Hydrology and Earth System Sciences Discussions

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Reply on RC2

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-AC2, 2021

Dear Anonymous Referee #2,

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.

General comments:

This paper analyzed regional moisture recycling and precipitation sources to individual ET components (transpiration (T), canopy evaporation (C), and ground evaporation (E)) by using the Community Earth System Model version 1.2 with online numerical water tracers, and found the role of the land surface and each individual ET components across North America and across seasons. It is found that the northern part of study area receives more contribution from land surface (80%), more than half of which originates from T moisture, while E moisture is dominant in the south and west. Meanwhile, the contributions of each component to recycling varies by season. During winter and fall E and C moisture make up a large proportion, while the summer is dominated by T, and the spring receives high contributions from all three components. This study separates the contribution from each ET components, which is of scientific significance. This paper is well-organized and well-written, and it can be accepted after the following questions are revised or explained.

Specific comments

- Although the title is "The contribution of transpiration, ground evaporation, and canopy evaporation to local and remote precipitation across North America", the study focuses only on precipitation in North America, while the sources are distinguished between local and remote. A revision of the title is suggested to emphasize local and remote contribution of the ET components to North America precipitation.

Thank you for this suggestion. We agree the local and remote contribution of the ET components should be emphasized, so we will change our title to "The contribution of local and remote transpiration, ground evaporation, and canopy evaporation to precipitation across North America".

- Line 49: "including the contributions from moisture transport and recycling". It will be better to replace "moisture transport" with "moisture advection".

We will make this change.

- Line 192: I do not get the meaning of this calculation equation and what it is trying to express here.

We include this equation to show that the matrix formulation developed in Singh et al. 2016 only works if all precipitation and evaporation over all the Earth's surface area is considered. Since we only consider evaporation & precipitation that occurs over the North American continent, we have to adjust their matrix formulation (as shown in the appendix). We will include some extra clarification about this in the methods section of our revised manuscript.

- Line 395-396: "This scaling ensures that regions with…is not solely a function of domain size": Please note that the local recycling ratio, or percent recycling in this paper, is not solely a function of area, but is also closely related to the local land-atmosphere coupling and circulation conditions. It is more appropriate to say that normalization can eliminate the impact of the size of the land area to a certain extent.

Thank you for this suggestion. We will change "this scaling ensures that regions with… is not solely a function of domain size" to "the scaling term helps to minimize the impact of domain size on recycling percentages".

- Figure7: Line 568 "All units are normalized units of length per m^{-1}". Please check if is should be "per m". And what are the units of each variable itself? For example, is the unit of evaporation in mm $day^{-1}$and then normalized to per m? And what about divergence/convergence?

Thank you for catching this mistake. We will change line 568 to per m rather than per m^-1. We also agree that our length per m units are difficult to interpret. We will clarify that length per m for the evaporation plots refers to the "normalized water amount per m" and the convergence/divergence plots refers to the "normalized water mass flux per m".

- All the figures in the result section do not show the latitude and longitude range, I suggest adding it. And keep all figures showing the same range.

We will make this change to all of our map plots.

- For Figure9-12, if the contribution of the same component in different seasons can be represented by the same range of colorbars, it will be easier for the reader to compare changes between seasons.

We will make sure that each ET component has the same colorbar scale for all seasons.