

# ***Interactive comment on “Contrasting roles of interception and transpiration in the hydrological cycle – Part 2: Moisture recycling” by R. J. van der Ent et al.***

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## **1 General comments**

The authors perform a diagnostic moisture tracing study to quantify continental moisture recycling with the new element that plant transpiration is treated separately from other continental evaporation fluxes. The methodology is sound and the results are well presented. My most substantial suggestion is to discuss the seasons separately in the first place instead of mainly discussing annual-mean results and discussing the seasonality on the sidelines. In the latter case, the interesting non-seasonal effects due

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to the different roles of transpiration and interception in moisture recycling are blurred by strong seasonal effects. In addition I have a number of minor comments and suggestions. Overall, I consider the manuscript well suited for publication in ESD after minor revisions.

## 2 Specific comments

P284, L1–4:

I think it would be appropriate to mention Trenberth (1999) here as well because he also showed local recycling estimates that can directly be translated to local length scales. (In fact, Trenberth (1999)'s estimates can be considered to be even more local as they are based only on the local conditions).

P288, Eq7:

Maybe this splitting would become even more clear to the reader if it was mentioned also that  $E_{o,i} + E_{c,i} = E_i$  and  $E_{o,t} + E_{c,t} = E_t$ .

P288, Eq8; P289, Eq9; Fig3a,c:

In my view the “continental evaporation recycling ratio for interception/transpiration” as they are currently defined are more confusing than informative. The authors mention that these quantities carry mixed information, and consequently they focus their discussion on other metrics. I would go even further and not discuss them at all. Also, I think that the term “continental evaporation recycling *ratio* for interception/transpiration” is better suited for what is currently termed “continental evaporation recycling *efficiency* for interception/transpiration” because it is the *ratio* of the recycled part of an evaporative flux.

P289–290, Sect2.2.2: “lifetime of continental precipitation/evaporation recycling”

Again regarding terminology, to me it is strange to assign a lifetime to a process (e.g. precipitation recycling) rather than to an object (e.g. recycled precipitation). I

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consider it more elegant to keep the terminology of Trenberth (1998) and talk about the “timescale of continental precipitation/evaporation recycling” despite the methodological difference between Trenberth (1998) (upscaling of local conditions) and this study (explicit tracing).

P294, L17–20:

It would be nice if the authors could comment on the reasons for this ~10% difference. If it is not due to the forcing data, it appears that the introduction of a second layer leads, on annual and global average, to a lower continental moisture recycling estimate. Following Goessling and Reick (2013), this suggests that accounting for vertically sheared winds (reducing recycling estimates) outweighs the effect from accounting for fast evaporation (increasing recycling estimates), or something along these lines?

P295, L22–23: “Regions with high evaporation recycling are important source regions for sustaining downwind precipitation.”

This holds only for regions that at the same time feature high evaporation rates. For example, the Arabian Peninsula has high evaporation recycling ratios, yet it has certainly no significance for downwind precipitation as the evaporation rate is close to zero throughout the year.

P296, L10–15:

In my view, such seasonal effects should be separated more clearly from the different roles of transpiration and non-biophysical evaporation in a fixed large-scale meteorological setting (i.e. within a season), see my comment above.

P298, L23–25:

I fully agree with this interpretation and think that this kind of reasoning is central to the manuscript and, to repeat myself, should be clearly separated from seasonal effects by discussing intra-seasonal (January/July) results in the first place.

P301, L22–27:

I do not understand why the described results fit well into the picture drawn in those

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earlier studies, maybe the authors could be more precise on this?

P302, L15–18:

This is a decent explanation for the fact that recycling of direct evaporation is faster and associated with shorter length scales compared to recycling of transpiration. The question remains, however, whether this is largely a passive effect due to the persistence of large-scale weather phenomena (particularly in the temperate zones), or whether the different recycling estimates for direct evaporation versus transpiration actually translate into a higher impact of direct evaporation compared to transpiration on local/regional/continental precipitation, leading once again to the question how telling diagnostic recycling estimates are regarding the importance of continental evaporation for precipitation as discussed in Goessling and Reick (2011).

P318, Fig1:

If I am not mistaken, there should be no blue fraction in the arrow for  $\sum F_{\text{out}}$ . To my mind the blue fraction would imply that the water advected to the continents and transported further to the ocean with intermediate recycling is also included, which is seemingly not the case.

## References

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