Referee #1 Comments:
June 23, 2011

Thank you for the comments on our manuscript, please find our responses in bold font below.

Ben Poulter

Overall comments: This article addressed a very important topic in estimating global carbon dynamics: the uncertainties from major model input data (i.e., climate and land cover). Although only one model (LPJ-DVGM) is used, it is robust enough to convey information about the uncertainties during model simulation. Huge work has been done by the authors since this study involves many data sets and simulations. A large variation in NEP/NPP/Rh is found based on the simulations of different input data. The CRU climate data (with MODIS land cover data) has been inferred to have higher agreement with the observed NEE. The authors also concluded that the uncertainties in estimating global carbon cycle are larger from climate data than that from land cover data. I very appreciate the authors' work for addressing this topic. However, there are some technical questions that were not described clearly and might undermine the results and conclusions drawn from this article. My final opinion is to accept this article after addressing below questions:

We appreciate the summary of our paper - while only 1 model is used in our work, similar results regarding the magnitude of uncertainty could be expected. We found in the literature a study related to forcing uncertainties and have referenced the range of uncertainty they found (Zhao et al., 2006).

1) Page 1621 line 25: the authors mentioned that the equilibrium status for all the simulations was based on the first 30 yr CRU climate data. As a modeler, I know there are big vibrations when the model simulation changes from equilibration to transient. Since the climate data for ERA and NCEP are only available since 1989 (ERA) and 1979 (NCEP), I can imagine large fluctuations occurring during the transient model simulations from 1989/1979 to 2010. These fluctuations might not primarily from the difference in various climate data but from the system (LPJ) vibration or errors. In addition, the LPJ model is parameterized based on CRU climate data. Since all the equilibrium statuses are based on CRU data, it is no doubt that CRUrelated simulations could yield better results than other simulations. This implies that although CRU-related simulations have better results (compared to observation), we cannot say CRU data is better than other data sets in reflecting the impacts of global climate change. I would like to hear the authors' clear explanations.

The spin-up proceedure we used for this study follows the standard spin-up methodology developed for the original LPJ DGVM (Sitch et al., 2003). This spin up results in a carbon cycle and vegetation dynamics that is in equilibrium with the climate before applying transient climate forcing. For the Reanalysis forcings, we extended the first observation year (i.e., 1989 for ERA-Interim) to 1901 by applying

the CRU trends from 1901-1989 to the 1989 observations. This way, the spin-up was conducted with data that were explicitly linked to the particular forcing dataset to prevent any jumps or 'vibrations' entering the transient phase. To further avoid any spin-up to transient phase problems, we present data from the overlapping observational period only for all datasets (1996-2005). We clarify this proceedure in the revised text.

2) The authors mentioned (Page 1621 line 1) that different temporal climate data (monthly: CRU and daily: ERA/NCEP) were used to do the simulations. The LPJ seems a daily time step model (I am not for sure), could the authors explain how they use the different temporal climate data as input data for LPJ?

LPJ uses a daily time step and requires daily climate data - in the case where daily climate data are not available, pseudo-daily values are derived from either linear interpolation of monthly values or from a weather generator (for precipitation). We clarify this in the revised text.

3) As I know that the classification system is different for those land cover data sets in this article. How to reconcile the land cover types to a unified system and to be used by LPJ? Hope the authors could clearly state this in the method.

We used the same classification methodology for all 4 land cover types - this is clarified now in the text, and the supporting publication with the detailed methodology and available data is now in Discussion (Poulter et al., Submitted).

4) The climate data spatial resolutions are different. All the climate data (CRU 0.5d, ERA 1.5d, NCEP 1.5d) are finally changed to 0.5 degree. In addition, the land cover classification is different for different land cover data sets.
Two questions then need to be answered: How much uncertainties are from these changes?

The spatial interpolation from 1.5 degrees to 0.5 degrees is unlikely to contribute a large source of uncertainty. Extensive work by Mueller and Lucht (2007) show that spatial resolution is a minor contribution to model bias within the range of 0.5 to 1.5 degrees resolution.

Are these uncertainties larger than that from the differences in climate and land cover data sets? Hope the authors can give some data to clarify it.

This is one of the goals of the manuscript, and we discuss the relative contribution of climate versus land cover uncertainty in Section 4 of the manuscript.

5) Page 1623 line 26: “between climate forcing” could be “among climate forces”

We made recommended grammatical change

6) Fig. 1 is too small to read.

We have updated all Figures

7) Table 5: I am unclear about why there are 3 different observation data. Could the authors offer some explanations on it?

We clarify this in the revised Table legend

8) Fig. 3 what is the dotted green line (not clear) that far from the main streams of model results? Is this line not necessary?

We clarify this in the revised Figure

Mueller, C., and Lucht, W.: Robustness of terrestrial carbon and water cycle simulations against variations in spatial resolution, Journal of Geophysical Research, 112, doi:10.1029/2006JD007875, 2007.

Poulter, B., Ciais, P., Hodson, E. L., Lischke, H., Maignan, F., Plummer, S., and Zimmermann, N. E.: Plant functional type mapping for earth system models, Biogeosciences, Submitted.

Sitch, S., Smith, B., Prentice, I. C., Arneth, A., Bondeau, A., Cramer, W., Kaplan, J. O., Levis, S., Lucht, W., Sykes, M. T., Thonicke, K., and Venevsky, S.: Evaluation of ecosystem dynamics, plant geography and terrestrial carbon cycling in the LPJ dynamic global vegetation model, Global Change Biology, 9, 161-185, 2003.

Zhao, M., Running, S. W., and Nemani, R.: Sensitivity of Moderate Resolution Imaging Spectroradiometer (MODIS) terrestrial primary production to the accuracy of meteorological reanalyses, Journal of Geophysical Research, 111, doi:10.1029/2004JG000004, 2006.