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Earth System Dynamics
Discussions

Interactive comment on "Synergy between land use and climate change increases future fire risk in Amazon forests" *by* Yannick Le Page et al.

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As a specialist in past ecological change, and having worked with reconstructing fire histories in the Amazon basin, I was interested to read the discussion manuscript by Le Page et al. related to the likely impact of future climate change on fire in Amazonia. In this manuscript Le Page et al. develop the global intermediate complexity Human-Earth System FIRE (HESFIRE) model (Le Page et al. 2015) to explore fire dynamics in the Amazon basin. The new outputs presented here project how understory fire activity could change within Amazonia over the next c. 100 years under two different future climate change scenarios (Representative Concentration Pathways 4.5 and 8.5; Thompson et al. 2011, Riahi et al. 2011). The HESFIRE model is evaluated favourably against observed fire activity between 1999 and 2010; interestingly the new parame-

terisation of the model (this manuscript) is shown to be a considerable improvement on the original parameterisation used in the global model (compare Figure 2 with Figure S2). The authors predict that over the coming decades climatic change will lead to changes in relative humidity, temperature and fuel moisture that will lead to increased duration and size of fires, and that fires will impact a larger area of the basin.

The manuscript presented by Le Page et al. is clearly written, well organised and contains clear figures (notwithstanding minor comments below). The model parameters make intuitive sense to me but I am not an expert in this area. The conclusion that the synergy of land-use (humans) and climate change are likely to increasing fire risk in Amazon basin is reasonable based on the data presented. It also does not come as a surprise to me as there is a long history of human-climate-fire interactions within the Amazon basin. Fire (most probably triggered by early human populations) has been a component of Amazonia for c. 8,000-9,000 years (e.g. Bush et al. 2007; Hammond et al. 2007), and the impact of this fire has likely been modulated by past climate change (Bush et al. 2008; Bush et al. 2017; Cordeiro et al. 2014). Indeed Bush et al. (2017) make a specific link past changes in the El Nino Southern Oscillation (ENSO), human activity, and changes in the Amazonian fire regime (based on fossil charcoal records). Given that the message from the past, and the projections for the future, seem to be providing consistent message (humans and climate synergistically modifying fire regimes within Amazonia) it might be interesting to add a short section of discussion to this manuscript to make this comparison. This could fit well at the start of the discussion section where ENSO is discussed in the context of future predictions.

MINOR COMMENTS

Page 3, line 10-20: There seems to be a bit of a jump in the HESFIRE model. It would be useful to add some linking text that makes clear what this model is, how it has been previously used and why the work presented her is a good next step.

Page 4, line 13: Additional space between "Figure" (also: page 6 line 11, page 7 line

30, page 8 line 29, page 10 line 10).

Page 8, line 33: Referencing anonymous new data seems a bit odd. Can you find a clearer way of referencing the source of these data?

Figures

Various fonts are used on the different figures. I think it would help the manuscript to look more coherent if these were standardised.

ADDITIONAL SUGGESTED REFERENCES

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