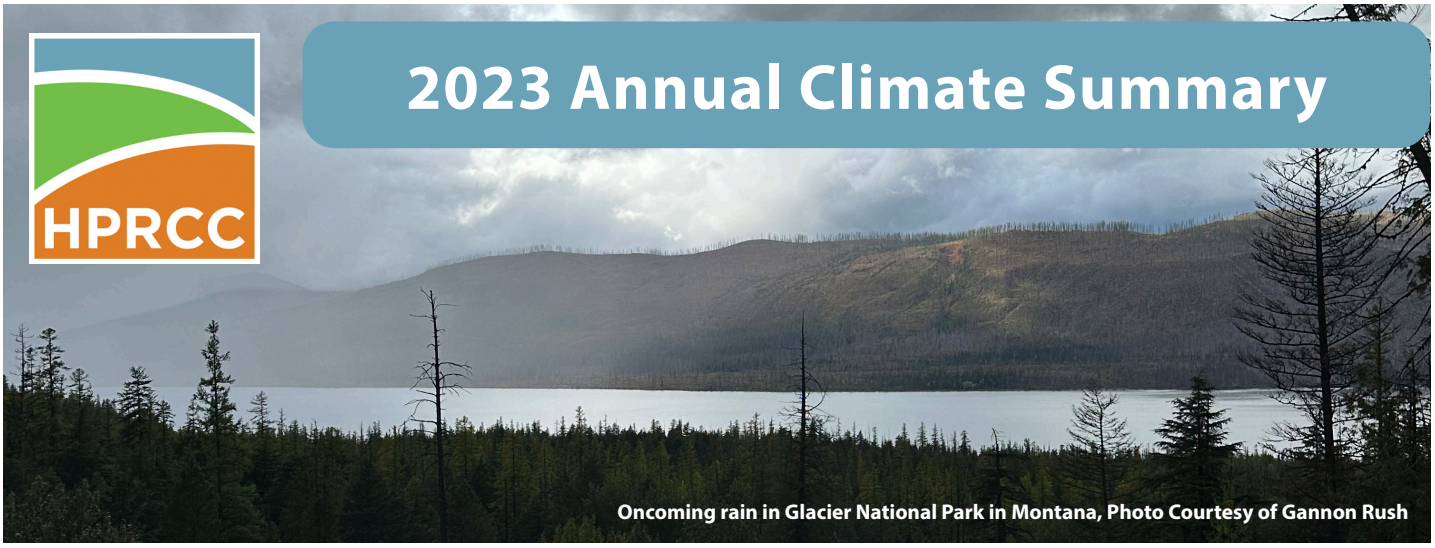
2023 Annual Climate Summary



Oncoming rain in Glacier National Park in Montana, Photo Courtesy of Gannon Rush

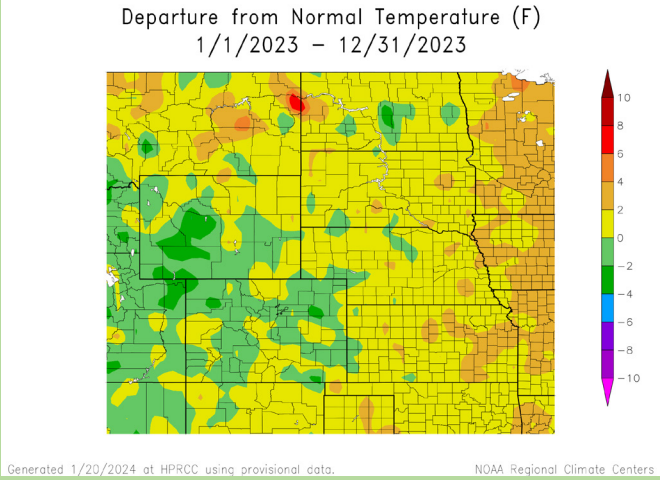
Regional Breakdown

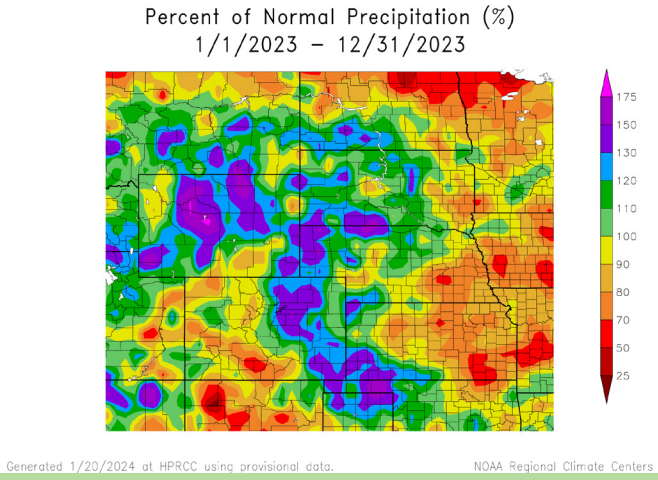
Climate-wise, 2023 was the opposite of 2022, which was marked by dryness and extreme drought. This year brought ample to plentiful precipitation to much of the region, which greatly improved drought conditions. While the precipitation was beneficial to mitigate drought conditions, it was too late to help some crops to recover. In August, a blistering heatwave further impacted all facets of life including agriculture. This heatwave led to a warm end to the year, culminating in a record-breaking December.

Several Notable Records for 2023 Include:

- The heat index reached 134 degrees F (56.7 degrees C) on August 20th in the midst of a historic heatwave. Dew points would reach up to 84 degrees F (28.9 degrees C) in some places, creating very unhealthy conditions.
- Chadron, Nebraska observed its wettest year on record, with 23.85 inches (60.58 cm) of precipitation beating out the previous record of 21.60 in (54.86 cm) set in 1947.
- From January to March, the average temperature in Lander, Wyoming was 16.4 degrees F (-8.7 degrees C). It was their coldest start to a year on record.

Temperature and Precipitation Overview





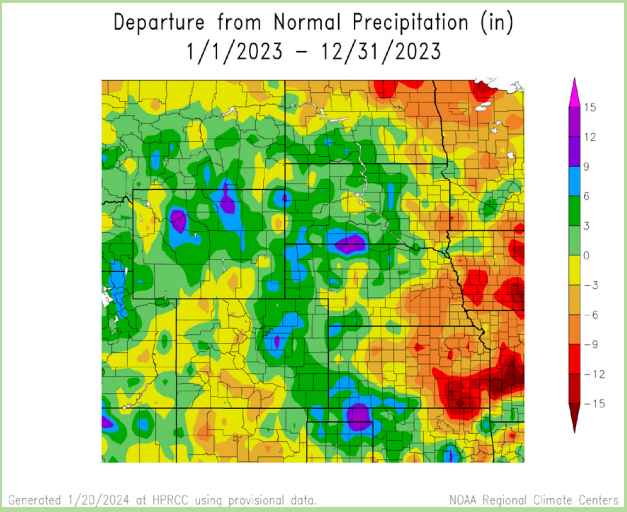
Above: Departure from 1991-2020 normal temperature (left) and percent of normal precipitation (right) for 2023 in the High Plains region. Maps produced by the High Plains Regional Climate Center and are available at: http://hprcc.unl.edu/maps/current .

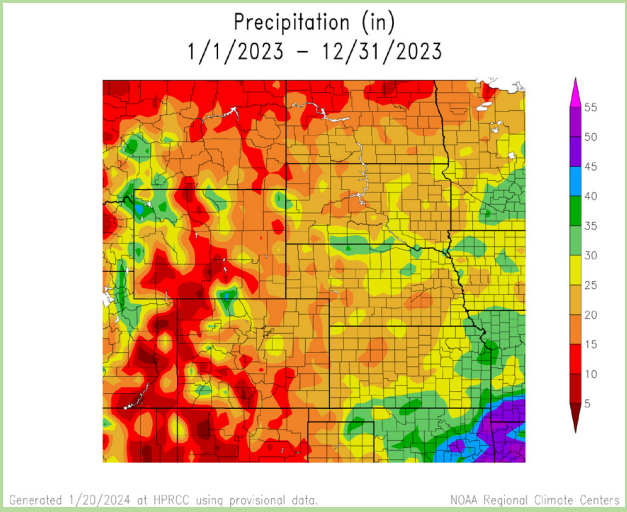
Precipitation and Water Resources

Precipitation came in spurts this year, with extreme amounts of precipitation occurring during several months. Snowfall was abundant in South Dakota, Wyoming, and northern Nebraska to start the year, but the rest of the region was rather dry. An onslaught of storms in May dumped generous amounts of rain across eastern Colorado, northwestern Kansas, and southwestern Nebraska, greatly improving drought conditions. Rain continued to pour into July for Colorado and Wyoming, with record wetness. Throughout the rest of the year, precipitation was not as widespread, however, those that did receive some were given generous amounts. Several locations recorded their wettest year, thanks to heavy snowfall at the beginning of the year and heavy rainfall towards the end. Compared to the extreme dryness that characterized 2022, this year leaves the region in much better shape heading into 2024.

Severe weather, particularly wind and hail, ravaged Colorado, Nebraska, and Wyoming this year. Colorado recorded their highest number of severe thunderstorm and tornado warnings issued in a year (period of record 2002-2023), with 1366. The Dakotas were the opposite, with a near-record low number of warnings issued. Hail wreaked havoc in Colorado, with two storms among the most notable. A hailstorm on June 21st interrupted a concert at the Red Rocks Amphitheater outside of Denver, with nearly 100 people injured after failing to heed warnings. The other storm occurred on August 8th, when a 5.25-inch (13.34 cm) hailstone fell outside of Kirk. After verification by the State Climate Extremes Committee, this would officially beat out the previous record of 4.83 inches (12.27 cm) from a stone from Bethune in 2019. In Kansas, a 115 mph (185 km/h) wind gust was recorded outside of Wallace. Combined with 2.5-inch (6.35 cm) hail, severe damage was reported from anything in the path of the deadly storm.

Regional Precipitation





Above: Total precipitation in inches (left) and departure from normal precipitation in inches (right) for 2023. These maps are produced by HPRCC and can be found on the Current Climate Summary Maps page at: http://hprcc.unl.edu/maps/current.

Temperatures

Overall, temperatures this year were slightly above normal for most of the region. Wyoming and parts of Colorado observed below normal temperature due to a very cool start of the year. Temperatures were mild for the rest of the region outside of May and June, before the entire region heated up from August until the end of the year. Multiple heatwaves impacted the region during the late summer and well into the fall, with temperatures surpassing 90 degrees F (32.2 degrees C) in Kansas during November. A dangerous and unbearable heatwave combined with extremely high dewpoints in August led to heat indices topping 130 degrees F (54.4 degrees C) in the southern Plains.

Notable temperature records for 2023 included:

- John Redmond Lake (outside of Emporia, Kansas) observed its warmest year on record with an average temperature of 59.8 degrees F (15.4 degrees C). To the north, Concordia narrowly missed their record warm year.
- December was very warm in the region, with temperatures over 12 degrees F (6.7 degrees C) above normal in the northern portions. Monthly records were broken all the way from North Dakota to Nebraska, while the rest of the region ranked in the top 10 warmest.

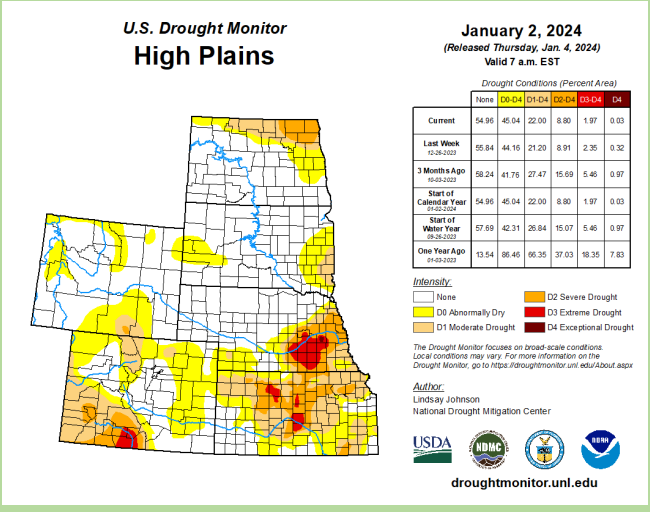
Drought Conditions

According to the U.S. Drought Monitor, overall drought coverage dramatically improved across the region. Heavy precipitation occurred this year primarily over areas plagued by drought coming into 2023.

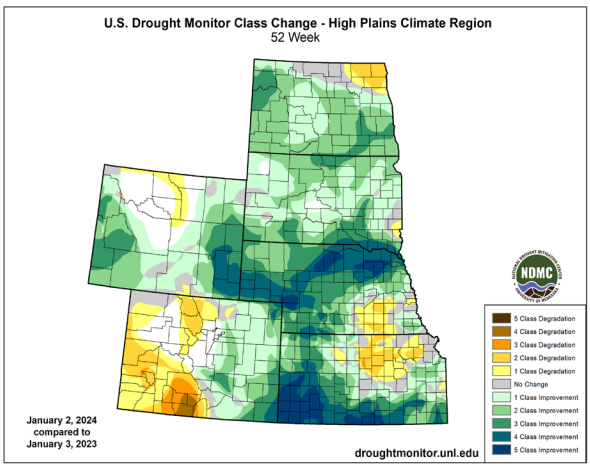
Undoubtedly, the biggest winner in 2023 was Kansas. Entering the year, close to 57 percent of the state was under extreme to exceptional drought (D3-D4) conditions. That number is down to 3 percent heading into 2024, a significant and much overdue improvement. While much of the state is still dealing with drought or abnormally dry (D0) conditions, the outlook is much more optimistic heading into the new year.

Overall, 21 percent of the High Plains was in D1-D4 at the end of the year, the lowest percentage since May 2020.

U.S. Drought Monitor



Drought Monitor 12-Month Change



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/.

Notable Events

Record-Breaking Hailstone in Colorado: Capping off an unusually active severe weather season in Colorado was the recovery and examination of a 5.25-inch (13.34 cm) hailstone on August 8th in Yuma County. A storm chaser reported significant hail near the town of Kirk and managed to recover a stone larger than a softball. With a caliper on-hand, he was able to photograph some measurements, but some melting occurred before it could be officially measured. The local National Weather Service office in Goodland, Kansas convened the State Climate Extremes Committee to verify if it would break the recent record of 4.83 inches (12.27 cm) in 2019. Despite the melting during transportation, the initial measurements and photographs were sufficient evidence to certify that it would become the new record for the state.

Drought Improvement Across the Region: The outlook for the multi-year drought in the High Plains seemed very bleak coming into 2023, with the previous year leaving Kansas and Nebraska in a dire situation. After multiple months of torrential rainfall, both states experienced significant improvements. D3-D4 was nearly eradicated in Kansas, however, a small patch does remain in Nebraska. The region as a whole is at the lowest percentage of drought conditions in nearly three years.

Agriculture Struggled Again: Despite the beneficial and significant amounts of precipitation, it was too late to improve winter wheat yields. Kansas harvested its lowest bushel count since 1966, with numerous fields abandoned due to the dry fall in 2022. Corn production was aided by the rains, however, the heatwave in August burnt many stalks to a crisp. North Dakota also recorded its largest cattle anthrax outbreak since 2005 due to a dry to suddenly wet pattern. The mild fall this year allowed the disease to linger, with a case reported in December.

Top: Platte River in central Nebraska (credit Gannon Rush)
Middle: Hazy sunset in Nebraska due to lingering smoke (credit Doug Kluck)
Bottom: Light showers over Eastern Wyoming (credit Gavin Rush)

Late August Heatwave: A rather unusual and deadly heatwave impacted the lower Plains in August. Temperatures reached up to 115 degrees F (46.1 degrees C) in Manhattan, Kansas and the average high for the week was 108 degrees F (42.2 degrees C). The presence of dewpoints up to 80 degrees F (26.7 degrees C) made this heatwave so unusual. Over 1000 temperature records were broken, with significant disruptions to daily life. Record power usage was recorded, placing a serious strain on utility providers. Schools in Kansas and Nebraska canceled classes or released students early to limit heat exposure outside or on buses.

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	61.7	36.7	49.2	-1.0	100	09/01	-15	02/23	22.40	7.01	146
Alamosa San Luis Airport	62.0	24.3	43.2	0.9	95	07/17	-24	02/17	4.44	-2.97	60
Colorado Springs Municipal Airport	64.6	37.7	51.2	0.7	97	08/18	-2	01/30	25.47	9.56	160
Denver International Airport	64.4	37.7	51.1	-0.1	99	08/21	-11	02/23	18.94	4.46	131
Grand Junction Walker Field Airport	67.1	41.6	54.3	1.1	107	07/17	1	02/16	7.52	-1.54	83
Pueblo Memorial Airport	70.4	37.0	53.7	0.4	106	07/25	-12	01/31	13.41	1.39	112

Kansas	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Concordia Municipal Airport	69.7	45.4	57.6	3.5	109	07/28	4	02/23	24.62	-3.76	87
Dodge City Regional Airport	70.6	30.7	56.9	0.9	107	08/19	3	02/23	24.10	2.10	110
Goodland Renner Field	65.6	45.1	51.7	0.0	102	07/25	-6	01/31	22.08	2.99	116
Topeka Municipal Airport	70.8	45.9	58.4	2.6	111	08/19	8	01/31	27.33	-9.20	75
Wichita Mid-Continent Airport	71.2	47.2	59.2	1.5	111	08/19	7	01/31	30.77	-3.54	90

Nebraska	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Chadron Municipal Airport	62.5	34.5	48.5	0.2	105	08/22	-19	02/23	23.85	8.63	157
Grand Island Airport	65.6	41.1	53.4	1.6	106	08/21	-2	02/23	16.52	-10.09	62
Lincoln Municipal Airport	67.2	41.3	54.2	1.9	105	08/24	-9	02/17	22.52	-6.82	77
Norfolk Karl Stefan Airfield	63.7	40.0	51.9	2.7	102	08/23	-8	01/30	27.52	0.51	102
North Platte Regional Airport	64.6	35.9	50.2	0.3	103	08/22	-11	01/31	22.36	1.28	106
Omaha Eppley Airport	64.9	42.4	53.7	1.3	104	08/24	0	01/30	24.98	-6.88	78
Valentine Miller Field	61.8	35.5	48.7	-0.4	104	08/21	-16	01/30	30.95	10.05	148

North Dakota	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	% Norm
Bismarck Municipal Airport	55.3	32.2	43.8	0.7	101	07/26	-29	02/24	20.55	1.50	108
Fargo International Airport	55.1	34.5	44.8	2.6	98	07/26	-22	01/30	22.37	-1.58	93
Grand Forks International Airport	52.7	30.7	41.7	1.9	100	06/20	-26	02/02	15.43	-6.31	71
Theodore Roosevelt Airport	55.2	31.9	43.6	0.8	97	07/25	-24	02/24	14.83	-0.80	95
Williston International Airport	53.5	33.0	43.2	1.5	102	07/24	-21	01/30	17.28	2.17	114

All data are preliminary and subject to change. + indicates multiple dates, latest date listed. * indicates some missing data for the period. ** indicates value is under evaluation.
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.

2023 Annual 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	57.3	33.1	45.2	1.2	102	06/19	-24	01/30	25.29	3.47	116
Huron Regional Airport	59.2	35.8	47.5	1.6	104	08/22	-23	02/24	20.14	-3.18	86
Pierre Regional Airport	60.5	35.9	48.2	1.2	107	07/26	-19	02/24	20.76	0.56	103
Rapid City Regional Airport	61.2	34.1	47.6	0.9	103	09/02	-24	01/30	19.63	2.19	113
Sioux Falls Joe Foss Field Airport	61.1	38.6	49.8	2.4	104	07/27	-14	02/24	18.79	-9.06	67

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	57.7	31.6	44.6	-1.0	101	07/17	-26	02/23	15.36	3.14	126
Cheyenne Municipal Airport	59.2	35.4	47.3	0.4	93	08/21	-19	02/23	20.37	4.96	132
Lander Hunt Field Airport	54.8	30.6	42.7	-2.4	97	07/17	-31	01/31	17.72	4.49	134
Laramie Regional Airport	56.5	28.6	42.6	1.2	93	07/17	-26	01/31	9.50	-1.02	90
Rawlins Municipal Airport	55.2	30.4	42.7	-0.4	96	07/17	-25	02/23	14.40	5.36	159
Sheridan County Airport	60.0	32.3	46.2	0.8	101	07/24	-27	01/30	22.55	7.62	151

Annual 2023 Highlights

Monthly Rankings

Temperature in degrees Fahrenheit, Precipitation in inches

Temperature	**Temperature / Ranking**	**Record / Year**	**Period of Record**
Concordia, Kansas	57.6 / 2nd Warmest	57.7 / 1934	1885-2023
Topeka, Kansas	58.4 / 3rd Warmest (tied with 1946+)	59.8 / 2012	1887-2023
Norfolk, Nebraska	51.9 / 4th Warmest (tied with 2006+)	53.2 / 2012	1893-2023
Grand Island, Nebraska	53.4 / 4th Warmest (tied with 2016)	56.0 / 1934	1895-2023
Sioux Falls, South Dakota	49.8 / 6th Warmest	50.6 / 1931	1893-2023
Laramie, Wyoming	42.6 / 6th Warmest (tied with 2016)	44.2 / 2012	1948-2023
Lincoln, Nebraska	54.2 / 8th Warmest	55.6 / 1934 and 1931	1887-2023
Fargo, North Dakota	44.8 / 9th Warmest	46.7 / 2016	1881-2023
Precipitation	**Precipitation/ Ranking**	**Record / Year**	**Period of Record**
Chadron, Nebraska	23.85 / Wettest	21.60 / 1947	1941-2023
Valentine, Nebraska	30.95 / 2nd Wettest	32.68 / 1977	1889-2023
Colorado Springs, Colorado	25.47 / 2nd Wettest	27.58 / 1999	1894-2023
Rawlins, Wyoming	14.40 / 2nd Wettest	16.06 / 2009	1951-2023
Akron, Colorado	22.40 / 4th Wettest	24.20 / 1987	1937-2023
Sheridan, Wyoming	22.55 / 5th Wettest	29.79 / 1923	1907-2023
Scottsbluff, Nebraska	22.22 / 6th Wettest	27.49 / 1915	1893-2023
Cheyenne, Wyoming	20.37 / 8th Wettest	23.69 / 1942	1871-2023

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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.

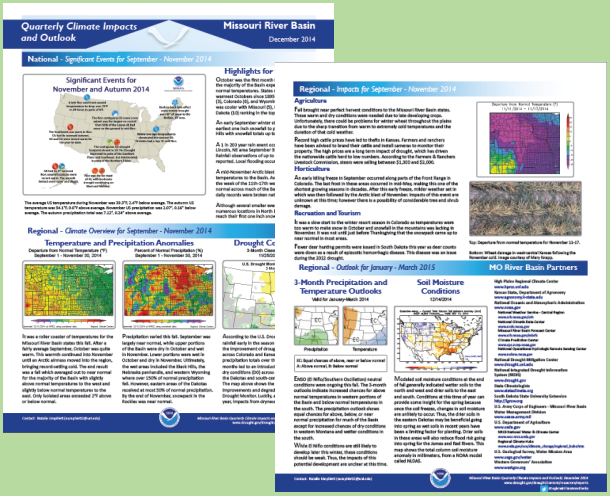
Much of the data and products found throughout this publication were built on the Applied Climate Information System (ACIS) framework. ACIS was designed to manage the complex flow of information from climate data collectors to the end users of climate data information. The main purpose of ACIS is to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

ACIS Applied Climate Information System

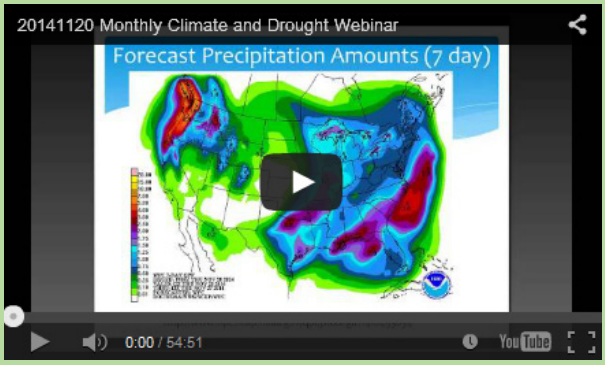
Additional Summary Information for the High Plains

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



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

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

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HPRCC

NOAA National Oceanic and Atmospheric Administration, US Department of Commerce