North Dakota Climate Bulletin

Spring 2010

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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 warmer and wetter spring following a cooler and wetter winter. Despite the overall wet trend, March was unusually dry. A snowless March in the Fargo-Moorhead area alleviated major flooding in the Red River. The river gauge at Fargo reached its highest stage of 36.99 feet (nearly 7 feet over the major flood category marking) on March 21. It was the first time three back-to-back major floods were observed in the recorded history for Fargo. Temperature-wise, this spring was the 15th warmest since 1895. Precipitation-wise, it was the 16th wettest winter since 1895. This year, North Dakota won the CoCoRaHS March Madness cup by recruiting the most observers per population. Currently, 132 volunteer observers representing 28 counties are actively reporting daily precipitation data in North Dakota. The total precipitation amounts as a percentage of the normal and average temperature departure from normal are shown on pages 6 through 8 (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

March 2010

The state average precipitation was 0.76 inches which is below the 1971-2000 normal of 0.80 inches. March 2010 state average precipitation ranked 62nd driest in the last 116 years with a maximum of 2.72 inches in 1902 and a minimum of 0.09 inches in 1930.

The north and western regions generally had from 0.1 to 1 inch of total March precipitation. The south central and southeast had from 1 to 2 inches of total precipitation. The north and western areas of the state had below normal precipitation. The south central and southeast had above normal precipitation ranging from 100 to 300% of normal. The majority of March precipitation fell from the 9th through the 12th. During the second half of March, moderate to major flooding from snowmelt occurred in the central and eastern parts of the state. The Red River crested at 46.07 feet (0.07' above the major flood stage) in Grand Forks on the 20th. At Fargo, the Red River crested on the 21st with 36.99 feet (6.99' above the major flood stage).

The National Weather Service (NWS) recorded breaking daily total precipitation records on the 9th at Grand Forks airport with 0.52 inches which broke the previous record of 0.25 inches set in 1993. Record breaking daily total precipitation was also recorded on the 10th at Jamestown with 0.56 inches, Dickinson with 0.08 inches, Grand Forks airport with 0.31 inches, Grand Forks NWS with 0.37 inches, and Fargo with 0.65 inches. March records are listed in the Storm and Record Events section of this bulletin.

The US Drought Monitor March 30, 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 0.60 inches on March 28. Road conditions were rated 89% open, 6% difficult, 5% closed with 1% drifted, 21% muddy, and 78% dry (Weekly Weather and Crop Bulletin Vol. 97, No. 13).

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

The top five March daily maximum wind speeds recorded from NDAWN were 40.1 mph on the 26th at Britton SD, 39.7 mph on the 18th at Turtle Lake, 39.4 mph on the 18th at Bowbells, 39.4 mph on the 18th at McHenry, and 38.3 mph on the 18th at Berthold. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 30.9°F which is above the 1971-2000 normal of 26.87°F. March 2010 state average air temperature ranked 20th warmest in the past 116 years with a maximum of 40.7°F in 1910 and a minimum of 6.9 °F in 1899.

March average monthly temperatures ranged from 28°F to 35°F. Average monthly temperatures of 28°F to 31°F covered the northern and western regions. The southeast and western edge had

average monthly temperatures of 32°F to 35°F. The central western part of the state had near normal to 4°F below normal average air temperatures. The remainder of the state had near normal to 8°F above normal average air temperatures. Daily average air temperatures started below normal and rose to near normal in the first few days of March. The temperatures continued as near normal and above for the rest of the month except for the 19th and 25th when temperatures were below normal.

The NWS recorded record high temperatures on the 29th in Williston with 71°F and on the 30th at Jamestown with 74°F.

NDAWN's highest recorded daily air temperature for March was 73.4°F at Mandan on the 30th. The lowest recorded daily air temperature was -11.0°F at Carrington on the 1st.

April 2010

The state average precipitation was 1.51 inches which was above to the 1971-2000 normal state average of 1.40 inches. April 2010 state average precipitation ranked the 40th wettest in the past 116 years with a maximum of 3.86 inches in 1896 and a minimum of 0.11 inches in 1987.

Monthly precipitation totals were 1.5 to 3.75 inches in the central and southeast corner of the state with less than an inch falling elsewhere. Percent of normal monthly precipitation was 150% to 300% of normal in the central part of the state. The southwest and southeast corners also had above normal precipitation. The western and eastern parts of the state had below normal precipitation. Most days in April were dry. The primary daily rainfall events happened from the 1st to the 3rd, 12th and 13th, and scattered showers across the state from the 22nd to the end of the month. The April 1st and 2nd severe storm event produced freezing rain, ice and heavy snow in the central part of the state. The storm caused thousands of residents to lose power. The President declared the storm a major disaster which released federal funds to be used by 12 counties and the Standing Rock Sioux Indian Reservation to repair the damage. The eastern part of the state continued with mild spring weather that produced only a trace or no snow throughout April.

The National Weather Service (NWS) reported breaking both a rainfall and snowfall record at Bismarck on the 2nd with 1.15 inches of rain and 5 inches of snow breaking the previous records of 0.51 set in 1986 and 3.2 set in 1911, respectively.

The US Drought Monitor May 4, 2010 report had no drought conditions reported in the state.

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 0% very short, 3% short, 83% adequate, and 14% surplus with a subsoil moisture reported as 0% very short, 1% short, 87% adequate, and 12% surplus (Weekly Weather and Crop Bulletin Vol. 97, No. 18).

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), severe weather reports for April had one report of high wind, 6 hail reports, and no reported tornadoes. All of these severe weather reports occurred on the 12th and 13th.

The top five April daily maximum wind speeds recorded from NDAWN were 58.7 mph at Watford City on the 28th, 54.4 mph at Linton on the 28th, 54.1 mph at Linton on the 13th, 52.6 mph at Dazey on the 28th, and 52.6 mph at Wishek on the 13th. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 46.9°F which is above the 1971-2000 normal of 41.71°F. April 2010 state average air temperature ranked the 14th warmest in the past 116 years with a maximum of 50.2°F in 1987 and a minimum of 31.1°F in 1907.

April average monthly temperatures ranged from 41°F to 52°F with the higher temperatures in the southeast and the lower temperatures in the northwest. The average departure from normal temperatures were primarily above normal across the state with a range of -2 to 10. The eastern half of the state had monthly departures of 4°F and greater. The western half of the state had near normal and slightly above normal monthly temperatures. The daily average air temperatures were near or above normal throughout most of the month. The last few days of the month had cooler than normal daily air temperatures. The mild April temperatures allowed producers to get in their fields two weeks earlier than the previous year. The USDA, National Agricultural Statistics Service, North Dakota Field Office reported the statewide average starting date for fieldwork was April 18.

NDAWN's highest recorded daily air temperature for April was 85.6°F at Watford City on the 29th. The lowest recorded daily air temperature was 14.6°F at Ross on the 11th.

May 2010

The state average precipitation was 4.20 inches which is above the 1971-2000 normal of 2.31 inches. May 2010 state average precipitation ranked 10th wettest in the past 116 years with a maximum of 5.73 inches in 1927 and a minimum of 0.31 inches in 1901.

Monthly precipitation totals ranged from 2 to 7 inches. The higher amounts from 5 to 7 fell in the northeast and east central regions with 2 to 4 inches falling elsewhere. Total precipitation was above normal for most of the state and ranged primarily from 50% to 300% of normal. The first half of the month had lighter scattered rainfall and a snowfall event. Snow fell in the southwest and central regions on the 7th with totals ranging from 8 inches in the southwest to 2 inches in the central region. The second half of the month had widespread heavy rains and thunderstorms. A major thunderstorm on the 24th produced hail and damaging high winds in the central, northeast, and southwest parts of the state. Tornadoes were reported on the 24th in Sioux and Morton counties.

The National Weather Service (NWS) reported record rainfall on the 7th at Fargo, on the 22nd at Grand Forks and Minot, on the 24th at Grand Forks, Jamestown, Dickinson, Minot, and Williston, and on the 27th at Minot.

The US Drought Monitor June 1, 2010 report had no drought conditions reported in the state.

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 0% very short, 1% short, 77% adequate, and 22% surplus with a subsoil moisture reported as 0% very short, 2% short, 78% adequate, and 20% surplus (Weekly Weather and Crop Bulletin Vol. 97, No. 22).

According to the preliminary reports of the National Weather Service's Storm Prediction Center (SPC), severe weather reports for May had 28 reports of high wind, 28 hail reports, and 4 reported tornadoes. The greatest majority of the events happened on the 24th.

The top five May daily maximum wind speeds recorded from NDAWN were Linton on the 22nd with 59.8 mph, Bowman on the 4th with 58.7 mph, Linton on the 4th with 58.7 mph, Rugby on

the 24th with 58.4 mph, and Turtle Lake on the 25th with 57.3 mph. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 51.9°F which is below the 1971-2000 normal of 54.80°F. May 2010 state average air temperature ranked the 44th coolest in the past 116 years with a maximum of 63.10°F in 1977 and a minimum of 43.30 °F in 1907.

May average monthly air temperatures ranged from 48°F to 58°F with the lower temperatures in the west and higher temperatures in the east. The average May temperatures were near normal in the east and below normal in the west with departure from normal temperatures ranging from 1°F to -5°F. Daily air temperatures were below normal in the first half of the month. The second half of the month had near normal daily temperatures with the last few days having above normal temperatures. The NWS recorded record high temperatures on the 29th at Grand Forks airport with 93°F and Fargo with 95°F.

NDAWN's highest recorded daily air temperature for May was 95.5°F at Hillsboro on the 29th. The lowest recorded daily air temperature was 19.9°F at Bottineau on the 8th.

Season in Graphics

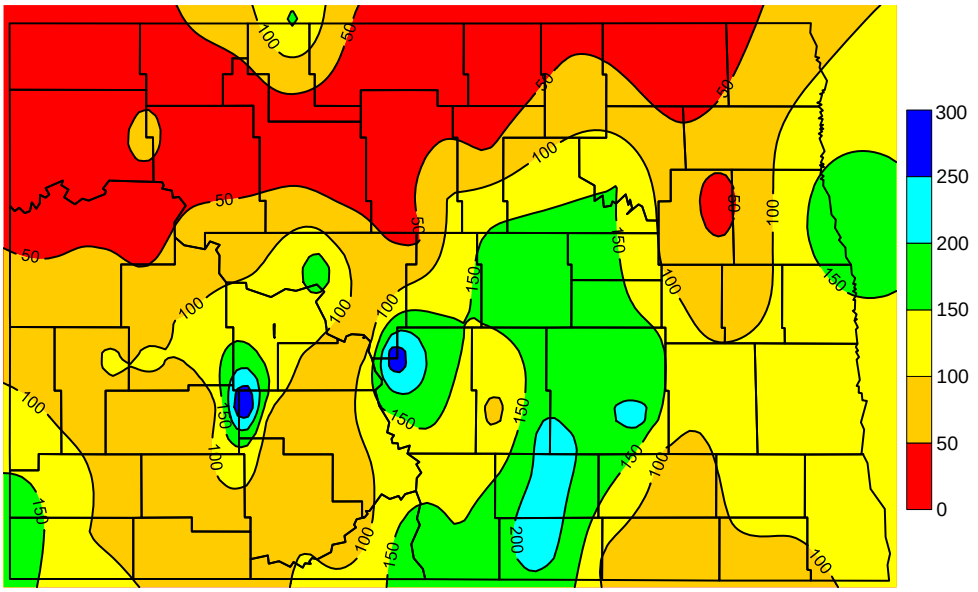
Spring 2010 Weather in North Dakota:

March 2010

Total Precipitation percent of mean (1971-2000)

Precipitation Percent of Normal

(Data from NWS Cooperative Network)



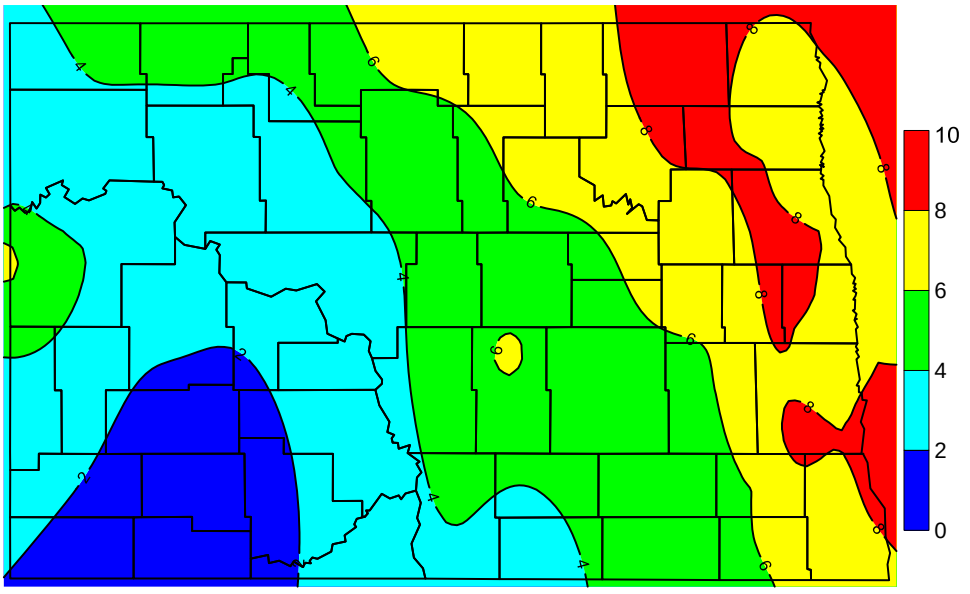
North Dakota State Climate Office

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

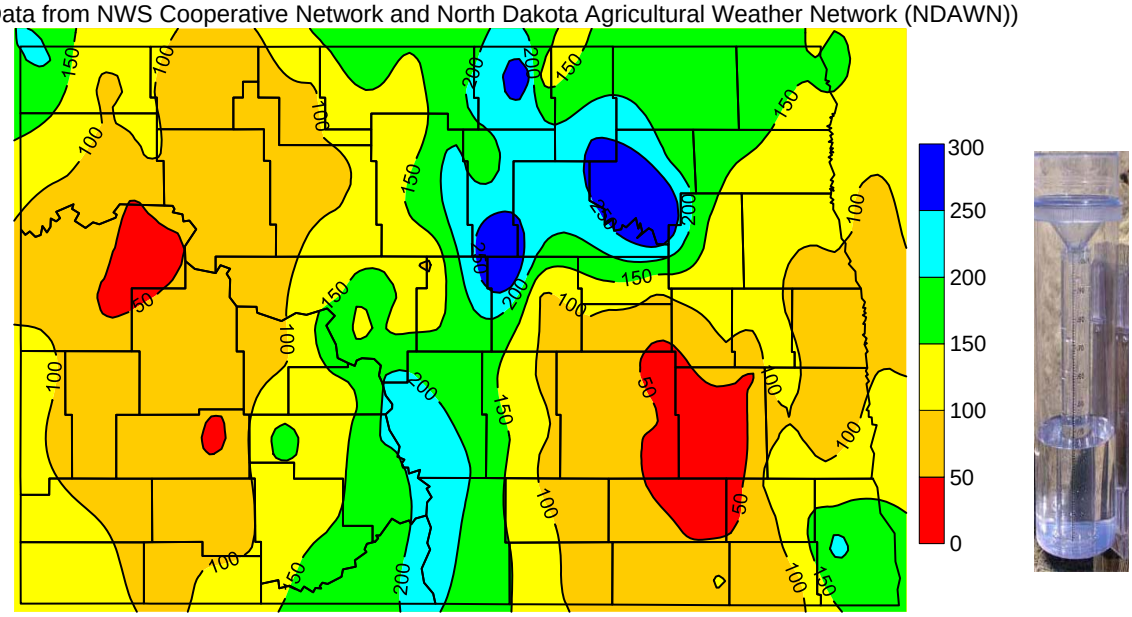
April 2010

Spring 2010 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))

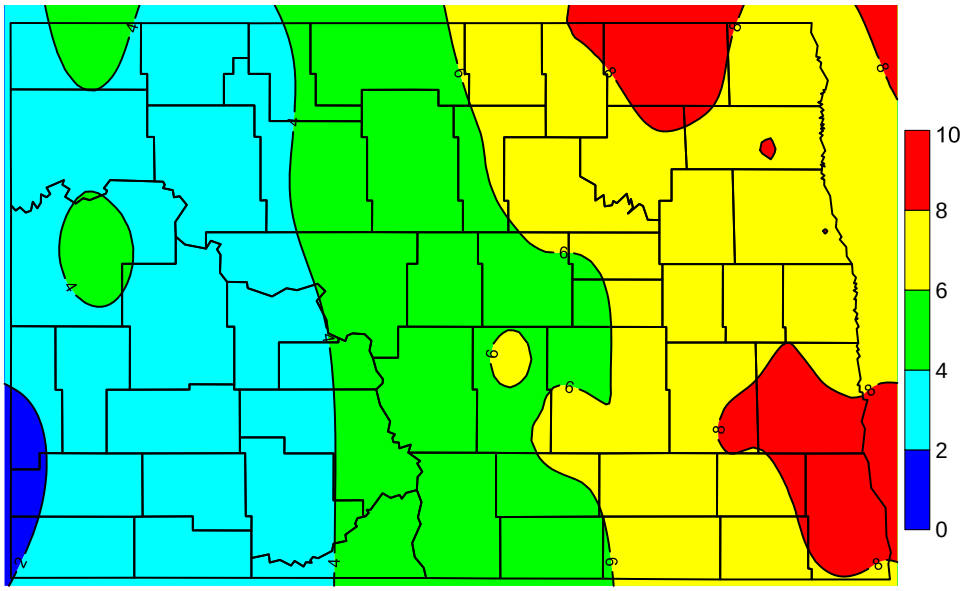


North Dakota State Climate Office

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

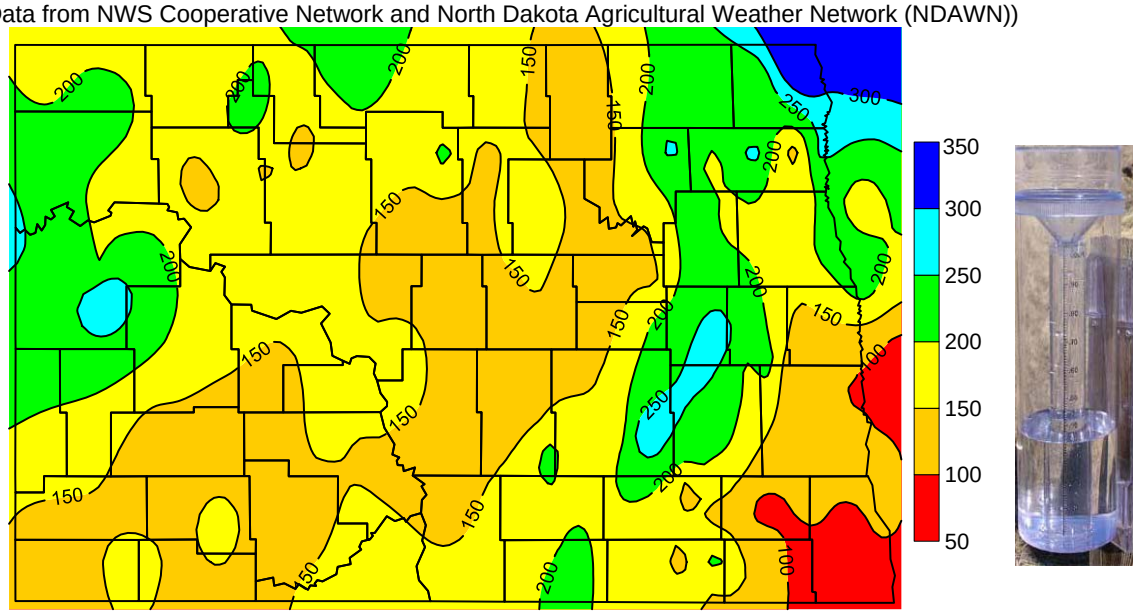
Spring 2010 Weather in North Dakota:

May 2010

Total Precipitation percent of mean (1971-2000)

Precipitation Percent of Normal

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

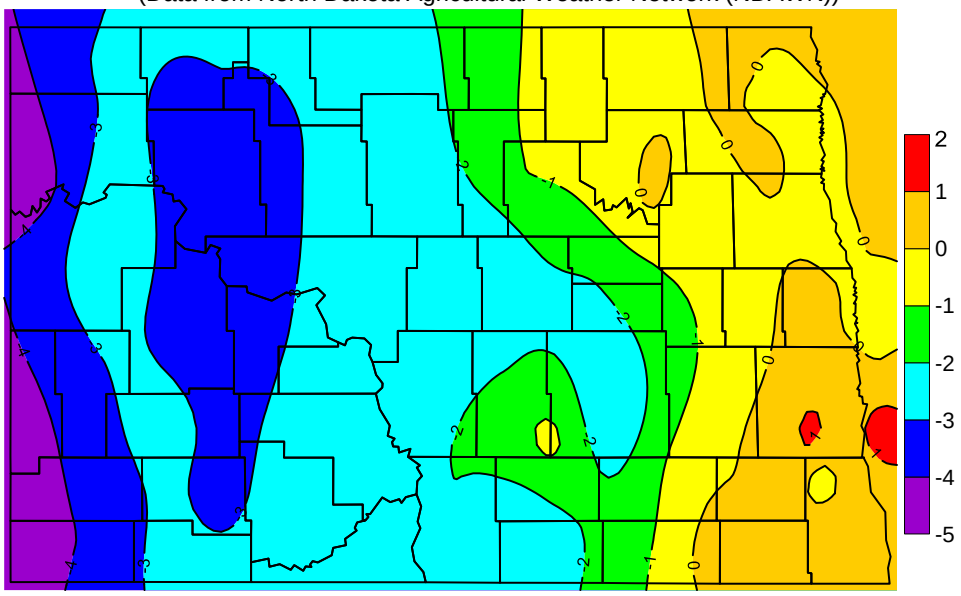


North Dakota State Climate Office

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

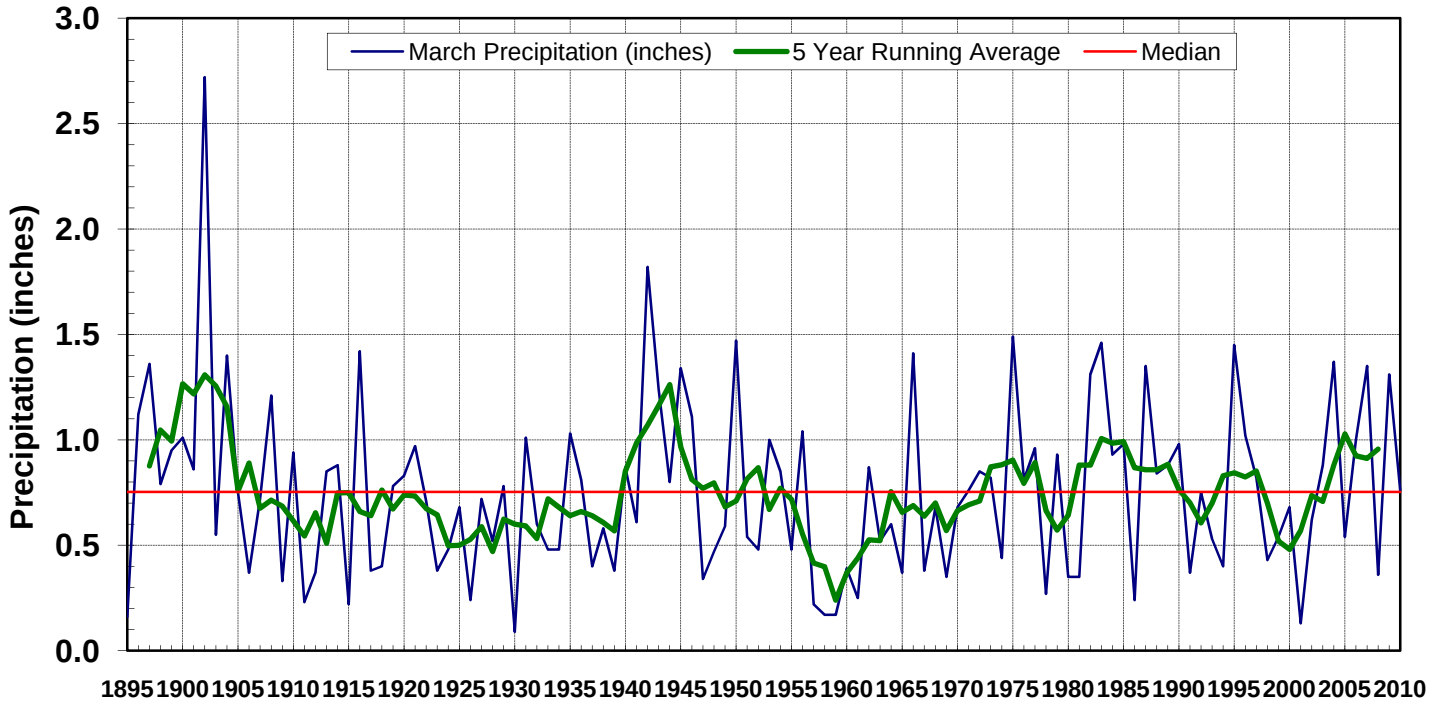
Departure From Normal Monthly
Average Air Temperature in degrees F

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



North Dakota State Climate Office

Historical March Precipitation for North Dakota

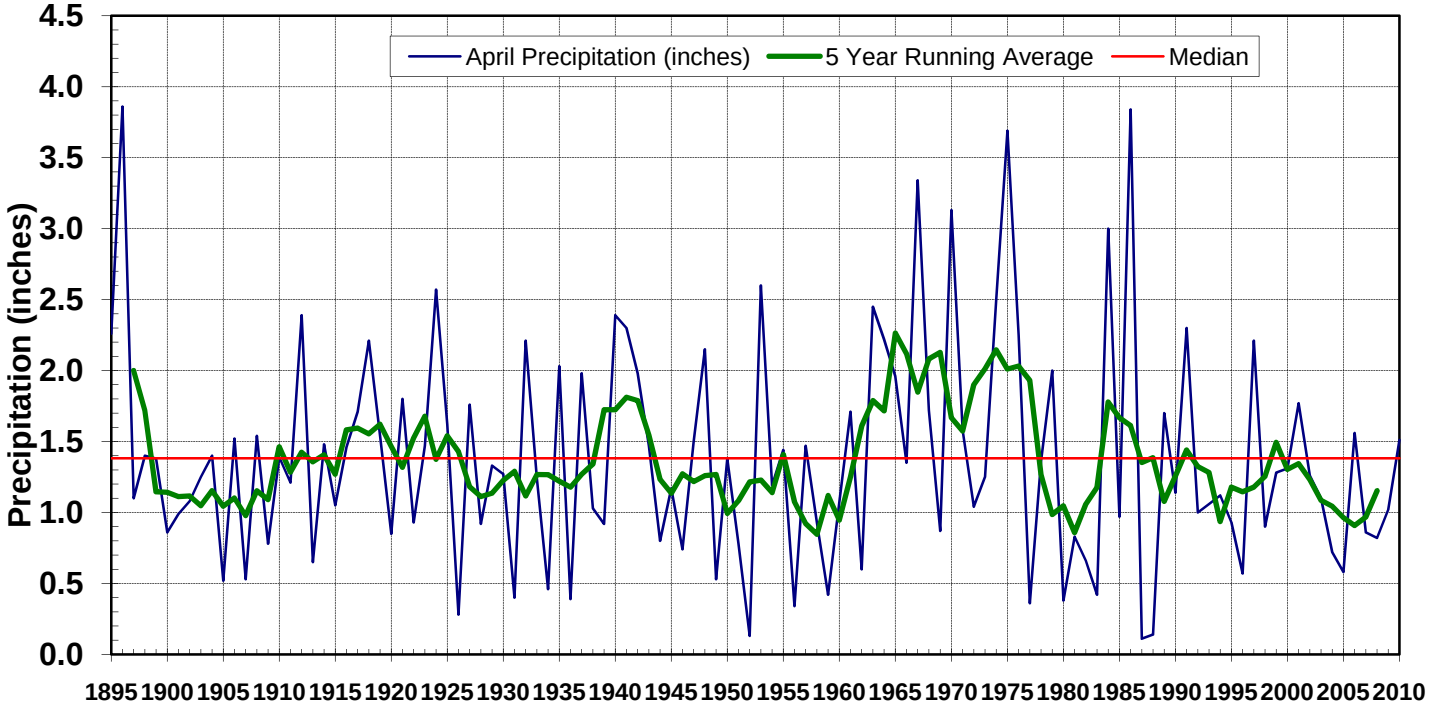


March Precipitation Statistics

2010 Amount: **0.76 inches**
Maximum: 2.72 inches in 1902
State Normal: 0.80” (1971-2000)

Monthly Ranking: 62nd Driest in 116 years
Minimum: 0.09 inches in 1930
Years in Record: 116

Historical April Precipitation for North Dakota

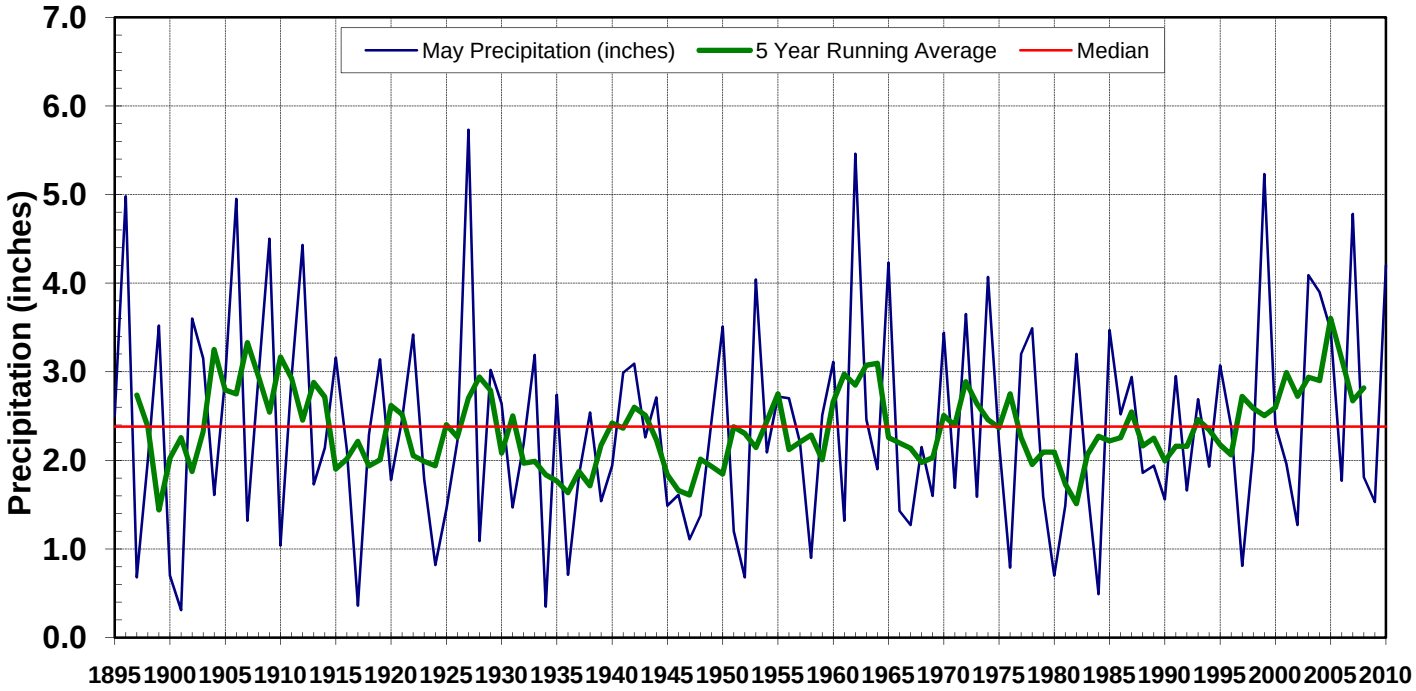


April Precipitation Statistics

2010 Amount: 1.51 inches
Maximum: 3.86 inches in 1896
State Normal: 1.40” (1971-2000)

Monthly Ranking: 40th wettest in 116 years
Minimum: 0.11 inches in 1987
Years in Record: 116

Historical May Precipitation for North Dakota

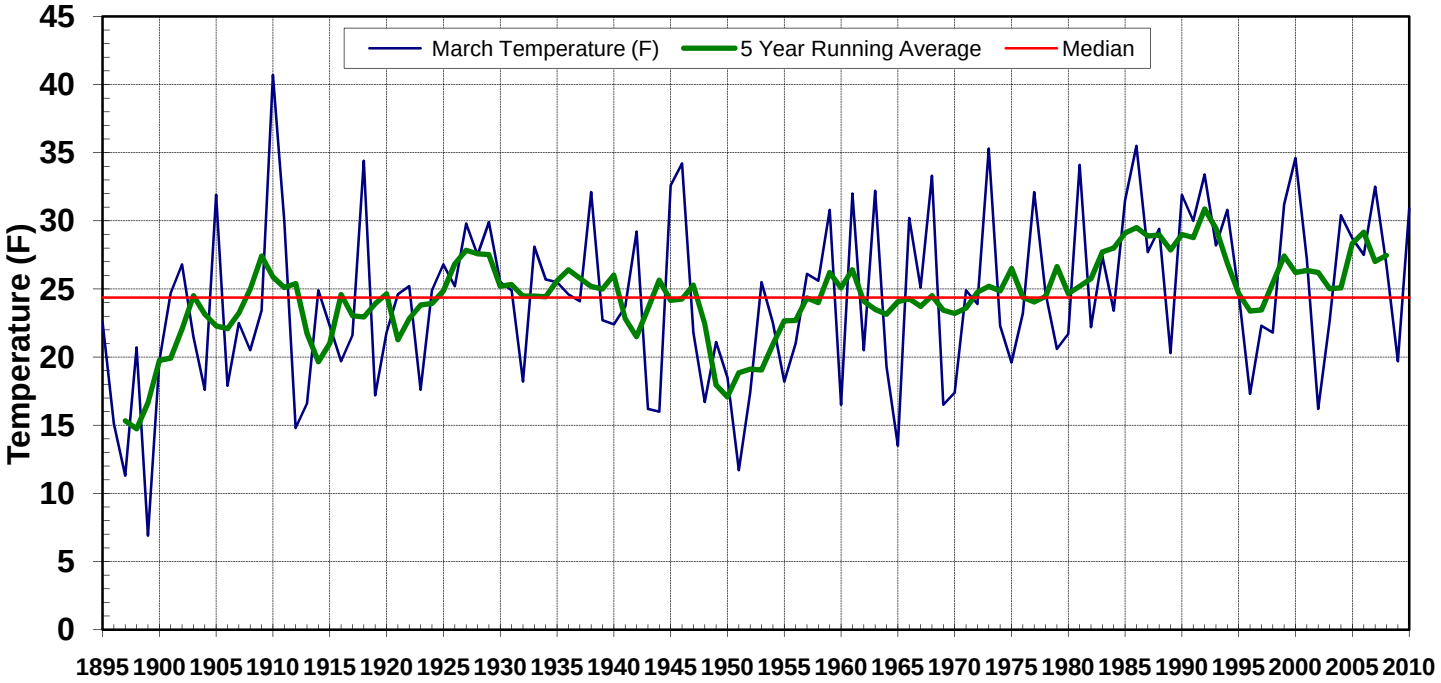


May Precipitation Statistics

2010 Amount: 4.20 **inches**
Maximum: 5.73 inches in 1927
State Normal: 2.31" (1971-2000)

Monthly Ranking: 10th wettest in 116 years
Minimum: 0.31 inches in 1901
Years in Record: 116

Historical March Temperature for North Dakota

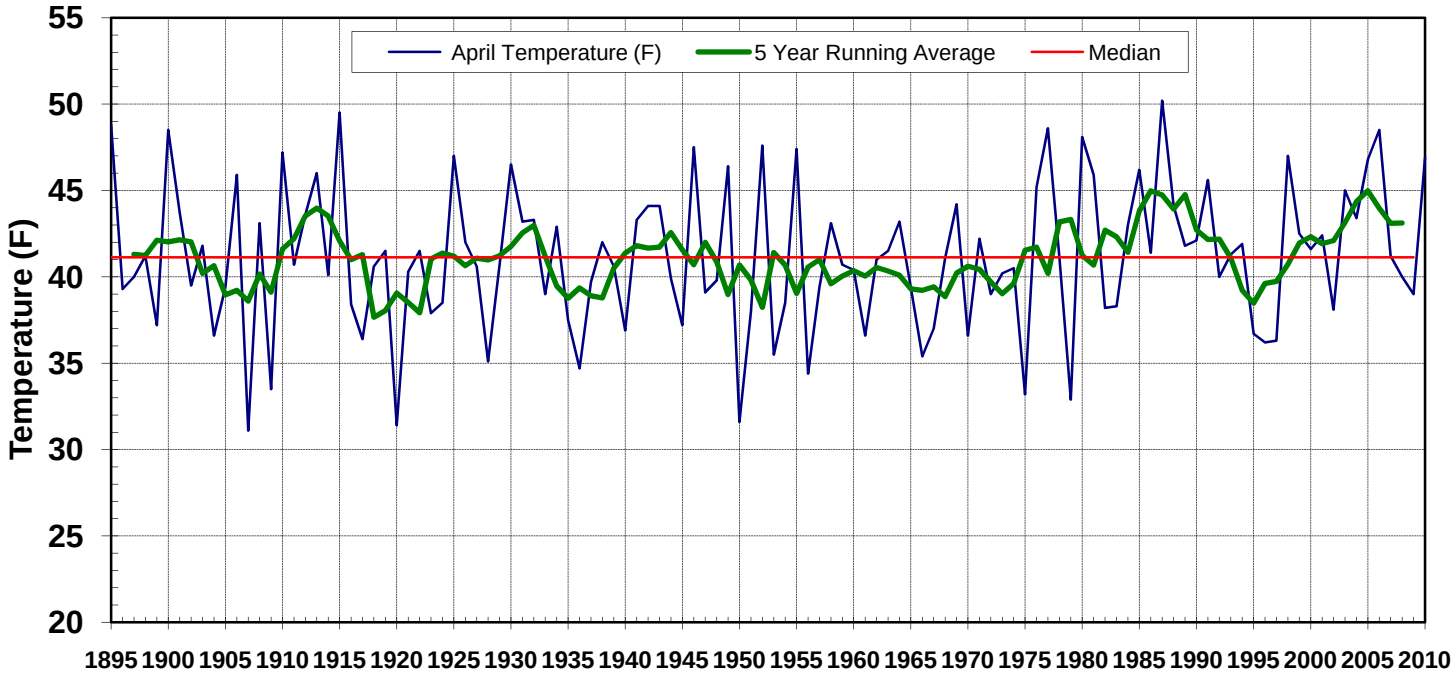


March Temperature Statistics

2010 Average: **30.9**°F
Maximum: 40.7°F in 1910
State Normal: 26.87°F (1971-2000)

Monthly Ranking: 20th Warmest in 116 years
Minimum: 6.9° F in 1899
Years in Record: 116

Historical April Temperature for North Dakota

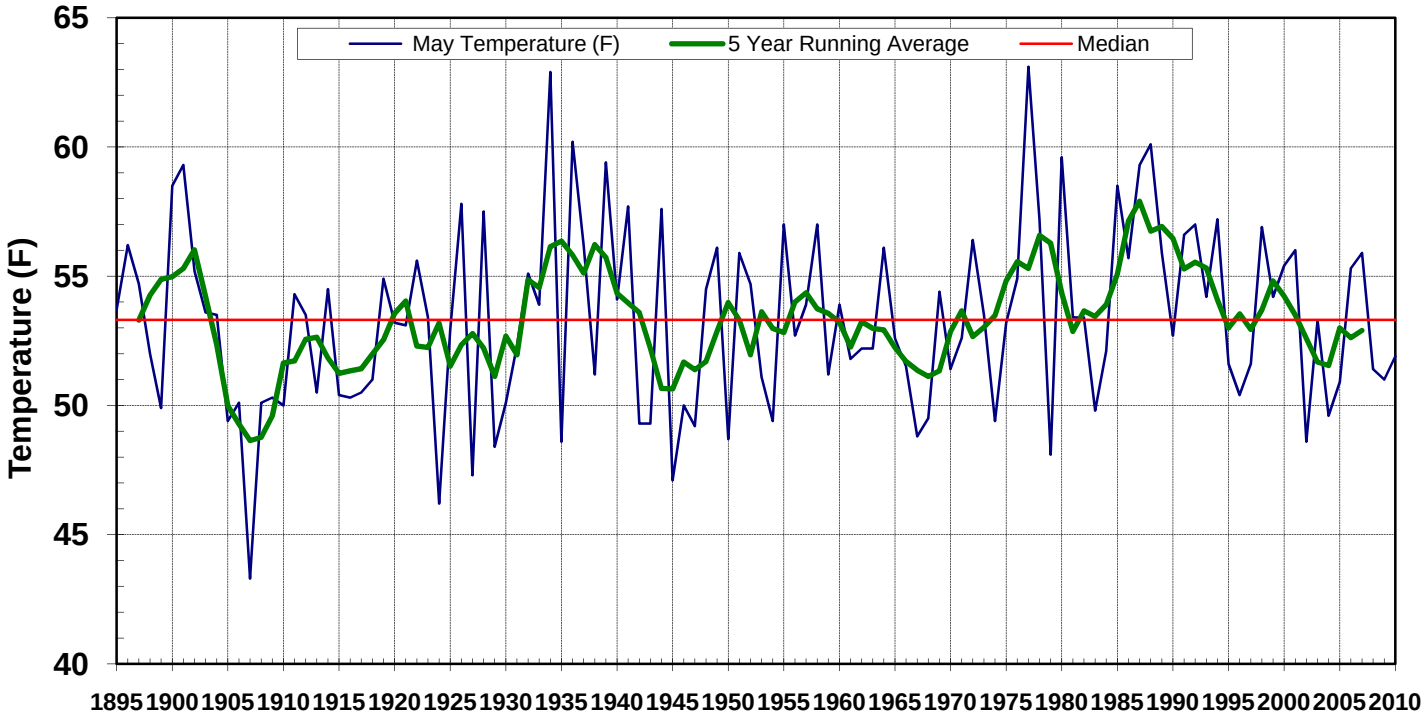


April Temperature Statistics

2010 Average: 46.9°F
Maximum: 50.2°F in 1987
State Normal: 41.71°F (1971-2000)

Monthly Ranking: 14th Warmest in 116 years
Minimum: 31.1°F in 1907
Years in Record: 116

Historical May Temperature for North Dakota



May Temperature Statistics

2010 Average: **51.9°F**
Maximum: 63.1°F in 1977
State Normal: 54.80°F (1971-2000)

Monthly Ranking: 44th Coolest in 116 years
Minimum: 43.3°F in 1907
Years in Record: 116

Storms & Record Events

State Tornado, Hail, and Wind Reports for Spring 2010 by B. A. Mullins

North Dakota 3 Month Total	Wind	Hail	Tornado
	29	34	4

Reports by Month			
Month	Wind	Hail	Tornado
Total March	0	0	0
Total April	1	6	0
Total May	28	28	4

North Dakota Record Event Reports for Spring 2010

Date	Location	Type of Record	Previous Record
03/09/10	Grand Forks airport	Precipitation of 0.52 inches	0.25 inches set in 1993
03/10/10	Jamestown	Rainfall of 0.56 inches	0.10 inches set in 1960
03/10/10	Dickinson	Rainfall of 0.08 inches	Ties previous record set in 1978
03/10/10	Grand Forks NWS	Precipitation of 0.37 inches	0.28 inches set in 1893
03/10/10	Grand Forks airport	Precipitation of 0.31 inches	0.26 inches set in 1982
03/10/10	Fargo	Precipitation of 0.65 inches	0.48 inches set in 1904
03/29/10	Williston	High temperature of 71°F	69°F set in 1978
03/30/10	Jamestown	High temperature of 74°F	71°F set in 1918
04/02/10	Bismarck	Rainfall of 1.15 inches	0.51 inches set in 1986
04/02/10	Bismarck	Snowfall of 5 inches	3.2 inches set in 1911
04/2010	Fargo	April Average Temp of 51.6°F	51.5°F in 1915
05/07/10	Bismarck	Snowfall of 0.5 inches	0.4 inches set in 1950
05/07/10	Grand Forks airport	Low maximum temperature of 42°F	45°F set in 1999
05/07/10	Fargo	Precipitation of 1.05 inches	0.96 inches set in 1904
05/07/10	Fargo	Snowfall trace	Ties record set in 1945, 1923, 1906
05/22/10	Grand Forks airport	Precipitation of 1.99 inches	1.31 inches set in 1962.
05/22/10	Minot	Rainfall of 0.72 inches	0.64 inches set in 2008
05/24/10	Grand Forks airport	Precipitation of 1.13 inches	0.85 inches set in 1981
05/24/10	Grand Forks NWS	Precipitation of 1.40 inches	0.9 inches set in 1896
05/24/10	Fargo	High temperature of 90°F	88°F set in 1980
05/24/10	Jamestown	Rainfall of 2.07 inches	0.89 inches set in 1989
05/24/10	Dickinson	Rainfall of 1.39 inches	1.23 inches set in 1965
05/24/10	Minot	Rainfall of 1.23 inches	1.03 inches set in 1962
05/24/10	Williston	Rainfall of 1.72 inches	1.02 inches set in 1953
05/27/10	Minot	Rainfall of 1.96 inches	1.02 inches set in 1955
05/28/10	Bismarck	High minimum temperature of 68°F	67°F set in 1900
05/29/10	Grand Forks airport	High temperature of 93°F	Ties previous record set in 1988
05/29/10	Fargo	High temperature of 95°F	Ties previous record set in 1939

Seasonal Outlook

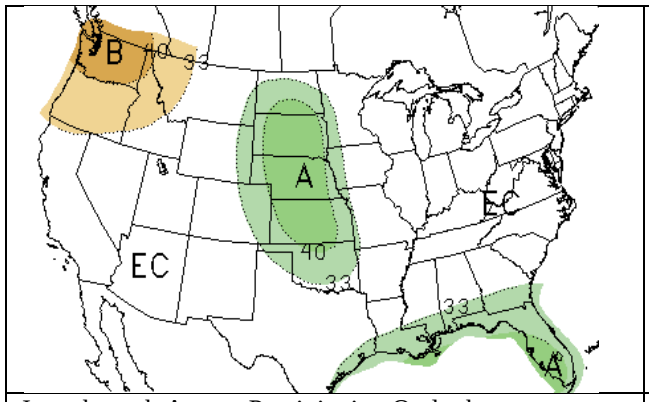
Summer Climate Outlooks

by D. Ritchison[1]

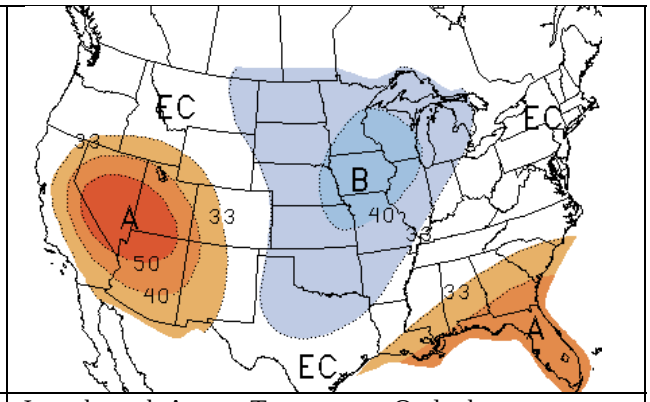
The summer of 2009 ranked as the 11th coolest summer on record in North Dakota and the 32nd driest. Many parts of North Dakota have experienced many cooler than average summers in recent years, especially the eastern one-half of the state because of a series of wet summers, but last year, was a more unusual situation where it was both cool and dry. The most asked question in recent weeks has been will this summer be yet another cool summer for the state.

The El Nino that dominated the Pacific Ocean since last fall faded away very quickly during the late April and early May time period. The equatorial Pacific has cooled so much that sea-surface temperatures are now below average and NOAA (National Oceanic and Atmospheric Administration) has issued a La Nina watch. Historically, summers that followed a moderate or strong El Nino that quickly turned to a La Nina has brought average to above average summer temperatures to North Dakota based on my own research.

My thoughts are that June will finish below average for temperatures with many areas in the state finishing above average for precipitation. Summer thunderstorms always bring spot to spot variation on rainfall. But then July and August will turn warmer and drier bringing the overall summer temperature to the average or slightly above average mark with summer precipitation finishing near the long-term average in most locations.This differs from the Climate Prediction Center's summer forecast for the area that can be seen below.



June through August Precipitation Outlook



June through August Temperature Outlook

The North Dakota State climate Office has links to the National Weather Service's local 3-month temperature outlooks for the next 12-month period (updated monthly). Those outlooks can be found at:
http://www.ndsu.edu/ndsco/outlook/L3MTO.html

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

A Tale of Two Floods

by A. Schlag[2]

With all due respect to the many areas of North Dakota that had high water this spring, it is likely that many hydrologists will remember this spring more for its lack of flooding than its severity as it was certainly not equal to that of 2009 even though much of the state had a similar snow-water equivalent (SWE). Given that much of North Dakota again had unusually high SWE in its early March snowpack, many believed that a repeat of March and April of 2009 was a virtual certainty, I happen to be one of those believers. That feeling was born out in the modeled numbers where the vast majority of western and central North Dakota had probabilities of flooding that started above 50% for minor flooding and many areas had probabilities of major flooding that exceeded 90%.

Through late February and early March, I and other members of our staff visited with local communities and discussed their flood risk in public meeting. All too the take home message we left people with was that our models, which use historical melt season data and current conditions, had few to zero examples of melting this snow without producing flooding. *Note: These probabilities were a part of the Hydro Talk section of the previous ND Climate Bulletin if you would like to go back and reference them.*

As the melt season approached there were some reasons for optimism that the flood season would at least not be at the upper end of expectations as observers began to report snow disappearing from the countryside with little to no runoff appearing in the streams. Numerous days and even weeks of a very gentle warm-up began to ripen the snowpack across much of central and western North Dakota. This remarkably gentle entry into spring allowed the soil underneath to begin losing its frost. In fact, reports of very shallow frost depths were more common than those of 30+ inches. These shallow frost depths in several areas are attributed to a thick blanket of snow that came in early winter and insulated the ground. This very gentle melt season also allowed the snow to slowly melt over weeks instead of mere days where numerous reports of ponded meltwater would appear during the late afternoon, yet by morning the water would be gone. Presumably this water was making it into the soil and not the local small streams and rivers in many areas.

So the question of "what happened to all that water" remains. For simplicity sake, I will only offer a couple of examples and offer a brief explanation that compares and contrasts the different basins highlighted in Table 1.

The reasons that the three locations in Table 1 were selected are because of completeness of data and their stark contrasts at the opposite ends of the spectrum. The Knife River watershed was especially primed for severe flooding this spring based upon SWE on the ground which was fairly similar to that of spring 2009. In the model used to predict flooding from runoff, the NWS had 2.3 inches of SWE in parts of the upper basin and over 4.5 in the Beulah/Hazen area.

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

Overall, it would appear that a 3.0 – 4.5 inch average on the contributing portion of the basin is reasonable. However, relatively simple calculations allow us to quantify how much water passed by the Hazen river gauge during the March 5th to April 15th timeframe. Even ignoring the precipitation received in that area during that period, we can only roughly account for 0.73 inches of that liquid water at Hazen. Similarly, we can only account for 0.78 inches of the roughly 2.5-3.5 inches of SWE above Regent. However, Linton eventually passed about 2.81 inches of approximately 4-5 inches of SWE on the ground in early March.

Table 1. SWE and runoff characteristics of select basins (*The data below have not been peer reviewed and are for relative comparison only).*

Basin	Location	Estimated SWE in inches entering March 2010	Runoff Equivalent in inches of water	Runoff Coefficient
Knife River	Hazen	3.0 – 4.5	0.73	0.24 – 0.16
Beaver Creek	Linton	4.0 – 5.0	2.81	0.70 – 0.56
Cannonball	Regent	2.5 - 3.5	0.78	0.31 – 0.22

Then we can look at the runoff coefficient, a simple ratio of how much water ended up in the stream of that which we could see on the ground. This number is highly variable and dependent on melt conditions making it one of the most difficult things to estimate going into the melt season. In these particular examples we see what is in all actuality a fairly normal ratio in the Beaver Creek basin of 0.70 to 0.56, but exceptionally low ratios in the Knife and Cannonball basins of 0.24 to 0.16 and 0.31 to 0.22, respectively.

However, when we observe the river stage data, of the three locations in Table 1, only the Beaver Creek near Linton actually reached flood stage and it didn't reach anything near the stages seen in 2009. First and foremost, ice-jams were not near the problem this year, but primarily the slow melt managed to string the high water over the course of many days rather than create one or two days of problematic flooding. And when we look at the Knife and Cannonball basins, the exceptionally low ratios of runoff signify that the SWE on the ground had to go somewhere other than the local streams. Anecdotally speaking, I believe the numerous reports I have fielded about groundwater problems in basements is the answer. Most of this missing water has in fact infiltrated into the ground and has been either captured as recharge to the local aquifers, or as a much slower time released baseflow to the nearby streams. In all actuality, it is probably some of each. Anecdotal reports of groundwater crating problems in basements and streamflow that tends to be a little a little high for this time of year suggest that this water didn't just evaporate.

So where do we find ourselves now as we near summer? Easy, it's a great time to be a duck lover! Rivers, lakes, and the prairie pothole region are full and should largely remain that way through the summer.

Sugarbeet Root Maggot Model Application

by F. A. Akyüz[3] and M. Boetel[4]

The North Dakota Agricultural Weather Network (NDAWN) Center has released a model to assist sugar beet growers with insecticide timing based on root maggot development. This new online model can help sugar beet growers decide when to apply insecticide for root maggots.

The new root maggot insecticide application model will have a positive economic and environmental impact because it will help growers apply insecticide during the most effective time of the maggot development. North Dakota already has the infrastructure - 72 state-of-the-art automated weather stations scattered across the region to observe atmospheric variables. These variables are used to calculate many agricultural applications for barley, canola, corn, potato, sunflower, wheat and other small grains. The center also assists farmers with irrigation scheduling applications and energy producers with heating and cooling degree day applications.

The NDAWN sugar beet root maggot application involves a model that correlates 15 years of root maggot fly activity with NDAWN-generated temperature accumulations from 119 sampling sites throughout the Red River Valley. It should be reliable and representative of how temperature accumulations impact this pest's flight activity.

The model is available at http://ndawn.ndsu.nodak.edu/sugarbeet-root-maggot.html.

Users either can select locations from the menu and view the data in table format or select a map and view the data in map format. The application will keep track of accumulated heat units, which correspond to certain maggot growth stages. The map will have color counters to easily separate different categories and recommendations. Figure 1 below depicts estimated sugarbeet root maggot activity stage based on the accumulated heat degrees shown in with numbers as of June 15. Each color indicates suggested timing to apply post emergence liquid or granular insecticides for three general areas within Red River Valley explained in Table 1.

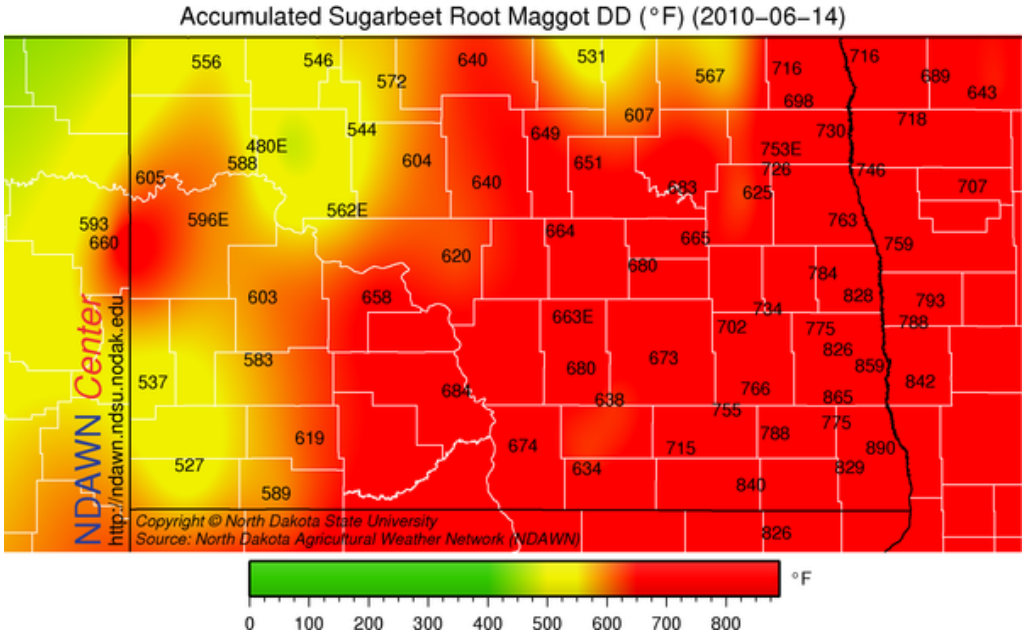


Figure 1 Accumulated Sugarbeet Root Maggot Degree Days as of June 15

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Insecticide timing

The following table shows suggested timing to apply postemergence liquid or granular insecticides for three general areas within Red River Valley. Recommendations are based on a 15-year average (1995-2009) of root maggot fly activity and associated weather patterns in the Red River Valley.

Table 1. Insecticide Timing Recommendation

	Target Degree Day for Insecticide Applications	
	Liquid Insecticides	**Granular Insecticides**
Northern RRV	590-620 Degree Day	440-550 Degree Day
Central RRV	585-615 Degree Day	410-545 Degree Day
Southern RRV	580-610 Degree Day	400-540 Degree Day

IMPORTANT! The following factors can cause deviations from this average:

Bare ground in maggot overwintering sites (e.g., late-planted small grain fields with little or no established plant canopy) can lead to accelerated insect development and earlier peaks in some fields. The following weather factors can delay/reduce activity if they occur near the expected peak:

- Winds above 10 mph
- Persistent or heavy rainfall
- Cool (less than 70°F) temperatures

General recommendations

- Granule Applications: apply at 6-14 days before expected SBRM fly activity peak.
- Liquid Applications: apply at 2-3 days before expected SBRM fly activity peak.

What to do if an early flare-up in activity occurs

Sugarbeet fields with infestations exceeding ***0.5 SBRM flies per plant*** (1 per 2 plants) should be treated immediately with a liquid insecticide application at its labeled rate, even if the area has not reached the suggested target DD for treatment. ***Closely monitor such fields*** for several days after the application, and ***repeat if counts return to the 0.5-fly/plant level***.

Recommendations based on sticky-stake counts

Growers are encouraged to monitor SBRM fly activity on their farms with sticky stake traps. Unprotected fields with cumulative fly counts of ***40 to 45 flies per stake*** should receive a postemergence rescue insecticide application. Fields initially treated with a granular or seed treatment should receive additive insecticide protection if counts exceed a cumulative average of ***70 flies per stake***.

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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