North Dakota Climate Bulletin

Fall 2012

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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.

Temperature-wise, this fall was near normal statewide. Precipitation-wise however, it was the 48th driest fall statewide since 1895.

The prospects of El Niño died towards the end of the season, along with the predictability of winter weather in the northern plains. However, it also brought a shift in the weather pattern. The driest September in North Dakota's climate history was followed by 14th wettest October and 38th wettest November statewide. Drought conditions improved after reaching its worst status on October 2nd with nearly 5% of the state experiencing extreme drought conditions. However, Eastern and Southern parts of the state continues to show stress of long term drought. Did the pattern shift? Is this going to be another mild winter? What are the hydrological implications? All answered in this issue.

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

Sunflowers in Hoar Frost. By Akyüz

Weather Highlights

Seasonal Summary:

by B. A. Mullins

September 2012

The state average precipitation was 0.20 inches which was below the 1981-2010 normal of 1.71 inches. September 2012 state average precipitation ranked the driest in the last 118 years with a maximum of 5.00 inches in 1900 and a minimum of 0.20 inches in 2012.

The North Dakota Agricultural Weather Network (NDAWN), September precipitation in North Dakota was well below normal with the lowest amounts of ~0.01 inches in the west and the far northeast corner. The greatest amounts of precipitation measured by NDAWN were 0.66 inches at Cando, 0.65 inches at Pillsbury, and 0.58 inches at Prosper. According to the U.S. Drought Monitor September 25th assessment, 28.49% of the state was experiencing severe to extreme drought (D2-D3) and 66.41% of the state was experiencing moderate drought (D1). The driest area with extreme drought (D3) was in parts of Grand Forks, Nelson, Griggs, Steele and Trail Counties.

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

The US Drought Monitor October 2, 2012 report had Severe (D2) to Extreme (D3) drought conditions for 51% of the state. The remaining 49% of the state was listed as Moderate (D1) drought.

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 43% very short, 46% short, 11% adequate, and 0% surplus with a subsoil moisture reported as 34% very short, 50% short, 16% adequate, and 0% surplus (Weekly Weather and Crop Bulletin Vol. 98, No. 40).

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

The top five September daily maximum wind speeds recorded from NDAWN were Williston on the 13th with 51.5 mph, Prosper on the 21st with 47.2 mph, Baker on the 12th with 44.7 mph, Dazey on the 19th with 44 mph and McHenry also on the 19th with 44 mph. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 57.9 °F which is above the 1981-2010 normal of 56.77 °F. September 2012 state average air temperature ranked 37th warmest in the past 118 years with a maximum of 63.4 °F in 1897 and a minimum of 45.2 °F in 1965.

NDAWN September average air temperatures ranged from ~53 °F in the northeast to ~61 °F in the west. Departure from normal average air temperatures ranged from below normal of approximately -2 °F in the Red River Valley to above normal of approximately 7 °F in the west.

The first wide spread frost occurred on the 17th. Producers were concerned about the lack of precipitation in September. However, conditions were suitable most days for harvest to progress at a swift rate.

The National Weather Service (NWS) recorded a record low temperature of 32 °F on the 18th at Grand Forks Airport, a record high temperature of 85 °F on the 28th at Williston, and a record high temperature of 85 °F on the 29th at the Grand Forks Airport. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

NDAWN's highest recorded daily air temperature for September was 101.3 °F at Mott on the 1st. The lowest recorded daily air temperature was 16.6 °F at Hazen on the 22nd.

October 2012

The state average precipitation was 1.96 inches which is above the 1981-2010 normal state average of 1.48 inches. October state average precipitation ranked the 14th wettest in the past 118 years with a maximum of 4.71 inches in 1982 and a minimum of 0.10 inches in 1952.

The North Dakota Agricultural Weather Network (NDAWN), October percent of normal precipitation was above normal in the north and below normal in the southern parts of the state. NDAWN total precipitation amounts ranged from 5.81 inches at Humboldt, MN to 0.66 inches in Hettinger. There were two major storm events that trekked across North Dakota in October. The first storm started in the west on the 3rd and ended in the east on the 4th and brought the first snow of the season. Snow accumulations ranged from 1-4 inches in the west to 2-5 inches in the east. The second slow moving storm brought rain and high winds starting on the 16th in the west and ending on the 19th in the east. The high winds fueled a fast moving wildfire that broke out near Bucyrus, ND on the 17th. The fire destroyed several homes in the small town.

The National Weather Service (NWS) reported breaking several precipitation records. Record snowfall was recorded on the 4th at Grand Forks Airport with 2.7 inches, Fargo Airport with 1.4 inches, and Grand Forks NWS with 3.5 inches along with a record 0.57 inches of precipitation. Grand Forks Airport had a record rainfall on 0.33 inches on the 23rd and Fargo had a record snowfall of 1.4 inches on the 27th. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

The US Drought Monitor October 30, 2012 report had 90.1% of the state with moderate to severe drought (D1-D2). The remainder of the state primarily in the central region had abnormally dry conditions.

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 22% very short, 34% short, 42% adequate, and 2% surplus with a subsoil moisture reported as 30% very short, 40% short, 29% adequate, and 1% surplus (Weekly Weather and Crop Bulletin Vol. 99, No. 44).

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

The top five October daily maximum wind speeds recorded from NDAWN were 57.6 mph on the 18th at Hazen, 57.6 mph on the 17th at Mott, 57.3 mph on the 17th at Bowman, 56.2 mph on

the 18th at Linton and 55.8 mph on the 17th at Beach. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 41 °F which is below the 1981-2010 normal of 43.24 °F. October state average air temperature ranked the 23rd coolest in the past 118 years with a maximum of 54.8 °F in 1963 and a minimum of 32.5 °F in 1925.

NDAWN October average air temperatures ranged from ~37 °F in the far north to ~43 °F in the southeast. Departure from normal average air temperatures were below normal across the state and ranged from approximately -1 °F to -5 °F. The beginning of the month was mostly below normal and then rebounded to near and above normal during much of the middle of the month but fell to below normal toward the end with the last couple of days being above normal. Cooler and wetter than normal conditions in the central and northeastern parts of the state helped to improve dry conditions. By the end of the month, significant improvements were observed.

The National Weather Service (NWS) reported breaking two low maximum temperature records on the 5th at Grand Forks Airport and Grand Forks NWS with 38 °F and 36 °F, respectively. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

NDAWN's highest recorded daily air temperature for October was 81.0 °F at Marion on the 2nd. The lowest recorded daily air temperature was 6.6 °F at Bottineau on the 28th.

November 2012

The state average precipitation was 0.67 inches which is below the 1981-2010 normal of 0.72 inches. November state average precipitation ranked 38th wettest in the past 118 years with a maximum of 2.51 inches in 2000 and a minimum of 0.02 inches in 1939.

The High Plains Regional Climate Center (HPRCC) percent of normal precipitation was above normal in the northwest, far north-central, and central regions with below normal in the remainder of the state. HPRCC total precipitation amounts ranged from approximately 2 inches in the northwest to less than 0.4 inches in the southwest and southeast. A major storm system that went across North Dakota from the 8th through the 11th brought freezing rain and snow. The highest 4-day snow totals were recorded in Divide and Rolette Counties with greater than 16 inches. A storm system on the 22nd, Thanksgiving Day, brought wind and freezing rain which hampered travel conditions for the holiday.

The National Weather Service (NWS) had few record precipitation events in November. The Grand Forks Airport recorded record snowfall of 2.0 inches on the 3rd. The 10th had record snowfall at Bismarck with 9.1 inches and Williston with 8.0 inches. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

The U.S. Drought Monitor November 27th report listed 32.64% of the state as having severe drought (D2) mostly in the far southern part of the state and the central and southern parts of the Red River Valley. No drought was reported at 8.66% of the state with the remaining 58.7% having abnormally dry or moderate drought conditions (D0-D1).

The USDA, National Agricultural Statistics Service, North Dakota Field Office reported a topsoil moisture of 11% very short, 35% short, 53% adequate, and 1% surplus with a subsoil

moisture reported as 26% very short, 37% short, 37% adequate, and 0% surplus (Weekly Weather and Crop Bulletin Vol. 99, No. 48).

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

The top five November daily maximum wind speeds recorded from NDAWN were from Bowman on the 5th with 43.7 mph, Warren, MN, on the 22nd with 42.9 mph, Galesburg on the 22nd with 41.5 mph, Dunn on the 5th with 41.1 mph and Beach on the 5th with 40.8 mph. NDAWN wind speeds are measured at a height of 10 feet (3 m).

The state average air temperature was 27.5 °F which is slightly above the 1981-2010 normal of 27.44 °F. November state average air temperature ranked the 56th warmest in the past 118 years with a maximum of 37.4 °F in 2001 and a minimum of 7.30 °F in 1896.

NDAWN November average air temperatures ranged from ~21 °F in the far north to ~33 °F in the southwest. Departure from normal average air temperatures were near normal in the central, eastern, and southeast part of the state, ~3 °F below normal in the north, and ~3 °F above normal in the southwest. The first few days in November were below normal. On the 4th, temperatures in most areas were above normal and held until the 9th when a storm system went across the state pushing temperatures below normal with freezing rain and snow. Temperatures for most were above normal from the 16th through the 21st. The storm system that started on the 22nd brought temperatures down to below normal on the 23rd. The remainder of the month had a mix of daily average air temperatures being above and below normal.

The National Weather Service (NWS) reported breaking two high temperature records on the 21st with 59 °F at Fargo and 65 °F at Dickinson. A complete list of record events can be found in the "Storms and Record Events" section later in this bulletin.

NDAWN's highest recorded daily air temperature for November was 70.9 °F at Bowman on the 7th. The lowest recorded daily air temperature was -12.2 °F at Bottineau on the 26th.

Season in Graphics

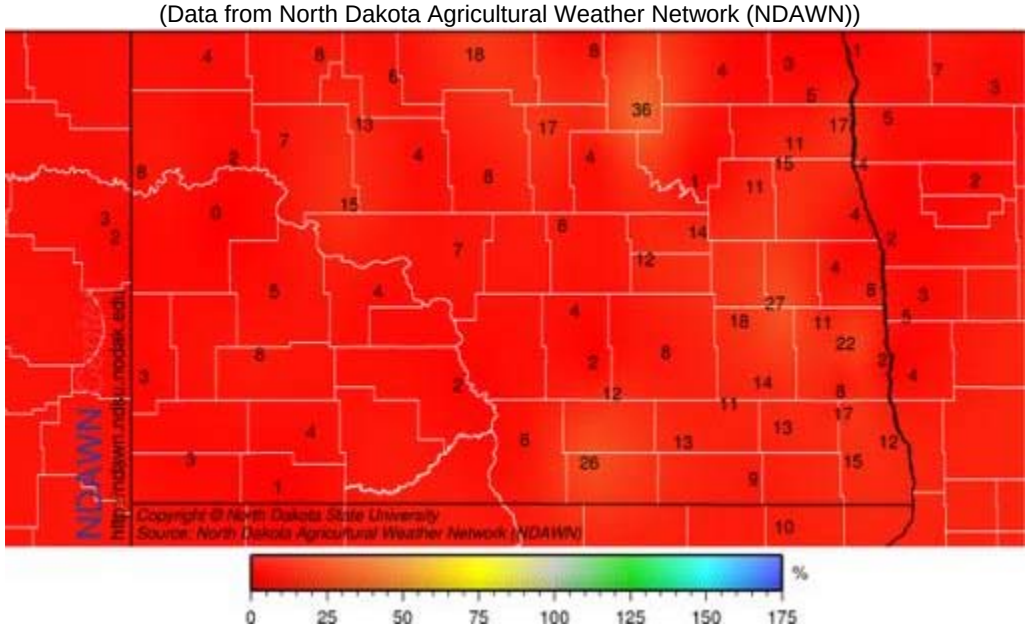
Fall 2012 Weather in North Dakota:

September 2012

Total Precipitation percent of mean (1981-2010)

Precipitation Percent of Normal

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

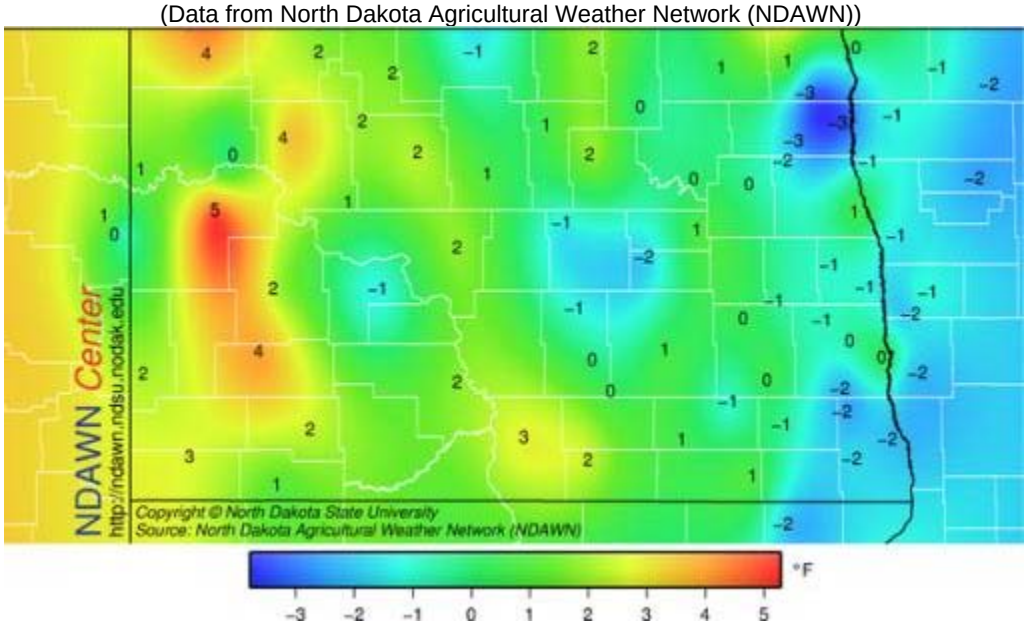


North Dakota State Climate Office

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

Departure From Normal Monthly
Average Air Temperature in degrees F

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



North Dakota State Climate Office

Season in Graphics

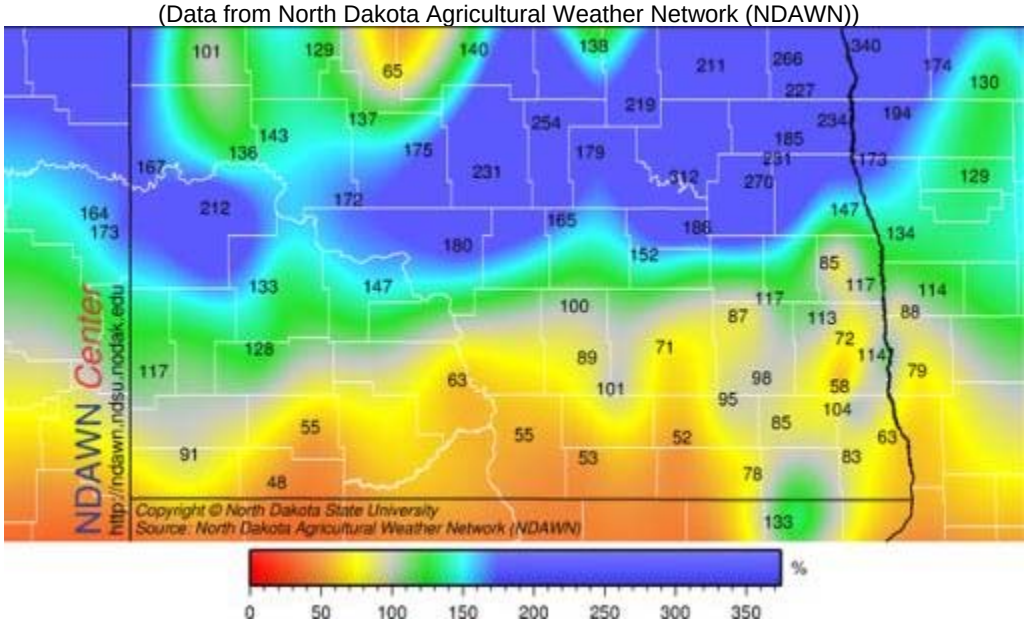
Fall 2012 Weather in North Dakota:

October 2012

Total Precipitation percent of mean (1981-2010)

Precipitation Percent of Normal

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

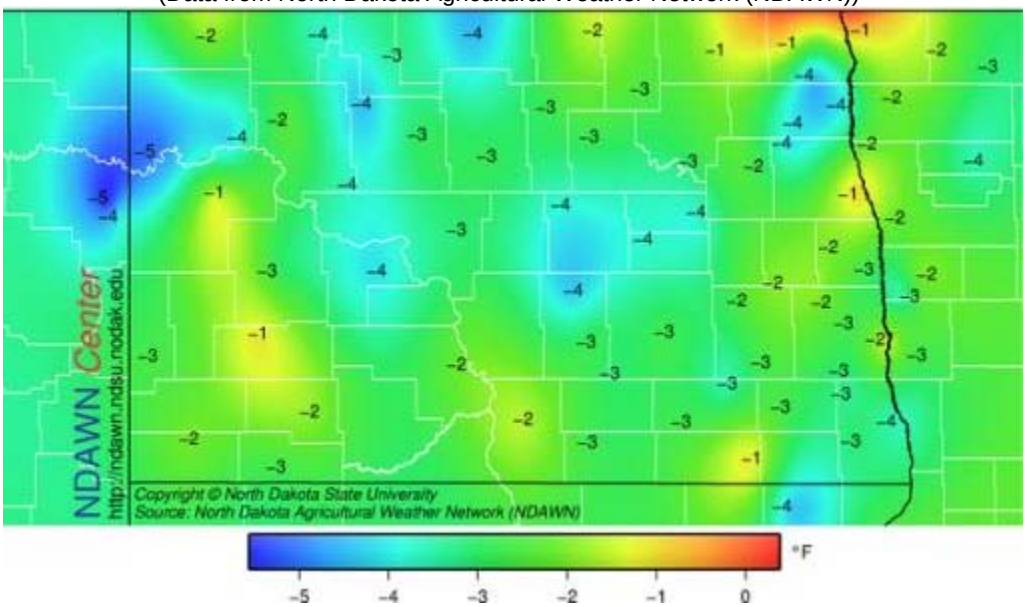


North Dakota State Climate Office

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

Departure From Normal Monthly
Average Air Temperature in degrees F

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



North Dakota State Climate Office

Season in Graphics

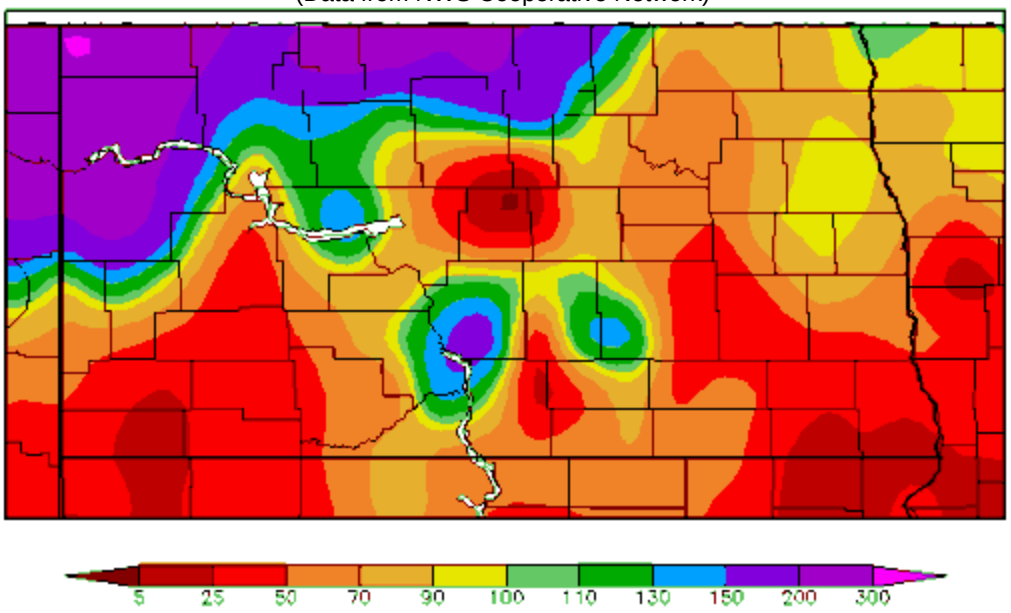
Fall 2012 Weather in North Dakota:

November 2012

Total Precipitation percent of mean (1981-2010)

Precipitation Percent of Normal

(Data from NWS Cooperative Network)

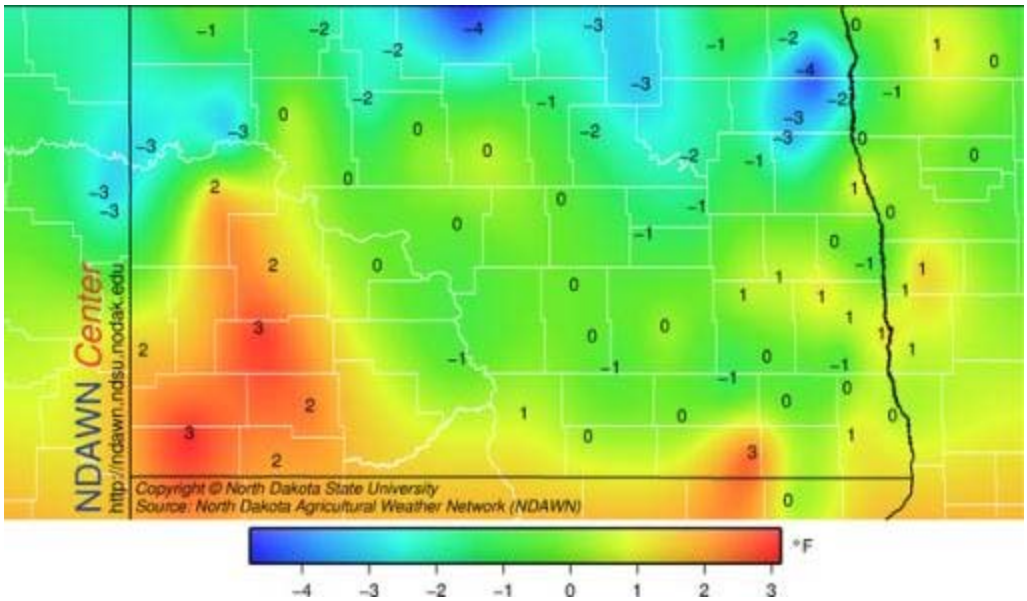


North Dakota State Climate Office

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

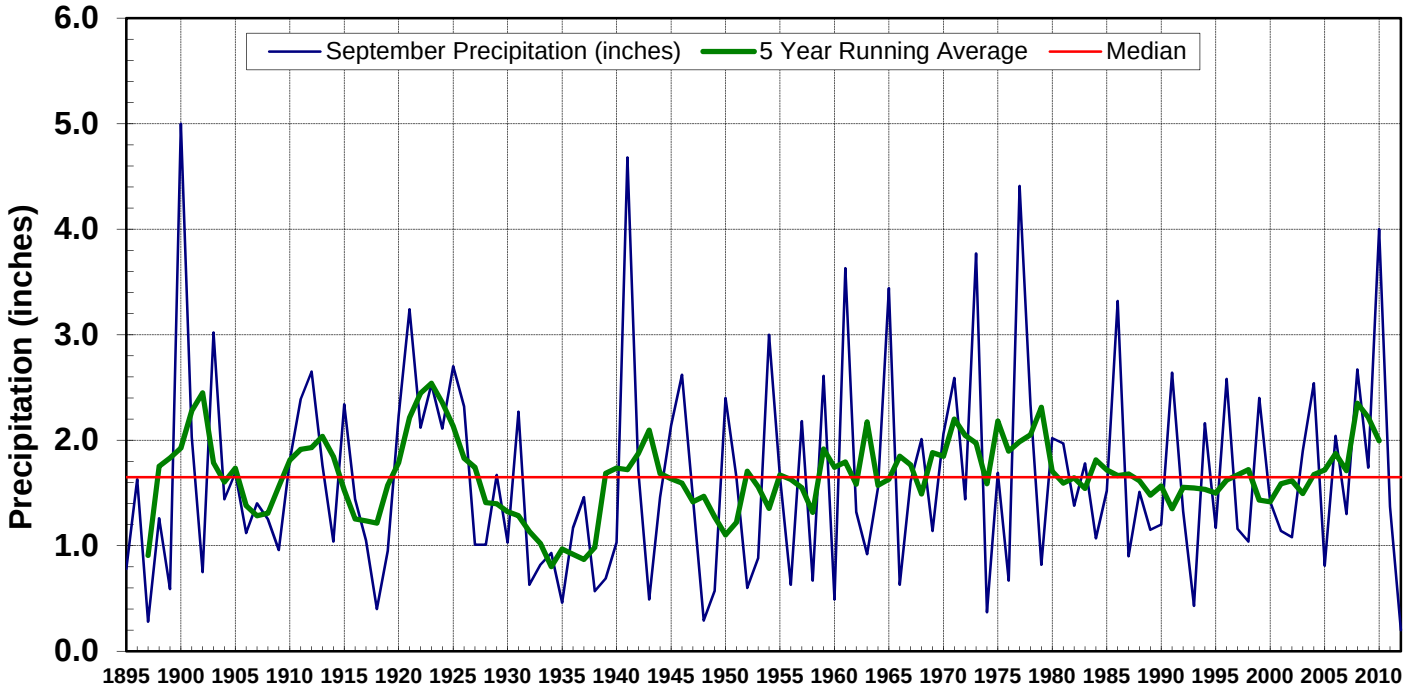
Departure From Normal Monthly
Average Air Temperature in degrees F

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



North Dakota State Climate Office

Historical September Precipitation for North Dakota

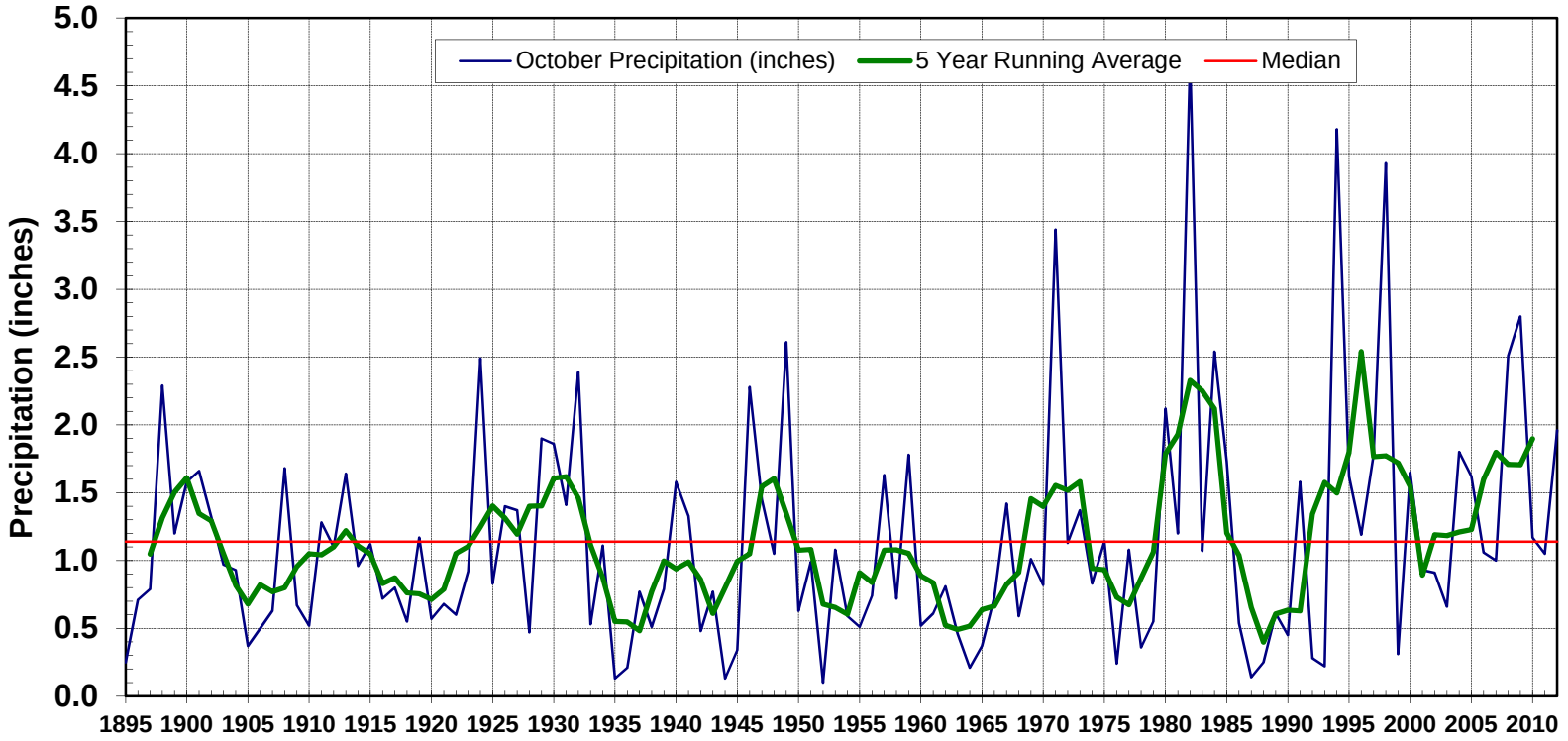


September Precipitation Statistics

2012 Amount: **0.20 inches**
Maximum: 5.00 inches in 1900
State Normal: 1.71” (1981-2010)

Monthly Ranking: 1st Driest in 118 years
Minimum: 0.20 inches in 2012
Years in Record: 118

Historical October Precipitation for North Dakota

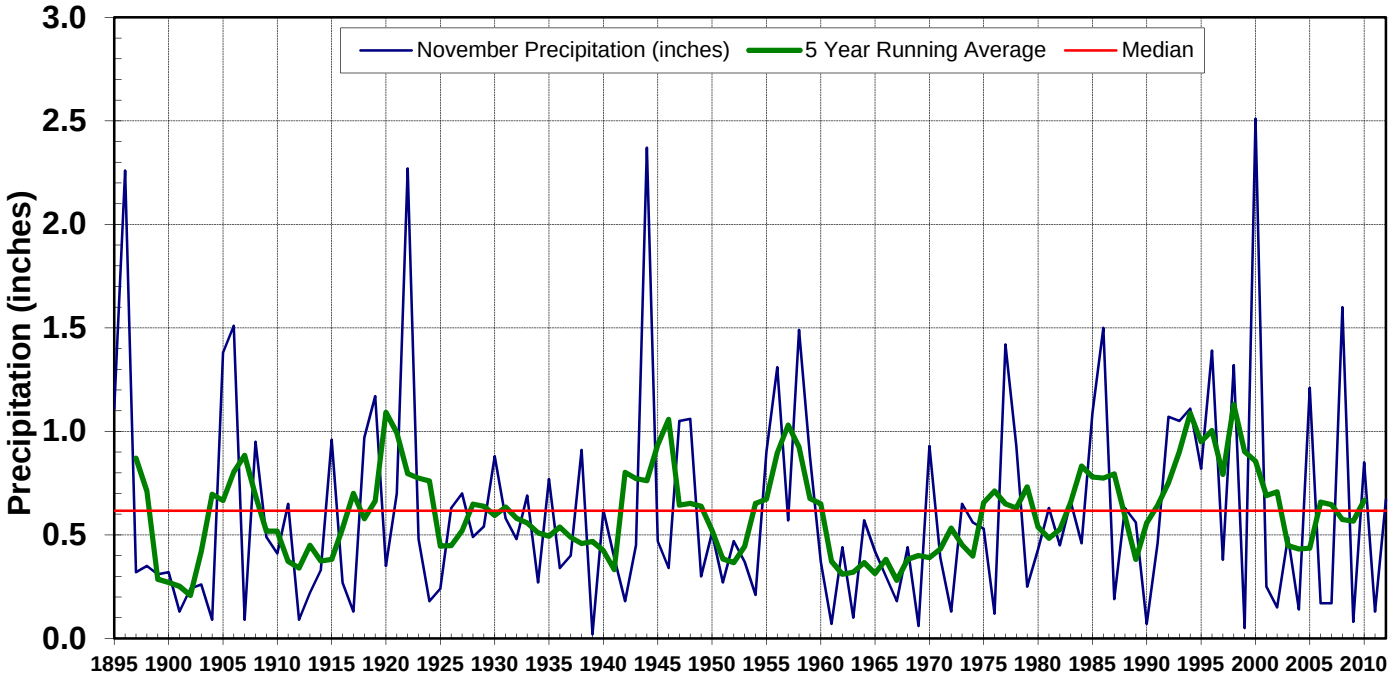


October Precipitation Statistics

2012 Amount: 1.96 inches
Maximum: 4.71 inches in 1982
State Normal: 1.48" (1981-2010)

Monthly Ranking: 14th wettest in 118 years
Minimum: 0.10 inches in 1952
Years in Record: 118

Historical November Precipitation for North Dakota

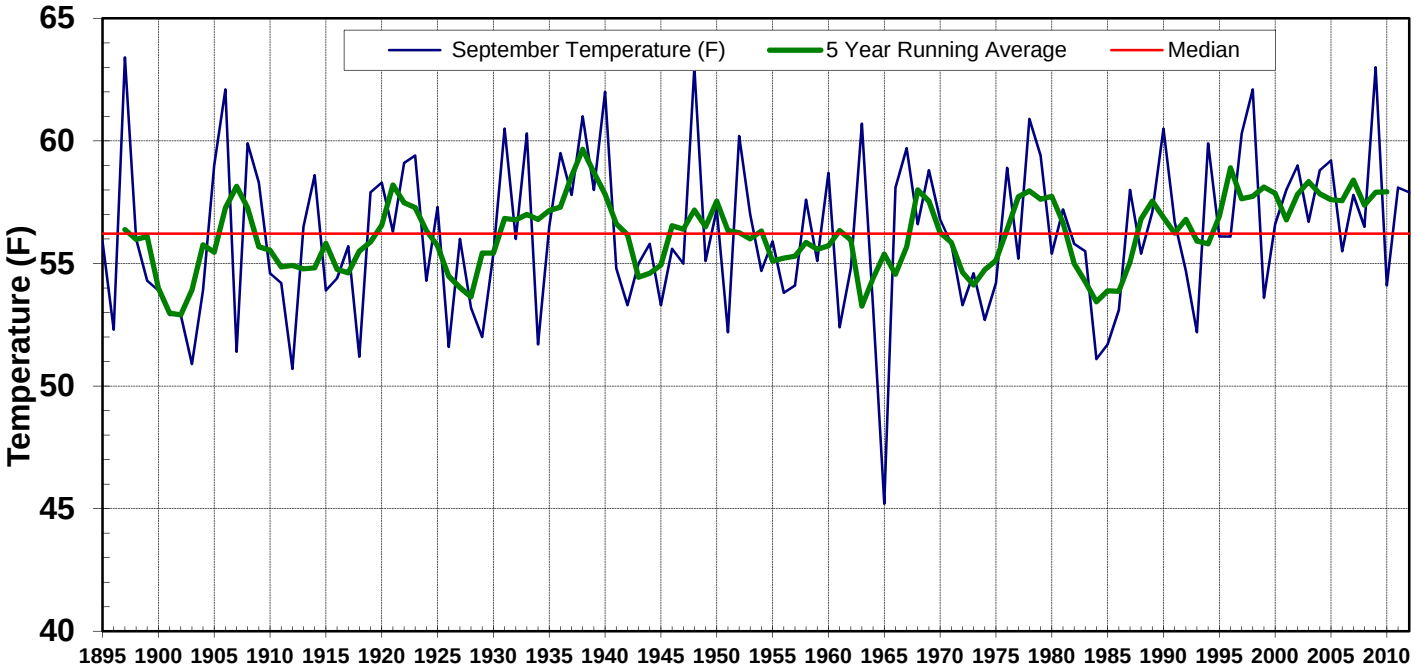


November Precipitation Statistics

2012 Amount: 0.67 **inches**
Maximum: 2.51 inches in 2000
State Normal: 0.72” (1981-2010)

Monthly Ranking: 38th wettest in 118 years
Minimum: 0.02 inches in 1939
Years in Record: 118

Historical September Temperature for North Dakota

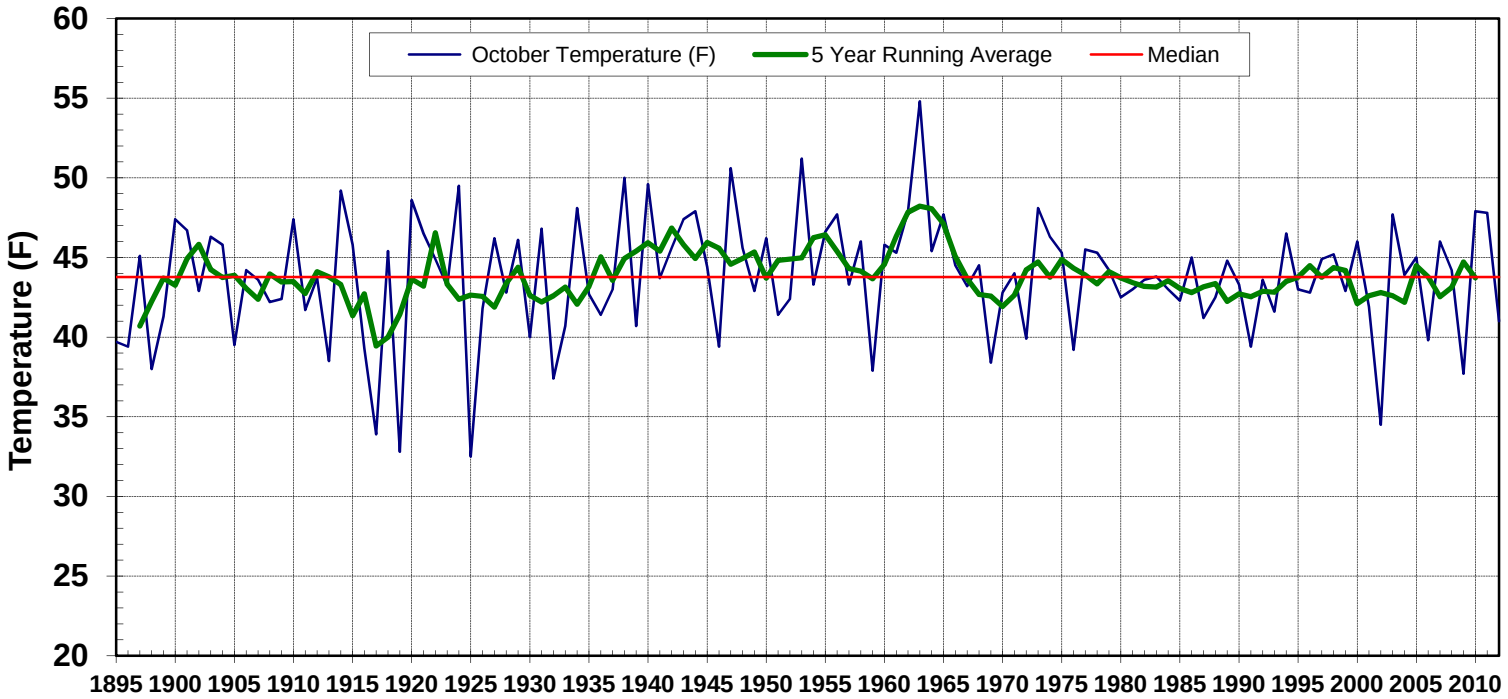


September Temperature Statistics

2012 Average: **57.9** °F
Maximum: 63.4 °F in 1897
State Normal: 56.77 °F (1981-2010)

Monthly Ranking: 37th Warmest in 118 years
Minimum: 45.2 ° F in 1965
Years in Record: 118

Historical October Temperature for North Dakota

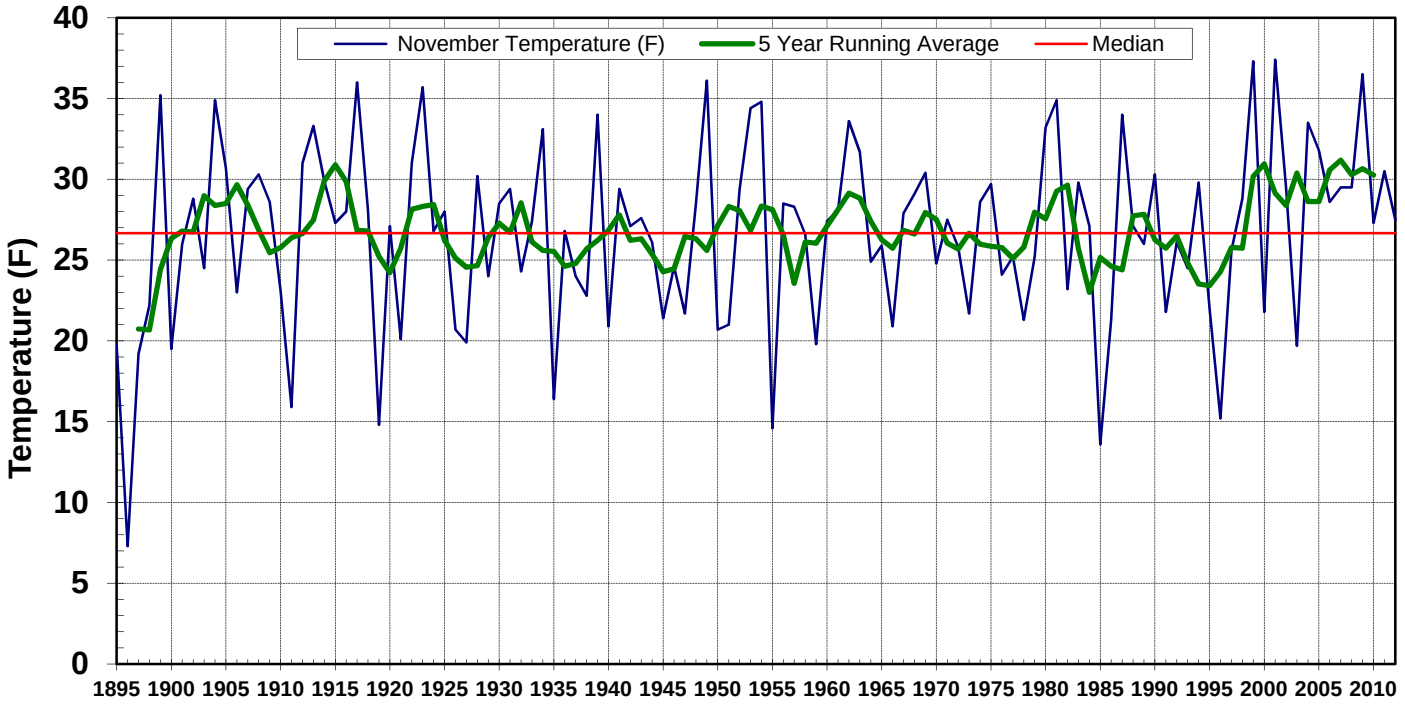


October Temperature Statistics

2012 Average: 41 °F
Maximum: 54.8 °F in 1963
State Normal: 43.24 °F (1981-2010)

Monthly Ranking: 23rd Coolest in 118 years
Minimum: 32.5 °F in 1925
Years in Record: 118

Historical November Temperature for North Dakota



November Temperature Statistics

2012 Average: **27.5 °F**
Maximum: 37.4 °F in 2001
State Normal: 27.44 °F (1981-2010)

Monthly Ranking: 56th warmest in 118 years
Minimum: 7.3 °F in 1896
Years in Record: 118

Storms & Record Events

State Tornado, Hail, and Wind Reports for Fall 2012

by B. A. Mullins

North Dakota 3 Month Total	Wind	Hail	Tornado
	0	0	0

Reports by Month			
Month	Wind	Hail	Tornado
Total September	0	0	0
Total October	0	0	0
Total November	0	0	0

North Dakota Record Event Reports for Fall 2012

Date	Location	Type of Record	Previous Record
09/18/12	Grand Forks Airport	Low temperature of 32 °F	33 °F in 1973
09/29/12	Williston Airport	High temperature of 85 °F	Ties 1989
09/29/12	Grand Forks Airport	High temperature of 85 °F	Ties 1943
10/04/12	Grand Forks Airport	Snowfall of 2.7 inches	Trace in 1952
10/04/12	Fargo Airport	Snowfall of 1.4 inches	0.60 inches in 1903
10/04/12	Grand Forks NWS	Snowfall of 3.5 inches	No snowfall
10/04/12	Grand Forks NWS	Precipitation of 0.57 inches	0.55 inches in 1913
10/05/12	Grand Forks Airport	Low maximum temperature of 38 °F	39 °F in 2001
10/05/12	Grand Forks NWS	Low maximum temperature of 36 °F	39 °F set in 2001
10/23/12	Grand Forks Airport	Rainfall of 0.33 inches	0.32 inches in 1947
10/27/12	Fargo Airport	Snowfall of 1.4 inches	1.2 inches in 1895
11/03/12	Grand Forks Airport	Snowfall of 2.0 inches	1.8 inches in 1951
11/10/12	Bismarck	Snowfall of 9.1 inches	5.9 inches in 1978
11/10/12	Williston	Snowfall of 8.0 inches	2.2 inches in 1940
11/21/12	Fargo	High temperature of 59 °F	58 °F in 2006
11/21/12	Dickinson	High temperature of 65 °F	64 °F in 1975

Seasonal Outlook

Winter 2012-13 Climate Outlooks

by D. Ritchison[1]

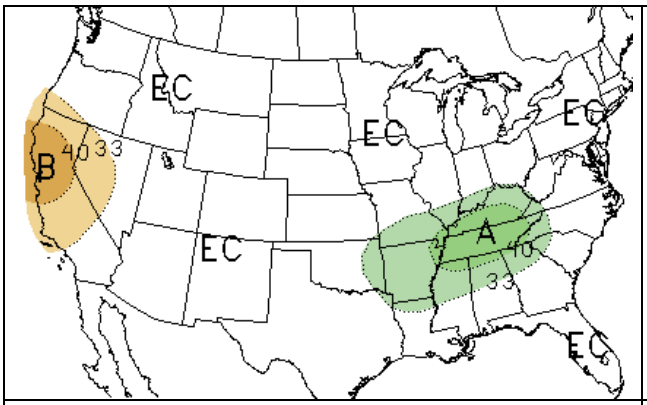
The persistent pattern that kept North Dakota with above average temperatures for an entire year finally broke down to some degree during our autumn season. Most of the state recorded either average or slightly below average temperatures during that time period. Although the recent hemispheric pattern changes ended our run of well above normal temperatures, it did not change the amount of moisture moving in the region, as drought conditions are still the rule.

It is with that backdrop that we look into our winter season. There are many atmospheric signals that suggest our current pattern of near or slightly below average temperatures will continue the next three months. One of these is the amount of snow cover over the northern hemisphere that is much greater than what was recorded last year at this time. This tends to enhance the cold in the high latitudes that increase the odds of more frequent arctic outbreaks in our area especially in January and February.

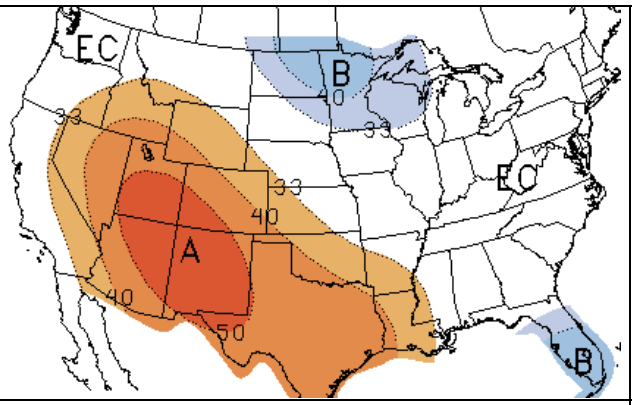
The signals for precipitation are far more difficult to determine. The autumn season brought abundant moisture (especially snow) to the Prairie Provinces to our north, but overall North Dakota has stayed dry. Winter moisture averages only near 2 inches so it will be the spring and early summer seasons that will be far more important for drought relief.

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

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



December through February Precipitation Outlook



December through FebruaryTemperature Outlook

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

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

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

Hydro-Talk

Spring Runoff Predictability in ND

by A. Schlag[2]

The one truth that all can agree on with respect to North Dakota is that our weather patterns are defined by extremes. The differences between the past two winters are wonderful examples of both ends of the extremes we see here in North Dakota with the 2010-2011 winter being remarkable for cold and snow, whereas the 2011-2012 winter was just as remarkable for above normal temperatures and lack of snow.

Long-term climate outlooks assembled by looking at known climate drivers in place remain challenging but can provide the best understanding of what the most likely scenario will be, granted it certainly isn't the only possibility. Through most of the summer and early fall, the prospect of an El Niño dominated winter seemed quite high. However, before that El Niño even materialized the general consensus was that we were going to find ourselves having to look for other indications of what the winter season will bring. A fairly recent journal article has positively linked a heavy snowpack in Eurasia to colder conditions across the northern Great Plains and that has been reflected in the December-February climate outlook with a fairly strong chance of below normal temperatures. This suggests that our best advice would be to prepare for a winter with a typical North Dakota variability in snow amounts and a favorable prospect of colder than normal winter. In the shorter term, the Arctic Oscillation (AO) can be a strong indicator of our winter weather for North Dakota. Positive AO favors more gentle conditions while a negative AO favors more wintry conditions this time of year. The winter of 2010-2011 seemed to follow this correlation very well as much of the winter saw a negative AO. Figure 1 shows the current AO index as well as a short-term forecast. Unfortunately, predictability of AO is only accurate in short term forecast.

So with this expectation, what do we already know about the other conditions that affect spring runoff? First and foremost, surface soil moisture levels in the area north of Interstate 94 from Beach to about Jamestown, and then angling off towards the Grand Forks area are already in the fair to above normal category based upon the last 45-60 days of precipitation. South of that line one would expect to still see fairly dry soils even near the surface. Soil moisture can play an important role in determining how much of the eventual snowpack infiltrates into the ground and how much runs off as higher soil moisture leaves the frozen ground less permeable in the early spring. Secondly, surface water storage in ponds, sloughs, and wetlands is generally well down from the highs of the past couple of years and suggests we have more storage available for 2013 than any other year since 2009.

Given the preponderance of indicators, the spring runoff season is not likely to be nearly as spectacular as 2009, 2010, or even 2011. However, it is impossible to rule out anything, including a repeat of the remarkably wet spring of 2011, as ND weather and climate tends to flip from one extreme to another with not much advance notice.

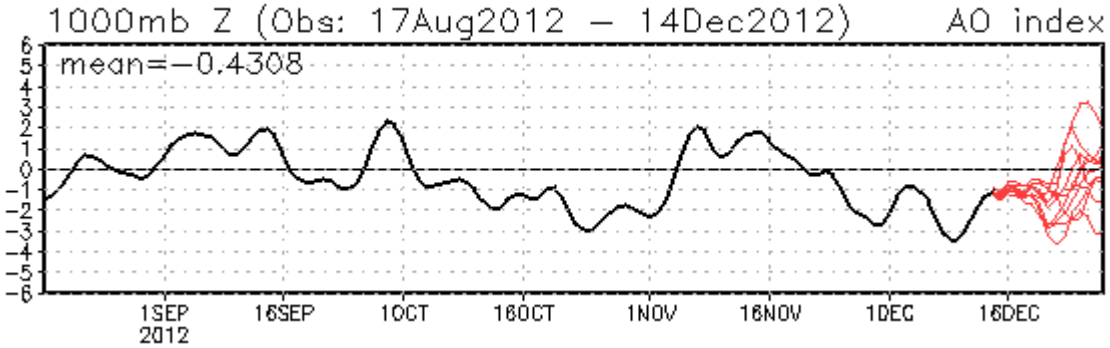


Figure 1. Arctic Oscillation (AO) Index (Current and Forecast)

[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

Science Bits

So You Want to Be a Meteorologist

by Hutch Johnson[3]

A career as a meteorologist could be right up your alley! If you have ever been in awe of our atmosphere's ability to change from peaceful and serene to violent in a matter of minutes, then you can quench your thirst to satisfy that curiosity. Meteorology is an exciting field that relies on advances in physics, chemistry, mathematics and computing technologies to advance our understanding and ability to predict the atmosphere. You might be surprised to learn of the wide variety of careers available in atmospheric sciences.

My career began in the field of research. Research meteorology is the foundation of our science. It is where new techniques are put to the test, where new technologies are developed, and where very specific aspects of our weather are studied in fine detail. Many spend their entire careers focusing their work on topics such as hurricanes, tornadoes, lightning, and blizzards. The work in these fields has no doubt contributed to our ability to better forecast these life-threatening events. Other researches focus on topics such as cloud development, arctic weather, or weather modification. The findings and conclusions reached in a number of these studies leads to new methods and technologies which are then passed along to meteorology students in text books and to professionals in publications. For the past decade, I have had the privilege of teaching a meteorology class. Education is another of the many career choices a meteorologist can make. Education is typically closely tied to the research field. In fact, a number of universities and colleges have graduate programs which allow students to continue to focus their studies in many of the areas mentioned above. Passing along current knowledge of the science to students eager to learn can be very rewarding.

Forecasting day to day weather, monitoring the current weather conditions and alerting the public to serious weather concerns is all encompassed in the field of operational meteorology. The National Weather Service, aviation industry and numerous other private firms employ meteorologists to stay on top of the current weather and to prepare forecasts to help plan. A good forecast might help you know whether a parka or a t-shirt will be the appropriate clothing for the expected conditions. More importantly however, we rely on accurate forecasts to save lives and property during hurricanes, winter storms and tornadoes. Industry and business rely on accurate forecasts to make daily decisions that impact their livelihood.

Broadcast meteorology is likely the most visible of the career choices a meteorologist can make. The art of presenting the science of meteorology in a language palatable to the audience in less than 3 to 4 minutes is indeed a challenge. One of the most frequent comments I hear from people regarding my career choice as a broadcast meteorologist is; "It must be nice to have a job where you can be wrong and still collect a paycheck!" . Years ago this phrase hurt a bit more than it does today. The fact remains that our atmosphere is something that we still strive to completely understand. There are more factors that influence our forecast than many of us can comprehend. As a science, we strive to reach the conclusions that will continue to improve our ability to be accurate every time.
So, you want to be a meteorologist? If you have that knack for mathematics and sciences and a relentless desire to learn more about the weather, then we need you! It is a blessing to have a job that provides something a little different each day. There are a number of career options for meteorologists and atmospheric scientists. Just think, you may be the one to perfect the hurricane forecast. You may help provide the weather warning that saves hundreds of lives. You might be the one who helps develop the new instrument that pinpoints the exact location of the next lightning strike.

Learn more about becoming a meteorologist at these web sites:
American Meteorological Society: http://www.ametsoc.org/pubs/careers.html
Careers in Meteorology: http://earthguide.ucsd.edu/earthguide/pdfs/careermet.pdf
National Weather Associations: http://www.nwas.org/links/career_info.php

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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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