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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the importance of cascading moisture recycling in South America" *by* D. C. Zemp et al.

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Below you find a point-by-point response to the comments of the referee #1. Excerpts from the referee's report have been marked in bold.

1. On the Relevance of the Paper: Rather than a study of marginal interest, appealing to a particular subset of readers interested in moisture dynamics over a particular region, we are in the presence of a study with much broader relevance, not least given the applicability of the methodologies to other scientific problems in Atmospheric Chemistry and Physics. Having said that, the topical problem of moisture recycling in South America is itself a fascinating problem,

with far-reaching implications to the wider atmospheric circulation.

We thank the referee for his encouraging comment. We are pleased to know that he does not doubt about the relevance of studying moisture recycling in South America and that he mentions the possible application of the complex network approach to different domains including atmospheric sciences.

2. On the Methodology: The methodology is sound, its implementation well explained and its use well justified. This is the opinion of the reviewer, which might not necessarily be shared by readers less familiar with the concepts. Bearing in mind the nature of the underlying system, the dynamics of which is driven by a multiplicity of spatiotemporally interconnected processes, it is appropriate to resort to complex network analysis methodologies. The authors aptly take grid cells as network nodes and the moisture transport (magnitude, direction) as network branches or interactions between nodes. By including self-interactions, the authors are then able to account for local reevaporation and in turn the cascading moisture recycling, aptly defined as having at least one such re-evaporation cycle in the process. For this purpose, an Eulerian approach to moisture transport is preferred, as is actually done in the paper. While a Lagrangian approach to tracking the water particle as it is advected by atmospheric circulation might be favoured in other contexts, here the authors have an important point in taking into account the local, Eulerian approach. This is make clear as the procedure enables the role of local re-evaporation to be brought out, with all its implications. Ultimately, nothing is lost for not opting for a Lagrangian approach, as its benefits in tracking down the particles travelling in the atmosphere are obtained by taking into account the water balance dynamics in each cell.

We thank the referee for the very positive comments and for the good justification of the use of the complex network approach. He also explains in a clever way why the

Eulerian approach is in this case more suitable than the Lagrangian one and gives a nice justification as how we recover the missing Lagrangian trajectories when we account for the water balance in each cell to build the network.

3. On the Results: While the role of the cascading moisture recycling addressed in the paper is not overwhelmingly impressive, it is undoubtedly relevant and cannot be neglected, as well pointed out by the authors. The discussion of intermediate moisture recycling nodes, acting as distributors rather than simply sources or sinks, brings added value to a more comprehensive assessment of moisture transport along the way. By analysing the interacting nodes of the system network, the study also brings out interesting land-atmosphere feedbacks that shed more light onto moisture dynamics in the atmosphere, and in turn precipitation regimes with all the implications that they ensue. The impacts of land use change on moisture recycling mechanisms are also very relevant and bring further awareness to the far-reaching effects of deforestation taking place in significant parts of the rainforest. The detailed processes are discussed in a clear and palatable way to the reader, therefore the reviewer would not suggest any significant changes. Still, it is worth noting that the last sentence of the main body of the paper, on page 17501, lines 5-7, is so important that the point should eventually be stressed from the very beginning in the paper.

We thank the referee for his very positive comments regarding our results and discussion. We agree with the referee that the last sentence should be highlighted already at the beginning of the paper. In the revised manuscript, we will add the following statement at the end of the abstract: “This study offers a better understanding of the feedback between the vegetation and the atmosphere on the water cycle which is needed in a context of land-use and climate change." We also propose to rephrase L. 23 - 24 in the introduction: “In order to improve predictability of rainfall changes with future land-use and climate change, further advancement in our understanding of continental

moisture recycling in South America is needed."

4. Minor mathematical typesetting remarks: The formulation is consistent, well presented and easy to follow. Therefore, only minor typesetting remarks can be raised: P. 17507, lines 12, 14-18: the parenthesis around the fractions should enclose the entire fraction. For instance, if typesetting in LaTeX, this can be done by "nleft(" "nright)" instead of just "(" and ")". A more appropriate use of the parenthesis is actually done further down on page 17508, line 8.

We thank the referee for this precision. We will make a better use of the parenthesis in the revised manuscript.

5. Minor grammar remarks: The text is well and clearly written in proper English. The reviewer would thus leave only a couple of minor remarks: a) The use of "which" in transitive statements: Page 17487, line 2: "which can be" should either be preceded by a comma (", which can be"), otherwise "which" would be replaced by "that". Page 17487, line 20: "which are important": same issue: either precede by comma or replace which by "that". Page 17487, line 22: "which is evaporated": same issue. Page 17488, line 18: "location which receive": same issue. Page 17489, line 4: "locations which distribute": as above. (among other instances)

We thank the referee for his positive comment regarding the writing of the paper. We will take into account his suggestion in the revised manuscript.

b) Missing preposition "as": Page 17490: "moisture that has final destination the La Plata basin": should read "moisture that has [as] final destination the La Plata basin".

We thank the referee for this remark. We will correct the manuscript accordingly.

Having mainly focused on the scientific content and formulation in this review, additional minor issues may have slipped under the radar.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 17479, 2014.