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Interactive comment on "Coupling carbon allocation with leaf and root phenology predicts tree-grass partitioning along a savanna rainfall gradient" *by* V. Haverd et al.

Anonymous Referee #1

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This manuscript presents a new addition (HAVANA) to previously developed model (POP) to consider carbon allocation in trees and grasses in order to maximise long term net primary productivity as a means of understanding the dynamics of trees and grasses in northern Australia.

As with any paper presenting a new model, considerable background material and the model formulae are presented along with simulation results and model validation. This is clearly presented with appropriate background literature.

The simulation results suggest that resource limitation is the driving force behind the three grass dynamics of northern Australia. This finding is in agreements with a number

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of recent Australian reviews and studies and adds to the international discussion on savanna function.

It would be interesting to consider the driving processes in this model (parameter sensitivity) and impact of various assumptions on the simulation outcomes. This could also allude to where the Australian setting differs from international savannas and how the global model could be achieved.

Specific comments

P16320 line 7. (and page 16318 Line 18). It is not clear in the text (without reading detail of Table 1) how the depth of the two layers was defined. Was the 20cm top layer cut-off defined from the soil description obtained from the soil maps, or is it related to the expected rooting depth of the native C4 tropical grasses? As grasses only have access to the top layer, an increase in this layer depth will affect grass growth. Likewise, the 4m depth of lower layer seems deeper than most soil descriptions from northern Australia (Soils Atlas) and this value will significantly influence tree biomass and population dynamics. Please state the basis for the depth cut-off as these are critical values and vary considerable in the literature with grasses reported from 20cm to > 1m. How would changing the depth of the bottom layer between 1 and 6 m influence the tree population and biomass? These soil properties need to be justified in order to validate the output of the simulations.

P16324 line 13. It is not clear whether multiple tree and grass species were simulated or only the tree/grass functional groups. A description of the type species could be provided.

Page 16330 line 25. I do not understand how the regular exposure of the vegetation to fire results in curing of C4 grasses. Surely, exposure to fire will result in combustion of grasses and low soil water is the cause of C4 grass curing.

Technical corrections

BGD

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Page 16324 line 5. “by proportion a” should this be alpha as per equation?

Page 16330 line 22. Woodlands rather than wood-lands as per grasslands and shrub-lands.

Page 16331 line 22. Is DINGO presented elsewhere that can be cited? The following paragraphs could then be condensed.

Page 16333 line 15. (see Table 1 for calibrated parameters)

Page 16339 line 10. Please define LSM.

Page 16348 Table 1. Lines for Ga, kE,w and KL,g could have source on single line to reduce size.

Page 16352 Figure 2. Consider adding “flux site abbreviations. . .” to caption as per Figure 3.

Page 16354 Figure 5. Is there an extra space between y and -1?

Page 16354 Figure 5. Replace square brackets with round brackets for Williams et al 1996 for consistency.

Interactive comment on Biogeosciences Discuss., 12, 16313, 2015.