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New Mexico scenery 2009 - Photo by Glen Roebke
<http://hprcc.unl.edu>

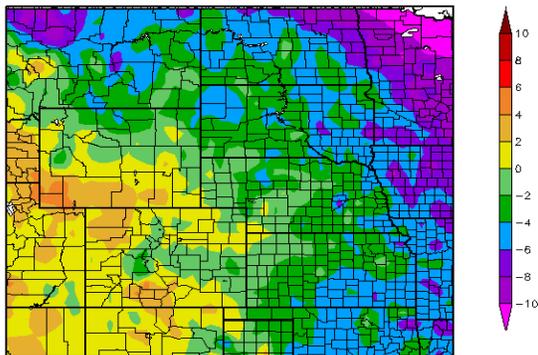
March 2014 Climate Summary

Region Breakdown

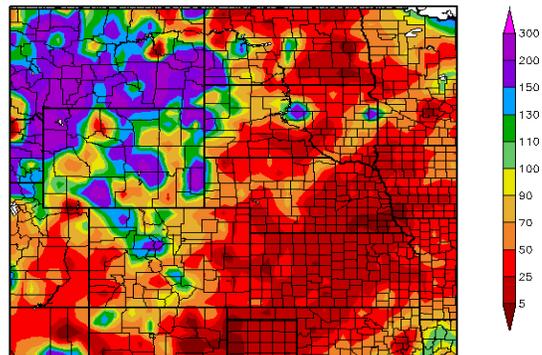
March 2014 was another chilly month for the High Plains Region. The first two days of the month were filled with record setting cold as many daily maximum and minimum temperature records were broken. One interesting record came from Grand Forks, North Dakota (period of record 1893-2014). On March 1, Grand Forks had a high temperature of only -11.0 degrees F (-23.9 degrees C). This not only set a new record lowest maximum temperature for the day, but also for the entire month of March. The old record of -6.0 degrees F (-21.1 degrees C) set on March 23, 1974 was crushed! Ultimately, most of the first week of March was extremely cold for the eastern half of the Region with temperature departures ranging from 15.0-25.0 degrees F (8.3-13.9 degrees C) below normal across the Dakotas, Nebraska, and Kansas.

Following the general pattern from last month, northwest flow brought many cold snaps which resulted in below normal temperatures for the eastern half of the Region. Most of the western side of the Region was unaffected and ended the month near to above normal. In general, departures ranged from 4.0 degrees F (2.2 degrees C) above normal in the west up to 6.0 degrees F (3.3 degrees C) below normal in the east. The largest departures, up to 10.0 degrees F (5.6 degrees C) below normal, occurred in northeastern North Dakota; however these were not record

Departure from Normal Temperature (F)
 3/1/2014 - 3/31/2014



Percent of Normal Precipitation (%)
 3/1/2014 - 3/31/2014



Departure from 1981-2010 Normal Average Temperature (left) and Percent of Normal Precipitation (right) for March 2014 in the High Plains Region. Maps produced by High Plains Regional Climate Center. Available at: <http://hprcc.unl.edu/maps/current>

March 2014 Climate Summary

breaking. Again, take Grand Forks for example. The month was 7.4 degrees F (4.1 degrees C) below normal, but this only ranked as the 28th coolest March on record there.

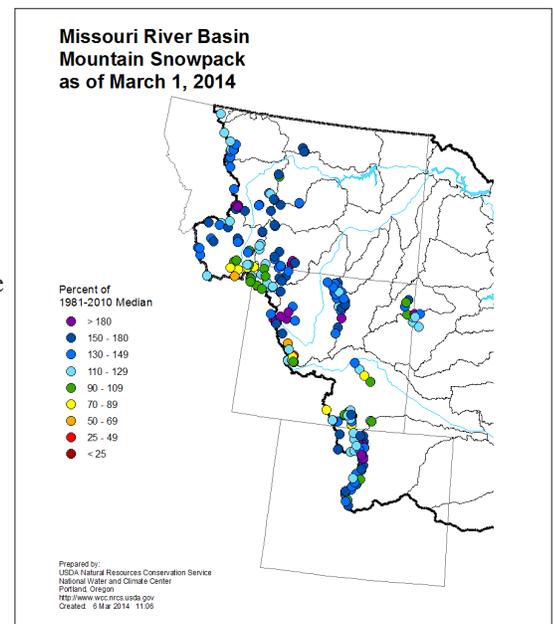
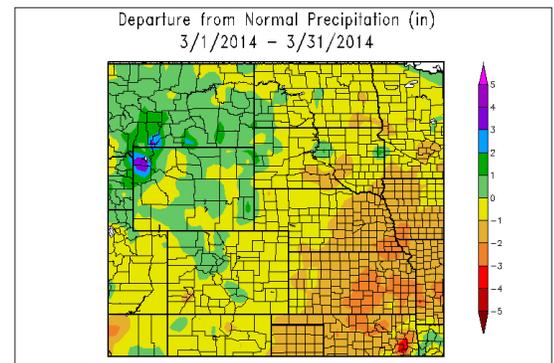
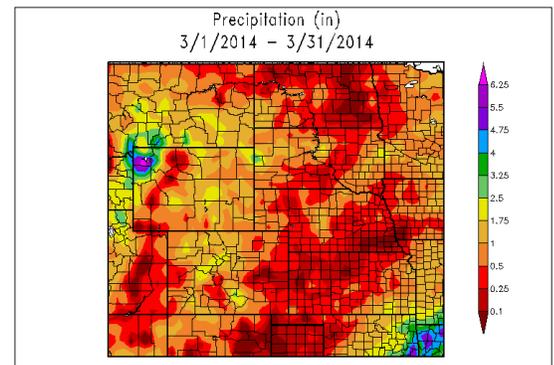
Precipitation Summary

It was a dry month for most of the High Plains Region. The majority of the Dakotas, Nebraska, and Kansas were quite dry with precipitation totals largely below 50 percent of normal. A large area of eastern Nebraska and central Kansas received at best 25 percent of normal precipitation. Now that winter is over, precipitation deficits can accumulate quite quickly and this lack of precipitation led to the reemergence of drought conditions in eastern parts of Nebraska and Kansas. Luckily the spring green-up is lagging due to the cooler temperatures and demand for water has not been high. One of the drier locations this month was Lincoln, Nebraska which tied for its 5th driest March on record with only 0.13 inches (0.3 mm) of precipitation (period of record 1887-2014). Not only was this the driest month in the past year, this was the driest month for Lincoln since October 2010. The driest March occurred in 1994 with 0.06 inches (0.2 mm).

The only areas receiving ample precipitation were northern and central Wyoming and north-central Colorado. The northwest corner of Wyoming was particularly wet with precipitation totals over 200 percent of normal. One of the stations in Yellowstone National Park called Snake River had its 4th wettest March on record with 6.29 inches (16 mm) of liquid equivalent precipitation (period of record 1905-2014). The record occurred in 1932 with 7.56 inches (19 mm).

Although the month as a whole was on the drier side, there were some storm systems that impacted parts of the Region. For instance, the month ended with quite a storm for parts of the Dakotas. Snowfall totals of 6.0-10.0 inches (15-25 cm) were widespread with locally heavier amounts as well. The snow was accompanied by high winds which created blizzard conditions that made travel quite hazardous. I-29 was closed from South Dakota all the way to the Canadian border as was I-94 from Fargo to Jamestown. In addition, several school districts in both North Dakota and South Dakota either closed or had early release due to the conditions.

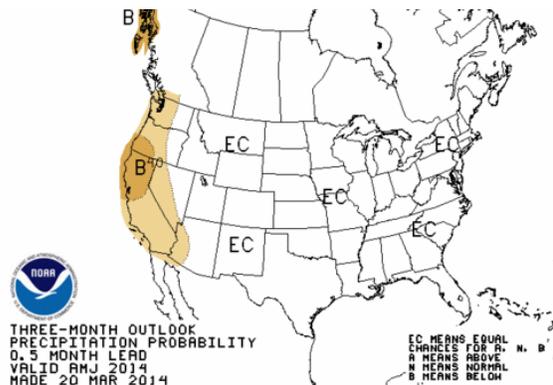
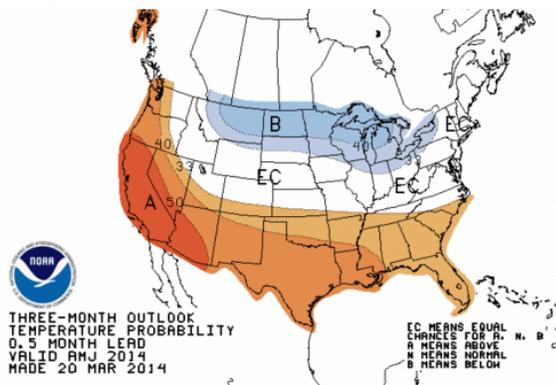
The snowpack continued to build over the past month with both Colorado and Wyoming increasing their statewide totals. Like last month, the southern basins in Colorado were still running below average, but other basins were near to above normal. This brought Colorado's statewide average at the end of March to 114 percent - up slightly from last month's 111 percent. Meanwhile, every basin in Wyoming was above average with the statewide snowpack at 138 percent of average, also up from last month's 132 percent. This ample snowpack in the Rockies is in stark contrast to the past two years when the snowpack was well below normal. This snowpack may draw memories of the 2011 flooding, however that is rather unlikely at this time. The 2011 Missouri River flooding was due to a number of factors, of which the snowpack was only one. For instance, record May precipitation in Montana greatly contributed to the flooding. Also, this year there is additional flood storage as a result of the 2012 drought.



Above: Total precipitation (inches) (top), Departure from Normal Precipitation (inches) (middle) for March 2014 in the High Plains Region, and the Missouri River Basin mountain snowpack as of March 1 (bottom). The top maps are produced by HPRCC and can be found at: <http://hprcc.unl.edu/maps/current>. The bottom map is produced by the NRCS.

Climate Outlook

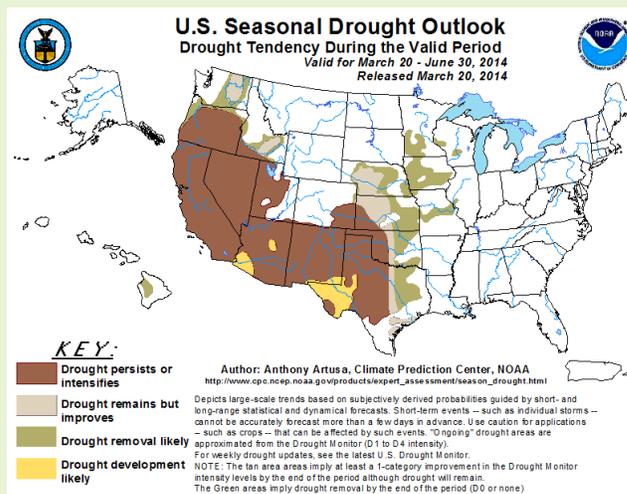
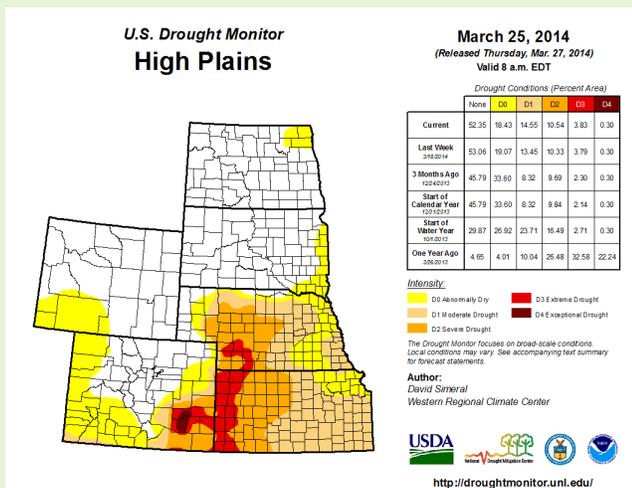
ENSO-neutral conditions continued this month; however there is a 50 percent chance that El Niño conditions will develop later this year in the summer or fall. For the next three months, the temperature outlook indicates a higher probability of above normal temperatures across southern areas of Colorado and Kansas. A higher probability of below normal temperatures exists for all of North Dakota, the northern half of South Dakota, and a small portion of northern Wyoming. Areas in between have equal chances of above, near, or below normal temperatures. The precipitation outlook shows no indications of either a wetter or drier spring as there are equal chances of above, near, or below normal precipitation for the entire High Plains Region. The seasonal outlooks combine the effects of long-term trends, soil moisture, and when applicable, the El Niño Southern Oscillation cycle (ENSO).



Above: 3-Month Outlook Maps Courtesy the NOAA Climate Prediction Center - <http://www.cpc.ncep.noaa.gov>
(left) The Three-Month Temperature Probability Outlook, (right) The Three-Month Precipitation Probability Outlook

Drought Watch

The first month of spring did not bring much needed precipitation to the drought areas of the High Plains Region. Most areas of the Dakotas, Nebraska, and Kansas received less than 50 percent of normal precipitation. A large area of the eastern sides of Kansas and Nebraska received less than 25 percent of normal precipitation which led to degradations. Much of eastern Kansas went from abnormally dry conditions (D0) to moderate drought conditions (D1). The extreme drought conditions (D3) in the western part of the state expanded as well. In Nebraska, severe drought conditions (D2) expanded eastward and a new area of D1 developed in the southeast. The only areas with improvements were eastern Wyoming and central Colorado where ample precipitation has fallen. According to the U.S. Seasonal Drought Outlook released March 20th, current drought conditions are expected to persist across eastern Colorado and southwestern Kansas through June. Meanwhile, drought conditions may improve or be eliminated in other parts of Kansas and Nebraska. Further drought development is not expected at this time.



The U.S. Drought Monitor is produced as a joint effort of the U.S. Department of Agriculture (USDA), National Drought Mitigation Center, U.S. Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA). Real-time data provided through ACIS from the Regional Climate Centers are often used by the agencies involved in the U.S. Drought Monitor when determining the area and intensity of drought conditions, although the product itself is not produced by HPRCC. For current Drought Monitor information, please see: <http://droughtmonitor.unl.edu/>
 Portions of this Drought Watch are courtesy the Drought Monitor Text Discussion found on the Drought Monitor webpage.

State Summaries

Colorado	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Akron Washington County Airport	53.4	24.9	39.1	-0.1	72	03/30+	-2	03/02+	0.43	-0.44	49
Alamosa San Luis Airport	53.8	19.3	36.5	3.0	64	03/25	9	03/20	0.40	-0.13	75
Colorado Springs Municipal Airport	54.2	24.9	39.5	0.4	73	03/10	6	03/02	0.42	-0.58	42
Grand Junction Walker Field Airport	57.5	30.0	43.8	-0.1	67	03/30	22	03/19	0.10	-0.82	11
Pueblo Memorial Airport	59.2	27.0	43.1	0.8	77	03/10	6	03/02	0.76	-0.17	82

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	53.1	25.1	39.1	-3.9	78	03/30+	-6	03/03	0.23	-1.78	11
Dodge City Regional Airport	55.3	25.6	40.5	-3.9	82	03/30	-5	03/03	0.27	-1.32	17
Goodland Renner Field	55.7	24.1	39.9	-0.6	77	03/09	-1	03/02	0.42	-0.65	39
Topeka Municipal Airport	56.1	27.7	41.9	-2.9	80	03/31	-3	03/03	0.73	-1.76	29
Wichita Mid-Continent Airport	56.7	29.1	42.9	-3.6	79	03/10	0	03/03	0.49	-2.20	18

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	49.8	21.5	35.6	-0.2	75	03/26	-8	03/02	0.32	-0.91	26
Grand Island Airport	51.3	23.2	37.2	-2.2	77	03/30+	-5	03/02	0.19	-1.61	11
Lincoln Municipal Airport	52.1	22.2	37.1	-3.0	78	03/10	-7	03/03	0.13	-1.80	7
Norfolk Karl Stefan Airfield	47.6	20.9	34.2	-3.2	77	03/10	-14	03/03	0.37	-1.40	21
North Platte Regional Airport	53.1	20.1	36.6	-1.4	76	03/26	-5	03/02	0.79	-0.26	75
Omaha Eppley Airport	49.2	23.3	36.3	-3.2	76	03/30	-6	03/03	0.21	-1.78	11
Valentine Miller Field	48.2	18.8	33.5	-2.7	74	03/09	-21	03/02	0.49	-0.58	46

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismark Municipal Airport	37.6	16.8	27.2	-2.7	64	03/29	-14	03/01	0.82	-0.05	94
Fargo International Airport	32.2	12.4	22.3	-5.5	58	03/13	-19	03/02	0.72	-0.58	55
Grand Forks International Airport	27.9	7.7	17.8	-7.4	48	03/13	-26	03/01	0.93	-0.03	97
Theodore Roosevelt Airport	38.0	14.5	26.2	-3.8	68	03/29	-17	03/02+	0.50	-0.19	72
Williston International Airport	37.0	14.9	26.0	-3.3	62	03/16	-22	03/01	0.32	-0.39	45

All Data are Preliminary and Subject to Change. + indicates multiple dates, latest date listed.

Source: National Weather Service Cooperative Observation Network Data

Data are retrieved through the Applied Climate Information System (ACIS).

These data are available for the entire period of record through the CLIMOD system. For more information please see <http://hprcc.unl.edu/services>.

March 2014 Climate Summary

South Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Aberdeen Regional Airport	36.5	14.2	25.3	-4.6	62	03/30	-16	03/02	0.77	-0.39	66
Huron Regional Airport	41.3	17.1	29.2	-3.9	67	03/30	-18	03/02	0.47	-0.99	32
Pierre Regional Airport	43.5	16.7	30.1	-4.3	72	03/29+	-20	03/02+	0.99	-0.24	80
Rapid City Regional Airport	45.4	18.5	32.0	-3.4	73	03/09	-18	03/02	1.09	0.16	117
Sioux Falls Joe Foss Field Airport	40.6	17.8	29.2	-3.7	71	03/31	-16	03/02	0.71	-1.05	40

Wyoming	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Casper Natrona County International AP	47.0	23.7	35.4	0.2	64	03/30	-4	03/01	1.64	0.82	200
Cheyenne Municipal Airport	48.9	24.3	36.6	0.7	64	03/30	-1	03/02+	0.90	-0.15	86
Lander Hunt Field Airport	48.9	22.8	35.9	0.4	64	03/10	-6	03/02	1.18	0.02	102
Laramie Regional Airport	44.7	20.5	32.6	1.7	58	03/30+	2	03/12	0.26	-0.32	45
Rawlins Municipal Airport	46.3	22.4	34.4	2.1	58	03/29+	6	03/01	0.49	-0.19	72
Sheridan County Airport	43.9	21.8	32.9	-2.3	67	03/29	-14	03/02	1.69	0.71	172

All Data are Preliminary and Subject to Change. + indicates multiple dates, latest date listed.

Source: National Weather Service Cooperative Observation Network Data

Data are retrieved through the Applied Climate Information System (ACIS).

These data are available for the entire period of record through the CLIMOD system. For more information please see <http://hprcc.unl.edu/services>.

State Spotlight - Kansas

Mary Knapp - Service Climatologist
 Kansas State Climate Office, Kansas State University

Winter Continues

Winter weather was a feature both to start and end the month, but overall the month was much drier than average. The state-wide average precipitation was just 0.46 inches, which was 19 percent of normal. This ranks it as the 10th driest March since 1895. The heaviest precipitation was limited in area. Greatest 24hr precipitation reported for a National Weather Service Coop (NWS) station was 1.17 inches at Chanute in Neosho County. For the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS), the greatest 24 hour total was 2.25 inches at Wichita 7.1 ESE in Sedgwick County. Not surprisingly, the greatest monthly totals were in the same areas. For the CoCoRaHS stations, Wichita 7.1 ESE in Sedgwick County had the greatest total at 4.20 inches. The NWS station with the greatest monthly total was Longton in Elk County, with 2.25 inches. Snow was a significant portion of the moisture received in parts of the state. The major events occurred on the 3rd and 24-25th. Council Grove (Morris County) and Loretta (Rush County) tied for the most snow in March at 8.0 inches. Fact (Russell County) and Marion (Marion County) had the greatest daily snowfall amount at 5.0 inches each, on the 25th and 3rd respectively.

Temperatures continued to be colder than average. State-wide, the average temperature was 39.7F, which was 3.7 degrees below normal. For the first quarter of the year (Jan-Mar), temperatures have averaged just 32.4F which places it as the 23rd coldest start to the year in the last 120 years. Coldest period was in 1912 when the three-month average was just 26.0F. The warmest was in 2012, when the average was 42.9F. In 2014, the highest temperature for March was 83F, and was recorded in three locations: Hutchinson 4E (Reno County) on the 3rd, and Cimarron and Montezuma (Gray County) on the 31st. The coldest reading for the month was -11F, recorded at Healy (Lane County) on the 3rd. When considering records established during the month, they mostly occurred for low events. While there were 3 record daily high maximum temperature records set, there were 87 record low maximum temperatures set. No daily record high minimum temperatures were set, but there were 48 record low minimum temperature recorded.

Drought conditions persist across the state. No portion of the state was in near normal conditions, and the portion of the state in abnormally dry conditions continues to shrink. Almost 8 percent of the state was in extreme drought at the end of February. By the end of March, that has climbed to over 14 percent of the state. The latest Drought Monitor shows that extreme drought now covers 14.43 percent of the state, with 50.57 percent of the state in severe drought. The latest Drought Outlook indicates drought conditions are expected to continue through June, although improvement is likely in all but the Southwestern division. The El Niño/Southern Oscillation (ENSO) is expected to remain neutral through the Spring. That means the signal for increased Spring precipitation will also be weaker. The jet stream is expected to shift northward. For April, chances are equally likely for precipitation to be above or below normal state-wide. The temperature outlook calls for below normal temperatures across the northern counties, with equal chances for above or below normal temperatures across the remainder of the state. This does not indicate how much cooler conditions might be, and does not exclude the possibility of warm weather in the period.

Severe weather came as a mixed bag. With both winter weather events, severe storms formed on the east side of the front. There were 56 hail events reported, and 6 damaging wind events. Red flag warnings continued, with a number of wildfires. One particularly large event occurred in Lyon County, where residue from a prescribed burn reignited under high winds.

For more information about the Kansas State Climate Office: <http://www.ksre.ksu.edu/wdl/>

The KSU's AWDN is a part of the High Plains Automated Weather Data Network (AWDN). Data are available through KSU or HPRCC.

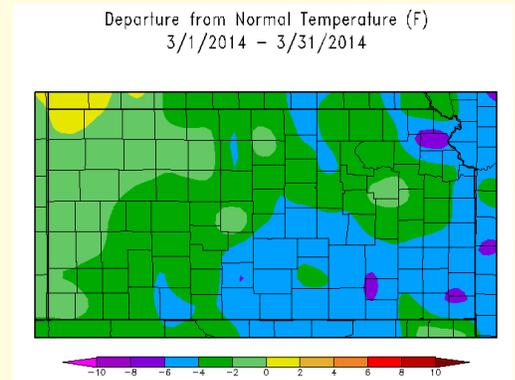


Figure 1. March 2014 departure from average temperatures across Kansas (High Plains Regional Climate Center)

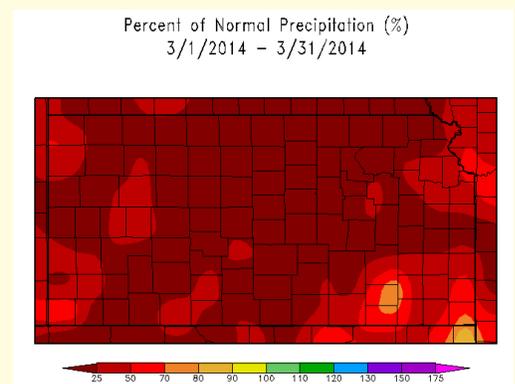


Figure 2. March 2014 percent of normal precipitation across Kansas (High Plains Regional Climate Center)

State Spotlight - North Dakota

F. Adnan Akyüz - State Climatologist, Daryl Ritchison - Research Specialist
North Dakota State Climate Office, North Dakota State University



Precipitation:

March 2014 was a dry month in much of North Dakota. Many parts of the state recorded less than 50% of normal precipitation (see Figure 1). Preliminary data suggest a state wide average of 0.42 inches of liquid precipitation in comparison to the average of 0.74 inches. That would rank March 2014 as the 31st driest March on record. The U.S. Drought Monitor listed a small portion of northeastern North Dakota as abnormally dry as of April 1. Of note many locations recorded a high percentage of that limited monthly moisture on the last day of the month.

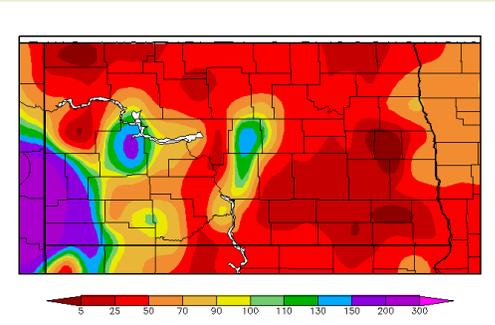


Figure 1. Percent of Normal Precipitation in March 2014 for North Dakota (HPRCC)

Temperature:

March was not only a dry month for the state but also a cold one. NDAWN average temperature anomalies ranged from 5 to 10 degrees below normal for the month. The coldest readings were in the northeastern portion of North Dakota. Not surprisingly, that area also maintained the highest snow cover from the winter throughout the month. The preliminary statewide average temperature was 22.2 degrees which is 2.6 degrees below normal and would rank March 2014 as the 30th coldest on record.

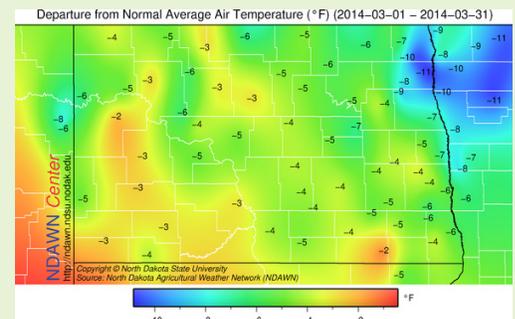


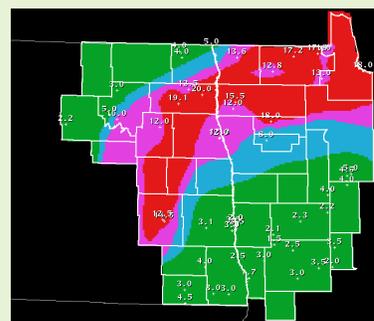
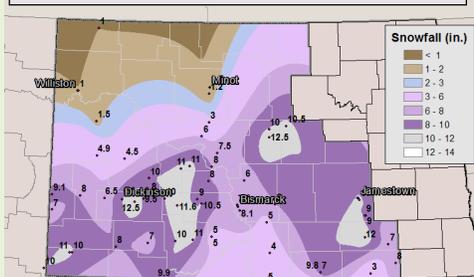
Figure 2. Temperature Departure from Normal in March 2014 for North Dakota (NDSCO)

Notable Weather:

The most notable weather event during the month was a severe blizzard that moved across the upper Midwest on March 31. Wind gusts over 50 mph were recorded in Valley City, Fargo, Emerado, Cooperstown and at the Grand Forks Air Force Base. That severe wind in combination of heavy snow in excess of 10 inches in some locations produced drifts over 6 feet. Many roads were closed, including Interstate 29 from the North Dakota/South Dakota line to Canada and Interstate 94 from Fargo to Jamestown because of near zero visibility being reported.

The highest snowfall fell in a band from the southwestern to northeastern corners of the state. The highest snow amount was an estimated 20 inches in Grafton (see Figures 3 and 4). That would be the highest daily total of record for that location. With the exception of a small portion of southwestern North Dakota that was hit with an even stronger blizzard in October 2013, the March 31 event was the strongest storm of the 2013-2014 cold season when snow totals and wind speeds are combined for the rest of the state.

March 31, 2014 Snowfall Amounts



Figures 3 and 4. Snow totals from March 31, 2014 blizzard in western and central North Dakota (NWS Bismarck) and eastern North Dakota and western Minnesota (NWS Grand Forks)

For more information about the North Dakota State Climate Office: <http://www.ndsu.edu/ndSCO>
 For more information on the North Dakota Agricultural Network: <http://www.ndawn.ndsu.nodak.edu>
 The North Dakota Agricultural Network is a part of the Automated Weather Data Network (AWDN).

About the High Plains Regional Climate Center

The High Plains Regional Climate Center (HPRCC) operates out of the University of Nebraska - Lincoln (UNL) in Lincoln, Nebraska. As one of 6 regional climate centers throughout the nation, HPRCC works closely with other organizations such as the National Climatic Data Center (NCDC), Local and Regional National Weather Service (NWS) Offices, and other climate services organizations such as the National Drought Mitigation Center (also located at UNL) to provide climate data services and specialized climate products.

For More Information Online

High Plains Regional Climate Center: <http://hprcc.unl.edu>

High Plains Regional Climate Services: <http://hprcc.unl.edu/services>

CLIMOD: <http://climod.unl.edu>

Regional Climate Centers and ACIS: <http://www.rcc-acis.org>

National Weather Service: <http://www.weather.gov>

National Climatic Data Center: <http://ncdc.noaa.gov>

University of Nebraska - Lincoln: <http://www.unl.edu>

National Drought Mitigation Center: <http://drought.unl.edu>

Climate Prediction Center: <http://www.cpc.noaa.gov>

NOAA Storm Prediction Center: <http://www.spc.noaa.gov>



Photo of the Nebraska Sandhills by Bill Sorensen - Senior Programmer - HPRCC

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