



July 2019 Climate Summary



Thin hay pasture, southern Pierce County, ND. Photo courtesy Yolanda Schmid, NDSU. <http://hprcc.unl.edu>

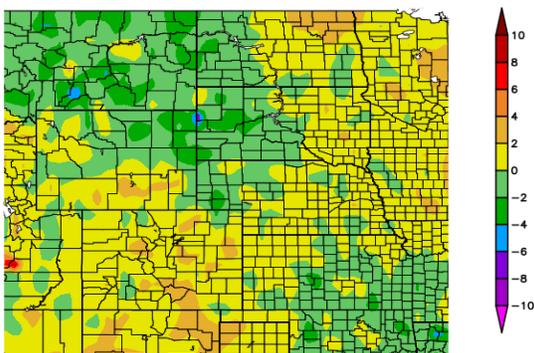
Precipitation Extremes Evident Throughout the Region

The High Plains experienced both ends of the precipitation spectrum during July, as areas of South Dakota and Nebraska continued to get pounded with heavy rainfall while other parts of the region remained dry. Heavy precipitation produced impressive records in places like Rapid City, South Dakota, which had its wettest July on record, and it also created additional flooding in areas of south-central Nebraska. Streamflows remained high throughout these areas, as well as along the James and Missouri Rivers in the eastern High Plains, where high flows have been present since March. A positive outcome of the heavy precipitation was the relief from drought conditions in northern North Dakota, although the rains may have come too late to lessen agricultural impacts in the region. On the other hand, abnormal dryness developed across several areas of the High Plains in July due to short-term precipitation deficits, and some minor impacts to crops were being reported. As for temperatures, they were nothing out of the ordinary for July, although a mid-month heat wave caused roads to buckle in eastern portions of the region.

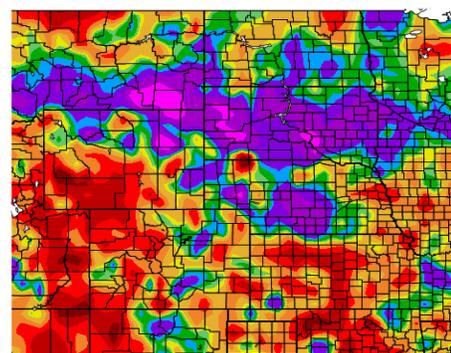
Crop progress continued to be behind the five-year average throughout the High Plains, especially in the Dakotas, but generally crops were in good condition. One issue that has been prevalent is many crops developed poor root systems this year, which was due to being planted into wet and compacted soils. A crop with a poorly-developed root system cannot easily tap into the deeper soil moisture profile when needed. This has become a concern in some parts of the region because of the short-term dryness that has developed, which has rapidly depleted topsoil moisture. As crops continue to mature, they will use more water, but if their root systems are not well developed and there is little topsoil moisture available, they will quickly become stressed. Additionally, freeze risk is still a concern across the region because a large majority of crops were planted late and may not reach maturity in time, but it is still too early to determine with any certainty when the first fall freeze will occur.

Temperature and Precipitation Overview

Departure from Normal Temperature (F)
7/1/2019 – 7/31/2019



Percent of Normal Precipitation (%)
7/1/2019 – 7/31/2019



Above: Departure from 1981-2010 normal temperature (left) and percent of normal precipitation (right) for July 2019 in the High Plains region. Maps produced by the High Plains Regional Climate Center and are available at: <http://hprcc.unl.edu/maps/current>.

Precipitation

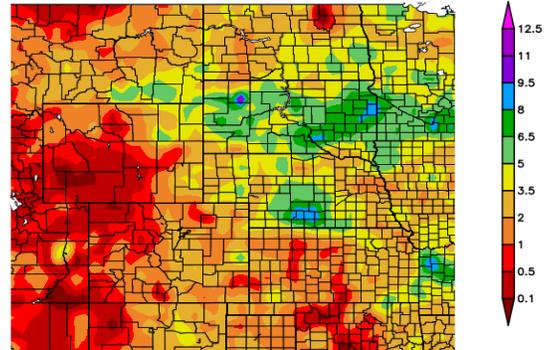
Precipitation extremes were evident across the High Plains during July. Wet conditions occurred across much of South Dakota, southern North Dakota, and central Nebraska. The majority of this area received 150 percent of normal precipitation for the month with isolated pockets receiving in excess of 300 percent of normal precipitation. As a result, the following locations ranked among the top 10 of wettest Julys: Rapid City, SD (wettest); Mobridge, SD (2nd wettest); Huron, SD (6th wettest); North Platte, NE (7th wettest); and Sioux Falls, SD (8th wettest).

Parts of Nebraska were impacted yet again by another flood event in early July. On the evening of the 8th, strong thunderstorms developed and repeatedly moved over areas of south-central Nebraska, producing more than 8.00 inches (203 mm) of rain in some areas. Kearney 4NE, a National Weather Service COOP station, received 5.04 inches (128 mm) of rain, which was the station's highest 1-day total precipitation ever recorded in July and 2nd highest 1-day total in any month (period of record 1894-2019). The city of Kearney experienced flash flooding, and many travelers were evacuated from hotels in the path of the floodwaters and taken to local shelters. The flooding caused a temporary closure of Interstate 80 and several other highways in the area, and it halted Amtrak train service as well. The excessive precipitation caused the Wood and Platte Rivers to rise quickly, threatening communities downstream.

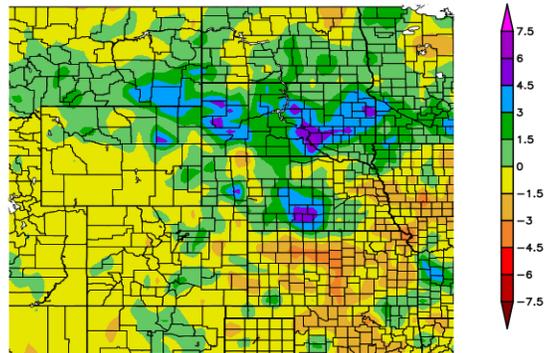
Meanwhile, dryness was present throughout a large part of the High Plains in July, including the majority of Kansas, Colorado, Wyoming, and eastern Nebraska where precipitation was less than 50 percent of normal. Alamosa, Colorado had its 3rd driest July on record. To some extent, the dryness was welcome in areas that have been excessively wet during the spring and early part of summer. However, dryness issues can develop quickly this time of year due to high crop water use and evaporative demand. The decline in topsoil moisture during July was evident throughout much of the High Plains. According to the USDA Weekly Weather and Crop Bulletin, topsoil moisture was in very good shape at the beginning of the month, but by the end of July, conditions had deteriorated rapidly. For instance, from July 7th to August 4th, the percent of topsoil moisture rated short to very short increased from four percent to 26 percent in Nebraska and from six percent to 40 percent in Kansas. With a month of summer left, this is something to watch closely moving forward.

Regional Precipitation

Precipitation (in)
7/1/2019 – 7/31/2019



Departure from Normal Precipitation (in)
7/1/2019 – 7/31/2019



Above: Total precipitation in inches (top) and departure from normal precipitation in inches (bottom) for July 2019. These maps are produced by HPRCC and can be found on the Current Climate Summary Maps page at: <http://hprcc.unl.edu/maps/current>.

Streamflow Update

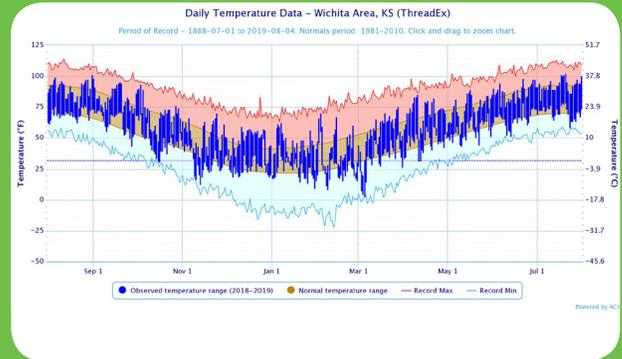
Mountain snowpack in the Upper Missouri Basin had completely melted out by early July. A late meltout of mountain snowpack in Colorado caused streamflows to continue to be above normal throughout much of the state in July. Ongoing wetness also caused streamflows to remain above normal throughout the eastern High Plains. Streamflows in western South Dakota were running very high due to above-normal precipitation, as this region received as much as 300 percent of normal precipitation over the course of the month. In June, streamflows were running below normal in northern and western North Dakota due to persistent dryness. However, much-needed precipitation occurred in these areas during July, which improved streamflow conditions. Only a few localized areas throughout the High Plains experienced below-normal streamflows during July.

Temperatures

Similar to June, average temperatures were near normal in July. Slightly below-normal temperatures occurred throughout the western Dakotas, the northern half of Wyoming, the Nebraska Panhandle, and eastern Kansas. Meanwhile, above-normal temperatures prevailed elsewhere, with several pockets of southern Wyoming, eastern Colorado, and northeastern North Dakota exceeding temperature departures of 2.0 degrees F (1.1 degrees C) above normal. Due to the near-normal temperatures experienced throughout the region, it was not a month noteworthy for temperature records.

Despite near-normal monthly temperatures, extremes occurred throughout July. Most notably, a heat wave spread across the region during the middle of the month. High maximum and minimum temperatures, as well as the availability of ample moisture, created dangerous conditions that prompted the National Weather Service to issue Excessive Heat Warnings across a large portion of the Plains and the Midwest. One location that was impacted by the heat wave was Wichita, Kansas, where temperatures reached or exceeded 100.0 degrees F (37.8 degrees C) four consecutive days from July 17th-20th. Minimum temperatures in the upper 70s created extremely uncomfortable conditions. In fact, the heat caused several roads to buckle in the Wichita area. Although maximum temperatures were not quite as high during this event, the heat caused Interstate 229 to buckle in Sioux Falls, South Dakota. Denver, Colorado was also impacted by this heat wave, setting daily maximum temperature records of 99.0 degrees F (37.2 degrees C) on the 18th and 101.0 degrees F (38.3 degrees C) on the 19th (period of record 1872-2019).

Station Spotlight: Wichita, KS



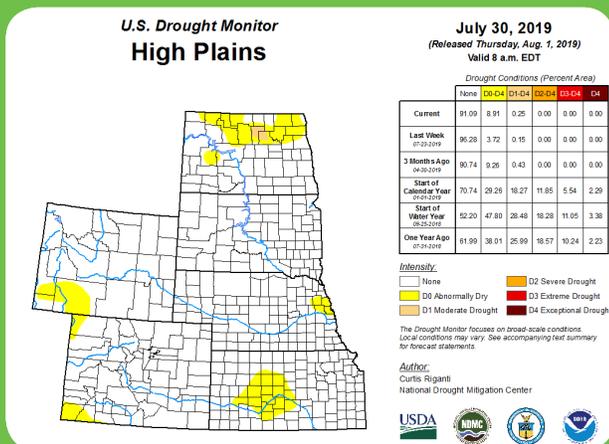
Above: Daily temperatures along with extremes and normals values since August 1, 2018 in Wichita, KS.

Drought Conditions

Drought conditions eased in northern North Dakota, while abnormal dryness developed in several areas of the High Plains during July. According to the U.S. Drought Monitor, the area experiencing drought or abnormal dryness (D0-D4) increased from approximately six percent to nine percent over the course of the month,

while the area in drought (D1-D4) decreased from about two percent to only a quarter of a percent.

U.S. Drought Monitor



Heavy showers and thunderstorms that occurred around the middle of the month provided relief to northern North Dakota, where drought developed and intensified during June. Severe drought (D2) was removed, while the areas experiencing moderate drought (D1) or abnormal dryness (D0) were reduced. Despite the welcomed rainfall, impacts still remained. For instance, hay production was low and a hay hotline was established, as the rains came too late to vastly improve the situation. Furthermore, this area is experiencing cumulative effects from drought that occurred during the past two summers.

Elsewhere in the High Plains, short-term precipitation deficits caused D0 to develop during the latter half of July in southwestern and northwestern Colorado, southwestern Wyoming, central Kansas, and eastern Nebraska. These areas were quite dry during July, receiving less than 50 percent of normal precipitation. Only South Dakota was free of dryness, as above-normal precipitation occurred throughout much of the state.

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). For current Drought Monitor information, please see: <http://droughtmonitor.unl.edu/>.

Climate Outlooks

According to the Climate Prediction Center, El Niño conditions are present in the Pacific and an El Niño Advisory is in effect. A transition from El Niño to ENSO-neutral is expected in the next month or two, with ENSO-neutral likely continuing through the fall and winter. For more information about ENSO, check out the ENSO blog here: <https://www.climate.gov/news-features/department/enso-blog>.

According to the National Weather Service's long-range flood outlook, minor to moderate flooding is expected to continue in eastern areas of the Missouri River Basin through October. In the High Plains, this includes eastern portions of South Dakota, Nebraska, and Kansas, particularly along the James, Missouri, and Neosho Rivers. Below-normal wildland fire potential is expected for portions of Wyoming, Colorado, and South Dakota in August, with normal conditions expected in the High Plains from September-November.

The seasonal temperature and precipitation outlooks below combine the effects of long-term trends, soil moisture, and when applicable, the El Niño Southern Oscillation cycle (ENSO). To learn more about these outlooks, please see: <http://www.cpc.ncep.noaa.gov>.

Temperature

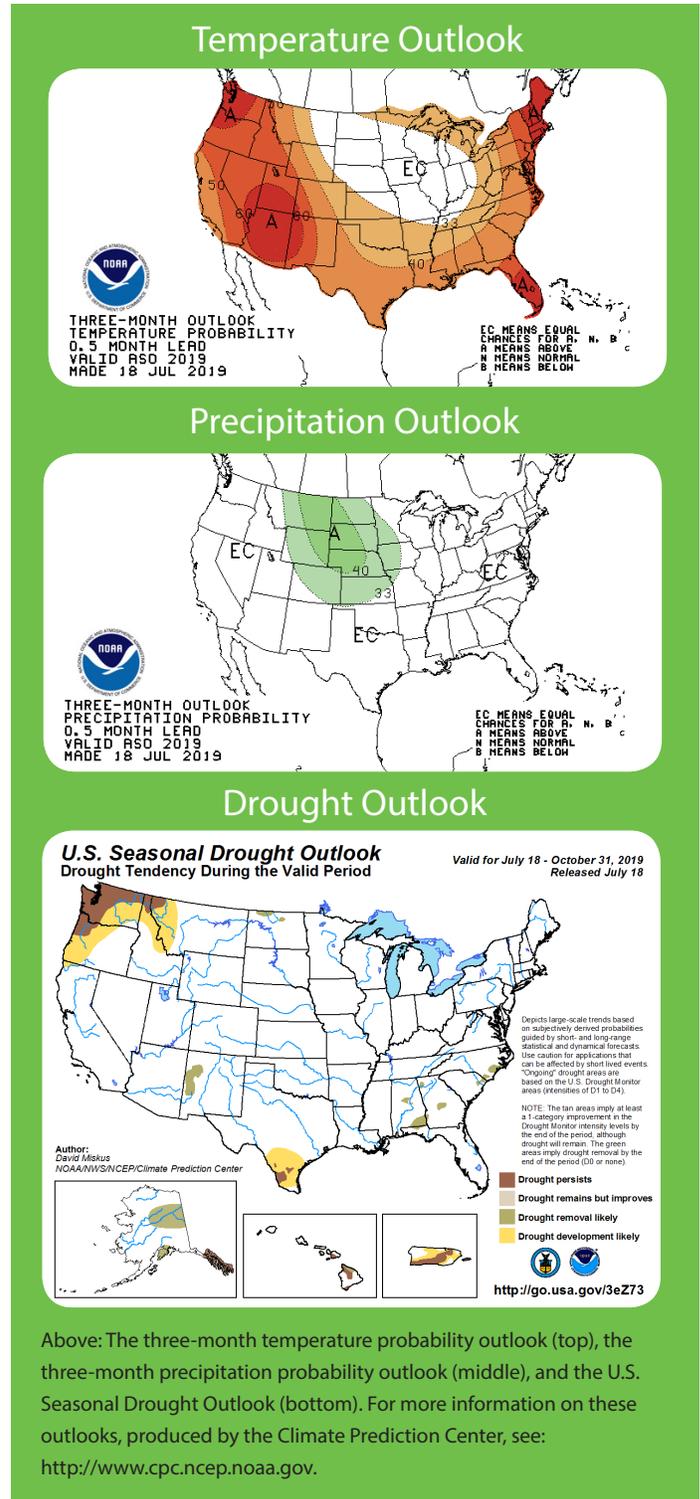
The August-October temperature outlook indicates an increased chance of above-normal temperatures for western, southern, and eastern portions of the contiguous U.S. In the High Plains, this includes Colorado, much of Wyoming, the southwestern half of Kansas, southwestern Nebraska, and northeastern North Dakota. Below-normal temperatures are not anticipated in the contiguous U.S. Elsewhere, there are equal chances for above-, below-, and near-normal temperatures during the August-October period.

Precipitation

The precipitation outlook for the next three months calls for a higher probability of above-normal precipitation across northern and central portions of the contiguous U.S. In the High Plains, this includes all of South Dakota and Nebraska, as well as the majority of North Dakota, Wyoming, Colorado, and Kansas. Below-normal precipitation is not anticipated in the contiguous U.S. Elsewhere, there are equal chances for above-, below-, and near-normal precipitation during the August-October period.

Drought

The July 18th U.S. Seasonal Drought Outlook indicates that drought is expected to persist and further develop across the Pacific Northwest and southern Texas. Drought may improve or be removed in the Northern Plains, Southwest, and Southeast. In the High Plains, this includes northern North Dakota. Drought is not expected to develop in the High Plains region through October. However, it is worth noting that several areas of abnormal dryness had developed in the region by the end of July.



Above: The three-month temperature probability outlook (top), the three-month precipitation probability outlook (middle), and the U.S. Seasonal Drought Outlook (bottom). For more information on these outlooks, produced by the Climate Prediction Center, see: <http://www.cpc.ncep.noaa.gov>.

Station Summaries: By the Numbers

Colorado	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Akron Washington County Airport	89.1	60.7	74.9	0.9	98	07/30+	51	07/10	3.40	0.85	133
Alamosa San Luis Airport	83.9	46.5	65.2	0.6	88	07/21+	37	07/09	0.08	-0.89	8
Colorado Springs Municipal Airport	88.3	57.7	73.0	2.1	97	07/19+	51	07/09	1.40	-1.44	49
Denver International Airport	91.1	60.4	75.7	1.5	101	07/19	52	07/10	2.42	0.26	112
Grand Junction Walker Field Airport	95.5	64.4	80.0	1.8	102	07/22	52	07/09	0.12	-0.49	20
Pueblo Memorial Airport	94.5	62.0	78.3	2.5	105	07/19	56	07/09+	3.02	0.96	147

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	90.9	69.8	80.4	1.3	102	07/17	56	07/23	3.16	-0.76	81
Dodge City Regional Airport	93.6	66.8	80.2	0.6	105	07/31+	55	07/23	1.34	-1.74	44
Goodland Renner Field	92.4	61.9	77.1	1.4	105	07/19	57	07/23+	1.71	-1.76	49
Topeka Municipal Airport	89.6	69.1	79.3	0.3	98	07/20+	58	07/23	4.14	0.32	108
Wichita Mid-Continent Airport	92.7	70.4	81.5	0.4	102	07/20	58	07/23	1.38	-1.94	42

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	88.6	58.6	73.6	0.0	98	07/24+	48	07/10	2.87	0.76	136
Grand Island Airport	87.7	67.1	77.4	1.2	97	07/19	56	07/23	5.21	1.81	153
Lincoln Municipal Airport	88.6	67.9	78.3	0.7	99	07/19+	55	07/23	4.08	0.68	120
Norfolk Karl Stefan Airfield	85.1	64.7	74.9	-0.1	94	07/19	51	07/23	2.82	-0.50	85
North Platte Regional Airport	88.2	63.5	75.9	1.6	102	07/18	55	07/23+	5.83	2.76	190
Omaha Eppley Airport	87.3	70.0	78.6	1.9	97	07/19+	59	07/23	2.64	-1.19	69
Valentine Miller Field	88.8	62.7	75.8	1.3	100	07/14	48	07/22	4.26	1.05	133

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismarck Municipal Airport	83.8	61.4	72.6	1.5	92	07/15	50	07/30	3.52	0.63	122
Fargo International Airport	82.8	61.7	72.3	1.3	91	07/15	45	07/30	4.70	1.91	168
Grand Forks International Airport	83.1	57.4	70.3	1.7	90	07/15+	43	07/30	3.50	0.35	111
Theodore Roosevelt Airport	81.0	56.1	68.5	-0.7	91	07/31	47	07/29	2.83	0.39	116
Williston International Airport	83.2	56.5	69.9	-0.2	95	07/27	46	07/04	3.23	0.69	127

All data are preliminary and subject to change. + indicates multiple dates, latest date listed. * indicates some missing data for the period. Data are retrieved through the Applied Climate Information System (ACIS) and are available online through the CLIMOD system. For more information please contact us: <http://www.hprcc.unl.edu/contact.php>.

July 2019 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	84.2	61.9	73.0	1.7	96	07/15	51	07/30	4.25	1.23	141
Huron Regional Airport	83.9	64.3	74.1	0.4	93	07/15	56	07/30	6.16	3.24	211
Pierre Regional Airport	85.0	62.7	73.8	-1.6	93	07/26+	52	07/22	4.32	1.71	166
Rapid City Regional Airport	82.6	58.7*	70.9*	-1.7*	92	07/24	50	07/10	6.37*	4.52*	344*
Sioux Falls Joe Foss Field Airport	84.8	65.5	75.2	2.2	96	07/19	54	07/30+	6.76	3.67	219

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	90.2	51.8	71.0	0.5	98	07/30	39	07/10	0.74	-0.67	52
Cheyenne Municipal Airport	84.2	56.3	70.2	0.8	95	07/19	47	07/10	1.37	-0.82	63
Lander Hunt Field Airport	86.4	54.7	70.5	-0.7	95	07/11	46	07/10+	0.43	-0.35	55
Laramie Regional Airport	83.0	49.5	66.2	2.2	92	07/19	40	07/10	0.40*	-1.03*	28*
Rawlins Municipal Airport	87.3	51.6	69.4	2.4	93	07/30+	43	07/05	0.29	-0.55	35
Sheridan County Airport	85.4	53.5	69.4	-0.6	97	07/31	43	07/10	1.40	0.22	119

July 2019 Highlights

Monthly Rankings

Precipitation in inches

Wettest	Precipitation / Ranking	Record / Year	Period of Record
Rapid City, SD	6.37 / WETTEST	6.13 / 1969	1942-2019
Mobridge, SD	5.25 / 2nd wettest (tie, 1981)	5.63 / 2001	1911-2019
Huron, SD	6.16 / 6th wettest	6.69 / 1993	1881-2019
North Platte, NE	5.83 / 7th wettest (tie, 1958)	8.47 / 1879	1874-2019
Sioux Falls, SD	6.76 / 8th wettest	9.11 / 1900	1893-2019
Driest	Precipitation / Ranking	Record / Year	Period of Record
Alamosa, CO	0.08 / 3rd driest	0.02 / 1994	1906-2019

All data are preliminary and subject to change. + indicates multiple dates, latest date listed. * indicates some missing data for the period. Data are retrieved through the Applied Climate Information System (ACIS) and are available online through the CLIMOD system. For more information please contact us: <http://www.hprcc.unl.edu/contact.php>.

North Dakota Climate Summary

Adnan Akyuz - State Climatologist

North Dakota State Climate Office, North Dakota State University

For more information: www.ndsu.edu/ndsco or www.ndawn.ndsu.nodak.edu



Precipitation:

Based on the National Centers for Environmental Information (NCEI), the statewide average July precipitation was 3.24 inches, which was 0.45 inch more than last month, 0.33 inch more than in July 2018 and 0.37 inch more than the 1981-2010 average, making it the 23rd wettest July in the 125-year period of record. It was the wettest July since 2016. The numbers less than 100 in Figure 1 below are shaded in yellow, orange and red to depict the region with below-average rainfall. In contrast, the numbers that are greater than 100 in the same figure are shaded in green, blue and purple to depict the region with above-average rainfall in July. The greatest monthly precipitation accumulation was 7.85 inches, recorded in LaMoure, LaMoure County. The greatest 24-hour precipitation was 3.34 inches, recorded in Tolley, Renville County, on July 10. The greatest monthly snowfall accumulation was a trace, recorded in Bismarck, Burleigh County; Litchville, Barnes County; and Underwood, McLean County. The greatest 24-hour snowfall was a trace, recorded also in Bismarck on July 8, Underwood on July 9 and Litchville on July 10. Based on historical records, statewide July precipitation showed a positive long-term trend of 0.29 inch per century since 1895. The highest and lowest July precipitation for the state ranged from 7.97 inches in 1993 to 0.64 inches in 1936.

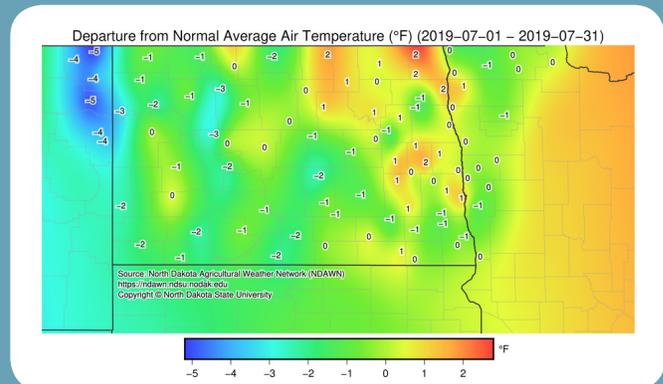
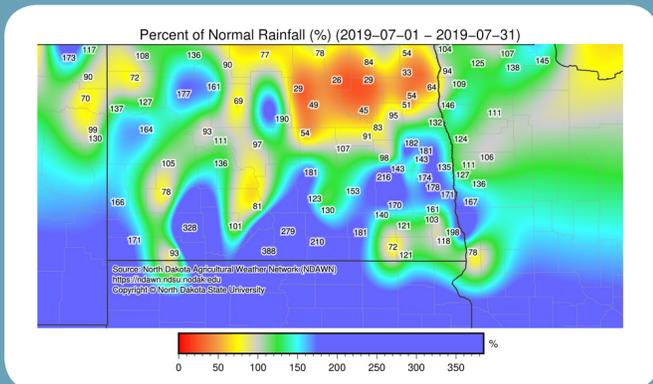
Temperature:

The official state average July temperature was 69.4 F, which is 5.5 F warmer than last month and 0.2 F warmer than in July 2018. The average July temperature was 0.3 F warmer than the 1981-2010 average, which made it the 59th warmest July in the 125-year period of record. It was the warmest July since 2017. The negative numbers in Figure 2 are shaded in green and blue to depict the region with cooler-than-average temperatures in July. In contrast, the positive numbers in the same figure are shaded in red and orange to depict the region with warmer-than-average temperatures in July. The state's highest and lowest daily temperatures ranged from 95 F on July 27 in Williston, Williams County, to 39 F on July 17 in Foxholm, Ward County. Based on the historical records, the state average July temperature showed a slight positive long-term trend of 0.1 F per decade since 1895. The highest and lowest monthly state July average temperatures ranged from 80.1 F in 1936 to 61.8 F in 1992.

Drought and other notable impacts:

The NOAA Storm Report showed 28 significant storm events in July. Across the observation network of weather stations with at least 30 years of history, 15 daily high- and one daily low-temperature records were set or tied. A total of 28 highest daily precipitation-related records were set or tied.

Temperature and Precipitation Overview



Above: Percent of normal precipitation (left, figure 1) and departure from normal average temperature (right, figure 2) for July 2019 in North Dakota. Both figures produced by NDAWN.

About the High Plains Regional Climate Center

The High Plains Regional Climate Center (HPRCC) is one of six NOAA Regional Climate Centers (RCCs) that has been providing timely climate data and information to the public for cost effective decision-making since 1987. The HPRCC primarily serves the six-state region of Colorado, Kansas, Nebraska, North Dakota, South Dakota, and Wyoming, but has also served people from all across the country and even throughout the world. HPRCC operates under a three-tiered structure of climate services and works closely with other organizations on the local, regional, and national levels. HPRCC staff engage with a wide range of stakeholders including K-20 education, the public, media, private industry, research, and state/tribal/federal entities, among others.

Much of the data and products found throughout this publication were built on the Applied Climate Information System (ACIS) framework. ACIS was designed to manage the complex flow of information from climate data collectors to the end users of climate data information. The main purpose of ACIS is to alleviate the burden of climate information management for people who use climate information to make management decisions.

HPRCC is involved in the ongoing development and management of ACIS. In the spring of 2014, the RCCs released a new website for ACIS. This new and improved website not only contains descriptions of ACIS and the sources of data found within, but also features real-world examples of how RCCs and external groups are using ACIS for their particular climate data needs. In addition to these examples, there is extensive documentation and tutorials on how ACIS can be used and accessed by external clients using Web Services. For more information see: <http://rcc-acis.org>.



Additional Summary Information for the High Plains

Missouri River Basin Quarterly Climate Impacts and Outlook

For more information:
<https://www.drought.gov/drought/dews/missouri-river-basin/reports-assessments-and-outlooks>

Midwest and Great Plains Monthly Climate and Drought Webinar

To sign up for future webinars:
<https://www.drought.gov/drought/calendar/webinars>

For an archive:
www.hprcc.unl.edu/webinars.php

Author Information

For questions, comments, or suggestions, please contact:
Crystal Stiles, Applied Climatologist
(402) 202-3320 - cstiles3@unl.edu
713 Hardin Hall, 3310 Holdrege Street
Lincoln, NE 68583-0997
<http://hprcc.unl.edu>

