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An improved radiation model and its applicability for understanding commuting patterns in the USA

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Several empirical models aimed at describing human mobility have been proposed in the past. Most of them are based on an unjustified analogy, with concepts and models borrowed from physics: gravity and vector or scalar fields. Recently however, statistical physicists introduced a new category of models motivated by simple and reasonable socioeconomic assumptions. The Radiation Model (RM) [1] and the Radiation Model with Selection (RMwS) [2] are two of such successful approaches. In these models, the salary a job pays and the commuting distance to it are the most important variables. In RM, the main hypothesis is that a worker will commute to the closest distance where he/she can improve his/her current income. If we assume now that the jobseekers are selective in their choices and they are willing to accept better offers only with a probability smaller than one, we get the RMwS model. Alternatively, the assumption behind this generalization can be interpreted as a fact that the jobseekers are aware only of a fraction of the available job offers. Recently a novel variation of the RM model was proposed, where one takes into account also the distance dependent travel costs. This new model, the Travel Cost Optimized Radiation Model (TCORM) [3] was already successfully tested for commuting patterns in Hungary. Here we use a much larger commuter dataset from USA, and critically compare the performance of the RM, RMwS and TCORM approximations. We find that the TCORM offers an improved description for the experimentally measured commuting patterns.

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