

Climate of Illinois

Introduction

This publication consists of a narrative that describes some of the principal climatic features and a number of climatological summaries for stations in various geographic regions of the State. The detailed information presented should be sufficient for general use; however, some users may require additional information.

The National Climatic Data Center (NCDC) located in Asheville, North Carolina is authorized to perform special services for other government agencies and for private clients at the expense of the requester. The amount charged in all cases is intended to solely defray the expenses incurred by the government in satisfying such specific requests to the best of its ability. It is essential that requesters furnish the NCDC with a precise statement describing the problem so that a mutual understanding of the specifications is reached.

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The Means and Extremes of meteorological variables in the Climatography of the U.S. No.20 series are recorded by observers in the cooperative network. The Normals, Means and Extremes in the Local Climatological Data, annuals are computed from observations taken primarily at airports.

The editor of this publication expresses his thanks to those State Climatologists, who, over the years, have made significant and lasting contributions toward the development of this very useful series.

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Topographic Features- Illinois lies midway between the Continental Divide and the Atlantic Ocean. The State's southern tip is 500 miles north of the Gulf of Mexico. Illinois' climate is typically continental with cold winters, warm summers and frequent short fluctuations in temperature, humidity, cloudiness and wind direction. Many people consider the more moderate temperatures of spring and fall to be the most pleasant.

Five factors control the climate of Illinois: 1) the sun, 2) weather systems, 3) topography, 4) urban areas and 5) Lake Michigan. Two major controls are latitude (reflecting the amount of solar input) and weather systems (air masses and cyclonic storms). The effects of topography, Lake Michigan and urban areas are of lesser significance because they influence local climate conditions, rather than conditions statewide.

The sun, primary energy source for virtually all weather phenomena, in large part, determines temperatures and seasonal variations. Solar energy is three to four times greater in early summer than in early winter at Illinois' mid-latitude location; resulting in warm summers and cold winters when combined with the State's inland location.

Weather systems, the second major factor affecting the State's climate, create the wide variety of weather conditions that occur almost daily as a result of varying air masses and passing storm systems. The polar jet stream often is located near or over Illinois, especially in fall, winter and spring, and is the focal point for the creation and movement of low-pressure storm systems characterized by clouds, winds and precipitation. The settled weather associated with high pressure systems is generally ended every few days by the passage of low-pressure systems.

Topography, urban areas and Lake Michigan are the three local influences with effects on Illinois' climate. The Shawnee Hills extend across southern Illinois and have elevations 500 to 900 feet higher than the surrounding terrain. This change in elevation is enough to increase annual precipitation by about 10 to 15 percent.

The second local feature is the urban climate found in many cities. Buildings, parking lots, roads and industrial activities make the urban climate noticeably different than that of surrounding rural areas. For example, Chicago tends to be warmer by two degrees Fahrenheit (°F), on average, especially at night. Urban areas also enhance summertime precipitation downwind of the city and cause changes in humidity, cloudiness, wind speeds and directions.

Lake Michigan influences the climate of northeastern Illinois, especially Chicago. The large thermal mass of the lake tends to moderate temperatures, causing cooler summers and warmer winters. One of the major benefits is cool lake breezes that provide some relief from summer heat. The lake also tends to increase cloudiness in the area and suppress summer precipitation. Winter precipitation totals are enhanced by lake-effect snows that occur when winds blow from

the north or northeast. These winds allow air to pass over the relatively warm lake, boosting storm system energy and water content, leading to increased snowfall.

Climate conditions have effects on human health and safety. Temperature extremes and storms are responsible for deaths and health problems. Each year, 20 to 30 deaths in Illinois are attributed to severe weather which includes floods, winter storms, tornadoes and lightning.

Heat and cold waves are other climate hazards associated with high death tolls. Illinois experienced two of its most deadly heat waves during the 1990s. The 1995 heat wave, the deadliest on record, led to 753 Illinois deaths. That heat wave and another one in 1999 caused major power outages in the Chicago metropolitan area. Annually, 74 deaths are attributed to heat, and 18 deaths are attributed to cold, far exceeding deaths due to tornadoes, lightning and floods.

Temperature- Average annual temperatures range from 48 (north) to 58° F (south), with highs ranging from 57 (north) to 67 (south). Average winter highs range from the 30s (north) to the mid 40s (south), while average lows range from the teens (north) to the upper 20s (south). Average summer highs are in the 80s, while lows are in the 60s across the State. Both spring and fall have more moderate temperatures. Average spring highs range from 57 (north) to 67° F (south), while average low temperatures range from 36 (north) to 48 (south). Average fall highs range from 60 (north) to 70° F (south), while average low temperatures range from 40 (north) to 48° F (south).

Northern Illinois averages 10 days at or above 90° F compared to over 40 days across southern parts of the State. Days at or above 100° F are infrequent, occurring about every other year in the north and two days annually in the south. Northern Illinois averages 140 days at or below 32° F in contrast to 80 such days the southern portion of the State. Days at or below 0° F decrease from 16 days annually (north) to two days (south).

Average annual heating-degree days, base 65° F, drop from 7000 days (north) to 4000 days (south). Average annual cooling-degree days, again the base is 65° F, range from 800 days (north) to 1600 days (south).

The average length of the frost-free growing season in Illinois ranges from 160 days (north) to more than 190 days (south). Average dates of the last occurrence of 32° F in spring range from April 28 (north) to three weeks earlier, April 7, (south), while the average dates of the first occurrence of this temperature in fall range from October 7 (north) to October 21 (south), and about October 14 near Lake Michigan, including the Chicago area, due to relatively warm waters of the lake.

The highest and lowest temperatures ever reported in Illinois were 117° F in East St. Louis on July 14, 1954, and -36° F at Congerville on January 5, 1999.

Precipitation- Average annual precipitation increases from less than 32 inches (north) to over 48 inches a year (south). Snowfall distribution is just the opposite, with averages of 36 inches a

year (north) and less than 10 inches (extreme south). Winter snowfall is heaviest in the Chicago area, enhanced by lake-effect snows from Lake Michigan.

Variability in precipitation also extends over time. There have been major multi-year droughts in the 1930s and 1950s and major prolonged wet periods during the 1970s and 1980s. May and June are typically the wettest months, while January and February are the driest. Each year, Illinois has rainstorms producing 40 or more flash-floods each with four to eight inches of rainfall in a few hours in localized areas.

The average number of days with measurable precipitation declines from 110 days (north) to just under 100 days (south). The number of days with an inch or more of precipitation ranges from eight days (north) to 13 days (south), and the number of days with an inch or more of snow decreases from 12 days (north) to four days (south). The occurrence of six inches or more of snow in a day are infrequent, ranging from once per year (north) to once in three years (south). Typical dates of the first inch of snow range from November 20th (Chicago area) to December 20th (south). Typical dates of the last inch of snow range from March 26 (north) to three weeks earlier, March 5 (south). The average number of days with a measurable snow depth (1 inch or more) drops noticeably from 60 days (northwest) to only 10 days (southwest).

Flooding is the single most damaging weather hazard in Illinois. Ever-increasing heavy precipitation since the 1940s has led to increased flood peaks on Illinois rivers. Flood losses in Illinois, \$257 million annually since 1983, are the third highest in the nation. Within Illinois and the Midwest, flood losses have been increasing at a greater rate than elsewhere in the nation. Over a 45-year period (1955 - 1999), Illinois had \$5.195 billion in flood losses, and 74% of these losses have occurred since 1985.

The following is a list of precipitation records for Illinois. The greatest 24-hour rainfall was 16.91 inches at Aurora on July 17 - 18, 1996. The greatest one-year precipitation was 74.58 inches at New Burnside in 1950. The greatest 24-hour snowfall was 37.8 inches at Astoria on February 27 - 28, 1900. The greatest winter snowfall was 105.1 inches at Antioch in 1978 - 1979.

Illinois averages 29 tornadoes annually. Peak months are April, May and June (63% of the total), but tornadoes have occurred in all months. Although Illinois averages four tornado-related fatalities per year, the number varies widely from year to year. Thunderstorms account for 50 to 60 percent of annual precipitation and are common in Illinois with an average of 60 storms (far northeast) to 80 storms (southwest). Nearly half of all thunderstorm days occur during June, July and August. Similarly, the average number of cloud-to-ground lightning strikes per square mile ranges from five (northeast) to more than 11 strikes (southwest). Some thunderstorms produce hail, and annual average hail-days decrease from 3.3 days (southwest) to less than 1.8 days (northeast).

The climate of Illinois has five unique features:

- Four distinct seasons, each with different conditions.
- Major north-south temperature contrasts.

- An extremely wide variety of types and amounts of precipitation with moderate variations between monthly and seasonal average values.
- Extreme variability of weather conditions in different parts of the State and, certainly, between years.
- A large number of storms during all seasons.

Climate and the Economy- Major businesses in Illinois are highly climate sensitive. Crop yields are dependent upon climate conditions because irrigation generally is not used. Illinois serves as the nation's center for air and surface transportation. With the nation's second busiest passenger airport (O'Hare) and the rail hub of the nation at Chicago, Illinois also is the heart of the nation's trucking industry. Each form of transportation is influenced by weather and climate extremes, and resulting delays in shipments are a major problem for manufacturers in Illinois. However, many Illinois businesses sometimes profit from weather extremes. For example, Illinois retailers received an estimated \$0.9 billion in additional revenue after shoppers took advantage of the unusually warm winter weather resulting from the 1997 - 1998 El Niño. Home sales also increased during this period.

Illinois Climate Atlas. S. A. Changnon, J. R. Angel, and K. E. Kunkel. Illinois State Water Survey, Champaign, Illinois, 2004.