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Natural Hazards and Earth System Sciences
Discussions

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

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An agent-based model for flood risk warning – O'Shea et al.

This paper attempts to present an integrated hydraulic-ABM model for modelling individual behaviour during flooding. Human interventions could significantly affect flood risk even during an event, especially in densely populated urban areas. This research represents an encouraging attempt to develop an approach to model human activities in the city of Carlisle during a flood event in 2005, which is an innovative and necessary step forward in flood risk assessment. But at its current form, the paper is difficult to follow, and it is not clear what the core focus and innovation is. It must be substantially revised and improved before accepting for publication. Hope the following comments will help the authors revise their paper.

The major concerns: 1. What is the major novelty or focus of this work? Is it the 'new' modelling framework? Or is it the application of the model to understand human

activities during a flood event in the case study?

"This paper presents a new flood risk behaviour model developed using a coupled Hydrodynamic Agent-Based Model (HABM)", which suggests the modelling framework is the key novelty in this work. But the presented HABM takes offline modelling outputs (flood depth) from LISFLOOD-FP to drive the agent-based model developed in the NetLogo framework. This is actually a 'step backwards' from the modelling approach as reported by Dawson et al. (2011), in which "a hydrodynamic model simulates the floodwave was also developed within the ABM platform and interacts directly with the agents and the built environment". The authors argued that "this study initially coded the hydrodynamic model directly within the ABM meaning advantage could not be taken of recent developments in efficient numerical methods for solving the shallow water equations ... and high-performance computing ..." But since the current modelling framework does not actually 'couple' with the 'more advanced' LISFLOOD-FP with the agent-based model, the modelling framework itself does not present any novelty in terms of numerical development or method. The approach of using offline flood modelling outputs to drive an agent-based model has also reported in the literature, e.g. Lumbroso et al. (2011) developed a life safety model to estimate risk to people imposed by dam breaks or flash floods. In their work, their Life Safety Model could use outputs from any available two-dimensional hydrodynamic models that solves the shallow water equations (e.g. Telemac-2D, TuFlow) or the simplified forms (e.g. LISFLOOD-FP).

If the focus of the paper lies in the application of the model to understand food-driven human dynamics in the case study. There is no strong evidence showing the model settings reflect reality and so the results and the conclusions may be misleading.

2. Following the above comments, it is difficult to be convinced that the model settings can represent actual human dynamics during a flood event in Carlisle since 1) the behaviour rules for individual are over-idealised and there is no evidence to back the choice of behaviour rules; 2) the communication rules between agents are also over-simplified, e.g. how are text, social media and other forms of wireless communications

taken into account, which may significantly affect the simulation results; 3) traffic systems and key organisations are not represented in the model which will inevitably have significant influence on the results and conclusions; and 4) the model results were not validated at all. Therefore, the results and the conclusions from the simulation may not be valid and may be actually misleading.

Minor issues: 1. Why the authors use the 2005 flood event but not look at the more recent 2015 event? More information would be available from different sources for the more recent event to inform and validate human activities. 2. The paper is difficult to follow and the authors should more explicitly explain the modelling framework, how the agents are interact and communicate, and how the behaviour rules are set and why, etc. 3. Since the human activities do not have any impact on the flood dynamics and the agent-based model is only driven by offline flood model outputs, it is NOT a 'coupled' model. 4. The title, 'an agent-based model for flood risk warning', is a bit confusing. Based on its current capacity, the model cannot be used for 'flood risk warning'.

References: Dawson, R., Peppe, R. & Wang, M., 2011, An agent based model for risk-based incident management of Natural Hazards. Nat. Haz., 59(1): 167-189. Lumbroso, D.M., Sakamoto, D., Johnstone, W.M., Tagg, A.F. and Lence, B.J., 2011. Development of a life safety model to estimate the risk posed to people by dam failures and floods. Dams and Reservoirs, 21(1): 31-43.

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