

Hailstorm Formation, Process, Factors Affecting, Indian Context

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Hailstorm Formation is a meteorological process linked with powerful thunderstorms where ice particles develop inside towering clouds. It requires specific atmospheric conditions like strong vertical air movement, moisture and freezing temperatures. These storms are short lived but highly destructive, causing serious damage to crops, vehicles and infrastructure within minutes.

What is Hail?

Hail is a process of solid precipitation made up of ice balls or irregular lumps called Hailstones. These hailstones form when water droplets freeze at high altitudes within thunderclouds. Their size varies widely, from very small pellets less than 1/4 inch to large stones reaching up to 15 cm in diameter.

Hailstorm

A Hailstorm is a type of thunderstorm that produces Hail as precipitation. It usually lasts less than 15 minutes but can cause severe damage. Hailstorms are common in mid latitude regions and are often associated with extreme

weather conditions like tornadoes, strong winds and heavy rainfall events.

Also Read: [Lagoon Formation](#)

Hailstorm Formation Process

Hailstorm Formation takes place inside thunderclouds through continuous freezing and growth of water droplets under strong updraft conditions in the atmosphere.

- Hail formation begins in cumulonimbus clouds, which can rise up to 65,000 feet and contain multiple layers with varying temperatures and moisture conditions.
- Strong upward winds called updrafts carry small water droplets high into the cloud where temperatures fall below freezing point rapidly.
- At high altitudes, droplets remain liquid below 0°C and freeze instantly when they collide with particles, forming initial ice nuclei.
- As Hailstones move upward and downward, layers of clear and opaque ice form due to alternating freezing rates and varying moisture availability.
- Continuous collision with supercooled droplets increases size, sometimes producing stones several centimeters wide with layered internal structure.
- When Hailstones become too heavy for updrafts to support, gravity pulls them down toward the ground as solid ice masses.
- Falling Hailstones may partially melt but usually reach the surface if diameter exceeds 5 mm, often causing damage due to high velocity.

Also Read: [Coral Atoll Formation](#)

Factors Affecting Hailstorm Formation

Hailstorm Formation depends on atmospheric instability, moisture, temperature conditions and wind dynamics that influence cloud development and hail growth significantly.

- **Atmospheric Instability:** Highly unstable air allows rapid vertical movement, supporting strong thunderstorm development.
- **Moisture Content:** High moisture levels increase availability of water droplets.
- **Freezing Level Height:** Lower freezing levels allow Hailstones to form and survive longer.
- **Vertical Wind Shear:** Strong wind variation with height helps maintain storm structure and supports repeated lifting.
- **Updraft Strength:** Powerful updrafts can exceed 180 km/h, allowing Hailstones to remain suspended longer and grow larger before falling.
- **Temperature Gradient:** Sharp temperature differences within cloud layers enable formation of both clear and opaque ice layers in Hailstones.
- **Continental Location:** Hailstorms are more frequent in mid latitude continental interiors where dry air mixing lowers freezing levels and promotes Hail formation.

Hailstorm Formation in India

Hailstorms in India mainly occur in **Himalayan regions** and during seasonal transitions, causing major agricultural and economic losses across regions.

- Hailstorms are most frequent in western and northeast Himalayan regions where strong thunderstorms develop during seasonal transitions.
- Maximum Hailstorm activity occurs in March and April when atmospheric instability increases during pre monsoon conditions.
- Hailstorms damage Rabi Crops like wheat during the harvesting stage, leading to significant economic losses for farmers.
- Severe Hailstorms recently affected Kulgam and Shopian districts of south Kashmir, damaging crops and fruit orchards extensively.
- In 1888, a deadly Hailstorm in Moradabad caused over 250 human deaths and around 1600 livestock fatalities.
- In 2015, Hailstorms and unseasonal rains caused losses of about ₹20,453 crores across multiple Indian states.
- The India Meteorological Department regularly predicts Hail related events.

Source: <https://vajiramandravi.com/current-affairs/hailstorm-formation/>

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