Hydrology and Earth System Sciences Discussions

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Reply on RC1

Jin Feng et al.

Author comment on "Improved soil evaporation remote sensing retrieval algorithms and associated uncertainty analysis on the Tibetan Plateau" by Jin Feng et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-210-AC1, 2022

We greatly appreciate the anonymous referee for providing valuable and constructive comments that are of great help for us to improve the quality of the manuscript. We have fully considered the comments and will revise the manuscript accordingly. The point-to-point responses to the comments and our plans for revision are listed below.

Replies to the General Comments:*This manuscript tried to improve the satellite-based land surface ET algorithm by introducing soil moisture. Using satellite data to simulate the water cycle or calibrate models are very attractive considering the growing availability of remote sensing data. The method is reasonable, the findings are useful, and the article was well written. However, there are still some minor issues that need to be addressed.*

Response:

Thanks for your positive evaluation and encouraging comments on our manuscript. Your individual comments are replied below.

Replies to the Specific Comments:

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- *L15: '… introducing two frameworks …' there are no any information about these 'two' in this sentence. It would be better combine this and the following sentence.*

Response:

Thanks for your suggestion. We proposed to modified the descriptions to "…remains understudied. In this study, we aimed to improve the satellite-driven Process-based Land Surface ET/Heat fluxes algorithm (P-LSH) by introducing two frameworks for quantifying moisture constraints to ET, with the first framework normalizing the surface soil moisture, and the second framework taking the ratio of cumulative precipitation to cumulative equilibrium evaporation. As a result, it formed two improved P-LSH algorithms. We systematically assessed the performances of the two improved P-LSH algorithms and …".

- *L20: 'two improved P-LSH algorithm' seems not clear. What are they?*

Response:

Thanks for your suggestion. "the two improved P-LSH algorithms" refers to the improved algorithms composed of the two moisture constraint frameworks. We have restated the description and make the sentence clearer, as shown in *Comment #1*.

- *It is better to highlight the significant point of the study further.*

Response:

Thanks for your suggestion. We conducted this study based on the following backgrounds. On one hand, the Tibetan Plateau is crucial for Asian monsoon development and concurrent water and energy cycles, but relatively few studies have been carried out on its hinterland because of the difficulty of surveying. Remote sensing retrieval can conveniently estimate ET in this region, but the accuracy needs to be evaluated. On the other hand, some studies (Zhang et al., 2015; Pan et al., 2020) have shown that water supply is the main control factor of ET in arid and semi-arid regions, whose structures are rarely systematically assessed or discussed in existing studies.

In this paper, the feasibility of various moisture constraint equations in existing ET algorithms in typical arid/semi-arid basins was analyzed, and then the soil moisture and precipitation were used to improve the P-LSH algorithm. Finally, the uncertainties of key inputs are assessed. Thanks again. We will further highlight the significant point in the revised manuscript.

- *Table 1: why use 30''*

Response:

As we mentioned in the caption of Table 1, we listed the original resolution of the datasets. The soil properties dataset is in a raster format with a resolution of 30 arc seconds. To match other inputs in the ET algorithm, we aggregated the dataset from the original 30'' resolution to 1/12° using the arithmetic averaging method.

- *Figure 3 and 4: More information (A1, …; ET_{recon}) is needed in the caption to make it be understandable.*

Response:

Thanks for your suggestion. The A1, A2, A3, A4, A5, A6 are the coupling algorithms that coupled the vegetation evapotranspiration scheme and water evaporation scheme from the P-LSH algorithm with the six existing soil evaporation algorithms (see Table 2). The ET_{recon} item represents the reconstructed ET estimates derived from the terrestrial water balance method. We will add more information in the caption of Figures 3 and 4 in the revised manuscript.

- *I am not quite clear how the authors evaluate the 'uncertainty'.*

Response:

In the improved algorithms, the precipitation and soil moisture data are used to express the moisture constraint on ET. We investigated the impact of various precipitation and soil moisture datasets on the ET to determine the impacts of key inputs uncertainty on model outputs. Taking the P-LSH$_\theta$ algorithm as an example, we investigated the variation between multiple ET estimates derived from multiple soil moisture datasets, and as a comparison, we also investigated the variation of multiple soil moisture datasets. The same method is also applied to the uncertainty evaluation of P-LSH$_P$algorithm, as shown in Figures 10-12. By quantifying the variations between soil moisture/precipitation and their responding ET estimates, the characteristics and uncertainties of the improved algorithms are discussed in Section 4.3. Thanks for your question. We will add the clear description to the revised manuscript.