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## ***Interactive comment on “Continued increase in atmospheric CO<sub>2</sub> seasonal amplitude in the 21st century projected by the CMIP5 Earth System Models” by F. Zhao and N. Zeng***

**Anonymous Referee #1**

Received and published: 20 July 2014

The increase of CO<sub>2</sub> seasonal cycle in the northern hemisphere has drawn considerable interests in the recent times although the attribution of causes remain unclear. This paper explore the affect of terrestrial biosphere fluxes and its change with time in relation with climate change. The topic is of interests to the earth science community. The manuscript is generally well written, but I have some concerns which should addressed before accepting for final publication in ESD.

p780, 113-15 : Why only "temperate and boreal"? Recently Wang et al. (Nature, 2014) suggested the tropical biosphere also respond to climate change. One might think that the terrestrial biosphere in the tropics will respond to the climate change in one direction only. But given that there is dry and wet seasons in tropics (analogical with

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cold and warm temperature in the temperate/boreal region?) we might expect some seasonally sensitive response to the CO<sub>2</sub> flux. And there are changes in seasonal atmospheric transport and magnitude of fossil fuel emissions. I am not suggesting you to solved all of these problems in this manuscript, but some thoughts should be interesting to discuss.

p782, l25 : Need a reference here? e.g. peylin et al. (BG, 2013)

p784, l23 : Clarify whether the seasonal amplitude calculation is applied to zonal mean or individual grid or global?

p785, l25 : How is the trends in FFE is considered?

p785, l27 : Not clear how the different fitted components are utilised here?

p786, l12 : Will some of the differences between GFDL and CanGCM arise from the method employed for NBP calculation.

p786, l25ff : What if some models have peak uptake outside the months from may to july? please comment how is that going to affect your analysis using the ensemble means.

p786, l27 : I am glad that you splled this out. I am most curious how the model's behaviour differ depending on the differences in timing of the seasonal minima? Then of course taking 3monthly mean may also have some implications for the model to model comparison.

p787, l10 : Replace minimums and maximums by minima and maxima, respectively, throughout the manuscript

p787, l19 : This package must be calculating peak to trough monthly values. Do you think these results are compatible with the three monthly means stated at the end of the methods section?

p787, l24ff : Gieven the state-of-the-art/quality of the ESSMs I have reservations about

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the utility of this result. Please clarify. For example when the models do not represent the past well, what should be our take home message for the future projections.

p788, l2ff : Not for all models! Do you mean model ensemble? This itself is not any interesting, unless you say something why some models do differently from others. If the model-to-model differences can be linked with the model settings or parameterisation, this paper will be of great significance. At least some attempts should be made.

Section 3.2 : Suggest deletion of Fig. 3. Looks nice but unnecessarily complicated. Since figure 4 essentially has the same information I recommend deleting. Some the text from this subsection can be moved to the next subsection.

p790, l19 : What if you excluded MRI-ESM1 or MIROC-ESM model? This is one of example where statistics are more often misleading than convincing.

p790, l23ff : Without doing further analysis/discussions of the drivers of these changes in models, I doubt that this manuscript is an useful contribution. Atleast bring some discussions about the temperature, rainfall, and landcover change between 1961 and 2080.

p791, l5 : This "possibly" can be avoided if you just bring in temp, pcp and luc for analysis

p791, l25 : May be add "crop cycle" too here

p792, l14ff : Is this para needed?

Figure 1: should the units for panel b) be ppm/mo, unless you converted ppm to CO2 burden. Please check

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Interactive comment on Earth Syst. Dynam. Discuss., 5, 779, 2014.

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