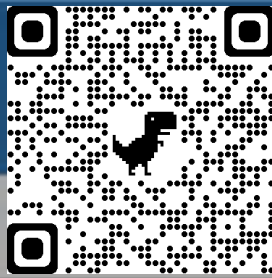




# Things to Know



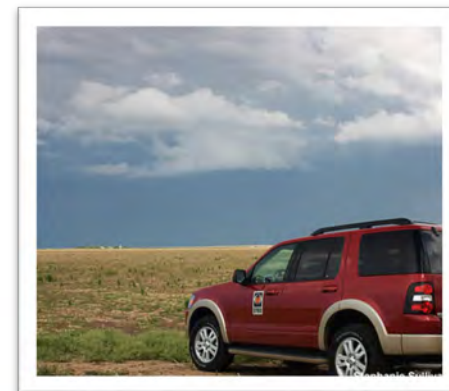
- A PDF version of these slides with speaker notes, URLs and other resources are available on our Spotter Webpage.  
<https://www.weather.gov/ind/spotter>
- Use the camera on your smart phone to scan QR Codes for most websites shown in this presentation.
- Central Indiana SKYWARN Spotters DO NOT receive spotter ID numbers and are considered volunteers





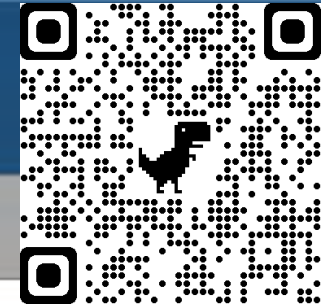
# Presentation Outline

- I. What is required from Skywarn Spotters
- II. Basic Weather Information, Terms and Reporting Procedures
- III. Tornadoes and Severe Thunderstorm Winds, Hail and Lightning
- IV. Basic Meteorology and Radar Terms and Concepts
- V. Storm Types and Associated Severe Weather
- VI. Tornado “Look A likes”
- VII. Spotter Resources





# What is Required to be a Spotter?



- Anyone can be a spotter. Complete training every 1 to 3 years
- Become knowledgeable about all forms of severe weather, know what to look for and know how to report what is observed
- Spotters play a critical role in the NWS warning process by adding credibility and confidence to NWS Warnings with ground truth that supports radar signatures
- Relay timely, accurate and credible reports that can help the NWS in warning decisions, EMA Directors and first responders allocate resources faster, and ultimately help save lives.
- **PLEASE MAKE REPORTS!** Many times we hear nothing from our spotters



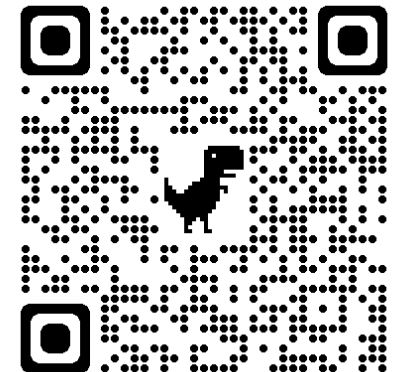
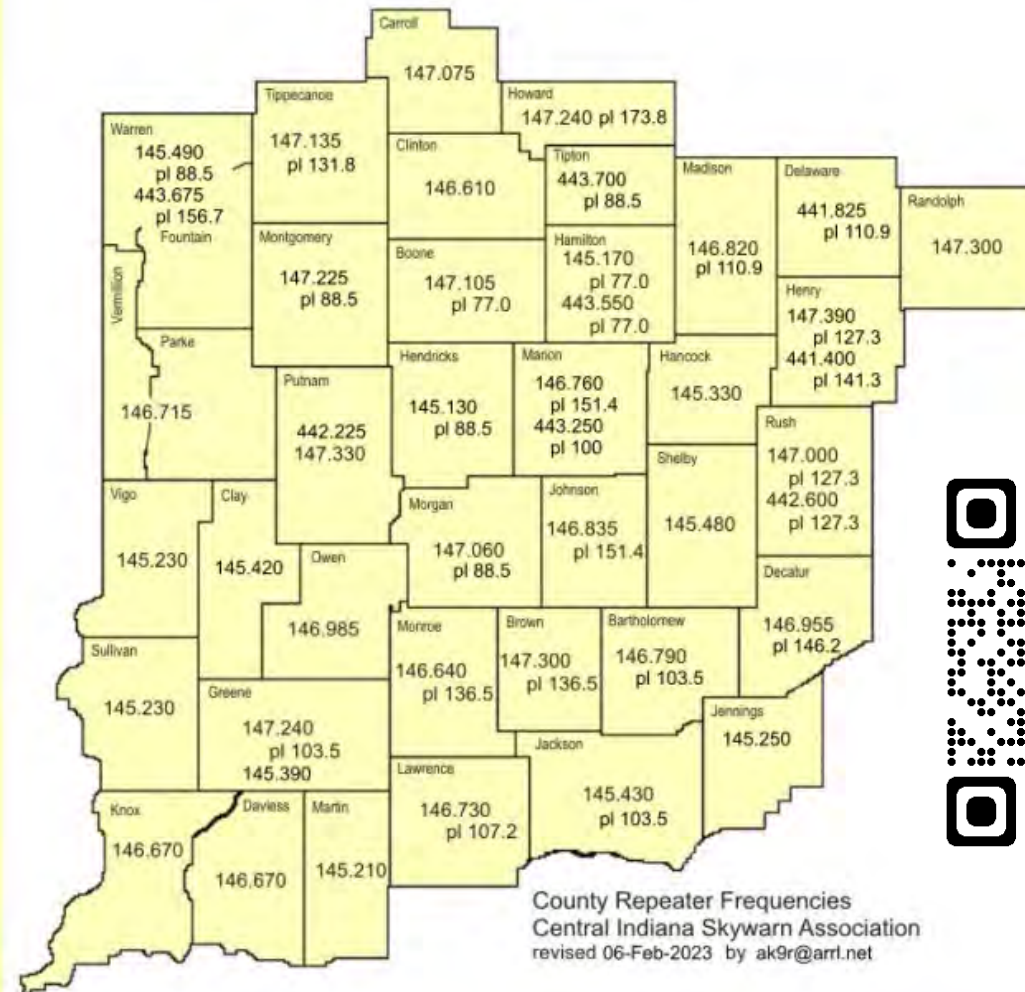




# Central Indiana Skywarn Association

## Central Indiana Amateur Radio Operations

- Amateur radio operators help the NWS as weather spotters but also serve as our backup for communications if primary systems fail
- Information for amateur radio operators across Central Indiana can be found at : <https://w9nws.org/>







# SKYWARN Spotter Basic Weather Information, Terms and Reporting Procedures





# Why are Spotters Important?

Spotters and EMA are a vital part of the warning process

## Why Spotters? Ground Truth and Timely Reports!

People react when  
they **KNOW** a tornado  
is on the ground!

Reports are most valuable **as the storm is happening**.  
This help us with warning decisions, and adds credibility to them.

- Spotters are our eyes and ears
- Your report makes a difference in the warning process.
- People react faster when warnings are supported by reliable ground truth
- You are **serving** the Warning Team, Your Community and Neighboring Counties



NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



Indianapolis, Indiana



# Spotters Need to be Aware

Help Spread the Word, Most People Do Not Know This Information



## Outdoor Warning Sirens

Meant as an alert for people  
that are **OUTDOORS**

NOT intended to wake you up

Activation varies by location

Check with you local city or  
county government for policy



NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



Indianapolis, Indiana





# 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...

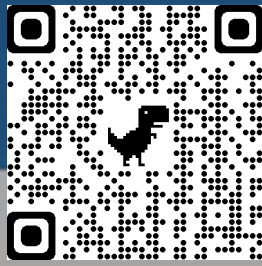
SPOTTERS ARE ENCOURAGED TO REPORT ANY HAIL THAT OCCURS WITH THE STORMS THIS MORNING. SPOTTER NETWORK ACTIVATION IS LIKELY THIS AFTERNOON AND EVENING.





# Outlooks, Watches and Warnings

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



## • Local Graphical Hazardous Weather Outlook (GHWO)

- Graphical depiction of potential hazards
- Where and When Easily Visualized

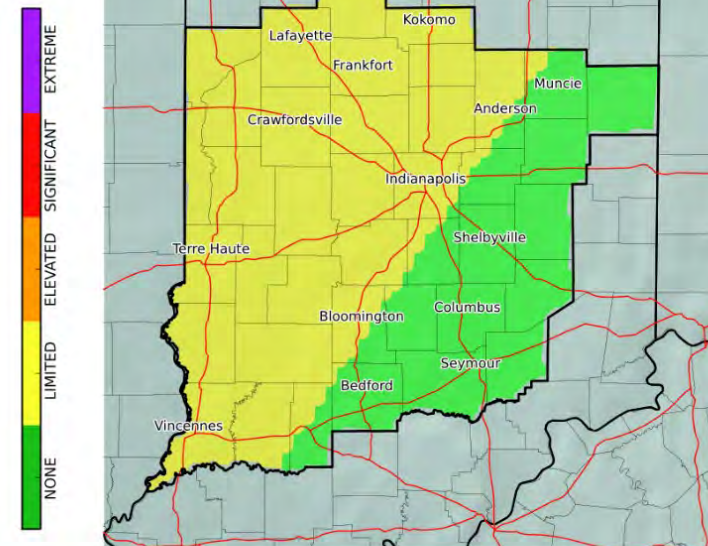
### Hazard Risks

24 Hr Hazard	Day 1	Fri	Sat	Sun	Mon	Tue	Wed
Excessive Cold	■	■	■	■	■	■	■
Excessive Heat	■	■	■	■	■	■	■
Fire Weather	■	■	■	■	■	■	■
Excessive Rainfall	■	■	■	■	■	■	■
Fog	■	■	■	■	■	■	■
Hail	■						
Lightning	■	■	■	■	■	■	■
NonThunderstorm Wind	■	■	■	■	■	■	■
Ice Accumulation	■	■	■	■	■	■	■
Snow Sleet	■	■	■	■	■	■	■
Spotter Outlook	■						
Severe Thunderstorms	■	■	■	■	■	■	■
Thunderstorm Wind	■						
Tornado	■						

### Excessive Rainfall Risk

### Flooding Risk

Valid: 01/10/2020 07:00 AM - 01/11/2020 07:00 AM EST



National Weather Service  
Indianapolis IN  
01/09/2020 04:04 AM EST

Follow Us:     
weather.gov/ind



NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION

<https://www.weather.gov/erh/ghwo?wfo=ind>



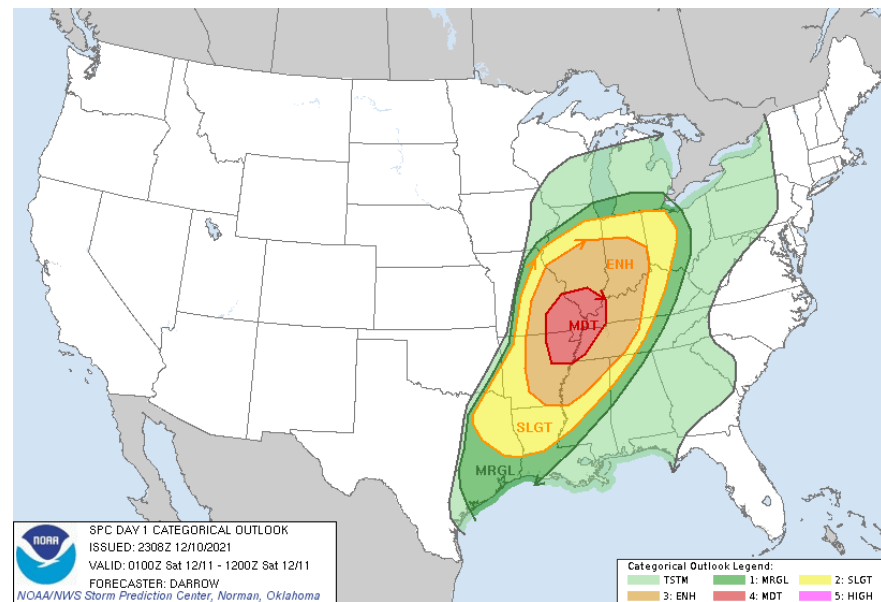




# Outlooks, Watches and Warnings

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

## Storm Prediction Center (SPC) Outlooks



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?	DEFINITIONS
	General Thunderstorm	Although severe weather is not expected, <i>all</i> thunderstorms can produce deadly lightning, gusty winds, and small hail.	No severe thunderstorms expected		Similar to storms your area experiences many times per year	<b>Severe Storm</b> 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
1	Marginal (MRGL)	Some storms could be capable of damaging winds and severe hail. Localized tornado threat could develop.	Isolated severe storms possible		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. <i>A few severe storms could be significant</i>	Isolated to scattered severe storms expected		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. <i>Several severe storms could be significant</i>	Scattered to numerous severe storms expected		Similar to intense storms your area may only experience once or twice per year	<b>Significant Severe</b> 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
4	Moderate (MDT)	High confidence that many storms will contain damaging winds, severe hail, and/or tornadoes. <i>Several severe storms likely to be significant</i>	Scattered to numerous severe storms expected		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. <i>Tornado outbreak and/or widespread damaging winds</i>	Numerous severe storms expected		Very intense storms your area may only experience once or twice in a lifetime	

[spc.noaa.gov](https://spc.noaa.gov) | [weather.gov](https://weather.gov)



NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



Indianapolis, Indiana



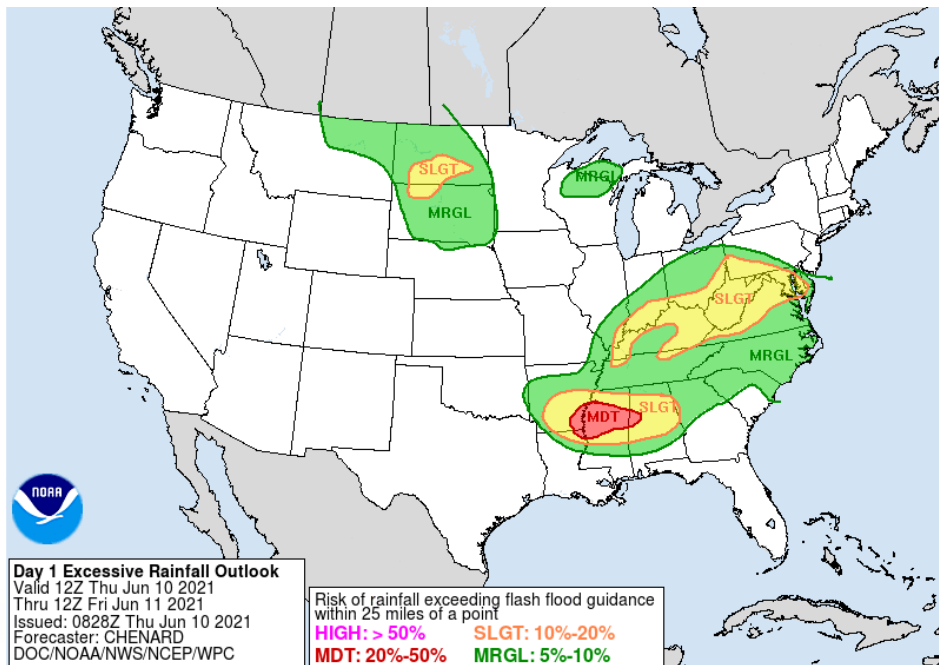


# Outlooks, Watches and Warnings






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

## Excessive Rainfall Outlooks

- General awareness of heavy rain and flash flooding potential and trends. Similar to SPC
  - Weather Prediction Center (WPC) issues Excessive Rain Outlook (ERO) for the entire country



Weather Prediction Center Excessive Rain Outlooks  
Issued for Days 1-7

Understanding WPC Excessive Rainfall Risk Categories				
No Area/Label	MARGINAL (MRGL)	SLIGHT (SLGT)	MODERATE (MDT)	HIGH (HIGH)
Flash floods are generally not expected.	Isolated flash floods possible	Scattered flash floods possible	Numerous flash floods likely	Widespread flash floods expected
Localized and primarily affecting places that can experience rapid runoff with heavy rainfall.	Mainly localized. Most vulnerable are urban areas, roads, small streams and washes. Isolated significant flash floods possible.	Numerous flash flooding events with significant events possible. Many streams may flood, potentially affecting larger rivers.	Severe, widespread flash flooding. Areas that don't normally experience flash flooding, could. Lives and property in greater danger.	
<a href="http://www.wpc.ncep.noaa.gov">@NWSWPC</a>				
Flash flooding near me?	Flash Flooding			
	NO Flash Flooding			
 WEATHER PREDICTION CENTER				





# Outlooks, Watches and 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

**WATCH VS. WARNING**  
Do YOU know the difference?

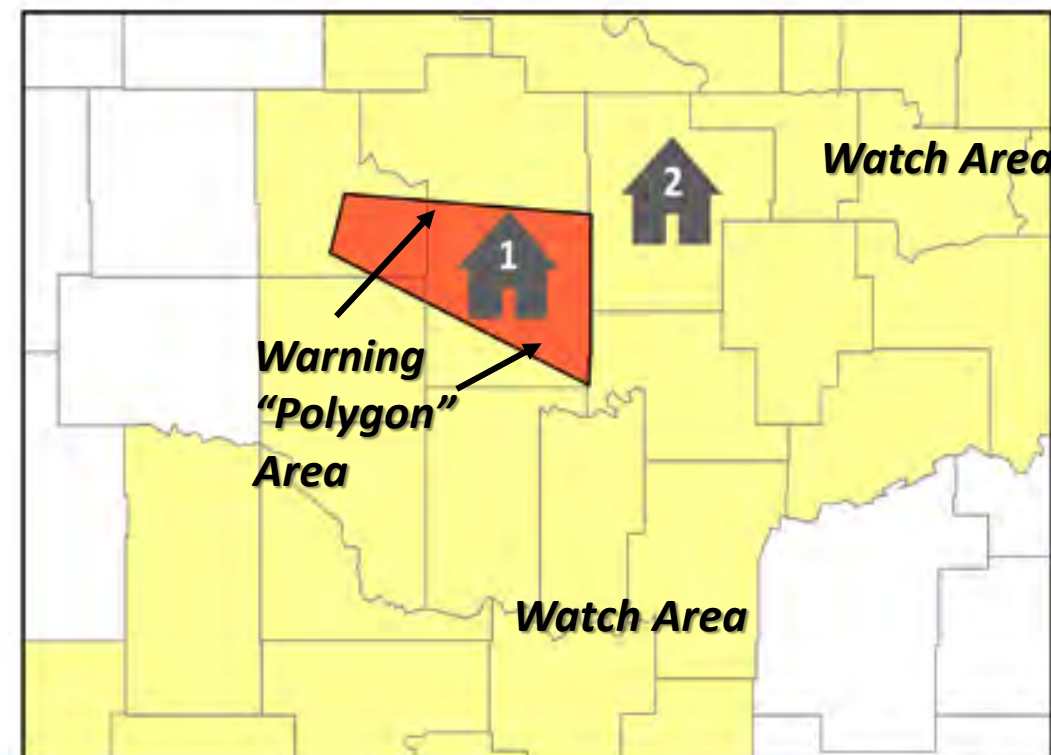
**WATCH**  
**BE ALERT.** Severe storms or tornadoes **MIGHT** form and affect your area.

**WARNING**  
**TAKE ACTION!** A severe storm or tornado is **expected** in your area.

**You should be...**

**Monitoring information**  
Keep an eye on the sky

**ACT IMMEDIATELY. GET IN, GET DOWN, AND COVER UP.**





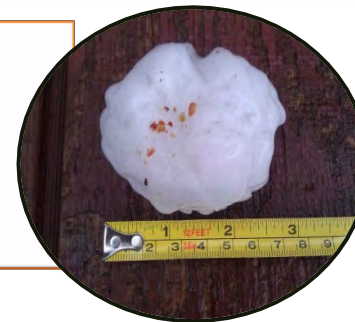


# Outlooks, Watches and Warnings

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

## Severe Thunderstorm Warning

- Thunderstorm wind gusts  $\geq 58$  mph & or:
- Hail  $\geq 1$  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





# STORM PLANNING TIMELINE

## A few days out

*If the forecast calls for severe weather in a few days, start preparing now.*



Make sure that you have emergency supplies



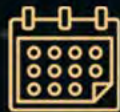
Know your safe places



Have a family communication plan

## The day before

*The day before, forecast accuracy continues to improve.*



Adjust plans



Make sure your phone can receive WEAs



Ensure your shelter is clean and accessible

## The day of

*Remain vigilant and aware of any active Watches. A Warning may be issued at a moment's notice!*



Remind your family of the communication plan



Know how to evacuate and/or get to safety from wherever you are



When a Warning is issued, you may only have seconds to take action!





# Spotter Reporting Procedures

## An Effective Spotter Report Should:

- Be timely, accurate, detailed but concise
- Be Reported in a clear and calm voice
- Follow specific guidelines
  - **Who you are:** Trained NWS Skywarn spotter (No Spotter ID)
  - **What you have witnessed:** Tornado, moving northeast
  - **When the event occurred:** Ongoing right now
  - **Where the event occurred:** I-74 and highway 75 Jamestown, looking north, possibly about two miles. Thin, rope shape, debris being lofted.





# What is a Tornado?

## Basic Definition, But Not All Tornadoes 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 trace a path of 1 mile or less

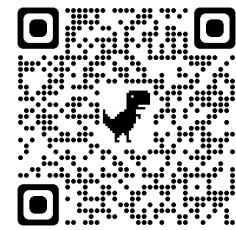






# Tornado Ratings

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



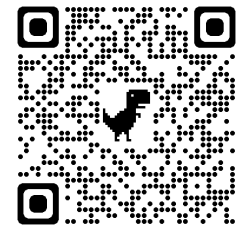
EF Rating	Wind Speeds	Expected Damage	
EF-0	65-85 mph	<p>“Minor” damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.</p>	
EF-1	86-110 mph	<p>“Moderate” damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.</p>	
EF-2	111-135 mph	<p>“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.</p>	





# Tornado Ratings

High End of EF-Scale ~ 6% of Indiana Tornadoes (Only 3 EF5s 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.



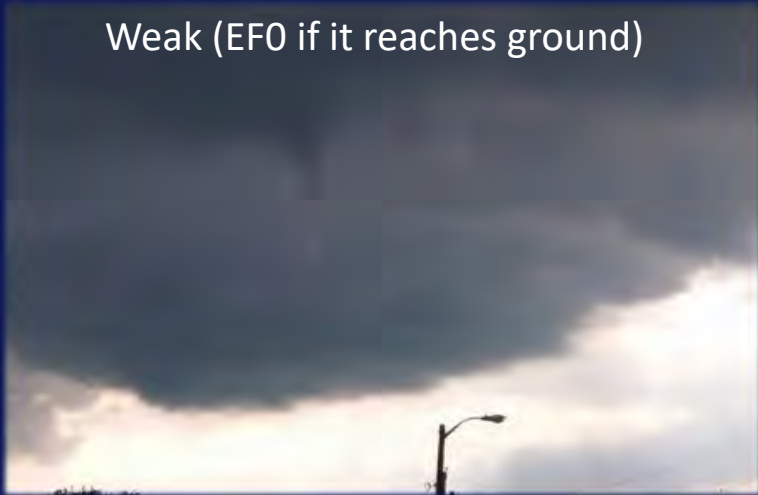




# Tornado Types and General Strengths

## Cold Air Funnel

Weak (EF0 if it reaches ground)

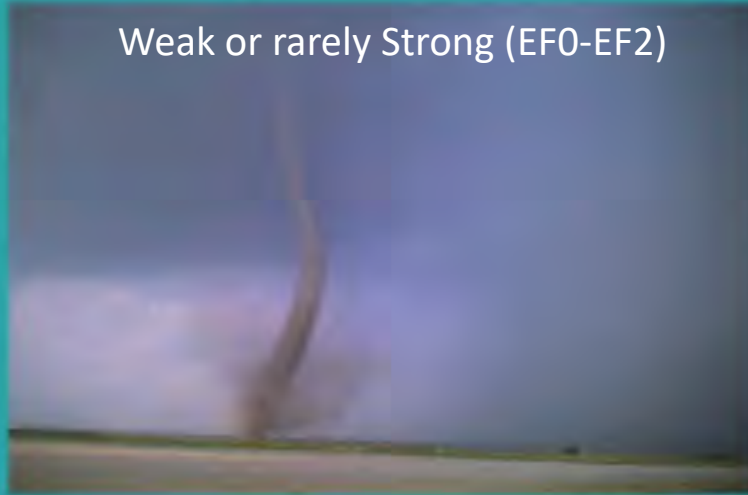


**Action:** report to NWS, monitor movement, be prepared to shelter indoors

- Originates near a strong low pressure system and weak surface boundaries
- Forms at the cloud base of a developing shower, often without thunder or lightning present
- Rarely reach the ground, but can create weak EF-0 damage if a tornado occurs

## Landspout Tornado

Weak or rarely Strong (EF0-EF2)



**Action:** seek shelter, report to NWS, monitor weather closely

- Originates when an updraft from a thunderstorm moves over a surface boundary
- Rotation starts at the ground and originates from the boundary, not the storm itself
- Typically short-lived, weak, and difficult to detect on radar

## Supercell Tornado

Strong to Violent (EF2-EF5)



**Action:** seek shelter immediately, report to NWS when safe

- Originates from a rotating updraft in a supercell thunderstorm
- Rotation is typically a result of vertical wind differences
- Typically longer-lived, stronger, and more pronounced on radar
- Responsible for most tornado fatalities in the U.S.



@NWSIndianapolis







# Tornado Types and General Strengths

## Landspout or Non-Supercell Tornadoes





# Tornado Types and General Strengths

## Supercell Tornadoes







# Observing and Reporting Tornadoes

- Be extremely cautious. Safety first!
  - Report immediately, as soon as safely possible
- Any rotation on ground? (Most Important!)
  - Don't assume on ground if view is obscured
  - How long has it been on ground?
  - Start and end times if known
  - Approximate width and path length
- Extent and amount of damage
  - Don't assume it's from a tornado if you do not see it happen. Just report what you see!







# Nighttime Tornadoes

Very Dangerous!

## CAUTION!

Nocturnal tornadoes are twice as likely to be deadly compared to daytime tornadoes!

Need radar support and complete understanding of atmosphere to know where a tornado might be!

*Lightning/Transformers/Power line flashes may help identify possible tornadoes*





# Tornado and Thunderstorm Safety

Severe Thunderstorms Can Be deadly Too. Seek Shelter From All Severe Thunderstorms

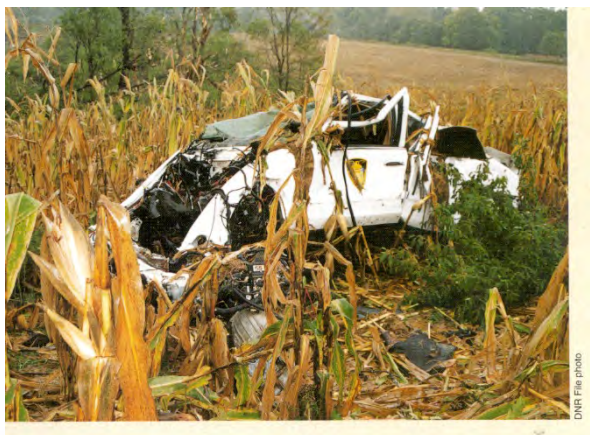


**Personal safety is your primary objective!**

**Shelter in a sturdy building away from windows on the lowest floor, interior room or closet**

**Cover your head with hands, blanket, pillow, etc.**

**Mobile home – find a safer building long before storm arrives, preferably when a watch is issued**



**In vehicle during a tornado – Seek safe buildings; drive away if possible; abandon to ditch as last resort**





# Estimating Thunderstorm Wind Speeds



Wind Speed (mph)		Effects on Land
25-31		Large branches of trees in motion; whistling heard in wires
32-38		Whole trees in motion; resistance felt in walking against the wind.
39-46		Twigs and small branches broken off trees.
47-54		Slight structural damage occurs; slate roofs blown off
55-63		Tree limbs broken, structural damage occurs.
64-72		Trees broken; usually with widespread damage.
72 or higher		Violence and destruction.







# 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





# 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!

Not a Recommended Practice



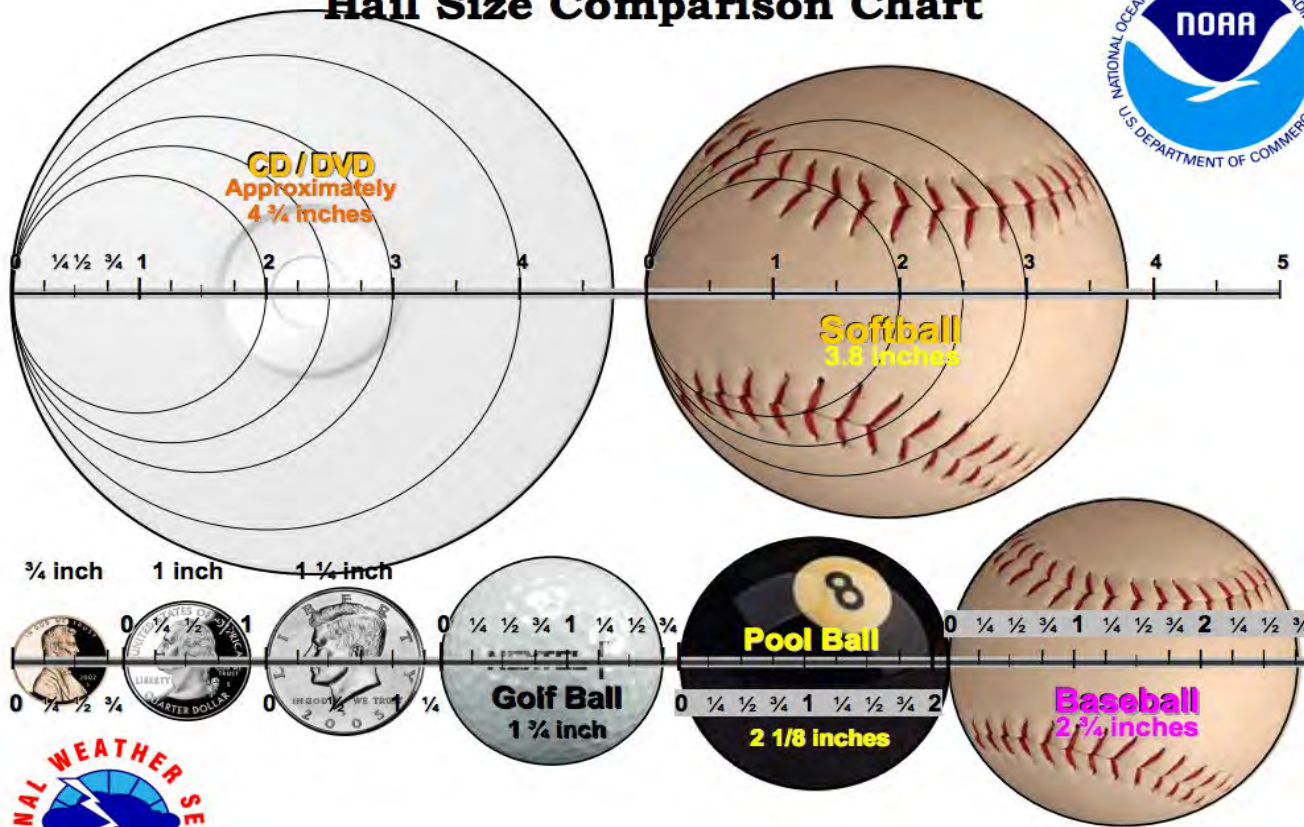




# Reporting and Measuring Hail

Use Common, Standard Size Objects When Reporting

Hail Size Comparison Chart



**Do Not Report "Marble Size" Hail!**

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







# Reporting Flooding

Evaluate the situation and surroundings

## Flash Flooding

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



## Streets, ditches, small streams/creeks flooding

- “Nuisance” or “Typical” flooding. Slower rise
- Report Street names, depth, flowing or standing
- Let us know if there is any visible debris







# Flash Flooding Safety

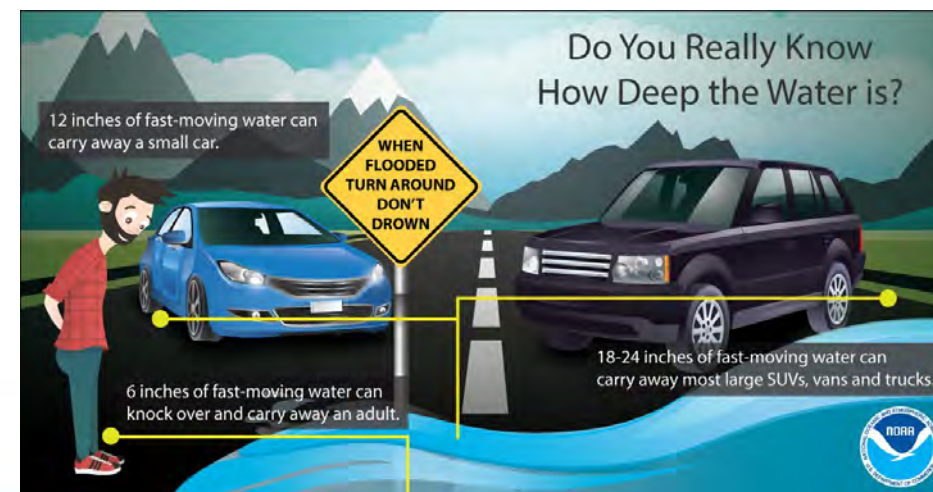


**Turn Around, Don't Drown!**

**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**





# Reporting Lightning

**No Need to Report. Get Inside a Sturdy Shelter**

- Spotters do not need to report lightning!
- All thunderstorms have lightning by definition
- The amount of lightning does not necessarily relate to the severity of a storm
- Technology allows meteorologist to monitor lightning strikes in real time



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



Indianapolis, Indiana

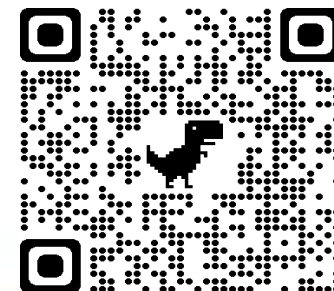




# How do Spotters report to the NWS?

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

- 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](mailto:nws.indianapolis@noaa.gov)
- Web Reports
  - [inws.ncep.noaa.gov/report](https://inws.ncep.noaa.gov/report)
  - [mping.nssl.noaa.gov](https://mping.nssl.noaa.gov)
- Amateur (HAM) Radio





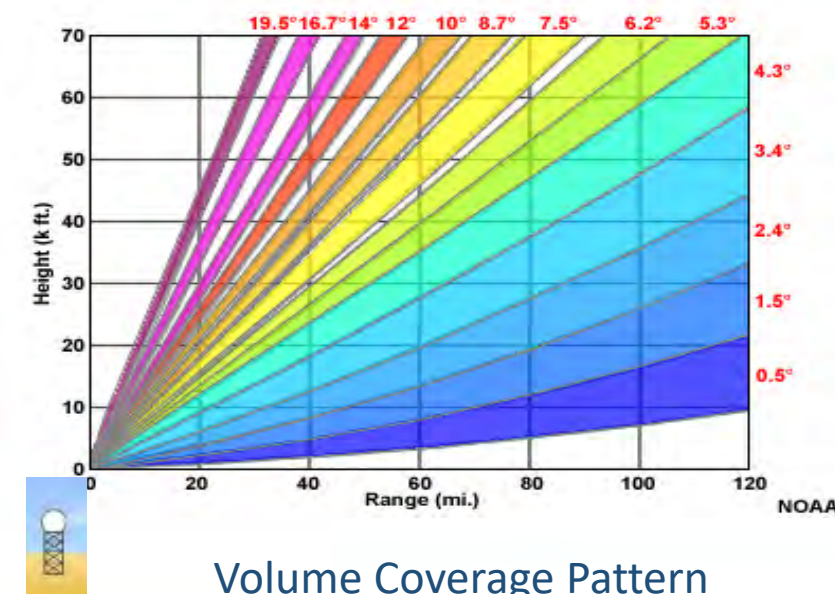
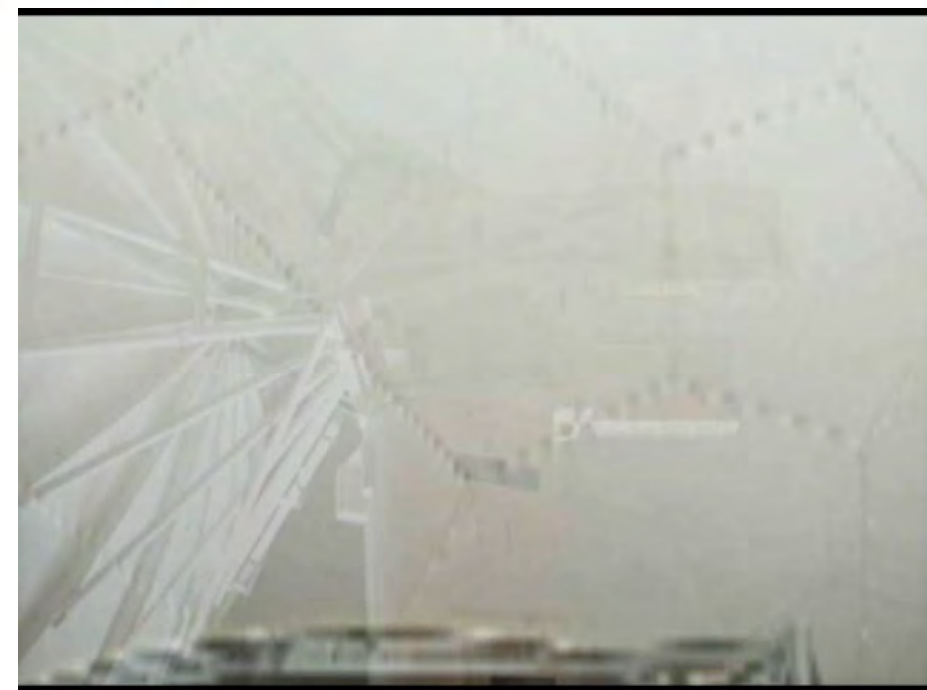
# Basic Meteorology for Spotters







# WSR-88D Basic Operations



Volume Coverage Pattern







# Basic Radar Display

Base Reflectivity (BR) – Energy Returned to the radar

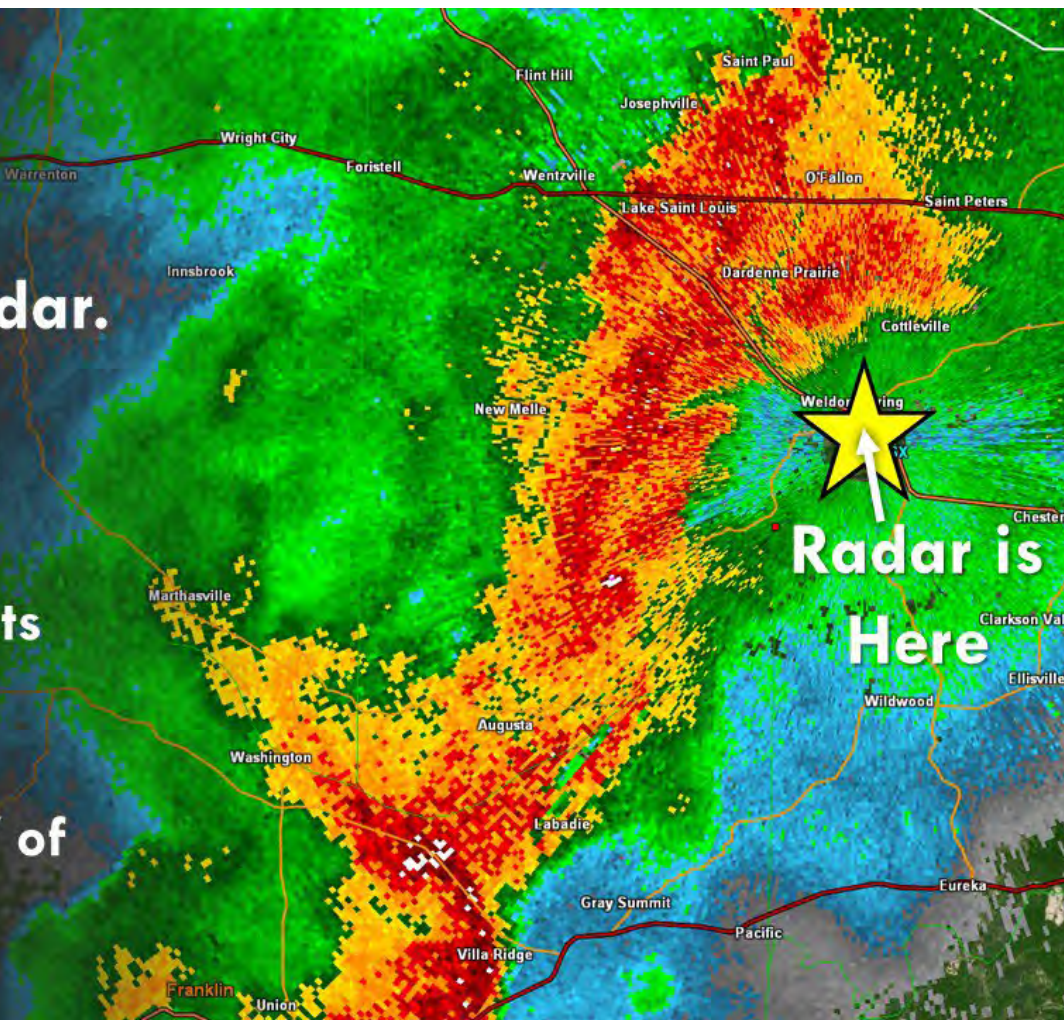
## Reflectivity

How much energy is reflected back to the radar.

Lots of factors influence this!

- Size of targets
- Density or number of targets
- Type of target

Tells us about the **INTENSITY** of precipitation.

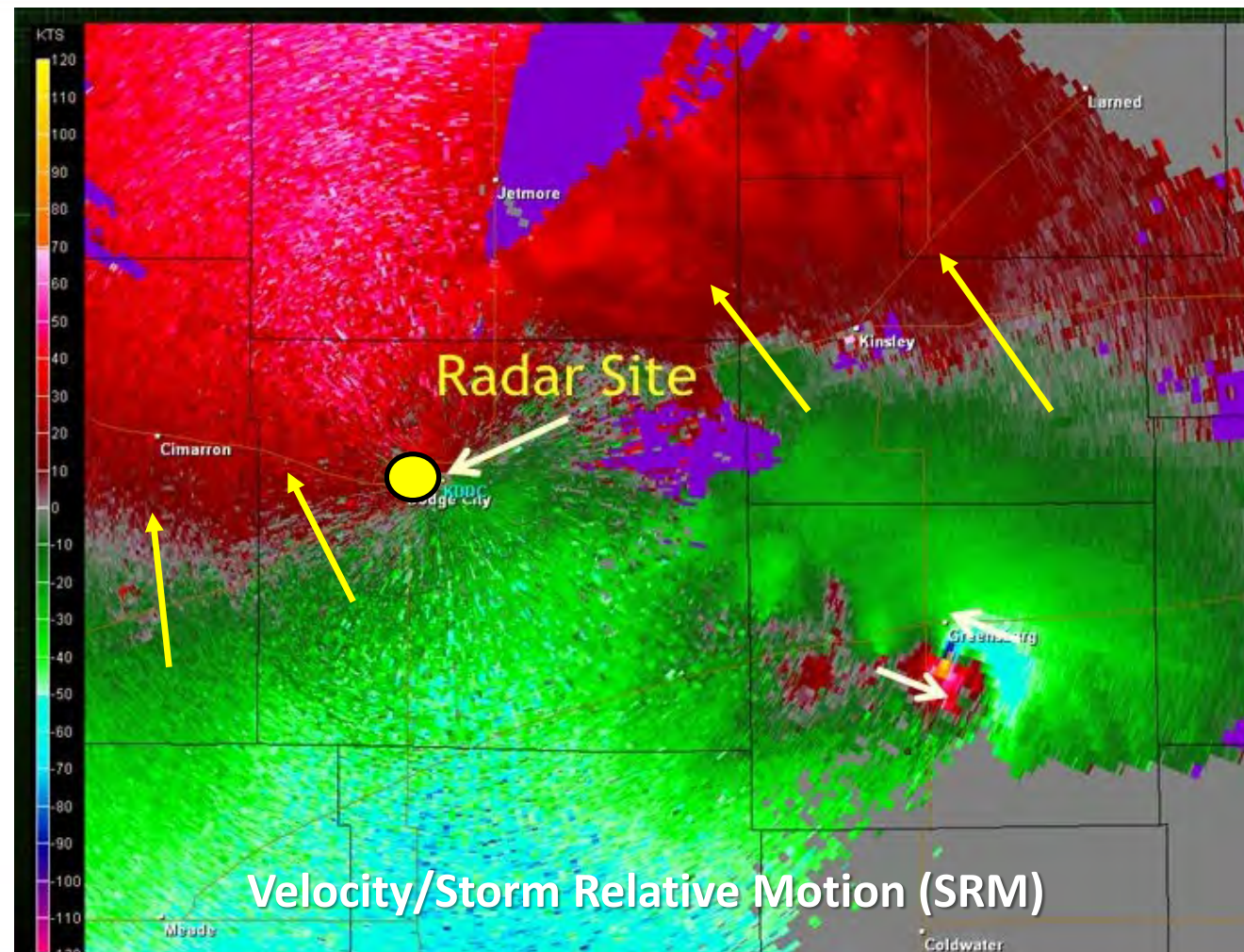
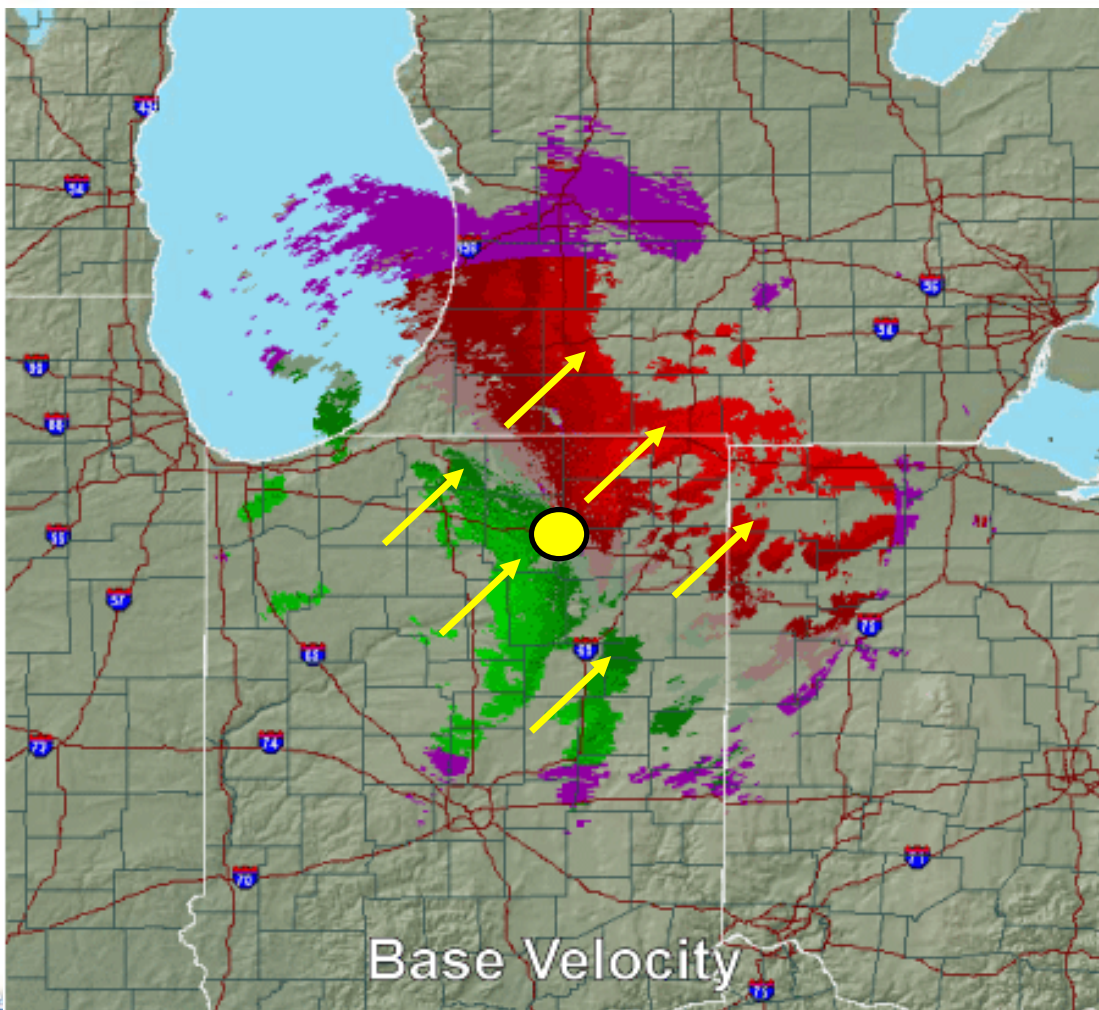






# Basic Radar Display

Base Velocity (BV) and Storm Relative Motion (SRM)



NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



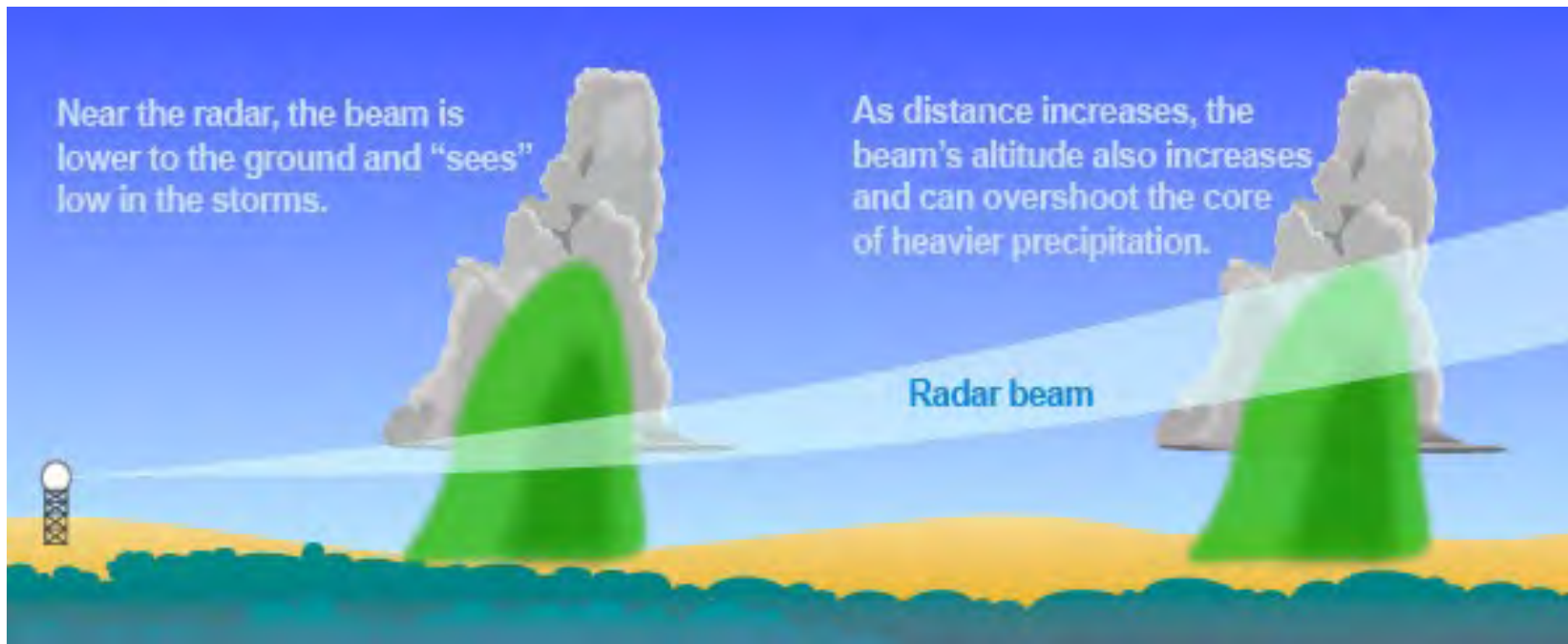
Indianapolis, Indiana





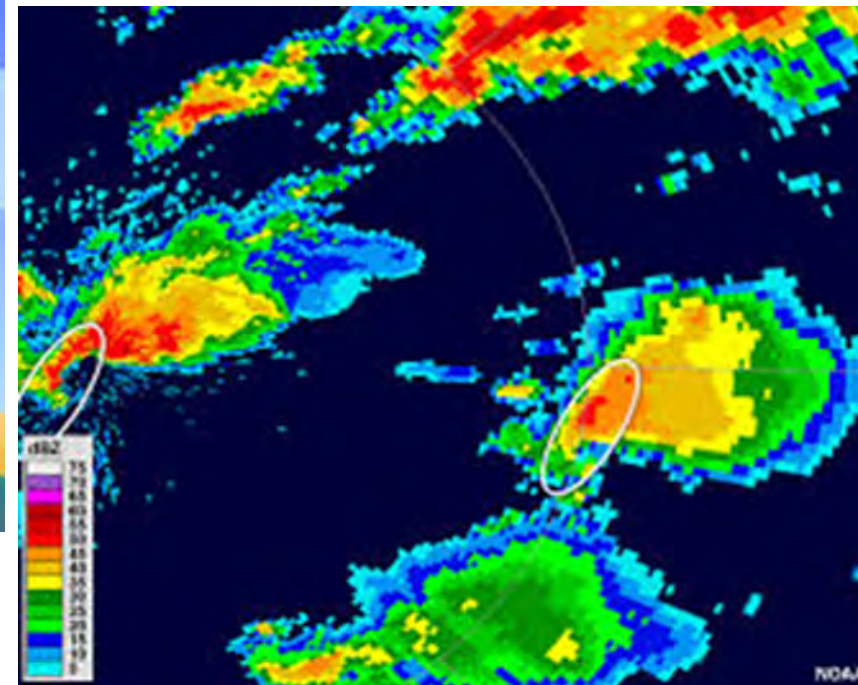
# WSR-88D Limitations

**This is One Reason Why Spotters are Important!**



As the beam gets further away from the radar, the beam is scanning higher up in the atmosphere, which can “**overshoot**” the important parts of storms.

Strong storms far away from the radar may look weaker than they really are.



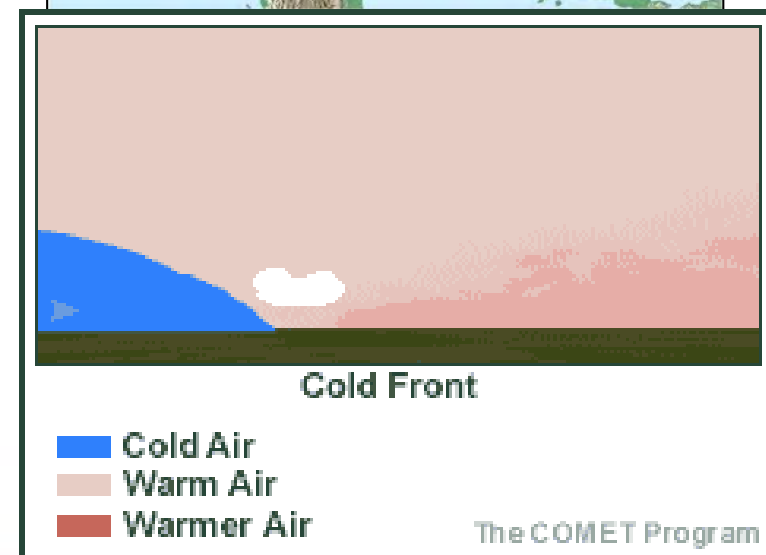
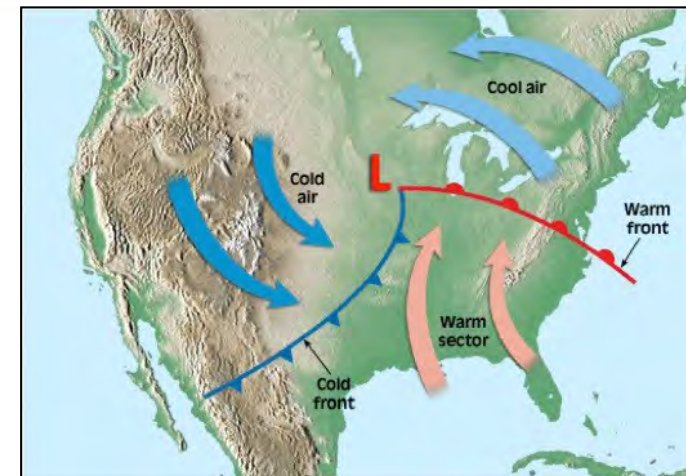




# Thunderstorm Ingredients

## How do Thunderstorms Develop?

- For General Thunderstorms to Develop:
  - Warm, moist air at the surface. Cooler, drier air aloft
    - This makes the atmosphere UNSTABLE and air will more easily rise on its own or helped by a front (CAPE)
    - Surface dew points are a measure of moisture and very important for thunderstorm development
  - Lifting mechanism or “Trigger”
    - Warm/cold fronts, outflow boundaries from other storms, jet stream, terrain
- For SEVERE Thunderstorms to Develop:
  - WIND SHEAR is Needed!
    - Speed and Directional shear help determine storm type

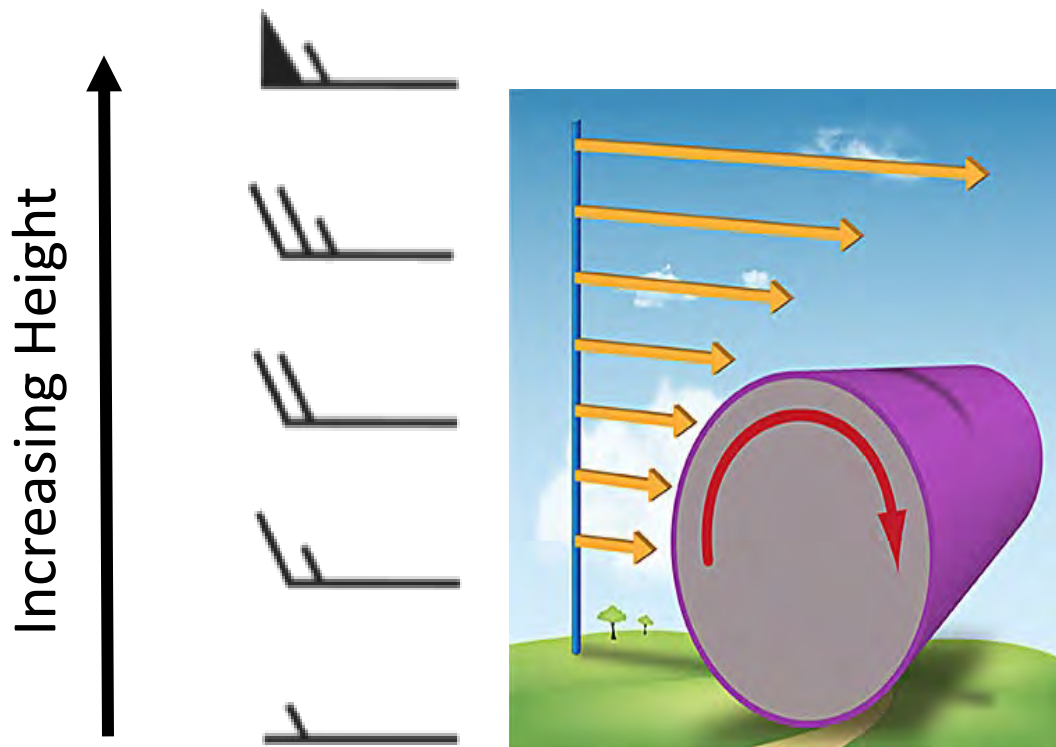




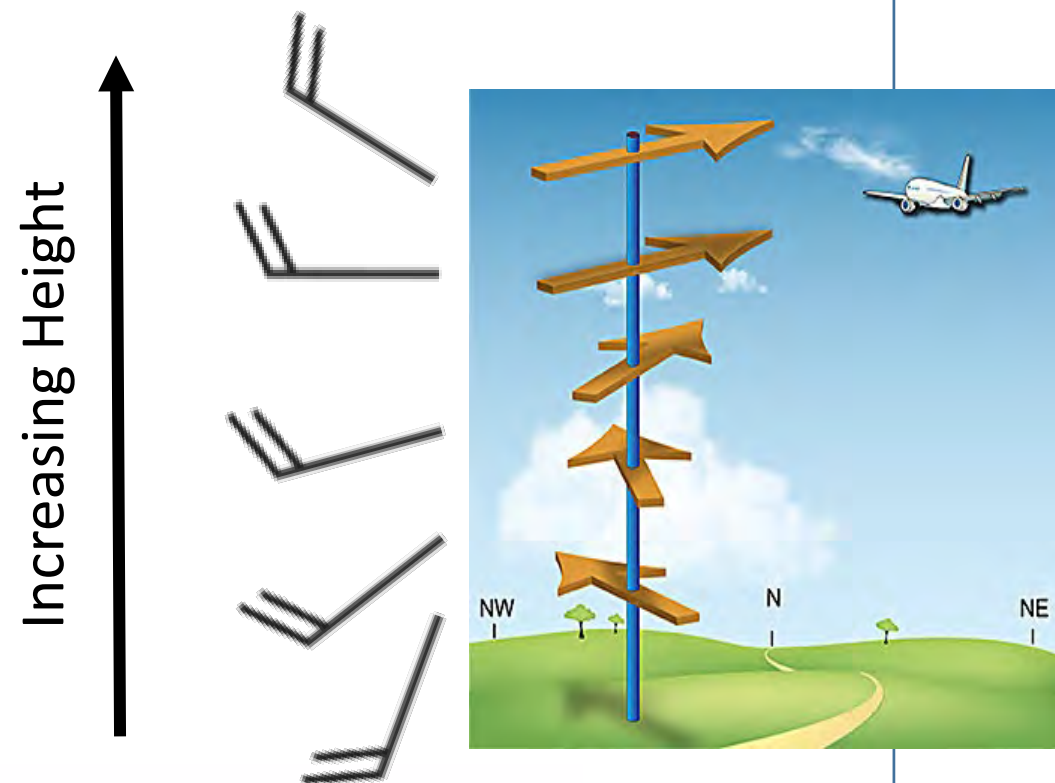
# The Role of Wind Shear

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

## Speed Shear



## Directional Shear



Has a strong influence on the type of thunderstorms that may develop

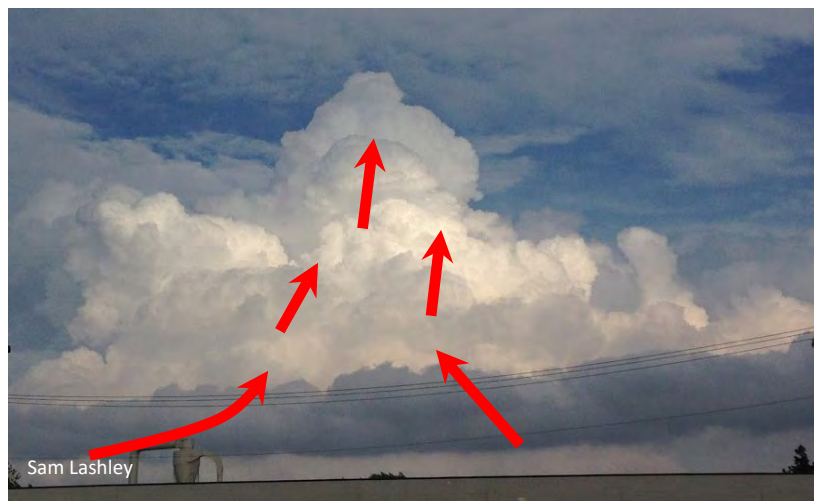




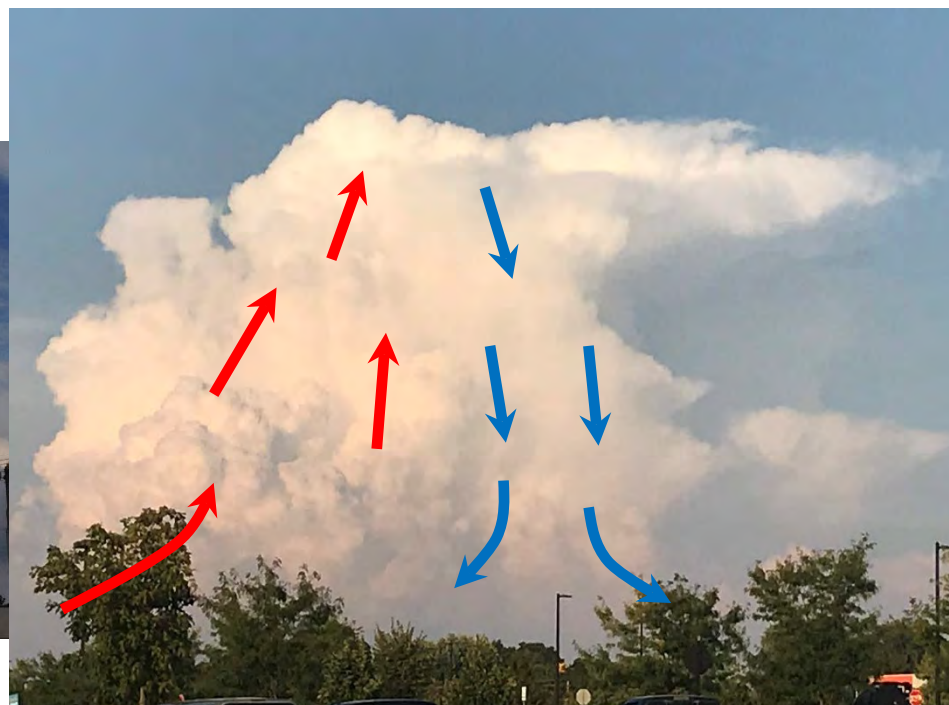


# Basic Thunderstorm Life Cycle

Little or No Wind Shear. Nearly Vertical Structure to Storms



Developing  
Towering Cumulus Stage



Mature  
Cumulonimbus Stage

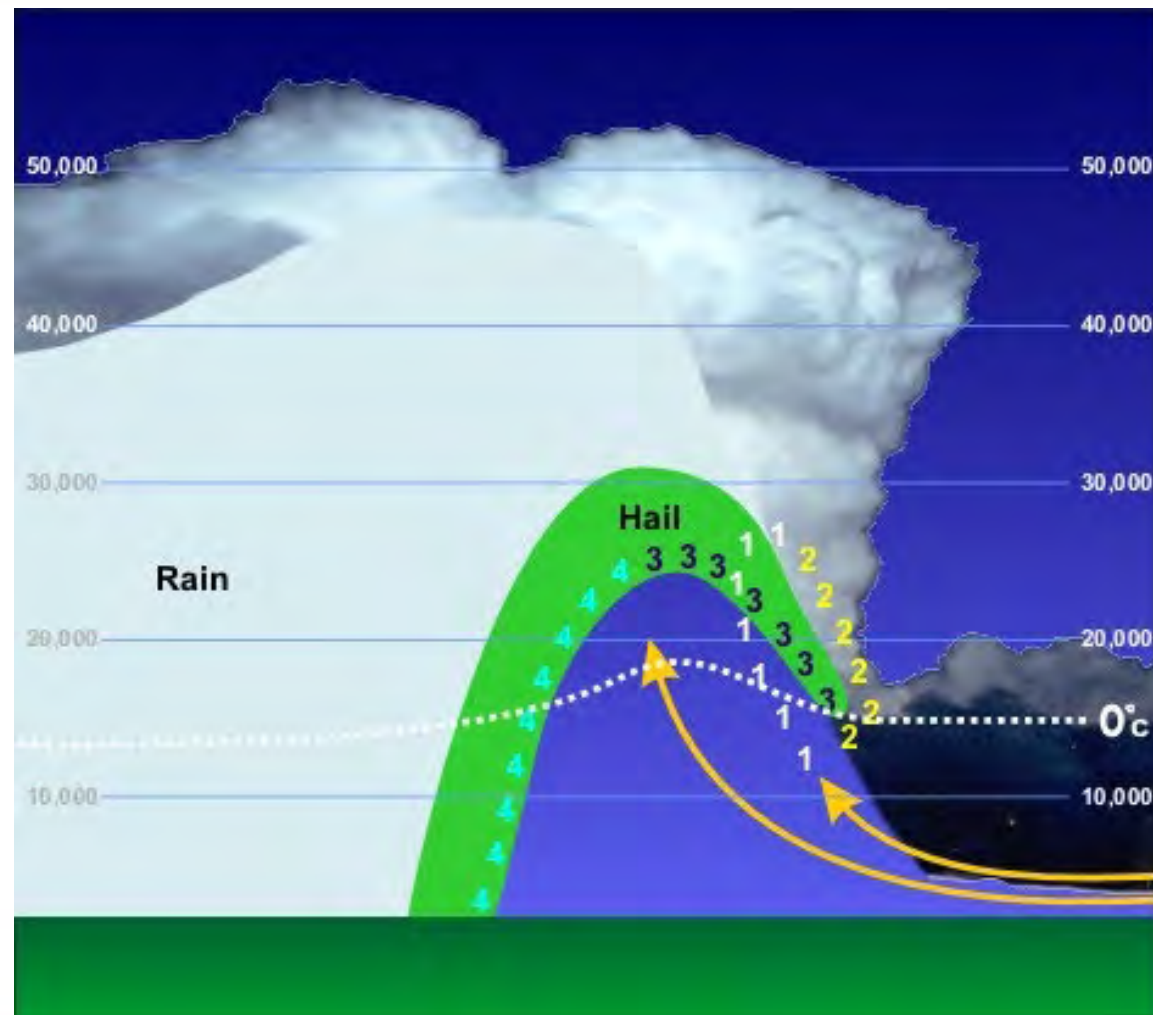
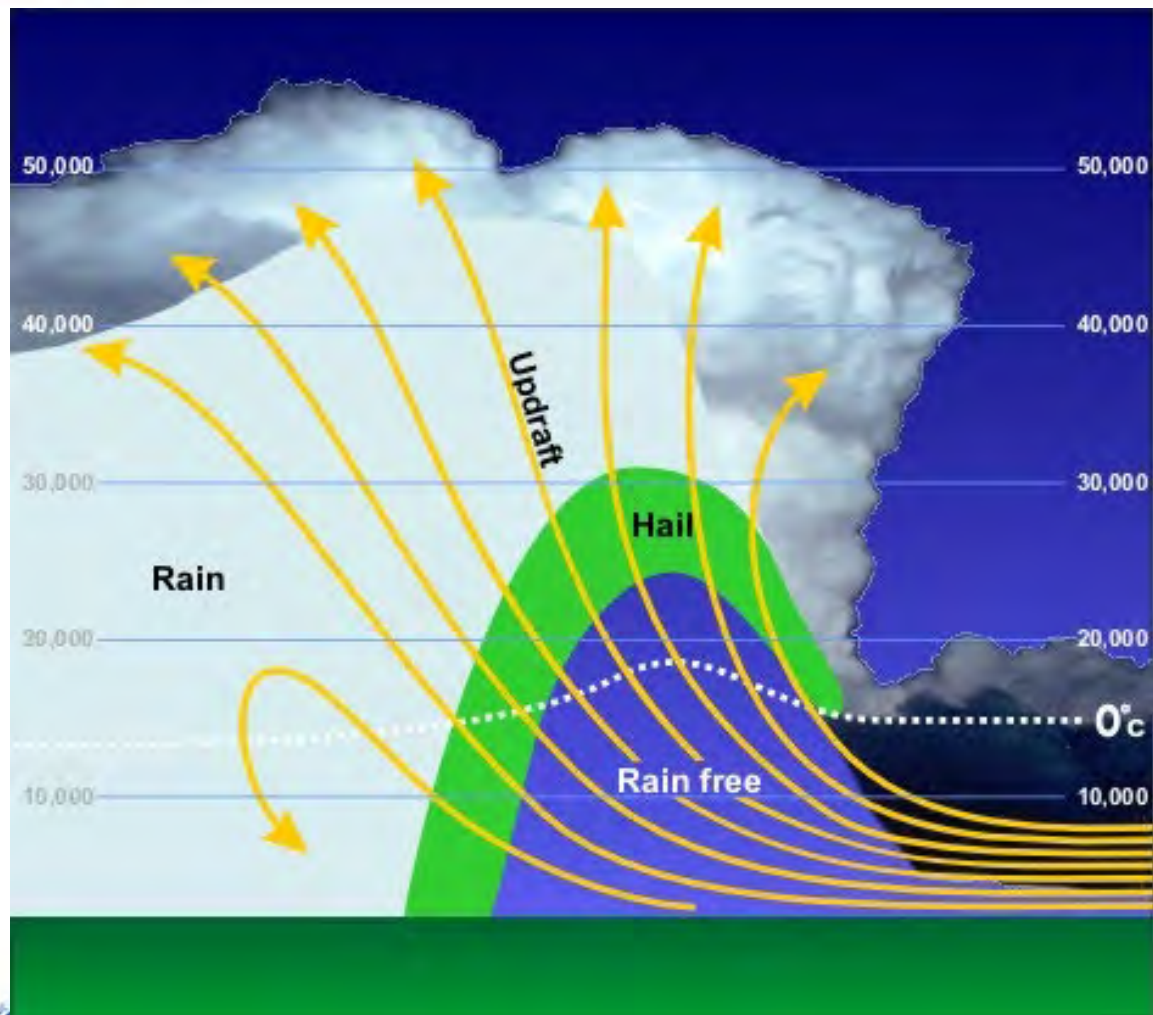


Dissipating  
Downdraft/Outflow Stage





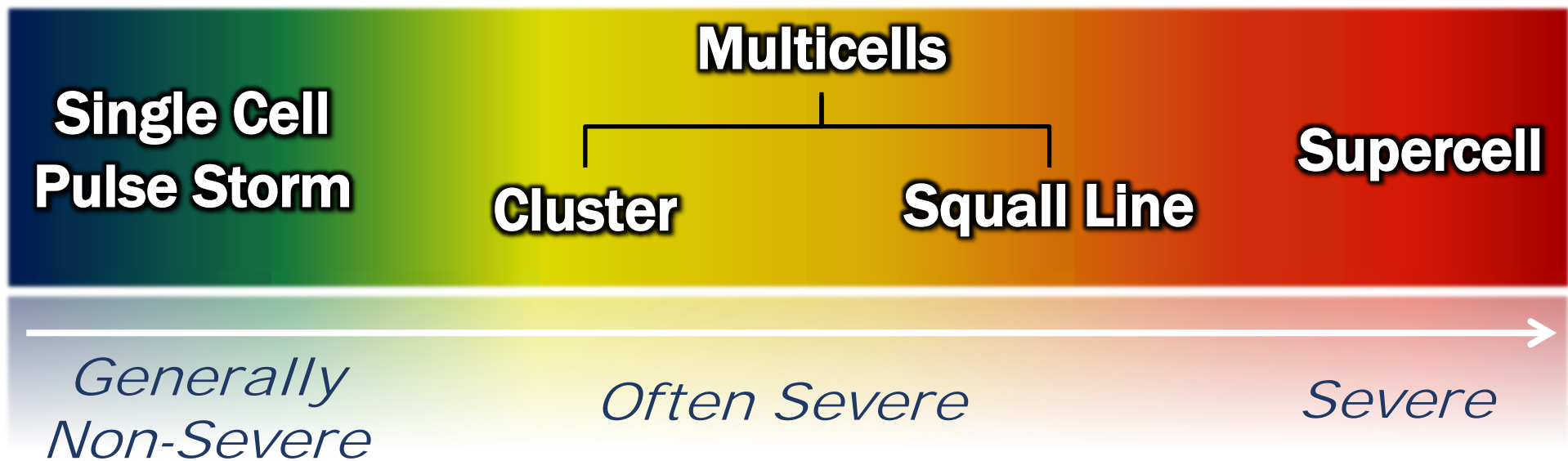
# How Does Hail Form?







# Thunderstorm Types and Severe Weather



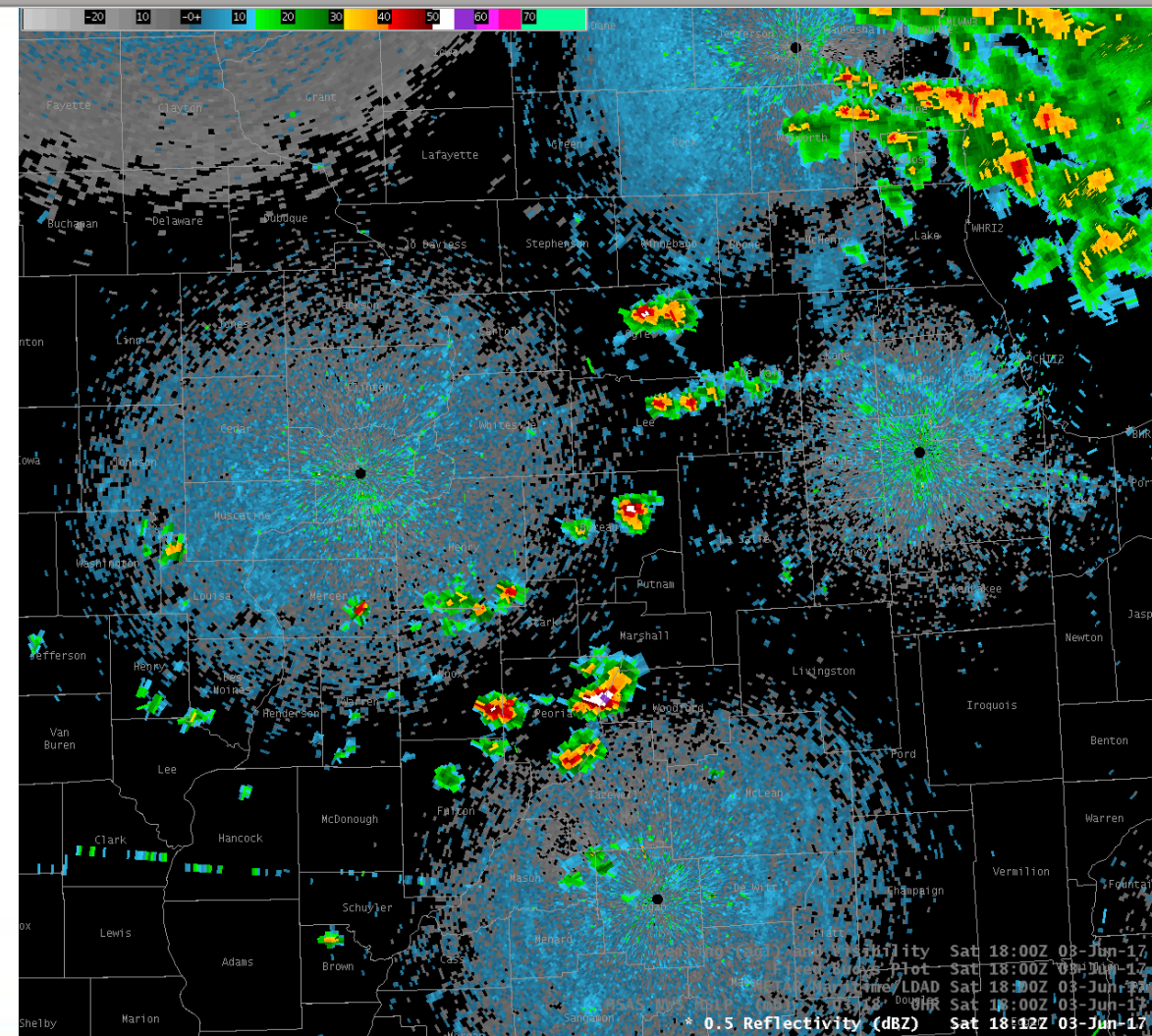
- Storms don't always fit into these exact types
- Can change type one or more times during their existence
- Atmospheric conditions will determine type of storm





# Single Cell or “Pulse” Storms

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

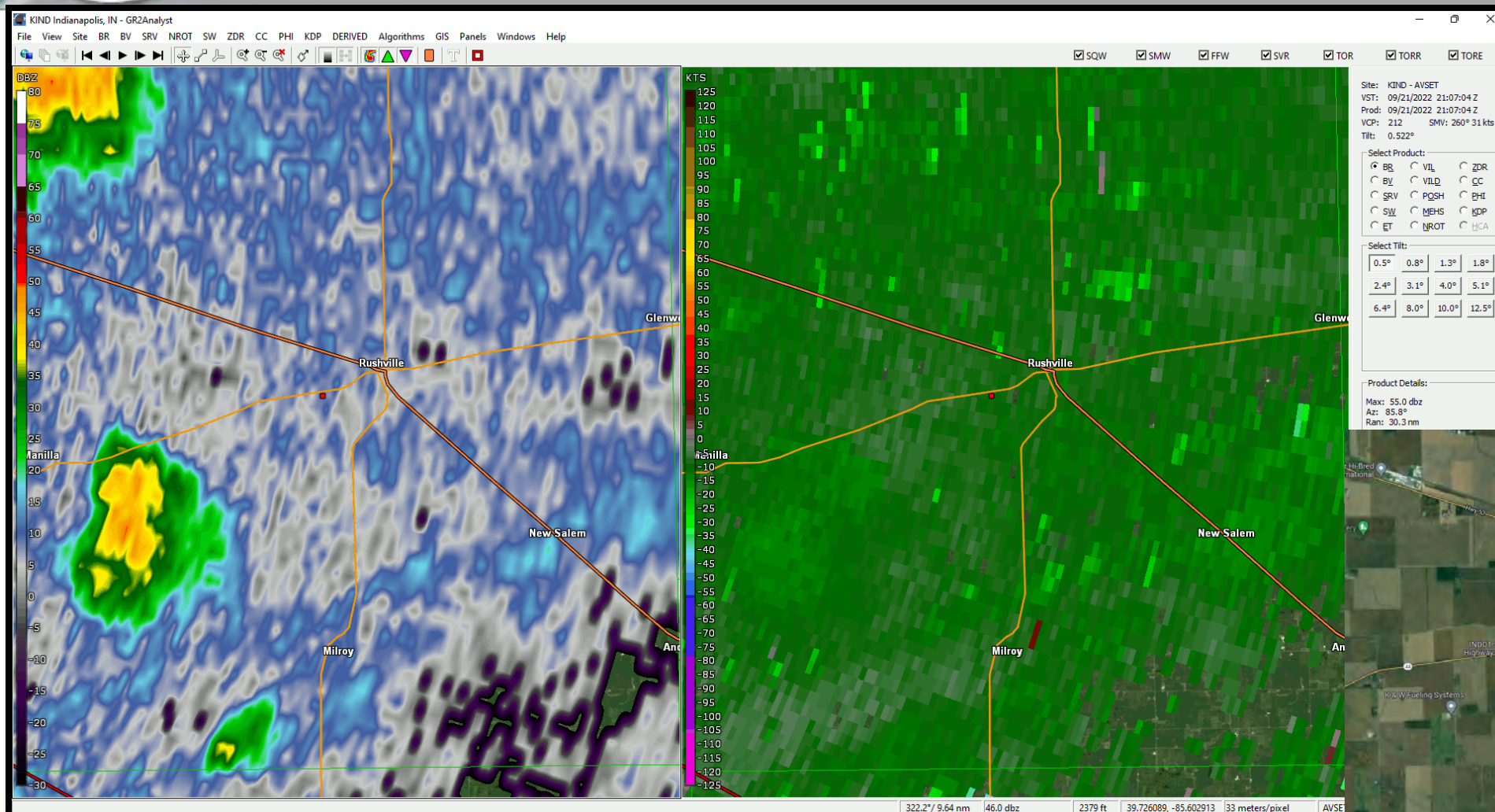




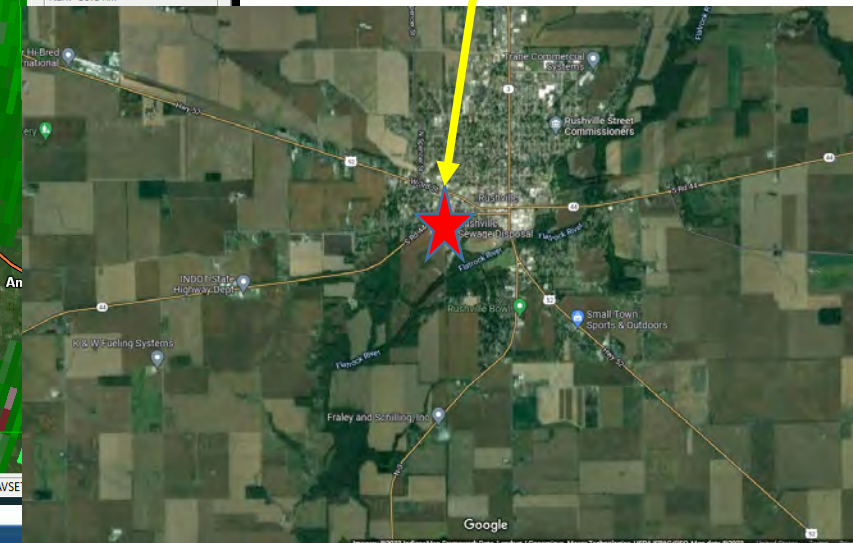


# Pulse Storm with Microburst

## Thunderstorm with a Fast Developing Microburst Over Rushville, IN



**Location of Damage at  
Rushville Wastewater  
Plant**



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION

Indianapolis, Indiana





# Pulse Storm with Microburst

Microburst Damage Usually Isolated and Mainly Trees, Utility Poles, Minor Structural Damage



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



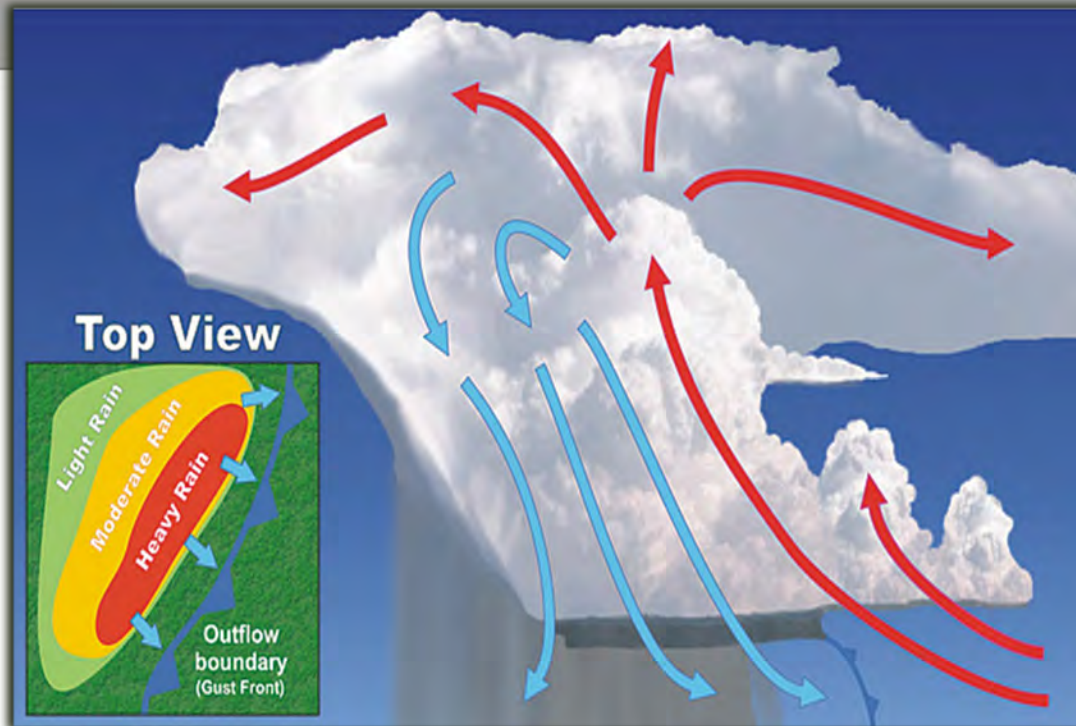
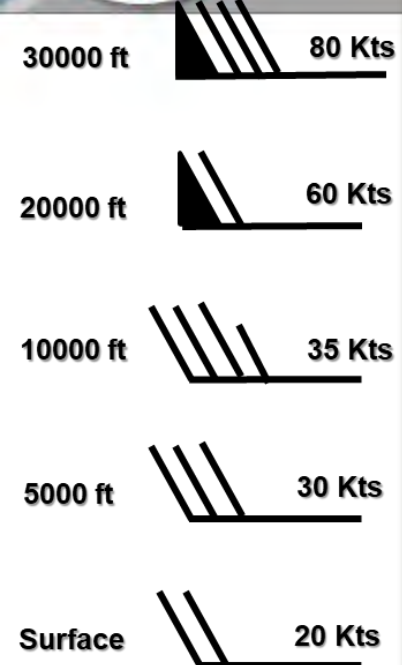
Indianapolis, Indiana





# Multi-cell Thunderstorms/Squall Lines

What You May See Coming at You



Overall Severe Weather Threat Level: **Moderate-High**

Hail



Wind



Heavy Rain



Tornado

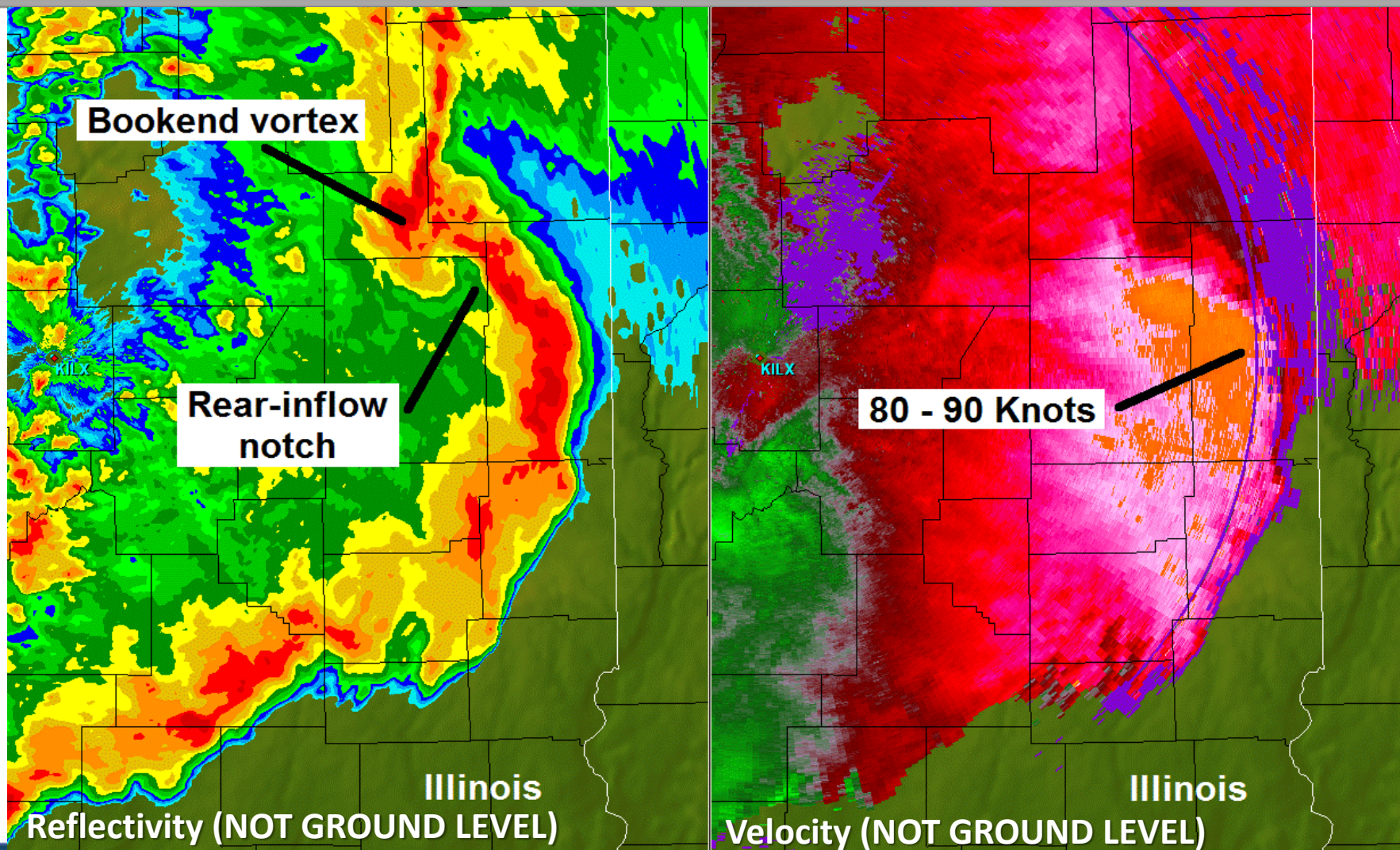






# Multi-cell – Squall Line or Bow Echo

What You Might See on Radar – Fast Moving



NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



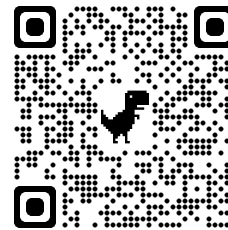
Indianapolis, Indiana



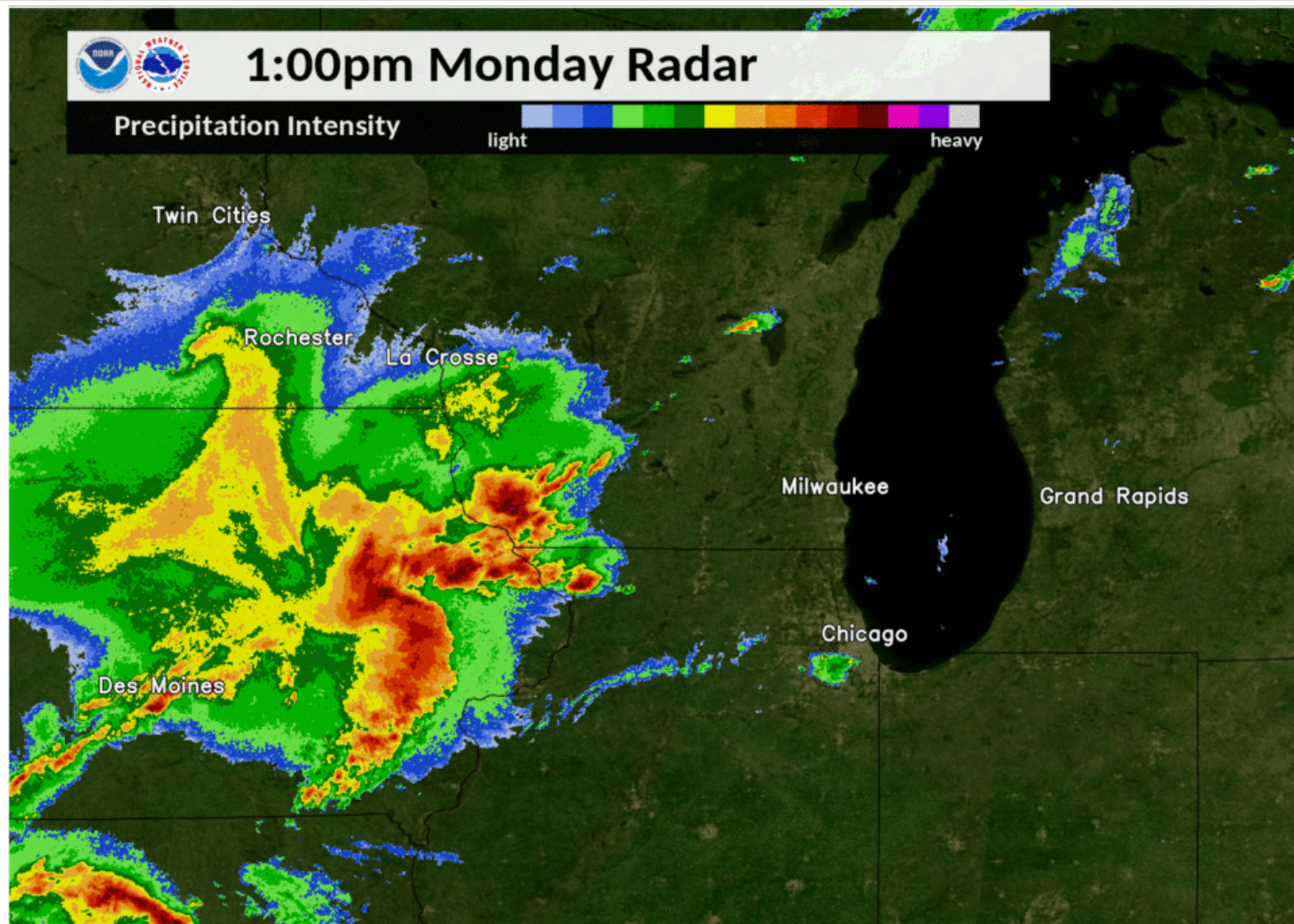


# Multi-cell Line - Derecho

August 10<sup>th</sup>, 2020 Radar Loop



- Wind Damage covered more than 90,000 sq miles
- \$11.5 Billion in damages
- 4 fatalities, hundreds of injuries
- Peak wind gusts 140 mph in Cedar Rapids, IA
- Severe winds lasted more than 30 minutes in some locations
- 26 tornadoes



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION

<https://storymaps.arcgis.com/stories/f98352e2153b4865b99ba53b86021b65>



Indianapolis, Indiana





# Multi-cell Line - Derecho

August 10<sup>th</sup>, 2020 Derecho Wind Damage – As Destructive as a Tornado



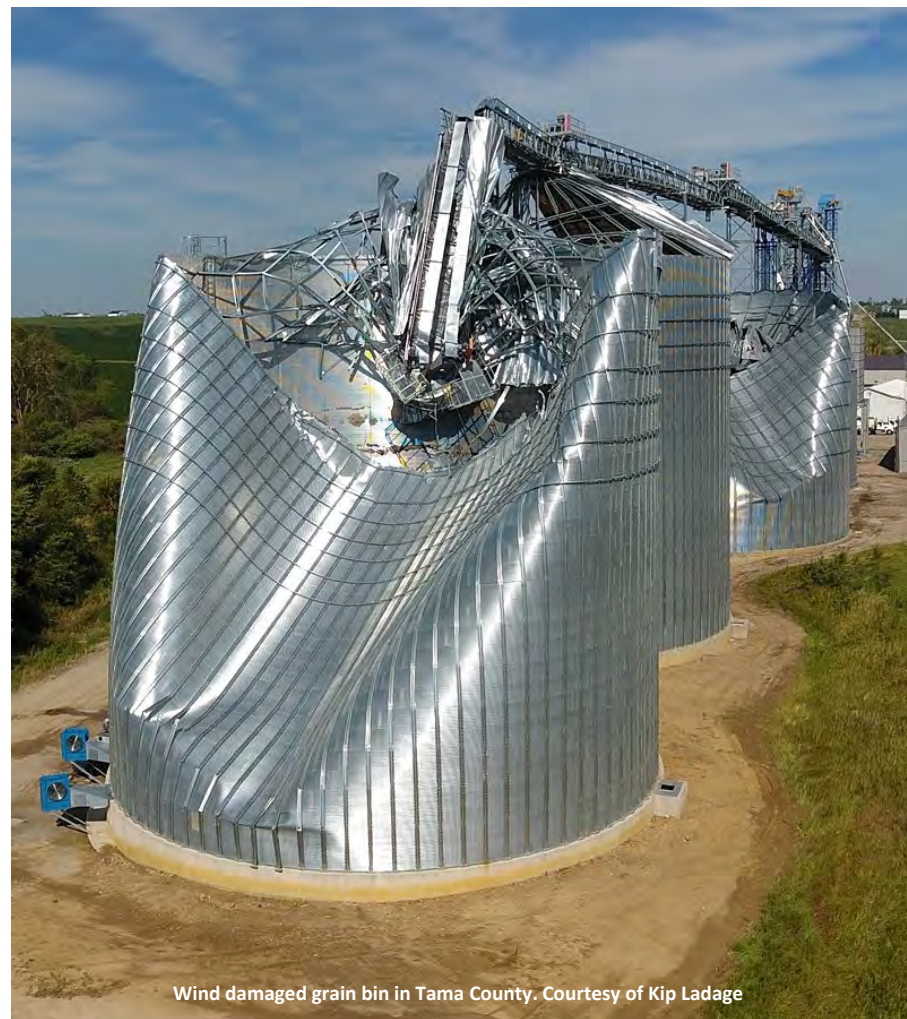
Photo Credits: Dallas County EMA



Photo Credits: Darrell Werning



Photo Credit: Justin Gehrts



Wind damaged grain bin in Tama County. Courtesy of Kip Ladage



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION

<https://storymaps.arcgis.com/stories/f98352e2153b4865b99ba53b86021b65>



Indianapolis, Indiana

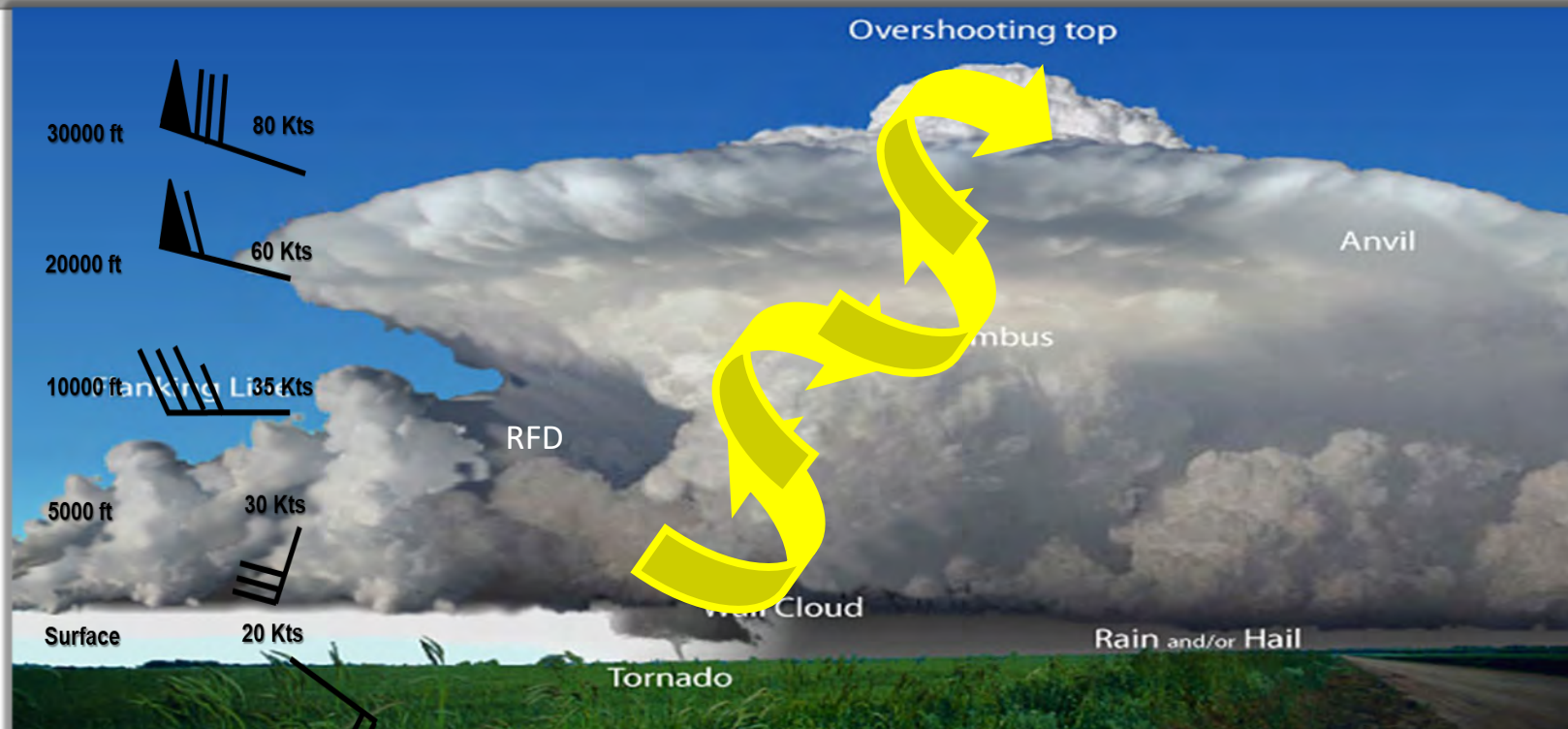




# Supercell Thunderstorms

“Granddaddy” of Severe Storms – Most Deadly

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



Overall Severe Weather Threat Level: **High**

Hail



Wind



Heavy  
Rain

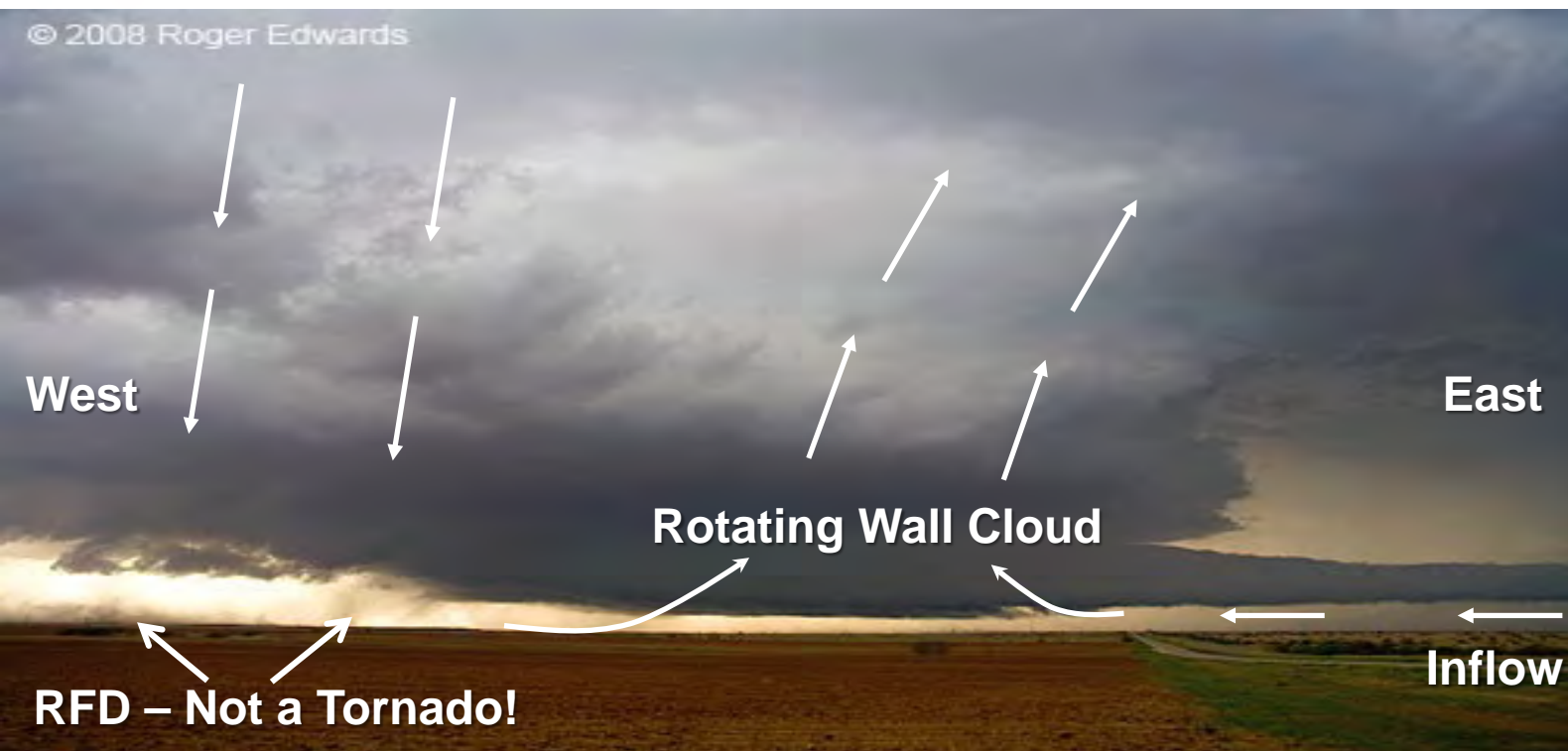


Tornado

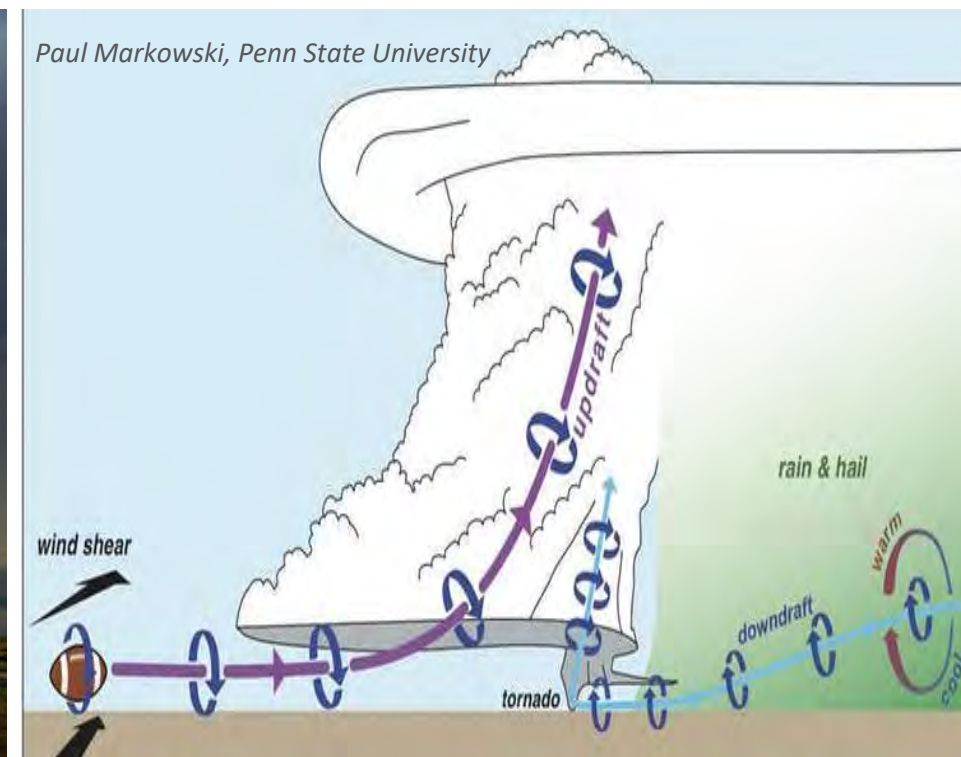




# Supercell Features – Wall Clouds, Inflow and RFD



Looking north toward an east moving Supercell



★  
Spotter Position





# Supercell Funnel Clouds

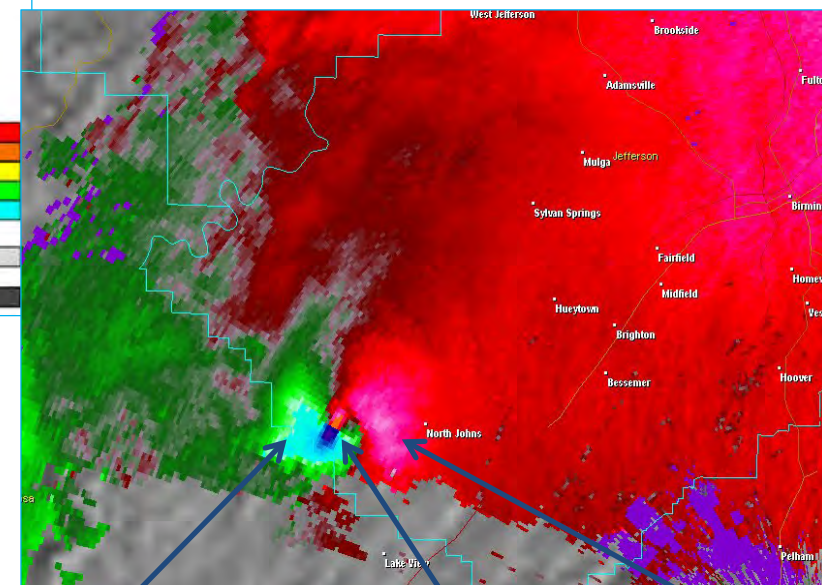
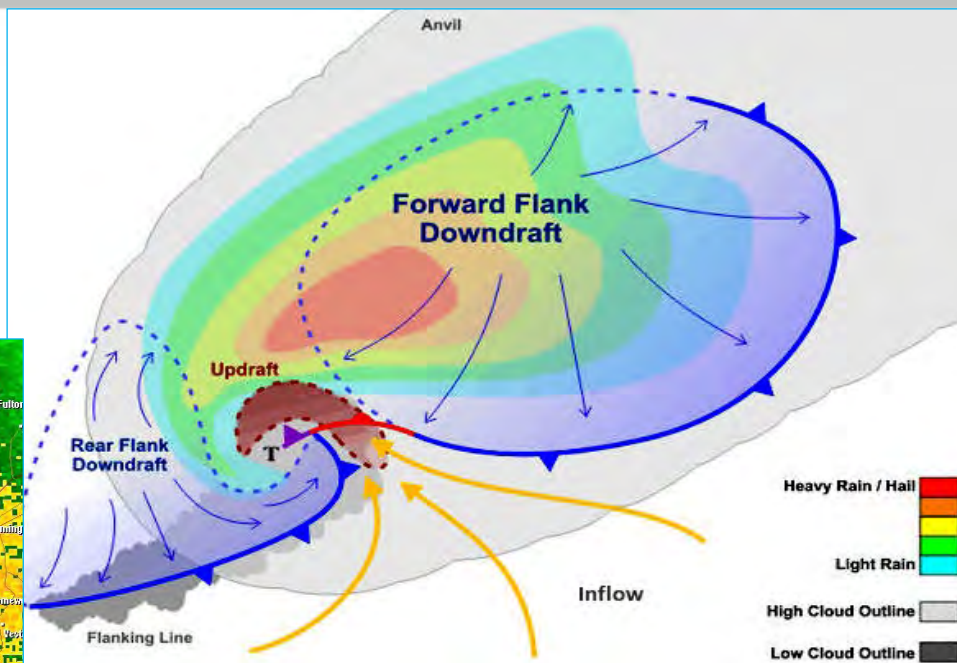
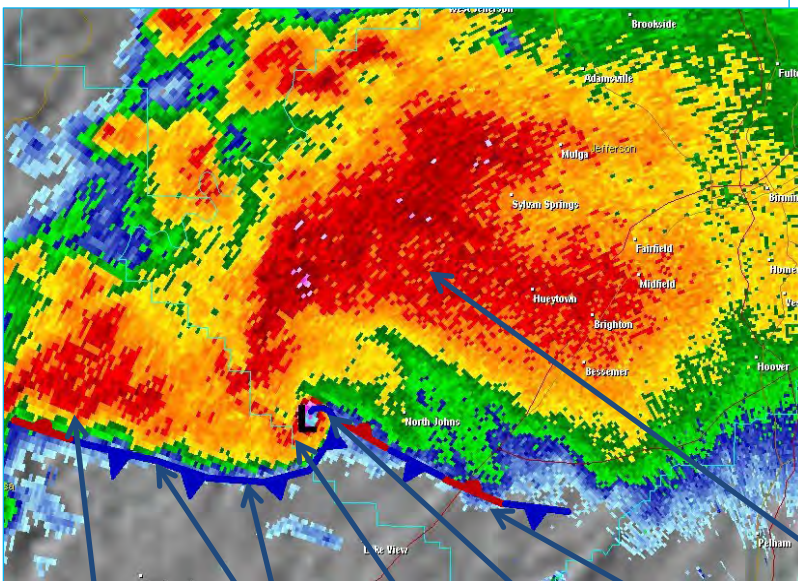
- Often precedes tornadoes
- Develops below rotating wall cloud
- Funnel or cone shaped, often smooth
- No rotation visible on the ground (not a tornado)
- Once rotation on ground is observed, it is a tornado



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

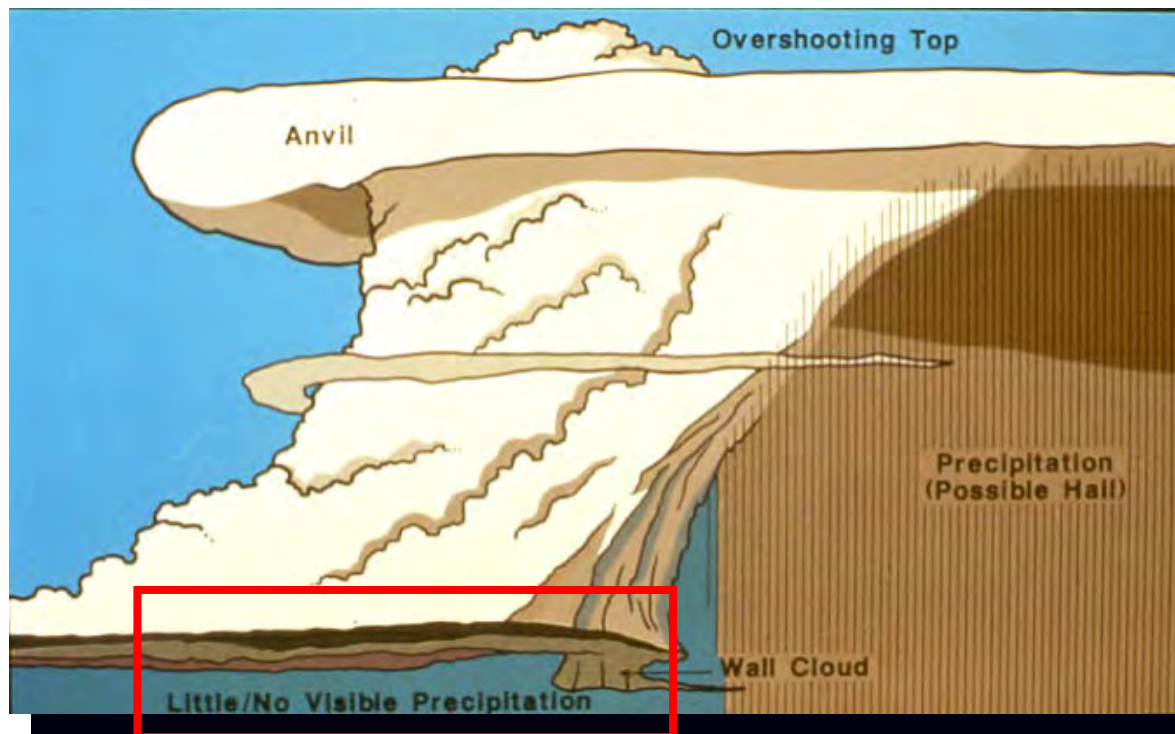




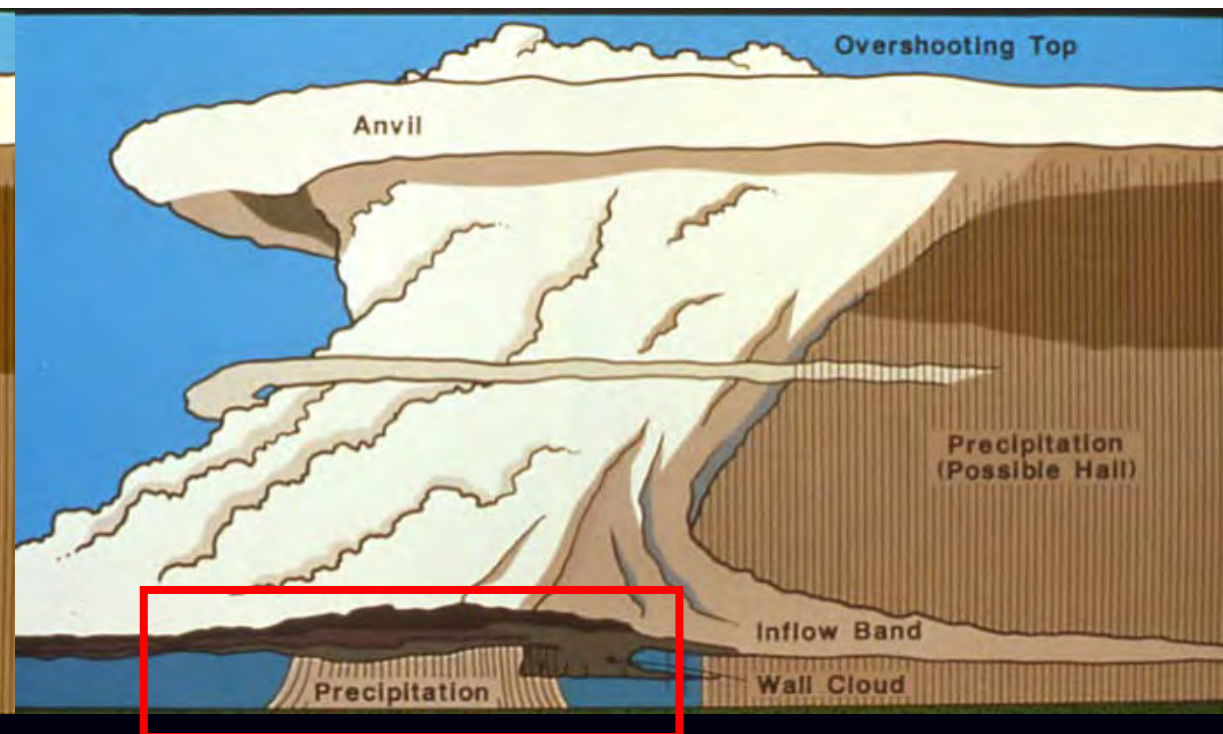
# Classic vs "HP" Supercell

Tornadoes with HP Supercells will be rain wrapped

## Classic Supercell



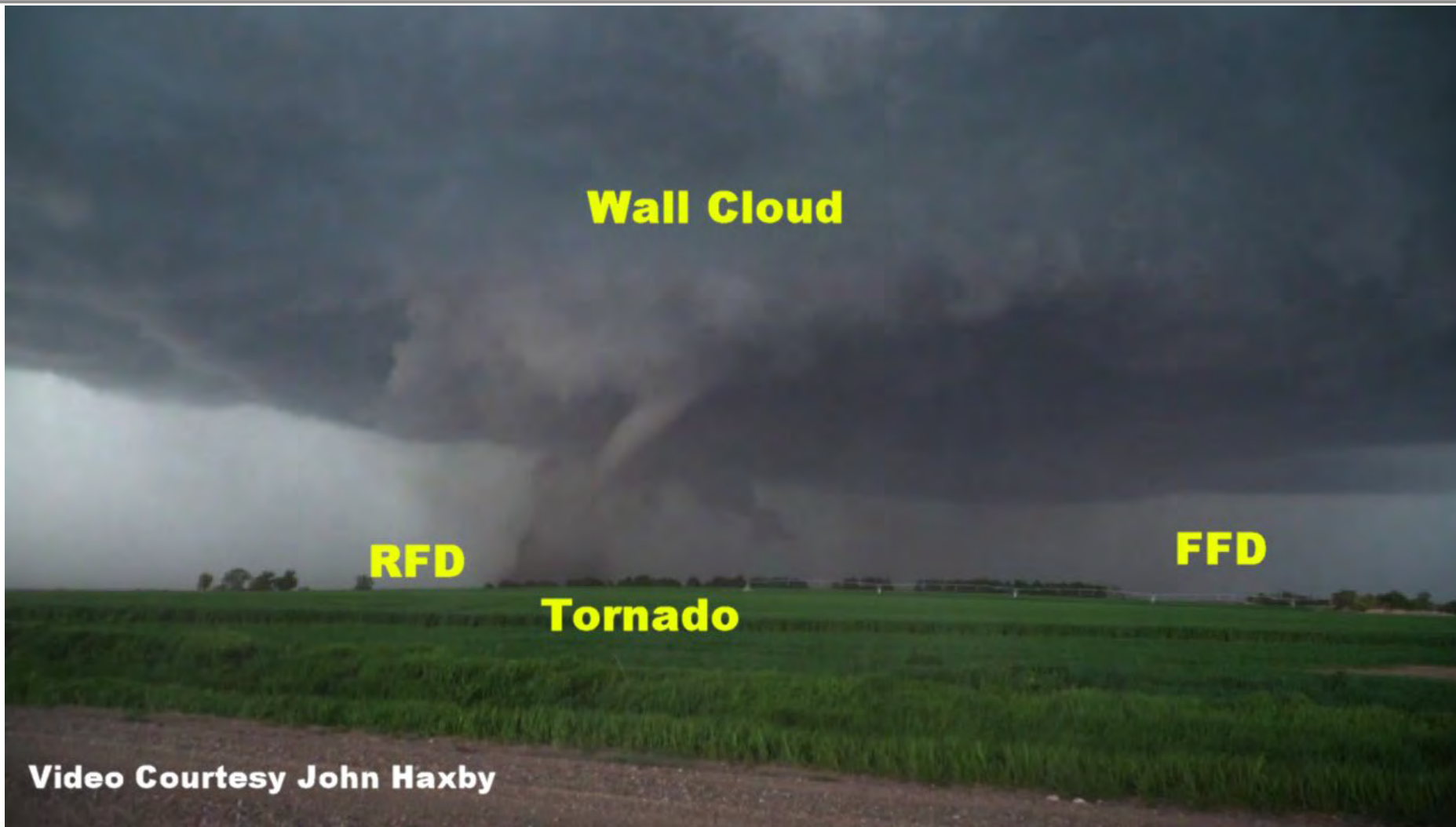
## High Precipitation Supercell





# Classic Supercell

**Tornadoes with Classic Supercells are Usually Visible**



**Video Courtesy John Haxby**



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



Indianapolis, Indiana





# HP Supercell in Oklahoma

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



Video Courtesy Evan Bentley



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



Indianapolis, Indiana



# HP Supercell in Oklahoma

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



Video Courtesy Evan Bentley



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



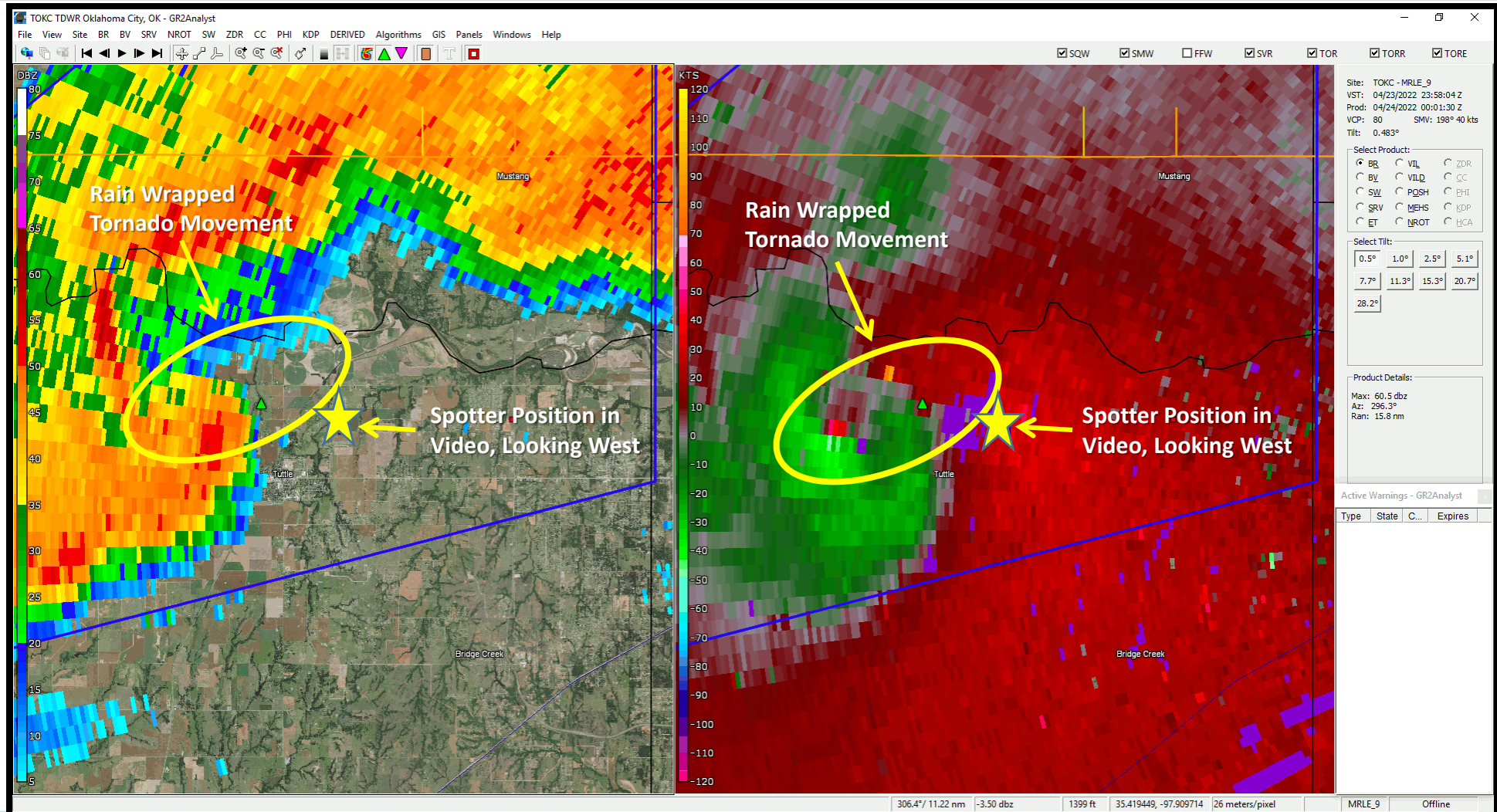
Indianapolis, Indiana



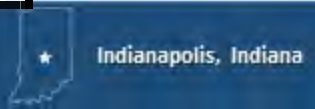


# HP Supercell in Oklahoma

Tornadoes with HP Supercells will be rain wrapped



NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION

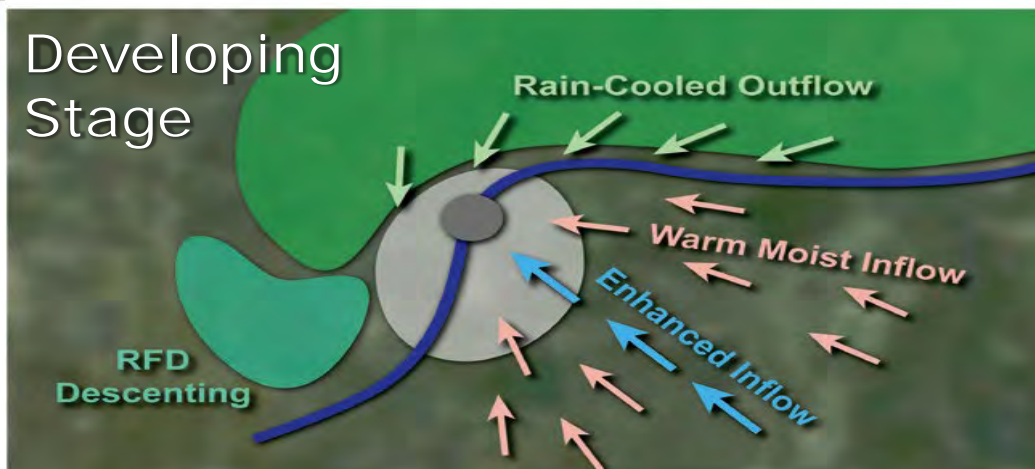




# Visual Clues of Supercell Tornado Formation

**Developing Stage – Don't be fooled by a rain shaft**

Developing Stage



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



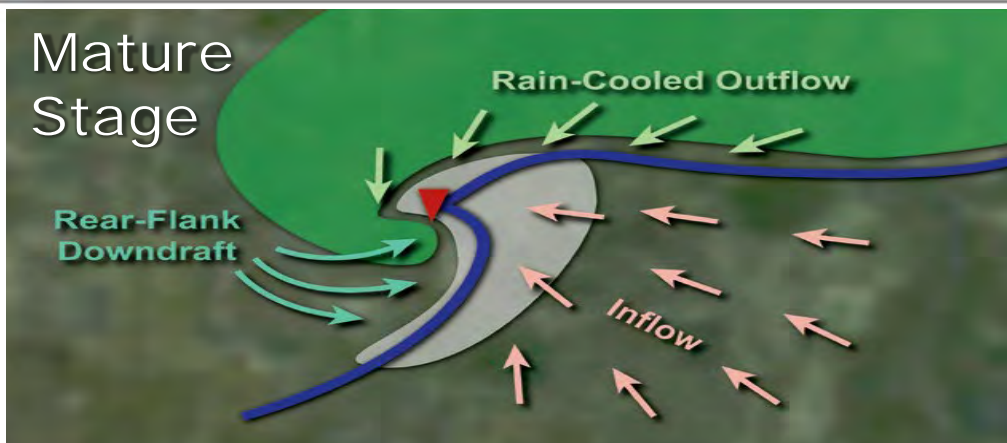
Indianapolis, Indiana





# Visual Clues of Supercell Tornado Formation

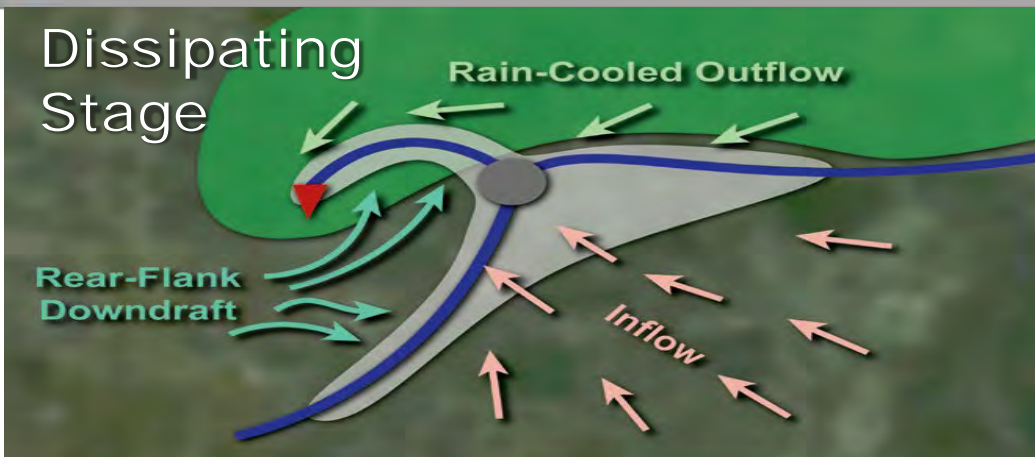
## Mature Stage of Henryville, IN Tornado – March 2<sup>nd</sup>, 2012





# Visual Clues of Supercell Tornado Formation

**Dissipating Stage, possible cyclic stage with new tornado**



Looking Northeast



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION

Photos by Chuck Doswell and Roger Edwards



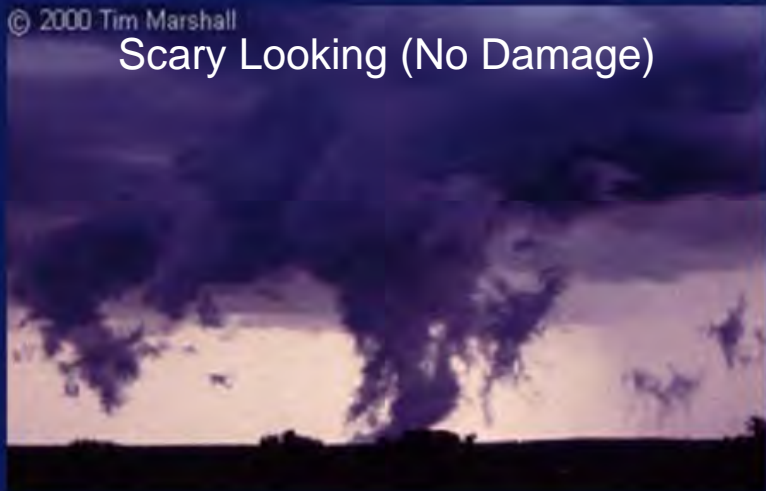


# Tornado Look-a-Likes

## Scud

© 2000 Tim Marshall

Scary Looking (No Damage)

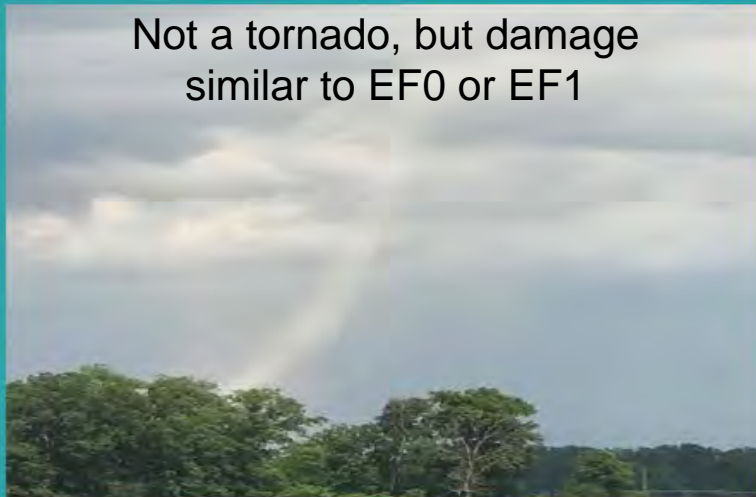


**Action:** no action required. Be prepared to shelter indoors from rain and lightning

- 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





# Tornado Look-a-Likes

Many Cloud Features Have Fooled Trained Spotters. Look For Rotation!

© 2000 Tim Marshall

Scud



Scud



Power Plant Steam



Smoke



© 2007 Roger Edwards

Virga/rain shaft







# Tornado Look-a-Likes

**Gustnadoes are NOT Tornadoes. No Parent Cloud Connection**



**NATIONAL WEATHER SERVICE**  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



Indianapolis, Indiana



# Spotter Resources

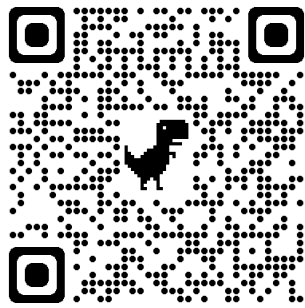




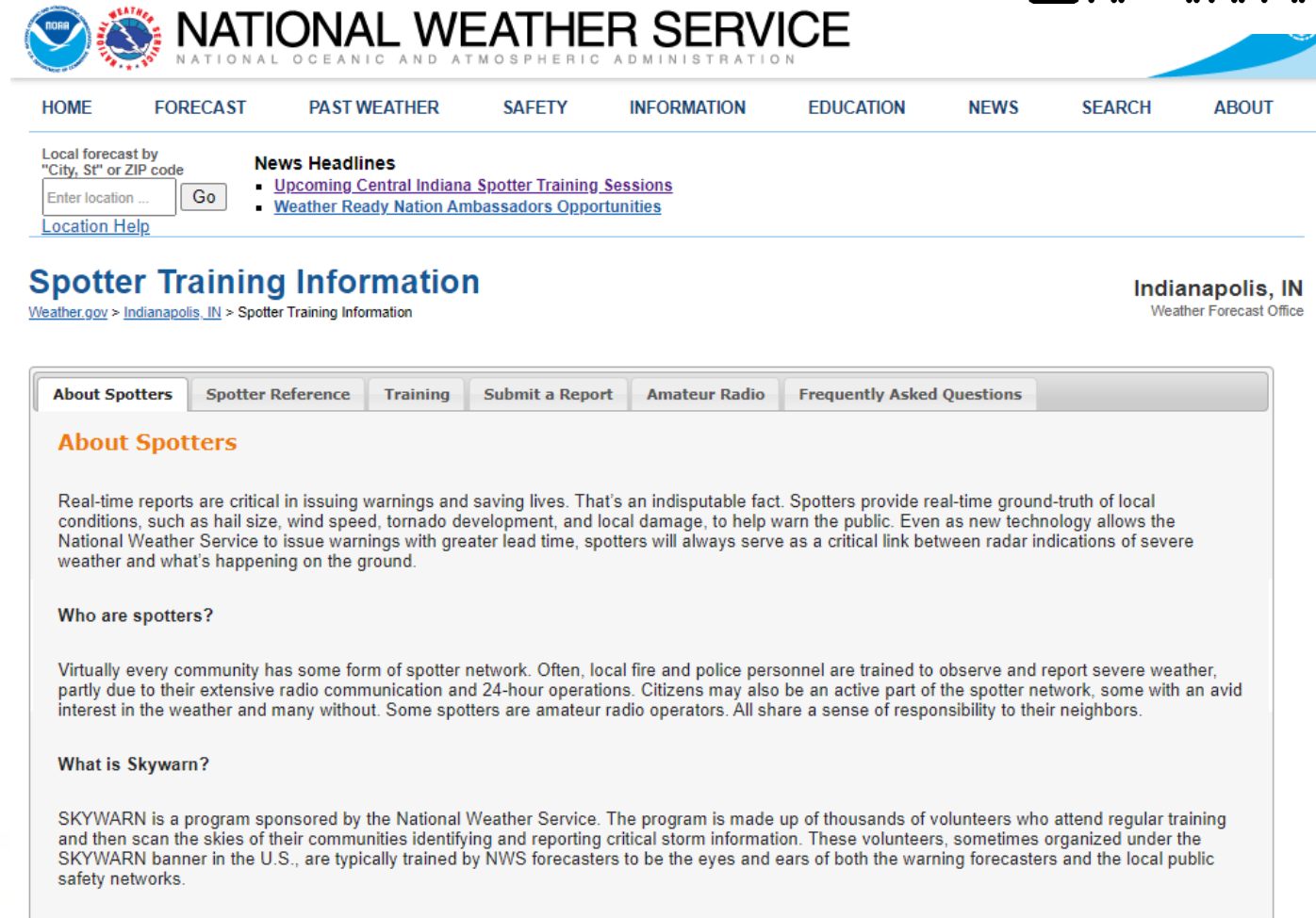


# NWS Indianapolis Spotter Page

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



The screenshot shows the NWS Indianapolis Spotter Page. At the top is the National Weather Service logo and the text "NATIONAL WEATHER SERVICE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION". Below this is a navigation bar with links: HOME, FORECAST, PAST WEATHER, SAFETY, INFORMATION, EDUCATION, NEWS, SEARCH, and ABOUT. A "Local forecast by 'City, St' or ZIP code" section includes a text input field "Enter location ..." and a "Go" button, with a "Location Help" link below. To the right is a "News Headlines" section with two links: "Upcoming Central Indiana Spotter Training Sessions" and "Weather Ready Nation Ambassadors Opportunities". Below the navigation bar is a "Spotter Training Information" section with a breadcrumb trail: "Weather.gov > Indianapolis, IN > Spotter Training Information". On the right side of this section is the text "Indianapolis, IN Weather Forecast Office". Below the "Spotter Training Information" section is a tabbed interface with tabs: "About Spotters", "Spotter Reference", "Training", "Submit a Report", "Amateur Radio", and "Frequently Asked Questions". The "About Spotters" tab is selected, showing the following content:

### 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?

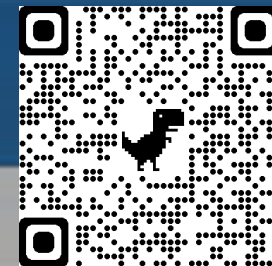
SKYWARN is a program sponsored by the National Weather Service. The program is made up of thousands of volunteers who attend regular training and then scan the skies of their communities identifying and reporting critical storm information. These volunteers, sometimes organized under the SKYWARN banner 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.



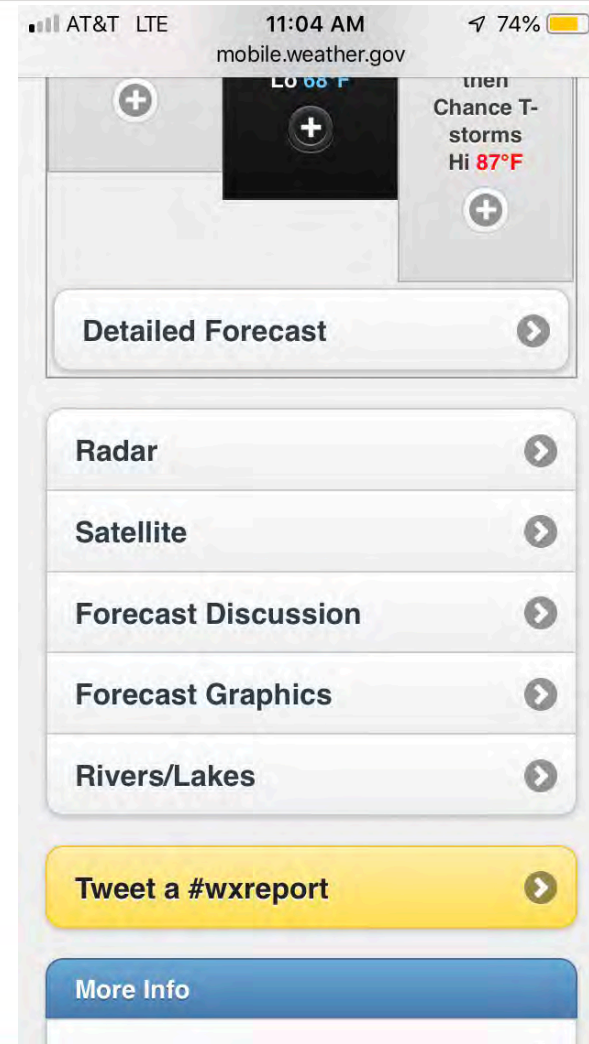


# NWS Forecasts for Your Phone

“It acts like an App but it’s not really an App”



- Open Safari or Internet
- Go to [mobile.weather.gov](https://mobile.weather.gov)
- Enter Zip Code
- Look at forecast, Scroll down to Forecast Discussion if desired
- Save to your home screen and it will act like an App







# Other Possible Phone Apps

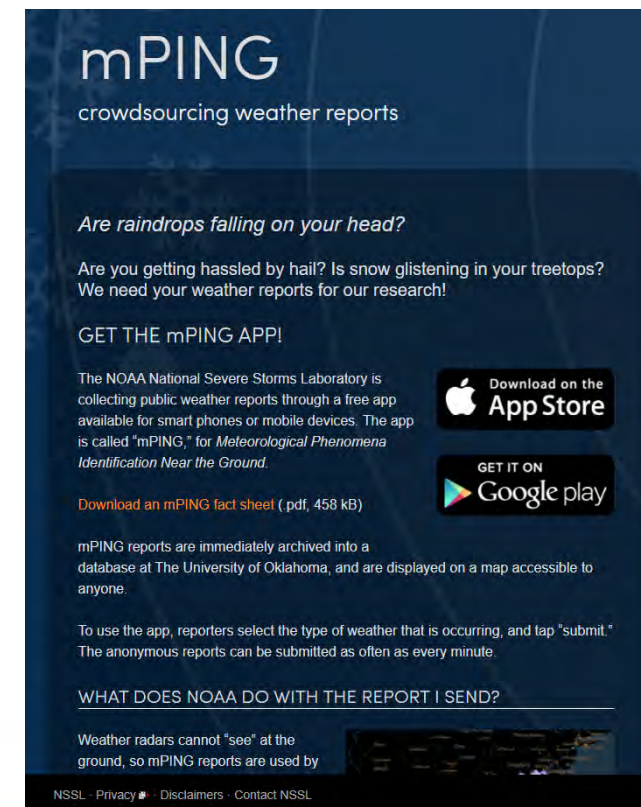
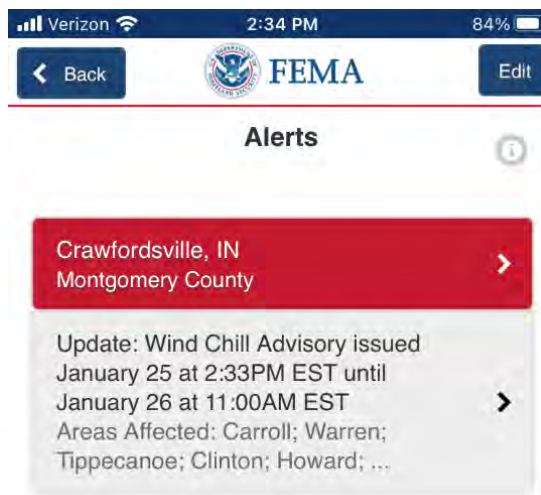
Available from your App Store – NWS Does Not Endorse any Apps

- FEMA App for Warning Notifications

- <https://www.fema.gov/>

- mPING for Precipitation Reports

- <https://mping.nssl.noaa.gov/>





## Indiana



A man with short dark hair, wearing a red button-down shirt with two chest pockets, is holding a blue handheld electronic device. The device has a screen and a vertical antenna. A speech bubble is visible above his head.



- Indianapolis, Indiana





# Additional Easy Ways to Volunteer

Community Collaborative  
Rain, Hail, & Snow Network

A Great Help to  
the NWS!

For more info: [www.cocorahs.org](http://www.cocorahs.org)



SCAN ME



- A grassroots, non-profit, community based, high density precipitation network
- Take daily precipitation measurements that are sent to the NWS and used by many
- Have a group who would be interested in participating? Contact us to set up a training session



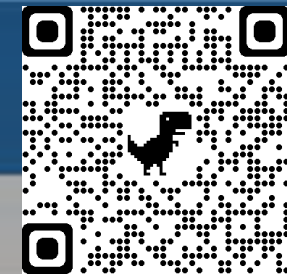
NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION



Indianapolis, Indiana



# Remember



- A PDF version of these slides with speaker notes and other resources are available on our Spotter Webpage.  
<https://www.weather.gov/ind/spotter>
- Central Indiana Skywarn Spotters DO NOT receive spotter ID numbers
- You are a volunteer, not “certified” or “official”. You cannot break laws or use this training as an excuse for unlawful acts
- Your safety is top priority, do not put yourself in harms way



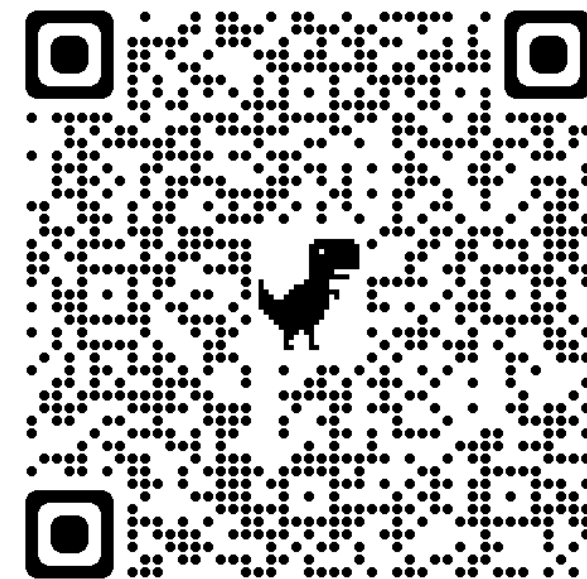




# Important Last Item, Optional

You can do this now from your smart phone or from home on your computer

- If you would like to be added to the NWS Indianapolis trained spotter database, remain in the database, or update your contact information, you will need to fill out our online registration form at the following link:
- <https://forms.gle/oeCeSRdSQPPPXRj98>
- Your information will be added to our internal spotter database and will not be shared with anyone
- This form is also available on the spotter webpage



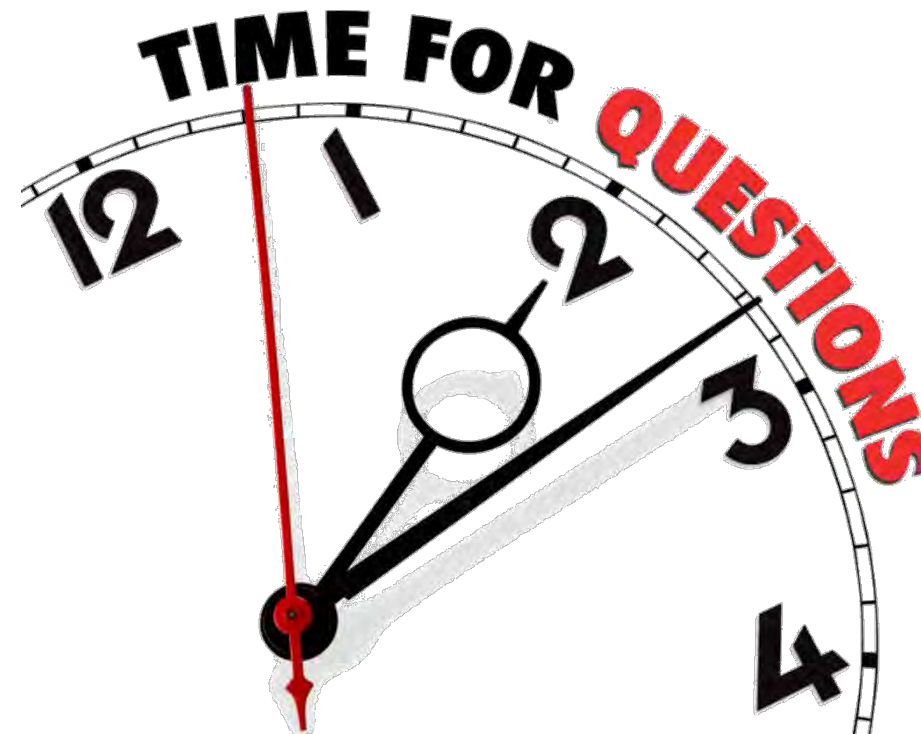


# Reporting Methods and Questions

Don't forget this information



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



Questions or comments on this presentation can be sent to:  
[Sam.Lashley@noaa.gov](mailto:Sam.Lashley@noaa.gov)



NATIONAL WEATHER SERVICE  
OCEANIC AND ATMOSPHERIC ADMINISTRATION

<https://www.weather.gov/ind/spotter>



Indianapolis, Indiana