METEOROLOGY

Thunderstorm—Huge Dynamo

Lightning, hail and torrential rains are the most destructive products of thunderstorms, which often develop from the seemingly innocent-looking clouds of late spring and summer.

By MICHAEL J. WALKER

➤ ALL OF US at one time or another in spring and summer have had our stroll through the woods, picnic in the park, boating on the lake, fishing in the river or outdoor work interrupted by a thunderstorm, nature's huge dynamo.

In their menacing advance, thunderstorms bend tree branches, drive huge waves in lakes, hurl dangerous bolts of lightning, and pelt the earth with crop-destroying hail and torrential rains.

Because some persons are unable to go indoors and escape the fury of such storms or because of carelessness, lightning kills about 230 each year in the United States. Hail causes hundreds of thousands of dollars worth of damage, and the heavy rains wash millions of tons of soil uselessly into streams and river beds or into the sea each year.

A lightning bolt, which can be charged with as much as five million volts of electricity, destroys homes, disrupts power service and causes fires damaging millions of dollars worth of timberland.

The losses from thunderstorm effects cost the country more than $150,000,000 each year.

Thunderstorms Prefer Tropics

At least 45,000 thunderstorms occur throughout the world each year, the U.S. Weather Bureau reports. They prefer the land areas of the tropics, are rare in the polar regions.

In spring and summer, they form over land in the U.S. and other temperate regions during the afternoons and evenings. Thunderstorms are especially numerous over Florida, where they occur about 100 days a year. They are seldom spawned over California, however.

A single cumulonimbus, or thundercloud, can sprawl over an area of several square miles. The storms also occur in lines as long as 300 miles. Cumulonimbus clouds are very tall, usually towering to 40,000 feet. They march across the country at 15 to 35 miles an hour while they live, which is anywhere from half an hour to an hour and a half.

Weather scientists have probed deep into thunderstorm clouds, using airplanes, balloons and other devices.

Although they have not learned how to alter the behavior of thunderstorms, scientists have learned some of the reasons such clouds behave as they do.

Among other things, they have discovered three distinct stages of development—birth, maturity and death.

The fleecy white cumulus cloud slowly drifting across the sky on warm days is the beginning of a thunderstorm. A strong updraft within the cloud forms a thunderhead, the towering "anvil" of a cumulonimbus cloud. Within this updraft, cloud droplets condense and grow, and some of these raindrops fall down through the cloud.

As the water vapor cools and condenses into droplets, or into tiny ice crystals in the upper, frigid heights, heat is released to add more power and lift to the updraft. The more powerful the updraft, the more water vapor is carried aloft.

Some of the lower droplets are tossed upward to the cooler regions, where they collide with the ice crystals and freeze, layer upon layer, around the crystals, thus building sizable hailstones. Some of the droplets stay in the lower regions and join to form larger raindrops.

Changes in Circulation

As the growing cumulus rapidly approaches maturity, sudden change takes place in the circulation of air within it. A cool downdraft forms in the upper part of the cloud, beside the warm updraft, and comes down to earth. The growing raindrops and hailstones high up become too heavy for the updraft to support, and they also begin to fall.

Gusts of wind are produced by the downdraft, bringing sudden drops in temperature of as much as 10 degrees, followed by rain and sometimes hail. Such a storm lasts for about 15 or 30 minutes, becoming very intense. Thunder and lightning also begin with the rainfall and also become very intense.

At final maturity, amid the thunder, lightning, hail and rain, the giant cloud stands crowned with ice crystals. The puffy protuberances reach high into the atmosphere, where the horizontal winds shear off the top, forming an anvil-like crown.

Falling rain and hail and the downdraft cool the ground below, reducing the updraft and therefore the amount of moisture carried upward. With less condensation, the thunderstorm's power dwindles rapidly—less rain falls and the downdraft weakens, lightning and thunder fade away, and the temperature within the cloud gradually approaches that of the surroundings.

Cloud Filled With Ice

Heat is one of the triggers for this three-stage development. Because the earth's surface absorbs and reflects the sun's energy at varying rates, a column of warm air forms near the surface and rises, becoming the updraft that changes the fair weather cumulus cloud into a thundercloud. This heat-type thunderstorm, common in Florida, is only one of several types.

Another is the mountain thunderstorm, in which warm moist air is driven to higher altitudes when it strikes a mountain, creating an updraft and cumulonimbus clouds.

Fremont Davis

THUNDERSTORM IN THE MAKING—A billowy white summer cloud such as this shows promise of developing into the destructive thundercloud, with accompanying lightning and hail storms.

This is a common cause of thunderstorms in some Rocky Mountain states, where lightning starts many forest fires.

Frontal thunderstorms develop in a long parade when a large mass of cold air moves into an area and wedges under a warm moist mass of air or when such moist air moves in over a cold mass of air. An updraft is created as the warm, moist air is driven skyward, and again the three-stage development takes place. Thunderstorms formed under such conditions are common in the Midwest.

Weather scientists can predict the frontal type of storm quite accurately by charting the movements of large masses of warm and cold air. The heat type, however, is the result of more local conditions and is more difficult to forecast.

How large electrical charges build up within a thunderstorm is still not understood. An excess of electrons gathers at the base of the giant cloud, creating a strong negative charge, while at the top there is a strong positive charge.

Lightning occurs between the positive and negative portions of a cloud, between two clouds, or between a cloud and earth, equalizing charges.

Explosive Heating Causes Thunder

Thunder arises in the explosion that occurs along the path of the lightning channel. Lightning's flood of electrons heats the air in its path with sudden violence, often to temperatures of 18,000 degrees Fahrenheit. The air is forced to expand in all directions, creating booming sound waves.

A rumbling type of thunder is heard when the sound is reflected off clouds, hills and buildings, or when successive discharges or flashes occur within a giant cloud.

Because tall objects like buildings and trees attract lightning, wise homeowners install well grounded lightning rods atop their homes and wise golfers avoid hiding under trees during lightning storms.

The favorite target of lightning in the United States is the Empire State Building, which is struck as many as 68 times a year. However, a lightning rod and grounding through the steel girders protect the building and the people in it.

Some weather scientists believe that seeding cumulus clouds could keep them from growing to thunderstorm size, thus preventing lightning flashes. This belief is now being tested in the Northwest by the U.S. Weather Bureau and the Forest Service in a seeding program called Project Skyfire.

In addition to especially equipped observer planes and radar, weather scientists are using special "sferics" receivers that pick up some of the electromagnetic waves radiated by lightning. These receivers are enabling researchers to pinpoint areas of unusually great lightning in Montana, Wyoming and Idaho.

Similar equipment also is being used by the U.S. Weather Bureau to watch thunderstorms in the Midwest.

Producing many small clouds instead of one large one by seeding would not only reduce the chances of destructive lightning but also of hail, which falls only from towering cumulonimbus clouds.

• Science News Letter, 85:362 June 6, 1964

ORNITHOLOGY

Whooping Cranes Summering in Canada

➤ WHOOPING CRANE number 32 has departed for his summer vacation in Canada.

The last of the wild flock to leave the sunny refuge in Texas, this crane had been hanging around by himself for about two weeks, a Fish and Wildlife expert reported in Washington, D. C.

The first of the wild flock of the great white birds left the Aransas National Wildlife Refuge on the Texas coast around April 10. Since then the rare birds have been taking off singly or in groups of two or three for their spectacular 2,500-mile flight up the middle of the United States to their summer refuge near Great Slave Lake, Canada.

This long flight usually takes from two to three weeks, during which time hunters along their route are warned not to shoot or harm the birds which have been on the edge of extinction for many years.

Whooping cranes fly north in the spring to their summer camping grounds where they nest and produce their young. Then each autumn, as the icy winds get stronger, the handsome tall birds make their long journey back to Texas.

Every once in a while, some of the birds stay throughout the summer in Texas, reported the Wildlife official. Four of them stayed during the summer of 1946, and during the past few years it is not unusual to have one or two stay behind. Reasons vary as to why the birds do not migrate. It might be a wing injury or some other factor.

Because of the precarious state of the existence of these beloved creatures, tallest of the American birds, scientists are reluctant to molest them in any way or track them down. Flights of other birds can be tracked by placing small radio devices on their bodies and tracing their progress by the signals. But not on whoopers, said the official. We do as much as possible to keep man and civilization from interrupting their lives.

An unhappy setback to the nation's bird lovers came when Zoe, an 18-day old baby whooper died at San Antonio, Texas, of an apparent pulmonary failure. Hopes had been high for wildlife officials to start with Zoe and build up a flock of captive whooping cranes which would gradually be released to the wild flock. There now are seven captive whoopers, all in the New Orleans zoo.

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Do You Know?

A new 40mm grenade *launcher* enables an infantryman to fire as many as 250 explosive shells per minute.

Risk of *bacteremia* in patients with rheumatic heart disease may be decreased by selecting dental procedures that are least likely to introduce microorganisms into the blood.

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