

***Interactive comment on* “Global Sensitivity Analysis and Adaptive Stochastic Sampling of a Subsurface-Flow Model Using Active Subspaces”** **by Daniel Erdal and Olaf A. Cirpka**

Anonymous Referee #2

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General Comments

Overall this paper provides a really nice extension of the active subspaces method to hydrologic modeling. Previous applications of active subspaces to hydrologic models have not used site specific model domains, nor used the active subspaces method in the context of a meta-model. For computationally expensive hydrologic models, the approach presented in this paper may prove to be very valuable to select parameter values but also evaluate sensitivities. The paper is interesting, well-written, and appropriate for this journal.

Specific Comments

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1. In order for readers to better understand plots like the ones shown in Figure 4, a description of the active variable needs to be added to the text. Specifically, how the active variable is computed and what the sign (- or +) and magnitude of the active variable means.

2. (Reference Page 8, Line 32) The unsaturated zone (assumed to be between 0 and 1 meter below the land surface in this model) serves as an important link between precipitation falling on the land surface and precipitation reaching the groundwater, and water flowing through this zone can and does contribute to stream discharge. In this model, what is happening to water between 0 and 1 meter below the land surface? How does groundwater recharge occur (Page 12 states that much water is loss to subsurface)? A brief explanation would help especially given that all of the behavioral targets reference stream discharge or recharge.

3. Why does the shape of the Lettenkeuper layer in Figure 1 not match the shapes in Figure 2?

4. Do the magnitude ranges of the output values align with any measured data? For example, and assuming measured data is available, is there some region of the active subspace in Figure 6 that more accurately captures actual watershed behavior?

Technical Corrections

1. Page 8, Line 27 – for clarity, should the word “exit” be replaced with “flow out of the model domain”

2. Figure 1 – main plot should identify the location of Stream A, Stream B, and Gauge C

3. Figure 1 – add acronyms for each geologic layer referenced in Table 1 to Figure 1; for example, Muchelakalk (mo), Lettenkeuper (ku), etc.

4. Figure 1 – Zones 0.5-5.5 are not referenced anywhere in the text of the paper; either add reference or remove legend from Figure 1

5. Page 11, Line 6 – should be flooding not flodding
6. Page 12, Line 5 – for clarity, should “incoming water” be “incoming groundwater”, or does incoming water include precipitation and groundwater?
7. Figure 4 – does the behavioral target label “top drain” mean the same thing as “limited flooding” (Section 3.4)? Clarify in the figure description.
8. Figure 4 – the x- and y-axis should be the same for each behavioral target column; this will help the reader compare between differences in the sampling number

No author comments to review or respond to in discussion comments.

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