**Thunderstorms and Lightning**

**Thunderstorm basics**

Thunderstorms are the most common form of severe weather and occur in every state in the United States. A thunderstorm is a storm with lightning and thunder. It’s produced by a cumulonimbus cloud, usually producing gusty winds, heavy rain and sometimes hail.

Each individual thunderstorm is relatively small in size. Thunderstorms average 15 miles in diameter and last an average of only 30 minutes. Worldwide, there are an estimated 16 million thunderstorms each year, and at any given moment, there are roughly 2,000 thunderstorms in progress. There are about 100,000 thunderstorms each year in the U.S. alone. About 10% of these reach severe levels.

Thunderstorms are most likely in the spring and summer months and during the afternoon and evening hours, but they can occur year-round and at all hours. There is even a thundersnowstorm, a snow-producing winter thunderstorm. Along the Gulf Coast and across the southeastern and western states, most thunderstorms occur during the afternoon. Thunderstorms frequently occur in the late afternoon and at night in the Plains states.

**How does a thunderstorm form?**

Three basic ingredients are required for a thunderstorm to form: moisture, rising unstable air (air that keeps rising when given a nudge), and lift.

The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise—hills or mountains, or areas where warm/cold or wet/dry air bump together can cause rising motion—it will continue to rise as long as it weighs less and stays warmer than the air around it.

As the air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool, releases the heat, condenses and forms a cloud. The cloud eventually grows upward into areas where the temperature is below freezing.

As a storm rises into freezing air, different types of ice particles can be created from freezing liquid drops. The ice particles can grow by condensing vapor (like frost) and by collecting smaller liquid drops that haven't frozen yet (a state called "supercooled"). When two ice particles collide, they usually bounce off each other, but one particle can rip off a little bit of ice from the other one and grab some electric charge. Lots of these collisions build up big regions of electric charges to cause a bolt of lightning, which creates the sound waves we hear as thunder.

If the thunderstorm is strong enough, it is classified as a severe thunderstorm. A thunderstorm is classified as “severe” when it contains one or more of the following: hail one inch or greater, winds gusting in excess of 57.5 mph (50 knots), or a tornado.

**Thunderstorm dangers**

Many hazardous weather events are associated with thunderstorms. Under the right conditions, rainfall from thunderstorms can cause flash flooding. Lightning strikes are responsible for injuries and deaths and start many fires around the world each year. Hail, which can reach the size of a softball, damages cars and windows and can injure and kill livestock caught out in the open. Strong (up to more than 120 mph) straight-line winds associated with thunderstorms knock down trees, power lines and can damage homes. Under certain conditions, thunderstorms can spawn tornadoes which can cause extensive damage and destruction to buildings and vegetation and injuries and deaths for people and animals. Of these many thunderstorm dangers, the biggest is lightning.

**Lightning**

Lightning is an electric current in the atmosphere between clouds, the air, or the ground. Within a thundercloud way up in the sky, many small bits of ice (frozen raindrops) bump into each other as they move around in the air. All of those collisions create an electric charge. After a while, the whole cloud fills up with electrical charges. The positive charges or protons form at the top of the cloud and the negative charges or electrons form at the bottom of the cloud. Since opposites attract, that causes a positive charge to build up on the ground beneath the cloud. The grounds electrical charge concentrates around anything that sticks up, such as mountains, people, or single trees. The charge coming up from these points eventually connects with a charge reaching down from the clouds and - zap - lightning strikes!
Lightning can occur between opposite charges within the thunderstorm cloud (intra-cloud lightning) or between opposite charges in the cloud and on the ground (cloud-to-ground lightning). Lightning is one of the oldest observed natural phenomena on earth. It can be seen in volcanic eruptions, extremely intense forest fires, surface nuclear detonations, heavy snowstorms, in large hurricanes, and obviously, thunderstorms.

Thunder is caused by lightning. When a lightning bolt travels from the cloud to the ground it actually opens up a little hole in the air, called a channel. Once then light is gone the air collapses back in and creates a sound wave that we hear as thunder. The reason we see lightning before we hear thunder is because light travels faster than sound.

**Thunderstorm Watch and Warning**

A Severe Thunderstorm Watchis issued by meteorologists who are watching the weather for conditions that show a severe thunderstorm is likely to develop. A watch can cover parts of a state or several states. A Watch means to **watch** and **prepare** for severe weather and stay tuned to the news for updates.

A Severe Thunderstorm Warning is issued by meteorologists when conditions are indicated by radar or seen by spotters. Warnings mean there is a serious threat to life and property to those in the path of the storm. When a warning is issued, it is important to **act** now to find safe shelter! A warning can cover parts of counties or several counties in the path of danger.

**Thunderstorm Safety**

If you’re outdoors: Keep an eye at the sky. Look for darkening skies, flashes of lightning, or increasing winds. Lightning often proceeds rain, so don’t wait for the rain to begin. If you hear the sound of thunder, go to a safe place immediately. The best place to go is a sturdy building or a car, but make sure the windows in the car are shut. Avoid sheds, picnic areas, baseball dugouts and bleachers. If there is no shelter around you, stay away from trees. Crouch down in the open area, keeping twice as far away from a tree as far as it is tall. Put your feet together and place your hands over your ears to minimize hearing damage from thunder. If you’re with a group of people stay about 15 feet from each other. Stay out of water, because it’s a great conductor of electricity. Swimming, wading, snorkeling and scuba diving are not safe. Also, don’t stand in puddles and avoid metal. Stay away from clotheslines, fences, and drop your backpacks because they often have metal on them. If you’re playing an outdoor activity, wait at least 30 minutes after the last observed lightning strike or thunder.

If you’re indoors: Avoid water. It’s a great conductor of electricity, so do not take a shower, wash your hands, wash dishes or do laundry. Lightning may travel along electric power lines. Do not use electric equipment like computers and appliances during a storm. Stay away from windows and doors and stay off porches.