

## ***Interactive comment on “Moving sociohydrology forward: a synthesis across studies” by T. J. Troy et al.***

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Troy et al. present a nice synthesis across recent studies to move socio-hydrology forward. I have enjoyed reviewing this paper and found it well written. It is a great contribution to the literature as it properly surveys the research work that has been done in the emerging field of socio-hydrology.

I have also appreciated the Section about norms, values, ethics and social responsibilities. I would suggest, on this topic, to consider a nice paper recently published on Geoforum by Ahlers et al. (2014), which deals with the issues of large dams in Afghanistan in the context of “ambitious development on fragile foundations”.

My only concern with this paper is about the absence of a differentiation between

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two different types of research, which can be categorized between basic (focusing on “why?”) and applied (focusing on “how?”). I think that, while basic and applied sciences are complementary and boundaries between them are unavoidably fuzzy, some sort of distinction is needed. Especially in surveying a field of studies and reviewing modeling efforts. I will make this point clearer in the rest of this report.

The authors rightfully propose to exploit econometric studies for moving forward socio-hydrology. In this field, McDonald (1989) made an excellent survey of econometric studies of urban population density, which I consider another interesting reading for socio-hydrologists.

This survey starts with a nice introduction, which I take the liberty to slightly rephrase here. McDonald (1989) discusses that the development of new knowledge typically requires five steps (text between quotation marks is literally taken from the paper): 1. Data collection, accumulation, and analysis. 2. Examination of these data “to determine the salient facts, which require formal explanation” through the development of theories and models. 3. Theory development or “Formulation of models capable of accounting for the salient facts”.

4. Calibration and validation of models (and uncertainty analysis). 5. Application of models (predictions and support to decision making process).

Many scientists are deeply “engaged in work that refines or makes use of the generally accepted model” (steps 4 and 5; more applied), while others are “in the process of questioning the generally accepted model” (steps 1, 2, and 3; more basic).

Steps 1-5 are all needed, of course. But, I think that at this stage (for the time being) socio-hydrology should focus on steps 1, 2, and 3 because a generally accepted theory is still to be developed. The interactions and feedback mechanisms between human and water systems are still largely unknown. To develop socio-hydrological theory, there is a need of iterations between case studies, comparative analyses and formal explanation of the salient facts (e.g. via general stylized models).

Jumping to the process of calibrating and validating models (steps 4 and 5), without diagnosing their fundamental capability to capture the “salient facts” (i.e. essential dynamics within the coupled human-water system framework), might limit the process of socio-hydrological theory development. I hope that socio-hydrology will be more than merely coupling hydrological models with socio-economic ones and adjusting a few parameters to fit some data.

This is, of course, only my personal opinion. However, I think that the paper cannot avoid discussing this point. For instance, the paper states in Section 3 that current models are either “too specific” or “too general”. I do not agree with it. First, the statement is not supported by evidence. So, it should be presented as authors’ opinion. Second, I don’t think that current models are either “too specific” or “too general”.

Again, they serve different purposes.

General stylized models aim to advance our understanding (focus is on “why?”). They aim to “capture the salient facts” or, better, explain essential dynamics of the coupled human-water system. Detail models of specific test sites have a different purpose, as they intend to support the decision making process by making predictions.

The distinction between modeling for understanding versus modeling for making predictions is essential, in my opinion, also when it comes to “testing”. General, stylized models are tested via diagnosis of their capability in capturing essential dynamics (e.g. Di Baldassarre et al., 2015), while case specific models are tested via calibration and validation exercises. Thus, I cannot agree on the comment in Section 4 that “one weakness of many of the toy or stylized models is the absence of validation against real-world observations”. First, as mentioned, these general models can be diagnosed, but not validated, as they are not meant to make predictions. Second, the sentence does not specify which stylized models were not “validated”. Speaking of the ones I know more about, models of human-flood interactions were based on a set of simple rules (i.e. differential equations) based on empirical evidence (i.e. real-world observations)

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and then tested by exploring their capability to capture and explain salient facts (e.g. “adaptation effect”; Di Baldassarre et al. 2015).

Lastly, it is worth mentioning that these critical aspects have also been part of an interesting debate about socio-hydrological research including a research paper, an editorial and four commentaries, which have been very recently published on *Water Resources Research*. It would be appropriate if the revised paper could discuss the issue of moving forward socio-hydrology by explicitly accounting for the issues discussed in the debate, including this distinction between understanding versus making predictions or capturing salient facts versus fitting data.

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