CRISMA

Modelling crisis management for improved action and preparedness

DynaPop-X: A population dynamics model applied to spatio-temporal exposure assessment

Implementation aspects from the CRISMA project

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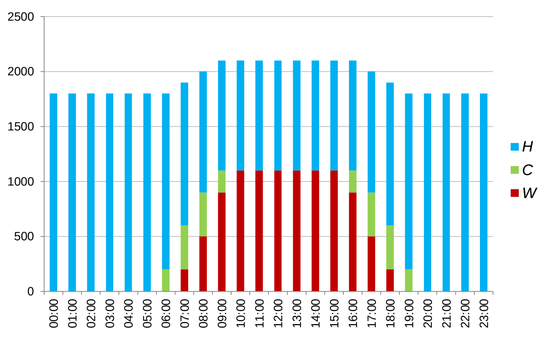
Abstract: In the context of proactive disaster risk as well as immediate situational crisis management knowledge of locational social aspects in terms of spatio-temporal population distribution dynamics is considered among the most important factors for disaster impact minimization. This applies to both the pre-event stage for designing appropriate preparedness measures and to acute crisis situations when an event chain actually unfolds for efficient situation-aware response.
The presented **DynaPop** population dynamics model is developed at the interface of those interlinked crisis stages and aims at providing basic input for social impact evaluation and decision support in crisis management. The model provides the starting point for assessing population exposure dynamics – thus here labeled as **DynaPop-X** – which can either be applied in a sense of illustrating the changing locations and numbers of affected people at different stages during an event or as ex-ante estimations of probable and maximum expected clusters of affected population. **DynaPop** is implemented via a gridded spatial disaggregation approach and integrates previous efforts on spatio-temporal modeling that account for various aspects of population dynamics such as human mobility and activity patterns that are particularly relevant in picturing the highly dynamic daytime situation. We will present ongoing developments particularly focusing on the implementation logic of the model using the *emikat* software tool, a data management system initially designed for inventorying and analysis of spatially resolved regional air pollutant emission scenarios.

[*for references please check EGU2014-1932 in the Geophysical Research Abstracts Archive*]

Population Dynamics → Exposure → Evacuation Planning – Casualty Assessment

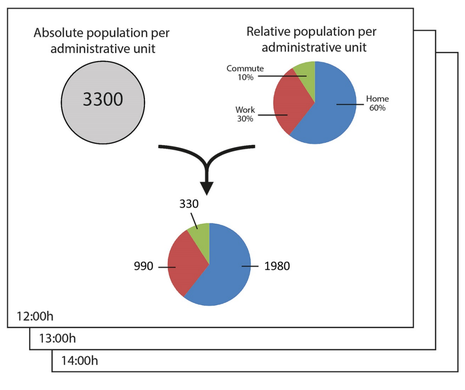
*Due to human activities and mobility, both **distribution and density of population** **vary greatly in the daily cycle***

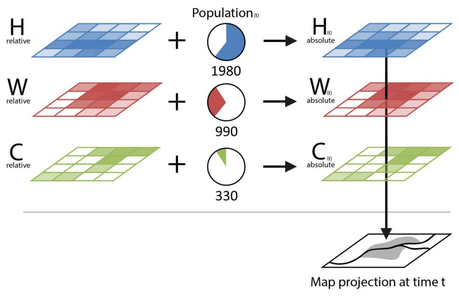


Work (W): represents the number of people working at a certain time unit
Commuters (C): represents the number of people commuting at a certain time unit
Home (H): represents the remaining number of people

The graph to the left illustrates the potential change of total population numbers per administrative unit over the day due to people commuting in and out of the area.

In addition to the varying total population numbers, implicit information on the dynamic changes of people's location is required (here illustrated exemplary in simplified form for ***Work***). Statistics based on **time use surveys** (and – more experimental – VGI) offer such information. Further activities to be considered include *study*, *eating*, *shopping*, *leisure*, etc.

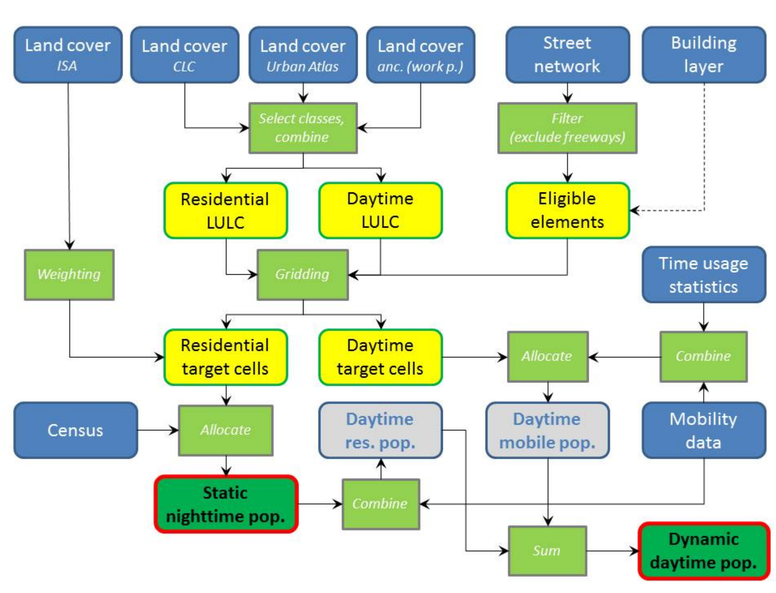




The final step is a weighted distribution of the population per location (**H**, **C**, **W**) and per pre-defined temporal unit (e.g. hourly steps), accounting for the corresponding target zones and density parameters (housing, transportation, workplaces).

*Output is a **spatio-temporal population density grid** featuring a cell size of 100m and 1h time slices – in a hazard context this then becomes **DynaPop-X***

DynaPop – Conceptual Workflow



Current work-in-progress includes the *integration of Volunteered Geographic Information (VGI) and time use statistics* in order to account for more specific and diverse human activity patterns as well as different temporal variations (e.g. weekends).

DynaPop** is being implemented in the CRISMA framework going **beyond population exposure dynamics

*In a set of pilot studies (e.g. earthquake and cascading events L'Aquila, Italy & coastal flooding Charente-Maritime, France) **DynaPop-X** also serves as input for **evacuation models** and **casualty assessments***

CRISMA Consortium

The CRISMA project (www.crismaproject.eu) is coordinated by VTT Technical Research Centre of Finland. The consortium counts 17 partners from 9 countries, representing end-users, research and industry. The project ends in August 2015.

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