

Accounting for co-evolutionary interactions between human and water systems

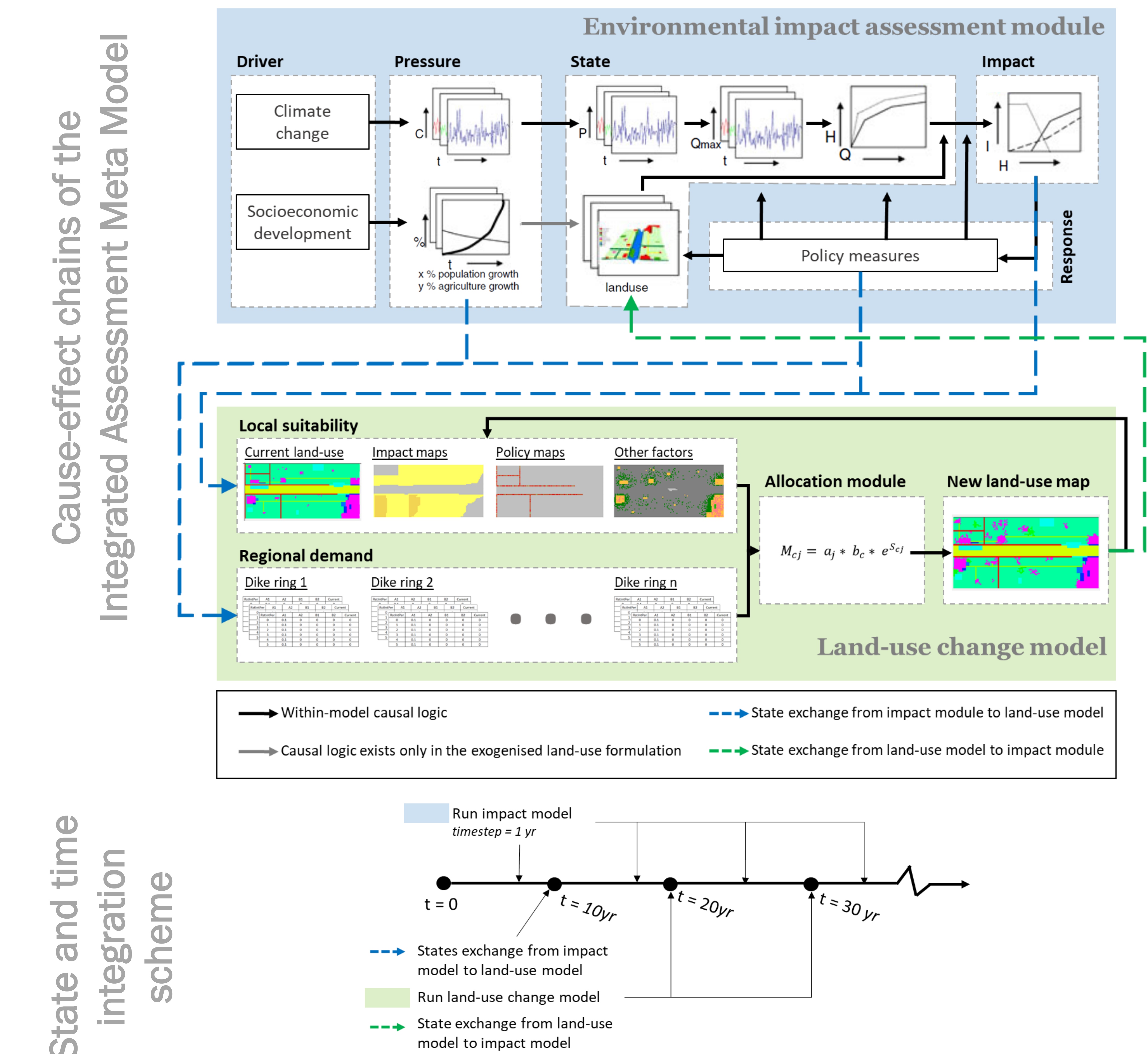
A spatially explicit, loosely-coupled hydrological and land-use model

Bramka Arga Jafino
Jan Kwakkel

Research background & objectives

- Land-use change dynamics often treated as exogenous in model-based climate adaptation studies
- Providing a proof of concept of endogenising land-use change dynamics in an integrated assessment model
- Investigating the implications of endogenising land-use change dynamics to the model outcomes
- A soft policy measure in the form of land-use based zoning policy is introduced into the policy portfolio of the model

Case study: Hypothetical Waas River



Results

We evaluate three outcomes based on the original Waas case study:

- Timing of adaptation tipping point
- Cumulative damage from floods
- Cumulative urban area flooded
- Cumulative damage to agriculture

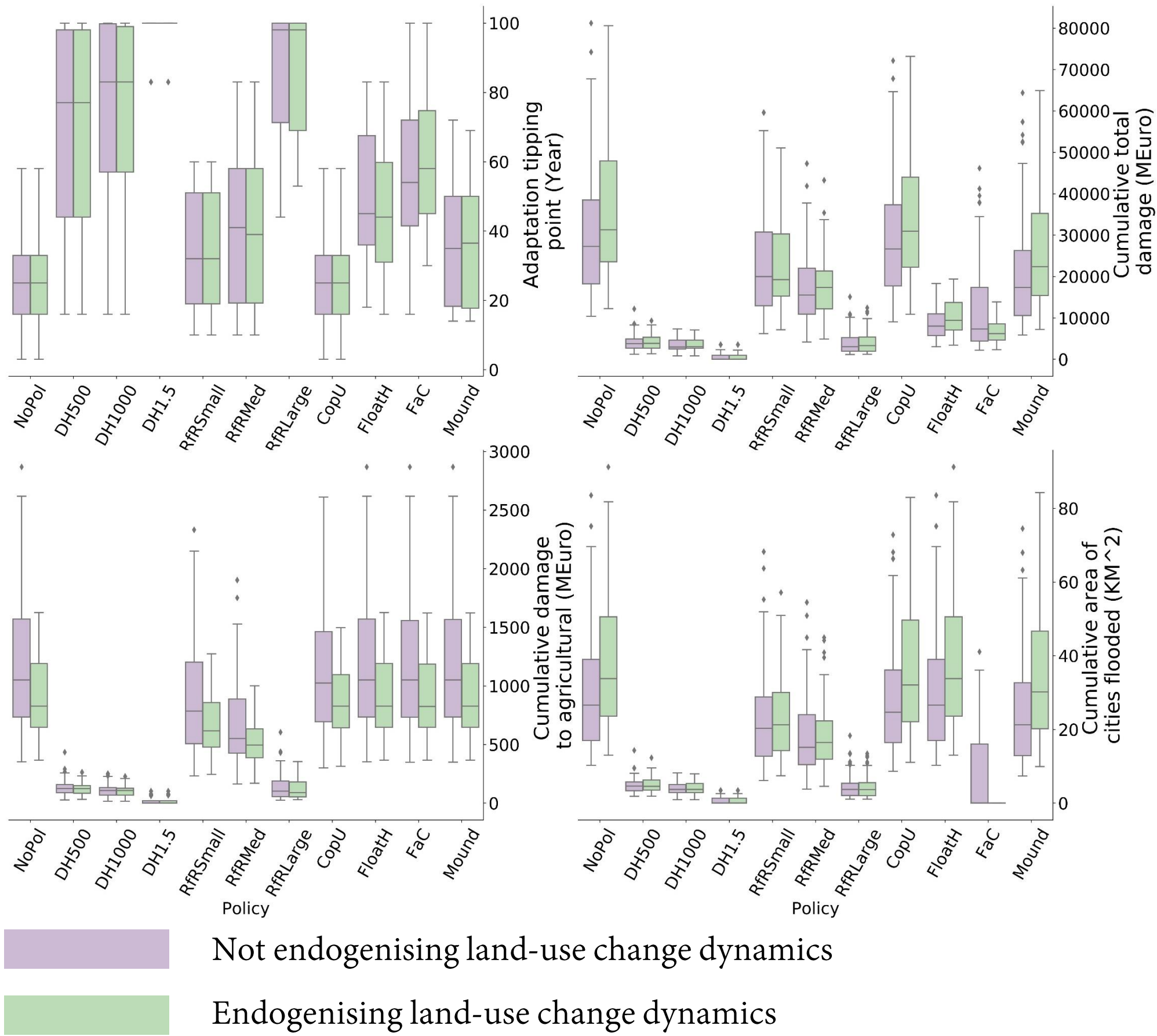
On top of two experiments:

- Experiment 1: Comparing exogenous and endogenous land-use change dynamics
- Experiment 2: Comparing the addition of a zoning policy on top of the standard policies

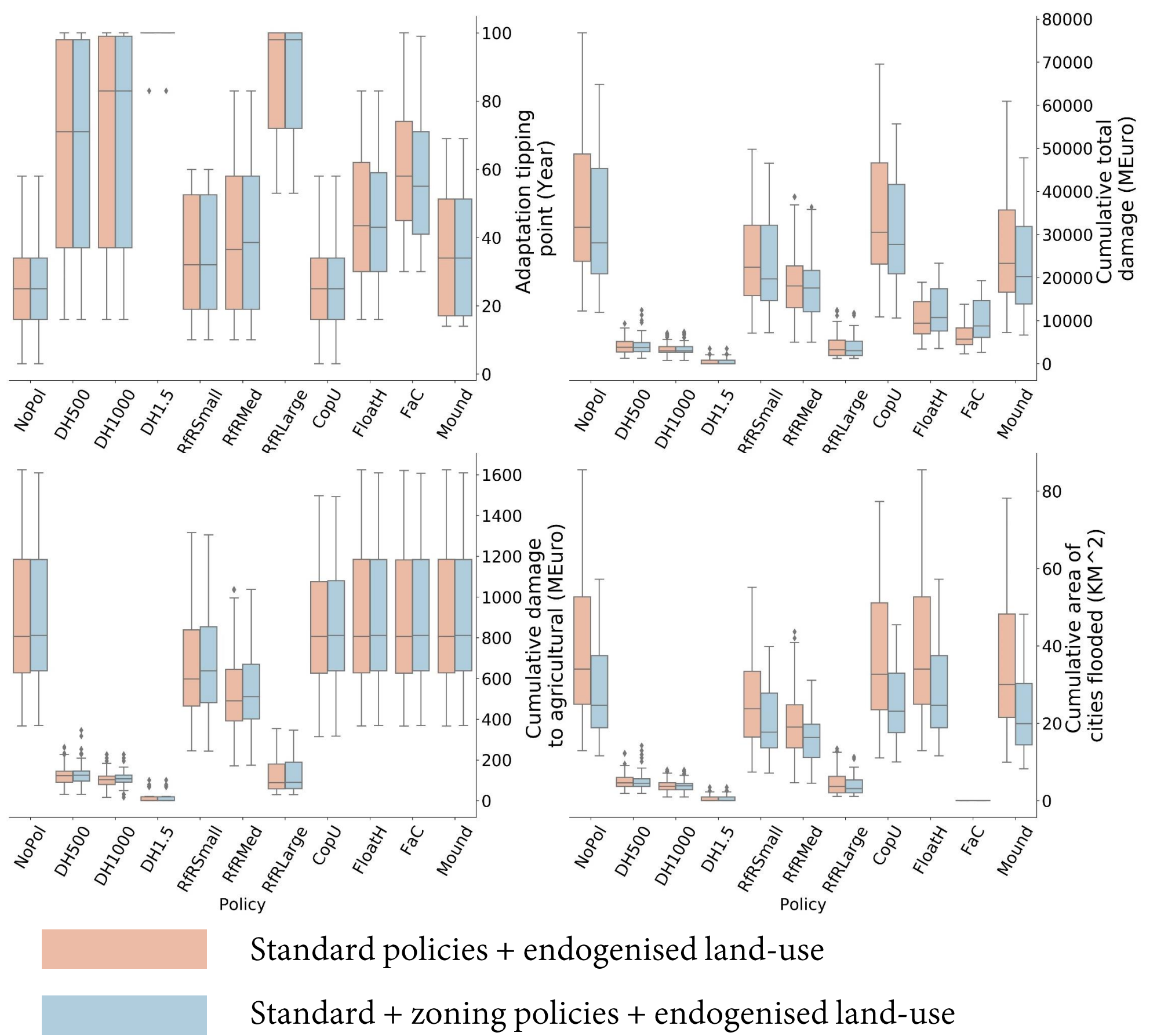
Policy measures:

Name	Description
No policy	Do nothing
DH500	Dike height rise to cope with a 1:500 discharge, based on measurements
DH1000	Dike height rise to cope with a 1:1000 discharge, based on measurements
DH1.5	Dike rise: adapting to 1.5 times the second highest discharge ever measured
RfR small	Room for the river - Small scale: with extra side channels, the river is given more space after a threshold discharge is exceeded
RfR medium	Room for the river - Medium scale
RfR large	Room for the river - Large scale
CopU	Upstream cooperation: discharges are reduced to 14.000 m3/s
FloatH	Floating houses: resulting in damage functions with 10 times less damage
FaC	Fort cities: extra embankments around the cities
Mound	All cities are raised by 4 m, resulting in houses on an area of elevated ground

Experiment 1:



Experiment 2:



Conclusions and future work

- Endogenising land-use dynamics better characterises of the society's bottom-up responses to climate events
- Endogenising land-use dynamics affects each outcome and each policy differently, but not doing so may over/underestimate the outcomes of alternative policies
- Land-use based zoning policies are beneficial for climate adaptation, and can be evaluated by this modeling approach
- Future works: (i) applying this approach in real cases with increasing complexity, (ii) observing when endogenising land-use dynamics becomes irrelevant