2012 SKYWARN Spotter Training

National Weather Service
Bismarck, North Dakota

Weather-Ready Nation:
Saving Lives and Livelihoods

Agenda

- What is a SKYWARN Storm Spotter?
- Severe Weather Definitions and Products
- 2011 Re-cap
- Thunderstorm Basics
- Thunderstorms In-Depth
- Spotter Positioning and Visual Clues
- Reporting Severe Weather
- Spotter Preparedness
- Thunderstorm Hazards / Safety

SKYWARN is…

- Volunteers like YOU
- Trained to observe and report (and stay safe)
- In support of the NWS mission to
  - **Protect life and property**
  - **Build a →**

SKYWARN is...
a group effort

SKYWARN

NDDES
Homeland Security
State Radio

NORTH DAKOTA STATE PATROL

You

FIRE AND RESCUE

SHERIFF

AMATEUR RADIO EMERGENCY SERVICE

EM

Broadcast Media

NATIONAL WEATHER SERVICE

Reports are critical !

Report the facts as you know them, using the dedicated SKYWARN Spotter line

1-800-247-0212 (reports only)

Your Report COULD…

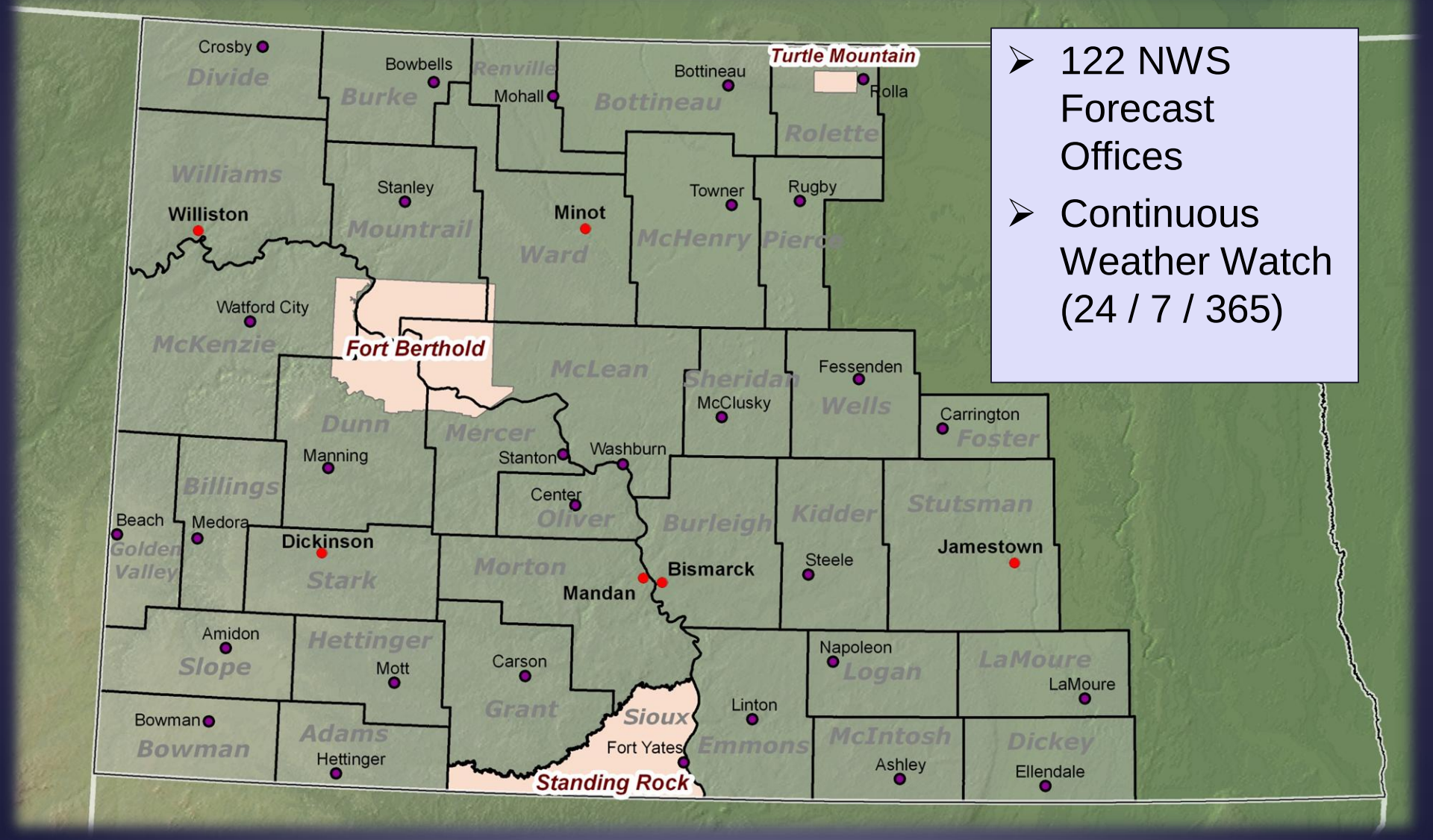
- Be the first indication of severe weather
- Help us decide whether or not to warn
- Add warning lead time and credibility

We are 24 / 7 … 365

Call us day or night.

1-800-247-0212

SKYWARN Spotters serve 36 counties in the Bismarck County Warning Area



- 122 NWS Forecast Offices
- Continuous Weather Watch (24 / 7 / 365)

9th largest by land area in the NWS

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- Tornado
  - Violently rotating column of air extending from the base of a cloud and in contact with the ground.

Tornado Rating Intensity…

- **EF0** 65 to 85 mph **weak**
- **EF1** 86 to 110 mph **weak**
- **EF2** 111 to 135 mph **strong**
- **EF3** 136 to 165 mph **strong**
- **EF4** 166 to 200 mph **violent**
- **EF5** 201 + mph **violent**

- Large Hail – 1 inch in diameter (or +)
  (quarter size or +)

Prairie Knights Casino - July 14th, 2010

- High Wind – gust of 58 mph (or +)

Napoleon - July 10th, 2011
Jessie Taylor

Watch Products

NWS / SPC will issue a Severe Weather Watch

Issued for a large area for a long time

(half of ND for 6 to 8 hours)

Severe Thunderstorm Watch means conditions in the atmosphere are right so that if thunderstorms develop…they could be severe

Tornado Watch means that conditions in the atmosphere are right so that if thunderstorms develop…they could produce tornadoes

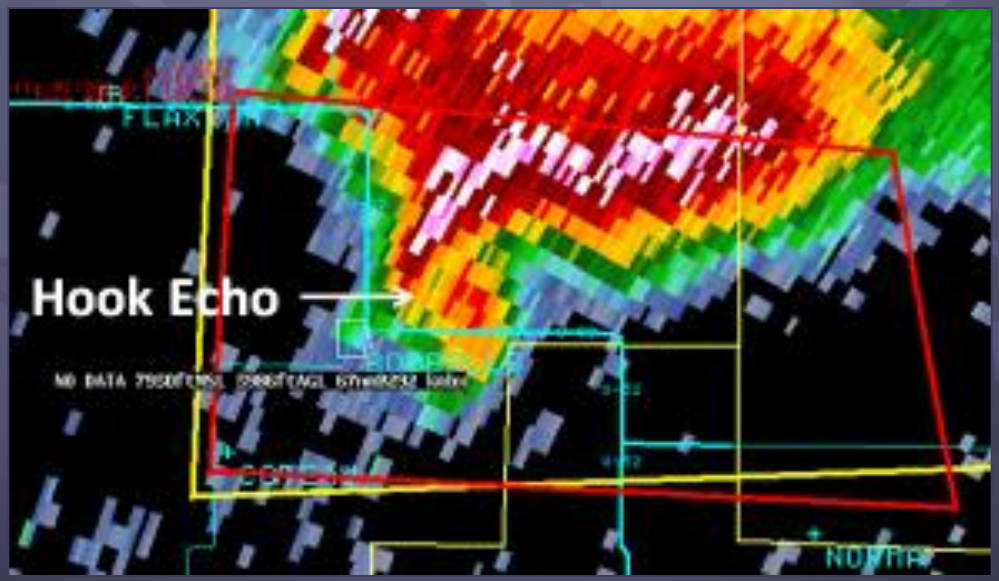
Warning Products

NWS will issue a Severe Weather Warning

(Warning Polygon approximately size of county for an hour or less)

Severe Thunderstorm Warning …severe weather (hail 1”+ / wind 58 mph+) has been reported or indicated by radar

Tornado Warning …tornado has been sighted or indicated by radar



- Flash Flood
  - A rapid rise in water over a short period of time

What Causes Flash Flooding?

- Heavy thunderstorm rains (1” or more in an hour)
- Repeat thunderstorms (training)
- Slow moving thunderstorms
- Saturated soils from recent rains can make the situation worse
- Quicker impact in steep terrain.

Flash Flood Watches and Warnings

Flash Flood Watch …flash flooding is possible.

(Issued Several Hours in advance of the possible event)

Flash Flood Warning …flash flooding is expected or has been reported.

(Issued up to an hour in advance of the likely event)

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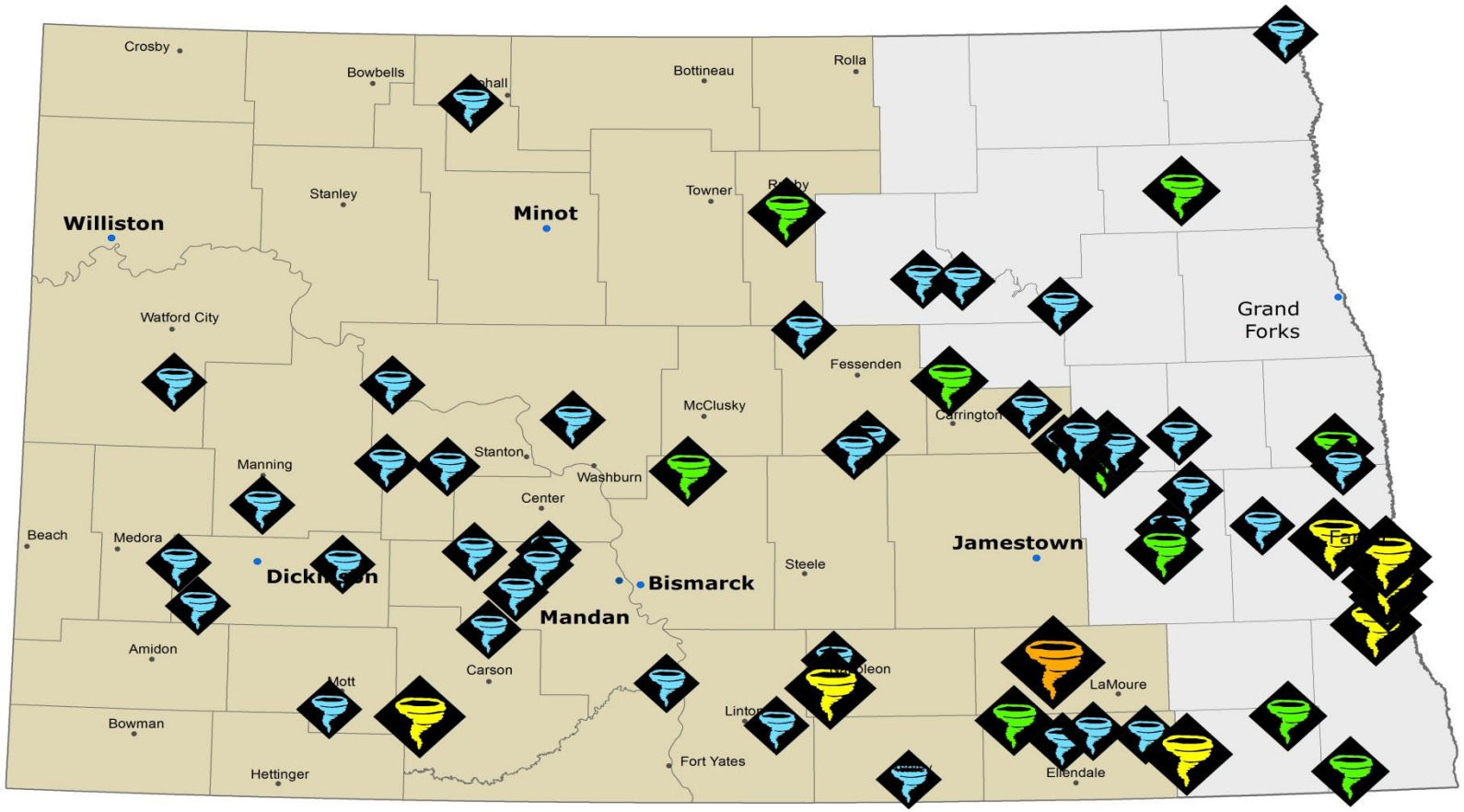
2011 ND Tornadoes



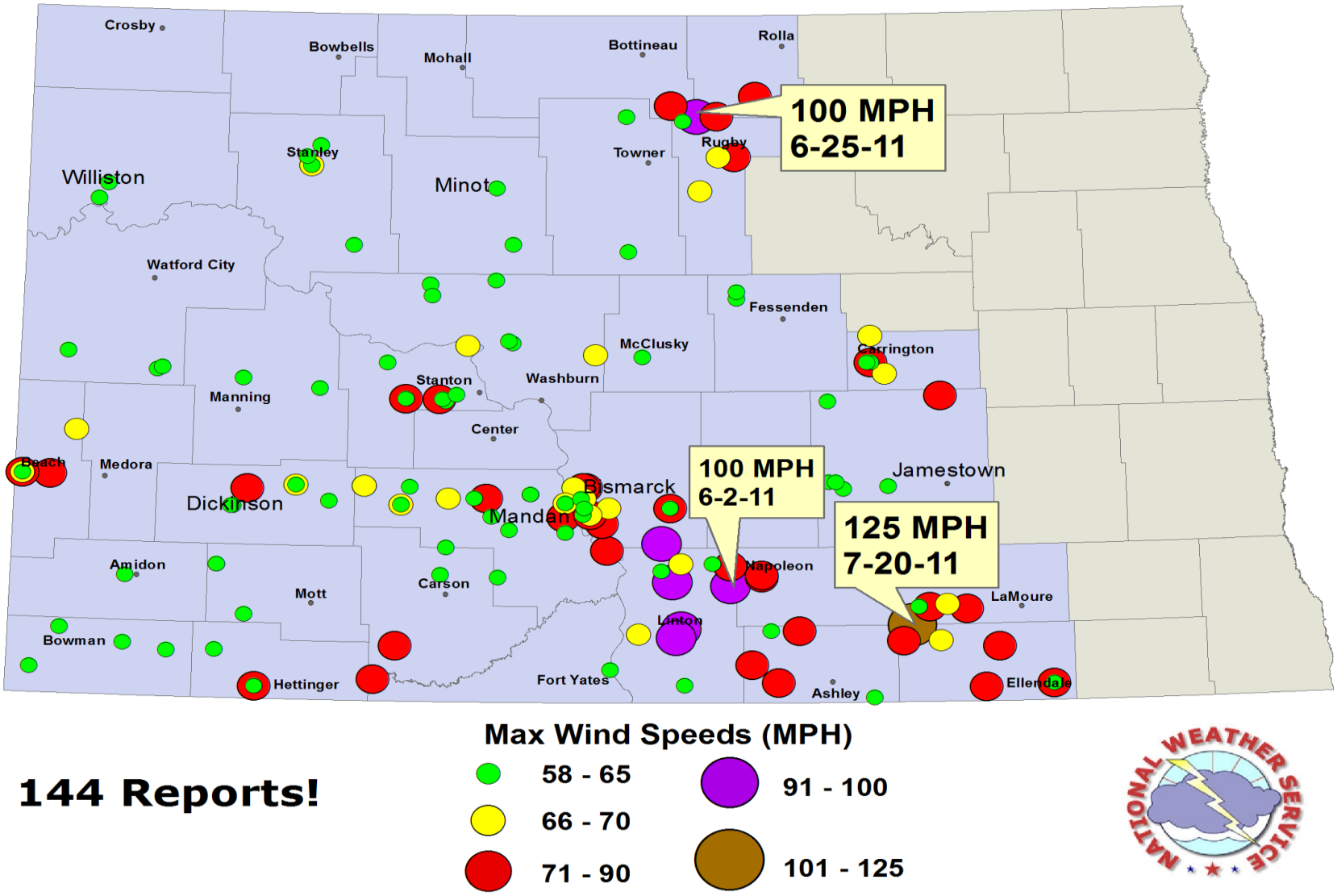
59 Tornadoes

EF Scale

0 1 2 3 4

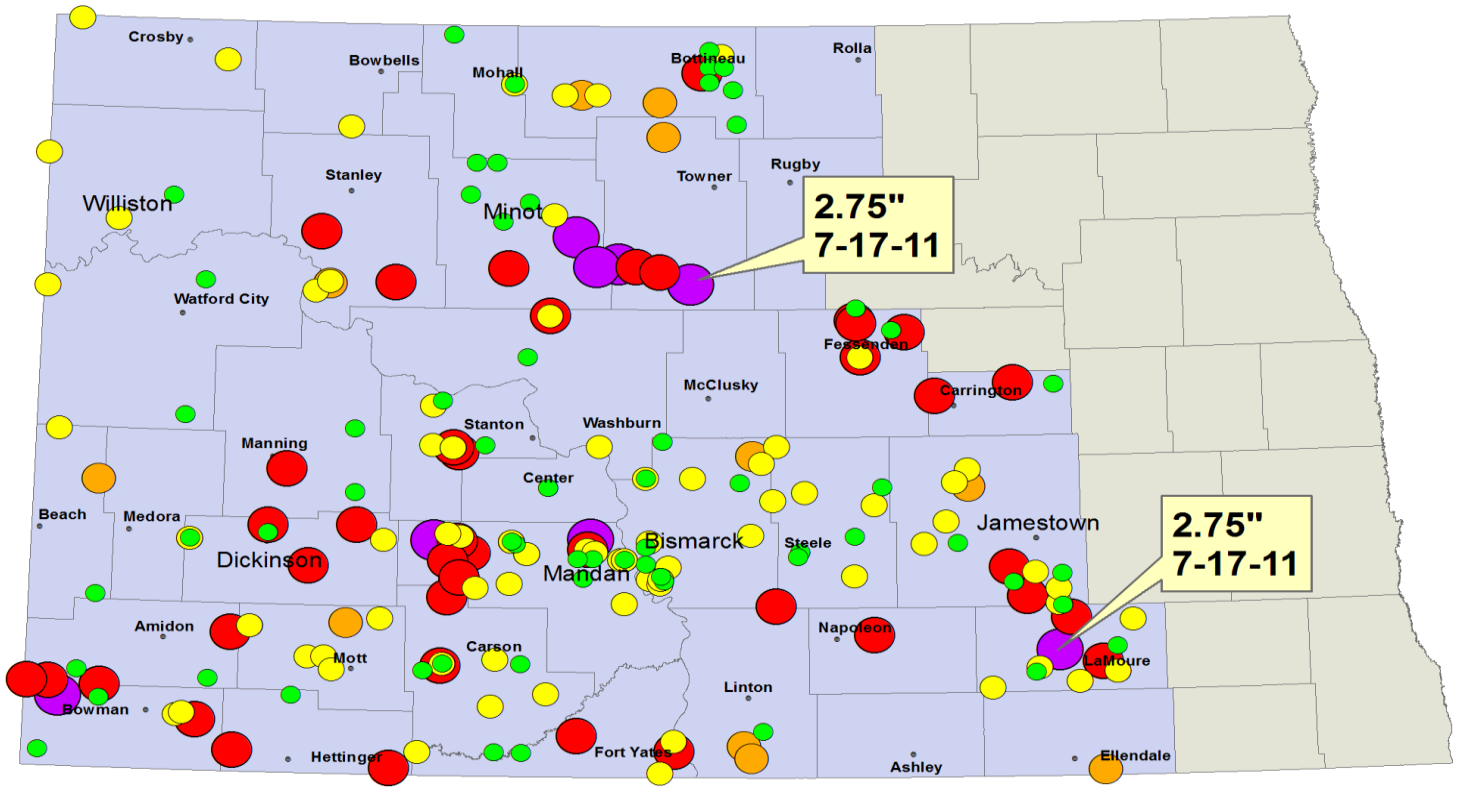
North Dakota Tornadoes
July 16, 2011

2011 Severe Wind Reports



Straight line wind damage Carson
Carson Press
July 31, 2011

2011 Severe Hail Reports



209 Reports!

Hail Size (Inches)

- 0.75 - 0.88
- 1.00 - 1.25
- >1.25 - 1.50
- > 1.50 - 2.25
- > 2.25 - 2.75

NATIONAL WEATHER SERVICE

2011 Severe Hail

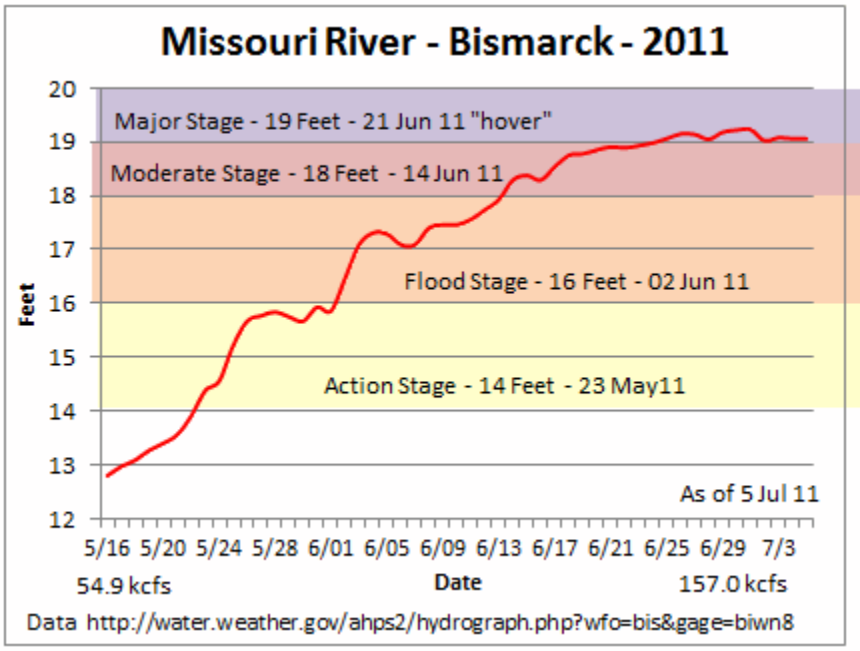

Bismarck


South of Minot


Dickinson

Historic 2011 Flooding Souris River

Historic 2011 Flooding Missouri River



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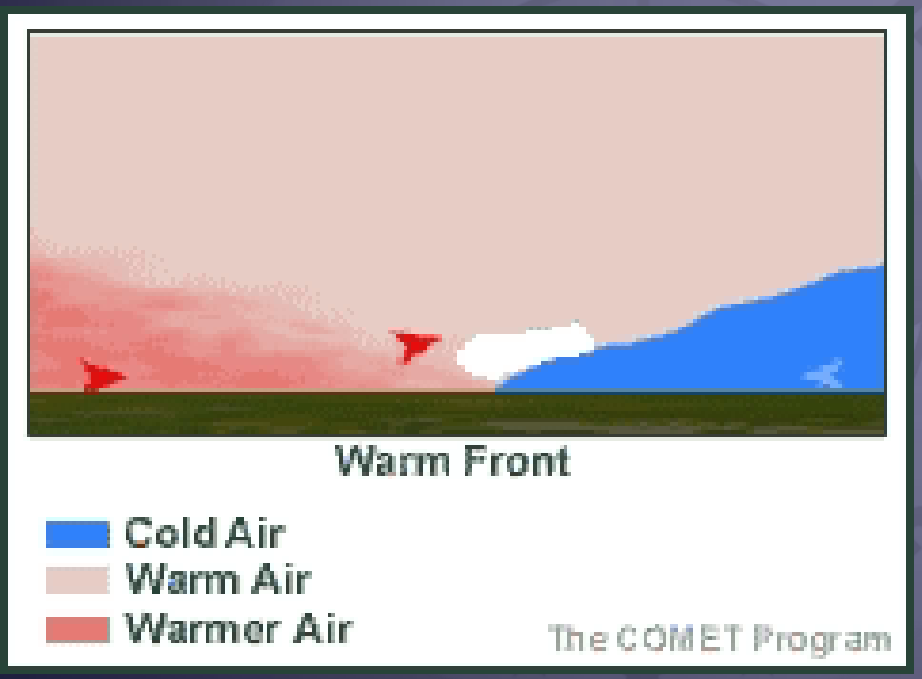
Thunderstorms Ingredients

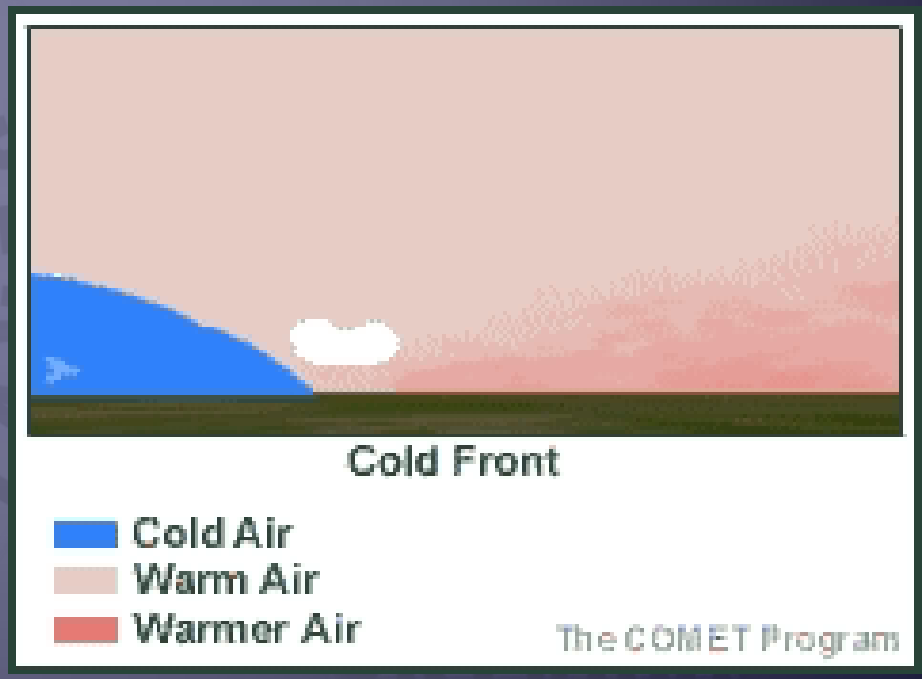
- Moisture …in the lower levels (humidity)
- Lift …get air parcels rising (converging air along fronts and boundaries)
- Unstable Air …keep that air rising (lifted air warmer than environment)

Moisture

Lift

- Associated with Warm / Cold Fronts
- Any other kind of surface convergence
  - Thunderstorm outflow

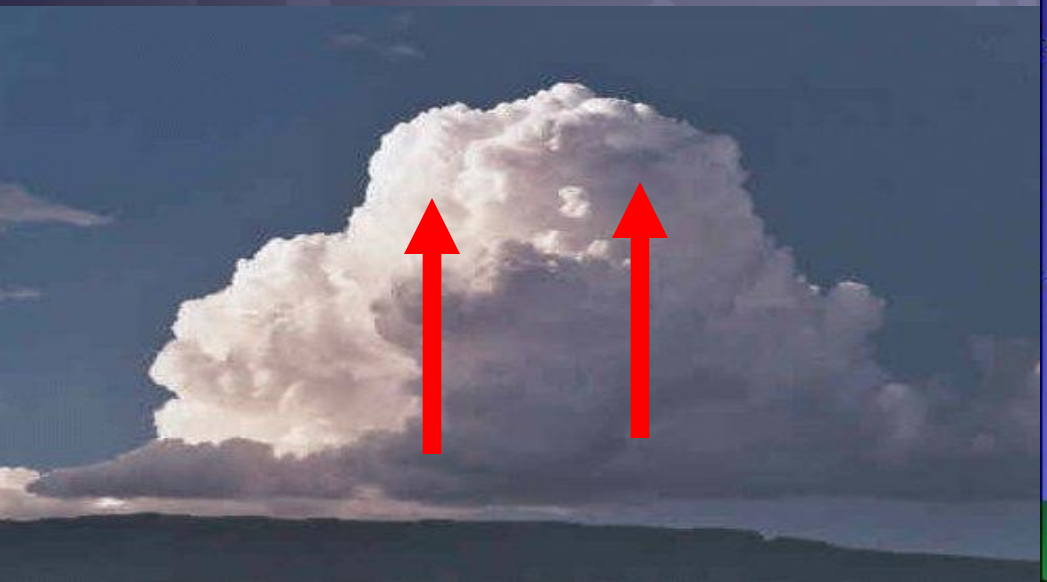


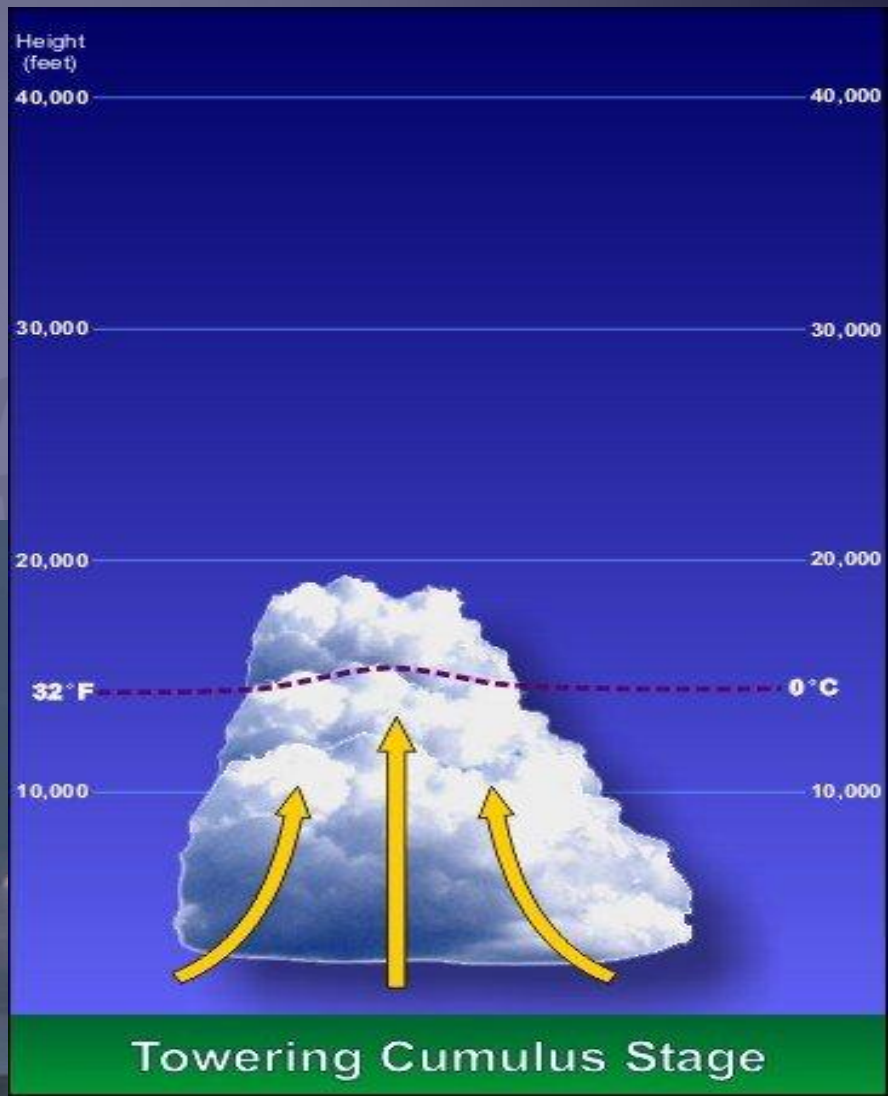


Thunderstorm Life Cycle

Towering Cumulus - Developing

- Towering, billowy, bright white clouds
- Dominated by updraft (rising air)
- First lightning flash

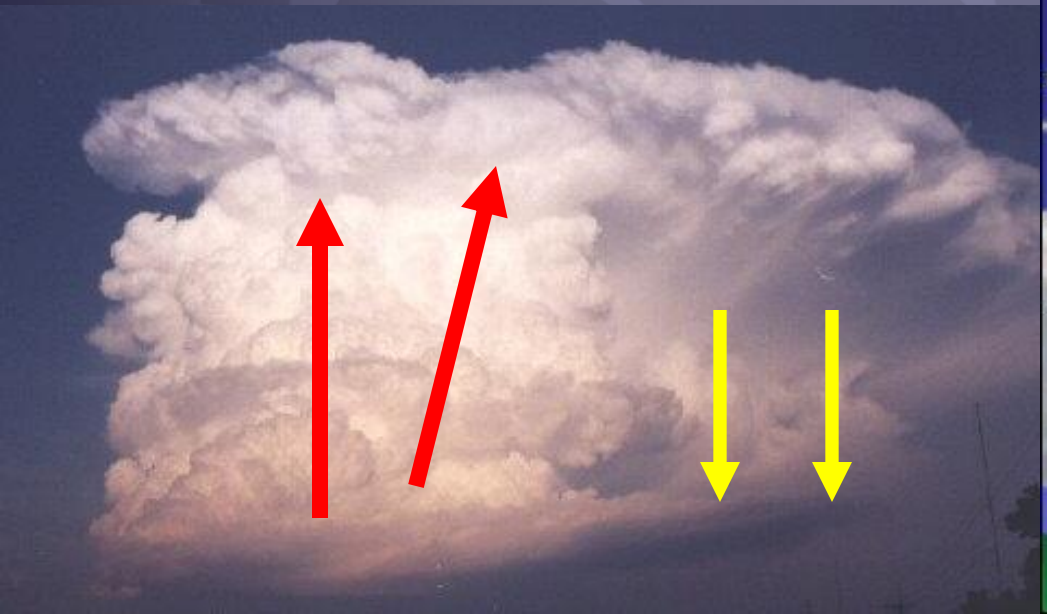


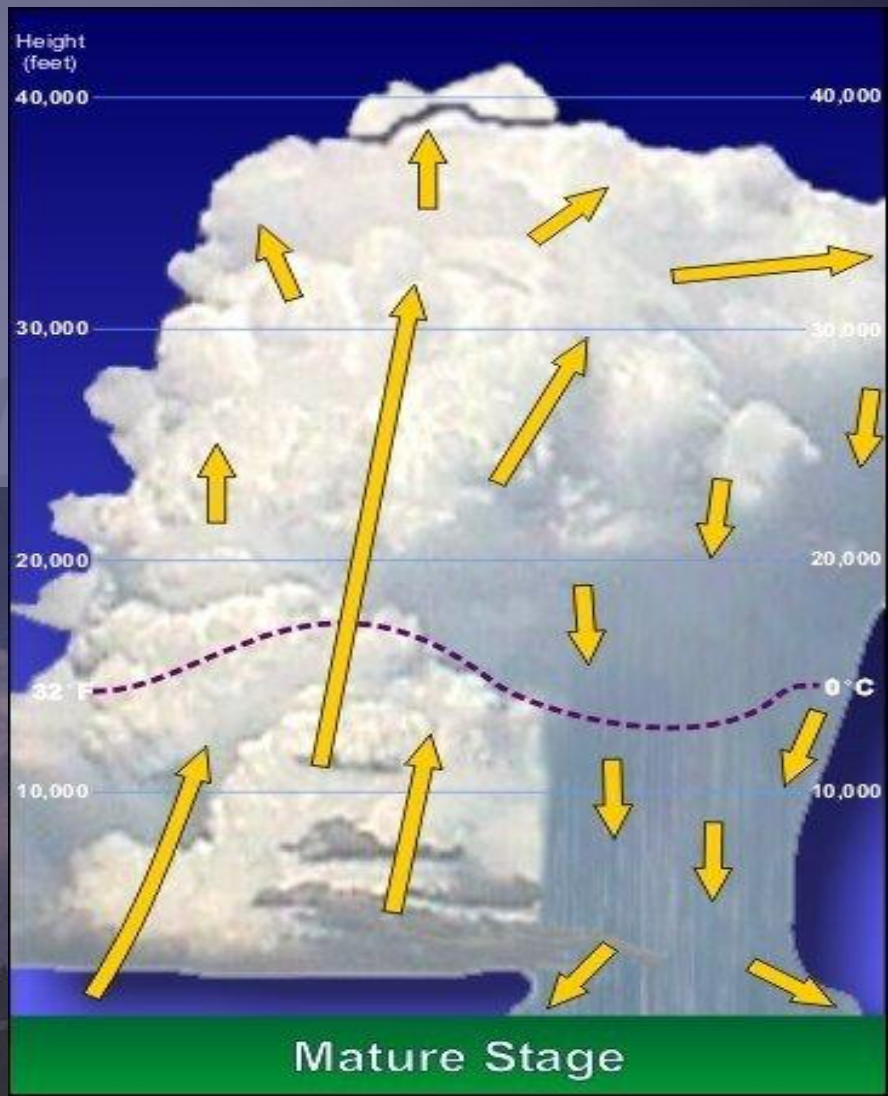


Thunderstorm Life Cycle

Mature Stage

- The weather stage
- Lightning, rain, hail, wind, tornado
- Anvil top
- Rising air (updraft)
- Falling rain (downdraft)

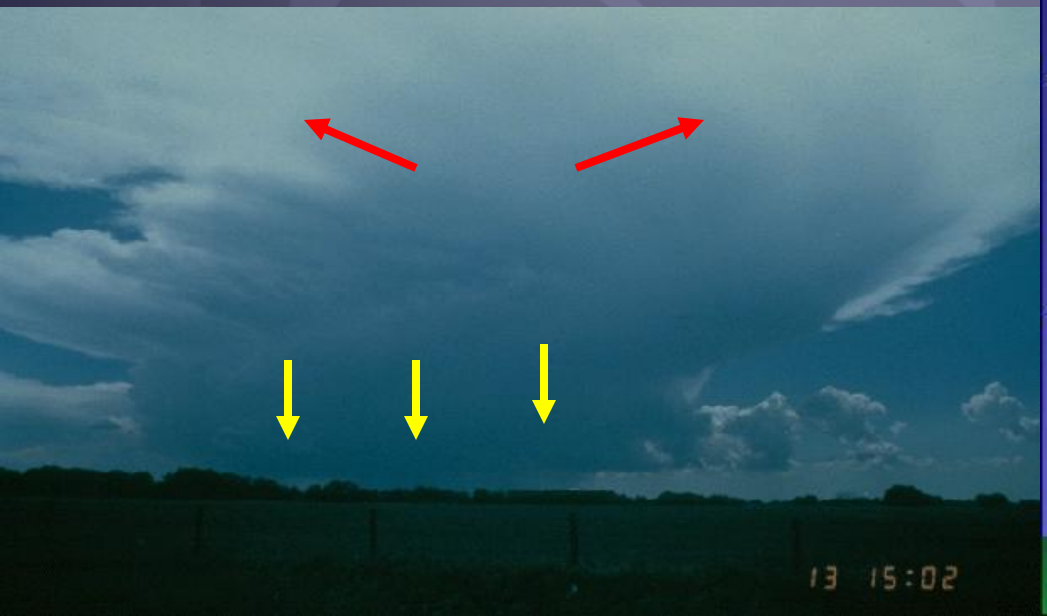


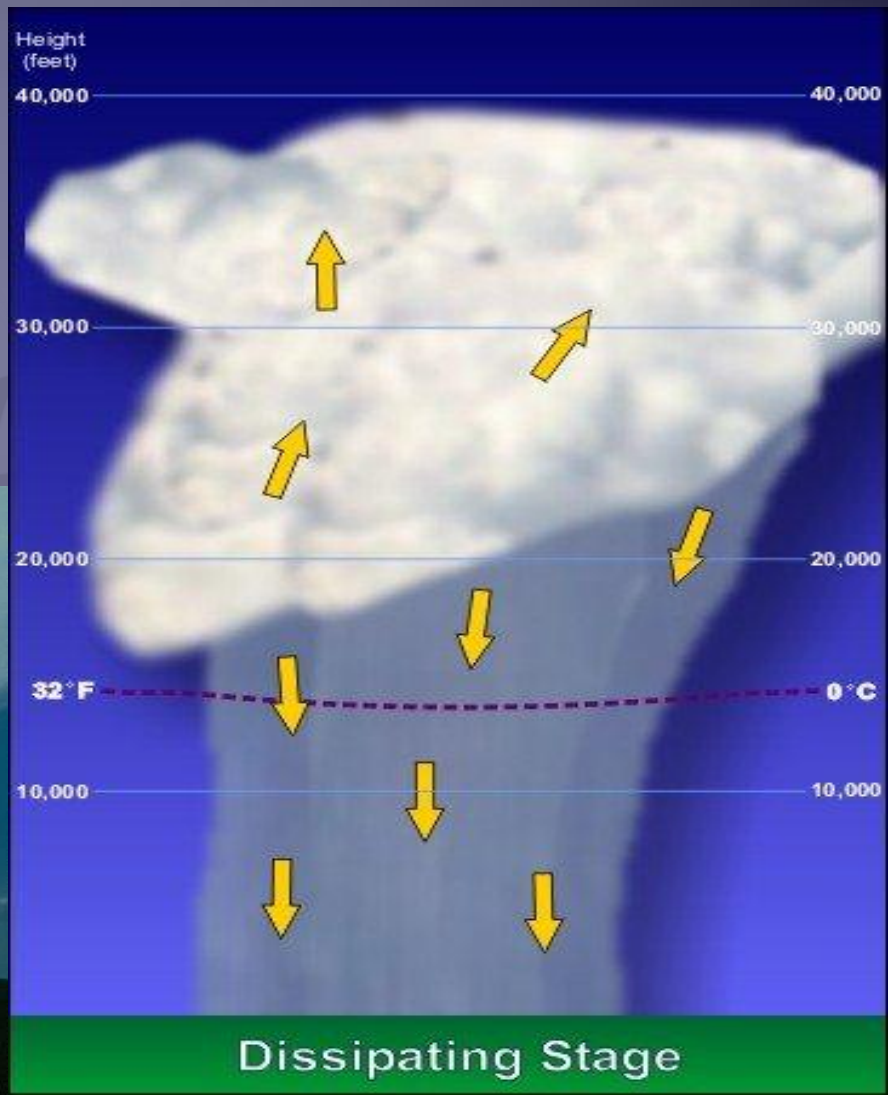


Thunderstorm Life Cycle

Dissipating Stage

- Updraft weakens
- Mostly descending air (downdraft)
- Rainfall intensity decreases
- Strong wind and hail decrease
- Lightning still frequent





Severe Thunderstorm Categories

Single Cell | **Multicell Cluster or Line** | **Supercell**

Short-Lived Pulse Severe → **Severe Rotating Updraft**

Brief/Slight Threat for Severe Weather

Moderate Threat for Severe Weather

Long-Lived/High Threat for Severe Weather

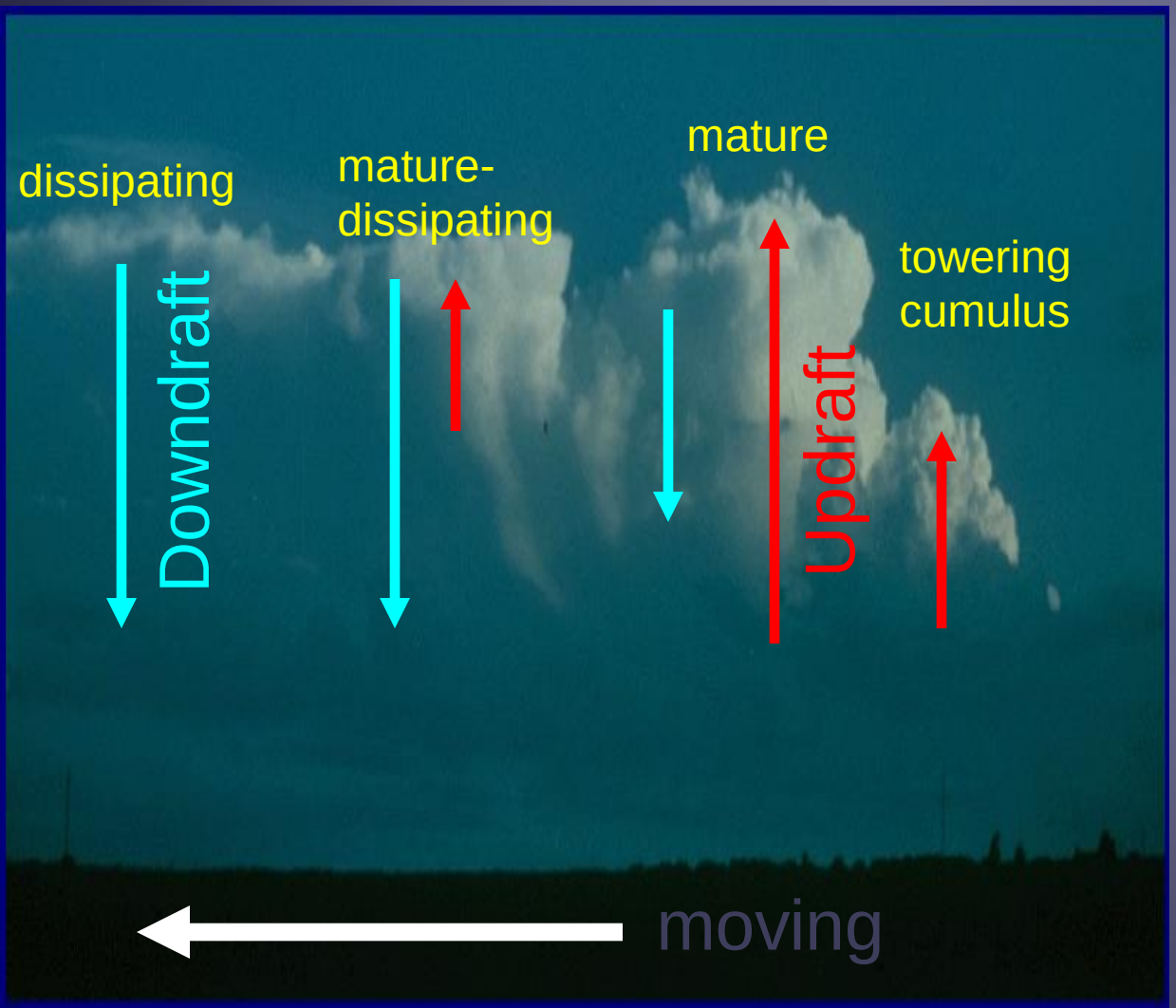
Thunderstorm Categories

Single Cell

- Short life…minutes to ~ hour
- Updraft / Downdraft are co-located with each other
- Weak and usually not severe…BUT…
- Can be "pulse" severe… intensify ⟲ weaken
- "Pulse" severe are hard to warn for
- Threats are marginally severe hail and brief severe winds

Thunderstorm Categories

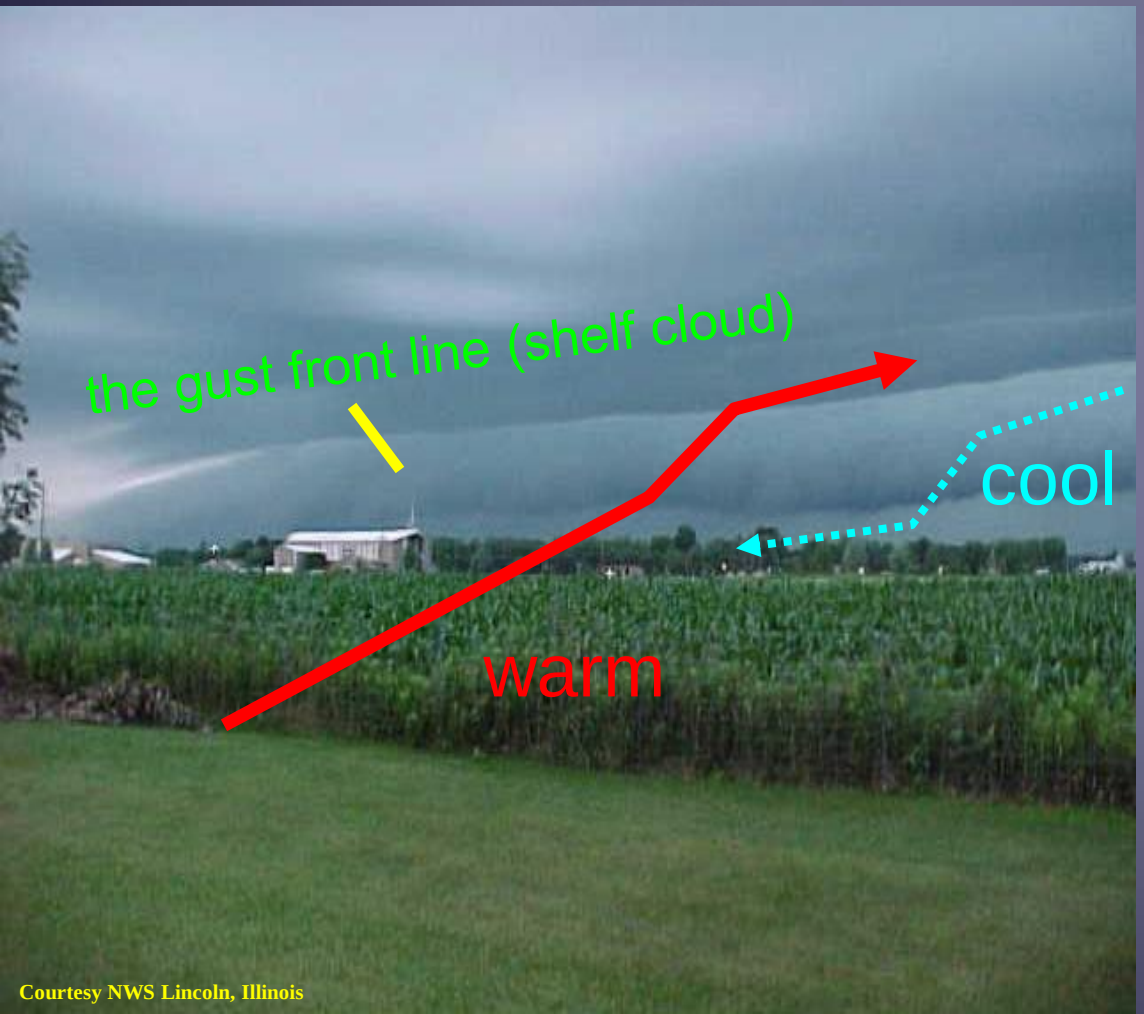
Multicell Cluster



- Group of single cell storms, each in a different stage.
- Long-lived (hours). Updraft and Downdraft separated.
- May produce large hail, high winds, and flash flooding.
- Weak tornadoes possible.

Thunderstorm Categories

Multicell Line (Squall Line)

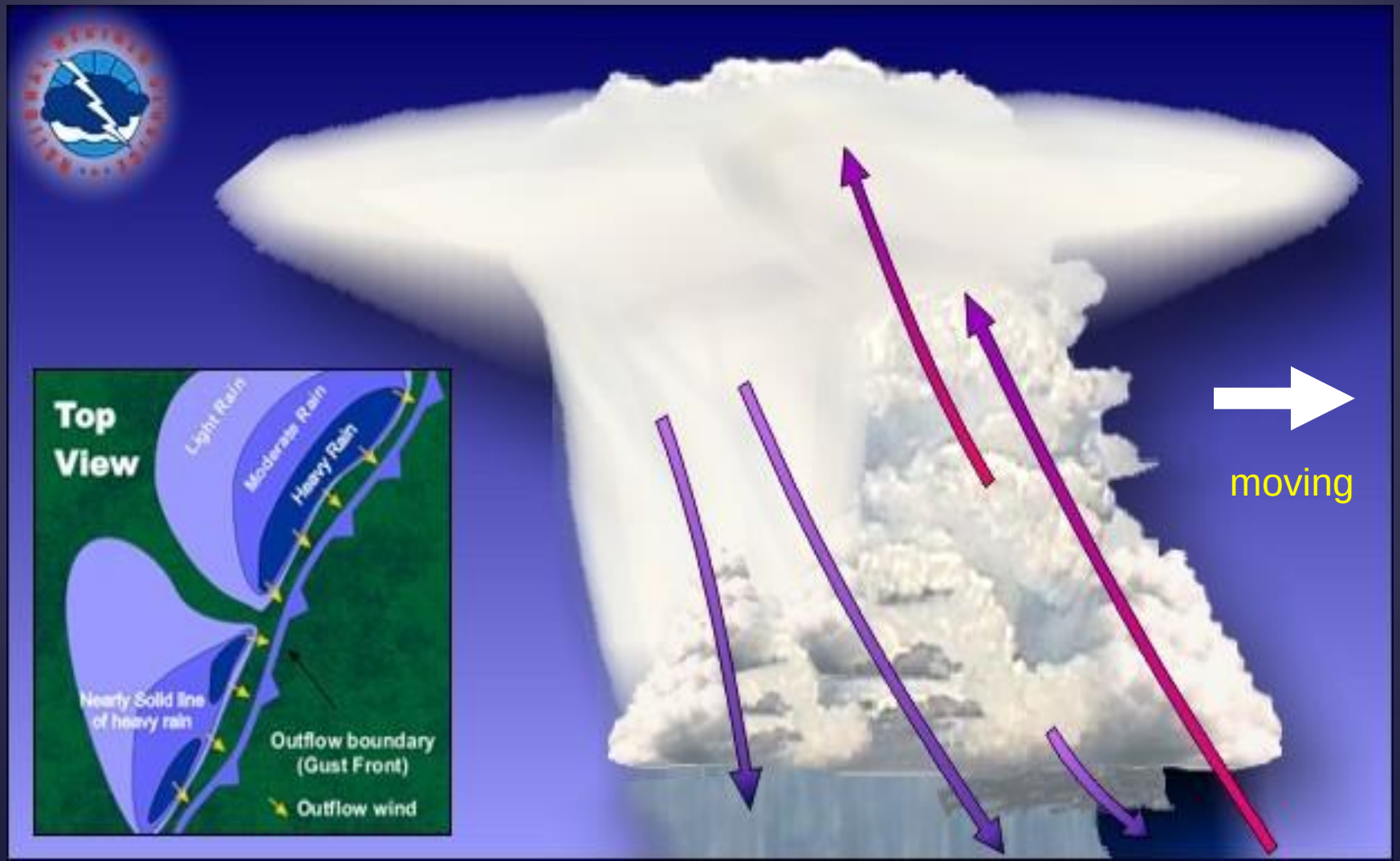


Courtesy NWS Lincoln, Illinois

- Line of storms.
- Can be more than 100 miles long.
- Primary threat is damaging winds.
- Can also produce large hail and tornadoes.

Thunderstorm Categories

Multicell Line (Squall Line)

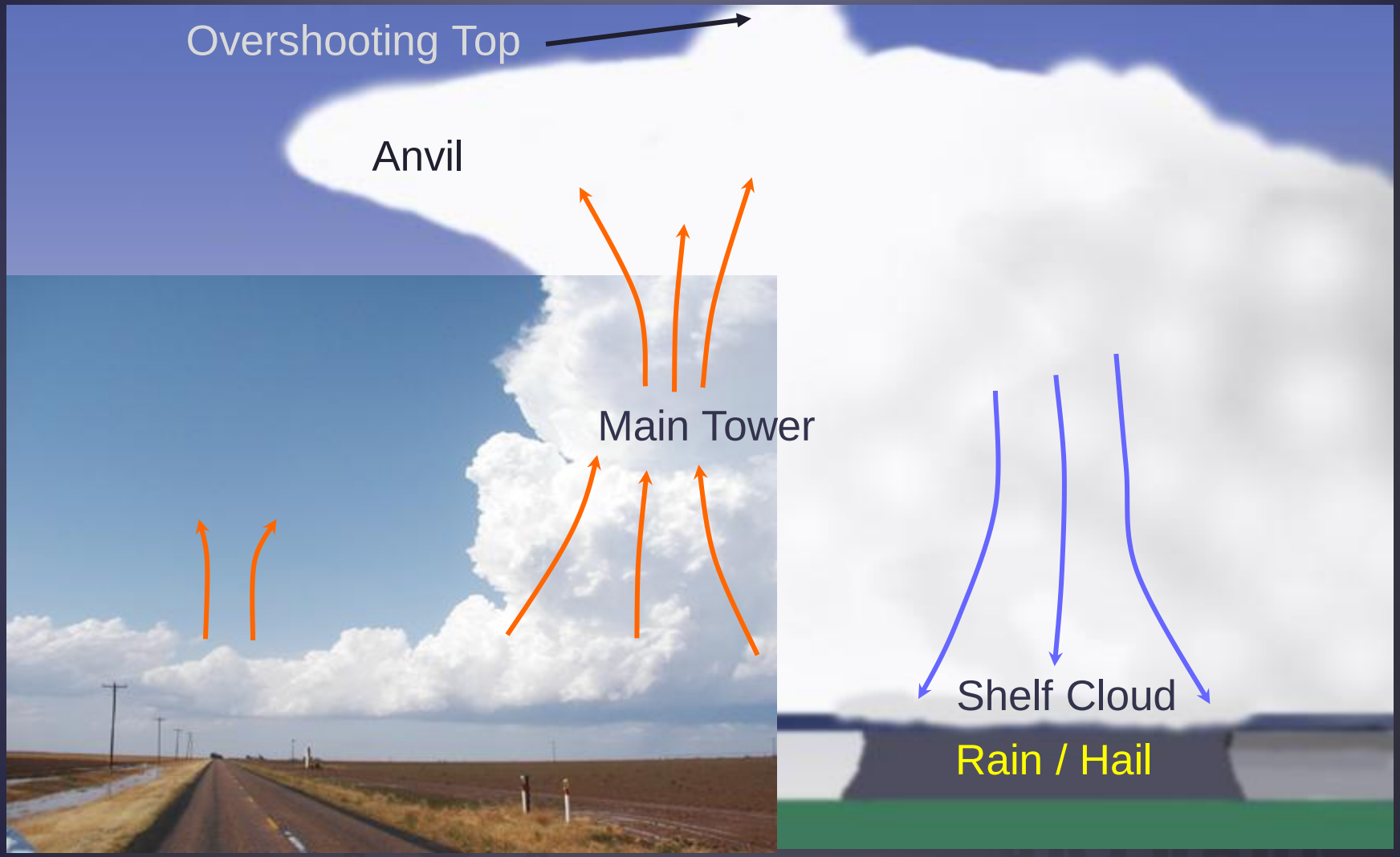


Thunderstorm Categories

Supercell

- Highly organized.
- Extremely strong updraft.
- Rotating updraft (mesocyclone).
- High risk of severe weather.
- Only a small percentage spawn tornadoes, but majority of violent tornadoes develop from supercells.

Supercells



Storm Movement

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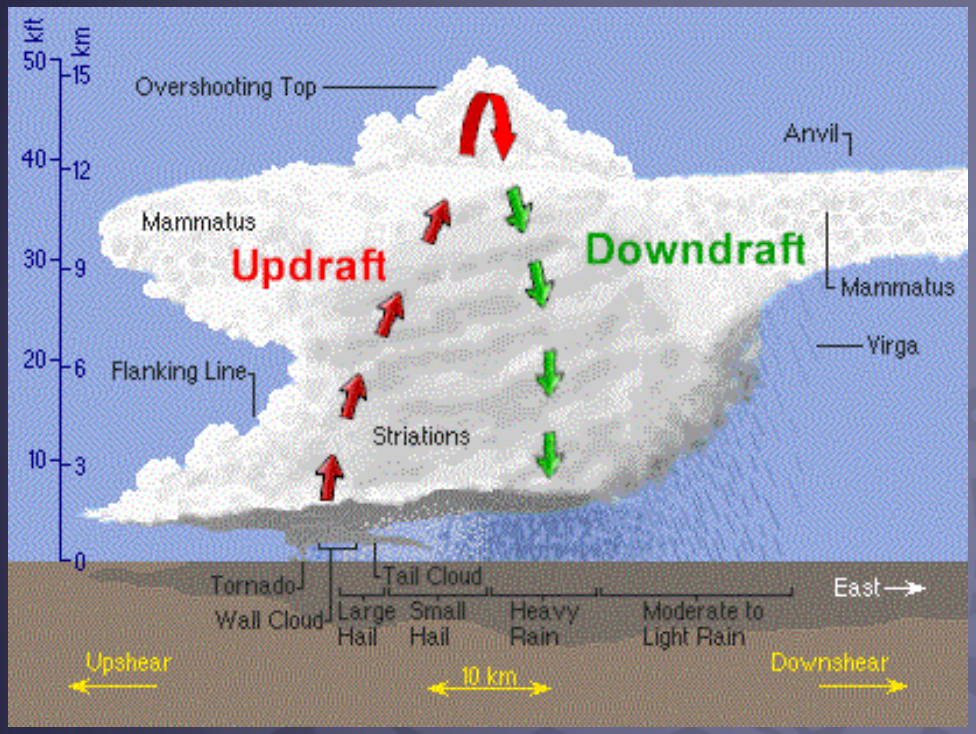
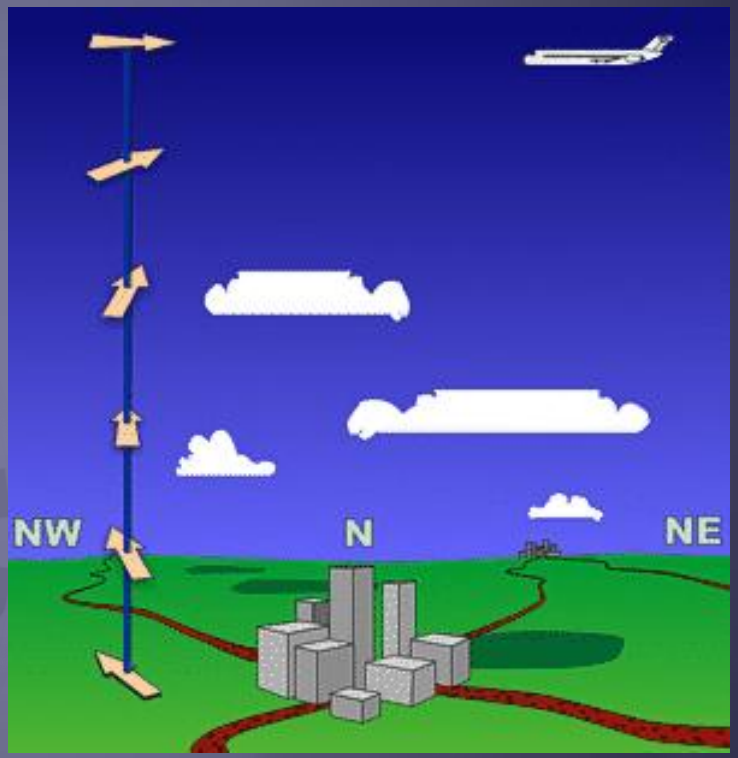
Wind Shear…*Speed* & *Directional*

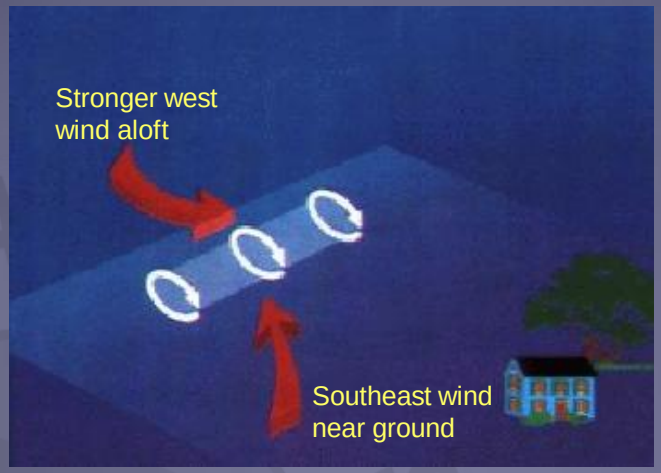


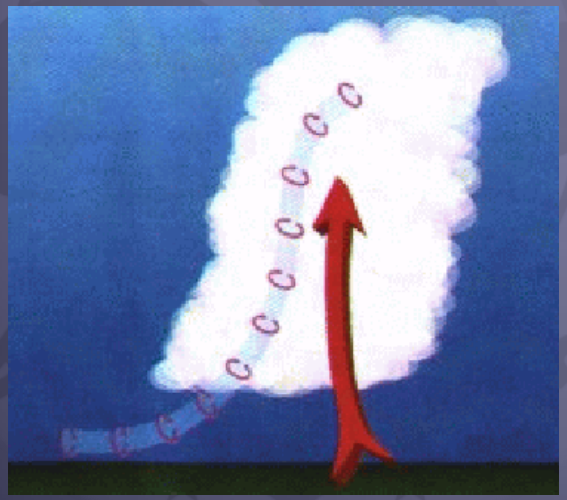
Speed shear tilts the updraft, separating it from the downdraft. (Storm lasts longer)

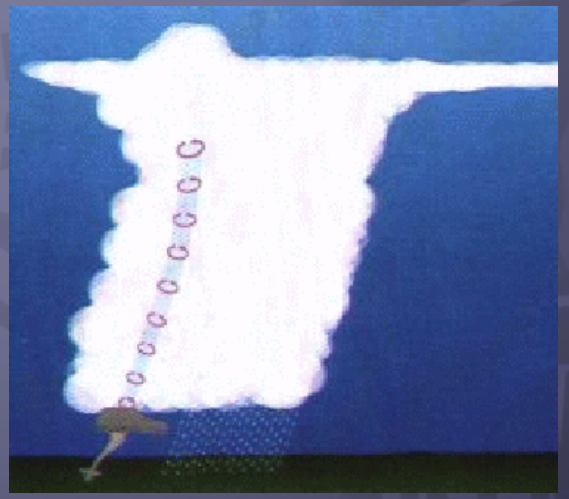


Directional shear increases the potential for rotating updrafts to form.

Why a Supercell Updraft Rotates







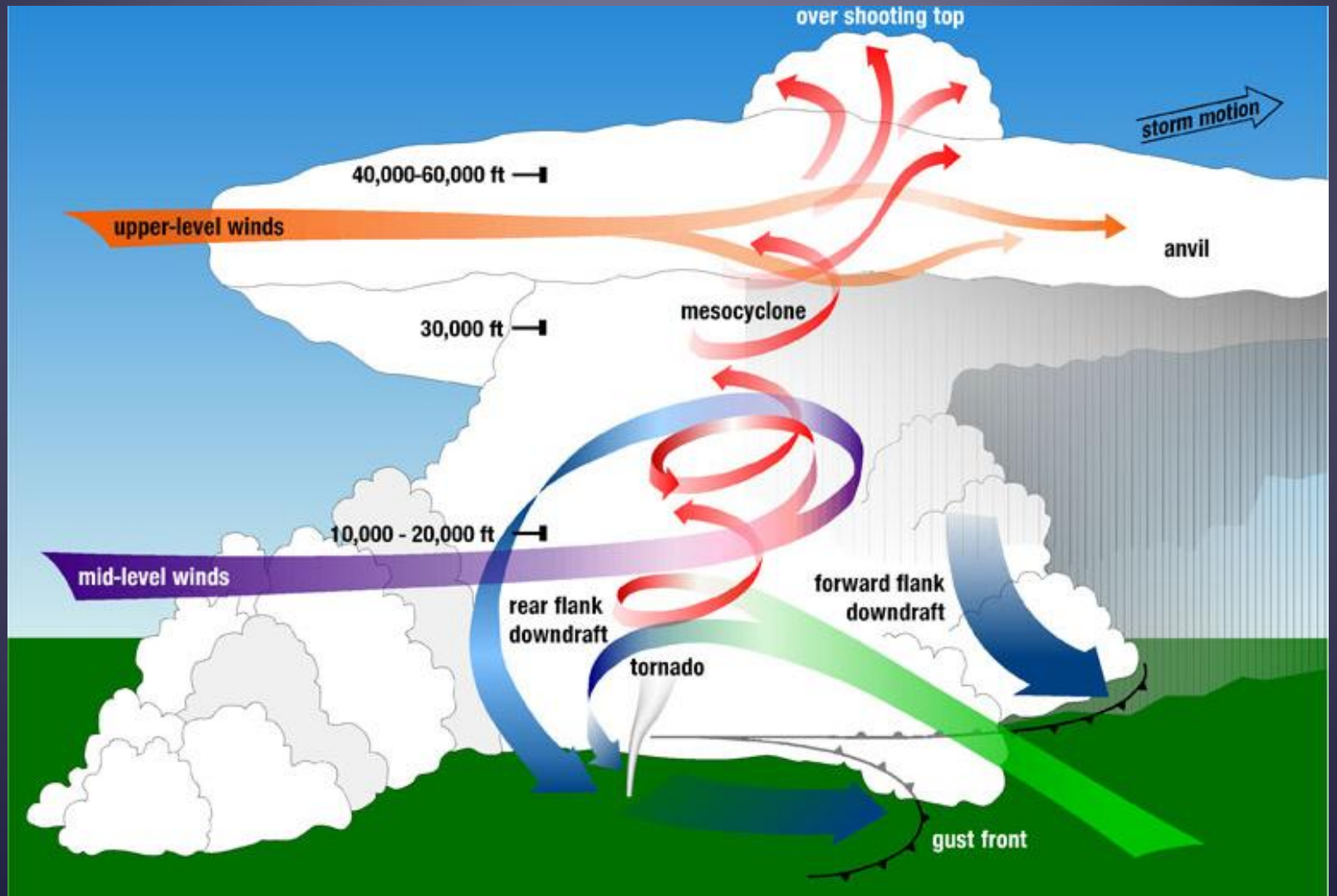
The rotating updrafts in these storms are called “mesocyclones.”

Mesocyclone

- Rotating portion of the updraft within supercell thunderstorms.
- Mesocyclones often are the parent circulation to tornadoes.

Rotating updraft, or Mesocyclone

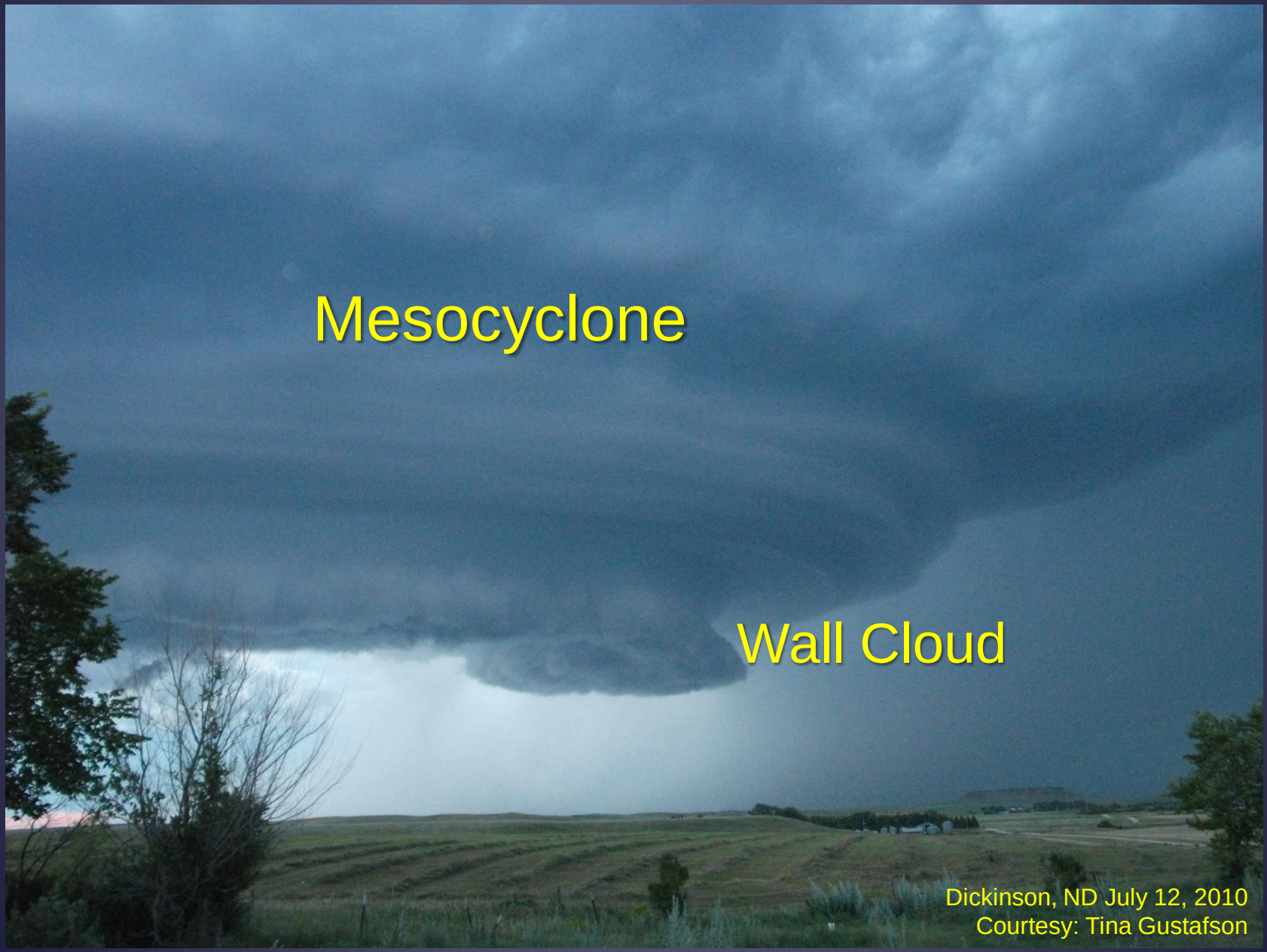
Supercell



Wall Cloud

- A cloud lowering beneath rain-free base, often rotating.
- Marks the updraft at the base of a thunderstorm.
- May precede a tornado.

Mesocyclone & Wall Cloud



Mesocylone

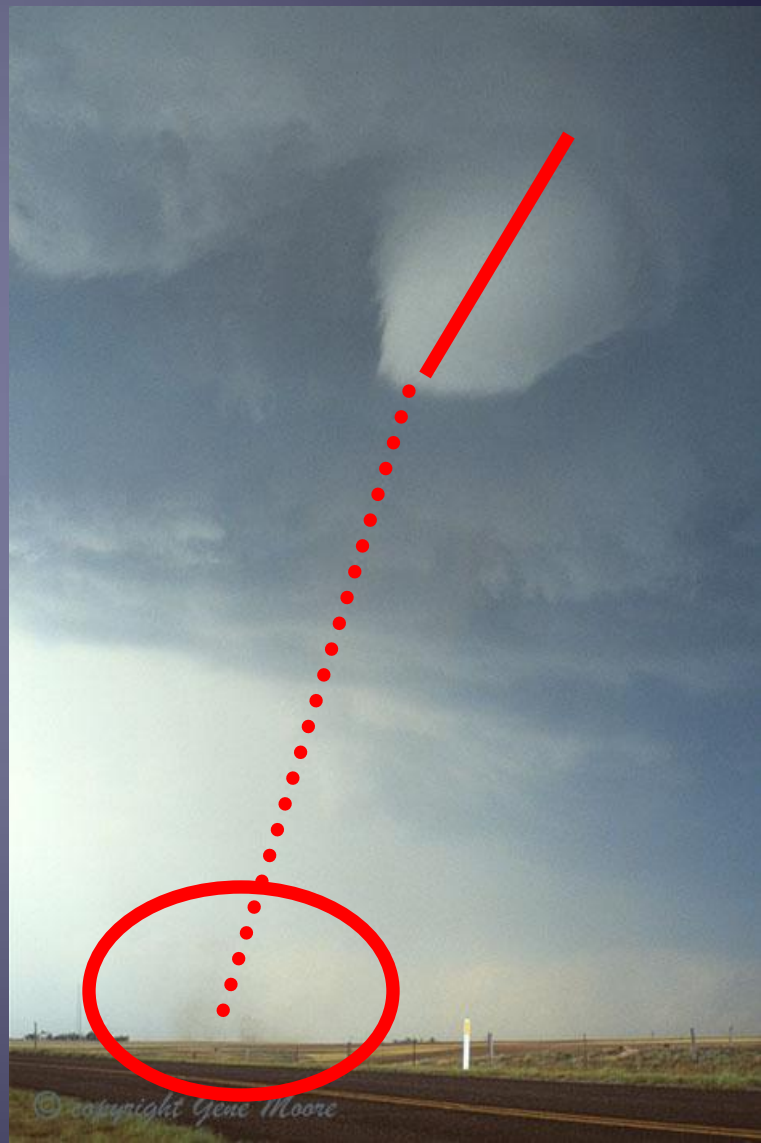
Funnel Clouds and Tornadoes

- FUNNEL CLOUD
  A rapidly rotating funnel-shaped cloud NOT in contact with the ground.

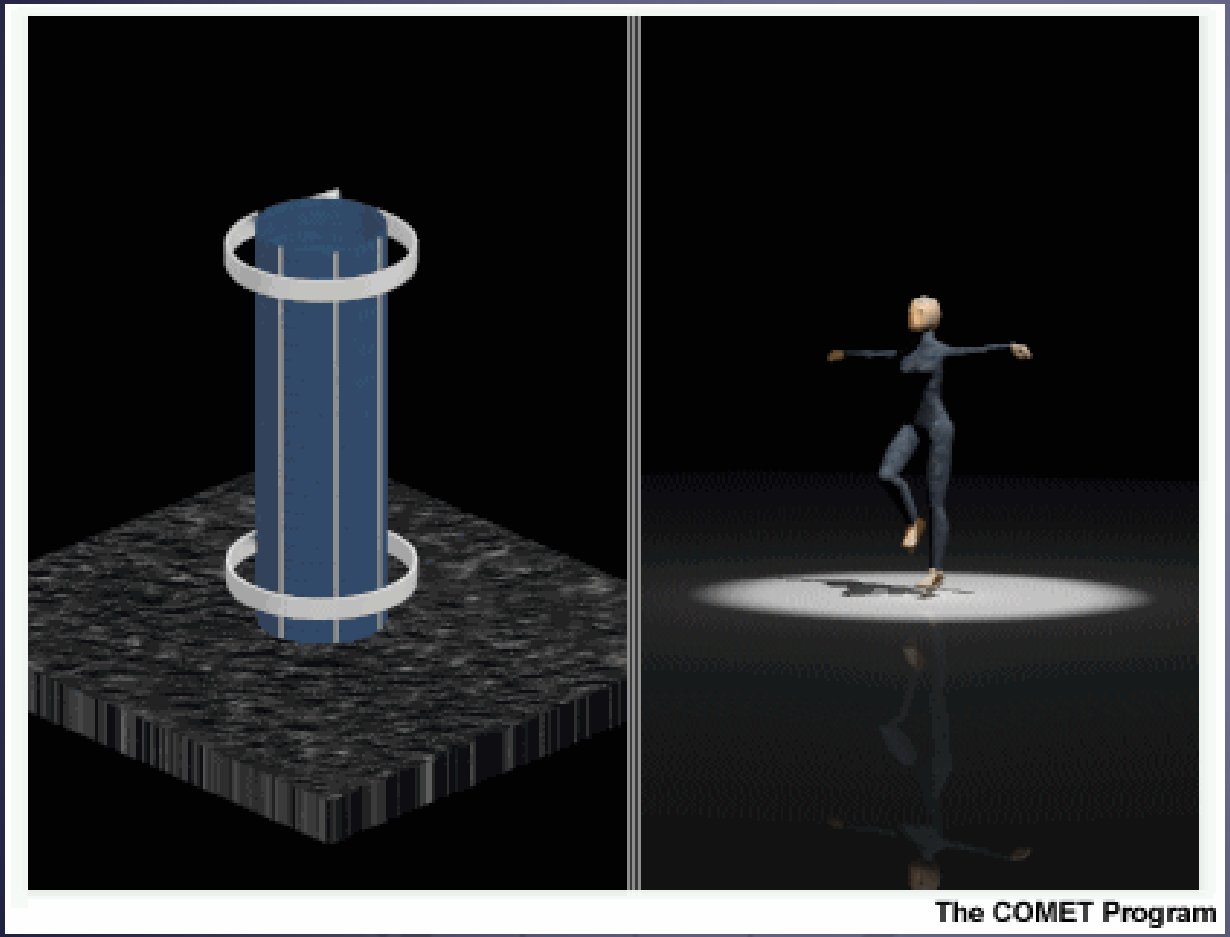
- TORNADO
  A violently rotating column of air extending from a cloud base and TOUCHING the ground.

  Visible funnel NOT needed (look for dust - debris swirling on the ground)

"funnel" + debris = tornado

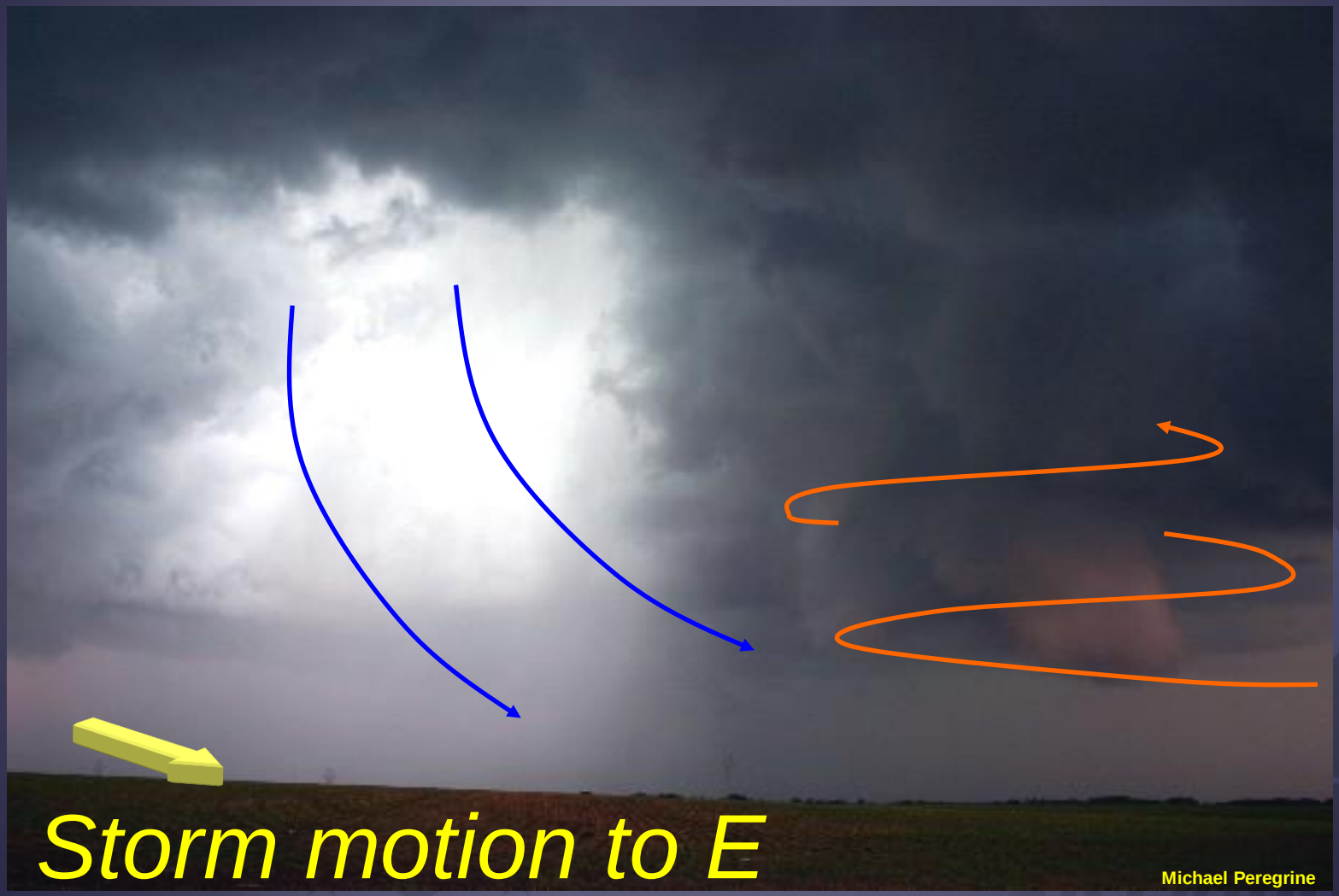


Tornado Formation



- Rotation intensifies as the main updraft core strengthens and is stretched.

The Role of the Rear Flank Downdraft



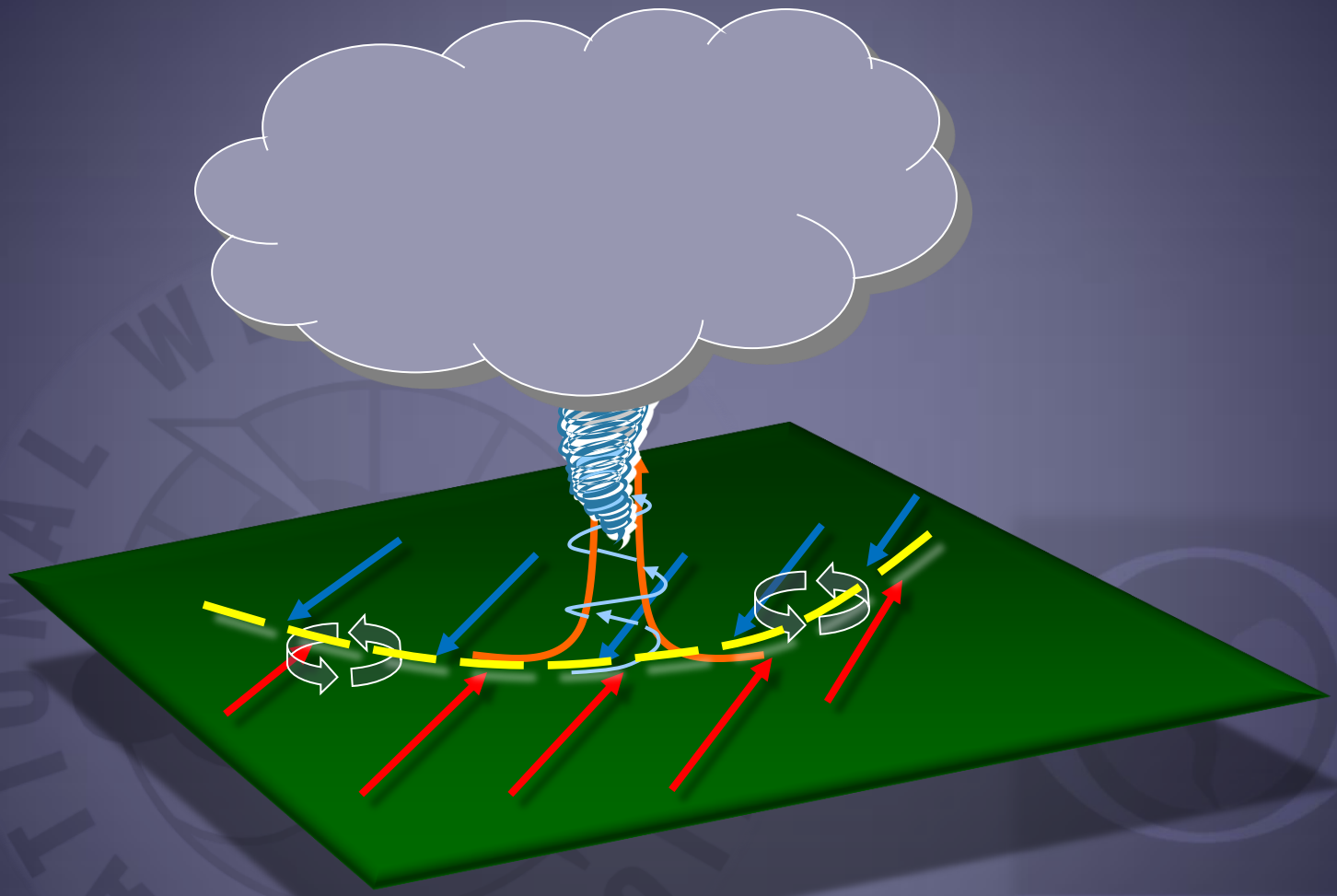
June 17th, 2010 Near Whapeton, ND

Do you need a Supercell to produce a Tornado?

NO! - Tornadoes can form in any part of a thunderstorm

- Landspout
  - Common name for a non-supercell tornado
  - Shallow, surface-based circulation

Landspout Tornado Formation



- Does establish connection with cloud base
- Not normally associated with rotating wall cloud

Microburst / Downburst

- Dry air aloft mixes with falling rain to produce cooling through evaporation
  - Cool air sinks…the cooler the air, the stronger the winds.
  - Any melting hail will add cooling, further accelerating downward motion.

Microburst/Downburst

Due to their small size and short lifetime, microbursts are difficult to detect and warn for!

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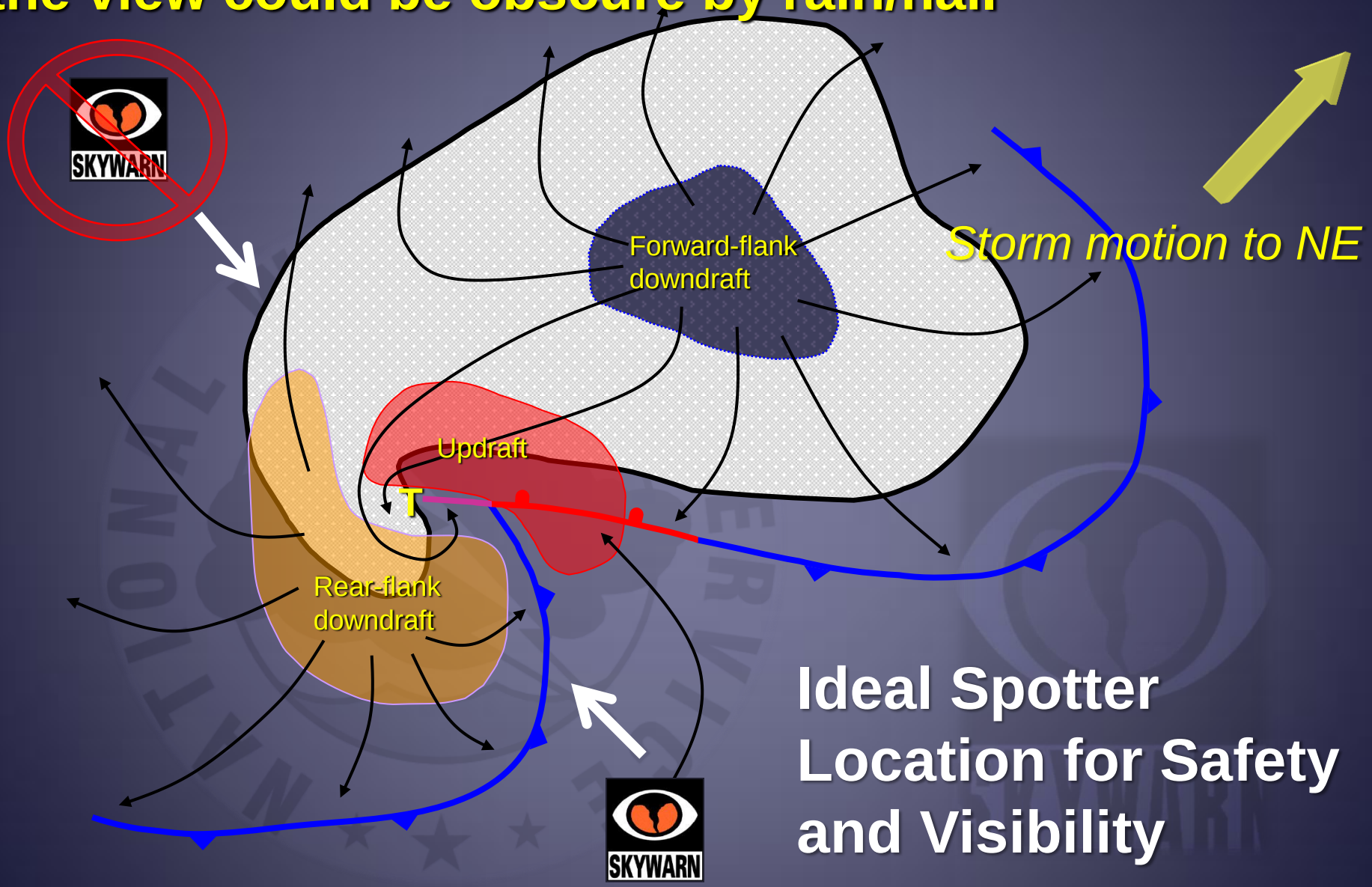
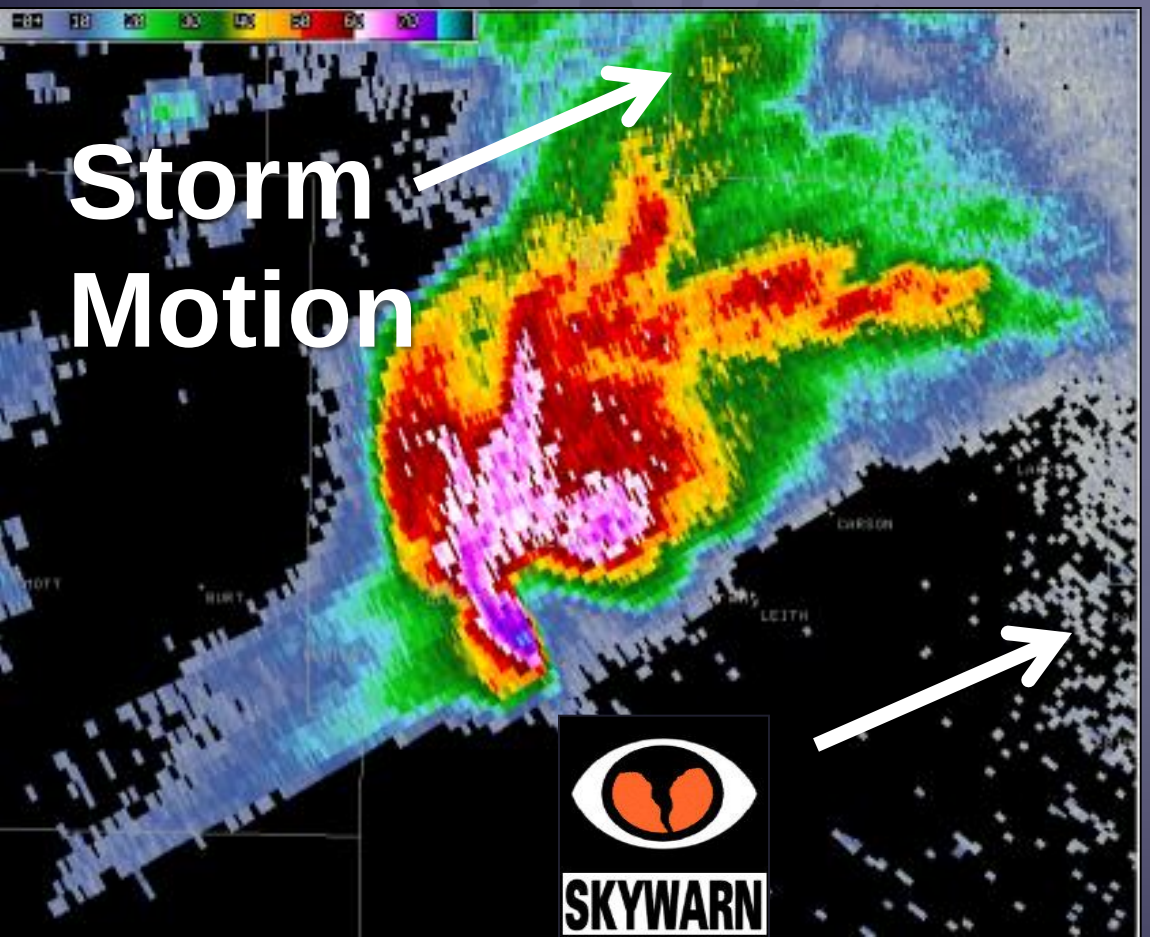
NOT ideal…with storm moving to your left, the view could be obscure by rain/hail



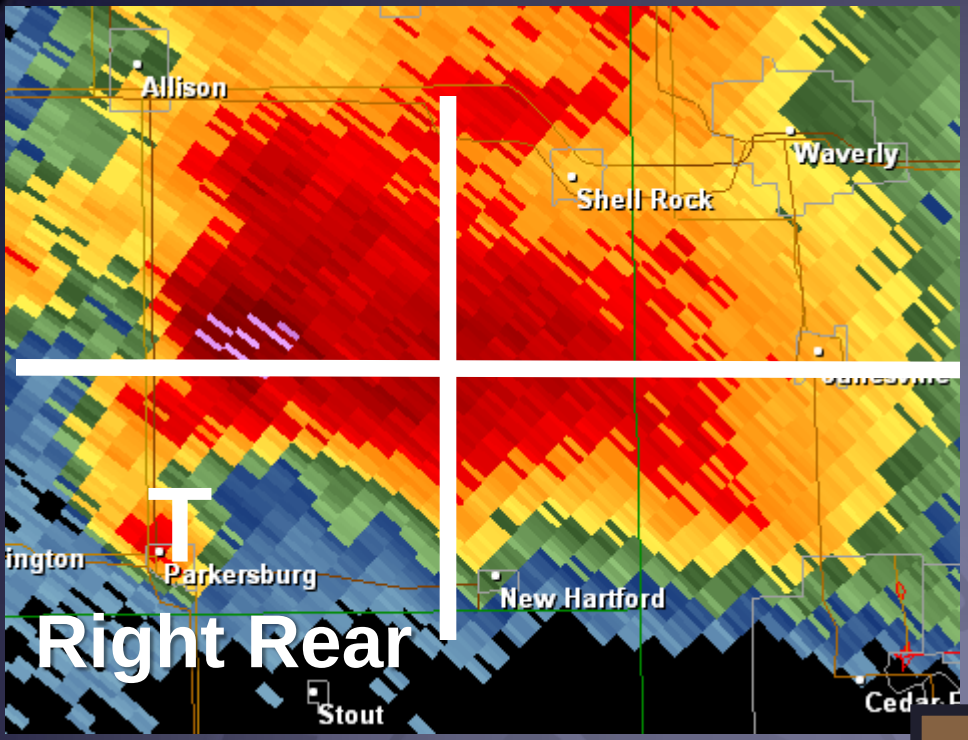
Ideal Spotter Location for Safety and Visibility

Mobile Spotter "Right-Hand Rule"

- Safest and best viewing angle is with the storm moving to your right

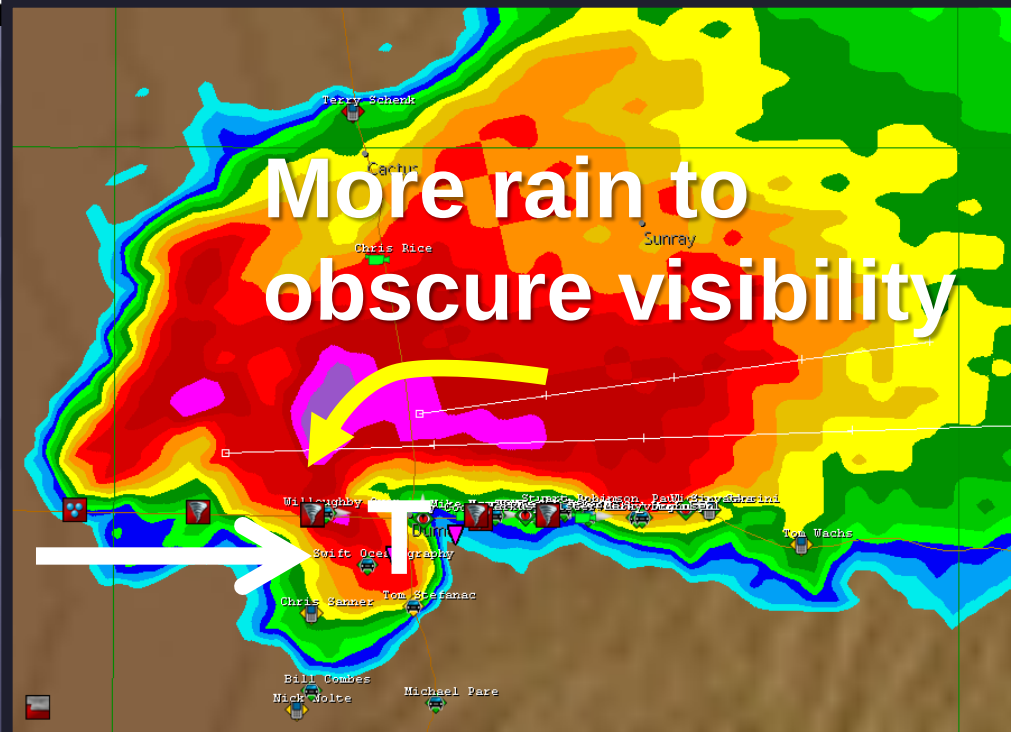


If the storm turns right (E or SE movement) adjust your movement accordingly



Wall clouds and tornadoes are typically located in the right rear quadrant of the storm with respect to their movement

With HP Supercells, the favored area for wall clouds/tornadoes may move more to the middle or forward flank of the storm



Spotter just west of Hazelton

Unfavorable spotting location: Located sw of storm as it was moving away

Spotter located west of tornado as it's moving away… little daylight left

View of tornado from the SE

Visual Clue- Mesocyclone

Tremendous updraft!

Stronger updraft suggests increased storm severity

Looks like Cauliflower

Visual Clue-
Rear Flank Downdraft

Visual Clue-
Overshooting Top

Visual Clues--Tornado Look-a-Likes

- One of the biggest challenges for spotters
- Two key features present with a tornado:
  - debris cloud near the ground
  - organized rotation about a vertical axis
- The rotating, tornadic condensation cloud edges will be fairly “smooth.” Many look-a-likes have a more ragged-looking appearance.

Visual Clues
Low Clouds – “Scud”

Visual Clues
Low Clouds – “Scud”

Visual Clues

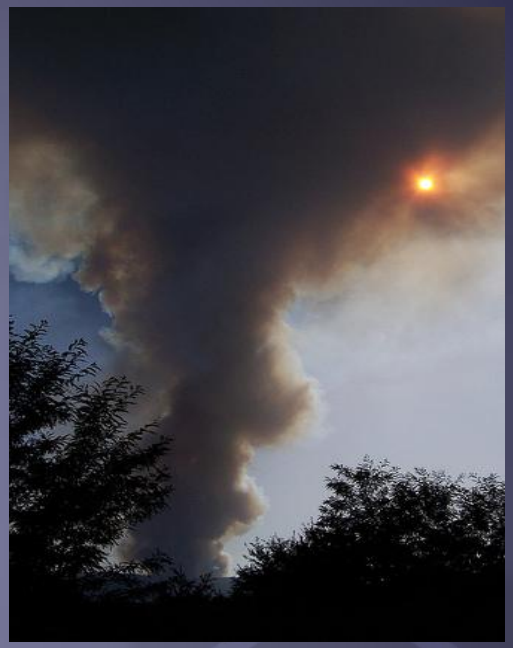
Shelf Cloud – False Funnels

- Most false funnel cloud reports are shelf clouds

Visual Clue

Smoke Plumes

Storm motion to NE



Smooth? Rotating?

Visual Clue

Rain Shafts / Virga

Is this a tornado?

No rotation

Distant rain shaft

True or False

Which ones are tornadoes?

See next slide for answers!

“funnel” + debris = tornado

Likely tornado just N of Oakes

7/10/11

Scud Cloud

- Cloud shreds beneath a thunderstorm. Not organized, may or may not be rotating. Often resulting from condensation as air is drawn into the updraft.

Lyndon Anderson
15N Bismarck, Burleigh
June 18, 2008


Hail Shaft
Courtesy: Erin Huntimer
Hannover / Center, ND
June 22, 2009

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Spotter Reporting Basics

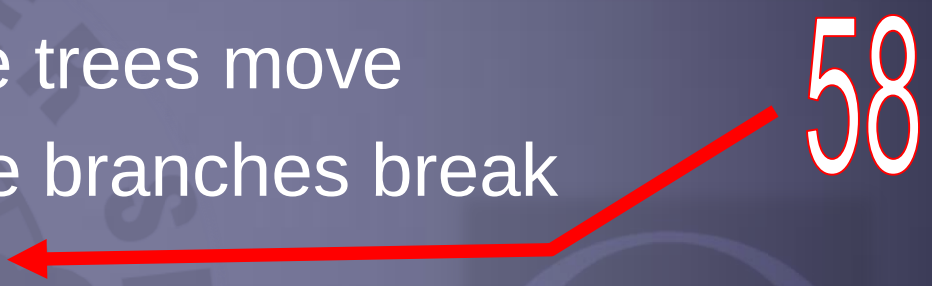
- Who?
- What?
  - Report exactly what you see.
  - Avoid vague descriptions such as ‘rotation’
  - Tell us what is rotating and how it is rotating
- Where are you located and where is the event?
- When did the event happen (now or before)?

- Accurate reports are critical.
- Late reports are better than no reports.
- **800 - 247 - 0212** … Twenty-four hours per day.

Report Wind (40 mph and higher)

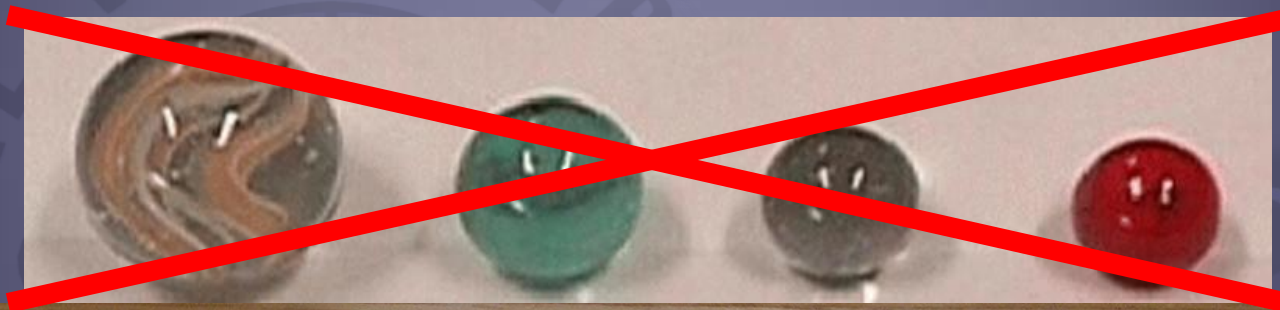
800-247-0212

- Will need to be estimated in most cases.
- Hard to do…round to nearest 10 mph
- 40 mph - large whole trees move
- 50 mph - smaller tree branches break slate blown off roofs
- 60 mph - smaller tree trunks broken or tree uprooted
- 70 mph - structural damage, large tree branches broken
- 80 mph - large tree trunks broken or uprooted



Report Hail 1-800-247-0212

- Hail size - DO NOT reference marbles (too many sizes)
- Hail size – reference objects like coins and balls
- Report the LARGEST stone you find



Which one do I measure / report ?
The LARGEST one!

Report Flooding 1-800-247-0212

- Rainfall of 1 inch or greater in a “storm”
- Flooding that covers roads or threatens property
- River flooding
- Ice jams

Report Severe Winter Weather

Snow

- Report during event & storm total
- Hard to measure if windy. Try to measure in a sheltered area.

Ice

- Freezing rain or sleet
- Serious impact on travel
- Damage (power lines, tree limbs)
- Estimate amount of glazing (½ inch, ¼ inch)

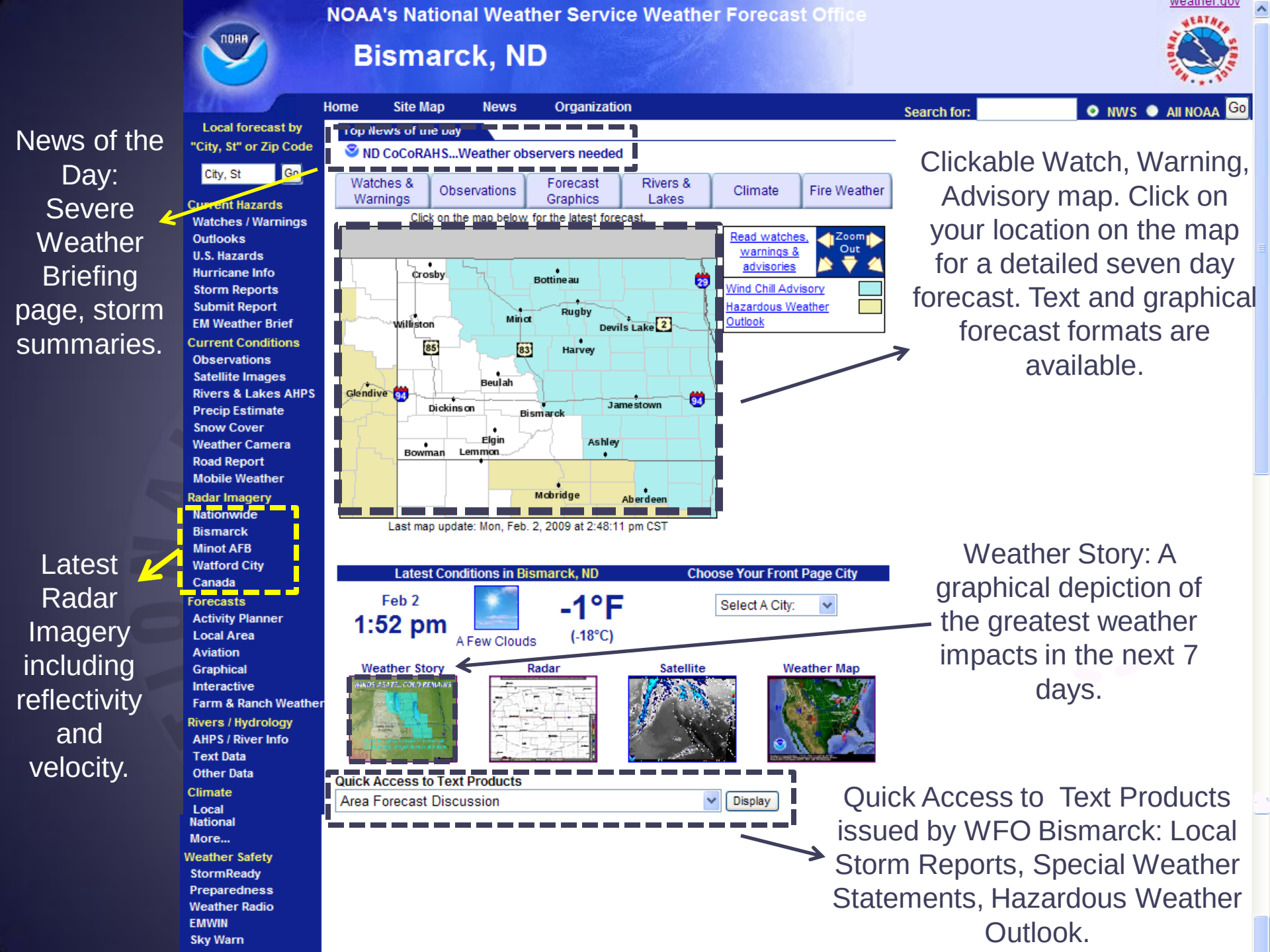
White Lake, MI
4-4-2003

Agenda

- What is a SKYWARN Storm Spotter?
- Severe Weather Definitions and Products
- 2011 Re-cap
- Thunderstorm Basics
- Thunderstorms In-Depth
- Spotter Positioning and Visual Clues
- Reporting Severe Weather
- Spotter Preparedness
- Thunderstorm Hazards / Safety

Spotter Preparedness For Severe Weather

- What is the main threat?
- When is the best chance?
- Where is it expected to happen?



News of the Day: Severe Weather Briefing page, storm summaries.

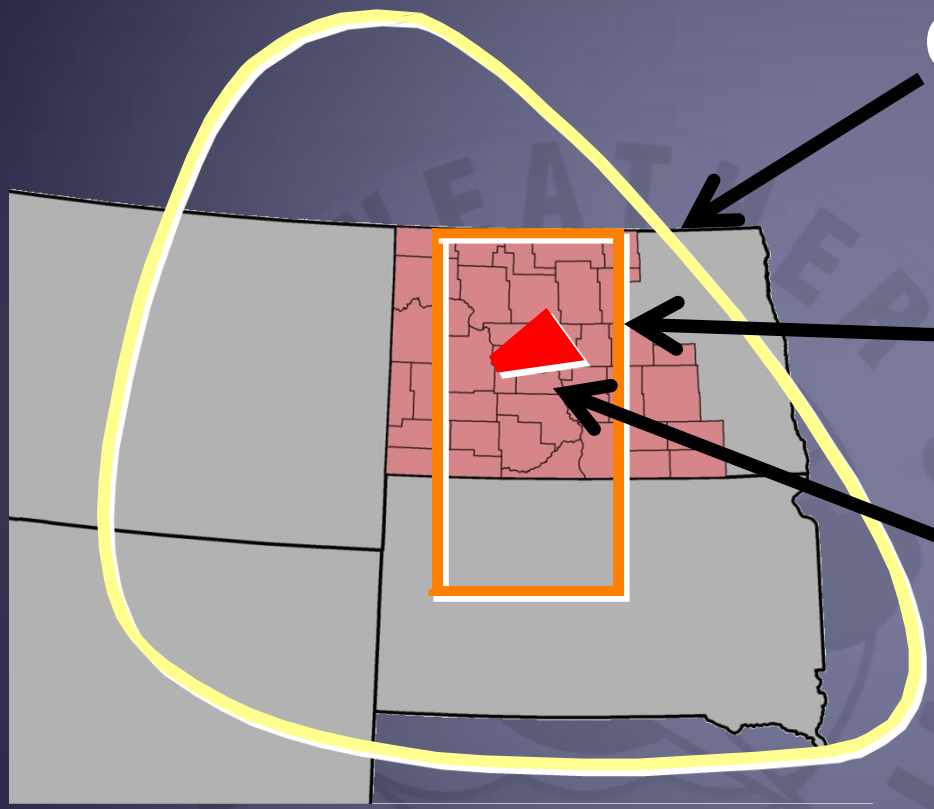
Latest Radar Imagery including reflectivity and velocity.

Clickable Watch, Warning, Advisory map. Click on your location on the map for a detailed seven day forecast. Text and graphical forecast formats are available.

Weather Story: A graphical depiction of the greatest weather impacts in the next 7 days.

Quick Access to Text Products issued by WFO Bismarck: Local Storm Reports, Special Weather Statements, Hazardous Weather Outlook.

NWS Information



Outlook

- Several days in advance
- Large area
- Graphical & Text

Watch

- 2-6 hours
- Smaller Area

Warning

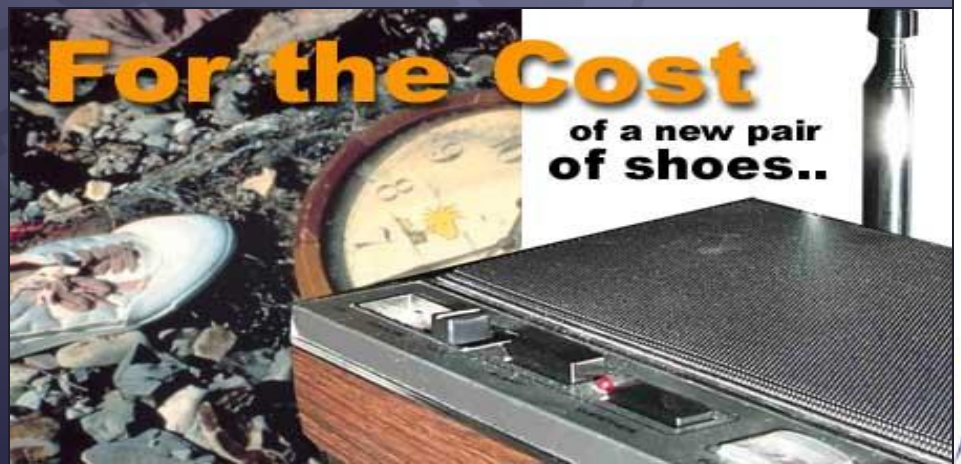
- 30-60 minutes
- Storm / county size

Storm Prediction Center

www.spc.noaa.gov

NOAA Weather Radio All Hazards

- 24 hour a day weather information (Direct from the Bismarck NWS Office).
- Emergency weather AND Non-weather messages.
- Built in alarms to alert you.
- Some have SAME (Specific Area Message Encoding) code technology.
- Well worth the price ($40 to $100).



All Hazards
NOAA
Weather Radio
NOAA's National Weather Service™

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Tornado Safety (If Outside)

- Get inside a sturdy structure if possible
- If you cannot get inside, get into a ditch or low lying area
- Protect your head, neck and spine
- Never try to outrun a tornado, especially in traffic

Tornado Safety (If in a Building)

- Go to the basement if available
- Get under the stairs or sturdy furniture
- If no basement, go to the center of the lowest level
- Stay away from windows (do not open the windows), gymnasiums or large auditoriums
- Protect your head, neck and spine

Tornado Safety (Mobile Home)

- Mobile homes offer little shelter
- Leave your mobile home and seek a storm shelter or nearby permanent building
- Plan ahead of time
- 40% of tornado deaths occur in mobile homes

Speaking of Tornado Safety…

Hope, ND June 17, 2010

Look at what is behind you!!

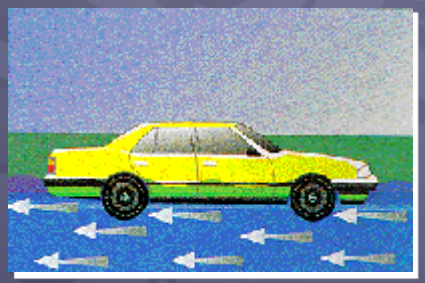
Worst tornadoes (deaths and injuries) occurred…

- Outside of normal season
- On a weekend
- At night
- At mobile home park

This implies that **PREPARATIONS** and reliable spotter reports **SAVE LIVES!**

Flash Flood Safety

- Be especially cautious at night!
- **2 feet of water can float vehicles.**
- 6 inches of fast moving water will knock you off your feet.
- Turn around – Don't drown!
- Use common sense.



Lightning Safety

- STAY AWAY FROM...Tall objects, trees, railroad tracks, barbed wire fences, electrical appliances, wall phones (unless emergency)
- NO bath, shower, or outdoor activities!
- Flash-to-Bang…5 seconds = 1 mile.
- Wait 30 minutes before heading back outside.





Lightning Safety

A vehicle with a metal shell acts as a conductor and deflects the electrical energy away from the occupants

Weather Safety

Your safety is
ALWAYS
more important
than a spotter
report!

Ways to Become a Skywarn Spotter

1. Attend a Skywarn Spotter Talk

2. Contact your local Emergency Manager

3. Contact the National Weather Service
   - For West and Central ND, call 701-250-4224

4. Review the Training Materials


SKYWARN
Thank YOU!
Please sign up to be a spotter!
National Weather Service
Bismarck, North Dakota
NATIONAL WEATHER SERVICE