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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Towards modelling flood protection investment as a coupled human and natural system" *by* P. E. O'Connell and G. O'Donnell

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I have really enjoyed reviewing this paper that aims to develop human-nature modelling for flood protection investments. The paper is well written and the authors showed a wide knowledge of the scientific literature. I found the first part of the paper outstanding with a nice review of coupled modelling. I agree with the authors about the potentials of CHANS modelling. Indeed, a better understanding of the interactions and feedbacks between socio-economic and hydrological processes is definitely needed to advance the science of flood risk (Sivapalan et al., 2012, Bloeschl et al., 2013, Di Baldassarre et al., 2013). However, I have two major comments related to the (possibly apparent)

lack of a consistent story linking the first and last part of the paper (focusing on coupled human and natural systems and proposing agent based modelling as a possible way out) with the example application (relating the performance of proactive/reactive approaches and the persistence of annual maximum floods) that is based on stochastic flood model and cost benefit analysis (sections 4 and 5).

My first comment is about the stochastic flood model (Section 4). ARMA(1,1) model is used to generate time series of annual maximum floods. The simple structure of the model is appropriate, in my opinion, because of the goal of this exercise. However, I think that using this approach may potentially result contradictory with the focus on fully coupled natural and human systems. In particular, the stochastic flood model simulating the natural system is not fully coupled with the human system. In particular, this model cannot simulate how human activities change the statistical properties of annual maximum floods (e.g. urbanization, land-use change, e.g. Brath et al., 2006) as well as the probability of flooding (e.g. flood protection structures, e.g. Di Baldassarre et al., 2009). The main goal of using coupled modelling in flood risk studies is the ability to simulate how the magnitude and frequency of floods shape human societies, while (in turn) human societies alter the magnitude and frequency of floods. In this study, only one side of these complex interactions and feedbacks is explored as the magnitude and frequency of floods are not directly altered by human interventions and simulated as a purely natural processes.

The second comment is related to the use of cost and benefit analysis (Section 5). Indeed, it has been often hypothesized that "societies react and adjust to a changing environment pursuing the maximization of their benefits or minimizing the (perceived) costs. However, defining cost and benefit functions of people is difficult as decision-making is often a balance of multiple, conflicting objectives, and the attitude towards risk and uncertainty can strongly vary across human societies" (Di Baldassarre et al., 2013) depending on political and socio-economic conditions as well as cultural values (Eiser et al., 2012; Wachinger et al., 2012, Scolobig et al., 2012). The limitations of cost

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benefit analysis are also recognized by the authors, who, in fact, eventually proposed the use of ABM framework. But, then, one may wonder (as also mentioned by the first Referee) why there is an entire section dedicated to the development of an exercise based on cost and benefit analysis, while the ABM framework is only mentioned at the end of the paper without an example application.

REFERENCES

Bloeschl, G., A. Viglione, and Montanari A.: Emerging Approaches to Hydrological Risk Management in a Changing World. Climate Vulnerability: Understanding and Addressing Threats to Essential Resources. Elsevier Inc., Academic Press, 3–10. ISBN: 9780123847034, 2013.

Brath, A., Montanari, A., and Moretti, G.: Assessing the effect on flood frequency of land use change via hydrological simulation (with uncertainty), J. Hydrol., 324, 141–153, 2006.

Di Baldassarre, G., Castellarin, A., and Brath, A.: Analysis on the effects of levee heightening on flood propagation: some thoughts on the River Po, Hydrol. Sci. J., 54, 1007–1017, 2009.

Di Baldassarre, G., Kooy, M., Kemerink, J. S., and Brandimarte L.: Towards understanding the dynamic behaviour of floodplains as human-water systems, Hydrology and Earth System Sciences, 17, 3235-3244, doi:10.5194/hess-17-3235-2013, 2013.

Eiser, J.R., Bostrom, A., Burton, I., Johnston, D., McClure, J., Paton, D., van der Pligt, J., and White, M.: Risk interpretation and action: A conceptual framework for research in the context of natural hazards, Int. J. Disaster Risk Reduct., doi:10.1016/j.ijdrr.2012.05.002, 2012.

Scolobig, A., De Marchi, B. and Borga, M.: The missing link between flood risk awareness and preparedness: findings from case studies in an Alpine Region, Natural Hazards, 63(2), 499-520, 2012.

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10, C4184–C4187, 2013

Sivapalan, M., Savenije, H. H., and Bloeschl, G.: Socio-hydrology: a new science of people and water, Hydrol. Process., 26, 1270–1276, doi:10.1002/hyp.8426, 2012.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 8279, 2013.