

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

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Thank you for the comments and suggestions. We have addressed these point-by-point below:

*"(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."*

Figure 5 is not a difference plot, but we have amend the difference plots so that they

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only show the statistically significant regions at the 95% level.

*"(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."*

We have checked this, and all acronyms and initialisms have been defined.

*"(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."*

FIXED has the same vegetation distribution as 2xDYN but has an atmospheric CO<sub>2</sub> of 4x pre-industrial. The difference between 2xDYN and FIXED was looked at in order to separate the effects of vegetation and CO<sub>2</sub> on climate. Looking at 4xDYN-2xDYN does not give this information.

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

2xDYN has the same vegetation distribution as FIXED, so it is essentially saying the same thing, but we have now changed this in the manuscript to make it clear.

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

This is a fair point. we have now include this in the caption of the figure.

*"(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 Lines 3-5 in p. 4708."*

We do not believe these two statements are contradictory. Our results show reduced poleward heat transport when CO<sub>2</sub> is doubled in the early Eocene simulations. Poleward heat transport is mentioned in the introduction as a possible mechanism for high latitude warmth during this time period, This is based on a study by Sloan et al.,(1995)

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(which we have now add as a citation in the paper), which calculated that an increase in poleward heat transport of 30% would be required to maintain Eocene high-latitude temperatures.

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

These difference figures are both included in the paper - see figure 7.

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

This was explained in the Methods section, but we have now reiterated it at the beginning of the "Separating effects of CO2 and vegetation on climate" section to remind the reader of this.

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