

## ***Interactive comment on “Potential of global land water recycling to mitigate local temperature extremes” by Mathias Hauser et al.***

### **Anonymous Referee #1**

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#### General comments

In the present paper the authors assess the potential to keep soil moisture at a certain level by means of sustainable land water recycling (LWR), and analyze the impact on temperature extremes and on the hydrological cycle. A relatively simple (but conclusive) LWR scheme is introduced, and coupled to an Earth system model (CESM). Sensitivity experiments are carried out using different LWR settings. The results indicate that (in the present simulations) sustainable LWR (i) reduce the land area with decreasing soil moisture, (ii) lead to an increase of precipitation in mid-latitudes and a reduction in monsoon regions, and (iii) reduce hot temperature extremes.

I think that this is an interesting paper, which on the one hand analyses the impact of sustainable water management (irrigation), and on the other hand indicates how this

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can be incorporated into Earth system models in a relatively easy way. The methodology is sound, the paper is well written and structured, and provides new and valuable results. Thus, I recommend publication. I have only minor comments the authors may like to consider.

#### Specific comments

1) P10L8-10: The authors state that changes in the radiation budget are responsible for the decrease in temperature, and a decrease of downward thermal radiation (LWin) indicates higher cloud cover. This seem to imply (perhaps unintentional) that the change in LWin is the most important factor. I may be wrong, but I would expect that higher cloud cover (and more moisture due to enhanced evapotranspiration) would increase the downward thermal radiation if the atmospheric temperature stays the same. Thus, the decrease in LWin may be a subsequent effect due to cooling of the atmosphere in response to a colder surface caused by higher evapotranspiration and less solar radiation (more clouds). This may need to be clarified.

2) P12L13-P13L2: In the sensitivity experiments SST and sea ice are prescribed. In my view this is a reasonable approach to analyze the (local) response for land areas, as it is done in most of the study. However, I think it is difficult to obtain robust conclusions for global and long-term properties (the global long term trend) without using interactive ocean and sea ice.

3) Precipitation: One main conclusion (and study-focus according to the title) is that LWR can reduce temperature extremes. However, also precipitation seems to change substantially. I'm wondering whether there is also a change of precipitation extremes. We may mitigate heat wave at the expense of having more flash floods in certain regions. Perhaps, the authors have looked at this, and may like to add a comment.

#### Technical corrections

1) P13L26: 1.06 -> -1.06 (?)

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