Small increases in agent-based model complexity can result in large increases in required calibration data

Objective

Agent-based models (ABMs) are often used to analyze human behavior in coupled natural-human systems. However, ABMs are often not statistically calibrated. We examine the amount and structure of data required to statistically calibrate ABMs of differing complexities.

Approach

We use a perfect model experiment to examine parameter estimation and model structure selection. We use a known ABM of housing abandonment under flood risk to generate pseudo-datasets of varying spatial and temporal sizes and use these pseudo-data to calibrate the data-generating model and another, more complex, ABM.

Impact

We show how limited data sets may not adequately constrain a simple ABM with relatively few parameters and minimal within-model interactions. We also illustrate how limited data can be insufficient to identify a known data-generating model structure.



Figure: Prior and posterior hindcasts of the number of vacant parcels – Panel c) for a simpler model, and panel d) for a more complex model with additional interactions between agents. Each panel includes the hindcasts for varying combinations of observed years and parcels. Modified from Srikrishnan & Keller (2001) under a CC-BY-4.0 license.

Srikrishnan, V, and Keller, K. 2021. Small Increases in Agent-Based Model Complexity Can Result in Large Increases in Required Calibration Data. *Environmental Modelling & Software* 138 (April): 104978. https://doi.org/10.1016/j.envsoft.2021.104978.

