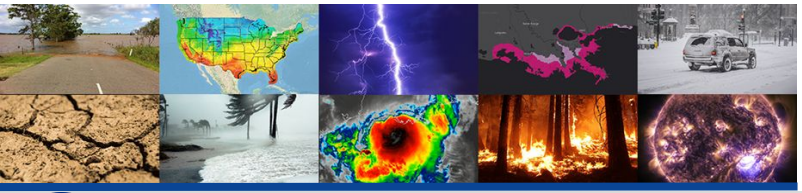
National Weather Service Burlington Weather Forecast Office

Robert Haynes - NWS Burlington



Presentation Layout

- How Skywarn Operates and Why We Need It.
- Overview of the National Weather Service in Burlington
- Review of Storm Ingredients, Storm Types, and the National Weather Service's Warning System
- Safety and Reporting Severe Weather

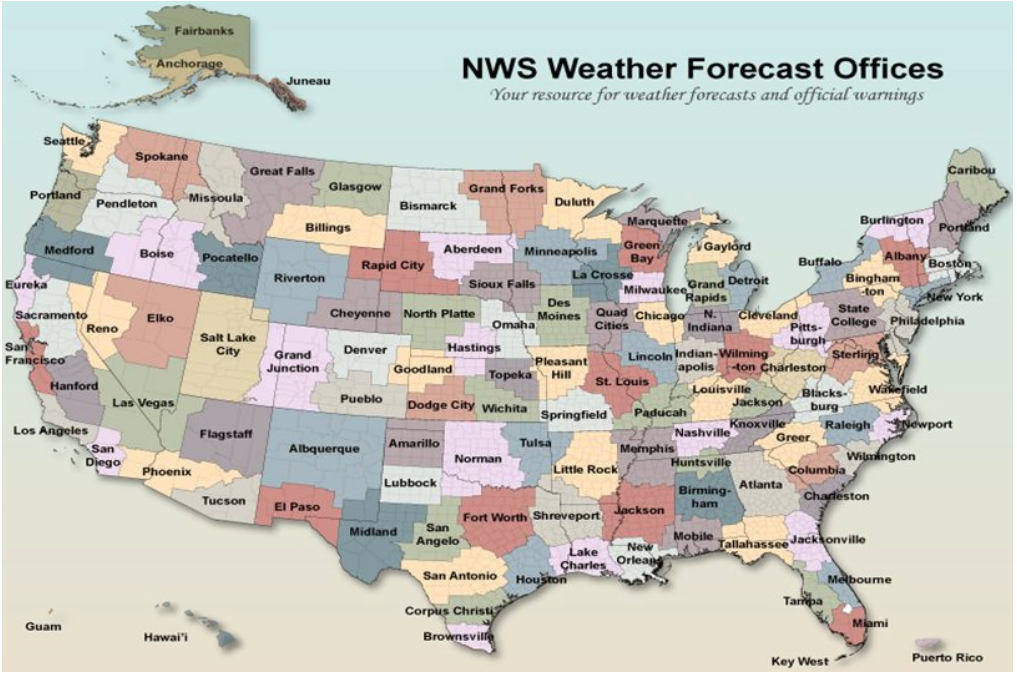
What is the National Weather Service?

NWS Mission

Provide weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy.

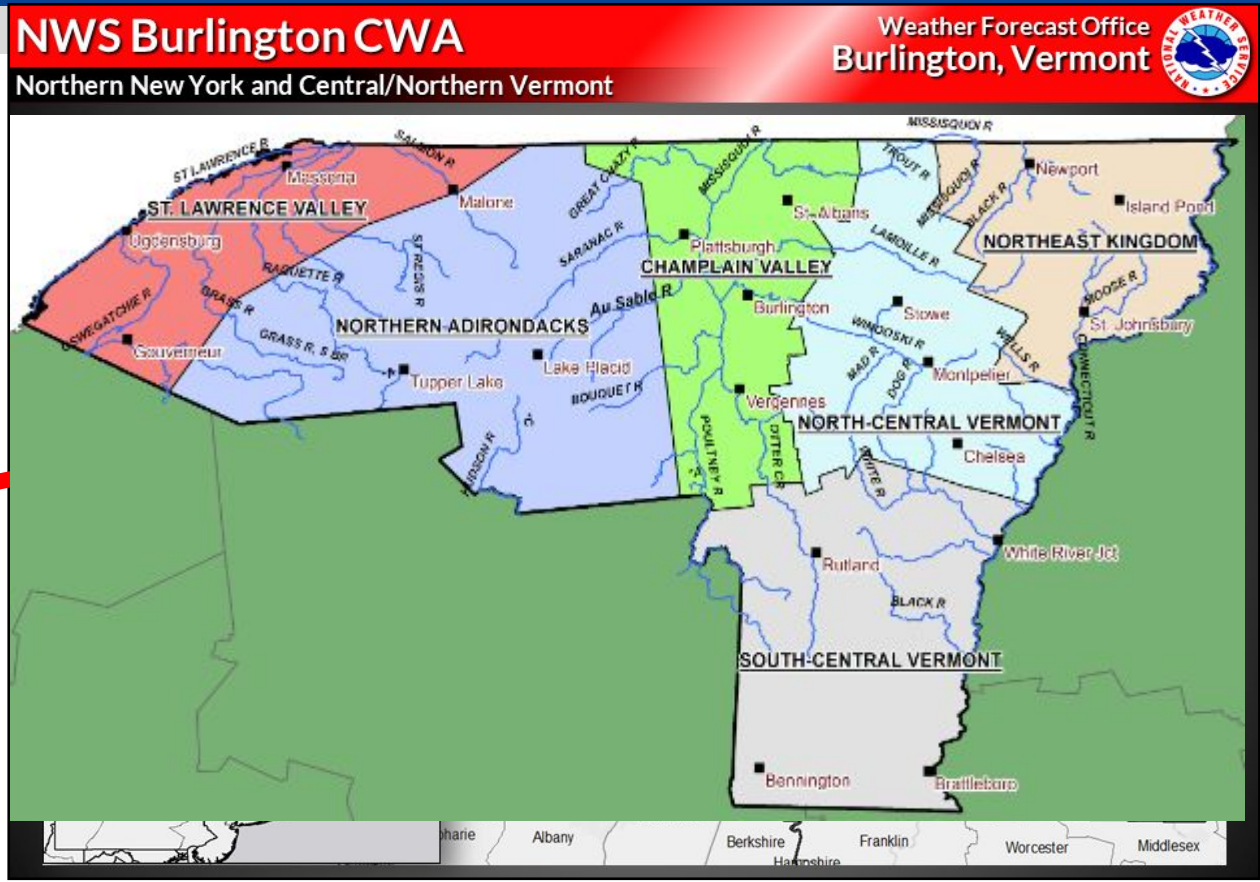
NWS Vision

A Weather-Ready Nation: Society is prepared for and responds to weather, water, and climate-dependent events.



Where Do We Service?

- We service all of Vermont, except Bennington and Windham Counties and the 4 northernmost counties of New York.



Hierarchy

Department of Commerce
~44,000 employees

National Oceanic & Atmospheric Administration
~12,000 employees

National Weather Service
~4,500 employees

Hierarchy


Western Region
Central Region
Eastern Region
Alaska Region
Pacific Region
Southern Region
Space Weather Prediction Center
Space Environment Center
Aviation Weather Center
Storm Prediction Center
NCEP Central Operations
Climate Prediction Center
Weather Prediction Center
Environmental Modeling Center
Ocean Prediction Center
National Hurricane Center
Puerto Rico
Regional Offices
National Centers
River Forecast Centers
Weather Forecast Offices

Not Just Meteorologists

Staffing

In addition to meteorologists, we have:

- Senior Service Hydrologist
- Information Technology Officer
- Electronic Technicians
- Administrative Assistant
- Observation Program Leader
- Electronic Systems Analyst

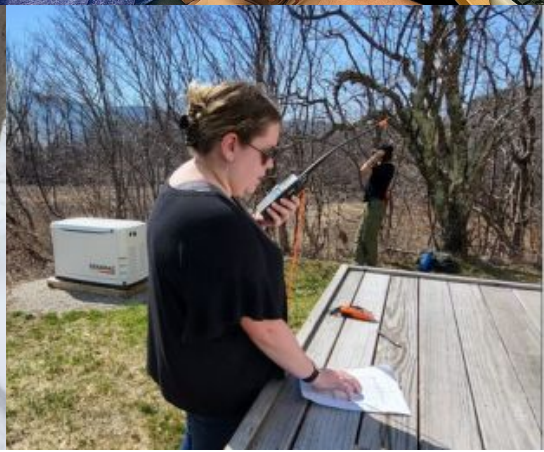
What do we do?

Some of our Duties

- Watch/Warning/Advisory
- Public Forecasts
- Aviation
- Hydrology
- Fire Weather Forecasts
- Marine Forecasts
- Data Management
- Climate Services
- Upper Air
- Hazmat Support
- Systems Management
- Research and Training
- Outreach

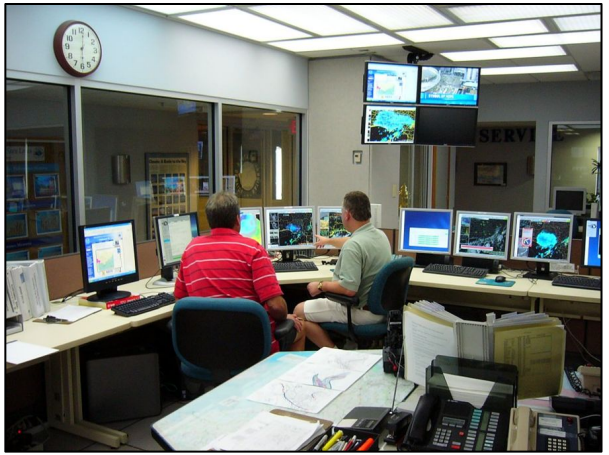







What is Skywarn?

A nearly 60 year old program that trains people to recognize and report severe/hazardous weather to help meteorologists make life-saving decisions



Why Do We Need Spotters?

The United States is the most severe weather prone country in the world

A typical year brings:

- 10,000 thunderstorms
- 5,000 floods
- 1,200 tornadoes
- 6 hurricanes
- 500 deaths and 5000 injuries
- $15.0 Billion in Losses
- 98% of all presidentially declared disasters are weather related

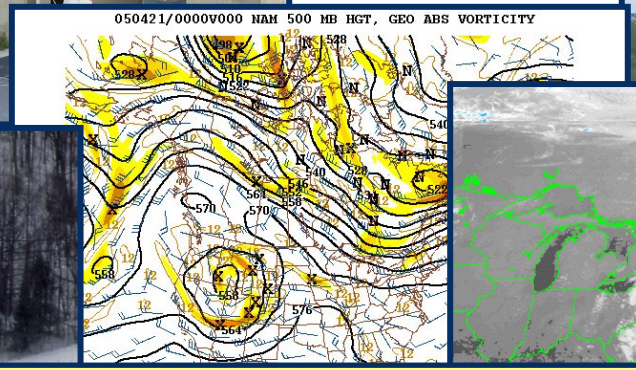
Who can be a Spotter?

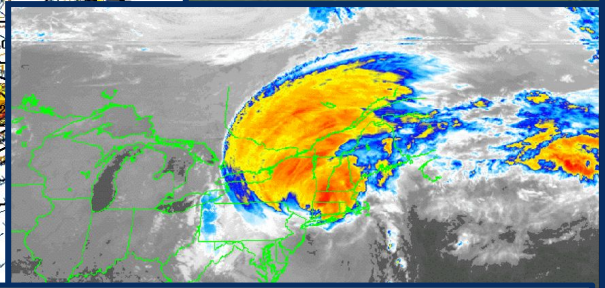
- Amateur Radio Operators (SKYWARN)
- Emergency Management Officials
- Firefighters
- Law Enforcement Officials
- Rescue Workers and EMTs
- Media
- Researchers
- Students
- General Public
- Storm Chasers
- COOP/CoCoRaHS

Anyone

Why Do We Need Spotters?

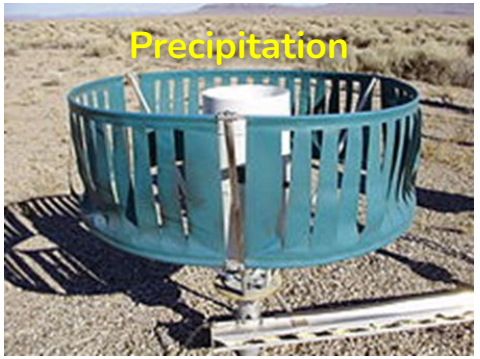
- ✔ We use all kinds of methods to make weather observations.
  - ✔ *Surface Observations*
  - ✔ *Upper Air Observations*
  - ✔ *Computer Models*
  - ✔ *Satellite Imagery*
  - ✔ *Radar*



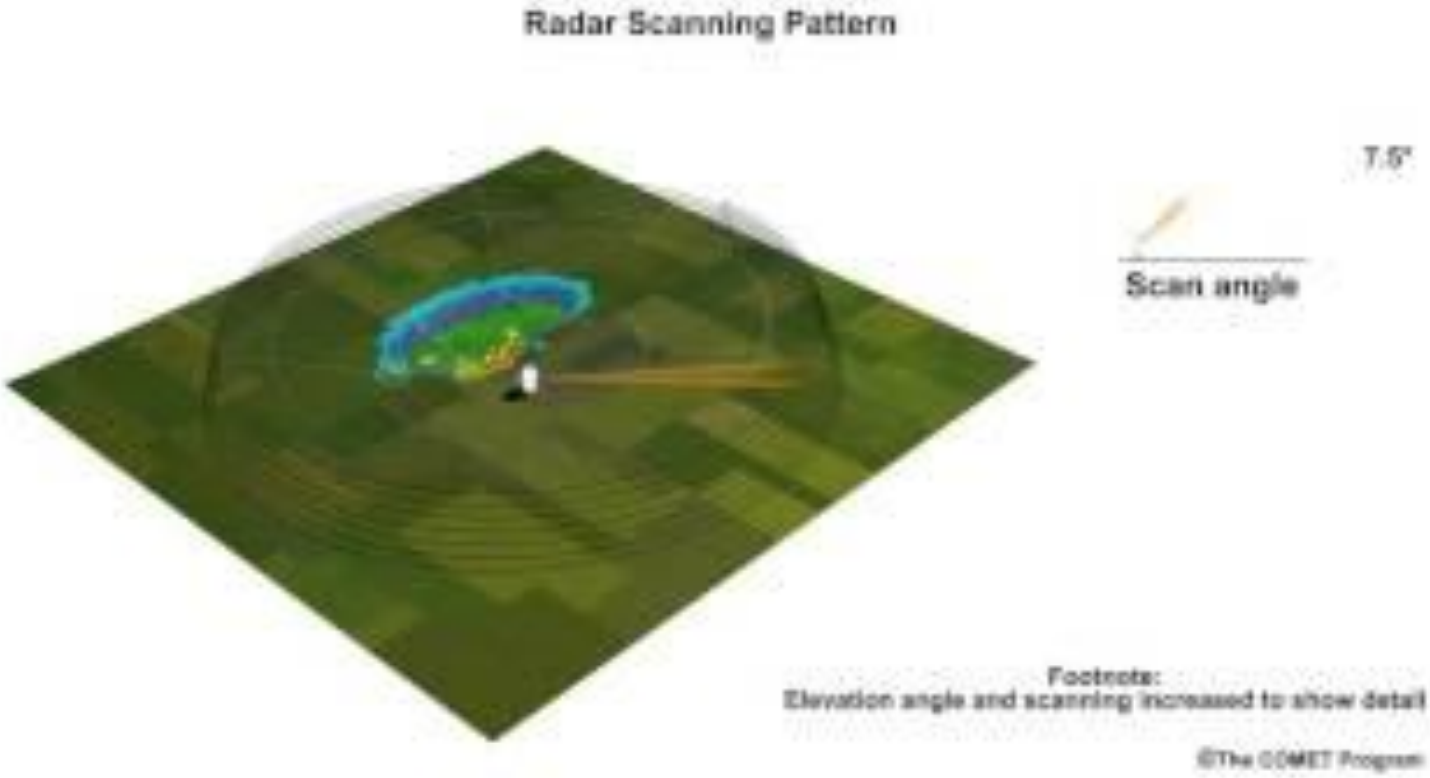


But they all have limitations

Observing Weather at a Point

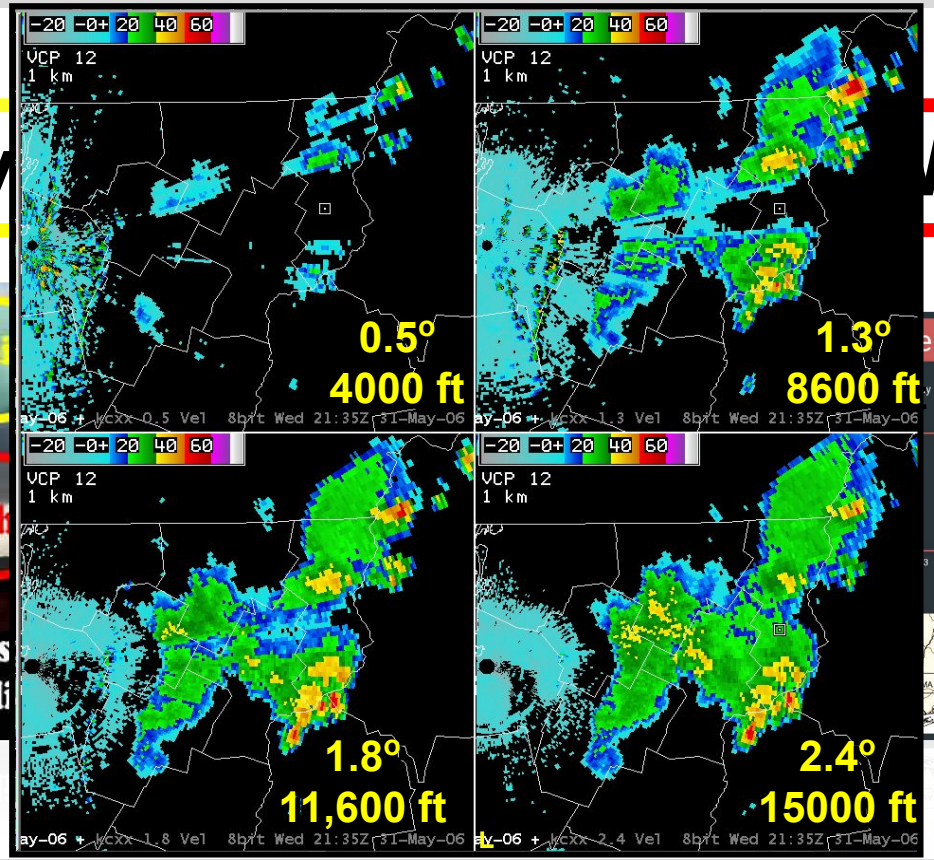


Observing Local Weather: Radar



Why Do We Need spotters?

Observ

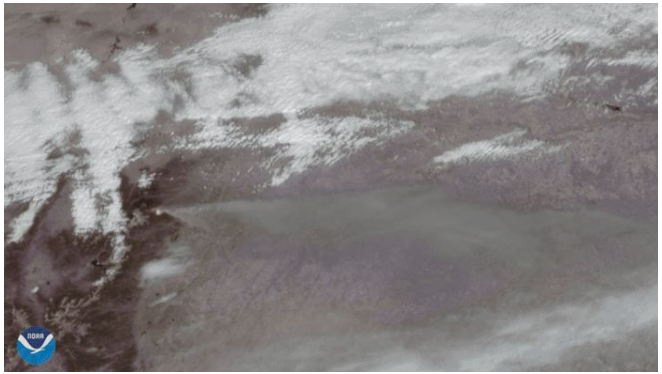


Warning

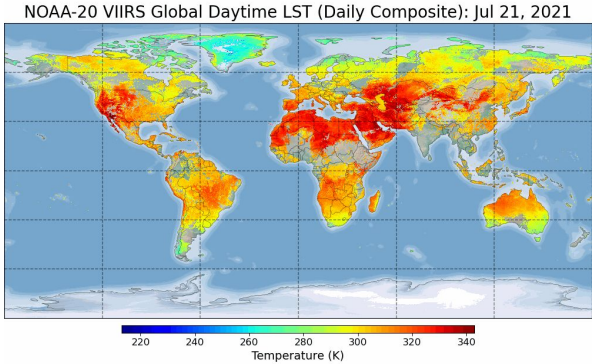
Observing Local Weather: Satellites

Satellites are probably the single most important technological advancement to our understanding of weather and observing Earth's climate.

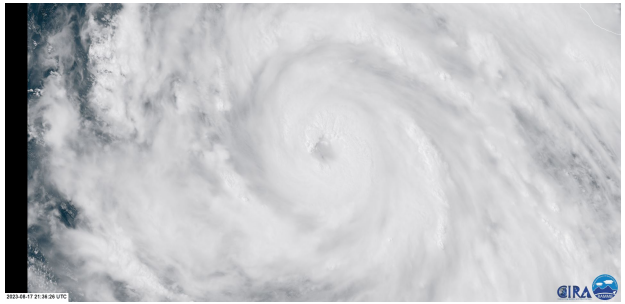
Detecting Fires and Smoke



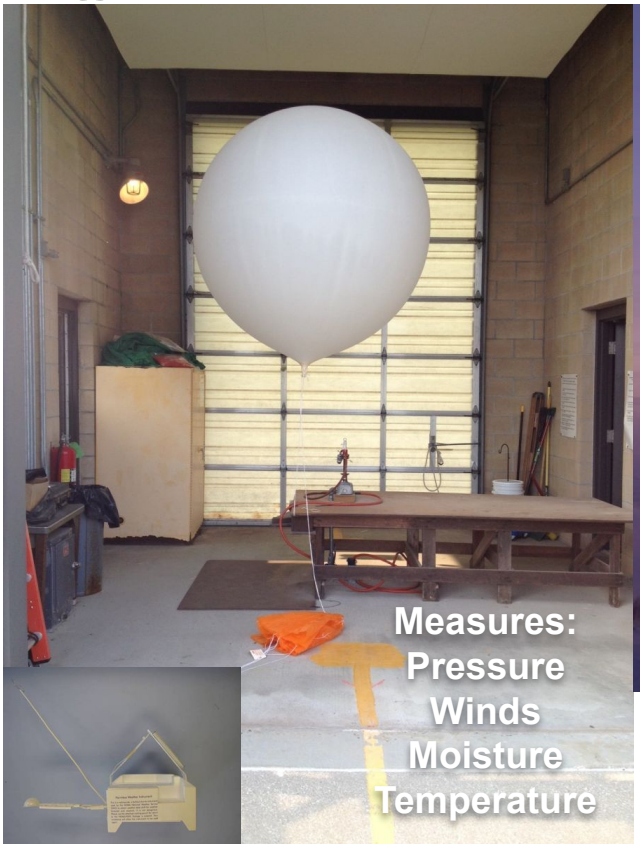
Measuring Earth's Temperature



Monitoring Hurricanes



The Weather Balloon

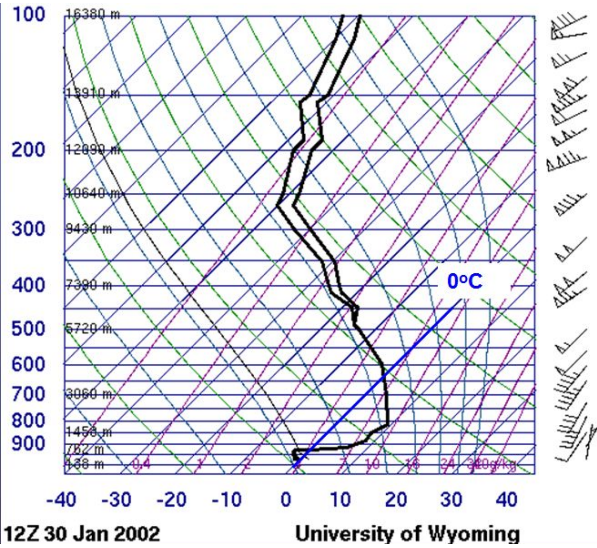


- 2+ hours of travel
- Goes as high as 115,000 ft.
- Can drift 180 miles from launch point

Weather balloons have helped us measure atmospheric conditions for over a century. Their first documented use was in 1896!

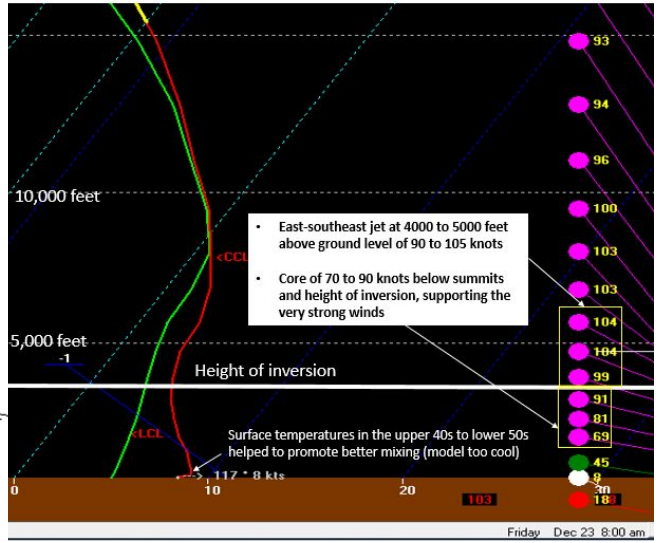
How We Use Weather Balloons

Determining whether it will be snow or be freezing rain



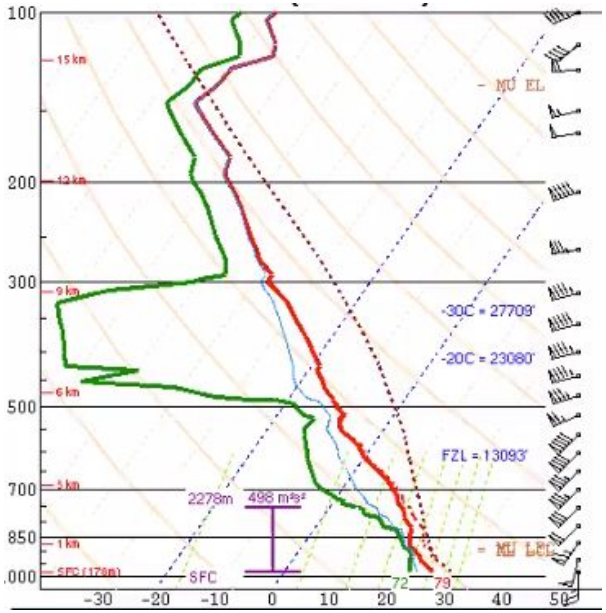
From one of Oklahoma's most devastating freezing rain events.

Whether we observe damaging downslope or gap winds



A 71 mph wind gust reported where I work Dec 23rd, 2022

Whether or not thunderstorms are possible

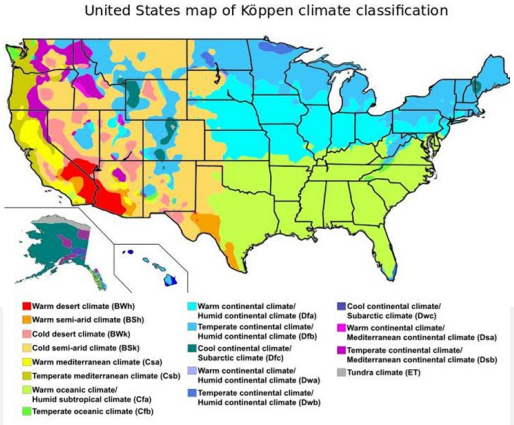


April 27, 2011 Super-Outbreak

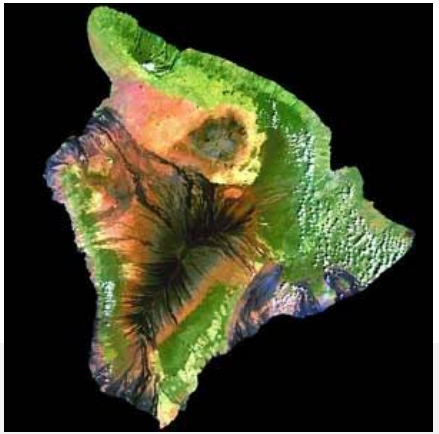
What Exactly Is Weather?

Weather	Climate
Day-to-Day	Long term – (20-40 years)
Fronts and High/Low Pressure	Planetary Circulations
Cold Snap/Heat Wave	Frequency, “Return intervals”

Climate is the baseline or “normal”, and weather describes the day to day conditions.



Climate zones can be tightly packed. For instance, the Big Island of Hawaii has 11 climate zones.



Images: NOAA Scijinks


The Sun Heats the Earth...
The Earth Heats the Air
Cold
Cool
Warm
Incoming Solar Radiation passes through the atmosphere and is absorbed by the Earth's surface.
Outgoing Terrestrial Radiation is absorbed by the atmosphere.

Uneven Heating of the Earth

Oblique Rays *(Less Radiation Received)*

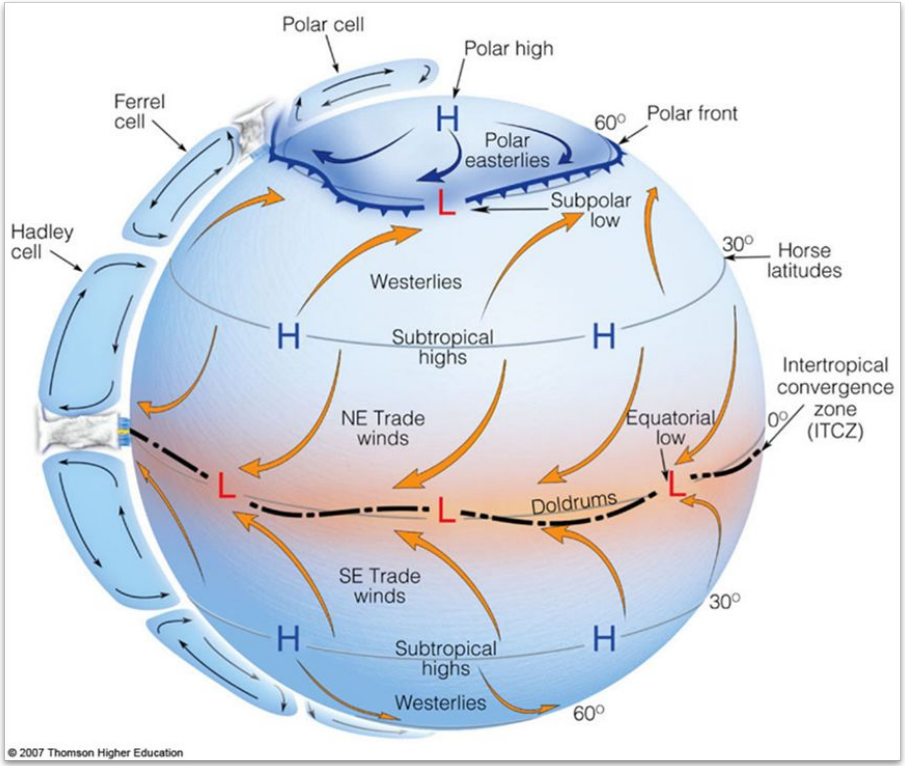
Vertical Rays *(More Radiation Received)*

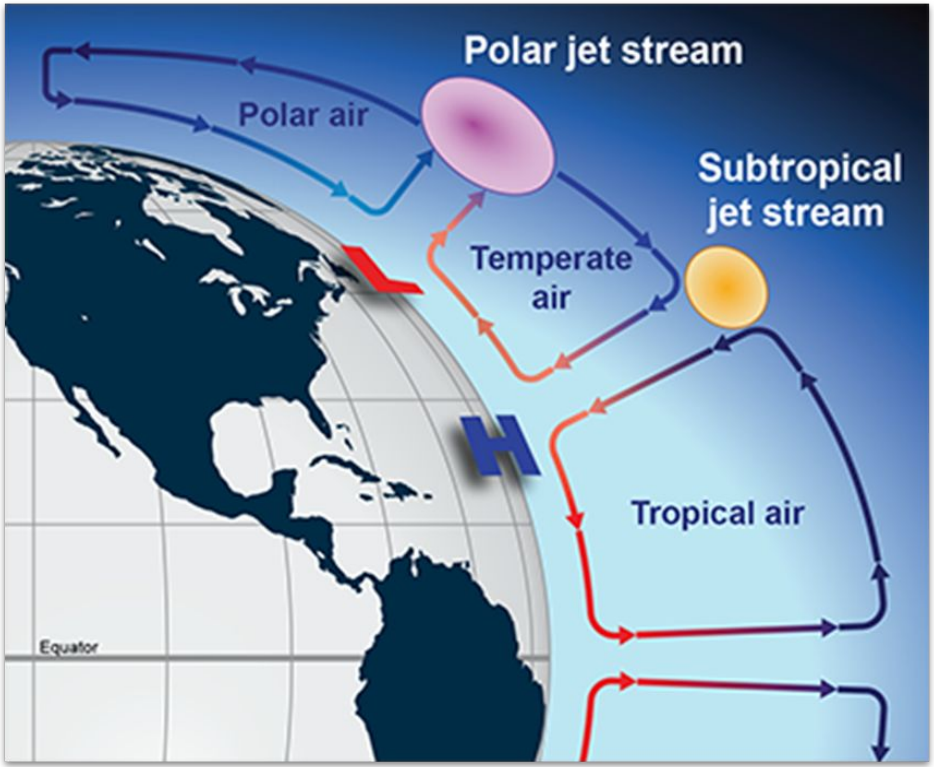
Oblique Rays *(Less Radiation Received)*

Equatorial Regions are Warmer *(Higher Sun Angles)*

Polar Regions are Colder *(Lower Sun Angles)*

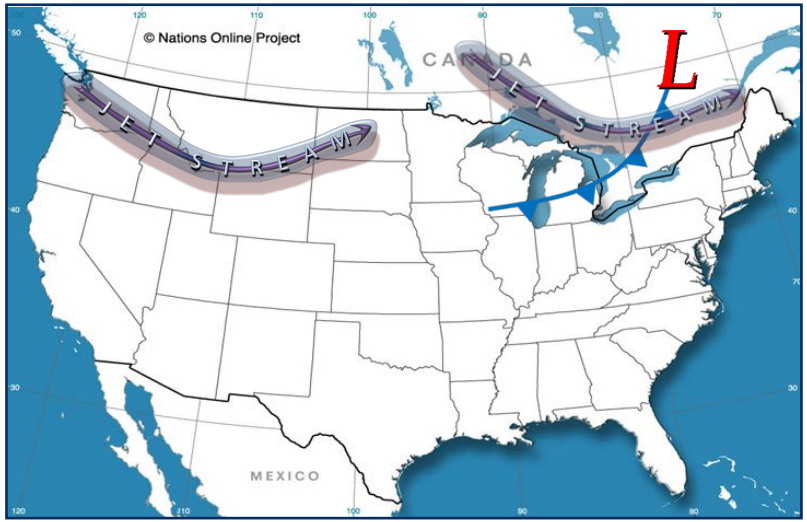
Our Global Circulations



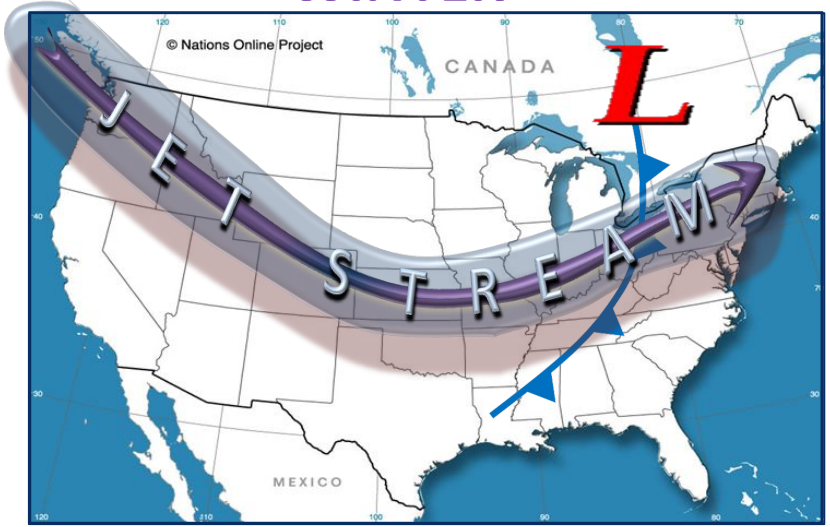


Zooming into a Continental US View

SUMMER

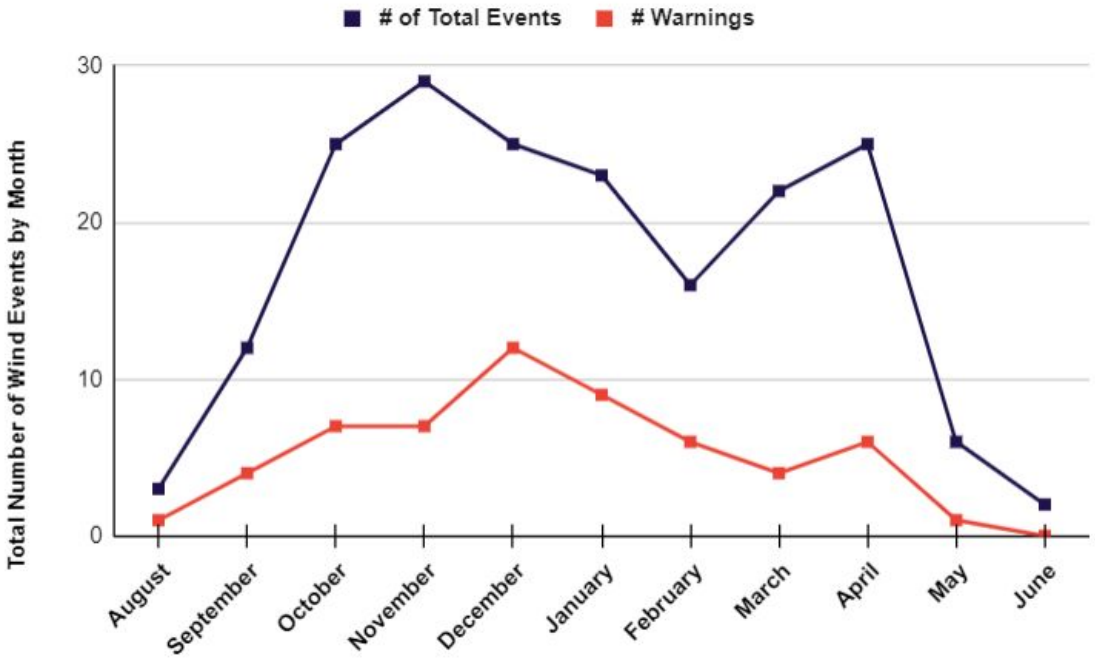


WINTER



- Changes in solar heating between seasons affects the jet stream and how strong fronts are.

Gusty Winds Are Common in Fall through Spring

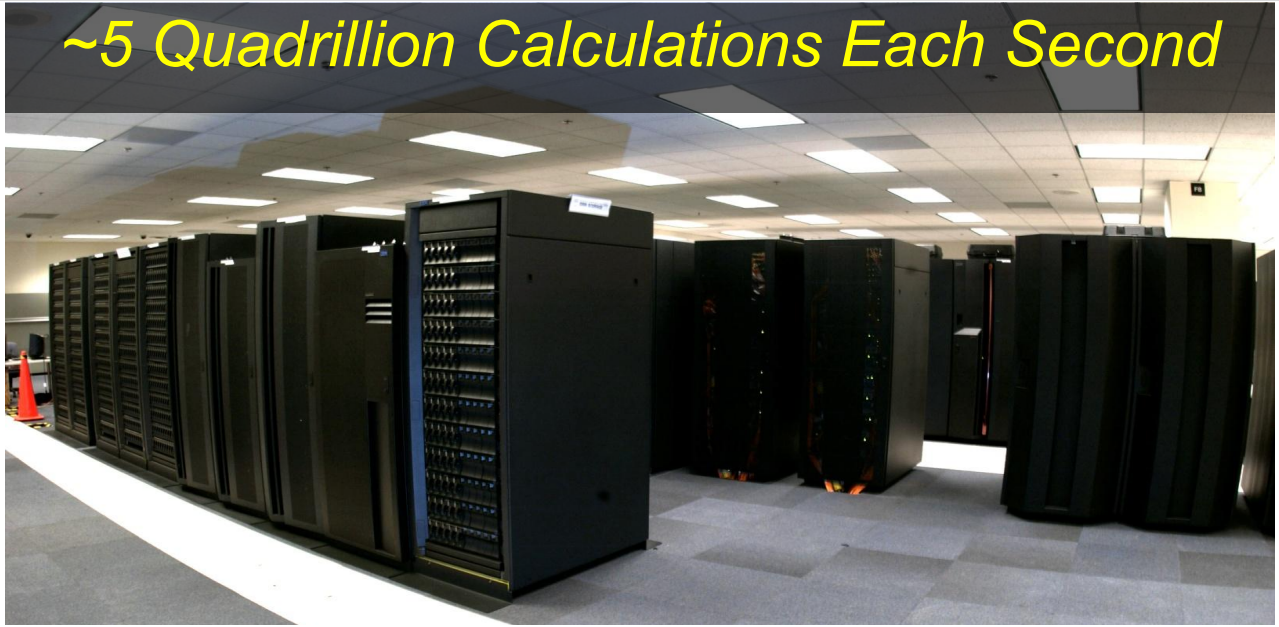


Strong Wind Gusts (greater than 45 mph) become increasingly common - posing risk of frostbite and power outages in cold

Why is this so?

- Extratropical cyclones are stronger in winter
- Temperature contrast at transition of seasons increases winds

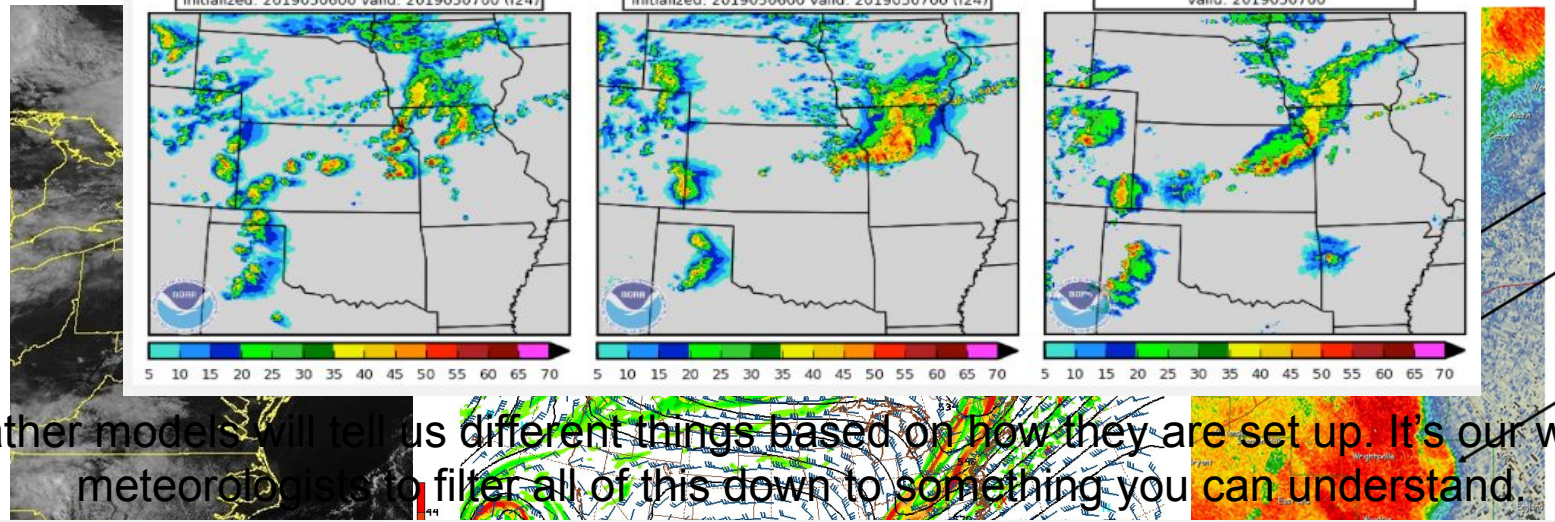
What Do We Use to Observe Weather?



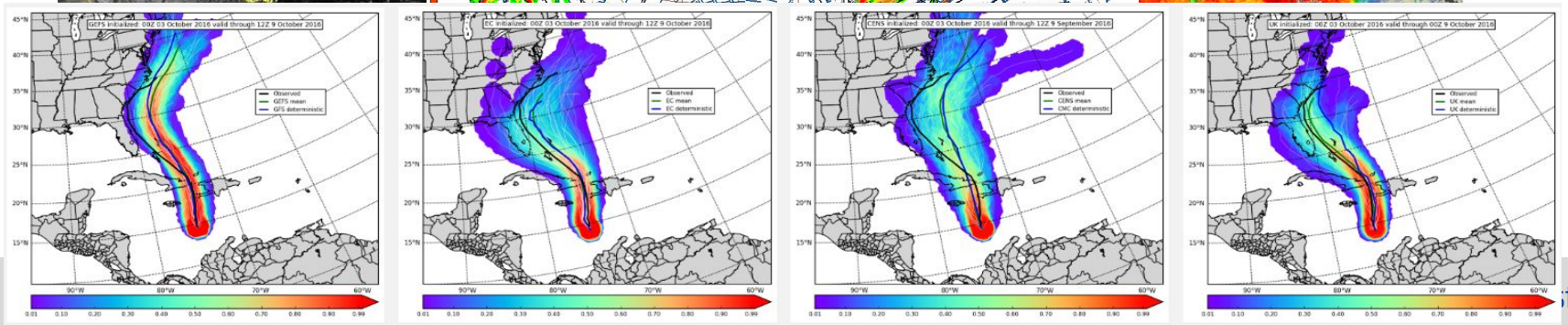
- The first “Weather Models” were handmade calculations
- Time-consuming and impractical for operational meteorology; best to use conceptual models

Bringing it all together

We use all these forecast maps, radar, and satellite



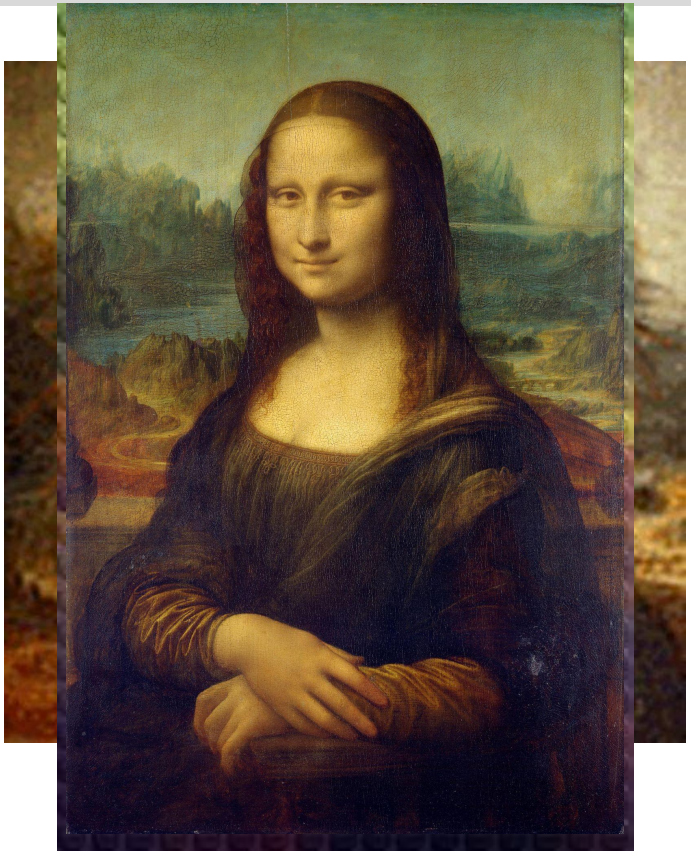
Weather models will tell us different things based on how they are set up. It's our work as meteorologists to filter all of this down to something you can understand.



What's Forecasting Weather Like?

Mona Lisa images accessed via public domain

- Forecasts after 4 days use low resolution models.
- We know some of the details, but other things are hard to distinguish.
- We can sort through different models and where they agree or disagree to get a better idea, and use consensus to tell if something is unlikely to be the real deal.
- And then, when we get within 48 hours or so, we have much more reliable higher resolution, but that sometimes means we have to closely look at minute details!



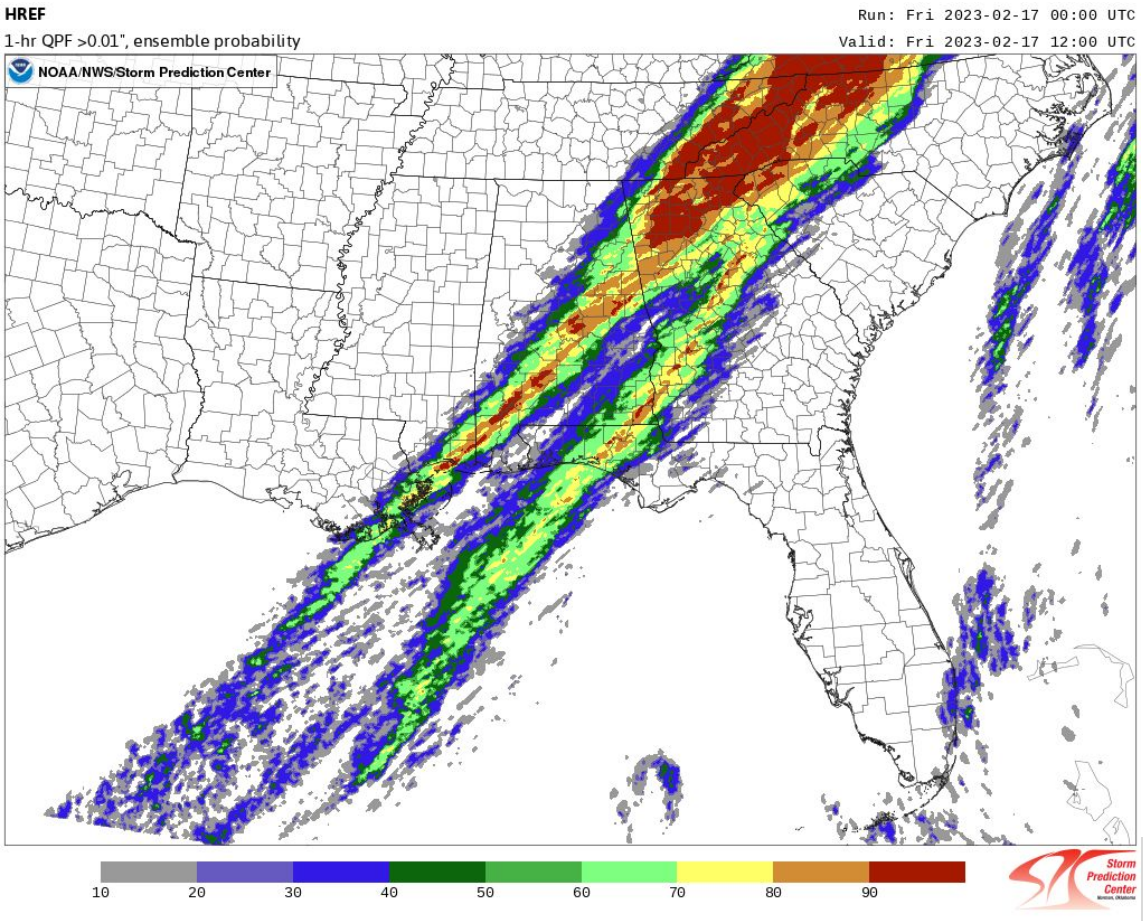
What Does a 40% Chance of Rain Mean?

Modern Technology Lets Us Say This Literally

We're not locked into 1 or 2 model like the 1980s or early 90s. A 40% chance for rain might vary from forecaster to forecaster.

Now, we have multiple families of models – or ensembles. Like a musical orchestra, a weather ensemble has many parts that make up the whole that let us account for these differences.

If 4 of 10 models show precipitation, then we can say there's a 40% chance of rain.

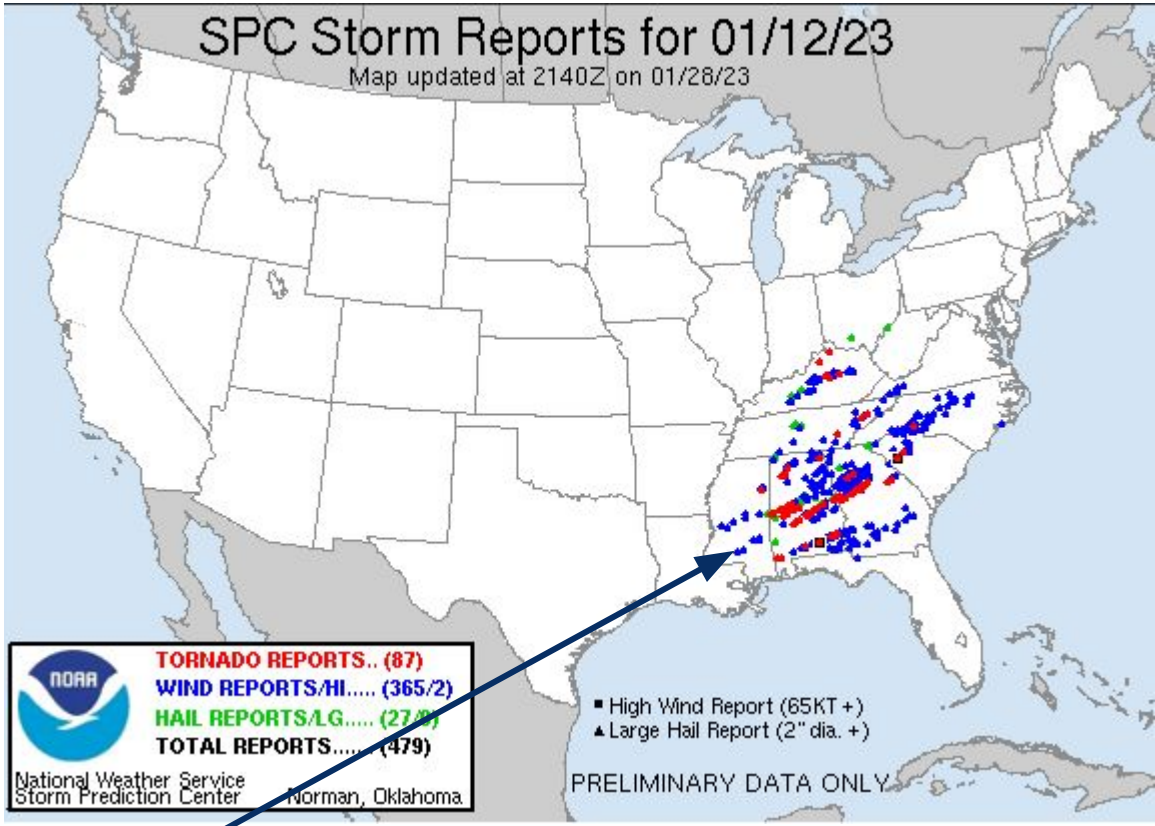


National Oceanic and Atmospheric Administration
U.S. Department of Commerce

The Technology is Still Growing

AI and Machine Learning will become a part of the weather forecasts of tomorrow.

They can use model data and look back to the past to forecast the chances for severe weather in future cases.

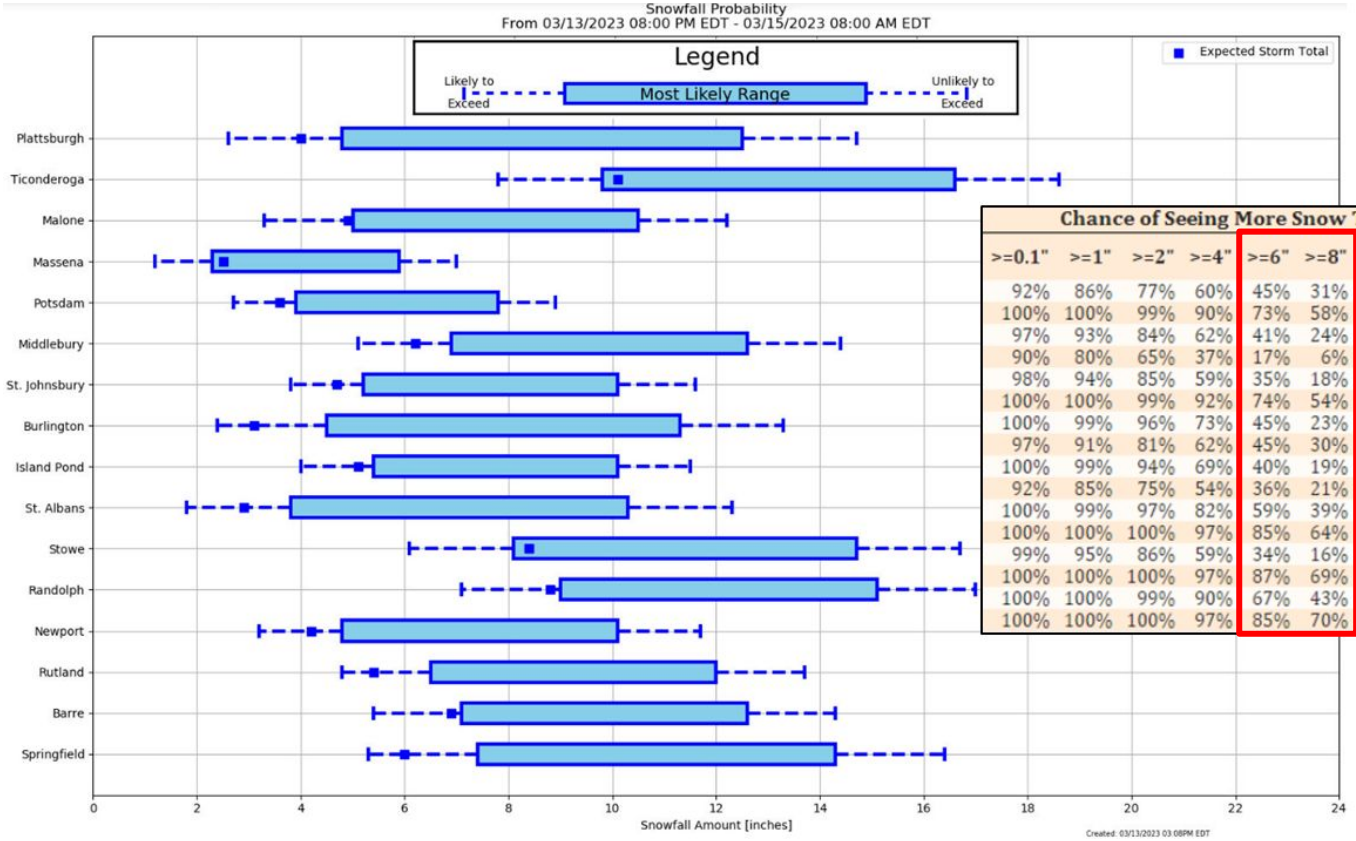


AI detected chances for severe weather

How do you handle forecast range of snow?

This box and whisker shows potential snowfall amounts.

What do you notice?



Chance of Seeing More Snow Than

>=0.1"	>=1"	>=2"	>=4"	>=6"	>=8"	>=12"	>=18"
92%	86%	77%	60%	45%	31%	13%	2%
100%	100%	99%	90%	73%	58%	31%	9%
97%	93%	84%	62%	41%	24%	6%	0%
90%	80%	65%	37%	17%	6%	0%	0%
98%	94%	85%	59%	35%	18%	3%	0%
100%	100%	99%	92%	74%	54%	23%	3%
100%	99%	96%	73%	45%	23%	3%	0%
97%	91%	81%	62%	45%	30%	11%	2%
100%	99%	94%	69%	40%	19%	2%	0%
92%	85%	75%	54%	36%	21%	6%	0%
100%	99%	97%	82%	59%	39%	11%	1%
100%	100%	100%	97%	85%	64%	29%	4%
99%	95%	86%	59%	34%	16%	2%	0%
100%	100%	100%	97%	87%	69%	36%	7%
100%	100%	99%	90%	67%	43%	11%	0%
100%	100%	100%	97%	85%	70%	42%	14%

Are there any questions?

- About Skywarn?
- About the National Weather Service in general?
- Anything else that comes to mind?


Awareness
Communication
Escape routes
Safety zones
SAFETY
FIRST
Your Safety is ALWAYS #1

SEVERE WEATHER

HAZARDS

TORNADO
Take shelter immediately in a sturdy structure

LARGE HAIL
Move indoors away from windows

SEVERE WIND
Move indoors away from windows

FLOODING
Avoid rising creeks and water covered roads

LIGHTNING
Move indoors if you hear thunder

Over 280 fatalities occur each year in the U.S. from thunderstorm related hazards.

weather.gov/safety

Don't underestimate the power of water!

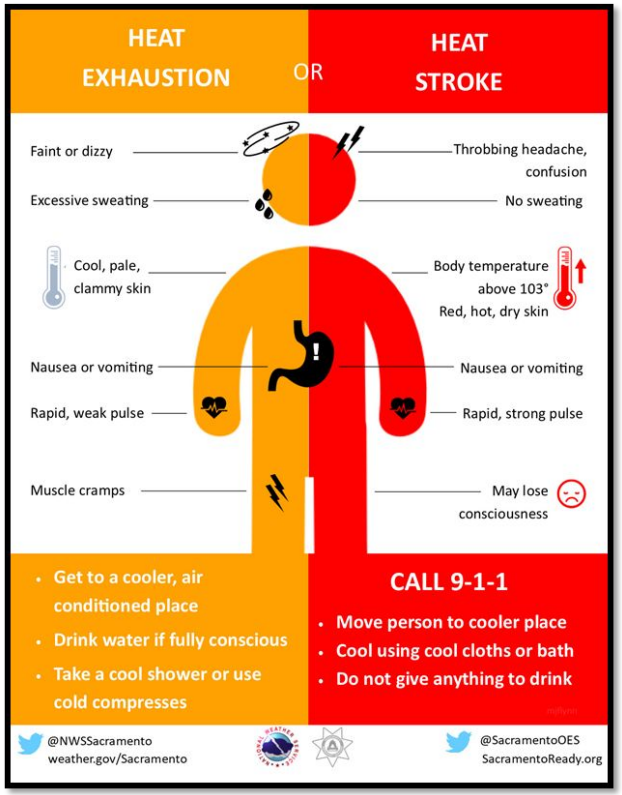
6 inches of fast-moving water can knock over and carry away an adult.

12 inches of fast-moving water can carry away a small car.

18-24 inches of fast-moving water can carry away most large SUVs, vans and trucks.

Heat Safety

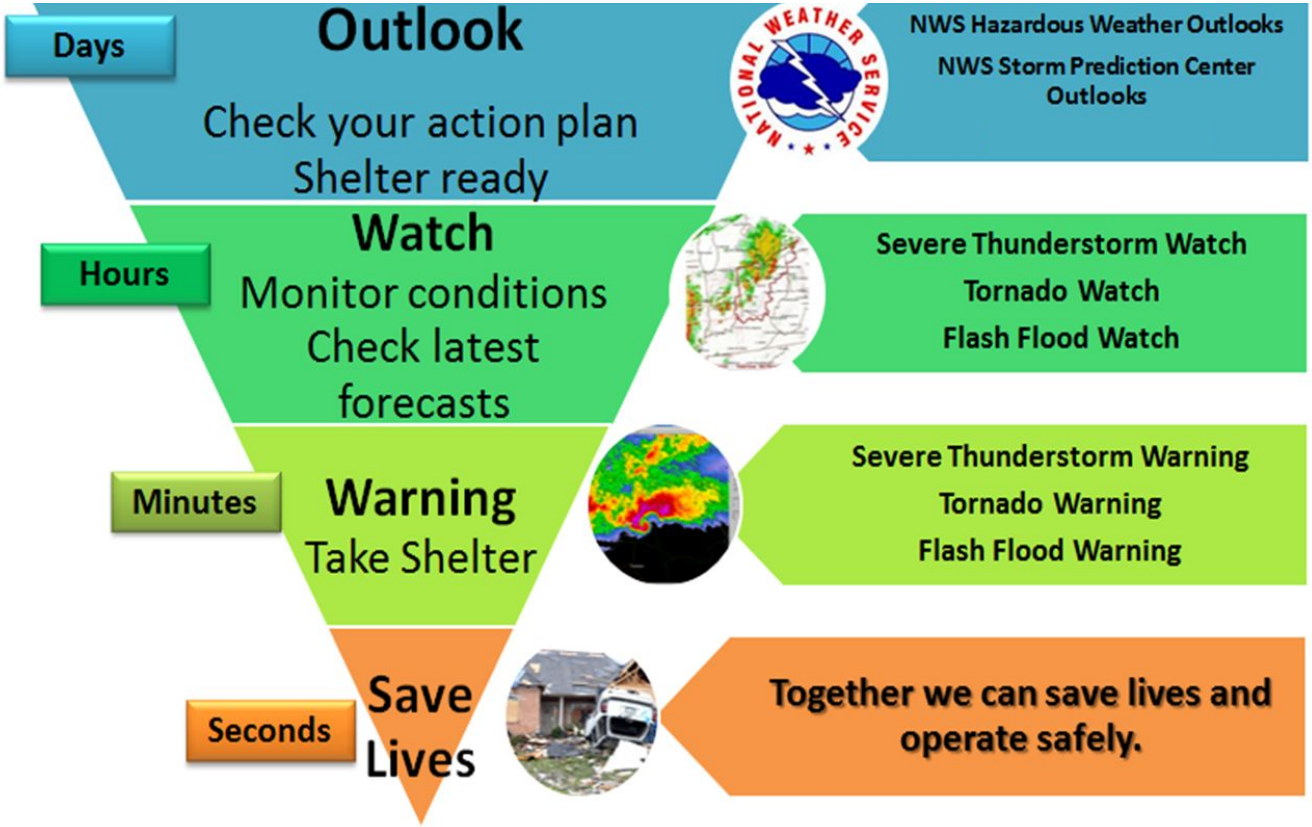
Heat index is a measure of temperature & Humidity - but know it's a broad measure



Heat Advisories issued for heat index of 95 or higher for at least 2 hrs.	Excessive Heat Warnings for heat index of or higher than 105 for at least 2 hrs.

- ✓ Slow Down
- ✓ Dress Appropriately
- ✓ Drink Plenty of Water
- ✓ Air Conditioning
- ✓ Sun Safety

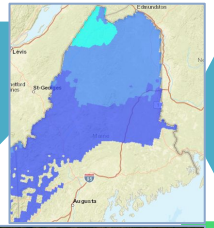
Messaging Evolves As We Get Closer to Severe Storms



Messaging Evolves As We Get Closer to Winter Storms

3-7 Days

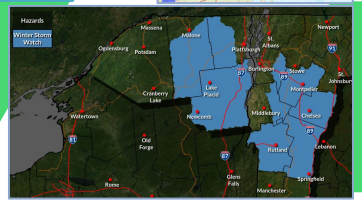
Outlook
Determine risk and need for any preparations



NWS Hazardous Weather Outlooks
Weather Prediction Center Snowfall Forecasts

1-3 Days

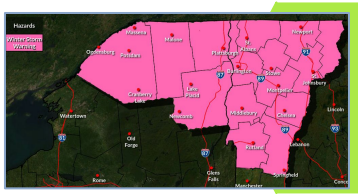
Watch
Consider Changing Plans



Winter Storm Watch (Snow > 7”)
Ice Storm Watch (Ice > 0.5”)
At least medium confidence

0 - 2 Day

Warning
Complete plans



Winter Storm Watch (Snow > 7”)
Ice Storm Watch (Ice > 0.5”)
At least high confidence

Day 0

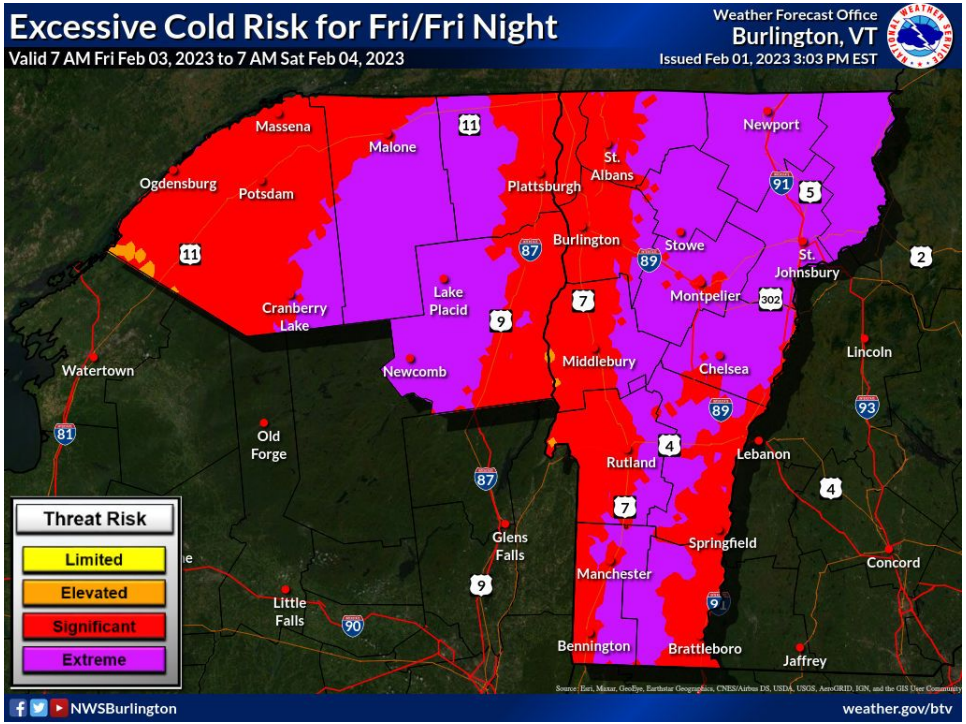
Know the road before you go!

Monitoring for any spot of particular heavy snow. Check local 5-1-1 for traffic. Have emergency kit ready if utilities fail

Messaging Winter Storms

Warning Type	Criteria
Winter Storm	•7” or more of snow •Significant mixed precipitation
Ice Storm	•0.50” of ice
Blizzard	•Visibility less than ¼ mile •Sustained wind or frequent gusts greater than 35 mph •Must last for 3 or more continuous hours
Extreme Cold	•Wind Chill or Temperatures below -30F
High Wind	•Wind gusts 58mph or greater •Sustained winds 40mph or greater

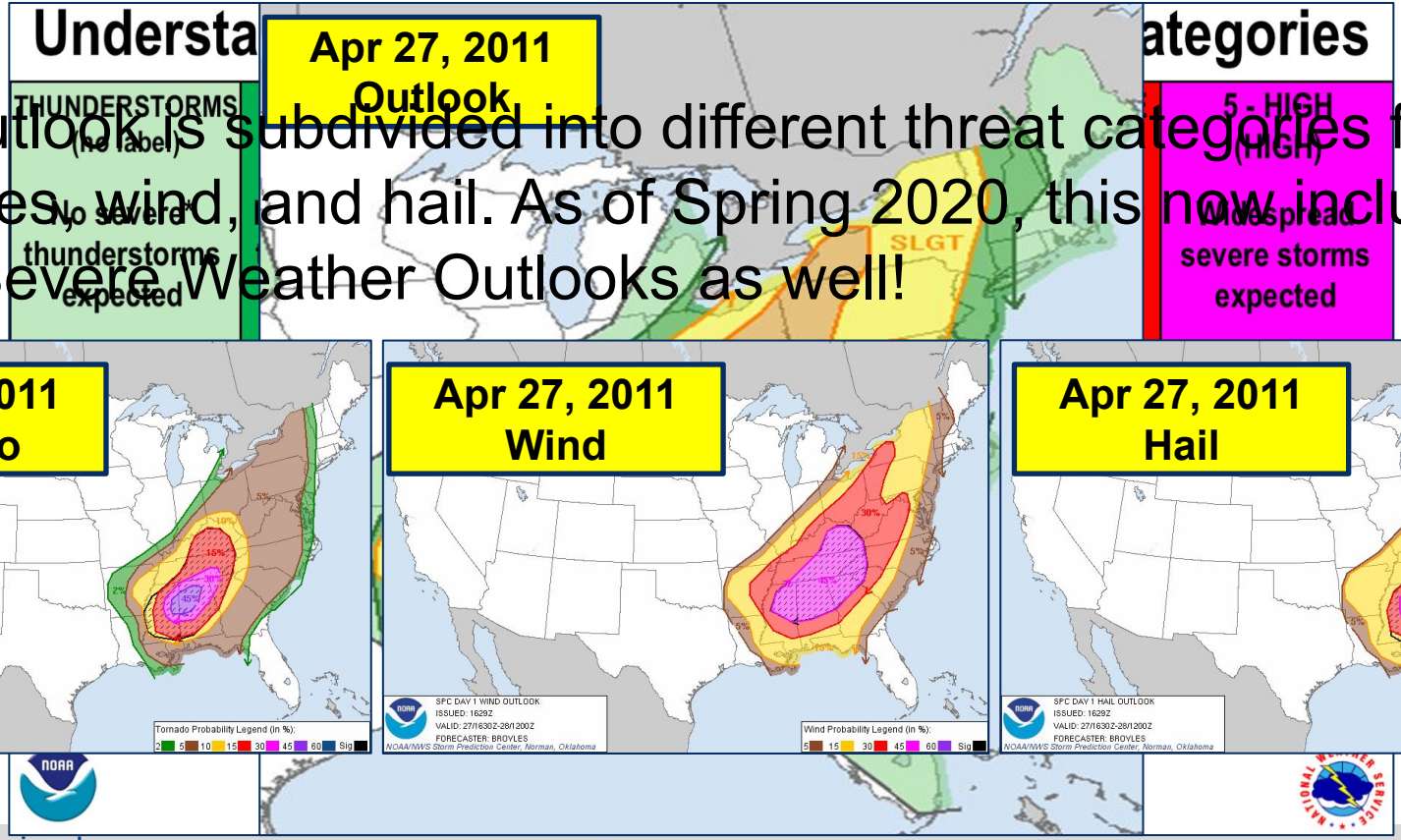
Graphical Hazardous Weather Outlook (GHWO)

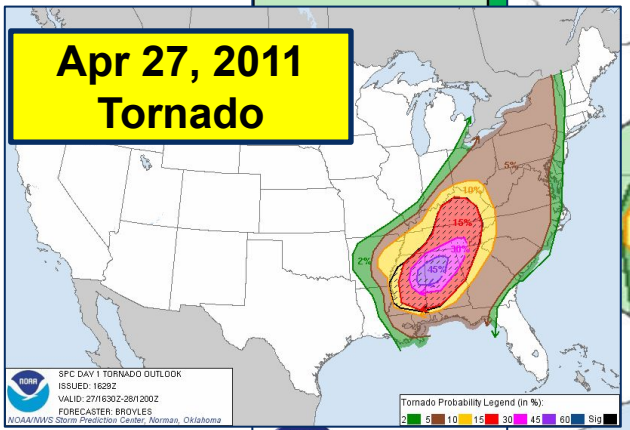


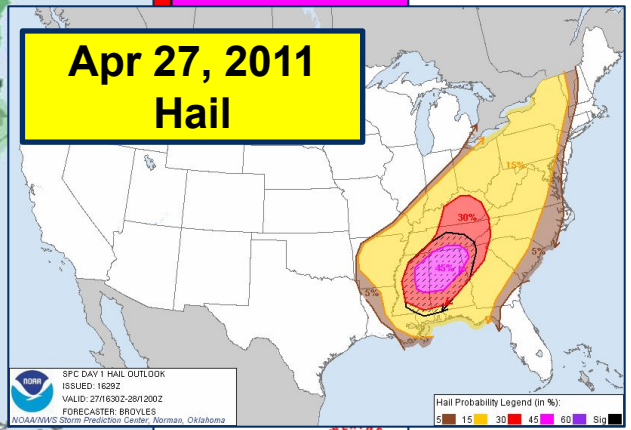
24 Hr Hazard Risks	Tonight	Thu	Fri	Sat	Sun	Mon	Tue
Severe Thunderstorm							
Tornado							
Thunderstorm Wind							
Hail							
Lightning							
Excessive Rainfall							
Wind							
Fog							
Excessive Cold							
Ice Accumulation							
Snow/Sleet							

Storm Prediction Center Outlooks

Each outlook is subdivided into different threat categories for tornadoes, wind, and hail. As of Spring 2020, this now includes Day 2 Severe Weather Outlooks as well!



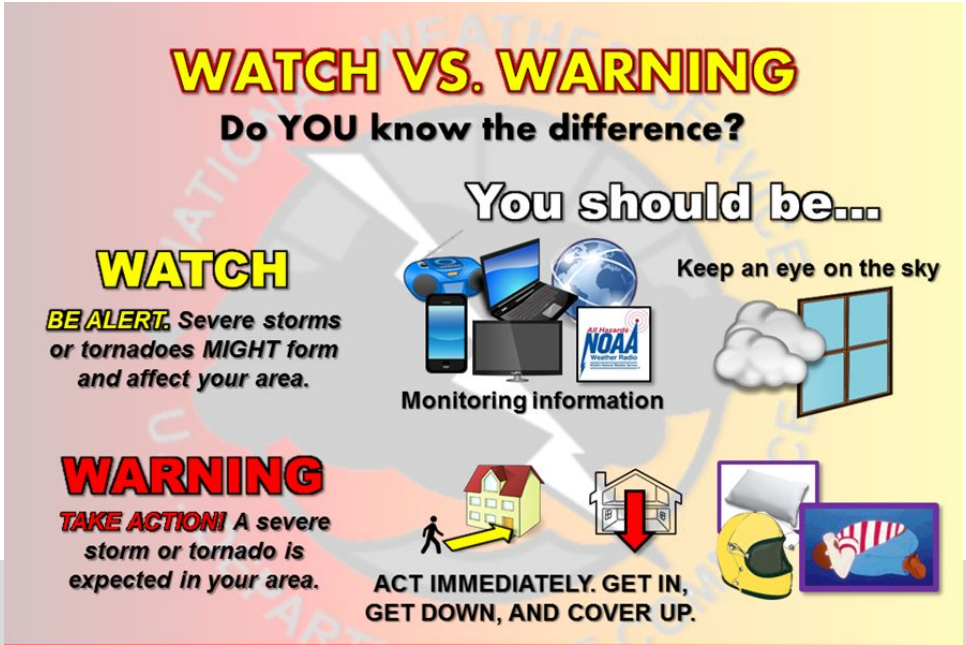




Watch vs Warning

Watch

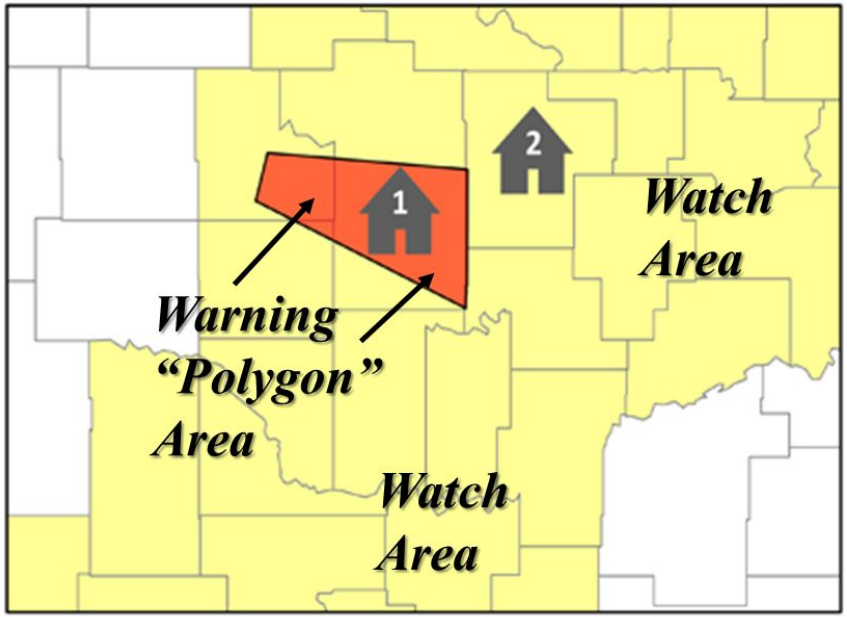
-Conditions are favorable for severe weather development over the coming **hours.**



Warning

-Severe weather is **imminent or ongoing**

-***Take immediate action!***

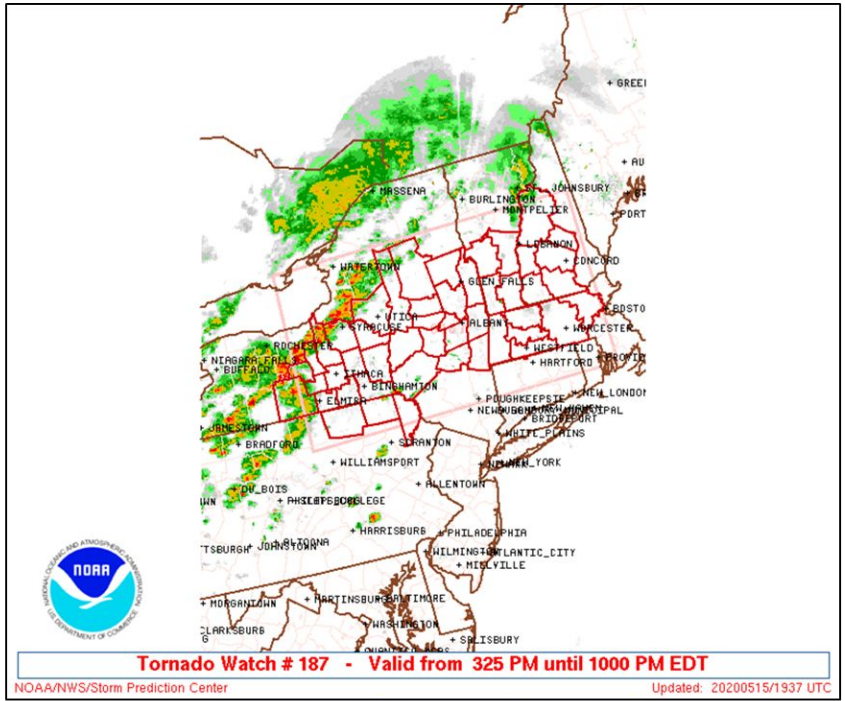


Watch vs Warning

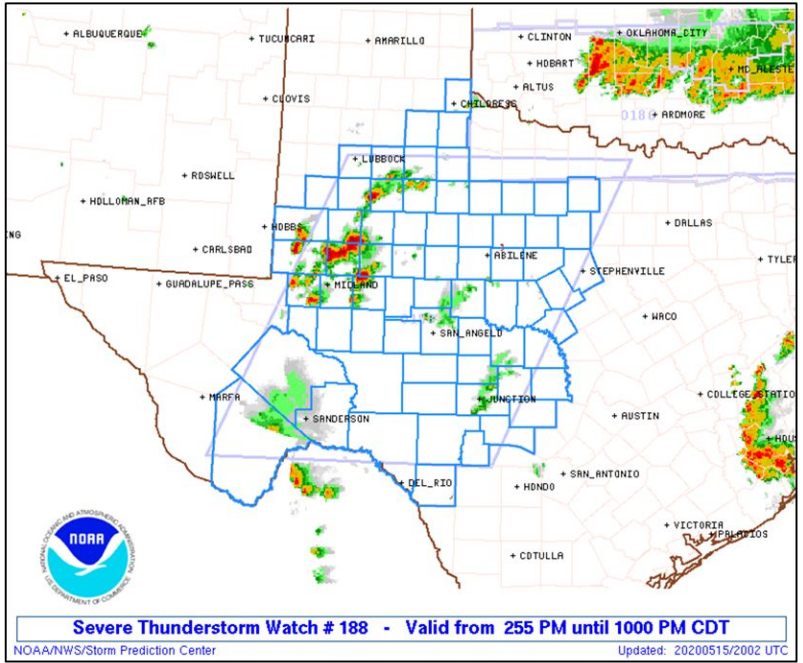
“Cupcake” Ingredients Are Present

“Cupcake” is imminent or already occurring

Tornado Watch vs Severe Thunderstorm Watch



Hazard	Tornadoes	EF2+ Tornadoes	Severe Wind	65 kt+ Wind	Severe Hail	2"+ Hail
Likelihood	Moderate	Low	High	Low	Moderate	Low



Hazard	Tornadoes	EF2+ Tornadoes	Severe Wind	65 kt+ Wind	Severe Hail	2"+ Hail
Likelihood	Low	Very Low	High	Moderate	Moderate	Moderate

The main difference is whether tornado threat is moderate or low. Other hazards may be more important!

Convective Warning Criteria

Severe Thunderstorm Warning

- Thunderstorm wind gusts ≥ 58 mph & or:
- Hail ≥ 1 inch in diameter

Tornado Warning

- Doppler Radar indicated rotation
- Confirmed reports of a tornado

Flash Flood Warning

- 6 inches or more of flowing water over roadways
- A rapid rise in water that is a threat to life & property

Tiered Impact Based System

Wording gets stronger the greater the threat to life.

Also includes:

- Tornadoes
- Flash Floods
- Snow Squalls

Thunderstorm
Damage Threat Categories

Considerable / Destructive Tags

Thunderstorm Damage Threat (tag category)	Wind	Hail diameter	WEA?
Base (no tag; default)	58 mph (60 mph will appear in the warning)	1.00 inch (U.S. quarter)	NO
Considerable	70 mph	1.75 inch (golfball)	NO
Destructive	80 mph	2.75 inch (baseball)	YES

Impact Based Severe Thunderstorm Warning Example

Tag Information at the end of the warning

```
TORNADO...POSSIBLE
THUNDERSTORM DAMAGE THREAT...CONSIDERABLE
HAIL THREAT...RADAR INDICATED
MAX HAIL SIZE...1.00 IN
WIND THREAT...OBSERVED
MAX WIND GUST...70 MPH
```

WIRELESS EMERGENCY ALERTS CAPABLE

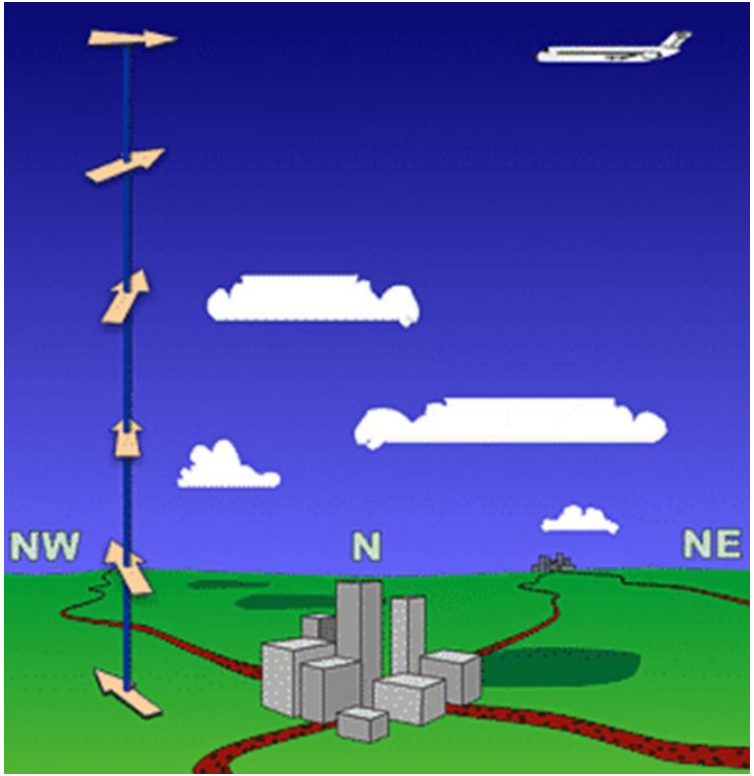
Thunderstorm Ingredients

At the minimum, thunderstorms need **3** things

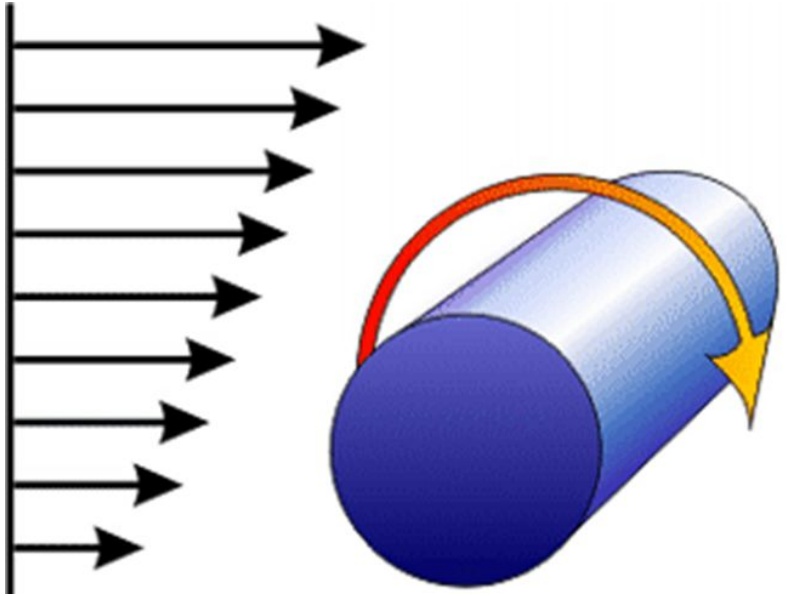
1. Moisture
2. Atmospheric Instability
3. Forcing mechanism (less needed in summer)
4. *To become severe, storms need something extra*

- A variety of other factors can combine to make storms more or less organized
- Generally, the more organized, the greater the severe threat.

What is Wind Shear



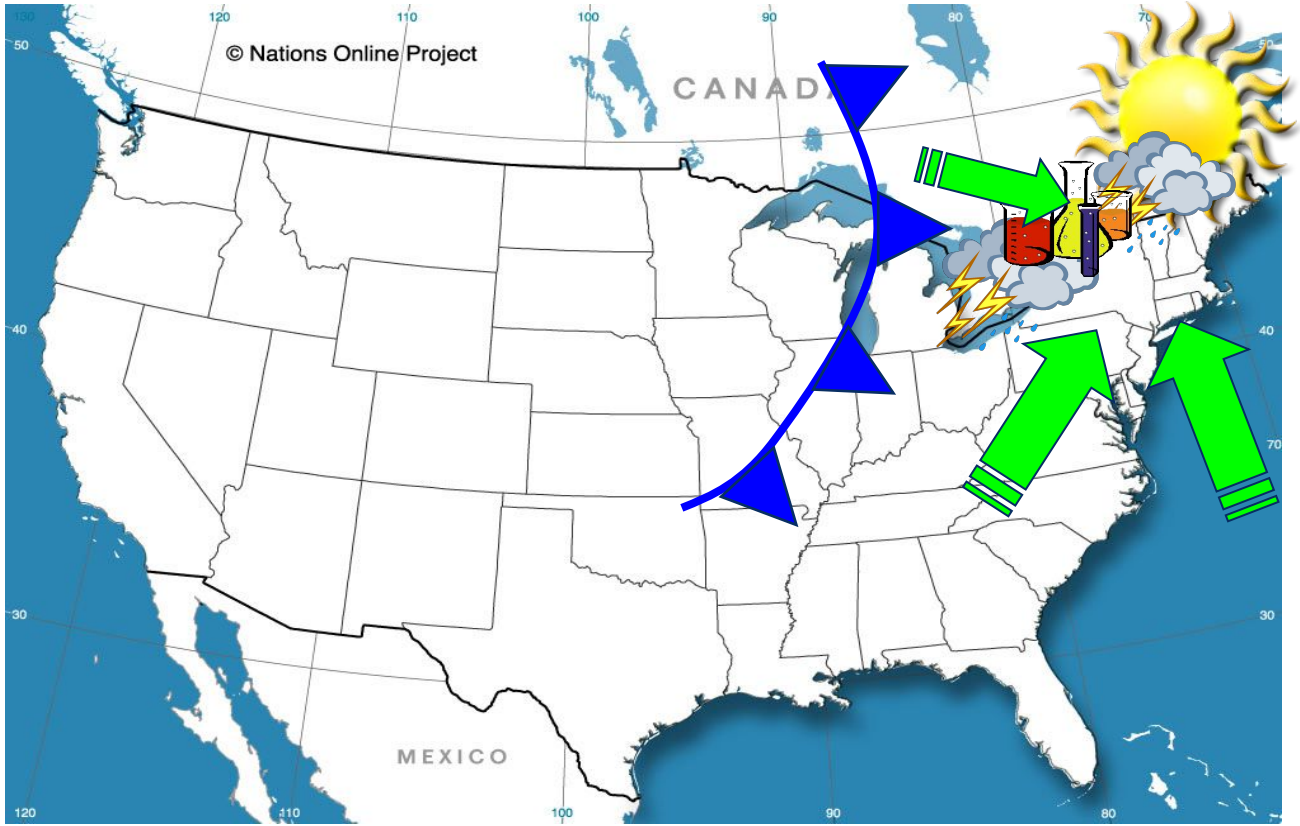
Directional Shear - Ideal for supercells



Unidirectional shear or “Speed Shear”

Ideal for producing squall lines

Thunderstorm Development 101



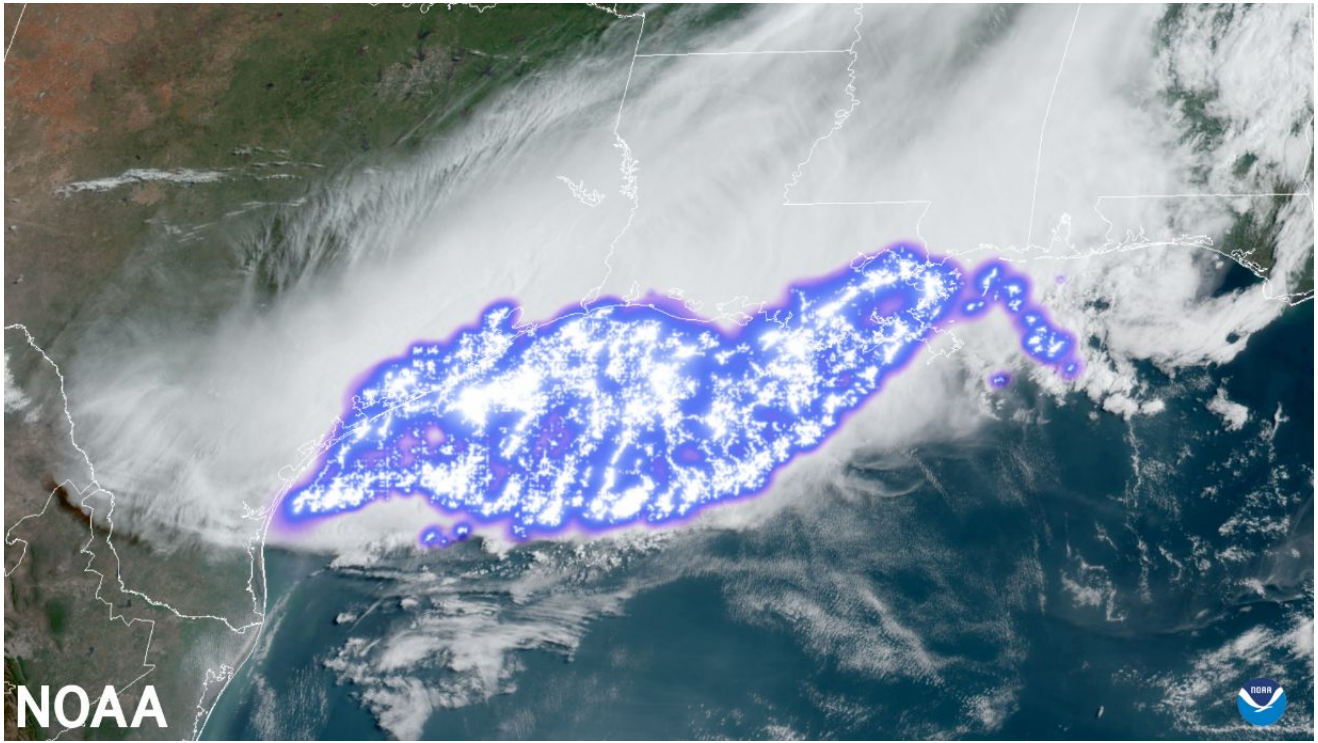
What is Thunder

The sound of air expanding as lightning bolt heats the air around it. After the flash, the air cools and quickly contracts. Hence the name thunder “clap”.

Usually the distance you can hear thunder is about 10 miles from the strike.

The world’s longest observed strike is 477 miles!

So when “thunder roars, go indoors”!

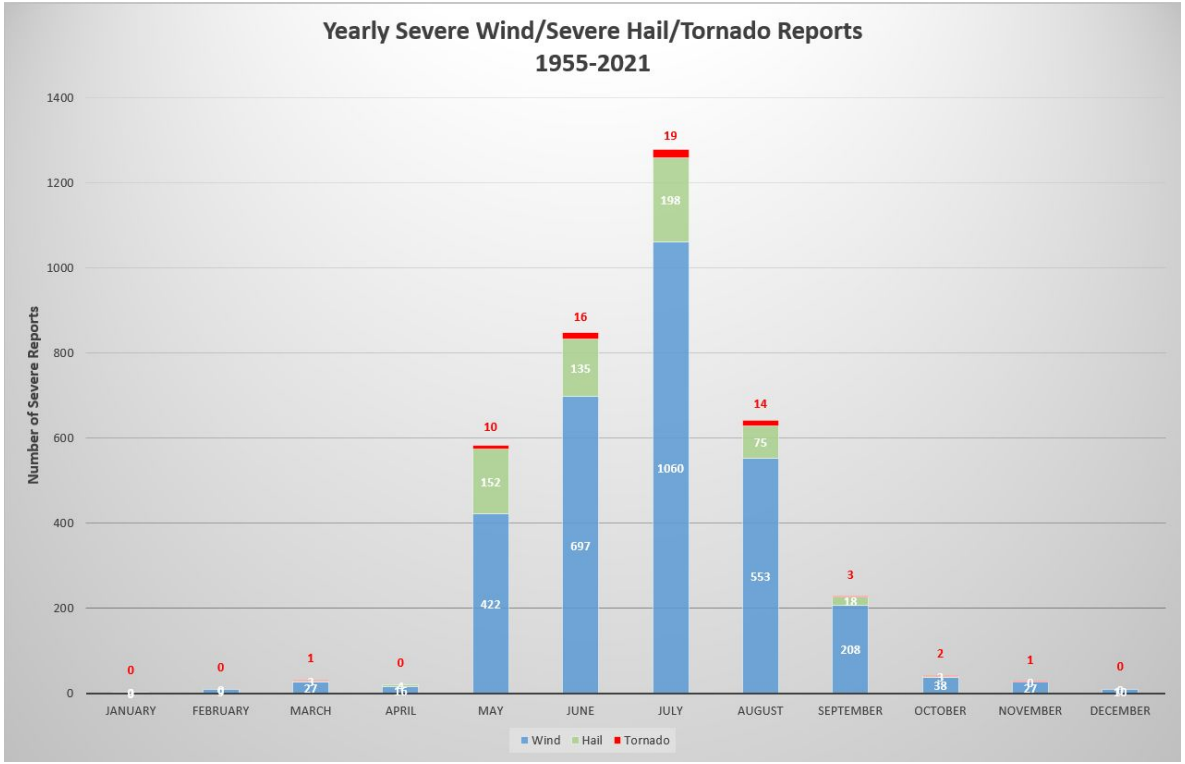


https://www.noaa.gov/stories/worlds-longest-lightning-flash-on-record-captured-by-noaa-satellites


Super Slow-Mo……..

Any Questions?

Brief Overview of Thunderstorm Types and Hazards



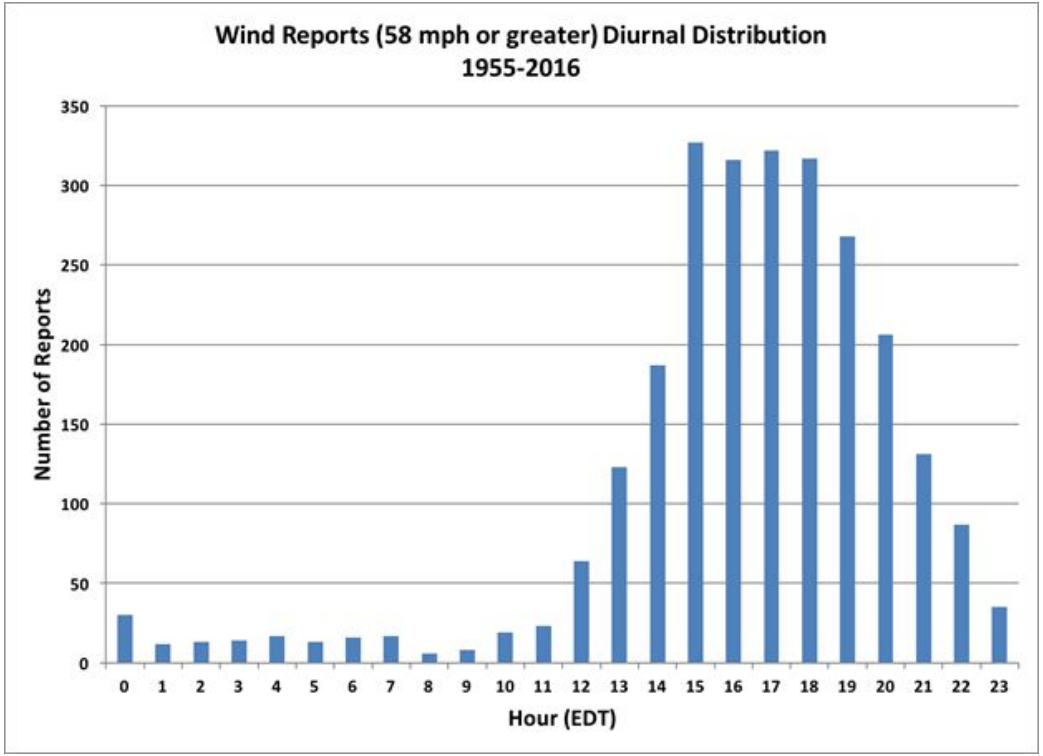
Climatological period of Severe Weather is the height of summer

Why is this so?

- More daytime heating – greater atmospheric instability
- Bermuda high usually allows moisture from the Gulf of Mexico advance northwards.
- While areas like Florida don't get fronts in the summer, we can still get weak frontal boundaries that help storms develop.

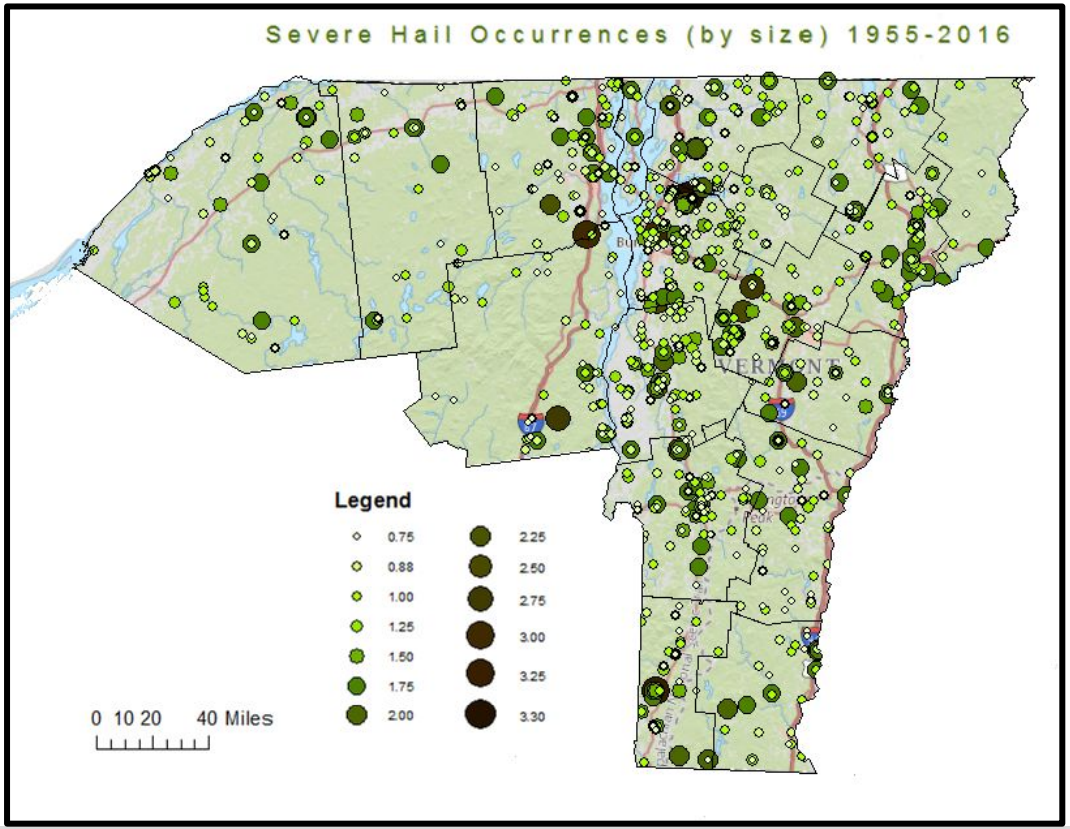
North Country Severe Weather Climatology

- In general, severe weather occurs between 1 PM and 10 PM EDT in the North Country



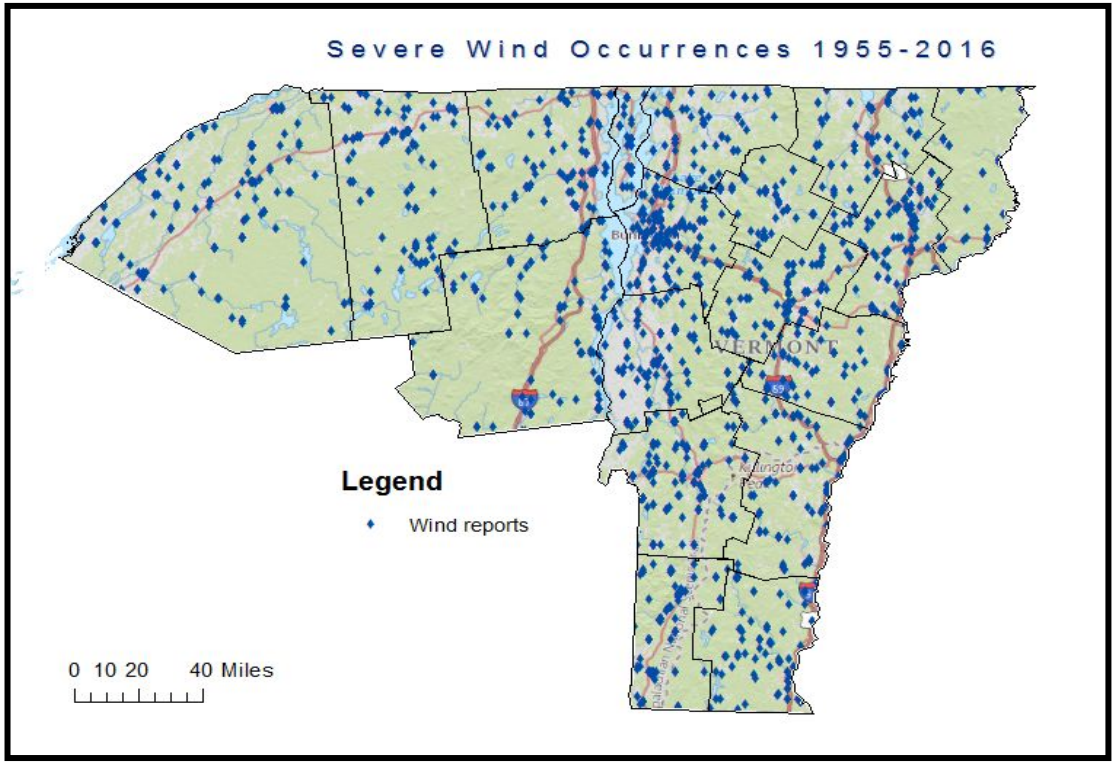
North Country Severe Weather - Hail

- Noticeable concentrations of reports around
  - Burlington, VT
  - Middlebury, VT -Rutland, VT
- Also note clusters along road networks



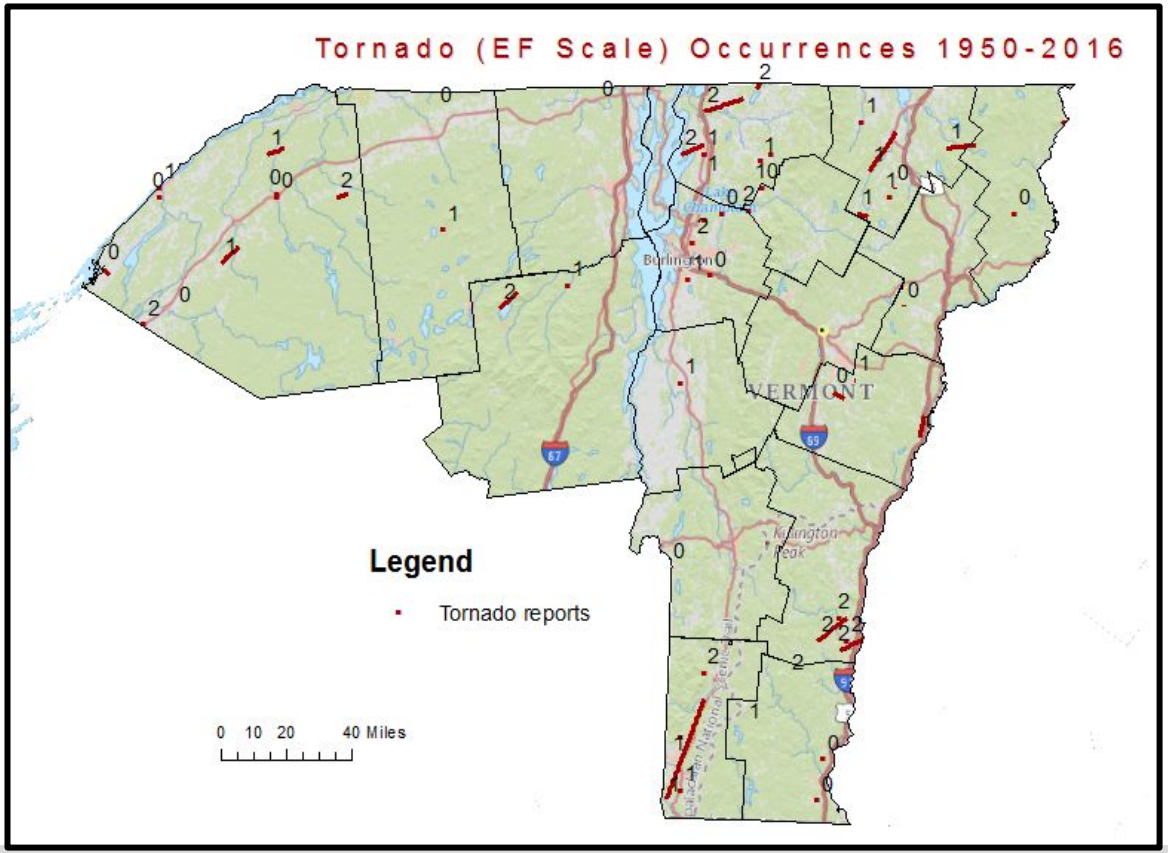
North Country Severe Weather - Wind

- Less noticeable association between wind reports and population
- Large cluster still around Burlington area
- More wind reports over St. Lawrence valley compared to hail



North Country Severe Weather - Tornadoes

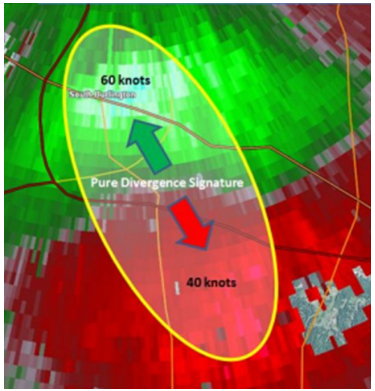
- No noticeable correlation between population and tornado reports
- More terrain influenced
- Wasula et al. (2002) noted N-S oriented river valleys important in veering profiles during tornado occurrences



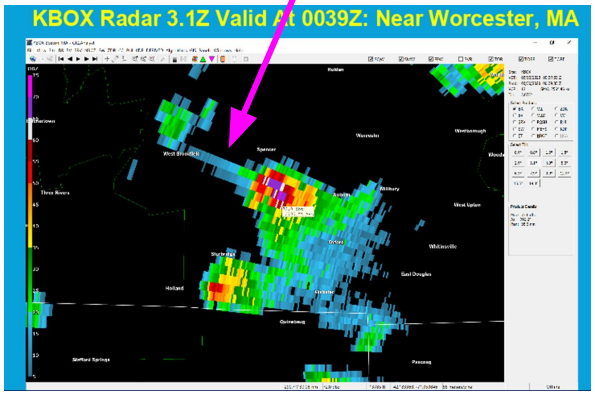
How Does Radar Work?

Look for changes in intensity and movement of reflectivities to identify weather hazards.

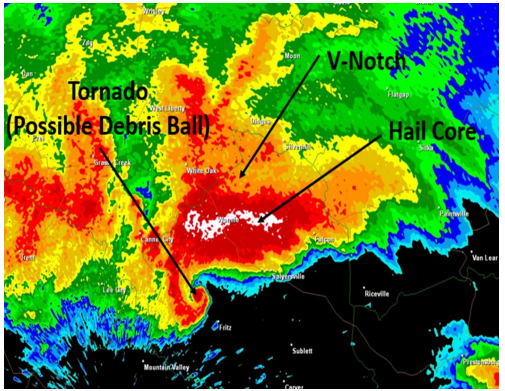
Downburst winds



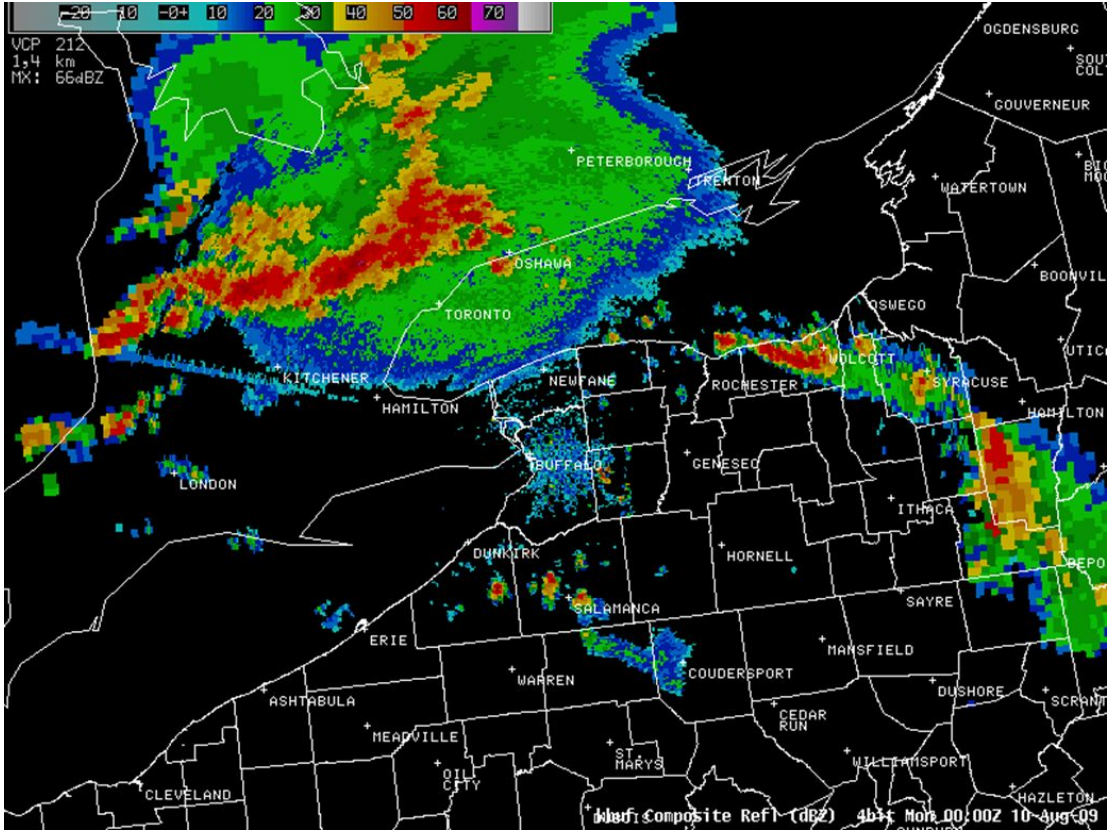
Hail



Supercells

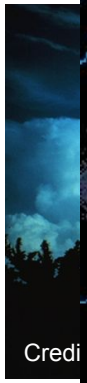


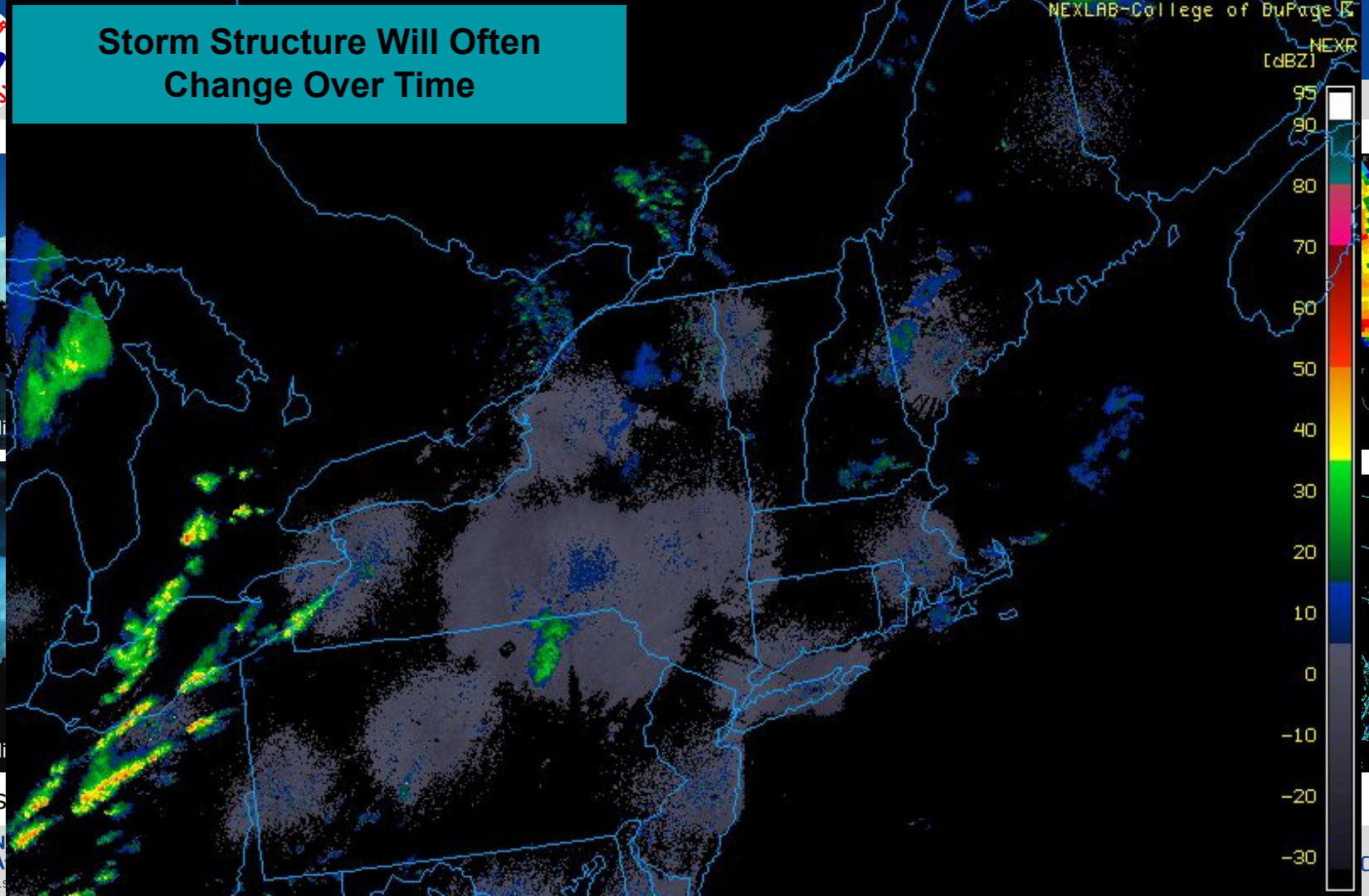
Radar Reflectivity

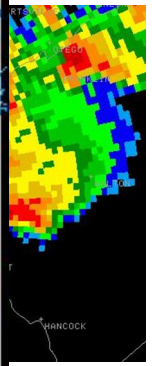


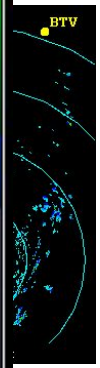
- **Displays energy reflected back to the radar**
- **Shows location and movement of rain, snow, hail, etc.**
- **Radar energy can also reflect back off birds, insects, and ground targets**

Storm Structure Will Often Change Over Time





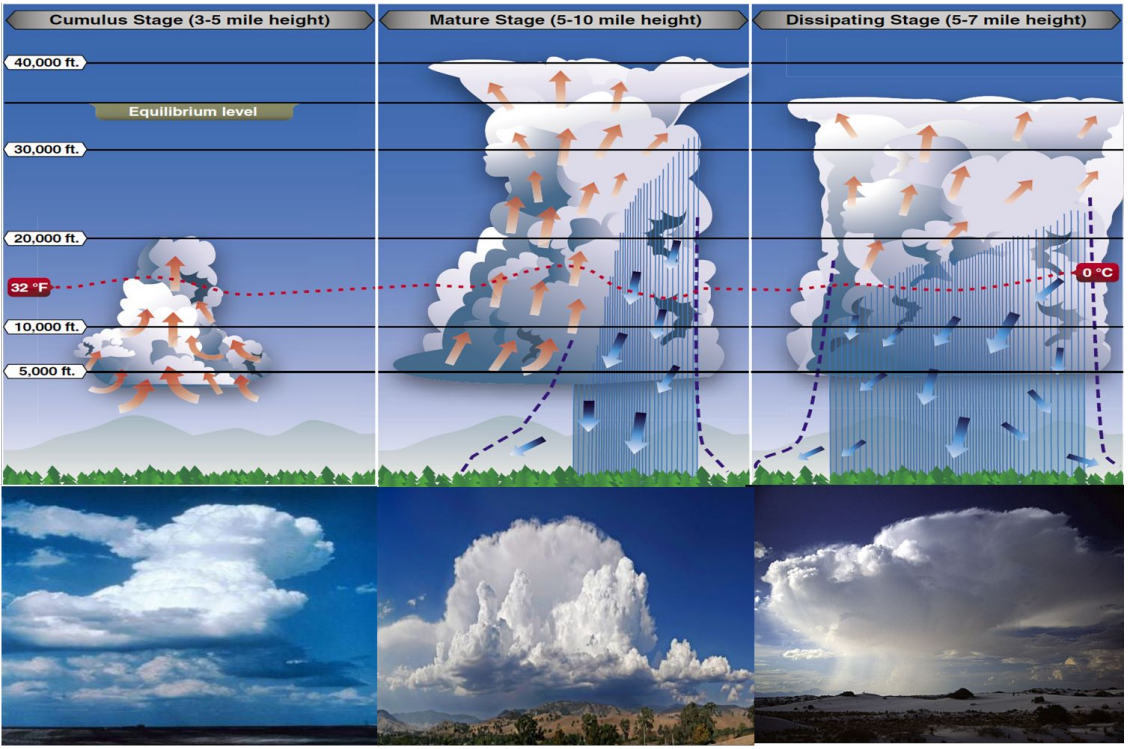




A s

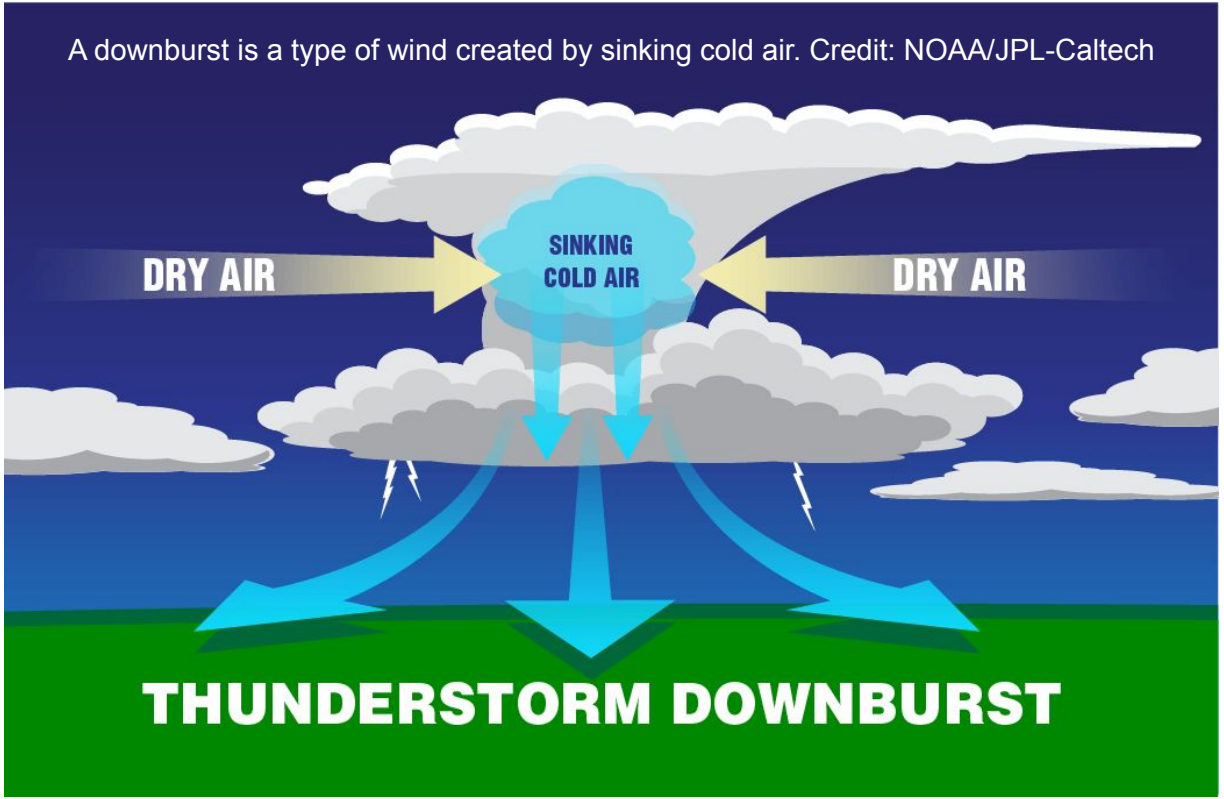
cast Office

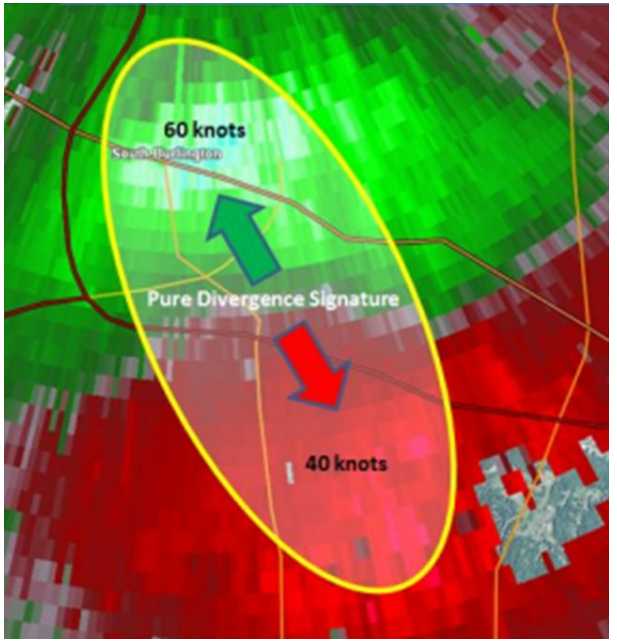
The Single Cell



- Downdraft overtakes the convective updraft.
- Causes the storm to dissipate, usually within an hour.
- Sometimes, the downdraft wind is strong enough to do minor damage.
- Look for an overshooting top above the anvil – indicates more vigorous updraft and likelihood for damaging winds.

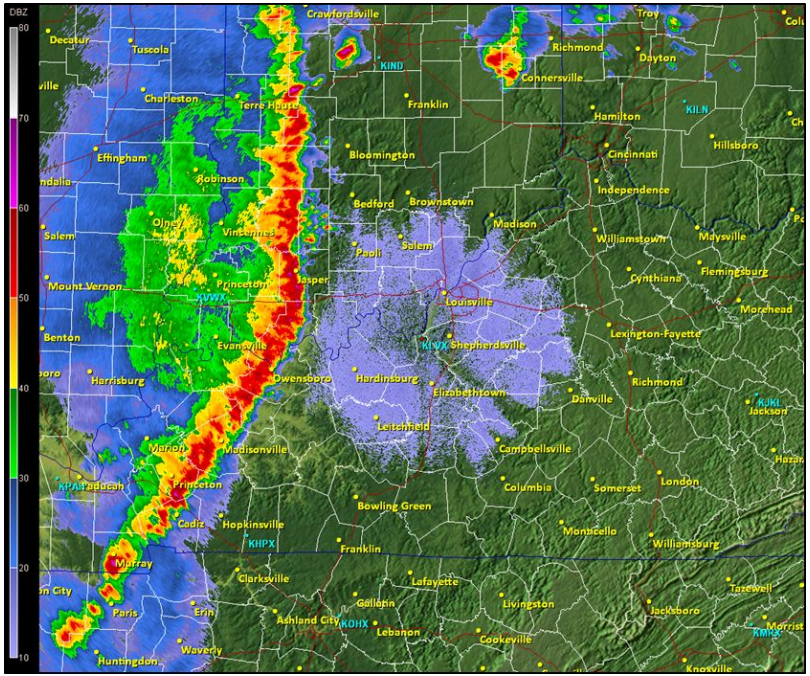
Microburst Visual Appearance





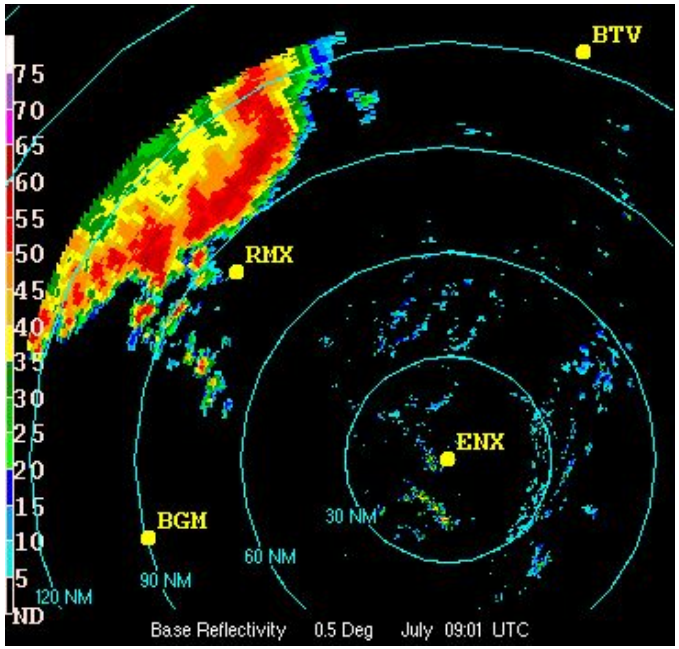
Downburst - From Mike Oblinski

Straight-Line Winds

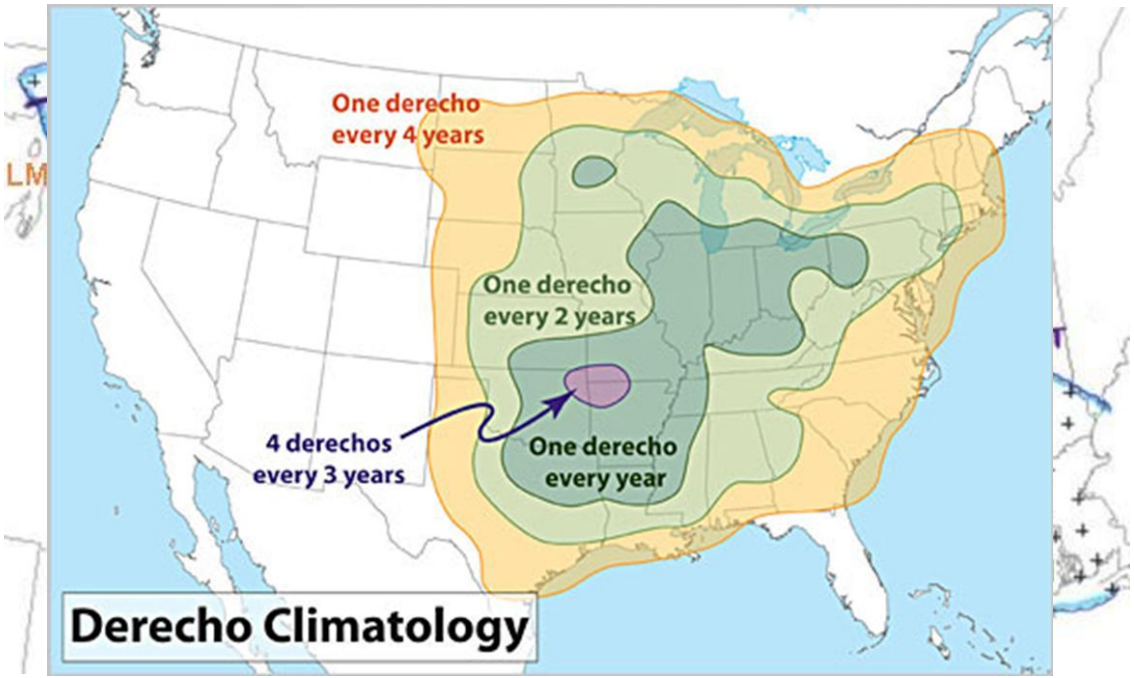


Squall Line (*Jargon term - Quasi Linear Convective System: QLCS*) - Group of thunderstorms that are often accompanied by high winds and heavy rain, occasionally with tornadoes (along breaks). Can be hundreds of miles long. Fast winds can be enhanced by convection and create powerful winds behind the front.

Derecho

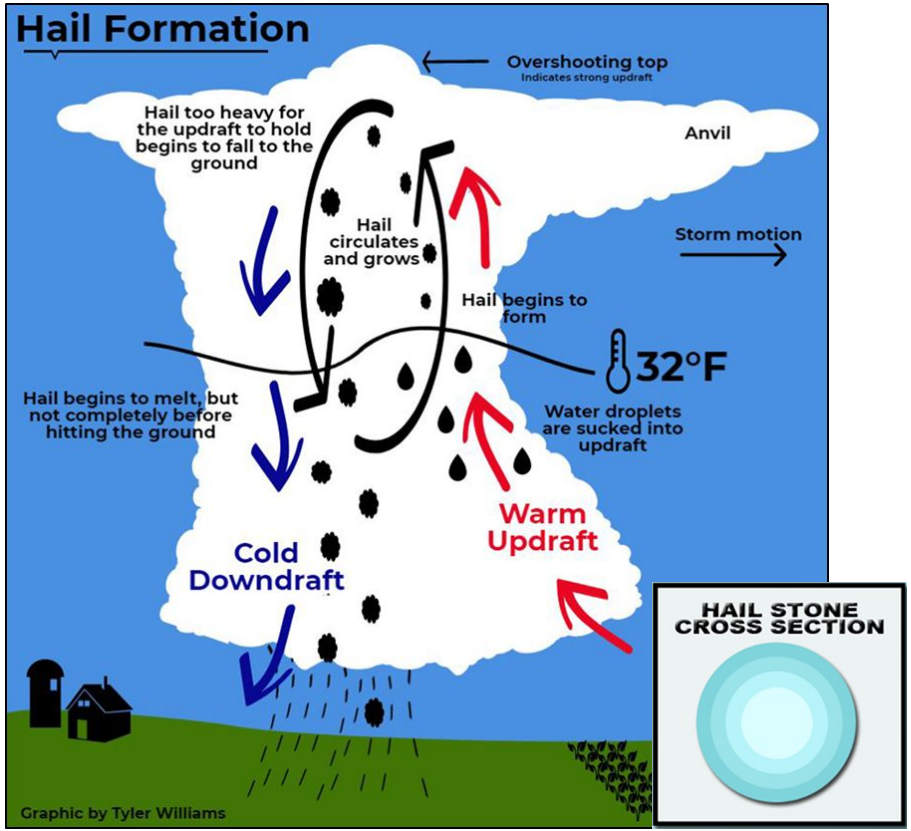


July 14-15, 1995
"The Ontario/Adirondacks Derecho"



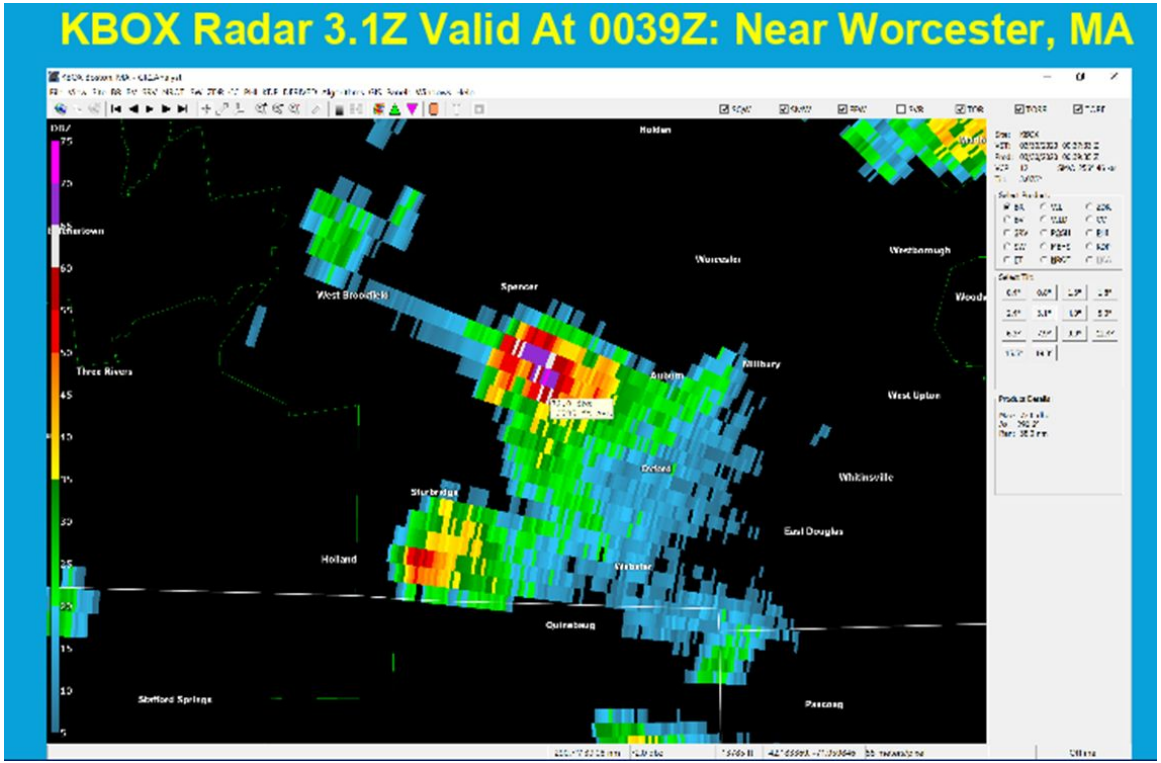
When winds are sufficiently strong (handful of hurricane force gusts) and extensive, then the event qualifies as a "derecho".

Hail Formation and Growth



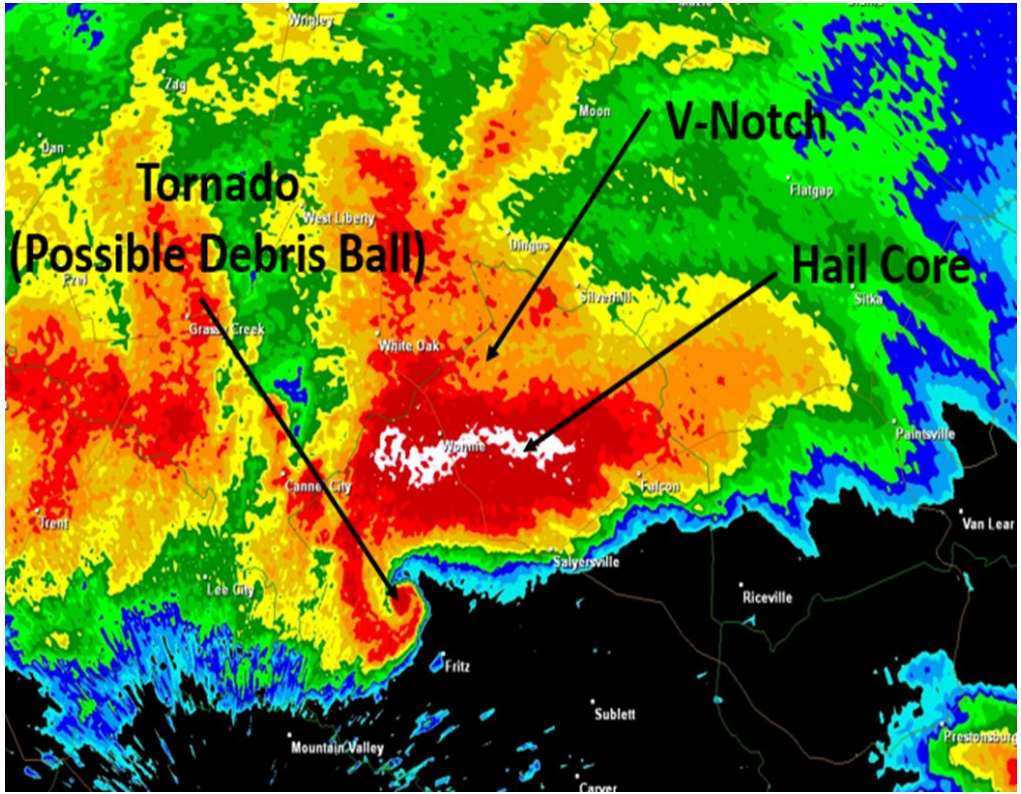
- Hail is more likely when updrafts are strong and the freezing level is low in the atmosphere.
- Hail is more likely when your updraft and downdraft are separate.
- Hail is more likely if the storm has been around a long time.

Hail on Radar



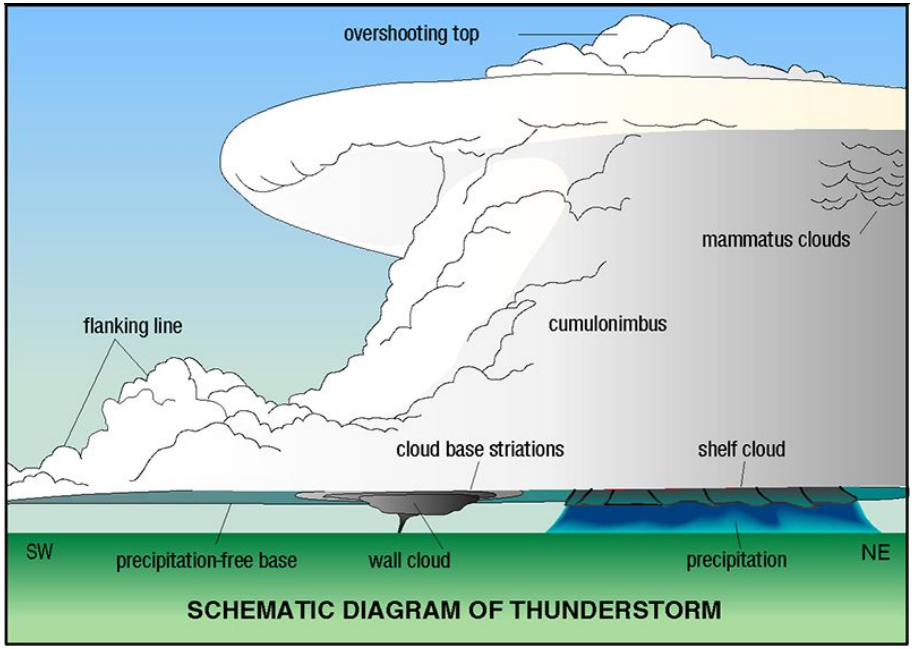
- Hail scatters the radar beam quite differently from rain.
- Most commonly you'll see a "three body scatter spike" – or simply hail spike – when dealing with large hail.

Supercells



- Named “Supercell” when they display strong mid-level rotation.
- Has a longer life-cycle (separation of updraft + downdraft from wind shear)
- Also capable of dropping very large hail up to 2-4 inches in diameter (Look for blues/green colors within clouds).
- Can last 20-60 minutes but can also persist longer in a favorable environment.
- About 1 out of 5 produce tornadoes.

Wall Cloud



It will usually be rain free, where downdraft and intense updraft meet and interact, which helps give it the iconic hook on radar. Look for entire wall cloud to rotate.

Shelf Cloud vs Wall Clouds

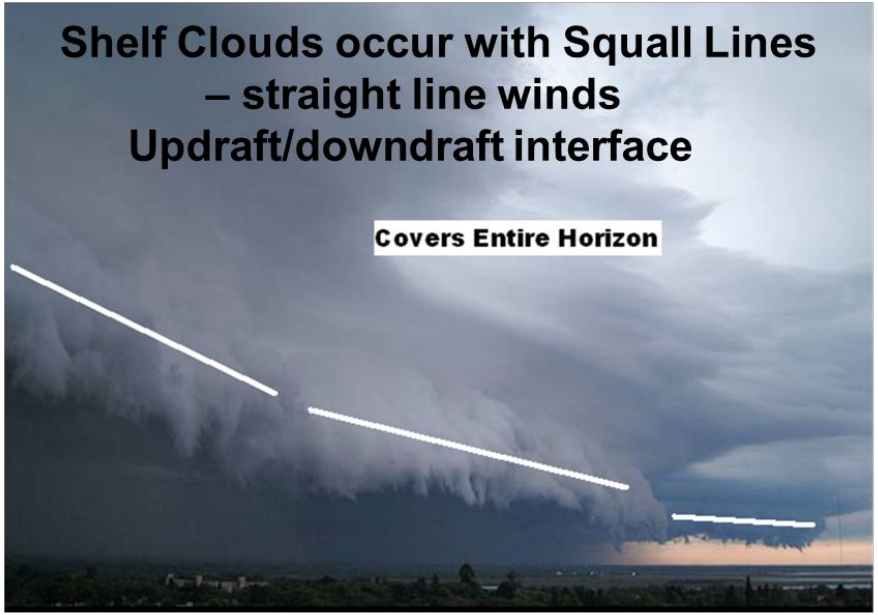
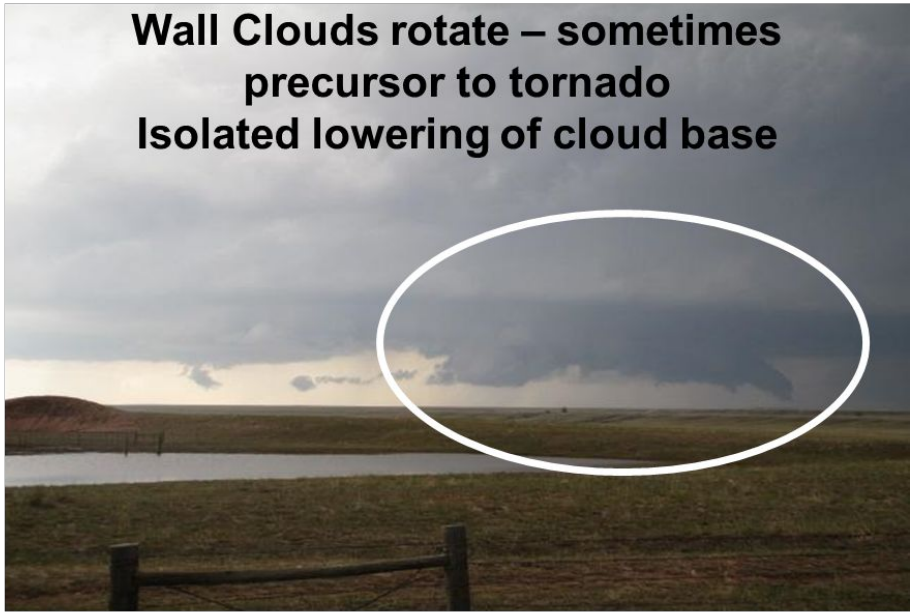
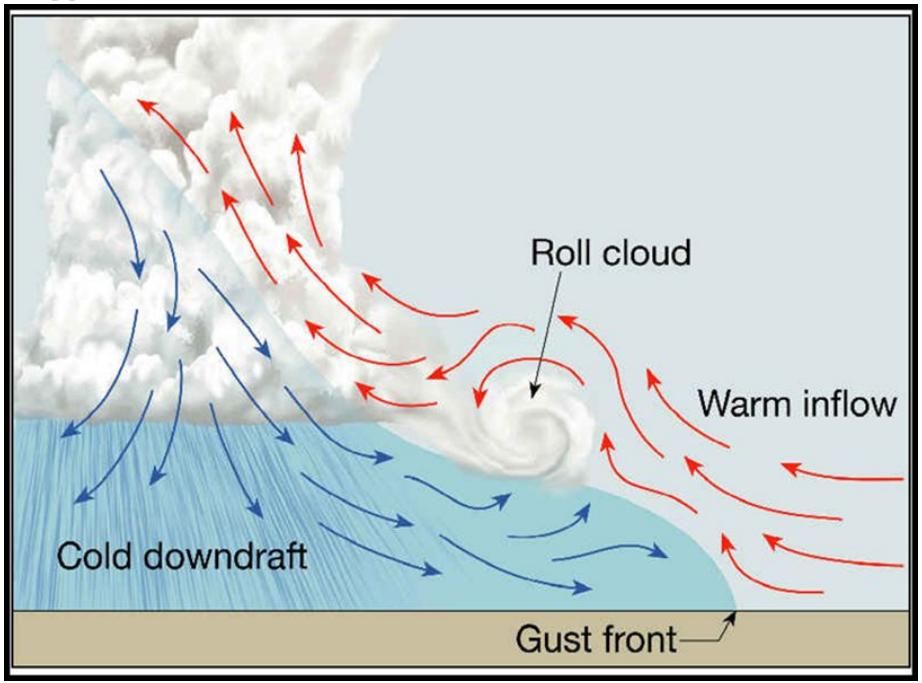


Photo courtesy of
https://www.weather.gov/lmk/shelfcloudversusawallcloud



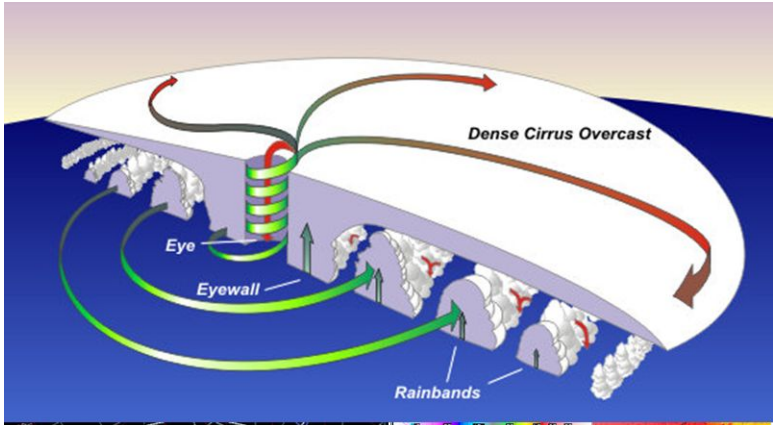
Wall cloud near Cheyenne, WY.
Photo courtesy of NWS Meteorologist Christina Speciale.

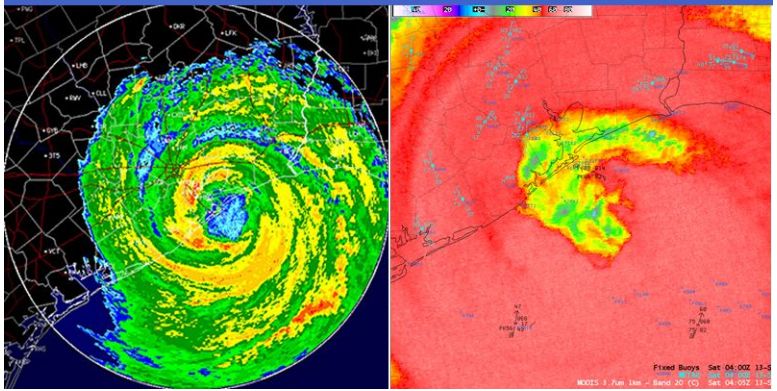
Shelf/Roll Cloud



Often, squalls are accompanied by shelf or roll clouds. When you see these, you are likely in for very heavy rain and damaging winds.

Tropical Cyclones





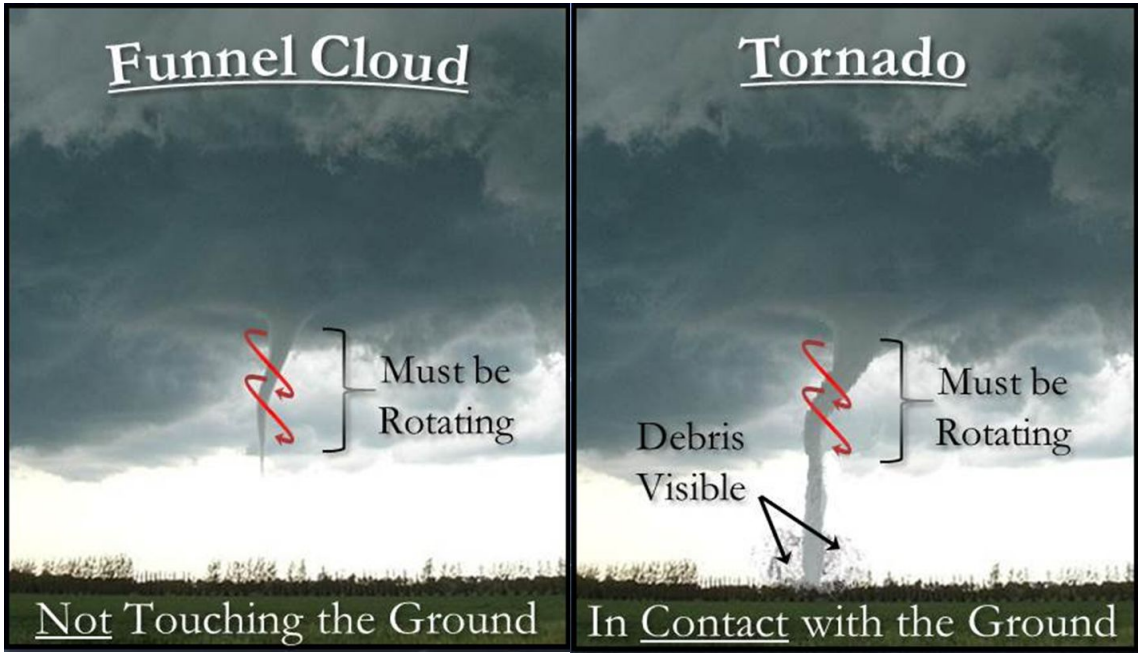
Radar and IR Satellite image of Ike before landfall

- Concentrated areas of thunderstorms over warm ocean waters results in falling pressures, that in the right environment becomes an organized, convectively driven area of low pressure (hurricane - see image to the left).
- When over land, greater friction and lack of warm, ocean waters causes these systems to quickly decay.
- Warm rain processes (small drops, but numerous in count) results in high rainfall rates, especially if the system is moving slowly or quite large.
- Can cause isolated tornadoes
- Often causes wind damage and storm surge (coastline only)

Any Questions?

Let's Talk About Tornadoes

- Tornado: A violently rotating column of air <u>in contact with the ground</u>
- Rare, 1 every 2 years in Burlington's area



Tornado look alikes

- Scud/Convective Debris
- Ask is it attached to the cloud? Are you mistaking a rain shaft for a cloud?
- Is it moving up into the cloud (funnels descend) or is it rotating?
- If asking us to evaluate, these questions are hard to answer without video or time of occurrence (helps us match to what we see on radar).

Weak Tornadoes

(EF0 and EF1)

- 80% of all tornadoes
- Less than 5% of tornado deaths
- Lifetime: 1 - 15 minutes
- Path: Up to 3 miles
- Wind speed: 65 - 109 mph
- Most North Country tornadoes

Strong Tornadoes
(EF2 and EF3)

- 19% of all tornadoes
- Less than 30% of tornado deaths
- Lifetime: 20 minutes or longer
- Path: 15+ miles
- Wind speed: 110 - 167 mph

Violent Tornadoes

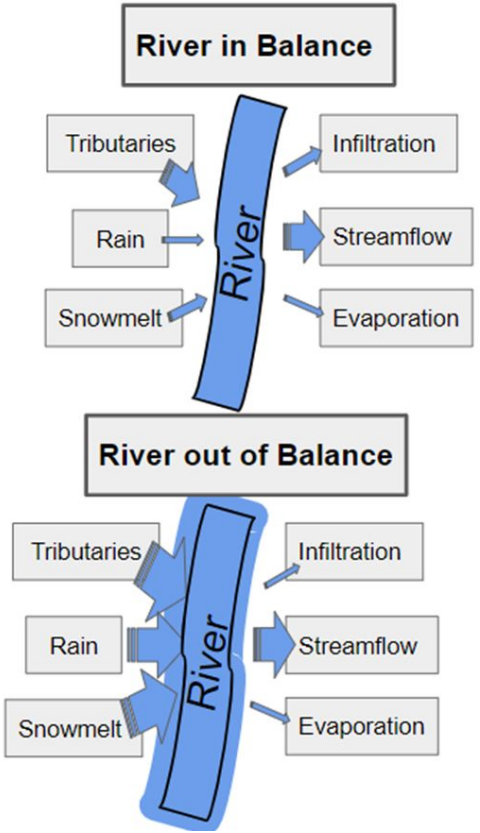
(EF4 and EF5)

- 1% of all tornadoes
- 70% of tornado deaths
- Lifetime: One hour or longer
- Path: 50+ miles
- Wind speed: 168 -234 mph

What causes flooding to take place?

- Several factors affect how easily water comes in and moves out with common regions of common characteristics grouped into basins

- When flooding occurs, the input into the river is greater than water flowing out
  - This can be gradual (flooding)
  - Or this can be rapid (flash flooding)



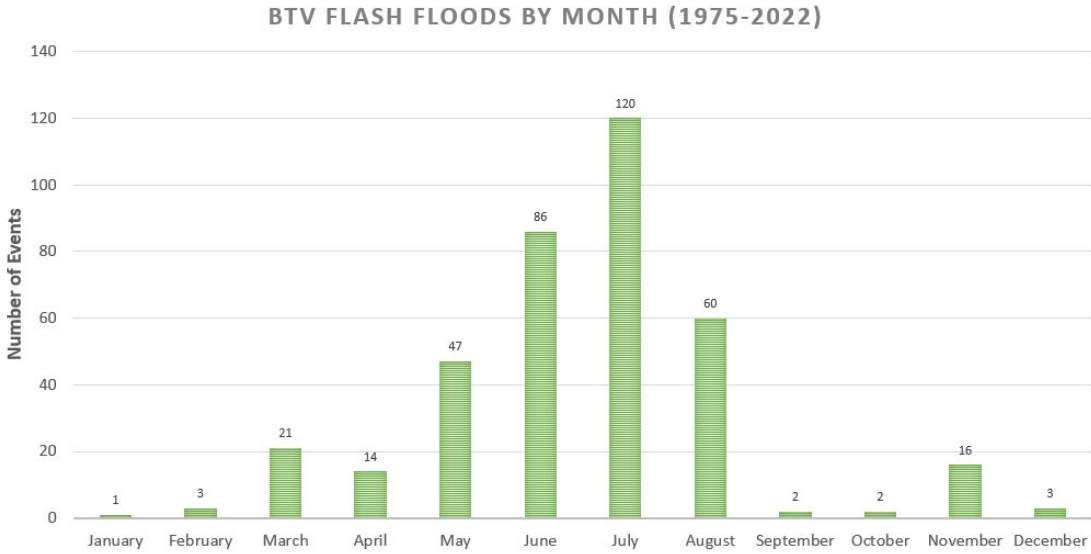
Flood vs Flash Flood

The key difference is whether waters rise quickly (***FLASH FLOOD***) or do waters rise gradually (***FLOOD***)?

- ***Flash Floods*** are most often caused from excessive rain in a short window of time (< 6 hrs)
- ***Flash Floods*** can readily transition into areal or river floods if water remains in place
- ***Floods*** arise from many gradual contributions to river rises.

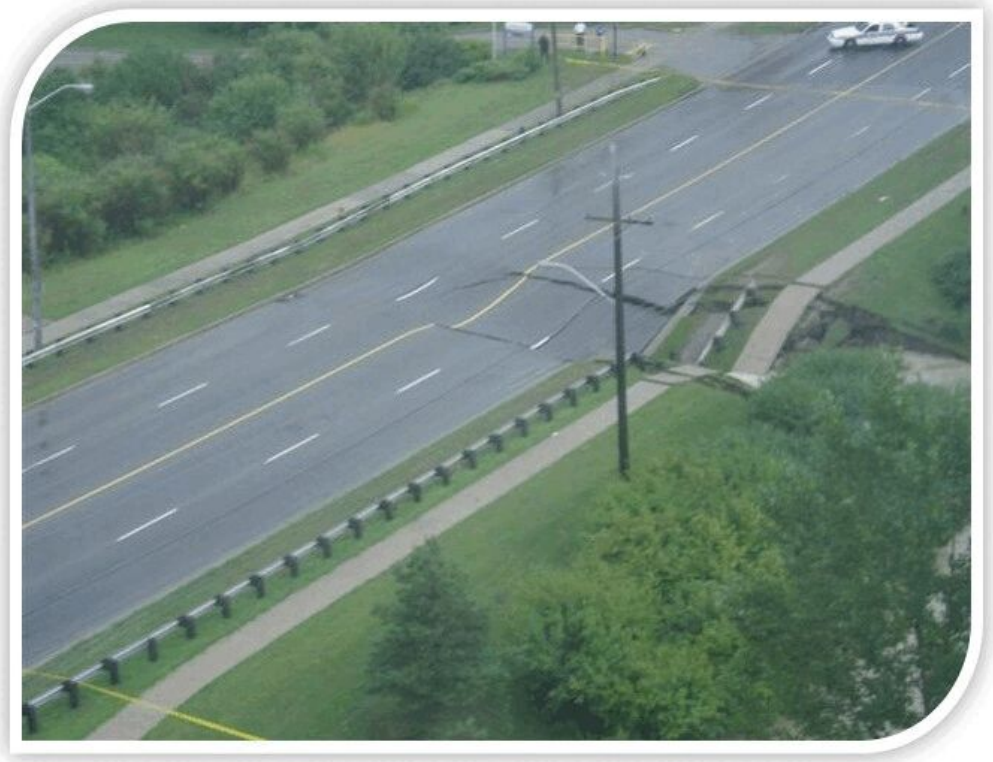
When is Flooding Common in the North Country

- Spring snowmelt saturates soils and produces run-off into waterways and contributes to ice jams in thaws
    - Jam stops flow of water
- In fall, vegetation goes into dormancy and vegetation collects less water
    - Leads to greater runoff
- Atmospheric flows with tropical moisture feeds
    - September and October, non-tropical cyclones (October 2017 storm/1927 Flood) or recurving tropical cyclones (Floyd/Irene)
- During the summer, training thunderstorms tends to be localized, but produces majority of flash floods



Safety Message!

- Don’t underestimate the power of running water
- You may not see the road below flood waters or what’s in the water (more of an issue down South)!
- Nearly two-thirds of flood-related deaths are from driving into floodwaters
- Turn around, don’t drown



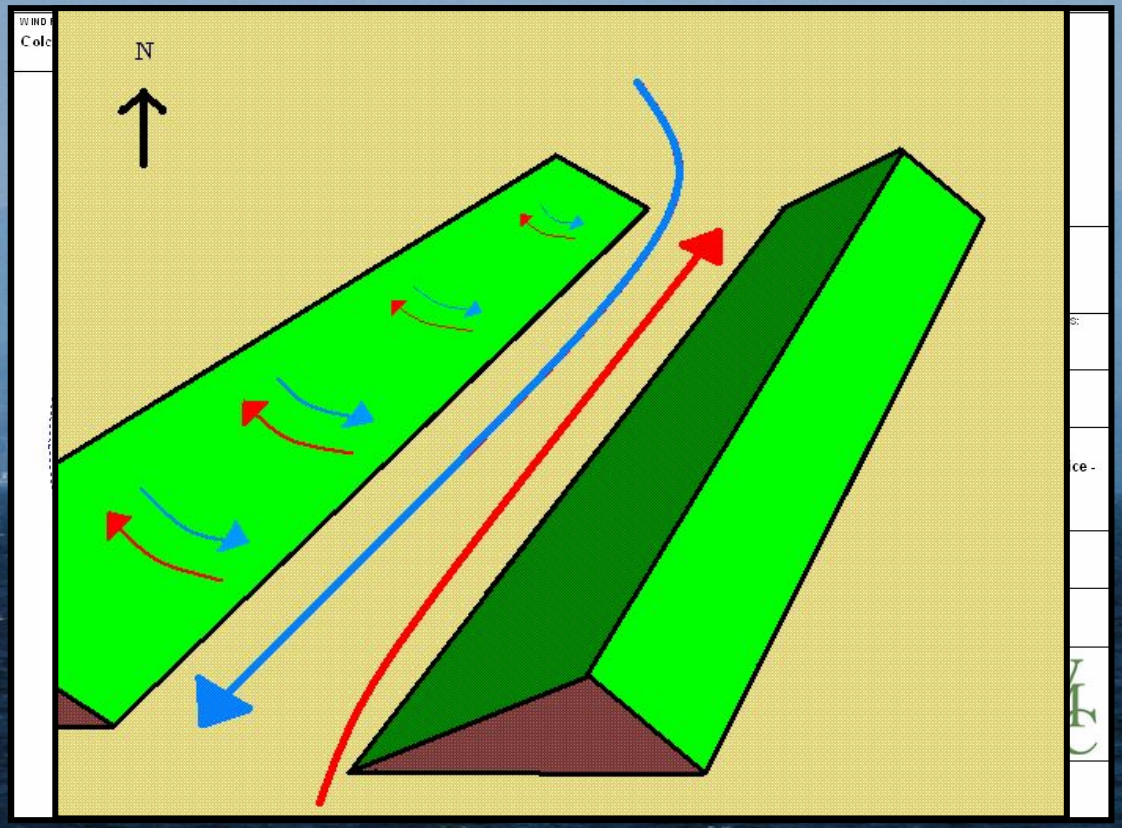
Forecasting Winds for Lake Champlain

It's all about mixing potential

1. Less friction over water means winds greater
2. Is water temperature warmer or colder than air?
   A. Water/air temperature profile governs mixing
   B. Cool air atop warm air is more unstable and means faster winds
3. Channeled flow causes winds to accelerate through the Champlain Valley (Bernoulli Principle)

Forecasting Winds for Lake Champlain

- **Channeled flow**
  - Winds tend to blow north/south due to valley topography
  - Winds become channeled and stronger in the valley than surrounding areas



Forecasting Winds for Lake Champlain

Seasonal Temperature and Stability Profiles Near Large Bodies of Water			
Season	**Relative Sea Surface Temperature**	**Relative Air Temperature**	**Boundary Layer Stability**
Winter	Cool	Cold	Unstable (Strong Winds)
Spring	Cold	Cool	Stable (Weak Winds)
Summer	Cool	Warm	Stable (Weak Winds)
Fall	Warm	Cool	Unstable (Strong Winds)

Any Questions?

Reporting Methods

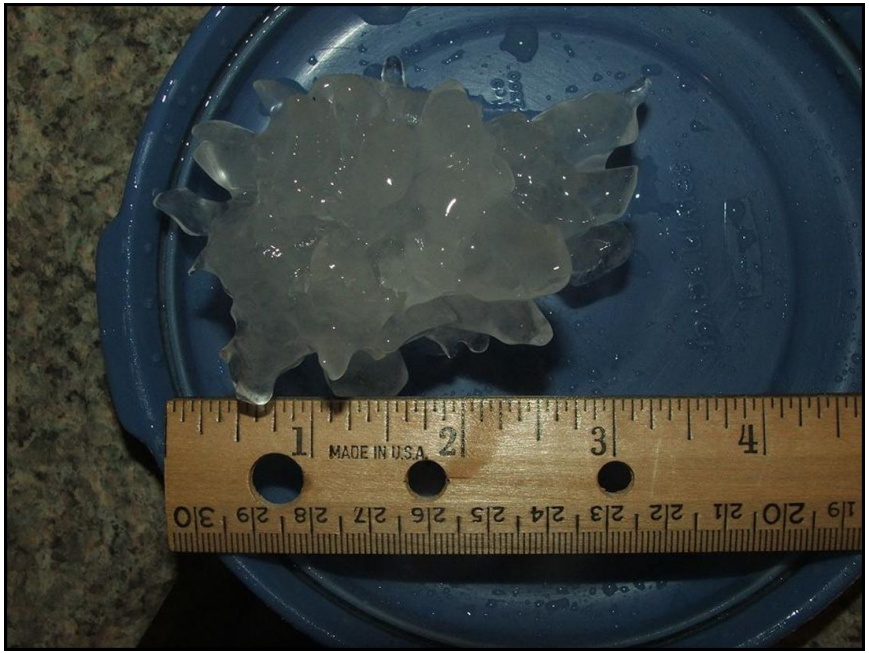
- By Phone (1-800-863-4279) - unlisted
- By Social Media (FB/Twitter)
- By Amateur Radio (WX1BTV - 145.110 MHz Whiteface Repeater)
- By our storm report page (https://www.weather.gov/btv/stormreport)
- By mPING (https://mping.ou.edu/static/mping/access.html) - access via iPhone or Google Store - and select your weather observation.
- Share with us your photos!

Reporting Severe Weather

- Funnel Clouds and Wall Clouds
- Tornado or Waterspout
- Heavy Rain (> 1 inch per hour)
- Hail
- Damaging Winds
- Flooding
- Weather Related Injuries or Deaths

Vermont Record Hail Westford, VT July 16, 2009

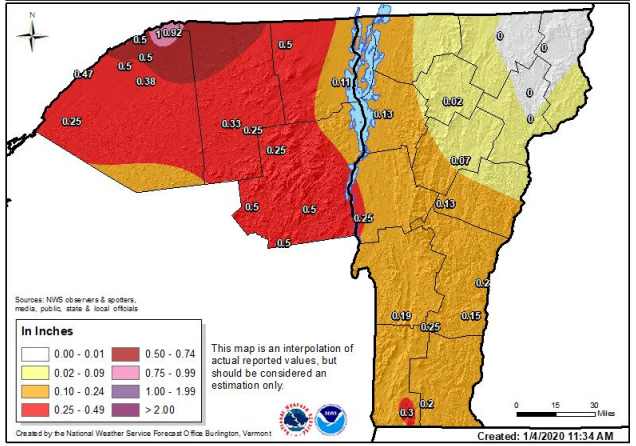
3.25” diameter



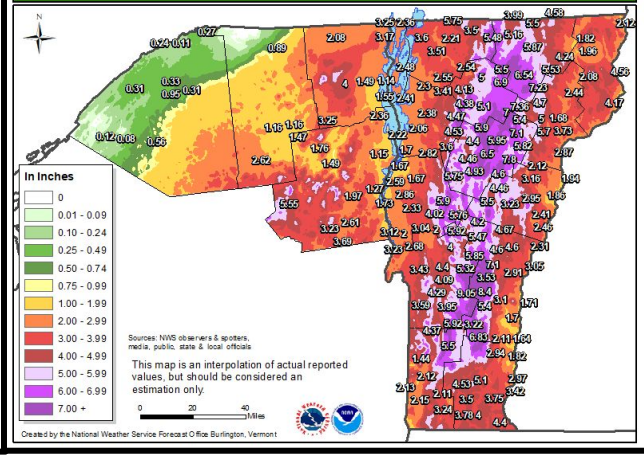
Took place in one of our employee’s own backyard!

- Measure hailstone from tip-to-tip
- And do it fast! That hail is melting.
- And if you get record hail, make sure to back it up with a photo.

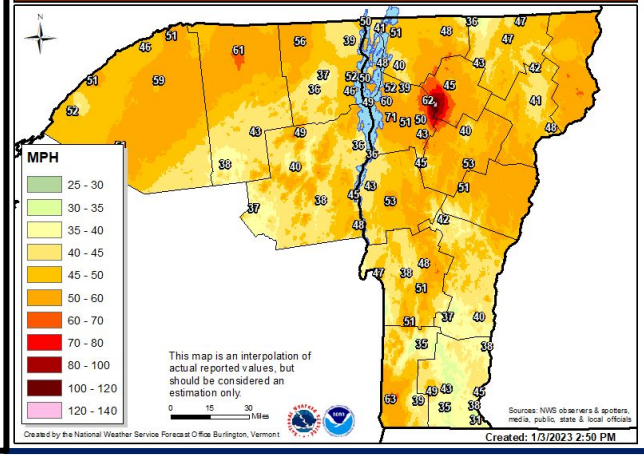
North Country Storm Total Ice Accumulation Ending December 31, 2019



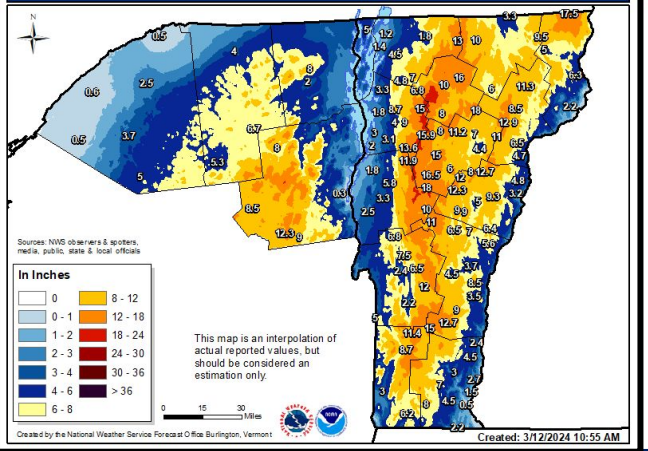
North Country Storm Total Rainfall July 10-11, 2023



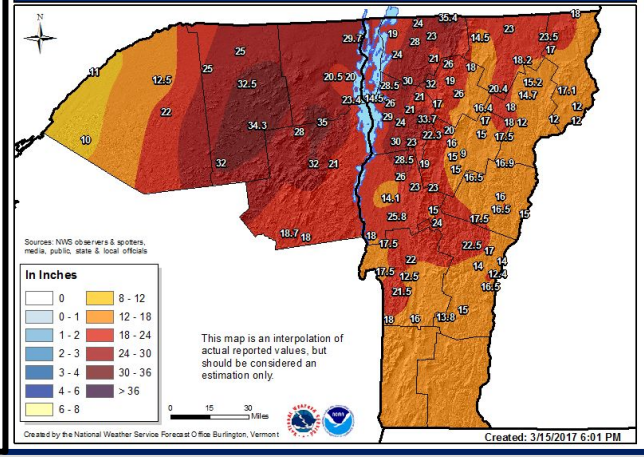
North Country Storm Maximum Wind Gusts - December 22-23, 2022



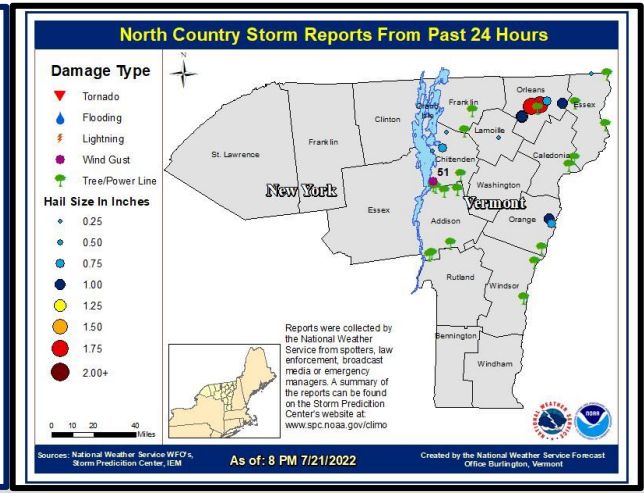
North Country Storm Total Snowfall Ending March 12, 2024



North Country Storm Total Snowfall Ending March 15, 2017



North Country Storm Reports From Past 24 Hours

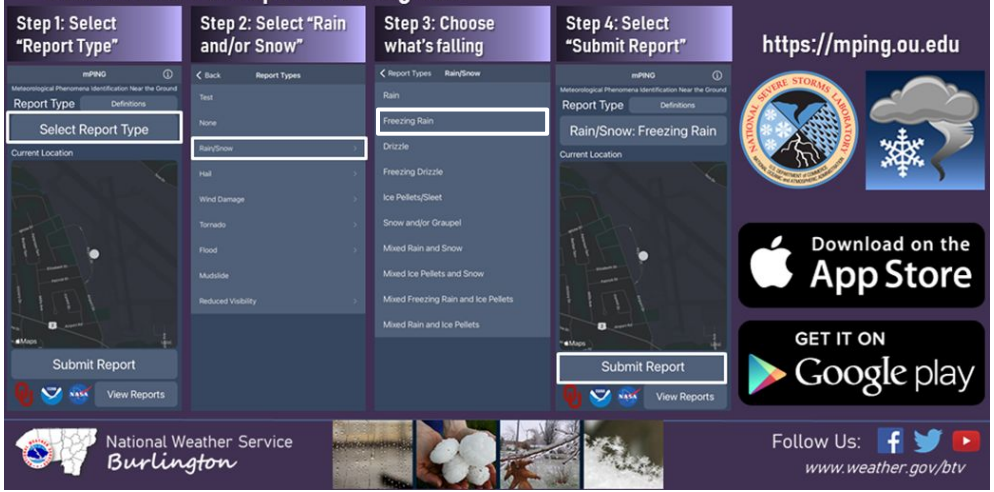


mPING

Submit reports with the tap of your finger!

Use the mPING App to record the weather at your location

- Download the free app
- Tell us when precipitation begins, changes, or ends where you're at!
- Support research as a citizen scientist – report as often as you would like
- Below is how to report freezing rain



https://mping.ou.edu

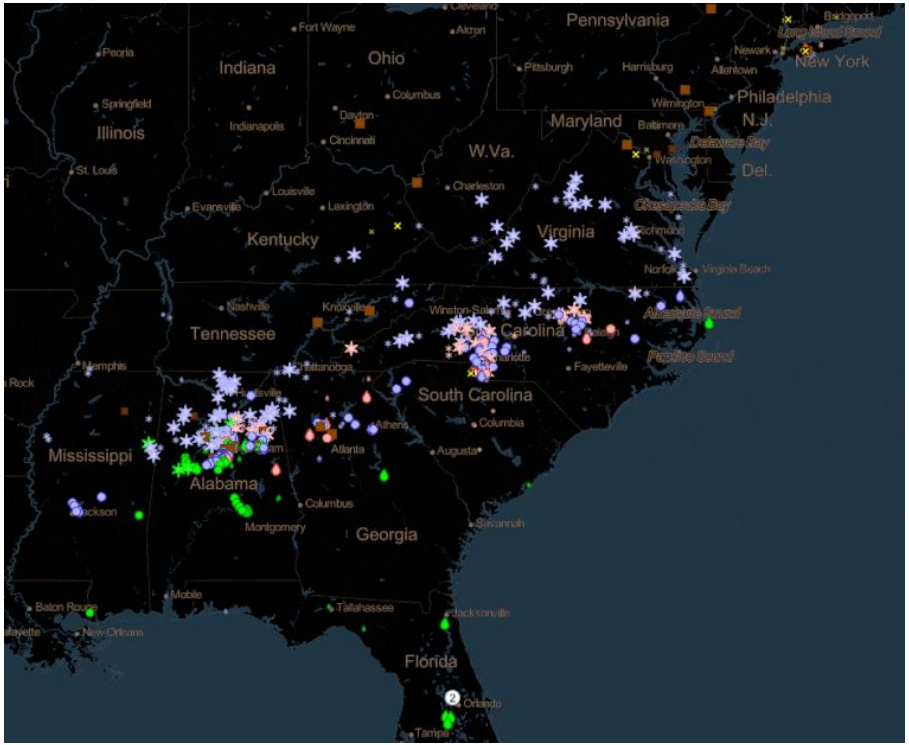
Download on the App Store

GET IT ON Google play

National Weather Service Burlington

Follow Us:

www.weather.gov/btv



How to get alerts

- NOAA Weather Radio
- Alerts through your phone (WEA)
- TV Broadcasts/Media Outlets

NWS Burlington

COOP vs CoCoRaHS vs Skywarn

The Cooperative Observer Network (COOP)

Who: Dedicated volunteers or contractors able to report daily

What: Provide long-running daily climate reports, managing station records, equipment requirements

How often: Daily

Where: Siting is critical

Community Collaborative Rain, Hail, and Snow Network

Who: Community volunteers eager to report weather

What: Focus on rain, snow, and hail with specific gauge equipment

How often: Daily

Where: Siting is important

Skywarn Spotter Network

SKYWARN
WEATHER.GOV

Who: Volunteer network trained by the NWS

What: Focus on severe weather spotting, but also measuring other weather phenomena

How often: As often as desired

Where: Wherever you are

For more info, contact marlon.verasamy@noaa.gov, seth.kutikoff@noaa.gov, robert.d.haynes@noaa.gov, or scott.whittier@noaa.gov

Summary

- A reliable Skywarn Spotter provides ground truth and potentially life-saving information (downed trees or lines/funnel clouds/heavy rain/wind damage)
- Storms come in various flavors. The more organized, the more likely severe impacts will occur
  - Wall clouds, shelf clouds, overshooting tops
  - Lines or bow echoes on radar
- Severe weather in the North Country is most common in June, July, and August.
- Your safety should come first. Never put yourself in harms way to provide us info.
- Be as specific as possible! We may not be as familiar with your roads/cities. Referencing nearby intersections, landmarks, or even your latitude/longitude will help us pinpoint where active weather is occurring.

Thanks for your attendance!

Robert Haynes – robert.d.haynes@noaa.gov

If you are interested in becoming a Spotter – email me or call our office to inform us that you have completed the course. You will be given our unlisted Spotter Number.

Please provide a: Name, Address (or lat/lon), Phone Number

Web:
http://www.weather.gov/btv/stormreport

Toll-Free Spotter Line
1-800-863-4279

E-mail:
nws.er.btv.operations@noaa.gov

Facebook:
https://www.facebook.com/NWSBurlington

Twitter:
https://twitter.com/NWSBurlington

YouTube:
https://www.youtube.com/NWSBurlington