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Institutional analysis for flood risk reduction: A coupled agent-based – flood model method

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Abstract: Flood risk results from flood hazard interacting with vulnerability and exposure of human and natural systems. Though many associate flooding as just a natural phenomenon, it is also attributed to the economic, social, political, institutional and governance factors of affected areas. Institutions such as rules, laws, policies and norms that shape and constrain human interaction drive the hazard, vulnerability and exposure components of flood risk. In this study, we conduct an institutional analysis of rules, norms and strategies for flood risk reduction. Based on the institutional analysis, we build an agent-based model that is coupled with a hydrodynamic flood model. The agent-based model is structured and conceptualised using the MAIA meta-model, and is developed using the Repast Symphony simulation environment. Institutions may affect hydrological and hydraulic input files for the flood model, and these files are updated conditionally to instantiate a flood model that provide a flood map. Number of flooded houses or levels of damage are used to evaluate various policy implementations. As a case study, we use the Caribbean island of Sint Maarten which is frequently flooded. The agents in this case are households and the government. There are many initiatives from the government to reduce flood related risks such as land-use/zoning policy and implementation of flood risk reduction measures. These institutions, policies and measures, govern the behaviour of agents. Preliminary results show that an institutional model coupled with flood model offers a useful exploratory tool to understand the system as a whole and test policy alternatives that match local conditions.

Keywords: Institutional analysis, agent-based modelling, flood risk.

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