

Interactive comment on “Socio-hydrology: conceptualising human-flood interactions” by G. Di Baldassarre et al.

Anonymous Referee #1

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I read this paper with pleasure and I am happy to see such work regarding the interactions of human behavior and hydrologic systems. The authors undertake an ambitious effort to create a dynamical model that simulates the interactions between human behavior and flooding. This research is particularly relevant in light of recent flooding events and decisions to re-develop flood-damaged areas from, for example, flooding due to hurricanes Sandy and Katrina. From reading the paper it is clear that the authors have thought in-depth about the nature of human-flood interactions, and even in this simplified framework are able to capture a wide variety of human behaviors and flood risks. The paper is well-written and I did not notice any grammatical or typographical errors. However, I do have concerns which I address below. The primary concern has to do with the connections between (a) observations and model assumptions and (b)

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model results and observations (validation).

Major comments

The formulation of the conceptual model relies on a number of simplifying assumptions based on previous research of the authors and others. Yet within this paper it remains unclear to the reader why the specific findings from other works (cited but not explained) can be incorporated into a general model of human-flooding behavior. Furthermore, the authors do not attempt to confront their model results with case studies or real data. In the absence of such a comparison, the paper remains an “educated hypothesis” to use the words of the authors. I would recommend that the authors:

1. in more detail, define the observations that lead to the assumptions of the model. This will also serve to help the reader understand which assumptions are well-documented, and which assumptions are based on the best-judgment of the authors. To give an example, I refer to the concept that some societies give “room to the river” and settle away from flood plains (page 4519 line 27). Without reading each of the cited papers, it is unclear how extensive this research was and if there is evidence that this type of behavior can be generalized and included as an important component of a long-term dynamical system. In other words, how (specifically) does the previous research demonstrate the behavior of a society to continuously drift towards or move away from a flood plain?
2. more carefully explain how the model results reflect these observations. The inclusion of data for validation would be a welcome addition to this paper. In the absence of data, a deliberate, detailed effort to relate results and observations would be beneficial. Doing so will re-enforce the conclusions that are drawn from the results, and give the reader more confidence in the ability of the model to reflect real-world scenarios.

Minor comments

With the simplifications inherent in this model, a number of parameters contain information that represents a wide array of complex processes. Parameterizing a system

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such as this is quite difficult. For this reason, I suggest the authors clarify the rationale behind the parameter choices in the model simulations. Were these parameters chosen arbitrarily or was there tuning involved? What assumptions were made in these selections? Was consideration given to the possibility of parameters changing over time? Why were the two variables (cost of building levees, decay of flood protection levels) chosen for sensitivity analysis and not others?

The equations of the dynamical system in this paper are greatly simplified. For instance, equation 4b (“Politics”) only captures politics as it relates to the distance from the channel, and as such it is a great simplification of the political system overall. I suggest the authors label each equation based on the state variable that it represents (e.g., “Distance to channel”) rather than the complex system (e.g., “Politics”) that forces the variable. While there are politics involved in this equation, it seems the equation is more closely related with the distance from the river. There is a possibility that such broad nomenclature would be disconcerting to someone who studies, e.g., political science. I would suggest this be considered for the other equations of the dynamical system as well.

In Equation 2, some of the variables have underscores ($H_$, $G_$). At first I thought this was a formatting error, but now I realize that it appears to be a subscript denoting the values of H and G immediately before a flood. I am not familiar with this notation, and the authors might consider changing this to something more common such as H_f and G_f . Consistent with this formatting, it seems that the H and D of Equation 1 should also be subscripted to denote the values prior to the flood event.

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