



Extreme Weather Watch

Volume 1, Issue 1

Third Quarter

Hailstones, also in the Philippines ...

Are you still dreaming of a white Christmas ? Dream no more ! We can also have ice falling from our skies. The only problem is that the particles are a lot bigger than what you would expect.



Imagine this falling from a height of over a thousand meters.

Inside this issue:

<i>Hailstones, also in the Philippines...</i>	1
<i>Hail Formation</i>	2
<i>Hailstones in Summer</i>	3

This form of precipitation is known as hail. The chunks of ice that fall to the ground are known as hailstones. Average-sized hailstones are a lot smaller than the one shown here. But even these can be very destructive since they fall from heights of over a thousand meters. They act like ice “bullets” that can puncture even plastic tables like the one shown here.

Does this mean that it is getting cooler in the Philippines ?

On the contrary, hail is more likely to form during very hot weather. More on this in page 3.



The holes in this table were caused by hailstones.



Hail Formation

Like all forms of precipitation, hail is just water. In the case of hail, the water must be cooled at least to its freezing point. For this to happen, updrafts (red arrows) must carry moisture-rich air above the freezing line.

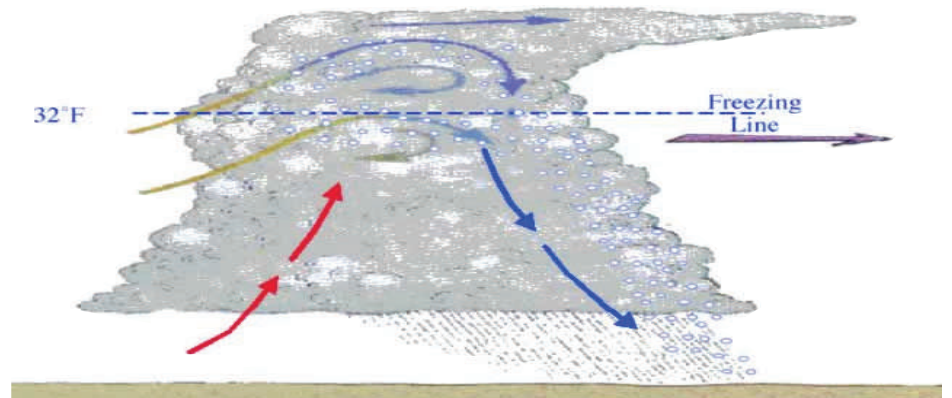


Illustration of the process of hail

As more and more water freezes, the ice particles become heavier and start to fall. The varying speed of updrafts repeatedly causes the ice particles to move up and down within the cloud. This is known as recirculation. When the ice particles can no longer be supported by the updrafts, they fall to the ground as hail.

Now, let's focus on the concentric structure of the hailstones. The layering would indicate that the formation process is gradual, building one layer after another. This would be consistent with the recirculation process. The up and down movement within the cloud would cause layers of ice to be deposited one after the other.



Concentric layers of ice in a hailstone

Another interesting feature of a hailstone is that the inner core has an opaque, milky appearance while the outer layer is clear. Would you know what causes this?

To start with, the opaque and clear layers must be formed in different ways. The inner layer is opaque due to the inclusion of tiny bubbles of air within the ice. This happens when small water drops collide with an ice particle, causing it to freeze quickly and trapping air particles inside. The clear outer layer is indicative of slow cooling and happens when an ice particle collides with large water drops. The slower cooling allows the air particles to escape, resulting in a clear ice layer.

“Another interesting feature of a hailstone is that the inner core has an opaque, milky appearance while the outer layer is clear.”

Hailstones in Summer?

It may seem unlikely that huge chunks of ice can fall from the sky during the hottest time of the year. However, weather conditions in summer are more conducive for hail formation than those in winter. How can this be?



To explain how this happens, we have to remember that for hail to form, air must be cooled at least to its freezing point. Then the ice particles that form must be carried up and down within the cloud to gradually increase their size. Why summer?

In summer, intense sunshine warms the ground causing surface air to warm and rise and sets up updrafts. The air must be lifted to great heights to cool the air and allow the water vapor in it to freeze. This requirement means there must be strong updrafts which also means that there must be intense heating of the ground. These conditions are typical in summer.

Carrying the ice particles up and down within the cloud requires not only stronger but also persistent updrafts. This again requires intense and continuous warming of the ground by sunshine. Ironically, the intense warming sets up conditions that can cause chunks of ice to fall from the sky. Why not in winter?

Ironically, the intense warming sets up conditions that can cause chunks of ice to fall from the sky.

Although air temperatures can be very low in winter, the required updrafts are not present. Ice may precipitate from clouds but without the updrafts to keep them aloft, they fall to the ground as snow.

References:

1. Heidorn, Keith C. "Weather Phenomenon and Elements." The Weather Doctor. July 1, 2002. Spectrum Educational Enterprises. February 11, 2003 <<http://www.islandnet.com/~see/weather/elements/hailform.htm>>.
2. O'Neill, Dan. "Hail Formation." Alaska Science Forum. August 9, 1979. University of Alaska Fairbanks. February 11, 2003 <<http://www.gi.alaska.edu/ScienceForum/ASF3/328.html>>.
3. Mulac, Brenda. "Hailstone growth and Formation in Thunderstorms." Brenda's Home Page. February 11, 2003 <<http://monsoon.colorado.edu/~mulac/intro1.html>>.