



# Development of a rationalized hydrometeorological network for an urban catchment under resource-constrained scenario

Mousumi Ghosh, Subhankar Karmakar and Subimal Ghosh  
Indian Institute of Technology Bombay

## Background

- Mumbai City, faces incessant precipitation events owing to erratic monsoon and urban heat island effect.
- Attempt to evaluate the existing Automatic Weather Station (AWS) network over Mumbai using multivariate statistical techniques
- Based on data consistency and continuity, data recorded from 35 common significant Automatic Weather Stations for the years 2015-2018 have been considered (Rainfall, Relative Humidity)

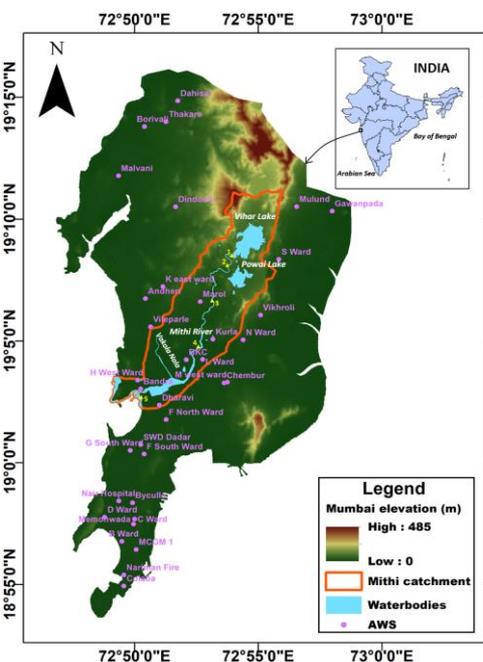


Fig : Location of study area and Automatic Weather Stations

## Framework for rationalization of AWS

Selection of Automatic Weather Stations (AWS) based on data consistency and continuity

Multivariate statistical analysis on daily hydro-meteorological data

Principal Component Analysis (PCA) on individual hydro-meteorological parameters for considered AWS (variables)

Varimax rotation on the factor loading matrix developed to calculate the factor loading

Design threshold of factor loading matrix for significant AWS station

Technique of Order Preference by Similarity to Ideal Solution (TOPSIS) on factor loading of all hydrometric data for all AWS

Construction of normalized and weighted normalized decision matrix

Determination of positive ideal and negative ideal solutions

Calculation of separation measure and subsequently relative closeness to the ideal solution

Rationalisation of stations based on their relative closeness values

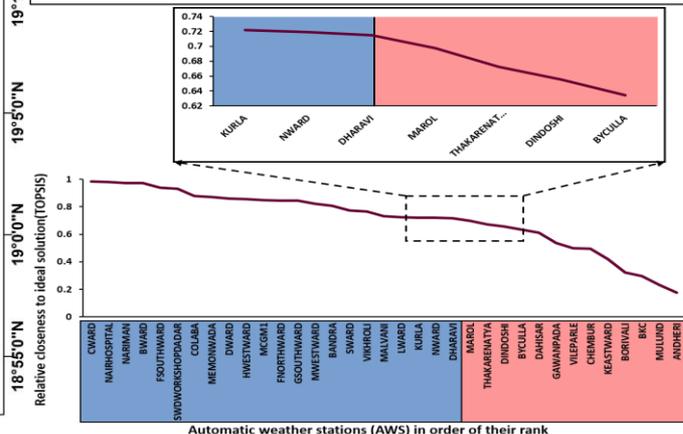


Fig: Ranking of AWS as per their ability to capture spatio-temporal variability of rainfall & relative humidity

## Verification of the framework

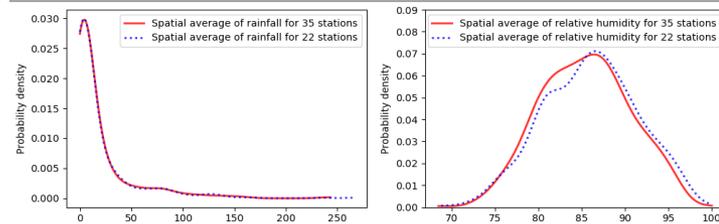


Fig: Comparison of PDFs for spatially averaged (a) rainfall and (b) relative humidity for all 35 AWS stations and TOPSIS ranked first 22 AWS stations.

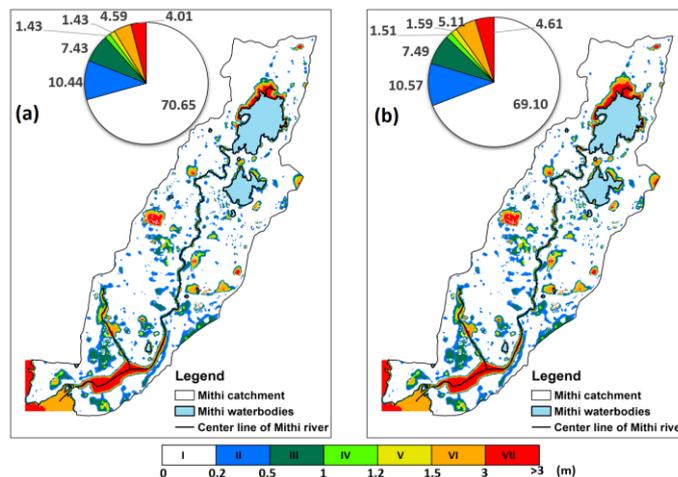


Fig: Comparison between flood inundation maps for rainfall of (a) all AWS stations within Mithi Catchment and (b) rationalized AWS stations within Mithi Catchment

- It can be deduced that the *rainfall plays an influential role* amongst other parameter in determining the overall temporal variability during monsoons.
- It is found that the temporal variability of rainfall and relative humidity are captured reasonably well at 22 stations
- This framework is generic and can be applied over other areas to rationalize the stations based on greater number of hydro-meteorological parameters

For more details refer "Ghosh, M., Singh, J., Sekharan, S., Karmakar, S., Ghosh, S., Zope. 2021. Rationalization of the automatic weather stations over a coastal urban catchment: A multivariate approach, *Atmospheric Research*, Elsevier Publishing, 254, 105511."