High Plains Wind

(Weather Information News Data)

July 19, 2013
Volume 7 Issue 2

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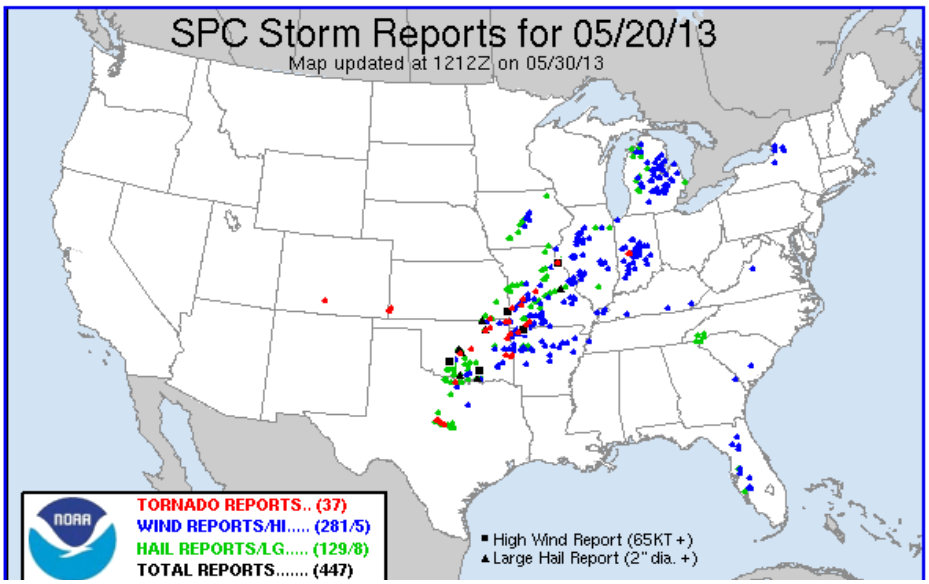
WFO Goodland 7/10/2013

A Message from the Meteorologist-in-Charge

Oklahoma Tornadoes

By Scott A. Mentzer

On May 20, 2013, a tornado outbreak developed over central Oklahoma. The most significant tornado, rated at EF5 on the Enhanced Fujita scale, occurred at Moore, Oklahoma. The tornado was on the ground for 39 minutes and traveled 17 miles. At its peak the tornado was 1.3 miles wide.



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This was the third tornado to hit Moore since 1999 (Figure 1).

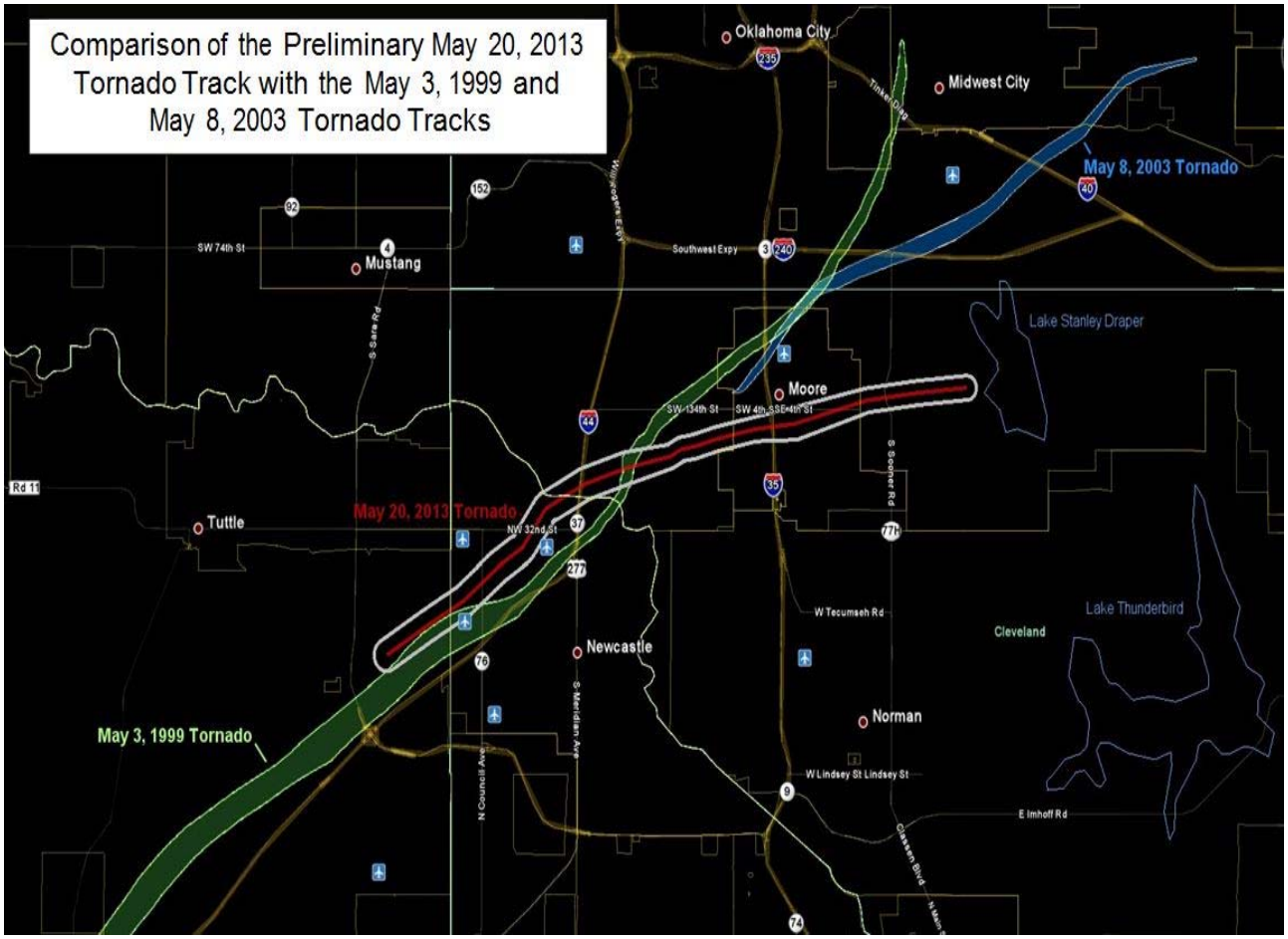

Figure 1 – Comparison of Moore Tornado Tracks (Courtesy of the NWS Office in Norman, OK)

Instead of delving into the meteorology about how the storms formed, I would like to focus on two of the services provided by the National Weather Service (NWS) office in Norman, Oklahoma: the use of social media (Twitter, Facebook, etc.) and integrated decision support services (IDSS). NWS offices already embrace these concepts, but each will grow greater in the coming years.

Social media has become an extremely important dissemination method to get information to the public. It also allows information to be sent to the NWS. Instead of a one-sided push of information, two-way communication develops between the NWS, its partners, and its customers. In addition to sending a standard suite of warning products, the NWS office in Norman actively utilized social media to inform folks about critical weather information and to receive information about tornado location and tornado damage. Figure 2, on the next page, shows some of the Tweets that were sent during the event.

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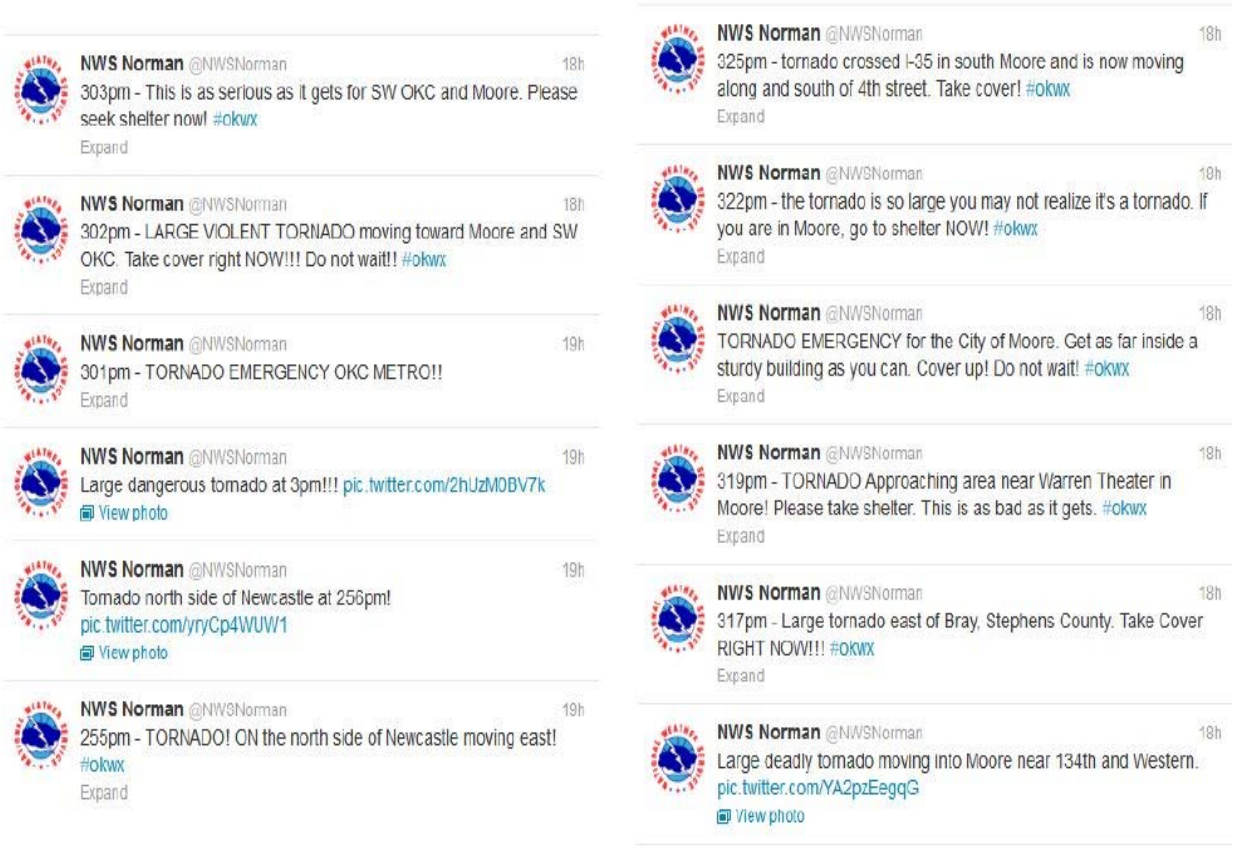

Figure 2 – Examples of Tweets Sent by the NWS Office in Norman, Oklahoma, on May 20, 2013

Statistics analyzed after the event indicated that Facebook posts and Twitter tweets reached over 800,000 people during the event.

Providing critical weather information and interpreting complex meteorological data are large components in impact-based decision support services. Decision makers such as emergency managers, community leaders, and rescue and recovery teams depend on high quality data to make important decisions. Prior to the tornadoes, the Norman office briefed key decision makers about the potential for dangerous, life-threatening weather.

Immediately after the event, the city of Moore and Cleveland county emergency management officials quickly set up an Incident Command (IC) Post in the parking lot of the Warren Theater. The NWS office was in immediate contact with the Moore IC and provided continuous weather updates and forecasts. The following day a NWS forecaster was deployed on site at the Moore IC. The Moore IC, pictured on the next page, was staffed with a NWS meteorologist for five days, providing on site weather support to the Incident Commanders and First Responders (Figure 3).

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Figure 3 – Incident Command Post in Moore, Oklahoma (Photo courtesy of NWS Norman, Oklahoma)

The NWS office in Goodland uses social media, too. The office posts to a Facebook page (http://www.facebook.com/US.NationalWeatherService.Goodland.gov), so please visit the page and "like" us. Once you like the page, you'll begin receiving weather information via Facebook. The Goodland office also sends tweets. To follow us on Twitter, visit https://twitter.com/NWSGoodland.

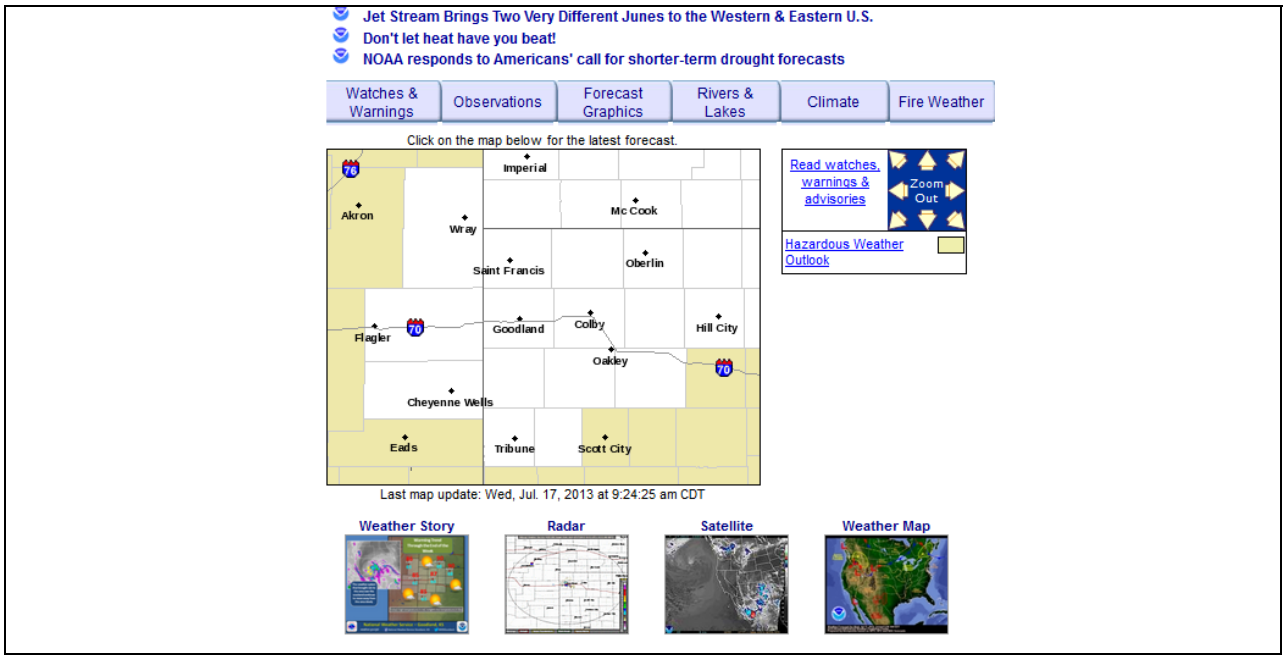
The Goodland office also engages in IDSS, especially with the emergency management community. Conference calls before significant weather events are conducted with emergency managers, school and transportation officials, and the local media. All of these entities work with one another to keep the people of the Tri-State area safe.

Hourly Weather Forecasts Available for Tri-State Area

By Jeremy Martin
Science and Operations Officer

National Weather Service forecast offices across the country maintain a detailed database of forecast information for their entire area of responsibility. This information is used for a variety of products ranging from the local zone forecast to detailed spot specific forecasts for wildfires. One of the more useful applications available to our users is the "Hourly Weather Graph" that displays our latest forecast data for specific locations on an hour by hour basis. This data can be very useful, but it also can be somewhat intimidating for new users. These instructions will work for any location across the country, however they will be primarily focused on the Tri-State area.

The first step for creating an hourly forecast for your location is to visit our website at http://www.weather.gov/goodland. Upon arriving you will see a color coded map of the area appear similar to the picture below :



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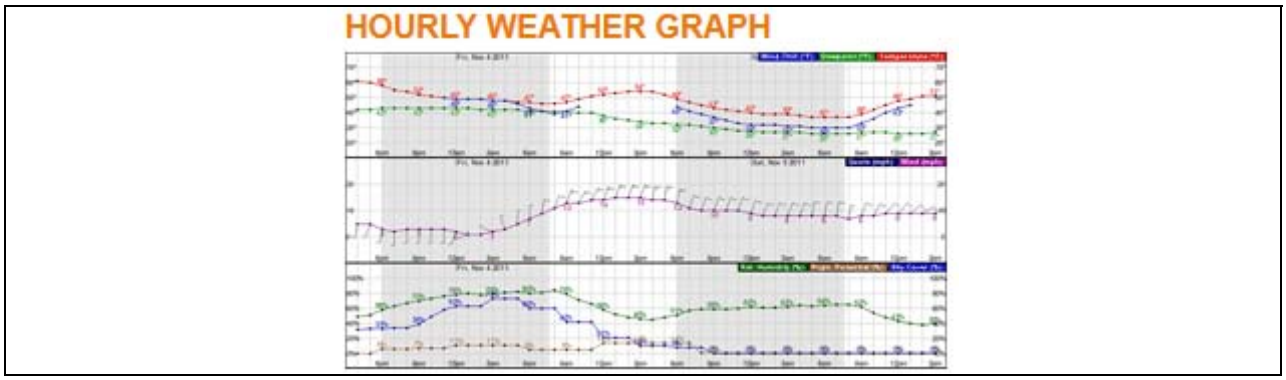
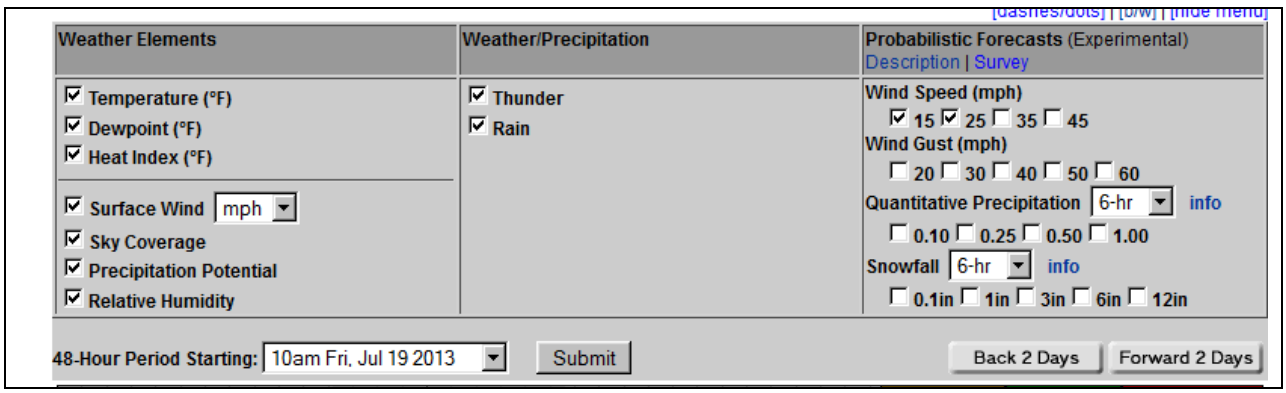
Locate the area of interest and click on the map near that point. This will take you to a web page that provides a local, zone style forecast for the point selected. On the right hand side of this page are several useful pieces of information including a zoomed in map that allows for a more precise area selection, information on when the forecast was last updated and links to the national forecast database. Another link titled 'Hourly Weather Graph', which is pictured below can be found there as well. Click on that image to proceed.



A web page with a detailed graph similar to the picture in the previous link will appear for the location selected on the map. There are many options to choose from, but regardless of the elements chosen the data will be displayed on similar graphs. Along the bottom of each graph displays the respective time that forecast is valid for with the vertical axis representing the forecast value. The plotted elements appear in the upper right corner, with the date displayed along the top. The shaded/white backgrounds represent nighttime and daytime periods.

To control the various elements that are displayed a menu is provided at the top of the web page allowing the user to select and deselect various elements. The menu also allows users to define a starting time for the graph and allow it to advance in 2 day increments. On clicking the "Submit" button the page will update.



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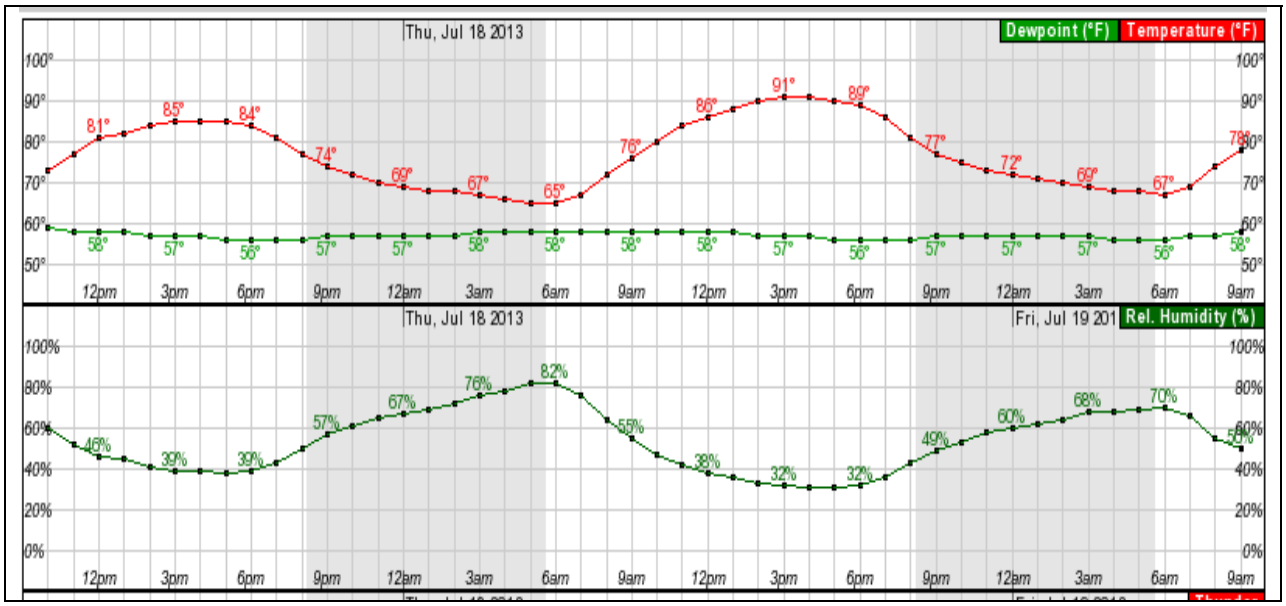
While many are familiar with the parameters available, there is often some confusion as to the specific meaning of a few parameters. For example, there is often confusion about the difference between the terms dewpoint and relative humidity. The dewpoint is defined as the temperature to which air must be cooled for dew to form. The relative humidity is the ratio between how much water vapor is required for the air to be saturated at a given temperature. While this difference may be difficult to visualize based on the definition, the following graph helps illustrate the differences.



Note that the dewpoint (green line in top graph) changes very little during this period and varies between 56 and 58 degrees. The relative humidity (bottom graph) varies greatly through the period ranging between 32 and 82 percent. So what is the cause of these changes in humidity? Notice how the humidity curve appears to be the inverse of the temperature curve, as the temperature warms humidity falls and vice versa. What this graph displays is that the actual amount of water vapor in the air (represented by the dewpoint) did not change much, but the actual amount of water vapor the air can hold is greatly impacted by temperature.

Another variable that is often difficult to totally understand is the probability of precipitation, also known as the PoP. This is defined at the probability of a location receiving 0.01 or more of precipitation in a 12 hour period. This definition alone does not provide a lot of information on when the best chance for precipitation during a given 12 hour period is expected, but timing of precipitation can be found by using the hourly weather graph.

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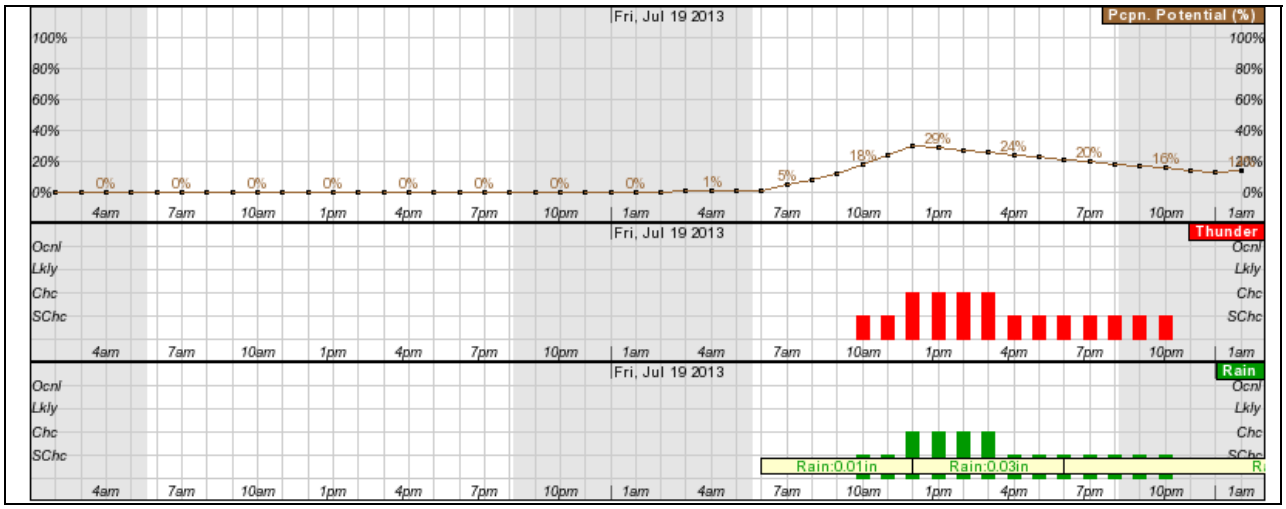


In the above graph the top curve is the forecasted PoP for a single location. Note that initially there is no chance for precipitation for the first 24 hours of the forecast. After 4 am on July 19th chances begin to increase with values slowly falling after that. Using this information you can see that the chance for rain will increase during the morning hours reaching its highest value around noon. While the probability falls after that, the relatively slow change in the probability indicates that precipitation threat will linger through the evening. The bottom chart displays the expected amount of rain during the period in 6 hour time segments.

A set of experimental probabilistic forecasts are also available on the right hand side of the menu. These are known as 'probability of exceedance' graphs. Using your local forecast and a statistical analysis, the probability of a parameter exceeding a threshold is displayed. For instance, if the wind speed parameter is chosen with a value of 15, a graph will be displayed showing the likelihood of winds 16 mph or more. This can be very useful for activities that are impacted by certain thresholds.

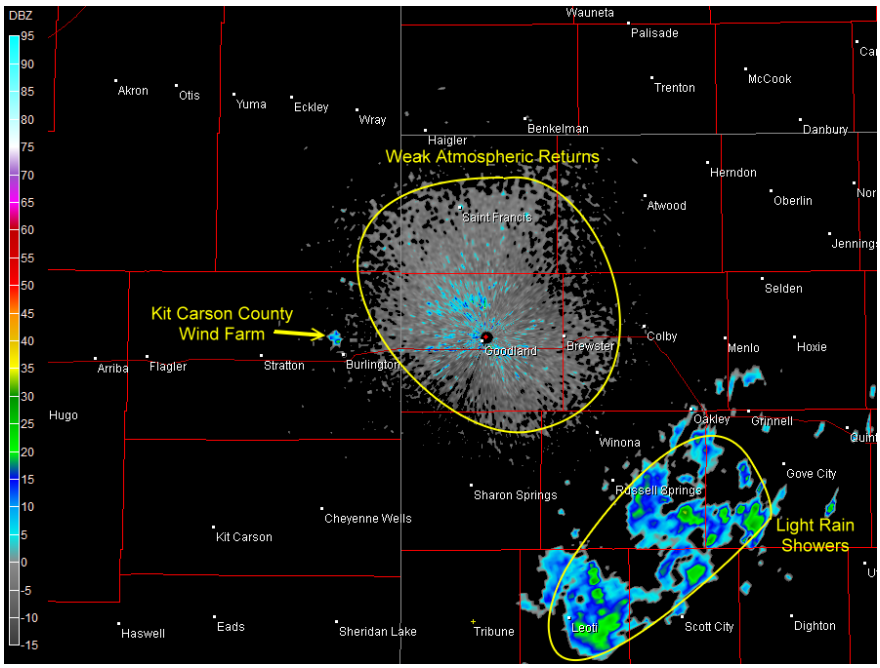
While there are many potential uses for this data, one of the most useful is to determine when certain events are expected to occur. Using this data you can get a forecast tailored for your area which allows the user to make decisions based on expected changes. These forecasts are updated frequently, generally every 3 hours or less throughout the day. If you have any questions about how to use this information, please contact me at Jeremy.Martin@noaa.gov.

Wind Farms Display on Goodland Doppler Radar

By Dave Floyd - WCM

The purpose of Doppler radar is to remotely detect precipitation and to provide operators with information about the location, altitude, intensity, and movement of the precipitation. It does this by transmitting pulses of electromagnetic energy, and if there is a target of sufficient size and composition in its path, some of this transmitted energy is returned to the radar.

In the case of precipitation, the targets which return radar energy to the antenna are raindrops, snowflakes, ice crystals and hail. The radar does a good job of detecting precipitation, but other atmospheric targets are also detected, including insects, birds, smoke, dirt, as well as sharp density gradients in the atmosphere. Furthermore, ground targets such as hills, barns, silos, grain elevators, transmission lines and other tall objects also return power back to the radar, but since these targets do not move, Doppler radar is able to filter them out from the display. In the image below, the weak returns immediately surrounding the Goodland radar are not ground clutter, they are insects and birds. Also seen in the image is an area of very light showers southeast of Goodland and a small blob just northwest of Burlington, Colorado which is a wind farm.



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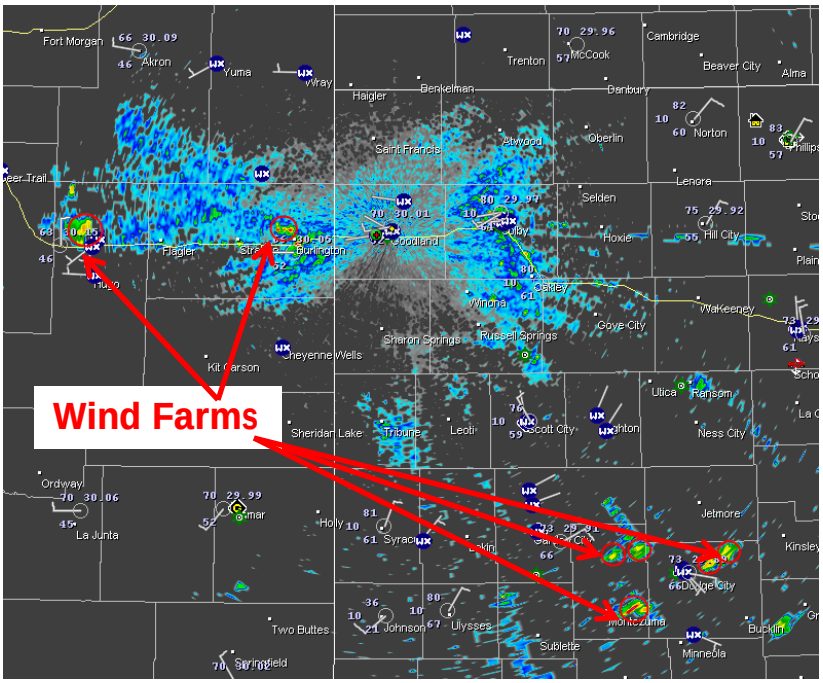
On most days, radar energy emitted from our antenna climbs in altitude as distance from the radar increases. The reasons for this are partly due to earth curvature, but more importantly, “beam elevation” is closely tied to atmospheric refraction (the distribution of temperature and moisture in the vertical). So the weak radar returns from bugs and birds tends to diminish with distance on an average day, as the radar energy climbs higher in altitude.



There are certain atmospheric conditions which can greatly distort the travel of electromagnetic energy. One of these is a temperature inversion (temperature increases with height instead of decreasing). This often occurs around daybreak with clear, calm conditions after a full night of cooling. In these situations, atmospheric refraction bends the radar “beam” and holds it close to the ground over long distances. In extreme cases, the radar may be sampling along the ground over one hundred miles from the radar.

An example of such a morning occurred this past June 26th; the image above was taken at 740 am MDT. It is zoomed out to show that energy from our Goodland radar was sampling close to the ground all the way out west to Limon, Colorado, and southeast to the Dodge City, Kansas area. The reason we know this fact is that the radar was detecting wind farms in those locations, indicated by the red circles.

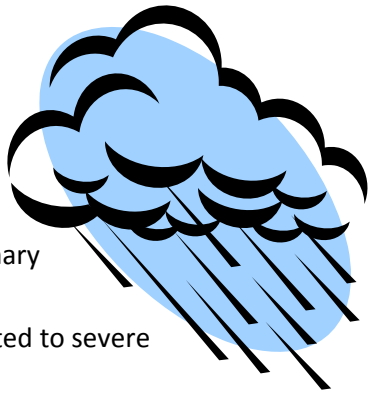
Although the towers comprising the wind farm are not moving, the turbine blades are, which mixes the air above. This makes it difficult for the Doppler system to remove these strong ground targets, because the targets are no longer stationary. The temperature inversion which occurred this morning resulted in “super-refraction” of the radar energy, keeping the “radar beam” close to the ground. On a typical day, the altitude of the radar energy from the Goodland radar would be around 16,000 feet over Dodge City.

Does My Severe Weather Report Matter? What Should I report?

By Jesse Lundquist
Meteorologist

In short, yes your severe weather report is **very** important to us. The following is a quick list of why your report is so important:

- Our radar can't see what is actually falling to the ground. We need spotters to confirm what we are seeing on radar.
- Our primary mission is to protect lives and property. Without your report we may not know what a particular storm is producing, so we need your report to help us fulfill our mission to let other people in the path of the storm know what is coming their way.
- You help us improve our warning and forecasting skills. Your report gives us ground truth and helps us assess if our instruments are accurately analyzing a given storm. Your report may be the one we need to help make the decision to warn or not to warn on a particular storm and your report improves the accuracy of the warning, should one be needed.
- Severe weather reports are published in Storm Data. Storm Data is the primary record of severe weather climatology across the U.S. This publication is an invaluable resource for severe weather research and other information related to severe weather such as insurance claims and storm damage.



As you can see from the above list, your report is very valuable to us in many ways. Don't think that someone else will call in a severe weather report. With all the reasons to report severe weather, you may be asking what you should report when storms move over your location, or just need a reminder of what we're looking for.

- Your location from the nearest town and the location of the report (if different).
- The size of the largest hailstone in relation to a coin.
- Wind gusts of 60+ MPH.
- Rotating wall clouds, funnel clouds, tornadoes.
- Rainfall amounts of 1"+ per hour.
- Any areas where there is 6"+ of water over the road or damage from flooding.
- Damage and injuries from storm.
- Start time, End time, Duration of any of the above events.

Even though severe weather reports are important, the top priority is your safety. Delayed reports are still very helpful. Thanks for your help during this severe weather season.

Severe Thunderstorm Wind Gusts Across the High Plains

By Scott A. Mentzer - MIC

Researchers across the country recently published a peer-reviewed paper about severe thunderstorm wind gusts. A thunderstorm is considered severe if it produces wind gusts of 58 mph or greater. In addition to determining severe thunderstorm gust climatology, the researchers wanted to contrast wind gusts measured by meteorological equipment with gusts that are estimated by human observers.

Photo courtesy of Doug Whitson

There are four official measuring sites across the Tri-State area. These sites, known as ASOS (Automated Surface Observing System) sites, meet specific meteorological siting requirements and are calibrated four times a year to ensure data quality is high. The ASOS sites are located at airports in the area: Burlington, CO; Goodland, KS; Hill City, KS; McCook, Nebraska. There are over 900 ASOS sites across the country.

Examining data from 2003-2009, researchers determined that 1,911 measured severe thunderstorm wind gusts occurred across the contiguous United States. Further, researchers discovered that ASOS sites in the High Plains recorded the highest number of severe thunderstorm wind gusts in that seven year period. In fact, the station that reported the most number of severe thunderstorm wind gusts across the country during that period was Burlington, Colorado, with 18 events. The ASOS in Hill City, Kansas, recorded the third highest number. ASOS sites in McCook, Nebraska, and Goodland, Kansas were in the top 10.

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Rank	Site	Number of Events	Rank	Site	Number of Events
1	Burlington, CO	18	4	Guadalupe Pass, TX	12
2	Lubbock, TX	15	4	Wichita Falls, TX	12
3	Hill City, KS	13	8	McCook, NE	11
4	Liberal, KS	12	8	Dodge City, KS	11
4	Childress, TX	12	10	Goodland, KS	10

Severe thunderstorm wind gusts are common across the High Plains and can originate via several processes. In dry microbursts, precipitation falling from a thunderstorm begins to evaporate when it encounters drier air below. This process can cool the air significantly, which then forms a rapidly descending downdraft which can produce extreme wind gusts of 70 to 90 mph or greater. Another mechanism responsible for strong thunderstorm winds occurs when precipitation falling from a thunderstorm channels faster-moving air from aloft down to the surface, which often results in a swath of damage. Still other examples include processes occurring in well-organized storms known as supercells, and organized clusters of storms called bow echoes. Each of these has its own mechanism for developing severe winds at the surface.

To read the entire paper, please visit: http://www.spc.noaa.gov/publications/smith/waf-wind.pdf

NWS Goodland Via Facebook and Twitter

http://www.facebook.com/US.NationalWeatherService.Goodland.gov

https://twitter.com/NWSGoodland

One more way to find us - load our page using your phone's camera and a QR code reader. Scan the code above and take the latest weather bulletins with you when you are on the go!

Chance of rain?

By Grady Bonsall - ESA

How many of us understand the forecasts? When we hear the forecast on the TV or radio or even see it come across our phones or the internet, do we really understand what it means? When we see 40% chance of rain, what are the forecasters saying? Will it rain 40% of the time, will it rain across 40% of the area, or is there a chance that 40% percent out of 100% there is the possibility of rain? We all see this differently and interpret it differently.

The other day I talked with a friend of mine and we discussed the weather. I came to the conclusion that he views the forecast differently than I do. I thought to myself, "Who's right and who's wrong?" I'm not a meteorologist but I do work for the NWS. Shouldn't I know what this means exactly? After browsing a few web sites, researching some NWS documents, and querying some of the local forecasters, here's my conclusion.

There is some confusion with terminology so let's clarify. When the NWS puts out a statement that there is a chance of rain, this means there will be a measurable amount. A measurable amount refers to 1/100th of an inch or .01 inches. When the forecast is 40% chance of rain then 4 out of 10 cases where the weather is similar, there will be measurable amount of precipitation in the area. When observers report trace amounts, this indicates precipitation at less than .01 inches. Therefore, it is not measureable.

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Statements issued by the NWS are known as Probability of Precipitation (PoP) reports. PoP reports are defined as:

The PoP describes the chance of precipitation occurring at any point you select in the area.

PoP = C x A

C = the confidence that precipitation will occur somewhere in the forecast area

A= the percent of the area that will receive measurable precipitation

So … in the case of the forecast above, if the forecaster knows precipitation is sure to occur (confidence is 100%), then they are expressing how much of the area will receive measurable precipitation. (PoP = C x A or 1 times .4 which equals .4 or 40%).

But, most of the time, the forecaster is expressing a combination of degree of confidence and areal coverage. If the forecaster is only 50% sure that precipitation will occur, and expects that, if it does occur, it will produce measurable rain over about 80% of the area, the PoP (chance of precipitation) is 40%. (Pop =.5 x .8 which equals .4 or 40%).

In either event, the correct way to interpret the forecast is: there is a 40% chance that precipitation will occur at any given point in the area.

Terms typically in weather forecasts based on POP:

- **0%** – No mention of precipitation
- **10%** – No mention of precipitation, or isolated/slight chance
- **20%** – Isolated/slight chance
- **30%** – (Widely) scattered/chance
- **40%** or **50%** – Scattered/chance
- **60%** or **70%** – Numerous/likely
- **80%**, **90%** or **100%** – No additional modifiers (e.g. "showers and thunderstorms")

Want more information, check out the following websites:

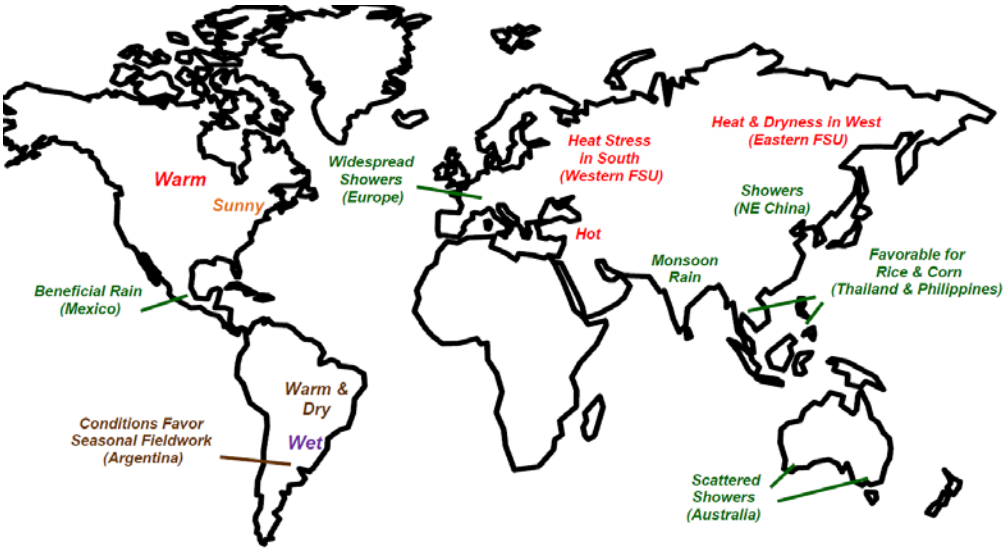
http://weather.about.com/od/c/g/chance_of_rain.htm
http://en.wikipedia.org/wiki/Probability_of_precipitation
http://www.srh.noaa.gov/ffc/?n=pop

Cooperative Observer News

James Claassen, pictured at right, Station Manager at KGCR in Brewster, KS, accepts an award for 25 years of service.

Photo by Scott Mentzer, MIC

Would you be interested in being a cooperative observer? Openings are available in Benkelman and Stratton, Nebraska and in Stratton, Colorado. Contact our office for more information!
1-800-272-7811



Wonder what the weather is like around the world. Click the website below for the latest information on weather and crop conditions around the world:
http://www.usda.gov/oce/weather/pubs/Weekly/Wwcb/wwcb.pdf

The Impressions of New Employees about the National Weather Service

By Scott Mentzer - MIC

I have had the privilege over the years to hire new employees into the National Weather Service (NWS). Many of these employees, who all have college degrees in meteorology, are classified as meteorological interns. NWS interns spend approximately three years enhancing their forecasting and severe weather warning skills, learning NWS policies and technology, and being offered opportunities in outreach, research, and other program areas.

Three new interns recently joined our office: Randy Bowers, Mike Kochasic, and Amanda Wertz. Each has been on our staff for three months. I sat down with them and asked them three questions.

Question 1: What surprised you the most about the NWS?

Randy Bowers

Wertz – "There are two things that struck me. First, everyone gets along with one another. It's a very collegiate environment. Second, I didn't plan on doing so much right off the bat. After just a little training, I was assisting in severe weather operations, making aviation forecasts, and giving weather safety presentations to school kids."

Kochasic – "The most surprising aspect of the National Weather Service is how many citizens rely on the public service we provide. We get numerous phone calls for weather information and data requests, really more than I expected. It is very satisfying to provide public service to the tri-state area!"

Bowers – "The High Plains definitely sees its fair share of wind and I didn't realize how much the wind can impact the agricultural community, especially the sprayers. Wind forecasts are one of the most popular information requests that we receive. It can be very challenging to forecast wind direction and speed here."

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Question 2 - What duty have you enjoyed the most since joining the NWS?

Amanda Wertz

Wertz – "I have really enjoyed doing the extended forecasts. These are the forecasts that are 4-7 days from the current day. I also get to write the Area Forecast Discussion to support my forecast, and I get a thrill out of that." (Editor's note: Area Forecast Discussions, or AFDs, are one of the most widely used products issued by the NWS.)

Kochasic – "I have really enjoyed working with other colleagues who are dedicated to serving the public and who love their jobs. When working with colleagues that are enthusiastic about their work, I realize that I am in the right place and working for the right organization!"

Bowers – "I really enjoy interacting with the people we serve and handling the variety of requests for weather information that we receive from them."

Question 3 - What have you found to be the most disappointing thing about the NWS?

Mike Kochasic

Wertz – "I was disappointed to learn that some outreach activities have been postponed or eliminated due to limited budgets. Outreach is an important component of what we do, and I hope we can provide more weather education in the future."

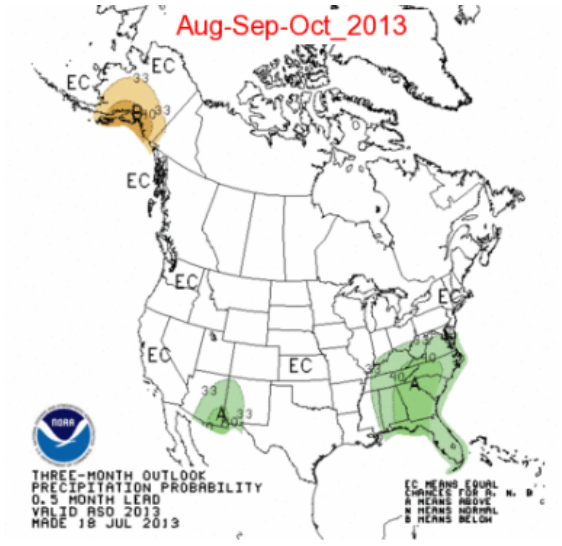
Kochasic – "Weather never rests, and neither do meteorologists. Working rotating shifts to keep up with the weather at all hours of the day or night can be tough at times. However, realizing that citizens rely on our weather information keeps me motivated to give my best at all times of the day."

Bowers – "The limitations that prevent us from reaching everyone with critical weather information are frustrating. However, improvements in technology such as smartphones and other mobile data devices have helped greatly and this has allowed us to reach more people now than we were able to in the past."

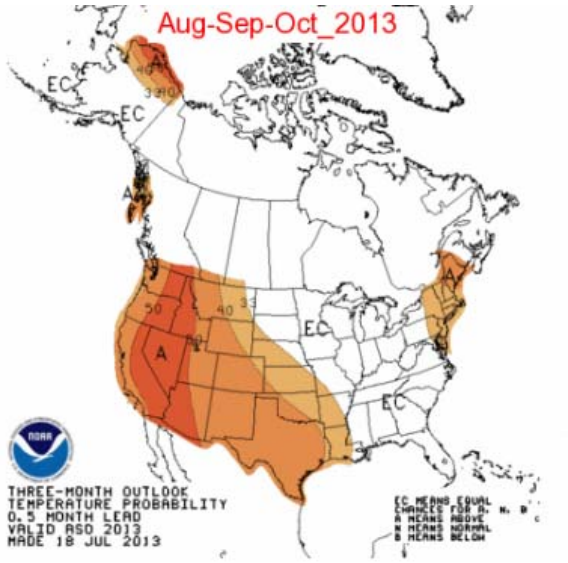
Climate Corner

Current Weather Information for Our Area

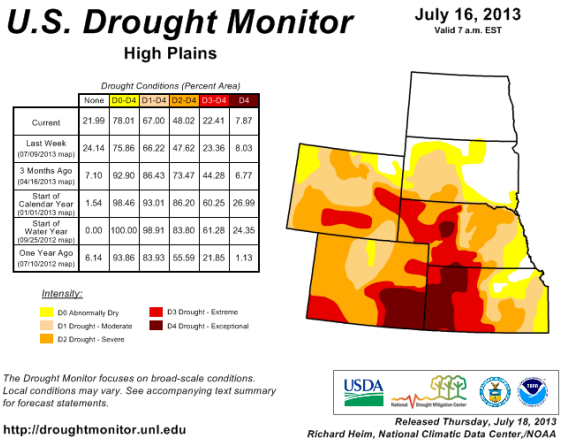
Latest Extended Outlooks



Precipitation Outlook (August - October 2013)

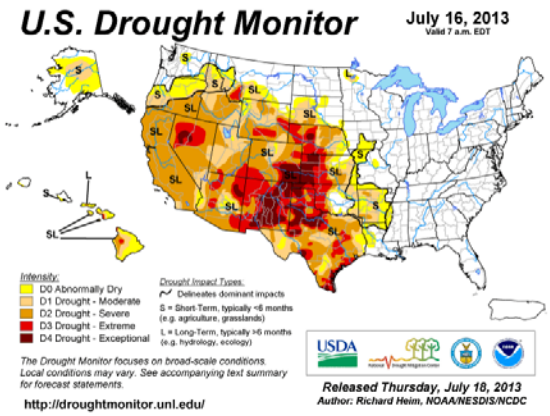


Temperature Outlook (August - October 2013)



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	21.99	78.01	67.00	48.02	22.41	7.87
Last Week (07/09/2013 map)	24.14	75.86	66.22	47.62	23.36	8.03
3 Months Ago (04/16/2013 map)	7.10	92.90	86.43	73.47	44.28	6.77
Start of Calendar Year (01/01/2013 map)	1.54	98.46	93.01	86.20	60.25	26.99
Start of Water Year (09/25/2012 map)	0.00	100.00	98.91	83.80	61.28	24.35
One Year Ago (07/10/2012 map)	6.14	93.86	83.93	55.59	21.85	1.13

Current Drought Monitor



Drought Outlook

Need more information? Check out the U.S. Drought Monitor website: http://droughtmonitor.unl.edu/

Site	Year-to-Date Precipitation	Departure from Normal
Burlington	8.15	-2.28
Goodland	7.42	-4.09
Hill City	7.23	-5.92
McCook	7.30	-5.73

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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.

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!