One-fourth of India's monsoon rain mass evaporates mid-air

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Why in News?

A recent study by the Indian Institute of Tropical Meteorology (IITM), Pune, has revealed that approximately 25% of India's monsoon rain mass evaporates mid-air before ever touching the ground.

Key Findings of the Study

- **Regional Focus** - The primary measurements were gathered over the *northern Western Ghats and Pune* during the Southwest monsoon season.
- **Massive Daily Swings**- While the average mid-air loss sits at 25%, the exact evaporation rate fluctuates wildly from day to day—ranging *from 4% up to 61%* depending on ambient weather conditions.
- **Atmospheric Drivers**- The mid-air loss is dictated primarily by localised atmospheric factors like ambient temperature, heat, and dry air.
- **Method -** The research team utilised advanced environmental tracking techniques to fingerprint the falling water.
    - **Isotopic Analysis** - When water evaporates, lighter water molecules escape into the air first.
    - This leaves the remaining falling raindrop highly enriched with heavier hydrogen and oxygen isotopes.
    - **Hardware Sampling**- Researchers spent hours freezing and trapping atmospheric vapor alongside surface rainwater, analysing their distinct molecular signatures using a laser spectrometer.
    - **Computer Simulation** - They fed this empirical isotopic data into a below-cloud interaction model to track individual raindrops from the base of the clouds to the surface.

Global Comparison

- India's 25% mid-air evaporation rate sits on the lower end of global

baselines.

- For context, satellite data measures tropical trade-wind evaporation at around 20%, Zurich averages 40% during cold fronts, and drier oceanic regions like Barbados can witness up to 63% of rain vanishing mid-air.
- The larger size of Indian monsoon drops and higher local humidity help shield India's rain from disappearing even faster.

Reference

[The Hindu | One-fourth of India’s monsoon rain evaporates mid-air]