

NOAA TECHNICAL MEMORANDUM NWS NSSFC-12



SEVERE LOCAL STORM WARNING VERIFICATION
PRELIMINARY PROCEDURES

Leo A. Grenier and John T. Halmstad
National Severe Storms Forecast Center
Kansas City, Missouri 64106

April 1986

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NOAA TECHNICAL MEMORANDA

National Weather Service
National Severe Storms Forecast Center

The National Severe Storms Forecast Center (NSSFC) has the responsibility for the issuance of severe thunderstorm and tornado watches for the contiguous 48 states. Watches are issued for those areas where thunderstorms are forecast to produce one or more of the following: (1) hailstones of 3/4 inch diameter or greater, (2) surface wind gusts of 50 knots or greater, or (3) tornadoes.

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- No. 4 The Enhanced-V, A Satellite Observable Severe Storm Signature. Donald W. McCann, March 1981, 31 p. (PB 230336).
- No. 5 The Operational Meteorology of Convective Weather Volume I: Operational Mesoanalysis. Charles A. Doswell III, November 1982, 160 p. (PB 83162321).
- No. 6 Severe Local Storm Warning and Event Summaries Available in AFOS. Preston W. Leftwich, Jr. and Lawrence C. Lee, January 1984, 10 p. (PB 84 150291).
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- No. 8 A Minimum Assumption Tornado Hazard Probability Model. Joseph T. Schaefer, Donald L. Kelly, and Robert F. Abbey, May 1985, 30 p. (PB85 206092/AS).
- No. 9 Verification Of Severe Local Storm Forecasts Issued By The National Severe Storms Forecast Center: 1984. Preston W. Leftwich, Jr., November 1985, 23 p., (PB86 128105/AS).
- No. 10 Severe Local Storm Warning Verification: 1984. Preston W. Leftwich, Jr. and Leo A. Grenier, December 1985, 14 p., (PB86 148244).
- No. 11 Severe Thunderstorm Cases of 1985. John E. Hales, Jr. and Hugh G. Crowther, February 1986, 51 p., (PB86 164340/AS).

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TABLE OF CONTENTS

	Page
Abstract	1
1. Introduction	1
2. Data Collection	1
3. Summaries Available Via AFOS	2
Table 1	3
4. Role of AFOS Messages In Verification Effort	3
Figure 1	4
Figure 2	4
Table 2	5
5. Related AFOS Products	6
6. Related Subjects	7
7. Problems	7
8. Summary	7
9. Acknowledgements	8
10. References	8
Appendix A	9
Appendix B	10

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ABSTRACT. Verification of severe local storm warnings issued by National Weather Service offices is performed at the National Severe Storms Forecast Center (NSSFC). Issued warnings and event reports are collected and processed prior to verification. As part of these preliminary procedures two products are routinely disseminated nationally via the AFOS network. A summary of severe local storm event reports received during the previous 24 hours (CCCSTADTS) is prepared daily. Once each week, a summary (CCCSTAXXX) is prepared for each WSFO. This summary lists events and warnings processed during the previous week for all stations within the management area of that WSFO. Routine review of these messages by local offices will facilitate both local compilation of storm data and quality control of information entering data bases maintained at the NSSFC.

A thorough knowledge of preliminary verification procedures and routine use of these products, as presented in this report, can insure greater accuracy of data and aid the WSFO in the preparation of "Storm Data and Unusual Weather Phenomena" (FORM F-8).

1. INTRODUCTION

As part of the national forecast verification program of the National Weather Service (NWS), the National Severe Storms Forecast Center (NSSFC) in Kansas City, Missouri performs verification of all severe local storm warnings issued in the United States (NWS, 1982). Increased needs for verification results by local, regional and national management has produced increased demands for timely verification reports. This, in turn, has increased demands for timely, accurate and detailed compilation of warnings and severe local storm reports that are used in verification procedures. Leftwich and Lee (1984) highlighted severe local storm warning verification procedures, placing emphasis on the role of two summary messages transmitted via AFOS. This updated report adds details concerning the collection of warning and event data.

2. DATA COLLECTION

The first step in verification of severe local storm warnings is collection of both the issued warnings and the reports of severe storm events. Collection

of warnings is accomplished almost entirely on a real-time basis via AFOS. Although reports of severe local storm occurrences are received from many sources, a high percentage of these are extracted from statements, warnings, observations, local storm reports, state weather summaries, etc., received via AFOS. Others are obtained from telephone conversations, letters and newspaper reports. Finally, data are extracted from the monthly "Storm Data and Unusual Weather Phenomena" (FORM F-8). Guidance for proper submission procedures is outlined in WSOM chap. F-42 and C-72.

To qualify as a valid severe local storm event, and thus be retained in the event data base, reports must clearly satisfy one of the criteria listed in Appendix A. Also, only reports specifically stating the (1) geographical location, (2) time of occurrence, and (3) type of event can be assured of proper notation in the data base. This applies to real time data as well as "storm data". "For verification purposes", two or more qualifying reports of any type (Appendix A Table A.1) that are within 10 statute miles and 15 minutes of each other and in the same county will be considered one event. However, the following will be retained for verification in any case. (i.e., time/distance criteria do not apply)

1. All tornadoes.
2. Any event causing extreme damage (category 6) and not associated with a tornado.
3. Any event causing fatalities or injuries and not associated with a tornado.

****NOTE**** If any "exempted event" occurs within 10 statute miles and 15 minutes of other non-injury, non-fatal hail and/or wind events, then the exempted event(s) will be retained and all others will not. Every severe weather episode is unique and evaluated with available data.

Thus, examples are too numerous to detail.

If a range of convective wind gusts is reported, an average value is used. Note that funnel clouds are not included and will not verify a severe local storm warning. Care should be taken to differentiate between lightning damage and wind damage. Lightning will not verify a severe local storm warning. Appendix A defines event criteria for severe weather verification.

****WARNING**** These are NSSFC verification procedures. They are provided here to enhance understanding of verification criteria. Local stations should NOT be concerned with this process prior to submission of local storm reports. All reports of all types should be forwarded to NSSFC in a timely manner.

3. SUMMARIES AVAILABLE VIA AFOS

The increased emphasis on severe local storm warning verification has led to increased reliability in data collection procedures. Even so, errors or omissions do occur. In such cases, corrections are vitally important if accurate verification is to be accomplished. Rapid corrections to warning or event data ensure proper credit in verification summaries, lessen the workload of the verification focal point at field stations, and reduce both duplication of effort and computer time required to maintain the data bases at the NSSFC. However, increasing automation of data base management has required constraints to be placed on the timeliness of acceptable corrections.

Two messages are routinely transmitted from the NSSFC via the Automation of Field Operations and Services (AFOS) network for the purposes of aiding both

compilation of local warning and event histories and rapid correction of the NSSFC data bases. Both are national products (thus available to all stations) which contain verification data recently compiled at the NSSFC.

The first message, having an AFOS PIL heading of "CCCSTADTS" is transmitted daily prior to 1200 GMT. It summarizes all severe local storm reports that have been received in real time at the NSSFC during the previous 24 hours. Figure 1 is an example from March 12, 1986. The type of severe weather event is coded as shown in Table 1. Also included are event locations, times of occurrence, and any remarks describing damage or significant facts concerning the events. Reports are numbered as received. All times are given in Central Standard Time (CST). An asterisk (*) preceding an event indicates that it occurred within a valid severe local storm watch. A (\$) preceding the source of the event is for NSSFC use only and should be ignored.

TABLE 1
CONTRACTIONS USED TO IDENTIFY SEVERE LOCAL
STORM EVENTS IN "CCCSTAXXX"

TORN	TORNADO (VERIFIED OR REPORTED)
WNDG	SIGNIFICANT WIND DAMAGE
GSSS	CONVECTIVE WIND GUSTS: SSS IS SPEED IN KNOTS. I.e. G075
ADDD	HAIL/SIZE: DDD IS DIAMETER IN HUNDREDTHS OF AN INCH. I.e. A175 INDICATES HAIL 1 3/4 INCHES IN DIAMETER.

A second message, having an AFOS PIL heading of "CCCSTAXXX" (where XXX is the WSFO node identifier) is transmitted on Wednesday of each week prior to 1200 GMT. (Thursday following a 3-day weekend) This message is composed of two sections. The first section is a summary of all severe local storm events noted and entered in real time into the NSSFC data base for all stations within the indicated WSFO's administrative area during the previous week and processed at the NSSFC. Fifty-four of these messages are disseminated each week. An example is given in Figure 2. Ocasionally, warnings will not be processed at the NSSFC during the week in which they are issued. In such a case, these warnings will be noted in "CCCSTAXXX" as soon as processing is completed.

In order to reduce computer processing and transmission times, these messages are coded. Information contained in the first section is denoted as column headings across the top of the message. Among data included are month, day, year, time, state, WSO/WSFO and source office. All times are CST. Additionally, the geographical location of each event is given by latitude and longitude (degrees and minutes). Hail size and wind gusts are coded as in Table 1. States and counties are denoted by standard identifying numbers (NBS; 1970, 1979). The second section is coded as indicated in Table 2. Tables in Appendix B can provide additional aid in decoding of these summaries.

WOUS00 KMKC 131035

NSSFC TORNADO AND SEVERE THUNDERSTORM REPORTS
PRELIMINARY LIST - INTERNAL DISSEMINATION ONLY
FOR 06CST WED MAR 12 1986 THRU 06CST THU MAR 13 1986

EVENT	LOCATION	REMARKS	(CST)TIME
1 *TORN	10 W PARIS KY (14 NNE LEX)	(----)	12/ 620
	ESTD TIME		\$LEX/TOR
2 *TORN	2 W FLEMINGSBURG KY (51 ENE LEX)	(----)	12/ 652
	3 MOBILE HOMES DSTRYD...ROOFS DMGD...TREES DOWN		\$LEX/TOR
3 *TORN	5 NNW LEXINGTON KY (7 NNE LEX)	(----)	12/ 655
	1 INJURED...TREES DMGD..BARN DOWN..ROOFS DMGD..TIME E		\$LES/TOR
6 WNDG	MONROVIA AL (8 NNE HSV)	(----)	12/ 715
	TRAILER DMGD		HSV/SPS
4 WNDG	TOLLESBORO KY (56 WNW HTS)	(----)	12/ 701
	TREE DWND		HTS/LSR
5 A 75	3 W MANCHESTER OH (49 SE LUK)	(----)	12/ 701
			HTS/LSR
8 A 75	TULLAHOVA TN (58 SSE BNA)	(----)	12/ 800
			BNA/LSR
7 A175	FAYETTE MS (15 ENE HEZ)	(----)	12/ 755
			JAN/SVR
11 A 75	UNION CHURCH MS (29 E HEZ)	(WT*026)	12/ 840
			JAN/LSR
9 *TORN	5 W MERIDIAN MS (4 WNW MEI)	(WT*026)	12/1325
	SAME TOR CAUSED DMG NR QUITMAN AND STRINGER MS		BHM/TOR

FIGURE 1. Example of product "CCSTADTS", which is transmitted daily via AFOS.

ZCZC MKCSTAABQ
WOUS00 KMKC 151028??SOU
ATTENTION SAT

SUMMARY OF SEVERE WEATHER REPORTED TO SELS
FOR PERIOD OCT 31 1985 NOV 06 1985
DATE TIME STATE/ RESP EVENT LOCATION SOURCE OF RPT
MODAYR CST COUNTY WSO LAT LONG OFFICE/MSG/
DGMN DGMN
110185 1430 TX 167 GLS TORNADO 2923 09447 GLS/ WRNG
110685 1650 TX 491 AUS HAIL175 3032 09733 AUS/ WRNG

**** THE FOLLOWING WARNINGS HAVE BEEN PROCESSED ****

8511 1 GLS 1435 1535 31 48167 10000
8511 6 BRO 930 1030 51 48215 10000
8511 6 BRO 950 1050 51 48 61 10000
8511 6 BRO 950 1050 51 48489 10000
8511 6 BRO 1050 1150 51 48 61 10000
8511 6 BRO 1050 1150 51 48489 10000
8511 6 BRO 1055 1155 11 48 61 10000
8511 6 AUS 1700 1800 61 48491 10000
8511 6 AUS 1715 1830 61 48453 90000
8511 6 AUS 1715 1830 61 48 21 60000
8511 6 AUS 1737 1830 21 48453 90000
8511 6 AUS 1737 1830 21 48 21 10000
WARNINGS ISSUED AFTER 11/06/85 - 22:14 CST HAVE NOT BEEN PROCESSED

GUST SPEED IN KT. HAIL IN INCHES

MISCELLANEOUS MESSAGES MAY BE INSERTED HERE.

REFER TO FIRS CHAPT. 5-1 AND 6-2 FOR STATE AND COUNTY NAME/NUM.

PREPARED BY NSSFC / KCMO.

FIGURE 2. Example of product CCSTAXXX transmitted weekly via AFOS,
for each WSFO area of responsibility.

TABLE 2
DECODING AID FOR WARNING INFORMATION IN CCCSTAXXX

Coded line from Fig. 2:

a YYMMDD WWV HMM Ts SSSCCPP
831106 BRO 1050 51 48061010000

Code	Example	Meaning	Decoding Reference
YY	83	Year - 1983	
MM	11	Month - November	
DD	06	Day - 6	
WWV	BRO	Brownsville, TX	
^b HMM	1050	Beginning time of warning	FAA Station Identifiers Appendix B, Table B.1
KKNN	1150	Ending time of warning	Appendix B, Table B.1
T	5	Type of warning (Severe Thunderstorm-Radar)	Appendix B, Table B.2
^c s	1	Number of States warned	^e FIPS PUB 5-1
SS	48	State number - Texas	^e FIPS PUB 6-3
CCC	61	County number - Cameron	Appendix B, Table B.3
^d PP	01	Portion of county warned - Whole county	
	0000	Space for verification	

^a Within-group blanks are equivalent to zeros.

^b All times are Central Standard Time (CST). Conversion to other times are given in Table 1 of Appendix A.

^c One state/county group (SSCCPP) is allowed on each line.

^d Currently, most values of PP will be "1", indicating entire counties.

^e Published by National Bureau of Standards. See References.

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4. ROLE OF AFOS MESSAGES IN VERIFICATION EFFORT

Both messages discussed in the previous section are available for collection and review by all field offices connected via the AFOS network. If several versions¹ are simultaneously retained, personnel who work variable schedules can be assured an opportunity to review warnings and events while still familiar with a particular situation. Also, pertinent daily and weekly summaries can be compared. Such a procedure provides a convenient means of quality control of the national severe local storm data base, which is maintained at the NSSFC.

Any corrections or additions to data concerning events other than tornadoes should be noted and mailed to the NSSFC. **Changes to Information regarding tornadoes should be made only via the "Storm Data and Unusual Weather Phenomena" (Form F-8).** Corrections or additions to warnings issued should also be mailed to the NSSFC, and must include a "hard copy" of each warning message. This copy is required for inclusion in the Warning Message File maintained at the NSSFC.

Significant improvements in verification data base contents can be achieved through routine review of both "CCCSTADTS" and "CCCSTAXXX" messages. Correct, timely and useful verification reports can result when initial severe local storm reports and, in the cases of errors, corrections are forwarded to the NSSFC as soon as operationally possible. Additionally, information compiled from these AFOS messages will be helpful in preparation of "Storm Data and Unusual Weather Phenomena" (Form F-8) by local offices at the end of each month. Such a cooperative effort, coupled with frequent communication among all persons involved in verification, will be mutually beneficial.

5. RELATED AFOS PRODUCTS

The NSSFC compiles additional data concerning tornadoes and distributes them via two other AFOS messages. Tornado occurrences are tabulated by month and state in "CCCSTAMTS." Tornado events resulting in fatalities are documented in "CCCSTATIJ."

The following are brief descriptions of the contents of these two messages:

(1) CCCSTAMTS: The numbers of reports received in real time are listed in the column "ROUGH." Those tornadoes whose occurrences are confirmed by "Storm Data..." are listed in the column "SMOOTH." "NORM" refers to averages for the period 1950-1985. "KILLERS" gives the number of tornadoes causing fatalities. This message is updated daily.

(2) CCCSTATIJ: All times are Central Standard Time (CST). Reports are preliminary until confirmed by "Storm Data..." Columns A, B, C and D refer to fatalities that occurred in tornado watches, in severe thunderstorm watches, close to watches, or without a watch, respectively. In the "REMARKS" section, "WW" refers to the number of a severe local storm watch that was valid for the

¹ Retention of several versions can be accomplished by use of the "VERSION PURGE" option in the AFOS.

² Address: National Severe Storms Forecast Center, Verification Section, Federal Building Room 1728, 601 E. 12th Street, Kansas City, MO 64106-2877.

time and location of the tornado occurrence. This message is updated as required.

6. RELATED SUBJECTS

The addition of flood, high wind, and winter storm verification programs will significantly increase the workload of the verification section. It is imperative that all offices closely monitor these messages for proper handling of the data.

A weekly verification of real time data is planned to begin about July 1986. These preliminary results will become a regular part of the "CCCSTAXXX" message.

Monthly and year-to-date verification summaries are distributed to all regional headquarters and local offices. The format of the summaries has changed little in the past few years. However, the daily office routines and computer programs that generate the summaries have been completely rewritten. Verification procedures are constantly reviewed for possible improvements. Adding the new verification programs will place the system under closer scrutiny.

7. PROBLEMS

Several data handling problems regularly appear.

(1) Verification uses Central Standard Time (CST) for numerous reasons, mainly because over 80 percent of all severe weather occurs in Central Time Zone. Time conversion errors will continue to be a major problem area until we can automate the reading of events and warnings. We anticipate automated reading will begin during 1987.

(2) Time zone designators are frequently omitted when reporting an event. "We must know the time zone", and we encourage everyone to use a time zone designator with every reported time. WSOM Chapter F-42 requires the use of Local Standard Time on the "Storm Data F-8". We recommend its use on the Local Storm Reports.

(3) Location differences: Please check the CCCSTAXXX carefully for more than one entry of the same event. Errors usually occur when the same event is reported and/or entered at two locations more than ten (10) miles apart. Also insure that your "Storm Data F-8" is consistent with your local storm reports and CCCSTAXXX.

If you have problems interpreting data or preparing any reports to us, please call NSSFC, Verification at FTS 758-3367.

8. SUMMARY

Recent increased emphasis on verification by management has produced increased demands for timely verification reports. Awareness of requirements for preliminary processing can increase the reliability of warning and event data. Two messages that are routinely transmitted via AFOS can be helpful. These messages summarize, on a daily and weekly basis, the warnings and event reports

that have been collected by the NSSFC and included in verification data bases. Review of these messages by local offices and rapid receipt of any needed changes by the NSSFC can help to assure that warning verification for field stations is both timely and accurate.

9. ACKNOWLEDGEMENTS

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APPENDIX A

***** SEVERE WEATHER VERIFICATION CRITERIA *****

TABLE A.1 ... THIS IS A SEVERE EVENT ...

- ... TORNADO ...
1. Tornado on the ground. (any credible report)
 2. Any waterspout that moves onshore.
 3. Any waterspout that originated as a tornado onshore.
- ... SEVERE THUNDERSTORM / WIND **
1. Measured convective gusts, 50 knots or more.
 2. Estimated convective gusts, 50 knots or more from reliable sources, i.e. Civil Defense, Law Enforcement, trained spotters, etc.
 3. Trees blown down or uprooted. (more than 1)
 4. Large limbs or branches blown down. (more than 1)
 5. Power lines blown down.
 6. Permanent signs blown down.
 7. Roof damage from the wind. (large area of roofing material removed)
 8. Windows broken by the wind.
 9. Structural damage to business, house, barn, shed, circus tent, etc.
 10. Radio tower or large antenna blown down.
 11. Home TV antennas blown down. (more than 1)
 12. Campers heavily damaged or destroyed.
 13. Mobile Home damage.

TABLE A.2 ... THIS IS -NOT- A SEVERE EVENT ...

- ... TORNADO ...
1. Tornado indicated by radar.
 2. Tornado-like winds. (no sighting)
 3. Funnel cloud, possible funnel cloud, unconfirmed funnel cloud.
- ... SEVERE THUNDERSTORM / WIND **
1. Measured convective gusts, less than 50 knots.
 2. Estimated convective gusts:
Less than 50 knots (58 mph) that are obvious guesses from unreliable sources
 3. Wind of 50 to 60 mph. (avg. is 55 mph/not severe)
 4. Tree damage. (non-specific)
 5. Limbs or branches blown down. (no size given)
 6. "Wind Damage", "Damaging Winds", "High Winds", "Strong Winds", are all non-specific.. terms.
 7. Wind damage to crops.
 8. Power lines downed by lightning or other non-wind event.
 9. Minor structural damage. (not specified)
- ... SEVERE THUNDERSTORM / HAIL ...
1. Hail smaller than 3/4 inch diameter.
 2. "Large Hail". (no size given)
 3. Hail damage to crops.
 4. Hail described as "Marble Size" or "Nothball Size" are considered less than 3/4 inch diameter.

- ... SEVERE THUNDERSTORM / HAIL ...
1. Hail 3/4 inch diameter at the surface..or aloft..
 - ... report PIREPS ...
 2. Windows or windshields broken by hail. (assume 3/4 inch or greater)
 3. Roofs or house siding damaged by hail. (assume 3/4 inch or greater)
 4. Hail the size of a ..dime.. or greater

** A CONVECTIVE GUST IS DEFINED AS ANY GUST OF 50 KT OR GREATER THAT IS ASSOCIATED WITH THUNDERSTORM ACTIVITY AND IS (1) ACCOMPANIED BY THUNDER AT THE STATION, OR (2) OCCURS AT THE STATION WHILE LIGHTNING IS BEING OBSERVED, OR (3) THUNDER OCCURS AT THE STATION WITHIN 1/2 HOUR AFTER A GUST OCCURS. (DOSWELL, 1985)

... NOTE ... CAREFUL STUDY OF THESE CRITERIA SHOULD AID IN ENHANCING VERIFICATION SCORES. KEEP THESE IN MIND WHEN YOU EVALUATE INCOMING REPORTS AND QUIZ SPOTTERS OR OTHER OBSERVERS, PRIOR TO PREPARING THE LOCAL STORM REPORT.

APPENDIX B

Table B.1 TIME CONVERSION

GMT	EDT	CDT	MDT	PDT	PST
+0	+4	+5	+6	+7	+8
0000	2000	1900	1800	1700	1600
0100	2100	2000	1900	1800	1700
0200	2200	2100	2000	1900	1800
0300	2300	3300	3100	2000	1900
0400	0000	2300	2200	2100	2000
0500	0100	0000	2300	2200	2100
0600	0200	0100	0000	2300	2200
0700	0300	0200	0100	0000	2300
0800	0400	0300	0200	0100	0000
0900	0500	0400	0300	0200	0100
1000	0600	0500	0400	0300	0200
1100	0700	0600	0500	0400	0300
1200	0800	0700	0600	0500	0200
1300	0900	0800	0700	0600	0500
1400	1000	0900	0800	0700	0600
1500	1100	1000	0900	0800	0700
1600	1200	1100	1000	0900	0800
1700	1300	1200	1100	1000	0900
1800	1400	1300	1200	1100	1000
1900	1500	1400	1300	1200	1100
2000	1600	1500	1400	1300	1200
2100	1700	1600	1500	1400	1300
2200	1800	1700	1600	1500	1400
2300	1900	1800	1700	1600	1500

Table B.2 WARNING TYPE/BASIS CODES

1	Tornado/Radar
2	Tornado/Public Tornado Report
3	Tornado/Public Funnel Report
4	Tornado/Satellite Analysis
5	Severe Tstm/Radar
6	Severe Tstm/Public Report
7	Severe Tstm/Satellite Analysis

Table B.3 COUNTY PORTION WARNED

01	Entire County
02	East Half
03	West Half
04	North Half
05	South Half
06	Northwest Half
07	Northeast Half
08	Southwest Half
09	Southeast Half
10	Northwest Quarter
11	Northeast Quarter
12	Southwest Quarter
13	Southeast Quarter
14	Central
15	North Central
16	West Central
17	East Central
18	South Central

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