University of Glasgow

Urban Big Data Centre

An ESRC Data Investment

Transport research

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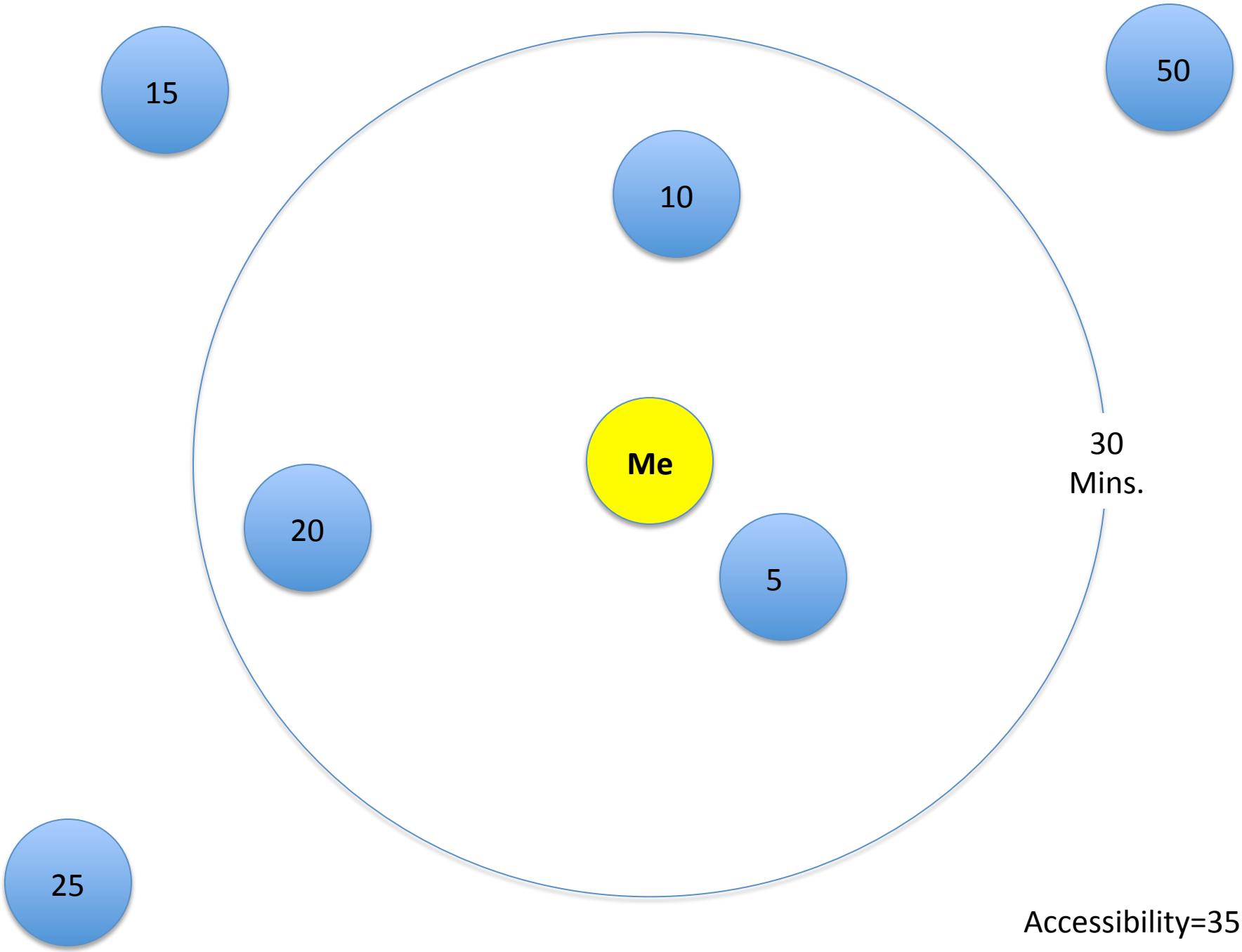
Labour-market accessibility patterns in UK Cities

Introduction

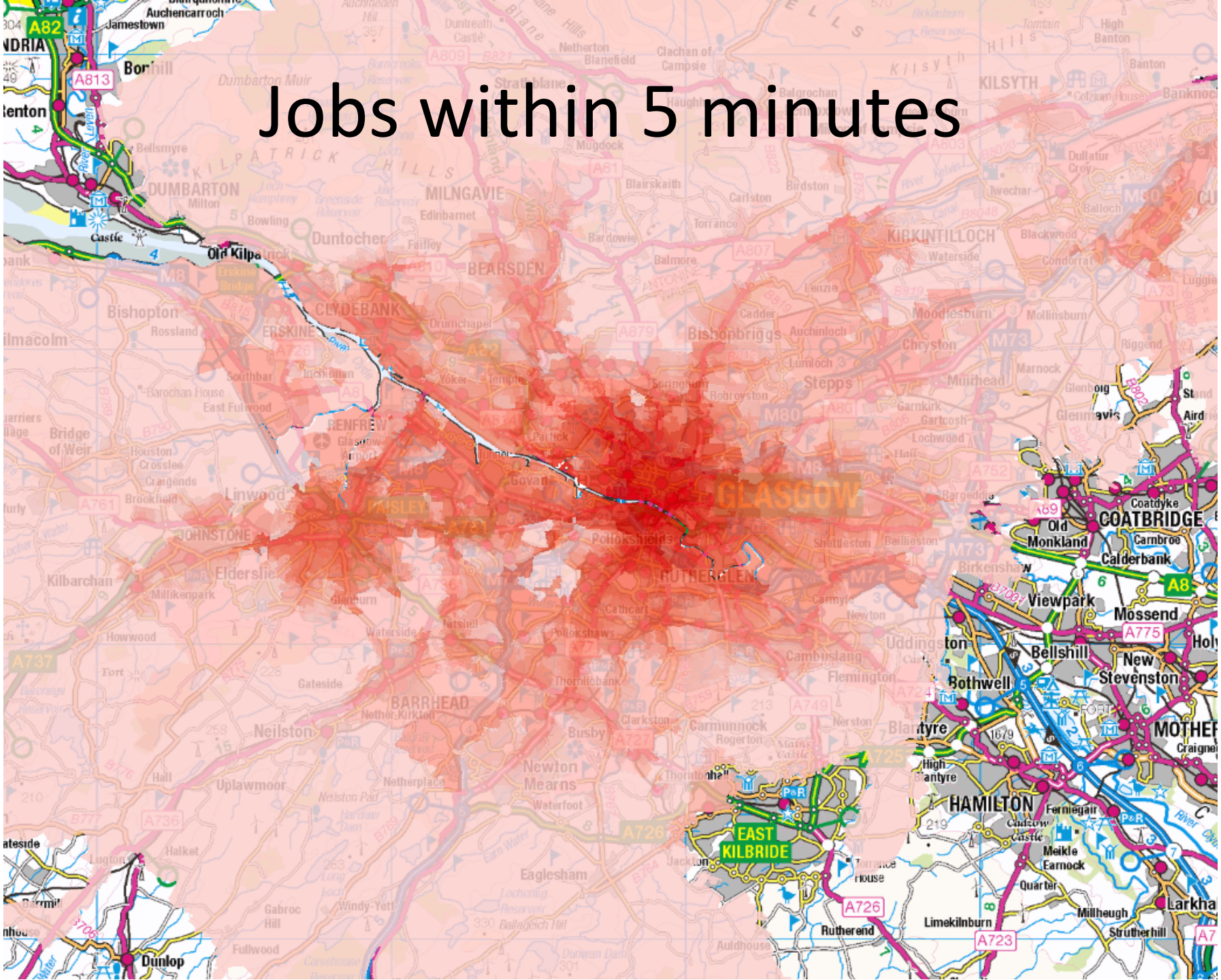
- We wish to study the effect of the recession on accessibility patterns in urban areas in the UK
- The temporal and spatial resolution of available data can make this difficult
- New data sources may provide possibilities for supplementing existing data sources

Accessibility

- An accessibility measure attempts to account for the fact that some locations are more central than others
- We can use a simple measure such as the number of jobs which can be reached within 30 minutes

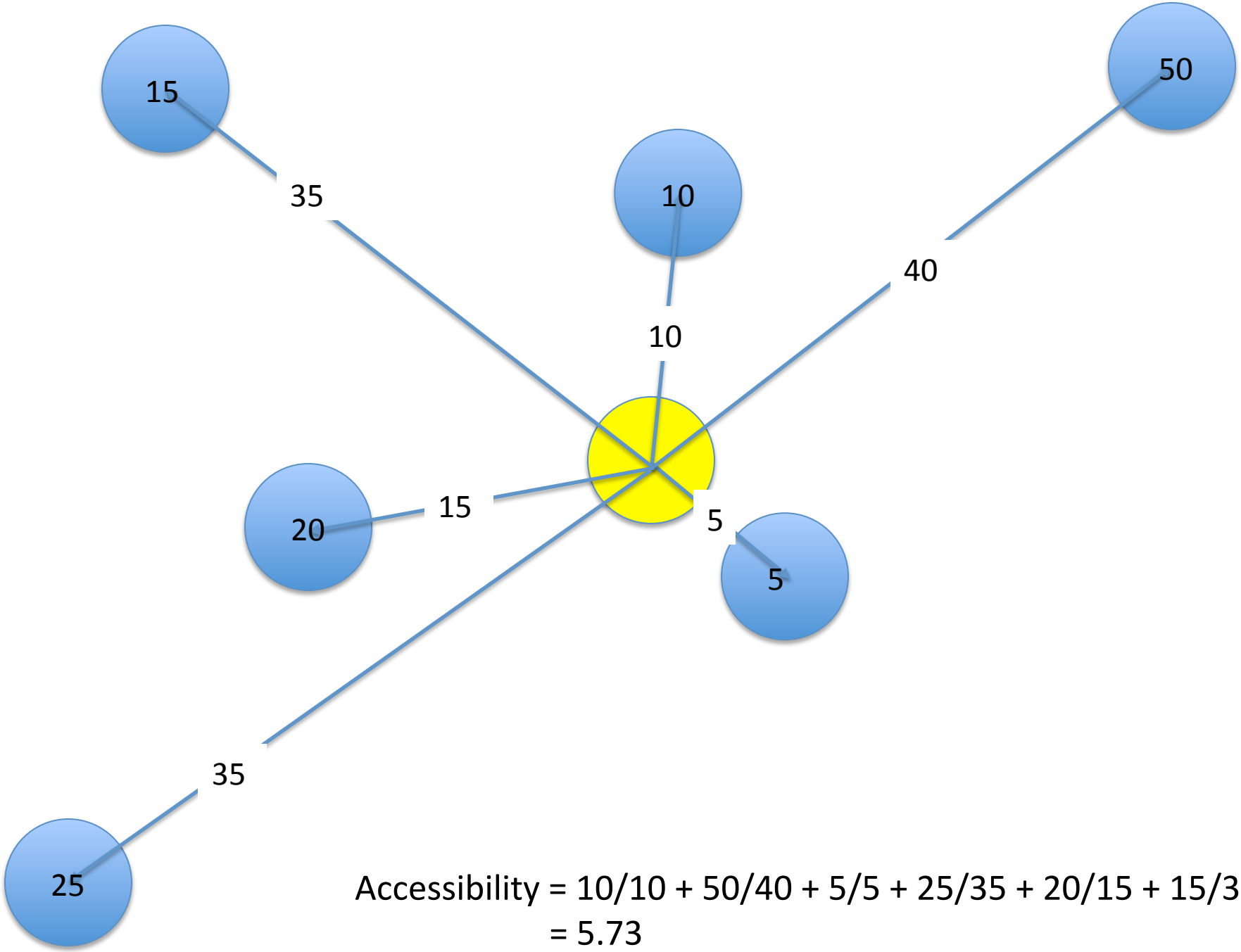

15
50
10
Me
30
Mins.
20
5
25
Accessibility=35

Jobs within 5 minutes



Accessibility

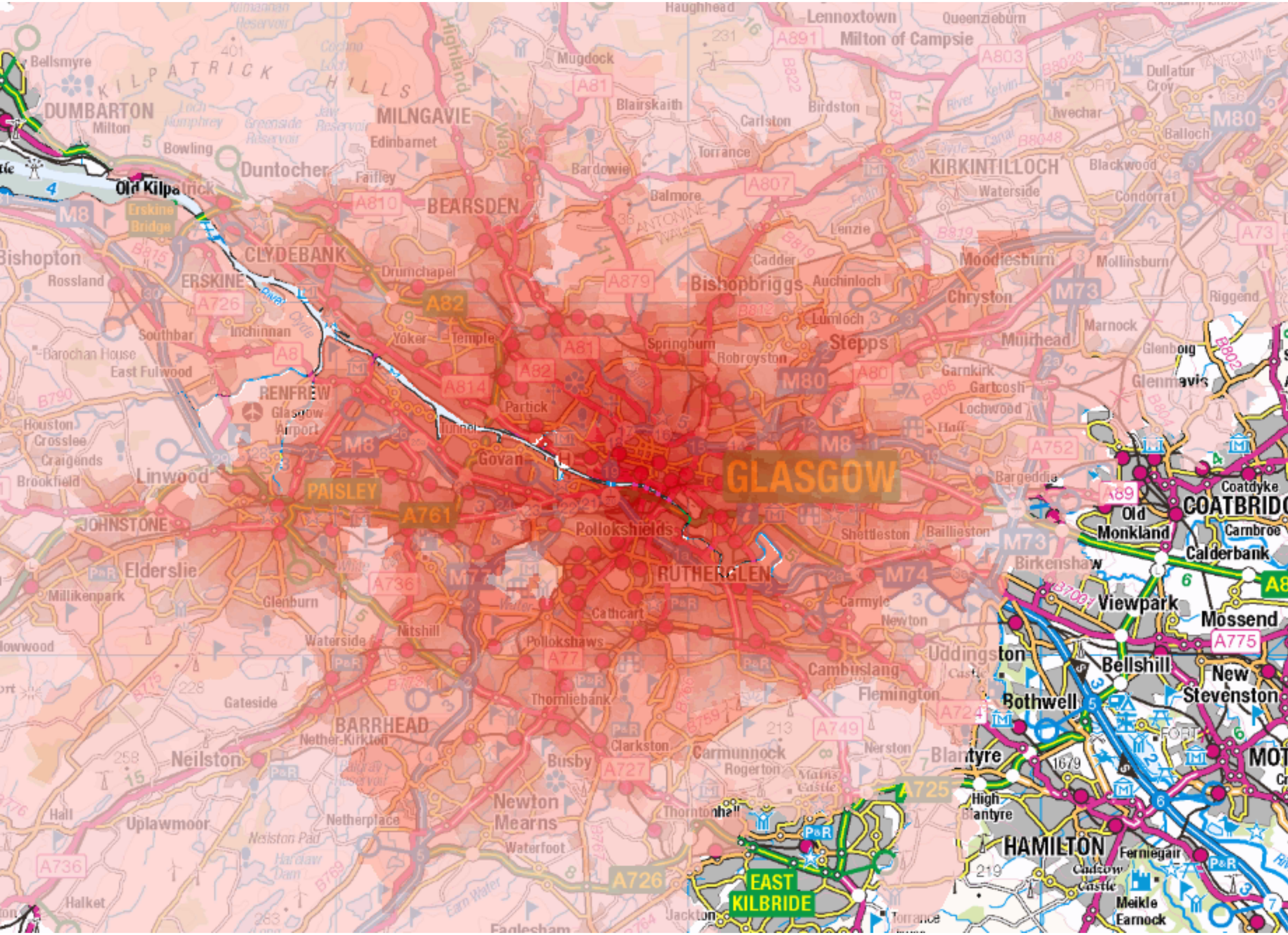
- We can use a weighted average
- We can weight by time or distance or some measure of generalised cost
- We can adjust the weighting to account for different travelling preferences
- A very simple form of this measure would be to take: accessibility = jobs / time



Accessibility = 10/10 + 50/40 + 5/5 + 25/35 + 20/15 + 15/35
= 5.73

Calibration

- In this example, we have made an assumption about people's reaction to travel time
- We can do better than simply assuming a value
- The so-called distance deterrence effect can be measured
- We do this by looking at patterns of travel to work



GLASGOW
DUMBARTON
Milton
Bellsmyre
KILPATRICK HILLS
Bowling
Duntocher
Old Kilpatrick
Erskine Bridge
MILNGAVIE
Edinbarnet
Faifley
BEARSDEN
Mugdock
Blairskaith
Bardowie
Balmore
Torrance
Carlston
Haughhead
Lennoxtown
Milton of Campsie
Queenzieburn
Birdston
KIRKINTILLOCH
Waterside
Lenzie
Dullatur
Croy
Twechar
Balloch
Blackwood
Condorrat
Moodiesburn
Mollinsburn
Chryston
Riggend
Marnock
Muirhead
Glenboig
Glenmavis
Bishopbriggs
Auchinloch
Cadder
Lumloch
Stepps
Springburn
Robroyston
Garnkirk
Gartcosh
Lochwood
CLYDEBANK
Drumchapel
Yoker
Temple
Partick
Govan
Bishopton
Rossland
ERSKINE
Inchinnan
Southbar
Barochan House
East Fulwood
RENFREW
Glasgow Airport
Houston
Crosslee
Craigends
Brookfield
Linwood
PAISLEY
JOHNSTONE
Elderslie
Millikenpark
Glenburn
Waterside
Nitshill
Pollokshields
Pollokshaws
Cathcart
RUTHERGLEN
Shettleston
Baillieston
Bargeddie
Birkenshaw
Carmyle
Newton
Uddingston
Cambuslang
Flemington
Thornliebank
Clarkston
Busby
Carmunnock
Rogerton
BARRHEAD
Nether Kirkton
Neilston
Gateside
Uplawmoor
Hall
Halket
Netherplace
Newton Mearns
Waterfoot
Eaglesham
Jackton
Thorntonhall
EAST KILBRIDE
Nerston
Blantyre
High Blantyre
HAMILTON
Ferniegair
Cadzow Castle
Meikle Earnock
Bothwell
Bellshill
New Stevenston
MOTH
Mossend
Viewpark
Calderbank
Cambroe
Coatdyke
COATBRIDGE
Old Monkland
M8
M80
M73
M74
M77
A82
A81
A8
A80
A89
A726
A761
A736
A77
A727
A725
A724
A749
A752
A775
A803
A807
A810
A814
A879
A891
A73

Data sources

- The census provides residential and workplace locations at a fine spatial resolution
- It also provides information on flows between these units
- These data can be used to estimate a variety of accessibility measures

Accessibility from spatial interaction models

- One way to measure people's reaction to distance is to use a gravity model

$$T_{ij} = O_i D_j f(c_{ij})$$

An extension

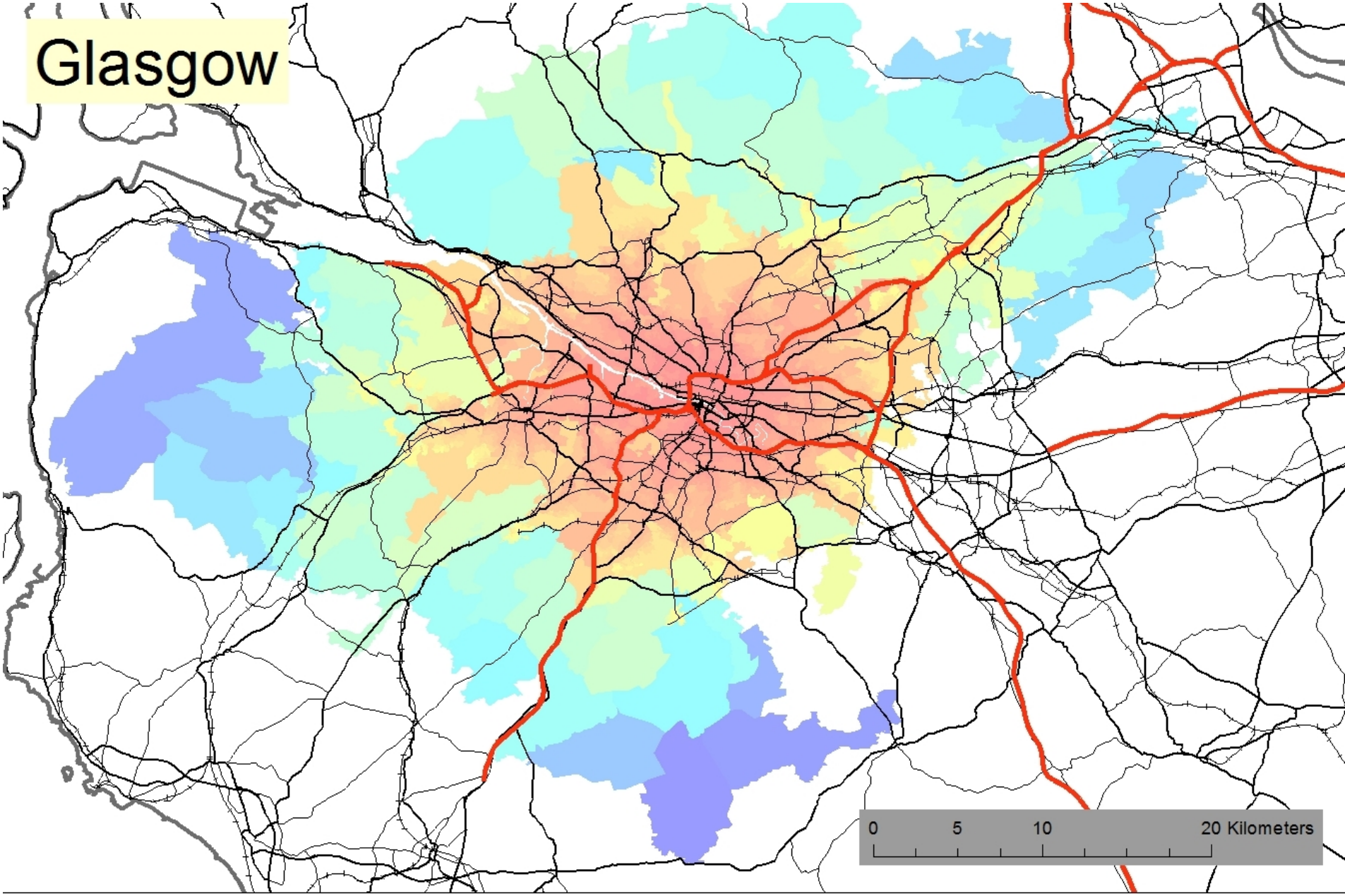
$$T\downarrow ij = A\downarrow i \, O\downarrow i \, B\downarrow j \, D\downarrow j \exp(-c\downarrow ij)$$

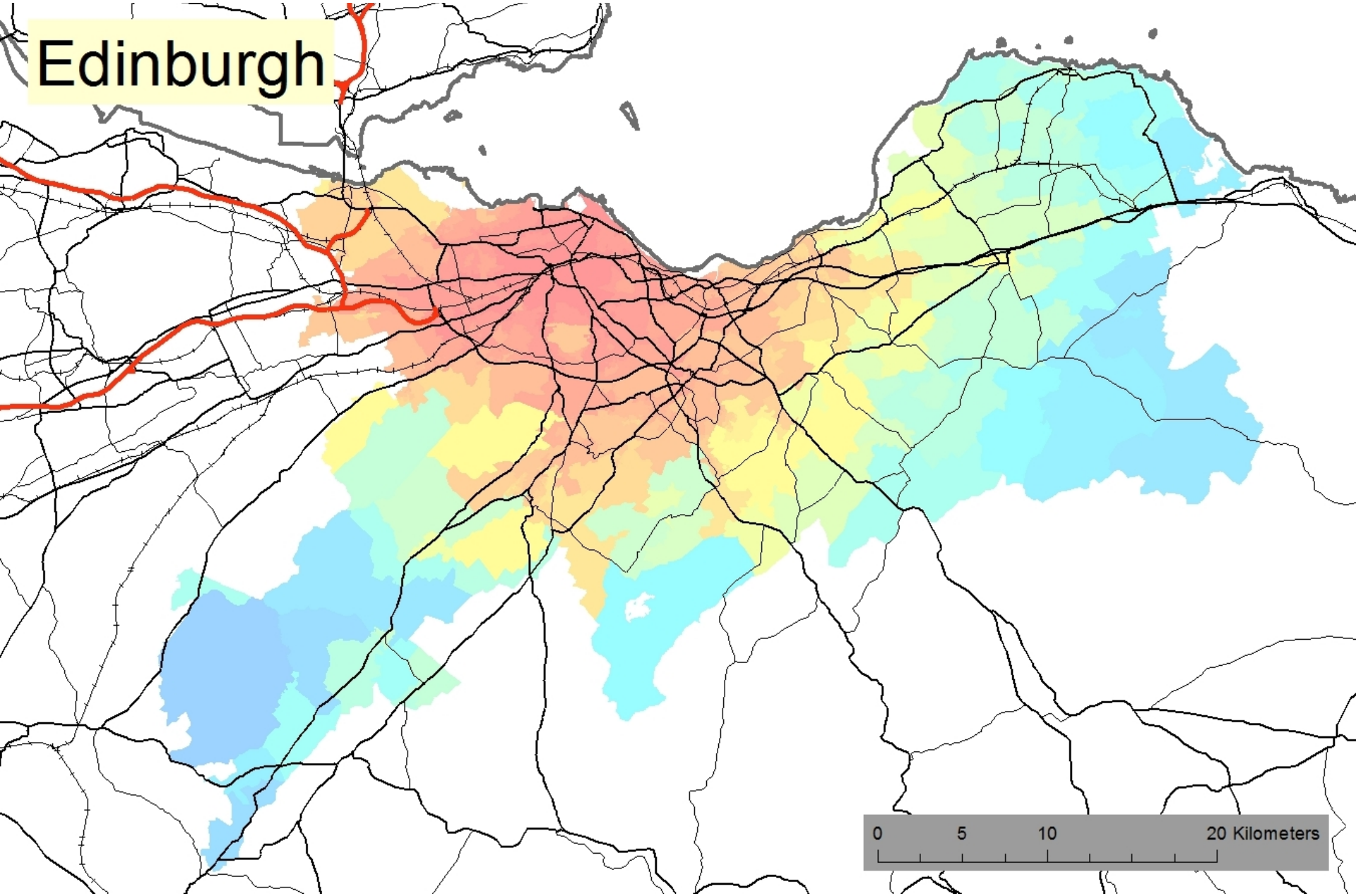
$$A\downarrow i = 1/B\downarrow j \, D\downarrow j \exp(-c\downarrow ij)$$

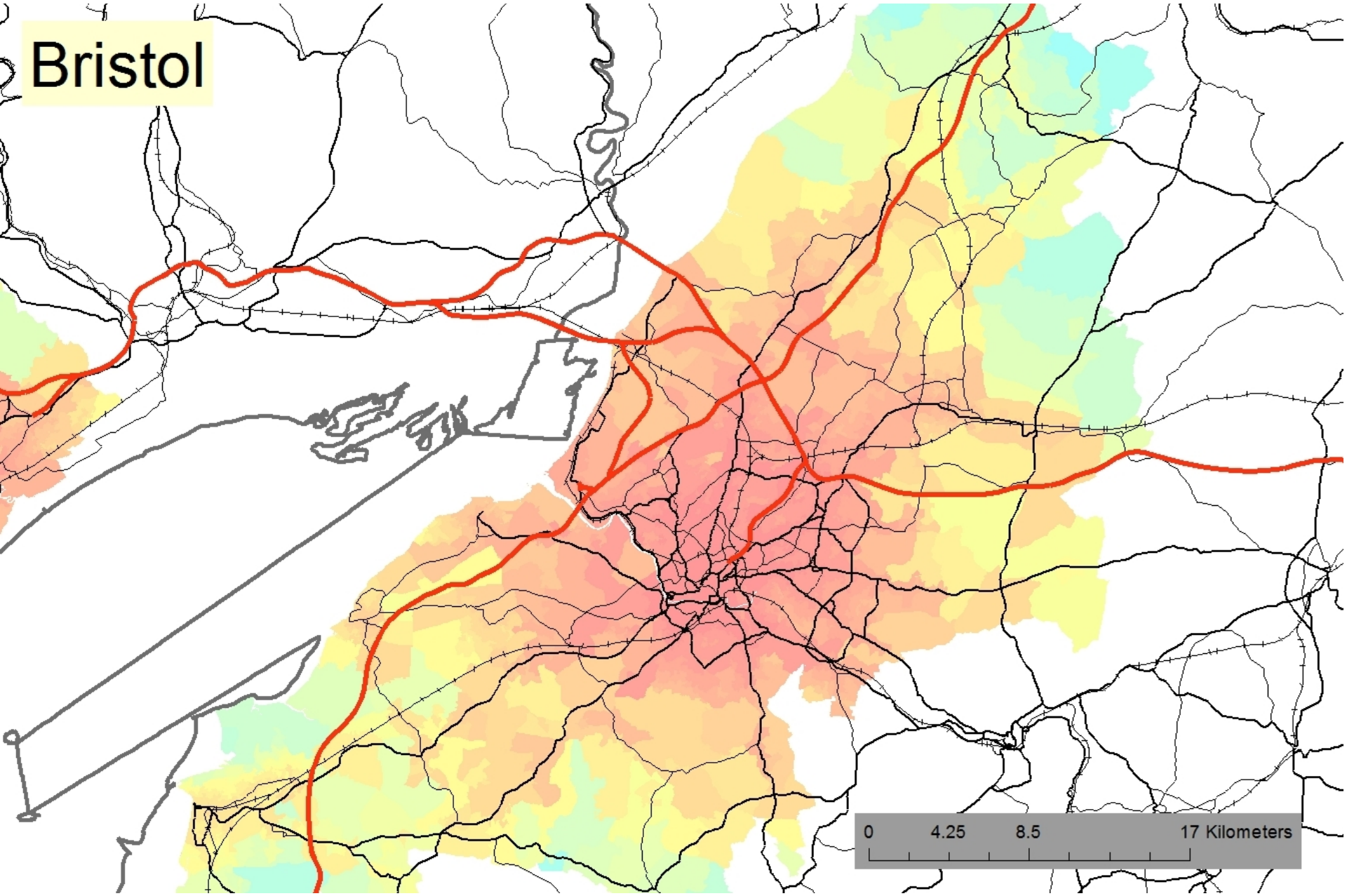
$$B\downarrow j = 1/A\downarrow i \, O\downarrow i \exp(-c\downarrow ij)$$

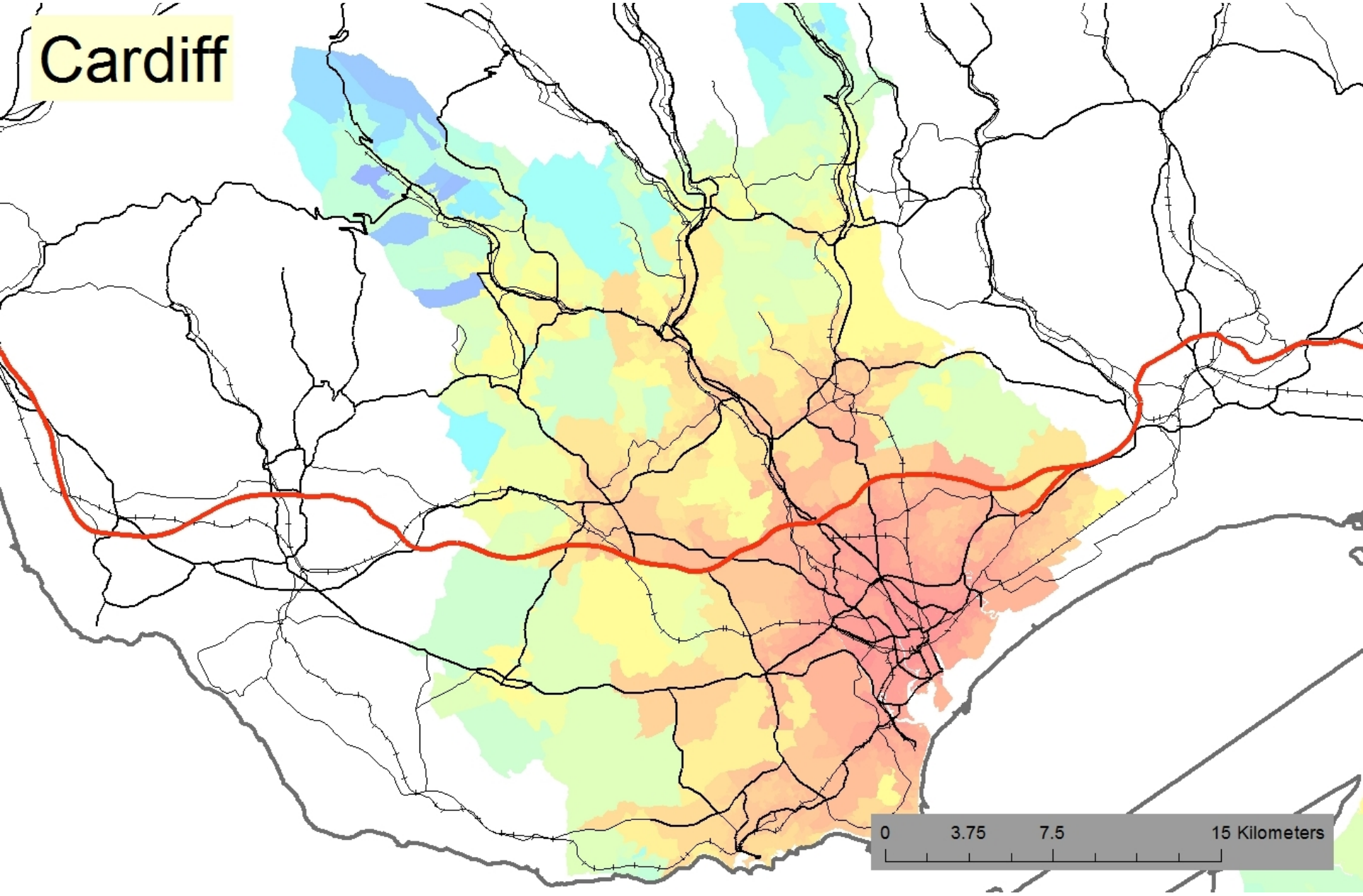
Adjusted accessibility

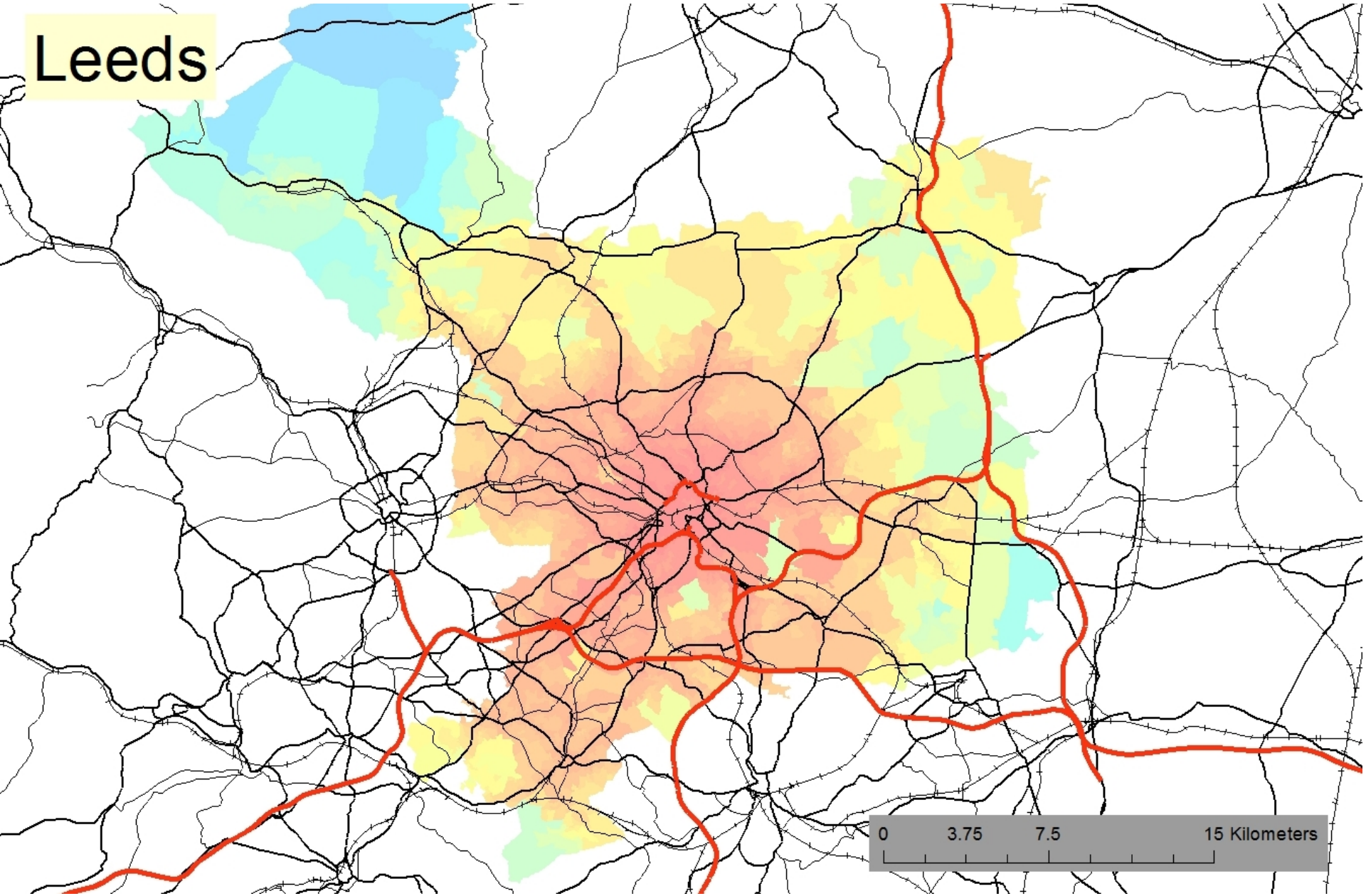
- Estimating the distance deterrence effect in this modelling framework generates a useful by-product
- One of the parameters used to calibrate the model can be interpreted as an accessibility measure
- Usefully, it adjusts for the competition for jobs at different locations

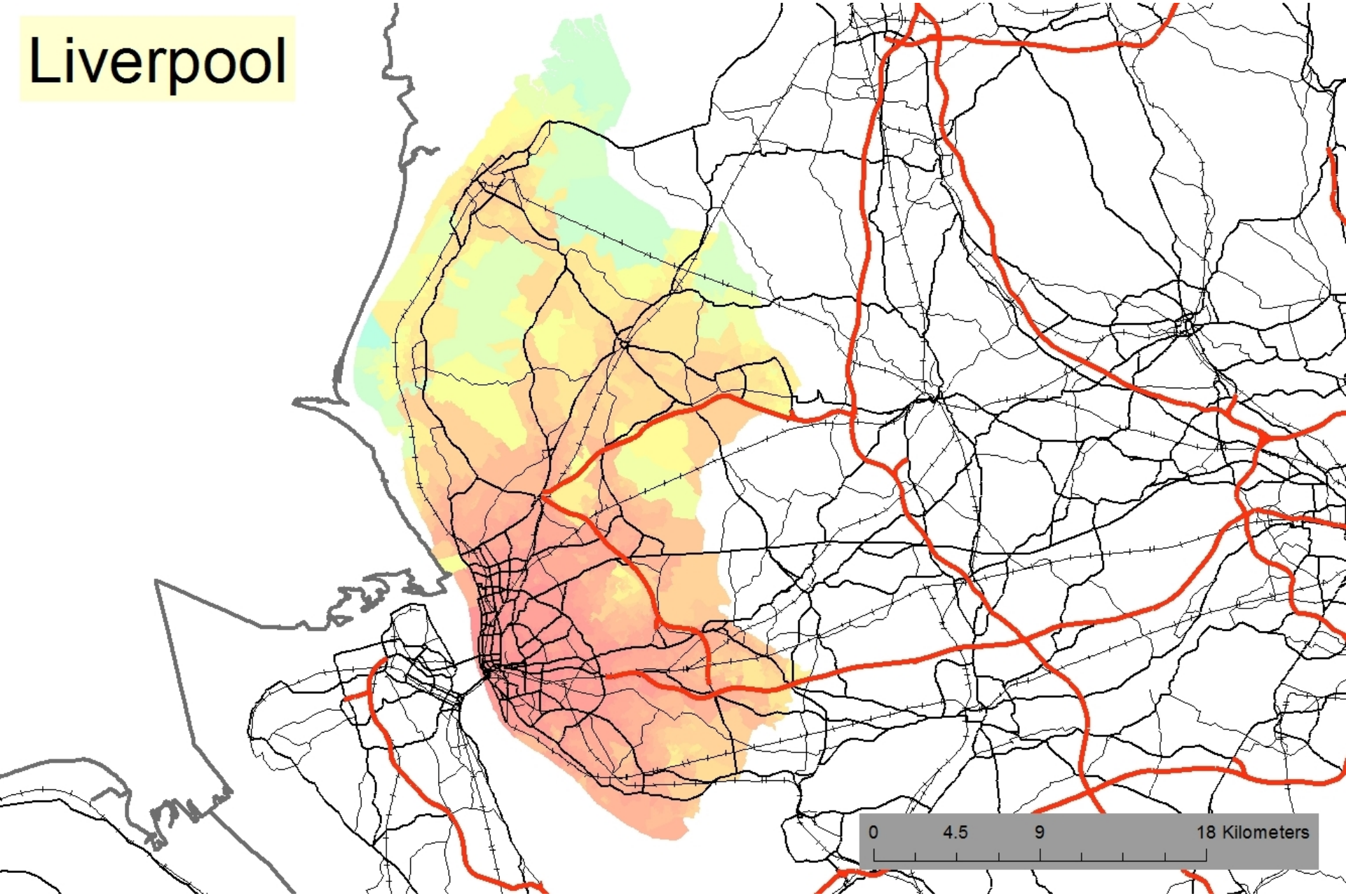

Glasgow
0
5
10
20 Kilometers

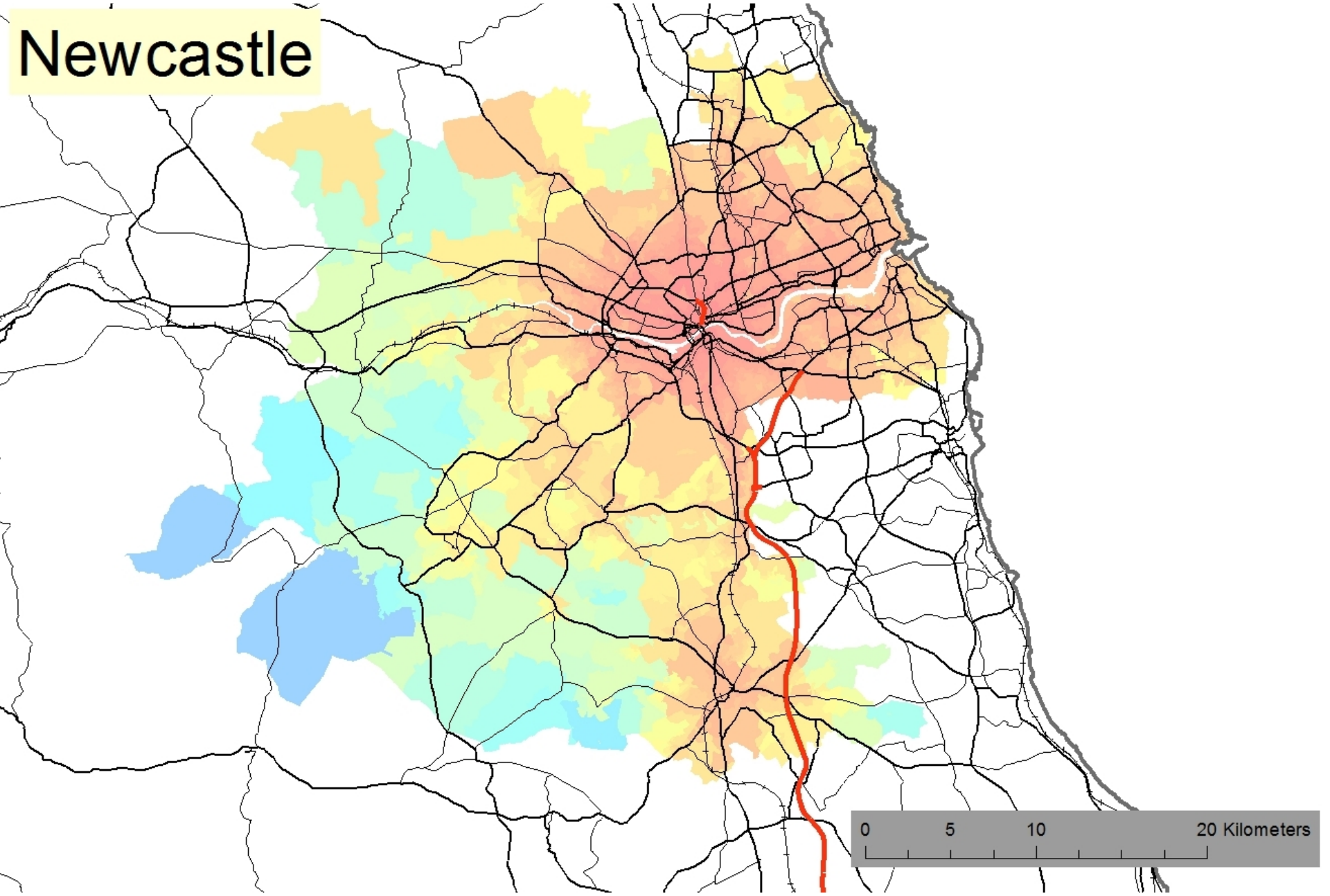

Edinburgh
0
5
10
20 Kilometers

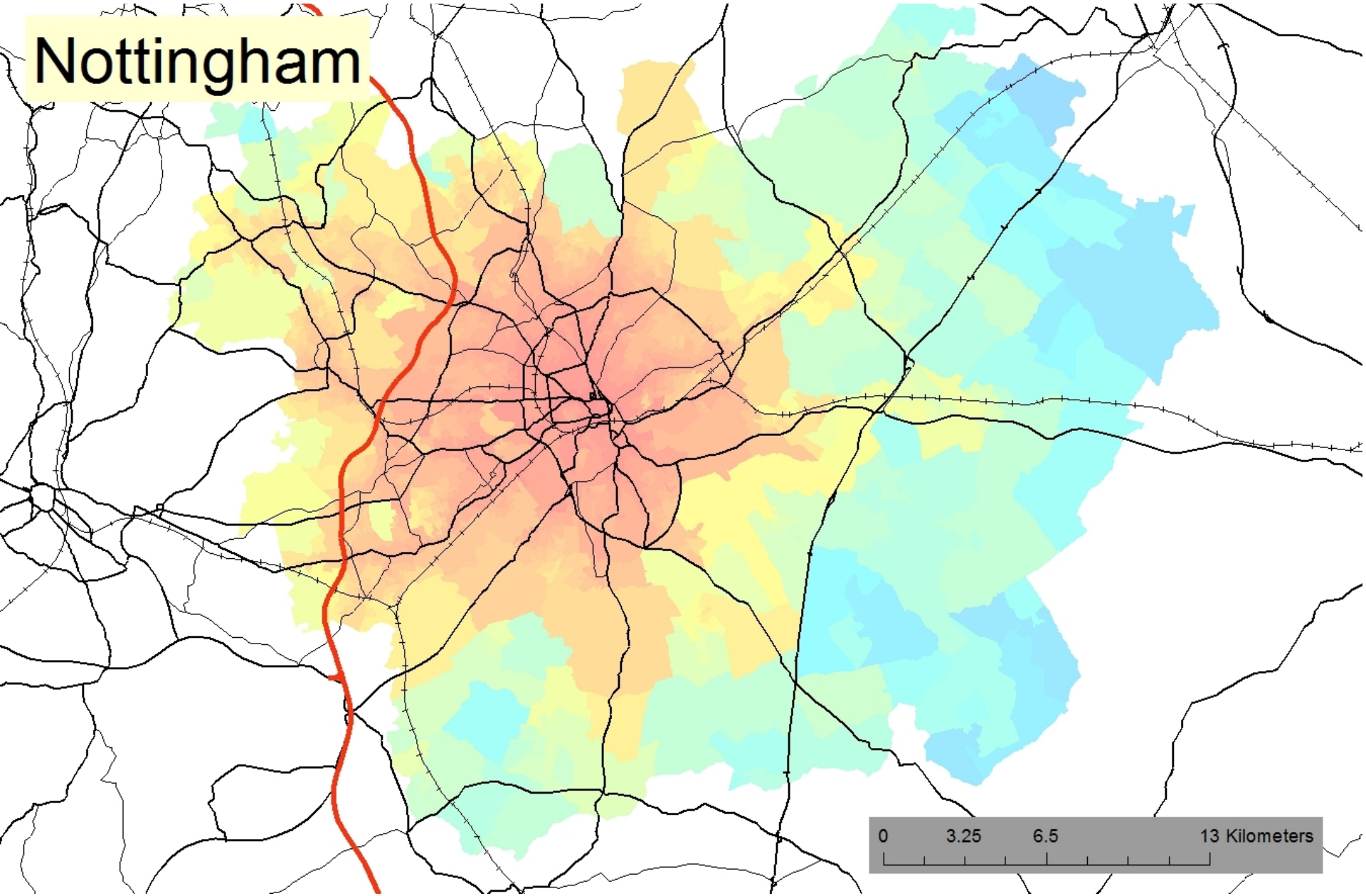

Bristol
0
4.25
8.5
17 Kilometers


Cardiff
0
3.75
7.5
15 Kilometers


Leeds
0
3.75
7.5
15 Kilometers


Liverpool
0
4.5
9
18 Kilometers

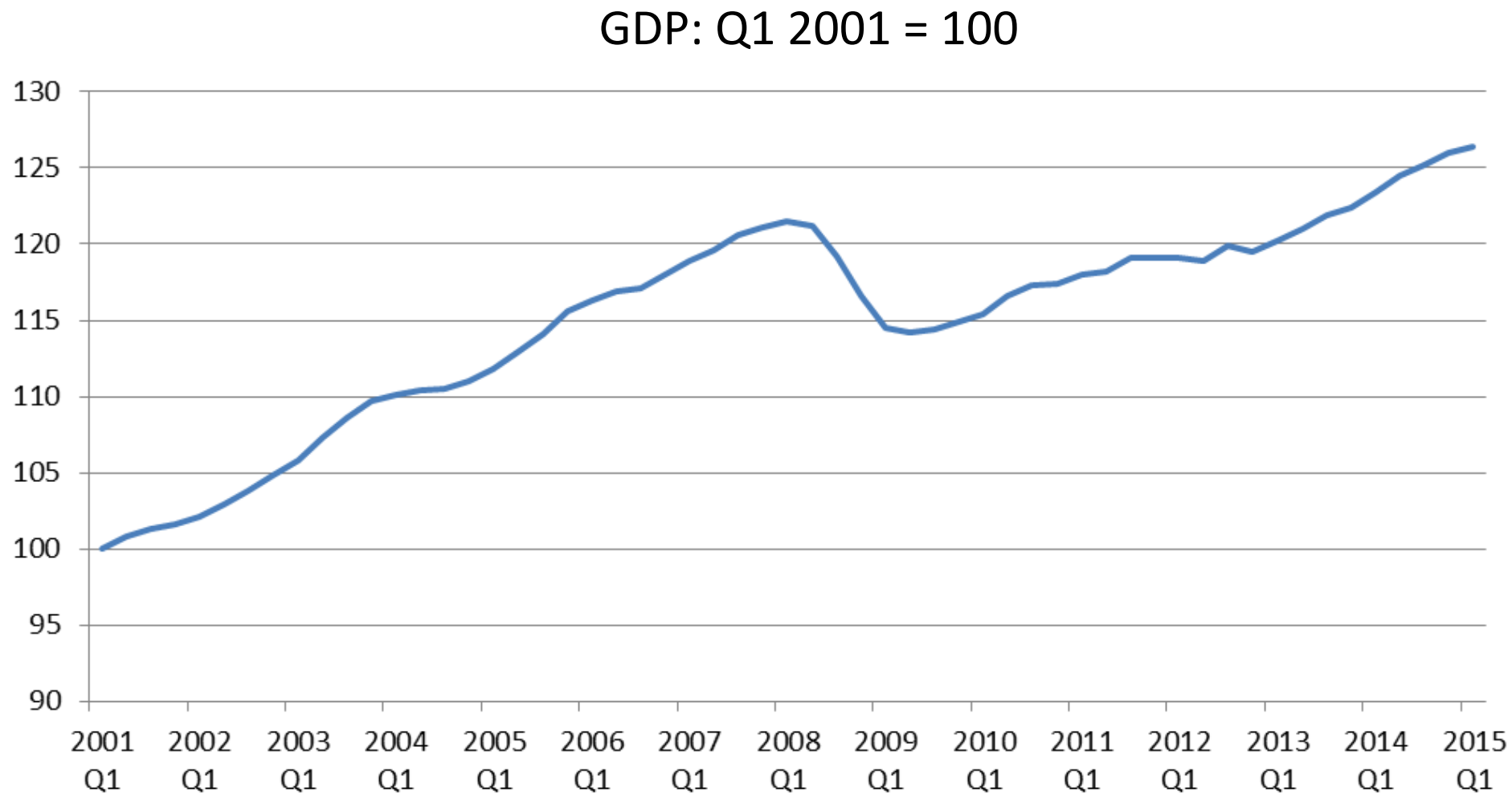

Newcastle
0
5
10
20 Kilometers


Nottingham
0
3.25
6.5
13 Kilometers

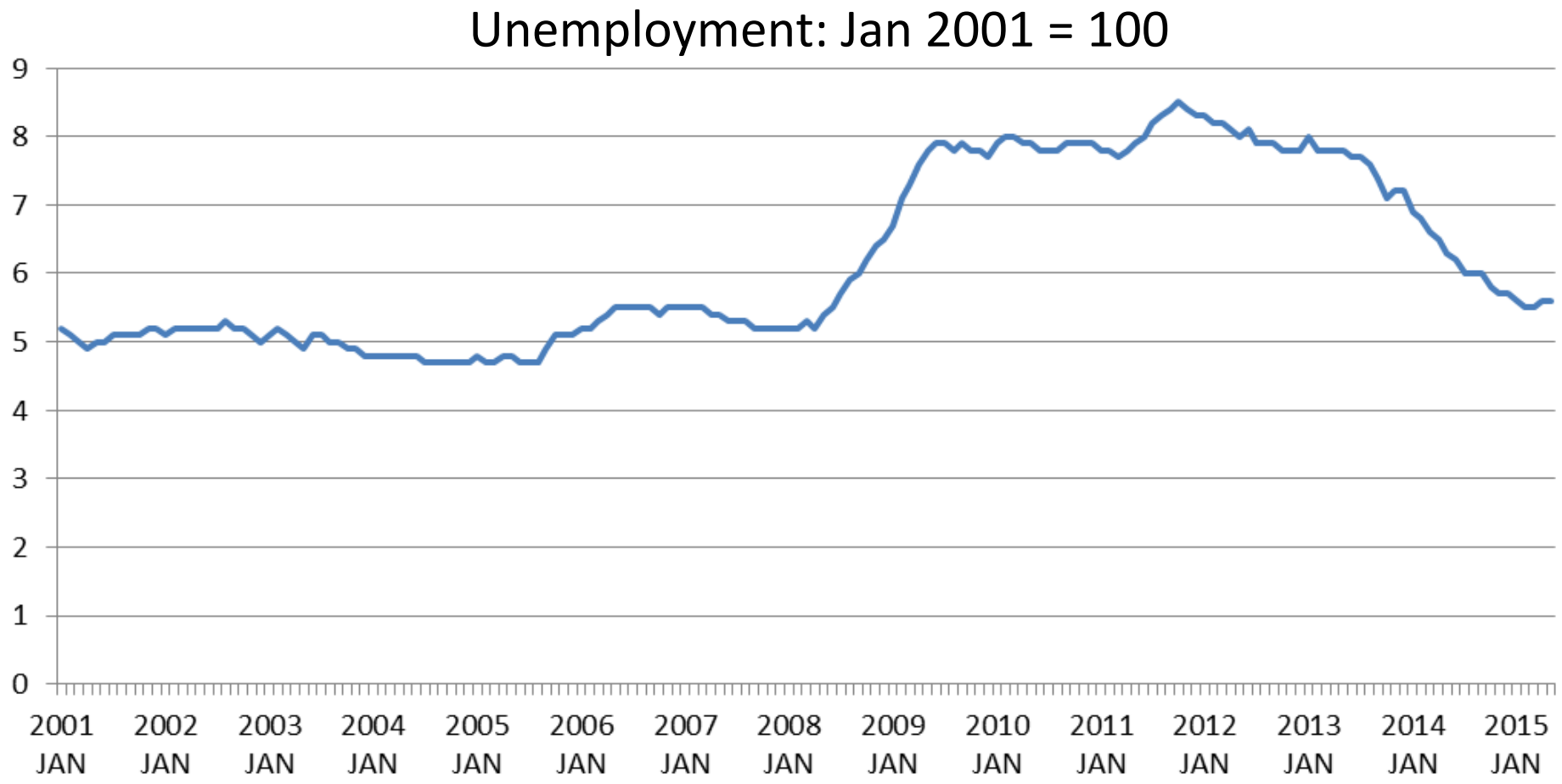
Problems

- The census is only collected every ten years (and may even be abolished/scaled back)
- Data for what happens in between are patchy
- Costs of travel vary substantially e.g. by time of day, by day of week, inter-year

The recession in the UK



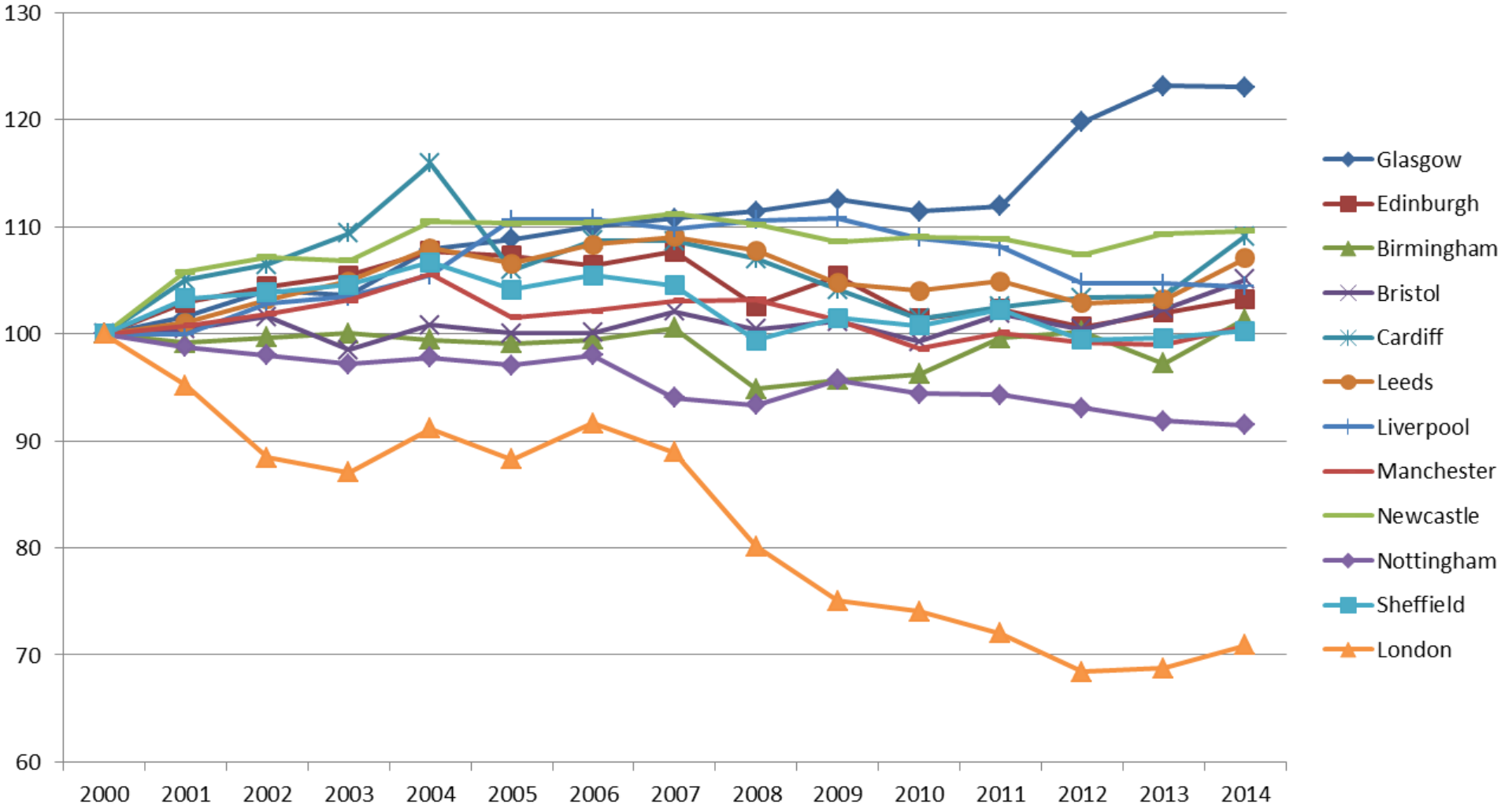
The recession in the UK



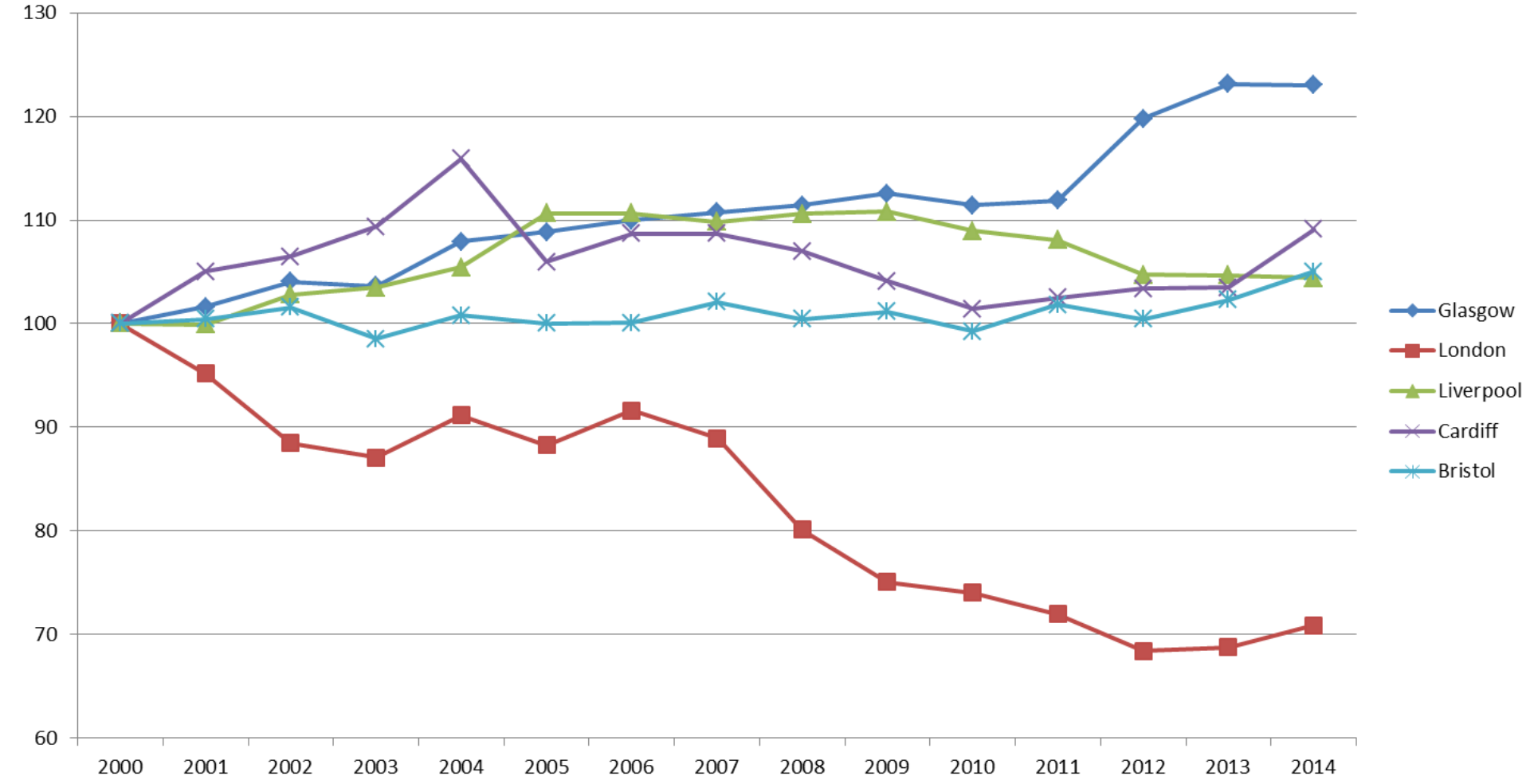
Data requirements and wishes

- Residential locations
- Workplace locations
- Transport network data

Traffic count data

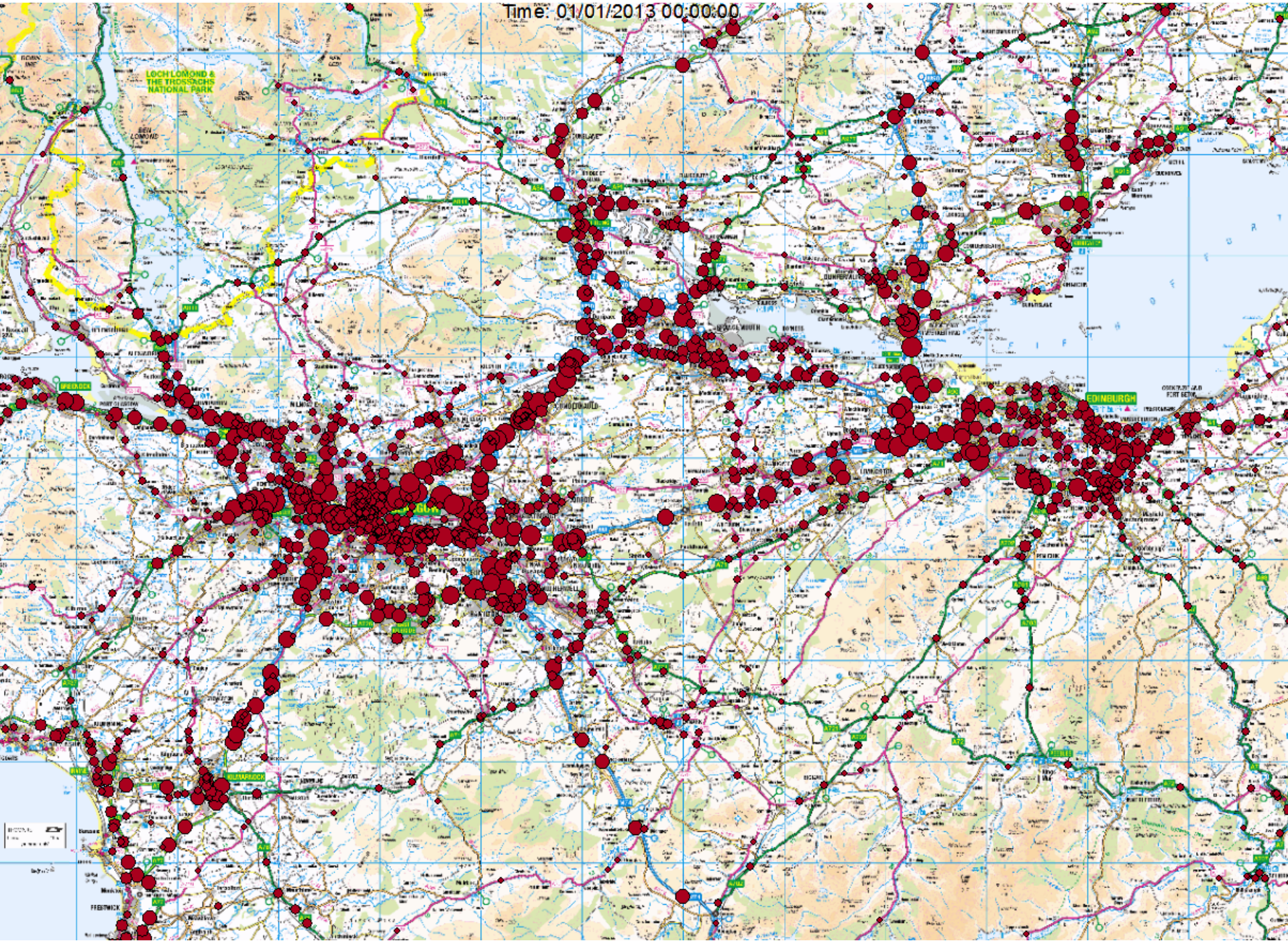


Traffic count data




HGV AADF
1200
1100
1000
900
800
2000
2005
2010
2015
Year


Cars AADF
15000
14000
13000
12000
2000
2005
2010
2015
Year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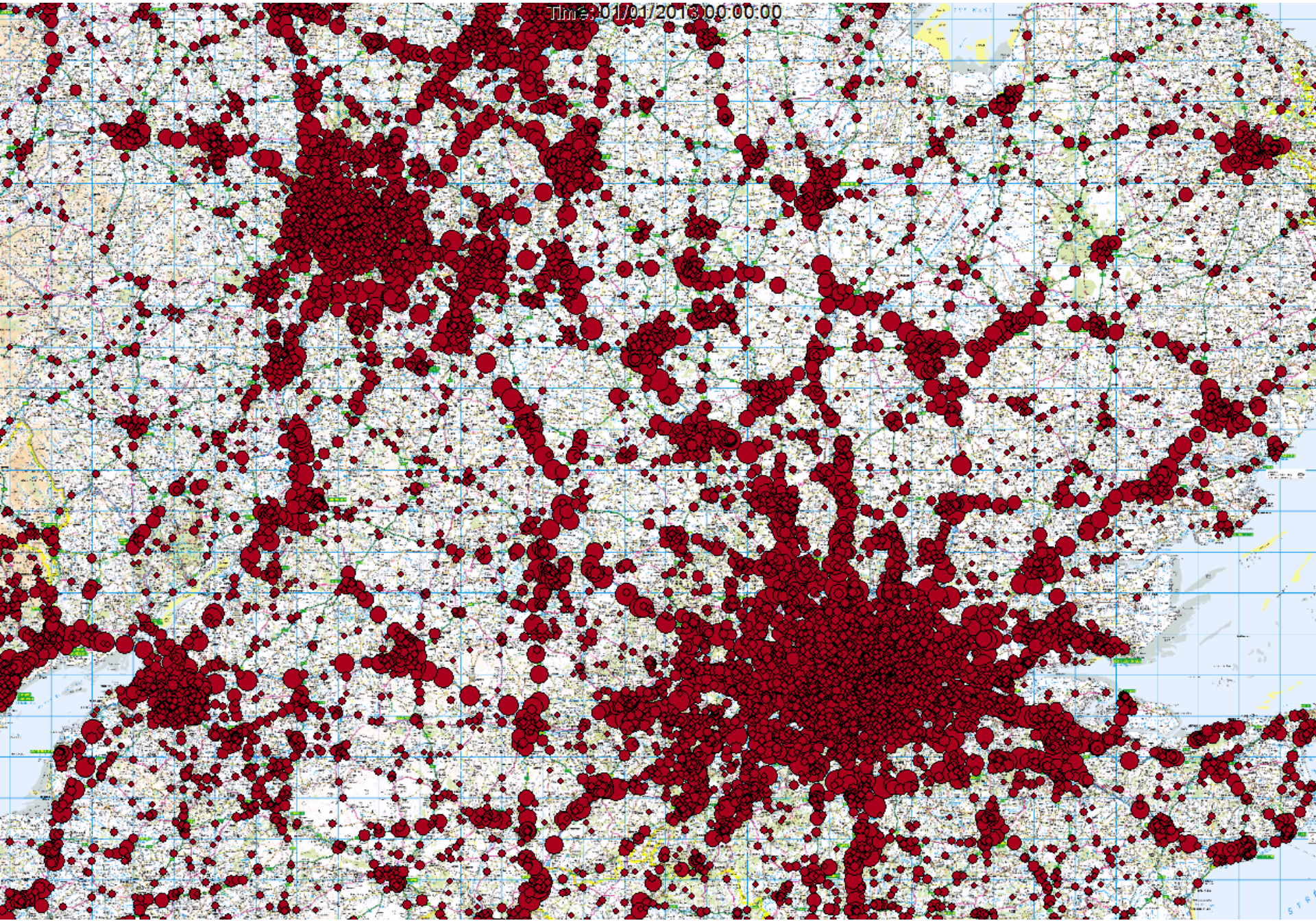
EDINBURGH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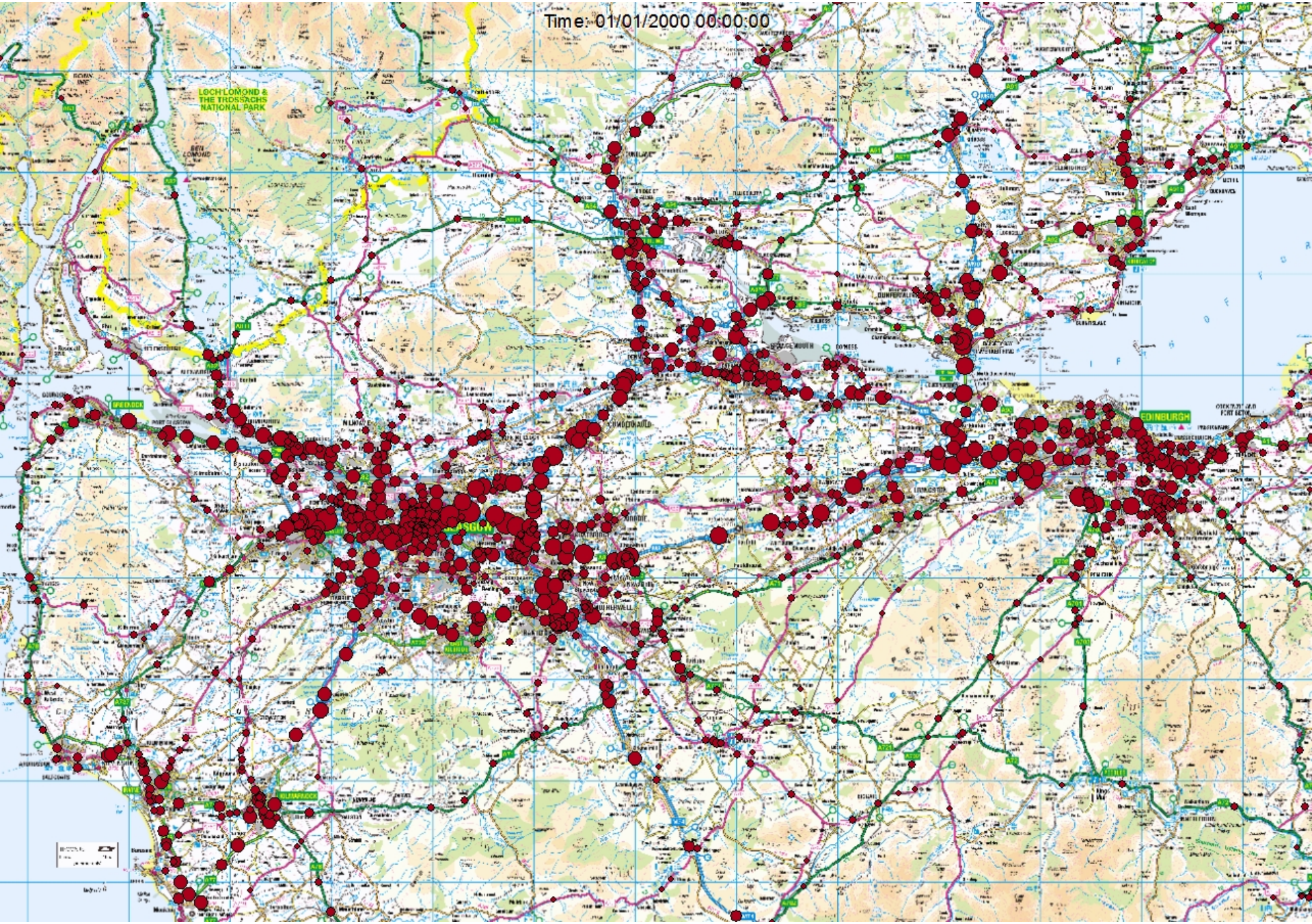
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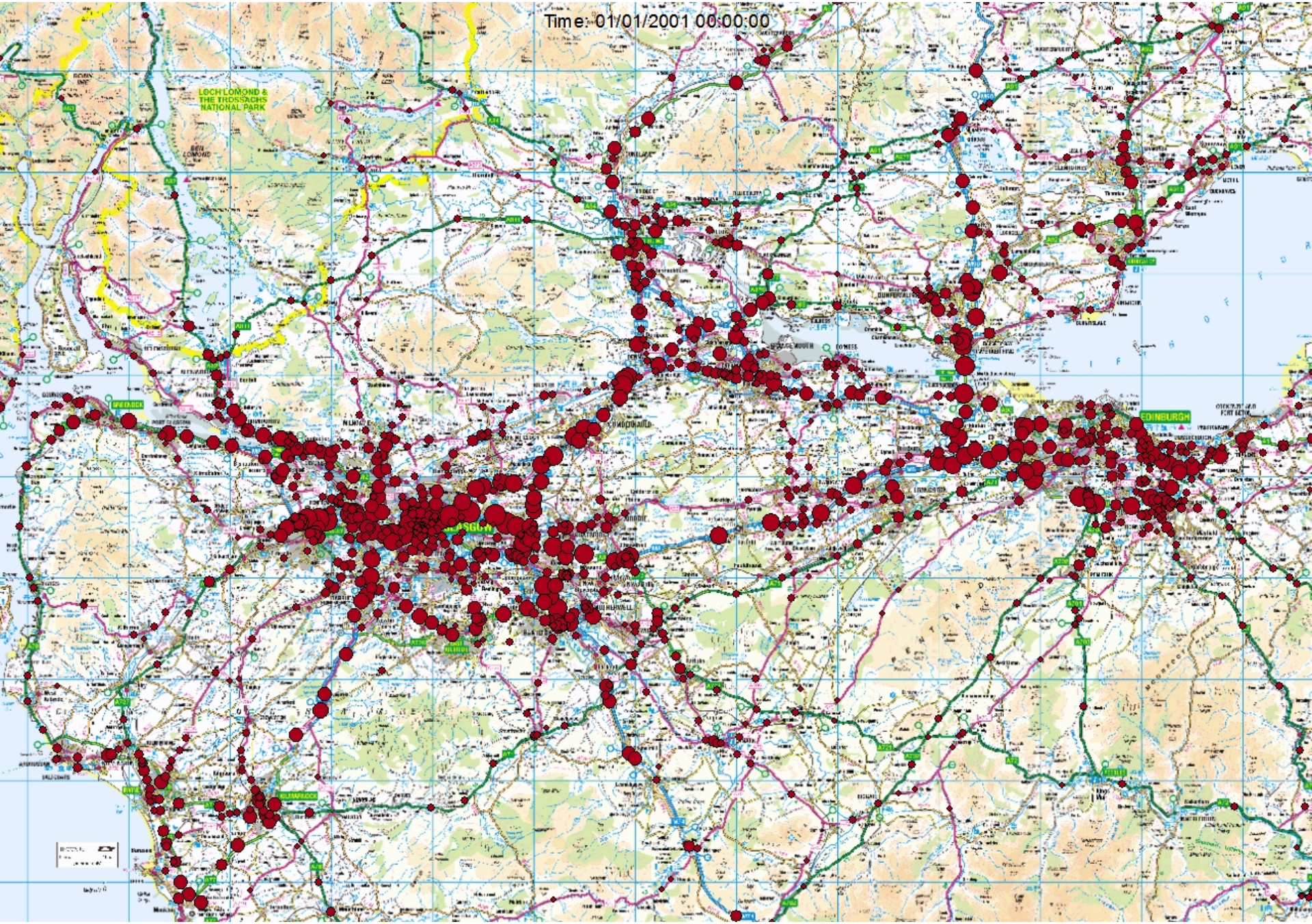
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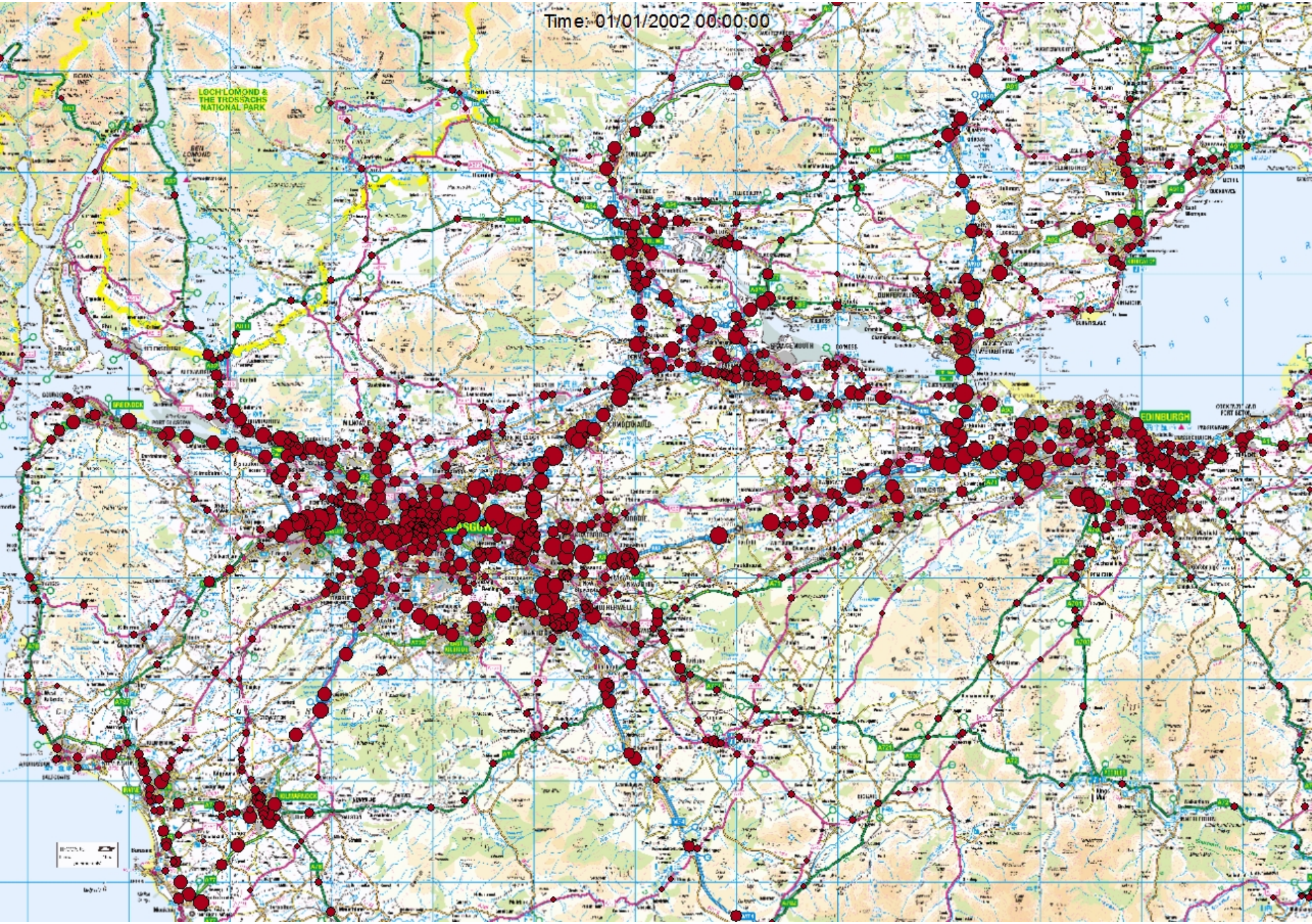
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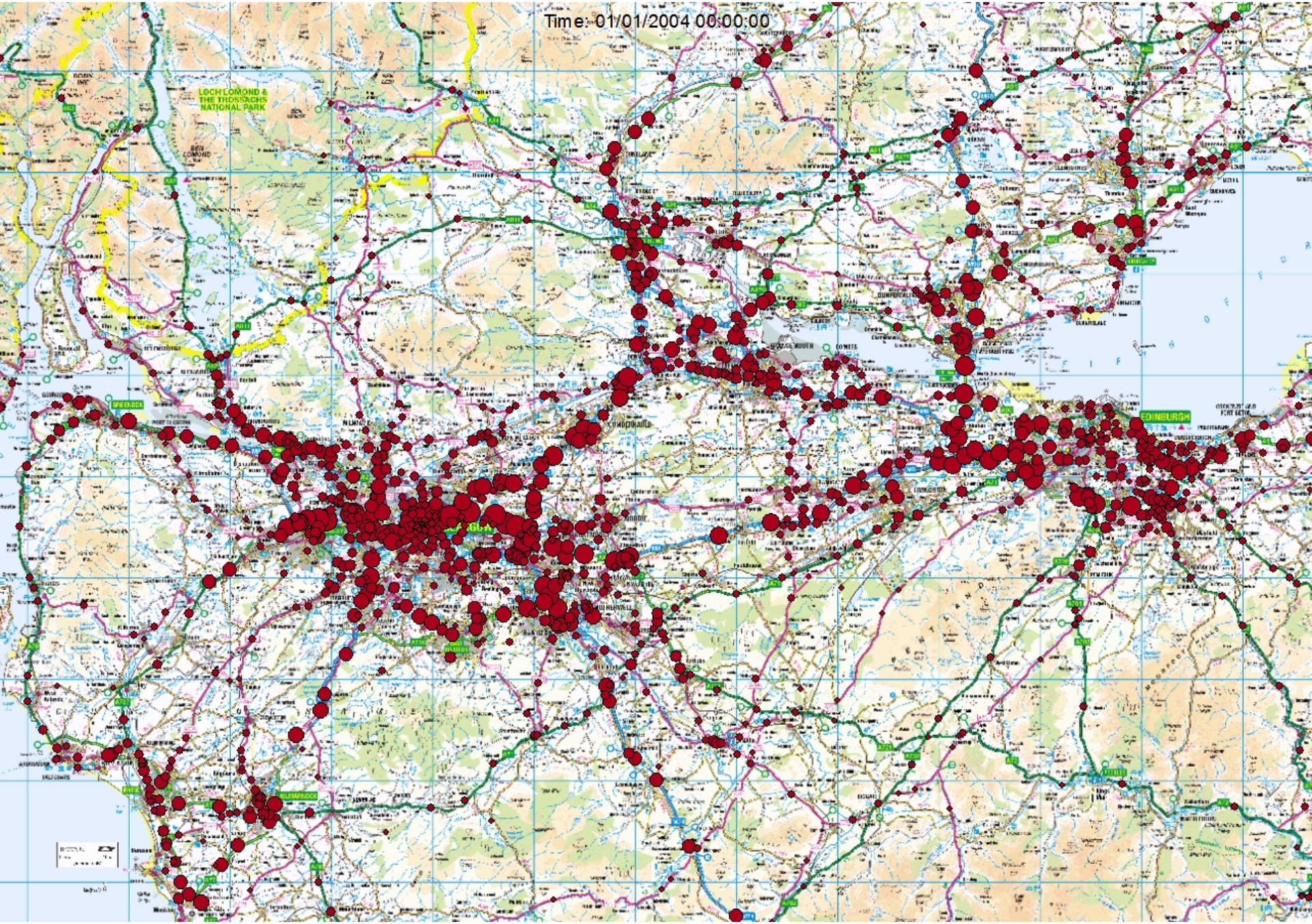
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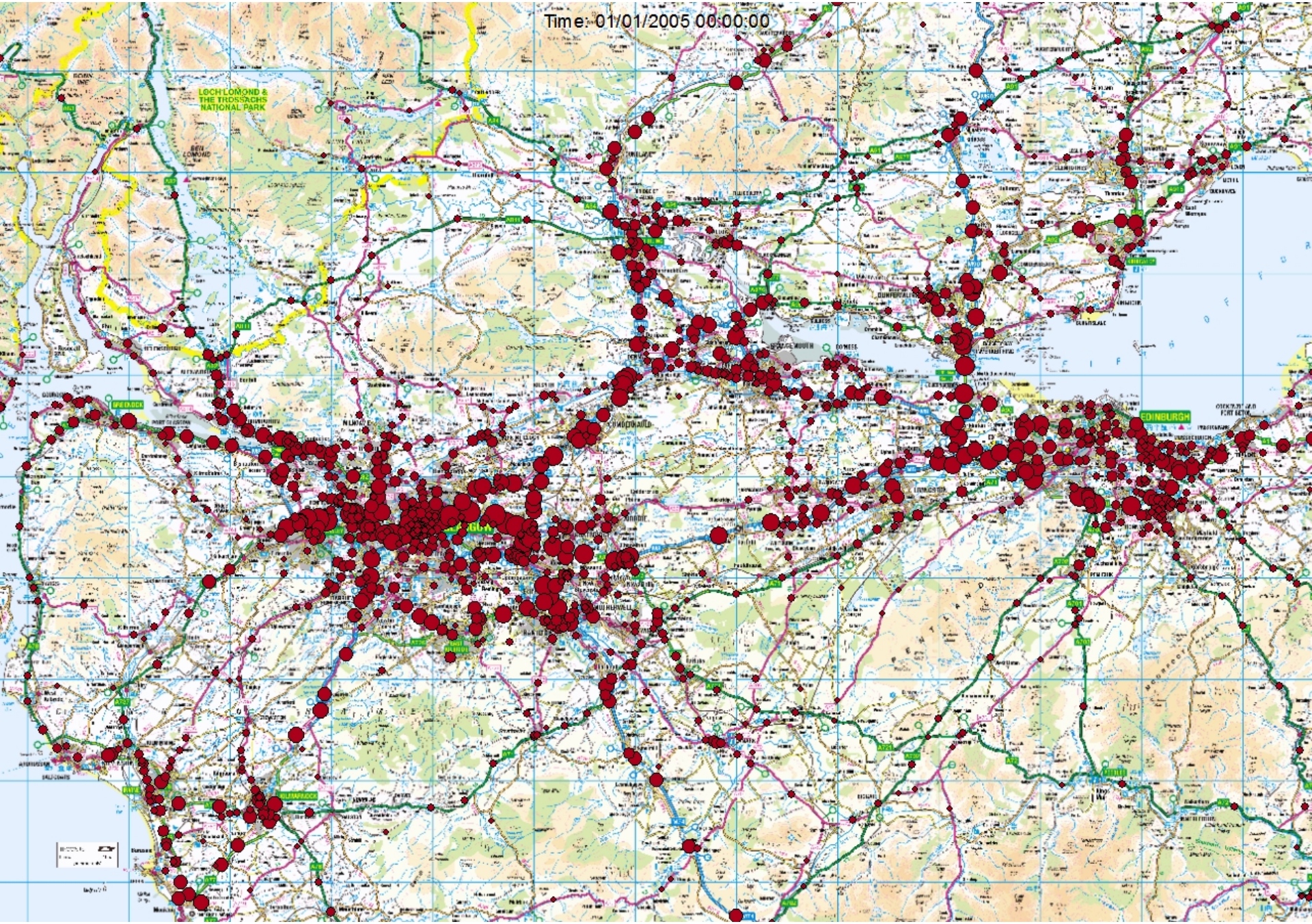
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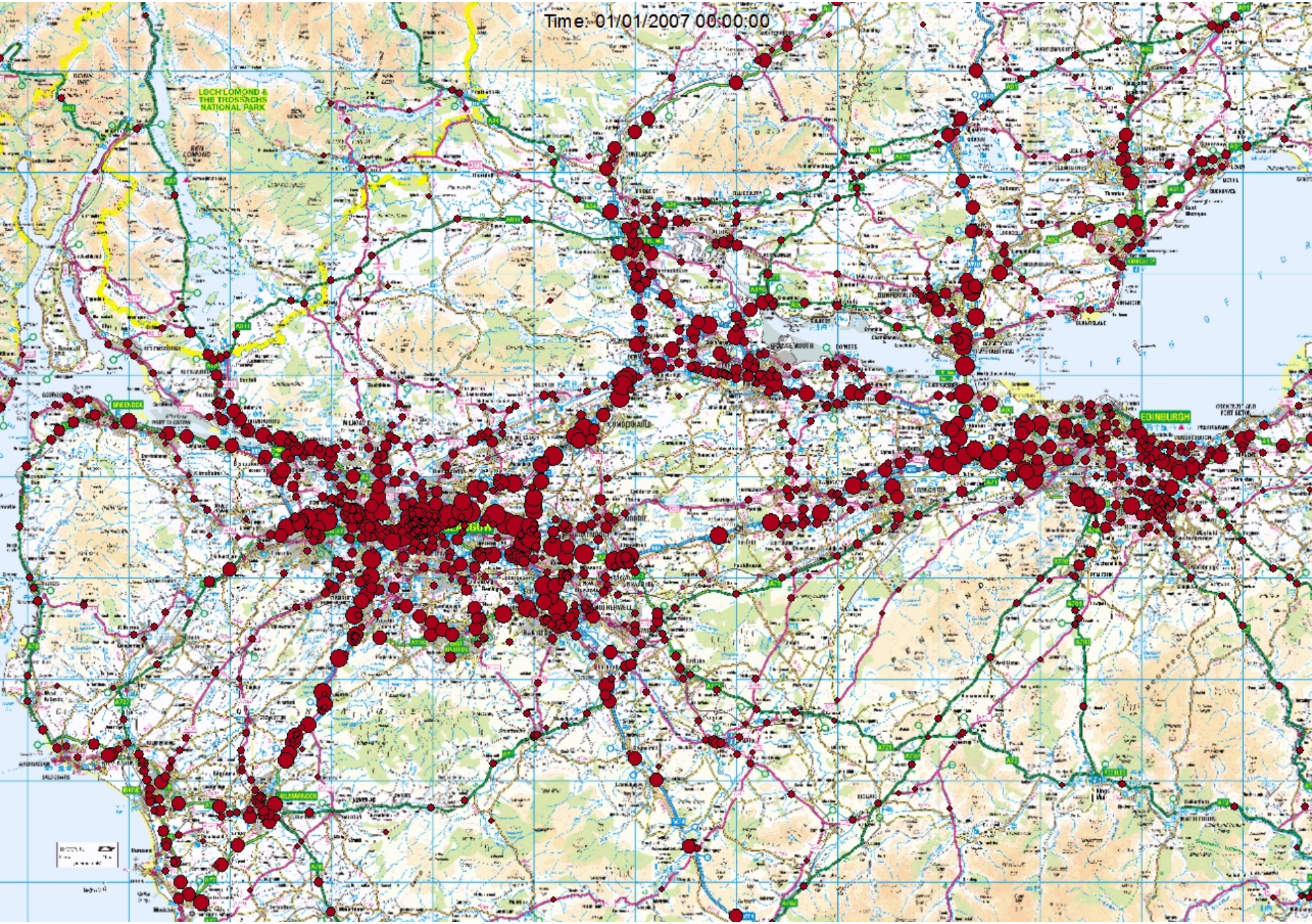
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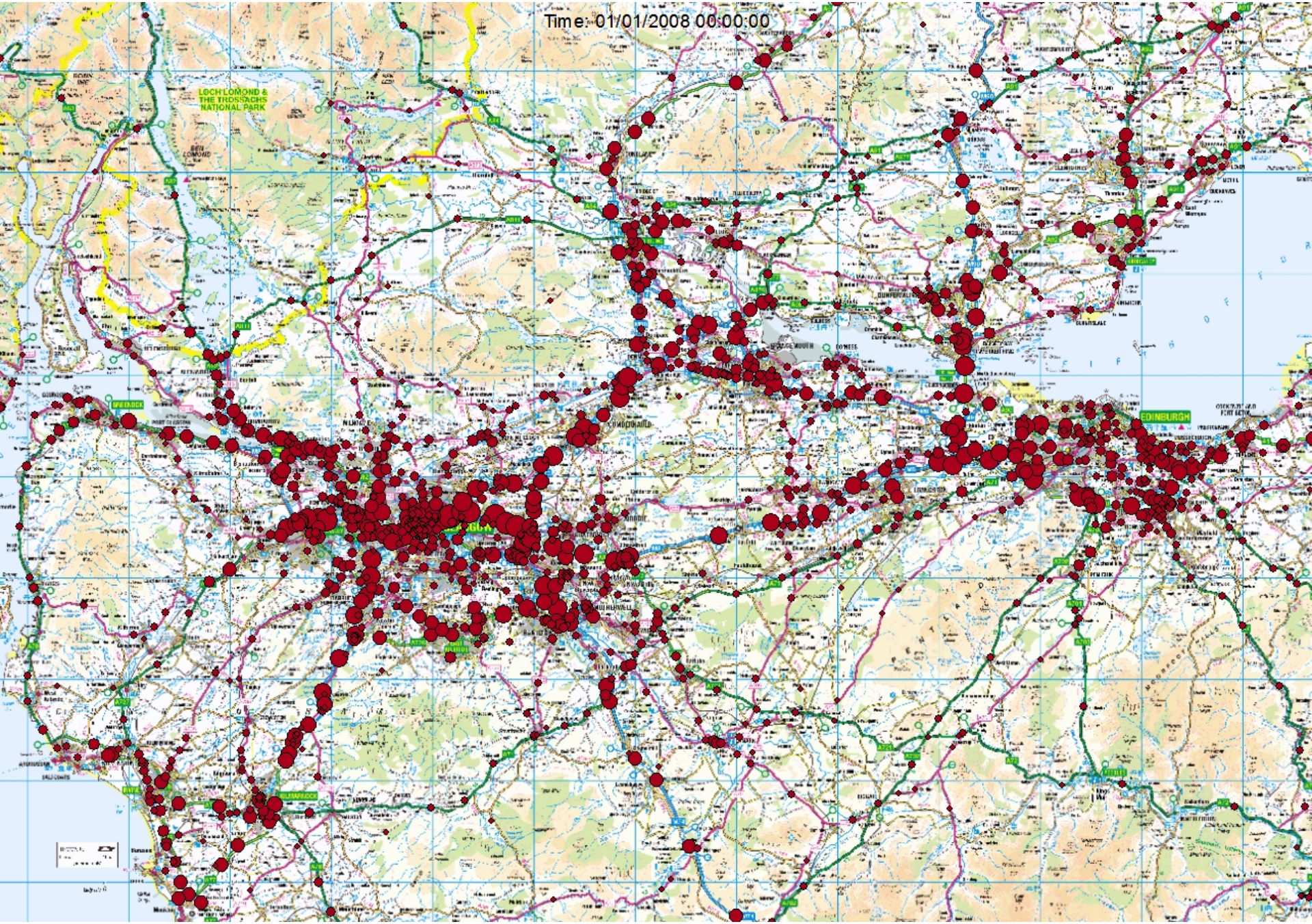
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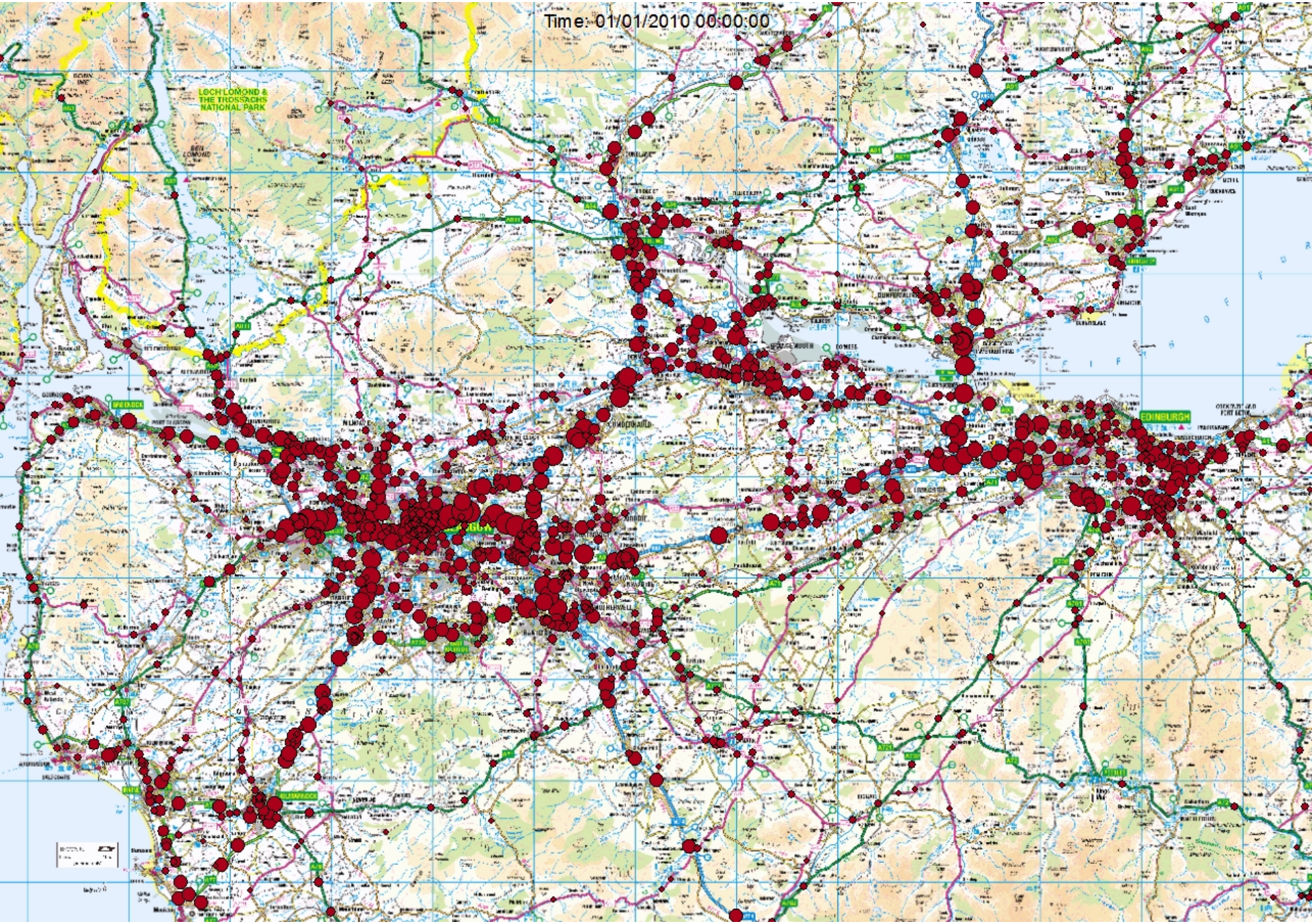
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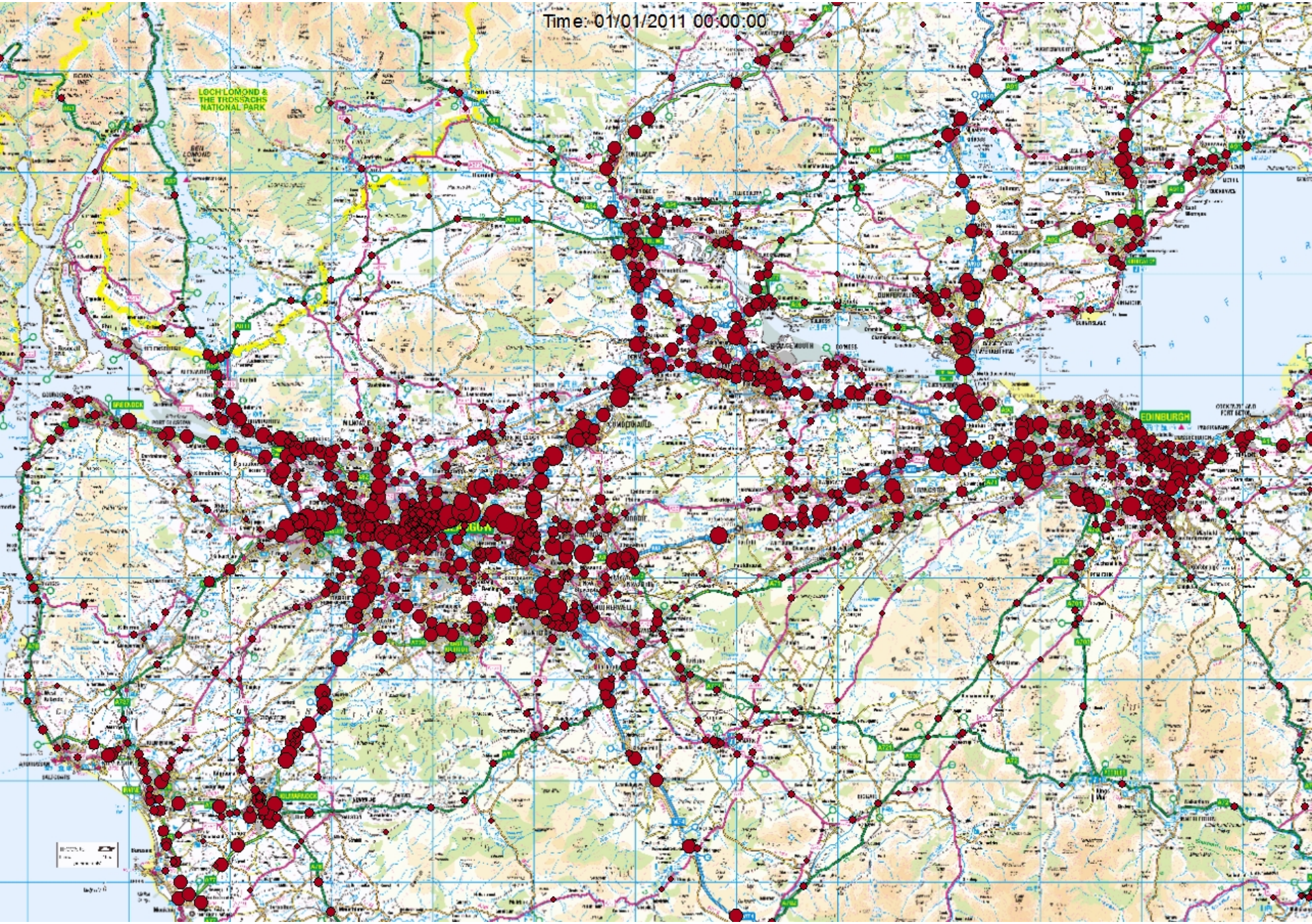
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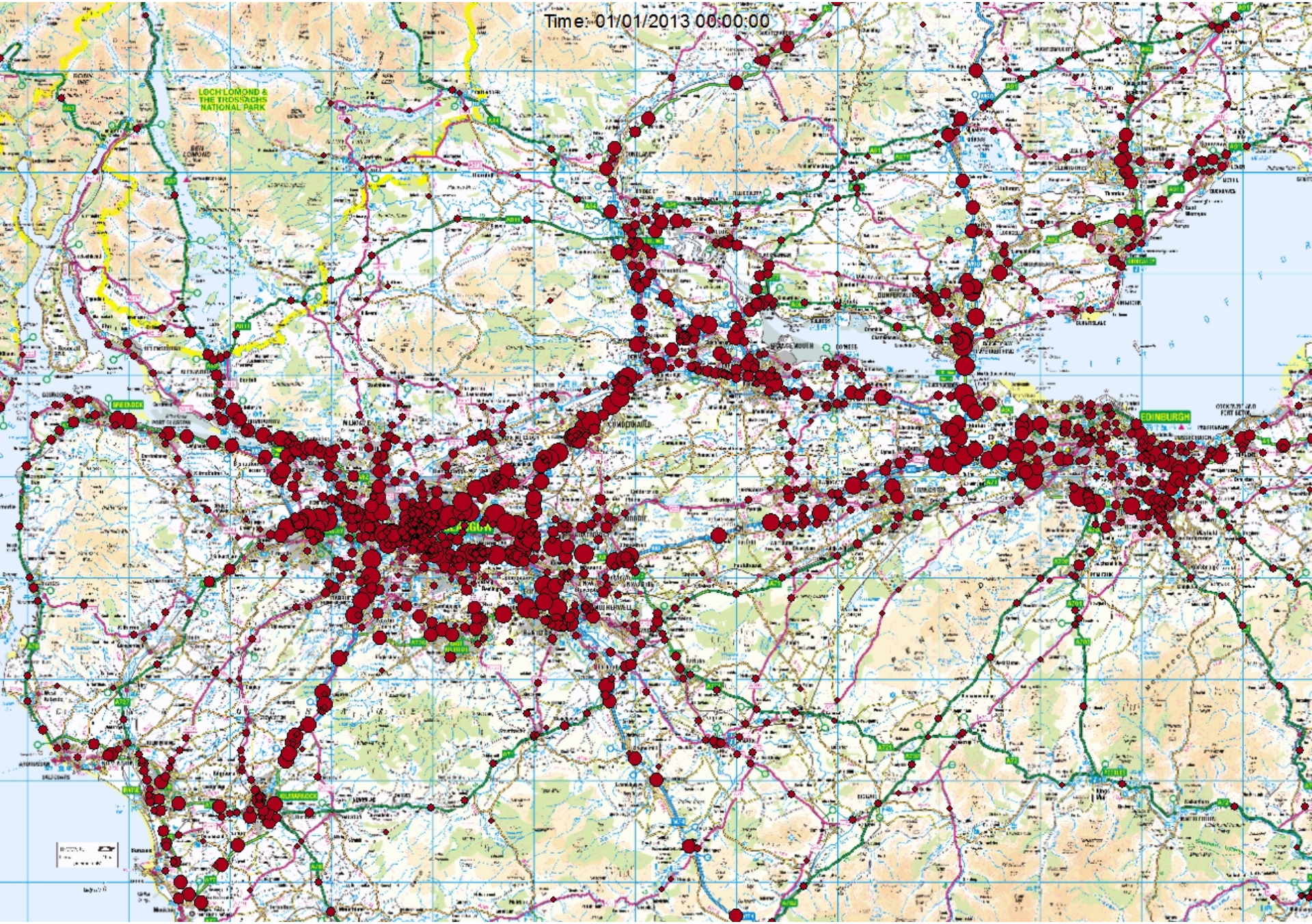
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Implications

- Changes in traffic volumes may lead to changes in travel costs
- It is possible that the recession enhanced accessibility in some parts of certain cities
- Changes in working patterns may change the time-of-day people travel at

Network data

- Traffic sensor data: inductive loop detectors, automatic number plate recognition (ANPL)
- Smart card scans, automatic passenger counters (APC), automatic vehicle location (AVL) data
- Mobile phone data, Bluetooth detector data, location enables apps
- Social media data

Residential location

- Potentially derivable from network data i.e. origins of journeys
- Administrative data sources
- Data from smart energy metres
- Social media data
- Web scraping property websites

Workplace location

- Again, potentially derivable from certain network data
- Smart metre data on energy use
- High-resolution satellite imagery
- Web-scraping recruitment websites
- Social media data

Challenges

- Data availability, licensing conditions, privacy concerns
- How do we combine numerous, heterogeneous streams of data in a consistent way?
- Validating results – what is our benchmark?

The effects of economic recession on travel behaviour: Focusing on the Information and Communication Technologies (ICT) and neighborhood impacts

Economic recession

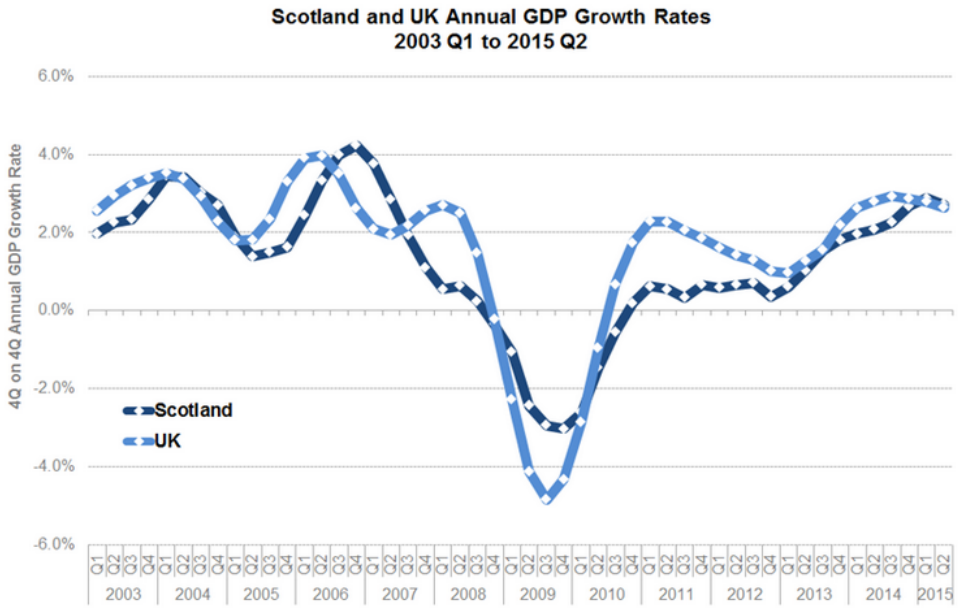
- Reductions in employment and achievable credit
- Increased home foreclosure
- Changes in people's behaviour

Neighborhood

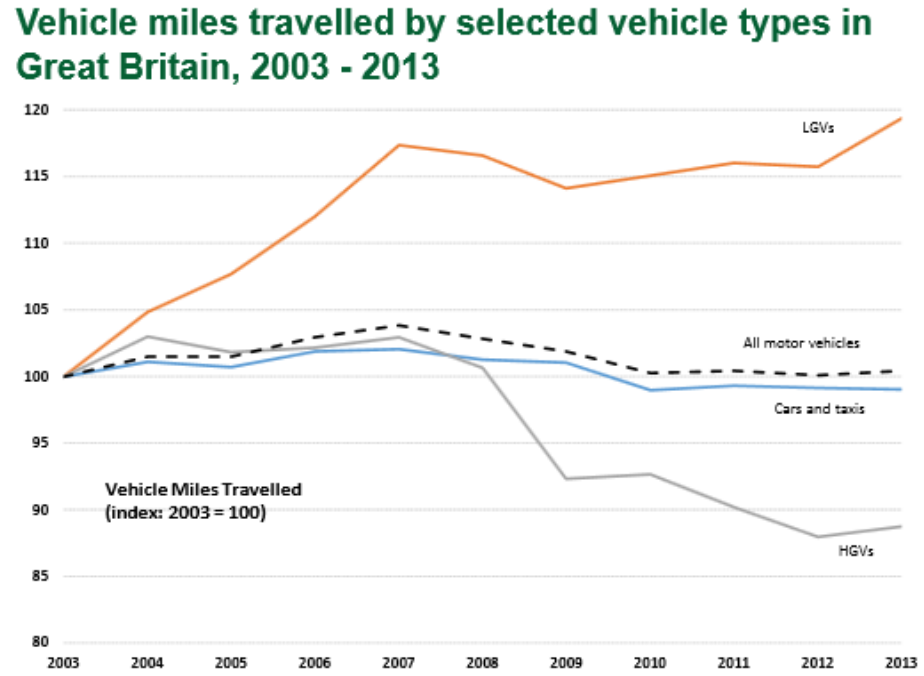
- Different level of accessibility to opportunities

Different impacts of ICT on mobility

- Substitution, generation, modification, neutrality



Source: The Scottish Government (2015)



Source: Department for Transport (2014)

Research Questions

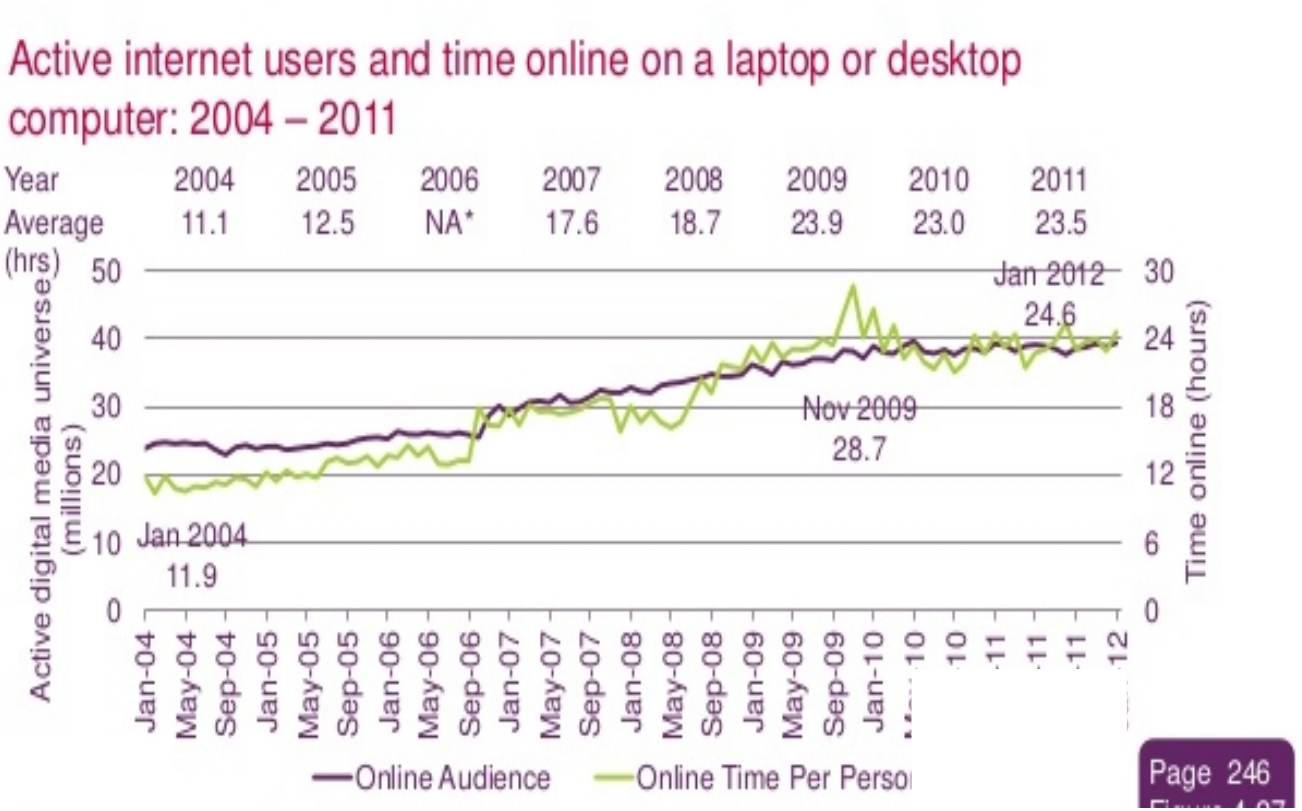
- What are the impacts of recent economic recession on motorized/non-motorized travel?
- What are the effects of ICT use on travel behaviour?
- Does the recent economic recession affect the use of ICT?
- How do the relationships among economic recession, ICT use and travel behaviour vary according to neighbourhoods?

Data sources

- 2003-2014 Scottish Household Survey data with geographic information (e.g., datazone or postcode)
- Urban indicators (e.g., accessibility)
- Scottish Index of Multiple Deprivation (SIMD)

Do new technologies benefit our health?

- New technologies (i.e., Internet and smartphone) have changed peoples' lifestyle
- Young vs. old adults?



Source: Ofcom technology (2012)

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Ofcom report: Smartphone Scotland 'rises sharply'

7 August 2014 | Scotland business

Ofcom said take-up of smartphones in Scotland climbed 17% in a year

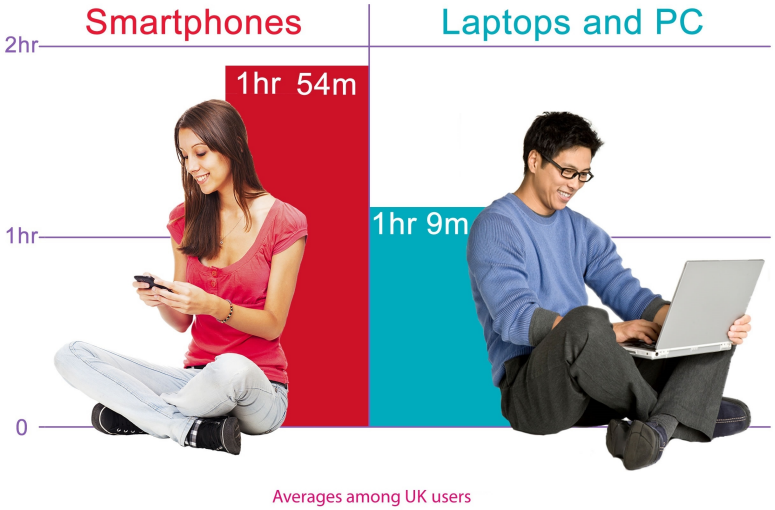
Scots are taking up smartphones at a faster rate than a according to Ofcom.

The regulator's 2014 Communications Market Report found a year to 62%, just ahead of the UK average.

- Ubiquitous access to the Internet
- More physical activity or sedentary lifestyle?

Time spent online

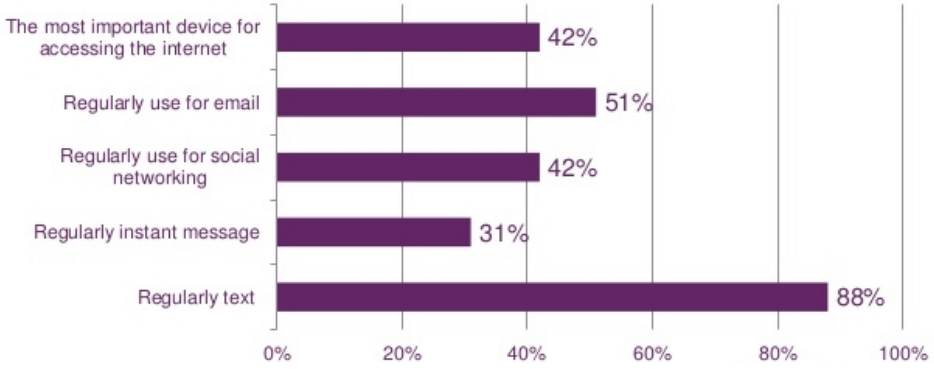
People spend almost two hours daily online with their smartphone, 45 minutes more than on their laptop



Averages among UK users

Source: Ofcom (2015)

Smartphones are becoming most important device for accessing the internet



Source: Ofcom omnibus research (2012)

Research Questions

- How do new technologies (i.e. Internet & smartphone) influence the level of physical activity?
- Are there significant differences in the level of ICT use between young and old adults? Do the impacts of ICT use on physical activity differ according to age?
- How do neighborhood characteristics alter the impacts of ICT use on physical activity?

Data sources

- Integrated Multimedia City Data survey
  - Main survey
  - GPS and lifelogging samples

- Urban indicators (e.g. accessibility)

Thank you for your attention.

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An ESRC Data Investment