Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., author comment AC1
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Reply on RC1

Tyler S. Harrington et al.

Author comment on "The contribution of local and remote transpiration, ground evaporation, and canopy evaporation to precipitation across North America" by Tyler S. Harrington et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-284-AC1, 2021

Dear Anonymous Referee #1,

Summary:

Thank you for your constructive feedback to help improve our manuscript. We will address each of your specific suggestions below and indicate how we plan to revise our manuscript.

This manuscript investigated the contribution of transpiration, ground evaporation, and canopy evaporation to local and remote precipitation across North America. They found that the role of the land surface and the individual ET components varies considerably across the continent and across seasons. In annual time scale, transpiration is the dominant source of precipitation across the north and east, while soil evaporation moisture is dominant in the south and west.

Comments:

I would recommend a major revision:

- Content needs to be condensed (see below). Many words should be removed since it is less important for the objective. It is really time-consuming to read those words.

We will condense the discussion section to help cut back on the length of the manuscript. Specifically, we will remove portions of the discussion section that repeat information from the results section. This will help reduce the total word count.

- This is also related to comment 1. There appears to be little focus within this manuscript. In my opinion, the result section should be re-organized, and most of the words in the discussion should be moved to the result section. Meanwhile, I think the uncertainties of simulation should be discussed in detail in the discussion section.

The results section is organized in the following way: a comparison of model

output to observations, an examination of total ET to precipitation, recycling, and moisture export, and an examination of each individual ET component to precipitation, recycling, and moisture export. Most of the research literature examines land surface ET in each of these processes, but does not investigate each component individually. We believe organizing our results section in this way first provides the reader with information that can be directly compared to other studies (though we look at recycling and export on a more refined spatial scale than many other studies), and then provides a further analysis by repeating the results for the individual ET components. As such, we prefer to keep the results section organized in this way.

As addressed in the previous comment, we plan to reduce the length of the discussion section. We will remove the parts of the discussion section that could be directly moved into the results section. We will also address uncertainties of our results given the constraints of the model, including those related to biases and model parameterizations.

- The method part is also unclear. Even though the authors provided an appendix to introduce the water tracers used in their study (it is hard to understand as well). It is still unclear why the author uses the isotope-enabled model to perform their simulation. Is isotope information used in this study? I did not find any information for it (I think it is not). Compared to other isotope-based studies (such as Yoshimura et al 2004; Sodemann et al., 2008), what is its advantage? Please specify.

Ref:

Yoshimura, Kei, et al. "Colored moisture analysis estimates of variations in 1998 Asian monsoon water sources." Journal of the Meteorological Society of Japan. Ser. II 82.5 (2004): 1315-1329.

Sodemann, H., Schwierz, C., & Wernli, H. (2008). Interannual variability of Greenland winter precipitation sources: Lagrangian moisture diagnostic and North Atlantic Oscillation influence. Journal of Geophysical Research, 113(D3). doi:10.1029/2007jd008503

The version of the Community Earth System Model that has water tracing capabilities is the isotope-enabled Community Earth System Model (iCESM). Though iCESM is needed to use the water tracers, isotopes are not used in the tracking nor in any of our analysis. We will add a couple of sentences to our methods section to clarify that isotopes are not used in our study.

- The validation of simulation is not enough. The comparison of climatology mean of simulation and observation is not fair enough to check the model performance. We need more detailed metrics, such as RMSE, PBIAS etc. At the same time, since the author compares simulated ET with GLEAM, why not compare simulated transpiration, soil evaporation, and canopy interception with those from GLEAM as well?

Thank you for this suggestion. We agree that more validation metrics can be useful to check our model performance. Though RMSE is a great metric for validating model performance, (Willmott & Matsuura, 2005) showed MAE is more appropriate for assessing climate model performance. We will include a Supplemental Table in our revised manuscript that shows the MAE and PBIAS for each region of our study domain for precipitation, ET, and each ET component.

In regards to comparing our model simulation to GLEAM transpiration, soil evaporation, and canopy interception separately, these comparisons are included in the supplemental document (Figures S1-S3) of our current manuscript.

Ref:

Willmott, C.J. and Matsuura, K. (2005) Advantages of the Mean Absolute Error (MAE) over the Root Mean Square Error (RMSE) in Assessing Average Model Performance. Climate Research, 30, 79-82. http://dx.doi.org/10.3354/cr030079

Detailed comments

- L97-L104: I suggest removing these words. Since the model used in this study can not answer the question about how Lai and co2 will change the ET partitioning (I think the model used climatology mean LAI and constant values of Co2 in MS).

While the model does not answer the question about how LAI and CO2 will change future ET partitioning, the partitioning of ET impacts moisture teleconnections (as we show in this manuscript). Understanding how future moisture teleconnections may change starts with understanding moisture teleconnections in the current climate. We believe including this section in our introduction serves as great motivation for our study, and would prefer to keep this text.

- L135-L138: Was isotope used here?

No isotopes are used in our study. We will make sure to note this in the methods section.

- L233: which version of the GLEAM dataset was used? Why not conduct a comparison of simulation and observed E, T, and C as well?

We used GLEAM version 3.5a and will note this in the Methods section of our revised manuscript. We have compared the simulated E, T, and C to GLEAM. These comparisons are shown in the supplemental document (Figures S1-S3) and referenced in Section 3.2.

- L257: We need to see other metrics such as RMSE and PBIAS. Indeed, even for climatology mean, the bias is still considerable in my opinion (about 0.25 mm/day)

We will add a supplemental table that lists the MAE and PBIAS for each region.

- L291: Again, other metrics such as RMSE or /and PBIAS are required.

We will add a supplemental table that lists the MAE and PBIAS for each region.

- Section 3.3. Content needs to be condensed. Eq 6 should be moved to the method part.

While we do not believe we can remove the majority of the text from this section without removing valuable results, we will be more concise with our words and will remove any extraneous information to reduce the Section's length. We also agree that most equations should be included in the methods section. However, the need for this equation arises in Section 3.4, and we believe incorporating this equation within our results (along with references to other manuscripts showing the need for this equation) is easier for the reader to follow.

- Section 3.5 and 3.6. Content needs to be condensed. I think to summarize as a table or Figure would be much better.

Sections 3.5 and 3.6 describe the seasonal evolution of regional moisture convergence/divergence, and the breakdown of the individual ET component contributions to precipitation, respectively. The results presented in these sections are key for understanding the teleconnections between regions, and for understanding the relative importance of transpiration, canopy evaporation, and ground evaporation in driving local and remote precipitation.

While we do not believe we can remove the majority of the text in these sections without removing valuable results, we will be more concise with our words and will remove any extraneous information to reduce each Section's length. Figure 7 combines all of Section 3.5 into one Figure to hopefully make seasonal comparisons easy for the reader.

- L728-L751: move to the method section.

We will move this to the methods section.