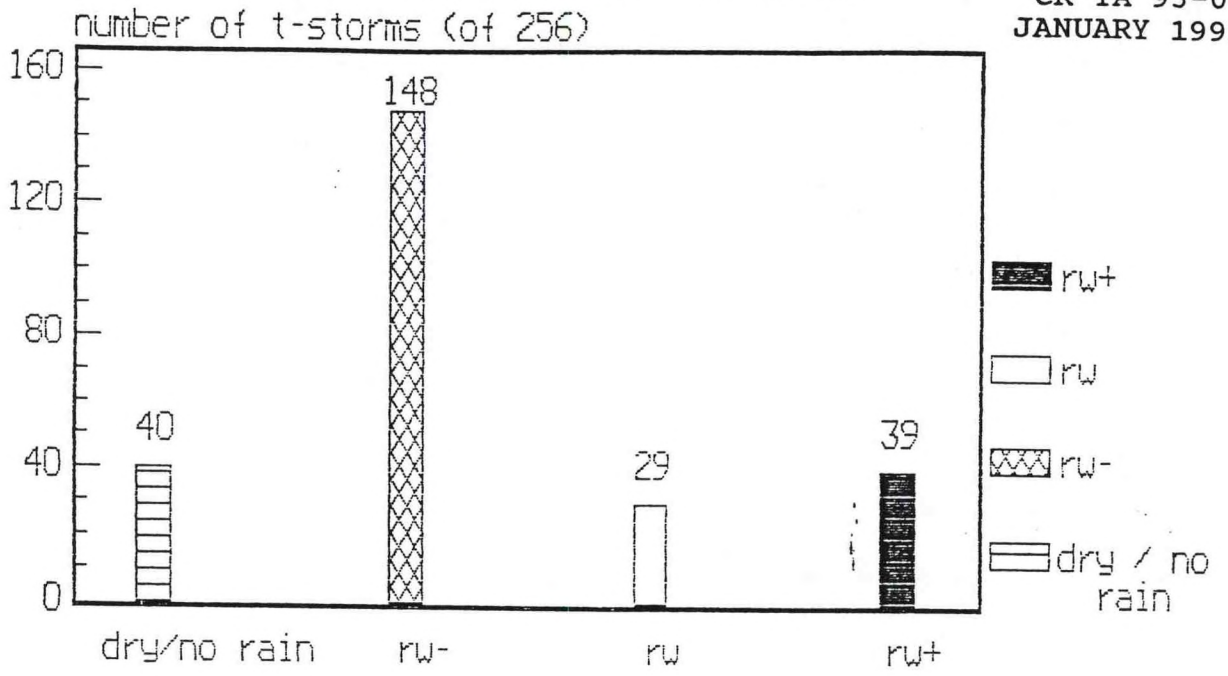
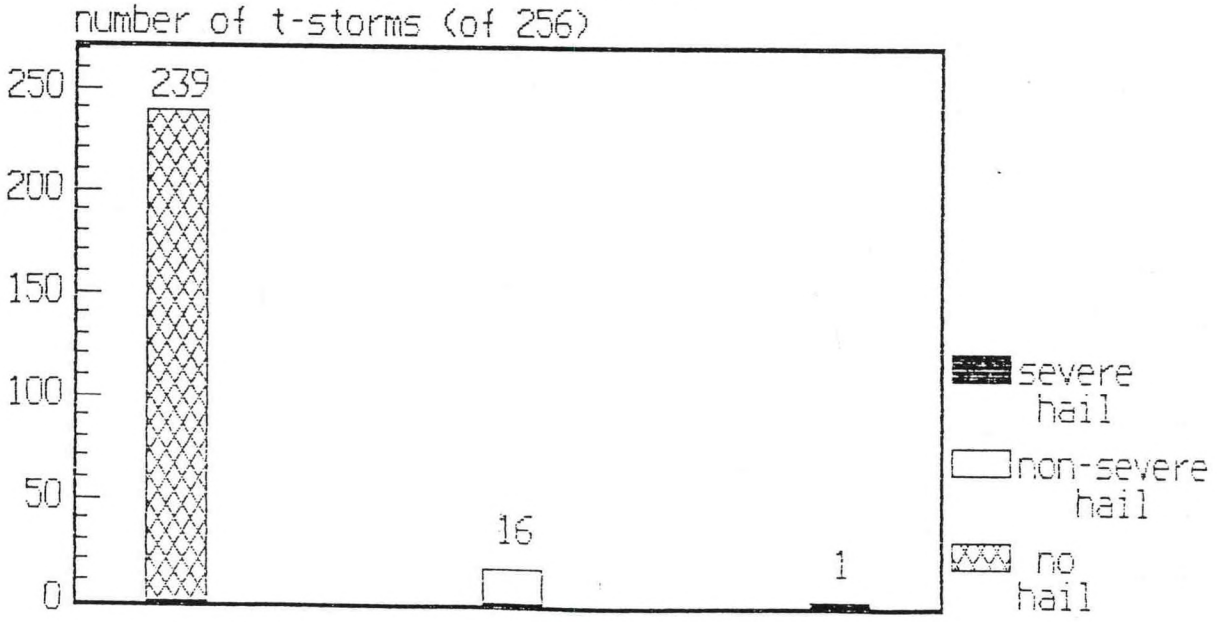
FIGURE 3
MAXIMUM RAIN INTENSITY PRODUCED



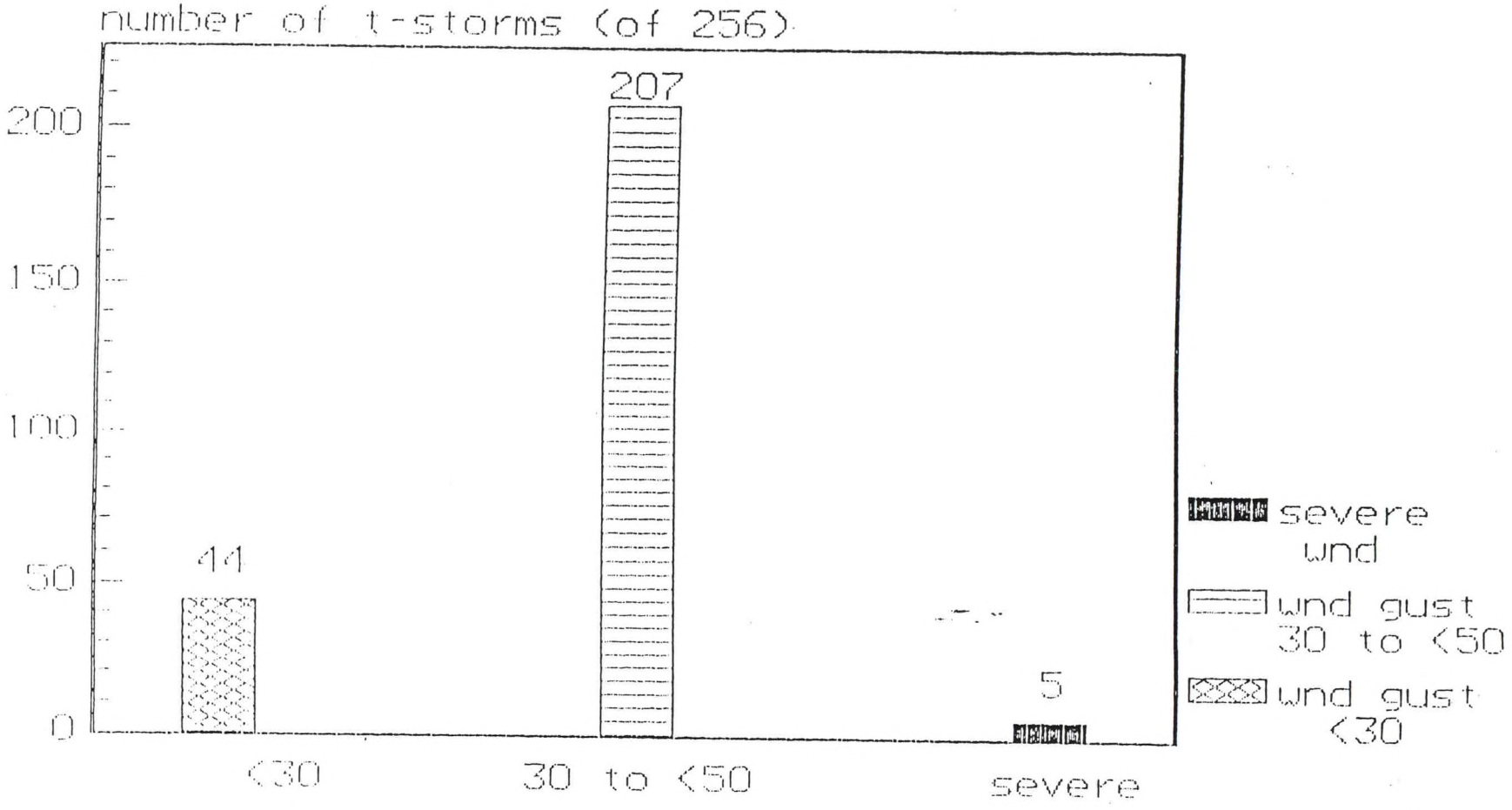
1988 - 1992

FIGURE 4
HAIL / SIZE PRODUCED



1988 - 1992

FIGURE 5
CATEGORIES OF PEAK WIND GUST
(knots)



1988 - 1992