Calibration of a Spatialized Urban Growth Model - Submission to PLOS Journals

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Abstract

Introduction

Urban Systems are complex socio-technical objects

Materials and Methods

The urban growth model

Indicators

As our model is only density-based, we propose to quantify its outputs through spatial morphology, i.e. characteristics of density spatial distribution. We need therefore quantities having a certain level of robustness and invariance. For example, two polycentric cities should be classified as morphologically close whereas a direct comparison of distributions (Earth Mover Distance e.g.) could give a very high distance between configurations depending on center positions. To tackle this issue, we refer to the Urban Morphology Analysis litterature which proposes an extensive set of indicators to describe urban form [1]. The number of dimensions can be reduced to obtain a robust description with relatively independant indicators [2]. For the choice of indicators, we follow the analysis done in [3] where a typology of large european cities is obtained in consistence with qualitative knowledge. Let denote $(P_i)_{1 \leq i \leq N}$ the population of cells, sorted in decreasing order, and d_{ij} the distance between cells i, j. The indicators are the following :

1. Rank-size slope, expressing the degree of hierarchy in the distribution
2. Distribution Entropy

$$\mathcal{E} = \sum_{i=1}^{N} P_i$$

Results

The model was implemented in NetLogo [4] for profiling, computation of indicators being delegated for performance reasons to a R script using the dedicated `raster` package [].

Generation of urban patterns.

Model Behavior

In the study of such a computational model of simulation, the lack of analytical tractability must be balanced by an extensive knowledge

Convergence

Exploration of parameter space

Statistical analysis.

Model Calibration

Real Data We use the population density grid provided openly by

Calibration Process

Discussion

Integration into a multi-scale growth model

Conclusion

Supporting Information

S1 Figure

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Acknowledgments

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