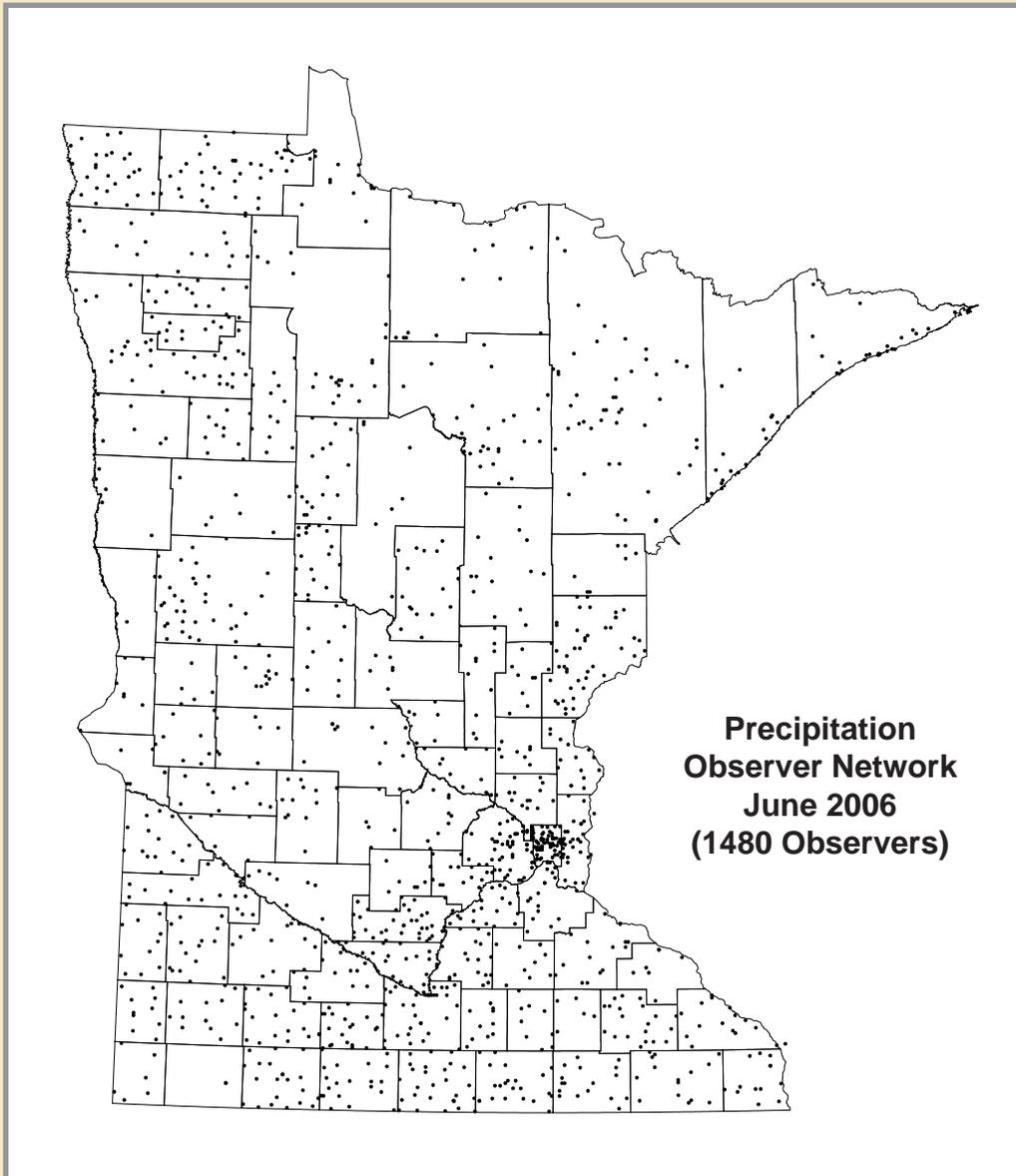


# Climatology



## *Chapter 1*



## Introduction

The DNR Waters State Climatology Office exists to gather and analyze climate data for the benefit of the State of Minnesota and its citizens. A variety of organizations provide climate data. These organizations rely primarily on the efforts of volunteer observers. The data are consolidated into a unified database and climate information is distributed to many users.

A review of climate information can assist in explaining a prior event or condition. Climate information aids long-range planning efforts by characterizing what is typical or extreme, likely or unlikely. Users of climate information include government agencies (local, state, federal), academic institutions, media, private sector professionals and the general public. Specifically, engineers use temperature and precipitation data to design roads and storm sewers. Wildlife managers use temperature and snow depth information to research animal health and mortality. Agricultural specialists use temperature and precipitation data to determine the types of crops that will grow in Minnesota. Others who rely on climate information include hydrologists, foresters, meteorologists, attorneys, insurance adjusters, journalists and recreation managers.

### Climate Data Sources:

*Soil and Water Conservation Districts*  
*National Weather Service*  
*University of Minnesota*  
*Department of Natural Resources*  
 - *Division of Forestry*  
 - *Division of Parks*  
 - *Division of Trails and Waterways*  
 - *Division of Waters*  
*State Climatology Office Back Yard Network*  
*Metropolitan Mosquito Control District*  
*Minnesota Association of Watershed Districts*  
*Metropolitan Waste Control Commission*  
*Minnesota Power and Light Company*  
*Emergency Management Offices*

## "Normal"

The word "normal" in this chapter refers to a 30-year mathematical average of measurements made over the period 1971-2000. Many individuals tend to (erroneously) perceive "normal" weather as what they should expect. Dr. Helmut E. Landsberg, former Director of Climatology for the U.S. Weather Bureau, summarized this misconception as follows: "The layman is often misled by the word. In his every-day language, the word 'normal' means something ordinary or frequent...When (the meteorologist) talks about 'normal,' it has nothing to do with a common event. For the meteorologist, the 'normal' is simply a point of departure or index which is convenient for keeping track of weather statistics."



Lorraine Hammerstrom

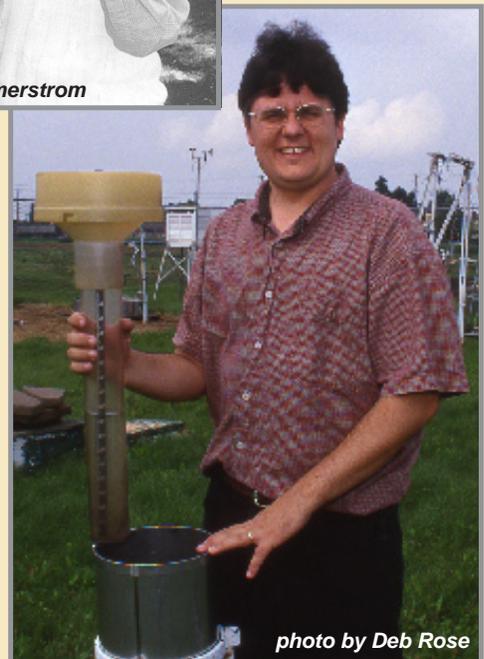


photo by Deb Rose

# The 2005 Water Year

## October 2004-September 2005

### Highlights

- Wet October and very dry November
  - Snowy winter northeast, meager snow south
  - Damp and cool spring
  - Warm and wet June
- Dry and warm late summer
- Wet autumn 2005 south, continued dryness north

## Autumn 2004

### October

October 2004 was wetter than normal everywhere in the state except portions of the south. One of the main rainmakers was an event that stretched from Montevideo to Pine City on October 28, dumping a narrow streak of 5 or more inches of rain in southwestern Chippewa and southwestern Kandiyohi counties. Considering the average monthly precipitation for October is just over 2 inches, this was a significant rainfall. [Heavy Rains Fall on Central Minnesota October 28, 2004](#)

The month started out more or less seasonably but there was a burst of summery weather with warm temperatures at the end of the month. Some record late-October dew point temperatures were recorded. [Record Late-October Dew Point Temperatures in Southern Minnesota October 29, 2004](#)

### November

There was a significant lack of rain or snow across the state in November 2004, with the driest areas in

the north. November was among the driest on modern record for a few communities with a scant 0.05 inch of melted precipitation recorded at Moorhead. But a swath of snow fell over the western and northern counties late in the month that brought some needed moisture.

November continued the mild fall that began in September. November wasn't record breaking but it was mild enough to contribute to the sixth warmest autumn (September to November) in the Twin Cities. The warm weather for both October and November was especially noted for mild overnight lows. As a result, lake ice freeze-up was delayed. [Mild Autumn in the Twin Cities](#)

## Winter 2004-2005

### December

December 2004 was another warm and dry month statewide. A taste of winter appeared with a strong Alberta Clipper on December 12. This clipper brought snow to the northeast and some very gusty winds statewide including a peak gust of 71 miles per hour (mph) at Welch in northern Goodhue County. Otherwise, snow was meager for the month and concerns about not having a white Christmas were widespread. Although just

**An Alberta Clipper, also known as a Canadian Clipper, is a fast-moving, low-pressure area that generally affects the central provinces of Canada, as well as parts of the Upper Midwest and Great Lakes regions of the United States. Most clippers occur in winter but can occur outside of the season; generally, off-season clippers would occur in November.**

enough snow fell to put those fears to rest, the month stayed dry overall.

December's monthly mean temperatures exceeded historical averages by 3 to 6 degrees in most locations. The warm temperatures on December 30 broke records in some communities, making the weather ideal for removing outdoor holiday decorations. Lamberton had a record high of 59 degrees on December 30. [Balmy December 30th in southern Minnesota](#)

## January

Monthly mean temperatures in January 2005 were slightly below average in the northern one-third of Minnesota and somewhat above average in the southern two-thirds of the state. A bitterly cold period during the middle of the month was offset by above average temperatures later in January. [Cold Mid-January](#)

January precipitation finished from nearly normal to above normal statewide. The Arrowhead had especially high precipitation for the month. Many northeastern locales recorded 40 inches or more snow for the month. Duluth experienced its second snowiest January on record with 45.7 inches.

Numerous significant weather events occurred during January. A wintry mix of weather on January 1 brought heavy snows to northern Minnesota and a sheet of freezing rain and sleet to southeastern counties [New Year's Day Winter Storm January 1-2, 2005](#). It was like shoveling shaved ice in the Twin Cities. On January 12, a narrow swath of 3 to 8 inches of snow fell across western and central Minnesota. Lake effect snow blanketed North Shore communities with a foot or more of snow on January 20, 21, and 22 [Deep Snow in Northeast Minnesota](#). On January 21, a strong storm system dropped into Minnesota from the Canadian prairie, leaving behind 6 to 9 inches of snow across west-central, central, and southeastern Minnesota. [Snowstorm and Blizzard: January 21-22, 2005](#) For many east-central Minnesota communities, this was the first substantial snow of the season.

## February

In February 2005, northern Minnesota missed some of the winter storms and finished nearly average or somewhat below average for monthly totals of precipitation. The southern one-third of the state reported above normal precipitation. A mid-month storm hit the south, with some southern communities reporting around three-quarters of an inch of liquid from this event, which set new daily precipitation records for February 13.

Warm temperatures eroded the snow pack until no snow lay on the landscape southwest of the Twin Cities by early February. The monthly mean temperatures were quite warm and finished 3 to 7 degrees above the historical average. For the meteorological winter 2004-2005 (December to February) it was the eighth time in 9 years that the average winter temperature finished above normal. [Record Warmth: February 3-4, 2005](#)

---

## Spring 2005

---

### March

A "tournament snowstorm" punctuated March precipitation [Boy's Basketball Tournament Snowstorm: March 17-18, 2005](#). Heavy snows fell on March 17-18 from northern Iowa to the Twin Cities. The greatest snowfall was 21 inches at Kiester in Faribault County. This storm, and an area of heavy rain and thunderstorms later in the month, helped the south have monthly precipitation totals close to normal. The northern and central parts of the state finished with somewhat below normal precipitation.

March 2005 monthly mean temperatures were near the historical average across Minnesota. Warmer than average temperatures at the end of March were offset by cooler than average temperatures early in the month.

## April

**A**pril 2005 monthly precipitation totals varied widely across Minnesota. Monthly precipitation totals across much of the northern one-third of the state were well below average, whereas portions of the central and south received above average precipitation. Many areas in the northwest and northeast reported less than a half inch of precipitation for April. By contrast, places like Mankato received more than 4 inches of rain for the month.

April arrived with temperatures more like May. The first 17 days of the month were 10 degrees above average statewide. Even the Arrowhead, which still retained a snow pack at the beginning of the month, was 7 degrees above average. The balmy conditions accelerated ice-out across the state. In general, lakes were ice-free from 3 days to a week ahead of average in central parts of the state and 7 to 10 days ahead of average in the north. A cold spell in the final days of the month came after virtually all the lakes in the state were ice-free. [Minnesota's Lake Ice-Out Status as of April 25, 2005](#)

## May

**S**oggy tomato plants and scarce sunshine dominated the first 3 weeks in May. May 1-18 was the least sunny start of May since solar records began at the St. Paul Campus Climate Observatory in 1963. [Gloomy May 1-18 in the Twin Cities](#) Many locations reported rainfall on more than half the days in May. Monthly rainfall totals topped 7 inches in some southwestern and south-central counties. Precipitation totals exceeded normal by more than 2 inches across much of the southwestern, south-central and north-central parts of the state.

Stream discharge values for two-thirds of Minnesota's rivers and streams ranked above the 75th percentile by the end of May. In a few areas, streamflows exceed the 90th percentile when compared to historical data for this date. Some minor flooding occurred in the Red River basin.

May was cool with a statewide average temperature of 3 degrees below normal. The first 3 days of the month averaged 14 to 16 degrees below normal. Record low maximum temperature records were set in some locations on May 1, 2, and 12.

## Summer 2005

### June

**R**ainfall was frequent and abundant in June 2005. June rainfalls exceeding 6 inches were common across the state. There were a few heavy rain events of note during the month. The first one affected southeastern counties on June 7 and 8. Multiple waves of thunderstorms led to flooding in Wabasha, Goodhue, Rice, and Le Sueur counties. The flooding was responsible for one fatality in Goodhue County. [Heavy Rains and Severe Weather Over Southeast Minnesota June 7-8, 2005](#)

On June 20, a powerful line of thunderstorms rolled across Minnesota, creating extensive wind damage in west-central Minnesota and urban flooding in communities such as Worthington, St. Cloud, and the Twin Cities. [Heavy Rains and Severe Weather Over Minnesota June 20, 2005](#)

June 2005 was the start of a warm summer with warmer than normal temperatures statewide. Monthly mean temperatures were 1 degree or 2 degrees above normal in the north and 3 to 5 degrees above normal in the south. In some southern communities, June mean monthly temperatures ranked among the 10 warmest on record. The mean monthly temperatures were elevated largely because of a preponderance of very warm nighttime conditions.

### July

**P**recipitation totals fell short of historical averages across much of the state in July 2005. Totals were less than 3 inches across much of Minnesota and less than 2 inches across significant portions of central and northern counties. Monthly rainfall deviated below historical averages by 2 or more inches in many areas. Rainfall deficits exceeded 3 inches in portions of east-central and northeastern Minnesota. When compared to other July rainfall totals in the historical database, July 2005 rainfall totals rank among the lowest on record for some central and northern locales. Combined with high evaporation rates due to warm July temperatures, the precipitation shortfall led to low streamflows and increased wildfire danger in many communities. [Dry July 2005 - maps](#)

Despite the dryness, there were two significant precipitation events. The heaviest rainstorm came on July 2. Because of very strong thunderstorms skirting the Canadian border, a small area of north-central Kittson County received more than 5 inches of rain in a relatively short time. Falling on already saturated ground, the deluge led to significant overland flooding. [Heavy Rains and Severe Weather Over Kittson County July 2-3, 2005](#) Some beneficial rains came with thunderstorms on July 25 that soaked a substantial portion of the state's corn and soybean growing areas. From 1 inch to 3 inches of rain fell over many south-central and southeastern counties.

July 2005 monthly mean temperatures were 1 degree to 3 degrees above normal in most areas. As happened in June, temperatures in July were consistently warm. Roughly two-thirds of all July days were at or above average. Relatively few cool spells broke up July's typically warm weather. [Mark Seeley's July 29, 2005 Minnesota WeatherTalk for MPR's Morning Edition](#)

## August

The dry spell that began in July continued into August. [Dry July and August 2005](#) Some heavy rain events brought relief to some areas, but most places remained dry. The Arrowhead was extremely dry, with precipitation totals falling short of historical averages by 2 or more inches. August rainfall totals in sections of Carlton, St. Louis, and Lake counties were among the lowest on record. July plus August 2005 rainfall totals ranked among the lowest on record in some locales. By contrast, northwestern, west-central, south-central, and southeastern parts of the state reported very heavy August rainfall. The above normal precipitation in these areas was the result of a few, very intense rainfall events.



On August 17 and 18, intense thunderstorms dropped more than 5 inches of rain on portions of Cottonwood, Jackson, Watonwan, Martin, and Blue Earth counties. Nearly 8 inches of rain fell in a small portion of south-central Watonwan County. [Heavy Rains Drench South Central Minnesota August 17-18, 2005](#)

On August 25 and 26, severe thunderstorms produced hail, high winds, and torrential rain over a multicounty area of west-central Minnesota. Rainfall totals topping 5 inches were reported in sections of Douglas, Pope, Stearns, Swift, Kandiyohi, and Chippewa counties. More than 8 inches of rain was recorded in northwestern Kandiyohi County during this event. [Torrential Rains Fall Upon West Central Minnesota August 25-26, 2005](#)

August 2005 monthly mean temperatures were near average in most areas. The very warm temperatures of June and July persisted into the first week of August. Temperatures then moderated for the remainder of August, leading to a rather remarkable stretch of pleasant weather.

## Autumn 2005

### September

September 2005 was more of an extension of summer than the beginning of autumn. For the southern half of Minnesota, the 2005 growing season ended on a very wet note. For many locations in the central and southern Minnesota, September 2005 precipitation totals exceeded 7 inches. Precipitation totals for some locations in east-central counties topped 10 inches for the month. Rainfall totals across large sections of southern Minnesota were 4 or more inches above normal for September. Precipitation departures were 6 inches above normal in some areas. [Wet September 2005 - Southern Minnesota](#)

In contrast, rainfall totals were well below historical averages across much of northeastern and north-central Minnesota in late summer and early autumn 2005. Dry July and August conditions experienced throughout Minnesota persisted into September in these areas. [Dry July through September 2005 in Northeastern Minnesota](#)

Monthly mean temperatures for September 2005 were much above normal across the state. September mean temperatures topped the historical average by 4 or more degrees in most locales. In the Twin Cities, the mean daily temperature was above average for 25 of 30 September days.

## Water Year 2005 Summary

**F**or the 2005 Water Year, precipitation totals were above normal for the most of the southern tier counties and the western counties as well. Some of the wettest spots were Martin County; the northern part of the county was 10 inches above normal. Wilkin County in west-central Minnesota was about 8 inches above normal. Another region with above normal precipitation was just southwest of International Falls, which was 8 inches above normal. Some drier than normal areas were found in a few pockets scattered around the state, most notably in the northeast with parts of southern St. Louis County 4 inches below average.

Figure 2

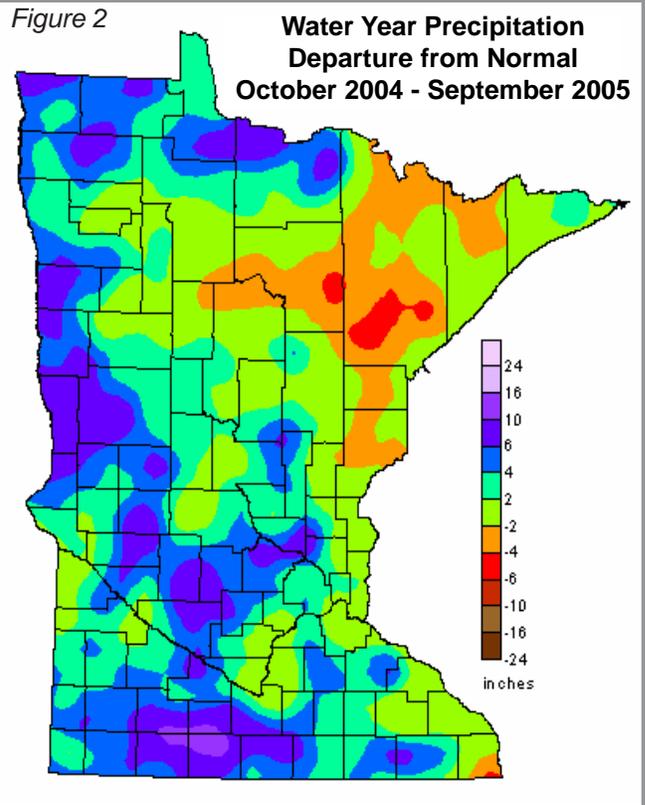


Figure 1

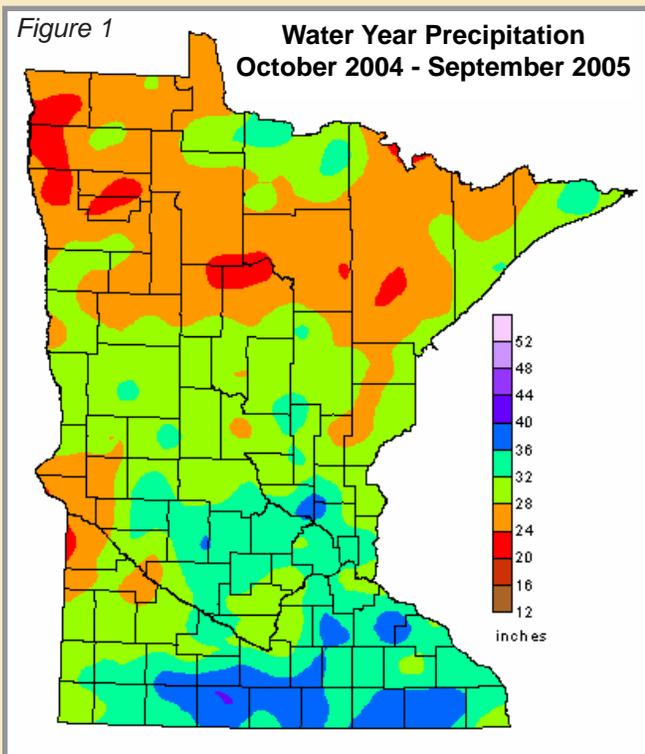
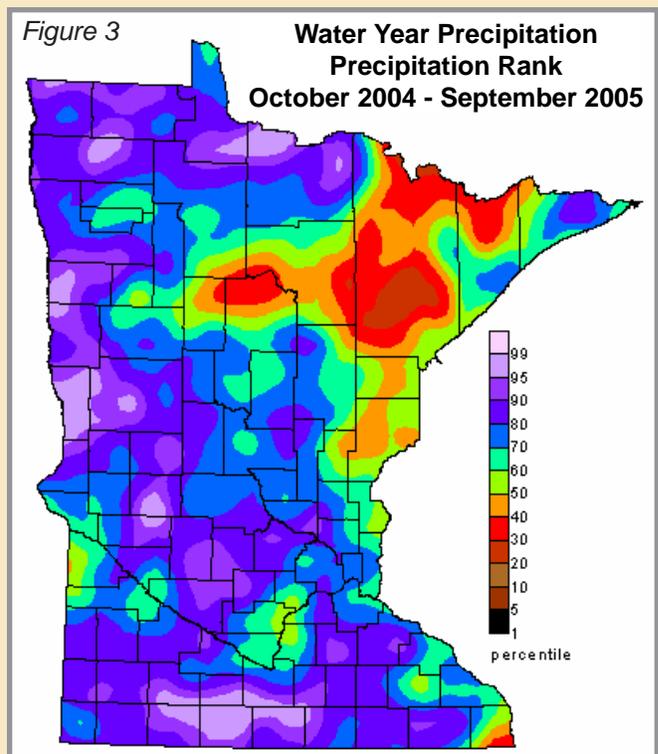


Figure 3



# The 2006 Water Year

## October 2005-September 2006

### Highlights

- Very warm and wet autumn
  - Record warm January
  - Wet spring
- Worst drought since 1988 from late spring to autumn

## Autumn 2005 cont'd...

### **October**

October began with a rare deluge for this time of year. A large portion of central and southern Minnesota received more than 2 inches of rain. Central and east-central counties received the most rain, recording up to 6 inches. A 6-inch daily rainfall total in October is nearly without precedent, occurring only one other time in the historical record. The 6.61-inch rainfall report from Wild River State Park (Chisago County) is now the largest single-day October value reported by a National Weather Service Cooperative Observer. Needless to say, the monthly totals for east-central counties exceeded average due to this one event. The



parched northeastern part of the state received some beneficial rains. The southeast was largely missed in October 2005 and fell about an inch below average for the month.

October was warm statewide. During the first few days, warm and muggy air fueled the intense rainfall and set the stage for above normal temperatures for several days during the month. The average statewide temperature for October finished nearly 3 degrees above normal.

### **November**

The wet autumn continued into November. A powerful storm moved through on November 28th and 29th. Redwood Falls and Willmar both saw more than an inch of precipitation. Duluth had just under an inch. The normal precipitation for the month of November is around 2 inches in eastern Minnesota, and about 1 inch to 1.5 inches over western Minnesota. At the same time, cold air prevailed over western and northern Minnesota and the rain that fell there became glaze ice. The ice coated branches and power lines especially throughout western Minnesota. The strong winds associated with the storm caused frozen power lines and poles to snap in places in southwest and west-central Minnesota, bringing back memories of the spring blizzard of 1997. Most places in the state wound up with above normal precipitation for the month. From September to November, St. Cloud had the wettest fall in 113 years of record-keeping.

November was another mild month. The average statewide temperature was 4.5 degrees above normal, which left few excuses for not completing that fall yard clean up. In fact, September through November 2005 was tied for the sixth warmest autumn in the Twin Cities. Until the storm of November 28-29, there was little snow of any consequence in the state. [Top Ten Warm Autumns in the Twin Cities 1891-2005](#)

## Winter 2006

### December

The first three weeks of December were reminiscent of the winters of yore with temperatures like January and a decent snowstorm as well. This and a second winter storm late in the month were enough to boost the monthly precipitation into the above normal category for the state. The first storm was a double-barreled system that brought a significant blanket of snow across much of the eastern half of Minnesota beginning in the evening hours of December 13. [Winter Storm: December 13-14, 2005](#) Another winter storm swept through the state on December 29 and 30, dropping a swath of snow across much of the state. The highest snow total for this event was 11 inches in Madison of Lac Qui Parle County. [Precipitation and Temperature Summary for December 2005](#)

Colder than normal Decembers have been unusual in recent years and December 2005 was no exception. Despite the first three weeks of the month being cooler than normal, warm and cloudy conditions pushed the statewide average to 2.4 degrees above normal. A gloom settled over the region for the last week of December and persist-

ed into the start of the New Year. The Twin Cities had its third gloomiest 12-day stretch in 42 years. [Gloomy Conditions in Minnesota: December 24, 2005 - January 4, 2006](#)

### January

January 2006 was warm and dry, thanks mainly to a west to east wind pattern that persisted for much of the month. January snowfall was light; only areas along the Canadian border were blessed with any appreciable snow. The statewide average precipitation was about a third of an inch below normal.

The pinnacle of the nearly nonwinter of 2005-2006 was the warmest January in the modern record for the state. The persistent clouds and fog during the first week in January elevated overnight low temperatures. This was a major contributor to the record-breaking January. The average statewide temperature was an incredible 17 degrees above normal. [Minnesota's Warmest January on Record: 2006](#)



## Winter 2006 cont'd...

### February

**F**ebruary 2006 had some semblance to a “normal” winter. Colder weather returned along with some snow, at least for parts of the state. A classic Colorado winter storm moved from Iowa to Chicago during the day on February 16, bringing just flurries to the Twin Cities but a sizable blanket of snow to the southeast. Measurable snow fell roughly south and east of a line from Jackson to Farmington. Another storm dropped some heavy snow from Fargo to Duluth on February 24-27. Precipitation totals statewide were somewhat below historical averages, except for an 80-mile wide swath in the north that was the recipient of the heavy snows late in the month. [Snowstorm Clips Southeast Minnesota: February 15-16, 2006](#)

February 2006 monthly mean temperatures were near average in the southern half of Minnesota. In the northern half of the state, February temperatures were 2 to 5 degrees cooler than average. A warm start to the month was counterbalanced by a midmonth cold snap. The arctic outbreak on February 17 and 18 led to dangerous wind chill temperatures in many areas. Despite the somewhat cooler February, the meteorological winter of 2005-2006 finished well above normal. It was the ninth warmest winter on record for the Twin Cities. [Yet Another Balmy Winter: 2005-2006](#)

## Spring 2006

### March

**P**recipitation totals for March 2006 were above average in the northern and southern thirds of Minnesota. Precipitation topped historical averages by 0.5 inch to 1.5 inches in these areas. In the central one-third of the state, precipitation generally fell short of average by 0.5 inch to 1 inch.

Two of the larger snow producers of March occurred during the third week of the month. On March 12 and 13, 6 to 12 inches of moisture-laden snow fell on southern and east-central Minnesota. [Heavy Snow over Southern and Central Minnesota: March 12-13, 2006](#) A location near Hastings reported 19 inches of snow during this event. Just two days later (March 15-16), another winter storm dropped 4 to 8 inches of snow over many of these same areas. [More Snow over Southern and Central Minnesota: March 15-16, 2006](#)

Moderate to heavy rain fell on March 30 and 31 across much of the state. Rainfall totals were generally from 0.5 inch to 1 inch. Daily rainfall records were set in some communities on the March 31. This rain exacerbated the flooding situation already in place for the Red River of the North.

Mean temperatures for March were above average in the northern third of the state and somewhat near average in the south. The middle of the month featured a cold wave that lasted about a week and delayed the snowmelt. The rapid transition to warmer temperatures in the month caused the snow pack to collapse in a few days to heighten the flood risk.



photo by Larry Duke

## April

The wet weather that started at the end of March continued into April. Far southern Minnesota had one of the wettest Aprils on record. Along the southern tier of counties, monthly rainfall totals topped 6 to 8 inches.

The heaviest rainfall events of April occurred during the first and last weeks of the month. Rainfall totals topped 3 inches during the first week of April along the southern tier of Minnesota counties. An April 6-7 event broke daily rainfall records for Fairmont, Albert Lea, Rochester, and elsewhere. On April 6, 2.58 inches of rain fell at the Twin Cities International Airport, the wettest April day of the modern record. [Heavy Springtime Rains over Southern Minnesota: April 6-7, 2006](#) The month of April ended on a wet note as well. A remarkably persistent rain event dropped 1 inch to 3 inches of rain over a large portion of Minnesota during the final three days of the month. [A Wet Finish to April: April 28-May 1, 2006](#); [Precipitation Map for April 25 - May 1, 2006](#)

Moderate to major flooding was in progress for the Red River of the North during the first week of April. Thanks to past flood mitigation efforts, damage was not as severe as in the floods of past years. The Red River of the North remained near or above flood stage for the rest of April.

April 2006 mean temperatures exceeded the historical average by 4 to 8 degrees in the state. Daily mean temperatures during a 9-day period in mid-April were consistently 10 to 20 degrees above normal. Many new records were broken in southern Minnesota on April 13 when maximum temperatures reached well into the 80s. These warm April temperatures hastened ice out progress on lakes in the state.

Ice out began more or less near average over the far southern lakes at the beginning of the April, then accelerated though the month to be 2 weeks early along the Canadian border. By the third week in April, [virtually all the lakes in the state were ice-free](#).

## May

May 2006 will be remembered as the month when the drought began. It was referred to as a “flash drought” due to its sudden onset. May precipitation totals in many communities fell short of the historical average by an inch or more. Combined with the extreme heat of late May, this precipitation shortage led to a rapid drying of the landscape. The only significant exceptions to the overall dryness were portions of St. Louis and Lake counties and small sections of west-central Minnesota where May precipitation exceeded the historical average by 2 or more inches.

One of the more notable rain events of May was produced by a sequence of thunderstorms that passed over Big Stone, Traverse, and Stevens counties on May 23. Nearly 3 inches of rain fell over a 3-hour period leading to small stream flooding and a road washout in Stevens County.

May 2006 monthly mean temperatures were slightly above average for most locations. Chilly temperatures encountered over the Mother’s Day weekend were offset by very hot weather during the Memorial Day weekend. Except for North Shore areas, most communities reported temperatures in the 90s at least once over the holiday weekend. Many high temperature and high minimum temperature records were set on May 24, 27, and 28. [High Heat Over Memorial Weekend: May 27-May 29, 2006](#)

---

## Summer 2006

---

### June

**J**une 2006 was the second consecutive month of below normal rainfall in Minnesota. June precipitation totals in many areas fell short of the historical average by 1 inch to 3 inches. For most communities, it was the second consecutive month of below average rainfall. The only significant exceptions to the overall dryness were isolated areas of southern Minnesota bolstered by a single, intense rainfall event. During the overnight hours of June 9-10, a storm dropped 2 to 4 inches of rain along a very narrow band that extended from Redwood County in the west to Winona County in the east. The heavy rain led to a mudslide in Mankato and urban flooding in Owatonna. [Heavy Rains Over Southern Minnesota: June 9, 2006.](#)

June was not excessively hot, with a few days reaching the low 90s. The month finished near to somewhat above average. The statewide average was 1.3 degrees above normal, with the warmest averages in the northwest.



### July

**T**he drought intensified in July. For most communities it was the third month in a row of below average rainfall. Rainfall deficits ranged from 1 inch to 3 inches. Some welcome rains that fell on July 19, 2006, focused primarily on south-central and southeastern Minnesota. Martin and Faribault counties were among the drier places in the southern half of the state. The 2- to 4-inch rains in these counties were beneficial to agricultural interests. Another streak of heavier rain, roughly from Mankato to Rochester, fell on an area that was somewhat better off than the rest of southern Minnesota. No significant widespread rain fell north of a line from Ortonville to Forest Lake. [Rain Brings Some Relief to Southern Minnesota: July 19, 2006](#)

The heat really set July apart. Monthly mean temperatures were 3 to 5 degrees above the historical average. For many Minnesota communities, July 2006 was among the five hottest months on record. The temperature climbed above 90 degrees on numerous occasions and many Minnesota communities reported at least one occurrence of 100 degrees. The hottest temperature reported was 107 degrees on July 30 at Browns Valley in Traverse County. [Hot July 2006](#) This heat elevated evaporation levels not seen since the 1988 drought. [Pan Evaporation](#) at the St. Paul Campus Climate Observatory for July was 9.15 inches.

## August

August 2006 precipitation totals varied widely across the state. For the fourth consecutive month, rainfall was below average for much of the northern half of Minnesota. Monthly rainfall totals fell short of average by 1 inch to 3 inches in many northern counties. Conversely, August was a very wet month in portions of east-central and southeastern Minnesota. Rainfall in these areas topped the historical average by 2 or more inches. Unfortunately, the heaviest of the August rains did not fall on those areas suffering the greatest from this season's drought.

Three extremely heavy rainfall events occurred during August. Very heavy rain fell on south-central Minnesota on August 1 and 2. [Heavy Rains Fall on South Central Minnesota August 1-2, 2006](#)

Portions of Martin and Faribault counties received more than 5 inches of rain in a 30-hour period. During the late evening of August 16 and early morning of August 17, nearly 6 inches of rain fell along a very narrow corridor in central Marshall County. On August 24, intense thunderstorms dropped more than 5 inches of rain on portions of Dodge and Olmsted counties. [Heavy Rains Over Southern and Central Minnesota: August 24, 2006](#)

After the rash of 100-degree temperatures on the last day of July, the heat wave broke and temperatures were more moderate in August. Minnesota's average temperatures finished near to slightly above normal when compared to historical averages.

## Autumn 2006

### September

September 2006 precipitation totals were nearly average to above average across much of the state. In some west-central and central counties, September rainfall topped average by 2 or more inches. The heavier rain brought welcome relief to central Minnesota communities that had experienced precipitation shortfalls earlier in the season. Unfortunately, many of the drought-stricken areas of north-central and north-eastern Minnesota received below average rainfall for the month. In these northern locales, the dry September marked the fifth consecutive month of precipitation deficits.

Monthly mean temperatures for September 2006 were generally cooler than normal in most areas of the state, except in northern counties. The average temperature for the month ranged from 1 degree to 3 degrees cooler than normal in the southern two-thirds of the state, but near to slightly above normal in the far north. There were multiple frosts in the north and single frosts in some central and southern counties during the month.

## The Drought of May 16 - September 30, 2006

The second half of the 2005-2006 water year featured an intensifying drought entrenched across northern and central Minnesota. The timing of the dry weather was most unfortunate. The period from mid-May through early September is historically the wettest time of the year in Minnesota. Long-term average rainfall rates during this time interval are around 1 inch per week. Very dry weather, occurring during a time of year when ample rain is typical, rapidly intensified the drought. The lack of precipitation, along with one of the hottest Julys on record, produced deteriorating crop conditions, low stream flows and lake levels, and increased the danger of wildfire.

Twenty-week rainfall totals from mid-May to the end of September were below historical averages by more than 4 inches across most of the northern half of Minnesota. Rainfall deficits exceeded 6 inches in many northern and central Minnesota communities. When compared with other rainfall totals for mid-May to the end of September in the historical database, the totals for the period rank below the fifth percentile (1 year in 20) in many northern and central Minnesota counties. For isolated areas of northern Minnesota, rainfall totals are among the lowest on record for the 20-week period. As the state settled into autumn, concerns about the drought for the next water year persisted.

## Water Year 2006 Summary

Figure 4 shows the water year precipitation and departure from normal from October 2005 to September 2006. The effects of the drought of 2006 reflect in the map with the driest spots in north central and northeast. Some areas in St. Louis County saw departures up to six inches below normal. A good part of central and southern Minnesota saw enough precipitation to finish near normal for the water year. There were few places in the state significantly wetter than normal for the water year. One exception was Traverse County, where an area near the South Dakota border was six inches above normal. For many areas of the central and south, a wet September 2006 helped to ease the effects of the drought. However, the replenishing rains of autumn did not fall over the north where the drought continued into the 2007 water year.



Figure 3

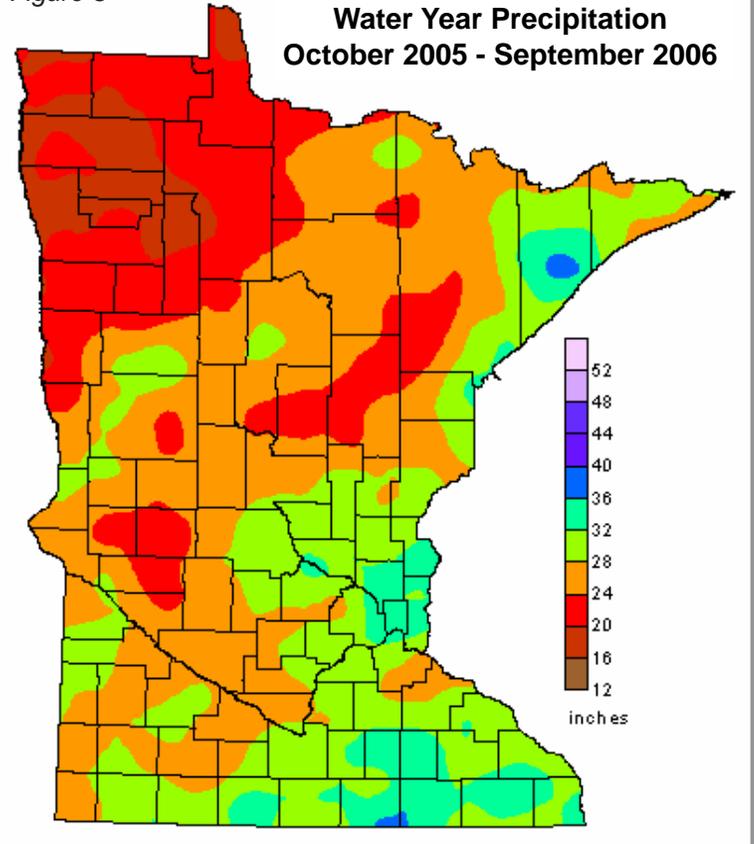


Figure 4

