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FP7 Collaborative research on flood resilience in urban areas

The development of a flood damage assessment tool for urban areas

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Presentation outline

- CORFU project and its objectives
- Development of the flood damage assessment tool
- Application of the tool – Dhaka City
- Conclusions and future work

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CORFU project

- Collaborative Research on Flood Resilience in Urban Areas
- Funded by European Commission's Seventh Framework Programme
- Overall aims of the project
  - European and Asian cities to learn from each other through joint investigation to help create flood resilient cities
  - To **assess flood impacts** for different futures or scenarios
  - Develop and **evaluate** state-of-the-art flood resilience measures and strategies

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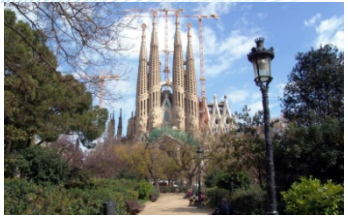
Case study cities



Barcelona

Beijing

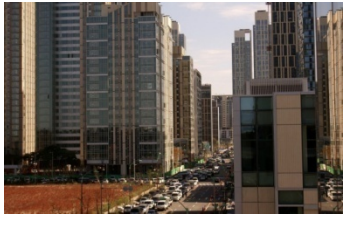
Dhaka

Hamburg

Mumbai

Nice

Seoul



Songdo

Taipei

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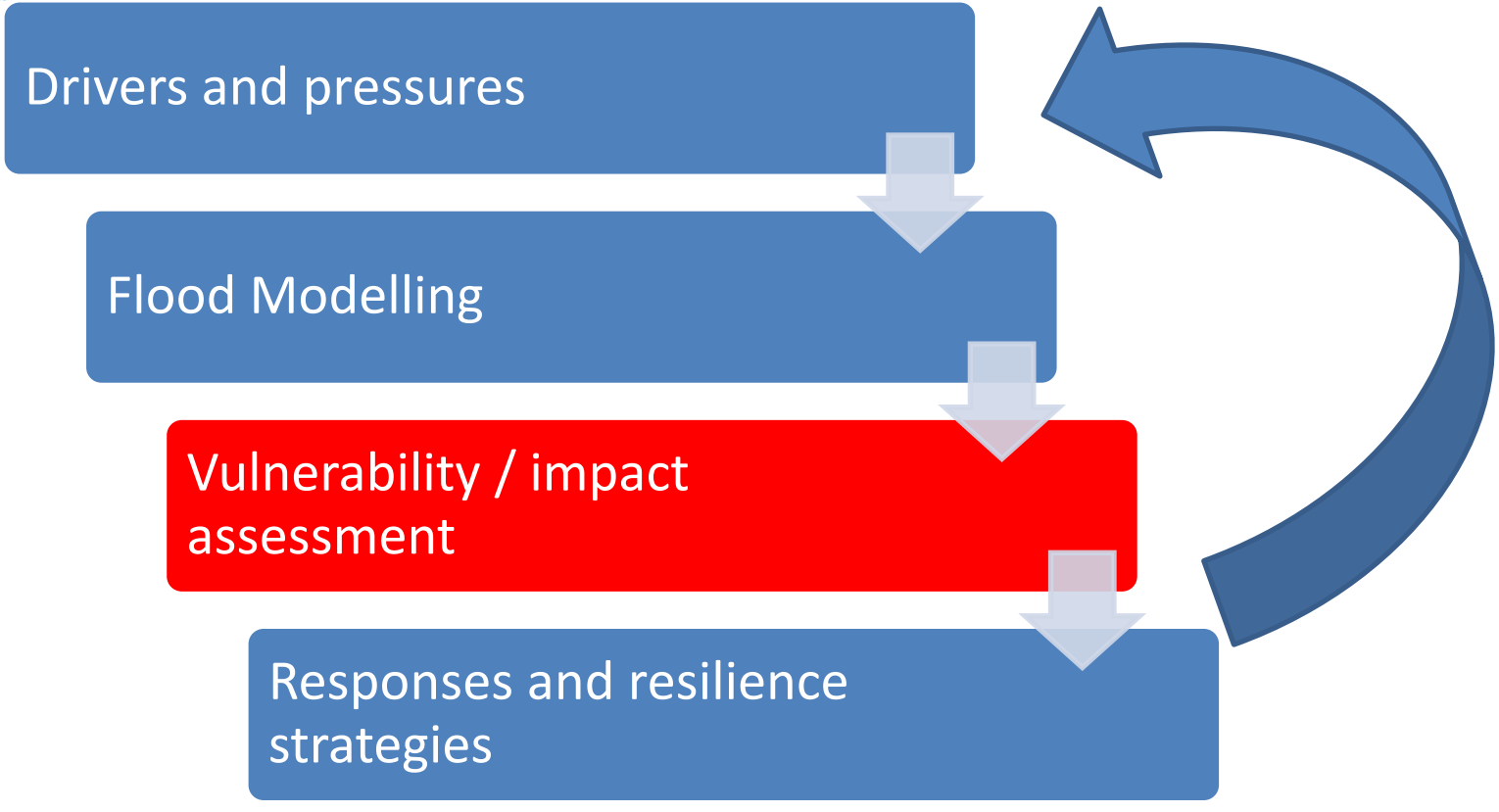
Project overview



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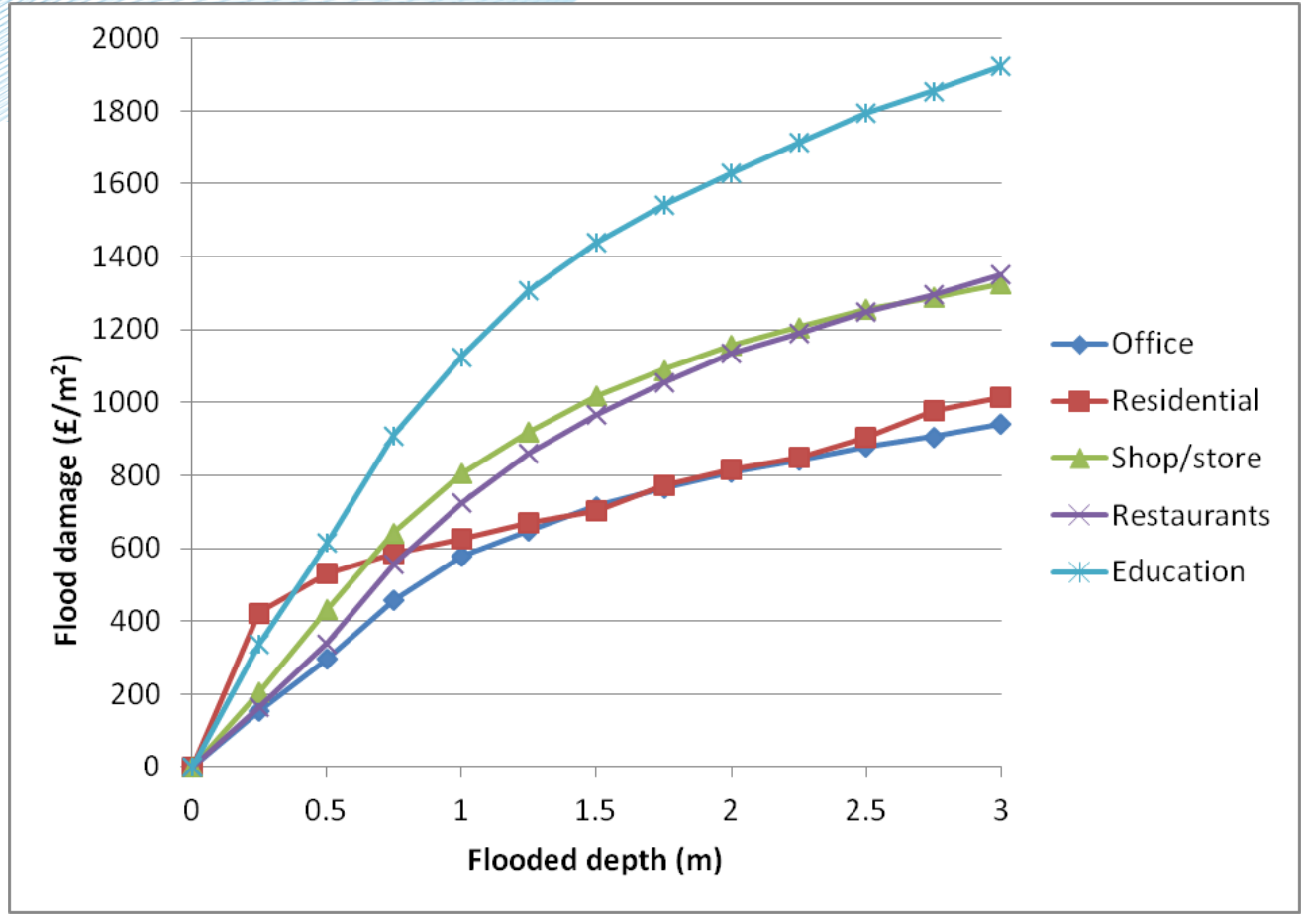
Flood impact typology

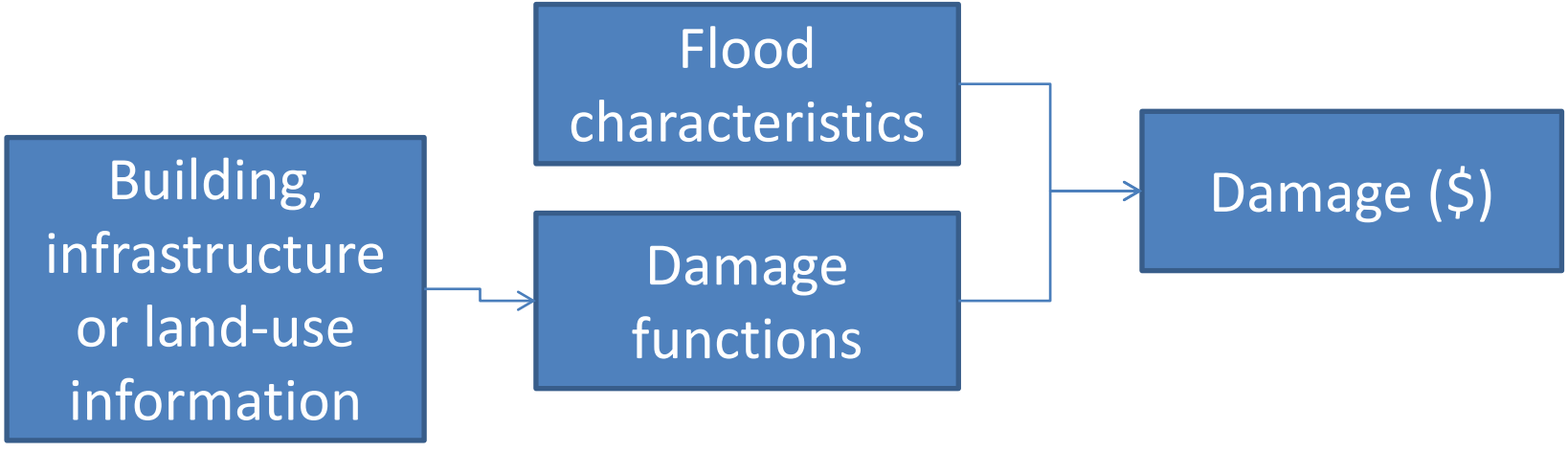
	Tangible	Intangible
Direct	Physical damage to assets •Buildings •Contents •Infrastructure	Loss of life Injuries Diseases Loss of ecological goods
Indirect	Loss of industrial production Traffic disruption	Inconvenience of post-flood recovery Increased vulnerability of population

Direct tangible flood damage assessment (ex-ante)

- Flood damage related to key parameters
  - Impact parameters – characteristics of the floodwaters
    - e.g. flooded depth, flow velocity, flooded duration
  - Resistance parameters – characteristics of the affected asset
    - e.g. building use, building materials
- Expressed through flood damage functions
  - Most typically a function of depth
- Different asset types will have different damage functions


2000
1800
1600
1400
1200
1000
800
600
400
200
0
Flood damage (£/m²)
0
0.5
1
1.5
2
2.5
3
Flooded depth (m)
Office
Residential
Shop/store
Restaurants
Education

Direct tangible flood damage assessment (ex-ante)



Tool requirements ...

- Work on a common platform
- Work with spatial data
- Flexible with different data types (e.g. raster or polygon) with different resolutions
- User friendly

... and solutions

- Work on a common platform
- Work with spatial data
- Flexible with different data types (e.g. raster or polygon) with different resolutions
- User friendly

- Developed to work in ArcGIS
- Interacts with data via Python Scripts, using in-built geoprocessing functions and executables
- This ensures algorithms are transferable
- Single step functionality

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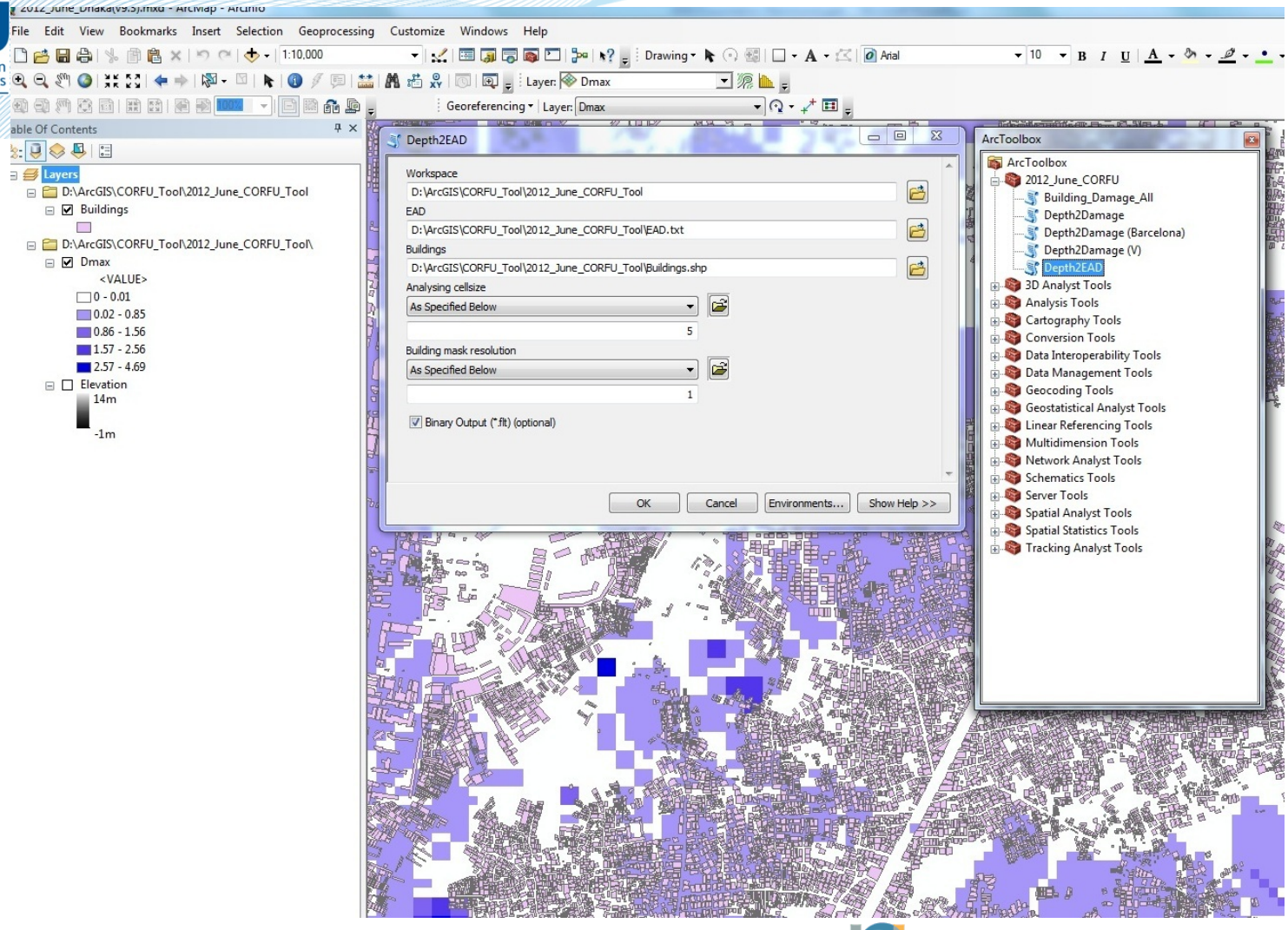

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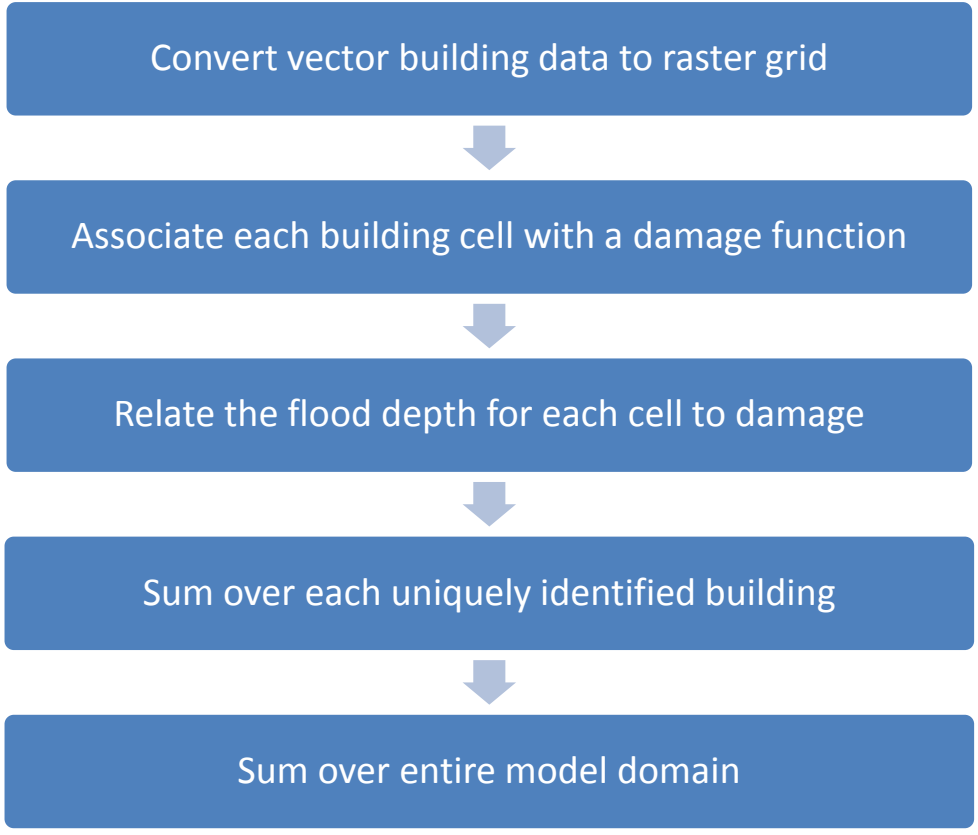
Algorithm for raster flood data

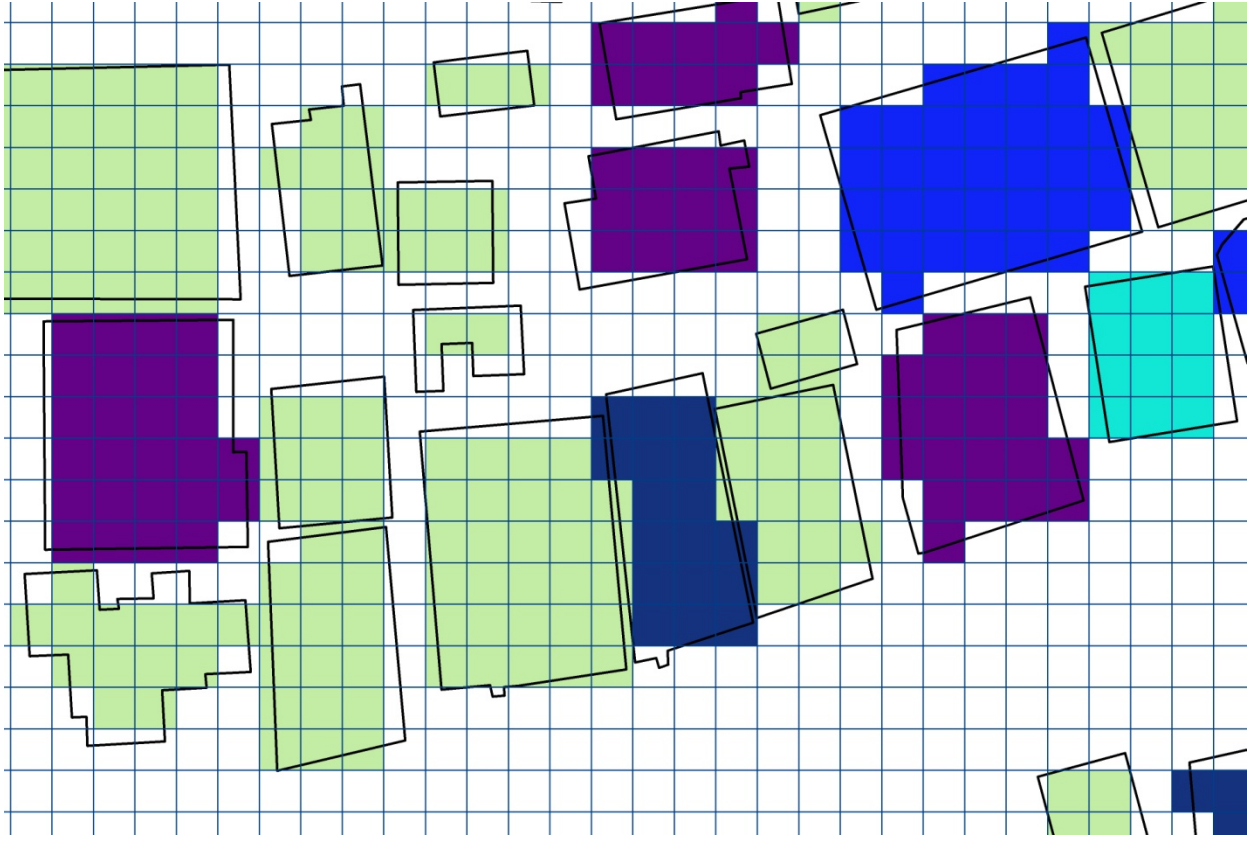


Technical challenges

- Asset data in polygon form
- Flood data (often) in raster form
- Polygon data must be converted to a raster format, while retaining the important information
- Spatial resolution issues
- Computational resources

25m grid

5m grid



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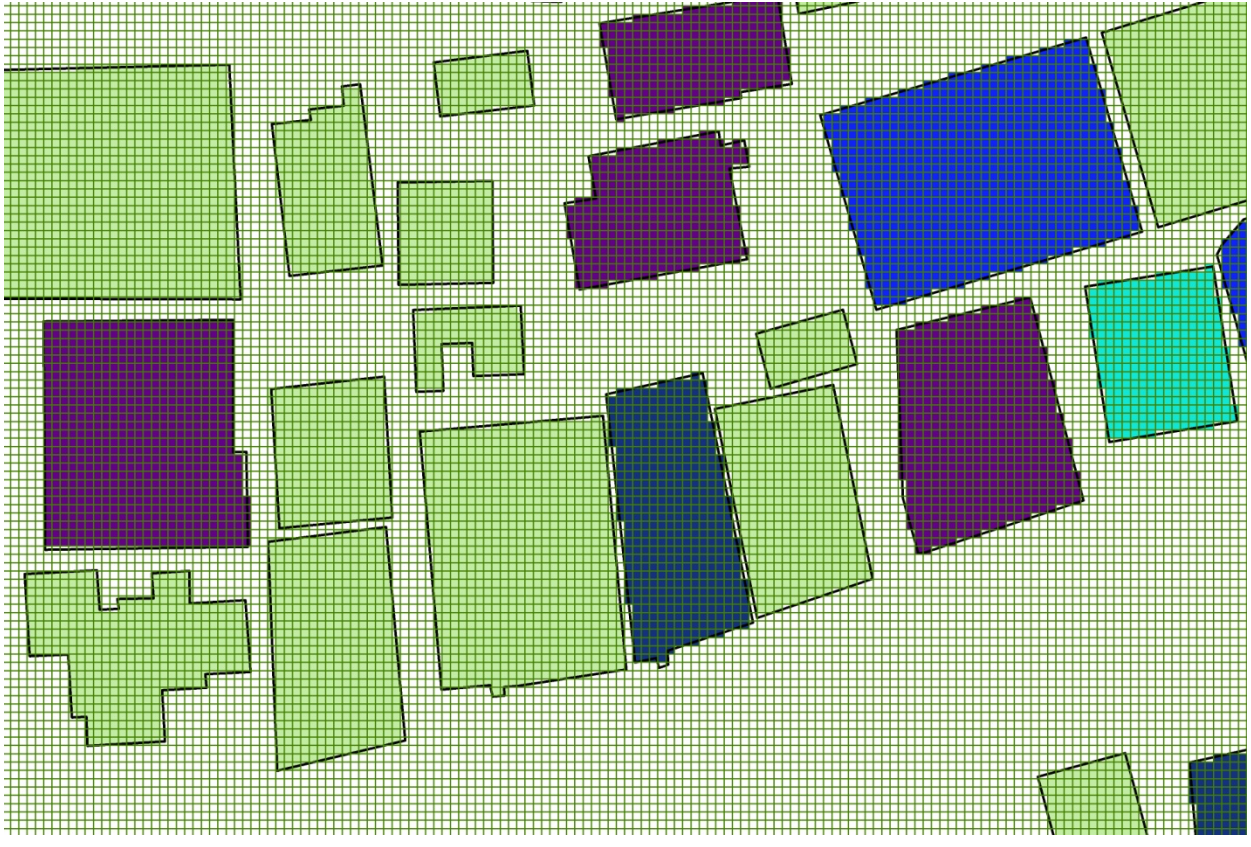
1m grid



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Dhaka City, Bangladesh

- Capital city of Bangladesh
- Rapidly growing mega-city
- Witnessed major flooding in 1998 and 2004
- Eastern side of city most prone to flooding

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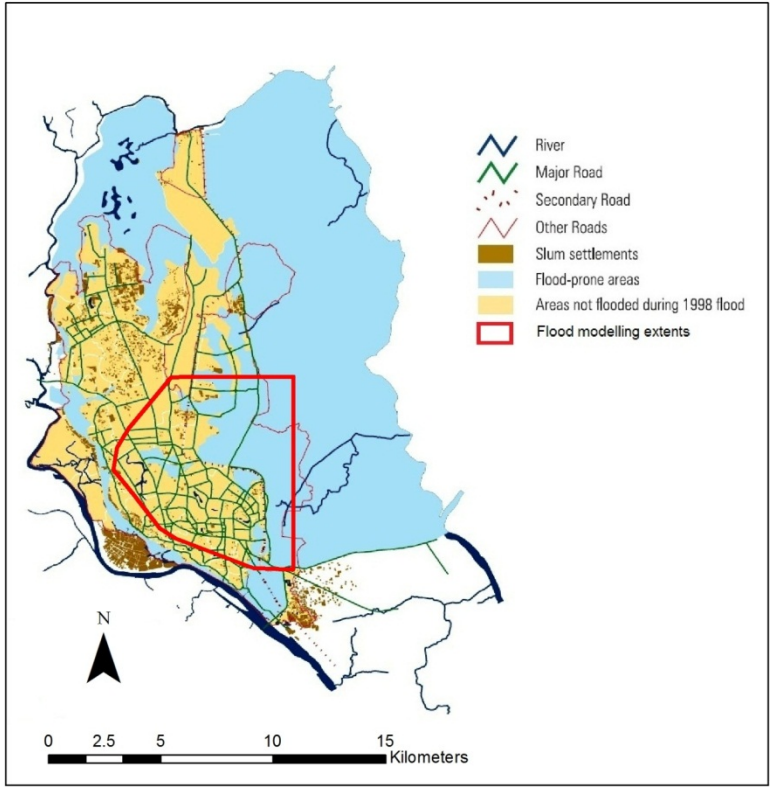

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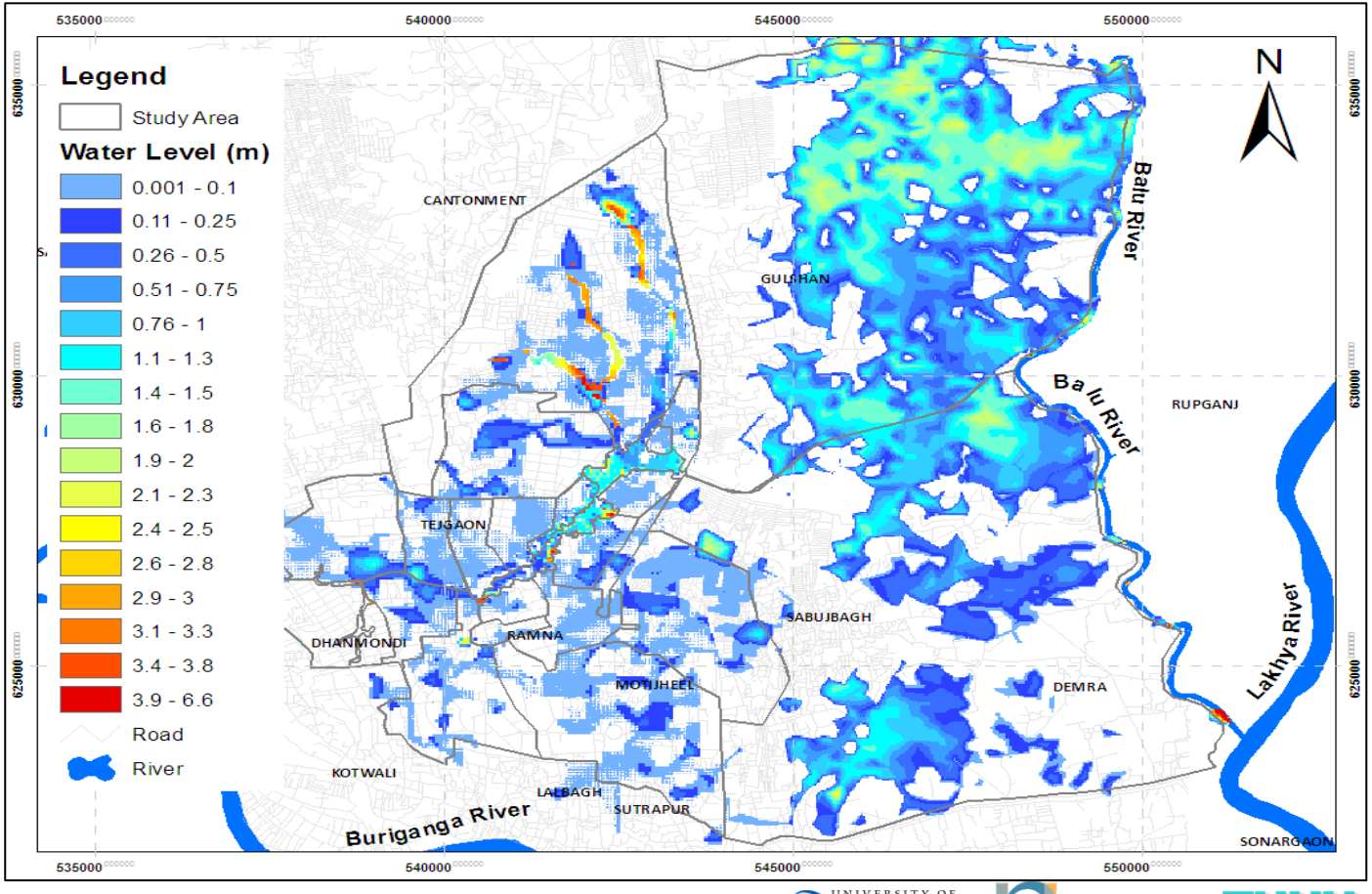
Flood map



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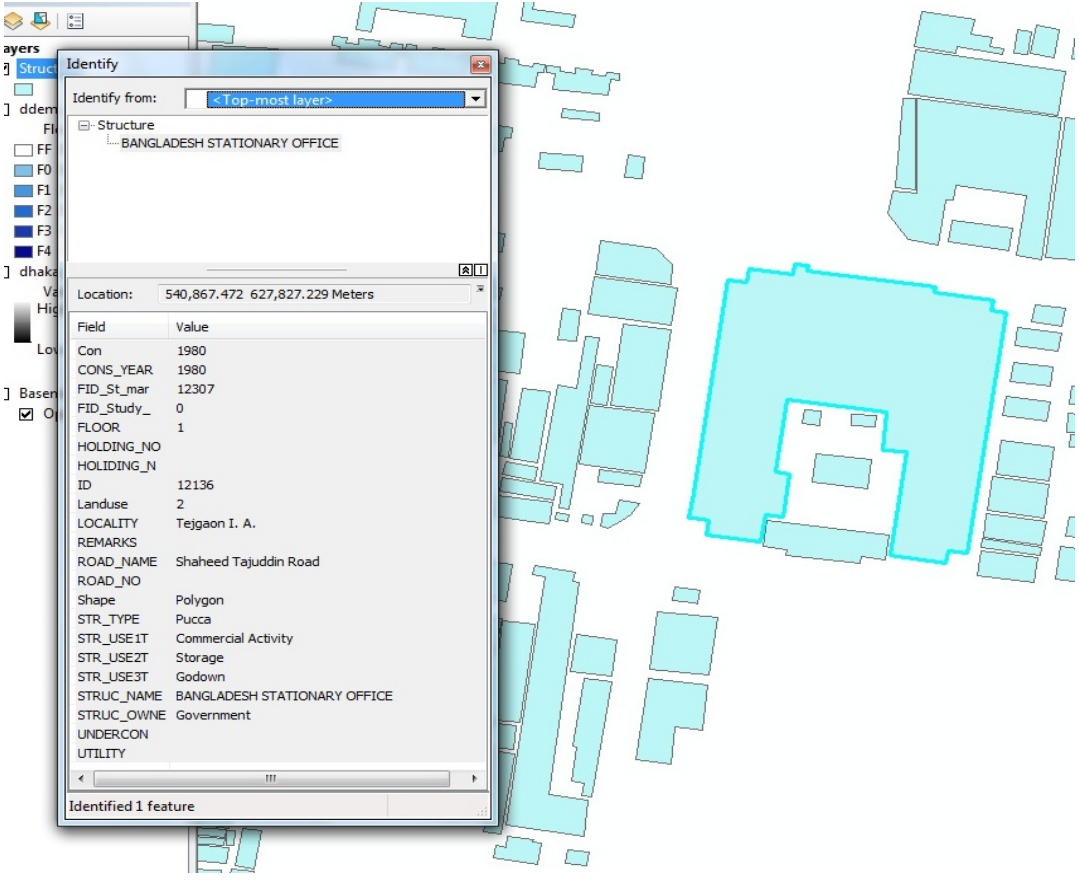
Building / asset data



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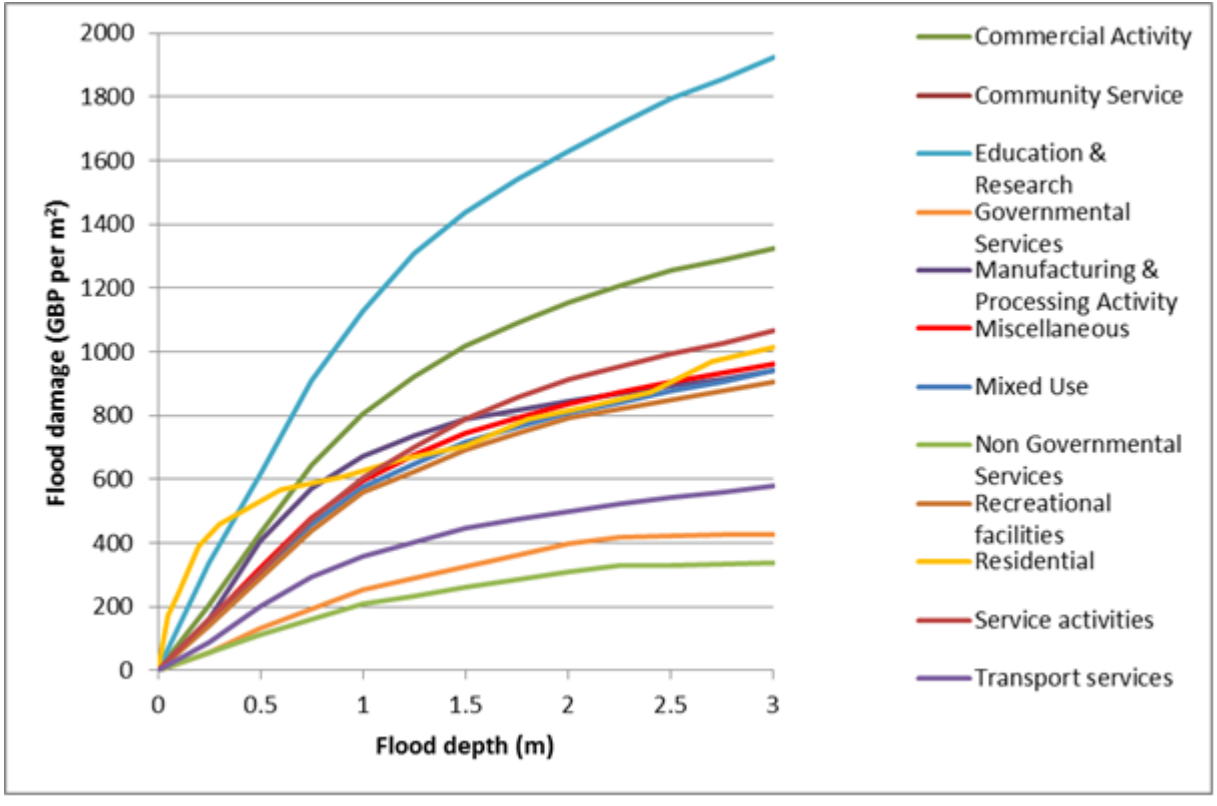
Depth-damage functions



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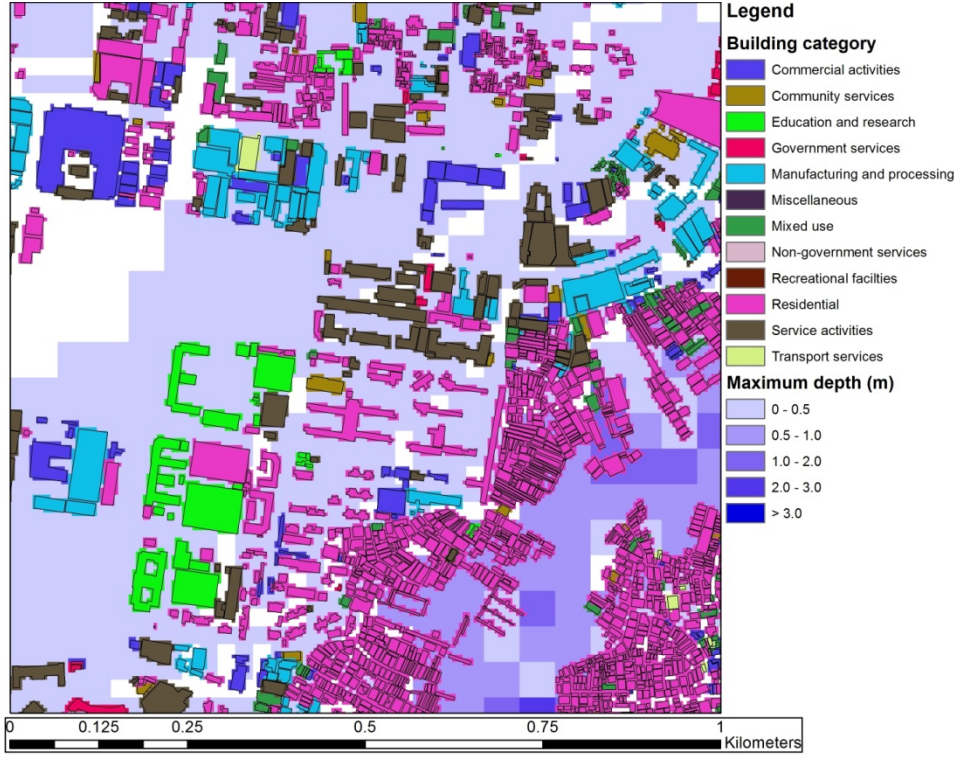
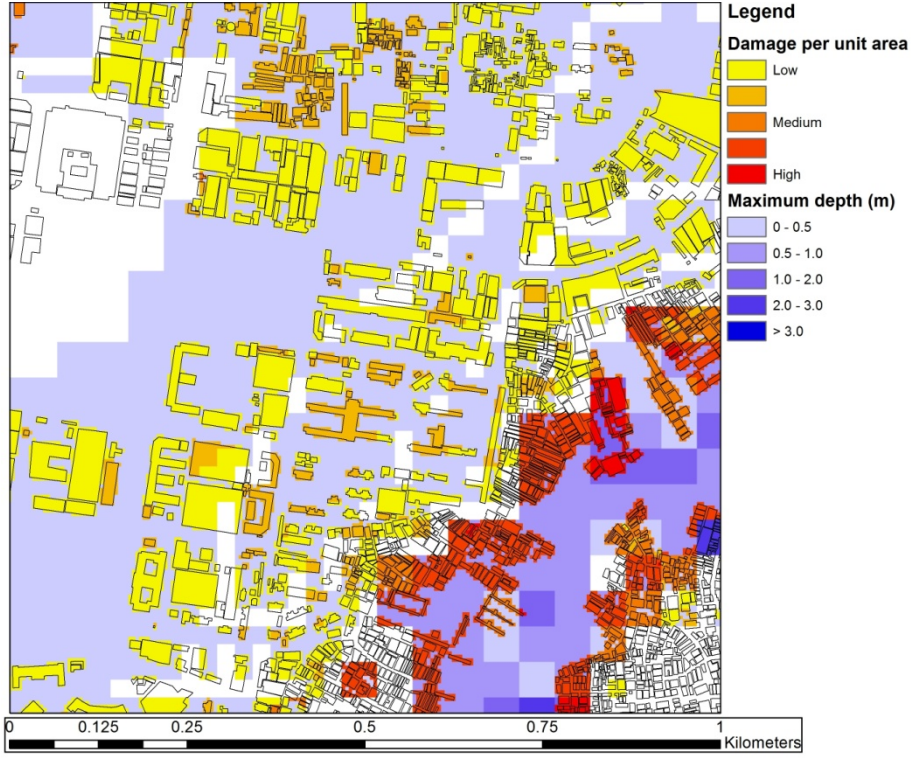
Results

Building types



Damage per unit area



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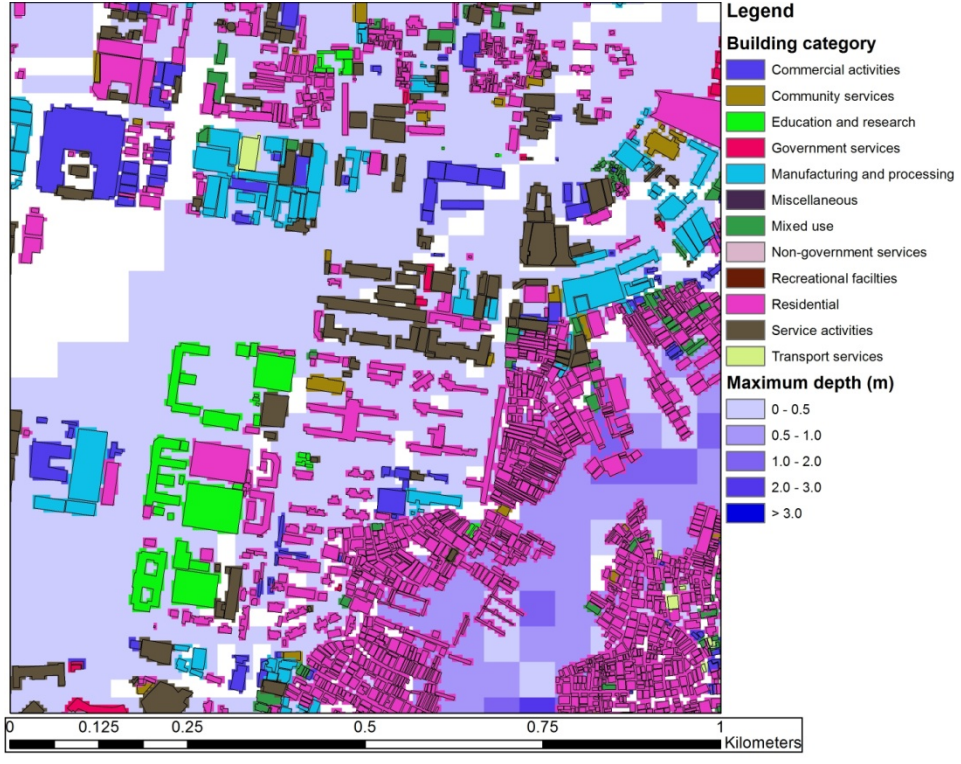
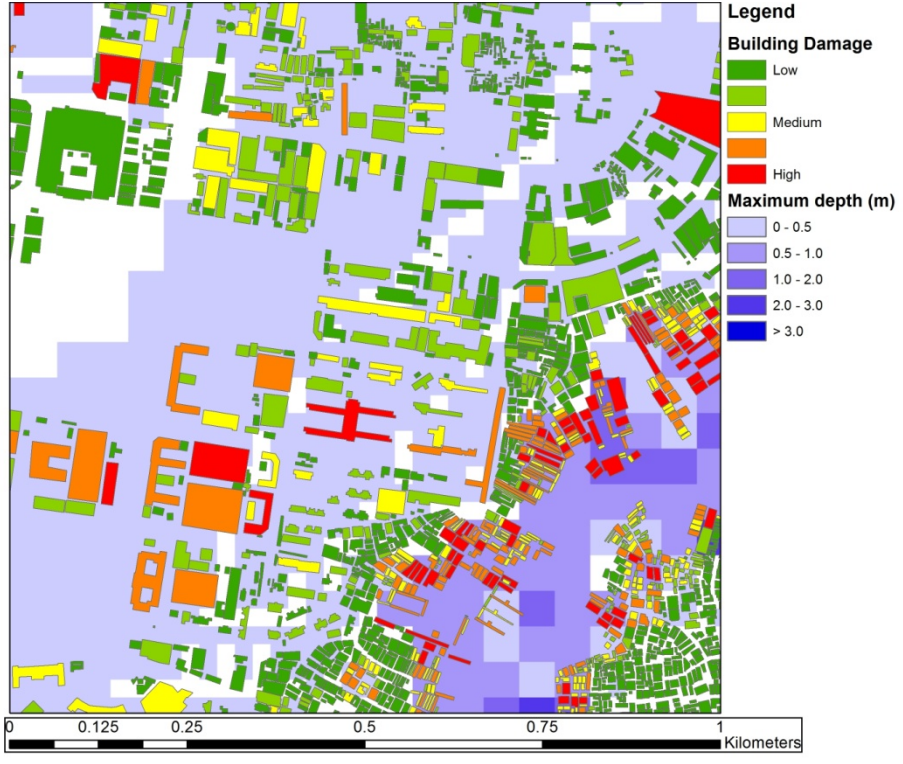


Damage per building



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Conclusions and future work

- User-friendly, flexible tool
- The algorithms are transferrable to other GIS software packages
- The tool has been extended to incorporate calculations for multiple events to allow estimation of Expected Annual Damage
- It is being applied in the project case study cities to aid the evaluation of flood risk and the effectiveness of resilience measures
- The tool will be extended to include other types of flood impacts
  - e.g. health impact assessment

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Thank you

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