Basic SKYWARN® Weather Spotter Training Webinar

Photo: Sherri George

Photo: Chris Kerr

National Weather Service
Charleston, WV
First Things First…

All webpages mentioned in this webinar, and additional Spotter resources can be found at:
https://www.weather.gov/rlx/weather-spotter

Additional Resources for Spotters

- Basic SKYWARN® Weather Spotter Training Webinar
  - Slides from 2020 Online Basic Weather Spotter Class (pdf)
- Weather Spotter’s Field Guide (pdf)
- NOAA Cloud Chart (pdf)

Real-Time Severe Weather Information
- Decision Support Self Briefing Page
- Enhanced Data Display
- Storm Prediction Center

Reporting Resources/Apps
- How and What to Report
- Beaufort Wind Scale Reference
- Hail Size Comparison Chart
- CoCoRaHS Volunteer Weather Observer Network
- mPING Crowdsourced Weather Reporting
Spotter Training Objectives

At the conclusion of this course, you should be able to:

- Describe your community’s severe weather threats
- Understand the role of a weather spotter and how important they are to NWS operations
- Properly define a severe thunderstorm and identify basic thunderstorm structure and clues to tornado development
- Provide accurate and timely reports of severe weather, increasing the weather readiness of your community
- Implement a severe weather safety plan
Section 1: Lessons from the Past
- Tornado history and climatology

Section 2: The Role of the Weather Spotter
- National Weather Service – Who We Are and What We Do
- Why We Need Spotters?
- How and What to Report

Section 3: Thunderstorms
- Ingredients…Anatomy…and Varieties
- Severe Thunderstorm Spotting Concepts
- Cloud Identification

Section 4: Staying Safe in Severe Weather
- Outlooks, Watches and Warnings – Oh my!
- Severe Weather Risk Awareness Resources and Apps
- Safety Basics

Section 5: Winter Weather Spotting

Section 6: Review & Quiz
The farther backward you can look, the farther forward you are likely to see.

-- Winston Churchill
Lessons from the Past

Great Appalachian Storm of November 1950

- Coburn Creek – 62"
- Pickens – 57"
- Clarksburg – 38"
- Parkersburg – 34.6"
- Morgantown – 31.3"
- Charleston – 25.7"
- Winds over 30 mph with temperatures in the single digits

160 Deaths!
Lessons from the Past

Winter Extremes

Record One Day Snowfall

Coldest Temperature Observed on Record

www.weather.gov/rlx/HazardRiskAssessment
Flash Flooding is our Region’s Biggest Threat

Flooding Kills More People Than Any Other Weather Type

Most People Die Trying To Cross Flooded Roadways
Floods & Flash Floods

Flood Deaths – 1990 to Present

Flood Deaths by Activity
NWS Charleston, WV County Warning Area
- Vehicle 45%
- Fell In/Outside 33%
- Other 1%
- Boat 8%
- Home 13%

Flood Deaths Day vs Night
NWS Charleston, WV County Warning Area
- Night 54%
- Day 46%

www.weather.gov/rlx/HazardRiskAssessment
Lessons from the Past

Election Day Floods of November 1985

- 3,500 homes/180 businesses destroyed
- 123 bridges damaged or destroyed
- $570 million in damages
- 47 people killed

Philippi, WV
Floods of June 2016

Hourly Radar and Summed Rainfall, Lewisburg, WV (ASOS)

24h Maximum Rainfall ~ 7”+

Accumulating Rainfall (inches) at Lewisburg, WV (LWB)

3.69” in 2 hours

24-hour Flash Flood Guidance (FFG) ~3 inches at LWB

--- 8 pm EDT 6/22 through Midnight EDT 6/24 ---

Analysis by G. Carbin

Radar data courtesy College of DuPage

24-hour FFG exceeded at LWB ~ 3 pm EDT 6/23
Flash Flood History

White Sulphur Springs area
Tornado History

- Total Tornadoes – 158
- Most in a County – 12
  Washington, OH
- Earliest – May 12, 1886
  Meigs County, OH F4
- Longest – 86 miles
  March 2, 2012
  Lawrence KY, Wayne and Lincoln Counties
- Strongest – F5
  April 23, 1968
  Greenup, Lawrence OH, Gallia Counties
- Deadliest – Shinnston F4
  100 Dead/381 Injured
  June 23, 1944

www.weather.gov/rlx/HazardRiskAssessment
The EF Scale - Tornadoes Intensity

**EF0 - EF1**
- 65-110 mph
- Short-lived, track < 3 miles
- Develop quickly, occasionally without warning

**EF2 - EF3**
- 111-165 mph
- Track 10-15 miles
- Better detection

**EF4 - EF5**
- 166-200+ mph
- Track 20-50 miles, can last up to an hour
- Develop from well organized supercell storms
Lessons from the Past

Wheelersburg, OH Tornado

- F5 Tornado tracked 45 miles from Greenup, KY through Scioto, Lawrence and Gallia Counties, lifting in Gallipolis, just before crossing the Ohio River.
- Tornado was nearly a half mile wide at one point
- 7 people died in Scioto County, 108 total injuries.
Tornado History

- Majority of tornadoes occur from April through July
- Majority of tornadoes occur from 2 pm through 9 pm

www.weather.gov/rlx/HazardRiskAssessment
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Safety is #1 Priority

Protect You and Your Family First

Know When to Contact the NWS

Stay Calm and Be Specific – Do Not Exaggerate Reports

Never Give Out the Spotter Phone Number
Spotter Guidelines

Important: We Train Spotters, Not Chasers!

Terrain and Vegetation Seriously Limit Visibility in our Region Making Storm Chasing Very Dangerous Here.

Spotting = Telling Us What is Happening Where You Are
The Role of the Weather Spotter

Your Accurate Reports
- Verify What NWS Sees on Radar
- Add Credibility to NWS Warnings

Credible WARNING!
Our Mission
The National Weather Service provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy.

Our Vision
A Weather-Ready Nation: Society is Prepared for and Responds to Weather-Dependent Events
The National Weather Service

- Includes 4 states, 49 counties
  - 34 WV
  - 9 OH
  - 4 KY
  - 2 VA
- Just under 22,000 sq mi.
- Highest elevation: 4,848 ft – Snowshoe, WV
- Lowest elevation: 495 ft – Greenup Co, KY
Why Do We Need Spotters

Radar Beams Travel Up and Away

Path of radar energy

Radar can miss bad going on here

© 2008  Scott Blair
Why Do We Need Spotters

What the Radar Gives Us Back

Reflectivity (dBZ)
- Small Particles: Light Rain, Dust, Bugs
- Big Particles: Hail, Big Rain Drops

Velocity (kts)
- Speed Moving Away from Radar
- Speed Moving Toward Radar
Spotters Are Integral Part of the NWS Warning Process

Why Do We Need Spotters

- The public is more likely to heed an NWS warning when an actual report has been confirmed.
- Impact based warnings contain tags at the bottom to better communicate the threat.

NWS Warnings + Ground Truth = Public Action
There are many ways to contact us. What method you use depends on your specific situation.

**Spotter Hotline (provided later)**

**Who** you are

**What** weather is occurring or has occurred

**When** did this weather happen

**Where** the weather took place

Your Reports Are Critical to Providing Life Saving Warnings

Real Time Reports are Crucial though Reports Received In the Days Following are Extremely Helpful
How to Report…

Post your report here. Pictures to document the damage are great!

NWS Charleston on Facebook & Twitter

@NWSCharlestonWV

https://www.weather.gov/socialmedia
How to Report...

Storm Report Form

Available on PC and Mobile.

Automatically routes your report to the appropriate NWS office (great when traveling!).

https://inws.ncep.noaa.gov
How to Report...

The Ping Project
Your reports will help the weather research community and are compared against radar data.

There’s an app for that! Search “mping”.

https://mping.nssl.noaa.gov/
Help Observe Precipitation in Your Community by Joining the Community Collaborative Rain, Hail & Snow Network

Volunteers take their readings once a day

Observers can easily transmit their observations using mobile devices

http://www.cocorahs.org
How can I join the network?

Simply sign-up on the CoCoRaHS web page: www.cocorahs.org

Obtain a 4” plastic rain gauge

View the on-line “training slide show” or attend a training session

Set-up the gauge in a “good” location in your yard

Start observing precipitation and report on-line daily
How to Report Severe Weather

How to Report

There are a variety of ways to report weather to the NWS office in Charleston, WV. By using the methods below, your severe weather reports will reach forecasters in real time. Please be sure to include the location of the weather event, e.g. 5 miles northwest of Charleston. You may also indicate if you are a trained spotter, a ham radio operator, a member of law enforcement, or other affiliation if applicable.

Submit Report
Use this Web Based Form: Submit Report

Spotter Hotline
Trained weather spotters can report significant weather conditions by calling the toll-free spotter hotline given to them as part of their training.

Facebook
Post information on our Facebook page: https://www.facebook.com/NWSCharlestonWV

Twitter
Send us a tweet: @NWSCharlestonWV

Email
Send us an email: rlx.ops@noaa.gov

Mobile App
Send reports from your location via a smartphone app: MPing

Wind Damage

What kind of damage did the wind cause?

- Small limbs down (less than 2" in diameter)
- Large limbs/branches down (more than 2" in diameter)
- Trees snapped or uprooted
- Power lines down
- Structural damage and/or Roof damage
What to Report…

Tornadoes
Funnel Clouds
Wall Clouds
Hail
Storm Damage
Flooding
Heavy Rainfall
Wind Damage
Winter Weather
Hello! I am a spotter currently in Logan. I have marble size hail here. It started hailing 3 minutes ago and has not stopped.
What to Report...

Reporting Hail

Always Report Largest Hailstone You See
### Reporting Wind

Note Damage Type and Estimate Speed if no Wind Measurement is Available

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 – 31</td>
<td>Large branches in motion</td>
</tr>
</tbody>
</table>
| 32 – 38     | Whole trees in motion  
Inconvenience felt walking in the wind |
| 39 – 54     | Some branches break off trees  
Wind impedes walking progress |
| 55 - 72     | Damage to chimneys or TV antennas  
Shallow rooted trees pushed over |
| 73 - 112    | Broken windows, peeled off roofing  
Mobile homes overturned, cars pushed off roads |
| 113 -157    | Roofs torn off, car lifted off of the ground |

58 MPH Wind = Severe Thunderstorm
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Thunderstorms...

Average Annual Thunderstorm Days
Though Lightning is Always Extremely Dangerous…

The Amount of Lightning in a Thunderstorm Does Not Determine if a Thunderstorm is Severe

National Weather Service Definition of a Severe Thunderstorm

- Hail 1 inch or greater
- Wind 58 mph or more
- Tornado

Just FYI: Less than 10% of thunderstorms are severe

Though Lightning is Always Extremely Dangerous…

The Amount of Lightning in a Thunderstorm Does Not Determine if a Thunderstorm is Severe
Lightning is one heck of a spark!

- 100 million to 1 billion volts and billions of watts
- Heats the immediate surrounding air 18,000 degrees to 60,000 degrees
Lightning often strikes outside of heavy rain; may occur as far as 10 miles away from where rain is falling.

More than 50% of lightning deaths occur AFTER the storm has passed.

When Thunder Roars, Go Indoors!
Lightning Safety

When Thunder Roars, Go Indoors!

Close Enough to Hear Thunder—Close Enough to Be Struck

Seek Indoor Shelter Immediately

Stay Away from Windows and Doors

Do Not Use the Telephone or Take a Bath or Shower

Get in a Vehicle if Caught Outside with No Other Shelter
Thunderstorm Ingredients

Moisture

Source of Lift

Instability

Vertical Wind Shear
Severe Weather Threat Increases

Thunderstorm Types

- Single Cell
- Multicell Cluster
- Multicell Line
- Supercell

Severe Weather Threat Increases
Mostly Non-Severe
Life Cycle of < 30 minutes
May Contain Small Hail & Gusty Winds
Multicell Thunderstorms

Overall Severe Weather Threat Level:

- **Low - Moderate**

- **Wind**
- **Hail**
- **Heavy Rain**
- **Tornado**

- Flash flooding due to slow movement
- Downbursts, straight-line winds, small-med sized hail, lightning
Microburst: affecting an area less than 2.5 miles across.

Macroburst: winds extending in excess of 2.5 miles across.
Downburst Winds

Damage Produced by a Tornado
Multicell Squall Line

Overall Severe Weather Threat Level:

- Hail: Moderate
- Wind: High
- Heavy Rain: Moderate
- Tornado: High

What You See
Bow echoes are usually associated with an axis of enhanced winds that create straight-line wind damage at the surface.
Squall Line Thunderstorms

Extreme Case: Derechos

Overall Severe Weather Threat Level: High

- Hail
- Wind
- Heavy Rain
- Tornado

SPC Storm Reports for 06/29/12
Map updated at 1213Z on 07/03/12

TORNADO REPORTS... (2)
WIND REPORTS/H... (1195/37)
HAIL REPORTS/H... (57)
TOTAL REPORTS..... (1294)

National Weather Service
Storm Prediction Center
Norman, Oklahoma

PRELIMINARY DATA ONLY.
More About the Shelf Cloud

Slopes Down and Away from the Rain

Associated With the Downdraft of a Thunderstorm
Super Cell Thunderstorms

Overall Severe Weather Threat Level: High

- Hail
- Wind
- Heavy Rain
- Tornado
A wall cloud is a **ROTATING** lowering from a T-storm updraft base, indicating a strong updraft.

Often precedes a funnel cloud or tornado.
Super Cell Thunderstorms

Typical Radar Signature of a Super Cell

What you see on the ground depends on where you are.
Super Cell Thunderstorms

Typical Radar Signature of a Super Cell

What you see on the ground depends on where you are.
Funnel Shaped Cloud Attached to the Cloud Base

May or May Not Appear from a Wall Cloud

Rotation is Visible

Has Not Touched Down
Think You See a Funnel Cloud?

Ask yourself two questions:

1. Is it rotating?

If the answer is yes:

2. Where’s it pointing?
Scud Clouds or “SLCs"

- Harmless, ragged looking clouds
- Do NOT rotate
- Can move up and down, may look turbulent
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Staying Safe in Severe Weather

Prepare & Be Aware

Know and Understand the Weather Forecast

Prepare Disaster Kits for All-Seasons

Identify Shelter Locations Before the Storm!!!

When a Watch is Issued, Plan Your Day Around the Weather

When a Warning is Issued, Take Appropriate Action!!!
Severe Weather Risk Awareness

Our Office Homepage
www.weather.gov/charlestonwv

Type in your location to go to a detailed local forecast page

Add your city to display your current conditions and forecast

Local radar link

Links to national content

News Headlines
Information you need to know

Links to local content

Watch/Warning/Advisory Map
Click in the map for local info

Featured content and links to seasonally important content

Additional quick links to frequently used content
3-Tiered Alert System for Severe Weather Outlook
Up to a Week Ahead Be Aware!

Watch
Threat Increased but Still Several Hours Ahead Get Prepared!

Warning
Severe Weather Imminent Take Action!

[Map highlighting regions for alert levels]
A Moderate Risk of Severe Thunderstorms is Forecast Today and/or Tonight

Severe thunderstorms capable of producing tornadoes, damaging winds, and isolated large hail will be likely over portions of the Gulf Coast states through tonight. A few strong tornadoes will be possible.

» For additional details, see the current Public Severe Weather Outlook (PWQ).

» A multi-media briefing is also available.
Wireless Emergency Alerts (WEA)

Alert Categories

- Presidential
- Imminent threat to life and property (e.g., severe weather, HazMat, earthquake)
- AMBER Alert/child abduction

Alert Message Content (90 characters)

- What is happening
- Area affected
- Til time
- Recommended action
- Alert originator
Severe Weather Alerts

Smartphone Apps

- **FEMA**
  - ALL NWS alerts for up to 5 locations
  - Android, Apple, and BlackBerry

- **Red Cross Apps**
  - Two apps with alerts and safety information (Android and Apple)
  - Emergency App: 35 different severe weather and emergency alerts
  - Tornado App: Tornado Watch and Warning Alerts
    - Audible siren for Tornado Warnings
Severe Weather Alerts

NOAA Weather Radio

- Programmable
- Battery back-up during power outages
- Tone alerts for warnings when not in use
Disaster Kits

- **Water**, one gallon of water per person per day for at least three days
- **Food & medicine/prescriptions**, at least a three-day supply
- **Radio**, battery-powered or hand crank radio and a NOAA Weather Radio with tone alert and extra batteries for both
- **Flashlight and extra batteries**
- **First aid kit**
- **Whistle** to signal for help
- **Dust mask** to help filter contaminated air and plastic sheeting and duct tape to shelter-in-place
- **Moist towelettes, garbage bags and plastic ties** for personal sanitation
- **Wrench or pliers** to turn off utilities
- **Manual can opener** for food
- **Local maps**
- **Cell phone with chargers, inverter or solar charger**

http://www.ready.gov/kit
Wind Blown Debris is the Greatest Danger in a Tornado

May 10, 2016 – Mayfield, KY EF-3 Tornado
Tornado Safety

If You Live in a House

Underground is the only safe place to be in a strong tornado (EF2 or greater).

Get in a basement or storm shelter if available.

If no basement is available, get in an interior room away from windows.

Underground or in a Basement is Best!

Menifee County, KY – 3/2/2012
Don’t wait for the warning... get out and go to a neighbor/relative’s house with a basement as early as possible, or get into a storm shelter.

Lie down in a ditch or culvert as a last resort but do not ride out a tornado in a mobile home.
Tornado Safety

If You are Traveling

- Consider delaying your trip if severe thunderstorms are in the area or along your path of travel.

- If enough time, get in a sturdy building on the lowest floor. Walk-in coolers make good storm shelters in convenience stores, etc.

- Find shelter in a ditch, culvert or low spot as a last resort.

- Highway overpasses are NOT tornado shelters!
Thunderstorm Safety

Treat Severe Thunderstorm Warnings Seriously!

Straight Line Winds Can Be As Destructive as a Tornado

Tama County Wind Eve
© Kip Ladage
Flood Safety

Water may be over a road you know very well...

...but under that water the road may have been washed away
Flood Safety

Turn Around, Don’t Drown!
Flood Safety

Move to Higher Ground Early – Do Not Wait Until Last Minute

Do Not Attempt to Cross Flowing Streams

Do Not Drive Around Road Closed Signs or Barriers

2 Feet of Flowing Water will Carry Away Most Vehicles
Report Flooding

Call 911 If Lives are Threatened

Provide Specific Location Information
Rocks - Intersections - Creek Names
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### Winter Weather Spotting

<table>
<thead>
<tr>
<th>Winter Storm Watch</th>
<th>Winter Weather Advisory</th>
<th>Winter Storm Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warning Conditions Are Possible</strong></td>
<td>1 to 4 Inches of Snow Less than ( \frac{1}{4} ) Inch of Ice</td>
<td>4 Inches of Snow or More (criteria varies) ( \frac{1}{4} ) inch of Ice or More</td>
</tr>
<tr>
<td>Issued 12 to 60 Hours in Advance</td>
<td>Issued up to 36 Hours in Advance</td>
<td>Issued up to 36 Hours in Advance</td>
</tr>
<tr>
<td>You Should Prepare for Winter Weather NOW</td>
<td>Hazardous Travel Conditions Minor Inconveniences</td>
<td>Stay Indoors-Avoid Travel High Potential for Life Threatening Conditions</td>
</tr>
</tbody>
</table>

Media broadcasts our watches, warnings and advisories, but doesn’t have to agree with our forecast.
** What to Report **

** Snow, Sleet & Freezing Rain Amounts **

Any Occurrence of Freezing Rain

Changing Precipitation Types
Rain – Freezing Rain – Snow
Snow – Sleet – Rain

Report Precip Type Easily Using mPing App!
Six Basic Steps for Properly Measuring Snow

Accurate and timely snowfall measurements are extremely important to your National Weather Service office, your community, local media, and many others. Here are the six steps you need to know for measuring snow:

1. Supplies
   - Ruler or yard stick
   - 24” x 24” white board, flag

2. Planning
   - Find an open area away from tall objects, but sheltered from wind

3. Set-up
   - Set up before snow begins
   - Put your board out and mark it with the flag

4. Measuring Snow
   - Record your total to the nearest tenth of an inch
   - Wipe the board off after measuring
   - Measure once daily at the same time, after measuring place the board on top of snow

5. When Snow Stops
   - Measure as soon as the snow stops to avoid lower totals due to melting, settling and drifting

6. Reporting
   - Choose your method: weather.gov, social media
   - Send us your report!
Let’s Review…

Spotter Hotline

**Who** you are

**What** weather is occurring or has occurred

**When** did this weather happen

**Where** the weather took place

Stay Calm and Be Specific - Do Not Exaggerate Reports
Let’s Review...

What to Report

Tornadoes

Funnel Clouds
Rotation?
Let’s Review…

What to Report

Wall Clouds

Wind or Storm Damage
Even if it happened in the recent past.
Let’s Review…

What to Report

Hail
Largest Stone?

Flooding or
Heavy Rainfall
** Snow, Sleet & Freezing Rain Amounts **

Any Occurrence of Freezing Rain

Changing Precipitation Types
Rain – Freezing Rain – Snow
Snow – Sleet – Rain
For Additional Training

Role of the SKYWARN® Spotter
Heather Brinkmann

SKYWARN® Spotter Convective Basics
Creative Commons Nicholas_T

weather.gov/rlx/weather-spotter
Email: Tony.Edwards@noaa.gov