

Interactive comment on “Potential effects of climate change on inundation patterns in the Amazon Basin” by F. Langerwisch et al.

Anonymous Referee #2

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1. General comment

The manuscript “Potential effects of climate change on inundation patterns in the Amazon Basin” discusses how these potential changes could impact “plant and animal species”. This is indeed an interesting scientific question within the scope of HESS. However, this discussion is very general, the evaluation of the results over the current period is very inconclusive, and therefore these results remain largely hypothetical forward-looking. The link between flooding and biodiversity is widely discussed but is not really the object of the present study. This study is generally disappointing against objectives and targets.

2. Specific comments

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Some sentences are characteristic of the approximations that dot this study; For example: The first sentence of the abstract “A key factor for the functioning and diversity of Amazonian rain forests is annual flooding”. The rain forest functioning and diversity depends on many factors, and only the Igapo and Varzea forests (this last one rapidly disappearing) are affected by flooding, as the terra firme forest, largely preponderant in area, occupies land never flooded (as its name clearly states) and therefore does not depend on flooding. Also: “Much of Central Amazonia is influenced by annual flooding caused by snow melt in the Andes and precipitation across the basin”; The part of snow and ice melting in the Amazon flood is anecdotal. Andean glaciers cover only 2000 km². The annual flow of glaciers is estimated at 25 m³ / s, with only 17 m³ / s draining towards the Amazon. This discharge represents little more than a drop of water (actually 0.0081% of the flow of the Amazon) J.-L. Guyot, pers. communication.

The entire study is based on a false premise: the flooding patterns that are influencing the biodiversity within floodplains are strongly related to the connectivity between the river and the floodplain (Bonnet et al., 2010, 2011). The connectivity is largely dependant on numerous narrow and spatially complex channels, overflowing representing a part very variable with time, seasonally and inter-annually. These characteristics turn impossible to assess these flooding patterns and therefore to investigate their future changes, describing them by a 0.5â×0.5â gridded model.

Nothing is new (or very close to nothing) in the methods and the data used. The LPJmL model has been applied in previous studies with a “globally homogeneous flow velocity of 1ms⁻¹ (Rost et al., 2008), which had difficulties to reproduce the Amazonian hydrograph”. A later study has “improved the reproduction of the hydrograph by applying a homogeneously reduced flow velocity of 0.25ms⁻¹ to the Amazon Basin”. The present study tries to discriminate flow velocity based on orography. It is well known that discharge and therefore flow velocity in the Amazon basin is not linearly related to slope in a large part of the basin. The method to derive slope from DEM is detailed unnecessarily. The well known Manning-Strickler equation is overly simplified in order

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to calculate the flow velocity. A complicate method is used to evaluate flow direction in order to assess the inundation areas, while flow direction grids are available in the same dataset that employed to calculate the flow velocity (HydroSHEDS - WWF HydroSHEDS, 2007). The derived inundated patterns are only assessed against global areal values. Studies based on multiple satellite data are ignored while they have long demonstrated the potential of flooding assessment (Decharme et al., 2008 and many studies by Prigent et al., Papa et al., Frappart et al., since this time). Only monthly data of temperature and cloud cover, linearly daily interpolated, are used, turning the daily time step of the model of little use, especially since the results are evaluated against monthly values of discharge.

3. Concluding remark

Taking into account all these comments, as well as the standards of publication in HESS, I recommend the authors to completely rework the manuscript.

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