

Interactive comment on “Proximate and underlying drivers of socio-hydrologic change in the upper Arkavathy watershed, India” by Veena Srinivasan et al.

Anonymous Referee #1

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The paper by Srinivasan et al. present a study to define the drivers of socio-hydrological change in an Indian river basin. In the paper, both a qualitative narrative of the development of the basin, as results from a modeling exercise are presented. Although the idea of the paper is very relevant and suitable for HESS, I believe that substantial additional work is necessary before publication in HESS can be considered. I find the paper written in a very unstructured way, and it is not very clear what the motivation and approach of the research are. In the following, I motivate my major concerns, followed by some minor comments. At its current state, I suggest rejection of the paper. However, I do encourage the authors to substantially rewrite the paper for resubmission to HESS.

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Major concerns

1. In general the paper reads unstructured. It is not clear what to expect, and the research methods, results and discussion are presented in a very on-the-fly fashion. I believe the paper can be rewritten in a more concise, clear, and structured way. The research questions appear in different forms throughout the manuscript, which are in itself poorly defined (see my comments later). It is not clear what the scientific merit of this work is, and what the greater socio-hydrological community can learn from this study.

2. Introduction: It is not clear from the introduction what the study is about. The authors illustrate that there's a need for hydrological models taking into account 'change', but the motivation to study the Arkavathy basin is unclear. Also, I feel that that the connection to existing socio-hydrological literature (on previous modeling efforts specifically) is missing. I suggest that the authors cut down on the amount of text illustrating how "urgent" it is to take into account change etc., and give a better introduction of the study area, the motivation and the taken approach.

3. Model: Please elaborate on why this modeling approach was chosen. Why was a multi-scale model used? It seems like the model comes with relatively high complexity, while one of the issues is data scarcity. Why did the authors not design a simple conceptual model? What makes this case study unique that no previously developed socio-hydrological modeling approaches could be applied here? Please also elaborate on the choice of different time-scales of the different model components. Why was the model not completely run at the lowest time scale? And why is the later presented socio-hydrological framework not used as a modeling framework

4. Discussion: The narrative is very interesting and key to understand the system. However, I would propose to include this before the modeling exercise. By first thoroughly introducing the basin, and understand qualitatively what happened, the modeling exercise and quantitative analysis follows easier (e.g. similar to the work in the

Murrumbidgee River Basin, first the qualitative analysis by Kandasamy et al. (2013) followed by the modeling work by van Emmerik et al. (2014)), see Mostert (2017).

5. I think the paper also misses a coupling to the socio-hydrological work in the recent years. Only few references are made to other modeling papers, and it seems like no socio-hydrologic literature from the past years is really used to develop a sound research method.

6. Quality of the figures should be improved considerably. The quality of a paper is, in my vision, reflected in the quality of the figures. The resolution is low, the font type can be more professional, and the titles and axis are sometimes inconsistent.

Minor comments

1. L28: Hydrologic non-stationarity?

2. L38: What is mean with rapid? Why is it italic?

3. L40: Rapid what?

4. L36-42: I don't really see the point of this paragraph, there's some oneliners, that doesn't necessary add to an argument.

5. L43-50: I suggest to summarize this paragraph in 1-2 sentences, and add it to L28-35.

6. L51-54: Rewrite, introduce proximate vs underlying drives, and then use land-use as an example.

7. L60: Sure, hydrologic models are not equipped to diagnose changes, but socio-hydrological models do. Quite some recent efforts on case studies (e.g. Elshafei et al., 2014; van Emmerik et al., 2014; Lui et al., 2015; Chen et al., 2016; M) developed models to study the influence of these changes. It would be good if the authors briefly reflect on these advances, and specify what

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8. L83: Give a better introduction of the term “tanks”.
9. L106: The authors can better remind the reader of what was found in the previous study, and what unknowns and questions were identified.
10. L107: Question can be posed better. What is meant with change? What proximate drivers are meant? All of them? Several specific ones?
11. L108: What is meant with “we”? We as a human race? Hydrologists? Policy makers? Water managers in the study area? What is meant here with change? “These underlying drivers” refer to the proximate drivers from question 1 or to actual underlying drivers? What is meant with predictive insights? Insights in river discharge? Evaporation? Water use?
12. L110: Implications for who? Rephrase question.
13. L120: Why is theory-based in parentheses?
14. L130: Year missing in Penny et al. (throughout the paper).
15. L130: Good to see that the authors found a solution to minimize equifinality, but how was this done for this study? One sentence paragraphs also read a bit awkward, so I suggest merging with the previous paragraph or expanding.
16. L132: Fig. 2 is introduced, but not explained. This model is rather crucial for the rest of the study, so I suggest to elaborate on it further.
17. L134: What is meant with “the data”?
18. L142: Why is the term “milli-watersheds” used? What does it mean?
19. L165-166: Provide some more details of these measurements as they were used to identify the dominant runoff mechanisms. How often were these measurements taken? How were they used to identify the dominant mechanisms?
20. L173: Please elaborate on the crowd-sourced data. Not clear what these are.

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21. L202-204: The rest of the plots are still flood irrigated?

22. L280-308: This section reads very confusing. I expect to read about the calibration strategy, and what data was used etc. The authors however describe and interpret results here.

23. L310: Please first introduce the results before concluding it was able to replicate the data.

24. L312: How did the simulation revealed the relative importance of different drivers?

25. L350 -367: Very messy paragraph. Reads like it's still work in progress. Are the questions the framework? If so, how are the questions answered?

26. L367: Why is the socio-hydrological framework not used as a modeling framework?

27. Go through all semi-colons and assess whether it's really necessary to use them.

References

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