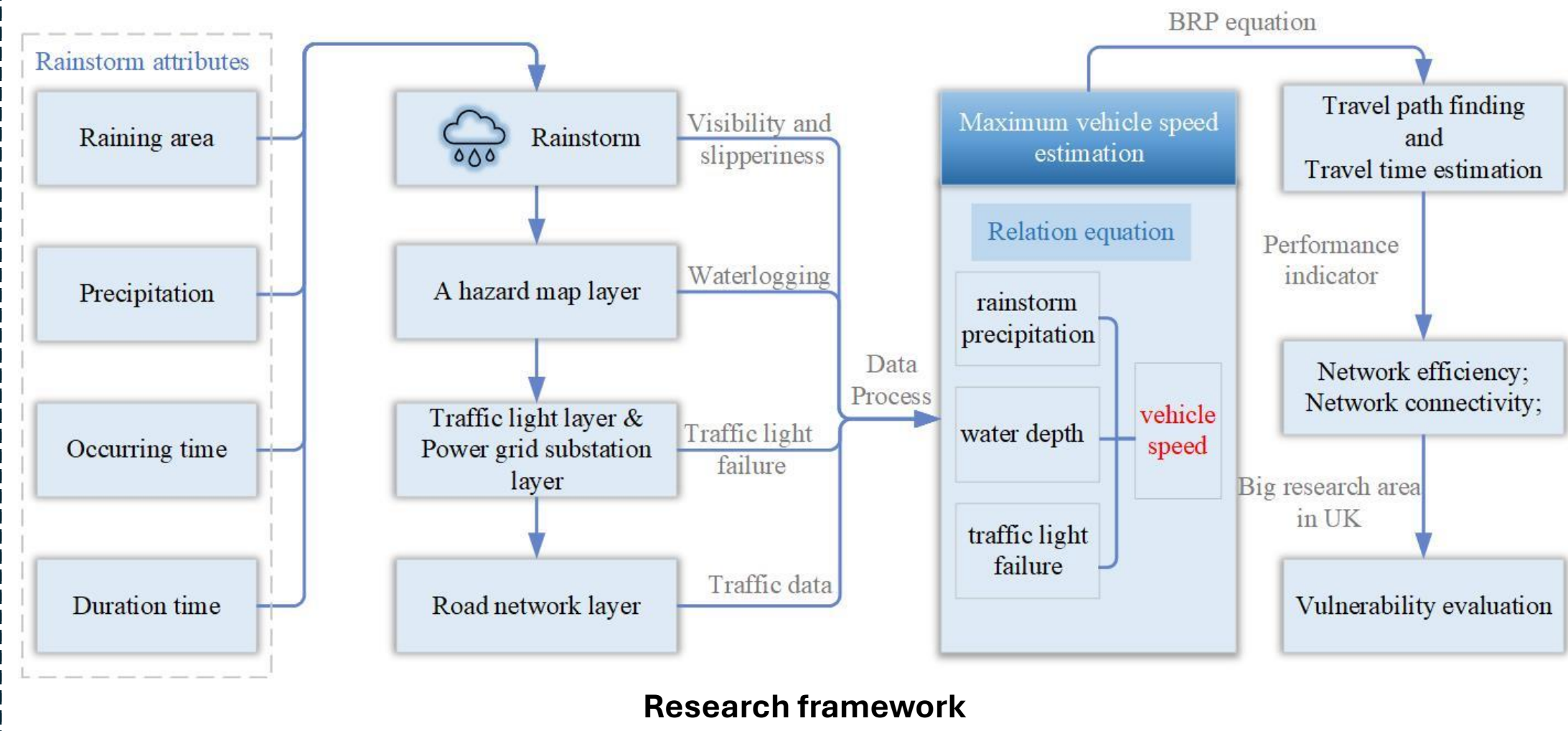


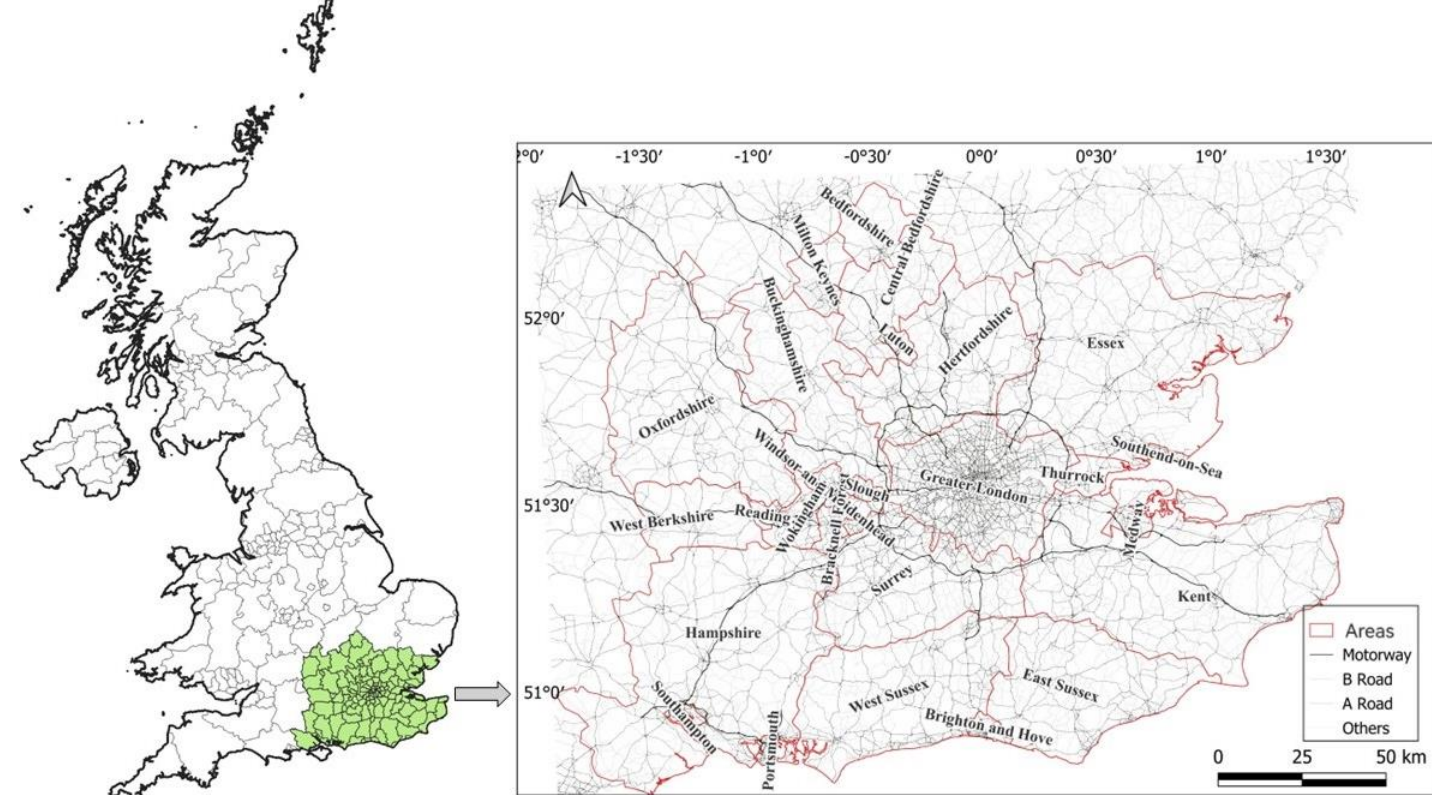
The rainstorm vulnerability of Road networks

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The impact and vulnerability of the road network in London and its surrounding regions are investigated. Three effects of waterlogging, visibility and slipperiness, as well as traffic signal failure on vehicle speed during rainstorms is modelled. Network travel efficiency and connectivity are used as the network performance indicators. The impact and vulnerability of the network are analysed under rainstorm events with return periods of 1 in 30, 100, and 1000 years across local government areas.



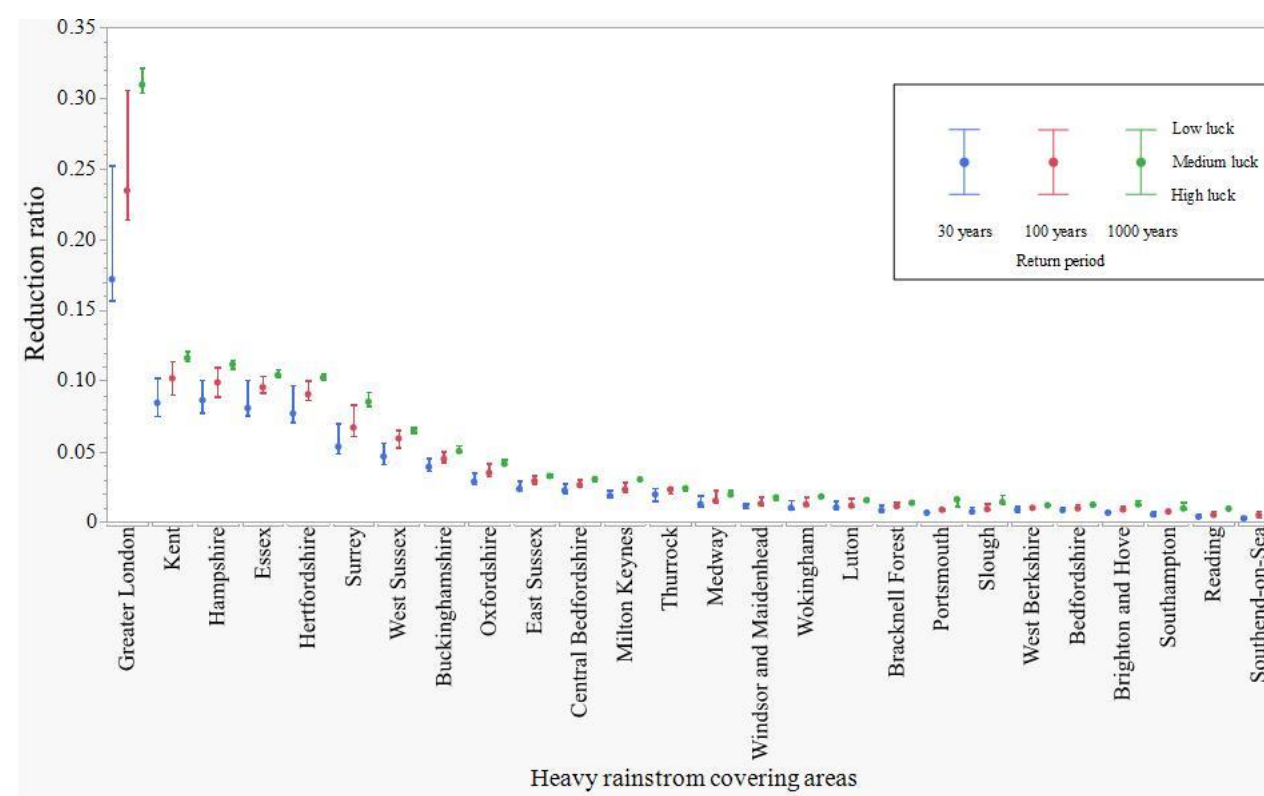
Research area and research data



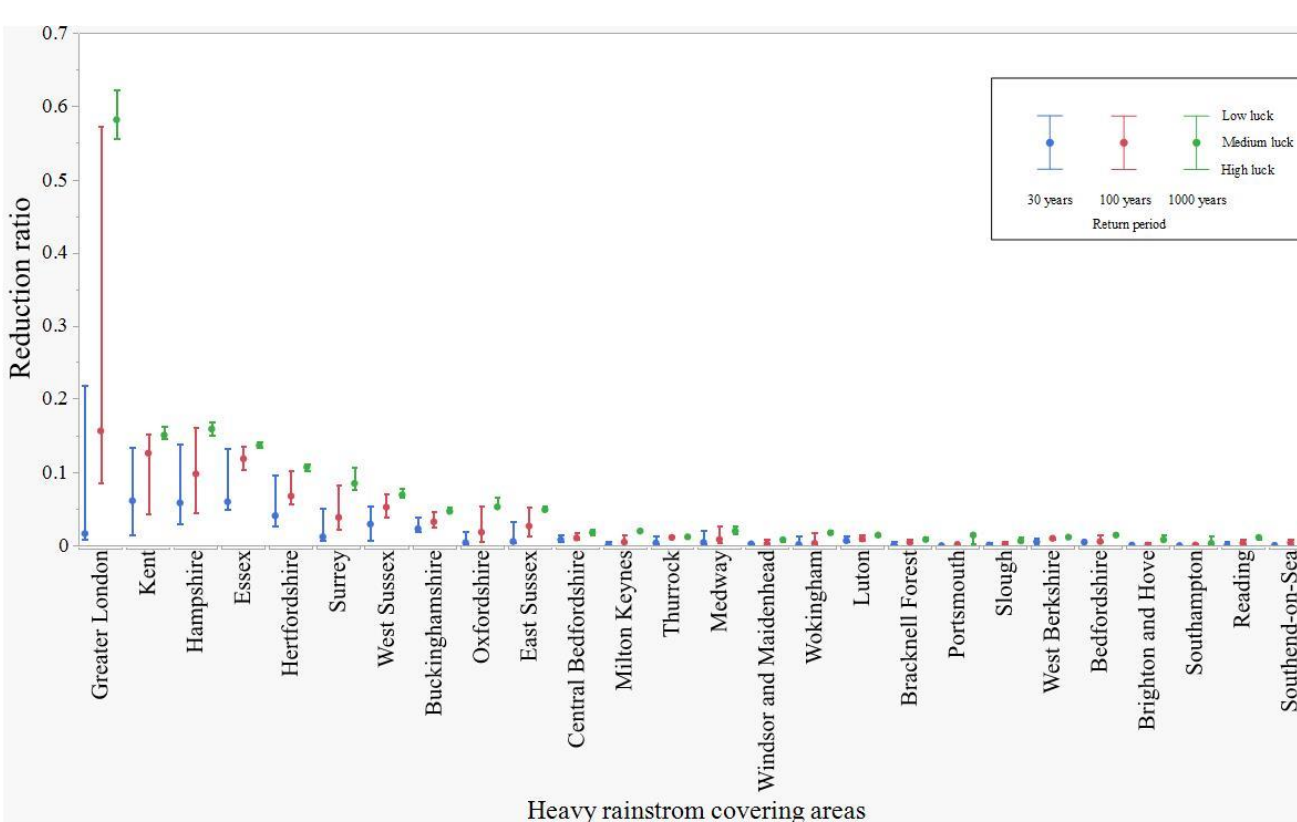
Data	Resolution	Attributes and unit	Data source
Water depth map after 30, 100, 1000 years return period rainstorm occurrence	2m (depth data provided in the format of a range)	Water depth (mm)	Environment Agency
Digital terrain elevation	2m (vertical accuracy 15 cm)	Elevation in each grid (mm)	Environment Agency
Digital surface elevation	2m (vertical accuracy 15 cm)	Elevation in each grid (mm)	Environment Agency
Road network	5-10m	Free-flow speed (mile/h) of each segment, traffic flow (vehicle/h), number of lanes, road classification.	OpenStreetMap
Traffic signal	-	The counting of vehicles per hour	OpenStreetMap
Power substation	-	The counting of vehicles per hour	OpenStreetMap
Historical traffic data	Hourly	The counting of vehicles per hour	Depart for Transport
Estimation of travel to work matrices	-	The Middle Layer Super Output Area is the basic unite for travel.	Office for national statics

The research area covers 26 local government areas and encompasses 26,837 km².

Vulnerability result

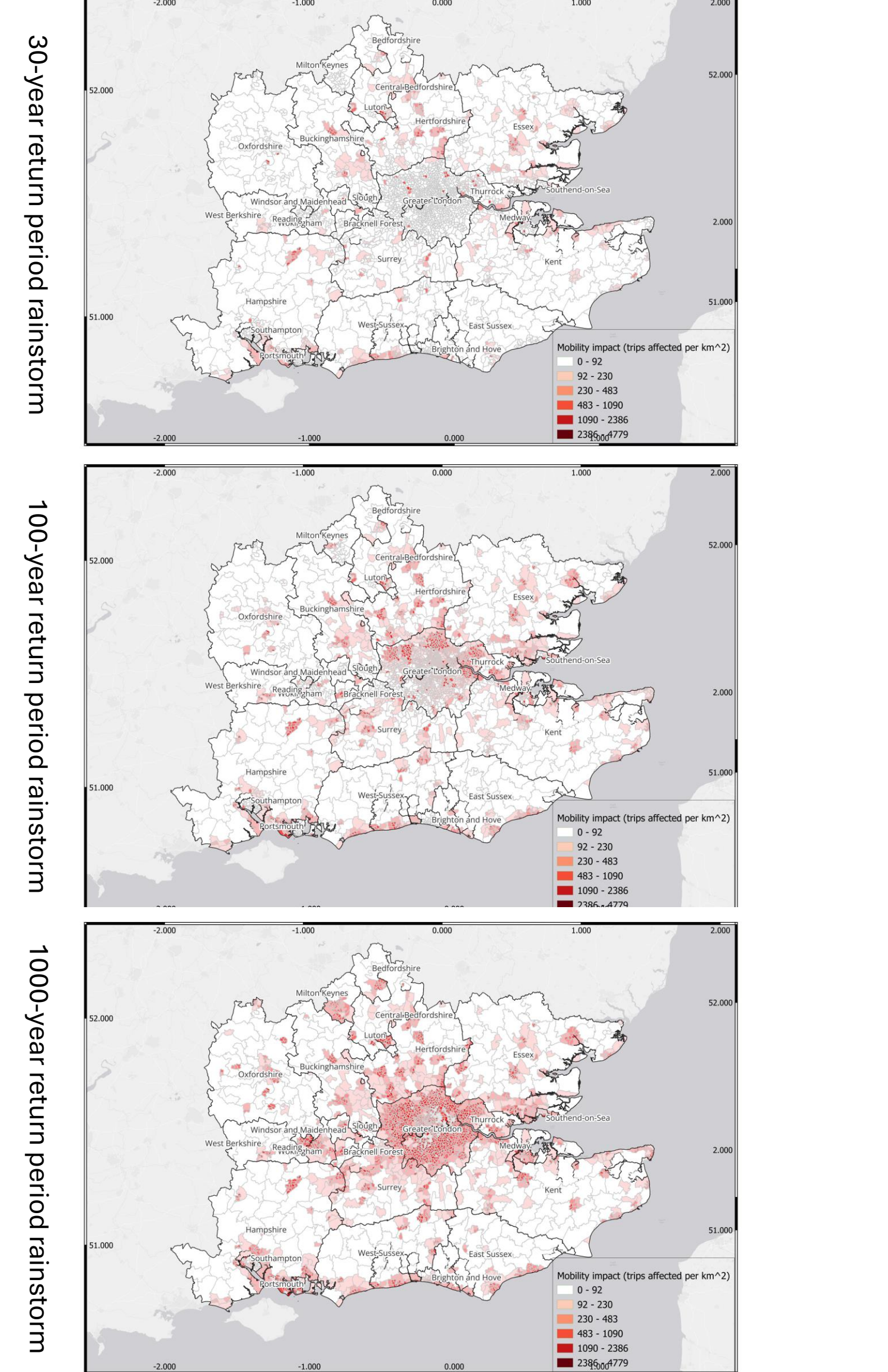


Network efficiency reduction ratio



Network connectivity reduction ratio

Rainstorm impact on traffic zones' mobility



Conclusions

- Travel time computing model and flood risk map are validated using the Google API, historical traffic flow data and historical flooding events.
- Rainstorms that covers Greater London, Kent, Hampshire, Essex, and Hertfordshire lead to substantial reductions in network travel efficiency and connectivity.
- Hotspot areas with high vulnerability to commuting disruptions from rainstorms are identified.
- Extreme rainstorms significantly impact network connectivity, resulting in network fragmentation and severely compromising efficiency.

Plan for the coming 12 months

- Measuring the resilience of the road transport network in the research area.
- Optimizing maintenance strategies to enhance the resilience of transport networks against flooding.
- Investigating the impact of high temperature on the road network.
- Attending conferences and industry secondments to exchange research ideas and ensure practical applications of the research.