New study reveals the resilience patterns of human mobility in response to extreme urban floods

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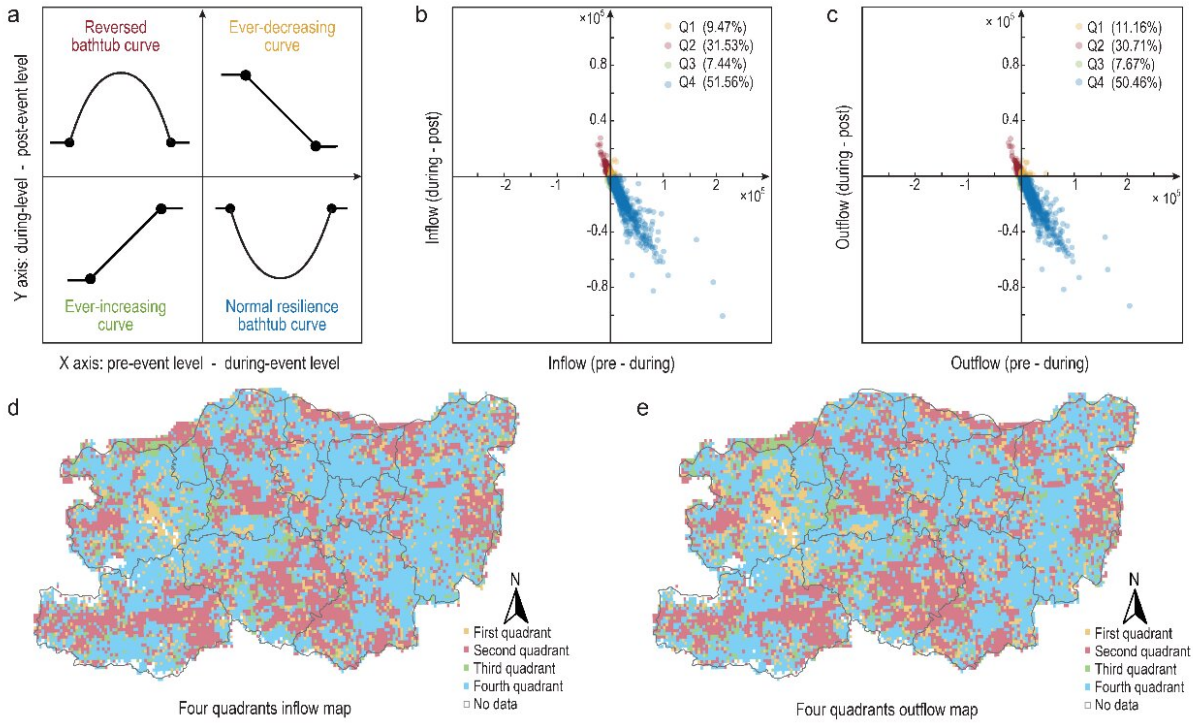


The four resilience patterns of human mobility in this event (together with corresponding occupation ratio in the area) and their geographical distribution from the view of both inflow and outflow. Credit: Science China Press

Resilience can be interpreted as the comprehensive ability of a system to prepare for, absorb, and recover from external or internal disturbances

and shocks. In the context of human mobility, resilience therefore refers to the ability of people's movements within and between cities to cope with and adapt to disruptive events, such as natural disasters.

On July 20, 2021, a record-breaking heavy rainfall occurred in the Zhengzhou region, Henan province, China, an inland densely-populated region with a total area of 7600 km^2, 12.7 million residents, and a 79.1% urbanization rate. The region is located in a semiarid area and is known for its relatively low average annual precipitation.

This unexpected heavy rainfall led to an extreme urban flood, causing massive injuries to the public and losses in critical infrastructure systems, with a death toll of 380; nearly two million people were affected. Very quickly, this apocalyptic event in central China drew extensive attention globally.

Using 1.32 billion mobile phone signaling records generated by 4.35 million people during the "720" Zhengzhou flood event, researchers from Peking University, Henan University, and Key National Geomatics Center of China jointly analyzed how people's mobility responded to this extreme urban flood disaster during the 2021 summer.

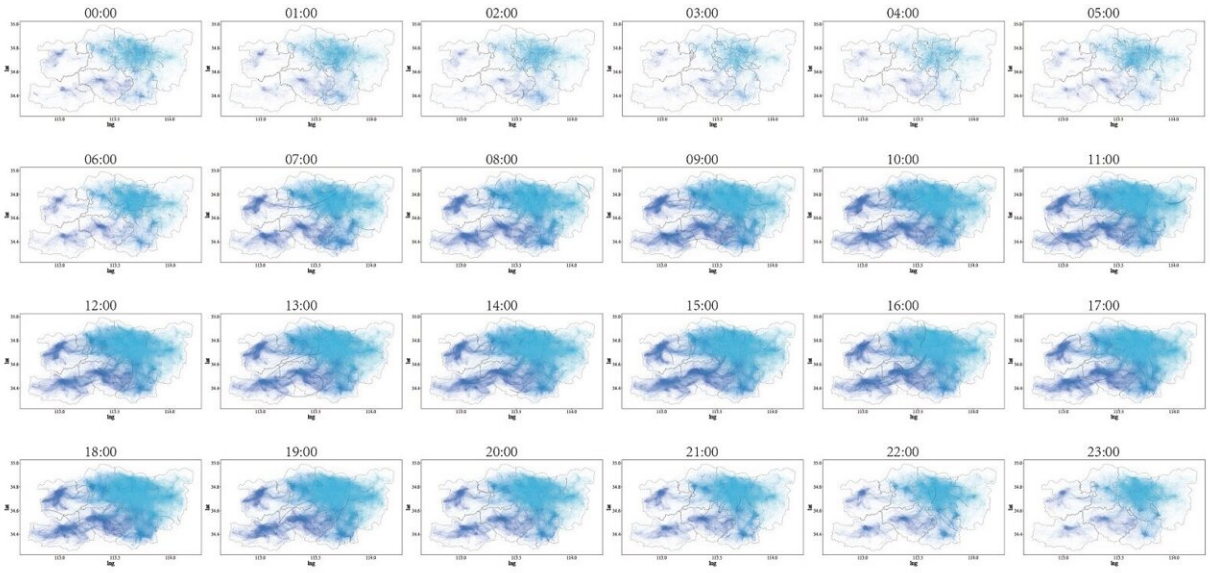
"Owing to the growing availability of mobile phone big data and advanced data mining techniques, we can now uncover more details regarding how people collectively moved and responded to this unprecedented urban flood disaster," said Professor Pengjun Zhao, the lead author of the study and the Dean of the School of Urban Planning and Design from Peking University.

Who is more vulnerable to the impact of this flooding event?

By grouping data based on traveler's gender and age, the study found that there were significant differences in the mobility resilience of different groups, with female, adolescent under 18 years old, and older adults over 60 years old exhibiting relatively lower resilience and therefore being more likely to be affected by flooding.

The study highlights the importance of considering demographic data in disaster planning and response efforts, as certain groups may require targeted support and resources in order to effectively mitigate the impact of disasters

"The result quantitatively illustrates the probability of maintaining the usual travel frequency in these population groups is much lower than other groups during the event, which explains their lower resilience level and insufficient recovery," said Prof. Zhao.



The structural changes of the mobility networks (G