Rising Flash Floods in India

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Rising Flash Floods in India: Causes, Patterns, and the Way Forward

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Context

India is witnessing a **sharp rise in flash flood events**, turning them into a **recurring and deadly hazard**. Recent disasters in **Himachal Pradesh (July 2025)**, **Wayanad, Kerala (July 2024)**, **Ladakh (June 2024)**, and **Sikkim (October 2023)** underscore the increasing frequency and severity of these sudden floods. The growing impact is linked to **climate change**, extreme rainfall, and insufficient localized mitigation strategies.

Introduction

Flash floods are **rapid-onset flooding events** that occur due to **intense rainfall** in a short time over a small area. According to the **Union Jal Shakti Ministry**, the number of flash flood events in India rose from **132 in 2020 to 184 in 2022**. Despite the growing threat, there remains a **lack of detailed research** on regional vulnerability, hampering the development of **effective early warning systems** and **disaster preparedness** mechanisms.

Findings from Recent Study on Flash Floods

- A study by **IIT Gandhinagar**, published in *Nature Hazards*, examined flash flood drivers across Indian subcontinental river basins.
- The study titled **'Drivers of flash floods in the Indian sub-continental river basins'** mapped sub-basin level vulnerability using **hydrological and geomorphological data**.
- **Himalayas**, **Western Coast**, and **Central India** were identified as **high-risk regions**.
- In the **Himalayas**, steep terrain and elevation contribute to increased flood risk.

- In **Central India and the West Coast**, high **runoff speed or flashiness** leads to faster water level rise.
- The study found that **nearly 75% of flash floods** result from a **combination of extreme rainfall and saturated soil**, while only **25% are caused by rainfall alone**.
- Many **previously low-risk basins** are now experiencing higher rainfall, suggesting **climate change is expanding flood-prone areas**.

Key Drivers Behind Flash Floods in India

- **Extreme rainfall alone** is responsible for only **25%** of flash floods.
- Most events occur when **heavy rainfall** meets **already saturated soil**, causing quick surface runoff.
- Only **23% of extreme rainfall events** lead to flash floods within six hours, showing that **prolonged rainfall** is often more dangerous.
- **Regional patterns** vary:
    - **Western coast and Central India**: High flashiness leads to immediate flood risks.
    - **Himalayan region**: Rugged terrain and slope elevate vulnerability.
    - **Ganga Basin**: Sub-basins in the **southern Himalayan stretch** are more prone than those in central regions.
- Terrain and **local climatic factors** play a larger role than rainfall intensity alone in determining flood risk.

Climate Change and Increasing Flash Floods

- Rising global temperatures have increased **atmospheric moisture capacity**, leading to **heavier rainfall**.
- For every **1°C rise**, the atmosphere holds about **7% more moisture**.

- Between **1981 and 2020**, India saw:
    - **Doubling** of pre-monsoon extreme rainfall
    - **56% rise** in monsoon rainfall
    - **40% rise** in post-monsoon rainfall
    - **12.5% rise** in winter rainfall
- Over **75% of flash floods** between **1980 and 2018** occurred during the **monsoon season**.
- Since **1995**, flash floods have increased notably in the **Brahmaputra**, **Ganga**, and **Krishna** basins.
- **51% of non-flood-prone sub-basins** now show higher rainfall and **66.5% show increased streamflow**.
- Conversely, some traditional flood zones are seeing **reduced wet hours**, reflecting **shifting climate patterns**.

Need for Region-Specific Adaptation

- A **one-size-fits-all** approach is insufficient to address flash flood risks.
- **Region-specific strategies** are essential, considering **topography, soil type, and hydrological behavior**.
- **Early warning systems** must incorporate **real-time, localized data** for better disaster preparedness.
- **Climate-resilient infrastructure** and **adaptive land-use planning** are necessary to reduce long-term risks.
- Identifying **emerging hotspots** and integrating them into **national and local planning frameworks** is vital.

Conclusion

Flash floods are becoming a widespread challenge across India, influenced by **climate change**, **land-use changes**, and **inadequate preparedness**. The findings of the **IIT Gandhinagar study** highlight the urgent need for **scientific, region-specific flood management strategies**. Addressing these risks requires a shift from reactive to **preventive planning**, supported by **robust data, resilient infrastructure**, and **integrated policy action** to safeguard lives and ecosystems.