Canton of Zurich
Statistics Office

Day Time Population Canton of Zurich

Statistics Canton of Zurich calculated a high resolution day time population based on Swiss census data 2000. With the main focus on visualization techniques, 2D and 3D-maps as well as interactive and animated applications have been published.

Day time population models are quite present today. How population is distributed over space and time is essential for hazard preparedness planning. As well it gives interesting insights in the massive daily population flow and allows to monitor the mutual dependency of housing settlements, transportation means, business, industrial and other infrastructures. Starting with a simplified day time distribution, our first goal was to create visualizations for the web user. An updated, more realistic and temporally more differentiated model of a day time population will be based on a combination of different data sources.

Location of People during Daytime

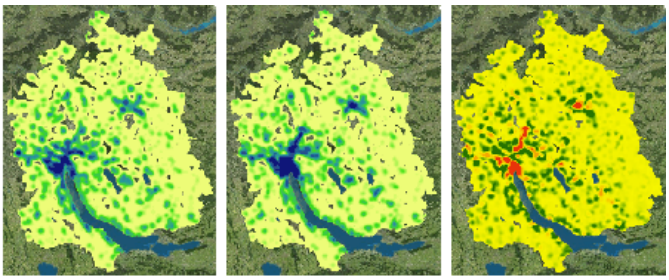
The Swiss Census 2000 is a complete inventory of the population and holds not only residential but also working and school address information.

Daytime population canton of Zurich is based on individual locations:

- place of work of employed people (outside of residence)
- school locations of scholars and students (outside of residence)
- not commuting persons (unemployed, retired persons, young children)
- persons from outside the region commuting in for work or school

Not considered are movements for shopping, cultural events, recreation, sports, movements during work or school and locations during transport. Our basic day time population characterizes best a situation around 10 in the morning on weekdays.

Hotspot Maps of Population Density

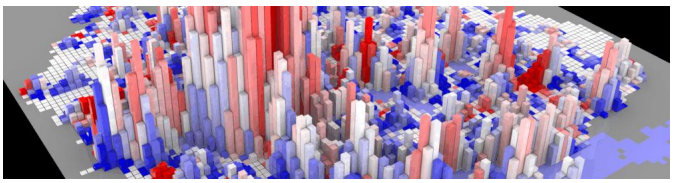


population density by night | population density by day | change: day minus night

Density maps: night time population, day time population, differences. (kernel density estimation).
Graph: Statistics Canton of Zurich; Source: Swiss Census 2000, FSO

The 1,2 mio residents of the Canton of Zurich build our night time population. During daytime nearly 100'000 people more are in the area. Hot spot maps (kernel density estimation) transform all these individual locations into a continuous statistical surface of the population density. The maps are calculated for different generalization levels and transformed into a GoogleMaps application.
Nighttime distribution shows the many villages and cities where people live. Daytime distribution appears in a more concentrated pattern. The third map shows the calculated difference between day and night. The regions loosing people during daytime are marked in green and identify residential areas. The red hotspots show areas that gain people and stand for highly frequented working and business areas.

Interactive and animated 3D-Models

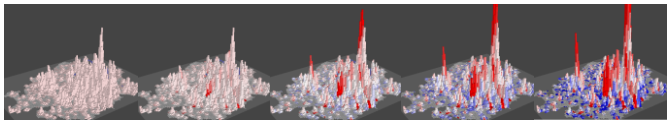


Day time population grid: quantity and quality: residential or working area ?
Graph: Statistics Canton of Zurich (StructureSynth, Sunflow); Source: Swiss Census 2000, FSO

Better visualization of the quantities, particularly of extreme values, can be achieved with 3D-models. We used a high quality rendering and a color key that indicates in blue residential areas loosing people during the day and in red business or working places, that gain daytime population. The intensity of each color corresponds to the ratio of the night to day population. The intenser the colors, the more likely the area is either a pure residential or a pure working zone. The absolute quantities shown in the height of the bars of the displayed images correspond to the daytime population in a 250x250m grid.

24 hour 3D-Population Density Animation

For a better comparison of the two calculated 12 hour peaks and the understanding of the population flows we interpolated the values between day- and nighttime situation in order to get a continuous animation over 24 hours. This does not lead to correct situations at any time of the day, but helps to study the spatial and temporal movements in detail. The film starts with the night situation in rose. Then population stacks grow or diminish until daytime peak is reached and the colors have the maximum intensity.

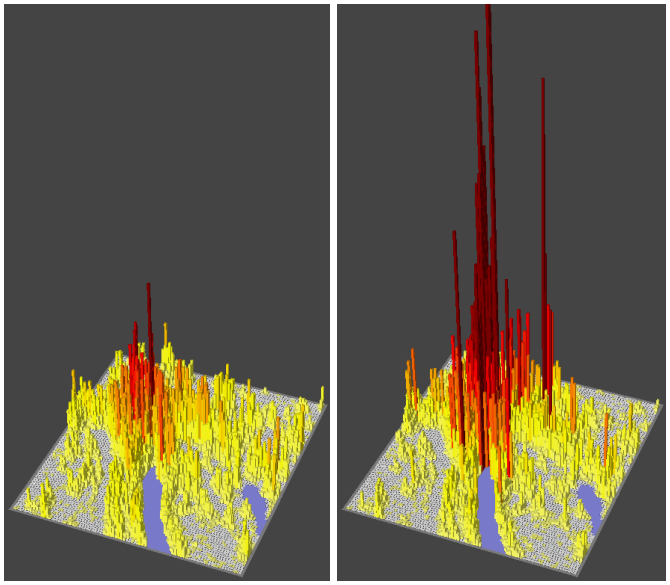


24 hours animation of night to daytime population distribution
Graph: Statistics Canton of Zurich; Source: Swiss Census 2000, FSO

Night and Daytime Population City of Zurich

The peak columns in Zurich (250mx250m) reach impressive heights, particularly in the city of Zurich. Due to the address coding of the school locations, most university students and employees are located at the same, central address, although in reality the university campus is located all over Zurich. The address quality is one of the problems in the datasource.

A characteristic of static 3D-visualizations is that foreground elements always hide some information in the background of the picture. Several view angles may help a bit. We used an interactive 3D-viewer to enable the web user to rotate and zoom in and to explore the model from different viewpoints. StructureSynth was used to generate 3D-structures, Sunflow for the rendering and JavaView for the interactive visualization applet.



3D-Model: nighttime and daytime population city of Zurich, 250x250m
Graph: Statistics Canton of Zurich (StructureSynth, Sunflow); Source: Swiss Census 2000, FSO

Data Sources for a Daytime Population 2010

Future Swiss census will be annually register based counts focused on basic information like age, sex, nationality. Topics like social structure, education, households, commuting behaviour, employment will be raised by sampling methods. To distinguish between residents leaving home (for work, school or other purposes) and residents not leaving, a discriminant analysis would be used. Multiple sources like census of enterprises, school statistics of the department of education and the Zurich traffic model, holding data about spatial distribution of cultural, shopping and other attractors, add the daytime locations of the people. Estimated parameters can be optimized then by a fit method to balance the distribution.

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