



# March 2021 Climate Summary

Flooding at Holmes Lake in Lincoln, NE. Photo courtesy Rezaul Mahmood.  
<http://hprcc.unl.edu>

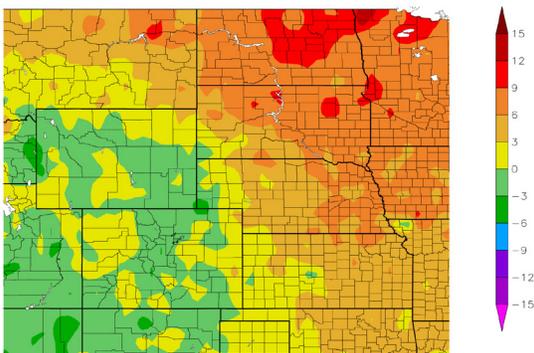
## Extremes Continue Across High Plains Region

Between heavy rain and snow, flooding and drought, and near-record warmth, it was another eventful month for the High Plains region. Northern areas of the region were largely warm and dry, with many locations having both a top 10 warmest and top 10 driest March on record. With little to no snowfall as well, these conditions contributed to an expansion of drought across North Dakota and parts of South Dakota. This continued the increased risk for wildfires, with several burning in recent months. In fact, at the end of March, multiple fires burned in the Black Hills of South Dakota, forcing evacuations and closing Mt. Rushmore National Memorial. At the beginning of April, fire emergencies were declared in both North Dakota and South Dakota.

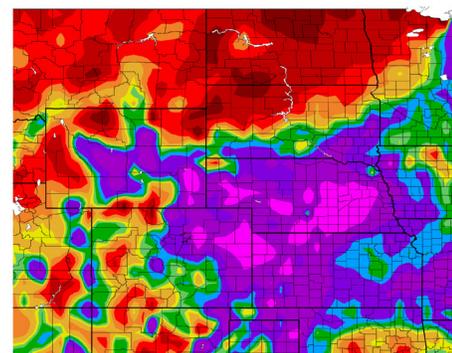
Areas to the south, however, were extremely wet, with a large portion of the region receiving over 200 percent of normal precipitation. Much of this precipitation fell in mid-March, when an intense, slow-moving storm system brought heavy rain and snow to parts of Colorado, Kansas, Nebraska, Wyoming, and South Dakota. Numerous daily and monthly records were set, with some locations receiving more precipitation in this storm than what would be expected for the entire month of March. This heavy precipitation helped to alleviate or remove drought conditions across a large part of the region by building snowpack in the mountains, reducing or eliminating long-term precipitation deficits, and recharging soil moisture. Interestingly, soils were so dry in central and eastern Nebraska that very little flooding was reported, despite the heavy rain. In western areas of the region, where heavy snow and blizzard conditions were reported, several roads were closed, thousands of flights were cancelled, and some livestock perished. Although this storm, along with subsequent precipitation events later in the month, helped to alleviate drought conditions, it will take much more precipitation to overcome the long-term deficits that have accumulated over time, particularly for parts of Colorado and Wyoming. More details about this storm may be found on page 2.

## Temperature and Precipitation Overview

Departure from Normal Temperature (F)  
3/1/2021 – 3/31/2021



Percent of Normal Precipitation (%)  
3/1/2021 – 3/31/2021



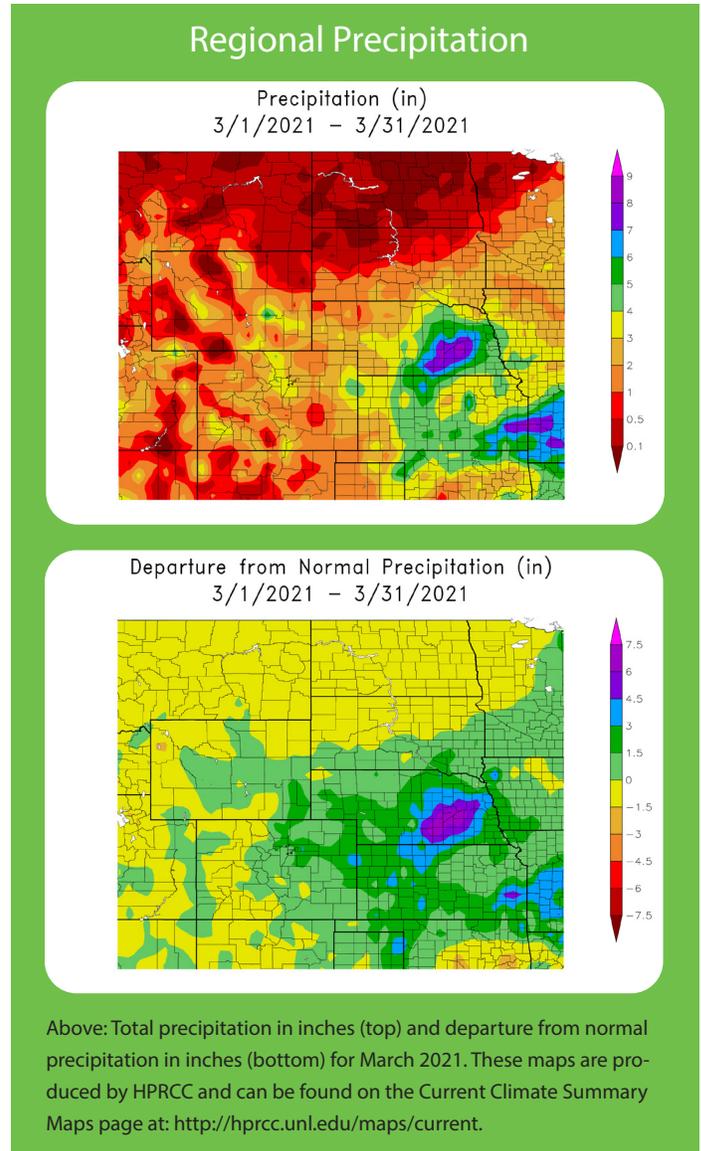
Above: Departure from 1981-2010 normal temperature (left) and percent of normal precipitation (right) for March 2021 in the High Plains region. Maps produced by the High Plains Regional Climate Center and are available at: <http://hprcc.unl.edu/maps/current>.

## Precipitation

Precipitation varied widely this month, with a large portion of the region receiving more than twice the normal amount and other areas of the region receiving little to none. Wetter areas included much of Nebraska, Kansas, Wyoming, eastern Colorado, and southern and eastern South Dakota. Embedded within this area, several locations received over 300 percent of normal precipitation, which led to numerous records. For instance, Grand Island, NE had a monthly total of 8.65 inches (220 mm), which was a whopping 6.85 inches (174 mm) above normal, or 481 percent of normal (period of record 1895-present). Not only was this a new record for wettest March, this amount came close to Grand Island's normal precipitation for the entire spring, which is 8.74 inches (222 mm). It is also noteworthy that all of Grand Island's precipitation fell as rain. While it is not unprecedented to have a snowless March, it is not typical, as the monthly normal is 5.4 inches (14 cm). Other areas of the region received ample amounts of snow, however. Denver, CO, had its snowiest March on record with 34.0 inches (86 cm) (period of record 1874-present). This amount was high enough to also rank as Denver's third snowiest month (of any month).

For these wet areas, an intense storm in mid-March contributed greatly to the monthly totals. In a matter of days, snowfall totals of 2.0-4.0 feet (61-122 cm) were reported in parts of Colorado and Wyoming, while rainfall totals of 2.00-6.00 inches (51-152 mm) occurred across portions of Kansas and Nebraska. Several interesting records were set due to the heavy precipitation. For example, Cheyenne, WY had its snowiest day on record (for any month) with 22.7 inches (58 cm) on March 14 (period of record 1883-present), and Grand Island, NE set new records for wettest and second wettest March days (March 14: 2.75 inches/70 mm; March 13: 2.56 inches/65 mm).

Meanwhile, North Dakota, along with the northern half of South Dakota, was quite dry. Much of this area received less than 25 percent of normal precipitation and many locations ranked in the top 10 driest Marches on record. This dryness, along with low soil moisture supplies and a reduced snowpack, contributed to a substantial deterioration in drought conditions, with many concerns about crops, livestock, and wildfires. Because late spring and early summer is typically the wettest time of the year for the Dakotas, additional deficits could begin to mount quickly if precipitation does not materialize.



## Snowpack Update

With variable amounts of snowfall across the Rockies this month, there were both increases and decreases in the upper Missouri Basin snowpack. According to the U.S. Army Corps of Engineers, between February 28th and March 28th, the Snow Water Equivalent (SWE) above Fort Peck Reservoir declined from 95 percent of average to 88 percent of average, while the reach between Fort Peck and Garrison Reservoirs increased by one percentage point to 95 percent of average. As of the week of March 29th, the statewide snowpack for Colorado and Wyoming was near median, at 92 and 98 percent of median, respectively. Plains snowpack, on the other hand, was largely non-existent most of the month. The 2021 runoff forecast for the upper Missouri Basin, as of March 2nd, was 21.7 MAF, which is 84 percent of average.

## Temperatures

After an extremely cold February, temperatures across much of the High Plains rebounded. While temperatures were generally near normal in Colorado and Wyoming, the eastern half of the region had widespread departures in excess of 3.0 degrees F (1.7 degrees C) above normal. The highest departures, in the 9.0-12.0 degrees F (5.0-6.7 degrees C) range, occurred across portions of the Dakotas.

These departures caused many locations in North Dakota, South Dakota, and Nebraska to be ranked among the warmest Marches on record. One of these locations was Grand Forks, ND, which had its 5th warmest March with an average temperature of 34.3 degrees F (1.3 degrees C). Although this temperature was 9.1 degrees F (5.1 degrees C) above normal, it did not come close to the 2012 record of 38.0 degrees F (3.3 degrees C) (period of record 1893-present). 2012 still holds the record for warmest March for most states in the region and for the entire U.S. Additional rankings may be found on page 6.

With much of the region experiencing above-normal temperatures, some may be wondering about the status of spring leaf out. According to the USA National Phenology Network, spring leaf out was well underway across southern parts of the region, including Kansas, eastern Colorado, southern and eastern Nebraska, as well as portions of southern South Dakota. Interestingly, timing of the leaf out was mixed, with some areas of the region ahead of schedule and others behind. For instance, leaf out in parts of eastern Nebraska and southern South Dakota was up to 3 weeks ahead of average. To continue to track spring leaf out, please see: <https://www.usanpn.org/news/spring>.

## Drought Conditions

There were numerous changes in drought conditions across the High Plains region this month. Overall, according to the U.S. Drought Monitor, the area experiencing drought (D1-D4) decreased from approximately 82 percent to 64 percent since the end of last month. The last time the region had an areal drought coverage less than 65 percent was at the beginning of October 2020.

### U.S. Drought Monitor

**U.S. Drought Monitor**  
**High Plains**

**March 30, 2021**  
(Released Thursday, Apr. 1, 2021)  
Valid 8 a.m. EDT

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	19.85	81.14	63.81	40.67	17.89	2.90
<b>Last Week</b> (3-23-2021)	18.14	81.85	63.87	40.76	14.10	3.00
<b>3 Months Ago</b> (12-29-2020)	3.82	96.18	82.46	50.36	27.09	5.71
<b>Start of Calendar Year</b> (1-1-2021)	3.82	96.18	82.46	50.36	27.09	5.71
<b>Start of Water Year</b> (8-25-2020)	6.73	93.27	82.11	36.56	16.16	0.54
<b>One Year Ago</b> (3-9-2020)	82.13	17.87	10.65	0.99	0.00	0.00

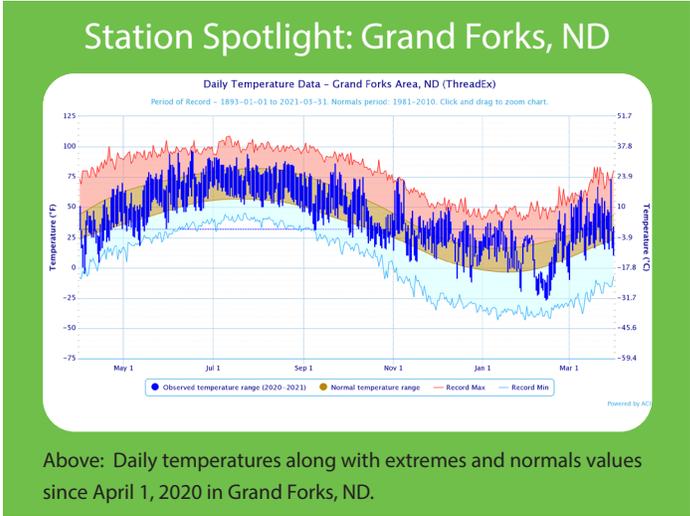
**Intensity:**

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/about.aspx>

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CPC/NOAA

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/>.



Heavy precipitation across portions of Colorado, Kansas, Nebraska, Wyoming, and southern South Dakota either improved or removed drought conditions for a large part of the region. The largest reductions occurred in Wyoming, Kansas, and Nebraska, at about 20 percent, 28 percent, and 56 percent, respectively. In Colorado, drought conditions remained in place for about 92 percent of the state; however, major improvements were made, especially in eastern areas that had extreme (D3) drought.

Meanwhile, drought conditions expanded and/or intensified across parts of the Dakotas due to persistent dryness, a lack of snow cover, and low soil moisture supplies. By the end of the month, D3 had developed and expanded to encompass a large area of western North Dakota and north-central South Dakota. It is also important to note that, as of March 9th, the entire state of North Dakota was in drought for the first time since 2012. For North Dakota, this is an exceedingly rare occurrence. Prior to 2021, the entire state had been in drought only 10 other weeks during the entire history of the U.S. Drought Monitor.

## Climate Outlooks

According to the Climate Prediction Center, La Niña conditions continued this month; however, there is about a 60 percent chance of a transition to neutral conditions later this spring or early summer. For more information, see: <https://www.climate.gov/news-features/department/enso-blog>.

Through June, the National Weather Service’s long-range flood outlook indicates that there is a greater than 50 percent chance of minor to moderate flooding along portions of the Missouri River and its tributaries in southeastern Nebraska and eastern Kansas, as well as tributaries of the Arkansas River in southeastern Kansas. According to the National Interagency Fire Center (NIFC), April wildland fire potential is above-normal for North Dakota, the northern half of South Dakota, northwestern Wyoming, and southern portions of Colorado and Kansas.

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

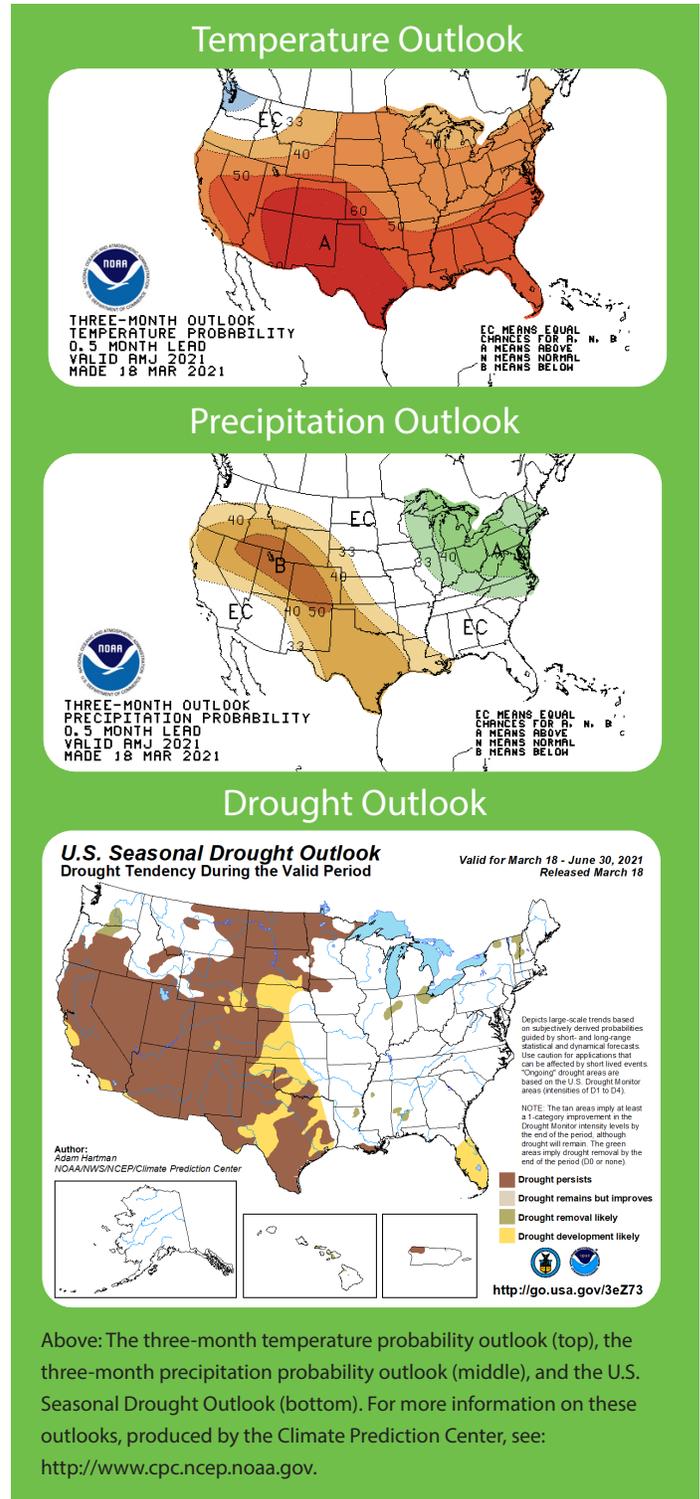
The temperature outlook for the next three months indicates increased chances of above-normal temperatures for the majority of the contiguous U.S. This includes the High Plains region, with the highest chances for above-normal temperatures across southern Colorado and southwestern Kansas. Below-normal temperatures are possible in portions of Washington State. Elsewhere, there are equal chances for above-, below-, and near-normal temperatures.

### Precipitation

The precipitation outlook shows a higher probability of above-normal precipitation across portions of the Northeast, Midwest, and Southeast. No areas of the High Plains region have increased chances for above-normal precipitation. Meanwhile, there are increased chances for below-normal precipitation across western and southern portions of the U.S. In the High Plains, this includes Colorado, Wyoming, southwestern South Dakota, and the western halves of Kansas and Nebraska. Elsewhere, there are equal chances for above-, below-, and near-normal precipitation through June.

### Drought

The March 18th U.S. Seasonal Drought Outlook indicates that drought is expected to persist or develop across much of the West, the Plains, and portions of the Midwest and Southeast over the next three months. In the High Plains, current drought conditions are expected to persist, with development likely across central Kansas, central Nebraska, southern South Dakota, southwestern Wyoming, and pockets of Colorado. Drought may improve or be removed in isolated areas of the Pacific Northwest, the Midwest, the Northeast, and the South. No areas of drought in the High Plains are expected to improve at this time.



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	51.6	26.6	39.1	-0.1	77	03/29	15	03/16+	1.94	1.07	223
Alamosa San Luis Airport	51.8	16.7	34.3	0.8	64	03/20	-1	03/01	0.26	-0.27	49
Colorado Springs Municipal Airport	52.0	27.7	39.8	0.7	74	03/29	18	03/01	1.40	0.40	140
Denver International Airport	51.2	27.6	39.4	-1.0	75	03/29	16	03/15	3.80	2.88	413
Grand Junction Walker Field Airport	56.5	30.9	43.7	-0.2	73	03/29	16	03/01	0.53	-0.39	58
Pueblo Memorial Airport	58.9	27.2	43.0	0.7	82	03/29	16	03/01	0.73	-0.20	78

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	60.2	37.3	48.8	5.8	81	03/29	24	03/01	2.82	0.81	140
Dodge City Regional Airport	60.6	34.1	47.4	3.0	85	03/29	16	03/01	4.11	2.52	258
Goodland Renner Field	56.4	28.5	42.4	1.9	84	03/29	14	03/01	4.03	2.96	377
Topeka Municipal Airport	61.4	38.2	49.8	5.0	80	03/10	22	03/02+	3.88	1.39	156
Wichita Mid-Continent Airport	62.9	38.7	50.8	4.3	80	03/10	20	03/01	4.88	2.19	181

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	52.0	24.9	38.5	2.7	72	03/29+	4	03/11	1.18	-0.05	96
Grand Island Airport	57.7	34.2	46.0	6.6	80	03/29	23	03/31	8.65	6.85	481
Lincoln Municipal Airport	59.3	33.8	46.6	6.5	79	03/29	21	03/19	5.23	3.30	271
Norfolk Karl Stefan Airfield	56.4	31.5	44.0	6.6	78	03/29	20	03/19	5.64	3.87	319
North Platte Regional Airport	58.4	27.8	43.1	5.1	83	03/29	15	03/31	3.73	2.68	355
Omaha Eppley Airport	57.6	34.6	46.1	6.6	78	03/29	22	03/01	4.58	2.59	230
Valentine Miller Field	56.9	29.1	43.0	6.8	81	03/29	14	03/31+	2.42	1.35	226

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismarck Municipal Airport	53.8	23.3	38.6	8.7	71	03/20	9	03/01	0.07	-0.80	8
Fargo International Airport	48.2	23.8	36.0	8.2	77	03/29	-5	03/01	0.28	-1.02	22
Grand Forks International Airport	48.3	20.2	34.3	9.1	73	03/29	-10	03/01	0.23	-0.73	24
Theodore Roosevelt Airport	52.8	22.0	37.4	7.4	67	03/19	6	03/31+	0.03	-0.66	4
Williston International Airport	50.4	24.4	37.4	8.1	70	03/19	6	03/31	0.19	-0.52	27

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>.

## March 2021 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	53.5	26.4	40.0	10.1	81	03/29	10	03/01	0.68	-0.48	59
Huron Regional Airport	53.2	27.7	40.5	7.4	83	03/29	13	03/31+	1.95	0.49	134
Pierre Regional Airport	54.2	27.1	40.6	6.2	81	03/29	10	03/01	1.24	0.01	101
Rapid City Regional Airport	53.1	25.1	39.1	3.7	71	03/28	11	03/31	0.89	-0.04	96
Sioux Falls Joe Foss Field Airport	52.6	29.1	40.9	8.0	81	03/29	17	03/01	2.63	0.87	149

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	44.5	19.8	32.2	-3.0	66	03/08	1	03/11	2.83	2.01	345
Cheyenne Municipal Airport	45.7	23.1	34.4	-1.5	65	03/07	10	03/15	3.49	2.44	332
Lander Hunt Field Airport	46.9	22.5	34.7	-0.8	64	03/08+	8	03/12	2.71	1.55	234
Laramie Regional Airport	43.3	18.1	30.7	-0.2	59	03/20+	8	03/11	0.49	-0.09	84
Rawlins Municipal Airport	43.7	21.7	32.7	0.4	59	03/20	8	03/11	1.12	0.44	165
Sheridan County Airport	50.5	23.7	37.1	1.9	70	03/28	13	03/01	1.47	0.49	150

## March 2021 Highlights

### Monthly Rankings

Temperature in degrees Fahrenheit, Precipitation/Snowfall in inches

Warmest	Temperature / Ranking	Record / Year	Period of Record
Aberdeen, SD	40.0 / 5th warmest	43.8 / 2012	1893-2021
Fargo, ND	36.0 / 5th warmest (tie)	41.6 / 2012	1881-2021
Sioux Falls, SD	40.9 / 5th warmest (tie)	49.8 / 2012	1893-2021
Omaha, NE	46.1 / 8th warmest (tie)	56.4 / 2012	1871-2021
Wettest / Driest	Precipitation / Ranking	Record / Year	Period of Record
Casper, WY	2.83 / WETTEST	2.43 / 1954	1939-2021
Goodland, KS	4.03 / WETTEST	3.60 / 1981	1895-2021
Grand Island, NE	8.65 / WETTEST	6.63 / 1987	1895-2021
Dickinson, ND	0.03 / DRIEST	0.04 / 2012	1938-2021
Bismarck, ND	0.07 / 3rd driest	Trace / 1930+	1874-2021
Mobridge, SD	0.08 / 4th driest (tie)	Trace / 1927	1911-2021
Snowiest	Snowfall / Ranking	Record / Year	Period of Record
Casper, WY	50.9 / SNOWIEST	36.2 / 1975	1939-2021
Denver, CO	34.0 / SNOWIEST	32.5 / 1944	1874-2021
Cheyenne, WY	35.2 / 3rd snowiest	39.2 / 1990	1883-2021
Scottsbluff, NE	21.2 / 6th snowiest	30.8 / 2019	1893-2021

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# 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](http://www.hprcc.unl.edu/webinars.php)

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