



North Dakota Climate Bulletin

Winter 2009-2010

Volume: 4 No: 1

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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, the College of Agriculture, Food Systems and Natural Resources, North Dakota State University in Fargo, North Dakota.

Compared historically, North Dakota had a cooler and a wetter winter following warmer and wetter fall. Wet fall and wetter winter was a bad combination coupled with geographic uniqueness of the valley for spring flooding. Flood fight among the communities near the river is underway as the Red River in Fargo reached to major flood levels in the middle of the March. This is the 4th back-to-back major floods in the recorded history for Fargo. There have never been major floods 3 years in a row. More on the Fargo flood is discussed in the Science Bits section of this bulletin (page 19). Temperature-wise, this winter was the 46th coldest since 1895. Precipitation-wise, it was the 15th wettest winter since 1895. The Community Collaborative Rain Hail and Snow Network (CoCoRaHS) currently has 112 observers representing 28 counties. The total precipitation amounts as a percentage of the normal and average temperature departure from normal are shown on pages 7 through 9 (Season in-Graphics) followed by the time series of monthly total precipitation and average temperature of North Dakota for respective months of the season. 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

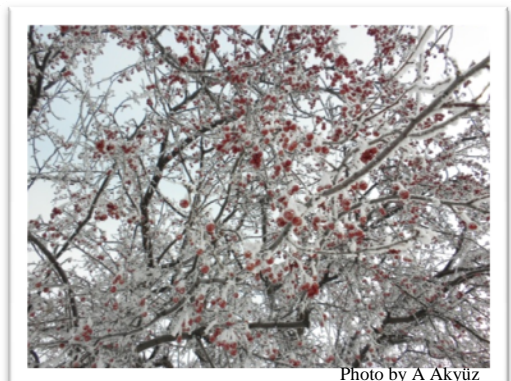


Photo by A. Akyüz



Weather Highlights



Seasonal Summary:

by B. A. Mullins

December 2009

The state average precipitation was 0.77 inches which is above the 1971-2000 normal of 0.44 inches. December 2009 state average precipitation ranked 13th wettest in the last 115 years with a maximum of 1.26" in 1909 and a minimum of 0.06" in 1944.

December monthly precipitation was below normal in the west and northwest plus a few Counties in the eastern central and southeastern part of the state with a range from 25% to 90% of normal. The remaining areas had above normal precipitation ranging from 150% to 300% plus percent of normal precipitation. Monthly total precipitation ranged from 0.1 to 2.7 inches. The higher amounts fell in the south central and eastern edge of the state. Traces to measurable amounts of snow fell almost daily during the first half of the month. A major winter storm system hit the eastern and central parts of the US from the 23rd through the 26th. All of North Dakota had snowfall during the four day event. Total snowfall in inches for the 23rd through the 26th was 6.0 at Williston, 13.8 at Bismarck, 17.2 at Fargo, and 23.6 at Grand Forks.

The National Weather Service (NWS) recorded breaking snowfall and precipitation records at Williston, Bismarck, Grand Forks, and Fargo on the 25th. Williston also had record snowfall on the 21st of 1.8 inches. These records can be viewed in the "storms and record events" section of this newsletter.

The US Drought Monitor January 5, 2010 report had no drought conditions reported in the state.

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported an average snow depth of 11.30 inches on January 3. Road conditions were rated 82% open, 14% difficult, 4% closed with 26% drifted, 12% icy, and 62% dry. (Weekly Weather and Crop Bulletin Vol. 97, No. 1).

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), severe weather reports for December had no reports of high wind events, hail, or tornadoes.

The top five December daily maximum wind speeds recorded from NDAWN was 50.8 mph at Turtle Lake on the 25th, 50.5 mph at Mandan on the 1st, 50.5 mph at Turtle Lake on the 26th, 49.4 mph at Watford City on the 1st, and 47.2 mph at Edgeley on the 1st. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 7.6°F which is well below the 1971-2000 normal of 13.0°F. December 2009 state average air temperature ranked 25th coolest in the past 115 years with a maximum of 25.6°F in 1939 and a minimum of -2.5 °F in 1983.

December monthly departure from normal air temperatures were below normal across the state with a range of -10°F in the west to -2°F in the east. The monthly average temperatures ranged

from 1°F in the north to 11°F in the south. Average air temperatures on December 1st were around 30°F. Daily average air temperatures quickly dropped 20 to 30°F below normal during the first half of the month. Daily average air temperatures were near normal or just below during the second half of the month.

The National Weather Service (NWS) recorded tying one temperature record in December. Dickinson recorded a minimum temperature of -26°F on the 15th which tied the previous record set in 1989.

The five coldest December daily minimum air temperatures recorded by the NDAWN weather station network were at Mott on the 15th with -29.9°F, Crosby on the 15th with -29.5°F, Dickinson on the 15th with -29.0°F, Bottineau on the 9th with -28.0°F, and Bowbells on the 8th with -27.3°F. The highest daily maximum air temperature recorded by NDAWN was 45.6°F on the 1st at Beach.

January 2010

The state average precipitation was 0.75 inches which was above to the 1971-2000 normal state average of 0.50 inches. January 2010 state average precipitation ranked the 20th wettest in the past 116 years with a maximum of 1.35 inches in 1916 and a minimum of 0.07 inches in 1973.

January monthly precipitation ranged from 0.01 inches to 1.5 inches. Monthly precipitation totals of 0.1 and less were in the southwest. The northwest and eastern regions had monthly totals of between 0.3 and 0.7 inches. The greater monthly totals were along the central regions and south eastern edge. The percent of normal precipitation ranged from 5% to 300%. The areas with greater than 100% of normal precipitation were the central, southeast, northeast, and a small portion of the northwest. The remaining areas in the eastern, northwest, and southwest regions had less than 100% of normal precipitation. A major storm system of rain, freezing rain, and snow traveled across North Dakota from the 22nd through the 25th. The freezing rain caused power outages for thousands in the southern parts of the state. The high winds and snow on the 25th causes white out conditions in the eastern part of the state. This in turn prompted the closing of a number of roads, schools and businesses. Bismarck had record precipitation on the 22nd of 0.25 inches. Fargo and Grand Forks airport had record precipitation on the 23rd of 0.9 inches and 0.25 inches, respectively.

The US Drought Monitor February 2, 2010 report had no drought conditions reported in the state.

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported an average snow depth of 13.3 inches on January 31. Road conditions were rated 80% open, 14% difficult, 6% closed with 27% drifted, 22% icy, and 51% dry. (Weekly Weather and Crop Bulletin Vol. 97, No. 5).

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), severe weather reports for January had no reports of high wind events, hail, or tornadoes.

The top five January daily maximum wind speeds recorded from NDAWN all happened on the 25th with McHenry at 54.8 mph, Warren MN at 50.8 mph, Marion at 50.5 mph, Ada MN at 50.1 mph and Wishek at 49.8 mph. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 10.0°F which is above the 1971-2000 normal of 7.9°F. January 2010 state average air temperature ranked the 43rd warmest in the past 116 years with a maximum of 25.9°F in 2006 and a minimum of -10.7°F in 1950.

January average monthly temperatures ranged from 6°F to 16°F. The monthly temperatures were coolest in the northeast and gradually progressed to the warmer temperatures in the southwest. The January monthly departure from normal temperatures ranged from -2°F to 6°F. Daily minimum air temperatures frequently dipped to -20°F and even -35°F across North Dakota during the first 10 days of January. Jamestown and Grand Forks airport had record low temperatures on the 1st of -28°F and -33°F, respectively and record low temperatures on the 2nd of -30°F and -35°F, respectively. Fargo had a record low on the 2nd of -33°F. Grand Forks airport also had a record low maximum temperature of -17°F on the 2nd. Following the cold spell, an unseasonably warm stretch occurred from the 11th through the 24th in which average air temperatures were around 10 to 20 degrees above normal. From the 25th through the end of the month, daily average air temperatures were much colder at around 10 degrees below normal.

The five coldest January daily minimum air temperatures recorded by the NDAWN weather station network were all on the 2nd with -39.7°F at Ada MN, -39.6°F at Roseau MN, -39.1°F at Hillsboro, -38.9°F at Mavie MN, and -38.2°F at Grand Forks. The highest daily maximum air temperature recorded by NDAWN was 46.0°F at Beach.

February 2010

The state average precipitation was 0.45 inches which is equivalent to the 1971-2000 normal of 0.45 inches. February 2010 state average precipitation ranked 43rd wettest in the past 116 years with a maximum of 1.83 inches in 1998 and a minimum of 0.06 inches in 1934.

Most of the February total precipitation ranged from 0.05 to 1.00 inches. The total monthly precipitation of less than 0.50 inches was recorded in the western part of the state, the northeast corner, and a small area in the south central regions. The remaining regions had between 0.50 and 1 inches of monthly precipitation. The percent of normal precipitation ranged from 25% to 300% of normal. Below normal precipitation was recorded in the west, the northeast corner, and a small area in the south central region with above normal precipitation falling elsewhere. Most of the precipitation fell in the first half of the month with the second half of the month being quiet and dry. A storm event from the 5th through the 8th affected the central and eastern parts of the state. Snow totals ranged from 3 inches in the central regions to nearly 8 inches in the east. A snowfall event on the 13th covered an area from the north central to the southwest corner and produced totals ranging from 2 to 12 inches. The National Weather Service (NWS) reported 0.11 inches of precipitation at Grand Forks airport on the 6th which broke the previous record of 0.07 inches set in 1988. The NWS also reported 0.16 inches of precipitation at the Jamestown airport on the 13th which tied the previous record set in 1962.

The US Drought Monitor March 2, 2010 report had no drought conditions reported in the state.

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported an average snow depth of 17.1 inches on February 28. Road conditions were rated 80% open, 14% difficult, 6% closed with 21% drifted, 22% icy, and 57% dry. (Weekly Weather and Crop Bulletin Vol. 97, No. 9).

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), severe weather reports for February had no reports of high wind events, hail, or tornadoes.

The top five February daily maximum wind speeds recorded from NDAWN were 46.5 mph on the 3rd at Bottineau, 40.1 mph on the 24th at Berthold, 40.1 mph on the 13th at Linton, 39.4 mph on the 13th at Streeter and 39.0 mph on the 14th at Eldred MN. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 8.9°F which is below the 1971-2000 normal of 15.4°F. February 2010 state average air temperature ranked the 43rd coolest in the past 116 years with a maximum of 29.7°F in 1954 and a minimum of -14.1 °F in 1936.

February average monthly temperatures ranged from 6°F in the north and northeast and gradually raising to 13°F in the southwest. February average temperatures were below normal across the state. The monthly departure from normal temperatures ranged from -1°F in the northeast corner and fell gradually to -10°F in the southwest corner. Outside of a couple of days in the first week with above normal daily air temperatures, most of the month had below normal average daily air temperatures.

The five coldest February daily minimum air temperatures recorded by the NDAWN weather station network were -30.2°F on the 24th at Roseau MN, -27.7°F on the 24th at Hillsboro, -26.5°F on the 10th at Ada MN, -26.3°F on the 24th at Britton SD, and -25.5°F on the 24th at Dazey. The highest daily maximum air temperature recorded by NDAWN was 38.3°F at Hettinger on the 25th.

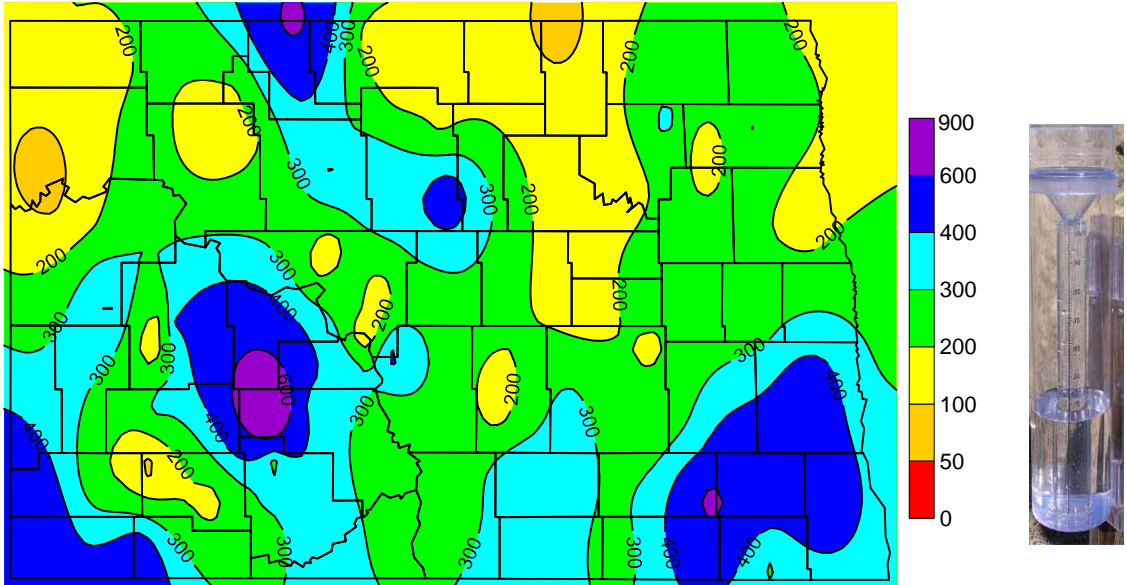
Season in Graphics

Winter 2009-2010 Weather in North Dakota:

Total Precipitation percent of mean (1971-2000)

Precipitation Percent of Normal

(Data from NWS Cooperative Network)

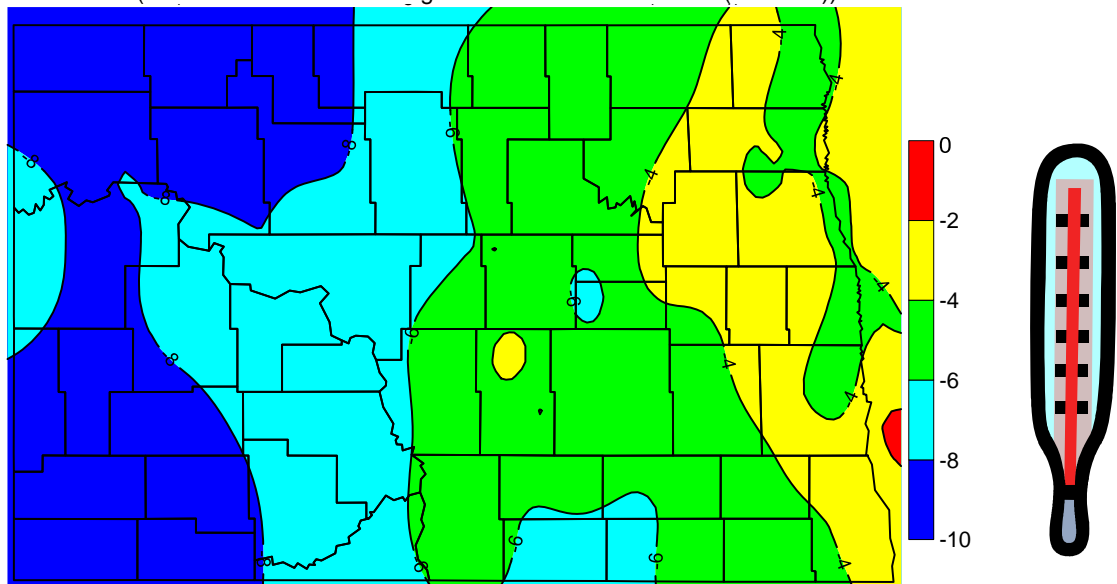


North Dakota State Climate Office

Average Temperature (°F) Deviation from Mean (1971-2000)

Departure From Normal Monthly
Average Air Temperature in degrees F

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



North Dakota State Climate Office

December 2009

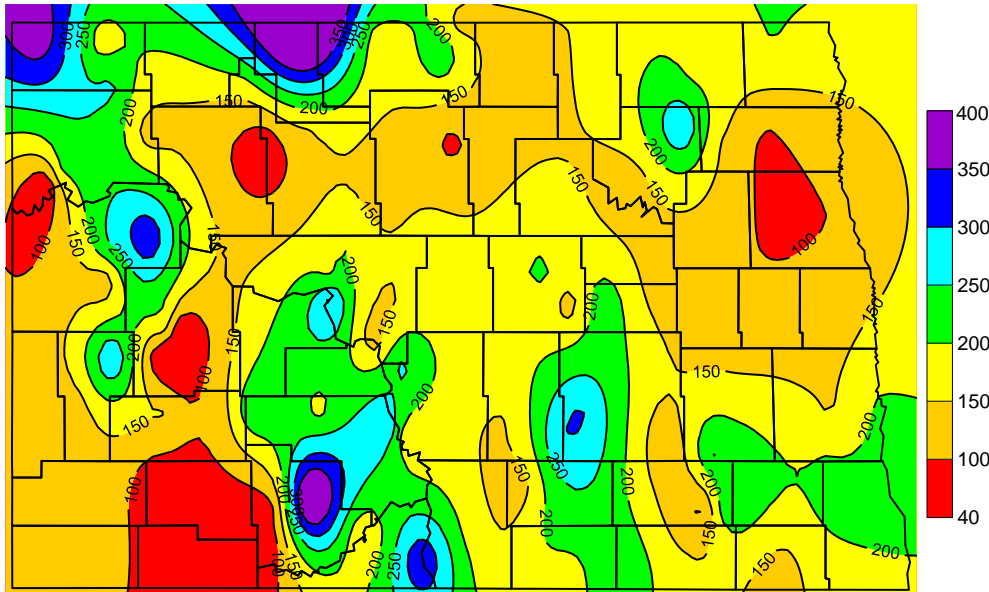
Season in Graphics

Winter 2009-2010 Weather in North Dakota:

Total Precipitation percent of mean (1971-2000)

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(Data from NWS Cooperative Network)

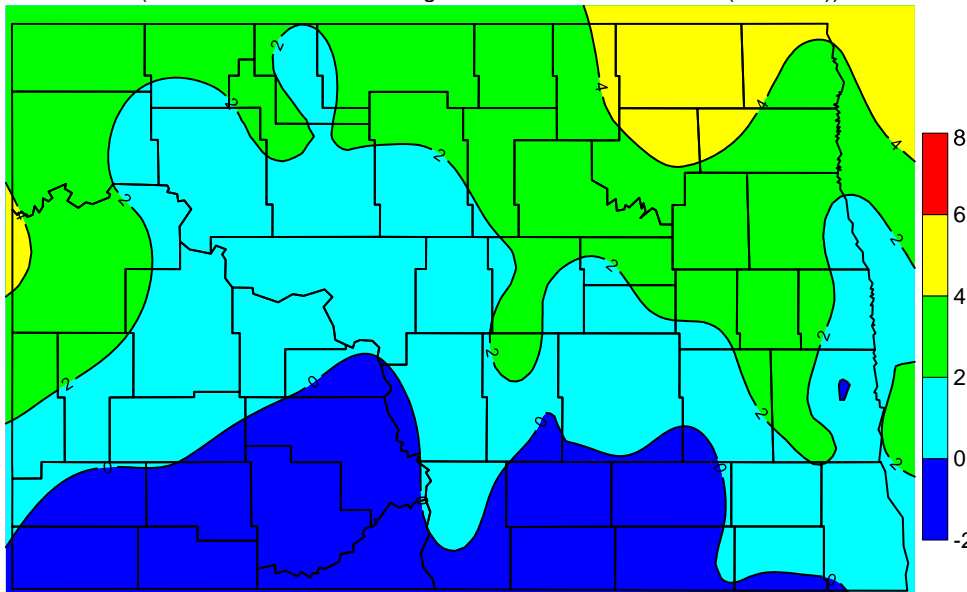


North Dakota State Climate Office

Average Temperature (°F) Deviation from Mean (1971-2000)

Departure From Normal Monthly
Average Air Temperature in degrees F

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



North Dakota State Climate Office

January 2010

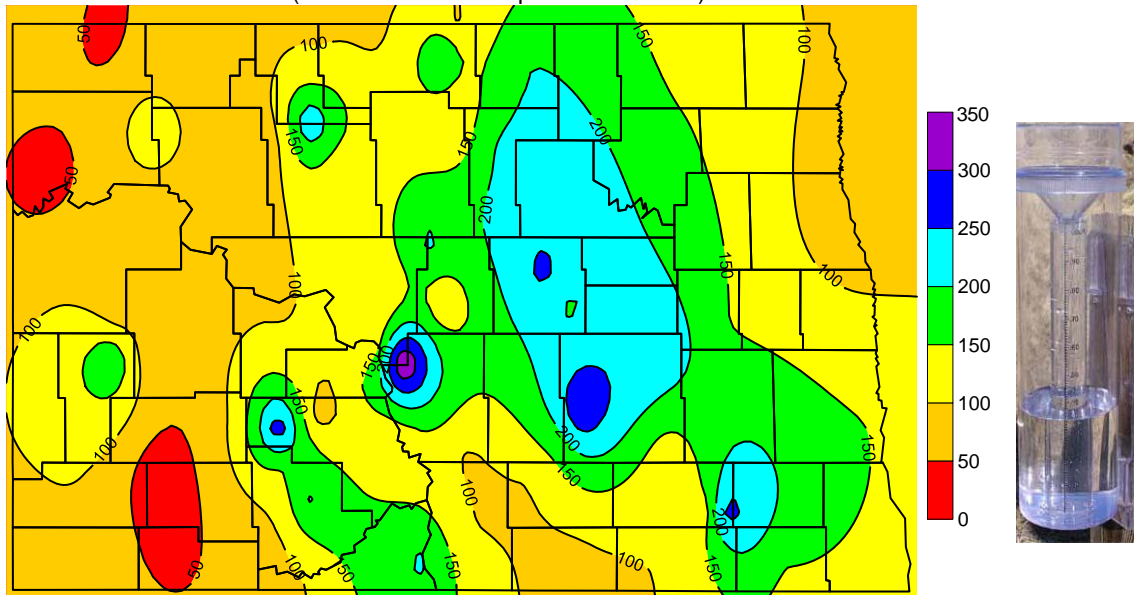
Season in Graphics

Winter 2009-2010 Weather in North Dakota:

Total Precipitation percent of mean (1971-2000)

Precipitation Percent of Normal

(Data from NWS Cooperative Network)

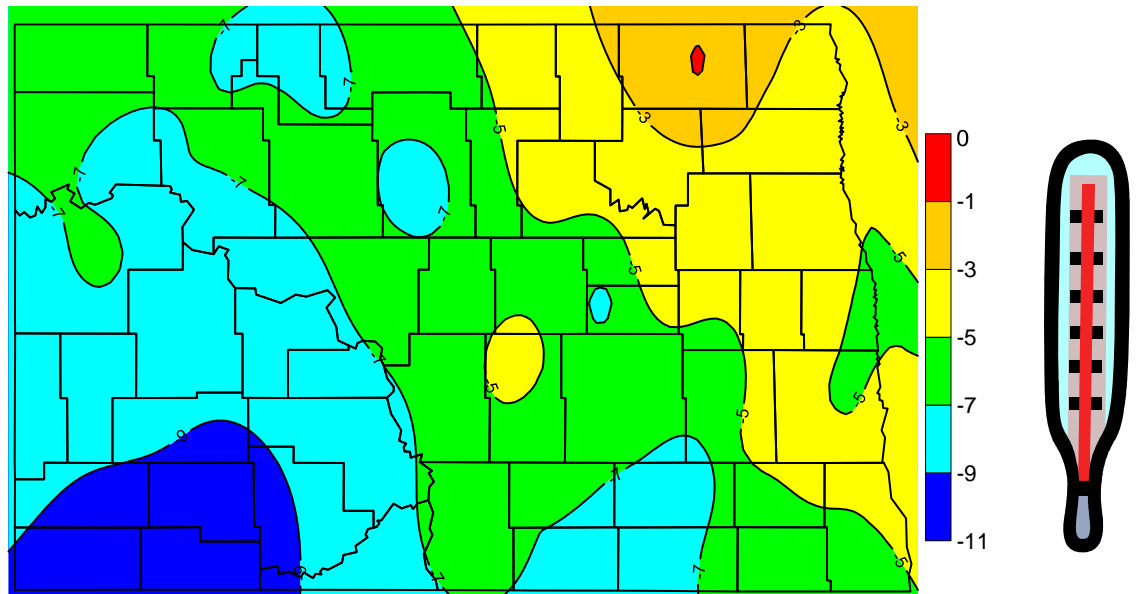


North Dakota State Climate Office

Average Temperature (°F) Deviation from Mean (1971-2000)

Departure From Normal Monthly Average Air Temperature in degrees F

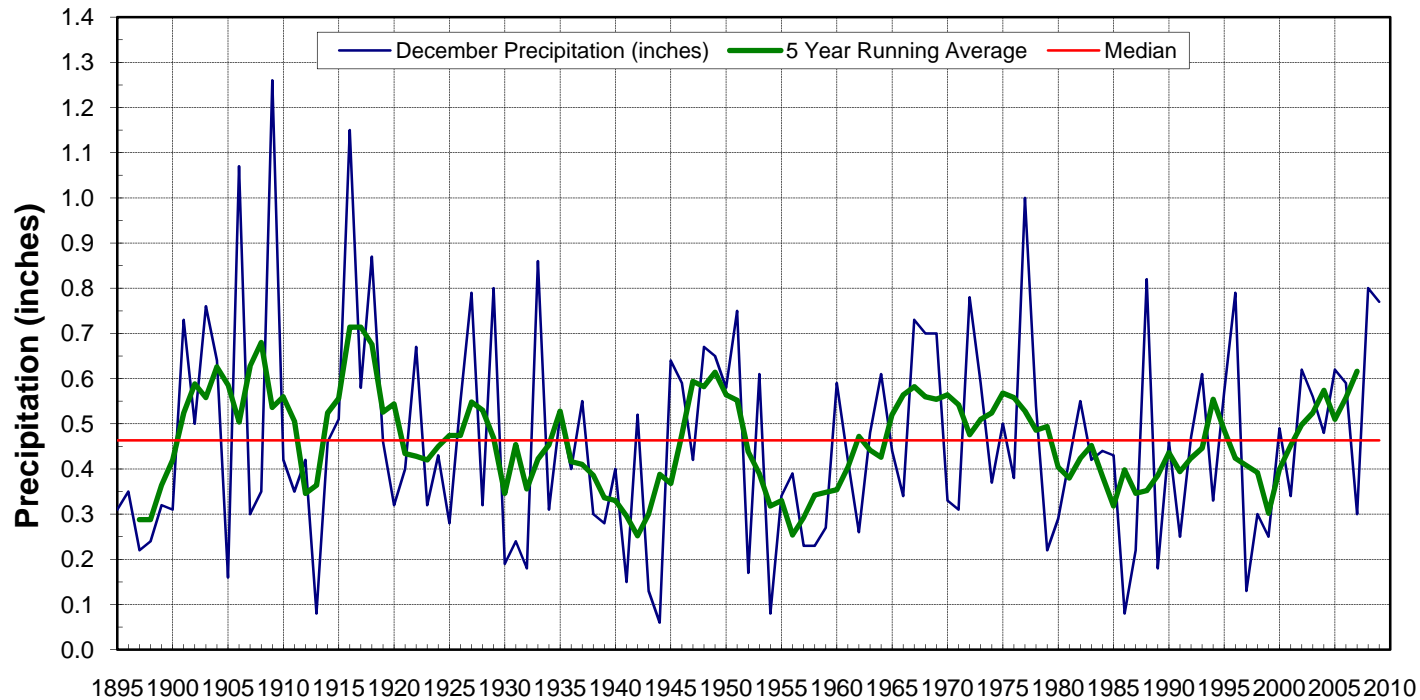
(Data from North Dakota Agricultural Weather Network (NDAWN))



North Dakota State Climate Office

February 2010

Historical December Precipitation for North Dakota



December Precipitation Statistics

2009 Amount: **0.77 inches**

Maximum: 1.26 inches in 1909

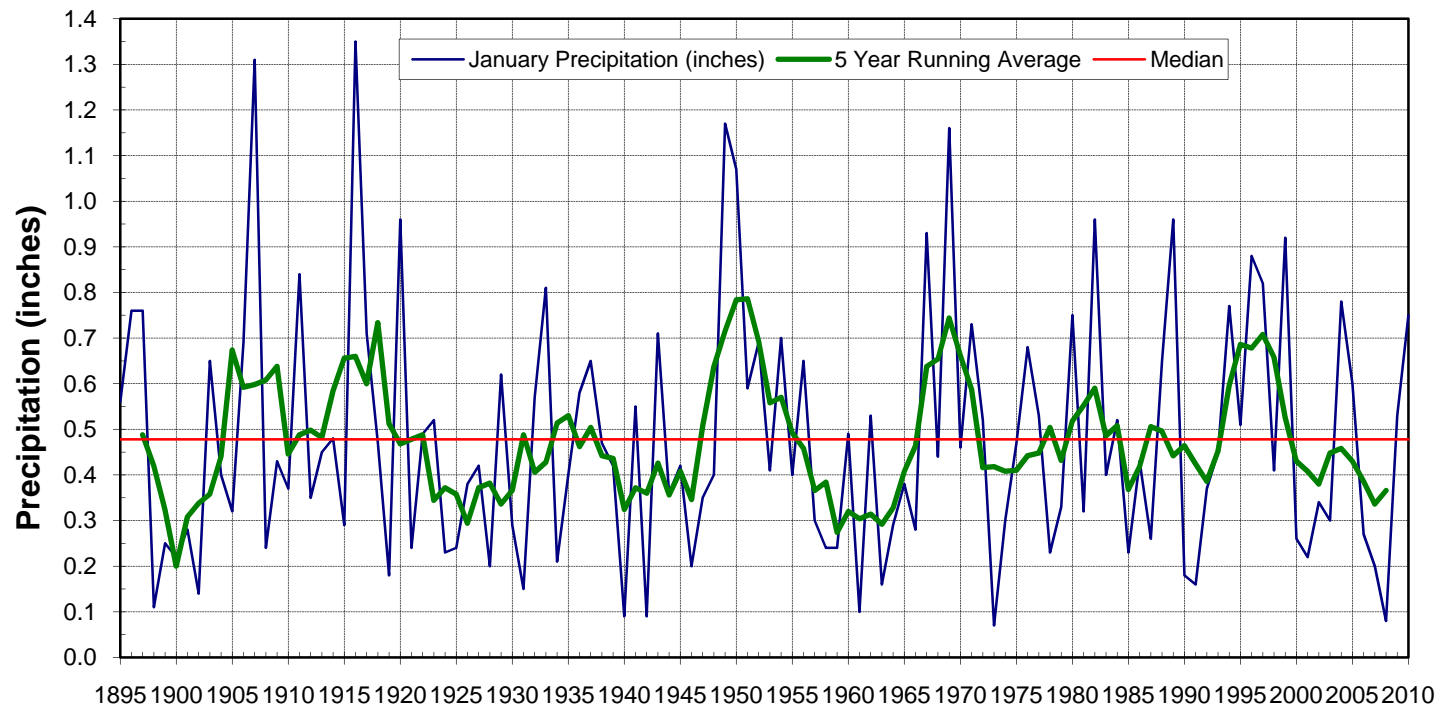
State Normal: 0.44" (1971-2000)

Monthly Ranking: 13th Wettest in 115 years

Minimum: 0.06 inches in 1944

Years in Record: 115

Historical January Precipitation for North Dakota



January Precipitation Statistics

2010 Amount: 0.75 inches

Maximum: 1.35 inches in 1916

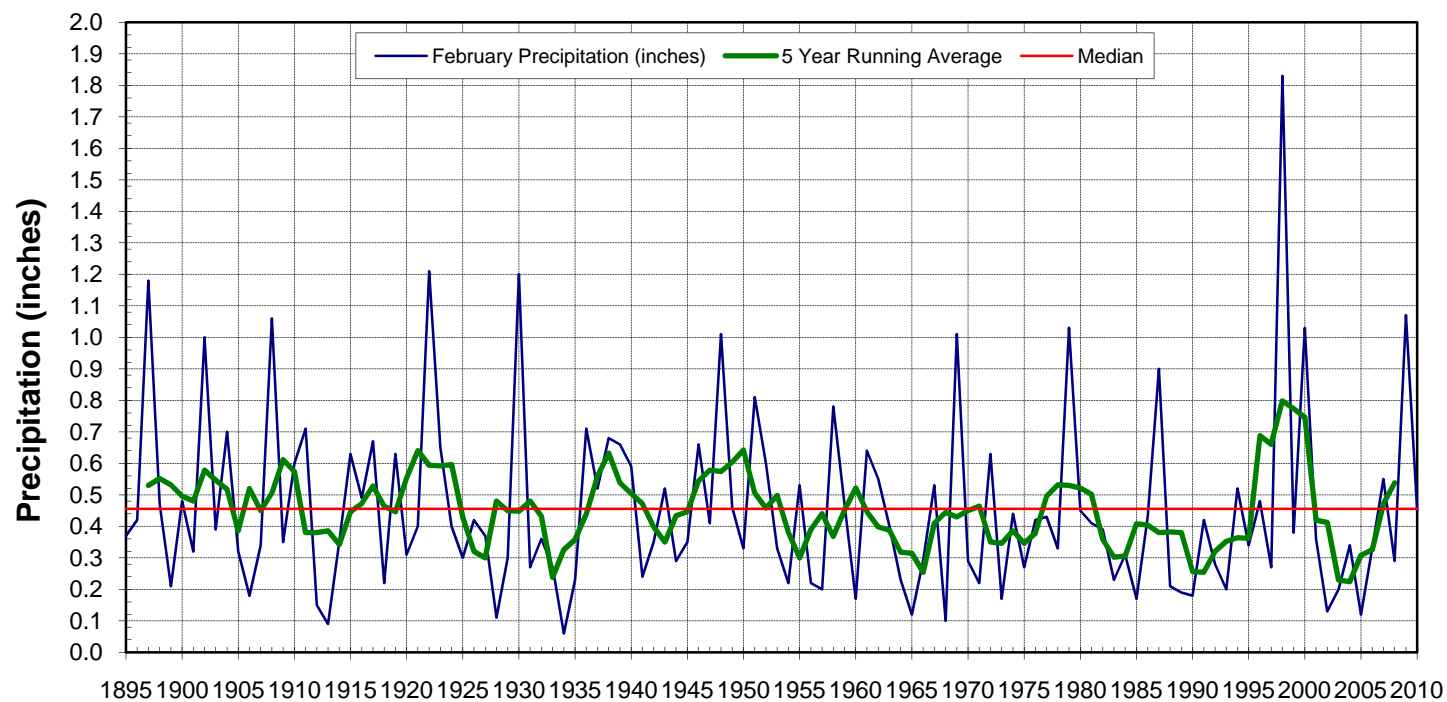
State Normal: 0.50" (1971-2000)

Monthly Ranking: 20th wettest in 116 years

Minimum: 0.07 inches in 1973

Years in Record: 116

Historical February Precipitation for North Dakota



February Precipitation Statistics

2010 Amount: 0.45 inches

Maximum: 1.83 inches in 1998

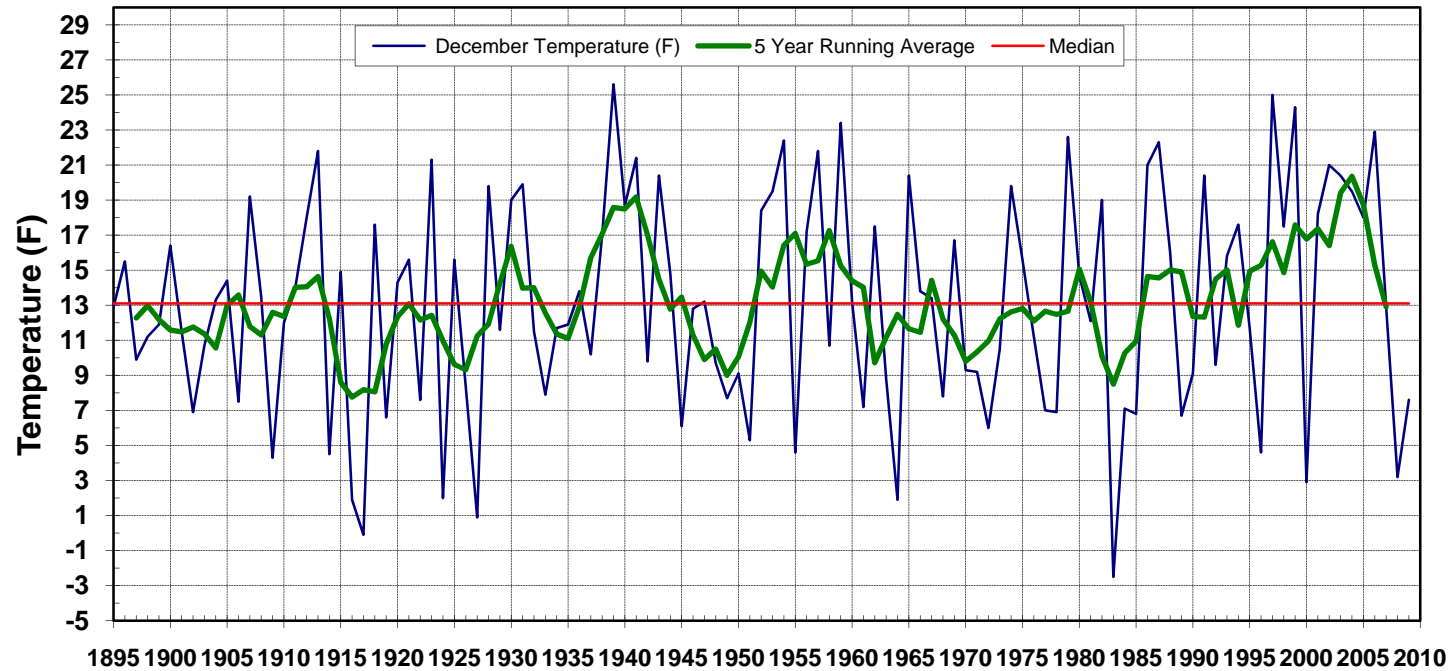
State Normal: 0.45" (1971-2000)

Monthly Ranking: 43rd wettest in 116 years

Minimum: 0.06 inches in 1934

Years in Record: 116

Historical December Temperature for North Dakota



December Temperature Statistics

2009 Average: **7.6°F**

Maximum: 25.6°F in 1939

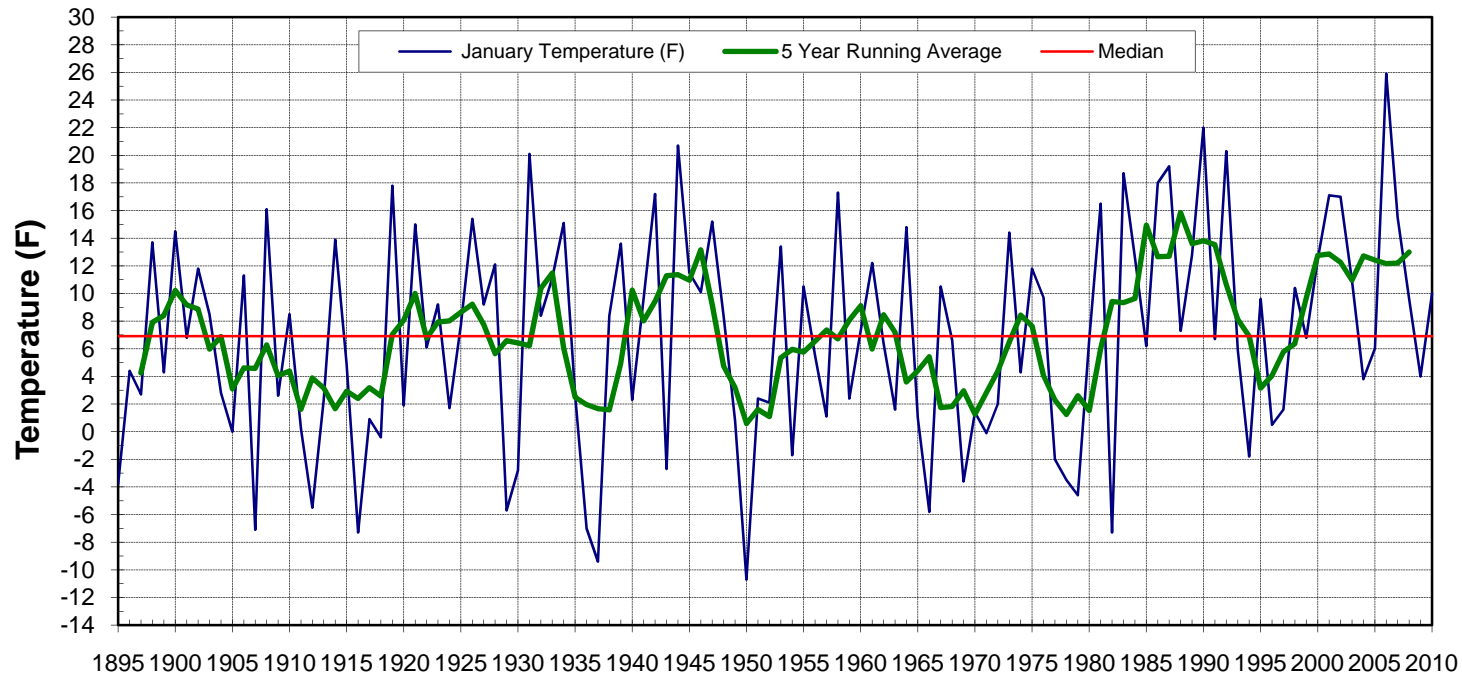
State Normal: 13.0°F (1971-2000)

Monthly Ranking: 25th Coolest in 115 years

Minimum: -2.5° F in 1983

Years in Record: 115

Historical January Temperature for North Dakota

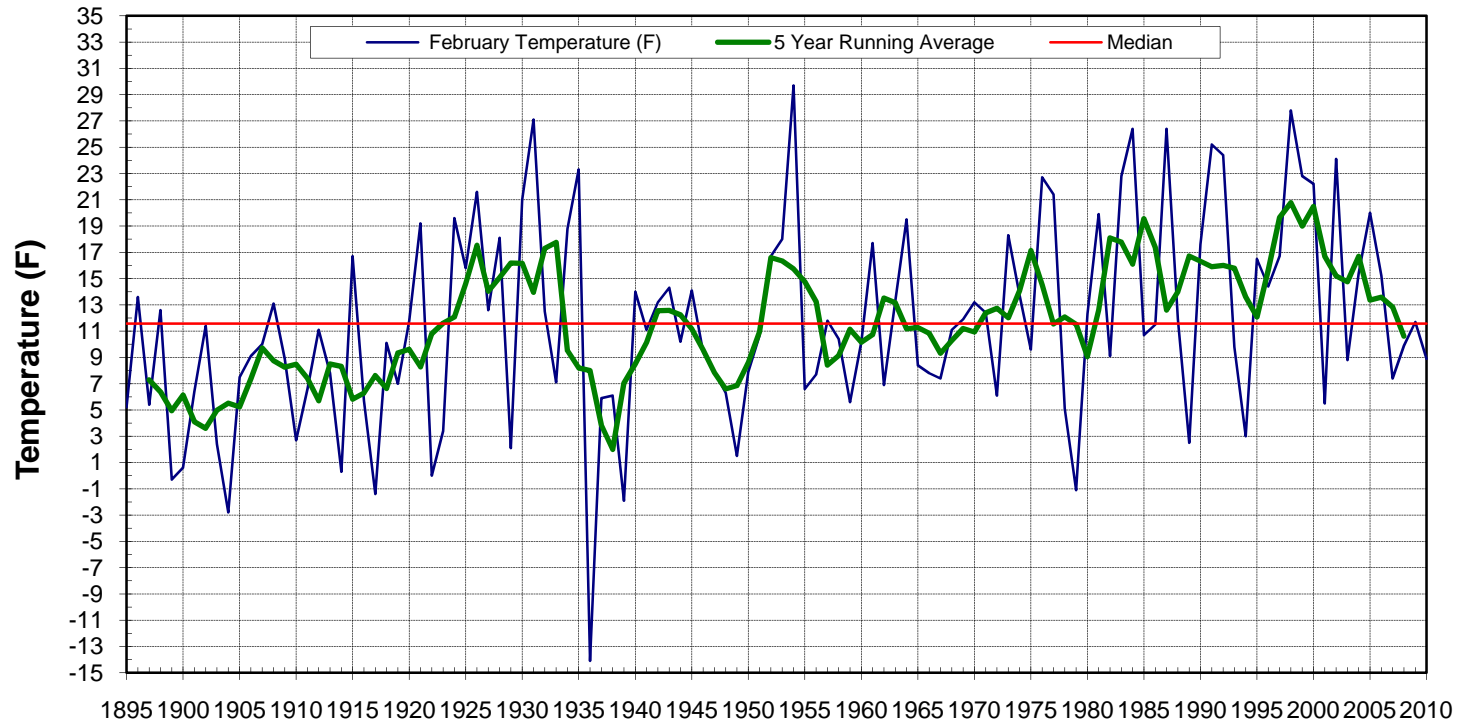


January Temperature Statistics

2010 Average: 10.0°F
Maximum: 25.9°F in 2006
State Normal: 7.9°F (1971-2000)

Monthly Ranking: 43rd Warmest in 116 years
Minimum: -10.7°F in 1950
Years in Record: 116

Historical February Temperature for North Dakota



February Temperature Statistics

2010 Average: **8.9°F**

Maximum: 29.7°F in 1954

State Normal: 15.4°F (1971-2000)

Monthly Ranking: 43rd Coolest in 116 years

Minimum: -14.1°F in 1936

Years in Record: 116



Storms & Record Events



State Tornado, Hail, and Wind Reports for Winter 2009-2010 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 2009-2010

Date	Location	Type of Record	Previous Record
12/15/09	Dickinson	Low temperature of -26°F.	Ties previous record set in 1989.
12/21/09	Williston	Snowfall of 1.8 inches.	1.6 inches set in 1911.
12/25/09	Williston NWS	Snowfall of 4.5 inches.	3.9 inches set in 1916.
12/25/09	Bismarck	Precipitation of 0.43 inches.	0.34 inches set in 1916.
12/25/09	Bismarck	Snowfall of 9.2 inches.	5.2 inches set in 1916.
12/25/09	Grand Forks NWS	Precipitation of 0.5 inches.	0.29 inches set in 1949.
12/25/09	Grand Forks NWS	Snowfall of 15.7 inches.	3.0 inches set in 1968.
12/25/09	Grand Forks airport	Snowfall of 5.4 inches.	2.1 inches set in 1970.
12/25/09	Fargo	Precipitation of 0.76 inches.	0.21 inches set in 1916.
12/25/09	Fargo	Snowfall of 8.1 inches.	3.6 inches set in 1912.
01/01/10	Jamestown	Low temperature of -28°F.	Ties previous record set in 1919.
01/01/10	Grand Forks airport	Low temperature of -33°F.	-30°F set in 1974.
01/02/10	Jamestown	Low temperature of -30°F.	Ties previous record set in 1928.
01/02/10	Grand Forks airport	Low maximum temperature of -17°F.	-13°F set in 1968.
01/02/10	Grand Forks airport	Low temperature of -35°F.	-27°F set in 1991.
01/02/10	Fargo	Low temperature of -33°F.	-32°F set in 1885.
01/17/10	Grand Forks airport	High minimum temperature of 22°F	20°F set in 1999.
01/22/10	Bismarck	High minimum temperature of 29°F	26°F set in 1909.
01/22/10	Bismarck	Precipitation of 0.25 inches.	0.20 inches set in 1969.
01/23/10	Grand Forks airport	Precipitation of 0.25 inches.	0.21 inches set in 1949.
01/23/10	Fargo	Precipitation of 0.90 inches.	0.30 inches set in 1909.
02/06/10	Grand Forks airport	Precipitation of 0.11 inches.	0.07 inches set in 1988.
02/13/10	Jamestown airport	Precipitation of 0.16 inches.	Ties previous record set in 1962.



Seasonal Outlook



Spring Climate Outlooks

by D. Ritchison¹

The North American continent during the winter of 2009-2010 was dominated by two principle players; an El Niño in the central Pacific Ocean and a strong negative Arctic Oscillation. An El Niño occurs when the waters of the equatorial eastern Pacific are warmer than normal. This extra heat energy into the atmosphere tends to enhance the sub-tropical jet stream making the southern tier of the United States cooler and wetter than normal, whereas the polar jet stream that impacts North Dakota tends to shift into southern Canada bringing above average winter temperatures and below average precipitation (snowfall) to the state.

Although the southern tier of the United States generally saw winter weather typical of most El Niños, North Dakota and other northern states did not. Although in a complex atmosphere there are always numerous unknown reasons that could be players, one reason this area finished colder than would otherwise be expected could be blamed on a phenomenon referred to as the Arctic Oscillation (AO). The AO is a climate pattern characterized by winds circulating counterclockwise around the arctic. When the AO is in its positive phase, a ring of stronger winds circulating around the North Pole tends to keep the coldest air in the higher latitudes. In the negative phase of the AO, this belt of winds becomes weaker allowing arctic air to more readily move southward bringing bitterly cold air to the state.

In recent months the Arctic Oscillation has been strongly negative several times which not only impacted our weather, but also conditions throughout the lower 48 states. The Arctic Oscillation can impact seasons besides winter; it was a strong negative AO that helped produce the cold summers in 2004 and 2009 and could also be a player during the spring of 2010. According to research being done by Rob Kupec a meteorologist at WDAY-TV in Fargo, ND as well as a graduate student at North Dakota State University, spring seasons in North Dakota when an El Niño is still present, like this year, tend to finish with slightly warmer than normal spring seasons. But a three-month average often means little if the warmer conditions come in March or early April before the planting season begins. Also, if the warmer Pacific Ocean does not fade by May, wetter than average conditions often arrive during the spring planting season.

These factors as well as the Arctic Oscillation continuing to be a player seems to be increasing the odds for the latter half of the spring being cooler and wetter than normal during the beginning of the growing season after the warmer than average start to the season.

The North Dakota State climate Office has links to the National Weather Service's local 3-month temperature outlooks for the upper coming year. Those outlooks can be found here: <http://www.ndsu.edu/ndsco/outlook/L3MTO.html>

The latest spring outlook from the Climate Prediction Center is giving equal chances for the spring season to be either average, above average or below average for both precipitation and temperatures throughout the state and considering the wide weather fluctuations we will likely experience in the coming weeks, that seems to be a valid analysis.

These outlooks are updated on the third Thursday of each month, with a final monthly outlook issued at the end of each month. These outlooks are available at <http://www.cpc.ncep.noaa.gov/products/predictions/90day/>

Also the readers will 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/>

¹ The corresponding author: Daryl Ritchison is a broadcast meteorologist working at WDAY-TV Fargo, ND.
E-Mail: daryl@ritchison.com



Hydro-Talk

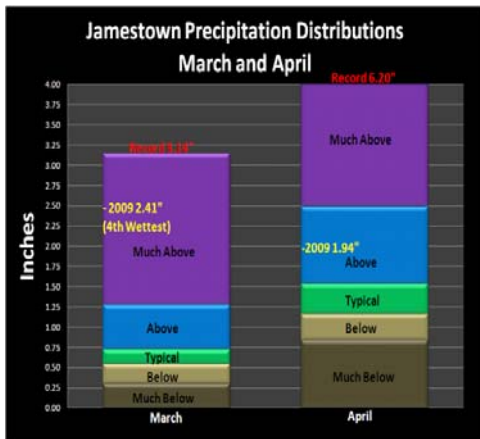


If the History Repeats:

by A. Schlag²

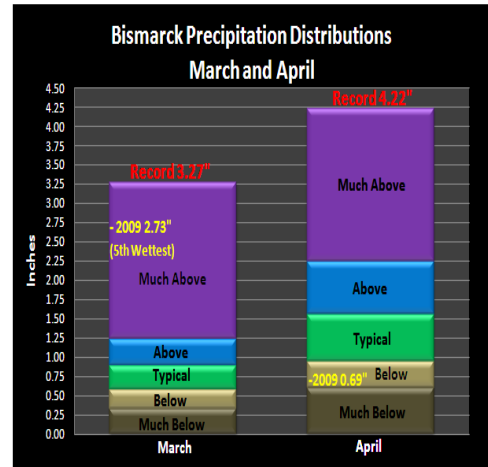
In the spring of 2009, most of North Dakota was coming out of a winter that we hadn't experienced since the late 1990s. This snow and its nearly ubiquitous water equivalence of 4-8 inches is something we rarely see. Quite simply most river watchers knew that with this much water on the ground it would take a nothing short of a weather miracle for there to be no flooding in the state, and a very fortunate weather pattern to even avoid major flooding. As it turns out, we had a little of each.

When we see the probabilities for flooding this high, the common initial response is one of either disbelief or panic. The reasonable truth is somewhere in between as merely exceeding the defined minor flood rarely creates problematic conditions. The real problems begin in the moderate to major range and last year, one can pick out those areas of the state that had "problematic" flooding by simply looking at how their March unfolded with respect to precipitation.

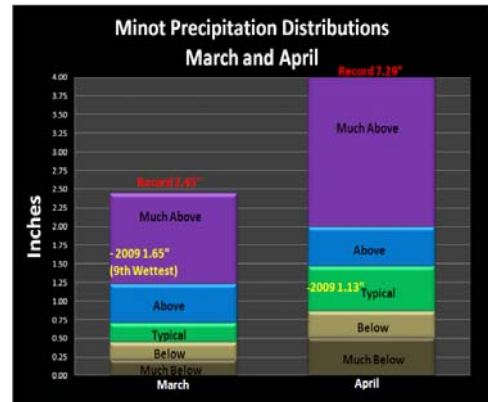
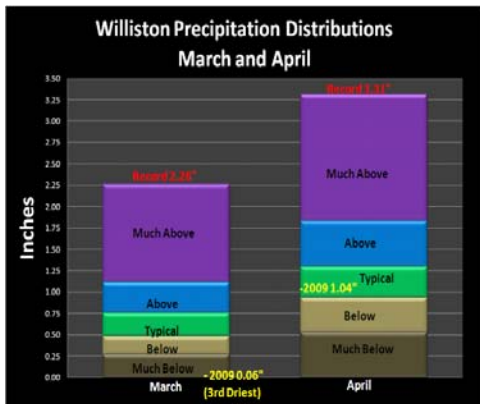


Several key locations are shown in the figures on this page with regard to their March and April of 2009 precipitation.

As shown in the figures on this page for Bismarck, Jamestown, Minot and Williston, there was a wide separation in the overall rankings of the different locations. Bismarck with a very wet March had substantial flood problems between ice jamming on the Missouri River and Apple Creek. The James River also had significant flooding issues, and actually lasted through the month of July and into August.



Minot on the other hand was pretty wet in March, but only slightly above average in April (during their melt) and flooding issues were less problematic. And finally, while the Williston area had relatively high probabilities of seeing flooding on the Little Muddy Creek, the exceptionally dry month of March reduced flooding in that area of the state to a real non-story.



Other areas with a little less data seemed to reflect a very similar correlation of problematic flooding to high precipitation in March. A NWS cooperative observer in Grant County recorded the highest March precipitation since records were established in 1949 at 3.07 inches. This is of course the Cannonball River and Cedar Creek watersheds that were very problematic to county roads and residents along the river.

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

Towner recorded a fairly pedestrian 1.05 inches of moisture in March, and while the Towner gauge reached the major flood stage, this is actually not that uncommon in that area and as a result wasn't really that problematic. It would appear that existing water content of the snowpack is only one piece of the puzzle and we should all keep a watchful eye on how the remainder of March unfolds, starting with the weather.

Does the history repeat? This year, we again see an unfortunately high probability of flooding in many locations as shown in the table below. Indeed, the probability of reaching major flood stage in several locations is a near certainty.

CHANCES OF EXCEEDING FLOOD STAGE AT SPECIFIC LOCATIONS IN THE BISMARCK HYDROLOGIC SERVICE AREA (VALID 7 MARCH - 5 JUNE 2010)

LOCATION	-----FLOOD STAGES-----						DEPARTURE FROM NORMAL OF REACHING FLOOD STAGE
	MINOR		MODERATE		MAJOR		
	STG	PCT	STG	PCT	STG	PCT	
-----MISSOURI AND JAMES RIVER BASIN-----							
LITTLE MUDDY RIVER							
WILLISTON 10NE	10	80%	12	29%	14	13%	16% GREATER
LITTLE MISSOURI RIVER							
MARMARTH	18	11%	23	5%	30	---	8% GREATER
MEDORA	15	86%	18	15%	20	6%	75% GREATER
WATFORD CITY	20	7%	24	---	30	---	NA
SPRING CREEK							
ZAP	14	>98%	18	87%	20	69%	NA
KNIFE RIVER							
MANNING	15	84%	17	9%	20	---	71% GREATER
HAZEN 1S	21	>98%	24	98%	25	90%	NA
HEART RIVER							
MANDAN 3W	17	80%	23	13%	28	2%	76% GREATER
APPLE CREEK							
MENOKEN 6W	15	>98%	16	96%	17	52%	NA
JAMES RIVER							
GRACE CITY 3W	12	93%	14	81%	15	64%	86% GREATER
LAMOURE	14	>98%	16	94%	18	25%	NA
LUDDEN 5SW	12	>98%	14	>98%	17	39%	NA
PIPESTEM CREEK							
PINGREE 3W	9	>98%	11	87%	13	---	NA
CANNONBALL RIVER							
REGENT	22	10%	24	7%	26	6%	NA
BREIEN	10	>98%	20	44%	23	8%	NA
CEDAR CREEK							
RALEIGH 19S	12	67%	14	38%	16	18%	64% GREATER
BEAVER CREEK							
LINTON 1W	9	95%	11	82%	13	69%	83% GREATER
-----SOURIS RIVER BASIN-----							
DES LACS RIVER							
FOXHOLM	16	4%	18	3%	19	1%	NEAR NORMAL
SOURIS RIVER							
SHERWOOD 15W	18	23%	20	13%	25	---	NEAR NORMAL
FOXHOLM 3E	10	57%	13	44%	15	3%	18% GREATER
MINOT 4NW	14	47%	17	13%	22	3%	25% GREATER
MINOT-BRDWY BRDG	1549	8%	1551	4%	1555	1%	NEAR NORMAL
LOGAN	34	73%	36	36%	38	1%	50% GREATER
SAWYER	22	68%	24	26%	26	4%	45% GREATER
VELVA	1505	70%	1510	3%	1515	---	46% GREATER
WINTERING RIVER							
KARLSRUHE 6N	7	96%	9	1%	10	---	88% GREATER
SOURIS RIVER							
TOWNER	52	>98%	54	96%	56	9%	NA
BANTRY 8E	11	>98%	12	>98%	14	6%	NA
WILLOW CREEK							
WILLOW CITY 7W	10	96%	14	55%	16	9%	59% GREATER
SOURIS RIVER							
WESTHOPE 7NNE	10	>98%	14	57%	16	24%	NA

FS = FLOOD STAGE NA = NOT APPLICABLE --- = STATISTICAL DISTRIBUTION BELOW THIS STAGE



Science Bits



Finding Comfort in Climatology

by F. A. Akyüz³

As the Red River of the North rises, so does the anxiety among the people living along the river. Last year the Red River reached record breaking stage levels in Fargo and Oslo; the second highest crest in Halstad, Drayton and Pembina; and the third highest crest in Wahpeton and Grand Forks. Major flood stage in Wahpeton occurred on Sunday, March 14 and in Fargo on Wednesday, March 17. The Red River in Fargo is expected to crest at 38 feet, just 2 feet shy of the record level of 40.82-foot stage set last year.

In 113 years of recorded history, there are only four periods when back-to-back major floods occurred (including the current major flood). The U.S. Geological Survey's gauge recorded the major flood stage in Fargo (at or above 30 feet) during the following years: 1965-66, 1978-79, 2006-07, and 2009-10. Major flooding was observed in Fargo-Moorhead during the following years: 1882, 1897, 1965, 1966, 1969, 1975, 1978, 1979, 1989, 1997, 2001, 2006, 2007, 2009, and 2010.

As of today, we have had 5 major floods since 2000. This statistic may raise even more concerns among our citizens, especially children ten years old and younger. Even though they are too young to understand all the flood-related statistics, they are aware of the sense of urgency and fear they see or hear in discussions during our recent flood fights. Even we, as adults, find it difficult to maintain a cool, calm composure as we not only deal with the current flood situation, but also as we reflect on the disruption we experienced in our lives during several recent past floods. There is a comfort that a climatologist can provide that will help to our community. Perhaps the figure below will provide that comfort.

Figure 1 shows the annual precipitation history with 5-year averages. The figure clearly indicates wet and dry periods lasting between 5 to 10 years. It indicates that the latest wet period started in 1992 and continued with varying intensities up until this year. It also shows that we are at the tail-end of the most current wet period. We have seen semi-accurate to not-so-accurate climate forecasts for local, regional, and global temperatures, but because of limitations in forecasting skills we are unable to accurately forecast precipitation. Forecasting precipitation is far more complicated than forecasting temperatures. Therefore some climate forecasts for precipitation are tied to temperature for one well-understood relationship: as the air temperature rises, it allows containing more moisture. We know that North Dakota is warming by 0.26°F per decade on the average. This may be interpreted that we are, on the average, 2.6°F warmer in North Dakota today than we were 100 years ago. We also know that our growing seasons are lengthening by 1.2 days per decade (Badh et al., 2009). In other words, on the average, North Dakota has 12 additional days when we can grow certain crops today that we could not grow 100 years ago. Our study also indicates that the warming trend observed locally since the 1890's did not impact the precipitation pattern in North Dakota (Badh and Akyüz, 2010). Therefore, we know that even if the temperatures rise in the future at the same rate they have been during the past 30 years (which we have no reason to believe), precipitation may not follow the temperature. As a result, Figure 1 is the best tool we have for assessing multi-decadal variation in precipitation.

Yes, one can see comfort in Figure 1, which indicates that the near-end of the wet period which started in 1992 may be in sight and perhaps the last sandbagging efforts as well, for a long time. There may be a time when people who lived in the Red River Valley during our current wet period will see the dikes and high walls and not remember why they are there!

References:

Badh, A., F. A. Akyüz, G. Vocke, B. Mullins. 2009: Impact of Climate Change on the Growing Seasons in Select Cities of North Dakota, United States of America. *International Journal of Climate Change: Impacts and Responses*. V.1, Number 1, 105-117.

Badh, A., F. A. Akyüz, G. Vocke. 2010: Studying Climate Change and Precipitation Trends for North Dakota, United States. *International Journal of Climate Change*. (Under Review).

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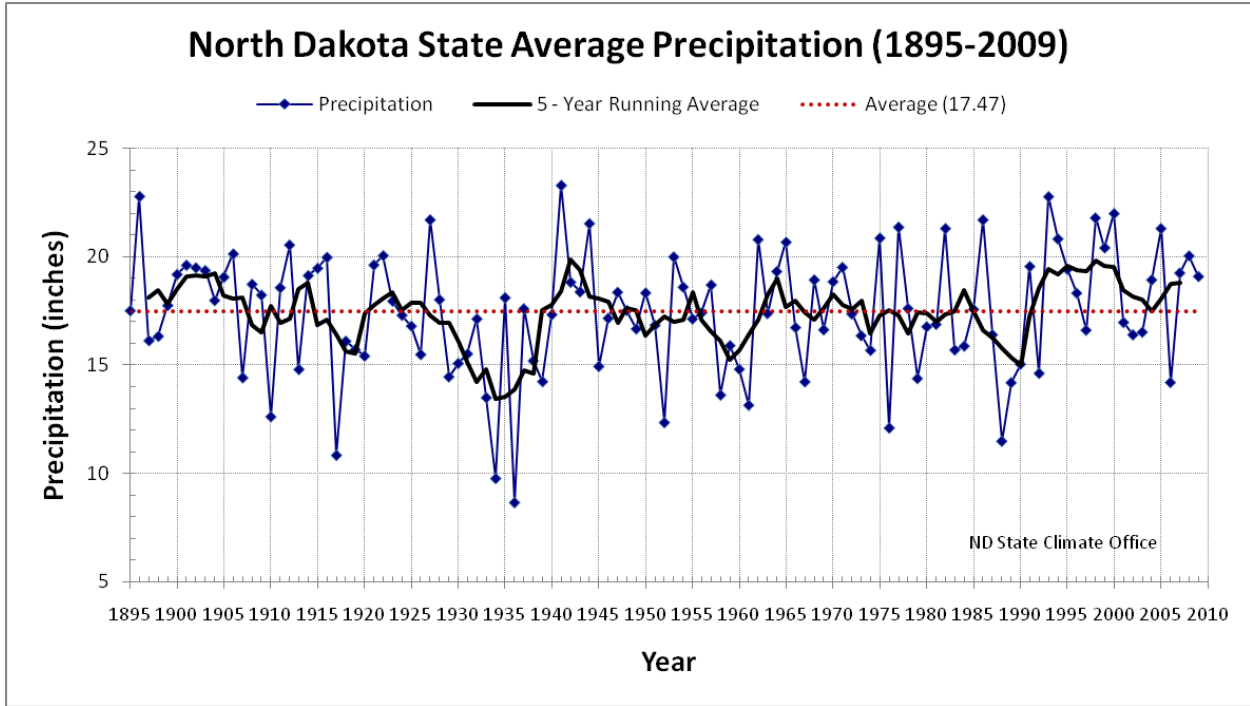


Figure 1. North Dakota annual precipitation history (1895-2009) with 5-year average (North Dakota State Climate Office, 2010)

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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