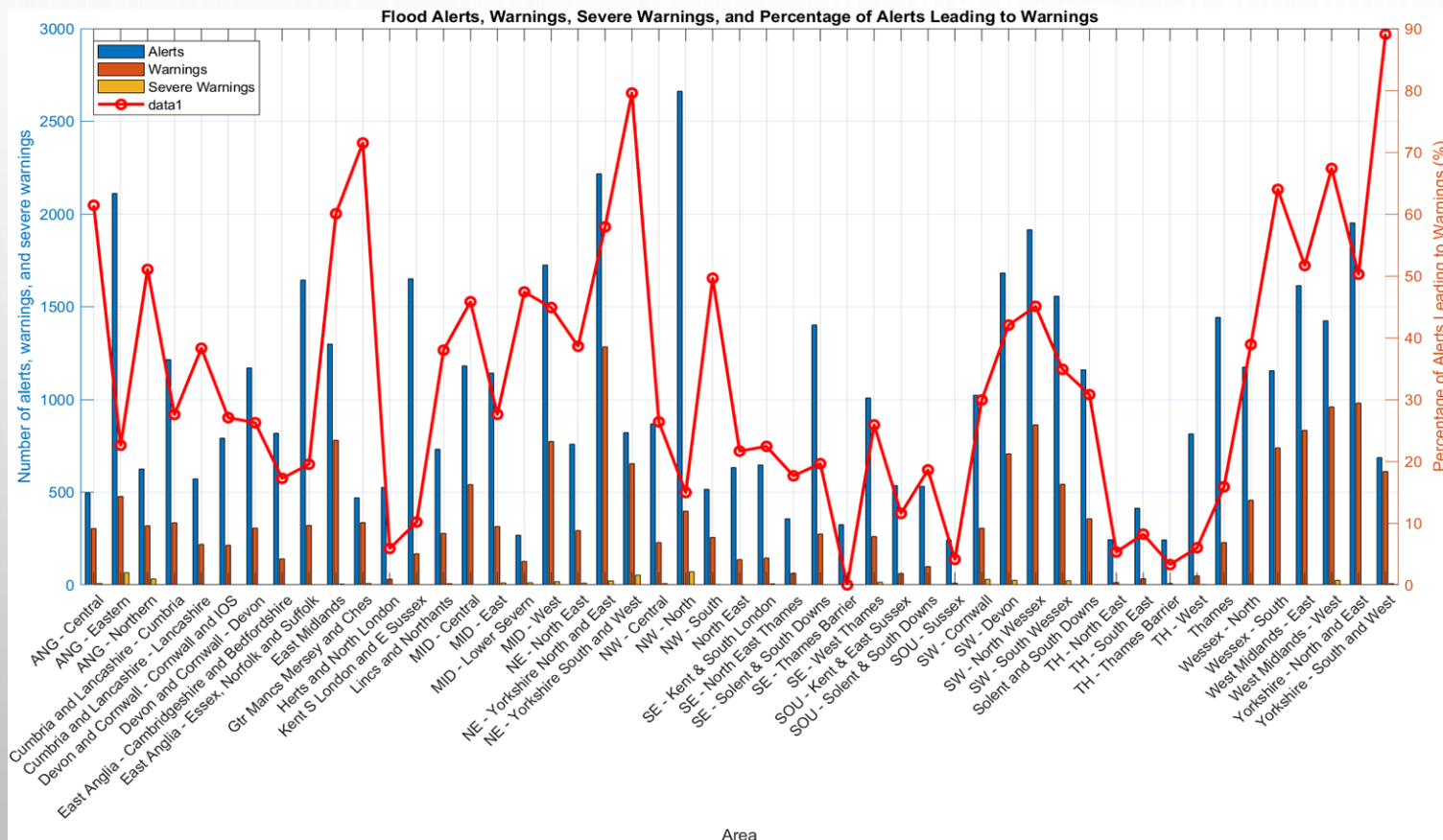# Flood Management Strategies Using Agent-Based Modelling and Public APIs: A Case Study in the UK

Saeid Najjarghabel, Kourosh Behzadian, Farzad Piadeh, Atiyeh Ardakanian

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Outline

- ➢ Overview
- ➢ Objectives
- ➢ Methodology
- ➢ Results
- ➢ Conclusion

Flood Alerts, Warnings, and Severe Warnings by area (2006-2024), Environment Agency

1 in 4 properties in England could be in areas at risk of flooding from rivers and the sea or surface water by the mid-century.

2.4m Properties in areas at risk

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Main Objectives

Evaluate agent behaviours during flood events

Assess the risk levels and the impacts of floods on affected populations

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Data Collection

|	Type of data	Sources	Example
Static data	Demographic data	Digimap	Population density, age distribution, and socioeconomic status
	Geographic data	Digimap	Infrastructure information, including the location of critical facilities such as hospitals, schools, and emergency services
	Infrastructure data	Digimap, OpenStreetMap	transportation networks
Dynamic Data	Traffic data	Google Traffic and Digimap	Real-time traffic flow and distribution data for urban mobility modelling
	Hydrological data	Environmental agencies	River levels, rainfall, and water discharge
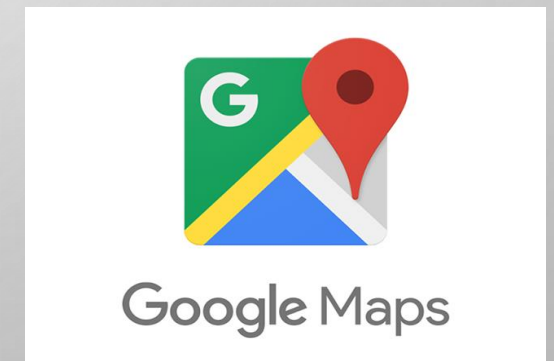
Buildings, Population Density and Road Networks
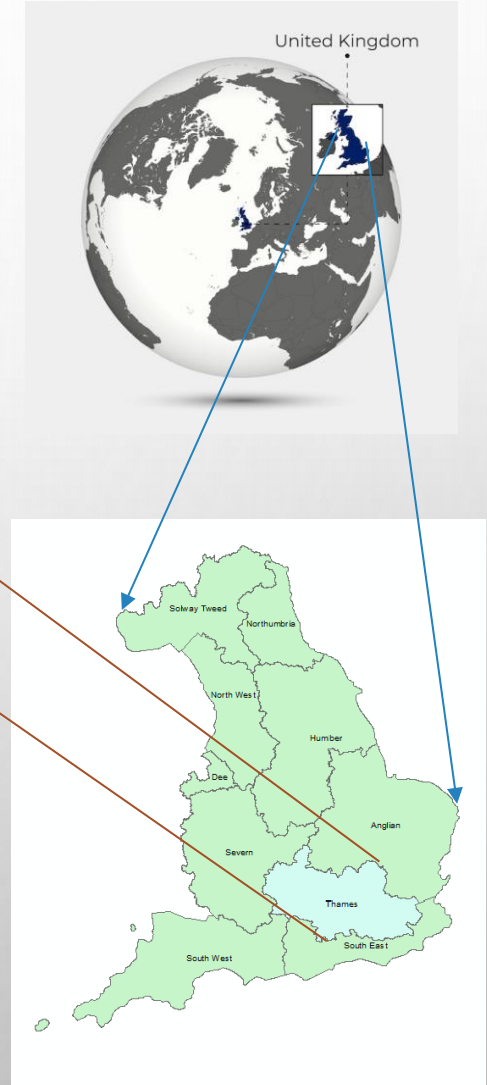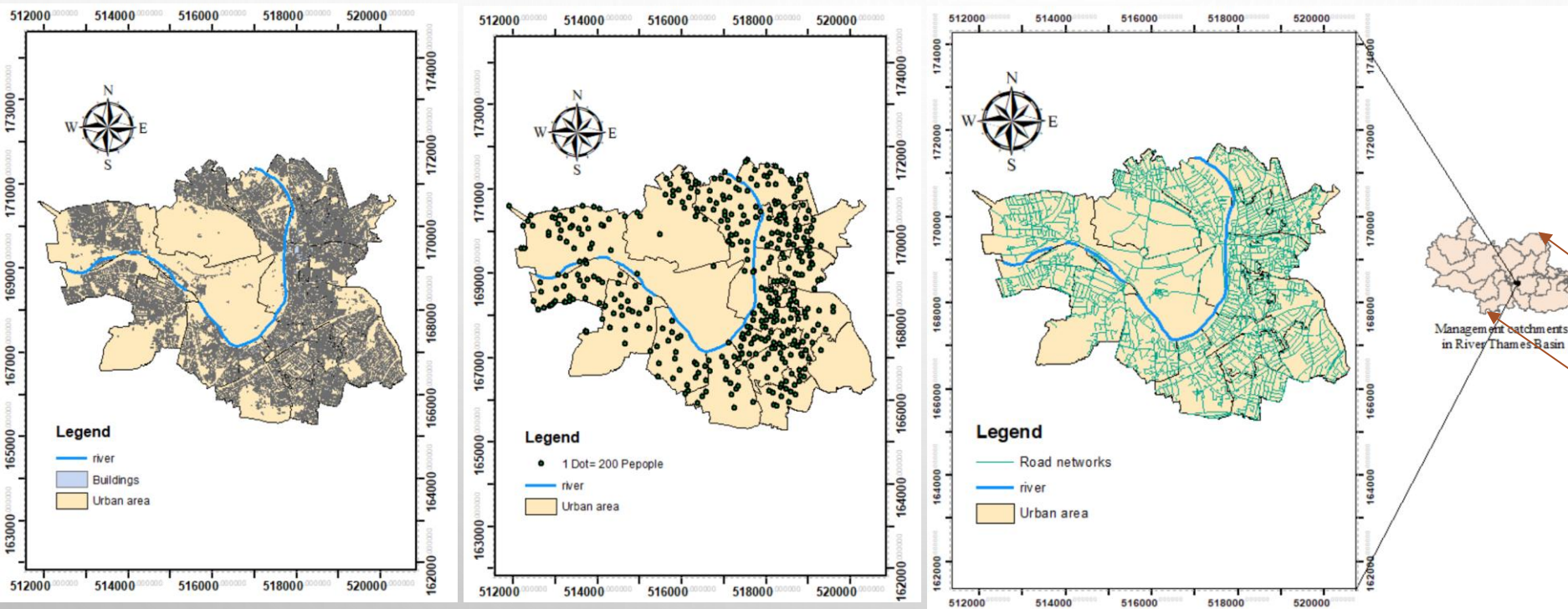
Flood Risk Zones

| Name	Definition	Expected flood event	Level of risk of flooding
Flood Zone 1	Less than a 0.1% annual probability of river or sea flooding	Less than 1 in 1000 chance.	Low
Flood Zone 2	An annual probability between 0.1% and 1% for river flooding, or between 0.1% and 0.5% for sea flooding	Once in every 100 to 1000 years for river flooding, and once in every 200 to 1000 years for sea flooding	Medium
Flood Zone 3	Represents an annual probability of fluvial flooding greater than 1% and coastal flooding greater than 0.5%.	1 in 30 storm event	High

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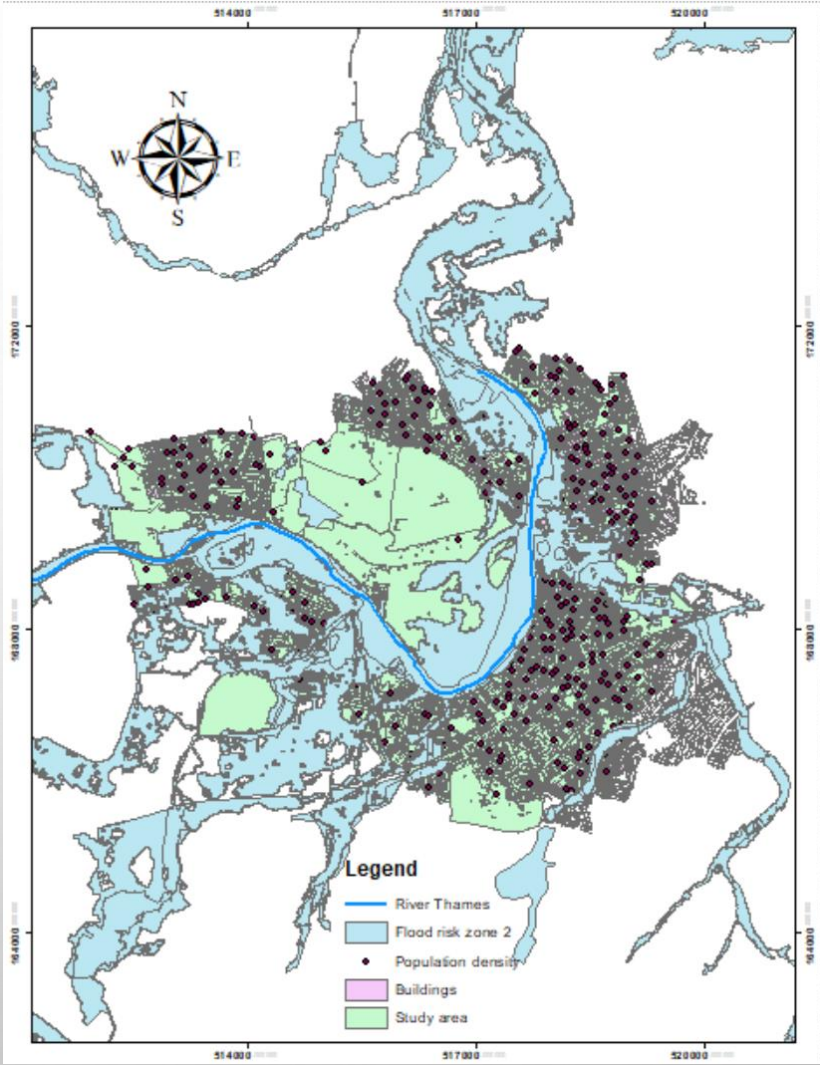
Agent-Based Model
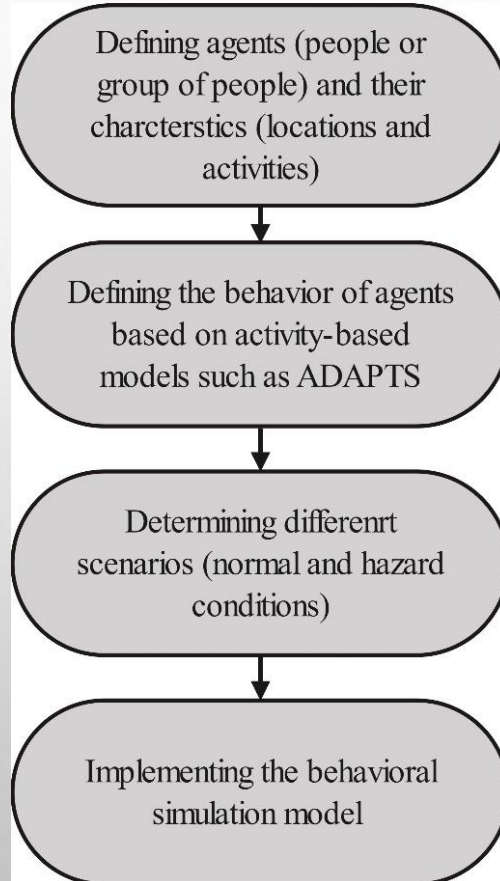
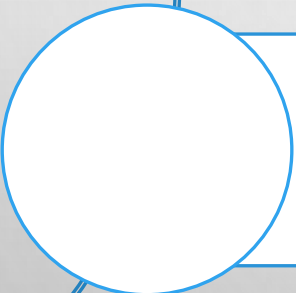| Variables	Values
Gender	Male/ Female
Age	0-17/ 18-65/ 65+ (Child/ Adult/ Senior)
Professional status	Employed/ unemployed/Student
Travel mode	Walk/ Bus/ Car

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Behaviour of Agents During Flooding

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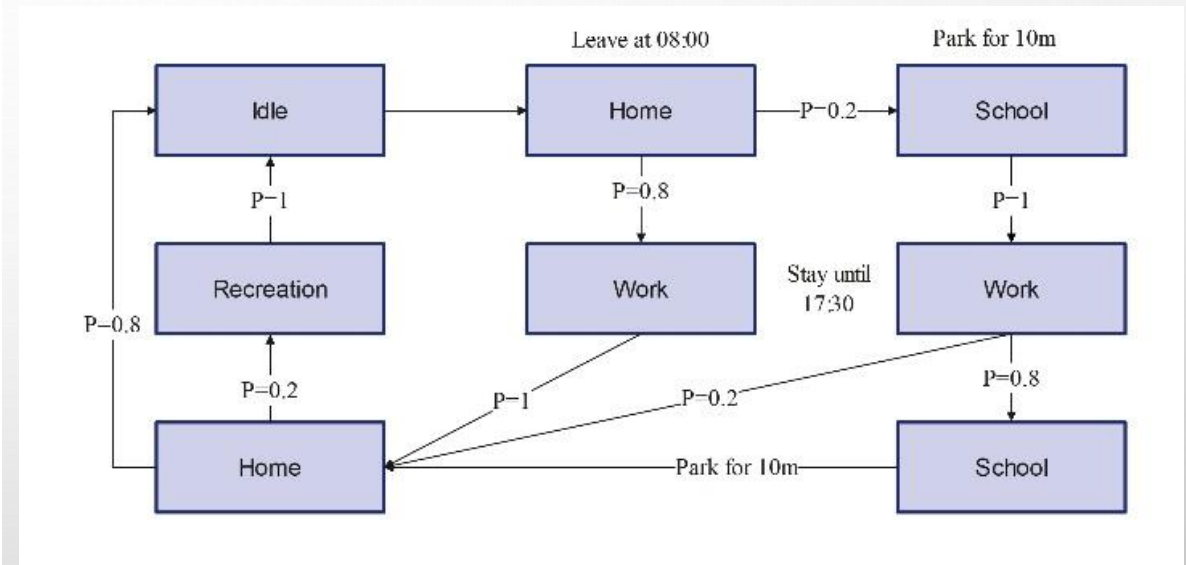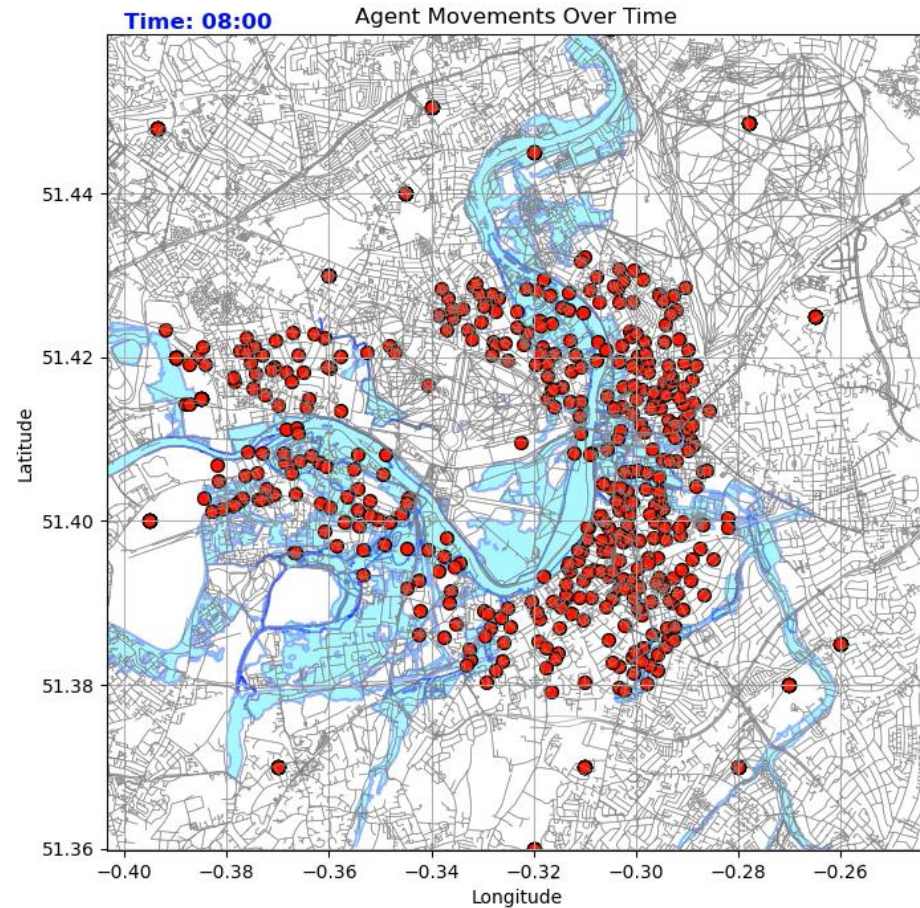
Risk Value and Impact of Flooding on Agents
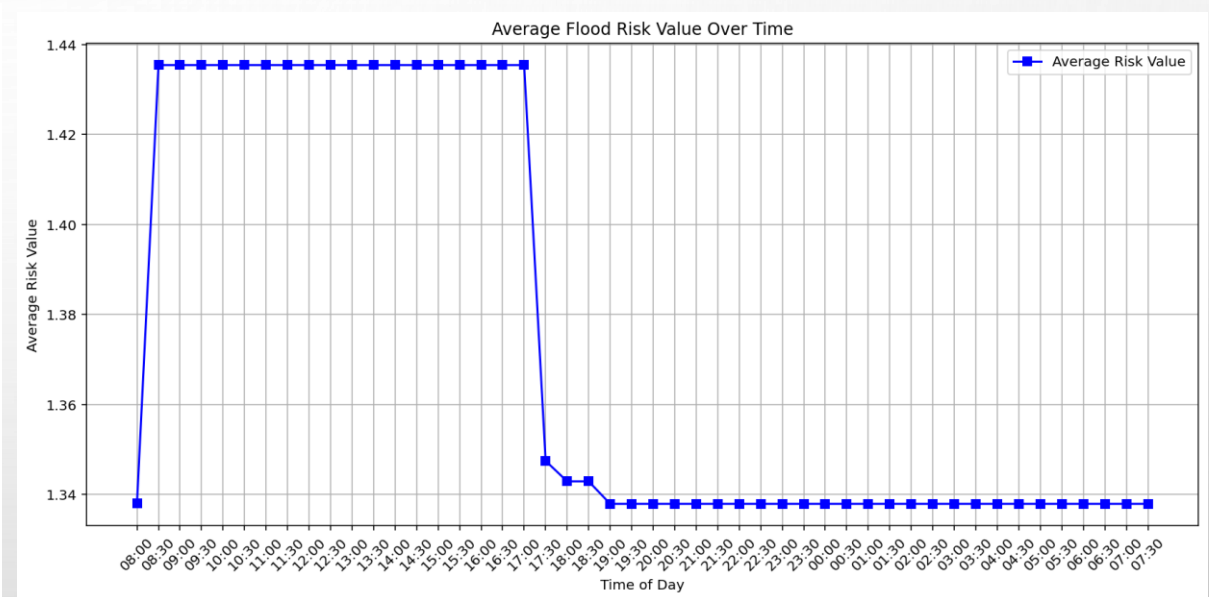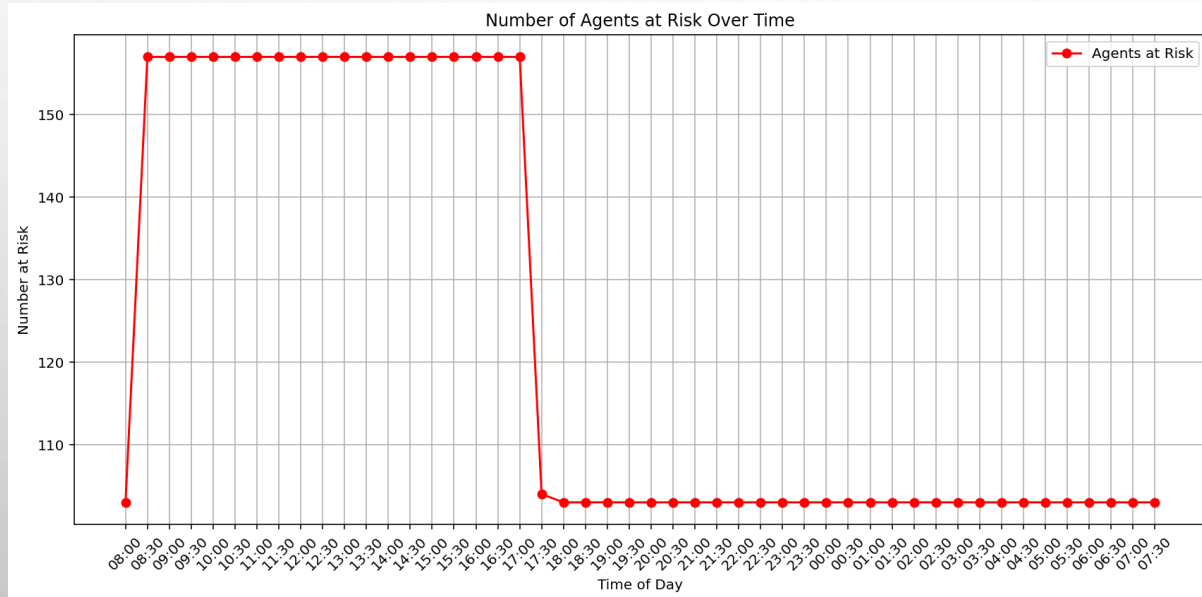
Conclusion

Integrating the Google Maps API with the agent-based model provides a powerful tool to simulate the real-time behaviour of agents

The average flood risk value varies depending on agent activities throughout the day, highlighting the need for the Environment Agency to implement specific action plans for peak hours

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Thank you for your attention!

Saeid.najjarghabel@uwl.ac.uk

📍 River Thames (https://www.ft.com/content/9a2df783-3c9f-419f-bfd6-029ada8e3f8d)

	Flood Alert	Flood Warning	Flood Severe Warning
Description	Forecasts show that flooding may be possible	Forecasts show that flooding is expected	Flooding poses a danger to life and could cause significant disruption to communities
Timeframe	Between 2 and 12 hours before flooding	30 minutes to 2 hours before flooding	When flooding threatens life and communities
Areas at risk	Fields, recreational land and carparks, minor roads, farmland, coastal areas	Homes and businesses, railway lines and infrastructure, roads, coastal areas	Buildings collapsing or at risk of collapse, requiring the evacuation of large numbers of people