Advanced Weather Spotting for the Inland Northwest

Spring 2021
National Weather Service - Spokane

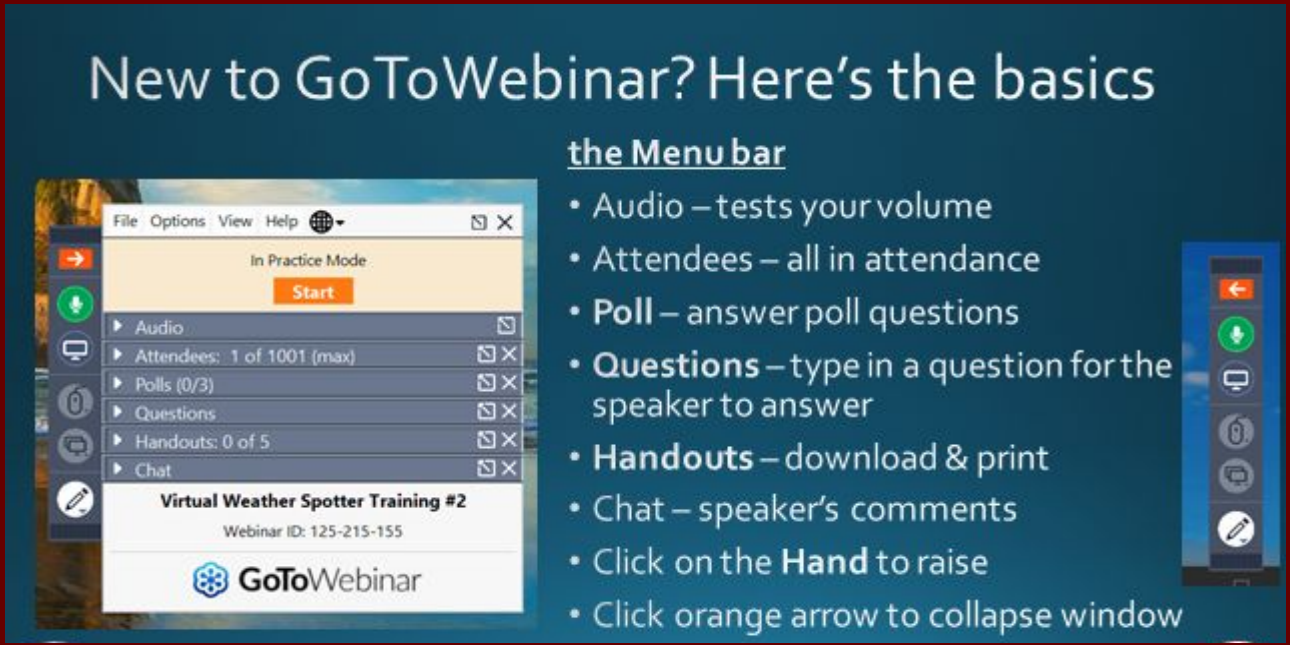
Clyde, WA - Dave Brock
May 2020

SKYWARN

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

This is a Live Virtual Class

- Voice in Computer - no phone needed - headphones helpful
- All are in listen mode until the end



Objectives

- Understand the roles & importance of the Weather Spotter
- Describe your community's severe weather threats
- Provide accurate and timely reports of severe weather
- Properly define a severe thunderstorm and basic thunderstorm structure
- Identify cloud types and features of thunderstorms.
- Learn how to prepare and be safe during severe weather

Concentration on Thunderstorms and Severe Weather Risk Awareness

Now let's look back to last year…

June 24, 2020 - Severe Thunderstorm Event

May 30, 2020 - Severe Thunderstorm Event

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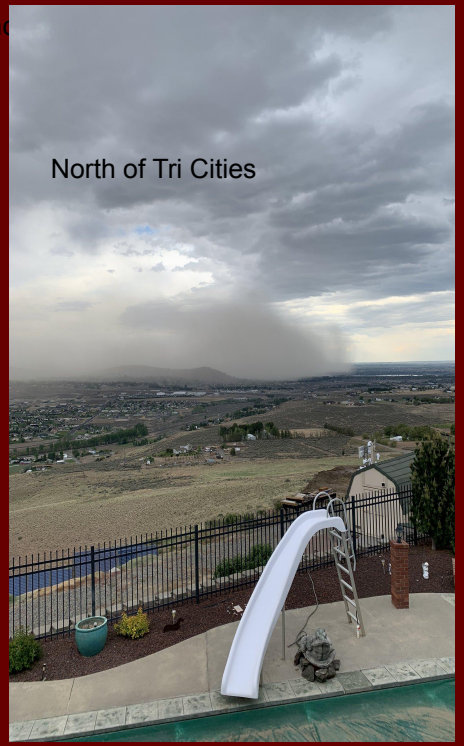
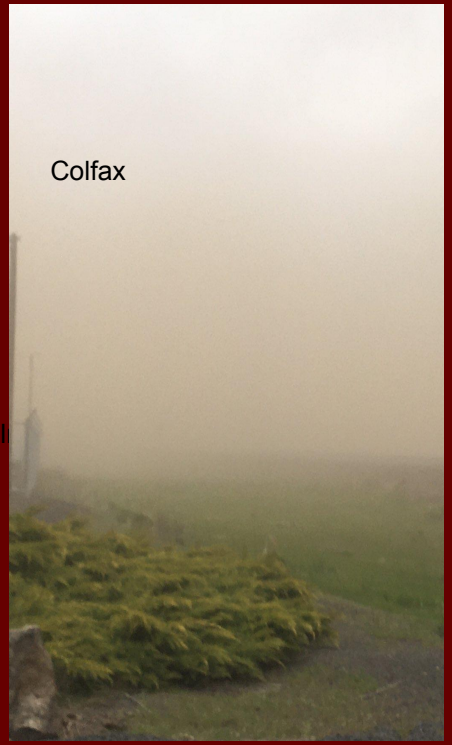
May 2, 2020 - Thunderstorm & Dust Event





To our current Weather Spotters….

THANK YOU!

SKYWARN

Eyes and Ears of the National Weather Service with a count of over 1200 across the Inland NW!

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National Weather Service (NWS)

- Part of the Federal Government – Dept of Commerce
- Responsible for all weather/water Watches & Warnings
- 126 offices across the country
- Work with local agencies
- Observe & Forecast
- “Behind the Scenes”
- Decision Support
- Preparedness & Education

Issue Weather and Water watches/warnings for the protection of life and property.

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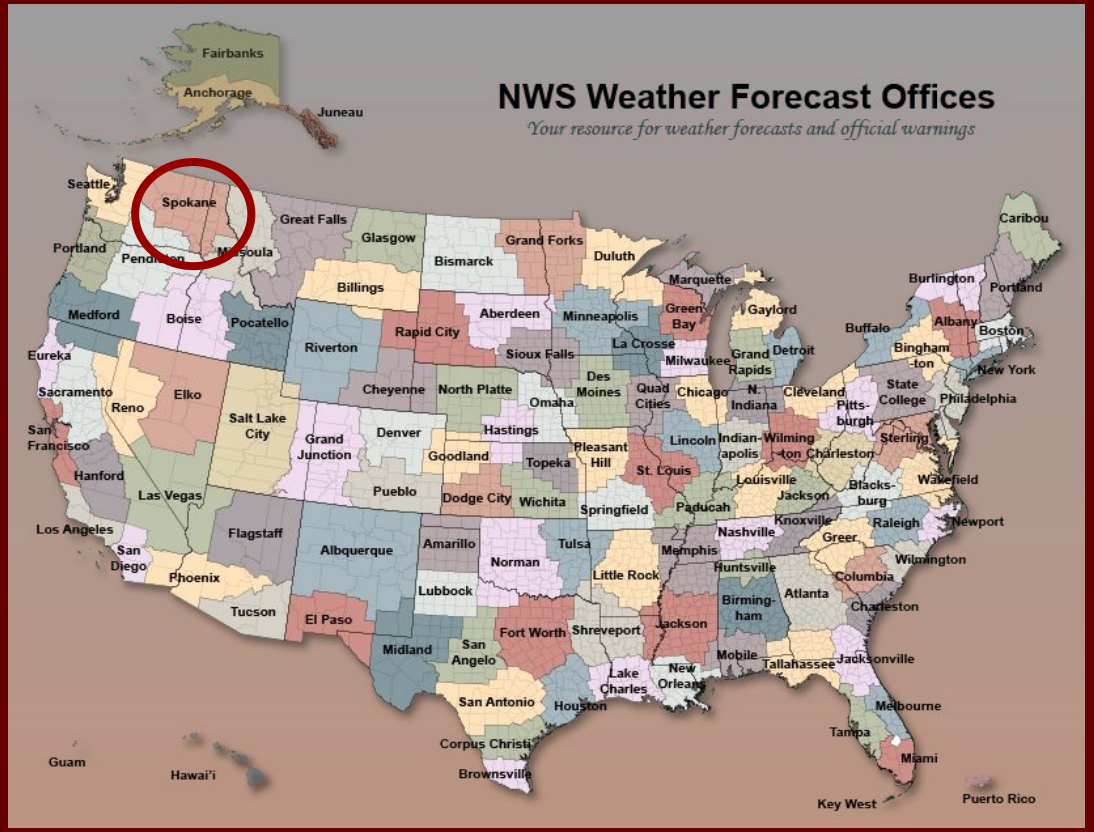
NWS Spokane Forecast and Warning Area

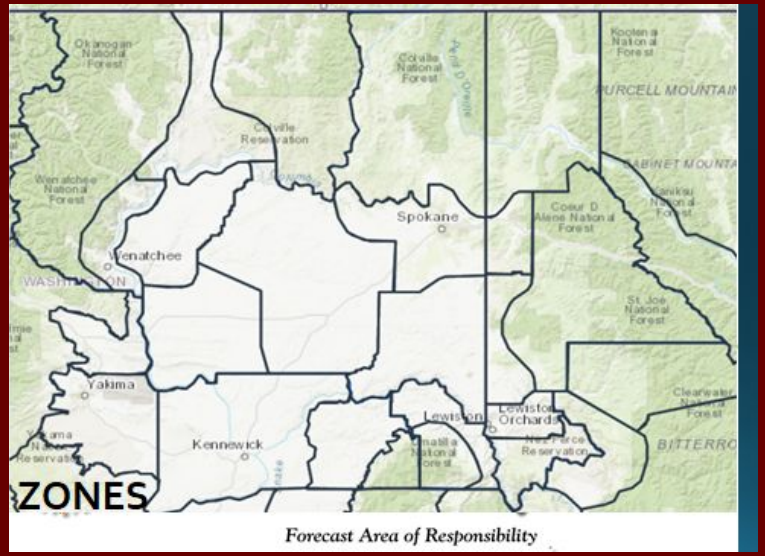


Includes 2 states

- 13 counties in eastern WA
- 8 counties in north Idaho

Elevations range

- 9500+ ft in the north Cascades
- 170 ft along the mid Columbia River



Issue watches/warnings for the protection of life and property

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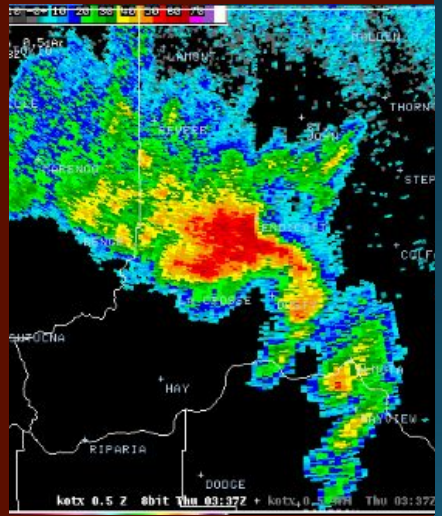
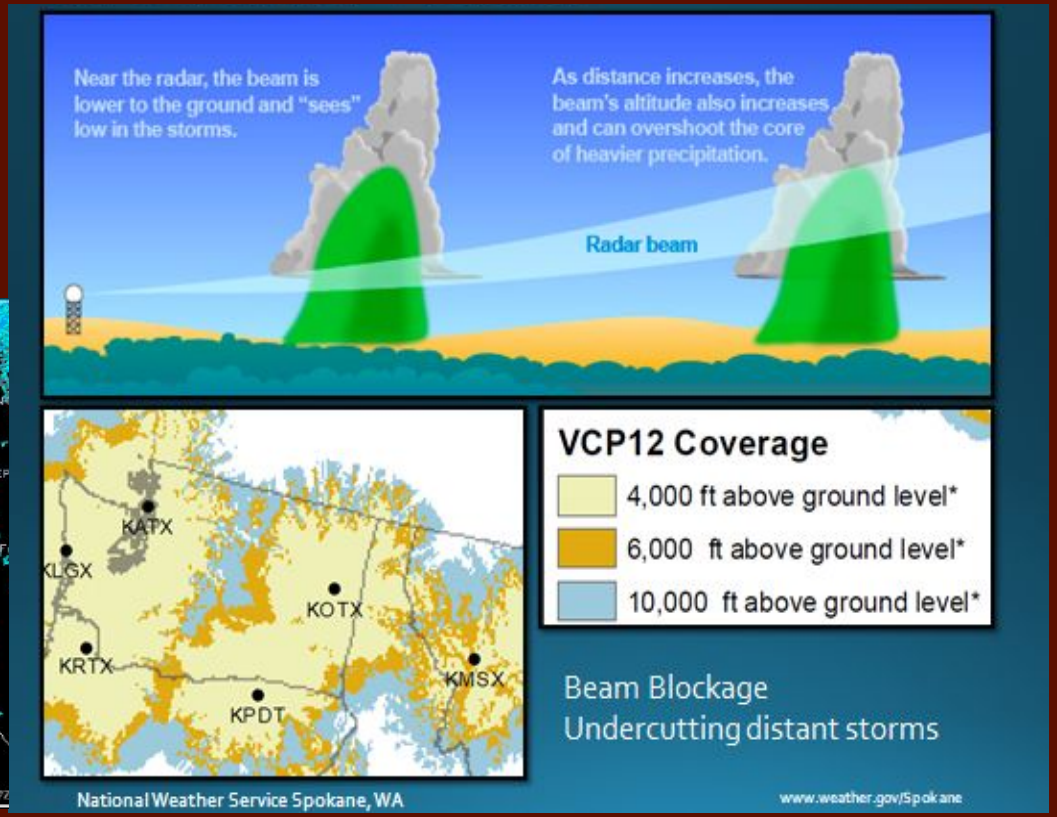
NWS Observations & Tools

Doppler Weather Radar





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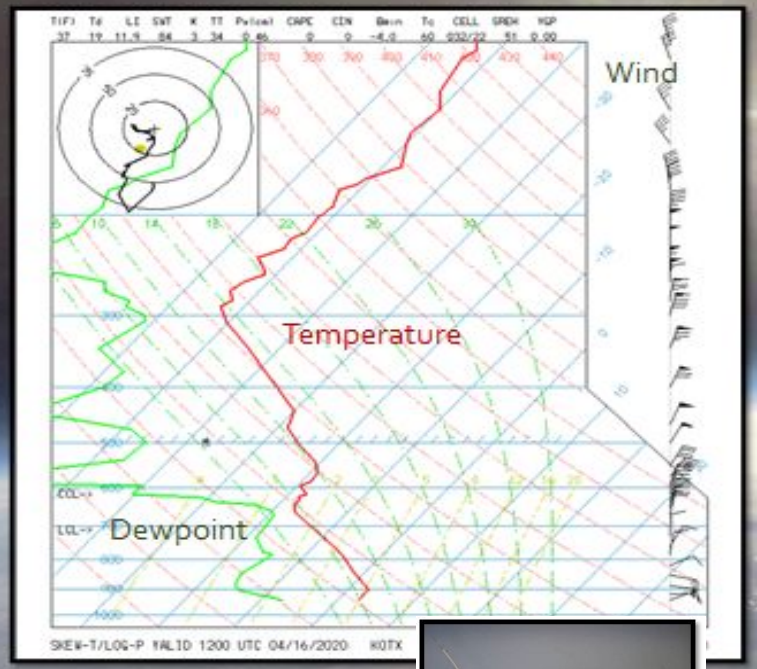
Radiosondes



- Twice a day; every day
- 92 Upper Air sites across the U.S.
- About 100,000 ft (~19 miles) high
- One hour and 45 minutes flight
- After the balloon pops, a parachute opens and it falls back to the earth
- Less than 20% are recovered and mailed back
- Radiosonde chart gives a profile of temperature, dewpoint, winds through a column of the atmosphere.

Photo courtesy of Earth to Sky Calculus

Where to find this chart online?

http://weather.rap.ucar.edu/upper/otx.gif

NWS Spokane web page:

Forecasts tab – Forecast models

Weather Satellites

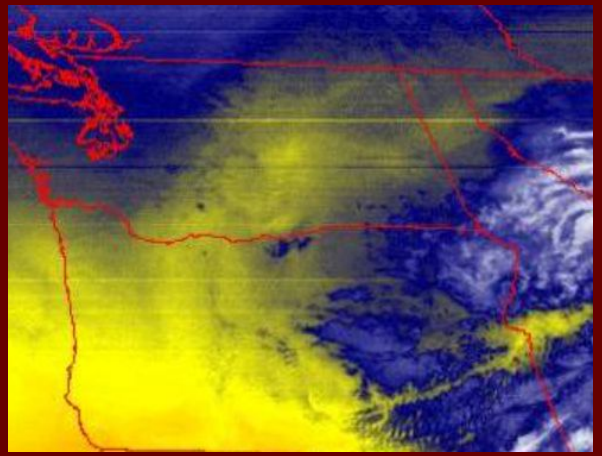
GOES 17 - 16 different channels

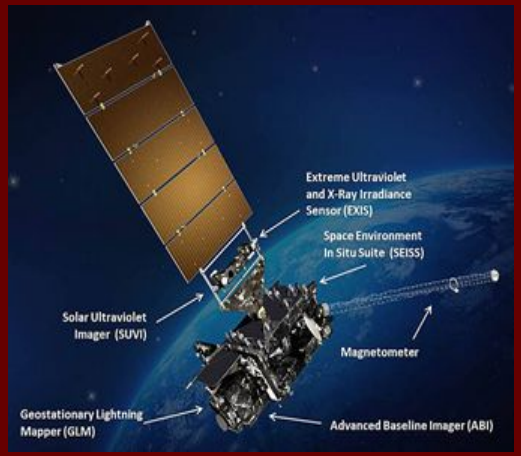
IR, Water Vapor & Visible

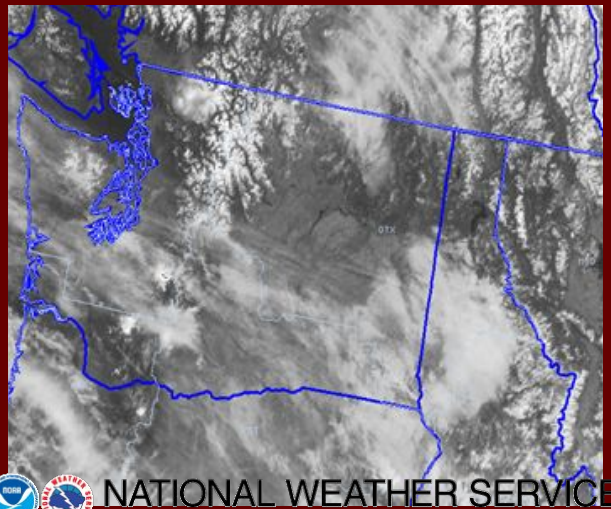
New images every 5 minutes

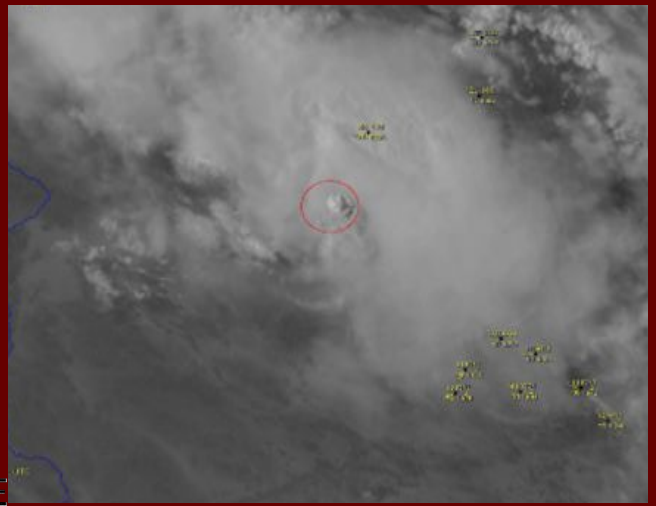
Aids in early detection

Thunderstorms & Wildfires

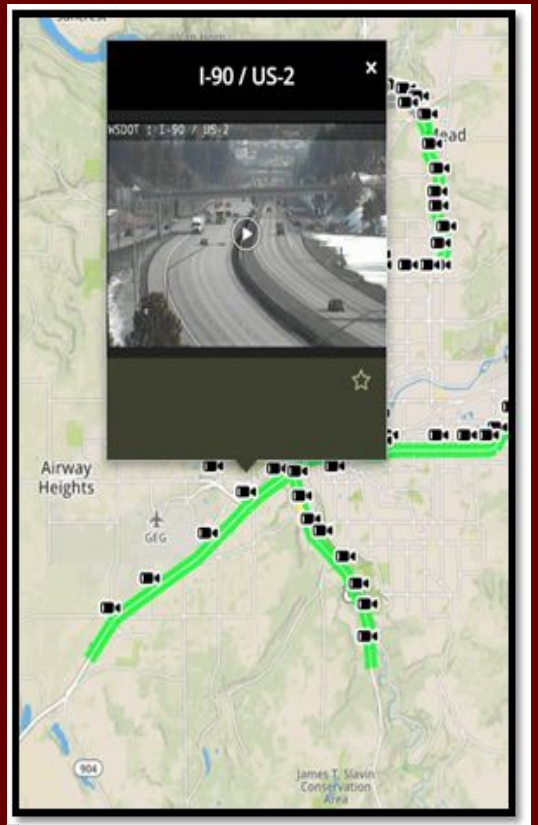


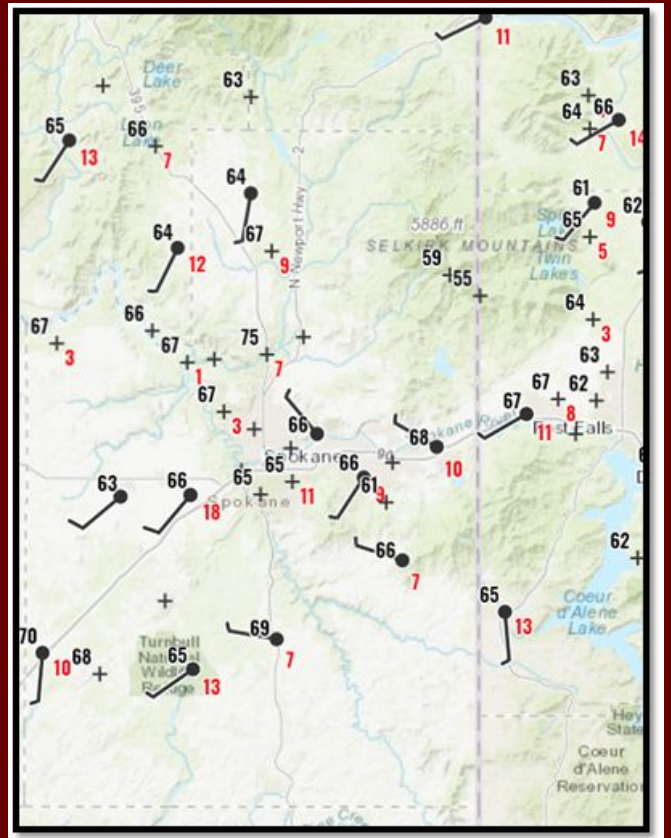




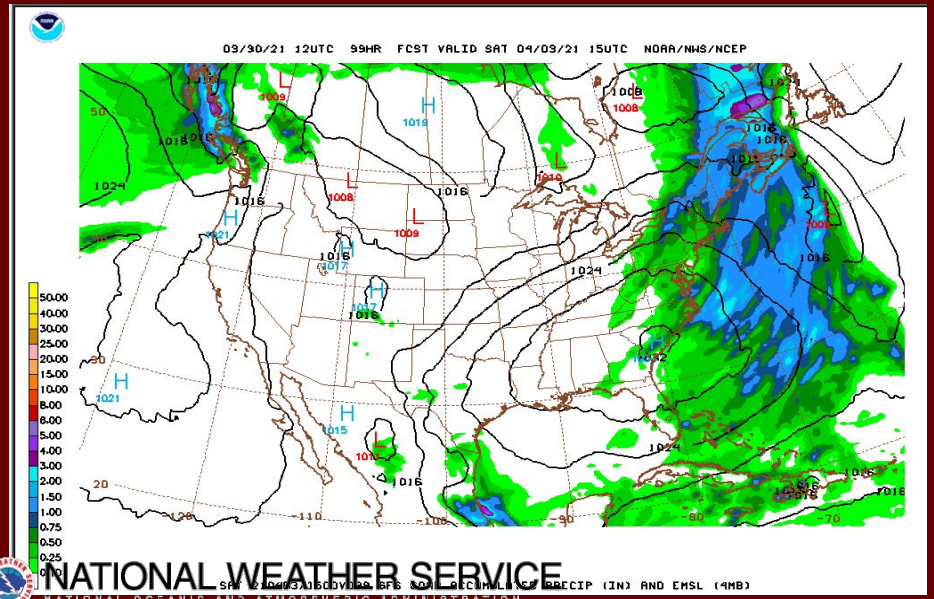


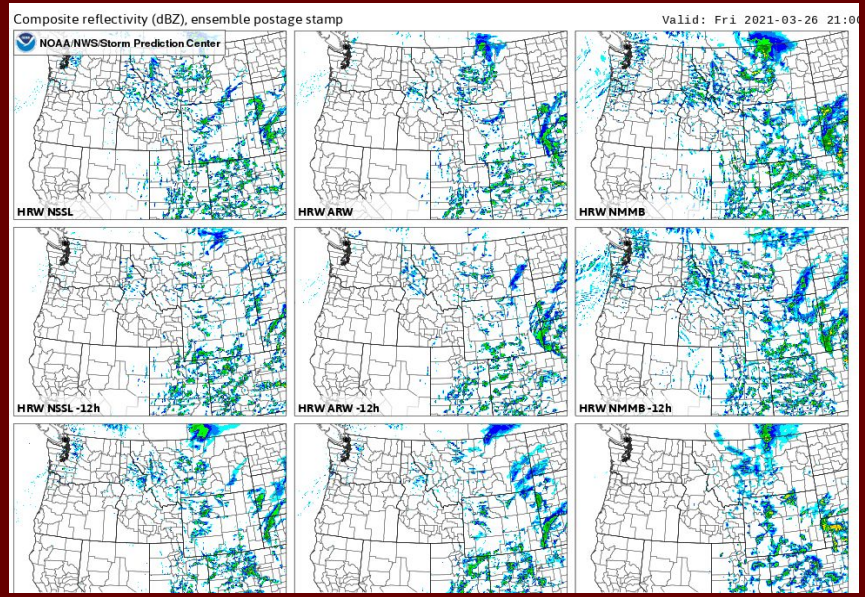
Surface Observations & Web Cams



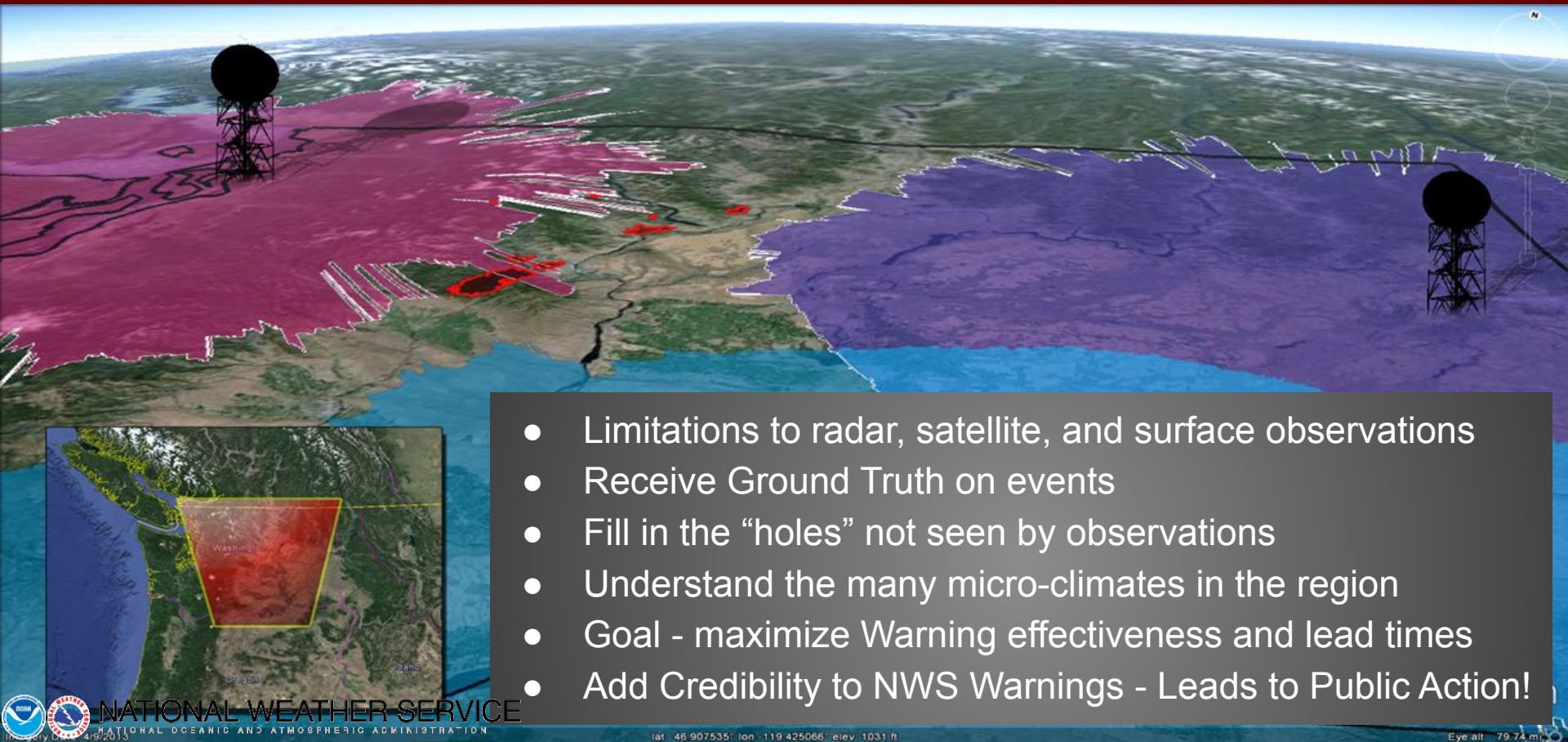


Supercomputers & Resolution Models





We need weather spotters! Why?



- Limitations to radar, satellite, and surface observations
- Receive Ground Truth on events
- Fill in the “holes” not seen by observations
- Understand the many micro-climates in the region
- Goal - maximize Warning effectiveness and lead times
- Add Credibility to NWS Warnings - Leads to Public Action!

#1 Poll Question

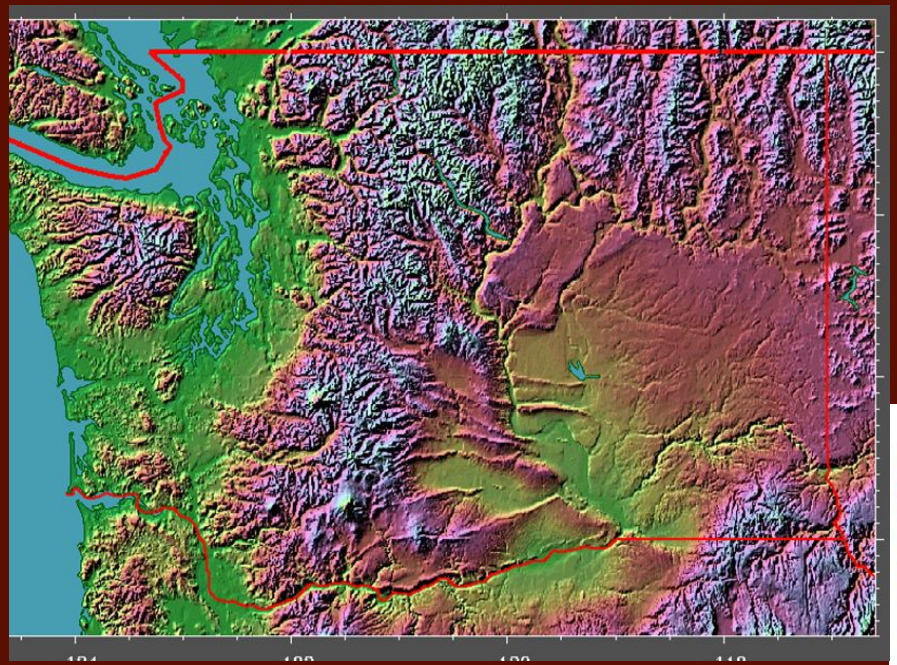
Why are weather spotters important?

Weather Hazards Change with the Seasons

Main weather concerns change with the season & include:

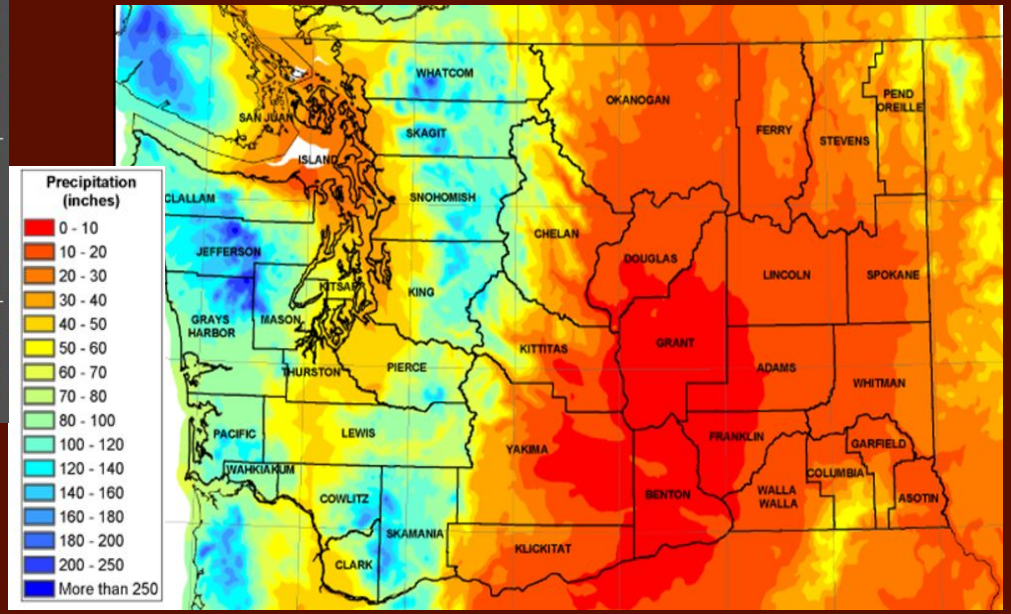
- Winter storms – snow, ice, rain and wind
- Flooding – river flooding and flash flooding
- Fire weather – wind and dryness, lightning and smoke
- Thunderstorms – hail, wind, rain and lightning

Terrain Makes ALL the Difference



Topography Map

Average Annual Precipitation Map



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What's in a Spotter Report?

- Specifics...Tell us the story!
  - Who...What...and Where
  - When the event began and/or ended
  - Estimate of wind speed and/or hail size
  - Damage and injury reports

Spotter ID & Location

- If unsure - report your uncertainty
- Include reports while traveling & any delayed or second hand reports

#2 Poll Question

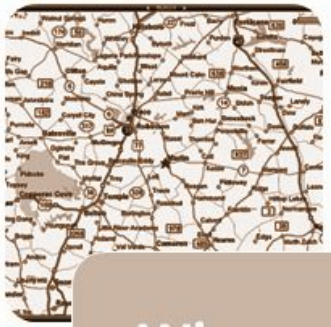
What types of severe or hazardous weather do we NOT experience in the Inland NW?

How Spotters Report - Easiest Phone Call

Dial :
1-800-483-4532

Spotter ID

What:
Event you Witnessed

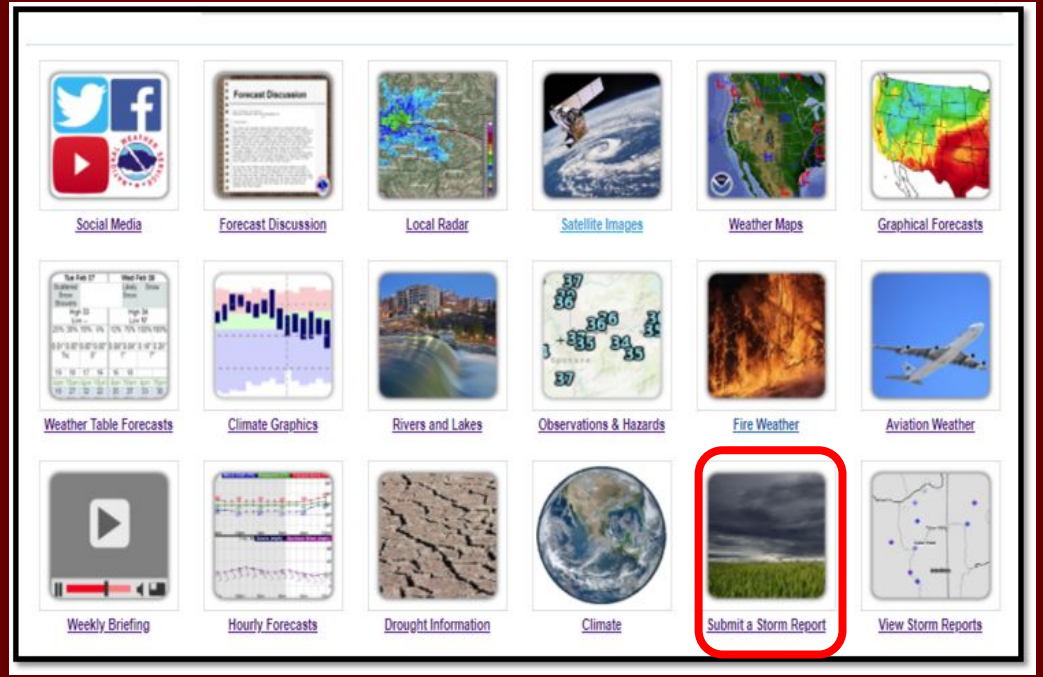


Where:
Location of event

When:
Time of the event

How Spotters Report – Just as easy
Online Reports

www.weather.gov/Spokane



Share weather data - Social Media

Twitter

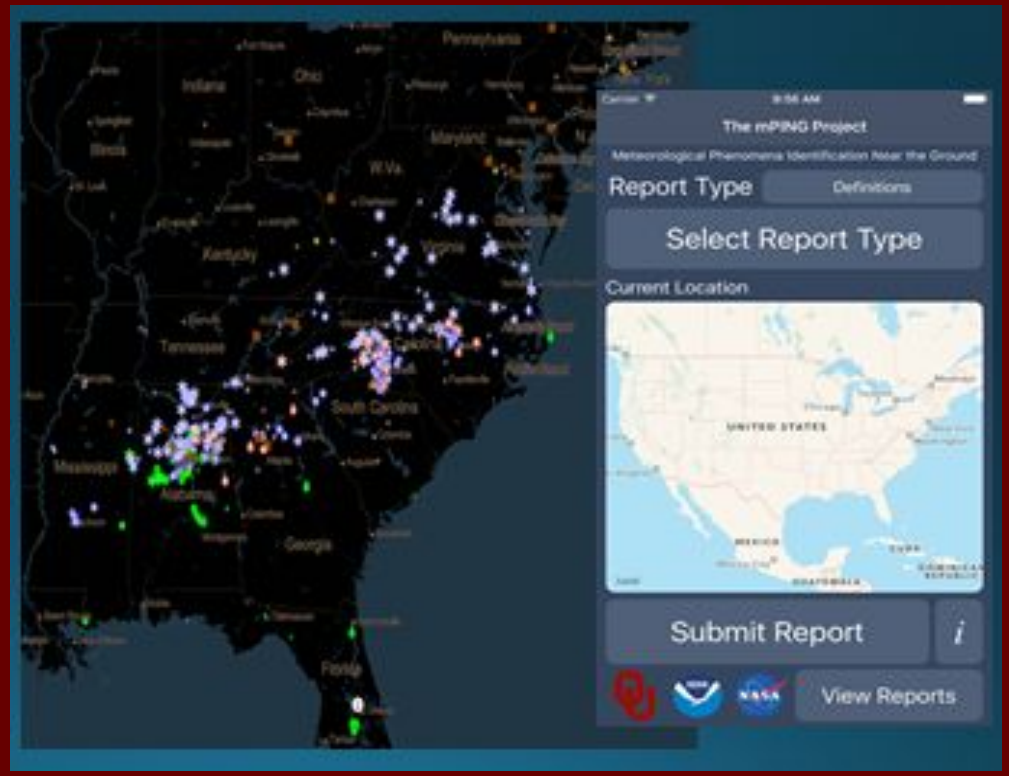
- @NWSSpokane
- #wawx & #idwx
- Share reports & pictures
- Monitored 24/7

Facebook

- NWS Spokane
- Send reports & pictures
- Monitored 24/7

Share weather data - mPING

- Smartphone App
- Available on IOS and Android
- Reports sent to NWS
- Reports are anonymous
- Crowdsourcing
- Very easy to use
- https://mping.nssl.noaa.gov



Share weather data - Email Photos

nws.spokane@noaa.gov

If ARES/RACES Hams, relay report to your central collection point.

National Weather Service · Spokane, WA

www.weather.gov/Spokane

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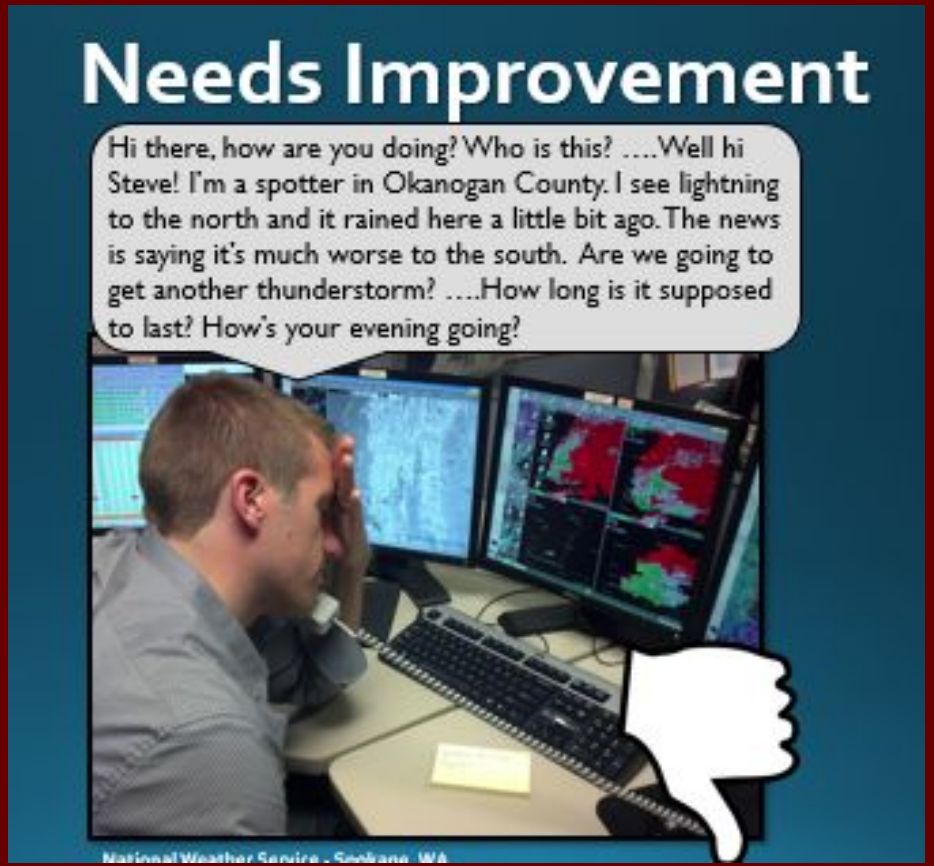
Examples of Spotter Reports

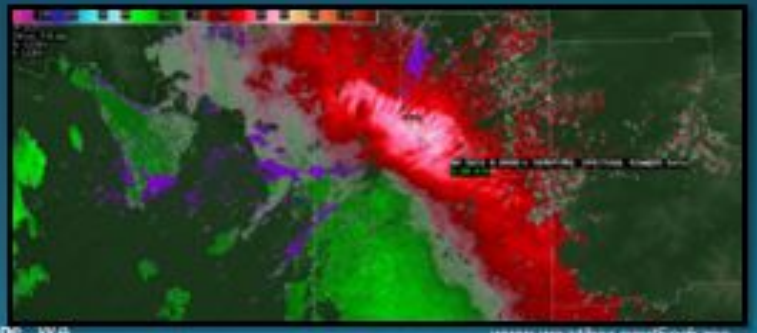


Keep in Mind – We may contact you

As a registered weather spotter, you'll share your phone number with the NWS.

If we see severe or hazardous weather near your location….

We will likely try to call and get information on what you are experiencing (ground truth) based on what is seen on radar



Emails are Important

Besides a phone number, it's important to keep emails current.

You will likely be notified the day before/day of by email when there is a WIDESPREAD Severe Weather Risk/Thunderstorm Outbreak

We send periodic emails to alert you of the quarterly newsletter and upcoming training opportunities.


YOUR NATIONAL WEATHER SERVICE SPOKANE QUARTERLY REPORT

VOL XXIV, ISSUE 1
MARCH 2019

The Weather Watcher
of the Inland Northwest

www.weather.gov/Spokane

#3 Poll question

What would be your preferred way to send reports to the NWS?

Thunderstorm Hazards

- Moisture
- Lift
- Instability
- Vertical Wind Shear

Ingredient #1: Moisture

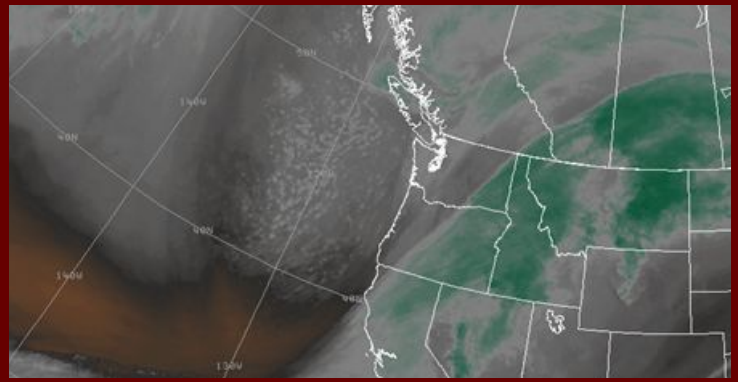
Forms the clouds and precipitation associated with thunderstorms

Primary Sources: Pacific Ocean

Occasionally: Gulf of California/Mexico during Monsoon Season

Monitor with satellite, upper level soundings and surface observations

Terms: Precipitable Water, Dewpoint, Relative Humidity



Ingredient #2: Instability

How the atmosphere naturally mixes

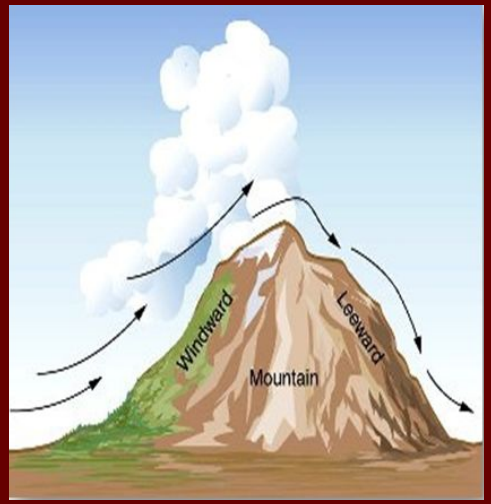
Unstable: warm moist air near the ground with cold air above

Stable: cold air at the surface and warm air above

Monitor with upper level soundings and surface observations

Terms: CAPE, Lifted Index, Lapse Rates

Ingredient #3: Lifting Mechanism



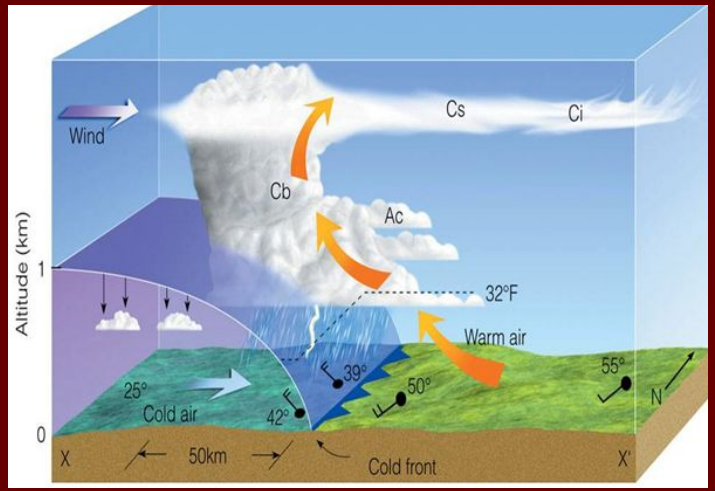
Something to force the air upward in the atmosphere.

Mountains/Terrain: air forced up a slope

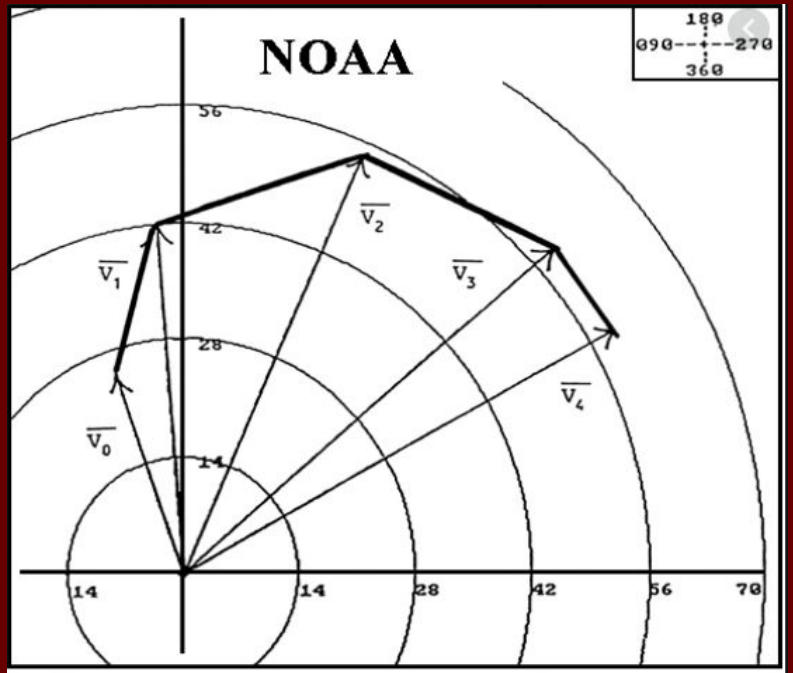
Cold Front: air is forced up by a frontal boundary

Monitor with satellite, radar, upper level soundings and surface observations

<u>Terms:</u> vertical velocity, vorticity, fronts

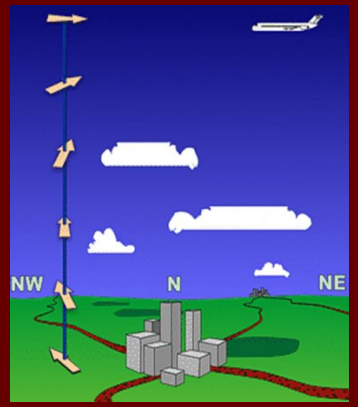


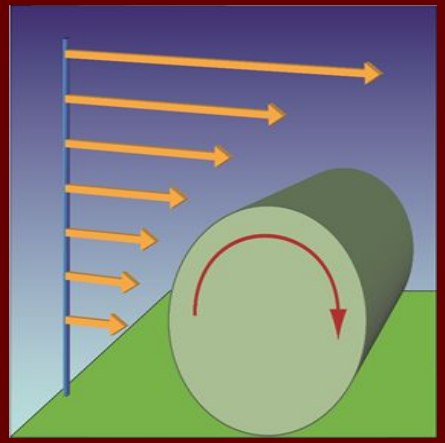
Ingredient #4: Wind Shear

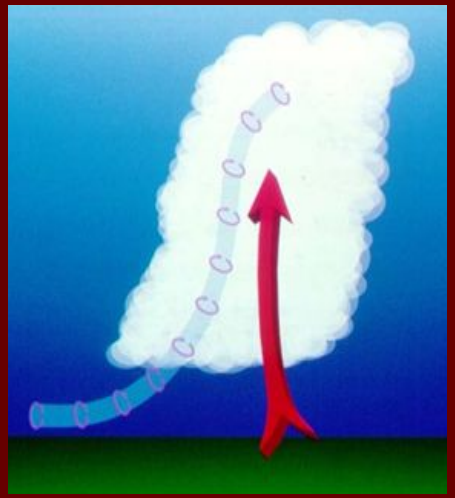


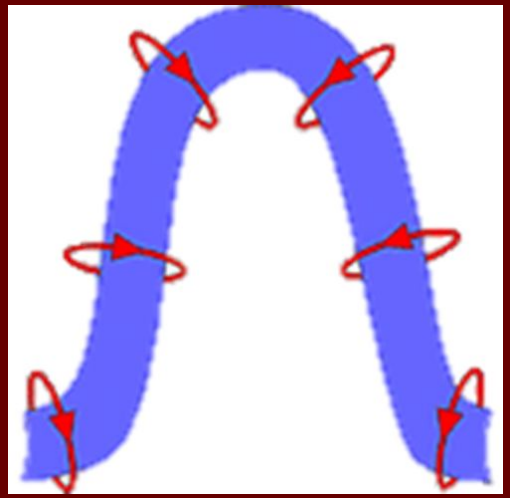
Winds / Vents

Height / Hauteur (km)	Dir	Speed / Vitesse
Sfc	161°	25
1	175°	42
2	204°	54
3	229°	59
4	241°	59





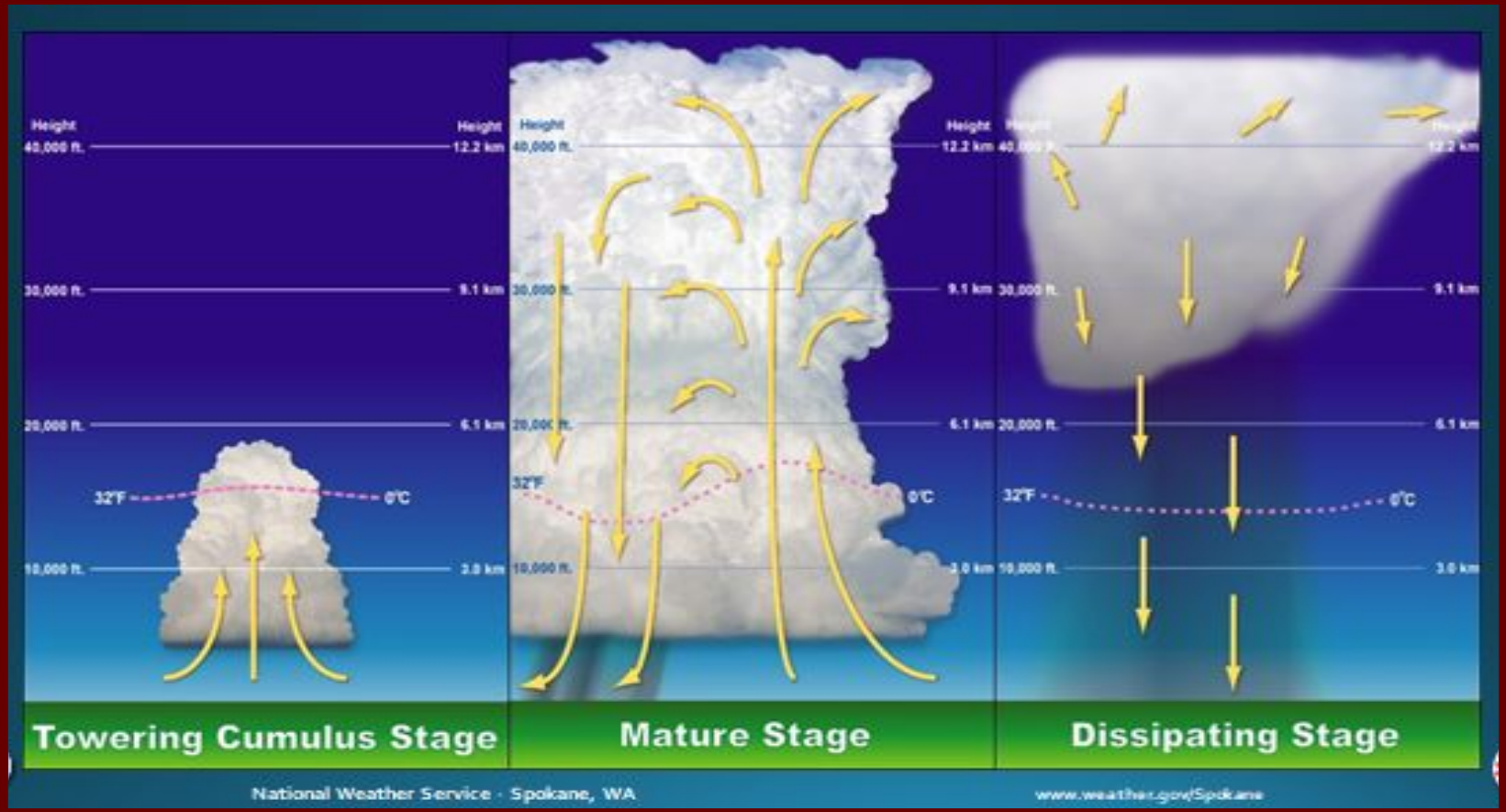




S-L-I-M – Basic Thunderstorm Elements

Shear	Lift	Instability	Moisture
Changing wind speed and direction with height	Mechanism to force air upwards	"Energy" for thunderstorms	Obviously!
Helps storms become better organized, increasing severity and longevity	Creates a focus for where storms can develop	Ability for air to rise or sink as storms develop	Needed to produce clouds and storms
Common ahead of or along a front	Cold Front, Warm Front, Leftover storm boundary, Lake Breeze	Warm surface, cool upper levels (cools at a very fast rate as you go up)	Use Dew Point

Stages of a Thunderstorm



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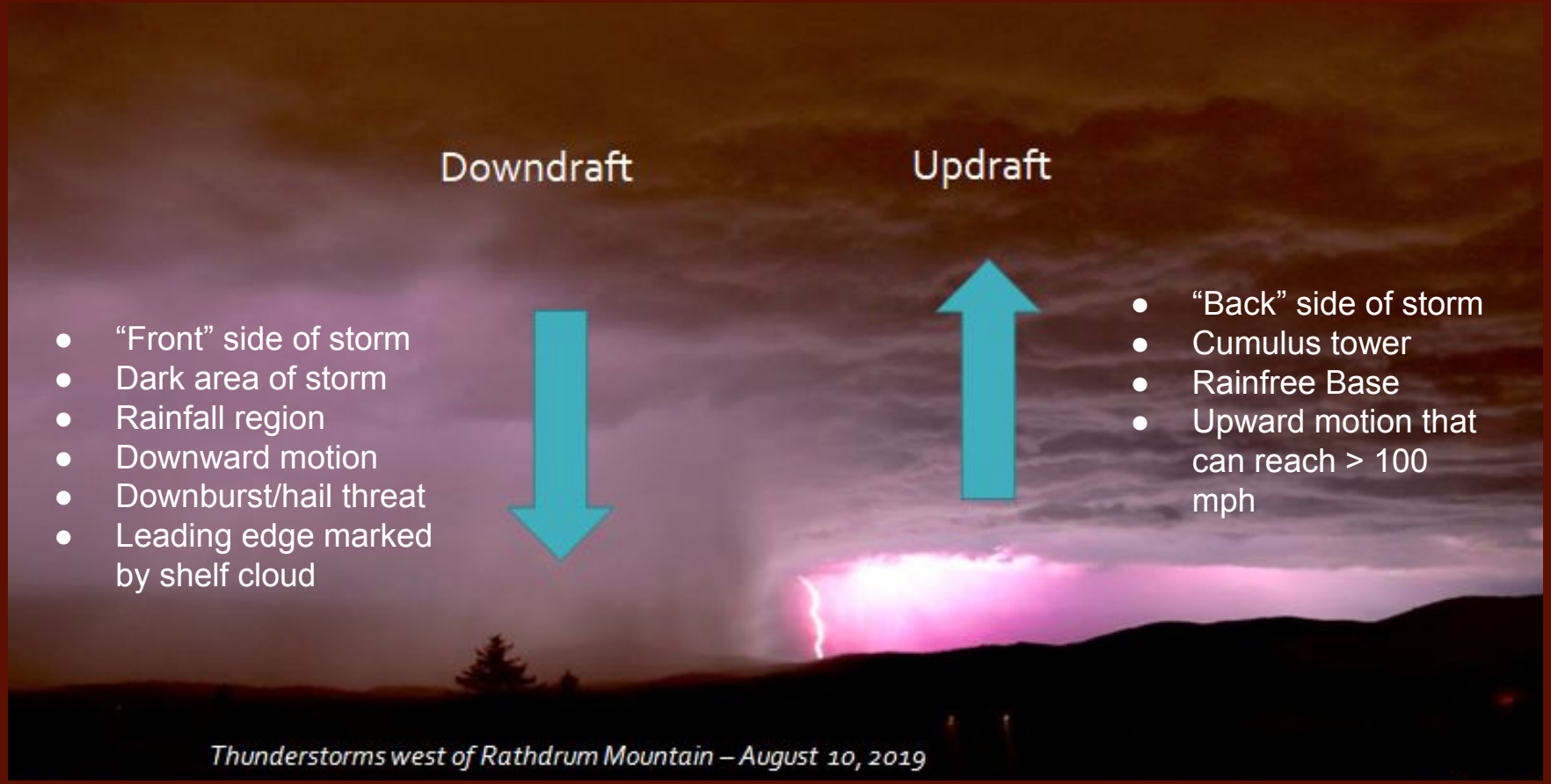
Thunderstorm Basics



- "Front" side of storm
- Dark area of storm
- Rainfall region
- Downward motion
- Downburst/hail threat
- Leading edge marked by shelf cloud

- "Back" side of storm
- Cumulus tower
- Rainfree Base
- Upward motion that can reach > 100 mph

What is a Severe Thunderstorm?

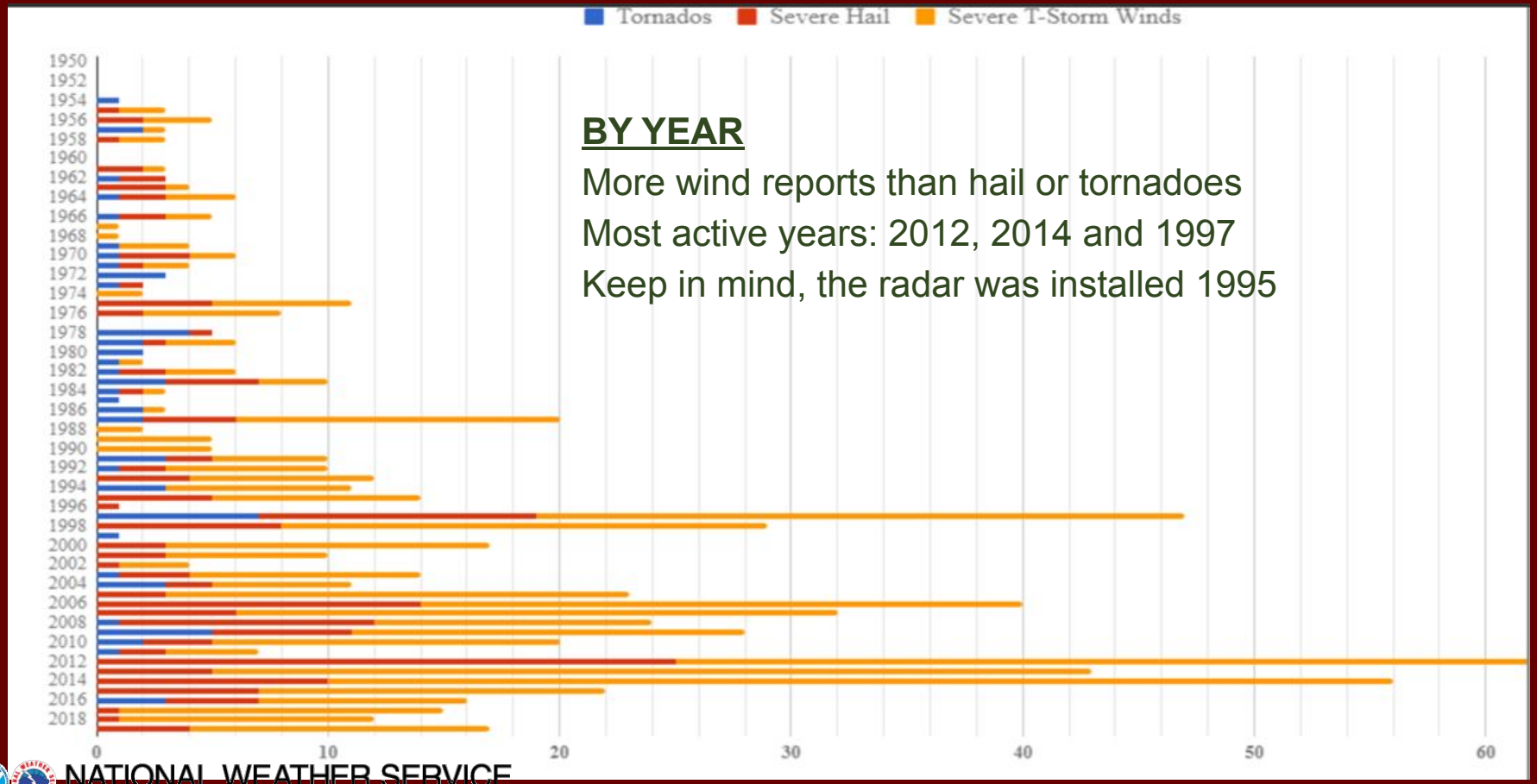
Winds ≥ 58 mph or Wind Damage

Hail > 1” in diameter

Tornado

- Less than 10% of all thunderstorms are Severe
- Though Lightning is ALWAYS extremely dangerous,
  the amount of lightning does not make a storm SEVERE.

Local Severe Weather Climatology



BY YEAR

More wind reports than hail or tornadoes

Most active years: 2012, 2014 and 1997

Keep in mind, the radar was installed 1995

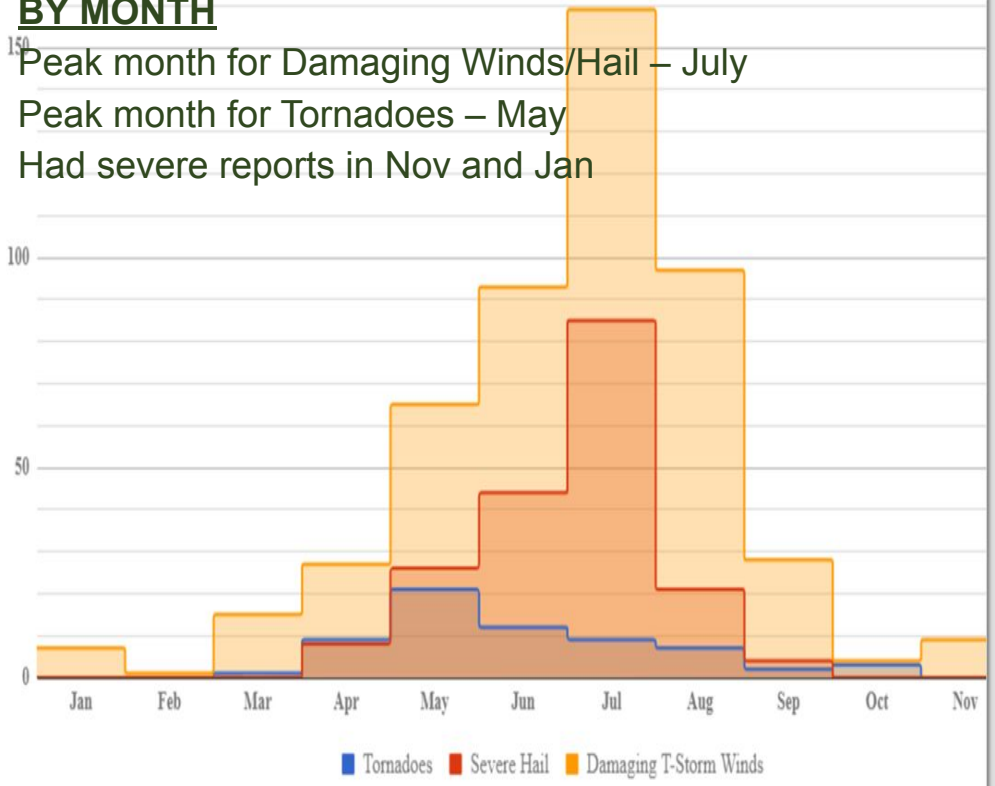
More Local Severe Weather Climatology

BY MONTH

Peak month for Damaging Winds/Hail – July

Peak month for Tornadoes – May

Had severe reports in Nov and Jan

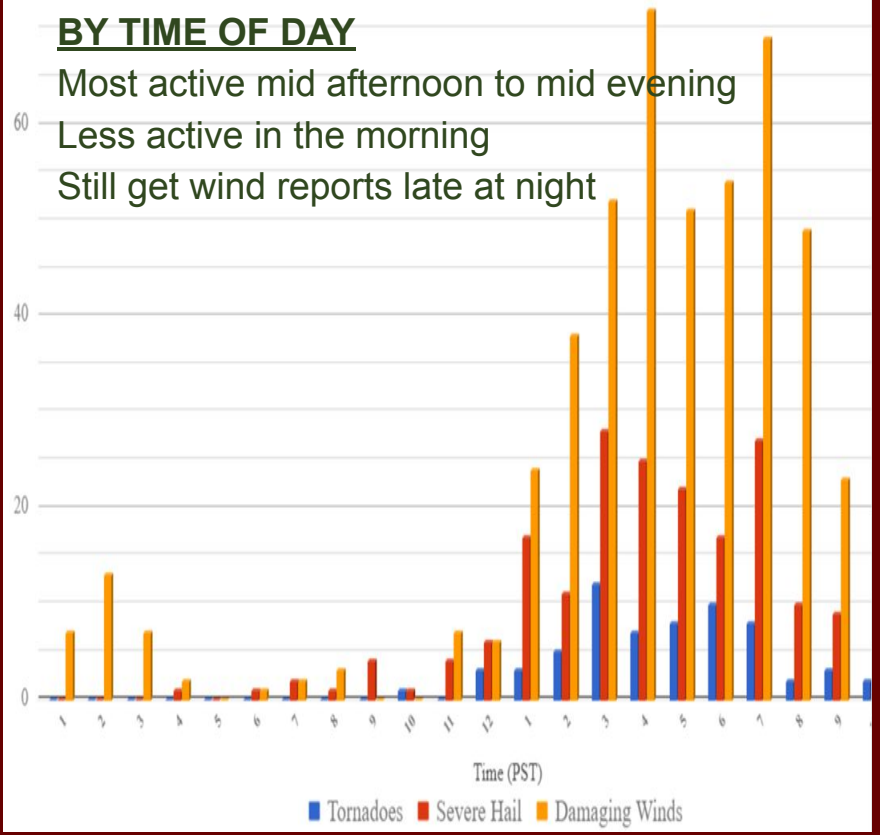


BY TIME OF DAY

Most active mid afternoon to mid evening

Less active in the morning

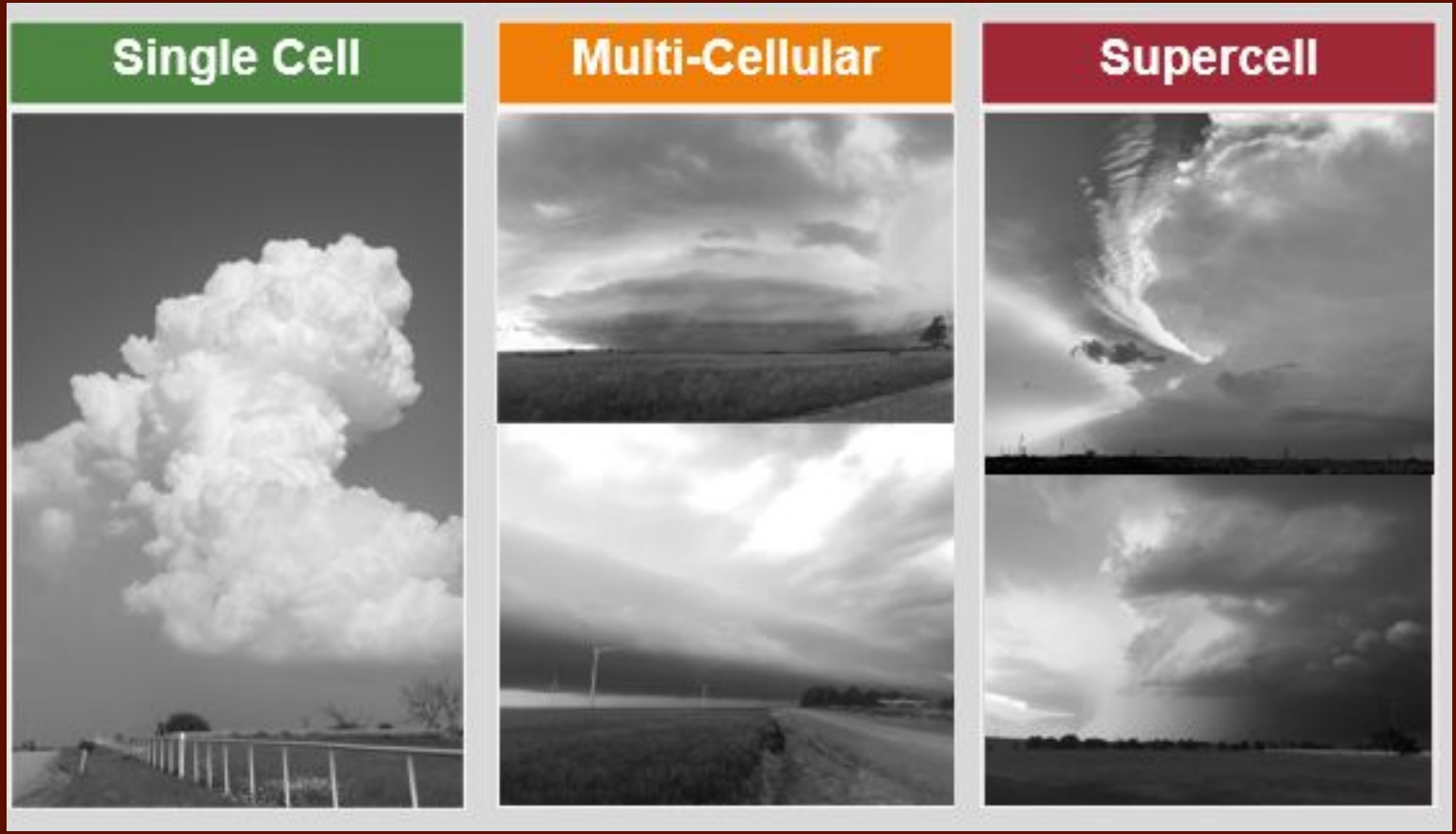
Still get wind reports late at night



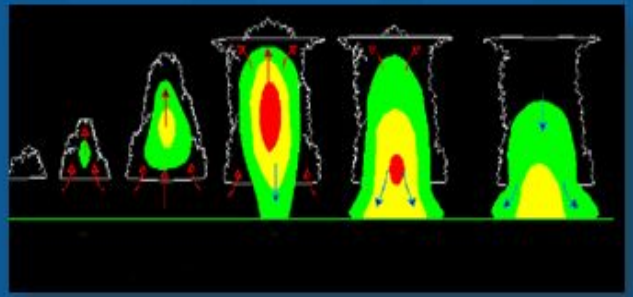
#4 Poll Question

What would be a good ingredient for thunderstorm development?

Types of Thunderstorms



Single Cell Thunderstorm



Mostly Non-Severe

Life Cycle of < 30 minutes

May Contain Small Hail

& Gusty Winds

Heavy Rain

Report heavy downpours or long periods of steady rain
Give specific locations - streets and creeks

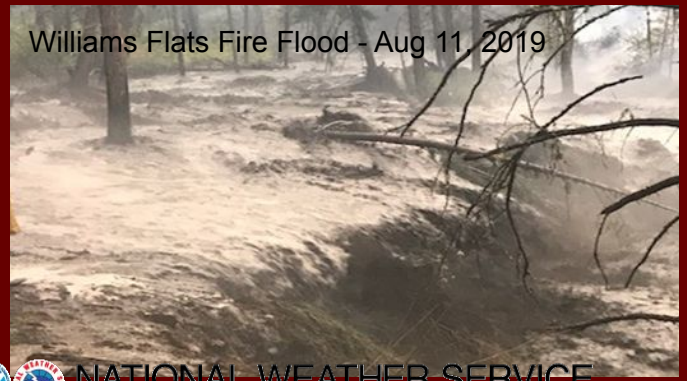
- 0.50”+ in 1 hour - convective
- 1.0” in 12 hours or 1.5”+ in 24 hours - stratiform

Flooding and Flash Flooding

Rising water on rivers, streams & low lying areas

Give specific locations of streams & streets

Turn Around, Don't Drown



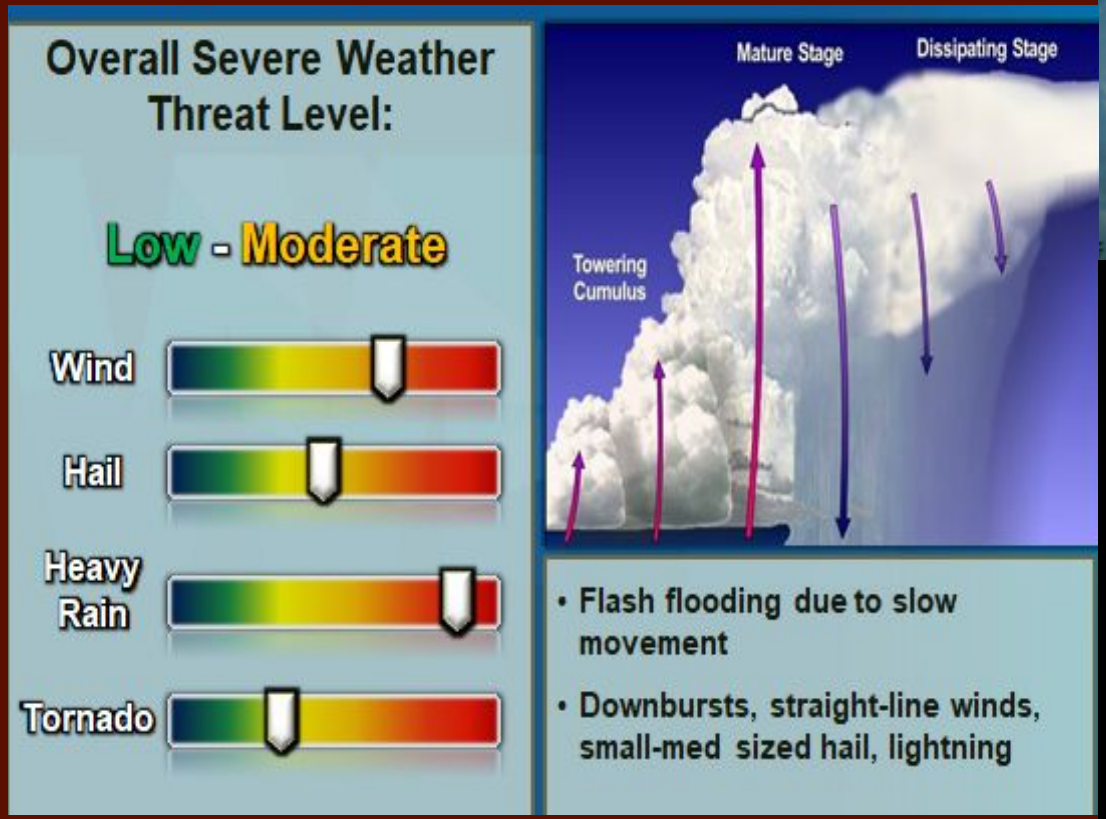
Mud and Debris Flows

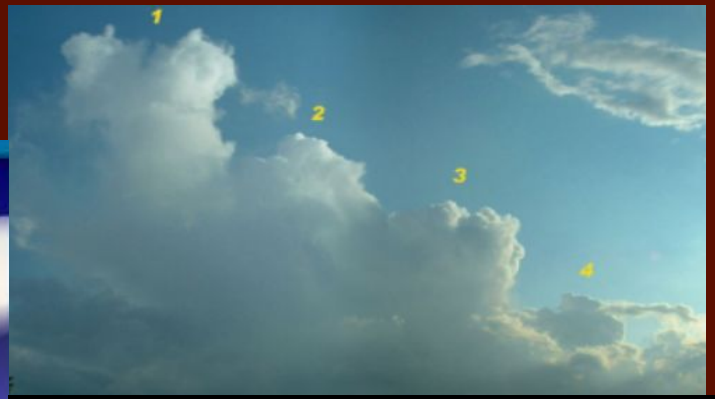
Water-saturated rock, mud and debris moving down a slope

Give specific locations, roadways or intersections

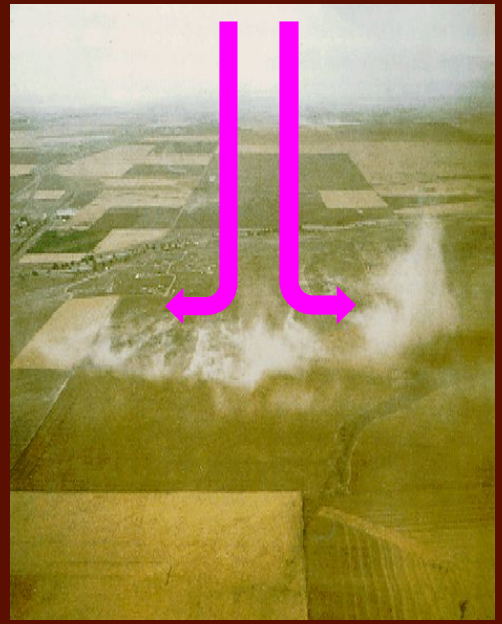
Post-fire Floods

Multicell Thunderstorms





Downburst & Straight Line Winds



Microburst: affecting an area *less than 2.5 miles* across.

Macroburst: winds extending in *excess of 2.5 miles* across.

Evaporative cooling causes the air parcels to become heavy/more dense.

Dust Storms

- Prolonged dry spell + strong winds + plowed fields
- Sudden reduction in visibility
- Give locations of roads and intersections
- Also called Haboobs

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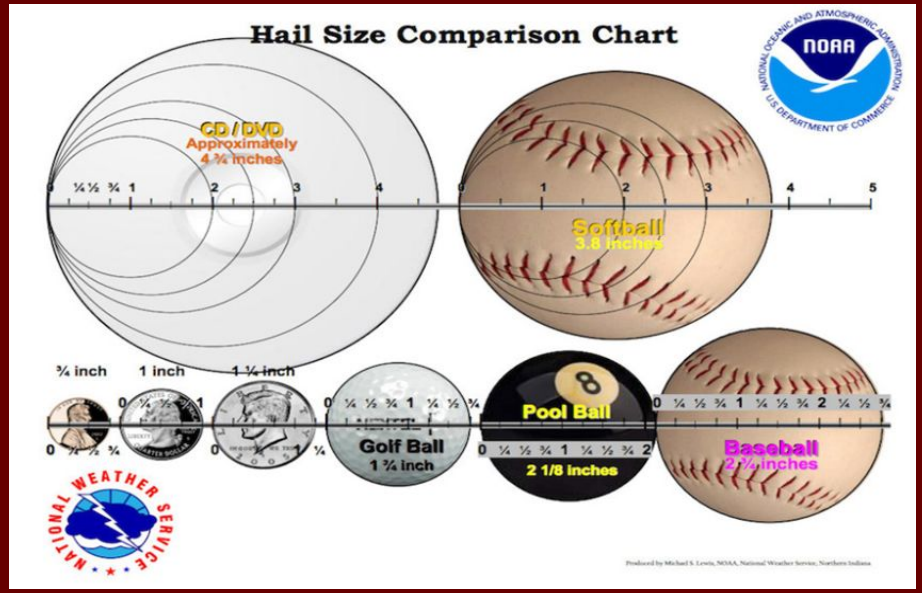
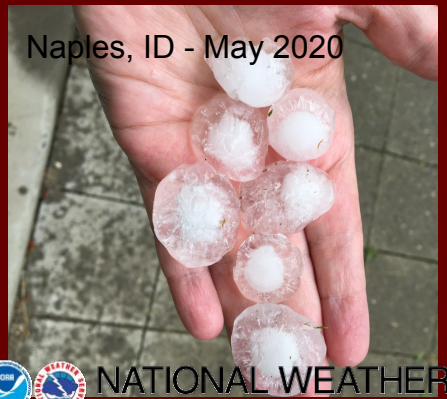
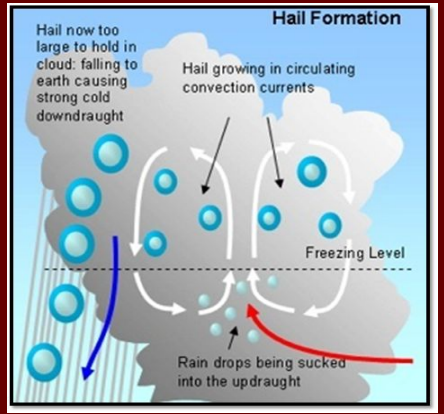
Hail

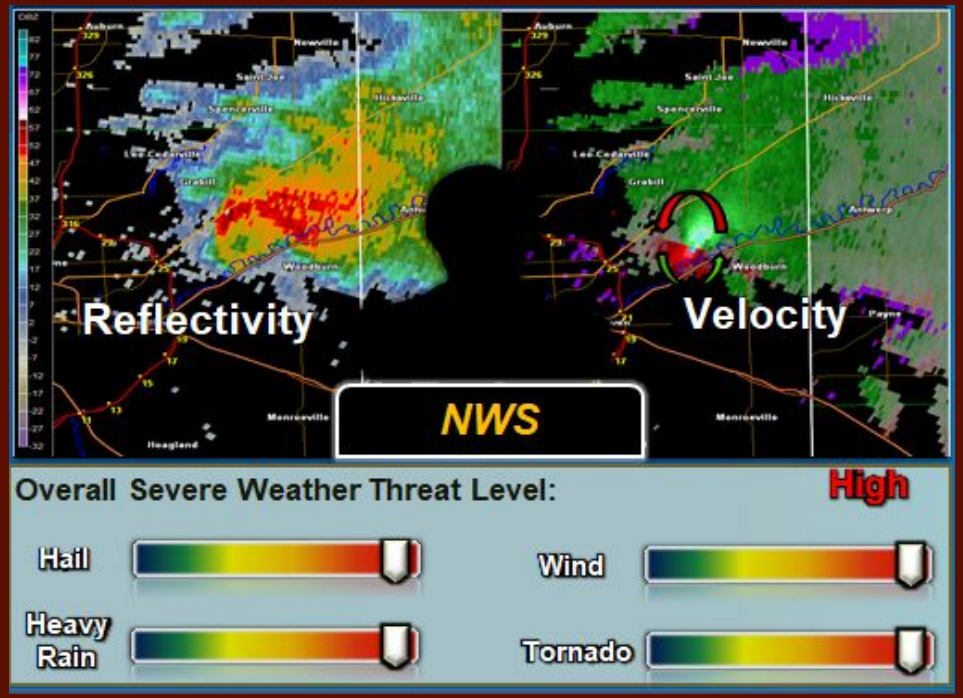
- Strong updraft keeps chunks of ice aloft
- Circulated within a storm and collects layers of water and freezes
- Can fall to the ground at > 100 mph
- Severe hail ≥ 1” diameter
- Always report the largest Hailstone you see in the pile.



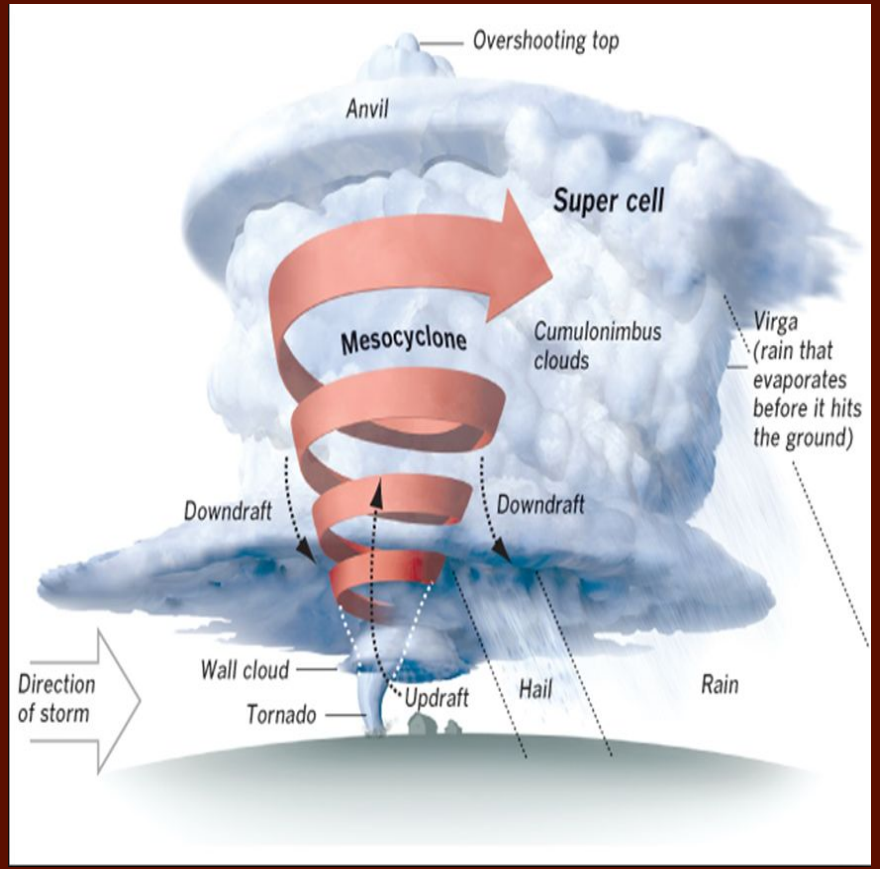




Supercell Thunderstorms



Supercell Thunderstorm Clues



Overshooting Tops

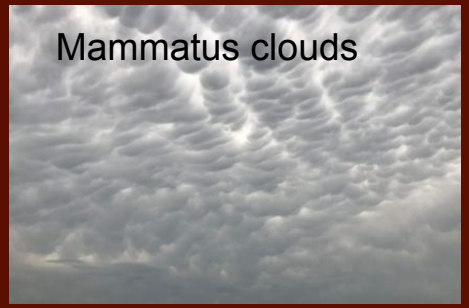
Cauliflower shaped towers

Mesocyclone or Wall Cloud

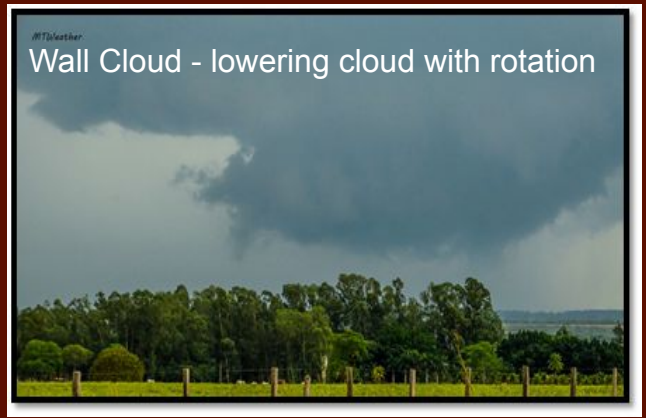
Cloud Types

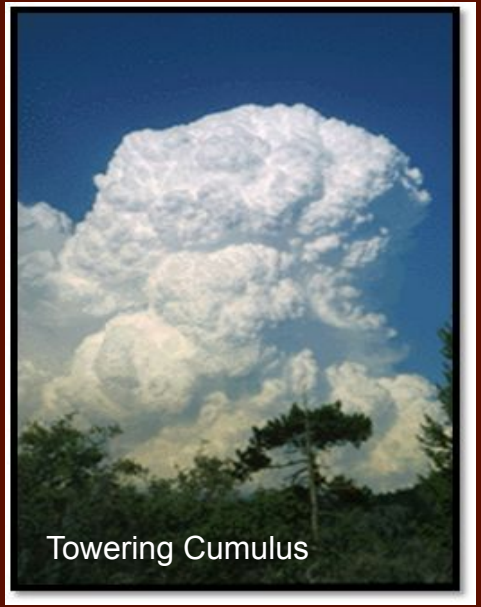

Scud clouds - ragged


Cumulus


Mammatus clouds


Stratus clouds - stable, hugs mountains


Wall Cloud - lowering cloud with rotation


Towering Cumulus

Tornado

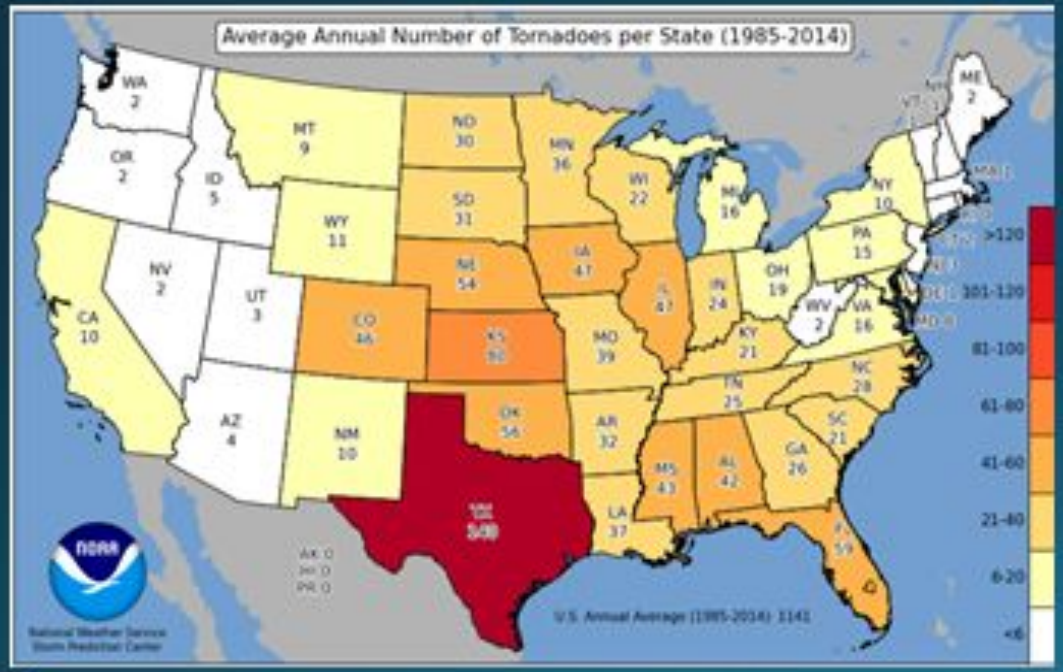
A violently rotating column of air, attached to a thunderstorm and touching the ground.

Typical Inland NW Tornado

- Less than 5 minutes on the ground
- 100 yards in diameter
- ¼ mile track
- Max wind speeds of 85-115 mph
- Mostly EF0 to EF1

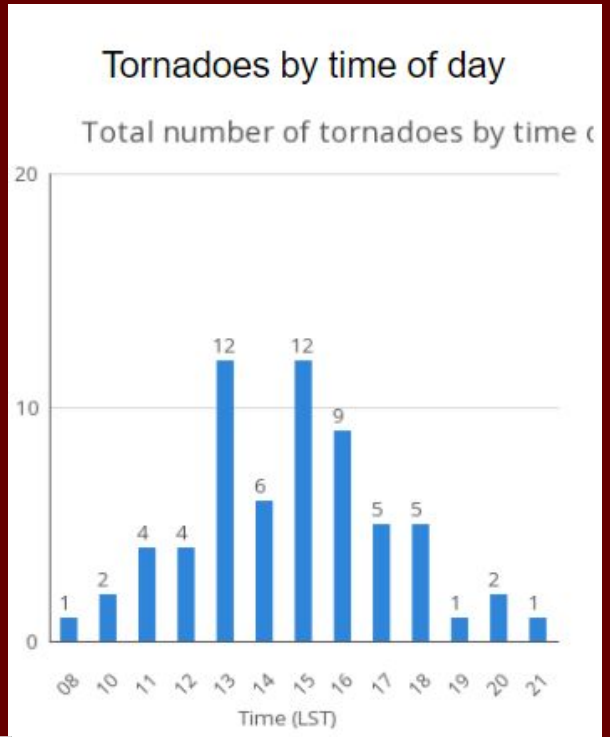
How are tornadoes measured?

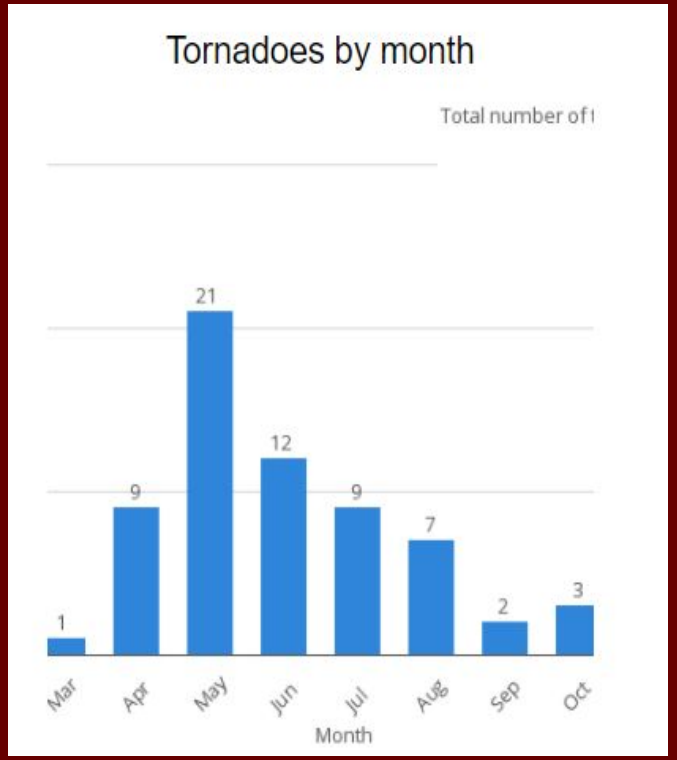
The Enhanced Fujita Scale

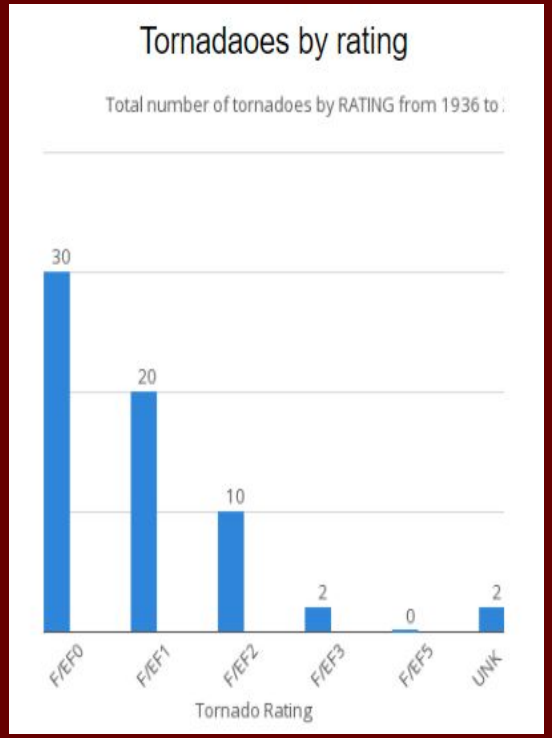


EF-Scale	Speed
EF0	65-85 mph
EF1	86-110 mph
EF2	111-135 mph
EF3	136-165 mph
EF4	166-200 mph
EF5	>200 mph

Inland NW Tornado Stats ~ 64 reports (1936-2016)







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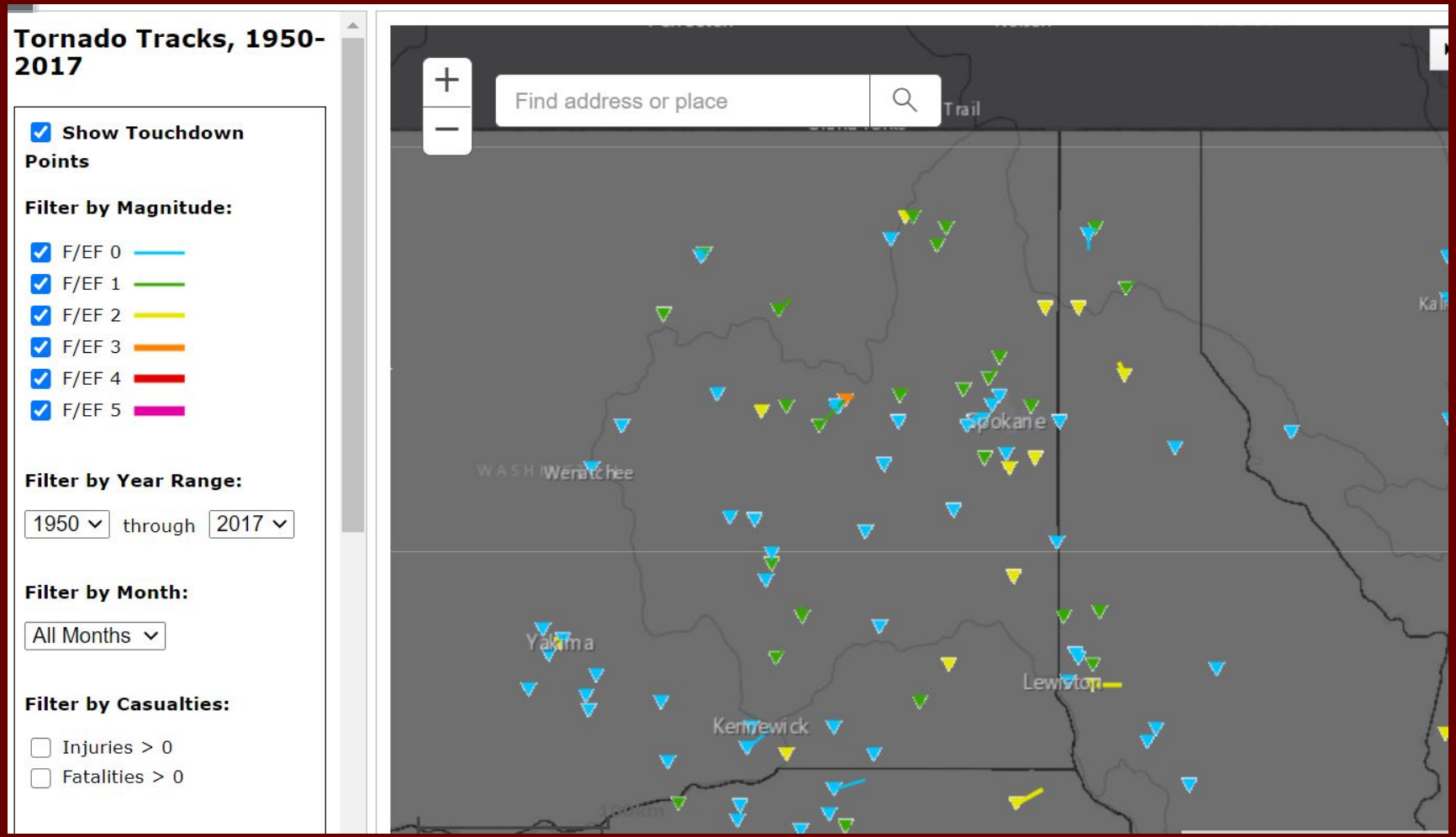


https://mrcc.illinois.edu/gismaps/cntytorn.htm#

What about Funnel Clouds & Dust Devils?

- Funnel clouds stay aloft attached to storm cloud
- Dust devils start at the ground and extend upward
- Tornadoes extend from storm cloud to the ground
- In doubt, check for cloud cover and debris on ground
- Take a picture and share!

#5 Poll Question

Identify this cloud.

Stay Informed

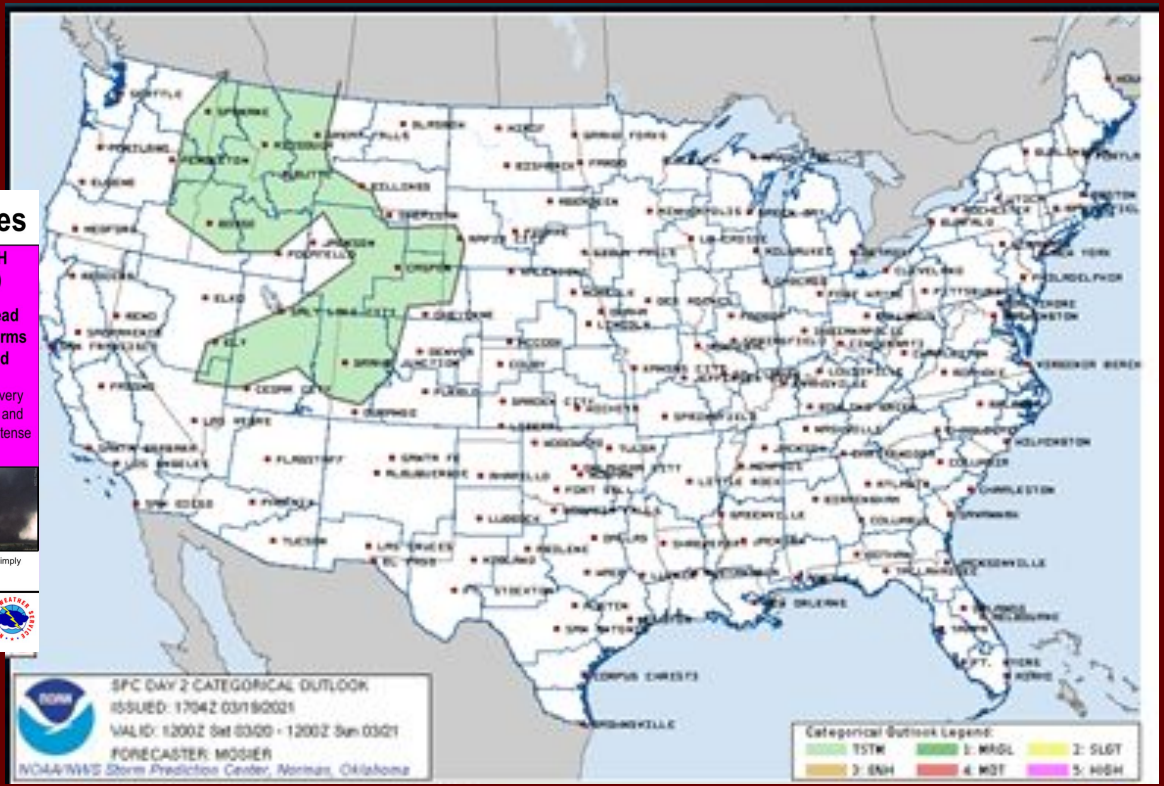
National Storm Prediction Center www.spc.noaa.gov

Understanding Severe Thunderstorm Risk Categories

THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	**Isolated severe thunderstorms possible**	**Scattered severe storms possible**	**Numerous severe storms possible**	**Widespread severe storms likely**	**Widespread severe storms expected**
Lightning/flooding threats exist with all thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense

* NWS defines a severe thunderstorm as measured wind gusts to at least 58 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.

National Weather Service
www.spc.noaa.gov



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Stay Informed

Do you have the time?

- Many weather products use the UTC/GMT/Z time zone
- UTC = PDT + 7 or PST +8
  - 10:00 AM PDT is 17:00 UTC
  - 10:00 AM PST is 18:00 UTC
- 00z and 12z are common times for models, weather balloons and other important weather information

00z = evening
12z = morning
24 hour clock is used for UTC/Z
Based off the lines of longitude
0 degrees = Greenwich, England

Stay Informed

NWS Spokane Web Page www.weather.gov/Spokane

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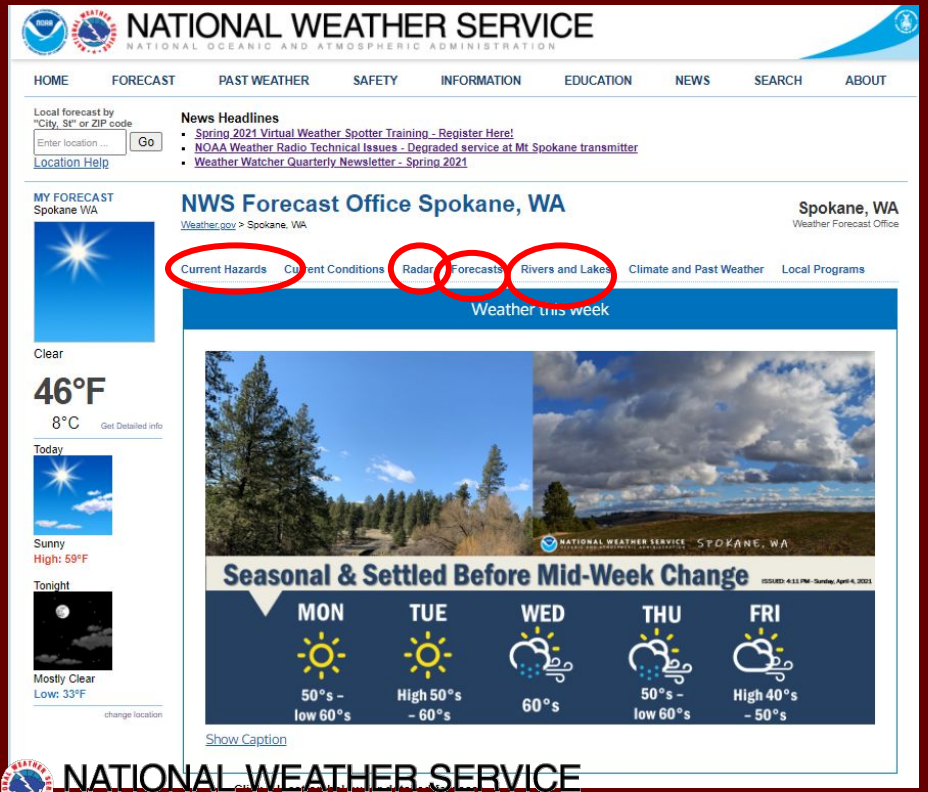
Stay Informed

NWS Spokane Web Page www.weather.gov/Spokane



Important NWS products to follow

- Hazardous Weather Outlook (HWO)
  - Daily updates on weather hazards 1-7 days out
- Forecast Computer Models
  - HRRR, GFS, ECMWF
- Radar Data
- River and Lake - forecasts

Stay Informed

NWS Spokane Web Page www.weather.gov/Spokane

Important NWS products to follow

- Area Forecast Discussion (AFD)
  - Forecasters thinking/confidence
- Radar images
- Satellite Images
- Current Observations
- Submit a Spotter Reports
- View Storm Reports

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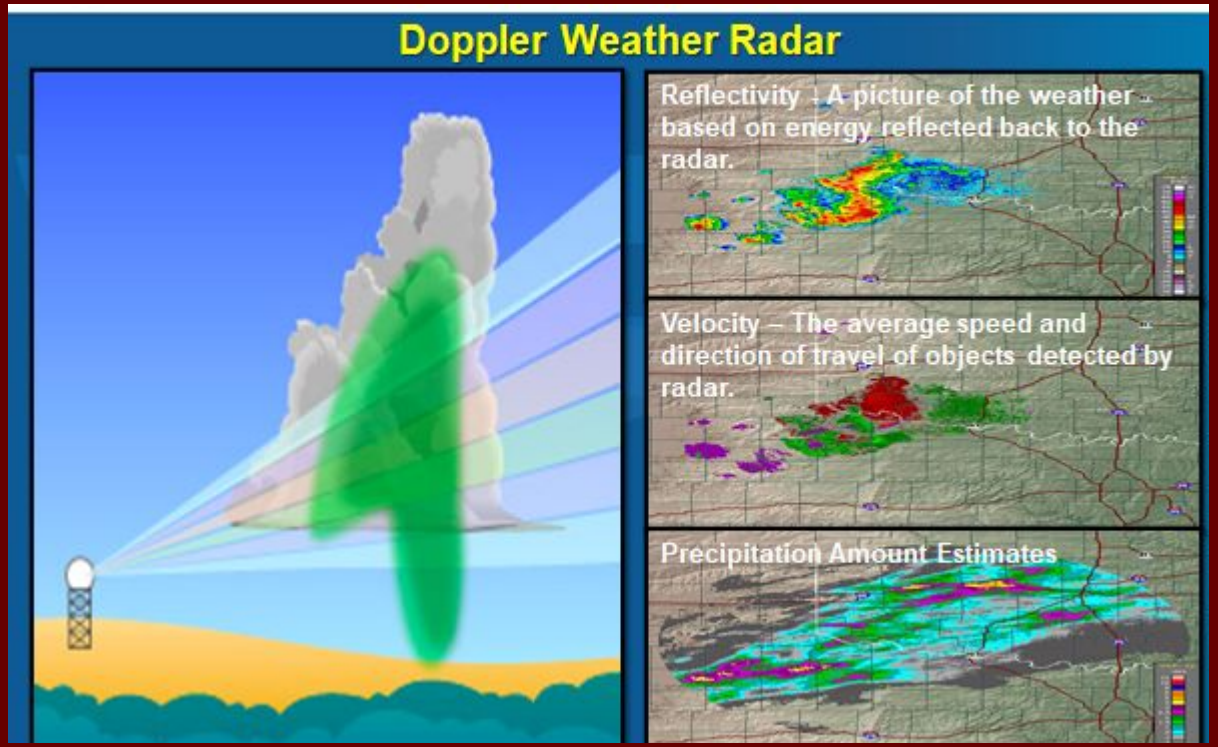
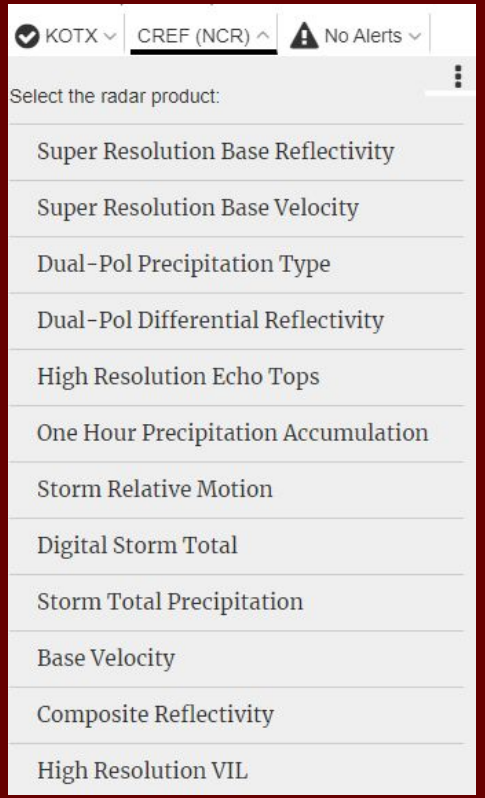
Basic Radar Interpretation



Updated Radar Map
Local Radar - Select Site

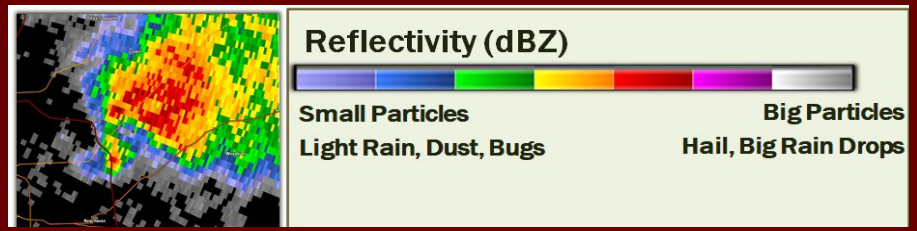


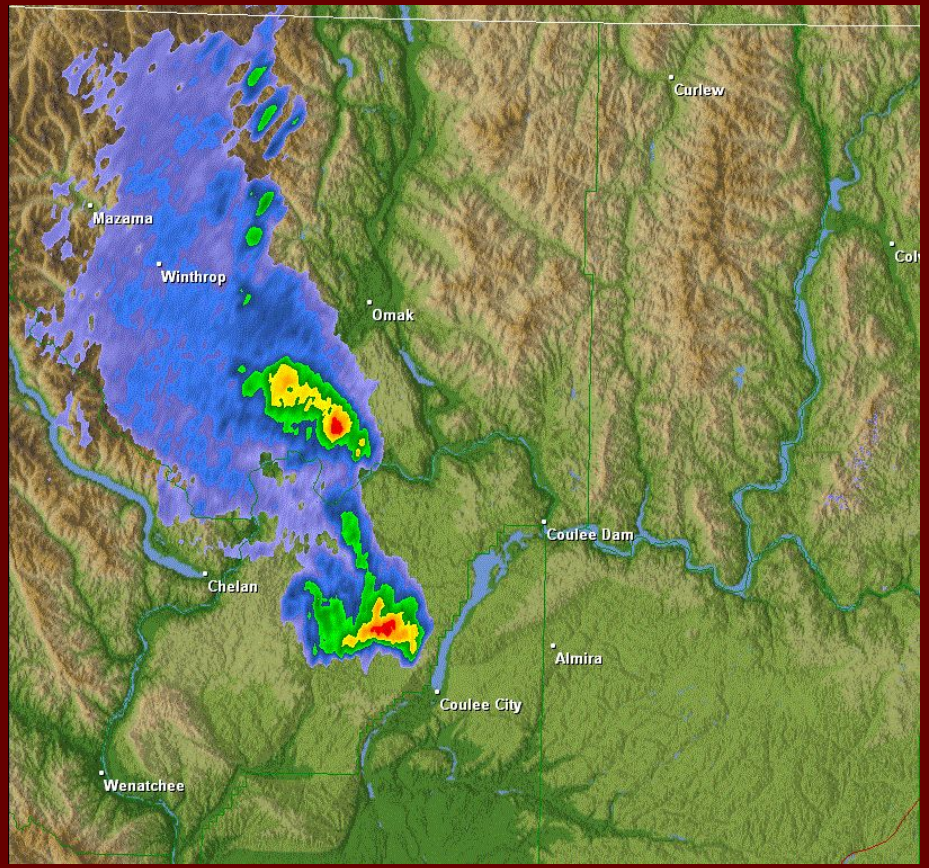
Radar Products - Reflectivity

Raw measure of how reflective targets within the beam are - typically (BUT NOT ALWAYS) indicates precipitation intensity

Measured in dbZ

“Base” or “Tilt X” = One Slice
“Composite” = Worst of all Slices



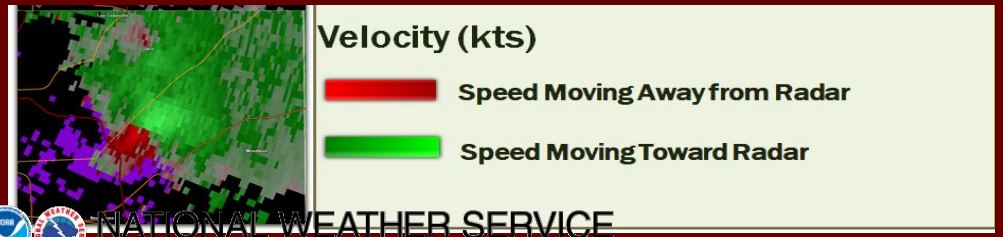


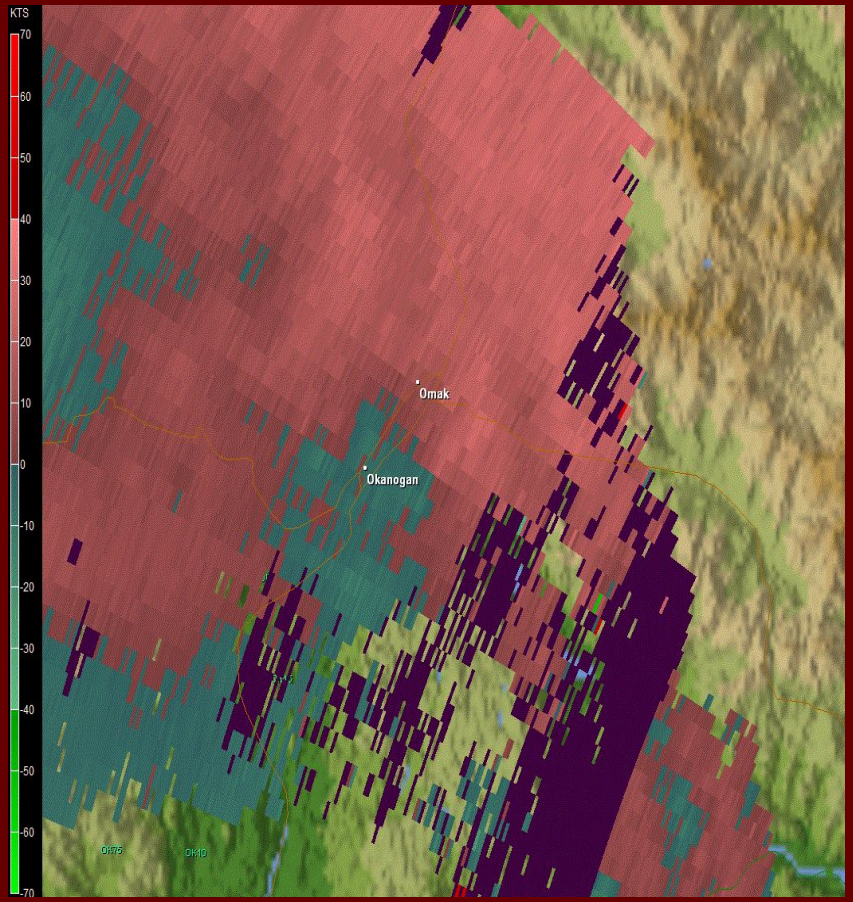
Radar Products - Velocity

Speed and direction of targets - rain, snow, hail, debris or other biological particles. Measured in knots.

Reds = outbound motion
Green = inbound motion

“Base” = ground relative motion
Good for straight line winds
“Storm Relative” = storm motion removed
Good for rotation in storms

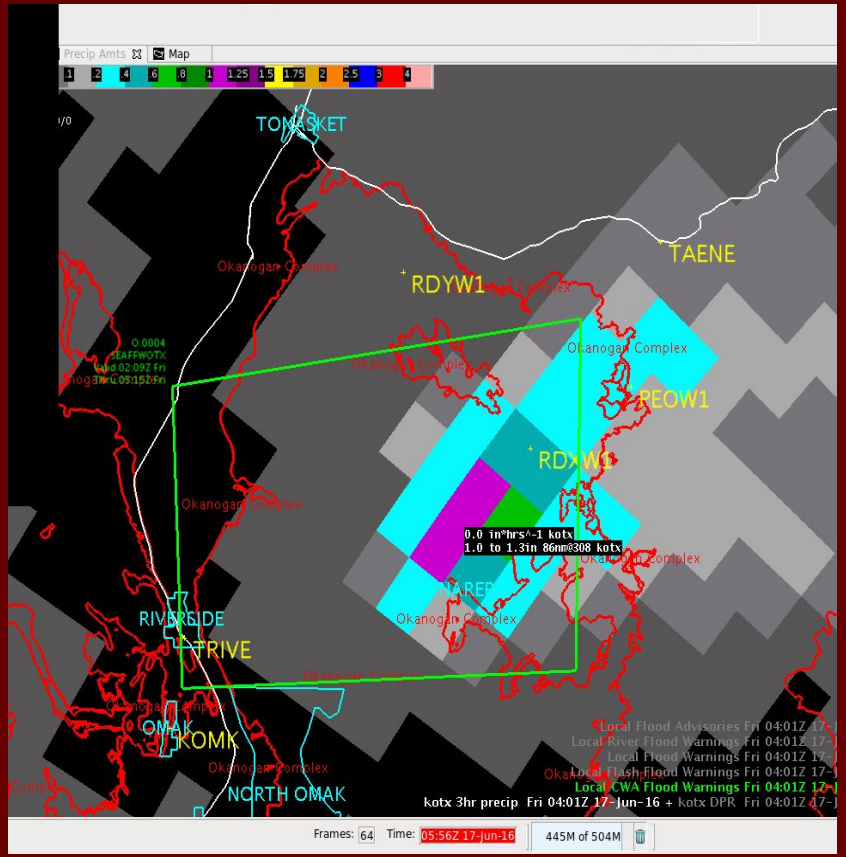




Radar Products - Precipitation

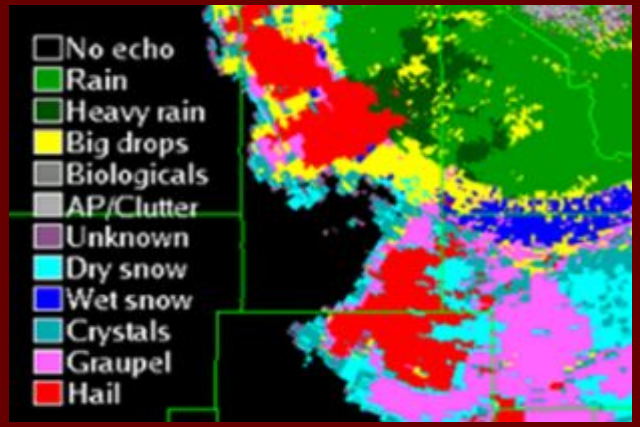
Radar estimate of precipitation reaching the ground. This can be overestimated from hail contamination

Hourly - 1 hour precipitation
Storm Total - total precipitation through the storm



Radar Products - More Products

- Precipitation Type
  - Estimate of type of precipitation
- Echo Tops
  - Estimate of height above ground of the 18 dBz echo or storm top
- Vertically Integrated Liquid - VIL
  - Estimate of the liquid water content - hail size



Cold Air Funnels - May 2020 Pullman

- No reports of damage or touchdowns
- Additional reports in Ritzville & Columbia Basin
- Weather pattern - upper level trough

Cold Air Funnel

- Circulation on Radar near I-90 where it was seen around 4:45 pm TO 4:50 pm May 26th

- "Red Shading" moving away from radar

- "Green Shading" moving away from radar

What is a "Cold Air Funnel"?

A funnel cloud that can develop from a small shower or thunderstorm when the air aloft is unusually cold (hence the name). They typically do NOT touch the ground and do not cause damage. But always be alert if you see one.

May 2015

#6 Poll question

What are some useful radar products?

Lightning

Close Enough to Hear Thunder,-
Close Enough to be Struck!

- Lightning can strike as far as 10 miles from the thunderstorm.
- More than 50% of lightning deaths occur AFTER the storm has passed

When Thunder Roars, Go Indoors

Seek Safe Shelter indoors - or vehicle if needed
Stay away from windows & doors
Don't use a corded phone or take a bath/shower

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Spotter Safety

Even the most careful and conscientious driver may have problems under severe weather conditions

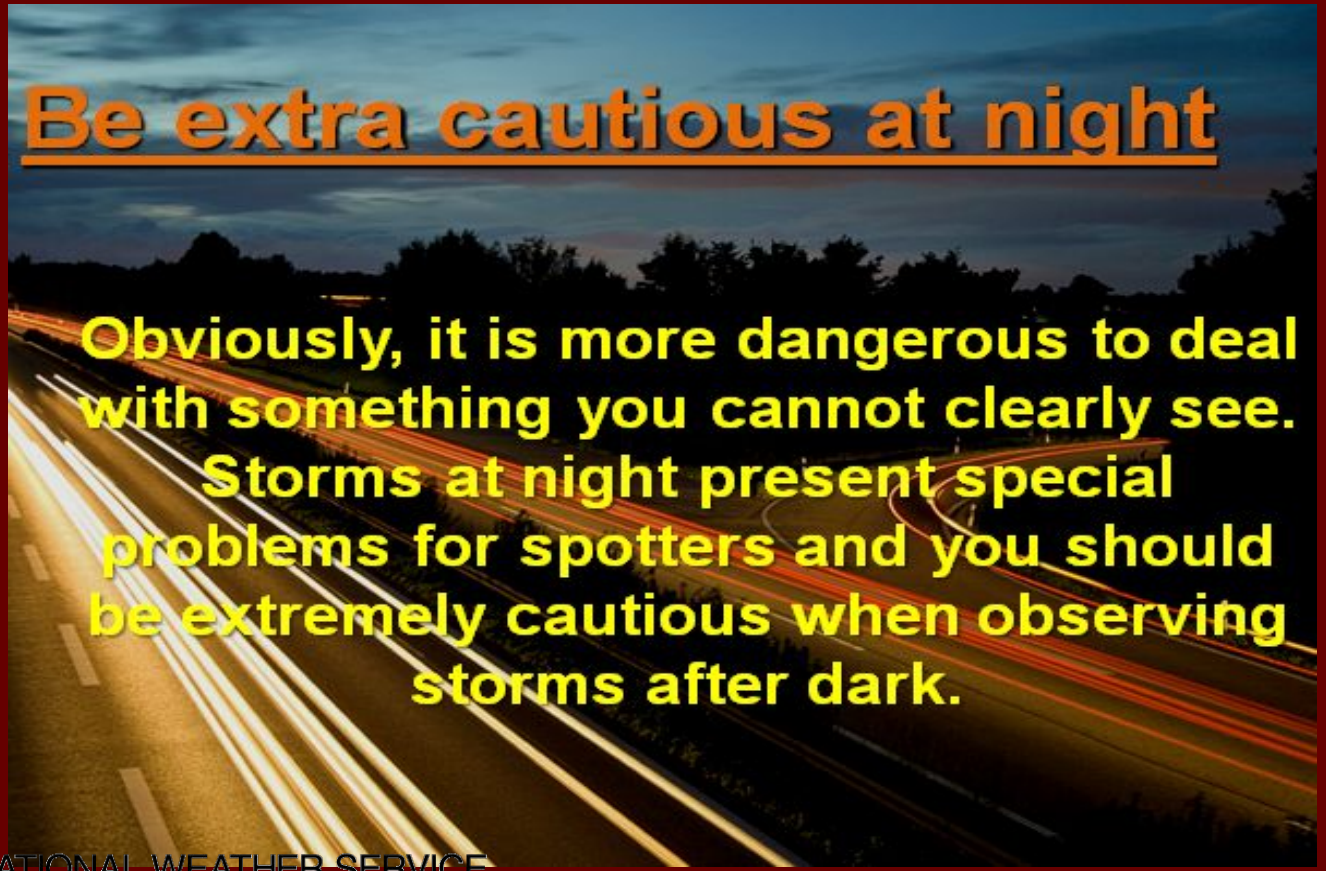
Number 1 Threat: Driving on the highways!

- **Spotters are prone to:**
  - Drive with less than 100% attention
  - Drive above the speed limit
  - Drive down rain/hail covered roads
  - Make sudden stops and starts without warning
  - Drive in adverse conditions, i.e. low visibilities, strong gusty winds etc.
  - Distractions due to various in-car devices, i.e. cell phone, laptop, PDA, GPS, camera etc.

Spotter Safety - Watch for Standing Water on Roads

- Hydroplaning is a serious threat.
- During a storm, water will likely collect along the tire paths.
- If you are hearing water splashing under your car, then you are on the verge of hydroplaning, if you are not doing so already.
- Use your headlights.

Spotter Safety - Watch for Night Spotting



Spotter Safety - Watch for Storm Damage

Stay out of damage areas

- Damage paths are full of hazards; downed power lines, jagged pieces of sheet metal, broken boards, etc.
- Avoid such places unless you have been asked to participate with cleanup or rescue efforts.
- Hindering cleanup – too many people in the way.
- Folks who have been hit by storm damage tend to be suspicious of strangers in their area.
- Gawkers are usually not appreciated and you could be taken for a potential looter.

Spotter Safety

Responsible Spotting…

- Effective spotting is a constant learning process, and responsible spotters should always be aware of the latest science relating to severe thunderstorms and tornadoes.
  - *Attend as many storm spotting classes as you can.*
  - *Each time you attend, you WILL learn something new.*
  - *Do additional research on your own (join blogs, forums etc)*

Additional Training

Spotter Resources

www.weather.gov/Spokane/Spotter_Resources

#7 poll question

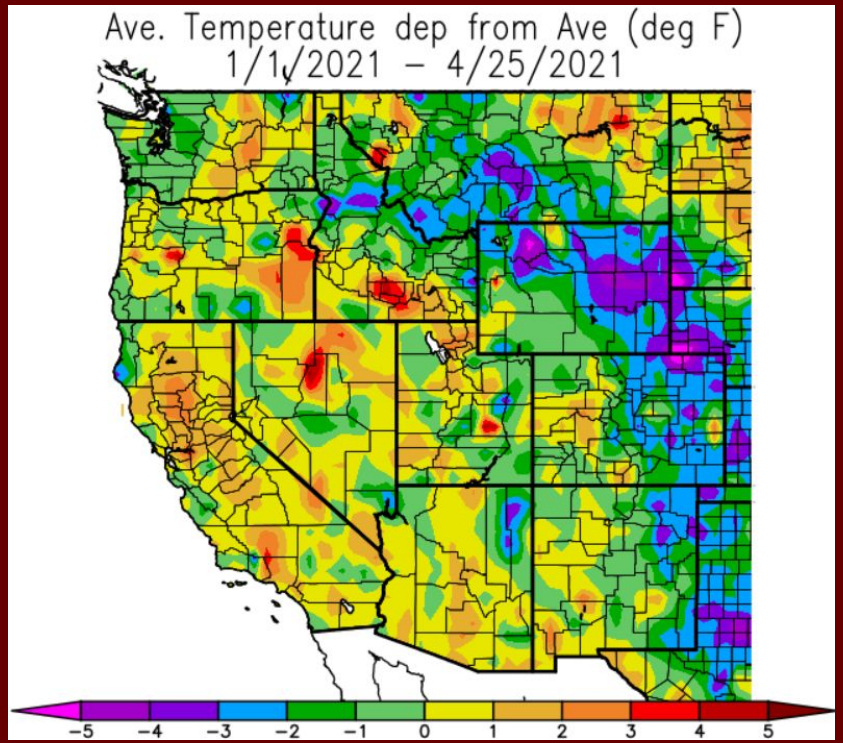
What would be a SAFE weather spotting scenario?

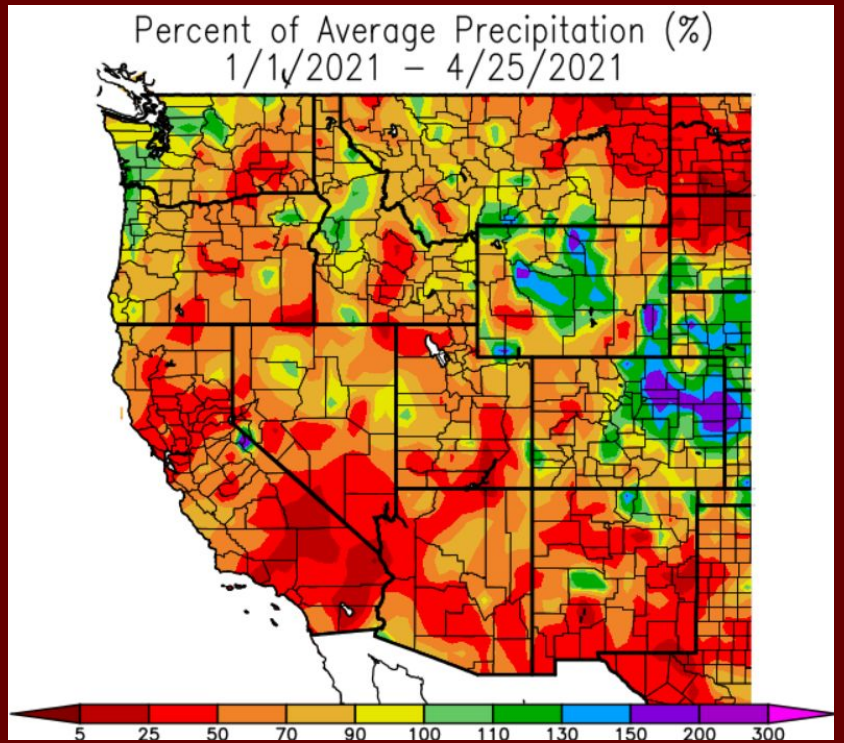
Seasonal Outlook 2021

So far this year…

wrcc.dri.edu/

January - Mild and Wet in the north
February - Cold and Wet in the south
March - Seasonal and Dry
April - Dry and near seasonal





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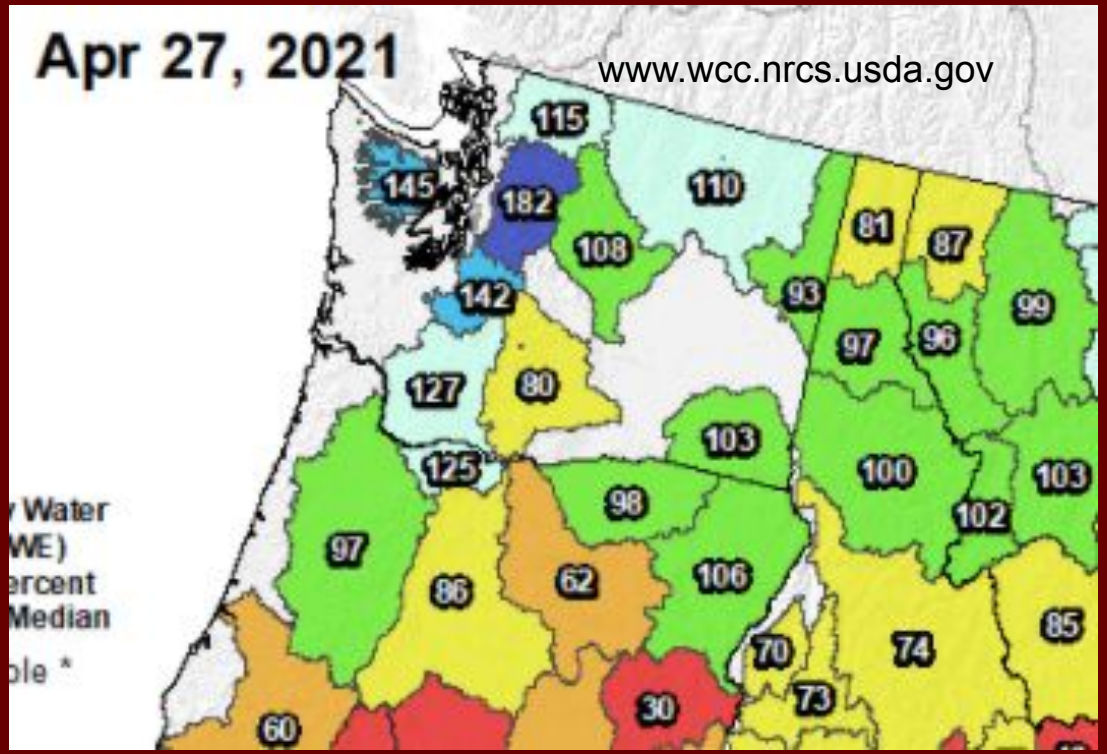
Seasonal Outlook 2021

Mountain Snowpack

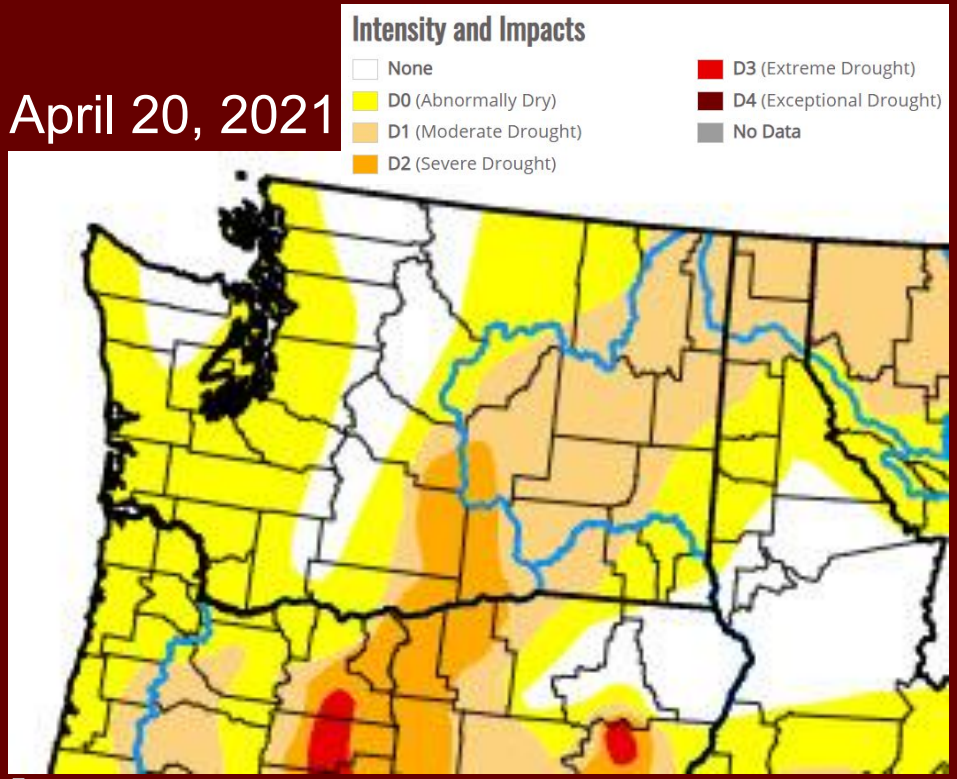


Seasonal Outlook 2021

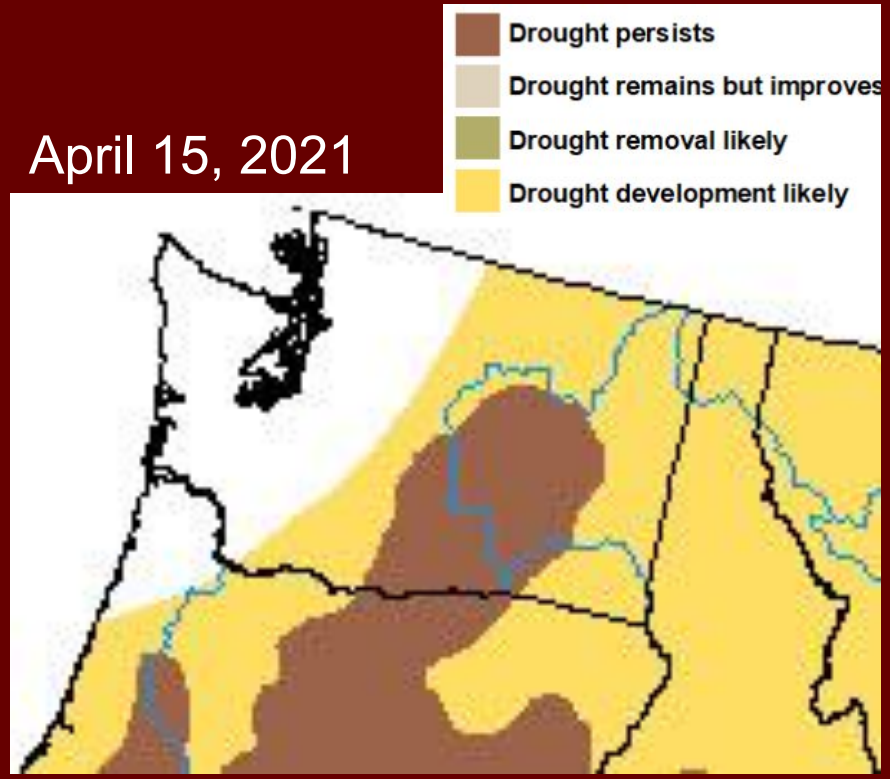
US Drought Monitor & Outlook

www.cpc.noaa.gov

April 20, 2021



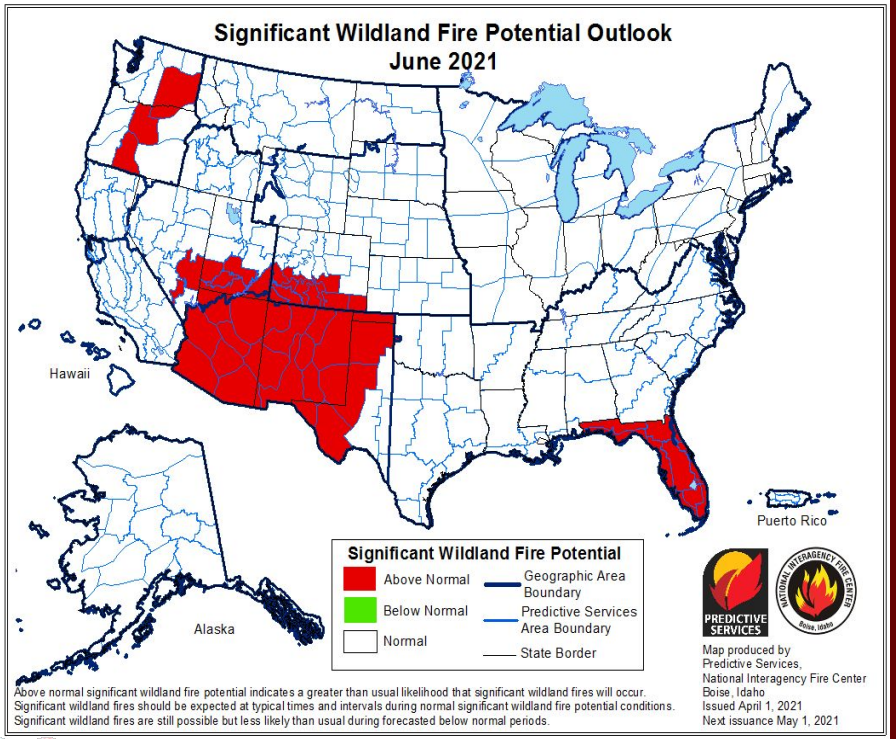
April 15, 2021

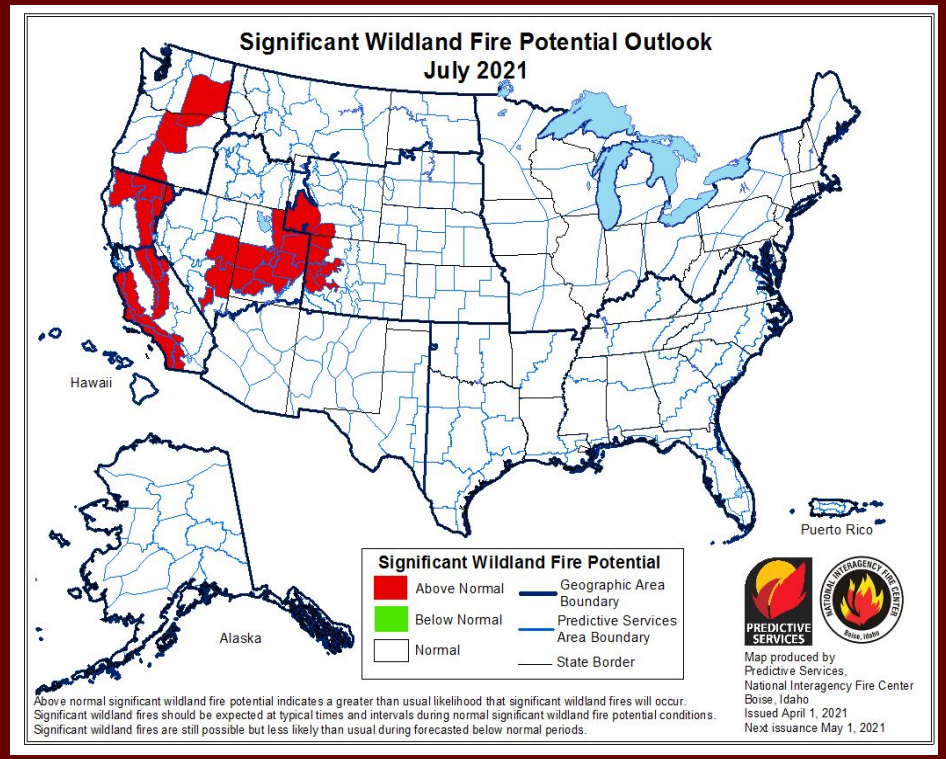


Seasonal Outlook 2021

Wildland Fire Potential

www.nifc.gov





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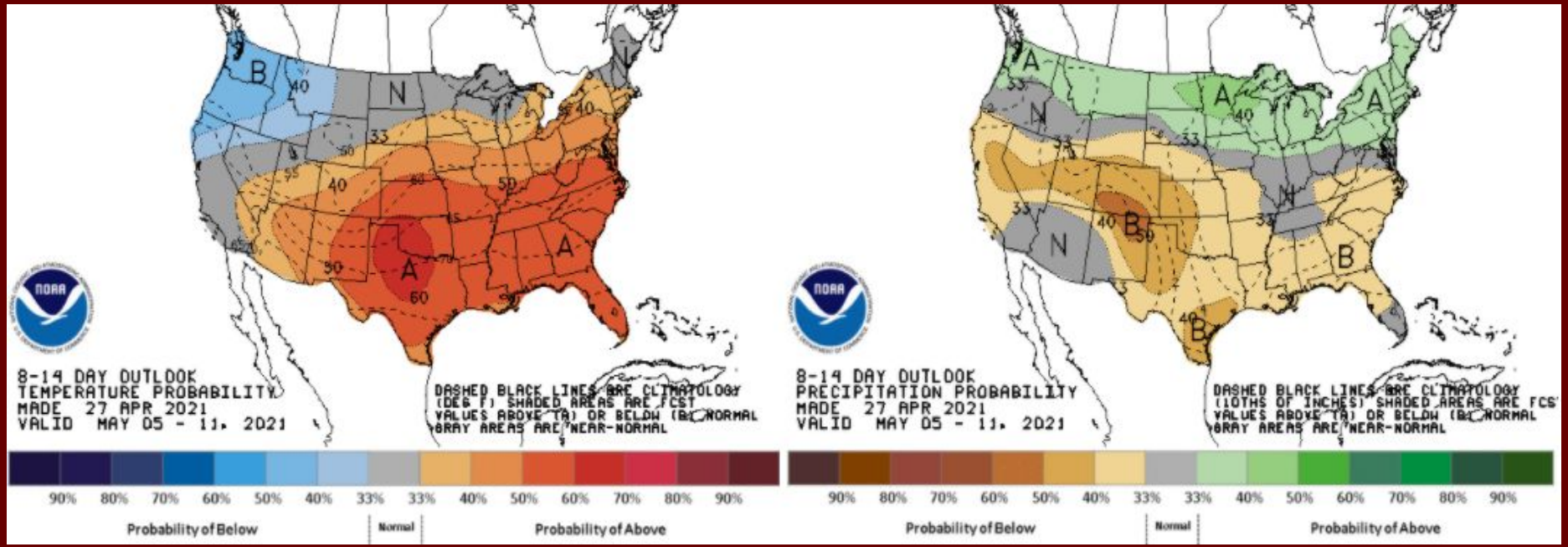
Seasonal Outlook 2021

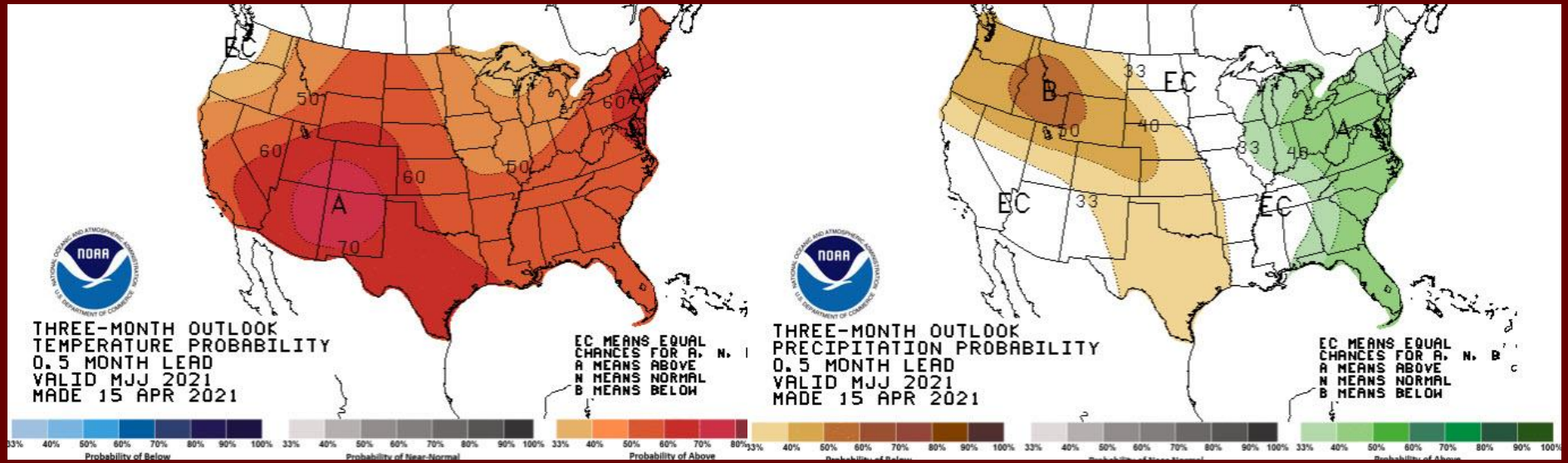
8-14 Day Outlook

www.cpc.noaa.gov



Seasonal Outlook 2021

3 Month Outlook www.cpc.noaa.gov



NWS + Weather Spotters = Saved Lives

nws.spokane@noaa.gov

THANK YOU!

What's Next?

You will receive a follow-up email

- register as a weather spotter
- Spotter ID
- Spotter training certificate

Any Questions?

I will unmute you - then you unmute yourself to talk.

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