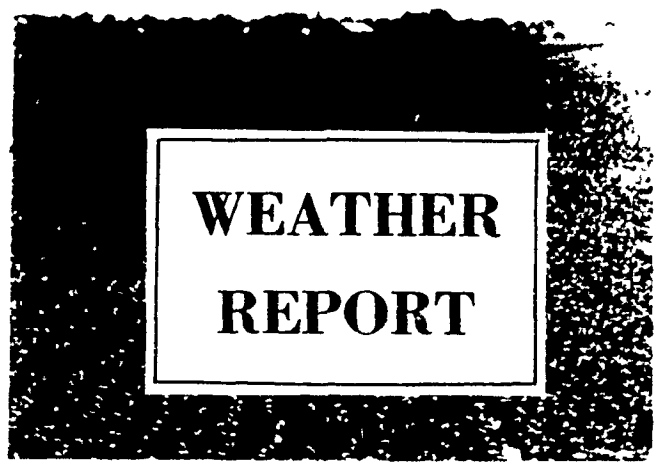
Nature's fireworks explained

By DIETER KRIEG

EDITOR'S NOTE - This is the eighth report on the forces which shape our weather.

"Whoooooooo," my little 2-year old son exclaims excitedly when he sees a flash of lightning in the sky "Look at that!" A bit frightened, but still fascinated, his 4-year old brother joins him and watches Nature's fireworks "See the big light, Daddy?" the older one might ask, while the little fellow points his little fingers towards the sky and says "big noise" A thunderstorm - lightning and thunder - is indeed Nature's most awesome aerial show. While it's fascinating to a degree, to most of us it has always been something more than that. Usually it's frightful, and why not. Lightning brings on more destruction each year than either hurricanes or tornadoes and an average of 150 Americans are killed by it annually. And then there are the barns and houses which are ignited by it, and livestock that's killed.



Understanding lightning is not easy, the experts admit, but they do offer some theories. Last week's "Weather Report" told of how the forces of Nature are at work to produce the 100 million volts which are involved in a massive thunderbolt being released. This week an explanation is offered as to how that electrical current leaps from cloud to ground, or cloud to cloud, or ground to cloud. The information which follows comes directly from a publication issued by the National Oceanic and Atmospheric Administration, Washington, D.C.

"Lightning occurs when the difference between the positive and negative charges—the electrical potential—becomes great enough to overcome the resistance of the insulating air, and to force a conductive path for current to flow between the two charges. Potential in these cases can be as much as 100 million volts. Lightning strokes represent a flow of current from negative to positive (in most cases), and may proceed from cloud to cloud, cloud to ground, or, where high structures are involved, from ground to cloud".

"The typical cloud-to-ground stroke we see most frequently begins as a pilot leader, too faint to be visible, advances downward from the cloud, and sets up the initial portion of the stroke path. A surge of current called a step leader follows the pilot, moving 100 feet or more at a time toward the ground, pausing, then repeating the sequence until the conductive path of electrified (ionized) particles is near the ground. There, discharge streamers extending from the ground intercept the leader path and complete the conductive channel between ground and cloud charges. When this path is complete, a return stroke leaps upward at speeds approaching that of light, illuminating the branches of the descending leader track. Because these tracks point downward, the stroke appears to come from the cloud. The bright light of the return stroke is the result of glowing atoms and molecules of air energized by the stroke."

"Once the channel has been established and the return stroke has ended, dart leaders from the cloud initiate secondary returns, until the opposing charges are dissipated or the channel is gradually broken up by air movement. Even when luminous lightning is not visible, current may continue to flow along the ionized channel set up by the initial step leader."

"Ground-to-cloud discharges are less frequently observed than the familiar cloud-to-ground stroke. In these cases, step leaders generally proceed from a tall conductive or semiconductive structure to the clouds; the initial leader stroke is not followed by a return stroke from the cloud, possible because charges are less mobile in the cloud than in the highly conducting earth. Once the conductive path is established, however, current flow may set up cloud-to-ground sequences of dart leaders and returns."

"Thunder is the crash and rumble associated with lightning, and is caused by explosive expansion of air heated by the stroke. When lightning is close by, the thunder is a sharp explosive sound. More distant strokes produce the familiar growl and rumble of thunder, a result of sound being refracted and modified by the turbulent environment of a thunderstorm. Because the speed of light is about a million times that of sound, the distance (in miles) to a lightning stroke can be estimated by counting the number of seconds between lightning and thunder, and dividing by five."

"Lightning comes in many forms. Streak lightning, a single or multiple line from cloud to ground, is the form seen most frequently. Forked lightning shows the conductive channel. Sheet lightning is a shapeless flash covering a broad area, often seen cloud-to-cloud discharges. Heat lightning is seen along the horizon during hot weather, and is believed to be the reflection of lightning occurring beyond the horizon. Ribbon lightning is streak lightning whose conductive channel is moved by high winds, making successive strokes seem to parallel one another. Beaded lightning appears as an interrupted stroke."

"Ball lightning is in some ways the most interesting—and most controversial—form. As reported, ball lightning appears as a luminous globe, toroid (doughnut-shape), or ellipsoid which hisses as it hurtles from cloud to earth, maneuvers at high speeds, rolls along structures, or hangs suspended in the air."

"The electromagnetic impulses of a lightning stroke produce whistlers—gliding tones which travel along lines of force in the earth's magnetic field from their lightning source in one hemisphere to a similar point in the opposite hemisphere, often echoing back and forth several times. Their sound is something like the whistle of World War II bombs, occasionally modified in a way that produces musical variations."

"The dual character of lightning—it is a carrier of high currents and produces destructive thermal effects—makes it doubly dangerous. The current peaks, which may reach magnitudes of 200,000 amperes or more, produce forces which have a crushing effect upon conductors, and which can build to explosive levels in nonconducting or semiconducting materials like wood or brick. The continuous current produces heat, and is responsible for the numerous fires attributed to lightning."

Member Chosen

OLEY, Pa. - Scott Alan Hauseman, Oley, was recently granted a junior membership in the Brown Swiss Cattle Breeders' Association of America. According to National Secretary Marvin L. Kruse of Beloit, Wis., junior memberships give boys and girls who have had their ninth birthday before January 1 of the current calendar year, and who have not had their 19th birthday before this base date, the privilege of registering individually owned offspring from Brown Swiss females at national membership rates.

The national secretary reports that Brown Swiss registrations have shown an increase each year for the past four years. He states that the reason for this growth is that Brown Swiss have a wide range of adaptation and produce a large volume of market milk high in protein. He adds that registered Brown Swiss offer a challenge to a dairyman's abilities and provide a greater return on his investment in time, labor, and money.