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Discussions

Interactive comment on "An agent-based model for flood risk warning" *by* Thomas O'Shea et al.

Anonymous Referee #2

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This paper proposed an innovative approach to represent the complex human behavior during flood evacuation in Carlisle by combining a hydraulic model (LISFLOOD-FP) and an Agent-Based Model (NetLogo). I have really liked the idea of using the Bass Diffusion Model to represent the agent's behavior during flooding. The results of this study demonstrated the importance of using a holistic approach to flood management purposes. Overall, I have enjoyed reading the paper and I found the manuscript well-written, clear, and results are properly described and discussed. For this reason, I do recommend a minor revision before this paper can be accepted in NHESS. However, I still have a few comments which I hope will be useful to the author to strengthen the manuscript.

1) It looks to me that one important aspect of the ABM is not included in your approach, i.e. the traffic model. In fact, during the evacuation process, traffic congestions can play a crucial role before the agents select to respond to the flood all at the same time. How-

ever, it is not clear to me what are the dynamic characteristics of the agents 'movement (e.g. speed) and how are the road features included in the ABM. In fact, evacuation strategies may change based on the direction, capacity, and maximum allowed speed of the road network in Carlisle.

2) Why did the authors coupled Lisflood with the ABM if societal actions will not influence flood propagation (at least in this study)? Of course, the proposed coupling framework can allow simulating more complex situations, e.g. placing sandbags or other tools to protect from flooding, but it will drastically increase computational costs. I assume that such costs may reduce if the raster files are uploaded within the NetLogo framework each simulation time step. Moreover, what is the computational time for 1 simulation?

3) How the working locations for all the agents are assigned? From what I could understand from the manuscript, the daily routine is randomly assigned at each simulation based on the census information of the specific commercial area in Carlisle for 2005. Is this valid also for the working locations?

4) When an agent receives the warning and decides to act immediately it will then exit the DEM using available network road. Is this a realistic situation? If yes, please provide a reference to support your choice.

5) Can you provide an example of the "innovative knowledge to respond to the flood upon onset" that a pre-prepared agent can use? (line 579) Maybe I have missed some details

6) Besides for the DEFRA estimation for Carlisle at line 756-758, did you evaluate the model results with other observation data (e.g. tweets or report for some specific parts of the city)? I have found some (maybe useful) information in this webpage http://www.intrescue.info/hub/index.php/carlisle-floods-8th-january-2005/

7) The authors stated that "The only study to date to drive an ABM with a hydrodynamic

model was that of Dawson (et al., 2011).” This is not totally correct. Also in Medina et al. (2016) an ABM and a hydraulic model were coupled to test large scale evacuation strategies in coastal cities under threat of imminent flooding due to extreme hydro-meteorological events. Moreover, other studies coupled ABM with a hydraulic model for flood risk management purposes (Abebe et al., 2019).

8) Try to improve the quality of figures 8 and 9

Reference:

- Abebe Y.A., Ghorbani, A., Nikolic, I., Vojinovic, Z. and Sanchez, A. (2019) A coupled flood-agent-institution modelling (CLAIM) framework for urban flood risk management, Environmental Modelling & Software, 111, 483-492.

- Medina, N., Sanchez, A. and Vojinovic, Z. (2016) The Potential of Agent Based Models for Testing City Evacuation Strategies Under a Flood Event, Procedia Engineering, 154, 765-772, https://doi.org/10.1016/j.proeng.2016.07.581.

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