

Severe Weather

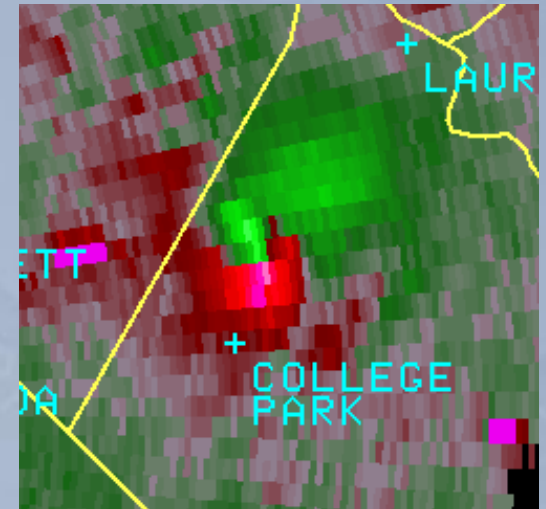
**National Weather Service
Baltimore/Washington Forecast Office**

*National Weather Service
Baltimore MD/Washington DC*



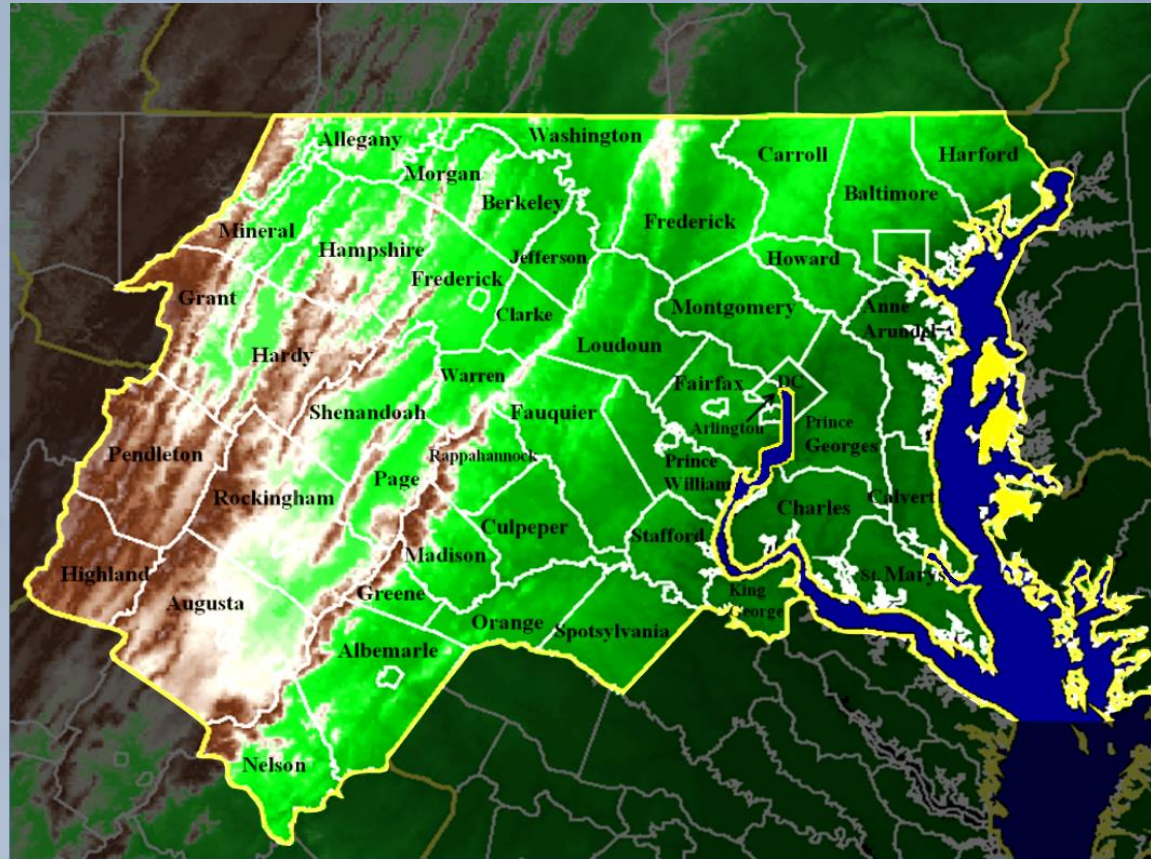
Today's Topics

- Severe Weather Storm Spotting Review
- Thunderstorms
- Severe Thunderstorms
- Radar Basics
- Advanced Interrogation Techniques
- Case Studies
- SPC Products



Area of Responsibility

- 13 MD Counties
- 8 WV Counties
- 22 VA Counties
 - 11 Independent Cities
- District of Columbia
- The City of Baltimore



...nearly 10 million people to look out for!

Why Do We Need Spotters?

Spotters report observed weather to the NWS during potentially severe weather events.

Remember our mission? **The protection of lives and property.** We can't do it alone.
We need you, the local experts!



The information that you relay to us has the potential to save lives and property – helping us complete our mission.

Spotters Reports Should Contain the Who, What When & Where

- Who is making the report?
- What are you reporting?
- When did the event occur?
- Where is the location of the report?



Reporting Criteria

- **Tornado or Funnel**
- **Hail** – Pea sized or larger
- **Rotation** within a storm
- **Wind** – 50 MPH or greater (sustained/gust and measured/estimated)
- **Damage** – Any weather related damage to trees or property. Give as many details as possible.



Making a Report

- Include your **full name and Spotter Number!**
- Be as specific as possible about when the event occurred
 - We can go back and look at archived radar data



- What you are reporting (funnel, downed trees, etc)

How to Report Information

1. Call NWS Baltimore/Washington if weather is imminent or occurring:
1.800.253.7091 OR 703.996.2201
2. Email *delayed* weather reports to:
lwz-report@noaa.gov
3. Contact local Emergency Management Officials
4. Relay your report through Amateur Radio when activated



Thunderstorm Review

- **Thunderstorm Ingredients**
- **Thunderstorm Life Cycle**
- **Types of Thunderstorms**



Thunderstorm Ingredients

Moisture



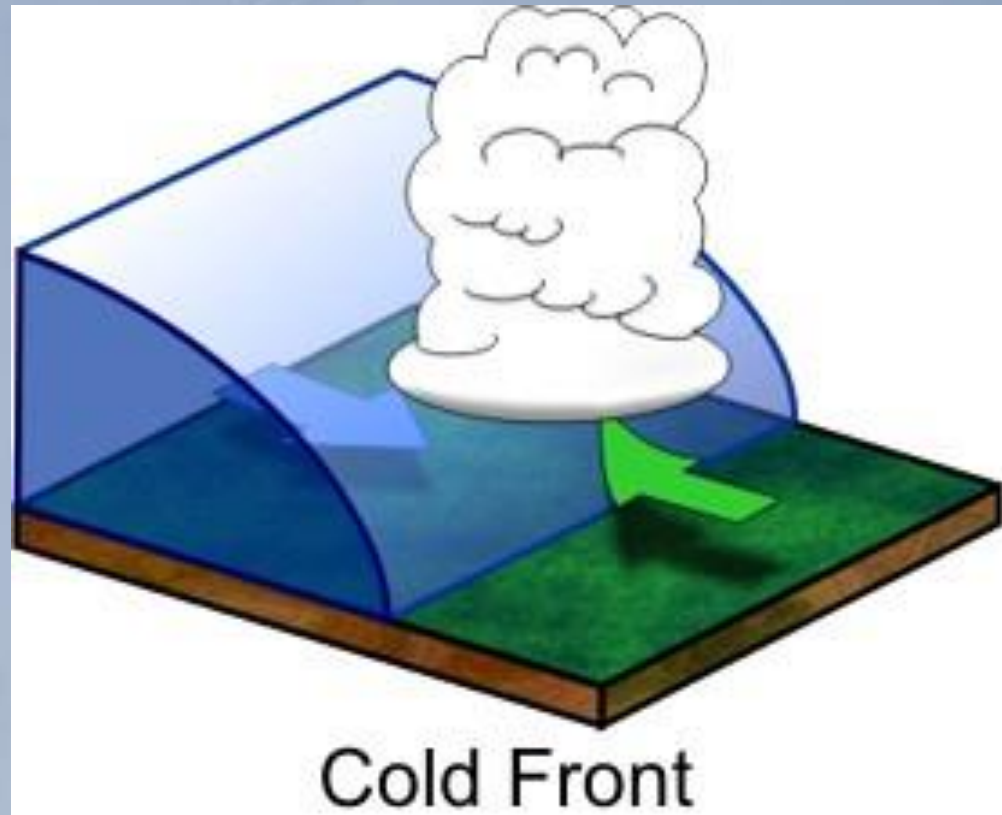
Our moisture sources are the Atlantic Ocean, Gulf of Mexico and the Chesapeake Bay.

Thunderstorm Ingredients

Lift

For lift, you need a mechanism or boundary for convergence. Cold fronts are a good source of lift.

When air is forced upward along a front, it cools/condenses and precipitation forms.



Convergence of wind along the cold front.

Thunderstorm Ingredients

Lift

Cold Front – cold air moving into warm

Warm Front – warm air moving into cold

Stationary Front – a stalled weather front

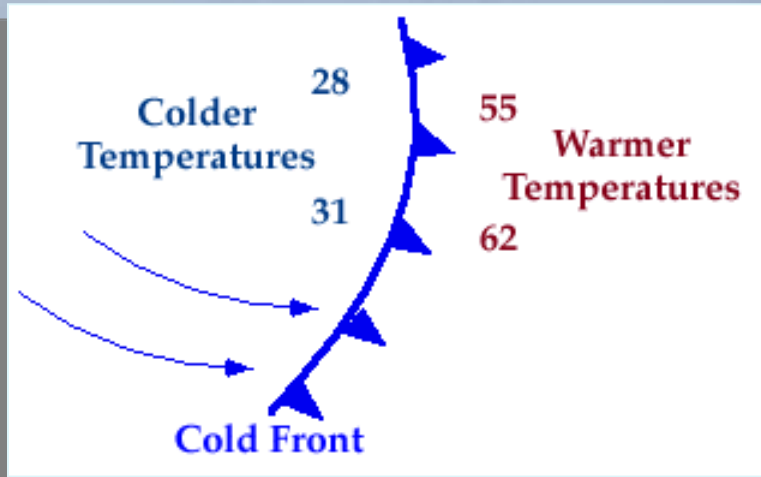
Bay Breeze – moist cool air moving inland

Orographic – hills/mountains

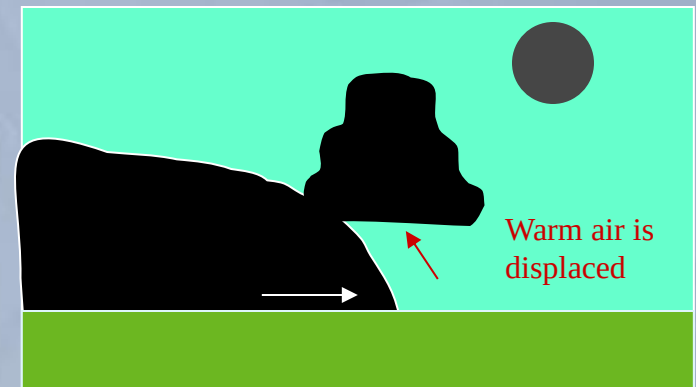
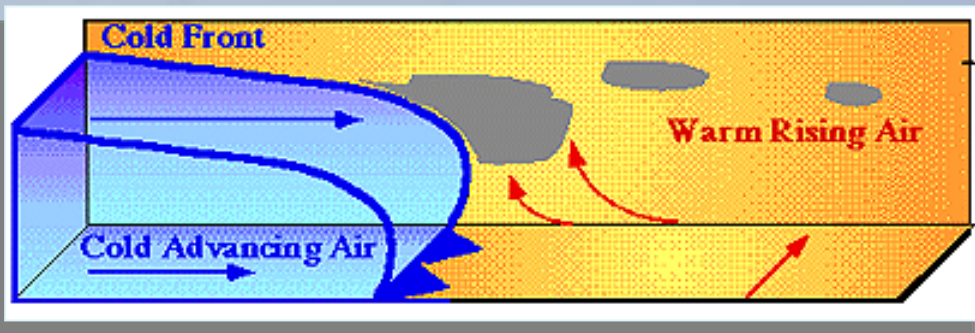
T-Storm Outflow – cold air blowing out of a thunderstorm

Thunderstorm Ingredients

Lift – Cold Front

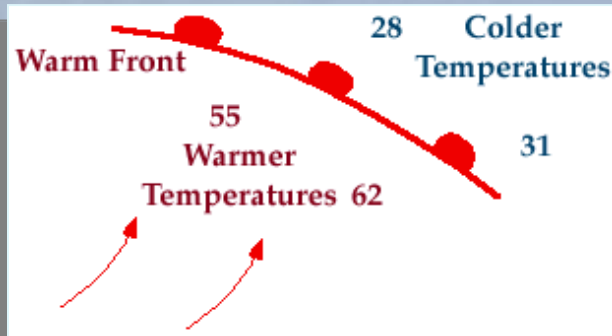


Colder air is denser than the warm air ahead of the front. The warmer air is forced to rise up. If the air is unstable, it will keep rising. Cold fronts often initiate lines of showers and thunderstorms.

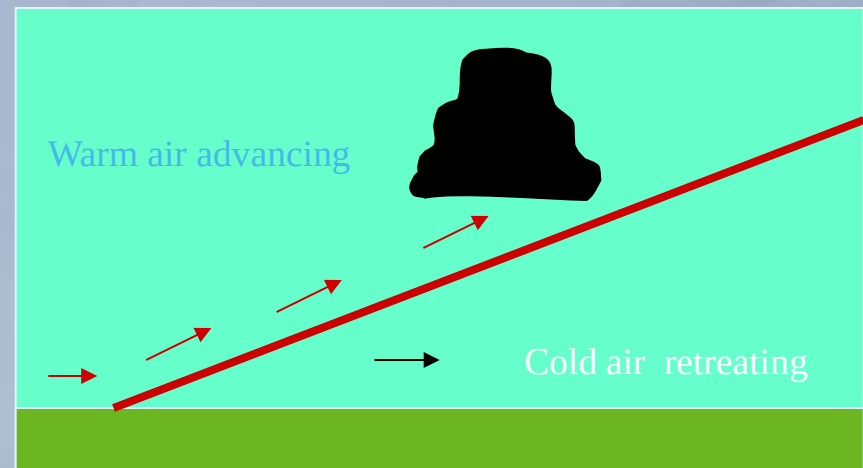
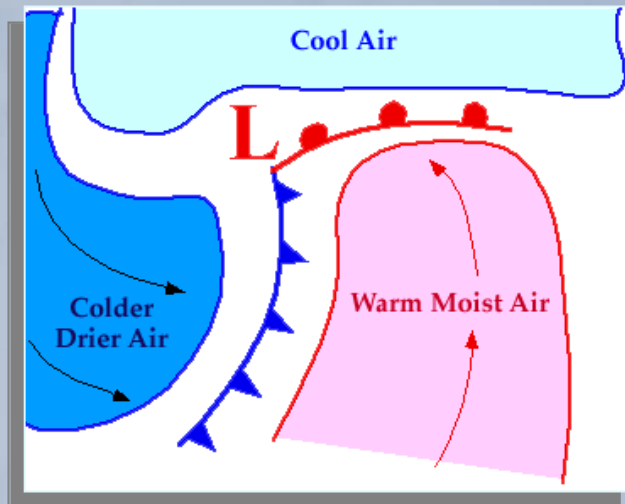


Thunderstorm Ingredients

Lift – Warm Front



Again, the colder air is denser than the warm air. As the warm air encounters the cold air, it is forced to rise up and over. If the air is unstable, showers and thunderstorms can form.



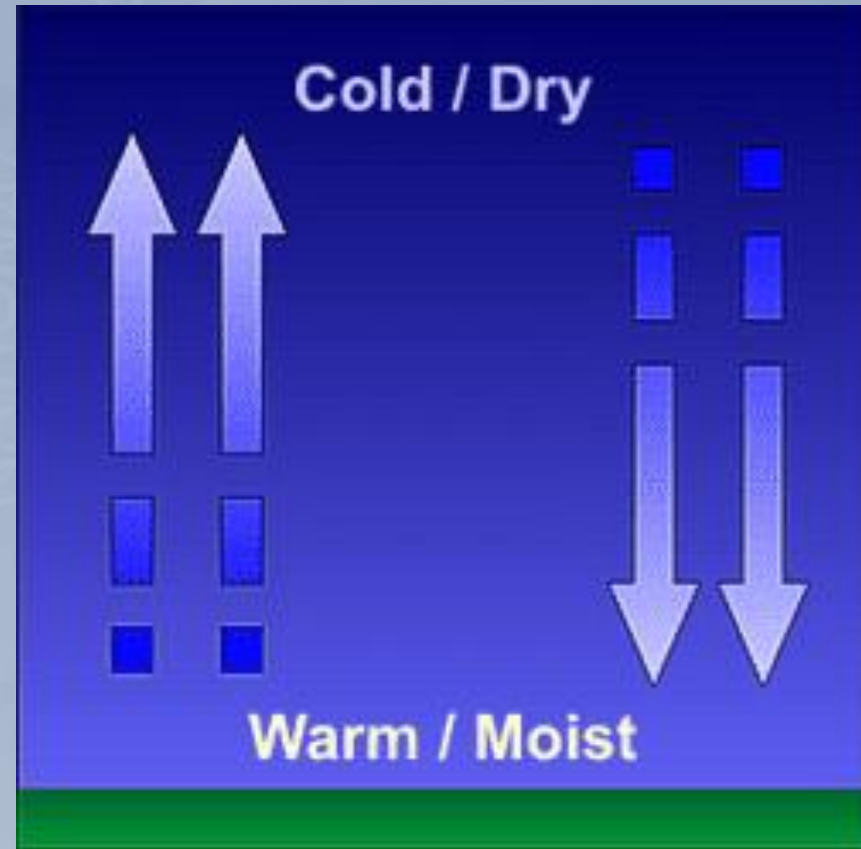
Thunderstorm Ingredients

Instability

An airmass is considered unstable if a parcel of air continues to rise when given a nudge upward (like a cold front).

In an unstable airmass, warm moist air is near the surface while cold dry air is aloft.

The more warm & moist the airmass is at the surface and the colder & drier the airmass is aloft...the more unstable the atmosphere is.



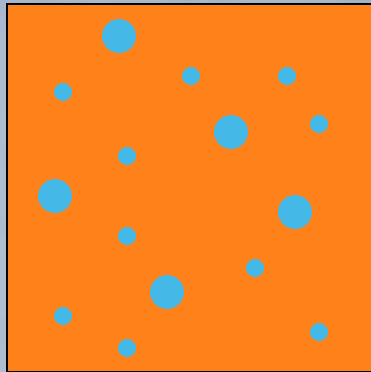
Thunderstorm Ingredients

Instability

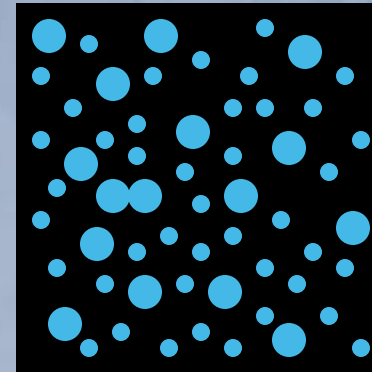
Warm air

versus

Cold air



Same size
air parcels



Warm air molecules are actively moving around limiting the number of molecules that an air parcel can hold. With less molecules per area, it is lighter.

Cold air parcel packs in a lot of molecules. There is less movement. With more molecules per area, this air is heavier and denser.

Thunderstorm Ingredients

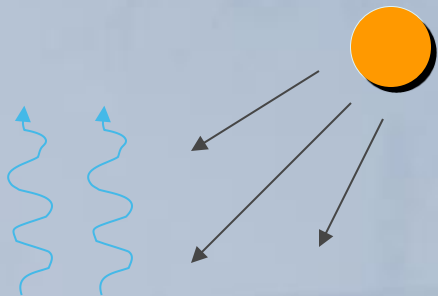
Instability

Warm air

versus

Cold air

- Warm air is lighter than cold air and will rise if it is warmer than its surroundings.
- Cold air is heavier than warm air. If the air is colder than its surroundings, it will sink and stay close to the ground.



Daytime heating is one way to warm up the lowest layer of the atmosphere.

Thunderstorm Ingredients

Instability

Dry air versus **Moist air**

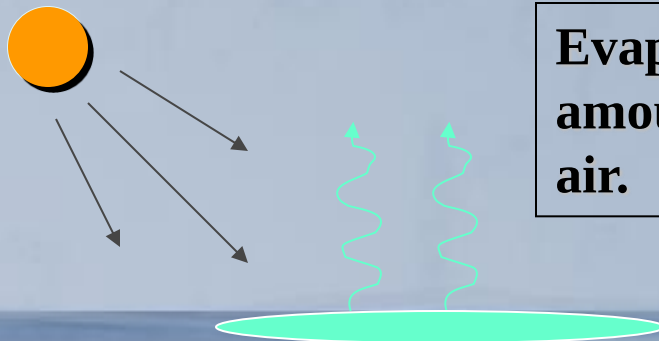
Molecule		Weight
Nitrogen (N ₂)	78% of air	28
Oxygen (O ₂)	21% of air	32
Water Vapor	H ₂ O	18

Thunderstorm Ingredients

Instability

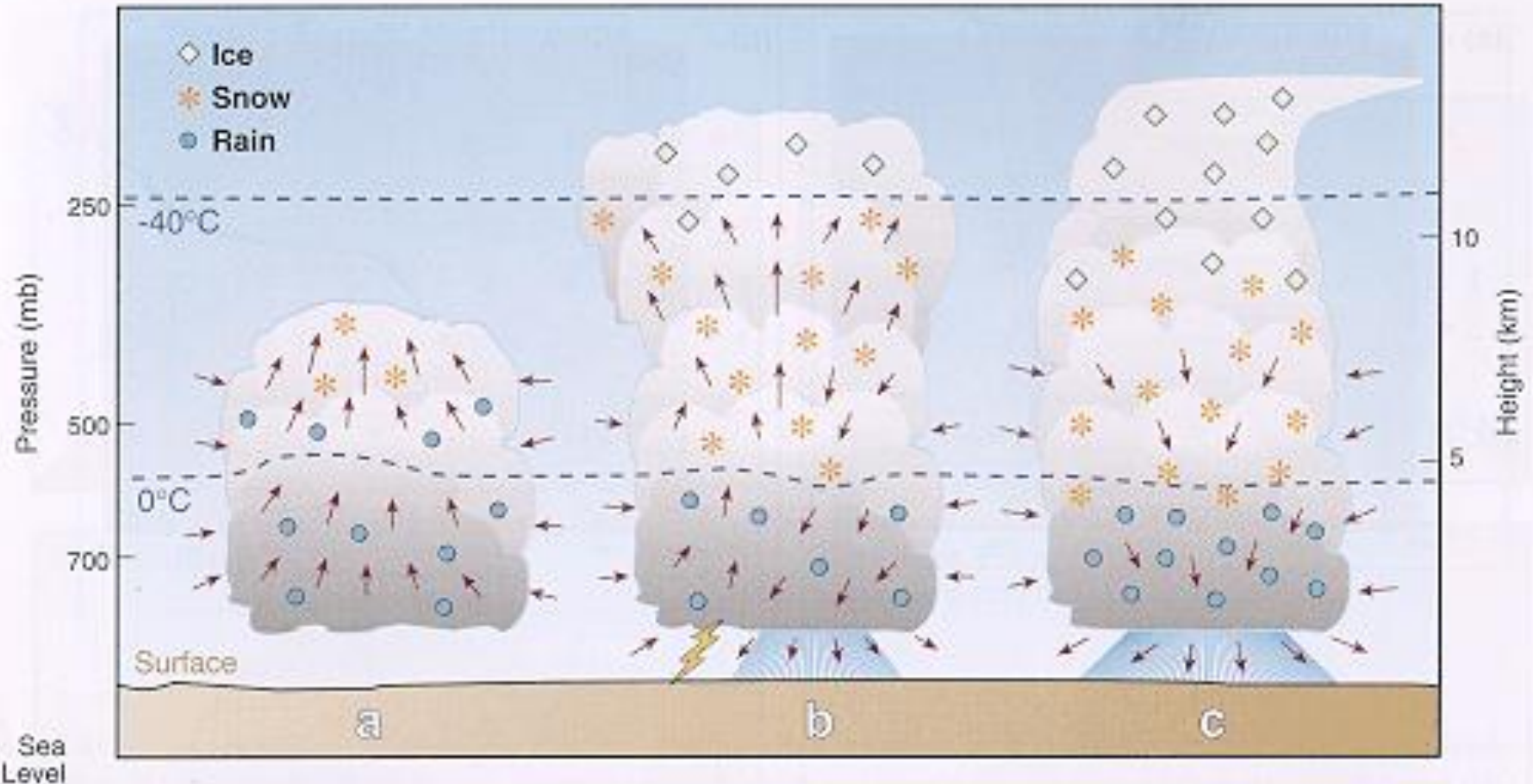
Dry air versus Moist air

- Moist air is lighter than dry air. Therefore if a parcel of air is more moist than its surroundings, it will rise.
- Dry air is heavier. If air is drier than that around it, it will sink.

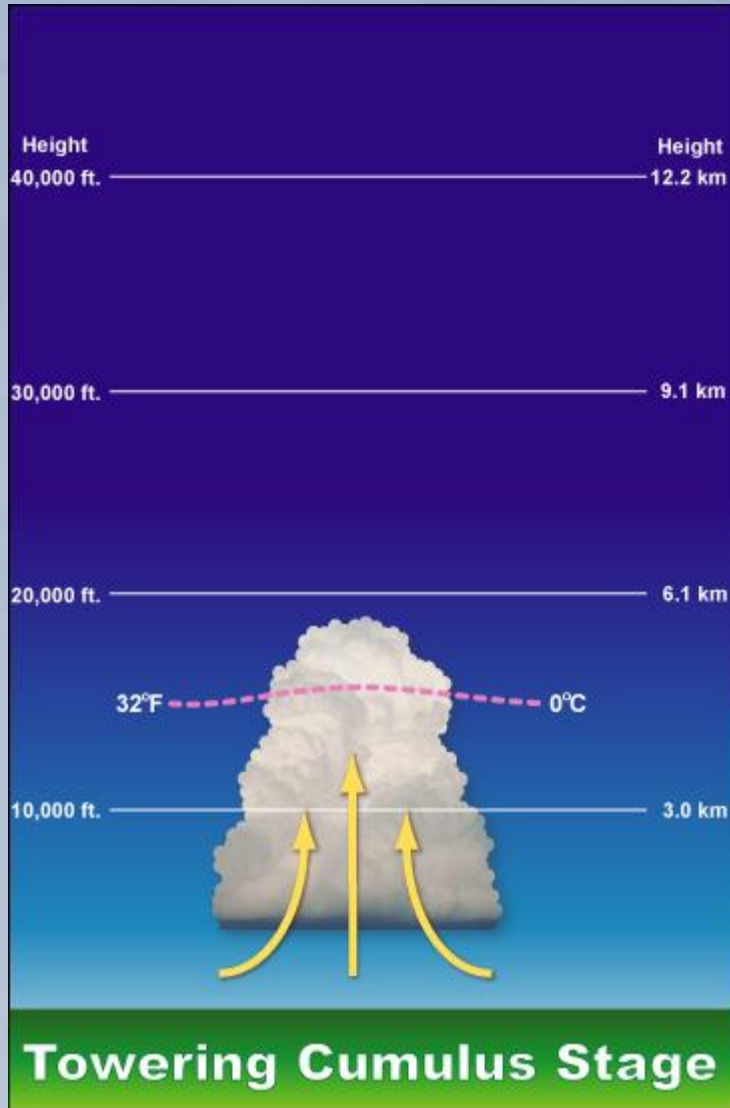


Evaporation is one way to increase the amount of water vapor and moisten the air.

The Thunderstorm Life Cycle



Cumulus Stage: Building Clouds

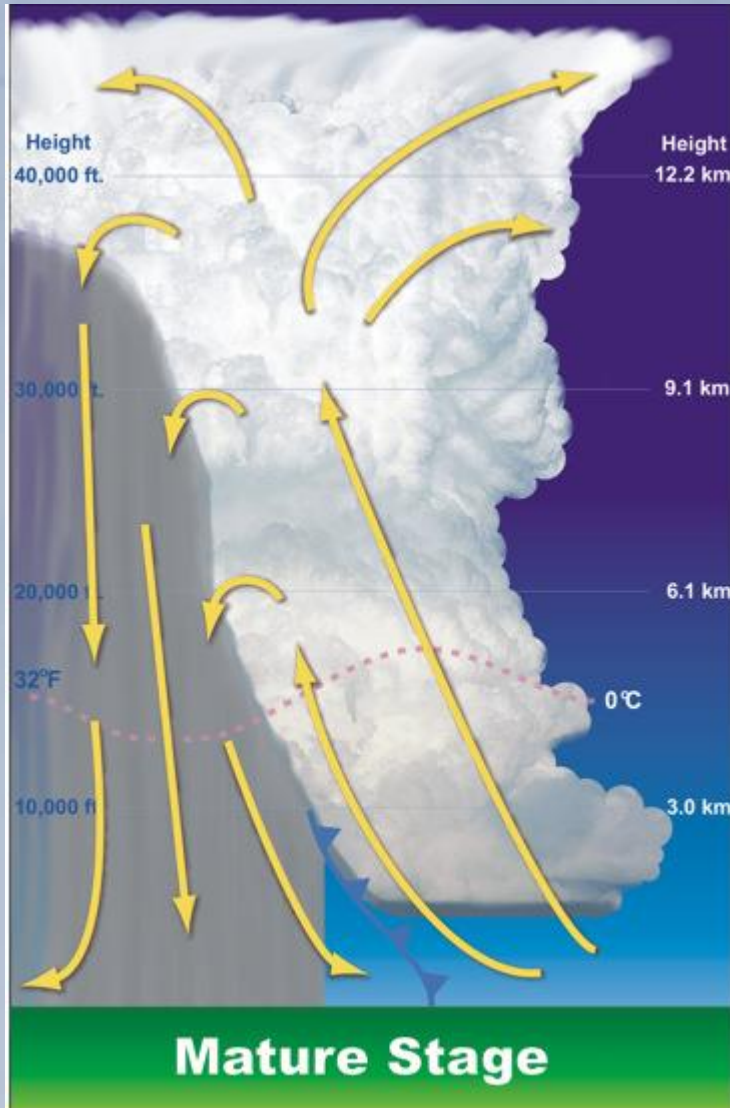


Updraft Dominant

Warm air is rising, cooling and condensing to form clouds.

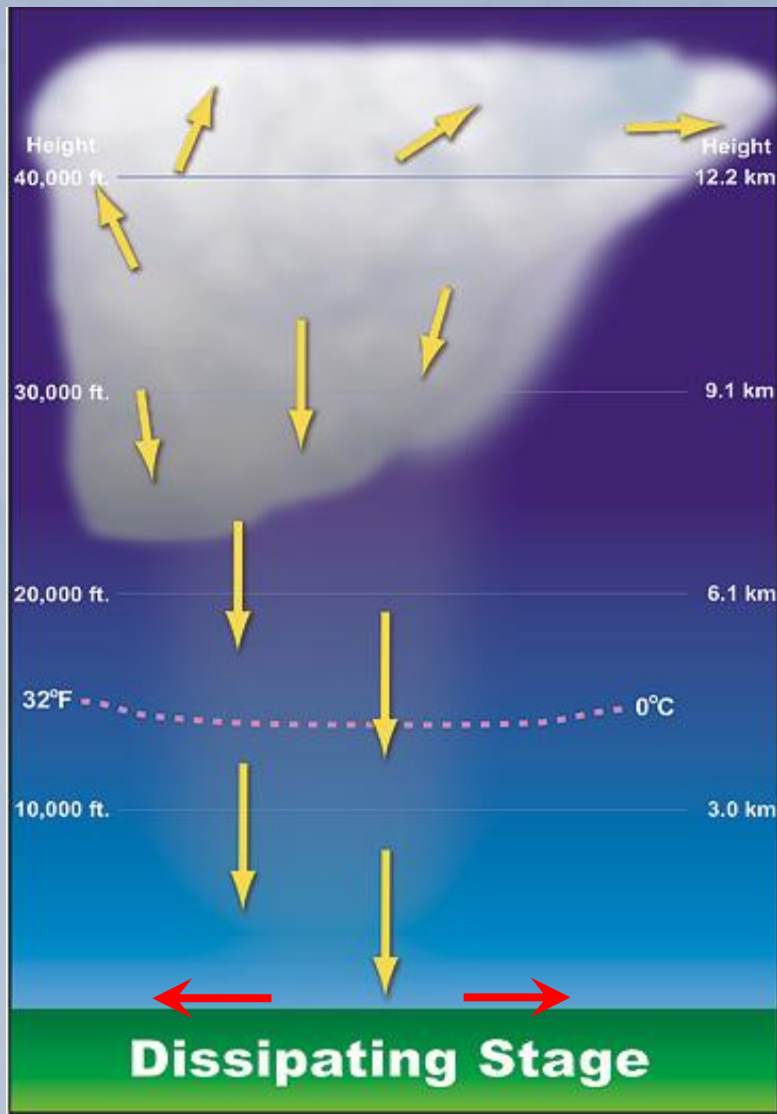
Mature Stage: Developed Thunderstorm

When the rain-cooled air impacts the surface and spreads out it creates a gust front. Sometimes winds can be very strong along the gust front.



Copyright 2004 Eric A. Helgeson

Dissipating Stage: Weakening Thunderstorm



As the gust front moves away from the base of the storm, it cuts off the storm's inflow and it begins to dissipate. The gust front may trigger new storms by convergence if the environment is moist and unstable.

Types of Thunderstorms

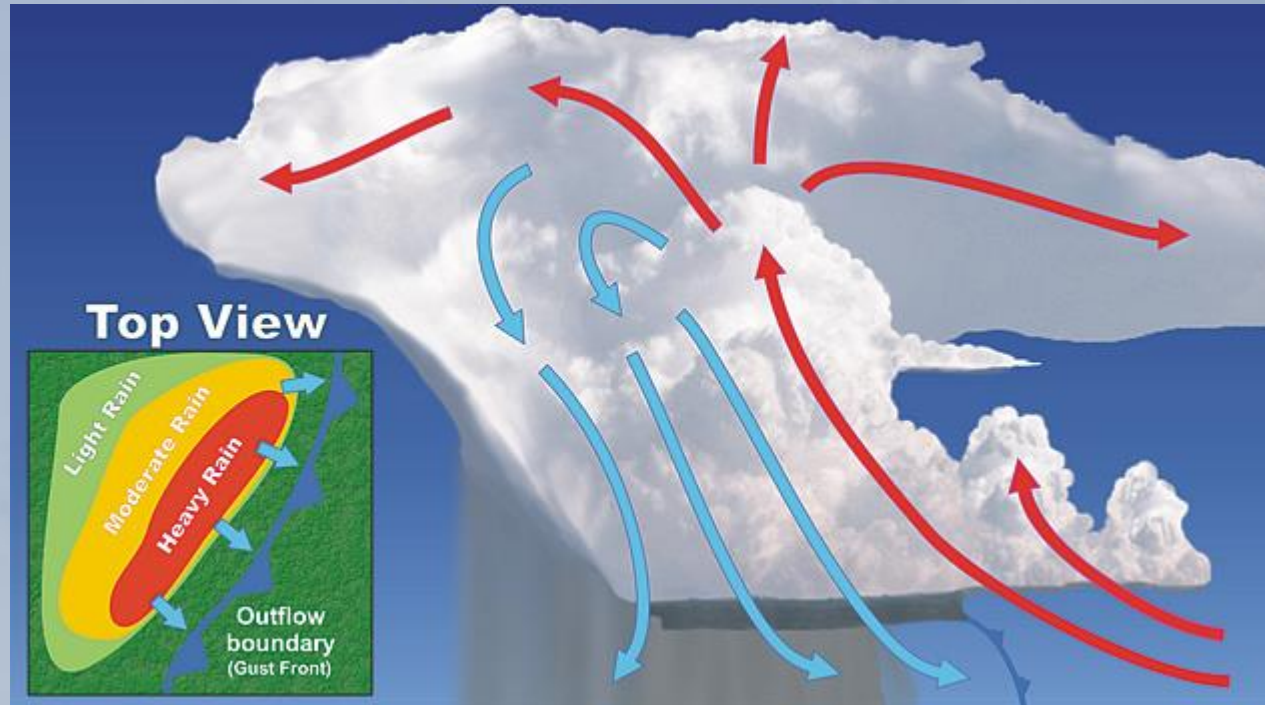
Single Cell

- Generally Weak
- Short Lived
- Poorly Organized
- “Pulse Storms”
- Usually “Rainers”



Types of Thunderstorms

Multicellular

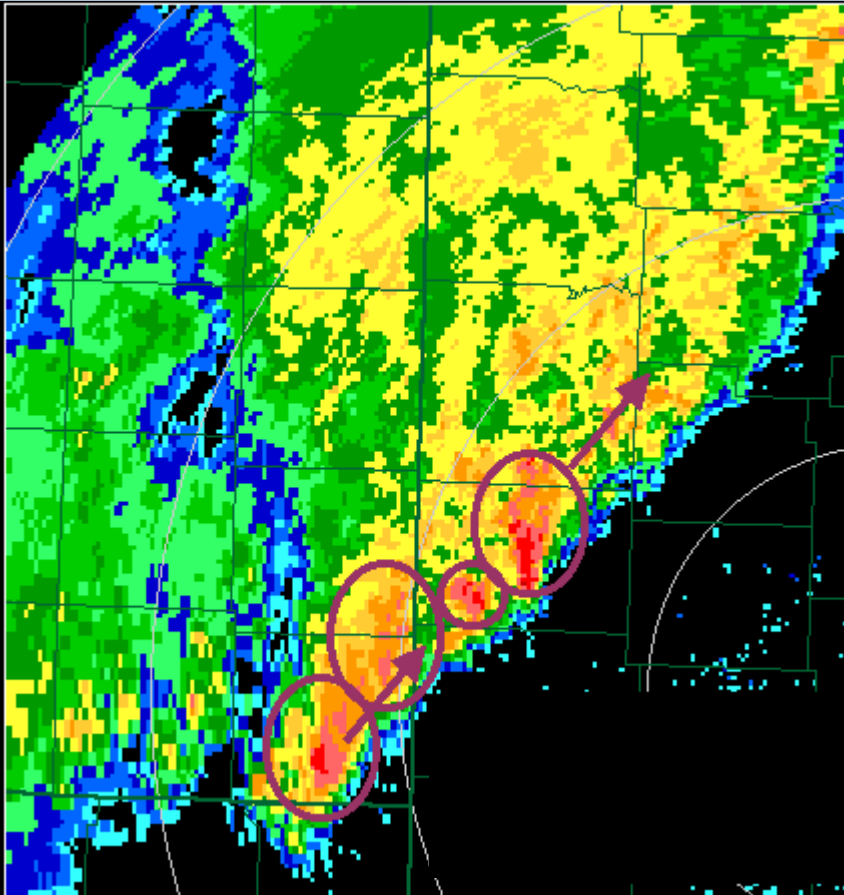


- **Most Common**
- **Series of thunderstorms that move as one unit**
 - Can be a cluster or a line
 - Can produce severe weather

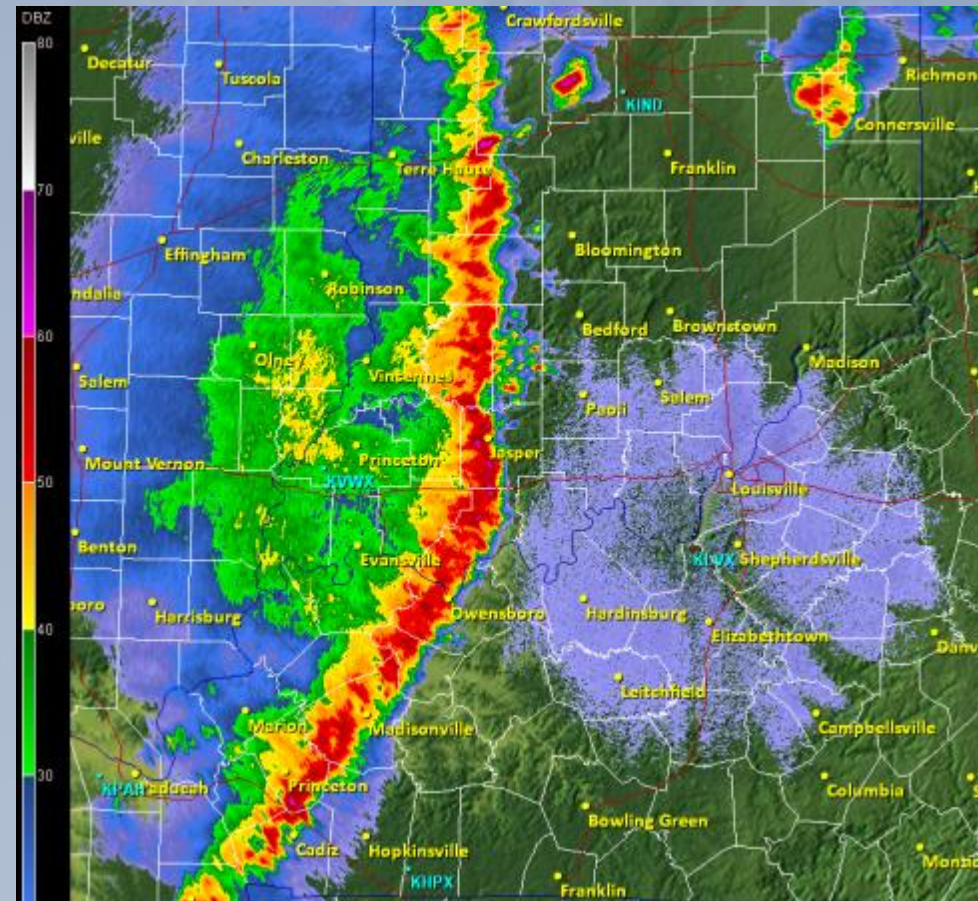
Types of Thunderstorms

Multicellular

Squall Line



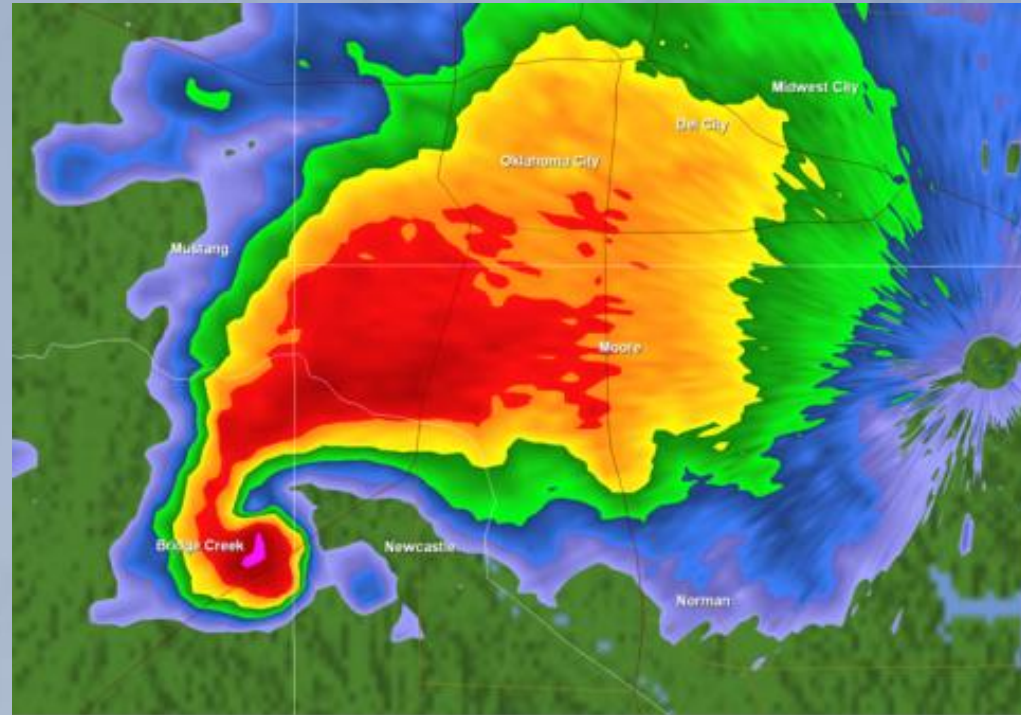
Cluster



Types of Thunderstorms

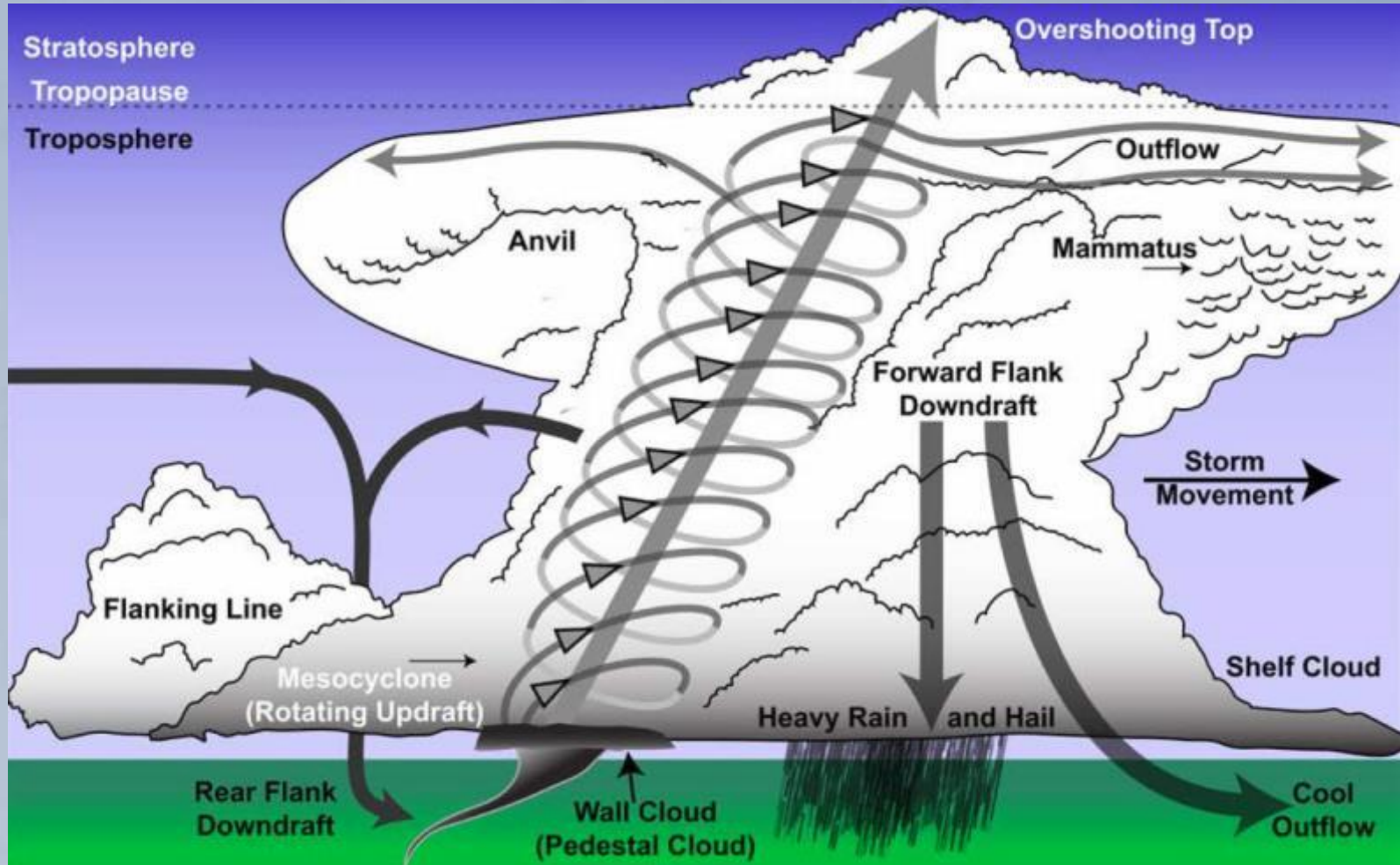
Supercells

- Rare
- Long Lived
- Very strong & persistent updrafts
- Strong mesocyclone
- Severe weather producer!

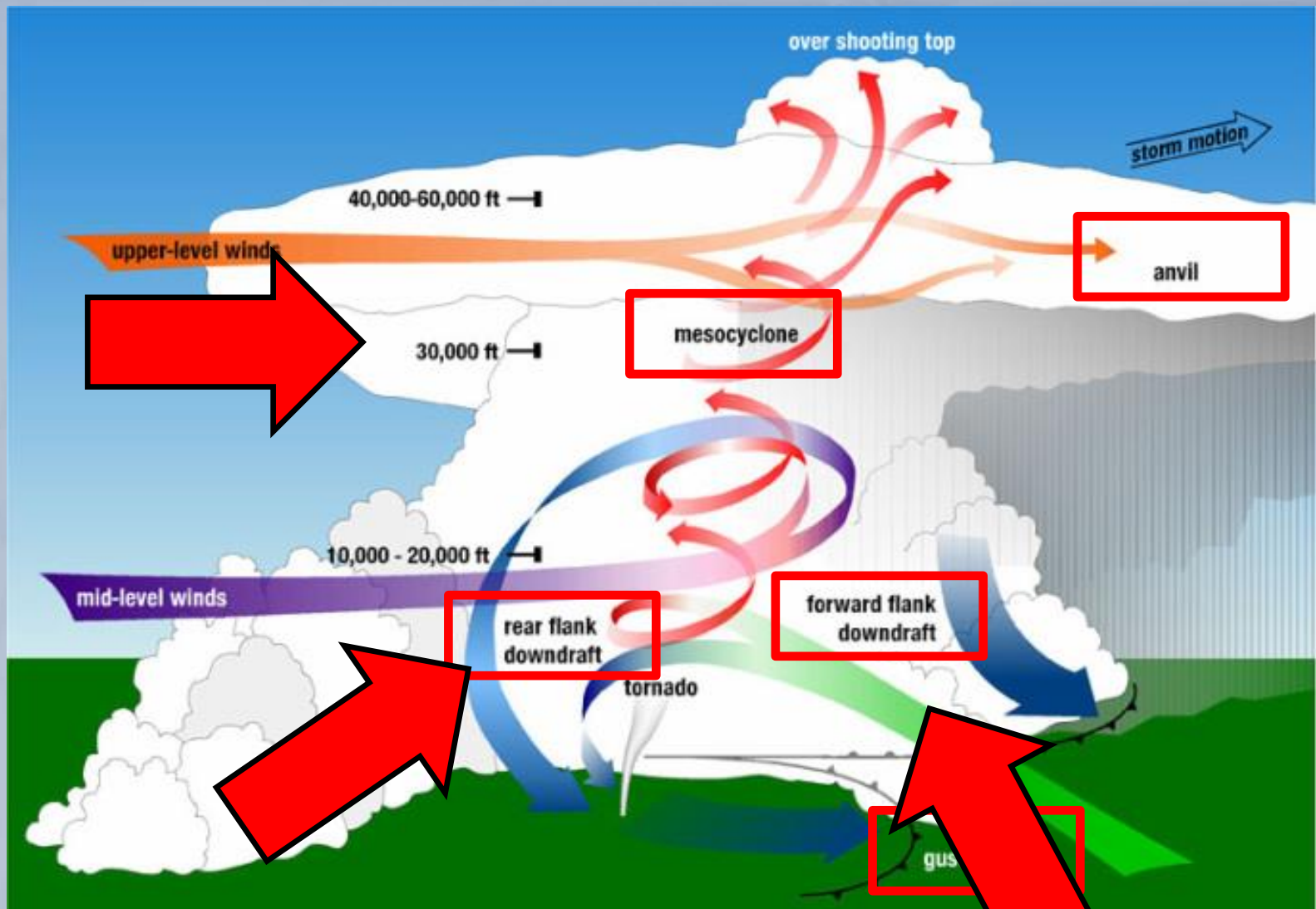


Mesocyclone: rotation within the storm

What is the Difference Between an Ordinary Thunderstorm and a Supercell?



Anatomy of a Supercell

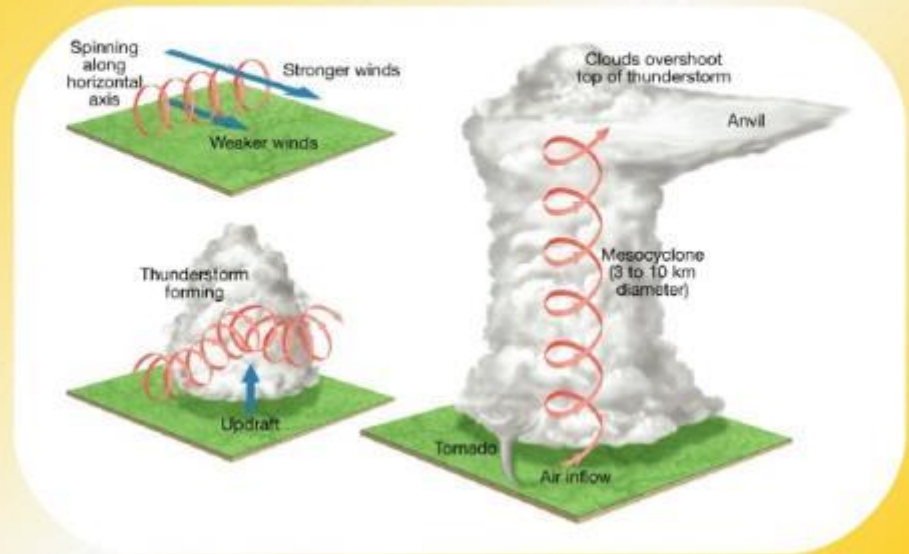


Mesocyclone

A storm-scale region of rotation, typically around 2-6 miles in diameter

A radar term, the rotation signature appearing on Doppler radar that meets specific criteria for magnitude, vertical depth, and duration.

Formation of a Mesocyclone

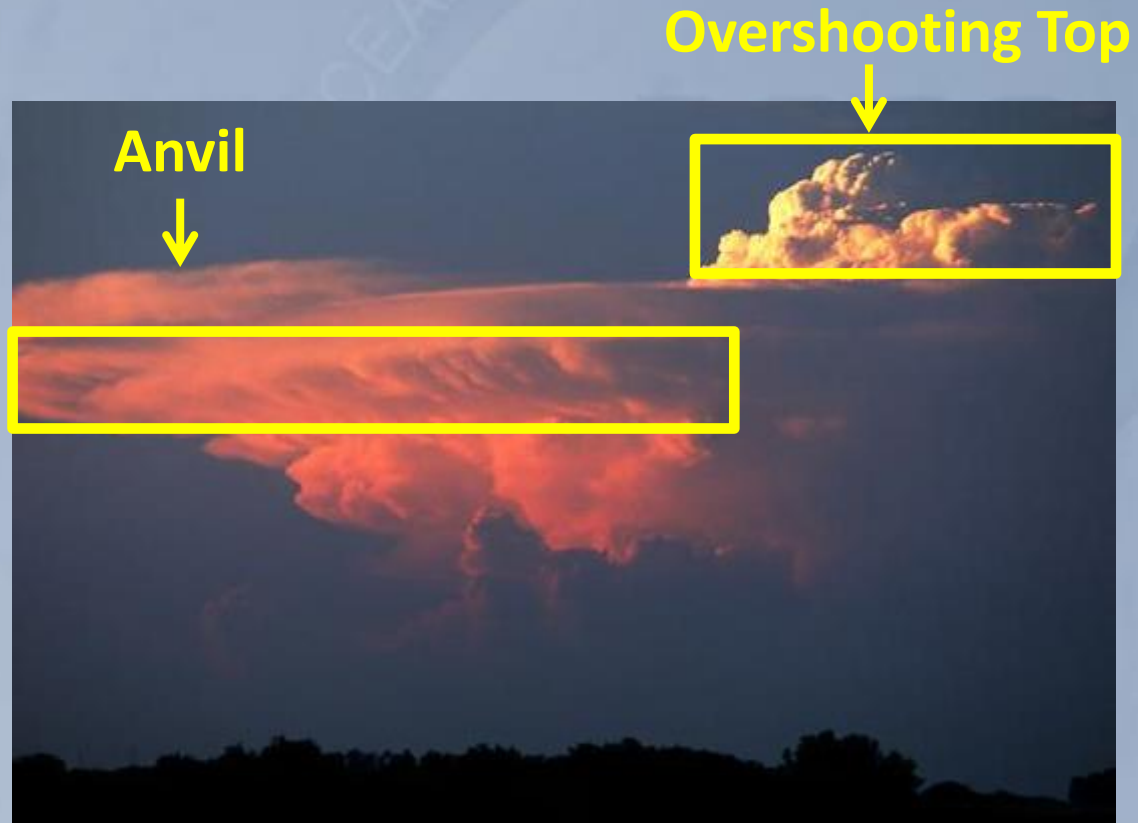


Anvil

The core of the updraft has the strongest vertical velocity. Air will rise until it reaches a stable layer (in the case of a severe thunderstorm, the tropopause).

When the moisture/air reaches the stable layer, it spreads out in the direction of the steering flow, forming the “anvil”.

A strong enough updraft will “punch” through the stable layer due to momentum, resulting in an “overshooting top”



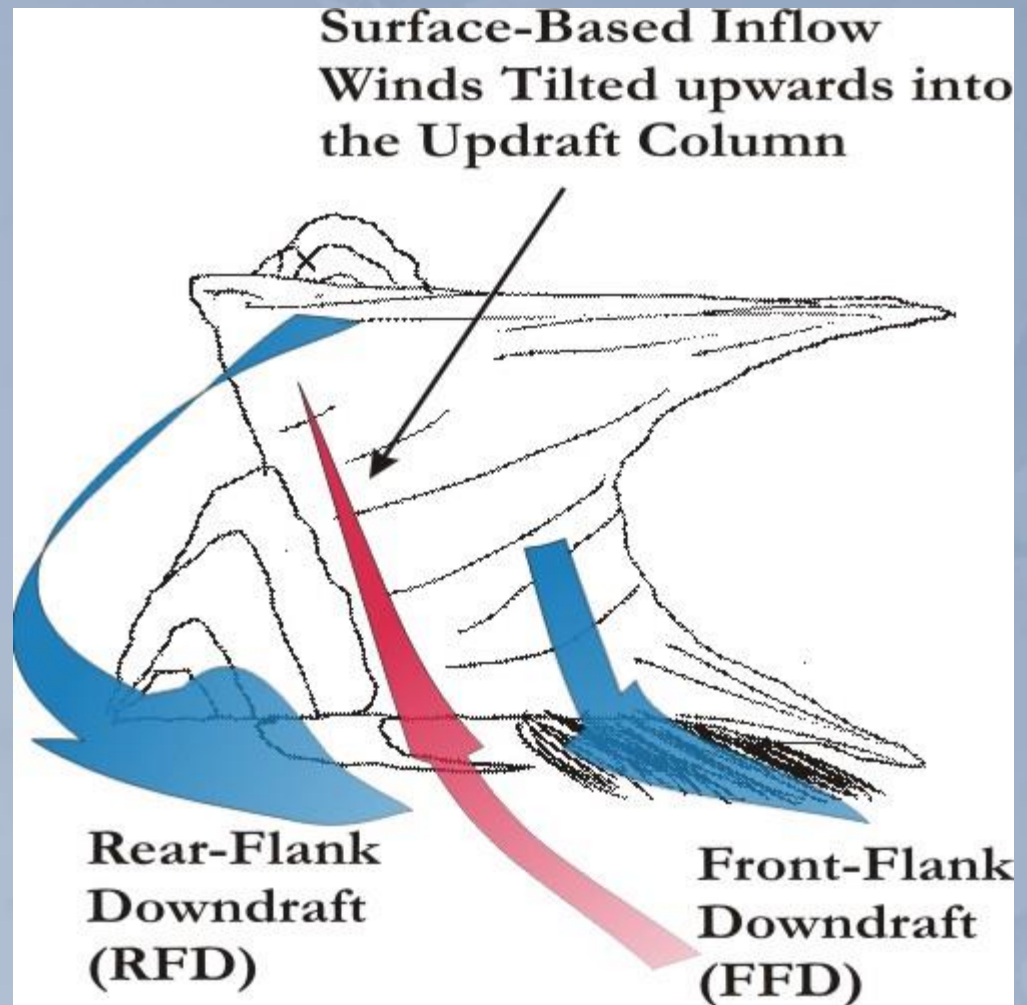
Forward Flank Downdraft

Associated with heaviest precipitation core

Results from evaporational cooling of air (moist, cool air). The temperature difference between these air particles and the ambient air causes the downdraft.

Forms in the forward flank (with respect to storm motion)

As it hits the surface, it spreads out, forming a gust front

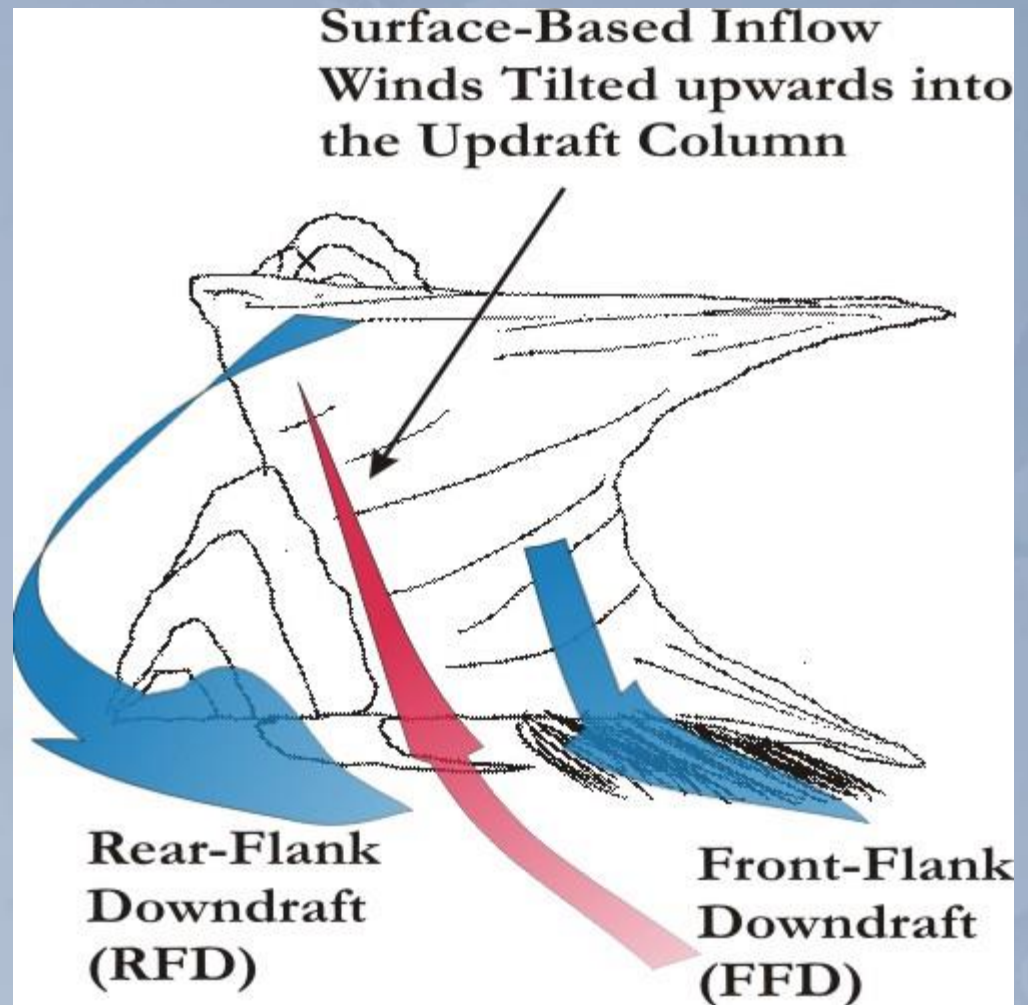


Rear Flank Downdraft

A region of dry air wrapping around the back of a mesocyclone in a supercell thunderstorm.

Warm, dry air forced down from the mid-levels of the atmosphere by vertical pressure differences.

Visible as a clear slot on radar. Scattered large precipitation particles (rain and hail) at the interface between the clear slot and wall cloud may show up on radar as a hook or pendant; thus the presence of a hook or pendant may indicate the presence of an RFD.



Wall Clouds

A localized, persistent, often abrupt lowering from a rain-free base (under the updraft)



Can range from a fraction of a mile up to nearly five miles in diameter

Normally found on the south or southwest (inflow) side of the thunderstorm.

Wall clouds don't necessarily rotate, but when they do, warn of the potential for tornadoes

Shelf Clouds

A low, horizontal wedge-shaped cloud, associated with a thunderstorm gust front (or occasionally with a cold front, even in the absence of thunderstorms).

A rising cloud motion often can be seen in the leading part of the shelf cloud, while the underside often appears turbulent, boiling, and wind-torn.



Difference between Shelf and Wall Clouds

Shelf

vs.

Wall



Slopes **away** from precip.

Indication of **outflow**/downdraft.

Accompanied by **horizontal** turbulent motions.

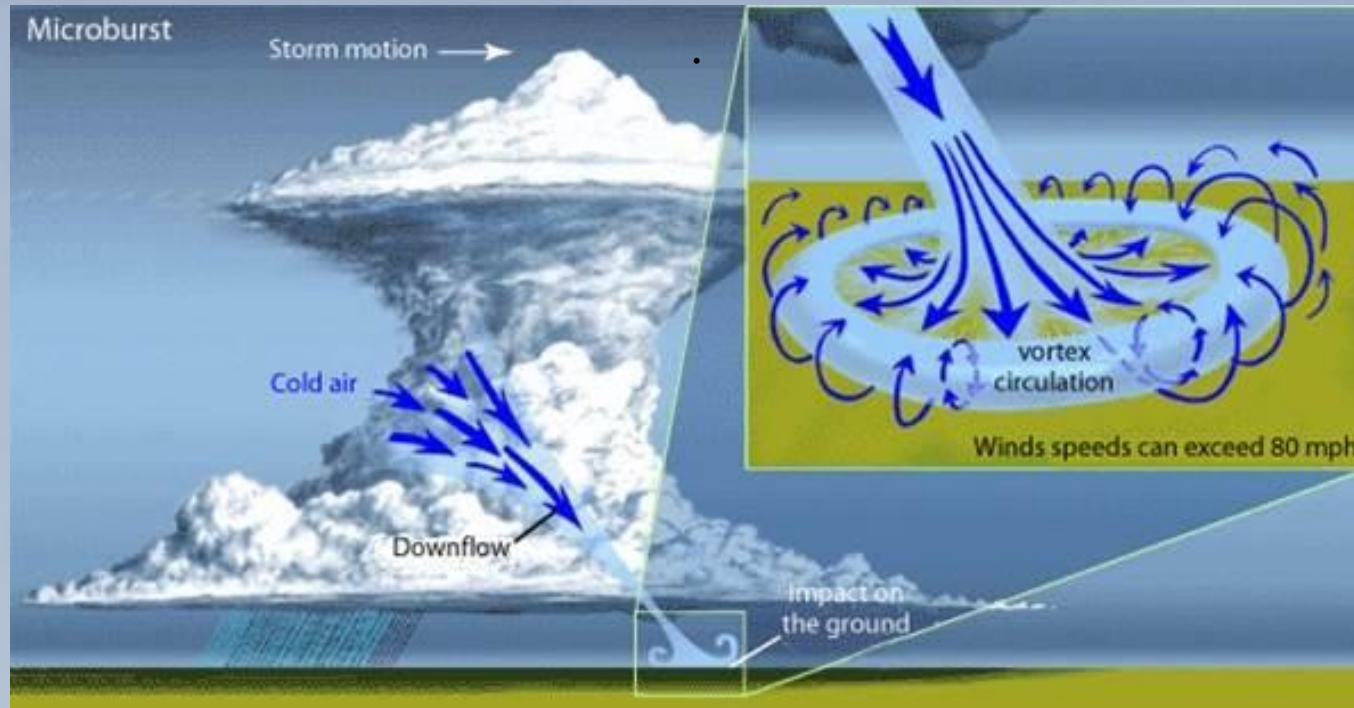


Slopes **toward** precip.

Indication of **inflow**/updraft.

Accompanied by **vertical** rotation.

Microbursts



A localized column of sinking air within a thunderstorm and is usually less than or equal to 2.5 miles in diameter. Microbursts can cause extensive damage at the surface, and in some instances, can be life-threatening.

When the updraft is no longer capable of holding the large core of rain/hail up in the thunderstorm, the core plummets to the ground. As it hits the ground it spreads out in all directions

Types of Supercells

Classic

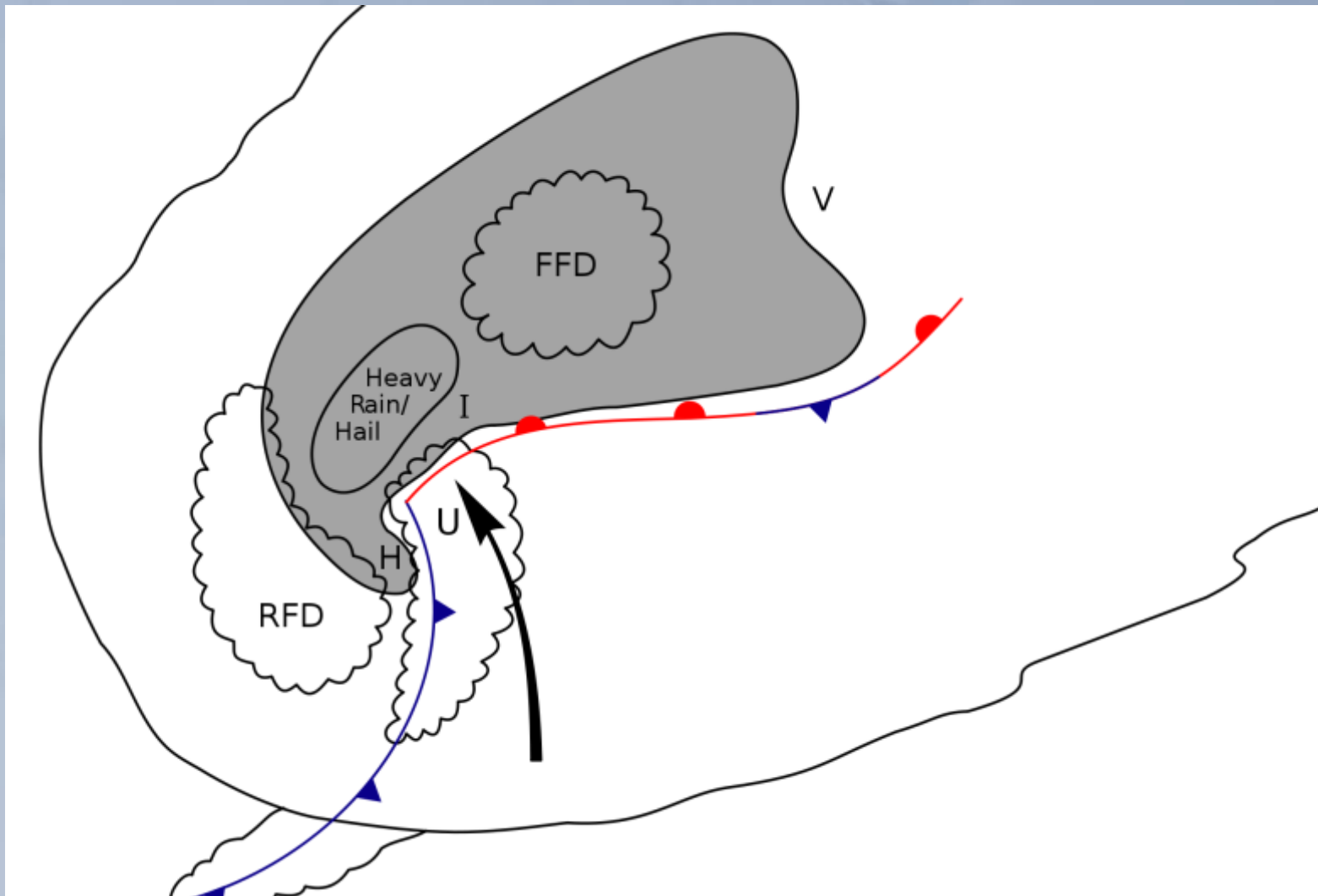
High Precipitation (HP)

Low Precipitation (LP)

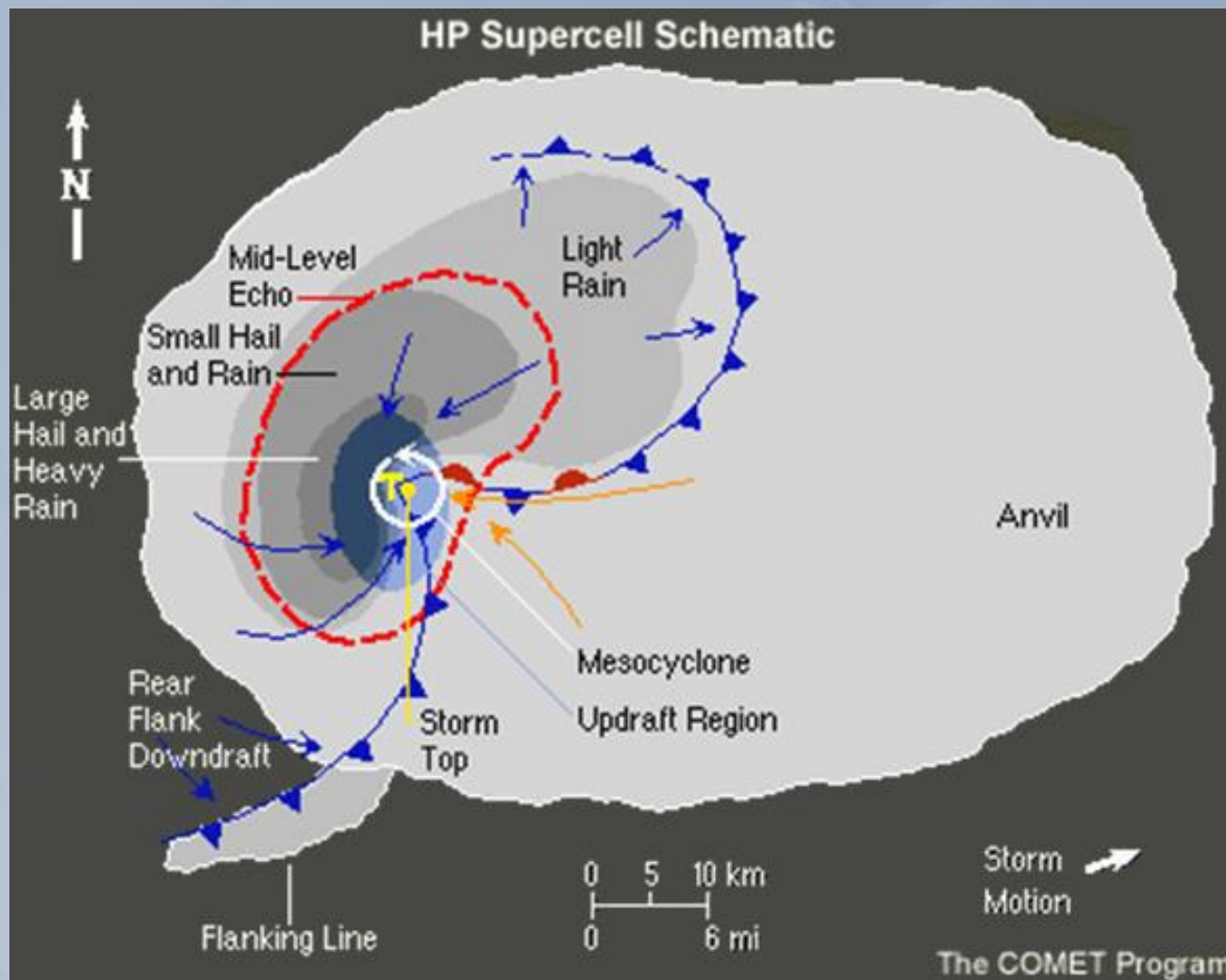
Types of Supercells

<u>Classic</u>	<u>HP</u>	<u>LP</u>
- Best indication of a hook on radar - Varying degrees of hail, winds and tornadoes - Some precipitation but not extremely heavy	- Heavy precipitation, most likely to produce flash flooding (rain-wrapped supercells) - May or may not have a recognizable hook echo on radar - Smaller hail - Often embedded with squall lines	- Little or no precipitation - Large hail and strong straight line winds - Weaker tornadoes (if they do occur). But clearly show rotation - Higher based, clear base

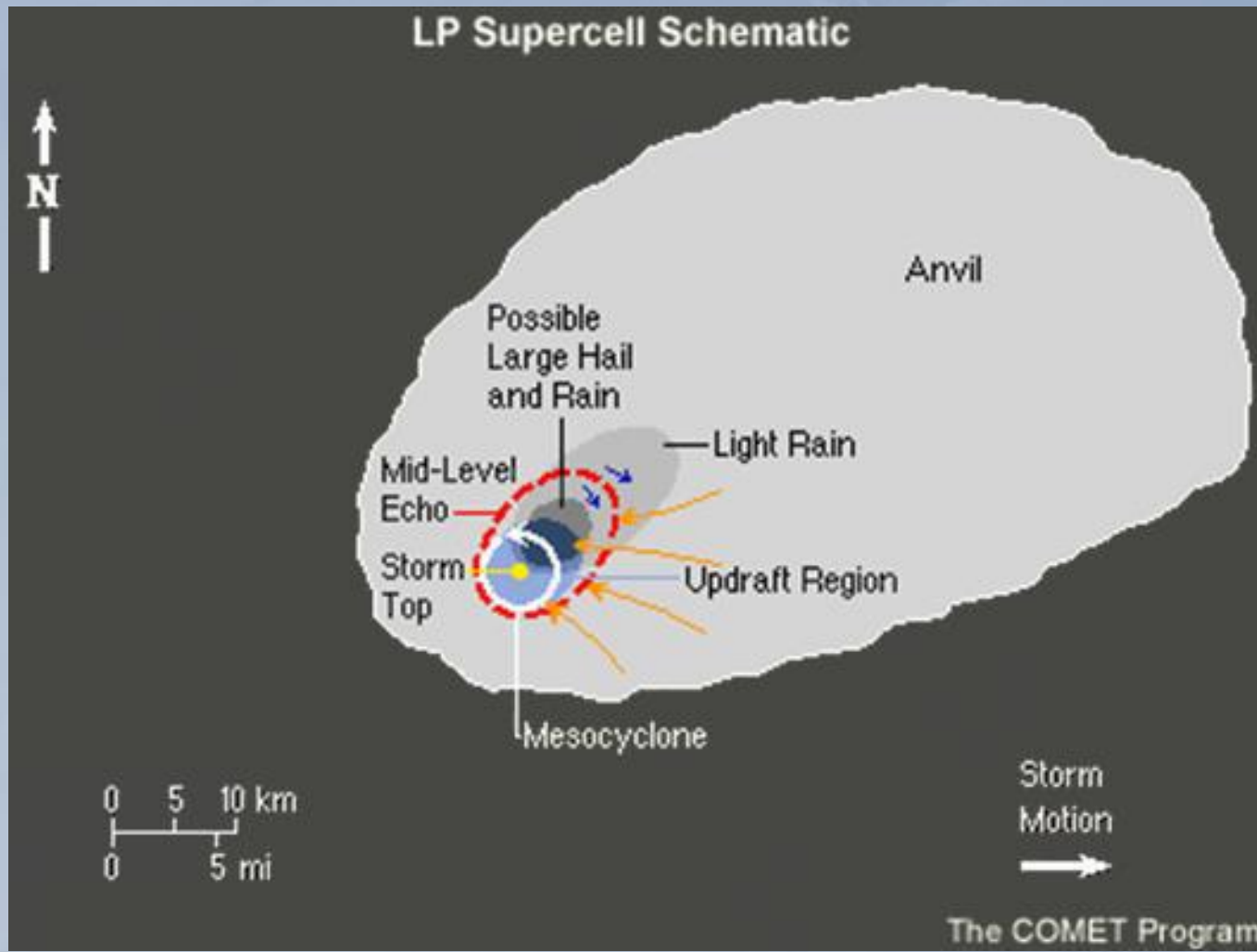
Classic



HP

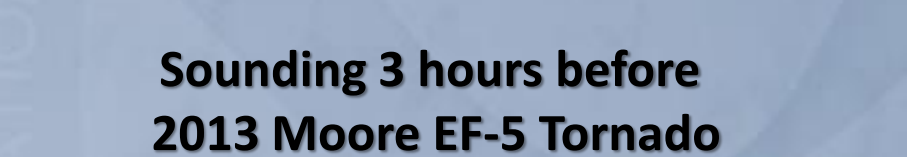


LP



Supercell Ingredients

- **Lift** - A lifting mechanism to focus the energy
- **Instability** - Heat and moisture
- **Shear** - Increasing winds with height and veering winds with height



Instability Indices

Index	Weak potential	High potential
Lifted Index	0 to -2	- 6 or less
CAPE	500-1000	> 2500
Total Totals	48 to 49	> 52
Sweat	200 - 300	> 400

Types of Wind Shear

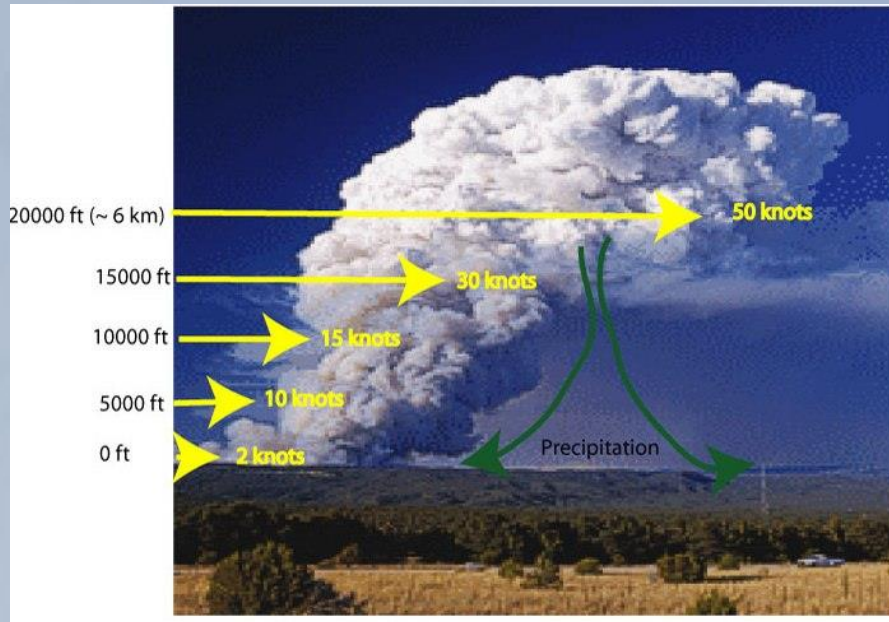
- **Directional Shear** – Winds changing direction with height
- **Speed Shear** – Changing wind speeds with height

Types of Wind Shear

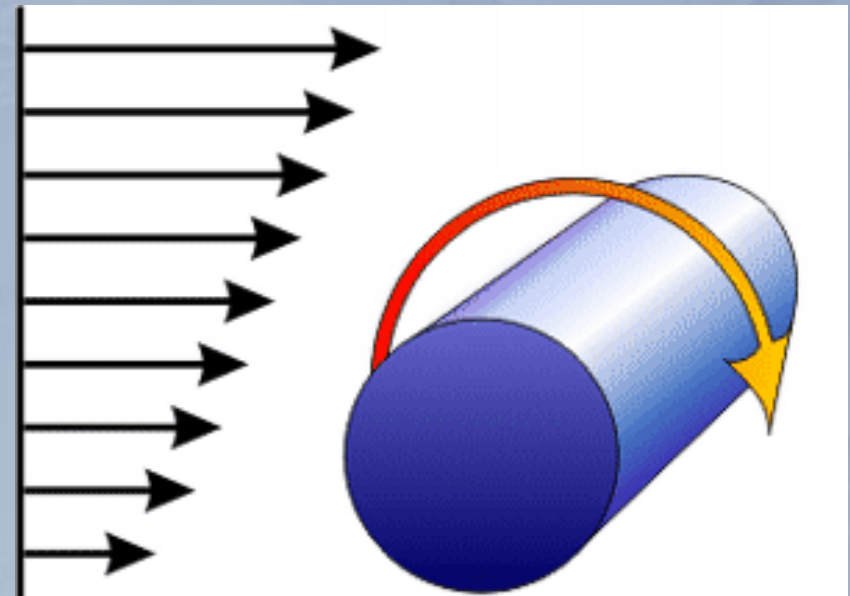
Directional Shear



Types of Wind Shear



Speed Shear

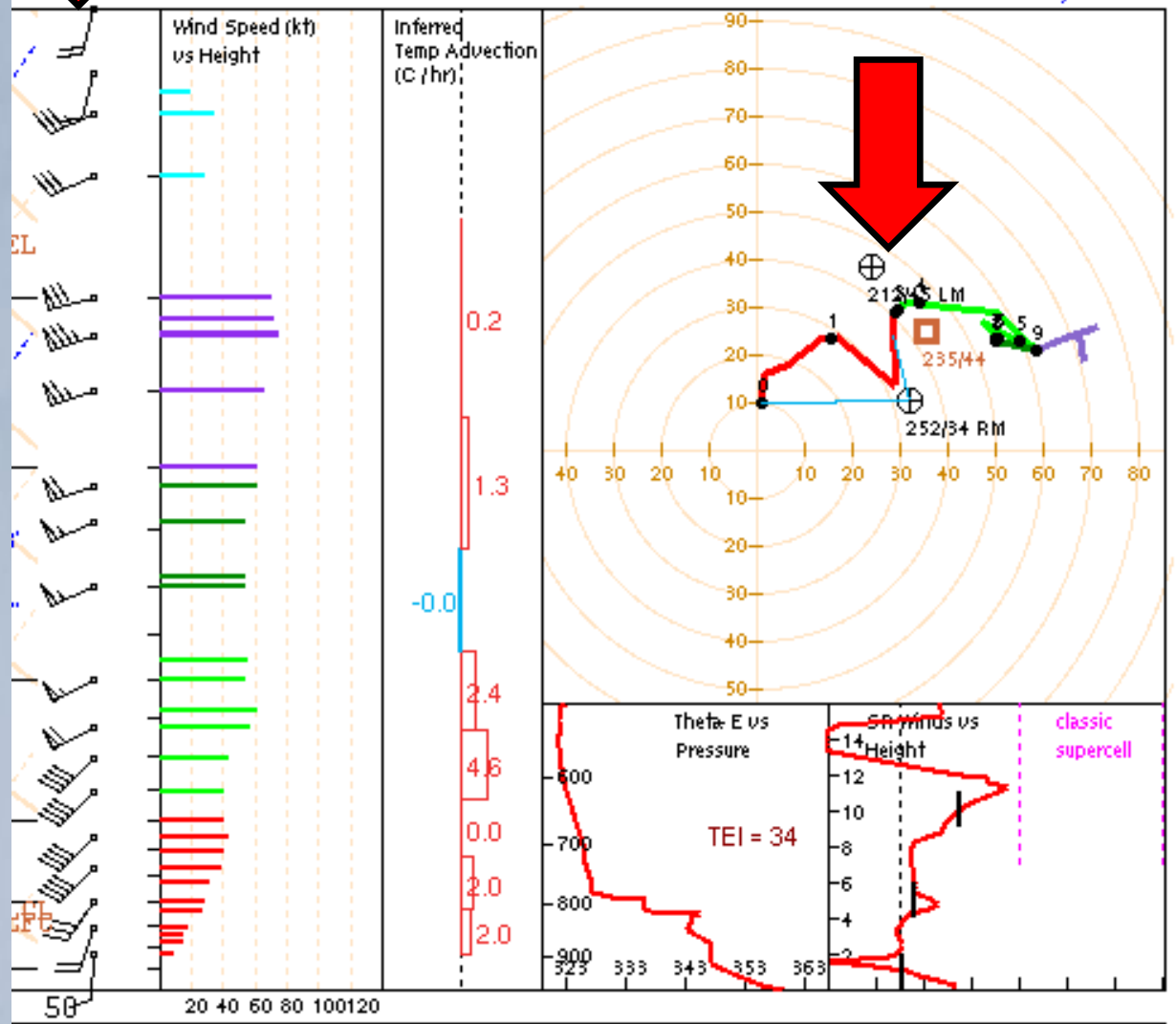


Vertical wind shear creates a “spin” in the atmosphere.

Wind Shear



NOAA/NWS Storm Prediction Center
Norman, Oklahoma



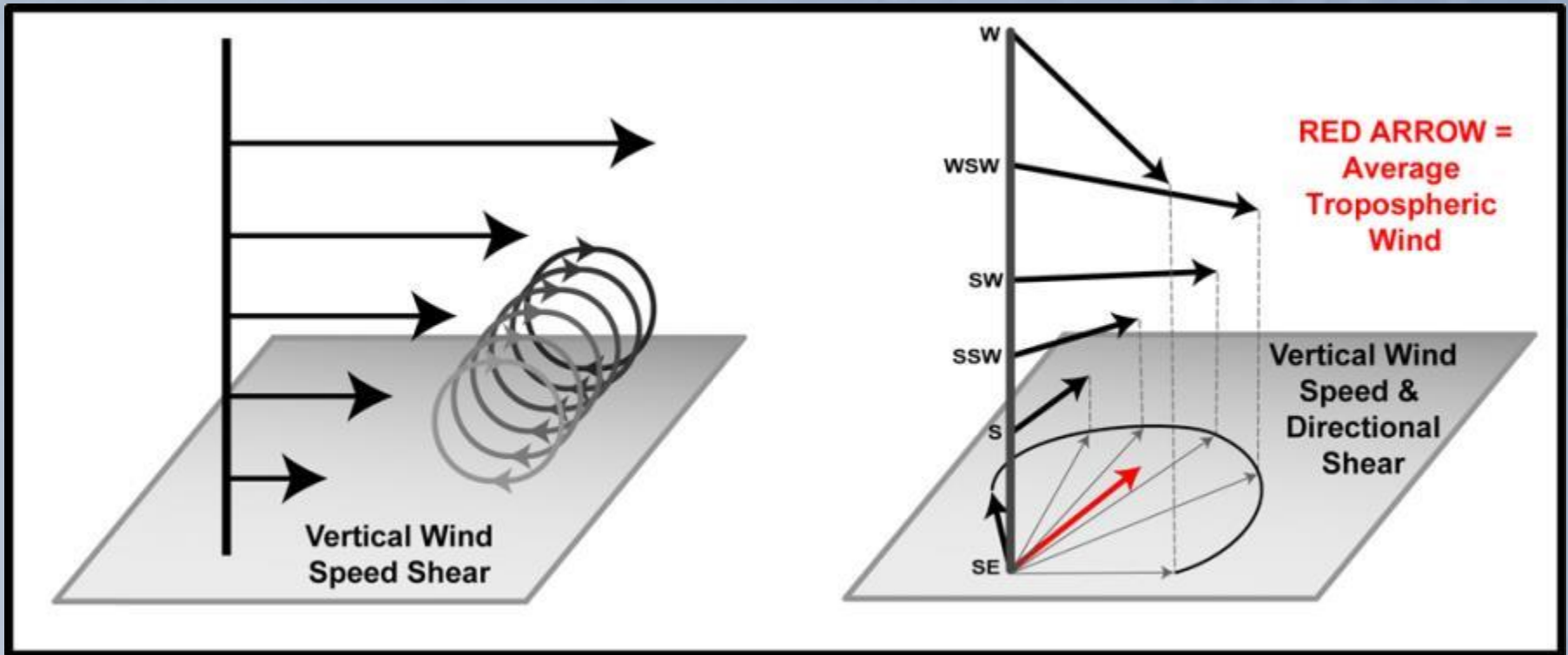
**Sounding 3 hours before
2013 Moore EF-5 Tornado**

Wind Shear Indices

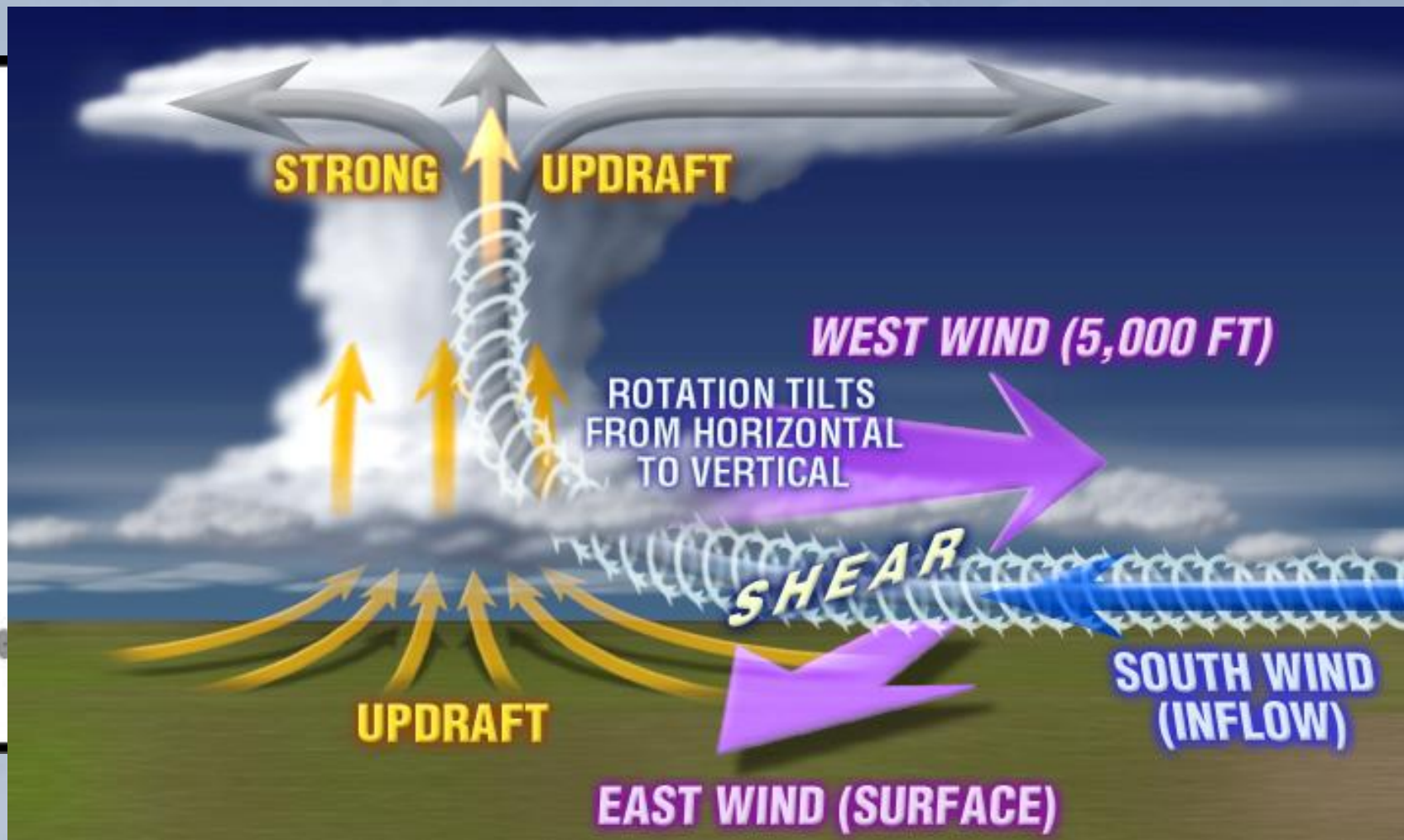
Index	Weak potential	High potential
Storm Relative Helicity	65 to 125	300 or more
Vertical Shear	< 30	40 or more
Storm Inflow	15 mph	25 or more
Storm Motion	15 to 30 mph	40 or more

Wind Shear and Tornadoes

For tornadogenesis: You need strong vertical wind shear, both directional and speed



Wind Shear and Tornadoes



How Does Hail Form?

Hail too large
for cloud to hold
falls to earth
causing strong
cold downdraft

Hail Formation

Hail growing in circulating
convection currents

Freezing Level

Rain drops being sucked
into the updraft

Hail forms by a process called
aggregation.



Instability and Wind Shear Indices

Index	Moderate	High
Energy Helicity Index (EHI)	0.5 to 2.0	> 3.0
Bulk Richardson Number (BRN)	10 – 15 or 35 to 50	15 to 35

Severe Thunderstorms

Warning Criteria: 1" Hail and/or 58 MPH Winds

- **Straight-Line Winds**
- **Hail**
- **Flash Flooding**
- **Tornadoes**



Radar Principals

- Radar Basics
- Dual-Polarization Radar
- Reflectivity, Velocity, SRM
- Hail Indications
- Precipitation Estimates
- What Else can the Radar See?
- MRMS



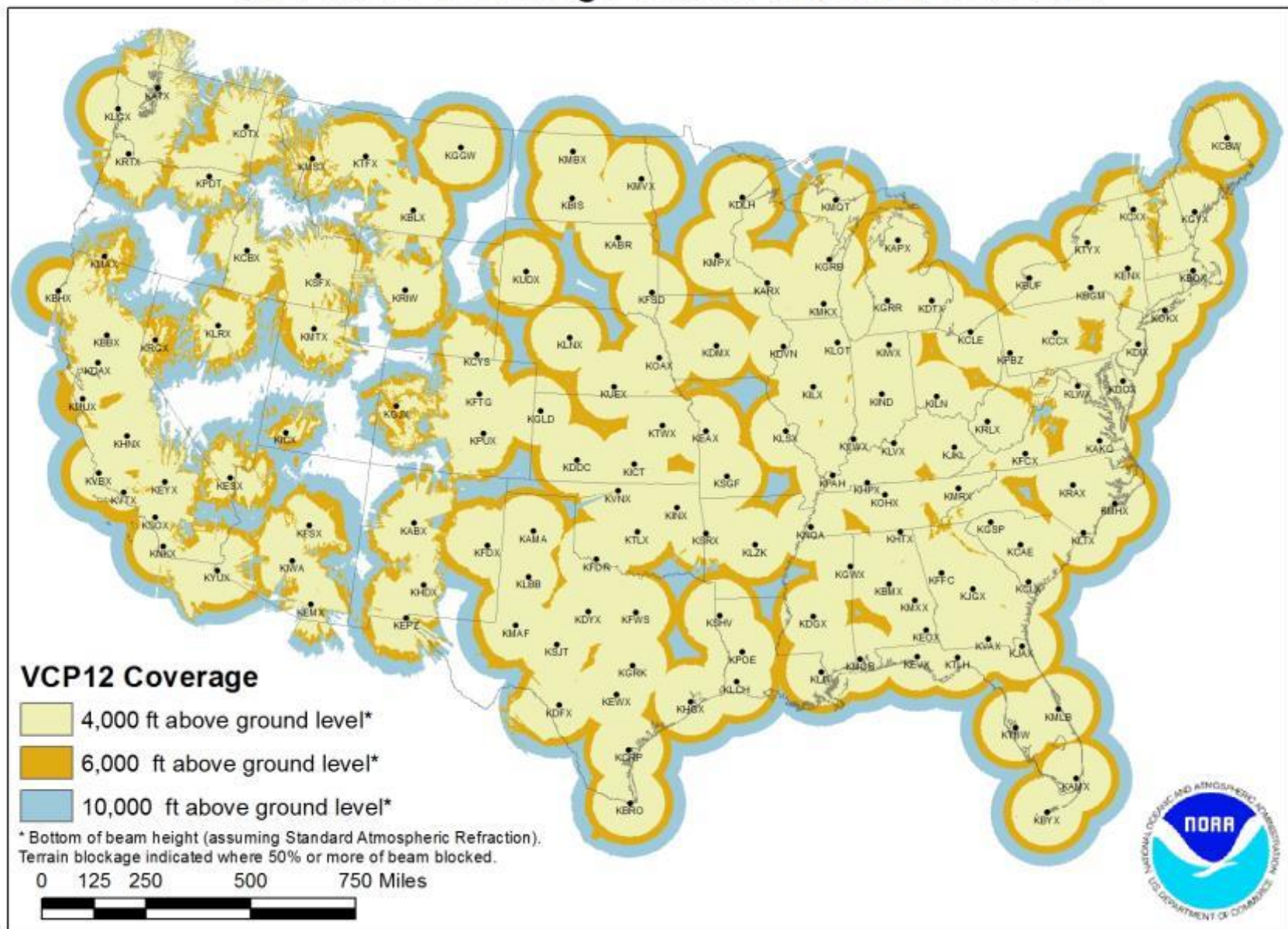
Basic Radar

WSR-88D (10 cm, S-Band)

- 70 Ft Tower
- 40 Ft Dome
- 30 Ft Radar Dish
- 750 KW Power
- 1° Beamwidth
- -1-20° Elevations

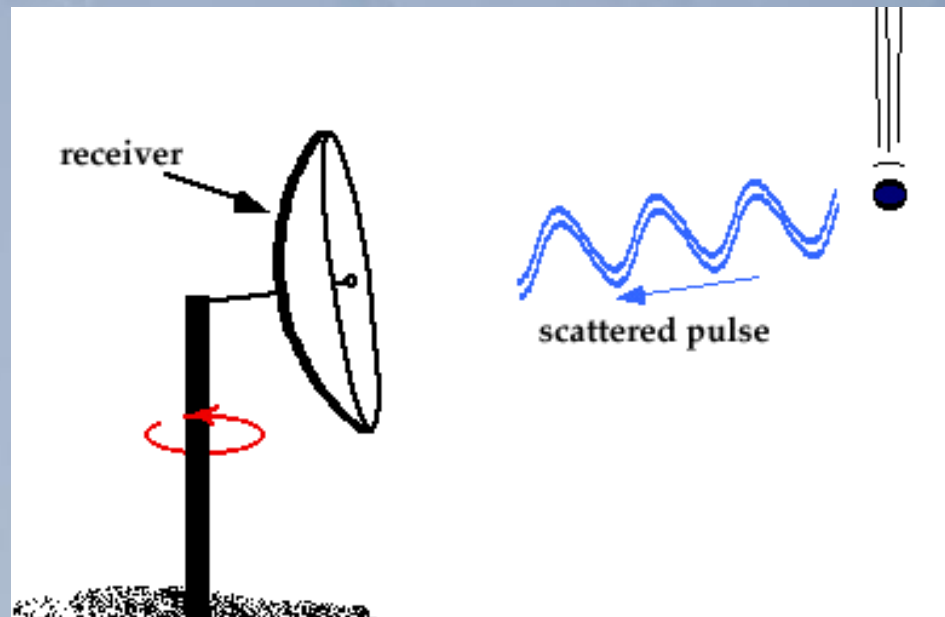
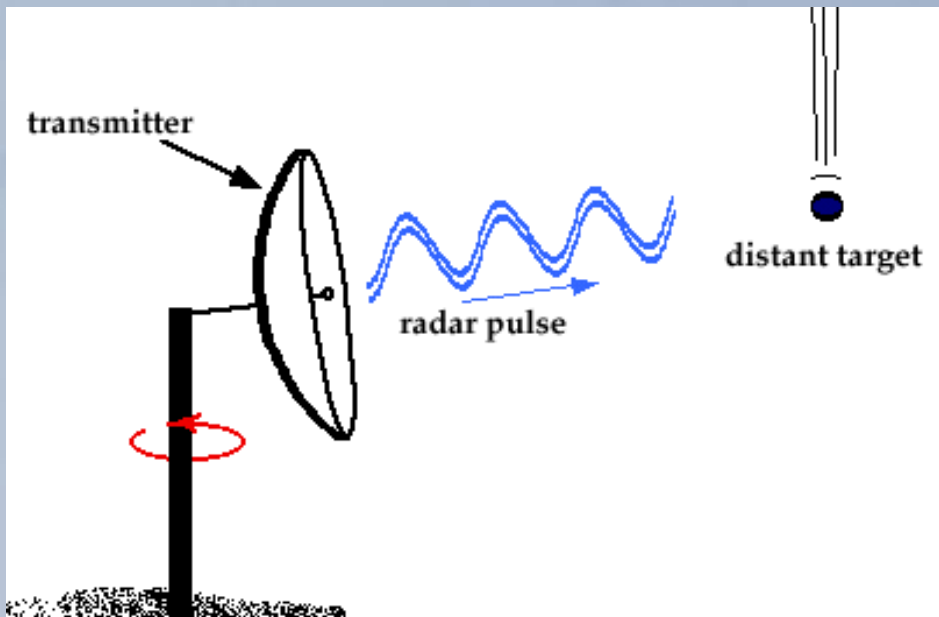


NEXRAD Coverage Below 10,000 Feet AGL



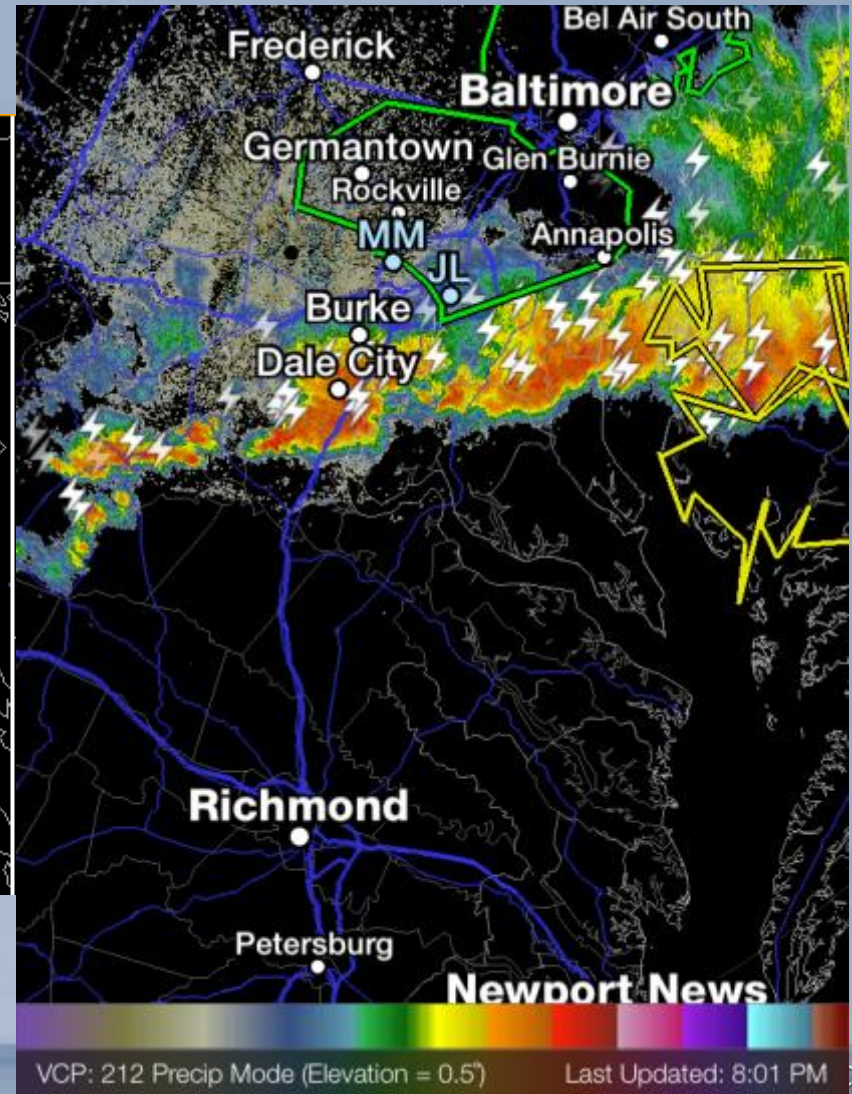
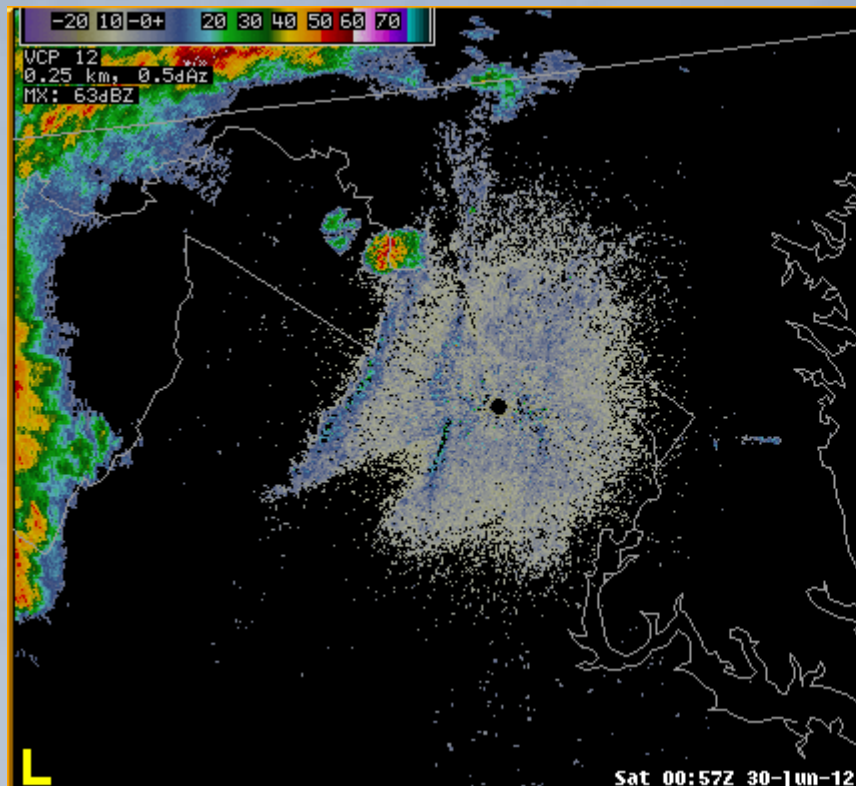
Basic Radar

RAdio Detecting And Ranging



Basic Radar

Base Reflectivity



Basic Radar

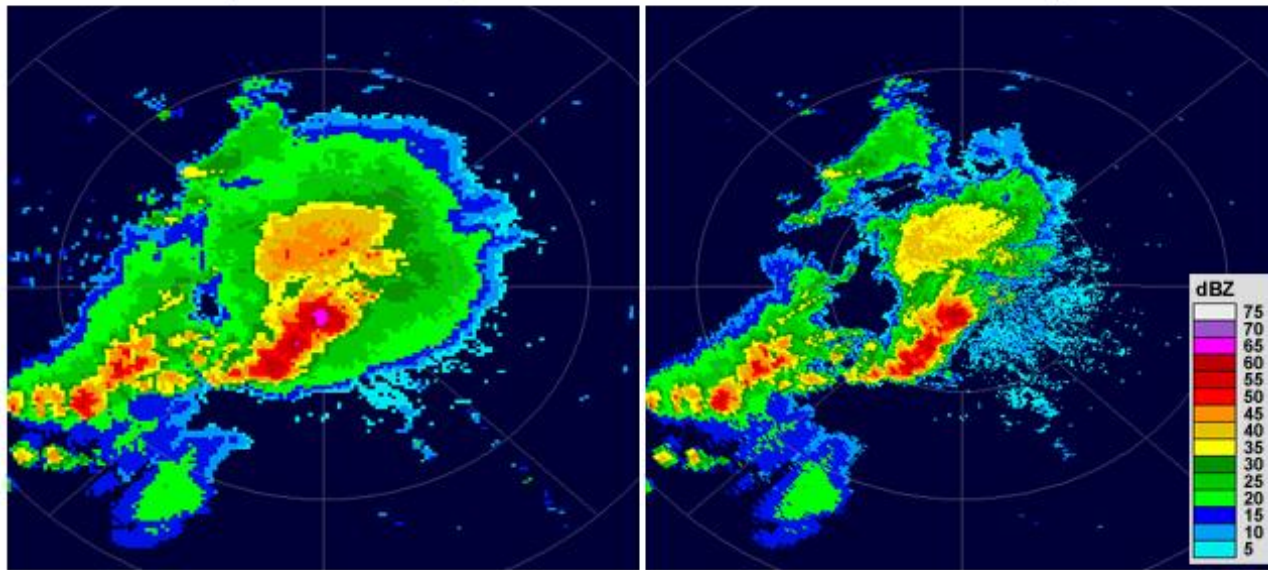
Composite Reflectivity

This display is of maximum echo intensity (reflectivity) from any elevation angle at every range from the radar.

Be careful using composite, it might mask low level features.

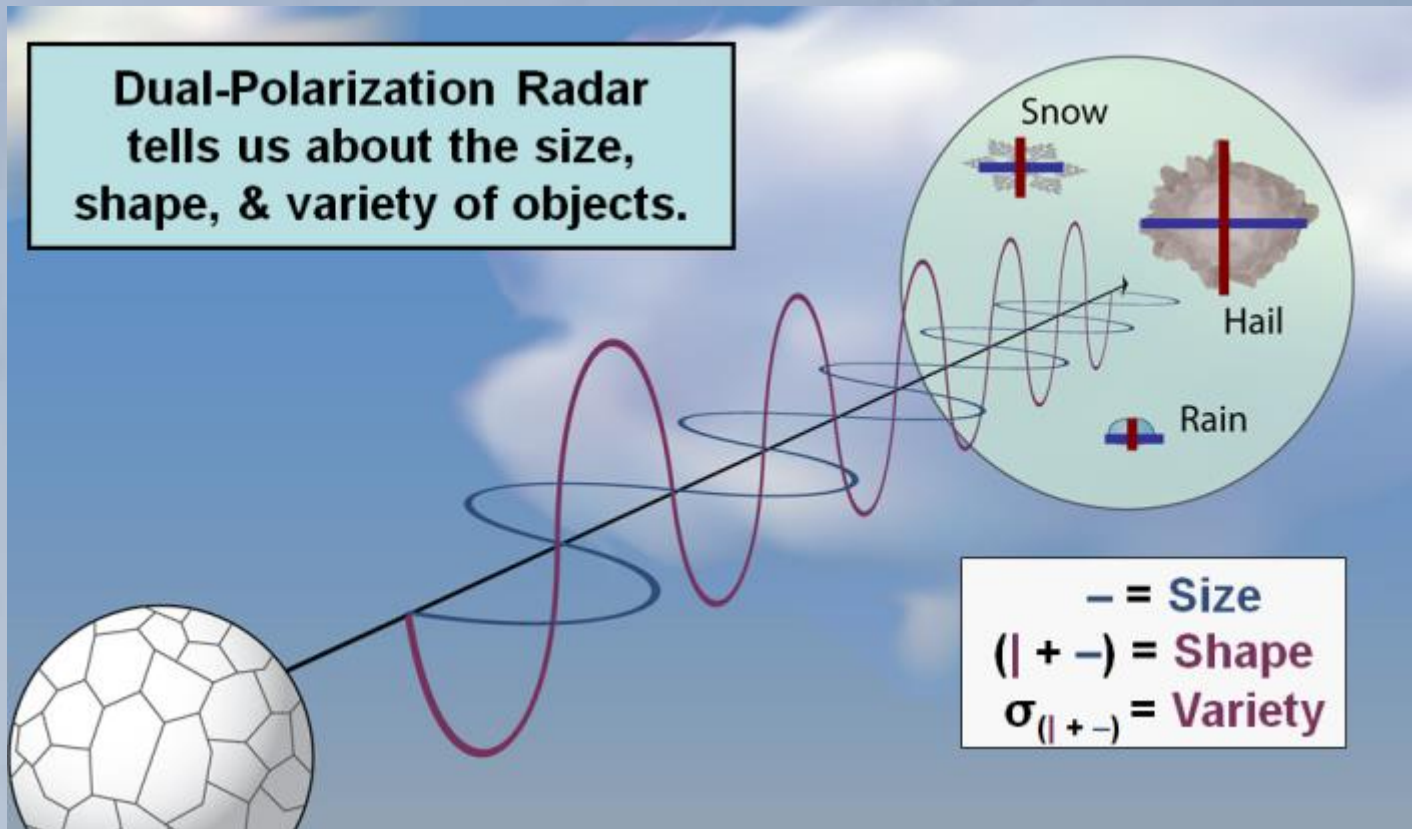
Composite Reflectivity

Base Reflectivity



NOAA

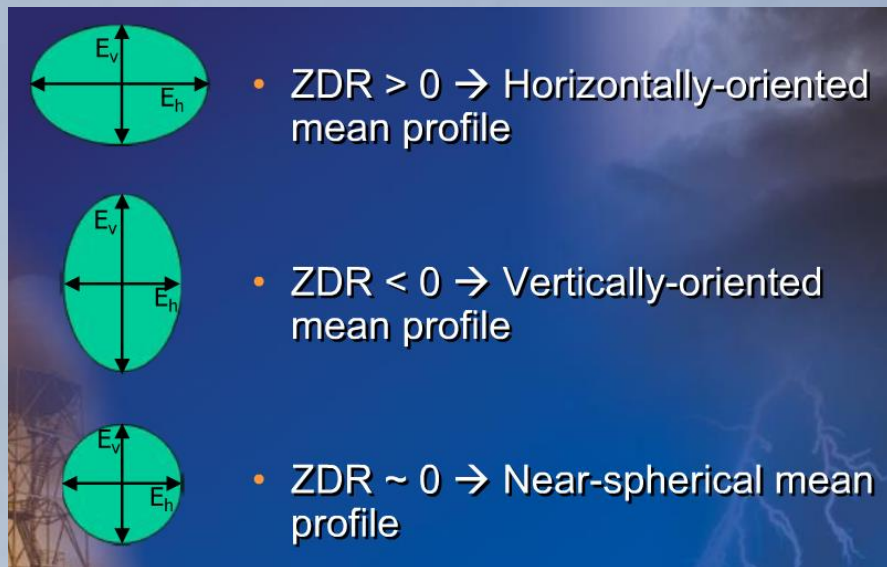
Dual - Polarization



Provides more insight into scatterers due to vertical and horizontal wavelengths

Dual - Polarization

ZDR



Differential Reflectivity (Z_{DR}) is a ratio of the reflected horizontal and vertical power returns.

CC

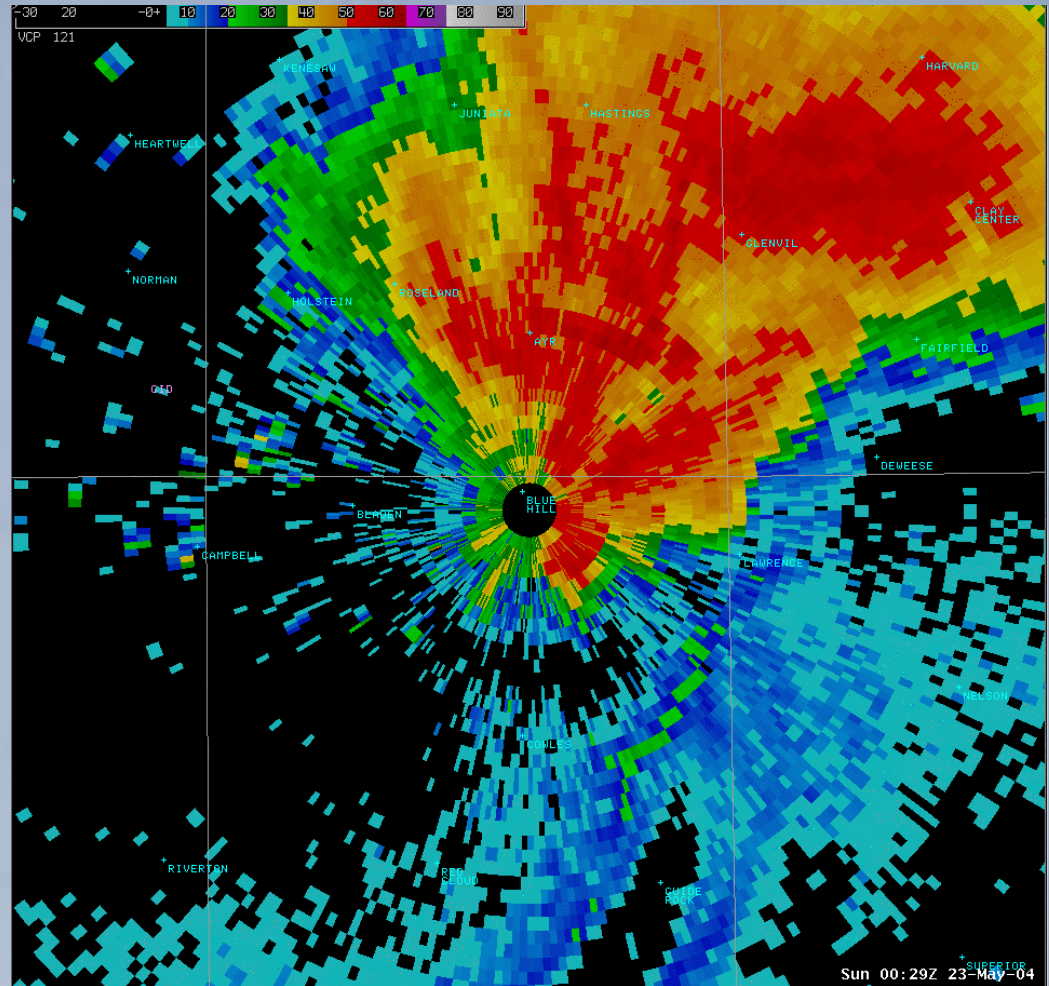
Correlation Coefficient (CC) is a measure of the diversity of scatterers within a sample volume

- $0.96 \leq CC \leq 1 \rightarrow$ Small hydrometeor diversity*
 - $0.85 \leq CC < 0.96 \rightarrow$ Large hydrometeor diversity*
 - $CC < 0.85 \rightarrow$ Non-hydrometeors present
- * Sizes, shapes, orientations, etc.

Basic Radar

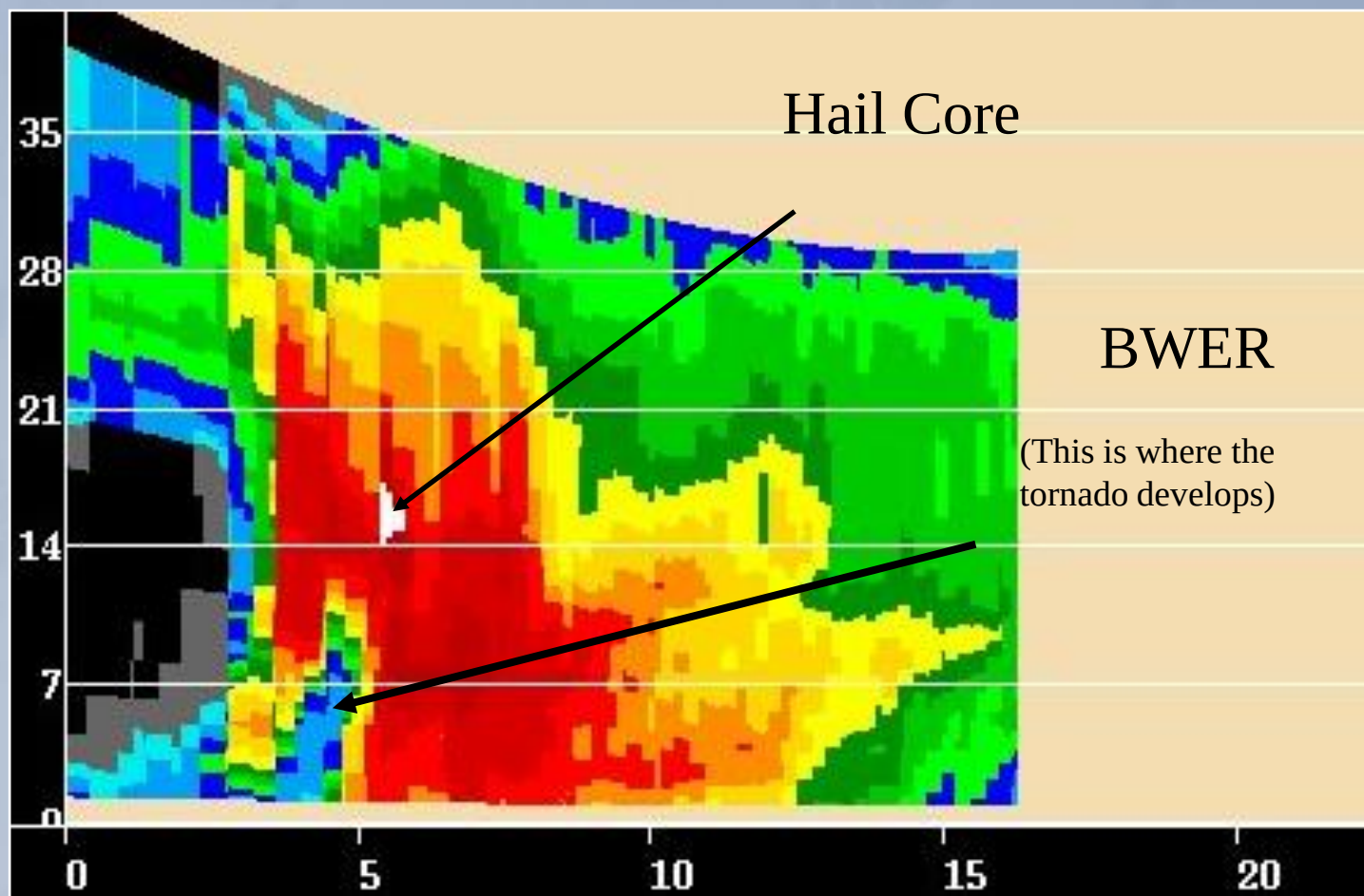
Cone of Silence

- Storm appears to weakening when approaching radar
- Storms moving away seem to get taller
- Harder to detect severe inside 10 nm
- How can we overcome the cone of silence?

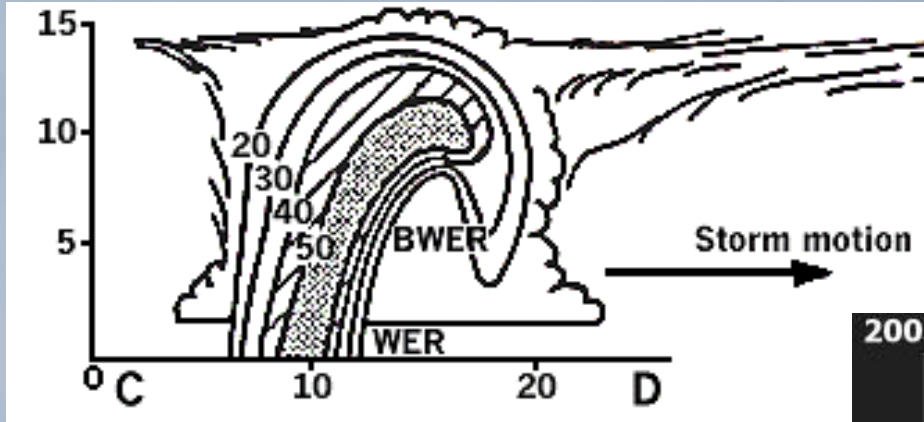


Basic Radar

Cross Sections



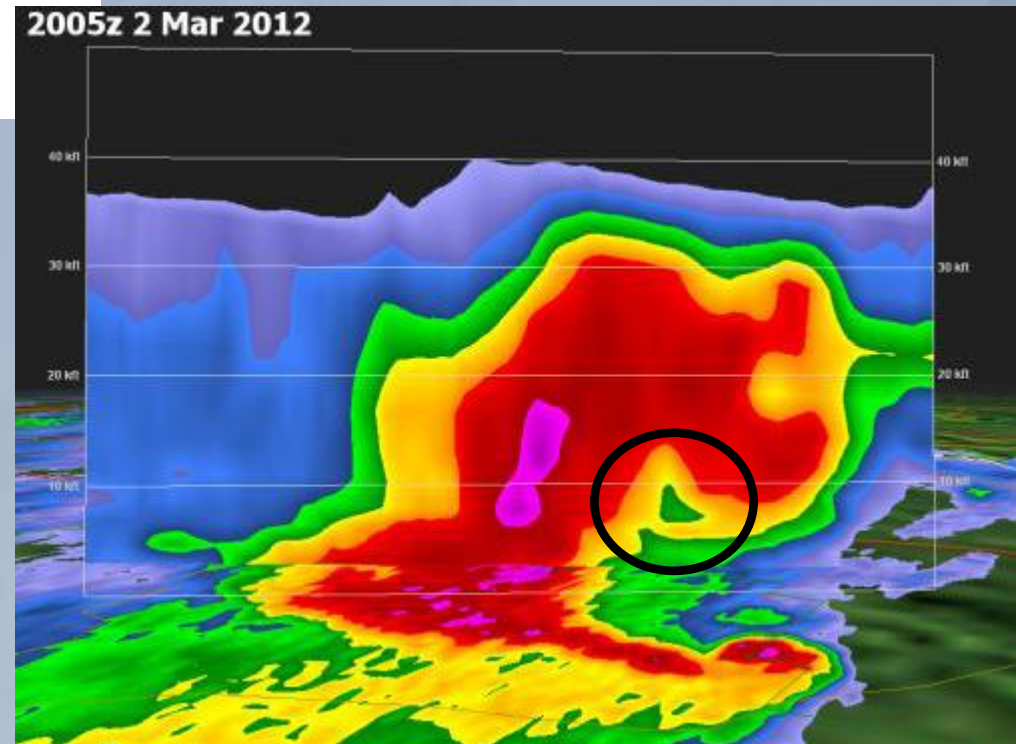
WER and BWER

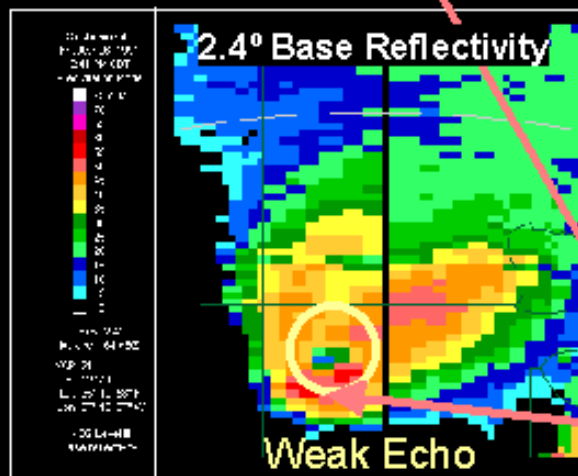
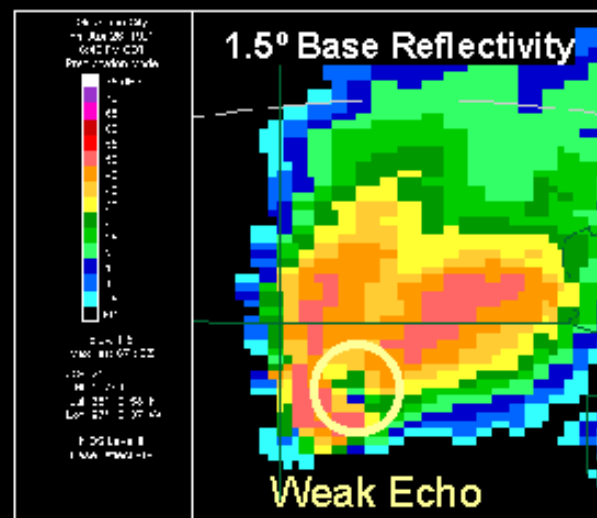


BWER location is coincident with core of mesocyclone

Weak echo region (WER) is a low-level area of weak/low reflectivity on radar as strong updraft suspends and prevents precipitation from falling in this area

Bounded weak echo region (BWER) is a mid-level weak/low reflectivity (cavity) aloft as intense updraft suspends and prevents precipitation from forming and falling in this area.





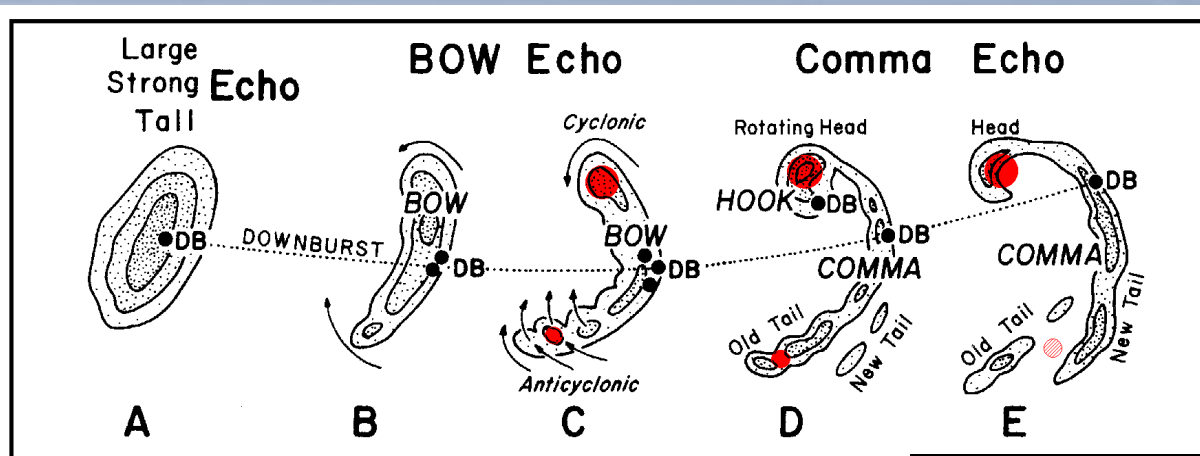
The Hook Echo at low levels transitions into a weakness in reflectivity at higher tilts. This weakness in echo (or dough-nut) is coincident with the location of the updraft.

Heavy Precip/Hail suspended
in updraft (large echoes on Tilt 3
where no echo is present on Tilt 1)

Copyright 1999 Oklahoma Climatological Survey

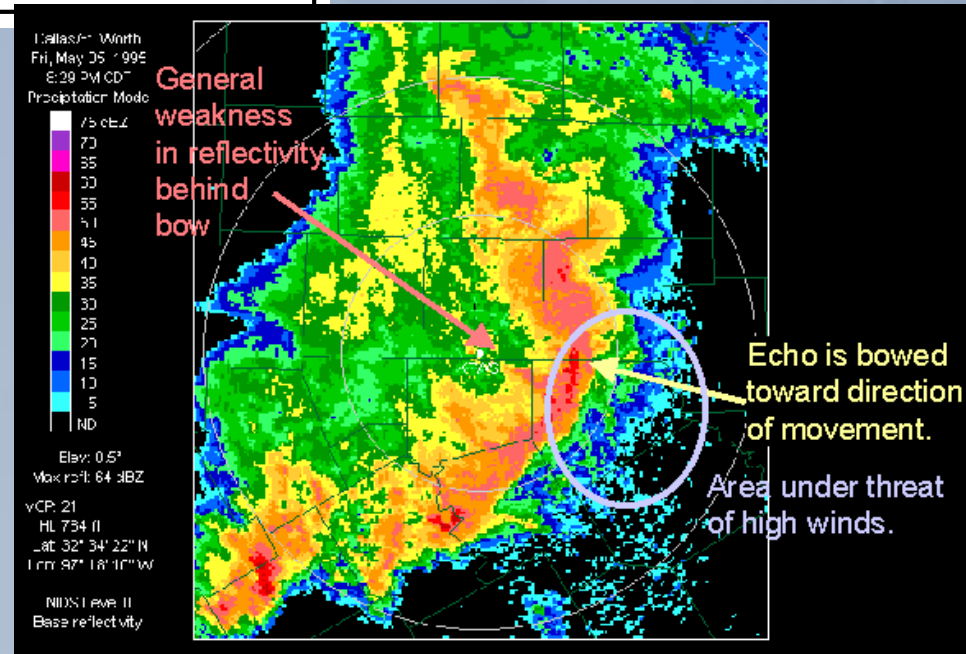


Bow Echoes



- A radar echo which is linear but bent outward in a bow shape.
- Damaging straight-line winds often occur near the "crest" or center of a bow echo.

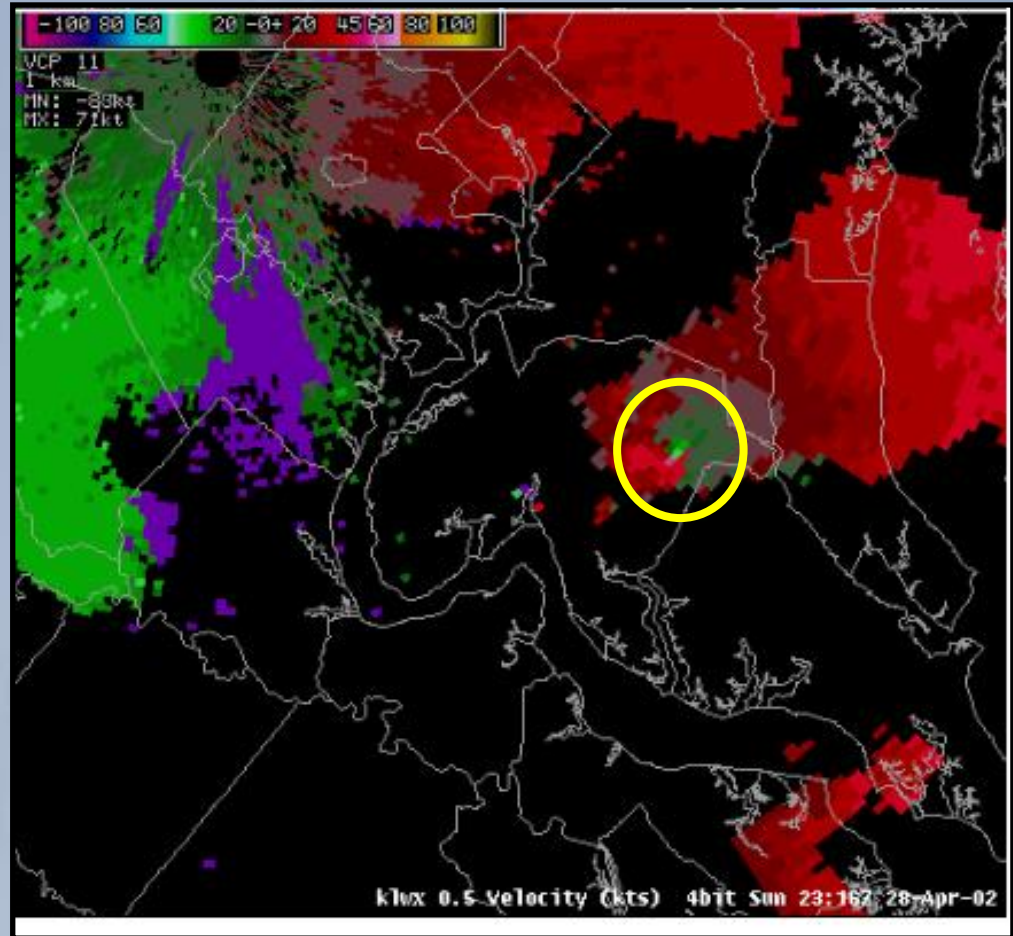
- Areas of circulation also can develop at either end of a bow echo, which sometimes can lead to tornado formation - especially in the left (usually northern) end, where the circulation exhibits cyclonic rotation.



Basic Radar

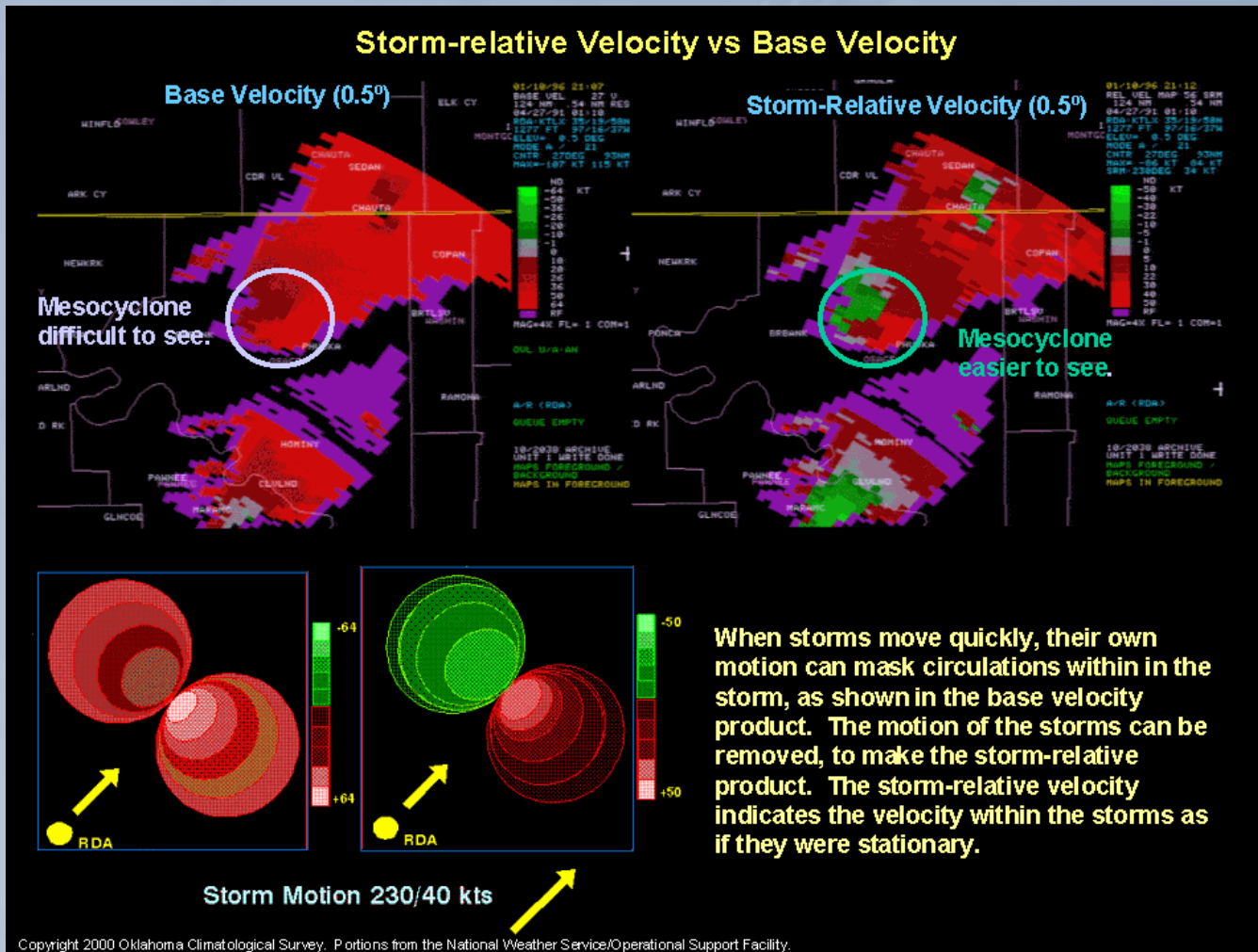
Base Velocity

- Particles moving away from the radar appear red
- Particles moving toward the radar appear green



Basic Radar

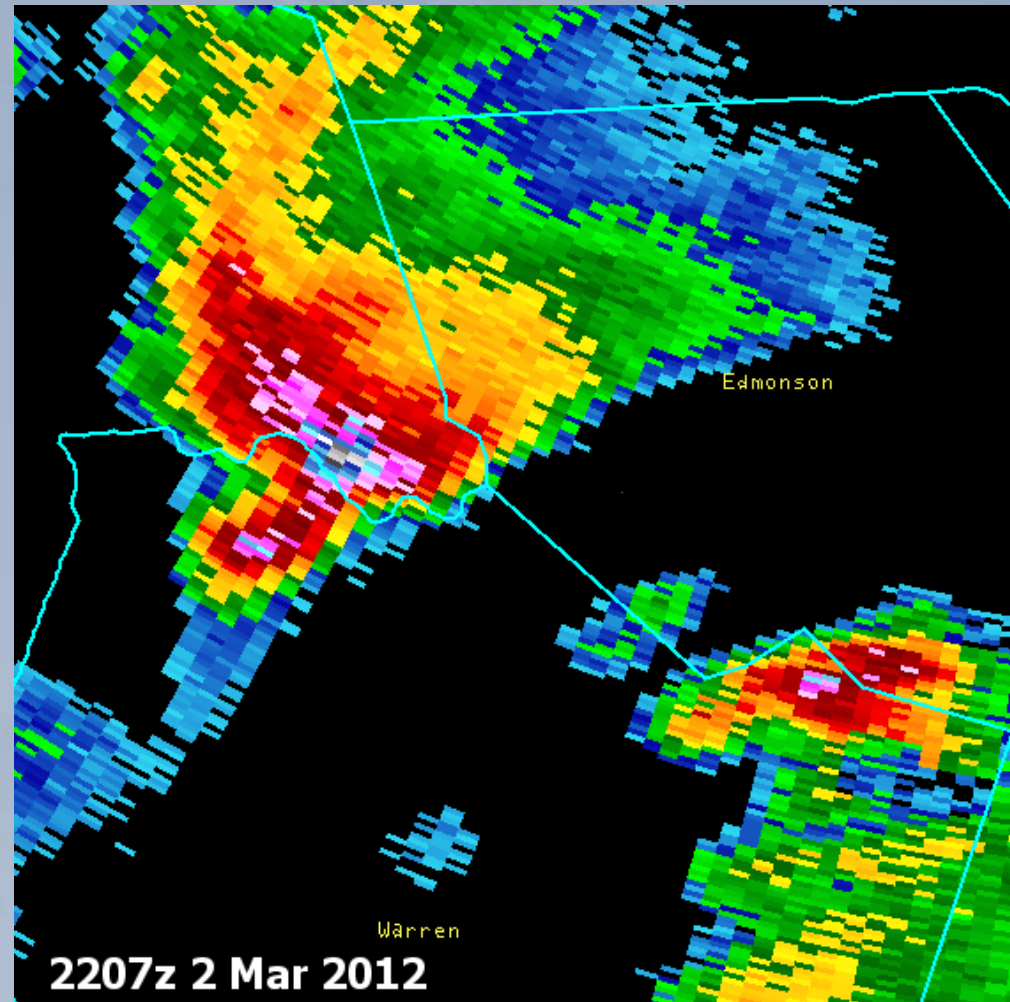
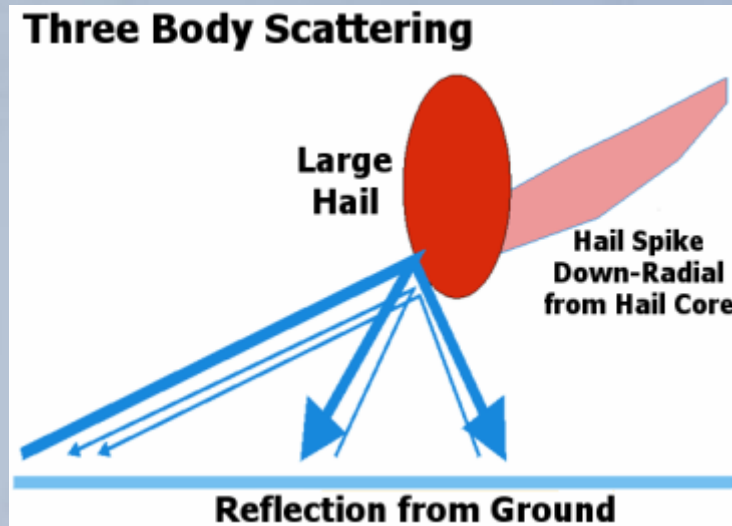
Storm Relative Velocity



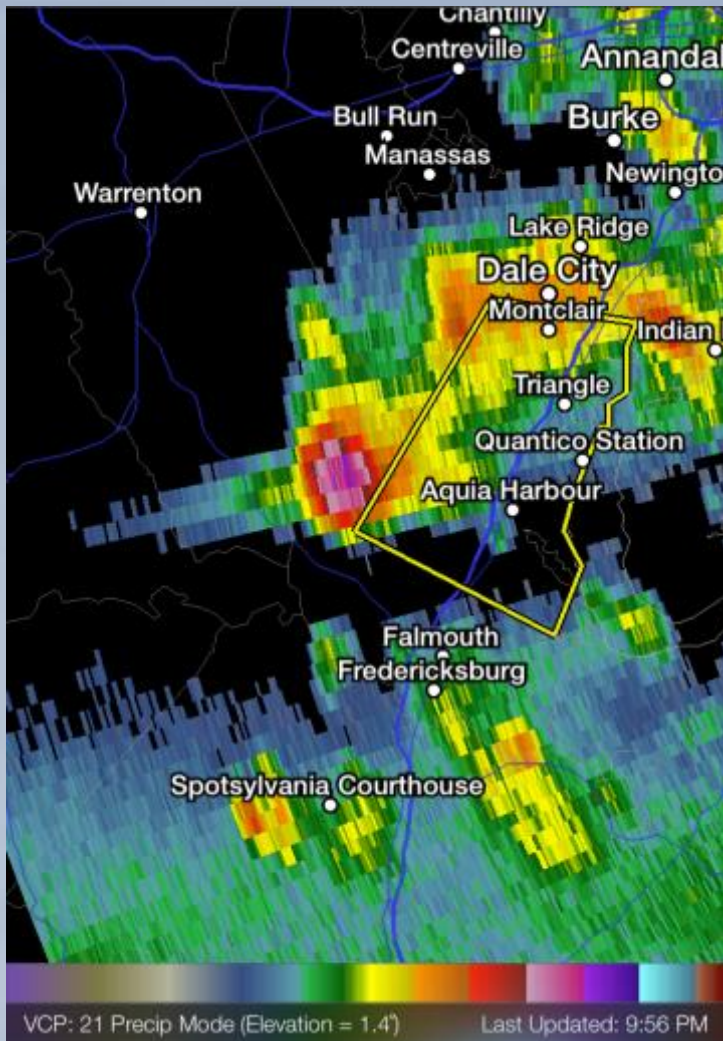
Hail on Radar

Indicates large hail in storm

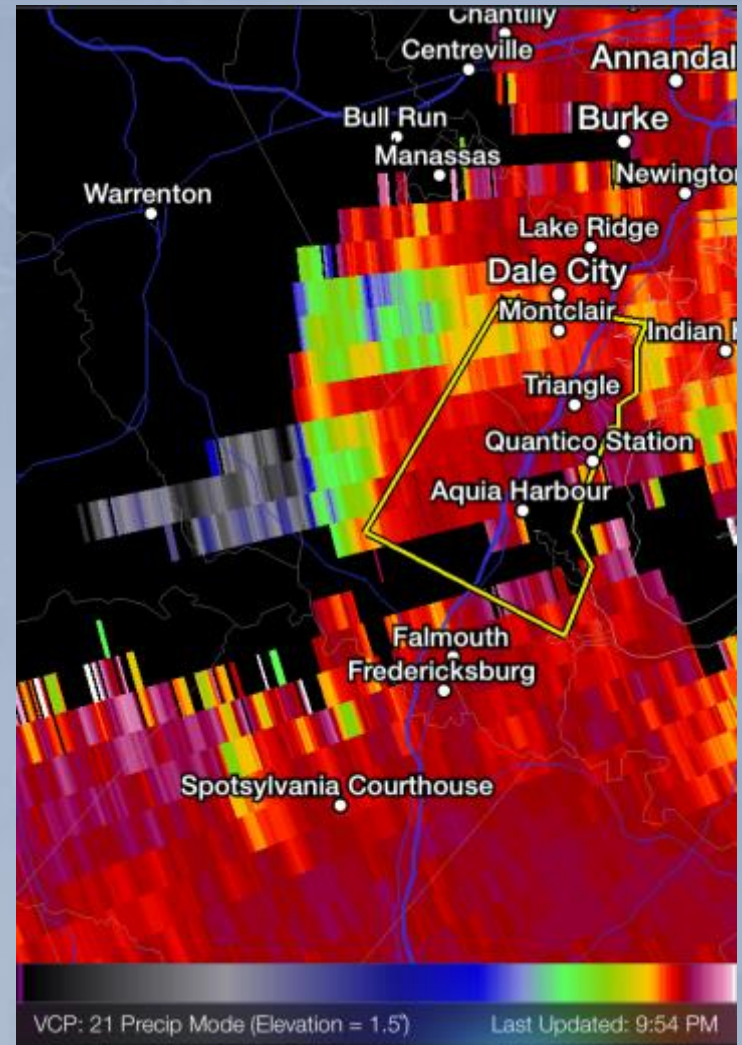
Spike appears down-radial or side-radial (side lobe) of hail core



Dual - Polarization

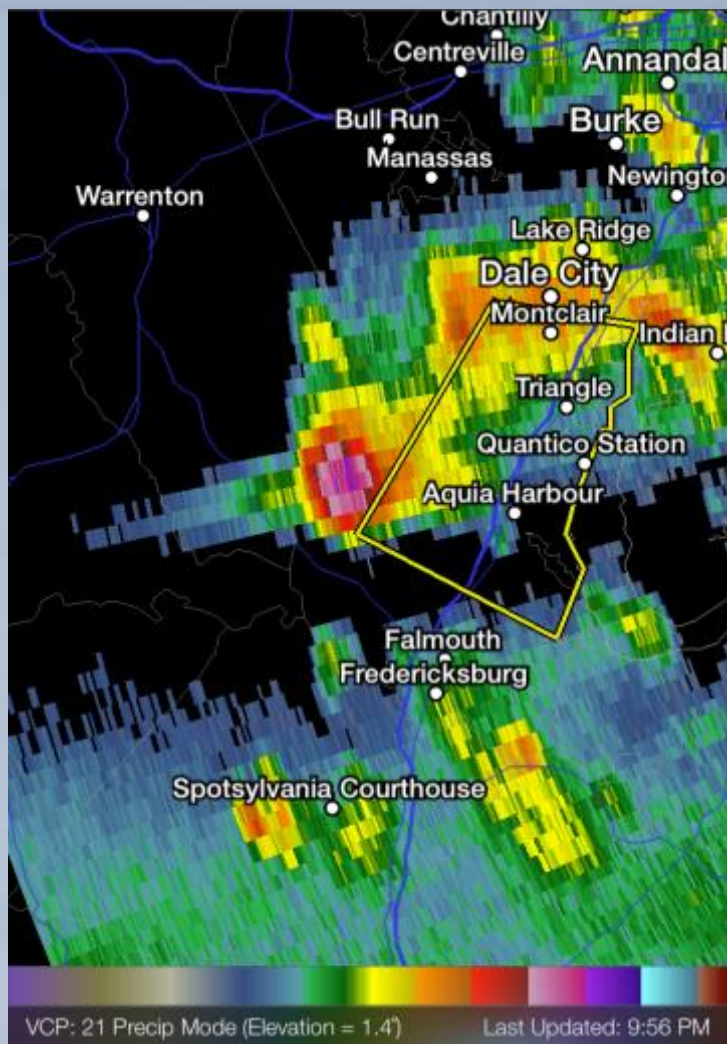


Reflectivity (Z)

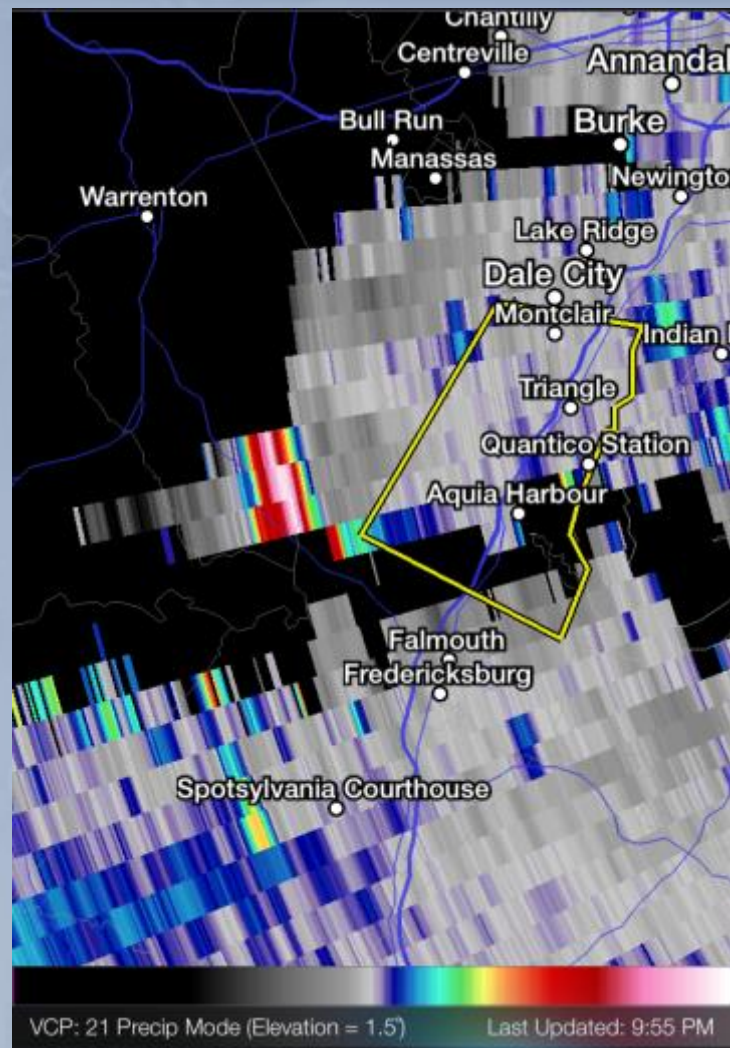


Correlation Coefficient (CC)

Dual - Polarization



Reflectivity (Z)



Differential Reflectivity (Z_{DR})

Dual - Polarization



Reflectivity (Z)



Differential Reflectivity (Z_{DR})

Dual - Polarization

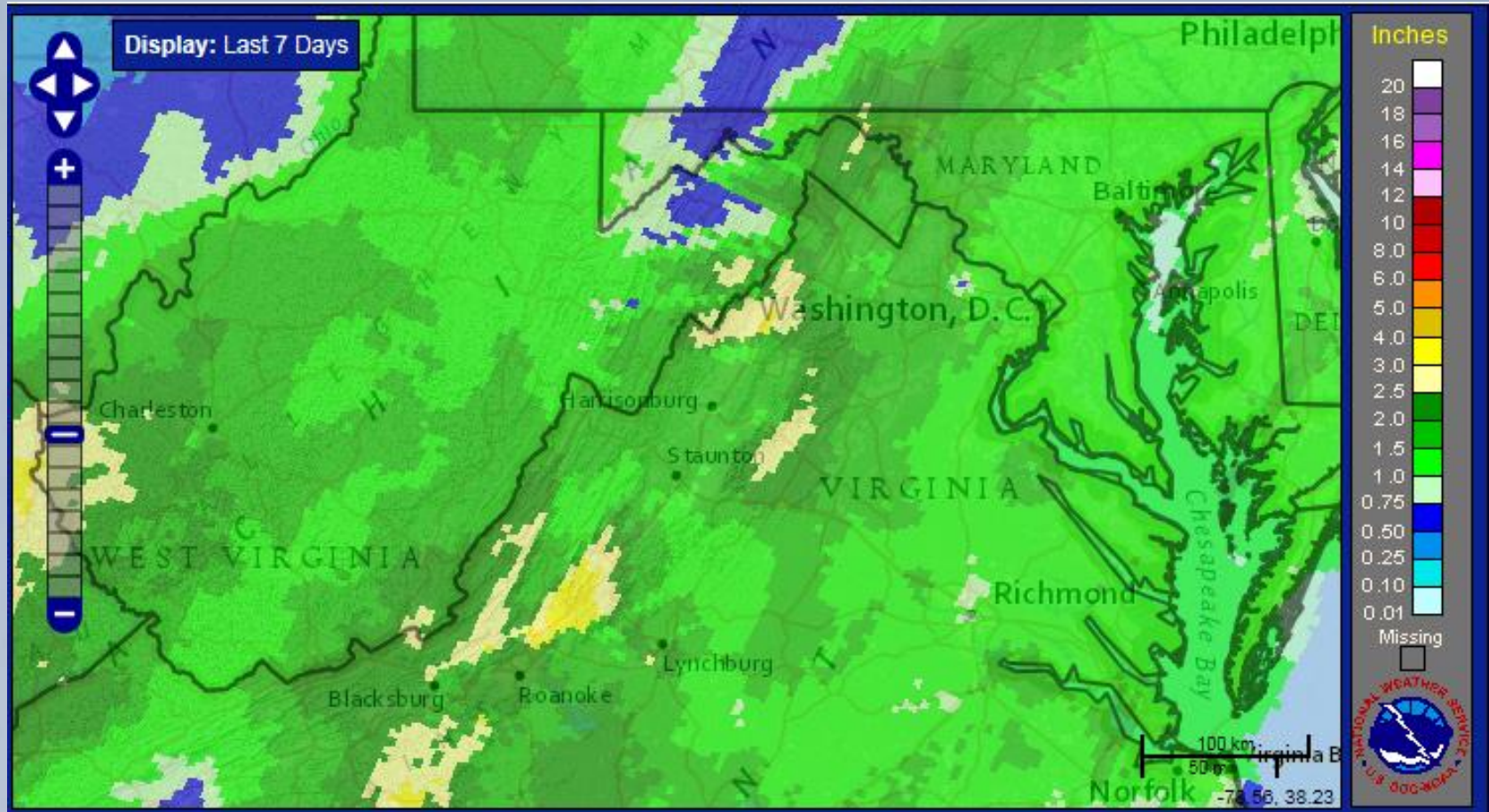


Reflectivity (Z)



Correlation Coefficient (CC)

Precipitation Estimates



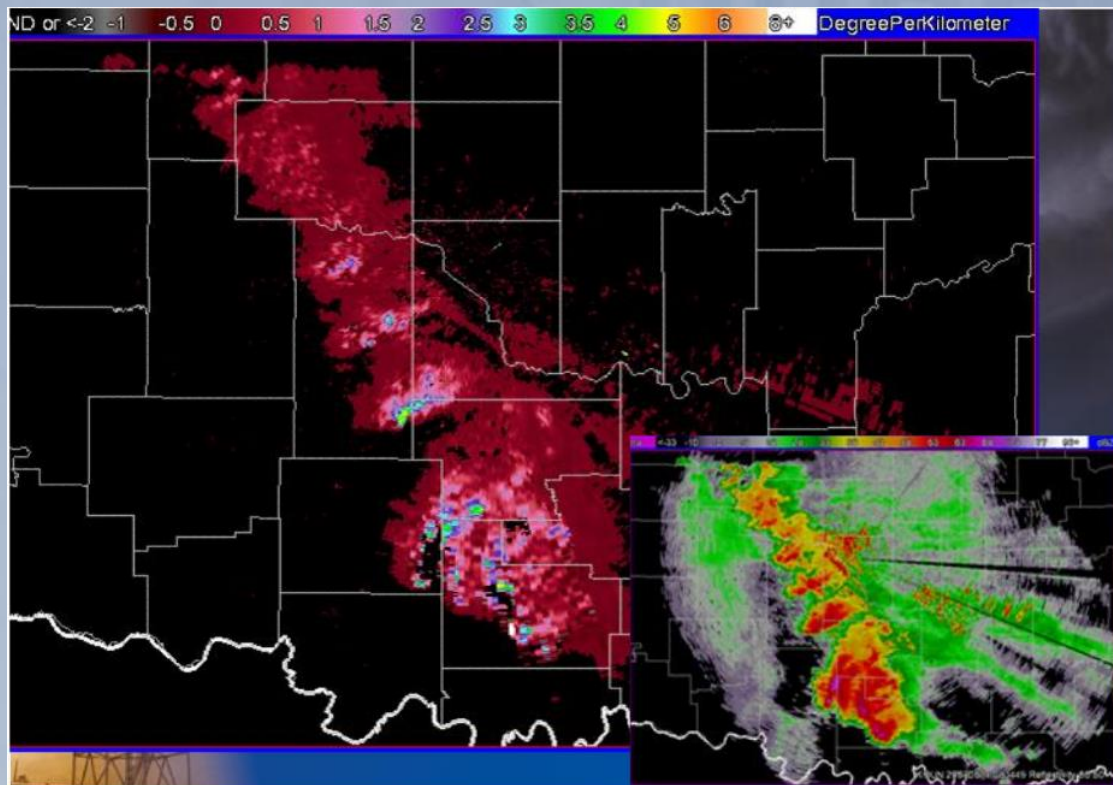
Dual - Polarization

Specific Differential Phase (KDP)

Measures rate of change of horizontally and vertically-polarized phase shift with distance

Improves Precipitation Amount Estimates

- Detects where most liquid water content is (higher values)
- Snow gives low values of KDP
- Removes effect of hail contamination

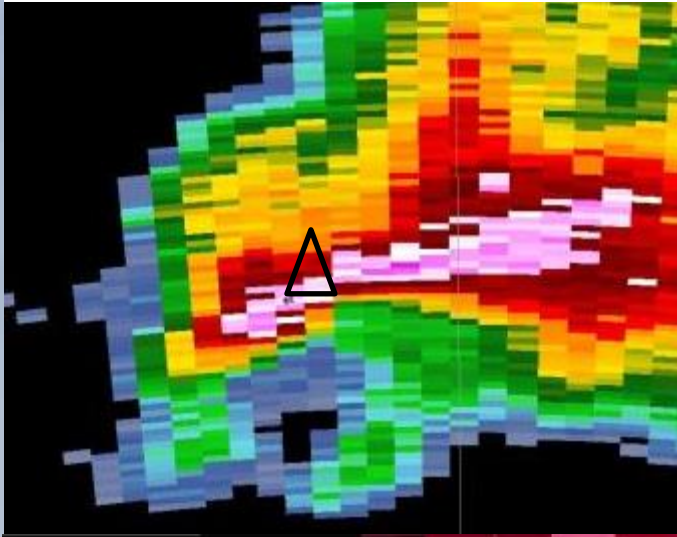


$Z \sim 65$, $ZDR \sim -.5$, $CC \sim .94$, $KDP \sim 2$

Hail & rain

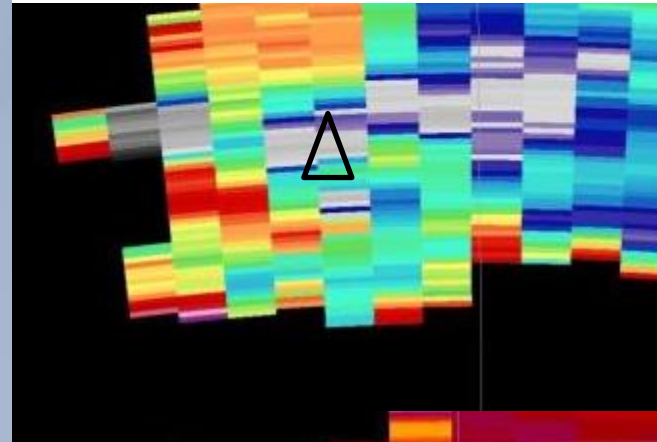
Z

Z high - hail possible



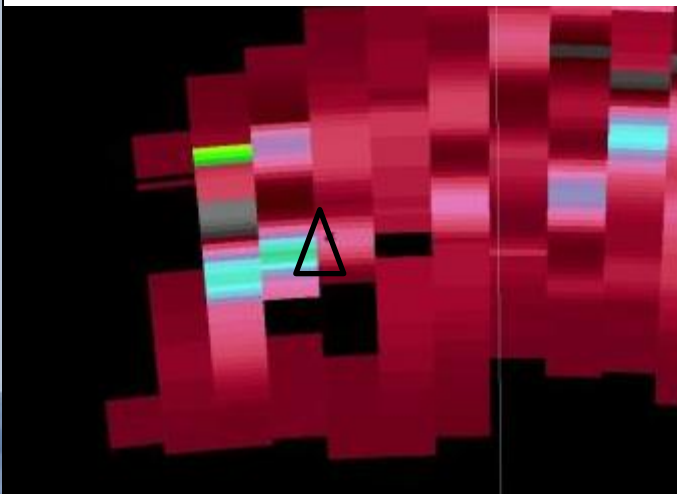
Z
D
R

ZDR Near 0 - many spherical particles

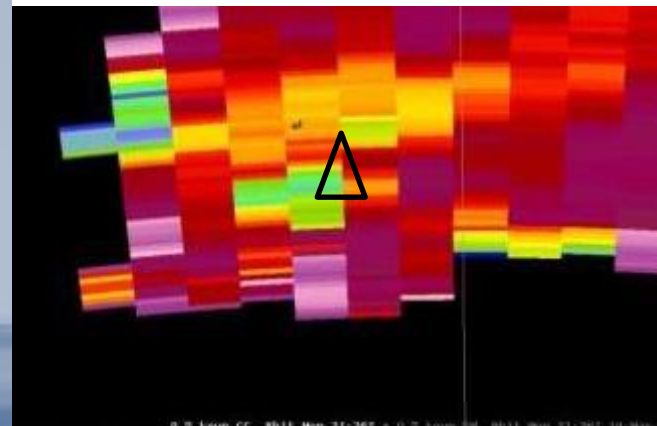


CC

KDP high - some liquid



CC depressed - likely mixed precip

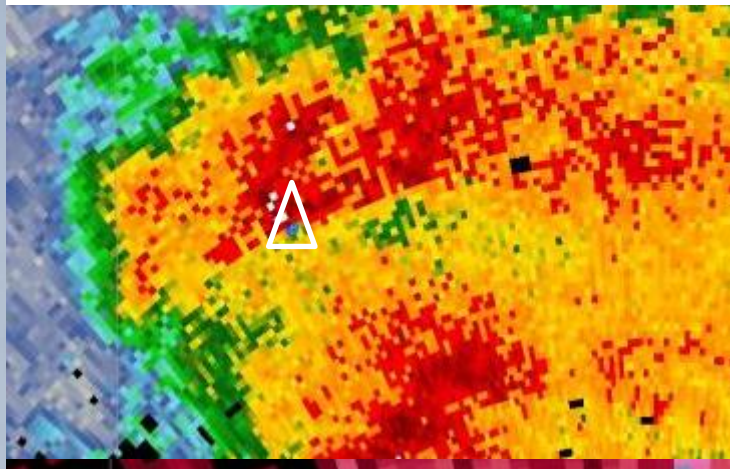


$Z \sim 61$, $ZDR \sim 3.7$, $CC \sim .95$, $KDP \sim 3.0$ What is it?

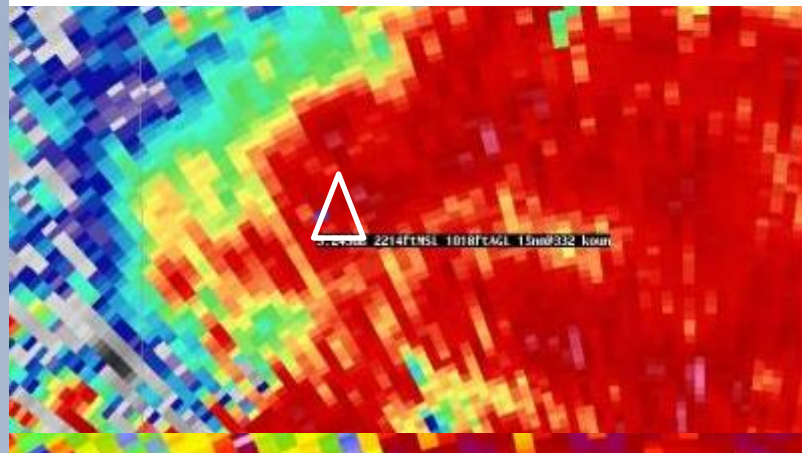
Heavy rain, little mix

Z

Z high - rain/hail

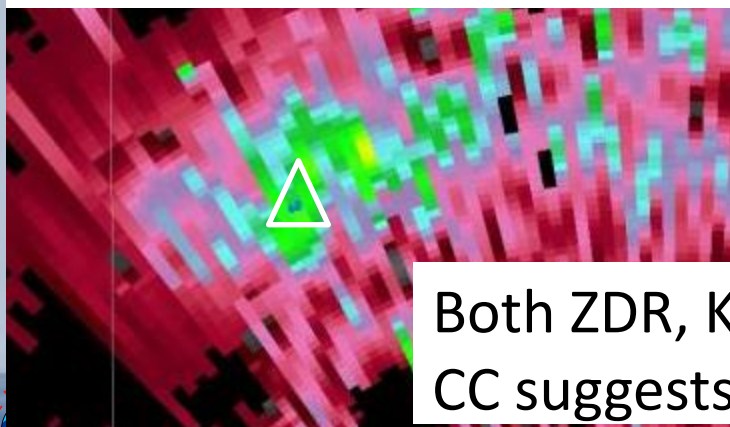


ZDR high - big raindrops



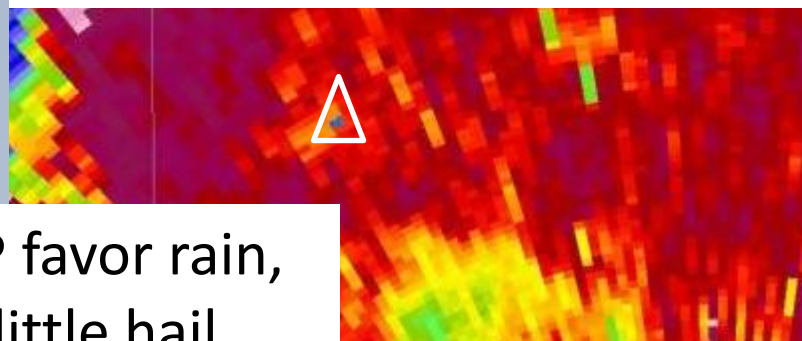
Z
D
R

KDP high - Lots of liquid



K
D
P

CC slightly depressed -
suggests mix



CC

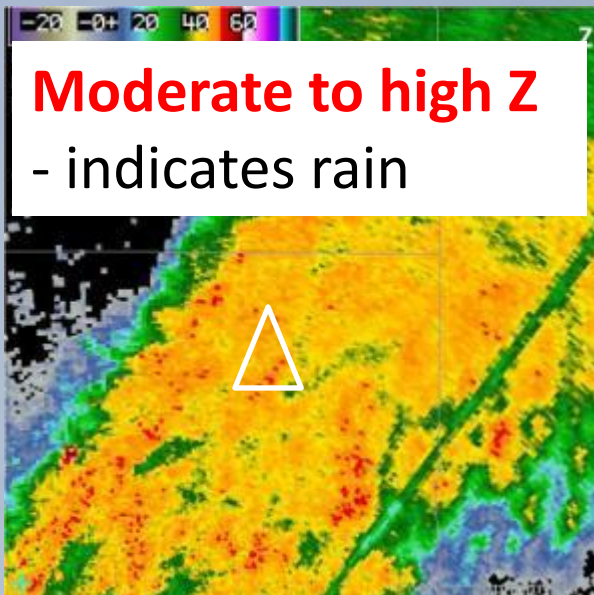
Both ZDR, KDP favor rain,
CC suggests a little hail

Z ~ 48, ZDR ~ 1.8, CC ~ .99, KDP ~ 1.8 What is it?

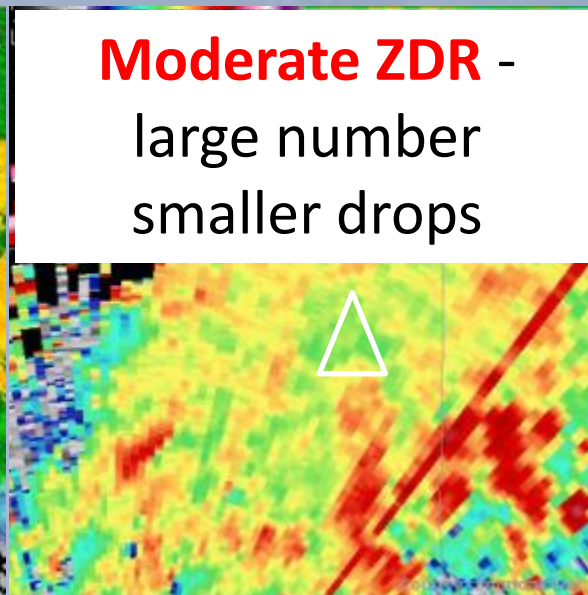
Tropical, heavy rain

Z

Moderate to high Z
- indicates rain



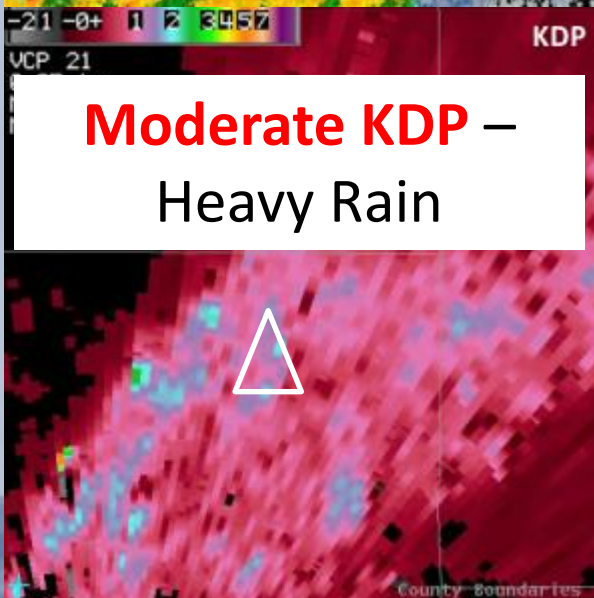
Moderate ZDR -
large number
smaller drops



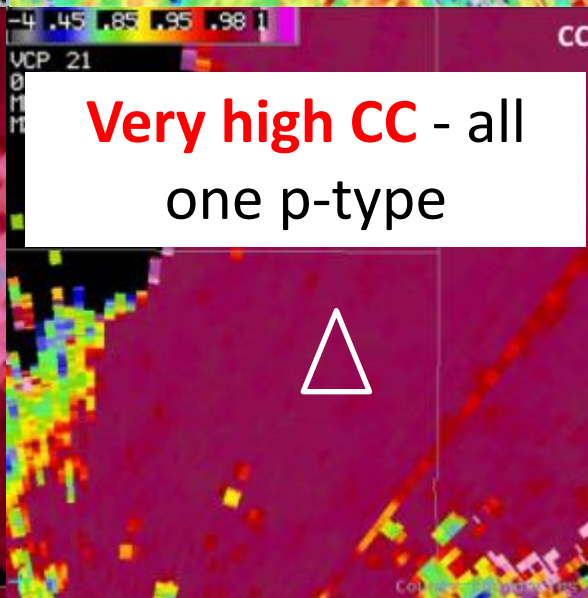
**Z
D
R**

**K
D
P**

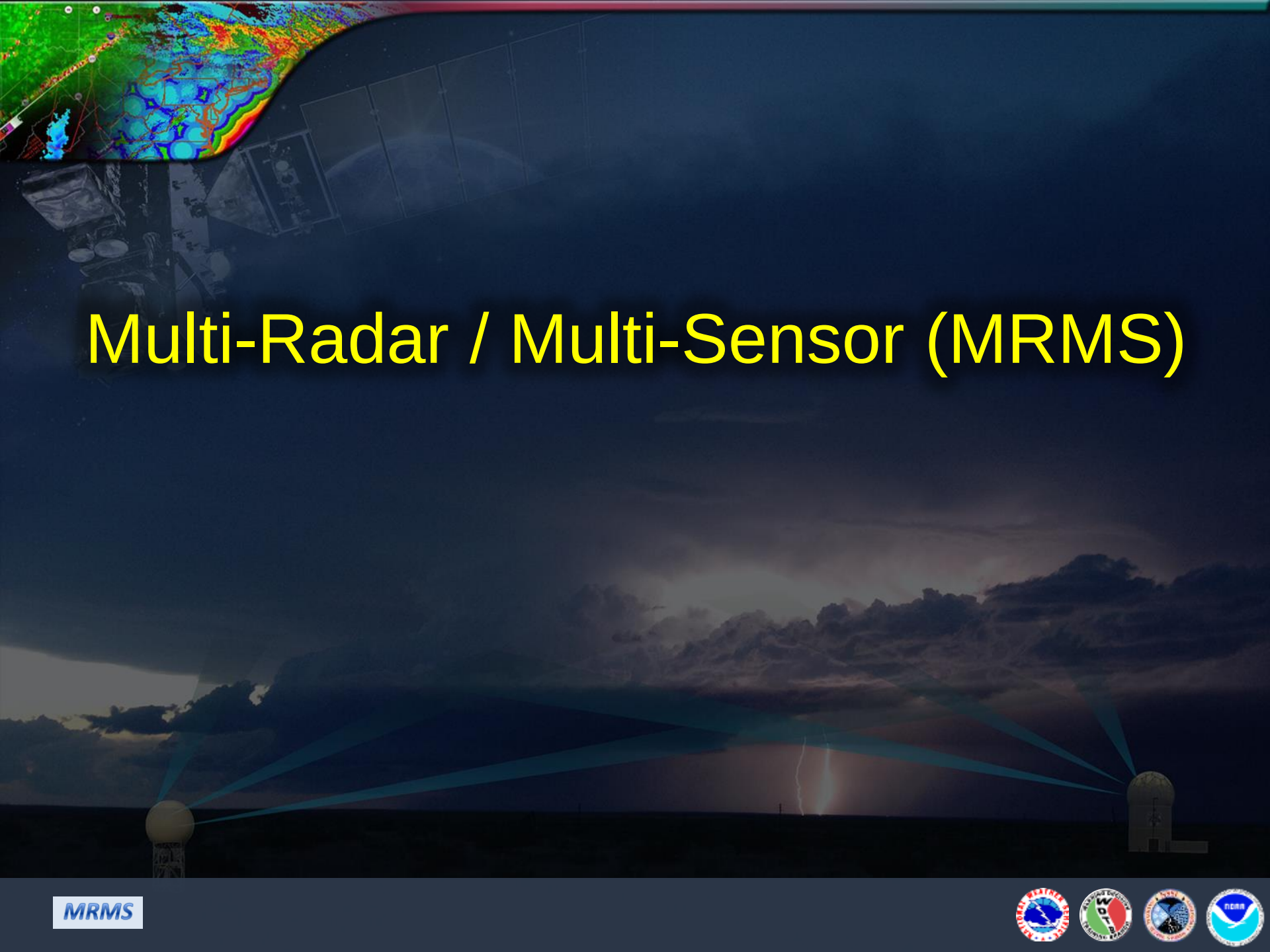
Moderate KDP -
Heavy Rain



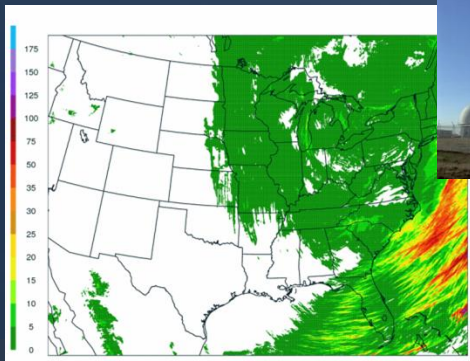
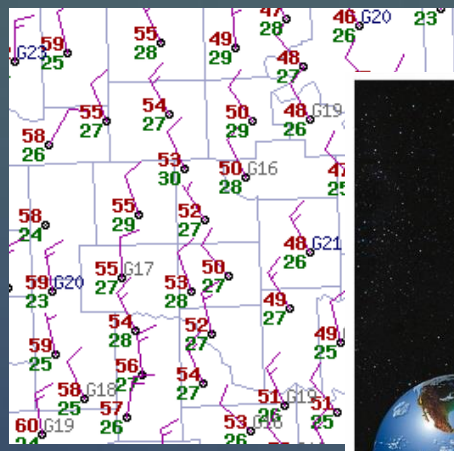
Very high CC - all
one p-type



CC



Multi-Radar / Multi-Sensor (MRMS)

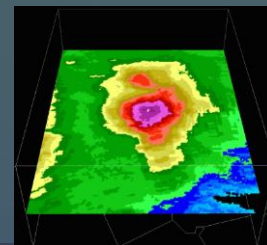
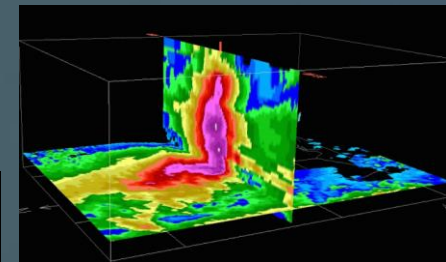
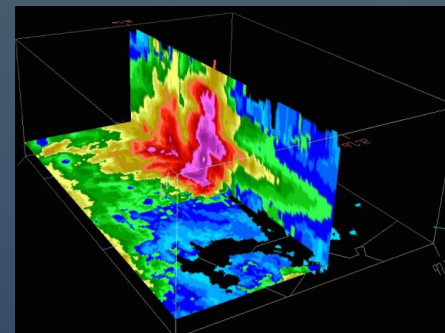
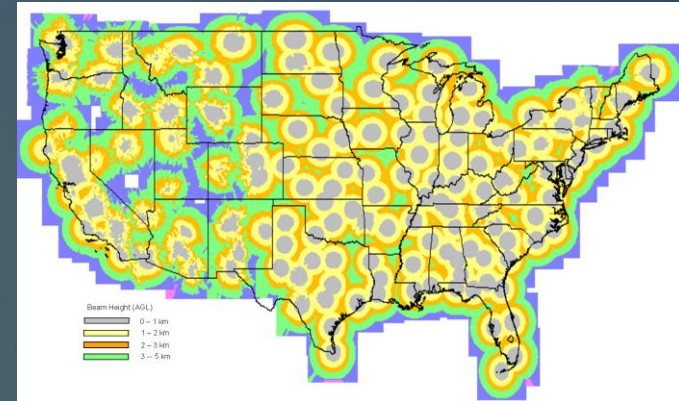


Multiple-Radar 3D Reflectivity Mosaic

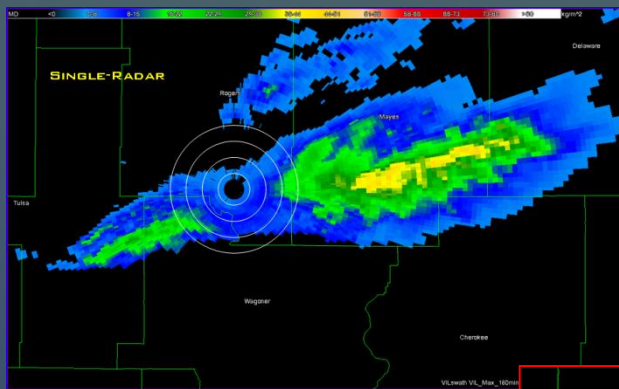
Exploits multiple-radar coverage to mitigate single-radar limitations

Seamless high-res 3D cubes of radar data covering CONUS:

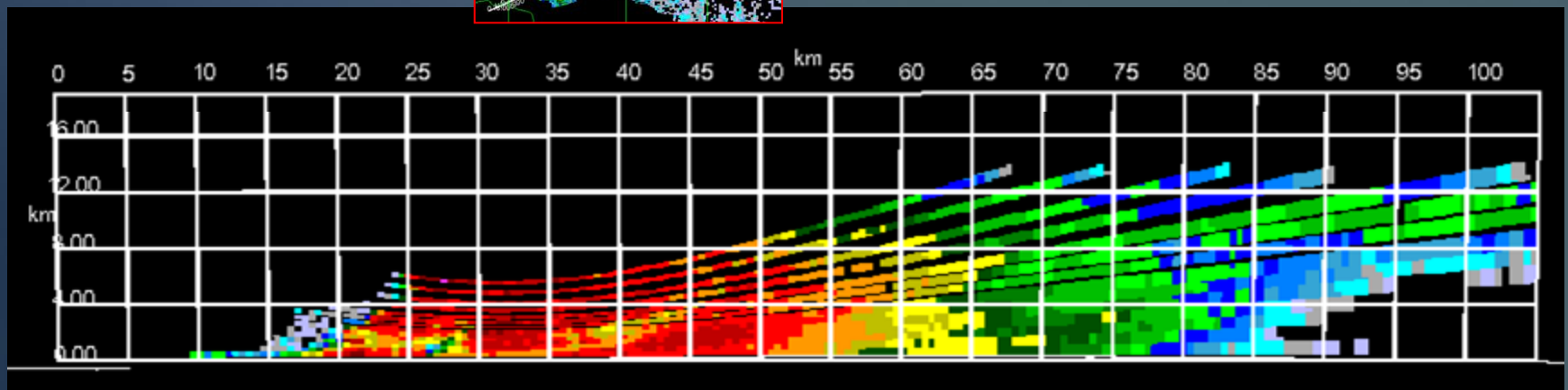
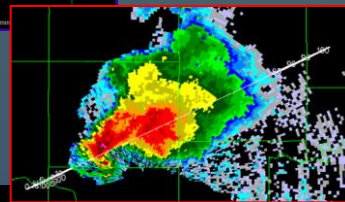
- Reflectivity (1 km)
- Azimuthal Shear (500 m)



Single radar data



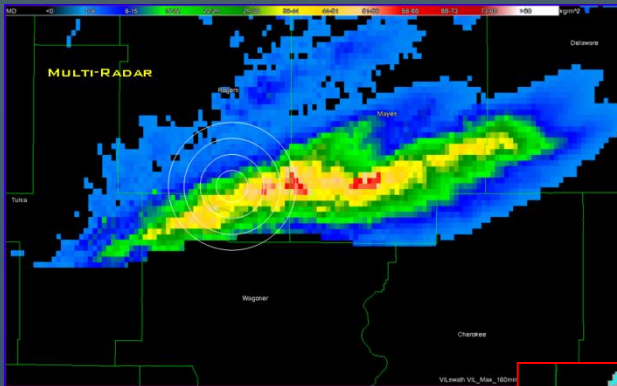
Single Radar



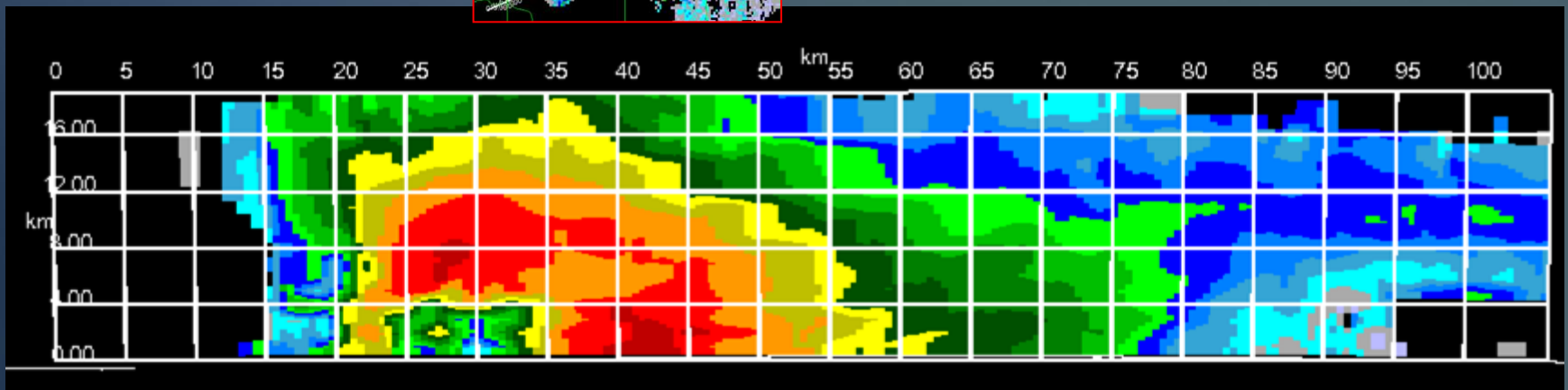
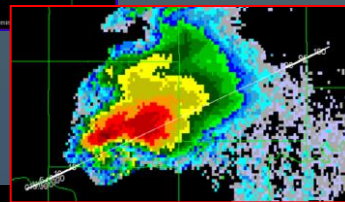
Blended 3D multi-radar data

Radars in network supplement each other:

- Overlapping coverage
- Fills in gaps from cones-of-silence and terrain blockage
- Increased sampling frequency



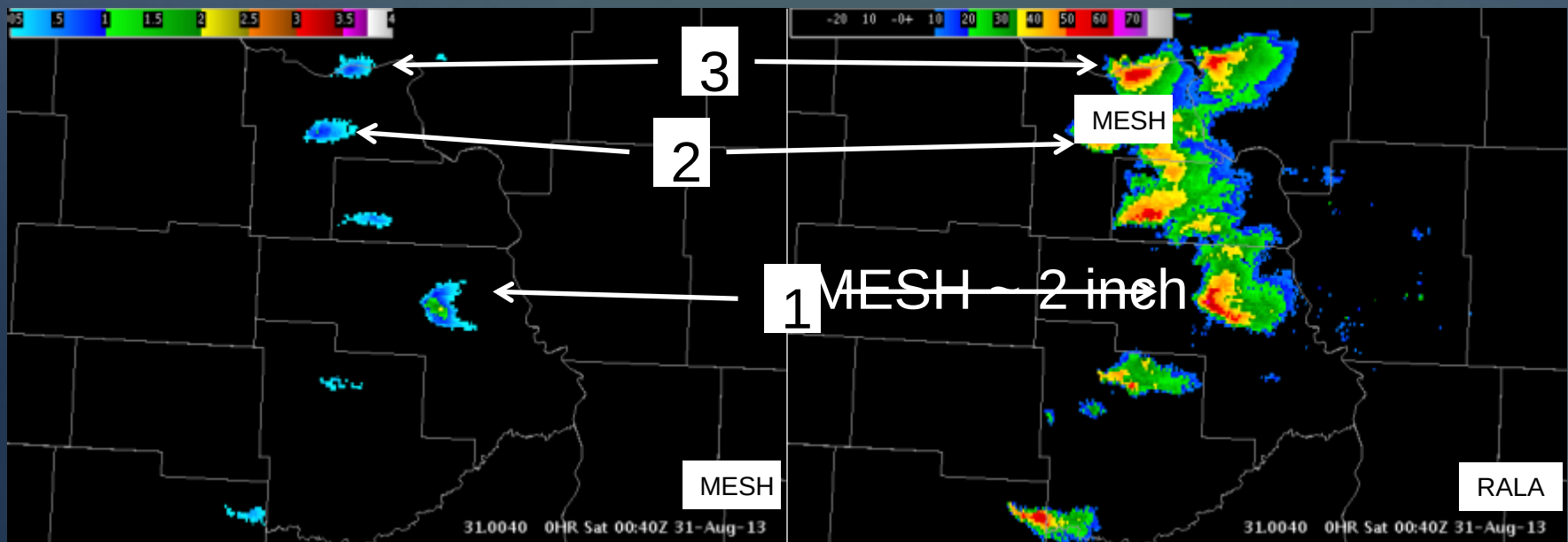
Multiple Radars



Max Est Size of Hail (MESH) Applications

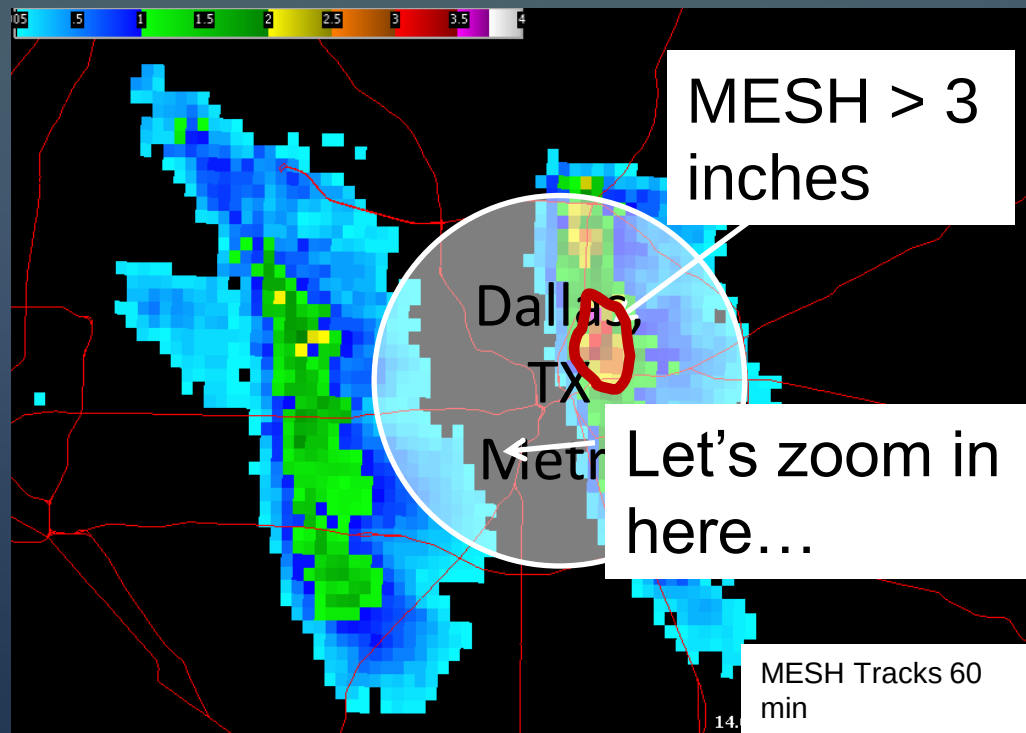
- Useful for assessing:
 - 2-D distribution of hail
 - Largest hailstone size

Rank the storms by hail potential...



MESH Tracks Applications

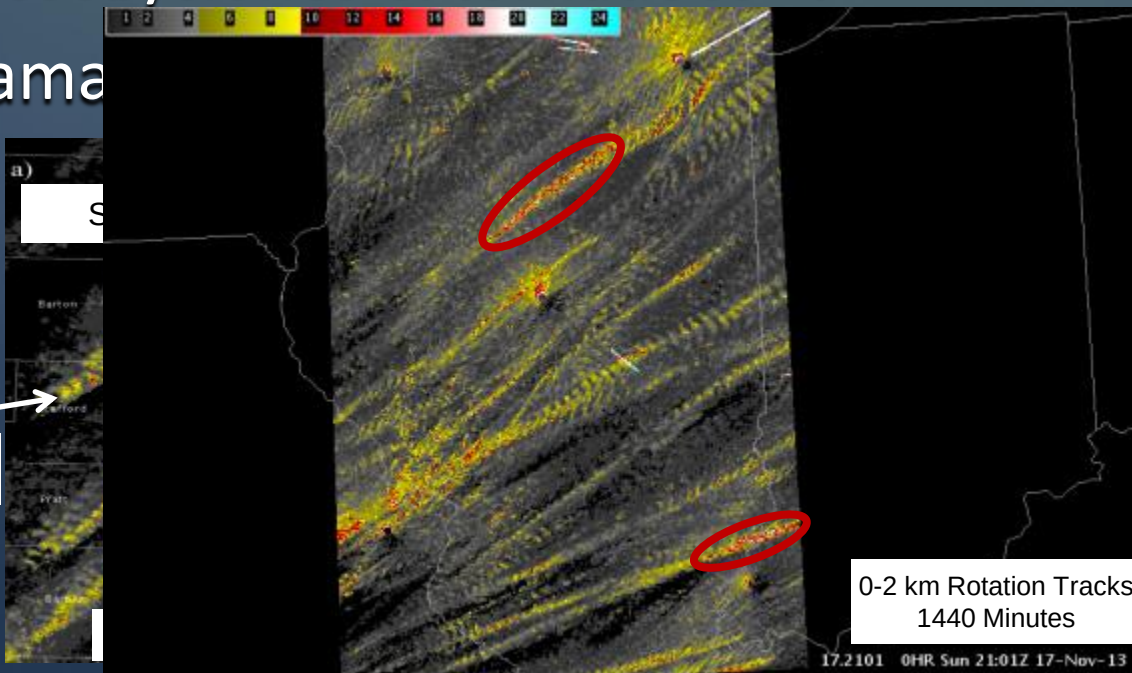
- Determining locations of largest hail fall for
 - Verification & emergency response



Damage and/or injuries possible!

Rotation Tracks Applications

- 0-2 km Rotation Tracks & spatial coverage of circulations with first responders & damage surveyors to areas affected by tornadoes
 - Messy clouds & tornados
 - Damage



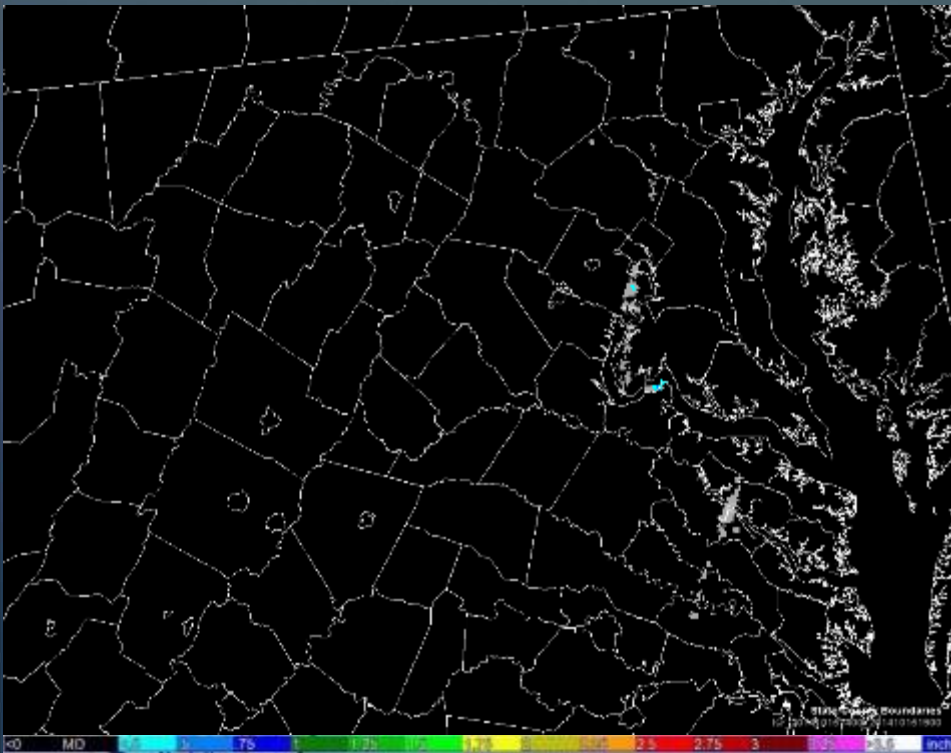
Damage and/or injuries likely!

Intensifying

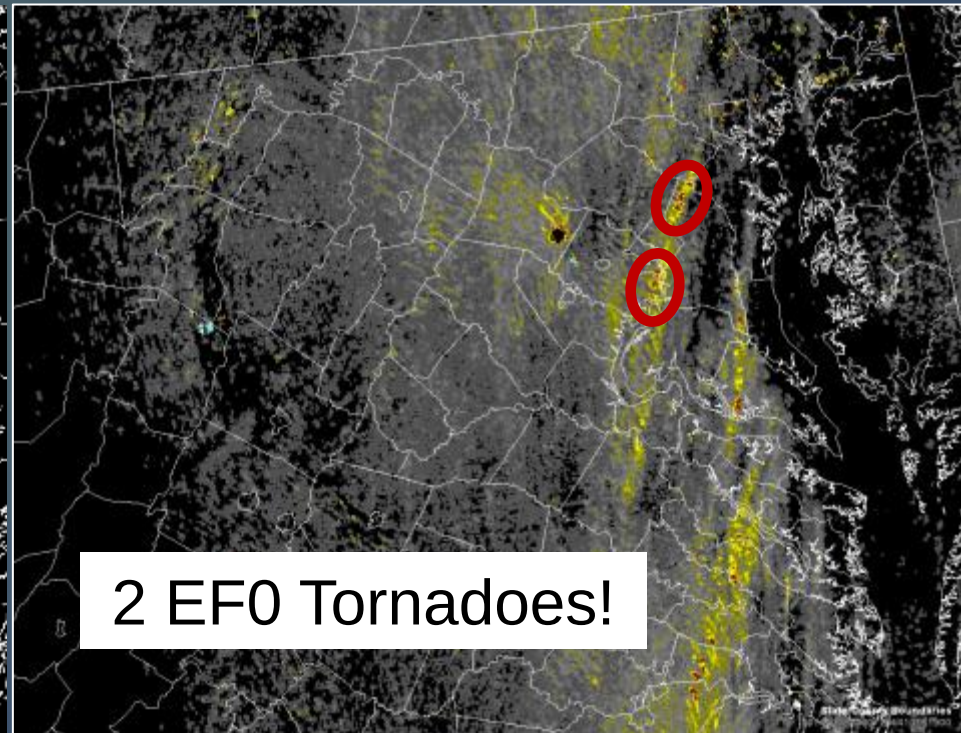


Local Examples

MESH Tracks



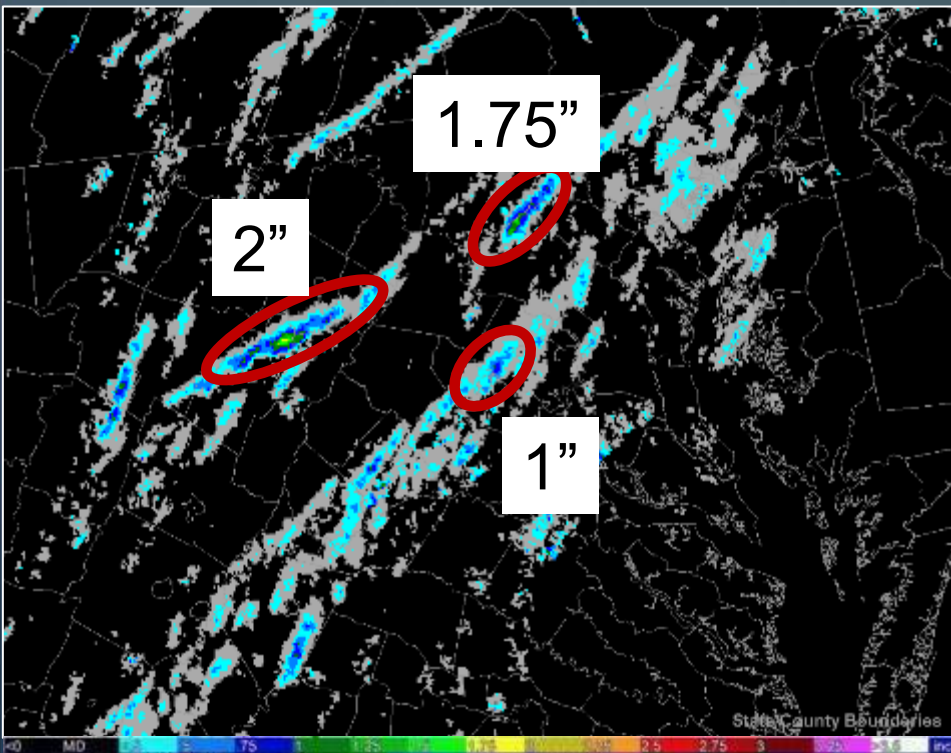
Rotation Tracks



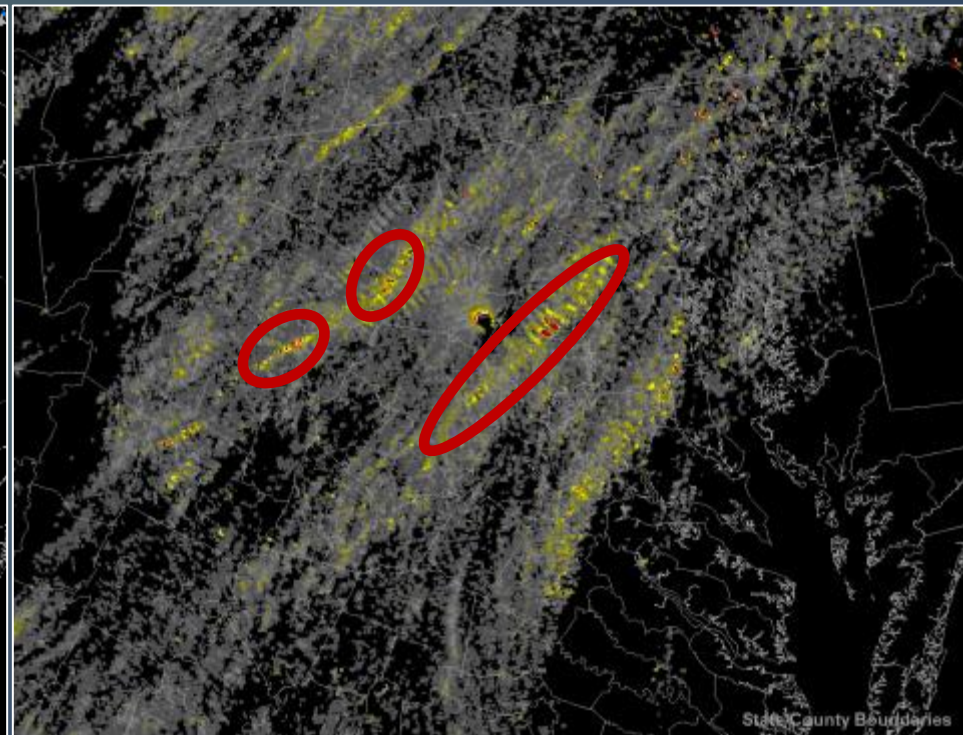
15 Oct 2014: Tornadoes & Damaging Wind

Local Examples

MESH Tracks



Rotation Tracks



3 July 2014: Hail & Damaging Wind

Local Examples

MESH Tracks

MESH Tracks

Rotation Tracks

2.75" Reports

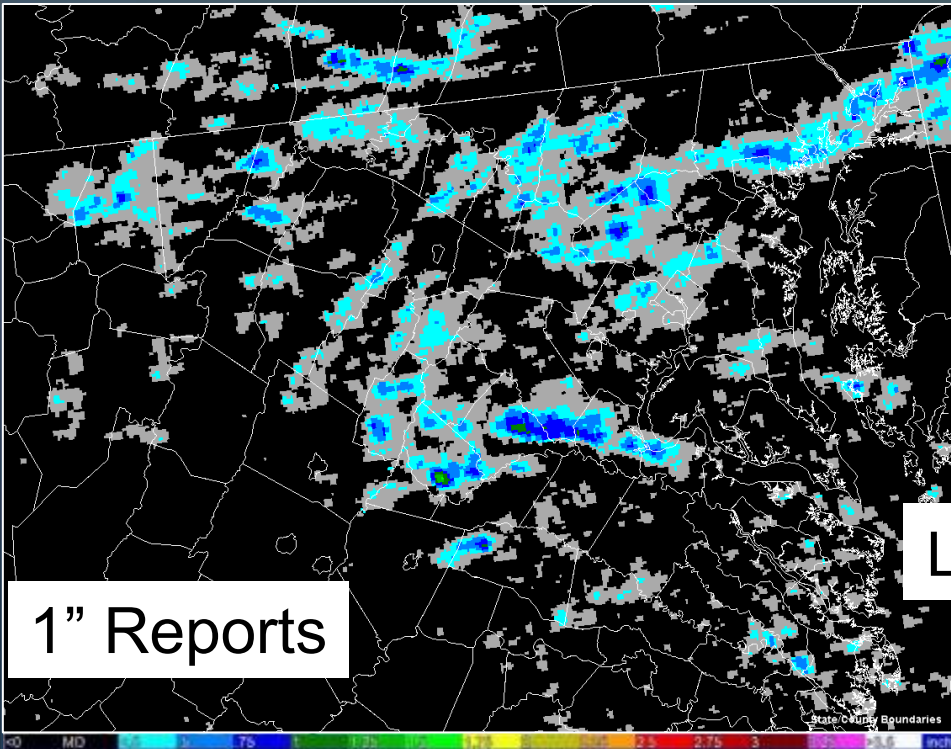
Damage and/or injuries possible!

26 May 2011: Damaging Hail

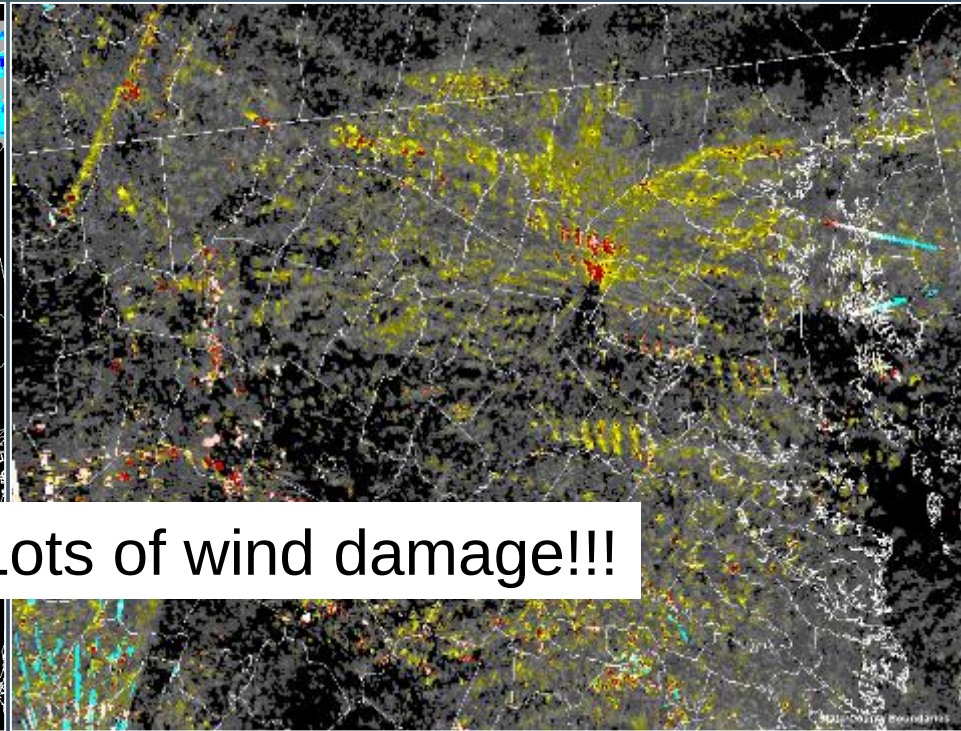
Local Examples

MESH Tracks

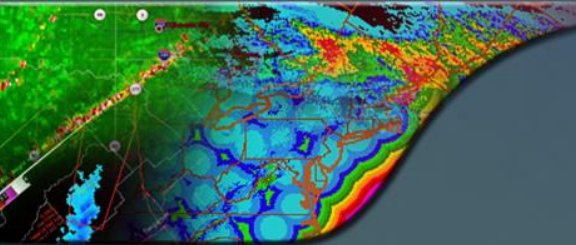
Rotation Tracks



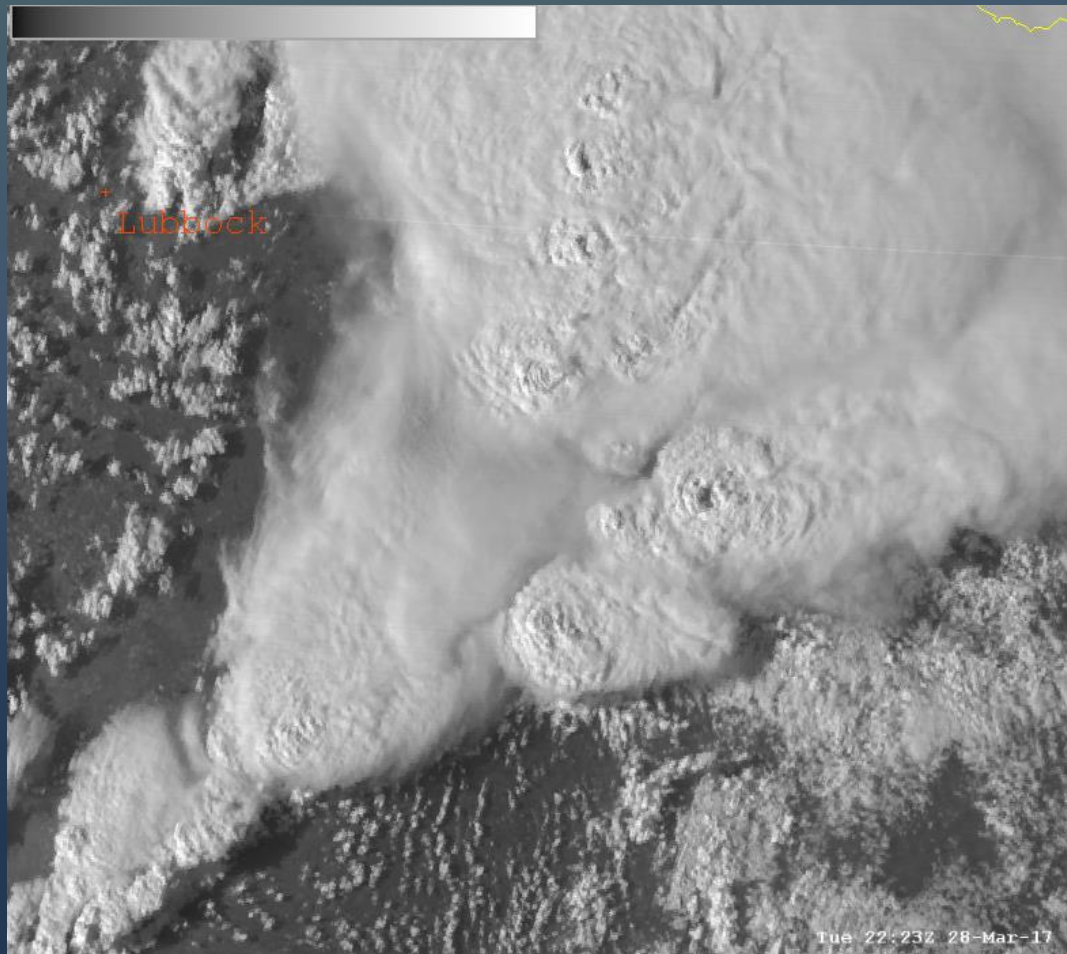
Lots of wind damage!!!



30 June 2012: Derecho



GOES-16 Satellite (currently in TEST mode)



Offers higher
spatial/temporal
resolution data

Critical in identifying
rapidly intensifying
thunderstorms

Uniform lightning data

SPC Products and Tools




Storm Prediction Center

N O A A / National Weather Service



[HOME](#) | [NEWS](#) | [SPC PRODUCTS](#) | [WEATHER INFO](#) | [FORECAST TOOLS](#) | [RESEARCH](#) | [OUTREACH](#) | [NWS/NCEP](#)

[f](#) [t](#) [r](#)

An Enhanced Risk of Severe Thunderstorms for Tue (02/02)

Scattered severe storms capable of damaging winds and a few tornadoes are possible across the lower Mississippi Valley into the lower Ohio Valley on Tuesday with a few strong storms across the central Gulf Coast overnight.

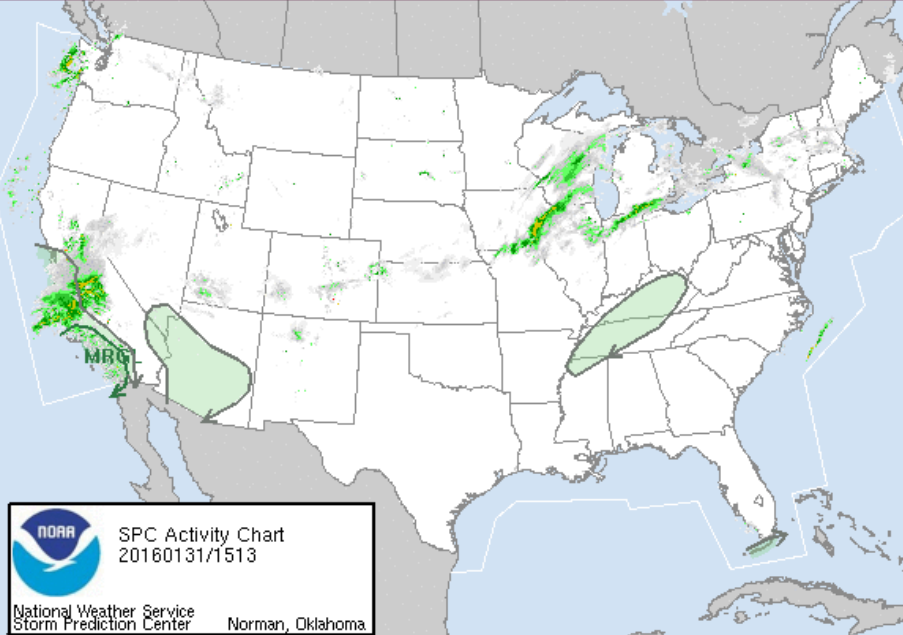
» For additional details, see the latest [Day 3 Convective Outlook](#).

» **Critical** fire weather conditions are forecast today. See [details...](#)

» **Critical** fire weather conditions are forecast on Mon (02/01). See [details...](#)

[Overview](#) | [Conv. Outlook](#) | [Watches](#) | [MDs](#) | [Storm Reports](#) | [Mesoanalysis](#) | [Fire](#) | [Hazards](#)

All Products
Watches
MDs
Outlooks
Fire





SPC Activity Chart
20160131/1513

National Weather Service
Storm Prediction Center Norman, Oklahoma

[Day 1 Convective Outlook](#)
 – Categorical Risk: Marginal
 – Issued: 01/31/2016 at 1304Z

[Thunderstorm Outlook](#)
 – Issued: 01/31/2016 at 1259Z

[Day 2 Fire Weather Outlook](#)
 – Categorical Risk: Critical
 – Issued: 01/31/2016 at 0921Z

[Day 1 Fire Weather Outlook](#)
 – Categorical Risk: Critical
 – Issued: 01/31/2016 at 0919Z

[Day 4-8 Convective Outlook](#)
 – Categorical Risk: No Areas
 – Issued: 01/31/2016 at 0903Z

[Day 3 Convective Outlook](#)
 – Categorical Risk: Enhanced

Hazard	Sun (01/31)	Mon (02/01)	Tue (02/02)	Wed (02/03)	Thu (02/04)	Fri (02/05)	Sat (02/06)	Sun (02/07)
Severe	Marginal	No Severe	Enhanced	No Area	No Area	No Area	No Area	No Area
Fire	Critical	Critical	No Area	No Area	No Area	No Area	No Area	No Area

95

National Weather Service
Baltimore MD/Washington DC

SPC Outlooks

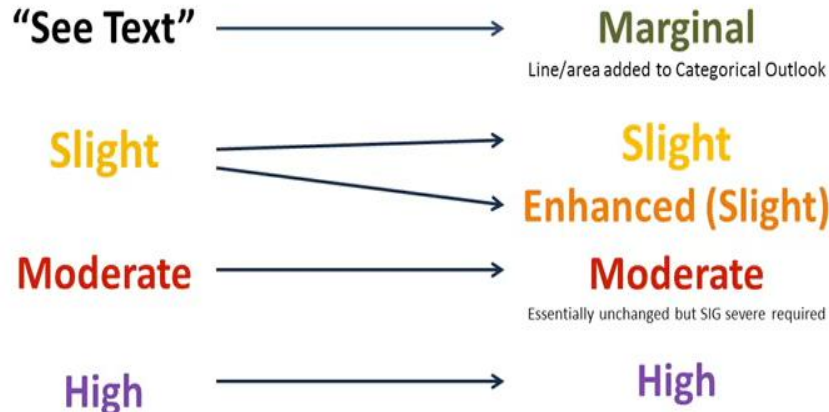
Have split the previous Slight Risk category into two new: Slight & Enhanced

Examples

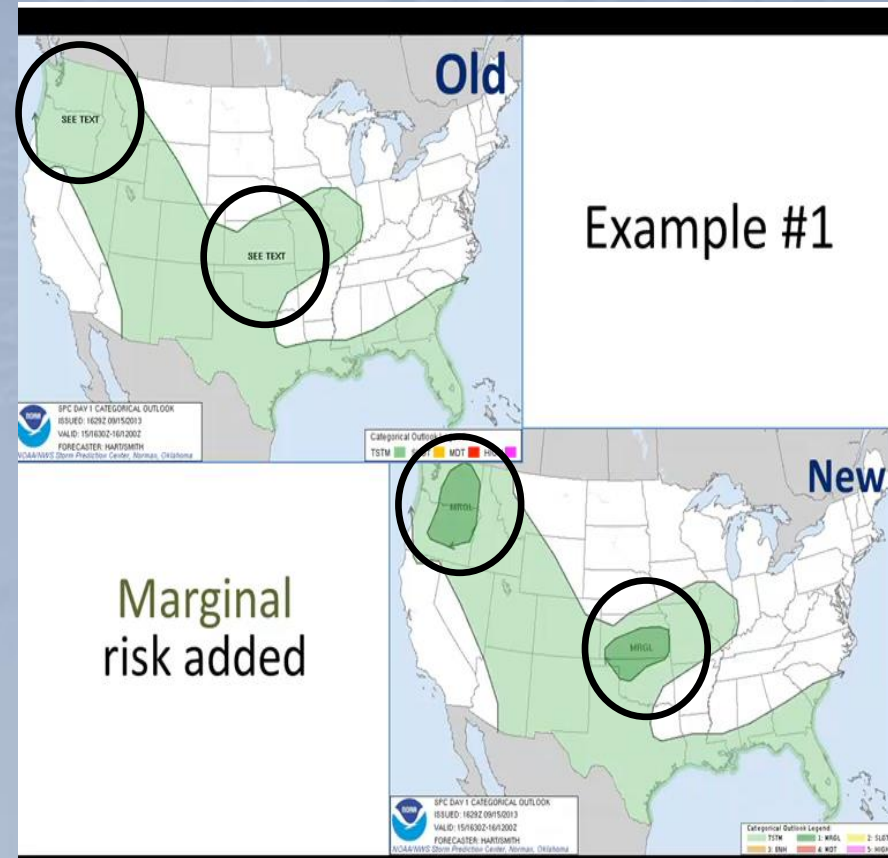
Day 1, Day 2, Day 3 Categorical Outlook Changes
effective October 22, 2014

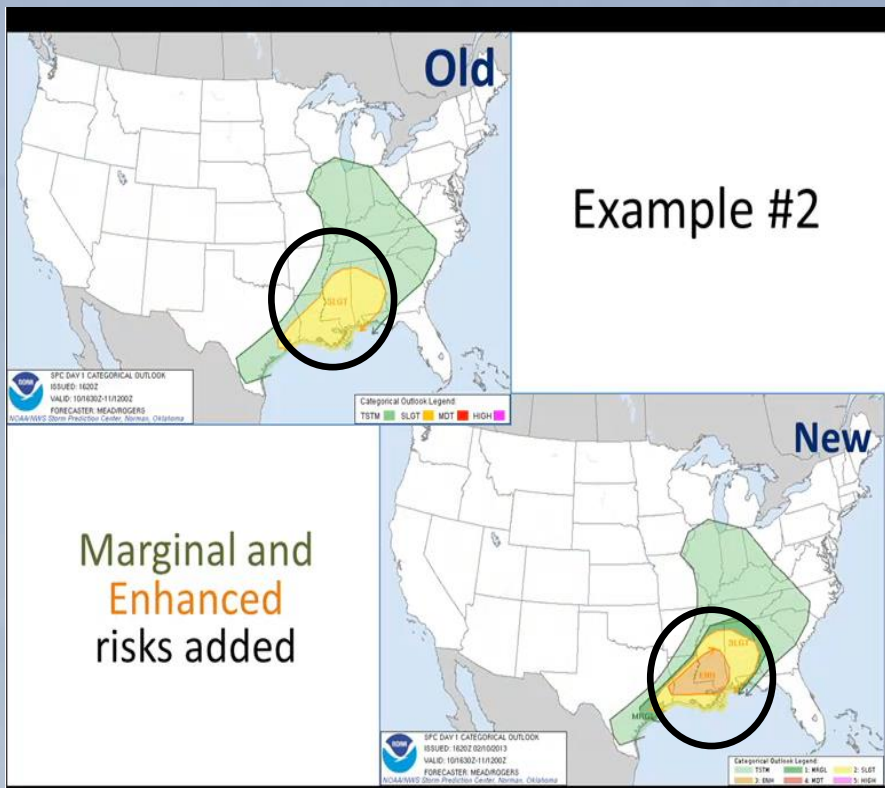
Increase risk categories to 5 levels for Day 1 and Day 2 Outlooks

Increase risk categories to 4 levels for Day 3 Outlook (High not forecast)



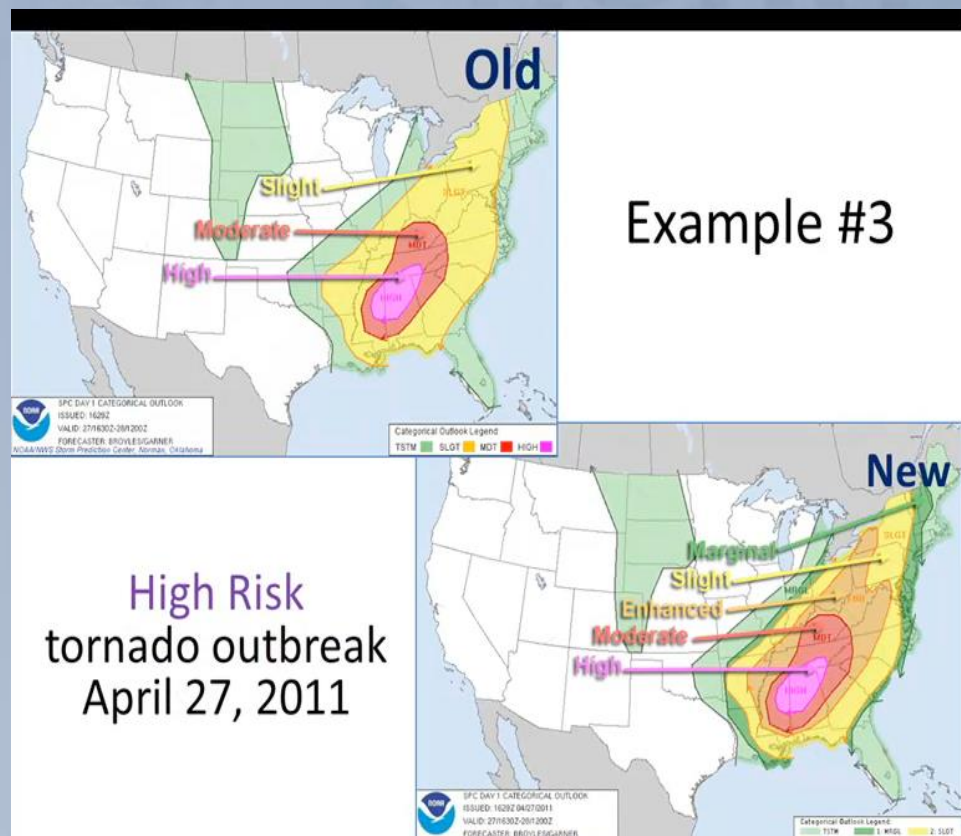
****General thunder will still be noted****



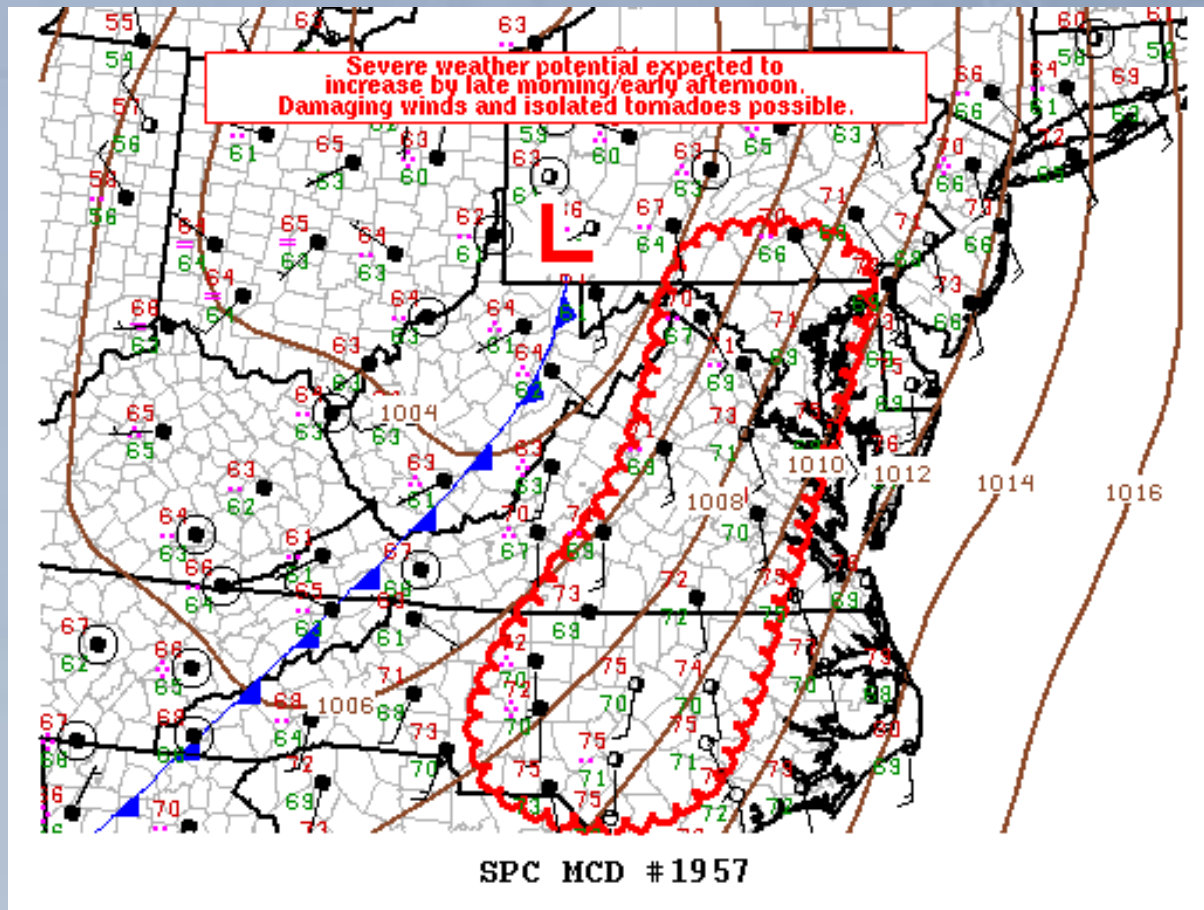


Categorical Outlook Legend:

TSTM	1: MRGL	2: SLGT
3: ENH	4: MDT	5: HIGH



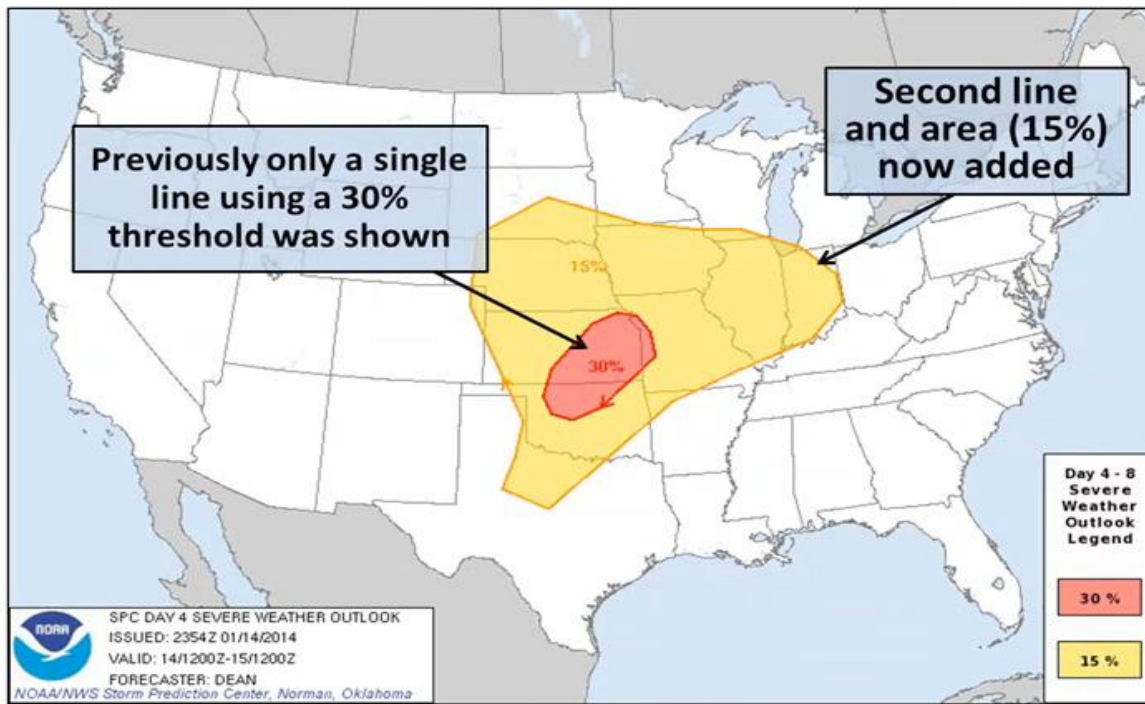
SPC Outlooks



SEVERE THUNDERSTORM POTENTIAL...INCLUDING DAMAGING WINDS AND A FEW TORNADOES...IS EXPECTED TO STEADILY INCREASE BY LATE MORNING/EARLY AFTERNOON...INCLUDING PIEDMONT PORTIONS OF NC INTO WESTERN/CENTRAL VA AND ADJACENT PARTS OF MD/EASTERN WV/SOUTHERN PA. CURRENT THINKING IS THAT ONE OR MORE WATCHES ARE LIKELY FOR THE MAJORITY OF THE REGION BY LATE MORNING.

SPC Outlooks

Example



The Day 4-8 Severe Weather Outlook denotes general areas where severe weather may occur.

The addition of the 15% line started in Dec 2014.

SPC Mesoscale Analysis Page

SPC Mesoscale Analysis

Auto-refresh is set to every minute [OFF 1 min 5 min]

[Change Sector](#)[Image Archive & Loops](#)[SPC Homepage](#)[Mobile Version](#)

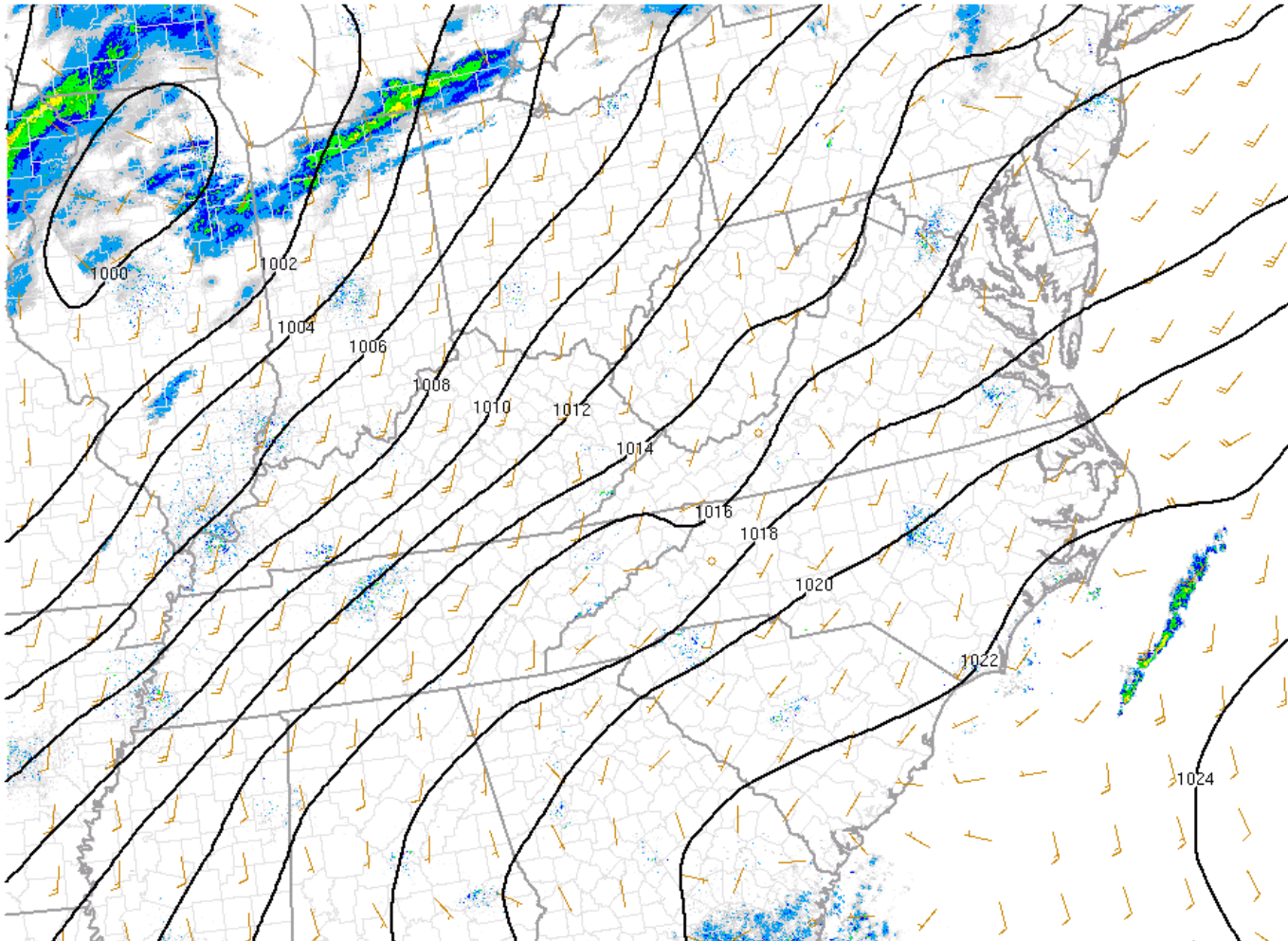
Operational EMC RAP

NEW: Double-click map for tornado climatology and environmental breakdowns.

[Observations](#)[Surface](#)[Upper Air](#)[Thermodynamics](#)[Wind Shear](#)[Composite Indices](#)[Multi-Parameter Fields](#)[Heavy Rain](#)[Winter Weather](#)[Fire Weather](#)[Classic](#)[Beta](#)

NOAA/NWS/Storm Prediction Center

Mesoscale Analysis Data



Review Time



- **Tornado or Funnel**
- **Hail** – Pea sized or larger
- **Rotation** within a storm
- **Wind** – 50 MPH or greater (sustained/gust and measured/estimated)
- **Damage** – Any weather related damage to trees or property. Give as many details as possible.
- **Fog** – Any fog resulting in hazardous driving conditions
- **Heavy Rain** – Measured 1” or More
- **Flooding** – Streams, creeks or rivers out of banks of flooding of roads from poor drainage (including coastal flooding)
- **Ice Accumulation** – Any glaze
- **Snow Accumulation** – Every 2”, any accumulation not reflected in the forecast , storm total
- **Tropical** – Flooding as a result of rain and/or storm surge, tornadoes, wind damage

Very Important Information

If your report is severe thunderstorm hail/wind/tornado/funnel cloud or flooding related, please DO NOT send your report via email!

This type of information is time critical and needs to be relayed to forecasters *immediately*.

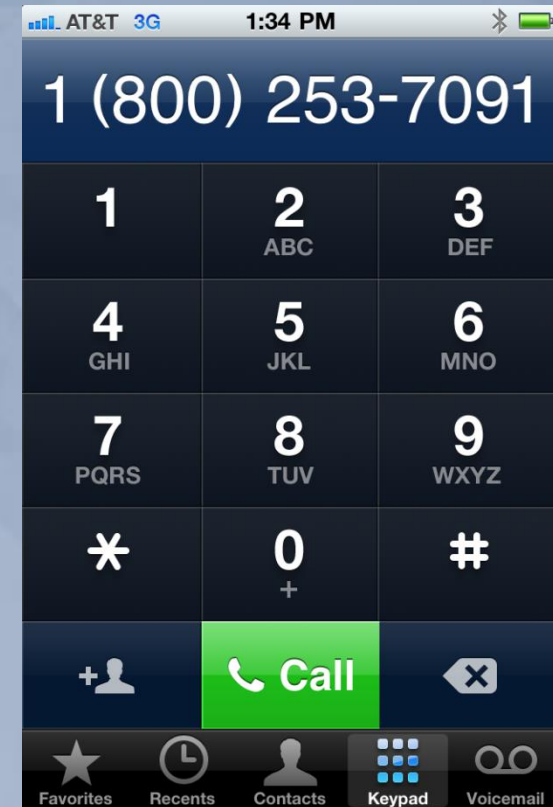
The best means to get information to the NWS quickly is by the telephone or Amateur Radio

PLEASE DON'T WAIT FOR US TO CALL YOU!



Making a Report

- Include your **full name and Spotter Number!**
- What are you reporting?
- What time was the event?
- Where did the event occur?

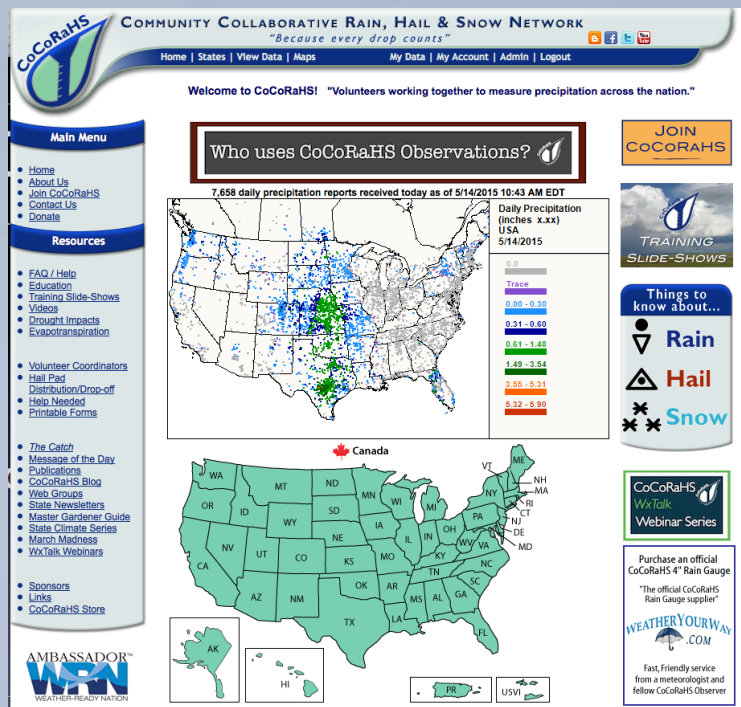


The more specific you are the better!

Email delayed reports, call in the rest!

CoCoRaHS

In addition to being a NWS spotter, you also have to opportunity to participate in this separate volunteer program if you choose...



How can I join the network?



Five easy steps

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

Obtain a 4" plastic rain gauge

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

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

Start observing precipitation
and report on-line daily

Questions or Comments?

Christopher Strong

Warning Coordination Meteorologist

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Heather Sheffield Kenyon

General Forecaster/SKYWARN Coordinator

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Severe Weather Program Leader

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703.996.2201

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*National Weather Service
Baltimore MD/Washington DC*

