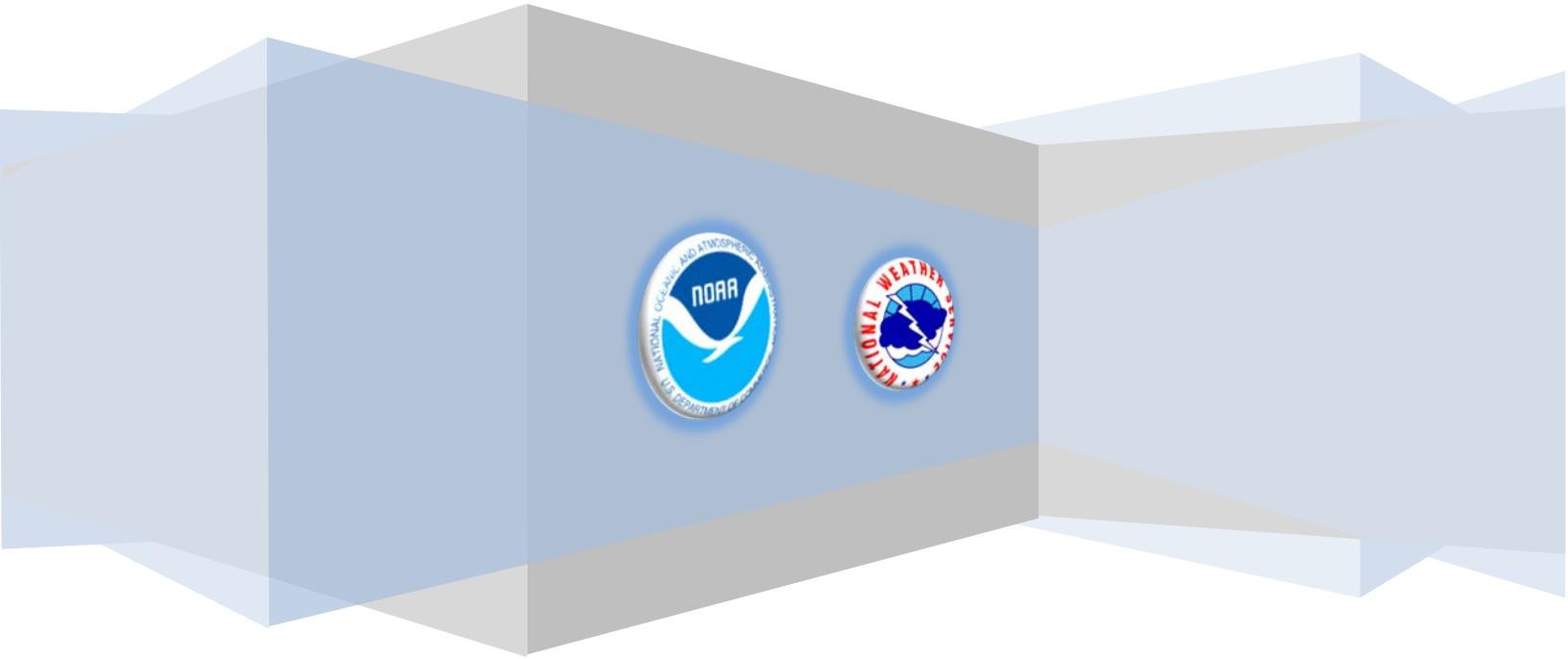
Natural Hazards Assessment

Winona County, MN

Prepared by: NOAA / National Weather Service La Crosse, WI



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for
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Prepared by NOAA / National Weather Service – La Crosse
Last Update: October 2013

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Overview

Winona County is in the Upper Mississippi River Valley of the Midwest with terrain ranging from relatively flat farm land in the western half of the county to very steep bluffs and valleys in the eastern half. It is bordered by the Mississippi River to the east.

The area experiences a temperate climate with both warm and cold season extremes.

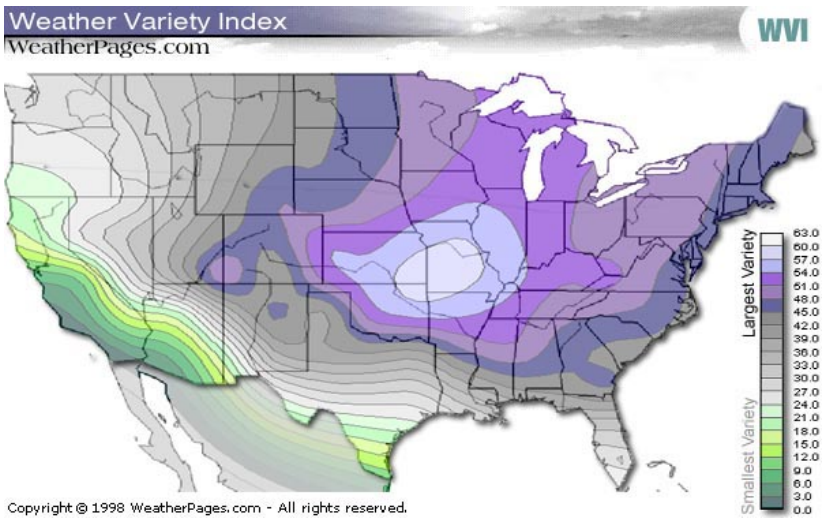
Winter months can bring occasional heavy snows, intermittent freezing precipitation or ice, and prolonged periods of cloudiness. While true blizzards are rare, winter storms impact the area on average about 3 to 4 times per season. Occasional arctic outbreaks bring extreme cold and dangerous wind chills.

Temperatures between river valleys and surrounding ridges can vary greatly. Typically high temperatures on ridges are 3° to 5°F colder than valleys. This can lead to slightly more average snowfall on ridge tops and occasionally a difference in winter precipitation types from ridge to valley.

Thunderstorms occur on average 30 to 50 times a year, mainly in the spring and summer months. The strongest storms can produce associated severe weather like tornadoes, large hail, or damaging wind. Both river flooding and flash flooding can occur, along with urban-related flood problems. The terrain can lead to mud slides and generally increases the flash flood threat. Heat and high humidity is occasionally observed in June, July, or August.

The autumn season usually has the quietest weather. Valley fog is most common in the late summer and early fall months. On calm nights, colder air settles into valleys leading to colder low temperatures compared to ridge top locations. High wind events can also occur occasionally, usually in the spring or fall.

The variability in weather can be seen in the following graphic, created by a private company (weatherpages.com) that rated each city on variations in temperature, precipitation, and other factors. La Crosse, WI ranked 27th highest and Rochester, MN ranked 3rd highest in variability out of 277 cities.

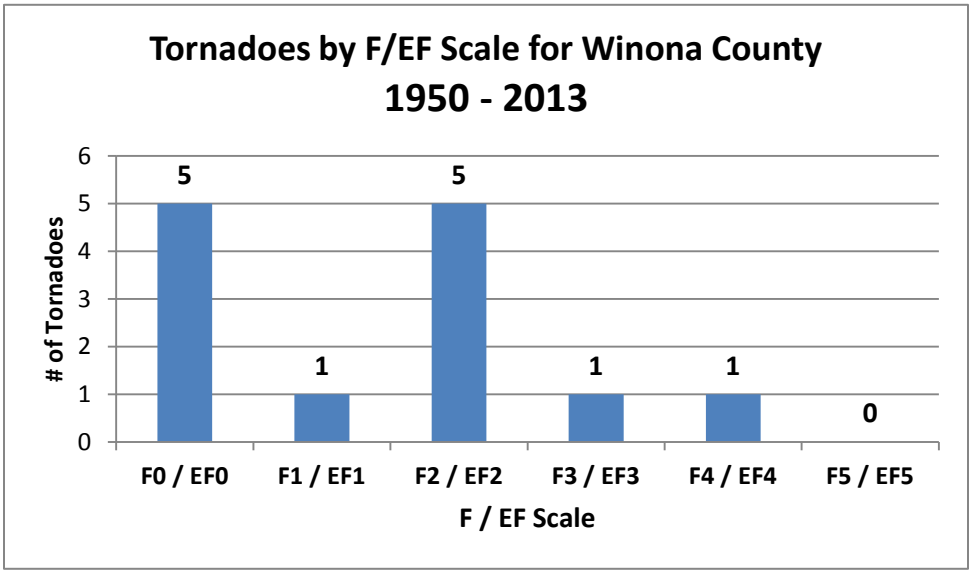


Since 1998, Winona County has been included in a FEMA Federal Disaster Declaration 5 times:

1998 – Severe storms
2000 – Severe storms / flooding
2001 – Flooding
2007 – Severe storms / flooding
2010 – Severe storms / flooding

Tornadoes

Even though Minnesota averages about 24 tornadoes per year, Winona County has only had 13 tornadoes since 1950, averaging about one tornado every 4-5 years. Most tornadoes are short-lived and small. May and June are the peak months and most occur between 3 and 9 p.m., but they can occur nearly any time of year and at all times of the day.



Most recent tornadoes:

- July 8, 1999 (F2)
- June 5, 1997 (F0)
- July 27, 1993 (F0)
- July 11, 1987 (F0)
- July 10, 1984 (F0)
- May 17, 1982 (F2)
- May 17, 1982 (F2)
- June 5, 1980 (F2)
- June 20, 1968 (F0)
- June 15, 1967 (F1)
- May 5, 1965 (F3)

One of the largest tornadoes to hit Winona County struck in October 1903 devastating St.Charles, MN. Seven people were killed and 30 injured as 50 homes and businesses were damaged or destroyed by the F4. More recently, a tornado passed through Lewiston, MN damaging homes, buildings, and cars along Main Street before moving east of town. Two people were injured by the F2 tornado. The terrain in the county may limit some tornadoes from forming but brief touchdowns and tracks are still possible even through bluffs and valleys.

Strongest tornadoes: (1850-2013)

- Oct. 3, 1903 (F4) – 30 inj, 7 dead
- May 10, 1953 (F4) – 5 inj, 0 dead
- Aug.21, 1883 (F3) – 19 inj, 1 dead
- May 5, 1965 (F3) – 1 inj, 0 dead
- June 17, 1899 (F3) – 5 inj, 0 dead

Winona County Tornado Facts:

- No F5 or EF5* tornadoes
- Two F4 and three F3 tornadoes
- 9 deaths and 65 injuries since 1850
- Tornadoes have occurred May – Oct.
- Most have occurred in May, June, and July (5)

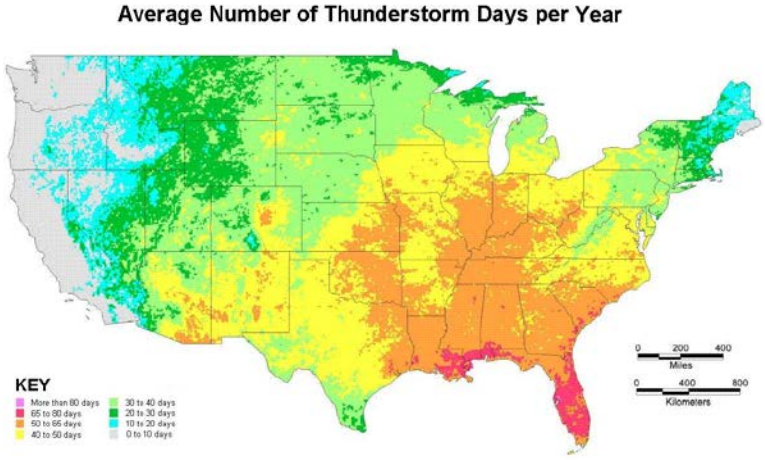
Tornado Watches		Tornado Warnings	
Year		Year	
2013	3	2013	1
2012	2	2012	0
2011	3	2011	0
2010	5	2010	0
2009	4	2009	1
2008	9	2008	1
2007	4	2007	0
2006	5	2006	0
2005	10	2005	0
2004	8	2004	0
2003	2	2003	0

Enhanced Fujita (EF*) Scale	
EF0	65-85 mph
EF1	86-110 mph
EF2	111-135 mph
EF3	136-165 mph
EF4	166-200 mph
EF5	>200 mph

* Started February 1, 2007

Severe Thunderstorms / Lightning

Winona County averages 39 thunderstorm days per year. The National Weather Service (NWS) considers a thunderstorm severe when it produces wind gusts of 58 mph (50 knots) or higher, 1 inch diameter hail or larger, or a tornado.



Downdraft winds from a severe thunderstorm can produce local or widespread damage, even tornado-like damage if strong enough. Most severe thunderstorm winds occur in June or July and between the hours of 4 and 8 p.m., but can occur at other times. Most damage involves blown down trees, power lines, and damage to weaker structures (i.e. barns, outbuildings, garages) with occasional related injuries. In 1998, a large squall line moved through the region with wind gusts in excess of 100 mph knocking down hundreds of trees and damaging buildings. Power was also out in many communities. A thunderstorm wind gust of 101 mph was also recorded in June 1963. There have 91 damaging wind reports since 1982.

Large hail can also occur in a severe thunderstorm. June is the peak month with the most common time between 1 and 9 p.m., but it can occur in other warm season months and at any time of day. Hail is typically a crop damaging hazard but can damage roofs, windows, and vehicles if large enough (> 1”). Expenses can be high. Injuries or fatalities are rare for hail. In September 2000, hail the size of tennis balls damaged numerous vehicles and hundreds of acres of crops in the Lewiston, MN area. In June 2001 hail up to 2” in diameter was reported in the city of Winona. There have been 102 large hail (≥ 3/4”) reports in the county since 1982.

Non-severe thunderstorms still pose a lightning risk. According to the Vaisala Group, an average of nearly 400,000 cloud-to-ground strikes hit Minnesota each year based on data from 1997 to 2010. Nationally, Minnesota ranks 28th in lightning related fatalities with 62 between 1959 and 2010. There was a lightning fatality in Minnesota in 2007 and two in 2009.

Severe Thunderstorm Watches		Severe Thunderstorm Warnings	
Year		Year	
2013	8	2013	16
2012	10	2012	16
2011	10	2011	12
2010	13	2010	16
2009	5	2009	2
2008	10	2008	7
2007	15	2007	6
2006	14	2006	4
2005	13	2005	4
2004	10	2004	6

(Photos: Damage from thunderstorm winds in June 1998)

Flooding and Hydrologic Concerns

On occasion intense, heavy rain producing thunderstorms or consecutive thunderstorms ("training") can bring excessive rainfall leading to flash flooding in Winona County. The hilly terrain promotes rapid run-off and enhances the threat. Mudslides can occur in extreme cases. Intense rainfall rates also lead to occasional urban street flooding, especially in/around the city of Winona.

Flash Flood Warnings	
Year	
2013	3
2012	0
2011	0
2010	3
2009	1
2008	1
2007	5
2006	0
2005	1
2004	3
2003	0
2002	0

June is the most common month for flash floods, but they can occur from May through September. They are most common in the evening hours, between 8-10 p.m., but can occur at other times and typically last from 3-6 hours. There were 18 flood related deaths in Minnesota between 1995 and 2013.

In mid-August 2007, 12 to 17 inches of rain fell in one evening across Winona County leading to record and widespread flash flooding. Runoff and erosion were extreme leading to evacuations and rescues in many communities. Five people were killed while driving in the county. Many roads and bridges were closed or damaged. Whitewater State Park experienced widespread damage as well, with 500 campers evacuated. The county was declared a federal disaster area with an estimated 45 million dollars in damage.

In September 1986, a man drowned when he fell into a culvert around St.Charles, MN after very heavy rains hit the area.

Mississippi River @ Winona Top 5 Crests (FS: 13 feet)	
Date	Crest
4/19/1965	20.77'
4/17/2001	20.07'
4/19/1969	19.44'
4/11/1997	18.27'
4/20/1952	17.91'

Two main rivers can impact Winona County – the Mississippi River and the Whitewater River. There are numerous other watersheds or larger creeks though that can and have flooded. The Mississippi River is often highest in the spring associated with the seasonal snowmelt, but on rare occasions can reach flood stage during the summer or fall from heavy rain patterns. The combination of up-river snowmelt and area rain brought major flooding along the Mississippi River in April 2001, setting the 2nd highest crest levels in many locations. The record crest year remains 1965.

Flooding along the branches of the Whitewater River and other creeks in the county usually stems from excessive rainfall. Water levels rise and fall far more quickly than the Mississippi River leading to more short-duration, dangerous situations.

The US Army Corps of Engineers maintains Lock and Dams at Minnesota City (#5), Fountain City, WI (#5A), Trempealeau, WI (#6), and Dresbach, MN (#7) that are used to manage navigational water levels, not for flood control.

Winter Storms and Extreme Cold

Hazardous winter weather can bring a variety of conditions to Winona County. The terrain in the eastern parts of the county does limit the number of true blizzards (only 3 since 1982) but heavy snow, blowing snow, ice, and sleet all occur.

The long term average seasonal snowfall at Winona is 42.4 inches, but nearby ridge tops are typically 3-5° F cooler and thus average several more inches per year. There are occasions where milder daytime temperatures in valleys produce rain when a wintry mix or snow is falling on ridges. Blowing snow is more common in western parts of the county and on ridge tops. The bulk of snow falls between December and March. The largest winter storms tend to form over the central or southern Plains, then move northeast towards the western Great Lakes.

On February 23-25, 2007, a major winter storm impacted Winona County. The combination of significant heavy snow, sleet, and ice accumulation paralyzed southeast Minnesota. Near the Mississippi River, snow accumulations were 20 to 26 inches with an unofficial total close to 30" around Winona, MN. Blizzard conditions impacted the region the second night with drifts of 5 to 6 feet. Another major storm hit less than a week later, leading to the snowiest week on record (34.2" in a 7-day period, ending 3/2/07).

Top 5 Seasonal Snowfalls in Winona	
Years	Snowfall
1961-62	90.2"
1951-52	88.5"
1970-71	85.9"
1950-51	81.2"
1978-79	66.6"

On December 10-11, 2010, a blizzard dropped 23.0" of snow at Lock and Dam #5A and 21" just south of Winona, with a foot of snow common across the county, in addition to major drifting and high wind.

March can often be a snowy month. Even though snowfall may be less frequent, heavy wet snow can form from large spring storms. In 1997, a large winter storm dropped 17 inches of wet snow in the Winona area on March 13-14th.

Ice storms (1/4" of ice or more) can occur but are relatively rare with only 5 occurrences since 1982.

Arctic cold outbreaks can occur in the upper Midwest as well. Snow depth can modify these cold temperatures leading to sub-zero readings on average 29 times a winter. Occasionally strong northwest winds will combine with arctic outbreaks to create dangerous wind chill conditions as well. The coldest temperatures are usually in January and February with average lows in the single digits and record lows colder than -25°F most days. The all-time record low is -35°F set in 1912.

Coldest Lows at Winona, MN	
Low	Date
-35°F	1/12/1912
-33°F	2/1/1918
-33°F	1/28/1915
-32°F	1/30/1951
-31°F	2/4/1996

In 1996, Winona went 6 consecutive days with temperatures below zero degrees (F) following a blizzard about a week earlier. Low temperatures of -27°F, -20°F, -31°F, -31°F, and -31°F were set on five straight mornings.

In January 1977, Winona went 20 straight days with lows below 0°F, including 27 days total for the month.

The La Crosse National Weather Service issues Wind Chill Advisories when wind chill readings of -20°F to -34°F are expected. Wind Chill Warnings are issued when wind chill values at or below -35°F are expected or occurring. On January 30, 2008, wind chill values of -37°F were observed in the Winona area.

Heat, Drought, and Wildfires

On occasion the weather pattern across the upper Midwest favors prolonged heat and humidity, leading to heat waves. June through August are the warmest months with average high temperatures in the 80s and record highs above 100°F most days. The warmest temperature on record at Winona is 108°F set on July 12, 1936.

Warmest Highs at Winona, MN	
High	Date
108°F	7/12/1936
107°F	7/14/1936
107°F	7/13/1936
107°F	7/11/1936
107°F	5/31/1934

In Winona County, there have been 6 heat waves since 1993. During that same time period, there were 16 fatalities directly related to heat in Minnesota.

One of the longest heat waves on record occurred in July 1936 when Winona hit 90°F or higher for 15 consecutive days, including 9 days at or above 100°F and an all-time record of high of 108°F as noted above. In more recent years, the high temperature hit 90°F or warmer 11 consecutive days from July 30th through August 9th in 2001. Other heat waves occurred in 1995 and 1999. In July 2011 heat index values climbed above 105 for 3 straight days (108 on July 17th, 114 on July 18th, and 111 on July 19th).

Prolonged dry spells can also lead to drought causing extreme damage to crops. Droughts vary in length and intensity but abnormally dry to moderate drought conditions can occur quite frequently. Severe to extreme droughts occur far less frequently, but did occur in 2012.

Dry weather can also lead to a wildfire threat, especially in the spring before foliage has emerged (i.e. before green up) or in the fall after vegetation has started to die off. Warm, dry (i.e. lower relative humidities), and windy conditions all favor higher fire danger and can lead to sporadic grass or cropland field fires in Winona County. Thick, wooded areas also pose a threat for wildfires under extremely dry conditions but occur far less frequently.

Local Climatology

Here are some basic climatology figures for the Winona County area. Data is valid for Winona, MN based on normals from a 30-year period (1981-2010).

Month	Normal Maximum Temperature	Normal Minimum Temperature	Average Temperature	Precipitation	Snowfall
JAN	27.0	10.1	18.5	1.01”	9.7”
FEB	32.5	14.8	23.6	0.80”	6.8”
MAR	44.3	25.5	34.9	1.80”	6.6”
APR	60.7	39.0	49.8	3.65”	1.0”
MAY	71.2	49.6	60.4	4.10”	0.0”
JUN	80.6	59.5	70.0	4.23”	0.0”
JUL	84.4	64.4	74.4	4.25”	0.0”
AUG	81.8	62.2	72.0	4.99”	0.0”
SEP	74.0	53.5	63.7	3.60”	0.0”
OCT	60.9	41.6	51.2	2.10”	0.3”
NOV	44.4	28.9	36.6	2.11”	2.6”
DEC	30.3	15.0	22.7	1.21”	8.9”
Year	57.9	39.0	48.4	34.30”	34.7”

Miscellaneous facts:

- Warmest year on record – 1931 (52.9°F)
- Warmest month on record – June 1933 (81.3°F)
- Warmest day on record – July 12, 1936 (108°F)
- Greatest number of days with 90°F or warmer – 1933 (47 times)

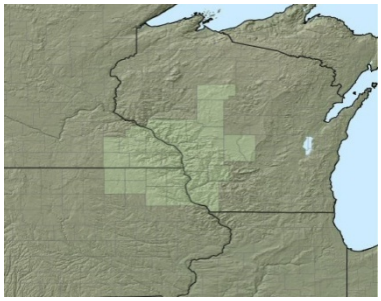
- Coldest year on record – 1917 (41.8°F)
- Coldest month on record – January 1912 (-1.1°F)
- Coldest day on record – January 12, 1912 (-35°F)
- Greatest number of days at 0°F or colder – 1978 (65 times)

- Wettest year on record – 1938 (47.89”)
- Wettest month on record – August 2007 (18.84”)
- Wettest day on record – August 19, 2007 (4.95”)
- Driest year on record – 1910 (16.14”)
- Driest month on record – Numerous (0.00”)

- Highest seasonal snowfall on record – 1961/62 (90.2”)
- Highest monthly snowfall on record – March 1951 and January 1971 (36.5”)
- Highest one-day snowfall on record – December 1, 1985 (16.0”)
- Least seasonal snowfall on record – 2002/03 (14.4”)

NOAA/National Weather Service Support and Weather Monitoring

NOAA's National Weather Service (NWS) forecast office at La Crosse, WI serves Winona County with weather information and support on a continuous basis. Operating 24 hours a day, a staff of 23 issues routine and non-routine informational products for the area, including all watches, warnings, and advisories related to natural hazards. Doppler radar (WSR-88D) is co-located with the La Crosse NWS office and covers the region.



NWS La Crosse has a web site at: www.weather.gov/lacrosse

Normal communication during hazardous weather scenarios is via 800 MHz (MN ARMER) Radio, the telephone, and amateur radio.

NOAA Weather Radio coverage in Winona County includes:

- KGG95 (Winona) on 162.425 MHz
- WXJ86 (La Crosse) on 162.550 MHz
- WXK41 (Rochester) on 162.475 MHz

Storm spotter groups consist of a nice mix between volunteer fire departments, amateur radio operators, law enforcement, and the general public. Spotter training is held nearly every year with an average attendance in the past 5 years of 56.

There are a variety of weather monitoring sources in Winona County, including:

Automated weather station(s):

- Winona Airport (KONA)

River Gauge(s):

- Mississippi River Lock & Dam #5 @ Minnesota City
- Mississippi River Lock & Dam #5A @ Fountain City, WI
- Mississippi River @ Winona
- Mississippi River Lock & Dam #6 @ Trempealeau, WI
- Mississippi River @ Dakota
- Mississippi River Lock & Dam #7 @ Dresbach / La Crescent, MN
- Whitewater River @ Beaver, MN
- Middle Fork of Whitewater River @ Whitewater State Park

Cooperative Observers

- Minnesota City (Lock & Dam #5)
- Winona Dam #5A
- Whitewater State Park (Altura 5W)

In addition, numerous volunteer reports from around the county are received at the La Crosse NWS office including rainfall, snowfall, and temperatures, on a routine basis.

Resources

National Weather Service – La Crosse	www.weather.gov/lacrosse
NWS La Crosse Tornado Database	www.weather.gov/lacrosse/?n=tornadomain
NWS La Crosse River Monitoring	http://www.crh.noaa.gov/ahps2/index.php?wfo=arx
NWS La Crosse Climate	www.weather.gov/climate/index.php?wfo=arx
NWS La Crosse Drought information	www.weather.gov/lacrosse/?n=drought
NWS La Crosse Storm Summaries	www.weather.gov/lacrosse/?n=events
NWS La Crosse NOAA Weather Radio page	www.weather.gov/lacrosse/?n=nwr
NWS Storm Prediction Center	http://www.spc.noaa.gov/
SPC Online Severe Weather Climatology	http://www.spc.nssl.noaa.gov/climo/online/grids/ http://www.spc.noaa.gov/climo/online/rda/ARX.html

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