

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

Anonymous Referee #2

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Using Satellite-based evapotranspiration estimates to improve the structure of a simple conceptual rainfall-runoff model

By Roy, Gupta, Serrat-Capdevila, Valdes

This paper presents results from a study examining the use of satellite estimates of actual evapotranspiration (SET) to firstly constrain and secondly modify a HyMod model of Nyangores River Basin in Kenya. Although the ideas presented here are interesting, I found that the reasoning used in the study was circular and I'm not convinced by the results. I think the presentation of the material is too much like a report and the method and results are often mixed up, with the vast majority of the method discussion provided in Section 3 which is nominally the results section. The paper also refers to another

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publication in preparation by the same authors on this catchment and without seeing this it is difficult to understand the similarity and any potential overlaps between the two publications. It's not clear why this paper would be presented first. I recommend that the paper is rejected and the authors undertake more extensive validation of the method in a catchment where there is data other than the SET to allow comparisons.

If I understand the method properly, in Case 1 HyMod is run and the AET from the model is found to be different from the SET estimates. So the model is run using SET to constrain the AET in the model by setting the requirement that the $AET \leq SET$. However then the model parameters are found to be unrealistic so the SET is bias corrected so that when the model is constrained to have $AET \leq SET$, the model parameters are more realistic. In all of this there is no evaluation of the SET itself and the bias correction step implies that there are problems with the SET. So you're trying to match a model to a biased quantity and then changing that quantity and then still trying to match it. It just seems very circular to me. Case 2 follows much the same logic except rather than using the constraint that $AET \leq SET$, the model structure is changed with a variety of different equations that factor the evaporative demand ratio. Finally in Figure 9 the model is compared back to the SET which was used to correct the model. I just don't understand how you can accept the SET data without having an external validation. I accept that this is unlikely to exist for the catchment you have chosen but I think you then need to test your method in a more instrumented catchment where you do have external validation data and once you have confidence in the method then you can apply to a poorly gauged basin.

More specific comments:

Page 2 – paragraph 3 – at this stage its not clear how ET can be a model target – I think you need to make it clearer at this point that PET is forcing data and AET is a model state.

Page 2, line 15 – good correlation of the SET does not give me confidence that the

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property is not biased which is key for this method and even line 23 where the annual bias is low doesn't guarantee that there are not other biases that are cancelling out throughout the year.

Page 4 – paragraph 12 – TRMM data is no longer available so not clear why you say that it is available to near-present? The study period is not clear from Section 2 in any case.

Page 4, line 34 – here you describe Stage 1 as “constraining” and you are at pains to point out that it is not assimilation and yet in the remainder of the manuscript you continue to use the term assimilation – I think you need to be more careful with the terminology e.g. Page 8, line 23; Page 12, Line 24

Page 5, Step 1-2 – given this is the method section, there are no details here of the actual constraints. These are provided in the results section. I think this makes the presentation quite confused and doesn't provide the reader with much of a sign post or guide as where the research is heading. Similar comments for Step II-1 where the four equations are mentioned.

Page 7, Line 24 – I don't understand why you validate your water balance using satellite precipitation which has its own concerns. Why not use some ground based data as well?

Page 7, Line 27 – “based on our expectation of how it would behave” – this comes to my concern about the validation. We generally expect a more robust validation than just a sense that the soil moisture should be smooth. Why should it be smooth for this catchment? You don't appear to have any soil moisture data to validate this statement.

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