



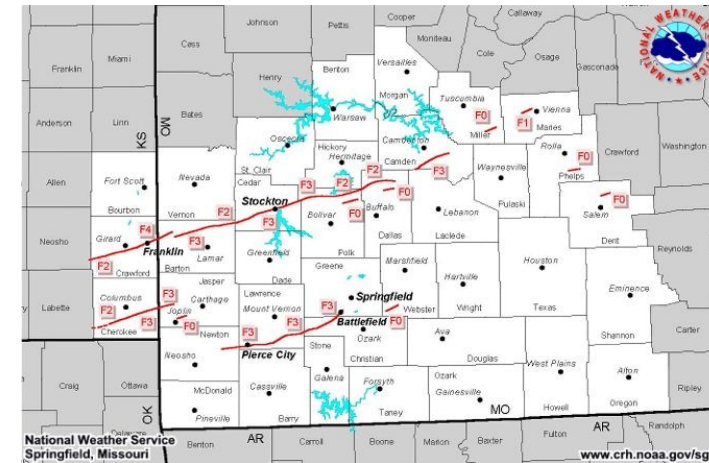
“To provide weather and flood warnings, public forecasts and advisories for all of the United States...and its territories...for the protection of life and property.”

National Weather Service

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National Weather Service

Natural Hazard Risk Assessment Information For: **Camden County Missouri**



Information Provided By
WFO Springfield, Mo

2009 Update

Includes data and information
through December 2008

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This document is intended to provide general information on severe weather that has affected Camden County and the communities with in the county.

By Gene Hatch
 Meteorologist Intern WFO Springfield. Mo.

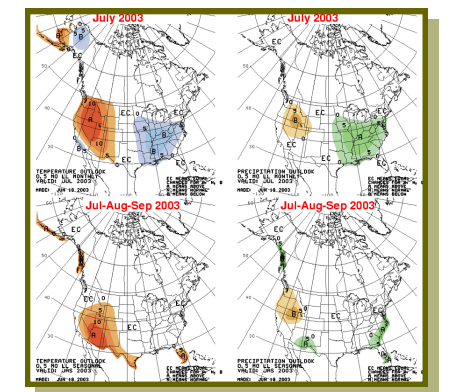
Local Climatology

Averages and records for Camdenton, Missouri in Camden County

43	22	5.1	85	-17	20.0
49	26	4.2	83	-13	23.3
61	36	2.4	86	-6	25.5
71	46	0.1	94	18	4.0
77	55	0	94	26	0
85	64	0	105	42	0
90	68	0	115	48	0
89	66	0	110	46	0
82	59	0	106	27	0
71	47	0	95	20	0
57	36	1.2	90	0	17.5
46	26	3.1	82	-19	17.0

Links for Climate information

- www.crh.noaa.gov/sgf/
- www.cpc.ncep.noaa.gov/
- www4.ncdc.noaa.gov
- web.missouri.edu/~moclimat/
- mrcc.sws.uiuc.edu/
- agebb.missouri.edu/weather/index.htm



Historic Weather in Southwest Missouri

Jan. 8th-1997...Six inches or more of snow fell over much southwest, south central and central Missouri from noon on the eighth to noon on the ninth. The heaviest snow fell in a band from Cassville to Springfield north to Hermitage where up to ten inches was recorded. Damage estimates at 670K dollars were due to the cost of snow removal.

Mar. 10th-2000...High winds gusting to 40 mph on March 8th combined with low humidity and dry brush to create extremely hazardous fire conditions in central and south central Missouri. The ongoing drought over the region contributed to the overall dry surface conditions. More than 17 residences and 31 structures were destroyed by more than 70 separate fires. The largest number of fires and structural damage occurred in Camden and Laclede counties. Local officials reported that 44 fires destroyed 15 homes and 16 outbuildings south of the Lake of the Ozarks. Over 250 firefighters and 75 pieces of equipment were dispatched from surrounding areas in Missouri. One firefighter was injured in northern Dallas County.

Apr. 6th-1999...High wind, low humidity and ongoing drought conditions in southwest Missouri resulted in 88 wildfires. Approximately 7600 acres were burned across the region. Over 15 separate



blazes occurred in Camden county alone.

Apr. 17th 1995...The Camden County Missouri sheriff reported that lightning struck the Country Bob's grocery store near the court house in Camdenton. The lightning started a small fire, but no injuries were reported.

May 4th- 2003...Three tornadic supercell thunderstorms formed over southeast Kansas and moved across the Missouri Ozarks, spawning 14 tornadoes. This was a very rare event for this part of Missouri since many of the tornadoes experienced across this area are short lived small tornadoes. This event surpassed the December 17-18, 2002 tornado event in both loss of lives and property damage, and exceeded tornado events that occurred over the past 100 Years for this part of Missouri. The hardest hit locations included Battlefield, Stockton and Pierce City. 14 tornadoes resulted in extensive damage and 24 deaths.

Aug. 20th-2000...A microburst caused extensive damage near Coffman Bend about 10 mile north-east of Climax Springs. Winds came across the Coffman Bend peninsula at about 80 mph during the storm. More than 20 docks were damaged or destroyed. A number of walkways were left twisted and turned, several boats were turned upside down, some tossed up on the shoreline. Estimated damage was near 520K dollars.

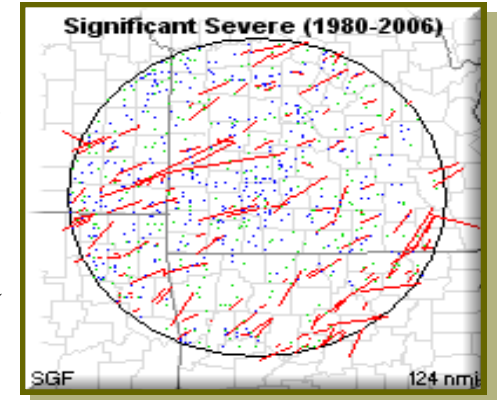


Overview of Weather Hazards in Southwest Missouri & Extreme Southeast Kansas

From 1961 to 2008, 522 tornadoes were reported in the 37 counties that WFO Springfield is responsible for, with an average of 11 occurring each year. There were 71 fatalities from these tornadoes, or near one and a half each year. Tornadoes occurred during every month of the year and at every hour of the day. The majority of these tornadoes are weak, but the occurrence of strong and violent storms is always a possibility and cannot be discounted.

The Ozarks experiences between 50 and 70 thunderstorm days a year. During any given storm, large hail, damaging winds and microbursts are possible. The Ozarks go through three severe thunderstorm seasons during the course of the year. The spring season is the period that supercell thunderstorms are most common, next comes summer as large clusters of storms move across the region, mainly during the overnight hours. Finally fall sees the return of supercells and tornadoes, squall lines and training storms (thunderstorms that form and move over the same area).

The region is affected during the course of any year by flooding, drought, heat and cold extremes and winter storms. Heat extremes and flooding have caused the greatest number of fatalities in the area. Winter storms affect the region in many forms. Ice storms, heavy snow and extreme cold have occurred across the area. Freezing rain is the typical form ice storms in the Ozarks take. Ice storms have deposited 2 to 3 inches of ice during their duration causing power outages, tree damage, and traffic problems.



Weather in the Ozarks

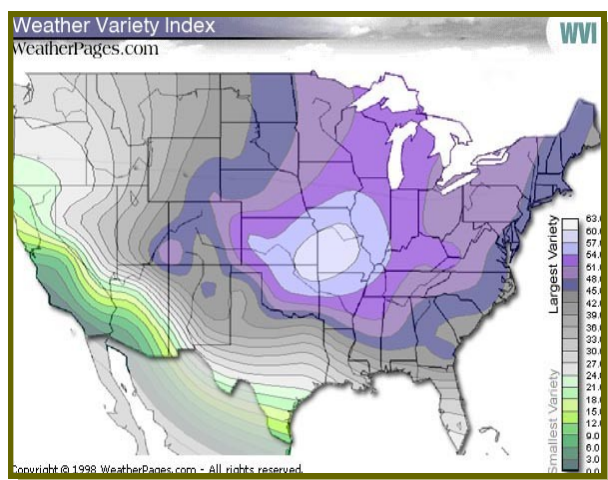
Tornadoes by county for the Springfield County Warning Area from 1950 to 2008

County	F0/1	F2	F3	F4	F5	County	F0/1	F2	F3	F4	F5	County	F0/1	F2	F3	F4	F5
BARRY	20	7	1	0	0	DOUGLAS	8	6	1	0	0	OREGON	9	4	2	1	0
BARTON	23	1	3	1	0	GREENE	19	10	3	1	0	OZARK	21	2	2	1	0
BENTON	18	2	4	0	0	HICKORY	8	1	1	0	0	PHELPS	15	4	2	0	0
BOURBON,KS	10	5	0	0	0	HOWELL	20	11	3	1	0	POLK	16	3	0	0	0
CAMDEN	15	6	1	0	0	JASPER	30	5	4	1	0	PULASKI	9	4	1	0	0
CEDAR	10	2	3	0	0	LACLEDE	9	6	1	0	0	SHANNON	11	1	1	0	0
CHEROKEE,KS	28	5	2	1	0	LAWRENCE	11	2	3	0	0	ST.CLAIR	13	2	2	0	0
CHRISTIAN	19	2	1	1	0	MARIES	4	3	0	0	0	STONE	10	3	0	0	0
CRAWFORD,KS	19	11	3	1	0	MCDONALD	11	5	0	0	0	TANEY	6	1	0	0	0
DADE	11	2	2	0	0	MILLER	22	3	0	0	0	TEXAS	14	8	1	2	0
DALLAS	7	1	1	0	0	MORGAN	11	7	0	0	0	VERNON	20	1	6	0	0
DENT	8	1	1	0	0	NEWTON	30	5	1	2	0	WEBTSEER	19	7	2	0	0
												WRIGHT	10	4	0	1	0

Historical information for Camden County, Missouri

Severe Weather in Camden County

In 2000, a private company looked at 277 cities across the United States. They rated each city on variations in temperature, precipitation and other factors. Of all the cities in their study Springfield, Missouri rated number one as the city with the most variable weather in the U.S.

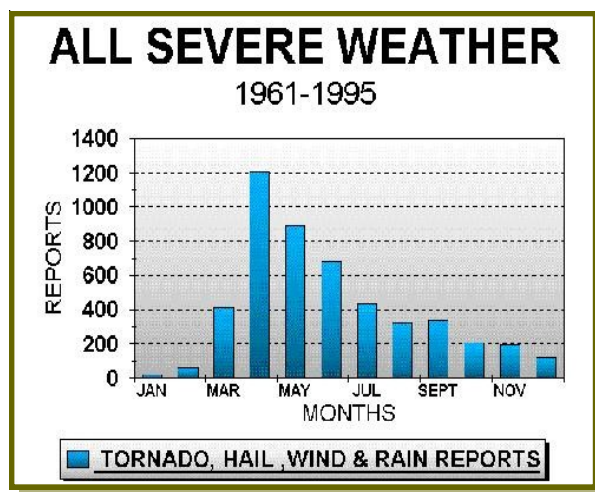


From www.weatherpages.com

Camden County Missouri is located on the Ozark Plateau along the eastern edge of tornado ally. Because of its location Camden County is subjected to severe thunderstorms, heavy rainfall, winter storms, flooding, ice storms, droughts, tornadoes and other wind storms.

When does severe weather occur ?

Severe weather in the Ozarks can occur in any month of the year. While the months of April through June are the peak severe weather season, there is a secondary peak from September to November.



Severe thunderstorms in Camden County have dropped hail up to 3 1/2" in diameter, created winds in excess of 80 miles an hour and rainfall rates greater than 2" in an hour. While southwest Missouri receives nearly 11 tornadoes a year, Camden County averages an event every 4 years.

Number of Tornadoes in Camden Co. (1950 to 2008)

F0/F1	F2	F3	F4	F5
15	6	1	0	0
68%	27%	5%	0%	0%

During the winter season Camden County averages 16.1 inches of snow. With the most snow in one season at 56.6 inches, falling during the 1959 to 1960 winter season. Ice storms also affect the county during the winter season causing significant damage to homes, trees and utilities.

Dam Failure

Dams in Camden County

Camden County contains 20 dams. While the majority of these dams are small and used primarily for storm water management, irrigation and recreation, some are a part of local reservoirs. Most of the dams in Camden County are of earthen construction with Tunnel Dam the only concrete construction dam. There have been no recorded failures.

Where are they Located

- Tunnel Dam: Niangua River, Macks Creek
- Autumn Lake Dam: Osage River, Bagnell
- Turner Lake Dam: Macks Creek, Macks Creek
- Ozark Fisheries Dam: Sellars Creek, Montreal
- Carnahan Lake Dam: Brush Creek, Macks Creek
- Good Oak Lake Dam: Osage River Trib., Bagnell
- Treeline Lake Dam: Osage River Trib., Bagnell
- Dogwood Hills Dam: Osage River Trib., Bagnell
- Burton Duenke #5 Dam: Lake of the Ozarks, Bagnell
- Burton Duenke Lake Dam N: Osage river Trib., Lake Ozark
- Burton Duenke Lake Dam D: Osage River Trib., Bagnell
- Steinberg Lake Dam: North Fork / Linn Creek, Linn Creek



- Carpenter Lake Dam: Little Niangua, Branch
- Moore Lake Dam: Murphy Creek, Stoutland
- Atkisson Lake Dam: Murphy Creek, Stoutland
- Burton Duenke Lake Dam #4: Lake of the Ozarks, Bagnell
- Marschke Lake Dam: McFarland Hollow Creek, Linn Creek
- Seasons Ridge Lake Dam: Jennings Branch, Camden

Most of the dams in Camden County are less than 100 feet high. Many are located on private land and fall under private ownership.

Tunnel Dam is the most significant dam in Camden county. It is a concrete construction dam used for hydro electric power generation.

Heat, Drought and Wildfires



Drought and wildfires can, and often do accompany excessive heat. Camden County has gone through dry periods and drought. The latest droughts occurred in 1999 and 2000 when well below normal rainfall and high temperatures combined to produce drought conditions.

Longest periods without rainfall in Camden County

- 37 days: 11 Dec 1955 ~16 Jan 56
- 35 days: 12 Sept 1963 ~ 16 Oct 63
- 30 days: 8 Oct 1950 ~ 6 Nov 50
- 29 days: 20 Dec 1985 ~ 17 Jan 86
- 27 days: 24 Dec 1960 ~ 19 Jan 61
- 26 days: 6 July 1985 ~ 31 July 85

Excessive heat is the leading cause of weather fatalities in the nation. With the variability of the weather in southwest Missouri, it is not surprising that excessive heat impacts Camden county on almost a yearly basis.

Camden County averages 8 days a year with temperatures at or above 95 degrees. July and August are the two warmest months, which average 7 days at or above 95 degrees.

Year	Days 95* +	Days 100* +	Days in a row
1953	64	24	18
1954	67	46	14
1956	33	11	8
1980	52	29	18
1983	39	17	13
1991	31	19	6
Normal # of Days	8	2	▲ Above 95*

Years with above average summer heat

While no major wildfires have affected Camden County, small grass fires do pose a hazard.

A twenty year study by the Missouri Department of Conservation, from 1970 to 1989 determined that over 11,000 fires occurred during that time in the Lake Ozark fire district which includes Morgan, Miller, Camden, Dallas and Laclede counties. This represented nearly 20% of the wildfires in the state with over 131,000 acres burned.

There are numerous ways wildfires can be started, but when dealing with weather related phenomenon, namely lightning, only 0.8% of the wildfires in the Lake Ozark fire district were the result of lightning.

Tornado Information

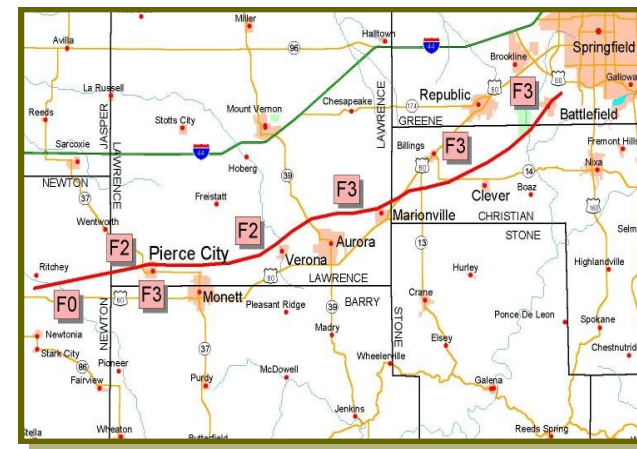
Camden County lies at the eastern edge of tornado ally and receives on average 2 tornadoes every three years. From 1950 to 2002 Camden county recorded 13 tornadoes from F0 to F2 in strength. The strongest tornado, an F2, passed across the county on the evening of April 7th, 1980. Along its track it caused 2.5 million dollars in damage and injured 3.

Historical Tornadoes of Camden County

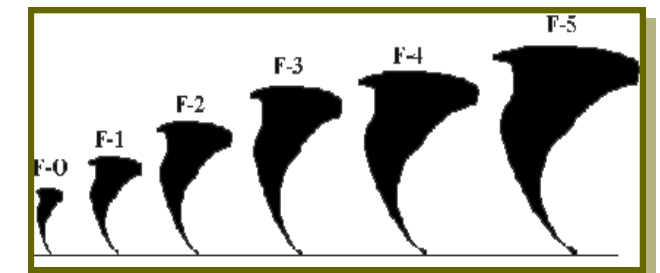
- Apr 18, 1880 (F4) 1 inj, 0 dead
- May 8, 1927 (F4) 3 inj, 0 dead
- Mar 23, 1936 (F2) 15 inj, 0 dead
- May 28, 1954 (F2) 0 inj, 0 dead
- Oct 14, 1966 (F2) 0 inj, 0 dead
- May 9, 1970 (F2) 0 inj, 0 dead
- Apr 74, 1980 (F2) 0 inj, 0 dead
- May 4 2003 (F3) 3 dead

For the Record Camden County

- Has experienced two F4 tornadoes.
- No F5 tornadoes
- Most recent Tornado June 3, 2008 (F1)
- 4 deaths and 30 injuries since 1880.

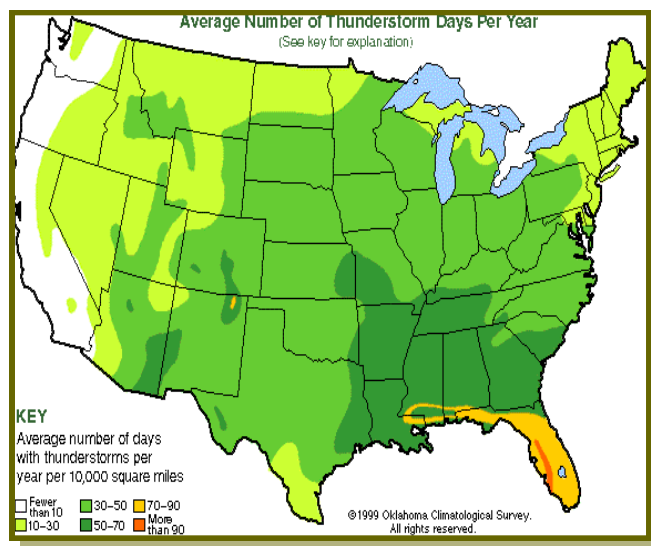


An F3 tornado moved south of Camdenton, MO before lifting just north of Montreal in Camden County. The Tornado dropped north of Decaturville and resulted in the deaths of three individuals in residences along Highway 5 southeast of Camdenton. The tornadic storm. The tornado tracked east northeast, heavily damaging more than a dozen additional homes.



- **F-0:** 40-72 mph, chimney damage, tree branches broken
- **F-1:** 73-112 mph, mobile homes pushed off foundation or overturned
- **F-2:** 113-157 mph, considerable damage, mobile homes demolished, trees uprooted
- **F-3:** 158-205 mph, roofs and walls torn down, trains overturned, cars thrown
- **F-4:** 207-260 mph, well-constructed walls leveled
- **F-5:** 261-318 mph, homes lifted off foundation and carried considerable distances, autos thrown as far as 100 meters.

Severe Hail, Lightning, Wind and Winter Weather



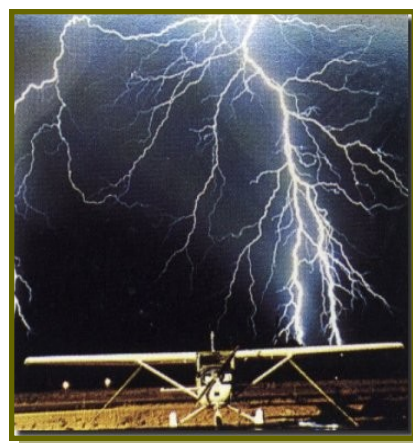
Average number of thunderstorm days per year.

Thunderstorms occur in the Ozarks on the average of 50 days per year.

April and May are the two most active hail months in the Ozarks. There is also evidence of a minor secondary peak in September. The greatest number of hail reports over 2 inches occur in the months of April, May and June with the largest report being 3.50 inches in diameter in Camden county on April 9, 2001. Hail can cause considerable damage to homes, vehicles, and crops.

Severe thunderstorm winds are defined by the NWS as convective wind gusts that reach or exceed 50 knots (58 mph). June is the most active month with April a close second. In general, the most active period for damaging wind events occurs from April to August. This is due in part to the shift from supercell thunderstorms to large clusters of storms and squall lines. The highest wind gust recorded in Camden county reached 81 mph and occurred in 1982 on the 2nd of April. Since 1961 high winds have caused around \$1,000,000.00 in damages.

With any thunderstorm, lightning will be present and the safest place to be is indoors. In August of 2002, four people were killed near Willard in Greene County during a funeral. As a thunderstorm moved into the area, the victims sought shelter under a tree.



Nationally, Missouri ranks 27th in Lightning fatality rate, 44th in injuries and 38th in property damage related to lightning. During the period from 1960 to 1994, the total number of lightning casualties in Missouri was 165. This is nearly five casualties per year in the state.

Winter weather across the Ozarks comes in many forms. Freezing rain or drizzle, sleet and snow are common occurrences during the winter season. In the past the Ozarks have had up to 54 inches of snow, Sleet storms that produced inches of sleet and ice storms that laid a covering of one to two inches of ice on most surfaces. While the immediate impact of these storms is to travel, winter storms cause hundreds of thousands of dollars in damages across the region on a near yearly basis.

21 Feb 2001: Sleet, freezing rain and embedded thunderstorms caused ice accumulations from one quarter, up to two inches in places across southwest, central and south central Missouri. The heaviest ice accumulations occurred along and north of Highway 60, and along the I-44 corridor. Howell-Oregon electric cooperative reported numerous power outages due to the ice around the communities of Willow Springs, Birch Tree, Mountain View, Winona, Eminence and Dora.

Flooding

From 1993 to 2002 Flooding has occurred in Camden County in every year. While usually nuisance flooding such as water on city streets, significant flooding has caused numerous problems in the county. During the previous decade, only one injury and no deaths have been attributed to flooding in Camden County. Camden County contains numerous low water crossings.

Typically, flooding in the county is caused by heavy rainfall associated with high rain producing thunderstorms which move very slowly. In towns, rainfall of one to two inches will cause streets and ditches to flood and make some low water crossings impassable. When rainfall rates reach 3 to 4

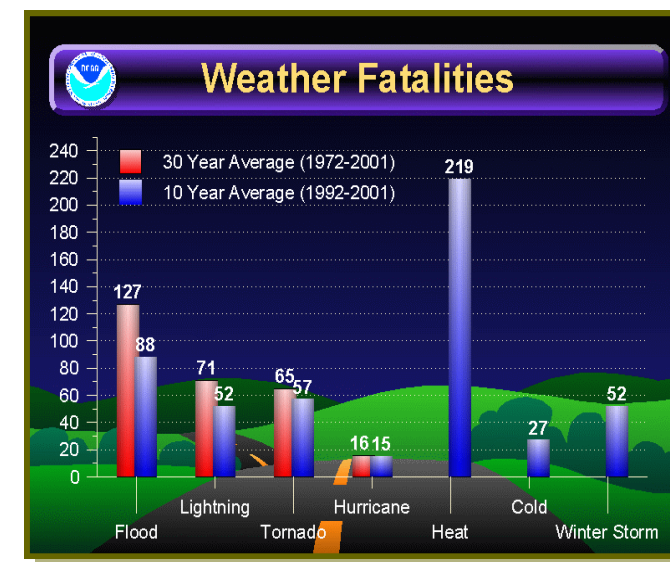


inches, major flooding can occur, and amounts over four inches creates significant flooding that affects most of the county.

Floods in Camden County

19 Aug 1997: Flooding was reported at the county courthouse. A large complex of thunderstorms produced 3 to 5 inches of rain in a band from just north of Nevada to near Rolla. The previous three weeks had been very dry across the region, so flooding problems were minor.

4 May 1999: Thunderstorms produced a large area of 2 to 6 inch rainfall over central, south central, and southwest Missouri. The hardest hit areas were along the Kansas state line from Nevada to Joplin where some damage to roads occurred. A few homes in the Carthage and Joplin areas required



National Weather Fatality Statistics

brief evacuations due to the flooding. About a half dozen homes in Carthage had minor flood damage on the lowest floor. Numerous low lying roads and low water crossings were closed due to the flooding. There was one flash flood related fatality in eastern Camden County on Dry Glaize Creek near Montreal. Early in the morning on May 5th, a women died when she drove into a flooded low water crossing.

30 May 2001: Two to four inches of rain fell across portions of southern Benton through north-west Camden and into southern Morgan County in less than two hours. Numerous low water crossings and county roads were impassable, especially from Warsaw, east and northeast across Climax Springs, and into the Gravois Mills area.