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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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We thank the reviewer, who identified himself as Prof. Abdolreza Bahremand, for nicely summarizing the key aspects of our study and pointing out their importance. We have addressed all of his comments and made the suggested changes in our revised manuscript.

NOTE: [1] The manuscript with tracked changes is uploaded in the form of a supplement. [2] Page and line numbers mentioned in the response correspond to the revised manuscript. [3] We have added an additional figure (Fig. 4) to demonstrate the structure of the modified model (HyMod-V2).

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Discussion paper

Reviewer Comment: 1. The paper and its discussion and conclusion has much more other useful contents than what has been given in the abstract. I guess the limitation of the abstract word numbers (500 words) has been the reason for this. 2. One concluding sentence (like those written in the conclusion) should be added here.

Author Response: As per the reviewer's suggestion, we have modified the last sentence of the abstract as in the following to summarize our main outlook: [Page 1 Line 15-17]

"Results suggest that both the approaches can provide improved simulations of streamflow, whereas the second approach also significantly improves the simulations of actual evapotranspiration, which substantiates the importance of 'diagnostic structural improvement' of hydrologic models."

Reviewer Comment: 3. GLEAM and HyMod could be other keywords for this paper? Don't you think so?

Author Response: We agree with the reviewer on this and have now included both GLEAM and HyMod as keywords.

Reviewer Comment: 4. Here, in such case I am sure the authors know better than me that the strong correlation is not enough :)

Author Response: Yes, we agree that a strong correlation is not enough. Therefore, in the revised manuscript, we have now included a detailed discussion on the evaluation of GLEAM. We are now citing one book chapter and four papers for this discussion. [Page 2 Line 21 – Page 3 Line 4]

"... Worldwide evaluations suggest that satellite-based ET estimates are strongly cor-

related (∼0.83) with ground-based observations made at flux towers (Demaria and Serrat-Capdevila, 2016). We use the Global Land Evaporation Amsterdam Model (GLEAM) as the source of the satellite-based ET (SET) data for this study. In GLEAM algorithm, ET is computed using only a small number of satellite-based inputs, which is largely beneficial for sparsely gauged basins. Miralles et al. (2011) have shown that GLEAM estimates of evaporation are strongly correlated (0.80) with annual cumulative evaporation estimated via eddy covariance at 43 stations, and have very low (-5%) average bias. The correlations at individual stations are strong (0.83) for all vegetation and climate conditions, and improve to 0.9 for monthly time series (Miralles et al., 2011). McCabe et al. (2016) have found satisfactory statistical performance (R2 = 0.68; Root Mean Square Difference = 64 Wm−2; Nash-Sutcliffe Efficiency = 0.62) of GLEAM while compared against the data from 45 globally-distributed eddy-covariance stations. Michel et al. (2016) compared Priestley-Taylor Jet Propulsion Laboratory model (PT-JPL), Moderate Resolution Imaging Spectroradiometer evaporation product (PM-MOD), Surface Energy Balance System (SEBS), and GLEAM simulations against 22 FLUXNET tower-based flux observations and found GLEAM and PT-JPL to be more closely matching the in-situ observations for the selection of towers and the reference period (2005-2007). Their extended analysis with 85 towers had similar overall outcomes. Miralles et al. (2016) compared three process-based ET methods (PM-MOD, GLEAM and PT-JPL) against surface water balance from 837 globally distributed catchments, and reported that GLEAM and PT-JPL provide more realistic estimates of ET. They found these two products to provide superior overall performance for most ecosystem and climate regimes, while PM-MOD tends to underestimate the flux in tropics and subtropics."

Reviewer Comment: 5. , and whether the model provides improved .....[here, i proposed this little correction to make it in harmony with the previous sentences. So, i think adding the conjunction "whether", like what you did for the previous sentence, is

better here.]

Author Response: Thanks for the suggestion. We have now modified the sentence as: [Page 3 Line 16-17]

“Finally, we test whether the use of GLEAM SET can further improve the performance of the structurally modified model, and whether there is any drop in the performance of the model if GLEAM SET data become unavailable.”

Reviewer Comment: 6. Unnecessary abbreviation makes the text a bit boring, as the text has already too many :) If you wish to reduce them then just start with the name of the rivers...

Author Response: We agree with the reviewer on this. We have now removed the abbreviations for the seasons as well as for the basins.

Reviewer Comment: 7. The abbreviation, HAET, has not been introduced in the paper so far. Perhaps you mean HyMod AET. First I thought that H stands for Hargreaves...

Author Response: Thanks for pointing this out. We have now introduced HAET in Section 2.3.

Reviewer Comment: 8. after the remove of the GAET data.

Author Response: We have now modified this part of the sentence as: “. . . after the removal of the GAET data.”

Reviewer Comment: 9. This sentence needs a little bit of improvement (grammar correction).

Author Response: Thanks for pointing this out. We changed the sentence as in the following:

“Therefore, our results suggest that ET constraining approach should be implemented only for the simulation periods when SET data are available.” However, this statement seems redundant once the constraining results are already discussed. Therefore, we deleted this from the revised manuscript.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-413/hess-2016-413-AC1-supplement.pdf

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