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TAILORED CLIMATOLOGY OF SEVERE WEATHER.(U)

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5TH WEATHER WING

TECHNICAL NOTE

78—2

TAILORED CLIMATOLOGY OF SEVERE WEATHER

JUNE 1978

PUBLISHED BY THE AEROSPACE SCIENCES DIVISION

FIFTH WEATHER WING

LANGLEY AFB, VIRGINIA 23665

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FOR THE COMMANDER

JURI V. NOU, Colonel, USAF
Chief, Aerospace Sciences Division

20 June 1978

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This technical note describes the design and use of computer-produced climatologies of severe weather reports within 50 statute miles of a given location.

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LANGLEY AIR FORCE BASE, VIRGINIA

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TAILORED CLIMATOLOGY OF SEVERE WEATHER

INTRODUCTION

Severe convective weather phenomena--such as large hail, strong gusts of wind, and tornadoes--present a serious environmental threat to valuable resources, mission accomplishment, and the safety of people. Fortunately, such occurrences are relatively rare. However, a single event can produce disastrous consequences if not accurately forecast in sufficient time to allow adequate protective action. How the threat of severe weather is understood by weather forecasters and operational decision makers will determine to a large degree the utility of the weather warning program and the protective action taken by the users of weather advisories. A representative climatology of local severe weather events is the first step in this regard. Yet, due to sample size limitations, severe weather climatology for a single location is not always representative of the potential for severe weather. A more accurate depiction of the likelihood of severe weather is possible if all available reports from the vicinity of a location or installation are compiled into specific seasonal and diurnal statistics. We have produced such a tailored climatology through the use of the Severe Local Storms (SELS) Log data, which are maintained by the National Severe Storms Forecast Center (NSSFC) in Kansas City, Missouri.

SELS LOG

All credible reports of convective severe weather in the conterminous United States have been recorded by the NSSFC. This record is termed the SELS Log, with reports dating from 1955. In addition to other types of data, the SELS Log lists the following events:

Tornadoes

Waterspouts

Waterspouts moving onshore

Tornadoes moving over a large body of water

Hail ≥ 3/4 inch in diameter

Non-tornadic winds ≥ 50 knots

When direct measurements of hail size or wind speed are not available, reports of these phenomena are included in the log only if damage reports indicate that the lower limits were probably exceeded. Primary sources of data for the SELS Log are Weather Service Forecast Offices (WSFOs), Weather Service Offices (WSOs), cooperative local civil spotter groups, and other conventional weather observations received over the weather teletype network. Additional sources include state highway patrols, civil defense organizations, and National Weather Service Monthly Storm Data Summaries. All reports are checked for reliability and validity (e.g., a severe weather report must be compatible with radar reports). Monthly Storm Data Summary reports are not included in the SELS Log if the estimated damage is less than $10,000. To insure that the same occurrence is not recorded more than once, reports are reviewed to eliminate duplication.

Reports in the SELS Log are listed in chronological order, with year, month, date, and Central Standard Time (CST) recorded for each report. The location of a severe weather event is described by latitude and longitude (degrees and minutes). For tornadic events, the starting point of the damage path is recorded as the location. For hail and wind gusts, the reported location of the event is used (e.g., one inch hail 16 miles north of Salina, Kansas; damaging winds 28 miles southeast of San Antonio, Texas).

SEVERE WEATHER CLIMATOLOGY

We have used the SELS Log, with a 22-year period of record from 1955 through 1976, to create a severe weather climatology, tailored for selected military installations. This climatology has been processed and depicted on standard-size (11" X 15") sheets of computer paper. It is divided into three sections under the headings of HAIL GE 3/4 INCH, WIND GE 50 KNOTS, and TORNADOES (i.e., tornadic activity affecting the earth's surface; funnel clouds are not included). Each section has two parts:

1. A chronological listing is provided of all reports within 50 statute miles of the selected installation. It shows YEAR, MONTH, DAY, TIME (CST), LOCATION, DISTANCE FROM STATION, and SIZE/SPEED. An example of the listing is shown in Figure 1.

SEVERE LOCAL STORMS LOG REPORT LISTING FOR HAIL GE 3/4 INCH
WITHIN 50 STATUTE MILES OF BERGSTROM AFB, TX
PERIOD OF RECORD: 1955 - 1976

YEAR	MONTH	DAY	TIME(CST)	LOCATION LATITUDE	LOCATION LONGITUDE	DISTANCE FROM STATION	SIZE/SPEED
1955	APR	12	835	3017N	9741W	5	1.00
1955	MAY	15	1800	2935N	9800W	47	
1956	OCT	3	1300	3017N	9741W	5	.75
1957	MAR	11	1900	3017N	9741W	5	1.00
1957	MAR	12	1557	2947N	9805W	38	.75
1957	MAR	20	1800	3011N	9741W	2	3.00
1957	MAR	20	1830	3011N	9741W	2	1.00
1957	MAR	20	1945	3023N	9741W	12	1.00
1957	MAR	27	1800	3030N	9730W	22	1.50
1957	MAR	27	1920	3011N	9747W	7	.75
1958	APR	13	2146	3017N	9741W	5	1.75
1958	APR	26	1700	3017N	9741W	5	.75
1959	APR	19	1550	3042N	9754W	36	1.00
1959	MAY	10	2145	3035N	9735W	25	2.00
1960	APR	26	1950	3047N	9800W	44	1.75
1960	OCT	9	1355	3017N	9741W	5	.75
1960	OCT	18	2100	3035N	9741W	25	2.00
1961	MAR	16	2028	3011N	9747W	7	1.00
1961	JUN	8	1930	3035N	9800W	31	.75
1962	APR	30	1805	3017N	9741W	5	1.00
1962	APR	30	1845	3017N	9741W	5	1.75
1962	JUN	1	2019	3047N	9811W	50	2.75
1962	JUN	3	1610	3017N	9747W	8	1.75
1962	OCT	20	1100	2941N	9805W	44	2.00
1963	APR	29	1710	3011N	9654W	45	1.50
1963	MAY	27	1930	3005N	9830W	50	1.75
1963	MAY	27	2020	3017N	9817W	37	1.75
1964	MAR	3	100	3035N	9724W	29	1.50
1964	APR	29	1900	3030N	9741W	20	1.75
1964	MAY	30	1600	3047N	9811W	50	1.75
1964	MAY	30	1740	3042N	9741W	33	1.75
1964	MAY	30	1930	3017N	9747W	8	1.00
1965	APR	19	130	3030N	9711W	35	.75
1965	APR	19	1600	3035N	9700W	46	1.25
1965	MAY	28	2222	3017N	9747W	8	1.75
1966	FEB	9	1930	3017N	9741W	5	1.50
1966	MAR	12	1300	3030N	9754W	23	1.75
1966	APR	12	1613	3030N	9735W	20	.75
1966	APR	12	1651	3023N	9754W	17	1.50
1966	APR	12	1700	3023N	9735W	12	.75
1966	APR	12	1805	3017N	9741W	5	1.50
1966	APR	12	1840	3011N	9654W	45	.75
1966	MAY	18	1630	3035N	9747W	25	.75
1966	MAY	21	1820	2941N	9805W	44	2.00
1967	APR	23	1015	3017N	9754W	14	.75
1967	APR	23	1025	3017N	9741W	5	1.50
1967	APR	23	1030	3017N	9747W	8	2.75

Figure 1. Example of Severe Local Storms Log Report Listing

For hail reports, the hail diameter is in inches (when available); for non-tornadic winds, the wind speed is in knots (when available). Wind speeds are not recorded for tornadoes.

2. Mapped statistics, based on the chronological data listing, are provided for the following four-hour periods for each month of the year:

0300 CST - 0659 CST

0700 CST - 1059 CST

1100 CST - 1459 CST

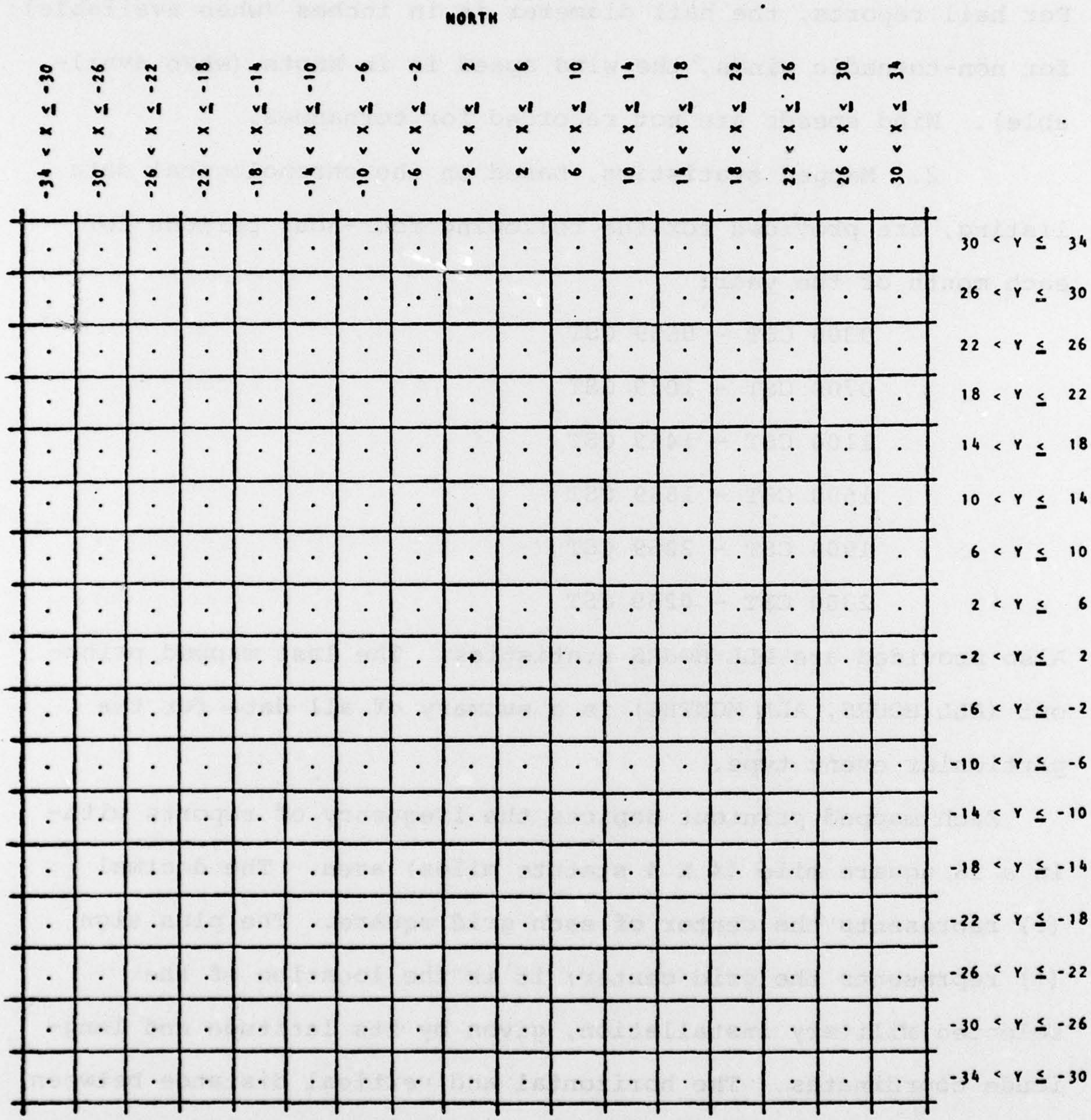
1500 CST - 1859 CST

1900 CST - 2259 CST

2300 CST - 0259 CST

Also provided are ALL HOURS statistics. The last mapped printout (ALL HOURS, ALL MONTHS) is a summary of all data for the particular event type.

Each mapped printout depicts the frequency of reports within a 16 square mile (4 X 4 statute miles) area. The decimal (.) represents the center of each grid square. The plus sign (+) represents the grid center; it is the location of the selected military installation, given by its latitude and longitude coordinates. The horizontal and vertical distance between decimal points is ½ inch. This equates to a scale of approximately 1:500,000--the scale of a Tactical Pilotage Chart (TPC). The grid square format for locating and accumulating reported occurrences is shown in Figure 2. The entire grid is 68 statute



X: EAST-WEST DISTANCE RELATIVE TO GRID CENTER(+). EAST OF GRID CENTER IS POSITIVE AND WEST OF GRID CENTER IS NEGATIVE.

Y: NORTH-SOUTH DISTANCE RELATIVE TO GRID CENTER(+). NORTH OF GRID CENTER IS POSITIVE AND SOUTH OF GRID CENTER IS NEGATIVE.

DISTANCES ARE IN STATUTE MILES. CONVERSION FACTORS: 1 STATUTE MILE = 0.868391 NAUTICAL MILE
1 NAUTICAL MILE = 1.151555 STATUTE MILES

Figure 2. Grid Square Format for Mapped Statistics

miles on a side. The cumulative frequency of reports as a function of radial distance from the grid center (in five statute mile increments from 0 to 25 statute miles) is listed in the lower right of the printout corner. An example of the printout is shown in Figure 3. If a grid square has a frequency of zero, the zero is not printed. If there are no reports within 50 statute miles of the grid center for a given time period and/or month, the printout is omitted from the tailored climatology.

DATA LIMITATIONS AND USES

The reported frequencies are probably underestimates of the actual number of severe weather occurrences and slanted towards populated areas, especially for those locations with a nearby WSFO or WSO. Therefore, statistics from populated areas should be reasonably representative of the actual severe weather frequency of occurrence. However, for remote areas the data may drastically underestimate the actual frequency of occurrence.

Units of 5th Weather Wing have been provided with a transparent overlay, copied from appropriate TPCs. To use this overlay, the airfield or installation should be centered over the "+" on the mapped statistics and longitude lines aligned relative to true North. The overlay helps to relate the distribution of severe weather reports to population centers and geographical features. Unless there are significant geographical variations in the local area (such as terrain changes or bodies of water),

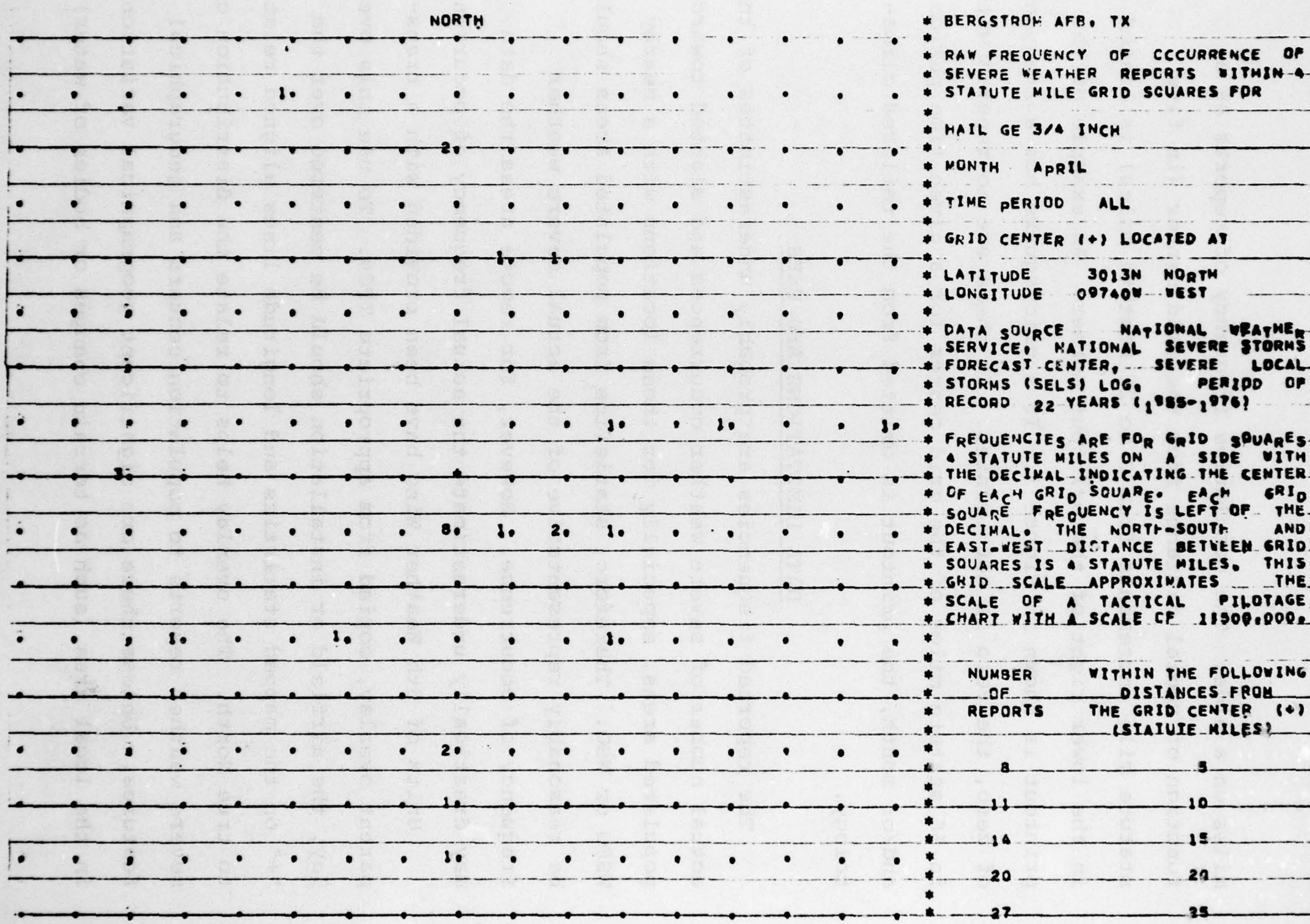


Figure 3. Example of Mapped Statistics

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the frequency of reports for a densely populated area should be representative of the frequency of severe weather for nearby sparsely populated areas.

The best way to use the data is to make a comparison of report frequencies for the same area at different times. An example of such a data comparison is shown in Figure 4. The maximum frequency (or threat) is for the month of June from 1500 CST to 1859 CST. A secondary maximum is indicated for the month of September from 1100 CST to 1459 CST. This comparison assumes that the likelihood of receiving a report of a severe weather event does not change with time. Such comparative statistics are valid, except for very small data samples (i.e., three or less in the 22-year period of record).

An important consideration to remember is that the statistics are for 22 years of record. The average number of reports per year, or the average number of years required to experience one report, should be used when assessing local severe weather threat.

TIME PERIOD (CST)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
	NUMBER OF REPORTS WITHIN 15 STATUTE MILES OF BUCKLEY ANGB, CO												
0300 - 0659	0	0	0	0	0	0	0	0	0	0	0	0	0
0700 - 1059	0	0	0	0	0	0	0	0	1	0	0	0	1
1100 - 1459	0	0	0	1	6	5	0	1	2	0	0	0	15
1500 - 1859	0	0	0	0	6	10	8	0	1	0	0	0	25
1900 - 2259	0	0	0	0	2	0	3	0	1	0	0	0	6
2300 - 0259	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTAL	0	0	0	1	14	16	11	1	5	0	0	0	48

Figure 4. Example of Data Comparison

5 WW TECHNICAL NOTES

72-1. The Use of Diurnal Temperature and Dew Point Curves, January 1972

78-1. The Use of Wind Stratified Conditional Climatology Tables, February 1978.

78-2. Tailored Climatology of Severe Weather, June 1978.