

Anonymous Referee #3

We would like to thank the referee for valuable comments. Below the referees comments are shown in *italics*, the replies are shown in normal type.

This manuscript analyzes influences of future climate and CO₂ scenarios on the trajectory of global carbon balance based on a terrestrial carbon cycle model. It is a very important topic, and Ahlstrom et al. have presented a thorough and methodical analysis. How climate will change in different emission scenarios does affect greatly the projection of carbon balance at large scale. Identifying uncertainties raised from GCMs characteristics will further our knowledge in this field. My concern is that future human activities (e.g. land use change), which also bring large uncertainty, are not considered in this study.

Comment 1:

This manuscript focuses on climate change-related uncertainties analysis. It is kind of arbitrary to conclude that GCMs characteristics explain the majority of uncertainties in projected terrestrial ecosystem carbon balance, given other influencing factors (such as land use change) are not well investigated.

Reply:

We concur that land use, not accounted for in this study, is a potentially large source of future carbon balance uncertainty. New text to the discussion makes this point. However, land use-related uncertainty is beyond the scope of our study, which intentionally focuses on impacts due to climate and CO₂ concentration change.

Comment 2:

P 13689, L5-9: Though the cumulative sum of NBP over time is analogous to the change in Cpool, showing net carbon exchange directly in figures would be more interesting.

Reply:

Because we base the analysis on cumulative NBP or total carbon pool we chose to present the total carbon pool throughout the paper, for consistency.

Comment 3:

As the referee #2 mentioned, LPJ-GUESS is a widely applied and well-tested tool, it is not reality. Results from only one process-based model also have big uncertainties. Besides, global carbon balance in response to future climate change is quite complicated; many associated processes are either simplified or ignored in current ecosystem models, which may bring big uncertainties as GCMs characteristics would do. Authors are encouraged to address those limitations in the discussion section.

Reply:

We now address limitations related to the use of a single DGVM in the discussion.