



Stimulating household flood risk mitigation investments through insurance and subsidies: an Agent-Based Modelling approach

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In the period 1998-2009, floods triggered roughly 52 billion euro in insured economic losses making floods the most costly natural hazard in Europe. Climate change and socio/economic trends are expected to further aggravate floods losses in many regions. Research shows that flood risk can be significantly reduced if households install protective measures, and that the implementation of such measures can be stimulated through flood insurance schemes and subsidies. However, the effectiveness of such incentives to stimulate implementation of loss-reducing measures greatly depends on the decision process of individuals and is hardly studied.

In our study, we developed an Agent-Based Model that integrates flood damage models, insurance mechanisms, subsidies, and household behaviour models to assess the effectiveness of different economic tools on stimulating households to invest in loss-reducing measures. Since the effectiveness depends on the decision making process of individuals, the study compares different household decision models ranging from standard economic models, to economic models for decision making under risk, to more complex decision models integrating economic models and risk perceptions, opinion dynamics, and the influence of flood experience.

The results show the effectiveness of incentives to stimulate investment in loss-reducing measures for different household behavior types, while assuming climate change scenarios. It shows how complex decision models can better reproduce observed real-world behaviour compared to traditional economic models. Furthermore, since flood events are included in the simulations, the results provide an analysis of the dynamics in insured and uninsured losses for households, the costs of reducing risk by implementing loss-reducing measures, the capacity of the insurance market, and the cost of government subsidies under different scenarios. The model has been applied to the City of Rotterdam in The Netherlands.