



## **Show-Me the Climate of Missouri: Precipitation**

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Missouri has a continental type of climate marked by strong seasonality. In winter, dry-cold air masses, unchallenged by any topographic barriers, periodically swing south from the northern plains and Canada. If they invade, reasonably humid air, snowfall and rainfall result. In summer, moist warm air masses, equally unchallenged by topographic barriers, swing north from the Gulf of Mexico and can produce copious amounts of rain, either by fronts or by convective processes. In some summers, high pressure stagnates over Missouri, creating extended droughty periods. Spring and fall are transitional seasons when abrupt changes in temperature and precipitation may occur due to successive, fast-moving fronts separating contrasting air masses.

Missouri experiences regional differences in climates, but these differences do not have obvious geographic boundaries. Regional climates grade inconspicuously into each other. Nevertheless, several basic principles help to understand climatic differences in Missouri. The basic gradient for most climatic characteristics is along a line diagonally crossing the state from northwest to southeast. Both mean annual temperature and precipitation exhibit gradients along this line.

Mean annual precipitation varies along the same gradient as temperature, from a low of 34 inches in the northwest to a high of 50 inches in the southeast. Seasonal climatic variations are more complex. In northwestern Missouri, seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages five times greater than January precipitation. In contrast, in southeastern Missouri, seasonality in precipitation is insignificant due to the greater influence of subtropical air masses throughout the year.

Mean January precipitation varies along the gradient from a low of 0.8 inches in the northwest to a high of 3.6 inches in the southeast. However, mean July precipitation is greatest in northeastern Missouri, largely the result of high-intensity convective precipitation (4.4 inches), and is least in southwestern Missouri (3.2 inches). Though much less precipitation falls in northern Missouri in the winter than in the summer, it tends to be seasonally affected precipitation, since temperature and evaporation rates are much lower in winter.

Snow has been known to fall in Missouri as early as October and as late as May. However, most of it falls in December, January, and February. As one would expect, the northern counties usually get the most snow. North of the Missouri River, the winter snowfall averages 18 to 24 inches. This average figure tapers off to 8 to 12 inches in the southernmost counties. It is unusual for snow to stay on the ground for more than a week or two before it melts. Winter precipitation usually is in the form of rain, or snow, or both. Conditions sometimes are on the borderline between rain and snow, and in these situations freezing drizzle or freezing rain occurs. This does not usually happen more than five times in a winter season.

Spring, summer, and early fall precipitation comes largely in the form of showers or thunderstorms. Thunderstorms have been observed in Missouri during the winter months, but they are most frequent from April to July. Hail also occurs in all regions and may occur throughout the year, but it is much less likely in winter. May has the greatest number of days with hail. Measurable precipitation occurs on an average of

about 100 days a year. About half of these will be days with thunderstorms. Occasionally, these produce some very heavy rains.

All of Missouri experiences "extreme" precipitation climate events, and such events must be considered part of the normal climate. Though infrequent in occurrence and often very geographically restricted, these "disturbances" produce environmental changes that may not otherwise have happened and that may be relatively long lasting in their effect. Among these extreme climatic events are high-intensity rains, ice storms and blizzards. These climatic events, in turn, may lead to other environmental disturbances such as floods, landslides, and abrupt changes in plant and animal populations and distributions.

High-intensity precipitation characterizes all regions of Missouri. The town of Holt in northwestern Missouri holds the world record for a high-intensity rain, having received 12 inches within a 42-minute period on June 22, 1947. Once every two years in southwestern Missouri, one should expect one precipitation event to produce at least 4.5 inches of rain in a 24-hour period. Over a five-year period, a ten-year period, a twenty-five-year period, a fifty-year period, and a hundred-year period one should expect one precipitation event to produce at least 5.5 inches, 6 inches, 7 inches, 8 inches, and 9 inches of rain respectively in a 24-hour period. Probabilities decline to the north and east away from southwestern Missouri. Please refer to Table 1 for information on state precipitation records and significant events.

The river drainage in Missouri is wholly — either directly or indirectly — into the Mississippi River, which forms the eastern boundary of the state. The northern part of the western boundary is formed by the Missouri River, which then flows eastward across the State from Kansas City, entering the Mississippi just above St. Louis. Most of northern Missouri is drained by tributaries of the Missouri River, the principal ones being the Grand, Chariton, One Hundred and Two, and the Nodaway Rivers. The principal southern tributaries of the Missouri are the Osage and the Gasconade. Important tributaries which drain directly into the Mississippi within the borders of the state are the Fox, Wyaconda, Fabius, and Salt Rivers in the northeast, and the Meramec River, which enters the Mississippi just below St. Louis. A small portion in the southwest corner of the state lies in the headwater area of some Arkansas River tributaries. A relatively small area in the south and southeast drains directly into the Mississippi outside the state through the White, St. Francis, and other minor streams.

Tributary flooding resulting from heavy rains (which may be expected once or twice in most years) and flash flooding — along minor streams following heavy thunderstorm rains — occur most frequently in the spring and summer, April to July, but may occur during any month. Serious flooding occurs less frequently along the main stems of the Missouri and Mississippi Rivers and usually occurs during the spring and early summer. Main stem flooding may be caused by prolonged periods of heavy rains, ice jams, or upstream flood crests synchronized with high tributary discharge. There are several flood-control structures in the Missouri Basin above Kansas City, which may be expected to reduce upstream flood crests in the future.

On the average the amount of water that falls in Missouri on a square mile in a year varies from nearly 600 million gallons in the northwest corner to over 800 million gallons in the southeast. This would be about 6 million gallons per person in some of the more thickly populated areas, and about 36 million gallons per person in some thinly populated sections. Some of this water runs off into the rivers and streams; some is consumed by animal life; and large amounts are evaporated back into the atmosphere or transpired by growing vegetation. During years when precipitation comes in a fairly normal manner, moisture is stored in the top layers of the soil during the winter and early spring, when evaporation and transpiration are low. During the summer months the loss of water by evaporation and transpiration is high, and if rainfall fails to occur at frequent intervals, drought will result. Nearly every year some areas have short periods of drought in Missouri. There have been occasional years when the soil moisture has been depleted, and the soil becomes arid when rains have failed to replace the water lost by evaporation and transpiration for prolonged periods. These conditions have caused widespread distress. With increasing population and more competition for the use of water, wise water management is becoming more important.

Drought may be conceptualized in different ways. Meteorological drought, based on precipitation records, is different from agricultural or soil-moisture drought and the physiological drought of plants. Drought is commonly thought of as a growing-season phenomenon, but precipitation deficiency during colder months

does affect moisture abundance during the following warmer months. If drought is defined as a month during which less than 40 percent of normal precipitation for that month is received, then the average probability of such a dry month, based on records at Columbia, is about 15 percent, or one in seven years. For the months of April and May, the probability reduces to 8 percent; but for August and September, it rises to 18 and 21 percent, respectively, or one in five years. Thus, monthly precipitation is more variable in August and September than in April and May. The probability of three consecutive months receiving less than 60 percent of mean precipitation, again at Columbia, for the months of April through October, is 13 percent, or about one year in eight. There is no convincing evidence that severe droughts occur in Missouri with any cyclic regularity. Drought directly affects plant and animal life by limiting water supplies, especially at times of high temperatures and high evaporation rates. Drought indirectly affects life by increasing plant and animal susceptibility to disease and the probability of fire and the severity of any fire.

Table 1.

<b><u>Precipitation</u></b>	<b><u>Year/Month(s)</u></b>	<b><u>State Average Precipitation (In.)</u></b>
Wettest Year:	2008	57.34
Driest Year:	1953	25.35
Wettest summer:	1915, Jun-Jul-Aug	20.54
Driest summer:	1936, Jun-Jul-Aug	3.87
Wettest winter:	1950, Dec-Jan-Feb	11.40
Driest winter:	1963, Dec-Jan-Feb	2.39
Wettest month:	1993, September	11.65
Driest month:	1986, January	0.08
Wettest Year:	Individual location: 1957, Portageville; 92.77 inches	
Driest Year:	Individual location: 1910, Conception; 14.37 inches	
Wettest day:	1965, July 20; 18.18 inches in Edgerton	
Snowiest month:	1960, March; State average snowfall: 20.6 inches	
Max month snowfall:	1960, March; 38.5 inches in Concordia	
Deepest snow depth:	1960, March 19-20; 36 inches in Union	
Latest heavy snowfall:	May 3, 1907: 8" in Fairport	
World record rainfall:	Holt; 12 inches in 42 minutes on June 22, 1947	

For more information on the climate of Missouri, please visit the Missouri Climate Center Web site at: <http://climate.missouri.edu/>