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Hydrology and Earth System Sciences
Discussions

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

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Dear Reviewer,

Thank you for your insightful comments regarding this paper; the effort that was put into this is much appreciated. Responses to the comments that you have made are included below, as is a summary of the comment that each response refers to.

- *Comment regarding paper coming across as a review of socio-hydrology generally, as opposed to socio-hydrological modelling.* Thank you for this comment, it is well received. I would agree that the review has indeed covered areas beyond socio-

hydrological modelling to socio-hydrology more generally. The idea behind this was that providing a comprehensive background to the subject would provide a better platform on which to build the material covering aspects more specific to modelling.

- *Pleased to see discussion on the differences between socio-ecology and socio-hydrology, however suggests missing differences (e.g. flowing water, hydrological cycle). Suggestion of summary section focusing on these similarities and differences.* I am glad that you agree that drawing on the similarities and differences between socio-ecology and socio-hydrology provides a useful insight, particularly at this stage in the development of socio-hydrology, where modelling studies are few. The omissions that you highlight in the differences between socio-ecology and socio-hydrology are important, and so the fact that socio-hydrology deals with flowing water and the hydrological cycle will be included in the revised version of this manuscript. As part of the restructuring which is detailed later, the suggested summary section discussing the similarities and differences between socio-ecology and socio-hydrology will be included.

- *Clear that the paper is not a review of socio-hydrological modelling studies, since there aren't many. Table 1 modelling studies not all strictly socio-hydrological.* I am glad that the review is clear what it is not – I tried to make sure of this. Since there are very few socio-hydrological models at present, I have tried to combine knowledge garnered from modelling efforts in existing subjects with the distinguishing features of socio-hydrology to formulate an idea of how socio-hydrological models could be developed. I agree that many of the studies included in Table 1 might not be considered socio-hydrological modelling, but I am glad that you see the merit in showing studies which include some element of human-water interaction. I will make it clear that many of the studies would not be classified as socio-hydrological modelling (while also making it clear which would be), but state why they are included.

- *Much of the literature review focuses on traditional modelling approaches. Traditional modelling approaches should be looked at critically, rather than accepted without examination.* This is a very good point, thank you for making it. When revising the

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manuscript, I will be cast a critical eye over the application of traditional techniques to this new subject area and change the material accordingly. Modelling techniques used in socio-hydrology will likely have their roots in traditional techniques, and so it seems appropriate to consider these traditional techniques as a starting point, however it is true that the characteristics of socio-hydrological systems will likely mean that these approaches will require alteration/adaptation, and could indeed render some inapplicable. I will also include a section in the restructured (see later) version where I discuss the potential for new/hybrid modelling techniques.

- *Lack of attention paid to the role of changing norms and values, and how understanding these dynamics requires collaboration with social scientists and sociologists.* I am glad that the review comes across as recognising the applicability of socio-hydrology in long-term analysis. The role of changing social norms and values is extremely important in this respect, and so their importance will be highlighted in the revised version of this manuscript. I agree that collaboration with social scientists and sociologists will be critical in gaining understanding the dynamics of changing values and norms, and so will highlight this in the revised version of the manuscript.

- *The suggestion that there should be more separation from other recent studies (Troy et al., 2015; Sivapalan and Blöschl, 2015) and and a more targeted, goal-oriented approach to the review via restructuring existing material around new headings and subheadings.*Thank you for this comment, it is well received and is very useful. You are indeed correct in thinking that the reason that some aspects of this review are similar to those of Troy et al. (2015) and Sivapalan and Blöschl (2015) is due to the fact that they were published in the latter stages of this paper being written. I have, therefore, now given attention to these papers in order to ascertain the aspects that they have covered, and so the ways in which this review may separate itself from them for the benefit of readers. Troy et al. (2015) covers the current state of socio-hydrology and gives an outline of the different research methodologies that can be used in socio-hydrology (of which modelling is one). An area that this paper covers particularly well

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is the role of researchers in socio-hydrology, particularly the impartiality required to do research in this area being in tension with the research process where researchers' ideas can influence the work that they do and the models they create. The way forward for socio-hydrology as a subject is then covered. Sivapalan and Blöschl (2015) gives in-depth analysis of: co-evolutionary processes in a mathematical sense; the nature of human versus environmental systems and the implications of this for modelling; the overall modelling process that should be followed in socio-hydrology across modelling techniques and the different model archetypes that might be produced (i.e. stylised versus comprehensive models). I agree that the material present in this review could be restructured and re-targeted towards an area that would provide separation. I feel that the areas in which this review can distinguish itself are: the background that it gives regarding other similar subjects, such as socio-ecology, and so looking at the ways in which socio-hydrology can learn from modelling in other synthesis subjects, while acknowledging the aspects which make socio-hydrology unique and so tailoring study to be appropriate; and in critically analysing the applicability of specific modelling approaches that may be used in socio-hydrology, and so detailing how different types of model (i.e. system dynamics versus agent-based) would be developed (as opposed to the general socio-hydrological model development process). To this end, the paper will be restructured and headings will be changes as is suggested, with the goal of providing guidance on choosing an appropriate modelling technique for different purposes in socio-hydrology.

References:

Sivapalan, M. and Blöschl, G. (2015), Time scale interactions and the coevolution of humans and water, Water Resources Research, doi: 10.1002/2015WR017896

Troy, T. J., Konar, M., Srinivasan, V., Thompson, S. (2015), Moving sociohydorlogy forward: a synthesis across studies, Hydrology and Earth System Sciences, 19(8), 3667-3679

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 8761, 2015.