Gridded models in the UK: beyond the 2011 census

David Martin, University of Southampton

EFGS Conference, Lisbon, 12-14 October 2011
Presentation overview

- 2011 census review
- Geographical data developments
- Implications for gridded population modelling
- Population 24/7 project update

*knowledgements: Samantha Cockings, Samuel Leung, ESRC Award RES-062-23-1811, ONS*
2011 census overview
2011 census

- UK coordination, but separate censuses with differences (England and Wales; Scotland; Northern Ireland)
- Census day 27 March 2011: conventional census with internet completion channel
- Mail-out (not Scotland) and mail-back, using address list
- Flexible enumeration effort focused on most difficult areas
- Extended imputation methodology
- First data July 2012: basic demographic statistics for local authorities, detailed data for small areas follow in autumn
H7 - What type of accommodation is this?

A whole house or bungalow that is:
- detached
- semi-detached
- terraced (including end-terrace)

A flat, maisonette or apartment that is:
- in a purpose-built block of flats or tenement
- part of a converted or shared house (including bedsits)
- in a commercial building (for example, in an office building, hotel, or over a shop)

A mobile or temporary structure:
- a caravan or other mobile or temporary structure

H8 - Is this household’s accommodation self-contained?

This means that all the rooms, including the kitchen, bathroom and toilet, are behind a door that only this household can use.

Yes, all the rooms are behind a door that only this household can use
- No.
How has it gone?

• Early days, but initial assessments are encouraging

• Response rate 94 per cent nationally and over 80 per cent in every local authority

• Most London boroughs (includes many of the hardest areas nationally) 5-15 percentage points better than in 2001; overall over 90 per cent

• Internet response disappointing: 16%, but quality is high
What about 2011 data?

- Broadly comparable questionnaire content to 2001
- Broadly comparable set of data outputs planned (2001+)
- More questions on citizenship, place of residence
- New population bases possible – daytime, weekday, majority of time, non-term time, etc.
- High degree of geographical boundary stability, based on 2001 output areas (OAs) with only essential changes
Geographical data developments
2011 geographies

• 2011 census OA geography will preserve 95%+ of 2001 OA boundaries. Hierarchical splits and mergers only where required by major population changes or local authority boundary change

• New geography of workplace zones (WZs) based on hierarchical splits and mergers of 2011 OAs to produce WZs suitable for publication of workplace ("daytime") data with much more detail than in 2001

• Boundaries, address-weighted centroids and lookup tables all included in census outputs products
OA populations: 2001 census

SOUTHAMP.KS0010001

- 122 - 212
- 212 - 259
- 259 - 296
- 296 - 336
- 336 - 400
- 400 - 668
- 668 - 1586
Southampton workplace zones – test data

- OAs split to form WZs
- OAs merged to form WZs
- OAs equivalent to WZs
2011 data products

- High level agenda for ‘Open Government’ promoting ‘Open Data’: all principal census outputs free at point of use under ‘Open Government Licence’

- Should include all the OA/WZ geographical boundaries and centroids

- Plans for user API-based access to data direct from ONS (alongside more conventional means of access)

- Indications of a much more open census user community, with richer web-based data access tools

- Practical example = InFuse! (University of Manchester)
### Filters

#### Topics
- Accommodation type (detailed)
- Age
- Sex
- Adults, Number Employed in Household
- Adults, Number in Household
- Age
- Age of Family Reference Person (FRP)
- Age of Household Reference Person (HRP)
- Age of Students and Schoolchildren
- Amenities
- Armed Forces
- Bath/Shower and Toilet, use of
- Care (unpaid), Provision of

<table>
<thead>
<tr>
<th>Topic Combination</th>
<th>Select</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodation type (detailed)</td>
<td>Select</td>
</tr>
<tr>
<td>Age</td>
<td>Select</td>
</tr>
<tr>
<td>Sex</td>
<td>Select</td>
</tr>
<tr>
<td>Adults, Number Employed in Household</td>
<td>Select</td>
</tr>
<tr>
<td>Adults, Number in Household</td>
<td>Select</td>
</tr>
<tr>
<td>Age of Family Reference Person (FRP)</td>
<td>Select</td>
</tr>
<tr>
<td>Age of Household Reference Person (HRP)</td>
<td>Select</td>
</tr>
<tr>
<td>Age of Students and Schoolchildren</td>
<td>Select</td>
</tr>
<tr>
<td>Amenities</td>
<td>Select</td>
</tr>
<tr>
<td>Armed Forces</td>
<td>Select</td>
</tr>
<tr>
<td>Bath/Shower and Toilet, use of</td>
<td>Select</td>
</tr>
<tr>
<td>Care (unpaid), Provision of</td>
<td>Select</td>
</tr>
</tbody>
</table>

---

**8 topic combination(s) found for topic(s) (Accommodation type (detailed), Age)**

Page 1 of 1

---

First < 1 > Last
Implications for gridded population modelling
Implications for gridded population modelling

• National Statistics geography policy based on one small area geography to avoid differencing

• No exact statistics published for any zones other than OAs, hence no gridded data in planned census outputs

• May be population counts for 1km grid map, but no firm commitment yet: will not be a census output

• Therefore... any gridded population models need to be generated from boundaries and centroids, as will not be directly aggregated from record-level data
Centroids, boundaries and grids

Centroid locations and boundaries

Centroid populations redistributed onto grid
Centroid set

- Gridded surface (from postcodes)
Population 24/7
project update
Mapping population over time

- Previously expressed interest in population distribution models for range of different timescales
  - Reflecting intercensal change, night time, day time, weekend, term time, etc. population movement cycles

- Applications in emergency planning, population risk modelling, catchment area planning, etc.

- Requires wide range of data sources, but census is key and many aspects of 2011 outputs are very promising, especially new population bases and WZ geography
Space-time population modelling

• Gridded approach attractive for all time-based applications because basic spatial units do not change

• Have published first version of gridded population modelling tool SurfaceBuilder247
  – Uses library of time-profiled population centroid locations and generates gridded model for specified target date and time

• Demonstrator models using 2001 and 2006 datasets being prepared by University of Manchester (not yet based on open data licensing!)
Acronyms: QLFS Quarterly Labour Force; DCSF Department for Children, Schools and Families; HESA Higher Education Statistics Agency; Survey; DCMS Department for Culture, Media and Sport; ALVA Association for Leading Visitor Attractions; DfT Department for Transport; TfL Transport for London; CAA Civil Aviation Authority
Centroid set

- 1696 census OAs
- 3329 workplaces
- 211 schools and colleges
- 2 universities
- Hospitals, stations, airport, etc.
Transport

- Rasterised road background layer
  Meridian™ 2 v1.1
  Release 2 2010
    - Motorway (blue)
    - Trunk A-Road (green)
    - Principal A-Road (grey)
- DfT NTM Area
  Type in the study area:
    - Rural (green)
    - Urban (peach)
- AADF Count
  Points (2006)
Origin centroid within area of influence $j$

time

centroid $i$

local extent $d$

area of influence $j$

background layer $b$

study area $a$
Conclusion

- 2011 census on track for production of high quality new statistics,
  - including new population bases and geographical units
- BUT gridded outputs not to be produced as a direct output from the census
- Open Data agenda is making available further relevant georeferenced population centroid data
- SurfaceBuilder247 tool now available for use: discussion under way with potential research and policy users
Acknowledgements