Improving Extreme Rainfall Forecasts for Mumbai

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Introduction

- Mumbai: Coastal City located on windward side of western ghats of India: Receives very high rainfall : Annual average rainfall -2,500 mm (96%: July to September) (Rana et al., 2012)
- Very high spatial variability (S.S Tripathy et al .,2023).
- 26th June 2005: Santacruz received 900 mm in 24 hours, while Colaba received just 84 mm
- A combination of high and low elevation area
- Almost fully concreted surface
- Numerical Weather Prediction (NWP) models face challenges in forecasting extreme rainfall in tropical regions due to complex weather patterns (Samantray & Gouda, 2023).

Objective :Improve the accuracy of forecasting Extreme Rainfall Events (EREs) at hyperlocal scale in Mumbai with lead days ranging from 1 to 3 days.

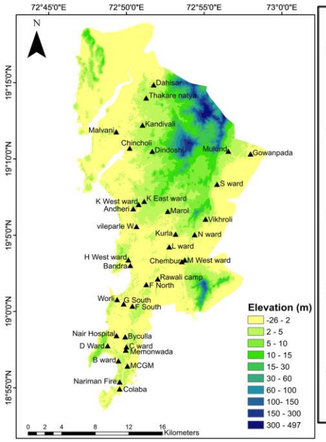


Figure 1:Elevation Map of Mumbai

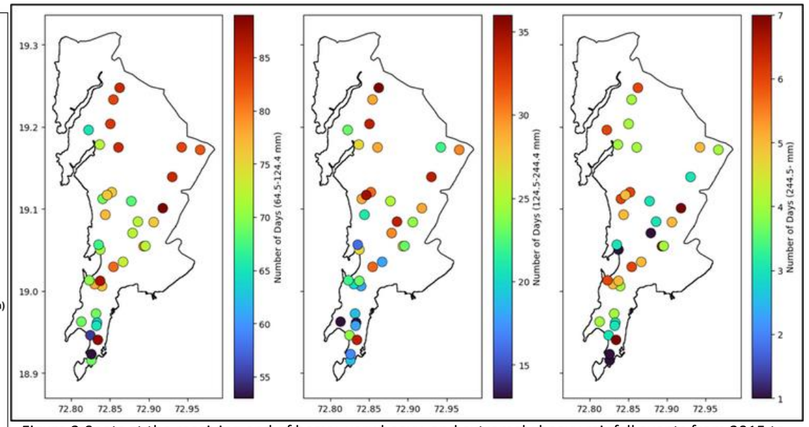


Figure 2:Spots at the receiving end of heavy, very heavy, and extremely heavy rainfall events from 2015 to 2023 in Mumbai's monsoon.

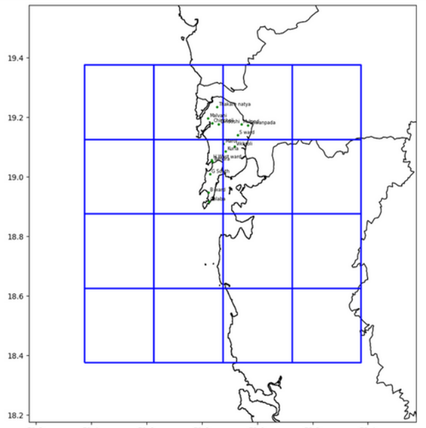


Figure 3:Spatial extent of GFS predictors selected

Results and Discussion

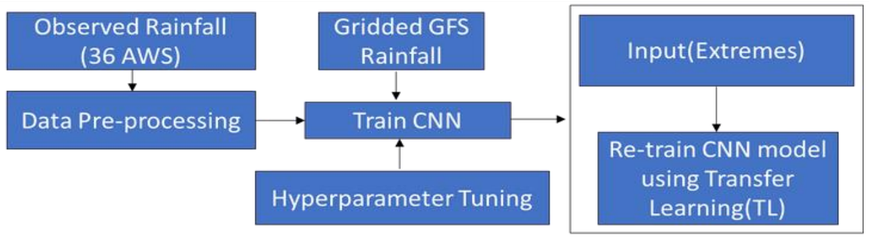


Figure 4:Methodological Flowchart

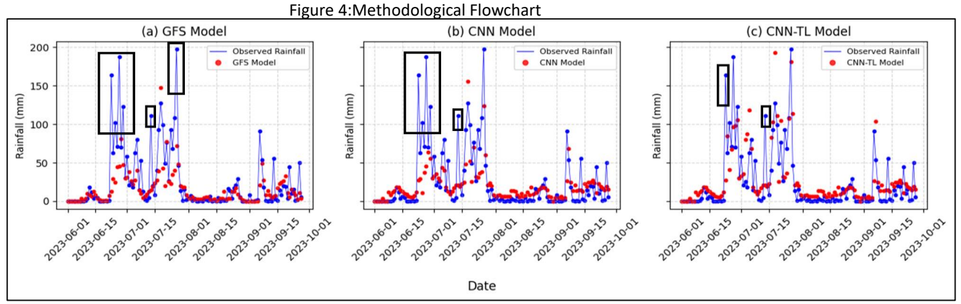


Figure 5:Time series plot of for Lead Day 1 of Thakare Natya of Observed Rainfall (2023) vs (a) GFS ,(b)CNN, (c) CNN-TL

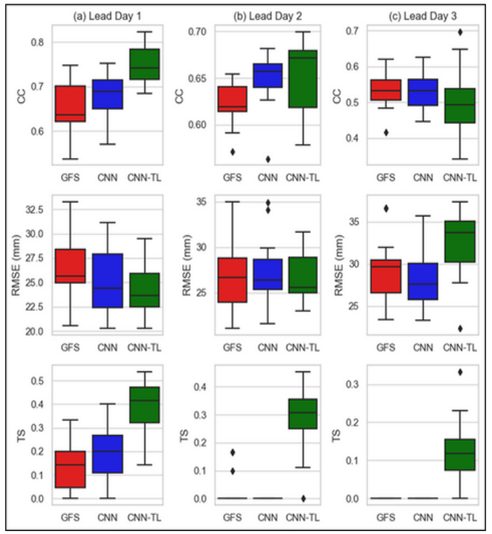


Figure 6:Performance Comparison of models Across Lead Days

1.The Combined model **improved the Threat Score (TS) by 176.5% at the 95th percentile, 126% at the 90th percentile, 43.7% at the 85th percentile, and 16.5% at the 80th percentile. It also decreased the RMSE by 9% and increased the CC by 14.8% for Lead Day 1**

2.For Lead Day 2, **CC values increased by 5%, and RMSE values decreased by 1.3%.** The Combined model enhanced the **TS by 15% at the 80th percentile, 85.4% at the 85th percentile, and 161% at the 90th percentile.**

3.For Lead Day 3, the Combined model improved the **TS by 36% at the 80th percentile, 94.6% at the 85th percentile, and 136.7% at the 90th percentile.**

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