

The Research Group Cartography and GIS

has the honor to invite you to the public defense of the PhD thesis of

Tomas CROLS

to obtain the degree of Doctor of Sciences

Title of the PhD thesis: Integrating network distances into an activity based cellular automata land-use model - Semi-automated calibration and application to Flanders, Belgium

Promotors: Prof. Dr. Frank Canters Prof. Dr. Roger White (Memorial Univ. of Newfoundland)

The defence will take place on

Friday 1 September 2017 at 16:00 h

in Auditorium D.0.05 at the campus Humanities, Sciences and Engineering of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene, and will be followed by a reception.

Members of the jury:

Prof. Dr. Matthieu Kervyn (chairman) Prof. Dr. Kobe Boussauw (secretary) Dr. Lien Poelmans (co-promotor, VITO) Prof. Dr. David Bassens Prof. Dr. Cathy Macharis Prof. Dr. Anton Van Rompaey (KUL) Prof. Dr. Nuno Pinto (Univ. of Manchester)

Curriculum vitae

Tomas Crols (born on 26 October 1987 in Mechelen, Belgium) obtained his MSc in Geography at the Vrije Universiteit Brussel in 2010. In December 2011. he started his PhD after obtaining a scholarship of the Flemish Institute for Technological Research (VITO), where he worked within the Environmental Modelling Unit. Tomas is first author of 2 peerreviewed publications and presented at 5 international conferences. Since April 2017, he is a research fellow at the School of Geography of the University of Leeds, where he models daily human routines with an agentbased model.

Abstract of the PhD research

A strong population growth, extended transportation networks and a lack of structured spatial planning have all caused strong urban sprawl in a large number of regions worldwide. Until recently, 6 ha of open space were transformed per day into non-natural land uses in Flanders, Belgium. Mapping and modelling of these land-use changes may support the government in tackling the problems related to urban sprawl and in controlling the urban sprawl phenomenon.

Cellular automata (CA) models allow to explicitly handle spatial interactions between different land-use categories. Recently, a more straightforward, activity-based CA model (ACA model) for urban dynamics was proposed, which directly models spatial changes in the values of different 'activities' (population and employment in several economic sectors). The complex spatial structure and the strong mixing of functions of Flanders can be better represented by this model than by a regular land-use change model.

The main goal of this research was to further enhance this ACA model and apply it to simulate the impact of alternative policy scenarios on the spatial development of a region, with Flanders as the key application. Several model improvements were accomplished: firstly, the model was extended with the option to calculate long distances along a transportation network using a variable grid approach. Next, changes were proposed to the model equations that determine the activity densities in the model.

To calibrate the model, input maps for the past were computed by combining maps of the present with data available from remote sensing. The resulting time series of population maps provides a good insight into the evolution of population in Flanders and Brussels after 1986. Next, a semiautomated methodology was developed to calibrate the model. Finally, different scenarios of future land use in Flanders until 2050 were examined. The white paper of the Spatial Policy Plan for Flanders proposes to limit future land take to places with good public transport accessibility and proximity to services. The effects of this land-take neutral scenario were compared with a business-as-usual scenario.