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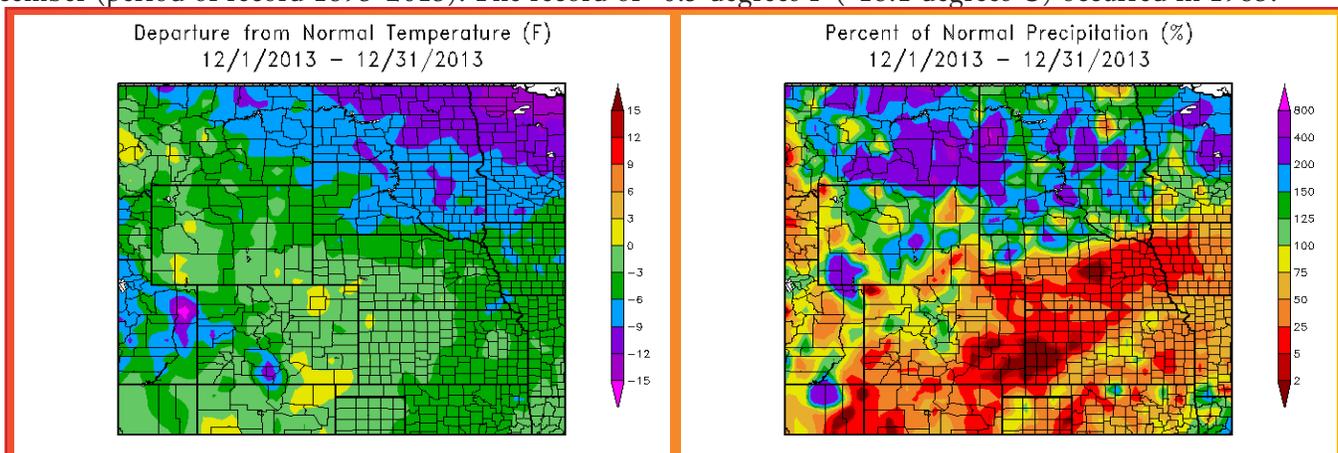
Snowy day in Lincoln, Nebraska - Photo by Natalie Umphlett
<http://hprcc.unl.edu>

December 2013 Climate Summary

Region Breakdown

Several Arctic blasts led to a bitterly cold end to the year. The first cold air outbreak of the month brought temperatures that were 20.0-30.0 degrees F (11.1-16.7 degrees C) below normal to the Region. Wind chills were dangerously low during this timeframe. Although there were a few reprieves from the bitterly cold air, temperatures across the majority of the High Plains Region were ultimately well below normal. North Dakota and South Dakota had the largest departures with temperatures ranging from 6.0-12.0 degrees F (3.3-6.7 degrees C) below normal. Temperature departures of 3.0-6.0 degrees F (1.7-3.3 degrees C) below normal were common across the remaining states in the Region.

While not record breaking, some locations did rank in the top 10 coolest Decembers on record. One example was Grand Forks, North Dakota which had its 3rd coolest December with an average temperature of -0.1 degrees F (-17.8 degrees C). Although this was 11.6 degrees F (6.4 degrees C) below normal, it was just shy of the record of -1.0 degree F (-18.3 degrees C) set back in 1917 (period of record 1893-2013). Another top 10 location was Aberdeen, South Dakota. With an average temperature of 6.5 degrees F (-14.2 degrees C), Aberdeen had its 4th coolest December (period of record 1893-2013). The record of -0.5 degrees F (-18.1 degrees C) occurred in 1983.



Departure from 1981-2010 Normal Average Temperature (left) and Percent of Normal Precipitation (right) for December 2013 in the High Plains Region. Maps produced by High Plains Regional Climate Center. Available at: <http://hprcc.unl.edu/maps/current>

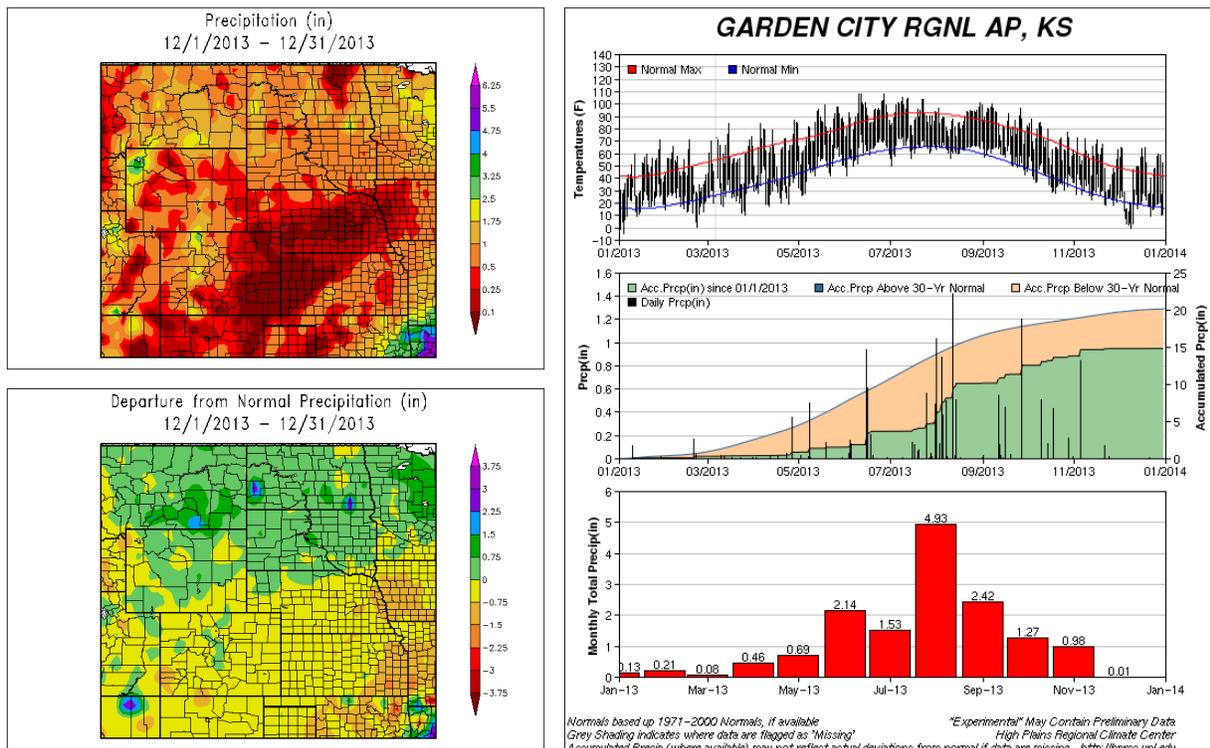
December 2013 Climate Summary

The bitterly cold weather did have impacts on travel and local business in North Dakota, according to the *Grand Forks Herald*. As temperatures plummeted, many folks were stranded in their vehicles when their diesel fuel turned to gel. One towing company indicated that business had quadrupled from the usual. Batteries and cold weather clothing were also in high demand. In addition, oil production in western areas of the state slowed due to the frigid temperatures.

Precipitation Summary

This month, the High Plains Region was generally wetter in the northern areas and drier in the southern areas. The heaviest precipitation was confined to North Dakota, South Dakota, and Wyoming where liquid equivalent precipitation totals ranged from near normal up to 400 percent of normal. Bismarck, North Dakota had its 9th wettest December on record by picking up 1.26 inches (32 mm) of liquid equivalent precipitation (period of record 1874-2013). Bismarck also had its 9th snowiest December on record. Other locations also ranked in the top 10 snowiest Decembers. For instance, Pierre, South Dakota had its 4th snowiest December with 14.2 inches (36 cm). Pierre's record amount of 31.3 inches (80 cm) occurred in 1951 (period of record 1897-2013). In addition, Grand Forks, North Dakota had its 5th snowiest December on record with 22.8 inches (58 cm). The old record of 30.2 inches (77 cm) fell in 1996 (period of record 1893-2013).

Some areas of the Region only received light precipitation throughout the month. A large area stretching from eastern Colorado into western Kansas and across Nebraska received at most 25 percent of normal precipitation. Isolated areas picked up little to no precipitation with totals of 5 percent of normal or less. Luckily, December is typically one of the driest months of the year, so below normal precipitation at this time of the year does little to impact the ongoing drought situation across Nebraska, Kansas, and Colorado. Garden City, Kansas was one of these dry spots and with only 0.01 inches (0.3 mm) of liquid equivalent precipitation, it tied for 4th driest December on record (period of record 1947-2013). The graph below shows the growing precipitation deficit over the past year for Garden City.

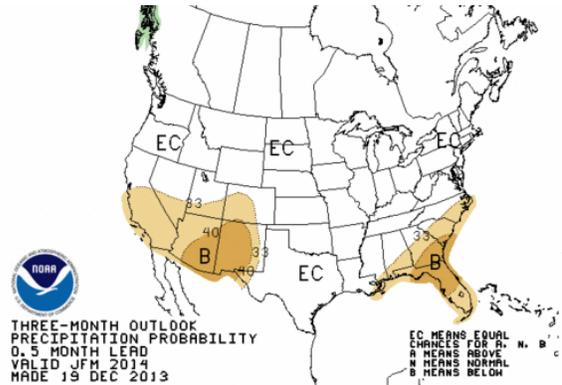
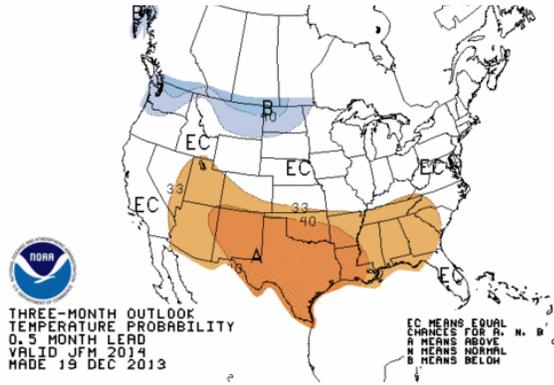


Above: Total precipitation (inches) (top left) and Departure from Normal Precipitation (inches) (bottom left) for December 2013 in the High Plains Region. Accumulated and monthly precipitation for Garden City, KS (right) over the past year. These maps are produced by HPRCC and can be found on the Current Climate Summary Maps page at: <http://hprcc.unl.edu/maps/current>.

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

Climate Outlook

ENSO-neutral conditions continued this month and are likely to continue into the summer of 2014. For the next three months, the temperature outlook indicates a higher probability of above normal temperatures in portions of southern and western Colorado and southern Kansas. Meanwhile, a higher probability of below normal temperatures exists for much of North Dakota and far northwestern South Dakota. The precipitation outlook indicates that much of the western half of Colorado has an increased probability of below normal precipitation. No areas in the Region have an enhanced chance of above normal precipitation. Equal chances of above, near, or below normal temperatures and precipitation exist for the rest of the Region. The seasonal outlooks combine the effects of long-term trends, soil moisture, and when applicable, the El Niño Southern Oscillation cycle (ENSO).

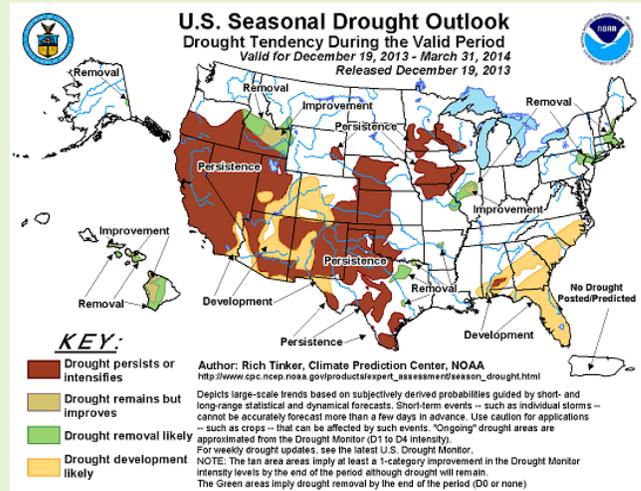
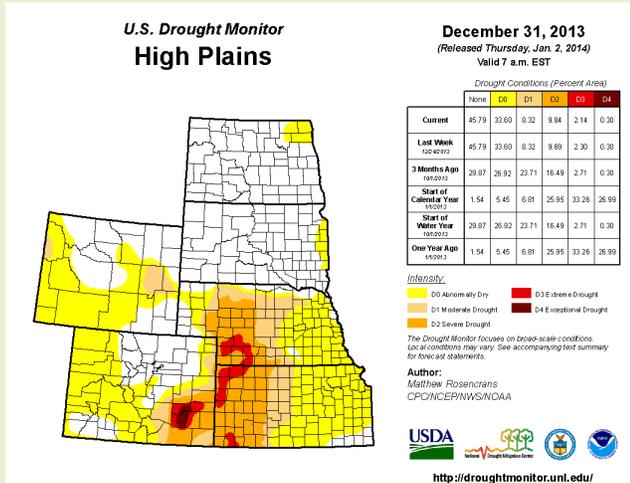


Above: 3-Month Outlook Maps Courtesy the NOAA Climate Prediction Center - <http://www.cpc.ncep.noaa.gov>
 (left) The Three-Month Temperature Probability Outlook, (right) The Three-Month Precipitation Probability Outlook

Drought Watch

As expected this time of year, changes in drought conditions in the High Plains Region were minor, according to the U.S. Drought Monitor. Approximately 20 percent of the Region was in moderate (D1) to exceptional (D4) drought at the end of the month, which was a slight increase from 19 percent at the end of November. One year ago, 93 percent of the Region was in drought with about 27 percent in the D4 designation - what a difference a year makes!

Although there were significant improvements in drought conditions throughout 2013, little change is expected over the winter. Since the winter is typically the driest part of the year in the High Plains Region, no improvements in drought conditions are expected over the next few months. According to the U.S. Seasonal Drought Outlook released December 19th, current drought conditions are expected to persist across Nebraska, Kansas, Colorado, and Wyoming through March 2014. Additionally, drought development is expected in western Colorado.



The U.S. Drought Monitor is produced as a joint effort of the U.S. Department of Agriculture (USDA), National Drought Mitigation Center, U.S. Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA). Real-time data provided through ACIS from the Regional Climate Centers are often used by the agencies involved in the U.S. Drought Monitor when determining the area and intensity of drought conditions, although the product itself is not produced by HPRCC. For current Drought Monitor information, please see: <http://droughtmonitor.unl.edu/>
 Portions of this Drought Watch are courtesy the Drought Monitor Text Discussion found on the Drought Monitor webpage.

State Summaries

| Colorado | Temperatures (degrees F) | | | | | | | | Precipitation (inches) | | |
|-------------------------------------|--------------------------|------|------|--------|----------|-------|-----|--------|------------------------|--------|--------|
| | Averages | | | | Extremes | | | | Totals | | |
| | Max | Min | Mean | Depart | High | Date | Low | Date | Obs | Depart | % Norm |
| Akron Washington County Airport | 40.6 | 13.9 | 27.3 | -1.0 | 63 | 12/02 | -10 | 12/05 | 0.02 | -0.38 | 5 |
| Alamosa San Luis Airport | 23.6 | -9.1 | 7.3 | -10.6 | 38 | 12/03 | -23 | 12/10 | 0.17 | -0.18 | 49 |
| Colorado Springs Municipal Airport | 42.2 | 16.2 | 29.2 | -0.6 | 65 | 12/18 | -8 | 12/06 | 0.07 | -0.27 | 21 |
| Grand Junction Walker Field Airport | 26.5 | 5.2 | 15.8 | -12.7 | 38 | 12/03 | -11 | 12/10+ | 0.96 | 0.37 | 163 |
| Pueblo Memorial Airport | 47.2 | 14.3 | 30.7 | 0.6 | 68 | 12/18 | -4 | 12/09 | 0.03 | -0.35 | 8 |

| Kansas | Temperatures (degrees F) | | | | | | | | Precipitation (inches) | | |
|-------------------------------|--------------------------|------|------|--------|----------|--------|-----|--------|------------------------|--------|--------|
| | Averages | | | | Extremes | | | | Totals | | |
| | Max | Min | Mean | Depart | High | Date | Low | Date | Obs | Depart | % Norm |
| Concordia Municipal Airport | 37.8 | 16.1 | 27.0 | -3.0 | 63 | 12/18 | -4 | 12/07 | 0.54 | -0.31 | 64 |
| Dodge City Regional Airport | 42.2 | 17.5 | 29.9 | -2.9 | 66 | 12/18+ | -5 | 12/07 | 0.48 | -0.36 | 57 |
| Goodland Renner Field | 44.4 | 14.5 | 29.5 | -0.4 | 73 | 12/18 | -6 | 12/08 | 0.05 | -0.41 | 11 |
| Topeka Municipal Airport | 41.1 | 17.0 | 29.0 | -3.0 | 68 | 12/18 | 2 | 12/07 | 0.56 | -0.79 | 42 |
| Wichita Mid-Continent Airport | 42.3 | 18.1 | 30.2 | -3.6 | 67 | 12/18 | 4 | 12/23+ | 0.60 | -0.60 | 50 |

| Nebraska | Temperatures (degrees F) | | | | | | | | Precipitation (inches) | | |
|-------------------------------|--------------------------|------|------|--------|----------|--------|-----|-------|------------------------|--------|--------|
| | Averages | | | | Extremes | | | | Totals | | |
| | Max | Min | Mean | Depart | High | Date | Low | Date | Obs | Depart | % Norm |
| Chadron Municipal Airport | 31.2 | 6.1 | 18.7 | -5.7 | 56 | 12/02+ | -23 | 12/06 | 0.15 | -0.37 | 29 |
| Grand Island Airport | 37.1 | 12.6 | 24.9 | -1.8 | 67 | 12/18 | -7 | 12/09 | 0.11 | -0.52 | 17 |
| Lincoln Municipal Airport | 34.6 | 9.8 | 22.2 | -4.6 | 65 | 12/02 | -10 | 12/09 | 0.22 | -0.73 | 23 |
| Norfolk Karl Stefan Airfield | 31.5 | 9.1 | 20.3 | -4.0 | 62 | 12/28+ | -9 | 12/07 | 0.14 | -0.61 | 19 |
| North Platte Regional Airport | 39.1 | 8.5 | 23.8 | -1.6 | 68 | 12/18 | -8 | 12/09 | 0.16 | -0.25 | 39 |
| Omaha Eppley Airport | 32.3 | 12.2 | 22.2 | -3.8 | 61 | 12/27 | -4 | 12/07 | 0.20 | -0.84 | 19 |
| Valentine Miller Field | 30.8 | 6.1 | 18.5 | -5.3 | 57 | 12/02 | -26 | 12/06 | 0.71 | 0.34 | 192 |

| North Dakota | Temperatures (degrees F) | | | | | | | | Precipitation (inches) | | |
|-----------------------------------|--------------------------|------|------|--------|----------|--------|-----|-------|------------------------|--------|--------|
| | Averages | | | | Extremes | | | | Totals | | |
| | Max | Min | Mean | Depart | High | Date | Low | Date | Obs | Depart | % Norm |
| Bismark Municipal Airport | 17.9 | -3.1 | 7.4 | -8.8 | 44 | 12/27+ | -31 | 12/23 | 1.26 | 0.77 | 257 |
| Fargo International Airport | 12.1 | -4.1 | 4.0 | -10.1 | 40 | 12/27 | -21 | 12/23 | 1.21 | 0.38 | 146 |
| Grand Forks International Airport | 8.6 | -8.7 | -0.1 | -11.6 | 38 | 12/27 | -28 | 12/31 | 0.85 | 0.24 | 139 |
| Theodore Roosevelt Airport | 19.8 | -0.7 | 9.5 | -8.4 | 50 | 12/01 | -29 | 12/23 | 0.36 | 0.12 | 150 |
| Williston International Airport | 17.2 | -2.2 | 7.5 | -6.4 | 41 | 12/27 | -30 | 12/23 | 1.07 | 0.45 | 173 |

All Data are Preliminary and Subject to Change. + indicates multiple dates, latest date listed.

Source: National Weather Service Cooperative Observation Network Data

Data are retrieved through the Applied Climate Information System (ACIS).

These data are available for the entire period of record through the CLIMOD system. For more information please see <http://hprcc.unl.edu/services>.

December 2013 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 | 16.7 | -3.6 | 6.5 | -9.2 | 42 | 12/27+ | -27 | 12/07 | 0.88 | 0.36 | 169 |
| Huron Regional Airport | 20.5 | 0.1 | 10.3 | -8.9 | 50 | 12/02 | -25 | 12/23 | 1.03 | 0.51 | 198 |
| Pierre Regional Airport | 22.7 | 3.6 | 13.2 | -8.5 | 55 | 12/02 | -21 | 12/23 | 1.48 | 0.93 | 269 |
| Rapid City Regional Airport | 30.8 | 6.7 | 18.8 | -6.1 | 60 | 12/18 | -15 | 12/23 | 0.56 | 0.14 | 133 |
| Sioux Falls Joe Foss Field Airport | 21.1 | 2.2 | 11.6 | -7.6 | 48 | 12/02 | -19 | 12/07 | 1.13 | 0.44 | 164 |

| 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 | 30.3 | 10.4 | 20.3 | -3.5 | 52 | 12/02 | -22 | 12/06 | 1.20 | 0.71 | 245 |
| Cheyenne Municipal Airport | 36.6 | 15.7 | 26.2 | -1.5 | 60 | 12/18 | -19 | 12/05 | 0.45 | -0.04 | 92 |
| Lander Hunt Field Airport | 31.9 | 8.4 | 20.1 | -0.6 | 52 | 12/18+ | -19 | 12/05 | 0.69 | 0.11 | 119 |
| Laramie Regional Airport | 30.2 | 9.0 | 19.6 | -1.5 | 50 | 12/18 | -31 | 12/05 | 0.10 | -0.22 | 31 |
| Rawlins Municipal Airport | 28.7 | 10.3 | 19.5 | -2.0 | 44 | 12/18 | -24 | 12/04 | 0.41 | -0.02 | 95 |
| Sheridan County Airport | 32.3 | 6.0 | 19.2 | -3.7 | 57 | 12/18+ | -28 | 12/07 | 1.12 | 0.56 | 200 |

All Data are Preliminary and Subject to Change. + indicates multiple dates, latest date listed.

Source: National Weather Service Cooperative Observation Network Data

Data are retrieved through the Applied Climate Information System (ACIS).

These data are available for the entire period of record through the CLIMOD system. For more information please see <http://hprcc.unl.edu/services>.

December 2013 Top 10 Rankings - Highlights

Monthly Rankings

Temperature in degrees F, Snowfall and Precipitation in inches

Coldest

| Location | Temperature / Rank | Record or Previous Record / Year | Period of Record |
|--------------------|--------------------|----------------------------------|------------------|
| Alamosa, CO | 7.3 / 4th coolest | 5.1 / 1991 | 1932-2013 |
| Grand Junction, CO | 15.8 / 2nd coolest | 15.6 / 1919 | 1893-2013 |
| Grand Forks, ND | -0.1 / 3rd coolest | -1.0 / 1917 | 1893-2013 |
| Aberdeen, SD | 6.5 / 4th coolest | -0.5 / 1983 | 1893-2013 |
| Pierre, SD | 13.2 / 5th coolest | 5.4 / 1983 | 1933-2013 |
| Casper, WY | 20.3 / 8th coolest | 10.9 / 1983 | 1939-2013 |

Snowiest

| Location | Snowfall / Rank | Record or Previous Record / Year | Period of Record |
|-----------------|----------------------|----------------------------------|------------------|
| Bismarck, ND | 15.5 / 9th snowiest | 33.3 / 2008 | 1886-2013 |
| Grand Forks, ND | 22.8 / 5th snowiest | 30.2 / 1996 | 1893-2013 |
| Pierre, SD | 14.2 / 4th snowiest | 31.3 / 1951 | 1897-2013 |
| Casper, WY | 15.7 / 10th snowiest | 62.8 / 1982 | 1939-2013 |

Wettest

| Location | Precipitation / Rank | Record or Previous Record / Year | Period of Record |
|--------------|----------------------|----------------------------------|------------------|
| Bismarck, ND | 1.26 / 9th wettest | 1.71 / 1884 | 1874-2013 |
| Casper, WY | 1.20 / 3rd wettest | 3.71 / 1982 | 1939-2013 |

All Data are Preliminary and Subject to Change.

* indicates multiple records, latest year is listed, T stands for Trace amount of precipitation.

Source: National Weather Service Cooperative Observation Network Data

State Spotlight - Kansas

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

Temperature roller coaster

December saw a mix of warmer and colder temperatures. Twenty-four new records for daily highs were set, and 11 records were tied. On the other hand, 50 records for cold high temperatures were set and 9 records were tied. For low temperatures, 7 record warm low temperatures were set and 3 were tied. On the cold side, 13 daily low minimums were set and 6 records were tied. There were no all-time records set for either high or low temperatures. Overall, this was the 23rd coldest December for the 119 years of record. This puts it in the bottom third of the temperature span. The coldest December on record was in 1983 when the mean temperature was a chilling 15.8F. The warmest temperature recorded in the state in December was 75F reported at Colby 1S (Thomas County) on the 19th. The coldest temperature recorded in December was -12F reported at Oberlin 1E (Decatur County) on the 9th.

State-wide moisture averaged only 0.38 inches, which was 31 percent of normal. No division had above normal precipitation. The South Central division fared best, when compared to normal. The divisional average was 0.63 inches which was 57 percent of normal. Much of that came as part of a winter storm on the 22nd and 23rd. The West Central Division had the lowest average precipitation at 0.02 inches, which was 3 percent of normal. None of the western divisions saw greater than 15 percent of the average for December. Only the Central and South Central divisions had greater than 50 percent of the normal December precipitation. The greatest monthly total precipitation for a National Weather Service Cooperative (NWS) station was 2.07 inches at Kinsley 1SE in Edwards County. For the Community Collaborative Rain Hail and Snow Network (CoCoRaHS), the greatest monthly total was 1.37 inches at Humboldt 4.6 ESE in Allen County. For daily totals, the greatest reported at NWS station was 1.12 on the 22nd at the Salina in Saline County. In the CoCoRaHS network, the greatest daily total was 1.52 inches on the 22nd at Salina 0.8 S, also in Saline County

The dry conditions resulted in further deterioration in the state drought conditions. Abnormally dry (D0) conditions continued in the eastern third of the state, which had been drought free at the end of October. In the western third of the state, where moderate to extreme drought conditions persist, there was an expansion of extreme drought conditions in the Northwest and West Central divisions. These areas saw the least moisture and were closest to normal in temperatures. The cooler than average temperatures somewhat reduced the negative impacts of the low precipitation. Outlooks suggest continued improvement on the eastern edges of the drought region. The Seasonal Drought Outlook and the monthly outlook for January call for continuing drought in the western third of the state. Given the fact that we are still in the drier part of the year, even normal precipitation will have minimal impact on the long term deficits in the region. The El Niño/Southern Oscillation (ENSO) is expected to remain neutral through the winter. For January, the temperature outlook is neutral. That means conditions are equally likely to be above or below normal. The precipitation outlook is also neutral with equal chances across the state for January. The mid-term outlook for the next 8-14 days calls for average temperatures through the 12th of January. The precipitation outlook also calls for equal chances for the state.

Severe weather in Kansas during December was limited to winter weather situations. There were no reports of tornadoes, hail, or high wind. There was an icing event on the 22nd and 23rd, which impacted parts of eastern Kansas. The biggest impact was traffic accidents. Unfortunately, there was also at least one fatality related to exposure in the Wichita area. Greatest snowfall reports were in South Central Kansas, where Larned reported 16.2 inches for the month, 15.2 of which came on the 22nd.

For more information about the Kansas State Climate Office: <http://www.ksre.ksu.edu/wdl/>

The KSU's AWDN is a part of the High Plains Automated Weather Data Network (AWDN). Data are available through KSU or HPRCC.

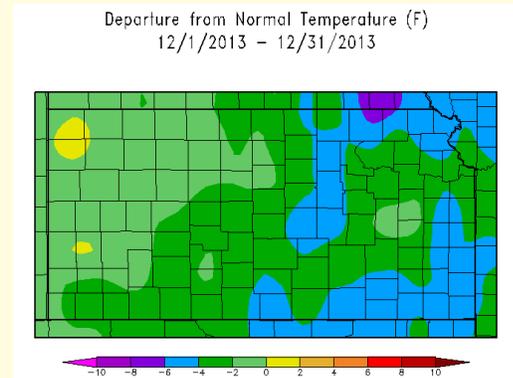


Figure 1. December 2013 departure from average temperatures across Kansas (High Plains Regional Climate Center)

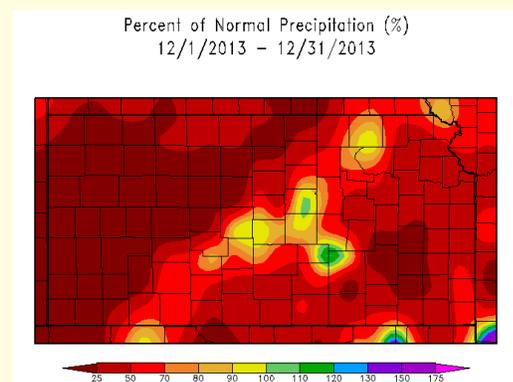


Figure 2. December 2013 percent of normal precipitation across Kansas (High Plains Regional Climate Center)

State Spotlight - North Dakota

F. Adnan Akyüz - State Climatologist, Barb Mullins - Assistant to the State Climatologist
 North Dakota State Climate Office, North Dakota State University



Precipitation:

December 2013 precipitation totals were above normal for nearly all of North Dakota (Figure 1). Parts of the east central and northeast had below normal precipitation. A snow storm from the 2nd through the 4th produced varying snowfall totals across the state with between 4 and 10 inches. The greater snowfall totals of 8 to 10 inches fell in parts of the far southwest corner and the northeast. The U.S. Drought Monitor December 31st report listed the northeast corner as abnormally dry with no drought conditions for the remainder of the state.

Temperature:

NDAWN December average air temperatures ranged from -2 °F in the north to 11 °F in the southwest. Departure from normal average air temperatures were from 7 °F to 14 °F below normal (Figure 2). Daily average air temperatures were above normal for most on the 1st, 16th through the 18th, and the 25th through the 27th. All other days were generally below or far below normal across the state. The National Weather Service ranked Bismarck December average air temperature as the 18th coldest on record with 7.4 °F, Williston as 17th coldest with 7.5 °F, Fargo as 11th coldest with 4.0 °F, and Grand Forks as 4th coldest with -0.1 °F.

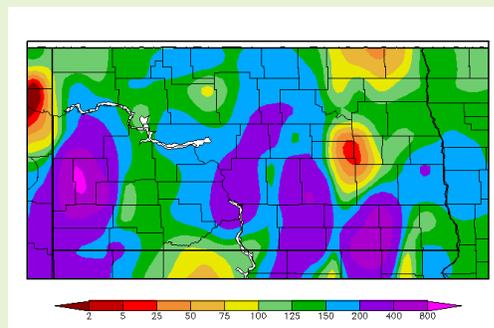


Figure 1. Percent of Normal Precipitation in December 2013 for North Dakota (High Plains Regional Climate Center)

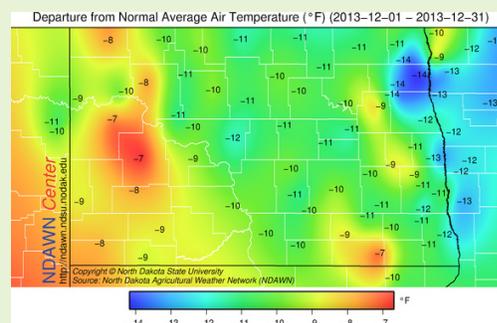


Figure 2. Temperature Departure from Normal in December 2013 for North Dakota (North Dakota State Climate Office)

About the High Plains Regional Climate Center

The High Plains Regional Climate Center (HPRCC) operates out of the University of Nebraska - Lincoln (UNL) in Lincoln, Nebraska. As one of 6 regional climate centers throughout the nation, HPRCC works closely with other organizations such as the National Climatic Data Center (NCDC), Local and Regional National Weather Service (NWS) Offices, and other climate services organizations such as the National Drought Mitigation Center (also located at UNL) to provide climate data services and specialized climate products.

For More Information Online

High Plains Regional Climate Center: <http://hprcc.unl.edu>

High Plains Regional Climate Services: <http://hprcc.unl.edu/services>

CLIMOD: <http://climod.unl.edu>

Regional Climate Centers and ACIS: <http://www.rcc-acis.org>

National Weather Service: <http://www.weather.gov>

National Climatic Data Center: <http://ncdc.noaa.gov>

University of Nebraska - Lincoln: <http://www.unl.edu>

National Drought Mitigation Center: <http://drought.unl.edu>

Climate Prediction Center: <http://www.cpc.noaa.gov>

NOAA Storm Prediction Center: <http://www.spc.noaa.gov>



Photo of the Nebraska Sandhills by Bill Sorensen - Senior Programmer - HPRCC

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