

Interactive comment on “The impact of nitrogen and phosphorous limitation on the estimated terrestrial carbon balance and warming of land use change over the last 156 yr” by Q. Zhang et al.

Anonymous Referee #2

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This study makes use of a low-resolution atmosphere only model coupled to a nutrient cycle to simulate changes in climate and C stores over the recent past. The interaction of nutrients and LULCC is a relatively novel experiment with relatively little literature covering this interaction.

The study makes use of an atmosphere only model driven by SSTs. The lack of a coupled ocean limits the analysis of the climate effects, but appropriate caveats are included and this is only a secondary focus to the biogeochemical implications.

My main comment is the need for greater clarification in the methods on how both nutrients and LULCC change are implemented in the models. Similarly, some clarity

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over what is considered a LULCC associated flux would also be useful.

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2.1. Although appropriate references to CASA-CNP are included more background information would be useful.

2.2. Some justification for the use of 1990s time-invariant N and P deposition rates

2.3

This section could do with clarification. For instance, implied in the 2.2 is that time-varying maps of PFTs distribution are used - thus including both deforestation and regrowth. How exactly are the timescales of regrowth calculated.

Is this flux fw^* in this section? Or is this flux actual wood harvest that doesn't involve any fractional area change in PFT extent? What happens to root C is this assumed to be harvested as well?

Eq 8 (fluc) implies this calculation is done using two simulations to bring out the net LUC emission, however this is not clear in the text.

P514 L16 - something missing/not reproduced in my version.

3.1 This section focuses on net changes in pool size, and mean annual fluxes between 1850 and 2005. However, Fig 3 shows some interesting behaviours in the 50/60s. Some analysis of the time series would be useful as would additional figures to 4/5 showing the timeseries of fluxes between pools (i.e. fLUC).

4. Using fixed SSTs the result found here is for a net cooling through LULCC. However, am I right to understand that previous versions of this model found a net warming due to LULCC (LUCID, 2012). Might this be related to climate biases (Pitman, 2011) influencing the model response to LULCC?

de Noblet-Ducoudre (2012) Determining Robust Impacts of Land-Use-Induced Land

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Cover Changes on Surface Climate over North America and Eurasia: Results from the First Set of LUCID Experiments

Pitman (2011) Importance of background climate in determining impact of land-cover change on regional climate

Interactive comment on Earth Syst. Dynam. Discuss., 4, 507, 2013.