

Chapter 15, Part 2

Lightning

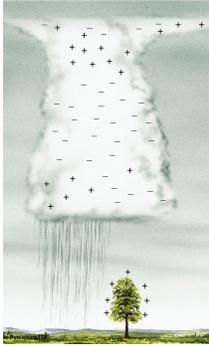
What is lightning?

- Lightning is a discharge of electricity which occurs in mature thunderstorms.
- Most lightning cloud to cloud. Only 20% cloud to ground.
- Lightning heats air (30,000°C), air expands explosively, initiating sound wave called thunder.

Speed of Lightning and Thunder

- Light travels at 300,000,000 meters/second.
- Sound travels at 330 meters/second.
- It takes sound 3 seconds to travel 1km, and 5 seconds to travel a mile.
- Can determine distance away from time between lightning and thunder.
- Sometimes atmosphere refracts thunder away.

Electrification of Clouds



- For lightning to occur, opposite charges must exist within a cumulonimbus cloud.
- Unlike charges attract. Ground positively charged under negative cloud.
- Dry air is a good insulator.

1. Cloud to Ground Lightning



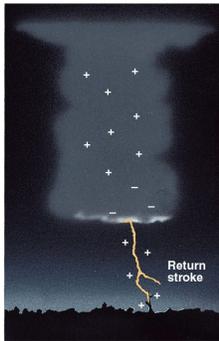
- Discharge of electrons rush towards cloud base and then towards ground.
- Called stepped leader.
- Very faint – usually invisible to human eye.

2. Cloud to Ground Lightning



- A current of positive charge starts upward from the ground to meet stepped leader.
- This current usually starts from elevated objects.

3. Cloud to Ground Lightning



- When the two currents meet, electrons flow to the ground and a brighter return stroke surges upward to the cloud along the path followed by the stepped leader.
- Happens quickly 1/10,000 sec. so appears as one flash.
- The leader-and-stroke process is usually repeated several times at intervals of ~0.04sec.

Some Types of Lightning

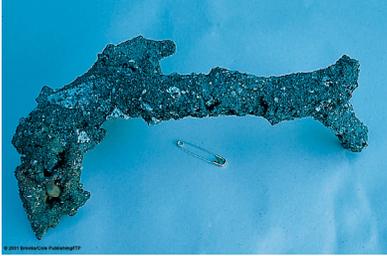
- Ball lightning – looks like a luminous sphere (still not understood)
- Sheet lightning – flash occurs inside a cloud or obscured by clouds so that part of cloud is a luminous sheet
- Heat lightning – light from distant electrical storms refracted (usually appears orange)
- St. Elmo's Fire – greenish, bluish halo from continuous discharge on tall objects (ship's mast)

Lightning Rods



- Lightning rods are tall and pointed to attract lightning and stop it from hitting buildings.

Fulgurite



- When lightning enters sandy soil, the high temperature fuses sand particles together.

Lightning Striking Cars



- Takes quickest path to ground along outside metal casing of vehicle. Note marks where lightning traveled along Sunshine State Parkway.

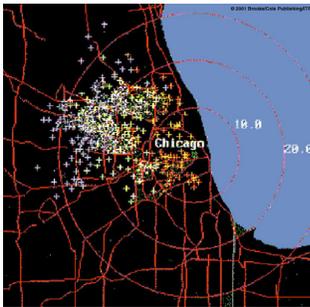
Lightning and Safety

- Can be electrocuted by lightning.
- Average death toll in US is ~100, most in Florida.
- If someone is struck, immediately give CPR.
- Most fatalities occur in the vicinity of isolated trees, which act as lightning rods.

Safety Tips

1. Stay inside buildings.
2. Stay inside cars and trucks (not golf carts).
3. Avoid elevated places and isolated trees.
4. Do not lie down.
5. Crouch down and minimize contact area you have with the grounds.

Lightning Detection



- Cloud-to-ground lightning is detected through radio waves (sferics) produced by lightning.

Lightning Research



Triggered lightning at Camp Blauvelt is used to study lightning discharges and their power and other effects on systems.

- UF is one of a few universities to conduct [research on lightning](#). Shown: triggered lightning.

Summary

- Lightning is an electrical discharge between cloud and ground or between clouds.
- The heating of the air by the discharge causes a sound wave (thunder).
- Lightning starts with a stepped leader from the cloud and finishes with a return stroke.
- Lightning is dangerous with ~100 fatalities occurring annually, mostly in Florida.
