**Responses to reviews on:**

# Enhanced Watershed Modeling by Incorporating Remotely Sensed Evapotranspiration and Leaf Area Index

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We thank the referee for the valuable comments on our manuscript. All comments are numbered and corresponding responses are followed by an arrow symbol (➔) with blue words. The line numbers (Line) referenced may have changed in the final version of the revised manuscript.

**Reviewer #1:** The authors apply remotely sensed evapotranspiration and leaf area index in addition to in-situ streamflow to calibrate a SWAT model in Tuckahoe Creek Watershed. The paper is well written, albeit the usage of numerous abbreviations. But, I am kind of skeptical to accept this version of the article.

**Major comment**:

**1.1.** Novelty: Even though the article is presented well, under the hood, it is a calibration paper constrained with two additional RS products which has been investigated previously by other researchers listed below.

- Parr, D., Wang, G., & Bjerklie, D. (2015). Integrating remote sensing data on evapotranspiration and leaf area index with hydrological modeling: Impacts on model performance and future predictions. Journal of Hydrometeorology, 16(5), 2086-2100.
- Andersen, J., Dybkjaer, G., Jensen, K. H., Refsgaard, J. C. and Rasmussen, K.: Use of remotely sensed precipitation and leaf area index in a distributed hydrological model, J. Hydrol., 264(1–4), 569 34–50, doi:10.1016/S0022-1694(02)00046-X, 2002.
- Jiang, D. and Wang, K.: The role of satellite-based remote sensing in improving simulated streamflow: A review, Water (Switzerland), 1615, doi:10.3390/w11081615, 2019.

➔ We have added several statements to emphasize the novelty of our study relative to previous studies in Line 477 – 484.

Lines 477 – 484: Especially, our results provided several insights on the use of two additional RS products although previous studies already reported the advantages of them (Andersen et al., 2002; Jiang and Wang, 2019; Parr et al., 2015). First, our studies showed limitations on the single use of additional RS-ET product with the emphasis on the equifinality issue. In addition, a substantial reduction of model uncertainty was highlighted by the model evaluation at two spatial scales using two RS products. Lastly, this study chose the two RS products frequently used to monitor croplands, and thus our results could inform an improved modeling approach for agricultural watersheds.

**Suggestion:**

Methodology: 20,000 LHS samples have a wealth of information.

**1.2.** One way to provide insight would be to see among all the parameters that are being calibrated find the one which has the largest influence on the KGE values in par1 and par2. Investigating why these parameters are influential would a very good insight.

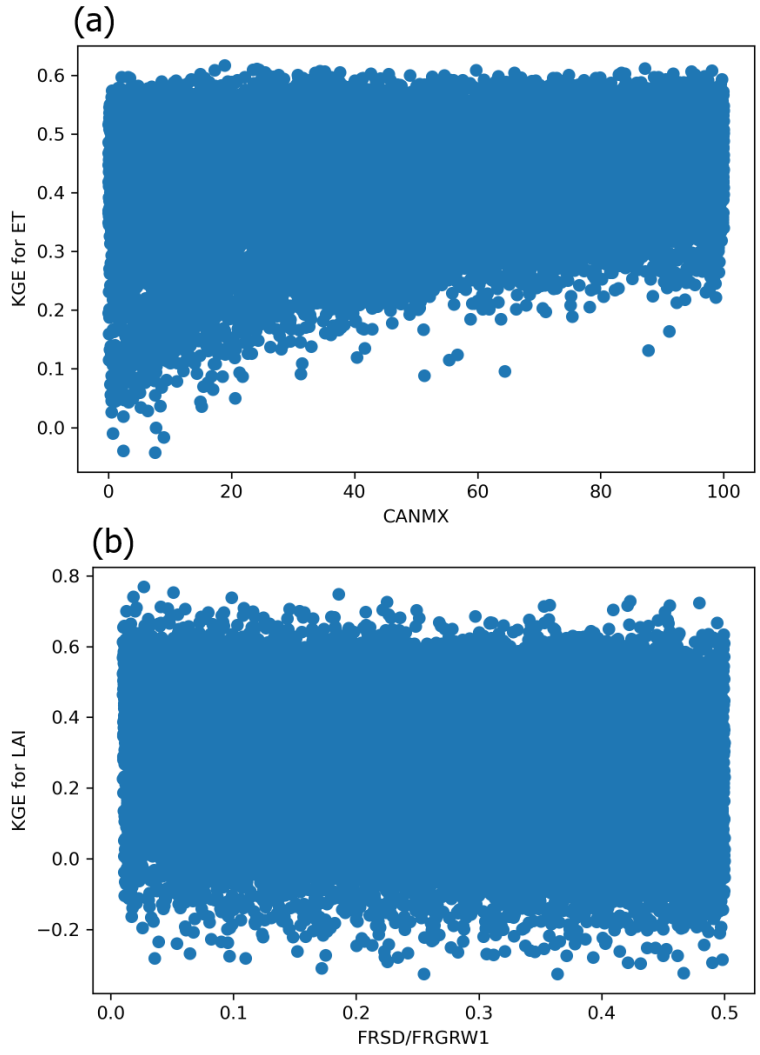
➔ We have conducted sensitivity analysis of calibrated parameters and calculated coefficient of variation (CV) to see which parameters have significant impacts on ET and LAI simulations. The Table 3 was updated to include sensitivity ranking, and the section 3.2 was made to show results. The analysis method and results have been illustrated in Lines 325 – 335 and 411 – 426, respectively.

**1.3.** Also, how to choose between single parameter set which gets best performance compared to a cluster of parameters (close in values) which gives good performance?

➔ In general, the single parameter set with the best performance is often selected for a scenario-based modeling approach. However, this practice faces the equifinality issue because the best single parameter set may not be better than decent multiple parameter sets when a model calibration is made by one observation. To address this issue, this study emphasized the benefits of two remotely sensed constraints since the additional constraints gradually reduce the number of decent multiple parameter sets. We have discussed this issue in Lines 485 – 494 in the section 4. and provided the conclusion that the use of multiple model constraints is needed for future studies as RS data are increasingly available. Since this study was conducted to reduce the parameter uncertainty, we have avoided illustrating the selection method of the single parameter set.

**1.4.** Is there a relationship (linear/non-linear) between parameter values and KGE?

➔ We have representatively compared the KGE values and CANMX/FRGRW1(FRSD) as below. Non-linear relationships were observed. Those results were not supportive of the major findings of our manuscript, so these results were excluded in our manuscript.




These are some of the questions that the authors can address to bring more value to science aspects of the paper.