# TEXT YOUR ZIP CODE TO 888777

# TO REGISTER: GO TO www.nixle.com

nixle

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- Click **"Sign Up"**
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- Enter an email address and cell phone number where you would like to receive messages and make a selection for voice messages
- Click **"I Accept. Sign me up!"**
- Enter your home address to receive local messages
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- Click **"Locations"** tab
- Click **"Add New Location"** to add addresses in your town or around the country. Do your relatives live out of the area? Keep track of what's happening near your loved ones and the places you work, live, or visit.
- Click **"Settings"** tab
- Select a location from the left-hand menu and subscribe to receive messages from each agency by checking the "Subscribe" option. Adjust which messages by priority level are sent to your email and/or cell phone. **Please note: you must opt-in to receive messages from non-public safety agencies.**

Need assistance? Send an email to **support@nixle.com**

www.nixle.com

# Skywarn Spotter Training 2015

National Weather Service

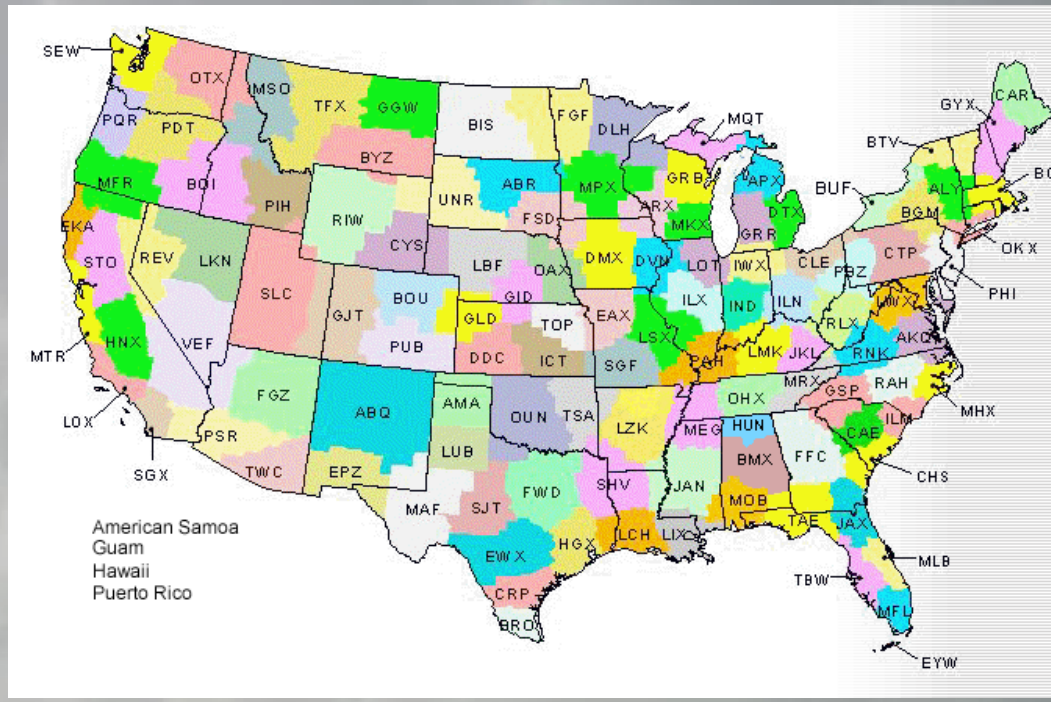
Detroit/Pontiac

# National Weather Service

- Federal government
  - Department of Commerce
    - National Oceanic and Atmospheric Administration (NOAA)

- 122 Weather Forecast Offices

- 9 National Centers
  - Storm Prediction Center
  - Tropical Prediction Center
  - Climate Prediction Center
  - Weather Prediction Center



# NWS Detroit/Pontiac

- A team of 24 professionals
  - Meteorologists, Hydrologist,
  - Electronics/IT, Administrative
- Mission: Provide forecasts and warnings for the protection of life and property
- Forecasts and warnings issued **24/7**
- 17 counties in Southeast Michigan
- All or portions of Lakes Huron, St. Clair, and Erie

# Weather Ready Nation

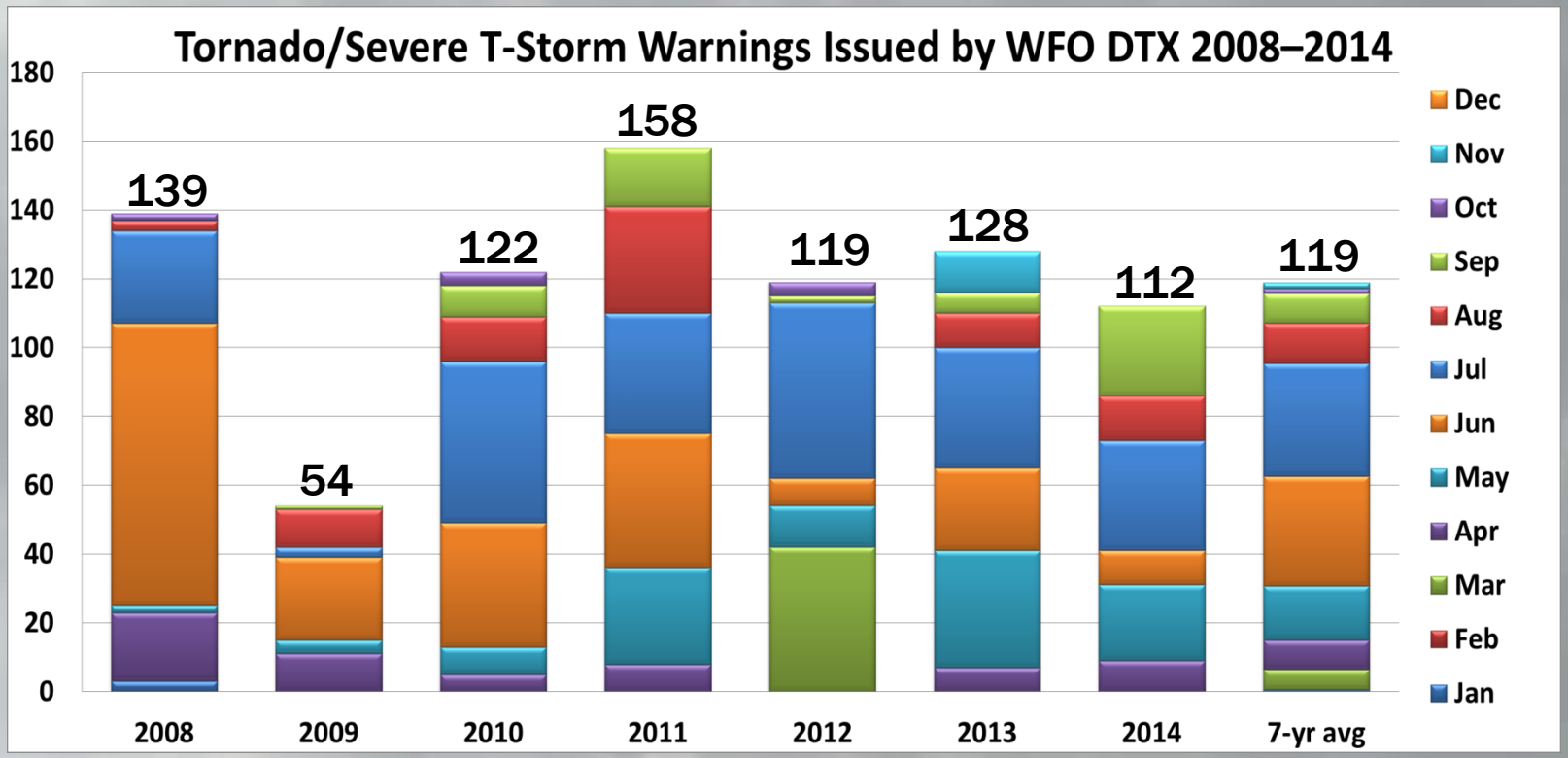
- People are killed or seriously injured by all types of extreme weather, despite advance warning
- Helping our nation become more resilient to increasing extreme weather, water and climate events
- A Weather-Ready Nation takes well-informed communities, businesses and individuals that are ready, responsive and resilient to extreme events

# Weather Ready Nation

- ***Know your risk*** - follow NWS warnings
- ***Take action*** - create a family emergency plan and kit (ready.gov)
- ***Be an example*** - use social media to share important hazard information

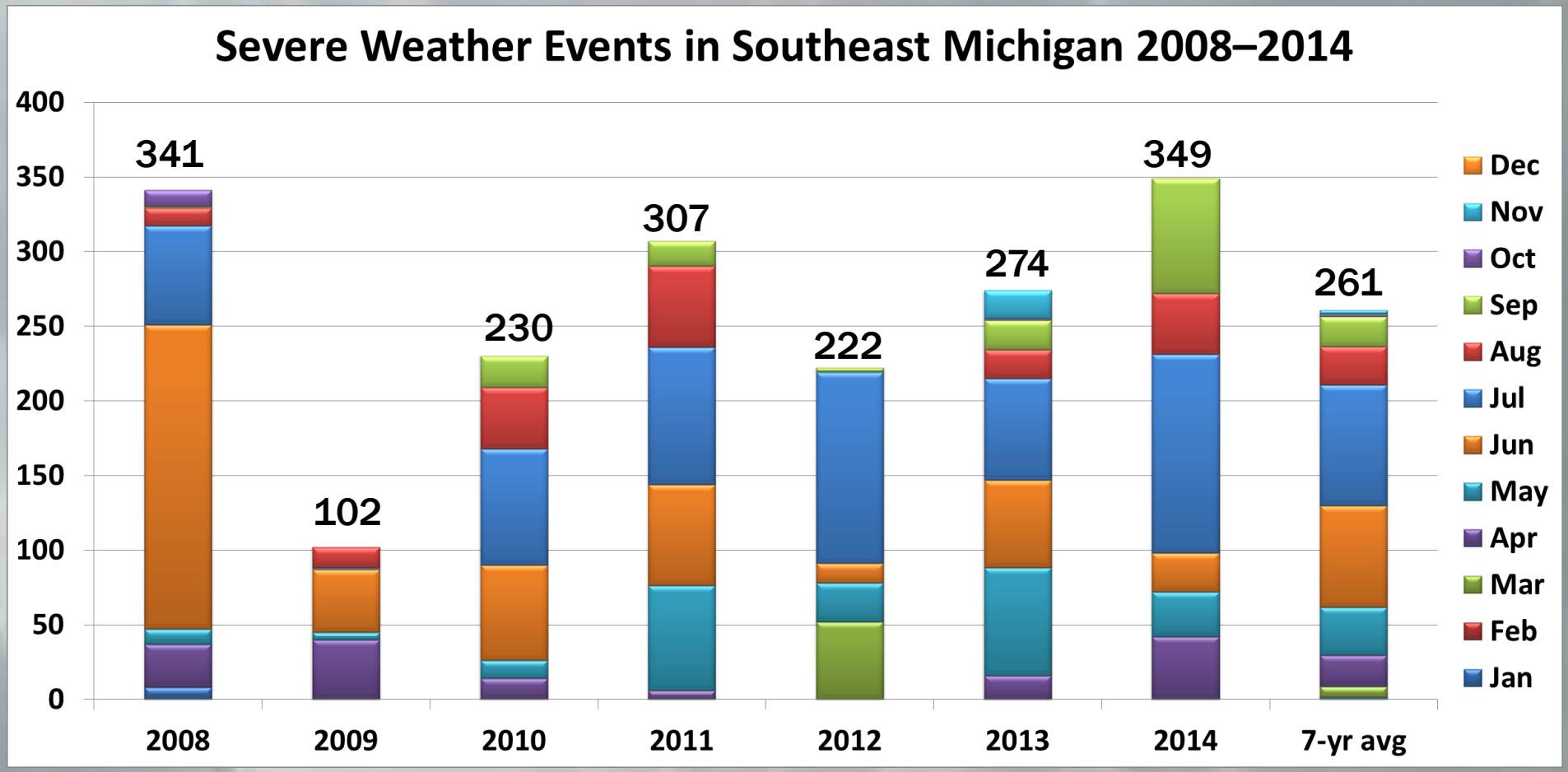
**www.noaa.gov/wrn**

# Review of Last Year

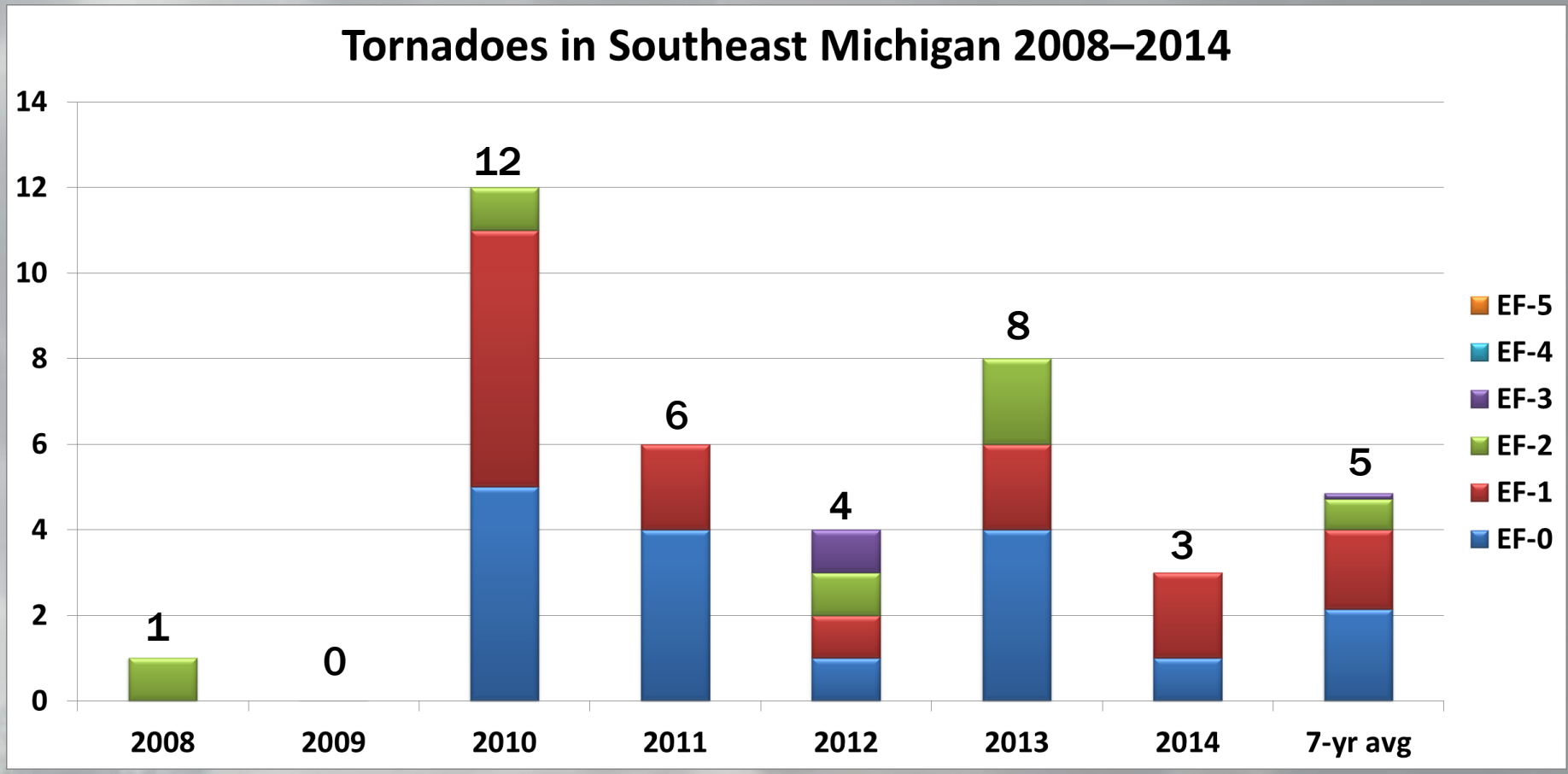



| | Severe Weather Detection Rate | Average Lead Time (minutes) |
|---|---|---|
| 2014 | 91% | 25.0 |
| Average (2008-2014) | 88% | 23.4 |

# Review of Last Year



# Review of Last Year




## Three 2014 Tornadoes

- June 11, St. Charles EF-1
- August 20, Rural Macomb Co. EF-0
- September 21, Rochester Hills EF-1

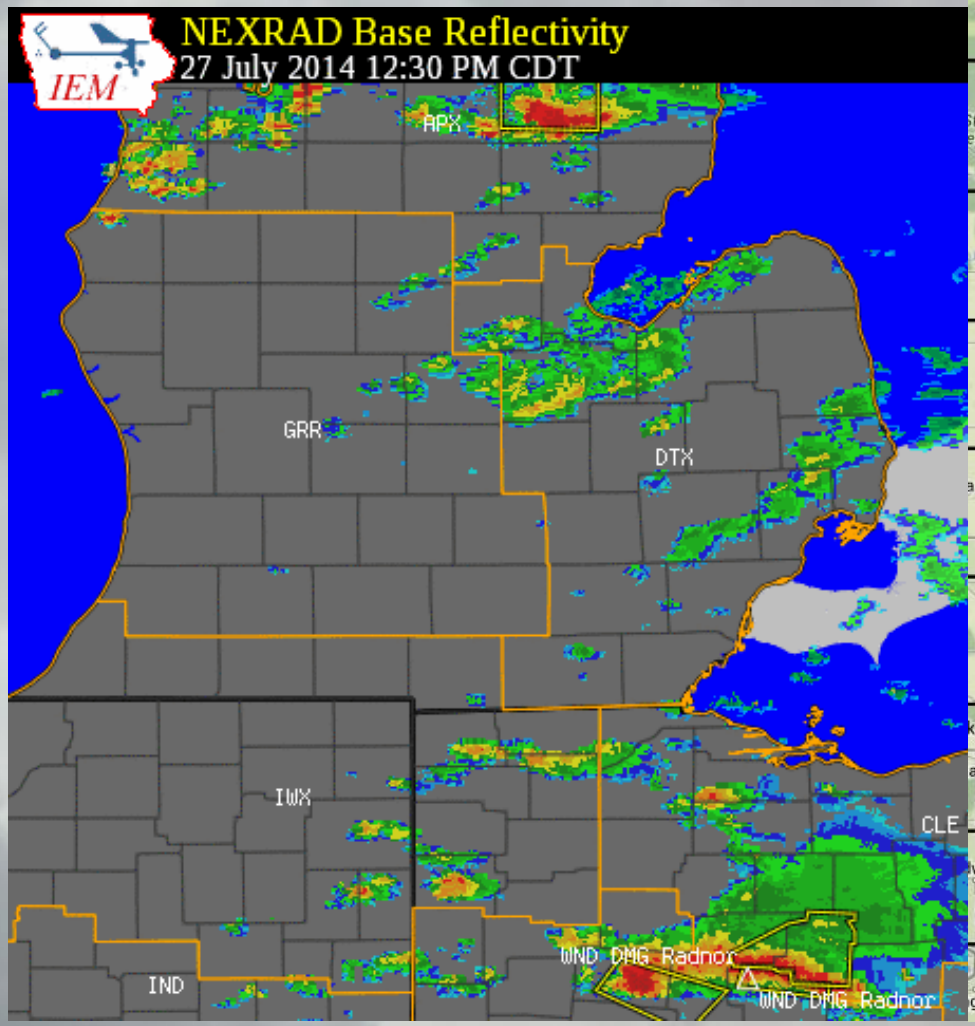
# Review of Last Year

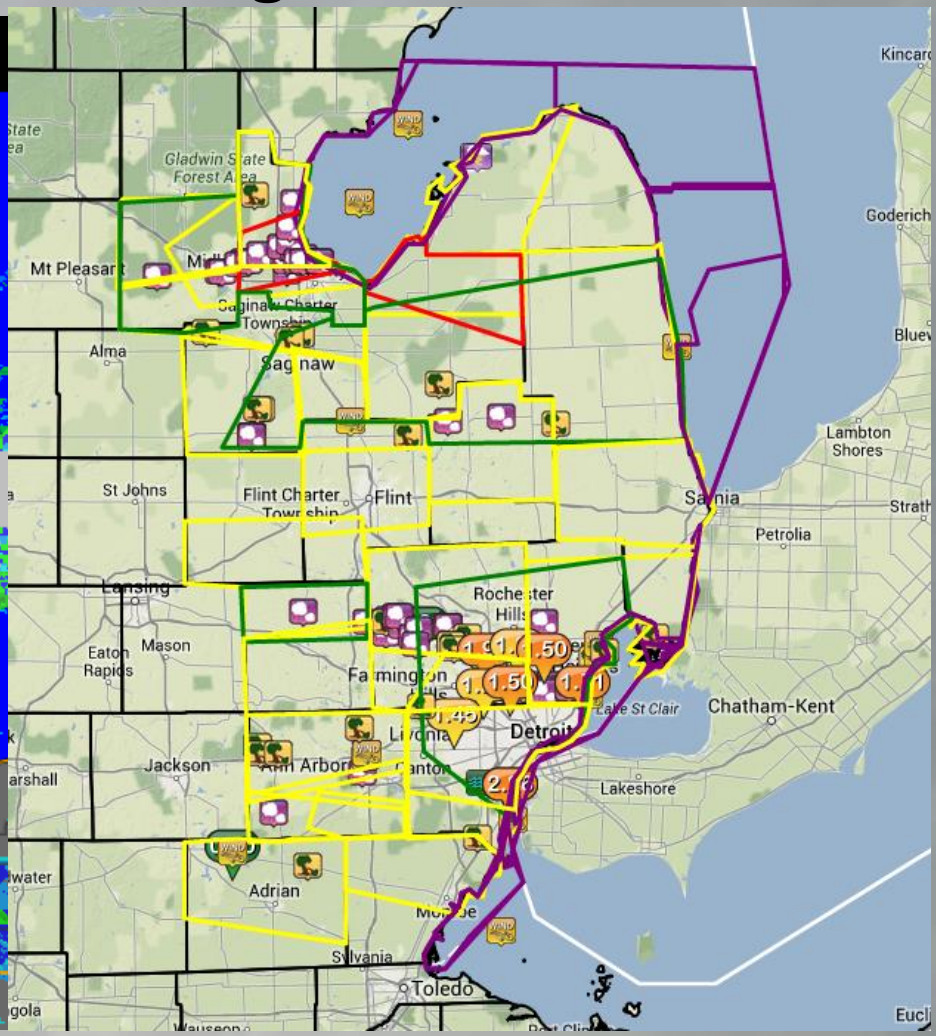
## *Three "Big Events"*

- **July 27** Large Hail & High Winds
- **August 11** Historic Flooding
- **September 5** High Winds

# Review of Last Year

## July 27, 2014 – Hail and High Winds



# Review of Last Year

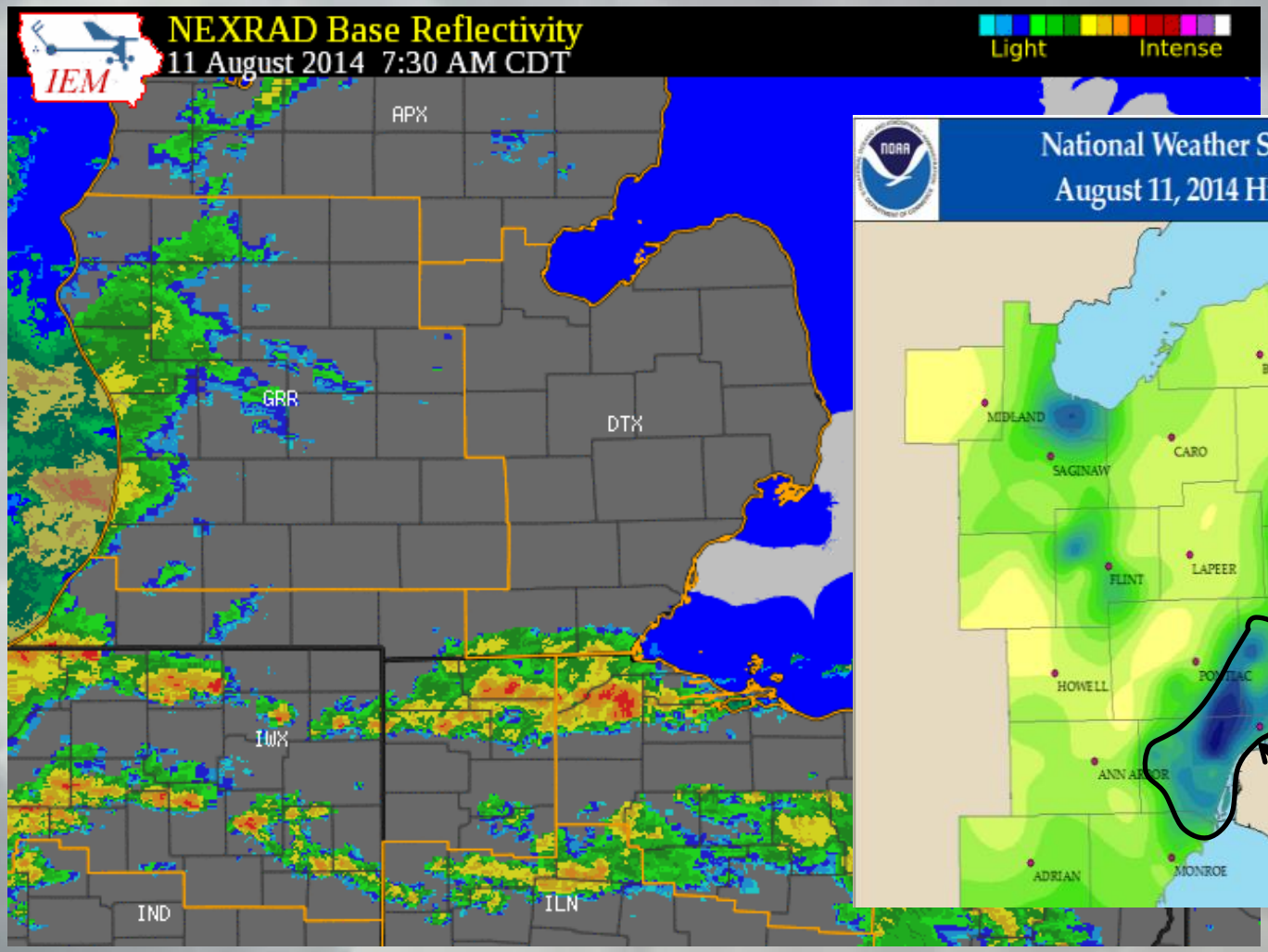
## July 27, 2014

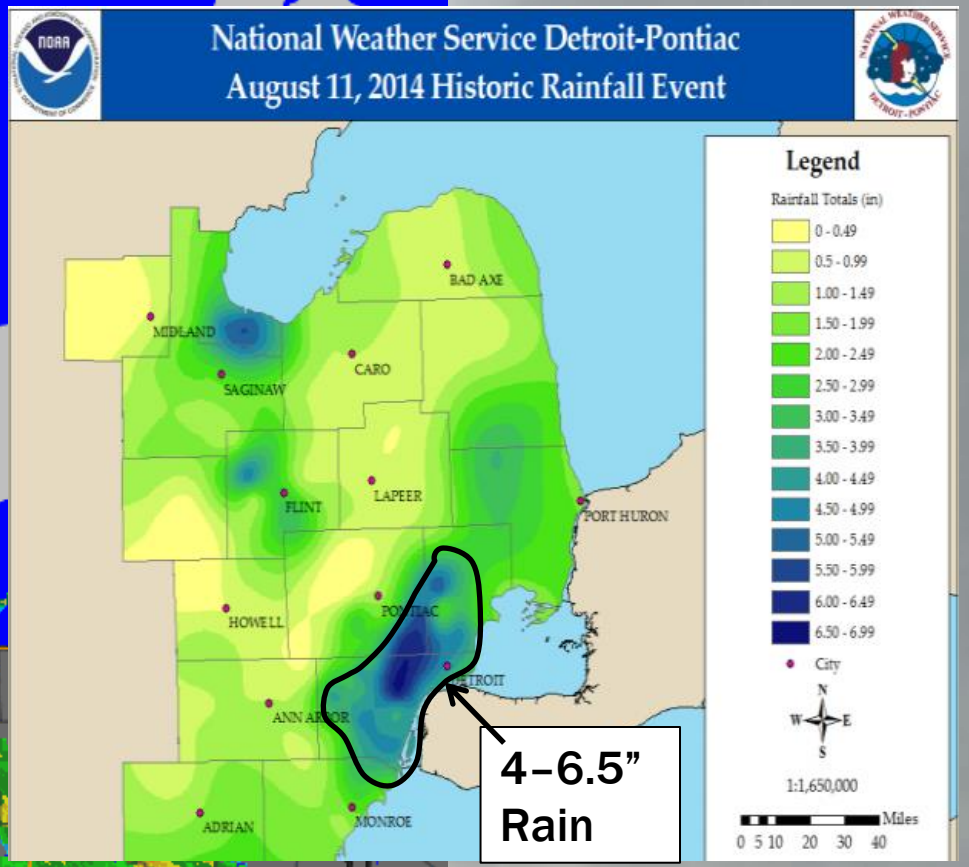

- 3” hail (larger than baseball) in Saginaw Valley
- Wind-driven hail to 2.5” (tennis ball) central Oakland County
- Wind gusts 60–70 mph
- 200,000 homes and businesses lost power
- $100 million in damages



# Review of Last Year

## August 11, 2014 – Historic Flood Event



# Review of Last Year

## Aug. 11, 2014

- Daily rainfall records at Detroit, Flint, & Saginaw
- 2nd wettest day on record at DTW (4.74”)
- Flooding on Clinton & Rouge river systems
  - Record crests of Clinton River & Ecorse Creek
- Major interstates closed, some for days
- Hundreds of vehicles stranded
- 75,000+ homes/businesses damaged
- $1.8 billion in damages; Presidential Disaster Declaration

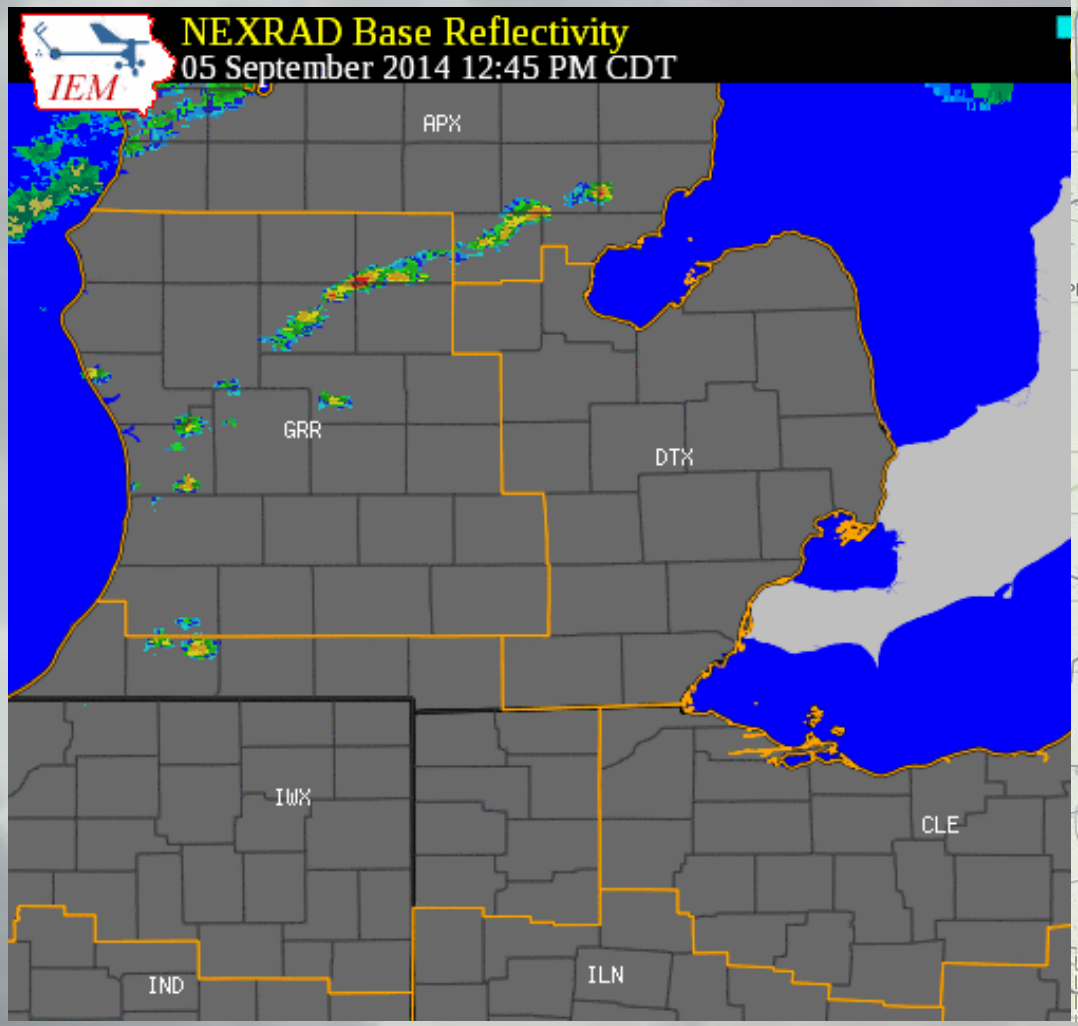
Elmhurst
Shawna Lancaster
Via Fox 2 Detroit

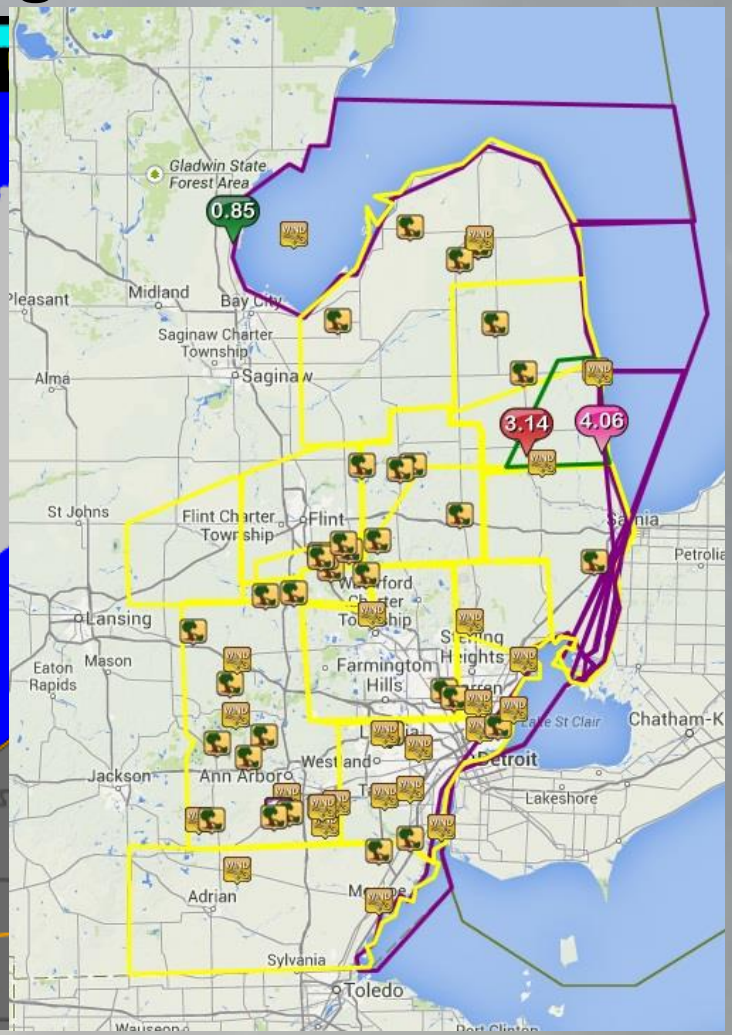

I-75/696 Interchange
Assoc. Press

Fox 2 Detroit

# Review of Last Year

## Sep. 5, 2014 – High Winds



# Review of Last Year

## Sep. 5, 2014

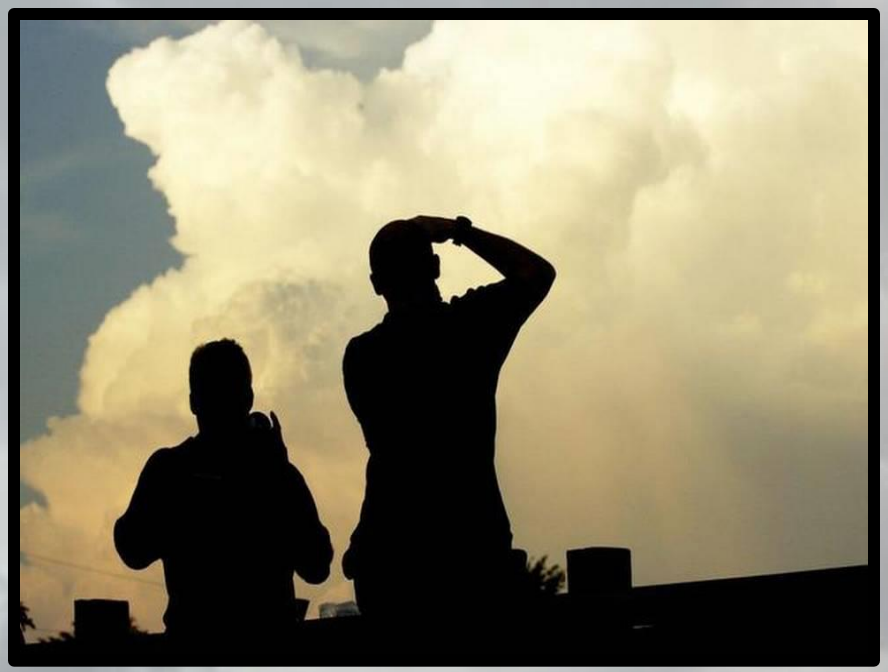
- Widespread damaging winds up to 74 mph
- 400,000 homes/businesses lost power; $20 million in damages
- 5 injured when a tent collapsed at an event in Dearborn


Westland
Tim O'Donnell


Columbiaville
Jacob Grades


Clinton Twp
Jacob Sketch

# How to be a Great Spotter



- PREPARE TO BE AWARE
  - Know When Severe Weather is in the Forecast
- KNOW WHAT TO REPORT
  - Review Reporting Criteria
- REPORT ACCURATELY
  - Don't report what you don't know
- BE BRIEF
  - Keep calls focused on the report
- Take a PHOTO to share with us on FACEBOOK or TWITTER!

# WHAT TO REPORT

- TORNADOES
- FUNNELS
- WATERSPOUTS
- HAIL 1/2 INCH OR GREATER
- WIND GUST 40MPH OR HIGHER
- RAINFALL 1 INCH OR MORE
- FLOODING THAT THREATENS PROPERTY OR COVERS ROADS
- FREEZING RAIN (ANY AMOUNT)
- SNOWFALL GREATER THAN 1 INCH
- WEATHER RELATED DAMAGE/INJURIES

# TORNADOES

- FUNNEL EXTENDS TO THE GROUND
- DEBRIS CLOUD SEEN AT BASE OF FUNNEL
- ROTATION IS SEEN ALONG THE VERTICAL AXIS
- FUNNEL IS SMOOTH
- **REPORT ALL TORNADOES**
  - ANY SIGNIFICANT DAMAGE
  - ANY SIGNIFICANT ACCIDENTS/ INJURIES DUE TO TORNADO

# FUNNEL CLOUDS

Funnel cloud

National Weather Service Forecase Office, San Antonio, TX NOAA Central Library

- FUNNEL IS SUSPENDED FROM CLOUD BUT DOES **NOT** TOUCH THE GROUND
- NO DEBRIS CLOUD EXISTS AT BASE OF FUNNEL
- ROTATION ALONG VERTICAL AXIS
- FUNNEL IS SMOOTH
- **REPORT ALL FUNNEL CLOUDS**

# Waterspouts

- WATERSPOUTS ARE TORNADOES OVER WATER
- FUNNEL TOUCHES WATER
- WATER DEBRIS CAN BE SEEN AT BASE
- ROTATION ALONG THE VERTICAL AXIS
- FUNNEL IS SMOOTH
- **REPORT ALL WATERSPOUTS**
  - ANY SIGNIFICANT DAMAGE
  - ANY SIGNIFICANT ACCIDENTS/INJURIES DUE TO WATERSPOUT

# HAIL

- **REPORT:**
  - HALF INCH DIAMETER OR MORE
  - IS THE HAIL REPORT MEASURED OR ESTIMATED?
  - DAMAGE TO HOMES OR VEHICLES
  - ANY KNOWN ACCIDENTS OR INJURIES DUE TO HAIL.
- DID YOU TAKE PICTURES USING RULERS OR COINS OR OTHER COMMON OBJECTS FOR SIZE REFERENCE?

# WIND

- 40 MPH OR GREATER
- IS THE WIND SPEED ESTIMATED OR MEASURED
- WIND DIRECTION (IF KNOWN)
- REPORT
  - LARGE TREE LIMBS DOWN (about the size of an Adult Arm)
  - UPROOTED OR BLOWN OVER LARGE TREES (are they rotten or healthy?)
  - DAMAGE TO HOMES OR OTHER STRUCTURES
  - MAJOR ACCIDENTS OR INJURIES DUE TO WIND
- DID YOU TAKE PICTURES?

# WIND-MEASURING INSTRUMENTS


- HAND-HELD ANEMOMETER
- WIND SOCK
- SOME HOME WEATHER SYSTEMS

# HOW TO ESTIMATE WIND SPEED
## The Beaufort Scale

| Beaufort* | Avg Miles per Hour | Knots | Surroundings |
|---|---|---|---|
| 0<br>calm | | 0-1 | Smoke rises vertically and the sea is mirror smooth |
| 1<br>light air | 1.2 - 3.0 | 1 - 3 | Smoke moves slightly with breeze and shows direction of wind |
| 2<br>light breeze | 3.7 - 7.5 | 4 - 6 | You can feel the breeze on your face and hear the leaves start to rustle |
| 3<br>gentle breeze | 8.0 - 12.5 | 7 - 10 | Smoke will move horizontally and small branches start to sway. Wind extends a light flag |
| 4<br>moderate | 13.0 - 18.6 | 11 - 16 | Loose dust or sand on the ground will move and larger branches will sway, loose paper blows |
| 5<br>fresh breeze | 19.3 - 25.0 | 17 - 21 | Surface waves form of water and small trees sway |
| 6<br>strong breeze | 25.5 - 31.0 | 22 - 27 | Trees begin to bend with the force of the wind and causes whistling in telephone wires. Some spray on the sea surface |
| 7<br>moderate gale | 32.0 - 38.0 | 28 - 33 | Large trees sway. Moderate sea spray |
| 8<br>fresh gale | 39.0 - 46.0 | 34 - 40 | Twigs break from trees, and long streaks of foam appear on the ocean |
| 9<br>strong gale | 47.0 - 55.0 | 41 - 47 | Branches break from trees |
| 10<br>whole gale | 56.0 - 64.0 | 48 - 55 | Trees are uprooted and the sea takes on a white appearance |
| 11<br>storm | 65.0 - 74.0 | 56 - 63 | Widespread damage |
| 12<br>hurricane | 75+ | 64 + | Structural damage on land, and storm waves at sea |

# MEASURING RAINFALL

- RAIN GAUGE (Manual Measure)
- TIPPING BUCKET (Electronic Weather Systems)
- MEASURE RAINFALL TO NEAREST HUNDREDTH OF AN INCH (0.75)

- REPORT
  - RAINFALL OF 1 INCH OR MORE THAT FELL IN 1-3 HOURS FROM THUNDERSTORMS
  - RAINFALL OF 1 INCH OR MORE IN 12 - 24 HOURS IN WINTER

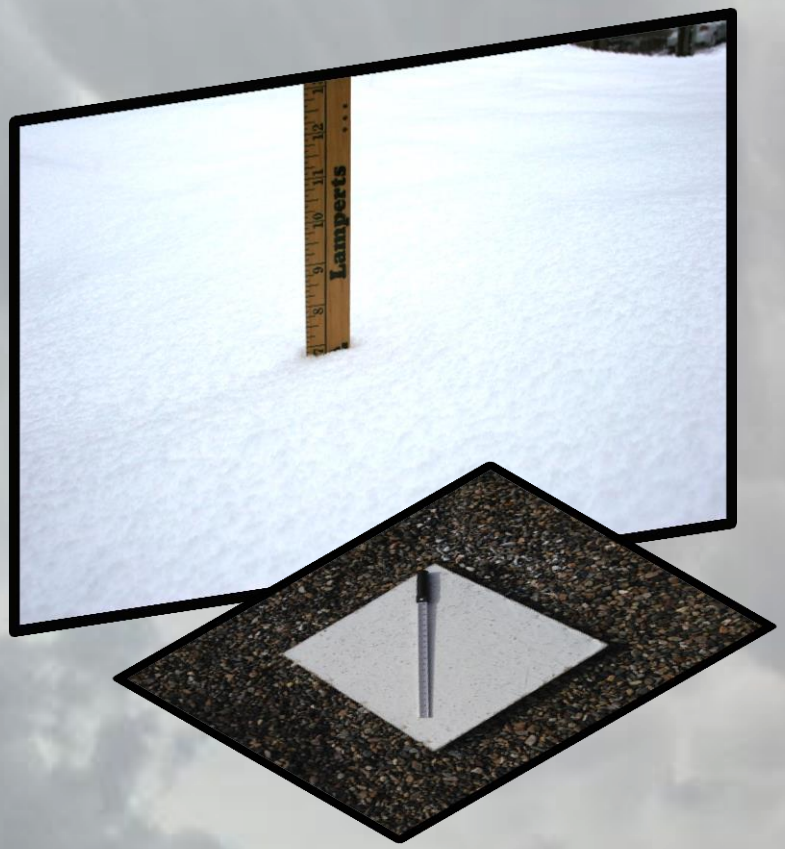
# FLOODING

- REPORT FLOODING WHEN:
  - WATER SIGNIFICANTLY COVERS ROAD – TRAFFIC IMPEDED.
  - WATER COMPLETELY BLOCKS ROAD. VEHICLES STRANDED.
  - WATER IS RISING OVER LAND AREAS AND THREATENS HOMES AND PROPERTY.
  - REPORT ANY DAMAGE TO ROADS, VEHICLES, HOMES OR OTHER STRUCTURES.
  - REPORT ANY SIGNIFICANT INJURIES DUE TO FLOODING.
- DID YOU TAKE PICTURES?

# FREEZING RAIN

- RAIN FREEZES INSTANTLY TO COLD SURFACES
- ACCUMULATION IS GENERALLY A QUARTER INCH OR LESS.
- MEASURE THICKNESS WITH A RULER – ONLY IF SAFE TO DO SO
- TELL US IF REPORT IS MEASURED OR ESTIMATED.
- REPORT ANY OCCURRENCE
  - ANY SIGNIFICANT ACCIDENTS/INJURIES DUE TO FREEZING RAIN
- DID YOU TAKE PICTURES?

# SNOWFALL




- REPORT
  - 1 INCH ACCUMULATION OR MORE IN 24 HOURS OR LESS
  - MEASURE TO NEAREST TENTH OF AN INCH (3.4)
  - DO NOT MEASURE IN A DRIFT
  - MEASURE AS SOON AS SNOW ENDS IF POSSIBLE TO KEEP FROM LOSING SNOW TO WIND OR MELTING.
  - MEASURE USING A DEDICATED SNOW BOARD THAT IS CLEARED AFTER EACH EVENT.
  - OR ESTIMATE MEASUREMENT TO THE BEST OF YOUR ABILITY

# REPORT THIS ✓ NOT THAT ✗

## HAIL


Golfball Size Hail or larger


Half Dollar/Quarter & Nickle Size Hail


Penny/ Quarter Size Hail


Pea Size Hail


Graupel / Snow Grains/ Ice Pellets

## FLOODING


Major Hwys Closed/Large Impact to area.


Road Impassable/Traffice Impacted/Cars stranded.


Ice Jam Flooding: blocked water flow/Rivers overflow ban


Shallow ponding of water on Road. Road Passable. Rain has ceased.


Water partially covers road. Road passible. Rain has ceased.

**If rain persists- keep an eye on these type of road situations.*

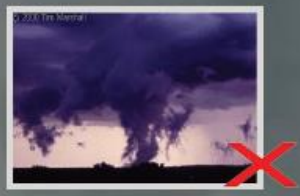
## TORNADOES/FUNNELS AND LOOK-ALIKES


Tornado w/ Debris Cloud

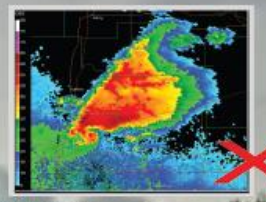

Funnel Cloud


Waterspout


Wall Cloud


Low Level SCUD Clouds

## MISCELLANEOUS WEATHER


RADAR Images


Precipitation Core


Lightning


Mammatus Clouds

# HOW TO REPORT YOUR WEATHER

**CALL US:**

SPOTTER REPORT LINE (**OBSERVATIONS ONLY**): **1-800-808-0006**

**LOCAL NETS:**

CONTACT LOCAL NET CONTROL FOR INFORMATION

**ONLINE:**

- SPOTTER REPORT FORM
  - http://www.weather.gov/detroit
- FACEBOOK - REPORTS AND PHOTOS
  - https://www.facebook.com/NWSDetroit
- TWITTER - REPORTS AND PHOTOS
  - https://twitter.com/NWSDetroit

# How Spotter Reports Aid Warning Decisions

SPOTTER

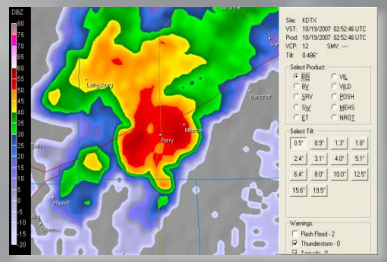

HAM RADIO

SPOTTER → NWS

- HAM RADIO OPERATOR
- NWS
- -VERIFIED - ENVIRONMENT SUPPORTED AND/OR RADAR INDICATED
- WARNING ISSUED
- EMERGENCY MANAGERS MEDIA AND PUBLIC NOTIFIED

- REPORT RECIEVED
- -VERIFIED- ENVIRONMENT SUPPORTED AND/OR RADAR INDICATED
- WARNING ISSUED
- EMERGENCY MANAGERS MEDIA AND PUBLIC NOTIFIED

NWS



RADAR

# How Warnings Reach the Public

NWS

LOCAL EM'S

NWR

MEDIA


CELL PHONES

INTERNET

# NWS Severe Warnings

- Severe Weather is Imminent or Ongoing
- Severe Thunderstorm Warning
  - Thunderstorm Wind Gusts >= 58 MPH
  - And/Or Hail 1 Inch in Diameter or Larger
- Tornado Warning
  - Doppler Radar Indicates Strong Rotation
  - Confirmed Reports of a Tornado

# Tornado Safety

- **Have a preparedness plan.** Know your tornado shelter!
- **Home:** Basement and under the stairwell or heavy piece of furniture. If *no basement*, then an interior closet, hall, or bathroom on lowest floor
- **Schools, hospitals, and office buildings:** Small interior rooms or interior halls on lowest floor, and avoid long corridors with windows and large open areas with free span roofs such as gymnasiums
- **Steel and concrete high rise buildings:** Interior halls, bathrooms or closets and stay away from windows
- **Shopping centers:** Bathrooms and small interior spaces and avoid large open areas and glass
- **Abandon mobile homes and vehicles for a nearby reinforced building**, and only to a ditch as a last resort

# Weather safety: lightning

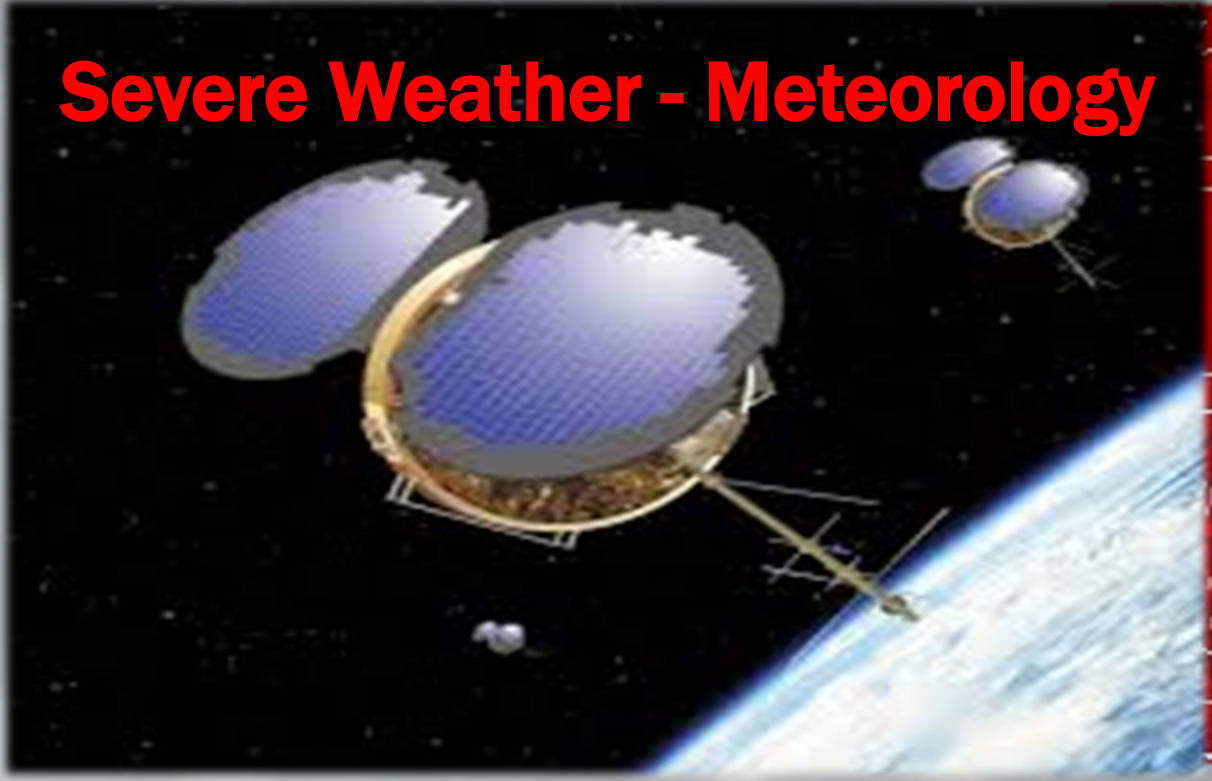
## Outdoor safety rules…

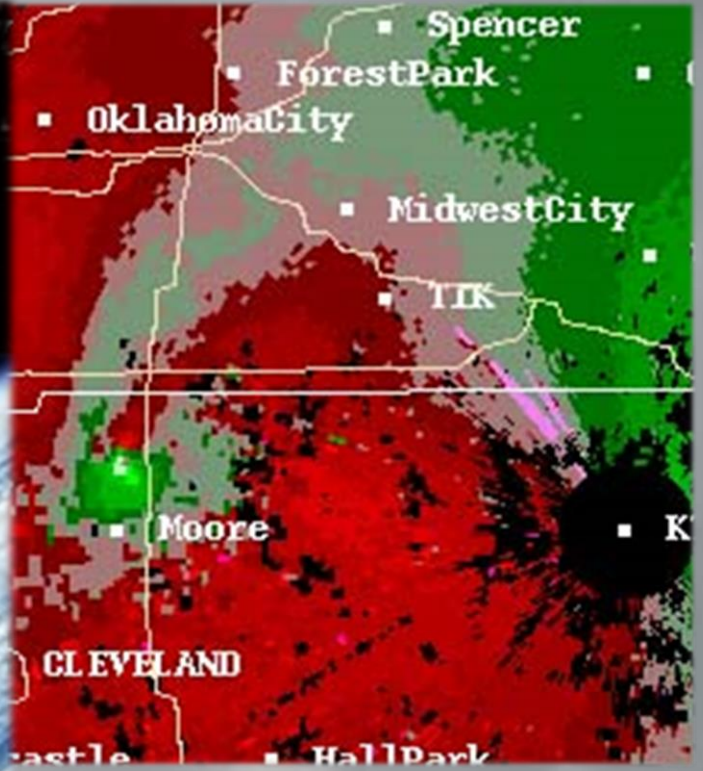
- Postpone activities. Do not wait for rain.
- Be the lowest point. Lightning hits the highest target.
- Get out of the water. It's a great conductor of electricity
- Move away from a group of people.
- Hard-Topped Vehicles offer suitable shelter if no other shelter is available.
- Lightning can strike as far as 20 miles away from the thunderstorm
- If thunder roars, go indoors

# Flooding – Safety Tips

- Do not drive over flooded roadways, especially at night.
- Just a foot of water can displace the entire weight of your vehicle.
- Seek higher ground when water rapidly starts to rise
- Nationwide, flooding is the number one severe weather related killer.

# Severe Weather - Meteorology






Equations of Motion - Cartesian Coordinates - Constant ρ and μ:

*x-component*

$$\rho\left(\frac{\partial v_x}{\partial t}+v_x\frac{\partial v_x}{\partial x}+v_y\frac{\partial v_x}{\partial y}+v_z\frac{\partial v_x}{\partial z}\right)=-\frac{\partial p}{\partial x}+\mu\left(\frac{\partial^2 v_x}{\partial x^2}+\frac{\partial^2 v_x}{\partial y^2}+\frac{\partial^2 v_x}{\partial z^2}\right)+\rho g_x$$

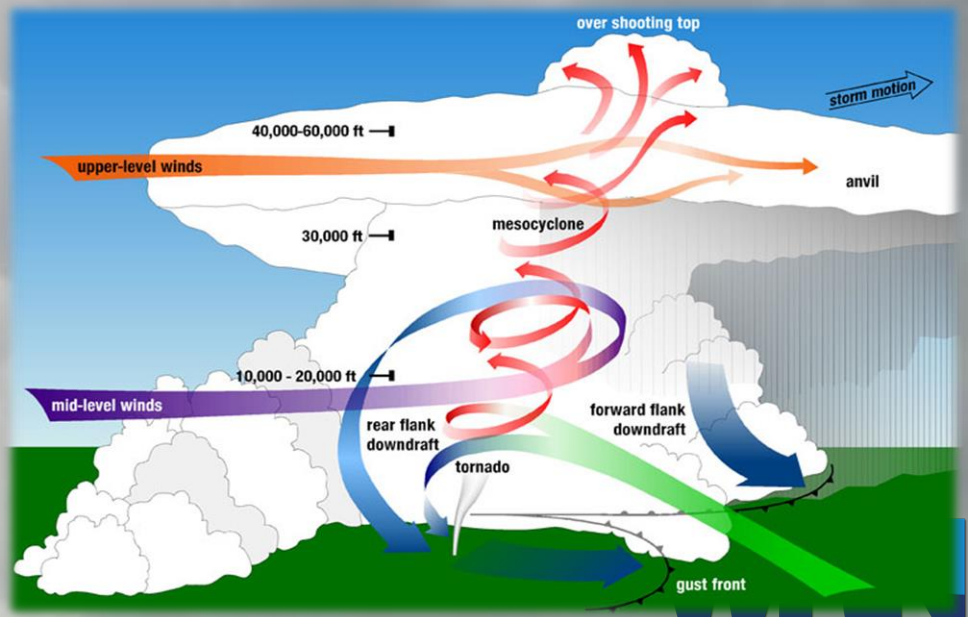
*y-component*

$$\rho\left(\frac{\partial v_y}{\partial t}+v_x\frac{\partial v_y}{\partial x}+v_y\frac{\partial v_y}{\partial y}+v_z\frac{\partial v_y}{\partial z}\right)=-\frac{\partial p}{\partial y}+\mu\left(\frac{\partial^2 v_y}{\partial x^2}+\frac{\partial^2 v_y}{\partial y^2}+\frac{\partial^2 v_y}{\partial z^2}\right)+\rho g_y$$

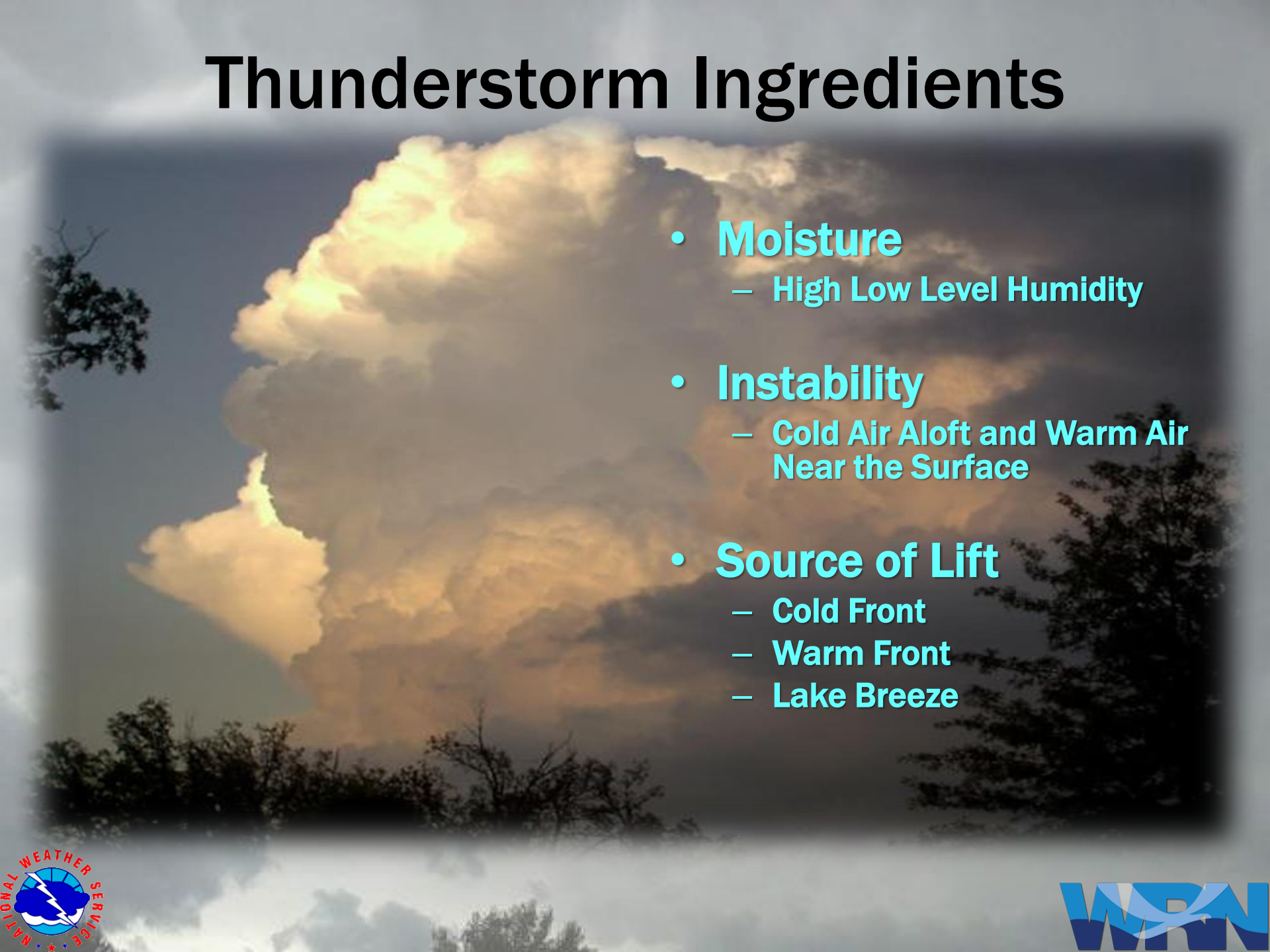
*z-component*

$$\rho\left(\frac{\partial v_z}{\partial t}+v_x\frac{\partial v_z}{\partial x}+v_y\frac{\partial v_z}{\partial y}+v_z\frac{\partial v_z}{\partial z}\right)=-\frac{\partial p}{\partial z}+\mu\left(\frac{\partial^2 v_z}{\partial x^2}+\frac{\partial^2 v_z}{\partial y^2}+\frac{\partial^2 v_z}{\partial z^2}\right)+\rho g_z$$

From BS&L, 1960

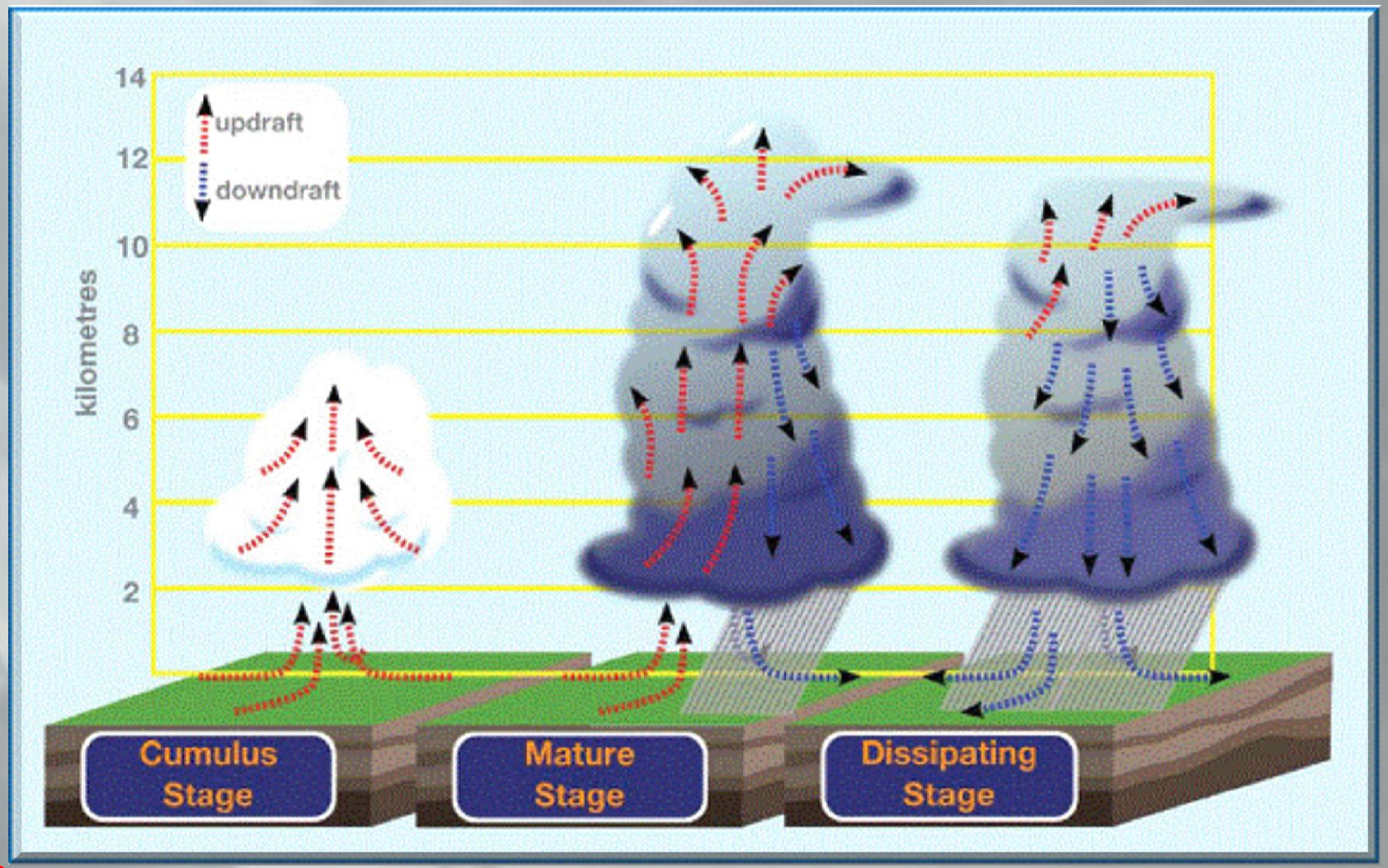


# Thunderstorm Ingredients



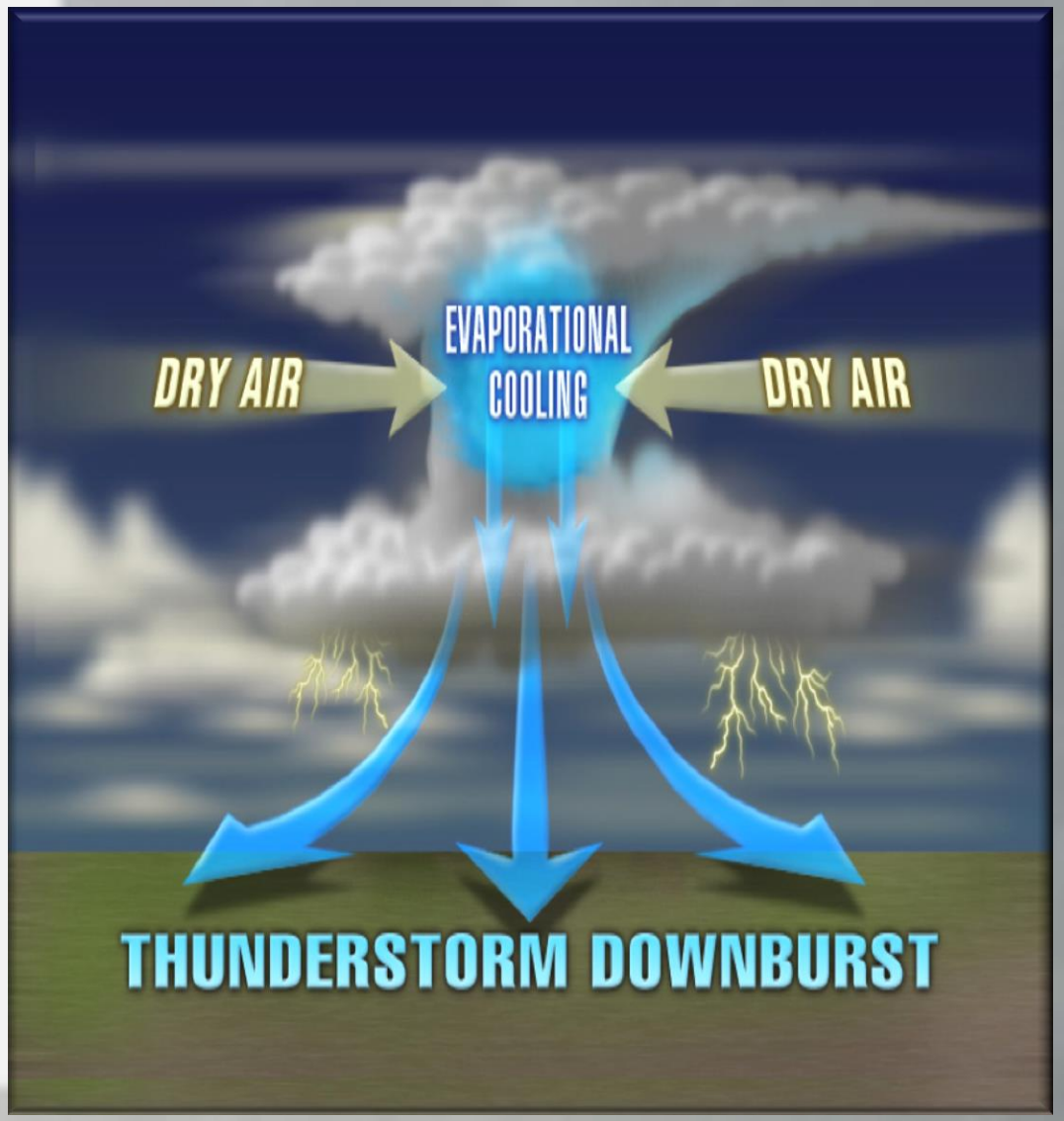
- **Moisture**
  - High Low Level Humidity
- **Instability**
  - Cold Air Aloft and Warm Air Near the Surface
- **Source of Lift**
  - Cold Front
  - Warm Front
  - Lake Breeze

# Thunderstorm Lifecycle



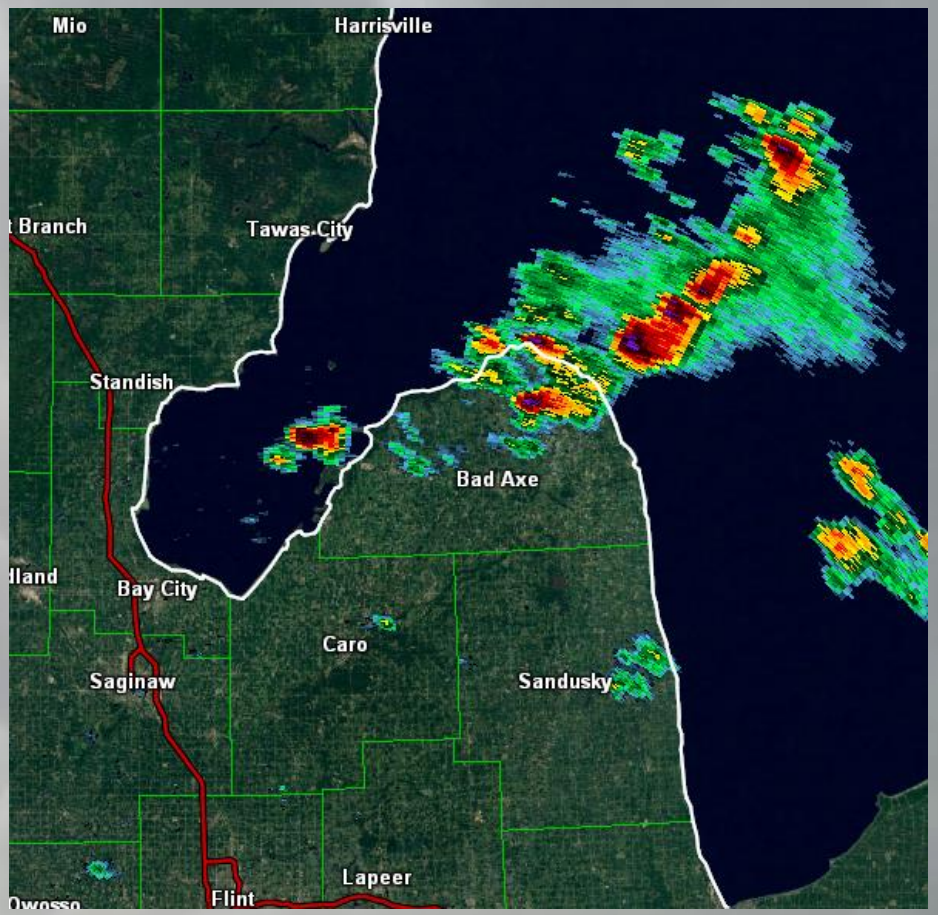
# Downbursts

- Where the downdraft first falls out of the storm and hits the ground.
- As the downdraft air falls, it builds momentum.
- Some evaporation also occurs which cools the air and makes it more dense.
- It then falls through the storm with a higher velocity.
- Cold air hits the ground & spreads outward, causing strong winds at the surface.
- The leading edge of this rain cooled air & strong winds is called the gust front.



# Thunderstorm Types
# Single Cell

- Generally have a lifetime of 40-50 minutes
- Weak, brief updraft
- Sometimes Called “Pulse Storms” because of their short lifespan



# Thunderstorm Types
# Single Cell

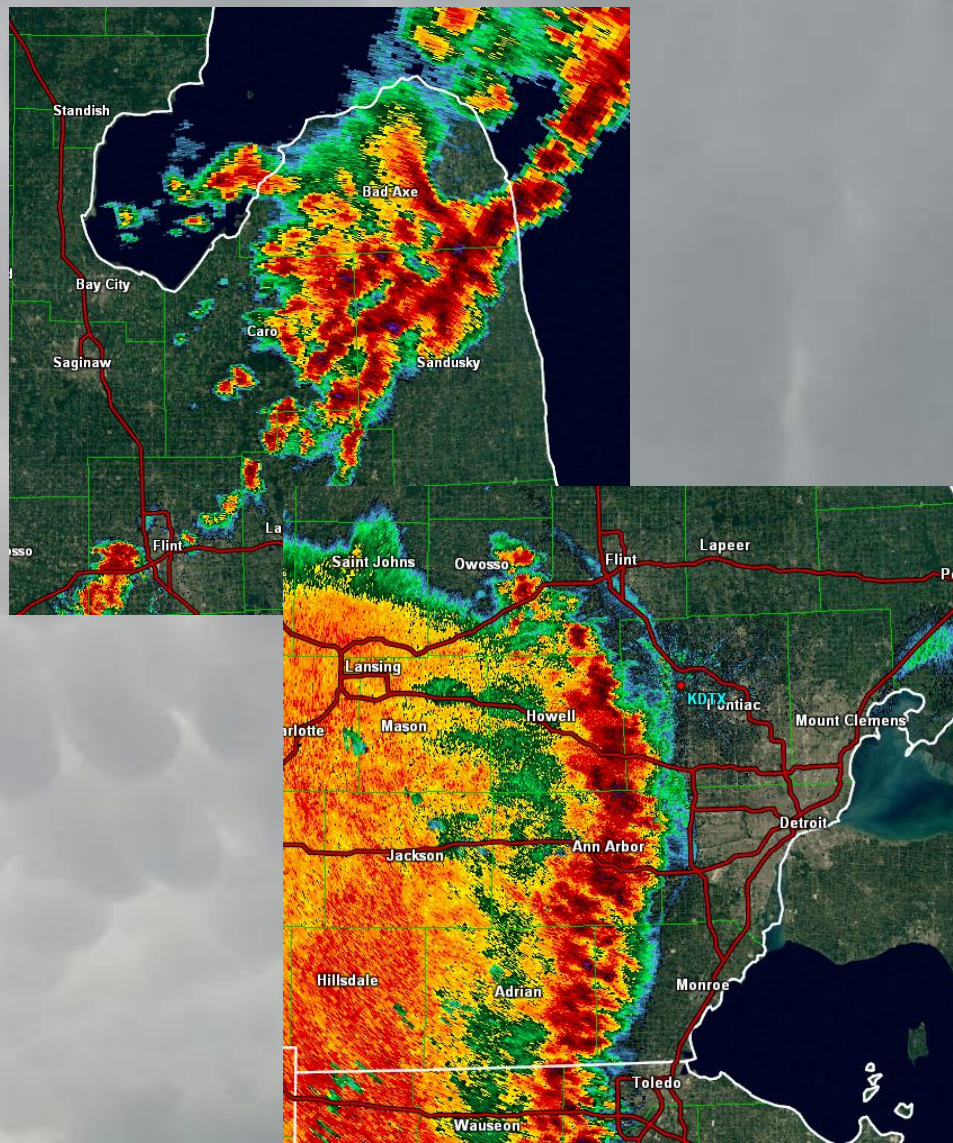
- Under the right circumstances may produce a microburst or hail ~1 inch
  - Most single cell storms are not severe

- Products the NWS will issue
  - Special Weather Statement
  - Significant Weather Advisory
  - Severe Thunderstorm Warning (rare)

# Thunderstorm Types
# Multicell Cluster or Line

- Cluster consists of a group of cells, moving along as one unit, each in a different phase of the thunderstorms life cycle.

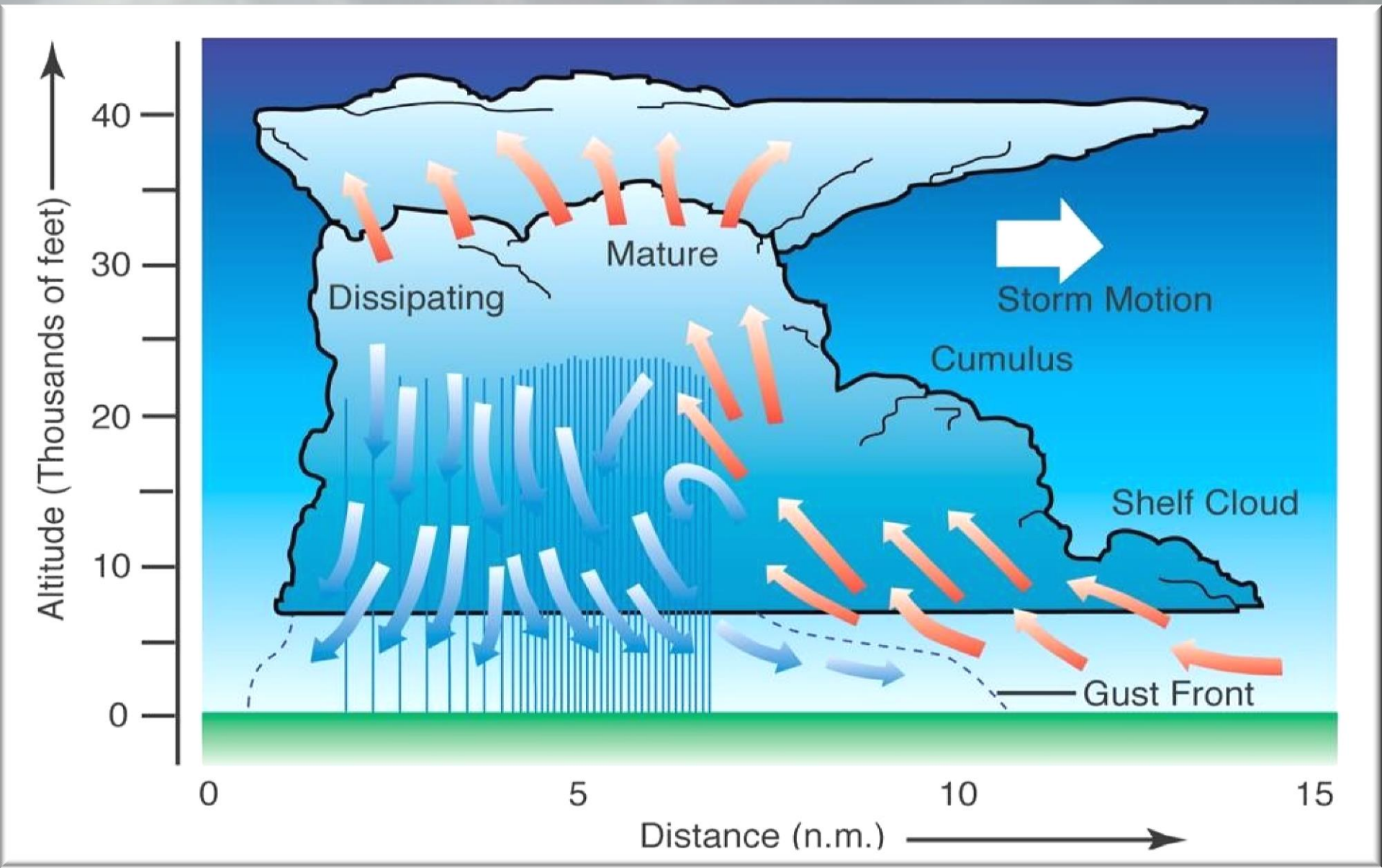
- Multicell lines (Squall Lines) occur in high shear/high instability environments.
  - Storms move in a line with strong winds along the lead edge of the line.



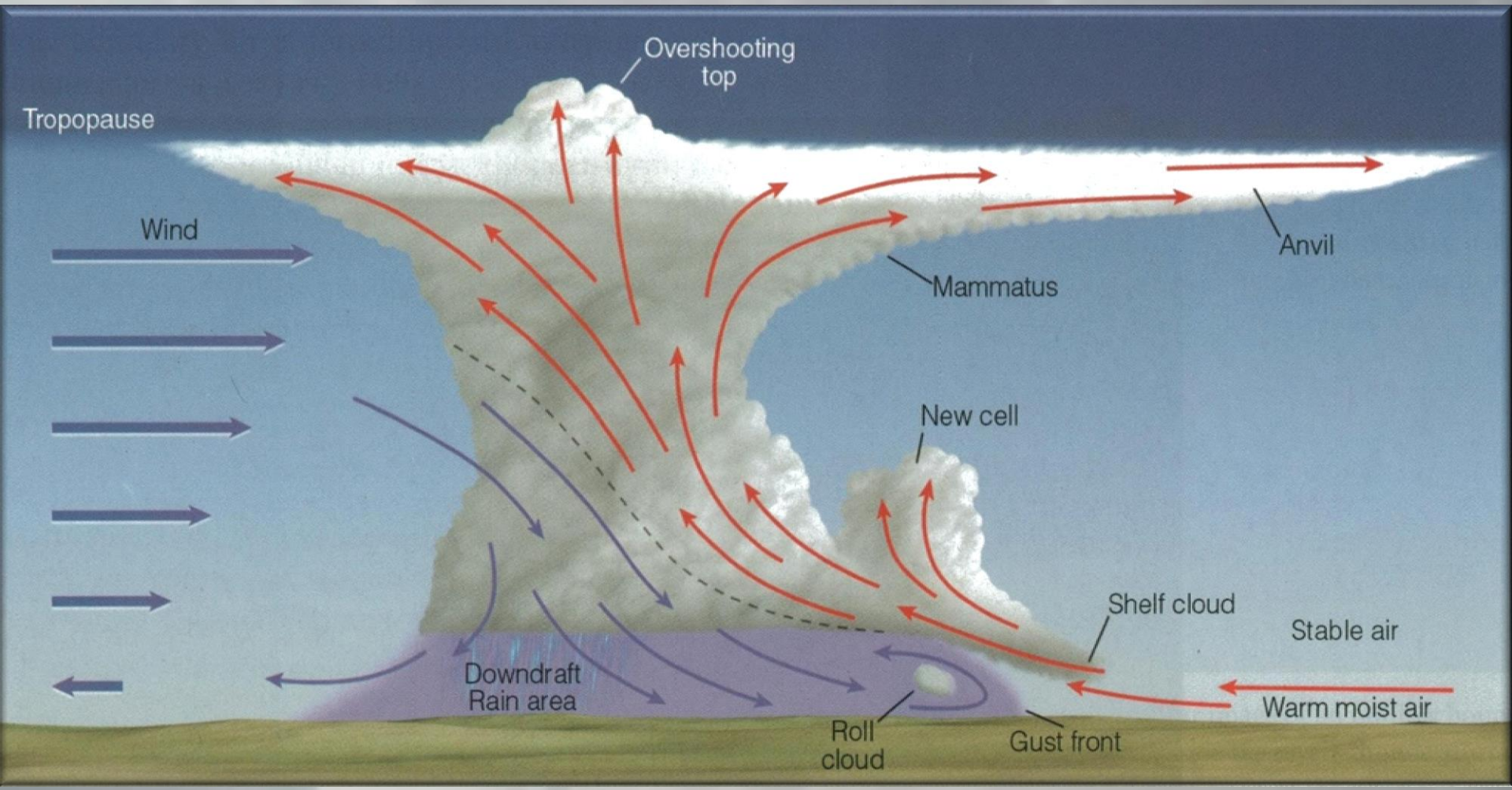
# Thunderstorm Types
# Multicell Cluster or Line

- Clusters can produce:
  - Severe winds
  - Large hail
  - Occasional tornadoes
  - Flooding
- Lines typically produce strong winds.
- Products the NWS will issue
  - Severe Thunderstorm Watch
  - Significant Weather Advisory
  - Severe Thunderstorm Warning
  - Tornado Warning (rare)
  - Flood Advisory (clusters)
  - Flash Flood Warning (clusters)


# Parts of a Thunderstorm
# Multicell Cluster

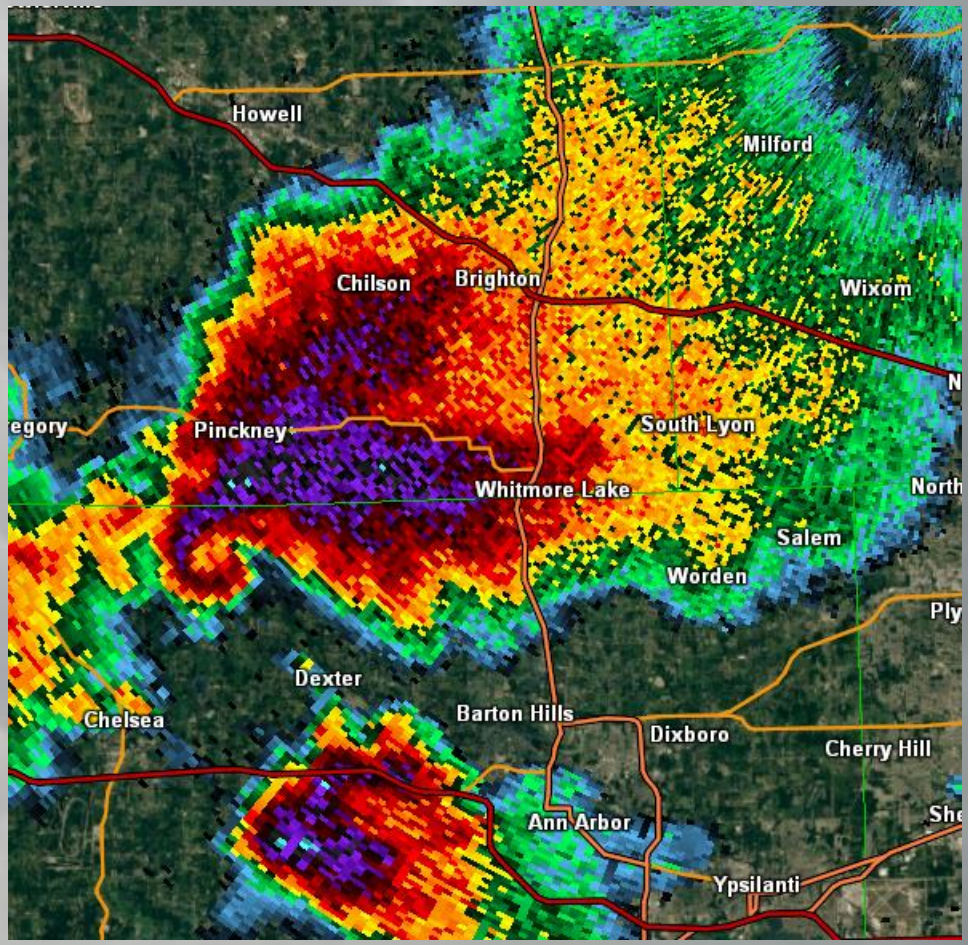


# Parts of a Thunderstorm
# Squall Line



# Thunderstorm Types
# Supercell

- Most organized thunderstorm
- Single, rotating updraft
- Pose high threat to life and property

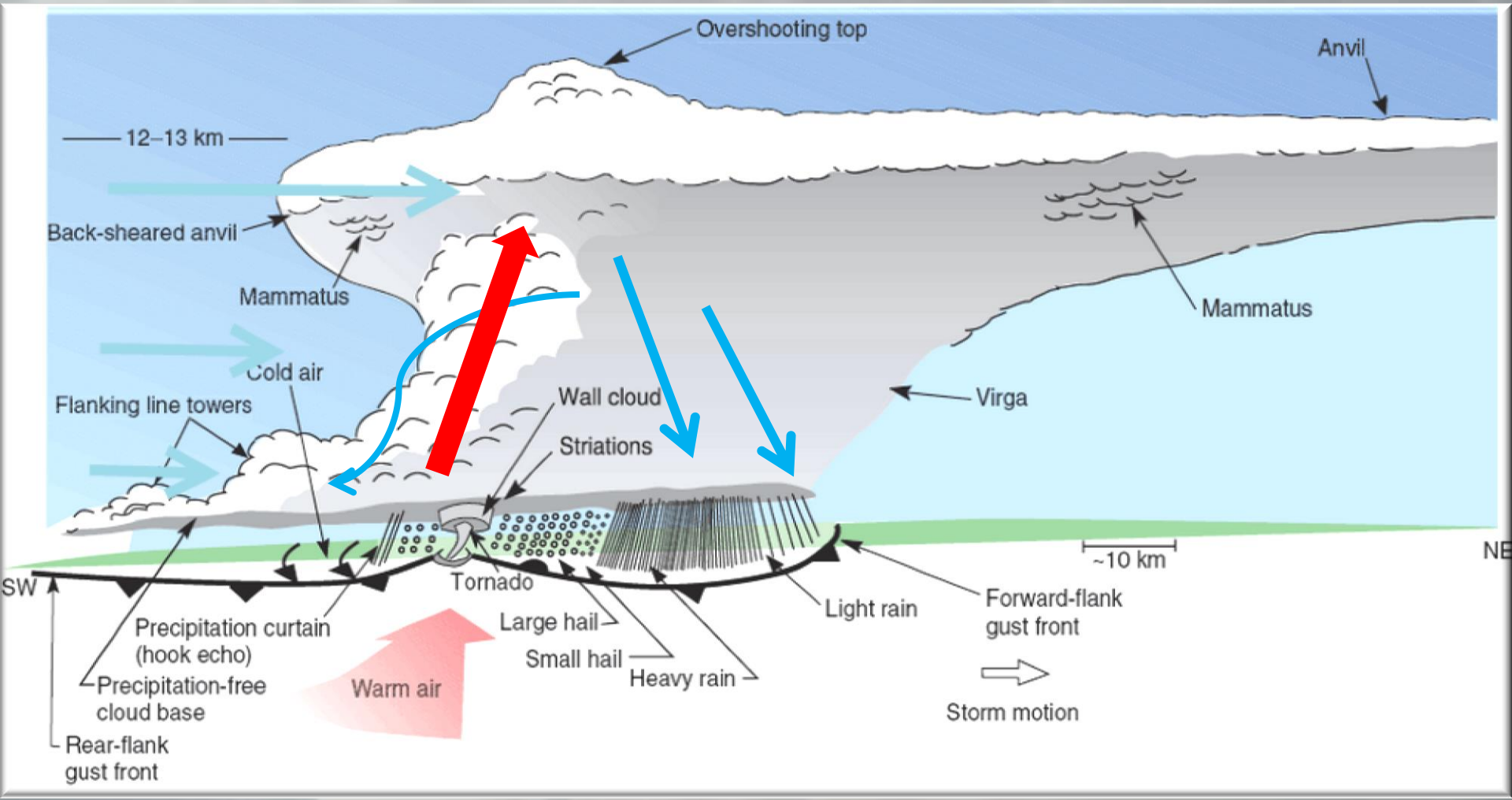


# Thunderstorm Types
# Supercell

- Almost always severe with destructive hail, extreme winds, tornadoes and flash flooding

- Products the NWS will issue
  - Tornado Watch
  - Severe Thunderstorm Warning
  - Tornado Warning
  - Flood Advisory
  - Flash Flood Warning

# Parts of a Thunderstorm
# Supercell



# Shelf Cloud vs Wall Cloud

# Shelf Clouds


- Leading edge of squall line
- Slopes down and away from precipitation
- Strong winds occur along and behind the shelf cloud
- Turbulent vertical motion due to strong winds
- Visible Warning!

# Shelf Cloud in Motion

# Wall Cloud

- Isolated lowering of the rain-free cloud base in a supercell
- Slopes down and toward the precipitation
- Indicates the possible location where a tornado could form
- Often exhibits signs of slow, churning rotation (mesocyclone)

# Wall Cloud in Motion

# Macomb Tornado

## August 20, 14

# Tornado Look-a-Likes

- One of the biggest challenges in tornado spotting is determining whether you are seeing the “real thing” or a tornado look-a-like.
- 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.

Tornado

# Tornado Look-a-likes

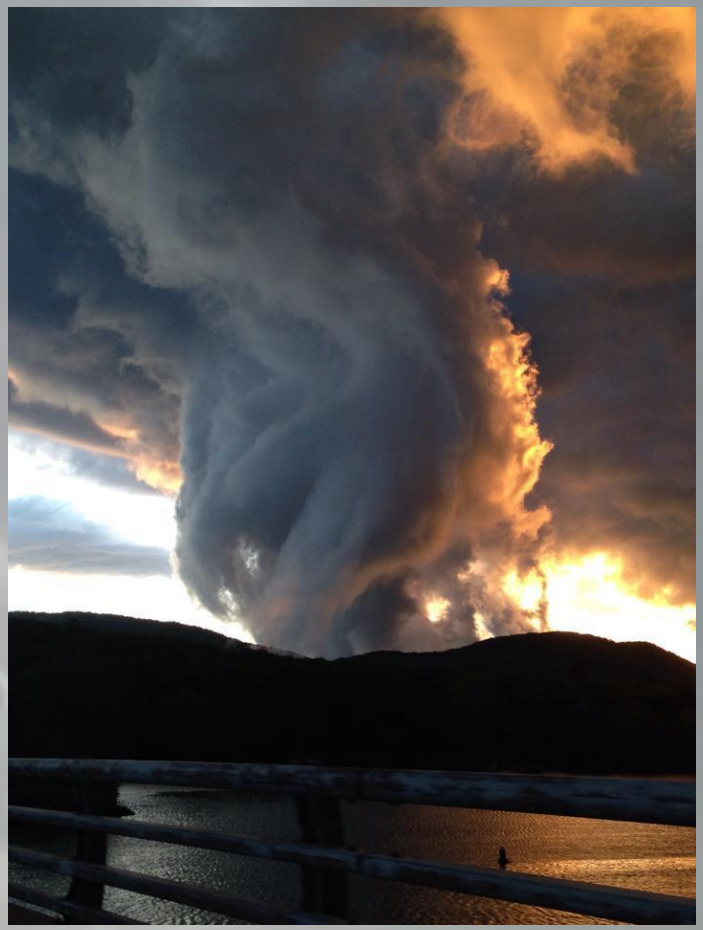
Scud


Smoke



Virga/Rain Shaft

# Examples of Scud



# Scud in Motion

# Skywarn Quiz

- Pull out your cell phone, web enabled tablet or web connected laptop
- Go to:  kahoot.it (no “www”) in your web browser
- Plug in the game pin (will be shown as soon as I click the link below)
- Let’s start!