NATIONAL WEATHER SERVICE INSTRUCTION 10-1605

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Performance and Evaluation, NWSPD 10-16

STORM DATA PREPARATION

NOTICE: This publication is available at: http://www.nws.noaa.gov/directives/.

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SUMMARY OF REVISIONS: This Directive supersedes National Weather Service Instruction (NWSI) 10-1605, dated July 16, 2018. The following changes were made:

- Updated broken web links throughout the document.
- Replaced references to casualties to fatalities/injuries for consistency.
- Updated references to other NWS directives and made grammatical corrections.
- Section 2.7 – Removed reference to using Verisk PCS for damage amounts.
- Section 2.9.1 – Added policy guidance on reporting Flood, Flash Flood, and Debris Flow events, per Water Resources Services Branch.
- Appendix A – Expanded definition and event narrative policy for reporting Debris Flow, and updated examples, per Water Resource Services Branch.
- Appendix A – Updated reporting policy for Dust Storm events caused by thunderstorms, per Public and Severe Weather Programs.
- Appendix A – Updated policy information for reporting Flash Flood events in Section 14.1, per Water Resources Services Branch.
- Appendix A – Clarified Hail event sizes to be reported per Severe Weather Program.
- Appendix A --Added policy to include reporting Snow Squalls in Winter Weather events, per Winter Weather Program.

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Storm Data Preparation

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1 *Storm Data* Disclaimer. *Storm Data* is an official publication of the National Oceanic and Atmospheric Administration (NOAA) which documents:

a. The occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce;

b. Rare, unusual, weather phenomena that generate media attention, such as snow flurries in South Florida or the San Diego coastal area; and

c. Other significant meteorological events, such as record maximum or minimum temperatures or precipitation that occur in connection with another event.

While *Storm Data* serves as official input to the National Weather Service (NWS) verification system for select programs, the primary purpose of *Storm Data* is to accurately describe events, regardless of the impact on verification scores.

Some information appearing in *Storm Data* may be provided by or gathered from sources outside the NWS, such as the media, law enforcement and/or other government agencies, emergency managers, private companies, individuals, etc. An effort is made to use the best available information, but because of time and resource constraints, information from these sources may be unverified by the NWS. Accordingly, the NWS does not guarantee the accuracy or validity of the information. Further, when information appearing in *Storm Data* originated from a source outside the NWS (frequently credit is provided), *Storm Data* users requiring additional information should contact that source directly.

In most cases, NWS employees will not have the knowledge to respond to such requests. In cases of legal proceedings, Federal regulations generally prohibit NWS employees from appearing as witnesses in litigation not involving the United States. Reference NWS Instruction (NWSI) 10-2005, *Handling and Releasing Accident-Related Weather Information*, or the NWS Forensic Services Program Manager for additional guidance. The determination of direct versus indirect causes of weather-related fatalities or injuries is not a legal determination and should not be considered as such. The determination is intended for internal NWS statistical review to assist NWS in its primary mission of issuing forecasts and warnings for hazardous hydrometeorological events.

1.1 Local Data Retention Requirements. All documentation used for the production of *Storm Data* will be retained locally for two years. Note: The National Centers for Environmental Information (NCEI) is the official custodian of NWS weather records and responds to requests for certified records for litigation purposes.

2 *Storm Data* Preparation. The *Storm Data* preparer should allocate a sufficient amount of preparation time to ensure that documentation and verification of significant weather phenomena are as accurate and complete as possible. The preparer will carefully coordinate the time and location of events that cross County Warning Area (CWA) boundaries to prevent inconsistencies in the *Storm Data* database. These quality control procedures are important, especially for events used in the NWS national verification program.

Preparation will be done using the currently authorized on-line *Storm Data* software program. Software methodology and hardware requirements are provided on the Office of Chief Operating Officer (OCOO) Performance and Evaluation Branch's Performance Management Website. Certification of the monthly data will be accomplished electronically on-line. Inclusion of pictures in the monthly reports should be limited to unusual or highly significant events to keep the *Storm Data* publication at a reasonable size. If pictures are not the property of NOAA, proper attribution should be provided.

2.1 Permitted Storm Data Events. The only events permitted in *Storm Data* are listed in Table 1 of section 2.1.1. The chosen event name should be the one that most accurately describes the meteorological event leading to fatalities, injuries, damage, etc. However, significant events, such as tornadoes, having no impact or causing no damage, should also be included in *Storm Data*. See section 5 for detailed examples.

If the event that occurred is considered significant (i.e., met local/regional/national threshold criteria, or generated impact, or was newsworthy), even though it affected a small area, it should be entered into *Storm Data*.

In the event it is obvious that a continuous or nearly continuous swath of thunderstorm wind or hail damage occurred, a single event should be entered into *Storm Data*. This single event would be described as occurring from Point A to Point B, during Time C to Time D. The related event narrative could describe the width and length of the damage swath. Scientifically, a swath is more accurate and reduces the chance of a researcher interpreting a single event as a series of events occurring across multiple points.

Additional details about record values of temperature, precipitation, etc., may be included in the episode narrative of which the appropriate *Storm Data* event is a part. However, only the more significant values should be summarized, such as monthly, seasonal, or yearly records. For example, a new monthly single-storm, snowfall record can be included in the event narrative of a Heavy Snow event, or a new, all-time, 4-hour rainfall record value can appear in the event narrative of a Flash Flood event.

2.1.1 Storm Data Event Table.

Event Name	Designator	Event Name	Designator
Astronomical Low Tide	Z	Freezing Fog	Z
Avalanche	Z	Hail	C
Blizzard	Z	Heat	Z
Coastal Flood	Z	Heavy Rain	C
Cold/Wind Chill	Z	Heavy Snow	Z
Debris Flow	C	High Surf	Z
Dense Fog	Z	High Wind	Z
Dense Smoke	Z	Hurricane (Typhoon)	Z
Drought	Z	Ice Storm	Z
Dust Devil	C	Lake-Effect Snow	Z
Dust Storm	Z	Lakeshore Flood	Z
Excessive Heat	Z	Lightning	C
Extreme Cold/Wind Chill	Z	Marine Dense Fog	M
Flash Flood	C	Marine Hail	M
Flood	C	Marine Heavy Freezing Spray	M
Frost/Freeze	Z	Marine High Wind	M
Funnel Cloud	C	Marine Hurricane/Typhoon	M

Marine Lightning	M	Thunderstorm Wind	C
Marine Strong Wind	M	Tornado	C
Marine Thunderstorm Wind	M	Tropical Depression	Z
Marine Tropical Depression	M	Tropical Storm	Z
Marine Tropical Storm	M	Tsunami	Z
Rip Current	Z	Volcanic Ash	Z
Seiche	Z	Waterspout	M
Sleet	Z	Wildfire	Z
Sneaker Wave	Z	Winter Storm	Z
Storm Surge/Tide	Z	Winter Weather	Z
Strong Wind	Z		

Legend: There are three designators: C – County/Parish; Z – Zone; and M – Marine Zone.

Table 1. *Storm Data* Event Table.

2.2 Aircraft/Marine Incidents. It is the responsibility of the National Transportation Safety Board (NTSB) to investigate and file reports on the probable causes of aviation and marine-related incidents. A *Storm Data* preparer, however, can include events that may have resulted in an incident in *Storm Data* as long as associated NWS operational performance is not discussed. See Funnel Cloud, Marine Thunderstorm Wind, and Seiche examples in Appendix A.

2.3 Time. The beginning and ending time for each event will be entered as accurately as possible. Use local standard time in 24-hour clock throughout the year, such as 0600 Eastern Standard Time (EST), 0925 Central Standard Time (CST), 1800 Mountain Standard Time (MST), etc. Forecast offices having a CWA responsibility in multiple time zones should enter data in the appropriate time zone for the event's location.

Establishing the time of an event to the nearest minute will be difficult in certain situations. To minimize this problem, the *Storm Data* preparer should carefully compare all storm reports to available radar data, using unique radar signatures to make adjustments in the event time.

The *Storm Data* preparer ensures that event times in the event header-strip are consistent with event times mentioned in the event narrative. Extra quality control is needed in order to minimize user confusion and ensure that the national severe weather database is as accurate as possible.

In general, the time of an event, as it appears in the header-strip, is the time when the event reached locally, regionally, or nationally established advisory or warning criteria (exceptions defined in section 2.3.1). The event time could be the single time that a peak wind gust of 65 knots (75 miles per hour (mph)) occurred, or it could be beginning and ending times of a 10-minute shower of large, damaging hailstones. If the time of the event is a broad estimate, then it should be indicated as such in the event narrative.

2.3.1 Winter Weather Event Times. For the winter-related events of Blizzard, Heavy Snow, Ice Storm, Lake-Effect Snow, Sleet, and Winter Storm, there will be three times that will be logged in the *Storm Data* software:

- Beginning Time - In most cases, the beginning time will be when accumulations began, since this is usually the approximate time that the event started to have an impact or became a nuisance. For Blizzard events, the beginning time will be when blizzard conditions were first experienced (meeting visibility and wind criteria). The *Storm Data* preparer employs good judgment, but are also be consistent from one event to the next;

- Criteria Time - This is the time when the event reached locally, regionally, or nationally-established warning criteria. The criteria time will not appear in the event's header-strip in the *Storm Data* publication; only the beginning and ending times of the event will appear. The criteria time occurs between the date/time the event began and the date/time the event ended;

- Ending Time - This is the ending time of an event. In most cases the ending time will be when precipitation ended. In Blizzard events, it will be when visibilities or winds no longer met blizzard criteria.

2.3.2 Events That Span More Than One Month. Events that span more than one month will be entered for each month they occur, and the fact that the event spanned two or more consecutive months should be documented in the appropriate narrative. Directly-related fatalities, injuries, and damages will be given in the appropriate column for the month currently being prepared. Additional summary information on cumulative fatalities, injuries, or damages from previous months can be explained in the episode narrative of the *Storm Data* entry for the final month of the event.

2.4 Location. A hydrometeorological event will be referenced, minimally, to the nearest hundredth of a mile, to the geographical center (not from the village/city boundaries or limits) of a particular village/city, airport, inland lake, or location providing that the reference point is documented in the S*torm Data* software location database.

The *Storm Data* preparer is strongly encouraged to enter latitude/longitude pairs of numbers to describe an event's location, since latitude/longitude values can be entered with a precision out to the 4th decimal place. In contrast, if the preparer utilized the range/azimuth feature of reference cities, the accuracy would only be reflected to the 2nd decimal place.

The geographical centers of large, irregular-shaped cities may not correspond to their cultural/economic/political centers. In some cases, the reference point of these large, irregularly-shaped cities may have been redefined to co-exist with the cultural/economic/political center of that city, commonly referred to as the "downtown" location.

Ensure the referenced location used in the *Storm Data* software is in the same county in which the event took place. Additional, detailed information on the exact location of an event can be included in the event narrative. This additional, detailed information, such as highway names or numbers, intersections of major roads, city parks, and small lakes or other landmarks, would be useful when the event occurs within the boundaries of a large city. In some cases, if the event is relatively widespread, the *Storm Data* preparer may reference two locations on either side of the impacted area and describe the impacted area in the event narrative.

The *Storm Data* preparer can enter the azimuth/range of an event with respect to a reference city or the latitude/longitude coordinates of the severe weather event within the *Storm Data* software. Given one set of numbers, the software is able to calculate the same data in the other format.

For all Flood, Flash Flood, and Debris Flow events, ensure the referenced location used in the *Storm Data* software is between four (4) and eight (8) points to outline the flooded area within the *Storm Data* software. However, in the final *Storm Data* publication, only two locations will describe the impacted area. Because of this limitation, for large or high impact Flood, Flash Flood, and Debris Flow events, the *Storm Data* preparer is encouraged to describe the bounds of the impacted area in the event narrative.

For marine zones, a hydrometeorological event will be referenced (azimuth and range) to the reference points documented in the *Storm Data* software location database. In general, these would be coastal harbors, buoys, lighthouses or other prominent coastal shoreline features.

2.5 Event Source. The source of each *Storm Data* event will be entered in the software program. Possible sources of reports include "trained spotter," "law enforcement," and "emergency management." Refer to Table 2 in section 2.5.1 for a complete listing of event sources.

In those cases where the source of the event report is not obvious or there are multiple sources, the preparer should use professional judgment as to what single source is appropriate. Even though the event source does not appear in the final *Storm Data* publication, this information is used in related NWS statistical studies.

2.5.1 *Storm Data* Event Source Table.

911 Call Center
Airplane Pilot
Amateur Radio
Automated Surface Observing System (ASOS)
Automated Weather Observing System (AWOS)
Automated Weather Sensor System (AWSS)
Broadcast Media
Buoy
Coastal-Marine Automated Network (C-MAN) Station
Coast Guard
Community Collaborative Rain, Hail and Snow Network (CoCoRaHS)
Cooperative Network Observer
County Official
Department of Highways
Drought Monitor
Emergency Manager
Fire Department/Rescue
Insurance Company
Law Enforcement
Lifeguard
Local Official
Mariner
Mesonet
Newspaper

NWS Employee	Snow Telemetry (SNOTEL)
NWS Storm Survey	Social Media
Official NWS Observations	State Official
Other Federal Agency	Storm Chaser
Park/Forest Service	Trained Spotter
Post Office	Tribal Official
Public	Unknown
Remote Automatic Weather Station (RAWS)	Utility Company
River/Stream Gage	National Water Level Observation Network (WLON)
Severe Hazards Analysis & Verification Experiment (SHAVE) Project	

Table 2. *Storm Data* Event Source Table.

2.6 Fatalities/Injuries. The determination of direct versus indirect causes of weather-related fatalities or injuries is one of the most difficult aspects of *Storm Data* preparation. Determining whether a fatality or injury was direct or indirect has to be examined on a case-by-case basis. It is impossible to include all possible cases in this Directive. The preparer should include the word “indirect” in all references to indirect fatalities or injuries in the event narrative. This will minimize any potential confusion as to what fatalities and injuries referenced in the event narrative were direct or indirect. An event narrative example follows.

> “Powerful thunderstorm winds leveled trees and power lines in and around Morristown, TN. One of the toppled trees struck and killed two men running for shelter. During the clean-up operations after the storm, a person on an all-terrain vehicle (ATV) was injured (indirect) when the vehicle struck a tree that blocked a road.”

Exercise special care when dealing with situations in which vehicles leave a road surface (due to a non-weather reason) not covered with flood waters and go into non-flooded rivers or canals. Any fatalities, injuries, or damage in these cases will not be entered using the *Storm Data* software, since they are not weather-related. However, if a vehicle drives into flood waters crossing a roadway, or a vehicle is driven into a river that is above flood stage and the driver drowns or dies after being struck by debris in the water, then such fatalities would be entered as direct deaths in the *Storm Data* software.

In some cases, such as with Hurricane Katrina, it may be nearly impossible to determine what event (i.e., Storm Surge/Tide, Hurricane, Flash Flood, or High Surf) resulted in a directly-related death. To simplify the *Storm Data* preparation process, for these situations, it is appropriate to assign the death to the Hurricane (Typhoon) event. However, state this fact in the episode narrative.

2.6.1 Direct Fatalities/Injuries. A direct fatality or injury is defined as a fatality or injury directly attributable to the hydrometeorological event itself, or impact by airborne/falling/moving debris (e.g., missiles generated by wind, water, ice, lightning, tornado, dust storms). In these cases, the "active" agent was the weather event itself or the debris/missiles. Generalized examples of direct fatalities/injuries would include:

a. Thunderstorm wind gust causes a moving vehicle to roll over;

b. Blizzard winds topple a tree onto a person; and

c. Vehicle is parked on a road, adjacent to a dry arroyo. A flash flood comes down the arroyo and flips over the car. The driver drowns.

Fatalities and injuries directly caused by the weather event will be entered in the *Storm Data* software "fatality" and "injury" entry fields, respectively. For direct fatalities, enter the specific data as queried by the software (e.g., number of individuals, age, gender, location). Obtain information from reliable sources. The alphanumeric fatality code trailing the narrative is automatically inserted by the software. See Appendix A for detailed examples for each event type.

A directly-related weather injury is one that requires treatment by a first-responder or subsequent treatment at a medical facility. Injured persons who deny medical treatment also may be included. Persons who are not considered injured, but who are affected by the phenomenon, may be discussed in the event narrative.

In very rare cases, a pregnant woman may die from the direct effects of an event. In these situations, only one death (the pregnant woman) will be documented in *Storm Data.*

If a child less than 1 year of age (e.g., 2-months old) dies directly in a weather event, the child's age is to be rounded up to 1 year of age.

Should a person be directly injured in a weather event, but subsequently die several days/weeks later due to unrelated causes such as pneumonia, the death would be indirectly related to the original weather event, or the *Storm Data* preparer may elect to make no entry.

In some cases, such as with Hurricane Katrina, a person in New Orleans, LA, may have been directly injured by the event, but was subsequently evacuated to another city, such as Houston, TX. If this person eventually died from his/her initial injuries while in Houston, TX, and if this information was made available in a timely fashion to the *Storm Data* preparer at the New Orleans/Slidell office, this death should be documented as if it occurred in New Orleans. If this person died from other causes (e.g., vehicle accident, homicide) while in Houston, then his/her death was not related to Hurricane Katrina, and there will be no *Storm Data* entry.

2.6.1.1 Specifying Direct Fatality Locations. When specifying the location of the direct fatality, only the choices found in Table 3 of section 2.6.1.2 are to be used. In some cases, it will be easy to establish the fatality location, and in others it will be difficult, especially with water situations. For example, a person drives a vehicle into a flash flood; the vehicle is overturned, and the person drowns. In this situation, you should choose the "Vehicle and/or Towed Trailer" location (VE), since the person died as a result of being in the vehicle in floodwaters. Also, VE should be used for instances where a victim drove into flood waters, made a conscious effort to leave the vehicle, and drowned. The flash flood was still the cause of the death, but the VE designation indicates the vehicle's role in the fatality. Boating fatalities should be coded as BO instead of IW.

With respect to the example described in the last paragraph of section 2.6.1, the preparer should use the "Other/Unknown" location (OT) for situations where a person was evacuated to another site and died from direct injuries suffered at an unknown initial location. However, if available information is sufficient to determine the location where the direct injuries were initially sustained, then the *Storm Data* preparer should choose the appropriate fatality location.

2.6.1.2 Direct Fatality Location Table.

BF	Ball Field	MH	Mobile/Trailer Home
BO	Boating	OT	Other/Unknown
BU	Business	OU	Outside/Open Areas
CA	Camping	PH	Permanent Home
CH	Church	PS	Permanent Structure
EQ	Heavy Equipment/Construction	SC	School
GF	Golfing	TE	Telephone
IW	In Water	UT	Under Tree
LS	Long Span Roof	VE	Vehicle and/or Towed Trailer

Table 3. Direct Fatality Location Table.

2.6.2 Indirect Fatalities/Injuries. Fatalities and injuries, occurring in the vicinity of a hydrometeorological event, or after it has ended, but not directly caused by impact or debris from the event (weather event was a passive entity), are classified as indirect. The *Storm Data* preparer can enter the number of indirect fatalities into a field in the *Storm Data* software, along with the age, gender, and location of the fatality. Consequently, this data lends itself to internal NWS statistical review. However, indirect fatality information will not appear in the header-strip of the *Storm Data* publication.

Any available indirect fatalities and injuries should be discussed in the event narrative. Indirect injuries may be entered into a field within the *Storm Data* software, but they will not be tallied in official *Storm Data* statistics.

Fatalities and injuries due to motor vehicle accidents on slippery, water, or ice-covered roads are indirect. Ice, snow, and water on road surfaces are "passive" agents that do not directly impact a person or property, even though they induce conditions that trigger another event causing a fatality or injury.

If the hydrometeorological event induced conditions that triggered another event resulting in the fatality/injury, then it is indirect. For example, heart attacks, resulting from overexertion during or following winter storms, electrocution caused by contact with a downed power line after a storm has ended, a death occurring during post-storm cleanup operations, or a death in a fire triggered by lightning are indirect.

Fatalities and injuries resulting from driving in dense fog, a blinding blizzard, a winter storm, a winter weather event, a dust/sandstorm, or other visibility reducing hazards are indirect.

Generalized examples of indirect fatalities/injuries (see Appendix A for detailed examples) include:

a. Dense fog reduces visibilities from zero to 1/8 mile. A 20-vehicle pile-up occurs;

b. Thunderstorm winds topple trees onto a road. A motorist runs into a tree 30 minutes after the storm occurred;

c. Heavy snow is in progress and roads become icy/snow-covered. A vehicle slides across the road into another vehicle;

d. Lightning starts a fire that destroys a home, killing its occupants;

e. People suffer carbon monoxide poisoning due to improper or inadequate venting of heating systems, portable heaters, generators, etc.; and

f. Vehicle accident occurs on a non-flooded roadway and the vehicle and its occupants end up in a ditch, creek, ravine, river, or lake and the vehicle's occupants drowns.

2.6.3 Delayed Fatalities. On occasion, a fatality will occur a few days after the end of a meteorological event, due to weather-related injuries or the effects of the event. This is most common with long-duration, excessive heat episodes in which individuals never recover from the initial effects of the heat wave. The *Storm Data* preparer enters the post-event fatality information as part of the meteorological event that just ended, but enter the actual date of delayed fatality in the fatality entry field. An explanation can be given in the episode narrative for zone-based events, or in the event narrative for county-based or marine zone-based events.

2.7 Damage. Property damage estimates should be entered as actual dollar amounts, if a reasonably accurate estimate from an insurance company or other qualified individual is available. If this estimate is not available, then the preparer has two choices: either check the "no information available" box, or make an estimate. The lone exception is for flood events. The *Storm Data* preparer enters monetary damage amounts for flood events, even if it is an estimate. The U.S. Army Corps of Engineers requires the NWS to provide monetary damage amounts (property and/or crop) resulting from any flood event.

Typically, damage refers to damage inflicted to private property (e.g., structures, objects, vegetation) as well as public infrastructure and facilities. The *Storm Data* preparer is encouraged to make a good faith attempt to obtain or estimate the damage. Damage estimates are very important for many users and should be obtained if at all possible.

Estimates can be obtained from emergency managers, U.S. Geological Survey, U.S. Army Corps of Engineers, utility companies, and newspaper articles. If the values provided are rough estimates, then this should be stated as such in the narrative.

Estimates should be in the form of US Dollar values and rounded to three significant digits, followed by the magnitude of the value (i.e., 1.55 Billion $USD for $1,550,000,000). Values used to signify magnitude include: Thousand $USD, Million $USD, and Billion $USD. If additional precision is available, it may be provided in the narrative part of the entry. When damage is due to more than one element of the storm, indicate, when possible, the amount of damage caused by each element. If the dollar amount of damage is unknown, or not available, check the "no information available" box.

When deciding whether vegetation should be considered as property or crop damage, keep in mind the intended purpose of the vegetation. If the purpose of the damaged vegetation was to enhance a property's appearance (e.g., shade trees, hedges, lawn grass), the loss estimate should be listed in the property damage category. If the purpose of the damaged vegetation was for harvest (e.g., fruit trees, lumber, grasslands used for feed, sod farms), the estimate should be classified as crop damage regardless of whether the intended use was for personal or commercial resale.

Specific breakdowns should be stated in the event narrative (refer to section 2.9), if possible. The number of structures with minor or moderate damage should be indicated, as well as the number of buildings destroyed.

To determine whether the damage is directly related or indirectly related to the hydrometeorological event, the *Storm Data* preparer will use the same guidelines for fatalities and injuries provided in section 2.6.

2.7.1 Flood-Related Damage. Each Weather Forecast Office (WFO) will report flood damage in their CWA. The Service Hydrologist should assist in the collection and assessment of flood/flash flood information that pertains to *Storm Data*.

2.7.2 Crop Damage Data. Crop damage information may be obtained from reliable sources, such as the U.S. Department of Agriculture (USDA), the county/parish agricultural extension agent, the state department of agriculture, crop insurance agencies, or any other reliable authority.

The *Storm Data* preparer should be very careful when using crop damage to infer that a Thunderstorm Wind event occurred with wind gusts equal to or greater than 50 knots (58 mph), or to infer that a Hail event occurred with hail stones one inch or larger. Lesser wind speeds and smaller hail stones can result in crop damage. Additional investigation will be needed in these situations, such as contacting a person who lives in the affected area, and/or comparing what happened to other severe weather reports in the vicinity.

2.7.3 Other Related Costs. The cost of such items as snow removal, debris clearing/moving, firefighting, personnel overtime charges, public housing assistance, etc., will not be tallied as directly-related parts of the property/crop damage. If "other related" cost estimates are available, they may be included in the narrative as a separate item ("for information only"), and stated as such.

2.7.4 Delayed Damage. On occasion, vegetative or structural damage will occur within a few days, or even a couple of weeks, after a meteorological event. This is most common after a very heavy snowfall, or very heavy rain due to weight loading on roofs or buildings, tree branches, or power lines. Windy conditions after a heavy snow or heavy rain event may amplify the damage. In these cases, the *Storm Data* preparer **enters** the post-event damage information as part of the hydrometeorological event that just ended and explains the situation in the event narrative.

2.8 Magnitude of Storm. Select the type of storm or phenomenon from the available options provided in the software. If known, maximum gusts will be encoded as "measured"; otherwise, they will be an estimate (gusts are given in knots).

Doppler-derived wind speeds will not be used to determine the character of the storm or the Enhanced Fujita (EF)-scale of a tornado since these values are representative of conditions aloft rather than ground-based. However, this information can be included in the event narrative for enhancement.

Hail size will be given in hundredths of an inch (0.50, 0.75, 0.88, 1.00, 1.50, etc.), are the most common). Data regarding multiple severe phenomena (events) within a single episode will be provided as separate entries.

2.9 Textual Description of Storm. There are two kinds of textual descriptions: episode narrative and event narrative. Minimally, a brief episode narrative is needed for any weather event entry within the *Storm Data* software. The event narrative may or may not be needed. If the event does not cause injury, fatality or property/crop damage, the event does not require an event narrative, unless otherwise significant. For example, Hail events, as a single phenomenon, should not necessitate narratives unless they are part of a more complex weather event or cause fatality/injury or property/crop damage.

2.9.1 Episode Narrative. Generate an episode with a narrative; otherwise individual events cannot be entered into the *Storm Data* software. An episode narrative describes the entire episode in a general fashion, and briefly describes the synoptic meteorology associated with the episode. Information in the episode narrative can be very useful for researchers and other users of *Storm Data*. This narrative does not need to be long or elaborate, rather make it brief and informative. An example would be "A strong cold front passed through the Washington, D.C. area, triggering several instances of damaging thunderstorm winds and large, baseball-sized hail."

To ensure events being logged in a single episode are part of the same synoptic meteorological system, events within the same episode may begin no more than five (5) calendar days apart. This will enable the *Storm Data* preparer to properly document events that double back into a specific region or events that are very slow moving. Examples include Hurricane and Winter Storm events.

The episode narrative will appear in the *Storm Data* publication after all events contained within the episode. The episode narrative does not appear in the examples shown in Appendix A, which is reserved for only event narratives. Additionally, a brief summary of fatalities and injuries should be part of the episode narrative for zone-based events.

Should a reference time be used in the episode narrative, it is recommended that a blank space not be inserted between the numerical time and the time zone (e.g., 1200EST is the preferred method). This practice helps save space in the printed *Storm Data* publication.

For episodes containing Flood, Flash Flood, and Debris Flow events which cause injury, fatality, or property/crop damage, the following information will be included in the episode narrative:

a. A statement as to the rivers, areas, and states in which the floods occurred; the period of flooding, its magnitude, and interesting or unusual features; and if floods were of unusual severity.

b. A summary relative to the rainfall or other conditions causing the floods indicating the approximate average precipitation over the basins. In the case of post-fire debris flows and flash floods, the summary should include rainfall rates or any available sub-hourly or hourly rainfall gage data and/or Quantitative Precipitation Estimates (QPE).

2.9.2 Event Narrative. Detailed information pertaining specifically to the event and not the overall episode will appear in an event narrative. The event narrative describes the significance or impact of an event within an episode. An event narrative is required for all Tornado events, all Thunderstorm Wind events, and all Lightning events, whether over land or marine zones. This narrative will appear immediately below the header-strip in the publication and should contain descriptive information about the times, locations, and severity of destruction of property, trees, crops, power lines, roads, bridges, etc. Additionally, a brief summary of fatalities and injuries should be part of the event narrative for county-based and marine zone-based events. For Thunderstorm Wind events with estimated gusts, use sentences such as "Several trees were toppled by powerful downburst gusts."

The event narrative should be concise and not repeat information provided in the quantitative data found in the header-strip. When used properly, the event narrative integrates the numerical data into a cohesive meteorological event.

The event narrative always appears as a complete description of the event. The event narrative will never consist of a single, stand-alone phrase such as "See the 07/18/09 Thunderstorm Wind event at 1800CST for details." However, it is permissible to include a similar reference phrase at the end of an event narrative when that event spans two CWAs or different months.

Should a reference time be used in the event narrative, it is recommended that a blank space not be inserted between the numerical time and the time zone (e.g., 1200EST is the preferred method). This practice helps save space in the printed *Storm Data* publication.

When writing the event narrative, always indicate when and where tornadoes and thunderstorm wind events cross county, parish, and state lines, and boundaries of WFO CWAs. *Storm Data* preparers will coordinate with other affected offices to determine time and location of border-crossing tornadoes or other events. Storm characteristics, such as the intermittence of tornado paths, may be included.

The *Storm Data* software program will automatically encode a wind speed conversion line at the end of each event that is characterized with measured or estimated wind speed values. Therefore, it is not necessary for the preparer to provide the miles-per-hour equivalent for wind speed values that are required to be expressed in knots. The encoded line will have this appearance:

Note: The (Measured/Estimated) Wind (Speed/Gust) of xxx knots is equivalent to xxx mph.

For lightning injuries, it is highly desirable to include in the event narrative, the age, gender, location, and weather conditions at the time of occurrence, if known or determinable. The age, gender, and location information is used in compiling lightning statistics used in the national report entitled *Summary of Natural Hazard Statistics in the United States*.

Additional event narrative remarks (or an electronically inserted picture or graphic) may serve to locate storms more precisely and may give the areal extent and the directional movement or speed.

To maintain a consistent look and feel to the *Storm Data* publication, use the following guidelines for writing narratives:

a. Type all narratives in sentence format. All sentences begin with a capital letter. All sentences end with a period;

b. Do not begin a sentence with a number; instead, spell out the number: “17 inches of snow fell overnight” *should* read “Seventeen inches of snow fell overnight;”

c. Do not title the narrative with “Event Summary for Month, Day:” The event narrative IS the event summary so there is no need to identify it as such;

d. If an event spans two or more consecutive months, then state this fact in the event narrative;

e. The *Storm Data* preparer should title episode narratives for tropical cyclones with the name of the cyclone. Example: “Hurricane Katrina”;

f. Do not use simple phrases such as "trees down." Instead, use complete sentences such as "Several trees were downed by powerful thunderstorm wind gusts";

g. Do not use the hard return key before or after the narrative. This adds an extra blank line that takes up valuable space in the printed publication; and

h. When beginning a new paragraph, use a hard return instead of an indent (tab key). In other words, each paragraph is left-justified.

2.9.3 Cause of Event. The cause or trigger for Flood, Flash Flood, and Debris Flow events will be entered into the *Storm Data* software, so the NWS can generate internal verification and other statistical calculations. Possible causes to choose from are displayed within the *Storm Data* software (e.g., heavy rain).

2.10 Pictures. Inclusion of electronic images (Joint Photographic Group (.jpg), Graphics Interchange Format (.gif), or Portable Network Graphic (.png) format) into the *Storm Data* software is encouraged to enhance the historical record of an event. Images should be limited to unusual or highly significant events in order to minimize the size of the *Storm Data* publication. Minimally, images should have a 1024x768 resolution at 200 dots per inch (dpi). The *Storm Data* preparer should make an effort to scale high resolution images down to a reasonable size, preferably fewer than 2 megabytes.

3 Disposition of *Storm Data*. *Storm Data* is required to be certified by the Warning Coordination Meteorologist (WCM) or Meteorologist-in-Charge (MIC), no later than 60 days after the end of the month for which the data is valid. Certification takes place for all months even if no events occurred in the given month. The WCM and MIC are the only people who are allowed to certify data. If the data are not certified, they will not appear in the *Storm Data* publication; nor will they be used in the verification process.

In the event of corrections and/or additions in the data to a previously certified month, the WCM or MIC recertifies the month in which the modification was made. This can only be accomplished going back 18 months from the current month. Corrections and/or additions that need to be made for events that occurred more than 18 months prior need to be coordinated through the *Storm Data* Program Manager in the Performance and Evaluation Branch. Requests for these changes can be sent to NWS.Verification@noaa.gov.

4 Tornado and Severe Thunderstorm Confirmation Reports. Four alphanumeric text products are produced by the Storm Prediction Center (SPC). These text products, referenced below in Table 4 of Section 4.1, summarize unofficial (preliminary) tornado and severe thunderstorm reports that were processed at SPC and originated from each WFO. Each WFO should compare the appropriate message with its local records. Any change in event information should be noted, but corrections will be made via *Storm Data*. Additional severe weather statistics and graphics can be found on the SPC Webpage: http://www.spc.noaa.gov/.

There will be differences between the STAHRY/STADTS messages and the WFO's Local Storm Reports (LSRs).

4.1 Table of SPC Statistical Messages.

AWIPS ID	WMO Communications Header	Product Description
STADTS	NWUS20 KWNS	Listing of tornado and severe thunderstorm reports from 6 AM CST the previous day to 6 AM CST on the current day
STAHRY	NWUS22 KWNS	Listing of tornado and severe thunderstorm reports from 6 AM CST on the current day, and updated on an hourly accumulative basis
STAMTS	NWUS21 KWNS	Statistics for tornado totals, tornado-related fatalities, and number of killer tornadoes on a monthly and yearly basis (current year and previous 3 years)
STATIJ	NWUS23 KWNS	Listing of killer tornadoes for current year

Table 4. SPC Tornado and Severe Thunderstorm Statistical Report Table.

5 Event Types. *Storm Data* will be entered into the *Storm Data* program using the guidance provided in Appendix A of this directive.

APPENDIX A – Event Types

This section provides guidelines for entering event types in the *Storm Data* software.

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1 **Astronomical Low Tide (Z).** Abnormal, or extremely low tide levels, that result in deaths, injuries, watercraft damage, or significant economic impact due to low water levels. The low water levels will be a result of, or enhanced by, the gravitational forces of the moon and sun. Astronomical low tides are made more extreme when strong winds produce a considerable seaward transport of water, resulting in previously submerged, non-hazardous objects become hazardous or exposed.

Beginning Time - When the low tide began.

Ending Time - When tides returned to normal.

Direct Fatalities/Injuries

ϒ A boat traversing an ocean inlet foundered on the rocks in the unusually low waters and the boaters were injured when equipment on the boat was suddenly thrown about.

Indirect Fatalities/Injuries

ϒ A sightseer was killed when he drove off the road while looking at the absence of water in an adjacent bay.

Example:

AKZ203-204 Eastern Beaufort Sea Coast - Central Beaufort Sea Coast
24 0100AST 0 0 Astronomical Low Tide
25 2300AST

Over the Arctic coast from the evening of the 23rd through the 25th, east winds ranging from 25 to 45 kts (28 to 52 mph) persisted. The sea ice edge was 20 miles offshore and the wind produced a considerable seaward transport of water, causing the water level in Prudhoe Bay to run several feet below normal. Normal tidal variations are only one foot or less along the Beaufort Sea coastline. Extensive marine operations were halted at Prudhoe Bay during this time, including the unloading of barges.

2 Avalanche (Z). A mass of snow, sometimes containing rocks, ice, trees, or other debris, that moves rapidly down a steep slope, resulting in a fatality, injury, or significant damage. If a search team inadvertently starts another avalanche, it will be entered as a new Avalanche event.

Beginning Time - When the snow mass started to descend.

Ending Time - When the snow mass ceased motion.

Example:

COZ012 West Elk and Sawatch Mountains/Taylor Park
06 1900MST 5 1 Avalanche
1915MST

Four college students were caught in an avalanche, triggered when one of the students crossed a slope just below the summit on Cumberland Pass, which is about 25 miles east-northeast of Gunnison in the Sawatch Mountain Range. The entire slope at the 12,000-foot elevation fractured 6-feet deep and 1,500 feet across and ran 400 vertical feet, with the resulting avalanche scouring the slope all the way to the 9,000-foot level. The skier who triggered the avalanche was buried next to a tree which provided an air space that was crucial to his survival. The other three students, including a snowmobiler, a snowboarder, and another skier, perished in the snow. The avalanche also destroyed a cabin, killing the occupant. Boulders dislodged by the avalanche struck a car, killing the driver. M19OU, M20OU, M22OU, M43PH, F37VE

3 **Blizzard (Z).** A winter storm which produces the following conditions for three (3) consecutive hours or longer: (1) sustained winds or frequent gusts 30 knots (35 mph) or greater, and (2) falling and/or blowing snow reducing visibility frequently to less than 1/4 mile. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*.

Some Winter Storm and Blizzard events may have had sustained or maximum wind gusts that met or exceeded High Wind criteria. Rather than document an additional High Wind event, the *Storm Data* preparer should just mention the time, location, and wind value in the Winter Storm or Blizzard event narrative.

Beginning Time - When public impact from the blizzard began or was inferred to begin from surrounding reports. Normally, this will be the time of the first observation when blizzard wind/visibility conditions were first observed. The time that snow started to accumulate and/or blowing snow was first observed can be mentioned in the event narrative.

Criteria Time - When the 3rd hour of blizzard conditions was observed to occur or inferred to occur from surrounding reports.

Ending Time - When blizzard wind and visibility conditions are no longer observed or have been inferred to end from surrounding reports.

In *Storm Data*, no blizzard should cover a time period of less than three (3) hours. If blizzard-like conditions occur for less than three (3) hours, the event should be entered as Winter Storm, Heavy Snow, or Winter Weather, perhaps noting in the narrative that near-blizzard or blizzard-like conditions were observed at the height of the storm.

Direct Fatalities/Injuries

- People who became trapped or disoriented in a blizzard and suffered/died from hypothermia.
- People who were struck by objects borne or toppled in blizzard wind.
- People suffered/died from a roof collapse due to the weight of heavy snow that fell during a blizzard.
- A vehicle stalled in a blizzard. The occupant suffered from/died of hypothermia.

Indirect Fatalities/Injuries

- Vehicle accidents caused by poor visibility and/or slippery roads during a blizzard.

Example:

NYZ009-036- Northern Oneida- Madison – Otsego – Southern Oneida

037-046-	**02 1800EST** **03 1300EST**	**2**	**0**	**Blizzard**

An intense winter storm tracked through western New England the evening of the 2nd to the morning of the 3rd. This storm brought a prolonged period of blizzard conditions to north central New York State. Total snow accumulations ranged from 1 to 2 feet. Frequent wind gusts to 50 mph combined with the heavy snow to create widespread whiteout conditions. Snow drifts 10 to 20 feet high closed numerous roads, including the New York State Thruway, for up to 24 hours. Power outages were widespread as high winds knocked down trees and power lines leaving tens of thousands without power. A state of emergency was declared in Oneida, Madison and Otsego counties. Two people in Oneida County froze to death after they left their snow-covered vehicle and attempted to walk to a nearby farm home. M55OU, F60OU

4 Coastal Flood (Z). Flooding of coastal areas due to the vertical rise above normal water level caused by strong, persistent onshore wind, high astronomical tide, and/or low atmospheric pressure, resulting in damage, erosion, flooding, fatalities, or injuries. Coastal areas are defined as those portions of coastal land zones (coastal county/parish) adjacent to the waters, bays, and estuaries of the oceans. Farther inland, the *Storm Data* preparer determines the boundary between coastal and inland areas, where flood events will be encoded as Flash Flood or Flood rather than Coastal Flood. Terrain (elevation) features will determine how far inland the coastal flooding extends.

Note: Flooding of lakeshore areas of lakes with assigned marine zones should be entered under the Lakeshore Flood event category.

If the astronomical tide height for the flooded area is known, it should be subtracted from the total water level/storm tide (run-up/debris line), and the result specifically labeled in the narrative as "surge." The method of measuring surge height should be mentioned in the narrative, e.g., "NWS survey team calculated a surge height of 4 feet by subtracting the astronomical tide height from the run-up/debris line height." For *Storm Data*, coastal flood events that are associated with a storm of tropical origin (e.g., hurricane, typhoon, or tropical storm) should be reported under the Storm Surge/Tide event category, even if the tropical system is hundreds of miles away. All other coastal flooding events should be reported as a Coastal Flood.

<u>Beginning Time</u> - When the water level began to cause damage or flooding.

<u>Ending Time</u> - When the water level dropped to a point where damage or flooding ended.

<u>Direct Fatalities/Injuries</u>

- A coastal dwelling was washed away injuring/killing the occupants.
- A person drowned when a vehicle was swept away by the storm surge/tide.

<u>Indirect Fatalities/Injuries</u>

- A person suffered a heart attack while evacuating from a storm tide.

ϒ A person died in a vehicle accident caused by the storm tide washing away a traffic signal.

ϒ A person died in a vehicle accident after losing control in standing water on a road.

Example:

ORZ022 Curry County Coast
07 0600PST 0 0 100K Coastal Flood
1000PST
A 4-foot storm tide, as reported by local police, affected a portion of the Oregon coast. The storm tide washed away part of Port Orford's sewage treatment plant.

5 Cold/Wind Chill (Z). Period of low temperatures or wind chill temperatures reaching or exceeding locally/regionally defined advisory (typical value is -18°F or colder) conditions. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*. There can be situations where advisory criteria are not met, but the combination of seasonably cold temperatures and low wind chill values (roughly 15° F below normal) may result in a fatality. In these situations, a cold/wind chill event may be documented if the weather conditions were the primary cause of death as determined by a medical examiner or coroner. Normally, cold/wind chill conditions should cause human and/or economic impact.

Use this event only if a fatality/injury does not occur during a winter precipitation event.

Beginning Time - When cold temperatures or wind chill equivalent temperatures began.

Ending Time - When cold temperatures or wind chill equivalent temperatures ended.

Direct Fatalities/Injuries

ϒ A fatality where hypothermia was ruled as the primary, or major contributing factor as determined by a medical examiner or coroner. If other weather factors, such as freezing/frozen precipitation, disorient the person, trap the person, or cause the person to collapse, but the cause of the fatality was determined to be exposure or hypothermia, the fatality may be entered under the event type Winter Storm, Winter Weather, etc. The *Storm Data* preparer exercises professional judgement and work with the local medical examiner or coroner.

ϒ Elderly person wandered away from a nursing home, became disoriented, and died outdoors. Medical examiner ruled that the major cause of death was hypothermia.

ϒ A person was clearing snow a day or two after a winter storm, fell and could not get back up. Medical examiner ruled that the major cause of death was hypothermia.

ϒ Cases in which people receive medical treatment for frostbite or cold-hypothermia can be considered a direct injury.

ϒ A man dies from hypothermia after falling down a flight of stairs and becoming unconscious in his dark, unheated home.

Indirect Fatalities/Injuries

- ϒ Cases where people suffer carbon monoxide poisoning from using an improperly ventilated fuel burning portable heater due to the cold.
- ϒ Cases where people are injured or killed in a house fire due to improper use of portable heaters due to the cold.

Example:

WIZ001>004 Ashland – Bayfield – Douglas - Iron
05 0600CST 2 0 400K Cold/Wind Chill
07 1200CST
Wind chill values dropped to -18 to -30 as northwest winds blew at 20 to 30 mph. The fire sprinkler system in several Ashland School District buildings burst from cold temperatures over the weekend, which was not discovered until Monday morning, causing $400K in damage. Additionally, two cross-country skiers died from exposure on a trail west of Hurley in Iron County. The medical examiner classified the fatalities as being due to cold-hypothermia. M32OU, F33OU

INZ001 Lake
11 2000CST 1 0 Cold/Wind Chill
12 1400CST
A homeless man was found dead in Gary, Indiana. The cause of death was hypothermia. It was raining on this cold October day with winds of 17 to 26 knots (20 to 30 mph) and temperatures in the 30s. M42OU

6 Debris Flow (C). A slurry of loose soil, rock, organic matter, and water, similar to wet concrete, which is capable of holding particles larger than gravel in suspension. They can mobilize from landslides on steep, nearly saturated slopes or be triggered by intense rain after wildfires. They can travel several miles from their source, growing in size as they pick up sediment, boulders, trees, cars, and other material. High velocity flows can transport large boulders in suspension and cause catastrophic damage, but even slower debris flows can rapidly infill channels, divert streams, and destroy automobiles, buildings, and infrastructure. Hyperconcentrated flows can also carry significant amounts of sediment and debris and are frequently mistaken for debris flows. However, unlike hyperconcentrated flows that have anywhere from 5-10 percent up to 20-60 percent sediment by volume, debris flows typically exceed 50 percent sediment by volume and the flow behavior is significantly controlled by the entrained sediment instead of the water. Many, but not all, flash floods originating in burn scars also contain debris flows. In most cases, lahars or mudflows from volcanic activity are not considered a debris flow. Details, such as the name of the burn scar a debris flow originated from, or whether it was triggered by a shallow landslide unrelated to a burn scar, should be included in the Event Narrative. Refer to NWSI 10-950, *Definitions and General Terminology*, for additional information.

Beginning Time - When the debris flow started to descend.

Ending Time - When the debris flow ceased motion.

Direct Fatalities/Injuries
- People were struck by the debris flow.
- People killed or injured when a vehicle was struck by moving debris flow.

Indirect Fatalities/Injuries
- Motorists who ran into the mass of debris flow in the road after the mass stopped moving.

Cause of Flash Flood Event – *Storm Data* software requires that an entry be made for the cause of the Debris Flow event (e.g., heavy rain). This cause will not appear in *the Storm Data* publication.

Example:

Flathead County
6 SE West Glacier 15 0700MST 0710MST 1 1 15K Debris Flow

A thunderstorm produced very heavy rain early in the morning over the Grizzly Mountain Fire burned area, along Highway 2 in the West Glacier Region. Due to poor radar coverage and no rain gage data in the area, no accurate rainfall depth or intensity is available. A debris flow slide of large rocks and mud cascaded onto Highway 2 between West Glacier and Essex. A large rock hit a moving vehicle and killed one of the occupants instantly. The driver was seriously injured. M36VE

Gila County
8.3 NW Government Hill 27 2107MST 2122MST 0 0 50K Debris Flow

Debris flow pushed over State Route 188 and into Roosevelt Lake in Gila County after a radar estimated 1.5 - 3.0 inches of rain in 45 minutes fell over a portion of the 2020 Bush Fire burn scar. The debris flow was near mile post 253 and led to the closing of a 13 mile stretch of SR-188 in order for heavy equipment to remove roughly 20,000 cubic yards of sediment and boulders and to repair guard rails on both sides of the road. It was determined through collaboration between NWS and Arizona Geological Survey (AZGS) that this event was classified as debris flow. For information only, labor costs, fuel costs, and costs to remove the sediment and reopen the road, in addition to the property damage, was estimated around $500,000 for this and the other event location.

Juneau Borough County
0.2 W Douglas 06 0000AKST 1000AKST 0 0 0.64M Debris Flow

Saturated soils in the steep terrain combined with heavy rain destabilized slopes and triggered debris flows across the area. Most of the damage from the erosion occurred when culverts were overwhelmed or blocked and debris flows that blocked roadways in Douglas were reported by trained weather spotters or emergency management right after midnight on October 6th. There were multiple calls from the public located on St. Anns Avenue about minor street flooding in Douglas along with a debris flow on David and John Street washing out portions of the street. Police started to evacuate people out of harm's way with the Red Cross helping people displaced from the damage. Just before sunrise more reports came in that Thane Road was blocked by a debris flow just before Mt. Roberts Street. There were also other reports in the morning of the 6th that there was a debris flows in Cope Park in downtown Juneau along with major damage to the Alaska Electric Light and Power's flume system as a debris took out a section of the flume. One report came in that a person's oil tank became dislodged from erosion and was spilling heating fuel into the ground and street.

7 Dense Fog (Z). Water droplets suspended in the air just above the Earth's surface reducing visibility to values equal to or below locally/regionally established values for dense fog (usually 1/4 mile or less) and impacting transportation or commerce. If the event that occurred is considered significant, even though it affected a small area, it should be entered *into Storm Data*. Accidents, which resulted in injuries or fatalities, during a dense fog event, are reported using this event category. These injuries or fatalities should be listed as indirect.

Beginning Time – When dense fog criteria were first met.

Ending Time – When dense fog criteria were no longer met.

Direct Fatalities/Injuries – None.

Indirect Fatalities/Injuries
- Fatalities and injuries resulting from vehicular accidents caused by dense fog.
- During extremely dense fog, a construction worker lifted a metal pipe which touched a power line, resulting in electrocution.

Example:

NCZ053-065 Buncombe - Henderson
30 0400EST 0 0 Dense Fog
1000EST
Dense fog developed in the early morning hours in the French Broad River Valley. The fog impacted the morning commute, and contributed to several accidents in and south of Asheville. At 0900EST, the fog contributed to a 25-car pile-up on Interstate 40 on the south side of Asheville. The accident claimed 4 lives (indirect fatalities) and injured 17 (indirect). Asheville Regional Airport

was closed for most of the morning. The North Carolina State Police shut down Interstate 26 between the airport and the city as a precautionary measure.

8 **Dense Smoke (Z).** Dense smoke, reducing visibilities to values equal to or below locally/regionally established values (usually ¼ mile or less), that adversely affects people and/or impacts transportation or commerce. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*. Dense smoke in various concentrations suspended in the air at the Earth's surface can cause problems for people with heart or respiratory ailments.

Beginning Time - When dense smoke criteria were first met.

Ending Time - When dense smoke criteria were no longer met.

Direct Fatalities/Injuries
- People who suffered/died from inhalation of dense smoke.

Indirect Fatalities/Injuries
- Fatalities and injuries resulting from vehicular accidents caused by dense smoke.

Example:

MTZ0005 **Missoula/Bitterroot Valleys**
31 0400MST 2 0 Dense Smoke
1000MST
Dense smoke developed in the early morning hours in the Missoula and Bitterroot Valleys from a combination of surrounding forest fires in the Bitterroot Mountains. The dense smoke played havoc with the morning commute, and contributed to several long delays from minor accidents on Highway 93 near Lolo. Two elderly people died after being hospitalized for smoke inhalation near Florence. Dense smoke also delayed morning flights for several hours at Missoula International Airport. M88OU, F92OU

9 **Drought (Z).** Drought is a deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area. Conceptually, drought is a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield. There are different kinds of drought: meteorological, agricultural, hydrological, and social-economic. Each kind of drought starts and ends at different times. Additional information can be obtained at this Web address:

http://drought.unl.edu/DroughtBasics/WhatisDrought.aspx

A drought event should be included in *Storm Data* in relation to the drought classification system which is the foundation of the *Drought Monitor*, a multi-agency effort. Droughts are rated as Abnormally Dry (D0), Moderate (D1), Severe (D2), Extreme (D3), or Exceptional (D4). This information should be included in the narrative. Details on the *Drought Monitor* can be found at the following Web address: http://droughtmonitor.unl.edu/.

For locations east of the Rocky Mountains, drought events should be included in *Storm Data* for classification of Severe (D2) or higher. For locations including and west of the Rocky Mountains, drought events should be included in *Storm Data* for classification of Extreme (D3) or higher. Drought events of lesser classification should be included if they cause significant impacts to people, animals, or vegetation.

Beginning Time - When an area first reaches Severe (D2) or Extreme (D3) classification or drought begins to cause significant impact to people, animals, or vegetation.

Ending Time - When an area is no longer in at least Severe (D2) or Extreme (D3) classification or drought no longer causes significant impact to people, animals, or vegetation.

Direct Fatalities/Injuries

ϒ None.

Indirect Fatalities/Injuries

ϒ None.

Example:

MTZ003	**Flathead/Mission Valleys**				
	01 0000MST	**0**	**0**	**55K**	**Drought**
	22 1800MST				

A drought, which began in early July ended for much of the Flathead and Mission Valleys on September 22, when 3 to 5 inches of precipitation fell. For many locations this was the first significant rain exceeding a quarter of an inch since July 4. The drought's effect was especially felt during the first 3 weeks of September (Severe - D3) after numerous grass fires prompted many communities to ban any type of outdoor burning. Among the largest fires reported were: 180-200 acres of grassland and timber from Pablo to St. Ignatius. The most costly reported fire was when smoldering leaves ignited dry grass near Ronan, eventually spreading into two homes and causing $55,000 worth of damage. Damage amounts do not include costs to individual fire departments for fire containment.

Note: This example above should have entries in July and August *Storm Data* as well. Damage amounts in the header are for the current month only. Grand totals for the entire drought episode should be mentioned in the narrative. In some cases, the effects and cost of a drought may not be known for some time.

10 Dust Devil (C). A ground-based, rotating column of air, not in contact with a cloud base, usually of short duration, rendered visible by dust, sand, or other debris picked up from the ground, resulting in a fatality, injury, or damage. Dust devils usually result from intense, localized heating interacting with the micro-scale wind field. Dust devils that do not produce a fatality, injury, or significant damage may be entered as an event if they are unusually large, noteworthy, or create strong public or media interest.

Beginning Time - When the rotating column of air first became visible.

Ending Time - When the rotating column of air was no longer visible.

Direct Fatalities/Injuries

- People who were asphyxiated due to high dust/sand content in the air. (Rare)
- People who were hit by flying debris.
- Fatalities and injuries resulting from a vehicle being tipped over or blown off a road.

Indirect Fatalities/Injuries

- Fatalities and injuries resulting from vehicular accidents caused by reduced visibility during a dust devil, or vehicular accidents caused by debris left on a road after a dust devil passed by.

Example:

Maricopa County

4 W Gila Bend12	**1400MST** **1420MST**	**0**	**2**	**20K**	**Dust Devil**

A fairly strong dust devil developed and moved directly along Interstate 8, according to amateur radio reports. Visibility was severely reduced in the dust devil. One motorist drove into the dust devil, which pushed and flipped the vehicle off the road. The driver and one passenger were injured. Winds were estimated at 56 knots (65 mph).

11 Dust Storm (Z). Strong winds over dry ground, with little or no vegetation, that lift particles of dust or sand, reducing visibility below locally/ regionally established values (usually 1/4 mile or less), which could result in a fatality, injury, damage, or major disruption of transportation. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*.

Some dust storms may be due to winds meeting or exceeding locally/regionally defined high wind warning criteria. The preparer should enter these events as Dust Storm events, as well as enter High Wind events for those events which met or exceeded locally/regionally defined warning criteria. All fatalities, injuries, and/or damage should be entered in association with the Dust Storm.

Dust storms that occur in direct relation to convection should be entered as a Thunderstorm Wind event, including the appropriate wind magnitude, *not* as a Dust Storm entry. For example, severe straight-line winds from a microburst generated a dust storm, which caused a traffic pileup with indirect fatalities and injuries. When a dust storm has moved away from the parent thunderstorm or convection, and presents as its own hazard or threat, it should be classified as a Dust Storm. This includes: when the parent thunderstorm dissipates and the dust storm continues; or, when the dust storm propagates out far enough ahead of the ongoing parent thunderstorm, such that the leading edge is no longer associated with the storm, and the dust storm continues to be a threat to life or property.

Beginning Time - When an area of blowing dust or sand first reduced visibility to locally/regionally established values or began to cause a major impact.

Ending Time - When an area of blowing dust or sand diminished so that visibility was above locally/regionally established values or no longer had a major impact.

Direct Fatalities/Injuries

ϒ People who were asphyxiated due to high dust/sand content in the air. (Rare)
ϒ People who were hit by flying debris.
ϒ Fatalities and injuries resulting from a vehicle being tipped/pushed over or blown off a road by the strong winds, resulting in an accident and associated fatalities/injuries.

Indirect Fatalities/Injuries

ϒ Fatalities and injuries resulting from vehicular accidents caused by reduced visibility during a dust storm or by debris left on a road after a dust storm passed.

Example:

KSZ061 Hamilton

24 1600MST 0 2 20K Dust Storm
1645MST

A strong cold front caused wind gusts to around 43 knots (50 mph) across far western Kansas. An area of dust and dirt was lifted hundreds of feet into the air, reducing the visibility to near zero across U.S. Highway 50, west of Syracuse. A wind gust overturned and damaged an empty semi-trailer, injuring the two occupants.

12 Excessive Heat (Z). Excessive Heat results from a combination of high temperatures (well above normal) and high humidity. An Excessive Heat event occurs and is reported in *Storm Data* whenever heat index values meet or exceed locally/regionally established excessive heat warning thresholds. Fatalities (directly-related) or major impacts to human health that occur during excessive heat warning conditions are reported using this event category. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*.

Fatalities or impacts to human health occurring when conditions meet locally/regionally defined heat advisory criteria are reported within the Heat event category (Refer to section 20 – Heat, for more details). If deaths are determined to be a result of the heat, but locally/regionally defined heat warning or heat advisory criteria are not met, then the fatalities can only be mentioned in the narrative of another *Storm Data* event that occurred near the time of death.

In some heat waves, fatalities may occur for several days following the meteorological end of the event. The preparer should include these fatalities in the event, but encode the actual date of the directly-related fatalities in the fatality entry table.

Depending on the part of the country experiencing high temperatures, the heat effects are modulated by relative humidity, cloud cover, wind speeds, the duration of a hot spell, the time of the year, and other factors, including mortality rates and types of housing.

Beginning Time - When local/regional established warning thresholds for excessive heat were first met or when abnormally hot conditions began.

Ending Time - When local/regional established warning thresholds for excessive heat were no longer met or abnormally hot conditions ended.

Direct Fatalities/Injuries

- Fatality where heat-related illness or heat stress was the primary or major contributing factor as determined by a medical examiner or coroner.
- An elderly person suffered heat stroke and died inside a poorly ventilated apartment during a heat wave.
- A toddler was left inside a car while a parent went inside a grocery store on a hot day where ambient conditions met the local/regional definition of excessive heat. The windows were left rolled up, and the toddler died. Likewise, any person or group of persons who die as a result of being trapped inside a vehicle or other enclosure during excessive heat conditions would be labeled as direct fatalities.
- Cases in which people receive medical treatment for heat-hyperthermia (severe dehydration, sunstroke, heatstroke, etc.) and survive are considered injuries, not illnesses, for *Storm Data* purposes.

Indirect Fatalities/Injuries

- Fatality where excessive heat was the secondary or contributing factor.
- Excessive heat triggered widespread power outages, which in turn caused a person's respirator to turn off, and that person died.

Examples:

MIZ068> Monroe - Livingston - Oakland - Macomb - Washtenaw - Wayne - Lenawee - 070-075-076-082-083

02 1300EST 4 24 Excessive Heat
05 2000EST

Very hot and humid weather occurred over southeast Michigan over the Fourth of July weekend. High temperatures were in the mid to upper 90s across metro Detroit all 4 days, with Detroit City Airport reaching 100 degrees on July 4. The high of 97 degrees at Detroit Metropolitan Airport on July 5 set a new record for that date.

Heat indices were in the 105 to 115-degree range all four afternoons. Dozens of people were treated at area hospitals for heat-related illnesses over the weekend, and four elderly people died from heat stroke based on medical reports. Two of the fatalities occurred on July 4, one on July 5, and one person died on July 7 after being hospitalized for heat stroke for 2 days. The heat wave finally broke when a cold front moved through Lower Michigan late in the day on July 5. M89PH, F77PH, M95PH, F72PH

MOZ037 Jackson
10 1800CST 1 0 Excessive Heat
11 2000CST
The high temperature reached 105 degrees with a heat index of 115 on the afternoon of June 11. During the overnight hours of June 10th, the heat indices stayed above 85. The medical examiner reported an elderly woman died from heat stress. She was found dead in her apartment. F84PH

ILZ027>031- Knox – Stark – Peoria – Marshall – Woodford – Fulton – Tazewell –
036>038-040> Mclean – Schuyler – Mason – Logan – DeWitt – Piatt – Champaign -
057-061>063- Vermilion – Cass – Menard – Scott – Morgan – Sangamon – Christian -
066>068-071> Macon – Moultrie – Douglas – Coles – Edgar – Shelby – Cumberland -
073 Clark – Effingham – Jasper – Crawford – Clay – Richland – Lawrence
30 1100CST 0 0 Excessive Heat
31 2359CST
An extended period of excessive heat and humidity occurred across central and southeast Illinois from July 30th to August 2nd. Afternoon high temperatures ranged from 99 to 106 degrees most afternoons, with afternoon heat index values ranging from 110 to 120. Overnight lows only fell into the upper 70s. A 39-year-old male from Mapleton (Peoria County) suffered a heart attack and died in his mobile home. The excessive heat was a contributing factor, since the victim was taking a medication that prevented him from sweating (indirect fatality).

12.1 Heat Index Table.

HEAT INDEX VALUES
DEWPOINTS (F)

T(F)	35	40	45	50	55	60	65	70	75	80	85
75	76	77	77	78	78	79	78	77	75		
80	79	79	79	80	80	81	82	83	85	87	
85	82	82	82	83	84	85	87	90	93	99	107
90	86	86	86	87	88	90	92	96	100	107	117
95	90	91	91	92	93	95	97	101	107	115	126
100	95	95	96	97	98	101	104	108	114	121	132
105	99	100	101	102	104	106	109	114	120	129	140
110	104	104	105	107	109	112	115	120	126	134	145
115	107	108	110	112	114	117	121	126	133	141	152
120	111	112	113	116	118	122	125	132	138	146	156
125	114	115	117	120	123	127	130	136	142	151	163
130	116	117	119	123	125	130	134	141	149	156	168

HEAT INDEX VALUES
RELATIVE HUMIDITY (%)

T(F)	20	30	35	40	45	50	55	60	70	80	90
75	71	72	73	73	74	74	75	75	76	77	78
80	79	79	80	80	80	81	81	82	83	84	86
85	82	83	84	84	85	87	88	89	93	97	102
90	86	88	89	91	93	95	97	100	106	113	122
95	92	94	97	99	102	105	109	113	123	134	147
100	98	102	106	109	114	118	124	130	143	158	
105	104	112	116	122	127	134	141	149	166		
110	112	122	129	136	143	152	161	171			
115	121	135	143	152	162	173	184				
120	130	148	159	170	182	196					
125	140	163	176	190	205						
130	151	179	195	212							

Table A1. Heat Index Values Based on Relative Humidity or Dew Point.

13 Extreme Cold/Wind Chill (Z). A period of extremely low temperatures or wind chill temperatures reaching or exceeding locally/regionally defined warning criteria (typical value around -35°F or colder). If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*. Normally these conditions should cause significant human and/or economic impact. However, if fatalities occur with cold temperatures/wind chills but extreme cold/wind chill criteria are not met, the event should also be included in *Storm Data* as a Cold/Wind Chill event and the fatalities are direct.

Use this event only if a fatality/injury does not occur during a winter precipitation event.

Beginning Time - When extreme or abnormally cold temperatures or wind chill equivalent temperatures began.

Ending Time - When extreme or abnormally cold temperatures or wind chill equivalent temperatures ended.

Direct Fatalities/Injuries

- ϒ A fatality where hypothermia was ruled as the primary, or major contributing factor, as determined by a medical examiner or coroner. If other weather factors, such as freezing/frozen precipitation, disorient the person, trap the person, or cause the person to collapse, but the cause of the fatality was determined to be from exposure or hypothermia, the fatality may be entered under the event type Winter Storm, Winter Weather, etc. The *Storm Data* preparer exercises professional judgment and work with the local medical examiner or coroner.
- ϒ Elderly person wandered away from a nursing home, became disoriented, and died outdoors. Medical examiner ruled that the major cause of death was hypothermia.
- ϒ Cases in which people receive medical treatment for frostbite or cold-hypothermia can be considered an injury.
- ϒ A man dies from hypothermia after falling down a flight of stairs and becoming unconscious in his dark, unheated home.

Indirect Fatalities/Injuries

- ϒ After shoveling snow, a man collapsed in the driveway. The medical examiner determined the primary cause of fatality was heart attack.

Examples:

WYZ054>058 North Campbell - South Campbell – Western Crook - Wyoming Black Hills - Weston
01 1200MST 4 0 500K 50K Extreme Cold/Wind Chill
03 1000MST
Temperatures fell to 35 below to 45 below zero (-45 in Gillette) on the 2nd. Four fishermen were found frozen at their campsite near Pine Haven at Keyhole State Park in Crook County. The medical examiner classified the fatalities as being due

to cold-hypothermia. The extreme cold caused water mains and pipes to freeze and burst in Gillette and Newcastle, resulting in water damage to homes and businesses. In addition, a couple of ranchers reported losses of livestock. M44OU, F42OU, F57OU, M59OU

NDZ050 **McIntosh**
15 1000CST **1** **0** **Extreme Cold/Wind Chill**
15 2200CST
An 84-year-old Lehr man died of hypothermia when he went to visit the grave of his wife. The man was found 1 mile from his house. Temperatures that day were around 20 below and wind speeds of 17 to 22 knots (20-25 mph). Wind chills were estimated to be around 50 below. The man was not wearing a coat or gloves when he was found. M84OU

13.1 Wind Chill Table.

Wind Chill Chart

Wind (mph)

Temperature (ºF)

Calm	5	10	15	20	25	30	35	40	45	50	55	60
40	36	34	32	30	29	28	28	27	26	26	25	25
35	31	27	25	24	23	22	21	20	19	19	18	17
30	25	21	19	17	16	15	14	13	12	12	11	10
25	19	15	13	11	9	8	7	6	5	4	4	3
20	13	9	6	4	3	1	0	-1	-2	-3	-3	-4
15	7	3	0	-2	-4	-5	-7	-8	-9	-10	-11	-11
10	1	-4	-7	-9	-11	-12	-14	-15	-16	-17	-18	-19
5	-5	-10	-13	-15	-17	-19	-21	-22	-23	-24	-25	-26
0	-11	-16	-19	-22	-24	-26	-27	-29	-30	-31	-32	-33
-5	-16	-22	-26	-29	-31	-33	-34	-36	-37	-38	-39	-40
-10	-22	-28	-32	-35	-37	-39	-41	-43	-44	-45	-46	-48
-15	-28	-35	-39	-42	-44	-46	-48	-50	-51	-52	-54	-55
-20	-34	-41	-45	-48	-51	-53	-55	-57	-58	-60	-61	-62
-25	40	47	51	55	58	60	62	64	65	67	68	69
-30	-46	-53	-58	-61	-64	-67	-69	-71	-72	-74	-75	-76
-35	-52	-59	-64	-68	-71	-73	-76	-78	-79	-81	-82	-84
-40	-57	-66	-71	-74	-78	-80	-82	-84	-86	-88	-89	-91
-45	-63	-72	-77	-81	-84	-87	-89	-91	-93	-95	-97	-98

Frostbite Times: 30 Minutes, 10 Minutes, 5 Minutes

Table A2. Wind Chill Values Based on Temperature and Wind Speed.

14 Flash Flood (C). A life-threatening, rapid rise of water into a normally dry area beginning within minutes to multiple hours of the causative event (e.g., intense rainfall, dam failure, ice jam). Ongoing flooding can intensify to the shorter term flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters. Flash flooding, such as dangerous small stream or urban flooding and dam or levee failures, requires immediate action to protect life and property. Conversely, flash flooding can transition into flooding as rapidly rising waters abate. The *Storm Data* preparer uses professional judgment in determining when the event is no longer characteristic of a Flash Flood and becomes a Flood.

Every Flash Flood event that occurred and meets the criteria defined in this directive will be logged in *Storm Data*, regardless of whether or not a flash flood warning was issued. The time entered into *Storm Data* for when flash flooding began will be determined by reports and/or observations from the flash flood-affected area and will not be influenced by the time a flash flood warning product was in effect.

14.1 Suggested Specific Guidelines. A Flash Flood event begins within minutes to multiple hours of the causative event such as moderate to heavy rain, dam break, or ice jam release. Criteria for determining if an event was a Flash Flood includes, but is not limited to:

- A river or stream rose rapidly and flowed out of its banks in a matter of a few hours, was a threat to life or property, and urgent response was necessary.
- Person or vehicle was swept away by flowing water from runoff that inundates land adjacent to a channel of any size.
- A maintained county or state road is closed by high water.
- Six inches or more of swiftly moving water flowed over a road or bridge, posing a threat to life or property.
- Dam break or ice jam release caused a dangerous out-of-bank stream flow or inundated normally dry areas, creating a hazard to life or property.
- Any amount of water in contact, flowing into or causing damage of an above ground residence or public building and is runoff from adjacent grounds.
- Three feet or more of ponded water that poses a threat to life or property (A 1988 United States Bureau of Reclamation (USBR) study indicated 3 feet or more as a danger to people and vehicles).
- Flash Floods containing debris (mud, rock, vegetation) should only be classified as Debris Flows if they meet the criteria outlined in Section 2.5 of NWS Manual (NWSM) 10-950.

The following can be used as signals to search further for evidence of a Flash Flood, but do not by themselves indicate a Flash Flood has occurred.

- Damage to any maintained road.
- Flood waters entering a structure (i.e., basement flooding).

Additional information should be gathered (i.e., actual reports of flooding in the area which meet local Flash Flood criteria) to justify the entry of a Flash Flood event.

14.2 Questions to Ask Observers, Emergency Managers, etc. Questions should be posed in such a way as to determine whether or not a flooding episode was truly a Flash Flood event. Example questions are given below.

The following are worded for follow-up verification, but could be re-worded to aid in the determination of a Flash Flood event:

- Was the river/stream flowing out of its banks and a danger to life or property? Was there around 6 inches or more of water flowing over the ground/bridge/road? Do you know about what time this began?
- Were any roads or bridges closed? Do you know about what time they were first closed?
- Was water rapidly flowing over the road or land surface (i.e., yard, field, etc.)?
- Can you estimate the maximum depth of the moving water? (May ask to compare to car tires. Six inches may qualify as an event.)
- Can you estimate the depth of ponded or standing water? (Three feet of ponded water may qualify as an event.)
- Did water enter any house or building? If so, was flooding the result of sewer backup or sump pump failure? (If yes to the second question, this does not qualify as an event.)
- Were there any evacuations due to flood waters?
- Can you estimate the beginning and ending time of the flood that created impacts?
- If you were not present at the time of flooding, can you determine high-water marks on trees, buildings, or other objects?

14.3 Low-impact Flooding vs. Threat to Life or Property. To maintain the most reliable data set it is important to separate low-impact flooding from flash flooding. Low-impact flooding should not be considered a Flash Flood event; rather it should be considered a Flood event. Low-impact flooding does not pose a significant threat to life or property in the same way a Flash Flood does. The following events should be considered as Flood events, not Flash Flood:

- Minor flooding in urban areas and bottom lands of small streams/creeks (conditions that do not pose a threat to life or property).
- Minor ponding of water during or after a heavy rain event or flood (deep ponding of water may pose a threat to life and property).
- High stream levels due to steady or slowly rising/receding creeks/streams that do not pose a threat to life or property.

Beginning Time - When flood waters became an immediate threat to life or property. Flash Flooding occurs in all environments. The distinction between Flash Flood and Flood events is that a Flash Flood event exhibits a rapid onset of adverse impacts to lives and property. The following are examples of potential flash flood onset time.

- A maintained county or state road is first closed by high water.
- Approximate time when 6 inches or more of flowing water is observed over a road or bridge.
- The point at which any amount of water comes in contact, flowing into, or causes damage to an above ground residence or public building and is the runoff from adjacent grounds.
- The time when 3 feet or more of water has ponded and poses a threat to life and property.

Ending Time - When flood waters receded to a point where there was no longer an immediate threat to life or property. The event may then be continued as a Flood event.

Cause of Flash Flood Event - *Storm Data* software requires that an entry be made for the cause of the Flash Flood event (e.g., heavy rain). This cause will not appear in *the Storm Data* publication.

Direct Fatalities/Injuries
When determining whether a fatality is directly related to a Flash Flood event, the *Storm Data* preparer should ask two basic questions.

- Was flash flooding ongoing at the time of death?
- Was the cause of death drowning, or death by impact related to the Flash Flood (i.e., large debris in flood waters) event?

If the answer to both questions is yes, the fatality is directly flash flood related. Figure 1 in section 15.1 can be used to help determine whether a fatality or injury is direct or indirect.

The following are examples of direct flash flood fatalities.

- An individual or individuals, regardless of extenuating circumstances, purposely entered a flooded waterway or inundated area and drowned.
- A person drowned in a flash flood or was struck by an object in flash flood waters.
- A motorist drowned in an overturned car after driving down a hill onto a flooded stretch of highway that had flood waters 4 feet deep. (It doesn't matter how irresponsible the driver was.).
- A recreational boater (kayak, raft, motorboat) drowns in flood waters.
- Several campers drowned when a thunderstorm 10 miles away in an adjacent county/parish sent a flash flood wave down an arroyo where they camped.
- Debris caught in flood waters struck and injured a person walking along a flooding river.
- Drowning or injuries due to flooding caused by a dam break.

Note: Direct fatalities which are vehicle-related will be coded as VE (Vehicle and/or Towed Trailer). In addition, if a person drives into a flooded area, exits his/her vehicle and drowns, the fatality will still be coded as VE.

The *Storm Data* preparer should work with the WFO Hydrology Program Manager to make case-by-case determinations on potential flood related fatalities. These determinations are often subjective, and can only be made by the professional assessment of the WFO team. When additional guidance is needed, WFO staff are encouraged to contact the National Hydrologic Information Coordinator at NWS Headquarters, or their Regional Hydrology Program Manager.

The *Storm Data* preparer cannot be influenced by factors which brought the victim to the flood waters, such as impairment by alcohol or drugs, or poor decision making of any sort. Those factors are extraneous to the hydrometeorological assessment of flooding, which only the local team is certified to make.

In some cases, it is not clear whether the victim died from drowning or another mechanism. For example, a vehicle accident caused impact which may have killed the victim upon contact. Flooding was ongoing at the time, but there is doubt as to whether the victim drowned or died by impact. In these cases, the *Storm Data* preparer will abstain from making a storm data entry, until law enforcement officials verify the official cause of death.

<u>Indirect Fatalities/Indirect Injuries</u>

ϒ Vehicular accidents and incidents that the flash flood contributed to but did not directly cause.

ϒ Children playing in debris or workers cleaning up debris left by a flash flood. Debris shifted and child or worker was struck, pinned, or crushed by debris.

ϒ A flash flood loosened rocks on a mountainside. After the water receded, a rock climber fell to his death after grabbing onto one of the loosened rocks for a handhold.

ϒ A remote mountain pass road was undermined in a flash flood by a nearby creek. After the water receded, a vehicle drove into the hole in the road, killing the passenger and injuring the driver.

<u>Examples</u>:

Milwaukee County
Wauwatosa to 06 1000CST 2 0 2.5M Flash Flood
Milwaukee 07 0000CST

Thunderstorms dumped rainfall amounts of 8 to 12 inches between 0700CST and 1900CST on July 6 in a 7-mile-wide band from the city of Waukesha (Waukesha Co.) east to downtown Milwaukee (Milwaukee Co.). Flash flooding killed two people who drowned when their car was swept away by flood waters at the intersection of I-94 and I-43. Widespread flood damage occurred to 2,000 homes and 500 businesses. The maximum rainfall total in Milwaukee County was 11.25 inches, which was measured at the downtown Public Safety Building. M25VE, F24VE

Jo Daviess County
East Dubuque 27 0300CST 2 0 2.5M Flash Flood
Elizabeth 28 1800 CST

Torrential rains of 7 to 15 inches caused some flash flooding across Jo Daviess County during the evening of July 27 and morning of July 28. Numerous streets were reported flooded in East Dubuque causing sink holes to form as well as buckling of the road rendering them impassable. A 70-year-old woman died in the flood waters after being thrown from a vehicle overcome by flood waters while traveling along Long Hollow Road near Elizabeth, IL. A 75-year-old man died in his car which was swept away in flood waters near Galena, IL. F70VE, M75VE

Herkimer County
Dolgeville 28 0930EST 0 0 4K Flash Flood
1S Dolgeville 1500EST
An ice jam developed during the morning of February 28 along East Canada Creek at the State Highway 29 bridge in the village of Dolgeville. The water rapidly backed up, flooding the cellars of nearby buildings. The ice jam broke up in the late afternoon without any further flooding downstream.

Cannon County
Woodbury 07 0830CST 0 0 100K Flash Flood
2E Woodbury 1300CST
A dam broke and the resultant flash flood damaged a dozen homes downstream.

Note: This example would apply to levees, retaining walls, and other structures.

14.4 Examples of a Flash Flood that Evolved into a Flood.

Kern County
3E Frazier Pk 10 1900PST 0 0 1.0M Flash Flood
4W Frazier Pk11 0100PST
A powerful storm dropped 3 to 4 inches of rain over portions of Kern County during the afternoon of the 10th. The heavy rains caused flash flooding on several creeks. Frazier Mountain Road, between I-5 and Lockwood Valley Road, was washed out in several spots by overflowing creeks.

Kern County
3E Frazier Pk 11 0100PST 0 0 Flood
4W Frazier Pk11 1000PST
A powerful storm dropped 3 to 4 inches of rain over portions of Kern County during the afternoon of the 10th. The heavy rains caused flash flooding of several creeks. Frazier Mountain Road, between I-5 and Lockwood Valley Road, was washed out in several locations. Additional 1 to 2 inches of rain caused creeks to remain flooded and roads remained closed through the night. Flood waters subsided by late morning on the 11th.

15 Flood (C). Any high flow, overflow, or inundation by water which causes damage. In general, this would mean the inundation of a normally dry area caused by an increased water level in an established watercourse, or ponding of water, that poses a threat to life or property. If the event is considered significant, it should be entered into *Storm Data,* even if it only affected a small area. Refer to the Flash Flood event (section 14) for guidelines for differentiating between Flood and Flash Flood events.

Urban and small stream flooding commonly occurs in poorly drained or low lying areas. These are types of areal flooding and are to be recorded as Flood events, not Heavy Rain.

River flooding may be included as a Flood event. However, such entries should be confined to the effects of the river flooding, such as roads and bridges washed out, homes and businesses damaged, and the dollar estimates of such damage. The Water Resources Services Branch at National Weather Service Headquarters will maintain the official records of river stages, flood stages, and crests. Therefore, river stages need not be included in *Storm Data*.

Note: Direct fatalities which are vehicle-related will be coded as VE. In addition, if a person drives into a flooded area, exits his/her vehicle and drowns, the fatality will be coded as VE (Vehicle and/or Towed Trailer), not IW (In Water).

15.1 Distinguishing Between Types of Flooding. There are times when fatalities or large scale damages occur during flood events that do not meet the Flash Flood event criteria outlined in section 14, and are not larger scale areal floods. These events will be entered in *Storm Data* as Flood events. Heavy Rain, will no longer be acceptable as a means to enter a low-impact or isolated flood event.

When deciding how to categorize an event, the *Storm Data* preparer will only consider flood impacts, not the type of watch, warning or advisory product used before the event, nor infrastructural components which compounded the flood (e.g., urban effects or poor drainage).

Beginning Time - When flood waters began to threaten life or property. In some cases, this might have been when water leaves the banks of a river, and in others it might have been after the water level was 2 to 3 feet above the river banks. Professional judgment should be used by the *Storm Data* preparer.

Ending Time - When flood waters receded to a point where there was no longer any threat to life or property. Keep in mind that flooding may continue to threaten life or property many days after the rain ends.

Cause of Flood Event - *Storm Data* software requires that an entry be made for the cause of the Flood event (e.g., heavy rain). This cause will not appear in *the Storm Data* publication.

Direct Fatalities/Injuries
When determining whether a fatality is directly related to a Flood event, the *Storm Data* preparer should ask two basic questions.

- Was flooding ongoing at the time of death?
- Was the cause of death drowning, or death by impact related to the Flood (i.e., large debris in flood waters)?

If the answer to both questions is yes, the fatality is directly flood-related. Figure A1 can be used to help determine whether a fatality or injury is direct or indirect.

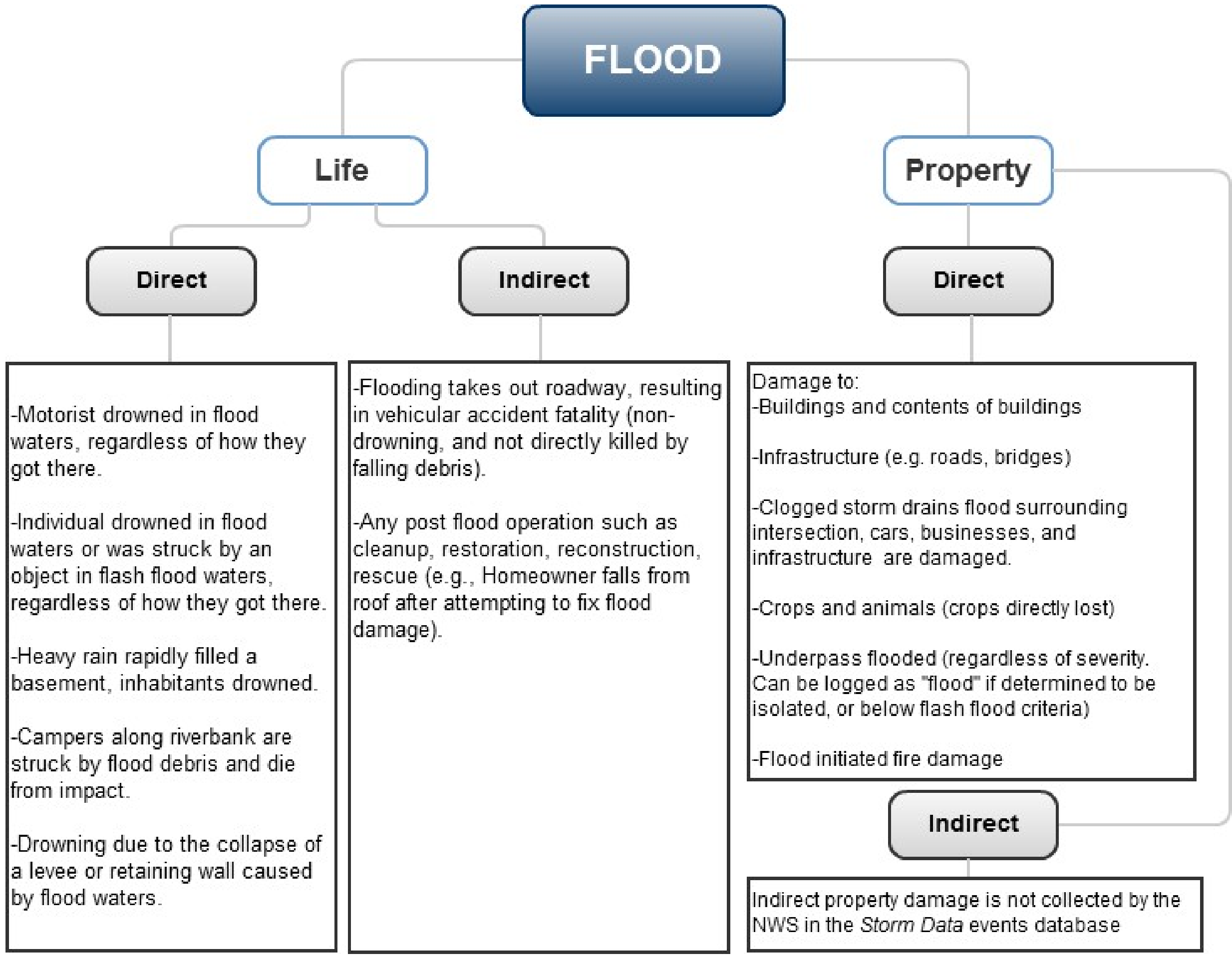

Figure A1. A decision tree to use when figuring out whether loss of life or property damage is direct or indirect.

The following are examples of direct flood fatalities.

- An individual or individuals, regardless of extenuating circumstances, purposely entered a flooded waterway or inundated area and drowned.
- A person drowned in a flood or was struck by an object in flood waters.
- A motorist drowned in an overturned car after driving down a hill onto a flooded stretch of highway that had flood waters 4 feet deep. (It doesn’t matter how irresponsible the driver was.).
- Two people were rafting down a flooded street hanging onto inner tubes. Water turbulence flipped them over, causing them to hit their heads on a curb, and both drowned.
- A recreational boater (kayak, raft, motorboat) drowns in flood waters.
- Debris caught in flood waters struck and injured a person walking along a flooding river.
- Drowning or injuries due to flooding caused by a dam break.

Note: Direct fatalities, which are vehicle-related, will be coded as VE (Vehicle and/or Towed Trailer). In addition, if a person drives into a flooded area, exits his/her vehicle and drowns, the fatality will still be coded as VE.

The *Storm Data* preparer should work with the WFO Hydrology Program Manager to make case-by-case determinations of potential flood-related fatalities. These determinations are often subjective and can only be made by the professional assessment of the WFO team. When additional guidance is needed, WFO staff are encouraged to contact the National Hydrologic Information Coordinator at NWS Headquarters, or the Regional Hydrology Program Manager.

The *Storm Data* preparer should not be influenced by factors that brought the victim to the flood waters, such as impairment by alcohol or drugs, or poor decision making of any sort. Those factors are extraneous to the hydrometeorological assessment of flooding, which only the local team is certified to make.

In some cases, it is not clear whether the victim died from drowning or another mechanism. For example, a vehicle accident caused the impact, which may have killed the victim upon contact. Flooding was ongoing at the time, but there is doubt as to whether the victim drowned or died by impact. In these cases, the *Storm Data* preparer will abstain from making a storm data entry until law enforcement officials verify the official cause of death.

<u>Indirect Fatalities/Injuries</u>

ϒ Vehicular accidents to which the flood contributed but did not directly cause.

ϒ A person suffered a heart attack participating in sandbagging operations.

<u>Example</u>:

Providence County
2N S. Foster 17 0200EST 0 2 3.5M 5.7M Flood
2SE S. Foster 18 1500EST

Widespread low-land flooding occurred in northwest Providence County, resulting in considerable flood damage to 1,500 homes, 400 businesses, and 200 agricultural farms. Two men near South Foster were injured by floating debris in the Ponaganset River when they rescued a dog. The flood was initiated by rainfall amounts of 4 to 5 inches (on top of wet ground) that fell between 1800EST on the 16th and 1800EST on the 17th.

16 Freezing Fog (Z). Fog which freezes on contact with exposed objects and forms a coating of rime and/or glaze, resulting in an impact on transportation, commerce, or individuals. Even small accumulations of ice can have an impact. Freezing fog can occur with any visibility of six (6) miles or less. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*.

<u>Beginning Time</u> - When freezing fog began.

Ending Time – When freezing fog ended.

Direct Fatalities/Injuries – None.

Indirect Fatalities/Injuries
- ϒ Fatalities and injuries resulting from vehicle accidents caused by freezing fog.
- ϒ Fatalities and injuries resulting from slippery surfaces (e.g., sidewalks, porch steps) caused by freezing fog.

Example:

ARZ044 Pulaski
14 0400CST 0 0 Freezing Fog
1100CST
Freezing fog occurred in areas near the Arkansas River, reducing visibility to below ½ mile. The fog resulted in a number of multiple-vehicle accidents during the morning rush hour. The majority of these accidents occurred on elevated sections of Interstate 440, on the river bridges of Interstates 30 and 430, and on the Levy Bridge on Interstate 40. Altogether, the accidents caused five injuries (indirect injuries).

17 Frost/Freeze (Z). A surface air temperature of 32 degrees Fahrenheit (°F) or lower, or the formation of ice crystals on the ground or other surfaces, for a period of time long enough to cause human or economic impact, during the locally defined growing season. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*.

Beginning Time - When the temperature first fell below freezing or frost began to form.

Ending Time - When the temperature rose above freezing or frost melted.

Direct Fatalities/Injuries
- ϒ None. This *Storm Data* event type applies to agricultural losses. Any fatality in which the medical examiner or coroner determined that the primary cause was hypothermia should be entered under the event type Extreme Cold/Wind Chill, or the Cold/Wind Chill event.

Indirect Fatalities/Injuries
- ϒ Any traffic fatalities/injuries due to ice formation on roads or bridges.
- ϒ Any pedestrian –fatalities/injuries due to icy walkways.

Examples:

FLZ039-042 Levy - Citrus – Hernando
-048 18 0500EST 0 0 50K Frost/Freeze

18 0800EST
Freezing temperatures between 30 and 32 degrees occurred. The average duration was around 1 hour, with up to 3 hours in isolated locations. Some crop damage was noted in Levy County.

GAZ028-029 Hart – Elbert
06 0500EST 0 0 Frost/Freeze
06 0800EST
Near-record low temperatures in the lower to mid-30s with clear skies and light winds resulted in widespread frost. No crop damage was reported, but frost formation on roads and bridges resulted in several traffic accidents, including one indirect fatality on Highway 72, at the Broad River Bridge.

18 Funnel Cloud (C). A rotating, visible extension of a cloud pendant from a convective cloud with circulation not reaching the ground. The funnel cloud should be large, noteworthy, or create strong public or media interest to be entered.

Beginning Time - When the funnel cloud was first observed.

Ending Time - When the funnel cloud was no longer visible.

Direct Fatalities/Injuries

ϒ A fatality or injury directly caused by the circulating winds of a funnel cloud. Note that by definition, a funnel cloud fatality cannot occur on the ground, so fatalities or injuries can only be associated with aviation mishaps. (Rare)

Indirect Fatalities/Injuries

ϒ All fatalities/injuries that resulted from distress brought on by the sight of the funnel cloud or by any telecommunication to those individuals of the possibility of funnel clouds.

Examples:

Tolland County
Gilead 10 1800EST 0 0 Funnel Cloud
1805EST
A funnel cloud was observed by local law enforcement officials, and Amateur Radio operators. It extended about halfway from the cloud base to the ground as it passed over town.

Power County
13 E American 30 1300MST 0 1 150K Funnel Cloud
Falls 1302MST
A small airplane flew into a funnel cloud west of Pocatello; and based on reports from highway motorists, the pilot lost control. The pilot crash-landed at

the Pocatello Municipal Airport, and was injured. The plane was a total loss, based on the insurance claim.

Deuel County
3 S Chappell 21 1612MST 0 0 Funnel Cloud
1620MST
A funnel cloud was observed overhead at a location about 3 miles south of Chappell, and persisted for 8 minutes. The funnel was observed by numerous citizens in Chappell and motorists, who stopped along Interstate 80.

19 Hail (C). Frozen precipitation in the form of balls or irregular lumps of ice. Although the minimum size of hail qualifying as "severe" is 1 inch diameter, all reports of hail that is 3/4 of an inch or larger in diameter will be entered. Observed hail accumulations of smaller sizes, or instances where hail accumulates to a measurable depth (e.g., "around 3 inches deep") that cause property and/or crop damage, should be entered. Injuries or fatalities that result from hail of any size should be entered. Maximum hail size will be encoded for all hail reports entered.

The *Storm Data* software permits only one event name for encoding severe and non-severe hail events, and allows the preparer to enter any hail size in hundredths of an inch. Therefore, the preparer is not restricted to only those sizes that appear in Table A3 of section 19.1. Encoded values of estimated or measured hail diameters below one inch (non-severe), regardless of extent and/or severity of fatalities, injuries, and damage, will not be used in the verification process.

Beginning Time - When hail first occurred.

Ending Time - When hail ended.

Direct Fatalities/Injuries
ϒ Baseball-size hail struck a person on the head, causing a fatality/injury.
ϒ A fatality/injury directly caused by wind-driven hail, where both the hail size and winds were below severe criteria. This would be an extremely rare event.

Indirect Fatalities/Injuries
ϒ Hail covered the road. A vehicle lost control on the slippery road and crashed into a tree, killing or injuring the driver.
ϒ Hail falls with sufficient intensity to restrict visibility, causing a driver to lose control of a vehicle. The vehicle rolls over or hits an object, resulting in a fatality/injury.

Examples:

Medina County
Brunswick 20 1730EST 1 3 1.3M 50K Hail (4.00)
1735EST
A prolific hailstorm sat over Brunswick, Ohio, for 5 minutes, resulting in a fatality, injuries, and considerable property damage. A 10-year old boy died on

a ball field due to head injuries sustained in a barrage of 4-inch diameter hail. Three other boys suffered head injuries. The large hail damaged at least 500 vehicles, and 700 homes reported broken windows or awnings. M10BF

King County
Guthrie **02** **2240CST 2245CST** **0** **0** **500K** **Hail (0.50)**

Hail up to ½ inch in diameter accumulated to several inches. The hail completely flattened and shredded young corn crops at several farms near Guthrie. Insurance company officials declared the corn crop a total loss.

19.1 Hail Conversion Table. Spotters should be encouraged to measure instead of estimate hail size whenever it is safe to do so. To assist in the task of converting spotter hail reports to actual hail diameter, a recommended guideline follows in Table A3. The comparisons may not be accurate, but may be used for estimates. Exercise care since apples, softballs, and grapefruit come in different sizes. For example, softballs range in size from 3.50 inches to 5.09 inches. Additionally, dime-size hail was the coin type associated with 0.75-inch diameter hailstones for many years. However, the diameter of a dime is 11/16 inch, slightly smaller than a penny, which is 12/16 inch (0.75 inch). Also, for many years, marble-size hail was associated with hailstones ½ inch in diameter. However, marbles come in different sizes. Therefore, use of the term "marble-size" or "dime-size" hail is not recommended.

Pea	0.25 - .375 inch	Lime	2.00 inches
Small marble	0.50 inch	Tennis Ball	2.50 inches
Penny	0.75 inch	Baseball	2.75 inches
Nickel	0.88 inch	Large Apple	3.00 inches
Quarter	1.00 inch (15/16")	Softball	4.00 inches
Half dollar	1.25 inch	Grapefruit	4.50 inches
Walnut/Ping Pong	1.50 inch	Computer CD/DVD	4.75 - 5.00 inches
Golf ball	1.75 inch		

Table A3. Hail Conversion Table.

20 Heat (Z). A period of heat resulting from the combination of high temperatures (above normal) and relative humidity. A Heat event occurs and is reported in *Storm Data* whenever heat index values meet or exceed locally/regionally established advisory thresholds. Fatalities or major impacts on human health occurring when ambient weather conditions meet heat advisory criteria are reported using the Heat event. If the ambient weather conditions are below heat advisory criteria, a Heat event entry is permissible only if a directly-related fatality occurred due to unseasonably warm weather, and not man-made environments.

Depending on the part of the country experiencing high temperatures, the heat effects are modulated by relative humidity, cloud cover, wind speeds, the duration of a hot spell, the time of the year, and other factors, including mortality rates and types of housing.

In some heat waves, fatalities occur in the few days following the meteorological end of the event. The preparer should include these fatalities in the Heat event, but encode the actual date of the directly-related fatalities in the fatality entry table.

Beginning Time - When local/regional established advisory thresholds for heat were first met or when unseasonably or abnormally hot conditions began.

Ending Time - When local/regional established advisory thresholds for heat were no longer met or unseasonably or abnormally hot conditions ended.

Direct Fatalities/Injuries

- Fatality where heat-related illness or heat stress was the primary or major contributing factor as determined by a medical examiner or coroner.
- An elderly person suffered heat stroke and died inside a stuffy apartment during a heat wave.
- Cases in which people receive medical treatment for heat-hyperthermia (severe dehydration, sunstroke, heatstroke, etc.) are considered injuries, not illnesses, for *Storm Data* purposes.
- Situations in which a person dies (primary cause was heat) in an unseasonably warm period in April in the Great Lakes region with maximum temperatures around 90 and surface dew-points in the upper 60s.

Indirect Fatalities/Injuries

- Fatality where heat was the secondary or contributing factor.
- Heat triggered a power outage, which in turn caused a person's respirator to turn off, and that person died.

Example:

MOZ064 St. Louis
02 1300CST 1 0 Heat
05 2000CST
Unseasonably hot and humid weather settled over Missouri during the first five days of June. On June 3rd, record-setting maximum air temperatures of 95 to 100 degrees combined with dew points of 70-75 resulted in heat index values of 105 to 110. As a result, 1 person in St. Louis died from the effects of this heat.
F90PH

21 Heavy Rain (C). Unusually large amount of rain which does not cause a Flash Flood or Flood event, but causes damage, e.g., roof collapse or other human/economic impact. Heavy Rain will no longer be acceptable as a means to record low-impact or isolated flood events.

Urban and small stream flooding commonly occurs in poorly drained or low lying areas. These are types of areal flooding and are to be recorded as Flood events, not Heavy Rain.

Beginning Time - When the heavy rain that led to damage began.

Ending Time - When the heavy rain diminished to the degree that it no longer posed a threat to life or property.

Direct Fatalities/Injuries

- A fatality or injury caused by debris from a structural collapse resulting from water loading.
- A fatality or injury caused by the collapse of a wooden deck due to the additional weight of heavy rain on a deep snow-cover on the deck.

Indirect Fatalities/Injuries

- All fatalities/injuries that resulted from vehicle accidents due to hydroplaning, or from sliding on slippery road surfaces, or from poor visibility.

Example:

Minnehaha County

Sioux Falls	**03**	**1100CST 1200CST**	**2**	**7**	**300K**	**Heavy Rain**

A short-lived but intense thunderstorm dumped 2 inches of rain between 0930CST and 1130CST, resulting in the collapse of a roof of an old school building at noon. Two students were crushed by roof debris, and 7 others were injured. Apparently, the rain came down so hard that water loading on the roof led to the roof collapse. Minor street flooding occurred elsewhere in Sioux Falls, but in general the city's drainage system was up to the task. M8SC, M9SC

22 Heavy Snow (Z). Snow accumulation meeting or exceeding locally/regionally defined 12 and/or 24 hour warning criteria. This could mean values such as 4, 6, or 8 inches or more in 12 hours or less; or 6, 8, or 10 inches in 24 hours or less. If the event that occurred is considered significant, even if it affected a small area, it should be entered into *Storm Data*. In some heavy snow events, structural damage, due to the excessive weight of snow accumulations, may occur in the few days following the meteorological end of the event. The preparer should include this damage as part of the original event and give details in the narrative. Normally, strong winds or other precipitation types are not present in a Heavy Snow event. If they were, then the Winter Storm event should be used.

The *Storm Data* preparer should include in the narrative the times that heavy snow began to accumulate, met criteria, and accumulation ended.

Beginning Time - When snow was first observed to accumulate or inferred to accumulate from surrounding reports.

Criteria Time - When snow accumulations reach locally/regionally established warning threshold values, or as inferred by damage reports.

Ending Time - When snow was observed to stop accumulating or inferred to stop accumulating from surrounding reports.

Direct Fatalities/Injuries

- A fatality/injury from a mass of snow sliding off a roof or falling through a structure.
- A tree toppled from heavy snow and landed on someone, killing him/her.
- A person walking through deep snow, fell down, and died of exposure.

Indirect Fatalities/Injuries

- Any fatality from a vehicle accident related to deep snow on the roads or slippery roads.
- Any fatality related to shoveling or moving snow.

Examples:

IA013-014 Fayette – Clayton

25 0800CST	**0**	**0**		**Heavy Snow**
25 1800CST				

Snow began to accumulate at 0800CST, and tapered off to flurries by 1800CST. A total of 6 to 8 inches of snow fell from Oelwein to Strawberry Point.

VTZ013-014 Bennington - Windham

11 1500EST	**1**	**0**	**500K**	**Heavy Snow**
12 1800EST				

Record-breaking heavy snow pounded the southern part of Vermont. Accumulations of 30 to 40 inches paralyzed the region. Travel and commerce came to a halt, and there were numerous reports of downed power lines and structural damage due to the weight of snow on roofs. Some roofs of businesses collapsed during the two days following the end of the heavy snow, since clean-up crews were unable to reach those buildings. One person died from exposure after he left his snow-covered vehicle and attempted to walk to a nearby residence during the height of the storm. Accumulating snow and lower visibilities began at 1500EST on the 11th, and accumulation rates increased to 2 to 3 inches per hour through the overnight and morning hours. M70OU

23 High Surf (Z). Large waves breaking on or near shore, resulting from swell spawned by a distant storm or from strong onshore winds, causing a fatality, injury or damage. In addition, if accompanied by anomalous astronomical high tides, high surf may produce beach erosion and possible damage to beachfront structures. High surf conditions are often accompanied by rip currents and near-shore breaks. Occasionally, high surf conditions can sweep people off rocks along the shore causing them to drown. If this occurs, include the fatality in the High Surf event type category. The *Storm Data* preparer exercises professional judgment to determine whether the fatality or injury is a result of a High Surf event.

Dry or secondary drowning occurs when a victim is rescued from a surf zone hazard such as a High Surf event and their respiratory system retains water. The victim passes away later from problems caused by the water retained in the respiratory system. A fatality associated with dry drowning should be included in a High Surf event, as this was the initial cause of the rescue.

Beginning Time - When near-shore wave heights met locally developed criteria (usually 7 to 10 feet).

Ending Time - When near-shore waves subsided below locally developed criteria.

Direct Fatalities/Injuries

- A surfer ventured out into severe wave conditions and was injured or drowned.
- A man fishing off a pier was swept into the sea.
- A boat traversing an ocean inlet foundered on the rocks and the boaters drowned.

Indirect Fatalities/Injuries

- A swimmer, struggling to get out of the high surf, suffered a heart attack.

Examples:

CAZ042-043 Orange County Coast - San Diego County Coast

09 2000PST 0 2 2M High Surf
10 0600PST

High surf and swells battered beachfront buildings. Waves, which occasionally reached 15 to 20 feet, damaged 32 homes in San Clemente. A Solana Beach lifeguard was injured while rescuing a drowning teen who also suffered minor injuries.

VAZ098>100 Virginia Beach - Northampton - Accomack

15 1500EST 0 0 10M High Surf
16 1200EST

A strong northeast wind caused significant beach and property damage along the Atlantic coast from Virginia Beach, VA, to Accomack, VA. At least 100 vacation homes reported damage.

24 High Wind (Z). Sustained non-convective winds of 35 knots (40 mph) or greater lasting for 1 hour or longer, or gusts of 50 knots (58 mph) or greater for any duration (or otherwise locally/regionally defined). In some mountainous areas, the above numerical values are 43 knots (50 mph) and 65 knots (75 mph), respectively. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*.

When high wind conditions are satisfied, a *Storm Data* event entry is required, and the preparer will indicate in the entry field whether the wind value represents a maximum sustained wind or maximum wind gust. Depending on the choice, the software will place an S or G in front of the wind value that appears in the *Storm Data* publication. Additionally, the on-line *Storm Data* software program requires the preparer to indicate whether the wind gust value or sustained wind value is measured or estimated.

Note that damage alone does not automatically imply wind speeds of 35 knots (40 mph) or greater lasting for 1 hour or longer or gusts of 50 knots (58 mph) or greater. When estimating a wind speed value, the preparer should take into account the amount and degree of severity and condition of the damaged property (i.e., age, type of construction technique used, exposure, topography, soil moisture/ composition, and local wind funneling effects due to orientation/closeness of other objects). The resultant damage supports such a value. Refer to Table A7 in section 46.4 for guidelines on estimating wind speeds as well as the EF-Scale information available at http://www.spc.noaa.gov/efscale/.

The *Storm Data* preparer exercises professional judgment to determine the estimated maximum wind value based on observed structural or tree damage. For example, a single rotted tree that is blown over would not support an estimated wind gust of 50 knots (58 mph). On the other hand, numerous large trees, power lines, and road signs toppled by high wind gusts would support an estimated gust value of 50 knots (58 mph) or greater.

Events with winds less than High Wind criteria, resulting in fatalities, injuries, or significant property damage will be encoded as a Strong Wind event (refer to section 45).

The High Wind event name will not be used for severe local storms or winter storm events. These events should be included in the Thunderstorm Wind and Winter Storm categories, respectively.

On occasion, a convective line with no lightning, embedded within an area with a tight surface pressure gradient, will result in widespread wind gusts of 50 knots (58 mph) or higher. In these cases, the Thunderstorm Wind event will be used, rather than a High Wind event. However, widespread “wake-low,” gusty winds will be documented with the High Wind event or Strong Wind event.

Events over large inland lakes with no specific, assigned Marine Forecast Zone number that meet High Wind criteria will be entered as High Wind events, rather than Marine High Wind events.

Tropical cyclones can move well inland and create damaging high winds. In these situations, it may be difficult to determine the event type to use. Inland offices should use either tropical or wind event type based on the products issued during the event. The *Storm Data* event type would be Hurricane, Tropical Storm, or Tropical Depression if Hurricane Local Statements were issued during the event (or, in the case of a Tropical Depression, would have been issued). The event type would be Strong Wind or High Wind if a wind advisory or high wind warning were issued for a tropical cyclone or the remnants of a cyclone that moved into the area.

The preparer should note in the *Storm Data* software program whether the High Wind was a measured gust (MG), estimated gust (EG), measured sustained (MS), or estimated sustained

(ES). This software program automatically inserts a wind speed conversion line at the end of the event narrative that equates knots with miles per hour.

Beginning Time - When damage first occurred, or when sustained winds or gusts first equaled or exceeded locally/regionally established criteria for high wind.

Ending Time - When damage ended or sustained winds or gusts dropped below high wind criteria.

Direct Fatalities/Injuries

- Fatalities or injuries caused by being struck by falling debris associated with structural failure (including falling trees, utility poles, and power lines).
- Fatalities or injuries associated with vehicles that were blown over, or vehicles that were blown into a structure or other vehicle.
- Fatalities or injuries caused by people or vehicles that were struck by airborne objects.
- Drowning due to a boat being capsized by wind.

Indirect Fatalities/Injuries

- Fatalities or injuries when vehicles collided with stationary obstructions/debris placed in roadways by high wind.
- Any fatalities or injuries incurred during the clean-up process.
- Fatalities or injuries associated with contact with power lines after they fell.
- Any fatalities or injuries that loss of electrical power contributed to, including lack of heat, cooling, or light, or failure of medical equipment.

Examples:

MNZ088-095 Fillmore - Winona
30 0100CST 0 0 2.5K High Wind (EG56)
0900CST
Southwest winds gusting to an estimated 56 knots (65 mph) for about 8 hours blew down numerous trees and toppled dozens of signs in Spring Valley and Lewiston. A young girl in Spring Valley was killed when she touched a downed power-line (indirect fatality).
Note: The estimated wind gust of 56 knots is equivalent to 65 mph.

SDZ001-002- Butte - Harding – Nrn Meade Co Plains - Perkins
012-013 06 0900MST 0 0 High Wind (ES39)
1300MST
Sustained west winds reached 39 knots (45 mph) for several hours across northwest South Dakota behind a fast-moving cold front. No gusts of 50 knots (58 mph) or higher were reported.
Note: The estimated wind gust of 39 knots is equivalent to 45 mph.

25 Hurricane/Typhoon (Z). A tropical cyclone in which the maximum 1-minute sustained surface wind is 64 knots (74 mph) or greater. In the Atlantic Ocean or the North Pacific Ocean east of the International Date Line, this event would be labeled a Hurricane, and in the North Pacific Ocean west of the International Dateline, this event would be classified as a Typhoon.

Use the Tropical Storm event type if a hurricane produced sustained 34 knot to 63 knot winds in part of the CWA. This means you may need a Hurricane/Typhoon event type for some zones and a Tropical Storm event type for other zones, even though all of the events are from one tropical cyclone. Other times, you may need a Hurricane/Typhoon event type for your land zones and a Marine Hurricane/Typhoon event for your marine zones. A Tropical Storm event related to a hurricane will include a reference to the hurricane in the Tropical Storm narrative section, (e.g., "Hurricane Dennis produced tropical storm force winds in ...").

Storm Data preparers may reference the National Hurricane Center's (NHC's) Tropical Cyclone Reports (TCR) for information on the storm history, track and intensity of a storm. The landfall intensity/location may change from what was indicated in real-time during the event. They may coordinate with the NHC staff if there are additional questions.

Tropical cyclones can move well inland and create damaging winds. In these situations, it can be difficult to determine the event type to use. Inland offices should use either tropical or wind event type, based on the products issued during the event. The event type would be Hurricane, Tropical Storm, or Tropical Depression if Hurricane Local Statements were issued (or would have been issued in the case of a Tropical Depression). The event type would be strong/high wind if a wind advisory or warning were issued for a tropical cyclone or the remnants of a cyclone that moved into the area.

25.1 Separating the Various Hurricane/Typhoon Hazards. After a tropical cyclone event, offices will:

ϒ Add an event for either Hurricane or Typhoon, summarizing the total impact in the narrative, but include only the wind related fatalities, injuries and damage in the header.

- Wind damage is the only individual hazard to be encoded in Hurricane/Typhoon, Tropical Storm, and Tropical Depression. This restriction prevents a "double-count" from occurring in the national report entitled "*A Summary of Natural Hazard Statistics for [Year] in the United States*," which is based upon the header strips of *Storm Data* events.
- Use tropical cyclone advisories as a guide when determining if wind was a result of the tropical cyclone or if it was caused by the pressure gradient between the storm and a high pressure system. This case is expected more in the Tropical Storm event type but could occur in the Hurricane/Typhoon event type.

ϒ Include all other impacts as separate events (e.g., storm surge/tide, freshwater flooding, tornadoes, debris flow, rip currents, etc.).

- These separate event entries and their associated fatalities, injuries, and damage amounts are not included in the hurricane/typhoon header-strip. However, do include this information in the hurricane/typhoon narrative to ensure a complete synopsis.
- Flooding along the coast, even if it is from distant swells, will be entered as Storm Surge/Tide, not Coastal Flood. Rip Currents and High Surf can be entered in addition to Storm Surge/Tide, if applicable.
- The name of the tropical cyclone will be included in the narrative of all associated individual hazards/events.

25.2 Writing the Narrative for a Hurricane/Typhoon Event. In order to provide complete documentation of the tropical cyclone effects, the *Storm Data* preparer exercises professional judgement to do the following:

ϒ Summarize all tropical cyclone hazards for affected coastal and inland counties/parishes within a CWA (e.g., "The collective effects of Hurricane Alpha during the period of August 1-3 resulted in 10 fatalities, 50 injuries, $800M in property damage, and $200M in crop damage in the counties of X, Y, and Z"). This will ensure that all tropical cyclone effects are summarized in one sentence.

ϒ Break down the individual tropical cyclone hazards for affected coastal and inland counties/parishes within a CWA, each with a listing of fatalities, injuries, and damage amounts (e.g., "During the passage of Hurricane Alpha in X County; five tornadoes killed 3 people and resulted in $1.0M in property damage, flash floods injured 20 people and resulted in $175M in crop damage, rip currents resulted in 5 fatalities," etc.).

ϒ In addition, the following information will be included in the narrative for tropical cyclones at coastal locations:
- Tropical cyclone name;
- The point of landfall, even if not in the WFO's CWA;
- Storm surge/tide;
- Minimum surface pressure; and
- Saffir-Simpson Hurricane Wind Scale or Modified Saffir-Simpson Hurricane Wind Scale, upon landfall, as appropriate. (See NWSI 10-604, *Tropical Cyclone Definitions*, for definitions of the Saffir-Simpson Hurricane Wind Scale for the North Atlantic and North East Pacific basin; Saffir-Simpson Hurricane Wind Scale for the North Central Pacific basin; and Modified Saffir-Simpson Hurricane Wind Scale for the Western North Pacific basin).

ϒ The following information will be included for both coastal and inland locations when known:
- Maximum sustained wind speed and peak gusts;
- Rainfall totals; and
- Record-breaking data.

- In some situations (i.e., delayed fatalities and delayed damage), there may be tropical cyclone-related hazards, as mentioned above, occurring prior to or after the beginning/ending time of the tropical cyclone event. Professional judgment is exercised in determining if these related hazards are part of the tropical cyclone. Refer to sections 2.6.3 and 2.7.4 for the decision process.

Beginning Time - When the direct effects of the Hurricane/Typhoon event were first experienced. Use surface observations and storm information from the Tropical Cyclone Public Advisories (TCP products) as a guide.

Ending Time - When the direct effects of the Hurricane/Typhoon event were no longer experienced. Use storm information from the Tropical Cyclone Public Advisories (TCP products) as a guide.

Direct Fatalities/Injuries
- Fatalities/injuries caused by wind-driven debris or structural failure due to winds.
- The wind caused a house to collapse or blew a tree onto someone.

Indirect Fatalities/Injuries
- Fatalities or injuries when vehicles collided with stationary obstructions/debris placed in roadways by high wind.
- Any fatalities or injuries incurred during the clean-up process.
- Fatalities or injuries associated with contact with power lines after they fell.
- Any fatalities or injuries that loss of electrical power contributed to, including lack of heat, cooling, or light, or failure of medical equipment.
- Someone was killed in a vehicle accident caused by a hurricane-related missing traffic signal.

Examples:

FLZ018-021 Broward - Collier - Dade - Monroe
>023 24 0325EST 4 50 13B 750M Hurricane/Typhoon
0900EST

The eye of Hurricane Andrew moved ashore in south Dade County near Homestead with a minimum central pressure of 922 mb and maximum storm surge of 16.9 feet. Maximum sustained winds were estimated at 145 knots (165 mph) with gusts to at least 152 knots (175 mph). Andrew was a Category 5 storm on landfall and was the third strongest in U.S. history. In southeast Florida, the maximum rainfall was 7.79 inches in Broward County. The height of the storm tide (the sum of the storm surge and astronomical tide, referenced to mean sea level) ranged from 4 to 6 ft in northern Biscayne Bay increasing to a maximum value of 16.9 ft at the Burger King International Headquarters, located on the western shoreline in the center of the bay, and decreasing to 4 to 5 ft in southern Biscayne Bay. The observed storm tide values on the Florida southwest coast ranged from 4 to 5 ft near Flamingo to 6 to 7 ft near Goodland. In Broward, Collier, Dade, and Monroe Counties, the winds killed 4 people (trees falling on moving vehicles). All of the associated effects of Andrew in southeast Florida resulted in 15 fatalities, 250 injuries, $25.0B in property damage, and around $1.0B in crop damage. Specifically in southeast Florida, Andrew's inland flood waters resulted in 5 fatalities, 100 injuries, $5B in property damage, and $250M in crop damage. The eight associated tornadoes resulted in 2 fatalities, 25 injuries, and $1B in property damage. The powerful winds resulted in 4 fatalities, 50 injuries, $13B in property damage, and $750M in crop damage. The storm tide along the coast resulted in 4 fatalities, 75 injuries, and $6M in property damage. Besides the 15 direct fatalities, at least 26 indirect fatalities occurred, during clean-up activities. M67VE, F12VE, M45VE, F46VE

GUZ001 Guam

15 1700ChST 0 1 254M Hurricane/Typhoon
16 1200ChST

Typhoon Paka entered the Marshall Islands as a tropical storm on December 10 became a typhoon on December 11 and crossed through the Marshall Islands until December 14, damaging structures and crops. Paka became a super typhoon on December 15 and passed 5 miles north of Guam. The lowest pressure observed on Guam was 948 mb and the highest sustained wind was measured at 100 knots (115 mph) with a gust to 152 knots (175 mph). On the Modified Saffir-Simpson Hurricane Wind Scale, this corresponds to a Category 3 typhoon based on the sustained-wind value but more accurately to a Category 4 typhoon based on the gust value. Maximum storm tide on Guam was about 30 feet (run-up/debris line) at Arunao Beach on the northwest coast, 16 feet (run-up/debris line) at the Commercial Port, 13 feet (run-up/debris line) on the north side of Tumon Bay (standing water measurement), and 8 feet (run-up/debris line) on Agana Bay. Maximum rainfall at WFO Guam was 20.75 inches from 16 December at 1600ChST to 17 December at 1600ChST. While Paka was on Guam, the typhoon winds resulted in 1 injury (debris hit a person on the head), and damaged numerous businesses and homes. Collectively, all of the effects of Typhoon Paka resulted in no fatalities, 2 people injured, and over $504M in property damage. Specifically, Paka's flood waters resulted in 1 injury, and $200M in property damage; associated winds resulted in 1 injury and over $254M in property damage. The storm tide resulted in $50M in property damage.

25.3 Tables for Determining Saffir-Simpson Hurricane Wind Scale and Modernized Saffir-Simpson Hurricane Wind Scale.

Category	Sustained Wind Speed	Types of Damage Due to Hurricane/Typhoon Winds

1	64-82 kts 74-95 mph 119-153 km/hr	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles will likely result in power outages that could last a few to several days.
2	83-95 kts 96-110 mph 154-177 km/hr	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	96-112 kts 111-129 mph 178-208 km/hr	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	113-136 kts 130-156 mph 209-251 km/hr	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	137 kts or higher 157 mph or higher 252 km/hr or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Table A4. Saffir-Simpson Hurricane Wind Scale for the North Atlantic and North East Pacific basins.

Tropical Storm Categories	Sustained Winds	Wind Gusts	Damage Level	Description of Damages
A Weak	26-43 kts 30-49 mph 48-79 km/hr	33-56 kts 40-64 mph 64-103 km/hr	Tiny	Damage done to only the flimsiest lean-to type structures. Unsecured light signs blown down. Minor damage to banana trees and near-coastal agriculture, primarily from salt spray. Some small dead limbs, ripe coconuts, and dead palm fronds blown down from trees. Some fragile and tender green leaves blown from trees such as papaya and fleshy broad leaf plants.
B Severe	44-63 kts 50-73 mph 80-118 km/hr	57-81 kts 65-94 mph 104-151 km/hr	Small	Minor damage to buildings of light material; major damage to huts made of thatch or loosely attached corrugated sheet metal or plywood. Unattached corrugated sheet metal and plywood may become airborne. Wooden signs not supported with guy wires are blown down. Moderate damage to banana trees, papaya trees, and most fleshy crops. Large dead limbs, ripe coconuts, many dead palm fronds, some green leaves, and small branches are blown from trees.
Typhoon Categories	**Sustained Winds**	**Wind Gusts**	**Damage Level**	**Description of Damages**
1 Minimal	64-82 kts 74-95 mph 119-153 km/hr	82-105 kts 95-120 mph 152-193 km/hr	Minimal	Corrugated metal and plywood stripped from poorly constructed or termite-infested structures and may become airborne. A few wooden, non-reinforced power poles tilted, and some rotten power poles broken and their attached lines down. Some damage to poorly constructed, loosely attached signs. Major damage to banana trees, papaya trees, and fleshy crops. Some young trees downed when the ground is saturated. Some palm fronds crimped and bent back through the crown of coconut palms; a few palm fronds torn from the crowns of most types of palm trees; many ripe coconuts blown from coconut palms. Less than 10 percent defoliation of shrubbery and trees; up to 10 percent defoliation of tangantangan. Some small tree limbs downed, especially from large bushy and frail trees such as mango, African tulip, poinciana, etc.
2 Moderate	83-95 kts 96-110 mph 154-177 km/hr	106-121 kts 121-139 mph 194-224 km/hr	Moderate	Several rotten wooden power poles snapped and many non-reinforced wooden power poles tilted. Some secondary power lines downed. Damage to wooden and tin roofs, and doors and windows of termite-infested or rotted wooden structures, but no major damage to well-constructed wooden, sheet metal, or concrete buildings. Considerable

				damage to structures made of light materials. Major damage to poorly constructed, attached signs. Exposed banana trees and papaya trees totally destroyed; 10-20 percent defoliation of trees and shrubbery; up to 30 percent defoliation of tangantangan. Light damage to sugar cane and bamboo. Many palm fronds crimped and bent through the crown of coconut palms and several green fronds ripped from palm trees. Some green coconuts blown from trees. Some trees blown down, especially shallow rooted ones such as small acacia, mango and breadfruit when the ground becomes saturated.
Typhoon Categories	**Sustained Winds**	**Wind Gusts**	**Damage Level**	**Description of Damages**
3 Strong	96-112 kts 111-129 mph 178-208 km/hr	122-142 kts 140-164 mph 225-264 km/hr	Extensive	A few non-reinforced hollow-spun concrete power poles broken or tilted and many non-reinforced wooden power poles broken or blown down; many secondary power lines downed. Practically all poorly constructed signs blown down and some stand-alone steel-framed signs bent over. Some roof, window, and door damage to well-built, wooden and metal residences and utility buildings. Extensive damage to wooden structures weakened by termite infestation, wet-and-dry wood rot, and corroded roof straps (hurricane clips). Non-reinforced cinder block walls blown down. Many mobile homes and buildings made of light materials destroyed. Some glass failure due to flying debris, but only minimal glass failure due to pressure forces associated with extreme gusts. Some unsecured construction cranes blown down. Air is full of light projectiles and debris. Major damage to shrubbery and trees; up to 50 percent of palm fronds bent or blown off; numerous ripe and many green coconuts blown off coconut palms; crowns blown off of a few palm trees. Moderate damage to sugar cane and bamboo. Some large trees (palm trees), blown down when the ground becomes saturated; 30-50 percent defoliation of most trees and shrubs; up to 70 percent defoliation of tangantangan. Some very exposed panax, tangantangan, and oleander bent over.
4 Very Strong	113-136 kts 130-156 mph 209-251 km/hr	143-173 kts 165-198 mph 265-319 km/hr	Extreme	Some reinforced hollow-spun concrete and many reinforced wooden power poles blown down; numerous secondary and a few primary power lines downed. Extensive damage to non-concrete roofs; complete failure of many roof structures, window frames and doors, especially

				unprotected, non-reinforced ones; many well-built wooden and metal structures severely damaged or destroyed. Considerable glass failures due to flying debris and explosive pressure forces created by extreme wind gusts. Weakly reinforced cinder block walls blown down. Complete disintegration of mobile homes and other structures of lighter materials. Most small and medium-sized steel-framed signs bent over or blown down. Some secured construction cranes and gantry cranes blown down. Some fuel storage tanks may rupture. Air is full of large projectiles and debris. Shrubs and trees 50-90 percent defoliated; up to 100 percent of tangantangan defoliated. Up to 75 percent of palm fronds bent, twisted, or blown off; many crowns stripped from palm trees. Numerous green and virtually all ripe coconuts blown from trees. Severe damage to sugar cane and bamboo. Many large trees blown down (palms, breadfruit, monkeypod, mango, acacia, and Australian pine.) Considerable bark and some pulp removed from trees; most standing trees are void of all but the largest branches (severely pruned), with remaining branches stubby in appearance; numerous trunks and branches are sandblasted. Patches of panax, tangantangan, and oleander bent over or flattened.

Typhoon Categories	Sustained Winds	Wind Gusts	Damage Level	Description of Damages
5 Devastating	137-170 kts 157-194 mph 252-312 km/hr	174-216 kts 199-246 mph 320-396 km/hr	Catastrophic	Severe damage to some solid concrete power poles, to numerous reinforced hollow-spun concrete power poles, to many steel towers, and to virtually all wooden poles; all secondary power lines and most primary power lines downed. Total failure of non-concrete reinforced roofs. Extensive or total destruction to non-concrete residences and industrial buildings. Some structural damage to concrete structures, especially from large debris, such as cars, large appliances, etc. Extensive glass failure due to impact of flying debris and explosive pressure forces during extreme gusts. Many well-constructed storm shutters ripped from structures. Some fuel storage tanks rupture. Nearly all construction cranes blown down. Air full of very large and heavy projectiles and debris. Shrubs and trees up to 100 percent defoliated; numerous large trees blown down. Up to 100 percent of palm fronds bent, twisted, or blown off; numerous crowns blown from palm trees; virtually all coconuts blown from trees. Most bark and considerable pulp removed from trees. Most standing trees are void of all but the largest branches, which are very stubby in appearance and severely sandblasted.

Table A5. Modified Saffir-Simpson Hurricane Wind Scale Table for the Western North Pacific Ocean.

26 Ice Storm (Z). Ice accretion meeting or exceeding locally/regionally defined warning criteria (typical value is 1/4 or 1/2 inch or more). If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*. The *Storm Data* preparer should include the times that ice accretion began, met criteria, and accretion ended. If the freezing rain was mixed with other precipitation types, then a Winter Storm event should be used.

The Ice Storm event is used for a fatality/injury resulting from hypothermia, due to power loss caused by an ice storm. Refer to section 2 for related details.

Beginning Time - When ice accretion first begins, or was inferred to begin, based on surrounding reports.

Criteria Time - When ice accretion equals locally/regionally established warning threshold values, or as inferred from damage reports.

Ending Time - When accretion ends, or was inferred to have ended, based on surrounding reports.

Direct Fatalities/Injuries
- A large chunk of ice falls off a structure resulting in death
- A large tree or other structure falls or collapses, due to ice load, resulting in death.
- Power is lost resulting in death caused from extreme cold.

Indirect Fatalities/Injuries
- All vehicle-related fatalities due to ice-covered roads and hazardous driving conditions.
- Someone suffers a heart attack and dies while removing or cleaning up downed trees or other structural debris.
- Any fatality/injury suffered by workers involved in post-storm recovery.

Example:

MEZ007>009-012 Northern Oxford - Northern Franklin - Central Somerset - Southern Oxford

06 0300EST 1 0 304M Ice Storm
08 1100EST

A severe ice storm hit sections of central and southern Maine where 1 to 3 inches of ice accreted on trees, power lines, and other exposed surfaces. Nearly everyone in the region experienced power loss. Due to the added weight of ice, an ice-covered tree limb broke and fell on a man who was walking underneath a tree. The man died from head injuries. M36OU

27 Lakeshore Flood (Z). Flooding of lakeshore areas due to the vertical rise of water above normal level caused by strong, persistent onshore wind and/or low atmospheric pressure, resulting in damage, erosion, flooding, fatalities, or injuries. Lakeshore areas are defined as those portions of land zones (coastal county/parish) adjacent to the waters of the Great Lakes and other lakes with specific assigned Marine Zones. Farther inland, the *Storm Data* preparer determines when and where to encode a flood event as Flash Flood or Flood. Terrain (elevation) features will determine how far inland the lakeshore flooding extends.

Note: Direct fatalities which are vehicle-related will be coded as VE. Thus, if a person drives into a flooded area, exits his/her vehicle and drowns, the fatality will be coded as VE (Vehicle and/or Towed Trailer), not IW (In Water).

Beginning Time - When the water level began to cause damage or flooding.

Ending Time - When the water level dropped to a point where damage or flooding ended.

Direct Fatalities/Injuries

- ϒ A lakeshore dwelling was washed away injuring/killing the occupants.
- ϒ A person drowned when a vehicle was swept away by the lakeshore flooding.

Indirect Fatalities/Injuries

- ϒ A person suffered a heart attack while evacuating from the lakeshore flooding.
- ϒ A person died in a vehicle accident caused by the lakeshore flooding, washing away a traffic signal.
- ϒ A person died in a vehicle accident after losing control in standing water on a road.

Example:

ILZ014 **Cook**
27 0600CST **0** **0** **250K** **Lakeshore Flood**
1200CST
North to northeast winds of 26 to 39 knots (30 to 45 mph) affected southern Lake Michigan. The Department of Transportation estimated a storm tide of 2 feet and 10 to 15 foot waves along the Chicago lakefront. Lake Shore Drive was closed due to water and sand on the pavement. Damage occurred to a dozen piers.

28 Lake-Effect Snow (Z). Convective snow bands that occur in the lee of large bodies of water (e.g., the Great Lakes or the Great Salt Lake), when relatively cold air flows over warm water. In extreme cases, snowfall rates of several inches per hour and thunder and lightning may occur. Lake-effect snow accumulations meet or exceed locally defined 12 and/or 24 hour warning criteria (typical values of 6 to 8 inches within 12 hours or 8 to 10 inches within 24 hours). If the event is considered significant, even though it affected a small area, it should be entered into *Storm Data*.

In some lake-effect snow events, structural damage, due to the excessive weight of snow accumulations, may occur in the few days following the meteorological end of the event. The preparer should include this damage as part of the original event and give details in the narrative.

The *Storm Data* preparer should include in the narrative the times that snow began to accumulate, met criteria, and stopped accumulating.

Beginning Time - When snow was first observed to begin to accumulate or inferred to begin to accumulate from surrounding reports.

Criteria Time - When lake-effect snow accumulation reached locally/regionally established warning threshold values, or as inferred from damage reports.

Ending Time - When snow accumulations ended.

Direct Fatalities/Injuries

- A fatality/injury from a mass of snow sliding off a roof or falling through a structure.
- A tree toppled from heavy snow and landed on someone, killing him.
- A person walking through deep snow, fell down, and died of exposure.

Indirect Fatalities/Injuries

- Any fatality from a vehicle accident related to deep snow on the roads or slippery roads.
- Any fatality related to shoveling or moving snow.

Examples:

OHZ003-013-014 Cuyahoga – Geauga – Ashtabula
16 0600EST 0 0 Lake-Effect Snow
17 1500EST

Lake-effect snow showers affected Northeast Ohio. This activity began during the predawn hours of the 16th with accumulations starting around 0600EST, and continued through midday on the 17th. The heaviest snow fell during the late afternoon and evening hours of the 16th when visibilities at times were near zero. Accumulations ranged from 6 to 8 inches in Geauga, southern Ashtabula and eastern Cuyahoga Counties. Dozens of accidents were reported.

PAZ002-003 Southern Erie – Crawford
19 0100EST 0 0 Lake-Effect Snow
20 2000EST

Lake-effect snow showers developed early on the 19th. This activity persisted into the evening hours and then dissipated. Accumulations through late evening on the 19th ranged from 6 to 10 inches. Just after midnight on the 20th, an intense band of snow redeveloped over southern Erie and northern Crawford Counties. Thunder and lightning were observed with this band and snowfall rates exceeded three inches per hour at times. The band moved slowly west during the predawn hours. Accumulations from shortly after midnight to daybreak on the 20th ranged from 8 to 14 inches over much of southern Erie and northern Crawford Counties. The snow finally tapered off during the afternoon hours after several more inches of accumulation. Some locations saw over two feet of snow during this two day event. Travel was severely hampered by this storm and hundreds of accidents were reported.

29 Lightning (C). A sudden electrical discharge from a thunderstorm, resulting in a fatality, injury, and/or damage.

Fatalities and injuries directly related to lightning strikes will be included in *Storm Data*. Report the specific location (see Table 3 in section 2.6.1.2), gender and age of fatalities. If reliable estimates of lightning-related damages (such as costs associated with structural fires, equipment loss, and electrical power and/or communications outages) are available or can be made, they should be entered into *Storm Data* as well. Because of the difficulty in obtaining lightning-related information, extra effort, such as fostering contacts with the media, fire departments or other first responders, hospitals and medical examiner offices, is recommended to help obtain such information.

The extent of lightning-related injuries is often difficult to determine. In many cases, the extent of an injury may not be known until days or weeks after the incident. As a general guideline, as with other injuries for *Storm Data*, anyone seeking or receiving medical attention following a lightning incident should be counted as a lightning injury. Anyone reporting numbness, a tingling sensation, a headache, or other pain following a lightning incident, whether or not they receive treatment, should be counted as an injury as well.

For lightning injuries, it is highly desirable to include in the event narrative, the age, gender, location, and weather conditions at the time of occurrence, if known or determinable. The age, gender, and location information is used in compiling lightning statistics used in the national report entitled *Summary of Natural Hazard Statistics for [Year] in the United States*.

Over the western states, lightning may start hundreds of wildfires in a single CWA. In these cases, the preparer may have to limit the number of incidents appearing in *Storm Data* by setting a threshold value based on minimum burned acreage, or some other parameter. In other situations, lightning may cause a fire that ultimately leads to fatalities and/or injuries. In these cases, the fatalities and/or injuries will be classified as indirectly-related. Refer to section 2.6 for additional information.

<u>Beginning Time</u> - Exact time of lightning strike(s).

<u>Ending Time</u> - Same as beginning time.

<u>Direct Fatalities/Injuries</u>

- A person was killed/injured by the electrical current that was generated when lightning struck the person directly.
- A person was killed/injured by an electrical current that was generated when lightning struck nearby.
- A person was killed/injured when lightning struck a tree and knocked it over onto the person.

<u>Indirect Fatalities/Injuries</u>

- A person was killed/injured in a traffic accident when lightning caused traffic signals to malfunction.
- A person was killed/injured while removing or cleaning up debris caused by a lightning strike.
- A person was killed/injured in a fire that was initiated by lightning.
- Lightning strikes a steeple which in turn falls into some scaffolding. The scaffolding strikes a pedestrian and kills him.

<u>Example</u>:

Tioga County
3 SW Tioga 06 1900EST 1 5 Lightning
A 26 year old male died when he was struck by lightning while boating on the Hammond Reservoir during a fishing contest. In addition, 5 other people received medical treatment for lightning-related injuries. M26BO

30 Marine Dense Fog (M). Water droplets suspended in the air just above the Earth's surface, resulting in a fatality, injury, or damage, over the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones. This fog reduces visibility to values equal to or below locally/regionally established values for dense fog (usually less than one mile). This fog may impact transportation or commerce within a marine environment. Accidents which resulted in injuries, fatalities, or significant damage during a dense fog event over marine waters are reported using this event category.

Beginning Time - When marine dense fog criteria were first met.

Ending Time - When marine dense fog criteria were no longer met.

Direct Fatalities/Injuries - None.

Indirect Fatalities/Injuries
- Two ships collide during a dense marine fog event, resulting in multiple fatalities and injuries.
- During extremely dense marine fog, a ship worker fell into the ocean, resulting in a drowning.

Example:

LMZ643>646 Sheboygan to Port Washington WI – Port Washington to North Point Light WI – North Point Light to Wind Point WI – Wind Point WI to Winthrop Harbor IL
14 0400CST 0 0 100K Marine Dense Fog
1100CST
Dense fog developed overnight over the near-shore waters of Lake Michigan from Sheboygan to Kenosha and lowered visibilities to 100 yards to 1/2 mile. The lowest visibilities were in the area from 1 to 3 miles off the shoreline based on boat reports. Around sunrise, two boats collided about 2 miles east of the Port Washington harbor, resulting in 1 indirectly-related death, injuries to 3 people, and considerable boat damage. Synoptically, offshore southwest winds generated upwelling of colder water, which allowed for saturation of moist air once it moved over the colder Lake Michigan waters.

31 Marine Hail (M). Hail 3/4 of an inch in diameter or larger, occurring over the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones, will be entered. Hail 3/4 of an inch in diameter or larger, occurring immediately along the shorelines of the waters and bays should be entered as a Marine Hail event, especially if the storm moved over the near-shore waters (it is reasonable to assume it maintained its strength). Hail of smaller size, causing damage to watercraft or fixed platforms, should be entered. A maximum hail size will be entered.

The use of WSR-88D Doppler radar intensities (dBZ values) cannot be used to infer that a thunderstorm was sufficiently strong enough to produce hailstones meeting or exceeding the criteria listed in the previous paragraph.

The *Storm Data* software permits only one event name for encoding severe and non-severe Marine Hail events. If hail diameters over water surfaces with an assigned marine zone number are equal to, or greater than, 3/4 of an inch, a Marine Hail event always will be encoded. It is recognized that a number of Marine Hail events will never be documented. Hail sizes equal to or greater than 3/4 of an inch initiate the verification process for Marine Hail events.

If hailstones with diameters less than 3/4 of an inch result in fatalities, injuries, or damage, encoding a Marine Hail event is recommended. Encoded values of estimated or measured marine hail diameters below 3/4 of an inch (non-severe), regardless of extent and/or severity of fatalities, injuries, and property damage, are not used in the verification process.

Refer to Table A3 in section 19.1 in order to convert estimated hail sizes to measured values.

Beginning Time - When hail began.

Ending Time - When hail ended.

Direct Fatalities/Injuries
- Hail injured a boater.
- Wind-driven hail shredded the sail of a sailboat, causing the boat to overturn, drowning the boater.

Indirect Fatalities/Injuries
- A boater panicked in a hailstorm and ran into a breakwater.

Examples:

ANZ230 **Boston Harbor MA**
10 1530EST **0** **0** **Marine Hail (1.00)**
1532EST
A boater reported quarter-size hail.

LEZ149 **Conneaut OH to Ripley NY**
18 1604EST **0** **0** **5K** **Marine Hail (0.50)**
1608EST
One-half-inch diameter hail driven by 30 knot (35 mph) winds damaged two sailboats near Erie, PA.

32 Marine Heavy Freezing Spray (M). Ice accretions on exposed surfaces of fixed platforms or marine vessels on the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones, which lead to the loss of life or property damage, should be entered. Normally, an ice accretion at the rate of 3 millimeters (mm) per hour is considered to be heavy freezing spray. Ice accretions occurring immediately along the shorelines of the waters and bays should be entered as a Marine Heavy Freezing Spray event as well.

Normally, freezing spray will occur when the air and water temperatures are sufficiently cold while winds and waves over water surfaces are strong enough and high enough to allow water spray to be projected up and onto exposed surfaces for a sufficient time period. This results in a build-up of ice accretions.

32.1 Table of Conditions Generating Heavy Freezing Spray.

Typically, a combination of the conditions listed in Table A6 will generate heavy freezing spray.

Water Temperature	Air Temperature	Winds	Waves
+4 C or colder	20 to 30 F	34 knots or higher	4 feet or higher
+4 C or colder	10 to 19 F	25 knots or higher	4 feet or higher
+4 C or colder	Less than 10 F	22 knots or higher	4 feet or higher

Table A6. Conditions that lead to the generation of heavy freezing spray.

Note: Direct fatalities, which are related to a marine vessel, will be coded as BO (Boating), not IW (In Water)

Beginning Time - When ice accretions reach or exceed 3 mm per hour on exposed surfaces.

Ending Time - When ice accretions end.

Direct Fatalities/Injuries

- Ice accretions fall off wires and onto a crew member that dies from injuries.
- Wind-driven ice accretions impact a passenger and result in head injuries.
- The weight of ice accretions results in the collapse of a roof over a boat's cabin.

Indirect Fatalities/Injuries

- While dislodging ice accretions, a crew member slips, and falls and breaks his leg.

Examples:

LMZ643 Sheboygan to Port Washington WI
10 0600CST 1 1 Marine Heavy Freezing Spray
1800CST
During a blizzard, heavy freezing spray on the west side of Lake Michigan resulted in a fatality, injury, and damage to a boat in the Sheboygan harbor. Ice accretions

of one foot tumbled onto a crew member who died from head injuries. Another crew member was injured. Frequent wind gusts to 40 to 50 knots were measured at the Sheboygan Coast Guard Station while air temperatures were in the teens. M33BO

33 Marine High Wind (M). Non-convective, sustained winds or frequent gusts of 48 knots (55 mph) or more, resulting in a fatality, injury, or damage, over the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones. These conditions would correspond to a "storm" situation (48 to 63 knots/55 to 73 mph), or a "hurricane-force" wind situation (64 knots or higher/74 mph or higher). A peak wind gust (estimated or measured) or maximum sustained wind value will be entered.

When these conditions are satisfied, a *Storm Data* event entry is required. The preparer will note in the *Storm Data* software program whether the Marine High Wind was a measured gust (MG), estimated gust (EG), measured sustained (MS), or estimated sustained (ES). The software will automatically insert a wind speed conversion line at the end of the event narrative that equates knots with miles per hour. Refer to sections 5.24 and 5.45 for related information.

Events with winds less than the above threshold numbers, resulting in fatalities, injuries, or property damage, will be encoded as a "Marine Strong Wind" event. Refer to section 36, Marine Strong Wind, for more details.

The preparer can use high wind events occurring along the shorelines (to a maximum distance of 1 mile inland) of the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones, to infer that a Marine High Wind event occurred over the near-shore waters (it is reasonable to assume its strength was maintained over water).

Note: Direct fatalities which are related to a marine vessel will be coded as BO (Boating), not IW (In Water).

Beginning Time - When Marine High Wind conditions, which resulted in a fatality, injury, or damage, were first met.

Ending Time - When Marine High Wind conditions, which resulted in a fatality, injury, or damage, were no longer met.

Direct Fatalities/Injuries

- Fatalities or injuries caused by falling or airborne debris associated with structural failure of a marine vessel due to wind.
- Fatalities resulting from drowning due to an overturned, damaged, or destroyed marine vessel.
- Any fatalities or injuries from loss of electrical power, including lack of heat or cooling.

Indirect Fatalities/Injuries

- ϒ Fatalities or injuries when a marine vessel collided with debris on the water surface left over from a previous wind or storm event.
- ϒ Any fatalities or injuries incurred during the clean-up process.
- ϒ Fatalities or injuries associated with making contact with power lines after they fell.

Example:

LMZ643 Sheboygan to Pt Washington
9 E Oostburg 04 1200CST 4 0 300K Marine High Wind (MG61)
2100CST

Powerful southwest winds persisted for about 9 hours over central Lake Michigan. The winds capsized a luxury cruise boat east of Oostburg in the open waters. Four people drowned inside the boat as it flipped over due to estimated waves of 8 to 12 feet. The boat sustained major structural damage.
M57BO F50BO M65BO F66BO
Note: The measured wind gust of 61 knots is equivalent to 70 mph.

34 Marine Hurricane/Typhoon (M). A tropical cyclone occurring over the waters and bays of the ocean (those assigned specific Marine Forecast Zones) in which the maximum 1-minute sustained surface wind is 64 knots (74 mph) or greater and results in a fatality, injury, or damage to watercraft or fixed platforms. In the Atlantic Ocean or the North Pacific Ocean east of the International Date Line, this event would be labeled a Hurricane, and in the North Pacific Ocean west of the International Dateline, this event would be classified as a Typhoon.

Use the Marine Tropical Storm event type if a hurricane produced sustained 34 knot to 63 knot winds in a part of the CWA covered by marine zones. This means you may need a Marine Hurricane/Typhoon event type for some zones and a Marine Tropical Storm event type for other zones, even though all of the events are from one tropical cyclone. Other times, you may need a Marine Hurricane/Typhoon event type for your marine zones and a Hurricane/Typhoon event for your land zones. Marine Tropical Storm event related to a hurricane will include a reference to the hurricane in the Marine Tropical Storm narrative section, (e.g., “Hurricane Dennis produced tropical storm force winds in ...).” Coordinate with NHC if you have any questions.

Note: Direct fatalities which are related to a marine vessel will be coded as BO (Boating), not IW (In Water).

Beginning Time - When winds of 64 knots or greater first occurred or when a fatality, injury, or damage began.

Ending Time - When winds diminished to less than 34 knots or when reports of fatalities, injuries, or damage were no longer received.

Direct Fatalities/Injuries

- ϒ Hurricane/Typhoon winds overturn a commercial or recreational vessel and the crew drowns.

Indirect Fatalities/Injuries

ϒ Hurricane/Typhoon winds significantly damaged an oil rig. Several hours later, an employee was killed by falling debris during post storm clean-up.

Examples:

ANZ151 Penobscot Bay ME
10 1530EST 1 0 Marine Hurricane/Typhoon
10 1532EST
A fishing vessel sailing in Penobscot Bay capsized on August 10 around 1530 EST when an estimated winds of 64 knots (74 mph), generated by Hurricane Bob, caught it broadside. The sailor drowned after hitting his head on the mast and being thrown into the water. M28BO

PMZ150 Guam
15 1700ChST 4 0 3M Marine Hurricane/Typhoon
15 1705ChST
A 70-foot fishing vessel capsized 20 miles southeast of Guam on December 15 around 1700 ChST. Typhoon Paka battered the boat with estimated winds in excess of 100 knots (115 mph). Four crew members were lost. Property loss was estimated at 3 million dollars. M28BO M31BO M65BO M18BO

35 **Marine Lightning (M).** A sudden electrical discharge from a thunderstorm, resulting in a fatality, injury, and/or damage, occurring over the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones.

Fatalities and injuries directly related to lightning strikes will be included in *Storm Data*. Report the specific location (see Table 3 in section 2.6.1.2), gender and age of fatalities. If reliable estimates of lightning-related damages (such as costs associated with structural fires, equipment loss, and electrical power and/or communications outages) are available or can be made, they should be entered into *Storm Data* as well. Because of the difficulty in obtaining lightning-related information, extra effort, such as fostering contacts with the media, marina entities, fire departments or other first responders, hospitals and medical examiner offices, is recommended to help obtain such information.

The extent of lightning-related injuries is often difficult to determine. In many cases, the extent of an injury may not be known until days or weeks after the incident. As a general guideline, as with other injuries for *Storm Data*, anyone seeking or receiving medical attention following a lightning incident should be counted as a lightning injury. Anyone reporting numbness, a tingling sensation, a headache, or other pain following a lightning incident, whether or not they receive treatment, should be counted as an injury as well.

For lightning injuries, it is recommended to include in the event narrative, the age, gender, location, and weather conditions at the time of occurrence, if known or determinable. The age, gender, and location information is used in compiling lightning statistics used in the national report entitled *Summary of Natural Hazard Statistics for [Year] in the United States*.

In some situations, lightning may cause a fire that ultimately leads to fatalities and/or injuries. In these cases, the fatalities and/or injuries will be classified as indirectly-related. Refer to section 2.6 for additional information.

Beginning Time - Exact time of lightning strike(s).

Ending Time - Same as beginning time.

Direct Fatalities/Injuries

- A person was killed/injured by the electrical current that was generated when lightning struck the person directly.
- A person was killed/injured by an electrical current that was generated when lightning struck nearby.
- A person was killed/injured when lightning struck a tree and knocked it over onto a person in a parked boat along the near-shore.

Indirect Fatalities/Injuries

- A person was killed/injured while removing or cleaning up debris caused by a lightning strike.
- A person was killed/injured in a fire that was initiated by lightning.

Example:

Monterey Bay
3 N Monterey 16 1500PST 1 3 Marine Lightning

A 46 year-old male died when he was struck by lightning while boating in Monterey Bay. In addition, 3 other people received medical treatment for lightning-related injuries. M46BO

36 Marine Strong Wind (M). Non-convective, sustained winds or frequent gusts up to 47 knots (54 mph), resulting in a fatality, injury, or damage, occurring over the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones. Wind speed values of 34 to 47 knots (39 to 54 mph) would correspond to a “gale” situation. A peak wind gust (estimated or measured) or maximum sustained wind value will be entered, in knots. Refer to sections 5.45 and 5.46 for related information.

The preparer can use strong wind events occurring immediately along the shorelines (to a maximum distance of 1 mile inland) of the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones, to infer that a Marine Strong Wind event occurred over the near-shore waters (it is reasonable to assume its strength was maintained over water).

The preparer should note in the *Storm Data* software program whether the Marine Strong Wind was a measured gust (MG), estimated gust (EG), measured sustained (MS), or estimated sustained (ES). This software program automatically inserts a wind speed conversion line at the end of the event narrative that equates knots with miles per hour.

Note: Direct fatalities, which are related to a marine vessel will be coded as BO (Boating), not IW (In Water).

Beginning Time - When Marine Strong Wind conditions were first met, which resulted in a fatality, injury, or damage.

Ending Time - When Marine Strong Wind conditions were no longer met, which resulted in a fatality, injury, or damage.

Direct Fatalities/Injuries
- Fatalities or injuries caused by falling or airborne debris associated with structural failure of a marine vessel due to wind.
- Fatalities resulting from drowning due to an overturned, damaged, or destroyed marine vessel.
- Any fatalities or injuries from loss of electrical power, including lack of heat or cooling.

Indirect Fatalities/Injuries
- Fatalities or injuries when a marine vessel collided with debris on the water surface left over from a previous wind or storm event.
- Any fatalities or injuries incurred during the clean-up process.
- Fatalities or injuries associated with making contact with power lines after they fell.

Example:

LMZ665 Sheboygan to Pt Washington
3 E Oostburg 31 0600CST 1 1 10K Marine Strong Wind (EG40)
1800CST

Strong, gusty southwest winds persisted for about 12 hours over central Lake Michigan. The winds capsized a small boat east of Oostburg in the near-shore waters. One person drowned after he was thrown into the water, and one person was injured as the boat flipped over due to estimated waves of 5 to 8 feet. The boat sustained minor structural damage. M27BO
Note: The estimated wind gust of 40 knots is equivalent to 46 mph.

37 Marine Thunderstorm Wind (M). Winds, associated with thunderstorms, occurring over the waters and bays of the ocean, Great Lakes, and other lakes with assigned specific Marine Forecast Zones with speeds of at least 34 knots (39 mph) for 2 hours or less, or winds of any speed that result in a fatality, injury, or damage to watercraft or fixed platforms. Similar thunderstorm winds occurring immediately along the shorelines (to a maximum distance of 1 mile inland) of the waters and bays should be entered as a Marine Thunderstorm Wind, especially if the storm then moved out over the near-shore waters (it is reasonable to assume it maintained its strength). Marine thunderstorm winds occur within 45 minutes before or after lightning is observed or detected.

The use of WSR-88D Doppler radar intensities (dBZ values) cannot be used to infer that a thunderstorm was sufficiently strong enough to produce wind gusts meeting, or exceeding, the criteria listed in the previous paragraph.

The *Storm Data* software permits only one event name for encoding severe and non-severe "Marine Thunderstorm Winds." Maximum wind gusts (measured or estimated) equal to or greater than 34 knots (39 mph) will always be entered. Values less than 34 knots (39 mph) should be entered only if they result in fatalities, injuries, or property damage.

Damage alone does not automatically imply wind speeds of 34 knots (39 mph) or greater. When estimating a wind speed value, the preparer should take into account the amount and degree of severity, and condition of the damaged property. The resultant damage is required to support such a value. Refer to Table A7 in section 46.4 for guidelines on estimating wind speeds. Estimated or measured wind gusts below 34 knots (39 mph), regardless of extent and/or severity of fatalities, injuries, and property damage, will not be used in the verification process. Wind values of 34 knots (39 mph) or more will initiate the verification process for Marine Thunderstorm Wind events.

The preparer should note in the *Storm Data* software program whether the Marine Thunderstorm Wind was a measured gust (MG), estimated gust (EG), measured sustained (MS), or estimated sustained (ES). This software program automatically inserts a wind speed conversion line at the end of the event narrative that equates knots with miles per hour.

Note: Direct fatalities related to a marine vessel are coded as BO (Boating), not IW (In Water).

<u>Beginning Time</u> - When winds of 34 knots or greater first occurred or when a fatality, injury, or damage began.

<u>Ending Time</u> - When winds diminished to less than 34 knots or when reports of fatalities, injuries, or damage were no longer received.

<u>Direct Fatalities/Injuries</u>

- A wind gust, associated with a thunderstorm, overturned a canoe and the canoeist drowned.
- A jet-skier, jumping large waves created by thunderstorm winds, was killed when the craft flipped over.
- A thunderstorm-generated wave hit a boat broadside, and a boater lost his balance, fell overboard and drowned.

<u>Indirect Fatalities/Injuries</u>

ϒ Thunderstorm winds uprooted a tree that fell in the water. An hour later, a water skier ran into the tree and was killed.

Examples:

ANZ531 **Chesapeake Bay from Pooles Island to Sandy Point MD**
10 1530EST 1 0 Marine Tstm Wind (EG25)
1532EST
A one-person catamaran sailing in Chesapeake Bay just offshore Sandy Point State Park capsized when an estimated wind gust of 25 knots generated by a thunderstorm, caught it broadside. The sailor drowned after hitting his head on the mast and being thrown into the water. M20BO
Note: The estimated wind gust of 25 knots is equivalent to 29 mph.

LMZ741 **Wilmette Harbor to Meigs Field IL**
18 1604CST 0 0 Marine Tstm Wind (MG42)
1606CST
A squall line moved through the Chicago area and off the lakefront. A peak gust to 42 knots was recorded at the Harrison Street Crib.
Note: The measured wind gust of 42 knots is equivalent to 48 mph.

38 Marine Tropical Depression (M). Damaging tropical depression force winds occurring over the waters and bays of the ocean (those assigned specific Marine Forecast Zones), in which the 1-minute sustained (not gust) surface wind is less than 33 knots (39 mph) for 2 hours or more, that result in a fatality, injury, or damage to watercraft or fixed platforms. Similar tropical depression force winds occurring immediately along the shorelines (to a maximum distance of 1 mile inland) of the waters and bays of the ocean should be entered as a "Marine Tropical Depression."

Note: Direct fatalities which are related to a marine vessel will be coded as BO (Boating), not IW (In Water).

Beginning Time - When winds less than 33 knots result in fatalities, injuries, or damage.

Ending Time - When winds have abated or reports of fatalities, injuries, or damage are no longer received.

Direct Fatalities/Injuries

ϒ Tropical depression force winds overturned a small fishing vessel and the crew drowned.

Indirect Fatalities/Injuries

ϒ Tropical depression force winds cause minor damage to an oil rig. Several hours later, an employee was killed by falling debris during post storm clean-up.

Examples:

GMZ073 Craig Key to the West End of 7 mile Bridge
15 0130EST 0 0 Marine Tropical Depression
0135EST
A sailboat regatta 30 miles south of 7 mile Bridge encountered tropical depression force winds while enroute to Key West, FL on November 15 around 0130EST. Winds were estimated at 30 knots. The winds were attributed to departing Tropical Depression Twenty-Two, situated 20 miles southeast of the Dry Tortugas at the time. Several boats in the group had their sails partially torn. A few masts were damaged. The boats reached safe haven and their destination by 1000EST.

GMZ078 Middle Gulf between 85W and 90W
11 0300CST 0 0 2M Marine Tropical Depression
11 1005CST
An oil rig platform 100 miles south of Mobile Bay, AL sustained damage on June 11 between 0300 and 1005CST as Tropical Depression Thirteen passed by. Two indirect injuries were reported and occurred due to falling debris during the clean-up phase. Measured winds at the platform peaked at 32 knots. Property loss was estimated at 2 million dollars.

39 Marine Tropical Storm (M). A tropical cyclone occurring over the waters and bays of the ocean (those assigned specific Marine Forecast Zones) in which the maximum 1-minute sustained surface wind is equal to or greater than 34 knots (39 mph) but less than 64 knots (74 mph) for 2 hours or more and results in a fatality, injury, or damage to watercraft or fixed platforms.

Use the Marine Hurricane/Typhoon event type if a hurricane produced sustained surface winds of 64 knot or greater in a part of the CWA covered by marine zones. This means you may need a Marine Hurricane/Typhoon event type for some zones and a Marine Tropical Storm event type for other zones even though all of the events are from one tropical cyclone. Other times, you may need a Marine Tropical Storm event type for your marine zones and a Tropical Storm event for your land zones. A Marine Tropical Storm event related to a hurricane will include a reference to the hurricane in the Marine Tropical Storm narrative section, (e.g., "Hurricane Dennis produced tropical storm force winds in ...)." Coordinate with NHC if you have any questions.

Note: Direct fatalities which are related to a marine vessel will be coded as BO (Boating), not IW (In Water).

Beginning Time - When winds equal to or greater than 34 knots (39 mph) but less than 64 knots first occurred or when a fatality, injury, or damage began.

Ending Time - When winds diminished to less than 34 knots or when reports of fatalities, injuries, or damage were no longer received.

Direct Fatalities/Injuries

ϒ Tropical storm force winds overturn a commercial or recreational vessel and the crew drowns.

Indirect Fatalities/Injuries

ϒ Tropical storm force winds cause moderate damage to an oil rig. Several hours later, an employee was killed by falling debris during post storm clean-up.

Examples:

ANZ270 Waters from Surf City NC to South Santee River SC
8 1000EST 1 0 Marine Tropical Storm
2200EST
A freighter 30 miles northeast of Myrtle Beach, SC received substantial damage on September 8 between 1000 and 2200EST, as 50 knot tropical storm force winds associated with far away Hurricane Floyd buffeted the ship for nearly twelve hours. The combination of rough seas and wind gusts knocked one crew member overboard, resulting in a drowning. M55BO

GMZ375 Waters from High Island to Freeport TX
21 0300CST 0 0 1M Marine Tropical Storm
21 1705CST
A 50-foot-high speed power boat capsized 40 miles south of Galveston Bay on July 21 around 1700CST. The outer bands of approaching Hurricane Phillip battered the boat with estimated tropical storm force winds to 45 knots. All three crew members were rescued by USCG helicopter. Property loss was estimated at 1 million dollars.

40 Rip Current (Z). A narrow channel of water that flows away from the beach, through the surf zone and dissipates beyond the breaking waves. Rip currents develop in the waters and bays of the ocean, Great Lakes and other lakes with assigned specific Marine Forecast Zones), or any location that experiences breaking waves. They often form when the gradient wind is strong and directly onshore or when swells from a distant extra-tropical or tropical cyclone impinge on the coast. Rip currents will be listed in *Storm Data* only when they cause a drowning, near-drowning, result in one or more rescues, or damage to watercraft. Events associated with other surf-related currents, such as long-shore or tidal currents, should be included in the appropriate event type category.

Occasionally, rip currents are designated as the cause of a surf zone drowning in media reports when the actual cause is from another current, longshore, tidal, etc., or outside of surf zone events (i.e., heart attack, weak swimmer). As a result, every attempt should be made to confirm the cause of the drowning, or near-drowning. The best way to confirm what caused the event is to contact the local lifeguards, beach services, or the law enforcement agency responsible for interviewing witnesses and filing the report. The *Storm Data* preparer exercises professional judgment to determine whether the fatality or injury is a result of a Rip Current event.

Dry or secondary drowning occurs when a victim is rescued from a surf zone hazard such as a Rip Current event, and their respiratory system retains water. The victim passes away later from problems caused by the water retained in the respiratory system. A fatality associated with dry drowning should be included in a Rip Current event, as this was the initial cause of the rescue.

Beginning Time - The time when a rip current drowning, near-drowning, or rescue incident began, or damage began.

Ending Time - The time that the rip current drowning, near-drowning, or rescue incident ended or damage ended.

Direct Fatalities/Injuries

- A fatality due to a drowning from a rip current that was caused by wind or wave activity.
- A near-drowning due to a rip current that required medical treatment (either on-site or at a hospital) is considered an injury.

Indirect Fatalities/Injuries

- None

Examples:

FLZ072	**Coastal Waters from Deerfield Beach to Ocean Reef FL**					
25	**1400EST**	**1**	**1**	**0**	**0**	**Rip Current**
	1630EST					
	A 78-year old tourist swimming in the Atlantic behind his hotel near Fort Lauderdale drowned in a rip current. The beach patrol rescued four others, one of whom was transported to the hospital for medical treatment. M78IW					
CAZ042	**Inner Waters from Pt. Mugu to San Mateo Pt CA**					
05	**0900PST**	**2**	**2**	**0**	**0**	**Rip Current**
	1600PST					
	A 25-year-old male and a 24-year-old female drowned in a rip current near a pier at Huntington Beach. Lifeguards made over two dozen rescues with two near-drownings as 10-foot swells from Hurricane Angelo swept north. M25IW, F24IW					

41 Seiche (Z). A standing-wave oscillation in any enclosed lake that continues after a forcing mechanism has ceased and results in shoreline flooding and/or damage. In the Great Lakes and large inland lakes, large pressure differences, high winds, or fast-moving squall lines may act as the forcing mechanism. In addition, earthquakes or debris flows can initiate a seiche. When the forcing mechanism ends, the water sloshes back and forth from one end of the lake to the other, causing water level fluctuations of up to several feet before damping out.

Beginning Time - When water levels rose to initiate shoreline flooding, resulting in a fatality, injury or damage.

Ending Time - When water returned to pre-seiche levels.

Direct Fatalities/Injuries
- ϒ Persons near shore were swept away by the large wave and drowned.
- ϒ A boat was overturned by the large wave, drowning or injuring those on board.
- ϒ A structure was damaged or flooded by the wave, killing or injuring those inside.

Indirect Fatalities/Injuries
- ϒ Person died when cleaning up seiche-generated debris after the seiche ended.
- ϒ Person died from a building that collapsed from beach erosion after a seiche ended.

Example:

MIZ071 Van Buren
28 0300EST 0 0 500K Seiche
0315EST
An early-morning seiche of 3 feet, caused by a thunderstorm squall line that crossed Lake Michigan, caused damage in western Lower Michigan. The rising water damaged boats and docks at South Haven. At least $500,000 in damage occurred to piers and boats along the shoreline.

42 Sleet (Z). Sleet accumulations meeting or exceeding locally/regionally defined warning criteria (typical value is 1/2 inch or more). The *Storm Data* preparer should include in the narrative the times that sleet accumulation began, met criteria, and ended.

Beginning Time - When sleet was first observed to accumulate, or inferred to start accumulating from surrounding reports.

Criteria Time - When sleet accumulations equaled locally/regionally established warning threshold values, or as inferred from damage reports.

Ending Time - When sleet accumulation was observed to end, or inferred to end from surrounding reports.

Direct Fatalities/Injuries
- ϒ The weight of sleet on a roof or other structure causes it to collapse, killing someone. (Rare)

Indirect Fatalities/Injuries
- ϒ Any automobile-related accident due to sleet accumulation or poor driving conditions.
- ϒ Any fatality or injury related to someone falling or slipping on sleet.

Example:

WYZ015-062 Natrona - North Carbon

03 1200MST	**0**	**0**	**65K**		**Sleet**
04 0200MST					

Sleet began to accumulate around 1200MST on the 3rd. Accumulations eventually reached as much as 8 inches in the central foothills of Wyoming, causing extensive ice conditions and drifts of sleet, before ending around 0200MST on the 4th. Driving was hazardous at best with numerous accidents along Highway 54. The slippery road surface resulted in one accident involving two trucks in which four people were injured (indirectly). The roof of a Natrona business collapsed due to the weight of the sleet.

43 Sneaker Wave (Z). A sneaker wave is the first wave of a set of larger waves that follows a period of relatively calm ocean conditions, resulting in a fatality or damage. The period of calm preceding a sneaker wave can last up to thirty minutes. This period of calm causes beach goers to inaccurately assess the hazard, leading to behavior that places them in harm's way, such as getting too close to the surf with attention diverted. The hazard caused by sneaker waves is not correlated to the absolute magnitude of the size, but it instead is derived from the relative size, compared to the size of the waves that preceded the sneaker wave.

Sneaker waves occur when two wave systems coincide that have very similar periods. When these wave systems are out of phase, wave heights temporarily decrease, and therefore, the distance that waves run up the beach also decreases. When people move toward the water's edge, this temporary decrease in wave run-up may catch them unaware and unprepared for when the wave systems come back into phase, resulting in a return to relatively larger waves and higher wave run-ups. The first few waves that result from this constructive interference are the waves that "sneak" up on people and catch them by surprise. Sneaker waves are a complex weather phenomenon. The technology does not exist to support deterministic sneaker wave forecasting.

Dry or secondary drowning occurs when a victim is rescued from a surf zone hazard such as a Sneaker Wave event, and his/her respiratory system retains water. The victim passes away later from problems caused by the water retained in the respiratory system. A fatality associated with dry drowning should be included in a Sneaker Wave event, as this was the initial cause of the rescue.

43.1 Difference between Sneaker Waves and Other Wave Hazards. Sneaker Waves compared to High Surf: High surf can be forecast, and well-defined criteria exist for issuing warnings and advisories. High surf damages and injuries/fatalities occur when average wave run up reaches far beyond the normal surf line and impact areas normally thought to be safe. Most sneaker wave fatalities occur when conditions are well below High Surf criteria. Sneaker waves are dangerous because they wash up much farther than most of the waves during a given period, even if the absolute magnitude of the wave run up is not significant. Sneaker waves do not usually cause coastal erosion or damage. Lowering High Surf criteria to wave heights that correspond to sneaker wave events would result in the almost continuous issuance of High Surf warnings/advisories.

Sneaker Waves compared to Rogue Waves: Sneaker waves do not necessarily meet the commonly held criteria for a wave to be considered a rogue wave – that it is at least twice as high as the significant wave height. A deadly sneaker wave may only be slightly above the significant wave height for a given time period, but it occurs immediately after a period of relative calm. The interspersed periods of calm and periods of enhanced wave heights is the source of the hazard associated with sneaker waves. Rogue wave events are characterized by periods of normal wave heights followed by brief periods of extraordinarily large waves. Rogue waves are statistically very rare compared to sneaker waves. The waves that result in the sneaker wave hazard on the beach would not usually be hazardous for mariners in open water. Conversely, a true rogue wave on the open water could be an especially large sneaker wave on the beach.

43.2 General Guidelines for Determining if a Sneaker Wave Occurred. Sneaker wave fatalities are distinct from High Surf and Rip Current fatalities. Care is be taken to ensure that beach and surf fatalities are attributed to the correct hazard.

- If High Surf criteria are met during the time when an incident occurs, it should be recorded as a High Surf event. The premise here is that if High Surf criteria are met, then the average wave conditions are hazardous and, therefore, the element of surprise associated with Sneaker Waves does not exist.
- If a person drowns who is already fully in the water (surfing, swimming, etc.), then the fatality should not be attributed to a Sneaker Wave event. The Sneaker Wave hazard is specific in that it catches people who are not in the water and pulls them into the surf.
- If there are no witnesses to a drowning, it is very hard to establish with certainty that a Sneaker Wave was involved. For witnessed events, typical statements will describe a very large wave that seems to come out of nowhere and catches the victims by surprise.
- If a site survey can be conducted within hours after a suspected Sneaker Wave event, the debris or "wet sand" line can be used to verify that a Sneaker Wave occurred. The debris or "wet sand" line should extend significantly beyond the normal wave run up for the average wave conditions, factoring in a rising or falling tide.

Beginning Time - The time when a sneaker wave drowning, near-drowning, or rescue incident began.

Ending Time - The time that the sneaker wave drowning, near-drowning, or rescue incident ended.

Direct Fatalities/Injuries

- Two people are walking on the beach during a time when the ocean appears calm, with waves of only about 5 feet. A 15-foot wave catches them by surprise, knocking them both down and pulling them into the ocean where they drown. Average wave conditions, as measured at buoys, did not meet High Surf criteria.

- A mother and her young daughter are having a picnic at the beach, at a distance from the surf that appears to be safe based on the wave conditions. An unusually large wave reaches their picnic site and pulls the young child into the ocean where she drowns. Average wave conditions did not meet High Surf criteria.
- A father and mother are having their picture taken by their teenage daughter at the end of a jetty when an unusually large wave washes both parents into the water. The mother is rescued by the Coast Guard, but the father is never found. Average wave conditions did not meet High Surf criteria.

Indirect Fatalities/Injuries

- None

Example:

CAZ001 **Redwood Coast**
09 2000PST **1** **0** **Sneaker Wave**
10 0600PST
An 8-year-old girl walking with her family at Orick Beach was swept off the beach by a sneaker wave and drowned. Rangers reported that average wave conditions were about 6-8 feet, but that there were periodic waves that reached 15 feet. A nearby buoy reported wave heights of 6 feet. The maximum extent of wave run up from the sneaker wave was determined to be 100 feet further inland than the run up distance of average wave conditions. F08IW

44 Storm Surge/Tide (Z). For coastal and select lakeshore areas, the vertical rise above normal water level associated with a storm of tropical origin (e.g., hurricane, typhoon, tropical storm, or subtropical storm), caused by any combination of strong, persistent onshore wind, high astronomical tide and low atmospheric pressure, resulting in damage, erosion, flooding, fatalities, or injuries. Note: Coastal flooding not associated with a typhoon, hurricane, tropical storm or subtropical storm should be reported under the Coastal Flood event; flooding adjacent to the Great Lakes and other lakes with specific assigned Marine Zones should be reported under the Lakeshore Flood event.

For coastal areas, normal water level is defined as mean sea level. Basically, storm tide is the sum of storm surge and astronomical tide. If the astronomical tide height for the flooded area is known, it should be subtracted from the total water level/storm tide (run-up/debris line), and the result specifically labeled in the event narrative as “storm surge.” The method of measuring surge height should be mentioned in the narrative, (e.g., “NWS survey team calculated a surge height of 4 feet by subtracting the astronomical tide height from the run-up/debris line height.”).

In association with Storm Surge/Tide events, coastal and lakeshore areas are defined as those portions of coastal land zones (coastal county/parish) adjacent to the waters and bays of the oceans, and other lakes with assigned specific Marine Forecast Zones, such as Lakes Maurepas, Pontchartrain, Okeechobee; this does not include the Great Lakes. Farther inland, the *Storm Data* preparer determines the boundary between coastal and inland areas, where flood events will be encoded as Flash Flood or Flood rather than Storm Surge/Tide. Terrain (elevation) features will determine how far inland the coastal/lakeshore flooding extends.

Beginning Time - When the water level began to cause damage or flooding.

Ending Time - When the water level dropped to a point where damage or flooding ended.

Direct Fatalities/Injuries

ϒ A coastal dwelling was washed away injuring/killing the occupants.
ϒ A person drowned when a vehicle was swept away by the storm tide.

Indirect Fatalities/Injuries

ϒ A person suffered a heart attack while evacuating from a storm tide.
ϒ A person suffered a heart attack, collapsed and drowned, while initially standing in two feet of storm tide.
ϒ A person died in a vehicle accident caused by the storm tide washing away a traffic signal.
ϒ A person died in a vehicle accident after losing control in standing water on a road.

Example:

FLZ041-047- Volusia - Brevard - Indian River - St. Lucie - Martin
054-059-064 25 2200EST 0 0 8M Storm Surge/Tide
26 1600EST
The greatest storm tides occurred between Brevard and St. Lucie Counties, to the right of the land-falling eyewall of Hurricane Jeanne. Initial estimates of storm tide ranged from 7 feet in Volusia County to around 11 feet in St. Lucie County. Storm surge heights for those areas ranged respectively from 6 to 10 feet, as determined by NWS survey teams that subtracted a 1 foot astronomical tide height from debris line heights. Damage would have been greater except that Jeanne came ashore during low tide. Hardest hit was the town of New Smyrna Beach where much of the sand east of the town's seawall was removed. About 100 ocean-front homes were damaged, as well as about 75 piers.

45 Strong Wind (Z). Non-convective winds gusting less than 50 knots (58 mph), or sustained winds less than 35 knots (40 mph), resulting in a fatality, injury, or damage. Consistent with regional guidelines, mountain states may have higher criteria. A peak wind gust (estimated or measured) or maximum sustained wind will be entered.

Inland counties/parishes which experience strong winds/damage associated with tropical cyclones will be documented under the Tropical Depression or Tropical Storm category, as appropriate, not as a Strong Wind event.

Events over large inland lakes (with no specific, assigned Marine Forecast Zone number) that meet Strong Wind criteria will be entered as a Strong Wind event, rather than a Marine Strong Wind event.

The preparer should note in the *Storm Data* software program whether the Strong Wind was a measured gust (MG), estimated gust (EG), measured sustained (MS), or estimated sustained (ES). This software program automatically inserts a wind speed conversion line at the end of the event narrative that equates knots with miles per hour.

Beginning Time - When the wind started to cause a fatality, injury, or significant damage.

Ending Time - When the wind no longer caused a fatality, injury, or significant damage.

Direct Fatalities/Injuries

- Fatalities or injuries caused by falling debris associated with structural failure (e.g., falling trees, utility poles, and power lines).
- Fatalities or injuries associated with vehicles that were blown over, or with vehicles that were blown into a structure or other vehicles.
- Fatalities or injuries caused by airborne objects striking people or vehicles.
- Drowning due to boats capsizing from wind on inland lakes without an assigned Marine Forecast Zone.
- Any fatalities or injuries from loss of electrical power, including lack of heat or cooling.

Indirect Fatalities/Injuries

- Fatalities or injuries when a vehicle collided with debris scattered on a roadway.
- Any fatalities or injuries incurred during the clean-up process.
- Fatalities or injuries associated with making contact with power lines after they fell.

Example:

TXZ252-253- Starr - Hidalgo - Cameron
255 22 1000CST 1 0 25K Strong Wind (MG45)
2100CST
Gusty winds to 45 knots occurred in the Rio Grande Valley of Deep South Texas. Power lines and store signs were downed in Rio Grande City, Mercedes, and Brownsville. The wind pushed a large store sign onto a passing car on US 281 in Brownsville, killing the driver. M27VE
Note: The measured wind gust of 45 knots is equivalent to 52 mph.

46 Thunderstorm Wind (C). Winds, arising from convection (occurring within 30 minutes of lightning being observed or detected), with speeds of at least 50 knots (58 mph), or winds of any speed (non-severe thunderstorm winds below 50 knots) producing a fatality, injury, or damage. Maximum sustained winds or wind gusts (measured or estimated) equal to or greater than 50 knots (58 mph) will always be entered. Events with maximum sustained winds or wind gusts less than 50 knots (58 mph) should be entered as a *Storm Data* event only if the result in fatalities, injuries, or serious property damage. *Storm Data* software permits only one event name for encoding severe and non-severe thunderstorm winds. The *Storm Data* software program requires the preparer to indicate whether the sustained wind or wind gust value was measured or estimated.

Note that damage alone does not automatically imply wind speeds of 50 knots (58 mph) or greater. When estimating a wind speed value, the preparer should take into account the amount and degree of severity, and condition of the damaged property (age, type of construction technique used, exposure, topography, soil moisture/composition, and local wind funneling effects due to orientation/closeness of other objects). The resultant damage supports such a value. Refer to Table A7 in section 46.4 for guidelines on estimating wind speeds, as well as the EF-Scale information available at https://www.spc.noaa.gov/efscale/.

On occasion, a convective line with no lightning, embedded within an area with a tight surface pressure gradient, will result in widespread wind gusts of 50 knots (58 mph) or higher. In these cases, the Thunderstorm Wind event will be used, rather than a High Wind event. However, widespread "wake-low," gusty winds will be documented with the High Wind or Strong Wind event.

Estimated or measured winds (sustained or gusts) below 50 knots (58 mph), regardless of extent and/or severity of fatalities, injuries, and property damage, will not initiate the verification process. Encoded wind values of 50 knots (58 mph) or more will initiate the verification process for Thunderstorm Wind events.

Note: "Extreme" damage, produced by thunderstorm winds greater than 64 knots (74 mph), is equivalent to estimated winds in the EF0 category of the Enhanced Fujita damage scale. Therefore, partial roofs removed, windows broken, light trailer homes pushed over/overturned, automobiles pushed off the road would be considered extreme wind damage. Refer to Table A7 in section 46.4 for guidance and to the EF-Scale information available at https://www.spc.noaa.gov/efscale/.

46.1 Downbursts. Downbursts, including dry, or wet, microbursts or macrobursts, will be classified as Thunderstorm Wind events. In some cases, the downburst may travel several miles from the parent thunderstorm, or the parent thunderstorm may have dissipated. However, since the initiation of the downburst event was related to a thunderstorm, Thunderstorm Wind is the appropriate event to use. Furthermore, the *Storm Data* preparer has the option of including "wind swath" information by inputting both a starting location latitude/longitude and an ending location latitude/longitude within the county where the wind damage swath exists. For wind swaths crossing county lines, the Thunderstorm Wind event would be continued into the next county as an additional *Storm Data* entry.

46.2 Gustnadoes. A gustnado is a small, usually weak whirlwind, which forms as an eddy in thunderstorm outflows. They do not connect with any cloud-base rotation and are not tornadoes. Since their origin is associated with cumuliform clouds, gustnadoes will be classified as Thunderstorm Wind events.

46.3 Thunderstorm Wind Damage. The *Storm Data* preparer exercises professional judgment to determine the estimated maximum wind value based on observed structural or tree damage. For example, a single rotted tree that is toppled by thunderstorm winds does not support an estimated wind gust of 50 knots (58 mph). Other examples of thunderstorm wind damage that do not support an estimated severe thunderstorm wind gust of 50 knots (58 mph) include: small twigs broken, toppled lawn furniture, poorly constructed/secured signs, billboards and awnings. Although some of these examples can be considered damage, it is likely that this damage can be incurred at wind speeds far below 50 knots (58 mph). On the other hand, numerous large trees, power lines, and road signs toppled by thunderstorm winds would support an estimated gust value at or above 50 knots (58 mph).

The preparer should note in the *Storm Data* software program whether the Thunderstorm Wind was measured gust (MG), estimated (EG), measured sustained (MS), or estimated sustained (ES). This software program will automatically insert a wind speed conversion line at the end of the event narrative that equates knots with miles per hour.

<u>Beginning Time</u> - When damage first occurred or winds 50 knots (58 mph) or greater were first reported.

<u>Ending Time</u> - When damage ended or winds of 50 knots (58 mph) were last reported.

<u>Direct Fatalities/Injuries</u>

- A thunderstorm wind gust snapped a large tree limb. The limb fell on a passing car, killing or injuring the driver.

<u>Indirect Fatalities/Injuries</u>

- A wind gust snapped a large tree limb which fell on the road. A few minutes later, a car drove into the tree limb and the driver was killed or injured.
- A wind gust downed numerous trees and limbs. The next morning, a person cleaning up the debris in his yard died or was injured from a chainsaw accident.
- A thunderstorm gust toppled a tree on a home’s gas meter, causing an explosion. The resultant fire subsequently killed two people who were in the home.

<u>Examples</u>:

El Paso County
Colorado Spgs 23 1730MST 0 0 Thunderstorm Wind (MG70)

A dry-microburst struck the 5100 block of North Nevada Avenue in Colorado Springs. The downburst winds tore down power lines (but left the poles standing), ripped 40 square feet of roofing off a building, blew a pontoon boat 30 feet off its trailer, damaged billboards, and brought down tree limbs 6 to 8 inches in diameter. A home weather station recorded the measured gust.
Note: The measured wind gust of 70 knots is equivalent to 81 mph.

DeKalb County

Malta **12 1505MST 0 0 15K 10K Thunderstorm Wind (EG65)**

Thunderstorm winds estimated at 65 knots downed numerous large trees, ripped off several barn roofs, and blew over a fuel storage tank. Two people were injured (indirectly related) when their vehicle struck a large tree on a road about 1 hour after the storm ended.

Note: The estimated wind gust of 65 knots is equivalent to 75 mph.

Langlade County

Antigo to Lily **10 1309CST 1320CST 0 0 200K Thunderstorm Wind (EG78)**

A powerful downburst leveled thousands of trees, downed power lines, and damaged at least 50 homes as it moved northeast. The downburst swath ranged from 2 to 4 miles in width.

Note: The estimated wind gust of 78 knots is equivalent to 90 mph.

Waukesha County

Genesee **15 1915CST 0 0 50K Thunderstorm Wind (EG61)**

A gustnado along the leading edge of a downburst produced wind gusts estimated at nearly 70 mph, damaging a barn and farm house along Highway 59 near Genesee. Interaction between the downburst and outflow from another thunderstorm just south of the city of Waukesha generated the gustnado.

Note: The estimated wind gust of 61 knots is equivalent to 70 mph.

46.4 Table for Estimating Wind Speed from Damage.

Wind Speed	Observations
26-38 kts (30-44 mph)	Trees in motion. Light-weight loose objects (e.g., lawn furniture) tossed or toppled.
39-49 kts (45-57 mph)	Large trees bend; twigs, small limbs break, and a few larger dead or weak branches may break. Old/weak structures (e.g., sheds, barns) may sustain minor damage (roof, doors). Building partially under construction may be damaged. A few loose shingles removed from houses. Carports may be uplifted; minor cosmetic damage to mobile homes and pool lanai cages.
50-64 kts (58-74 mph)	Large limbs break; shallow rooted trees pushed over. Semi-trucks overturned. More significant damage to old/weak structures. Shingles, awnings removed from houses; damage to chimneys and antennas; mobile homes, carports incur minor structural damage; large billboard signs may be toppled.
65-77 kts (75-89 mph)	Widespread damage to trees with trees broken/uprooted. Mobile homes may incur more significant structural damage; be pushed off foundations or overturned. Roof may be partially peeled off industrial/commercial/ warehouse buildings. Some minor roof damage to homes. Weak structures (e.g., farm buildings, airplane hangars) may be severely damaged.
78+ kts (90+ mph)	Many large trees broken and uprooted. Mobile homes severely damaged; moderate roof damage to homes. Roofs partially peeled off homes and buildings. Moving automobiles pushed off dry roads. Barns, sheds demolished.

Table A7. Estimating Wind Speed from Damage.

Note: All references to trees are for trees with foliage. Appreciably higher winds may be required to cause similar damage to trees without foliage. In addition, very wet soil conditions may allow weaker winds of 26 to 49 knots (30 to 57 mph) to uproot trees. For additional information, please refer to Damage Indicators 27 and 28 in the EF-Scale information located at http://www.spc.noaa.gov/efscale/.

46.5 Knot-Miles Per Hour Conversion Tables. Tables A8 and A9 will assist in conversion of wind speed values between knots and miles per hour.

KTS	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	5	6	7	8	9	10
10	12	13	14	15	16	17	18	20	21	22
20	23	24	25	26	28	29	30	31	32	33
30	35	36	37	38	39	40	41	43	44	45
40	46	47	48	50	51	52	53	54	55	56
50	58	59	60	61	62	63	64	66	67	68
60	69	70	71	73	74	75	76	77	78	79
70	81	82	83	84	85	86	88	89	90	91
80	92	93	94	96	97	98	99	100	101	102
90	104	105	106	107	108	109	111	112	113	114

Table A8. Knots to miles per hour. (Example: 45 knots equals 52 mph)

MPH	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	3	4	5	6	7	8
10	9	10	10	11	12	13	14	15	16	16
20	17	18	19	20	21	22	23	23	24	25
30	26	27	28	29	30	30	31	32	33	34
40	35	36	36	37	38	39	40	41	42	43
50	43	44	45	46	47	48	49	49	50	51
60	52	53	54	55	56	56	57	58	59	60
70	61	62	63	63	64	65	66	67	68	69
80	70	70	71	72	73	74	75	76	76	77
90	78	79	80	81	82	82	83	84	85	86

Table A9. Miles per hour to knots. (Example...45 mph equals 39 knots)

46.6 Speed-Distance Conversion Table. On occasion, the *Storm Data* preparer may need to calculate beginning and ending times, time of arrival, or validity of storm report times, based on a known thunderstorm speed from radar. To assist in this task, use Table A10.

KTS/MPH	1 Mile in X Minutes	KTS/MPH	1 Mile in X Minutes
52/60	1 mile in 1.0 min	**26/30**	1 mile in 2.0 min
48/55	1 mile in 1.1 min	**22/25**	1 mile in 2.4 min
43/50	1 mile in 1.2 min	**17/20**	1 mile in 3.0 min
39/45	1 mile in 1.3 min	**13/15**	1 mile in 4.0 min
35/40	1 mile in 1.5 min	**9/10**	1 mile in 6.0 min
30/35	1 mile in 1.7 min	**4/5**	1 mile in 12.0 min

Table A10. Speed to Distance Conversion.

47 Tornado (C). A violently rotating column of air, extending to or from a cumuliform cloud or underneath a cumuliform cloud, to the ground, and often (but not always) visible as a condensation funnel. For a vortex to be classified as a tornado, it must be in contact with the ground and extend to/from the cloud base, and there should be some semblance of ground-based visual effects such as dust/dirt rotational markings/swirls, or structural or vegetative damage or disturbance.

The tornado path length will be entered in miles and tenths of a mile. The maximum tornado path width will be entered in yards. See section 47.7 for details in determining path length (including beginning and ending points) and path width. Exercise professional judgment in determining the existence of separate tornadoes. Each and every case is a different situation.

An Enhanced Fujita (EF) Damage Scale value will be entered. Although not required, the inclusion of Damage Indicator (DI) and Degree of Damage (DOD) information in the event narrative that led to the EF Damage Scale value assigned to the tornado is strongly encouraged.

As an option, the type of thunderstorm that produced the tornado can be included in the event narrative. Some examples include high- or low-precipitation supercell, non-supercell, squall line, bookend vortex, tropical cyclone (TC) supercell, etc.

When discernible, wind damage from the rear-flank downdraft should not be considered part of the tornado path but should be entered as a Thunderstorm Wind event.

Gustnadoes will be reported as Thunderstorm Wind events. Refer to section 46.2 for details.

Landspouts and funnels, ultimately meeting the objective tornado criteria listed in section 47.6, will be classified as Tornado events.

47.1 Tornado, Funnel Cloud, and Waterspout Events. The terms Tornado, Funnel Cloud, and Waterspout are defined below:

a. Tornado. A violently rotating column of air extending from a cumuliform cloud or underneath a cumuliform cloud, to the ground, and often (but not always) visible as a condensation funnel. Literally, in order for a vortex to be classified as a tornado, it must be in contact with the ground and extend to/from the cloud base. On a local scale, it is the most destructive of all atmospheric phenomena;

b. Waterspout. A violently rotating column of air usually pendant to a cumulus/cumulonimbus, over a body of water, with its circulation reaching the water; and

c. Funnel Cloud. A rotating visible extension of cloud pendant to a cumulus/cumulonimbus with circulation not reaching the ground or water.

In some situations, many public and spotter reports of funnel clouds are passed on to a WFO. In these cases, the preparer should document only the most significant funnel clouds, especially those that generate public or media attention. Refer to section 18 for additional funnel cloud details.

WFOs are responsible for identifying, investigating, and confirming storms occurring in their warning areas. To accomplish this, the *Storm Data* preparer uses all available severe weather reports, including information from newspapers, letters and photographs, airborne surveys and pilot reports, state/local emergency management, and personal inspections.

When available information includes a reliable report that a tornado vortex was distinctly visible (condensation funnel pendant from a cloud - usually a cumulonimbus), and in contact with the ground, or a rotating dust/dirt/debris column at the ground is overlaid with a condensation funnel pendant above, identification of a tornado is a simple matter. This is particularly true when reports have been investigated by the responsible NWS official and found to be reliable. However, tornadoes, funnel clouds, and waterspouts can be hidden by precipitation, low clouds, or dust. Darkness or lack of observers may also result in a tornado or waterspout not being observed. The WFO staff exercises professional judgment to identify a tornado or waterspout from its effects.

47.2 Criteria for a Waterspout. A vortex in contact with the water surface that develops on, or moves over, the waters and bays of the oceans, Great Lakes, and other lakes with assigned Marine Forecast Zones, will be characterized as a Waterspout for that portion of its path over those water surfaces. The vortex will be classified as a Tornado for that portion of its path over land or inland bodies of water that are not assigned Marine Forecast Zones. Refer to section 52 for additional waterspout details.

47.3 Tornadoes Crossing CWA Boundaries. Tornadoes crossing state lines or boundaries of WFO CWA responsibility will be coordinated between WFOs. The preparer will ensure that the exact location where a tornado crosses a county, parish, or state line, is incorporated into the event narrative. Sharp-turning tornadoes may need to be segmented into individual pieces to adequately describe the path of that event. However, segmenting a tornado within the same county/parish is not permitted since this practice may lead to confusion and over-counting of tornadoes by the SPC, NCEI, and *Storm Data* users. It is recommended that the preparer encode only one beginning and ending point for the tornado path within each county/parish affected, and provide detailed information in the event narrative about the intermediate locations where the tornado turned sharply. Additional instructional information regarding these "border-crossing" tornadoes can be found in the Tornado event examples in this section.

47.4 Landspouts and Dust Devils. A landspout (slang-term for non-supercell tornado) will be classified as a Tornado event, assuming the preparer has reliable reports meeting the criteria outlined in section 47.6. Similarly, cold-air funnels, meeting the criteria outlined in section 47.6, will be classified as a Tornado event.

On the other hand, dust devils will not be classified as tornadoes since they are ground-based whirlwinds that do not meet the tornado criteria outlined in section 47.6. A dust devil is an allowable *Storm Data* event name as indicated in section 10.

47.5 On-site Inspections (Surveys). WFO tornado/waterspout and extreme downburst damage surveys are desirable in those cases when the MIC or WCM believes additional information is needed for *Storm Data* preparation. A survey should be completed as soon as possible before clean-up operations remove too much damage evidence.

The NWS has developed the Damage Assessment Toolkit (DAT) to assist with the collection of storm damage survey information. The DAT is a Geographic Information System (GIS) application designed for efficient collection, analysis, and delivery of storm damage data. The toolkit is built around a central geospatial database, which is used to store the data. To ensure accurate tornado paths are recorded, WFOs should use the DAT to collect storm damage survey information. More information on the DAT is located at: https://sites.google.com/a/noaa.gov/damage-assessment-toolkit/.

When strong to extreme Tornado events occur (e.g., greater than EF3 tornado damage expected), a Post Storm Damage Assessment (PSDA) report should be compiled. To quickly gather the data necessary for accurate post-event analysis, the deployment of a PSDA Quick Response Team (QRT) may be required. The guidelines and requirements for initiating a PSDA QRT action are contained in NWSI 10-1604, *Post-Storm Data Acquisition*, available at http://www.nws.noaa.gov/directives/sym/pd01016004curr.pdf.

47.6 Objective Criteria for Tornadoes. An event will be characterized as a tornado if the type or intensity of the structural and vegetative damage and/or scarring of the ground could only have been tornadic, or if any two of the following guidelines are satisfied:

a. Well-defined lateral boundaries of the damage path;

b. Evidence of cross-path wind component, e.g., trees lying 30 degrees or more to the left/right of the path axis (suggesting the presence of a circulation);

c. Evidence of suction vortices, ground striations, and extreme missiles; or

d. Evidence of surface wind convergence as suggested by debris-fall pattern and distribution. In fast-moving storms, the convergence pattern may not be present and debris pattern may appear to fall in the same direction.

Additionally, an event will be characterized as a tornado if:

a. Eyewitness reports from credible sources, even with little or no structural or vegetative damage, and/or little or no scarring of the ground, indicate that a violent circulation extended from the convective cloud base to the ground; or

b. Videos or photographs from credible sources, even with little or no structural or vegetative damage, and/or little or no scarring of the ground, indicate that a violent circulation extended from the convective cloud base to the ground.

There may be situations, especially in the central or western parts of the United States, where verification of tornadoes will be difficult. However, if available evidence establishes that it was highly likely a Tornado event occurred, the preparer will enter the event in *Storm Data*.

47.7 Determining Path Length and Width. Path length (in miles and tenths of miles) and maximum path width (in yards) will be indicated for all tornadoes, including each member of families of tornadoes, or for all segments of multi-segmented tornadoes. The length in the header-strip is the length of that particular segment in that particular county/parish. The SPC, NCEI, or a *Storm Data* user can determine the entire length of a multi-segmented tornado by adding the lengths from each segment as well as using the latitude and longitude of that segment. Note that latitude and longitude are not available in the *Storm Data* publication, but are available on the internet in the NCEI and SPC databases.

The tornado path length generally excludes sections without surface damage/disturbance, unless other evidence of the touchdown (e.g., a trained spotter report, video of the tornado over a plowed field) is available. The excluded section will not exceed 2 continuous miles or four (4) consecutive minutes of travel time; otherwise, the path will be categorized as separate Tornado events. The beginning and ending locations of the excluded sections should be described as accurately as possible in the event narrative. In some cases, careful analysis and eyewitness descriptions will determine if separate tornadoes actually occurred within 2 miles or four (4) minutes. Refer to section 47.9 for related information. Use the event narrative to describe whether a tornado was continuous or had small gaps in these types of cases.

The width in the header-strip is the maximum observed through the entire length of a tornado, or of each segment in a multi-segment tornado. In the absence of structural damage, broken small tree branches of at least 3 inches in diameter can be considered as a marker for tornado width (assuming this damage isn't related to the rear flank downdraft). In arid regions where there is a lack of trees, other vegetation or landscape material must be used as a marker. To determine the tornado's maximum width, the SPC or *Storm Data* user checks each segment which is entered as a separate event.

The preparer is encouraged to include in the event narrative the average path width (in yards) of all tornadoes, especially for strong or violent tornadoes (EF2 damage or worse). Availability of average path width information in *Storm Data* benefits the scientific research community and other users.

47.8 Using the Enhanced Fujita (EF) Scale. Use of the EF-Scale is listed at https://www.spc.noaa.gov/efscale/ and https://training.weather.gov/wdtd/courses/EF-scale/index.php. EF-Scale values will be assigned to every documented tornado. The *Storm Data* preparer may refer to the Internet documents (links above) and exercise professional judgment to determine the EF-Scale rating. These documents provide more examples and descriptions through the use of Damage Indicators (DI) and Degrees of Damage (DOD) to evaluate tornado damage.

Eyewitness verbal accounts, newspaper or personal photographs, and videos of the Tornado events may be relied upon when an inspection/survey is not possible. In cases where there is damage to numerous structures, damage to a single structure should not be used as the deciding factor for the appropriate EF-Scale rating. The surveyor should take into account the overall damage, evaluating tornado damage versus debris-caused damage and other extenuating circumstances. Experience has shown that tornado F-Scale ratings could not be determined consistently and reliably solely on the appearance of damage. This is also assumed with the newer EF-Scale. Although there are more documented examples of tornado damage, the assigned EF-Scale value may still vary by +/- 1.

When composing the event narrative of a tornado event, the description should be written remembering that it is a damage scale and the winds listed are estimated. Thus, a tornado does not necessarily "strengthen" as it moves into a city, housing development, subdivision or industrial area. If the tornado increases in speed or widens, then it may be assumed that the tornado physically is strengthening. Because the tornado moves into an area encountering more structures, creating more debris, does not necessarily indicate a strengthening of the tornado.

Doppler-derived wind speeds will not be used to determine the character of the storm or the EF-Scale of a tornado since these values are representative of conditions aloft rather than ground-based. However, this information may be included in the event narrative for enhancement. For example, the *Storm Data* preparer could include the following in the event narrative of a tornado surveyed by a Doppler on Wheels vehicle: "Based on damage evidence in path of the tornado, the tornado was officially rated an EF2. However, the NWS received derived wind speeds from a Doppler on Wheels vehicle located approximately 1 mile north of the tornado. These Doppler-derived observations indicated wind speeds of 170 mph at approximately the 300 foot level of the funnel. This is consistent with wind speeds associated with an EF4 tornado."

47.9 Tornadoes Without Visible Damage Evidence. On rare occasions, it is impossible to rate the strength of a confirmed tornado because there is little to no damage evidence. In these cases, the *Storm Data* preparer can document such a tornado as "EF-Unknown" (EFU). Narratives of tornadoes rated as EFU will include a brief narrative explaining why the tornado was unrated. For example, the *Storm Data* preparer could include the following in the event narrative of a tornado causing no damage: “Storm chasers captured video of a tornado briefly touching down in a remote section of Cheyenne County. The tornado caused no damage from which the NWS could assign an EF-scale rating.”

The following are a few examples of when the Storm Data preparer would rate a tornado an EFU:

1. A tornado traverses through an area that was severely damaged by a previous tornado. There are no damage indicators left that can be used to characterize the new tornado.

2. A tornado traverses through a wilderness or a high mountain area that is difficult to reach to conduct a damage survey, or through land lacking damage indicators such as trees or structures.

3. A tornado spins-up and stays over an inland lake that does not have an assigned marine zone. Unless a boat or an above-water-surface structure on the lake is damaged, or a buoy with an anemometer is within the path, a rating cannot be assigned.

4. A “satellite” tornado (or tornadoes) is (are) observed in association with a primary tornado. The damage survey team finds it is difficult to distinguish the damage caused by the primary tornado from the satellite tornado(es). The primary tornado should be assigned an EF-Scale rating and the satellite tornadoes may be rated as EFU.

47.10 Simultaneously Occurring Tornadoes. On occasions, especially over the Plains States, a single cumulonimbus may have several, separate, tornadoes occurring simultaneously. They may be separated by a distance of as little as 1/2 to 1 mile; and each may have a distinct, separate trajectory. In these cases, the *Storm Data* preparer should classify the tornadoes as separate events, each with a unique start/end location/time combination. The preparer will have to rely on credible evidence such as eyewitness reports, videos, and damage along the path to determine how many tornadoes actually existed. Existing *Storm Data* indicates that “landspout” tornadic situations have resulted in several simultaneously occurring tornadoes.

If evidence suggests that a multiple-vortex tornado occurred, the *Storm Data* preparer will document this situation as a single tornado event, even though each vortex created a distinct damage path. The multiple vortices rotate around a common center – the tornado center. Conversely, separate tornadoes, even if they are closely spaced, will not rotate around a common center.

A brief, detailed explanation of simultaneously occurring tornadoes may be included in the narrative associated with each tornado event.

<u>Beginning Time</u> - When the sub-cloud vortex first contacted the ground.

<u>Ending Time</u> - When the sub-cloud vortex lost contact with the ground.

<u>Direct Fatalities/Injuries</u>

ϒ Structures or trees were blown over and landed on someone, resulting in a fatality/injury.
ϒ People became airborne and struck the ground or objects, resulting in a fatality/injury.
ϒ High voltage power lines were blown onto a car, killing or injuring those inside.
ϒ A high-profile vehicle was blown over, resulting in a fatality/injury.
ϒ A vehicle was blown into a structure or oncoming traffic, resulting in a fatality/injury.
ϒ Objects became airborne (debris, missiles), resulting in a fatality/injury.
ϒ A boat on an inland lake or river was blown over or capsized, resulting in a drowning.

<u>Indirect Fatalities/Injuries</u>
ϒ A person was killed or injured after driving into a tree downed by the tornado.
ϒ Someone was electrocuted by touching downed power lines.
ϒ Someone suffered a heart attack and died as a result of removing debris.

47.11 Single-Segment (Non Border-crossing) Tornado Entries.

47.11.1 Example of a Tornado Within One County/Parish.

Page County
Bingham to 22 1905CST 6 75 0 0 5K 5K Tornado (EF0)
2 NE Norwich 1917CST

A tornado spun up 0.5 mile west of the intersection of SH 33 and SH 55 near Bingham, and moved east to Norwich before dissipating 0.25 mile northeast of the intersection of SH 18 and SH 12 northeast of Norwich. Two homes in Bingham and one in Norwich sustained minor damage (DI 2, DOD 2). The tornado track was not continuous; there were two areas (both about one-half-mile long) east of Bingham where damage was not discernable. Average path width was 30 yards.

47.11.2 Example of a Tornado that Changed Direction Within One County/Parish. A tornado that affects only one county/parish should be entered as only one segment, even if the tornado changed direction within a county/parish. The end points should be entered in the header-strip and the complete description of the tornado's path, including any variation from a straight line, should be described in the event narrative.

Jackson County
5 W Vernon to 14 2308CST 10 150 0 0 150K Tornado (EF1)
5 NNE Vernon 2326CST

A tornado spun up 5 miles west of Vernon just northeast of the intersection of Interstate 80 and SH 29. The tornado moved east through the city of Vernon, and then veered left at the center of the city. It finally dissipated about 5 miles north-northeast of Vernon about 0.25 mile east of the intersection of CTH E and CTH V. Trees and power lines were blown down and several barns were damaged. A business (DI 12, DOD 3) and a home were partially unroofed in Vernon. Average path width was 75 yards.

47.11.3 Example of a Tornado over an Inland Body of Water (Without an Assigned Marine Forecast Zone).

Davis County								
7SW Layton	**01**	**1738MST 1741MST**	**1**	**30**	**0**	**0**		**Tornado (EF0)**

State Police spotted a tornado over Great Salt Lake. It dissipated before reaching shore.

47.11.4 Examples of a Tornado that Became a Waterspout (Body of Water with Assigned Marine Forecast Zone).

St. Louis County								
2E Arnold to French River	**28**	**1651CST 1655CST**	**4.4**	**60**	**0**	**0**		**Tornado (EF1)**

A tornado spun up 2 miles east of Arnold at the entrance of Arrowhead State Park, and traveled until it reached the shore of Lake Superior at French River where it continued as a waterspout. A barn and an outbuilding were destroyed (DI 1, DOD 8) and trees were damaged. Average path width was 40 yards.

LSZ144								
Two Harbors to Duluth MN	**28**	**1655CST 1657CST**			**0**	**0**		**Waterspout**

The St. Louis County tornado event reached the shores of Lake Superior at French Creek. This waterspout then moved northeast and lasted another 2 minutes before dissipating.

47.11.5 Examples of a Waterspout (Body of Water with Assigned Marine Forecast Zone) That Became a Tornado.

LMZ645								
5NE Wind Pt to Wind Pt WI	**15**	**1700CST 1705CST**			**0**	**1**	**100K**	**Waterspout**

A waterspout developed 5 miles northeast of Wind Point and moved slowly southwest. Three sailboats about 2 miles offshore were destroyed and one person was injured. The waterspout moved onshore at the Wind Point Lighthouse and continued southwest as a tornado in Racine County.

Racine County								
Wind Pt to 3SW Wind Pt	**15**	**1705CST 1707CST**	**1**	**25**	**0**	**0**	**1M**	**Tornado (EF1)**

The waterspout that spun up 5 miles northeast of Wind Point moved onshore as a tornado at the Wind Point Lighthouse, and dissipated about 3 miles inland at the John H. Batten Airport. The tornado weakened but still managed to cause significant damage to two piers, a yacht club building, two small boats, and a dozen homes (DI 2, DOD 4). Estimated wind speeds of the tornado were about 87 knots (100 mph).

47.12 Segmented and Border-crossing Tornado Entries.

47.12.1 Examples of a County/Parish Line-crossing Tornado Within a CWA. Tornadoes that cross county/parish lines are entered as segments with one segment per county/parish. *Storm Data* preparers coordinate entries for tornadoes that cross state lines or CWAs. Consistency between *Storm Data* entries of border crossing tornadoes is needed to ensure an accurate tornado path. Otherwise, a single tornado may be misinterpreted as two separate tornadoes. This can easily occur when external users, not familiar with *Storm Data* practices, use the NCEI Website query feature. It is critical that all counties/parishes affected by a single tornado, and the exact location that a tornado exits or enters a county/parish, be mentioned in the event narrative that discusses that tornado. Do not segment a tornado within a county/parish (an entry for each portion of a tornado that appreciably changes directions). In the example below, the first line of the event narrative makes it clear that the tornado moved across a county/parish line, and indicates exactly where the tornado exited the first county/parish.

Coal County
4 SE Coalgate 11 0425CST 8 200 1 1 75K Tornado (EF2)
2.5 ENE Cairo 0434CST

This tornado formed 4 miles southeast of Coalgate at the intersection of SH 25 and County Road 17 and tracked northeastward for 8 miles before exiting Coal County about 2.5 miles east-northeast of Cairo at about 100 yards southeast of the intersection of SH 15 and Wilson Road. The tornado continued in Atoka County for another 5 miles, before dissipating at 0440CST. In Coal County, 1 fatality and injuries to another person occurred when a mobile home was thrown approximately 200 yards and disintegrated 4 miles east of Coalgate. In addition, a well-constructed frame home suffered severe roof damage and exterior wall damage in extreme eastern Coal County (DI 2, DOD 6). While in Coal County, it was rated as EF2, but in Atoka County, it was rated as EF0. Average path width in Coal County was 100 yards, while the maximum width was 200 yards. F62MH

Atoka County
1.5 NW Wardville 11 0434CST 5 100 0 0 6K Tornado (EF0)
to 5.5 SE Wardville 0440CST

This tornado formed 4 miles southeast of Coalgate in Coal County and entered Atoka County about 1.5 miles northwest of Wardville, about 100 yards southeast of the intersection of SH 15 and Wilson Road. The tornado then continued for another 5 miles before dissipating 5.5 miles southeast of Wardville about 0.25 mile northwest of the intersection of Bark Road and Hardscrabble Road. In

Atoka County, minor roof damage was inflicted on a mobile home (DI 3, DOD 2), and numerous trees were damaged. While in Coal County, it was rated as EF2, but in Atoka County, it was rated as EF0. Average path width in Coal County was 50 yards.

47.12.2 Example of a Triple-segmented, Two-County Tornado. In some cases, a tornado may spin up in County A, cut across the corner of County B, and re-enter and dissipate in County A. In these situations, three Tornado events will be entered into the *Storm Data* software: the first event covers the first County A segment, the second event covers the County B segment, and the third event covers the second County A segment.

Columbia County
3 E Wis Dells to 06 1754CST 6.1 200 0 0 400K Tornado (EF1)
2 SE Lewiston 1813CST

The first segment of a multi-segmented tornado spun up near the intersection of Broadway Road and CTH Q east of Wisconsin Dells. It damaged 9 homes (DI 2, DOD 4) before it exited Columbia County on the Wisconsin River at 1813CST. This tornado then clipped the northeast corner of Sauk County (southeast of Lake Delton) and re-entered Columbia County at 1817CST. Average path width was 75 yards.

Sauk County
9 SE Lk Delton to 06 1813CST 1.6 100 0 0 1K Tornado (EF0)
10 SE Lk Delton 1817CST

This tornado segment is a continuation of a tornado that initially started 3 E of Wisconsin Dells at 1754CST on June 6th. In Sauk County, it lightly damaged a home's siding (DI 2, DOD 2), and ripped up some trees. It entered Sauk County at the intersection of N. Hein Road and Levee Road, and exited Sauk County into Columbia County where Levee Road enters Columbia County. Average path width was 50 yards.

Columbia County
7 W Portage to 06 1817CST 9.2 200 0 0 600K Tornado (EF1)
1 SW Dekorra 1840CST

This is the 3rd segment of a single tornado that initially started east of Wisconsin Dells at 1754CST, crossed into Sauk County at 1813CST, and re-entered Columbia County at 1817CST where Levee Road enters Columbia County from the west. In Columbia County, 10 homes (DI 2, DOD 4) and a campground sustained damage. Five vehicles were slightly damaged by tree debris. This tornado dissipated southwest of Dekorra, just after crossing the Wisconsin River for the second time. Average path width was 100 yards.

47.12.3 Example of CWA Boundary-crossing Tornado. WFOs coordinate the beginning and ending locations of tornadoes that move from one CWA into another. This will assure that all affected counties/parishes are mentioned. In the following example, both segments mention that the tornado crossed from one county into another one.

TEXAS, North Cooke County
4 NW Gainesville 11 0255CST 2.6 150 0 0 30K Tornado (EF1)
to 6 N Gainesville 0258CST

A tornado touched down 4 miles northwest of Gainesville at the intersection of Pearl Road and Washington Road. It then moved into Love County, Oklahoma, 6 miles north of Gainesville (see *Storm Data* for Oklahoma, Western, Central and Southeast) where Red River goes under SH 66. In Cooke County, a mobile home (DI 3, DOD 5) and a storage pole barn were heavily damaged northwest of Gainesville. Average path width for the Texas portion was 75 yards.

OKLAHOMA, Western, Central, and Southeast Love County
5 S Thackerville to 11 0258CST 5 100 0 0 100K 100K Tornado (EF1)
3 ESE Thackerville 0304CST

This tornado developed in Cooke County, Texas, about 4 miles northwest of Gainesville, and tracked northeastward before crossing the Red River into Love County in Oklahoma (see *Storm Data* for Texas, North, for more information on the beginning portion of this tornado in Texas) at 0258CST at a point 5 miles south of Thackerville near the intersection of SH 52 and Baker Road. This tornado dissipated about a 0.5 mile northeast of the intersection of CTH 118 and Simple Road. In Oklahoma, the most significant damage, rated EF1, occurred 3 miles southeast of Thackerville where a barn was destroyed (DI 1, DOD 8), and part of a soybean crop was uprooted. Nearby, a mobile home was severely damaged. Average path width for the Oklahoma portion was 50 yards.

47.13 The Enhanced Fujita Tornado Damage Scale Table.

Derived EF-Scale		Operational EF-Scale
EF Classes	**3-Second Gust Speed (mph)**	**3-Second Gust Speed (mph)**
EF0	65 - 85	65 – 85
EF1	86 - 109	86 – 110
EF2	110 - 137	111 – 135
EF3	138 - 167	136 – 165
EF4	168 - 199	166 – 200
EF5	200 - 234	> 200

Table A11. Enhanced Fujita Tornado Damage Scale

48 Tropical Depression (Z). A tropical cyclone in which the 1-minute sustained wind speed is 33 knots (38 mph), or less. A Tropical Depression should be included as an entry when these conditions are experienced in the WFO's CWA. The tropical depression number will be included in the narrative section.

The tropical depression may be associated with many individual hazards, such as storm surge, freshwater flooding, tornadoes, debris flows, rip currents, etc. These individual hazards and their associated fatalities, injuries, and damage amounts are not to be included as part of the Tropical Depression event type. Rather, these individual hazards are to be entered as separate events. However, do include this information in the Tropical Depression narrative to ensure a complete synopsis. Refer to section 25 for additional information that may be applicable for tropical depressions, as well as their associated individual hazards (section 25.1). Wind damage that occurred inland as well as in coastal counties/parishes and islands affected by tropical depression winds will be entered as a Tropical Depression event.

The following information explains the content of the Tropical Depression entry:

Beginning Time - When the direct effects of the tropical depression were first experienced.

Ending Time - When the direct effects of the tropical depression were no longer experienced.

Direct Fatalities/Injuries:
- Fatalities/injuries caused by wind-driven debris or structural failure due to the winds.
- Wind caused a tree to blow onto someone.

Indirect Fatalities/Injuries:
- Someone suffered a heart attack while removing debris.
- Someone was electrocuted by touching downed power lines.

Example:

TXZ183 Val Verde
23 2200CST 0 0 Tropical Depression
1000CST
The remnants of Tropical Depression Two stalled over the Big Bend area and produced up to 18 inches of rain in Del Rio. Wind gusts of 35 knots (40 mph) and minimum sea-level pressure of 1015 mb were reported at Del Rio. The main effect of T.D. #2, flash flooding on San Felipe Creek, resulted in 9 fatalities (drowning), and 150 injuries. For a complete description of the flash flooding impacts, refer to the Flash Flood event for September 23, 2006.

49 Tropical Storm (Z). A tropical cyclone in which the 1-minute sustained surface wind ranges from 34 to 63 knots (39 to 73 mph). A Tropical Storm should be included as an entry when these conditions are experienced in the WFO's CWA.

The tropical storm may be associated with many individual hazards, such as storm tide, freshwater flooding, tornadoes, debris flows, rip currents, etc. These individual hazards and their associated fatalities, injuries, and damage amounts are not to be included as part of the Tropical Storm event type. Rather, these individual hazards are to be entered as separate events. However, do include this information in the Tropical Storm narrative to ensure a complete synopsis. Refer to section 25 for additional information that may be applicable for tropical storms, as well as their associated individual hazards (section 25.1).

Tropical cyclones can move well inland and create damaging winds. In these situations, it can be difficult to determine the event type to use. Inland offices should use either Tropical or Wind event type based on the products issued during the event. The *Storm Data* event type would be Tropical Storm if Hurricane Local Statements were issued during the event. The event type would be Strong Wind or High Wind if a wind advisory or high wind warning were issued for a tropical cyclone or the remnants of a cyclone that moved into the area.

Storm Data preparers may reference NHC's Tropical Cyclone Reports (TCR) or the NHC product archive (found on-line at hurricanes.gov/archive) for information on the storm history, track and intensity of a storm. The landfall intensity/location may change from what was indicated in real time during the event. They may coordinate with the NHC staff if there are additional questions.

If a hurricane produces only winds as high as tropical storm-force winds within a particular CWA, the entry should be made under Tropical Storm. If a hurricane produces only winds as high as tropical depression strength within a particular CWA, the entry should be made under Tropical Depression. However, such entries should include a reference to the hurricane in the narrative section, e.g., "Hurricane Dennis produced tropical storm force winds in ...".

The following information explains the content of the Tropical Storm entry:

Beginning Time - When the direct effects of the tropical storm were first experienced.

Ending Time - When the direct effects of the tropical storm were no longer experienced.

Direct Fatalities/Injuries:
- Fatalities/injuries caused by wind-driven debris or structural failure due to the winds.
- Wind caused a tree to blow onto someone.

Indirect Fatalities/Injuries:
- Someone suffered a heart attack while removing debris.
- Someone was electrocuted by touching downed power lines.
- Someone was killed in a vehicle accident caused by a tropical storm-related missing traffic signal.

Example:

FLZ007>019- Inland Walton - Coastal Walton - Holmes - Washington - Jackson - Bay -
026>028 Calhoun - Gulf - Franklin - Gadsden - Leon - Jefferson - Madison - Liberty – Taylor - Wakulla
21 1800EST 0 0 1M 100K Tropical Storm
23 0000EST

Tropical Storm Helene made landfall near Fort Walton Beach during the late morning hours of September 22. Storm total rainfall ranged from a half inch at Perry to 9.56 inches at Apalachicola. The highest sustained wind of 39 knots (45 mph) with a peak gust of 56 knots (65 mph) was recorded at Cape San Blas. The lowest sea-level pressure was 1011 mb at Panama City. Coastal storm tides of 2 feet or less above astronomical tide levels were common, with only minor beach erosion reported. Near the coast, as well as inland, many properties, homes, and businesses sustained wind damage. No fatalities or injuries were attributed to the winds. All of the associated effects of Helene resulted in 4 fatalities, 13 injuries, $3.0M in property damage, and around $1.0M in crop damage. Specifically, Helene's flood waters in the Florida Panhandle resulted in 2 fatalities, 3 injuries, $1.0M in property damage, and $750K in crop damage. The nine associated tornadoes resulted in 2 fatalities, 10 injuries, $1M in property damage, and $150K in crop damage. The powerful winds caused $1M in property damage and $100K in crop damage. The storm surge along the coast resulted in $500K in property damage.

50 Tsunami (Z). A series of very long waves generated by any rapid, large-scale disturbance of the sea (e.g., an underwater earthquake, landslide, or volcanic eruption) resulting in a fatality, injury or damage. When the wave reaches the coast, a tsunami may appear as a rapidly rising or falling tide, a series of breaking waves, or even a bore. The event narrative should include the source of the Tsunami event (e.g., 8.5 magnitude earthquake near the western coast of Chile), the height and time of the maximum wave, and the inland distance of inundation. Any other characteristics, such as the observation of water draining from bays should be included.

Beginning Time - When the water level first began to change rapidly.

Ending Time - When the water level returned to near normal.

Direct Fatalities/Injuries
- A coastal dwelling was washed away injuring or killing the occupants.
- A person drowned when a vehicle was swept away.

Indirect Fatalities/Injuries
- A person suffered a heart attack while evacuating.
- After the tsunami, a person died when the house he returned to collapsed.

Example:

HIZ008 South Hawaii including Kauna Point
07 0600HST 0 0 5M Tsunami
1000HST
A tsunami wave affected coastal sections of the south and east shores of the Big Island of Hawaii from Hilo Harbor to Kauna Point. The tsunami resulted from an 8.3 earthquake that occurred off the coast of Chile. Tide gauges located on

buoys 150 miles SE of the Big Island of Hawaii reported a 2-inch rise as the tsunami passed. A 20-foot wave at Punaluu Harbor was the highest of three waves that occurred over a 2-hour and 20-minute period. The wave went inland as far as 1/2 mile. The height of the waves ranged from 5 feet at Hilo Harbor on the east coast to 20 feet at Punaluu Harbor on the southeast coast to 3 feet near Kauna Point on the southwest coast. There were no deaths or injuries, but several marinas were heavily damaged and coastal roads were flooded. These damages amounted to $5.0 million.

51 Volcanic Ash (Z). Fine particles of mineral matter from a volcanic eruption which can be dispersed long distances by winds aloft, resulting in fatalities, injuries, damage, or a disruption of transportation and/or commerce.

Beginning Time - When volcanic ash began to cause disruption to transportation, commerce, fatality, injury, or damage.

Ending Time - When volcanic ash stopped falling.

Direct Fatalities/Injuries
- People who were asphyxiated due to high ash content in the air. (Rare)
- People who were involved in aircraft accidents due to ash being ingested into the engines.

Indirect Fatalities/Injuries
- Vehicular accidents caused by reduced visibility and slippery roads due to volcanic ash fall, or due to falls while walking through volcanic ash.

Example:

WAZ040 Southern Cascade Foothills
10 1800PST 0 0 Volcanic Ash
2100PST
A minor eruption of Mt. St. Helens caused ash to rise about 10,000 feet into the atmosphere. The ash drifted to the southwest and fell in the southern Cascade foothills. State Highway 503 became slippery when it was covered with ash, which caused a head-on collision of two vehicles. One person was killed (indirect fatality) and the other seriously injured (indirect injury).

52 Waterspout (M). A rotating column of air, pendant from a convective cloud, with its circulation extending from cloud base to the water surface of bays and waters of the Great Lakes, and other lakes with assigned Marine Forecast Zones. A condensation funnel may or may not be visible in the vortex.

A vortex that moves over both water and land will be characterized as a Waterspout for that portion of its path over the water surface of an assigned Marine Forecast Zone, and a Tornado for its path over the land. A vortex over any water surface not designated as an official marine zone will be entered as a Tornado.

Note: Direct fatalities related to a marine vessel will be coded as BO (Boating), not IW (In Water).

Beginning Time - When a waterspout was first reported to exist.

Ending Time - When a waterspout was last reported to exist.

Direct Fatalities/Injuries
- A waterspout capsized a small boat, drowning the occupant.
- A waterspout blew a vehicle off a bridge and the driver drowned.

Indirect Fatalities/Injuries
- A boater fleeing a waterspout crashed into a breakwater.
- A boater suffered a heart attack after sighting a waterspout.

Examples:

LMZ654
2 E Port Washington 18 1835CST 0 0 Waterspout
A brief waterspout was spotted over Lake Michigan a couple miles offshore of Port Washington. The distance was estimated.

GMZ053
Craig Key to West end of 7 Mile Bridge FL 10 1200EST 1206EST 0 2 50K Waterspout
A large waterspout from the Florida Straits moved across a marina at Marathon damaging three sailboats and injuring two people.

52.1 Example of a Tornado That Became a Waterspout (Body of Water with Assigned Marine Forecast Zone).

St. Louis County
2 E Arnold to 1 S French River 28 1651CST 1655CST 4.4 60 0 0 100K Tornado (EF1)
A tornado touched down north of Duluth. A barn and an outbuilding were destroyed (DI 1, DOD 8) and trees were damaged. The tornado reached the shore of Lake Superior just south of French River, and then curved northeast as a waterspout moving toward Two Harbors.

LSZ144
1 S French River to Two Harbors 28 1655CST 1705CST 0 0 Waterspout

This waterspout initially began as a tornado in St. Louis County near Arnold. It crossed over the Lake Superior shoreline just south of the village of French River, and then curved northeast toward Two Harbors. No marine-related damage was noted.

52.2 <u>Example of a Waterspout (Body of Water with Assigned Marine Forecast Zone) That Became a Tornado</u>.

Lake County
.5 S Two Harbors 28 1705CST 2.5 25 0 0 250K Tornado (EF1)
to 2N Two Harbors 1707CST

A waterspout on Lake Superior moved onshore as a tornado just south of Two Harbors. The tornado continued on the ground for about 2.5 miles before dissipating. A small building was destroyed (DI 1, DOD 8) and a cottage damaged near where the tornado came onshore. The tornado damaged four more homes and downed around three dozen trees before finally dissipating. The damage path was no more than 25 yards in width.

53 <u>Wildfire (Z)</u>. Any significant forest fire, grassland fire, rangeland fire, or wildland-urban interface fire that consumes the natural fuels and spreads in response to its environment. "Significant" is defined as a wildfire that causes one or more fatalities, one or more significant injuries, and/or property damage (optional: include significant damages to firefighting equipment if loss estimates are available). Professional judgment should be used in deciding to include a Wildfire in *Storm Data*. In general, forest fires smaller than 100 acres, grassland or rangeland fires smaller than 300 acres, and wildland use fires not actively managed as wildfires should <u>not</u> be included. This is consistent with the definitions for significant and/or large fires utilized by most land use agencies.

<u>Beginning Time</u> - When a forest fire, grassland fire, rangeland fire, or wild land/urban-interface fire became out of control.

<u>Ending Time</u> - When a wildfire became under control.

<u>Direct Fatalities/Injuries</u>
- A wildfire swept through a campground. Two campers died when their RV was consumed by fire.
- A man drove into an evacuated area to try and save belongings from a cabin that was threatened by a wildfire. The man died when fire burned the cabin to the ground.
- People who were asphyxiated due to smoke inhalation.
- Firefighters who suffer heat exhaustion or smoke inhalation will be considered injuries, whether they are treated at the scene or transported to the hospital.

<u>Indirect Fatalities/Injuries</u>
- All vehicular accidents caused by reduced visibility due to smoke.

Example:

MTZ005-006 Missoula/Bitterroot Valleys-Bitterroot

06 1500MST 0 0 8M Wildfire
31 1500MST

Dry lightning and strong winds started fires which spread into urban areas of the southern part of the county. Structural damage from fires occurred from August 6-8, but fires raged to the end of the month with a total of 335,356 acres burned. Sixty-four residences and cabins were destroyed, and five were partially destroyed. A total of 164 outbuildings and 87 vehicles were destroyed.

54 Winter Storm (Z). A winter weather event that has more than one significant hazard (i.e., heavy snow and blowing snow; snow and ice; snow and sleet; sleet and ice; or snow, sleet and ice) and meets or exceeds locally/regionally defined 12 and/or 24 hour warning criteria for at least one of the precipitation elements. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*. Normally, a Winter Storm would pose a threat to life or property.

In cases of winter storms, the preparer should be careful to classify the event properly *in Storm Data*. In general, the event should be classified as a Winter Storm event (rather than an Ice Storm event or a Heavy Snow event) only if more than one winter precipitation type presented a significant hazard.

Some Winter Storm and Blizzard events may have had sustained or maximum wind gusts that met or exceeded High Wind criteria. Rather than document an additional High Wind event, the *Storm Data* preparer should just mention the time, location, and wind value in the Winter Storm or Blizzard event narrative. This is permissible even if only light snow and minor blowing snow (no serious reduction in visibility below 3 miles) occurred with the high winds, as long as the high wind report is deemed reliable, and was generated by the same synoptic storm system that resulted in the Winter Storm or Blizzard event. This scenario would be most likely in the mountains of the western United States.

Beginning Time - The time when accumulating precipitation (measurable) began.

Criteria Time - The time when the winter storm first met or exceeded locally or regionally defined warning criteria.

Ending Time - The time when precipitation stopped accumulating.

Direct Fatalities/Injuries

- The weight of snow and ice caused a machine shed roof to collapse, killing a farmer.

Indirect Fatalities/Injuries

- All vehicle-related fatalities or injuries due to poor visibility and/or slippery roads.

Example:

WVZ033>035-042>044 **McDowell - Mercer - Monroe - Raleigh - Summers – Wyoming** **Winter Storm**
01 1500EST **0** **0**
02 1800EST
The New Year started off with a major winter storm. A combination of snow, sleet, and freezing rain began around 1400MST, started to accumulate about 1500MST, and eventually left about 10 inches of frozen precipitation on the ground across the area. Transportation came to a stop for much of the holiday weekend.

55 **Winter Weather (Z).** A winter precipitation event that causes a death, injury, or a significant impact to commerce or transportation, but does not meet locally/regionally defined warning criteria. A Winter Weather event could result from one or more winter precipitation types (snow, or blowing/drifting snow, or freezing rain/drizzle). The Winter Weather event can also be used to document out-of-season and other unusual or rare occurrences of snow, or blowing/drifting snow, or freezing rain/drizzle. If the event that occurred is considered significant, even though it affected a small area, it should be entered into *Storm Data*.

Note that, in *Storm Data*, Blizzard events should cover a time period of 3 hours or more. Therefore, if blizzard-like conditions occur for less than 3 hours, the event should be entered as a Winter Storm, Heavy Snow, or Winter Weather, noting in the event narrative that near-blizzard or blizzard-like conditions were observed at the height of the event. WFOs will use a Winter Weather event type entry for Snow Squalls as well, until such a time when Snow Squall is designated a separate event type; the Event Narrative will begin with the words “Snow Squall”, in similar format to their LSR entry, per guidance shared by the NWS Winter Weather program.

Beginning Time - Time when winter weather precipitation started to accumulate or phenomena, such as blowing snow, began.

Ending Time - Time when the winter weather precipitation stopped accumulating or phenomena ended.

Direct Fatalities/Injuries

- A vehicle gets stuck in a snow drift and the driver attempts to walk to a shelter but is overcome by the weather elements and dies from exposure.

Indirect Fatalities/Injuries

- Almost all vehicle-related fatalities/injuries due to snow or ice covered roads, hazardous driving conditions, and visibility restrictions.
- Any vehicle accident involving a snow plow.

Examples:

MAZ001>004 Berkshire - Western Franklin - Eastern Franklin - Northern Worcester **Winter Weather**
06 0500EST 0 0
1900EST
A period of freezing drizzle and freezing rain led to a thin layer of ice or glaze over northwest Massachusetts. There were numerous car accidents with minor injuries (indirect) due to the icy conditions, especially along Highways 2 and 202.

SCZ047>049 Jasper - Beaufort - Southern Colleton **Winter Weather**
01 1800EST 0 0
2200EST
A mixture of freezing rain, sleet, and snow brought hazardous travel conditions to sections of southern South Carolina. Although the accumulation of ice was small, (less than 1/8 inch), the combination of elements led to accidents, especially along Interstate 95.

NDZ014-015 Benson – Ramsey **Winter Weather**
12 2200CST 0 0
13 0300CST
Strong winds and fresh snow caused blowing snow to lower visibilities to 1/4 to 1/2 mile at times overnight. Several cars were stranded along County Road 5 in Benson County.

KYZ004-005 Ballard - McCracken **Winter Weather**
16 1300CST 0 0
2200CST
Slippery driving conditions caused by an extended period of sleet led to numerous car accidents across extreme western Kentucky. The worst conditions were around Paducah where slick streets led to multi-car accidents and the closing of some highways around town.

PAZ001-002 Northern Erie - Southern Erie
25 1400EST 0 0 **Winter Weather**
2000EST
Slippery roads caused by 4 to 5 inches of snow led to numerous accidents and minor injuries (indirect) across Erie County in northwest Pennsylvania. Two school buses collided on a snow-covered hill just east of Fairfield, but no one was seriously injured.

APPENDIX B - Glossary of Terms

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County Warning Area (CWA) - The geographical area of responsibility assigned to a WFO for providing warnings, forecasts, and other weather information. Sometimes referred to as County Warning and Forecast Area.

Enhanced Fujita-Scale - A 0 to 5 rating of a tornado's observed damage. Since structural design determines damage, probable wind speeds are associated with each EF-Scale number. There are 28 Damage Indicators (DI), each with varying numbers of Degree of Damage (DOD) that are utilized in determining each EF-rating.

Header-strip - Bold-faced lines of text and numbers at the beginning of each *Storm Data* entry, providing specific information on the time and character of the weather event. This includes location, beginning and ending times, deaths, injuries, property and crop damage, and type of event. In some cases, it also includes the Universal Generic Code and the magnitude of the event, i.e., hail size and tornado EF-Scale.

Modified Saffir/Simpson Hurricane Wind Scale - A rating scale of the intensity of a tropical cyclone for the Western North Pacific. The scale has two categories for below typhoon intensity (tropical depression and tropical storm) and 5 typhoon categories. This scale provides examples of the type of damage and impacts associated with winds of the indicated intensity. The scale does not address the potential for other related impacts, such as storm surge, rainfall-induced floods, and tornadoes.

Saffir/Simpson Hurricane Wind Scale - A 1 to 5 rating of a hurricane's intensity. This scale provides examples of the type of damage and impacts associated with winds of the indicated intensity. The scale does not address the potential for other related impacts, such as storm surge, rainfall-induced floods, and tornadoes.

Storm Data - NOAA's official publication which documents the occurrence of storms and other significant natural hazards having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce.

***Storm Data* Software** - The on-line software program that documents specifics and narratives of significant or unusual weather events. Data is transferred from WFOs to the Performance and Evaluation Branch in OCOO for use in the NWS verification program and to the NCEI for publication of *Storm Data*. Also referred to as StormDat.