

Questions and Answers about Thunderstorms

1. **How do they form?**

We need three basic ingredients to make a thunderstorm. The basic fuel is moisture (water vapor) in the lowest levels of the atmosphere. The air above the lowest levels has to cool off rapidly with height, so that 2-3 miles above the ground, it is very cold. Finally, we need something in the atmosphere to push that moist air from near the ground up to where the air around it is cold. This "something" could be a cold front or the boundary between where the cold air from one thunderstorm meets the air outside of the storm (called an outflow boundary) or anything else that forces the air at the ground together. When that happens the moist air is pushed up. What happens to a blob of moist air as it rises? It cools off and after a while, some of the water vapor turns into liquid drops (that we see as clouds). That warms up the rest of the air in the blob so that it doesn't cool off as fast as it would if the air was dry. When that blob of air gets to the part of the atmosphere where it is very cold, it will be warmer and less dense than the air around it. Since it is less dense, it will start to rise faster without being pushed, just like a balloon filled with helium does. Then more water vapor turns into liquid in the blob and the blob warms up more and rises even faster until all of water vapor is gone and the blob eventually reaches a part of the atmosphere where it isn't warmer than the environment (typically 5-10 miles).

2. **How are they detected?**

We can see thunderstorms with a variety of tools. Radars let us see where rain and hail are located in the storm. Doppler radars also let us see how the wind is blowing within and near the storm. Some features of thunderstorms, such as the anvil that spreads out at the top of the storm, can be seen from satellites.

3. **What type of damage can they cause?**

Many hazardous weather events are associated with thunderstorms. Fortunately, the area affected by any one of them is fairly small and, most of the time, the damage is fairly light. Lightning is responsible for many fires around the world each year, as well as causing deaths when people are struck. Under the right conditions, rainfall from thunderstorms causes flash flooding, which can change small creeks into raging torrents in a matter of minutes, washing away large boulders and most man-made structures. Hail up to the size of softballs damages cars and windows, and kills wildlife caught out in the open. Strong (up to more than 120 mph) straight-line winds associated with thunderstorms knock down trees and power lines. In one storm in Canada in 1991, an area of forest approximately 10 miles wide and 50 miles long was blown down. Tornadoes (with winds up to about 300 mph) can destroy all but the best-built man-made structures.

4. **How does atmospheric pressure change in and around thunderstorms?**

Conditions in the atmosphere change a lot over a small distance in the vicinity of thunderstorms. Where the rain is falling, the pressure goes up by a few millibars (about 0.1 inches of mercury). This is because as the rain falls, some of it evaporates, which makes the air cooler and heavier. Another process is going on, however, that makes the picture complicated. As the air goes up in the thunderstorm's updraft, it creates an area of low pressure under the updraft that acts to pull air in from around the thunderstorm. This low pressure region is also typically a few millibars lower than the environment of the storm. At the top of the storm the pressure is high compared to places far away from the storm and air is blown out.

5. **Is there such a thing as software that helps track thunderstorm development?**

Thunderstorms may be 10 to 15 miles in diameter, and have average lifetimes of 20 to 30 minutes. Add to this the fact that even PhD researchers can't agree on what exactly a supercell is...and maybe you can see the problems.

There is no computer program available that;

1. tracks individual storms (including supercells)
2. is available to the public
3. is available in near real time.

By the way, there are computer algorithms that run on our display of the WSR-88D NEXRAD radar that track storms and supercells...but they are not used much. Why? Because they are still not as good as a trained radar operator at looking at the structure of the storms.

6. **I have heard Meteorologists mention numbers like -6 to -10 when talking about thunderstorms. What does this mean?**

When Meteorologists talk about -6 to -10, or numbers like that, they are probably referring to the Lifted Index (LI). This is a measure of how unstable the atmosphere is at any given moment when the measurement is taken, usually by a weather balloon. The larger the negative number, the more unstable the air is and the greater the chance of forming thunderstorms with violent updrafts, hail, strong winds, and perhaps even tornadoes.