Integrating data-driven and physical models for urban flood prediction in a single framework

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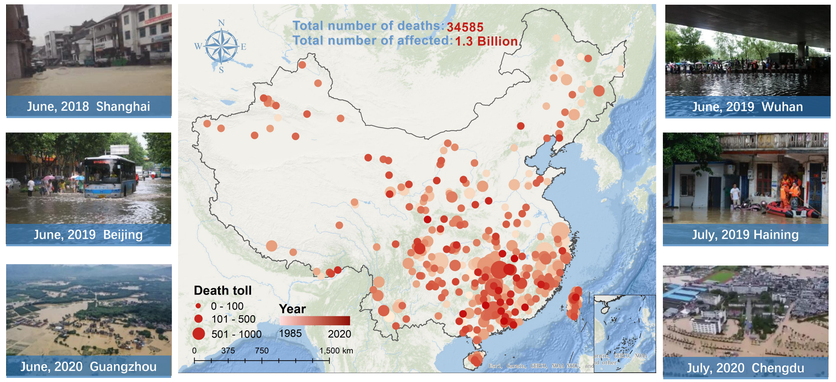
Introduction

Urban flooding, driven by rapid urbanization and climate change poses critical challenges globally.

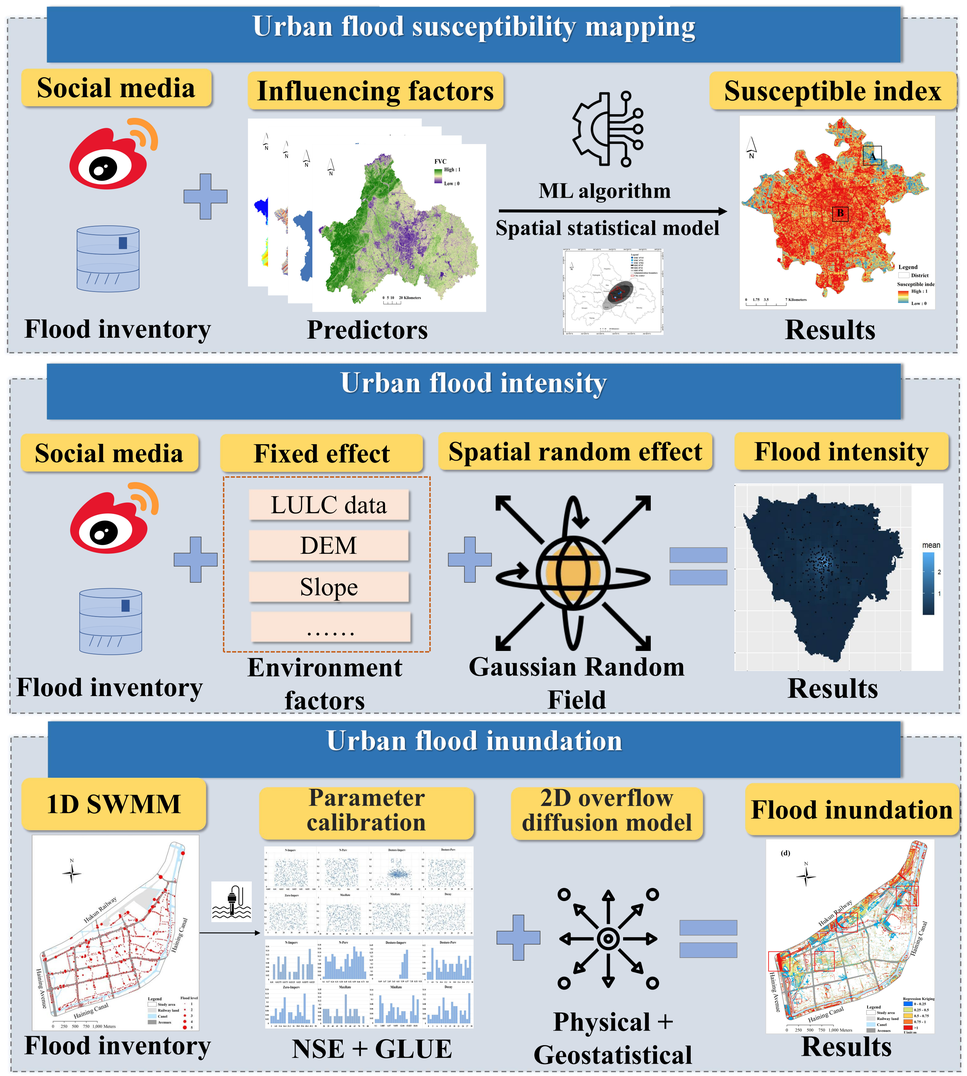


The urban flood status in China

Multi-source flood data

- Time and money consuming.
- Field survey during flood is dangerous.
- Lack formal infrastructures.
- Station monitoring data is with corse scale.
- Optical satellite image (Clouds cover).
- SAR (Too much noise in urban area).
- Fast, low-cost and efficient.
- real-time feedback on real-space events.

Framework



Integrating models

(1) The data-driven model can assess flood susceptibility and provide flood-prone areas in regional scale.

(2) The Log-Gaussian Cox Process (LGCP) model as a spatial statistical model, for predicting flood intensity while capturing unexplained spatial variability;

(3) A coupled 1D-2D hydrodynamic model that integrates a 1-dimensional flooding model with a 2D spatial model to simulate inundation.

Conclusion

- Developed an integrating framework for urban flood prediction and mapping, from susceptibility to intentity to inundation results.
- Effectively integrated data-driven and physically-based modeling approaches.
- Demonstrated potential for application to other natural hazard predictions.

Next step: Framework's applicability and model optimization.

- Li, Y.*, Osei, F. B., & Stein, A. (2023). Urban flood susceptibility mapping based on social media data in Chengdu city, China. Sustainable Cities and Society, 88,104307.
- Li, Y. *, Badu Osei, F., & Stein, A. (2024). Urban inundation mapping by coupling 1D − 2D models and model comparison. International Journal of Applied Earth Observation and Geoinformation, 130, 103869.

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