Weather Spotter Training

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National Weather Service

- 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
Missoula Forecast Area
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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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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

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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
- Violet 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 an hour, sometimes in as little as 30 minutes.
- Severity depends on amount of 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
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
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

- **Temperature**
  50,000 degrees F
- **Intensity**
  200,000,000 + volts
  20,000 amperes
- **Size**
  One inch in diameter
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 it to become heavier (more dense)
- Accelerates at the speed of gravity. The farther the 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 cannot be too cold or the air will be too dense to be pulled upward.
- Can rate from EF0 to EF5.
- EF5s records:
  - 2.6 miles wide (May 2013)
  - 301 mph (May 1999)
  - 235 miles (March 1925)
Probability of Severe Weather

Storm Prediction Center

Wind Probabilities*: 01 July (1982-2011)

*Probability of severe thunderstorm wind within 25 miles

0.25%  1.00%  2.00%  3.00%  4.00%  5.00%  6.00%  7.00%+
River Flooding

- November through June
- The peak hits in May and June with the melting of the snowpack
River Flooding
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.
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°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°F, water below freezing is called super cooled.
Where are the Impacts?
The Need For Spotters
Lake Effect

- 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
Spotter Reporting Criteria

- Tornado, funnel cloud and waterspout
- High wind - estimated or measured >40 mph
- Heavy rain - ½” or more per hour
- Flooding - of any kind
- Hail – ¼” or larger
- Visibility reduced to less than ¼ mile
- Heavy snow - one inch or more per hour
- Weather related damage or injuries
- Moderate to High impacts
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.
Where to find information

www.weather.gov/missoula

mobile.weather.gov
Other Means for Reporting

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 town/cities.

Event Time: 01 30 PM
Event Date: Mar 13 2016
Location: Missoula, MT

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.
- Flood
- Hail
- High Wind Speed
- Tornado/ funnel cloud
- Wind Damage
- Snow
- Freezing Rain/Icing
- Heavy Rain

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

Contact Information
Your Name:
Spottor id:
E-mail address:
Phone number:
Observer Profile:

NATIONAL WEATHER SERVICE
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Help observe precipitation in your community!!

www.cocorahs.org
All you need is a simple 4” diameter plastic rain gauge and ten minutes a day!

TEN MINUTES

It’s fun and easy. We need your help!

Gauge measures to the hundredth of an inch

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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!
7.12”, 24-hour amount - May 6, 2008, New Braunfels, Texas

“All but 0.02” fell between 3:30 and 5:30PM.”
Station TX-CML-17

Your observation can make a difference!
How can I join the network?

Five easy steps

- Simply sign-up on the CoCoRaHS web page: 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
The End Questions?