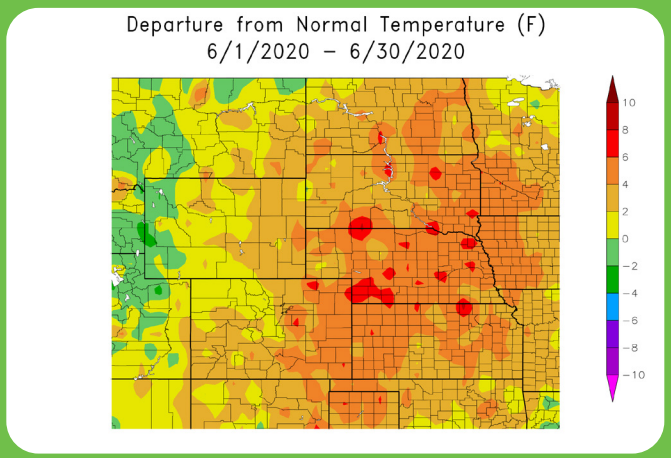
Drought Expands Across High Plains Region

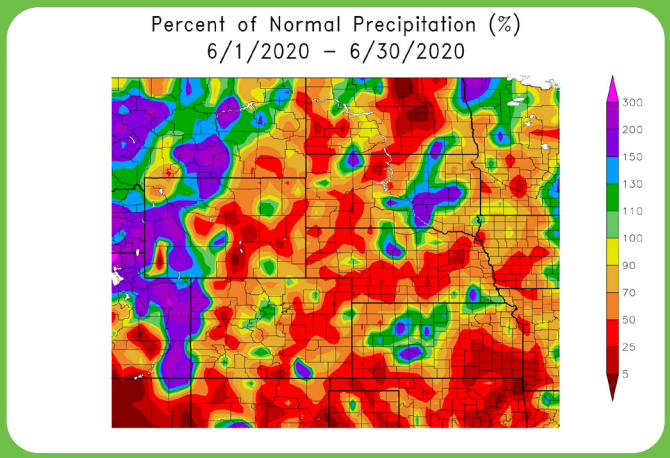
Hot and dry conditions contributed to a rapid expansion of drought across the High Plains region this month. As of June 30th, nearly 40 percent of the region was experiencing drought (D1-D4), which was about double the areal coverage at the end of May. With drought expanding and deteriorating, many impacts have been reported, from cattle sell-offs to winter wheat failures, particularly in eastern Colorado and western Kansas. Low relative humidities and high winds often accompanied this month's hot and dry weather, which increased the evaporative demand and depleted soil moisture reserves.

Although the month was predominantly dry, a notable severe weather event occurred just on the heels of a very slow start to the severe weather season. On June 6th, parts of the High Plains region experienced a rare western U.S. derecho. The long-lived, high wind event started in eastern Utah and tracked over 750 miles across parts of Colorado, Wyoming, Nebraska, South Dakota, and Montana, until it finally ended in North Dakota. According to the Storm Prediction Center, there was a total of 339 wind reports during the event, 44 of which were 75 mph (121 km/hr) or greater. Interestingly, 41 of these 44 high wind reports were directly measured. The highest measured wind gust was 110 mph (177 km/hr) at the Winter Park Ski Area, located just west of Denver, Colorado. Although quite high, this wind gust was much lower than Colorado's unofficial highest gust of 148 mph (238 km/hr) that was recorded at the Monarch Pass AWOS station in February of 2016. Derechos in this part of the country are exceptionally rare, with the Storm Prediction Center indicating that only two other derecho events occurring in the western U.S. have been documented in the literature.

At the end of the month, another rare event occurred. A large, dense plume of Saharan dust traversed across the Atlantic Ocean throughout the month, eventually creating hazy skies and poor air quality across portions of Kansas and Nebraska during the last weekend of June. While Saharan dust routinely reaches the U.S. each year, this particular dust cloud was one of the most intense on record, according to NASA.

Temperature and Precipitation Overview





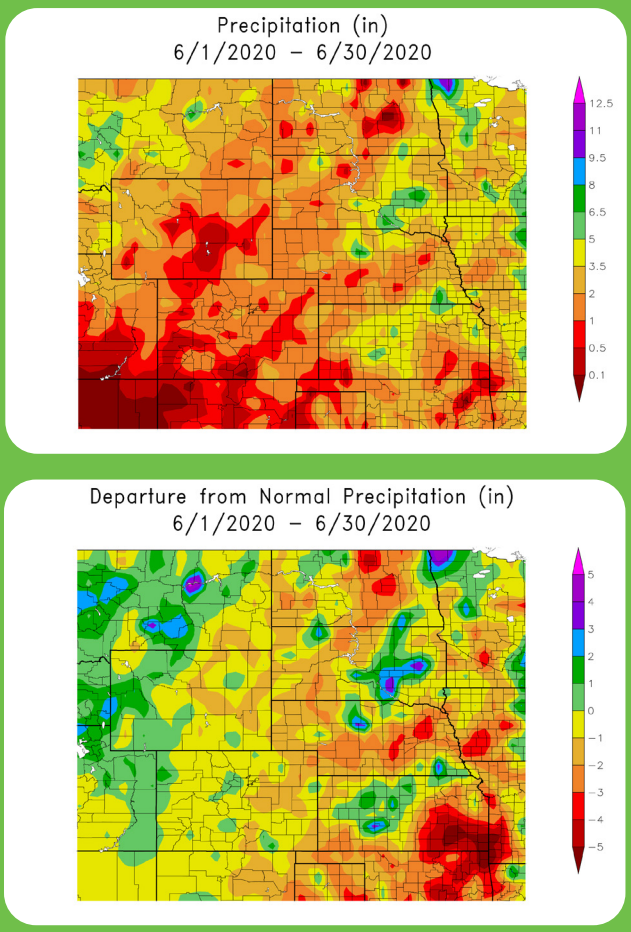
Above: Departure from 1981-2010 normal temperature (left) and percent of normal precipitation (right) for June 2020 in the High Plains region. Maps produced by the High Plains Regional Climate Center and are available at: http://hprcc.unl.edu/maps/current .

Precipitation

June was a dry month for the High Plains, with portions of each state receiving less than 50 percent of normal precipitation. These areas included southern and eastern Kansas, western Colorado, eastern Wyoming, western South Dakota, western and central North Dakota, and a swath running from eastern Colorado through northeastern Nebraska. In eastern parts of North Dakota, Nebraska, and Kansas, this translated into deficits of 3.00-5.00 inches (76-127 mm). Large deficits are hard to overcome at this time of the year, as May and June are typically the wettest two months for the Plains. Even in areas that managed to pick up near-normal precipitation, deficits continued to mount. Bismarck, ND received 2.64 inches (67 mm) of precipitation in June, which was 83 percent of normal. Interestingly, June's precipitation total accounted for over half of this year's precipitation in Bismarck, 4.49 inches (114 mm), making 2020 rank as the 6th driest January-June time period on record (period of record 1874-present).

Despite the widespread dryness, there were a few areas that received above-normal precipitation. The areas with the largest departures, up to 200 percent of normal precipitation, were generally confined to western portions of Colorado and Wyoming, as well as pockets of central Kansas, southeastern and north-central Nebraska, eastern South Dakota, and southern North Dakota. Within these areas, a few locations ranked among the top 10 wettest. One location was the Russell, KS airport station, which had its 8th wettest June with 6.29 inches (160 mm) of precipitation. Russell's wettest June on record occurred in 1951 when it received 10.45 inches (265 mm) (period of record 1949-present).

Regional Precipitation



Above: Total precipitation in inches (top) and departure from normal precipitation in inches (bottom) for June 2020. These maps are produced by HPRCC and can be found on the Current Climate Summary Maps page at: http://hprcc.unl.edu/maps/current.

Although summer had already started, wintry weather impacted portions of the region during a very late-season snowstorm. On June 8-9, a storm system brought heavy, wet snow to areas of southern Wyoming and northern Colorado. The highest totals were located in the Laramie, WY area. For instance, Laramie 4SE, WY had a daily total of 12.0 inches (30 cm), which was the 3rd largest one-day snowfall total in the station's 21-year history (period of record 2000-present). When compared to other stations in the area, it is evident that this snowstorm was one of the largest for the Laramie area for this late in the year. The wet, heavy nature of the event caused power outages that impacted more than 10,000 people. The snowstorm also briefly led to the closure of I-80 between Laramie and Cheyenne, WY.

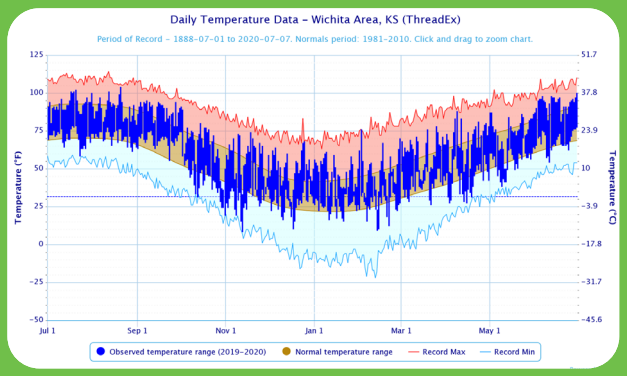
Streamflow Update

Rocky Mountain snowpack continued to melt throughout the month of June, and had nearly melted off in the Upper Missouri Basin by the end of the month. Monthly streamflows were mixed across the region. Streamflows were below normal across western Colorado, portions of Wyoming, western North Dakota, and southwestern Nebraska. Some of the lowest streamflows were located along the Republican River in southwestern Nebraska. Across Kansas, eastern Nebraska, South Dakota, and eastern North Dakota, streamflows were generally near normal or above normal, with some of the highest streamflows being located along the James River in eastern South Dakota. According to the U.S. Army Corps of Engineers, the June 1st runoff forecast for the Upper Missouri Basin was 32.3 MAF, which is above normal.

Temperatures

Temperatures were, in general, above normal across most of the High Plains in June. In fact, the region had the greatest temperature departures in the country, with widespread departures of 4.0-6.0 degrees F (2.2-3.3 degrees C) above normal and localized departures of up to 8.0 degrees F (4.4 degrees C) above normal. The highest departures mostly occurred in pockets of Nebraska and South Dakota. Farther west, across portions of western Wyoming and northwestern Colorado, temperature departures were generally within 2.0 degrees F (1.1 degrees C) of normal.

Station Spotlight: Wichita, KS



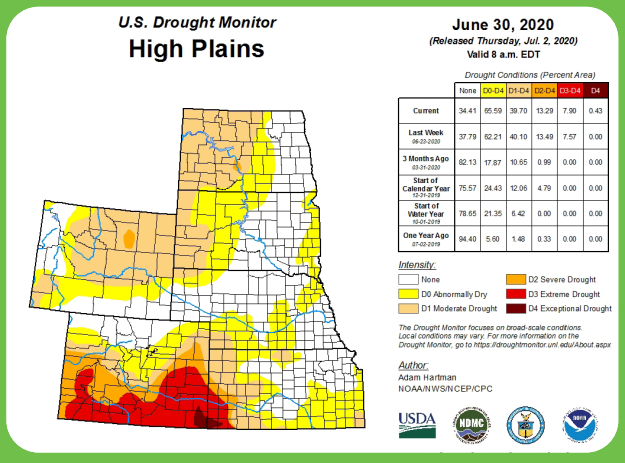
Above: Daily temperatures along with extremes and normals values since July 1, 2019 in Wichita, KS.

With much of the area observing above-normal temperatures, there were many locations that nearly set records this month. The following locations ranked in the top 10 warmest Junes on record: Sioux Falls, SD (3rd warmest); Bismarck, ND (4th warmest); Concordia, KS (5th warmest); Valentine, NE (6th warmest); Omaha, NE (7th warmest); Goodland, KS (8th warmest); Topeka, KS (9th warmest); and Dodge City, KS (10th warmest). One location that was rather warm this month was Wichita, Kansas, which had its 11th warmest June on record with an average temperature of 80.3 degrees F (26.8 degrees C). The warmest June in Wichita was in 1953 with an average temperature of 83.1 degrees F (28.4 degrees C) (period of record 1888-present). Though this June did not rank in the top 10 warmest, Wichita did tie 1911 for the most number of 90.0 degrees F (32.2 degrees C) days for the month of June, with 25 days. In addition to Wichita, a number of locations in the southern part of the region ranked in the top 10 for most number of 90.0 degrees F (32.2 degrees C) days for the month of June.

Drought Conditions

This month, drought conditions continued to expand and worsen in many places across the High Plains region. According to the U.S. Drought Monitor, the area experiencing drought (D1-D4) in the region increased by nearly 20 percent between May 26th and June 30th.

U.S. Drought Monitor



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/.

A combination of above-normal temperatures, high winds, and below-normal precipitation led to an increase in abnormally dry and drought conditions during the month of June. Abnormally dry conditions (D0) increased in coverage across portions of the High Plains region during the month of June, including areas of Colorado, Kansas, Nebraska, and South Dakota. Areas of moderate drought (D1) conditions expanded across portions of North Dakota, Kansas, Wyoming, and western South Dakota. D1 conditions also developed over portions of southwestern Nebraska. One area of slight improvement was across west-central Kansas where there were reductions in severe drought (D2) conditions. New spots of D2 conditions did develop, however, in areas of northeastern Wyoming and central North Dakota. Extreme drought (D3) conditions also expanded across southern and eastern Colorado, and in southwestern Kansas as well. A small pocket of exceptional drought (D4) conditions developed at the end of the month across southeastern Colorado and southwestern Kansas. As of June 30th, over a third of Colorado was in extreme or exceptional drought.

Climate Outlooks

According to the Climate Prediction Center, ENSO-neutral conditions continued through June in the Pacific. There are equal chances (~40-50%) of La Niña or ENSO-neutral during the upcoming autumn 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, there is a greater than 50 percent chance of minor to moderate flooding across portions of the region. This primarily includes portions of the James River in South Dakota. Above-normal wildland fire potential is expected across western Colorado and southwestern Wyoming through July, and across northern Wyoming, western South Dakota, and western North Dakota in August and September.

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 July-September temperature outlook indicates an increased probability of above-normal temperatures for much of the contiguous U.S. In the High Plains, this includes Wyoming, Colorado, North Dakota, South Dakota, and the majority of Kansas and Nebraska. Although there are no areas with an increased chance for below-normal temperatures, there is an area of the Plains and Midwest that has equal chances of above-, below-, or near-normal temperatures. This includes eastern Kansas and the far southeastern corner of Nebraska in the High Plains region.

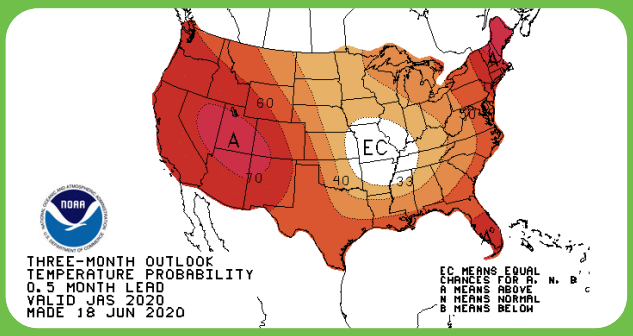
Precipitation

The July-September precipitation outlook indicates a higher chance of above-normal precipitation across portions of the eastern half of the contiguous U.S. In the High Plains, this includes eastern Nebraska, southeastern South Dakota, and eastern Kansas. Meanwhile, there is an increased chance of below-normal precipitation across portions of the western and northwestern U.S. In the High Plains, this includes much of Colorado and Wyoming. Elsewhere, there are equal chances for above-, below-, and near-normal precipitation through September.

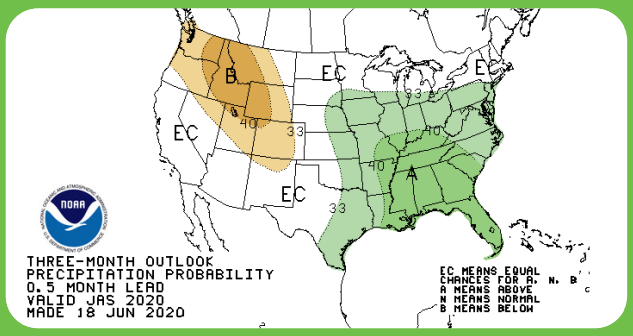
Drought

The June 18th Seasonal Drought Outlook indicates that, over the next three months, drought is expected to develop or persist in parts of the West, Northwest, and Plains. Drought may improve or be removed across portions of the southern U.S., north-central U.S, and the Plains. In the High Plains, drought conditions are expected to persist across much of Colorado, northern Wyoming, western South Dakota, western North Dakota, and western Kansas. Drought will likely be removed in a small area of northern Kansas and over far southern Kansas over the next three months. Drought conditions may further develop across much of Wyoming, northern Colorado, western South Dakota, northwestern Nebraska, and central North Dakota through September.

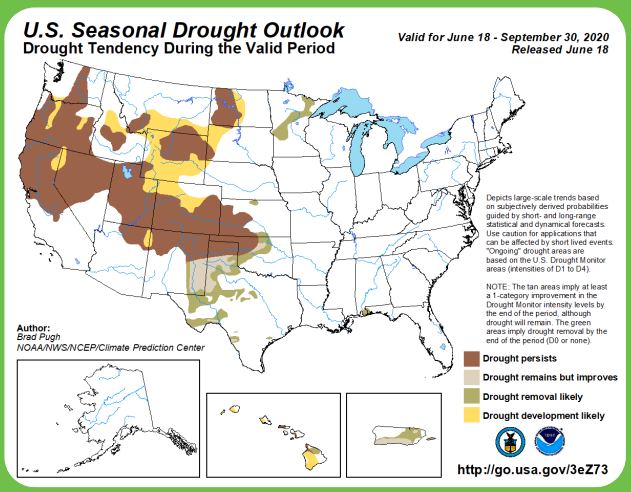
Temperature Outlook



Precipitation Outlook



Drought Outlook



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	89.8*	56.7*	73.3*	6.1*	99	06/25+	42	06/10	0.46*	-2.00*	19*
Alamosa San Luis Airport	81.6	41.9	61.8	2.2	89	06/05	28	06/10	0.17	-0.32	35
Colorado Springs Municipal Airport	85.6	53.5	69.6	4.5	95	06/25	39	06/09	0.78	-1.72	31
Denver International Airport	87.7	54.4	71.1	3.7	96	06/29+	41	06/10	0.71	-1.27	36
Grand Junction Walker Field Airport	89.6	56.5	73.1	1.1	100	06/05	37	06/09	0.51	0.05	111
Pueblo Memorial Airport	92.9	56.2	74.5	4.5	101	06/25+	46	06/09	0.66	-0.70	49

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	91.9	67.1	79.5	6.1	98	06/30+	57	06/10	3.64	-0.41	90
Dodge City Regional Airport	93.3	64.3	78.8	4.9	103	06/30+	50	06/09	4.15	0.91	128
Goodland Renner Field	91.5	58.9	75.2	5.5	104	06/29	44	06/10	1.71	-1.54	53
Topeka Municipal Airport	90.0	68.2	79.1	4.9	96	06/25	55	06/11	3.74	-1.66	69
Wichita Mid-Continent Airport	93.0	67.6	80.3	4.5	100	06/30	54	06/11	1.71	-3.49	33

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	87.6	53.4	70.5	4.6	101	06/29	39	06/10	1.82	-1.42	56
Grand Island Airport	90.2	65.1	77.6	6.3	99	06/14	53	06/11	1.82	-2.48	42
Lincoln Municipal Airport	89.4	66.3	77.9	5.3	96	06/02	53	06/11	3.15	-1.20	72
Norfolk Karl Stefan Airfield	88.3	63.2	75.8	5.6	97	06/02	50	06/24+	0.65	-3.61	15
North Platte Regional Airport	90.3	59.7	75.0	7.1	99	06/17+	45	06/11+	1.69	-1.73	49
Omaha Eppley Airport	89.2	67.0	78.1	6.0	96	06/07+	56	06/23	2.61	-1.57	62
Valentine Miller Field	88.0	60.1	74.1	6.6	100	06/07+	46	06/11+	4.76	1.20	134

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismarck Municipal Airport	85.0	57.1	71.1	6.4	97	06/27	44	06/19+	2.64	-0.53	83
Fargo International Airport	83.9	59.2	71.5	5.3	99	06/07	49	06/06	2.65	-1.25	68
Grand Forks International Airport	81.8	55.2	68.5	4.5	97	06/16	45	06/06	5.90	2.42	170
Theodore Roosevelt Airport	80.9	50.8	65.9	3.7	97	06/27	39	06/10	2.13	-1.07	67
Williston International Airport	79.3	53.9	66.6	3.4	97	06/27	40	06/19	1.61	-0.91	64

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.

June 2020 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	84.9	60.2	72.5	6.9	98	06/01	48	06/03	4.43	0.73	120
Huron Regional Airport	83.7	61.7	72.7	4.9	95	06/07+	52	06/10	5.77	1.84	147
Pierre Regional Airport	83.6	58.9	71.2	3.5	97	06/07	49	06/23	2.14	-1.43	60
Rapid City Regional Airport	82.0	53.4	67.7	3.2	96	06/29	40	06/10	2.16	-0.37	85
Sioux Falls Joe Foss Field Airport	86.4	63.8	75.1	7.3	98	06/07	53	06/19+	3.42	-0.50	87

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	82.1	45.7	63.9	1.7	94	06/05	31	06/18	0.30	-1.31	19
Cheyenne Municipal Airport	81.3	50.9	66.1	4.0	92	06/01	37	06/08	2.09	-0.25	89
Lander Hunt Field Airport	79.2	49.4	64.3	1.3	93	06/05	34	06/09	0.40	-0.87	31
Laramie Regional Airport	77.4	44.4	60.9	3.7	87	06/05	36	06/20	1.43	-0.11	93
Rawlins Municipal Airport	77.0	45.6	61.3	2.0	89	06/05	36	06/18	0.01	-1.02	1
Sheridan County Airport	80.7	48.8	64.7	3.1	98	06/13	38	06/19	1.73	-0.39	82

June 2020 Highlights

Monthly Rankings

Precipitation and Snowfall in inches

Driest	**Precipitation / Ranking**	**Record / Year**	**Period of Record**
Norfolk, NE	0.65 / 3rd driest	0.44 / 1933	1893-2020
Rawlins, WY	0.01 / 4th driest	0.00 / 2014	1951-2020
Warmest	**Temperature / Ranking**	**Record / Year**	**Period of Record**
Sioux Falls, SD	75.1 / 3rd warmest	76.3 / 1988	1893-2020
Bismarck, ND	71.1 / 4th warmest	75.6 / 1988	1874-2020
Concordia, KS	79.5 / 5th warmest	82.0 / 1952	1885-2020
Norfolk, NE	75.8 / 5th warmest	80.0 / 1933	1893-2020
North Platte, NE	75.0 / 5th warmest	77.0 / 1933	1874-2020
Valentine, NE	74.1 / 6th warmest	77.2 / 1933	1889-2020
Omaha, NE	78.1 / 7th warmest	81.5 / 1933	1871-2020
Goodland, KS	75.2 / 8th warmest	77.2 / 1911	1895-2020
Topeka, KS	79.1 / 9th warmest	82.3 / 1934	1887-2020
Lincoln, NE	77.9 / 9th warmest	80.4 / 1933	1887-2020
Dodge City, KS	78.8 / 10th warmest	81.7 / 1952	1874-2020

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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 June precipitation was 2.55 inches, which was 1.12 inches more than last month but 0.52 inch less than in June 2019. It also was 0.79 inch less than the 1981-2010 average, making it the 30th driest June in the 126-year period of record. It was the driest June since 2017. The values 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 values 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 June. The greatest monthly precipitation accumulation was 6.7 inches, recorded in Fullerton, Dickey County. Based on historical records, statewide June precipitation showed a slight positive long-term trend of 0.2 inch per century since 1895. The lowest and highest June precipitation for the state ranged from 1.11 inches in 1974 to 7.01 inches in 2005.

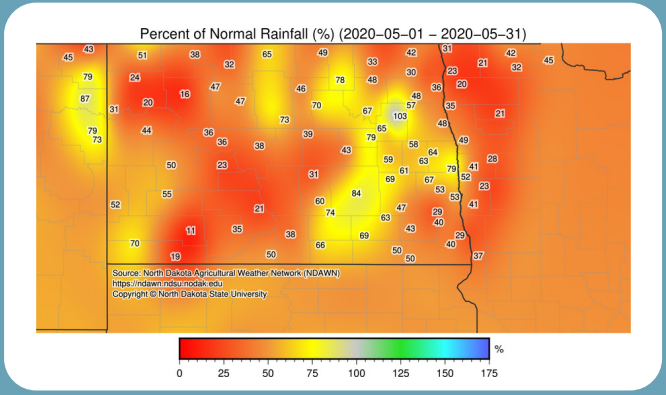
Temperature:

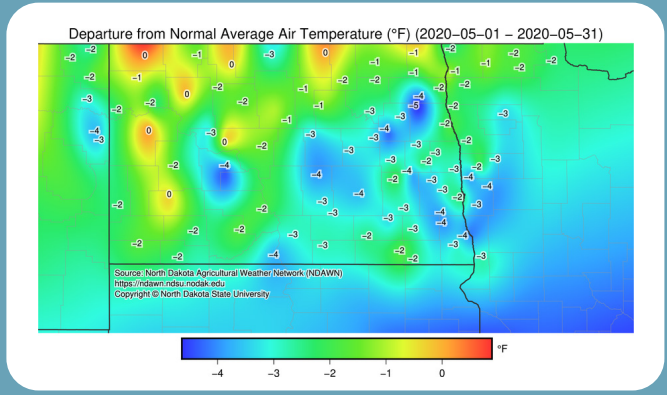
The official state average June temperature was 67 F, which is 14.9 degrees warmer than last month and 3 degrees warmer than in June 2019. The average June temperature also was 3.7 degrees warmer than the 1981-2010 average, which made it the 12th warmest June in the 126 years of record. The negative numbers in Figure 3 are shaded in green and blue to depict the region with cooler-than-average temperatures in June. In contrast, the positive numbers in the same figure are shaded in red and orange to illustrate the region with warmer-than-average temperatures in June. The state's lowest and highest daily temperatures ranged from 34 F on June 19 in Hettinger, Adams County, to 99 F on June 7 in Fargo, Cass County. Based on the historical records, the state average June temperature showed a slight positive long-term trend of 0.2 degree per decade since 1895. The lowest and highest monthly state June average temperatures ranged from 56.8 F in 1915 to 74.1 F in 1988 (Figure 2).

Drought and other notable impacts:

The NOAA Storm Report showed 12 tornado, 106 hail and 93 damaging wind reports, with a total of 211 significant storm events in June. Across the observation network of weather stations with at least 30 years of history, 40 daily high- and four daily low-temperature records were set or tied. A total of 10 highest daily precipitation-related records were set or tied. A highest daily maximum temperature record of 99 degrees was tied in Fargo on June 7, tying the previous record that was set in 1959. (years on record: 129).

Temperature and Precipitation Overview





Above: Percent of normal precipitation (left, figure 1) and departure from normal average temperature (right, figure 2) for June 2020 in North Dakota. Figures 1 and 2 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.

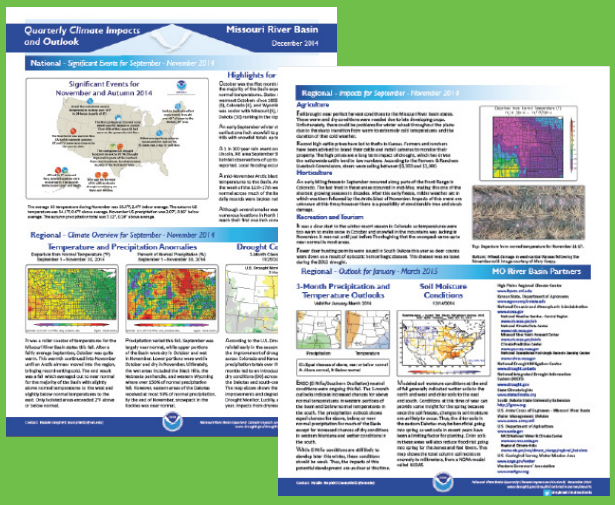
Much of the data and products found throughout this publication were built on the Applied Climate Information System (ACIS) framework. ACIS was designed to manage the complex flow of information from climate data collectors to the end users of climate data information. The main purpose of ACIS is to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

ACIS Applied Climate Information System

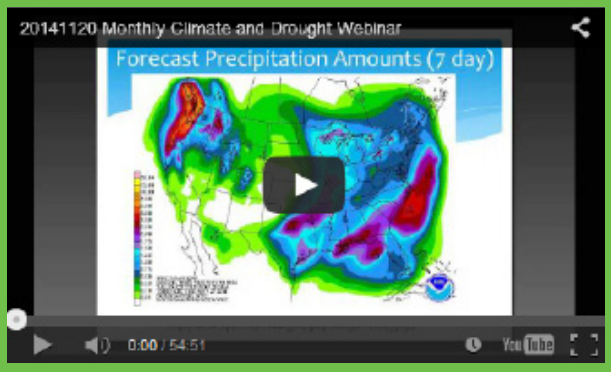
Additional Summary Information for the High Plains

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



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