

Interactive comment on “Investigating vegetation-climate feedbacks during the early Eocene” by C. A. Loptson et al.

Anonymous Referee #3

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The authors investigate how the vegetation distributions simulated by the dynamic vegetation model in GCM change with atmospheric CO₂ concentration, and how the changes affect early Eocene climate. In addition, they validate if the coupled model simulation with the dynamic vegetation can reduce the model-data discrepancies. The physical processes behind those changes by the dynamic vegetation are also explained by energy balance analysis.

This study describes important interactions between land and atmosphere regarding to vegetation feedbacks during the early Eocene. The simulated results found that the dynamic vegetation play an crucial role in controlling the climate conditions during the early Eocene and thus the coupled model could improve the model performance in simulating the climates during the period. This is one of the important findings of

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this study. Another novelty of this research is in providing the physical processes (e.g. feedback mechanisms) to be able to support the changes by the dynamic vegetation. Overall, the results are discussed in an appropriate way in consideration of related work, including appropriate references.

I therefore recommend its publication after revising the manuscript with the comments suggested below.

Specific comments:

1) Statistical test for the differences: I suggest performing the statistical analysis to check if the differences between the simulations are statistically significant. For example, a student t test can be conducted to quantify the statistical significance of the difference of means. Based on the t test, the statistically insignificant regions in the figures 5, 7, 8, 9, 10, 11, and 12 could be masked out and the significant regions at the 95% (or 99%) level could be shown.

Minor comments:

1) Spell out: Please double check if the abbreviations used in the manuscript are spelled out. E.g. 'CCN' in p. 4708; 'SHRUB' in p. 4712; 'TRIFFID' in p. 4712.

2) Lines 26-28 in p. 4716: If you see the only difference of the atmospheric CO₂ concentration, you might want to use the differences between 2xDYN and 4xDYN instead of FIXED.

3) Line 5 in p. 4717: '2xDYN and 4xDYN' is not consistent with the one mentioned in figure 8b, which is 4xDYN – FIXED.

4) Figure 11: Add the names of simulations used in the calculation of the differences. E.g. '(4xDYN – 2xDYN) – (4xSHRUB – 2x SHRUB)'.

5) Lines 23-26 in p. 4721: The reduction of the northward heat transport in the DYN simulations is interesting point, while it's contradicted with the sentence mentioned in

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Lines 3-5 in p. 4708.

6) Figure 5: Add the difference figures between '4xSHRUB – 2x SHRUB' and '4xDYN – 2xDYN'.

7) FIXED simulation: This simulation has 4xCO₂ level. Why the vegetation distribution from 2xDYN has been used instead of that from 4xDYN?

Interactive comment on Clim. Past Discuss., 9, 4705, 2013.

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