



NOAA / National Weather Service

Weather Spotter Training

NATIONAL WEATHER SERVICE
Columbia, SC





Outline

- **National Weather Service Overview**
- **What is Skywarn?**
 - **Why are Storm Spotters Important?**
- **Outlooks/Watches/Warnings**
- **Weather Hazards and Safety**
- **Severe Weather Reporting Procedure**
- **Monitoring Severe Weather**





National Weather Service Overview

- **Dept of Commerce**
 - **NOAA (National Oceanic & Atmospheric Administration)**
 - **NWS (National Weather Service)** ← **We are here!**
- **Mission:** Provide weather, water and climate data, forecasts, warnings and impact-based decision support services for the **protection of life and property and enhancement of the national economy.**



A map of Alaska with three locations highlighted: Fairbanks in the north-central region, Anchorage in the south-central region, and Juneau in the southeastern panhandle. The locations are marked with colored dots and labeled with text.

Key West

Puerto Rico

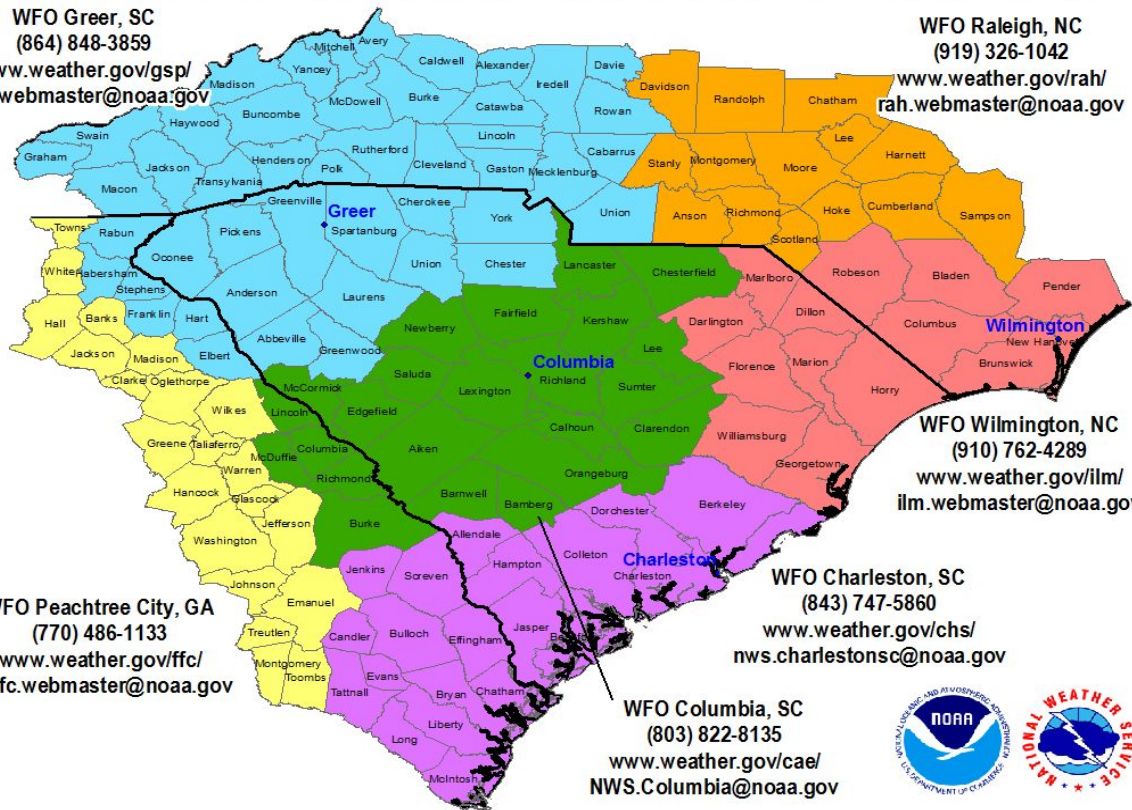


NWS Columbia Area of Responsibility

National Weather Service Offices Covering South Carolina and Eastern Georgia

WFO Greer, SC
(864) 848-3859
www.weather.gov/gsp/
gsp.webmaster@noaa.gov

WFO Raleigh, NC
(919) 326-1042
www.weather.gov/rah/
rah.webmaster@noaa.gov



WFO Peachtree City, GA
(770) 486-1133
www.weather.gov/ffc/
sr-ffc.webmaster@noaa.gov

WFO Charleston, SC
(843) 747-5860
www.weather.gov/chs/
nws.charlestonsc@noaa.gov

WFO Columbia, SC
(803) 822-8135
www.weather.gov/cae/
NWS.Columbia@noaa.gov



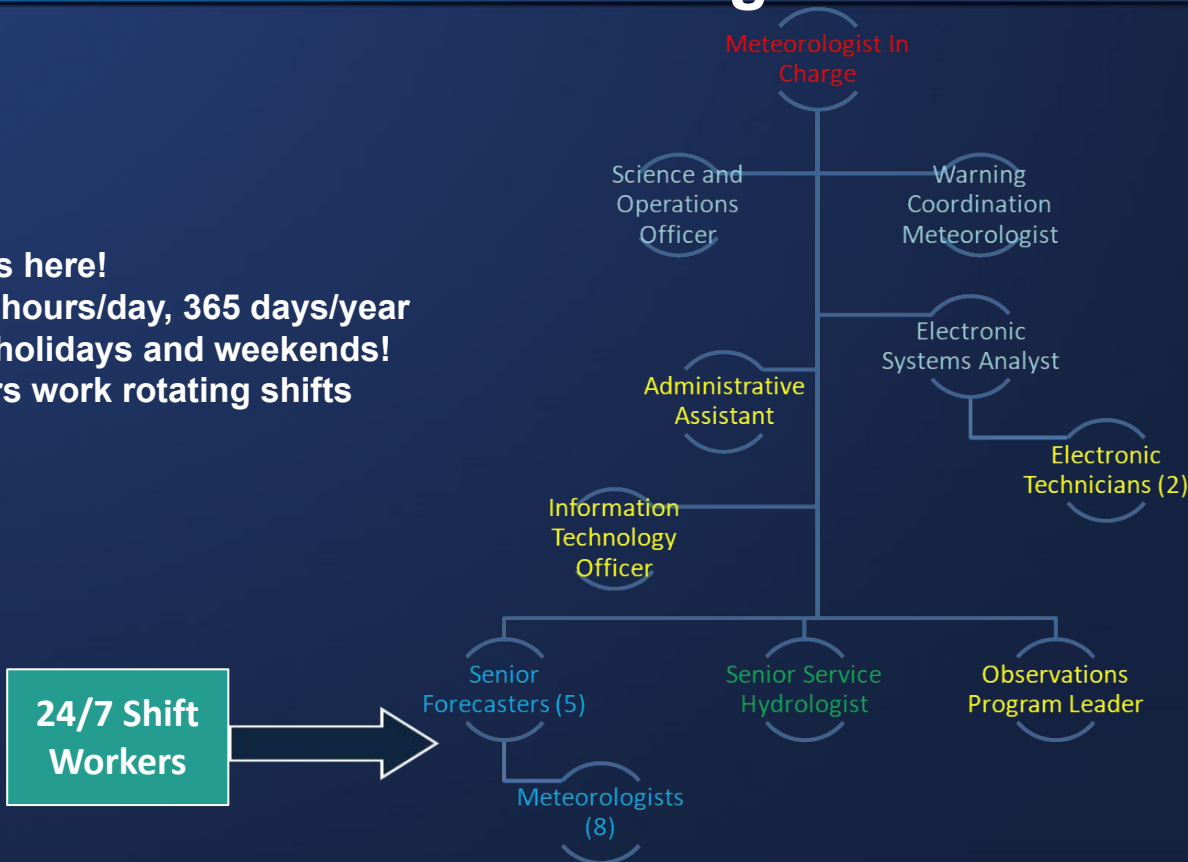
Population (2020):
1,907,306

23 Counties
(18 in SC, 5 in GA)



NWS Columbia Staffing

- We are always here!
 - Staffed 24 hours/day, 365 days/year
 - Yes, even holidays and weekends!
 - Forecasters work rotating shifts



23 Employees
Complete the NWS
Columbia Family

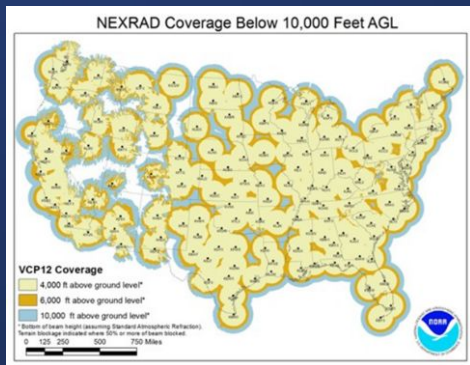
24/7 Shift
Workers





National Weather Service Overview

Doppler Radars



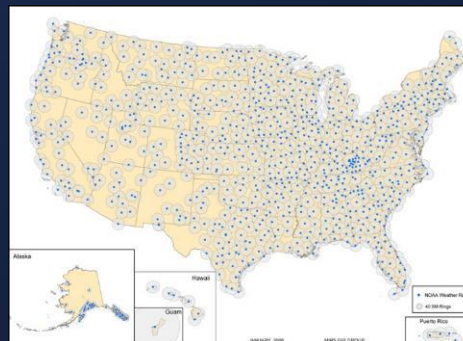
Automated Surface Observing Sites



Cooperative Observer Sites

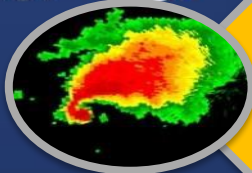


NOAA Weather Radio Transmitters





NWS Columbia Responsibilities



Highest Priority:

Severe Weather
Watches, Warnings and
Advisories



7 Day Public Forecasts



Aviation Forecasts



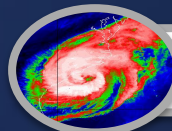
Fire Weather Forecasts



River Flood Warnings



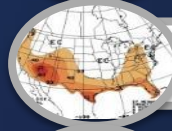
Lake Forecasts



Tropical Support



Collect Weather Data



Climate Reports



Decision Support Services



Education/Outreach &
Preparedness



Collaboration w/ Federal,
State, Media, etc.



Local Research, Attend
Scientific Conferences



Outline

- National Weather Service Overview
- What is Skywarn?
 - Why are Storm Spotters Important?
- Outlooks/Watches/Warnings
- Weather Hazards and Safety
- Severe Weather Reporting Procedure
- Monitoring Severe Weather



SKYWARN Program

Spotters are **Trained volunteers** who report hazardous weather in order to:

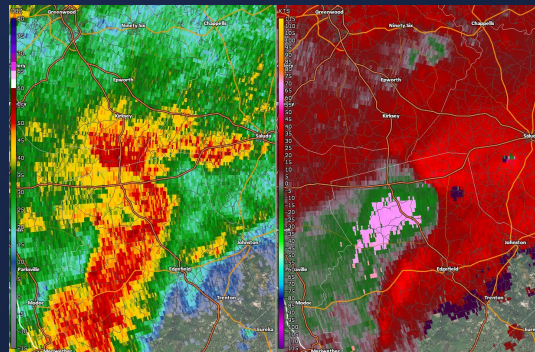
- Supplement remote sensing equipment (radar, satellite)
- Provide real-time ground truth reports
- Add credibility to NWS products and services

SKYWARN Spotters are “boots on the ground” in the field, supporting our forecasts and warnings.



The Importance of Spotter Reports

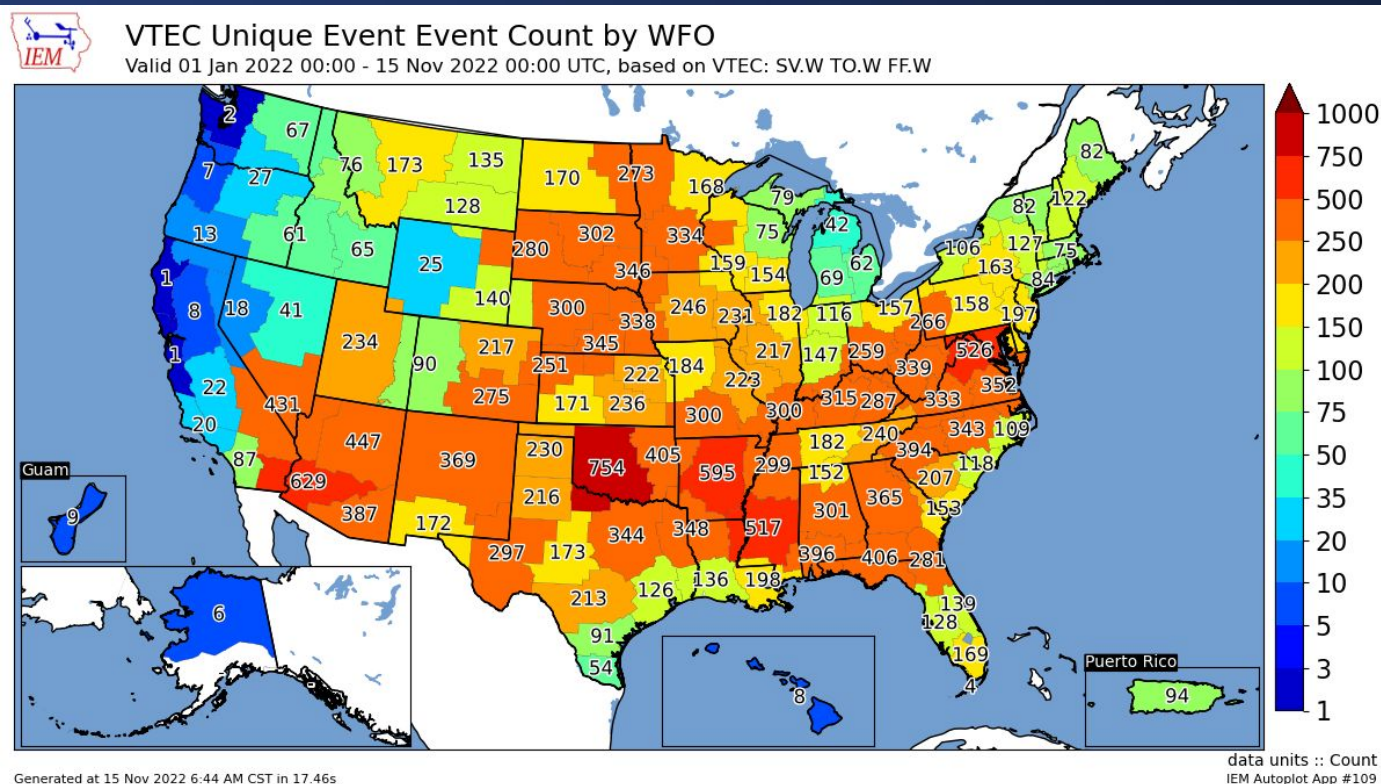
Because our radar can't see everything!





The Importance of Spotter Reports

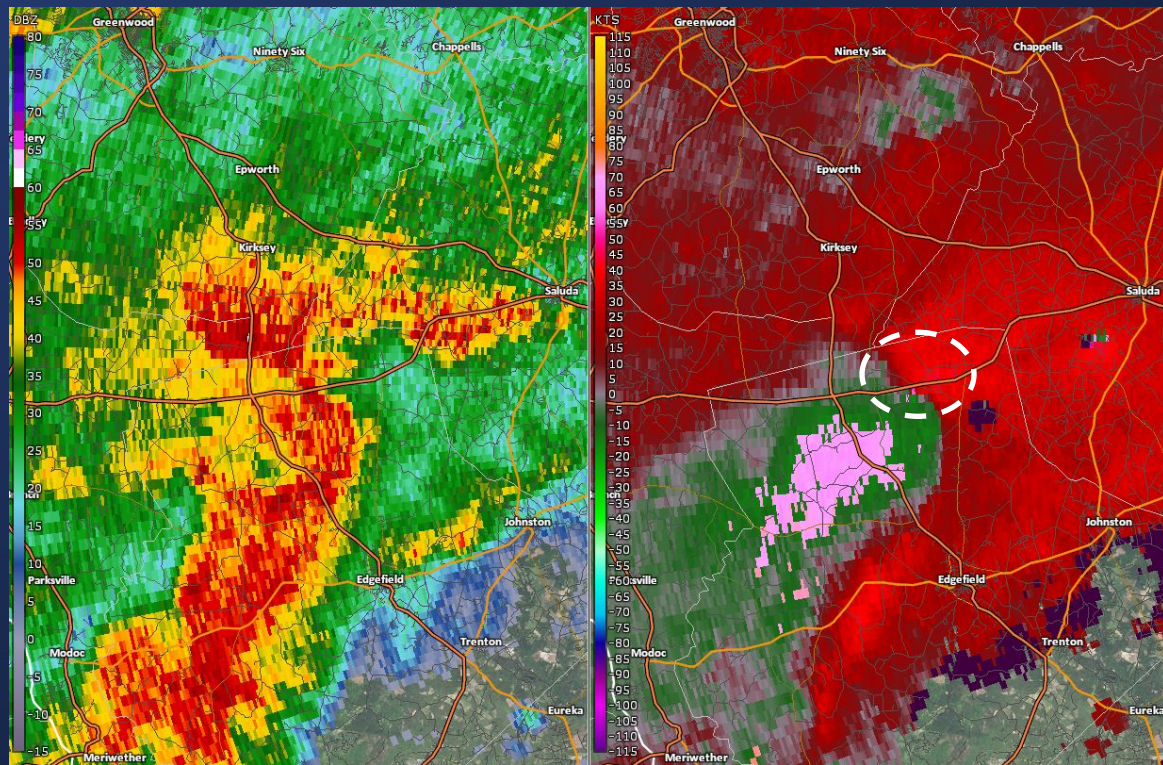
Tornado, Severe Thunderstorm and Flash Flood Warnings in 2022





The Importance of Spotter Reports

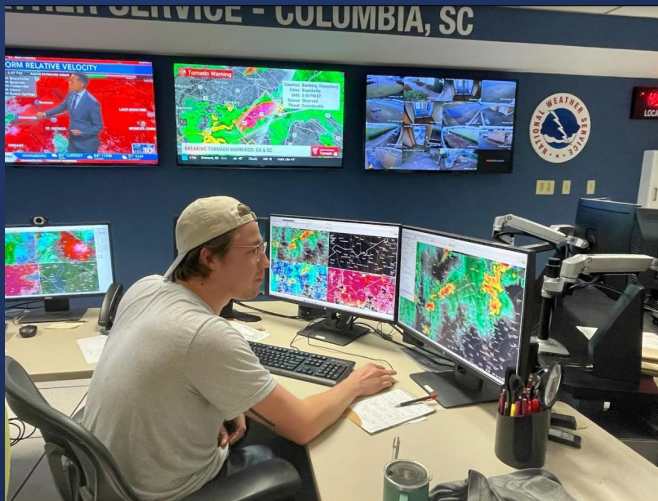
Is the storm Severe or Tornadic?



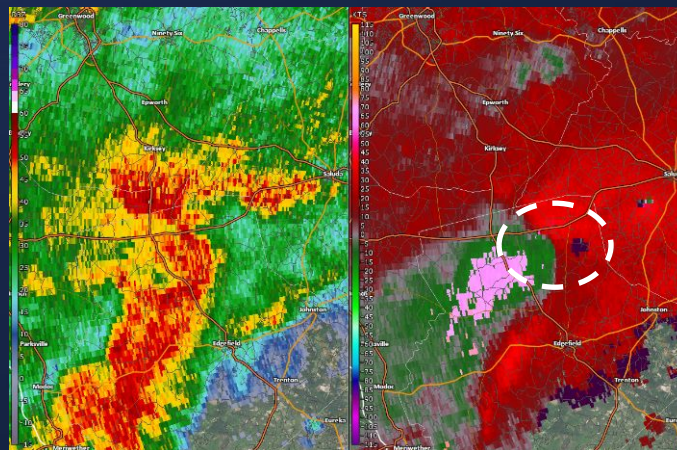


The Importance of Spotter Reports

Should a Warning be issued?



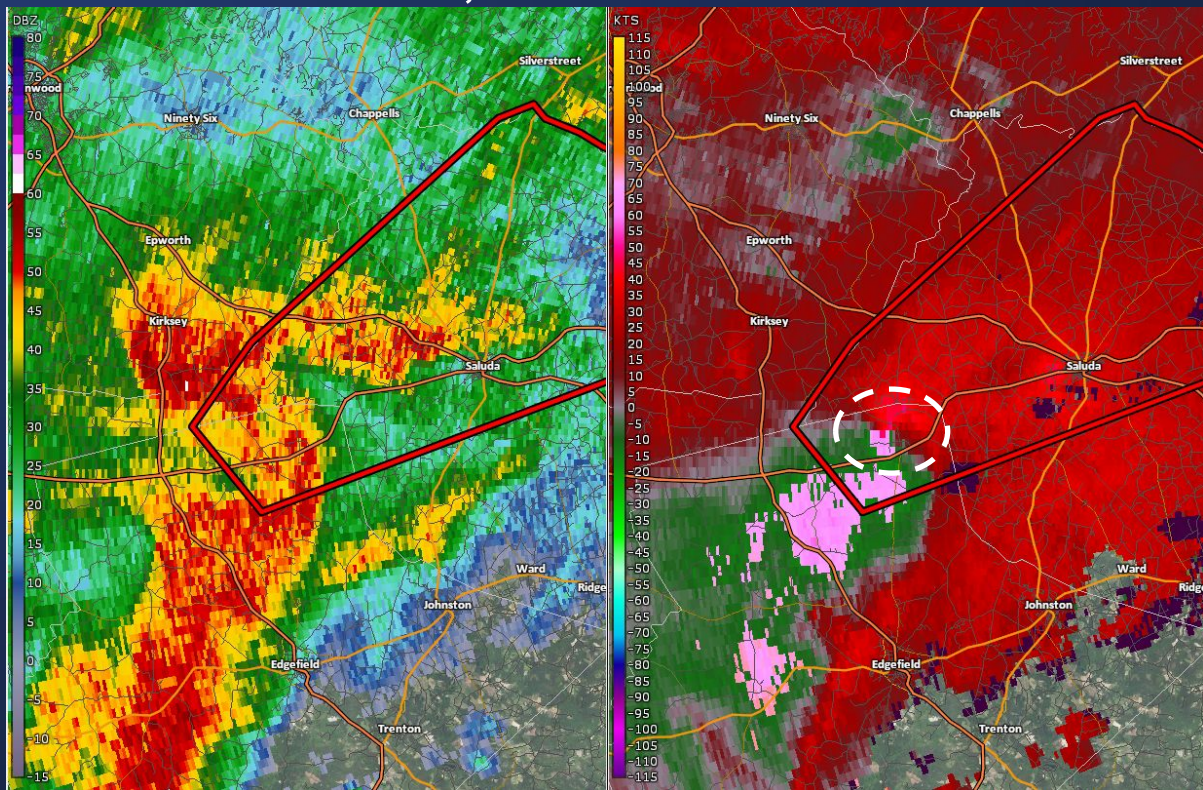
Storm has good rotation,
but NO reports!





The Importance of Spotter Reports

Based on radar indication, a TORNADO WARNING is issued!

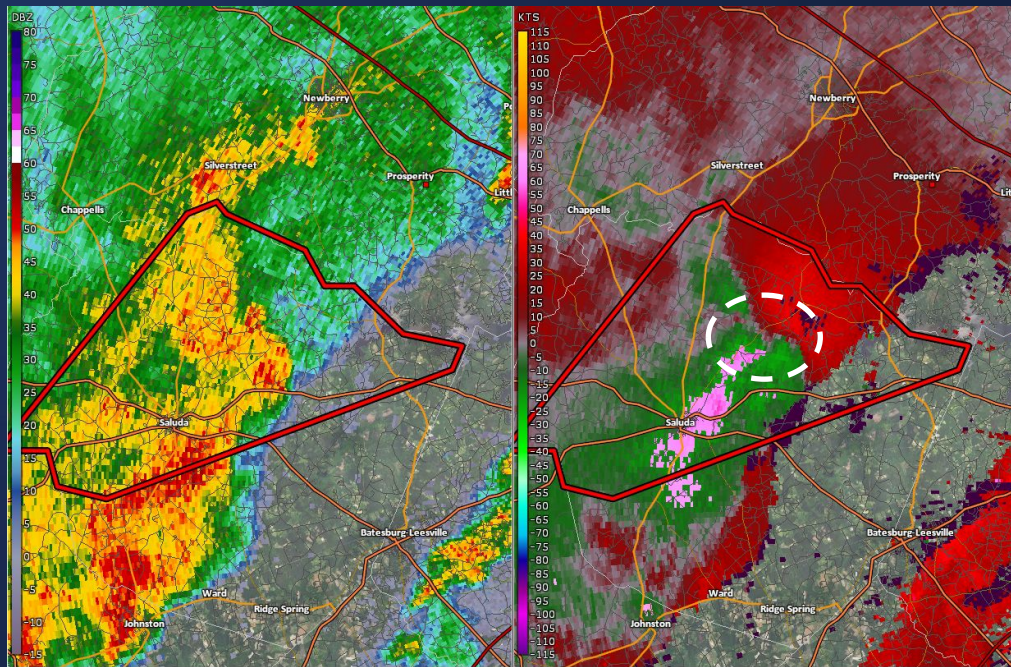




The Importance of Spotter Reports

It's 20 minutes later...

- The storm is about to move out of the warned area.
- The storm has weakened slightly, but still has strong rotation
- Still NO reports!!!



Should a new warning be issued?



The Importance of Spotter Reports

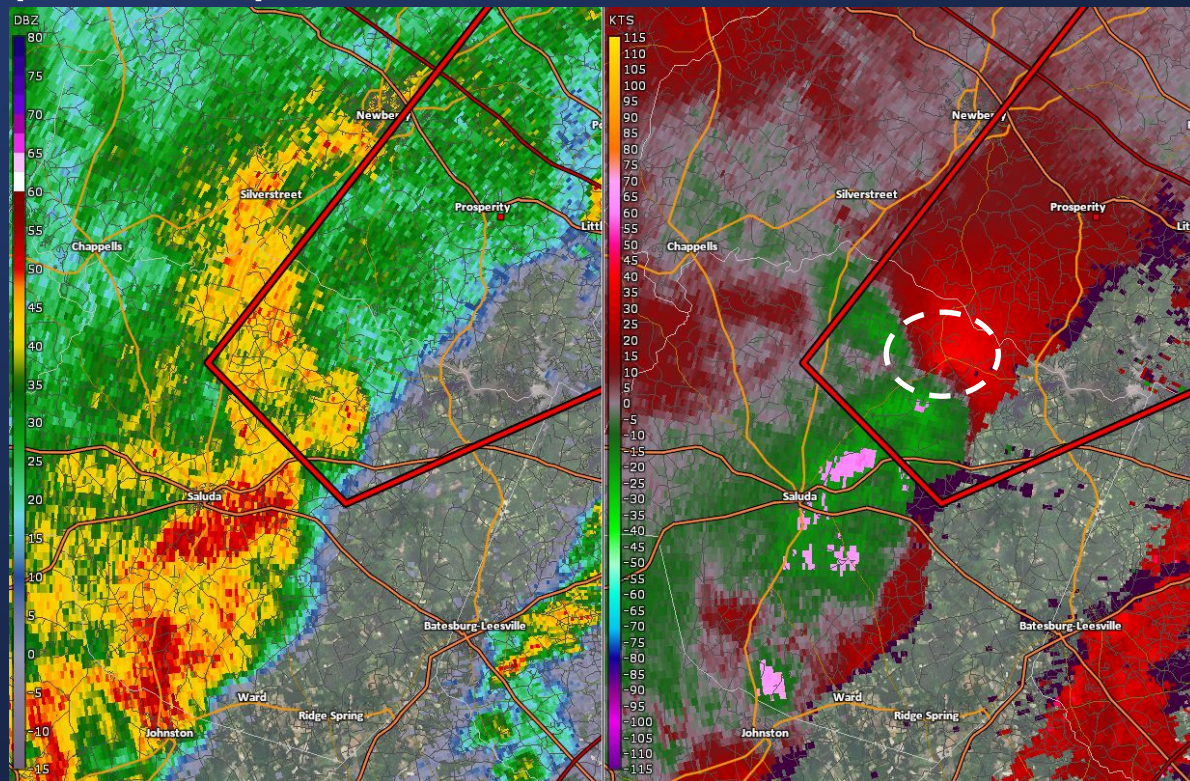
Spotter reports tornado on the ground with mobile homes damaged and numerous trees down!!!





The Importance of Spotter Reports

Based on spotter report, a new TORNADO WARNING is issued!





The Importance of Spotter Reports



Warning text without spotter report...

“National Weather Service Doppler Radar indicated a severe thunderstorm capable of producing a tornado...”

Warning text with spotter report...

“National Weather Service trained spotter reported a tornado moving northeast toward Prosperity, SC...”



The Importance of Spotter Reports

Summary



- Helps NWS fulfill mission of protecting life and property!
- Gives confidence to the warning forecaster
- Adds critical details to the warning, which highlights impacts and increase response
- Can provide downstream communities a more timely warning (minutes make a difference!)



Outline

- National Weather Service Overview
- What is Skywarn?
 - Why are Storm Spotters Important?
- Outlooks/Watches/Warnings
- Weather Hazards and Safety
- Severe Weather Reporting Procedure
- Monitoring Severe Weather



Watch vs. Warning: What's the Difference?



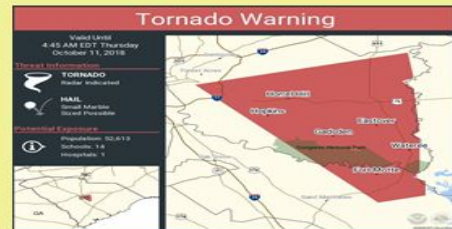
Watch

The ingredients for cornbread are present. Cornbread **may** develop in the next few hours. Now is the time to **prepare** for cornbread.



Warning

Cornbread has developed or will develop shortly. Now is the time to **take action**!



weather.gov/cae



US National Weather Service Columbia, SC



@NWSColumbia





Outlooks/Watches/Warnings

*Variation due to type of weather event (not just convective)

Approximate Lead Times*

Longer

Shorter

Outlooks

Watches

Warnings

Lower

Higher

Confidence in the forecast






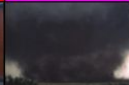


Outlooks/Watches/Warnings

• Outlooks: Know Your Risk!

- Possible weather event in the future (lower confidence, 30-49% chance of occurrence).
- Issued by the Storm Prediction Center (SPC).
- Outlooks go out 7 days, but provide the most detail in the 1-3 day period.

Understanding Severe Thunderstorm Risk Categories

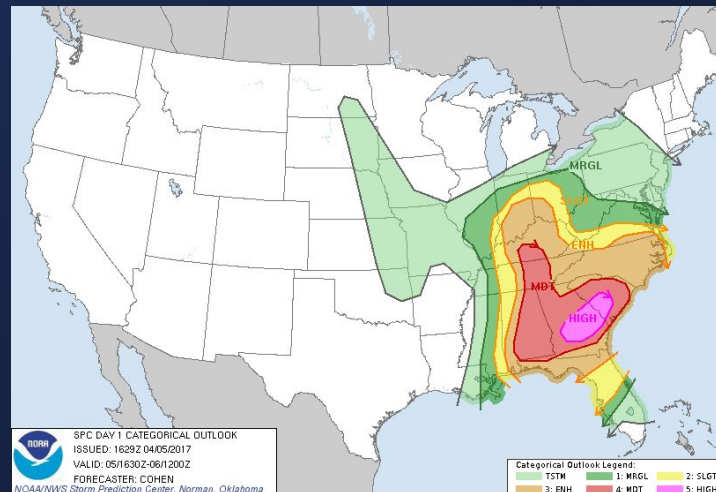
THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightning/flooding threats exist with all thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
					

* NWS defines a severe thunderstorm as measured wind gusts to at least 56 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.



National Weather Service

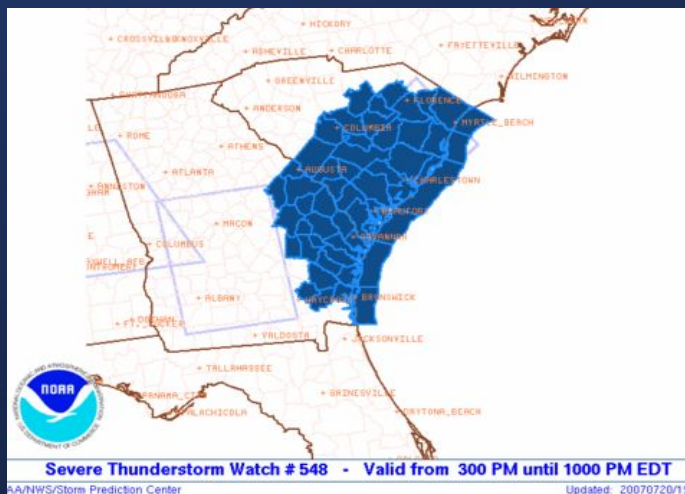
www.spc.noaa.gov





Outlooks/Watches/Warnings

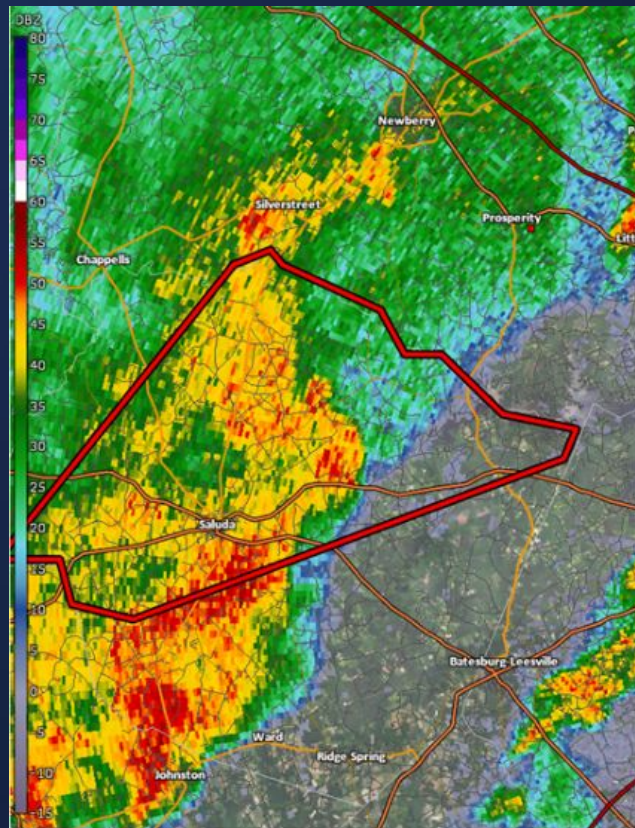
- **WATCH:** Conditions favorable for severe weather.
- ***Be prepared to take action!***
 - Higher confidence (50-79%), but still not a certainty.
 - Issued by the Storm Prediction Center (SPC).
 - Usually cover large areas for 4-6 hours. More details in timing and severity.





Outlooks/Watches/Warnings

- **WARNING:** Severe weather occurring or imminent.
- ***Take action! Seek shelter now!***
 - Highest confidence (>80%).
 - Issued by the local NWS office.
 - Shortest lead time and most detail in timing and potential hazards.
 - Usually cover a portion of a county or counties and in effect for 30-45 minutes.





Outlooks/Watches/Warnings

Terms to Know...

- **Radar Confirmed Tornado:**

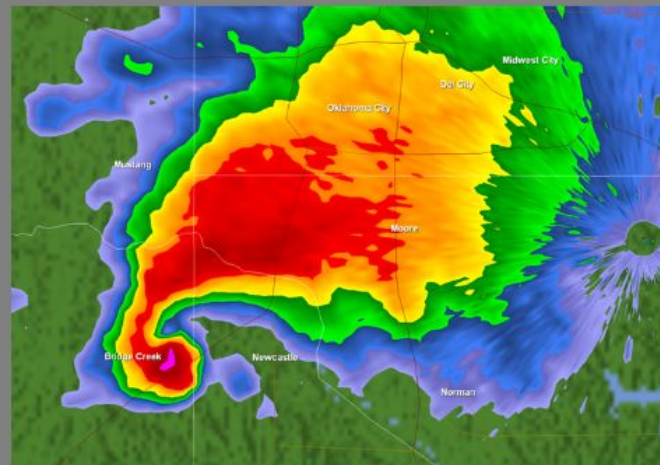
- A tornado debris signature (TDS) or a **debris ball** on radar is caused by debris lofting into the sky, usually associated with a tornado.
- With this signature on radar, NWS will use “Radar Confirmed Tornado” in warning products to “confirm” that a tornado is occurring.



Terms to Know...

- **Tornado Emergency:**
 - Used during significant tornado occurrences in highly populated areas
 - Significant, widespread damage is expected to occur
 - A high likelihood of numerous fatalities expected with a large, strong to violent tornado
 - Intended to convey the *urgency* of the weather situation

TORNADO EMERGENCY



...TORNADO EMERGENCY IN SOUTH OKLAHOMA CITY METRO AREA...
AT 657 PM CDT...A LARGE TORNADO WAS MOVING ALONG INTERSTATE 44 WEST OF NEWCASTLE. ON ITS PRESENT PATH...THIS LARGE DAMAGING TORNADO WILL ENTER SOUTHWEST SECTIONS OF THE OKLAHOMA CITY METRO AREA BETWEEN 715 PM AND 730 PM. PERSONS IN MOORE AND SOUTH OKLAHOMA CITY SHOULD TAKE IMMEDIATE TORNADO PRECAUTIONS!



Outline

- National Weather Service Overview
- What is Skywarn?
 - Why are Storm Spotters Important?
- Outlooks/Watches/Warnings
- Weather Hazards and Safety
- Severe Weather Reporting Procedure
- Monitoring Severe Weather



Weather Hazards and Safety

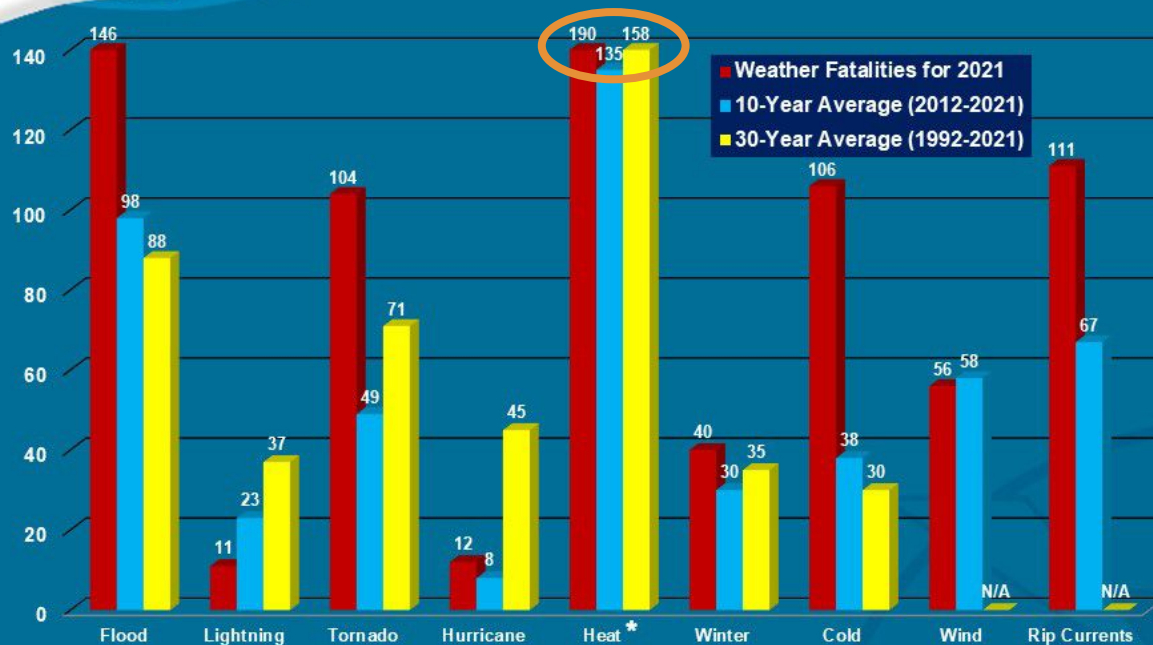




Weather Hazards and Safety



Weather Fatalities 2021



*Due to an inherent delay in the reporting of official heat fatalities in some jurisdictions, this number will likely rise in subsequent updates.



What is Considered Severe Weather?

Severe Thunderstorm Warning

Wind Gusts Higher
than 58 mph (50kts)



Hail Greater Than 1
inch (Quarter sized)



Tornado Warning

Tornado





Severe Thunderstorm Winds

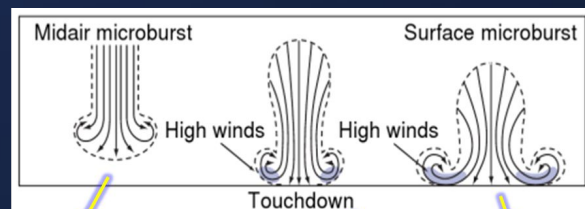
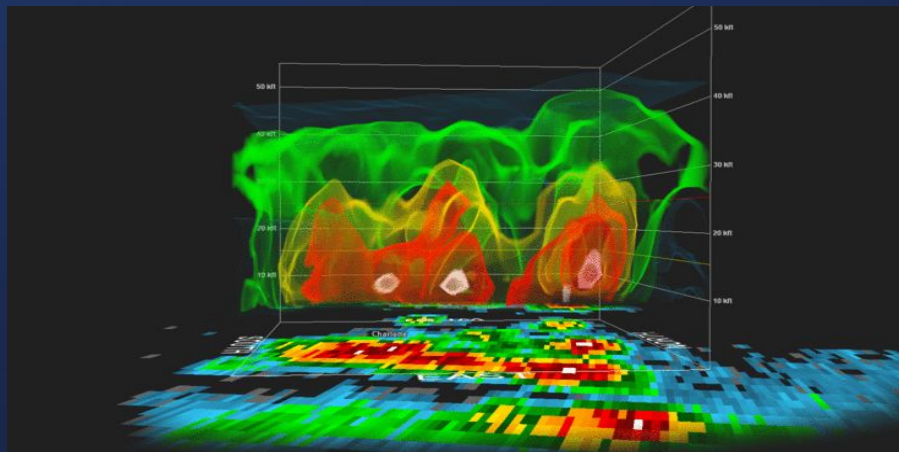
**Greater than
58 mph, or
proxy by
damage**





Severe Thunderstorm Winds - Downburst

- Clouds and thunderstorms form from rising air.
- Precipitation forms then falls and “drags” cooler air down to the ground, where it spreads out horizontally in all directions.
- **Drier air helps to create stronger downward motion.**
- Wind speeds of 58+ mph (and up to 100 mph!) start to cause damage.



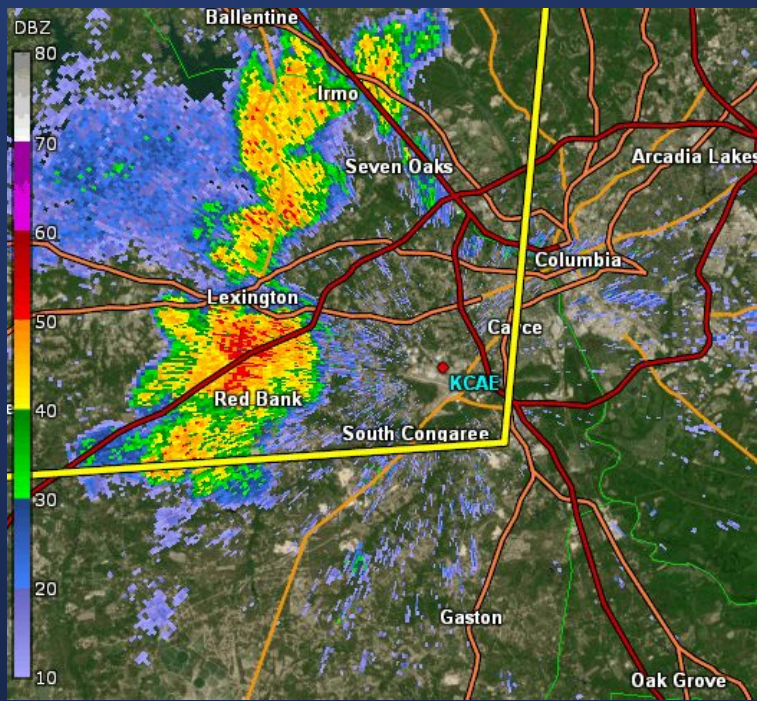
Photos: Weather Spotter Field Guide – William Bunting

Diagram - Wallace & Hobbs - "Atmospheric Science"



Local Microburst Example

August 15th, 2023



NWS Columbia

@NWSolumbia

Today's wind gust of 88 mph at CAE was the highest measured wind speed at CAE since observations began at CAE (@iflycae) in 1947. The previous record wind speed measured at CAE was 78 mph in June 1989. 2/2 #scwx #caewx

8:42 PM · Aug 15, 2023 · 4,347 Views

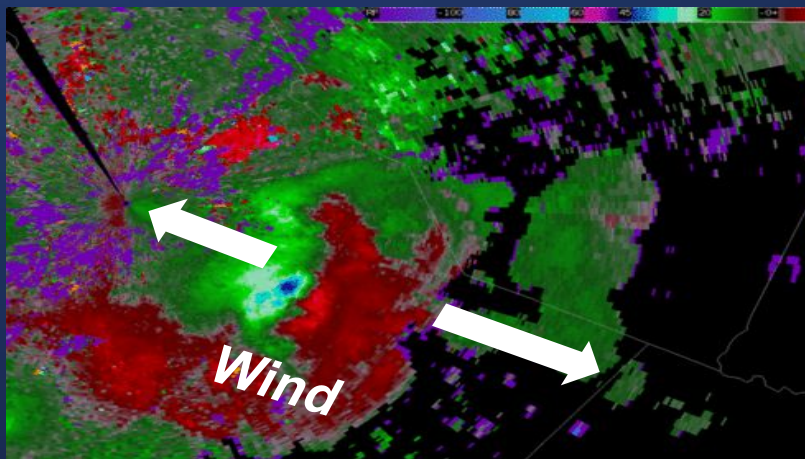
Even a microburst can be
deceptively strong and cause
significant damage!



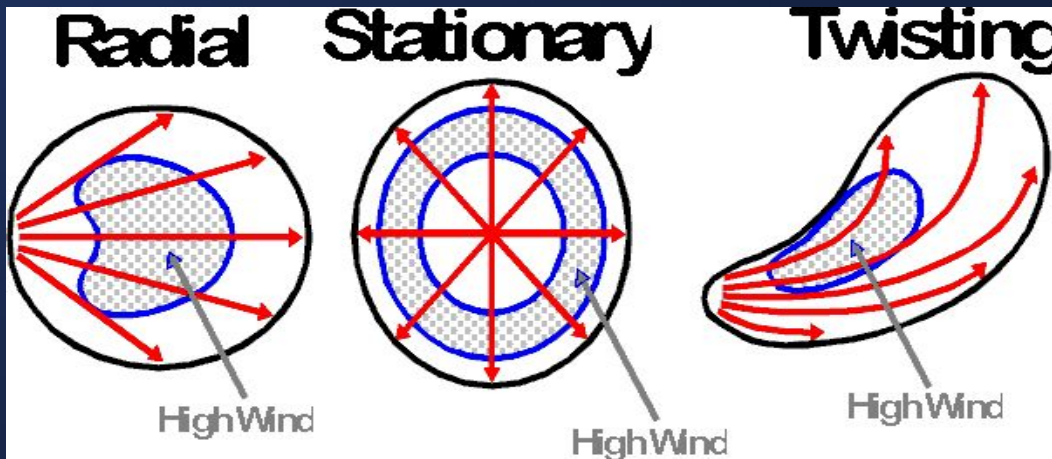
Downburst – Straight Line Winds

What do They Look Like?

On Radar – difficult to detect & warn for!



Damage patterns on the ground





Thunderstorm Cloud Features

Shelf Cloud

- Leading edge of: strong winds, heavy rainfall, and hail (if present)
- Slope down and away from rain
- Moves away from the storm



Mammatus

- Can be present on underside of thunderstorm clouds
- Suggest lots of atmospheric turbulence
- Storm may be producing severe weather somewhere





Severe Thunderstorm Winds

Safety

- Go into a sturdy shelter
- Lowest level, interior room, away from windows
- Protect your head





Severe Thunderstorm Winds

Have a plan if you live in a mobile home!

Mobile homes can roll in 80+ mph winds





Tornadoes



© Instagram / Quinton Myers





Wall Cloud

Localized abrupt lowering of clouds beneath a storm associated with a strong updraft

**Look for rotation!
Often precedes tornado development**





Funnel Cloud

Funnel Cloud: Rotating column of air from base of cloud – NO contact with ground



Funnel cloud

National Weather Service Forecast Office, San Antonio, TX NOAA Central Library



Tornado

**Tornado: Violently rotating column of air from a thunderstorm and in contact with the ground.
Funnel may not be visible.**

Look for debris

Keep your eye on the sky AND the ground!





Tornado Intensity

- Based on the damage
 - Cannot be determined while the tornado is occurring
- Winds NOT directly measured

**Rated from EF0 – EF5
(Enhanced Fujita Scale)**

Size \neq Strength





Weak Tornadoes



- **EF0 and EF1** on the Enhanced Fujita Scale (65-110 mph)
- **88% +** of All Tornadoes
- **< 5%** of all Tornado Deaths
- **Brief Touchdowns, or Paths < Few Miles Long**



Strong Tornadoes



- **EF2 and EF3** (111-165 mph)
- **11%** of All Tornadoes
- **Up to 30%** of Tornado Deaths
- **Paths as Long as 10 - 15 Miles Long**



Violent Tornadoes



Photo by Doug Berry

- **EF4 and EF5** (166-200+ mph)
- **1% or Less** of All Tornadoes
- **~70%** of all Fatalities
- **Paths May Be > 70 miles Long, up to 1 mile Wide**



Tornado Damage

EF0 Damage



EF1 Damage



EF2 Damage



EF3 Damage



EF4 Damage



EF5 Damage





Tornado Safety

- Seek sturdy shelter
- Interior room, on lowest level
- Away from windows
- Protect your head





Tornado Safety



Mobile Homes = 51% of Tornado Fatalities (2015-2020)



Tornado Safety

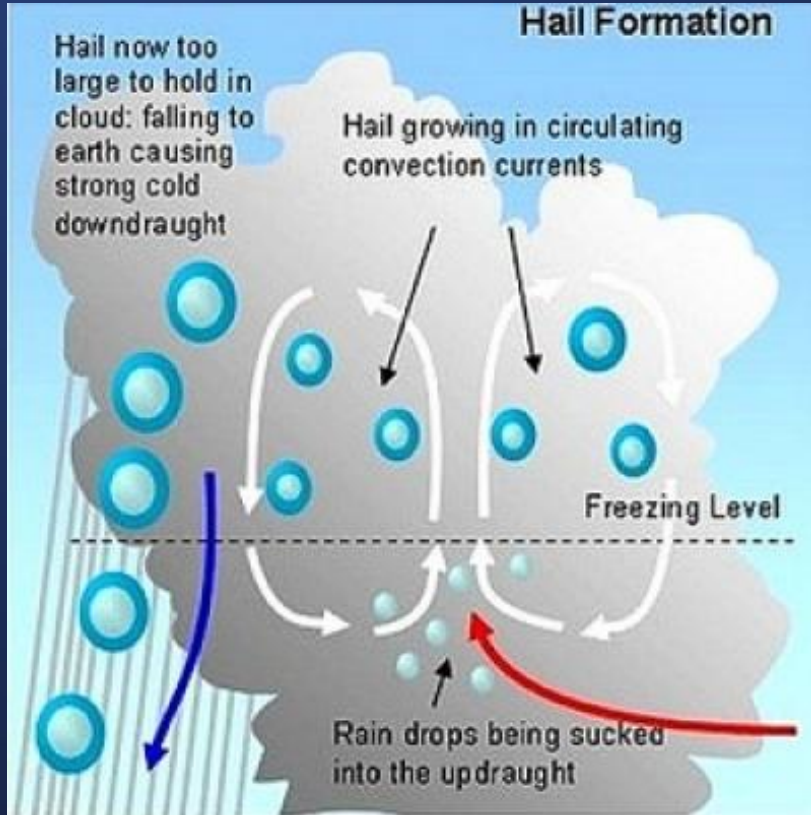


All Survived in Interior Rooms or Closets!

Hail



Hail Formation



- Not all thunderstorms produce hail
- Chunks of ice falling from a thunderstorm
- Size of hail indicates storm severity
- Stronger updrafts = larger hail
- Please report all hail, regardless of size



Hail: Many Shapes and Sizes

Record
Vivian, SD Jul 23, 2010

Diameter: 8"
Weight: 1.94 lbs
Circumference: 18.62"



Typical Size Spectrum
Pea to Baseball



© 2004 Tom Santillo, Simon Brewer, Jim Bishop/Stormgasm.com



Warning Criteria for Hail

Severe Hail is 1" Diameter (Quarter Size) or Larger

Note: Report Hail of ANY Size!





Hail Damage

Car



Roof



Plants



Airplanes



Siding on Home





Lightning



While lightning itself does not make a storm “severe”, it likely indicates a stronger storm.



Lightning Facts



Photo by Doug Berry

- Most people injured or killed by 1st or 2nd strike
- Bolt can heat the air to 18,000° F- 60,000° F in a few millionths of a second
- Causes an average of 20-40 U.S. deaths/year
- Thunder is the sound wave which results from extreme heating/expansion of the air
- Time between lightning and thunder:
 - 5 sec ~ 1 mile

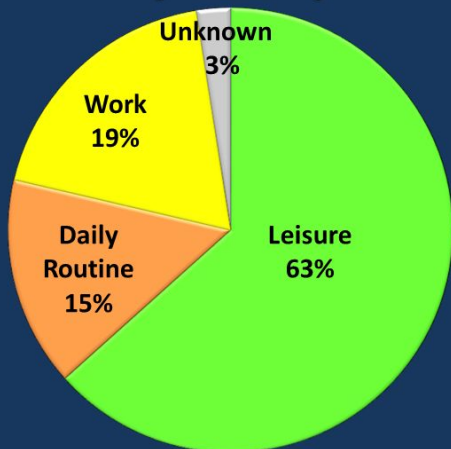




Lightning Fatalities



Lightning Fatalities By Activity

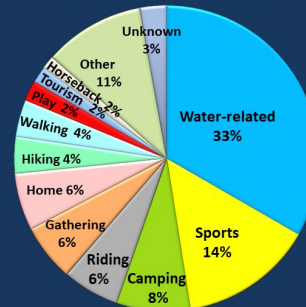


Based on 446 cases from 2006 through 2021

Compiled by John Jensenius



Lightning Fatalities Leisure Activities

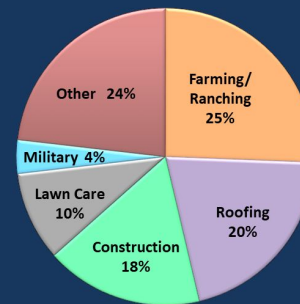


Based on 282 cases from 2006 through 2021

Compiled by John Jensenius



Lightning Fatalities Work-Related Activities



Based on 84 cases from 2006 through 2021

Compiled by John Jensenius



Lightning Facts



Lightning can strike “**Out of the Blue**”,
10-15 miles away from the thunderstorm!





Lightning Safety Tips

- When Thunder Roars, Go Indoors!
- Seek protection in a sturdy, fully enclosed structure
- Keep away from electrical equipment and plumbing
- Wait 30 minutes after the last rumble of thunder to go back outside





Flooding

Spotter reports of flooding are extremely important because we estimate rainfalls and drainage. Spotters are the ground truth.





Flash Flooding

One of the Biggest
Weather-Related Killers!

**Don't drive through
low water crossings!**

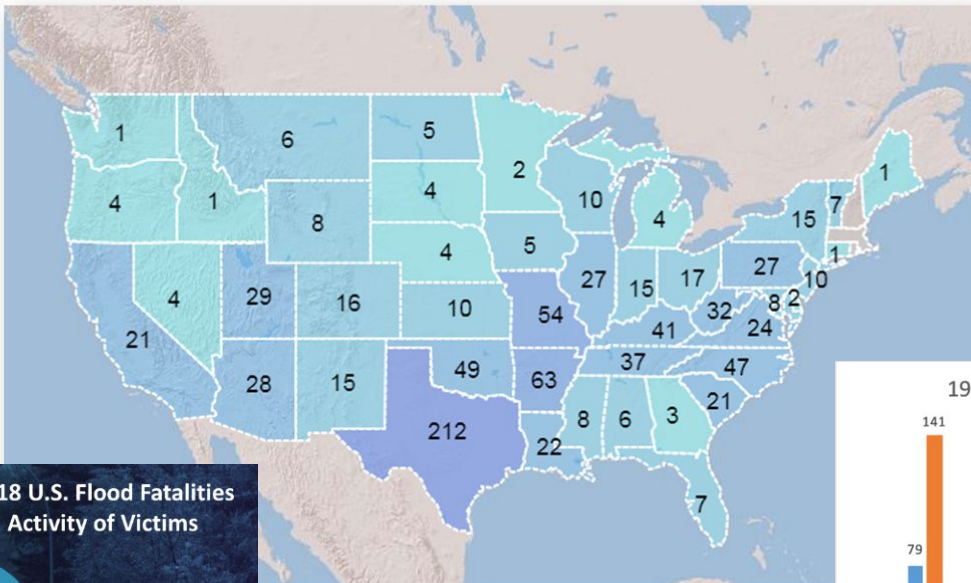


**Nearly 70% of all flash
flood-related deaths
involve automobiles**

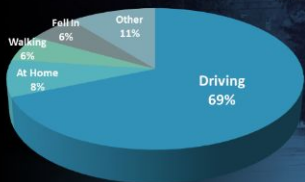


Flood Fatalities (# varies year to year)

2010-2018 U.S. Flood Fatalities



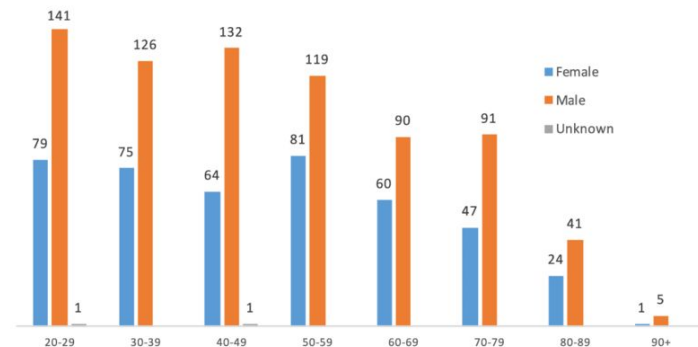
2018 U.S. Flood Fatalities Activity of Victims



Source: NOAA/National Weather Service

Source: NOAA/N

1996-2015 Flood Fatality Totals by Age Group & Gender





Flash Flooding: Turn Around, Don't Drown





Outline

- National Weather Service Overview
- What is Skywarn?
 - Why are Storm Spotters Important?
- Outlooks/Watches/Warnings
- Weather Hazards and Safety
- Severe Weather Reporting Procedure
- Monitoring Severe Weather



What a spotter IS What a spotter ISN'T

✓ Observes the weather

✓ Communicates

✓ Stays safe!

✓ Critical role in helping the National Weather Service and local officials

✗ Storm chaser (*though almost all storm chasers are spotters!*)

✗ An NWS meteorologist

✗ Above the law

✗ Immune to the laws of physics



Severe Weather Reporting Procedures

Time

When did it occur?

Event

What are you reporting?

Location

Where did it occur?

Wind Damage



- ☐ Uprooted trees, snapped limbs
- ☐ Measured/ Estimated winds 50+ mph
- ☐ Wires down
- ☐ Damaged infrastructure
- ☐ Include photos

Hail



- ☐ Hail of any size
- ☐ Please measure hail with a ruler or a common object for accurate sizing
- ☐ Include photos if possible

Tornadoes



- ☐ Visible rotation in a wall cloud
- ☐ Funnel cloud
- ☐ Tornado
- ☐ Waterspout
- ☐ Include photos if possible

Flooding



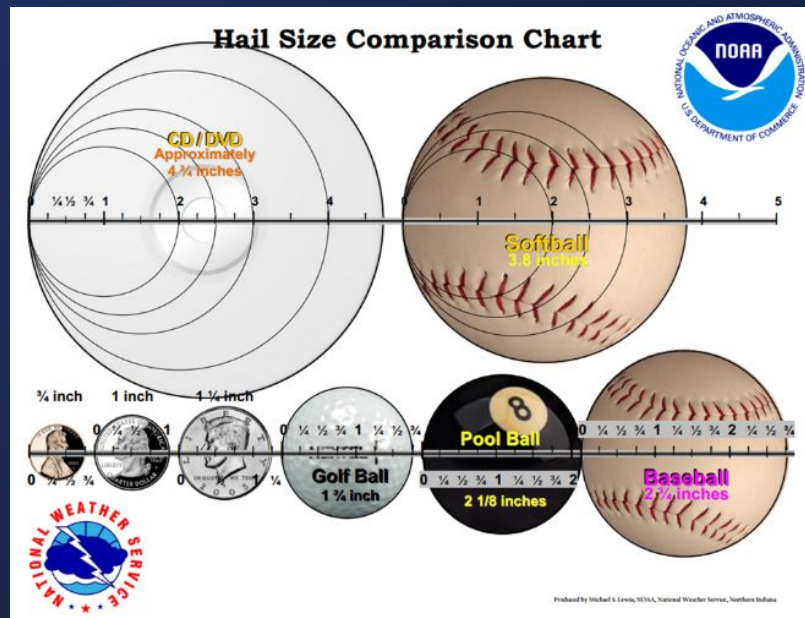
- ☐ Any significant flooding
- ☐ Water over roads, impassable roads
- ☐ Streams rising to near bank full
- ☐ Include photos if possible



Severe Weather Reporting Procedures

Reportable Hail Sizes

1/4"	Pea
3/4"	Penny
0.88"	Nickel
1"	Quarter
1 3/4"	Golf ball
2 1/2"	Tennis ball
2 3/4"	Baseball
4"	Grapefruit/Softball



July 23, 2010
Vivian, SD
8" diameter
1.9 lbs



Other Weather to Report

- Most reports will be severe thunderstorm, flash flooding, and tornado but there are some less common weather events such as:



Ice Accumulations



Snowfall Accumulations

Non-Thunderstorm
Wind Damage



Change in Precipitation Type



Winter Weather Reporting Procedures

Time

When did it occur?

Event

What are you reporting?

Location

Where did it occur?

Snow

- ☐ *Snowfall – During the Storm* (nearest 1/10 of an inch)
Report when accumulations reach thresholds
- ☐ *Snowfall – Storm Total* (nearest 1/10 of an inch)
Report as soon as you can after the storm ends
- ☐ *Snow Depth – TOTAL snow on the ground* (nearest inch)
Might be the result of multiple storms
Remember, snowfall ≠ snow depth
- ☐ *Snowfall RATES*
1 inch or more per hour (that's pretty heavy snow!)
Visibility restrictions below 1/4 mile

Sleet



- ☐ *Any occurrence and any accumulation*

Freezing Rain



- ☐ *Any occurrence*
- ☐ *Measuring on branches is easiest*
- ☐ *Remember to divide by 2 if measuring total ice accumulation on a branch!*



Stay In Touch on Facebook

- Join the NWS Columbia SKYWARN Facebook Group!



- Must register as a Spotter first (only those in Spotter database accepted into the group).
- Relay reports you see from friends, family or other groups!



Example of Severe Weather Report

- My name is Jane Doe
- I am a trained spotter located 2 miles N of Aiken (provide lat/lon, address or nearest intersection if possible)
- I see a Tornado 2 miles to my west, moving to the NE.
- We also had Golfball size hail at my location.
- It began at 6:35 pm and lasted for 5 minutes.



What Would You Report?



Tornado or Rain Shaft?

Rain shaft: You would notice NO rotation!



What Would You Report?



Tornado! The funnel is embedded in very heavy precipitation, but is a tornado. The observer noticed strong rotation and power flashes in the circled area, and reported the tornado.



Outline

- National Weather Service Overview
- What is Skywarn?
 - Why are Storm Spotters Important?
- Outlooks/Watches/Warnings
- Weather Hazards and Safety
- Severe Weather Reporting Procedure
- **Monitoring Severe Weather**



NWS Watches and Warnings are disseminated to the public via the EAS (Emergency Alert System).
You can get this information from a variety of sources...

NOAA Weather Radio

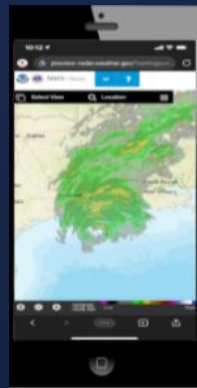


Commercial Radio



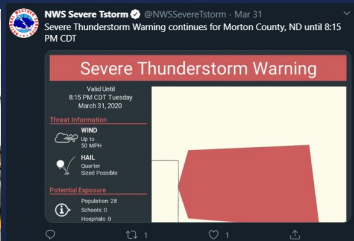
Television

Cell Phone



(WEA via FEMA IPAWS)

Internet - Social Media



Public Signage

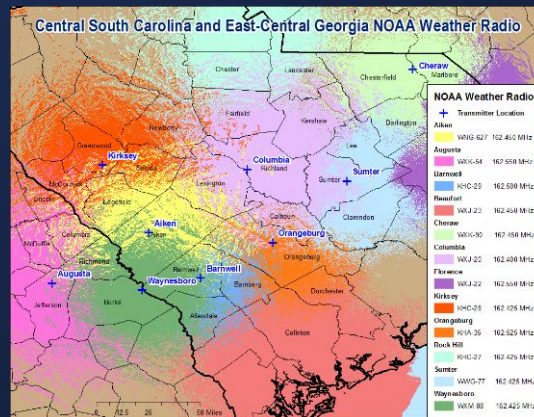




Staying Informed

- **NOAA Weather Radio All-Hazards (NWR)**

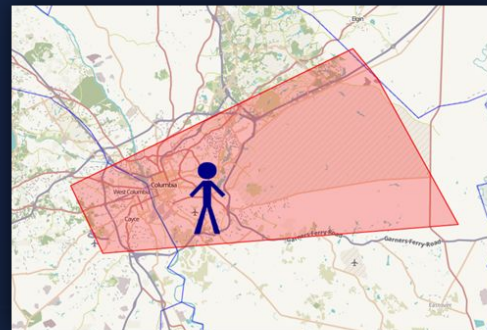
- Nationwide network of radio stations broadcasting weather information directly from the NWS 24 hours a day.
- In conjunction with Federal, State, and local EM's and other public officials, NWR broadcasts warnings and information for all types of hazards:
 - Natural (weather, earthquakes, etc.)
 - Environmental (chemical releases or oil spills)
 - Public Safety (Civil Emergency Messages, AMBER alerts, 911 telephone outages, etc.)





Staying Informed

- **Wireless Emergency Alerts (WEA):**
 - Sent by authorized government authorities (including NWS)
 - Automatically sent to mobile device (no app or subscription needed)
 - Uses radio technology to broadcast the alert from cell towers to mobile devices in the area of threat
 - FREE! Can opt-out (except for Presidential)
 - Will alert you even if your phone is turned off as long as there is battery charge
 - Alerts do not interrupt when you are on a phone call





How Else You Can Help



- Weather stations available at many major retailers such as: Walmart, weathershack.com, Lowe's, Home Depot, Costco, Amazon.

The NWS does not endorse any specific brand or retailer

- The Citizen Weather Observer Program (CWOP) is a private-public partnership
 - If you have a weather station, you can upload your data to the internet
 - The data can then be used by the NWS to produce short-term forecasts.
 - More information at <http://www.wxqa.com/>



Help observe precipitation in your community!!



www.cocorahs.org

CoCoRaHS COMMUNITY COLLABORATIVE RAIN, HAIL & SNOW NETWORK
"Because every drop counts"

Home | States | View Data | Maps | My Data | My Account | Admin | Logout

Welcome to CoCoRaHS! "Volunteers working together to measure precipitation across the nation."

Main Menu

- Home
- About Us
- Join CoCoRaHS
- Contact Us
- Donate

Resources

- FAQ / Help
- Education
- Training Slide-Shows
- Videos
- Drought Impacts
- Evapotranspiration
- Volunteer Coordinators
- Hail Pad
- Distribution/Drop-off
- Help Needed
- Printable Forms
- The Catch
- Message of the Day
- Publications
- CoCoRaHS Blog
- Web Groups
- State Newsletters
- Master Gardener Guide
- State Climate Series
- March Madness
- VxTalk Webinars
- Sponsors
- Links
- CoCoRaHS Store

Who uses CoCoRaHS Observations?

7,658 daily precipitation reports received today as of 5/14/2015 10:43 AM EDT

Daily Precipitation (inches x.xx)
USA
5/14/2015

Legend:

- Trace
- 0.00 - 0.30
- 0.31 - 0.60
- 0.61 - 1.48
- 1.49 - 3.54
- 3.55 - 5.31
- 5.32 - 5.50

Canada

USVI

JOIN CoCoRaHS

TRAINING SLIDE-SHOWS





How can I join the network?

5 Easy Steps

- 1 Sign-up on the CoCoRaHS web page:
www.cocorahs.org
- 2 Obtain a 4" plastic rain gauge
(available through CoCoRaHS)
- 3 View the online "training slide show"
or attend a training session
- 4 Set-up the gauge in a "good"
location in your yard
- 5 Start observing precipitation
and report online daily

