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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Using Satellite-Based Evapotranspiration Estimates to Improve the Structure of a Simple Conceptual Rainfall-Runoff Model" *by* Tirthankar Roy et al.

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Author Comments: General

Our study explores two (three after combining) different ways of incorporating satellite-based actual ET (AET) data into conceptual hydrologic modeling framework to improve its performance in terms of streamflow and AET simulations:

(i) Based on constraining the ET process within the model. (ii) Based on changing the model structure to improve the ET process parameterization. (iii) Combination of both (constraining and structural improvement).

Following are some key points that we think are unique about this study:

[1] We have followed a strategy that includes several important aspects of modeling, such as: (a) Process constraining (including the new constraint adjustments) (b) Model re-calibration (using SCE-UA) (c) Use of new sources of information (d) Diagnostic model structural improvement and (e) Uncertainty analysis

[2] Diagnostic structural improvement has now become a new focus in the field of hydrology, where earlier the main focus was only on model calibration. A recent paper on this topic is Gupta et al. (2012). In this study, our main focus it to correct the model structure first and then calibrate the model parameters. We have tested several structural forms of the ET process parameterization equation within the model with increasing complexity and selected the one that performed the best.

[3] Although potential ET (PET) data are frequently available, the availability of actual ET (AET) data has always been very limited. The AET product we used (GLEAM) is quite new. We are using the latest version of GLEAM satellite-only AET which was made available few months ago.

[4] This study shows how the new sources of information (satellite AET in this case) can be utilized within the hydrologic modeling framework to improve its performance. The model HyMod has been there for a long time, however, only after the availability of the new AET datasets, the model could be improved.

[5] We think that both structural improvement and model calibration are equally important for models that have practical applications, and in this study, we apply both. We change the structure of the ET process parameterization equation and then calibrate the model against streamflow. Note that we deliberately did not calibrate the model against AET. The main reason for that was to show that if the model structure is changed, the importance of calibration is significantly reduced. Prof. Abdolreza Bahremand, who is also the first reviewer of this paper (see his positive comments in the discussion forum), has a recent opinion paper on this topic (Bahremand, 2016).

[6] The final plot of the paper (Figure 11 in the revised manuscript which is also avail-

able in the discussion forum) clearly shows the improvements after carrying out the structural modifications within the model. The left column is the original benchmark model and the right column is the final model with structural modifications. As can be seen, the streamflow simulations are more accurate when the model structure is changed. The recession are more accurately simulated. For AET simulations, the improvement is even more prominent. The blue line is the HyMod generated AET. As can be seen, after the structural modification, the AET simulations are way much better. The blue line in the second-column last-row plot is following the red line (GLEAM) more closely and the confidence bounds (grey) are also narrowed down significantly. These results clearly signify the importance of this study.

References

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