

NOAA'S National Weather Service



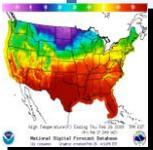
Advanced Concepts of *Severe Storm Spotting*

2012 – Rusty Kapela
Milwaukee/Sullivan
Weather.gov/milwaukee

Doug Ratlik
East of Madison
Dane County
June 23, 2004

Problems Spotters Encounter

- **Every storm is different – the classic text-book images, graphics, and video clips you see in this presentation will most likely not be seen all the time in the real world.**
 - *Many spotters have said “things always look different in the field.”*
- **If the storms are moving rapidly you will not have much time to recognize the important features and “put it all together”**
 - *this is when you are likely to make a mistake!*



The Big Picture

- Spotters should self-educate themselves with on-line educational material, courses, Top News of the Day stories, SkyWarn pages, etc.
- The NWS Southern Region Office has an on-line School for Weather entitled “JetStream”

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weather.gov

National Weather Service
JetStream - Online School for Weather

Go to: Topic Matrix NWS Home Weather forecast by "City, St" or zip code City, St Go

Jetstream Topics

1. Why JetStream?
2. The Atmosphere
3. The Ocean
4. Global Weather
5. Synoptic Meteorology
6. Thunderstorms
7. Lightning
8. Tropical Weather
9. Doppler Radar
10. Remote Sensing
11. Weather on the Web
12. The National Weather Service
13. Appendix

Additional Info:
Lesson Plan Overview
Topic Matrix
JetStream News



Nova Scotia and the Bay of Fundy are featured in this image, acquired January 23, 2010 by the MODIS on the Aqua satellite. Nova Scotia, a Canadian province, is the long peninsula that runs diagonally across the image. Snow covers the ground.

The Bay of Fundy is on the western side of the island. Note the reddish coloration near the northern coastline of the Bay. In this image, much of the red coloring is in the sub-bays - Chignecto Bay is the one to the north. Minas Basin and its eastern portion, the Cobequid Bay, make up the more southern inlet of the two you see here.

The color of the water is due to sediment caused by tides. The Bay of Fundy has the highest tides in the world - the water can rise and fall as much as 50 feet each day! During each tidal cycle, huge quantities of fine sediments are brought in to flood the coastal area. Much of the sediment remains in the sheltered areas along the coast, forming the famous red mudflats of the upper Bay. [Learn more about the Bay of Fundy.](#)

Credit: Jeff Schmalz; [MODIS](#) Land Rapid Response Team, NASA GSFC [Click to enlarge.](#)

<http://www.srh.weather.gov/jetstream/index.htm>



➤ **COMET on-line spotter courses (two)**

https://www.meted.ucar.edu/training_course.php?id=23



Thunderstorm Development

National Weather Service



Iowa State University
MesoNet

Video is time lapse fast forward



Types of Thunderstorms

Single
Cell

Multicell
Cluster

Multicell
Line

Supercell

Weak updraft
(non-severe
or severe)

Moderate
updraft (non-
severe
or severe)

Moderate
updraft (non-
severe
or severe)

Intense updraft
(Always severe)

**Mesocyclone -
Rotating updraft**

Slight threat

*Moderate
threat*

*Moderate
threat*

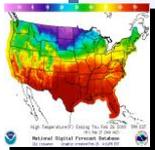
High threat



Single Cell Storms



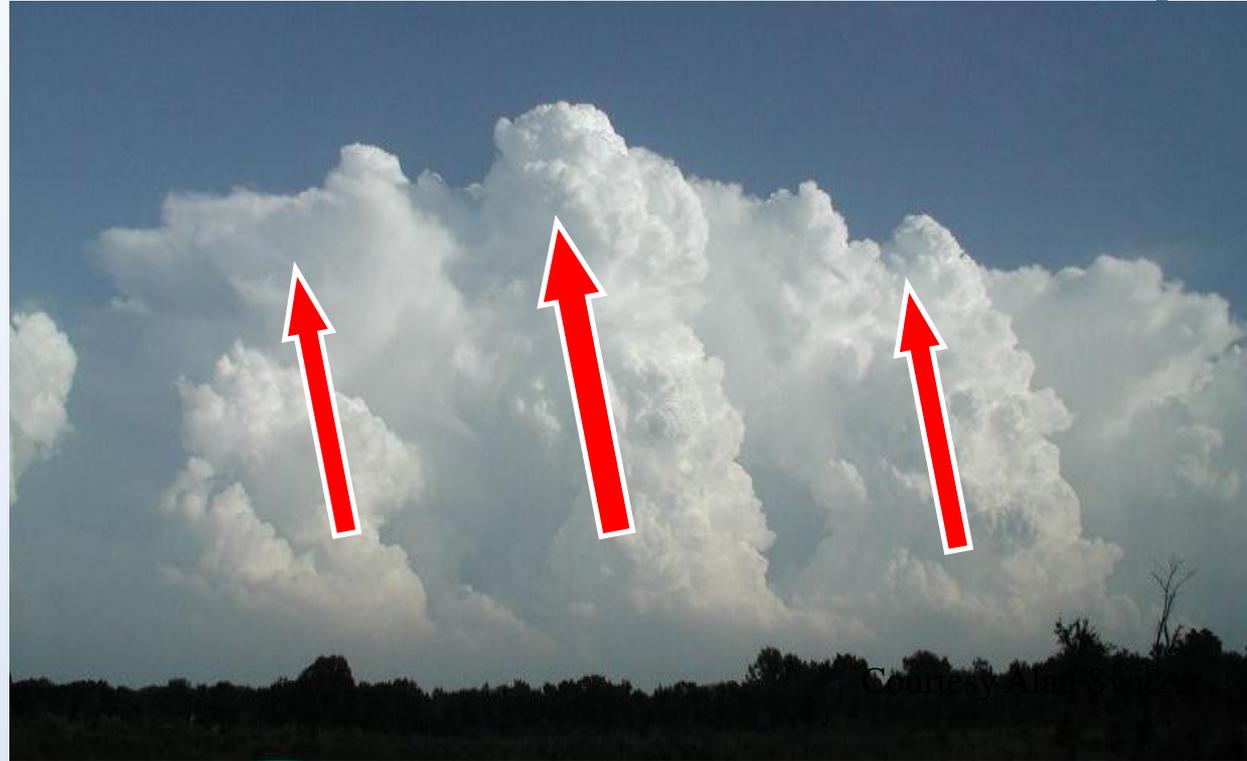
May produce brief severe events



Multi-cell T'storm Clusters

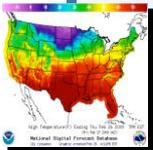
Ordinary non-organized storms with low severe threat

Each cell lasts 20-30 minutes, but a cluster can last for hours



Heavy rain is the main problem

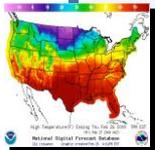
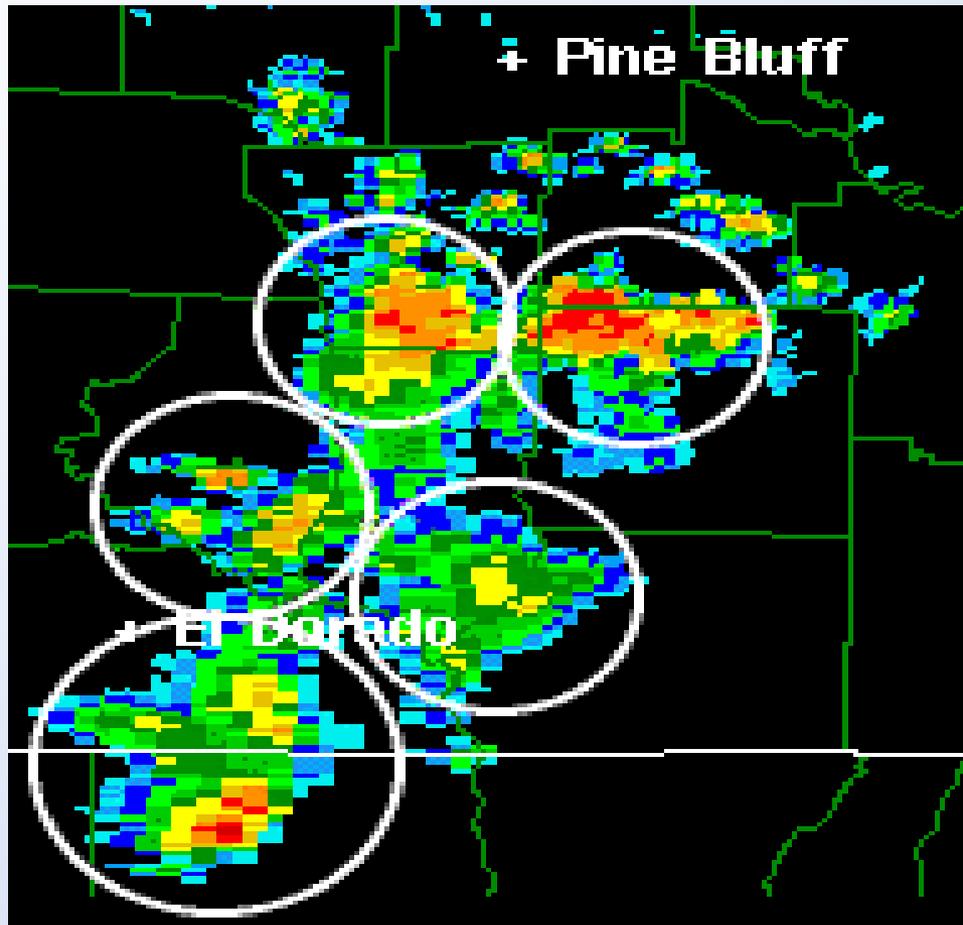
However, strong winds, small hail and weak tornadoes are possible



Multi-cell Thunderstorms

Ordinary non-organized storms with low severe threat

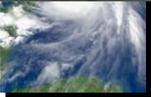
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Multi-cell (Squall) Line

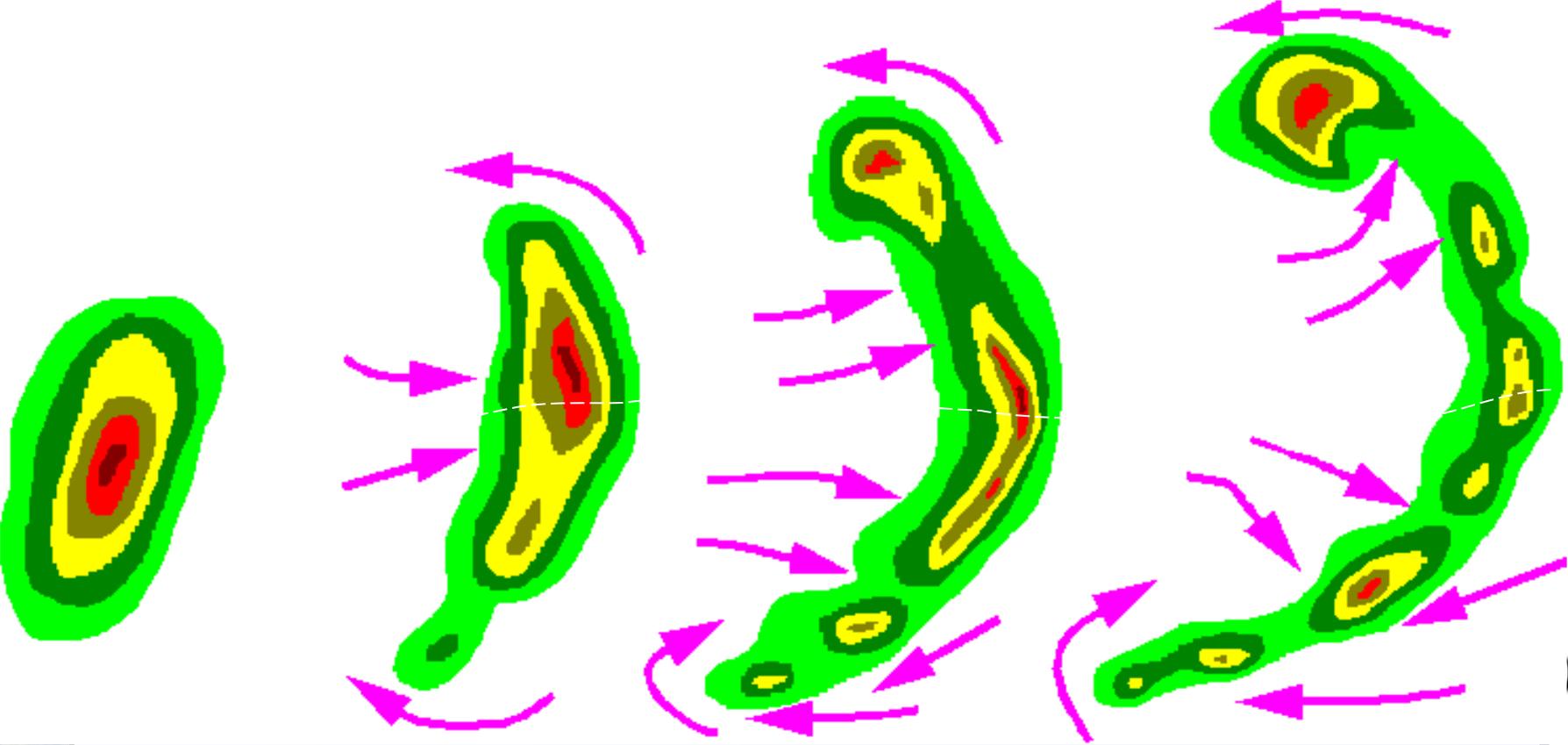


- Leading edge of Squall Line usually marked by shelf cloud. Do not report shelf clouds.
- What to expect
Strong and possibly damaging wind
Heavy rain/hail



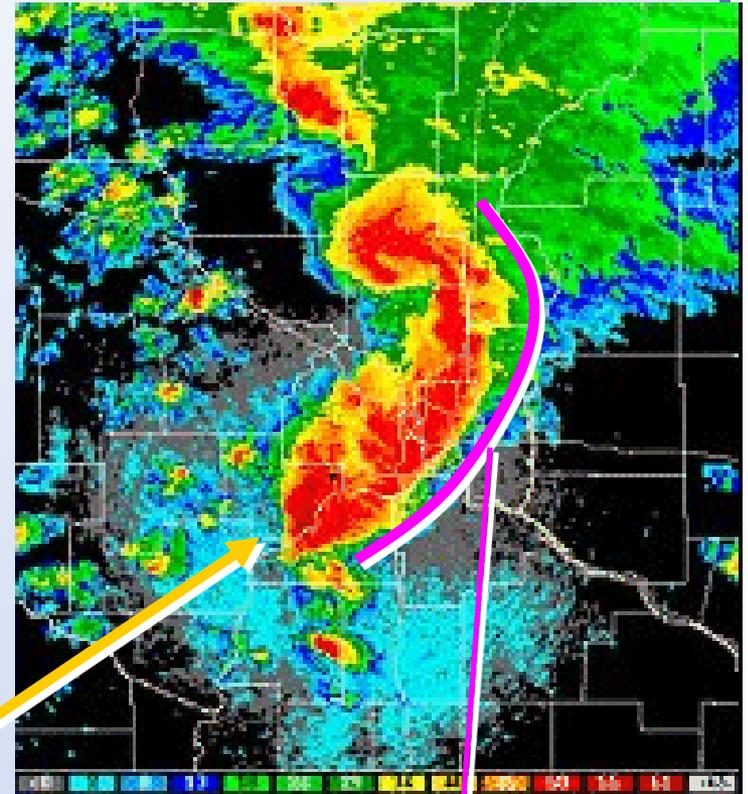
Multi-cell Line (Bow Echo)

National Weather Service



Squall Line - Bow Echo

This shelf cloud is ahead of bow echo on right!



Storm moving left to right (W-E)

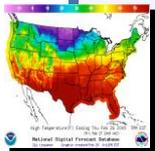
Well-developed shelf cloud is found on front side of line



Rain Foot



Rain Foot = Strong downburst winds

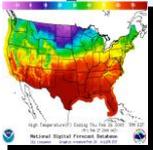


Hail Shaft

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Copyright Paul Craven



“Classic” Tornado

ice
erty



Near Central City, IA, Apr 26, 2009



Wedge Tornado

TwisterChasers.com

©2010 - Shannon Lupton

MSSL Photo

©2003 D. Lewison www.facethewind.com

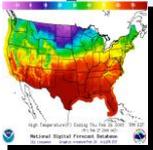
They look wider than the distance from the ground to the cloud base



Rope Tornado



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Supercell

Main Features

Overshooting Top



Anvil

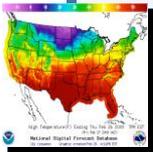


Rotating & Tilted
Updraft
(Meso-cyclone)

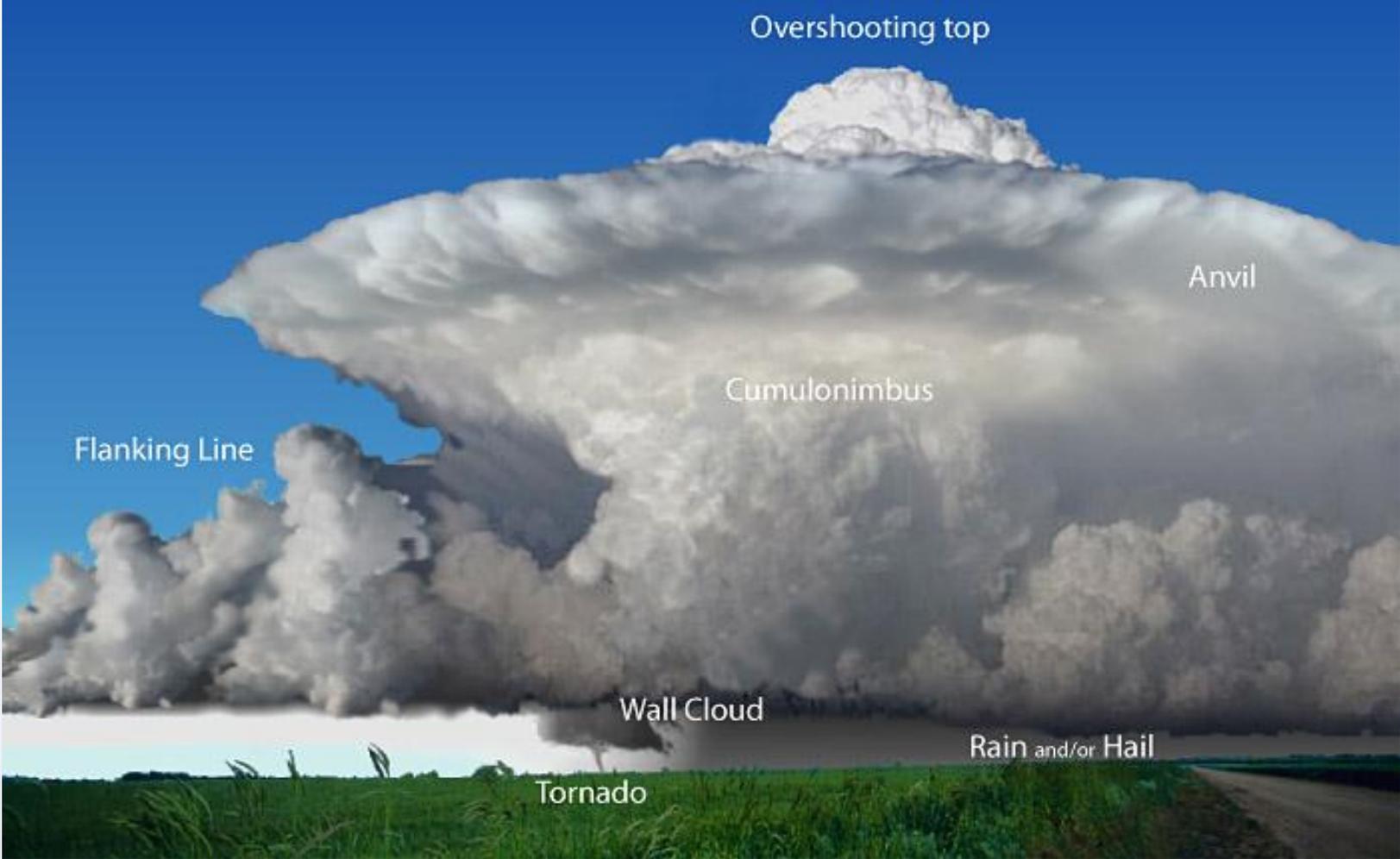


Supercell Thunderstorm

- Contains a rotating updraft called a mesocyclone
- Only about 10% of radar-detected meso's are associated with a tornado
- Produce large hail, high winds, and strong to violent tornadoes
- Can last for several hours



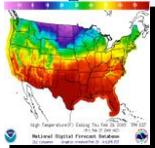
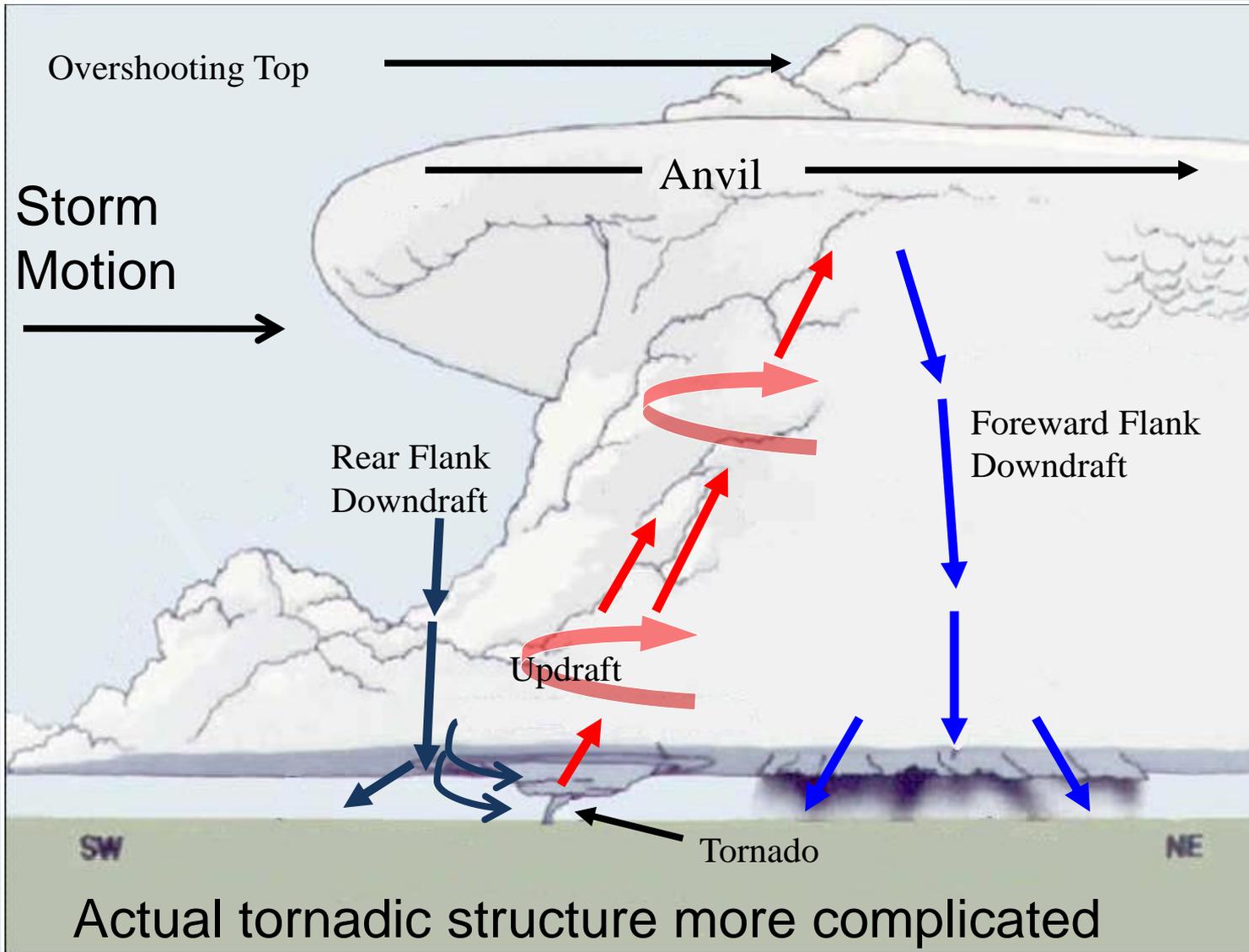
Supercell



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Tornadic Tstm Structure



Supercell

Main Features

Rear Flank
Downdraft

Forward Flank
Downdraft



Rain Free Base

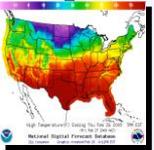
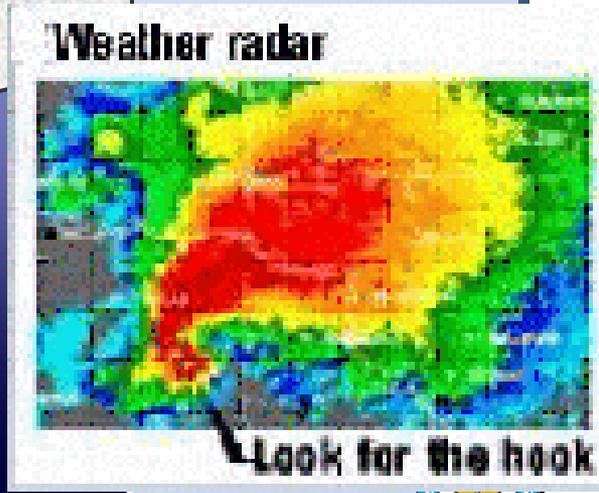
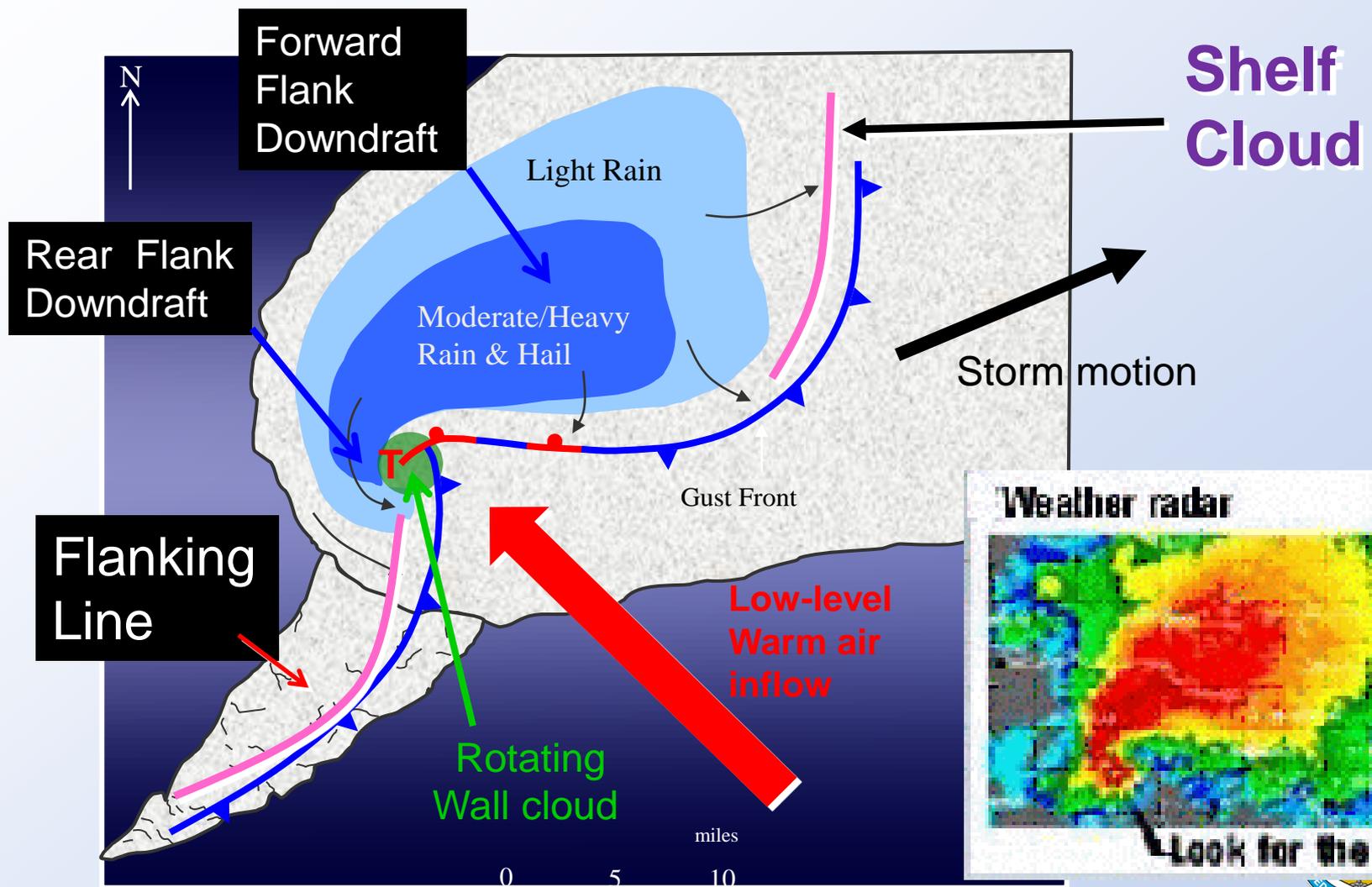
Wall Cloud

National Weather Service



Tornadic Supercell Thunderstorm

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Wall Cloud

Movement 

RFD

Wall Cloud

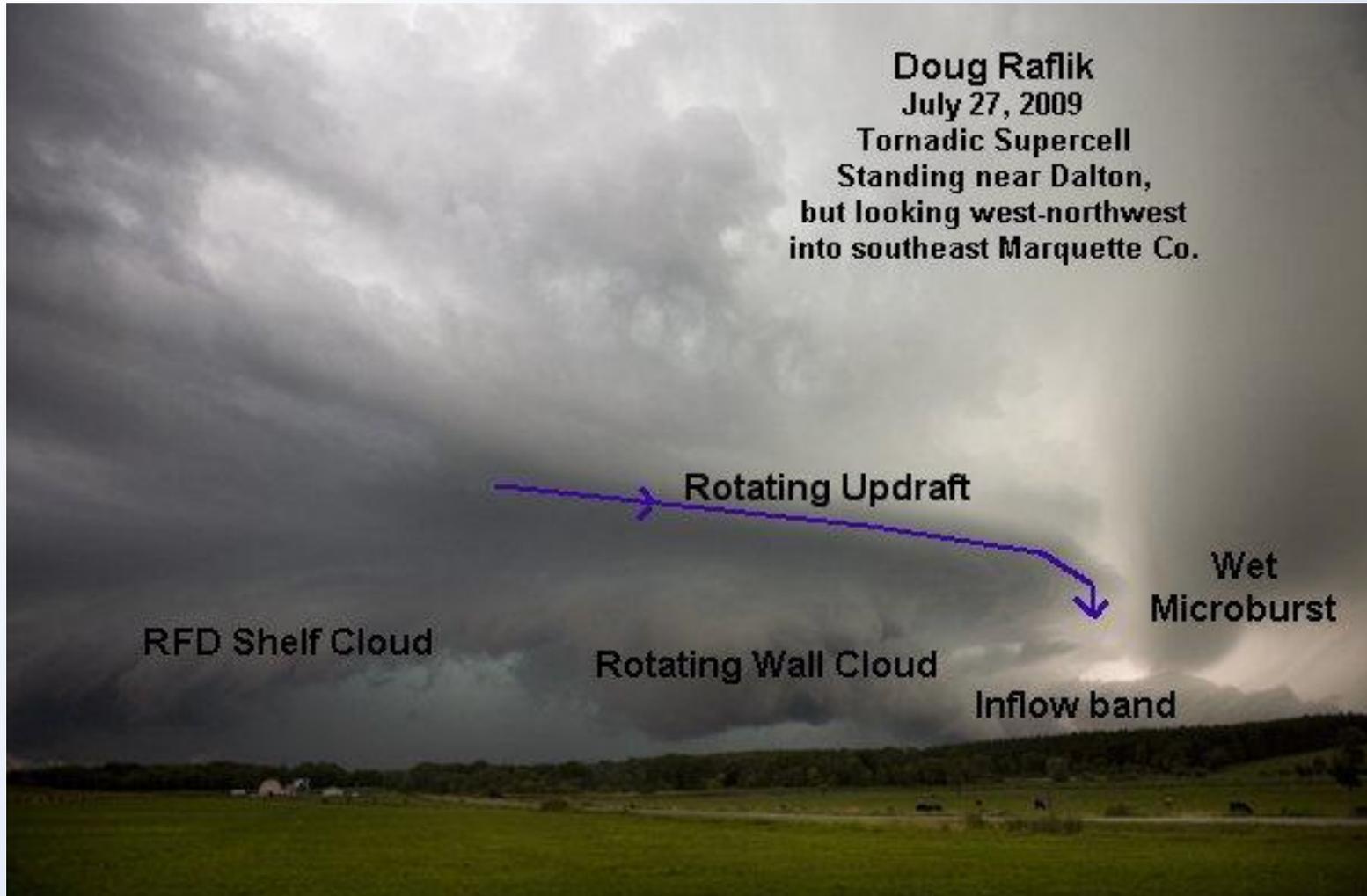
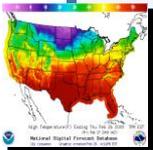
Beaver Tail

FFD

©2009 – Shannon Lupton



Supercell Features



Wall Cloud & RFD & FFD

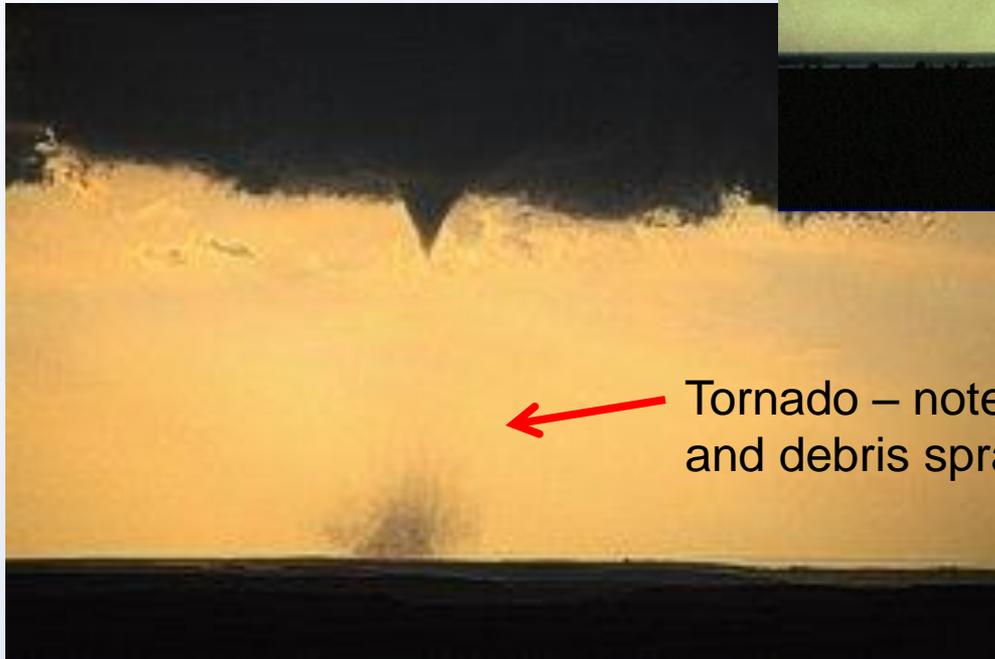


What a difference a few minutes can make!

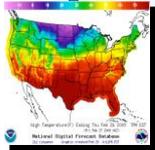




o – note condensation funnel and spray at ground



← Tornado – note condensation funnel and debris spray at ground



Storm Evolution

Mike Hollingshead
July 13, 2009
Kodoka SD to Valentine NE



©www.extremeinstability.com



Rotating
Wall Cloud

©www.extremeinstability.com



Storm Evolution

Mike Hollingshead
July 13, 2009
Kodoka SD to Valentine NE



RFD

Tornado



Storm Strength Clues

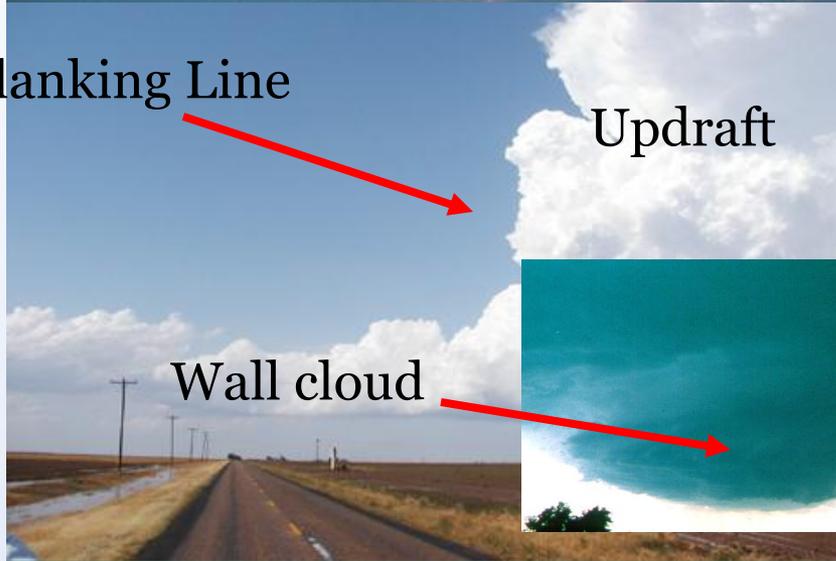


Overshooting Top

Flanking Line

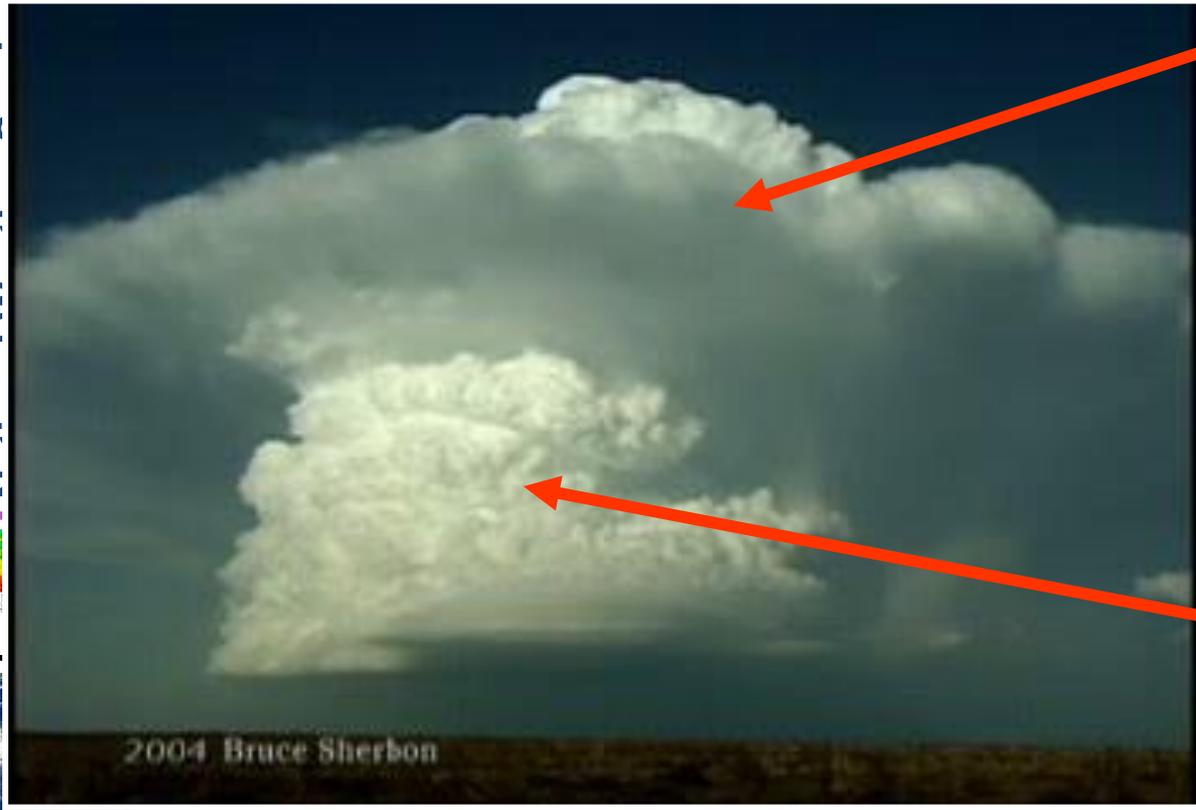
Updraft

Wall cloud



Evaluating the Surroundings

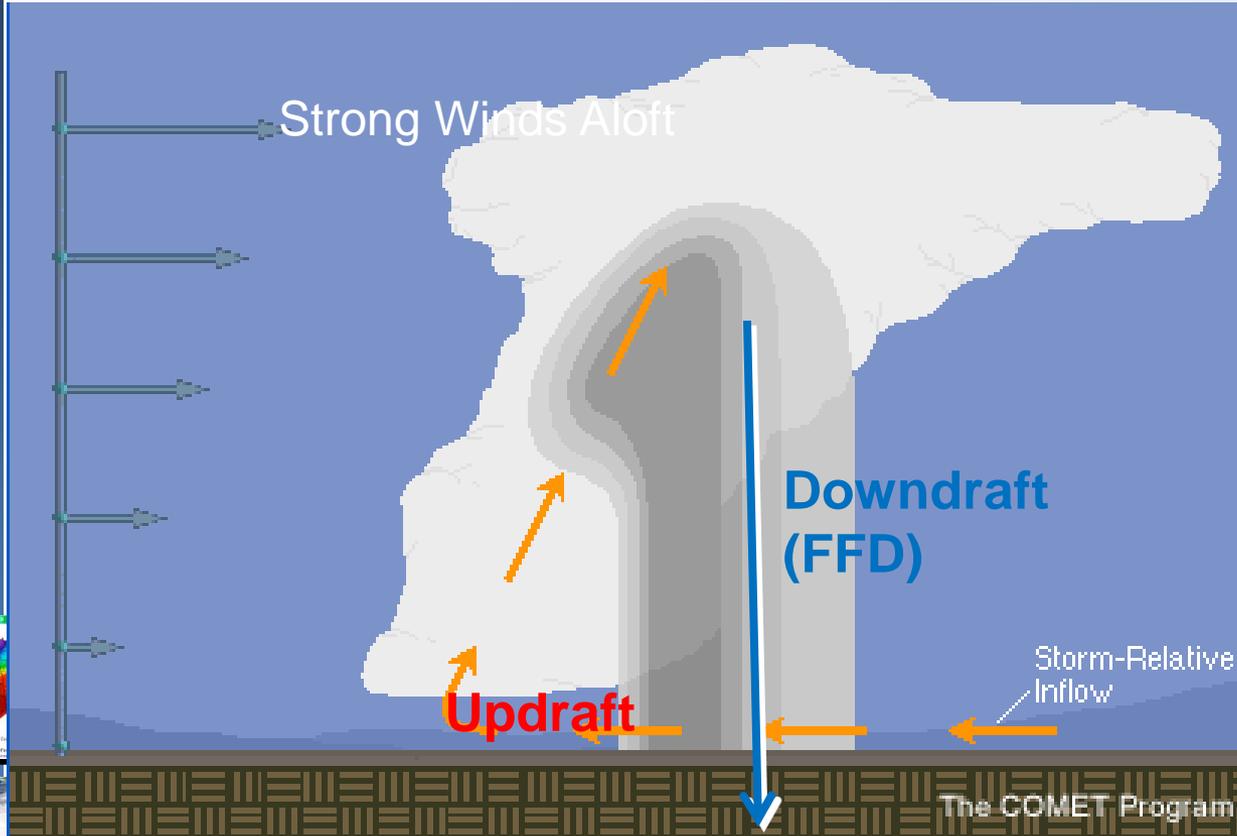
A thick, crisp anvil is another sign of a strong updraft



An indication of a rapidly intensifying storm!



Updraft Tilt

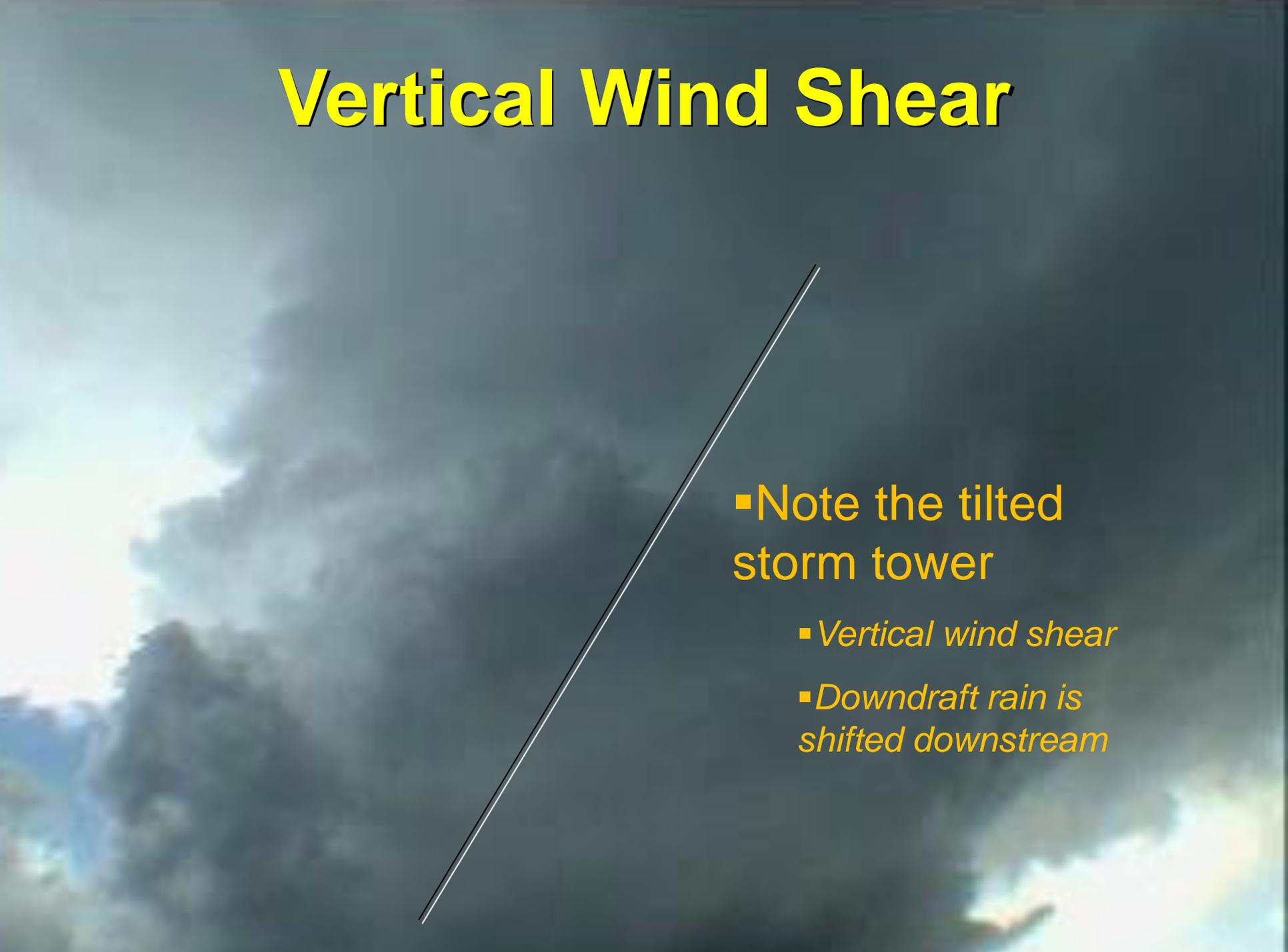


Tilted updraft allows most of rain to fall downstream outside of updraft area.

Updraft isn't choked off by rain-cooled air and lives for more than an hour!



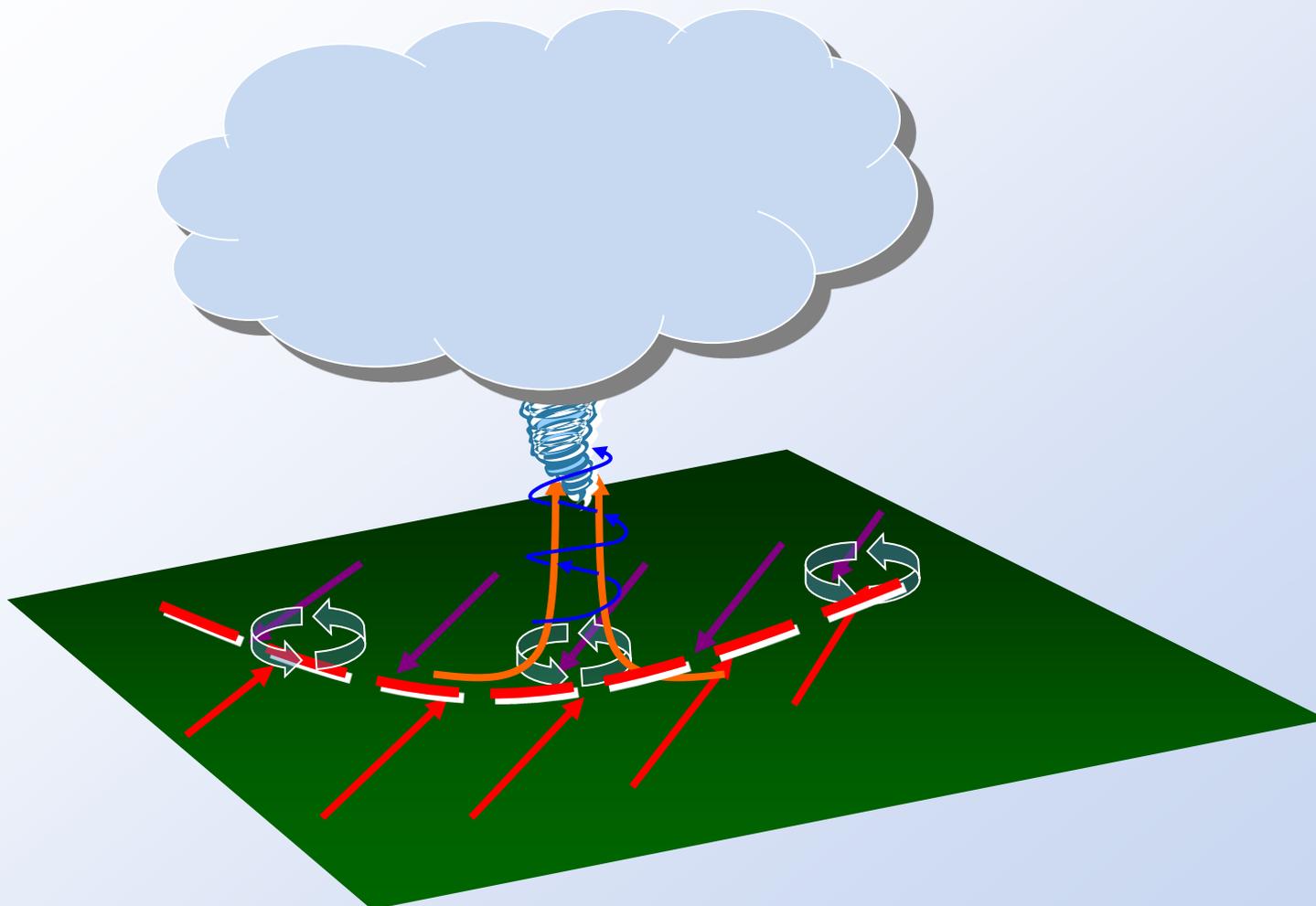
Vertical Wind Shear



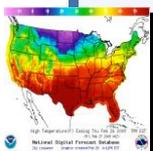
- Note the tilted storm tower

- *Vertical wind shear*
- *Downdraft rain is shifted downstream*

Landspouts



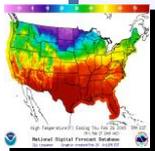
Non-Supercell – no rotating wall cloud or mesocyclone – circulation starts at ground and builds upward



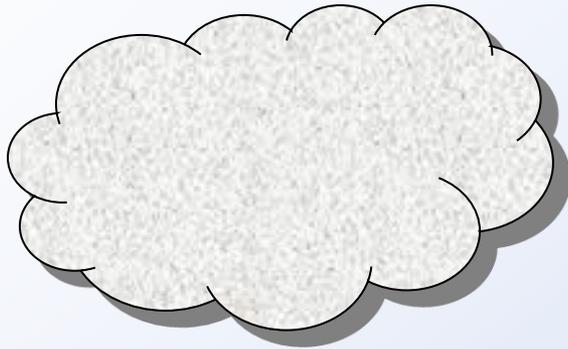
Landspout Tornado



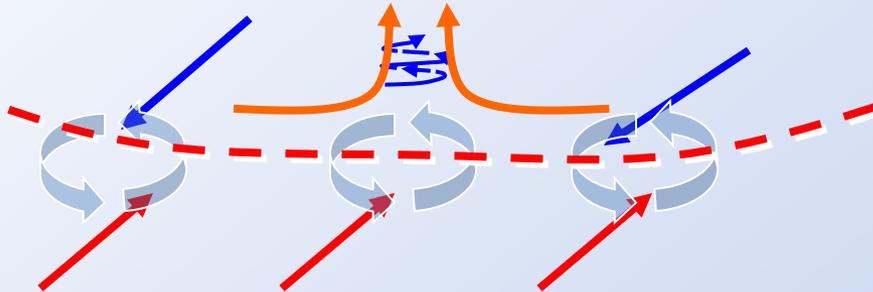
Weaker than a supercell tornado



Gustnadoes



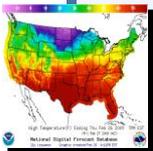
- Aren't tornadoes since they don't extend to the cloud base
- Form along gust fronts
- Shallow vortices
- Report as "gustnadoes" if confident, otherwise report as thunderstorm wind damage if damage occurs



Gustnado



Weak, short-lived, ground-based vortex on gust front



July 22, 2010



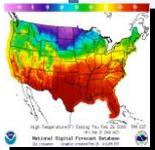
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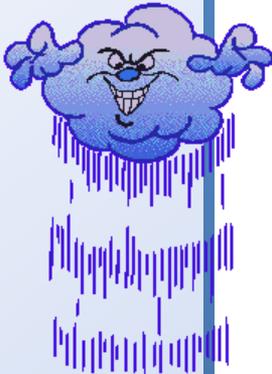
Albion Tornado
Dima Smirnov & Dan Henz
UW- Madison



Albion storm after tornado ended
Dima Smirnov & Dan Henz
UW- Madison

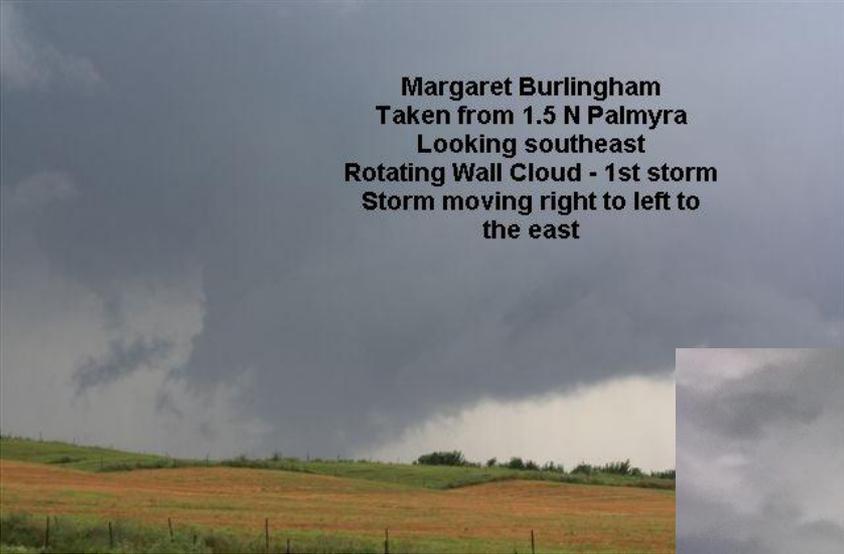


July 22, 2010



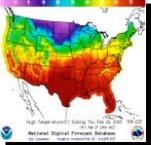
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Margaret Burlingham
Taken from 1.5 N Palmyra
Looking southeast
Rotating Wall Cloud - 1st storm
Storm moving right to left to
the east



Andrew Pritchard
July 22, 2010
Hwy 59 and N
NW of Milton
Rock County
Looking NE

© Andrew Pritchard - PrairieStormMedia.Com



End of Class!

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