

## ***Interactive comment on* “What do moisture recycling estimates tell? Lessons from an extreme global land-cover change model experiment” by H. F. Goessling and C. H. Reick**

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General response: Major changes to the manuscript

The editor condensed the three referees' criticism into three major concerns, namely (I) unclear terminology, (II) missing dynamical perspective, and (III) overstated conclusions. We think that the new version of our manuscript is greatly improved regarding all of these three points.

In response to this critique we have rewritten most parts of the manuscript, including the abstract and even the title. As a consequence, many of the referees' spe-

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cific comments are no more attributable to a particular sentence or paragraph of the new manuscript. Nevertheless, we try to respond to them one-by-one. But since the changes made are more fundamental than could be grasped from these one-by-one answers we list here the most important general modifications to the manuscript.

I:

The terminology has been changed considerably. To make the paper as a whole as clear as possible, the original section "Introduction" is split into "Introduction" and "Background". In "Introduction" we motivate our study and distinguish three mechanisms through which evaporation affects climate. In "Background" we elaborate on each of these mechanisms separately and discuss at which spatial scales they are thought to act. Also, to avoid the confusion seen in the referees comments that arose from using uniformly-weighted time-averaged recycling ratios in the original manuscript, we now use the more common precipitation-weighted recycling ratios. We have added a figure to the supplementary material (Fig. S1) that elucidates the differences which are found to be very small for monthly means but larger for annual means.

II:

The largest improvement of the paper, at least in our opinion, regards the analysis of changes in the atmospheric circulation. The strategy underlying the original manuscript was to treat the atmosphere more or less as a "black box". This seemed justifiable to us since the main intention of the paper is to demonstrate that the response to a very large perturbation is dominated by other processes than moisture recycling, so that moisture recycling estimates are generally applicable to "predict" the response to (very large-scale) land-use change, so that further research is needed to identify the conditions for their applicability. We must however admit that, as the reviewers suspected correctly, we underestimated the contribution from changes in the large-scale circulation. In Sec. 5.2 we now elaborate on these changes and added appropriate figures.

III:

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In the light of the aspects discussed in the previous paragraph, our conclusions are now more cautious. We make clear that the paper is meant (I) to demonstrate that the question what moisture recycling estimates tell has no clear answer so far and deserves further investigation, and (II) to make "only" a first step towards an answer by reviewing and demonstrating the processes that have to be taken into account when trying to answer that question. In reaction to the sharp critique by the referees, the issue of scale-dependence of the perturbation and the response is now a central aspect of the paper.

Further major changes:

- We changed the second part of the title to a less provocative formulation.
- In response to the referees suggestions we repeated our simulations with another moist convection scheme. Since the response turns out to be very similar we only mention this result in the main paper but show the results from this second convection scheme in the supplementary material.
- We now focus the analysis on July to keep the paper concise and provide figures for January in the supplementary material.
- We abandoned the zonal-mean figures because the vertical profiles they show are not central to the study.
- In response to the referees comments, we now have added figures showing absolute values of precipitation and precipitable water that now complement the relative differences that we already showed in the original manuscript.
- We added a table showing averages for continental-scale regions.

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