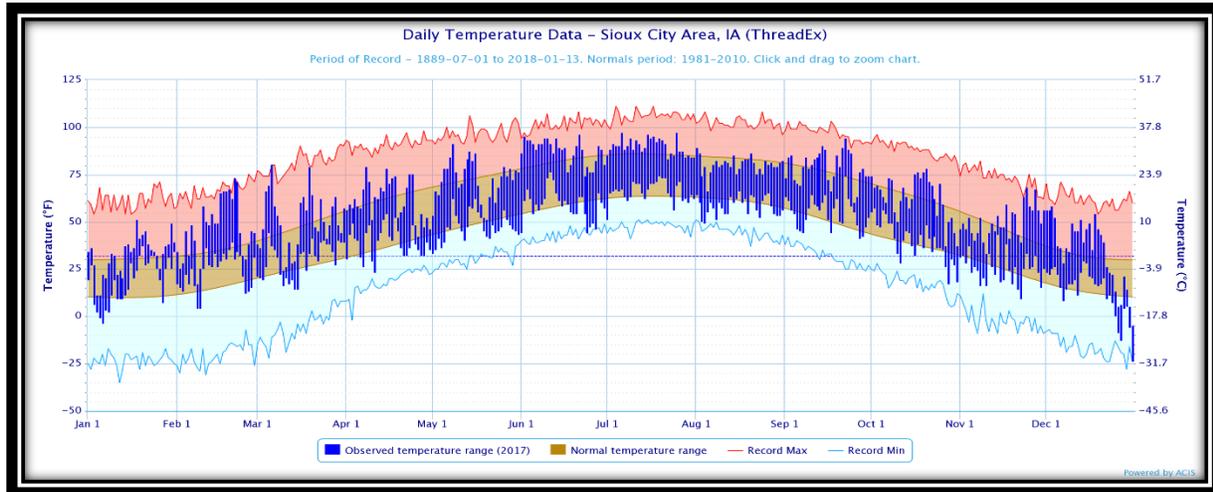


2017 Again Shades Warm and Wet in Sioux City

While 2017 might be most easily remembered for the extreme cold at the years end, it would be quite misleading for the character of the year. A weak La Nina at the start of 2017 quickly gave way to neutral ENSO indices through most of the year, before a weak La Nina returned late. Hazardous events only sporadically highlighted what was another warm and variably wet year for the Sioux City area.



The annual average temperature for 2017 was 50.7 degrees (2.2 degrees above normal), making for the **12th warmest year on record**. This was 1.6 degrees cooler than 2016, and a just a tenth of a degree cooler than 2015. The bulk of the warm ranking for the year was a result of maximum temperatures. Maximum temperatures averaged **9th warmest on record** (62.1 degrees – 2.3 degrees above normal). The mean maximum temperature was the **3rd consecutive top 10 warmest annual maximum temperature**. Minimum temperatures averaged to a tie for 32nd warmest (39.2 degrees – 2.0 degrees above normal). Greatest monthly departures were concentrated largely during the first quarter of the year, with additional warmer months during the summer. The big story for temperatures for the year was the **ending of the consecutive streak of above normal months at 20** (Sept. 2015 – April 2017), when May 2017 came up a bit shy of normal with cooler temperatures over the final half of the month. Despite only a single month in the top 20 warmest for the particular month [February (4th)], the consistency to the warmth during the year helped bring the annual ranking to the 12th warmest. The highest ranking departure occurred in February (+10.0), which also acquired status as the warmest ranking month (4th warmest). The coolest month compared to average occurred in August (-3.1). The only other months to rank in the lower half of monthly means were May (-1.2) and October (+0.4). During 2017, 182 days were considered “above normal” (more than 2 degrees warmer than average), 116 “below normal” (more than 2 degrees colder than average) and 67 “normal”.

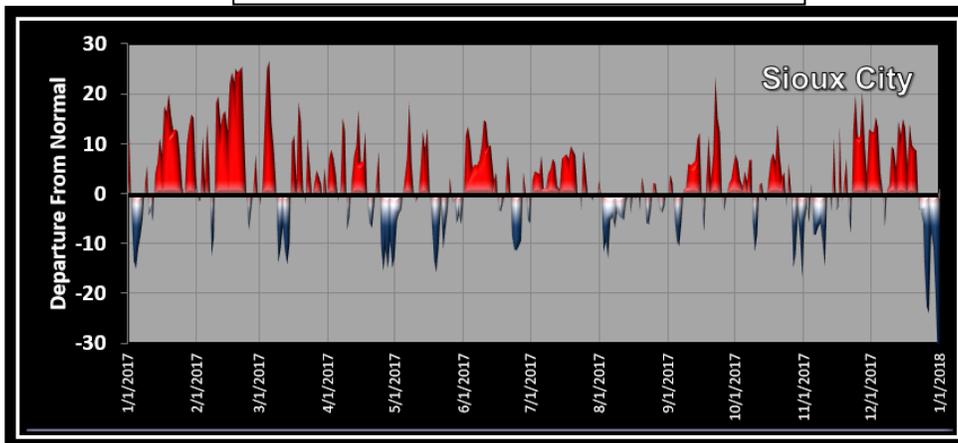
The **warmest temperature of the year was 97 degrees** on the 6th and 25th of July. While it was a warm average year, this warmest reading of the year was the **26th coolest for a warmest reading of the year**. 32 days with high temperatures of 90 degrees or above matched 2016 and was 11 more than normal. The greater contribution to the annual warmth came with highs of 32 degrees or less, for which the total of 34 days was the **10th fewest 32 degree or less maximum temperatures for a year on record**.

For the second consecutive year, Sioux City experienced the earliest occurrence of 80 degrees or warmer. The 80 degree high on March 6th was one day earlier than that in 2016.

It literally waited until the last minute of 2017 to reach the **coldest reading of the year of 24 degrees below zero**. This was the **13th coldest for the coldest reading during a calendar year** and the **24th all-time coldest minimum temperature on record**. The cold was fairly scarce though, with but six days of below zero readings (4 of which occurred in December), 11 fewer than normal and **tied for the 10th fewest below zero readings in a calendar year**.

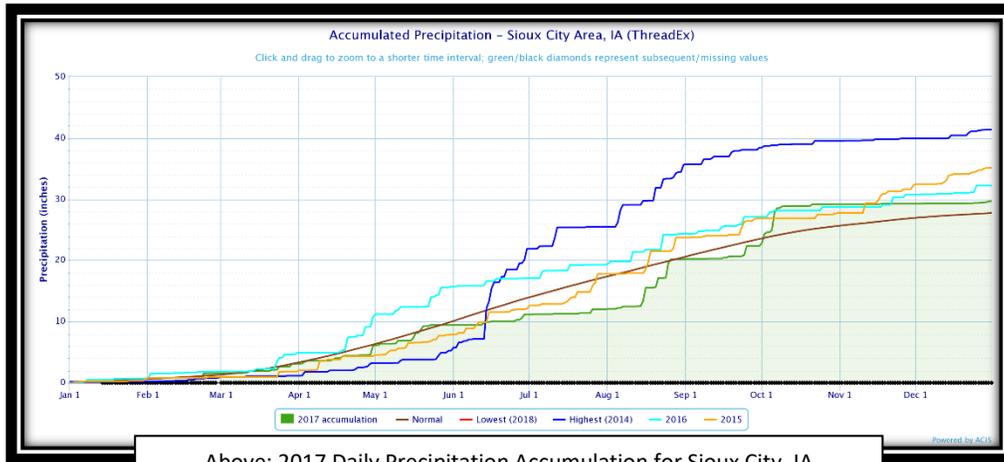
Sioux City, IA							
Month	Average Temperature			Departure from normal	Extremes		Monthly Records
	Max	Min	Mean		High	Low	
January	32.4	18.1	25.3	4.9	51	-4	24th warmest
February	46.6	23.6	35.1	10.0	73	4	4th warmest
March	50.4	29.5	40.0	3.5	80	14	29th warmest
April	61.4	38.9	50.2	0.6	79	23	55th warmest
May	72.3	47.0	59.6	-1.2	91	33	53rd coolest
June	87.1	58.7	72.9	2.6	96	44	22nd warmest
July	89.6	65.7	77.7	3.4	97	51	23rd warmest
August	79.9	58.0	69.0	-3.1	89	49	10th coolest
September	78.8	54.3	66.6	3.2	94	41	27th warmest
October	62.7	39.4	51.1	0.4	78	17	49th coolest
November	49.8	24.9	37.3	1.5	68	9	56th warmest
December	34.3	12.7	23.5	0.9	58	-24	63rd warmest
Year	62.1	39.2	50.7	2.2	97	-24	12th warmest

Above: 2017 Monthly Temperature Data for Sioux City, IA
 Below: 2017 Daily Temperature Departures for Sioux City, IA



2017 annual precipitation measured up to the least since 2013, but still managed to reach the fourth straight year of above normal precipitation with 29.67 inches (+1.93 inches), which ranked as the **36th wettest year on record**. Despite a wet year, eight months during the year featured below average precipitation. It was two of the four above normal months (August and October) that were appreciably above normal, and primarily a result of three major rainfall events which responsible for nearly one-third of the precipitation for the year. With some extended dry periods to accompany early summer heat, moderate drought conditions evolved by mid-summer, alleviated by the August and early October rainfall. Annual snowfall totaled 30.4 inches (4.4 inches below normal). January and February above

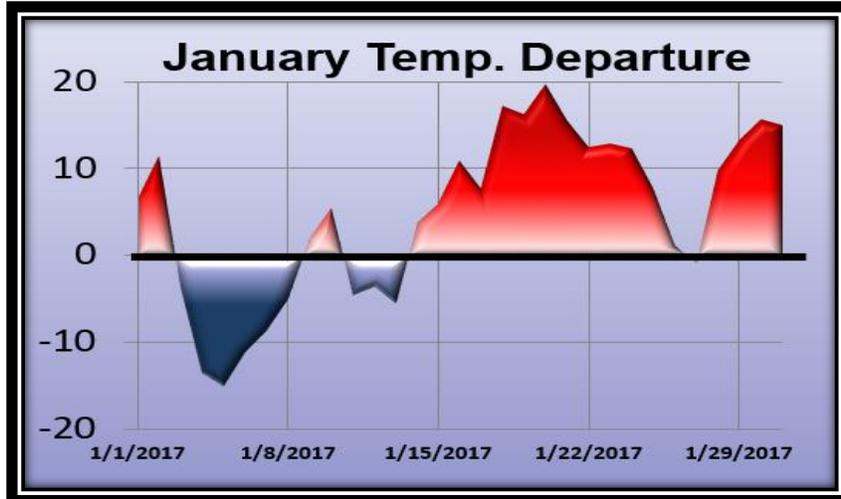
normal snowfall more than made up for lack of snow during the fall and early winter, with winter making a comeback after its official start on the 21st. There were 10 days with an inch or more snowfall, which was one fewer than normal.



Above: 2017 Daily Precipitation Accumulation for Sioux City, IA
 Below: 2017 Monthly Precipitation Data for Sioux City, IA

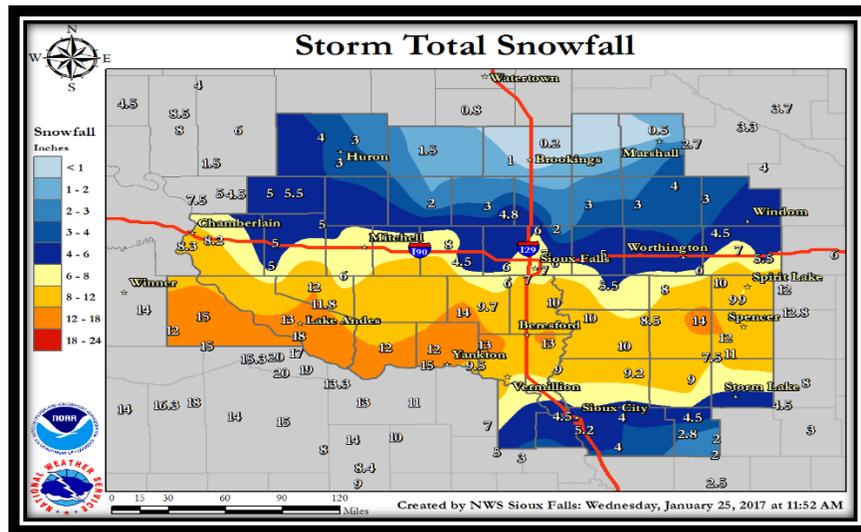
Sioux City, IA						
Month	Precipitation		Snowfall		Precipitation Rank	Max Wind Gust Direction/MPH/Date
	Amt	Departure	Amount	Departure		
January	0.67	0.05	7.2	0.5	48th wettest	NW 50 mph on 10th
February	0.92	0.25	12.8	6.2	44th wettest	N 40 mph on 24th
March	1.51	-0.49	3.1	-3.4	57th wettest	N 51 mph on 6th
April	2.93	-0.02	T	-1.8	51st wettest	NW 39 mph on 20th
May	3.44	-0.30	T	0.0	64th wettest	W 51 mph on 16th
June	1.72	-2.17	0.0	0.0	11th driest	SW 65 mph on 13th
July	0.84	-2.60	0.0	0.0	12th driest	SW 37 mph on 6th
August	8.16	4.93	0.0	0.0	3rd wettest	NW 41 mph on 1st
September	2.18	-0.78	0.0	0.0	59th driest	NW 42 mph on 20th
October	6.83	4.70	T	-1.0	* wettest *	NW 59 mph on 26th
November	0.08	-1.23	0.0	-4.4	12th driest	N 49 mph on 24th
December	0.39	-0.41	7.3	-0.5	39th driest	NW 57 mph on 13th
Year	29.67	1.93	30.4	-4.4	36th wettest	SW 65 mph on June 13

The exceptionally mild finish to 2016 continued into the New Year, but only for the first couple of days. Some light freezing rain would glaze roadways in the predawn hours of the 2nd, followed by passage of a strong cold front in the evening. This set up the area for nearly a week of below normal temperatures with some dangerous wind chills around the 4th, but little snowfall. After wandering a bit above and below normal through 13th, the final 18 days of the month would see but a single day with a high below freezing and below normal - a "January Thaw" for sure with 10 of the final 16 days of the month more than 10 degrees above normal! This includes the warmest high temperature of the month (51 on the 18th) as well as a pair of **record high minimum temperatures set on the 20th (37) and tied on the 31st (34)**. The warmer and moist pattern would break down into a winter storm on the 24th into early on the 25th that brought **record daily snowfall (4.2") on the 24th**, but more north of the city.

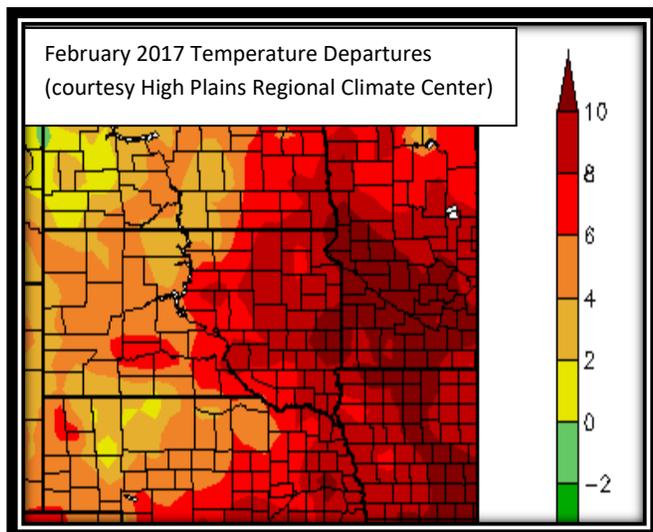


Above: Daily January Temperature Departures

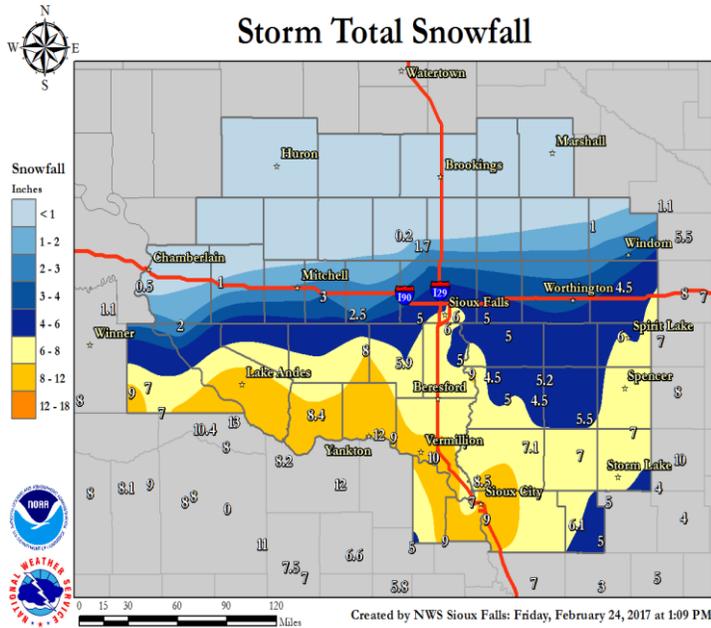
Below: Accumulated Snowfall from Jan. 24-25



The most memorable feature of February 2017 was certainly the excessive warmth - the **4th warmest February on record**. Much of the area had temperatures in excess of 8 degrees above normal for the month, and for Sioux City it was the **greatest departure from normal for the year (+10.0 degrees)**. The average maximum/minimum temperature for the month of 46.6/23.6 degrees was 2nd/9th warmest on record. A record was established for the **most 60 degree or warmer maximum temperatures (7)** in February, the most since 4 in 2005. More impressive is these all occurred



consecutively. Record highs were set on the 21st (73 degrees) and the 22nd (71 degrees). The 73 degree reading on the 21st was the 3rd earliest 70 degree or warmer, and the warmest so early in the season



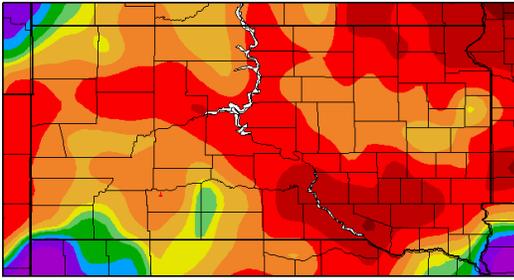
This was not to say that February did not have its wintry period. A light snow event ushered in the first cooldown on the 7th. Most significantly, the Missouri River valley including Sioux City was smacked by a snowstorm on 23rd and 24th. Blizzard conditions with nearly impossible travel occurred as winds reached 40 mph and 8 to 11 inches of snow accumulated around Siouxland. The greatest snow depth of the year was 10 inches on the 25th, but the return of above normal temps wiped out the snow cover quickly and bare ground returned at the end of the month.

Sioux City, IA					
Season	Average Temperature				Temperature Rank
	Max	Min	Mean	Departure	
Winter '16-'17	37.7	19.0	28.4	5.7	5th warmest
Spring '17	61.4	38.5	49.9	0.9	39th warmest
Summer '17	85.5	60.8	73.2	1.0	59th warmest
Fall '17	63.8	39.5	51.7	1.7	43rd warmest

The winter season of Dec. 2016-Feb. 2017 with a mean temperature of 28.4 degrees (+5.7 degrees) would go down as the **5th warmest on record**. The average maximum temperature (37.7 degrees) was 9th warmest while the average minimum temperature (19.0 degrees) was 8th warmest. There were only 5 days with temperatures below zero, well below the 30-year normal of 16 days. Of those below zero days, only 2 had low temperatures of -10 or colder, tied for the 16th fewest for a winter period on record. Overall, winter precipitation (3.07 inches) was well above normal (25th wettest), with snowfall

Sioux City, IA			
Season	Precipitation		Precipitation Rank
	Total	Departure	
Winter '16-'17	3.07	0.98	25th wettest
Spring '17	7.88	-0.81	57th wettest
Summer '17	10.72	0.16	49th wettest
Fall '17	9.09	2.69	15th wettest

(24.5 inches – 38th snowiest) a little above normal for the period. Snowfall generally came in pulses throughout the winter, with the greatest 24 February 23-24 (9.9 inches). However, without **RECORD RAINFALL** (1.09 inches) on Christmas Day 2016, complete with thunder, precipitation for the season would surely been below normal.



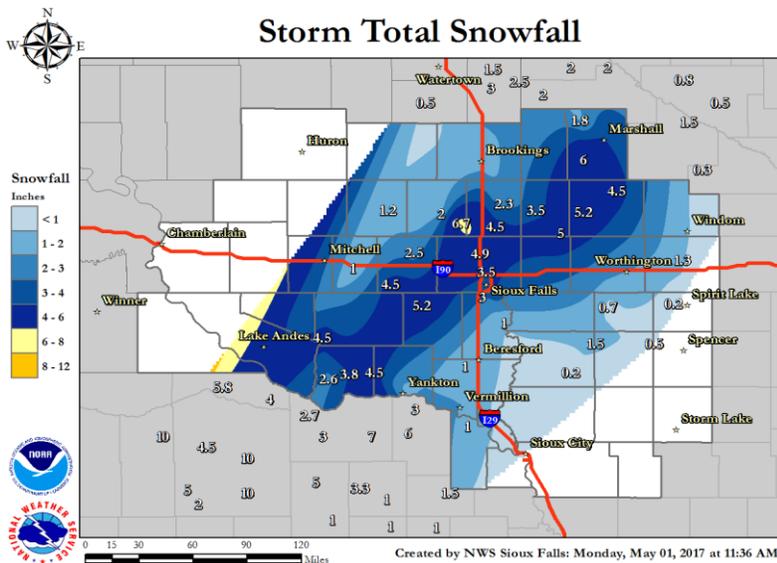
March Percent of Normal Precipitation (courtesy High Plains Regional Climate Center)

March started on track with average the first three days, but temperatures warmed to well above normal by the latter half of the opening week. An 80 degree reading on the 6th was the **earliest occurrence of an 80 degree reading**, more than a month earlier than the average date. Amazingly enough, the passage of a strong cold front that afternoon would bring not only the strongest winds of the month, but enough of a temperature drop for **snow to fall a mere 10 hours after the 80 degree reading!** A wintry system on the 12th and 13th dropped 2 to 4 inches of snowfall, and ushered in the coldest

temperatures of the month. One more light snowfall on the first full day of spring would be the final measurable snowfall of the season. As for most cold spells over the winter, this was a brief trek as only two days in the final half of the month would be below normal and the month ended up **29th warmest** with a departure of +3.5 degrees. Despite being below normal precipitation, it was slightly on the wetter side of ranking. The first thunderstorm of the year occurred on the 23rd.

April averaged out fairly close to normal (50.2 degrees/+0.6/**55th warmest**). The first three weeks of the month varied from a bit below normal and well above normal along with frequent light precipitation. The warmest reading of the month occurred on the 8th (79 degrees). Several thunderstorms rumbled from the 15th to the 19th. The fairly mild temperatures of the month gave a quick start to vegetation, which then battled several light freezes the last third of the month. Despite the 7th greatest daily precipitation for 2017 occurring on the final day of the month (1.46 inches) - almost half the monthly precipitation - April 2017 still ended up a shade below normal (2.93 inches/-0.02 inches/**51st wettest**).

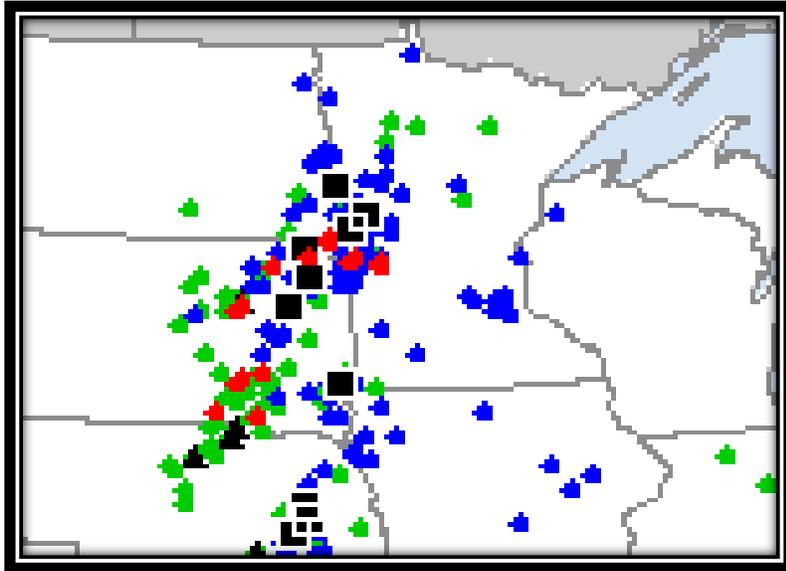
An unusual late season snowfall set up on the 1st of May, with only a trace of snowfall in Sioux City, but as much as an inch of snowfall as nearby as Newcastle NE and Beresford, SD. For Sioux City, it was only the 6th time there was snowfall on May 1.



A few cool days after the snowfall would yield to another very mild period through the first 17 days of the month. No better example was Mother's Day (a top 10 warmest at 87 degrees), as well as the warmest May reading of 91 degrees on the 8th. Several thunderstorms from the 15th to 17th produced rainfall from 1 to 3 inches around the Sioux City area over the three day period. After the 18th, only a single day would be warmer than normal through the rest of the month,

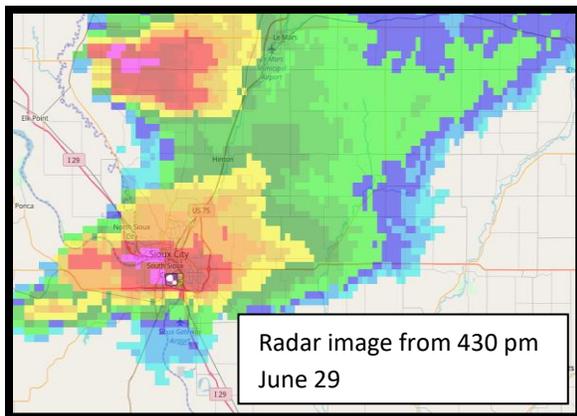
enough for the **monthly mean temperature end up below normal** (-1.2 degrees) for the first time in 20 months!

The spring months of March through May accumulated 7.88 inches of precipitation (0.81 inches below normal) and ended **57nd wettest on record**. Temperatures averaged a shade to the warm side of normal with a mean temperature of 49.9 degrees (departure of +0.9 degrees) to finish **39th warmest on record**. High temperatures carried a bulk of the warming weight, ranking 35th warmest on record compared to minimum temperatures (45th warmest). Snowfall was 3.1 inches, **33rd least on record**.



Storm Reports for early morning June 13 2017 (courtesy Storm Prediction Center archives)

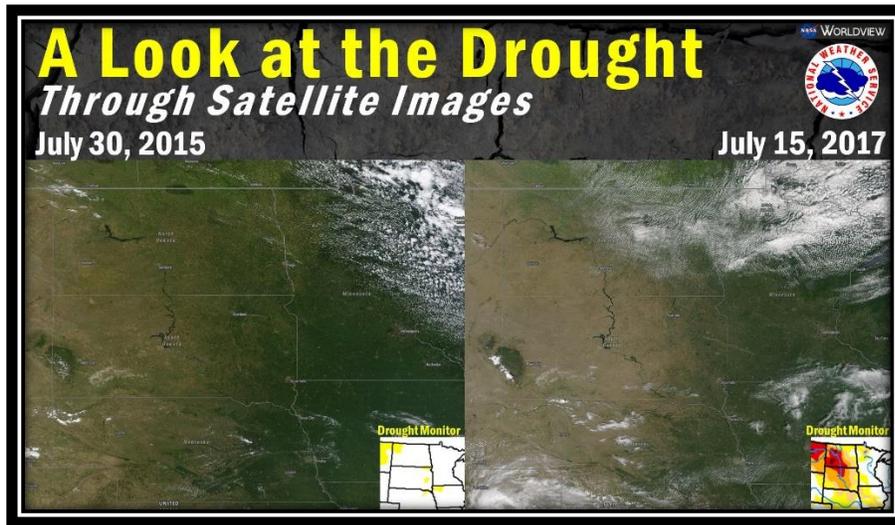
June started on a very warm and dry note. No precipitation fell through the first 12 days, with maximum temperatures June 1 to June 12 averaging **2nd warmest (91.1 degrees)**. The mean temperatures were a temperatures averaging a whopping 11.6 degrees above normal, the **2nd warmest start to the month on record**. Increased humidity toward the end of the period propped up low temperatures, with a **record high minimum of 76 degrees on the 11th**. Rainfall finally arrived on the 13th, with an eruption of severe storms around Sioux City on the evening of the 13th. Between 9-930 pm, winds from 60 to 70 mph blew into the metro area, measuring **65 mph at Sioux Gateway Airport for the highest wind speed of June**.



Radar image from 430 pm June 29

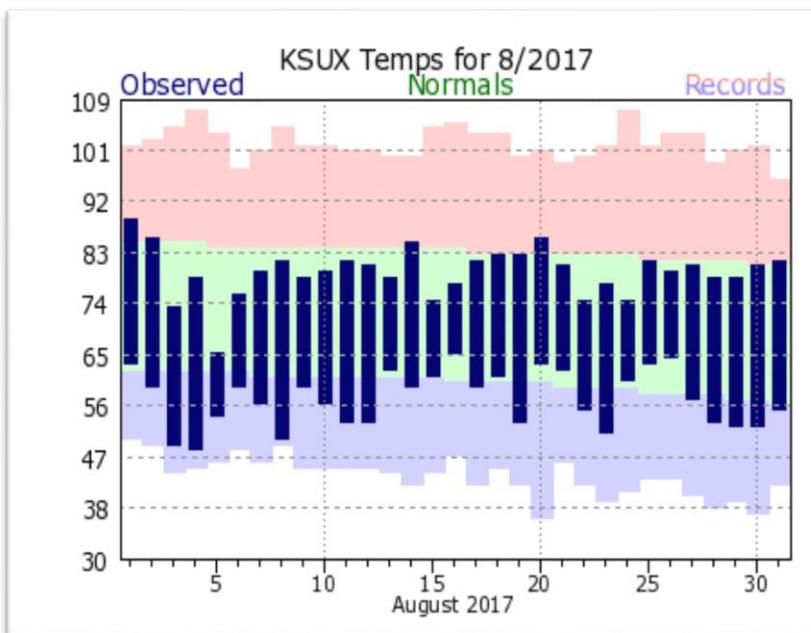
Cooler and occasionally wetter conditions filled the balance of the month, with the coolest period from June 23-27 averaging around 10 degrees below normal. A record low temperature of 44 degrees was set on June 24. However, it was neither cool enough persistently to keep June from being the **22nd warmest**, nor wet enough to avoid the **11th driest**. Severe storms returned on the afternoon of the 29th with hail up to golf ball size around southern portions of Sioux City around 430 pm. Winds also gusted to 60 mph at the airport, and 65

mph in South Sioux City. A funnel cloud was sighted in northeast Nebraska to the west of the Sioux City metro area.



Drought Conditions
Worsen During July 2017

July 2017 saw the dry conditions across the region take a rapid turn for the worse, with moderate to severe drought developing around Sioux City and adjacent areas. As in June, the month started with a prolonged dry stretch. During the first 25 days, no day measured a tenth of an inch, and there were two seven day stretches with no measurable precipitation. The only significant rain of the month occurred on the 26th, when a half inch to inch of rain dotted the area. While July finished as the **12th driest** with only 0.84 inches of rainfall, for the sake of the developing drought there were fortunately no days 10 degrees or more above normal. However, consistent and relatively modest warmth resulted in a **23rd warmest** monthly ranking. 97 degrees on the 6th and 25th tied for the warmest readings of the year.



In most regards, August will be known for its astronomical, not meteorological, phenomenon. Of course, the solar eclipse of the 21st was what the world was watching, but for Sioux City and some surrounding locations, the weather would not only throw a monkey wrench into viewing aspects with clouds and heavy rainfall of 1.47 inches. This would be only the third greatest daily rainfall of the month, with heavy amounts of 1 to 3 inches both on the 16th and the 25th-26th. **Record rainfall of 2.42 inches** doused the city on the 25th.

The periodic moderate to heavy rains during the month would accumulate to produce the **3rd wettest August** and the greatest departure from normal for any month of the year (+4.93 inches), easing drought conditions. Ten days with thunder was the most of any month in 2017.

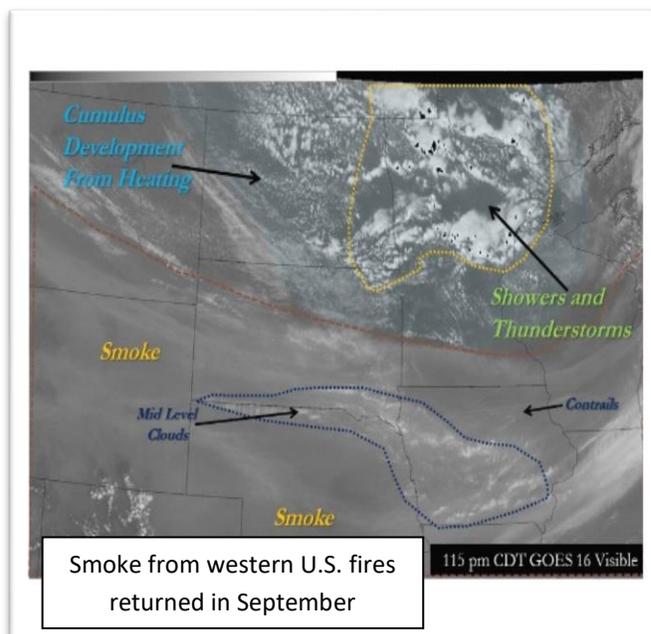
For the first time in the previous 22 months, the monthly mean temperature (69.0 degrees) registered as solidly below normal as the **10th coolest August**. There were only two days for which the average temperature was three degrees or more above normal. In fact, on one of those days, the 89 degree maximum on the 1st was the warmest reading of the month, and was the **coldest on record for warmest temperature of the month of August**. The high temperature of 66 degrees on the 5th would set a **record low maximum** for the date. There was no favoritism on which part of the temperature was cooler – the mean maximum (79.9) was 8th coolest and the mean minimum (58.0) was 7th coolest on record for August.

Looking at the big picture, summer 2017 ranked close to the median for temperature (59th warmest) and precipitation (49th wettest). Despite the wet finale of the summer season, total precipitation amassing 10.72 inches would end up just a shade less than a two-tenths of an inch above normal. Mean maximum temperatures carried most of the weight to the warmer summer, with a mean of 85.5 degrees (34th warmest). Minimum temperatures averaged to 60.8 degrees (33rd coolest). The dry conditions provided a means for greater diurnal ranges. There were 29 90-degree days, the same number as 2016, and tied for 37th most on record.

September arrived peacefully – mainly dry with temperatures a touch cooler than normal through the first week. Over the following two and a half weeks, six days would register 10 degrees or more above normal, with only sporadic modest precipitation. The first day of autumn reached a toasty and summery 94 degrees, the **second warmest maximum on the first day of autumn on record**. A **record high minimum of 74 degrees** that morning registered as the **warmest minimum temperature so late in**

the year. Combined, these temperatures resulted in the **warmest mean temperature so late in the season**, barely edging out 366 days earlier.

The only concentrated period of rainfall would occur from the 22nd-24th, with a maximum 24 hour rainfall of 1.23 inches on the 24th. Near normal temperatures and dry weather closed out the month. With few days below normal and the excessive warmth around the first day of autumn, the month ranked as the **27th warmest September** on record. The coolest reading of the month (41 degrees) was reached on the 30th, tied for the 15th warmest monthly



minimum temperature for September with last year. Monthly rainfall of 2.18 inches was back below normal for the sixth time in seven months, ranking 59th driest.

With the drop of a hat, the pattern changed to bring a week or heavy rainfall to start the month of October. Record rainfall doused Sioux City residents on the 2nd (1.50 inches) and 6th (2.85 inches). The first week was far and above the **wettest start on record for October (6.18 inches)**, exceeding the former monthly record of 5.70 inches in 2009. After this rainfall, precipitation became very scarce with only another 0.65 inches through the remainder of the month, with only 0.02" over the last 10 days. Even with the prolonged dry spell, it was the ***wettest October on record at 6.83 inches***. The

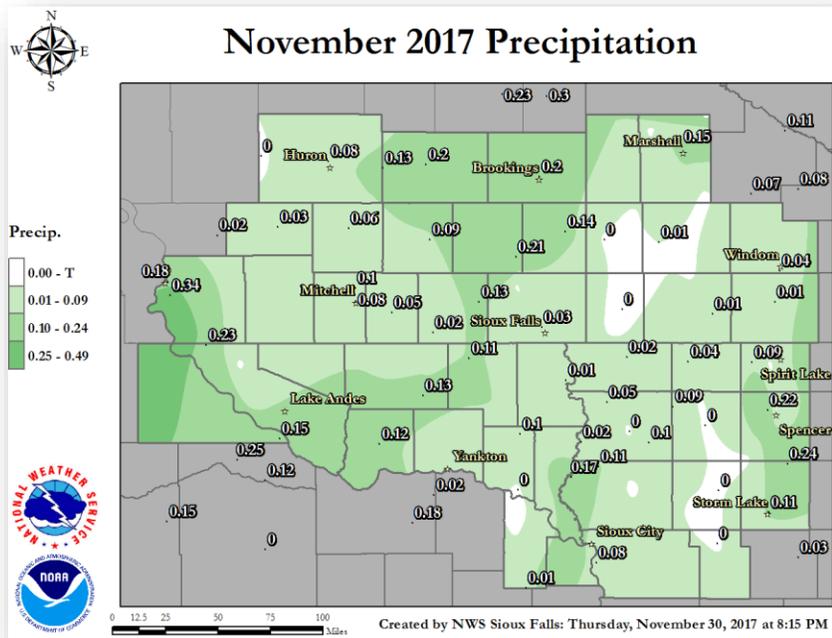
State	Name	Station Type	Total Precipitation
NE	COLERIDGE 5.4 NE	CoCoRaHS	6.42
IA	SIOUX CITY AP	WBAN	6.18
NE	FORDYCE 1.6 W	CoCoRaHS	5.97
IA	REMSEN NO. 2	COOP	5.70
IA	SIOUX CITY ANG	COOP	5.61
NE	CROFTON	COOP	5.56
NE	EMERSON	COOP	5.51
NE	WAKEFIELD 5.1 SSE	CoCoRaHS	5.22
IA	LE MARS	COOP	5.01
SD	YANKTON	WBAN	4.96
IA	ORANGE CITY 2.5 S	CoCoRaHS	4.94
NE	ST. HELENA 4.1 SW	CoCoRaHS	4.78
NE	HUBBARD 3.1 SW	CoCoRaHS	4.77
SD	VERMILLION 2 SE	COOP	4.76
IA	DENISON	COOP	4.75
SD	VERMILLION 1.4 SE	CoCoRaHS	4.71
IA	ALTON	COOP	4.50
IA	AKRON	COOP	4.46
SD	GAYVILLE 1.8 SSW	CoCoRaHS	4.44

Precipitation totals for the first week of October

rainfall on the 6th was the **2nd wettest October day on record**. Other than one brief period from the 9th to the 11th, temperatures through the first 3 ½ weeks of October were above normal. This window did contain the first sub-freezing temperature, ending the growing season with a **hard freeze of 28 degrees on the 11th**. The growing season reached 165 days, 3 more than the average length of 162 days. The final five days of the month were well below normal, and 18 degrees on Halloween morning certainly put frost on the pumpkins. Overall, October battled to finish slightly above normal (+0.4 degrees, **49th coolest**) with a mean of 51.1 degrees. A trace of snow on the 27th was the first solid precipitation of the season.

November was a strange month. While the first week of the month featured a mean temperature of 37.3 degrees, the last seven days averaged 42.1 degrees. This occurred during a time when the average temperature sees a drop of around 15 degrees, instead of an increase of nearly five degrees. The **eight-day period from the 23th to 30th was the 4th warmest on record**, which included a **record high temperature of 63 degrees on the 23rd (4th warmest Thanksgiving Day on record) and a tied record high of 68 degrees on the 24th**. November 2017 ended 1.5 degrees above normal, **56th warmest on record**. The other noteworthy occurrence for November was actually a lack of occurrence – of precipitation. It was quite dry, with a paltry 0.08 inches of precipitation over the month. This placed November 2017 at the **8th driest November on record** and the **driest month since Nov. 2011**. Nov. 2017 was also only **the 3rd November on record with no snowfall**.

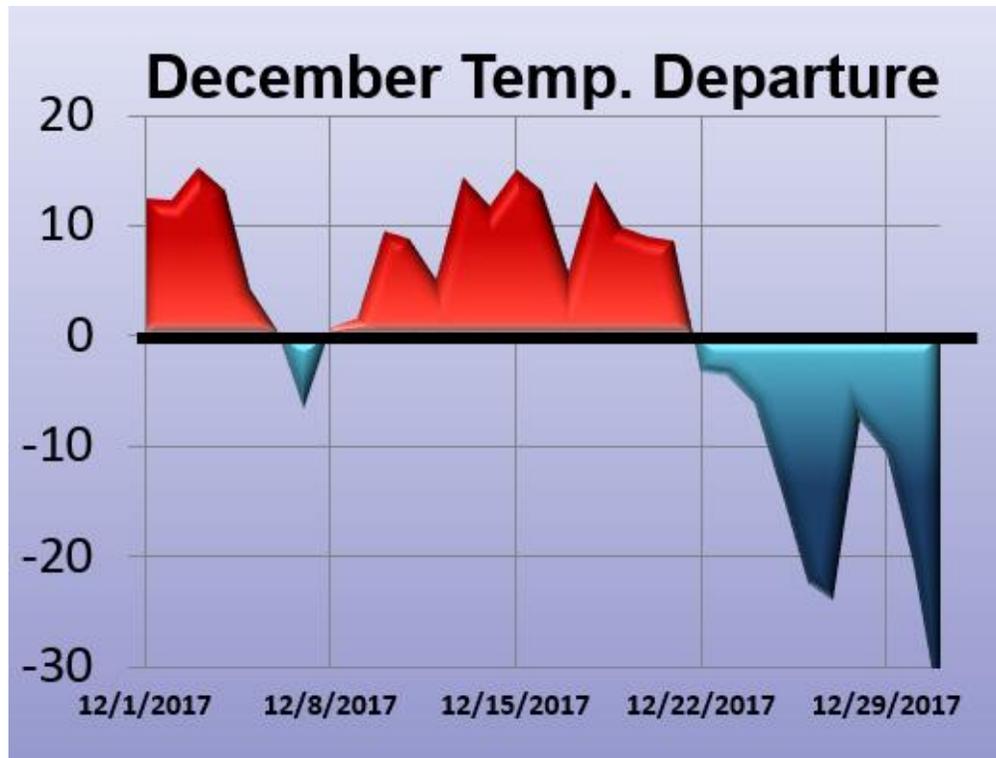
As conditions dried out during the mild and snowless month fire danger became an almost daily concern with increased winds and lower humidity. While several days featured smaller fires around the area, the evening of November 24 (with winds gusts late day of 40 to 50 mph) saw a grass fire erupt along the highway 75 bypass on the southeast side of Sioux City.



Area precipitation totals for November 2017

Three months of modestly ranked above normal temperatures made the fall season the **43rd warmest** on record with a mean temperature of 51.7 degrees, 1.7 degrees above normal. The soggy October was more than enough to offset the extreme dryness of November and well below normal September to tally the **15th wettest** fall with 9.09 inches of precipitation. With a trace of snowfall during the fall, only 1963 and 2007 tallied less with zero snow.

December was just another month of extremes. The start of the month continued the unseasonable warmth from the end of November, with four days more than 10 degrees above normal at the onset. The final day of this streak would bring a first cold push (back to around normal) accompanied by strong winds and a dusting of snow by early evening, the first measurable snowfall of the year - just over three weeks later than the long term average for the first measurable snowfall. Temperatures would settle to a little either side of normal from the 5th to the 9th with some occasional flurries. From the 10th through the 21st, the dry weather and mild temperatures would return along with periodic fire concerns. Right on schedule, the next snow arrived on the first day of winter, measuring an inch or two across the area. With the pattern change, frigid air would invade Siouxland through the end of the year. The final day of the year failed to break zero, after a **record low of -24**, the **24th coolest reading on record for Sioux City**. In fact, for the last week of the year from Christmas through New Year's Eve, the **mean temperature (1.1 degrees) was the coldest on record**.



Wind chills at the end of the year made for a dangerous time for celebrating New Year's Eve, plunging to 25 below to 40 below zero.

Sitting at over 10 degrees warmer than normal at the winter solstice, temperatures would battle to the final minutes of the year to remain just above normal. Overall, December was the **63rd warmest** on record, with a departure from normal of +0.9 degrees. It was the **39th driest** month, and the fifth straight month in the snow season with below normal snowfall (-0.5 inches).