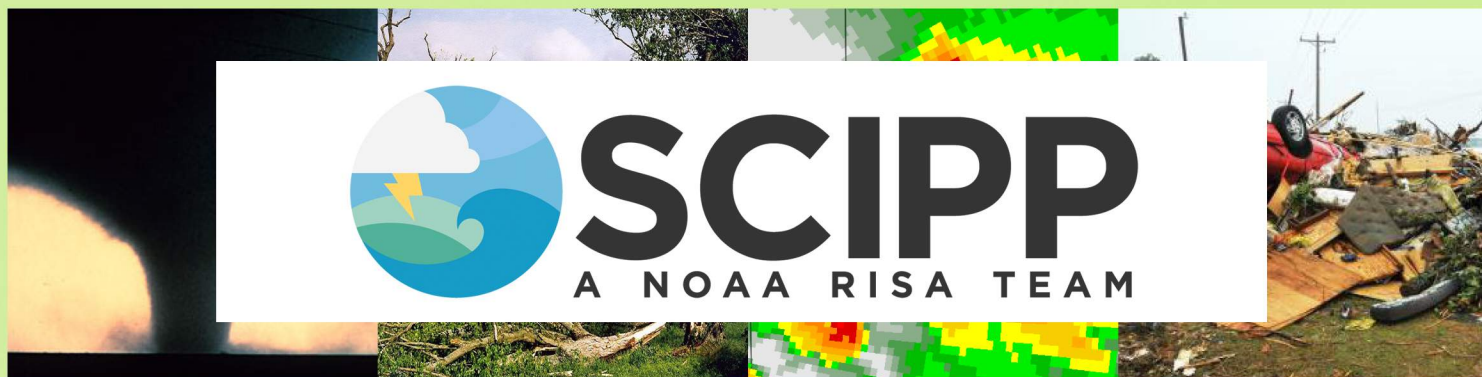




SCIPP TORNADO INFORMATION DOCUMENT

INTRODUCTION TO TORNADOES:

Tornadoes are among the most destructive weather-related hazards. While tornadoes are most common in the United States east of the Rocky Mountains during the late afternoon, they have occurred in all states, during all months, and during all times of day. Many of the states which have the highest numbers of tornadoes and deaths caused by tornadoes are located in the SCIPP region (See Figure 1).

What is a tornado? A tornado is traditionally defined as a violently rotating column of air that reaches from the bottom of a cumulonimubs cloud to the ground. Tornadoes are found in severe thunderstorms, but not all severe thunderstorms will contain tornadoes. While all tornadoes touch both the ground and the bottom of a cloud, it is possible for part or all of the tornado to be invisible. Tornadoes can appear in a variety of shapes and sizes ranging from thin ropelike circulations to large wedge shapes greater than one mile in width. However, a tornado's size is not necessarily related to its wind speed. The Enhanced Fujita (EF) scale uses property damage to estimate a tornado's wind speed (See Table 1).

Weather forecasters use highly advanced computer models to anticipate outbreaks of severe thunderstorms and tornadoes several days in advance. On the day of such an outbreak, there are two types of alerts that government organizations issue to warn the public of a possible tornado threat. The first is a tornado watch, issued by the Storm Prediction Center (SPC) in Norman, Oklahoma. A tornado watch means that conditions are favorable for a tornado in the watch area. Watches last for several hours and cover several hundred square miles. The second advisory, the tornado warning, represents a more immediate threat. A tornado warning means that a tornado is imminent or already occurring. This can be indicated by either Doppler radar or reports made by people. A tornado warning typically lasts for about one hour and covers an area about the size of a county or parish. The warnings are issued by the dozens of National Weather Service (NWS) Weather Forecast Offices (WFOs) around the country. A severe thunderstorm is defined as any thunderstorm that has winds greater than 58 mph, hail greater than 1 inch in diameter, or a tornado. Watches and warnings that are issued are relayed to the public by television

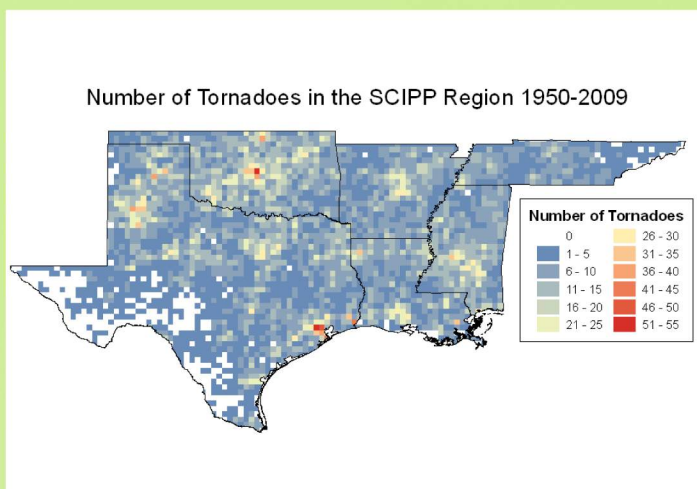


Figure 1: The number of tornadoes in the SCIPP region from 1950-2009. Data on tornado occurrence are available for 60 years, so the areas that most frequently experience tornadoes see an average of almost one tornado per year. Each grid box has an area of 0.2 degrees x 0.2 degrees.

and radio stations, as well as weather radios. They can also be viewed by visiting the NWS web site, <http://www.weather.gov>.

During an average year in the United States tornadoes kill around 60 people, injure hundreds more, and cause about 1 billion dollars in property damage, but these numbers can vary greatly from year to year. While these numbers indicate how devastating a tornado can be, there are many actions you can take to increase your safety in the event of a tornado.

Number	EF-Scale Winds (mph)	F-Scale Winds (mph)
0	65-85	45-78
1	86-110	79-117
2	111-135	118-161
3	136-165	162-209
4	166-200	210-261
5	200+	262-317

Table 1: Wind speeds for tornadoes using the Enhanced Fujita (EF) scale and the Fujita (F) scale.

TORNADOES IN THE SCIPP REGION

Number of F2 or Greater Tornadoes in the SCIPP Region 1950-2009

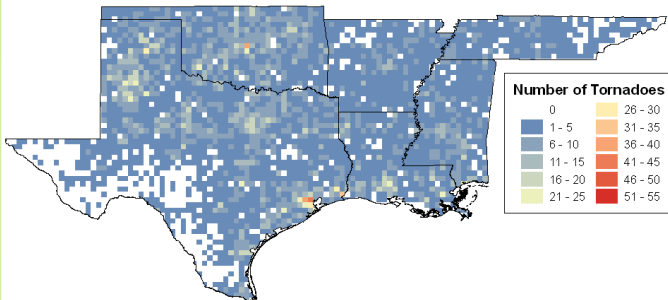


Figure 2: A map of tornadoes with a strength of at least F2 in the SCIPP region between 1950 and 2009. Many of the areas in the SCIPP region that have the highest numbers of tornadoes also have the highest numbers of strong tornadoes.

Moving Average of Percentage of Days With a Tornado in the SCIPP Region 1950-2009

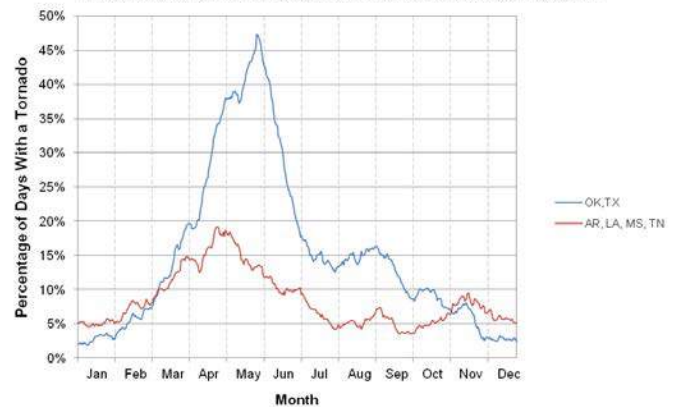


Figure 3: A moving average of the percentage of days with at least one tornado in the SCIPP region for each month from 1950 to 2009. The SCIPP region is divided into two smaller regions.

Number of Tornado Fatalities Per Year in the SCIPP Region 1950-2009

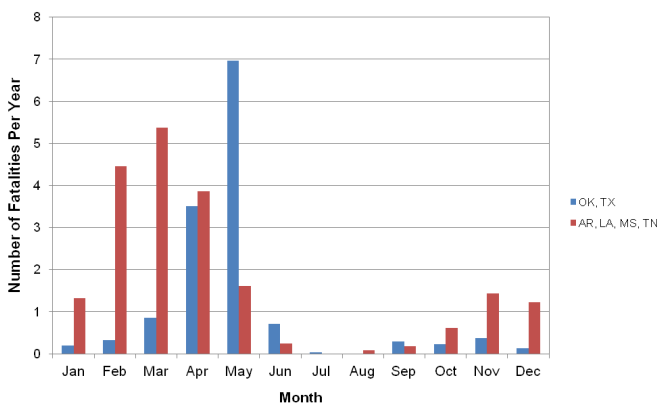


Figure 4: The number of fatalities caused by tornadoes in the SCIPP region per year between 1950 and 2009. The number of fatalities in the eastern part of the region peaks in the early spring, while in the western region it peaks in May.

Number of Tornado Hours Per Year in the SCIPP Region 1950-2009

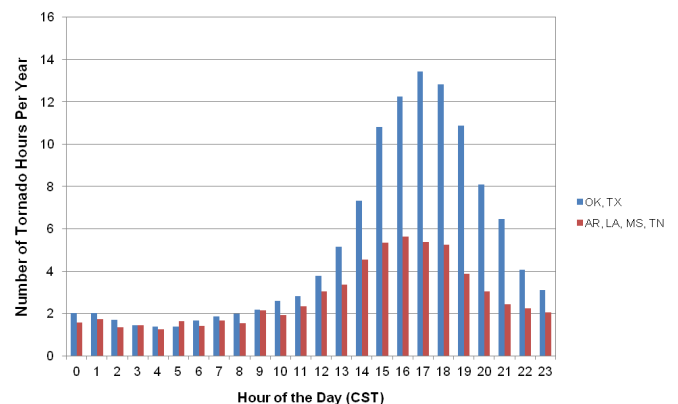


Figure 5: The number of hours per year with at least one tornado in the SCIPP region. In this graph hour 0 represents the time between 12:00 am and 12:59 am. The two regions are similar during the early morning hours, but not the afternoon.

Number of Fatal Tornadoes Per Year in the SCIPP Region 1950-2009

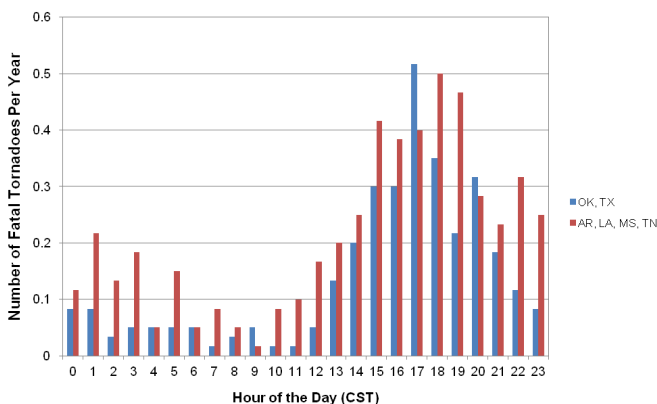


Figure 6: The number of fatal tornadoes per year during each hour of the day. Comparison to Figure 5 shows that the eastern region has a higher percentage of fatal tornadoes than the west at nearly all hours of the day.

Number of Tornado Fatalities in the SCIPP Region

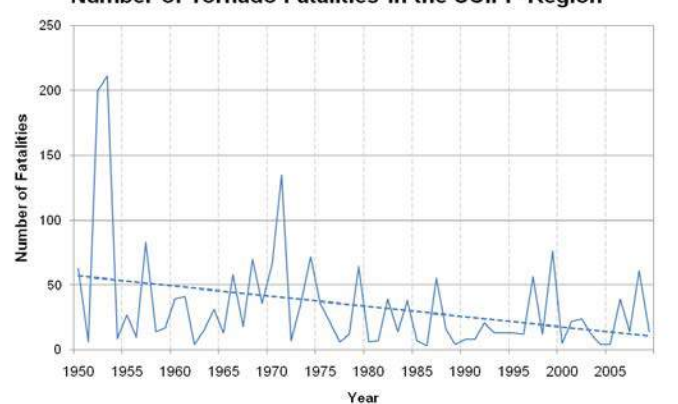


Figure 7: The number of fatalities caused by tornadoes in the entire SCIPP region. Events with a high number of fatalities have decreased over time as forecasts, warning systems, and public awareness have improved.

PAST TORNADOES:

While Oklahoma and Texas experience the highest numbers of tornadoes in the entire country, deaths caused by tornadoes are actually more common in the eastern part of the SCIPP region. The average number of tornadoes in the entire United States in a year is close to 1000. Typically around 300 of these occur in the SCIPP region. The previous page shows several ways of looking at tornadoes in the SCIPP region between 1950 and 2009. The data used to make these maps were compiled by the National Climatic Data Center (NCDC) and the SPC. The maps and graphs reveal important information about the location and time of past tornadoes and the fatalities they have caused. These figures only indicate what has happened in the past. They are not a prediction for future tornadoes. Figure 1 shows the areas in the SCIPP region that have seen the most tornadoes between 1950 and 2009. Figure 2 is similar to Figure 1, except only tornadoes rated F2 (or EF2) or higher are shown. Many of the areas in the SCIPP region that have had the highest number of tornadoes have also had the highest number of strong tornadoes.

The peak season for tornadoes is late March to early May in Arkansas, Louisiana, Mississippi, and Tennessee and April to May in Oklahoma and Texas (Figure 3). However, tornadoes are more common in winter in the eastern part of the region than in the west. Tornadoes outside of the usual peak season are more often deadly because people tend to be less prepared for severe weather risks out of the peak season. Figure 4 shows that in the eastern part of the SCIPP region the peak in fatalities caused by tornadoes occurs earlier in the year (February and March) than the peak in the number of tornadoes (late March to early May).

Another important factor is the time of day. The peak time for tornadoes is between 3:00 pm and 8:00 pm (Figure 5), but once again Arkansas, Louisiana, Mississippi, and Tennessee deviate from this average. While Texas and Oklahoma see a far greater portion of their tornadoes during the late afternoon, in the eastern part of the SCIPP region the difference between the number of tornadoes that occur during the afternoon and at night is not as large. The number of tornadoes that occur during the night in each region is similar (Figure 5), but the number of tornadoes that cause fatalities during the night is far larger in Arkansas, Louisiana, Mississippi, and Tennessee.

The good news is that fatalities caused by tornadoes have decreased over time both in the SCIPP region (Figure 7) and across the country. This is a result of improved technology and techniques for predicting and identifying tornadoes, better alert systems, improved tornado shelters, and increased public awareness. However, the potential for a large number of fatalities during a widespread outbreak still exists. The most recent evidence for this occurred during the Super Tuesday outbreak of February 2008, which killed 57 people in Alabama, Arkansas, Kentucky, Mississippi, and Tennessee. These deaths were spread across a large area, and no single community suffered a large number of fatalities.

TORNADO PLANNING:

Stay aware of forecasts:

Tornadoes are very difficult to forecast. Even though forecasters can often identify a region that will be threatened by tornadoes on a given day, a tornado usually affects such a small area that it is impossible to know in advance which towns will be affected. Also, areas around the tornado's path may not be damaged at all. Low predictability on this scale means that everyone in an alerted area should be ready to seek shelter. Tornado warnings are usually signaled by a siren, but some communities use their sirens differently, so it is important to know your community's system.

Know where to take shelter:

The best place to be during a tornado warning is in an underground shelter or an interior room on the lowest level of a sturdy building. It is also helpful to get under a heavy piece of furniture and cover your head with blankets or pillows. Underground shelters can be built directly under a building or in a different area. Above ground safe rooms have also become popular. Some subsidies for safe rooms for homes and small business often are available.

Large buildings with high roofs, such as gymnasiums or shopping malls, are not safe because these roofs can collapse more easily. These types of buildings should have rooms specifically used as tornado shelters. Mobile homes, trailers, and vehicles are not safe because they can easily be flipped over or destroyed even by weak tornadoes. If you are in one of these, leave and go to a sturdy shelter immediately. If you are outside and cannot get to a sturdy building, the best option is to lie flat in a ditch to avoid flying debris.

Signs of a tornado:

Aside from a tornado warning, the following signs can indicate the possibility of a tornado in the immediate area:

- Clouds rotating or moving in different directions
- A loud roaring noise like a freight train
- Very dark or greenish clouds
- Large hail

Other items to consider:

When planning for tornadoes, it is important to consider other factors besides the weather. High population density, poor or disabled communication networks, and low building construction quality can increase the impacts of a tornado. If particular buildings - such as schools, hospitals, or facilities that handle hazardous materials - are in a tornado's path, this can create unique and challenging hazards. Additionally, debris tossed by a tornado can make roads impassable and create health risks during the cleanup process. After a strong tornado water, electricity, and other services may be unavailable for several days and roads may be impassable. Your plans should account for these possibilities. You may also need easy access to non-perishable food, first aid, and other essentials.

TORNADO MYTHS

There are many myths about tornadoes which can still prevent some people from taking appropriate action when tornadoes threaten. Here is a list of some of these myths and reasons that they are false.

Tornadoes don't happen here: In areas that have not experienced a tornado in many years, a mentality can develop that the area is protected from tornadoes by any number of things. Some examples that have been suggested include cities, hills, rivers, and ancient burial grounds. Previous events have shown that none of these items or any others can stop a tornado. For example, major cities in the SCIPP region that have been hit in their downtown areas by tornadoes include Nashville, TN, Ft. Worth, TX, New Orleans, LA, and Little Rock, AR. Thinking that an unrealistic barrier to tornadoes in your area exists is especially dangerous if it stops you from preparing for an actual event.

Opening the windows in a house will equalize the pressure and prevent the house from being blown apart: Opening the windows uses up precious time for seeking shelter while exposing you to great danger. Besides, a tornado will likely break the windows anyway.

An overpass is a safe place to take shelter if you are outside:

Going underneath an overpass is one of the worst things you can do during a tornado. Wind speeds can actually be higher in the confined space under a bridge. This will make flying debris even more dangerous. Also, the overpass could collapse on top of you. This myth is largely based on video taken by television news crew in the Andover, KS, tornado of April 26, 1991. The news crew went under an overpass and recorded a tornado passing by. Contrary to what was reported at the time, the tornado did not pass directly over the news crew. The crew was very fortunate, but other people taking shelter under overpasses since then have been killed.

The southwest corner is the safest part of a basement: It has never been confirmed that any part of a basement is especially safe or unsafe.

The biggest tornadoes are the strongest and deadliest: In many cases large tornadoes do not necessarily rate highly on the EF-scale and vice versa. Also, some violent and long-lived tornadoes do not cause many casualties, while some small tornadoes do. Location and awareness are the most important factors.

TORNADO MITIGATION

Plan: Tornadoes form so quickly that a plan for responding to the threat they pose must be made ahead of time. These plans should include use of selected shelters, ways to receive severe weather alerts and forecasts, and ways to communicate with others as needed. They should also include actions to take after a tornado strikes.

Assess: Any assessment should outline the economic sectors or geographic areas that have been affected by previous storms. Assessments need to consider changes in population density, construction quality, and social attitudes.

Monitor: Following weather forecasts ahead of severe weather will reduce the time needed to take action if tornadoes do occur.

Respond: This involves implementing any or all actions necessary in an attempt to reduce the impacts of tornadoes if they happen. Response actions may need to change quickly as the situation develops.

Examples in the SCIPP region:

In Arkansas, the Arkansas Hazard Mitigation Grant Program provides funds for county governments that have suffered repetitive loss from natural disasters - including tornadoes - in order to develop ways to reduce the effects of these hazards in the future.

In Texas, a regional awareness campaign called KnowWhat2Do informs the public on what to do in the event of a tornado and many other natural and manmade hazards

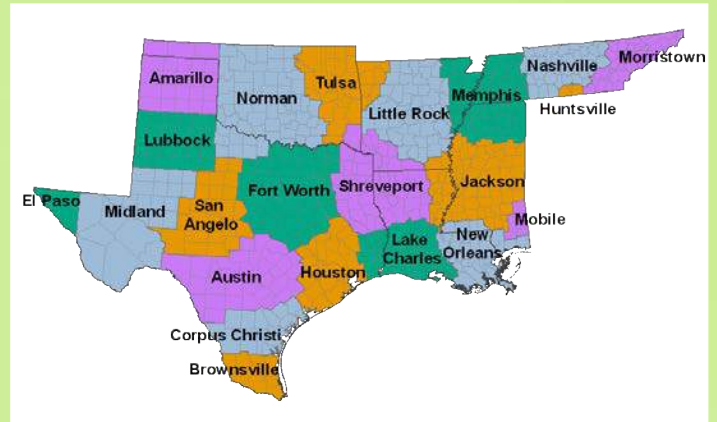
In Tarrant County, Texas, the Special Needs Assistance Program (SNAP) provides emergency managers with information about people who need help most urgently after a disaster.

Many schools all over the region have built safe rooms into their buildings. These rooms can protect hundreds children and school staff at one time.

TORNADO FORECASTS AND REPORTS

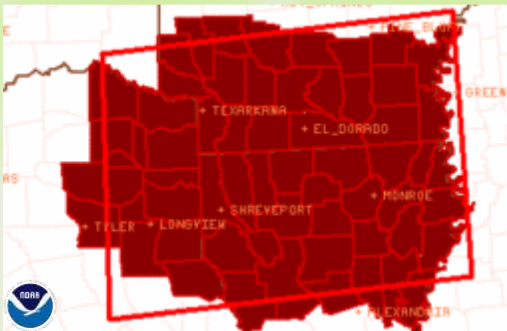
Forecasting Tornadoes:

The SPC releases an information product called a convective outlook for Day 1 (the current day), Day 2, Day 3, and Days 4-8. These outlooks also include forecasts for the probability of tornadoes, severe hail, and severe wind. As the expected time for tornadic development approaches, the SPC issues tornado watches in broad regions, and the local NWS offices issue tornado warnings for individual storms as needed. Trained spotters, law enforcement officials, and the public report severe storm observations to their local NWS office, which relays the information to the SPC and media outlets. A map showing the different NWS offices in the south central U.S. and the areas that they cover is shown in the figure to the right.



Tornado Watches:

The SPC issues tornado watches for periods lasting several hours. Areas in a tornado watch have conditions favorable for tornadoes. At this time you should monitor the situation and be prepared to seek shelter if necessary. On rare occasions, the SPC may also issue a particularly dangerous situation (PDS) tornado watch. This means that there is an increased risk for a major tornado outbreak.



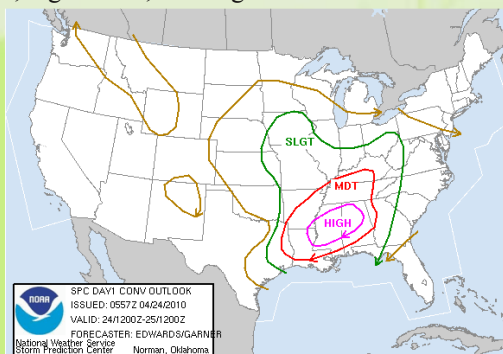
Tornado Warnings:

The NWS is responsible for issuing tornado warnings. A tornado warning means that a tornado has either been indicated by weather radar or spotted by a person. This is the time to seek shelter in an underground location or an interior room in the lowest floor of a sturdy building. In this example from April 24, 2010 (below) the red polygons are tornado warnings and the orange polygons are severe thunderstorms warnings.



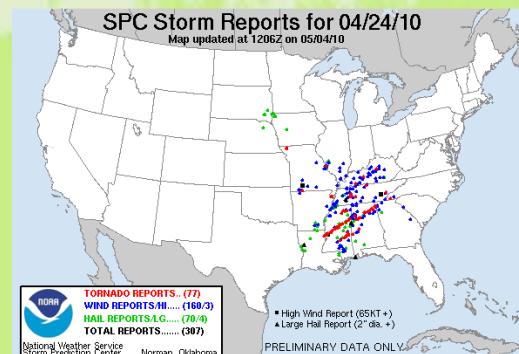
Convective Outlooks:

The SPC issues convective outlooks for Day 1 (the current day), Day 2, Day 3, and Days 4-8. These outlooks categorize the threat for severe thunderstorms as slight, moderate, and high. On Day 1 the outlooks also indicate the probability of tornadoes, high winds, and large hail.



Storm Reports:

The SPC also constantly updates a map of tornado, high wind, and large hail reports that the various NWS WFOs receive. Looking at where storms have already caused damage can be an indicator of what you may expect in the near future.



WHAT YOU CAN DO TO PREPARE:

Protect your house ahead of time:

There are several construction improvements that can be made to safeguard a house. The amount of money and effort they require to install varies widely. Some of the possibilities include:

- Attach hurricane clips or straps to your roof
- Secure the house to its foundation with anchor bolts
- Move unsecured items from your yard to an indoor location
- Install wind resistant doors and windows

Have a family plan:

A plan for each member of your family is vital during a tornado. The plan should include at least the following:

- Places to seek shelter during a tornado warning
- Methods to communicate if you get separated
- Make sure that everyone knows how to administer first aid
- Know how to turn off utility valves in case of an emergency
- Store critical documents in a safe
- Practice tornado drills to remind everyone of the plan

Become a storm spotter:

SKYWARN is a program run by the National Weather Service which trains volunteers to identify and report and severe weather. For more information on how to become a storm spotter visit

<http://www.weather.gov/skywarn>



Be mindful of other thunderstorm-related hazards:

Thunderstorms can produce other dangerous hazards besides tornadoes. Hail, high winds, lightning, and flooding can also cause deaths, injuries, and damage. After storms pass through, fallen power lines and trees can also be dangerous and hamper recovery efforts. Power outages can last for days, and other services may also be temporarily unavailable.

FOR MORE INFORMATION:

For more information on tornadoes visit the following sites:

1) The Online Tornado FAQ: A detailed introduction to many different aspects of tornadoes. Written by the Storm Prediction Center.

<http://www.spc.noaa.gov/faq/tornado>

2) The Storm Prediction Center: The organization responsible for forecasting thunderstorms for the entire United States.

<http://www.spc.noaa.gov>

3) The National Weather Service: The organization that issues tornado warnings and weather forecasts for the entire country. Over 100 forecast offices cover small geographic areas.

<http://www.weather.gov>

4) NOAA Weather Radio: The National Oceanic and Atmospheric Administration (NOAA) provides radio broadcasts of all weather advisories issued by the National Weather Service. This site provides information about purchasing and setting a weather radio.

<http://www.weather.gov/nwr>

5) The Federal Emergency Management Agency (FEMA): Provides a wealth of information and support for the public, first responders, and emergency managers on all hazards.

<http://www.fema.gov>

6) Centers for Disease Control and Prevention: Provides detailed information on preparing for tornadoes, as well as many other emergency situations.

<http://emergency.cdc.gov/disasters/tornadoes/prepared.asp>

7) StormReady: A program run by the NWS which recognizes cities, counties, universities, and other entities for taking measures to alert and protect its members.

<http://www.stormready.noaa.gov>

CONTACT US:

Please contact either one of our two program managers for more information about SCIPP or to get involved:

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Please also visit us at: <http://www.southernclimate.org>

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