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## WHAT IS A TORNADO?

A tornado is a violent rotating column of air that stretches from the base of a thunderstorm to the ground. The funnel is typically visible due to condensation, or water droplets present throughout the funnel. Tornadoes come in various colors depending on the soil type of the region. However, it is not considered a tornado until the funnel reaches the ground.

A tornado can come in many sizes ranging from a thin rope to more than a mile wide. One of the largest tornadoes on record is the El Reno, Oklahoma tornado May 31, 2013. It was 2.6 miles wide at its maximum width and on the ground for 40 minutes. **Tornadoes can last from a few seconds to more than an hour on the ground.** The strongest tornadoes are capable of wind speeds near 300 mph. It's no secret that this atmospheric phenomenon can be deadly and often loaves behind a path of

COLD

STRONG WIND

WARM

COLD AIR

MESOCYCLONE

TORNADO

leaves behind a path of destruction.

Tornadoes can occur at any time of day or night and during any month of the year. On average more than 1,000 tornadoes a year occur in the United States and they have been reported in all 50 states. In Illinois, tornadoes are most common during April, May and June.

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STORM TRACK SEVERE WEATHER GUIDE

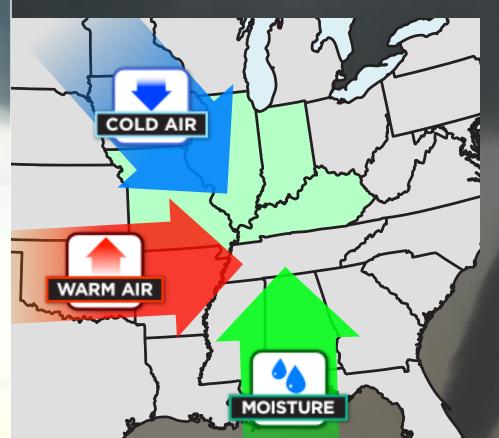
WARM AIR

## **TORNADO INGREDIENTS**

Tornadoes form in thunderstorms and thunderstorms need ingredients to develop and build. Moisture, instability and some form of lift in the right amounts will lead to the development of thunderstorms. **Moisture in the atmosphere is humidity** and the biggest source of humidity here at home is the Gulf of Mexico. Instability in the simplest form is cold air over warm air.

Warm air rises and if it encounters colder air it rises more rapidly. This is a key element in the development of thunderstorms that lead to tornadoes. Tornado development is tied to violent updrafts. Hail is directly related to strong updrafts and hail can be found near tornadoes in many cases. There are many lifting mechanisms that can initiate the development of thunder-storms and tornadoes. *Once we have instability the lifting mechanism is the initiating factor.* 

**Boundaries or lines created by differences in the air** are the easiest to identify and track. Fronts are an example of a boundary that can work to initiate lift. **Dry lines are boundaries between humid and dry air.** The dry air works as a wedge to lift the lighter humid air. Many times the downdrafts from thunderstorms spread out as they reach ground level and race away from the



existing storm to start a next series of storms and we call these winds outflow boundaries.

Sometimes just the heating of the ground with different cover can be enough to kick off a storm. Sunshine striking a bare ground field will heat up more quickly than a grass covered field creating difference in air densities leading to a focused rising column of air that starts a thunderstorm cycle. We see these type storms mostly in mid to late summer.





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## THE TOOLS WE USE

Radar is a tool we use to track storms. The word RADAR is actually an acronym. It stands for Radio Detection And Ranging, and it's useful for tracking more than just storms. A radar sends out radio waves in all directions. When those waves hit something (like raindrops) the radio waves bounce back and are collected by the radar. A computer then makes sense of this information, categorizes it, and displays it to us just like you see on TV or on your phone. The system can even tell how heavy the rainfall is, coloring light to heavy precipitation as green to red, and sometimes even purple or black. Radar can detect any type of precipitation, including snow, and hail. In fact, anything that reflects radio waves can show up on a radar. The radars we use will sometimes even pick up large groups of birds!

Not only will radar show us where weather is, it can help us track it. Every time a radar sends and receives a signal is called a scan. The radars that we use can scan the atmosphere once every 5 to 10 minutes. It's important to remember that radar images always have a slight delay due to data processing and transmission, and are usually a few minutes behind. This is important because we use radar to track tornadoes. Radar can detect which direction winds are blowing in a thunderstorm, which helps us know when a storm is rotating. A rotating storm can indicate a tornado has, or may soon form. Given that tornadoes are deadly weather phenomena, it's important to understand that what's really happening in a thunderstorm is minutes ahead of what you're seeing from a radar.

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#### Weather Balloons are one

of the most important tools for weather forecasting. These are large balloons that measure about 6 ft wide, and are filled with hydrogen gas, then launched into the sky. They carry weather sensing instruments into the upper atmosphere, sometimes over 100,000 feet high. This instrumentation measures temperature, relative humidity, winds, and atmospheric pressure. This instrumentation, along with a GPS and data transmitter, are built into a device called a radiosonde that is attached to the balloon. The radiosonde records what the weather is like at every level of the atmosphere, and shares it back with meteorologists on earth. This information helps improve forecast computer models, and gives meteorologists a more detailed look at the atmosphere so they can make a better forecast. These balloons are launched twice a day from hundreds of locations worldwide, including nearly 100 National Weather Service offices here in the United States.

Sometimes, special launches are made to get more information when severe weather is expected. This can give meteorologists a more up-to-date look at the atmosphere, in order to make a more accurate forecast when dangerous weather is expected. One especially helpful measurement a radiosonde takes is wind speed and direction. You may have heard a meteorologist talk about wind shear. Wind shear can essentially be referred to the change in wind speed or direction with height. This can help meteorologists decide whether or not future thunderstorms will be capable of forming a tornado.

> Tornado Warning Expires: 1/30/2021 4:15 PM

**Satellites** are an important way for us to view our weather from another perspective. Satellites sit in the earth's orbit, thousands of miles above its surface. They have many uses, and have several tools with which they monitor our weather. **Satellites are capable of taking high quality visual images of the earth's surface and atmosphere**. This helps us see the weather as we would if we were in space, looking back at earth. As you can imagine, this is only helpful during the day, when there is sunlight illuminating what we are looking at. Fortunately, satellites have tools that don't rely on visible light. Other than cameras, satellites use instrumentation that collect near infrared and microwave radiation. These can detect temperatures of clouds, sea surfaces, and the ground we walk on.

Scientists now use a new series of satellites, titled "GOES R". GOES is an acronym, and stands for Geostationary Operational Environmental Satellites.

The first in the GOES R series of satellites was put into service as "GOES East" in 2017. All GOES satellites are geostationary, meaning they orbit the earth over the same geographical location 24/7. GOES East is placed strategically so it has a direct view of the eastern half of the continental United States. In 2019, the second in the GOES R series went into operation as GOES West. Fittingly, Goes West's view is centered on the western half of the continental United States are provided weather forecasting with the addition of new and enhanced instruments on board. **One new instrument, called the Lightning Mapper, uses near infrared radiation to detect lightning in real time**. Big increases in lightning over a short period of time can signify a quickly intensifying storm. This is important for forecasting strong storms that can produce severe weather, including tornadoes.

#### Numerical Weather Prediction Models Meteorologists use

observations from weather balloons, radar, and satellites to help them understand current and near future weather conditions. These observations are also used to help forecast the weather days ahead of time. We use a method called "Numerical Weather Prediction", or what you may be familiar with as "weather models." These are computer calculations that try to simulate how the weather may change. These calculations are made using observational data from all over the world. In fact, data from weather balloon launches, National Weather Service offices, and some commercial airplanes are all put into weather models to make forecasts as accurate as possible. The idea here is, the more observations we take, the more accurate a computer forecast will be. It's important to note that however many observations we have, computer models will always need to be used with caution, as computing power is limited and models cannot account for every detail in the atmosphere. This means that a meteorologist needs to apply their judgement to potentially make a forecast better. In fact, weather models are told to calculate multiple times a day, and each time the solution changes. Every calculation is called a "run". Some models run as often as once every hour. We often compare each model run with other models to compare the outcome.

When meteorologists warn of severe weather and the possibility of tornadoes several days ahead of time, it's because computer models have shown enough of the ingredients for tornados in their model runs. If this is consistent with past performance, and concurrent runs of separate models, then meteorologists know that severe weather may be imminent.

## WATCHES VS WARNINGS

### Tornado Watch:

A Tornado Watch is issued by the National Weather Service when the ingredients in the atmosphere are favorable for tornadoes. A watch means tornadoes will be possible in and around the watch area in the near future. It does not mean a tornado is on the ground. When a watch is issued it's time to be weather aware, have a safety plan in place and be prepared to act quickly.

### **Tornado Warning:**

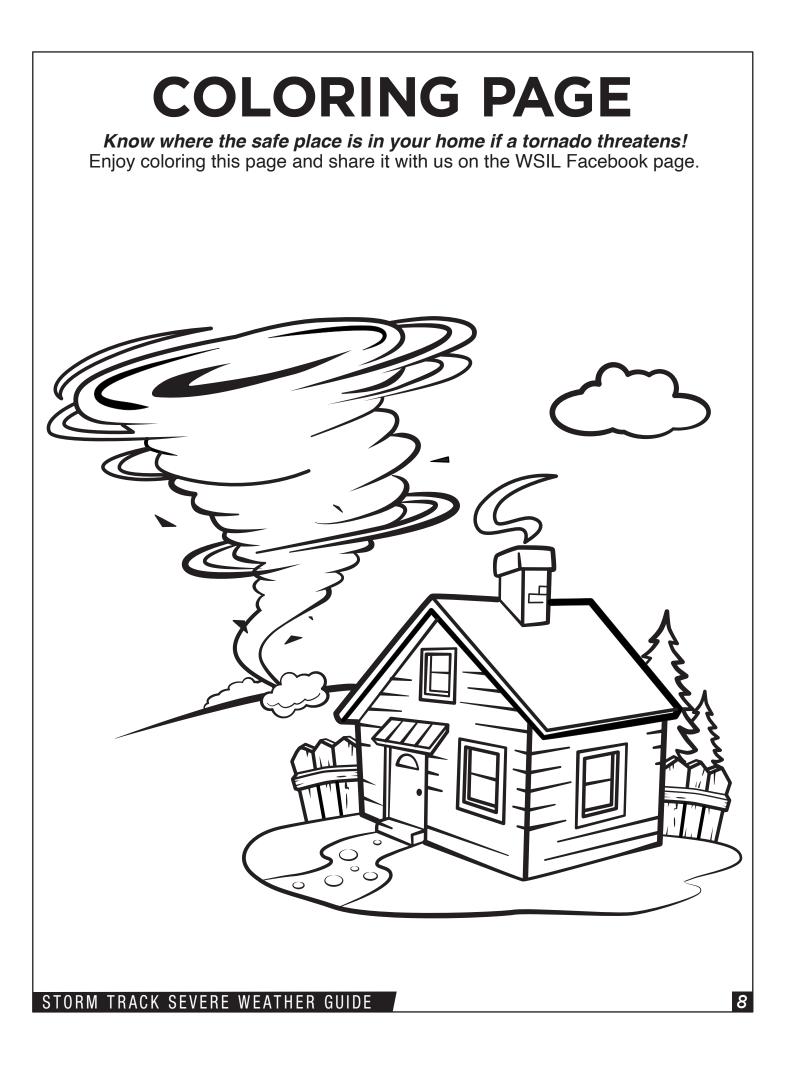
A Tornado Warning is issued by the National Weather Service when a tornado has been sighted or indicated by radar. When a tornado warning is issued it's time to take action because a possible tornado is heading your way. Immediately take shelter and stay in your safe place until the warning is over.

Here is a simple analogy to remember the difference between a watch and a warning, we call it the "Cup Cake Analogy."

Imagine you're at grandma's house and she has all of the ingredients on the counter to make cupcakes. She's likely going to make cupcakes but she hasn't made them yet. *That's our "Cup Cake Watch".* 

Once grandma begins making the cupcakes, then cupcakes are imminent. When they've been spotted and are ready to eat we have a *"Cup Cake Warning"*, meaning it's time to take action.

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# THE E-F SCALE

Every tornado is surveyed by the National Weather Service and **rated according to the damage.** The original Fujita scale was enhanced to better categorize the strength of storms including those that did not strike structures. **The Enhanced Fujita scale** or EF is the standard for classifying the strength of tornadoes.



# **TORNADO ALLEY**

Tornadoes occur all around the world but the spot that sees the most tornado activity on average is the south central United States. Often referred to as Tornado Alley, the area of eastern Oklahoma, northeast Texas into Arkansas was for decades the most activity tornadic region in the world.

There has been a shift during the last 20 years or so and a secondary bullseye has seen more tornado activity. Parts of Mississippi, Alabama and northern Louisiana are the focus of the shift to what many call Dixie Alley away from Tornado Alley.

Here at home we sit at the edge of the most active tornado regions making it very important that we stay aware of changing weather conditions.

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STORM TRACK SEVERE WEATHER GUIDE

CONFIRMED TORNADOS APRIL 2011

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EF-2

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EF-5

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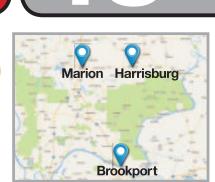
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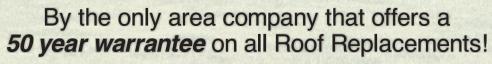
As I walked to your office I found very peaceful surroundings. It is as if I walked into another world. Thank you for your help. I'll send you all the business I can. Buncombe, IL My husband loves his hearing aids, he has from day one... He said I have never heard the birds sing before. But the best was when I was pouring him a glass of Pepsi Cola; he said I can hear the fizz. Eddyville, KY



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#### • March 18, 1925 TRISTATE TORNADO

It's been nearly 100 years, but the Tri-State Tornado that devastated parts of Southeast Missouri, Southern Illinois, and Southwest Indiana on March 18, 1925 still holds many records, some of which may never be broken.

Weather information was much more sparse in 1925 and radar did not exist. Little was known about how tornadoes develop. *In fact, to limit panic, the word "tornado" was banned from weather forecasts at the time.* 

Witness accounts described the day as warm and windy. Not uncommon for early spring. Little did they know, the warm wind was a sign severe storms could be brewing.

The historic tornado would first begin at around 1 p.m. near Ellington, Missouri. Towns impacted by the tornado in the Show-Me-State include Annapolis and Biehle, resulting in 11 dead.

When the tornado crossed the Mississippi River near Gorham, Illinois, it was likely near its strongest. Gorham was essentially destroyed, and 37 people died.

Just a few miles to the northeast, Murphysboro, Illinois sustained damage and loss of life that is almost unfathomable. Schools, factories, entire blocks of houses, gone. 234 people lost their lives in Murphysboro, a record for a tornado in a single community. Another 69 people died in DeSoto, including 33 in a school.

The twister moved through the northern side of West Frankfort and neighboring Parrish farther to the east. 147 lost their lives in West Frankfort and another 46 in Parrish. Parrish never recovered.

Later in the afternoon, the tornado crossed the Wabash River into Indiana. Before dissipating, it would destroy Griffin and heavily damage Princeton, resulting in dozens more fatalities.

In total, the Tri-State Tornado traveled 219 miles across portions of three states and 13 counties. It was on the ground for an astonishing 3 hours 29 minutes. 695 people died in the tornado, and another 2027 sustained injuries.



### May 29, 1982 MARION TORNADO

On May 29th, 1982 a large and deadly tornado ripped through Williamson County Illinois leaving its mark in history.

The tornado was rated an F4 on the Fujita Scale putting max wind speeds between 207 and 260 miles per hour. The vortex left behind a 17 mile long path of catastrophic damage, killing 10 people.

It was a little after 3 in the afternoon when the twister first touched down just northwest of Carterville. That's where the damage path began with two homes destroyed in a subdivision. The tornado then began to 'hop' leaving behind damaged businesses and homes in parts of Carterville and Crainville. It was when the tornado was east of Crainville that it began gaining strength, putting Marion in its sights.

The tornado barreled along Route 13 into Marion where it wreaked havoc. At its largest the tornado was close to a quarter mile wide and was on the ground for 30 minutes.

The twister demolished nearly 50 businesses and 161 homes in Marion. Three shopping centers and two schools were among those that received significant damage. One of the hardest hit areas was the Shawnee Village Apartments, where 7 of the 10 people lost their lives.

Local resident, Lori Baysinger recalled what it was like returning home after the storm, "It was surprising, the damage when driving back into town. The apartments I had moved out of three weeks prior were annihilated. There was nothing there."

The tornado began losing strength in east Marion before it finally lifted, north of Route 13. Roughly 1,000 people were left homeless in Williamson County and 181 were injured. The damage left behind was estimated to be over 85 million dollars.

Major technology advancements have been made since the 1980s allowing meteorologists to have a better handle on severe weather.

At the time of the Marion tornado Williamson County was covered by NOAA'S National Weather Service Office in St. Louis, Missouri. The Paducah office didn't open until 1984. While tornadoes can occur during any month of the year, in Illinois they peak in the month of May.

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### • May 8, 2009 SUPER DERECHO

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Commonly known in the region as "The May 8th Storm", the Super Derecho of 2009 was one of the most wide-reaching damaging wind events in our region's history.

The Storm Prediction Center calls it **"one of the most intense and unusual derechos ever observed."** Stretching from western Kansas to eastern Kentucky, the wind storm produced a path of damage for more than 1,000 miles.

Tracking across southern Missouri, the storm complex would produce multiple small tornadoes along with straight-line winds that even toppled a TV station's broadcast tower in Joplin. As it approached the News 3 area in southeast Missouri and southern Illinois, the winds were near peak strength.

In northern Bollinger and Perry counties in southeast Missouri, it's estimated that 80% of trees were flattened. Due to the unusual nature of this storm, the strong wind at times lasted up to 45 minutes.

Farther to the east, storms arrived in southern Illinois just after noon. Destruction was most noted across Jackson, Franklin, Williamson, and Saline counties. A wind gust of *106 miles per hour* was reported at Southern Illinois Airport in Murphysboro and 82 miles per hour at the Williamson County Airport in Marion.

Windows were blown out of many buildings on SIU's campus. Roofs were peeled back on businesses, schools, and homes. Stretching down Route 13, downed trees created travel problems for emergency response. Power outages were in the tens of thousands and some didn't get electricity back for more than a week.

One person died. A tree limb fell on a man in Murphysboro, killing him. Multiple injuries occurred, including a man whose semi overturned on I-57.

The size, strength, and long-lasting nature made the Super Derecho on May 8, 2009 sparked research by meteorologists around the country. More than a decade later, it's still one of the most talked about storms in the area.

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# November 17, 2013 BROOKPORT TORNADO

The Brookport Tornado struck in the afternoon of November 17, 2013. The rainwrapped EF3 twister was a strong, long-tracking tornado, crossing the Ohio River twice on its path.

Video from a tugboat on the Ohio River captured the tornado as it was moving into Brookport. It showed a very rain-wrapped tornado, difficult to see, appearing like a large cloud of rain hovering close to the ground.

In Brookport, many structures sustained major damage including homes, garages and businesses, mainly within a half-mile of the river. As the tornado tracked down Unionville Road, just east of town, it rolled several large double-wide mobile homes.

An amazing story of survival emerged as one family was able to evade the tornado by seeking shelter under a small bridge about 100 yards from their home. Sheltering with blankets, tucked up, and shielded from the wind and debris, they were able to ride out the cloud of rain and wind.

When the family emerged from under the bridge, the landscape was forever changed. They saw trees toppled and twisted, neighbors homes rolled into nearby fields, their home flipped up on its side, the metal undercarriage exposed and household items and insulation scattered into nearby woods.

#### Quick thinking likely saved their lives.

In total, the tornado tracked 42 miles, starting in McCracken County, Kentucky, crossing into Massac and Pope counties in southern Illinois, before crossing back into Livingston County, Kentucky. Three people lost their lives in mobile homes in Brookport. An additional 33 people were injured. Delaying some of the clean up efforts in the days following the tornado, was a light dusting of snow.

November tornadoes may seem rare, but our area sees a slight uptick in the number of tornadoes in the fall. It serves as a reminder that severe weather can strike at any time of the year.

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# February 28, 2017 PERRYVILLE TORNADO

*It was a nightmare situation!* A massive wedge tornado more than a half-mile wide with peak winds of 185 miles per hour and on the ground for 50 miles. That describes the Perryville Tornado of 2017.

At 7:55 p.m. on February 28, the tornado touched down a few miles north of Perryville, Missouri and quickly gained strength.

The tornado claimed its only life as it crossed I-55 shortly after developing.

It crossed the Mississippi River just south of Rockwood, Illinois, showing signs of multiple vortexes and was near its widest, at just over a half-mile.

One of the hardest hit areas was just south of Vergennes, where a home was destroyed, its roof left sitting on Route 127. The tornado tracked another 15 miles and finally dissipated in western Franklin County as another storm merged from the south at 8:07 p.m.

Tracking 50.4 miles and on the ground for 1 hour, 2 minutes, this was the longest tracking tornado in the region since April 22, 1981.

The same storm would produce an EF3 tornado in White County, killing a man in Crossville, Illinois and then tracking nearly 45 miles into Southern Indiana.

This supercell tracked on an eerily similar path as the 1925 Tri-State Tornado, but the outcome was much different.

There is little doubt that lives were saved that night due to early warning.



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## KNOW YOUR SAFE PLACE!



### YOUR HOME

**A basement is the safest place!** If you do not have a basement, head to an interior room on the lowest level. Wear any available helmet.

**Avoid windows.** Even a weak tornado can break windows and send glass flying creating a safety hazard.



#### SCHOOLS/OFFICES OR STORES

Follow instructions of officials and or proceed to designated and labeled safe zones. In the event of a tornado watch for a region *it is best to avoid visiting large buildings with expansive roofs.* 



### MOBILE HOME

No mobile home is protection from a tornado. Have a plan to evacuate well before expected time of arrival. Discuss today with friends and family members where the safest place is that can be traveled to quickly and safely.



### VEHICLES

**You cannot outrun a tornado** that is moving toward you but you can stop and avoid driving into the path of a known storm. If you are in a vehicle and threatened by the possibility of a tornado, seek shelter in a nearby building. **A highway underpass is not adequate protection** and can result in other deadly hazards. A last resort is to seek shelter in a ditch or culvert but be sure it is not full of water. Flash flooding kills more people than tornadoes.



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## **The Storm Track 3 Team**

WSIL is fortunate to have **4 full time professional meteorologists** working around the clock to keep you prepared. Adjusting forecasts is a non stop effort to stay ahead of changing weather. Jim, Nick, Jacie and John are always tracking the next storm system to make sure you are aware and ready to keep your family safe.

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