

## Comment on hess-2022-172

Anonymous Referee #1

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Referee comment on "Cooperation in a Transboundary River Basin: a Large Scale Socio-hydrological Model of the Eastern Nile" by Mohammad Ghoreishi et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-172-RC1>, 2022

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While I find the overall paper topic to be interesting and important, it seems the emphasis on being one of the first to perform a quantitative basis of water boundary conflicts is far-fetched. A quick search reveals several papers that have proposed the same end-goal, yet were not cited. How does this study extend, contrast, confirm, or completely refute such previous studies? To name a few:

- Avisse, N., Tilmant, A., Rosenberg, D., & Talozzi, S. (2020). Quantitative assessment of contested water uses and management in the conflict-torn Yarmouk River Basin. *Journal of Water Resources Planning and Management*, 146(7), 05020010.
- Jacob-Rousseau, N. (2015). Water diversions, environmental impacts and social conflicts: the contribution of quantitative archives to the history of hydraulics. French cases (nineteenth century). *Water History*, 7(1), 101-129.
- Beck, L., Bernauer, T., Siegfried, T., & Böhmelt, T. (2014). Implications of hydro-political dependency for international water cooperation and conflict: Insights from new data. *Political Geography*, 42, 23-33.
- Van Baalen, S., & Mobjörk, M. (2018). Climate change and violent conflict in East Africa: Integrating qualitative and quantitative research to probe the mechanisms. *International Studies Review*, 20(4), 547-575.
- Kilgour, D. M., & Dinar, A. (2001). Flexible water sharing within an international river basin. *Environmental and Resource Economics*, 18(1), 43-60.
- Tinti, A. (2015). Water scarcity and regional fragmentation in the Middle East: A quantitative assessment. *Politikon: The IAPSS Journal of Political Science*, 27, 177-205.
- Madani, K. (2010). Game theory and water resources. *Journal of Hydrology*, 381(3-4), 225-238.
- Grech-Madin, C., Döring, S., Kim, K., & Swain, A. (2018). Negotiating water across levels: A peace and conflict "Toolbox" for water diplomacy. *Journal of Hydrology*, 559, 100-109.
- + many others

If the overall paper's contribution is to be a premier study emphasizing quantitative

components of water conflict issues, then a deeper literature review and framing within the existing body of research is essential. If the overall paper's contribution is something else, consider changing the abstract to emphasize that component.

General: There are quite a bit of acronyms used in this paper, which is fine, but it might be helpful to the reader to include a list of all acronyms at the forefront or as an Appendix to the paper.

General: It was not immediately clear at first read why the ENB was emphasized for conflict out of the entire Nile – do the other countries not have qualms over the water usage? A quick search suggests that many of the countries along the Nile have had conflict to-date over water. (e.g., <https://www.tandfonline.com/doi/pdf/10.1080/17531050701625565>). For example, even though perhaps Ethiopia and Sudan are most vocal about the Nile dam, such decisions significantly impact Kenyans and Ugandans. It is acceptable to limit the scope of the study to a portion of such a large river basin, but I was just unclear as to the rationale at first read of the paper.

Fig. 1 is good, but a few minor suggestions: Try to avoid using pink and red to differentiate very similar boundary types (e.g., use a more contrasting color); considering adding the datum to the caption for referencing the lat/lon values (I'm sure it's the standard WGS 1984 datum, but it always helps to include this type of information in GIS-based maps); consider adding to the legend what the dark blue polygon boundary represents; ensure final figure to the Journal (usually in PDF format) is very high-resolution, as it appears blurry in the current embedded format.

Introduction (General): Overall introduction appears to have all of the "pieces" there but is put together in a manner that reads as disjointed in thought. A bit more effort is encouraged in telling the story here, by starting with the general problem, its importance, and then narrowing down into what has been done thus far to address, how those still have gaps, and then finally what this paper brings to the table.

Line 30-33: What is C&C? In general, I think there needs to be a bit more elaboration on the overall "big picture problem" and why it is important to the reader (and society) before jumping into details of the literature, particularly with acronyms that are not explicit.

Line 33-35: Sentence seems to belong before explanation of literature. Describe water conflicts, political agreements, and the overall mindset of socio-hydrology before delving into details.

Line 38: Describe hydro-hegemony. Remember, HESS is read by a broad group of

hydrologists and earth scientists who may not be familiar with the common lingo in socio-hydrology.

Line 57-60: While this literature on the Nile is robust, it is too focused on the geographical case study. Further literature, which is important for framing the overall novelty of the paper, is generally missing.

Line 70: Cooperation "and conflict"?

Line 70: Choice of word "confronted" here seems out of place.

Lines 83-133: This large amount of text could be significantly condensed and/or added to SI. It is not yet clear how this historically based narrative can be considered quantitative (perhaps semi-quantitative or fuzzy-based transformation from qualitative to semi-quantitative?).

3 Method: Temporally, what data? Precipitation, streamflow, where did you get it, how was it verified or roughly calibrated? What are the "units" being discussed? What is the basis of this model? If it is meant to be a stylized socio-hydrological model, this should be discussed somewhere prior to identifying the system variables and assumptions.

Overall Methodological section is in piece-meal nature and is not, in my opinion, at a quality and coherency level for publication. I do think there are strong bases here, and a well-intended study was conducted, but the way it is written and presented could use further explanation for the reader to be introduced to this type of model-thinking.

Figure 3: A suggestion – consider changing the Eth, Sud, Egy nomenclature to be represented by different color nodes, rather than text additions.

Section 3.3: I do not agree that this is a causal "loop" diagram. The loops, in terms of reinforcing/balancing and how they then interact dynamically amongst one another are not depicted graphically. Rather, this is a causal feedback diagram. There are 3 loops in the middle, but they are all reinforcing, which would not make much sense in terms of figuring out overall causality as the entire system would keep, theoretically, reinforcing itself on a forever trajectory.

Eq. 1-8: It is hard to review the equations, when the overall picture and causal depiction is unclear. Perhaps a bit more explanation on these variables, and/or why they were

hypothesized as such, and/or tables showing the variables and their dynamic simulation in the SI would help the reader follow?

4 Results: The explanations here are helpful in making sense of the previous section. I still recommend a deeper review of how the work is being presented and organized for overall readability.

General Note: All equation variables, when listed in-text, are showing up as very large, blurry, and distorted in the PrePrint PDF. I am not sure if this is an issue with the HESS conversion format into PDF, but please verify that the texts are provided in the proper fonts.

Conclusion: Most of the conclusion section is actually a further listing of detailed Results. Please consider re-phrasing the Results section to be cohesive in one read, and then in the Conclusions, highlight the overall take-away, not re-listing the methodological outputs.