Response to 2nd Referee's Comments

We would like to thank the reviewer's positive and constructive comments on our manuscripts. We will modify the manuscript accordingly, and the detailed responses are listed below.

1. I would like to encourage the authors to clearly state the assumptions made in their procedure and evaluate the uncertainty associated with the assumptions when possible. The difference between the dataset and what have been done in Lawrence and Chase (2007) may be further clarified.

Response:

We thank the reviewer's suggestions. The basic idea of our method was to aggregate the 500m grids of the MODIS land cover product to 0.05 degree model grid in order to calculate the subgrid composition of each PFT. The underlying assumption of this method was that each 500m grid of the MODIS land cover product was exclusively covered by one PFT. This assumption is valid in homogeneous landscapes; however, we acknowledged that this assumption may misrepresent more heterogeneous landscapes such as savannas and shrub lands, which may be the major reason that caused the big difference between the new and CLM 4 default dataset in the shrub distribution. In the revised manuscript, we will clearly state this assumption and further discuss the uncertainty caused by the assumption.

In the revised manuscript we will also further clarify the method developed in Lawrence and Chase (2007) and discuss the differences between our method and theirs.

2. The year of 2005 was used in this paper. Is there a particular reason for using 2005 rather than the climatology in (a part of) MODIS period? If time-varying data are not applicable, it seems to me the climatological data are more useful.

Response:

In this study, we used the year of 2005 to represent the current day land cover condition. CLM 4.0 is capable of modeling land cover change in a transient mode. It includes a treatment of mass and energy fluxes associated with prescribed temporal change in land cover. It diagnoses the

change in area for PFTs at each model time step and performs mass and energy balance to represent the expansion and contraction of PFT area based on an annual time series of PFT distribution data sets (Oleson et al., 2010). Consistent with this capability, we have chosen to represent the current day PFT distribution and the corresponding LAI dataset to represent the condition for a particular year rather than in the form of climatology. In CLM 4.0, the current day PFT and LAI were based on Lawrence and Chase (2007) representing the year of 2000 while the annual transition of CLM4 PFT and tree PFT wood harvest parameters were derived from the CMIP5 land cover change and wood harvest database from 1850 to 2100 developed by Hurtt et al. (2011) which represents the historical period from 1850 to 2005 and the four RCP scenarios from 2006 to 2100 (Lawrence et al., 2012). In our study, both current day PFT and current day LAI were developed consistently using MODIS product in the year of 2005. Such a dataset will facilitate the development of a MODIS-consistent transient land cover dataset for use with high-resolution CLM applications in the future.

Lawrence, Peter J., and Coauthors, 2012: Simulating the Biogeochemical and Biogeophysical Impacts of Transient Land Cover Change and Wood Harvest in the Community Climate System Model (CCSM4) from 1850 to 2100. *J. Climate*, 25, 3071–3095.doi: http://dx.doi.org/10.1175/JCLI-D-11-00256.1

Hurtt, G. C., and Coauthors, 2011: Harmonization of land-use scenarios for the period 1500-2100: 600 years of global gridded annual land-use transitions, wood harvest, and resulting secondary lands. *Climatic Change*, DOI 10.1007/s10584-011-0153-2.

Oleson, K. W., and Coauthors, 2010: Technical Description of version 4.0 of the Community Land Model (CLM), 257 pp.
http://www.cesm.ucar.edu/models/ccsm4.0/clm/CLM4_Tech_Note.pdf

3. Although the WRF-CLM experiment demonstrates the use of the dataset, it takes away focus of the paper because it does not add much valuable information on the advantage of using the dataset without comparison with a control experiment.

Response:

We stated in our manuscript that one of the contributions of the new dataset was to facilitate offline and coupled simulations at higher resolution. The main purpose of describing the WRF-CLM experiment was to highlight spatially resolved features that are enabled by using the higher resolution CLM input data. Since higher resolution or improved land surface datasets do not necessarily improve land surface modeling in coupled simulations, more analyses will be needed to understand the differences in coupled simulations using the CLM 4.0 and the new dataset. We intend to report more detailed analysis of WRF-CLM simulations in future publications and limit our discussion in this paper to highlight the impacts of data resolution and the importance of developing a consistent high-resolution dataset (page 1455 line 16-20).

In the WRF-CLM experiment, we also demonstrated a method to remap the CLM grids with regular latitude-longitude geographic coordinate system onto the fixed-distance WRF grids generated with map projection such as the Lambert Conformal projection shown for the western U.S. domain. The documentation of this method will also benefit other studies on WRF-CLM coupling.

In the revised manuscript, we will further clarify the purposes of the WRF-CLM experiments and emphasize the importance of the remapping method developed in the study.

4. Figs. 1, 2, 4-7, and 10. Although we may guess the corresponding panel according to the words on the top-left, it is better to include the panel names in the caption of the figures. Fig. 11. There is a sharp edge at the top and right sides in panel (c) and (d).

Response:

We will follow the reviewer's suggestion to make the technical corrections in the revised manuscript.

For the sharp edges in Figure 11, WRF does not calculate all the input data needed by CLM in the buffer zone of the lateral boundaries because it uses specified boundary conditions. Hence, the CLM simulation is not meaningful at the lateral boundaries and we will remove the plotting of values at the lateral boundaries in the updated version.