

Climatological aspects of rainfall and urban flood modeling for the City of Hyderabad

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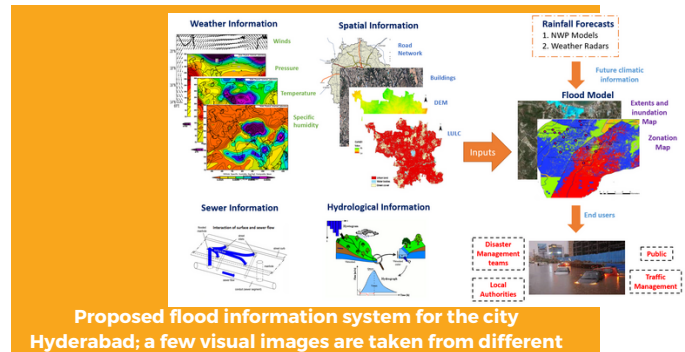


Every year in the recent past we observed severe flooding in Hyderabad city which witnessed human fatalities along with monetary loss and in the least it caused hindrances in daily life activities. In fact the floods that happened during October 13 - 18th, 2020 were unprecedented which caused loss of life and property. The rising trend of urban floods does raise certain questions - are these floods resulting from anthropogenic climate change ? or are these floods a result of unplanned urbanization ? It can be said unequivocally that both the aspects i.e., changing climate and urbanization are responsible for floods in cities. In this context as well as for the effective flood mitigation measures, understanding of the region's climate and effects of urbanization is necessary.

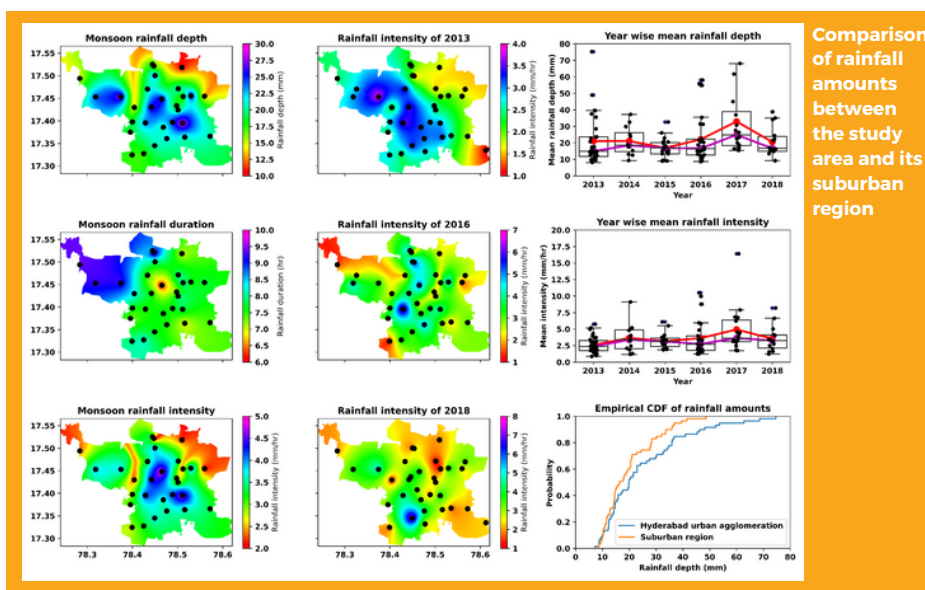
Rainfall analysis for the city of Hyderabad (figure given below) suggested that the spatial patterns of climatological rainfall attributes have a relatively large amount of rainfall depth and intensity for the central region of Hyderabad. In regards to rainfall intensities an increased spatial extent was observed over the time and increasing year wise mean rainfall depth and intensity over the study area implied non-stationarity of rainfall. Comparison of rainfall amounts between the study area and its suburban region suggest likelihood of larger rainfall amounts for the urban region hinting influence of urbanization and its effects.

Non-stationarity in rainfall of Hyderabad, i.e., rising trends in the intensity of rainfall (Mohammed et al., 2022), can be attributable to climate change and urbanization effects, including the urban heat island phenomenon. Changing trends in rainfall intensities make it imperative to verify whether

the stormwater management systems (SWMS) have enough potential to house the resultant runoff. The rise in flooding events in Hyderabad city in recent decades implies that the existing SWMS is insufficient and requires redesigning. While redesigning has its challenges (e.g., the high cost of redesign), the forecasting techniques appear to be a good solution for lessening the impact of floods. Noting that rainfall is a key variable and as data is available at different spatial and temporal resolution is available from multiple sources, i.e., weather radar rainfall estimates, satellite rainfall estimates and Automatic Weather Station (AWS) data, the techniques that integrate rainfall estimates from all the sources are explored. In this regard, rainfall estimates from the weather radars and Integrated Multi-satellite Retrievals for GPM (IMERG) algorithm were analyzed for the city of Hyderabad.



Realizing the data relevant issues including quality and unavailability for a longer period of the record, exploration of new methodologies explored for the city of Hyderabad are underway (Figure 1). This consists of integration of climate understanding, data of different variables and combination of physically based and statistical methods so that difficulties such as limited data resources are overcome and information/products of different levels of accuracy is provided. In addition to developing technologies, it is important to have a platform that connects stakeholders, decision-makers, engineers and scientists so that the gaps will be addressed. Given the future's unpredictable weather patterns and continuing urbanization, it is crucial that all of the aforementioned segments of society share responsibility and work together to build a city that is climate and flood resistant and can proudly claim that "Hyderabad - a flood resilient city".



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