



North Dakota Climate Bulletin

Summer 2016

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From the State Climatologist



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

This summer was the 30th warmest (the warmest summer since 2012) and 30th wettest (the wettest summer since 2014) on record since 1895 statewide in ND.

Despite North Dakota having the steepest annual temperature trend record in the nation, summer temperatures in ND increased a modest 0.21°F per decade on average. Precipitation trend during this period was only 0.02” per decade. Warmer than normal conditions caused above normal seasonally accumulated growing degree days for most crops. However, heavy rains in some regions, especially in the Red River Valley, not only caused a delayed harvest but also crop losses for edible bean farmers. Active storms also caused crop damage due to hail and high wind. A detailed monthly summary, storm reports and record events, as well as evaluations of multi-vortex tornadoes, can be found later in this issue. The bulletin will also contain graphical displays of statewide temperature, precipitation, and the other weather highlights.

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.
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North Dakota Sunset by Vern Whitten©



Weather Highlights

Seasonal Summary

By Adnan Akyüz

June 2016

Based on the NCEI calculations, the state averaged 2.34” of precipitation, which is 0.29” below the 1981-2010 average. It was 1.05” drier than last year and was the driest June since 2006. The statewide average precipitation was ranked the 23rd driest on record since 1895. As the northern parts of the state received well-above to slightly-above precipitation, the southern 2/3 of the state received below-normal amounts (Fig. 1). Some areas in the northeastern parts of the state received between 2-3” rain on the first week of June causing crops to drown. However, wide-spread precipitation, for the most part, helped replenish soil moisture for seed germination. In the second week, the northern locations benefited from needed moisture, but some areas had heavy rain and hail caused crop damage. The southern half of the state, by the end of the second week, showed crop stress due to dry and windy conditions. Windy conditions also caused a delayed herbicide application in these regions. The largest amount of accumulated precipitation in June was 7.14”, recorded in Northgate, Burke County. The least amount of accumulated precipitation in June was 0.48”, recorded in Pretty Rock, Grant County. The highest 24-hr rainfall was recorded in Bismarck as 2.62” on June 14, which was also the daily 24-hr rainfall record for BIS. Based on the historical

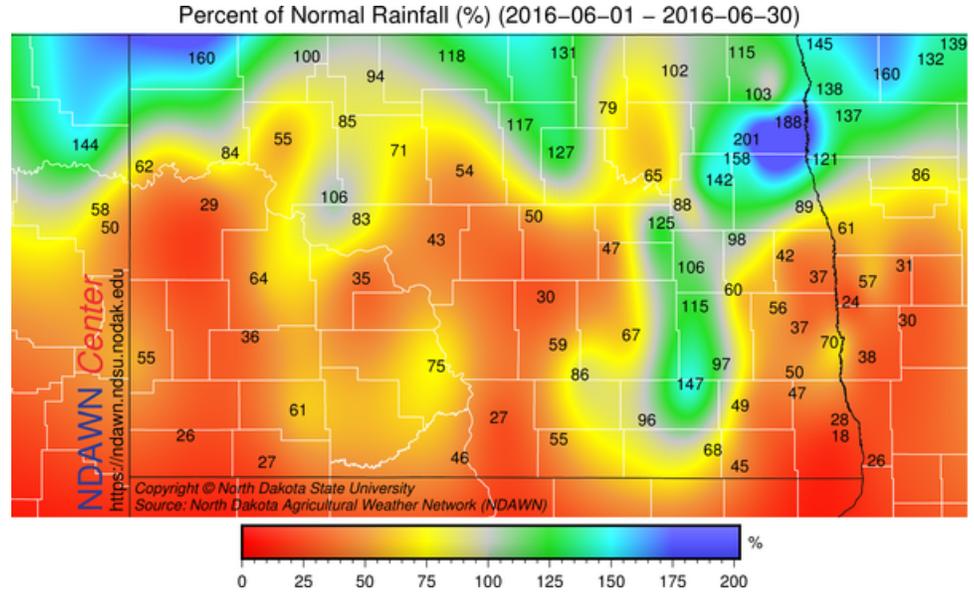


Figure 1. Precipitation Percent of Normal in June 2016 for North Dakota (NDAWN)

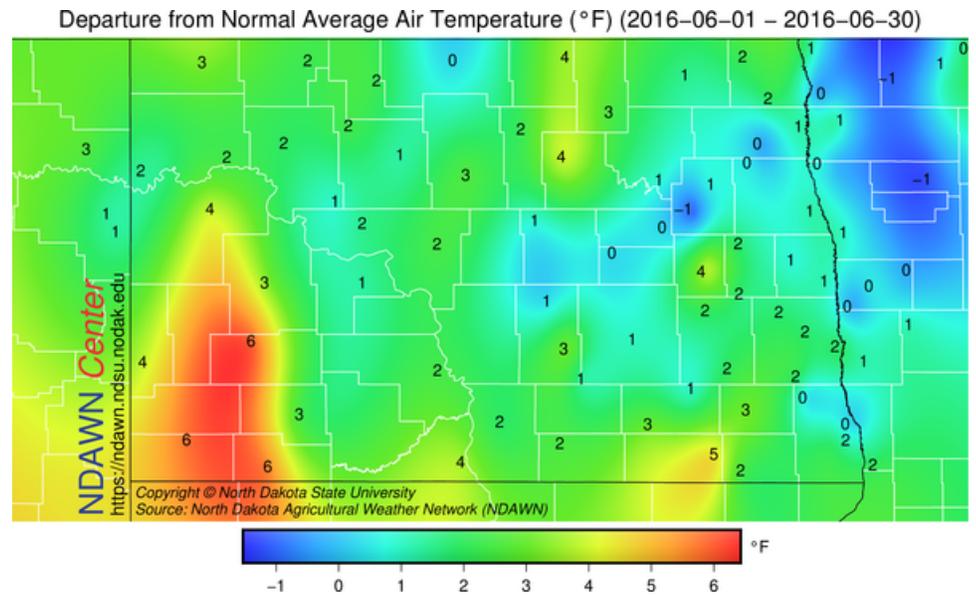


Figure 2. Temperature Departure from Normal in June 2016 for North Dakota (NDAWN)

records since 1890, the state average annual precipitation accumulation showed a decreasing trend by 0.02” per decade.

The state average temperature in June was 65.9°F, which is the 20th warmest June on record since 1895. It was 0.8°F warmer than last year and was the warmest June since 1997. Most of the state ranged between slightly-above to much-above the 1981-2010 average. There were some small pockets where the monthly average was near normal (Fig. 2). The state’s highest and lowest temperatures ranged from 101° on June 25 in Flasher to 37° on June 23 in Hettinger, ND. The daily maximum of 101°F that was recorded on June 25 in Flasher was the only 100-degree day to this date in ND. Based on the historical records since 1890, the state average annual temperature showed an increasing trend by 0.13°F per decade. The highest and the lowest monthly state average temperatures ranged from 74.1° in 1988 to 56.8° in 1915.

Drought and Other Notable Impacts:

Crops in the south central region showed stress from dry conditions according to the USDA Agricultural Statistic Service (NASS). NWS Storm Prediction Center reported 3 tornadoes, 62 hail event, and 97 high wind events in ND (Figure 3). Two tornadoes were reported through social media near Watford City on June 21. However, no known damage was reported with these tornadoes. One of these tornados was reported near Mott on June 21 also with Emergency Management reporting minor roof damages. This storm near mott also produced hail with a 2.5” diameter. NDAWN’s highest peak gust in June was recorded at McHenry weather station as 78.5 mph at 5:58 am on June 17, 2016. Locations receiving excessive rain and hail especially in the northeastern portions of the state reported crop damage due to hail. Excessive moisture also caused crop disease issues according to NASS.

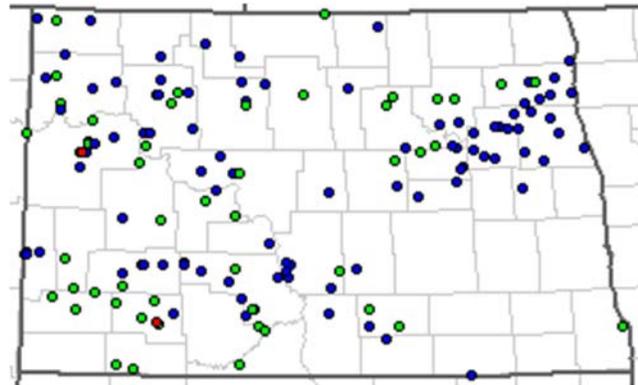


Figure 3. June 2016 North Dakota Storm Events (Red: Tornado; Blue: Wind; Green: Hail).

By the end of the month, less than 1% of the state (SW corner of Richland County) experienced severe drought while less than 4% of the state experienced moderate drought (Figure 4). The counties in the moderate drought areas are Bowman, Adams, Hettinger, Grant and Sioux in the southwest; Sargent and Richland counties in the southeast. More than 80% of the state did not have any drought or abnormally dry conditions.

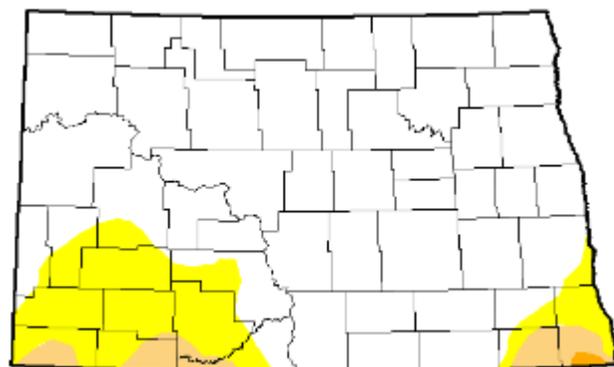


Figure 4. Drought Monitor Map of North Dakota as of June 28, 2016.

July 2016

Based on the National Centers for Environmental Information (NCEI), statewide averaged monthly accumulated precipitation was 4.38", 1.73" greater than last year and 1.5" greater than the 1981-2010 average July precipitation. The statewide average precipitation was ranked the 9th wettest on record since 1895. A majority of the state received above to much-above-normal precipitation (Figure 5).

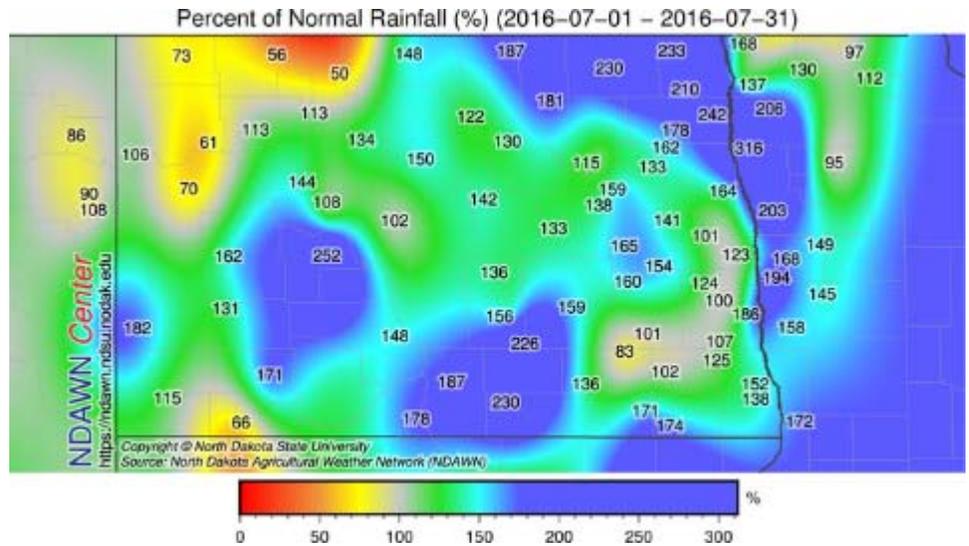


Figure 5. Precipitation Percent of Normal in July 2016 for North Dakota (NDAWN)

Northeastern parts of the state received between 1.7 and 2.3 times as much rain as normally falls in these regions. Northwestern parts and some small pockets of the southwest, Adams county, continued to stay on the dryer end. The largest amount of monthly accumulation was 9.89", recorded in Cavalier, Pembina County by a CoCoRaHS observer. The least amount of monthly accumulation was 0.6", in Hettinger, Adams County. The greatest 24-hr rainfall was 3.13", recorded in Fargo on July 27 by another CoCoRaHS observer. Based on the historical records since 1895, the state average annual precipitation accumulation showed an increasing trend of 0.09" per decade. The highest and the lowest monthly state July precipitation ranged from 7.97" in 1993 to 0.94" in 1936.

The state average temperature in July based on NCEI was 69.2°F, 0.7° cooler than last year but 0.2° warmer than the 1981-2010 average. It was ranked the 63rd warmest or 60th coldest July on record since 1895. For most of the state, it was either an average July or within one degree from the 1981-2010 average (Fig. 6). The state's highest and lowest daily temperatures ranged from 105° on July 20 in Hettinger (Adams County) to 39° on July 1 in Hazelton (Emmons County) and Willow City (Bottineau County). Based on the historical records since 1895, the state average annual temperature showed an increasing trend of 0.03°F per decade. The highest and the lowest monthly state July average temperatures ranged from 80.1° in 1936 to 61.8° in 1992.

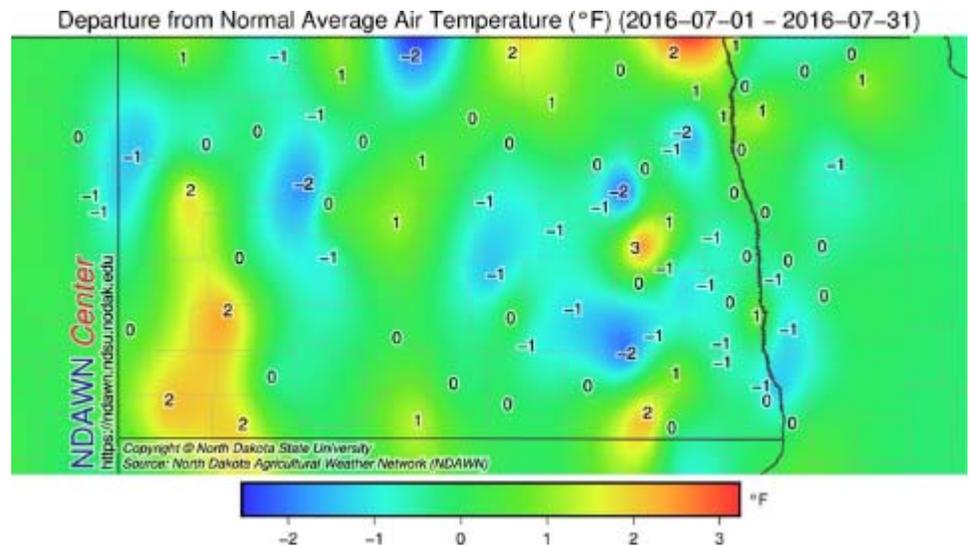


Figure 6. Temperature Departure from Normal in July 2016 for North Dakota (NDAWN)

Drought and Other Notable Impacts:

NWS Storm Prediction Center reported 15 tornadoes, 120 hail events, and 113 high wind events in ND. Figure 7 shows the storm reports in July 2016. In that figure red, blue and green dots represent tornado, wind, and hail respectively. NDAWN's highest peak gust in July was 89.5mph recorded at the McHenry weather station on July 4, 2016.

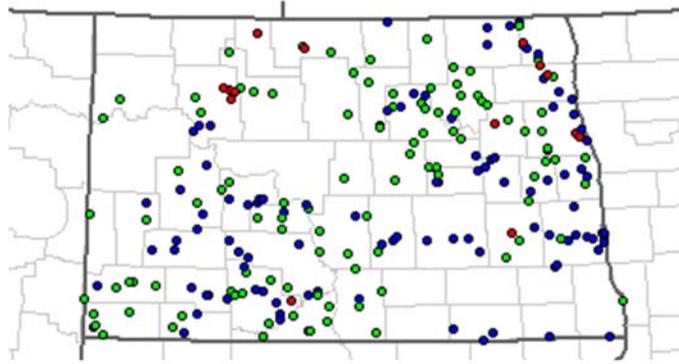


Figure 7. July 2016 North Dakota Storm Events (Red: Tornado; Blue: Wind; Green: Hail).

Based on the Drought Monitor (DM) on July 26, 2016, less than 3% of the state was under a drought designation (Figure 8). Out of that, only 1.2% was designated in the severe category, or D2, based on the index used by the DM from D0 (Abnormally Dry) to D4 (Exceptional Drought) .

Counties in the severe drought areas as of July 26: Bowman and Slope.

Counties in moderate drought areas: Bowman, Slope, and Adams in the southwest; Richland in the southeast.

More than 90% of the state did not have any D-designation including abnormally dry conditions.

Locations receiving excessive rain and storm damage in Pembina and Walsh counties impacted the state's overall potato conditions. Based on the ND Agricultural Statistical Services, the state's potato crop was rated at 21% percent poor or very poor conditions.

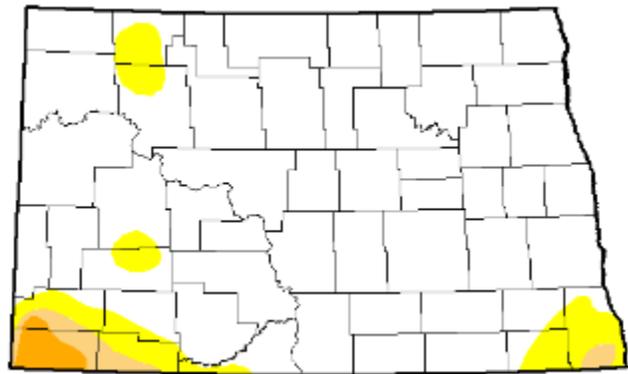


Figure 8. Drought Monitor Map of North Dakota as of July 26, 2016.

August 2016

Based on the National Centers for Environmental Information (NCEI), statewide averaged monthly accumulated precipitation was 2.27", 0.68" greater than last year, 0.17" greater than the 1981-2010 average August precipitation and was the wettest August since 2014. The statewide average precipitation was ranked the 45th wettest on record since 1895. A majority of the central and eastern parts of the state received above to much-above-normal

precipitation (Figure 9). On the contrary, northwestern parts of the state stayed dryer than normal. The largest amount of monthly accumulation was 7.45" and was recorded in Oakes, Dickey County by a Coop observer. The least amount of monthly accumulation was 0.45" and recorded at Williston Sloulin Int. Airport, Williams County. The greatest 24-hr rainfall was 3.89" and was recorded in Fullerton on August 10 by a Coop observer. Based on historical records, the state average annual precipitation accumulation showed no long-term trend since 1895. The highest and the lowest monthly state August precipitation ranged from 4.54" in 1900 to 0.73" in 1929.

The state average temperature in August based on NCEI was

67.9°F, nearly as warm as last year, 0.4° warmer than the 1981-2010 average and was the warmest August since 2015. It was ranked the 50th warmest August on record since 1895. As the northern parts of the state showed warmer than normal conditions, eastern parts of the state were cooler than normal and southern parts of the state were near normal (Fig. 10). The state's highest and lowest daily temperatures ranged from 99° on August 1 in Watford City, McKenzie County to 58° on August 29 in Taylor, Stark County. Based on historical records, the state average annual temperature showed an increasing trend of 0.02°F per decade since 1895. The highest and the lowest monthly state August average temperatures ranged from 80.1° in 1936 to 61.8° in 1992.

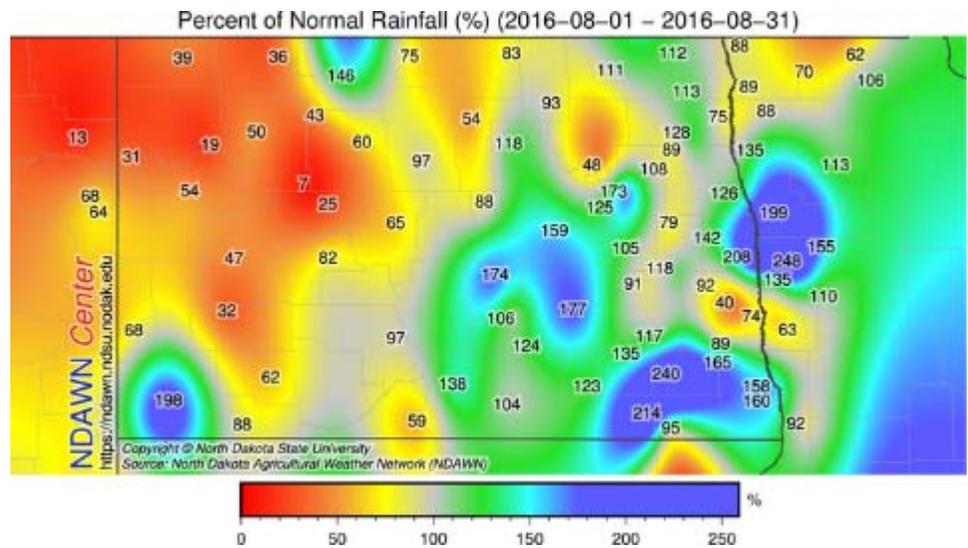


Figure 9. Precipitation Percent of Normal in August 2016 for North Dakota (NDAWN)

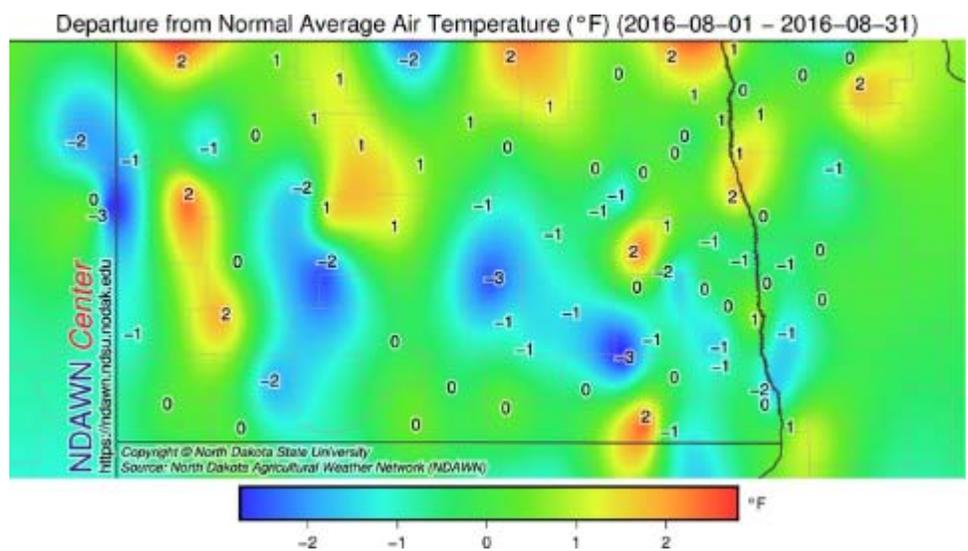


Figure 10. Temperature Departure from Normal in August 2016 for North Dakota (NDAWN)

Drought and Other Notable Impact:

Based on the Drought Monitor (DM) on August 30, 2016, less than 2% of the state was under a drought designation (Figure 11).

Out of that, only 0.29% was designated in a severe category, or D2, based on the index used by the DM from D0 (Abnormally Dry) to D4 (Exceptional Drought).

Counties in the severe drought areas as of August 30: Bowman.

Counties in moderate drought areas as of August 30: Bowman and Adams.

Nearly 90% of the state stayed in the clear avoiding any designation including abnormally dry conditions.

NWS Storm Prediction Center reported 13 tornadoes, 77 hail, and 48 high wind events in ND. Figure 12 shows the storm reports in August 2016. In that figure, red, blue and green dots represent tornado, wind, and hail respectively. NDAWN's highest peak gust in July was 80 mph recorded at the Linton weather station on August 9, 2016.

On August 3, thunderstorms embedded in a very strong upper level low produced tornadoes (mostly concentrated in Devils Lake Basin) with numerous wind damage to crops and other property.

By the end of the summer, the ND Ag Statistical Service reported corn 8% mature (near average), soybean dropping leaves 29% (slightly ahead of average).

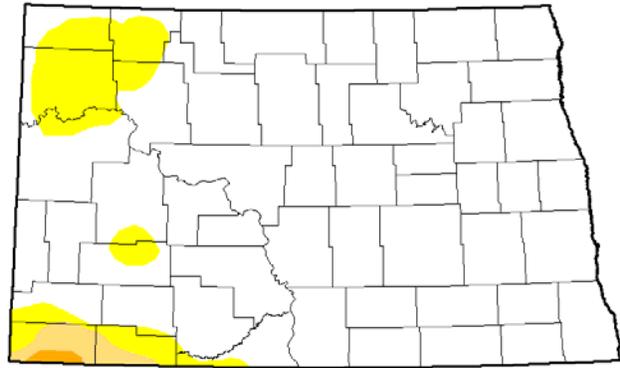


Figure 11. Drought Monitor map for North Dakota as of August 30, 2016.

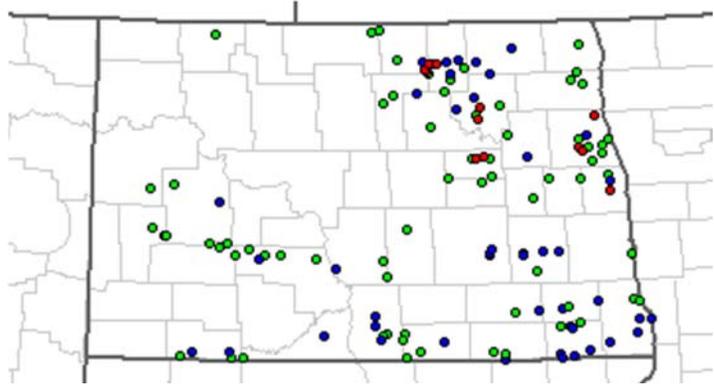


Figure 12. August 2016 North Dakota Storm Events (Red: Tornado; Blue: Wind; Green: Hail).

Summer 2016

Using analysis from the National Centers for Environmental Information (NCEI), the average North Dakota precipitation for the summer season (June 1 through August 31) was 9.28 inches, which was 1.41” greater than last year, 0.91” greater than the 1981-2010 average August precipitation and was the wettest August since 2014. This would rank summer 2016 as the 30th wettest summer since such records began in 1895. Figure 13 shows the percent of normal precipitation distribution geographically. Based on historical records, the state average summer precipitation showed an increasing trend of 0.02” per decade since 1895. The highest and the lowest seasonal summer average precipitation for the state ranged from the highest amount of 15.54” in 1993 to the lowest amount of 3.32” in 1929.

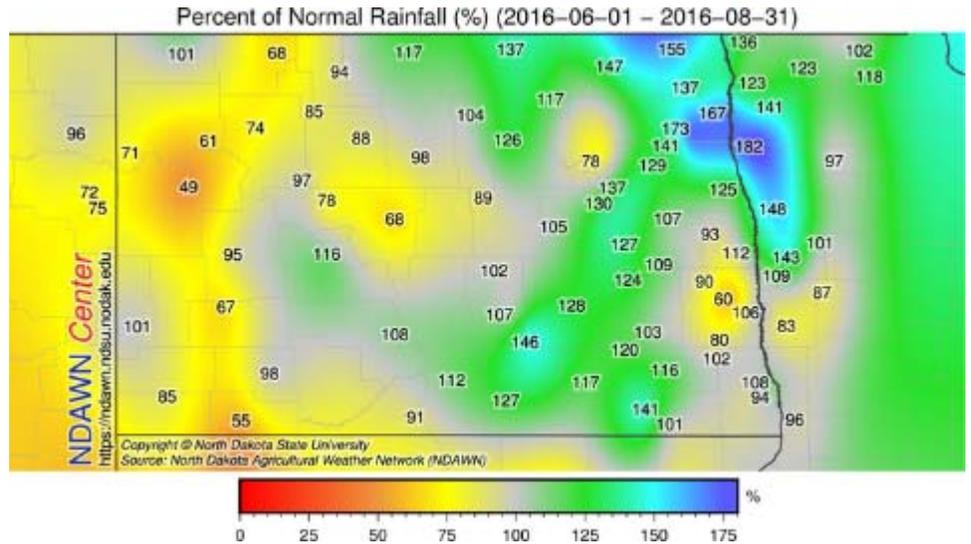


Figure 13. Precipitation % of Normal in Summer 2016 for North Dakota (NDAWN)

Figure 13 shows the percent of normal precipitation distribution geographically. Based on historical records, the state average summer precipitation showed an increasing trend of 0.02” per decade since 1895. The highest and the lowest seasonal summer average precipitation for the state ranged from the highest amount of 15.54” in 1993 to the lowest amount of 3.32” in 1929.

The average North Dakota temperature for the summer season (June 1 through August 31) was 67.7°F, which was the same as last year, 1.1° warmer than the 1981-2010 average Summer temperature and the warmest summer since 2012. This would rank summer 2016 as the 30th warmest summer since such records began in 1895. Figure 14 shows the departure from normal temperature distribution geographically. Based on historical records, the state average summer temperature showed an increasing trend of 1.5°F per decade since 1895.

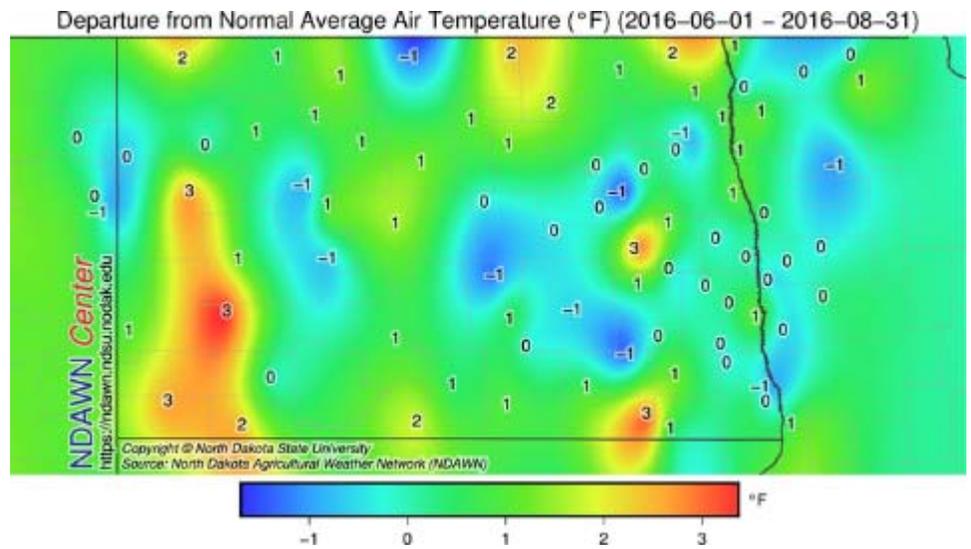
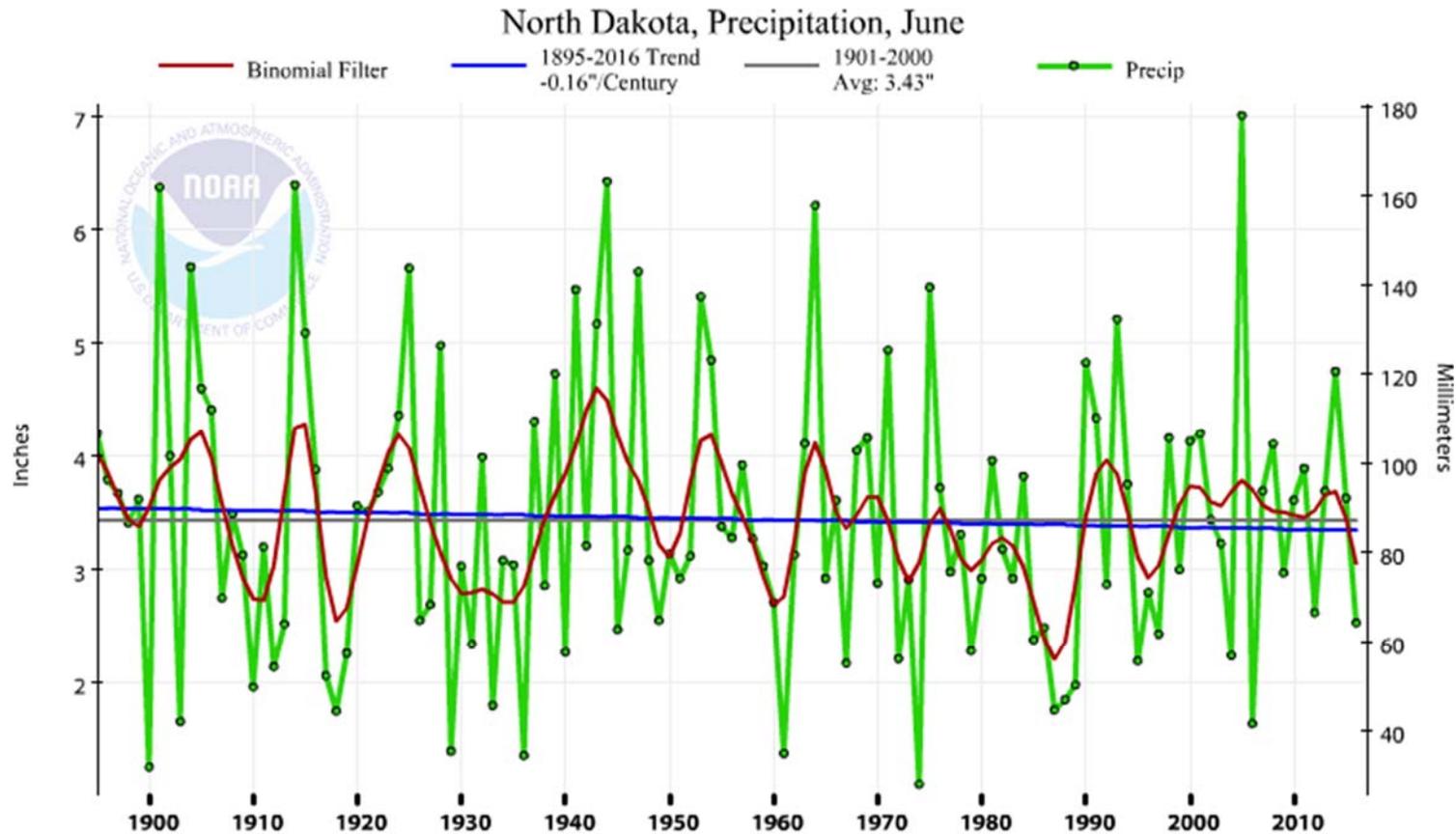


Figure 14. Temperature Departure from Normal in Summer 2016 for North Dakota (NDAWN)

The highest and the lowest seasonal summer average temperatures for the state ranged from the highest amount of 72° in 1936 to the lowest amount of 61.2° in 1915.

Agricultural Impact: Warmer than normal conditions caused above normal seasonally accumulated growing degree days for most crops. However, heavy rains in some regions especially in the Red River Valley not only caused delayed harvest but also caused crop losses for edible bean farmers. Active storms caused crop damage due to hail and high wind.

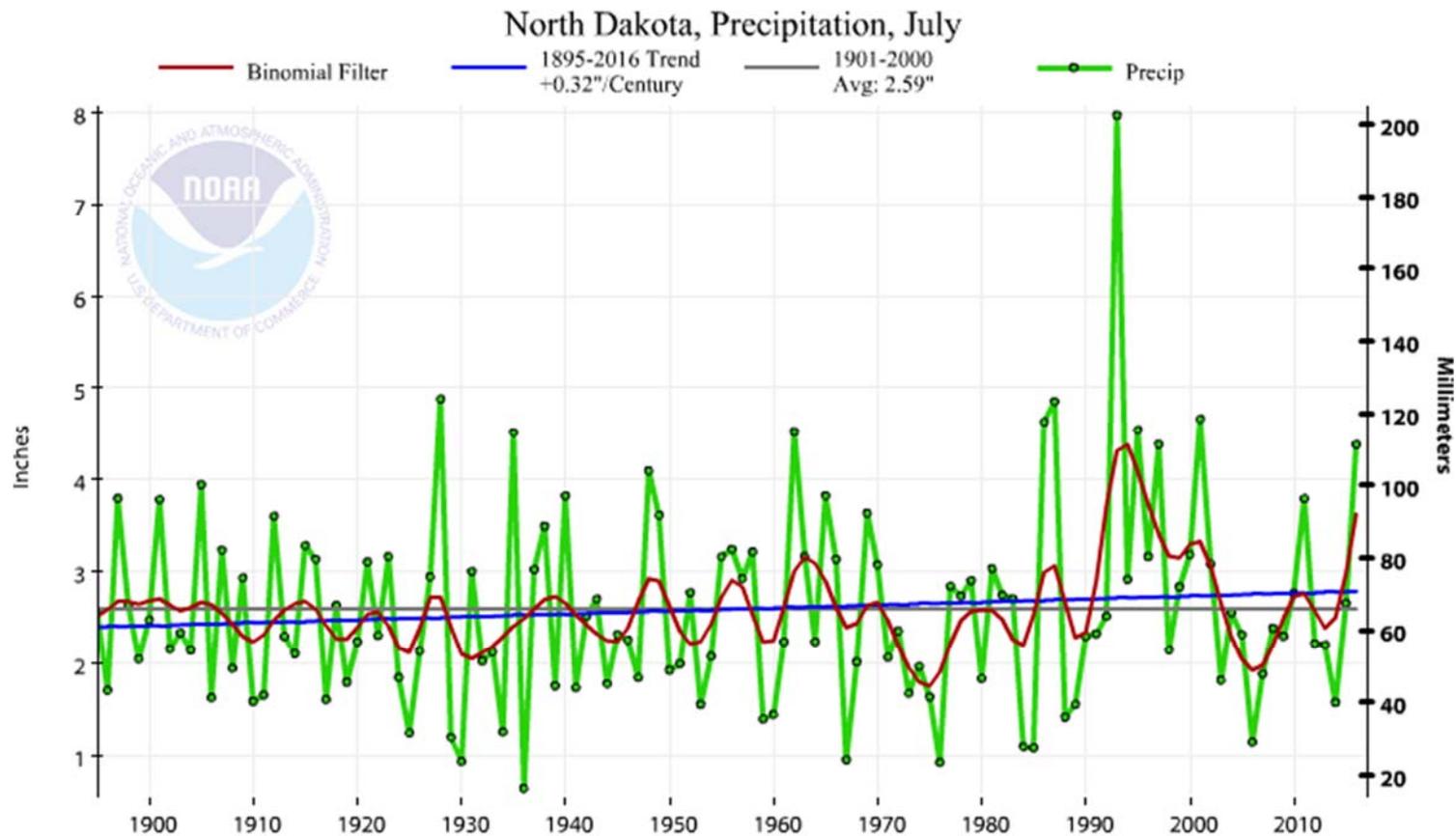
HISTORICAL JUNE PRECIPITATION FOR NORTH DAKOTA



June Precipitation Statistics
 2016 Amount: 2.53 inches
 Maximum: 7.01 inches in 2005
 Minimum: 1.11 inches in 1974

State Normal: 2.63 inches (1981-2010)
 Years in Record: 122
 Monthly Ranking: 29th Driest
 Trend: -0.02" per Decade

HISTORICAL JULY PRECIPITATION FOR NORTH DAKOTA

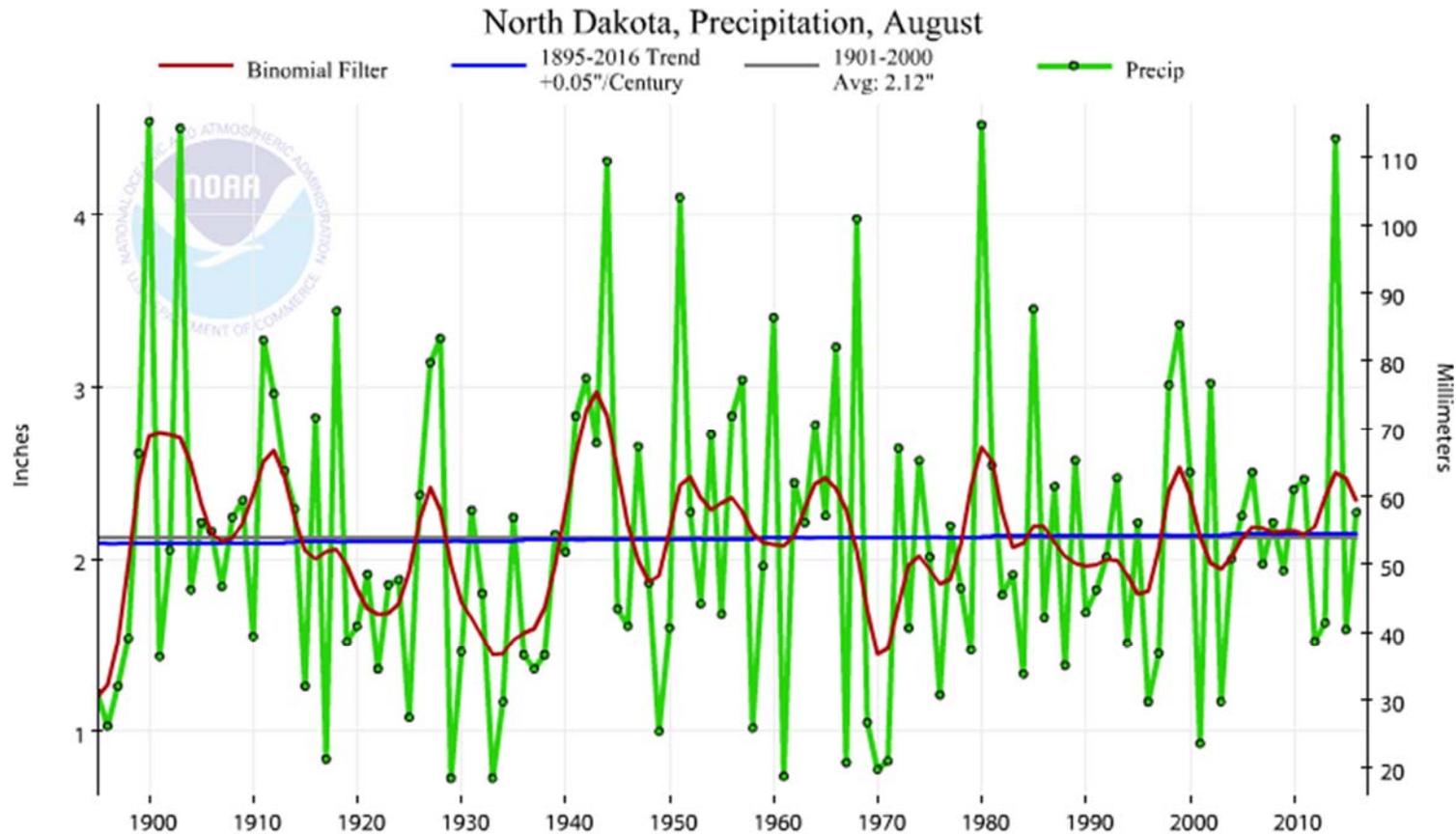


July Precipitation Statistics

2016 Amount: 4.38 inches
 Maximum: 7.97 inches in 1993
 Minimum: 0.64 inches in 1936

State Normal: 2.88 inches (1981-2010)
 Years in Record: 122
 Monthly Ranking: 9th Wettest
 Trend: 0.03" per Decade

HISTORICAL AUGUST PRECIPITATION FOR NORTH DAKOTA

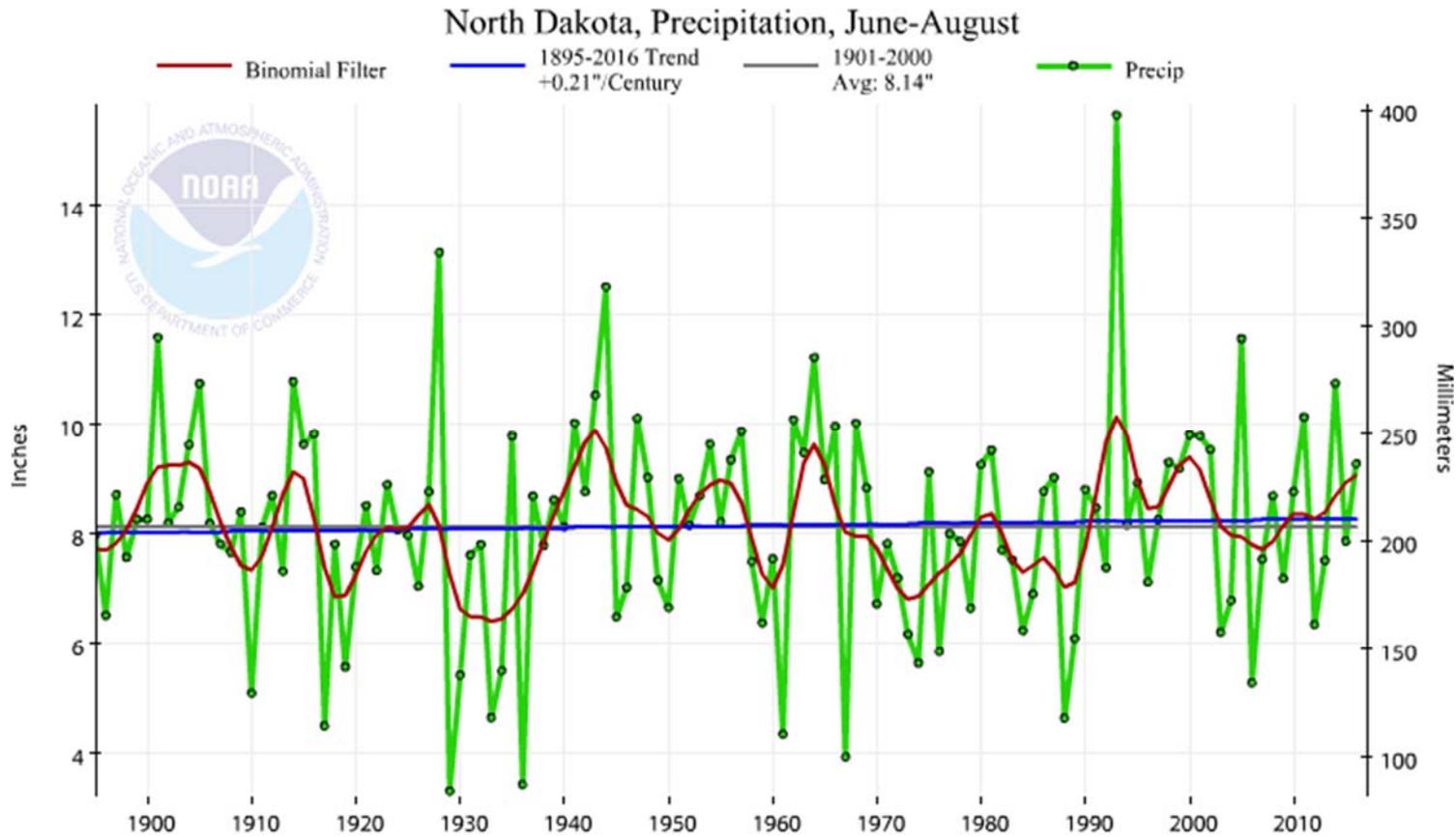


August Precipitation Statistics

2016 Amount: 2.27 inches
 Maximum: 4.54 inches in 1900
 Minimum: 0.73 inches in 1929

State Normal: 2.10 inches (1981-2010)
 Years in Record: 122
 Monthly Ranking: 45th Wettest
 Trend: 0.01" per Decade

HISTORICAL SUMMER PRECIPITATION FOR NORTH DAKOTA

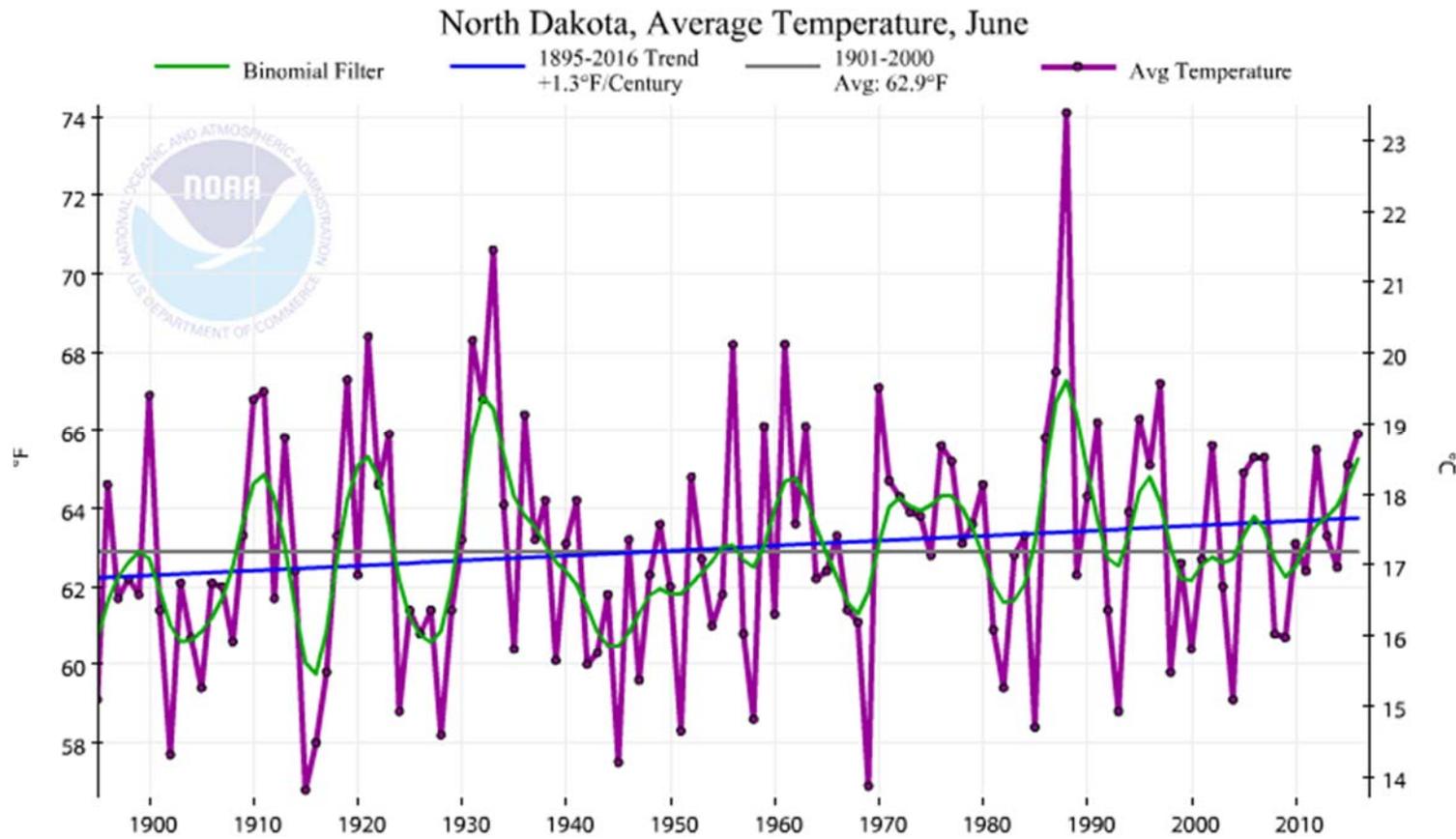


Summer Precipitation Statistics

2016 Amount: 9.28" in 1993
 Maximum: 15.54" in 1993
 Minimum: 3.32" in 1929

State Normal: 8.38 inches (1981-2010)
 Years in Record: 122
 Monthly Ranking: 30th Wettest
 Trend: 0.02" per Decade

HISTORICAL JUNE TEMPERATURE FOR NORTH DAKOTA

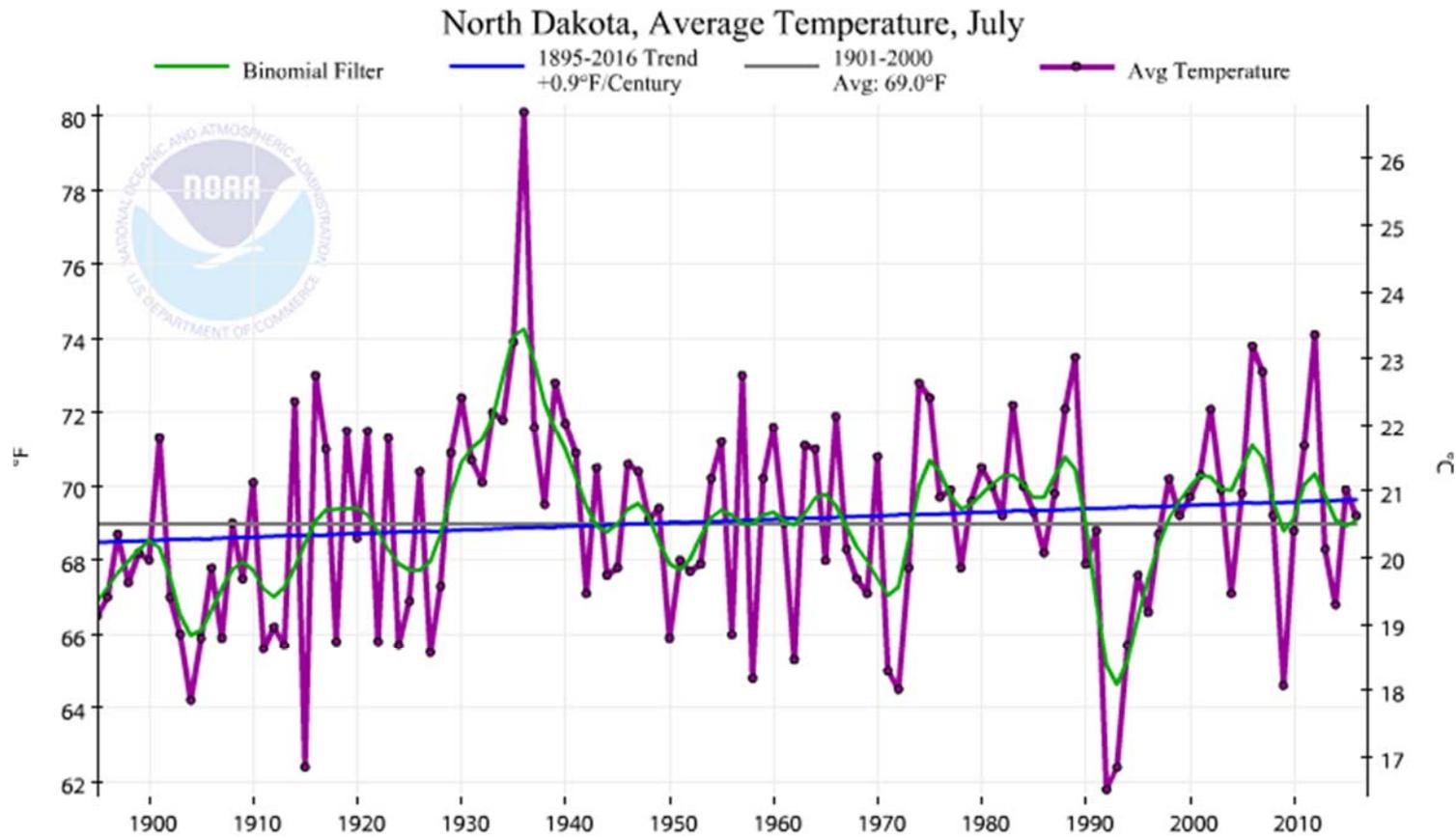


June Temperature Statistics

2016 Amount: 65.9°F
 Maximum: 74.1° in 1988
 Minimum: 56.8° in 1915

State Normal: 63.37°F (1981-2010)
 Years in Record: 122
 Monthly Ranking: 20th Warmest
 Trend: 0.13°F per Decade

HISTORICAL JULY TEMPERATURE FOR NORTH DAKOTA

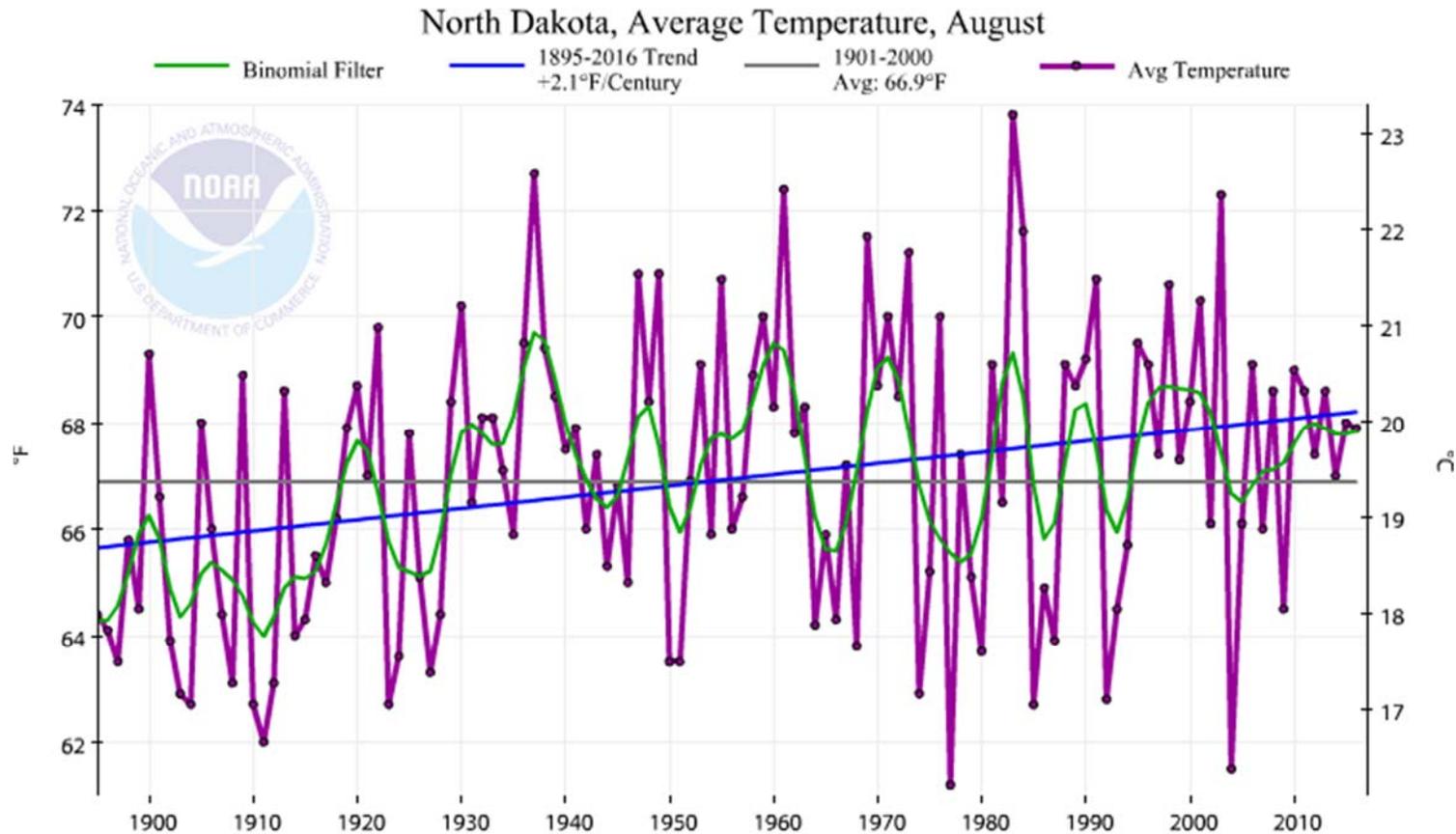


July Temperature Statistics

2016 Amount: 65.9°F
 Maximum: 80.1° in 1936
 Minimum: 61.8° in 1992

State Normal: 69.2°F (1981-2010)
 Years in Record: 122
 Monthly Ranking: 60th Coldest
 Trend: 0.09°F per Decade

HISTORICAL AUGUST TEMPERATURE FOR NORTH DAKOTA

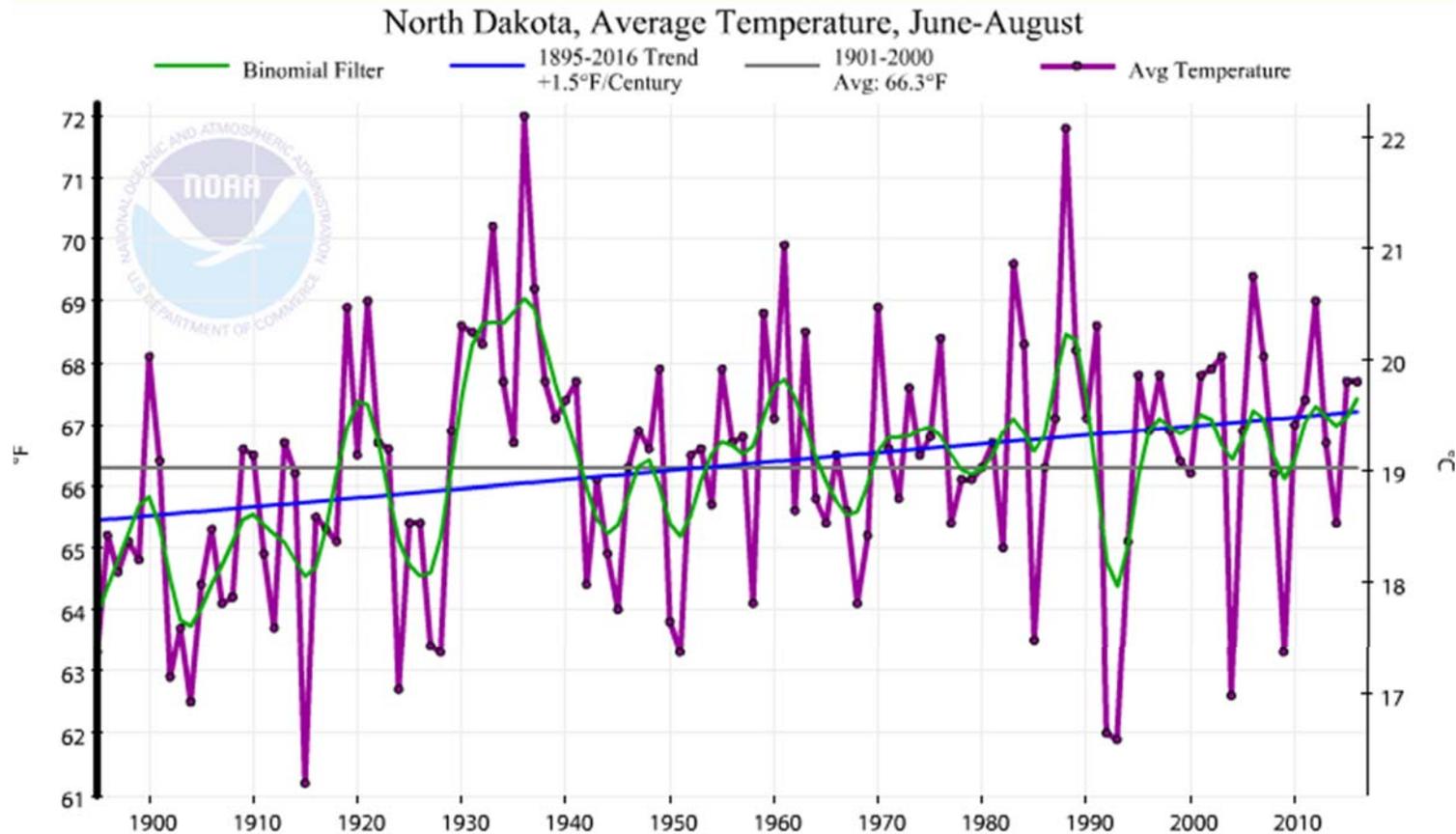


August Temperature Statistics

2016 Amount: 67.3°F
 Maximum: 73.8° in 1983
 Minimum: 61.2° in 1977

State Normal: 67.9°F (1981-2010)
 Years in Record: 122
 Monthly Ranking: 50th Warmest
 Trend: 0.21°F per Decade

HISTORICAL SUMMER TEMPERATURE FOR NORTH DAKOTA



Summer Temperature Statistics

2016 Amount: 67.7°F

Maximum: 72.0° in 1936

Minimum: 61.2° in 1915

State Normal: 66.6°F (1981-2010)

Years in Record: 122

Monthly Ranking: 30th Warmest

Trend: 1.5°F per Decade

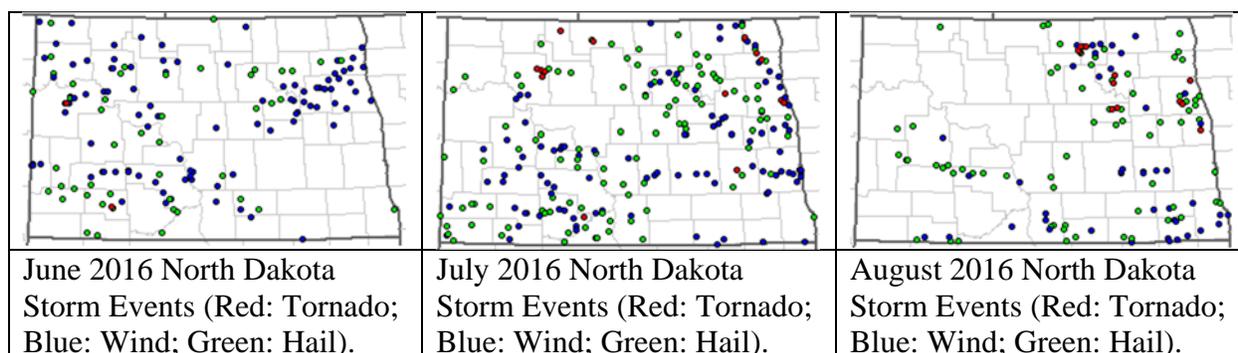


Storms & Record Events

State Tornado, Hail, and Wind Events for Summer 2016

<i>Month</i>	Tornado	Hail	Wind	Total
<i>June Total</i>	3	62	97	162
<i>July Total</i>	15	120	113	248
<i>August</i>	13	77	48	138
3-Month Total	31	259	258	548

Numbers in the table above represent the number of tornado, hail and wind events accumulated monthly and seasonally.



State Record Events for Summer 2016

<i>Month</i>	Highest Maximum Temperature	Lowest Minimum Temperature	Highest Daily Precipitation	Total
<i>June Total</i>	6	2	8	16
<i>July Total</i>	3	2	41	46
<i>August</i>	0	0	22	22
3-Month Total	9	4	71	84

Numbers in the table above represent the number of select state record events accumulated monthly and seasonally.



Seasonal Outlook



Fall 2016 Outlook

By R. Kupec¹

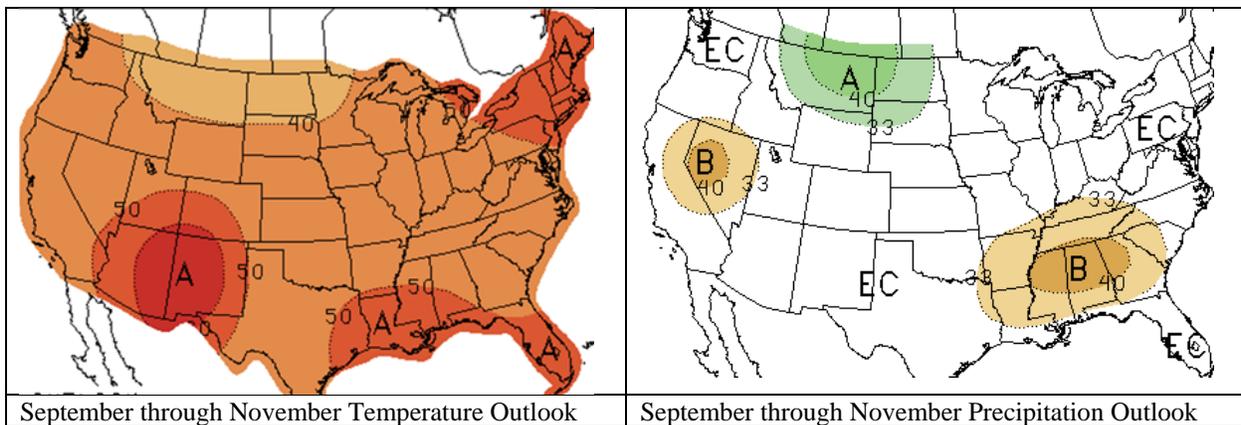
As we head into Fall 2016, several of the global climate drivers are in a period of change. The trend over the summer of the fading El Niño continued to the point that we are now in a neutral phase, trending towards a weak La Niña. There are some teleconnections for the South Pacific and North Dakota for the fall, although these are not particularly strong. Factors in other parts of the world are strong enough to draw some conclusions about what the autumn may bring to the state.

The fact that we may be stuck somewhere between a La Niña and neutral conditions does make the outlook a little tricky but some other factors should come into play. Sea surface temperatures in both the Northern Pacific and Atlantic Oceans remain warm and sea ice in the Arctic is on the low side. This means North America is surrounded by relatively warm water, therefore most of the United States and North Dakota should experience warmer than average temperatures for the fall season. Even without these factors, neutral conditions in the Southern Pacific correlate with average fall temperatures across North Dakota. If conditions move from neutral to La Niña, the correlation is for average to slightly warmer than average temperatures for fall. October, in particular, has a tendency for slightly warmer than average temperatures during a La Niña.

Precipitation for both neutral and La Niña conditions trends towards average across all of North Dakota. A deeper examination does find in years with warm water in the Northern Pacific and a developing La Niña, a trend for wet Septembers followed by drier Octobers and closer to average precipitation for November. Certainly, the deluge many areas experienced in early September has set many locations on a path to above average precipitation this month.

The Summer Climate Outlook accurately predicted the warmer than average temperatures and pockets of wet and dry conditions that prevailed. This fall, look for the above average temperatures to continue with precipitation likely trending more towards average across the state rather than the pockets of excess and shortfalls of moisture experienced in the summer. The current Climate Prediction Center (CPC) Fall Outlook also gives the state a better than average chance of seeing above average temperatures for the season. The CPC has nearly the entire state with a chance of above average precipitation; the one exception is the southeast corner which is forecasted to have an equal chance of above or below average precipitation (see figure 2).

The next 90-day outlook from the CPC should be available after September 16th at <http://www.cpc.ncep.noaa.gov/products/predictions/90day>.



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Hydro-Talk



Hydrologic Conditions in Missouri Basin By A. Schlag²

Perhaps the best way to describe the current state of hydrology in North Dakota is to simply call it boring, and that is amazing given that I have been known to just sit and watch waves crash on a shoreline for hours at a time. However, in regards to the current summer season drawing to a close, I am generally referring to an overall lack of eye-catching floods or droughts. Yes, there have been some impressive thunderstorms with minor overland flooding, but there really hasn't been much in the way of stream flooding this summer. Similarly, there have only been relatively small areas of the state that saw prolonged periods of time with a lack of moisture. In some regards, the resilient nature of the countryside in preventing excessive runoff this summer has been the most interesting aspect of a fairly normal summer. In the simplest of explanations, most of the larger storms were just spaced far enough apart in time for the soils to sufficiently dry out and provide storage for some pretty heavy rains.

That brings me to already start looking ahead to the coming winter season and its prospects for accumulating excessive amounts of snow-water equivalent (SWE) on the ground for the 2017 spring flood season. Current expectations from climate forecasters suggest a 55-60% chance for a La Niña to be in place beginning this fall and lasting through the winter. If I were to only remark that 2010-2012 were La Niña winters and leave it at that, some may immediately come to the conclusion that we are in for quite a change compared to the most recent winter and spring flood season. However, that would be an unfair characterization of the risks posed for the upcoming winter season. In reality, that small sampling of La Niña affected winters also came with what is called a negative Pacific Decadal Oscillation. When these two are in sync, they have something of a synergistic effect on the winter weather patterns we see in the Northern Great Plains; however, when they are out of sync the winter weather tends to be a bit more varied as is the eventual SWE on the ground come spring time. In the upcoming winter, all indicators are that the current positive PDO (Figure 1) will remain in place and also influence our weather.

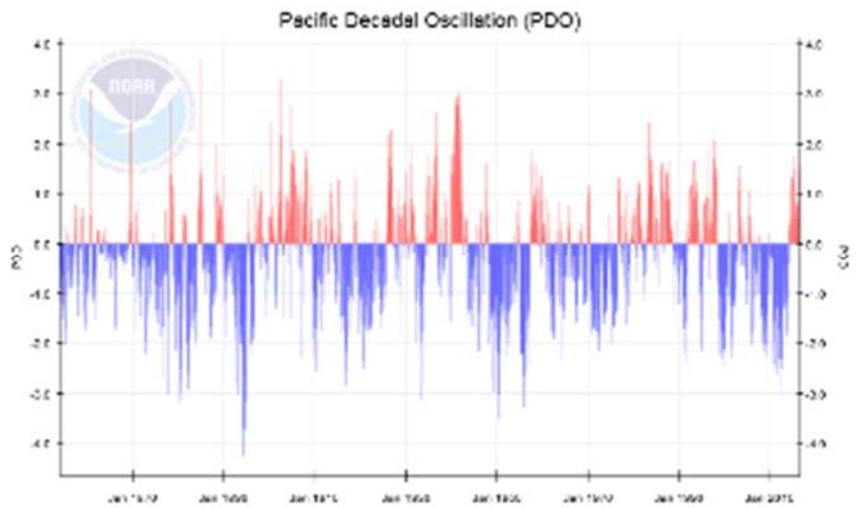


Figure 1. Historical PDO Values (NCEI, 2016)

While March and April of 2017 are long ways in the future, the most realistic expectation for the spring 2017 snowmelt season is that it will not be at either end of the extremes despite the now fairly long-standing expectation for a La Niña influenced winter. There are just too many other climate drivers such as the PDO and Arctic Oscillation that can override the effects of what is expected to be a weak La Niña.

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



Multi-Vortex Tornadoes in North Dakota

By G. Gust³

Big Multi-Vortex Tornadoes in North Dakota – Say What?!

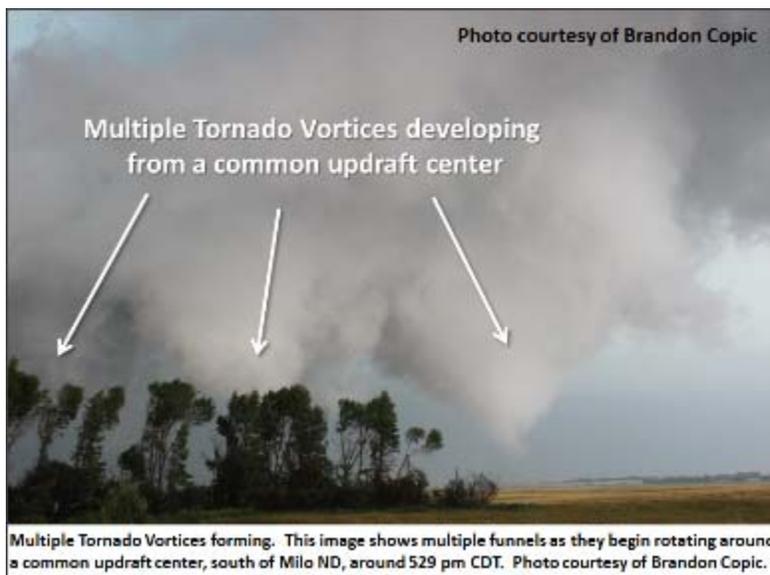
Our NWS Damage Survey Team completed ground assessments on Thursday, August 4th, across portions of Rolette and Towner Counties, in north-central ND, following on the heels of the massive storms which had raked through that area the preceding day, August 3rd. We weren't *too* surprised by what we saw there, thanks to the many storm spotters and chasers who had submitted reports, pictures, and videos related to the episode.

We weren't too surprised... in that, *we* had seen this type of damage before, in other parts of our Northern Plains area, but we recognize that this is not the kind of thing a North Dakotan typically expects to happen in their own backyard. What I'm talking about is a massive multi-vortex wedge-tornado, leaving a track of extreme damage pushing nearly a mile wide at times.

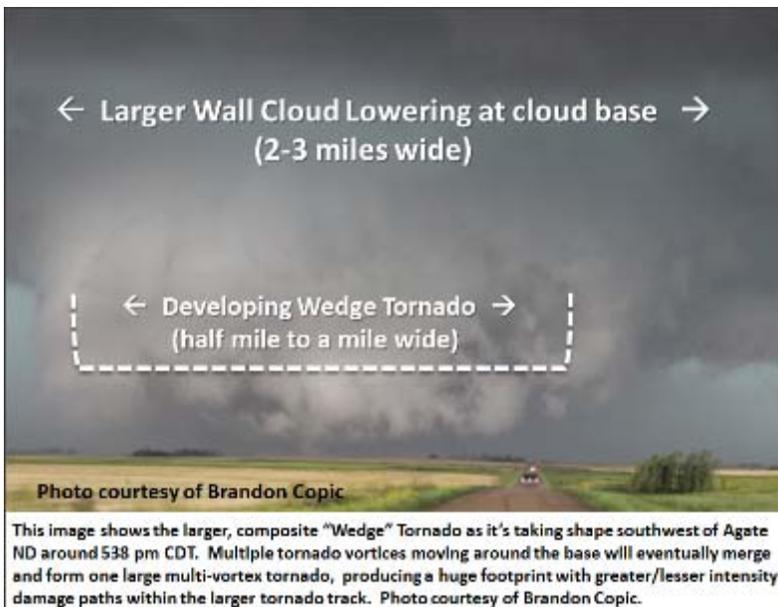
A Brief 3 August 2016 Episode

Summary: The Rolette-Towner County combined tornado track length runs upwards of 20 miles long, with numerous additional miles of extreme (rear-flank) downburst wind persisting across central Towner Co., then weakening a bit across northwest Ramsey and southwest Cavalier Counties.

This tornado was the multi-vortex style which can often produce the very wide and extremely destructive types of storms we often hear about in more southern parts of Tornado Alley. In this particular case, the larger tornado vortex never quite



Multiple Tornado Vortices forming. This image shows multiple funnels as they begin rotating around a common updraft center, south of Milo ND, around 529 pm CDT. Photo courtesy of Brandon Copic.



This image shows the larger, composite "Wedge" Tornado as it's taking shape southwest of Agate ND around 538 pm CDT. Multiple tornado vortices moving around the base will eventually merge and form one large multi-vortex tornado, producing a huge footprint with greater/lesser intensity damage paths within the larger tornado track. Photo courtesy of Brandon Copic.

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became the larger scale dirt-churning machine but stayed a bit looser (fluffier) and with the multiple smaller vortices continually wrapping around the larger center in a more opened fashion. To a degree, both video and debris patterns showed this.

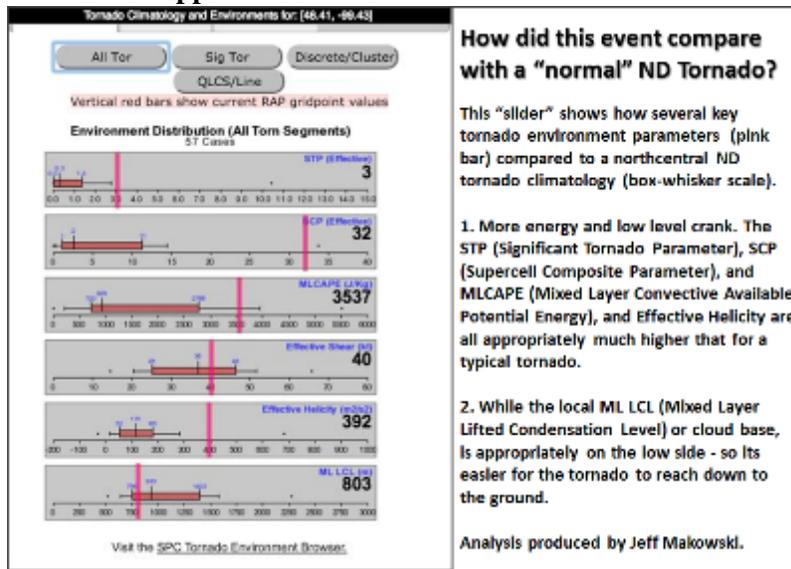
Kelley Williamson's video of this tornado is online at: <https://www.youtube.com/watch?v=JfX9Yxfe528>

Brandon Copic's video of this tornado is online at: <https://www.youtube.com/watch?v=0W8DIYVABr8>

Yet the wide path of tornadic destruction was clearly evident across the area southwest of Agate, in Rolette County, it weakened a bit in the area between Agate and Bisbee, and then became quite wide and strong from just northwest of Bisbee and eastward, across to Hwy 281, north of Arndt. At that point, the tornado likely became completely rain-wrapped and the extreme rear-flank downdraft winds then cut across its south edge and continued eastward.

In the area from 2-3 miles north of Bisbee through to Highway 281, it became difficult to ascertain where we were seeing damage from a one-half to three-quarter mile wide multi-vortex tornado... to a 2-3 mile wide path of the tornado and extreme downburst wind. Radar imagery helped to corroborate the idea that as the tornado approached and then passed Highway 281 the descending rear-flank downdraft (RFD) had cut through the near-surface updraft and was effectively choking off the tornado. Those extreme RFD winds then produced a wider and more divergent wind pattern as the storm propagated eastward.

So has this happened before in ND? The nature of the tornado development and evolution did appear to



be quite similar to both the Rugh Lake⁴ (Nelson Co.) and Northwood⁵ (Grand Forks Co.) ND Tornadoes of 26 Aug 2007, and the Otter Tail-Wadena County MN tornadoes of 17 Jun 2010.

The Rolette-Towner County damage did not reach the EF3-EF4 level of intensity those tornadoes exhibited, in part because the main tornado vortex did not appear to focus as tightly (within the storm updraft) and in part because the storm did not directly impact any of the towns in the area... where damage levels may have increased due to higher debris loading. Such

a big tornado impacting a community is almost always likely to produce a higher scale of damage, largely because of the added force of debris loading.

⁴ Find Rugh Lake/Northwood Tornado info at: http://www.weather.gov/fgf/2007_08_26_NorthwoodTornado

⁵ Detailed technical review of Northwood: http://www.weather.gov/media/crh/publications/TA/TA_1302.pdf

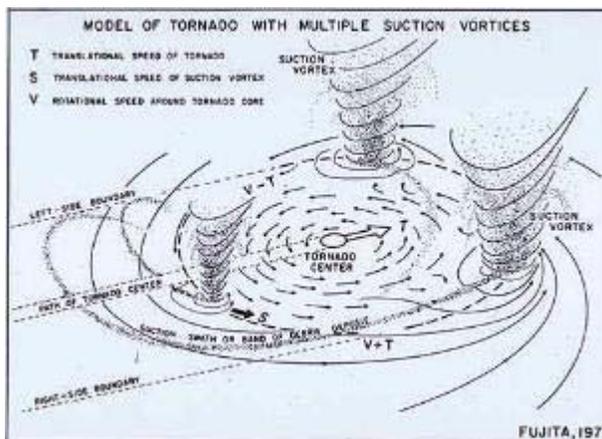
As it is, tornadoes are still rated on the damage they produce, not on the explicit measurement of actual wind speeds. Thus tornadoes which occur in our largely opened North Dakota countryside are inevitably considered weaker than their big city cousins, even though they may be near as potentially damaging.

Is this common in ND? Tornadoes throughout the Great Plains area are produced most commonly as a part of a distinct supercell thunderstorm, though they can often occur as part of a squall line with embedded supercells. Low-precipitation (LP) supercells, with longer rope-like tornadoes, are more common in the drier western or high plains environment, while the high-precipitation (HP) supercells which also tend to produce the larger wedge-shaped tornadoes are more common in the humid eastern plains states. The classic supercell, which is *most* common throughout ND and the larger Great Plains area, tends to produce a more columnar or “stove-pipe” type tornado.

In checking with colleagues in the NWS Bismarck and NWS Grand Forks offices, it doesn't appear that there are many of these large wedge-shaped multi-vortex tornadoes apparent in the historical database for North Dakota. Of course, numerous Significant to Catastrophic (EF2-EF5) tornadoes have occurred in the state, some 190 of such stronger tornadoes have occurred just since 1950. And several of these have been described with quite wide tornado tracks, of a quarter mile wide or wider. So it is quite likely that some of these have had multi-vortex tendencies as well.

In fact, Dr. Ted Fujita, famous for his detailed survey following the EF5 Fargo Tornado of 1957, published this early depiction of a multi-vortex tornado back in 1971. (Graphic at right)

As the SPC Slider shown above would suggest, the conditions more favorable for the production of a multi-vortex tornado would likely include 1) a higher degree of instability; 2) a higher degree of low-level helicity, or natural spin, in the atmosphere; and 3) a lower cloud base - generally associated with more humid environments. These conditions were certainly present in the Northwood 2007 case and in other recent cases. Undoubtedly they have occurred in some of our more historic cases.



For this author, the 26 August 2007 events were the first time I had either seen video evidence of a multi-vortex tornado in these parts (see Rugh Lake video linked above) or surveyed such a wide tornado track as Northwood, coming in at 8/10ths of a mile wide.

In ironic fashion, since I began writing this article there have been two other episodes which have produced multi-vortex events in my area of responsibility... one which produced an EF2 rated multi-vortex tornado southwest of Emerado (Grand Forks Co.) ND, on August 27th, and another that produced an EF2 rated multi-vortex tornado northwest of Gary (Norman Co.) MN, on August 28th.

Find a more detailed event write-up for the Severe Weather Event Summary of August 3 online at:
https://www.weather.gov/fgf/2016_08_03_EventSummary

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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