J170-P003 **Room: Poster Session Hall** **Time: May 20**

Neighborhood interaction at different stages of urban growth

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Urban geosimulation modeling has become an effective approach to understand the mechanism and spatial process of urban growth at a micro-scale. More importantly, such urban geosimulation models can be used to predict urban form and structure for the future by inheriting the mechanism of urban growth in past time. Neighborhood interaction is one vital component in Cellular Automata (CA) - based urban geosimulation models. Many methods have been proposed to understand the interaction towards the construction of sophisticated urban models. These efforts mostly focused on the calibration of neighborhood interaction of certain stage of urban growth. However, characteristics of the neighborhood interaction at continuous different stages of urban growth have not been touched. The objective of this research is to clarify characteristics of neighborhood interaction of spatial process of urban growth at continuous different stages using the Tokyo metropolitan area as a case study. Herein urban growth in the Tokyo metropolitan area is divided into four stages: 1974 to 1979, 1979 to 1984, 1984 to 1989, and 1989 to 1994 according to the available dataset. And at each stage the study area is resampled into 100 by 100m cells. A method based on the integration of Tobler's First Law of Geography (FLG) with Reilly's gravity model and coupled with a logistical regression approach is used to calibrate the neighborhood interaction for each stage of urban growth. All of four changed active land-use types (i.e. vacant, industrial, residential, and commercial) at each stage are sampled except that in the area with distance less than 600 m to the boundary of study area. A random sampling is implemented for undeveloped cells. For unbiased parameter estimation, the number of sampled undeveloped cells is equal to that of sampled cells of active land-use types. The result of calibration of neighborhood interaction at different stages is compared with each other. The results illustrate that neighborhood effect of urban land-use types on one active land-use type differ from that on other active type. Although the coefficients of calibration for one changed land-use type are a little different between different stages, the general trend of neighborhood effect of urban land-use types on it keeps same. The little difference would come from sample errors. The results also indicate that neighborhood interaction in certain period keep sable. This research confirms the utility of the adopted method in capturing the neighborhood effect. Further, the results provide an empirical evidence for urban geosimulation models to predict urban form and structure in the future based on the result of calibration using past dataset.