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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Aerial and surface rivers: downwind impacts on water availability from land use changes in Amazonia" *by* Wei Weng et al.

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GENERAL COMMENTS

Weng et al. (hereafter, the authors) explore the role of land-use change on the hydrology of the Amazon, focusing on the implications of changes in evaporation on moisture recycling, precipitation, and subsequent runoff. The authors identify key regions in the Amazon that are particularly sensitive to changes in continental moisture recycling, and further identify how different land-use change scenarios can impact hydrology.

I find the study to be interesting, relevant, and timely. I recommend the paper receive minor revisions, prior to acceptance for publication in HESS. I will summarize my comments briefly, and then lay out more detailed comments below.

1) The paper is on the cutting edge of land-use change & moisture recycling research, in the sense that it is examining sensitive regions to land-use change, the role of internal-watershed vs. external-watershed land-use change impacts, and the importance of different types of land-use change having very different types of consequences on hydrology. I encourage the authors to emphasize the 'cutting-edge' nature of their work a bit more, and be more bold in their conclusions.

2) I'm very interested in the development of the 'most influential precipitationshed' (MIP) concept. However, the MIP is essentially a definition of a precipitationshed boundary. The precipitationshed boundary that contains 100% of evaporation is the entire planet (at least in the context of the WAM-2layers). Thus, anything less than that domain requires the selection of a boundary. There is quite a bit of discussion on boundary selection and comparative advantages and disadvantages in the existing literature (e.g. the 70% boundary in Keys et al. (2012), the identification of the 'core precipitationshed' as a persistent, inter-annual source of moisture in Keys et al. (2014), and the discussion of the 1% boundary in Keys et al. (2017)). It is good that the authors are innovating on the concept of the precipitationshed, but I think the MIP should be put into better context as an approach for quantifying a boundary.

3) Regarding the MIP, I think that the authors need to emphasize more clearly that the 40% threshold is related to grid resolution (as far as I can tell, the only reference to this is at line 22-24).

Again, I think this paper is quite good, and is in need only of minor revisions before publication.

DETAILED COMMENTS (P = Page, L = Line)

P2 L4 This sentence is confusing, especially the section "...operate under uncertainties of the undergoing land use change...". Please revise.

P2 L24-25 I suggest the authors remove the part of the sentence "...,which has not

been covered in depth by previous studies", since many studies have looked in detail at how land-use change might impact the hydrological regime in the Amazon. There is still much work to do of course, but there has still been quite a lot of research into land-use change, moisture recycling and the hydrological cycle throughout the Amazon.

P2 L22 Consider including Badger & Dirmeyer (2015) and Keys et al. (2016). Badger and Dirmeyer conducted a detailed examination of the climate impacts of land-use change in the Amazon, including a very detailed analysis of the hydroclimate. Keys et al. examine the role of vegetation change on moisture recycling, including a regional focus on a part of the Amazon experiencing rapid land-use change (as well as using the WAM-2layers for the moisture tracking).

P2 L26 If this is the first instance of the abbreviation 'SDGs', please spell it out. Also, which of the 17 SDGs are the authors referring to? Consider adding some specificity here and a citation to support the relevance of moisture recycling (I'm not doubting its relevance, but it would be useful for the authors to chart this relevance more clearly and specifically).

P5 L4 In section 2.1.3, the authors explain their concept of the 'most influential precipitationshed'. From my understanding, this is simply a threshold-based boundary, correct? As stated earlier, this a very interesting idea, but the authors ought to acknowledge that this is one of several methods for delineating a precipitationshed boundary. I highlighted the previous studies in my General Comments that have discussed boundary methods. Essentially, the 40% MIP is the boundary which provides 40% of continentally recycled precipitation, correct?

P6 L26 It would be useful to remind the reader that MIP essentially means the 40% terrestrial moisture recycling boundary (again, assuming I understand it correctly).

P7 L12 What is meant by "with high spatial efficiency"?

P7 L13 Why does the MIP account for 50% of the Amazonian evapotranspiration?

Shouldn't it be 40%? Please clarify for easier interpretation of the result.

P8 L7 A bit confusing. Please replace "adding an extra time... on the original flow" with "more than doubling... the original flow"

P8 L22 Perhaps replace "fashion" with "pattern"?

P8 L30 Very interesting finding!

P9 L6-7 The finding about the rice planting not having very large impacts on run-off makes me curious about seasonal impacts (e.g. trees evaporate at different times than crops, etc.). Did you explore seasonal impacts? If so, please include some information on that analysis; if not, please include a few comments as to why it is outside the scope of this present work.

P9 L20 "As it controls half the Amazonian evapotranspiration..." Again, I am confused about whether the MIP represents 50% or 40%.

P10 L25 Do the authors mean "increases" where they wrote "increments"?

P11 L12 The authors should consider citing Wang-Erlandsson et al. (2017) since they find these same types of results. Both the Wang-Erlandsson paper and this paper are currently in HESSD, and it would be useful as a reader to see they find complimentary results using a variation in methods. In the interest of full disclosure, I am a co-author on the Wang-Erlandsson et al. article, and will suggest to the lead author of that paper that they also cite this work (for the same reasons I suggested already).

P13 L2-5 Here the authors could be bolder in their conclusions about what is important and novel about their work. E.g. The importance of relatively small source areas for sensitive regions in the Amazon; also the importance of extra-basin land-use change on basin runoff.

P14 L1 Confusing sentence "...strong controls on the rainfall and runoff regimes of the sensitives." I think the authors are missing a word; perhaps "sensitive regions"?

P14 L1-2 I recommend removing the final sentence since it is unnecessary.

Fig 2 & 3 Both figures need a label on the colorbar

REFERENCES Badger, A. M. and Dirmeyer, P. A.: Climate response to Amazon forest replacement by heterogeneous crop cover, Hydrol. Earth Syst. Sci., 19, 4547-4557, https://doi.org/10.5194/hess-19-4547-2015, 2015.

Keys, P. W., Wang-Erlandsson, L., & Gordon, L. J. (2016). Revealing invisible water: moisture recycling as an ecosystem service. PloS one, 11(3), e0151993.

Wang-Erlandsson, L., Fetzer, I., Keys, P. W., van der Ent, R. J., Savenije, H. H. G., and Gordon, L. J.: Remote land use impacts on river flows through atmospheric teleconnections, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-494, in review, 2017.

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