

Advanced Storm Spotter Training

National Weather Service - Birmingham, AL
[weather.gov](https://www.weather.gov)





Topics Coming Up

1

Quick refresher

2

**Severe thunderstorm
ingredients**

3

Weather systems

4

Radar signatures

5

Forecasts & warnings

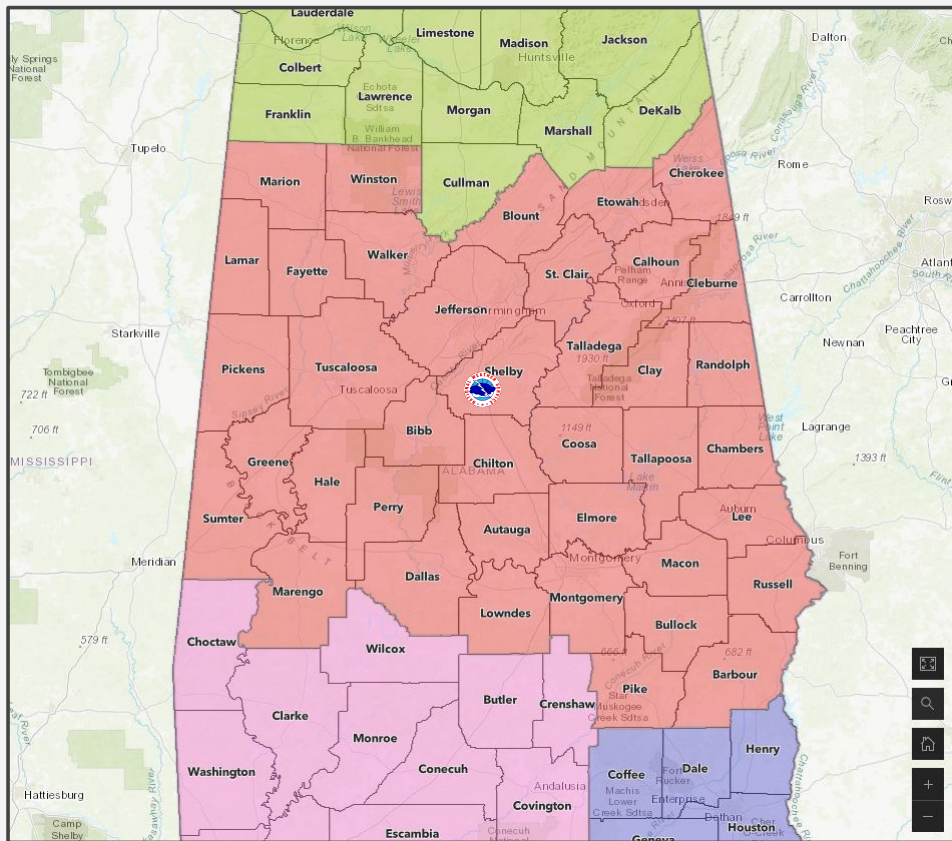
Note: This is **not** storm chaser training!



Section One

1

Quick refresher: a few reminders from your basic class



NWS Birmingham

39 counties served



Provide weather, water & climate data



Forecasts, weather alerts, decision support services, research & community outreach



Operate 24/7/365

weather.gov

Severe Thunderstorm Criteria ⚠️



any combination of:



tornado



**hail 1" or
larger
(quarter size)**



**winds of
58+ mph**

What to Report



LOWERINGS

rotating wall cloud

funnel cloud

tornado

HAIL OF ANY SIZE

measure or
reference a common
item like a coin or
sports ball

largest size & any
damage

DAMAGING WINDS

downed healthy trees
or large branches

damage to buildings,
infrastructure, or
other property

FLOODING

areas where flooding
is uncommon or
notable

structures affected
or roads impassable

What **NOT** to Report

A Few Examples...



What you see on your radar app. or weather models



Lightning



A "heavy storm" or "mean-looking sky"



Routine ponding of water on roads or in ditches



Patio umbrella, trash can, twigs, etc. blown around



How to Make a Report



PHONE: 205-664-3010, then select option 2. Tip: Save as a contact "SKYWARN" in your smartphone



FACEBOOK & X: Direct message or tag, #alwx



SPOTTER CHAT & AMATEUR RADIO: alert-alabama.org, then click on the storm spotter chat tab



BE BRIEF, CONCISE & ACCURATE: what, when, where + photo or video if you can do so safely

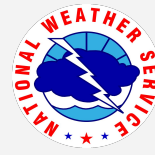


Section Two

2

**Severe thunderstorm
ingredients:** a light insight

Recall Severe Thunderstorm Ingredients: **SLIM**



Shear (wind shear)



Lift



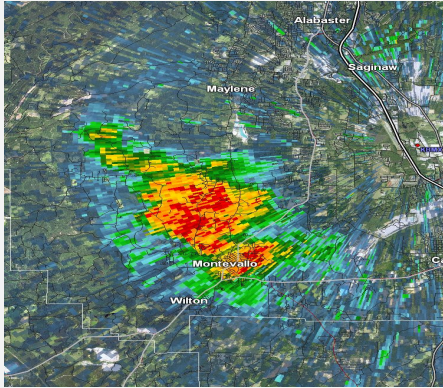
Instability



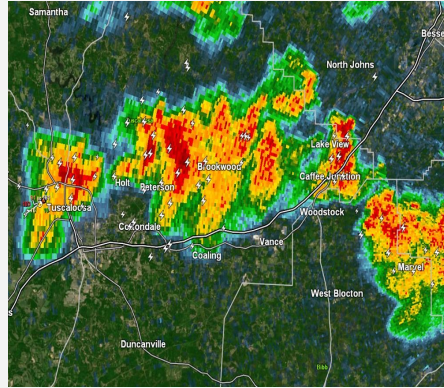
Moisture



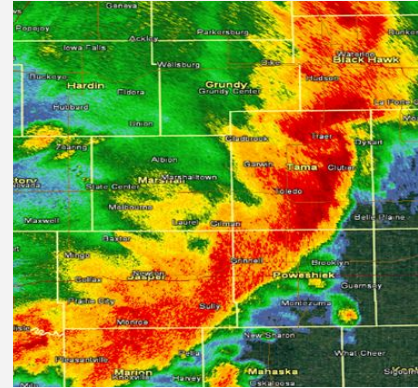
Recall: Thunderstorm Modes



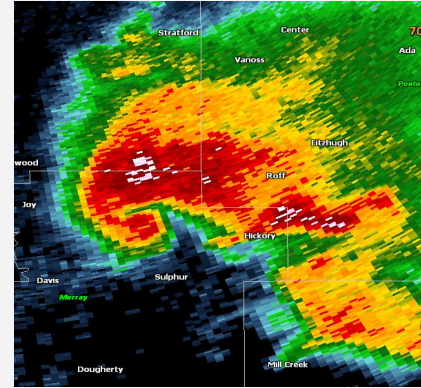
Single cell



Multicell



Squall line



Supercell
***has a rotating updraft**

A Key Instability Parameter:

CAPE (Convective Available Potential Energy)



Low CAPE values

=

Weaker rising
motion and a less
intense storm



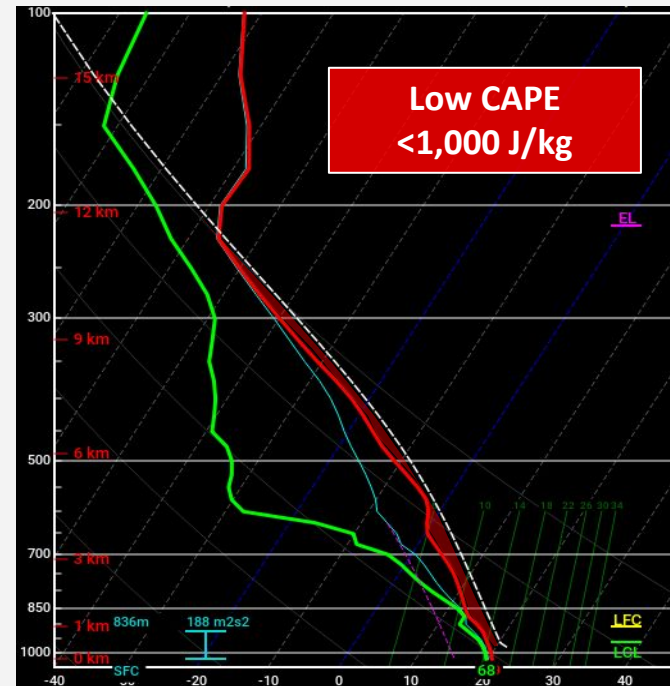
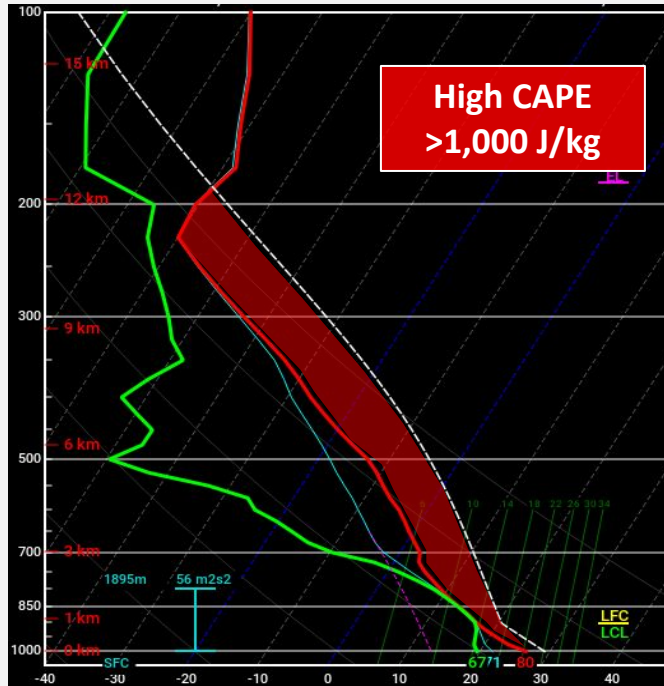
High CAPE values

=

Stronger rising
motion and a more
intense storm



A Key Instability Parameter: **CAPE** (Convective Available Potential Energy)



Visual Differences in Instability



Weakly unstable air mass
Low CAPE



Strongly unstable air mass
High CAPE

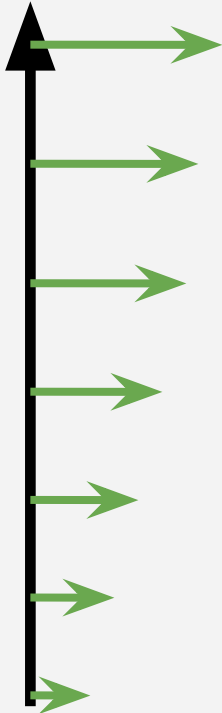
Wind Shear:

A Change in Wind Speed and/or Direction



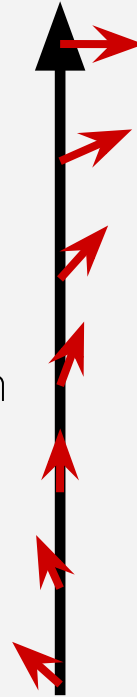
Speed shear:

Change in
wind speed
with height



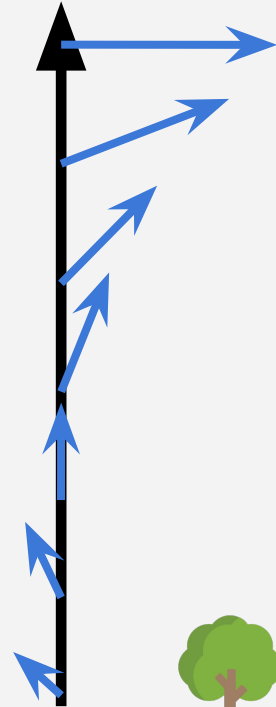
Directional shear:

Change in
wind direction
with height

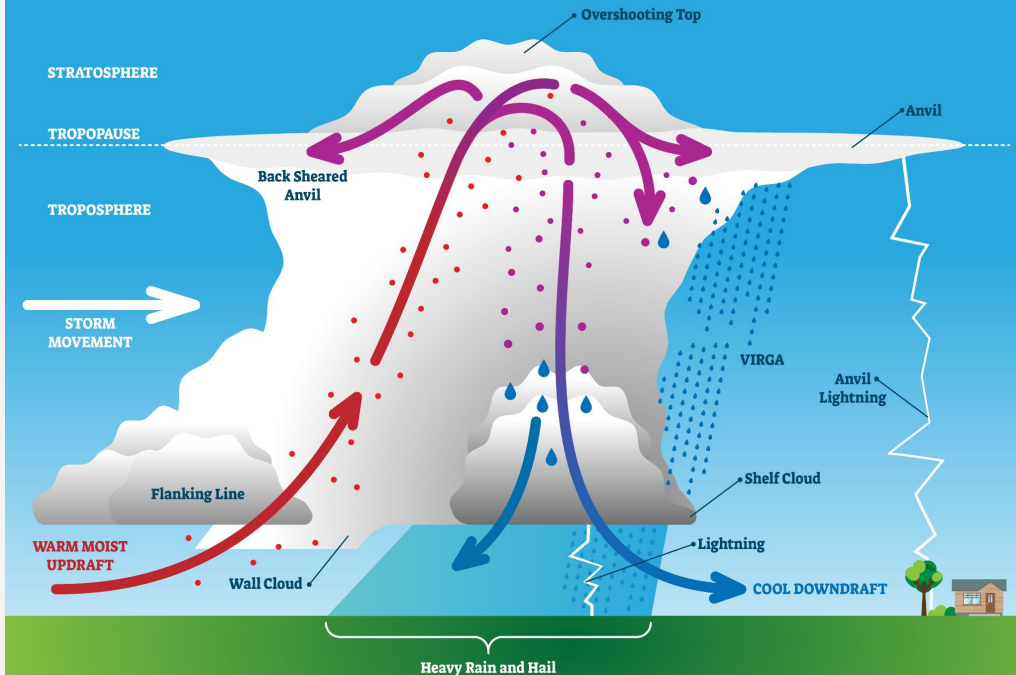


Speed & directional shear:

Change in
wind speed &
wind direction
with height



THUNDERSTORM



A Sheared Thunderstorm

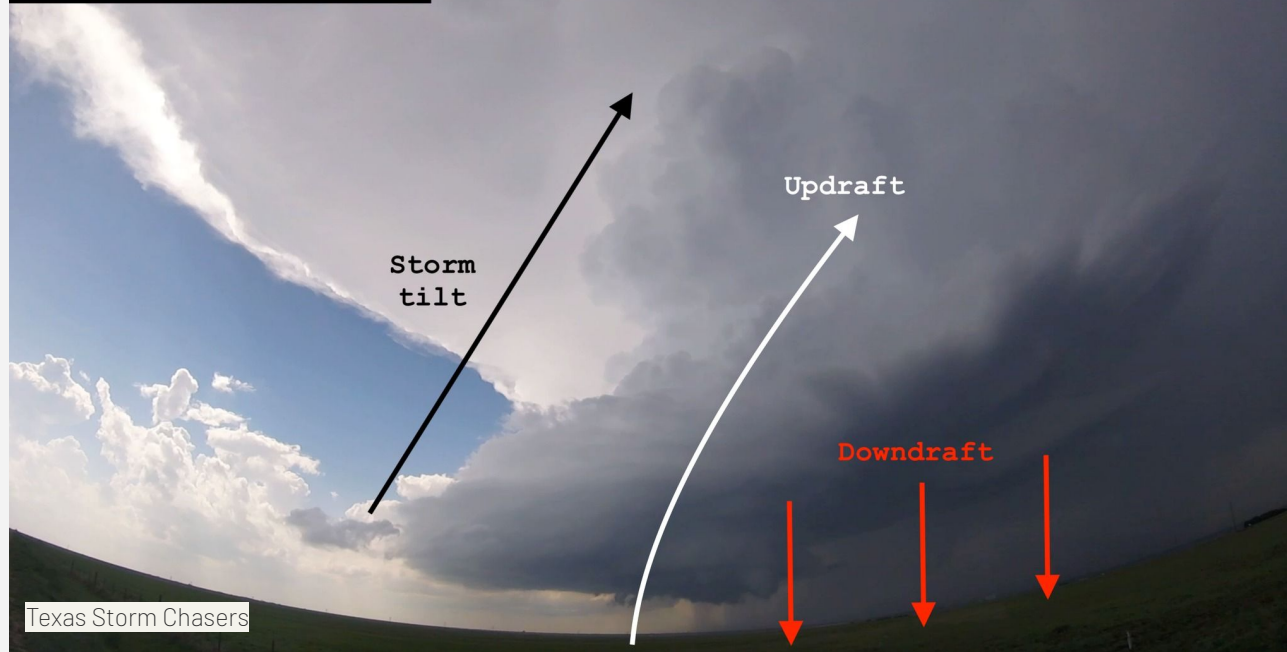


Wind shear helps with ventilation and with pushing precipitation away from the updraft. A sheared thunderstorm can become **better** organized, more intense, and longer-lived.

A **Sheared** Supercell Thunderstorm



Supercell near Morse, TX
May 28, 2023

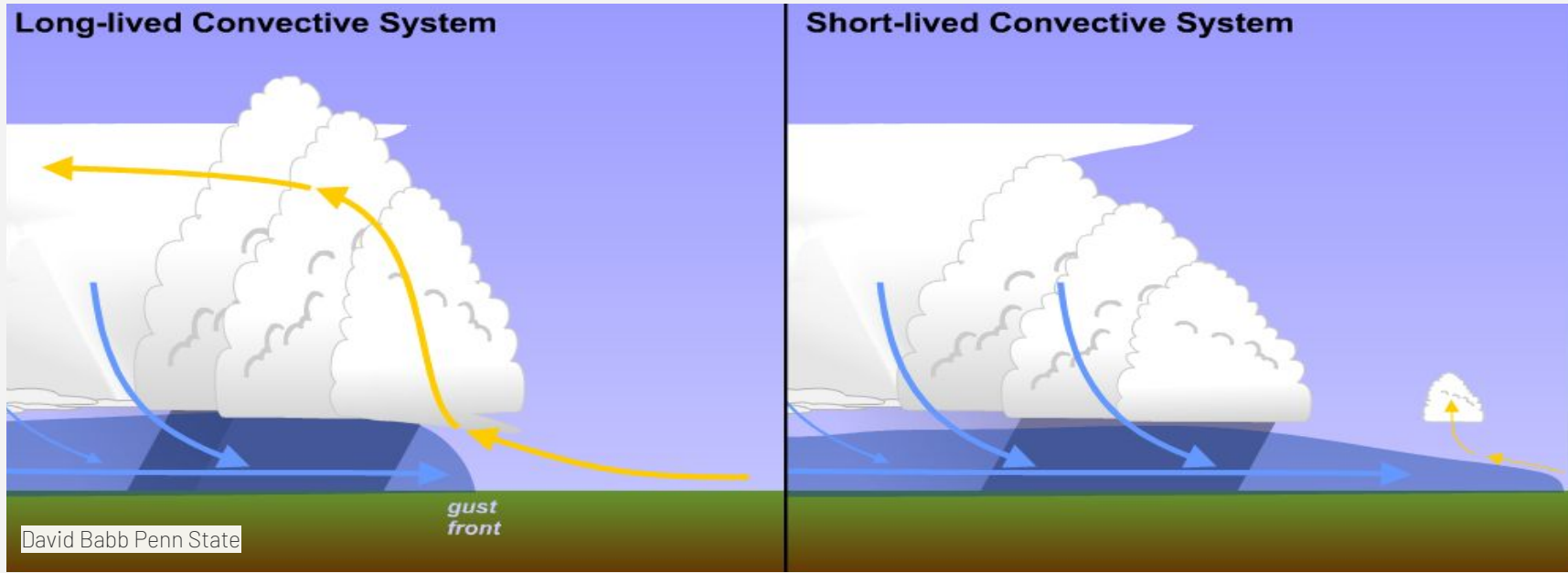


Texas Storm Chasers



Wind shear helps with ventilation and with pushing precipitation away from the updraft. A sheared thunderstorm can become **better organized, more intense, and longer-lived**. Speed and directional shear are preferred by supercells.

Sheared Squall Line Thunderstorms



A sheared thunderstorm can become **better organized, more intense, and longer-lived**. Speed shear is preferred by squall lines, along with a balance of warm inflow & cool outflow along the gustfront.

Balance of Ingredients Supports a Healthy Storm



Storm mode, storm interactions, and boundaries can have a positive or negative influence as well!

Increasing Wind Shear

Organized
but weak up/downdraft

Organized
and strong up/downdraft

Unorganized
and weak up/downdraft

Unorganized
but strong up/downdraft

Increasing Instability



Section Three

3

Weather features: systems,
fronts, boundaries

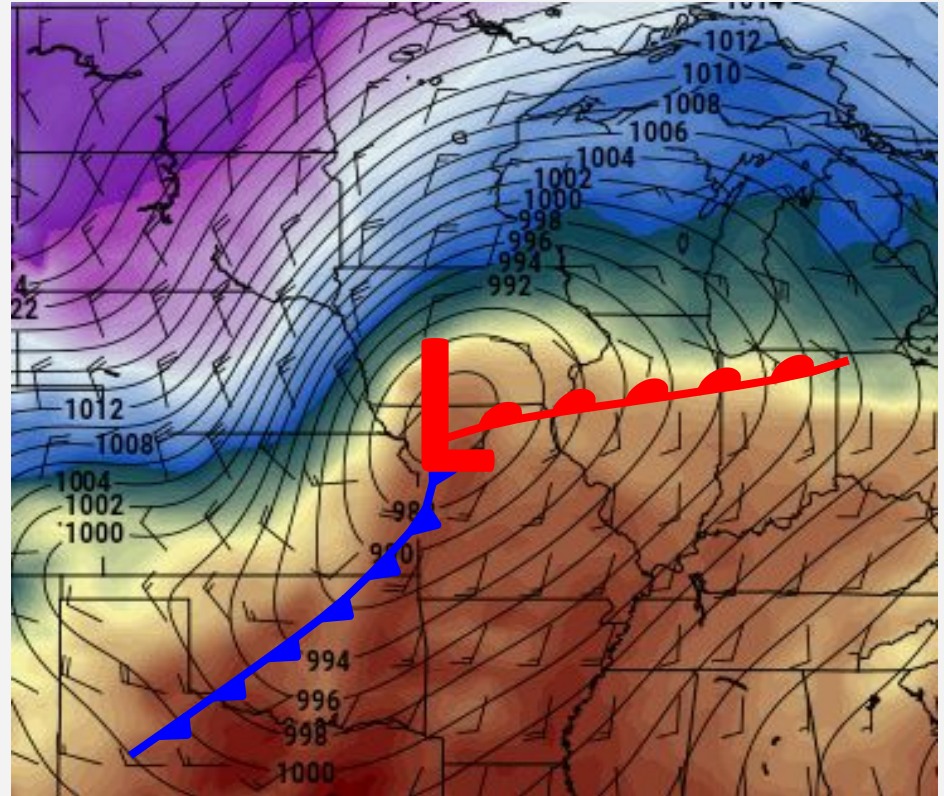


A Couple Types of Fronts: **Cold vs. Warm**

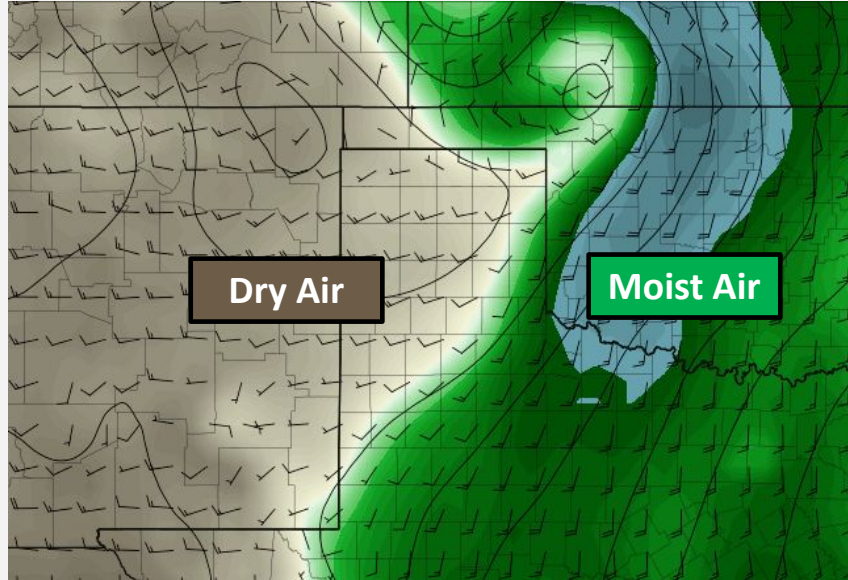


Cold front: A separation of two air masses; colder air replaces warmer air

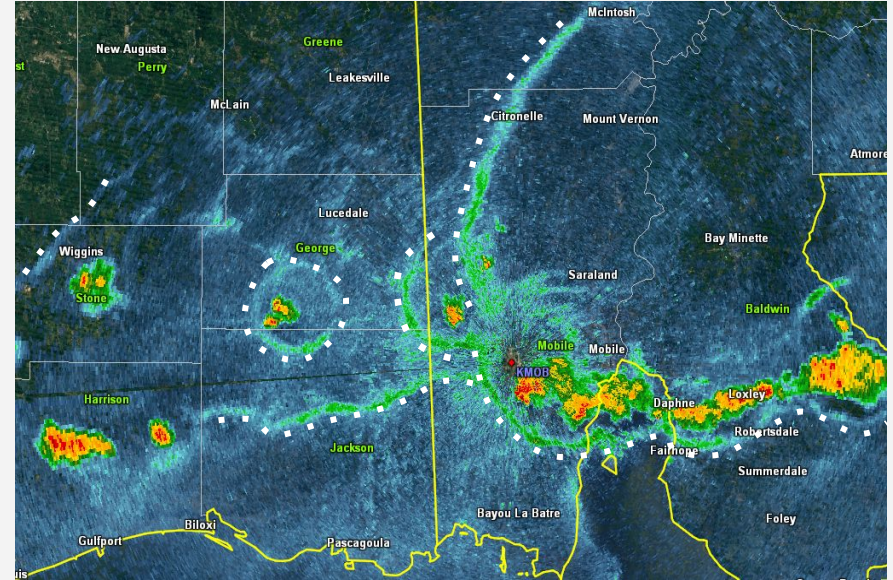
Warm front: A separation of two air masses; warmer air replaces cooler air



A Couple Types of Boundaries: **Dryline & Outflow**



Dryline: A separation of hot, dry air (west) and warm, moist air (east); can aid in the explosive development of severe thunderstorms
[drylines are uncommon in Alabama]



Outflow: Exhaust from showers and thunderstorms; separates rain-cooled air from surrounding air; can trigger new showers and thunderstorms



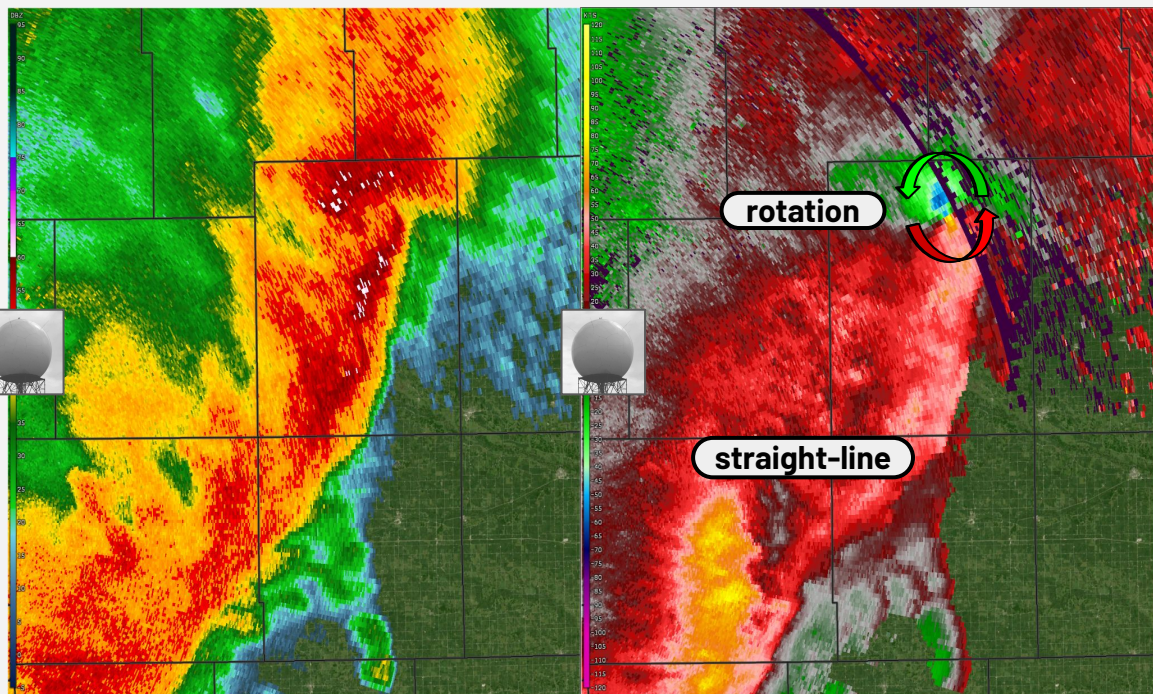
Section Four

4

Radar signatures: key features
you're likely to come across

Key Radar Products

Reflectivity & Velocity



Reflectivity (left)

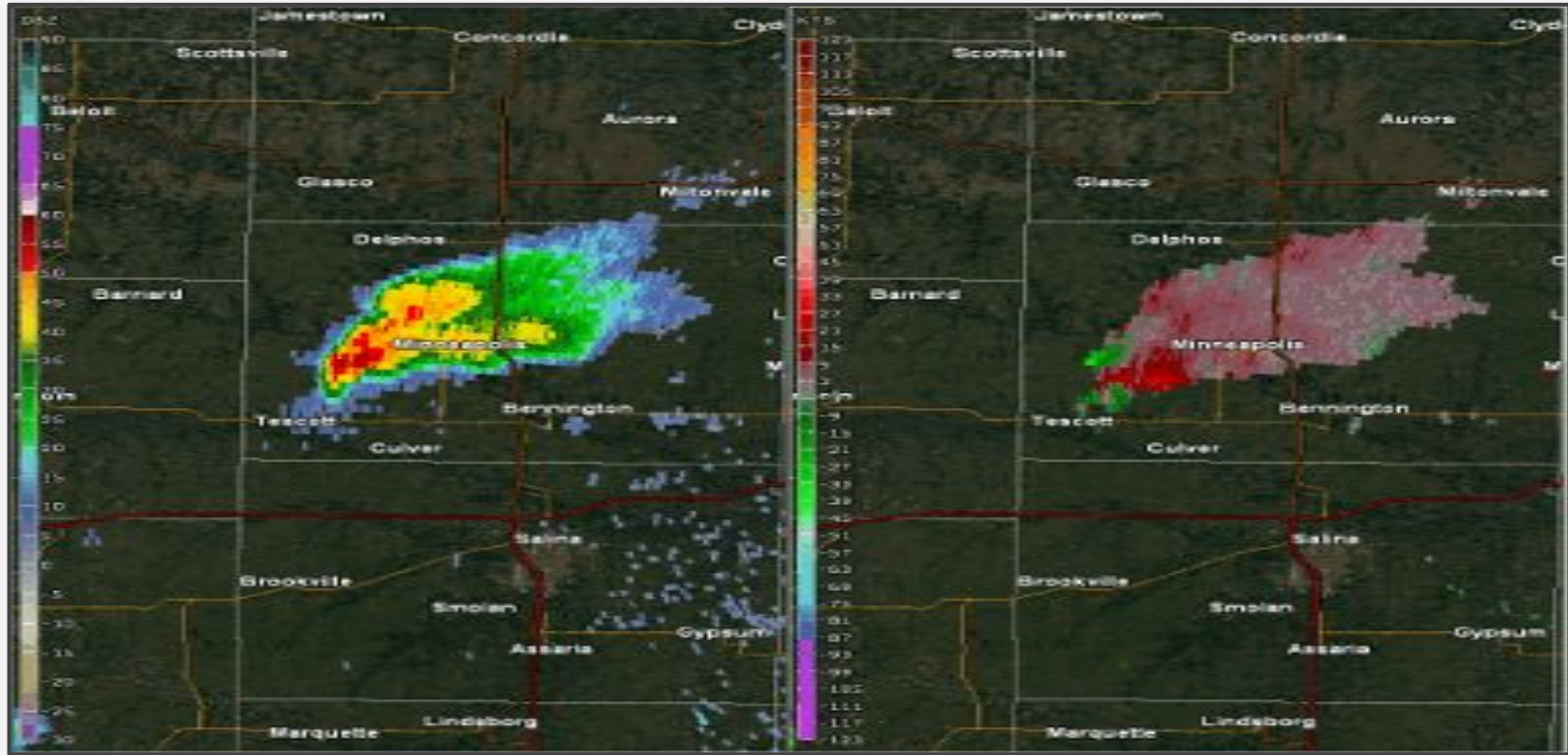
Shows location & intensity of precipitation. Bright colors indicate heavy precipitation.

Velocity (right)

Shows wind speed & direction within areas of precipitation. Used to assess **straight-line vs. rotational** winds. **Red** shows wind moving away from the radar, **green** shows wind moving toward the radar.

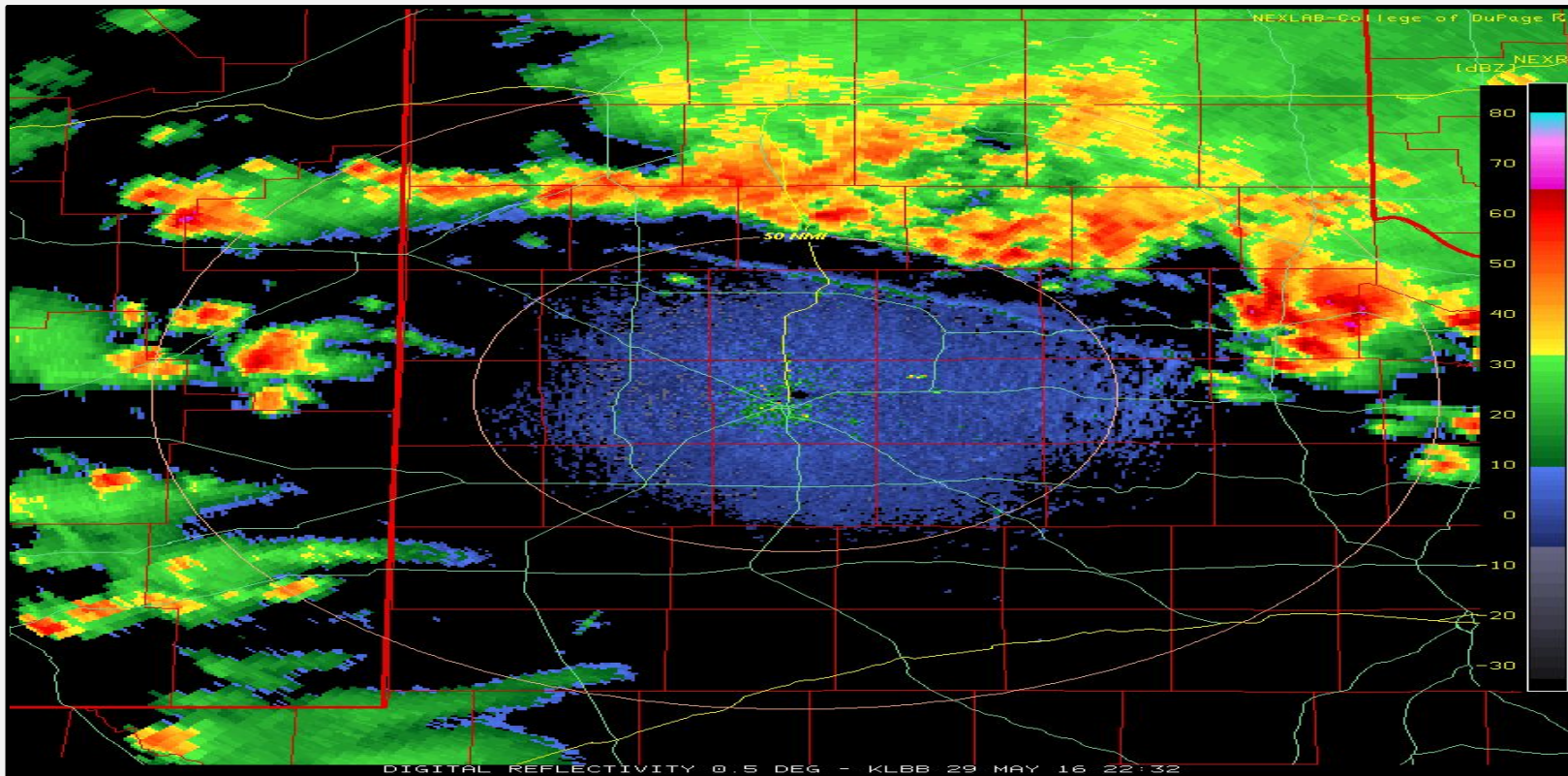
Hook Echo

Associated with the Rotating Part of the Storm



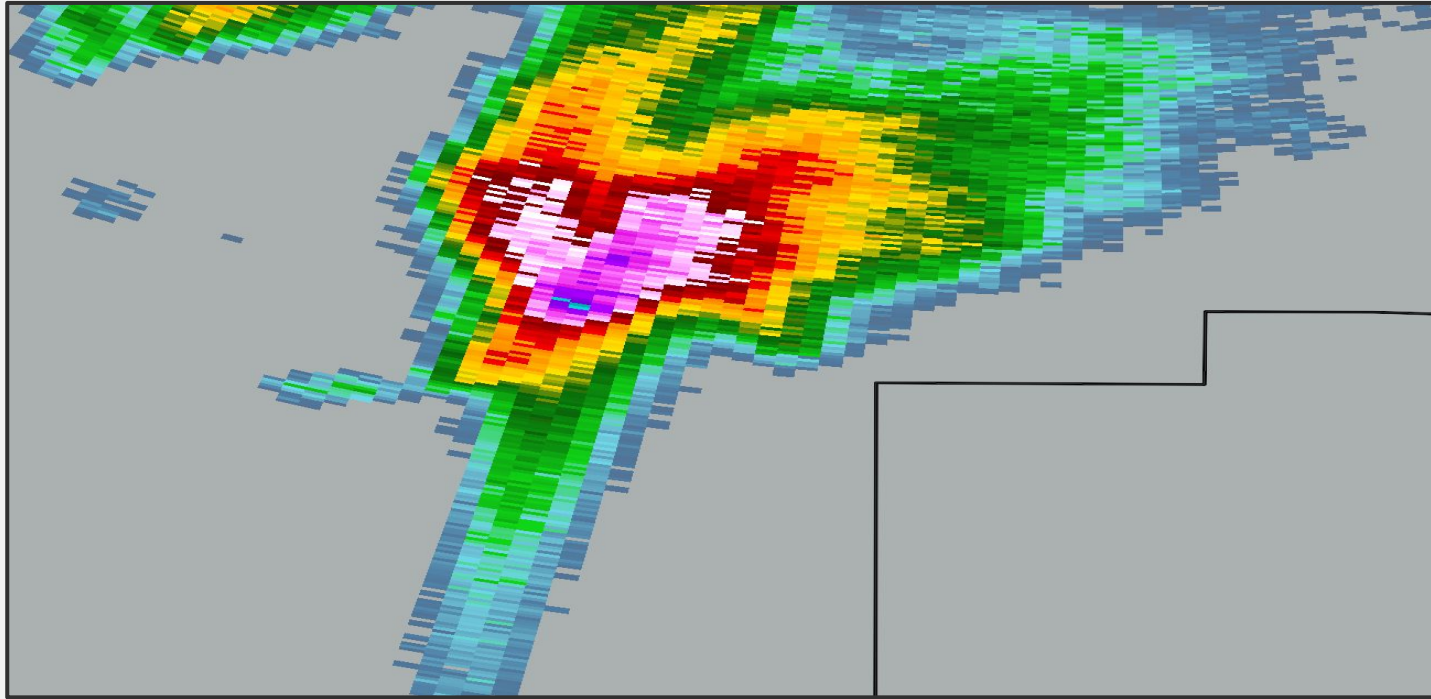
Outflow Boundary

Rain-cooled Exhaust from Showers & Storms

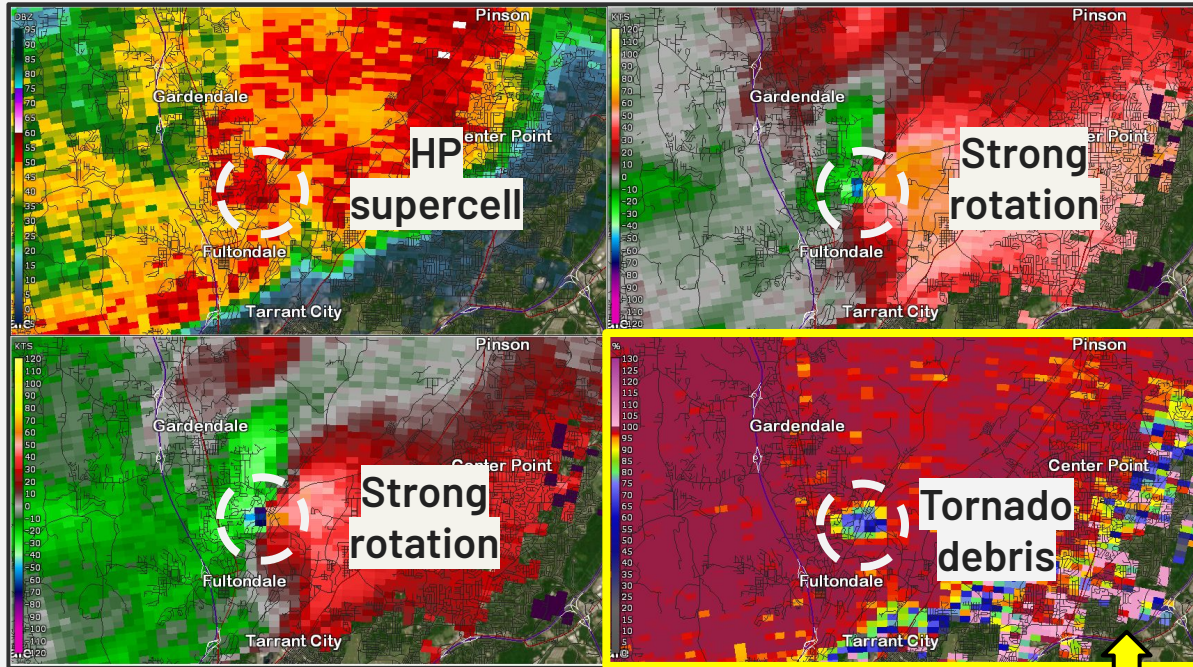


Hail Spike

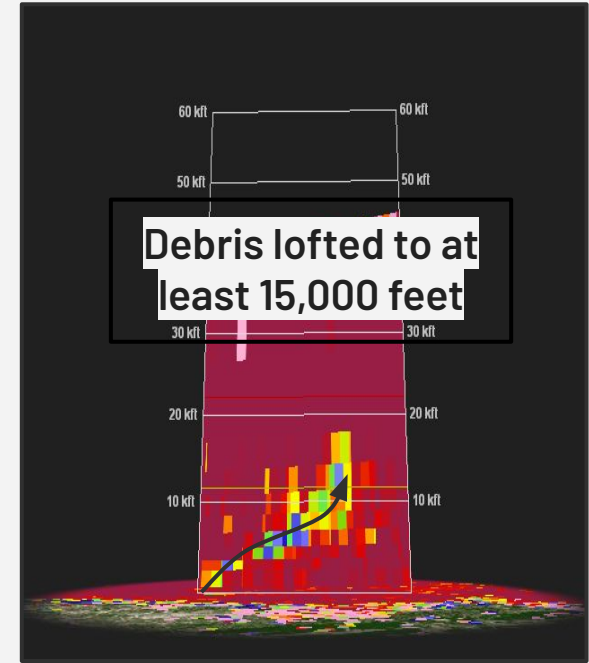
Artifact Caused by Very Large Hail **or** a High Volume of Small Hail



Tornado Debris Signature a.k.a "CC Drop"



CC = correlation coefficient



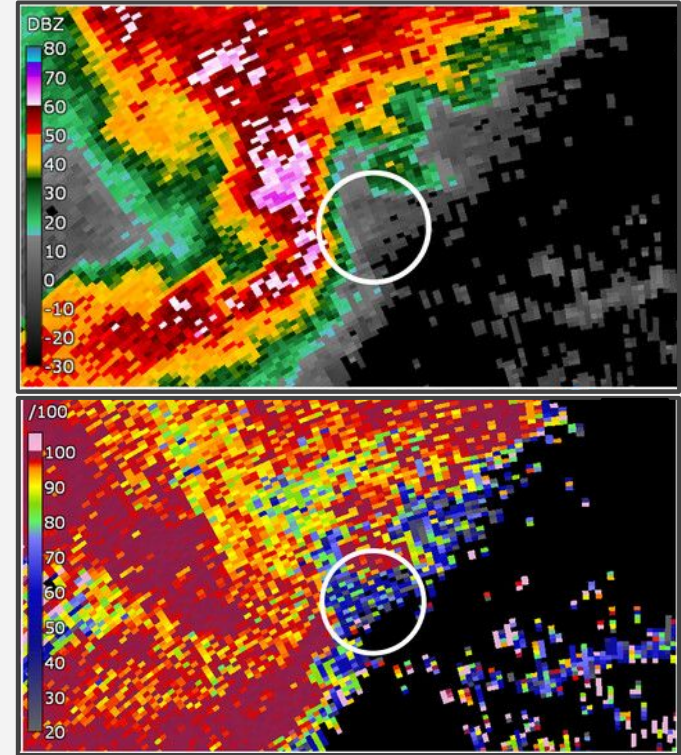
More on Correlation Coefficient (CC)



An area of “blue” on CC does **not** automatically mean tornado debris!

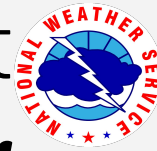
Low CC signatures can result from:

- Dust or bugs in inflow
- Hail
- Noisy data
- Terrain, wind farms, etc.

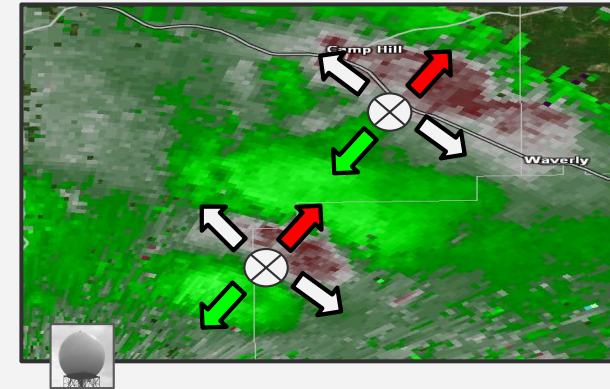
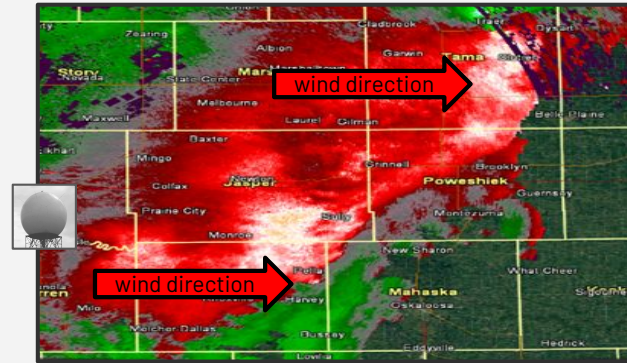
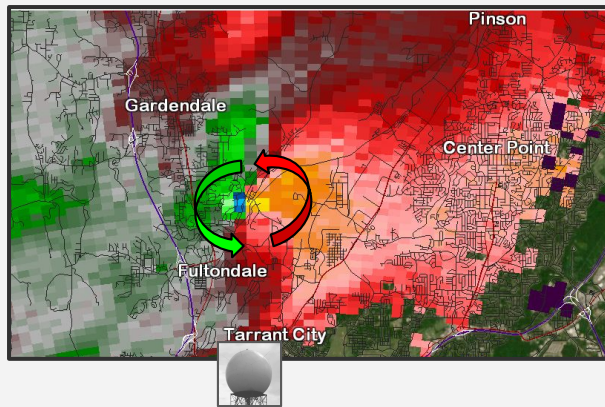


not tornado debris

Couplet vs. Straight-line vs. Downburst



! Know Storm Position Relative to the Radar



☁ Rotation

An area of winds blowing toward and away from the radar - **appears as a tight area of greens and reds.**

Doesn't always guarantee a tornado, but is something to watch closely!

☁ Straight-line

An area of winds with near uniform direction toward or away from the radar

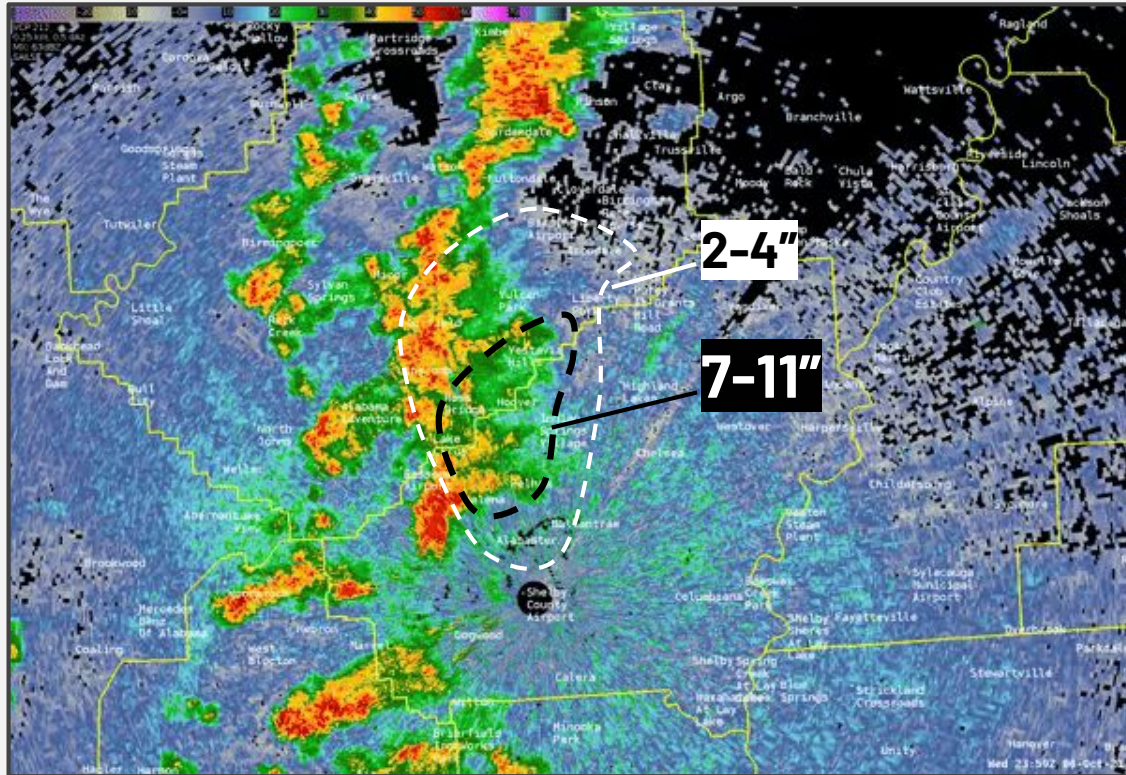
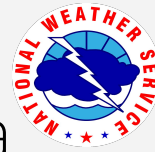
☁ Downburst

Greens and reds will be close to each other, but is not an indication of rotation!

Winds are blowing away from each other; another form of straight-line winds

Training Thunderstorms

Repeated Rounds of Activity Over the Same Area



October 6, 2021
Flash Flood Emergency

2 fatalities from vehicle
swept away

Numerous residences and
roadways flooded,
waterways overflowed

Over 100 water rescues
involving homes and vehicles
in Pelham alone



Section Five

5

Forecasts & warnings: locating forecasts, understanding warning tiers

Recall: Severe Risk Levels



General Thunder Severe* Storms are not expected Any thunderstorms could still produce gusty winds and small hail	1 Marginal (MRGL) Severe storms will produce hail, damaging winds and/or possibly tornadoes Isolated Severe Storms are Possible	2 Slight (SLGT) Severe storms will produce hail, damaging winds, and/or tornadoes Isolated to Scattered Severe Storms are Expected	3 Enhanced (ENH) Several severe storms will produce very large hail, damaging winds, and/or tornadoes Scattered to Numerous Severe Storms are Expected	4 Moderate (MDT) Many severe storms will produce very large hail, damaging winds, and/or tornadoes Scattered to Numerous Severe Storms are Expected	5 High (HIGH) Severe storm outbreak will produce tornadoes, damaging winds, and/or very large hail Numerous Severe Storms are Expected
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Available:

Daily- spc.noaa.gov



When in effect- weather.gov/bmx

Severe Weather Outlooks



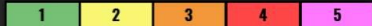
Severe Weather Risk

Risk Level 2: Central Alabama

Latest info at weather.gov/bmx



Risk Level



NATIONAL WEATHER SERVICE
Birmingham

Follow: @NWSBirmingham



WHEN

Through midnight tonight

THREATS



Damaging Winds

Gusts up to 60 mph



Large Hail

Up to quarter size

WHAT TO DO



Have multiple
ways to get alerts



Have access to a
sturdy shelter



Check for
updates

June 25, 2025 | 2:35 PM

Tiers of NWS Warnings



Severe thunderstorm

Base: 60 mph, 1" hail

Considerable: 70 mph, 1.75" hail

Destructive: 80 mph, 2.75" hail **(WEA)**



Tornado

Base: Radar indicated or confirmed **(WEA)**

Considerable: Considerable damage risk **(WEA)**

Catastrophic: Catastrophic damage risk **(WEA)**



Flash flood

Base: Flash flood possible

Considerable: Flash flood of unusual severity **(WEA)**

Catastrophic: Flash flood of exceedingly rare severity **(WEA)**



Wireless Emergency
Alert **(WEA)** triggered
on smartphones!



ALC007-073-117-125-181200-
/O.CON.KBHX.SV.W.0141.00000T0000Z-250518T1200Z/
Tuscaloosa AL-Shelby AL-Bibb AL-Jefferson AL-
618 AM CDT Sun May 18 2025

...A SEVERE THUNDERSTORM WARNING REMAINS IN EFFECT UNTIL 700 AM CDT
FOR EASTERN TUSCALOOSA...WESTERN SHELBY...NORTHEASTERN BIBB AND
SOUTHERN JEFFERSON COUNTIES...

At 617 AM CDT, a severe thunderstorm was located over Abernath, or 13
miles west of Bessemer, moving east at 65 mph.

THIS IS A DESTRUCTIVE STORM FOR BIBB, JEFFERSON, SHELBY COUNTIES.

HAZARD...80 mph wind gusts and quarter size hail.

SOURCE...Radar indicated.

IMPACT...Flying debris will be dangerous to those caught without
shelter. Mobile homes will be heavily damaged. Expect
considerable damage to roofs, windows, and vehicles.
Extensive tree damage and power outages are likely.

Locations impacted include...

American Village, Brookwood, Oak Mountain State Park, Camp Branch,
Green Pond, Maylene, Helena, Camp Horne B.S.A., Wilton, Patton Creek,
Weller, McAdory, West Blocton, The Summit, Shelby County Airport,
Calera, Meadowbrook, Dolomite, Abernath, and East Brookwood.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

For your protection move to an interior room on the lowest floor of a
building.

This is a DANGEROUS SITUATION. This storm is producing widespread
wind damage across Tuscaloosa County. SEEK SHELTER NOW inside a
sturdy structure and stay away from windows.

This is an EXTREMELY DANGEROUS SITUATION with tornado like wind
speeds expected. Mobile homes and high profile vehicles are
especially susceptible to winds of this magnitude and may be
overturned. For your protection move to an interior room on the
lowest floor of a building. This storm has the potential to cause
serious injury and significant property damage.

Continuous cloud to ground lightning is occurring with this storm.
Move indoors immediately. Lightning is one of nature's leading
killers. Remember, if you can hear thunder, you are close enough to
be struck by lightning.

&&

LAT...LON 3353 8736 3353 8732 3351 8732 3351 8727
3353 8727 3352 8726 3352 8724 3346 8657
3307 8667 3307 8688 3302 8688 3317 8752
TIME...MOT...LOC 1117Z 279DEG 55KT 3333 8720

THUNDERSTORM DAMAGE THREAT...DESTRUCTIVE
HAIL THREAT...RADAR INDICATED
MAX HAIL SIZE...1.00 IN
WIND THREAT...RADAR INDICATED
MAX WIND GUST...80 MPH



ALC081-113-032045-
/O.CON.KBHX.TO.W.0023.00000T0000Z-190303T2045Z/
Lee AL-Russell AL-
207 PM CST SUN MAR 3 2019

...A TORNADO WARNING REMAINS IN EFFECT UNTIL 245 PM CST FOR CENTRAL
LEE AND NORTHWESTERN RUSSELL COUNTIES...

At 206 PM CST, a confirmed large and extremely dangerous tornado was
located near Society Hill, or 10 miles southeast of Auburn, moving
east at 55 mph.

This is a PARTICULARLY DANGEROUS SITUATION. TAKE COVER NOW!

HAZARD...Damaging tornado.

SOURCE...Radar confirmed tornado.

IMPACT...You are in a life-threatening situation. Flying debris may
be deadly to those caught without shelter. Mobile homes
will be destroyed. Considerable damage to homes,
businesses, and vehicles is likely and complete destruction
is possible.

Locations impacted include...

Auburn, Phenix City, Opelika, Smiths, Smiths Station, Ladonia,
Beauregard, Bleecker, Griffen Mill, Bibb City, Monterey Heights,
Chewacla State Park, Ladonia Sports Complex, Marvyn and Bartlett's
Ferry Dam.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

To repeat, a large, extremely dangerous and potentially deadly
tornado is on the ground. To protect your life, TAKE COVER NOW! Move
to a basement or an interior room on the lowest floor of a sturdy
building. Avoid windows. If you are outdoors, in a mobile home, or in
a vehicle, move to the closest substantial shelter and protect
yourself from flying debris.

&&

LAT...LON 3239 8544 3250 8544 3250 8549 3253 8556
3268 8511 3267 8509 3265 8509 3265 8511
3263 8508 3262 8509 3258 8507 3251 8500
3249 8499 3247 8500 3245 8499
TIME...MOT...LOC 2006Z 258DEG 48KT 3247 8538

TORNADO...OBSERVED
TORNADO DAMAGE THREAT...CONSIDERABLE
HAIL...<.75IN



NWS Warning Text Info.

Storm Spotter Certificate + Other Resources



⚡ This presentation & resources:
weather.gov/bmx/skywarn



🧐 **Advanced class:** Deeper dive into radar, storm structure, weather systems/features, warnings...



Thanks for Attending! Questions?

National Weather Service - Birmingham, AL
[weather.gov](https://www.weather.gov)

