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Modelling adaptive behaviour in spatial agent-based models: coastal cities and climate change

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Abstract: A major part of world population lives in coastal and delta areas threatened by adverse consequences of climate change (increasing probabilities or severity of floods and hurricanes). It might lead to a forced displacement of up to 187 million people in coastal zones. Still, exposure and vulnerability in coastal areas rapidly escalate due to the clustering of population and growth of property values in flood-prone areas. Land markets driven by individual location preferences are crucial in the formation of spatial patterns of activities and the economic value they receive. Under the conditions of uncertainty where probabilistic disasters and rich amenities are spatially correlated, a choice where to live is largely affected by individual risk perceptions. The latter, however, are known to be subjective, biased and dynamic with awareness escalating immediately after a disaster and vanishing with time. It is argued that with more frequent disasters occurrences under climate change areas that are currently attractive will experience a mass outmigration and abrupt fall of prices. To design effective adaptation strategies governments need to understand cumulative consequences of individual behavioural changes for a region as a whole. We present a spatial agent-based housing market model calibrated for a coastal town in North Carolina, USA. We integrate a bilateral market model into an empirical GIS landscape. Heterogeneous households sell and buy houses and update price expectations based on the recent market trends. We present aggregated trends of rising housing prices and change in the spatial patterns of prices for a scenario with climate-driven increases in hurricane risks and dynamic risk perceptions. We discuss the modelling choices related to operationalizing of adaptive behaviour of households in our spatial agent-based model and data sources used.

Keywords: *climate change, agent based model, price expectations, housing market, risk perception.*