Natural Hazards Assessment

Houston County, MN

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

Natural Hazards Assessment
for
Houston County, MN

Prepared by NOAA / National Weather Service – La Crosse
Last Update: November 2010

Table of Contents:

Overview……. 3

Tornadoes……4

Severe Thunderstorms / Lightning……5

Flooding and Hydrologic Concerns…….6

Winter Storms and Extreme Cold…….7

Heat, Drought, and Wildfires……..8

Local Climatology……9

National Weather Service &
Weather Monitoring……. 10

Resources…… 11

Natural Hazards Assessment
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Overview

Houston County is in the Upper Mississippi River Valley of the Midwest with relatively hilly terrain and bluffs. It is bordered by the Mississippi River to the east.

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

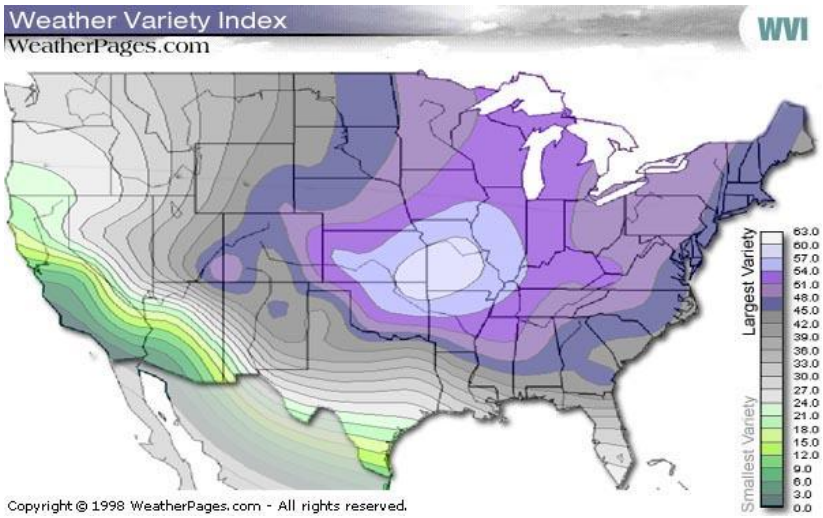
Winter months can bring occasional heavy snows, intermittent freezing precipitation or ice, and prolonged periods of cloudiness. While true blizzards are rare, winter storms impact the area on average about 3 to 4 times per season. Occasional arctic outbreaks bring extreme cold and dangerous wind chills.

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. Rochester, MN ranked 3rd and La Crosse, WI ranked 27th highest in variability out of 277 cities.

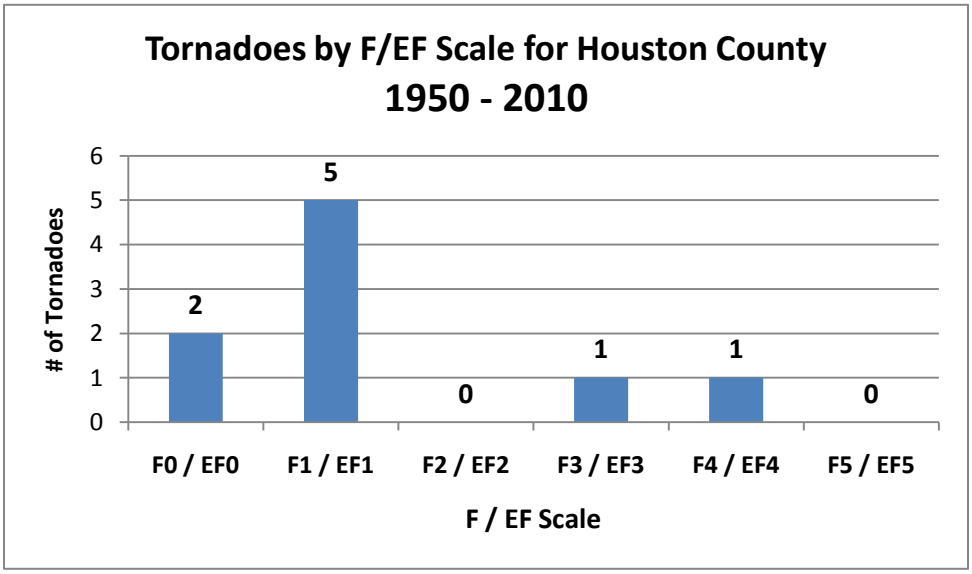


Since 1998, Houston County has been included in a FEMA Federal Disaster Declaration 6 times:

1998 – Severe storms
2000 – Severe storms / flooding
2001 – Flooding
2007 – Severe storms / flooding
2008 – Severe storms / flooding
2010 – Severe storms / flooding

Tornadoes

Even though Minnesota averages about 24 tornadoes per year, Houston County has only had 9 documented tornadoes since 1950, averaging about one tornado every 6-7 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:

- June 7, 2008 (EF0*)
- Aug. 23, 1997 (F0)
- Apr. 8, 1991 (F1)
- May 29, 1978 (F1)
- June 27, 1977 (F1)
- Aug. 25, 1965 (F1)
- May 5, 1965 (F3)
- May 5, 1965 (F4)
- June 10, 1960 (F1)

One of the strongest tornadoes to hit Houston County occurred way back in 1906 when an F4 tornado formed southwest of Caledonia and moved east-northeast killing two near Freeburg, MN. The tornado crossed into Wisconsin before dissipating. Two other strong to violent tornadoes hit on May 5, 1965. One tornado (F3) started near Money Creek and moved east-northeast crossing the Mississippi River near Dakota. Another tornado (F4) formed in northeast Iowa and after doing tremendous damage in neighboring Winneshiek County, IA and Fillmore County, MN crossed into southwest Houston County near Yucatan. The terrain may limit some tornadoes from forming but brief touchdowns and tracks are still possible even through the bluffs and valleys.

Strongest tornadoes: (1850-2010)

- June 6, 1906 (F4) – 26 inj, 4 dead
- May 5, 1965 (F4) – 17 inj, 0 dead
- June 6, 1906 (F3) – 3 inj, 0 dead
- May 5, 1965 (F3) – 1 inj, 0 dead
- May 23, 1933 (F2) – 3 inj, 0 dead

Houston County Tornado Facts:

- No F5 or EF5* tornadoes
- Only two F4 tornadoes and two F3s
- 4 deaths and 50 injuries since 1850
- Tornadoes have occurred April – Aug.
- Most have occurred in June (6 times)

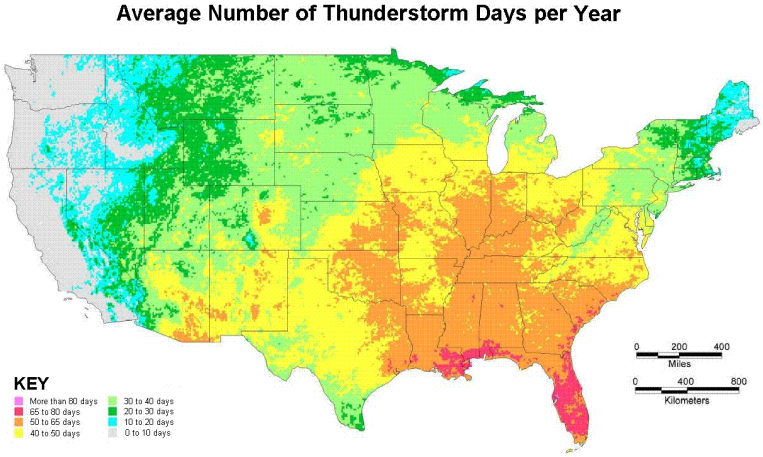
Tornado Watches		Tornado Warnings	
Year		Year	
2010	5	2010	0
2009	3	2009	0
2008	9	2008	0
2007	4	2007	0
2006	4	2006	0
2005	10	2005	0
2004	8	2004	1
2003	2	2003	0
2002	6	2002	0
2001	7	2001	0

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

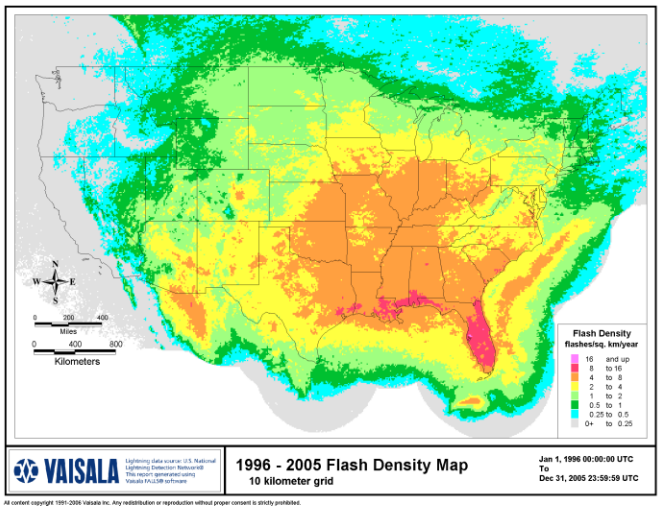
Houston County averages 39 thunderstorm days per year. The National Weather Service (NWS) considers a thunderstorm severe when it produces wind gusts of 58 mph (50 knots) or higher, 1 inch diameter hail or larger, or a tornado.



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. There have been 40 damaging wind reports since 1995 in the county.

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 May 1996, baseball size hail hit the Eitzen area causing nearly $2 million in damages. More recently golf ball size hail fell near Houston, MN in 2008 and around Hokah, MN on July 17, 2010. There have been 37 large hail (≥ ¾”) reports in the county since 1995.

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 1996 to 2005. Nationally, Minnesota ranks 28th in lightning related fatalities with 62 deaths since 1959. There was a lightning fatality in Minnesota in 2007 and two in 2009.



Severe Thunderstorm Watches		Severe Thunderstorm Warnings	
Year		Year	
2010	13	2010	15
2009	5	2009	1
2008	10	2008	9
2007	13	2007	7
2006	14	2006	5
2005	13	2005	4
2004	11	2004	7
2003	8	2003	5
2002	21	2002	2
2001	12	2001	2

Flooding and Hydrologic Concerns

On occasion intense, heavy rain producing thunderstorms or consecutive thunderstorms ("training") can bring excessive rainfall leading to flash flooding in Houston 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.

Flash Flood Warnings	
Year	
2010	2
2009	1
2008	4
2007	6
2006	0
2005	1
2004	0
2003	0
2002	0
2001	0

Flooding is one of the leading killers in the United States with an annual average of 99 fatalities from 1977 to 2006. 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.

In August 2007, a major flash flood event hit the region with officially 15.1 inches of rain falling near Hokah, MN setting an all-time 24 hour rainfall record for the state of Minnesota. There was widespread flash flooding, mudslides, and property damage. Two people died and 2 were injured. At least 20 roads were washed out and closed with evacuations ordered in Houston. The county was declared a federal disaster area with an estimated 40 million dollars in damage.

Flash flooding also hit the county hard in June 2008 when 7-10" rainfalls were reported over one weekend. Many roads were washed out again and mudslides reoccurred. Roughly $10 million in damages was reported.

Two main rivers can impact Houston County – the Mississippi River and the Root River. 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.

Root River @ Houston Top 5 Crests (FS: 15 feet)	
Year	Crest
1965	18.3'
2007	18.2'
2000	17.6'
2004	16.6'
1985	16.5'

Steep terrain in the county causes the Root River to rise and fall more quickly than the Mississippi River, except near Hokah where they merge. Flooding along the Root River can occur from snowmelt or ice jams in the early spring, but more commonly from heavy rain patterns anytime from spring to fall.

The US Army Corps of Engineers maintains a Lock and Dam (#8) at Genoa, WI that is 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 Houston County. An average of 3-4 winter storms impact the area each season. The terrain in the county does limit the number of true blizzards (only 2 since 1982) but heavy snow, blowing snow, ice, and sleet all occur.

The 30-year average seasonal snowfall at Caledonia is 47.8 inches, but nearby ridge tops are typically 3-5° F cooler and thus average about 6-7" more. 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 on ridge tops as well. The all-time record one-day snowfall at Caledonia was 22.7 inches set on March 7, 1959. 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 Houston County. Heavy snow, including lightning, brought nearly a foot of snow the first night. Winds later increased and created major blowing and drifting. Sleet and freezing rain fell the next day, followed by another round of heavy snow and blizzard conditions later that evening. When the storm finally moved out, 20.9 inches of snow had fallen in the La Crescent area with 19.5 inches near Caledonia. Another major storm hit less than a week later dropping nearly ten more inches of snow (9.6" at Caledonia, MN) leading to one of the snowiest weeks on record (ending 3/2/07).

Top 5 Seasonal Snowfalls at Caledonia	
Years	Snowfall
1958-59	91.6"
1950-51	84.3"
1961-62	80.2"
1992-93	72.8"
1917-18	69.6"

March can often be a snowy month. Even though snowfall may be less frequent, heavy wet snow can form from large spring storms. In 2005, a large winter storm dropped 23 inches of snow near Houston, MN and 22 inches near Caledonia, MN in Houston County on March 18-19th. Nearly 12 inches of snow fell around March 14, 1997 as well.

Ice storms (1/4" of ice or more) can occur but are relatively rare with only 4 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 31 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. Since 1993 there have been 7 fatalities reported due to extreme cold in Minnesota.

Coldest Lows at Caledonia, MN	
Low	Date
-37°F	1/15/1963
-35°F	2/3/1996
-35°F	1/18/1967
-35°F	1/29/1966
-35°F	1/25/1904

In 1996, Caledonia went 7 consecutive days with temperatures below zero degrees (F) following a blizzard about a week earlier. Low temperatures of -33°F, -35°F, and -33°F were set on three straight mornings.

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. In January 2009, wind chill values hit -37°F in Houston County during a 3-day cold wave.

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 Caledonia is 104°F set on July 26, 1894.

In Houston County, there have been 5 heat waves since 1993. During that same time period, there were 15 fatalities directly related to heat waves in Minnesota.

Warmest Highs at Caledonia, MN	
High	Date
104°F	7/26/1894
103°F	7/21/1901
102°F	8/2/1988
102°F	8/1/1988
102°F	7/24/1901

One of the longest heat waves on record occurred in July 1936 when the area hit 90°F or higher for 14 consecutive days, including 9 days at or above 100°F. More recently, a short heat wave hit in late July and early August 2001 with high temperatures in the 90s and heat indices near 115°F.

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.

Droughts have occurred in Minnesota as recently as 1999, 2000, and 2006 through 2009.

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 fires in Houston 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 Houston County area. Data is valid for Caledonia, MN based on normals from a 30-year period (1971-2000).

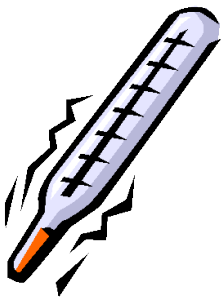
Month	Normal Maximum Temperature	Normal Minimum Temperature	Average Temperature	Precipitation	Snowfall
JAN	23.0	4.0	13.5	0.84”	10.8”
FEB	29.2	10.0	19.5	0.86”	8.1”
MAR	41.4	22.5	32.0	1.89”	7.5”
APR	56.2	34.3	45.3	3.71”	3.1”
MAY	68.7	46.2	57.5	3.83”	0.0”
JUN	77.9	55.6	66.9	4.54”	0.0”
JUL	81.9	59.9	70.9	4.67”	0.0”
AUG	79.3	58.0	68.7	4.81”	0.0”
SEP	70.7	48.3	59.5	3.50”	0.0”
OCT	58.9	37.2	48.1	2.35”	0.2”
NOV	40.8	24.1	32.4	2.36”	5.4”
DEC	27.2	10.5	18.8	1.21”	9.7”
Year	54.6	34.2	44.4	34.57”	44.8”

NOTE: Climate information for Caledonia, MN has missing data from 1919 – 1959.

Miscellaneous facts:

- Warmest year on record – 1987 (47.9°F)
- Warmest month on record – July 1901 (77.3°F)
- Warmest day on record – July 26, 1894 (104°F)
- Greatest number of days with 90°F or warmer – 1988 (39 times)

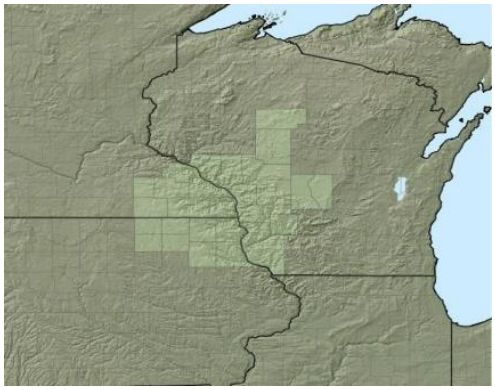
- Coldest year on record – 1996 (41.8°F)
- Coldest month on record – January 1912 (-2.2°F)
- Coldest day on record – January 15, 1963 (-37°F)
- Greatest number of days at 0°F or colder – 1978 (57 times)



- Wettest year on record – 2007 (52.85”)
- Wettest month on record – August 2007 (18.96”)
- Wettest day on record – July 21, 1951 (6.60”)
- Driest year on record – 1910 (14.30”)
- Driest month on record – Numerous
-
- Highest seasonal snowfall on record – 1958/59 (91.6”)
- Highest monthly snowfall on record – March 1959 (44.8”)
- Highest one-day snowfall on record – February 2, 1915 (20.0”)
- Least seasonal snowfall on record – 1967/68 (3.7”)

NOAA/National Weather Service Support and Weather Monitoring

NOAA's National Weather Service (NWS) forecast office at La Crosse, WI serves Houston 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 telephone, with limited amateur radio use.

NOAA Weather Radio coverage in Houston County includes three stations:

- WXJ86 (La Crosse) on 162.550 MHz
- KGG95 (Winona) on 162. 425 MHz
- KXI60 (Decorah) on 162.525 MHz

Storm spotter groups consist of a limited number of fire departments and a few amateur radio operators. Spotter training has been held sporadically over the past five years with 96 in attendance in 2010 when training was held in Caledonia.

There is a variety of weather monitoring sources in Houston County, including:

Automated weather station(s):

- None, except for road monitoring equipment between Hokah and Caledonia.

River Gauge(s):

- Mississippi River @ La Crosse
- Mississippi River @ Brownsville
- Mississippi River Lock & Dam #8 @ Genoa, WI
- South Branch Root River @ Houston 2S, MN
- Root River @ Houston, MN
- Root River @ Mound Prairie, MN
- Root River @ Hokah, MN (staff gauge only)

Cooperative Observers:

- Caledonia
- Houston 1N
- Hokah 4NW
- Hokah 1S
- Spring Grove 4N

In addition, other 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 La Crosse Severe Weather Climatology	www.weather.gov/lacrosse/svr_climate.php
Midwest Climate Center	http://mcc.sws.uiuc.edu/
Minnesota Climatology Working Group	http://climate.umn.edu/
Wisconsin State Climatology Office	http://www.aos.wisc.edu/~sco/
Iowa Climatology	http://www.iowaagriculture.gov/climatology.asp
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

Contact information: Todd Shea
Warning Coordination Meteorologist
NWS La Crosse
todd.shea@noaa.gov

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