North Dakota Climate Bulletin

Winter 2013-2014

Volume: 8 No: 1

In This Issue

NDSCO

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From the State Climatologist

The North Dakota Climate Bulletin is a digital quarterly publication of the North Dakota State Climate Office, College of Agriculture, Food Systems and Natural Resources, North Dakota State University in Fargo, North Dakota.

Temperature-wise, this winter was the 25th coldest statewide. Precipitation-wise, it was the 46th wettest winter statewide since 1895.

An unusually cold and wet December predominated the nature of the season. For example, although the statewide precipitation in January and February was dry, the 8th wettest December was so significant, it played a major role on determining the seasonal precipitation average for the state. The good news is since the wet pattern changed in January, the conditions have significantly changed the spring flooding potential in the Red River Valley. Most North Dakota citizens, especially in the eastern part of the state will remember this winter as one of the coldest in history. The statewide average shows that it was the coldest winter since the 1993-94 winter. In Fargo, there were 65 days with temperatures in the red (5th largest occurrence in Fargo's climate history since 1881). More on the winter temperature climatology in the Science Bits section (Page 19)

This bulletin can be accessed at http://www.ndsu.edu/ndsco/. This website hosts other great resources for climate and weather information.

Adnan Akyüz, Ph.D.
North Dakota State Climatologist

Feb 19, 2014/Glen Ullin, ND by Jay Brausch

Weather Highlights

Seasonal Summary:

by B. A. Mullins

December 2013

The state average precipitation was 0.90 inches which is above the 1981-2010 normal of 0.52 inches. December 2013 state average precipitation ranked 11th wettest in the last 119 years with a maximum of 1.27 inches in 2008 and a minimum of 0.05 inches in 1944.

December 2013 precipitation totals were above normal for nearly all of North Dakota. 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.

The National Weather Service (NWS) reported record snowfall of 7.3 inches at Grand Forks Airport on the 4th of 7.3 inches. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

The US Drought Monitor January 21, 2014 report had no drought conditions for 94.41% of the state with 5.59% as abnormally dry (D0). The abnormally dry area was in the northeast corner of the state (http://droughtmonitor.unl.edu/).

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), severe weather reports for December had 0 reports of high wind, 0 hail reports, and 0 reported tornadoes.

The top five December daily maximum wind speeds recorded from NDAWN were all on the 28th and included Mayville with 49.4 mph, Prosper with 49.0 mph, Turtle Lake with 49.0 mph, Bowman with 48.3 mph and Leonard with 47.6 mph. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 5.1 °F which is below the 1981-2010 normal of 14.0 °F. December 2013 state average air temperature ranked 13th coolest in the past 119 years with a maximum of 25.4 °F in 1939 and a minimum of -3.2 °F in 1927.

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. 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.

The National Weather Service (NWS) recorded breaking or tying a few low temperature records in December. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

NDAWN's highest recorded daily air temperature for December was 51.4 °F at Mott on the 1st. The lowest recorded daily air temperature was -36.8 °F at Hofflund on the 23rd.

January 2014

The state average precipitation was 0.41 inches which is below the 1981-2010 normal state average of 0.49 inches. January 2014 state average precipitation ranked the 54th driest in the past 120 years with a maximum of 1.27 inches in 1916 and a minimum of 0.09 inches in 1973.

The statewide average January 2014 precipitation total was 0.41" that is about 84% of the 1981-2010 average of 0.49". Even though the entire state average was ranked as the 54th driest January since 1881, there were notable areas receiving much above normal precipitation including central and northeastern ND. The driest parts of the state in the west-central and north eastern ND received only 5 to 25% of normal precipitation. The North Central River Forecast Center issued the spring hydrological outlook delineating probability of the Red River of the North exceeding certain flood stages. Based on the hydrological outlook the Red River in Wahpeton, Fargo, Grand Forks and Pembina has 6, 32, <5, and 20% chance of exceeding their respective major flood stages respectively during the next 3-month period which usually includes the spring flooding period. The U.S. Drought Monitor Jan 28th report listed the northeast corner as abnormally dry with no drought conditions for the remainder of the state.

The National Weather Service (NWS) reported no precipitation records in January. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

The US Drought Monitor February 11, 2014 report had no drought conditions for 94.41% of the state with 5.59% as abnormally dry (D0). The abnormally dry area was in the northeast corner of the state (http://droughtmonitor.unl.edu/).

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 0% very short, 3% short, 86% adequate, and 11% surplus with a subsoil moisture reported as 0% very short, 4% short, 85% adequate, and 11% surplus. (Weekly Weather and Crop Bulletin Vol. 101, No. 5).

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), severe weather reports for January had 0 reports of high wind, 0 hail reports, and 0 reported tornadoes.

The top five January daily maximum wind speeds recorded from NDAWN were 65.5 mph on the 16th at Linton, 64.1 mph on the 16th at Berthold, 63.4 mph on the 15th at Berthold, 61.6 mph on the 16th at Turtle Lake and 61.2 mph on the 16th at Garrison. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 8.7 °F which is below the 1981-2010 normal of 10.6 °F. January 2014 state average air temperature ranked the 68th coolest in the past 120 years with a maximum of 25.9 °F in 2006 and a minimum of -11.9 °F in 1950.

NDAWN January average air temperatures ranged from a minimum of -13 °F in northeast to 24 °F in the West central ND. Departure from normal average air temperatures were from 7 °F below normal to 4°F above normal. The state average temperature was 8.7 °F which is 1.9 °F below the 1981-2010 average. January 2014 was ranked the 68th coldest January since 1890. The coldest temperature was -34° that was recorded in Turtle Lake on January 6, 2014. The warmest temperature was 69° and was recorded in Dunn Center on Jan 14, 2014.

The National Weather Service (NWS) reported breaking two temperature records in January. Grand Forks Airport and Grand Forks NWS reported a record high temperature of 39 °F on the 15th. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

NDAWN's highest recorded daily air temperature for January was 51.8 °F at Sidney, MT on the 25th. The lowest recorded daily air temperature was -39.5 °F at Roseau, MN on the 2nd.

February 2014

The state average precipitation was 0.21 inches which is below to the 1981-2010 normal of 0.44 inches. February 2014 state average precipitation ranked 16th driest in the past 120 years with a maximum of 1.59 inches in 1998 and a minimum of 0.07 inches in 1934.

February 2014 precipitation totals were below average for most of the state. The statewide average February 2014 precipitation total was 0.21 inches which was 47% lower than the 1981-2010 average of 0.44 inches. A precipitation total of 0.21" puts February 2014 as the 16th driest in the past 120 years. Recent years of February 2005 (0.12") and 2002 (0.14") ranked 5th and 7th driest, respectively. The top three February 2014 snowfall totals were Elgin (COOP) with 9.5", Grand Forks 0.6 WS (CoCoRaHS) with 7.7" and Pembina (WBAN) with 7.5". The U.S. Drought Monitor February 25th report listed the northeast corner as abnormally dry with no drought conditions for the remainder of the state.

The National Weather Service (NWS) reported no precipitation records in February. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

The U.S. Drought Monitor March 4th report had no drought conditions for 94.41% of the state with 5.59% as abnormally dry (D0). The abnormally dry area was in the northeast corner of the state (http://droughtmonitor.unl.edu/).

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 1% very short, 7% short, 83% adequate, and 9% surplus with a subsoil moisture reported as 1% very short, 5% short, 83% adequate, and 11% surplus. (Weekly Weather and Crop Bulletin Vol. 101, No. 9).

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), severe weather reports for February had 0 reports of high wind, 0 hail reports, and 0 reported tornadoes.

The top five February daily maximum wind speeds recorded from NDAWN were from Fingal on the 13th with 52.3 mph, Dazey on the 13th with 51.2 mph, Edgeley on the 13th with 50.1 mph, Robinson on the 28th with 49.0 mph and Garrison on the 12th with 48.7 mph. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 5.9 °F which is below the 1981-2010 normal of 15.7 °F. February 2014 state average air temperature ranked the 21st coolest in the past 120 years with a maximum of 29.6 °F in 1954 and a minimum of -14.1 °F in 1936.

NDAWN February average air temperatures ranged from a minimum of -2 °F in northeast to 11 °F in the southwest. Departure from normal average air temperatures were between 7 °F and 14 °F below normal. The state average temperature was 5.9 °F which is 9.8 °F below the 1981-2010 average of 15.7 °F. This puts February's rank as 21st coldest in the past 120 years. The most recent year of 2001 (5.5 ° F) ranked 18th coldest. February daily average temperatures were consistently below normal for most places with only a few days from the 17th through the 20th with above normal temperatures.

The National Weather Service (NWS) reported breaking one temperature in February. Grand Forks Airport reported a record low temperature of -29 °F on the 27th. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

NDAWN's highest recorded daily air temperature for February was 48.8 °F at Sidney, MT, on the 17th. The lowest recorded daily air temperature was -32.9 °F at Roseau, MN, on the 27th.

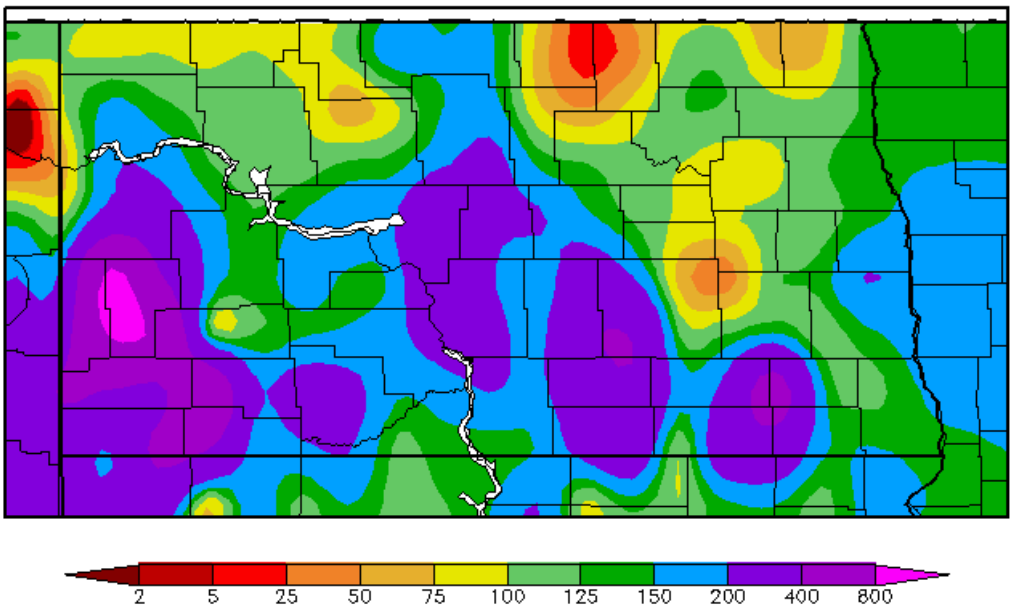
Season in Graphics

December 2013

Winter 2013-2014 Weather in North Dakota:

Total Precipitation percent of mean (1981-2010)

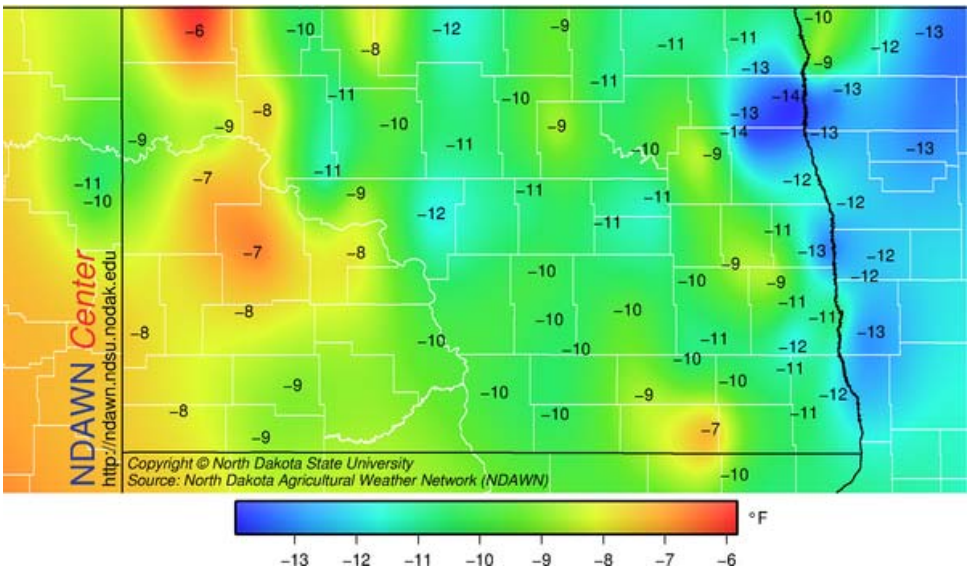
Precipitation Percent of Normal
(Data from NWS Cooperative Network)



North Dakota State Climate Office

Average Temperature (°F) Deviation from Mean (1981-2010)

Departure From Normal Monthly
Average Air Temperature in degrees F
(Data from North Dakota Agricultural Weather Network (NDAWN))



North Dakota State Climate Office

Season in Graphics

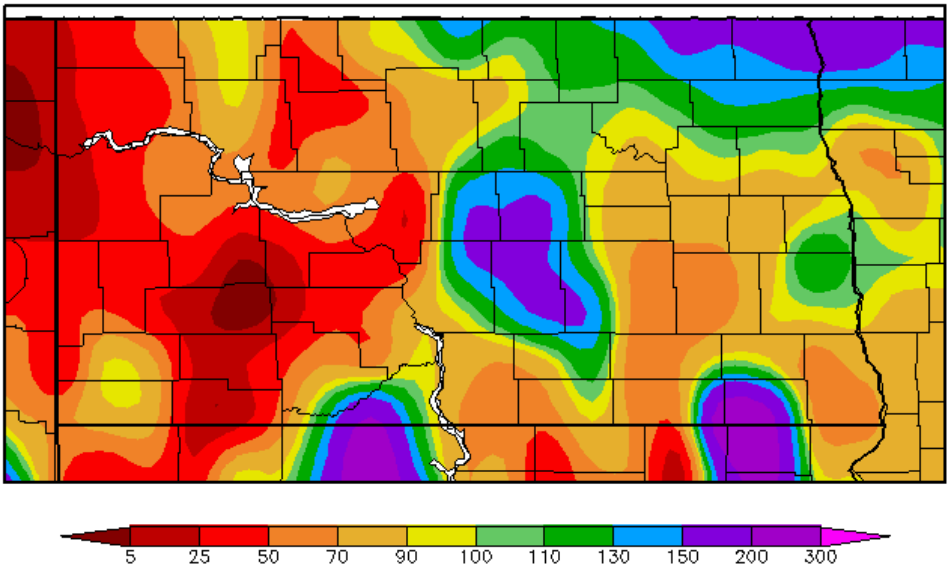
January 2014

Winter 2013-2014 Weather in North Dakota:

Total Precipitation percent of mean (1981-2010)

Precipitation Percent of Normal

(Data from NWS Cooperative Network)

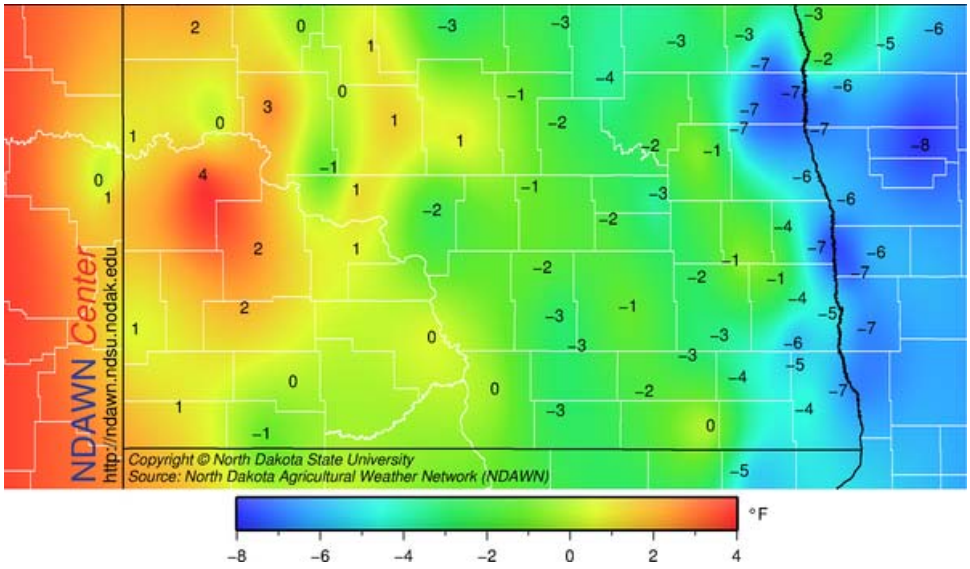


North Dakota State Climate Office

Average Temperature (°F) Deviation from Mean (1981-2010)

Departure From Normal Monthly
Average Air Temperature in degrees F

(Data from North Dakota Agricultural Weather Network (NDAWN))



North Dakota State Climate Office

Season in Graphics

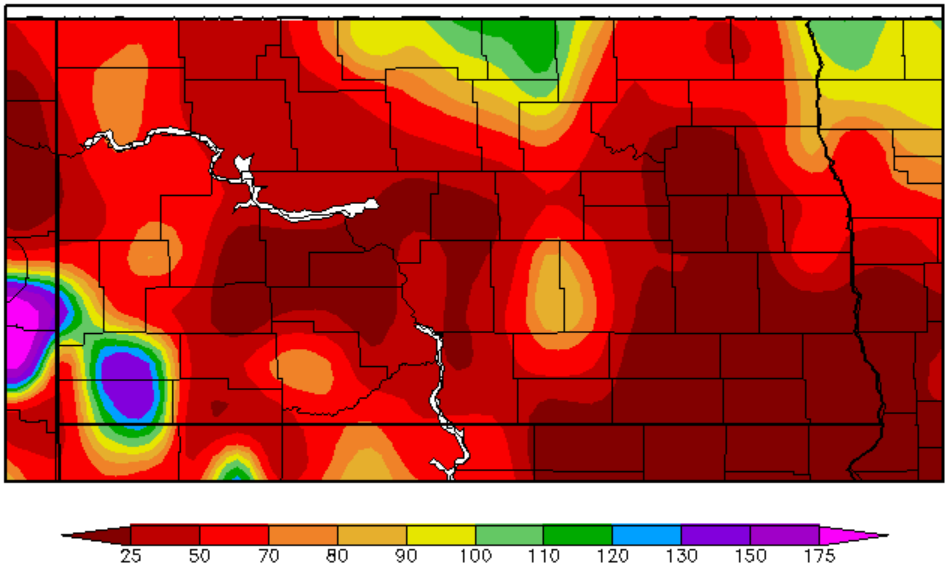
Winter 2013-2014 Weather in North Dakota:

February 2014

Total Precipitation percent of mean (1981-2010)

Precipitation Percent of Normal

(Data from NWS Cooperative Network)



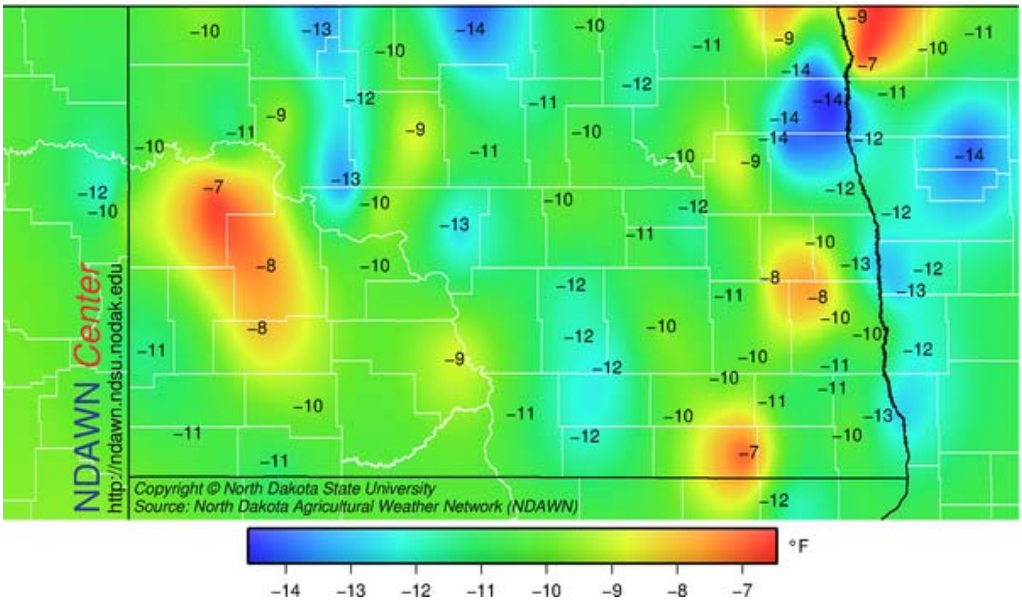
North Dakota State Climate Office

Average Temperature (°F) Deviation from Mean (1981-2010)

Departure From Normal Monthly

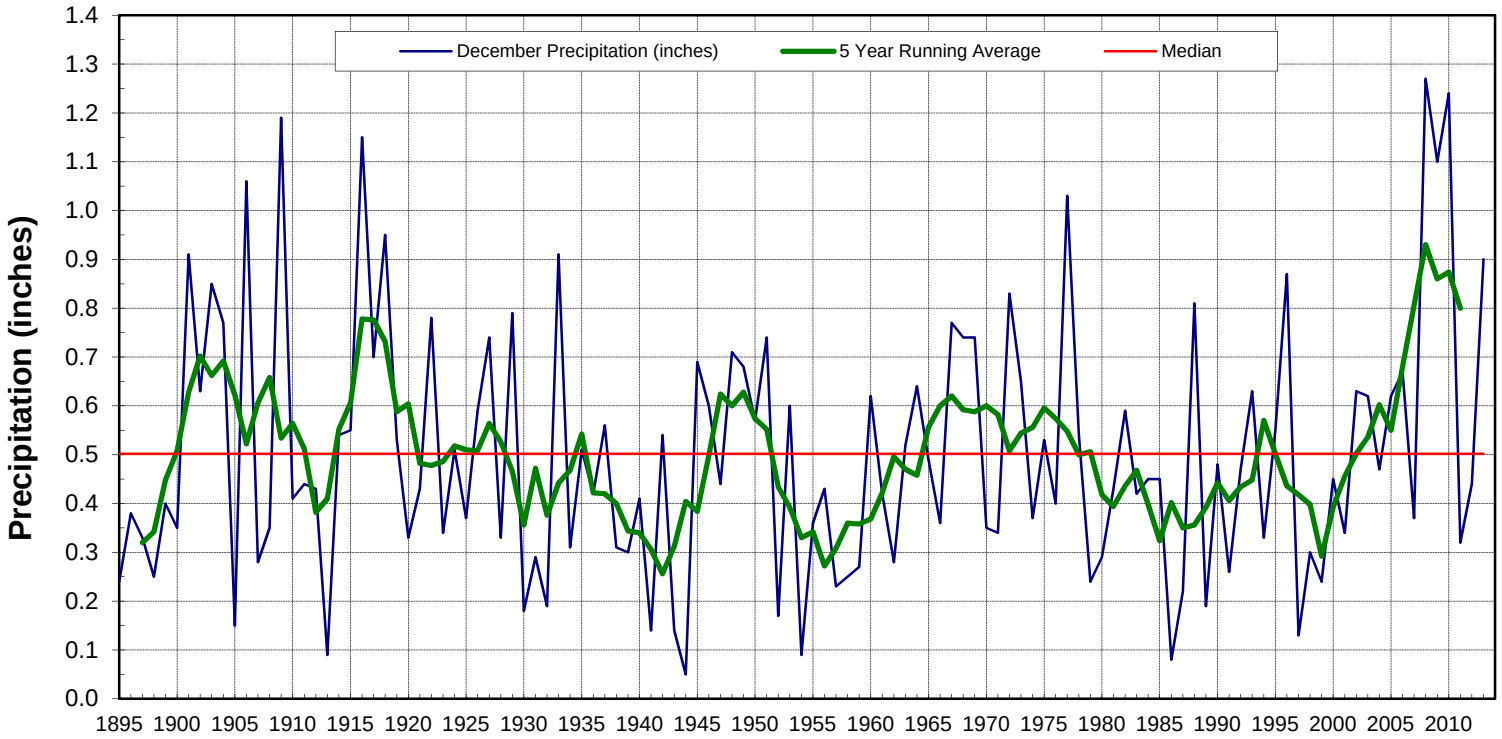
Average Air Temperature in degrees F

(Data from North Dakota Agricultural Weather Network (NDAWN))



North Dakota State Climate Office

Historical December Precipitation for North Dakota

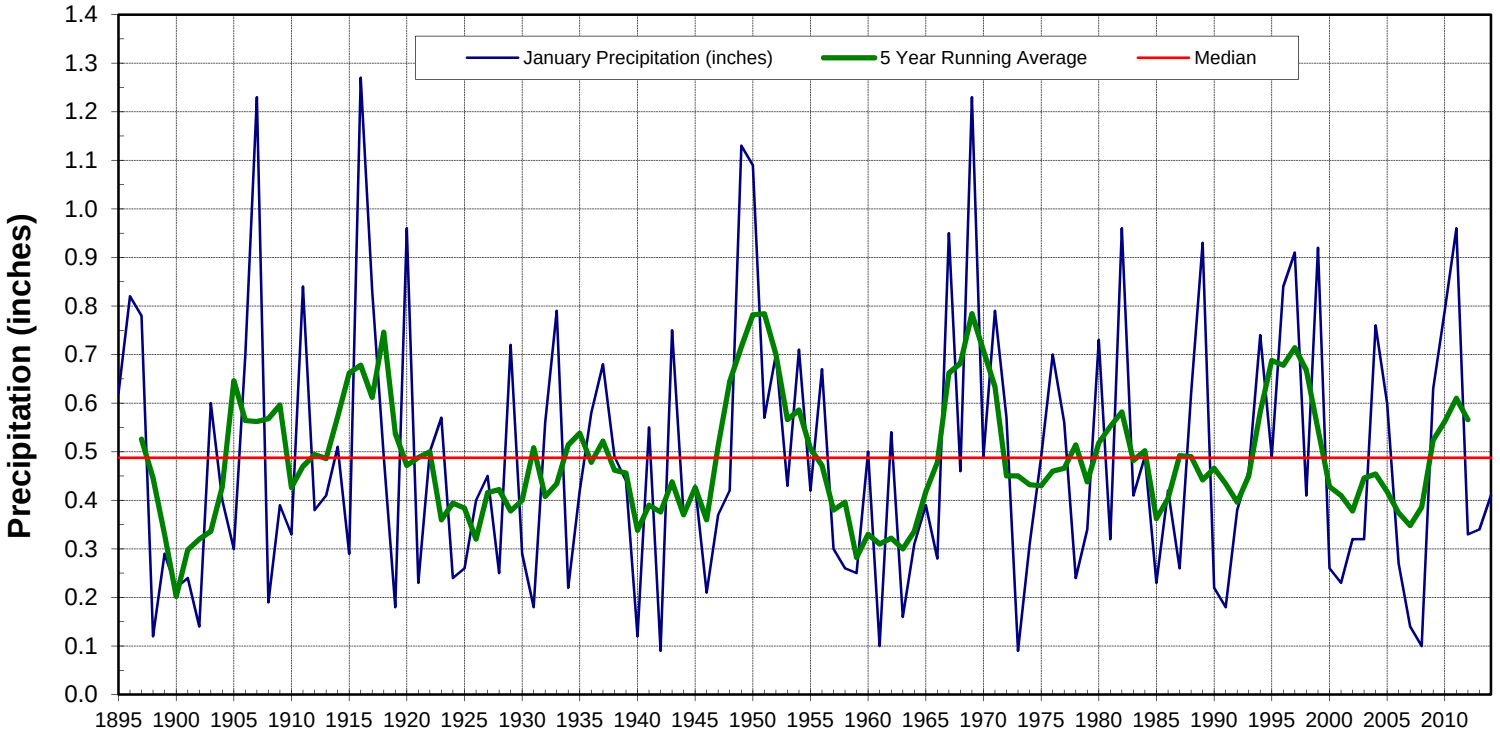


December Precipitation Statistics

2013 Amount: **0.90 inches**
Maximum: 1.27 inches in 2008
State Normal: 0.52" (1981-2010)

Monthly Ranking: 11th wettest in 119 years
Minimum: 0.05 inches in 1944
Years in Record: 119

Historical January Precipitation for North Dakota

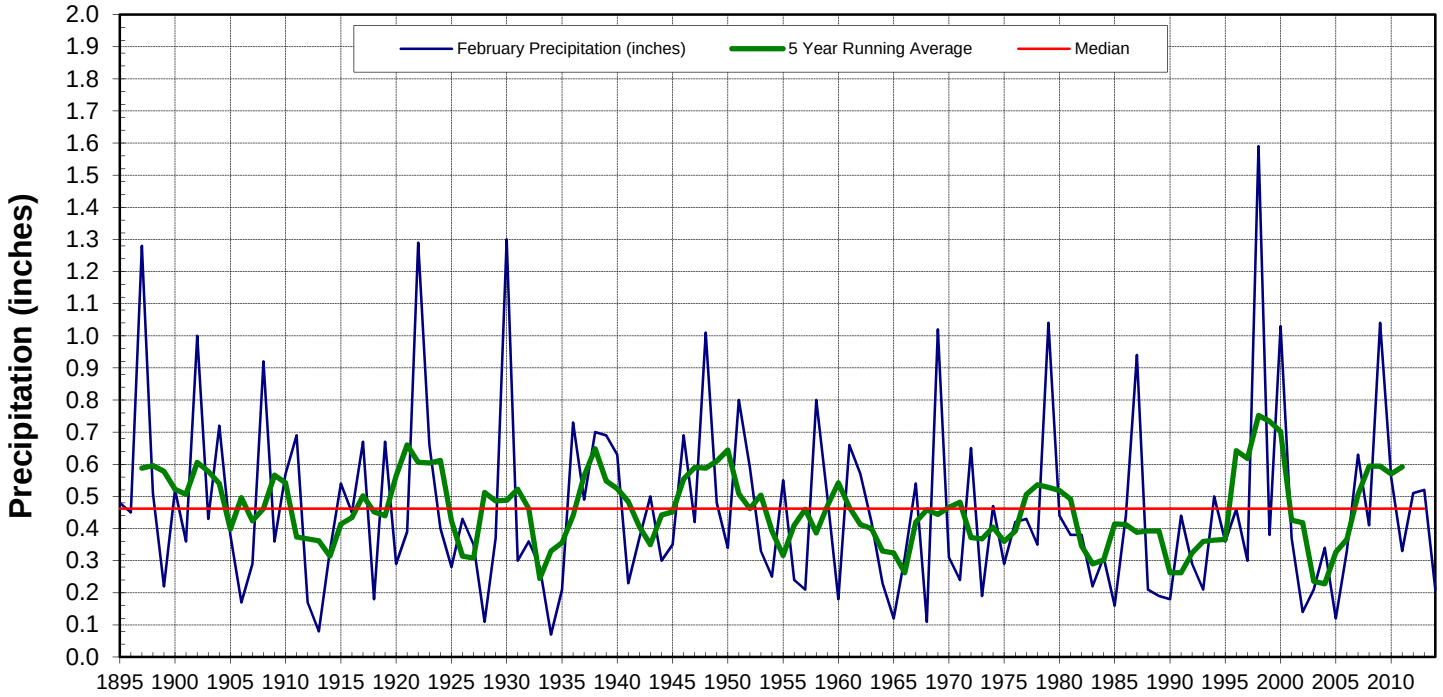


January Precipitation Statistics

2014 Amount: 0.41 inches
Maximum: 1.27 inches in 1916
State Normal: 0.49” (1981-2010)

Monthly Ranking: 54th driest in 120 years
Minimum: 0.09 inches in 1973
Years in Record: 120

Historical February Precipitation for North Dakota

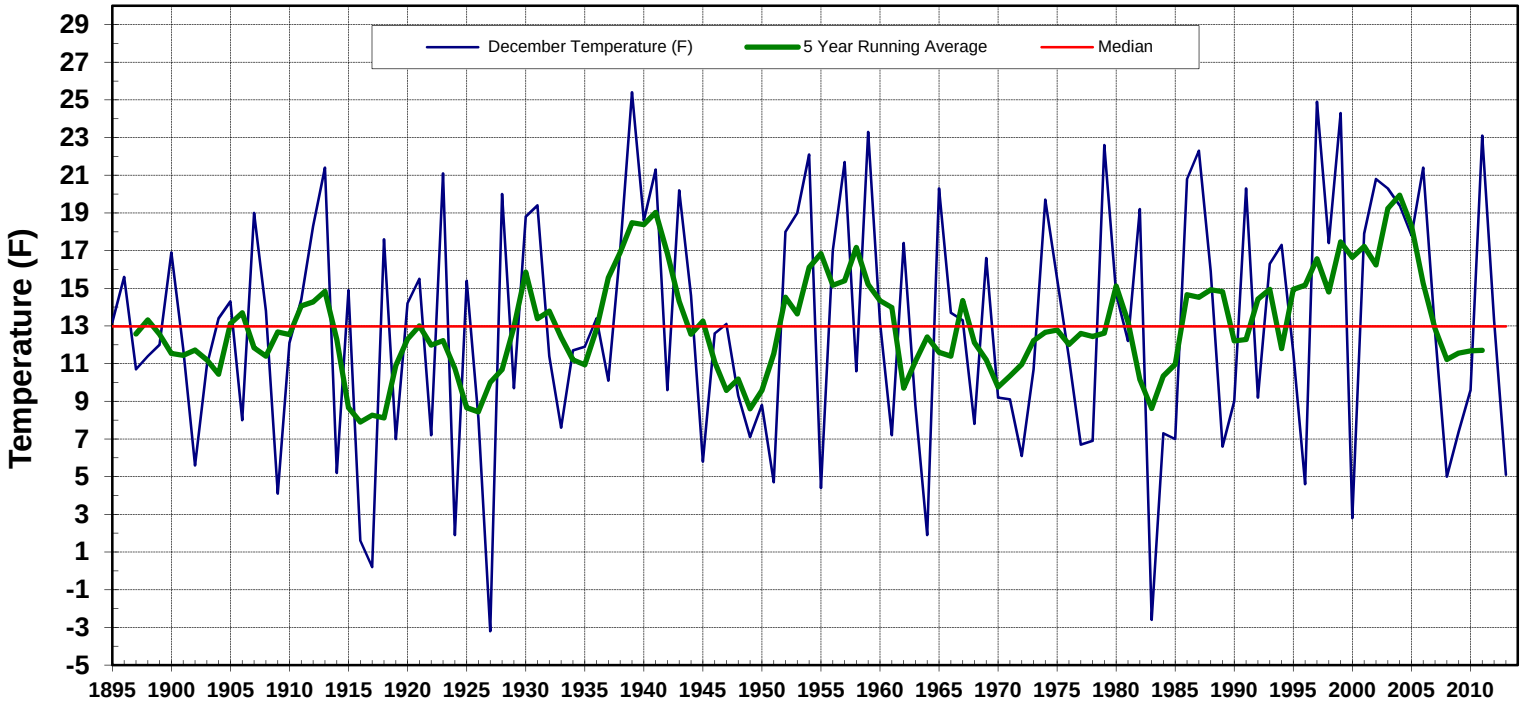


February Precipitation Statistics

2014 Amount: 0.21 **inches**
Maximum: 1.59 inches in 1998
State Normal: 0.44" (1981-2010)

Monthly Ranking: 16th driest in 120 years
Minimum: 0.07 inches in 1934
Years in Record: 120

Historical December Temperature for North Dakota

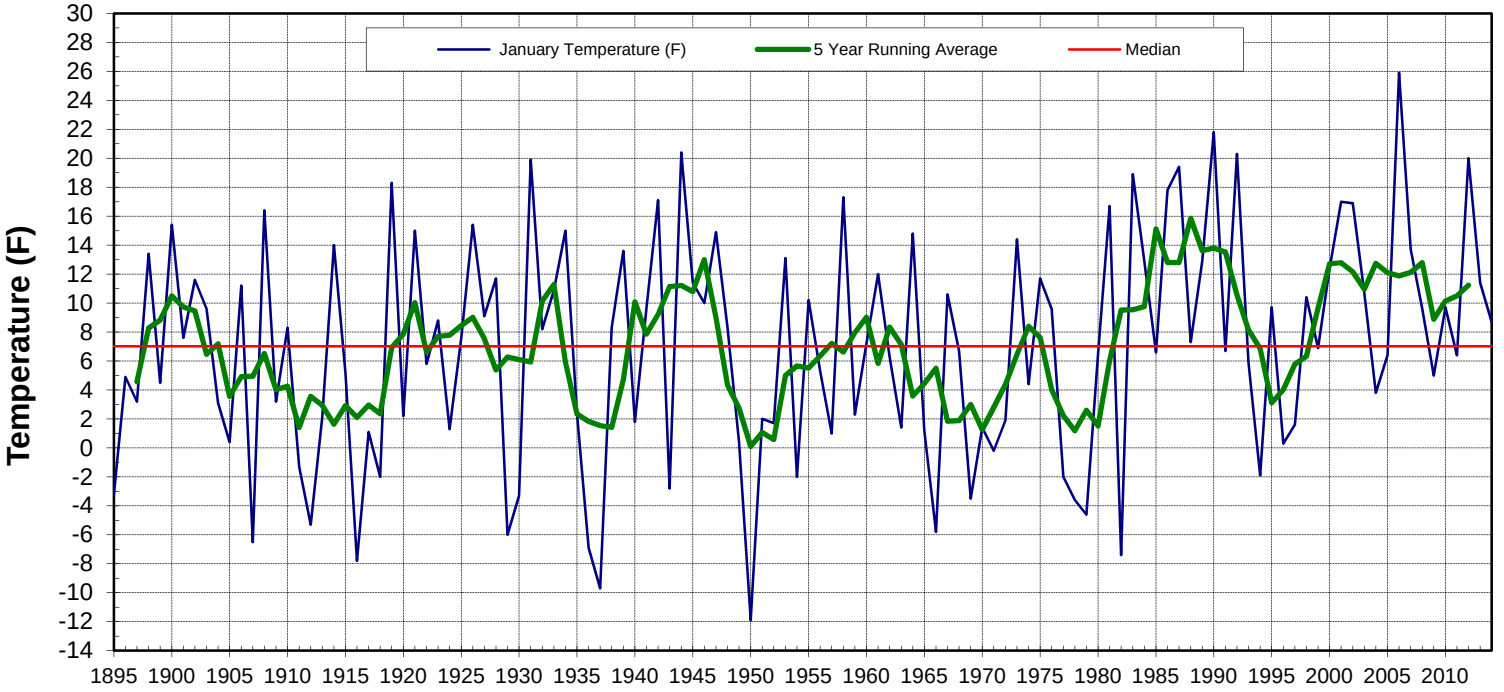


December Temperature Statistics

2013 Average: **5.1** °F
Maximum: 25.4 °F in 1939
State Normal: 14.0 °F (1981-2010)

Monthly Ranking: 13th Coolest in 119 years
Minimum: -3.2 ° F in 1927
Years in Record: 119

Historical January Temperature for North Dakota

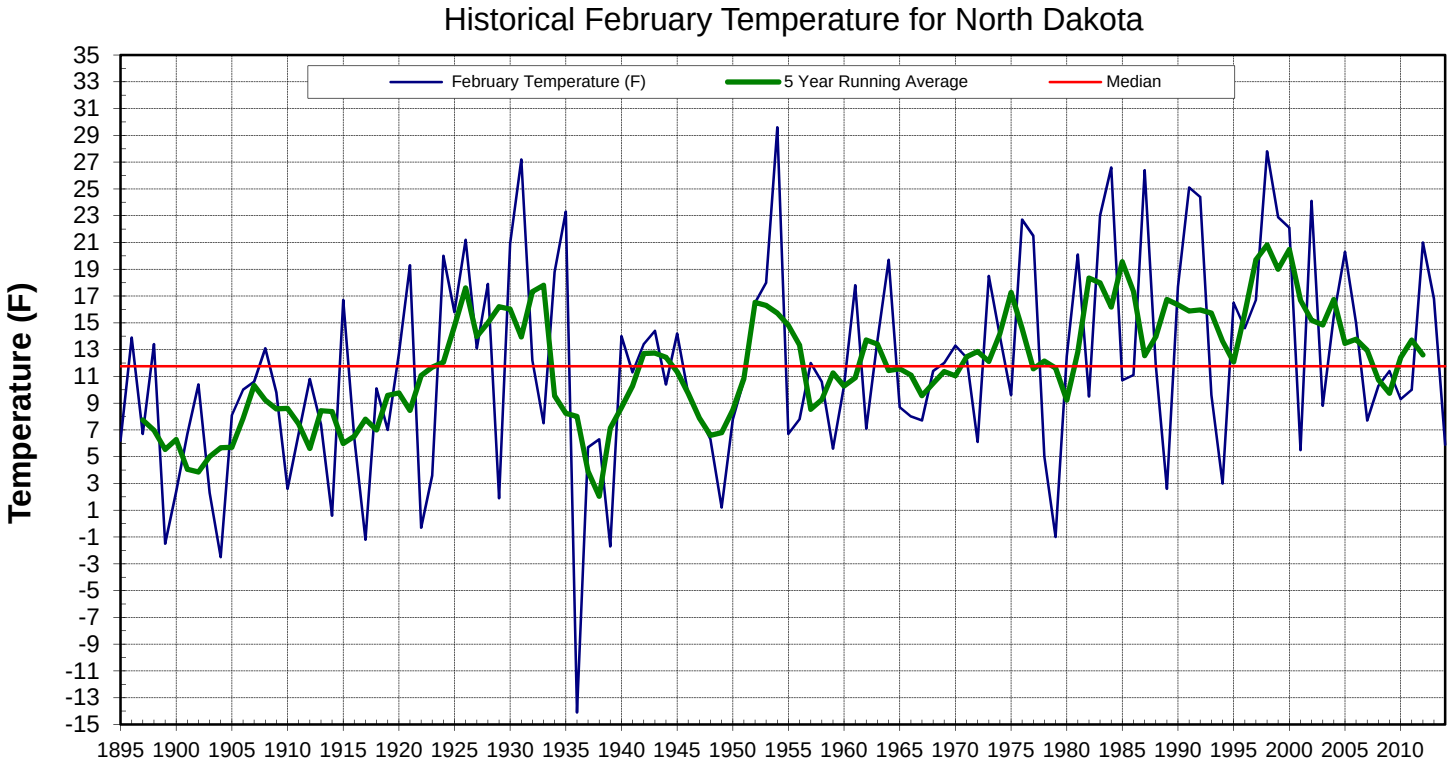


January Temperature Statistics

2014 Average: 8.7 °F
Maximum: 25.9 °F in 2006
State Normal: 10.6 °F (1981-2010)

Monthly Ranking: 68th Coolest in 120 years
Minimum: -11.9 °F in 1950
Years in Record: 120

Historical February Temperature for North Dakota



February Temperature Statistics

2014 Average: **5.9 °F**
Maximum: 29.6 °F in 1954
State Normal: 15.7 °F (1981-2010)

Monthly Ranking: 21st coolest in 120 years
Minimum: -14.1 °F in 1936
Years in Record: 120

Storms & Record Events

State Tornado, Hail, and Wind Reports for Winter 2013-2014

by B. A. Mullins

North Dakota 3 Month Total	Wind	Hail	Tornado
	0	0	0

Reports by Month			
Month	Wind	Hail	Tornado
Total December	0	0	0
Total January	0	0	0
Total February	0	0	0

North Dakota Record Event Reports for Winter 2013-2014

Date	Location	Type of Record	Previous Record
12/04/13	Grand Forks Airport	7.3 inches of snowfall	6.2 inches in 2007
12/07/13	Grand Forks Airport	-24 °F low temperature	-20 °F in 1972
12/11/13	Bismarck	-22 °F low temperature	-21 °F in 1945
12/14/13	Grand Forks Airport	-21 °F low temperature	Ties 1975 and 1989
12/29/13	Grand Forks Airport	-26 °F low temperature	Ties 1976
01/15/14	Grand Forks Airport	39 °F high temperature	38 °F in 1942
01/15/14	Grand Forks NWS	39 °F high temperature	37 °F in 1973
02/27/14	Grand Forks Airport	-29 °F low temperature	-28 °F in 1962

Seasonal Outlook

Spring 2014 Climate Outlooks

by D. Ritchison[1]

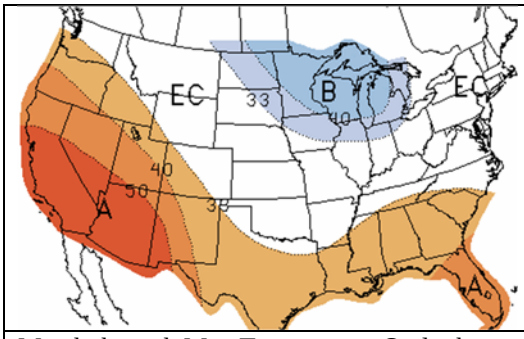
This past winter was the coldest in 30 years for some parts of the state. Meaning, most North Dakotans, more so than usual, are anticipating spring and the rebirth of our frozen landscape. Early spring is expected to be disappointing in this region, but the fear is the cold pattern will last well into spring, as was the case in 2013.

Although the month of March will likely finish with an average temperature below normal, there are positive signs that a repeat of the severe cold experienced in March and April 2013 will not be repeated. One factor helping this year is the lack of a snow cover over much of the state as March begins. The bare soils will enhance daily high temperatures and speed the melt of the new snow falling on a warmer surface rather than on the cold snow cover of winter. Plus, it appears the upper-level wind flow will be frequently from the northwest throughout early spring, which is a drier pattern than the moisture laden southwesterly wind flow that dominated the spring of 2013.

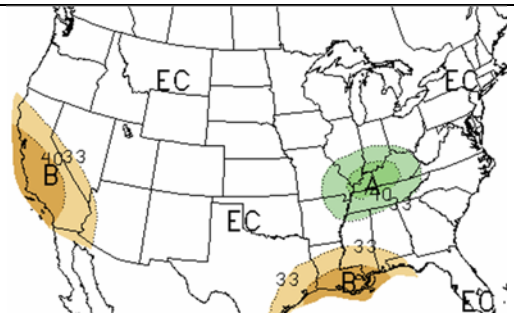
Once we get beyond March, using analogs for past years with similar atmospheric and oceanic conditions to this year, suggest that April will finish close to average and May slightly above average for temperatures. Precipitation looks to remain close to the average for much of the state during the next three months. One possible exception may be the northern portions of North Dakota with some analogs suggesting that area having a higher risk of above average precipitation.

The latest spring outlook from the Climate Prediction Center (CPC) for the next three months can be seen below. The CPC is forecasting equal chances of above, below or normal precipitation a slightly higher than average chance of below normal temperatures. You can find their current and future outlooks at http://www.cpc.ncep.noaa.gov/products/predictions/90day.

Also, the North Dakota State Climate Office has links to the National Weather Service's local 3-month temperature outlooks for the upcoming year. Those forecasts can be found at: http://www.ndsu.edu/ndsco/outlook/L3MTO.html .



March through May Temperature Outlook



March through May Precipitation Outlook

The readers will also find the following National Weather Service office web sites very useful for shorter term weather forecasts:

Eastern North Dakota: http://www.crh.noaa.gov/fgf/
Western North Dakota: http://www.crh.noaa.gov/bis/

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Hydro-Talk

Spring 2014 Hydrologic Outlook

by A. Schlag[2] and Michael Mathews[3]

For the Missouri and James River basins the spring melt season is well underway. Daytime high temperatures in the 50s and even 60s with overnight lows near to above freezing have melted most of the snowpack. Due to the well below normal snowpack that these two basins started with and the sudden warm up, the spring melt was on the early side of normal for 2014. As for the Souris (Mouse) and Red River basins the spring melt has gotten off to a more seasonal start. This can be attributed to the heartier snowpack and more modest temperatures experienced over the past week.

Even though the snow pack and overall water content across the Missouri and James basins was below normal, the speed at which it melted has caused some problems. The volume of water flowing into the smaller tributaries was enough to lift, fracture, and mobilize the ice. This caused multiple ice jams on a handful of Missouri tributaries. Fortunately the sudden increases in stream level from the ice jams have not been enough to cause any real damage to communities or roadways. Problems from ice jams are expected to dissipate on the tributaries as the ice flow makes it closer to the mouths of the streams, where the ice will most likely stick in the river channel as the Missouri is not yet open enough to accept the ice. As for the Missouri itself the sudden melt has caused no real problems, except at Williston. The thicker than normal ice over Lake Sakakawea and run off from upstream has caused a steady rise into flood stage at Williston on the Missouri. This is a typical occurrence at this location; however the real issue is with the large amount of broken up ice on the Yellowstone River. As of now the ice jam on the Yellowstone near its confluence with the Missouri has not poured into the Missouri itself. However when and if the ice makes it to Williston further rises on the Missouri will be possible. As for the James River basin the rapid melt has caused no problems as of yet. Snow pack over the northern portion of the basin was more robust than the rest of the basin. This should be just enough to keep reservoirs along the James and its northern tributaries full, while keeping flood risk to a minimum.

For the Souris River basin the spring melt season is just beginning. Run off caused by the warm temperatures were not enough to fracture the river ice in place and no ice jams have occurred as a result. With temperatures over the basin expected to cool off again this weekend only modest run off is anticipated. That said even with the Souris frozen over, runoff is expected to cause minor flooding at Bantry and Towner by the third week of March. Just like the James River basin the northern portions of the Souris River basin contains the majority of the snow pack. This will certainly be enough to keep reservoirs full along the Souris. It is too early to predict exactly how the spring flood season will unfold along the Souris. As additional spring rains cannot be ruled out this far in advance.

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[2] The corresponding author: Allen Schlag is the Service Hydrologist at the NOAA's National Weather Service, Weather Forecast Office in Bismarck, ND. E-Mail: Allen.Schlag@noaa.gov

[3] The The corresponding author: Michael Mathews is a Meteorologist intern at the NOAA's National Weather Service, Weather Forecast Office in Bismarck, ND. E-Mail: Michael.Mathews@noaa.gov.

The situation for the Red River basin is very similar to that of the Souris River basin. The only real difference is the Red River basin is even further behind in its spring melt season. In general, most rivers and lakes remain completely ice covered with thicker than normal ice. Southern portions of the basin have seen a reduction in snow pack due to the recent warm up, with bare soil showing in many places. However, since snow pack was already below normal the run off generated by the melting was not enough to fracture river ice or even cause significant rises on streams. Across the north the near to above normal snow pack remains largely in place. The warm up the rest of the state experienced this past week only produced highs in the 30s with lows overnight well below freezing across the northern portions of the Red River basin, causing little in the way melting. As of the writing of this article…all is generally quiet on the Red River front, but much of the spring melt season is still to come.

Looking forward: Deep frost and wet soil conditions still exist for much of North Dakota. These conditions have already created well above normal runoff in places with below normal snowpack. Until the soils thaw, the threat presented by heavy spring rains cannot be ignored. As an example, back in February there was a very modest rain over the upper Heart River watershed above Dickinson Dam. Within 24 hours, Dickinson Dam was in a controlled release that created the earliest controlled spill event in the history of the dam. These kinds of unusual runoff events are a testament to the effect of frozen, wet soils. This will continue to be a risk for most all the state during the remainder of March and maybe into early April until the soils are sufficiently opened up enough to accept its share of spring rains. Fortunately no such heavy rainfall events are in the near-term forecast.

Science Bits

A Winter to Remember

by Adnan Akyüz[4]

Although it was not the record cold winter for any of the US Climate Divisions (CD), it will be a winter to be remembered for a long time. Figure 1 (below) shows the climate divisional temperature ranking of the winter 2013-14. The coldest rankings are indicated with the smallest numbers, with 3 indicating the 3rd coldest period in history for the respective CD. In North Dakota, the coldest part of the state was the eastern 1/3 where the CDs along the Red River Valley (RRV) ranked in the top 10 coldest in history. Coupled with the statewide second wettest fall, it created favorable conditions for unusually deep frost in the soil, which elevated concerns for another major flood this coming spring along the Red River of the North early in the season.

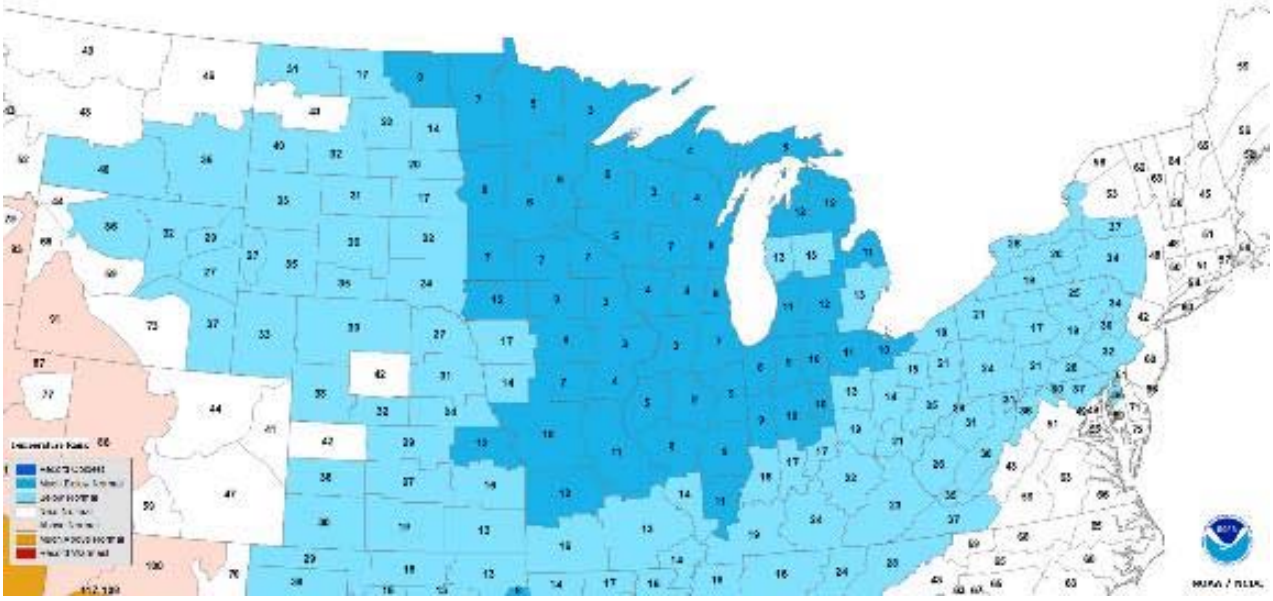

Figure 1 NOAA Divisional Temperature Rank (Winter 2013-14)

The coldest temperature of the state this winter was -35, recorded in Hebron, and Hearth Butte Dam on December 24, 2013. Fargo's average temperature in this winter was 4.3° which was the 15th coldest in history. It was the coldest since the 1981-82 winter. There were 65 days with temperatures in the red in Fargo (5th most occurrences in history). It was the record number since the winter of 1935-36. It is also important to note that the state record cold temperature of -61° was broken on February 15, 1936.

The highest 1-day snowfall total of the state was 16" recorded in Hettinger on October 5, 2013. A blizzard with an unusual strength this early in the season caused significant loss of cattle in SD and loss of sunflower seed in ND. The North Dakota Agricultural Weather Network's Linton station measured a peak gust of 51.5mph at 3m height at 11pm on October 4, 2013. The impact of this storm was not as severe as it was in SD; however, it caused an estimated direct economic

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loss of $8M due to the damage to public infrastructure and power utilities. It delayed the harvest that was already delayed because of the wet fields. It was severe enough to put most southwestern counties including Adams, Bowman, Grant, Hettinger, Morton, Sioux, and Slope counties in Presidential disaster declaration list (Figure 2).

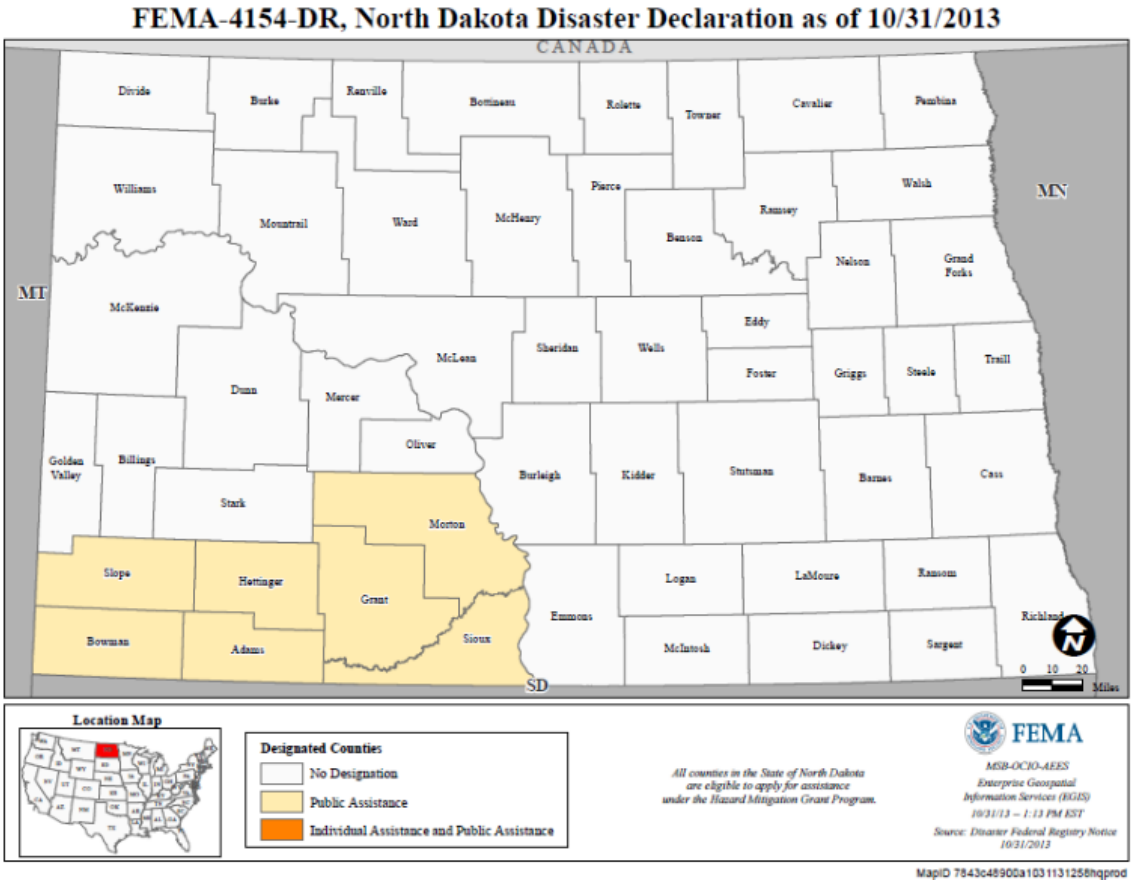

Figure 2. ND Disaster Declaration for the October Blizzard (FEMA, 2013)

This winter, we also heard the term “Polar Vortex” almost every day, especially in February. The system generated a persistent strong northeasterly flow carrying cold air along its path all the way into the southern US and causing temperatures in in Fargo to remain in the red 21 consecutive days not ending until February 14, 2014. It was the longest run since 1982. However, the polar vortex is neither a new nor a rare phenomenon. It is a part of the “Polar Front Theory” by Bjerkness and Solberg which has been known to all rudimentary meteorologists since 1922. In fact, a vortex is a rotating column of air such as tornadoes and hurricanes. So, next time we observe a tornado, I will call it a mid-latitude vortex just to be different.

CONTACTING THE NORTH DAKOTA STATE CLIMATE OFFICE

Please contact us if you have any inquiries, comments, or would like to know how to contribute to this quarterly bulletin.

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