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Biogeosciences Discussions

Interactive comment on "Influence of climate variability, fire and phosphorus limitation on the vegetation structure and dynamics in the Amazon-Cerrado border" *by* Emily Ane Dionizio da Silva et al.

Anonymous Referee #1

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General Comments:

Reviewer summary: The manuscript presents results from the DGVM INLAND evaluating the effect of climate variability, fire and phosphorus limitation on vegetation structure and dynamics in the transitional zone between the forested Amazon and grassland savanna of the Cerrado. Changes in net primary production, aboveground biomass, and leaf area index are assessed between simulations, and simulated aboveground biomass is compared to observations. Transects along the Amazon-Cerrado transition zone are analyzed in subsets, as well as the region as a whole. Inclusion of climate

variability, fire and maps phosphorus limitation improves simulation of vegetation structure across the region and for four of five transects. The cerrado transect has the lowest correlation to observations. Fire has the strongest impact on vegetation characteristics, followed by phosphorous limitation. Overall, INLAND with these included factors appears effective at simulating vegetation across the region, but regional deficiencies show that more improvements can be made.

Article contribution and overall impact: This study highlights the need for improved simulation of vegetation in a key forest-savanna transition zone. A shift in vegetation in this region has the capacity to impact the cycling of water and nutrients as well as energy fluxes beyond the area of forest-savanna transition. Uncertainty in future climate and fire behavior as well as the feedback between these factors make the vegetation state of this region difficult to predict. The manuscript does a good job of presenting the challenges of simulating vegetation in this transitional zone where climate, nutrients and fire are essential contributors to vegetation state. The inclusion of phosphorous limitation in the simulations for the region is an important addition to the evaluation of vegetation state. The discussion would benefit from a more detailed description of the fire model and fire activity during simulation. The concluding recommendations for future work also need to be clarified. Discussion of the importance of vegetation size structure and how this is or is not represented in INLAND should also be added. A key component of the mortality of woody vegetation to fire is its size at the time of fire and the ability to accumulate size between fires. This is central to the work of many of W. Hoffman's papers in the region (Hoffman et al 2003, Hoffman et al 2009, Hoffman et al 2012). Please add discussion of size structure to the manuscript.

Detailed comments:

Page 6 line 101-107: Add the 1x1 degree grid size to this section.

Page 9 line 159-164: Provide more detail concerning fire model. Is the fire ignition probability the same in every pixel, or is there spatial variability? If there is spatial

variability what drives this parameterization? Does flammability vary by PFT?

Page 16 line 316: define “transition” here and throughout manuscript. The reference is not always clear. Most often it appears to be Amazon-Cerrado transition or forest-savanna transition, if that is correct please add the extra detail here and throughout manuscript (Pg 20 line 403, pg 21 line 419, pg 22 line 426,428,443, pg 23 line 451)

Page 17 line 323-325: Update sentence to “responsible for altering the simulated AGB to approach the observed AGB” or some variant. Current sentence structure is unclear.

Page 18 line 345-349: What observational data set is this being compared to for current vegetation state? Is this a by pixel comparison of the same grid size?

Page 18 line 359-364: Do the climate datasets used in simulation include reduced rainfall and ENSO effects? Explain this further.

Page 21 line 409: Update to “for the most part Dynamic Vegetation Models”

Page 22 line 435-437: Add more detail clarifying how the INLAND model differs from reality. Is it able to simulate rapid restoration following fire? If not, what would need to be added to the model’s fire or vegetation characteristics?

Page 22 line 444: Update to “but the inclusion of these effects”

Page 22 line 442-445: This needs more explanation. Is the vegetation simulation insufficient because of the presence of transitional and robust pixels in the cerrado in fig 5? Or is this because of comparisons to observed data of vegetation in the cerrado?

Page 23 line 449: what is meant by residence time?

Page 24 line 477-479: Explain this in more detail: “It does not dynamically change the allocation”

Page 25 line 495-496: Reword this sentence. The meaning is not clear.

Page 26 line 522-525: Inclusion of spatially explicit parameters may or may not improve

DGVM simulation. This assumes that the existing processes are accurate, and that it is merely parameters. Provide more discussion of this possibility, or re-word this section.

Page 26 line 525-527: What is meant by temporal variability? Size structure?

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