

# 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



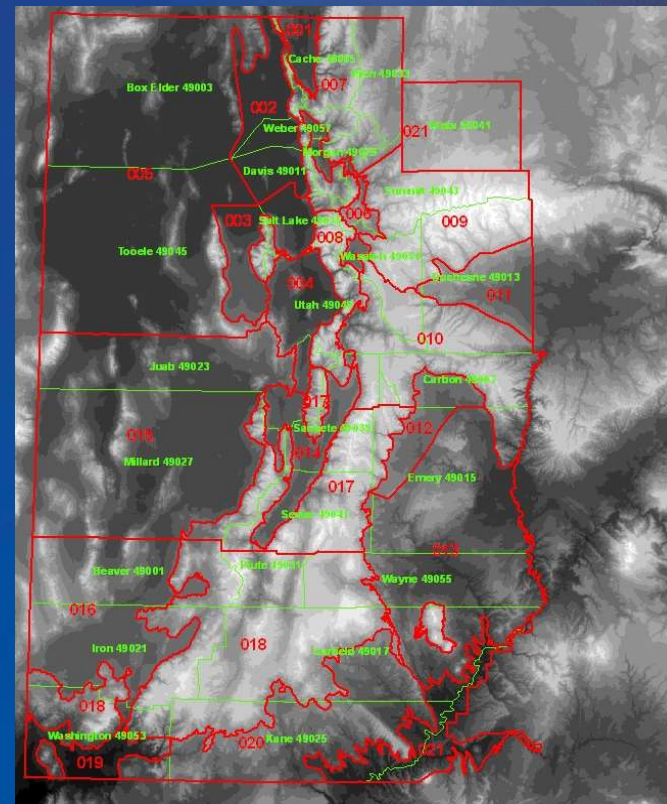
# About the National Weather Service (NWS)

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

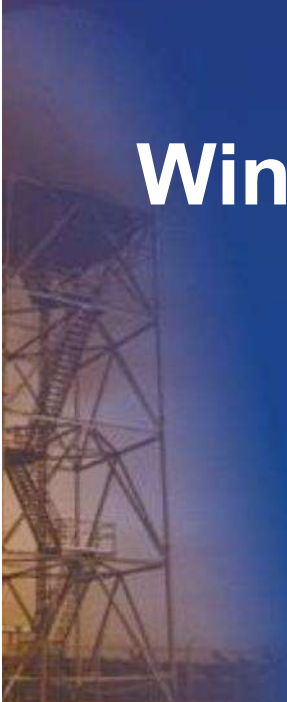
Debris Flows

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



Photo courtesy Scott G Winterton, Deseret News

**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



Photo courtesy Amber Bird

## **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



**102 mph wind gust  
recorded in Centerville**

**\$4 million damage to  
public infrastructure**

**\$78 million damage to  
insured property**

**Centerville**

Photo courtesy Deseret News



**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



I-80 - Salt Lake City

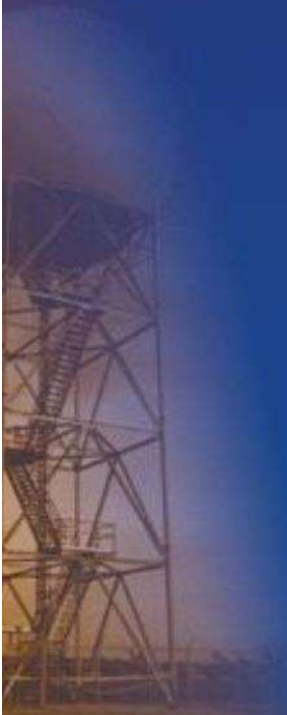
Photo courtesy Kristin Murphy Deseret News

# Winter Storms

Photo courtesy Kevin Barjenbruch



Draper



# 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](mailto:utah.spotter@noaa.gov)

Twitter

[@NWSSaltLakeCity](https://twitter.com/NWSSaltLakeCity)

<https://twitter.com/NWSSaltLakeCity>

Facebook

US National Weather Service Salt Lake City Utah

<https://www.facebook.com/NWSSaltLakeCity>



**Dust storm near Milford, UT**

# 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](mailto: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

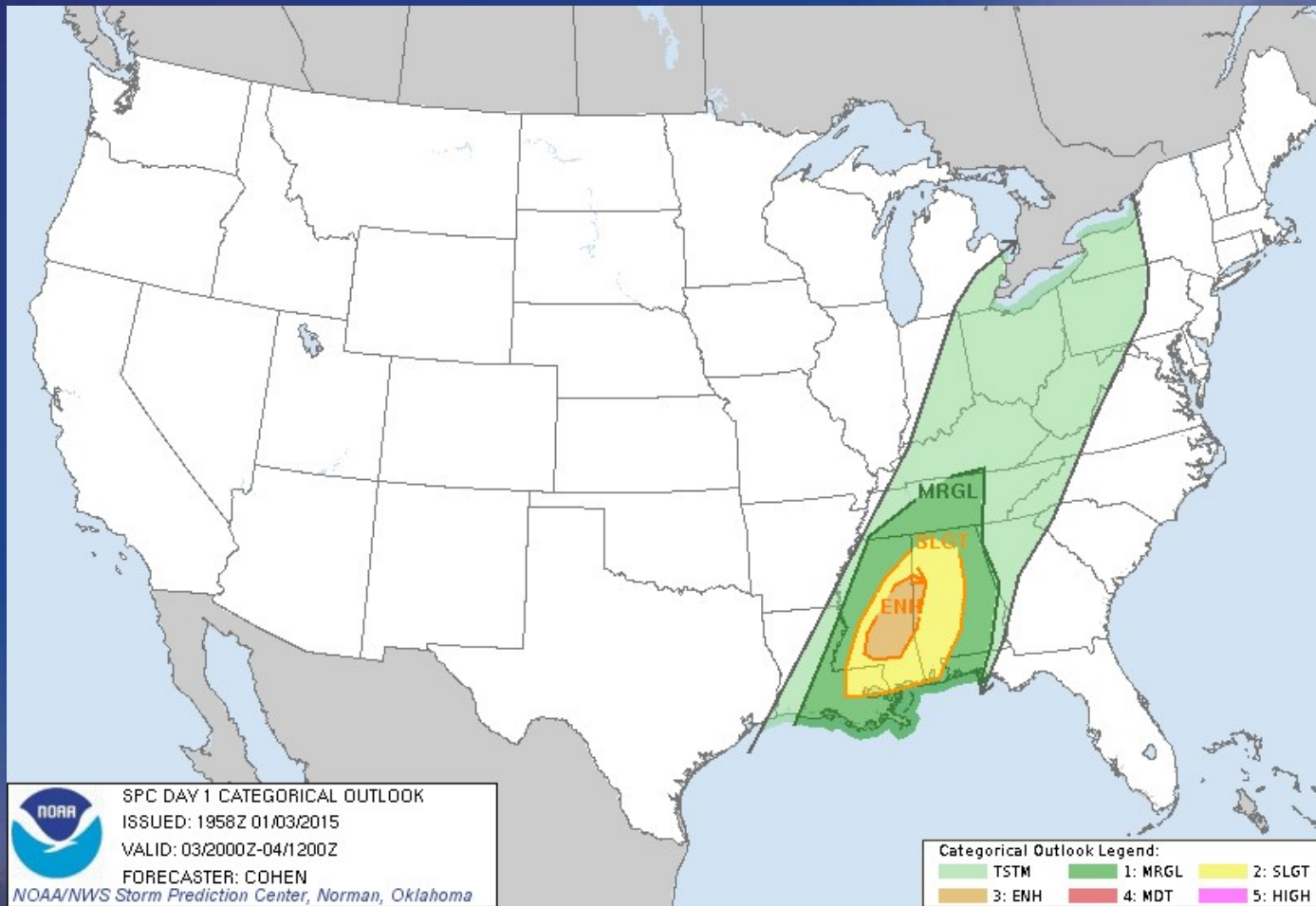
- Utilize WFO Salt Lake City web services  
<http://weather.gov/saltlakecity>
  - Text and graphical services
    - Dynamically generated forecasts
    - Hazardous Weather Outlook
    - Watches, warnings, and advisories
  - YouTube briefings
  - Weather Story
  - Social media
  - Radar imagery
- NOAA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

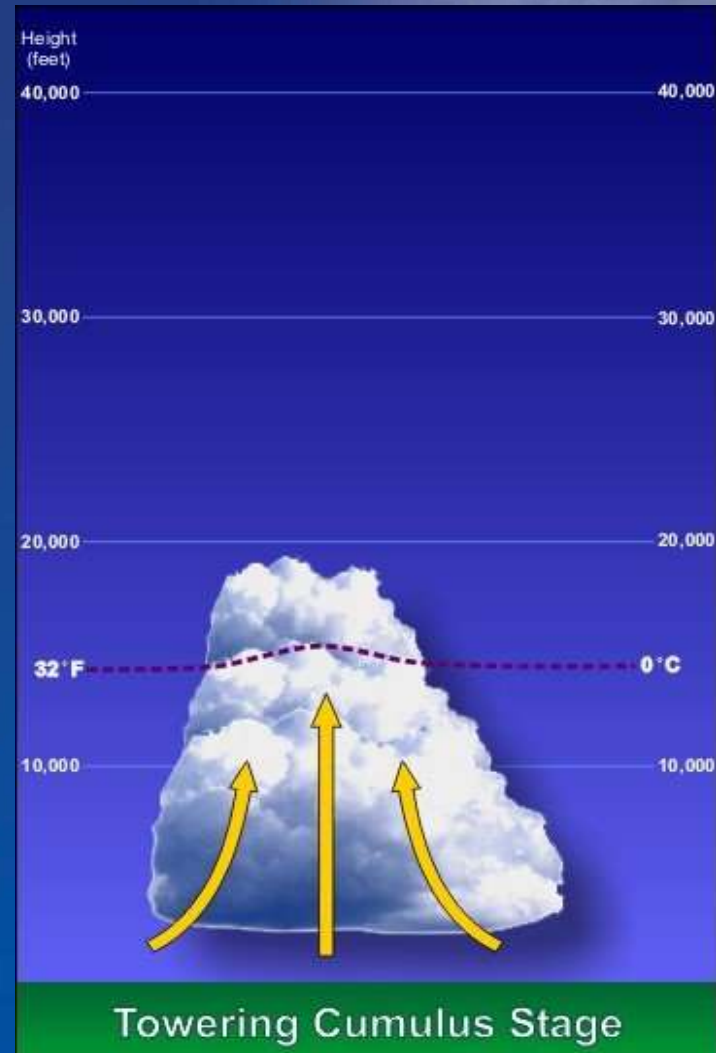
- Tornado
- Winds at least 58 mph or reports of wind damage
- Hail at least 1 inch in diameter



# 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

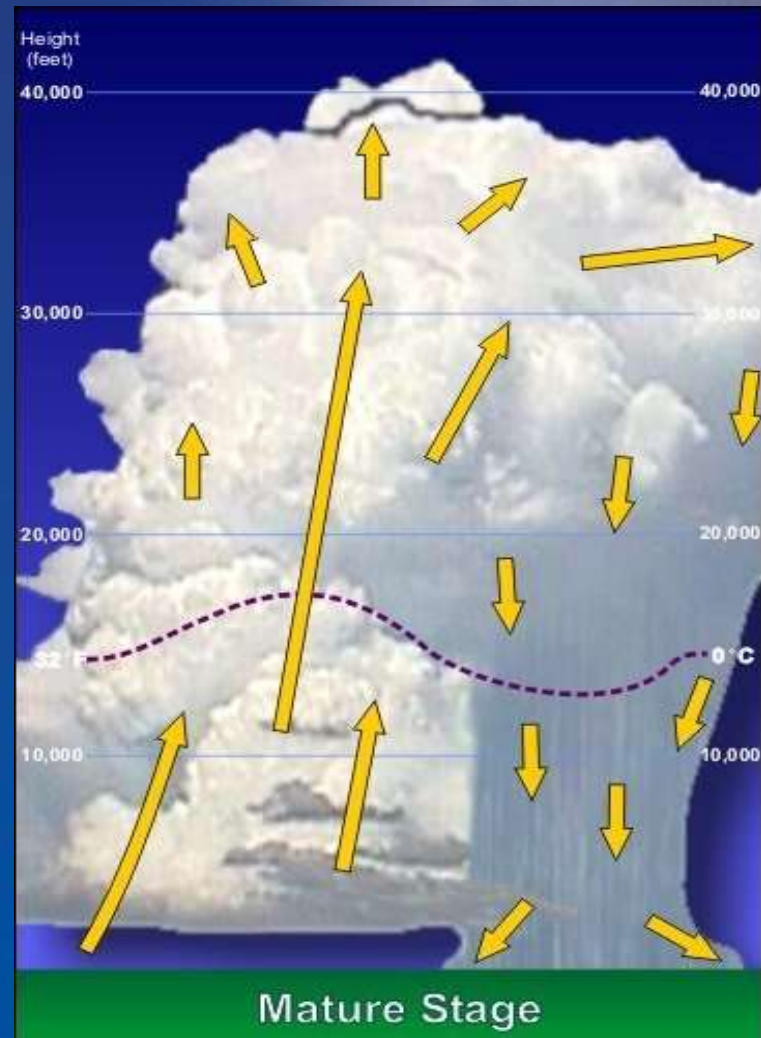




# Thunderstorm Life Cycle

## Mature Stage

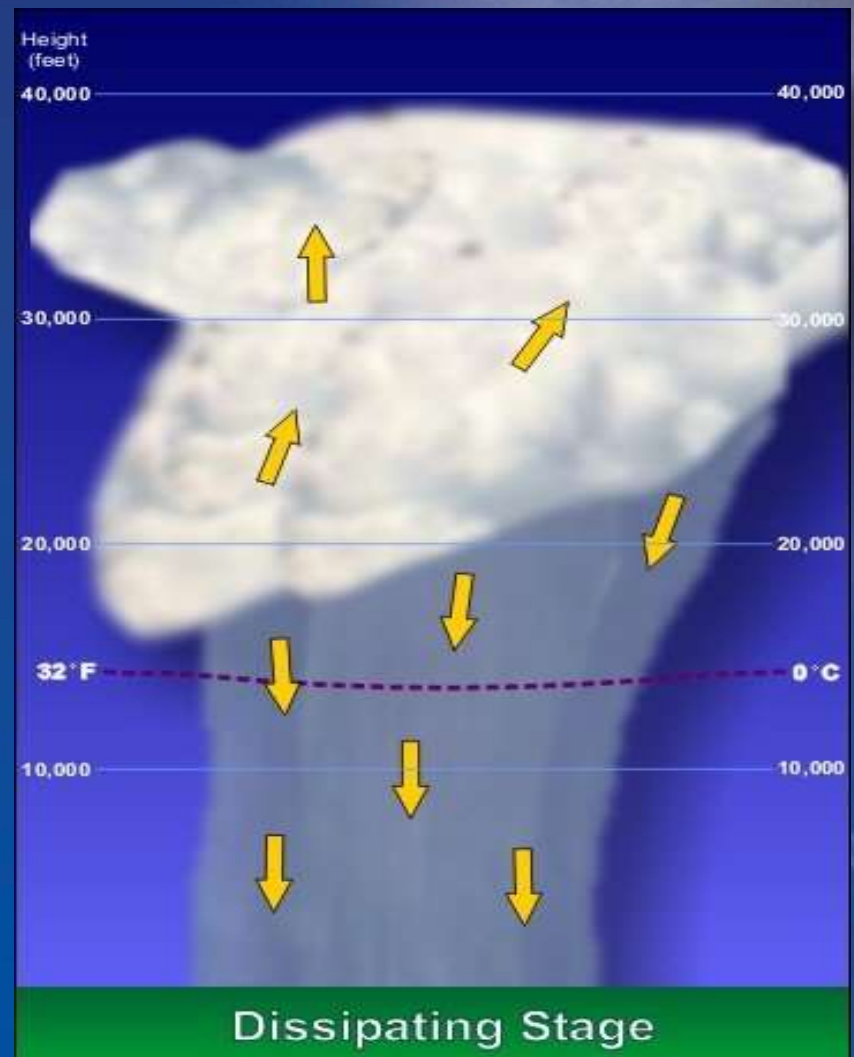
- The weather stage
- Hail, heavy rain, lightning, strong winds, tornadoes
- Anvil at storm top
- Rising air/falling rain (updraft/downdraft)
- Typically lasts 10-20 minutes



# 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



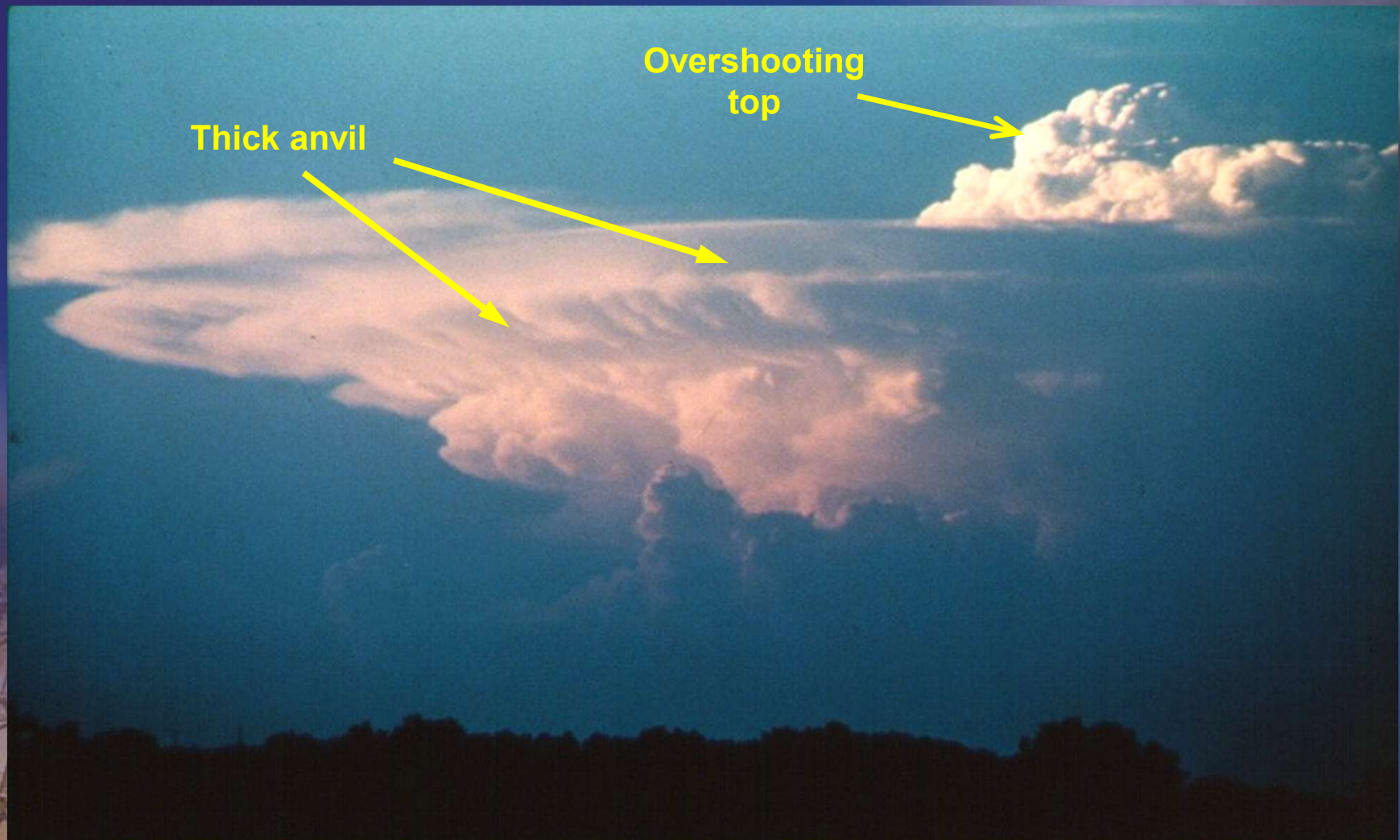
# Observing Upper Level Storm Clues

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

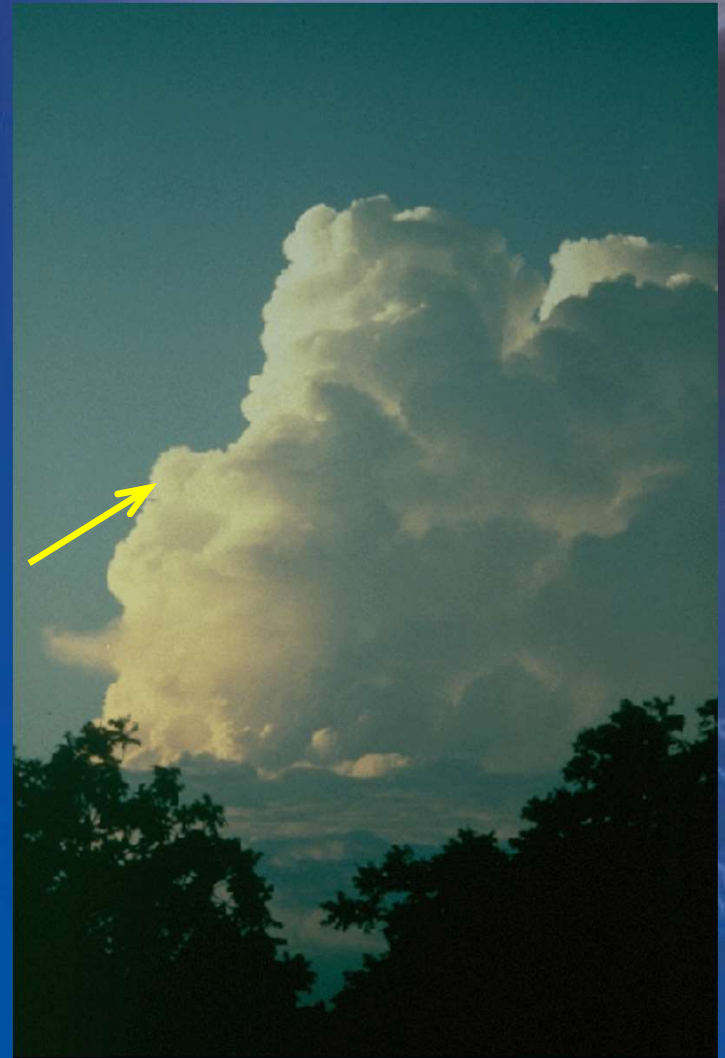
Vertically upright

## 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



**Measure wind speeds when possible!**

# Hail Clues

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



Southern Utah - October 2006



- **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”



Reference hail size in inches or relate it to the size of a coin.



**Quarter  
(1 inch)**



**Nickel**



**Penny  
(3/4  
inch)**



**Dime  
(11/16  
inch)**

# Hail Boys



# A Closer Look

## Supercells, Tornadoes, Funnel Clouds, and Wall Clouds



Dunlap, IN - April 11, 1965



# Yes...Tornadoes Do Happen in Utah!



# Fundamental Definitions – Supercell Thunderstorm

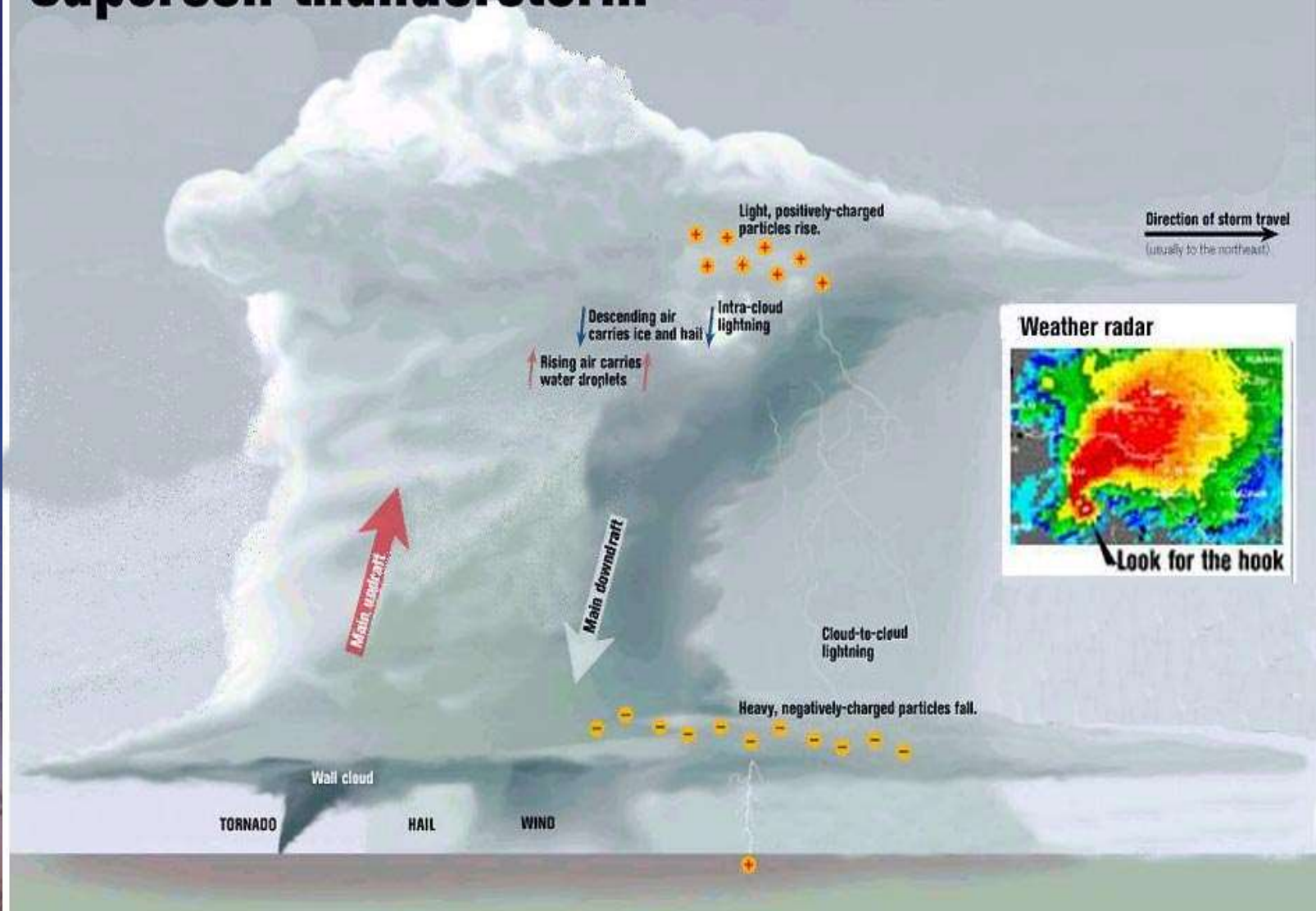
- **Supercell** – A thunderstorm with a persistent rotating updraft
- Almost always severe with large hail, damaging winds, and tornadoes

Photo courtesy Greg Lunden

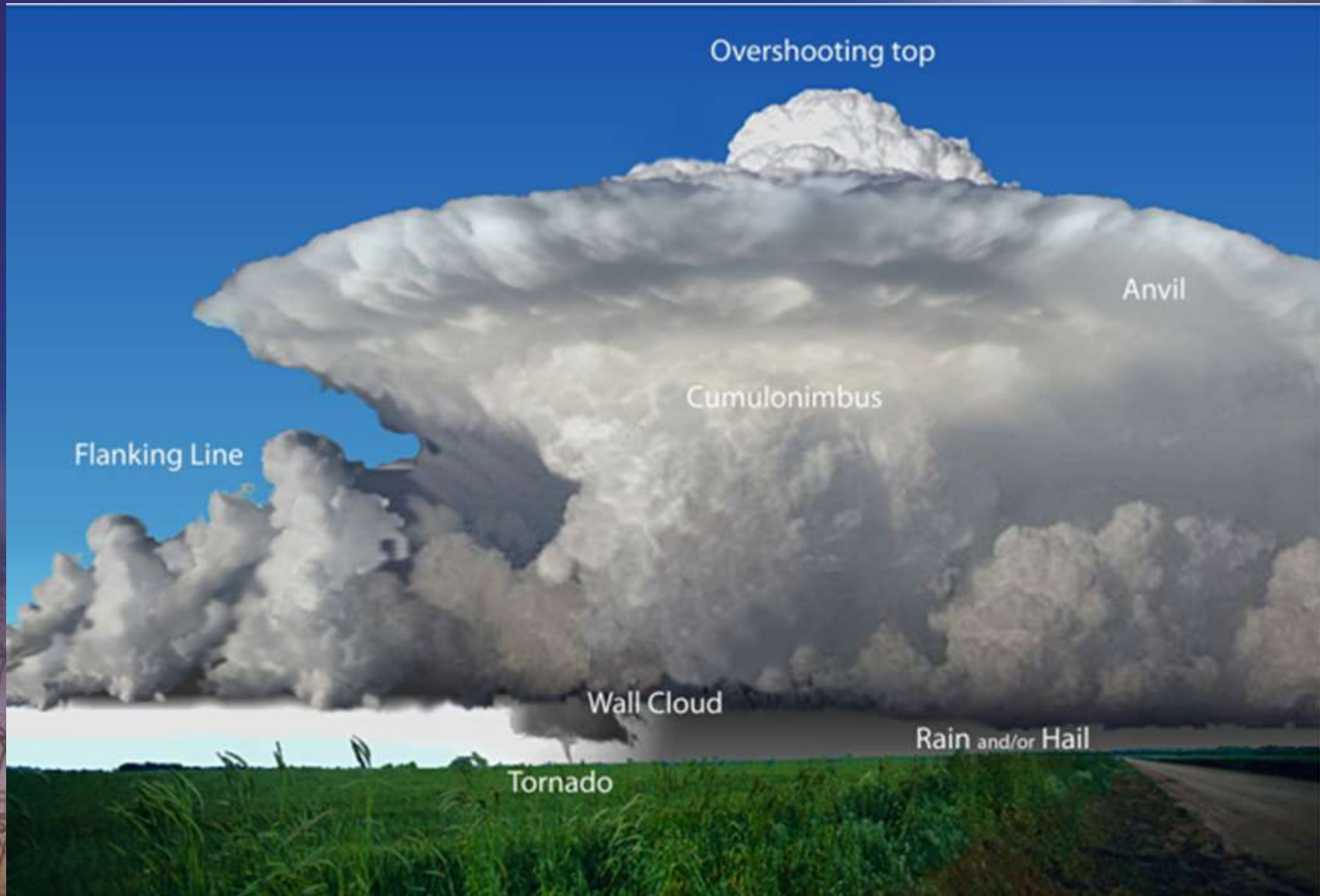


# Supercell Depiction

## Supercell thunderstorm



# Supercell Depiction – Second Look



# Fundamental Definitions - Mesocyclone

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

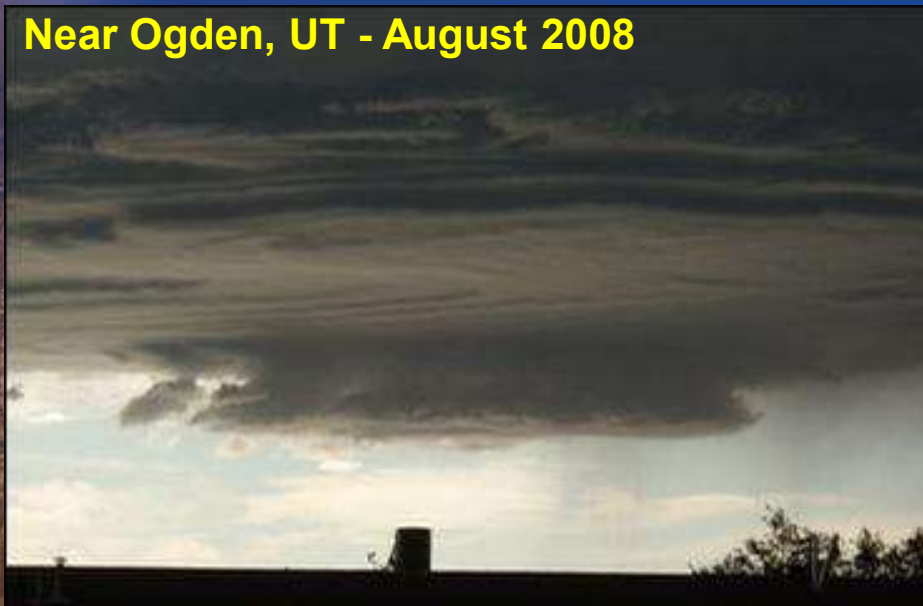


# Fundamental Definitions – Wall Cloud

- **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

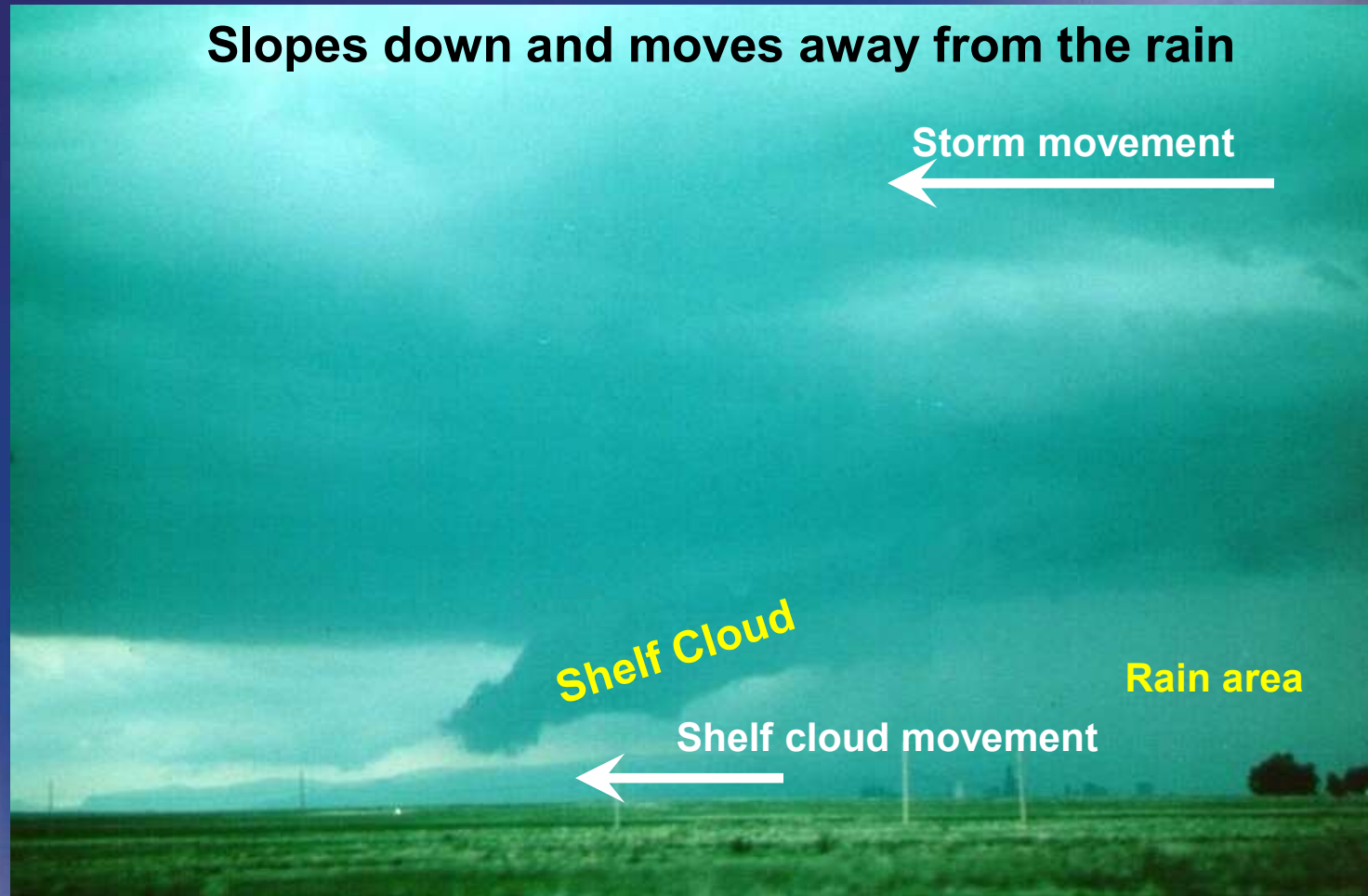
## Wall Clouds



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

# Shelf Cloud

Slopes down and moves away from the rain



The Shelf Cloud is the leading edge of the wind shift



# Wall Cloud

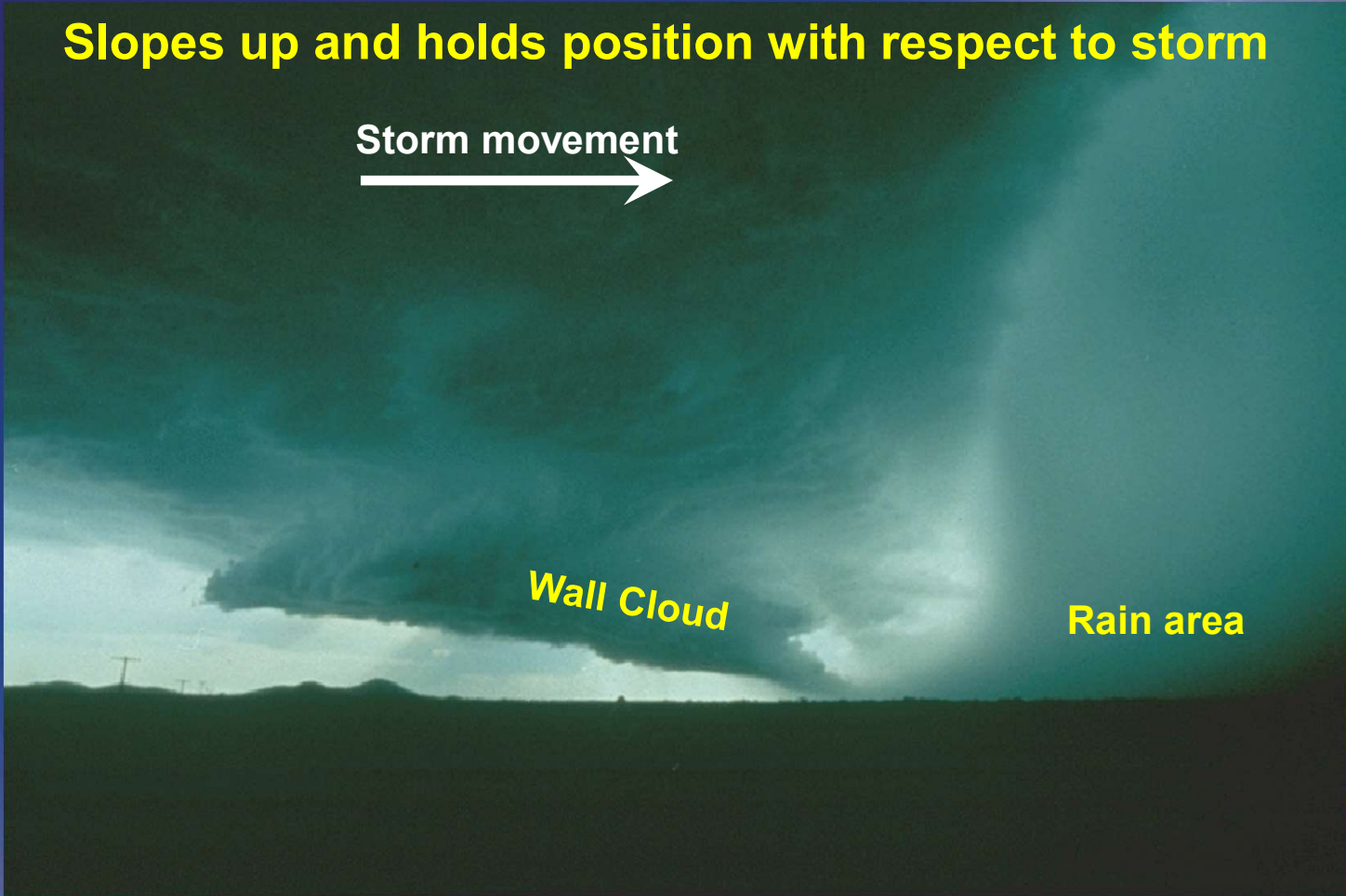
Slopes up and holds position with respect to storm

Storm movement  
→

Wall Cloud

Rain area

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

Panguitch, UT - August 26, 2016



Photo courtesy Shilo Hatch

# 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

Duchesne, UT - June, 2005



# 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 an 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



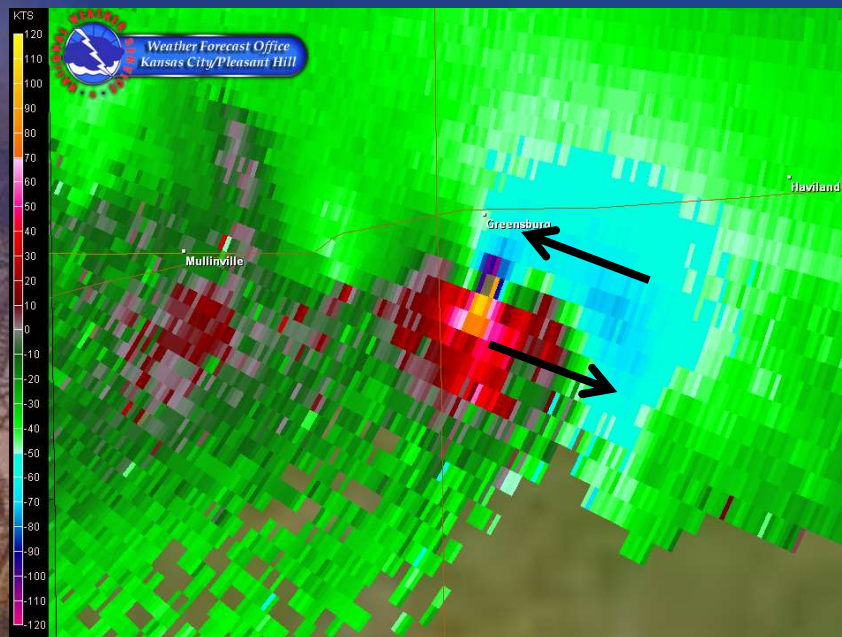
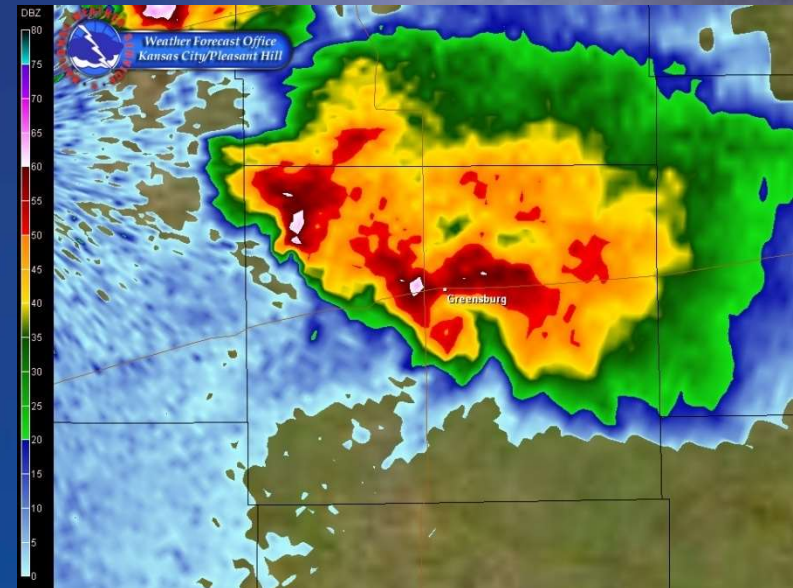


# Radar Interpretation 101

Doppler radar data available from NWS web pages

Reflectivity - **Hot colors**  
= more intense echoes

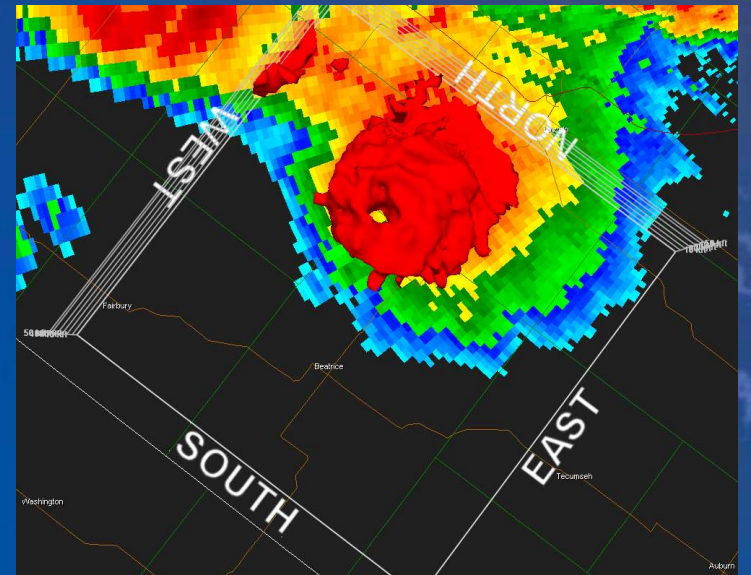
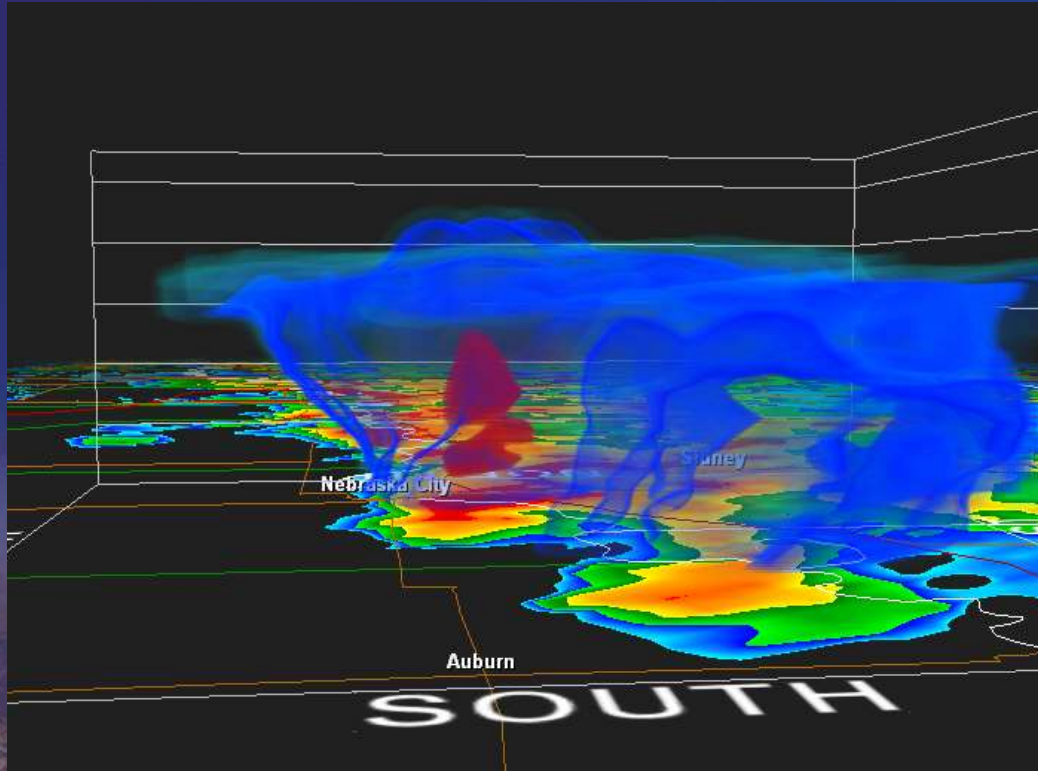
Greensburg, KS EF-5 May 4, 2007



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

# Radar Interpretation 101

## Doppler in 3-D



A dark, stormy sky with a lightning bolt striking down on the right side. On the left side, a metal tower structure is visible against the dark background.

# 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



**Lower Enterprise Dam  
January 13, 2005**



# 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

Photo courtesy David Rankin



**Navajo Generating Station**

# Marine Weather Terms

## What to watch for

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

Photo courtesy David Rankin



Wahweap Bay and Warm Creek Bay

# 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**

Salt Creek Fire – July 2007



# 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)

Photo courtesy KSL

**Corner Canyon Fire  
August 25, 2008**



# 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

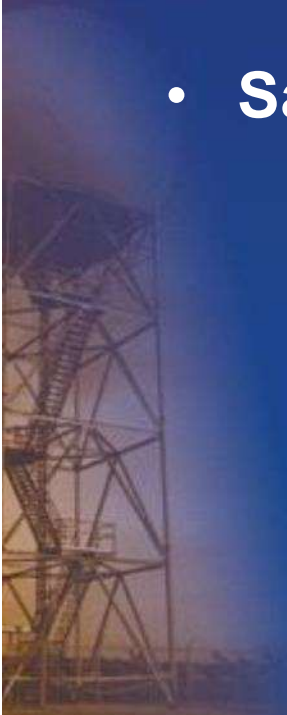
Report the following:

- **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**



# 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](tel:800-882-1432)

Storm Reports

<https://inws.ncep.noaa.gov/report>

Spotter Reports E-mail:

[utah.spotter@noaa.gov](mailto:utah.spotter@noaa.gov)

Twitter

[@NWSSaltLakeCity](https://twitter.com/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*



**Photo Courtesy Chris Maier**

# 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](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>**