Spatiotemporal patterns of population distribution as crucial element for risk management

Karin Gokesch (1), Catrin Promper (1), Cees J. van Westen (2), and Thomas Glade (1)

(1) Department of Geography and Regional Research, University of Vienna, Austria. Contact: karin.gokesch@univie.ac.at

(2) Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, Enschede, The Netherlands.

Introduction

Detailed information on spatiotemporal population distribution is a crucial element of natural hazard risk management. Regarding evacuation and adequate response in case of emergency related to fast onset hazards, knowledge on the exact location of the population affected is imperative. Population distribution not only changes on different days, e.g. schooldays or weekends, but also on an hourly basis related to different groups of people, for example pupils or employees. These changes need to be accounted for in assessing population vulnerability. This study presents a method for assessing population distribution change on an hourly basis thus pointing out different "hot spots" of population aggregation for each hour of an average schoolday and weekend.

Study area

The study area is located in the city of Waidhofen/Ybbs situated in the correspondent municipality in Lower Austria. The hourly analysis was carried out for the center of the city, where, besides including the main infrastructure, e.g. hospitals or nursery homes, also several schools, office buildings and residential houses as well as a combination of the different uses are located. Furthermore, the city center of Waidhofen/Ybbs also serves as the cultural capital of the region, thus attracting numerous tourists and guests who stay in several hotels in the area.

Methods

The analysis method applied here is an advancement of the calculations done in poster B337 (abstract EGU2014-10815) and resolves the spatial distribution of the population on an hourly basis. To obtain such detailed information, specific data on the opening hours of shops and offices, the school hours as well as the hours of church service and other public institutions were assessed. The average household size was included for residential buildings using the previously calculated data. For infrastructural buildings a full occupancy at all times was assumed. The respective number of people in the different buildings was then calculated for each hour of an average schoolday (also representing workdays) as well as for an average weekend (also representing holidays).

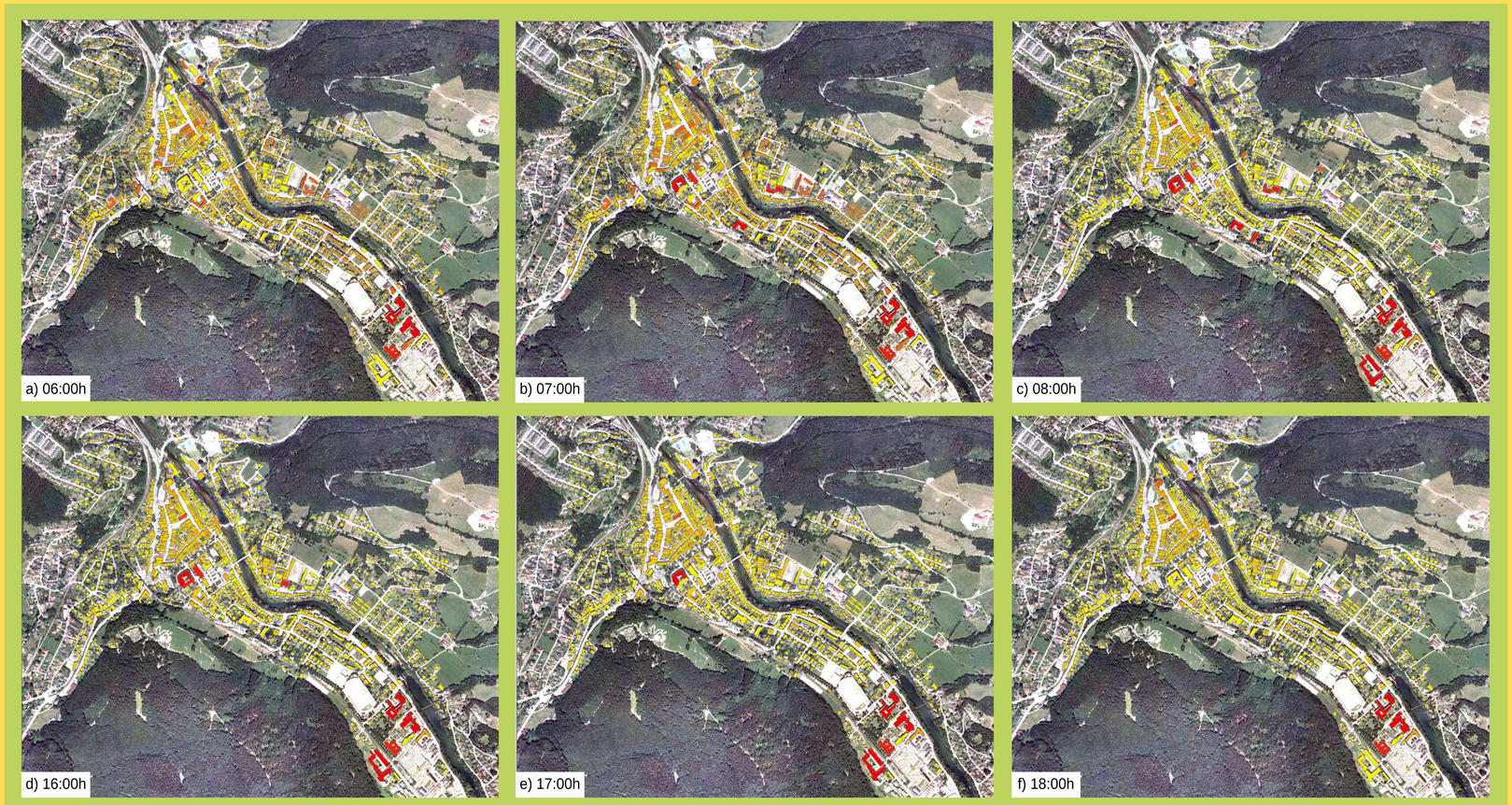
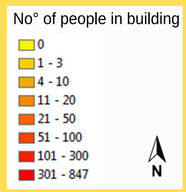


Fig. 1: average schoolday - Population distribution (a - c) 06 :00 - 08:00h, (d - f) 16:00 - 18:00h. (sources see poster B377)

Fig. 2: average weekend - Population distribution (a - c) 10:00 - 12:00h. (sources see poster B377)

Results & Discussion

The detailed time-series obtained by the hourly assessment of the population distribution represents the spatiotemporal changes of population over a certain time-period. Distinctive changes in patterns of population could be assessed for the early morning hours, when people leave their homes to got to work or school (Fig. 1 a - c) as well as for the evening hours when they return home (Fig. 1 d - f). For weekends rather less drastic changes were detected. However, a shift in population density at certain locations, according to church service, could be identified (Fig. 2 a - c). Besides the changes in distribution related to daily work- and educational migration, significant differences between the spatiotemporal patterns of population distribution between schooldays and weekends could be detected.



Conclusions

The analysis of the hourly population distribution revealed distinct patterns of spatiotemporal change in population density. This information not only gives further evidence on the likely locations of the people affected, but also helps prioritize emergency actions and fast response to natural hazards, thus being a crucial part of a thorough risk management.

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