Basic Spotter Training 2020

NWS State College

NOAA Photo Library

Attendee Engagement

- Ask us a question!
  - Enter your question in the GoToWebinar window on your screen.

- Raise your hand at the end
  - Using the “Raise your hand button”

Brief Introduction - Who We Are

NWS State College Central PA Weather Forecast Office

- 14 forecasters, 6 electronic technicians/IT support, 1 hydrologist, 1 science & operations officer, 1 observations program leader, 1 warning coordination meteorologist, 1 administrative assistant, and 1 meteorologist in charge
- Open 24x7x365 to provide forecasts and warnings, as well as maintain the Doppler radar and other observation systems

How to Find Us Online

@NWSStateCollege

/NWSStateCollege

/NWSStateCollege

www.weather.gov/ctp

National Weather Service

- National Weather Service
  - Our parent agency is NOAA
    - National Oceanic and Atmospheric Administration
  - NWS (and NOAA) fall under the Department of Commerce
    - Federal agency

  - **Primary Mission:**
    - The protection of Life and Property through the issuance of Forecasts and Warnings

Organization of the National Weather Service

9 National Centers (NCEP)

1. AWC – Aviation Weather Center
2. CPC – Climate Prediction Center
3. EMC – Environmental Modeling Center
4. NCO – NCEP Central Operations
5. NHC – National Hurricane Center
6. OPC – Ocean Prediction Center
7. SPC – Storm Prediction Center
8. SWPC – Space Weather Prediction Center
9. WPC – Weather Prediction Center

Local Offices

122 Local Weather Forecast Offices

- Five offices serve Pennsylvania

13 River Forecast Centers

- Two serve Pennsylvania

6 Regional Offices

- Eastern, Central Southern, Western, Alaska and Pacific

NWS Headquarters

- Silver Spring, MD

Where are all those Local Offices?

NWS Offices Serving Pennsylvania

Cleveland, OH

Binghamton, NY

State College

Pittsburgh

Philadelphia/ Mt. Holly, NJ

A look at the Local Office

- Staffing: ~26 persons
  - 14 Forecasters
  - 1 Meteorologist in Charge
  - 5 Electronics Technicians
  - 6 "specialists"
    - Observations
    - Hydrology
    - Research / Training
    - Outreach
    - Information technology
    - Administrative assistant
- Open 24x7x365

How We "typically" Work

Short Term

0-24 hours (maybe 36 hour forecast)

- Often staffed by the Lead Forecaster
  - Warning decisions, aviation support, staffing, etc.

Long Term

Day 2 – Day 7

- Looking at longer term models
- Often doing Decision Support duties

Public Service

- Phones, Product QC, NOAA Weather Radio, Social Media

When the weather "ramps up"

Key Pieces of Equipment

Doppler Radar

Satellites

Computers

Remote Sensing Equipment

SKYWARN Program Background

SKYWARN Program

A group of **trained volunteers** who report hazardous weather in order to:

- Supplement remote sensing equipment
- Provide real-time ground truth reports
- Add credibility to NWS products and services

SKYWARN Spotters act as thousands of "eyes and ears" out in the field, supporting our forecast and warning program!

SKYWARN Program

NWS State College has over 3,000 trained spotters

- State-Wide, there are about 10,000 spotters
- Nationally, there are nearly 300,000 trained spotters!

<u>Note:</u> *Although you are receiving your training today from the State College office, your training is portable*

- *If you move, contact your new "local" office and we can start the process to transfer your credentials*

SKYWARN Program

Today's class will cover basic aspects of observing weather, and emphasize the <u>accurate reporting</u> of those observations

- Review of some key definitions
- A look at different weather elements

When the course is complete, you will be a certified member of the national SKYWARN Team!

NWS Products: A 3–Tiered Approach

Outlook vs. Watch vs. Warning

OUTLOOK: *possible* weather event in the future

- Lower confidence...a [??] chance of occurrence
- Lead time can range from about 3 to 7 days
- No details, either in timing or severity...just a "heads-up"

WATCH: Conditions are *favorable* for a given weather event

- Still not a Certainty...in fact the chances of occurrence are [??]
- Lead Time can range in time from a few hours to several days
- Some Watches will result in bad weather...some will not.

WARNING: Conditions *imminent* (or extremely likely) for a given weather event

- Not necessarily 100% certainty, but getting there [??]
- Lead Time can range from a few minutes (Severe) to about a day (Flood, Winter)

Product Guide - Outlook

- Text Product: HWO (Hazardous Weather Outlook)
- Storm Prediction Center – Specialized graphical Outlooks for Severe Weather

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Hazardous Weather Outlook
National Weather Service State College PA
1243 PM EDT Wed Jun 3 2020

PAZ012-018-019-041-042-045-046-049>053-058-041645-
Northern Clinton-Northern Centre-Southern Centre-Northern Lycoming-
Sullivan-Southern Clinton-Southern Lycoming-Union-Snyder-Montour-
Northumberland-Columbia-Schuylkill-
1243 PM EDT Wed Jun 3 2020

This Hazardous Weather Outlook is for central Pennsylvania.

.DAY ONE...This afternoon and tonight.

Isolated strong to severe thunderstorms with localized damaging wind
gusts 60 mph or greater and large hail exceeding 1 inch in diameter
are possible late this afternoon and evening. An isolated weak,
short- lived tornado is also possible.

.DAYS TWO THROUGH SEVEN...Thursday through Tuesday.

The probability for widespread hazardous weather is low.

.SPOTTER INFORMATION STATEMENT...

Spotter activation is not expected at this time.
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Severe Weather Outlooks

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 58 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

Product Guide - Watch

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378
WWUS61 KCTP 031408
WCNCTP

WATCH COUNTY NOTIFICATION FOR WATCH 242
NATIONAL WEATHER SERVICE STATE COLLEGE PA
1008 AM EDT WED JUN 3 2020

PAC001-013-021-027-033-035-037-041-043-055-061-067-071-075-081-
087-093-097-099-107-109-113-119-133-031900-
/O.NEW.KCTP.SV.A.0242.200603T1408Z-200603T1900Z/

THE NATIONAL WEATHER SERVICE HAS ISSUED SEVERE THUNDERSTORM WATCH
242 IN EFFECT UNTIL 3 PM EDT THIS AFTERNOON FOR THE FOLLOWING
AREAS

IN PENNSYLVANIA THIS WATCH INCLUDES 24 COUNTIES

IN CENTRAL PENNSYLVANIA

ADAMS                  BLAIR                  CAMBRIA
CENTRE                 CLEARFIELD             CLINTON
COLUMBIA               CUMBERLAND             DAUPHIN
FRANKLIN               HUNTINGDON             JUNIATA
LANCASTER              LEBANON                LYCOMING
MIFFLIN                MONTOUR                NORTHUMBERLAND
PERRY                  SCHUYLKILL             SNYDER
SULLIVAN               UNION                  YORK

THIS INCLUDES THE CITIES OF ALTOONA, BERWICK, BLOOMSBURG,
CARLISLE, CHAMBERSBURG, CLEARFIELD, DANVILLE, DUBOIS, GETTYSBURG,
HARRISBURG, HERSHEY, HUNTINGDON, JOHNSTOWN, LANCASTER, LAPORTE,
LEBANON, LEWISBURG, LEWISTOWN, LOCK HAVEN, MIFFLINTOWN,
MOUNT UNION, NEWPORT, POTTSVILLE, RENOVO, SELINSGROVE, SHAMOKIN,
STATE COLLEGE, SUNBURY, WAYNESBORO, WILLIAMSPORT, AND YORK.

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LAMBERT
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Product Guide - Warning

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737
WUUS51 KCTP 032011
SVRCTP
PAC027-035-119-032115-
/O.NEW.KCTP.SV.W.0044.200603T2011Z-200603T2115Z/

BULLETIN - IMMEDIATE BROADCAST REQUESTED
Severe Thunderstorm Warning
National Weather Service State College PA
411 PM EDT Wed Jun 3 2020

The National Weather Service in State College PA has issued a

* Severe Thunderstorm Warning for...
  East central Centre County in central Pennsylvania...
  Union County in central Pennsylvania...
  Southeastern Clinton County in north central Pennsylvania...

* Until 515 PM EDT.

* At 410 PM EDT, a severe thunderstorm was located over Monument,
  moving southeast at 35 mph.

  HAZARD...60 mph wind gusts and quarter size hail.

  SOURCE...Radar indicated.

  IMPACT...Hail damage to vehicles is expected. Expect wind damage
           to trees, roofs, and siding.

* Locations impacted include...
  Lock Haven, Mifflinburg, Carroll, Woodward, Winfield, Lamar, Mill
  Hall, Flemington, Castanea, Millheim, Blanchard, Penns Creek,
  Aaronsburg, Rebersburg, Vicksburg, Coburn, Madisonburg, Monument,
  Weikert and Bald Eagle State Park.
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BREAK

5-minutes

Winter Weather

Snow Measurements

NOT AN EXACT SCIENCE…

Need to be clear on the difference between snow **rates** and snow **accumulation**

<u>Snowfall **rates**</u> are short term accumulation amounts

- "...it's snowing at the rate of an inch an hour"

<u>Snowfall **accumulation**</u> is how much snow is falling from a storm

Snow Measurement – Equipment Needed

SNOW BOARD

- ~ 2’ x 2’ board, preferably painted white

RULER

- If you want to get fancy, find a ruler divided into tenths

FLAG

- A white board in the white snow will be hard to find!

Snow Measurement – The "official" method

STEP #1

- Find a LOCATION that is representative <u>before the storm</u>
  - Not near a building, which may affect snow / drifting
  - Not near trees and bushes – may shelter the board
  - Hardcore snow enthusiasts may have several locations to measure snow, and average them

STEP #2

- Place your Snow Board (and Flag)
  - Don't just measure in the grass, you're ruler will press into the grass below and inflate your measurements
  - Using a white snow board will lessen melting

Snow Measurement – The "official" method

STEP #3

- Measure the snow ... Use that ruler!
  - **Once every 6 hours**
    - More frequent measurements will not allow for settling and inflate totals
    - Less frequent measurements will allow for too much settling
    - 6 hour intervals is the agreed upon STANDARD
  - Wipe the board clean after your 6 hourly measurement
  - Repeat until storm is finished
    - If storm ends before your scheduled 6-hourly reading, measure when the snow stops (don't wait the full 6 hours)
  - Add your 6 hourly measurements together, that's your **Storm Total Snowfall!**

What about Snow Depth?

Snow Depth

- That's snow on the ground and NOT a sum of your 6 hourly measurements
  - Most times, snow depth is less than total snow fall (compaction)
- Again, measure on a flat, hard surface!
  - No measurements in the lawn
  - Consider wiping only a portion of your snow board each 6 hours
    - The undisturbed portion could be used as your snow depth

SUPER PAIL
0200 AM EDT Tue Mar 14 2017

SLEET and FREEZING RAIN

SLEET

- "Balls of Ice" that bounce when they fall
- Treat this similar to snow, since it accumulates

FREEZING RAIN

- A liquid that freezes on contact with the ground and forms a glaze
- Measure the accumulation of ice, generally in 1/10's of an inch

Ice Jams/River Flooding

- In the spring, river ice can break up and get caught in the river.

- Flooding is possible upstream of the ice jam.

Severe Summertime Weather

Severe Thunderstorms

- What makes a thunderstorm severe?
  - Winds ≥ 58 mph (50 knots)
  - Hail ≥ 1 inch in maximum dimension
  - Tornado
- Other threats:
  - Lightning
  - Flooding

What about those sub-severe storms?

- SPECIAL WEATHER STATEMENTS can be issued for storms that may have some impacts, but do not meet severe criteria
  - Can be issued for thunderstorms producing:
    - Winds of 30-54 mph
    - Pea to Nickel sized hail
  - These will not set off tone alerts, EAS, and rarely trigger phone apps.

NOTE: *In winter situations, conditions not meeting Winter Storm Warning criteria can be covered by an ADVISORY*

- *Don't think of an advisory as less likely occurrence than a Warning, just think of it as an event with lower impacts.*

7 2K 1SS7

River Flooding

- Forecasts handled by the River Forecast Center
  - These are for specific, gauged locations along Main Stem Rivers and large tributaries
  - Locations where it takes more than 6 hours for the waterway to respond to heavy rainfall
    - Many streams and creeks are ungauged, and are covered by Flood and Flash Flood products
  - River Forecasts are driven by....
    - Time of Year (foliage)
    - Routing of upstream water
    - Reservoir and Dam releases

Flash Flooding / Flooding

- Rapid Rises on small (ungauged) streams and creeks
  - Mainly driven by...
    - Slow moving, heavy rain producing thunderstorms
    - Repeated rainfall over the same area
    - Dam Breaks
  - These streams and creeks respond in minutes to a few hours after a heavy rain event
  - Major threat to LIFE and PROPERTY

  - Long duration moderate rain may also cause flooding, but at a slower rate.

(Areal) Flooding

- Slower Rises on small (ungauged) streams and creeks
  - Mainly driven by...
    - Slow moving, prolonged rain events
    - Repeated rainfall over the same area
  - Situations where streams and creeks respond after several hours of rain
  - More of a threat to PROPERTY than LIFE

Thunderstorm Ingredients

1. Instability
2. Moisture
3. Lift

Most severe storms also require **<u>wind shear</u>**

Ordinary Thunderstorms

Towering Cumulus

Mature Storm

Dissipation

Multi-cell Thunderstorms

- Upper-level winds carry the first cell downstream with a new cell forming upwind of the previous cell.
- If the upper-level wind is opposite of the low-level winds, **backbuilding** can develop – leading to flash flooding.
- A line of multi-cell thunderstorms is called a squall line.

Supercell Thunderstorms

- Characterized by updrafts that can attain speeds over 100 mph and are able to produce giant hail with strong or even violent tornadoes.
- Downdrafts can produce downbursts/outflow winds in excess of 100 mph.
- Increased risk for tornadic supercells when winds turn clockwise with height (veering).

Thunderstorms can produce different types of damaging winds

- Straight Line Winds
- Downburst Winds
- Tornadoes

Straight Line Winds

- The most common wind damage type we see here in Pennsylvania
  - Often the result of a Squall Line
- Result from a combination of the <u>forward movement</u> of the storm, and <u>transport</u> of high winds aloft <u>down to the surface</u>.
- Straight line winds may occur ahead of the actual "storm" at the leading edge (or gust front)

Straight Line Winds

35 mph winds at 5000 feet

+

Downdraft-Enhanced Winds

=

Surface wind gusts of 65 mph

Straight Line Winds

- Winds produce damage generally in a single direction, oriented parallel to the direction the storms were coming from
- Can be VERY DESTRUCTIVE, and cover a LARGE AREA
  - Winds up to 100 mph or more!
  - Often accompanied by many reports of damage throughout the county.

Straight-line wind event May 15, 2018

Straight Line Winds

Damage shows a clear UNI-DIRECTIONAL pattern

STRAIGHT LINE WIND "fingerprint"

Downburst Winds

- Similar to of Straight Line winds, but a little different

- Downburst damage driven by the <u>outrush of air</u> from aloft brought down by the thunderstorm, not on the movement of the storm itself.

- Damage often more concentrated than Straight Line Winds
  - Winds can exceed 150 mph...**That's the equivalent of an EF3 Tornado!**

Microburst series. Photos by William Bunti

Downburst

Damage shows a clear DIVERGING pattern

DOWNBURST "fingerprint"

Downburst Terms

Downburst

- Generic Term for a specific type of wind damage, where wind is descending from above, impacting the ground, then spreading out at the surface

  - **<u>Microburst</u>** – Downburst wind damage covering an area 2.5 miles or less

  - **<u>Macroburst</u>** – Downburst wind damage covering an area more than 2.5 miles

BREAK

5-minutes

Tornado

- Very specialized wind event
  - It takes unique conditions aloft in the storm, and very close to the ground, to produce a Tornado
- About 1 in 10,000 thunderstorms produce a tornado
  - Pennsylvania sees about **15** tornadoes per year.
  - Tornadoes usually produce a very small and defined area of damage (path)

    - **Remember:** the degree of damage does not indicate whether or not there was a tornado!

April 2019 – A record breaking month

County	Date	Hour	Rating
Crawford	4/14	6 PM	EF-0
Venango	4/14	7 PM	EF-0
Venango	4/14	7 PM	EF-0
Warren	4/14	8 PM	EF-2
Union	4/15	12 AM	EF-1
Columbia	4/15	1 AM	EF-2
Sullivan	4/15	1 AM	EF-1
Lackawanna	4/15	1 AM	EF-0
Susquehanna	4/15	1 AM	EF-1
Fulton	4/19	7 PM	EF-1
Franklin	4/19	7 PM	EF-2
Huntingdon	4/19	7 PM	EF-1
Juniata	4/19	7 PM	EF-1
Mifflin	4/19	7 PM	EF-2

Total 2019 Tornadoes: 14

NEW Record for April

Previous: 11-1991

Strength	Count
EF-0 (65-85mph)	4
EF-1 (86-110mph)	6
EF-2 (111-135mph)	4

A look at a Tornado on Doppler Radar

Tornado Winds

- Much different than Straight Line and Downburst Winds
  - Pattern of Damage shows signs of CONVERGENCE... winds being pulled into the center of the tornado

Tornado Debris Signatures

1. Identify a valid velocity circulation
2. Low correlation coefficient (CC <.85) ***collocated*** with circulation
3. Sufficient reflectivity (>35 dbZ)
4. Lo lectivity (Z

Tornado Debris Signatures

Tornadoes – Some Terms

- **Wall Cloud** – Rotating lowering (and often rain-free) section of a thunderstorm.
    - Rotation is the key!
    - Sign that conditions within the storm are right for producing a tornado
        - But what are the low-level conditions below the storm?

- A Wall Cloud, while looking impressive, **is not causing damage!**

Funnel Cloud

Funnel Cloud – Fast spinning funnel descending from the thunderstorm cloud...but not yet reaching the ground!

- Rotation is the key!
- Sign that conditions **within** the storm are right for producing a tornado
  - Again, what about conditions below the storm?

- A Funnel Cloud, while looking very impressive, is NOT causing damage.
  - But it may become a tornado soon!

Funnel cloud

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

Tornadoes

Tornado – Rapidly rotating funnel of air ***in contact with the ground!***

- Rotation is the key!
- Look for Damage: No Damage = No Tornado!

Tornado Damage

Damage shows a clear CRISS-CROSS pattern

Tornado Damage

Damage shows a clear CONVERGENT pattern

TORNADO “fingerprint”

Damage shows a clear CYCLONIC turning

Tornado Damage– Oct 2, 2018

Pretty Impressive...right?

Spotter Registration

What a spotter IS

- ✓ Observes the weather
- ✓ Communicates
- ✓ Stays safe!
- ✓ Critical role in helping the National Weather Service and local officials

What a spotter ISN'T

- x Weather expert
- x Storm chaser *(though almost all storm chasers are spotters!)*
- x Above the law
- x Immune to the laws of physics

What to Report

Time	Location	Condition	Source
When did it occur?	**Where?** *(Unsure? Give us a nearby intersection or landmark and we'll figure it out!)*	**What are you reporting?**	**Who are you?**

"Hi, this is John. I'm one of your spotters and I'm calling to report hail. I'm located in Lancaster City and we've got at least quarter size hail falling right now, maybe larger."

Reporting Tips

1. Late reports are okay!
2. We really appreciate your pictures and videos!
3. Please remember to tell us where you are, even if it's just a highway and a city reference!

Time

Location

Condition

Source

"Yo, it's getting dark here. Looks like it might be a tornado!"

Storm Reports for the National Weather Service

Time

When did it occur?

Location

Where?

(Unsure? Give us a nearby intersection or landmark and we'll figure it out!)

Condition

What are you reporting?

Source

Who are you?

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 ¼ mile

Sleet

- *Any occurrence and any accumulation*

Freezing Rain

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

Storm Reports for the National Weather Service

Time

When did it occur?

Location

Where?

(Unsure? Give us a nearby intersection or landmark and we'll figure it out!)

Condition

What are you reporting?

Source

Who are you?

Wind Damage

- *Uprooted or downed trees*
- *Large branches down*
- *Wires down*
- *Damaged infrastructure*
- *Include photos if possible*

Hail

- *Hail of any size*
- *Please measure hail with a ruler or a common object for accurate sizing*
- *If possible, measure the weight and include photos*

Tornadoes and Funnel Clouds

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

Flooding

- *Any significant (uncommon) flooding*
- *Water over roads*
- *Streams rising to near bank full*
- *Include photos if possible*

How to Report

UNLISTED:
800-697-0010
LISTED:
814-231-2408

@NWSStateCollege

US National
Weather Service
State College, PA

ctp.stormreports@noaa.gov

What's next?

EMAIL WILL BE SENT OUT TOMORROW

What to expect:

- Are you a spotter already?
- Contact Information
- Course Evaluation

NOT A SPOTTER YET?

- You'll receive a spotter confirmation letter.
  - Please be patient as we process 600+ registrants.

A note about spotter IDs

- We are discontinuing issuance of Spotter IDs
- If you already have one – you can keep!
- If you don't have one yet, we'll just ask for your name!

Thank You!

John Banghoff

John.Banghoff@noaa.gov

Rachel Gutierrez

Rachel.Gutierrez@noaa.gov

@NWSStateCollege

/NWSStateCollege

/NWSStateCollege

www.weather.gov/ctp

Any Questions?