Detailed population distribution maps for Europe's cities

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The objective of this work was to estimate the residential population in each polygon of each map of the Urban Atlas in order to produce a complete a consistent snapshot of the population distribution in 2006. The Urban Atlas is a set of 305 land use/cover maps covering the major European (EU-27) cities and towns, and it was produced in the context of the European Programme for Global Monitoring for Environment and Security (GMES). The maps were produced in a consistent manner following common cartographic guidelines, and are freely available in the original vector-polygonal format. This set of maps characterize land use with high spatial resolution (minimum mapping unit of 0,25 hectares for artificial surfaces) and a thematic resolution of 20 land use/cover categories, for the reference year of 2006 +/- 1.

The large spatial coverage, the cross-comparability and the high spatial and thematic resolution yields a high analytical potential for these maps. This potential can be even more amplified if the maps are used to store a population attribute. An attribute like residential population could broaden the range of uses of the Urban Atlas dataset, contributing to assessments in different thematic fields such as urban quality of life, urban morphology, or vulnerability to different hazards.

The estimation was done through an areal interpolation procedure whereby population counts at a given 'source' geometry were transferred to the 'target' geometry, i.e. the Urban Atlas polygons. The transfer of the population counts from the source to the target geometry was done by means of GIS operations, and automatized through scripting in ArcGIS/Python environment.

The source data varies from country to country. For each country of the EU-27, the highest resolution source of population was used, subject to availability. As preferred option, high resolution bottom-up grids (< 1 km cell size) were chosen as source data. Bottom-up grids refer to population values assigned to grid systems of regular squared cells, usually based on geo-referenced register data or obtained by field surveys/census produced by national statistical offices. Such grids were only available for Denmark, Finland, Sweden, and Slovenia. Therefore, for the remaining countries, other sources of population data were sought, namely census tracts (Belgium, England and Wales, Netherlands, and Spain), 1 km bottom-up grids (Austria, France, and Portugal), and commune

boundaries (all remaining EU-27 countries). In addition, the Soil Sealing layer 2006 – also available Europe wide – was taken as a proxy for population density, and thus used to derive weights to redistribute population totals from the source to the target geometries.

The paper further details the method and assumptions used in the disaggregation procedure and examines the results obtained. The final focus of the paper is a validation exercise for the case of Madrid, Spain, for which several sources of population data of varying resolution were available. This exercise allowed us to understand how the resolution of the source data influences the accuracy of the final disaggregated maps.

Figure 1 depicts an example of the input and output of the work done.

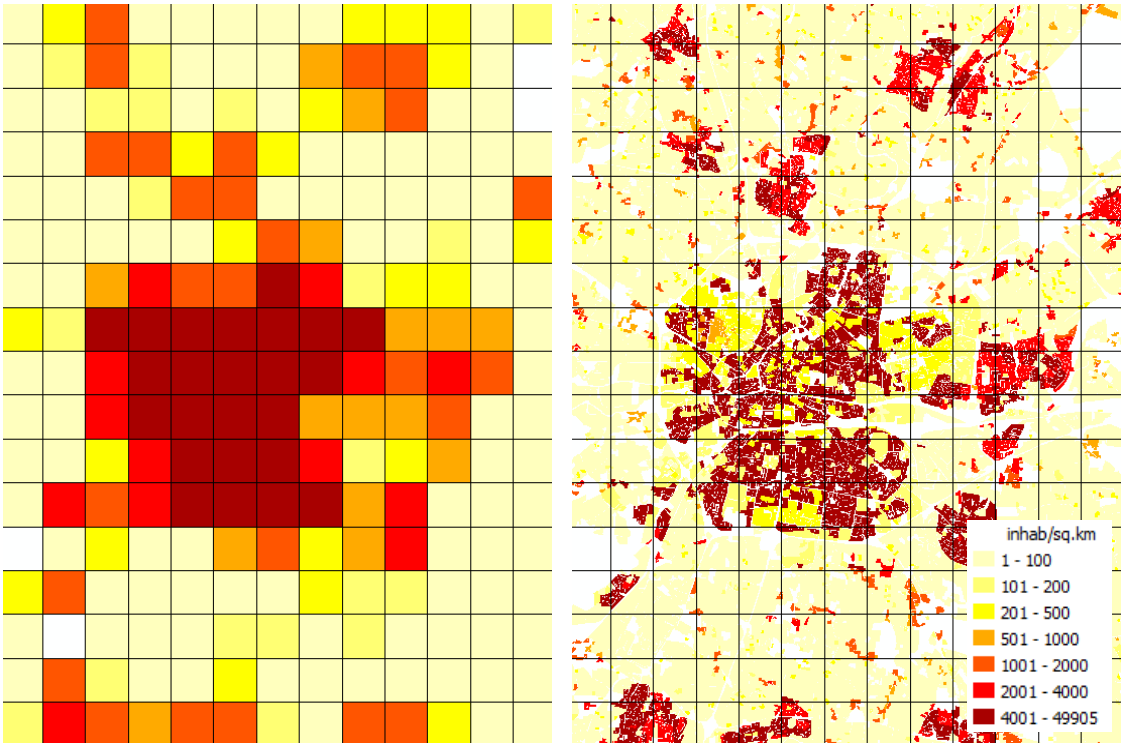

Figure 1. Disaggregation operated for Rennes, France. On the left, source population aggregated to a 1 by 1 km grid. On the right, the final result of the disaggregation. For visual comparison reasons, population is expressed as nr. of inhabitants per square kilometre in both left and right images.