

Interactive comment on “Interactions between nitrogen deposition, land cover conversion, and climate change determine the contemporary carbon balance of Europe” by G. Churkina et al.

Anonymous Referee #1

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I reviewed the manuscript entitled “Interactions between nitrogen deposition, land cover conversion, and climate change determine the contemporary carbon balance of Europe” by Churkina et al. This is an interesting study that complements and expands previous studies about the carbon balance of Europe. The results presented in this study are consistent within the range (and error) of previous estimates. However, one important advancement is the study of potential interactions between climate, land use change and nitrogen deposition. To accomplish this goal, the authors applied a factorial approach in simulations derived from four models (Table 3). Using this approach the authors were able to provide biophysical explanations about the observed model differences. That said I believe the manuscript could be improved by addressing some

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critical issues.

The explanation of the factorial design could be improved in the text to expand the information presented in table 2. I believe this is a very clever analysis that represents a modeling experiment which could be improved (in the future) by a multi-factorial approach (page 2249).

My main concern is that once the actual factorial experiment was done (according to the description provided in table 2), the results are not treated according to a statistical factorial experimental design. Instead, all the interpretation of the results are based on the observed absolute means without consideration of the errors associated with each model, model simulation, and the interactions among the factors of the experiment (from a statistical approach). Multiple examples of the lack of a rigorous statistical analysis are found in the manuscript and I encourage the authors to explore the interactions and differences from this factorial experiment to support the results. In fact, the authors state at the end of the manuscript (page 2249 line 20-21) that the absolute values need to be treated with caution.

Examples on how the results could be supported by a factorial analysis could be found in figure 3 and 4. For example, in figure 3 there are several questions that remind unanswered: the effects of climate and LCC seem to be not significant different from zero (testing this could support the discussion in the text); the effect of all factors seem to be only significant different from zero for JULES and BIOME-BGC (is this correct?).

Figure 4 does not have error bars and similar to figure 3 there is no test to show if the results (1) are different from zero, or (2) if there are significant differences among the models.

Finally, all the interpretations are based on the absolute means without considering the errors derived from interannual variation and different models.

I encourage the authors to test the important results (sections 3.1 to 3.2.2) from this

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clever factorial approach, and then use those results to support the interpretations presented in the current version of the manuscript. Does a rigorous test of this factorial experiment supports the interpretations based on absolute means? It is likely that the results and interpretations will not change, but this additional effort will make the manuscript more elegant and robust.

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