North Dakota Climate Bulletin

Spring 2009

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

Compared historically, North Dakota had a colder and a dryer spring following cooler and very wet winter leading Red River to flood at record intensities in most main-stem locations. Temperature-wise, this spring was the 33rd coldest since 1895. Precipitation-wise, it was the 39th driest spring since 1895 which was welcomed by most ND citizens. The flood in the Red River Valley would have been much worse even if ND received normal amount of precipitation. Furthermore most farmers needed this much needed dry period to finish some field work. Details of the State Flood of 2009 are discussed in the "Hydro-Talk" and March "Weather Highlights" sections of this bulletin. The Community Collaborative Rain Hail and Snow Network (CoCoRaHS) currently has 80 observers representing 26 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

Fargo Flood 2009

Photo by Akyüz

Weather Highlights

Seasonal Summary: by B. A. Mullins

March 2009

The State average precipitation was 1.31 inches which is above the 1971-2000 normal of 0.80 inches. March 2009 state average precipitation ranked 15th wettest in the last 115 years with a maximum of 2.72 inches in 1902 and a minimum of 0.09 inches 1930.

March precipitation ranged from 0.1 inches to 5.0 inches plus. Amounts of less than a quarter inch were recorded in the northwest corner. Precipitation totals of greater than 3 inches were measured in the southwest and southeastern regions. Most of the percent of normal precipitation ranged from less than 25% to 300%. The area with less than normal precipitation was the northwest region. The areas with primarily 300% plus percent of normal precipitation were the southwest, south-central, and southeastern regions. The US Drought Monitor has currently lifted all drought classifications from North Dakota.

There were three major precipitation events that occurred in March. The first was March 9-10 in which heavy snow fell mainly in the southeastern regions. The National Weather Service (NWS) recorded a two day total snowfall (9th – 10th) at Jamestown of 14.0 inches, Fargo of 10.1 inches, Fort Yates of 10.0 inches, and Linton of 10.0 inches. The second major precipitation event was March 22-26 in which heavy snow fell in the southwest, central, and eastern regions. During the second precipitation event, some of the higher amounts recorded by the NWS were 22.5 inches of snow at Marmarth (Southwest corner of the sate), 18.0 inches at Dickinson, and 15.3 inches at Beulah. The third major precipitation event was March 29-31 in which heavy snow fell in the south central and eastern areas. The NWS recorded record breaking amounts of snowfall on the 30th at Bismarck of 11.8 inches and Fargo of 5.8 inches. Fargo also had record breaking snowfall on the 31st of 4.6 inches. NWS recorded Fargo as having a record breaking total March snowfall of 28.1 inches.

The NWS recorded the second highest seasonal snowfall amount at Bismarck with 100.2 inches for 2008-2009. The highest seasonal snowfall amount recorded at Bismarck was 101.6 inches in 1996-1997.

The snow melt in March was the beginning of devastating flooding across North Dakota. As the snow melted, river levels rose quickly from overland flooding. By March 24th, a Presidential major disaster declared was issued for 34 of 53 counties that were struck by severe weather and flooding. Ice jams along the Missouri River caused flooding in the Bismarck-Mandan areas. Demolition teams used explosives in an attempt to break up the ice jams along the Missouri River. The west side of Linton, ND was evacuated due to flooding from Bear Creek.

The flooding along the eastern part of the state hit record and near record levels. North Dakota residents built dikes to protect homes and property but in many cases, the rising waters came too quickly causing residents to evacuate the flooded areas. Many rural residents and small towns along the Wild Rice River, Sheyenne River, and Red River were evacuated. A few residents were air lifted to safety. Extremely high Red River levels were reported from the South Dakota

to the Canadian border. In Fargo, the Red River crested at 40.82 feet on March 28th breaking the previous record of 39.72 feet set on April 18, 1997. Many homes in the Fargo and Moorhead areas located near the Red River were evacuated as a precaution. Homes were lost but the property damage would have been far greater if not for the community effort to build and maintain dikes. Volunteers filled 3.5 million sandbags in approximately 10 days. The Red River at Fargo rose from 17.3 feet on the 20th to 40.82 feet on the 28th.

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), throughout March there was only one high wind event, zero reports of hail, and zero reported tornadoes. The one high wind event was reported on the 22nd at the Minot Air Force Base of 60 mph.

The top five March daily maximum wind speeds recorded from the North Dakota Agricultural Weather Network (NDAWN) were 61.9 mph at Robinson on the 22nd, 55.1 mph at Jamestown on the 22nd, 52.6 mph at McHenry on the 22nd, 51.1 mph at Linton on the 22nd, and 50.8 mph at Bowman on the 23rd. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 19.7°F which is well below the 1971-2000 normal of 26.9°F. March 2009 state average air temperature ranked 26th coolest in the past 115 years with a maximum of 40.7°F in 1910 and a minimum of 6.9 °F in 1899.

The March average air temperatures ranged from 16°F primarily in the north to 27°F along the western central edge. The central regions had air temperatures of 18 to 20°F. The southwest, southeast, and eastern central regions had average air temperatures of 21 to 25°F. March had below normal temperatures across the State and ranged from -2 to -10 degrees. The daily temperatures for the first half of March were far below normal with extreme low temperatures from 9th through the 12th of March. The daily temperatures for the second half of March were primarily below normal with a few days of above normal temperatures.

The National Weather Service (NWS) recorded record low maximum temperatures at Bismarck and Williston on March 10th. NWS also recorded a record low maximum temperature at Bismarck on the 11th. A record low minimum temperature was recorded at Jamestown on the 12th. (See page 16, Storms and Record Events)

The top five March daily minimum air temperatures recorded from the North Dakota Agricultural Weather Network (NDAWN) were -29.8°F at Britton, SD on the 1st, -28.2°F at Wyndmere on the 12th, -27.6°F at Crosby on the 11th, -26.6°F at Roseau, MN on the 1st, and -26.2°F at Bowbells on the 11th. The top five March daily maximum air temperatures recorded from the North Dakota Agricultural Weather Network (NDAWN) were 70.3°F at Beach on the 22nd, 69.7°F at Bowman on the 22nd, 68.1°F at Beach on the 21st, 66.7°F at Sidney, MT on the 22nd, and 66.5°F at Bowman on the 21st.

April 2009

The State average precipitation was 1.02 inches which was below the 1971-2000 normal state average of 1.40 inches. April 2009 state average precipitation ranked the 40th driest in the past 115 years with a maximum of 3.86 inches in 1896 and a minimum of 0.11 inches in 1987.

Most of the first few days of April were dry across the State with some snow in the central and northeast regions. The middle of the month saw more rain showers across the State. The last few days of April had heavier rains that turned to flurries with the larger snow accumulations in the

western and central regions. Most of the NDAWN (North Dakota Agricultural Weather Network) weather stations recorded their highest daily April rainfall amounts on the 29th. The top four NDAWN daily rainfall amounts from April 29th was 1.26 inches at Crosby, 1.21 inches at Brorson MT, 1.01 inches at Williston, and 1.00 inches at Berthold.

Monthly precipitation totals ranged from 0.5 inches to 1.9 inches. The southwest corner and the far southeast corner had less than an inch of total monthly precipitation with the remaining areas receiving greater than an inch. The southwest region of the State had monthly percent of normal precipitation of 50% and less. The southeast region had 50 to 90 percent of normal monthly precipitation. The northwest and northeast monthly precipitation percent of normal ranged from 100% to 200%.

Flooding continued in eastern North Dakota along Devils Lake, the Sheyenne River, the James River, and the Red River. Lisbon and Valley City prepared for flooding along the Sheyenne River. The Fargo Red River level dropped from 40.82 feet on March 27th to 31.51 feet on April 9th and then began to rise to a second crest of 34.0 feet on the 16th.

The Bismarck National Weather Service (NWS) office recorded breaking one precipitation record in April. NWS recorded record precipitation at Minot on the 29th of 0.8 inches which broke the previous record of 0.43 inches set in 1967.

The US Drought Monitor classified the counties in the southwest corner of the State primarily including Bowman, Slope, Hettinger, Stark, Billings and Golden Valley counties as “abnormally dry”. The remainder of the State had no drought conditions reported. The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 1% short, 60% adequate, and 39% surplus with a subsoil moisture reported as 1% very short, 5% short, 60% adequate, and 34% surplus (Weekly Weather and Crop Bulletin Vol. 96, No. 17).

According to the preliminary reports of the National Weather Service’s Storm Prediction Center (SPC), throughout April there were no reports of high wind, hail, or tornadoes.

The top five April daily maximum wind speeds recorded from NDAWN were 52.6 mph on the 15th at Linton, 44.0 mph on the 29th at Beach, 42.6 mph on the 23rd at Wahpeton, 42.2 mph on the 23rd at Marion, and 41.9 mph on the 19th at Berthold. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 39.0°F which is below the 1971-2000 normal of 41.7°F. April 2009 state average air temperature ranked 32nd coolest in the past 115 years with a maximum of 50.2°F in 1987 and a minimum of 31.1°F in 1907.

The average April air temperature was below normal across the State. There were a few days of above normal average air temperatures during the middle of the month. However, most of the daily average air temperatures were below normal. Many of the days that had above normal temperatures were quickly followed by precipitation events. For example, on April 23rd, the average air temperatures at Fargo dropped from 81°F to 68°F in one hour and temperatures continued to fall as a low pressure system moved in and brought cooler temperatures and rain showers to the area. The monthly average air temperatures ranged from 36°F to 42°F. The north central, central, and southwest regions had monthly air temperatures ranging from 36 to 39°F. The eastern and northwest regions had average monthly air temperatures from 40 to 42°F. The monthly departure from normal air temperatures ranged from 0 to -4°F. The northwest region

had between 0 and -2°F departure from normal air temperatures with the remaining areas of the State having April departures of -2 to -4°F.

NDAWN's highest recorded daily air temperature for April was 86.7°F at Britton, SD on the 23rd. The lowest recorded daily air temperature was -3.1°F at Dickinson on the 1st.

May 2009

The North Dakota State average precipitation was 1.53 inches which is below the 1971-2000 normal state average of 2.31 inches. May 2009 state average precipitation ranked the 28th driest in the past 115 years with a maximum of 5.73 inches in 1927 and a minimum of 0.31 inches in 1901.

The wide spread rain events for May happened from the 11th through the 13th and the 24th through the 25th. The rain event two day totals for the 24th and 25th was heaviest in the northeast corner with amounts of over 2 inches. The total May rainfall ranged from 3.73 inches at Turtle Lake to 0.19 inches at Bowbells. The smallest monthly totals of a quarter inch and less were in the northwest corner. The highest monthly totals of greater than 3 inches were primarily recorded in Mercer, Mclean, Pierce, Benson, Rolette, and Pembina counties. The majority of the State had below normal precipitation. The areas of above normal precipitation ranged from 100% to 160% and included the west central, north-central, and northwestern corner.

As of May 26th, the US Drought Monitor has classified no drought conditions in North Dakota. The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 1% very short, 3% short, 71% adequate, and 25% surplus with a subsoil moisture reported as 0% very short, 4% short, 77% adequate, and 25% surplus (Weekly Weather and Crop Bulletin Vol. 96, No. 21).

The National Weather Service (NWS) did not break any precipitation records for May 2009. The top five May daily rainfall totals measured from the North Dakota Agricultural Weather Network (NDAWN) were all on May 25th. The top five were 2.91 inches at Cavalier, 2.46 inches at St. Thomas, 2.38 inches at Greenbush MN, 2.30 inches at Humboldt MN, and 2.11 inches at Baker.

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), throughout May there were 4 reported high wind event, 4 reports of hail, and no reported tornadoes. The hail reports came from Richland County on the 31st, Emmons County on the 28th, Stark County on the 12th, and Ward County on the 12th. The high wind reports came from Morton County on the 12th and the19th, Burleigh County on the 12th, and Sheridan County on the 12th.

Three of the top five NDAWN daily maximum wind speeds were recorded at Watford City. NDAWN's top five May daily maximum wind speeds were 52.6 mph on the 12th at Linton, 51.9 mph on the 29th at Warren MN, 51.5 mph on the 5th at Watford City, 48.3 mph on the 13th at Watford City, and 48.0 mph on the 6th again at Watford City. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 51.0°F which is below the 1971-2000 normal of 54.8°F. May 2009 state average air temperature ranked the 33rd coolest in the past 115 years with a maximum of 63.1°F in 1977 and a minimum of 43.3°F in 1907.

May departure from normal monthly air temperatures were below normal across the State. The departures ranged from -7°F in the upper northeast to near zero in the lower southwest. The average monthly air temperatures ranged from 47°F in the northeast to 56°F in the southeast. Most daily average air temperatures during the first half of May were well below 60°F. The second half of May had slightly warmer temperatures with daily temperatures in the upper 50's and some just above 60°F. The southeast corner of the State had two days with average daily air temperatures over 70°F.

The National Weather Service (NWS) recorded two temperature records at Williston. On May 16th, Williston had a record low temperature of 21°F which broke the previous record of 23°F set in 1925. On May 21st, Williston tied the low temperature record of 26°F set previously in 1931.

NDAWN's highest recorded daily air temperature for May was 95.3°F on the 19th at Britton, SD. The lowest recorded daily air temperature was 18.5°F on the 16th at Ross.

Season in Graphics

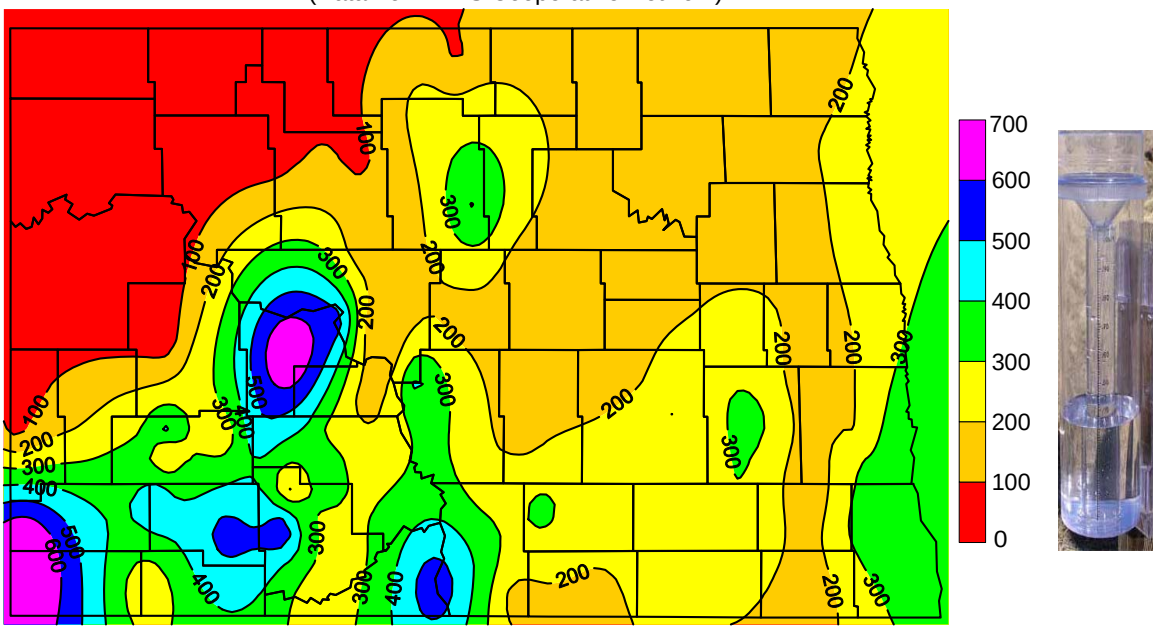
Spring 2009 Weather in North Dakota:

March 2009

Total Precipitation percent of mean (1971-2000)

Precipitation Percent of Normal

(Data from NWS Cooperative Network)



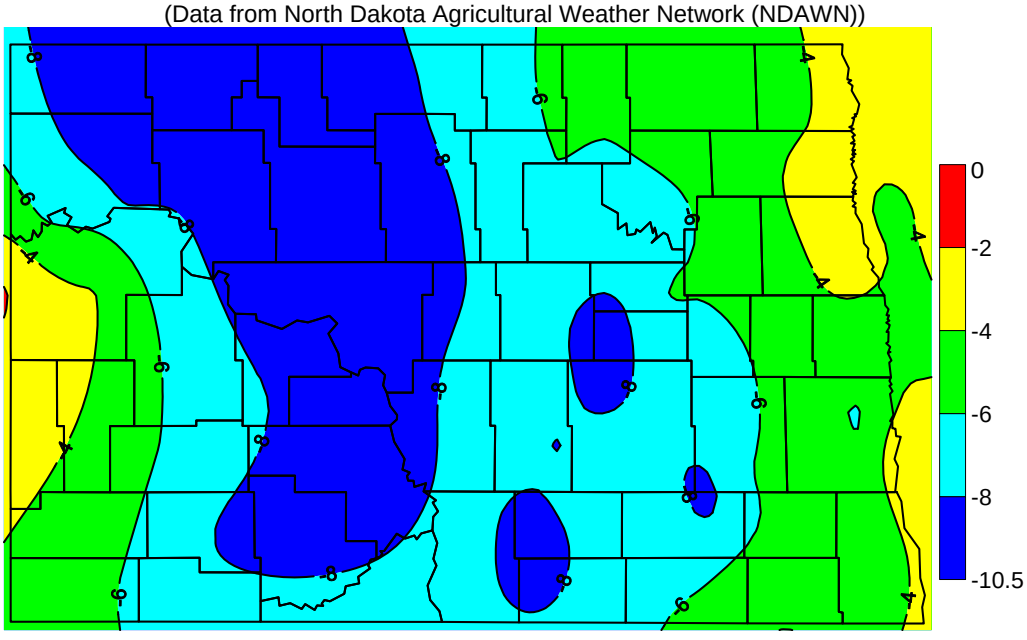
North Dakota State Climate Office

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

Season in Graphics

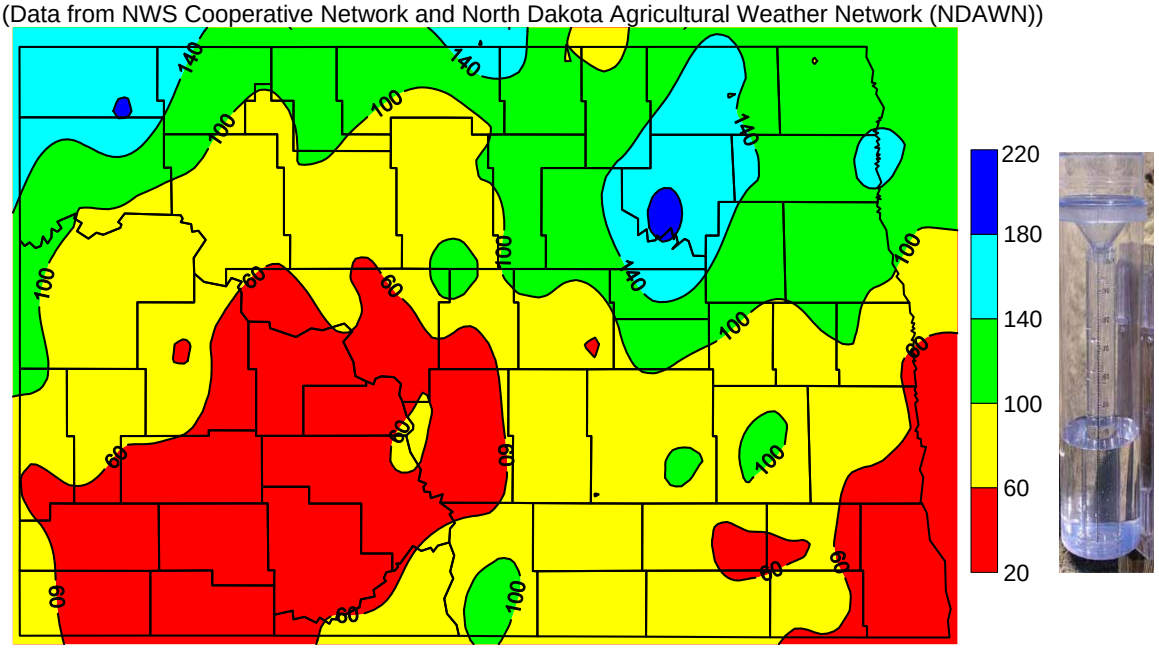
April 2009

Spring 2009 Weather in North Dakota:

Total Precipitation percent of mean (1971-2000)

Precipitation Percent of Normal

(Data from NWS Cooperative Network and North Dakota Agricultural Weather Network (NDAWN))

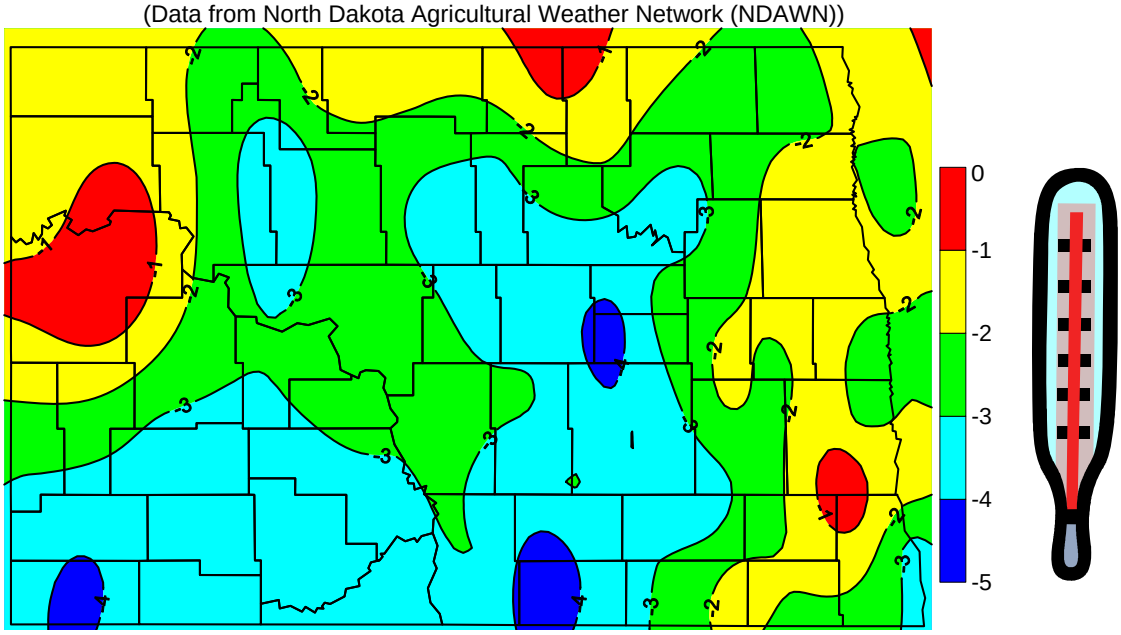


North Dakota State Climate Office

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

Season in Graphics

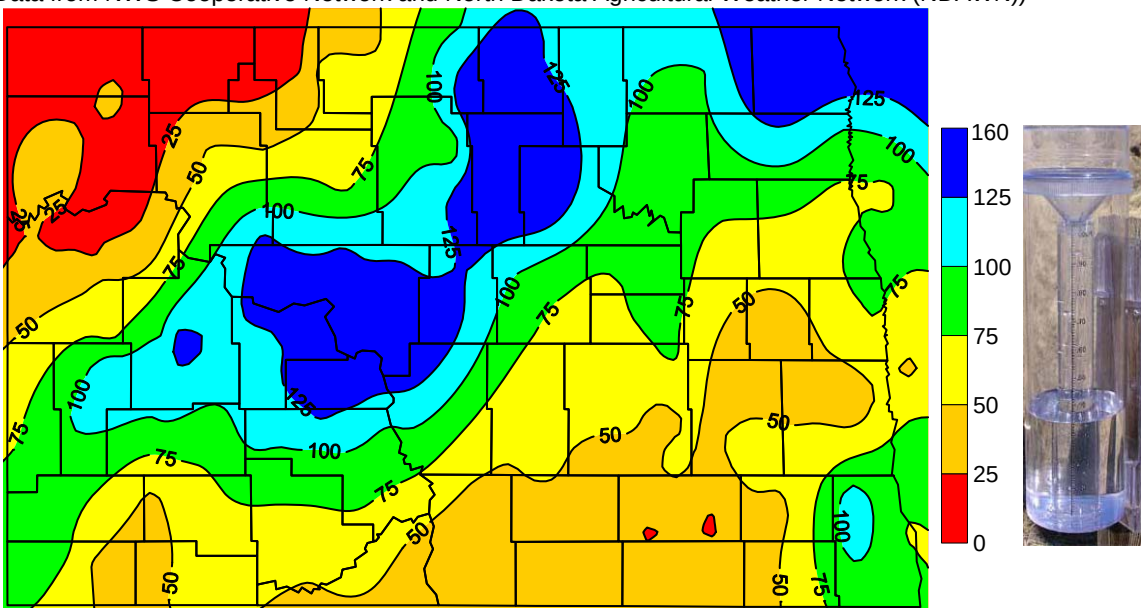
Spring 2009 Weather in North Dakota:

May 2009

Total Precipitation percent of mean (1971-2000)

Precipitation Percent of Normal

(Data from NWS Cooperative Network and North Dakota Agricultural Weather Network (NDAWN))

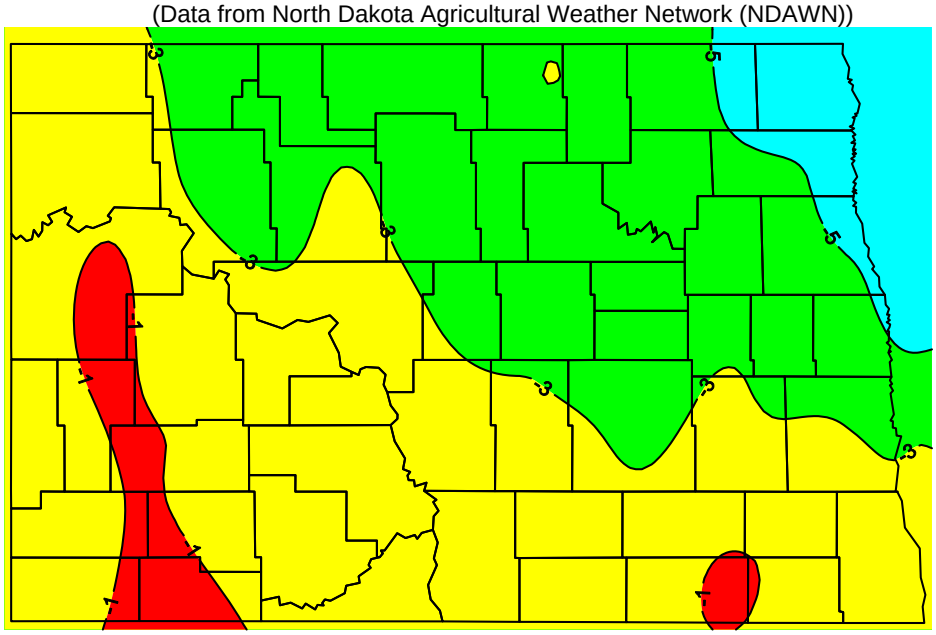


North Dakota State Climate Office

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

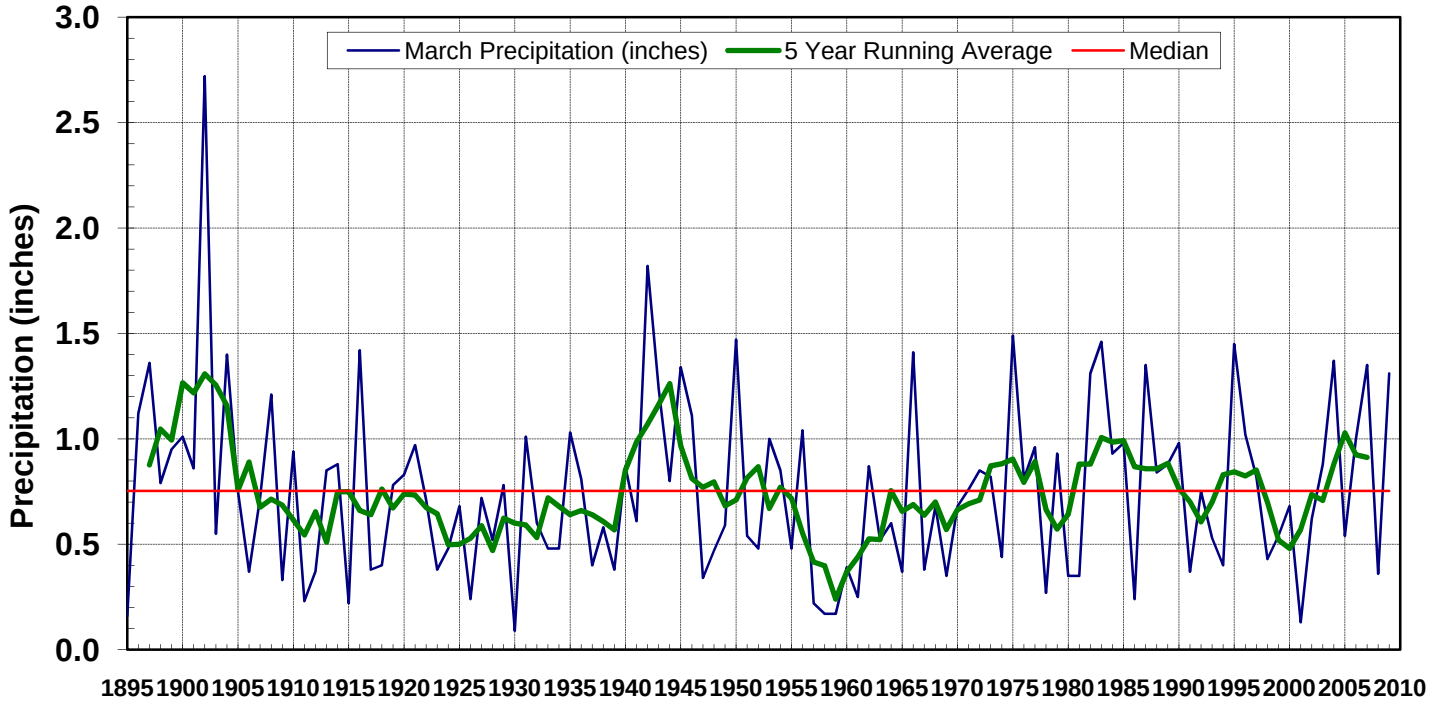
Departure From Normal Monthly
Average Air Temperature in degrees F

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



North Dakota State Climate Office

Historical March Precipitation for North Dakota

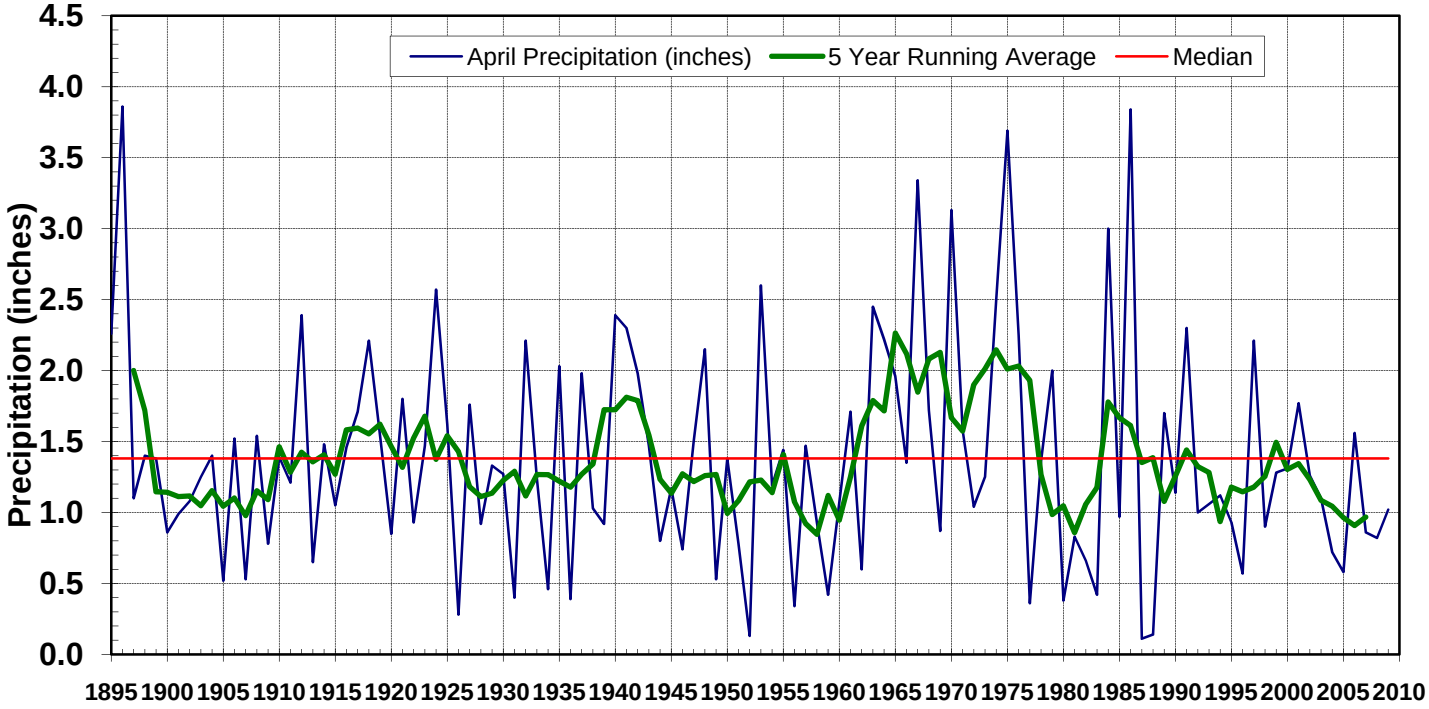


March Precipitation Statistics

2009 Amount: **1.31 inches**
Maximum: 2.72 inches in 1902
State Normal: 0.80” (1971-2000)

Monthly Ranking: 15th Wettest in 115 years
Minimum: 0.09 inches in 1930
Years in Record: 115

Historical April Precipitation for North Dakota

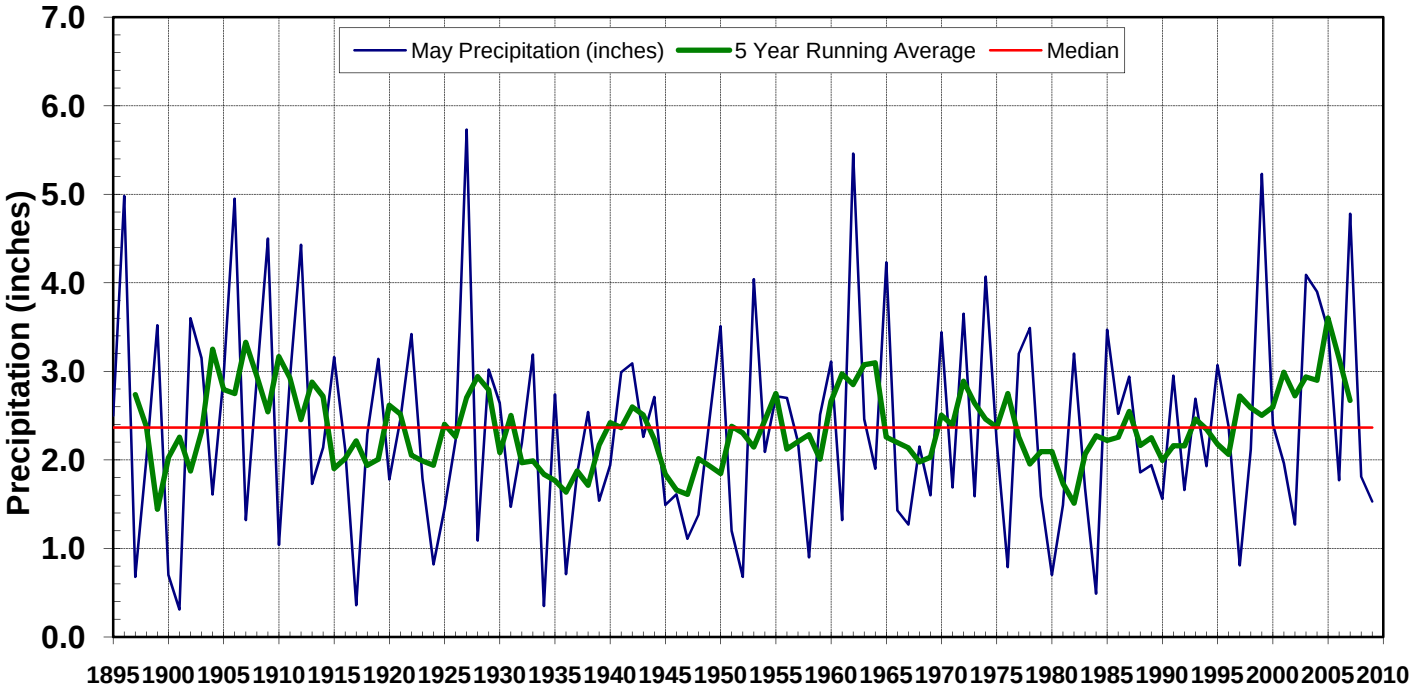


April Precipitation Statistics

2009 Amount: 1.02 inches
Maximum: 3.86 inches in 1896
State Normal: 1.40” (1971-2000)

Monthly Ranking: 40th Driest in 115 years
Minimum: 0.11 inches in 1987
Years in Record: 115

Historical May Precipitation for North Dakota

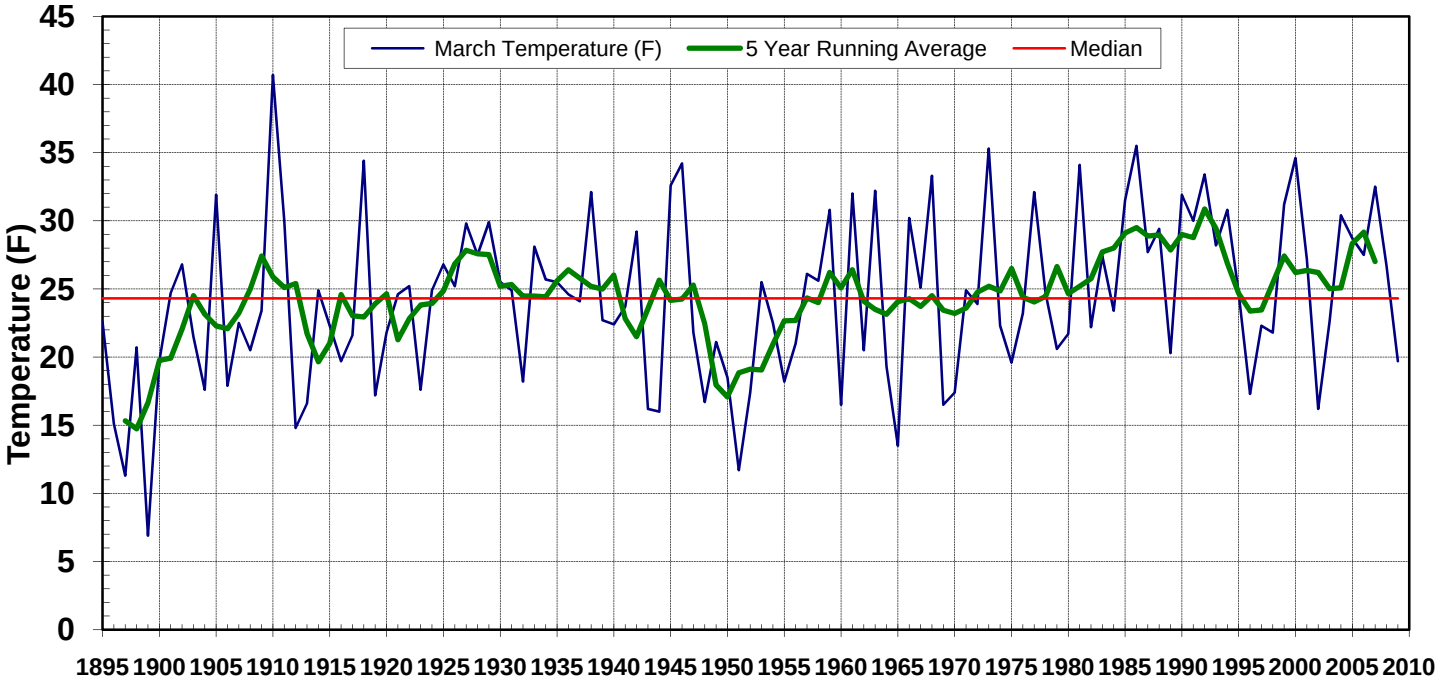


May Precipitation Statistics

2009 Amount: 1.53 **inches**
Maximum: 5.73 inches in 1927
State Normal: 2.31" (1971-2000)

Monthly Ranking: 28th Driest in 115 years
Minimum: 0.31 inches in 1901
Years in Record: 115

Historical March Temperature for North Dakota

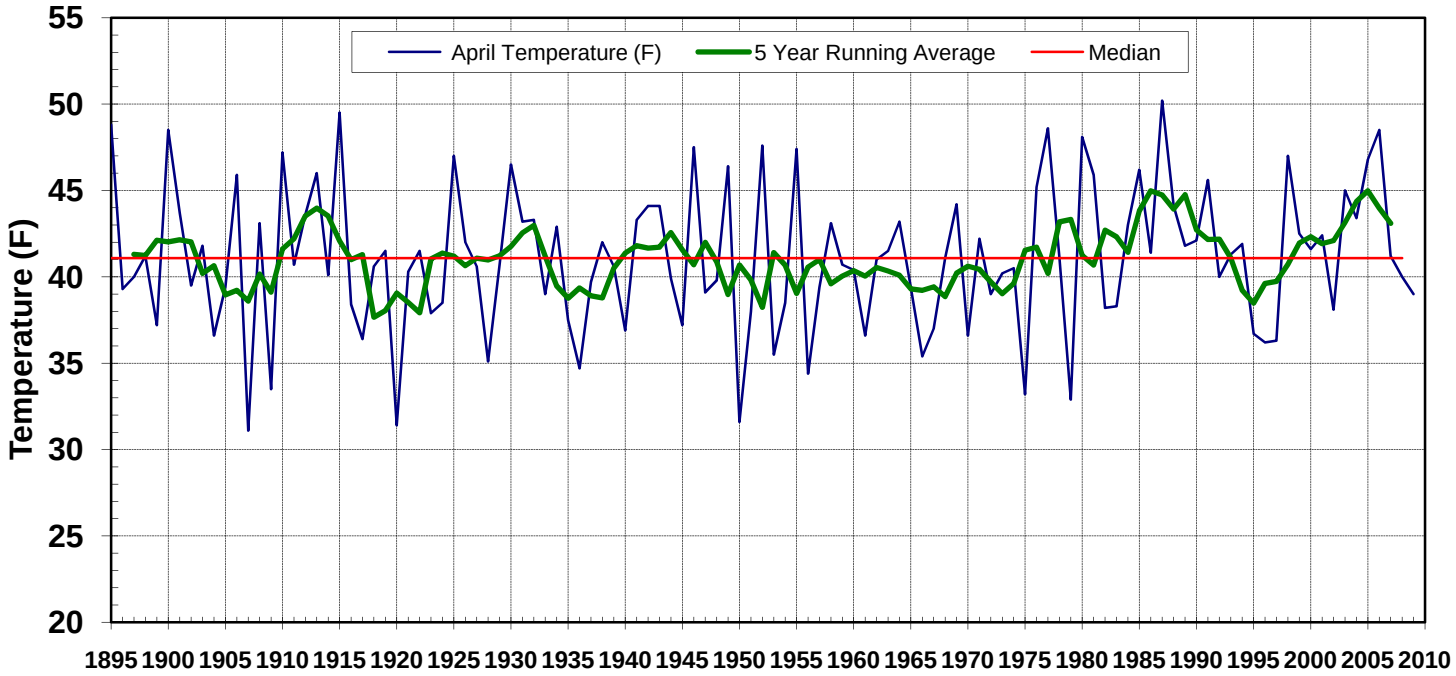


March Temperature Statistics

2009 Average: **19.7**°F
Maximum: 40.7°F in 1910
State Normal: 26.9°F (1971-2000)

Monthly Ranking: 26th Coolest in 115 years
Minimum: 6.9° F in 1899
Years in Record: 115

Historical April Temperature for North Dakota

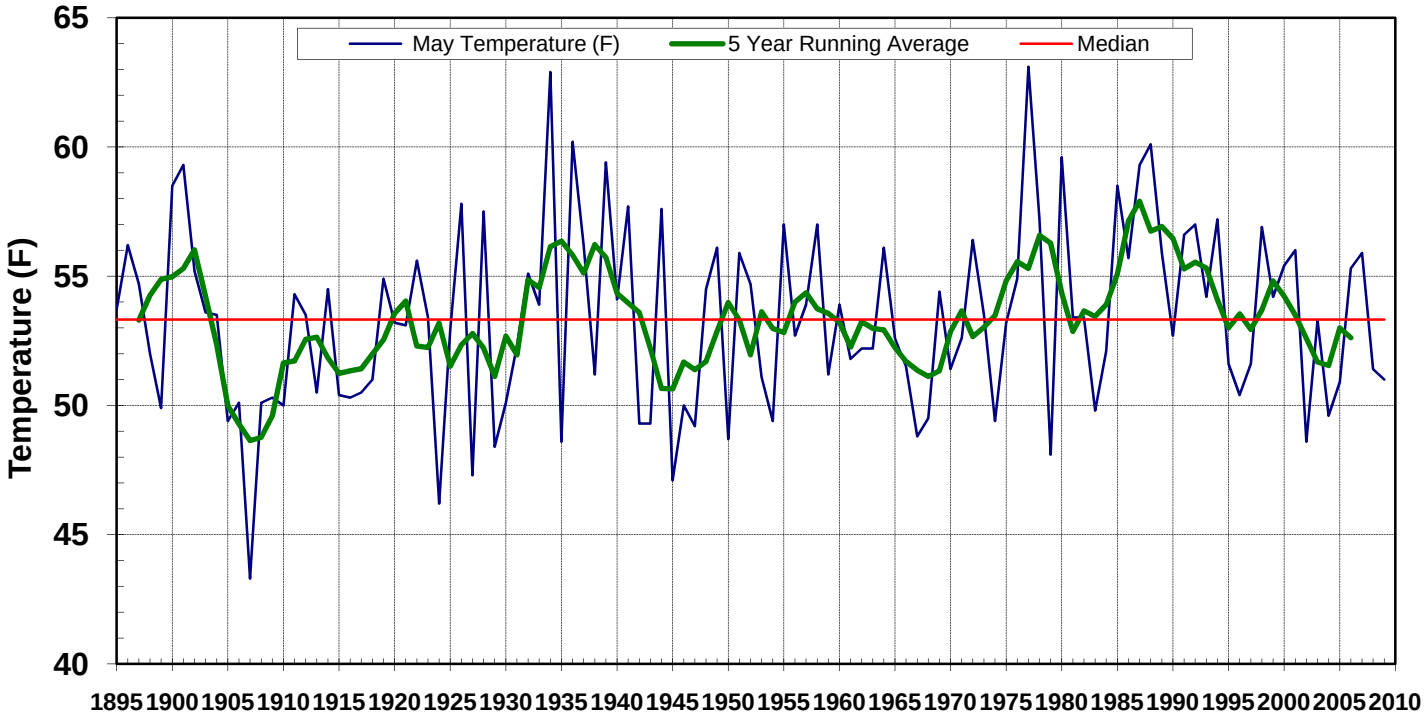


April Temperature Statistics

2009 Average: 39.0°F
Maximum: 50.2°F in 1987
State Normal: 41.7°F (1971-2000)

Monthly Ranking: 32nd Coolest in 115 years
Minimum: 31.1°F in 1907
Years in Record: 115

Historical May Temperature for North Dakota



May Temperature Statistics

2009 Average: **51.0°F**
Maximum: 63.1°F in 1977
State Normal: 54.8°F (1971-2000)

Monthly Ranking: 33rd Coolest in 115 years
Minimum: 43.3°F in 1907
Years in Record: 115

Storms & Record Events

State Tornado, Hail, and Wind Reports for Spring 2009

by B. A. Mullins

North Dakota 3 Month Total	Wind	Hail	Tornado
	5	4	0

Reports by Month			
Month	Wind	Hail	Tornado
Total March	1	0	0
Total April	0	0	0
Total May	4	4	0

North Dakota Record Event Reports for Spring 2009

Date	Location	Type of Record	Previous Record
03/10/09	Fargo	Snowfall of 6.5 inches.	5.0 inches in 1921.
03/10/09	Bismarck	Low maximum temperature of -1°F.	0°F in 1948.
03/10/09	Williston	Low maximum temperature of -4°F.	2°F in 1998.
03/11/09	Bismarck	Low maximum temperature of -1°F.	3°F in 1880 and 1956.
03/12/09	Jamestown	Low minimum temperature of -21°F.	-18°F in 1896.
03/22/09	Grand Forks AP	Rainfall of 0.54 inches.	0.37 inches in 1962.
03/22/09	Jamestown	Rainfall of 0.41 inches.	0.40 inches in 1952.
03/23/09	Grand Forks AP	Rainfall of 0.46 inches.	0.37 inches in 1964.
03/23/09	Fargo	Rainfall of 0.90 inches.	0.64 inches in 1994 and 1975
03/23/09	Jamestown	Rainfall of 0.72 inches.	0.40 inches in 1975.
03/24/09	Grand Forks AP	Rainfall of 0.61 inches.	0.51 inches in 1949.
03/24/09	Bismarck	Snowfall of 7.9 inches.	7.5 inches in 1914.
03/24/09	Bismarck	Liquid equivalent of 0.78 inches.	0.75 inches in 1914.
03/25/09	Grand Forks AP	Rainfall of 0.22 inches.	0.18 inches in 1977.
03/28/09	Fargo	Record Red River Crest of 40.82 feet.	40.1 feet on April 7, 1897.
03/30/09	Bismarck	Liquid equivalent of 0.62 inches.	0.56 inches in 2007.
03/30/09	Bismarck	Snowfall of 11.8 inches.	1.8 inches in 1916.
03/30/09	Fargo	Snowfall of 5.8 inches.	2.8 inches in 1977.
03/31/09	Fargo	Snowfall of 4.6 inches.	3.4 inches in 1962.
03/31/09	Fargo	Liquid equivalent of 0.60 inches.	0.50 inches in 2007.
03/2009	Fargo	March snowfall of 28.1 inches.	26.2 inches in 1997.
03/2009	Fargo	March precipitation of 4.62 inches.	2.83 inches in 1882.
04/29/09	Minot	Precipitation of 0.8 inches.	0.43 inches in 1967.
05/16/09	Williston	Low temperature of 21°F.	23°F in 1925.
05/21/09	Williston	Low temperature of 26°F.	Ties record in 1931.

Seasonal Outlook

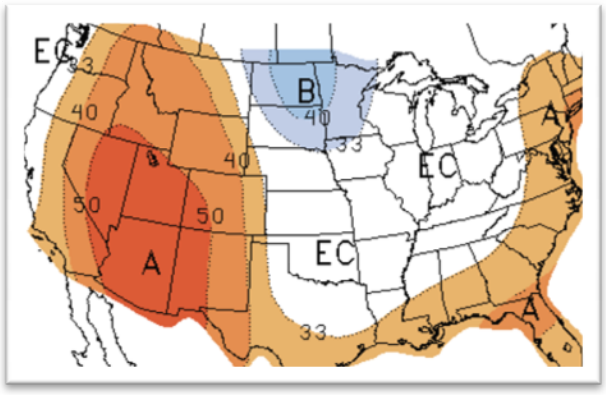
Spring Climate Outlooks

by M. Ewens[1]

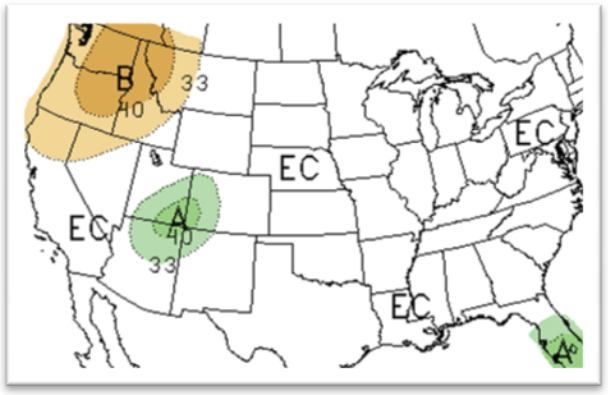
After a colder than normal winter and spring season, area residents, ranchers and farmers in particular, are looking toward nature for warmer and drier weather. Unfortunately, the summer season has started out with the same cold pattern, and no significant changes in sight.

Although the La Nina has ended and Equatorial Sea Surface Temperatures have returned to normal, the affects of the colder than average ocean water will influence the weather through the summer.
Typically, the summers that follow a La Nina are cooler and wetter, on balance, than the long term average.

The official outlook for the spring months of June – August 2009 is presented below. The Climate Prediction Center (CPC) indicates there are equal chances for normal, above or below normal precipitation over the northern plains. Unfortunately, the CPC indicates a statistically significant chance that the summer season will average out cooler than normal.



3-Month Temperature Outlook (June-August)



3-Month Precipitation Outlook (June-August)

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/OUTLOOKS_index.shtml

North Dakota State Climate Office has links to National Weather Service's local 3-month temperature outlooks into the fall of 2009. Those outlooks can be accessed from the following web site for your location:
http://www.ndsu.nodak.edu/ndsu/ndsco/outlook/L3MTO.html

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: Mark Ewens is the Data Acquisition Program Manager and the Climate Services Focal Point at the NOAA's National Weather Service, Weather Forecast Office in Grand Forks, ND. E-Mail: Mark.Ewens@noaa.gov

Hydro-Talk

North Dakota Flood of 2009

by A. Schlag[2]

Hydrologists do not often associate flooding with climate as several of the factors that contribute to flooding are generally much shorter weather events. However, the severe winter of 2008-2009 experienced over most of North Dakota was a major driving factor behind this spring's record flooding in many locations.

The effects of a lengthy weather pattern that lasts several days to a couple weeks and a longer-term climate pattern are not always clear as the differences are somewhat arbitrarily set in the length of the event. However, one can reasonably infer that this year's winter was sufficiently long and severe enough to qualify as a climatic event that did affect the spring flooding. Figure 1 below is showing water equivalent of the snow on the ground as of March 12. The graphic is indicating that, a wide band extending from Northwest to Southeast containing up to eight inches of water waiting to melt.

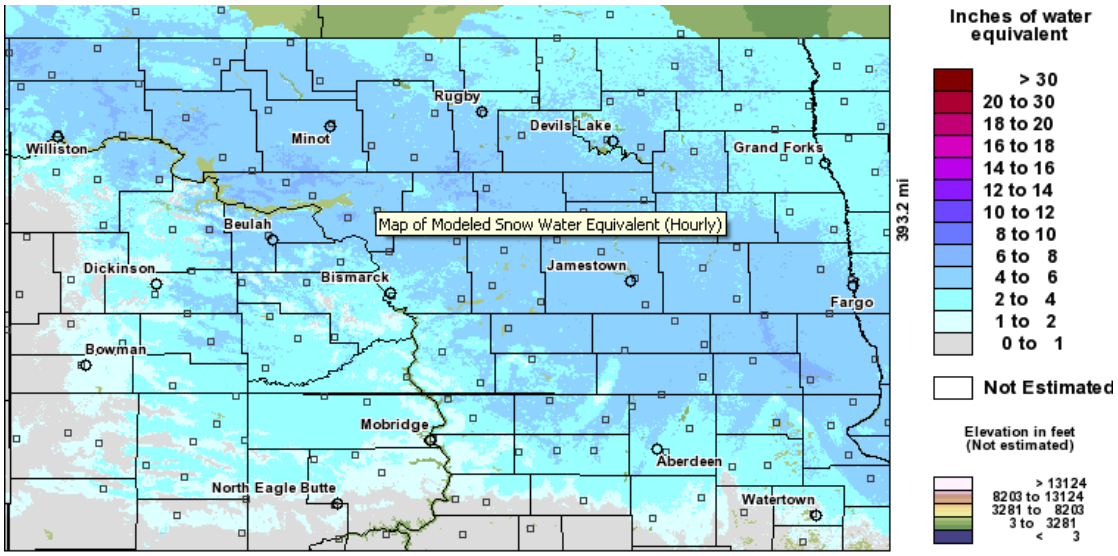


Figure 1. Modeled snow-water equivalent for North Dakota on March 12, 2009.

With the initial severity of the snow season, as early as late December and with regular frequency during January and February, my telephone began ringing from people wanting to discuss the likelihood of flooding during the spring melt. My initial response back then was one of it is clearly too early to know if the snowy winter would continue, if a brief warm spell would remove some of the water in the basins, or if the spring melt would be a slow non-event as it was still more than two months away. As time wore on and the early months of 2009 were more in keeping with normal snowfall, I remained unalarmed even though the probabilities for flooding were starting to creep upward with the models. With the first half of March being snowy and cold, the probability of flooding went up virtually daily as we entered the normal beginning of

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the melting season being below normal in temperature and far above normal in standing moisture. This is when I began to really get alarmed as the cool and wet period extended past what is normally the beginning of the spring melt and that meant that any warming trend could result in a significant temperature shift that would bring on a rapid melt.

Around the middle of March a brief warm spell came with rain across some areas of the state which literally caused the snowpack to start to rapidly disappear. This caused rapid runoff leading to tremendous overland flooding in many areas and rapid rises to flood stage on nearly all river gages monitored by the Bismarck office of the National Weather Service. Thankfully, Mother Nature gave us a bit of reprieve with another fairly cold spell towards the end of March that literally froze runoff in several watersheds in place and allowed those areas to release the water much slower. Regrettably though, this reprieve was short-lived as enough water-equivalent remained to again send many rivers above flood stage again in April.

Perhaps the single largest beneficiary of this alternating warm, cold, then warm again cycle was the upper Souris River (Mouse River), Apple Creek, and Little Muddy Creek watersheds. All of these systems had runoff rates tempered by the cold and dry entry into April.

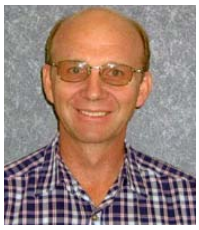
The best way to summarize the difference between the climate and weather driven factors that affected flooding in North Dakota this year is: The lengthy wet winter primed the area for substantial flooding, but the cool and dry weather in April (Bismarck for example was 2.1 degrees and 0.77 inches below normal for temperature and moisture respectively) spared many areas an even worse flood season.

The several years of drought going into this winter had many of the reservoirs, lakes, and prairie potholes very low. This is no longer the case as Lake Oahe and the prairie potholes are now full, Lake Sakakawea is now in its "normal" operating levels and the reservoirs behind Jamestown and Pipestem dams will continue to be above normal for several weeks as they continue to hold back flood waters that are being released slowly to avoid even more flooding downstream of Jamestown.

The spring flooding of 2009 has supplanted the flood of 1997 in many people's memory as the Grand Daddy of them all and will be long remembered. Thankfully, there were no direct flood related deaths although over 200 injuries and sadly, two deaths have been reported related to fighting the flooding.

The Bismarck National Weather Service Forecast Office: www.weather.gov/bis
The Grand Forks National Weather Service Forecast Office: www.weather.gov/fgf

Science Bits



Cool Spring Weather-What is it good for?

by J.K. Ransom[3]

Cool spring weather is good news for small grains, but worrisome for corn. This spring has turned out to be the 21st coldest springs in the recorded history since 1895. Like much of the recent economic downturn, global warming seems to have missed North Dakota! The cooler temperatures are good news for the small grain crops, including and especially those that were planted later than is considered optimal. Cool weather favors more tillering and the development of larger spikes in wheat and barley. Potential spike size and potential tiller numbers are "fixed" in the plant before the 5-6 leaf stage, so the current cold weather should add a few bushels of yield potential to these cool season crops. In fact our current weather is nearly ideal for small grain development. Protecting and maintaining this higher yield potential will be the challenge in the weeks ahead. Hot and dry weather during flowering, scab and foliar diseases are worries as we look to the rest of the growing season.

For corn, on the other hand, cool spring weather is worrisome. Cool weather does not necessarily reduce yield potential in corn. What concerns us is that corn development is delayed. Since we need every growing degree day (GDD) we can get to mature and dry our corn in ND, delayed development means that the corn crop may be immature, have low test weight and most assuredly have more moisture at harvest than is desired. We only have to look to last year to remember the impact of a cool growing season on corn. In this article my intent is to compare the corn growing degree day accumulations this spring with those of other years since 2000 and for the same years determine if there is a relationship between GDD accumulations in the spring and GDD accumulations for the entire corn growing season (May 1 through October 1).

This year corn GDDs, assuming a May 1st planting date, range from 207 in Landon to 327 in Fargo and are lagging behind normal by 86 to 169 GDD (Table 1). When considering normal GDDs from May 1st to October 1st, this deficit represents about 5% of the total growing season's GDD. This spring is coolest (largest negative departure from normal) of any year for the period analyzed since 2000.

Table 2. Corn GDD accumulations for May 1 to June 9, 2009, departures from normal for this period and total GDDs May 1st to October 1st, for selected locations in ND.

	GDDs May 1 to June 8	Departures from normal GDDs, May 1 to June 8	Normal GDDs May 1 to October 1
Carrington	280	-169	2281
Dickinson	298	-86	2183
Fargo	327	-103	2348
Langdon	207	-130	1770
Minot	291	-92	2007

Weather is hard to predict, but often follows trends. This spring I have been asking myself, does this cool spring weather mean that we will end up with a short season, or might we catch up in

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GDDs as the season progresses? To answer this question, I analyzed the departures from normal of GDD accumulations for the spring and for the entire season since 2000 to see if there might be any obvious trends (Table 2). I averaged data for the five locations included in Table 1 to give a more statewide picture. The first thing to note from these data is that eight of the last ten springs have been cooler than normal (had negative departures from normal); six of those negative departures were greater than -60 GDDs. Only two (2004 and 2008) of the past nine years, however, have been cooler than normal seasons. Unfortunately, those two seasons started with the coldest springs of the years analyzed with the exception of this year. Before we despair, there have been a couple of years, 2002 and 2006 where the year started out cool but ended up warmer than normal. Moreover, the fact that only two of the last nine seasons have been cooler than normal should also give us some hope. This analysis suggests to me that there is a fairly high probability that this season will be cooler than normal. It does not close the door, however, on things improving later in the summer and we end up with a reasonable season for corn. Let's hope for the latter.

Table 3. Departures from normal GDD accumulations for early in the season and the full season for the years 2000-2009.

	Departures from normal GDD accumulations for the period	
Year	May 1-June 9	May 1 – Oct 1
2000	-8	15
2001	15	108
2002	-70	87
2003	-76	37
2004	-98	-350
2005	-66	18
2006	51	200
2007	-8	151
2008	-92	-87
2009	-116	?

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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