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Mount Rushmore, SD - Photo by Crystal Stiles
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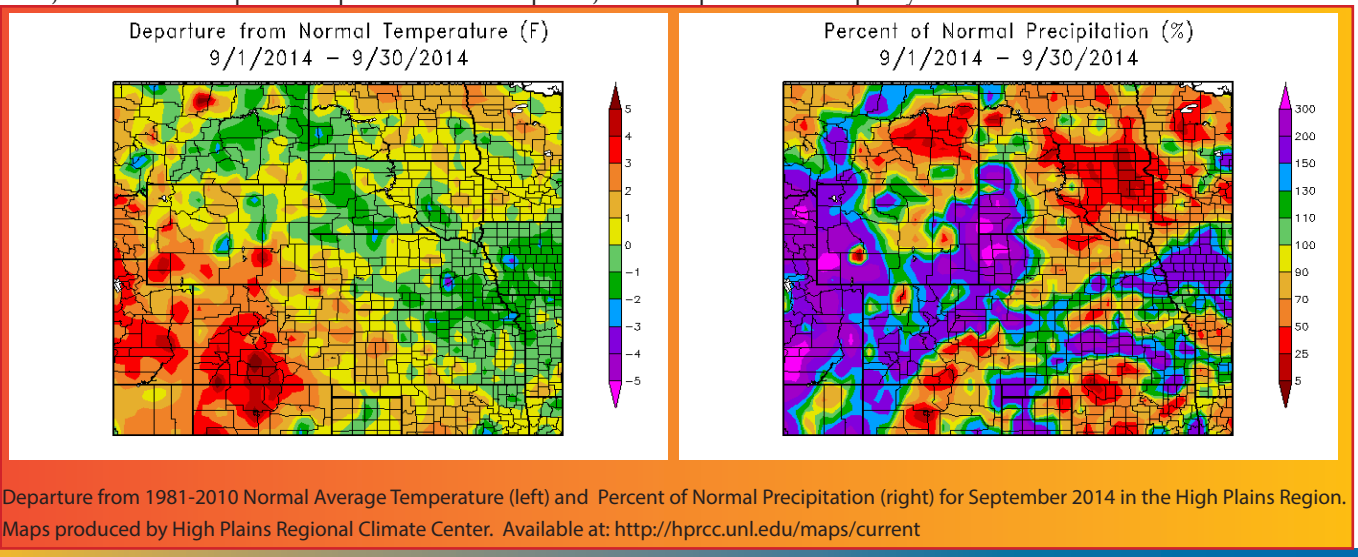
September 2014 Climate Summary

Region Breakdown

September temperatures were largely near normal across the High Plains Region. While most average temperatures were within 2.0 degrees F (1.1 degrees C) of normal, there were a few warmer spots. A large area of western Colorado and a few pockets of southern Wyoming had temperature departures of 3.0-4.0 degrees F (1.7-2.2 degrees C) above normal. Alamosa, Colorado, located in the south-central part of the state, had its second warmest September on record with an average temperature of 58.7 degrees F (14.8 degrees C). The warmest September occurred with a temperature of 59.0 degrees F (15.0 degrees C) back in 1933 (period of record 1906-2014).

Record yields are expected for both corn and soybean crops even though development was behind due to a cool, wet summer. Because of the conditions this summer, combined with late planting there is a higher risk for frost/freeze damage in the northern part of the High Plains Region. Freezing temperatures did impact late season crop development in some areas, however the overall impact has not been serious. Warmer temperatures prevailed at the last week of the month with departures ranging from 6.0-12.0 degrees F (3.3-6.7 degrees C) above normal for a large area extending from Kansas north through the Dakotas. These warm temperatures offered good harvest weather, aided row crop development in some parts, and helped with crop dry down in others.



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

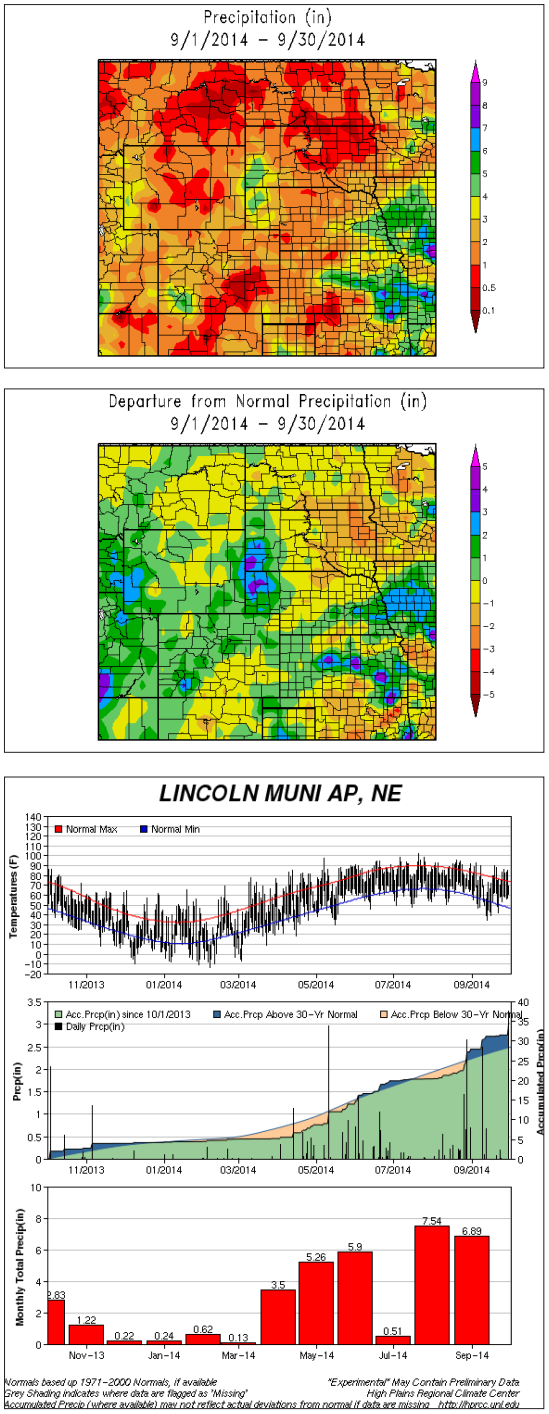
Precipitation Summary

There were areas of extreme wetness and dryness this month across the High Plains Region. A large area of southern North Dakota, central and eastern South Dakota, and isolated pockets throughout the Region received at best 50 percent of normal precipitation. Wichita, Kansas was one dry location and only received 0.47 inches (12 mm), or 15 percent of normal precipitation. This ranked as the 6th driest September on record in Wichita. The driest September occurred back in 1956 with 0.03 inches (1 mm) (period of record 1888-2014).

Areas receiving over 150 percent of normal precipitation included western Wyoming, central Kansas, parts of eastern Nebraska, and a large swath running from southwestern to northeastern Colorado up through eastern Wyoming, the panhandle of Nebraska, and western South Dakota. It was the wettest September on record in areas of the Black Hills with widespread precipitation totals of at least 200 percent of normal and isolated locations topping 300 percent of normal. Rapid City, South Dakota had its second wettest September on record with 3.17 inches (81 mm). This amount was 1.88 inches (48 mm) above normal, or 246 percent of normal precipitation. The record of 3.94 inches (100 mm) set back in 1946 held (period of record 1942-2014). An early season snowstorm brought the earliest recorded snow to the Black Hills this month. 1.6 inches (4 cm) fell at the Rapid City National Weather Service Office, while 8.1 inches (21 cm) fell at Mount Rushmore. That made this September the second snowiest for Mount Rushmore coming in just shy of the record of 8.3 inches (21 cm) set back in 1965 (period of record 1962-2014).

Another wet location was Lincoln, Nebraska which had its 7th wettest September on record (period of record 1887-2014). A late month heavy rain event dropped 5.0-8.0 inches (127-203 mm) across the city during the day of the 30th and during the early morning hours of October 1. The September total for the Lincoln Municipal Airport was 6.89 inches (175 mm) (this total does not include the precipitation which fell on October 1). Flooding was an issue for roads, lakes, streams, and basements. According to the Omaha/Valley National Weather Service Office, this was a 1 in 200 year event. The graph to the right shows precipitation over the past year in Lincoln. The past three months have all ranked in the top 10 for Lincoln with the city having its 7th driest July, 6th wettest August, and 7th wettest September.

The heavy precipitation across the Region has led to much above normal to high flows in the Missouri River Basin. Long-term conditions have also impacted flow in the Basin. For instance, the Black Hills of South Dakota has been experiencing higher flows since the October 2013 blizzard, while lower flows were present along the Republican River, which has been experiencing long-term drought effects. Additionally, increased soil moisture conditions were present across much of Wyoming, the western Dakotas, the panhandle of Nebraska, western and northern Colorado, and eastern Nebraska. Meanwhile, eastern Kansas showed drier conditions.



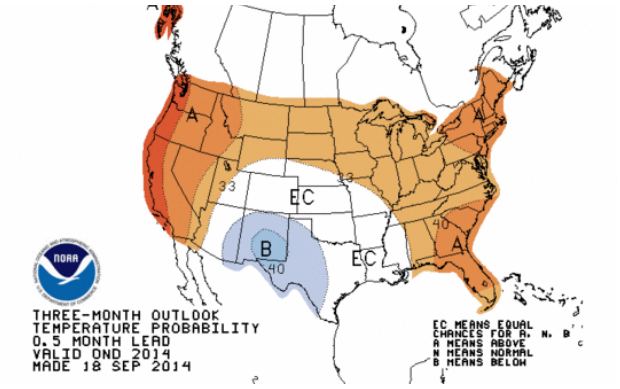
Above: Total precipitation (inches) (top) and Departure from Normal Precipitation (inches) (middle) for September 2014 in the High Plains Region. Accumulated and monthly precipitation for Lincoln, NE (bottom) over the past year. These maps are produced by HPRCC and can be found on the Current Climate Summary Maps page at: http://hprcc.unl.edu/maps/current.

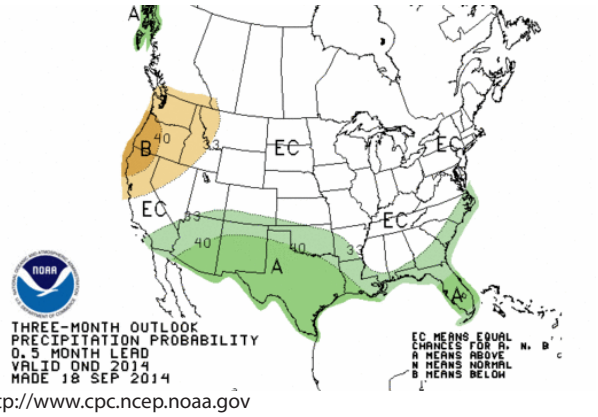
The High Plains Regional Climate Center is one of the Regional Climate Centers, and is involved in the Applied Climate Information System (ACIS) development and management effort. Data found throughout this publication were derived using products built on the ACIS framework.

ACIS
Applied Climate Information System - Regional Climate Centers

Climate Outlook

Like last month, ENSO-neutral conditions continued, but there is still a 60-65 percent chance of El Niño development during the fall and winter. The temperature outlook through December indicates a higher probability of above normal temperatures for much of the United States and includes northern portions of the High Plains Region - the Dakotas, northeastern Nebraska, and northern and western Wyoming. No areas in the Region have a higher probability for below normal temperatures. Meanwhile, the precipitation outlook shows a higher probability for above normal precipitation in southern Colorado and southwestern Kansas. All other areas in the Region have equal chances of above, near, or below normal temperatures and precipitation. The seasonal outlooks combine the effects of long-term trends, soil moisture, and when applicable, the El Niño Southern Oscillation cycle (ENSO).

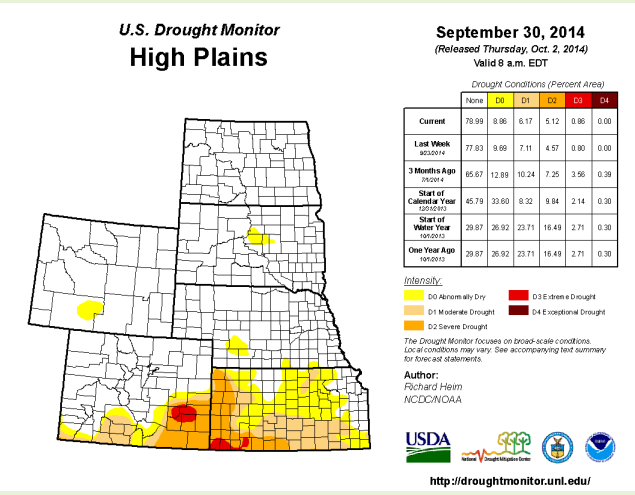


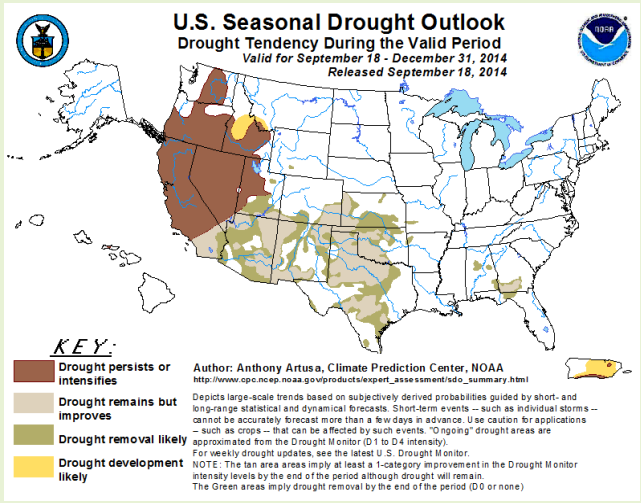


Above: 3-Month Outlook Maps Courtesy of the NOAA Climate Prediction Center - http://www.cpc.ncep.noaa.gov
(left) The Three-Month Temperature Probability Outlook, (right) The Three-Month Precipitation Probability Outlook

Drought Watch

More improvements were in store this month as heavy rains impacted the High Plains Region. The total area in drought (D1-D4) dropped from 21 percent to 12 percent. Nebraska and Wyoming joined the Dakotas as the drought free states in the Region. At the end of the month, all drought was confined to Colorado and Kansas, however there were improvements in both states. Over the past month, Kansas went from 88 percent in drought to 46 percent in drought. The extreme drought conditions (D3) in the northwestern part of the state improved one category and only 2 percent of the state was left with D3. Many improvements were made in northern and eastern areas of the state as well. In Colorado, the main improvement was the removal of moderate drought conditions (D1) in the northwestern portion of the state. Drought in the southeastern part of the state remained about the same, although there were some improvements in the southwest corner of the state. According to the U.S. Seasonal Drought Outlook released September 18th, all drought conditions in the Region should improve or be removed.





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 of 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	77.8	50.2	64.0	1.0	94	09/03	33	09/12+	1.94	0.78	167
Alamosa San Luis Airport	77.8	39.6	58.7	3.7	86	09/03	30	09/30	0.41	-0.50	45
Colorado Springs Municipal Airport	77.8	50.0	63.9	3.0	92	09/03	34	09/12	0.61	-0.58	51
Denver International Airport	78.9	50.6	64.8	1.4	94	09/03	33	09/12	1.79	0.83	186
Grand Junction Walker Field Airport	81.5	53.2	67.4	1.3	91	09/03	43	09/30	1.84	0.65	155
Pueblo Memorial Airport	83.4	51.0	67.2	2.5	100	09/03	39	09/13+	0.62	-0.15	81

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	77.5	55.6	66.6	-1.4	94	09/04	34	09/13	3.25	0.34	112
Dodge City Regional Airport	83.1	56.1	69.6	0.4	100	09/09	35	09/13	1.66	-0.01	99
Goodland Renner Field	79.3	51.4	65.3	0.7	100	09/03	34	09/12	2.04	0.82	167
Topeka Municipal Airport	80.1	57.7	68.9	0.6	95	09/04	38	09/13	4.14	0.48	113
Wichita Mid-Continent Airport	85.6	60.9	73.3	2.3	99	09/09+	42	09/13	0.47	-2.67	15

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	77.3	46.3	61.8	0.8	97	09/03	31	09/12	3.70	1.97	214
Grand Island Airport	76.3	52.9	64.6	-0.5	90	09/19	36	09/13	3.03	0.80	136
Lincoln Municipal Airport	77.2	53.9	65.6	-0.4	93	09/04	35	09/13	6.89	3.87	228
Norfolk Karl Stefan Airfield	75.0	52.0	63.5	-0.3	90	09/19	35	09/13	2.00	-0.69	74
North Platte Regional Airport	77.2	49.0	63.1	0.8	93	09/19	33	09/11	1.39	-0.02	99
Omaha Eppley Airport	76.3	56.3	66.3	0.6	93	09/04	41	09/13	6.11	3.43	228
Valentine Miller Field	77.5	49.0	63.3	1.0	97	09/03	35	09/12	0.74	-0.90	45

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismark Municipal Airport	74.3	46.1	60.2	1.7	93	09/26+	31	09/15	0.37	-1.22	23
Fargo International Airport	72.2	49.5	60.8	1.7	87	09/27	39	09/13	2.44	-0.13	95
Grand Forks International Airport	71.9	47.1	59.5	2.6	87	09/27	33	09/15	1.29	-0.76	63
Theodore Roosevelt Airport	70.0	43.5	56.7	-0.5	91	09/25	30	09/14+	1.36	-0.11	93
Williston International Airport	71.8	43.2	57.5	0.8	97	09/25	26	09/12	1.35	0.29	127

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.

September 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	72.4	46.8	59.6	0.7	86	09/26+	31	09/14	1.00	-1.19	46
Huron Regional Airport	75.0	50.2	62.6	0.9	92	09/04	35	09/14	1.10	-1.36	45
Pierre Regional Airport	76.9	49.7	63.3	0.4	93	09/26	36	09/15	0.61	-1.26	33
Rapid City Regional Airport	74.7	45.3	60.0	-0.8	95	09/26	28	09/12	3.17	1.88	246
Sioux Falls Joe Foss Field Airport	72.9	51.9	62.4	1.1	89	09/19	36	09/13	2.28	-0.49	82

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	76.6	42.2	59.4	1.5	92	09/18	25	09/12	0.64	-0.44	59
Cheyenne Municipal Airport	74.4	46.7	60.6	2.4	90	09/03	29	09/12+	1.74	0.26	118
Lander Hunt Field Airport	75.8	46.1	61.0	2.4	89	09/18	31	09/12	1.79	0.74	170
Laramie Regional Airport	71.2	40.2	55.7	2.4	83	09/26+	27	09/12+	2.07	0.96	186
Rawlins Municipal Airport	73.4	41.5	57.5	2.1	85	09/03	21	09/12	1.26	0.29	130
Sheridan County Airport	74.2	42.0	58.1	0.2	94	09/26	18	09/12	1.63	0.20	114

All Data are Preliminary and Subject to Change. + indicates multiple dates, latest date listed.
Source: National Weather Service Cooperative Observation Network Data
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State Spotlight - Kansas

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

Early autumn

While there was a warm start to the month, on average September was very close to normal. The state-wide average temperature for the month was 67.9F, which is just 0.2 degrees cooler than normal. The Southwestern Division had the greatest departure with an average of 69.7F, or 1.0 degree warmer than normal. The North Central and Northeastern divisions vied for coolest. The Northeast Division averaged 66.0F, or 1.4 degrees cooler than normal. The North Central Division averaged 66.7F, or 1.2 degrees cooler than normal. The most dramatic incursion of cold air occurred between the 12th and 14th. Alton saw the low for the month at 29F on the 13th. All divisions saw temperatures above 90F during the month. The warmest reading was 104F and reported at multiple locations. The latest of these occurred on the 4th, again at multiple stations. The reading of 104F at Ulysses on the 1st set a new record at that location for the date. It was one of six new daily record highs set during September. There were also 23 new record warm minimums set during the month. On the cool side, there were 93 new daily record low maximum temperatures and 99 new daily record low minimum temperatures for the month. Emporia 3 W saw the only monthly record broken: 35F reading on the 13th.

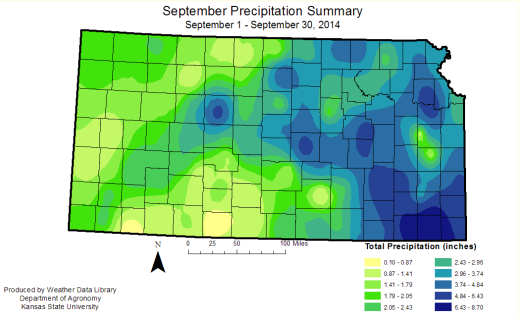

Figure 1. September 2014 total precipitation for Kansas (Kansas State Climate Office)

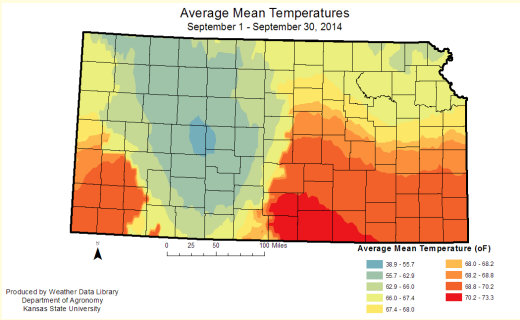

Figure 2. September 2014 average temperatures for Kansas (Kansas State Climate Office)

The state-wide average precipitation for September was 3.04 inches, which is a 0.45 inch surplus for the month. The total is 116 percent of the normal precipitation for the month, and places it as the 78th driest (42nd wettest) of 120 years, or on the wet side of the normal range. Only the South Central Division averaged below normal, with 1.82 inches, or 70 percent of normal. It should be noted that this does not include the rain that fell during the afternoon and evening of September 30th. Those totals were reported on the 1st of October, and will be included in next month's summary. September saw heavy rains both to start and end the month, with more isolated events during the middle of the month. Madison reported the greatest monthly total for a National Weather Service (NWS) station with 9.45 inches; Waverly 5.1 W had the greatest monthly total for a CoCoRaHS station at 8.77 inches. Highest daily totals were 6.54 inches at Coffeyville on the 2nd for the NWS and 5.80 inches at Peabody 2.6 NNE on the 1st for the CoCoRaHS network.

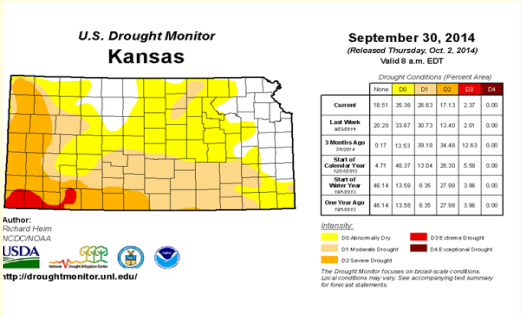

Figure 3. September 30, 2014 U.S. Drought Monitor map and statistics for Kansas (U.S. Drought Monitor)

Two tornadoes were reported on the 1st in Cowley and Chautauqua counties. The most severe damage was reported in Hewins. Fortunately, there were no reports of deaths or injuries. Preliminary totals for the month: 6 tornadoes, 32 hail reports, and 40 wind reports.

Drought conditions persist across the state, but there was continued improvement. Conditions deteriorated in the South Central part of the state, as might be expected with lower than normal precipitation in that region. At the start of September only two percent of the state was considered drought free. At the end of September, the portion of the state that was drought free increased to almost 19 percent. The cooler temperatures during the summer and the increased precipitation in September moderated some of the negative impacts from the lack of moisture in August. The El Niño/Southern Oscillation is still expected to switch to an El Niño event before winter, but it still remains to be seen what impact will be felt. Other global circulation patterns, including the North Atlantic Oscillation, can have significant impacts on the winter season. The October temperature outlook is neutral for the entire state, with equal chances of above normal, normal, or below normal temperatures. The precipitation outlook is also neutral except for extreme eastern KS. In that area, there is a slight chance for above normal precipitation. This does not indicate how that moisture might be distributed, and heavy rains or extended dry periods are both possible.

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.

State Spotlight - North Dakota

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

Precipitation:

There were pockets of above average rainfall during September 2014, especially in western North Dakota, but a high percentage of the state recorded below normal precipitation during the month (Figure 1). Using data from the North Dakota Agricultural Weather Network (NDAWN), the statewide average precipitation for September 2014 was 1.30 inches. That is below the 30 year average of 1.71 inches. That would rank September 2014 as the 52nd driest on record. Although September was dry across many parts of North Dakota, August 2014 was exceptionally wet, meaning that as of September 30, 2014, no part of North Dakota was listed with drought conditions by the U.S. Drought Monitor.

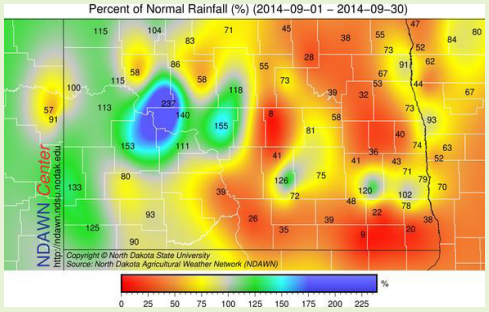

Figure 1. Percent of Normal Precipitation in September 2014 for North Dakota (NDSCO)

Temperature:

September 2013 was the last month with above average temperatures in North Dakota. The following 11 months all recorded a statewide monthly temperature that was below normal. That cold stretch ended last month with most NDAWN stations, with the exception of far western North Dakota, recording slightly above average temperatures (Figure 2). The overall NDAWN average temperature was 58.0 degrees which is 1.1 degrees above the average temperature of 56.9 degrees. That would place September 2014 as the 41st warmest September since such records began in 1895.

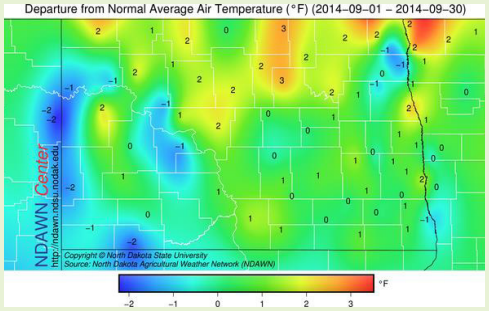

Figure 2. Temperature Departure from Normal in September 2014 for North Dakota (NDSCO)

Notable Weather:

The warm season in North Dakota did not record many days with high temperatures in the 90s. The first week of September recorded highs in the 70s and 80s across the region, but on September 8, a cold front pushed through the state and the following week the temperatures were well below average. As an example, Williston recorded a high of 86 degrees on September 7, but on September 10 the high was only 46 degrees.

The cold temperatures led to an early season frost that either ended the growing season in some localized areas or did noticeable crop damage that will impact yield potential during harvest for many others. After that period of cold temperatures, a brief period of well above normal temperatures moved into the northern plains. These warmer temperatures ended up being close to the warmest recorded in 2014.

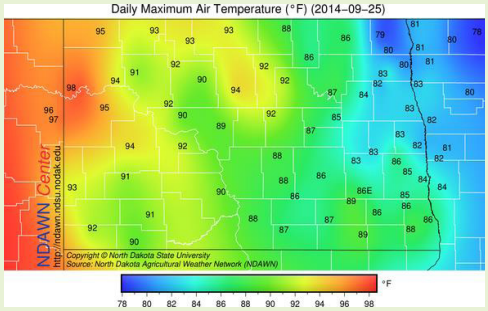

Figure 3. High Temperatures on September 25, 2014 (NDSCO)

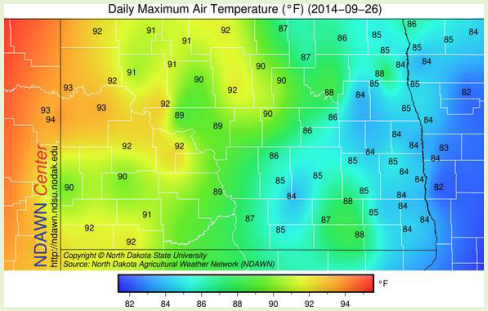

Figure 4. High Temperatures on September 26, 2014 (NDSCO)

At least one NDAWN station recorded a high of 90 degrees or higher in a stretch from September 24-27. September 25 and 26 were the warmest of the days with fairly widespread high temperatures near or above 90 degrees (Figures 3 and 4). The warmest temperature during this stretch was a 98 degree high at the NDAWN station near Williston, North Dakota on September 25. That was the warmest temperature so late in the year at any NDAWN station since the network was started 25 years ago.

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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