

Comment on hess-2021-324

Anonymous Referee #2

Referee comment on "Guidance on evaluating parametric model uncertainty at decision-relevant scales" by Jared D. Smith et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-324-RC2>, 2021

- L8-10: "We evaluate six sensitivity metrics that align with four decision objectives; two metrics consider model residual error that would be considered in spatial optimizations of engineering designs." This sentence is confusing -- do the six sensitivity metrics add up to the four decision objectives + two model residual error metrics?
- L39: extremes or high flows?
- It would be helpful to somewhere define "engineering controls".
- L 116: here are you write flooding, low flow, reservoir water supply objectives, but earlier you wrote flooding, low flow, and all other flows. If these are the same, that should be explicitly stated.
- L320: "The goal of this sensitivity analysis is to inform the selection of parameters to calibrate a RHESSys model that could be used in such a reforestation optimization." is this the overall goal of this paper? If so, this should be stated in the introduction section much earlier.
- L 328: are the elementary effects for all the parameters normalized on a percentage basis? Why compare the 95th percentile for the elementary effects to the overall mean of all parameters' elementary effects, if that is what is being explained in this sentence? What does the 95th percentile estimate for the elementary effects mean?
- Figure 3 seems to be referred to before figure 2 (L335).
- L349: does an elementary effect value of exactly 0 mean that this parameter has no effect on the stream flow or hillslope metric? It would be helpful to state this explicitly.
- The text discussing figure 2 is useful, (line 348 in the rest of this paragraph), but without knowing what the specific parameter numbers are in figure 2, I'm not sure what to take from this graphic.
- Line 480: I see now that engineering designs are not explicitly evaluated in this paper. My earlier comment (comment 3), asked about what engineering controls meant. The focus on engineering controls in the introduction section led me to believe that this paper would be about engineering controls. Rather it seems that this paper has

implications for where to locate engineering controls but does not directly investigate this placement. If this is accurate, then I would suggest deemphasizing engineering controls from the introduction section.

- From what I understood of this article, the first main finding was that parameters describing watershed characteristics are sometimes important for modeling hillslope hydrologic response even though they do not affect the streamflow at the model outlet much. The authors state that this might be important in the spatial location of engineering controls. There are many other reasons why getting the hydrology right within the watershed is important (modeling of spatially distributed soil moisture, etc.), but a major limitation is that we don't normally have data to compare to within the watershed, so in practice it would be hard to calibrate these parameters that don't affect streamflow much. The second main finding was that commonly used metrics (e.g., NSE) are not as sensitive to the decision relevant streamflows that we would want them to be. These are both important findings and points to make, but I found the article overall hard to read and understand. The authors may be served by focusing the text on the main findings and reducing discussion of peripheral topics.