

Cloudburst Forecast in India

A cloud burst incident in the **Lasko river** flowing close to the India and Nepal border in Uttarakhand has resulted in significant damages to life and property

About Cloudbursts

- Sudden, violent and voluminous amounts of rain in a short duration that is local in nature.
- Defined by the amount of rainfall.
- Defined as a geo-hydrological hazard due to their aggressive nature and the scale of destruction.
- Cloudburst is difficult to predict since it occurs suddenly with a catastrophic force and thereby inflicts enormous losses due to inundation and erosion.

Areas prone to cloudbursts:

- Occur mostly over the rugged terrains over the Himalayas, the Western Ghats, NE hill States of India
 - Due to **orographic** lifting together with a strong moisture convergence that can lead to intense cumulonimbus clouds taking in huge volumes of moisture.
- Heavy rainfall on steep slopes trigger landslides, debris flows, and flash floods, causing significant destruction and loss of people and property.
- Strong monsoon wind surges along the coast can also result in cloudbursts

- Eg. Mumbai (2005) and Chennai (2015).
- Coastal cities are particularly vulnerable to cloudbursts
 - Since the flash floods make the conventional stormwater and flood management policies in these cities dysfunctional.
- Climate change is projected to increase the frequency and intensity of cloudbursts as the air gets warmer, it can hold more moisture and for a longer time.

Why forecasting cloudbursts is a challenge

Efforts to monitor and forecast cloudbursts are still at a nascent stage

1 As per the IMD definition, over **100 mm of rainfall in one hour** is called a cloudburst. It usually occurs over a small geographical region (20-30 sq. km)

2 Rainfall of 100 mm per hour translates to **100 litres for every square metre** where a cloudburst occurs. For a small region of 20 sq. km, it is about **two billion litres of water** in an hour

3 Tall cumulonimbus clouds causing cloudbursts can develop quickly (in about **30 minutes**) as the moisture

updraft happens rapidly – 60-120 km/hr

4 Cloudbursts occur mostly over the rugged terrains over **the Himalayas, Western Ghats**, and northeastern hill States of India

5 In India, cloudbursts often occur during the monsoon season, when the **SW monsoon winds bring in** copious amounts of moisture inland

6 Satellites fail to detect cloudburst systems as the **resolution of the**

precipitation radars are much smaller than the area of individual cloudburst events

7 Multiple doppler weather radars can **monitor moving cloud droplets** and help to provide forecast for the next three hours. But **radars are expensive** and installing them widely may not be feasible

8 The change in monsoon extremes and cloudbursts are in response to the **1-degree Celsius rise** in global surface temperature

The Cloudburst forecasting in India

- IMD's forecasts are at an advanced stage with respect to extreme rains and cyclones.
- But our efforts in monitoring and forecasting cloudburst are at the early developmental stage.
- Monitoring stations on the ground can hardly capture the cloudburst characteristics due to their highly localised and short occurrence.
- Resolution of the precipitation radars of weather satellites can be much smaller than the area of

individual cloudburst events, hence they go undetected.

- Skillful forecasting of rainfall in hilly regions remains challenging due to the uncertainties in the interaction between the moisture convergence and the hilly terrain,
 - The cloud microphysics, and the heating cooling mechanisms at different atmospheric levels.

Recommendations:

- Cloudburst-prone regions should be mapped using automatic rain gauges.
- Locations can be designated as hazardous if cloudburst-prone regions are co-located with landslide-prone regions.
- With IMD enhancing its automatic weather stations, we may have hourly data that can help map cloudburst-prone regions.
- People in risk prone areas should be moved, and construction and mining in nearby regions should be restricted as that can worsen the landslides and flash flood impacts.