## Spells of heavy rainfall see two-fold increase

The two-member team from IIT-Gandhinagar found that climate warming and dynamic contributions are 1.5 times more in the case of sub-daily extreme rainfall than daily extreme rainfall. File photo of rescue efforts in Bengaluru during November rains.

Very heavy rainfall lasting less than 24 hours (sub-daily) in urban locations in India has become more intense during the last few decades.

The frequency of sub-daily rainfall extreme has also witnessed a two-fold increase between 1979 and 2015, say researchers from the Indian Institute of Technology-Gandhinagar.

Currently, rainfall data is reported on 24-hour basis and long-term sub-daily observations are limited. In cities, heavy downpour for less than an hour can create urban flooding due to large impervious area.

"Since heavy rainfall for less than an hour causes flooding and deaths, it is now necessary to record the amount of rainfall every 15 minutes especially in the urban areas," says Prof. Vimal Mishra from the Department of Civil Engineering at IIT-Gandhinagar and corresponding author of the paper published in the journal *Geophysical Research Letters*.

Most of the previous studies have considered changes in atmospheric moisture on account of local or global change in climate warming (thermodynamic). But extreme precipitation is also linked to variations in atmospheric motion and vertical wind velocity (dynamic).

## **Profound implications**

"Though rainfall extremes have profound implications for urban areas, the response of shortduration rainfall extremes in India to thermodynamic and dynamic changes remains largely unexplored," says Haider Ali from the Department of Civil Engineering at IIT-Gandhinagar and first author of the paper.

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The team found that changes in sub-daily precipitation extremes are more strongly related to variations in the atmospheric motion and increase in vertical velocity than the increase in atmospheric moisture content and climate warming.

However, sub-daily rainfall extreme is more sensitive to warming than daily extremes. For 1 Kelvin temperature increase, the half-hourly rainfall extreme increases by about 10%, while it is only about 6% in the case of daily rainfall extreme.

"We found that urban flooding is more prone to sub-daily rainfall extremes. Both large-scale change in climate warming and localised heating due to urban heat island effect could be contributing to increased air temperature in cities leading to intense rainfall," says Prof. Mishra.

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