



Report of Investigation 120

The Unusual Weather of 2009 in Illinois Created Major Economic Impacts

Stanley Changnon, James Angel, David Kristovich



Illinois State Water Survey
Institute of Natural Resource Sustainability
University of Illinois at Urbana-Champaign

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Illinois State Water Survey
A division of the Institute of Natural Resource Sustainability
Champaign, Illinois



I L L I N O I S

Cover photo: A towering cumulonimbus

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Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the Illinois State Water Survey.

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Note: Appendix A appears in the digital version of this report, but is not included in the printed version. The illustrations in the appendix show the Midwestern temperature and precipitation patterns for each month from March to November 2009.

Abstract

Abnormal weather conditions existed in Illinois during every month from March 2009 through November 2009. March–August conditions were exceptionally wet and cool with frequent cloudy skies. The fall months brought a dry September, a cold and wet October, and a warm and dry November.

Wet, cool spring conditions delayed planting of major crops and led to flooding along many rivers. Summer temperatures were nearly 3 degrees F below normal, reducing the use of air conditioning but delaying crop maturity. Summer 2009 was rated as the 8th wettest and 11th coldest in Illinois since 1895. A shift to warm and dry weather in September, followed by cool and wet conditions in October sustained flooding and delayed harvesting of Illinois crops. Conditions shifted again in November, becoming warm and relatively dry, so corn and soybean harvesting moved forward rapidly. In early December, most soybeans had been harvested, but 15 percent of the corn crop was still in the fields. The crop harvest in 2009 was rated as the slowest ever in Illinois.

The unusual weather during the 2009 crop season led to worries over production, yet near-record-high yields were recorded for corn (174 bu/acre) and soybeans (46 bu/acre). These large yields helped farm incomes, but delays in corn drying and tillage (preparing soil for future planting) increased costs. In addition, high yields across the Corn Belt lowered crop prices, which also decreased farm incomes.

Storms in 2009 were more frequent than usual and resulted in extensive property damage in Illinois. Included were four record-setting rainstorms and several hailstorms. Storms in northern Illinois produced large hailstones of 2 inches in diameter, frequent cases of high winds with gusts greater than 60 mph, and 18 tornadoes. More than \$400 million in property losses were reported along with \$120 million in crop losses from severe storms.

Flooding on most rivers occurred various times during March–November 2009. The Illinois River was above flood stage for 89 consecutive days, setting a new record. Heavy rains of 2009 helped bring Lake Michigan's level up to near average for the first time since 2004. Wet and cloudy conditions affected human behavior, including a reduction in retail shopping. Construction and repair of highways and buildings were delayed, a negative outcome in a struggling economic time across the nation.

The unusual weather in 2009 persisted through December, and some of the 2009 weather impacts continued into the following months of 2010. Corn harvesting in northern Illinois continued into January 2010, soil tillage awaited drier conditions in the spring of 2010, and fertilizer applications in the fall of 2009 were delayed until 2010. Flooding on the Illinois River and several of its tributaries also continued into January 2010.

Introduction

The March–August 2009 period in Illinois was exceptionally wet and cool, except for a few short-term dry periods. These conditions followed 2008, which was the third wettest year on record in Illinois. The spring season (March–May 2009) ranked as the fifth wettest on record, and the spring and summer seasons were cloudier than normal. Several severe storms with heavy rains occurred, some creating flash floods. Fall weather was unusual with a cool, wet October and a warm, dry November.

This report describes the unusual weather conditions in 2009 and their climatological significance, followed by an explanation of the atmospheric conditions that caused the unusual weather. Another section describes the many impacts caused by the unusual conditions.

Rainfall in the spring of 2009 averaged 15.8 inches across Illinois (FarmWeek, June 8). The state's highest rain totals in spring included 20.9 inches at Galesburg, 19.9 inches at Peoria, and 17.9 inches at Chicago. Spring totals at Peoria and Chicago were the highest on record based on records dating back to the 1890s.

The 2009 growing season was one of the most challenging for agriculture in Illinois because of three unusual weather features: an extraordinarily wet spring, a cold summer, and a cold October and wet fall. The wet spring hindered field operations, including the application of fertilizer and pesticides, field tillage, and corn and soybean planting. The cold summer meant slow development of a late-planted crop. Further, the cold, wet fall meant additional

delays in crop development and maturation as well as difficulties in harvesting and other fall operations.

Some of the remarkable features of 2009 include the following: the year was the second wettest, April was the ninth wettest, April–June was the ninth wettest, July was the coldest, and October was the second wettest and sixth coldest on record.

Not all impacts of the cold, wet weather affected agriculture. The Illinois River at Peoria was above flood stage from March 7 to June 5, a total of 89 consecutive days, which is a new record over the 71 consecutive days set in the past.

Summer 2009 had much lower temperatures with a statewide average of 71.1 degrees F, which was 2.3 degrees below normal. It was labeled “The year without a summer” (Chicago Tribune, July 28), and thus did not require as much air conditioning as usual. At Peoria and Lincoln, it rated as the coldest summer on record. Summer rainfall across Illinois averaged 14.5 inches, which was 2.8 inches above normal. The summer rated as the 10th wettest and 8th coldest in Illinois. These conditions were not harmful to Illinois crops, particularly after the late planting.

The March–August 2009 period (spring and summer) was the wettest since records began in 1895, and four of the six months had below-normal temperatures. July 2009 was the coldest July on record (LeComte, 2010). Chicago normally has five summer days with high temperatures at 70 degrees or below, but during the 2009 summer, Chicago had 15 such days, setting a new record number of cool days.



A growing cumulonimbus cloud.

Weather Conditions and Climate Significance

This section describes the details of temperature and precipitation patterns that shaped the 2009 growing season. Statewide average monthly precipitation and departures for 2009 are summarized in Table 1. Statewide average monthly temperatures are summarized in Table 2. Bar plots of the monthly precipitation departures (Figure 1) and monthly temperature departures (Figure 2) are shown as well. Official statewide temperature and precipitation records used herein are based on data that extend back to 1895. In this report, normal refers to the 1971–2000 average.

Atmospheric conditions leading to the weather during 2009 are described for each month. Near surface conditions and larger-scale, higher-altitude height and wind fields are highly interactive, therefore high-altitude conditions should not be considered the

“cause” of the anomalously wet conditions in Illinois during the growing season. Rather, the influence of surface and higher-altitude conditions combined to provide ample moisture to the region. Regardless of the causes of the anomalous Illinois weather conditions, discussions of the 500 hPa height anomalies (often more easily visualized as pressure anomalies at mid-levels) and low-level wind patterns (at 850 hPa) are presented herein, and show considerable agreement between these and the surface conditions.

PRE-SEASON

January in Illinois was exceptionally cold and dry. The statewide average temperature was 20.3 degrees, 4.3 degrees below normal, and the 16th coldest January on record. Meanwhile, the statewide average

Table 1. Monthly precipitation in 2009, normal (average 1971–2000), and departure from normal, in inches, in Illinois

	<i>2009</i>	<i>Normal</i>	<i>Departure</i>
January	1.03	1.97	-0.94
February	2.52	1.99	0.53
March	4.15	3.22	0.93
April	6.02	3.83	2.19
May	5.66	4.31	1.35
June	5.19	4.12	1.07
July	4.57	3.94	0.63
August	4.70	3.69	1.01
September	2.29	3.24	-0.95
October	8.40	2.87	5.53
November	2.47	3.34	-0.87
December	4.02	2.73	1.29

Table 2. Monthly temperatures in 2009, normal (average 1971–2000), and departure from normal, in degrees Fahrenheit, in Illinois

	<i>2009</i>	<i>Normal</i>	<i>Departure</i>
January	20.3	24.6	-4.3
February	32.3	30.1	2.2
March	43.2	40.7	2.5
April	51.1	51.7	-0.6
May	62.5	62.4	0.1
June	72.4	71.6	0.9
July	70.2	75.4	-5.2
August	70.6	73.2	-2.6
September	65.5	65.8	-0.3
October	49.6	54.2	-4.6
November	47.1	41.5	5.6
December	29.1	29.8	-0.7

precipitation was 1.03 inches, or 0.94 inches below normal and the 13th driest January on record. Much of the precipitation fell as snow. Snowfall totals ranged from 3 inches in far southern Illinois to over 18 inches in the Chicago area. January had lower-than-normal heights at 500 hPa along the nation's northeast coast and higher heights than normal along the U.S. northwest coast at 500 hPa. The Midwest had somewhat lower 500 hPa heights than normal, but was near the transition. At 850 hPa, this west-to-east gradient in height resulted in strong monthly-mean winds from western Canada into the Midwest, supporting both dry and cold conditions.

February, on the other hand, was both warmer and wetter than normal. The statewide average temperature was 32.3 degrees, 2.2 degrees above normal. The statewide precipitation was 2.52 inches, 0.53 inches

above normal. February is noteworthy as it began the seven-month streak of above-normal precipitation in the state. Large-scale 500 hPa height fields in February were slightly above average from northern Mexico to the eastern half of Canada. This gave rise to a more zonal flow of winds across the U.S., with large-scale convergence of winds from the northwestern Gulf of Mexico and the Dakotas at 850 hPa. These conditions allowed for an ample supply of moisture and heat from the Gulf and frequent cyclones moving southwest-to-northeast across the Midwest.

March was both warmer and wetter than normal as well (Tables 1, 2). The statewide average temperature was 43.2 degrees, 2.5 degrees above normal. Warmer-than-normal temperatures were prevalent throughout the state. The statewide precipitation averaged 4.15 inches, 0.93 inches above normal.

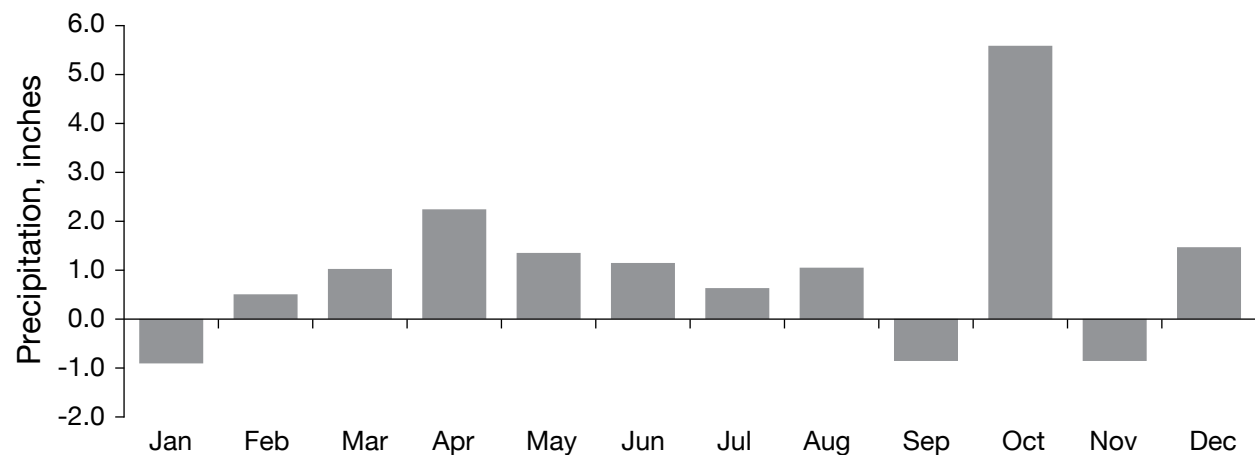


Figure 1. Monthly precipitation departures from normal in Illinois during 2009.

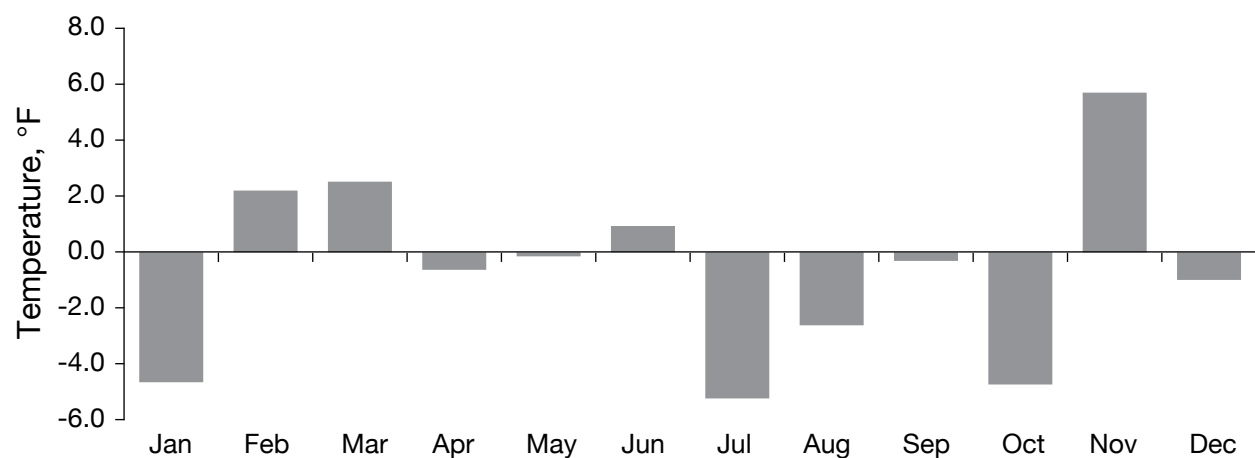


Figure 2. Monthly temperature departures from normal in Illinois during 2009.

The heaviest precipitation fell in the northern half of the state with amounts ranging from 4 to more than 6 inches and well above normal. Amounts in the southern half of the state were at or below normal for the month.

The general pattern of strong southwesterly winds at 850 hPa and frequent northeast-moving storms became even more established in March. A large area of higher-than-normal 500 hPa heights in the eastern U. S. was centered near northern Ohio, enhancing the flow of warm, moist air from the Gulf of Mexico. Occasional cyclones moved through and east of the region, with particularly intense cyclones in the latter half of the month.

By the end of March, soil moisture was near to slightly above normal in the top 6 inches of the soil. Streamflows and shallow groundwater levels were above their long-term averages as well. At the end of March, the U.S. Department of Agriculture's (USDA) National Agriculture Statistics Service (NASS, 2009) reported topsoil moisture as 50 percent adequate and 50 percent surplus.

EARLY SEASON

April is usually the month when major agricultural field work is performed throughout the state. Typical early-season operations include fertilizer application, tillage, and finally, corn and soybean planting. However, April weather brought the first signs of real trouble for the start of the 2009 growing season. April precipitation was 6.02 inches, 2.19 inches above normal, and the ninth wettest April on record. Heavy rains were widespread across the state and were part of a pattern of wet conditions that extended across Missouri, as well as parts of Indiana and Michigan. Temperatures were slightly below normal for the month as well. As of April 26, only 4 percent of the corn had been planted, compared to the five-year average of 43 percent. Topsoils in Illinois were rated at 42 percent adequate and 58 percent surplus.

The wetter-than-normal precipitation continued in May with a statewide average of 5.66 inches, 1.35 inches above normal, and the 20th wettest May on record. Precipitation was widespread around the state but was heaviest across central and southern Illinois. May temperatures were near normal. Because of the wet conditions, only 62 percent of the corn had been planted, compared to a five-year average of 96

percent. Meanwhile, only 12 percent of the soybeans had been planted, compared to a five-year average of 69 percent.

Near-normal 500 hPa pressure fields had returned to the Midwest in April and May, with higher-than-normal heights centered near the U.S. east and west coasts. These conditions supported near-normal temperatures in the region and an abundant moisture supply from the Gulf of Mexico. An average of 850 hPa convergence was again observed across Illinois.

Wet weather problems continued in June. Statewide precipitation was 5.19 inches, 1.07 inches above normal. The heaviest precipitation was found in western Illinois with amounts of 6 to 7 inches common in that area. Heavy precipitation plagued parts of eastern Nebraska and Kansas, southern Iowa, most of Missouri, to the west as well as southern Indiana, and central Kentucky to the east. Temperatures were 0.9 degrees above normal. The wettest site in June was Belvidere (northern border) with 8.75 inches of rain. Palestine, Oregon, Farmer City, and Tuscola all reported precipitation totals in excess of 8 inches (8.2, 8.3, 8.4, and 8.6 inches, respectively). By the end of June, soil moisture, streamflow, lake levels, and shallow groundwater levels were above normal throughout the state.

The long-term precipitation statistics for the first half of 2009 were impressive. This was the 13th wettest January–June with 24.57 inches of precipitation, 5.13 inches above normal. Also, it was the 9th wettest April–June with 16.87 inches of precipitation, 4.61 inches above normal, equivalent to an extra month's worth of precipitation in the critical April–June period.

The average statewide temperature for June was 72.4 degrees, 0.9 degrees above average. However, there were two distinct temperature periods in June. The first half was marked by statewide temperatures that were 2.6 degrees below normal. Furthermore, the below-normal temperature departures became increasingly more significant from southern Illinois to northern Illinois. Temperature departures ranged from less than 1 degree below normal in southern Illinois to 4 degrees or more below normal in far northern Illinois.

The second half of June was considerably warmer. The statewide temperature was 4.1 degrees above normal. High temperatures well into the 90s and dew points in the 70s were common throughout much of

the Midwest. While the warm, humid weather was uncomfortable for humans and livestock, grain farmers welcomed the conditions more favorable for crop development (Climate Watch, June 2009). However, at the end of June a strong low pressure system moved through the Midwest, bringing colder and cloudier conditions to Illinois.

Average height fields in June were near normal at 500 hPa, with slightly lower heights along the mid-Atlantic coast and anomalously low heights near southern California. While 850 hPa winds were from the northwest across the mid-Atlantic coast and New England, strong south-southwest flow from the northern Gulf of Mexico transported moisture and heat throughout the southeast U.S. and into Illinois (particularly southern regions of the state).

MID-SEASON

July was the turning point of the 2009 growing season when record-setting cold descended on the state. The average statewide temperature was 70.2 degrees, 5.2 degrees below normal and the coldest July on record in Illinois. Amazingly, while July is normally the hottest month of the year, in 2009 it was colder than both June and August. Temperature departures were most pronounced in northwestern Illinois. July precipitation was 4.57 inches, 0.63 inches above normal. The heaviest precipitation of over 6 inches fell in far northwestern Illinois and over much of southern Illinois.

While southern Illinois reported a few days with temperatures in the 90s in July, much of the rest of the state reported no such days. The normal number of days in the 90s typically ranges from 5 in northern Illinois to 15 in southern Illinois.

Another remarkable feature of July was the consistency of the colder-than-normal temperatures. Statewide, every day was below normal except for July 11. While this reduced the use of air conditioning, corn growing degree days in July were down an average of 16 percent around the state.

The Midwestern Regional Climate Center reported that July was the coldest July on record for the nine-state region. The average temperature for the region was 68.0 degrees, 4.7 degrees below normal. The previous record was 68.9 degrees in 1992. It was the coldest July on record for Indiana, Illinois, and Iowa; the second coldest on record for Michigan,

Kentucky, Ohio, and Wisconsin; the third coldest in Minnesota; and the fourth coldest on record for Missouri. Records for the region date back 114 years. In addition, more than 400 record low minimum temperatures and 1,300 record low maximum temperatures (lowest high temperature) were set during July across the nine-state region.

A considerable atmospheric shift occurred in July. The large-scale height and wind fields shifted with 500 hPa heights anomalously low over the Great Lakes and winds at 850 hPa averaging from the west-northwest. This gave rise to a widespread area of cooler-than-average temperatures throughout the Midwest, northern Plains, and much of the U.S. East Coast. Frequent cold frontal passages through the region and moist soil conditions contributed to more frequent precipitation events, leading to relatively wet conditions in Illinois, despite the cut-off of heat and moisture from the Gulf of Mexico.

August continued the cool pattern with temperatures averaging 70.6 degrees, 2.6 degrees below normal and the ninth coldest August on record. The cold weather was prevalent throughout Illinois and the surrounding states.

August precipitation was distributed unevenly throughout the state. Generally drier conditions prevailed in southern Illinois while very wet conditions were reported in western and northwestern Illinois. For example, Moline reported 8.06 inches of precipitation for the month.

Anomalously low mid-level heights weakened and moved to the western Great Lakes in August and cool weather continued in the Midwest. While the average low-level winds from the Gulf of Mexico became re-established over the Plains, winds across Illinois tended to be westerly rather than the more typical southwesterly summer direction. Storm systems regularly moved across northern areas of the Midwest, contributing to wet conditions in northern areas of the state.

July and August combined to produce the third coldest July–August on record with a temperature of 70.4 degrees, 3.9 degrees below normal. The 2009 season was slightly behind those in 1915 and 1967 with 69.8 degrees and 70.3 degrees, respectively.

The stretch of above-normal precipitation that started in February continued in August with a statewide average precipitation of 4.70 inches, 1.01 inch

above normal. The combined total precipitation for the period was 32.81 inches, ranking as the wettest February–August on record. Total precipitation for the June–August period was 14.46 inches, and was the 10th wettest June–August on record.

The summer of 2009 was the cloudiest in 115 years at Chicago. The monthly percentages of possible sunshine were June at 51 percent, July at 52 percent, and August at 57 percent. The summer average was 53 percent, much below the summer normal of 67 percent. Paducah, Kentucky, just beyond the other end of Illinois, had 57 percent sunshine in June, 59 percent in July, and 62 percent in August with a summer average of 59 percent, which is much less than the average of 71 percent. These cloudy conditions limited sunshine needed for crop photosynthesis and ultimate crop development. Chicago normally has five summer days with high temperatures at 70 degrees or below. Summer 2009 had 15 such days, a new record high number.

LATE SEASON

By the end of August, another concern for the crops was the prospect of an early frost. Normal first frost dates range from early October in northern Illinois to late October in southern Illinois. It comes as no surprise that a colder-than-normal September increases the chance of an early frost. Fortunately, September was probably the most favorable month of the growing season. Temperatures were only 0.3 degrees below normal. The statewide average precipitation was actually 1 inch below normal. Chicago Midway had only 0.38 inches of rain, the second driest September on record. However, wetter conditions prevailed in far southeastern Illinois.

October erased any ideas of a nice end to the growing season as colder and wetter conditions returned to the state. The statewide average temperature was 49.6 degrees, 4.6 degrees below normal, and the sixth coolest October on record. Temperatures were coldest in western Illinois and extended into the western half of the Corn Belt. Nationally, October rated as the nation's wettest and third coldest in 115 years (LeComte, 2010). Statewide precipitation was 8.4 inches, 5.5 inches above normal, and the second wettest October on record. Exceptionally heavy rains in excess of 11 inches were reported in the St. Louis area. Granite City (Madison County) reported 14.20

inches of precipitation for the month. Several locations reported a record number of days with rain, and Chicago had 24 days, a record high and double the average number of October rain days. As would be expected, there were many cloudy days. Chicago experienced 38 percent of possible sunshine in October, as compared to a normal of 58 percent.

October was the end of a four-month stretch of below-normal temperatures in Illinois. The average temperature for July–October was 64.0 degrees, 3.2 degrees below normal, and the coldest July–October on record.

Average height fields at 500 hPa and 850 hPa winds were closer to normal for the September to November period. This led to a closer to typical average temperature and precipitation patterns for that time period.

Milder conditions prevailed in November with temperatures 5.6 degrees above normal, the second warmest November on record. Precipitation was only 2.47 inches, 0.87 inches below normal. Only a narrow band of wet conditions prevailed, extending from Quincy eastward to about Springfield. Unfortunately, the warm and dry conditions came too late to help much in the fields. The remaining corn and soybeans continued to be slowly harvested in November and December. December was wet and cold (Figures 1 and 2).

ANNUAL SUMMARY

The year 2009 was the second wettest on record with a statewide average precipitation of 51.02 inches, 11.76 inches above normal. Nine of the 12 months received above-normal precipitation (Table 1). Only 1993 was wetter with 51.19 inches, while 2008 placed as the third wettest year with 50.46 inches. As shown in Figure 1, 9 of the 12 months in 2009 had above-normal precipitation.

In terms of temperature, 2009 was not as outstanding. Exceptionally cold weather prevailed in January, July, August, and October. On the other hand, milder conditions in the remaining months and near-record warmth in November balanced out the year. Figure 2 shows that 8 of the 12 months had below-normal temperatures. The statewide average temperature for 2009 was 51.2 degrees, just 0.6 degrees below normal. It was the 31st coldest year on record.

Both 2008 and 2009 were extraordinarily wet with a combined precipitation of 100.5 inches, 22.0 inches above normal. No other back-to-back years in modern history have been as wet. While the records are spotty in the 1800s, there appears to have been a period from 1845 to 1851 with consecutive unusually wet years.

Impacts

ENERGY USE/PRODUCTION

The much-below-normal summer temperatures affected energy use. Cooling degree days in Illinois were 26 percent below average. These conditions greatly reduced the use of air conditioning, resulting in savings to consumers, but also decreased profits for power companies. Ironically, reduced power generation affected the railroads. Operations of trains that bring coal from Wyoming to Illinois power plants were decreased 15 percent, causing a negative impact on railroad companies (Trains, 2009). Severe thunderstorms in June caused power outages for 103,000 customers in Chicago.

AGRICULTURE

The cool, rainy, and cloudy weather conditions during April limited corn planting across the state (FarmWeek, May 4), a problem which persisted through May. The slow start to the 2009 growing season became evident by April 19 (Table 3 and Figure 3) when only 1 percent of the corn was planted, compared to the five-year average of 23 percent. Even so, the delays were similar to those in 2008 when wet weather also delayed planting.

For the next two weeks, the percentage of corn planted remained in the single digits and eventually fell behind even the slow start to 2008. By May 10, only 10 percent of the corn was planted, compared to 55 percent in 2008, and the five-year average of 82 percent.

The only significant jump in corn planting progress occurred between May 17 and May 24 when 42 percent of the corn was planted. This was largely the result of a warm, dry week when the statewide precipitation averaged only 0.02 inches. Even so, experts were concerned about planting in wet soils as 41

percent of the state experienced surplus soil moisture. Wet conditions persisted in June such that the corn planting was not complete until June 21, almost a month behind the five-year average.

Problems continued in July as a result of the record-cold conditions. As of July 5, only 5 percent of the corn was silking, compared to a five-year average of 31 percent. The average height of the corn also lagged the historical average, coming in at 41 inches compared to a five-year average of 61 inches. As of July 26, only 53 percent of the corn was silking, compared to the five-year average of 93 percent.

Table 3. Rate of completed corn planting and corn harvesting, in percentages, for 2009 and the 5-year average (2004–2008)

<i>Rate of Planting</i>			<i>Rate of Harvesting</i>		
<i>Date</i>	<i>2009</i>	<i>Average</i>	<i>Date</i>	<i>2009</i>	<i>Average</i>
April 5	0	1	August 30	0	0
April 12	0	7	Sept. 6	1	3
April 19	1	23	Sept 13	1	7
April 26	4	43	Sept 20	1	16
May 3	5	66	Sept 27	2	28
May 10	10	84	Oct. 4	5	41
May 17	20	92	Oct. 11	6	56
May 24	62	96	Oct. 18	11	68
May 31	82	98	Oct. 25	14	77
June 7	93	99	Nov. 1	19	86
June 14	96	99	Nov. 8	31	92
June 21	99	99	Nov. 15	52	95
			Nov. 22	60	98
			Dec. 6	85	100
			Dec. 20	95	100

As of August 30, 26 percent of the corn was at the dent stage, compared to 45 percent in 2008 and 73 percent for the five-year average. The dent stage occurs when an indentation forms on the end of the corn kernel and is considered the last stage before maturity. Only 2 percent of the corn was rated as mature, compared to the five-year average of 16 percent. At this point, some producers were concerned that the ongoing El Niño might trigger an early frost, an event that would be devastating to a corn crop so far behind in development. However, an analysis of past El Niño events revealed no relationship with an early frost (Angel and Hilberg, 2009).

Agricultural experts claimed the wet, cool weather would reduce the state's expected corn and soybean yields (FarmWeek, June 8). However, later assessments of expected yields issued in mid-August were unexpectedly high, 175 bushels per acre (bu/acre) for corn, and 44 bu/acre for soybeans (FarmWeek, August 17). Corn yields were expected to be much higher in Iowa and other Corn Belt states, an expectation which drove corn prices down (Chicago Tribune, August 26). Thus, Illinois farmers faced both lower

yields and lower prices. One month later, in mid-September, experts declared that the mild summer weather had led to higher crop yields in Illinois than expected (FarmWeek, September 14). Projected corn yields in Illinois averaged 179 bu/acre, and soybean yields averaged 46 bu/acre.

In September, the USDA declared 58 Illinois counties (Figure 4) as disaster areas because of the harm caused by excessively wet and cool spring conditions (FarmWeek, September 21). They estimated that 1,000,000 acres planted with corn had to be abandoned. The April–July rainfall across Illinois averaged 20.94 inches, 4.74 inches above normal, and the ninth wettest period on record. The USDA also declared that farmers in 30 other Illinois counties could receive assistance and low-interest loans (Figure 4).

Cool, wet conditions also increased the risk of disease in corn, especially ear rot. Two common types were *Diplodia* and *Gibberella* ear rot. The presence of these and other fungi reduces the quality of the grain, incurring discounts upon delivery to elevators. In the case of *Gibberella* ear rot, mycotoxins can be produced that are detrimental to livestock. (Nafziger, 2009a).

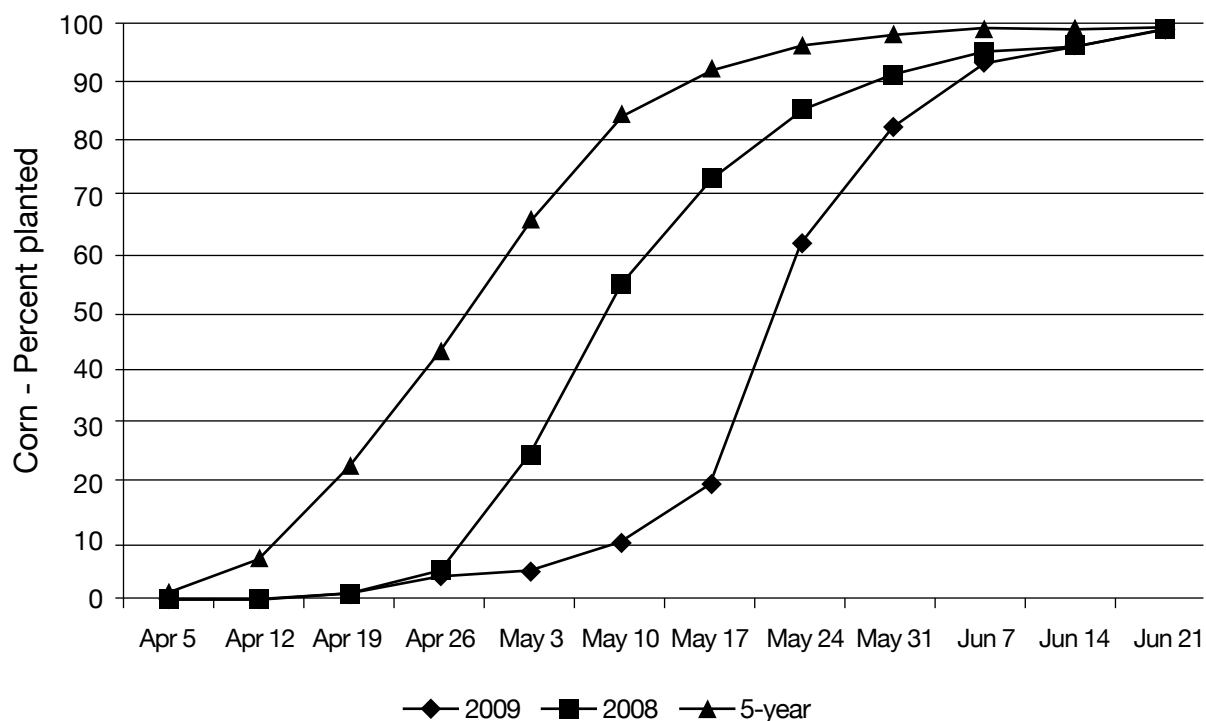


Figure 3. Percent of the corn planted on each date for 2009, 2008, and the 5-year average (2004–2008). The farther right a curve is on the plot indicates the farther behind Illinois was on planting.

Fall harvest of corn usually begins after Labor Day. While September was drier than normal, but with near-normal temperatures, very little corn was harvested as it had not sufficiently matured (Table 3). As of September 27, only 2 percent of the corn was harvested, compared to the five-year average of 28 percent. At the end of September, only 24 percent of the corn was rated as mature, compared to the five-year average of 84 percent.

The cool, wet conditions during the growing season also hurt many specialty crops (fruits and vegetables). Wet conditions delayed planting, flooding damaged some crops, below-normal temperatures delayed ripening of certain crops such as tomatoes,

and the conditions helped spread various crop diseases. Yields of many specialty crops declined 30 to 65 percent (FarmWeek, January 11).

Harvesting in 2009 was quite late, and in some areas did not occur until Thanksgiving (FarmWeek, September 28). Cold, wet conditions in October further delayed the maturing and harvesting of corn. As of October 25, only 14 percent of the corn was harvested, compared to the average of 77 percent (Figure 5). Only 88 percent of the corn was mature, compared to the average of 100 percent. The NASS report (2009) stated that “some farmers have reported standing water in the fields, forcing them to work around those areas when they are able to harvest.”

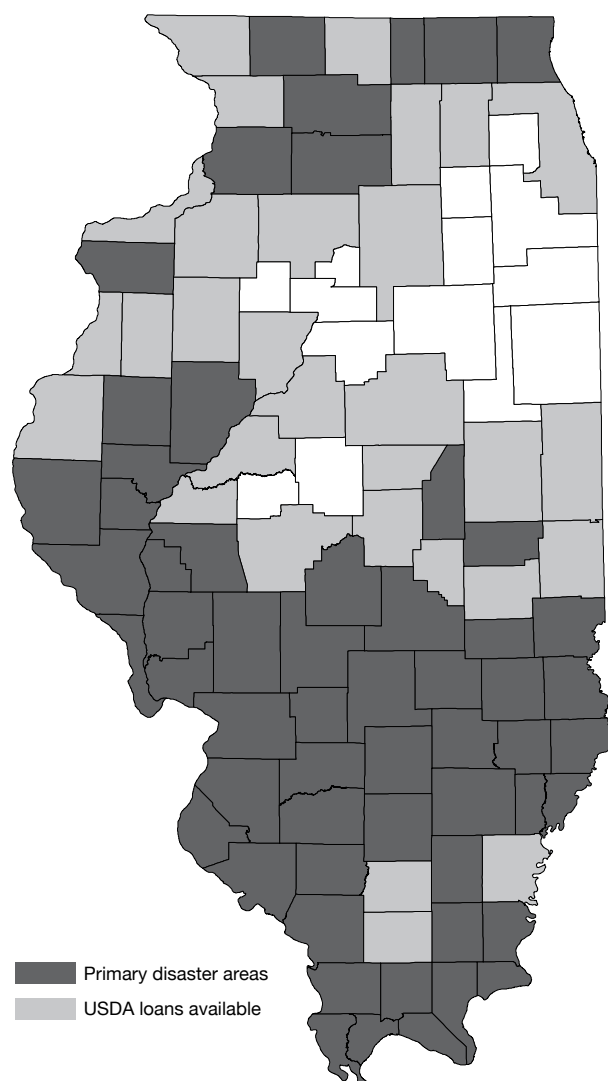


Figure 4. Counties declared disaster areas by USDA, and those declared eligible for farm loans.



Farm fields partly covered with water.



Water covers a large farm field in Iroquois County.

By late October, most crops had matured (79 percent for corn and 93 percent for soybeans), but only 11 percent of the corn crop had been harvested (68 percent is average for late October), and only 13 percent of the soybean crop was harvested (79 percent is average) (FarmWeek, October 26b). By the end of November, amounts of harvested crops were still much behind average levels, ranking 2009 as the slowest harvest ever (FarmWeek, October 26a). The extremely wet November soils kept harvesting equipment from entering many fields (FarmWeek, November 2).

Crop prices remained highly volatile in the fall, and in October, prices were projected to remain unpredictable in the coming winter months as the weather and its impacts on harvested yield levels left production values uncertain (FarmWeek, October 19). If yields fell below USDA expectations, crop prices would soar—corn to \$4 bu/acre and soybeans to \$10 bu/acre. By November 9, a total of 31 percent of the state's corn crop had been harvested (92 percent is normal), and 69 percent of the soybeans had been harvested (96 percent is normal).

One issue that slowed down the corn harvest was the high moisture content of the corn, even in fields where the crop had reached maturity. In a normal year, farmers can allow the corn to dry down naturally in the fields, saving on expensive dryer costs. However, the cool, wet weather in October prevented this option. By November, even with warmer-than-normal temperatures for the month, temperatures in the 40s and 50s were too cold for efficient dry down. Dryer costs were approximately 3.5 cents per bushel per point of moisture lost (Nafziger, 2009b). Therefore, to dry a bushel of corn from 25 percent moisture to the ideal of about 15 percent moisture costs about 35 cents per bushel. Not only was drying corn in a dryer more expensive, but a general lack of dryer capacity in Illinois meant great delays at the elevators.

Fortunately, the first half of November had above-normal temperatures and no rain, allowing harvesting to move forward rapidly. By November 15, the state's corn harvest was 52 percent complete (Figure 5). There was so much corn harvested quickly that local elevators were overwhelmed, delaying drying and storage. Several elevators closed due to limited dryer capacity

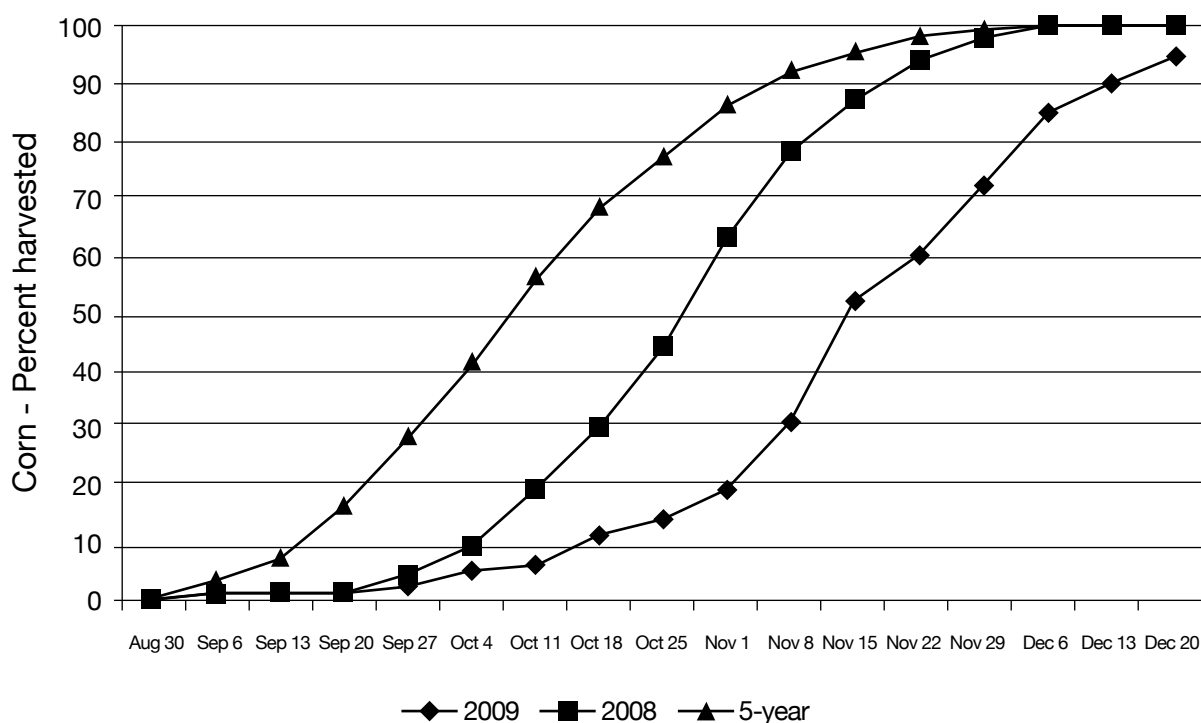


Figure 5. Percent of the corn harvested on each date for 2009, 2008, and the 5-year average (2004–2008). The farther right a curve is on the plot indicates the farther behind Illinois was on planting. The USDA National Agricultural Statistics Service stopped reporting corn harvest after December 20, 2009.

and/or shortage of propane used as fuel for the dryers. Hence, movement of corn from the elevators was not as fast as desired. This led to a major increase in the sales of grain dryers for farm installation (FarmWeek, February 22). Many farmers completed their soybean harvests by November 9 (FarmWeek, November 16a), but widespread rains began in Illinois on November 15 and lasted until November 20, halting the harvesting. In mid-November, the USDA estimated that the Illinois corn yield would average 175 bu/acre and soybeans at 45 bu/acre (FarmWeek, November 16b).

The Illinois Farm Bureau sought an extension of the crop insurance claim deadline of December 10 since the delayed harvest meant that 30 to 40 percent of the crops would still be in the fields after December 10, at which time producers would have no knowledge of yield outcomes for possible insurance claims (FarmWeek, November 23b).

Significant harvesting progress occurred during a dry week at the start of December (FarmWeek, December 7). Then, a winter snowstorm hit northern Illinois on December 9–10, where 15 percent of

the corn crop awaited harvest. By December 16, 10 percent of the state's corn crop was still in the fields (FarmWeek, December 21). By December 22, 95 percent of the Illinois crop had been harvested, although 21 percent of the crop in northeastern Illinois was still in the fields (FarmWeek, January 4a).

Poor weather conditions during 2009 further created several agricultural problems for the following year, 2010. Soil compaction resulted from excessive precipitation delaying most fall 2009 tillage efforts until spring 2010. The wet fall conditions in farm fields also limited normal fall applications of fertilizer, meaning that many applications would have to be done during 2010 and at higher prices. There was also concern that the crop-limiting conditions would lower seed production and delay seed shipments needed for planting in 2010. Another 2010 problem created by 2009 conditions related to the danger of toxins inside grain bins. The storage of moist corn created fungal mycotoxin, a serious health hazard if inhaled (FarmWeek, February 22).



Grains awaiting drying have been stored outside an elevator near Champaign.

The wet fall also delayed planting of winter wheat (FarmWeek, November 9); only 35 percent had been planted by November 6 versus an average of 90 percent by this date. This outcome was predicted to cause a loss in future wheat production. By November 15, wheat planting was 77 percent complete (FarmWeek, November 23a). An agricultural expert declared, “This was one of the worst, if not the worst, wheat planting season” (FarmWeek, January 18). Wheat acreage planted in the fall of 2009 was the lowest on record (FarmWeek, February 22).

In general, weather impacts of the 2009 growing season were mixed and often misunderstood. They resulted in above-average yields (corn +8bu/acre and soybeans +4 bu/acre), losses of farm income for various reasons, and wide use of crop insurance. Three major weather conditions affected farming and crop yields in 2009, including

- 1) overly wet conditions that delayed spring planting;
- 2) a cool and wet growing season that slowed the rate of crop development and maturity; and
- 3) heavy fall rains that halted crop harvesting efforts.

Predicted yield outcomes issued at various times during the growing season oscillated greatly, varying from low to high to low. An agricultural expert in December stated, “This was one of the most unusual growing seasons ever experienced in Illinois” (FarmWeek, December 7). The USDA’s final values of statewide yields for 2009 were 175 bu/acre for corn



Corn badly damaged by a massive hailstorm.

and 46 bu/acre for soybeans (FarmWeek, January 18). The USDA stated that the nationwide 2009 production of corn and soybeans set record highs. The Illinois corn crop was the fourth largest on record and 10 percent less than the record high set in 2007. However, in March 2010, the USDA decreased its Illinois average corn yield to 174 bu/acre.

In-season assessments of the 2009 crop status and questionable yield expectations, coupled with the high final yields, reveal that major improvements have been made in the genetics of corn and soybeans. Years ago, a growing season like that in 2009 would have resulted in low yields of both crops. But in 2009, after a very wet spring, a cool, wet summer, and a very wet fall, the yields were high and only slightly below record levels.

HUMAN BEHAVIOR

The wet and cool weather of 2009 also affected human behavior. For example, attendance at the Illinois State Fair was down 11 percent and sales there were down 50 percent. Use of swimming pools was down 15 to 20 percent. The Chicago Tribune (July 28) ran a front-page headline stating this was “The year without a summer.” The July average temperature in Chicago was 68.9 degrees, 4.5 degrees below normal, and no summer high daily temperatures were above 86 degrees. Only three July days had above-normal temperatures. High floodwaters in Chicago from a June 19 rainstorm were released into Lake Michigan, leading to the closure of lake beaches for 10 days. Weather conditions were viewed by many as detrimental to agriculture, which caused anxiety for farm families during the growing season.

CONSTRUCTION

Construction of highways and buildings was delayed across the state, hurting incomes and expected stimulus projects. The repair and maintenance of city streets and some highways were 35 percent behind schedule at the end of August. As a result, workers’ income declined. For example, the Chicago area experienced a 22 percent drop in income for construction workers (Chicago Tribune, September 22).

LAKE MICHIGAN

Lake Michigan was considerably affected by the cool and wet conditions in 2009. The lake level on

May 1, 2009 was 11 inches above the level on May 1, 2008 (Chicago Tribune, May 1). Lake temperatures in July 2009 were 5.9 degrees below that in July 2008, a result of the cool summer. The basin of Lake Michigan had an average 12-month precipitation (September 2008–August 2009) that was 117 percent of normal. Thus, the lake level by August 31 was increased and was just 5 inches below average and the closest to the long-term average since 2004 (U.S. Army Corps of Engineers, September 2009).

STORMS AND THEIR DAMAGES

The storminess of the spring and summer caused major damage to crops and property in Illinois. Weather catastrophes (events causing >\$1 million in losses) in the Midwest were more frequent than normal and their costs for the second quarter were a record high. Allstate, an Illinois-based insurance firm, had losses that totaled \$818 million, 17 percent above those in 2008 (Chicago Tribune, August 6). The property insurance industry identified five catastrophes that each produced losses above \$25 million in Illinois (PCS, 2009). These catastrophes are listed in Table 4. The state total was \$400 million.

On June 17, winds with speeds greater than 60 mph created major damages to trees in northeastern

Illinois. In late June, severe storms in southern Illinois caused major damages due to high winds and two tornadoes. On July 24, a severe hailstorm crossed northwestern Illinois, depositing some hailstones that were 2 inches in diameter (Chicago Tribune, July 20), and winds of 60 to 70 mph created major crop losses (FarmWeek, August 3). Areas west of Rockford suffered significant property damage; the storm total was \$39 million in losses (Table 4).

Another major rainstorm occurred across northern Illinois on August 26–27. Rainfall amounts included 4.9 inches at Rockford, 4.6 inches at Genoa, 4 inches at Monee, and 3.9 inches at Elgin. This led to flash flooding along the Fox and Kishwaukee Rivers.

Table 4. Causes and losses from property catastrophes in Illinois during March–August 2009

<i>Date</i>	<i>Type of damaging conditions</i>	<i>Amount of losses, \$ millions</i>
March 7-8	Hail, tornado, and high winds	\$25
May 8-9	Flooding, hail, and tornadoes	\$280
May 13-14	Tornado and high winds	\$29
June 6-8	Tornado, winds, and hail	\$27
July 24-25	Hail and high winds	\$39



A flooded soybean field.

FLOODING

A major impact of the very wet and cool weather of 2009 was flooding of major and minor rivers in Illinois. By May 1, the levels of the Illinois River, the middle and lower Mississippi River in Illinois (Quincy to Thebes), and Ohio River at Cairo were all much above flood stage.

On June 17, 3.97 inches of rain fell at O'Hare Airport, the third greatest calendar day amount on record and the 12th wettest day ever in Chicago. Rockford had 3.25 inches in one hour (Chicago Tribune, June 17). Widespread flash flooding of streams and many road closures occurred in the state's northernmost counties.

A significant rainstorm occurred on June 11 across north-central Illinois. Chicago Midway had 1.8 inches of rain and Momence had 2.3 inches. This led to flash flooding on the Kankakee River in Kankakee County and in upstream areas, including the Iroquois River.

On June 16, heavy rains fell across northeastern Illinois, and Joliet had 4.08 inches. These rains created street flooding in Chicago's southwest suburbs (Chicago Tribune, June 17). Three days later, Chicago had 3.5 inches of rain (a record high for June 19), and excessive urban flooding resulted. To reduce the severe flooding, the Metropolitan Sanitary District of Chicago chose to release floodwaters into Lake Michigan.

By the end of June, the Illinois River was 8 feet above flood stage from Peoria to Hardin, and the Mississippi River was above flood stages from Grafton south to Chester and Thebes. By the end of August, the Illinois and Mississippi Rivers had fallen below flood stages. However, heavy rains in October brought flooding to farm fields by October 24, and several rivers were above flood stage, including the Sangamon and Kaskaskia.

WEATHER PREDICTIONS

Long-range predictions of the weather during 2009 varied in accuracy. One forecast issued in January 2009 by agricultural scientists stated, "There will be lots of rain in early spring and corn planting will be delayed, creating more soybean planting, and the summer will be cool and wet." This outlook was correct (News Gazette, January 20). A private forecast company issued a prediction on July 1 calling for July weather to be normal (Chicago Tribune, July 2). Unfortunately, July conditions were far from normal. The head of the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center, which issues official long-range predictions, stated in June that the atmosphere's behavior was very odd and not explainable (News Gazette, June 19). Hence, these later long-range predictions for summer and fall 2009 were not considered to be accurate.



Flooding along the Illinois River.

Summary

Abnormal weather conditions existed in every month from January 2009 through December 2009. March–August conditions were exceptionally wet and cool with frequent cloudy skies. The fall months had a variety of abnormal conditions: warm and dry in November after a cool and wet October.

The wet and cool spring delayed planting of major crops and led to flooding along many rivers. The summer had temperatures nearly 3 degrees below normal, reducing use of air conditioning but delaying crop maturity. Summer of 2009 rated as the 8th wettest and 11th coolest in Illinois since 1895.

A shift to typical drier weather in September followed by cool and wet conditions in October sustained flooding and delayed harvesting of Illinois crops. Conditions shifted again in November, becoming a warm and relatively dry month, and corn and soybean harvesting went rapidly forward. Wet corn required drying at elevators everywhere, but facilities and fuel for drying were not adequate to meet the demand. In early December, most soybeans had been harvested, but 15 percent of the corn crop was still in the fields. The harvest of crops in 2009 was rated as the slowest ever in Illinois. Nine months in 2009 had above-normal precipitation and eight months had below-normal temperatures.

The unusual crop season weather in 2009 led to worries over poor production, yet near-record-high yields were produced for corn (174 bu/acre) and soybeans (46 bu/acre). These yields helped farm incomes, but delays in corn drying and tillage increased costs. Furthermore, high yields across the Corn Belt lowered crop prices, which also decreased farm incomes. The President of the American Farm Bureau Federation declared that “The biggest news story for 2009 was weather extremes including unseasonably cool and

wet harvests in Illinois and surrounding states.” (FarmWeek, January 4b).

Storms in 2009 were more frequent than usual and resulted in extensive property damage in Illinois. Included were four record-setting rainstorms; several hailstorms, with one in northern Illinois producing hailstones of 2 inches in diameter; frequent cases of high winds with gusts greater than 60 mph; and 18 tornadoes. More than \$400 million in property losses were reported along with \$120 million in crop losses from severe storms.

Flooding on most rivers occurred at various times during March–November 2009. The Illinois River was above flood stage for 89 consecutive days, setting a new record. Heavy rains of 2009 helped bring Lake Michigan’s level up to near average for the first time since 2004.

Wet and cloudy conditions affected human behavior, including a reduction in retail shopping. Construction and repair of highways and buildings were delayed.

Although the unusual weather in 2009 ended after December, some of the impacts on agriculture and flooding continued into the following months. Corn harvesting in northern Illinois continued into January 2010, tillage of soils awaited drier conditions in the spring of 2010, and fertilizer applications in the fall of 2009 were delayed until 2010. Flooding of the Illinois River and several of its tributaries also continued into January 2010.

Importantly, the wet year of 2009, combined with a wet 2008, produced an average of 100.8 inches of rainfall across Illinois, a value that is 22.8 inches above normal. These were two of the wettest consecutive years on record.

Acknowledgements

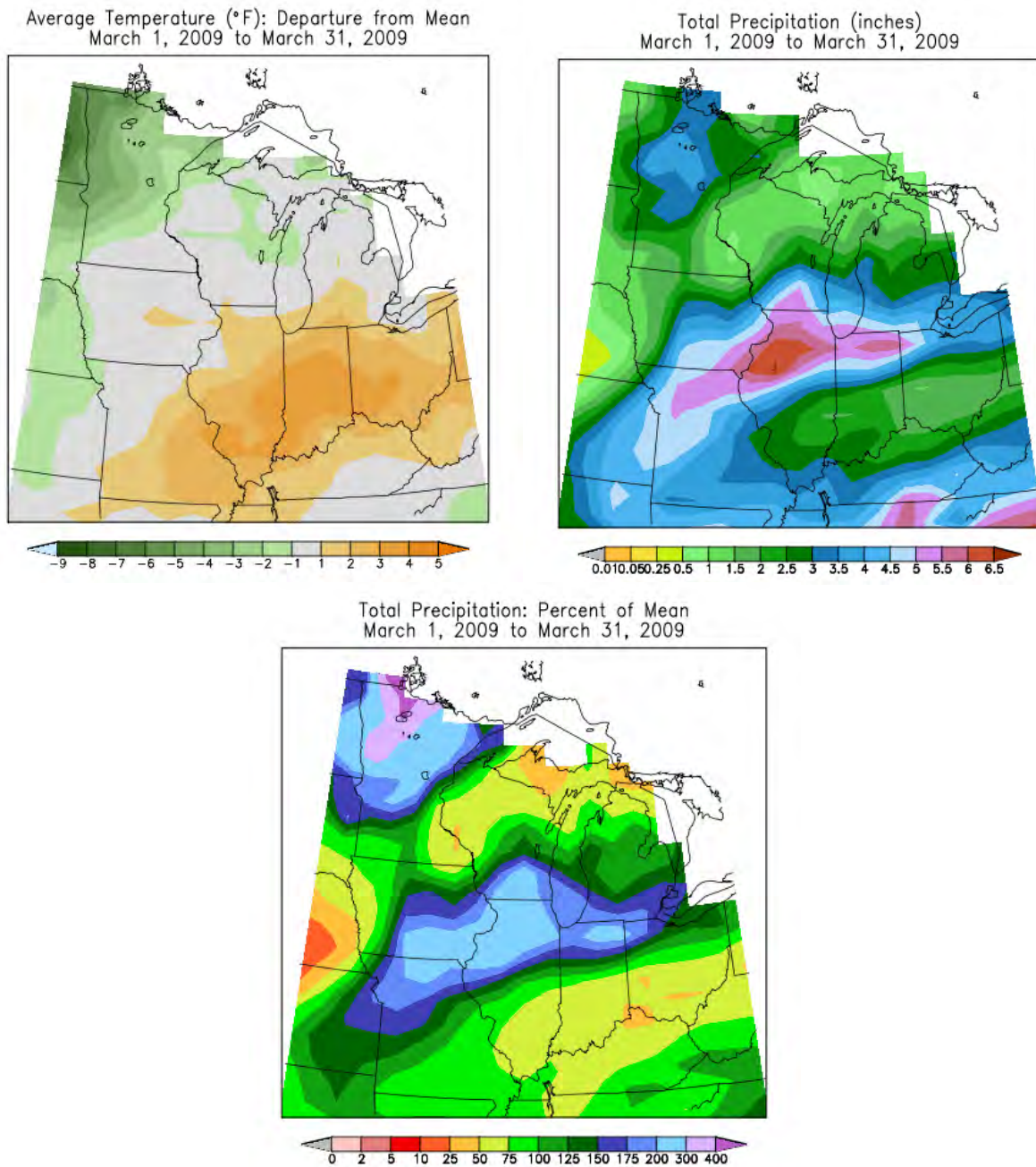
The authors appreciate the scientific reviews of Leslie Stoecker and Michael Caughey. Lisa Sheppard did an excellent editing of the manuscript, and Eileen Deremiah and Sara Olson prepared the illustrations. Sara Olson prepared an excellent layout.

References

- Angel, J.R., and S.E. Hilberg, 2009: El Niño not likely to affect first fall freeze. Press release, Illinois State Water Survey, <http://www.isws.illinois.edu/hilites/press/090820elnino.asp>.
- Champaign News Gazette, January 20, 2009: Analyst: Corn, soybeans to hit bottom in 2009. Page A-3.
- Champaign News Gazette, June 19, 2009: America remains all wet as rains won't go away. Page A-11.
- Chicago Tribune, May 1, 2009: Lake Michigan waters. Section 3, page 12.
- Chicago Tribune, June 17, 2009: More storms threaten. Section 3, page 8.
- Chicago Tribune, June 20, 2009: Record rain has beach on back burner. Section 1, page 4.
- Chicago Tribune, July 2, 2009: Normal July could bolster corn. Section 1, page 21.
- Chicago Tribune, July 28, 2009: The year without a summer. Section 1, page 1.
- Chicago Tribune, August 6, 2009: Allstate profit soars despite surging catastrophe losses. Section 1, page 2.
- Chicago Tribune, August 26, 2009: Biggest corn crop to yield price qualms. Section 3, page 8.
- Chicago Tribune, September 22, 2009: Construction problems. Section 2, page 2.
- Climate Watch, June 2009: Midwest Regional Climate Center, Illinois State Water Survey, Champaign, IL.
- FarmWeek, May 4, 2009: Planters remain parked, forecast is not promising. Page 5.
- FarmWeek, June 8, 2009: Number of corn acres could be lost for season. Page 3.
- FarmWeek, August 3, 2009: Unusual July weather good, bad for crop development. Page 2.
- FarmWeek, August 17, 2009: High yields. Page 3.
- FarmWeek, September 14, 2009: Yield predictions up. Page 1.
- FarmWeek, September 21, 2009: Disaster declaration. Page 4.
- FarmWeek, September 28, 2009: Grain industry braces for a late and large harvest. Page 5.
- FarmWeek, October 19, 2009: Harvest fortunes have a big impact on price direction. Page 8.
- FarmWeek, October 26a, 2009: Wet crop presents a number of harvest challenges. Page 1.
- FarmWeek, October 26b, 2009: Harvest delays may linger as weather remains unsettled. Page 8.
- FarmWeek, November 2, 2009: Harvest halts as soil conditions continue to deteriorate. Page 5.
- FarmWeek, November 9, 2009: Near record rains not conducive to planting wheat. Page 8.
- FarmWeek, November 16a, 2009: Bean harvest nears completion: focus shifts to corn. Page 7.
- FarmWeek, November 16b, 2009: Record yield forecasts could weigh markets. Page 9.

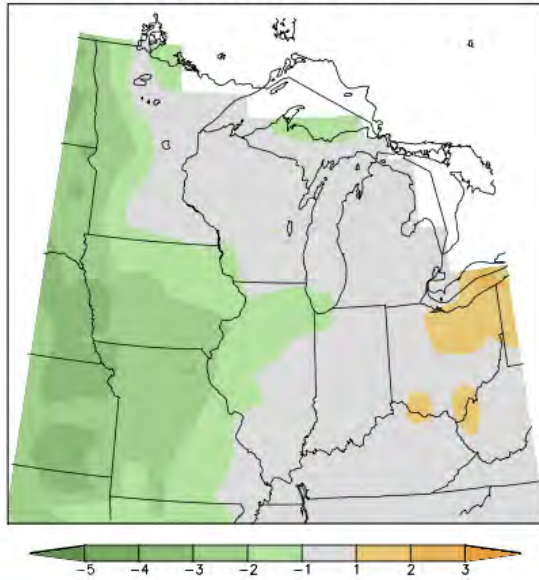
- FarmWeek, November 23a, 2009: Rains bring widespread harvest delays to Illinois. Page 7.
- FarmWeek, November 23b, 2009: IFB seeks extension of insurance period. Page 14.
- FarmWeek, December 7, 2009: End is near. Most crops out of fields. Page 8.
- FarmWeek, December 21, 2009: Home for the holidays? Some farmers still in the fields. Page 7.
- FarmWeek, January 4a, 2010: Winter off to active start while harvest drags on. Page 5.
- FarmWeek, January 4b, 2010: The year in ag. Page 2.
- FarmWeek, January 11, 2010: Consecutive wet years a challenge for specialty growers. Page 5.
- FarmWeek, January 18b, 2010: 2009 a record year for corn, soybean production. Page 7.
- FarmWeek, February 22, 2010: New problems. Page 7.
- LeCompte, May-June 2010: Unusually cool and soggy weather persisted for much of the year in the Midwest. *Weatherwise*, 15–23.
- Midwest Regional Climate Center, August 4, 2009: Press Release.
- Nafziger, E. 2009a. Dealing with moldy corn and mycotoxin risks. *The Bulletin*, College of Agricultural, Consumer, and Environmental Sciences, University of Illinois. <http://ipm.illinois.edu/bulletin/article.php?id=1244>
- Nafziger, E. 2009b. Late harvest issues. *The Bulletin*, College of Agricultural, Consumer, and Environmental Sciences, University of Illinois. <http://ipm.illinois.edu/bulletin/article.php?id=1245>
- National Agricultural Statistics Service, 2009. Illinois Weather and Crops. U.S. Department of Agriculture, Vol. 30.
- Property Claims Services, 2009: *Catastrophes in 2009*. Property Casualty Insurance, New York.
- Trains*, October 2009: How strong is coal? Pages 7–8.
- U.S. Army Corps of Engineers, September 2009: *Monthly bulletin of lake levels*. Detroit, MI.
- Weatherwise*, September-October 2009: Weatherwatch, Pages 48–62.

Appendix A

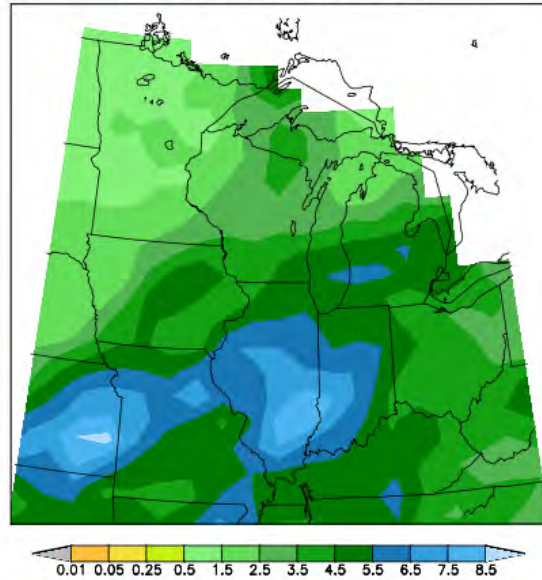


*March temperature departures, total precipitation, and precipitation departures
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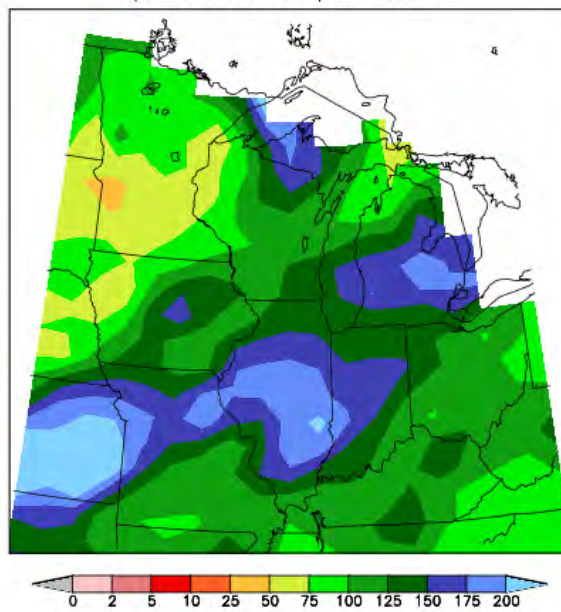
Average Temperature (°F): Departure from Mean
April 1, 2009 to April 30, 2009



Total Precipitation (inches)
April 1, 2009 to April 30, 2009

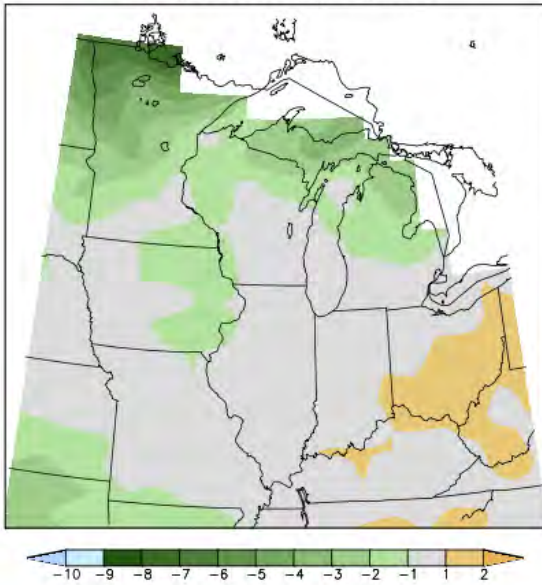


Total Precipitation: Percent of Mean
April 1, 2009 to April 30, 2009

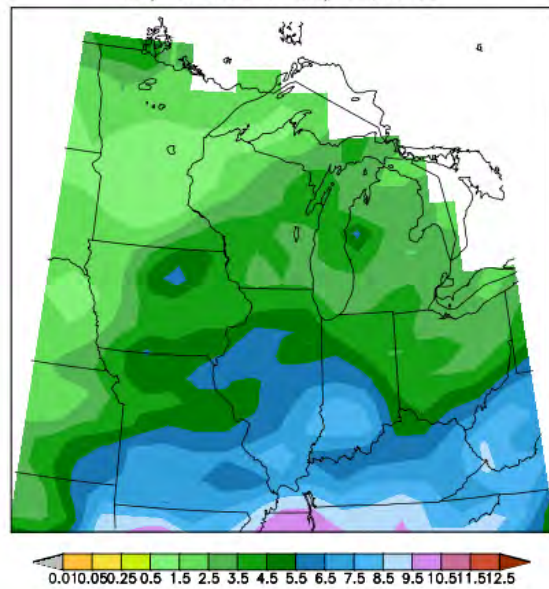


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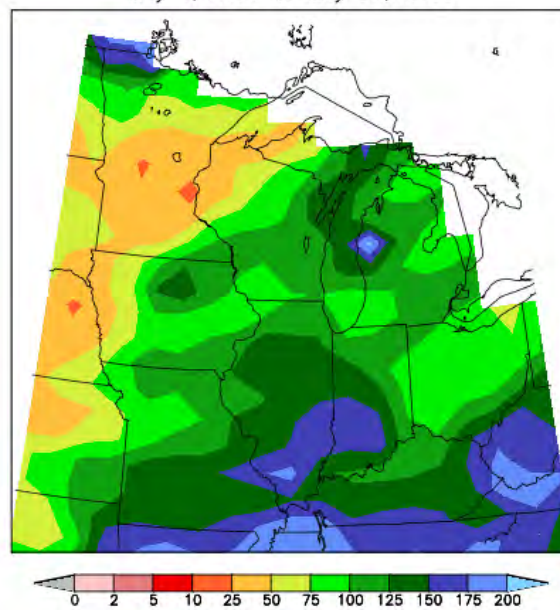
Average Temperature (°F): Departure from Mean
May 1, 2009 to May 31, 2009



Total Precipitation (inches)
May 1, 2009 to May 31, 2009

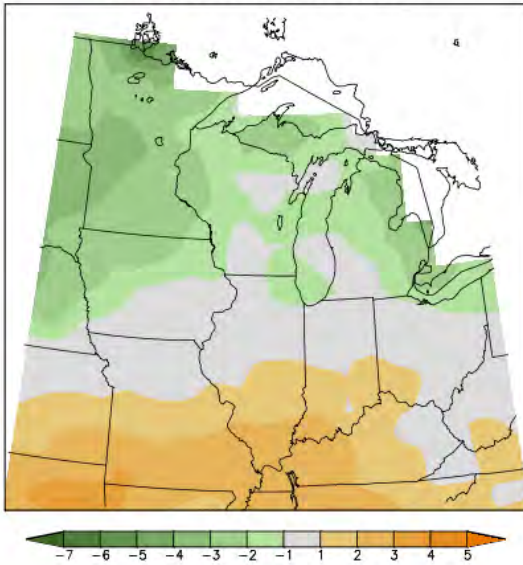


Total Precipitation: Percent of Mean
May 1, 2009 to May 31, 2009

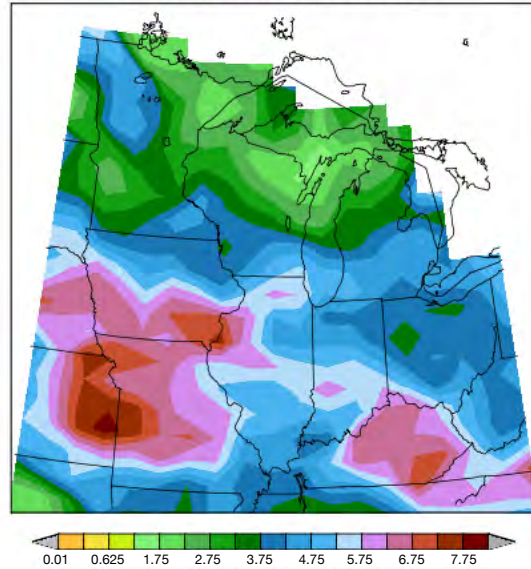


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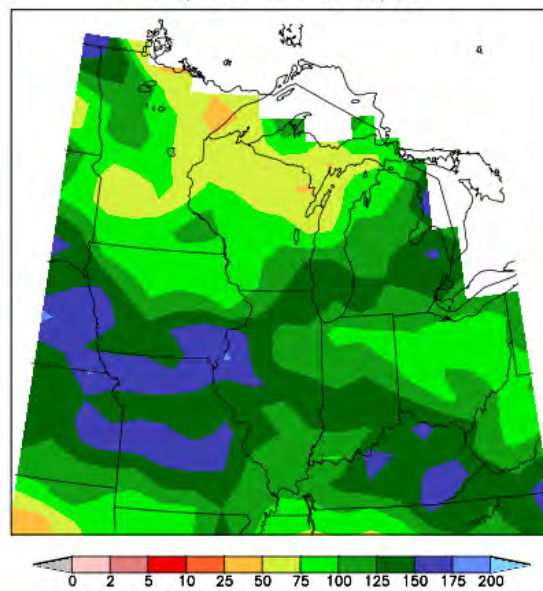
Average Temperature (°F): Departure from Mean
June 1, 2009 to June 30, 2009



Total Precipitation (inches)
June 1, 2009 to June 30, 2009

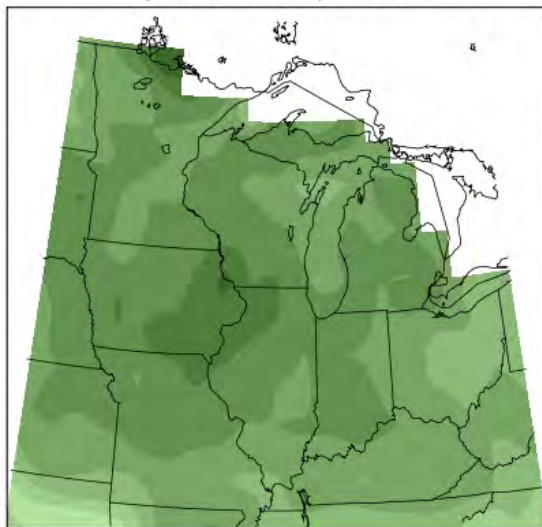


Total Precipitation: Percent of Mean
June 1, 2009 to June 30, 2009

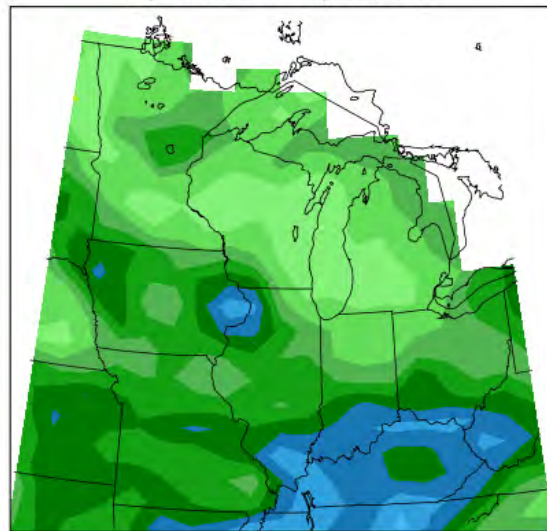


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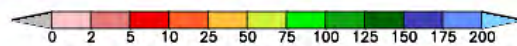
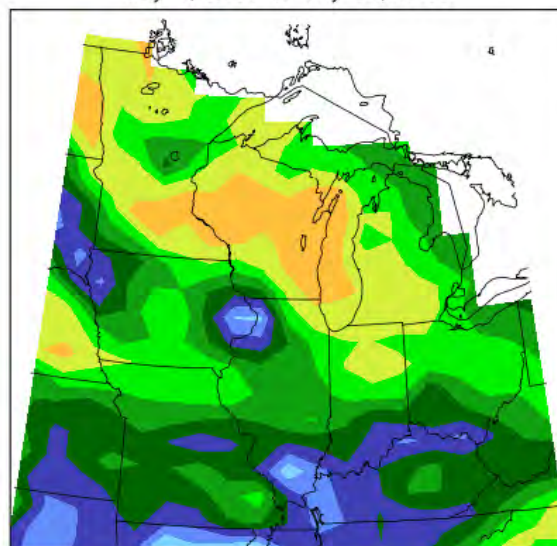
Average Temperature (°F): Departure from Mean
July 1, 2009 to July 31, 2009



Total Precipitation (inches)
July 1, 2009 to July 31, 2009

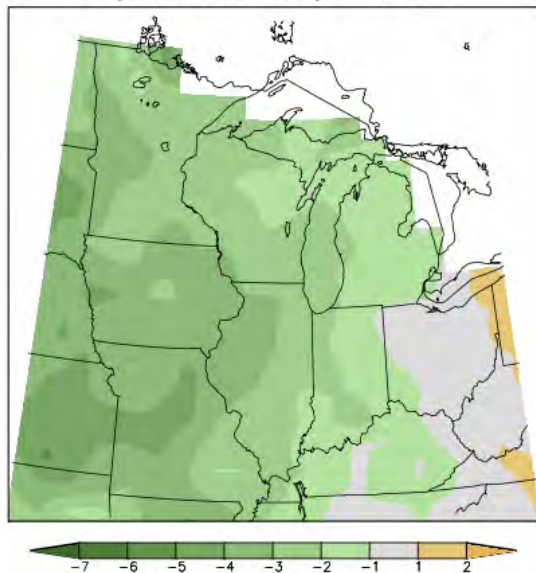


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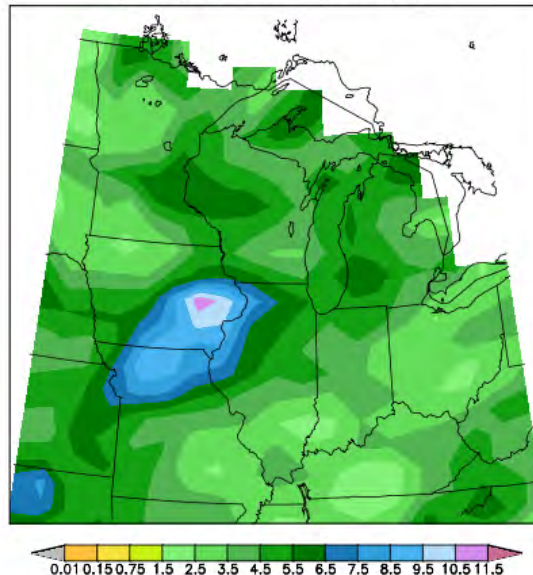


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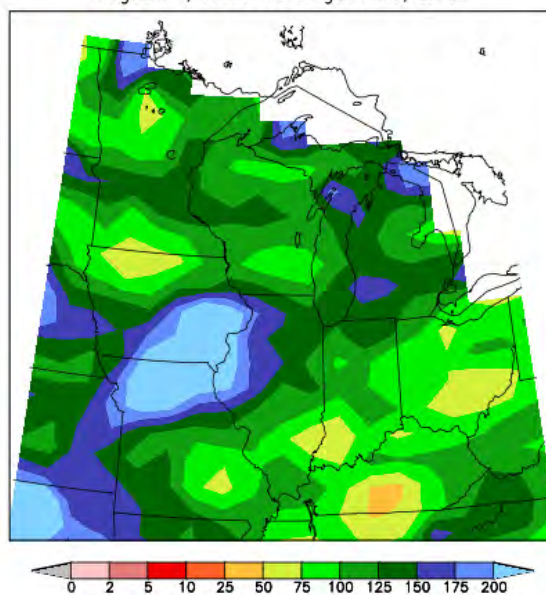
Average Temperature (°F): Departure from Mean
August 1, 2009 to August 31, 2009



Total Precipitation (inches)
August 1, 2009 to August 31, 2009

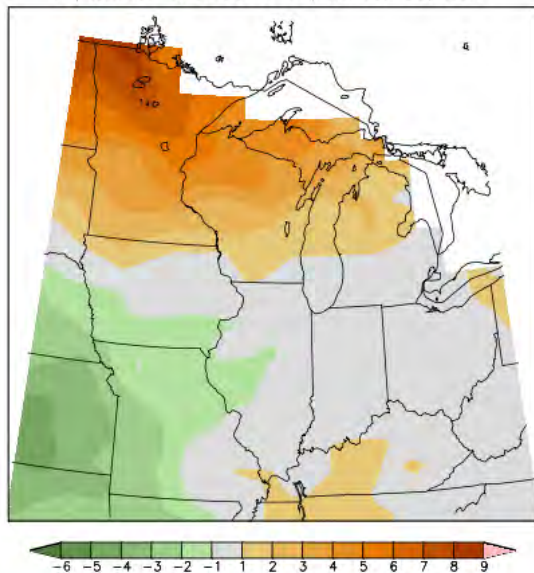


Total Precipitation: Percent of Mean
August 1, 2009 to August 31, 2009

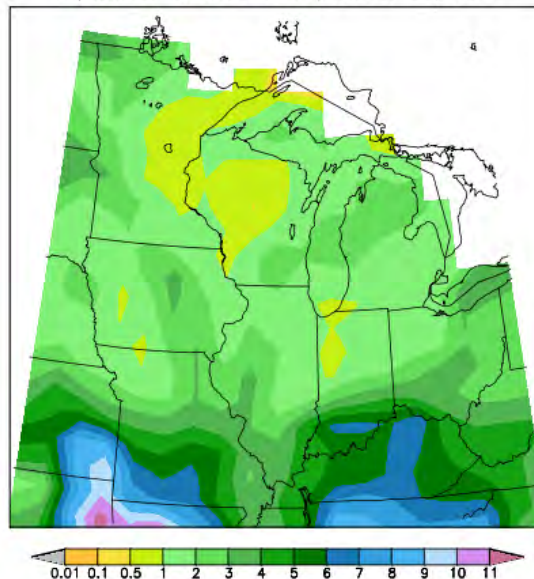


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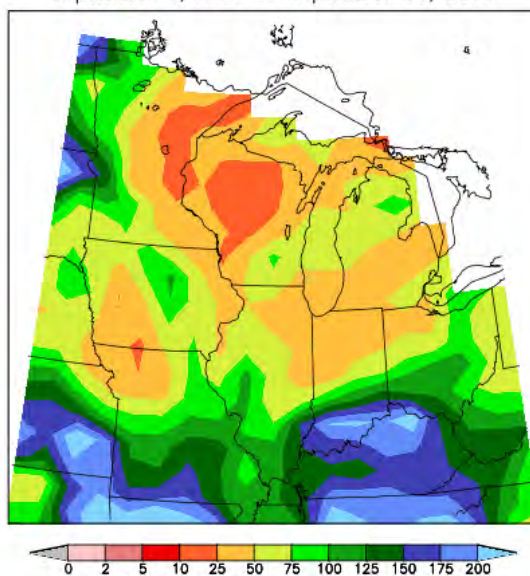
Average Temperature (°F): Departure from Mean
September 1, 2009 to September 30, 2009



Total Precipitation (inches)
September 1, 2009 to September 30, 2009

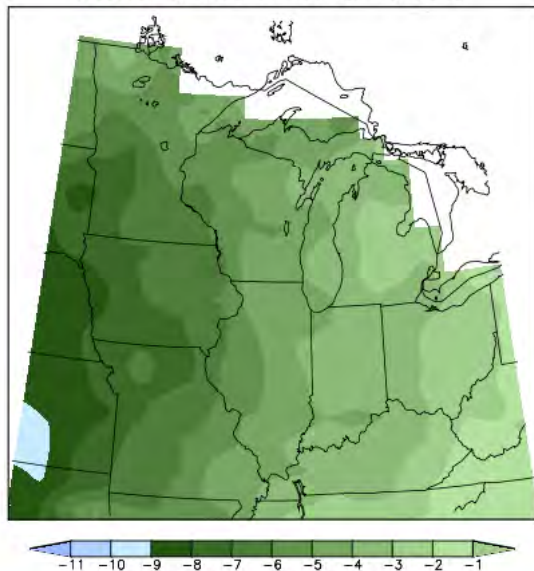


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September 1, 2009 to September 30, 2009

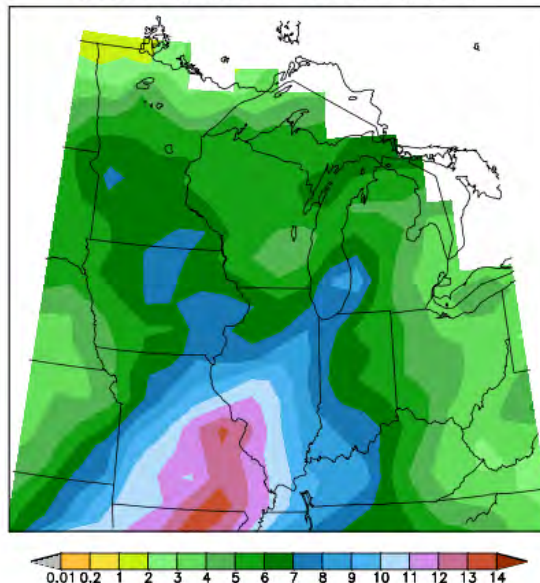


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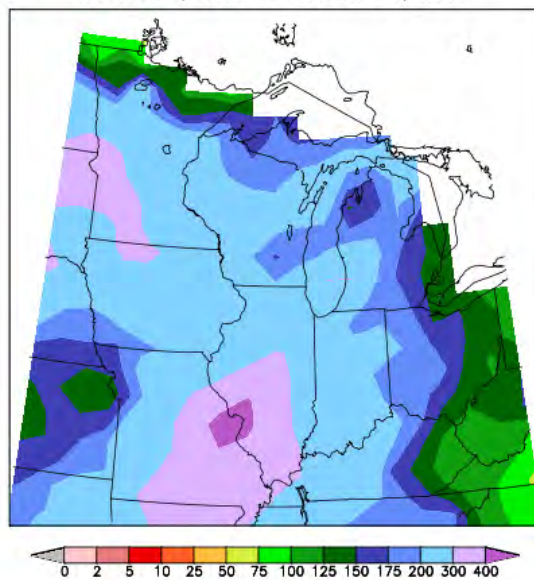
Average Temperature (°F): Departure from Mean
October 1, 2009 to October 31, 2009



Total Precipitation (inches)
October 1, 2009 to October 31, 2009

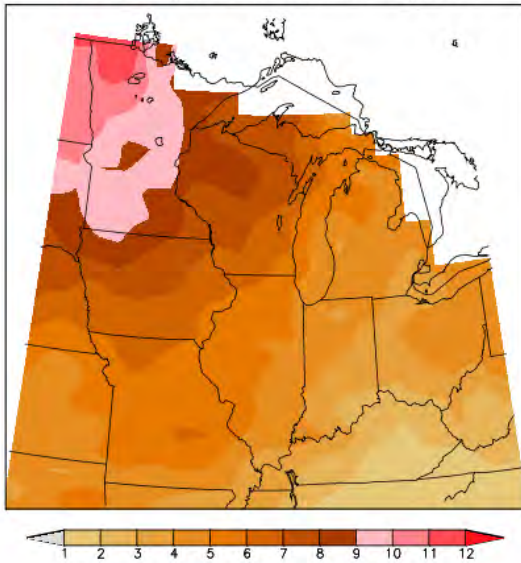


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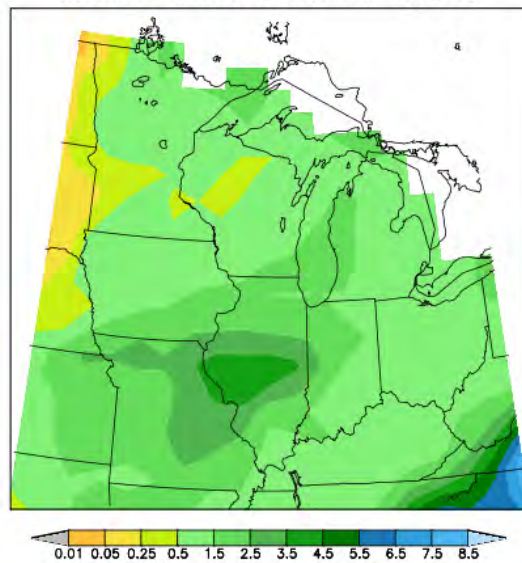


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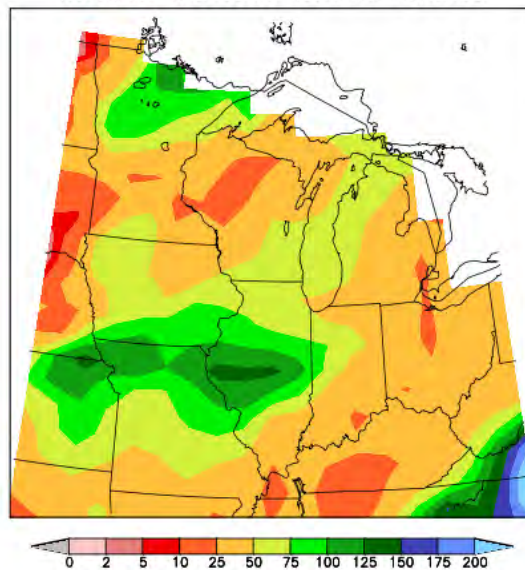
Average Temperature (°F): Departure from Mean
November 1, 2009 to November 30, 2009



Total Precipitation (inches)
November 1, 2009 to November 30, 2009



Total Precipitation: Percent of Mean
November 1, 2009 to November 30, 2009



*November temperature departures, total precipitation, and precipitation departures
(courtesy of NOAA Midwestern Regional Climate Center)*

