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Interactive comment on "Impacts of future deforestation and climate change on the hydrology of the Amazon basin: a multi-model analysis with a new set of land-cover change scenarios" *by* Matthieu Guimberteau et al.

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In addition to our answers to the reviewers, we re-wrote a new version of the manuscript which is available in Supplement. In this new version, the additional text is in blue and the deleted one in red.

REVIEWER

1) One point of confusion is introduced in Line 4-5 from page 6, Section 2.3. As I understand correctly, all the percentages and differences for the scenarios with future land use change (LODEF, HIDEF and EXDEF) are relative to a future scenario with cli-

mate change only (NODEF). This would mean that all the percentages and differences mentioned in, for example, Section 3.3 and Figures 9 and 10, are referring to the difference between two future scenarios at the same point in time (the year 2099). In this way, figures like Figure 15 are not very fair, as apples and oranges are compared, with a different benchmark. It may be more interesting to compare all the results with the same benchmark (thus, HIST and the year 2009).

AUTHORS

We agree with that. We recomputed all the relative difference using the same reference both against future land cover change and future climate change (HIST 2009) and we clarified this in the section 2.4 of the new version of the manuscript. The results of the percentages of change do not change a lot, except for the low-flow decrease which is less pronounced (Figure 13 of the new version of the manuscript) than with the previous computation with future extension of deforestation (as expected future deforestation already reduced low flow runoff making the % change lower when this reference was used).

REVIEWER

Now, it becomes hard to answer, for example, the question posed in the title of Section 4.1, as the percentages only reflect the isolated effect of deforestation. Thus, it can only be concluded that evaporation with a forest land cover is higher compared to non-forest. Considering this, I would like to point at other land use change experiments, which in general show that water yields increase after deforestation, in line with the findings presented here (e.g. Hornbeck et al., 2014; Rothacher, 1970; Swift and Swank, 1981). Overviews of these experiments are given by, for example, Bosch and Hewlett (1982), Andréassian (2004) and Brown et al. (2005).

AUTHORS

Thank you for these references. We have cited Hornbeck et al., 2014 and Rothacher, 1970 's results in section 4.1. in discussion.

REVIEWER

2) I find the discussion in section 3.3.3 very interesting. Nevertheless, the modelled and observed river discharges in Figure 14, may add several discussion points. It can be noted that Orchidee is much closer to the observations (HIST-scenario) compared to LPJml (for subfigure MAIN, AMAZ). In this way, it can be argued that Orchidee may better represent the current processes, and may (but not necessarily) also better reflect what happens in the future scenarios. The opposite reasoning may also hold. Why trust a model that is not able to capture the historical series? Anyway, it may be interesting to reflect on these issues.

AUTHORS

The point [3] raised by the reviewer 3 concerning the calibration of the LSMs in historical period, is related to your question. The LSMs were not calibrated using a detailed adjustment of hydrological and water routing parameters. The best model in present time may not give necessary more trustable results in a climatic change perspective, as reported by e.g. Habets et al. (2013). In addition, dominant hydrological processes (and sources of uncertainty from each process) can change between present and future. With the CLSM model, Magand et al. (2015) found that the parameters controlling soil moisture had more influence in the future than in present, for instance. Under climatic change conditions, they found that the dominant process was no longer related to snow but rather to evapotranspiration model equations. Thus, that is why we did not trust any specific LSM more than others based on its performance for present day, even if ORCHIDEE does better for present-day, and we preferred to adopt a multi-model approach in our paper, recommended by Knutti (2010). Nevertheless, in the new Table S2 in Supplementary Material of the new manuscript, we give now the results of compar-

ison (Relative bias, Correlation and NRMSE) between ET and runoff simulated by the three models in present time and the observations. For ET comparison, we used the machine-learning FLUXNET product (Jung et al., 2010) itself uncertain for the Amazon basin because given the small number of flux tower measurements available. The evaluation of historical ET and runoff simulated by the different models over the Amazon basin can be also found in the literature:

- for ORCHIDEE: Guimberteau et al. (2012, 2014)

- for LPJmL-DGVM: Langerwisch et al. (2013)

- for INLAND-DGVM: Dias et al. (2015), Lyra et al. (2016)

We introduced Table S2 and cited these references in section 2.1. of the new manuscript.

References cited:

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REVIEWER

3) Throughout the paper, the term evapotranspiration (ET) is used, whereas the more general term ‘evaporation’ or ‘total evaporation’ may be more clear. I would like to refer to Savenije (2004) for some arguments to not use the term evapotranspiration as well. Briefly, transpiration is a rather different process compared to, for example, interception evaporation. Especially with regard to deforestation, it is important to make

this distinction, as it is probably transpiration that decreases.

AUTHORS

In the land-surface model community, the term evapotranspiration is commonly used and defined as the sum of soil evaporation, interception evaporation, and vegetation transpiration (Wang and Dickinson, 2012). Using the term “evaporation” may not be enough precise for all readers from different communities and could lead to misunderstandings and misinterpretations. Thus, we acknowledge the reviewer for the suggestions related to Savenije (2004) but would prefer using the evapotranspiration in our paper.

References cited:

- Wang, K. and Dickinson, R. E. A review of global terrestrial evapotranspiration: Observation, modeling, climatology, and climatic variability, Rev. Geophys., 2012, 50, RG200

REVIEWER

Detailed comments: P4.L30. What do you mean with “business-as-usual”? The current situation? P12.L1. Idem

AUTHORS

The term “Business-as-usual” is commonly used for a reference scenario which is defined as a continuation of the current trend, here in term of deforestation. We added the definition in section 2.3. of the new manuscript.

REVIEWER

P23.Fig3. Define the abbreviation of ASO (now only later in the text)

AUTHORS

ASO is already defined, and at its first use, at line 28 of page 6 in section 3.1.1. in the first version of the manuscript (now, line 4 of page 9 in section 3.1.1 of the new manuscript).

REVIEWER

P33.Fig.14. Why is the third model not shown?

AUTHORS

INLAND-DGVM does not include a river routing scheme and thus cannot simulate river discharge. Only ORCHIDEE and LPJmL-DGVM are able to simulate discharge. To clarify this point, we added the information:

- in the text at line 24, page 12, in section 3.3.5 of the new manuscript.

- in the “Model setup” column of Table 1 of the new manuscript

- in the captions of Figures 12 and 13 of the new manuscript

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-430/hess-2016-430-AC1-supplement.pdf

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