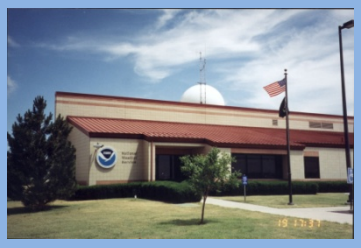

High Plains Wind

(Weather Information News Data)

March 19, 2010
Volume 4 Issue 1

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

"The first indication that "*something was going on*" did not come from radar."

A Message from the Meteorologist-in-Charge

By Scott A. Mentzer

The Importance of Storm Spotters

I really enjoy the picture below. It depicts a tornado that occurred on the afternoon of July 21, 1996, approximately four miles north of Colby, Kansas. This highly visible tornado was on the ground around 25 minutes and had a track length of three miles.

Colby Tornado - July 21, 1996 (Photo by Tom Jones)

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How To Measure Moisture … It's All Relative

by David L. Floyd, WCM

Relative humidity. The term is used every day. We hear it on TV and radio during the weather segment. We see it displayed on our own National Weather Service web sites along with temperature, wind and air pressure. Relative humidity describes the moisture content of the air, and it can be important. Crops must be dried below a certain relative humidity value before harvest and storage; wood swells and shrinks with changes in humidity; paint dries faster when the air is less humid. There are many ways to describe atmospheric moisture content. In addition to relative humidity (RH), there are also absolute humidity, specific humidity, vapor pressure, mixing ratio, wet bulb and dew point to name a few.

The amount of water vapor in the air changes seasonally, daily and even hourly. Water vapor is water in gas form, just as ice is water in solid form. Our bodies' sense water vapor, and the more vapor that exists, the more uncomfortable we feel. We typically state that the air feels "humid" as the water vapor content of the air increases. The amount of water vapor usually drops when a cold, dry air mass arrives from Canada; it increases after a heavy rain when evaporation from the wet soil sends water vapor back into the air. So what's the best way to measure these changes? Let's examine the two most popular ways to describe moisture content: dew point and relative humidity. Weather meteorologists prefer dew point, the rest of the world is happy with relative humidity.

Dew point is often confusing because it is expressed as a temperature. For example, I might say "the dew point at 2 pm was 46 degrees". A good way to think of dew point is that it is an absolute measure of water vapor. The higher the dewpoint, the greater the mass of water vapor in the air. If the dew point at 2 pm is 46 and the dew point at 10 am was 38, there is more "water mass" in the air at 2 pm compared to 10 am.

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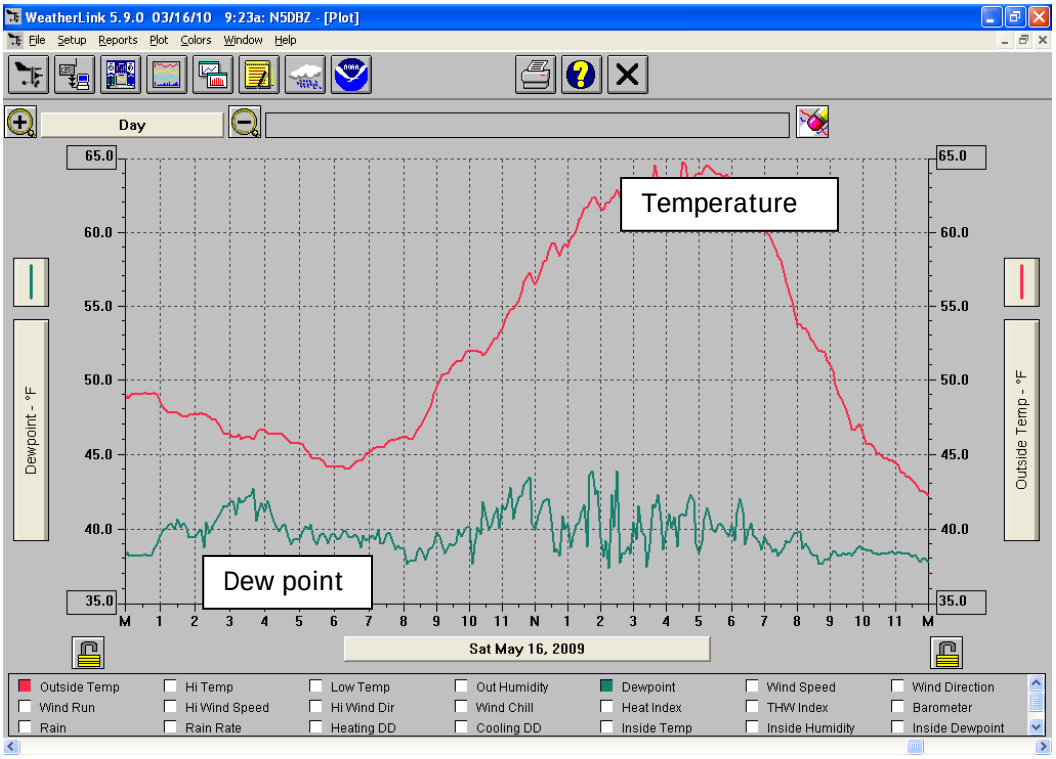

The chart above is taken from my home weather station. The red line is air temperature; the blue-green line is dew point temperature. Notice the dew point is fairly constant through the day, which tells me the mass of water vapor in the air did not change much in 24 hours. The air temperature peaks during the afternoon as you'd expect. Note the temperature scales in degrees Fahrenheit.

Dew point is used by meteorologists in thunderstorm forecasting, and also to help assess the potential for heavy rain and snow, and flash flooding. When the dew point is higher there is physically more water vapor in the air. Thunderstorms need water vapor, often referred to as "the fuel for the storm". When air is lifted within the storm updraft, it cools and the water vapor in the air condenses back into a liquid or solid (the cloud we see). Condensation releases heat, which in turn helps the storm updraft remain buoyant. Higher dewpoint … more water vapor … more buoyant cloud. A higher dewpoint also means there is physically more water vapor in the air that can ultimately fall out as precipitation. When the dew point climbs into the upper 50s, we start to notice that it "feels humid". When the dew point climbs into the upper 60s and lower 70s, most people will say the air "feels muggy" or even "oppressive".

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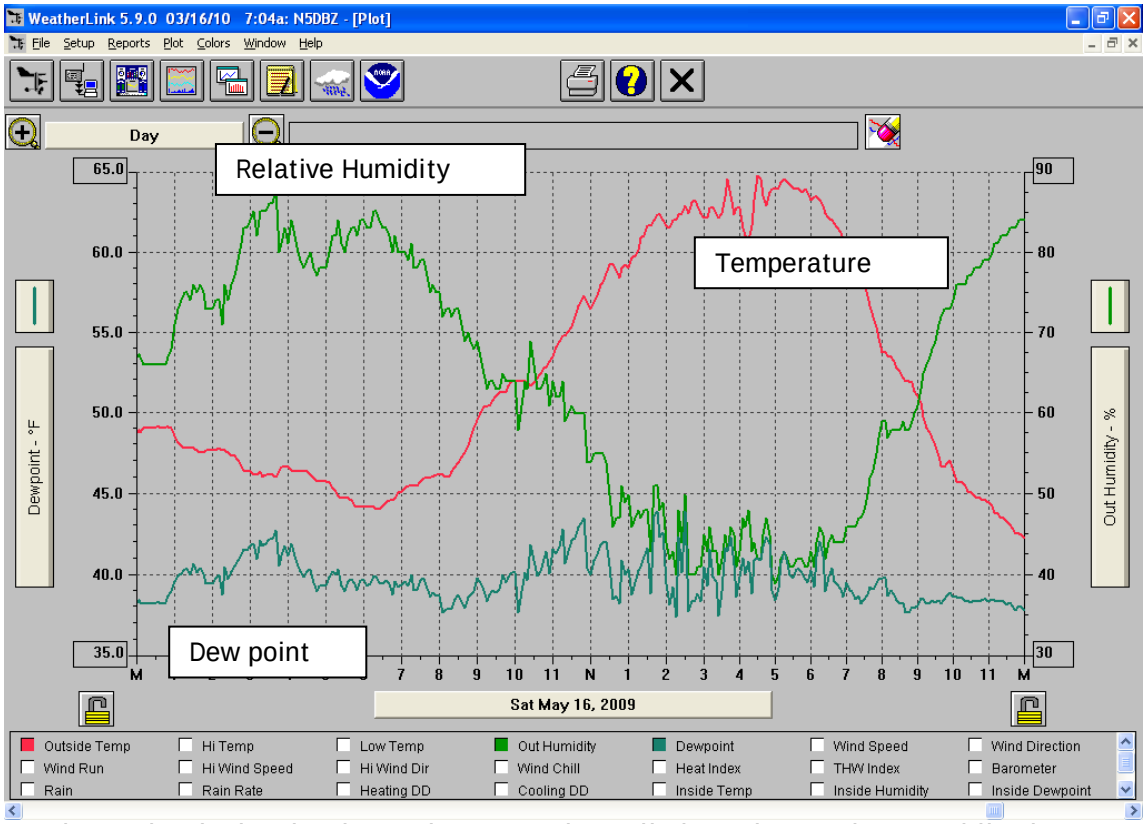
Now let's add relative humidity to the same graph; it is the green line. Note the scale of relative humidity is on the right side, and it ranges from 30% to 90%, while the temperature and dew point scales are unchanged on the left. Hmmm. Interesting. The green RH curve shows the humidity is highest between 3 and 7 am, peaking at 88% just before 4 am. The RH drops to 40% between 2 and 6 pm. According to the relative humidity curve, the moisture content of the air is changing dramatically during the day; the air is "more humid" at daybreak and "less humid" during the afternoon. But did the moisture content <u>really</u> change? Look at the dew point curve again: it's flat.



So what's the deal? The dew point curve shows little moisture change while the relative humidity curve shows huge swings in moisture. Which one is right? Well, of course they're both right, they're just measuring different things. As mentioned earlier, dew point measures absolute moisture and is related to the mass of water vapor in the air. The relative humidity is measuring moisture that is, well, relative to something else. And therein lies the rub. The relative humidity is dependent not only on the absolute moisture in the air, it is also dependent on air temperature. The astute observer (which I know all of you are!) notices that when the air temperature is highest during the afternoon in the chart above, the relative humidity is lowest. Conversely, when air temperature is lowest, relative humidity is highest.

One problem with relative humidity is that in order to know the true amount of water vapor in the air, I need to know two things…the RH value <u>and</u> the current air temperature. A 60% relative humidity at an air temperature of 80 degrees refers to a much, much higher value of water mass than a 60% relative humidity at an air temperature of 40 degrees. This is why meteorologists prefer to use dew point. It is absolute, not relative.

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Relative humidity does have its uses. It relates how much water vapor currently exists compared to how much water vapor can exist at the current air temperature. For any given air temperature, only a certain amount of water vapor can exist. Further increases will result in condensation into a liquid. The higher the air temperature, the more water vapor can exist before condensation occurs.

If the air temperature begins to cool at night, but the absolute moisture (as measured by dew point) does not change, what happens to the relative humidity? It increases. As the air temperature continues to fall, it is less able to accommodate moisture in vapor form, and the RH value continues to rise. When the relative humidity gets close to 100%, what we are saying is that now the air is able to accommodate just about all the water vapor it can. At this point, water vapor may start to condense into fog, or perhaps vapor may get deposited on the ground as dew (or frost if the ground temperature is below 32 F).

Meteorologists use relative humidity to assess cloud and fog potential, higher values leading to a greater likelihood of either. Low values of relative humidity is certain layers of the atmosphere can have big consequences for severe weather, especially the occurrence of strong or damaging thunderstorm outflows. Rain falling into a layer of dry air will partially or completely evaporate, which will suddenly cool the air causing it to rapidly sink. This can result in a downburst of damaging straight line winds. Relative humidity is also monitored to assess fire potential. Low RH values, especially when combined with strong winds, will increase the potential for wildfires if the ground cover is dry.

So perhaps meteorologists aren't so hung up on dew point after all. I guess maybe it's all…relative.

If you have not already done so, there is still time to attend a Spotter Training Class!

Click on our website for training locations near you!

www.weather.gov/gld

The Importance of Storm Spotters

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I like the photograph for several reasons. First, I find the peaceful grazing of the sheep in the foreground is a wonderful contrast to what is occurring in the background. Second, it simply is an excellent photograph of a tornado with its condensation funnel, the debris on the ground, and the parent thunderstorm above the main feature. **Third, and most importantly, it reminds me how important storm spotters are in the warning process.**

The first indication our office received that "something was going on" that afternoon did not come from radar. The radar indicated two thunderstorms: one south of Colby and one north of Gem, Kansas (see Figure 1). The radar did not show much in the area just north of Colby where the tornado occurred.

Luckily, storm spotters in Colby saw the tornado, called the National Weather Service (NWS) office in Goodland, and relayed information about the storm to the on-duty meteorologists. Their reports prompted the NWS to issue a tornado warning for the area immediately.

The storm spotters who called the NWS that afternoon were amateur radio operators, but storm spotters come from all walks of life. Many spotters work for law enforcement agencies, fire departments, or other first response entities. Most spotters, however, are citizens who have taken a few hours of training and have an interest in serving the public. These spotters are teachers, students, farmers, clerks, truck drivers, doctors, well, you name it!

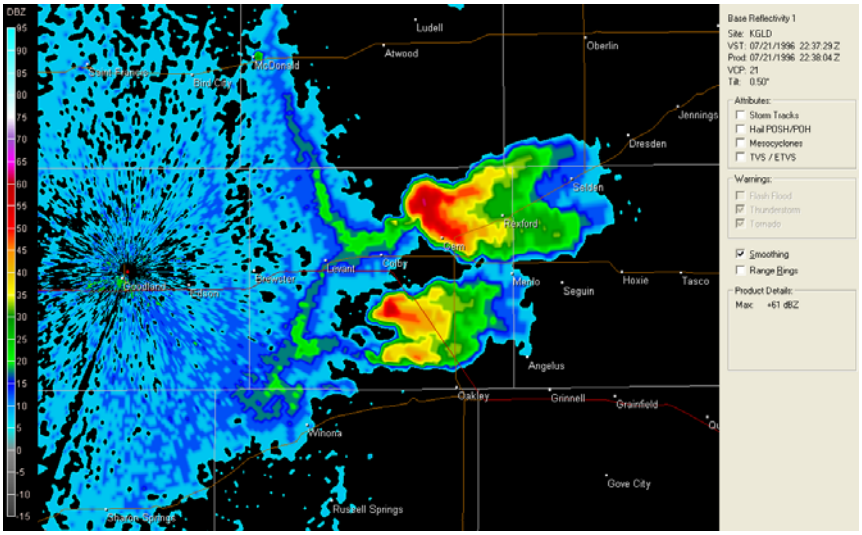

Figure 1 - Radar Display (July 21, 1996 – 5:37 PM CDT)

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The NWS conducts storm spotter training sessions each year in the early spring. These sessions generally last a couple of hours. They give participants a good overview about severe thunderstorm structure plus tips about where to safely observe storms. The classes also give instructions on the different ways to contact the NWS about severe storms.

Once storm reports are received by the NWS office, they are forwarded to local media and cataloged in a database. Storm reports are used by radar operators in real time to confirm their thinking about storms, or, sometimes, to force them to reevaluate their thinking about storm evolution. Although the radar is a wonderful tool to examine storms, it has limitations. "Ground truth" reports from storm spotters are essential in the warning process.

By the way, a picture of the Colby tornado hangs prominently in the Goodland NWS office. We give many tours during the year. Invariably, one member of a tour group will see the picture and say "Wow! What a neat tornado!" I just smile and reflect on the importance that storm spotters had that afternoon in July …and do have on all of the severe weather events across the Tri-State area.

Photo above of St. Francis Power Plant May 31, 1935

Don't forget to contact us if you have any stories or photos related to the 1935 Republican River Flood. We are adding to our website daily and would appreciate any help you could give us. Check it out at:

http://www.crh.noaa.gov/gld/?n=1935flood

Ever Wonder?

By David Thede, Lead Forecaster and David L. Floyd, WCM

Have you ever wondered or been curious about where the weather observations you hear on NOAA All Hazards radio or various media outlets come from? We'll feature a different weather station in each newsletter.

Kit Carson, Colorado Weather Station

The weather station 9 miles northeast of Kit Carson, Colorado is part of a nationwide network of thousands of unofficial, yet very useful, weather stations. This station features a Davis Vantage Pro Wireless Weather Station which records temperature, dew point, humidity, wind direction, wind speed, precipitation (rainfall and melted snow), and barometric pressure. The station was installed approximately two years ago.

The wind sensor is located about 20 feet above ground level on a wooden pole. It is free of obstructions from trees and buildings. The standard height for wind sensors is 10 meters (32.8 ft) above the ground, but 20 feet was the highest that could be reached in this case. The temperature, humidity and precipitation data is gathered from a sensor located approximately 9 feet above the ground. The recommended height is 2 meters (about 6 feet) above the ground over a grassy area. The height of this sensor was chosen to help mitigate the effects of the nearby building.

This unofficial data are transmitted at ten minute intervals to several web sites, and are ingested in near real time by the National Weather Service office in Goodland.

Here are two Internet links to view the data in near real time:
http://www.findu.com/cgi-bin/wxpage.cgi?call=CW9626&last=24

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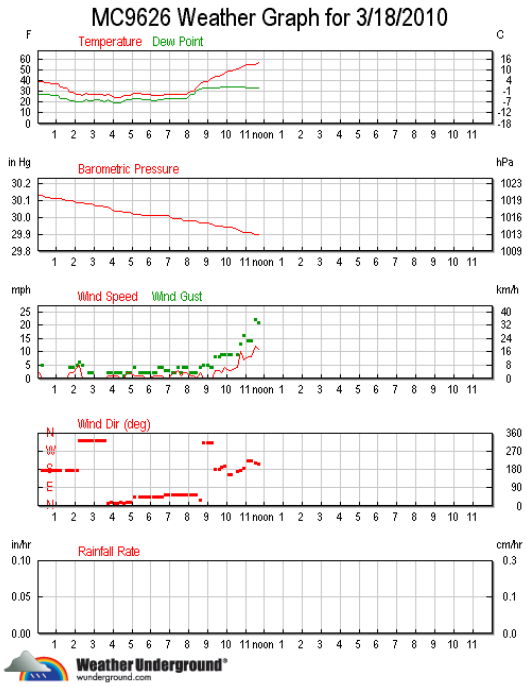
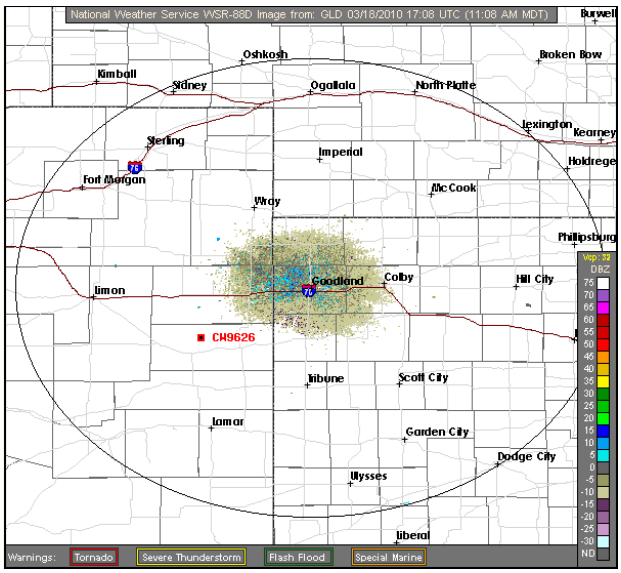
The radar image below on the right shows the location of the station in Kit Carson, Colorado and its relation to other nearby towns.





High Water Mark

May 31, 1935

On this day, extreme rainfall caused water from the Republican River to rise to this level at this location.

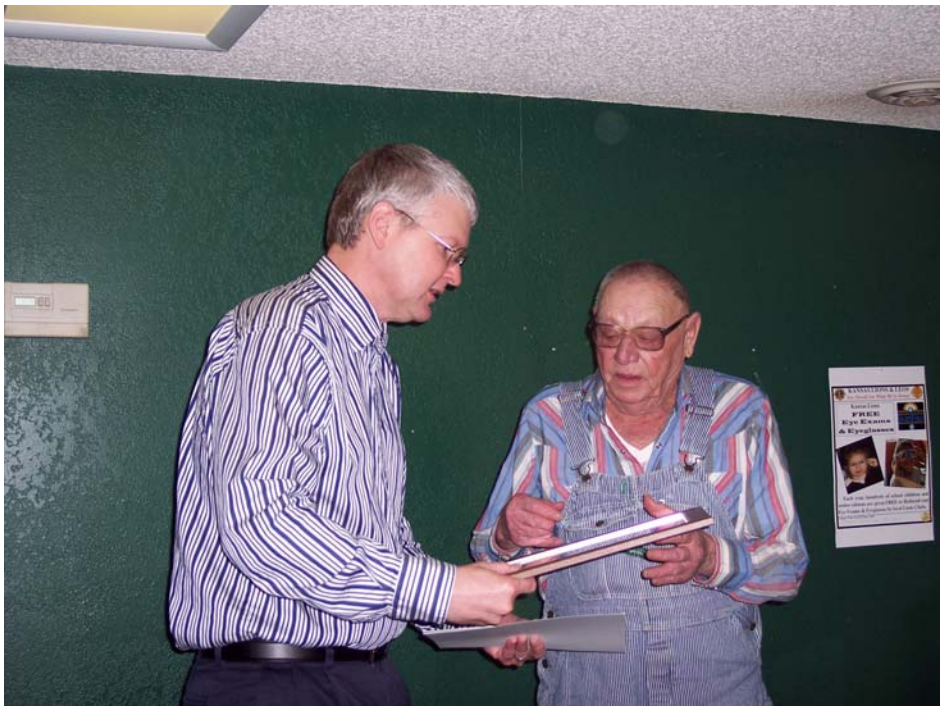
For more information contact:

National Weather Service
http://weather.gov/gld

Signs like this will be going up around the area this summer. Watch our newsletter for more information!

Cooperative Observer News

by Mike Lammers, OPL, and Christina Henderson, HMT



Wilford Martin (right), from McDonald, Kansas, accepts a 40-Year Length of Service Award from Scott Mentzer, Meteorologist in Charge.

Photo taken March 9, 2010 by Joy Hayden, ASA.

Mike Lammers (left), presents Dallas Saffer, Flagler, Colorado, with a 10-year length of service award.

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Tips for Great Observations

1. Please do not move any equipment before consulting with the National Weather Service Office in Goodland. You can either call Mike Lammers, OPL or email him at michael.lammers@noaa.gov. The reason for this is that any move in location requires a change in paperwork (B44 Form) for your station and must get prior approval before moving.

2. Be aware of any obstructions that could adversely affect your weather data (temperature or precipitation). The SRG (Standard Rain Gauge) should not be placed near trees or buildings and the MMTS (temperature) should be at least 100 feet away from any extensive concrete or paved surface. Situations may arise where these measurements cannot be exactly followed. In that case a detailed description of each obstruction will be listed in the form B44 for that station. A good example is equipment near small trees or bushes. With time we all know that trees and bushes will grow. With time your National Weather Service representative will determine when he visits the station whether your equipment needs to be moved away from those obstructions.

3. If you feel or notice any of your equipment not producing good reliable data do not hesitate to let Mike Lammers or Christina Henderson know at once about this concern. Either call us at 1-800-272-7811 or email us at either michael.lammers@noaa.gov or christina.henderson@noaa.gov.

4. If you have a Fischer Porter Rain Gauge, please check it at least twice a week. Open the door and look at the chart and watch for at least one or two punches to be sure it is still working. There have been a few instances in the past where observers have not looked inside until time to take off the tape for a month only to find that the Fischer Porter had been down all month and could have been repaired much sooner.

5. Since winter will be with us awhile longer and we will probably see more snow, continue to keep up the good work you are doing in taking your snow measurements. If it is at all possible take your 8 inch gauge, get a sample of the snow and melt it down so that you can also put the liquid amount in your daily record. If you record snowfall without recording how much liquid was in the snow, your monthly and annual precipitation record will be archived as missing. If you have any questions about this give us a call or email us at once. We will be glad to help.

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6. Also those of you who use WxCoder III, please check your data and then close out your weather data for the month no later than the fifth of the month (see illustration below). We are getting better with this each month, but the sooner you finalize your report, the sooner we can submit your data as we have to close out here at the National Weather Service by the twentieth of the month. When we do this your data goes electronically to NCDC (National Climatic Data Center) in Asheville, NC.

7. The following sites are now paperless and send their reports to us only by computer and do not need to send their handwritten copies to us.

Colorado
Arapahoe 12S
Bonny Dam 2NE
Burlington
Cheyenne Wells
Flagler 1S
Stratton
Yuma

Kansas
Atwood
Atwood 8SSE
Brewster 4W
Colby 1SW
Densmore 2N
Dresden
Goodland City
Goodland WFO
Gove 4W

Kansas
Grainfield
Lenora
Leoti
Mingo 6E
Norton Dam
Oberlin
Sharon Springs
Tribune 1W
Tribune 13NNE
Wallace

Nebraska
Haigler
McCook #2
Max 13N
Stratton
Trenton Dam

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8. Those of you, who diligently call in your reports each morning, keep up the good work. Try to keep up with each day's record and get your hardcopy into the mail as soon as possible after the first of each month. We here at the National Weather Service compare your daily phone reports with your handwritten form, which takes a bit of time.

Observers that call us or use IV-ROCS

Colorado	**Kansas**	**Nebraska**
Clarkville 1N	23 SW Goodland	Benkelman
Joes	Hill City 1E	Culbertson
Kit Carson 9NNE	Quinter	Palisade
Vernon 4E	St. Francis 8NW	
Wild Horse 6N	Russell Springs 3N	
Wray	Studley 9NNW (calls when precip. occurs)	
	Wakeeney 16N (calls when precip. occurs)	

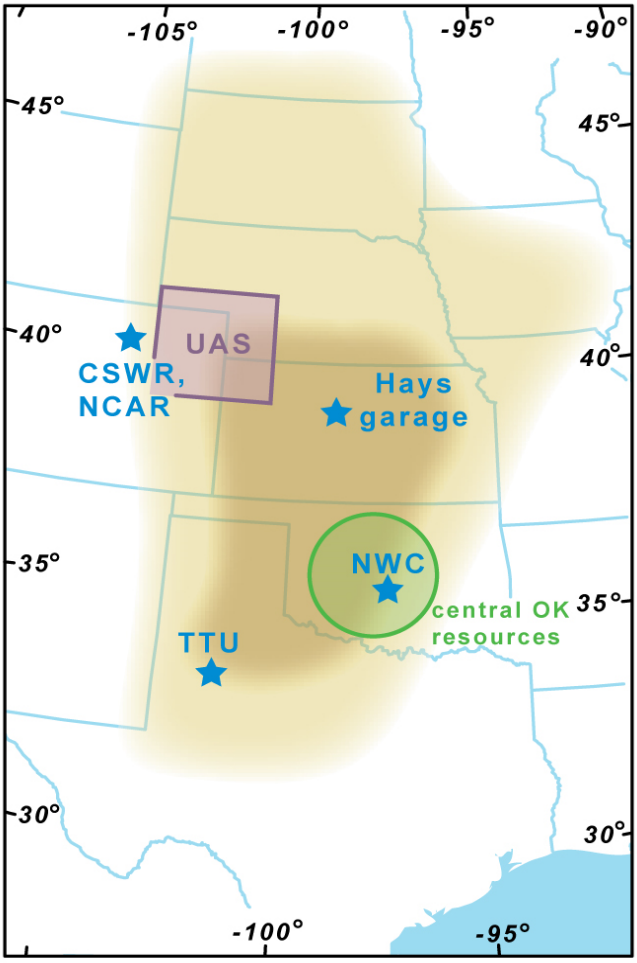
Observers who only mail in forms

Colorado	**Kansas**	**Kansas**	**Nebraska**
Arapahoe	Bird City 10S	Selden 11NW	Parks 17N
Kit Carson	Morland 2N	St. Francis	
Seibert	Norcatur 3WSW	St. Peter 4 ENE	
Wild Horse 11SSE	Norton 9SSE	Winona	
	Oakley 22S		
	Rexford 1SW		

Tornado Researchers Return in 2010

By Chris Foltz, Journeyman Forecaster

The second year of the **V**erification of the **O**rigin of **R**otation in **T**ornadoes **EX**periment **2** (**VORTEX2)** will take place from May 1-June 15, 2010. More than 100 scientific researchers will once again converge on the Plains in an effort to sample severe thunderstorms with the hope of gaining greater insight into why some thunderstorms produce tornadoes while other similar storms do not. One of the most difficult portions of the research project will involve determining exactly which storm to intercept. Often times, there will be numerous options which may be hundreds of miles apart on a given day. This is where the expertise of the Principal Investigators (PI's) will come into play. A target area for the day is usually identified at least one or two days in advance. This is required because of the large number of vehicles and individuals involved.



2010 VORTEX2 Domain
Courtesy: www.vortex2.org

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The armada of vehicles will include 10 mobile radars, numerous mobile mesonets and various other scientific equipment. A mobile mesonet is a vehicle with a series of high quality weather instruments attached. These vehicles are driven in an organized grid pattern around all sides of the thunderstorm in an attempt to sample, among other things, the temperature, dew point, barometric pressure and winds. This information will then allow researchers to better understand the near-surface thunderstorm environment.

Doppler On Wheels (DOW) mobile radar
Courtesy: www.vortex2.org

Mobile Mesonet vehicle
Courtesy: NOAA National Severe Storms Laboratory

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While it is difficult to predict exactly if or when the research project will be in our area, they will be very noticeable when they are present. If you do see them, especially during the afternoon and evening hours when thunderstorms are ongoing, please refrain from approaching them as they will be focused on obtaining data which will hopefully help your NOAA National Weather Service forecasters provide better warnings which will in turn help save lives and protect property.

National Weather Service
Goodland, KS
Looking for Weather Observer
in Atwood, KS
Hoxie, KS
Lenora, KS

History of Cooperative Weather Observer Program

John Companius Holm's weather records, taken without the benefit of instruments in 1644 and 1645, were the earliest known observations in the United States. Subsequently such famous personages as George Washington, Thomas Jefferson, and Benjamin Franklin maintained weather records spanning many years.

The first extensive network of cooperative stations was set up in the 1890's as the result of an act of Congress in 1890 that established the Weather Bureau. Today, there are over 11,000 volunteer cooperative observers scattered aver the 50 states, taking observations seven days a week throughout the year.

The above observers regularly and conscientiously contribute their time so that their observations can provide the vital information needed to define the climate in their areas. The records are also used constantly to answer questions and guide the actions of public agencies, agricultural and commercial organizations, and individuals. Their records also form a basis for preparedness for national and local emergencies, such as flooding.

The National Weather Service in Goodland is looking for Cooperative Weather Observers to take over the observations in Atwood, Hoxie and Lenora, Kansas. Weather Observations started in 1889 in Atwood, in 1888 in Hoxie, and in 1913 in Lenora. We would love to continue these historical sites, but need your help!

Do you live in these communities? Would you be willing to record the temperatures and precipitation everyday at 7 am Central?

All equipment will be provided. If interested, contact Christina Henderson for more details.

National Weather Service
Goodland,KS

National Weather Service
Cooperative Weather Observing Program
920 Armory Drive
Goodland, KS 67735

Phone: 1-800-272-7811
E-mail: christina.henderson@noaa.gov

Wondering when to plant your garden? Keep these dates in mind!

From the National Weather Service Homepage at www.weather.gov/gld

Northwest Kansas	Average Spring	Frost-Free Days
Atwood	08 May	144
Colby	04 May	151
Goodland	03 May	156
Hill City	25 Apr	167
Hoxie	28 Apr	160
Leoti	01 May	161
Norton	30 Apr	164
Oakley	25 Apr	171
Oberlin	04 May	149
Russell Springs	30 Apr	151
Saint Francis	01 May	157
Sharon Springs	30 Apr	160
Tribune	04 May	151

Eastern Colorado	Average Spring	Frost-Free Days
Burlington	03 May	153
Cheyenne Wells	05 May	150
Flagler	13 May	138
Idalia	03 May	-
Kit Carson	10 May	141
Wray	10 May	146
Yuma	07 May	147

Southwest Nebraska	Average Spring	Frost-Free Days
Benkelman	07 May	152
McCook	28 Apr	163
Trenton	02 May	162

The above table depicts the average date of the last freeze in the spring, and the total number of frost free days per year.

Additional information can be found on the website of the Kansas State Climatologist at:

http://www.ksre.ksu.edu/wdl/

or by contacting your local County Extension Service.

ICS 300 and ICS 400

By David Thede, Lead Forecaster

On December 17-18 2009 meteorologists David Thede and Kelly James from the National Weather Service in Goodland attended Incident Command System (ICS) classes ICS300 and ICS400 at the Goodland Regional Medical Center through the Department of Homeland Security, specifically the Homeland Security Presidential Directive – 8 (i.e. the "National Preparedness Goal"). Both of these classes target emergency management, police, fire, emergency medical services, elected and appointed officials, volunteer agencies, military and the Department of Natural Resources.

The role of the National Weather Service would be to provide time specific weather information and forecasts to those first responders who request it. This could be over the phone, in person on site, fax, e-mail, etc.

One example on a fairly small scale could include a semi-truck and trailer that loses control and overturns, spilling a large quantity of fuel onto the highway and into a stream or ditch. A second truck and trailer must suddenly avoid the first truck and trailer and swerves off the roadway, also overturning and spilling anhydrous ammonia. The first responder(s) such as law enforcement, fire, emergency manager, etc., analyze the scene and develop a plan (through ICS training) to minimize further contamination, securing the scene, etc. The role of the National Weather Service would be for weather support including site specific data such as wind, temperature, humidity, chances of precipitation, etc. This could be for the next few hours to several days or months (larger scale).

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The importance of timely and accurate weather information will be critical in evaluating (for this example) whether any towns, cities, roadways, etc would have to be evacuated as the plume of anhydrous ammonia drifts toward and/or over them. What happens if it rains or a thunderstorm moves over the spill area or a cold front with strong winds is expected to move through, how would that impact those on seen where fuel has spilled? Through close coordination between the National Weather Service and first responders we can help answer those questions.

National Weather Service
920 Armory Road
Goodland, KS 67735

Phone:
785-899-7119

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.