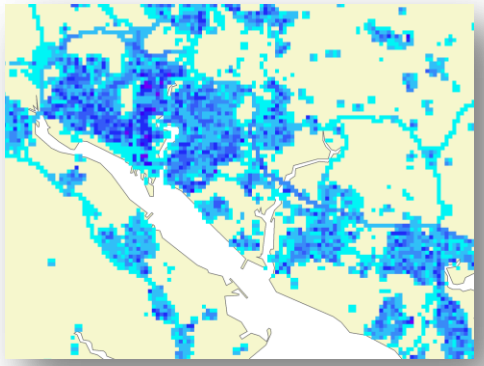

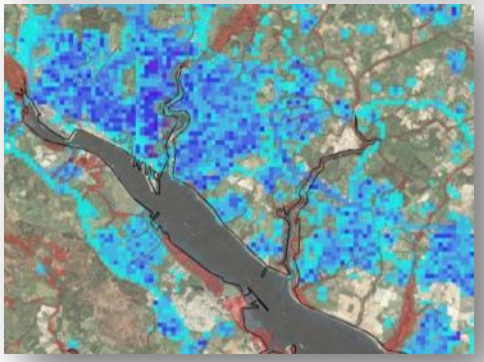

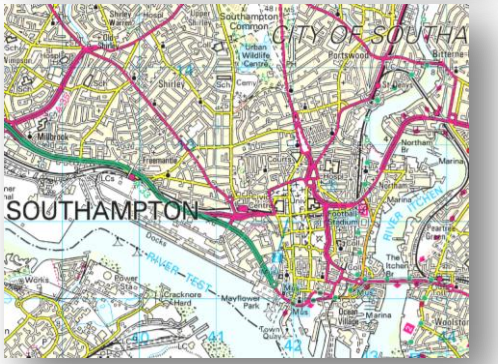

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24/7 Population modelling for natural hazard assessment

Alan Smith

University of Southampton, UK

PopFest, University of Southampton, 9 July 2013

Geography and Environment

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Acknowledgments

Developing the “Pop 24/7” methodologies:

Professor David Martin

Dr Samantha Cockings

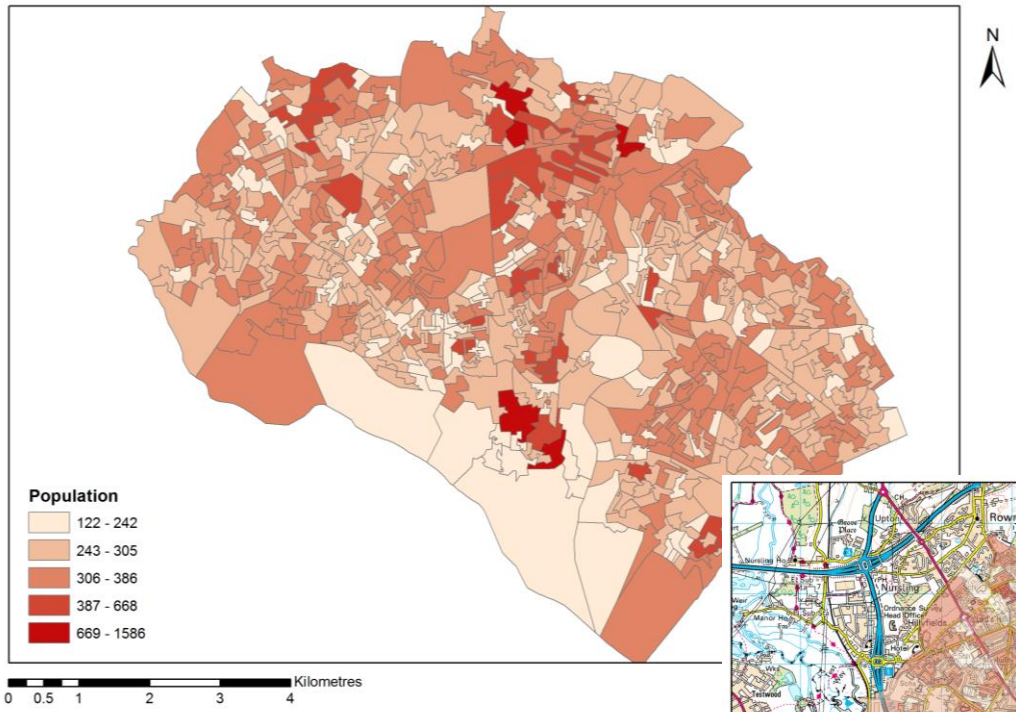
http://www.southampton.ac.uk/geography/research/projects/space_time.page

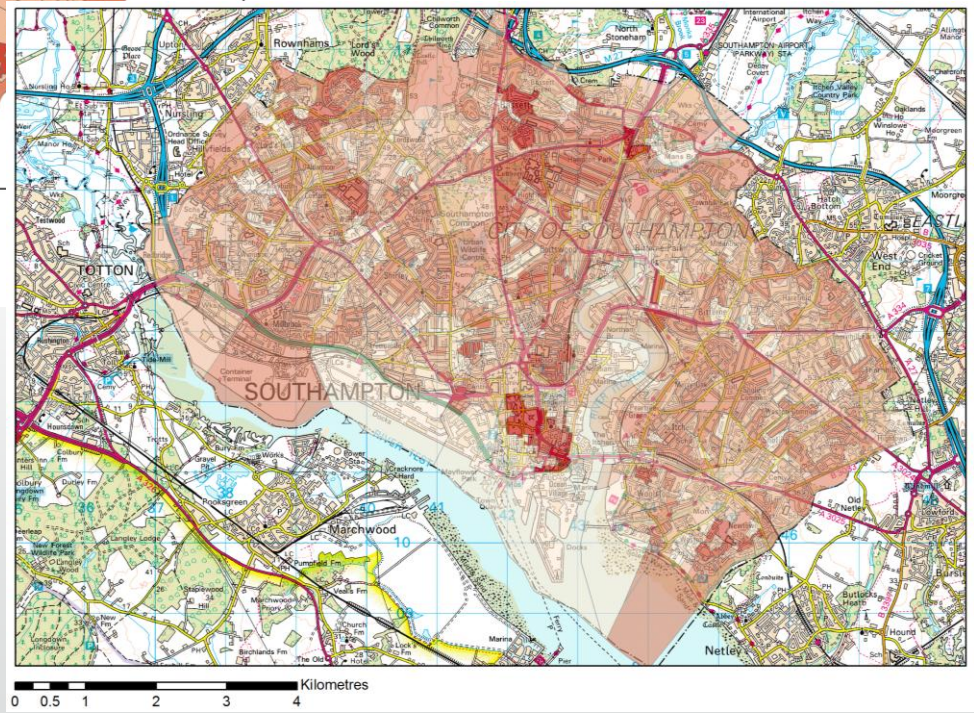
Background

- Better population estimations are required for hazard risk assessment
- Censuses typically provide a decadal ‘night-time’ population estimation
- This does not take into account the large fluxes of temporary populations during the day
- Events of 2011/12 have focused global attention on natural hazards and their impacts

Christchurch, NZ

Conventional density maps





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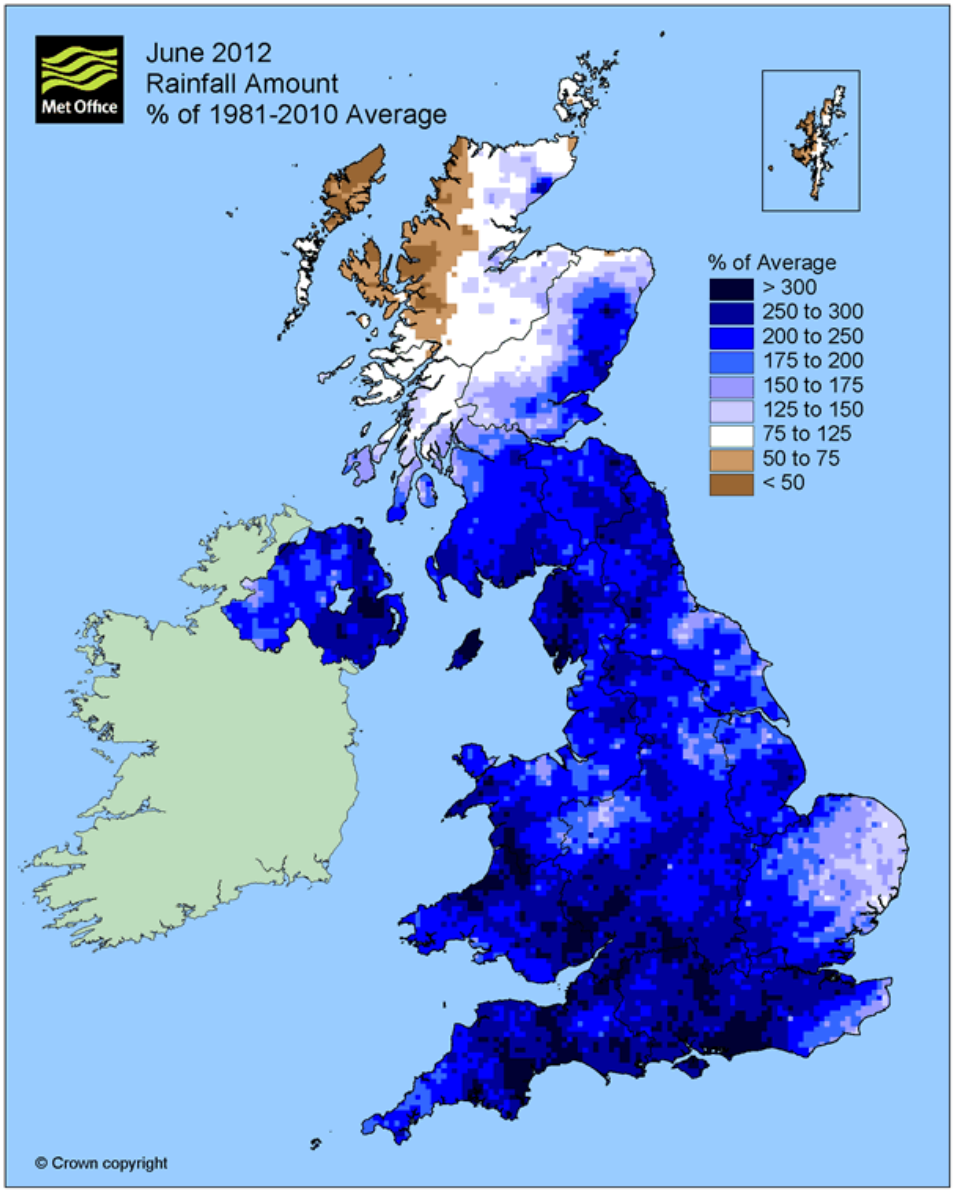
News › UK news › Weather

Flood warnings for UK as storm builds over Atlantic

Met Office issues severe weather warning – high speed winds and heavy rains to batter England, Wales and Northern Ireland

Steven Morris
The Guardian, Thursday 14 June 2012 19.32 BST

Monsoon in summer: more rain is on its way, the Met Office has warned.



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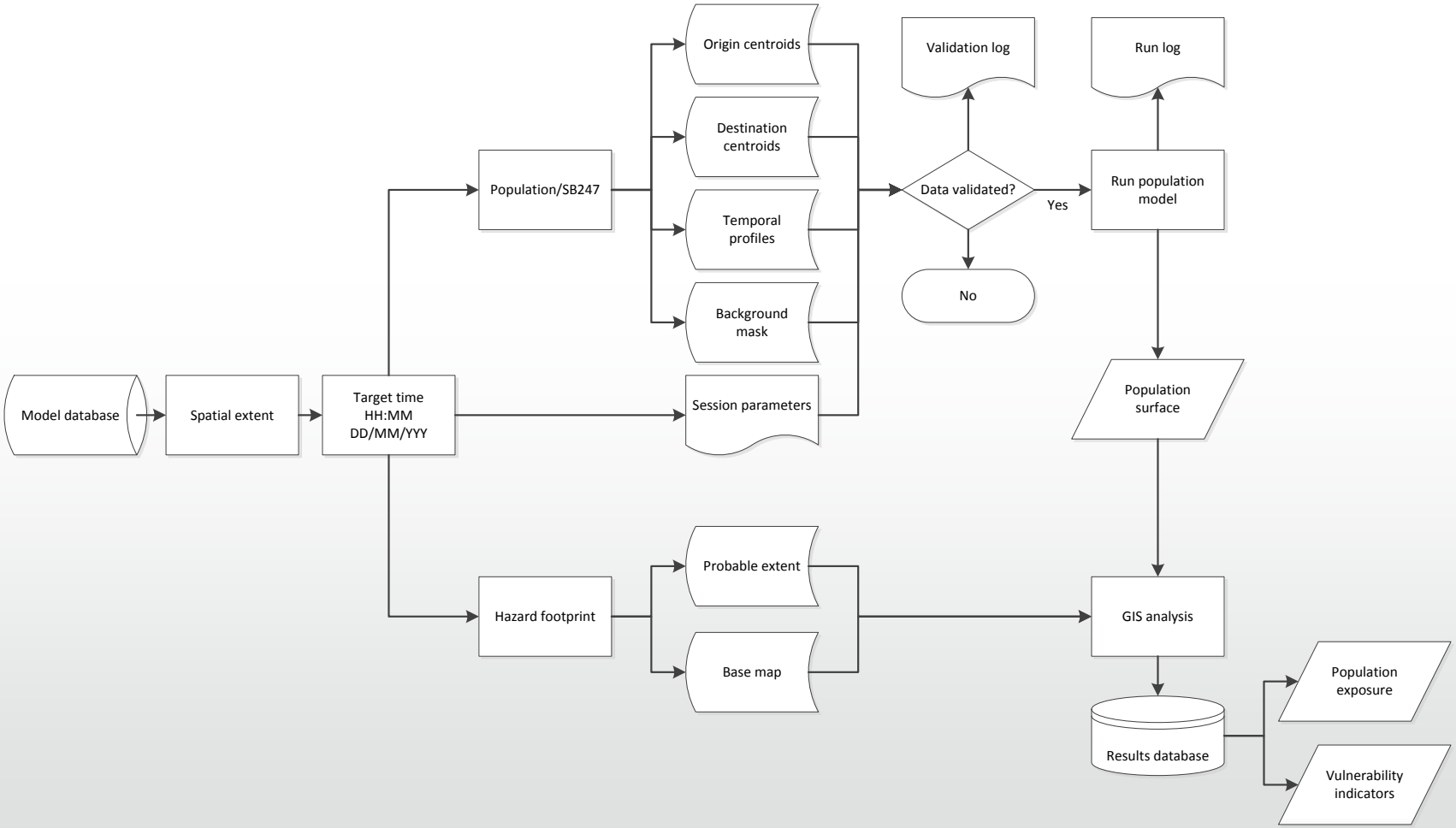
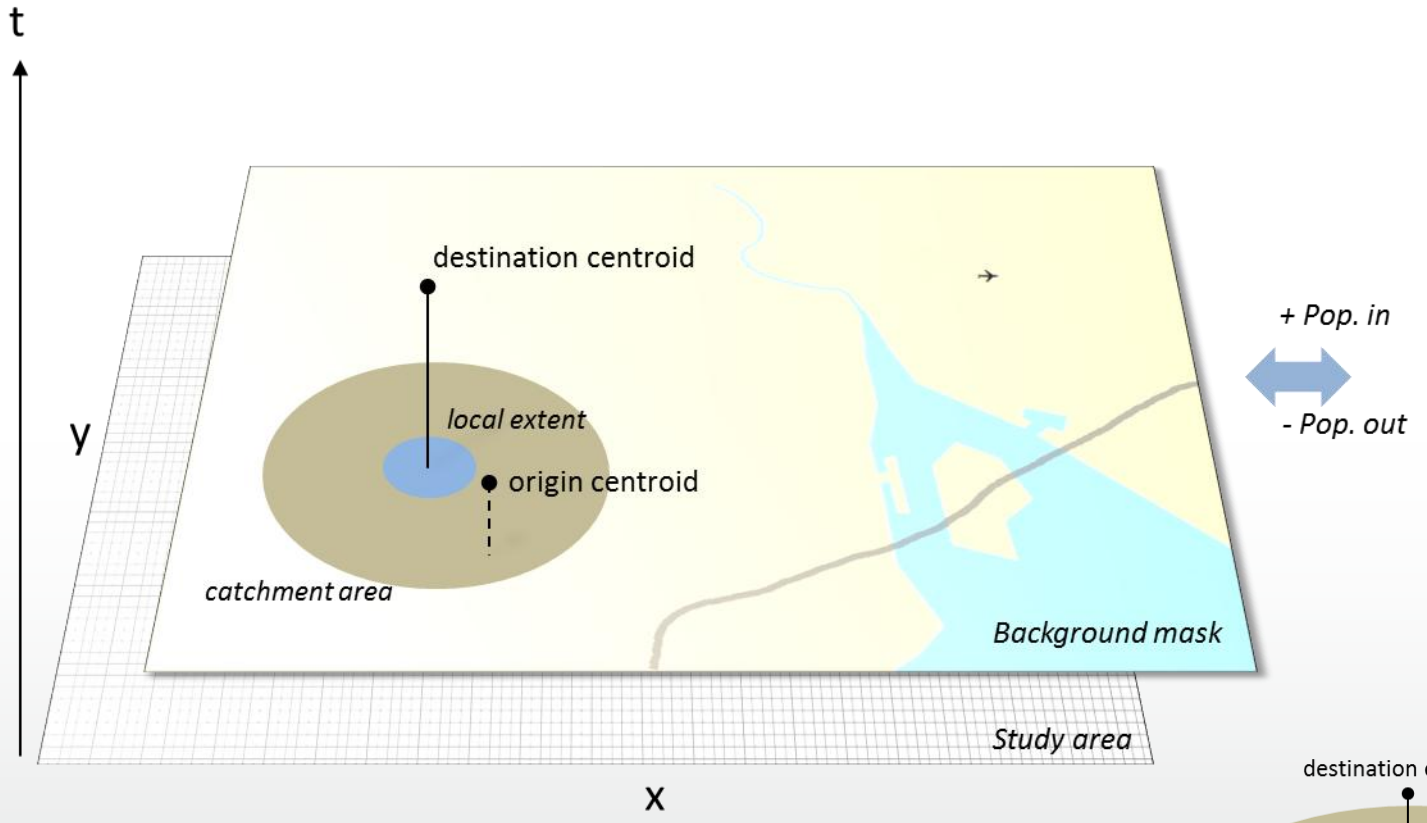
“Pop 24/7” overview

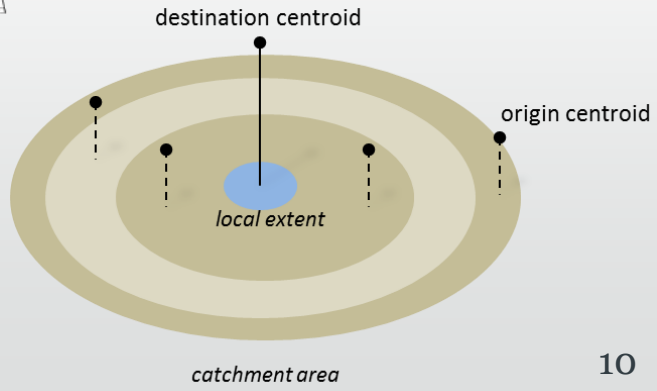
- Spatio-temporal gridded population modelling
  - Variable kernel density estimation (KDE)
  - Utilises population centroids
  - Redistributes resident populations according to a temporal profile
  - Population subgroups
- Removal of arbitrary administrative boundaries
- Allows locations of zero population density (Eg. Water)

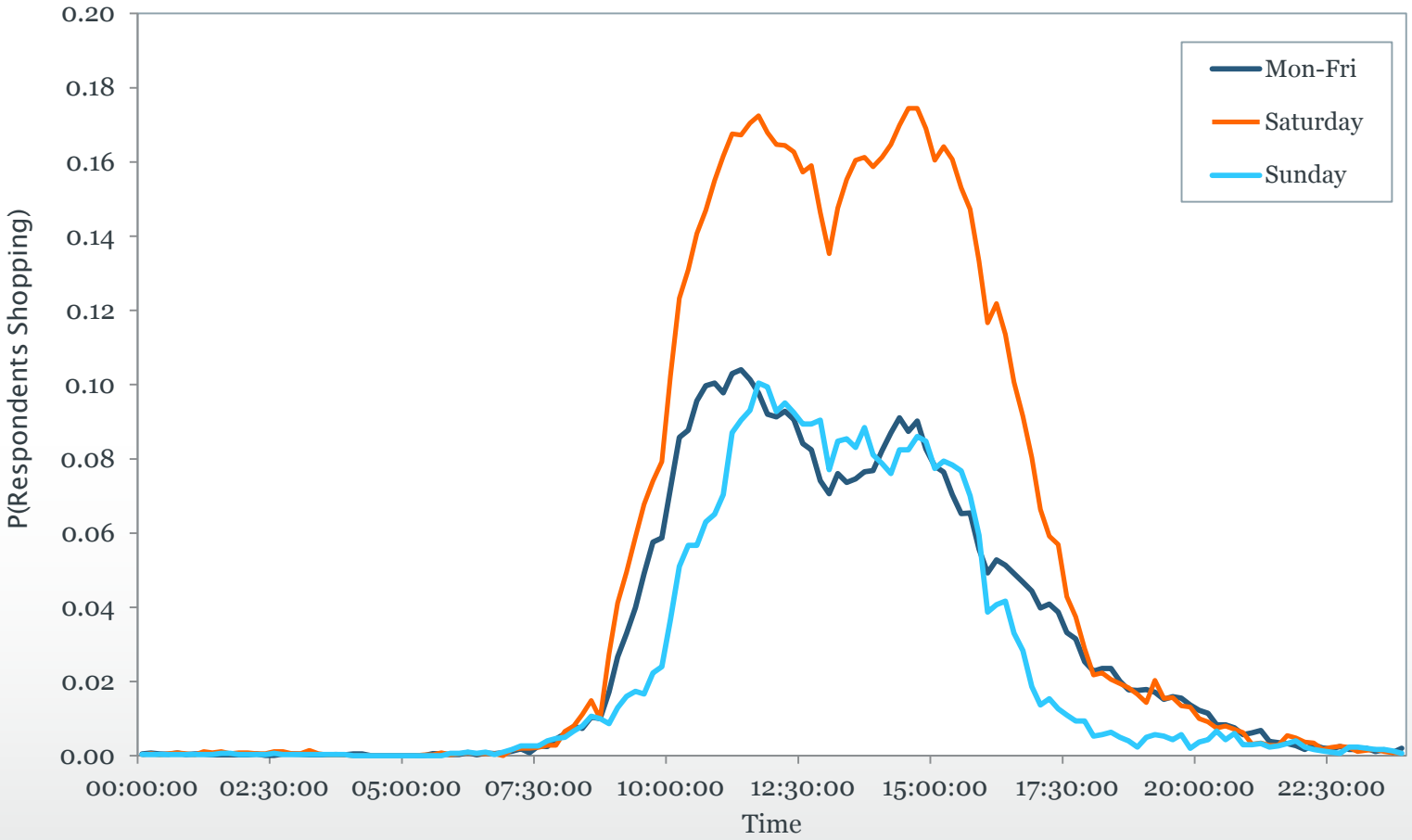
Analytical overview



Space-time interpolation







Temporal Profile

A retail example of a temporal profile derived from the *Time Use Survey 2000* indicating potential shopper numbers for a given time.

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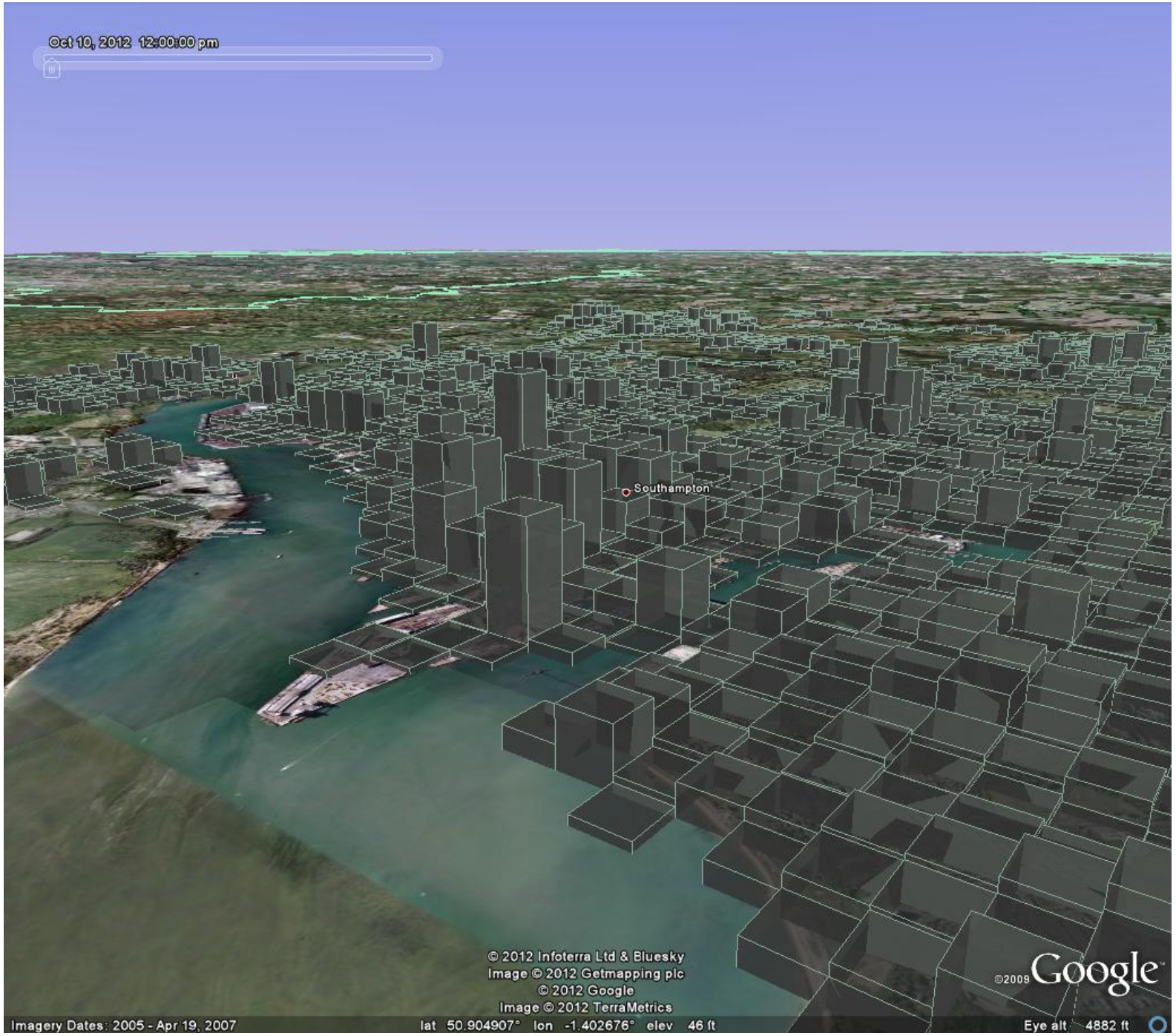
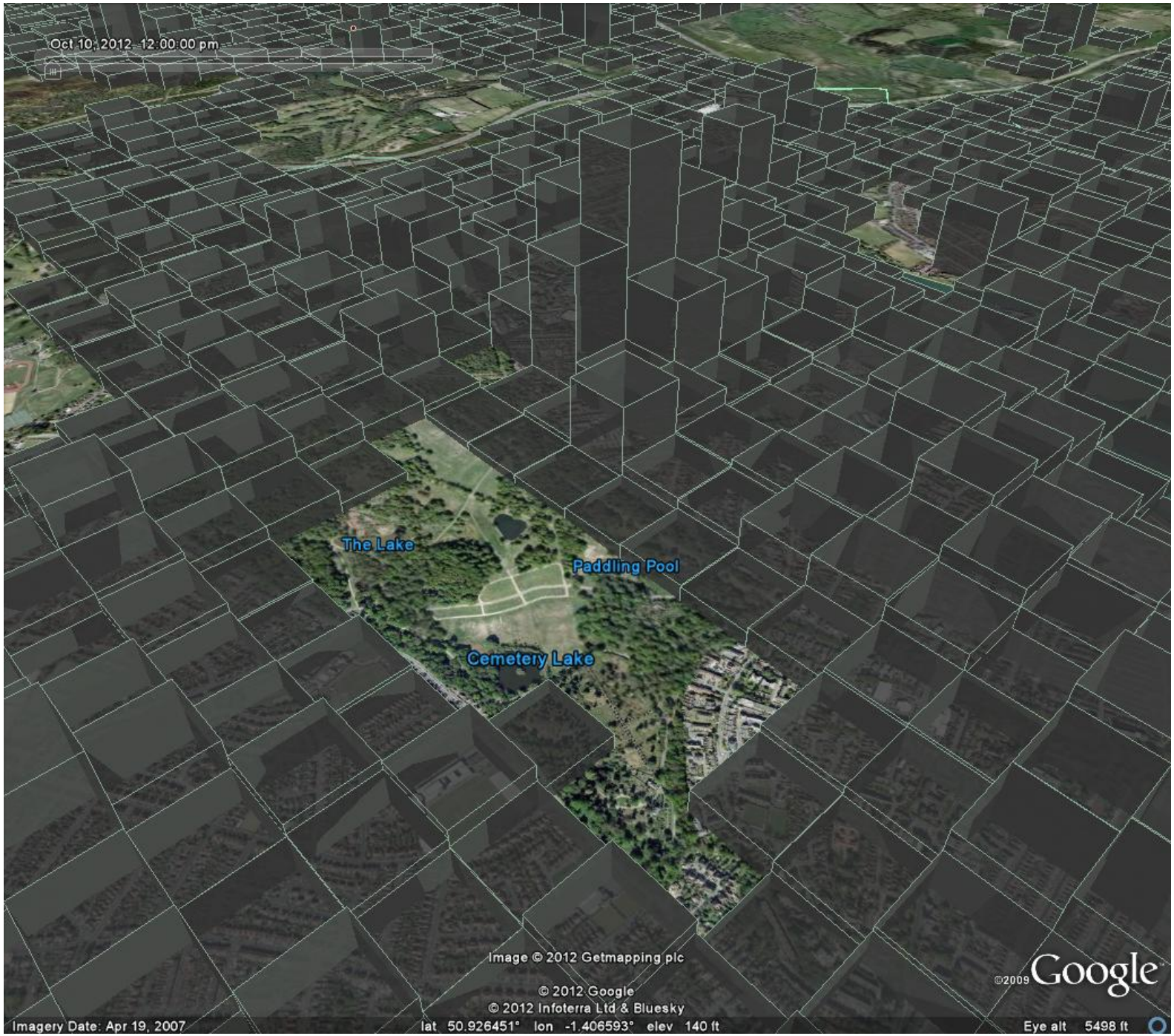
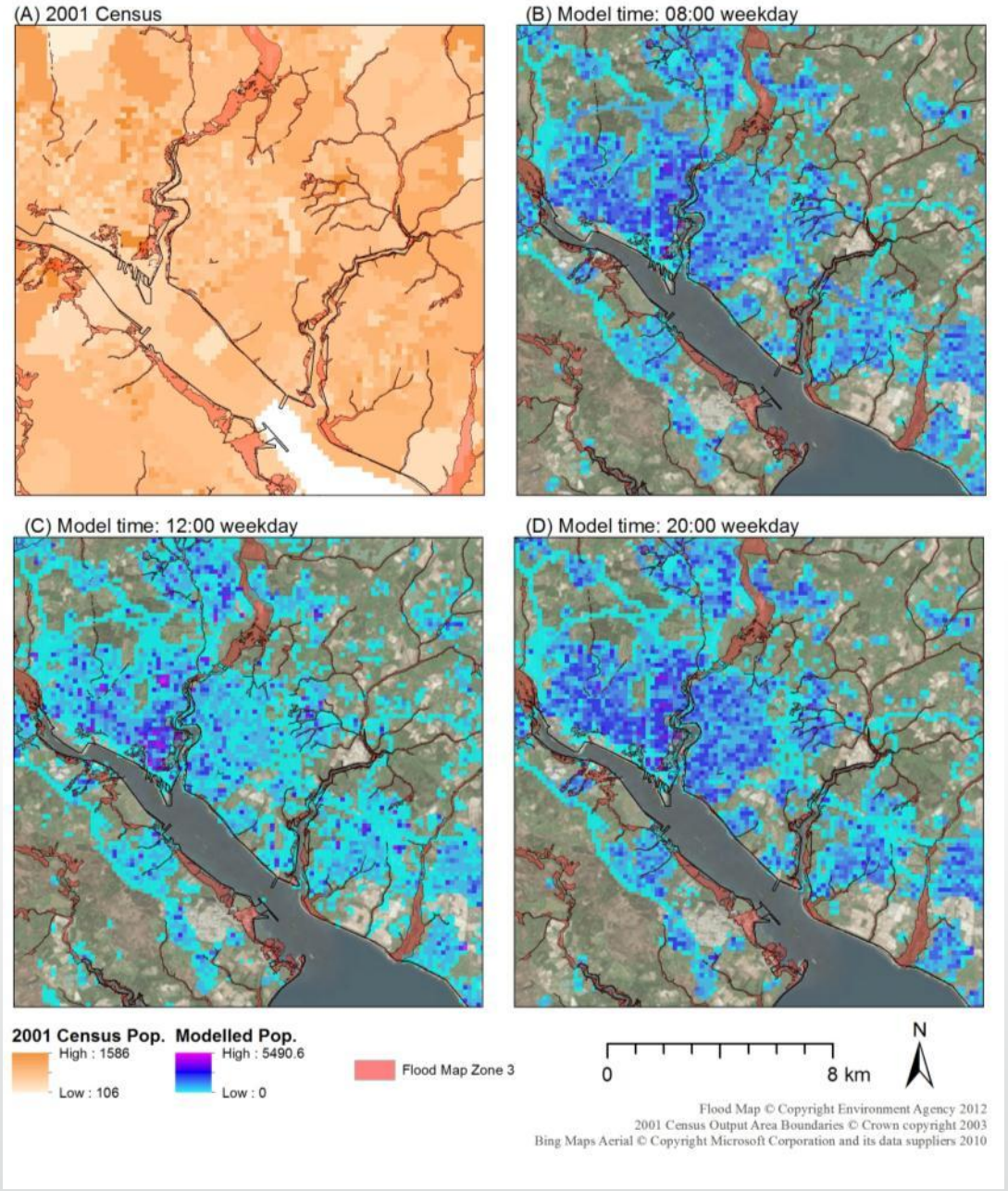
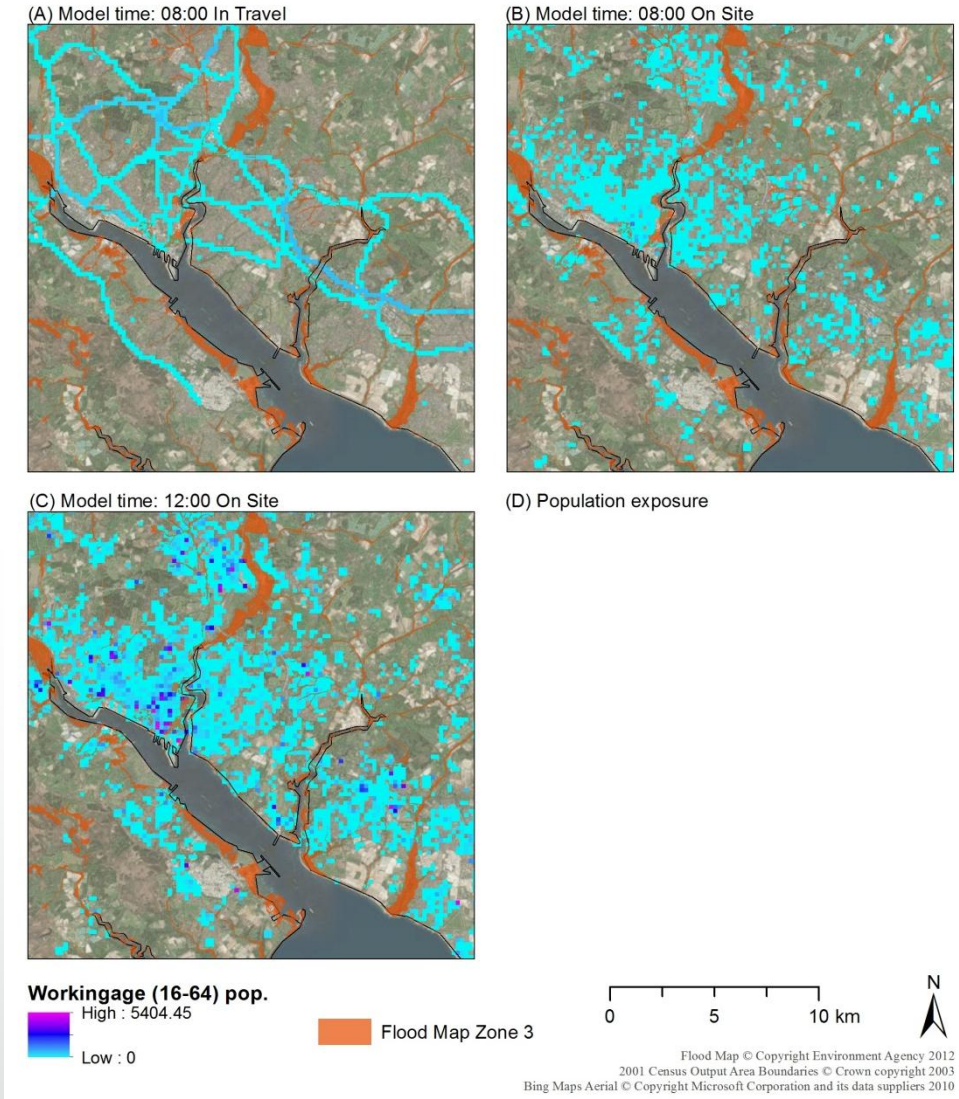
Results

- Variable grid size, currently using 200 metre resolution
- Visualization for public communication
- Population weighted to background mask
- Combination and analysis with hazard footprint data
- Application to a UK flooding scenario, using the Environment Agency's 'Flood Map'.


Oct 10, 2012 12:00:00 pm
Southampton
© 2012 Infoterra Ltd & Bluesky
Image © 2012 Getmapping plc
© 2012 Google
Image © 2012 TerraMetrics
©2009 Google
Imagery Dates: 2005 - Apr 19, 2007
lat 50.904907° lon -1.402676° elev 46 ft
Eye alt 4882 ft


Oct 10, 2012 12:00:00 pm
The Lake
Paddling Pool
Cemetery Lake
Image © 2012 Getmapping plc
© 2012 Google
© 2012 Infoterra Ltd & Bluesky
©2009 Google
Imagery Date: Apr 19, 2007
lat 50.926451° lon -1.406593° elev 140 ft
Eye alt 5498 ft


(A) 2001 Census
(B) Model time: 08:00 weekday
(C) Model time: 12:00 weekday
(D) Model time: 20:00 weekday
2001 Census Pop.
High : 1586
Low : 106
Modelled Pop.
High : 5490.6
Low : 0
Flood Map Zone 3
0
8 km
N
Flood Map © Copyright Environment Agency 2012
2001 Census Output Area Boundaries © Crown copyright 2003
Bing Maps Aerial © Copyright Microsoft Corporation and its data suppliers 2010


(A) Model time: 08:00 In Travel
(B) Model time: 08:00 On Site
(C) Model time: 12:00 On Site
(D) Population exposure
Workingage (16-64) pop.
High : 5404.45
Low : 0
Flood Map Zone 3
0
5
10 km
N
Flood Map © Copyright Environment Agency 2012
2001 Census Output Area Boundaries © Crown copyright 2003
Bing Maps Aerial © Copyright Microsoft Corporation and its data suppliers 2010

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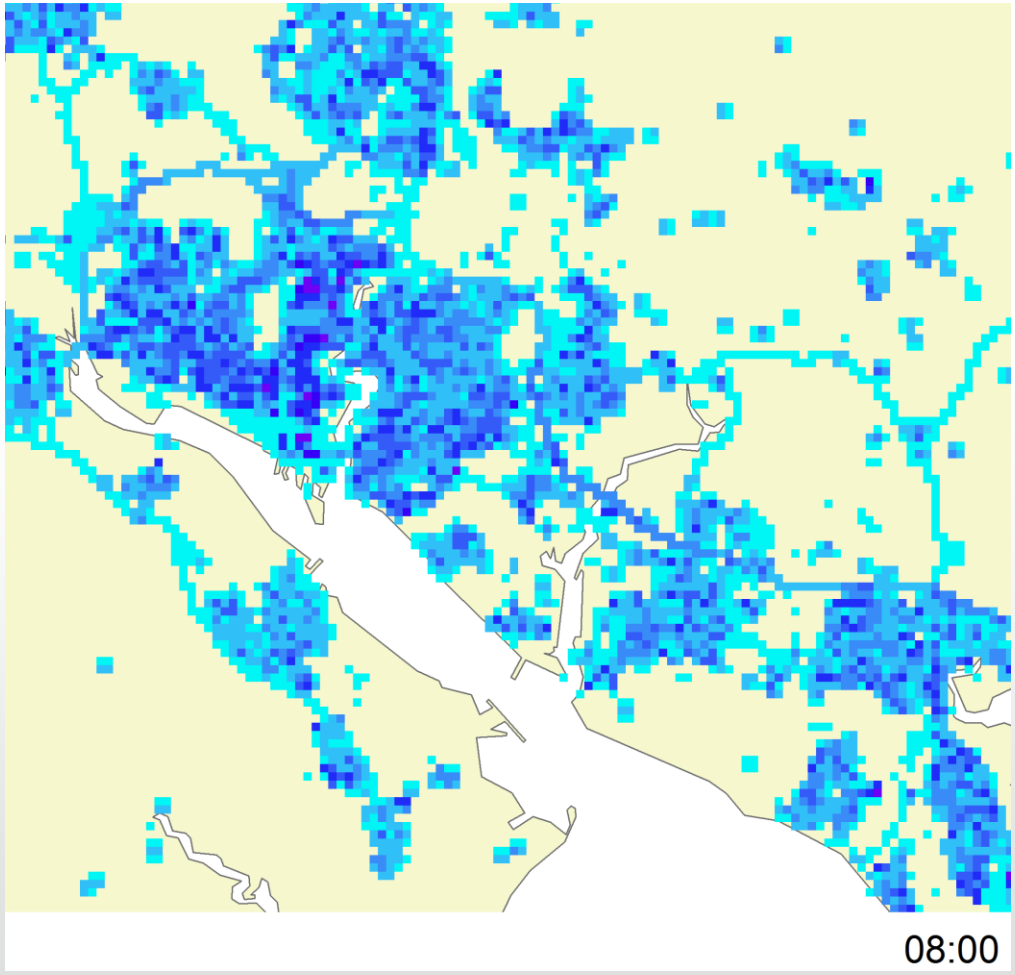
Example weekday population



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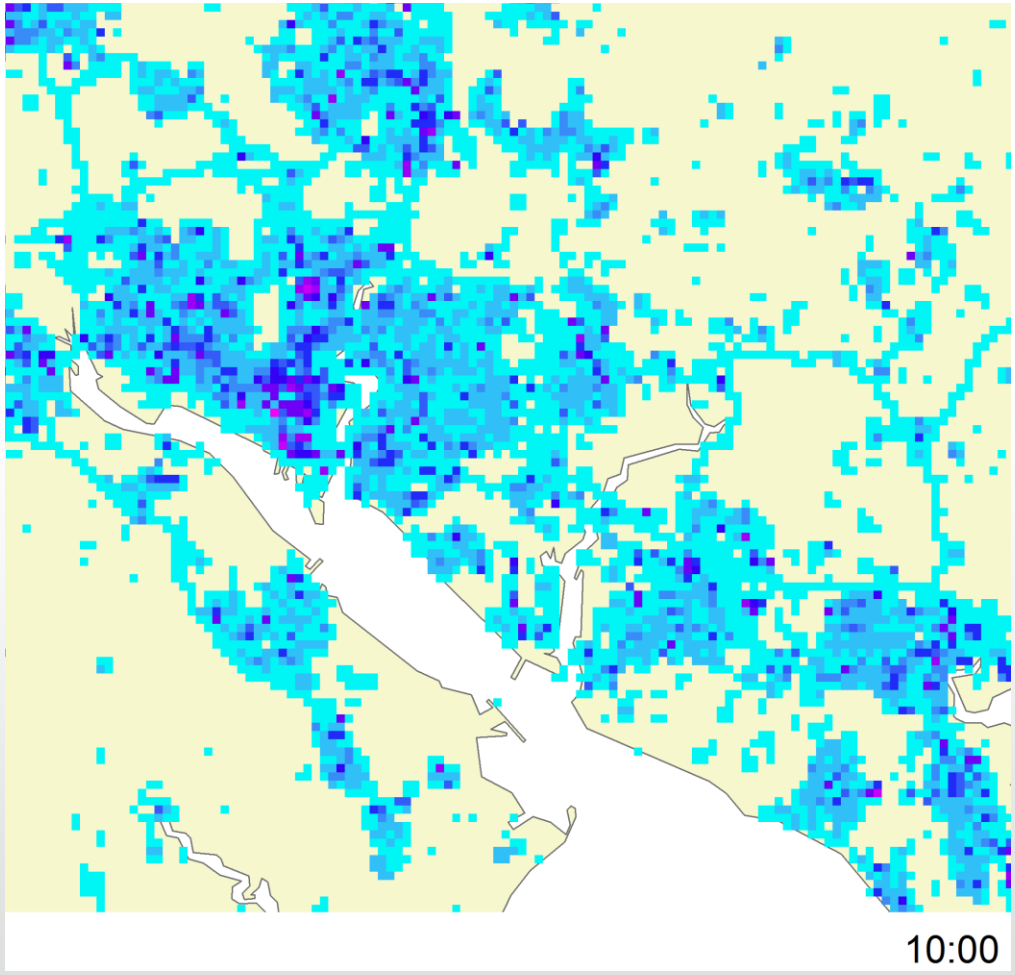
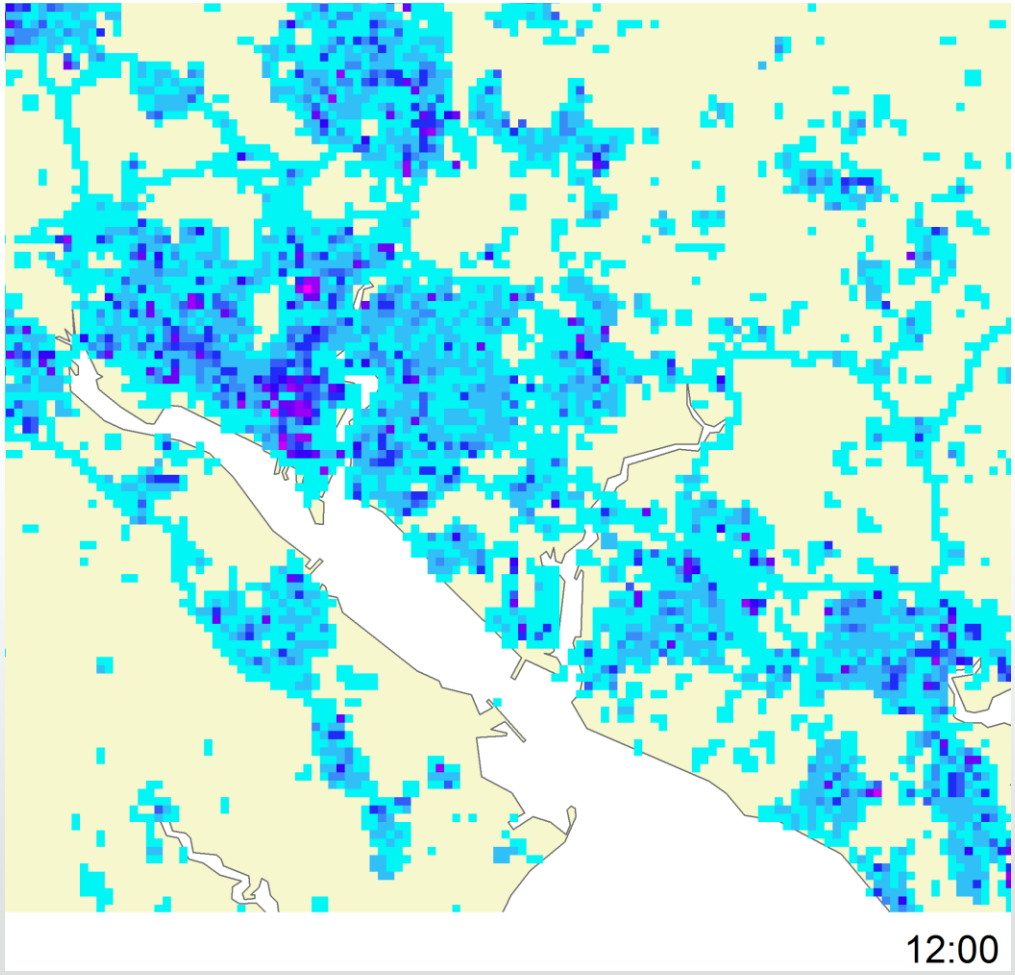
Example weekday population



Example weekday population



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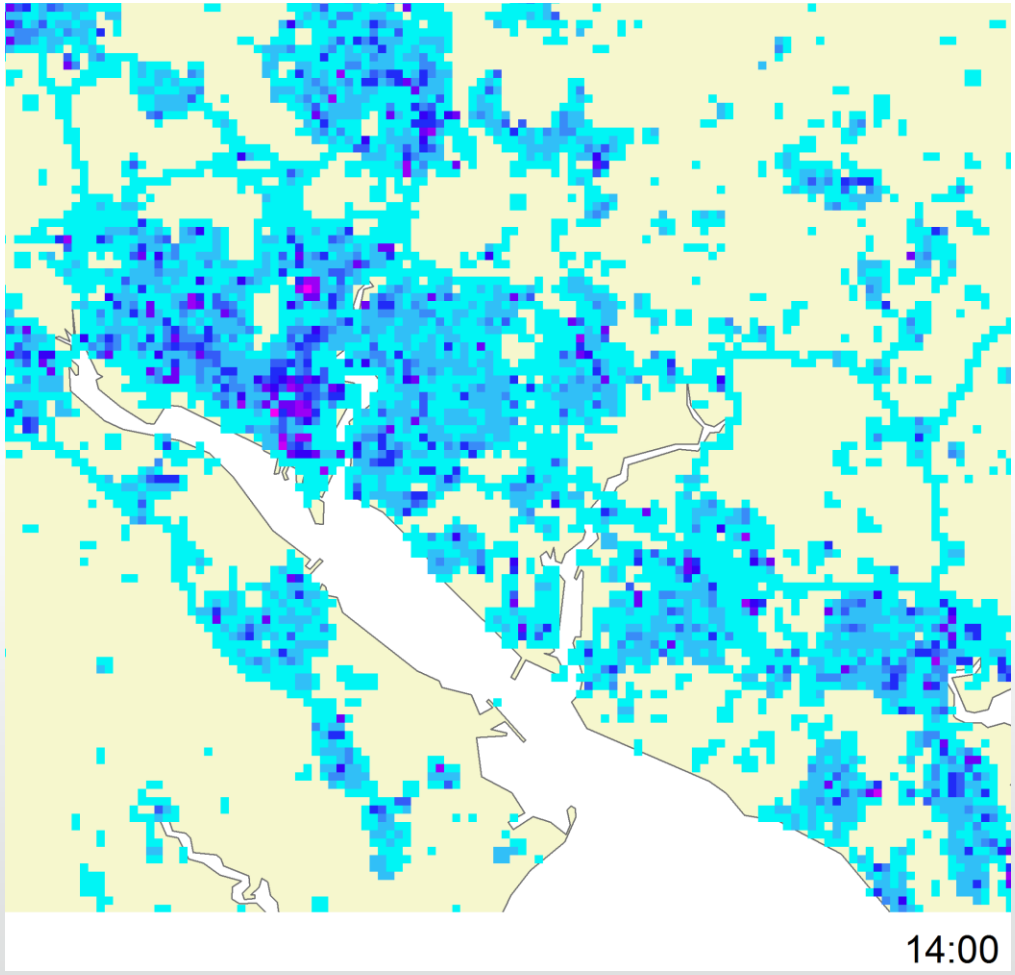
Example weekday population



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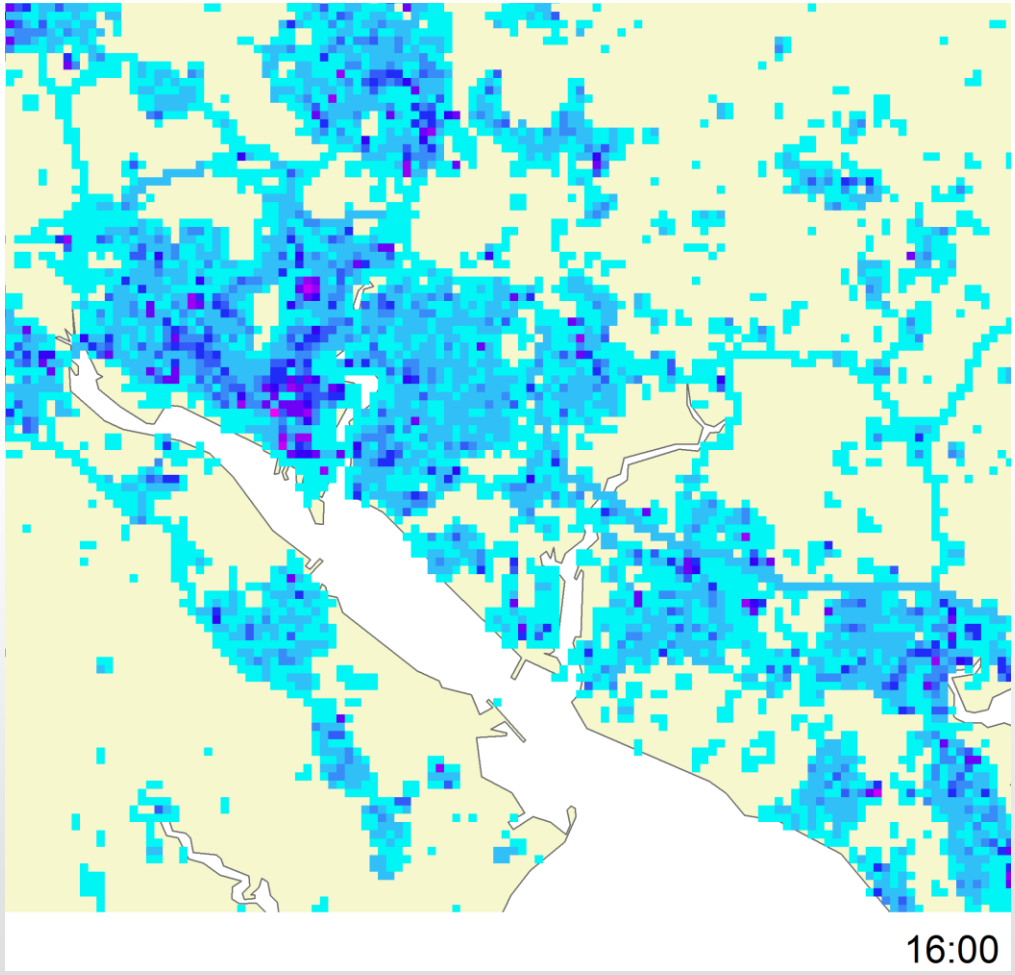
Example weekday population



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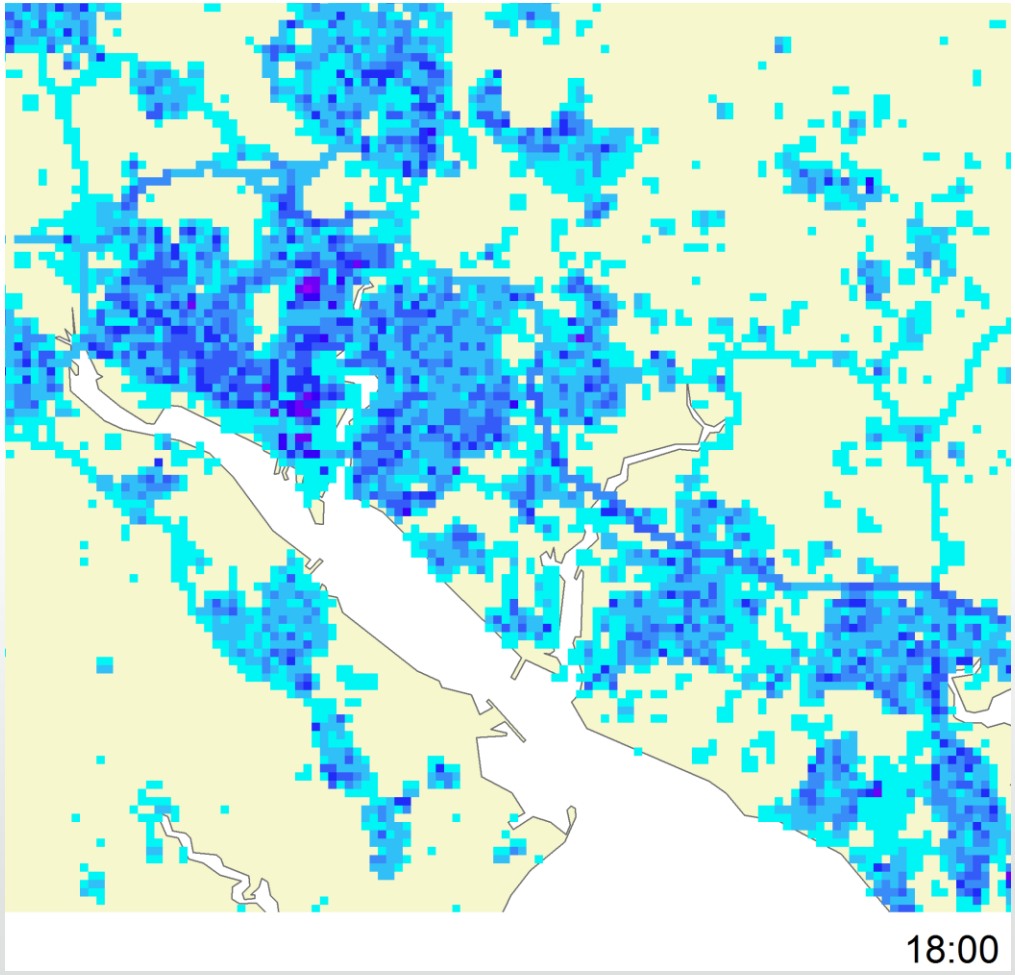
Example weekday population



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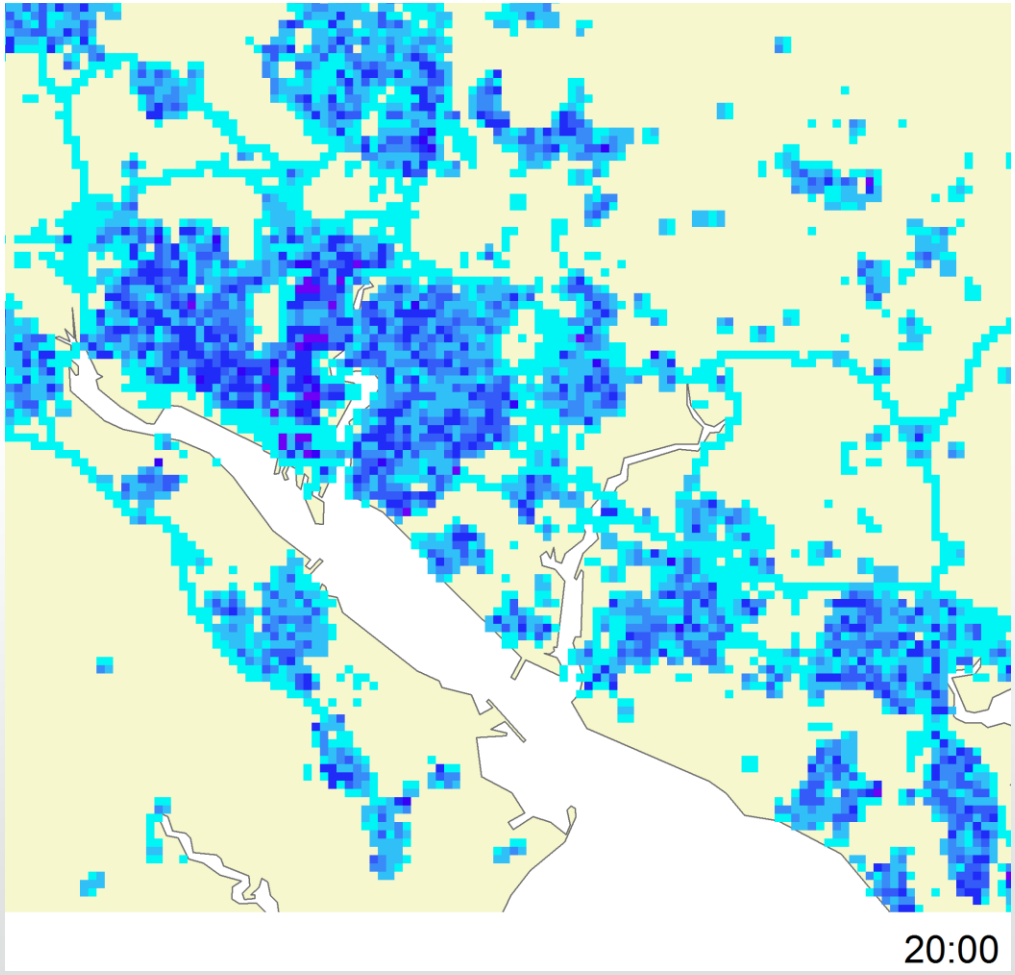
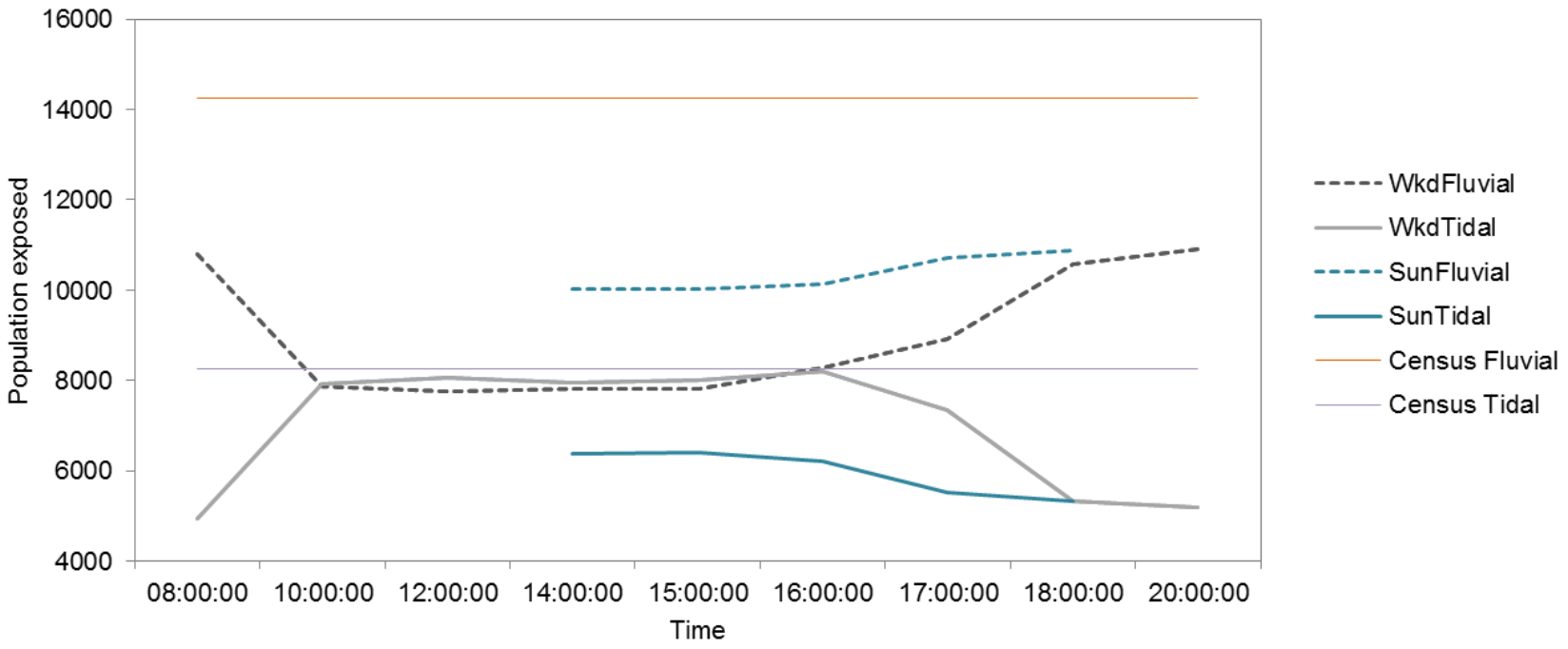
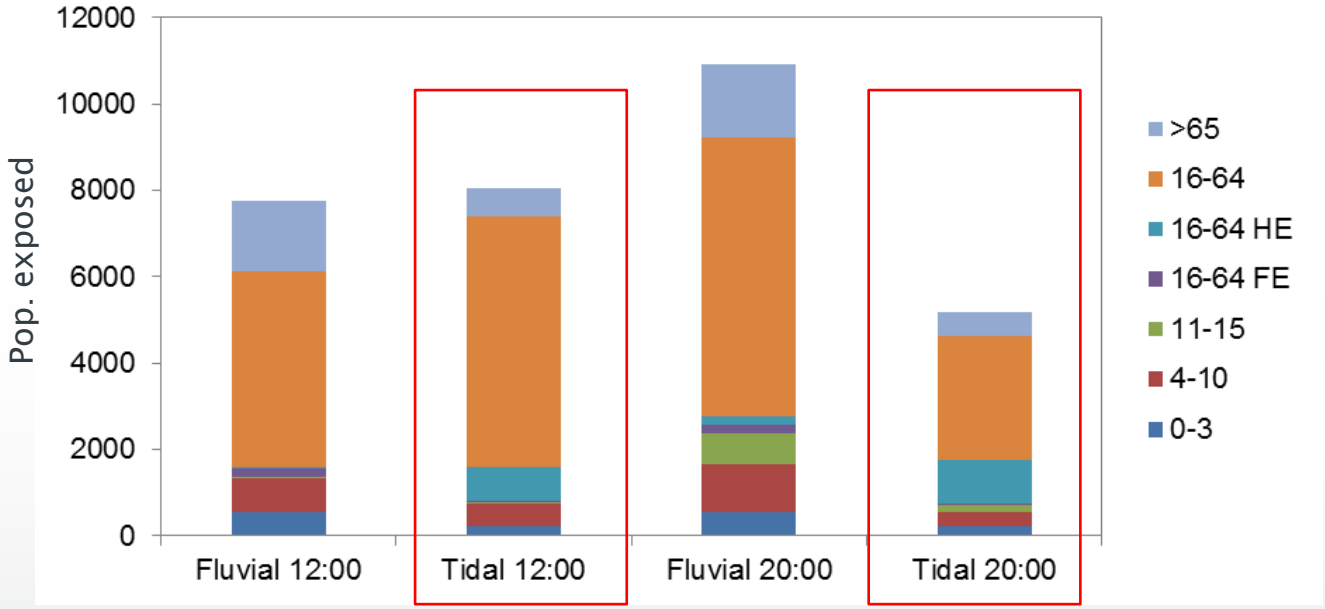
Example weekday population



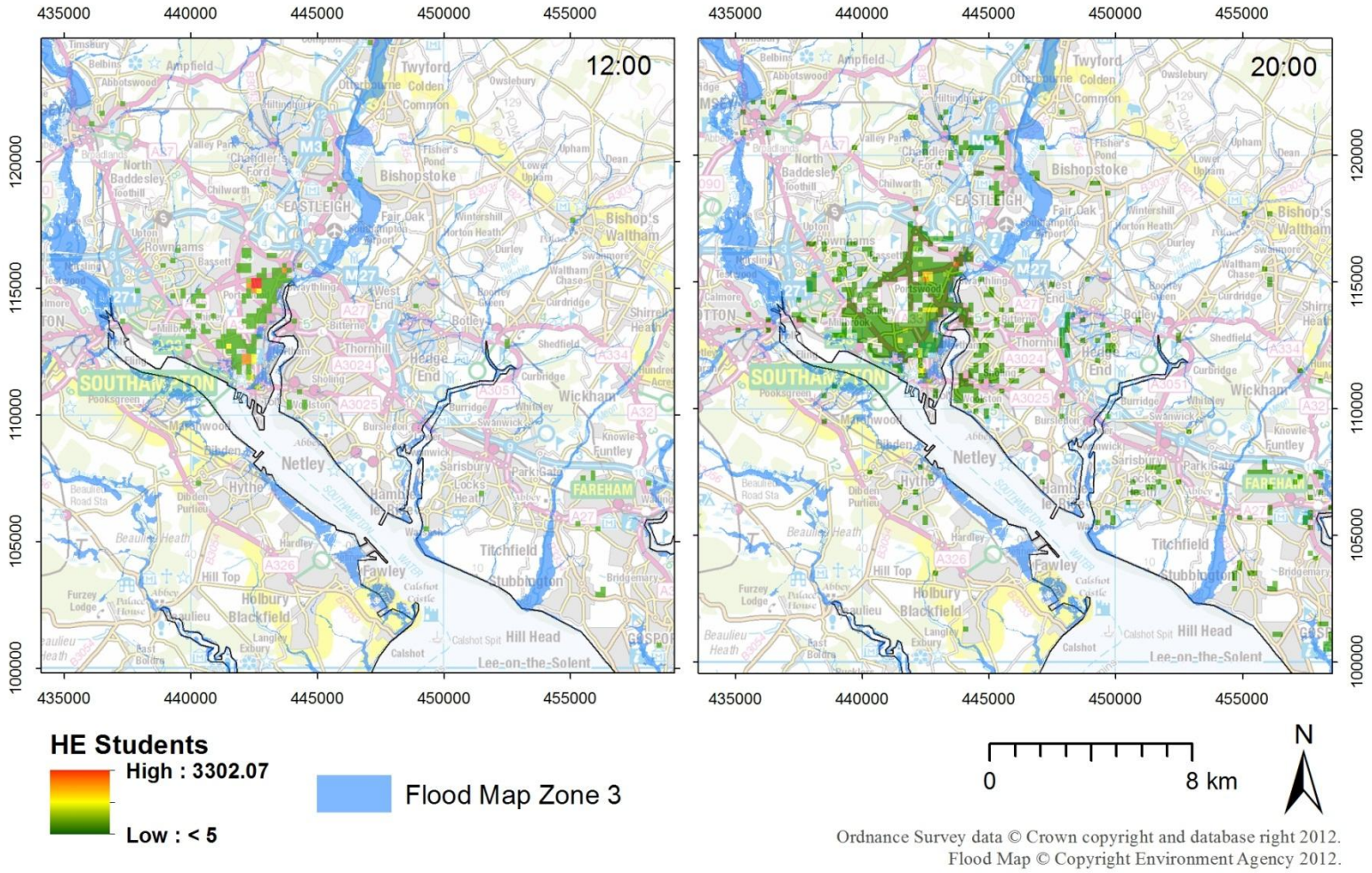
Fluvial and tidal exposure



Exposure by age subgroup



Student saptio-temporal distribution



Next steps

- Further analysis of results
- Continued development of datasets and temporal profiles
- Application to a hazard scenario
  - St Austell
  - Ulley Dam burst (S. Yorkshire)
- Advances in natural hazard risk management
- **Many more potential applications…**

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Any questions?

Alan.Smith@soton.ac.uk

@NatHazard

www.personal.soton.ac.uk/ads4g11