Profile

Lightning

What it is

From over the Atlantic Ocean and the Gulf of Mexico, air masses directly affect Florida's weather. Warm air is lifted high into cool, upper air layers in the atmosphere. The cooling of this rising air causes its moisture to condense and clouds to form.

Moisture droplets that form in the upper, cold parts of the clouds begin to fall earthward when they reach a certain size, back into warm, uplifting currents where the droplets may again vaporize and be lifted even higher into the upper air layers.

This repeated cycle of warming, lifting, and cooling creates tall columns of billowy clouds. While the bases of the clouds may be 3,000 feet above sea level, the tops of the cloud columns develop upward to levels of 60,000 feet.

Clouds may contain millions and millions of water droplets and ice suspended in the air. As the process of evaporation and condensation continues, the rising and falling droplets collide. The collisions cause electrons to be knocked off of the rising moisture, creating a *charge separation.*

Inside the clouds, electrical charges build up and separate into positive and negative centers. The upper portion of the cloud becomes positively charged and the lower portion becomes negatively charged.

When there is a charge separation in a cloud, an *electric field* is created which is also positive in the upper region and negative in the lower region.

The strength or intensity of the electric field is directly related to the amount of charge buildup in the cloud. As the collisions and freezing continue to occur and the charges at the top and bottom of the cloud increase, the electric field becomes intense.

In fair weather, ground has a negative charge. However, the extreme intensity of an electric field in a cloud causes electrons at the earth's surface to be repelled deeper into the earth by the strong negative charge at the lower portion of the cloud. This repulsion of electrons causes the earth's surface to acquire a strong positive charge.

The strong electric field, being somewhat self-sufficient, creates a conductive path between the negative cloud bottom and the positive earth surface. This leads to cloud-to-ground lightning discharges.

What it does

More deaths are caused by lightning than any other natural phenomena including floods, hurricanes and tornadoes. More than 100 people die annually in the United States as a result of lightning. Serious injuries are caused in about 1,000-1,500 persons each year. Of those survivors, 74% sustain permanent injuries.

Lightning deaths are less well publicized than those from other natural phenomena because they are in individuals or small groups and not associated with large-scale property damage that tv and other media love to feature.

Lighting has about a 50 yard search radius on the ground in an area that a strike will occur. It can strike as much as 10 miles from the rain of a thunderstorm and occur even when the storm appears to be weakening or moving away. Lightning usually seeks the tallest objects in that area, like cypress trees along the boardwalk.

The current in a lightning bolt can be as high as 30,000 amperes with 1,000,000 or more volts. The short duration of from 1-100 milliseconds limits injury but doesn't prevent it.

Types of lightning injury

The most severe is a *direct strike*, either to the victim or an object the victim is holding like a tripod or umbrella.

A *side flash* occurs when lightning hits a nearby object, like a cypress tree, and jumps to the victim.

Ground current injures the victim when lightning strikes the ground nearby and it spreads to the person.

Rarely, people maybe injured or killed indoors while using the telephone (copper wires) or taking a shower (copper pipes). Burns may occur from jewelry, clothing or other heated material.

Finally, blunt injury and trauma may occur secondary to the shockwave from a lightning strike or from a resulting fall.

Types of strikes

Cloud-to-ground, already explained, is the most common.

Ground-to-cloud is same as above with the exception that usually a tall, earth-bound object initiates the strike to the cloud. It is less common.

Cloud-to-cloud is also the same as discussed above, except the strike travels from one cloud to another.

Types of lightning

Regular lightning is already explained.

Sheet lightning is regular lightning that is reflected in the clouds.

Heat lightning is regular lightning near the horizon that is reflected by high clouds; the strike is too distant to hear thunder.

Blue jet is a blue, cone-shaped burst that occurs above the center of a storm cloud and moves upward, toward the stratosphere, at a high rate of speed. It is not visible from the ground.

Additional information

www.science.howstuffworks.com/lightning.htm

Good video at the Discovery Channel:
http://link.brightcove.com/services/link/bcpid1213900614/bctid1346591818

Lightning Safety

If caught outside in a storm, always look for appropriate shelter. Do not take any chances — lightning will use people as a path to the earth just as easily as it will use any other object.

Appropriate shelter would be a building or a car. If there isn't anywhere close by to go, then avoid taking shelter under trees. Most trees attract lightning.

Put your feet as close together as possible and crouch down with your head as low as possible without touching the ground – the *lightning crouch.*

Never lie on the ground. After lightning strikes the ground, there is an electric potential that radiates outward from the point of contact. If a body is in that area, current can flow through it. Powerful current passing through a body is *not* a good thing. It can cause cardiac arrest as well as burns and damage to other organs.

By making the body as low to the ground as possible and minimizing the amount of body in contact with the ground, the possibility of a lightning-related injury is greatly reduced. If a strike were to occur near a person, the current would have a much more difficult time flowing through a body in the lightning crouch position.

If indoors, stay off the telephone. If lightning strikes the phone line, the strike will travel to every phone on the line, and potentially to you if you are holding the phone. If you must call someone, use a cell phone.

Stay away from plumbing pipes and outlets such as a bath tub, shower, or sink. Lightning has the ability to strike a house or near a house and impart an electrical charge to the metal pipes used for plumbing.

This threat is not as great as it used to be because PVC (polyvinyl chloride) is often used for indoor plumbing these days. If you are not sure what your pipes are made of, don't gamble – just wait until the storm is long over.

Lightning Myths

MYTH: Lightning never strikes twice in the same place
TRUTH: *False.* Lightning often strikes the same place repeatedly, especially if it's a tall, pointy, isolated object.

MYTH: If there's no rain or clouds overhead, lightning won't strike
TRUTH: *False*. Lightning can strike up to 10 miles from the thunderstorm, well away from the rain or even thunderstorm cloud.

MYTH: Rubber tires on a car protect people from lightning by insulating them from the ground
TRUTH: *False.* Lightning laughs at two inches of rubber! Most cars are reasonably safe from lightning, but it's the metal roof and metal sides that provide the protection, not the rubber tires. The metal, being a good conductor, directs current and charge around the car where it discarges safely to the ground. Thus, convertibles, motorcycles, golf carts, and cars with plastic or fiberglass bodies offer no lightning protection.

MYTH: A lightning victim is electrified. If anyone touches them, they'll be electrocuted
TRUTH: *False*. The human body doesn't store electricity. It is perfectly safe to touch lightning victims to give them first aid.

MYTH: If outside in a thunderstorm, go under a tree to stay dry.
TRUTH: *False*. Being underneath trees is the second leading activity for lightning casualties – enough said!

MYTH: When playing sports and thunderstorms threaten, it's okay to finish the game before seeking shelter.
TRUTH: Sports is the activity with the fastest rising rate of lightning casualties. No game is worth death or lifelong severe injury.

MYTH: Metal on the body (jewelry, watches, glasses, cell phone) or metal on structures attracts lightning
TRUTH: *False.* Height, pointy shape, and isolation are the dominant factors controlling where a lightning bolt may strike. The presence of metal makes virtually no difference to where lightning strikes. But while metal doesn't attract lightning, touching or being near long metal objects (fences, bleachers, vehicles, etc.) is still unsafe when thunderstorms are nearby. If lightning does happen to hit it, the metal can conduct the electricity a long distance, up to 100 yards, and still cause electrocution.

MYTH: Carrying an umbrella increases the risk of being hit.
TRUTH: *True.* Increasing height by any amount increases the chances of being hit. Basically, avoid being the highest object anywhere, be it a beach, small open boat, pier, boardwalk, field, yard, or ridge.

MYTH: Wearing a rubber raincoat or rubber-soled sneakers decreases the chance of being hit.
TRUTH: *False.* If lightning has burned its way through a mile or more of air, which is a superb insulator, a few millimeters of any insulating material isn't going to make any difference.

MYTH: A surge protector protects computers and other electronic equipment from lightning damage.
TRUTH: *False*. The surge protector isn't much bigger than a piece of jewelry, and it is just as insignificant to a million-voltage lightning bolt. The surge protector may be good insurance against problems when the power in the house goes off and is later restored, but it's useless against actual lightning strike damage. To protect electronic gear, turn it off and then unplug it from the wall