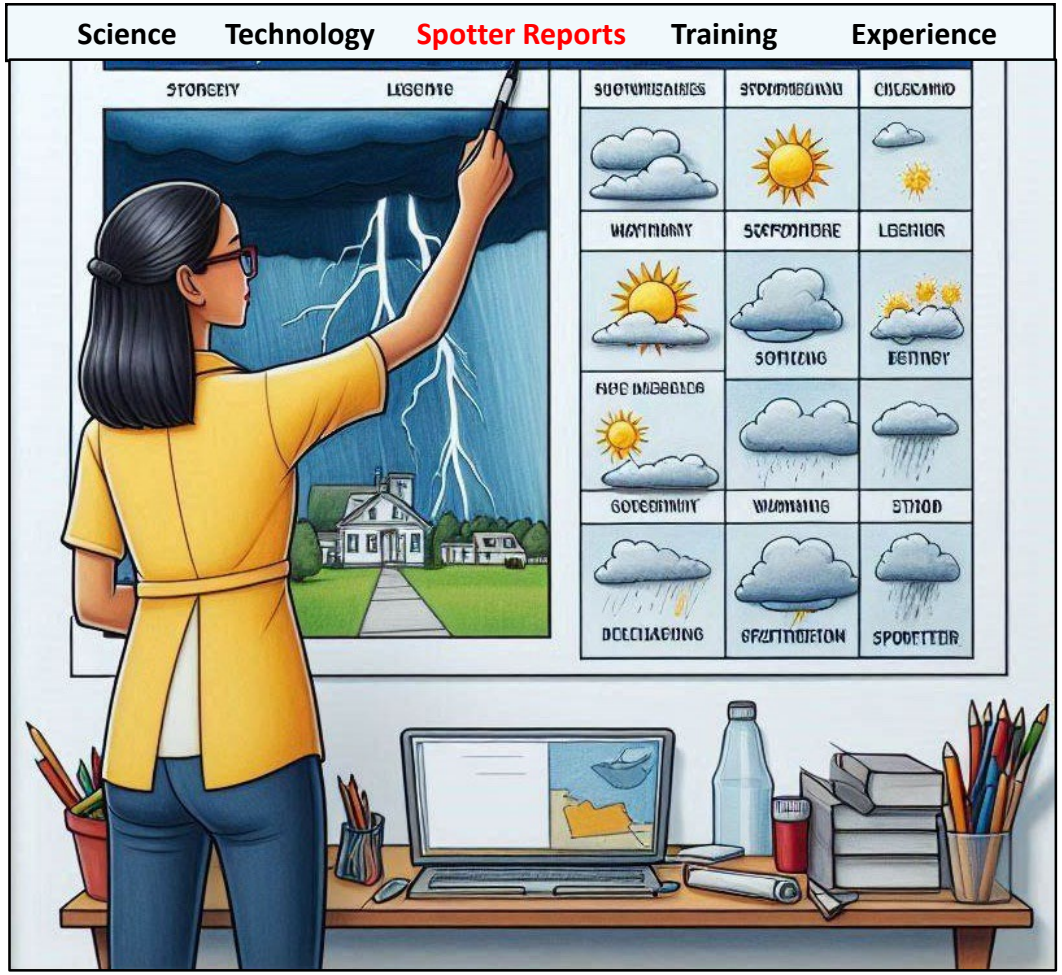
SKYWARN Spotter

Section 1

Spotter’s Role and Reporting Procedures

Spotter Reporting Procedures

- Effective spotter reports are a critical component of NWS severe weather operations
- NWS meteorologists use science, technology, training, experience, and spotter reports when making warning decisions
- An effective spotter report is one that is timely, accurate, and detailed



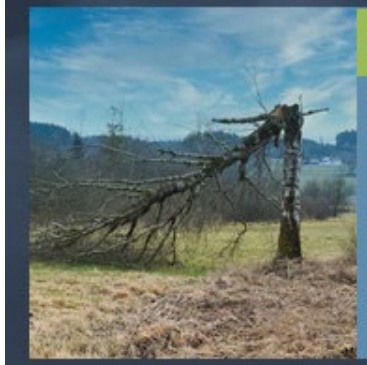
What Should You Report?

Time
- **When** did it occur?

Location
- **Where**?

Condition
- **What** are you reporting?

Source
- **Who** are you?



Wind Damage / Speed
- Uprooted or downed trees
- Large branches down
- Wires down
- Damaged infrastructure
- Include photos if possible
- Wind Speeds

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

Hail
- Hail of any size
- Please measure with a ruler or common object for most accurate report
- If possible, measure weight and include photos

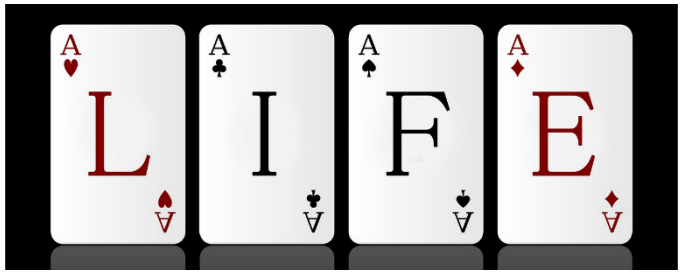
Flooding
- Any significant (uncommon) flooding
- Water over roads
- Streams rising to over bank full
- Include photos if possible

SKYWARN Spotter

Section 2

Thunderstorm Hazards and Spotter Safety

ACES' for Personal Safety



- ***AWARENESS*** – **Remain aware of your surroundings at all times. Includes changing weather conditions as well as physical structures and roads**

- ***COMMUNICATION*** – **Let others know your location often and have multiple methods to communicate**

- ***ESCAPE ROUTES*** – **Know your possible escape routes, have more than one**

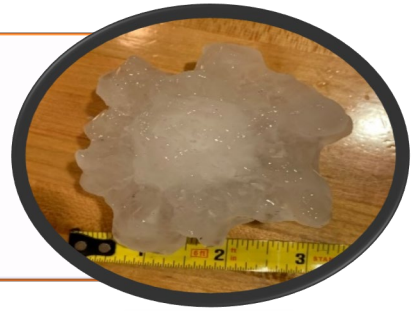
- ***SHELTERS*** – **In case escape routes are unavailable, know where safe zones or shelters are located nearby**

What Makes a Storm Severe?

Severe/Tornado/Flash Flood Criteria and Warning Thresholds

Severe Thunderstorm Warning

- Thunderstorm wind gusts ≥ 58 mph & or:
- Hail ≥ 1 inch in diameter



Tornado Warning

- Doppler Radar indicated strong rotation
- Confirmed reports of a tornado
- Confirmed reports of funnel cloud in a favorable environment for tornadoes and radar support

Flash Flood Warning

- 6 inches or more of flowing water over roadways
- A rapid rise in water that is a threat to life & property

Tornadoes

Basic Definition, But Not All Tornados Are The Same

- Violently rotating columns of air descending from thunderstorm clouds and ***in contact with the earth***
- Often visible as a funnel shaped cloud, but not always
- Winds can be as high as 200+ MPH (EF5)
- ***Usually*** less than a few hundred yards wide, last a few minutes, and have a path of 1 mile or less

Tornado Types and General Strengths

Supercell Tornadoes. Large and Violent, Can Stay on Ground for Hours

Tornado Types and General Strengths

Most Tornadoes in Indiana are from Non-Supercell Thunderstorms and are EF0 or EF1

- Not all tornadoes come from supercells
- Lines of strong thunderstorms (QLCS) produce tornadoes that tend to be weaker and shorter-lived on average than those associated with supercells

- A ***landspout*** tornado forms while the thunderstorm cloud is still growing and there is no mid level rotating updraft
- The spinning motion originates near the ground and grows upward

Tornado Ratings

Low End of EF-Scale ~ 94% of Indiana Tornadoes (EF0/EF1 ~ 85%) Since 1950

EF Rating	Wind Speeds	Expected Damage
EF-0	65-85 mph	"Minor" damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.
EF-1	86-110 mph	"Moderate" damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.
EF-2	111-135 mph	"Considerable" damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.

Tornado Ratings

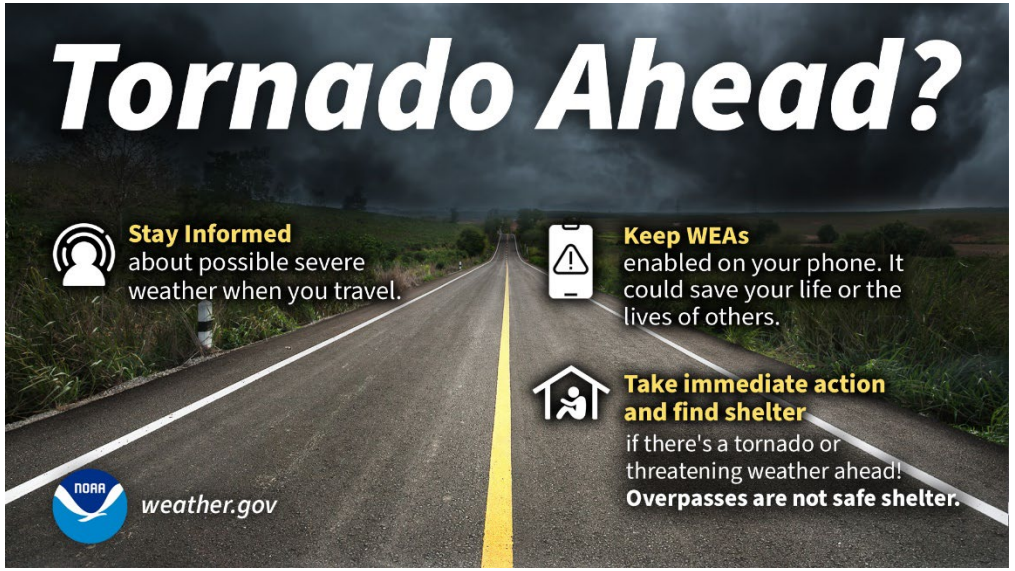
High End of EF-Scale ~ 6% of Indiana Tornadoes (Only 1 EF5 Day Since 1950)

EF-3	136-165 mph	**"Severe" damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose bark.**
EF-4	166-200 mph	**"Extreme" damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.**
EF-5	> 200 mph	**"Massive/Incredible" damage: well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees usually completely debarked, stripped of branches and snapped.**






Tornado Safety Tips



- Personal safety is your primary objective!
- Shelter in a sturdy building away from windows on the lowest floor, interior room
- Cover your head with hands, blanket, etc.
- Mobile home – find a safer building long before storm arrives, preferably when a watch is issued
- In vehicle – Drive away; abandon to ditch as last resort.

Flash Flooding

Evaluate the situation and surroundings. Seek Higher Ground Immediately!

Flash Flooding

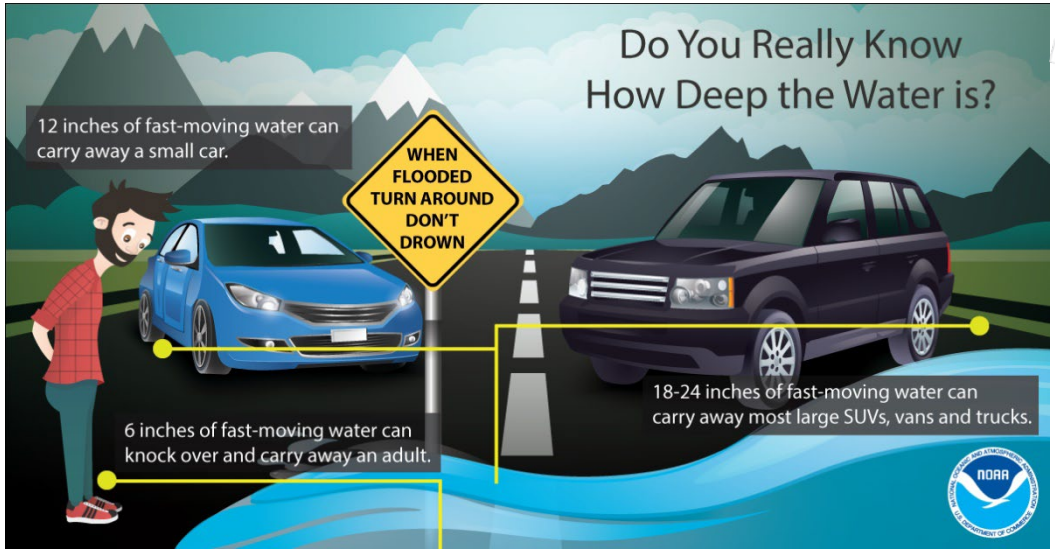
- Rapidly rising water, lives in ***immediate danger***
- "Unusual" type flooding
- Be careful using this phrase!

Streets, ditches, small streams/creeks flooding

- "Areal" Flooding
- "Nuisance" or "Typical" flooding. Slower rise
- Is water standing or flowing?
- Let us know if there is any visible debris

Flash Flooding Safety

- Turn Around, Don't Drown!
- Flash flooding is particularly dangerous at night
- Flooding causes more fatalities each year than any other thunderstorm hazard
- More than half of all flood related drownings involve a vehicle



Lightning Reporting

- **No Need to Report, Unless it Strikes People or Creates Damage**
- All thunderstorms have lightning
- The amount of lightning does not necessarily relate to the severity of a storm
- Technology allows meteorologist to monitor lightning strikes in real time

Lightning Safety

- Safe Place: INSIDE a fully enclosed building with plumbing or wiring
- Automobile is next safest place
- Outdoors: DANGEROUS
- When Thunder Roars, Go Indoors Immediately

Straight-line and Downburst Wind Reporting

- Does the impact of the wind match what you are estimating for speed?
- For example, if you are reporting a 75 mph wind gust, is there extensive structural damage or trees uprooted?
- Inconsistencies between your estimate and the reported damage will cause NWS to question your report
- NEVER use wind speeds listed in the NWS warning text as your guide

Estimating Wind Speed

32 – 38 mph

Whole trees in motion

39 – 46 mph

Twigs & small branches breaking

47 – 54 mph

Some structural damage (shingles blown off), Large branches breaking

55 – 65 mph

Structural damage (Parts of roofs blown off), Trees uprooted

66+ mph

Widespread structural damage

Whole roof removed, walls blown in

Reporting Wind Damage

Let us know when you observe any damage such as:

- Tree Damage
  - Extent of damage
    - One or more, full tree or limbs, large area of woods
  - Uprooted or snapped
  - Height, diameter, general size
  - Health of tree or limbs. Look for signs of rot

- Utility lines or poles down
- Outbuildings or vehicles overturned
- Loss of roofing materials, siding, windows, etc
- Any other significant wind or damage noted

Straight-line and Downburst Wind Safety

- Downbursts can occur suddenly with an abrupt change in wind speed and direction
- Keep a firm grip on your vehicle's steering wheel to maintain control.
- If you can do so safely, point your vehicle into the wind to minimize the risk of the vehicle being blown over
- Be prepared for sudden reductions of visibility due to blowing dust or heavy rain associated with downbursts
- Spotters observing from a substantial building should move away from windows as strong winds approach

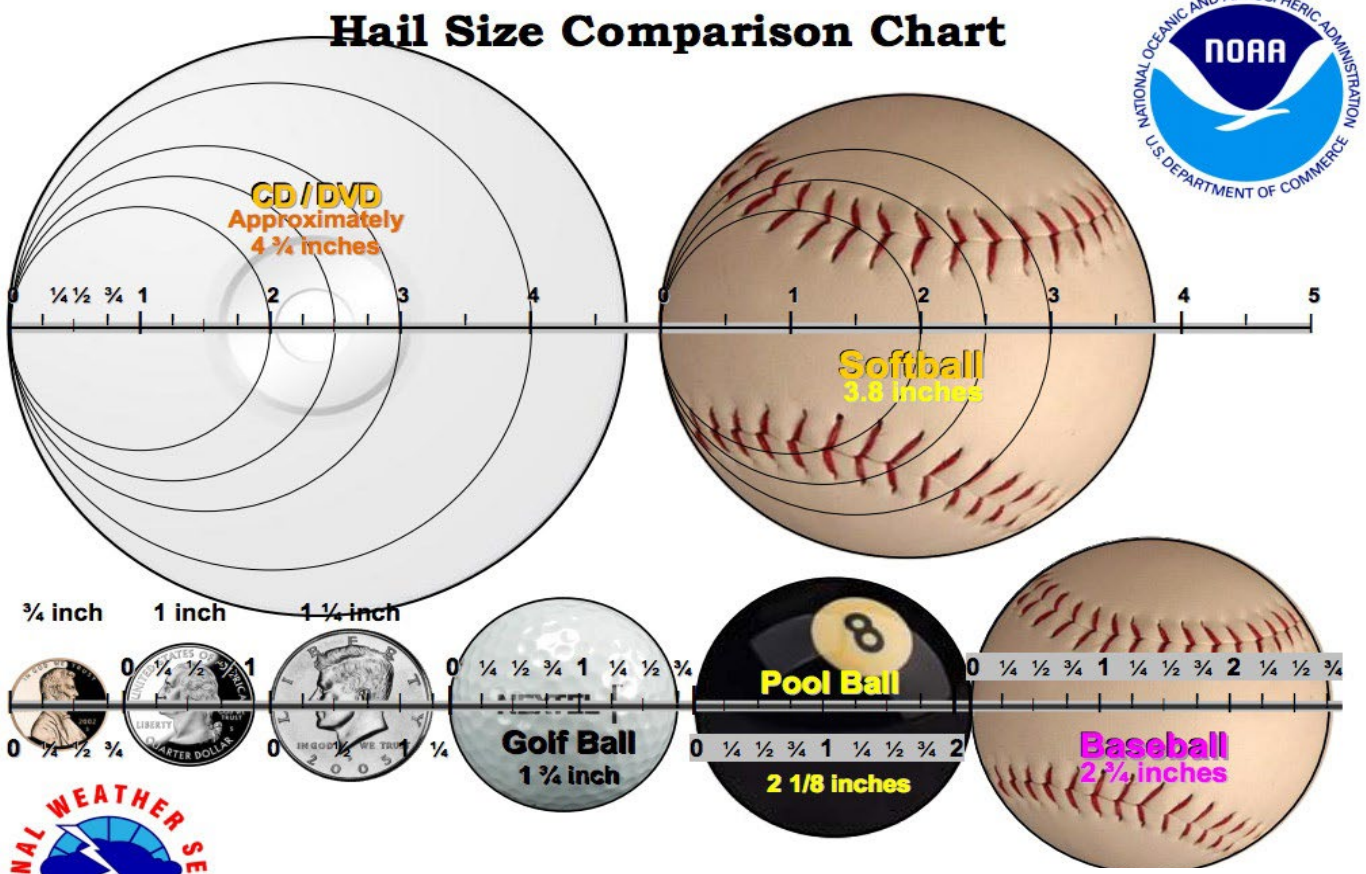
Reporting and Measuring Hail

Let us know when hail approaches or exceeds the size of a penny or dime (larger than ½”)

- Select the largest stone(s) you can find
- Measure across the widest part of the stone
- Report diameter of largest stone
- Protect yourself, stay indoors until safe!

Reporting and Measuring Hail

Use Common, Standard Size Objects When Reporting



0.25 inches	Pea	2.00 inches	Hen Egg
0.75 inches	Penny	2.50 inches	Tennis Ball
1.00 inches	Quarter	2.75 inches	Baseball
1.50 inches	Ping Pong Ball	3.80 inches	Softball
1.75 inches	Golf Ball	4.50 inches	Grapefruit

How to Report to the NWS?

Contact Your Local NWS Office. Information Below is for NWS Indianapolis

Please Make Reports, It Could Save a Life!

- Call us @ 1-800-499-2133
  - Spotter reports only!
- Social Media
  - Twitter - @NWSIndianapolis
  - Facebook – @NWSIndianapolis
    - Hashtags - #INwx #NWSIND and any weather related terms such as #Hail or #Tornado
- Email photos with details to:
  - nws.indianapolis@noaa.gov
- Web Reports
  - inws.ncep.noaa.gov/report
  - mping.nssl.noaa.gov
- Amateur (HAM) Radio

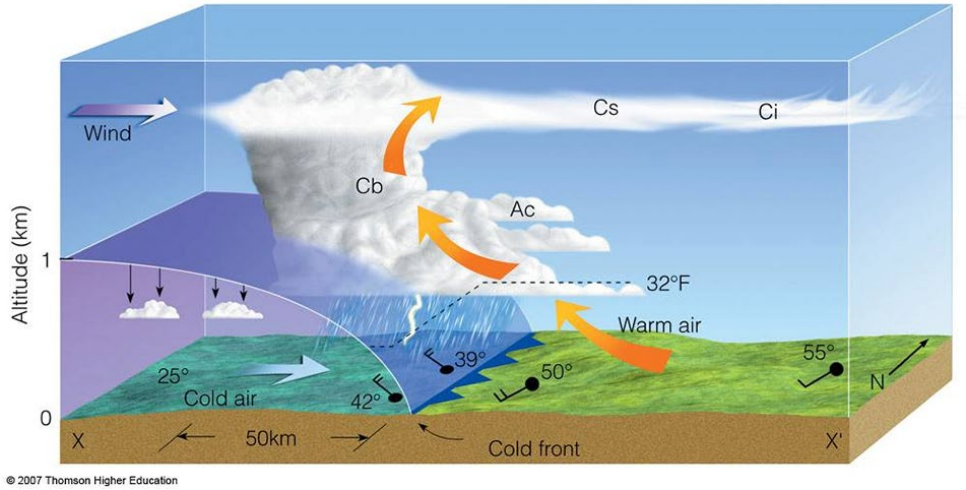
SKYWARN Spotter

Section 3

Basic Meteorology and Thunderstorm Structure

Thunderstorm Ingredients

How do Thunderstorms Develop?

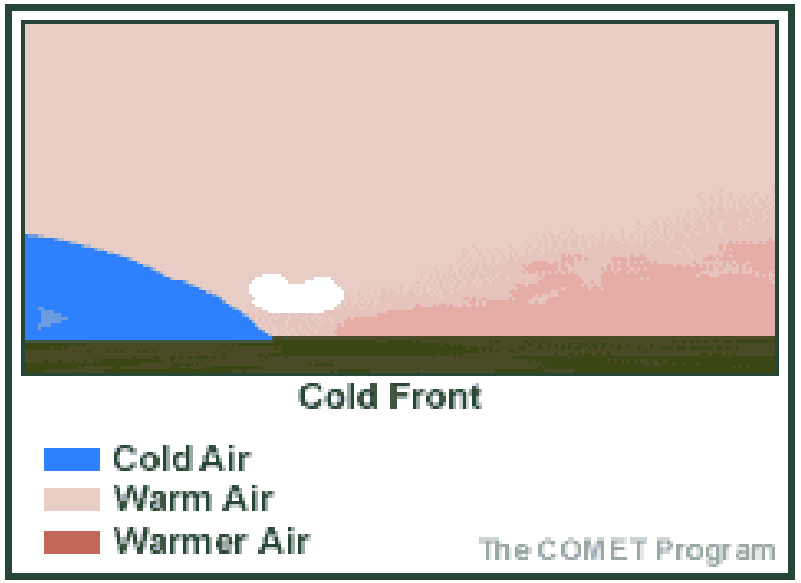


Ingredients for General Thunderstorms:

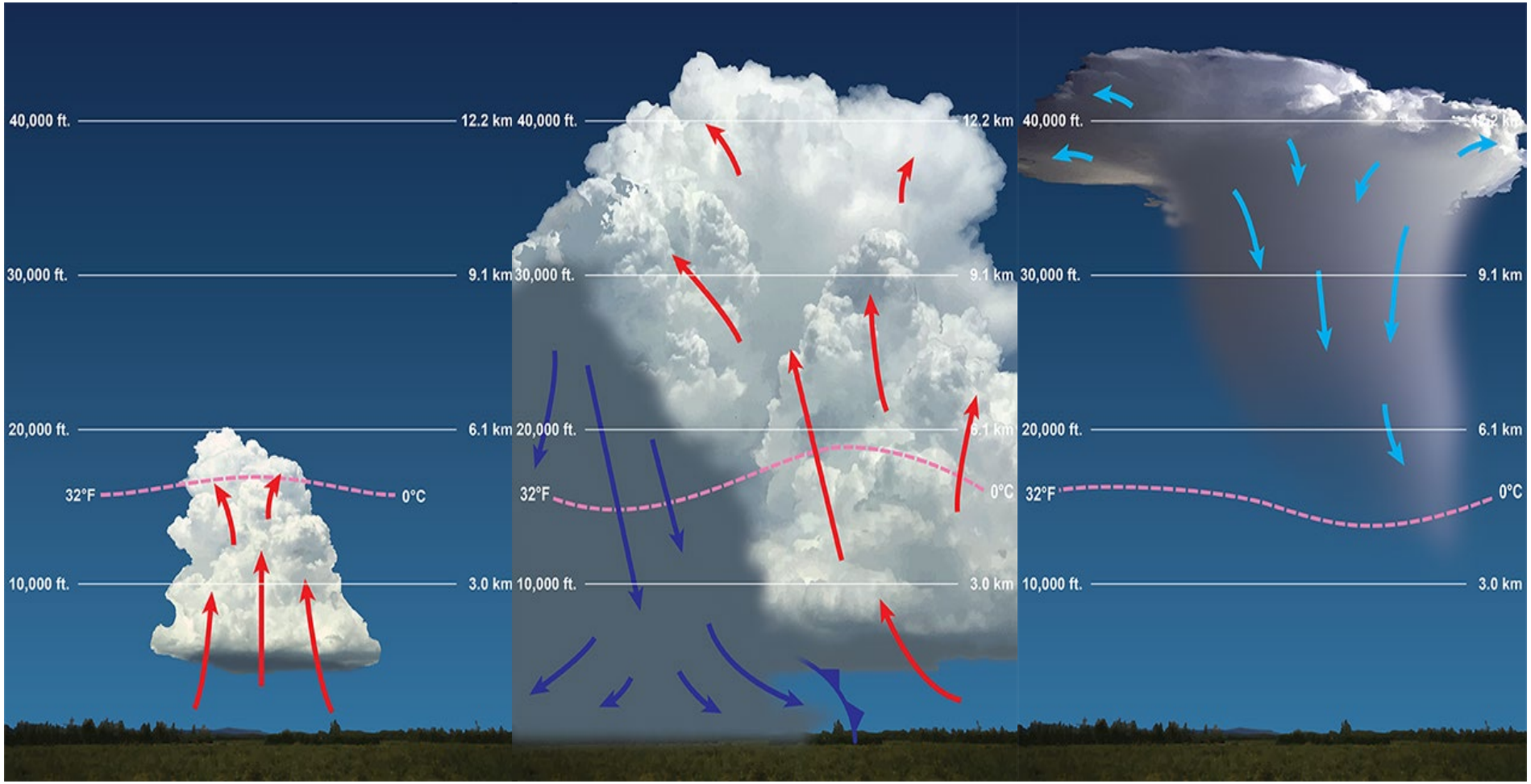
- **Moisture** - Surface dew points are a measure of moisture and very important for thunderstorm development

- **Instability** - Warm, moist air at the surface. Cooler, drier air aloft
  - The atmosphere is UNSTABLE and air will rise more easily on its own or helped by a front (CAPE)

- **Lifting mechanism or "Trigger"**
  - Warm/cold fronts, outflow boundaries from other storms, jet stream, terrain



Basic Thunderstorm Life Cycle



Cumulus **Mature** **Dissipating**

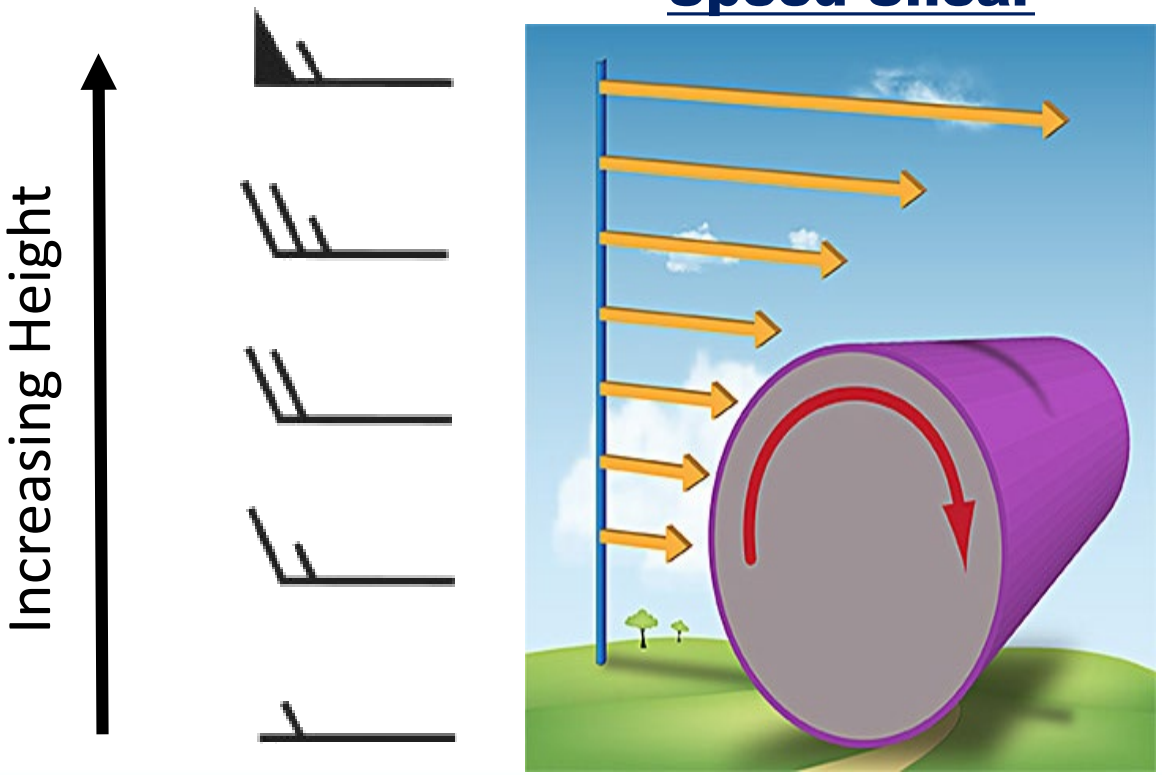
The Role of Wind Shear

What is Wind Shear and Why is it Important to Know?

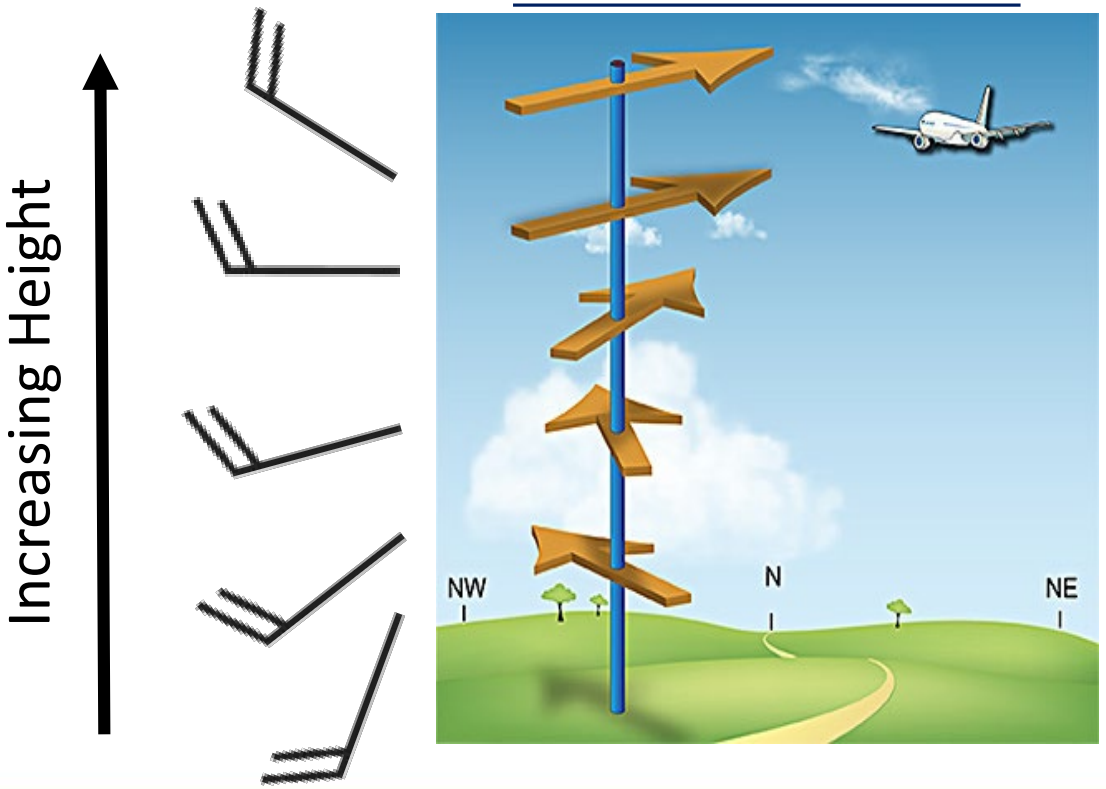
For Organized, Possible Severe Thunderstorms: WIND SHEAR is Needed!

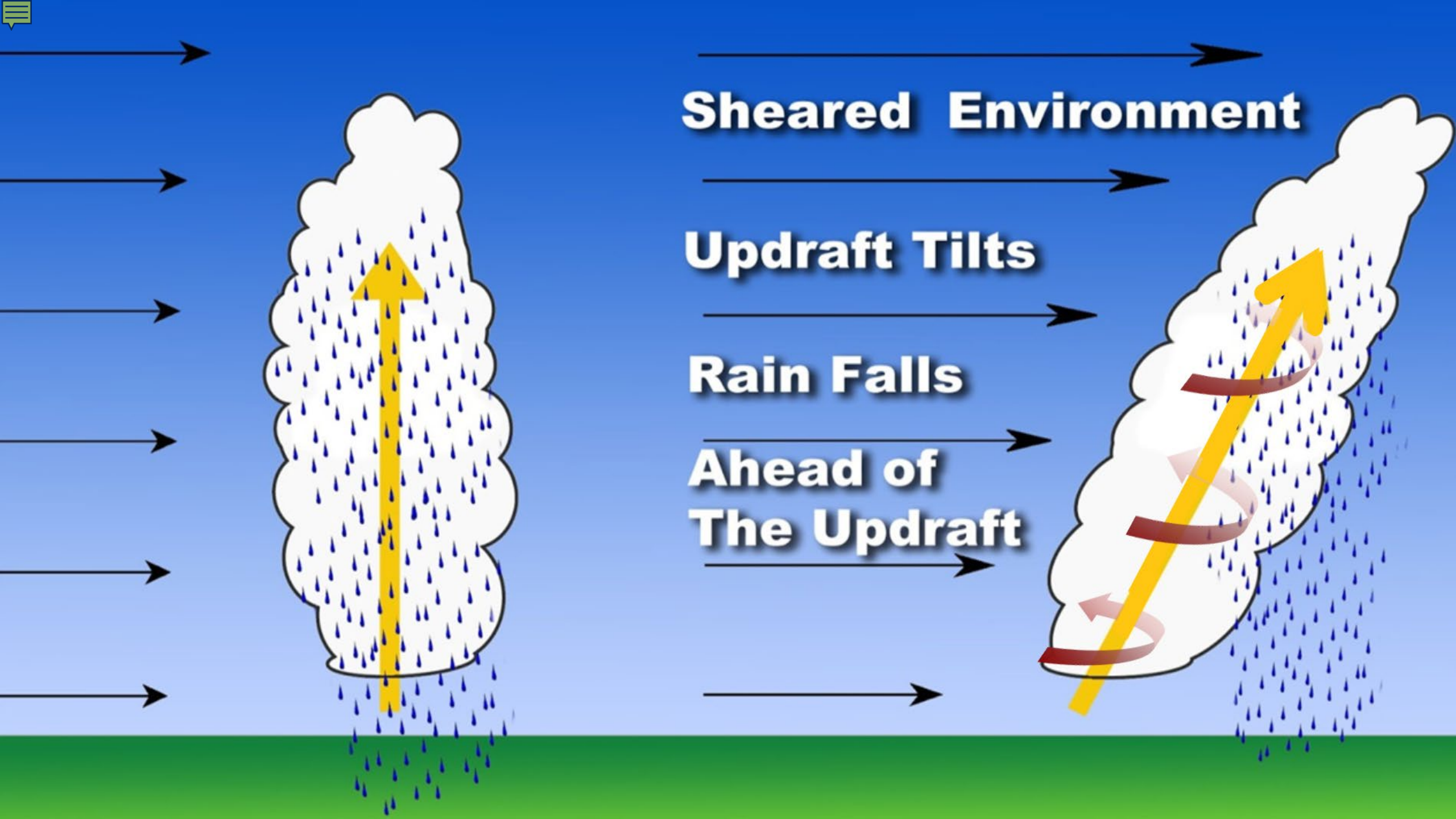
Speed and Directional shear help determine storm type

Speed Shear



Directional Shear




Sheared Environment
Updraft Tilts
Rain Falls
Ahead of
The Updraft

Watch Versus Warnings

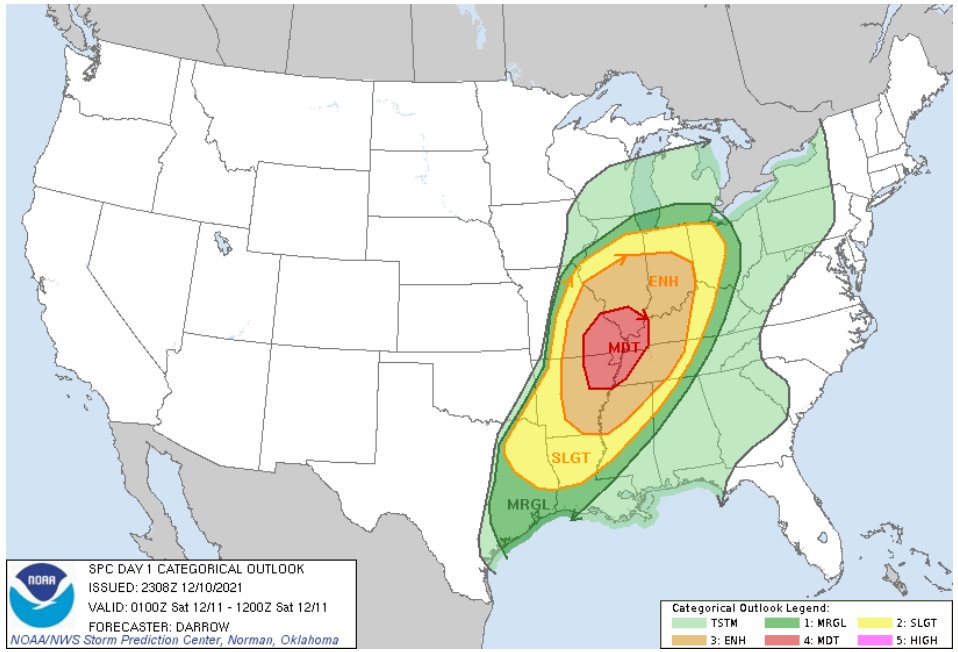
Spotters Need to Know When to Be Ready and When to take Action

- ***Watch*** - Covers large areas and usually issued “hours” ahead of severe weather
- ***Warning*** - Covers small areas and usually issued “minutes” ahead of severe weather

Outlooks and Watches

Spotters Need to Know When to Be Ready and When to take Action

The Storm Prediction Center issues Convective Outlooks and Watches



Storm Prediction Center Convective Outlooks
Days 1,2,3 and Days 4-8 combined

Understanding Severe Thunderstorm Outlook Categories

LEVEL	CATEGORY	DETAILS	SUMMARY	How many severe storms are possible?	How bad could the worst storms be?
	General Thunderstorm	Although severe weather is not expected, ***all*** thunderstorms can produce deadly lightning, gusty winds, and small hail.	No severe thunderstorms expected	None – Numerous	Similar to storms your area experiences many times per year
1	Marginal (MRGL)	**Some storms could be capable of damaging winds and severe hail. Localized tornado threat could develop.**	Isolated severe storms possible	None – Numerous	Similar to storms your area may experience several times per year
2	Slight (SLGT)	**Increased confidence that some storms will contain damaging winds, severe hail, and/or tornado potential.** *A few severe storms could be significant*	Isolated to scattered severe storms expected	None – Numerous	Similar to storms your area may experience a few times per year
3	Enhanced (ENH)	**High confidence that several storms will contain damaging winds, severe hail, and/or tornadoes.** *Several severe storms could be significant*	Scattered to numerous severe storms expected	None – Numerous	Similar to intense storms your area may only experience once or twice per year
4	Moderate (MDT)	**High confidence that many storms will contain damaging winds, severe hail, and/or tornadoes.** *Several severe storms likely to be significant*	Scattered to numerous severe storms expected	None – Numerous	Similar to intense storms your area may only experience once per year or less
5	High (HIGH)	**High confidence that an outbreak of storms will contain tornadoes, damaging winds, and/or severe hail.** *Tornado outbreak and/or widespread damaging winds*	Numerous severe storms expected	None – Numerous	Very intense storms your area may only experience once or twice in a lifetime

DEFINITIONS

Severe Storm

Any storm that contains at least one of the following:

Wind gusts of at least 58 mph

Hail at least one inch in diameter

Tornado

Significant Severe

Any of the following hazards:

Wind gusts of at least 75 mph

Hail at least two inches in diameter

Tornado of at least EF-2 rating

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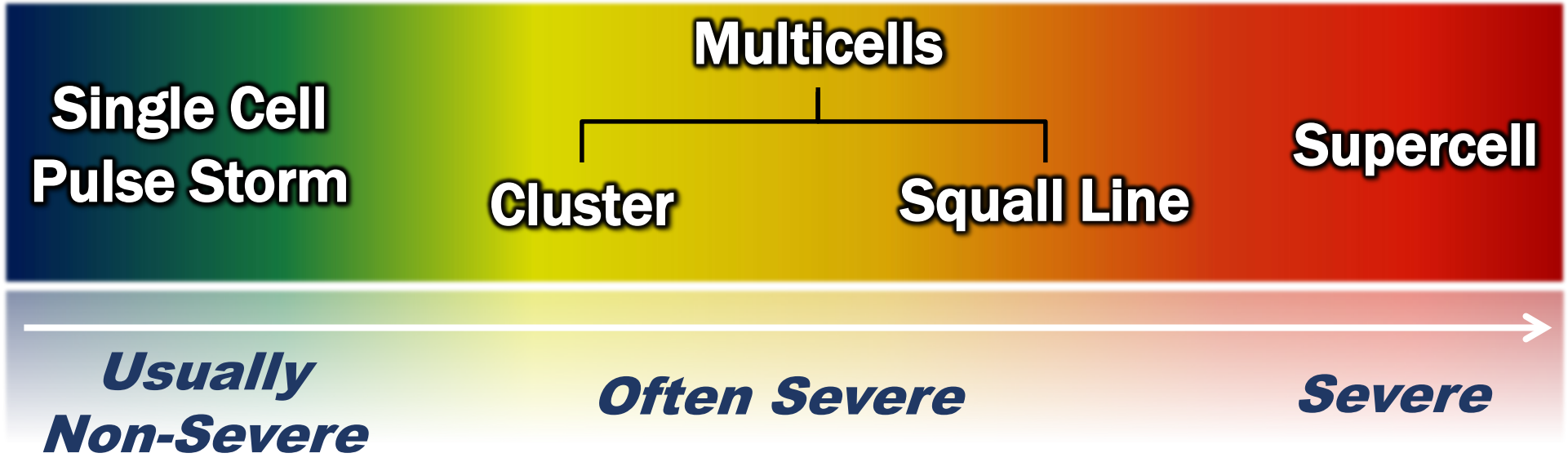
SKYWARN Spotter

Section 4

Storm Types, Structure and Severe Weather

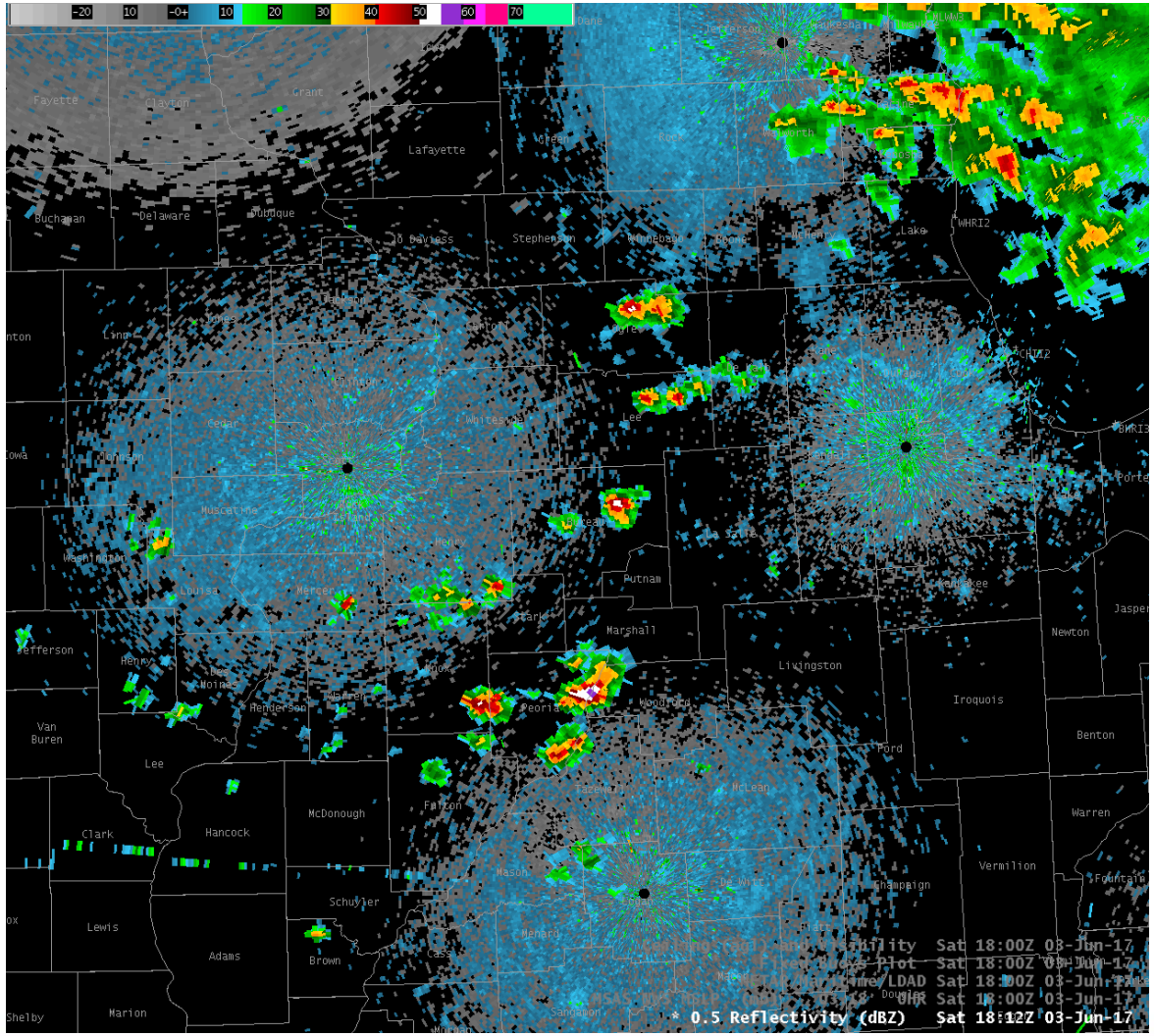
Thunderstorm Types



- Storms don't always fit into these exact types
- Can change type one or more times during their existence
- Atmospheric conditions will determine type of storm

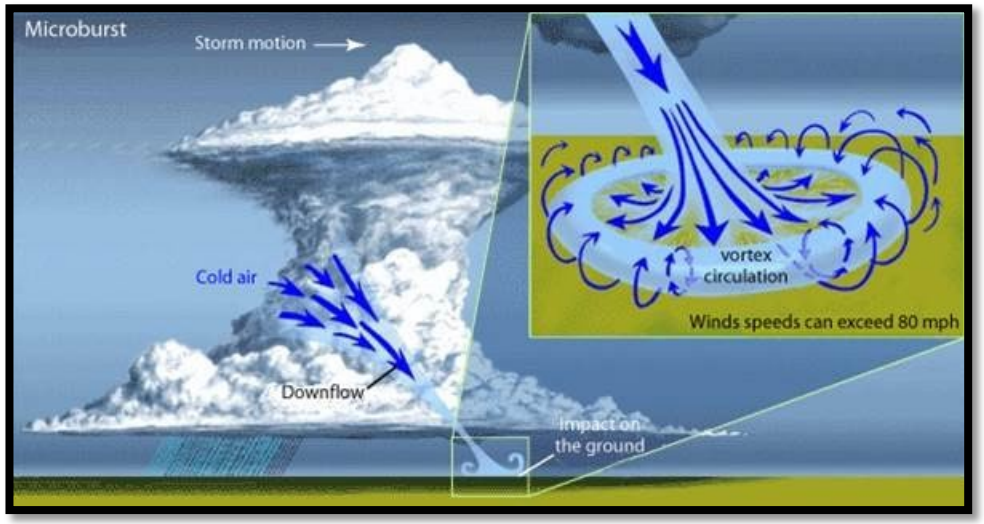
Single Cell or “Pulse” Storms

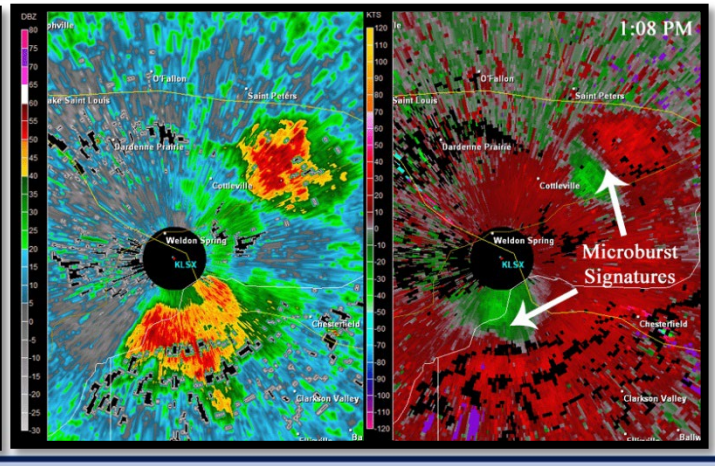
- Can have many storms at once
- Intersecting “Outflow” boundaries
- Brief, isolated severe “downbursts” or “Microbursts” possible
- In a few cases, intersecting boundaries and new storms could lead to brief and weak tornadoes



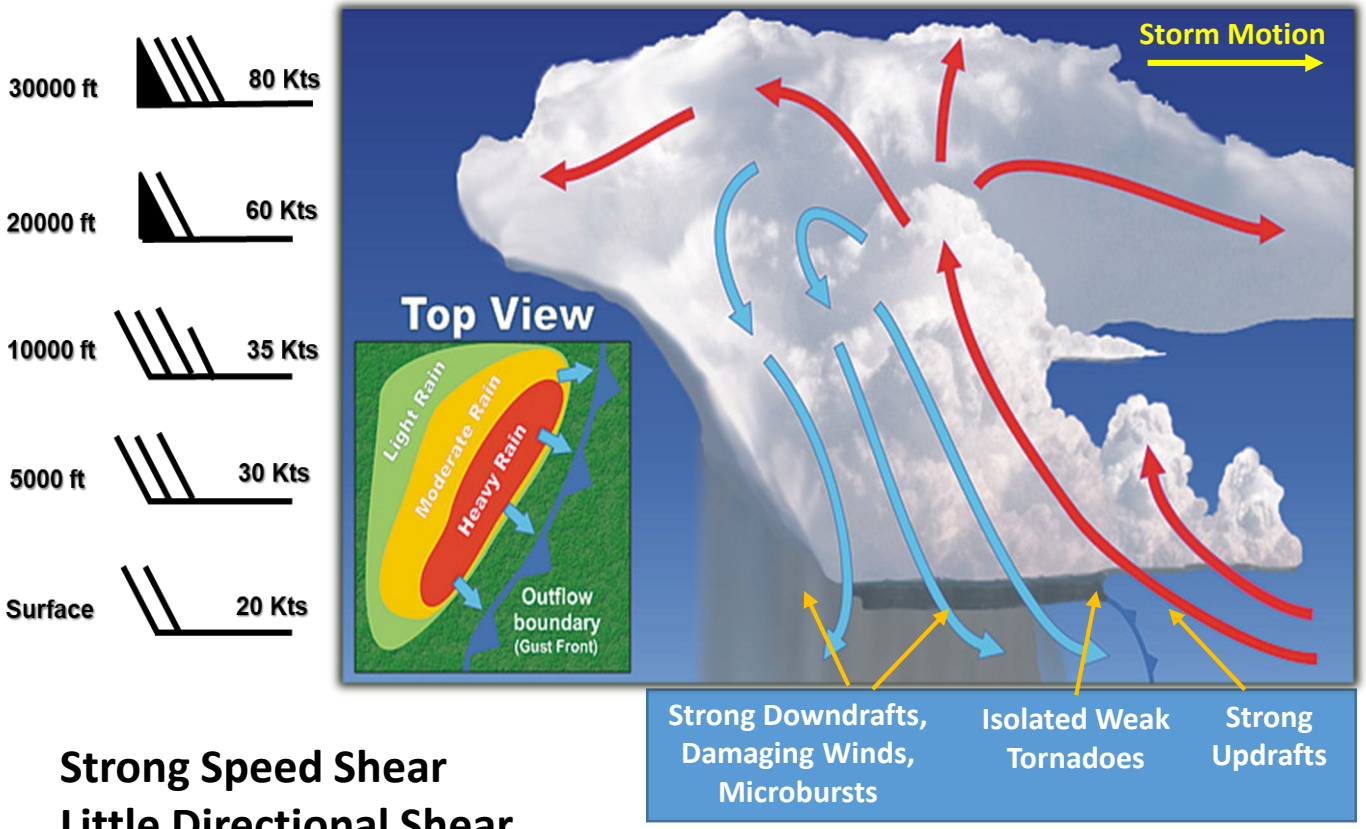
Single Cell or “Pulse” Storms

Microbursts May be Intense with Small Damage Areas, Similar to Brief Tornado

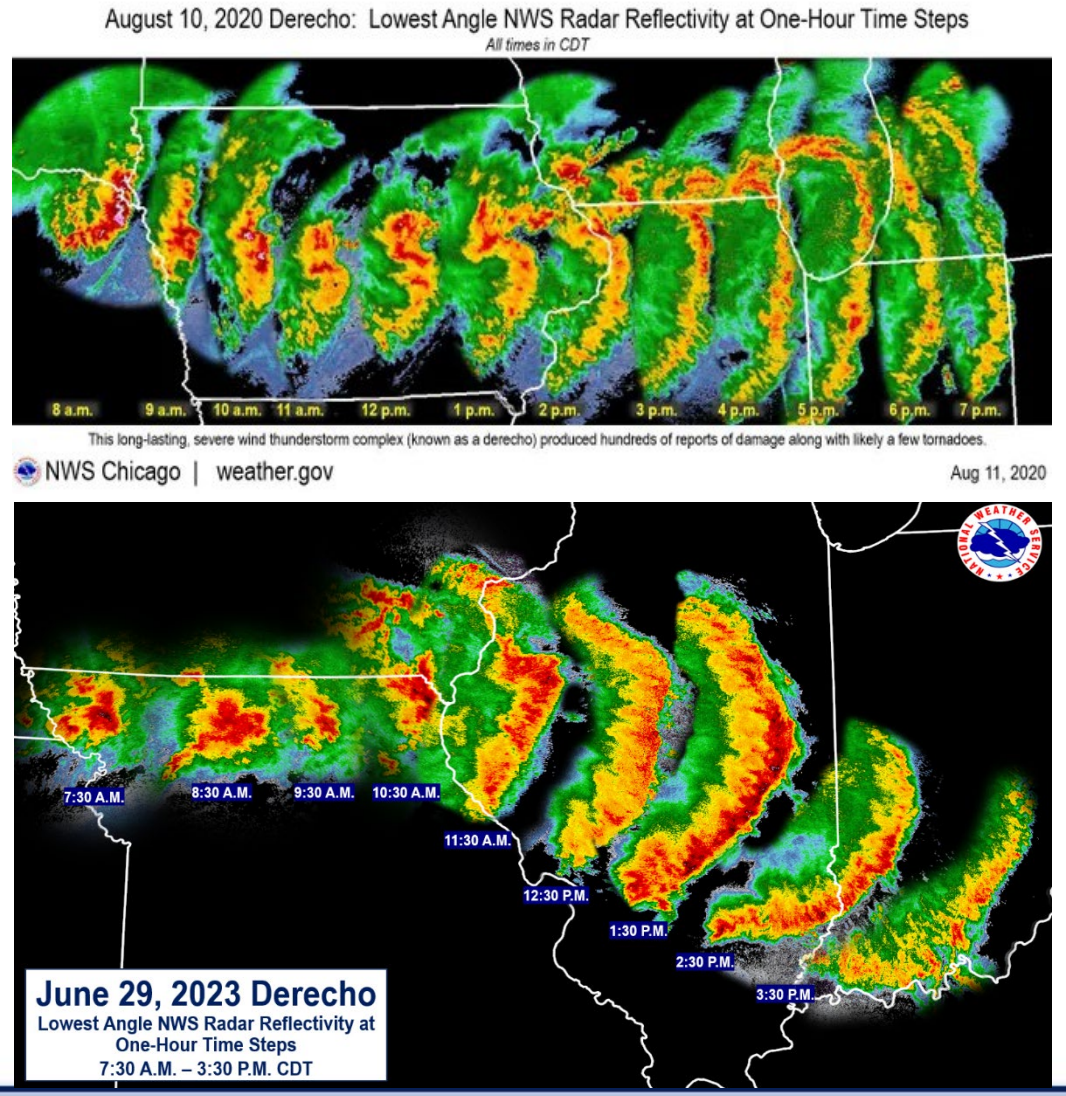


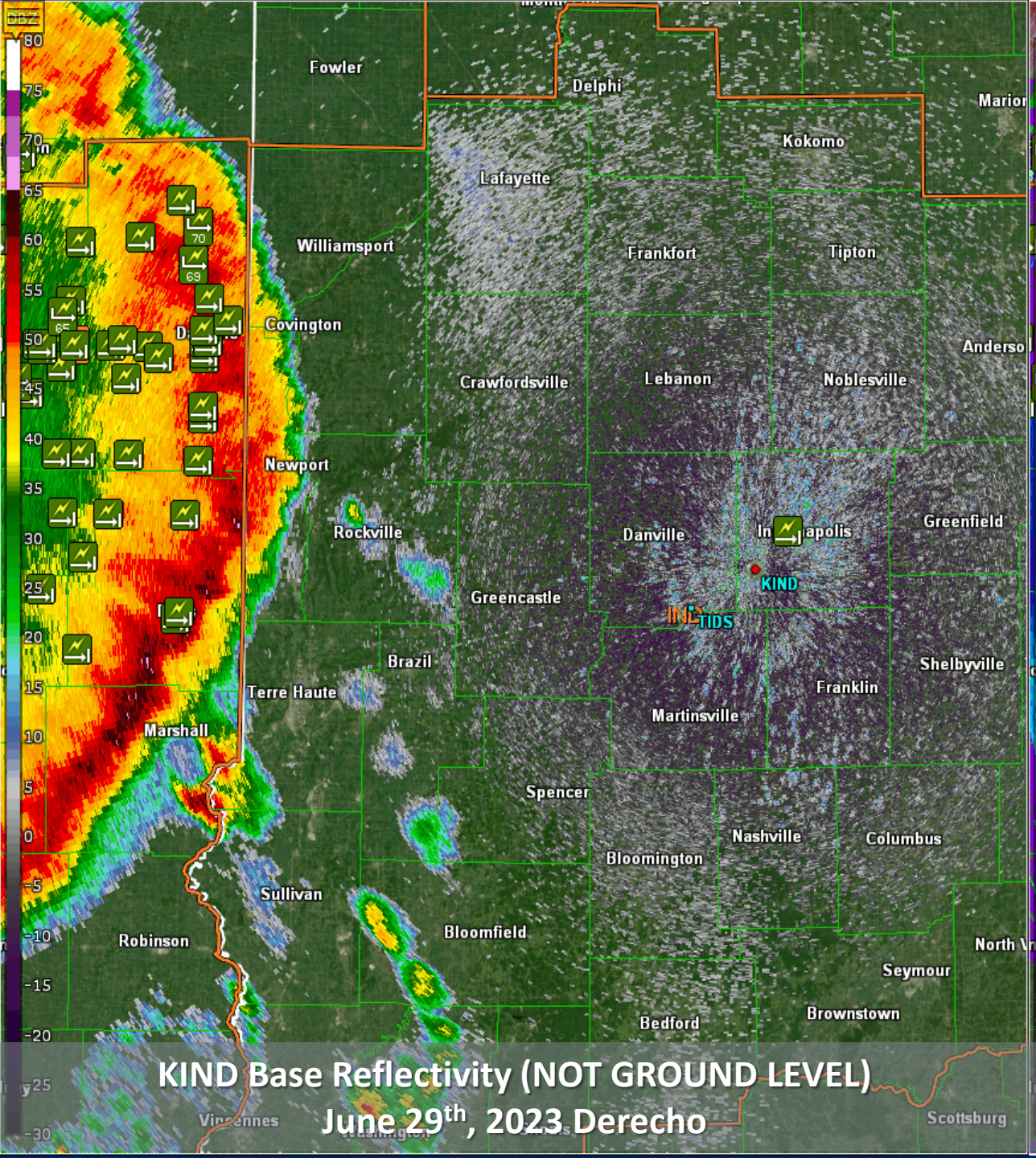


Multi-cell Thunderstorms/Squall Lines

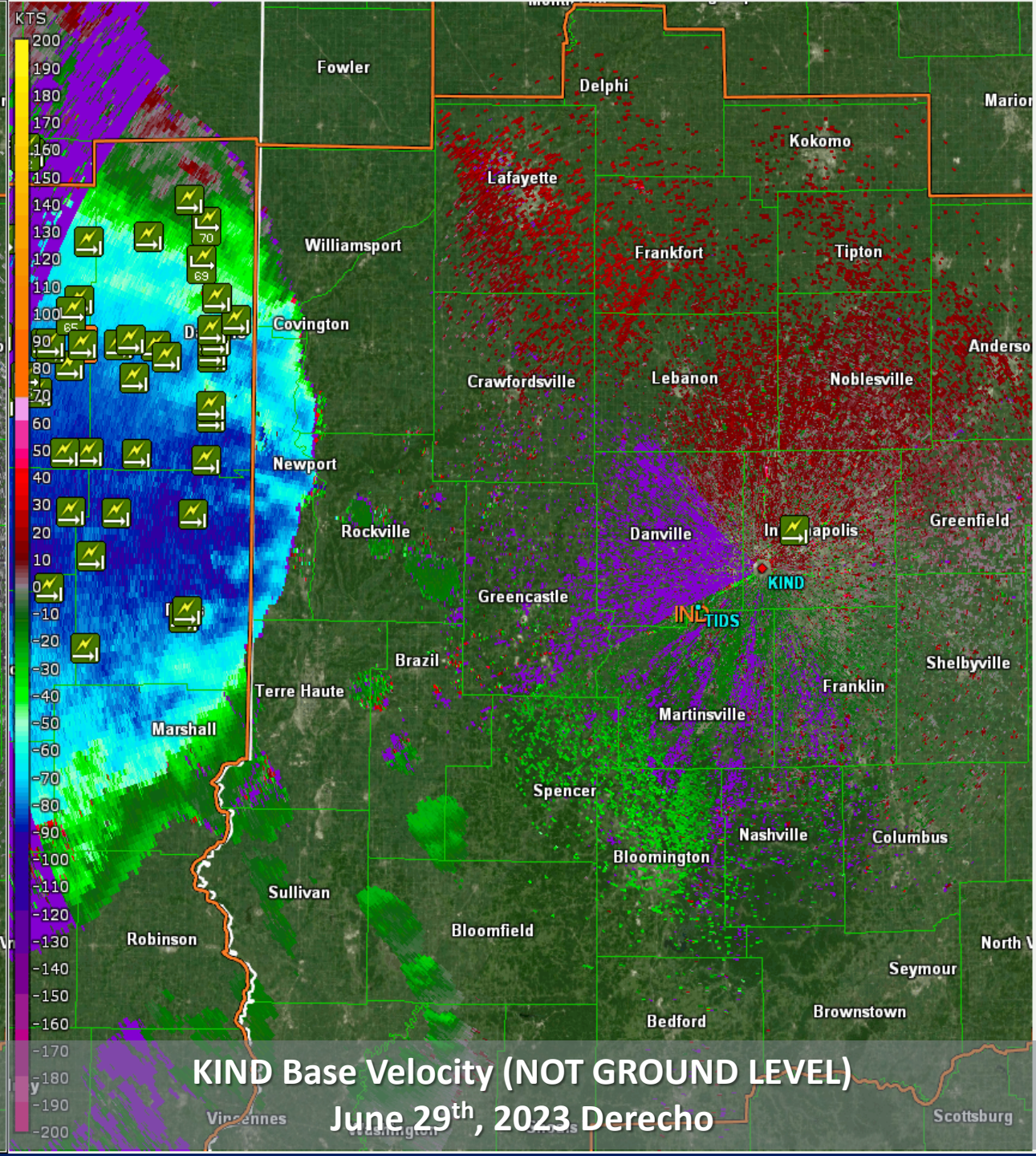


Strong Speed Shear
Little Directional Shear



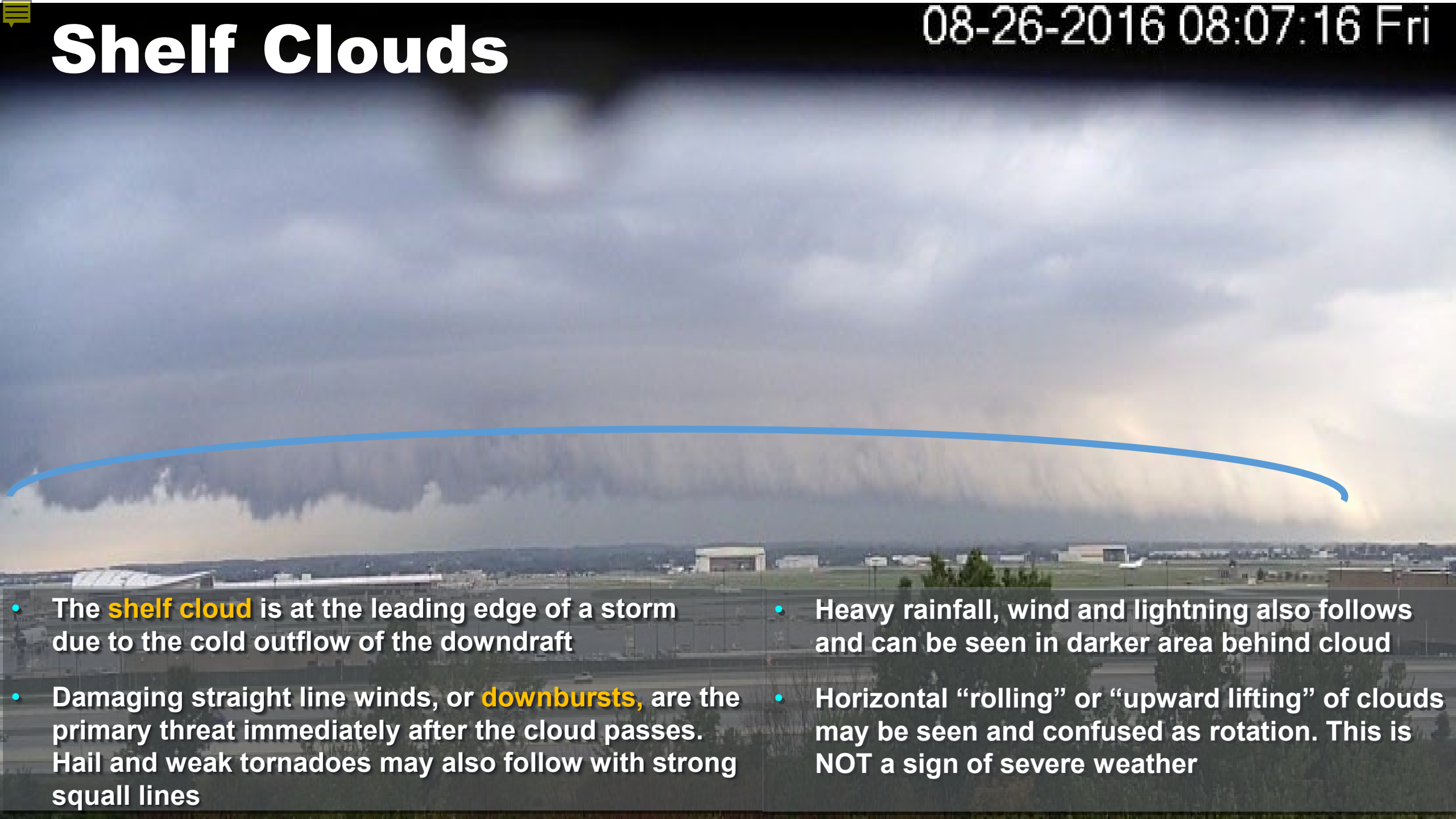


KIND Base Reflectivity (NOT GROUND LEVEL)
June 29th, 2023 Derecho



KIND Base Velocity (NOT GROUND LEVEL)
June 29th, 2023 Derecho

Shelf Clouds



- The shelf cloud is at the leading edge of a storm due to the cold outflow of the downdraft
- Damaging straight line winds, or downbursts, are the primary threat immediately after the cloud passes. Hail and weak tornadoes may also follow with strong squall lines
- Heavy rainfall, wind and lightning also follows and can be seen in darker area behind cloud
- Horizontal “rolling” or “upward lifting” of clouds may be seen and confused as rotation. This is NOT a sign of severe weather

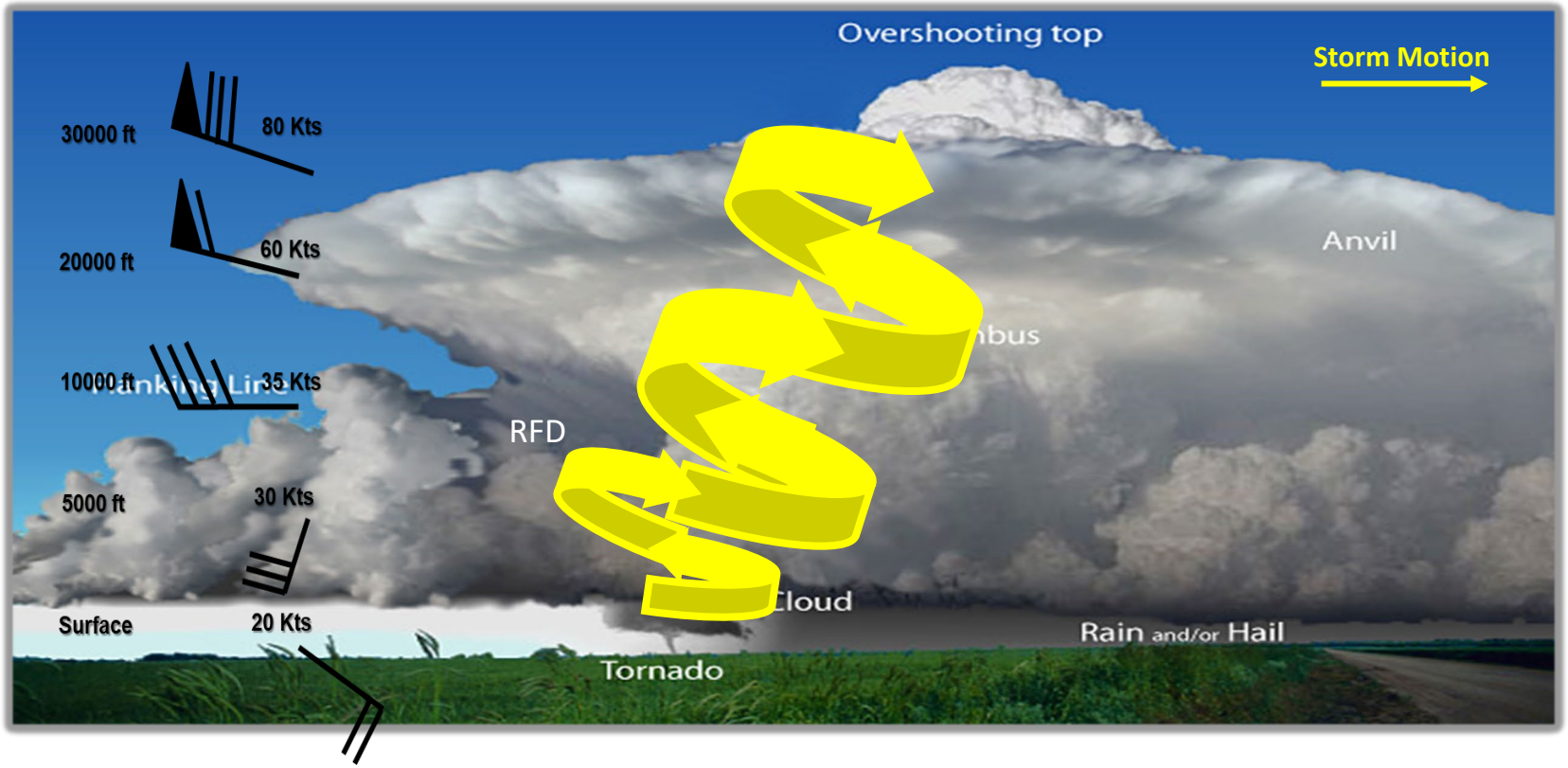
Multi-cell Thunderstorms/Squall Lines

Shelf Cloud Ahead of a Squall Line

Supercell Thunderstorms

"Granddaddy" of Severe Storms – Less Frequent but Potentially More Deadly

- *Persistent* rotating updraft
  - Strong Vertical wind shear
    - Directional and Speed
- Rear-flank downdraft
- Wall Cloud and Funnel Cloud Before Tornado
- Tornado
  - Long lived, violent possible
  - Responsible for most tornado fatalities



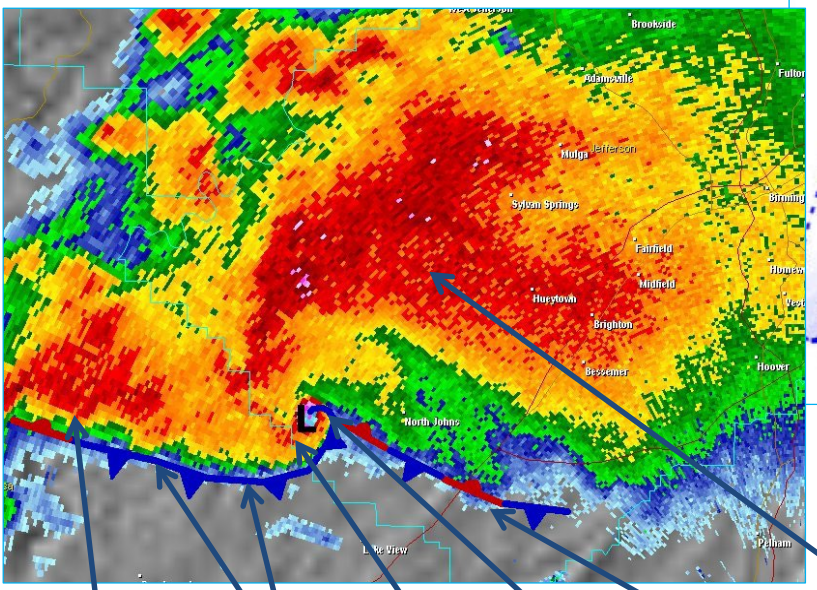
All Severe Weather Hazards Possible

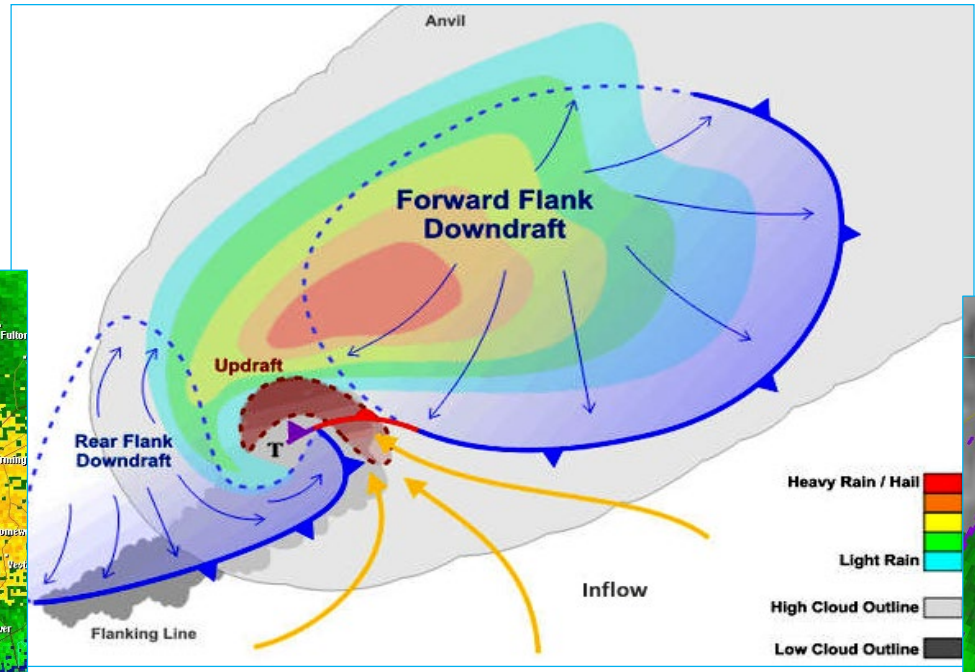
Wall Clouds and Funnel Clouds

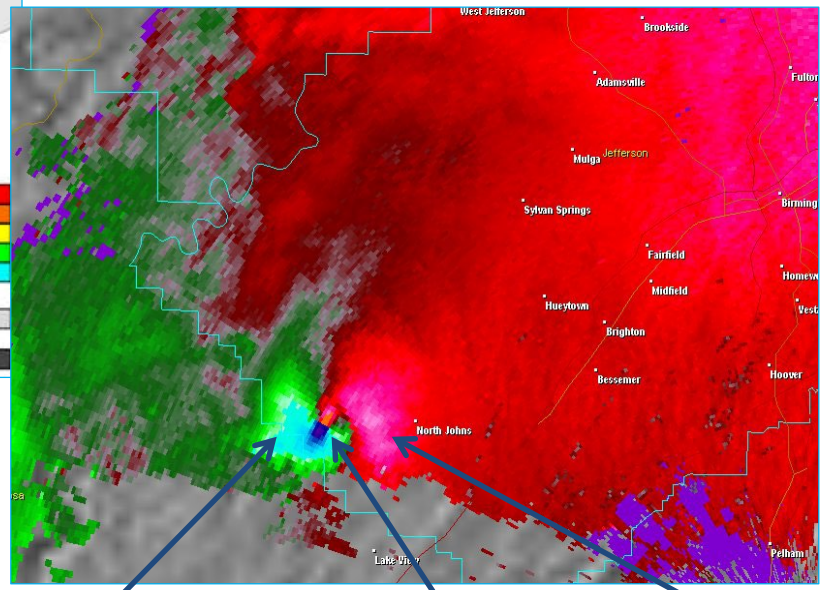
- Precede supercell tornadoes
- Develops below rotating updraft
- Wall Cloud may be smooth or ragged, tail points toward rain shaft
- Funnel Cloud often cone shaped and less ragged, more smooth looking
- Both will be rotating, but NO rotation visible on the ground (not a tornado)
- Once rotation on ground is observed, it is a tornado!

Let us know immediately any time you see a Wall Cloud and/or Funnel Cloud

Supercell Structure and Radar





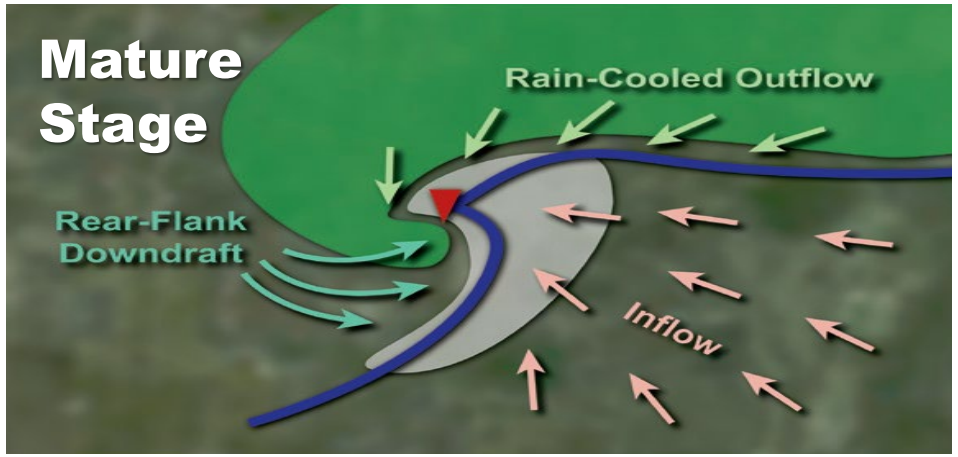


Flanking line | Leading edge RFD | Hook echo | Tornado TDS | Leading edge FFD | Hail Heavy Rain

RFD wrapping around mesocyclone on back side of storm | Low-level mesocyclone/ tornado location | SR inflow into updraft

Visual Clues of Supercell Tornado Formation

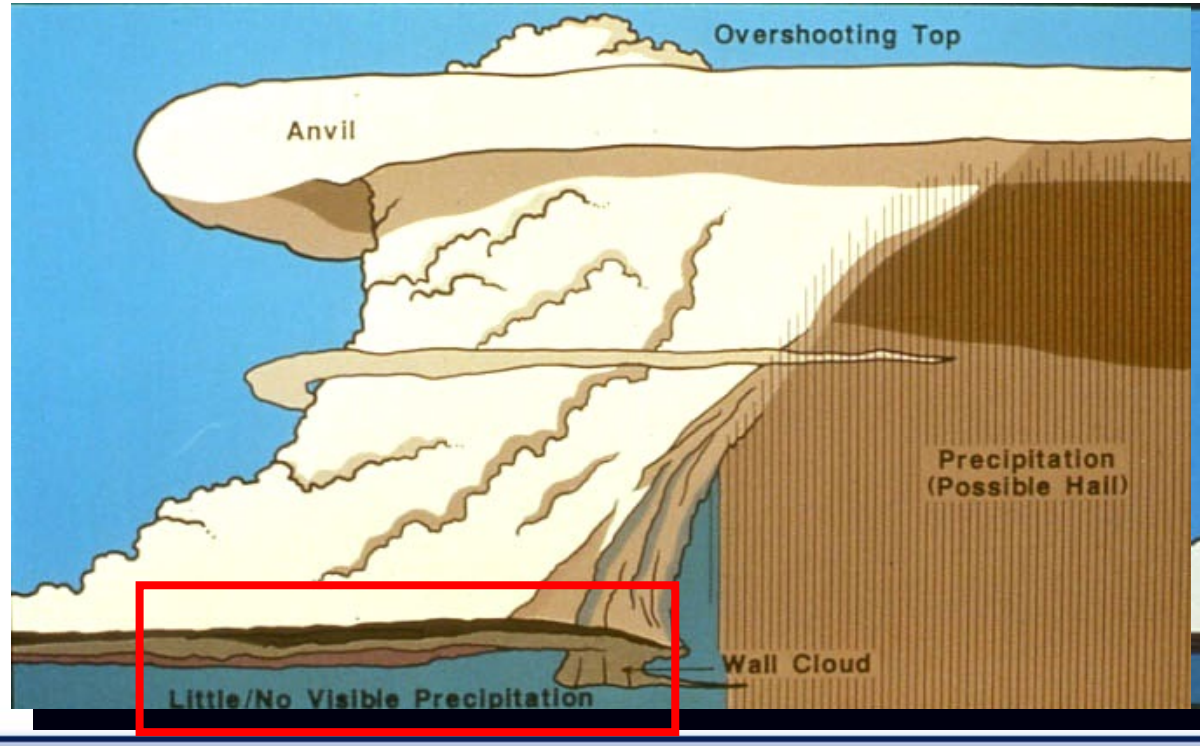
Mature Stage of Henryville, IN Tornado – March 2nd, 2012



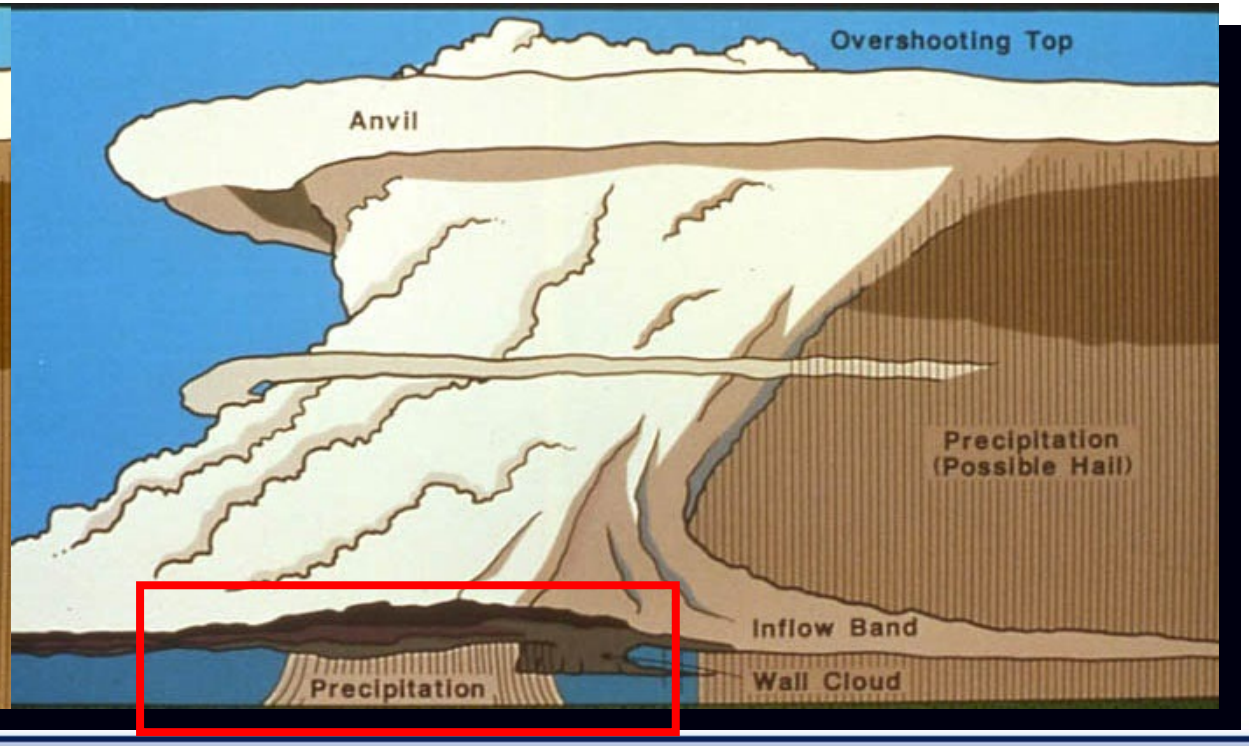
Classic vs “HP” Supercell

Tornadoes with HP Supercells will be rain wrapped

Classic Supercell

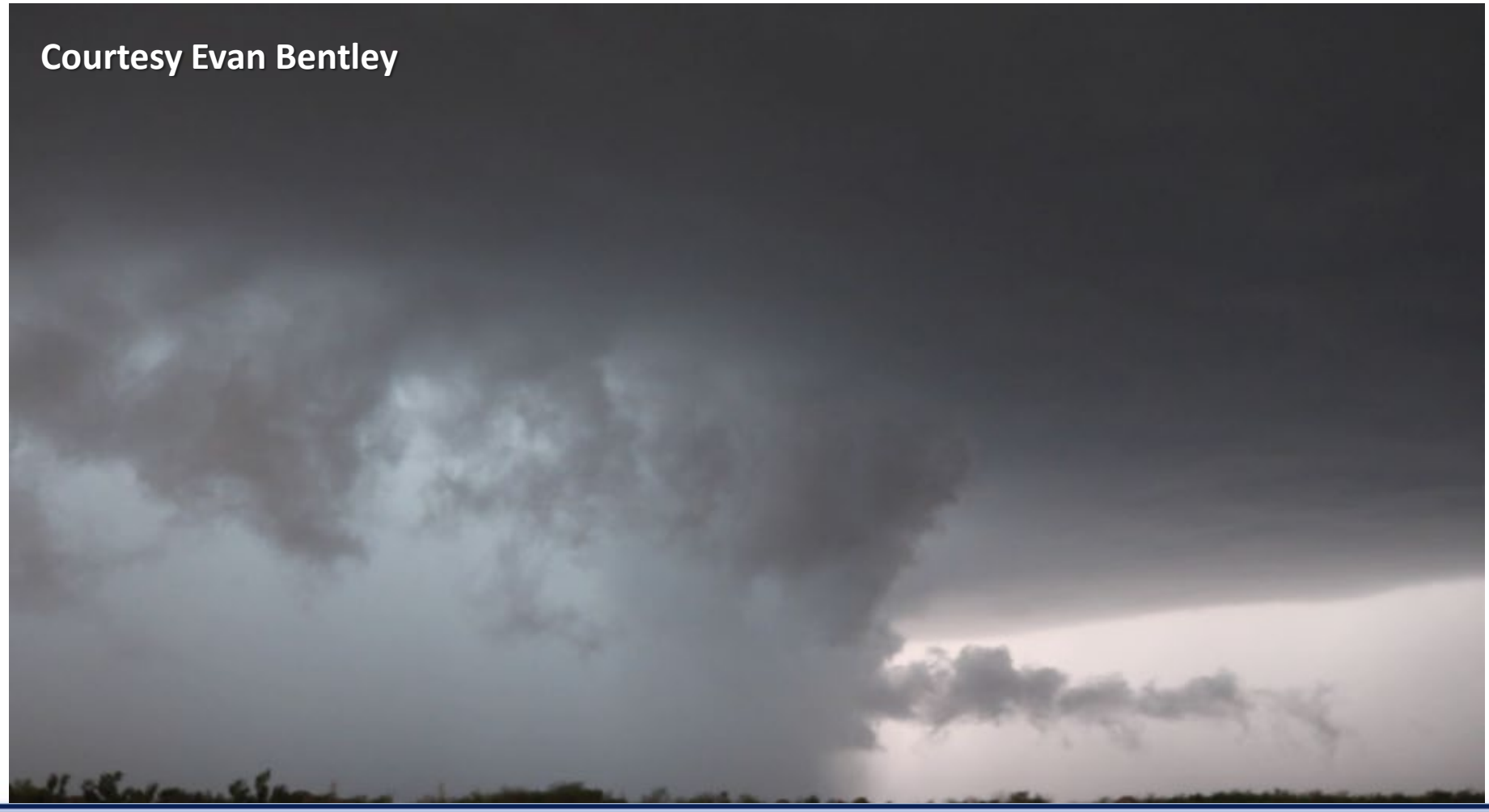


High Precipitation Supercell



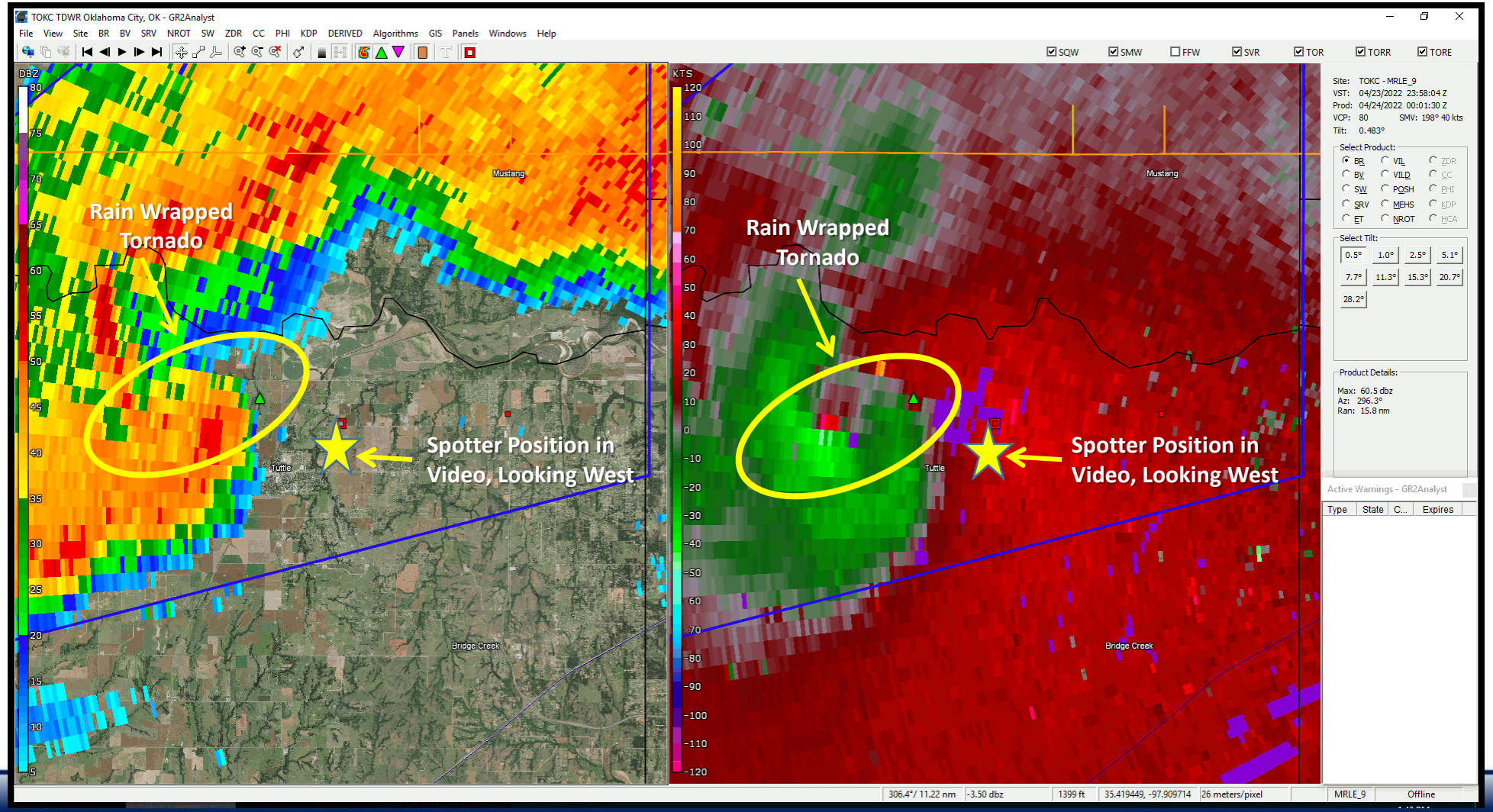
HP Supercell in Oklahoma

Tornadoes with HP Supercells will be rain wrapped and Not Easily Recognizable



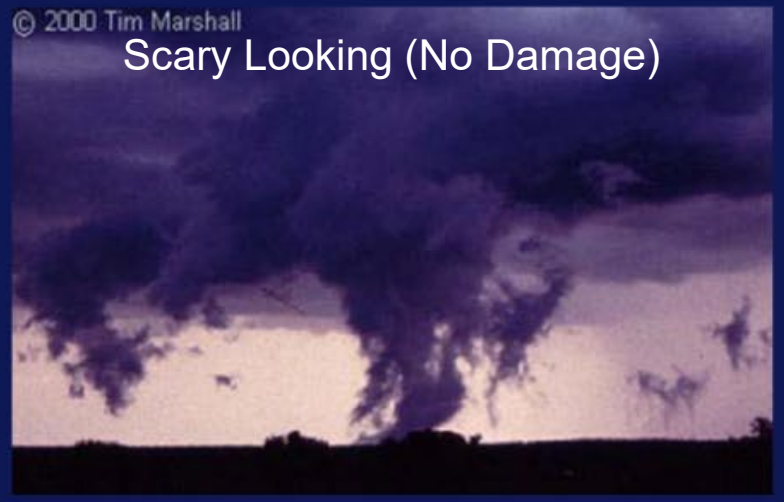
Supercell in Oklahoma

Tornadoes with HP Supercells will be rain wrapped



Don’t Be Fooled!

Scud

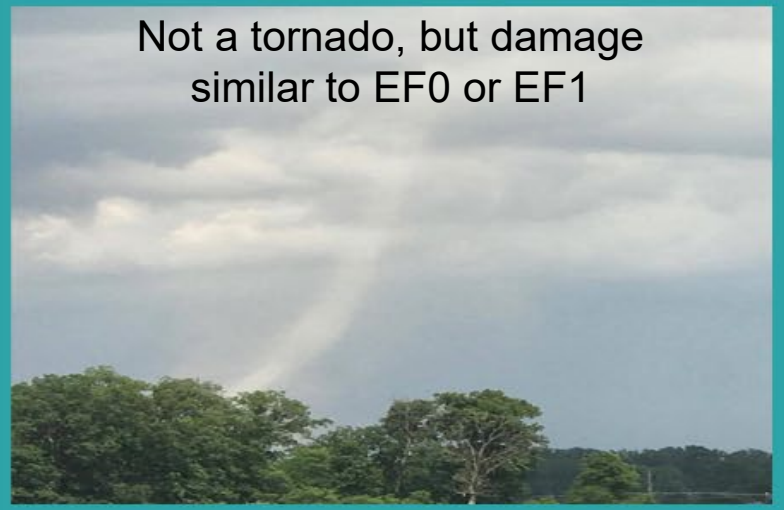


Scary Looking (No Damage)

Action: no action required. Be prepared to shelter indoors from rain and lightning

- Cloud fragments near the base of a thunderstorm that appear wind-torn and ragged
- May be moving slowly, but not rotating
- Often associated with gust fronts in general thunderstorms
- Are not necessarily associated with severe weather

Gustnado


Not a tornado, but damage similar to EF0 or EF1

Action: seek shelter if nearby, report to NWS, monitor weather closely

- Originates within the outflow boundary of a thunderstorm
- Spins up from the ground, rather than connecting to the thunderstorm’s mesocyclone or updraft
- Typically brief, weak, and shallow

Dust Devil


Not a tornado, but damage similar to EF0 or EF1

Action: seek shelter to be safe, report to NWS, monitor closely

- Dust, dirt or sand raised from the ground in the form of a whirling column of air
- Rotation is typically a result of strong surface heating and temperature gradients on sunny days
- Typically brief and weak but heights can extend several hundred feet

@NWSIndianapolis

Don’t Be Fooled! Rotation, But No Connection To Cloud

Gustnado That is Over Water

SKYWARN Spotter

Section 5

Spotter Resources and Training Certificates

Outlooks, Watches and Warnings

Spotters Need to Know When to Be Ready and When to take Action

Local Hazardous Weather Outlook (HWO)

Outlook and awareness information issued daily by each NWS office

- **Hazards and timing of impacts today and tonight**
- **Hazards Day 2 to Day 7**
- **Spotter information stating when and if spotters will be needed**

```
.DAY ONE...TODAY AND TONIGHT.

A SIGNIFICANT SEVERE WEATHER OUTBREAK IS EXPECTED IN THE OHIO
VALLEY TODAY.

THUNDERSTORMS THAT DEVELOP ON THE WARM FRONT THIS MORNING COULD
BECOME SEVERE. THE MAIN THREAT IS LARGE HAIL.

THUNDERSTORMS THAT DEVELOP IN THE WARM SECTOR THIS AFTERNOON WILL
BECOME SEVERE. TORNADOES...DAMAGING WINDS...AND LARGE HAIL ARE ALL
POSSIBLE...AND A FEW OF THE TORNADOES COULD BE STRONG AND LONG-
LIVED. SEVERE WEATHER COULD OCCUR ANYWHERE IN THE OUTLOOK
AREA...BUT THE GREATEST THREAT WILL BE EAST OF INTERSTATE 65 AND
SOUTH OF THE BLUEGRASS PARKWAY.

A SQUALL LINE MAY DEVELOP ALONG THE COLD FRONT LATE THIS AFTERNOON
AND INTO THIS EVENING. DAMAGING WINDS WILL BE THE MAIN THREAT WITH
THE SQUALL LINE...BUT ISOLATED TORNADOES WILL ALSO BE POSSIBLE.

.DAYS TWO THROUGH SEVEN...SATURDAY THROUGH THURSDAY.

LIGHT SNOW SHOWERS ARE POSSIBLE EARLY SUNDAY MORNING AND AGAIN ON
SUNDAY NIGHT AND EARLY MONDAY...MAINLY NORTH OF THE I 64 CORRIDOR.
ACCUMULATIONS ARE NOT EXPECTED AT THIS TIME.

THERE IS A CHANCE OF THUNDERSTORMS ON THURSDAY...MAINLY NORTH OF
THE I 64 CORRIDOR.

.SPOTTER INFORMATION STATEMENT...

SPOTTERS ARE ENCOURAGED TO REPORT ANY HAIL THAT OCCURS WITH THE
STORMS THIS MORNING. SPOTTER NETWORK ACTIVATION IS LIKELY THIS
AFTERNOON AND EVENING.
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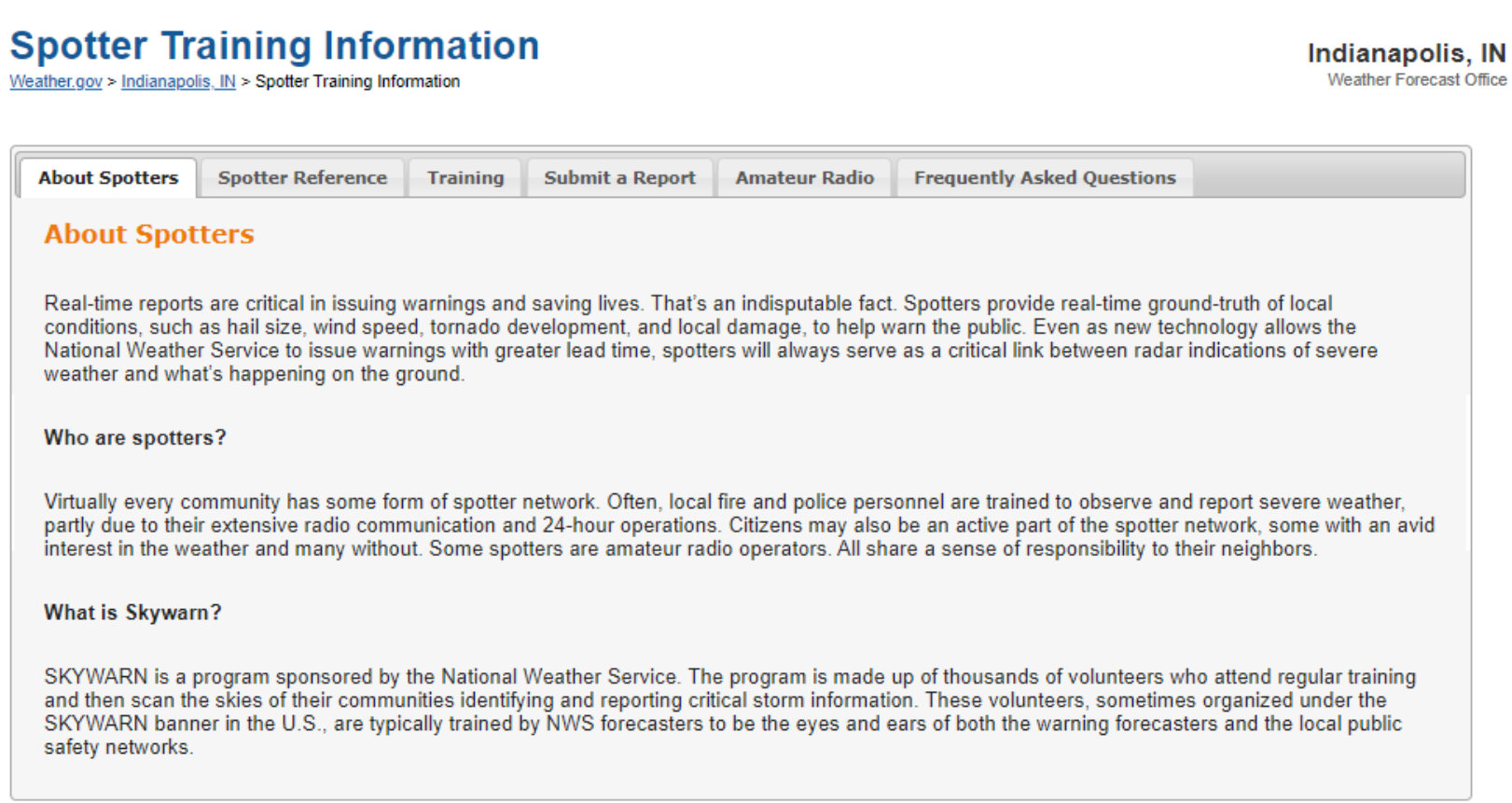
NWS Indianapolis Spotter Page

One Stop Shop for Spotters. Let us Know What Else You Might Need

- Spotter Reference Materials
- Training
- Forecast Graphics
- Methods to Submit Reports
- Spotter Registration Form
- Amateur Radio Information
- FAQs



Spotter Training Information

Weather.gov > Indianapolis, IN > Spotter Training Information

Indianapolis, IN
Weather Forecast Office

About Spotters | Spotter Reference | Training | Submit a Report | Amateur Radio | Frequently Asked Questions

About Spotters

Real-time reports are critical in issuing warnings and saving lives. That's an indisputable fact. Spotters provide real-time ground-truth of local conditions, such as hail size, wind speed, tornado development, and local damage, to help warn the public. Even as new technology allows the National Weather Service to issue warnings with greater lead time, spotters will always serve as a critical link between radar indications of severe weather and what's happening on the ground.

Who are spotters?

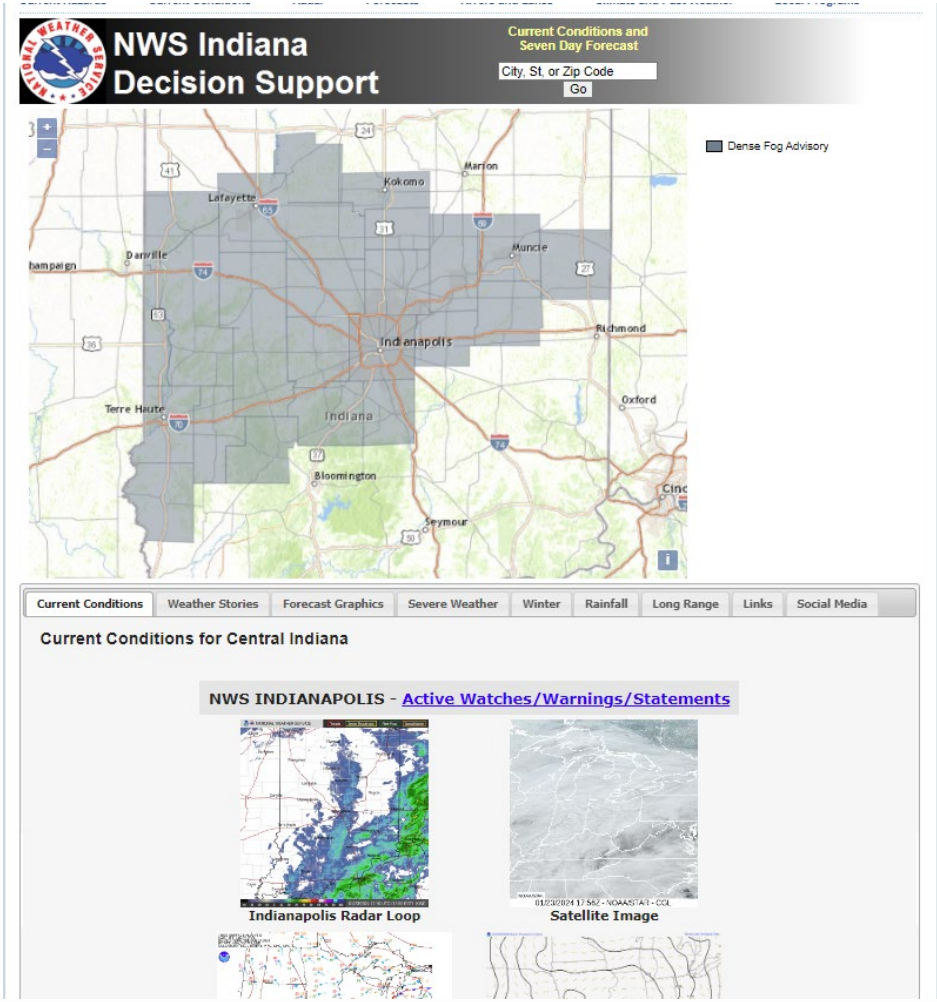
Virtually every community has some form of spotter network. Often, local fire and police personnel are trained to observe and report severe weather, partly due to their extensive radio communication and 24-hour operations. Citizens may also be an active part of the spotter network, some with an avid interest in the weather and many without. Some spotters are amateur radio operators. All share a sense of responsibility to their neighbors.

What is Skywarn?

SKYWARN is a program sponsored by the National Weather Service. The program is made up of thousands of volunteers who attend regular training and then scan the skies of their communities identifying and reporting critical storm information. These volunteers, sometimes organized under the SKYWARN banner in the U.S., are typically trained by NWS forecasters to be the eyes and ears of both the warning forecasters and the local public safety networks.

NWS Indianapolis Briefing Page

Self briefing to stay updated on potential weather



Other Possible Phone Apps for Alerts

Available from your App Store – NWS Does Not Endorse any Apps

- **Red Cross Severe Weather App**
  (Disponible en español también)

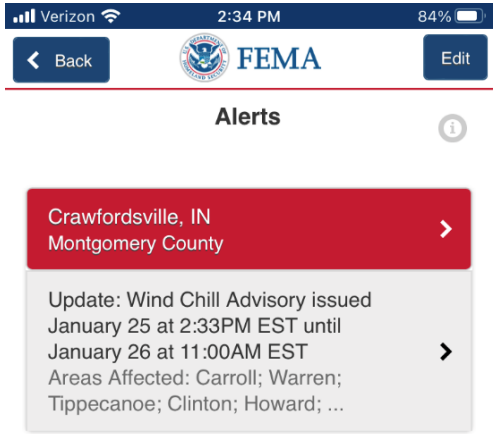
  https://www.redcross.org/

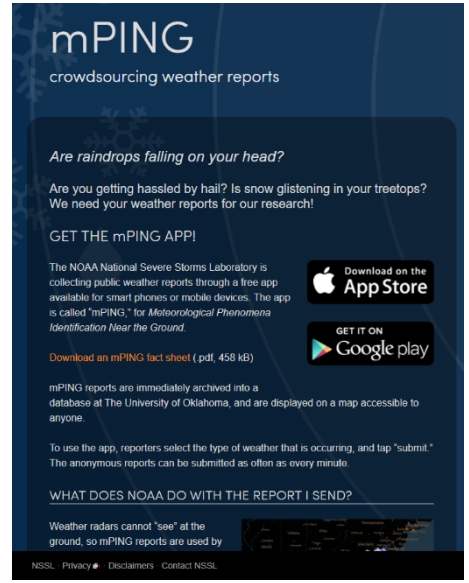
- **FEMA App for Warning Notifications**
  (Disponible en español también)

  https://www.fema.gov/

- **mPING for Precipitation Reports**

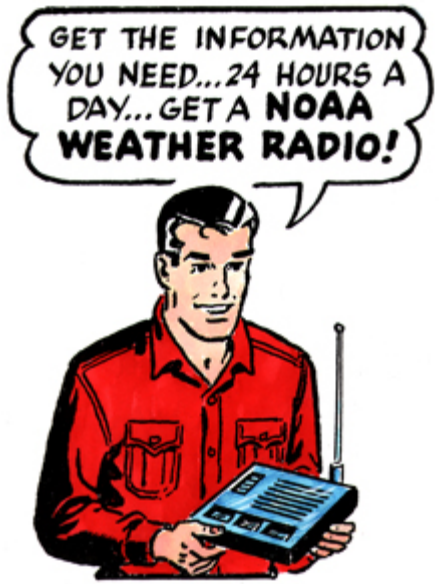
  https://mping.nssl.noaa.gov/





NOAA All Hazards Weather Radio

Your Own Personal Weather Monitoring and Alert Device



All Hazards NOAA Weather Radio
NOAA's National Weather Service

Reporting Methods and Questions

- Social Media (Facebook and X)
  - @NWSIndianapolis
    - Hashtags - #INwx #NWSIND
- Spotter Reports Hotline - (800) 499-2133
- Submit Report via NWS Indy website (inws.ncep.noaa.gov/report)
- Email (nws.indianapolis@noaa.gov)
- Amateur Radio

Questions or comments on this presentation can be sent to:
Sam.Lashley@noaa.gov