The secrets of hail formation

Hail is a type of precipitation made up of pieces of ice, the size of which, sometimes large (several millimetres or even centimetres), can cause damage. How is it formed? During the ascent of air in the cumulonimbus, water vapour can condense as droplets under the 0°C isotherm, and as ice crystals above. When the lift is very strong, droplets are transported above the 0°C isotherm, where they can remain liquid as "supercooled water". They agglomerate around ice crystals and freeze, forming a layer of translucent ice around them. Hail grows by accumulating several of these layers of ice forming hail. They can also grow by collecting small ice crystals, forming a layer of white ice. When the deposition of layers of translucent ice and icing alternate, hail with a concentric layer structure is obtained (Figure a). This occurs when the hail rises and falls several times in a row, or when it encounters an alternation of such conditions during its ascent. Hail can also grow by agglomeration of other ice crystals or other hailstones, forming aggregates (Figures b and c). They fall when their fall speed exceeds the upward velocity of ascending air, so only the fastest ascents can allow large hail to grow.

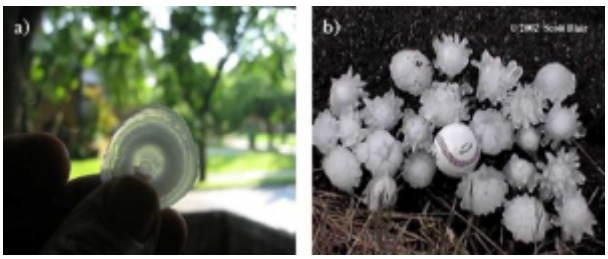

Figure 1. Photos of hail: (a) cutting of a hail showing its concentric layer structure [Licensed under the GFDL]; (b) hail consisting of aggregates of ice crystals [Source: © Scott Blair]

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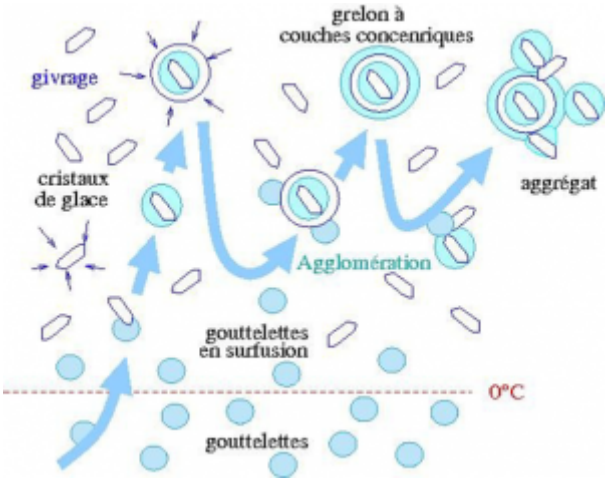

Figure 2. (c) Diagram explaining the formation of hail that grows by the accumulation of several layers of ice from the freezing of supercooling droplets. They can also grow by icing, forming a layer of white ice, or by agglomeration of other ice crystals or other hail then forming aggregates.