

Why the southern US is prone to December tornadoes

December 13 2021, by Alisa Hass, Kelsey Ellis

EF Rating	Wind Speeds	Expected Damage
EF-0	65-85 mph	<p>'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.</p> 
EF-1	86-110 mph	<p>'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.</p> 
EF-2	111-135 mph	<p>'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.</p> 
EF-3	136-165 mph	<p>'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.</p> 
EF-4	166-200 mph	<p>'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.</p> 
EF-5	> 200 mph	<p>'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.</p> 

Expected damage from tornadoes at different levels of the Enhanced Fujita (EF) scale, using examples from a massive outbreak in 2011. Credit: National Weather Service

On the night of Dec. 10–11, 2021, an outbreak of powerful tornadoes tore through parts of Arkansas, Mississippi, Missouri, Kentucky, Tennessee and Illinois, killing [dozens of people](#) and leaving wreckage over hundreds of miles. Hazard climatologists [Alisa Hass](#) and [Kelsey Ellis](#) explain the conditions that generated this event—including what may be the first "quad-state tornado" in the U.S.—and why the Southeast is vulnerable to these disasters year-round, especially at night.

What factors came together to cause such a huge outbreak?

On Dec. 10, a powerful storm system approached the central U.S. from the west. While the system brought heavy snow and slick conditions to the colder West and northern Midwest, the South was enjoying [near-record breaking warmth](#), courtesy of warm, moist air flowing north from the Gulf of Mexico.

The storm system ushered in cold, dense air to the region, which interacted with the warm air, creating [unstable atmospheric conditions](#). When warm and cold air masses collide, less dense warm air rises upward into cooler levels of the atmosphere. As this warm air cools, the moisture that it contains condenses into clouds and [can form storms](#).

When this instability combines with significant [wind shear](#)—winds shifting in direction and speed at different heights in the atmosphere—it can create an ideal setup for strong rotating storms to occur.

On a tornado ranking scale, how intense was this event?

At least [38 tornadoes](#) have been reported in six states during this outbreak, causing [widespread power outages, damage and fatalities](#). The

National Weather Service rates [tornadoes](#) based on the intensity of damage using 28 damage indicators from the [Enhanced Fujita, or EF, scale](#). Storm assessments and tornado ratings can take several days or longer to complete.

As of Dec. 12, [at least four](#) EF-3 and five EF-2 tornadoes have been confirmed. EF-2 and EF-3 tornadoes are considered strong, with wind speeds of 113–157 mph and 158–206 mph respectively.

Strong straight-line winds also occur with [severe storms](#) and can create as much damage as a tornado. After severe storms and reports of tornadoes, the National Weather Service conducts in-person storm damage surveys to determine whether a tornado or straight-line winds created the reported damage and the degree of damage. Investigators will look to see if debris is scattered in one direction, which would indicate straight-line winds, or in many different directions—the hallmark of a tornado.

One tornado reportedly traveled 240 miles across four states. Why is this unusual?

Most tornadoes stay on the ground for a short amount of time and [travel short distances](#)—[3–4 miles on average](#). Long-track and very long-track tornadoes—those that travel [at least 25 and 100 miles respectively](#)—are relatively uncommon. They account for [less than 1%](#) of all tornadoes in the United States.

Long-track tornadoes require [a very specific set of ingredients](#) that must exist across a wide area. These uncommon tornadoes form from a single [supercell storm](#)—a storm with a rotating updraft called a [mesocyclone](#)—that can persist for hours.

Significant tornadoes often stay on the ground longer than weaker tornadoes. Their tracks are [especially long in the Southeast](#), where significant tornadoes in the cool season move quickly, thus covering more ground.

The [previous record](#) for a long-track tornado was from 1925, when the F-5 Tri-State Tornado traveled 219 miles through Missouri, Illinois and Indiana. The "Quad-State Tornado," as this tornado has been nicknamed, is [expected to break that record](#). In the coming days, the National Weather Service will confirm whether one tornado stayed on the ground for more than 200 miles or multiple tornadoes resulted from the same [storm](#).

Why do more nighttime and winter tornadoes occur in the Southeast than in other regions?

Spring is typically considered tornado season, but tornadoes can occur at any time throughout the year. The Southeast experiences a [second peak](#) in tornadic activity in the fall and early winter, and winter tornadoes are not uncommon.

Similarly, tornadoes can happen at any time of the day. Nighttime tornado events are [especially common](#) in the Southeast, where the [ingredients for storms](#) are different and more conducive to nocturnal tornadoes than in "[Tornado Alley](#)" in the Great Plains.

Tornadic storms in the Southeast are often powered by an abundance of wind shear. They do not rely as heavily on rising warm, humid air that creates atmospheric [instability](#)—conditions that require daytime heating of the earth's surface and are more prevalent in the spring.

Forecasting for this event was [accurate](#) and predicted a major outbreak

several days in advance. The National Weather Service's [Storm Prediction Center](#) in Norman, Oklahoma, and the affected National Weather Service local Weather Forecast Offices issued timely watches, warnings and information on how to stay safe.

But nighttime tornadoes can be [especially deadly](#). More fatalities tend to occur because people often [don't receive warning communications](#) when they are sleeping. Storm spotting is [more difficult in the dark](#), and people are more likely to be in more vulnerable housing, such as mobile homes, at night than during the day when they are at work in sturdier buildings.

Having multiple reliable methods for receiving warnings at night is critical, since power can go out and cellphone service can go down during severe weather. Unfortunately, during the Dec. 10–11 event, some people who went to shelters were killed [when tornadoes struck the building](#) they were in. But timely warnings that allow people to shelter safely in a solid structure tied to a foundation or basement can mean survival during less-devastating events.

This article is republished from [The Conversation](#) under a Creative Commons license. Read the [original article](#).

Provided by The Conversation

Citation: Why the southern US is prone to December tornadoes (2021, December 13) retrieved 27 April 2024 from <https://phys.org/news/2021-12-southern-prone-december-tornadoes.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.