Geography in the News™

Neal G. Lineback

HAIL TO SUMMER

Hail is a devastating atmospheric phenomenon, most often occurring in the spring and summer seasons. Associated with convectional storms and strong cold fronts, this form of precipitation can cause extreme damage to crops, autos and roofs of buildings. Occasionally, it causes serious injuries to humans and domestic animals.

Hailstones are irregularly shaped balls of ice that may range in size from a single rain drop to that of a small grapefruit. The largest hailstone ever recorded in the United States fell in Kansas. It measured 17.5 inches (44.5 cm) in circumference and weighed 1.66 pounds (0.8 kilograms).

Hailstones form in updrafts of air and are very different from sleet and snow, the other two forms of frozen precipitation. Sleet occurs during the winter and develops when raindrops are formed in warm air overlying a layer of subfreezing air. As the raindrops fall through colder air near the ground, some may freeze into small pellets of ice. Because of the way sleet forms, it is often associated with freezing rain. Consequently, sleet pellets are never larger than raindrops.

Snowflakes, on the other hand, form if air temperature is below freezing when condensation-technically, sublimation-occurs. Thus, each snowflake is fluffy rather than solid, as with sleet or hail.

Hail is most often associated with thunderstorms. Almost any kind of storm can cause lightning and thunder, but the most common hail-producing thunderstorm is the convectional storm. Such storms have strong updrafts, caused by the differential heating of the earth's surface by the sun. When these updrafts occur, air begins to gently lift from the ground surface, gaining speed as it expands and colder air around it constricts the column of rising air.

As the air in the column expands and cools, condensation may develop to form a cloud. If the velocity of the updraft is sufficient to drive the droplets of moisture upward until subfreezing temperatures are reached, the droplets will freeze. At this point, the frozen balls of hail appear no different than sleet, but then the size of the hailstone may begin to grow.

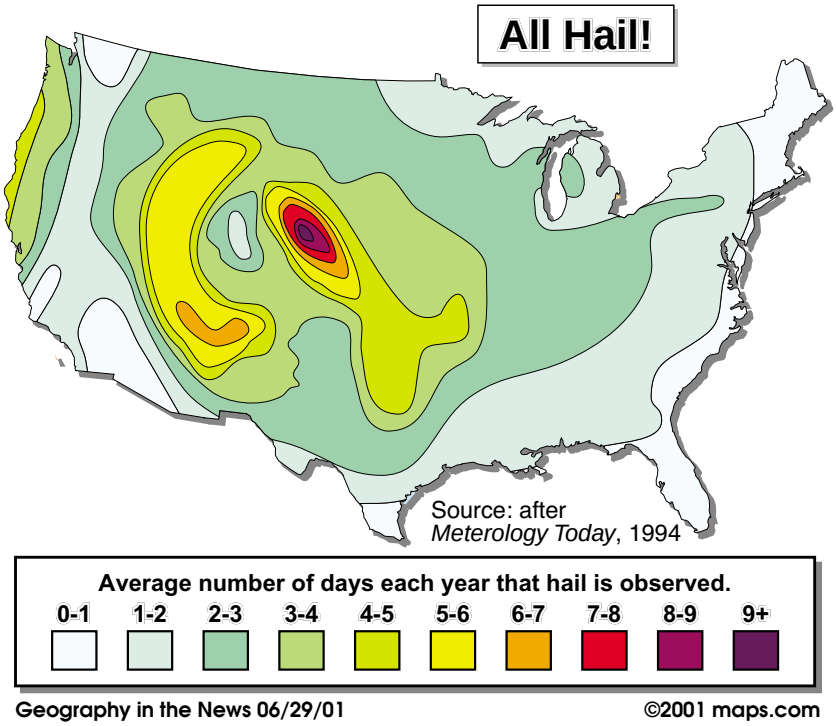
Depending on the turbulence and velocity of the updraft, hailstones may fall a few thousand feet, collect more liquid in the cloud and be carried upward once more. As this process is repeated and consecutive layers of water are frozen on each hailstone, its size grows proportionally. Because of this incremental growth, hailstones typically consist of concentric layers of ice. The larger the hailstone, the stronger is the storm that produces it.

Sometimes two or more hailstones will freeze together during the circulation and formation processes. Such composite hailstones-clearly composed of multiple stones stuck together-tend to be the largest and most damaging during a storm.

Storms other than convectional storms will sometimes produce hail. These include tornadoes, strong cold fronts and their associated squall lines and periodic orographic storms, where air rises rapidly up the front of a mountain range. But by far, however, the most common cause is convectional thunderstorms, most of which occur in the afternoons and early evenings during the spring and summer.

There are several interesting geographic facts about hail. It is almost unheard of in the tropics, perhaps because hailstones may melt as they fall through warm tropical air. Hail virtually never falls in polar regions because there is seldom enough terrestrial heating by the sun to cause convectional storms. Hail seldom falls over the oceans of the world, in large part because convectional thunderstorms occur mostly over land.

Farmers greatly fear hail. Generally, hail occurs well after crops are planted and beginning to produce maximum foliage. Even the smallest hailstorm will devastate most crops with large leaves, such as corn and tobacco. Because such events tend to occur in midsummer, it is usually too late in the growing season to replant damaged fields. Consequently, hail insurance is sometimes purchased as a hedge against this disaster, but many farmers simply cannot afford it.



Hail is most common in the U.S. Great Plains, with Colorado and Wyoming having the most. Although the Southeast has more thunderstorms than the rest of the country, the majority does not produce hail. Huge towering thunderstorms, particularly in the Great Plains, are awesome sights and they frequently produce hail, as well as tornadoes.

Hail, however, can occur anywhere across the country, if the conditions are right. Property losses to this phenomenon may exceed $2 billion and an average of five people are killed by hailstones in the United States every year.

And that is Geography in the News. June 29, 2001. #578.

(The author is a Professor of Geography at Appalachian State University, Boone. NC. This article was rewritten from an article first published in 1989.)