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Biogeosciences Discussions

Interactive comment on "A model investigation of vegetation-atmosphere interactions on a millennial timescale" *by* N. Devaraju et al.

Anonymous Referee #2

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The manuscript by Devaraju et al. addresses an important question of possibility of multiple states in the climate-vegetation system due to interactions between climate and forest cover. The manuscript is well written; presented results are of interest for the readers of Biogeosciences. I recommend accepting this manuscript after the authors account for minor comments listed below.

1. The IBIS model differs from most of other DGVMs as it uses two-layer scheme with the grass layer underneath the tree canopy. The JSBACH model used by Brovkin et al. (2009) uses a tiling approach; trees and grass compete for free available area. Does this difference in the land surface representation influence model results? An interesting question also is a possibility of multiple vegetation states independent of vegetation-atmosphere interactions but inherent to the vegetation model. It would be

good to discuss this point in the paper.

2. Can we infer time scale of vegetation dynamics from this study? The tree cover dynamics is not presented in the Fig. 1, and this makes it difficult to tell how quickly tree cover recovers after perturbation. A plot of dynamics of tree cover (e.g. area of tree classes lumped together) will be very helpful. A related question is on a difference in time scales of vegetation convergence between different regions. For example, where is the tree recovery slower - in tropics or in high latitudes?

3. The point on the millennium timescale as a novel aspect of this study (p. 8766, l. 1-2) is not very convincing. According to the Fig. 1, the climate and carbon cycle approach new equilibrium in few hundred years. What is then a rationale for the millennium-long simulation? What new could be expected, e.g., in comparison with the 500-years simulation performed by Brovkin et al. (2009)? The climate model used by Devaraju et al. does not include dynamic ocean, which long time scales could be a good reason for long-term simulations.

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