Integrating regional climate model in flood modeling to quantify human health risk from contaminated urban floodwaters

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Abstract

- Urban flooding is a major concern due to its location along the Yamuna River, rapid urbanization, and increasingly extreme rainfall linked to climate change. The risks of microbial contamination in flood-prone areas remain underexplored.
- To address this , we quantify the risk to human health associated with contaminated urban floodwaters in flood-prone regions of Delhi adjoining the Yamuna River by integrating the climate change.
- We gather deatiled hydro-meteoroloigcal data, project future rainfall projections from CORDEX under RCP 4.5 and RCP 8.5 statistically downscaled. The flood outputs are generated using MIKE+ model.
- To analyze the water quality dynamics and Faecal Indiacator Bacteria (FIB) spread these flood outputs are used as input for MIKE EcoLab and the human health risk is estimated.
- The study aims to protect the vulnerable communities by creating a strong resilience strategies and assist developing and under developing nations facing increasing flood risk due to climate change.

Motivation and Study Area

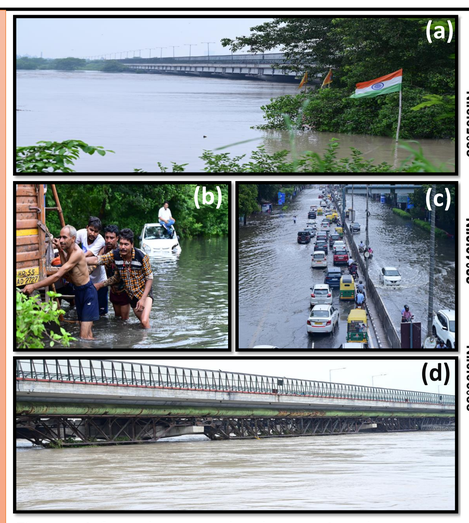
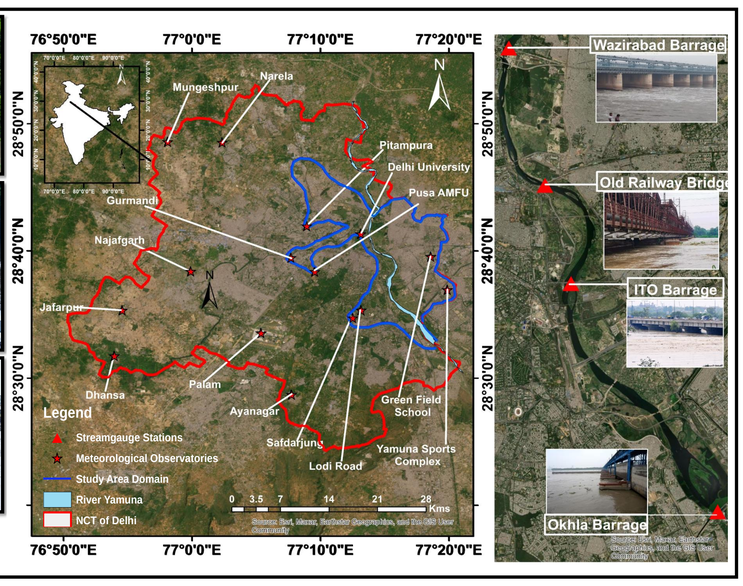
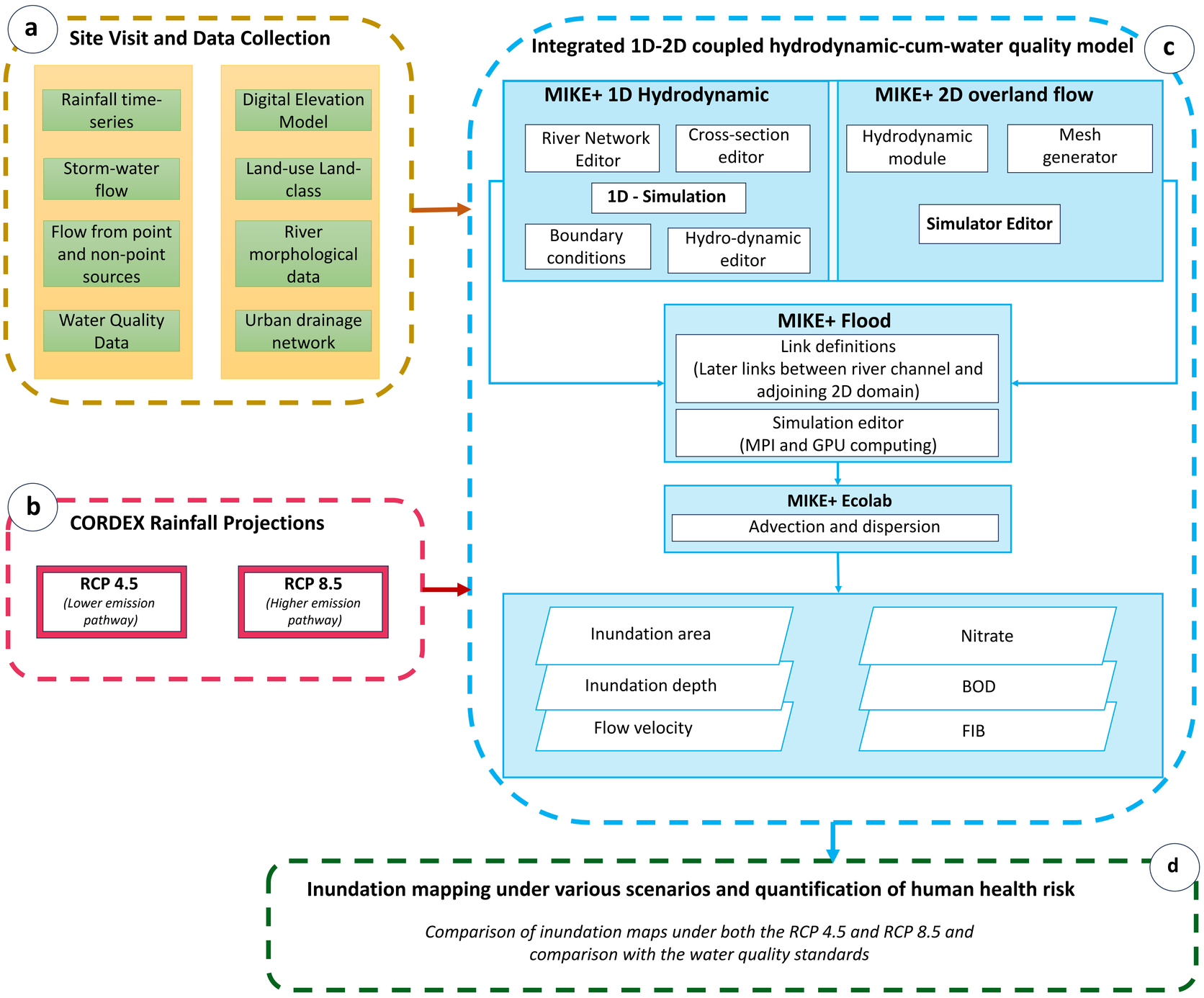


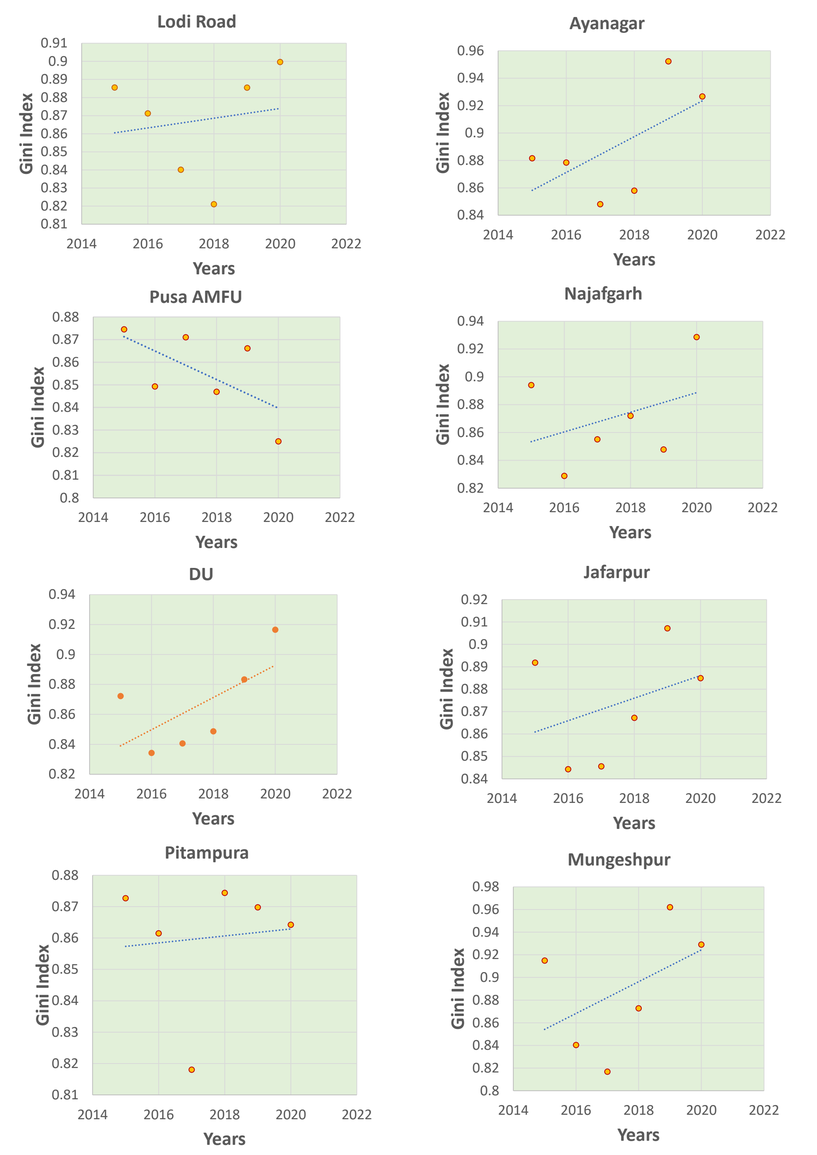
Figure. A few photographs showcasing the repercussions of a flood in Delhi, India



Data Synthesis and Methods



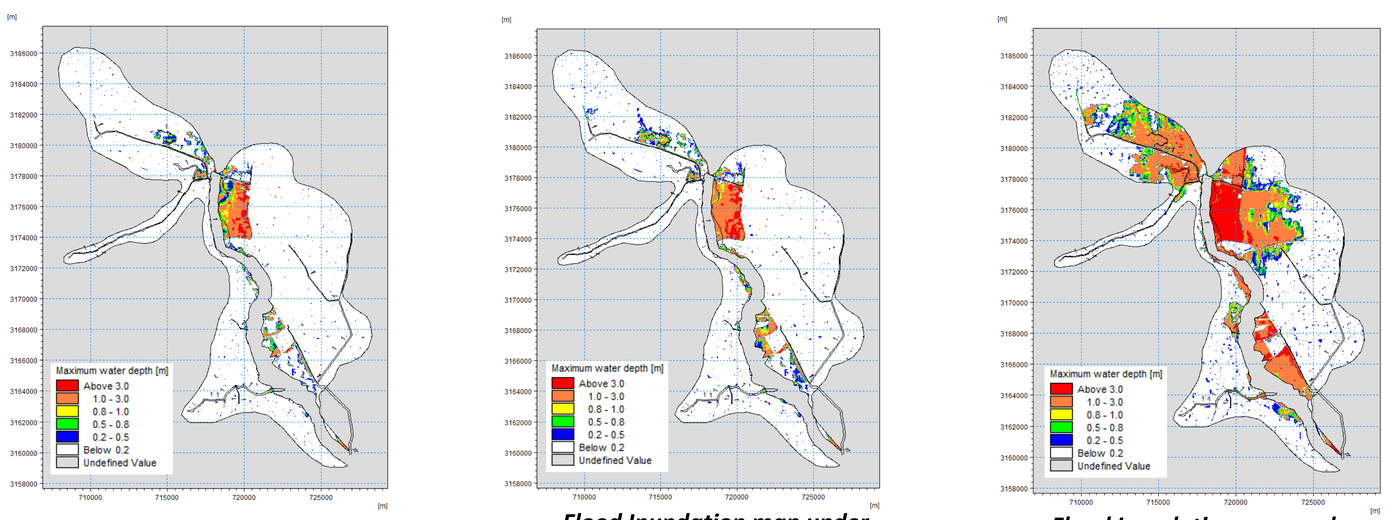
Rainfall Temporal Distribution



METHOD:

Once daily precipitation is acquired, cumulatively aggregated, and normalized to a proportion of total precipitation, the Lorenz curve, a graphical representation of inequality degree in data distribution, is used to determine the Gini index value.

Flood Inundation Maps

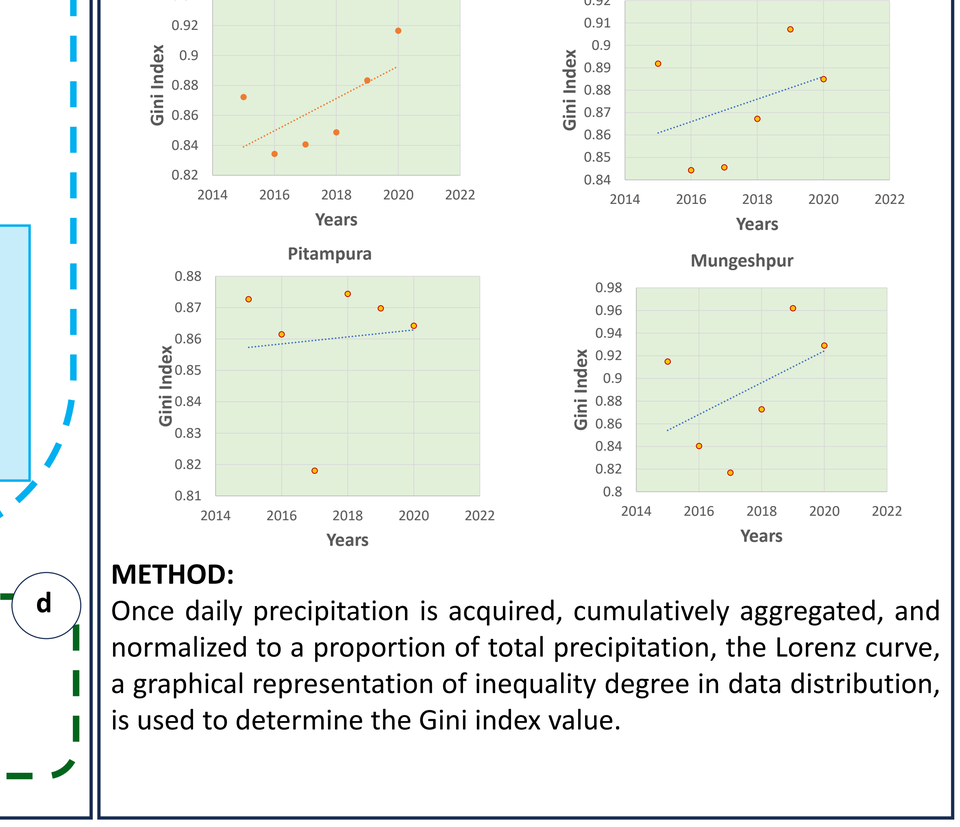


Flood Model Delhi (2013 Flood Event)

Flood Inundation map under RCP 4.5 scenario

Flood Inundation map under RCP 8.5 scenario

Water Quality along the River



Conclusions

- Unpredictability of rainfall incidents are seen in the Delhi as Gini Index Co-efficient for 8 rainfall AWS yielded value of 0.8 indicating a non-uniform distribution of rainfall over the years during the monsoon season without any discernible spatiotemporal pattern which leads to extreme events like floods.
- The flood model within the MIKE+ is developed considering a 50-year return period and simulating multiple scenarios involving RCP 4.5 and RCP 8.5. This endeavor produced inundation maps that pinpoint the areas most susceptible to water quality challenges. Water quality breaches acceptable limit, with high levels of faecal indicator bacteria and BOD_5 values especially in four locations which are also the flood-prone areas. This contamination spreads, elevating the risk to human health.

Acknowledgement

WCRP World Climate Research Programme

ICTP The Abdus Salam International Centre for Theoretical Physics