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Tornadoes are quite common in the Great Plains of the Central United States. This natural disaster, one of the most devastating atmospheric storms, happens very often in this region that it has been termed the Tornado Alley. So, can a tornado go through a brick house?Bricks are very strong, but they're not strong enough to withstand tornados. However, it's possible to limit damage to the property by tornado-proofing your house. You can install wind-resistant roofs and impact-resistant windows, prepare home shelter, secure the entry doors, and brace garage doors.Even though the strongest brick houses can't withstand tornados above the EF-3 category, it's still better than wood. The best construction against tornado is an insulated concrete form, but it can be quite costly. Here, we discuss whether a tornado can go through a brick house and how to protect your home against tornadoes.Bricks are one of the strongest building materials. This makes a brick house one likely to withstand any natural disasters. They can usually withstand hailstorms, high winds, wildfires, earthquakes, etc. But that doesn't mean they're invisible. Instead, they have higher durability than other materials such as wood and vinyl. The durability of bricks means they can better withstand high impact and are less likely to crack and dent.However, brick houses aren't safe from tornados. Regular bricks can't withstand tornados, especially those above the EF-3 intensity. But if it's between EF-0 and EF-3, it's possible for a brick house to survive, especially if it's not in the tornado's path. Even then, brick homes can be safer in a tornado as they're not combustible. So, they won't aid the spread of fires which could also happen when there's a tornado.The only kind of building that can withstand a tornado is an insulated concrete form. This building can withstand winds of over 200 mph due to its stiffness and structural capacity. Combining modern building codes with strong concrete material makes it possible to construct a house that can survive a tornado. However, the cost of such homes in terms of construction and energy efficiency means there aren't so popular in the country.Keeping your house safe in a tornado is very important, and it's best to do it well ahead of the Tornado. Ways to make your home Tornado-resistant include:All the doors leading into your house should be well-secured. Use deadbolt locks and hinges and extra-long screws to fasten the door and frame to the wall framing. The last thing you want is for the wind to tear away the door from its frame. Framing is very important if the entry doors are to survive as they're usually the weakest point. Once the door comes apart, wind and debris can enter the building, causing further damage indoors. You can also opt for a strong steel door to ensure better protection. But no matter the kind of door you get, you need to make sure the frames are strong.The garage door is another entry door that can be very vulnerable. This is the largest entry point into the house, and a missing garage door can compromise the entire structure of the building. Generally, a single car garage door can withstand up to 50 pounds of pressure per square foot, so it might not require bracing. But if you have a multi-car garage, you need to install support such as metal or wood stiffeners to make it stronger. Also, bracing makes it more resistant to wind. But if you sense a tornado and haven't braced your door, you can quickly install a vertical brace into the wall's framing just as if you're boarding it up.The regular roof installations aren't strong enough to withstand tornado winds. Thus, installing suitable roofs is important if you live in a tornado-prone area. Use hurricane clips rather than nails for the installation. These are usually compulsory in hurricane-prone areas and help maintain roof integrity.You don't want your certificates flying around in the wind. So, make sure they're all in one place, and you can easily pick them up and take them with you when you're leaving for a shelter. Although you can always store some documents online, Cloud storage comes with risks. You can also get a sturdy safe with a high-tech lock for keeping your valuables safe.It's important to have a home shelter when you live in a tornado-prone area. This shelter should have all the basic items for survival, such as battery-powered flashlights and radios, batteries, water, and food that doesn't require cooking. You should also have some cash because machines might not work after a tornado. In addition, the home shelter should be the safest part of the house, usually the basement. Apart from this, only places such as storm cellars and specially constructed bunkers can offer better protection during a tornado.If your house doesn't have a basement, the safest place will be an inside room on the lowest floor of the house. This could be a bathroom, center hallway, or closet. It's best if that room doesn't have windows, and you can also stay under something heavy such as a workbench or sturdy table. It is also advisable to cover your head with a helmet, blankets, or mattresses during a tornado to prevent any debris from falling on your head. Whatever you do, it's not advisable to stay upstairs in a tornado. Any room above the roofline would be easily exposed to the tornado.If you live in tornado-prone areas, you need impact-resistant windows. Shattered windows are one of the major causes of injury during a tornado. So, it's best to go for impact-resistant windows, especially if it's a new home or you're remodeling. This kind of window costs more than regular windows, but they offer better protection. In some parts of Florida and Texas, where tornadoes are common, these windows are required by law.Another option is to go for hurricane shutters which can also be customized to fit your residence. At worst, you should have plywood covers for your windows. You can have these covers made long before the tornado. Make sure they're big enough to cover the window's exterior frame and have long screws for attaching them to the windows. Put them up when a storm is near for protection. It's important to close all windows when a tornado is coming. Leaving the window open will increase the air pressure inside the house, forcing the house to collapse like a balloon after reaching its expansion limit.Brick houses are quite strong, but they can't withstand a tornado. This will depend on the tornado's intensity and whether it's in the tornado path. Regardless, it's always better to tornado-prof your house. Floor, walls, and ceiling, with a foundation dug deep into the ground. After seeing firsthand the atomic blast like destruction that a tornado can cause l wouldn't feel safe in even one of these saferooms. So, No. A brick house cannot withstand a tornado. Likewise, can a tornado destroy a brick house?A big enough tornado will take out anything above ground. A big enough hurricane will take out most anything above ground. Brick and concrete homes will withstand higher winds than most wood construction, but it's actually the type and quality of construction, based on local building codes, that determine storm damage.Similarly, are brick homes stronger? Even if you have a fire, brick walls will keep it contained to one particular room or part of the house. Brick structures can also handle high-speed objects flying into them from high winds much better than other materials. Because of its color retention and durability, brick doesn't take a lot of upkeep. In this way, are brick houses better in hurricane? A brick, stone, or concrete wall is usually going to stand up to high winds better than a timber frame wall but your problem more often than not is going to be your roof, which is still usually timber. A timber frame house is much more likely to get swept away.Are brick houses better than wood houses? Buying or Building a Wood Home While wood is more affordable than brick, according to a 2017 study conducted by RSMeans and the Brick Industry Association, the national average total construction cost of a clay brick-sided home is only two percent more than wood and fiber cement. So it's cheaper but not by much. Masonry Nation Brick & Stone Masonry Services, Ottawa. Home » Can a Brick House Protect You From Tornados? Published December 14, 2021 Most brick houses could withstand a tornado as strong as EF2 and remain mostly intact. Around EF3 intensity, through even brick houses will be largely destroyed. If the house is hit by EF5 winds, it doesn't stand a chance. Can a tornado pick up a concrete house? That's why nobody really tornado-proofs an entire house; it's expensive and for the 99 percent of the time that you're not being bombarded with a tornado, you'll hate it. But that's really the only way to fully tornado-proof a home: thick concrete, properly anchored in the ground, will withstand pretty much anything. Can a concrete house survive a hurricane? If you've been watching the news about Florida's devastating category 4 hurricane, Hurricane Michael, you will know the answer to this question—yes, concrete homes can absolutely withstand hurricanes! Walls were built of 1-foot thick poured concrete, reinforced with rebar and cables. What wind speed can a brick house withstand? In a hurricane simulation study called the Three Little Pigs Project, a full-scale two-story red brick house will be hit with the equivalent of 186-mile-per-hour winds and sprayed with water until it is on the brink of collapse. READ: What does a shadow on your breast mean?How much wind speed can a concrete house withstand? An average house can usually withstand wind speeds of about a 100 mph, or 110 mph if located in an area where strong winds are a common event. Are brick houses better in hurricane? The answer is NO. If you are under 14 yrs of age, no, a brick home cannot survive a hurricane much better than a wooden built home. A brick house is brick just on the outside and is no stronger than any other house. Are houses cheaper in tornado Alley? Because of the risk of hail damage, tornadoes and flooding are greater in tornado zones, your mortgage, insurance, and other costs will typically be higher as well – making getting a mortgage more difficult if you're on a tight budget. Are brick houses better insulated? Brick generally offers better insulating capabilities than other building materials. Brick absorbs and releases heat slowly during the day, keeping homes cooler during the day and warmer at night. READ: Can Zerodha steal your money?Can hurricanes destroy concrete houses? Researchers at the National Wind Institute of Texas Tech University in Lubbock have determined that concrete walls are strong enough to withstand flying debris from hurricanes and tornadoes. Is a brick house safe in a hurricane? For centuries, buildings constructed of brick have withstood the ravages of hurricanes, tornadoes, high winds, hail and punishing rain. When used in conjunction with modern building codes, brick homes can remain standing when others on the same block might be destroyed. Can a tornado take out a brick house? A big enough tornado will take out anything above ground. A big enough hurricane will take out most anything above ground. Brick and concrete homes will withstand higher winds than most wood construction, but it's actually the type and quality of construction, based on local building codes, that determine storm damage. Can you live in a house that can withstand a tornado? You can live in a house made of solid concrete, with a steel door and no windows. You'd probably have to build it from scratch, though. Uhhhh But that's really the only way to fully tornado-proof a home: thick concrete, properly anchored in the ground, will withstand pretty much anything. READ: Why Nokia is not popular anymore?Can a brick house survive a hurricane? Hurricanes, Tornadoes, Rain and Hail Are No Match for Brick For centuries, buildings constructed of brick have withstood the ravages of hurricanes, tornadoes, high winds, hail and punishing rain. When used in conjunction with modern building codes, brick homes can remain standing when others on the same block might be destroyed. Is it possible to have a hurricane proof house? If the structure is really really strong, then yes, you could have a hurricane proof house. A brick and concrete structure should be very strong, able to resist huge forces – provided that the pressure doesn't blow the windows out or the root off! Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. How can financial brands set themselves apart through visual storytelling? Our experts explain how.Learn MoreThe Motorsport Images Collections captures events from 1895 to today's most recent coverage.Discover The CollectionCurated, compelling, and worth your time. Explore our latest gallery of Editors' Picks.Browse Editors' FavoritesHow can financial brands set themselves apart through visual storytelling? 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This article delves into the safety of brick buildings during tornadoes, examining their resilience, the factors influencing their performance, and essential considerations for improving their safety.Brick buildings are constructed using a variety of materials including:Clay Bricks: Fired in kilns to increase durability. Concrete Bricks: Made from a mixture of cement, sand, and aggregate. Mortar: Used to bind bricks together.These components create a robust structure, but their effectiveness in tornado conditions can vary based on several factors.Brick buildings offer numerous benefits:Durability: Bricks are known for their strength and longevity. Fire Resistance: Brick structures have high fire resistance compared to other materials. Thermal Mass: Bricks provide excellent thermal insulation, maintaining stable indoor temperatures.Brick buildings are often praised for their ability to withstand high winds, but several factors influence their safety during tornadoes:Brick Quality: Higher quality bricks with fewer defects are more resistant to damage. Mortar Strength: Strong mortar is crucial for holding bricks together during intense wind forces. Construction Methods: Proper construction techniques, including reinforcement and proper mortar application, enhance stability.Despite their strengths, brick buildings have vulnerabilities in tornado conditions:Lack of Reinforcement: Unreinforced brick walls may collapse under severe wind pressures. Structural Weak Points: Areas such as windows, doors, and roof joints can be weak points. Flying Debris: Tornadoes often carry debris that can cause significant damage to brick walls.Reinforcing a brick building can significantly enhance its ability to withstand tornadoes:Steel Reinforcement: Adding steel bars or mesh within the mortar can provide additional strength. Bond Beams: Horizontal reinforcements known as bond beams can distribute stress more evenly across the structure.Adhering to best practices during construction ensures greater resilience:Foundation: A strong, well-anchored foundation is essential for withstanding tornado forces. Mortar Application: Ensure that mortar is applied correctly and cured properly to maximize its strength. Wall Thickness: Thicker walls provide better resistance against high winds.Incorporating tornado-resistant features into the design can improve safety:Aerodynamic Shapes: Designing buildings with aerodynamic shapes can reduce wind pressure on surfaces. Impact-Resistant Windows: Installing impact-resistant windows can protect against debris and wind forces.Analyzing historical data provides insight into the performance of brick buildings during tornadoes:Case Study 1: A review of tornado damage in Midwestern cities reveals that well-constructed brick buildings often fare better than frame structures. Case Study 2: Tornado damage assessments show that brick buildings with proper reinforcement withstand tornadoes with less structural damage.Lessons from past tornado events highlight the importance of:Reinforcement: Proper reinforcement is crucial for brick buildings to survive extreme conditions. Design Adaptations: Implementing tornado-resistant design features can mitigate potential damage.Maintenance and PreparationRegular inspections can help identify and address vulnerabilities:Check for Cracks: Inspect brick walls for any signs of cracking or damage. Evaluate Mortar: Ensure that mortar joints are intact and replace any deteriorated mortar.Being prepared for tornadoes involves:Safe Rooms: Designating a safe room within the building where occupants can shelter during a tornado. Emergency Plans: Developing and practicing emergency evacuation plans.Brick buildings offer substantial protection against tornadoes due to their durability and strength. However, their effectiveness can be compromised without proper reinforcement and construction practices. By incorporating recommended reinforcement techniques, adhering to best construction practices, and considering design modifications, brick buildings can be significantly enhanced to withstand the severe conditions of a tornado. When tornado sirens are blaring, wondering where to seek shelter from the storm is the last thing you want to be thinking.And while your home's basement is the safest place to be in a tornado, they weren't built as storm shelters. While a basement may provide some protection against weaker tornadoes, houses – and most buildings in general – aren't designed to resist the most extreme wind speeds associated with tornadoes like the ones that struck Illinois and Kentucky in late 2021, according to Rose Quint, the assistant vice president of survey research at the National Association of Home Builders. "Only a storm shelter or safe room specifically designed to resist tornadoes will keep occupants safe," Quint said. "A portion of a basement could be constructed to those standards if a homeowner desired, or prefabricated units that can be bolted to the concrete floor of a basement are available."TORNADO SAFETY: IDENTIFYING THE SAFEST PLACES INSIDE YOUR HOMENew homes in the South lack basementsMost basements are reinforced concrete walls buried underground. The International Residential Code, which forms the basis for most residential building codes adopted in the U.S., tabulates how thick a concrete or masonry basement wall needs to be and the amount of any steel reinforcing needed in the wall. The code also specifies measures to protect against groundwater or rainwater leaking into a basement."The digging has to happen by code," Quint said.That code, she added, requires the footings of a house must extend at least 12 inches below the undisturbed ground surface or to the frost line – the depth to which the ground freezes in the winter. For some regions where it's already necessary to dig deep to build foundations that will withstand freezing temperatures, adding a basement makes economic sense. "The frost line is much deeper in the colder Northeast and Midwest regions of the U.S. than in the warmer South and West, as much as 3 or 4 feet below the ground in some places," Quint said. "Once you are excavating down that far and removing that much soil, going down a few more feet to create a basement is cost-effective."HOW TO WATCH FOX WEATHERWhen comparing new homes in the U.S. and across the four regions, the United States Census Bureau showed the share with a full or partial basement in 2020 was as high as 68% in the Northeast and as low as 6% in the South, where the ground is not conducive for basements."In Florida, the high level of the water table makes it impossible to have a basement," Quint said.No such thing as guaranteed safety when it comes to tornadoesBut recently, the South has been among the most active for tornadoes.There were 1,374 tornadoes in the U.S. in 2021, and about 10% of them were reported in Texas. Alabama and Mississippi were a close second and third with more than 200 combined.EF-4, EF-5 TORNADOES: 7 THINGS TO KNOW ABOUT EARTH'S MOST VIOLENT CYCLONESThere is no such thing as guaranteed safety inside a tornado, according to the National Oceanic and Atmospheric Administration's Storm Prediction Center.But while the most violent and rare EF-5 tornado can level and blow away almost any house, most tornadoes are much weaker and can be survived using some safety precautions – chiefly, taking advantage of a basement if your home happens to have one.In a house with a basement, NOAA recommends avoiding windows and finding a sturdy object to hide underneath, like a heavy table, or cover yourself with a mattress or sleeping bag. "This protects you from flying debris and also walls or roofs that may collapse," says FOX Weather meteorologist Stephen McCloud. "There have been several studies on where to go or what corner of the basement do you shelter in. Regardless, being underground is your safest bet."MOORE 9-YEAR ANNIVERSARY HIGHLIGHTS RECORD-LONG EF-5 TORNADO DROUGHT IN U.S.You also want to avoid staying under any heavy objects that might be placed on the floor above you, like a refrigerator or furniture. A weakened floor might cause those items to crush you.If you don't have a basement, an interior room of your home with no windows is the next place to go in the event of a tornado. Anyone living in a mobile home should get out and find a more stable structure where they can take shelter. The question of whether brick homes are safer in tornadoes is complex and doesn't have a simple yes or no answer. The short, most accurate response is that brick homes offer improved resistance against tornado damage compared to some other building materials, but they are not tornado-proof. Their performance in a tornado depends on several factors, including the strength of the tornado, the building's construction quality, and the presence of additional storm-proofing measures. While brick provides inherent robustness, it is crucial to understand its limitations and how it compares to other building strategies in tornado-prone regions. Brick Homes and Tornado Resistance: An In-Depth Look The Advantages of Brick Brick has long been a popular building material, and for good reason. Its inherent properties provide significant advantages, particularly in severe weather conditions: Wind Resistance: Brick is dense and heavy, offering substantial resistance to wind pressure. This inherent strength allows brick structures to withstand higher wind speeds than buildings constructed from lighter materials like wood or vinyl siding. A brick home can often remain standing during storms that might easily damage or destroy less robust structures. The article says, "Brick holds up to wind and impacts better than other building materials." Impact Resistance: Unlike some siding materials, brick is not easily damaged by impact from flying debris, which is a common hazard in tornadoes. This resistance is vital, as airborne objects are a major source of damage during severe wind events. The density and solidity of brick help it to deflect debris, reducing the risk of penetration and structural compromise. Fire Resistance: Although fire is not a direct risk from tornadoes, brick's fire resistance is an added advantage. In the event of a post-tornado fire, brick can help contain the blaze, preventing it from spreading to neighboring structures. The article states, "because brick homes are not flammable, they can be less risky in hurricanes." The Limitations of Brick Despite its benefits, brick is not impervious to tornado damage. Certain limitations must be considered: Tornado Intensity: The crucial factor is the strength of the tornado. While brick homes can often withstand EF0, EF1, and even EF2 tornadoes with minimal structural damage, their ability to resist wanes as tornado intensity increases. The article says, "Most brick houses could withstand a tornado as strong as EF2 and remain mostly intact." EF3 and Above: When dealing with an EF3 tornado and higher, even brick homes face significant risk of damage and possible destruction. The sheer power of high winds in these categories can compromise the structural integrity of a brick building. This can lead to roof loss, wall collapse, and overall building failure. The article notes "Around EF3 intensity, though even brick houses will be largely destroyed." Mortar Weakness: While bricks themselves are strong, the mortar that binds them together can be a weak point. During an earthquake or under extreme wind pressure, mortar can crack, leading to the disintegration of the masonry. While this article focuses on tornadoes, the article says "The mortar holding the masonry together is generally not strong enough to resist earthquake forces." Foundation and Roof Connection: The connection between the brick structure, foundation, and roof plays a key role in how well it will perform in a tornado. Inadequately secured roofs and foundations can lead to building collapse even if the brick walls remain intact. The article notes that a video shows, "an F5 tornado … lifting a well-anchored brick house from its foundation and tearing it apart in midair." Debris: While brick itself is good at stopping debris, if the roof or windows fail, then the damage can increase greatly inside the house. The Importance of Comprehensive Storm Proofing It's essential to recognize that building construction is not solely about material selection; it's a holistic process. To maximize the protection offered by a brick home, several additional measures need to be implemented: Reinforced Construction: Homes constructed using techniques like insulated concrete forms (ICF), which can withstand winds over 200 mph, can provide a superior level of protection. "Homes built with insulated concrete forms (ICF) … maintain their integrity during the high winds of a tornado. Insulating concrete forms can withstand winds of over 200 mph." Secure Roof: A well-anchored roof is critical. Proper roof-to-wall connections, reinforced truss systems, and the use of impact-resistant roofing materials are essential. Impact-Resistant Windows and Doors: Installing windows and doors rated for high-wind conditions helps minimize damage from flying debris and pressure fluctuations. The article says, "Missile-resistant walls, roof, windows, doors, and garage doors to protect it from airborne debris." Storm Shelters: The safest place during a tornado is an underground storm shelter or basement. If a shelter is not available, move to an interior room on the lowest level of the house. The article says "the safest place to be when a tornado approaches is in a basement or storm shelter underground." and "If there is no basement, go to an inside room, without windows, on the lowest floor. This could be a center hallway, bathroom, or closet." Safe Rooms: Constructing a designated safe room within your home designed to meet FEMA guidelines provides an added layer of protection, especially during the most severe storms. The article says, "A safe room is a storm shelter specifically designed to meet FEMA Funding Criteria and provide near-absolute protection in extreme wind events, including tornadoes and hurricanes." Maintenance: Keeping your house well maintained and checking it for damage is an important step to preparing for a tornado. The article lists, "Trim your trees, Know how to turn off utilities, Avoid creating more flying objects, Strengthen the weak spots, Check gutters and down spouts, and Keep your roof in good shape." Conclusion While brick homes offer significant advantages when dealing with tornadoes, they are not tornado-proof. Their ability to withstand a tornado depends heavily on the strength of the storm. To enhance safety, it's crucial to integrate brick with comprehensive storm-proofing measures. These measures include building according to modern codes, reinforcing vulnerable parts of the structure, and installing storm-resistant materials. Most importantly, having a designated safe space, like a basement or a safe room, is paramount for protection during a tornado. Therefore, while a brick house can be safer than some other alternatives, it's only one aspect of a multi-layered strategy for protection from extreme weather events. Frequently Asked Questions (FAQs) 1. Can a brick house withstand a Category 5 hurricane? While brick is durable, a regular brick house may not withstand the full force of a Category 5 hurricane, particularly if it's in the direct path of the storm. The article says, "Regular bricks cannot endure storms, particularly ones that are more intense beyond a certain point." However, brick homes can be less risky due to their fire resistance. 2. Is a brick house better than a wood house in an earthquake? No, wood-frame houses generally fare better in earthquakes than brick homes. Wood is more flexible and can withstand the shaking better, carrying less weight and thus less chance of a catastrophic collapse. The article states, "Wood-frame houses actually survive earthquakes much better than concrete as they ride the shaking much better, carry much less weight…". 3. Can a brick house survive a tsunami? A brick house can withstand a small tsunami, but is not resistant to large tsunamis. According to the article, " The brick house can only take tsunamis less than 20 feet." 4. Can an F5 tornado destroy a brick house? Yes, an F5/EF5 tornado can destroy a brick house. The wind speed is so high it will destroy anything in its path. The article says, "Virtually nothing can withstand and F5/EF5 tornado." and, "*the only *safe* place from an F5 is underground or out of it's path.*" 5. Are there tornado-proof houses? No, there is no such thing as a completely tornado-proof house. While homes can be built with increased tornado resistance, the extreme forces of a strong tornado mean that complete protection is impossible. The article states, "Simply, no. There's no such thing as a completely tornado-proof house." 6. Can a concrete house withstand a tornado? A concrete house can withstand tornadoes up to EF-3. The article states, "A concrete home can withstand EF-O or even an EF-3 tornado. However, they can not resist an EF-4 or above tornado with a wind speed of more than 200 miles per hour." 7. What is the safest building for a tornado? The safest place during a tornado is underground in a basement or storm shelter. If no shelter is available, an interior, windowless room on the lowest floor is the next best option. The article says, "Of course, the safest place to be when a tornado approaches is in a basement or storm shelter underground." 8. What corner of the house is safest in a tornado? The safest location is the interior of a basement. If no basement is available, move to an inside room on the lowest floor with no windows like a hallway, closet, or bathroom. The article states, "The safest place in the home is the interior part of a basement." and "If there is no basement, go to an inside room, without windows, on the lowest floor." 9. What are the disadvantages of brick houses? Brick houses are more expensive to build compared to other materials and can be prone to issues like mold and plant growth. The article notes, "Though durable, brick is more expensive than many other building materials, and a brick home may cost 6 to 7 percent more than one with vinyl siding." and, "Porous brick can be vulnerable to mold in damp conditions, and It can also be damaged by plant growth, such as ivy." 10. Why don't they build brick houses anymore? The rise of alternative building materials like fiber cement and vinyl siding, as well as concrete forms, has led to a decline in brick construction. These materials can offer durability, energy efficiency and are low maintenance. The article states, "Modern materials like fiber cement siding, vinyl siding, and insulated concrete forms offer durability, energy efficiency, and low maintenance…" 11. How long do brick homes last? Brick homes can last at least 100 years with minimal maintenance, and potentially 500 years or more with regular care. The article states, "Brick houses can last at least 100 years with minimal maintenance. With regular care and attention… brick houses can last 500 years or more." 12. What can withstand an F5 tornado? Very little can withstand the full force of an F5 tornado. The best protection is to be in a reinforced underground shelter. The article notes, "*the only *safe* place from an F5 is underground or out of it's path.*" 13. Can wind pick up a brick? Yes, strong winds can lift a loose brick. The article states, "Yes, a loose brick on the ground outside can still be lifted by strong winds such as a hurricane." 14. How fast can a tornado destroy a house? A moderately powerful tornado can completely destroy a house in as little as four seconds. The article says, "Four seconds is all a moderately powerful tornado needs to wipe a foundation clean." 15. Would a brick house survive a fire? Brick is a non-combustible material, so a brick house will not burn and will help contain a fire. The article says, "According to most building codes, brick is officially listed as "non-combustible."… Fire will not penetrate brick walls from the outside." Violently rotating column of air For the current tornado season, see Tornadoes of 2025. This article is about the weather phenomenon. For other uses, see Tornado (disambiguation). TornadoThe 2007 Elie tornado approaching Elie, Manitoba, Canada in June 2007.Area of occurrenceNorth America (particularly in central and southeastern regions of the United States colloquially known as Tornado Alley), South Africa, much of Europe (except most of the Alps), western and eastern Australia, New Zealand, Bangladesh and adjacent eastern India, Japan, the Philippines, and southeastern South America (Uruguay and Argentina)SeasonPrimarily spring and summer, but can occur at any time of year with the right atmospheric conditionsEffectWind damage Part of a series onWeather Temperate and polar seasons Winter Spring Summer Autumn Tropical seasons Dry season Harmattan Wet season Storms Cloud Cumulonimbus cloud Arcus cloud Downburst Microburst Heat burst Derecho Lightning Volcanic lightning Thunderstorm Air-mass thunderstorm Thundersnow Dry thunderstorm Mesocyclone Supercell Tornado Anticyclonic tornado Landspout Waterspout Dust devil Fire whirl Anticyclone Cyclone Polar low Extratropical cyclone European windstorm Nor'easter Subtropical cyclone Tropical cyclone Atlantic hurricane Typhoon Storm surge Dust storm Simoom Haboob Monsoon Amihan Gale Sirocco Firestorm Winter storm Ice storm Blizzard Ground blizzard Snow squall Precipitation Drizzle Freezing Graupel Hail Megacryometeor Ice pellets Diamond dust Rain Freezing Cloudburst Snow Rain and snow mixed Snow grains Snow roller Slush Topics Air pollution Atmosphere Chemistry Convection Physics River Climate Cloud Physics Fog Mist Season Cold wave Heat wave Jet stream Meteorology Severe weather List Extreme Severe weather terminology Canada Japan United States Weather forecasting Weather modification Glossaries Meteorology Climate change Tornado terms Tropical cyclone terms Weather portalvte Wikimedia Commons has media related to Tornadoes. Wikimedia Commons has media related to Pictures of tornadoes. A tornado is a violently rotating column of air that is in contact with the surface of Earth and a cumulonimbus cloud or, in rare cases, the base of a cumulus cloud. It is often referred to as a twister, whirlwind or cyclone,[1] although the word cyclone is used in meteorology to name a weather system with a low-pressure area in the center around which, from an observer looking down toward the surface of the Earth, winds blow counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.[2] Tornadoes come in many shapes and sizes, and they are often (but not always) visible in the form of a condensation funnel originating from the base of a cumulonimbus cloud, with a cloud of rotating debris and dust beneath it. Most tornadoes have wind speeds less than 180 kilometers per hour (110 miles per hour), are about 80 meters (250 feet) across, and travel several kilometers (a few miles) before dissipating. The most extreme tornadoes can attain wind speeds of more than 480 kilometers per hour (300 mph), can be more than 3 kilometers (2 mi) in diameter, and can stay on the ground for more than 100 km (62 mi).[3][4][5] Various types of tornadoes include the multiple-vortex tornado, landspout, and waterspout. Waterspouts are characterized by a spiraling funnel-shaped wind current, connecting to a large cumulus or cumulonimbus cloud. They are generally classified as non-supercellular tornadoes that develop over bodies of water, but there is disagreement over whether to classify them as true tornadoes. These spiraling columns of air frequently develop in tropical areas close to the equator and are less common at high latitudes.[6] Other tornado-like phenomena that exist in nature include the gustnado, dust devil, fire whirl, and steam devil. Tornadoes occur most frequently in North America (particularly in central and southeastern regions of the United States colloquially known as Tornado Alley; the United States has by far the most tornadoes of any country in the world).[7] Tornadoes also occur in South Africa, much of Europe (except most of the Alps), western and eastern Australia, New Zealand, Bangladesh and adjacent eastern India, Japan, the Philippines, and southeastern South America (Uruguay and Argentina).[8][9] Tornadoes can be detected before or as they occur through the use of pulse-Doppler radar by recognizing patterns in velocity and reflectivity data, such as hook echoes or debris balls, as well as through the efforts of storm spotters.[10][11] See also: Research history of tornadoes There are several scales for rating the strength of tornadoes. The Fujita scale rates tornadoes by damage caused and has been replaced in some countries by the updated Enhanced Fujita Scale. An F0 or EF0 tornado, the weakest category, damages trees, but not substantial structures. An F5 or EF5 tornado, the strongest category, rips buildings off their foundations and can deform large skyscrapers. The similar TORRO scale ranges from T0 for extremely weak tornadoes to T11 for the most powerful known tornadoes.[12] The International Fujita scale is also used to rate the intensity of tornadoes and other wind events based on the severity of the damage they cause.[13] Doppler radar data, photogrammetry, and ground swirl patterns (trochoidal marks) may also be analyzed to determine intensity and assign a rating.[14][15] Tornadoes are so common in the U.S. that plotting their mid-points alone generates a recognizable map of the U.S. ...all tornadoes in the US, 1950–2013, highest F-scale on top, source NOAA Storm Prediction Center. The word tornado comes from the Spanish tronada (meaning 'thunderstorm', past participle of tronar 'to thunder', itself in turn from the Latin tonāre 'to thunder').[16][17] The metathesis of the r and o in the English spelling was influenced by the Spanish tornado (past participle of tornar 'to twist, turn,', from Latin tornō 'to turn').[16] The English word has been reborrowed into Spanish, referring to the same weather phenomenon. Tornadoes' opposite phenomena are the widespread, straight-line derechos (/dəˈreɪtʃoʊ/, from Spanish: derecho Spanish pronunciation: [deˈɾetʃo], 'straight'). A tornado is also commonly referred to as a "twister" or the old-fashioned colloquial term cyclone.[18][19] A tornado is a violently rotating column of air, in contact with the ground, either pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud.[20] For a vortex to be classified as a tornado, it must be in contact with both the ground and the cloud base. The term is not precisely defined; for example, there is disagreement as to whether separate touchdowns of the same funnel constitute separate tornadoes.[5] Tornado refers to the vortex of wind, not the condensation cloud.[21][22] Main article: Funnel cloud A tornado near Anadarko, Oklahoma, 1999. The funnel is the thin tube reaching from the cloud to the ground. The lower part of this tornado is surrounded by a translucent dust cloud, kicked up by the tornado's strong winds at the surface. The wind of the tornado has a much wider radius than the funnel itself. A tornado is not necessarily visible; however, the intense low pressure caused by the high wind speeds (as described by Bernoulli's principle) and rapid rotation (due to cyclostrophic balance) usually cause water vapor in the air to condense into cloud droplets due to adiabatic cooling. This results in the formation of a visible funnel cloud or condensation funnel.[23] There is some disagreement over the definition of a funnel cloud and a condensation funnel. According to the Glossary of Meteorology, a funnel cloud is any rotating cloud pendant from a cumulus or cumulonimbus, and thus most tornadoes are included under this definition.[24] Among many meteorologists, the "funnel cloud" term is strictly defined as a rotating cloud which is not associated with strong winds at the surface, and condensation funnel is a broad term for any rotating cloud below a cumuliform cloud.[5] Tornadoes often begin as funnel clouds with no associated strong winds at the surface, and not all funnel clouds evolve into tornadoes. Most tornadoes produce strong winds at the surface while the visible funnel is still above the ground, so it is difficult to discern the difference between a funnel cloud and a tornado from a distance.[5] Main articles: Tornado family, tornado outbreak, and tornado outbreak sequence Occasionally, a single storm will produce more than one tornado, either simultaneously or in succession. Multiple tornadoes produced by the same storm cell are referred to as a "tornado family".[25] Several tornadoes are sometimes spawned from the same large-scale storm system. If there is no break in activity, this is considered a tornado outbreak (although the term "tornado outbreak" has various definitions). A period of several successive days with tornado outbreaks in the same general area (spawned by multiple weather systems) is a tornado outbreak sequence, occasionally called an extended tornado outbreak.[20][26][27] This F5 rated tornado in Wichita Falls, Texas in April 1964, has a "rope" structure. This usually occurs when a tornado first forms or when a tornado ropes out and dissipates. This nocturnal wedge EF5 tornado near Greensburg, Kansas in May 2007, has a "wedge" structure, these can reach widths of 1 mile or even 2 miles in rare occasions. Most tornadoes take on the appearance of a narrow funnel, a few hundred meters (yards) across, with a small cloud of debris near the ground. Tornadoes may be obscured completely by rain or dust. These tornadoes are especially dangerous, as even experienced meteorologists might not see them.[28] Small, relatively weak landspouts may be visible only as a small swirl of dust on the ground. Although the condensation funnel may not extend all the way to the ground, if associated surface winds are greater than 64 km/h (40 mph), the circulation is considered a tornado.[21] A tornado with a nearly cylindrical profile and relatively low height is sometimes referred to as a "stovepipe" tornado. Large tornadoes which appear wider than their cloud-to-ground height can look like large wedges stuck into the ground, and so are known as "wedge tornadoes" or "wedges".[29] The "stovepipe" classification is also used for this type of tornado if it otherwise fits that profile. A wedge can be so wide that it appears to be a block of dark clouds, wider than the distance from the cloud base to the ground. Even experienced storm observers may not be able to tell the difference between a low-hanging cloud and a wedge tornado from a distance. Many, but not all major tornadoes are wedges.[29] Tornadoes in the dissipating stage can resemble narrow tubes or ropes, and often curl or twist into complex shapes. These tornadoes are said to be "roping out", or becoming a "rope tornado". When they rope out, the length of their funnel increases, which forces the winds within the funnel to weaken due to conservation of angular momentum.[30] Multiple-vortex tornadoes can appear as a family of swirls circling a common center, or they may be completely obscured by condensation, dust, and debris, appearing to be a single funnel.[31] In the United States, tornadoes are around 500 feet (150 m) across on average.[28] However, there is a wide range of tornado sizes. Weak tornadoes, or strong yet dissipating tornadoes, can be exceedingly narrow, sometimes only a few feet or couple meters across. One tornado was reported to have a damage path only 7 feet (2.1 m) long.[28] On the other end of the spectrum, wedge tornadoes can have a damage path a mile (1.6 km) wide or more. A tornado that affected Hallam, Nebraska on May 22, 2004, was up to 2.5 miles (4.0 km) wide at the ground, and a tornado in El Reno, Oklahoma on May 31, 2013, was approximately 2.6 miles (4.2 km) wide, the widest on record.[4][32] In the United States, the average tornado travels on the ground for 5 miles (8.0 km). However, tornadoes are capable of both much shorter and much longer damage paths: one tornado was reported to have a damage path only 7 feet (2.1 m) long, while the record-holding tornado for path length—the Tri-State Tornado, which affected parts of Missouri, Illinois, and Indiana on March 18, 1925—was on the ground continuously for 219 miles (352 km).[28] Many tornadoes which appear to have path lengths of 100 miles (160 km) or longer are composed of a family of tornadoes which have formed in quick succession; however, there is no substantial evidence that this occurred in the case of the Tri-State Tornado.[26] A 2007 reanalysis of the path suggests that the tornado may have begun 15 miles (24 km) further west than previously thought.[33] Photographs of the Waurika, Oklahoma tornado of May 30, 1976, taken at nearly the same time by two photographers. In the top picture, the tornado is lit by the sunlight focused from behind the camera, thus the funnel appears bluish. In the lower image, where the camera is facing the opposite direction, the sun is behind the tornado, giving it a dark appearance.[34]Tornadoes can have a wide range of colors, depending on the environment in which they form. Those that form in dry environments can be nearly invisible, marked only by swirling debris at the base of the funnel. Condensation funnels that pick up little or no debris can be gray to white. While traveling over a body of water (as a waterspout), tornadoes can turn

confounded by the forces affecting larger patterns and by the local, nuanced nature of tornadoes. Although it is reasonable to suspect that global warming may affect trends in tornado activity,[106] any such effect is not yet identifiable due to the complexity, local nature of the storms, and database quality issues. Any effect would vary by region.[107]

Path of a tornado across Wisconsin on August 21, 1857 Main article: Convective storm detection Rigorous attempts to warn of tornadoes began in the United States in the mid-20th century. Before the 1950s, the only method of detecting a tornado was by someone seeing it on the ground. Often, news of a tornado would reach a local weather office after the storm. However, with the advent of weather radar, areas near a local office could get advance warning of severe weather. The first public tornado warnings were issued in 1950 and the first tornado watches and convective outlooks came about in 1952. In 1953, it was confirmed that hook echoes were associated with tornadoes.[108] By recognizing these radar signatures, meteorologists could detect thunderstorms probably producing tornadoes from several miles away.[109] See also: Pulse-Doppler radar and weather radar A 2021 EF3 tornado in Illinois is displayed across various NEXRAD data types. Dual-polarization and Doppler velocity products have greatly improved forecasters' ability to detect tornadoes while they are ongoing or imminent when no visual confirmation is available. Today most developed countries have a network of weather radars, which serves as the primary method of detecting hook signatures that are likely associated with tornadoes. In the United States and a few other countries, Doppler weather radar stations are used. These devices measure the velocity and radial direction (towards or away from the radar) of the winds within a storm, and so can spot evidence of rotation in storms from over 160 km (100 miles) away. When storms are distant from a radar, only areas high within the storm are observed and the important areas below are not sampled.[110] Data resolution also decreases with distance from the radar. Some meteorological situations leading to tornadogenesis are not readily detectable by radar and tornado development may occasionally take place more quickly than radar can complete a scan and send the batch of data. Doppler weather radar systems can detect mesocyclones within a supercell thunderstorm. This allows meteorologists to predict tornado formations throughout thunderstorms.[111] In the mid-1970s, the U.S. National Weather Service (NWS) increased its efforts to train storm spotters so they could spot key features of storms that indicate severe hail, damaging winds, and tornadoes, as well as storm damage and flash flooding. The program was called Skywarn, and the spotters were local sheriff's deputies, state troopers, firefighters, ambulance drivers, amateur radio operators, civil defense (now emergency management) spotters, storm chasers, and ordinary citizens. When severe weather is anticipated, local weather service offices request these spotters to look out for severe weather and report any tornadoes immediately, so that the office can warn of the hazard.[citation needed] Spotters usually are trained by the NWS on behalf of their respective organizations, and report to them. The organizations activate public warning systems such as sirens and the Emergency Alert System (EAS), and they forward the report to the NWS.[112] There are more than 230,000 trained Skywarn weather spotters across the United States.[113] In Canada, a similar network of volunteer weather watchers, called Canwarn, helps spot severe weather, with more than 1,000 volunteers.[114] In Europe, several nations are organizing spotter networks under the auspices of Skywarn Europe[115] and the Tornado and Storm Research Organisation (TORRO) has maintained a network of spotters in the United Kingdom since 1974.[116] Storm spotters are required because radar systems such as NEXRAD detect signatures that suggest the presence of tornadoes, rather than tornadoes as such.[117] Radar may give a warning before there is any visual evidence of a tornado or an imminent one, but ground truth from an observer can give definitive information.[118] The spotter's ability to see what radar cannot is especially important as distance from the radar site increases, because the radar beam becomes progressively higher in altitude further away from the radar, chiefly due to curvature of Earth, and the beam also spreads out.[110] A rotating wall cloud with rear flank downdraft clear slot evident to its left rear Storm spotters are trained to discern whether or not a storm seen from a distance is a supercell. They typically look to its rear, the main region of updraft and inflow. Under that updraft is a rain-free base, and the next step of tornadogenesis is the formation of a rotating wall cloud. The vast majority of intense tornadoes occur with a wall cloud on the backside of a supercell.[76] Evidence of a supercell is based on the storm's shape and structure, and cloud tower features such as a hard and vigorous updraft tower, a persistent, large overshooting top, a hard anvil (especially when backsheared against strong upper level winds), and a corkscrew look or striations. Under the storm and closer to where most tornadoes are found, evidence of a supercell and the likelihood of a tornado includes inflow bands (particularly when curved) such as a "beaver tail", and other clues such as strength of inflow, warmth and moistness of inflow air, how outflow- or inflow-dominant a storm appears, and how far is the front flank precipitation core from the wall cloud. Tornadogenesis is most likely at the interface of the updraft and rear flank downdraft, and requires a balance between the outflow and inflow.[21] Only wall clouds that rotate spawn tornadoes, and they usually precede the tornado between five and thirty minutes. Rotating wall clouds may be a visual manifestation of a low-level mesocyclone. Barring a low-level boundary, tornadogenesis is highly unlikely unless a rear flank downdraft occurs, which is usually visibly evidenced by evaporation of cloud adjacent to a corner of a wall cloud. A tornado often occurs as this happens or shortly afterwards; first, a funnel cloud dips and in nearly all cases by the time it reaches halfway down, a surface swirl has already developed, signifying a tornado is on the ground before condensation connects the surface circulation to the storm. Tornadoes may also develop without wall clouds, under flanking lines and on the leading edge. Spotters watch all areas of a storm, and the cloud base and surface.[119] Main article: Tornado records Twin EF4 tornadoes near Pilger, Nebraska in 2014 The tornado which holds most records in history was the Tri-State Tornado, which roared through parts of Missouri, Illinois, and Indiana on March 18, 1925. It was likely an F5, though tornadoes were not ranked on any scale in that era. It holds records for longest path length (219 miles; 352 km), longest duration (about 3.5 hours), and fastest forward speed for a significant tornado (73 mph; 117 km/h) anywhere on Earth. In addition, it is the deadliest single tornado in United States history (695 dead).[26] The tornado was also the costliest tornado in history at the time (unadjusted for inflation), but in the years since has been surpassed by several others if population changes over time are not considered. When costs are normalized for wealth and inflation, it ranks third today.[120] The deadliest tornado in world history was the Daultipur-Salturia Tornado in Bangladesh on April 26, 1989, which killed approximately 1,300 people.[88] Bangladesh has had at least 24 tornadoes in its history that killed more than 100 people, almost half of the rest of the world.[121][122] One of the most extensive tornado outbreaks on record was the 1974 Super Outbreak, which affected a large area of the central United States and extreme southern Ontario on April 3 and 4, 1974. The outbreak featured 148 tornadoes in 18 hours, many of which were violent; seven were of F5 intensity, and twenty-three peaked at F4 strength. Sixteen tornadoes were on the ground at the same time during its peak. More than 300 people, possibly as many as 330, were killed.[123] While direct measurement of the most violent tornado wind speeds is nearly impossible, since conventional anemometers would be destroyed by the intense winds and flying debris, some tornadoes have been scanned by mobile Doppler radar units, which can provide a good estimate of the tornado's winds. The highest wind speed ever measured in a tornado, which is also the highest wind speed ever recorded on the planet, is 301 ± 20 mph (484 ± 32 km/h) in the F5 Bridge Creek-Moore, Oklahoma, tornado which killed 36 people.[124] The reading was taken about 100 feet (30 m) above the ground.[3] Storms that produce tornadoes can feature intense updrafts, sometimes exceeding 150 mph (240 km/h). Debris from a tornado can be lofted into the parent storm and carried a very long distance. A tornado which affected Great Bend, Kansas, in November 1915, was an extreme case, where a "rain of debris" occurred 80 miles (130 km) from the town, a sack of flour was found 110 miles (180 km) away, and a cancelled check from the Great Bend bank was found in a field outside of Palmyra, Nebraska, 305 miles (491 km) to the northeast.[125] Waterspouts and tornadoes have been advanced as an explanation for instances of raining fish and other animals.[126] Main article: Tornado preparedness Damage from the Birmingham tornado of 2005. An unusually strong example of a tornado event in the United Kingdom, the Birmingham Tornado resulted in 19 injuries, mostly from falling trees. Though tornadoes can strike in an instant, there are precautions and preventative measures that can be taken to increase the chances of survival. Authorities such as the Storm Prediction Center in the United States advise having a pre-determined plan should a tornado warning be issued. When a warning is issued, going to a basement or an interior first-floor room of a sturdy building greatly increases chances of survival.[127] In tornado-prone areas, many buildings have underground storm cellars, which have saved thousands of lives.[128] Some countries have meteorological agencies which distribute tornado forecasts and increase levels of alert of a possible tornado (such as tornado watches and warnings in the United States and Canada). Weather radios provide an alarm when a severe weather advisory is issued for the local area, mainly available only in the United States. Unless the tornado is far away and highly visible, meteorologists advise that drivers park their vehicles far to the side of the road (so as not to block emergency traffic), and find a sturdy shelter. If no sturdy shelter is nearby, getting low in a ditch is the next best option. Highway overpasses are one of the worst places to take shelter during tornadoes, as the constricted space can be subject to increased wind speed and funneling of debris underneath the overpass.[129] Main article: Tornado myths Folklore often identifies a green sky with tornadoes, and though the phenomenon may be associated with severe weather, there is no evidence linking it specifically with tornadoes.[130] It is often thought that opening windows will lessen the damage caused by the tornado. While there is a large drop in atmospheric pressure inside a strong tornado, the pressure difference is unlikely to cause significant damage. Opening windows may instead increase the severity of the tornado's damage.[131] A violent tornado can destroy a house whether its windows are open or closed.[131][132] Another commonly held misconception is that highway overpasses provide adequate shelter from tornadoes. This belief is partly inspired by widely circulated video captured during the 1991 tornado outbreak near Andover, Kansas, where a news crew and several other people took shelter under an overpass on the Kansas Turnpike and safely rode out a tornado as it passed nearby.[133] However, a highway overpass is a dangerous place during a tornado, and the subjects of the video remained safe due to an unlikely combination of events: the storm in question was a weak tornado, the tornado did not directly strike the overpass,[133] and the overpass itself was of a unique design. Due to the Venturi effect, tornadic winds are accelerated in the confined space of an overpass.[134] Indeed, in the 1999 Oklahoma tornado outbreak of May 3, 1999, three highway overpasses were directly struck by tornadoes, and at each of the three locations there was a fatality, along with many life-threatening injuries.[135] By comparison, during the same tornado outbreak, more than 2,000 homes were completely destroyed and another 7,000 damaged, and yet only a few dozen people died in their homes.[129] An old belief is that the southwest corner of a basement provides the most protection during a tornado. The safest place is the side or corner of an underground room opposite the tornado's direction of approach (usually the northeast corner), or the central-most room on the lowest floor. Taking shelter in a basement, under a staircase, or under a sturdy piece of furniture such as a workbench further increases the chances of survival.[131][132] There are areas which people believe to be protected from tornadoes, whether by being in a city, near a major river, hill, or mountain, or even protected by supernatural forces.[136] Tornadoes have been known to cross major rivers, climb mountains,[137] affect valleys, and have damaged several city centers. As a general rule, no area is safe from tornadoes, though some areas are more susceptible than others.[28][131][132] Main article: History of tornado research A Doppler on Wheels unit observing a tornado near Attica, Kansas Meteorology is a relatively young science and the study of tornadoes is newer still. Although researched for about 140 years and intensively so for around 60 years, there are still aspects of tornadoes which remain a mystery.[138] Meteorologists have a fairly good understanding of the development of thunderstorms and mesocyclones,[139][140] and the meteorological conditions conducive to their formation. However, the step from supercell, or other respective formative processes, to tornadogenesis and the prediction of tornadic vs. non-tornadic mesocyclones is not yet well known and is the focus of much research.[91] Also under study are the low-level mesocyclone and the stretching of low-level vorticity which tightens into a tornado,[91] in particular, what are the processes and what is the relationship of the environment and the convective storm. Intense tornadoes have been observed forming simultaneously with a mesocyclone aloft (rather than succeeding mesocyclogenesis) and some intense tornadoes have occurred without a mid-level mesocyclone.[141] In particular, the role of downdrafts, particularly the rear-flank downdraft, and the role of baroclinic boundaries, are intense areas of study.[142] Reliably predicting tornado intensity and longevity remains a problem, as do details affecting characteristics of a tornado during its life cycle and tornadolysis. Other rich areas of research are tornadoes associated with mesovortices within linear thunderstorm structures and within tropical cyclones.[143] Meteorologists still do not know the exact mechanisms by which most tornadoes form, and occasional tornadoes still strike without a tornado warning being issued.[144] Analysis of observations including both stationary and mobile (surface and aerial) in-situ and remote sensing (passive and active) instruments generates new ideas and refines existing notions. Numerical modeling also provides new insights as observations and new discoveries are integrated into our physical understanding and then tested in computer simulations which validate new notions as well as produce entirely new theoretical findings, many of which are otherwise unattainable. Importantly, development of new observation technologies and installation of finer spatial and temporal resolution observation networks have aided increased understanding and better predictions.[145] Research programs, including field projects such as the VORTEX projects (Verification of the Origins of Rotation in Tornadoes Experiment), deployment of TOTO (the TOtable Tornado Observatory), Doppler on Wheels (DOW), and dozens of other programs, hope to solve many questions that still plague meteorologists.[49] Universities, government agencies such as the National Severe Storms Laboratory, private-sector meteorologists, and the National Center for Atmospheric Research are some of the organizations very active in research; with various sources of funding, both private and public, a chief entity being the National Science Foundation.[117][146] The pace of research is partly constrained by the number of observations that can be taken; gaps in information about the wind, pressure, and moisture content throughout the local atmosphere; and the computing power available for simulation.[147] Solar storms similar to tornadoes have been recorded, but it is unknown how closely related they are to their terrestrial counterparts.[148] Rope Tornado near Yuma, Colorado on August 8, 2023. A wall cloud with tornado South of Limon, Colorado. F0 tornado in its final stages over the North Sea near Vrångö, Sweden on July 17, 2011. A tornado in its roping out stage near the town of Merino, Colorado during a historic tornado outbreak that produced 37 tornadoes across the state. The 2022 Andover tornado seen from the Andover City Hall camera. Time-lapse of a tornado's life cycle near Prospect Valley, Colorado on June 19, 2018. A radar reflectivity image of a classic tornadic supercell near Oklahoma City, Oklahoma on May 3, 1999. Classic hook echo can be seen for this Kansas EF2 tornado in 2024 A Doppler on Wheels image of a tornadic thunderstorm near La Grange, Wyoming (USA) captured during the VORTEX2 project. In the velocity image on the left, Blues/green represent winds moving towards the radar, and reds/yellows indicate winds moving away from the radar. In the reflectivity image on the right, the main body of the storm can be seen, with the appendage on the bottom of the storm being a hook echo. Tornadoes portalWeather portal Cultural significance of tornadoes Cyclone Derecho List of tornadoes and tornado outbreaks List of F5 and EF5 tornadoes List of F4 and EF4 tornadoes List of F4 and EF4 tornadoes (2020–present) List of tropical cyclone-spawned tornadoes List of tornadoes with confirmed satellite tornadoes Secondary flow Skipping tornado Space tornado Tornado preparedness Tornadoes of 2025 Tropical cyclone Hypercane Typhoon Vortex Whirlwind

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