Response to Mr. Coen Maas's comments

The paper discusses the impact of land use change on the hydrology of the Amazon. Land use change is happening a lot in the amazon these days and therefore, it is important to know the impact of this change on the regional and global scale. By using a moisture recycling tracking algorithm, Weng et al. tried to get a better understanding of the influence of land use change on rainfall, evapotranspiration and runoff. The results of the paper are that by all the land use changes the rainfall decreases. The extend of this change depends on the location where the land use changes happen. Furthermore, a change of the whole Amazon to a certain type of land use has a large influence on both the precipitation and the runoff. The paper touches a topic which is very relevant at the moment, other studies have been looking into this as well(Snyder, 2010, Gordon et al., 2005), but the spatial different sensitivity in the hydrological responses to land use change was not well understood. Like said in the paper itself, deforestation is happening in the Amazon to create agricultural land(INPE, 2017). This change to agricultural land use can have a massive impact on the hydrology in the Amazon. Due to the fact that the Amazon is such a large area, this could even have an influence on the world as well. Therefore, it is a very interesting topic which should be looked into even more with other researches. The paper is well written, but there are some minor improvements which could be made to make this better. These minor improvements will be stated later on in this review. Little research is done at this topic so the research which is conducted by Weng et al. is innovative. It is interesting because the outcomes of this research can be used in other areas which suffer from deforestation as well. For this reason this paper can be an eye opener for other people to investigate this process even more. The hydrological impact which is the result of this paper perfectly fits the aim of the Hydrology and earth system sciences (HESS) scientific journal. The research which is conducted is donewell, but there are some minor issues which could be solved. Therefore, I recommend some minor revisions before publications by HESS. The revisions that should be made in my opinion are listed below.

We appreciate the comments from Mr. Maas highlighting the original findings of our manuscript.

In my opinion there should be made a better substantiation of the use of MOD16ET data. The authors say: "Loarie et al. (2011) validated MOD16ET's estimation with eddy flux tower data and reported its good performance (differences in annual aver-age of evapotranspiration are less than 4 % in savannas, 5 % in tropical forests and 13 % in pasture agricultural lands)". However, other references say something else: "While all three evaporation products adequately represent the expected average ge-ographical patterns and seasonality, there is a tendency in PM-MOD to underestimate the flux in the tropics and subtropics. Overall, results from GLEAM and PT-JPL appear more realistic when compared to surface water balances from 837 globally distributed catchments and to separate evaporation estimates from ERAInterim and the model tree ensemble (MTE)."(Miralles et al., 2016). These references are opposites of each other. The use of the MOD16ET method can have an uncertainty on all the figures and results that are made in this research.

I would suggest to make a better substantiation why the MOD16ET data is used and why for example the GLEAM or the PT-JPL were not used. Furthermore, a paragraph can be added to the discussion with the topic what the uncertainty of the MOD16ET is on the results that are made.

We thank Mr. Maas for the general comments discussing over the input data and model usage. We agree that better input data might exist but Miralles et al. (2016) also pointed out a generally good capture of geographical patterns and seasonality in ET among the three datasets. Since Miralles et al. have not specifically presented their results on the dataset's robustness at the Amazon basin for ET (though they have presented that for interception), we think it is still better to provide the validation on ET by Loarie et al. (2011) in the Amazon basin for reader's reference (P.4 L25-27). The interpretation and comparison between different input data is out of the scope of the presented research. However, we agree with Mr. Maas that uncertainties in the ET data might generate uncertainties in the recycling ratio and we have not specified that in the manuscript. It has already been discussed in Zemp et al. (2014) Sect 2.1.2., and we therefore referred the readers to such discussion in Sect. 4.1 (P.9L26-30) in the revision.

A second revision is to give more substantiation and discussion on the use of the WAM-2layers model. The WAM-2layers simulations of another experiment are used but the use of a WAM-2layers offline model give worse results than an online model like the RCM-tag model. In a paper by Van der Ent et al., 2013 a comparison is made between the WAM-2layer model and the RCM-tag model, a result of this comparison was that simulations of both models give globally the same result. However, at a regional scale, the error for the recycling ratio of the WAM-2layers model is relatively large if it is compared with this error of the RCM-tag model(respectively 2.8% against 1.9%(Van der Ent et al., 2013)). The research is mostly about the Amazon, which is a regional scale as well. Therefore, the results and figures could be different when a more precise method was used. I suggest the authors to take this into account in the discussion as well. The use of the WAM-2layers model has a larger uncertainty than an online model. Therefore, this uncertainty should be mentioned in the discussion.

We thank Mr. Maas who raises an important question related to the moisture tracking method. We decided to use the posteriori model because it can be based on observational data (as done in our study) (P.2L27) and it is less computational expensive compared to online models. Actually, we think that it wasn't concluded in van der Ent et al., 2013 which model was superior but they suggested avoiding usage of posteriori models at local scale. The recycling ratio provided by Mr. Maas was that in Lake Volta area and was not used in the indicated paper for interpreting regional study's results. Van der Ent et al., (2013) have suggested that the error was majorly from strong wind shear in West Africa thus we used the improved version (WAM-2layers) of the WAM model to decrease such errors in our estimation (P.4 L9-11). For the uncertainties from modelling choice, we have compared our results with the meta-analysis of the 44 GCM and RCM studies' results by Spracklen and Garcia-Carreras (2015) in P.10 L16-24. In our revised manuscript we have also added a reference to Table 2 in Zemp et al. (2014) that compares recycling ratios for the Amazon basin from the WAM-2layers model and other modelling approaches.

A third revision is the title of the manuscript is: "Aerial and surface rivers: downwind impacts on water availability from land use changes in Amazonia". This gives the feeling that the paper is about the water availability in the downwind areas. However, the conclusions that are stated in this manuscript are all about discharge and reduction of precipitation. If I look at the definition of water availability in a random dictionary I get the following: "The portion of a water resource that can be abstracted, as determined by the total water resource and the rights to abstract water from that water resource.".So the title will attract readers who are interested in the amount of water which is available in the amazon to abstract. The first sentence of the conclusion is: "From our analysis of the moisture recycling process, we conclude that Amazonian land use change's impacts on the water regime have spatial heterogeneity in two ways.". So the conclusion is about the water regime, not the availability. I would suggest that the title of the manuscript is going to be changed, especially the term "availability". This is a term which could attract the wrong readers. In my opinion, a term like "water regime" would fit better in this manuscript.

We thank Mr. Maas for this interesting suggestion and agree that there might be different interpretations on the title. However, according to FAO corporate document repository, http://www.fao.org/docrep/u5835e/u5835e03.htm, water availability is defined "The possibility of supplying as much water to the irrigation area… depends primarily on the availability of the water at its source…". We used the term because rainfall and runoff determines "the availability of the water at its source". We have considered Mr. Maas's suggestion carefully but decided to keep the title as it provides better hints to our discussions, especially Sect. 4.3 Water conservation hotspots out of watersheds and Sect. 4.4 Managing interconnected surface and aerial rivers crossing boundary. However, we have revised the conclusion (P13 L4-5 and P14L1) for better linkage of those ideas.

MINOR COMMENTS

- P2, line 7: place a space between 80 and the % sign
- P2, line 26: There is an abbreviation SDGs in this sentence but it is not said what this abbreviation means.

- P4, line 6-10: this is part of a methodology already. This should not be in the introduction
- P5, line 22: eg. Should be e.g.
- Fig 2: What are the units of the color bar? Give it a label.
- Fig 3: What are the units of the color bar? Give it a label.
- P11, line 19: “The results is: : :.” Remove the “s” in the word “results”.
- Revised as suggested.

P7, line 25 and 26: in the first line the reference to a figure is like: ”Fig. 4” in the next sentence the reference is like: “figure. 5” Please be consistent. Use “Fig” or “Figure”
P8, line 15: “For that, we apply in the following: : :” remove “in”.
Fig 1: Has no title in the figure itself.
Fig 4: Add a title at the figure itself
Fig 6: Try to give it the same mask as the other figures, now the whole of south America is showed while the results that are mentioned are only about the amazon.

- Thanks for the comments, we consider changes where appropriate.

References

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