

# Weather Spotter Training



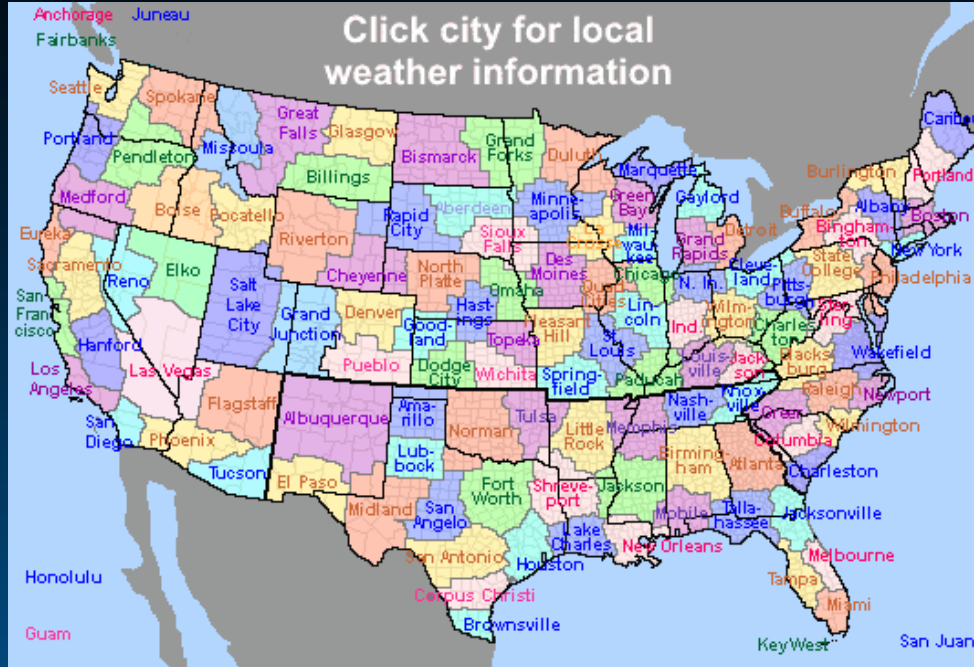
Trent Smith – Forecaster, NWS Missoula, [trent.smith@noaa.gov](mailto:trent.smith@noaa.gov)



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

# National Weather Service

Click city for local weather information



- 76 Billion Observations
- 1.5 Million Forecasts
- 50,000 Warnings

## A Typical Year Brings



6 Hurricanes



1270 Tornadoes



5000 Floods



10,000 Violent Thunderstorms



Drought Conditions



58,500 Wildfires burning  
6.35M acres

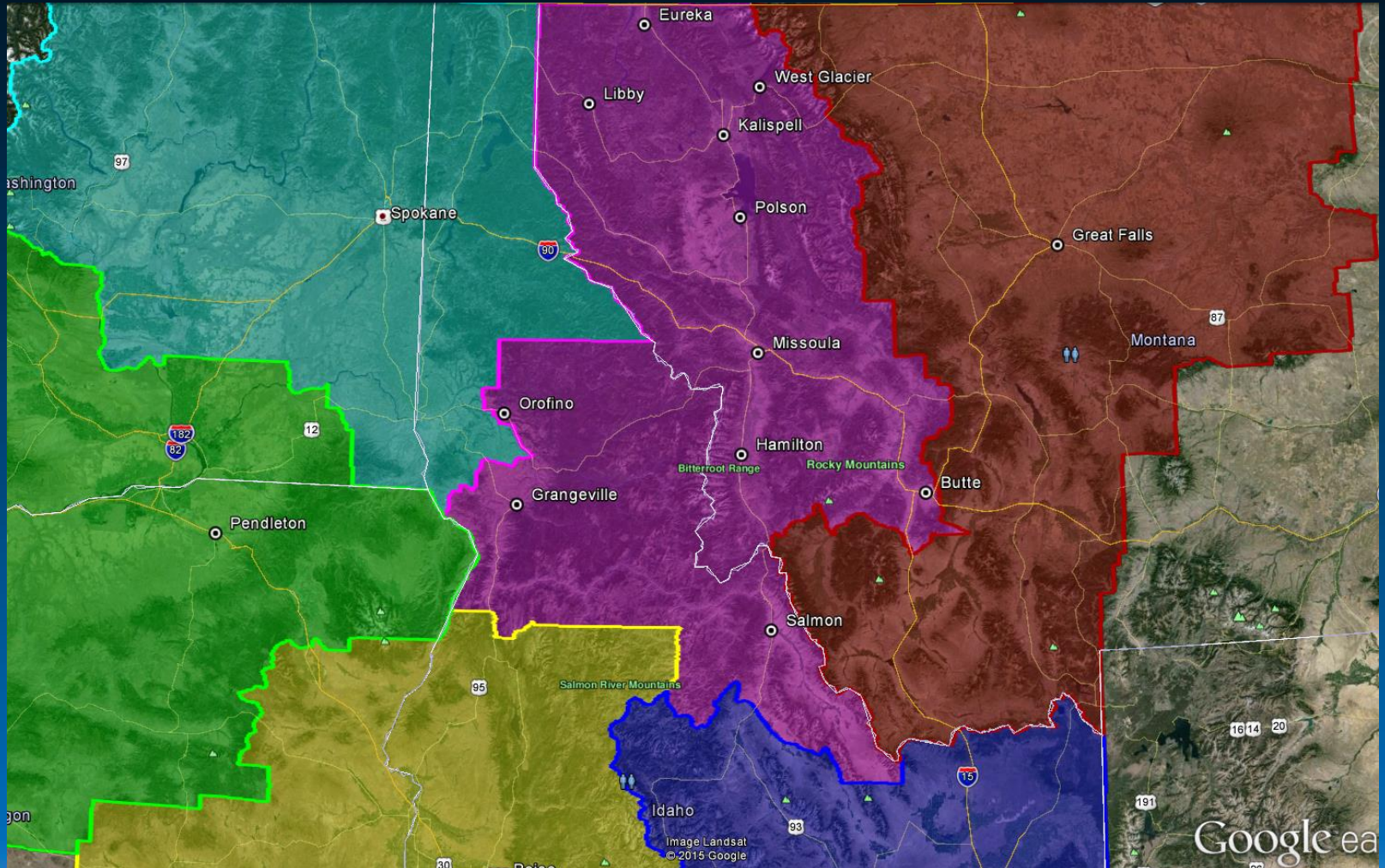
- Local Forecasts & Warnings
- Work with Local Agencies
- Give Expert Advice
- Provide Awareness and Education



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# Missoula Forecast Area



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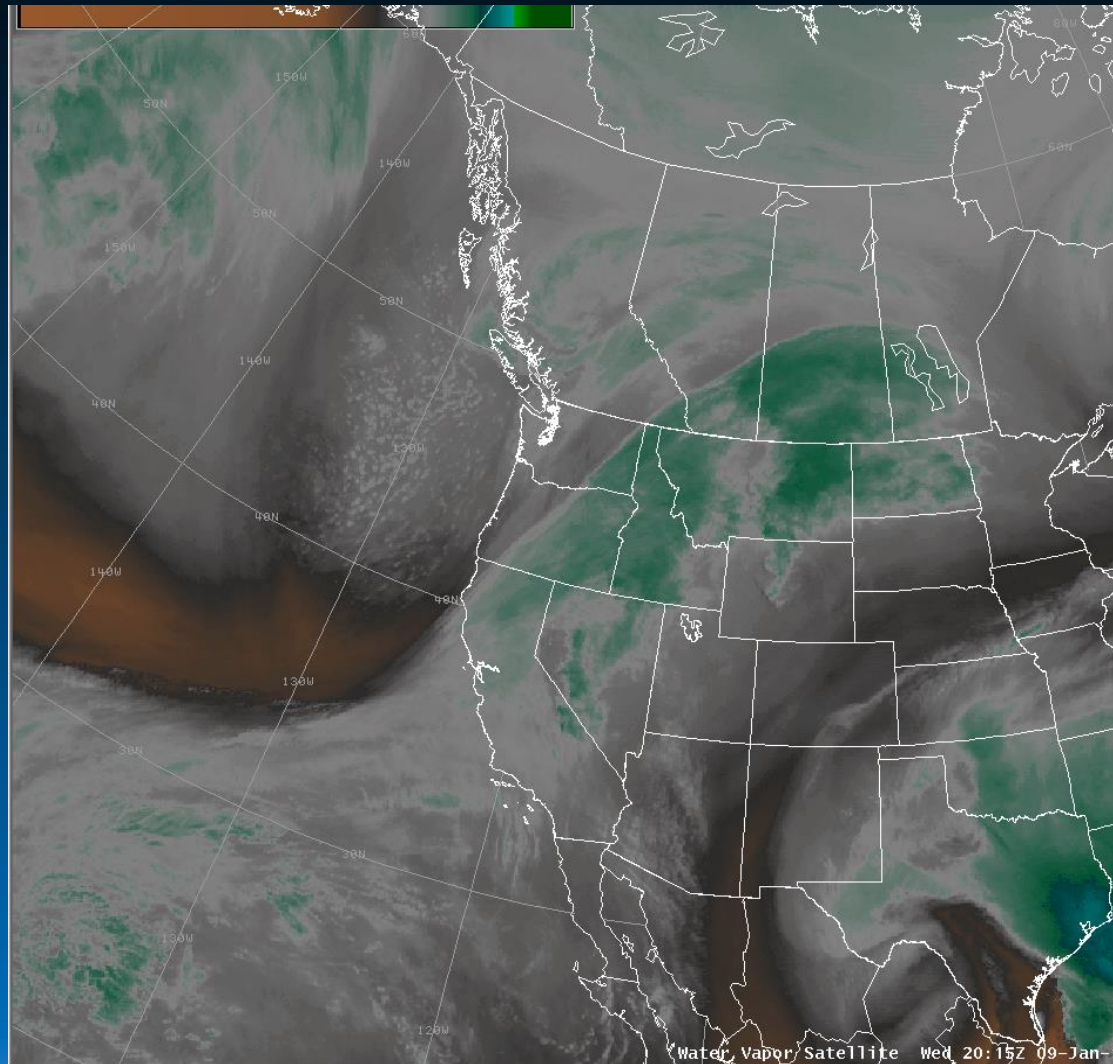
# Thunderstorm Ingredients

- **MOISTURE**
  - Preferably in the lower or middle levels of the atmosphere
- **INSTABILITY**
  - Ability of air to accelerate upward/downward when motion initiated
- **LIFT**
  - Moist, unstable air acted on by terrain, fronts, storm outflow boundaries, etc...



# Moisture

- Upper level low pressure over the eastern Pacific ocean and a ridge inland
- Subtropical jet stream brings Pacific moisture
- Occasional tap into the Southwest monsoon



# Instability

STABLE



NEUTRAL



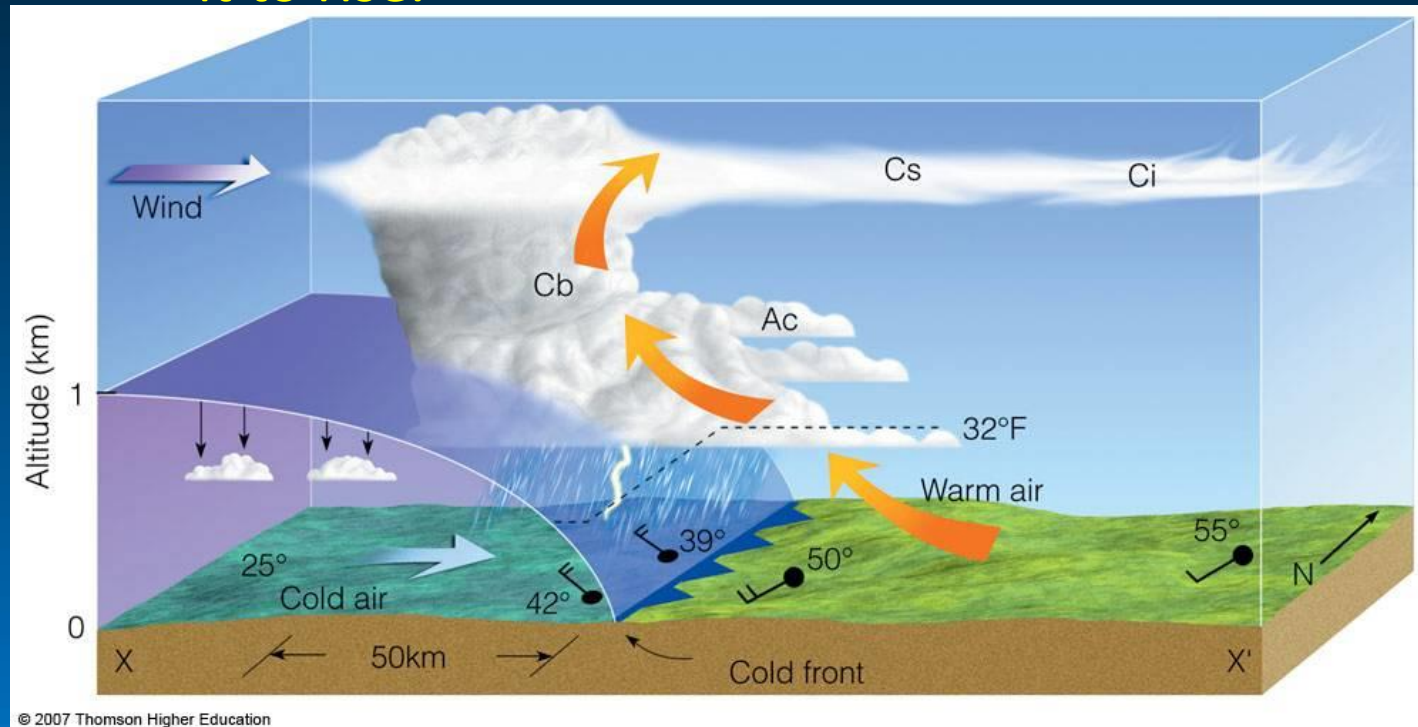
UNSTABLE



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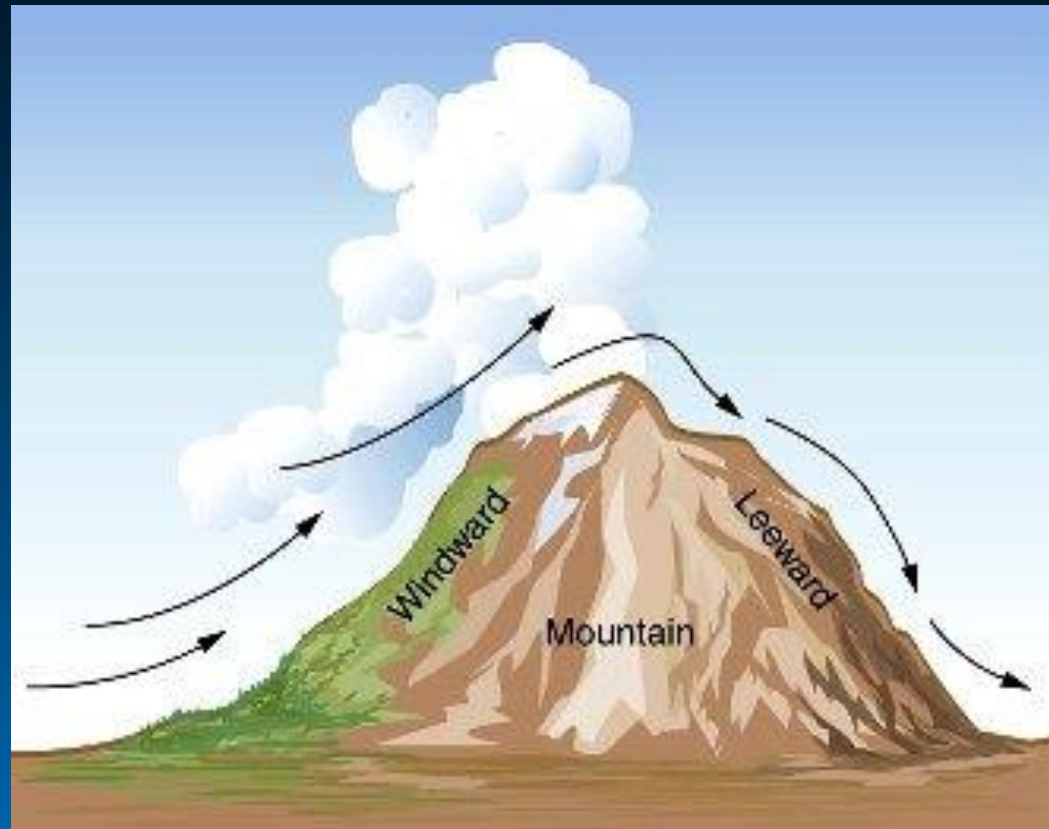
# Lift Associated with a Cold Front

- Colder more dense air pushes underneath warmer moist air, creating condensation and cloud development.
- Air converges along a frontal boundary, forcing it to rise.



# Lift Associated with Topography

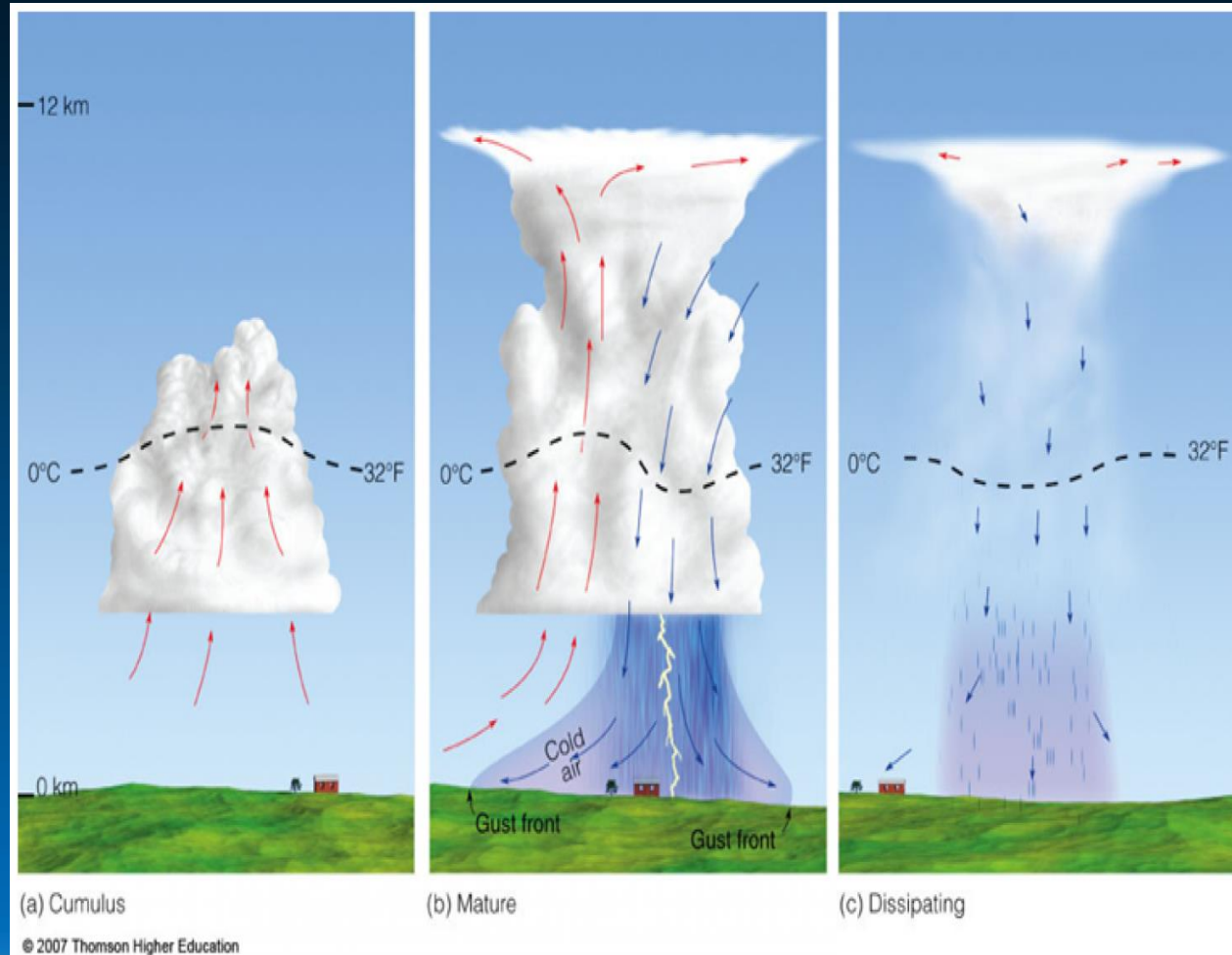
- Air rises on windward side of a mountain
  - Results in cooling and formation of clouds and precipitation
- Air descends on leeward side of a mountain
  - Results in warming and drying
- Prevailing wind direction determines precipitation





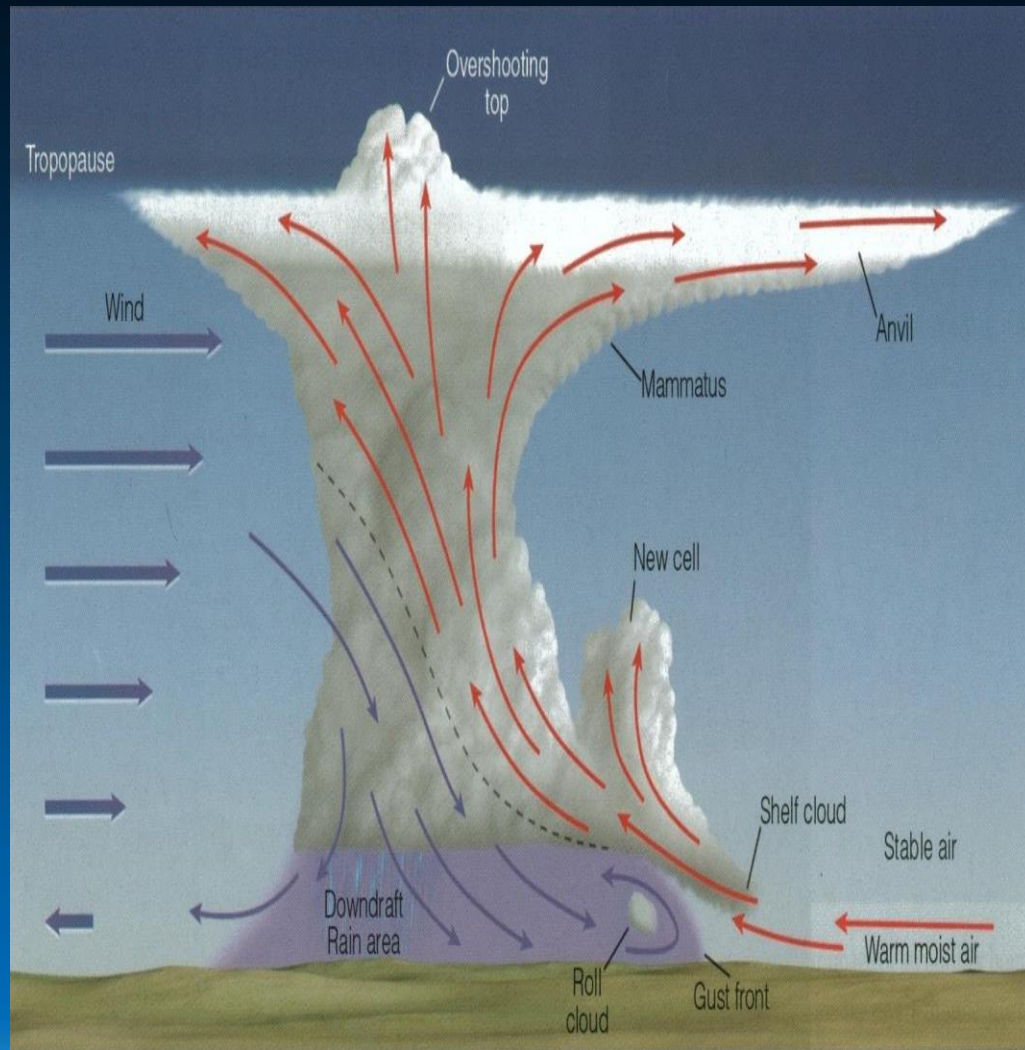
# Thunderstorm Life Cycle (Air-Mass Thunderstorm)

- Three Stages
  - Cumulus
    - All updraft
  - Mature
    - Updraft and Downdraft
  - Dissipating
    - All downdraft



# Strong Thunderstorm Structure

- Need strong vertical wind shear
- Tilts the updraft and downdraft
  - Precipitation falls into downdraft region in stead of the updraft
- Updrafts may be strong enough to intrude into the stable stratosphere
- Violent updrafts can suspend hailstones
- Downdraft is fed by precipitation but enhanced by cooling due to evaporation of precipitation



# Single Cell “Pulse” Thunderstorm

- Goes through the three stages of thunderstorms in less than hour, sometimes in as little of 30 minutes.
- Severity depends on amount instability and moisture
- Lacks strong vertical wind shear and lift mechanism is thermals



# Multi Cell Thunderstorm

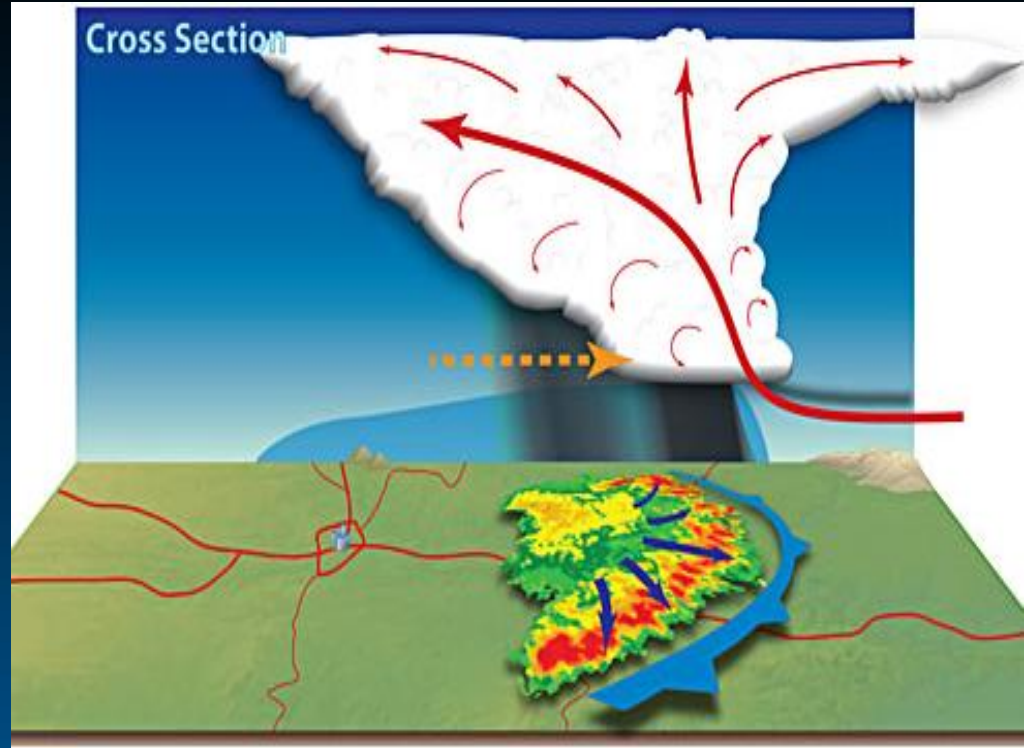
- Downdraft (outflow) from one cell can cause another cell to develop
- Mountains can have a similar effect
- Training of storms could cause flooding



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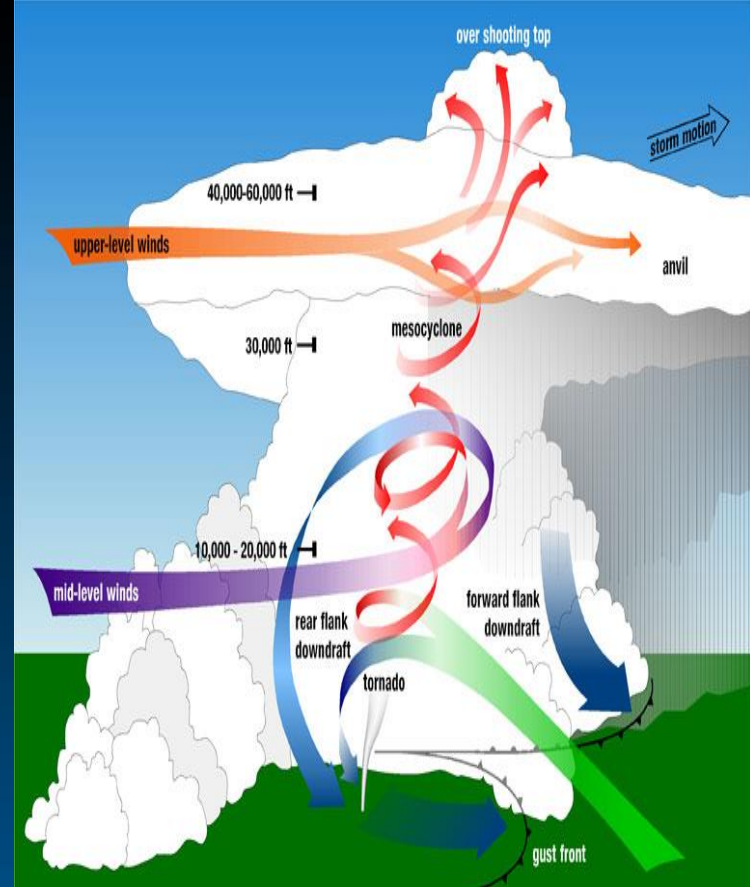
# Squall Line

- Narrow, often linear line of thunderstorms. Develops along or usually ahead of a cold front.
- Once thunderstorms develop, the outflow of cold air becomes the lifting mechanism keeping the line alive.
- Lines can persist for six hours, due to the alignment of individual cells do not interfere with each other
- Smaller scale phenomenon is called a Bow Echo



# Supercell

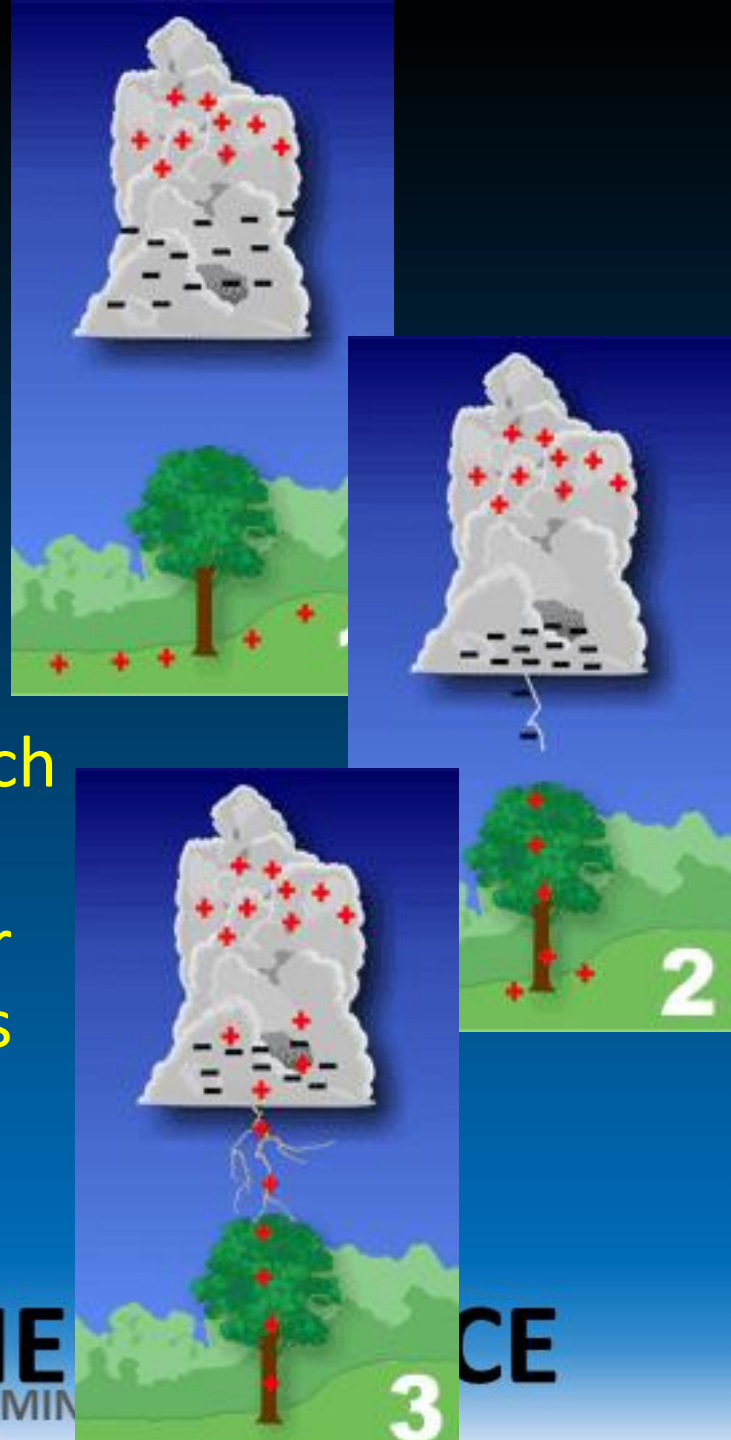
- Needs speed and directional wind shear
- One updraft, but two downdrafts
- Can last for several hours, as long as there is a supply of warm surface moisture
- Updraft's vertical velocity can reach 100 mph



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# Lightning

- Ice and liquid hold different charges
- Charges become imbalance within a thunderstorms
- Positive and negative strikes
- Cloud-to-cloud, cloud-to-ground, or cloud-to-air
- Average 80 fatalities/300 injuries each year
- Thunder is the rapid expansion of air around the lightning bolt that breaks the sound barrier



# Lightning

[www.WeatherVideoHD.TV](http://www.WeatherVideoHD.TV)

- Temperature  
50,000 degrees F
- Intensity  
200,000,000+  
volts  
20,000 amperes
- Size  
One inch in  
diameter

Time: Sat Jul 21 2007 22:35:09.221 984 S

Img#: -8315 AcqRes: 640 x 480 Rate: 7207 Exp: 135  $\mu$ s Durat: 0.193 s

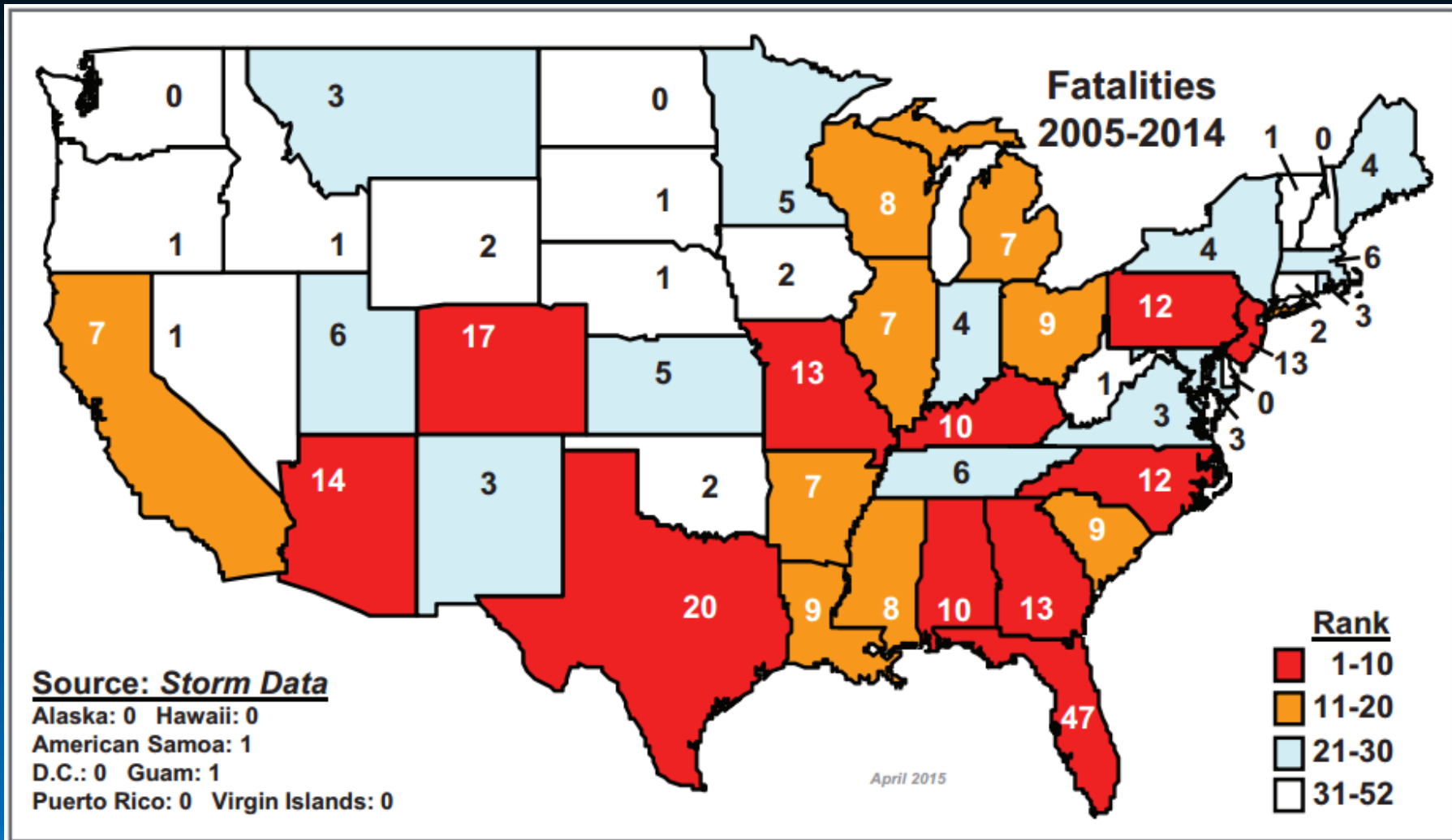
Tom A. Warner



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# Fatalities by State 2005-2014



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# Hail

- ▶ Strong updraft to keep large chunks of ice aloft
- ▶ Circulates within a thunderstorm to collect a layer of water or smaller hail then freezes it on
- ▶ Can fall to the ground at >100 mph



# Microburst & Straight Line Wind

- Downdraft or precipitation can drag strong mid level winds down to the surface
- Evaporation can cool a parcel of air causing to become heavier (more dense)
- Accelerates at the speed of gravity. The farther of distance, the faster the speed
- Wet microburst and dry microburst



# Non-Supercell Tornado

- ▶ A boundary causing an spinning eddy or a rolling horizontal column
- ▶ Strong enough convection to pull and stretch the eddy or column into the vertical
- ▶ Stretching causing the air to spin faster
- ▶ Typically only rate EF0-EF2

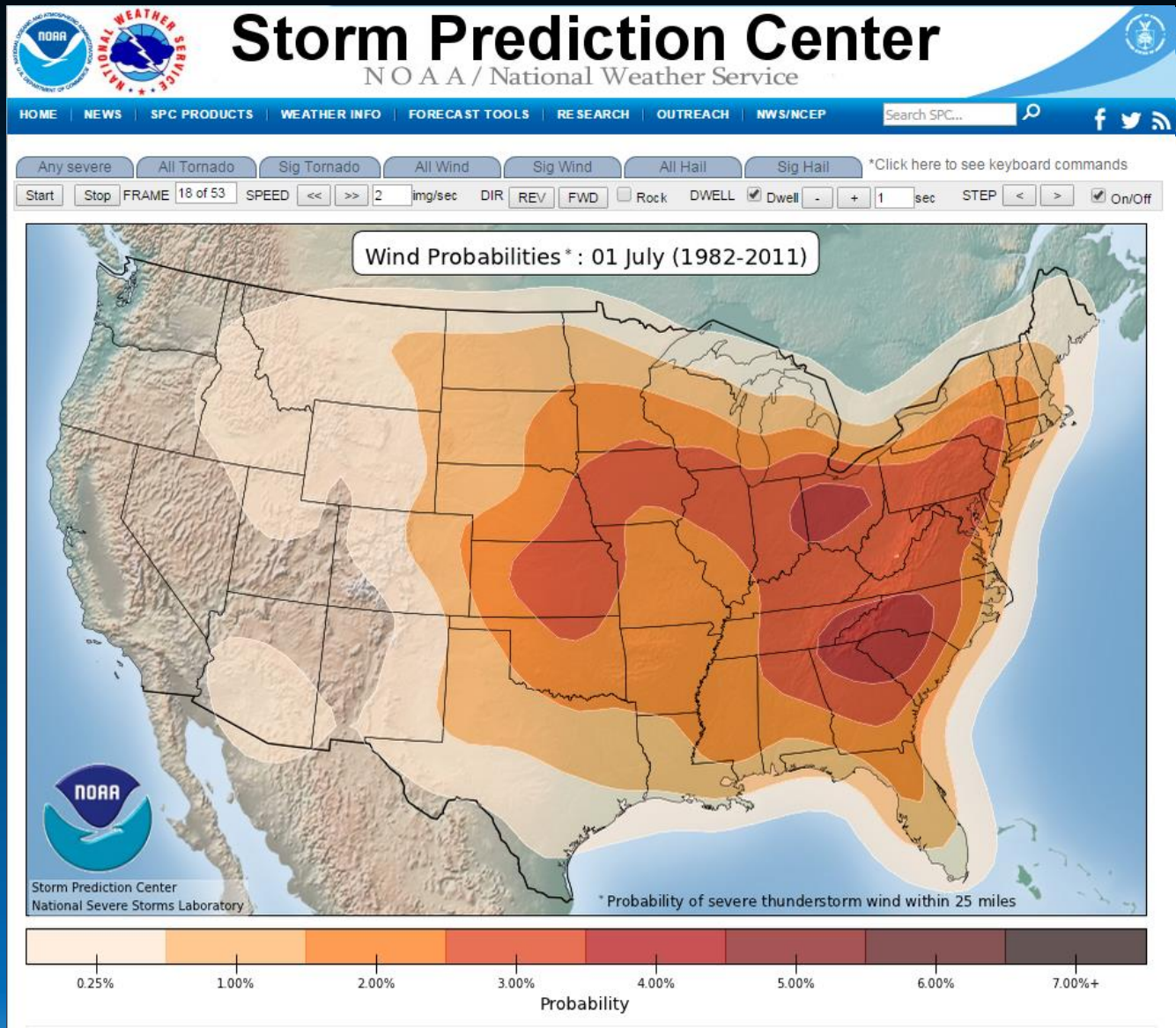


# Supercell Tornado

- Supercell is already spinning  
need some low level spinning  
to be stretched upward
- Interaction of the rear flank  
downdraft (RFD) and updraft  
creates this spin
- If RFD can not be too cold or the  
air will be too dense to be pulled  
upward
- Can range from EF0 to EF5
- EF5s records:
  - 2.6 miles wide (May 2013)
  - 301 mph (May 1999)
  - 235 miles (March 1925)



# Probability of Severe Weather



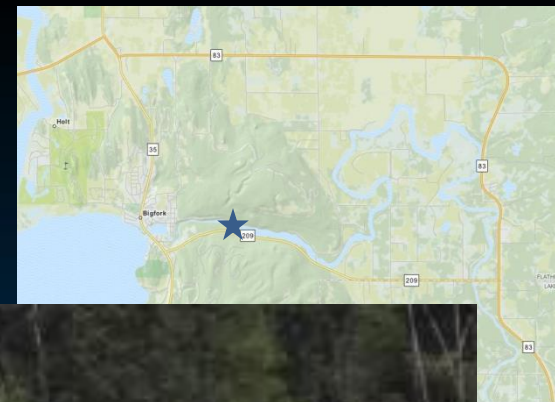
# River Flooding

- November through June
- The peak hits in May and June with the melting of the snowpack



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# River Flooding



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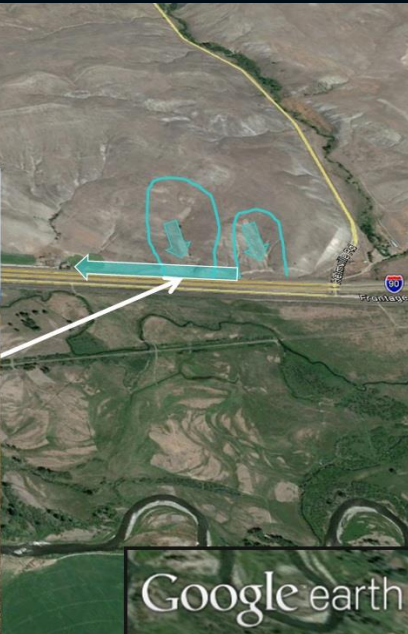
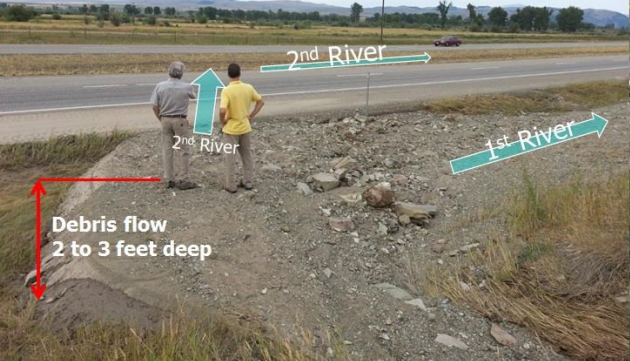
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Click on picture to play video

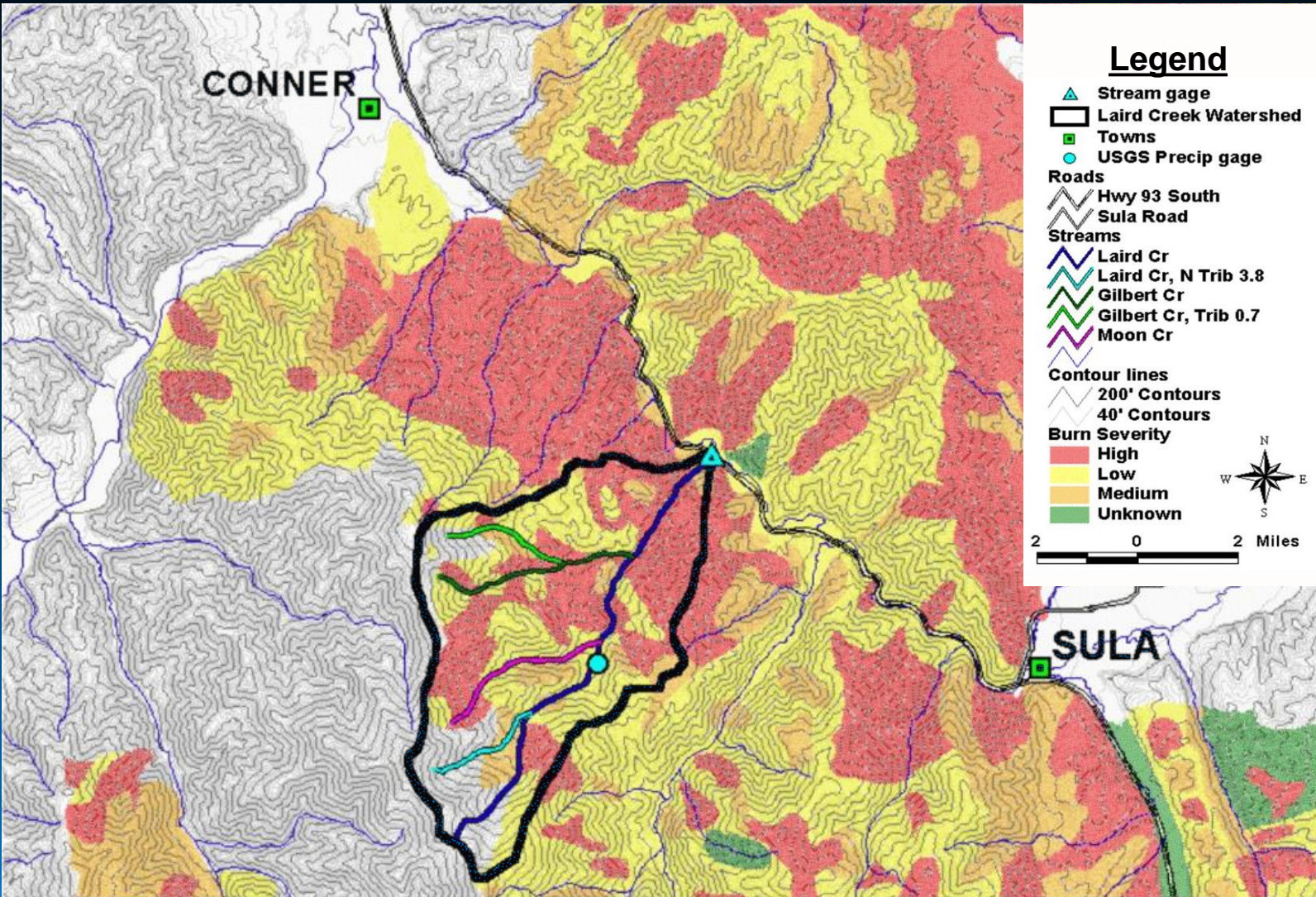


# Flash Flooding

Water & Debris flow came across I-90 forming 2 flash flood rivers about 3 to 4 feet deep. One vehicle was swept off I-90.



# Burn Area Flash Flooding



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# Burn Area Flash Flooding



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# Land Slides



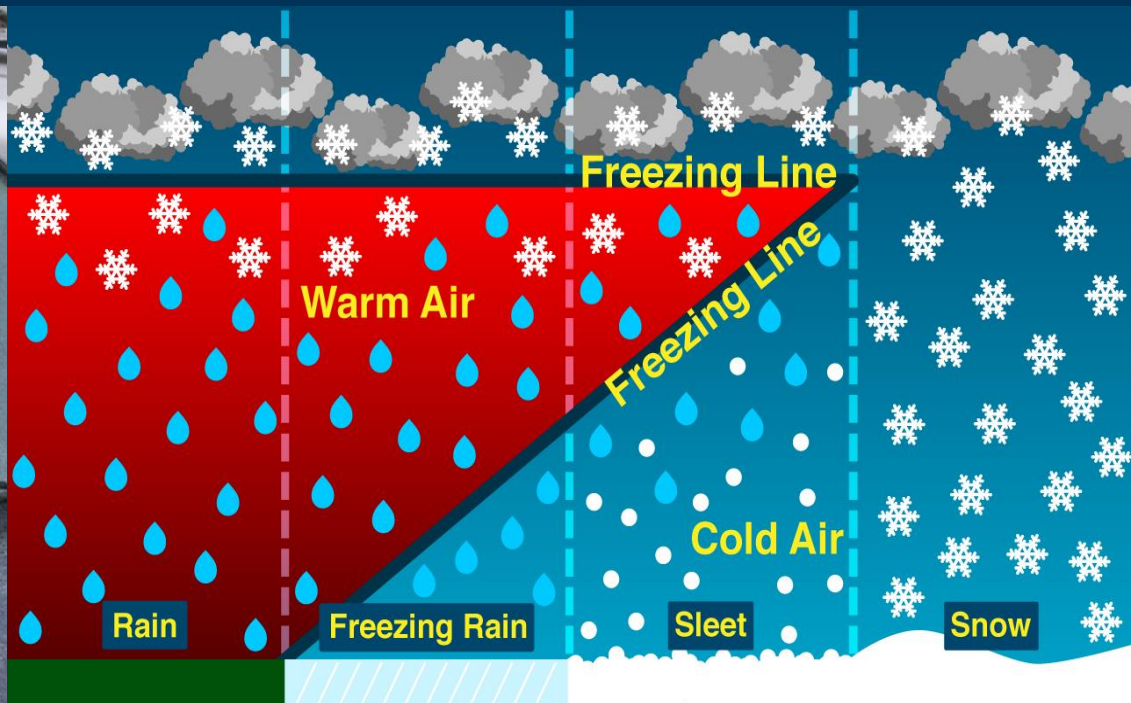
# Snow

- ▶ Temperature plays a big role on snow type
- ▶ Not surface temperature but temperatures aloft
- ▶ Snow types determine snow to liquid ratio
- ▶ Dendrite in the  $-10$  to  $-18^{\circ}$  C range generally produces the largest amounts of snow.

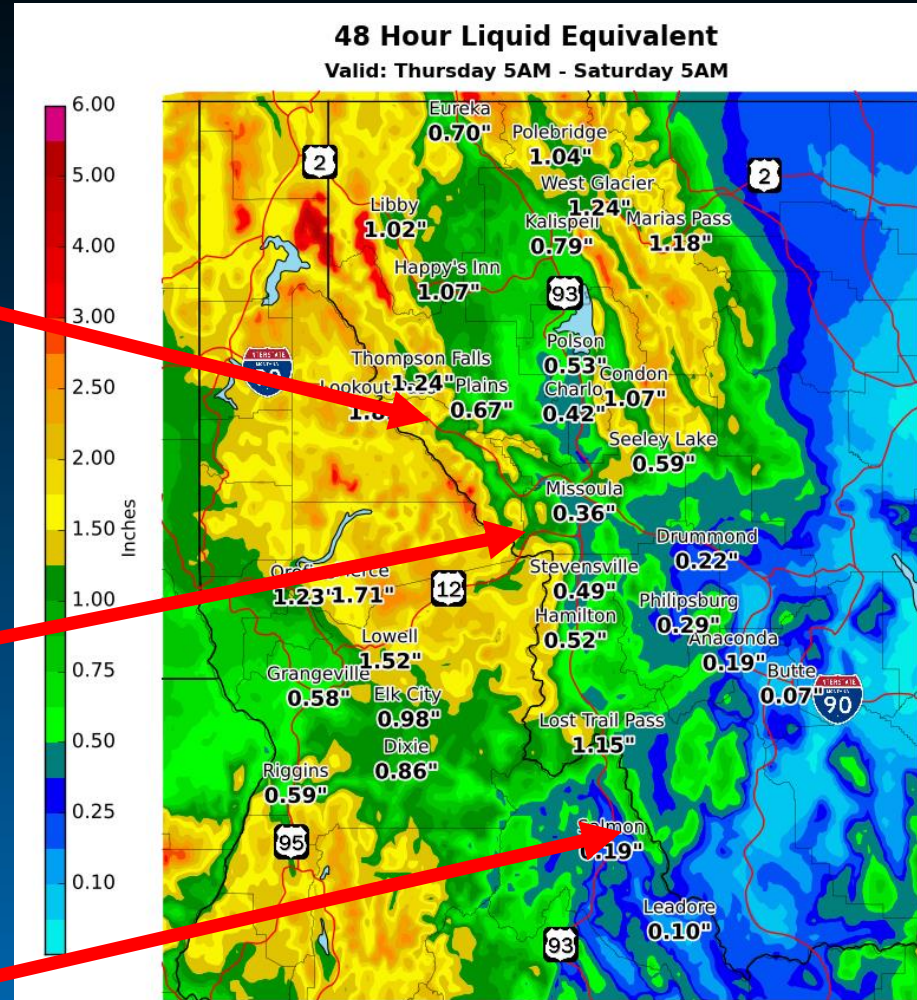


# Freezing Rain

- ▶ A layer of warm (above freezing) air moves into an area.
- ▶ Depth of cold air under the warm layer determines precipitation at the surface
- ▶ Water can stay liquid until  $-40^{\circ}$  F, water below freezing is called super cooled



# Where are the Impacts?

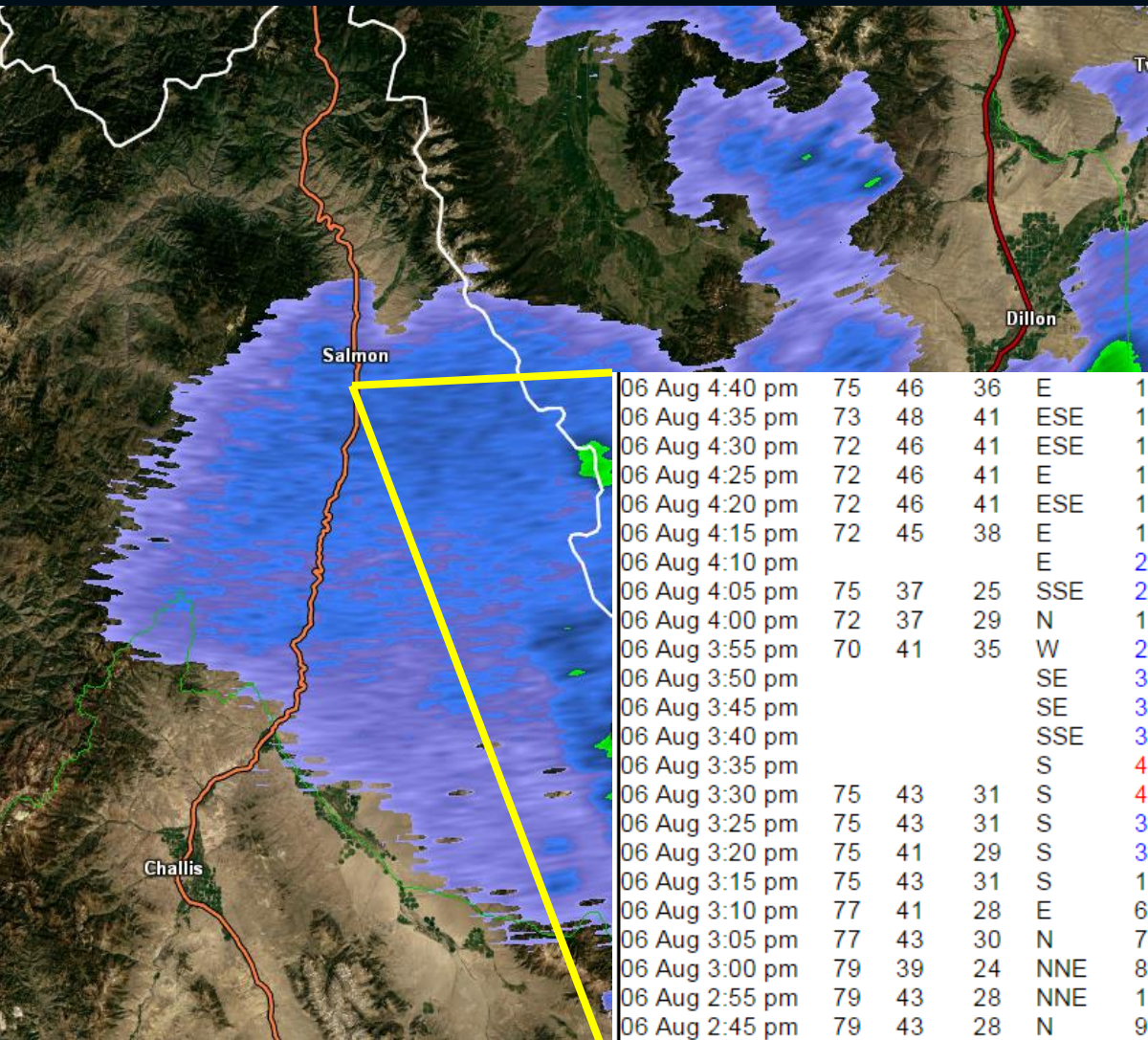


National Weather Service  
NWS Missoula Montana  
02/03/2015 09:07 PM GMT

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[weather.gov/Missoula](http://weather.gov/Missoula)

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# The Need For Spotters



06 Aug 4:40 pm	75	46	36	E	12G22	10.00	CLR	29.90	25.788
06 Aug 4:35 pm	73	48	41	ESE	16G22	10.00	CLR	29.90	25.788
06 Aug 4:30 pm	72	46	41	ESE	14	10.00	CLR	29.90	25.788
06 Aug 4:25 pm	72	46	41	E	15	10.00	CLR	29.90	25.788
06 Aug 4:20 pm	72	46	41	ESE	17	10.00	FEW075 FEW090	29.90	25.788
06 Aug 4:15 pm	72	45	38	E	18G30	10.00	FEW075 SCT090	29.89	25.779
06 Aug 4:10 pm				E	21G30	10.00	FEW075 SCT090 SCT110	29.88	25.770
06 Aug 4:05 pm	75	37	25	SSE	22G31	10.00	FEW026 FEW070 BKN090	29.88	25.770
06 Aug 4:00 pm	72	37	29	N	12G49	9.00	FEW026 SCT050 BKN090	29.84	25.734
06 Aug 3:55 pm	70	41	35	W	24G49	10.00	FEW050 FEW080 OVC100	29.89	25.779
06 Aug 3:50 pm				SE	30G46	10.00	FEW050 BKN100 OVC120	29.91	25.797
06 Aug 3:45 pm				SE	33G46	8.00	FEW050 OVC110	29.91	25.797
06 Aug 3:40 pm				SSE	37G64	5.00	FEW050 OVC110	29.92	25.805
06 Aug 3:35 pm				S	41G64	7.00	FEW050 OVC110	29.94	25.823
06 Aug 3:30 pm	75	43	31	S	40G53	10.00	SCT085 OVC120	29.94	25.823
06 Aug 3:25 pm	75	43	31	S	32G43	9.00	SCT085 BKN120	29.93	25.814
06 Aug 3:20 pm	75	41	29	S	33G43	9.00	FEW085 BKN120	29.93	25.814
06 Aug 3:15 pm	75	43	31	S	16G24	10.00	FEW085 BKN120	29.94	25.823
06 Aug 3:10 pm	77	41	28	E	6	10.00	FEW085 SCT120	29.92	25.805
06 Aug 3:05 pm	77	43	30	N	7	10.00	SCT120	29.90	25.788
06 Aug 3:00 pm	79	39	24	NNE	8	10.00	FEW120	29.88	25.770
06 Aug 2:55 pm	79	43	28	NNE	13	10.00	FEW120	29.88	25.770
06 Aug 2:45 pm	79	43	28	N	9	10.00	CLR	29.88	25.770
06 Aug 2:35 pm	79	45	30	NNW	12	10.00	FEW110	29.87	25.761



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# Lake Effect

2014-12-26 MST 10:58:01



- ▶ A cold air mass moves over a warm large body of water
- ▶ Creates an unstable environment allowing for convection to develop
- ▶ Convection generally develops in bands and are fairly narrow
- ▶ Snow fall rates can be heavy and conditions can change quickly



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# Spotter Reporting Criteria

- Tornado, funnel cloud and waterspout
- High wind - estimated or measured >40 mph
- Heavy rain -  $\frac{1}{2}$ " or more per hour
- Flooding - of any kind
- Hail –  $\frac{1}{4}$ " or larger
- Visibility reduced to less than  $\frac{1}{4}$  mile
- Heavy snow - one inch or more per hour
- Weather related damage or injuries
- Moderate to High impacts



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# Missoula Spotter Number

## 1-800-676-6975

When leaving a message:  
Please leave your name,  
approximate location, date/time of  
your observation and what you are  
reporting.



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# Where to find information



**NWS Missoula, MT**

Home Videos Playlists Channels Discussion



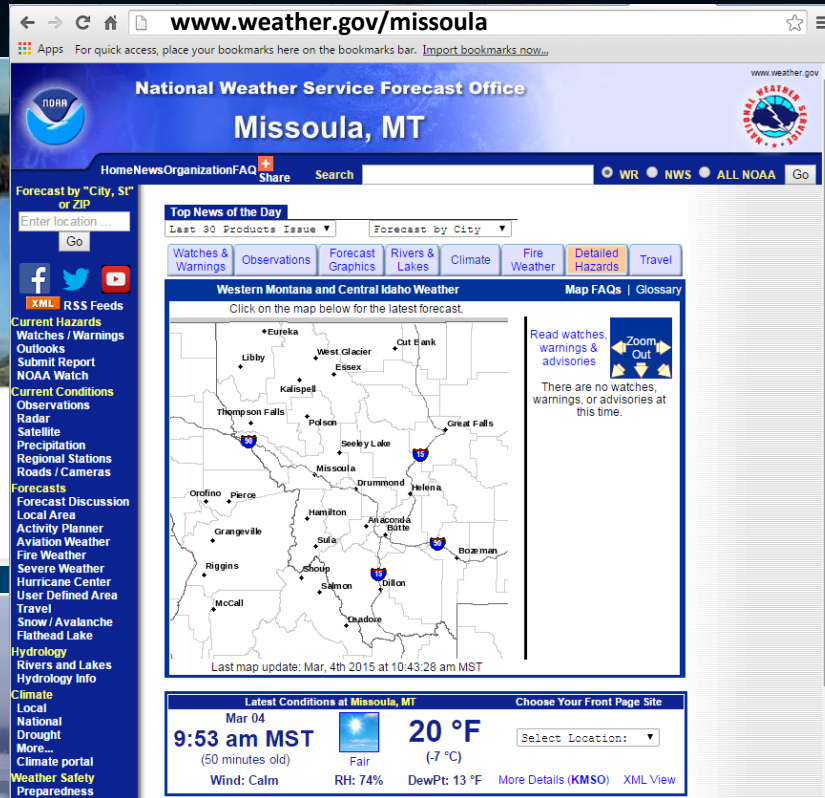
**NWS Missoula**  
@NWSMissoula

TWEETS 7,137 FOLLOWING 148 FOLLOWERS 2,814

Following

Official Twitter account for the National Weather Service Missoula, MT. Details: [weather.gov/twitter](http://weather.gov/twitter)

Missoula, MT · [weather.gov/missoula](http://weather.gov/missoula)



[www.weather.gov/missoula](http://www.weather.gov/missoula)

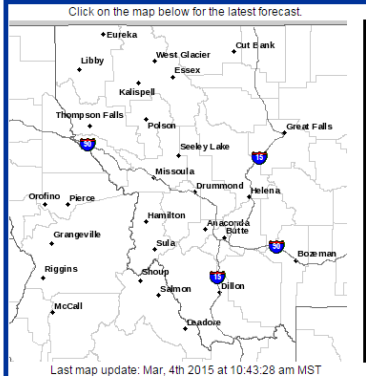
National Weather Service Forecast Office  
**Missoula, MT**

Forecast by "City, St" or ZIP  
Enter location... Go

Top News of the Day  
Last 30 Products Issue Forecast by City

Watches & Warnings Observations Forecast Graphics Rivers & Lakes Climate Fire Weather Detailed Hazards Travel

Western Montana and Central Idaho Weather  
Click on the map below for the latest forecast.



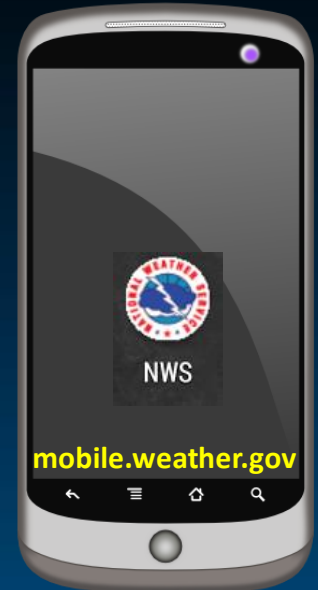
Read watches, warnings & advisories  
Zoom Out

There are no watches, warnings, or advisories at this time.

Latest Conditions at Missoula, MT  
Mar 04  
**9:53 am MST**  
(50 minutes old)  
Fair  
Wind: Calm RH: 74% DewPt: 13 °F

20 °F  
(-7 °C)

Select Location: More Details (KMSO) XML View



**US National Weather Service Missoula Montana**  
Government Organization

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5,493 likes 50 visits



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# Other Means for Reporting

National Weather Service Weather Forecast Office  
Missoula, MT

Home Site Map News Organization Search for: [ ] NWS All NOAA

## Submit a Storm Report

This interface is intended to be used solely for the relay of storm information to the NWS. Other comments or information should be sent to the [National Weather Service Missoula, Montana](#).

### Event Location

Enter date/time/location of event. Please reference to major roadway or intersection for events within towns/cities.

Event Time: 01 30 PM Mountain  
Event Date: Mar 13 2016  
County: --Select a County--  
Location (7 NW Mytown): [ ]

### Event Type (Select all that apply)

Click box next to events you observed. Next, select appropriate sub-descriptor in pull down menus to describe event.

<input type="checkbox"/> Flood	--Select a flooding category--	
<input type="checkbox"/> Hail	--Select a Hail size--	
<input type="checkbox"/> High Wind Speed	--Select a Wind speed--	
<input type="checkbox"/> Tornado/Funnel Cloud	--Select a report--	
<input type="checkbox"/> Wind Damage	--Select a Wind Damage Des--	
<input type="checkbox"/> Snow	--Select a snow total--	--Select a duration--
<input type="checkbox"/> Freezing Rain/Icing	--Select an ice total--	--Select a duration--
<input type="checkbox"/> Heavy Rain	--Select a rainfall total--	--Select a duration--

### Additional Details

Provide any additional information that you feel is pertinent to your submission (500 characters maximum).

[ ]

You may also pass along additional information by [e-mailing](#) them to the National Weather Service Missoula, Montana separately. ([WFO MSO](#))

### Contact Information

**VOLUNTARY** and **WILL NOT** be distributed.

Your Name: [ ]  
Spotter Id: [ ]  
E-mail address: [ ]  
Phone number: [ ]  
Observer Profile: --Select a Profile--

Reset Report Review Report

mPING

Meteorological Phenomena Identification Near the Ground

Report Type Definitions

Select Report Type

Current Location

Submit Report

View Reports

Logos: OU, NOAA, NASA



# Help observe precipitation in your community !!



[www.cocorahs.org](http://www.cocorahs.org)



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All you need is a simple 4" diameter plastic rain gauge and ten minutes a day!



Gauge measures to the hundredth of an inch



It's fun and easy.  
We need your help!



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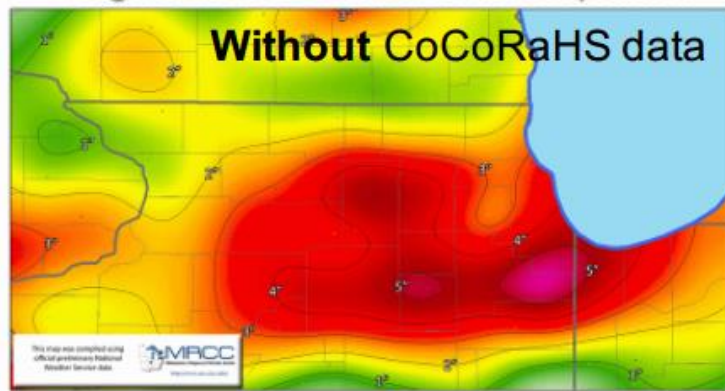
Volunteers take their readings once a day

Observers can easily transmit their observations using mobile devices

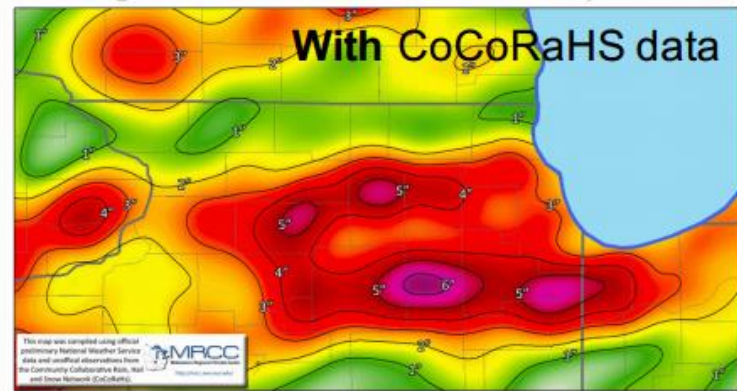


CoCoRaHS observers help provide a much better post-storm analysis picture!

(A) August 23 & 24 Accumulated Precipitation



(B) August 23 & 24 Accumulated Precipitation



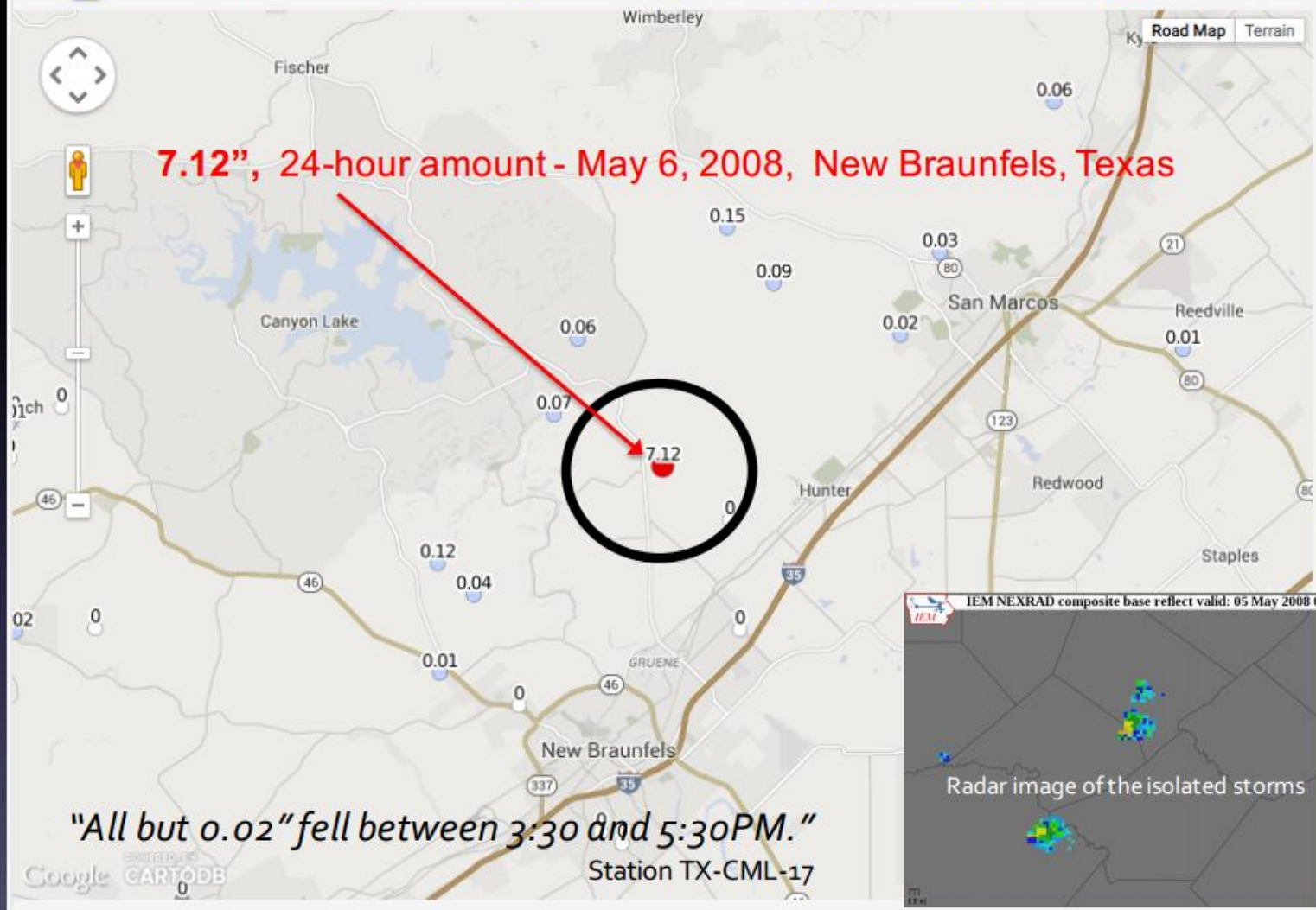
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# Precipitation for 2008-05-06 values in inches

Zero Trace 0.01 - 0.36" 0.37 - 0.72" 0.73 - 1.79" 1.80 - 4.28" 4.29 - 6.42" 6.43 - 7.12"



Your observation can make a difference!



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# HOW CAN I JOIN THE NETWORK?

## Five easy steps

*Simply sign-up on the  
CoCoRaHS web page:  
[www.cocorahs.org](http://www.cocorahs.org)*

*Obtain a 4" plastic rain gauge*

*View the on-line "training slide show"  
or attend a training session*

*Set-up the gauge in a "good"  
location in your yard*

*Start observing precipitation  
and report on-line daily*



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# The End Questions?



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