

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



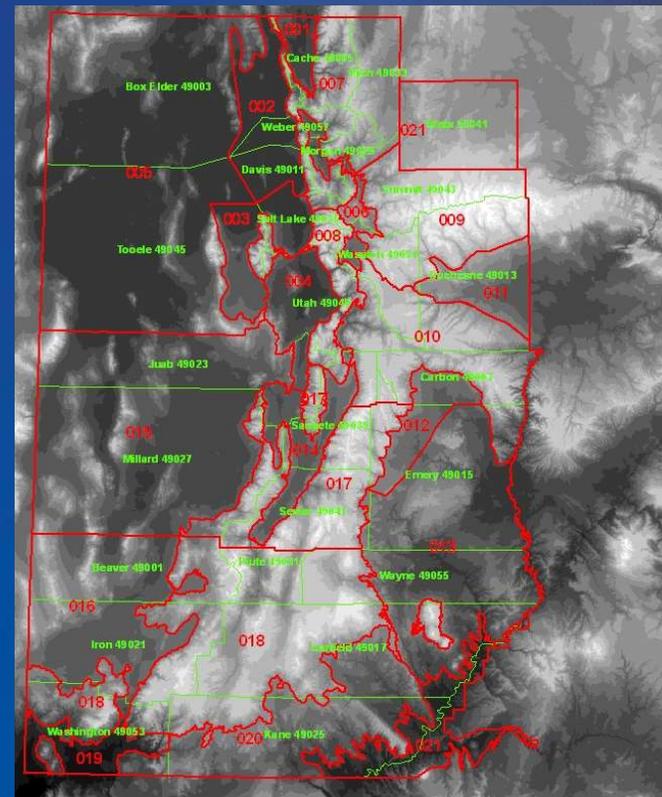
About the National Weather Service (NWS)

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



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

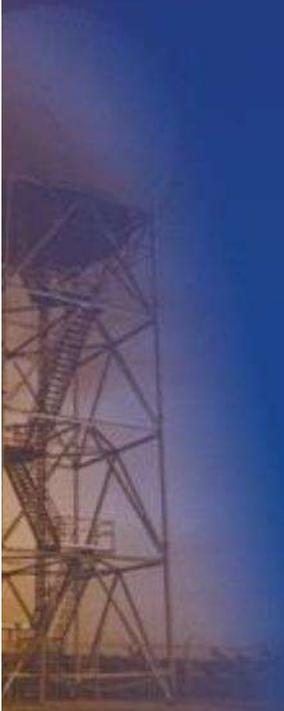
Photo courtesy Kristin Murphy Deseret News

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

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



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

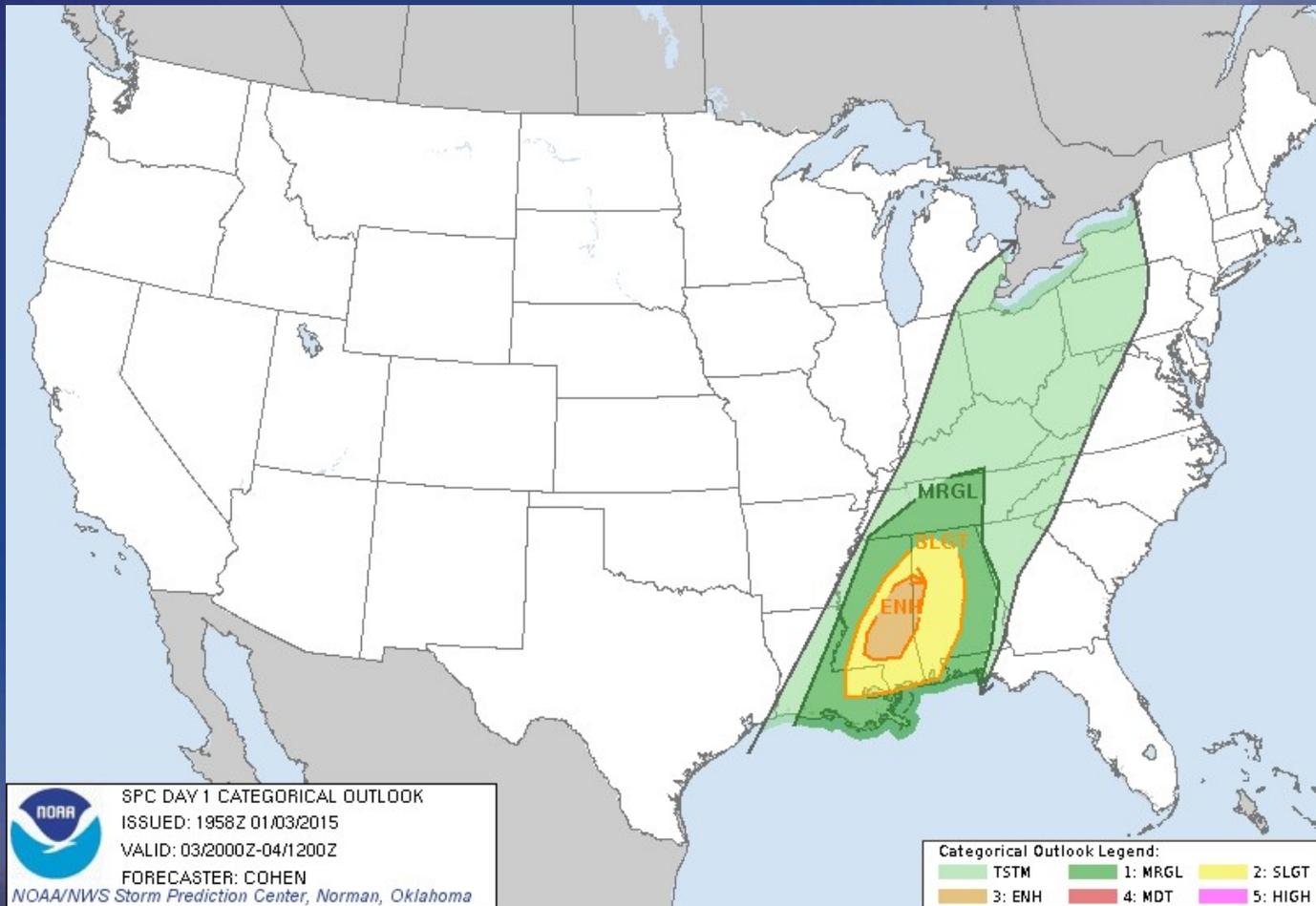
- Utilize WFO Salt Lake City web services
<http://weather.gov/saltlakecity>
 - Text and graphical services
 - Dynamically generated forecasts
 - Hazardous Weather Outlook
 - Watches, warnings, and advisories
 - YouTube briefings
 - Weather Story
 - Social media
 - Radar imagery
- NOAA Weather Radio All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

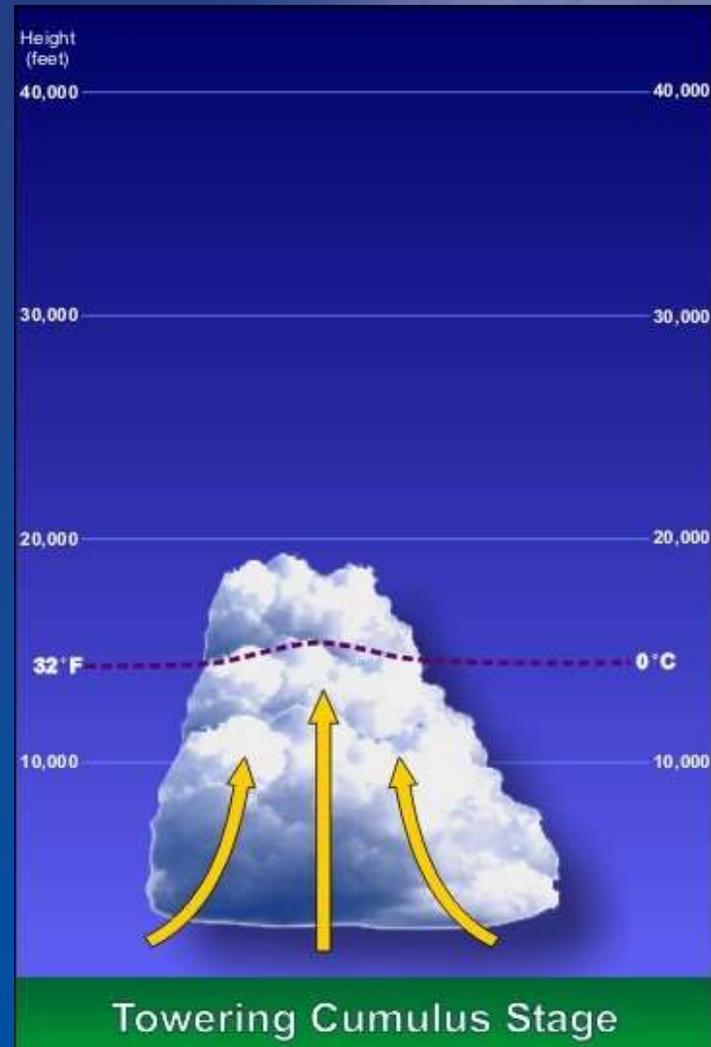
- Tornado
- Winds at least 58 mph or reports of wind damage
- Hail at least 1 inch in diameter



Thunderstorm Life Cycle

Towering Cumulus - Developing

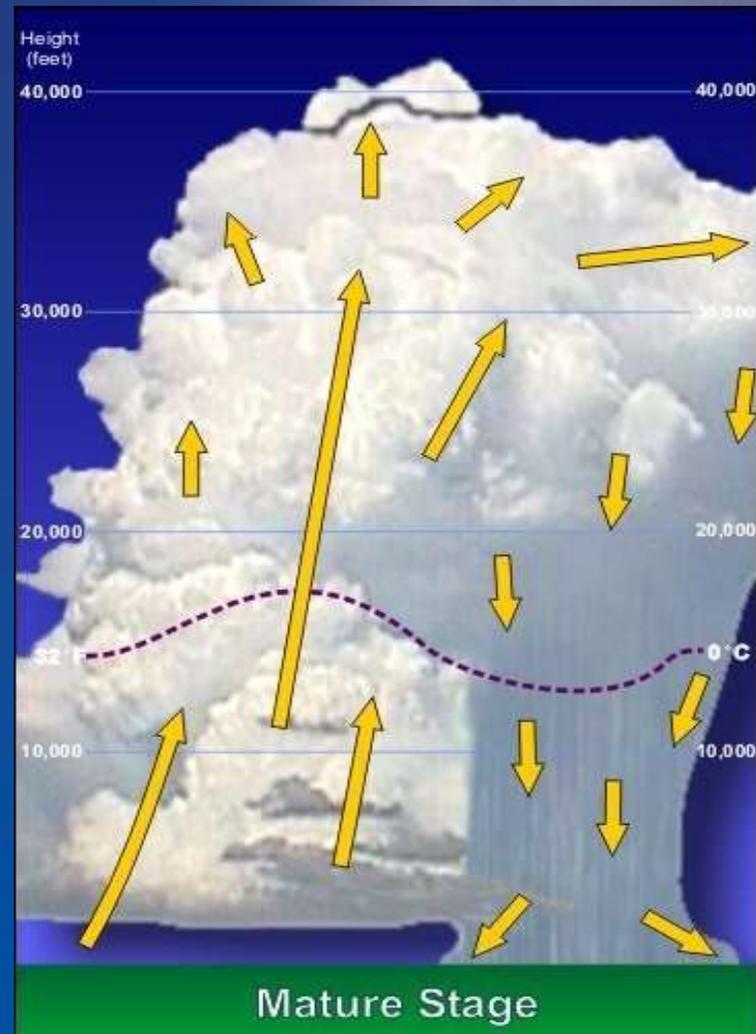
- Towering, billowy bright white clouds
- Dominated by updraft – rising air
- Lasts 10-15 minutes
- Little rain, but lightning possible



Thunderstorm Life Cycle

Mature Stage

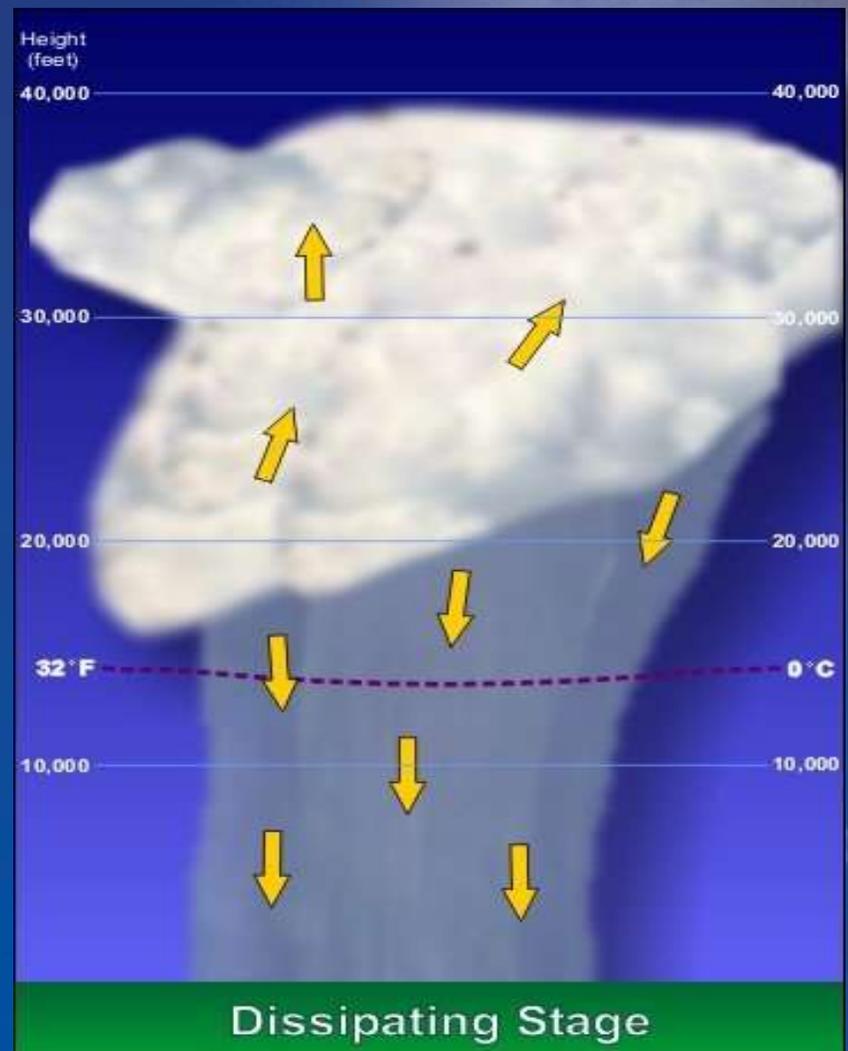
- The weather stage
- Hail, heavy rain, lightning, strong winds, tornadoes
- Anvil at storm top
- Rising air/falling rain (updraft/downdraft)
- Typically lasts 10-20 minutes



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



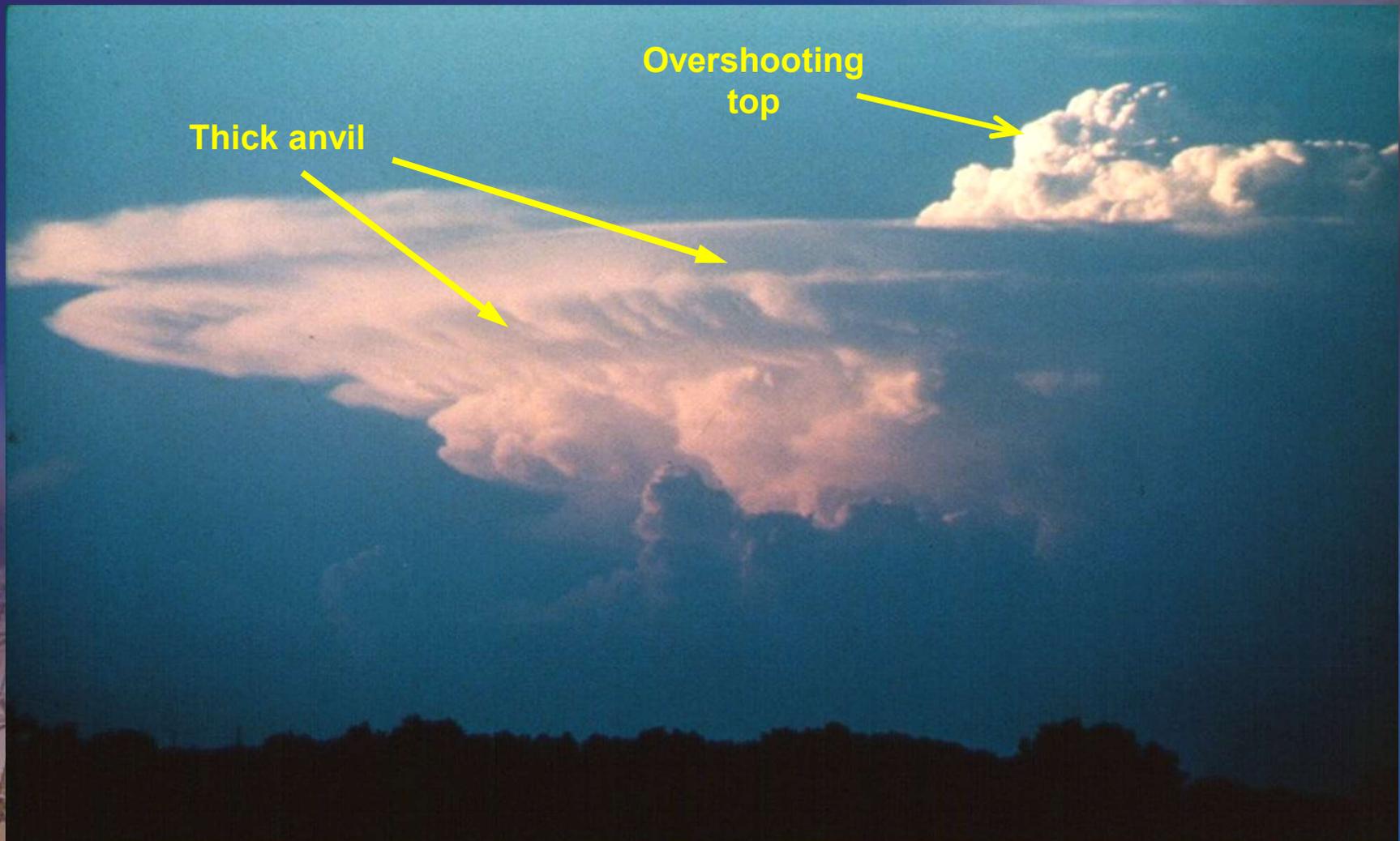
Observing Upper Level Storm Clues

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



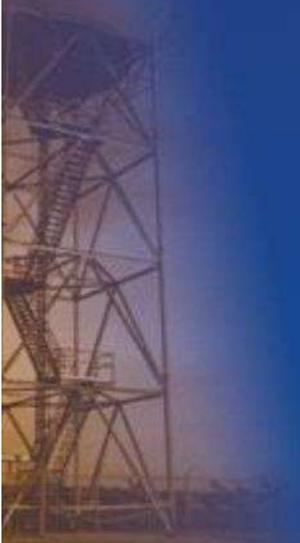
Intensity clues – Overshooting Top



Intensity Clues - Anvil



Well defined anvil



Wispy anvil



13 14:54

Intensity clues - Updraft

Viewed 10-20 miles from the storm



Strong updraft

Hard cauliflower appearance

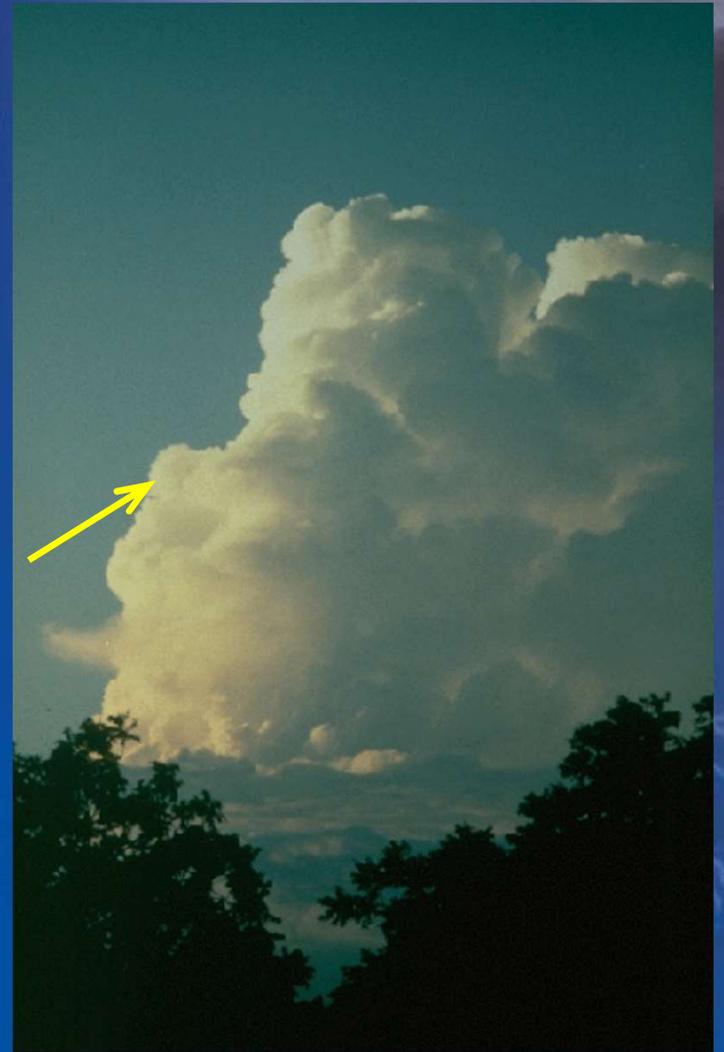
Vertically upright

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



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!



**Salt Lake City
August 11, 1999**



**Manti
September 8, 2002**

Fundamental Definitions – Supercell Thunderstorm

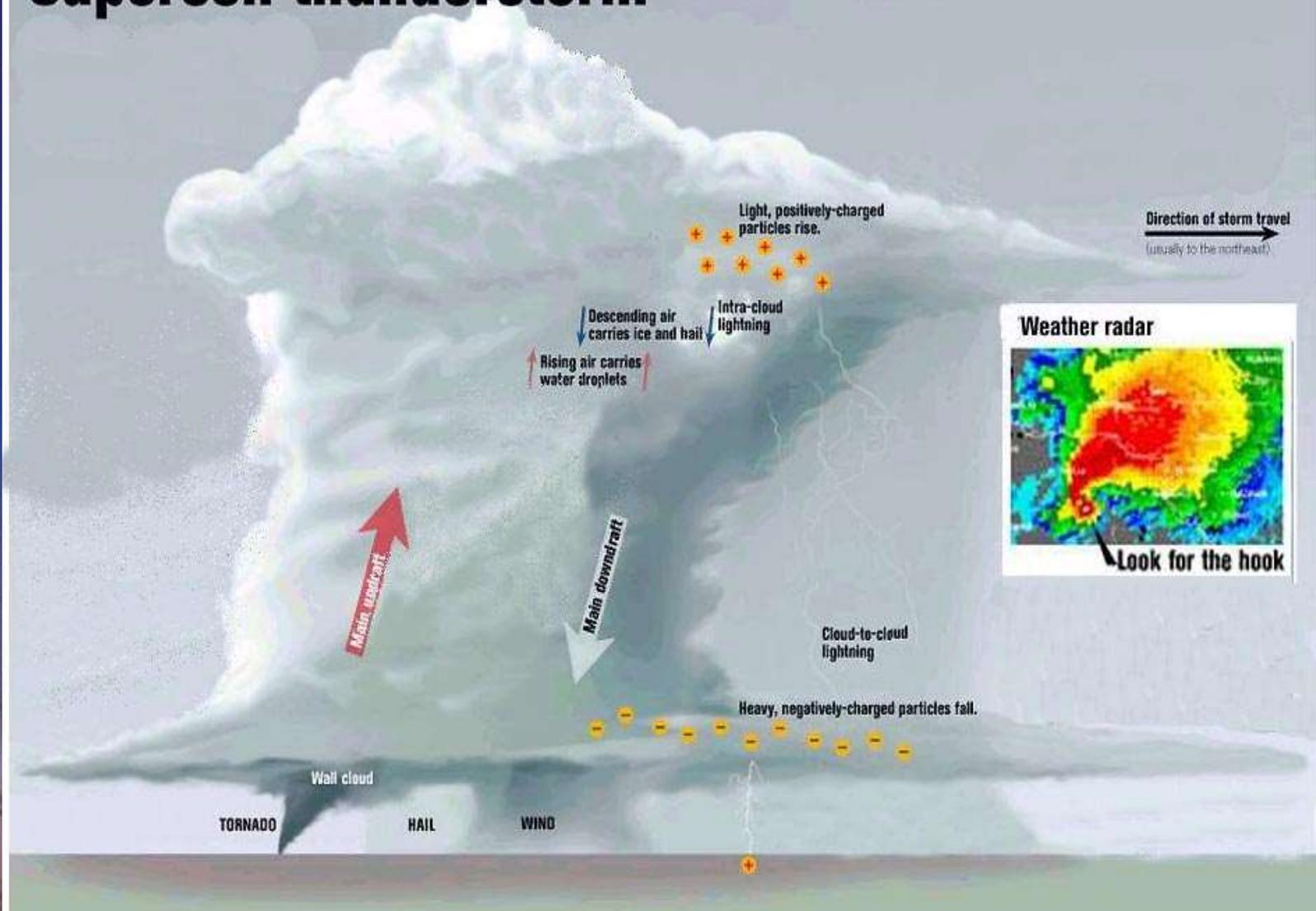
- **Supercell** – A thunderstorm with a persistent rotating updraft
- Almost always severe with large hail, damaging winds, and tornadoes

Photo courtesy Greg Lunden

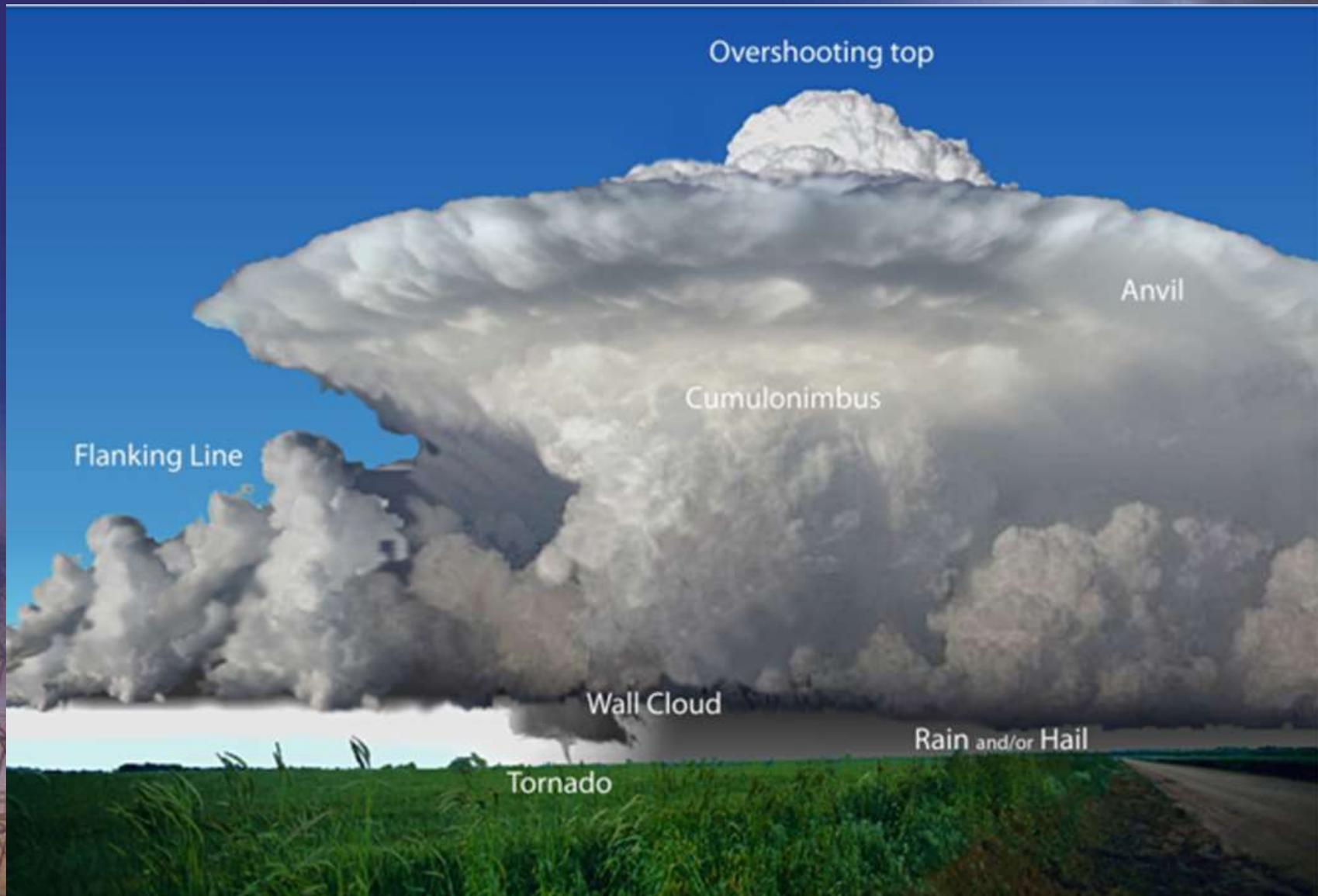


Supercell Depiction

Supercell thunderstorm



Supercell Depiction – Second Look



Fundamental Definitions - Mesocyclone

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

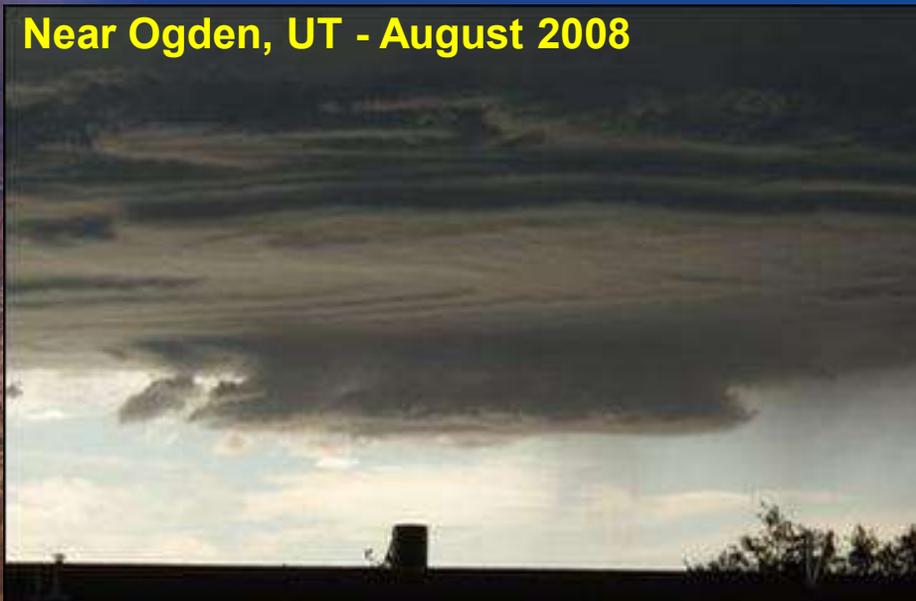


Fundamental Definitions – Wall Cloud

- **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

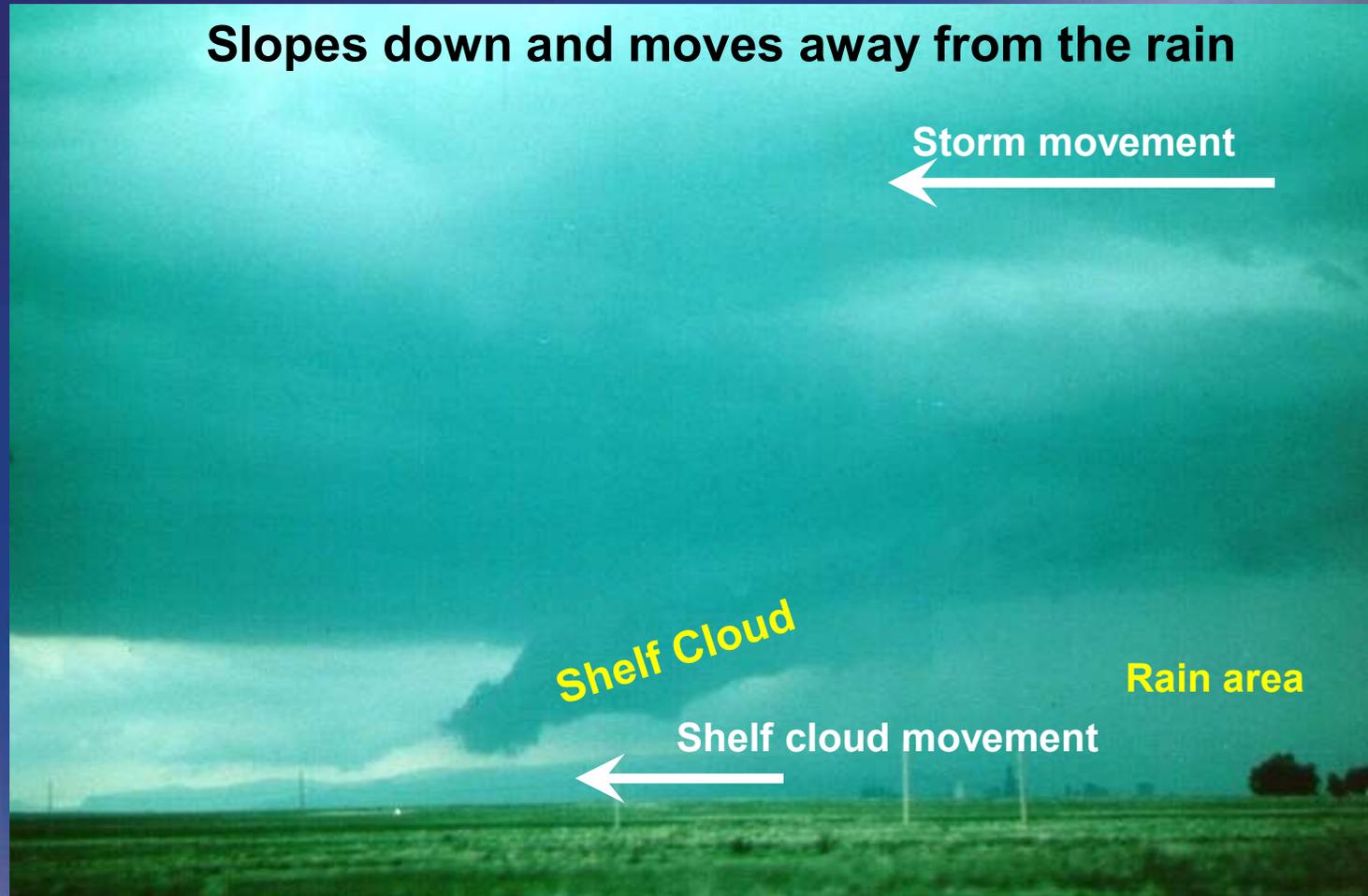
Wall Clouds



- 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

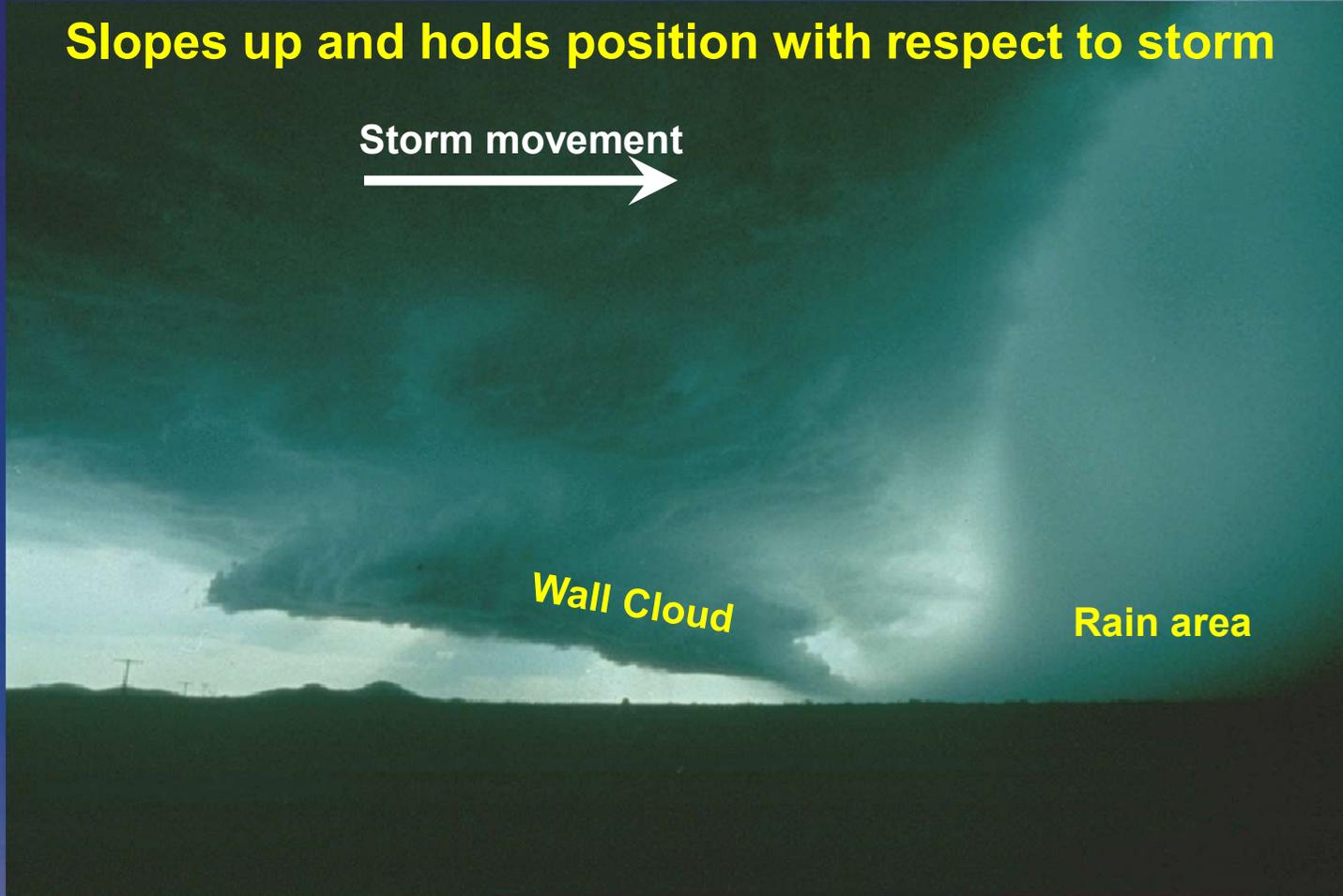
Slopes up and holds position with respect to storm

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



5/29/04 Platte County

Wide country Blown Away Storm
Chasing Adventures
(www.blownawaytours.com)

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

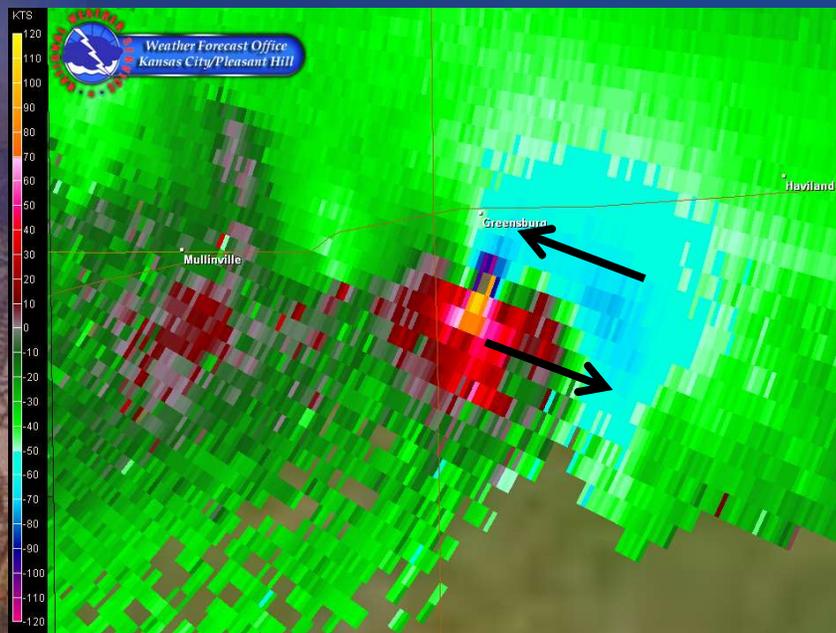
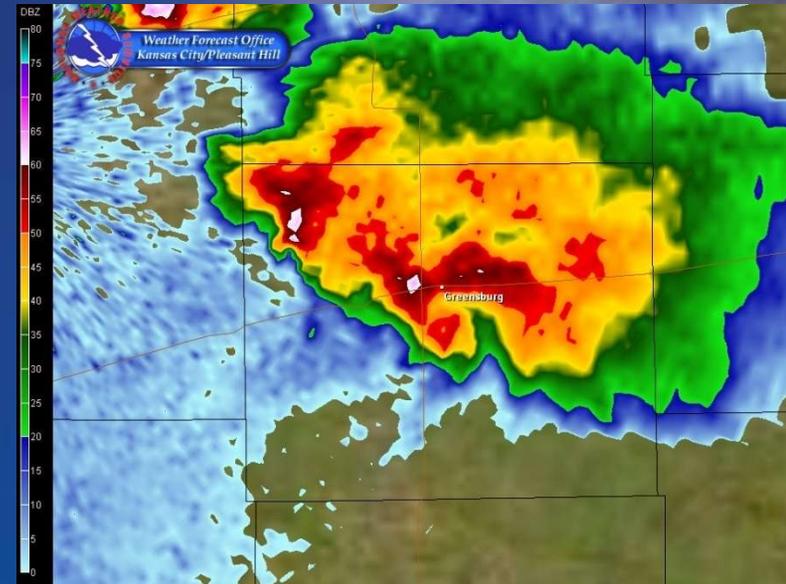


Radar Interpretation 101

Doppler radar data available from NWS web pages

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

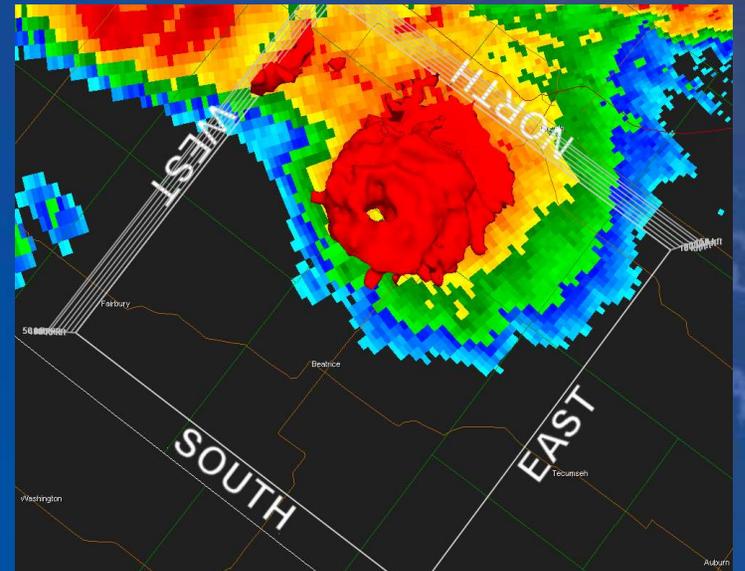
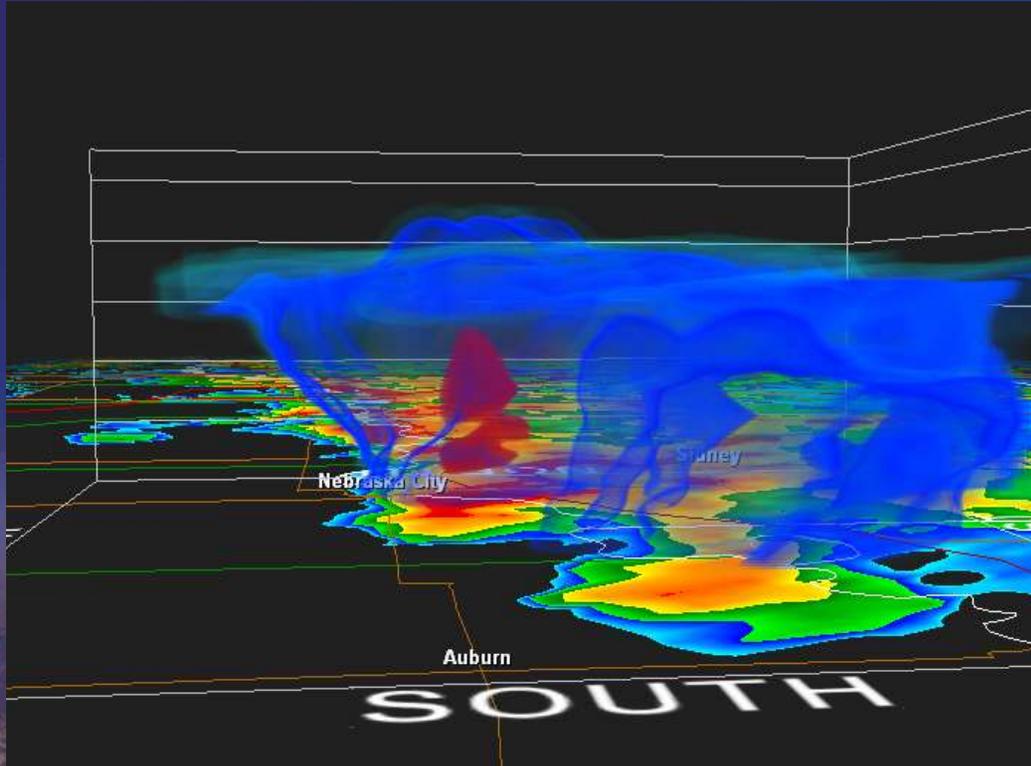
Greensburg, KS EF-5 May 4, 2007



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!

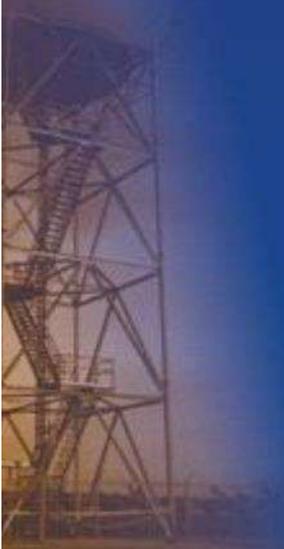
Switching Gears...



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

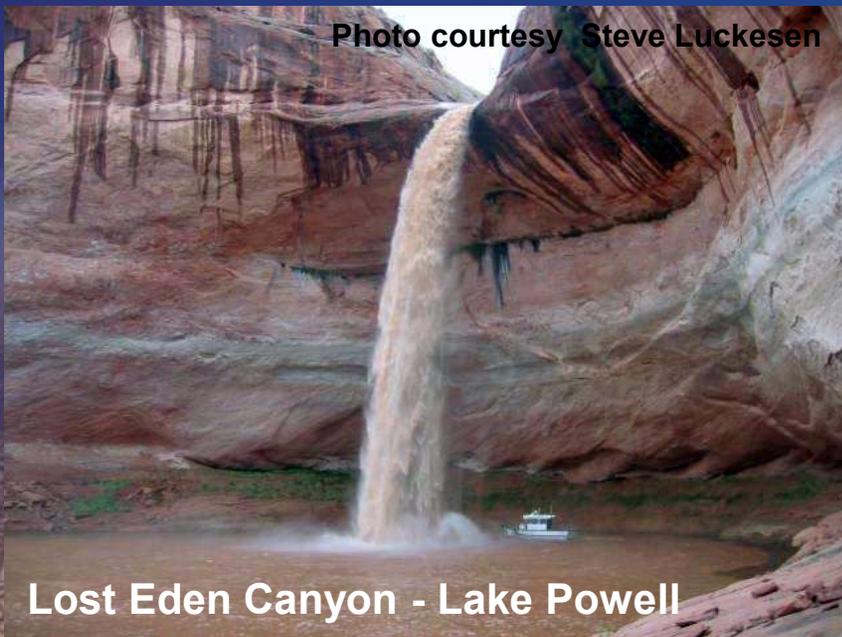


Wahweap Bay and Warm Creek Bay

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:

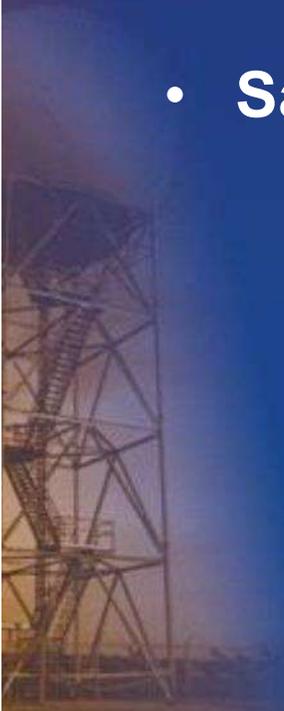
- **Snowfall accumulations**
 - How much total snow fell (period of time)
 - When snow began/ended
 - When snow total reached warning level
- **Snow depth**
- **Freezing rain accumulation**
- **Precipitation type changes**



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](tel:800-882-1432)

Storm Reports

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

Spotter Reports E-mail:

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
- **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>