

METEOROLOGY

Tornadoes—Vicious Storms

A twirling funnel swooping down from the dark underside of a thunderstorm cloud generates terror in persons who see it and strews death and destruction in its path.

By ANN EWING

► TORNADOES are nature's most vicious storms.

The twister's twirling funnel is a terrifying sight. In a seemingly erratic way, the elephant-like trunk of swirling winds deals death and destruction in its path.

A tornado is born in the dark march across the countryside of a row of thunderstorms, called a squall line. The general weather conditions in which a twister is spawned are known, but the exact forces that trigger tornado formation at one time and not at another remain a mystery.

New radar techniques being tested this year may help uncork the secret of the birth, life and death of the spinning funnels. "Pulsed radars" now in operation at Norman, Okla., are able to detect tornadoes as they are formed, and measure the wind speed of the twirling air columns, as well as in the clouds in which they are found.

New Research Radars

These new research radars are only one gun in the constant battle being waged to determine what makes a tornado tick, and when. Knowing these factors is essential to a warning system more accurate and precise than now available.

Another weapon in the anti-twister campaign is the weather satellite. Tiros satellites have photographed intense clouds at high altitudes associated with severe thunderstorms, but so far weathermen have not been able to spot a unique key that can be used in timely forecasts.

When the Nimbus satellite is launched next year, the chances of finding this key will be increased because many more meteorologists around the world will be looking at the photographs much more quickly than they are now. This is because photos from the Nimbus satellites can be received by a system called APT, for automatic picture transmission, that allows inexpensive ground stations to receive up to three pictures each time a Nimbus passes overhead.

Without an adequate warning system, disastrous loss of life and property damage can occur. On March 18, 1925, the most destructive tornado in life and property known in the United States swooped across a three-state area of Missouri, Illinois and Indiana. It killed 689 persons, injured 1,980 others and caused property losses then valued at \$16,632,000, probably at least twice that total now.

Today a catastrophe like that would not happen. A huge tornado warning network now blankets the United States, especially concentrated where twisters are most likely to occur. This network is supplemented by

observations from many public-spirited citizens who contact the local Weather Bureau office or the police when they spot a tornado.

Since the early 1950's, weathermen have made great strides in developing the tornado warning network. Although the system is not foolproof, it has considerably reduced losses in lives and property whenever a twister strikes.

The hub of the tornado warning network is in Kansas City, Mo., in the heart of "Tornado Alley," so called because it is the belt of land in which the storms are most frequent. The belt includes the great lowland areas of the central and upper Mississippi, the Ohio and the lower Missouri River Valleys.

No state, however, is entirely free from tornadoes. A tornado over water is called a waterspout.

Tornadoes are not confined to the U.S. They occur in many parts of the world and have been reported in Canada, England, France, Holland, Germany, Hungary, Italy, Australia, India, Russia, China and Japan. Such unexpected places as the Bermuda Islands and the Fiji Islands have also been hit, Snowden D. Flora of the U.S. Weather Bureau states.

However, the U.S. experiences the most violent and destructive of these storms.

To help learn more about tornadoes, the

Weather Bureau is this year concentrating all research on such storms at the National Severe Storms Laboratory, Norman, Okla. Dr. Edwin Kessler, formerly of the Travelers Research Center, Hartford, Conn., is in charge, and Dr. Roger L'Hermitte will be working with him as a consultant.

With their associates, they will concentrate particularly on indirect methods of probing the atmosphere, using several kinds of radar and also a technique called "sferics," short for atmospheric, which is tuning in on the noises produced by electrical activity in the air.

Funnel's Wind Speed

The "pulsed radar" uses the Doppler Effect to measure the funnel's wind speeds. The Doppler Effect is the shortening or stretching of the radar beam's wavelength as it bounces back from the funnel, depending on the direction of the twister's motion toward or away from the observer.

As Dr. Robert H. Simpson, the Weather Bureau's assistant director of research for severe storms, put it:

"Airplanes flying as close as possible to squall lines and tornadoes have shown us the skin of the elephant. The storms are too hazardous to penetrate directly. Therefore we must rely on indirect probing to find out what kind of organs are inside the skin."

One theory to be checked, Dr. Simpson said, is that the jet stream flows around thunderstorm clouds towering high in the atmosphere in much the same way a stream flows around a log, setting up pressure



Culver Davison

TERRIFYING TWISTER—The destructive funnel of a tornado is shown as it appeared near Scottsbluff, Neb. It was photographed by Culver Davison from about two and a half miles away in the late afternoon.

differences that generate the tornado's swirling vortex.

However, Dr. Simpson noted, there are a "bucketful" of theories to be tested, then accepted or discarded.

In the realm of the known are the overall weather patterns needed to spawn tornadoes. Whenever two large air masses—one moisture-rich and warm, the other dry and cooler—battle for supremacy, the stage is set for stormy weather. If other factors are right, the resulting thunderstorms may give birth to a tornado's vicious funnel.

Temperature Difference Required

One factor is a big temperature difference between the tropical air and the colder air, such as temperatures in the high 90's ahead of the cold front, in the 60's behind it. High in the atmosphere is the swiftly moving jet stream, usually flowing from west to east, bringing with it drier, cooler air.

The width of the path over which the tornado funnel causes such damage averages less than one-quarter of a mile, and the length is usually 10 to 40 miles.

The tornado's destructive effects are awesome. Strong buildings are torn apart and scattered like kindling wood. Large trees

are uprooted and the bark stripped off. Persons and farm animals are hurled through the air, then dashed to earth. Slivers of wood are driven deep into boards and posts.

Although instruments cannot withstand such forceful winds and are themselves blown away, weathermen have estimated from such effects that the wind speeds within tornadoes are as high as 500 miles an hour.

A simple and spectacular experiment that shows how tornadoes twirl can be done by anyone with a record player. This is what to do:

Place a clear bottle of soda water, minus the label and the top few inches of liquid, on the center of the turntable and rotate the record player until the soda reaches the same speed. Drop in a pinch of sugar—any other solid particles will do, but sugar is recommended if the soda is to be drinkable afterward.

Bubbles of gas produce an upcurrent and hence an inflow, and a tight vortex, like that of a twister, will form suddenly.

Dr. J. S. Turner of the Commonwealth Scientific and Industrial Organization in Sydney, Australia, developed the do-it-yourself "tornado" using soda water.

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BOTANY

Spring Blooms All Year

► THE FLOWERS that bloom in the spring can be made to grow all year round by adding some extra light and chemicals.

Those shrubs known as woody ornamentals, such as azaleas and rhododendrons, can be treated with additional incandescent light and certain chemicals to make the bushes bloom earlier, produce more blossoms and stay blooming all the year.

Petunias and marigolds can be made to put out more blossoms, and chrysanthemums grow with shorter stems, explained Dr. Henry M. Cathey, horticulturist with the Agricultural Research Service, U.S. Department of Agriculture.

Remarkable effects on flowering plants can be caused by the careful use of additional light and various new plant chemicals that control growth, stated Dr. Cathey who demonstrated some of the flower examples at the USDA Food and Home Fair in Washington, D. C.

Agricultural scientists have been unearthing new facts about the light requirements of plants, and of the part played by a plant pigment called phytochrome in regulating the lives of flowering plants.

Petunia seeds, for example, will germinate more readily than usual when they are exposed to supplemental incandescent light during each 24 hours, Dr. Cathey demonstrated.

Germination rates of more than 90% are possible with the use of extra light.

In addition, the flowering of petunias can be speeded up by exposing them to extra light each day. Petunias are a type of plant that grows better when the days are long. When they are exposed to more than 12 hours of light each day, they produce many more blossoms.

Other garden annuals that respond to

more light include bachelor's button, China aster, snapdragon, phlox and verbena. When the young plants are given eight hours of light each day, and then set out in the garden, they will flower profusely all summer during the long hours of light.

Key pigment in this light-response pattern is the light-sensitive phytochrome which is a protein substance found in all plants. It triggers the flowering in a plant, Dr. Cathey explained.

By altering the light upon a plant, a person can alter the manner in which a plant also produces flowers, he said.

The stems of flower plants also can be made longer or shorter by careful use of various new chemicals, such as B-Nine, phosfon, and Cycocel.

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AGRICULTURE

New Automatic Milking Machine Developed

► MILKING MACHINES are now being developed that automatically release from the cow should attendants wander off and forget them. Irritation of the cow's udder can result when the last drop of milk is extracted. This can cause mastitis, an inflammation and congestion of blood in the udder, explains Prof. W. E. Petersen, department of dairy husbandry, University of Minnesota.

The new milking machines will have an automatic release of the vacuum to each quarter of the udder as the quarter is milked out, because it sometimes takes up to 35% longer to milk out some quarters than others.

• Science News Letter, 85:283 May 2, 1964

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