Earth System
Dynamics

Discussions

Interactive comment on "Different response of surface temperature and air temperature to deforestation in climate models" *by* Johannes Winckler et al.

Anonymous Referee #2

Received and published: 13 November 2018

In this paper, the authors evaluate how the land cover change response differs for surface temperature relative to air temperature in observations and models. This paper provides important clarification in terms of how these two different temperatures respond to land cover change with observations indicating that changes in surface temperature are roughly twice as strong as they are for air temperature. Models show a varying amount of agreement with the observations. The assessment of local versus nonlocal responses is less developed and is less likely to be the 'final word' on this topic, but I believe the nonlocal results are still worthy of publication. The paper is generally well-written (though it could use another full edit) and the figures are clear. I recommend the paper for publication pending minor revisions as outlined below:

1. Definition of local: The authors use the term local to refer to responses to deforestation within the same grid cell where the deforestation occurs and nonlocal changes to situations where deforestation has effects that extend beyond the deforested region. This is a reasonable definition, but it's worth noting that several recent studies have looked at even more local responses by examining the sub-grid responses within a grid cell (e.g., forested vs cropland). Perhaps it would be helpful to note the difference in definition and to cite a few of these studies (e.g., Malyshev et al., 2015, Schulz et al., 2016, Meier et al., 2018).

2. P.1, Line 17: Not sure I agree with the statement "Much less considered are the climate changes". Researchers have been investigating the climate impacts of deforestation for decades.

3. P.2, Line 34: For clarification, consider changing: "the local effects have to beisolated from the climate model results" to "the local effects need to be disaggregated from the nonlocal effects when analyzing climate model results."

4. P.3, Line 26. Can you provide a rationale for the method of removing forest in 3 out of 4 grid cells? Why not 2 out of 4 or 1 out of 4 or 5 out of 6? Would be helpful to be able to refer to the deforestation map, either as a figure in the main text or as supplemental material.

5. P.5, Line 24. It's not totally clear to me how T2m is derived from S2m using eqn. 1. Equation 1 describes how to calculate Szaero, not S2m.

6. P.5, Line 22: Change "Different functions gamma are used" to "Different functions for gamma are used"

7. P.6, Line 27: An extra "and" in this line.

8. P.6, Line 26: This sentence confused me at first because I had forgotten about the way the global-deforestation run was done (i.e., with 3 out of 4 gridcells deforested). Please clarify. Seems possible that what you mean is actually "large-scale" deforesta-

tion rather than global-scale.

9. Figure 1. Seems like some level of significance is needed here or at the very least selection of a color scale that doesn't imply a near-global signal from deforestation (i.e., colors everywhere).

10. P.11, line 5: Should probably note that CCSM4, CESM1-CAM5 and NorESM1 all share the same land model, CLM4).

11. P. 11, line 17. I don't think this is an assumption, this is a result of your analysis. There is no 'assumption' that Tatm does not respond to deforestation.

12. P.12, line 26: Personally, I don't think the comment about carbon cycle feedbacks and the fact that they are non-local is necessary. First, this is stating the obvious. Second, this paper is about biogeophysical impacts.

References

Malyshev, Sergey, et al. "Contrasting local versus regional effects of land-use-change-induced heterogeneity on historical climate: Analysis with the GFDL Earth System Model." Journal of Climate 28.13 (2015): 5448-5469.

Meier, R., Davin, E. L., Lejeune, Q., Hauser, M., Li, Y., Martens, B., et al. (2018). Evaluating and improving the Community Land Model's sensitivity to land cover. Biogeosciences, 15(15), 4731-4757. https://doi.org/10.5194/bg-15-4731-2018

Schultz, N.M., X. Lee, P.J. Lawrence, D.M. Lawrence, L. Zhao, 2016: Assessing the use of sub-grid land model output to study impacts of land cover change. JGR., 121, 6133-6147, DOI: 10.1002/2016JD025094.