Weather Spotter Training 2019

NOAA/National Weather Service
Weather Forecast Office Salt Lake City, UT

Goals of the Training

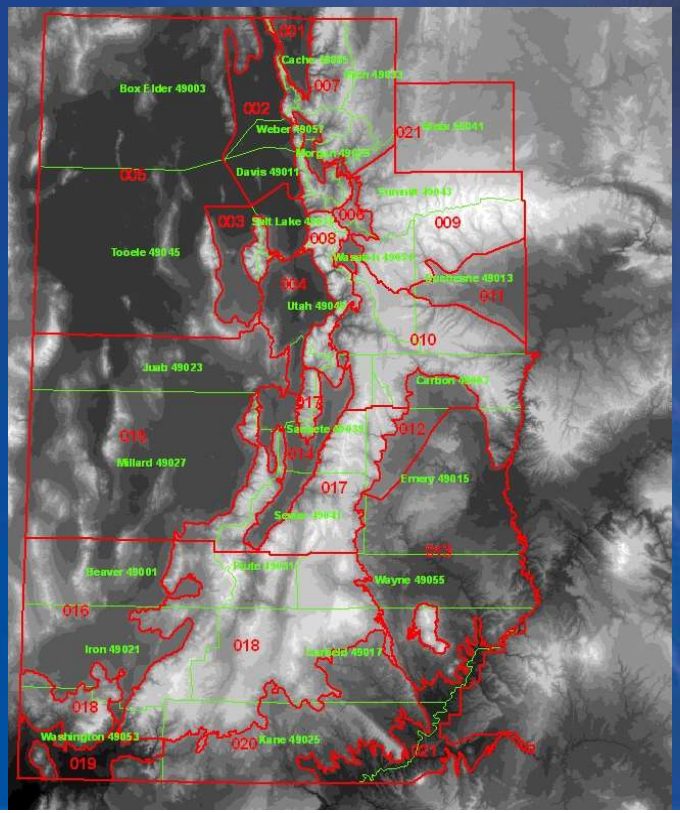
You will learn:

- Definitions of important weather terminology and extreme weather criteria
- How to correctly identify significant weather features and events
- What information the spotter is to report and how to report it
- Ways to receive weather information before and during extreme weather events
- Spotter Safety

Near Grantsville, UT - September 4, 2007

About the National Weather Service (NWS)

Provides weather, hydrologic, and climate forecasts and warnings for the protection of life and property and the enhancement of the national economy



Salt Lake City Weather Forecast Office (WFO) prepares and issues forecasts and warnings for 26 counties in Utah and extreme southwest Wyoming

24/7 Operation

Past Weather Events

Severe Thunderstorms/Tornadoes

Floods/Flash Floods

Debris Flows

Winter Storms

Wildland Fires

Lightning

Windstorms

Severe Thunderstorms/Tornadoes

West Jordan Microburst

August 5, 2013

37 large transmission poles and 4 smaller distribution poles

3,000 customers lost power

State Route 111 closed

$300,000 dollars damage

Severe Thunderstorms/Tornadoes

Riverdale/Washington Terrace/South Ogden Tornado

September 22, 2016
Enhanced Fujita (EF) Scale - EF1
Track length – nearly 3 miles
Max width - approximately 50 yards
5 injuries
Total damage - $2,000,000

Severe Thunderstorms/Tornadoes

Panguitch Tornado
September 22, 2016
Enhanced Fujita (EF) Scale – EF1
Track length - three-quarters of a mile
Max width - 25 yards
Total damage - $300,000

Floods/Flash Floods

- 2018 Statistics
  - 79 fatalities in the United States
  - 0 in Utah
- Utah statistics since 1950
  - 53 fatalities

Floods/Flash Floods

Hildale Flash Flood

September 14, 2015

13 fatalities

3 injuries

Total damage - $750,000

Floods/Flash Floods

Zion National Park – Keyhole Canyon Flash Flood
September 14, 2015
7 fatalities

Lightning

- 2018 statistics
  - 20 fatalities in the United States
  - 0 fatalities in Utah
- Utah statistics since 1950
  - 67 fatalities

July 5, 2011 - Utah County

Wildland Fires

Brianhead Fire
June 17-July 28, 2017
71,673 acres
13 homes destroyed
Estimated cost - $36.6 million

Wildland Fires

Dollar Ridge Fire

July 1, 2018-August 31, 2018
68,869 acres
74 homes destroyed
$25 million in property damage
$18 million in suppression costs
1,100 people evacuated

Wildland Fires

Bald Mountain Fire/Pole Creek Fire

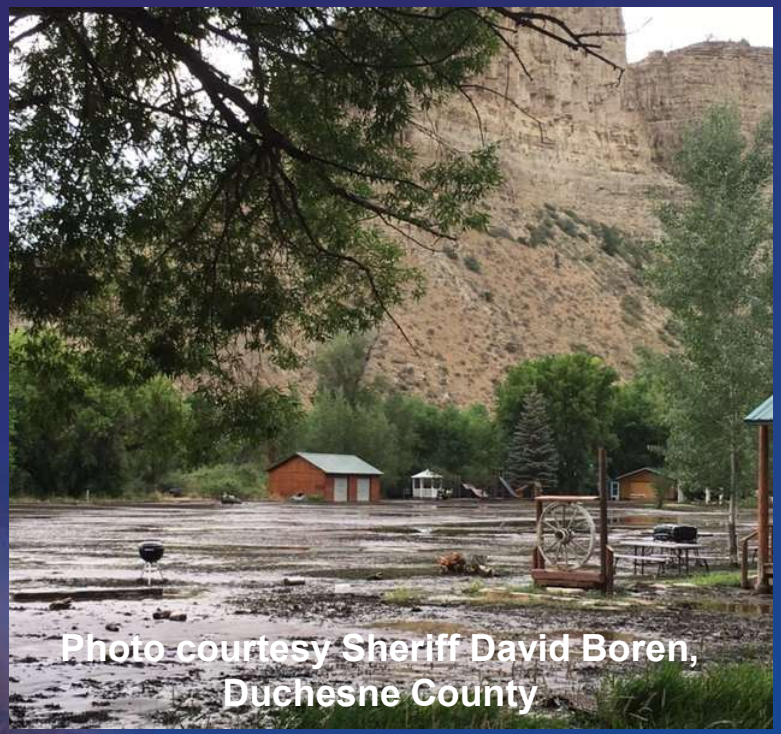
August 24, 2018-October 2, 2018/September 6, 2018-October 7, 2018

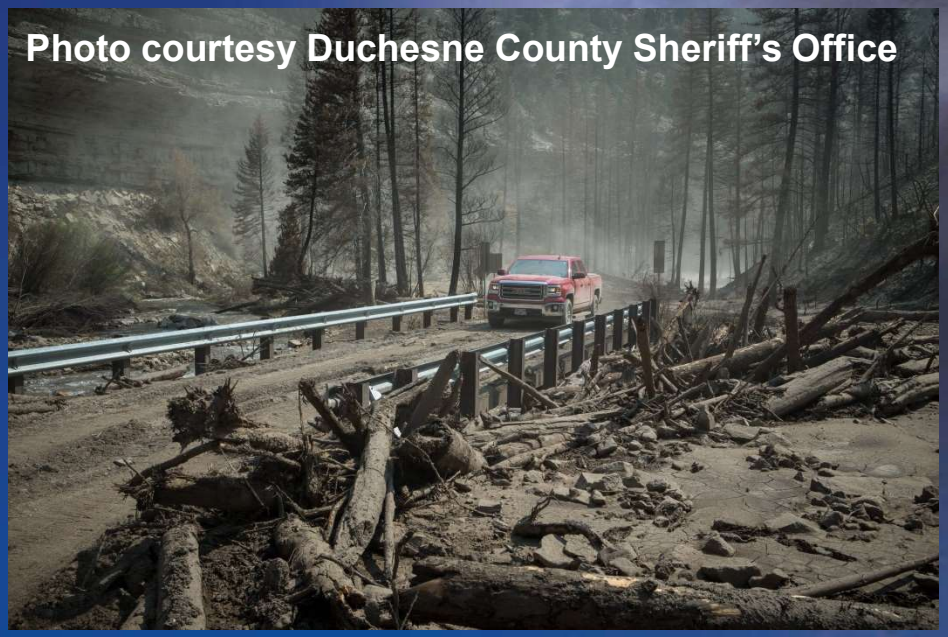
18,620 acres/102,190 acres

$23.8 million in suppression costs

6,000 people evacuated

Debris Flows





Debris flow from Dollar Ridge Fire Burn Scar
Duchesne County
July 22, 2018
Camelot Resort - 30 adults/13 children rescued
Timber Canyon - Dozen people rescued
$150,000 in damage

Windstorms

Wasatch Front Downslope Windstorm

December 1, 2011

Farmington

Photo courtesy Deseret News

Centerville

Photo courtesy Deseret News

102 mph wind gust recorded in Centerville

$4 million damage to public infrastructure

$78 million damage to insured property

50,000 homes and businesses without power

Interstate closures

School closures

Winter Storms

Photo courtesy Raval Call Deseret News

Salt Lake City International Airport

Wasatch Front Ice Storm

January 24, 2013
.09 inches of freezing rain
557 reported accidents
300 injuries
Salt Lake City International Airport closed operations

Photo courtesy Kristin Murphy Deseret News

I-80 - Salt Lake City

Winter Storms

NWS Operations Before Weather Spotters

SKYWARN (Severe Weather) Spotters

Why are you critical to NWS operations?

- **Help overcome Doppler Radar limitations**
  - Extreme terrain leads to less than optimal radar coverage
  - Radar doesn't 'see' below cloud base
  - Radar is good at indicating circulations (mesocyclones), but most circulations are not associated with a tornado

- **Provide ground truth, which can help motivate people downstream to take action to protect lives and property**
  - Ground truth reports included in warnings heighten public awareness, add credibility to warnings, and allow forecasters to have confidence in warning decisions

- **Ground truth can be correlated with radar signatures *prior to*, *during*, *and* *after* severe weather to aid in warning decisions**
  - We archive severe weather events for research and verification and use a Weather Event Simulator for training with past weather events

Reporting…What We Want to Hear About

Don’t assume we already know it’s happening!

- Tornadoes, Funnel Clouds, and Wall Clouds
- Flooding/flash flooding and/or rapidly rising water
- Strong and/or damaging winds
- Hail
- Wildland fires
- Snowfall, snow depth, and freezing rain
- Marine-related weather events

Continue to monitor and report!

When You Report

4 Ws – who, what, when, and where

- **Identify yourself as a trained spotter (who)**
- **Describe severe weather feature (what)**
- **Provide exact time feature was spotted (when)**
  - This may or may not be the current time of your call
- **Be as specific as possible with location (where)**
  - Reference distance and direction from nearest city
  - Use interstate, state, or county road information
  - Reference marina, or other navigational information

Continue to monitor and report!

Reporting Options

Severe Weather Spotter Line:
800-882-1432 x1

Storm Reports
https://inws.ncep.noaa.gov/report

E-mail
utah.spotter@noaa.gov


Dust storm near Milford, UT

Twitter
@NWSSaltLakeCity
https://twitter.com/NWSSaltLakeCity

Facebook
US National Weather Service Salt Lake City Utah
https://www.facebook.com/NWSSaltLakeCity

CoCoRaHS
Community Collaborative Rain, Hail and Snow Network

- Report rain, hail, and snow
- Visit CoCoRaHS home page at http://www.cocorahs.org
  - Registration
  - View observations

Contact
Mike Seaman
Senior Forecaster
mike.seaman@noaa.gov

Meteorological Phenomena Identification Near the Ground (mPING)

- NOAA/National Severe Storms Laboratory, University of Oklahoma, and the Cooperative Institute for Mesoscale Meteorological Studies
- Submit weather observations and view reports
- Report through mPING app, available on iTunes and Google Play
- mPING page at http://mping.nssl.noaa.gov

Anticipating Severe Weather

Situational Awareness # 1 - Be aware of your environment!

Plymouth, UT - July 27, 2007

Ready…Set…Go!!!


3–tiered approach
Time Until Event
7 Days
Now
OUTLOOKS
(Ready)
WATCHES
(Set)
WARNINGS
or
ADVISORIES
(Go!!!)
Possible
Conditions Favorable
Imminent
Certainty of Event

Severe Weather Terms

What to watch for

- **Watch** - Issued when conditions are **favorable** for a particular severe weather hazard to develop during the next several hours. Plan, prepare, and be aware.`
- **Warning** - Issued when a particular severe weather hazard is either **imminent or occurring**, and poses a significant risk to life and/or property. Immediate action is necessary to protect life and/or property.
- **Advisory** – A low-impact event is imminent or occurring, which may result in inconvenience or nuisance weather conditions - primarily impacting travel. Reasonable precautions will prevent injury or property damage.

Anticipating Severe Weather

What to look and listen for…be Informed

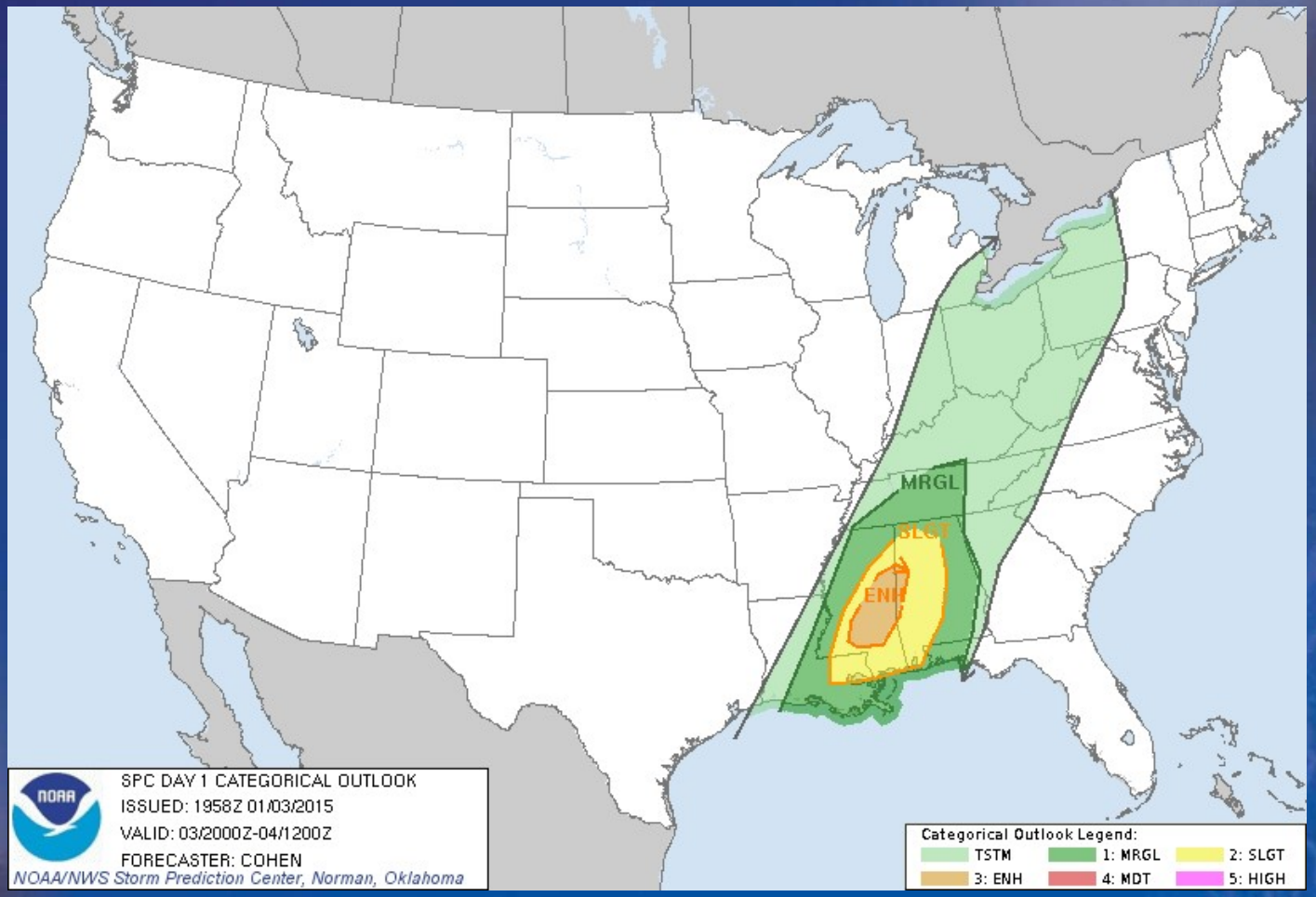
- Utilize WFO Salt Lake City web services http://weather.gov/saltlakecity
  - Text and graphical services
    - Dynamically generated forecasts
    - Hazardous Weather Outlook
    - Watches, warnings, and advisories
  - YouTube briefings
  - Weather Story
  - Social media
  - Radar imagery
- NOAA Weather Radio All Hazards
- Local media sources

Anticipating Severe Weather

What to look and listen for…be Informed

- **Utilize Storm Prediction Center services**

http://www.spc.noaa.gov



What Makes a Thunderstorm Severe?

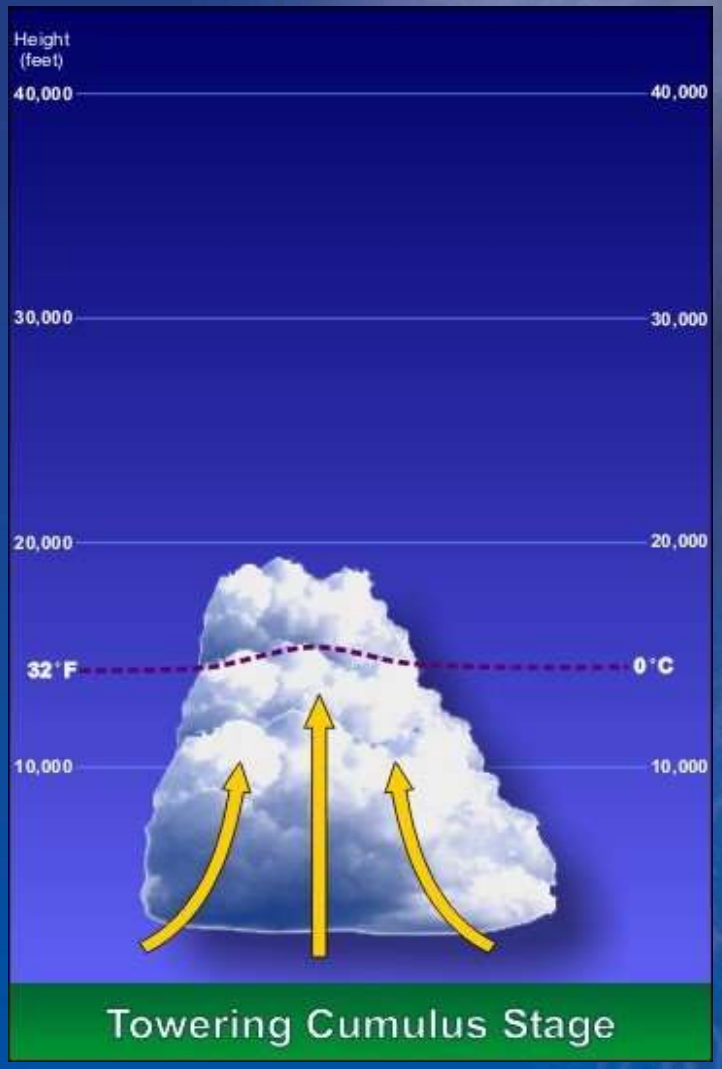
- Tornado
- Winds at least 58 mph or reports of wind damage
- Hail at least 1 inch in diameter


Roosevelt , UT- July 19 2008

Thunderstorm Life Cycle

Towering Cumulus - Developing

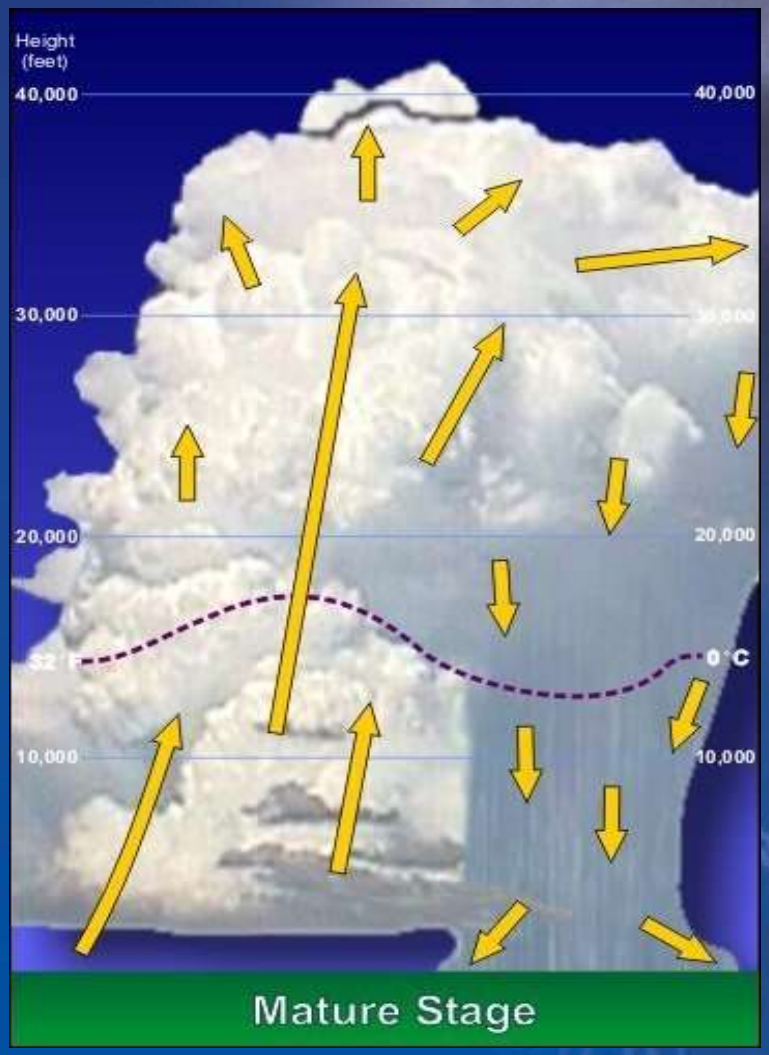
- Towering, billowy bright white clouds
- Dominated by updraft – rising air
- Lasts 10-15 minutes
- Little rain, but lightning possible



Thunderstorm Life Cycle

Mature Stage

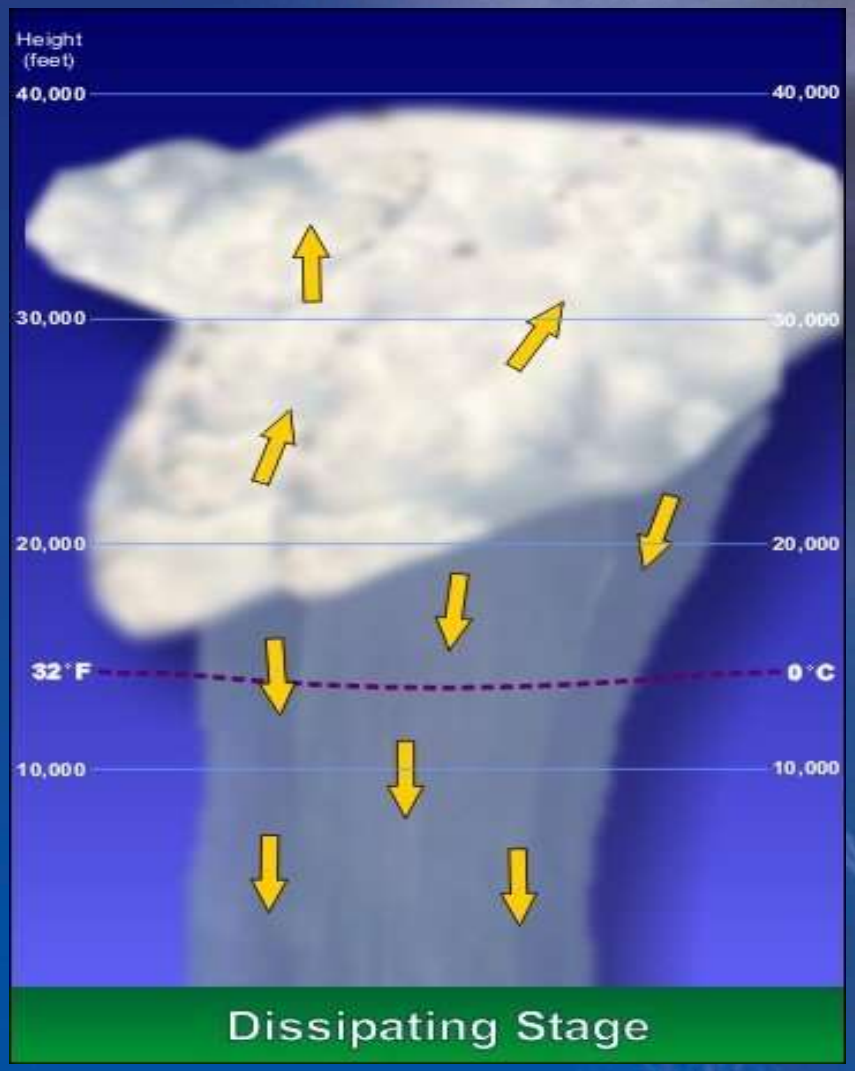
- The weather stage
- Hail, heavy rain, lightning, strong winds, tornadoes
- Anvil at storm top
- Rising air/falling rain (updraft/downdraft)
- Typically lasts 10-20 minutes



Thunderstorm Life Cycle

Dissipating Stage

- Tall, billowy updraft shrinking
- Mostly descending air
- Rainfall intensity decreases
- Strong wind and hail still possible from some storms
- Lightning can still be quite frequent
- Lifespan is 45-50 minutes

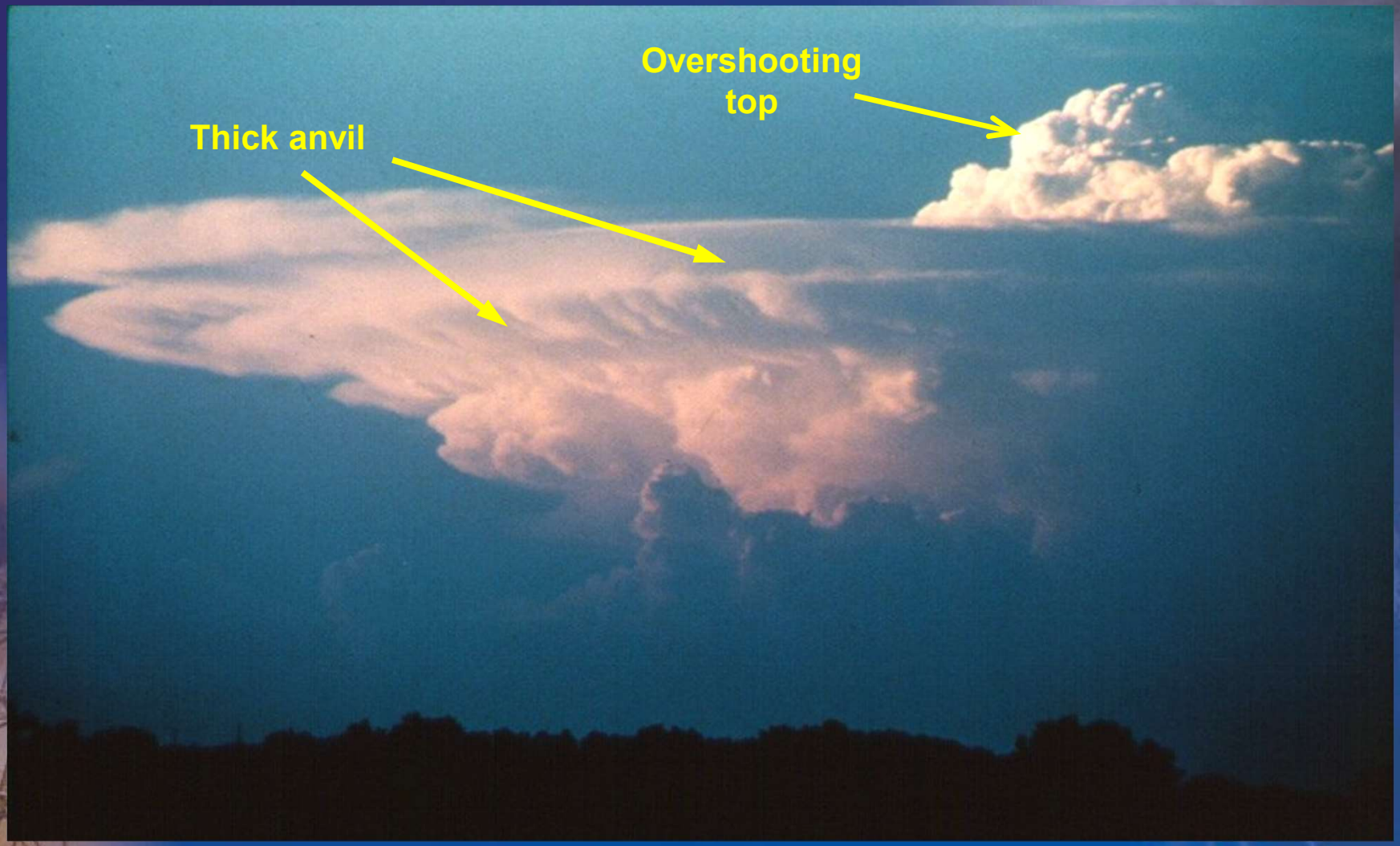


Observing Upper Level Storm Clues

Viewed 30-40 miles from storm

- **Overshooting Top**
  - Dome-like bubble of cloud extending above anvil and persisting for >10 minutes
  - Indicates strong updraft
- **Anvil characteristics**
  - Thick, cumuliform anvil with sharp, well-defined edges
  - ‘Bubbling’ look

Intensity clues – Overshooting Top



Intensity Clues - Anvil

Well defined anvil

Wispy anvil

Intensity clues - Updraft

Viewed 10-20 miles from the storm

Strong updraft

Hard cauliflower appearance

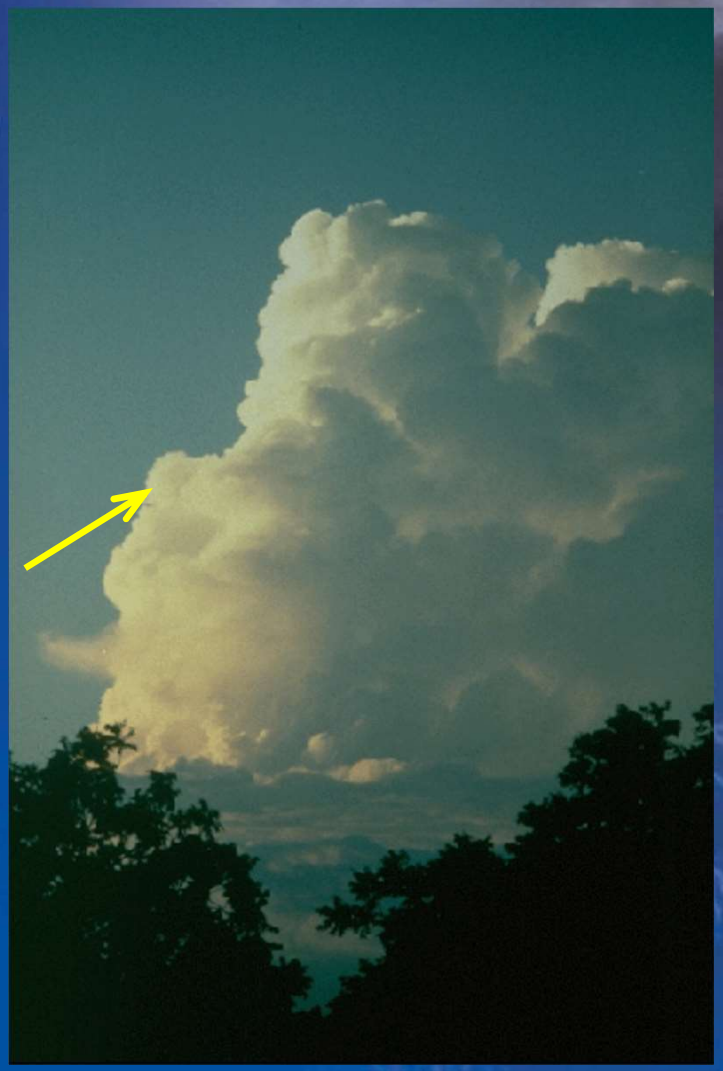
Vertically upright

Weak updraft

Soft, mushy appearance

Vertically tilted

Sunlight shining through



Observing Low Level Storm Clues

Viewed within 10 miles of storm

- **Wind clues**
  - Shelf Cloud/Roll Cloud
  - Downburst
- **Hail clues**
  - White hail shaft
  - Greenish tint to sky

- **Tornadoes, Funnel Clouds, and Wall Clouds**
  - Rain-Free Base (Low, flat cloud base with little visible precipitation falling and updraft towers above)
  - Wall Cloud (Isolated lowering of rain-free base, rotating, and usually near the north side of the updraft)

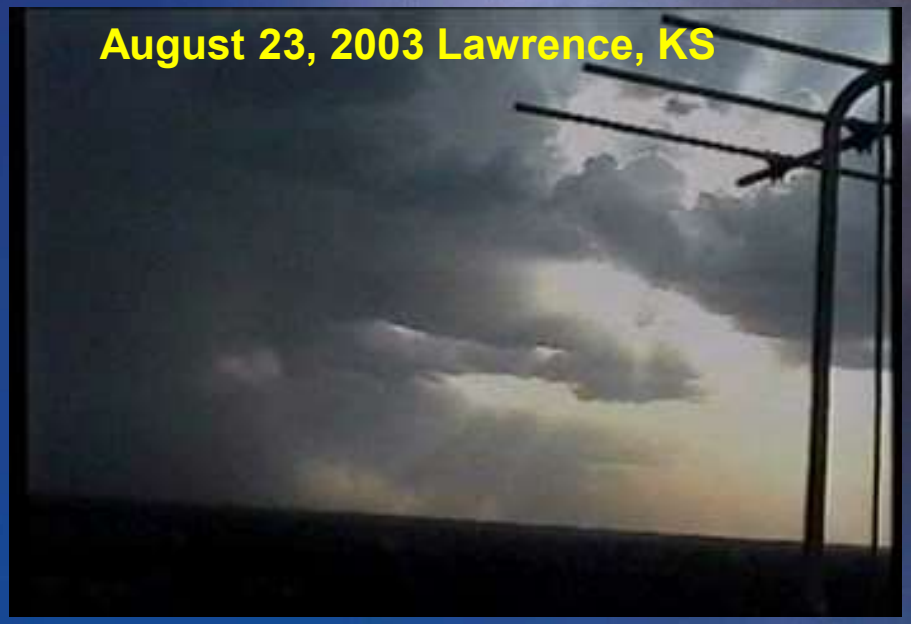
Fundamental Definitions – Shelf Cloud

- **Shelf Cloud** – Low level, *horizontal*, wedge shaped cloud, occurring on leading edge of a thunderstorm (Wind, rain, and hail may follow, but may not be severe)

Fundamental Definitions - Microburst

- **Microburst** – An intense downdraft from a thunderstorm with an outrush of damaging wind

- Winds can exceed 100 mph



Reporting Winds/Wind Damage

- Use Beaufort Scale to estimate wind speeds
  - ~50 MPH - Slight structural damage and large branches may break
  - ~60 MPH - Moderate structural and tree damage
  - ~ 70 MPH - Heavy to severe structural and tree damage
- Report immediately:
  - Wind damage
  - 50+ mph winds

Salt Lake County - September 4, 2007

Measure wind speeds when possible!

Hail Clues

- **Look for**
  - White hail shafts/streamers
  - Greenish tint to sky

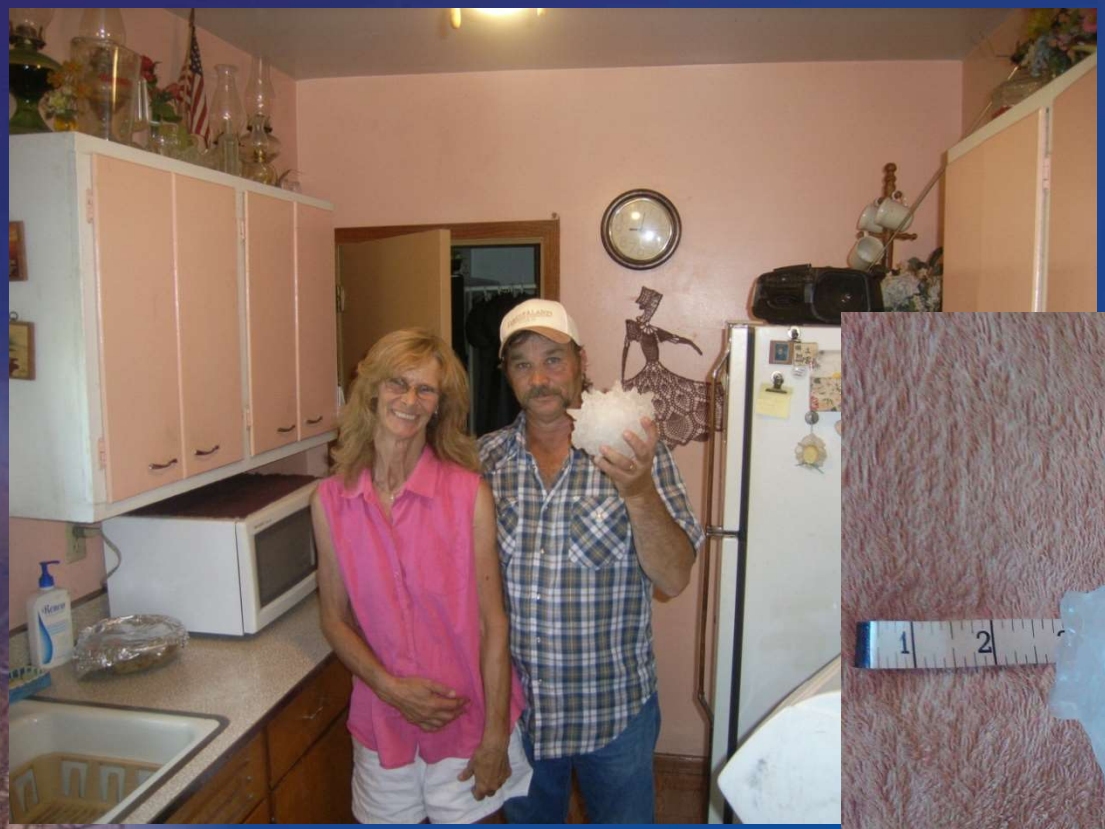
- **Report any size hail**

Measure the Hail

United States Record Hail (circumference)
Aurora, NE - June 22, 2003

Measure the Hail

United States Record Hail (weight and diameter)
Vivian SD - July 23, 2010



Do Not Report "Marble Size Hail"

Hail Boys

A Closer Look

Supercells, Tornadoes, Funnel Clouds, and Wall Clouds

Dunlap, IN - April 11, 1965

Yes…Tornadoes Do Happen in Utah!

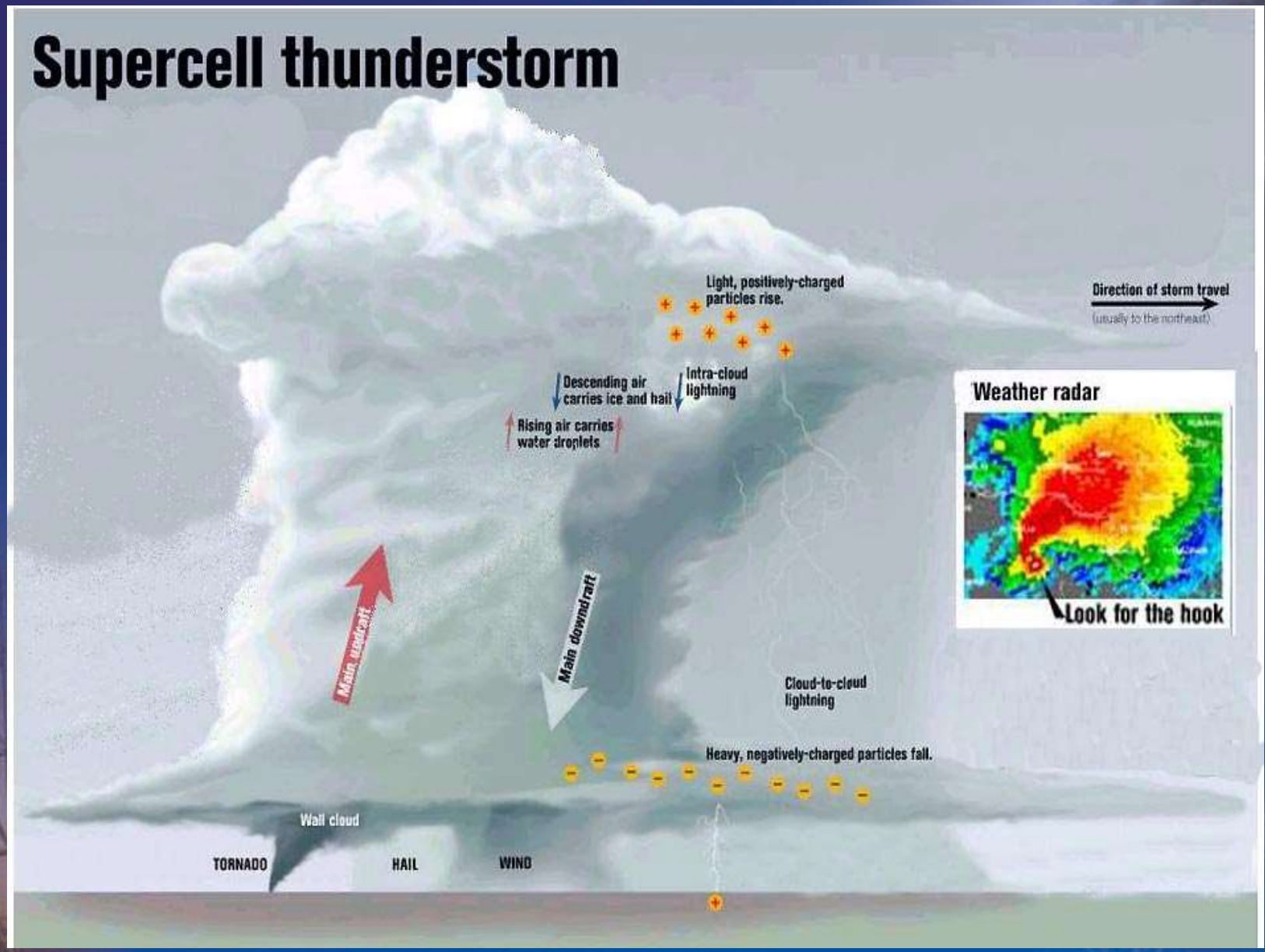
Salt Lake City
August 11, 1999

Manti
September 8, 2002

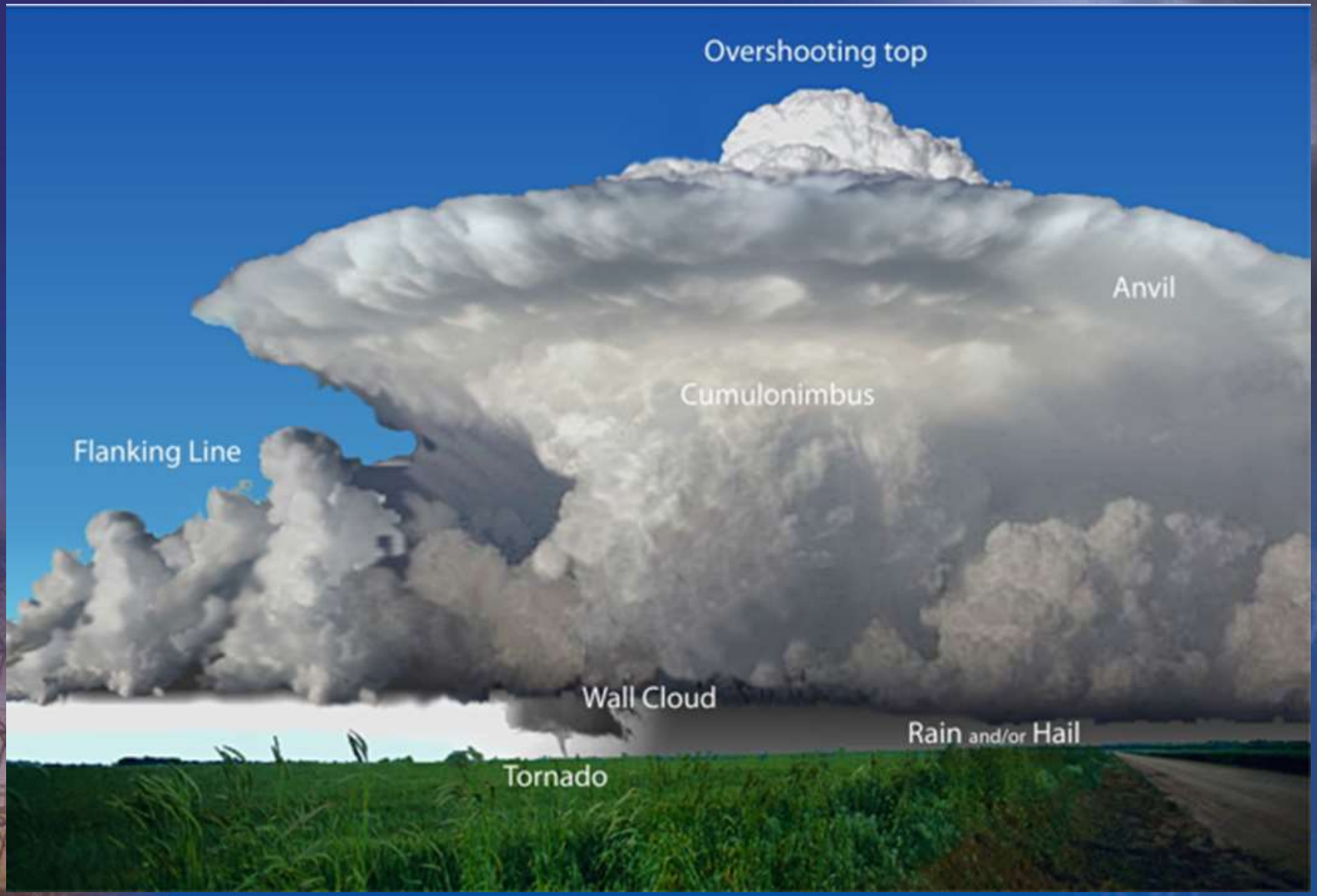
Fundamental Definitions – Supercell Thunderstorm

- **Supercell** – A thunderstorm with a persistent rotating updraft
- Almost always severe with large hail, damaging winds, and tornadoes

Supercell Depiction



Supercell Depiction – Second Look

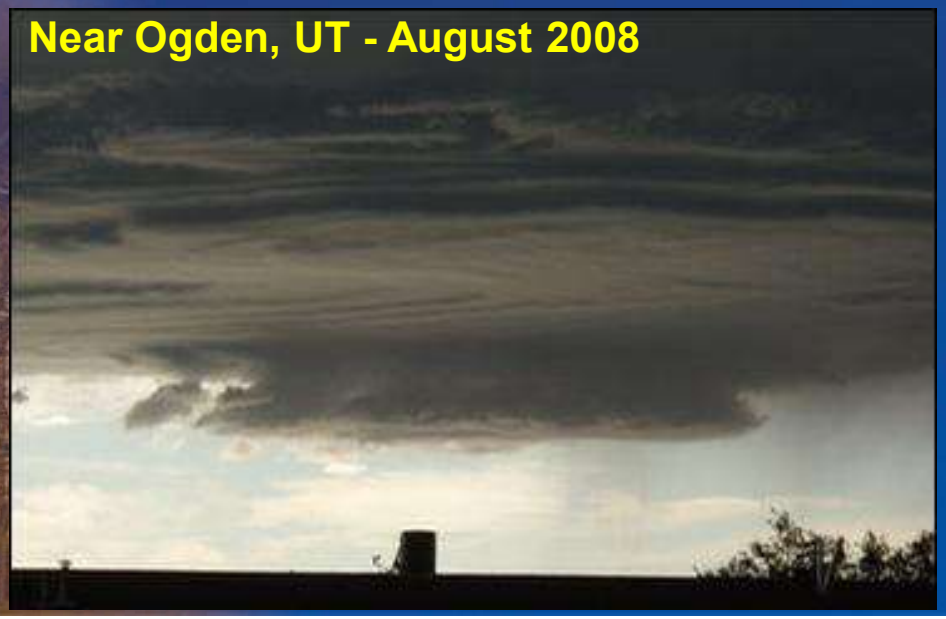


Fundamental Definitions - Mesocyclone

- **Mesocyclone** – A storm-scale region of rotation within the updraft region of a supercell thunderstorm

Fundamental Definitions – Wall Cloud

- **Wall Cloud** - An isolated lowering under a rain-free cumulonimbus cloud base, resembles a pedestal.
- Persistent (5-10 minutes) and often rotating
- Can precede funnel cloud and tornado formation



Near Ogden, UT - August 2008

Shelf Clouds vs. Wall Clouds

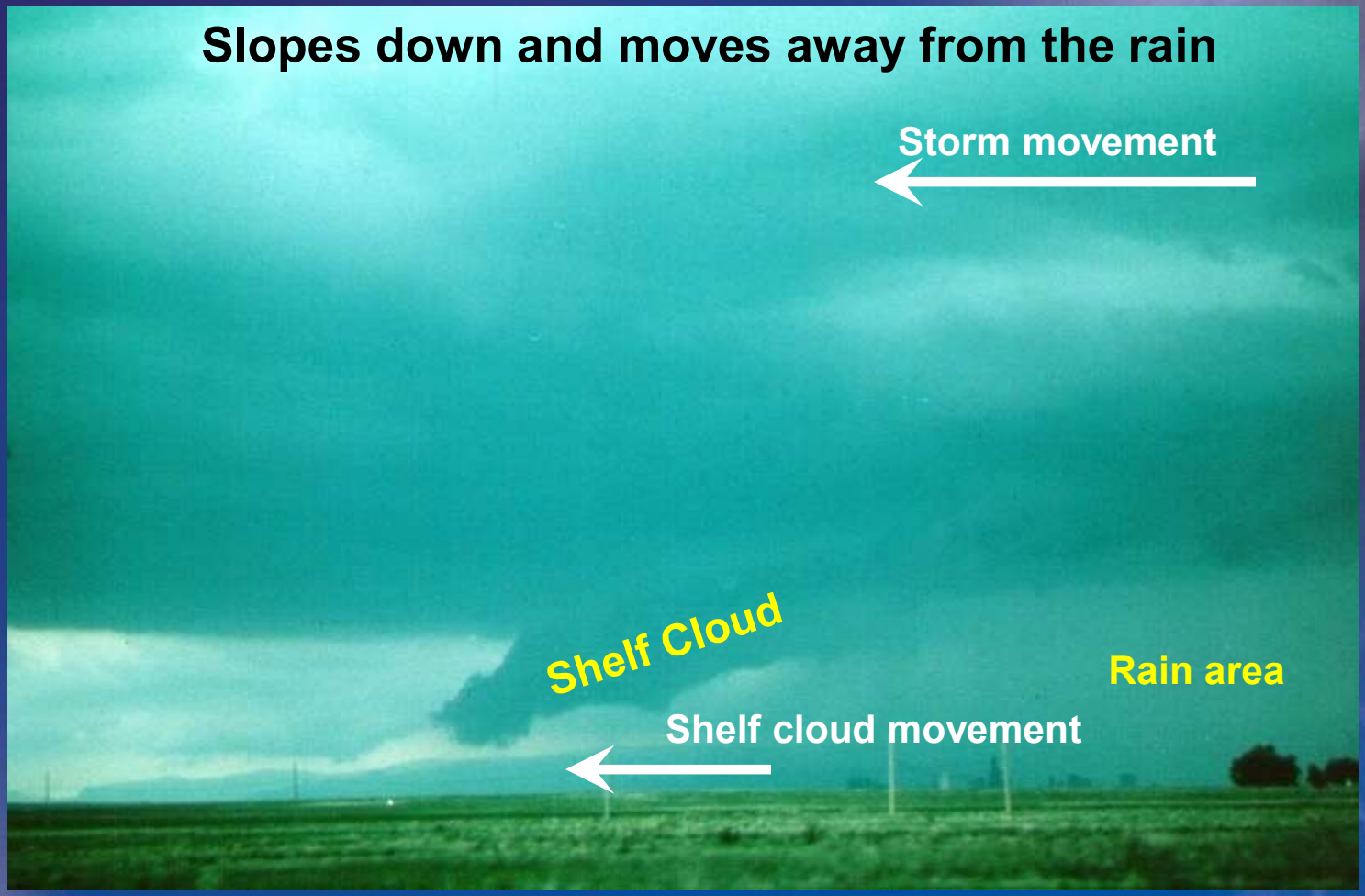
Shelf Clouds

- Suggest downdraft/outflow
- Move away from precipitation areas
- Horizontally orientated and can extend for miles, may ‘roll’ like a rolling pin

Wall Clouds

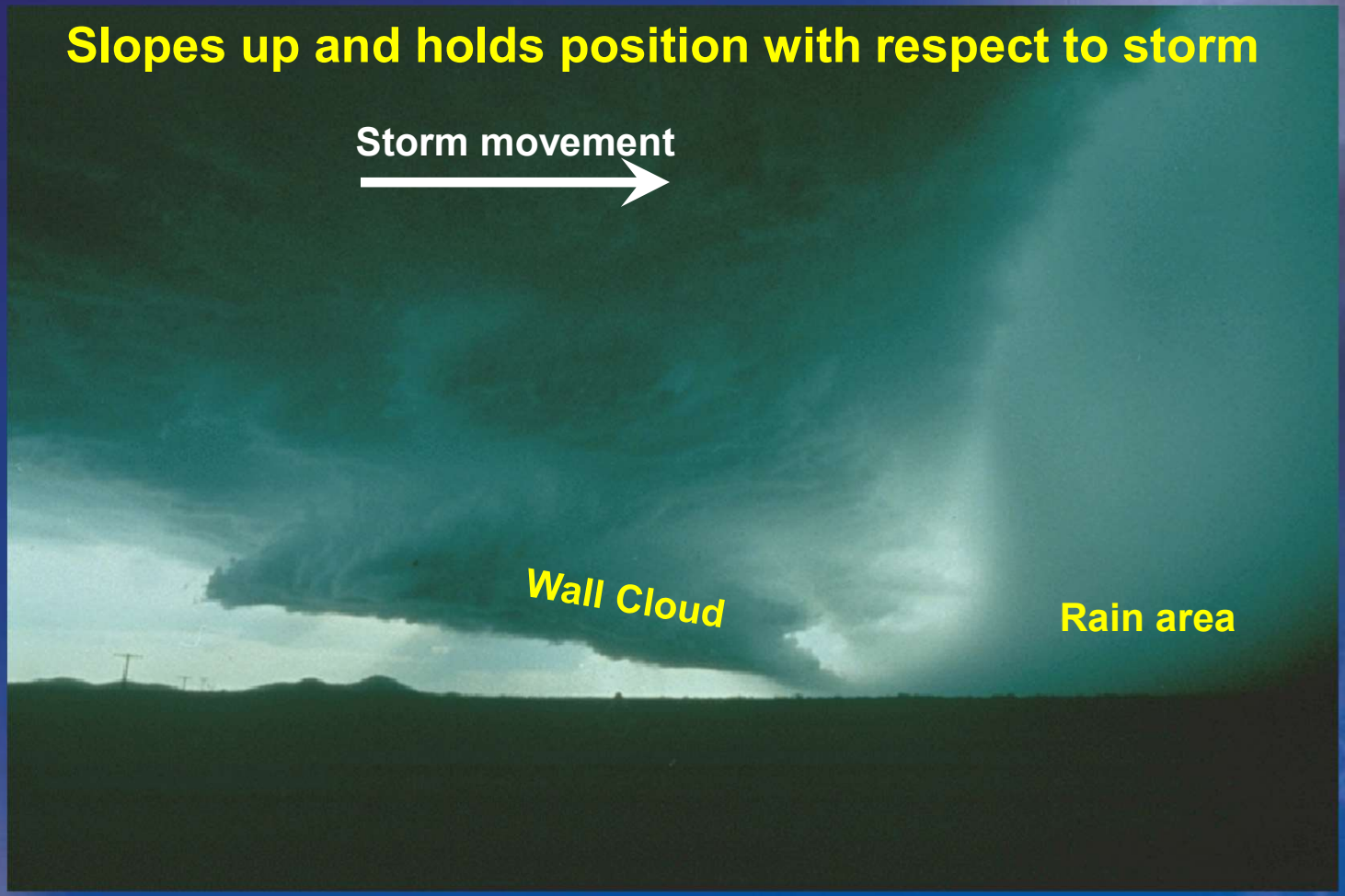
- Suggest updraft/inflow
- Maintain position with respect to precipitation
- Isolated, vertically orientated, *and rotating, like a spinning skater*

Shelf Cloud



The Shelf Cloud is the leading edge of the wind shift

Wall Cloud



The wall cloud does not move away from the rain

Fundamental Definitions – Funnel Cloud

- **Funnel Cloud** - A violently rotating column of air, extending downward from the base of a thunderstorm that ***does not*** reach the ground

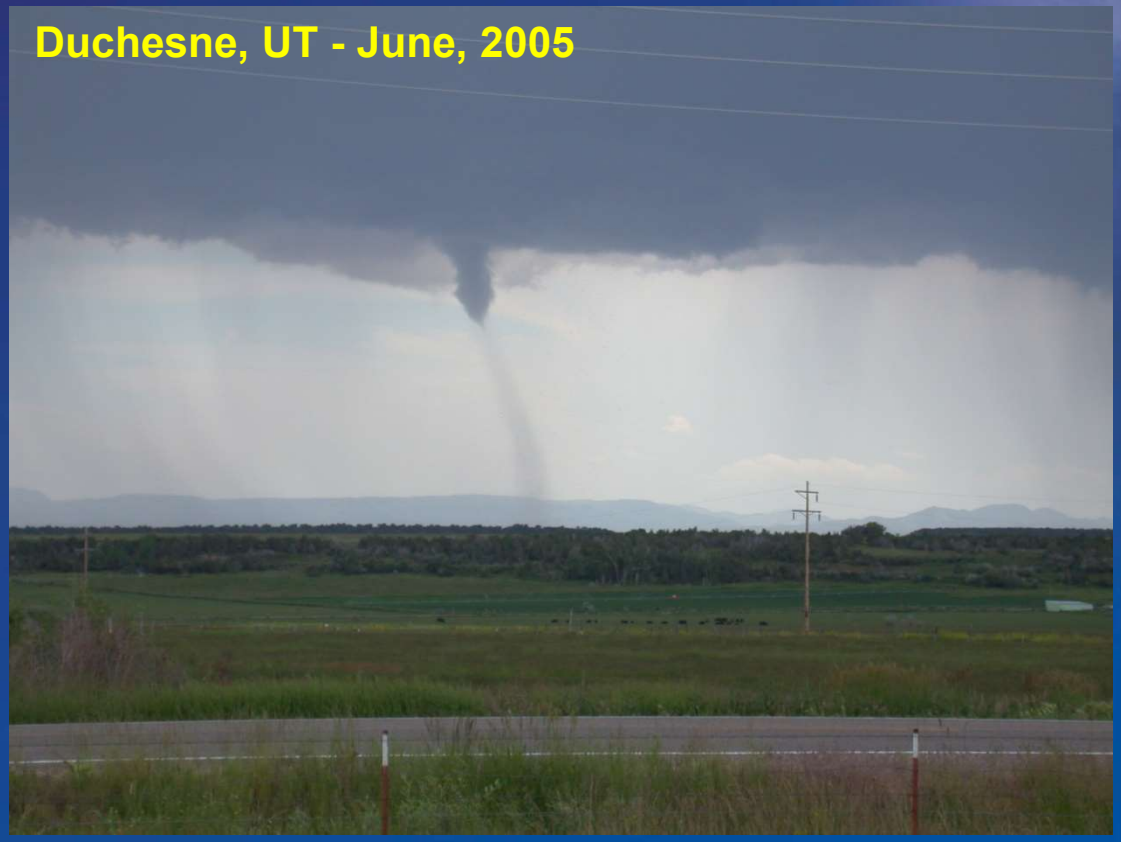
- No circulation is seen on the surface

Fundamental Definitions - Tornado

Tornado - A violently rotating column of air extending from the base of a severe thunderstorm to the ground

Platte/Colfax Counties Nebraska

Funnel Cloud and Initial Tornado
Development Stage



Tornado – Mature Stage

Look-alikes
Don't Be Fooled!

- **Scud Clouds** - Ragged edge clouds that *do not* rotate and are located below the main cloud base…may move up and into cloud base under an updraft

- **Virga** - Rain falling from clouds, but evaporating before reaching the ground…NO rotation, but can imply microburst winds

Night Severe Weather Spotting

What to look and listen for

- Utilize illumination provided by lightning
- If experiencing large hail, you are near the portion of a storm where a tornado may form
- Search horizon for bright flashes of light from power lines and transformers being hit by a tornado

- Listen for a loud roaring sound (not present with all tornadoes and may be from straight line winds)

Lightning Safety

- Monitor NOAA Weather Radio All Hazards, your favorite news source, and/or NWS web sites for vital weather information
- Keep and eye on the sky and listen for the sound of thunder

If you can hear thunder, go to a safe shelter immediately!

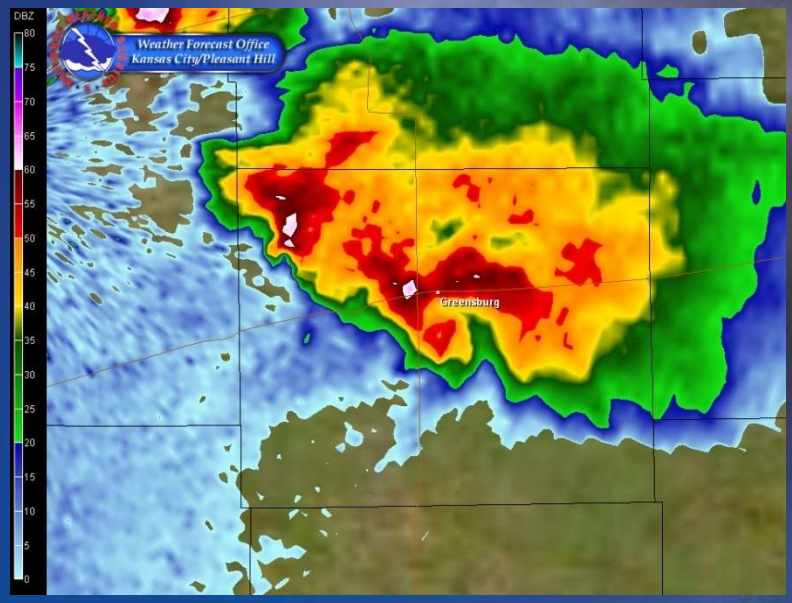
- If you can't get to a safe shelter, stay away from trees and other tall objects
- Avoid leaning against vehicles
- Get out of or off the water

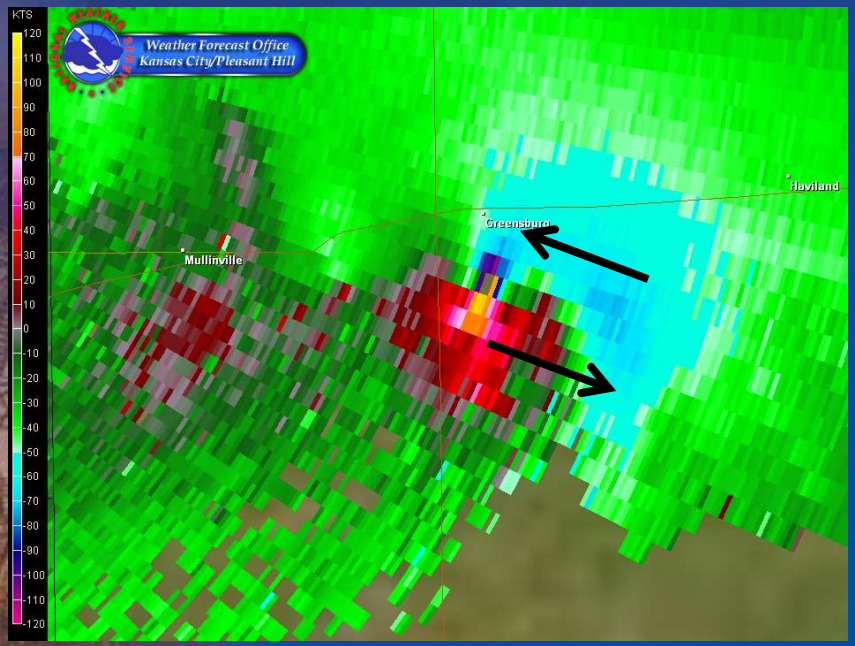
Radar Interpretation 101

Doppler radar data available from NWS web pages

Reflectivity - Hot colors
= more intense echoes

Greensburg, KS EF-5 May 4, 2007

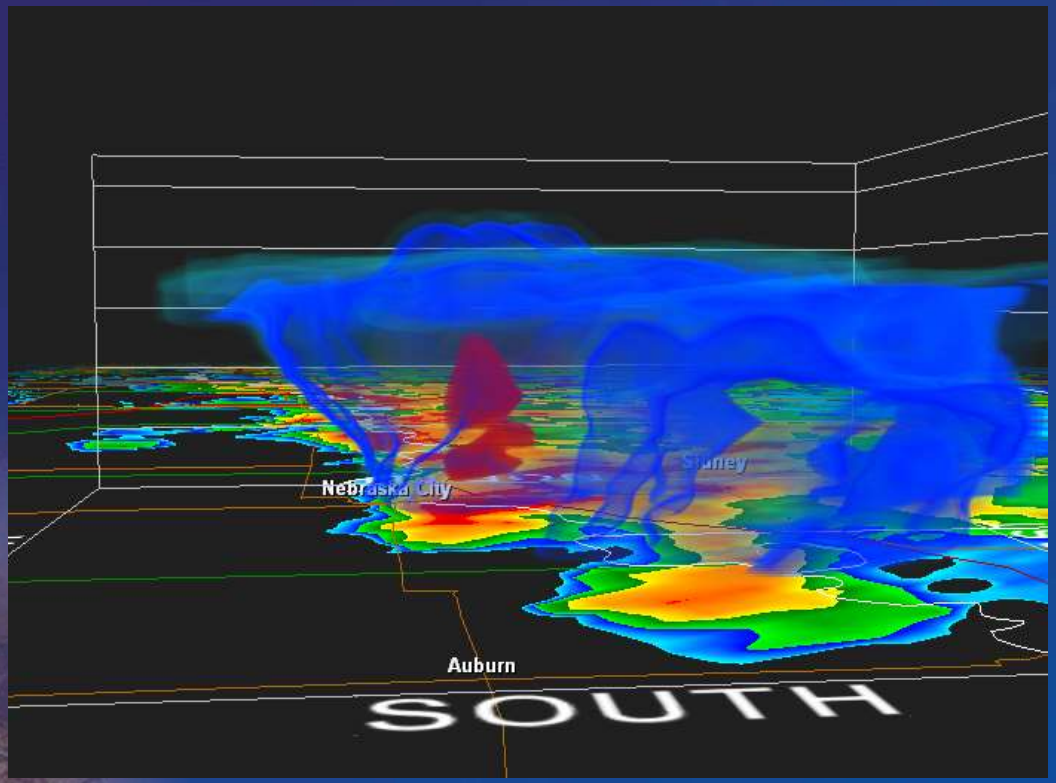


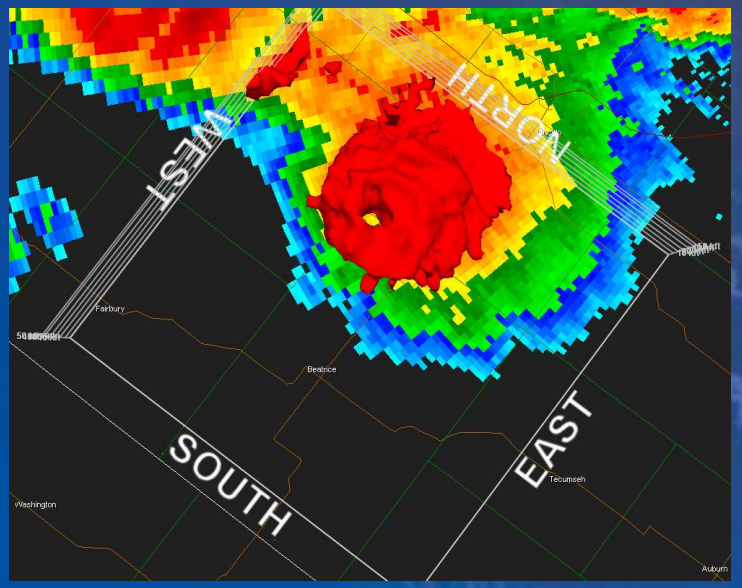


Velocity - Warm colors indicate winds directed away from radar and cool colors winds directed toward radar

Radar Interpretation 101

Doppler in 3-D





Remember…
We Want To Hear From You When the Following Is Observed…

- Tornado
- Funnel Clouds and Wall Clouds
  - Rotating and persistent
- Strong or damaging winds
- Hail (any size)

Don’t assume that we already know it’s happening!

Switching Gears…

Flooding/Flash Flooding

Flooding/Flash Flooding

Respect the water…and think!

Near El Paso, Texas- June 20, 1999

Flooding/Flash Flooding Terms

What to watch for

- Hazardous Weather Outlooks/Special Weather Statements
- Flash Flood Potential Rating
- Watches
- Warnings
- Advisories

Flooding/Flash Flooding Reporting

Report the following immediately:

- Flooding or rapidly rising water
- Unusually high or flowing faster than normal
- Water approaching bankfull stage or nearing roads/structures
- Inch or more of rainfall observed in a short duration (less in steep/rocky terrain or in burn areas)
- Any flooding observed
- Debris flows or rock slides

Flooding/Flash Flooding Reporting

Additional guidance:

- Watch for extended periods of heavy rainfall from slow moving thunderstorms
- Look for thunderstorms ‘training’ over the same locations
- Report water as it begins to rise and before it starts to impact people’s lives
- Don’t assume that we already know it’s happening!

Marine Weather

Marine Weather Terms

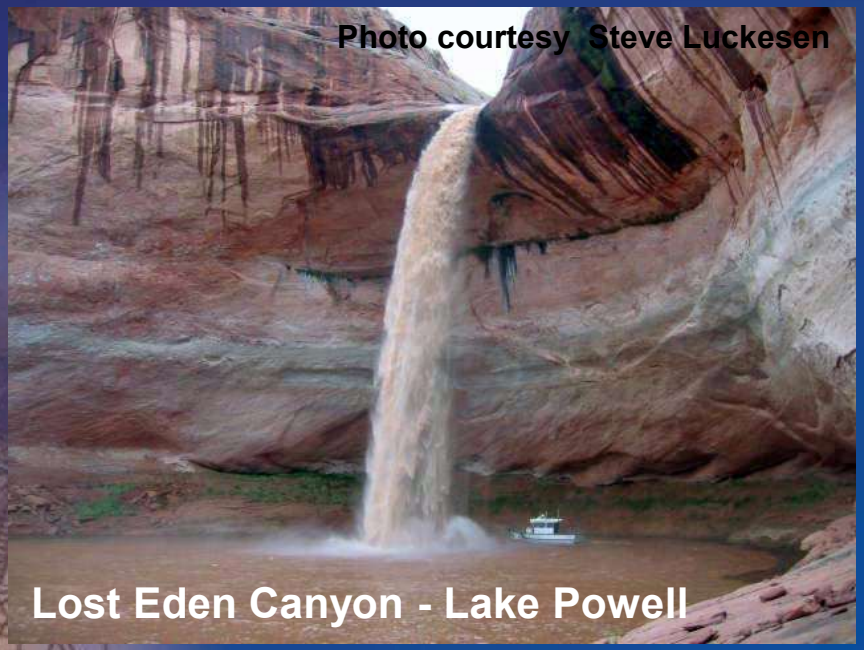
What to watch for

- Hazardous Weather Outlooks/Special Weather Statements
- Watches
- Warnings
- Advisories

Marine Weather Reporting

Report the following:

- **Winds and waves impacting craft**
- **Waterspouts**
- **Dense fog**



Fire Weather

Salt Creek Fire – July 2007

Fire Weather Terms

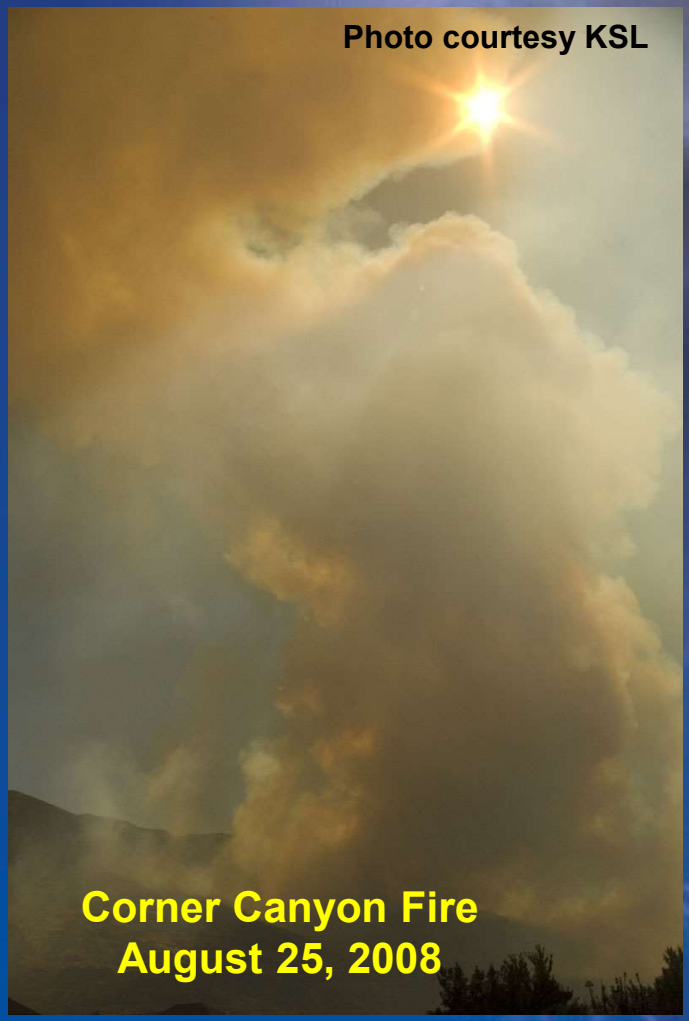
What to watch for

- Hazardous Weather Outlooks
- Watches
- Warnings

Wildfire Reporting

Report the following:

- New wildfire starts, especially if threatening life and property
- Smoke reducing visibility to less than 2 miles
- Weather pattern information (afternoon wind shifts) in wildfire locations (provides insight to forecasters)



Winter Weather

Elk Point Avalanche

Winter Weather Terms

What to watch for

Cedar City Doppler Radar
Blowhard Mountain

- Hazardous Weather Outlooks/Special Weather Statements
- Watches
- Warnings
- Advisories

Winter Weather Reporting

Report the following:

- Snowfall accumulations
  - –How much total snow fell (period of time)
  - –When snow began/ended
  - –When snow total reached warning level
- Snow depth
- Freezing rain accumulation
- Precipitation type changes

Draper - February 2008

Safety - ACES

- Awareness
- Communication
- Escape Routes
- Safe Zones

El Reno: Lessons From the Most Dangerous Tornado in Storm Observing History

http://www.youtube.com/watch?v=TBjr-nvA2Jg

Share Your Information!

Severe Weather Spotter Line:
800-882-1432 x1

Storm Reports
https://inws.ncep.noaa.gov/report

Spotter Reports E-mail:
utah.spotter@noaa.gov

Twitter
@NWSSaltLakeCity
https://twitter.com/NWSSaltLakeCity

Facebook
US National Weather Service Salt Lake City Utah
https://www.facebook.com/NWSSaltLakeCity

Call for Video and Photos

If you are in a SAFE location and have the chance to shoot video/pictures, please share it with us for inclusion in future presentations

Additional Training

- **SKYWARN® Spotter Training**
  - **Role of the Skywarn Spotter**
  - **Skywarn Spotter Convective Basics**
- **Available at https://www.meted.ucar.edu/training_course.php?id=23**
- **The COMET® Program - MetEd**

Contact WFO SLC

Kevin Barjenbruch
Warning Coordination Meteorologist
kevin.barjenbruch@noaa.gov


Salt Creek Fire - July 2007

National Weather Service Salt Lake City
2242 West North Temple
Salt Lake City, UT 84116
https://www.weather.gov/saltlakecity

UTAH AND SOUTHWEST WYOMING WEATHER SPOTTER HOME PAGE
https://www.weather.gov/slc/spotter