

Composite of Brown County

General weather patterns and geography make Brown County susceptible to the threat of tornadoes. A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. Tornadoes are spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage produced by a tornado is a result of high wind velocity and wind-blown debris.

A weather event which appears frequently in Brown County is the microburst. Microbursts generally occur within an isolated area, but can cause damage similar to that of a tornado. This chapter will focus on the history of tornadoes and microbursts, and activities in place to mitigate the effects of their damage in Brown County.

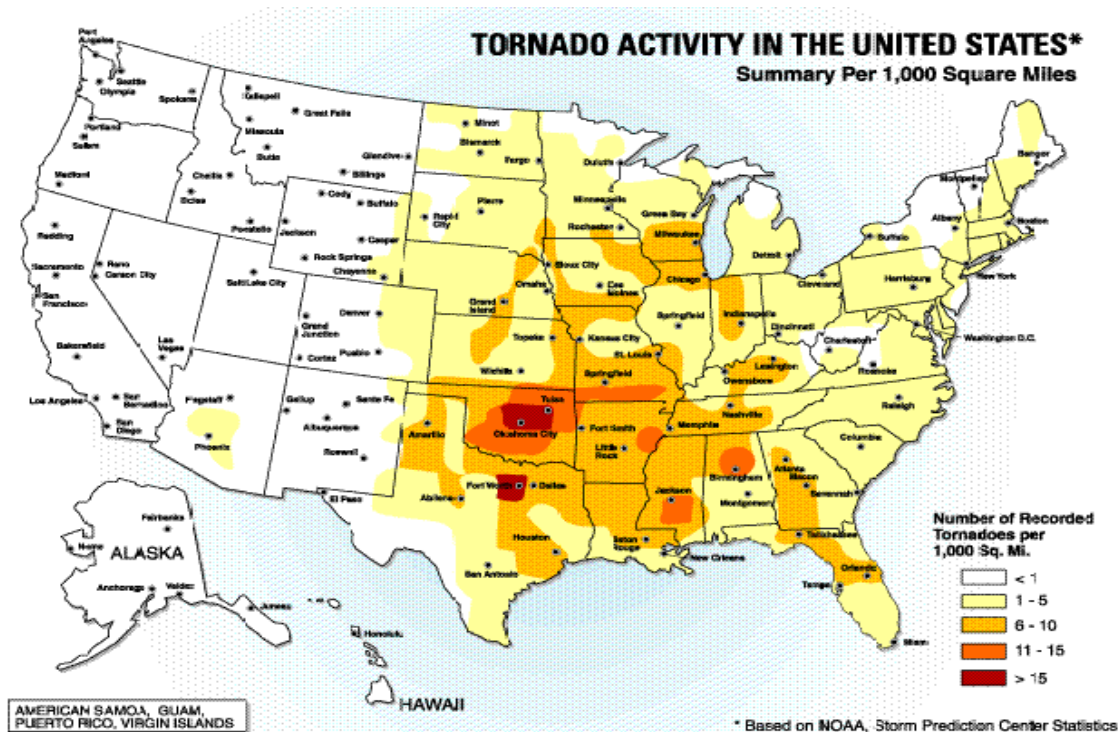


Figure I.1 The number of tornadoes recorded per 1,000 square miles

source: <http://www.fema.gov>

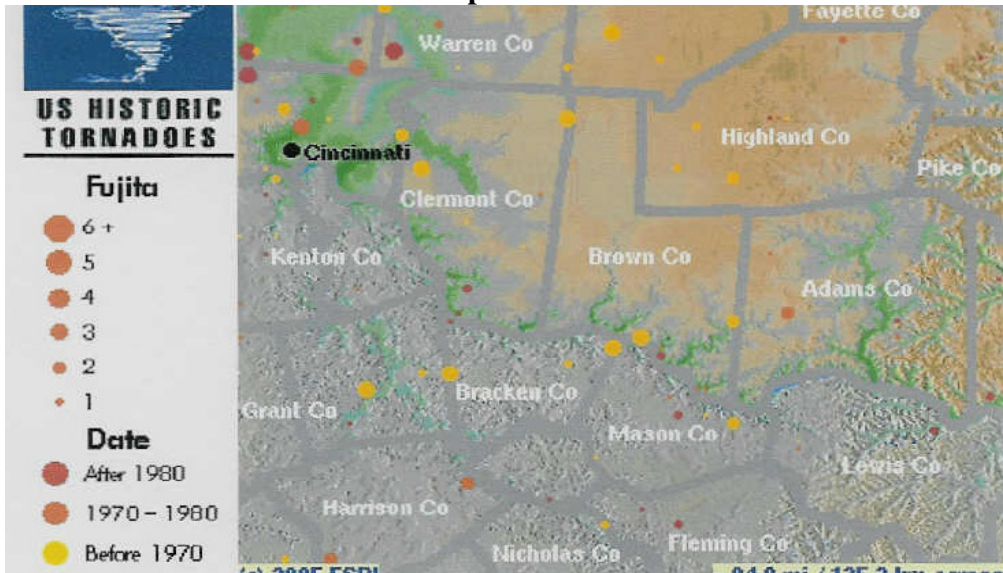
History

In Ohio the peak tornado season runs from April through mid-July, with June reporting the most occurrences. However, tornadoes and severe thunderstorms can and have occurred in any month. On Palm Sunday, April 11, 1965 a tornado outbreak devastated much of the Midwest. A total of 57 people died in Ohio from 47 tornadoes that occurred that day.

Devastating tornadoes struck Ohio during the afternoon and early evening of April 3, 1974 resulting in the death of 41 people, injuries of 2,000 and damage to more than 7,000 homes. The series of tornadoes that touched down in the western part of Ohio that day rank as one of the most devastating hazard events in recent Ohio history. Compared with other states, Ohio ranks 21 for frequency of tornadoes, 11 for number of deaths, 4 for injuries and 7 for cost of damages. Brown County has had 11 tornadoes reported for the period between January 1950 and January 2004, with only 1 recorded death during that same period. Fortunately, Brown County has not experienced maximum tornado damage.

Historic weather events collected by the National Weather Service during this same period indicate the most severe Tornado experienced in Brown County occurred on April 23, 1968. The tornado event registered F4 on the Fujita Scale, resulting in one death and four injuries. Damage and property loss totaled more than \$2 million.

Historic Tornado Touchdown Map



source: www.esri.com/hazards

This historic tornado touchdown data displayed on this site has been assembled by ESRI from various sources. The maps indicate the relative intensity of the historic tornadoes as measured on the Fujita Scale.



Characteristics of Tornadoes & Microbursts

Tornadoes

Tornadoes are capable of striking anywhere in the United States. A tornado is defined as a violently rotating column of air extending from the base of a thunderstorm to the ground. A tornado outbreak typically involves an intense upper-level disturbance that provides the strong vertical wind shear that gives an updraft its twisting motion. Approximately 1,000 tornadoes are spawned by severe thunderstorms each year.

Before thunderstorms develop, a change in wind direction and an increase in wind speed with increasing height creates an invisible, horizontal spinning effect in the lower atmosphere. Rising air within the thunderstorm's updraft tilts the rotating air from horizontal to vertical. Most strong and violent tornadoes form within this area of rotation.

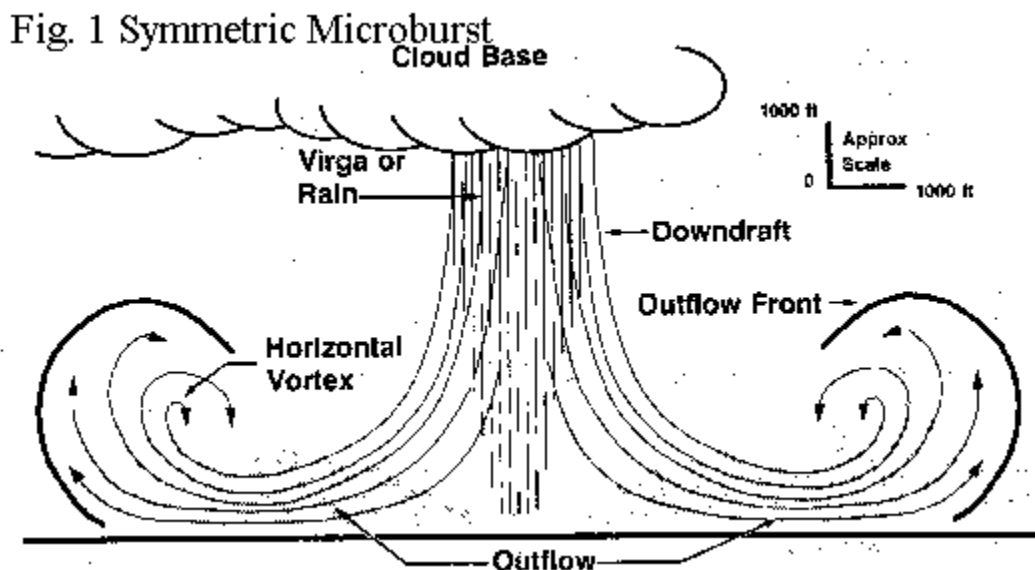


Microbursts

Microbursts (also known as downbursts) are powerful downdrafts associated with thunderstorms, rain showers and particularly hail or virga. Virga is rain that evaporates before it reaches the ground, causing a dry microburst. Hail and virga contribute to the downdraft as they evaporate while falling, thus cooling the environment and increasing the weight of the falling airmass.

Inside a thunderstorm there are powerful updrafts and, as the storm matures, downdrafts. The downdrafts are caused by factors such as the drag from heavy masses of rain and hail, and especially the fact that falling precipitation evaporates and cools the air, making it heavier than its environment. Most thunderstorms generate downdrafts, the cooling outward-rushing air that often breaks the heat of a hot summer afternoon. The leading edge of the downdraft is called the gustfront. It is sometimes marked by spectacular cloud features called shelf or roll clouds. On some occasions, downdrafts can become very intense, slamming into the surface with wind gusts well in excess of hurricane force. That is a downburst. The smallest of these is called a microburst, some of which may be only several hundred yards wide. Recent research has shown that much storm damage once ascribed to tornadoes is actually the result of microbursts. Their winds can equal that of small tornadoes and the damage looks as if a tornado went through the area. They can also be accompanied by very loud roaring noises. Wind speeds above 120 mph in downbursts are not that uncommon. In 1995, downburst winds were clocked at 136 mph at Grissom Air Force Base, Indiana, with some estimates as high as 140 mph in Miami County, Indiana.

Downdrafts associated with microbursts are typically a few hundred or a few thousand feet wide. As the downdraft hits the ground, it spreads out horizontally.



Moving thunderstorms can cause a microburst to have an uneven shape. The outflow is greater in one direction.

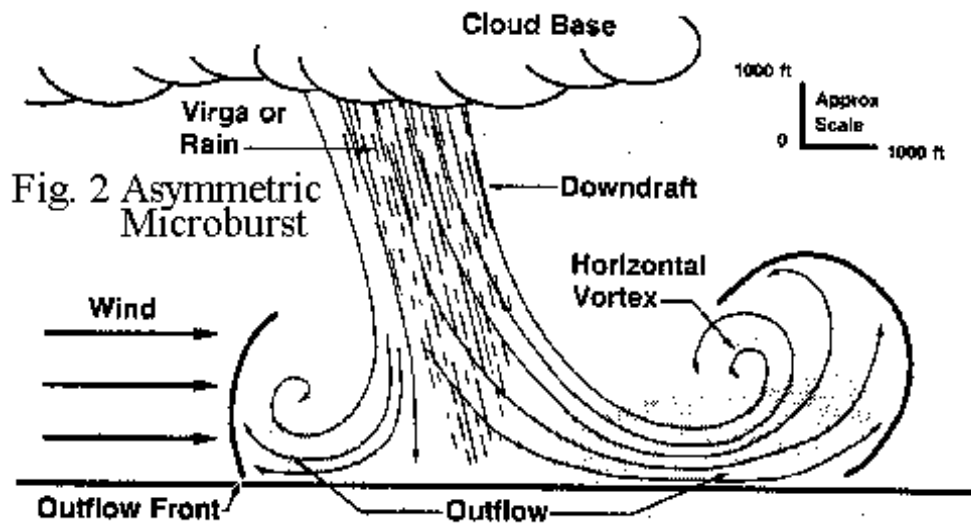


Fig. 2 Asymmetric Microburst

A microburst can occur without rain ever touching the ground as in the case of a virga. The rain evaporates causing a cooling of the air, which causes the downdraft.

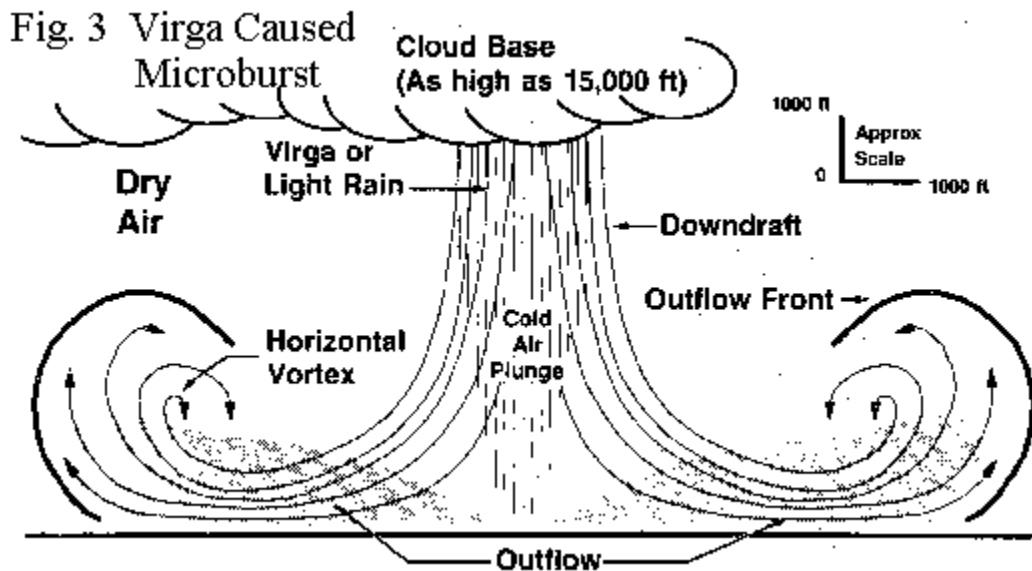


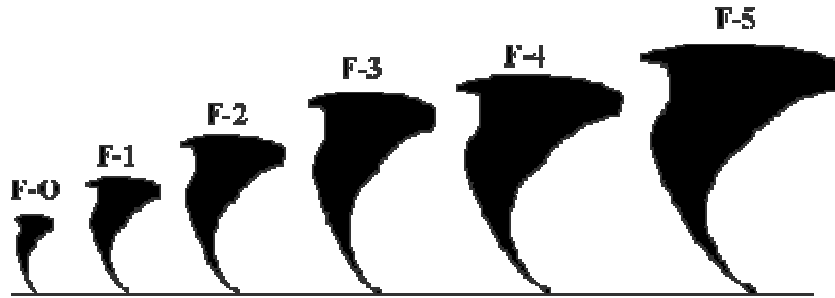
Fig. 3 Virga Caused Microburst

Weather Forecasting

A tornado watch is issued by the National Weather Service when weather conditions indicate a tornado is possible in the county. This is the best time to seek out a safe location to take cover, and listen to news or NOAA weather radio for further developments. A tornado warning is issued when a tornado has been sighted or is reflected on weather radar.

The Fujita Scale

Tornado damage severity is measured by the Fujita Tornado Scale. Named after its creator, Tetsuya Theodore Fujita, it assigns numerical values based on wind speeds and categorizes tornadoes from 0 to 5. The letter “F” usually precedes the numerical value. The graph shown below reflects the general characteristics of the Fujita Scale. Scale values above F5 are not used because wind speeds in excess of 318 mph is highly unlikely.



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

source: <http://www.fema.gov>

Public Education

The Brown County Emergency Management Agency is an active participant in Tornado Safety Week. Each year, businesses and schools participate in Brown County’s Tornado Safety Day drill to teach staff and schoolchildren about how to protect themselves in the event of a tornado.

Outdoor Siren Warning System

Brown County has several outdoor warning sirens. Currently there are 22 sirens located in the following areas of Brown County:

Aberdeen	1
Huntington Twp.	1
Ripley	2
Higginsport	1
Byrd Twp.	1
Russellville	1

Georgetown	2
Lewis Twp.	1
Hamersville	1
Lake Waynoka	2
Eagle Twp.	1
Sardinia	1
Mt. Orab	4
Lake Lorelei	1
Fayetteville	1
St. Martin	1

As development occurs and population growth increases, expansion of these systems should also occur.

Vulnerability and Risk

Anything in the path of a tornado is at risk. Rural areas are more exposed to tornadoes, but the destructive capability increases in urban areas, as was demonstrated in Xenia, Ohio.

While the county has a low number of recorded deaths and injuries from tornadoes, the potential for destruction and death remains. Population increases and further expansion of the outdoor siren warning system will also necessitate a continued emphasis on public education.