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German Grid Cell Database: From Spatial to Statistics

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Abstract:

A new operative method for the generation, processing and maintenance of accessibility areas from given Points of Interest (POI) is presented as the result of a cooperative research and development project. After the scientific and technical analyses of different accessibility concepts an automatized and innovative processing infrastructure including an integrated management system was developed and installed. Its scope, methodology and features are described below.

Official statistics on living conditions have raised a growing demand for small area data in terms of comparability. In the past, suitable data and defined processes for their generation, maintenance and merging with statistical information were lacking. Integration of geospatial information and statistics are required both to support and monitor evidence-based policy in social, economic, environmental and sustainability scopes, with respect to harmonization of living conditions e.g. access to healthcare, education, work and wealth.

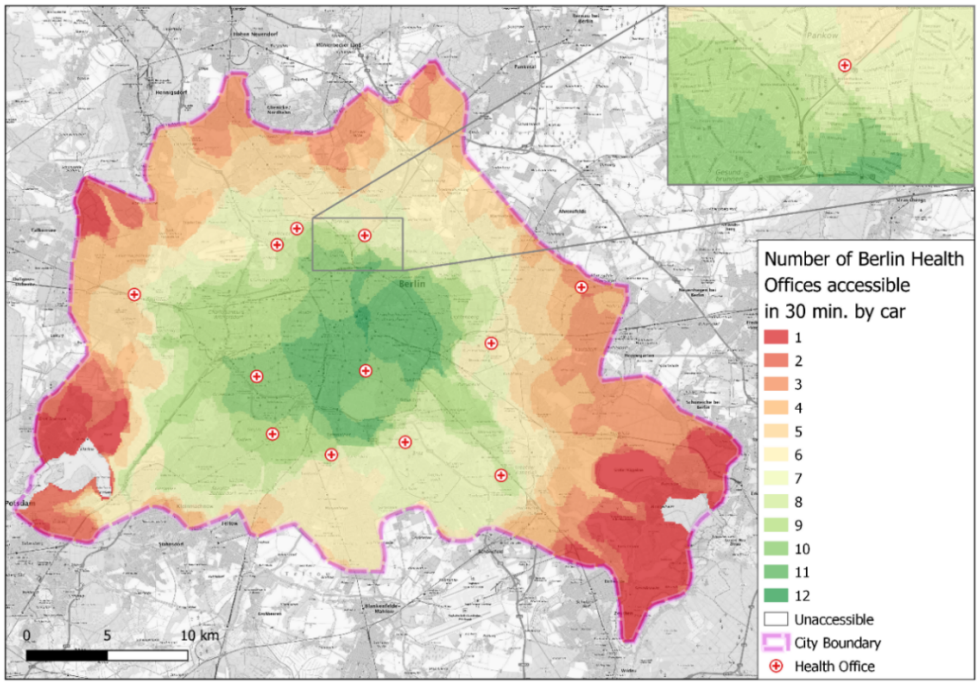

Figure 1. Number of Berlin Health Offices accessible in 30 minutes by car.

Determining accessibility areas helps to answer relevant questions on spatial scales such as “Who can reach what, where, and how in what time?” However, analysing, comparing or merging data from different spatial units requires a defined reference scale. Objective of the German Grid Cell Database project was to develop and install permanent IT infrastructure that allows for the operative and automatized processing of geospatial data (points-of-interest) and the calculation of accessibility data on the standardised European INSPIRE 100-metre grid. Results can be easily aggregated with existing statistics and geodata throughout Germany.

Thereby, users can choose from a given variety of several POI categories, e.g. infrastructure (airports, stations, etc.), industry (chemical parks, power stations, etc.), basic services (schools, hospitals, etc.), others (ATM’s, battery-charging stations, etc.) or upload their own POI datasets. Calculations of accessibility areas are performed by proved and

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established RoutingPlus service routing algorithms (based on Openrouteservice) of the Federal Agency for Cartography and Geodesy. The latter offers routing profiles for car and pedestrian, uses automatically updated network routing data and performs in a very fast and effective way. The resource-intensive accessibility computation is implemented as an asynchronous workflow, including an automatized order and job storing queue system. Resulting isochrones for pedestrian (in metre) or car (in minutes) are then merged with the 100-metre grid. As a basis the Python framework Django was used, since it offers important features such as a logging and user system.

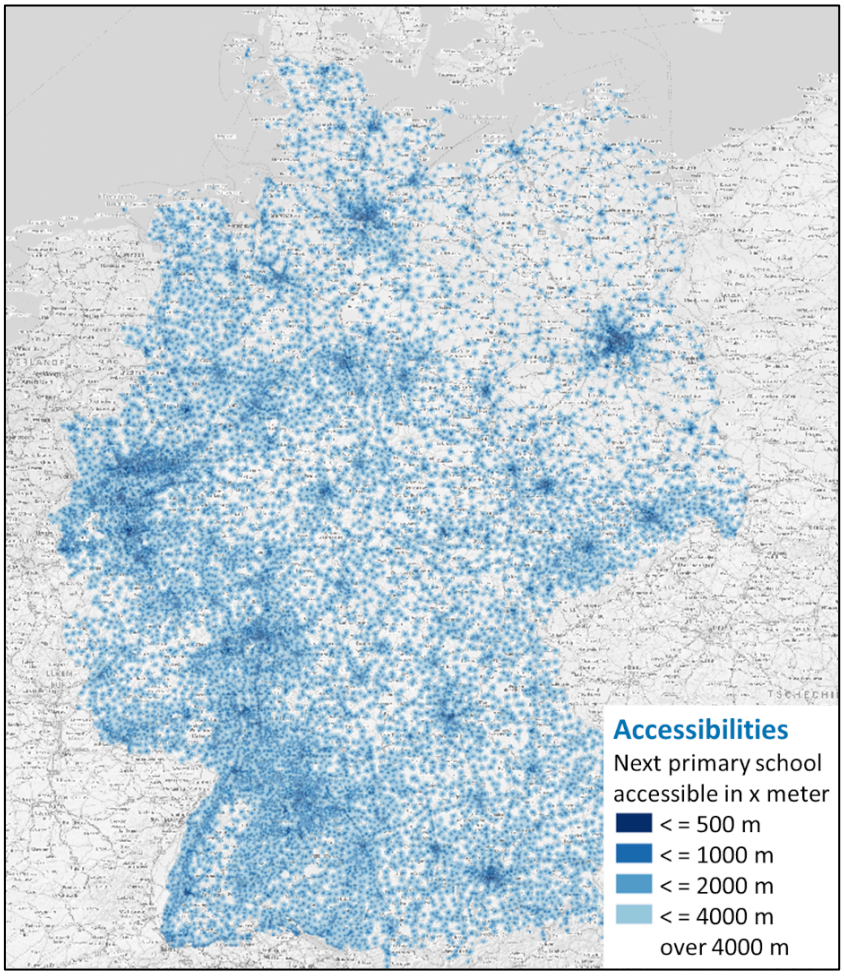

Figure 2. Primary Schools accessible within 4 kilometres throughout Germany

Results contain information and numbers of reachable points-of-interest by car or foot in a given time or distance for each of the 38 million German grid cells with unique cell IDs as reference geometries. Additionally, the developed integrated management framework allows for administration of an initial stock of data, supervision and monitoring of user generated data from various subjects via a user-friendly browser application. Furthermore, it supports managing data life cycles (new data, update, archiving, historization, possible erasure), it also enables the use and storage of metadata and corresponding subset functions as well as it offers users the option of a convenient download of the resulting data.

The grid cell database offers the potential to create value-added products by the combination of multiple data sets that can help analysing circumstances, infrastructure and supply in a detailed spatial context. Its resulting data is suitable for comparing living conditions between rural and urban areas, investigate regional and national coverage of basic services (e.g. schools, surgeries and institutions) (see Fig. 1 & Fig. 2), usable for crisis prevention and management and monitoring policy impact and evaluation. Possibly, using accessibility information can help to uncover nuisance and might improve access to healthcare, education or can reduce inequality conversely, it eventually contributes for the achievement of sustainable development goals.

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