

## ***Interactive comment on “Modelling socio-hydrological systems: a review of concepts, approaches and applications” by P. Blair and W. Buytaert***

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This paper reviews concepts and methods in socio-hydrological modelling. The review work has been as comprehensive as possible and I think that this article, which is very timely, has the potential to become a reference in the study of dynamic human-water systems. The paper is also well written, despite a few typos (see below). Yet, I have a number of comments/suggestions that can help improve the content of the manuscript.

1) The paper discusses three different model purposes. I think that a possibly missing purpose (which is perhaps a sub-goal of “system understanding”) is that socio-

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hydrological models can give insights about the types of data needed to describe the feedbacks between hydrological and social processes and capture the behaviour of human-water systems. The paper would benefit from a more comprehensive discussion on this point, which is also related to the data section and conclusions. For instance, the paper concludes: “while methods for collection of hydrological data are well established, the social data that will be required (beyond population statistics) may pose issues in availability and collection.” This is right, but I think that socio-hydrology should go beyond the mere summation of (more quantitative) hydrological data and (more qualitative) social data. To capture and explain the socio-nature interplay, we also need to consider new (potentially unconventional) types of data. In this context, stylized models can be useful tools in providing indications about the information that should be gathered to observe feedbacks -within an iterative process of empirical research and theory/model development. This point is also briefly discussed in the referenced 2015 WRR Debate.

2) I fully agree about the need to explore the intertwined dynamics of droughts and humans. Very recently, an interesting commentary about the need to recognize anthropogenic droughts has been published by Nature (AghaKouchak et al., 2015), but research about human impact on (and response to) droughts is still fragmented.

3) The sub-section about uncertainty is perhaps not completed. In my opinion, the subject has not been sufficiently described. I fully agree with the authors that the study of human-water systems is affected by remarkable uncertainty, which is indeed very different from the intrinsic uncertainty of e.g. hydrological models. In particular, surprises might play a bigger role (see e.g. black swans in economics). Two papers that deal with this issue have been published very recently. Di Baldassarre et al. (Hydrological Sciences Journal, 2015) discuss aleatory and epistemic uncertainty in socio-hydrology, while Merz et al. (Water Resources Research, 2015) present an interesting framework to cope better with potential surprises in flood risk management. The aforementioned two articles also provide potentially useful references in the topic.

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#### Suggested Recent References

AghaKouchak et al. 2015. Water and Climate: Recognizing Anthropogenic Droughts. *Nature*.

Di Baldassarre et al. 2015. The seventh facet of uncertainty: wrong assumptions, unknowns and surprises in the dynamics of human–water systems, *Hydrological Sciences Journal*.

Merz et al. 2015. Charting unknown waters: On the role of surprise in flood risk assessment and management, *Water Resources Research*.

4) In principle, I agree with the statement “game theory has been used extensively in water resource management problems (Madani and Hooshyar, 2014), and so there is no reason why this would not extend to problems in a sociohydrological setting.” However, it should be mentioned (as stated in the point above) that the (wild) uncertainty of dynamic human-water systems is much more complex than the (mild) uncertainty we enjoy when playing die or roulette.

5) A few typos: e.g. “has lead”, “is was”, etc. . .

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