

## ***Interactive comment on “The role of household adaptation measures to reduce vulnerability to flooding: a coupled agent-based and flood modelling approach” by Yared Abayneh Abebe et al.***

### **Anonymous Referee #2**

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1. This paper is a follow up to research studies (Abebe et al., 2019a &b) that employ the coupled flood-agent-institution modelling (CLAIM) framework to model the interaction of human with physical flood system in urban environment setting. 2. The novel contribution of this paper is to introduce a new concept of individual behavioral model (Protection Motivation Theory PMT) in exploring the key factors that attributes to household decision making in appraising flood threats and motivations for decision making at the individual level. 3. While the concept itself seems to be innovative and warrant publications, the following reservations/concerns are made:

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a. The CLAIM framework as introduced by Abebe et al., (2019a), did not consider the interaction between individual agents and their feedback loop or mechanism. It assumes that agents change interact with the environment and their behavior is greatly influenced by the institutions and their past exposure to flooding. While this could represent the key attributes that impact or influence individual agent's behavior, the role of micro-level agent interactions with each other seems to be ignored. b. The threat appraisal and coping appraisal as presented in the decision trees (Figures 4 & 5), seems to provide level of rationality and control in agent behavior that far from reality and customized around predict and control. There are no feedback loops in the decision trees on figures 4 & 5 and the processes are assumed causative and linear. I would argue human behavior is far messier than following coupled or few trajectories in decision making. The role of social network cannot be considered as an external factor as the process of social learning is part of the complex dynamics of interaction between models. c. Having studied the threat appraisal and coping appraisal as shown on Figures 4 and 5, I would clearly be able to predict the behavior of the model without a need for a mathematical simulation. This is quite evident from the results as there are few key factors that drive the results. These are: (i) the design of scenarios and the sequencing of storm events; (ii) household past experience to flooding; and (iii) the role of subsidies in the decision making. d. The institutions as defined in Table 1 (shared strategies) seem to be an oversimplification of the reality which makes it hard to generalize the results and make them more specific to the case under consideration. In the US, the role of formal institutions, such as floodplain regulations and penalties associated with nonconformance, played a significant role in the decision making at a household level. Also, flood insurance and flood rating as part of risk hazard played a significant role in how households appraise threats that could be fundamentally different from the threat appraisal action and coping actions as discussed in this tree. Another assumption that the source of information as provided by government agencies (levees and flood walls provide protection) is highly subjective and debatable. I would argue being part of the flood managers in one of

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the US localities, we are sending different message to our citizens on not relying on structural measures. e. It seems that the PhD thesis (Birkholz, 2014) and structured survey that was undertaken as part of this greatly inform the conceptualization of PMT (Threat and coping appraisals). Hence there should be more of elaboration to link this study with the work of Birkholz. This could be in a form of appendix if the authors believe it would crowd the paper. 4. Having outlined the key concerns , I still believe that the present paper with technical corrections and acknowledgement to the limitations and assumptions discussed above, presented a novel concept and ideas that warrant publication. The design of experiment is adequate, the level of simulations and presentation of results are sufficient and complete. The conclusions researched is substantial and would motivate other research to carry further research. In overall the layout and presentation of the paper is well structured and clear.

Please also note the supplement to this comment:

<https://hess.copernicus.org/preprints/hess-2020-272/hess-2020-272-RC2-supplement.pdf>

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