



COASTMOVE: A global agent-based model of adaptation and migration decisions in face of sea level rise

Lars Tierolf,¹ Toon Haer¹, Wouter Botzen¹, Lena Reimann¹, Jens de Bruijn¹, Jeroen Aerts¹

¹Institute for environmental studies, Vrije Universiteit, Amsterdam, the Netherlands

Context

Sea-level rise (SLR) and socioeconomic trends are increasing the population and assets exposed to extreme coastal flood events in the coming decades. People residing in communities experiencing this increase in coastal flood risk may choose to **stay and adapt** their homes, or to **migrate** towards safer areas. However, these migration decisions are influenced by many socio-economic and environmental factors. For example, current assessments of SLR adaptation and migration do often not address risk perceptions of residents related to different environmental risks, such as flooding and erosion.

In this study, we aim to improve the representation of the dynamics of adaptive behaviour of coastal communities in flood risk assessment by including **human behaviour** and its effect on **adaptation decisions**, in face of SLR. Therefore, we develop a **global agent-based model** and simulate adaptation- and migration decisions of households facing coastal environmental risks until the year 2080. The model will be first parameterized and calibrated for France.



Coastal erosion in East Riding of Yorkshire, England (Wikimedia Commons)



Coastal flooding following storm Xynthia in Fouras, France (Wikimedia Commons)

Methodology

For this research we will develop an agent-based model capable of simulating both **adaptation- and migration decisions** of households in coastal communities on the global scale. The model consists of a **flood risk module** simulating changes in coastal flood risk driven by SLR, and a **behavioural module** simulating household decisions (e.g. adaptation of houses, migration) based on subjective expected utility theory.

- **Spatially explicit household agents** in the 1/1000yr flood zone of 2100.
- **Aggregated household agents** in the regional nodes. Here information on income, population composition and amenity values is stored.
- Households make decisions based on **subjective expected utility theory**. Decisions are explicitly modelled in the coastal zone. A **gravity-based approach** is applied to model migration from the regional nodes.

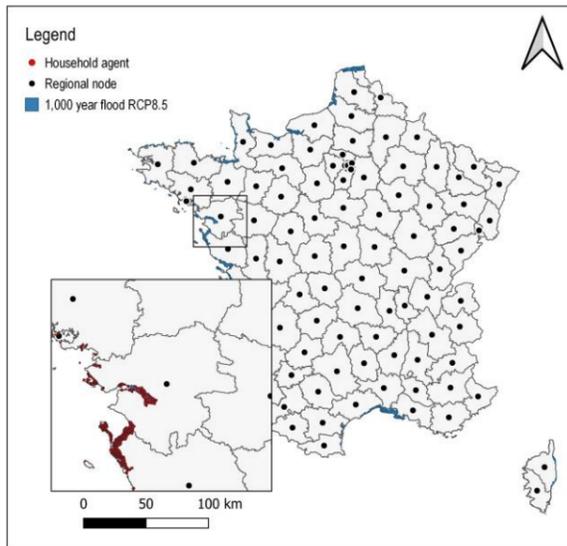
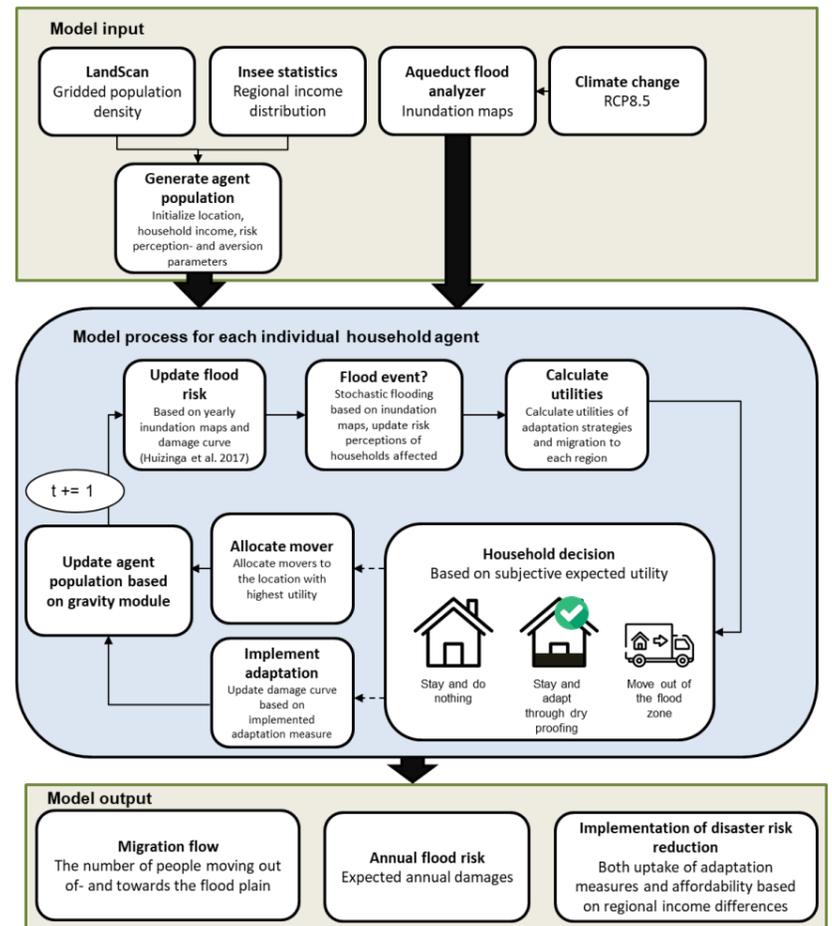


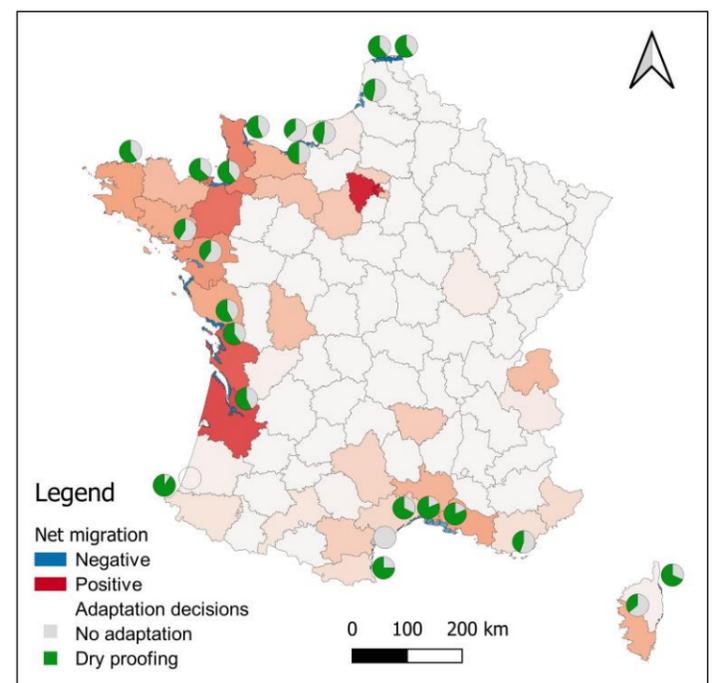
Figure showing household agents and regional nodes in the model application to France.

Modelling framework



Schematic representation the model process for household agents in the coastal zone

Preliminary model output



Preliminary model output. Shadings of red and blue indicate net migration, pie charts show fractions of simulated adaptation measures in the 1/100yr flood plain. The model will be calibrated and validated using empirical data on adaptation measure uptake and regional migration flows.



Lars Tierolf MSc
PhD researcher
t: +31 20 59 83308
e: lars.tierolf@vu.nl
i: <https://research.vu.nl/en/persons/lars-tierolf>

IVM INSTITUTE FOR ENVIRONMENTAL STUDIES
VU University Amsterdam
De Boelelaan 1085 (visiting address)
De Boelelaan 1087 (postal address)
1081 HV Amsterdam