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Earth System Dynamics
Discussions

Interactive comment on "On the social dynamics of moisture recycling" *by* Patrick W. Keys and Lan Wang-Erlandsson

Anonymous Referee #1

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This study examines the social dimensions of moisture recycling taking the case of three countries: Mongolia, Niger, and Bolivia. The characteristics of sources and sinks of moisture are examined to understand the heterogeneity of moisture recycling social-ecological systems. A moisture tracking model called the Water Accounting Model-2layers (WAM-2layers) is used to track the sources and sinks of moisture starting from the moisture entering a grid cell as evaporation. The study finds that sources and sinks of moisture can experience different levels of human well-being and highlights the need to include power discontinuities in the description of moisture recycling social-ecological systems, and aims to contribute to the ongoing discussion about the emerging discipline of socio-hydrology. The paper is well written and is a good fit for Earth System Dynamics, but significant revisions should be made before the manuscript can

be considered for publication. Please find my comments below.

1. The abstract is not fully representative of the paper. First, there is no mention about what model/tool is used to carry out the analysis. And second, the abstract is too qualitative. I suggest (a) adding some information about the model; (b) adding some quantitative information about the key findings; and (c) providing some take-home message about the differences in the coupled social-hydrological systems among the three selected regions in relation to the archetypes discussed in the paper.

2. Page 2, Line 28: It is not clear of how this paper provides information for land-water managers; I didn't find any discussion in the remainder of the paper. It is important to add this information because it has been highlighted as one of the major contributions of the paper.

3. Section 2.1: The selection of the three countries for case studies is justified based on the authors' prior work and the global regions that receive significant precipitation from upwind evaporation. Given that the goal of the paper is to examine the connections between moisture recycling dynamics and social-ecological systems, wouldn't it be interesting to conduct the study in regions where there is an ongoing intensification of human activities and where hydrological-social systems are more tightly coupled and are fast evolving? In South America, the Cerrado Biome is one of such regions that is undergoing rapid land use/land cover change due to agriculture expansion. Studies have shown that the changes in land use in the Cerrado region have decreased the amount of water recycled to the atmosphere via evapotranspiration (Spera et al. 2016). There are also other regions where rainfall patterns and ET have been altered by human activities, especially land use change and irrigation (e.g., High Plains, Northwest India, Eastern China). Some of these regions also coincide with the regions of strong land-atmosphere coupling identified by Koster et al. (2004). Finally, from hydrologic point of view it would be more meaningful to conduct such a study over a river basin.

4. Page 4, Line 11: What are the necessary inputs for WAM model? What is the spatial

resolution? Please provide detailed information about the model, data, and experiment settings.

5. Page 5, Line 19: "...coarsest grid resolution": Please specify the resolution/grid size?

6. Section 3.3: This short section about the integration of moisture recycling and social features doesn't provide much information about such integration. The authors present a figure from their previous study and refer to the literature review section for further context. In the current form, I don't see this section providing any new information. I suggest the author to revise this section and make a strong case about this important integration.

7. Section 3.4: This is related to the previous comment. This rather lengthy and descriptive section provides a good literature review but it is purely qualitative and doesn't provide a good linkage with the quantitative analysis provided in other sections. A better integration of the "quantitative" and "qualitative" parts is needed.

8. Sections 3.1 and 3.5: How is land use change considered in the model? What data is used and at what resolution? Is deforestation and agricultural and irrigation expansion considered? If so, does the model account for the changes in ET because of such land use changes? Please provide these details. I also suggest that the author strengthen Section 3.1 (the quantitative analysis) by including more results from the model (e.g., results of changes in land use and the impacts on moisture recycling). Currently, this section is too brief and focuses mostly on the precipitationsheds shown in Figure 2. Please also see comment #6 on better integration.

9. Section 3.8: Please consider expanding the discussion by adding information about studying human-water interface using hydrological modeling, in line with the discussion provided by Wada et al. (2017).

10. Figure 2: This is a minor issue, but I suggest changing the unit to mm.

11. Page 8, Line 23: reference needed after "malnourished rangeland systems".

12. Page 12, Line 21: change "lead" to "led"

13. Page 12, Line 31: reference needed after "corrupt leaders".

14. Page 14, Line 31: MRSES has already been defined.

References

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