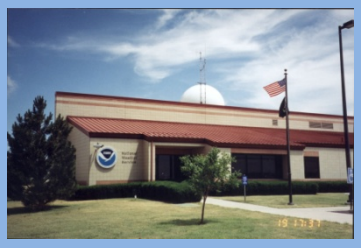

High Plains Wind

(Weather Information News Data)

July 3, 2008
Volume 2 Issue 3

National Weather Service, 920 Armory Road, Goodland, KS 67735
http://www.weather.gov/gld/ w-gld.webmaster@noaa.gov 785-899-7119

INSIDE THIS ISSUE

1 Storms Keep Office Busy
2 Heat Stress
3 May Storm Outbreak
7 Global Warming
9 Meet Chris
10 Cooperative Observer News
12 Storm Prediction Center
14 Thunderstorms - Hail
16 How do I find that?
17 Ask a Meteorologist

"Together, as a team, we try to keep people safe."

A Message from the Meteorologist-in-Charge

By Scott A. Mentzer

Storms Keep Office Busy

Tornadoes, severe thunderstorms, and flash floods kept the National Weather Service (NWS) office in Goodland quite busy in May and June. Approximately 25 tornadoes have occurred in the Tri-State so far this year, well above the annual average. The strongest tornado occurred on May 23, 2008, when it completely destroyed homes southwest of Quinter, Kansas. There is an article in this newsletter that provides more details on the storm. The tornado was eventually rated an EF4, the strongest tornado across the area since June 15, 1990.

There has only been one tornado classified as F5 in the Goodland County Warning Area. That tornado occurred on April 29, 1942, in Decatur County. The tornado developed approximately eight miles southeast of Oberlin, moved northwest, and dissipated just east of Cedar Bluffs. It passed just one mile east of Oberlin. The tornado killed 15 people and injured 25 others. The storm ranks as one of the worst natural disasters across the Tri-State area following the Dust Bowl storms of the 1930's and the 1935 Republican River Flood.

The NWS is a key player in the warning endeavor, but we are not the only ones that play critical roles. Severe weather spotters, emergency managers, law enforcement officials, and media partners are all essential to inform citizens of hazardous weather. Together, as a team, we try to keep people safe.

It is very gratifying to see these components work together during a day like May 23 and to know that volunteers and professionals are doing their best to help save lives and protect property.

Heat Stress

Preparing for Summer Weather

"Know the signs/symptoms of heat related illnesses."

Factors Leading to Heat Stress

- High temperature and humidity
- Direct sun or heat
- Limited air movement
- Physical exertion
- Poor physical condition
- Some medicines
- Inadequate tolerance for hot workplaces

Symptoms of Heat Exhaustion

- Headaches, dizziness, light-headedness or fainting
- Weakness or moist skin
- Mood changes such as irritability or confusion
- Upset stomach or vomiting

Symptoms of Heat Stroke

- Dry, hot skin with no sweating
- Mental confusion or losing consciousness
- Seizures

Preventing Heat Stress

- Know signs/symptoms of heat related illnesses
- Block out direct sun or other heat sources
- Use cooling fans or air-conditioning
- Rest regularly
- Drink lots of water if you can, about 1 cup every 15 minutes
- Wear lightweight, light colored, loose fitting clothes
- Avoid alcohol and caffeinated drinks

May 22 and 23rd Tornado Outbreak

By
Jeremy Martin, Meteorologist
Sarah Johnson, Meteorologist Intern

Two severe weather outbreaks occurred across the Tri State area on May 22nd and May 23rd. Over the course of these two days, much of the region dealt with large hail, flooding, tornadoes and strong winds. Over these two days, there were at least 15 tornadoes in the NWS Goodland County Warning (CWA) Area. This is notable because on average the Goodland CWA only has 13 tornadoes in an entire year. The strongest of these tornadoes occurred on May 23 in Gove County ; it was rated EF4 on the Enhanced Fujita Scale which rates tornadoes on a scale from EF0 to EF5, with EF5 being the strongest. This was the first time in almost 18 years that there has been a tornado rated EF4 or higher in the Goodland CWA. Unfortunately this tornado resulted in 2 injuries.

Figure 1 is a display of all the reports of severe weather received for the period. As you can see from the image, the majority of the tornadoes occurred over a rather small area. Figure 2 shows preliminary map of tornado tracks on May 22nd. Figure 3 is of preliminary tornado tracks on May 23rd, zoomed in on a particularly hard hit area between Quinter and Park. Large hail was also common with these storms and the NWS in Goodland received 35 reports of large (1 inch diameter or larger) hail. The largest hail reported was 3.5 inches in diameter (slightly smaller than a grapefruit) in Sheridan County, Kansas on May 22.

The meteorological pattern across the area was very favorable for widespread severe weather during the period. A developing surface low pressure system helped maintain a southeasterly flow of moist and unstable air across the region. A warm front and dryline remained across the area on both days, and helped provide a focus for thunderstorm development. An unseasonably strong upper level trough was in place across much of the western United States; this trough was nearly stationary over the period.

"This was the first time in almost 18 years that there has been a tornado rated EF4 or higher in the Goodland CWA."

Do you have a weather story?

Have you experienced a tornado, flood or blizzard and lived to tell about it? If so, please share your story with us. We would love to publish your real life weather stories!

You can share your story by writing us at joy.hayden@noaa.gov or writing us at the address on the first page of our newsletter.

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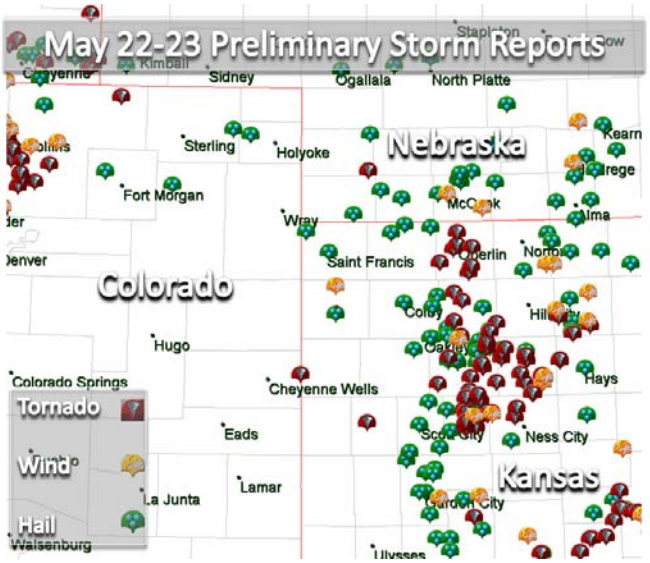

Figure 1: Preliminary local storm reports received by the National Weather Service on May 22nd and May 23rd.

Strong south-southwesterly winds ahead of this trough, combined with the east-southeasterly flow at the surface provided strong wind shear across the area. Figure 4 provides a general composite of the surface and upper level features that played a role in this severe weather event. With strong wind shear and instability in place, numerous supercell thunderstorms formed and tracked across the area.

National Weather Service Doppler radar data indicated a few classic signatures of tornadic storms, especially with the storm that produced an EF4 near Quinter KS. Figure 5 is an image of reflectivity data taken at 617 PM CDT (517 PM MDT) on May 23rd. The curl in the reflectivity to the southwest of Quinter is known as a "hook echo".

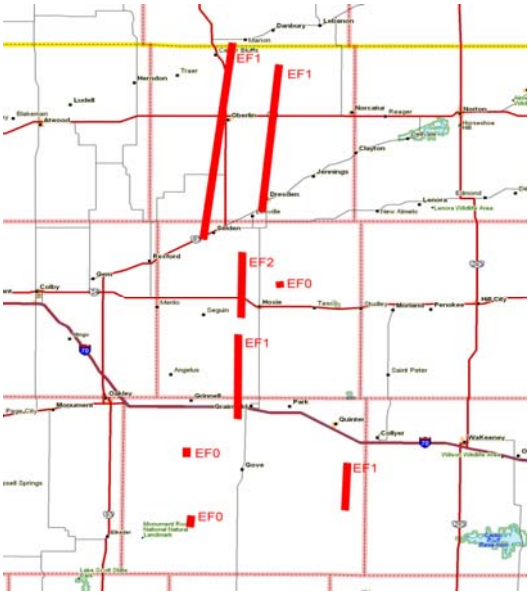

Figure 2: Preliminary tornado tracks on May 22nd.

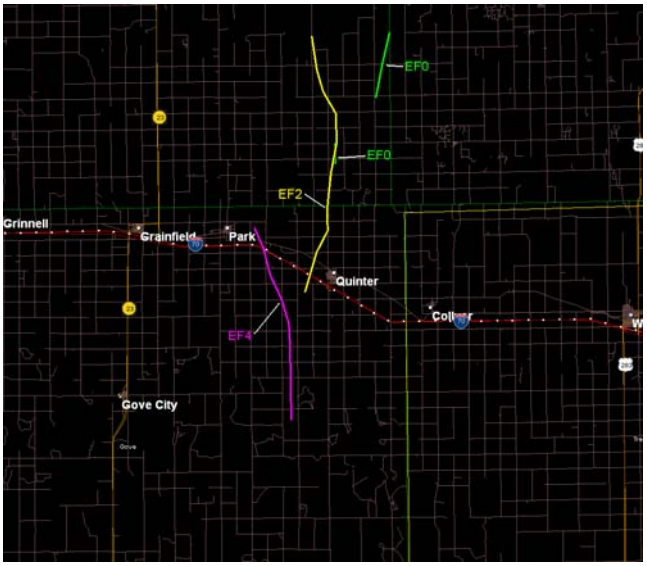

Figure 3: Preliminary tornado tracks centered on Quinter on May 23rd.

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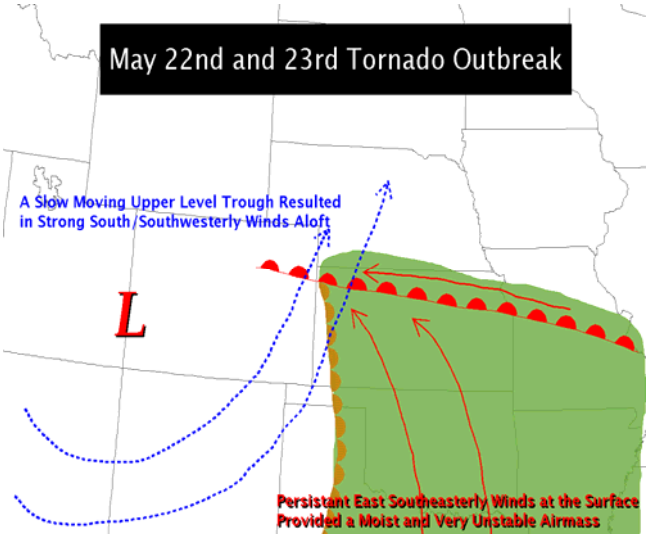


Figure 4: Composite of upper level and surface pattern across the area.

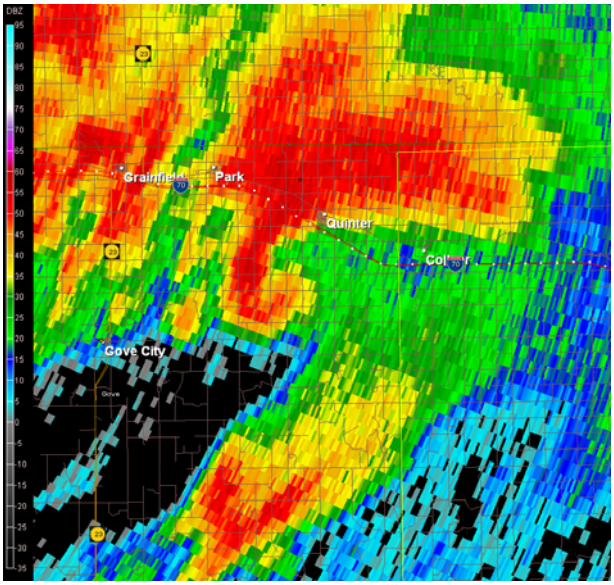


Figure 5: Radar reflectivity taken at 617 PM CDT. Hook echo is located approximately 2 miles southwest of Quinter.

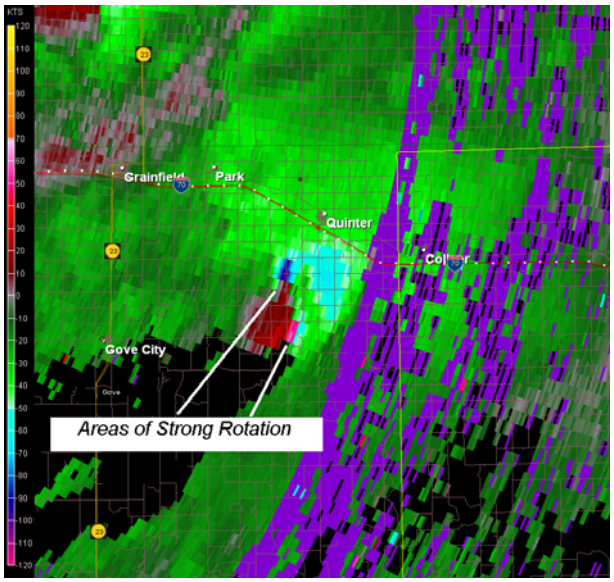


Figure 6: Radar storm relative motion in knots taken at 617 PM CDT. 1 knot is 1.15 mile per hour.

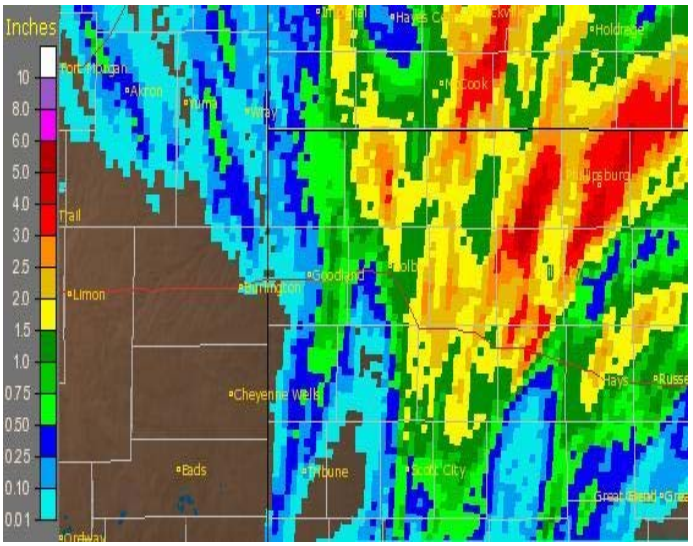


Figure 7: 24 hour total precipitation in inches ending at 6 am MDT (7 am CDT) on May 23rd.

Continued on page 6

"The North Fork of the Solomon River was in major flood stage when it crested at 14.2 ft…."

In this case this feature formed as strong rotation within the updraft of the storm pulled precipitation from the north around the southern flank of the updraft. Figure 6 is of storm relative velocity taken at the same time. The greens and blues indicate motion towards the radar, while the reds and oranges indicate motion away. Intense rotation is indicated by an area of inbound motion next to outbound motion as highlighted on figure 6.

Eastern counties in the region were also hard hit by flash flooding as thunderstorms trained over the same locations on both days. Figure 7 is a map of total precipitation for May 22nd, while Figure 8 is the same image for May 23rd. These images show heavy rain occurred over the same areas on both days, which caused flash flooding across Gove, Decatur, and Norton counties in Kansas as well as Red Willow County in Nebraska.

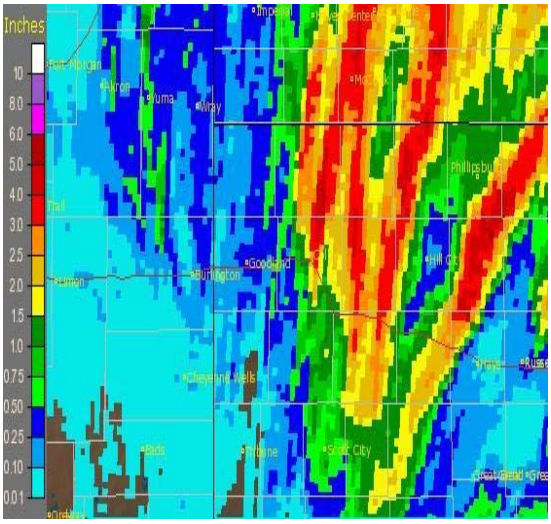


Figure 8: 24 hour total precipitation in inches ending at 6 am MDT (7 am CDT) on May 24th

Flooding was reported on four area creeks and rivers as a result of the event. Red Willow Creek in Nebraska and Sappa Creek in Kansas crested with minor flooding. In fact, in the 13 years there has been a river gauge 15 miles northeast of Norcatur on the Sappa creek, there have been no flood stages higher than the crest of 17.9 ft that was reported on May 24. The North Fork of the Solomon River (near Lenora, Kansas) was in major flood stage when it crested at 14.2 ft, over 4 ft above flood stage. Prairie Dog Creek, 4 miles east of Clayton, also had major flooding with a crest of 14.3 ft, about 3 ft above flood stage.

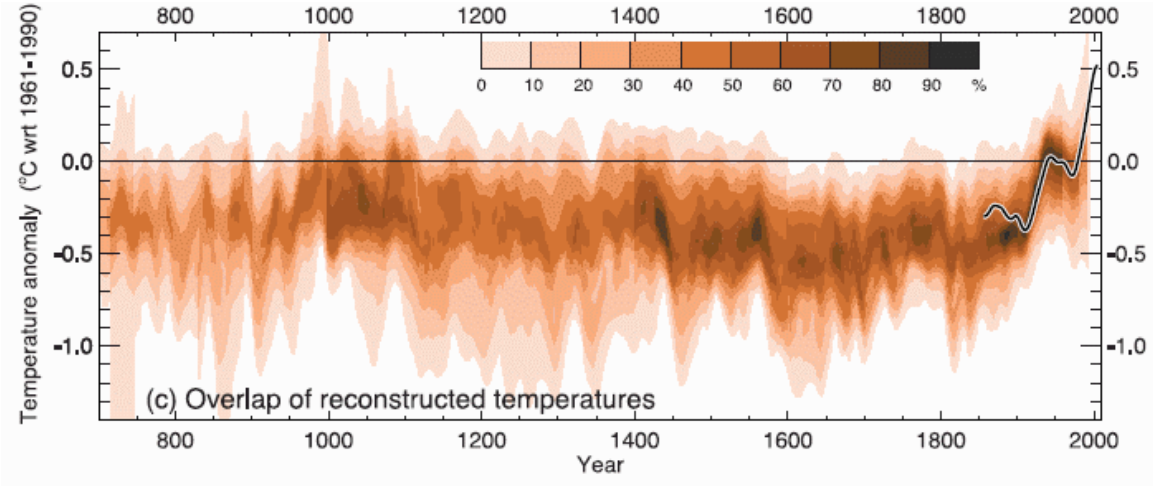
Will we be having more storms like these? Check our website for the latest hazardous weather outlook:

http://www.crh.noaa.gov/hazards/gld

Global Warming

By David Easterling and Tom Karl
National Climatic Data Center, Asheville, NC

We have had several requests for more information about Global Warming. Here is an excerpt from a report from two meteorologists who study weather records from around the world.



From the Intergovernmental Panel on Climate Change Fourth Assessment Report (AR4)
http://ipcc-wg1.ucar.edu/wg1/wg1-report.html

Is the climate becoming more variable or extreme?

Examination of changes in climate extremes requires long-term daily or even hourly data sets which, until recently, have been scarce for many parts of the globe; however these data sets have become more widely available, allowing research into changes in temperature and precipitation extremes on global and regional scales. Global changes in temperature extremes include decreases in the number of unusually cold days and nights and increases in the number of unusually warm days and nights. Other observed changes include lengthened growing seasons and decreases in the number of frost days.

Global temperature extremes have been found to exhibit no significant trend in inter-annual variability, but several studies suggest a significant decrease in intra-annual variability. There has been a clear trend to fewer extremely low minimum temperatures in several widely separated areas in recent decades. Scientists have not observed widespread significant changes in extreme high temperature events. There is some indication of decreasing temperature variability in recent decades.

In areas were a drought or excessive wetness usually accompanies an El Nino or La Nina, these dry or wet spells have been more intense in recent years. There is some evidence for increasing drought worldwide; however, in the United States as a whole, there is no evidence of increasing drought.

Continued on page 8

In some areas where overall precipitation has increased (i.e., the mid-high northern latitudes), there is evidence of increases in the heavy and extreme precipitation events. Even in areas such as eastern Asia, it has been found that extreme precipitation events have increased despite total precipitation remaining constant or even decreasing somewhat. This change is related to a decrease in the frequency of precipitation in this region.

For the Northern Hemisphere temperature, recent decades appear to be the warmest since at least about 1,000 A.D.

Many studies show extra-tropical cyclone activity seems to have increased over the last half of the 20th century in the northern hemisphere, but decreased in the southern hemisphere. Furthermore, hurricane activity in the Atlantic has shown an increase in number since 1970 with a peak in 2005. It is not clear whether these trends are multi-decadal fluctuations or part of a long term trend.

How important are these changes in a long-term context?

Paleoclimatic data are critical for enabling scientists to extend our knowledge of climatic variablity beyond what is measured by modern instruments. Many natural phenomena are climate dependent, such as the growth rate of a tree for example, and as such, provide natural "archives" of climate information.

Some useful paleoclimate data can be found in sources as diverse as tree rings, ice cores, corals, lake sediments (including fossil insects and pollen data), speleothems (stalactites, etc.), and ocean sediments. Some of these, including ice cores and tree rings, provide scientists with a chronology due to the nature of how they are formed, and so high resolution climate reconstruction is possible in these cases. There is not a comprehensive network of paleoclimate data as there is with instrumental coverage, however, so global climate reconstructions are often difficult to obtain. Nevertheless, combining different types of paleoclimate records enables us to gain a near-global picture of climate changes.

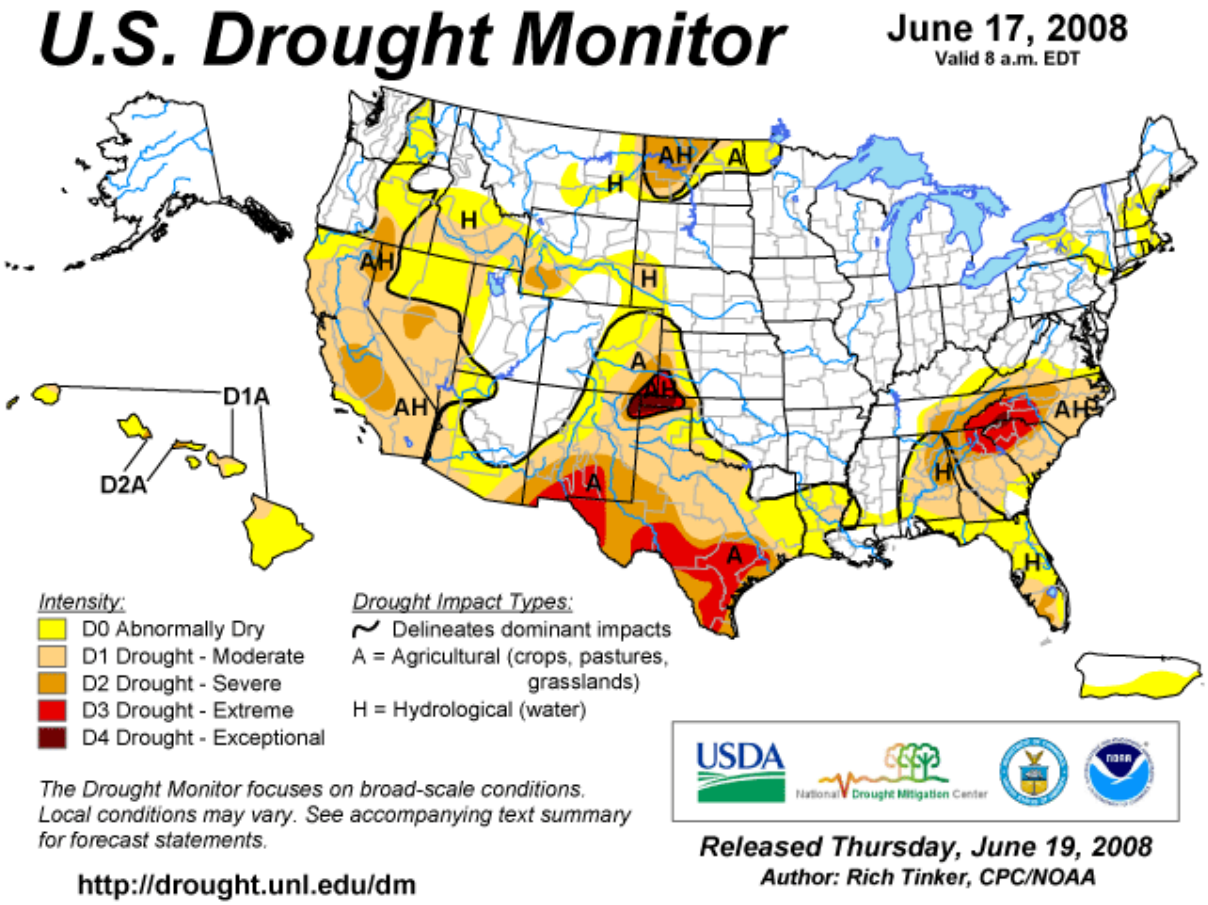
For the Northern Hemisphere temperature, recent decades appear to be the warmest since at least about 1,000 A.D. and the warming since the late 19th century is unprecedented over the last 1,000 years. Older data are insufficient to provide reliable hemispheric temperature estimates. Ice core data suggest that the 20th century has been warm in many parts of the globe, but also the significance of warming varies geographically, when viewed in the context of climate variations of the last millennium.

For more information on this topic link to the National Cooperative Observer newsletters at this address:

http://www.weather.gov/om/coop/newsletters/08spring-coop.pdf

Continued on page 9

Need information about drought and precipitation?



http://drought.unl.edu/dm/monitor.html

Meet Chris…

My name is Chris Foltz and I am a forecaster at the National Weather Service office in Goodland. I'm originally from the small town of Macon, MO and graduated from the University of Missouri with a Bachelor of Science degree in Atmospheric Science. I've been married to my wonderful wife Renae for almost 6 years. When I'm not at the office, I enjoy storm chasing and nature photography.

Cooperative Observer News

By Mike Lammers, OPL

Two Observers to Receive Awards!

We have two observers who will soon be receiving awards. Lara Arnold and her son John will both be receiving 30-year awards for the site 3 WSW of Norcatur, Kansas. Lara is the wife of the late Lee Arnold. The Arnold family has provided complete and accurate records of rainfall and temperature in their area since April 26, 1978.

Marilyn Kadlecek of Stratton, Nebraska has been taking observations since June 1, 1988. She will be receiving a 20 year-award for her daily observations and for taking river readings from the nearby Republican River.

Thanks to all of you for keeping up the great work with temperature and precipitation reports! Don't forget that even if you are using WxCoder III, we still need your hand written copy of the B91 each month. I have been very happy to read some excellent remarks on some of your recent reports. We appreciate remarks regarding things like when a thunderstorm occurred, hail size, and any additional information that will add value to your report.

Don't forget to tune into weather radio in the summer. Severe weather can occur any time!

If you need additional supplies or help with an equipment problem, please call or email our office. You can leave a message for me at 1-800-272-7811 or email me directly at:

michael.lammers@noaa.gov

Thanks again for all you do to provide timely and accurate reports. Have a great summer!

Welcome Christina!

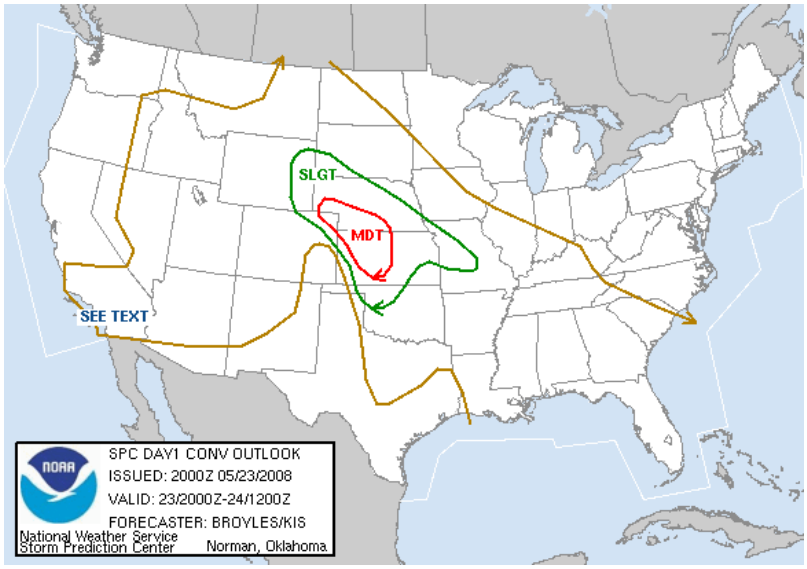
Hi! My name is Christina Henderson, Goodland's newest Hydro-meteorological Technician. After growing up in Northern Michigan I moved south to the University of Oklahoma for a Bachelor's of Science in Meteorology then to Penn State for a Masters degree in Meteorology. While working at the North Platte, Nebraska office, I began working with the Cooperative Observing Program and found my passion. While not at work, I'm helping with work at the farm and ranch north of Stratton, Nebraska.

Meet **Dave Floyd**

Watch for the next newsletter
featuring our Warning Coordination Meteorologist!

Storm Prediction Center Convective Outlooks

By Dave Floyd … Warning Coordination Meteorologist



I am guessing many people reading this newsletter have heard the phrase: "There is a moderate risk of severe weather this afternoon and evening". I am also guessing many people are curious to know exactly who determines what the risk is, and what is meant by the terms SLIGHT (SLGT), MODERATE (MDT) and HIGH risk. Read on…

The Storm Prediction Center (SPC) in Norman, Oklahoma is been tasked with monitoring severe weather potential in the lower 48 states. The Storm Prediction Center issues a product called a Convective Outlook which describes the anticipated risk of severe thunderstorms. The Convective Outlook consists of a graphic similar to the one seen above, as well as a narrative description of the day's threat. To view the current Convective Outlook visit: http://www.spc.noaa.gov/products/outlook/. SPC is also tasked with the issuance of Severe Thunderstorm and Tornado Watches in the lower 48 states. When conditions appear favorable for a Watch, the Storm Prediction Center is in close contact with local National Weather Service (NWS) offices such as Goodland, Boulder and North Platte, and the exact locations of the watch areas are collaborated.

According to the Storm Prediction Center, three risk categories (SLGT, MDT, and HIGH) are used to symbolize the coverage and intensity of the expected severe weather threat. A SLGT risk implies well-organized severe thunderstorms are expected, but in small numbers and/or low coverage.

Continued on page 13

Depending on the size of the area, approximately 5-25 reports of ¾ inch or larger hail, and/or 5-25 wind events of 58 mph or greater, and/or 1-5 tornadoes would be possible. A MDT risk indicates a potential for a greater concentration of severe thunderstorms than the slight risk, and in most situations, greater magnitude of the severe weather. A HIGH risk area suggests a major severe weather outbreak is expected, with a high concentration of severe weather reports and an enhanced likelihood of extreme severe (i.e., violent tornadoes or very damaging convective wind events occurring across a large area). In a high risk, the potential exists for 20 or more tornadoes, some possibly EF2 or stronger, or an extreme wind event which potentially would cause widespread wind damage and higher end wind gusts over 80 mph that may result in structural damage.

The categories of SLGT, MDT and HIGH are chosen based on the forecast probability of a given severe event as shown in the table below. In other words, if SPC feels there is a 30% probability of a tornado, it would warrant a HIGH risk that day in that area, whereas a 30% probability of wind or hail would yield only a SLGT risk.

Outlook Probability	TORN	WIND	HAIL
2%	SEE TEXT	NOT USED	NOT USED
5%	SLGT	SEE TEXT	SEE TEXT
10%	SLGT	NOT USED	NOT USED
15%	MDT	SLGT	SLGT
30%	HIGH	SLGT	SLGT
45%	HIGH	MDT	MDT
60%	HIGH	HIGH	MDT

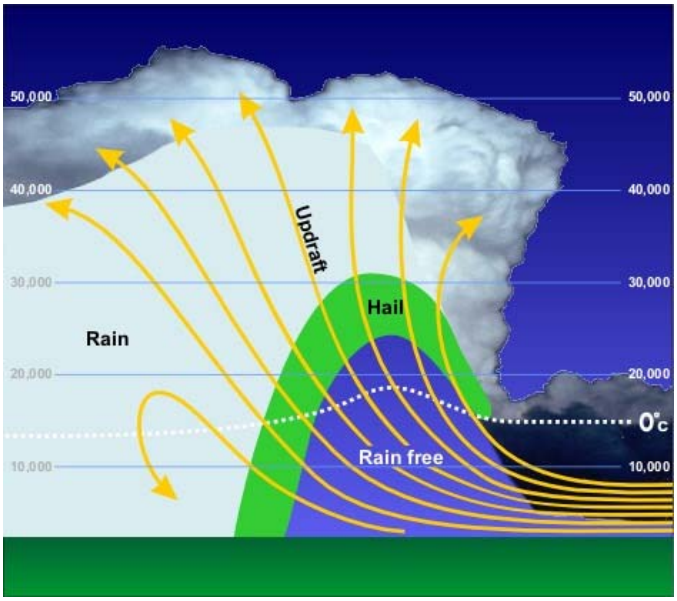
Do you have a question about the weather or our office?
If so, write us at
w-gld.webmaster@noaa.gov
and we'll include your question in a future issue.

Thunderstorm Hazards – Hail

By Kelly James, Meteorologist Intern

Source: National Weather Service JetStream - Online School for Weather

Hail is precipitation that is formed when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people. One of the people killed during the March 28, 2000 tornado in Fort Worth was killed when struck by grapefruit-size hail.



While Florida has the most thunderstorms, New Mexico, Colorado, and Wyoming usually have the most hail storms. Why? The freezing level in the Florida thunderstorms is so high, the hail often melts before reaching the ground.

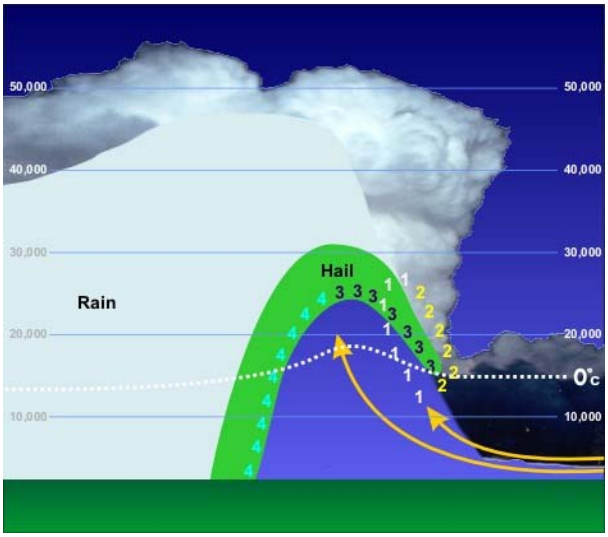
Hailstones grow by collision with supercooled water drops. (Supercooled drops are liquid drops surrounded by air that is below freezing which is a common occurrence in thunderstorms.) There are two methods by which the hailstone grows, wet growth and dry growth, and which produce the "layered look" of hail.

In wet growth, the hailstone nucleus (a tiny piece of ice) is in a region where the air temperature is below freezing, but not super cold. Upon colliding with a supercooled drop the water does not immediately freeze around the nucleus.

Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape resulting in a layer of clear ice.

With dry growth, the air temperature is well below freezing and the water droplet immediately freezes as it collides with the nucleus. The air bubbles are "frozen" in place, leaving cloudy ice.

Strong updrafts create a rain-free area in supercell thunderstorms (above). We call this area a WER which stands for "weak echo region". This term, WER, comes from an apparently rain free region of a thunderstorm which is bounded on one side AND above by very intense precipitation indicted by a strong echo on radar.



This rain-free region is produced by the updraft and is what suspends rain and hail aloft producing the strong radar echo.

1. The hail nucleus, buoyed by the updraft is carried aloft by the updraft and begins to grow in size as it collides with supercooled raindrops and other small pieces of hail.

2. Sometimes the hailstone is blown out of the main updraft and begins to falls to the earth.

3. If the updraft is strong enough it will move the hailstone back into the cloud where it once again collides with water and hail and grows. This process may be repeated several times.

4. In all cases, when the hailstone can no longer be supported by the updraft it falls to the earth. The stronger the updraft, the larger the hailstones that can be produced by the thunderstorm.

Multi-cell thunderstorms produce many hail storms but usually not the largest hailstones. The reason is that the mature stage in the life cycle of the multi-cell is relatively short which decreases the time for growth.

However, the sustained updraft in supercell thunderstorms support large hail formation by repeatedly lifting the hailstones into the very cold air at the top of the thunderstorm cloud.

In all cases, the hail falls when the thunderstorm's updraft can no longer support the weight of the ice. The stronger the updraft the larger the hailstone can grow.

For more information on hail and other weather topics please visit:
http://www.srh.noaa.gov/srh/jetstream/index.htm

Fast Facts

On June 22, 2003, a hailstone recovered in Aurora, NE, had a diameter of 7" (17.8 cm) and a circumference of 18 3/4" (47.6 cm). This hailstone was larger than the previous record large hailstone that fell in Coffeyville, KS, in 1970 (5.7" (14.5 cm) diameter and 17.5" (44.5 cm) circumference). However, weight, is the most important measurement. An accurate weight could not be determined for the Aurora hailstone; so the Coffeyville hailstone of 1970 remains the heaviest hailstone weighed and verified in the United States at 1.67 pounds (0.76 kg).

Hail causes $1 billion in damages to crops and property each year.

Hailstones can fall at speeds up to 120 mph (53 m/s).

Costliest United States hailstorm: Fort worth, Texas, May 5 1995. Total damage was $2 billion

How do I find that?

Curious how to find the local storm reports on our website? Try this:

Go to our website at: www.weather.gov/gld

Click on Watches/Warnings

Click on Local Storm Reports

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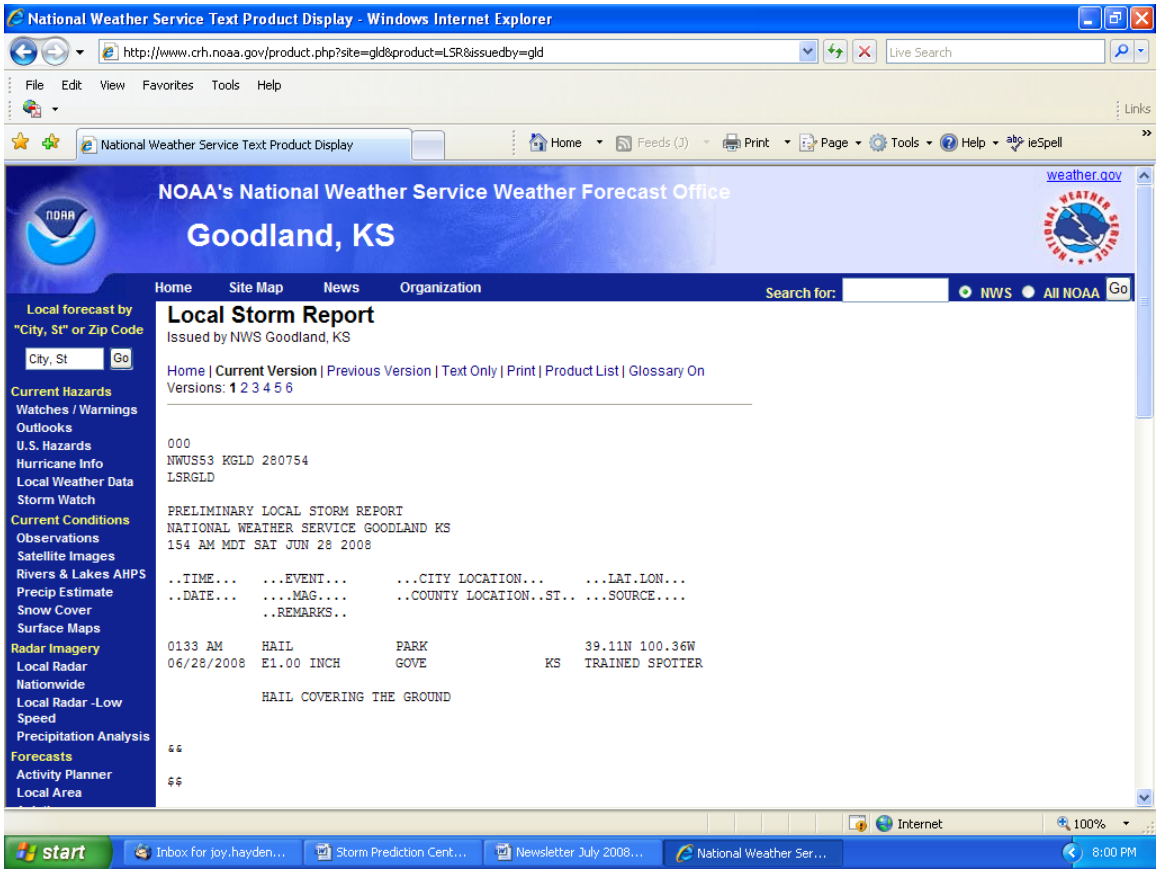

Then check out the latest reports!

Ask a Meteorologist

Does lightning travel from the cloud to the ground, or from the ground to the cloud?

The answer is both. Cloud-to-ground lightning comes from the sky down, but the part you see comes from the ground up. A typical cloud-to-ground flash lowers a path of negative electricity (that we cannot see) towards the ground in a series of steps. Objects on the ground generally have a positive charge. Since opposites attract, an upward streamer is sent out from the object about to be struck. When these two paths meet, a return stroke zips back up to the sky. It is the return stroke that produces the visible flash, but it all happens so fast - in about one-millionth of a second - so the human eye doesn't see the actual formation of the stroke.

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Goodland, KS 67735

Phone:
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Fax:
785-899-3501

E-mail:
w-gld.webmaster@noaa.gov

Please don't forget, if you have pictures or video to share of any severe weather events that take place this year, please contact ***david.l.floyd@noaa.gov***

With your permission, your pictures and video will provide information and training materials for future storm spotters and meteorologists!

The National Weather Service provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community. It is accomplished by providing warnings and forecasts of hazardous weather, including thunderstorms, flooding, hurricanes, tornadoes, winter weather, tsunamis, and climate events. The NWS is the sole United States OFFICIAL voice for issuing warnings during life-threatening weather situations.