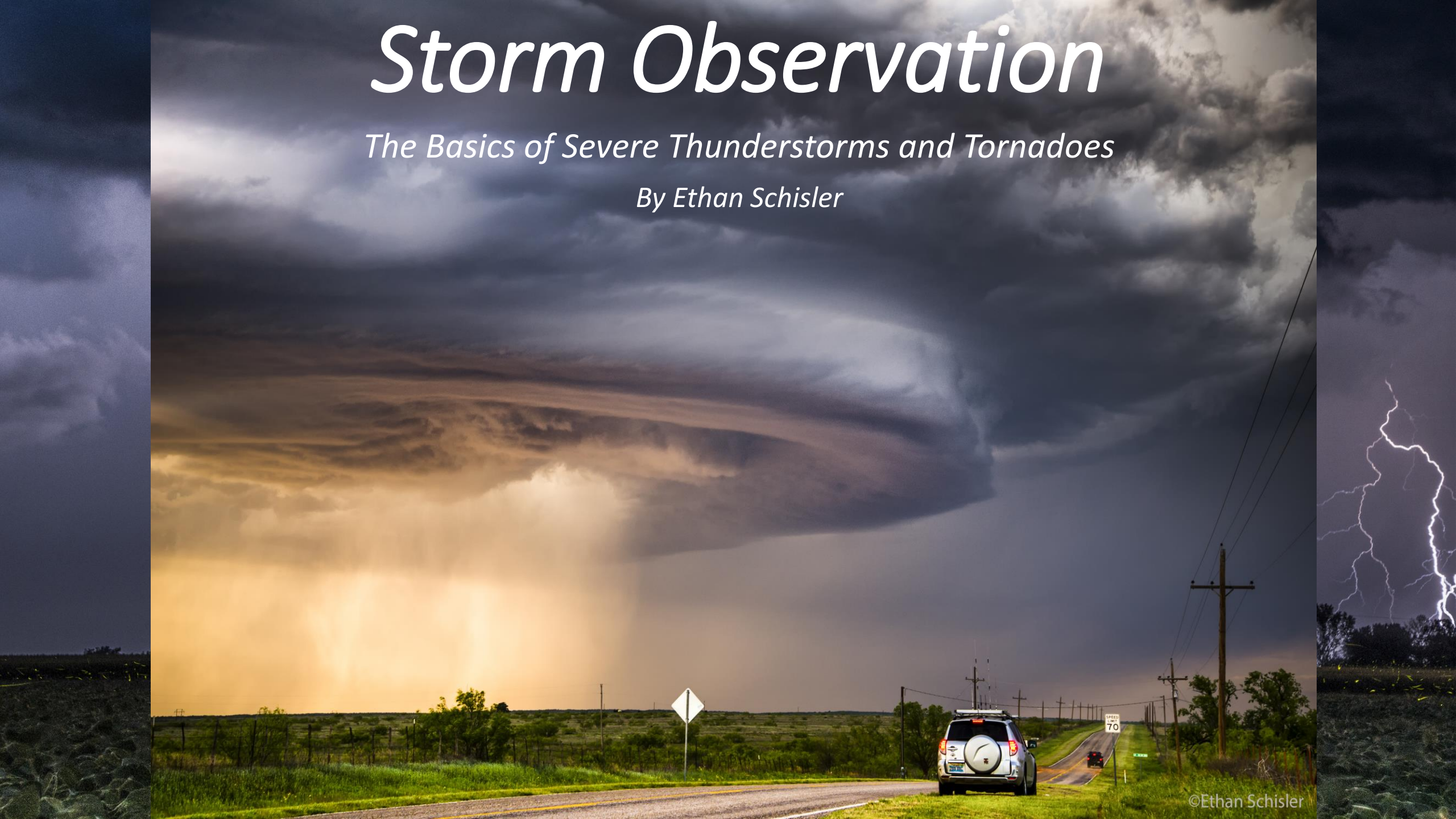
# *Storm Observation*

*The Basics of Severe Thunderstorms and Tornadoes*

*By Ethan Schisler*



# *Introduction*

- *About Me:*
  - *Storm Chasing since 2003*
  - *Have chased from Montana to Florida*
  - *Observed over 100 tornadoes*
  - *Several strong hurricanes*
  - *Blizzards*
  - *Ice Storms*


**Goal: Minimize the risks and maximize the positives**

# *Introduction*

- *Storm Observation Can Be:*
  - *Exciting*
  - *Rewarding*
  - *Awe Inspiring*
  - *Fun*
  - *And Informative*
- *Storm Observation Can Also Be….*
  - *Dangerous*
  - *Time Consuming*
  - *And even costly…..*

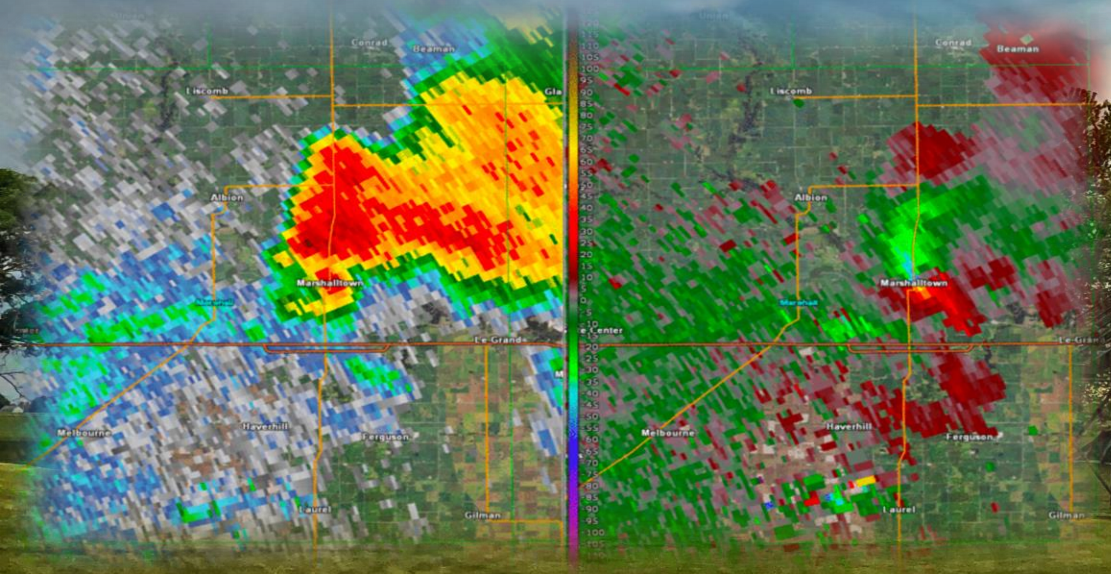

**<u>Goal: Minimize the risks and maximize the positives</u>**

# Enhanced Fujita Scale

- EF0 to EF5
- EF0 – 60-85 mph
- EF1 – 86-110 mph
- EF2 – 111-135 mph
- EF3 – 136-165 mph
- EF4 – 166-200 mph
- EF5 – 200+ mph

# *Why Storm Spotting?*

- *Limitations in Doppler Radar*
- *Warning Verification*
- *To gain additional knowledge*

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BULLETIN - EAS ACTIVATION REQUESTED
Tornado Warning
National Weather Service Des Moines IA
437 PM CDT THU JUL 19 2018

...TORNADO EMERGENCY FOR MARSHALLTOWN...

The National Weather Service in Des Moines  has issued a

* Tornado Warning for...
  Eastern Marshall County in central Iowa...
  Southwestern Tama County in central Iowa...

* Until 500 PM CDT.

* At 437 PM CDT, a confirmed large and destructive tornado was
  observed over Marshalltown, moving east at 25 mph.

  TORNADO EMERGENCY for Marshalltown. This is a   PARTICULARLY
DANGEROUS SITUATION. TAKE COVER NOW!

  HAZARD...Deadly tornado.

  SOURCE...Law enforcement confirmed tornado.
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**July 19 2018: Marshalltown, IA**

-Large EF-3 Tornado impacts town

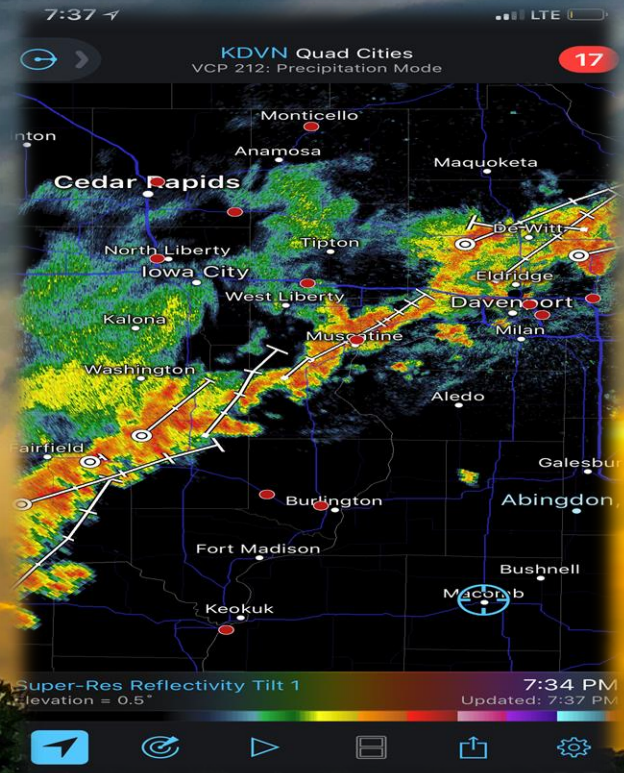
-Up to 43 minutes lead time

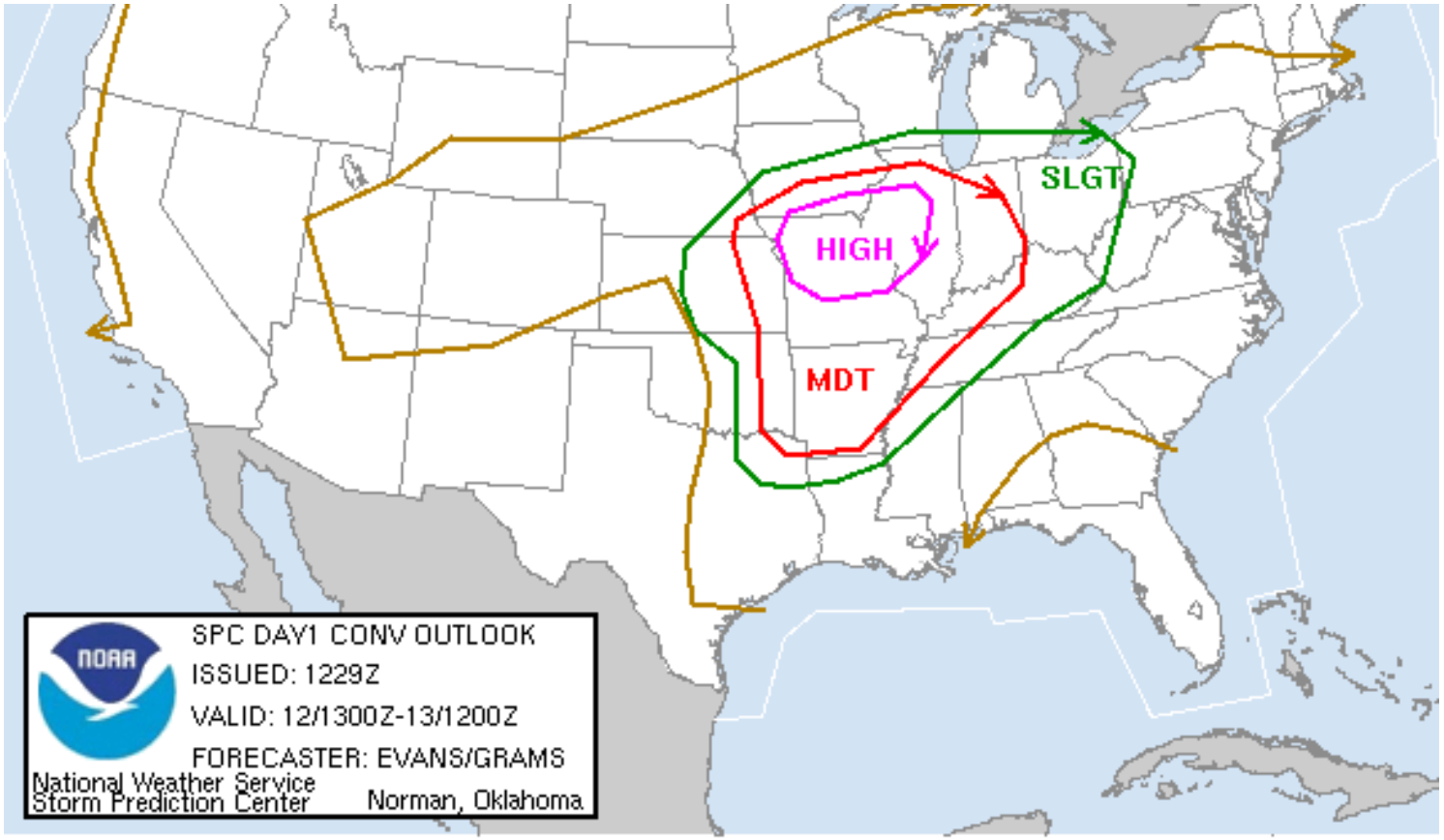
-Only minor injuries and no deaths

–Attributed to advanced warning, radar, and **storm spotters**!

# *Storm Observation: Equipment*

- *Cell phone/computer with radar application*
  - *Radarscope (Iphone, Mac, Windows); PYKL3 (Android); GR Level 3 (Windows)*
- *Reliable vehicle to get from point A to point B*
- *A partner to navigate*
  - *Stay distraction free while driving to the target area or storms*
- *Video camera or still camera for documentation*
- *Road maps and weather radio*
  - *Cell phone data can be sketchy in rural areas…have a backup plan*






# Storm Prediction Center Outlooks

- Marginal Risk
- Slight Risk
- Moderate Risk
- High Risk

# Basics of Storm Development

- *Instability*
  - *Ability for air parcels to rise*
- *Wind Shear*
  - *Increasing and turning of winds with height*
- *Moisture*
  - *Local crops or Gulf of Mexico*
- *Lifting/Forcing Mechanism*
  - *Some type of boundary!*

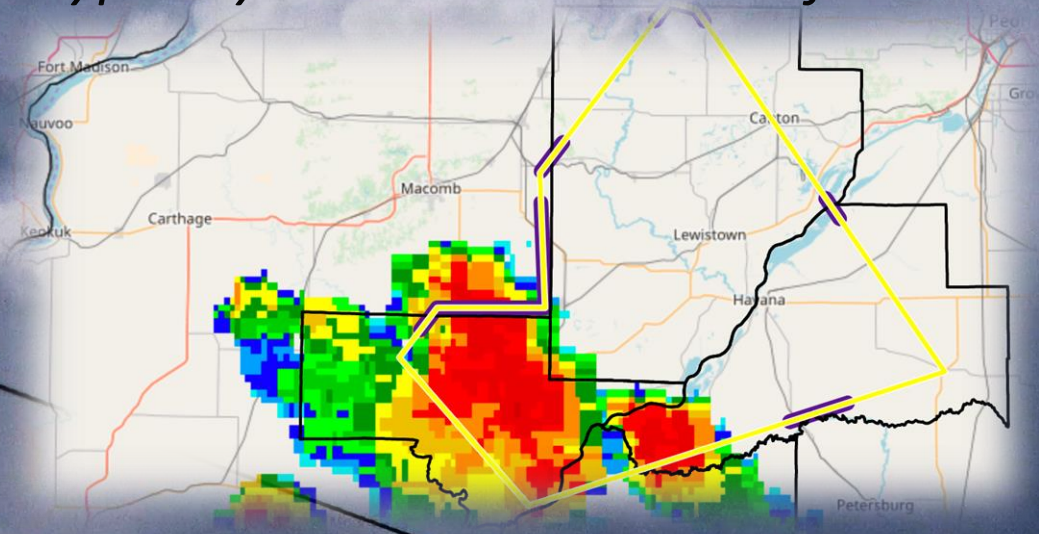
# *Types of Storms*

- *Multi/Single-Cell Thunderstorms*
- *Squall Line*
- *Supercells*
  - *High Precipitation*
  - *Classic*
  - *Low Precipitation*

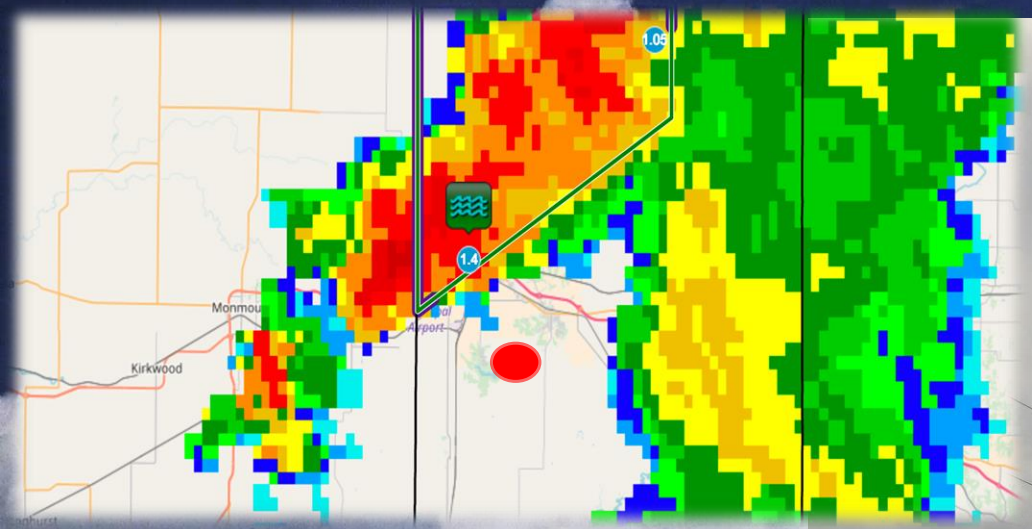

# *Single/Multi-Cell Storms*

- *Main Hazards*
  - *Small hail (occasionally will get severe)*
  - *Gusty winds (Can be severe on occasion)*
  - *Flash Flooding (watch for flooded roads)*
  - ***LIGHTNING***
- *Best Positioning Tips*
  - *Usually slow moving.*
    - *However, always check using radar or NWS warning statements*
  - *Typically south or southeast of the storm looki*

617 PM CDT...NATIONAL WEATHER SERVICE METEOROLOGISTS DETECTED A SEVERE THUNDERSTORM CAPABLE OF PRODUCING PENNY SIZE HAIL...AND DAMAGING WINDS IN EXCESS OF 60 MPH. THIS STORM WAS LOCATED 6 MILES NORTHEAST OF RUSHVILLE...AND WAS MOVING NORTHEAST AT 33 MPH.




# *Single/Multi-Cell Storms*



# *Single/Multi-Cell Storms*

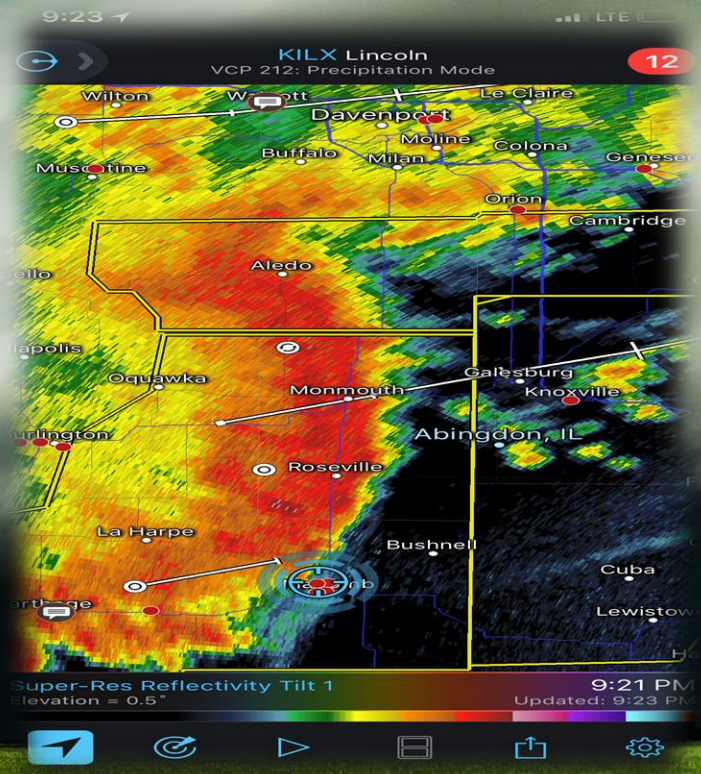
- *Spotting and Safety Tips*
  - *Stay in vehicle when near storm to avoid contact with lightning*
  - *Flooding can make roads impassable in prone areas*
  - *Can contain extremely high winds on RARE occasion.* ***ALWAYS*** *watch out for rapidly changing conditions near a thunderstorm*
  - ***NEVER park under or near trees***

**May 28, 2013: Galesburg, IL**

- 3 to 5 inches of rain in 1 hour
-Nearly every road in Knox County flooded
-Several million dollars in damages
–Non severe/slow moving thunderstorm was the culprit

# *Squall Line*

- *Main Hazards*
  - *Damaging Winds (sometimes widespread and significant)*
  - *Rain-wrapped tornadoes*
  - *Downed trees in roadways*
  - *Rapidly changing visibility conditions, poor road conditions*
  - ***LIGHTNING***
  - Very Common in Eastern Iowa/Western IL
- *Spotting Tips*
  - *Usually moderate to fast moving*
  - *Evident by "shelf cloud" proceeding the highest winds*
  - *Best position is usually east or southeast of the storm*
    - *Depends on motion of the storm*

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* At 1012 PM CST, severe thunderstorms were located along a line
  extending from near Keithsburg to near Denmark to 6 miles northwest
  of Canton, moving east at 60 mph.

  HAZARD...70 mph wind gusts.

  SOURCE...Trained weather spotters. This line of storms has a
           history of producing damaging winds.
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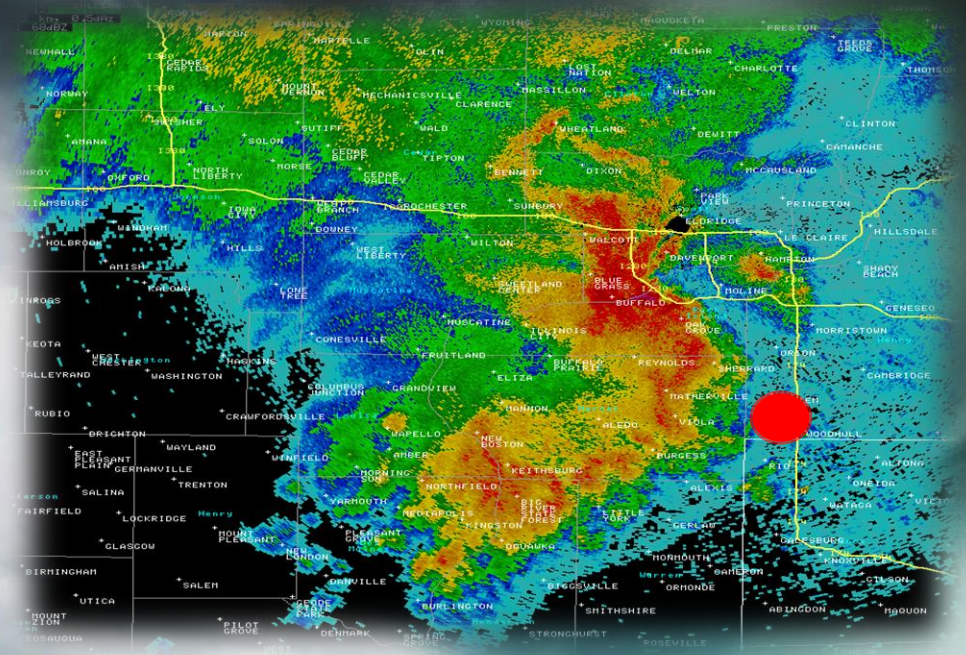
# *Squall Line*




*July 21, 2008*
*90-100 mph winds in Henry County, IL*
*2 deaths at campground where hundreds of trees fell*

## Safety Tips

- *Con contain tornadoes and tornado-like winds*
- *Stay in vehicle when shelf cloud passes overhead*
- *Never park near trees or other loose debris*
- *Winds can exceed 80 MPH in some storms*

*July 16, 2016: Oneida, IL*

# *Squall Line*

- *After the Storm*
  - *Watch for debris filled roadways*
  - *Watch for live power-lines in areas where trees are down*
  - *Never leave your vehicle in areas where power lines are down*
  - *Always report tree and power line damage to NWS and local emergency management.*

**June 20, 2015: Birmingham, IA**

- Severe squall line with 80 MPH winds hit town
– Widespread tree and power line damage
–Numerous homes damaged due to high winds

# *Squall Line: More Examples*

June 20, 2018 Moline, IL

- Can contain convincing ”scud” tags that look like tornadoes
- Rotation is key though, typically are non threatening and shouldn't be reported unless rapid rotation is occurring

July 16, 2018 Monmouth, IL

- After dark spotting is difficult
- Photography and lightning are your best bets
- Keep a bigger “buffer” zone for safety
- Be more vigilant of road hazards

*Background: June 17, 2012; Watertown*

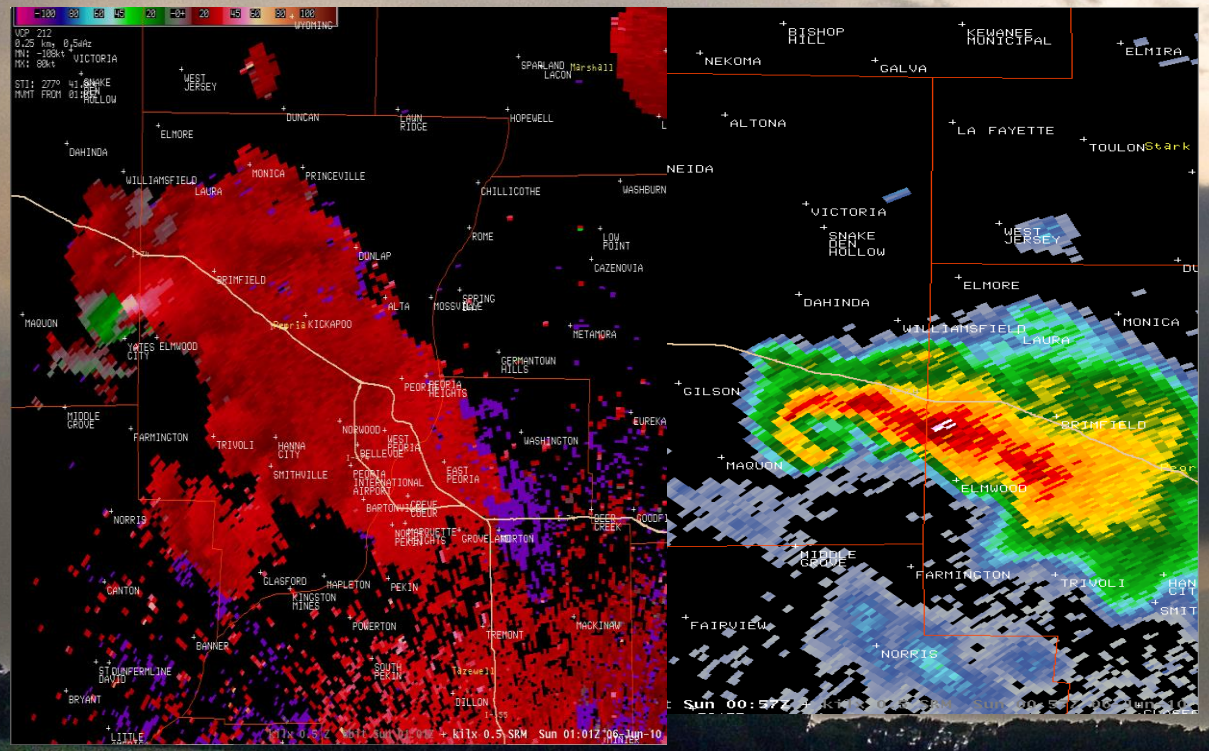
# *Supercell Thunderstorms*

- *Main Hazards*
  - *Very Large Hail (up to grapefruit size occassionally)*
  - *Damaging winds (possibly hurricane force)*
  - *Tornadoes (sometimes intense EF2+)*
  - *Flooding rains*
  - ***LIGHTNING***
- *Supercells produce the most intense weather of any storm*
- *Responsible for the majority of strong (EF2-EF5) tornaoes in the US*
- *Exercise extreme caution when near a supercell thunderstorm*
- *Behavior of these storms can be quite erratic*
- *Poses the highest risk to storm spotters and chasers alike*
  - *Potential vehicle damage due to hail*
  - *Potential to have multiple tornadoes ongoing*
  - *All of the above (other hazards discussed in previous sections)*

*June 9, 2018: Eastern Iowa*

# *Supercell Thunderstorms: Radar*

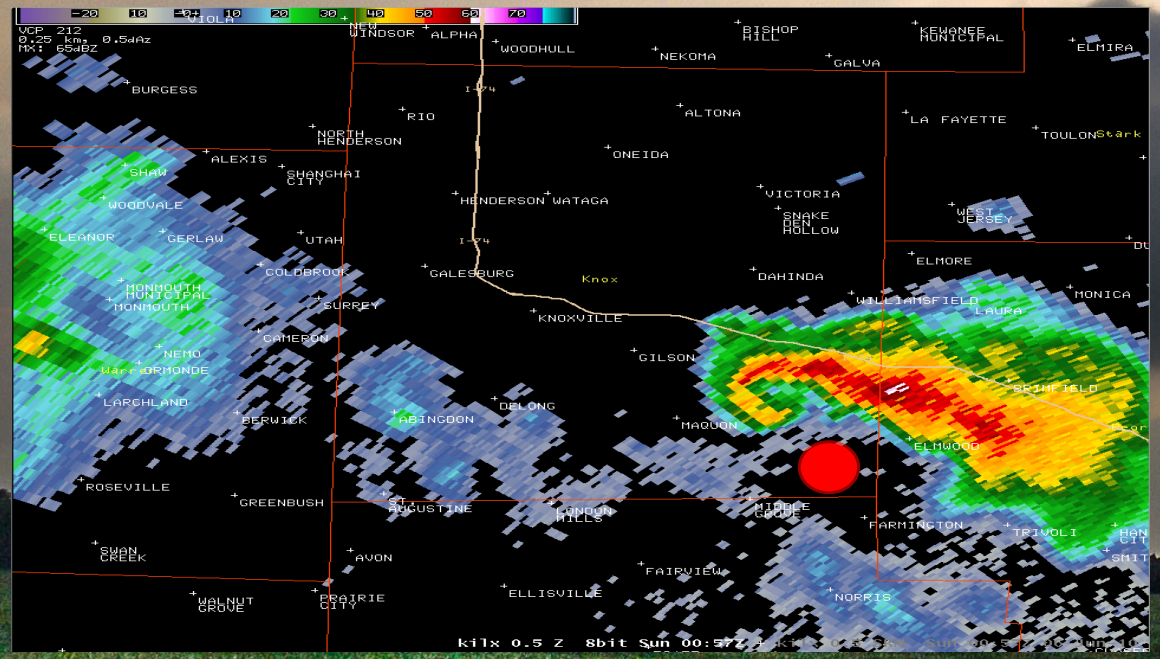
- *Identification tips on Doppler radar*
  - *Usually smaller in size than most counties*
  - *Characterized by a single persistent deep rotating updraft (mesocyclone)*
  - *Look for a hook echo feature on the southeast or southwest flank of the storm*
  - *Movement is typically northeast or east in our area, sometimes southeast*




*June 5, 2010 – Elmwood, IL EF2 Tornado*

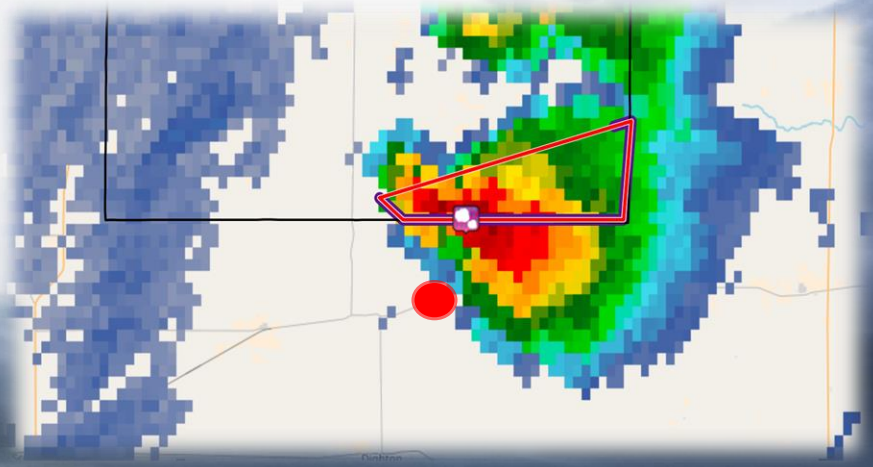
# *Supercell Thunderstorms: Positioning*

- *Positioning tips*
  - *Southeast of the storm is a good place for visibility and safety*
  - *NEVER drive through the precipitation region of a supercell*
    - *You could potentially run into extremely large hail or a tornado with little warning*
  - *Always have an escape route ready that doesn't cross the path of the storm*
    - *This is typically to your south if the storm is moving east or northeast*
    - *Or a right angle to the movement of the supercell*



# *Supercell Thunderstorms: Spotting*

- *Typical Classic-LP supercell*
  - *Common in the Plains*
  - *Unusual for Eastern Iowa/Western Illinois*
  - *Storm motion is to the east slowly, while looking north*
  - *Intense lightning, means, STAY IN THE VEHICLE, while observing*



**June 4, 2015 – Hill City, KS**

# *Supercell Thunderstorms: Spotting*

- *Wall Cloud*
  - *Precursor to tornado development…..sometimes*
  - *Not all storms that have wall clouds will produce a tornado. Many do not.*
  - *Watch for rotation. From the east this will usually appear as left to right motion*
    - *This should be reported to the NWS via phone or internet*
  - *Always stay vigilant.*

*March 28, 2017: Abilene, TX*

# *Supercell Thunderstorms: Spotting*

- *Funnel Cloud*
  - *Usually forms out of a wall cloud*
  - *Can quickly develop and evolve into a tornado*
  - *Can also form in unexpected areas….*
  - *Will not always "appear" to make contact with the ground*
    - *This CAN still be a tornado. Watch for debris near the surface*

*May 6, 2015: Oklahoma*

# *Supercell Thunderstorms: Spotting*

- *Tornadoes*
  - *Doesn't always have to have a funnel to be a tornado*
  - *Tornadoes are defined by their circulation at ground level*
  - *Can become heavily "wrapped" in rain after their birth*

*March 15, 2016: Good Hope, IL*

# *Supercell Thunderstorms: Spotting*

- *Tornadoes*
  - *Can form quickly. Usually evolving from a wall cloud then a funnel*
  - *Some storms have funnels and wall clouds, but never produce a tornado*
  - *Can last for seconds up to over an hour in duration and grow quite large*
  - *Winds surrounding a tornado (~1 mil distance) can be quite severe*
    - *Inflow or Rear Flank Downdraft Winds*
    - *Debris at this range can be quite dangerous*

*Feb 28, 2017: Naplate, IL*

# *Supercell Thunderstorms: Spotting*

- *Other Factors*
  - *Some storms contain multiple tornadoes*
  - *Large hail can surround a tornado, even with good visibility.*
  - *Debris filled roadways behind a tornado*

*June 16, 2014: Northeast Nebraska*

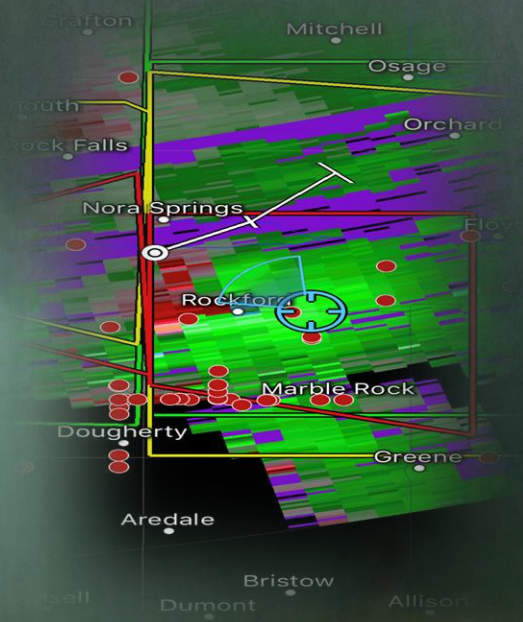
# *Supercell Thunderstorms: Spotting Challenges*

- *Typical HP (High Precipitation) Supercell*
  - *Common in Eastern Iowa/Western Illinois*
  - *Tornadoes are difficult to observe*
  - *Should remain southeast of the storm out of path at all times.*
    - *High risk for destructive hail and damaging winds, possible embedded tornadoes*
    - *Tornadoes can form very quickly with little warning*


*June 9, 2018: Northern Iowa*

# *Supercell Thunderstorms: HP Supercells*

- *Most common supercell type in our area*
  - *Spotting is difficult due to high amounts of precipitation*
  - *Wall cloud and tornado are in the middle but buried by hail/rain*
  - *View is looking southwest from the northeast*
    - *Very dangerous position to be in*
    - *Both escape routes contain high risks of hazards*



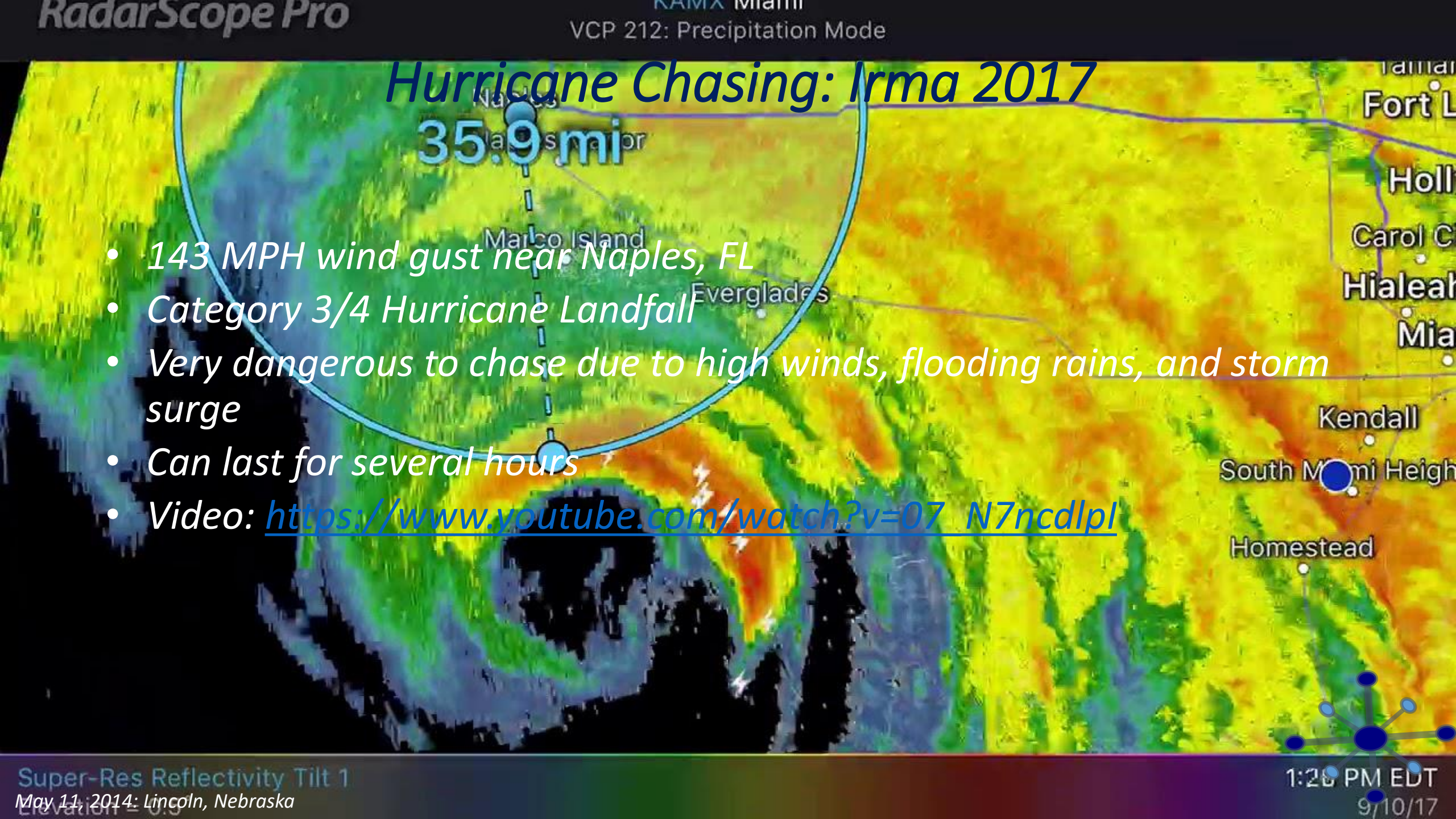

*June 9, 2018: Northern Iowa*

# *Supercell Thunderstorms: HP Supercells*

- *Positioning Tips*
  - *Southeast of the storm will yield the lowest safety risks*
  - *Visibility can still be quite poor here though*
  - *Tornado will appear either toward the back of the storm or completely invisible to the spotter*
  - *EF-2 tornado was ongoing to my NW in this example*
  - *This is a SAFE position to be in. Storm is moving to my right (northeast)*

*May 11, 2014: Lincoln, Nebraska*

# Hurricane Chasing: Irma 2017




- *143 MPH wind gust near Naples, FL*
- *Category 3/4 Hurricane Landfall*
- *Very dangerous to chase due to high winds, flooding rains, and storm surge*
- *Can last for several hours*
- *Video: https://www.youtube.com/watch?v=07_N7ncdlpI*

*May 11, 2014: Lincoln, Nebraska*

# Pilger Twin Tornadoes

- Multiple (10) tornadoes from one storm
- 4 EF4 rated tornadoes
- Entire town destroyed, injuries and fatalities still occurred despite ample warning
- Sometimes storms can produce simultaneous tornadoes
- Video

# *Conclusion*

- *Always stay vigilant when around any thunderstorm*
- *Your life isn't worth a report or a photograph*
- *If you can safely report severe weather, please do so, but safely*

- *Any Questions? Thank you for watching!!!*

*August 16, 2018: Fulton Co, IL*