



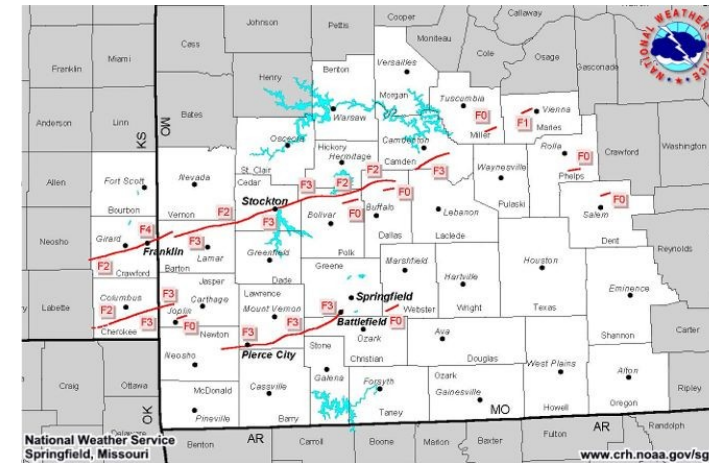
“To provide weather and flood warnings, public forecasts and advisories for all of the United States...and its territories...for the protection of life and property.”

National Weather Service

5808 W Hwy EE
Springfield, Mo. 65802
Phone: 417-864-8535
Email: Steve.Runnels@noaa.gov
Gene.Hatch@noaa.gov

National Weather Service

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



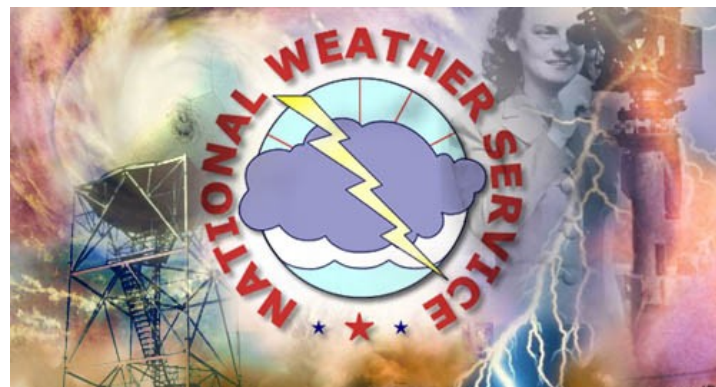
Information Provided By
WFO Springfield, Mo

2009 Update

Includes data and information
through December 2008

Table of Contents

| | |
|---|----|
| Overview of Weather Hazards in Southwest Missouri | 2 |
| Historical information for Phelps County Missouri | 3 |
| Tornado Information | 4 |
| Severe Hail, Lightning, Wind and Winter Weather | 5 |
| Flooding | 6 |
| Heat , Drought and Wildfires | 7 |
| Dam Failure | 8 |
| Historic Weather in Southwest Missouri | 9 |
| Local Climatology | 10 |



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

By Gene Hatch
 Meteorologist Intern WFO Springfield. Mo.

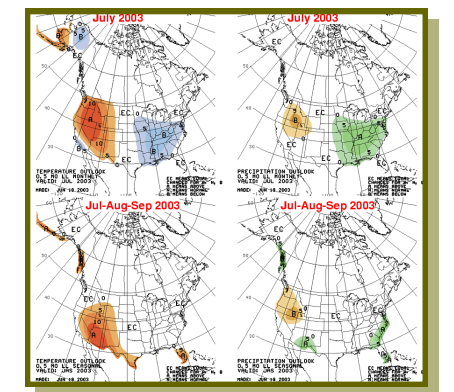
Local Climatology

Averages and records for Rolla, Missouri in Phelps County

| | | | | | |
|----|----|-----|-----|-----|------|
| 40 | 21 | 6.2 | 78 | -24 | 19.7 |
| 46 | 26 | 4.3 | 84 | -14 | 13.1 |
| 55 | 35 | 3.0 | 92 | -3 | 17.8 |
| 66 | 45 | 0.7 | 93 | 13 | 8.0 |
| 75 | 55 | 0 | 98 | 31 | 2.0 |
| 84 | 64 | 0 | 104 | 40 | 0 |
| 89 | 68 | 0 | 113 | 46 | 0 |
| 88 | 66 | 0 | 108 | 42 | 0 |
| 79 | 58 | 0 | 105 | 32 | 0 |
| 69 | 47 | 0.1 | 94 | 19 | 2.0 |
| 55 | 36 | 1.6 | 85 | 3 | 16.9 |
| 43 | 25 | 4.4 | 79 | -19 | 19.6 |

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. 2nd 1996...A winter storm produced heavy snow across much of Southwest and Central Missouri during the evening of the first into the early morning of the second. 12 inches of snow fell from Ava to Houston, while greater than 8 inches fell from Branson to Wet Plains northward to Rolla.

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.

Feb. 26th-1989...An upper level weather disturbance brought snow to parts of the central U.S. which just the day earlier were enjoying temperatures in the upper 60s. Snowfall totals in Missouri ranged up to nine inches at Rolla.

Apr. 9th-2000...Flash flooding was reported over numerous low-water bridges and low-lying areas. A 29-year-old mother and her 3-year-old son were killed when their car was swept off a low-water bridge at Mill Creek in Phelps county MO. Their bodies were found about 12 hours later. A 9-year-old daughter was injured, but managed to escape the car. Livestock was reportedly stranded and



crops and pastures were under high water.

May 4th- 2003...Three tornadic supercell thunderstorms formed over southeast Kansas and moved across the Missouri Ozarks, spawning 13 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. Several of the tornadoes tracked long distances ranging from 15 to 80 miles.

Jun. 27th-1999...Severe thunderstorms during the early afternoon produced high winds in Rolla and Edgar Springs MO. Numerous power line were blown down by the intense gust.

Oct. 2nd-1944...During the afternoon thunderstorms formed a tornado in Springfield, MO near Phelps Grove Park. The tornado moved northeast along Grand Street. One person was injured and numerous buildings were damaged as the tornado tracked across the area.

Nov. 20th-1988...Near 8 inches of snow fell at Rolla, MO during a winter storm as a fast moving cold front raced through the region.

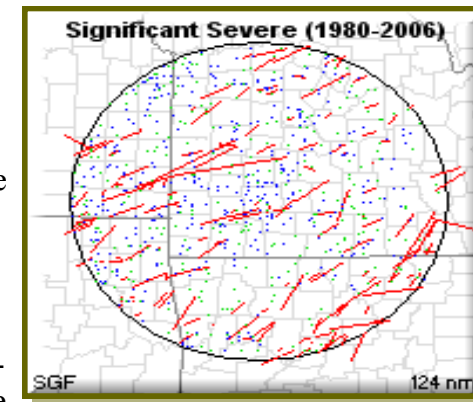


Overview of Weather Hazards in Southwest Missouri & Extreme Southeast Kansas

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

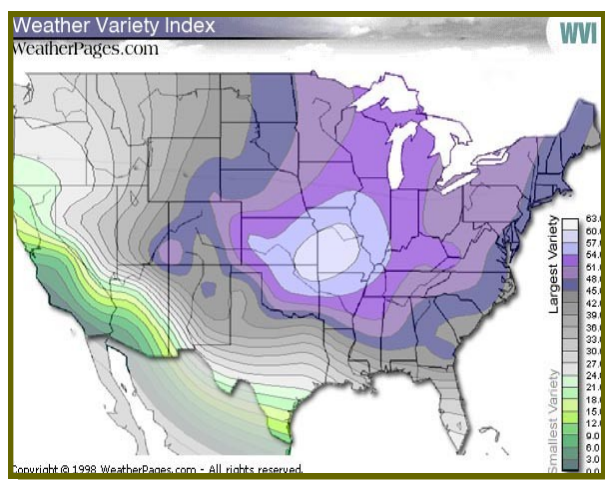
Tornadoes by county for the Springfield County Warning Area from 1950 to 2008

| 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 | WEBTSE | 19 | 7 | 2 | 0 | 0 |
| | | | | | | | | | | | | WRIGHT | 10 | 4 | 0 | 1 | 0 |

Historical information for Phelps County, Missouri

Severe Weather in Phelps 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.

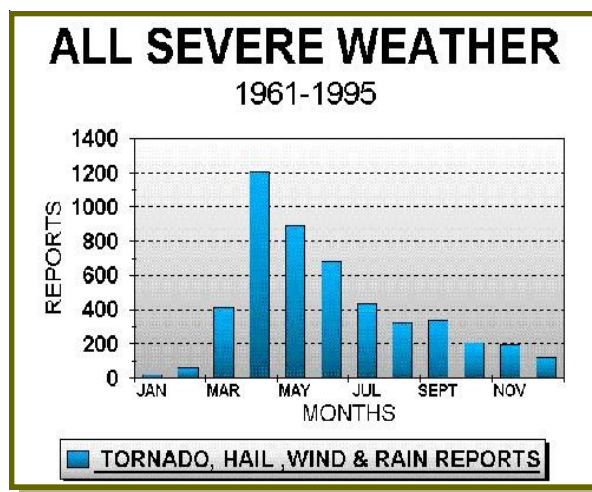


From www.weatherpages.com

Phelps County Missouri is located on the Ozark Plateau along the eastern edge of tornado ally. Because of its location Phelps 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 thunder storms in Phelps County have dropped hail up to 2 3/4" in diameter, created winds in excess of 70 miles an hour and rainfall rates greater than 2" in an hour. While southwest Missouri receives nearly 11 tornadoes a year, Phelps County averages an event every 2 1/2 years.

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

| F0/F1 | F2 | F3 | F4 | F5 |
|-------|-----|----|----|----|
| 15 | 4 | 2 | 0 | 0 |
| 64% | 29% | 7% | 0% | 0% |

During the winter season Phelps County averages 20.3 inches of snow. With the most snow in one season at 37.1 inches, falling during the 1989 to 19902 winter season. Ice storms also affect the county during the winter season causing significant damage to homes, trees and utilities.

Dam Failure

Dams in Phelps County

Phelps County contains 24 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. All of the dams in Phelps County are of earthen construction and there have been no recorded failures.

Where are they Located

- Highway Lake Dam: Peters Branch, Lake Spring
- Little Prairie Dam: Trib. Boubeuse River, Dillon
- Lake Scioto Dam: Luther Branch Creek, Steeleville
- Brays Lake Dam: Abbot Branch, Newburg
- Wheelgate Lake Dam: Boubeuse River, Redbird
- Moty Lake Dam: Dry Fork River, Fanning
- Amos Lake Dam: Cox Branch, Northwye
- Cardetti Lake Dam: Clear Creek, Fanning
- Seven Springs Lake Dam: West Fork Benton Creek, Bangert
- Tripoli Valley Dam: Meramec River, Steeleville
- Scott's Pond Dam: Little Dry Fork River, Lake Spring
- Foster Lake Dam: Clear Creek, Bangert
- Walnut Hill Lake Dam: Dry Fork River, Gascondy
- Affolter Lake Dam: Tick Creek, Gascondy
- McCloskey Lake Dam: Bourbeuse River, Redbird
- Egan Lake Dam: Clear Creek, Royal
- Bedell Lake Dam: Luther Branch, St. James
- Boyd Lake Dam: Beaver Creek, Newburg
- Blues Pond Dam: Little Beaver Creek, Newburg
- Dennis Lake Dam: Mungy Brach, Dixon
- Knoblauch Lake Dam: Duncan Creek, Dixon
- Harke Lake Dam: Big Piney River, Evening Shade
- Wayman-Fuhring Lake Dam: Dry Fork Meramec River, St. James
- McNulty Lake Dam: Grouro Creek, Vida



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

Heat, Drought and Wildfires



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 Phelps county on almost a yearly basis.

Phelps County averages 14 days a year with temperatures at or above 95 degrees. July and August are the two warmest months, which average 5 days at or above 95 degrees.

| Year | Days 95* + | Days 100* + | Days in a row |
|---------------------|---------------|----------------|-------------------|
| 1913 | 55 | 20 | 13 |
| 1934 | 47 | 25 | 19 |
| 1936 | 54 | 27 | 17 |
| 1954 | 51 | 25 | 6 |
| 1980 | 46 | 26 | 18 |
| 1983 | 30 | 11 | 6 |
| Normal # of Days | 14 | 4 | ▲ Above 95* |

Years with above average summer heat

Drought and wildfires can, and often do accompany excessive heat. Phelps 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 Phelps County

- 41 days: 13 Aug 1970 ~ 22 Sept 70
- 39 days: 10 Dec 1955 ~ 17 Jan 56
- 34 days: 13 Sept 1963 ~ 16 Oct 63
- 32 days: 13 Sept 1928 ~ 14 Oct 28
- 32 days: 8 Sept 1979 ~ 9 Oct 79
- 29 days: 21 Dec 1985 ~ 18 Jan 86

While no major wildfires have affected Phelps 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 4600 fires occurred during that time in the Gasconade Fire district which includes Osage, Maries, Pulaski, Phelps and Dent counties. This represented nearly 8% of the wildfires in the state with over 38,000 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 Gasconade fire district were the result of lightning.

Tornado Information

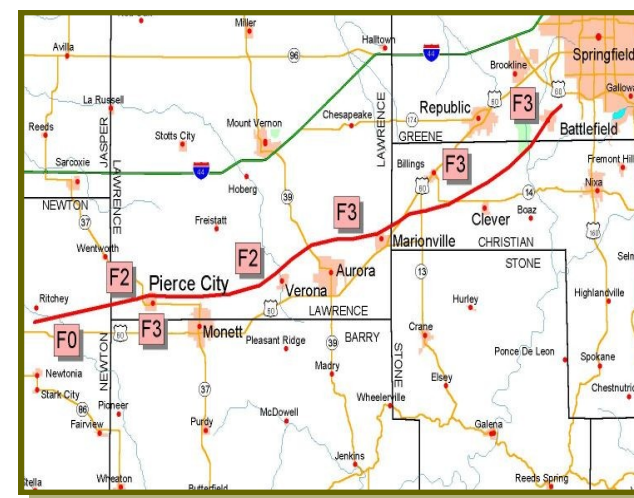
Phelps County lies at the eastern edge of tornado ally and receives on average a tornado every 2 1/2 years. From 1950 to 2008 Phelps county recorded 21 tornadoes from F0 to F3 in strength. The strongest tornado, an F3, passed across the county on the evening of June 1st, 1999. Along its 7 mile track it caused 3.5 million dollars in damage.

Historical Tornadoes of Phelps County

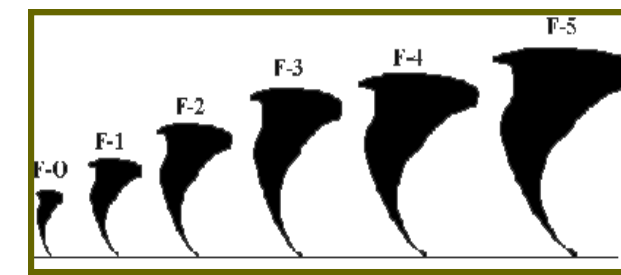
- May 30, 1917 (F4) 0 inj, 0 dead
- Nov 25, 1926 (F3) 10 inj, 0 dead
- Apr 29, 1947 (F3) 0 inj, 0 dead
- Nov 15, 1960 (F3) 1 inj, 0 dead
- Jun 4, 1973 (F2) 1 inj, 0 dead
- May 12, 1978 (F2) 0 inj, 0 dead
- Jun 1, 1999 (F3) 0 inj, 0 dead
- Jun 1, 1999 (F2) 0 inj, 0 dead

For the Record Phelps County

- Has experienced one F4 tornadoes.
- No F5 tornadoes
- Most recent Tornado January 7, 2008 (F1)
- 0 deaths and 12 injuries since 1880.

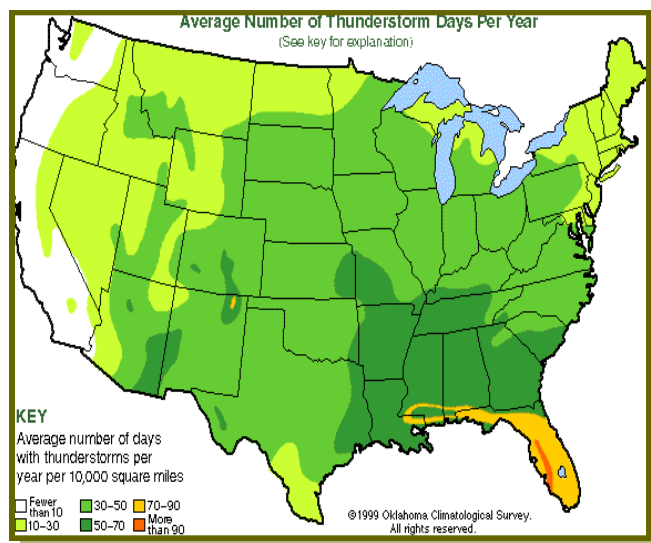


The tornado outbreaks of May 4 & 6, 2003 was one of the worst that southwest Missouri has had since the late 1800's. Fourteen tornadoes touched down across the Ozarks during the evening of May 4th one of which was an F0 that struck near the town of Rolla. This F0 and another F0 that touched down on May 6th are the latest tornadoes to strike Phelps county since an F2 that struck Edgar Springs in June of 1999.



- **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



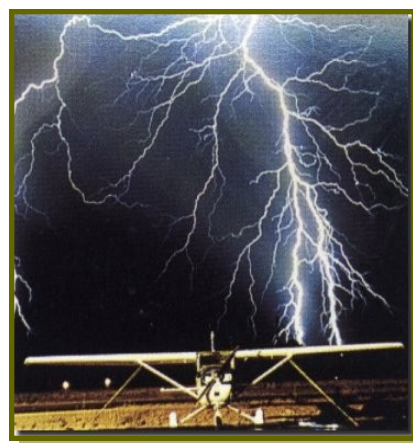
Average number of thunderstorm days per year.

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 2.75 inches in diameter in Phelps county on May 4, 2003. 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 Phelps county reached 75 mph and occurred in 2003 on the 10th of May. Since 1961 high winds have caused around \$1,631,000.00 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 Phelps 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 Phelps County. Phelps 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

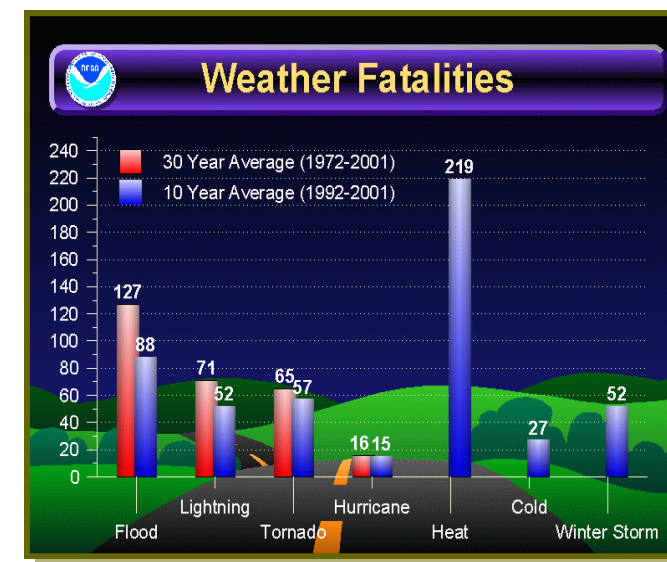
inches, major flooding can occur, and amounts over four inches creates significant flooding that affects most of the county.



Floods in Phelps County

14 Nov 1993: The Missouri Highway Patrol reported flash flooding west of Rolla along Highway 63 and several county roads around Jerome and Newburg. Most low water areas were flooded after as much as six inches of rain fell. Several deer hunters, campers, and livestock were stranded and evacuations were needed. Some crops and hay-pastures were flooded out with severe erosion to secondary roads.

9 Apr 1994: Flash flooding was reported over numerous low-water bridges and low-lying areas. A 29-year-old mother and her 3-year-old son were killed when their car was swept off a low-water



National Weather Fatality Statistics

ridge at Mill Creek. Their bodies were found about 12 hours later. A 9-year-old daughter was injured, but managed to escape the car. Livestock was reportedly stranded and crops and pastures were under high water. Damage was also reported to fences and bridges.

19 Mar 1998: Heavy rain falling on saturated ground resulted in flooding of numerous low water crossings in the county. Highway Y, 5 miles north of Rolla, and Highway T, just north of Flat, were closed. Parts of Route C between Newburg and the Gasconade River were also closed.

20 Aug 2002: Four inches of rain fell in less than 3 hours over portions of northern Dent County and southern Phelps County. Local law enforcement officers reported Highway 32 east of Salem flooded with nearly 12 inches of water flowing over the road at one point. One of the officer's car nearly floated away due to the extremely high water level as he drove down the highway, however, he was able to get out with no injuries. Numerous low water crossings also flooded across the area with several roads closed.