Interactive comment on "Temporal parameter sensitivity guided verification of process dynamics" *by* M. Pfannerstill et al.

Anonymous Referee #2

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1   General comments

The manuscript presents a study on the use of temporal variation of parameter sensitivity to assess structural modifications to a hydrological model.

To be honest, I find the manuscript hard to read for a combination of reasons. The language is unnecessarily complicated in places (see below for a couple of particularly striking sentences), and the used terminology really makes it hard to understand what is exactly meant (e.g., I was halfway through the paper before I understood more or less what was meant with "expected sequence of parameter sensitivity".

But more importantly, the way that I understand the procedure I can only conclude that

it is fundamentally flawed. I really wonder how the use of TEDPAS as a diagnostic tool does more than just reflecting the properties of the procedural model as it is implemented. The authors present an application in which they modify the groundwater representation of the SWAT model. They include two pathways, one being faster shallow aquifer response and one slower responding aquifer. From the TEDPAS analysis, they conclude that the parameters related to the faster pathway are more sensitive earlier after a rainfall response, and the parameters related to the slower pathway are more sensitive a longer time after the precipitation event.

So how does this say something about the model performance? Does it not just reflect that the mathematical model does what is intended, i.e. represent a faster and a slower pathway? I do not think that this can be seen as an independent evaluation, on the contrary, I think the authors get trapped in a circular reasoning pattern, where the model parameter behaviour is a direct result of the assumptions made when building the model.

I sincerely hope that I have missed the point of the manuscript. But as I currently understand the procedure, I think that the procedure simply reflects the way that the model is conceived. As such, it only confirms that the hypotheses are correctly implemented in a procedural model, but does not say anything about the real-world validity of those hypotheses.

2   Specific comments

1731/12-13: "how well they represent the corresponding real-world processes": See specific comments - I am not convinced that this is really tested. All that is tested is whether the model represents the perceptual model of the modeller.

1732/3: "High temporal resolution": vague. What is the time step, and why do you consider it high resolution? Further on it seems that the model is implemented at

daily resolution, which might even be considered relatively low for a catchment of only 50km2. The point of emphasizing this escapes me.

1732: "For this...": this is an example of a monster of a sentence. I really struggle to understand what is meant here.

1733/1: wihthin -> within

1736: I am not sure I really understand the difference between TEDPASsingle and TEDPASSall from the way that it is formulated here.

1737/9: "the concept of the model structure": what do you mean with this?

1737/15: "Therefore, the...": again, you try to test a hypothesis (the sequence of processes) with another hypothesis (the model structure) both based on the same knowledge (catchment processes). This would not seem to make sense.

1737/19: "Framework demonstration example": Is this not simply an application?

1746/19: build -> built?

1749/6: "The expected sequence of processes is derived from the model concept": again this is the fundamental issue. If you do so, of course you cannot use this sequence to evaluate the model structure, because this double counts the available information.