

Comment on hess-2021-72

Anonymous Referee #3

Referee comment on "Water sharing policies conditioned on hydrologic variability to inform reservoir operations" by Guang Yang and Paul Block, Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-72-RC3>, 2021

This paper presents a water-sharing policy framework that incorporates reservoir operating rules optimization based on conflicting uses and hydrologic variability, specifically tailored to drought conditions. The framework is illustrated using GERD as a case study. The results clearly show the trade-off between annual hydropower generation and the inter-annual variability of releases. The paper is well-written and the topic should be of interest to both researchers and practitioners. As explained below, my main concern is with the methodology, which seems to be overly "complex" given the relative simplicity of the case study.

Comments/questions:

- The emphasis is put on average annual power output. However, power companies are also concerned by the firm energy, i.e. the energy output that you can guarantee 90% or 95% of the time. Can you show us what the trade-off would look like when the average energy output is replaced by the firm energy?
- Does the term "water releases" include turbined outflows AND spillage losses?
- When minimizing the variance of water releases, do you end up to a point where the energy output starts decreasing due to excessive spillages losses?
- My main concern. Why didn't you constrain the operating rule with a minimum "water release" (or minimum deviation from a target release) in the first step of the methodology and construct your Pareto front by varying that minimum like in the traditional constraint method in MOP? The system is small (just one reservoir) and it looks like to me that the Pareto front could be traced out using mathematical programming techniques in a MO framework. In my opinion the introduction must be revised to better explain why that framework was proposed instead of traditional MOP approaches.
- Line 90. Please check the paper from Teasley and McKinney, JWRPM, 2011 on water and benefits sharing in the Aral Sea Basin.
- I have a small gripe with the title. The methodology is actually applicable to any reservoir and it is not limited to transboundary river basins. Please remove

“transboundary” from the title and revise the text accordingly.

- Line 56. A wide variety of physiographic conditions is not limited to transboundary river basins!
- Figure 12. Could you also include spillages losses and evaporation losses? Keeping the water level as high and as constant as possible will likely increase these two losses, up to a point where they can negatively impact the power output and the total outflows.