

**Responses to Referee #1 comment on “Contrasting terrestrial carbon cycle responses to the two strongest El Niño events: 1997–98 and 2015–16 El Niños”**

Dear Referee and Editor,

Thank you very much for your efforts to deal with our manuscript and provide constructive comments. We have tried our best to re-summarize the results, and modify this manuscript accordingly. The following is our point-by-point reply to the comments.

1) Introduction: While the literature review is comprehensive and the introduction clearly describes the problem and the state of the science, the novelty of this research needs to be more clearly stated in the introduction. I suggest including a sentence explicitly stating how this research is novel compared to previous studies up front so the reader can better understand how this research is set apart from other studies.

Reply: Thanks very much for your suggestions. We have added a sentence [“Therefore, it is of great importance for us to have the clear insight into the impacts of ENSO events on the terrestrial carbon cycle through the typical case study.”](#) in the introduction to illustrate the importance of the comparison in the impacts between 1997-98 and 2015-16 El Ninos.

2) Conclusions and Discussion: The conclusions are clearly outlined and are consistent with the interpretation of the results. However, this section seems to be more conclusion, and is lacking in discussion. This left me interested with many questions that should be added after the conclusions, such as the caveats of this study (model, datasets, etc.), implications of the research (i.e., how does this research advance our science), and what, if any, future research may be done to build on the conclusions established (i.e., additional model/data analysis, additional El Niño years analyzed, etc.). More discussion would tie the manuscript and the state of the science in better, and will give a better big picture view.

Reply: Thanks very much for your suggestions. We have added some discussions after conclusions according to your suggestions. Part of them is as below: [“In addition, we](#)

should be cautious that the responses of terrestrial carbon cycle to El Niño events in this study are simulated by an individual DGVM, namely VEGAS. Uncertainties remain among the different state-of-the-art DGVMs owing to their different model structures, biological processes considered, parameterizations, and so on (Piao et al., 2013; Sitch et al., 2015; Wang et al., 2016). If possible, we can quantify the inter-model uncertainties in regional responses of terrestrial carbon cycle to El Niño events when the new round TRENDY simulations (TRENDY-v6, 1901–2016) are available. Also, though we take three inversion datasets as references for the VEGAS simulation in the context, they cover different periods. Importantly, there are also large uncertainties among different atmospheric CO<sub>2</sub> inversions because of their different prescribed priors, a priori uncertainties, inverse methods, and observational datasets (Peylin et al., 2013). Future atmospheric CO<sub>2</sub> inversions may give us more accurate results based on more observational datasets including the surface and satellite-based observations. ...”. Details can be seen in the context.

#### References:

- (1) Peylin, P., Law, R. M., Gurney, K. R., Chevallier, F., Jacobson, A. R., Maki, T., Niwa, Y., Patra, P. K., Peters, W., Rayner, P. J., Rödenbeck, C., van der Laan-Luijkx, I. T., and Zhang, X.: Global atmospheric carbon budget: results from an ensemble of atmospheric CO<sub>2</sub> inversions, *Biogeosciences*, 10, 6699–6720, 2013.
- (2) Piao, S., Sitch, S., Ciais, P., Friedlingstein, P., Peylin, P., Wang, X., Ahlström, A., Anav, A., Canadell, J. G., Cong, N., Huntingford, C., Jung, M., Levis, S., Levy, P. E., Li, J., Lin, X., Lomas, M. R., Lu, M., Luo, Y., Ma, Y., Myneni, R. B., Poulter, B., Sun, Z., Wang, T., Viovy, N., Zaehle, S., and Zeng, N.: Evaluation of terrestrial carbon cycle models for their response to climate variability and to CO<sub>2</sub> trends, *Global Change Biology*, doi: 10.1111/gcb.12187, 2013. 2117–2132, 2013.
- (3) Sitch, S., Friedlingstein, P., Gruber, N., Jones, S. D., Murray-Tortarolo, G., Ahlström, A., Doney, S. C., Graven, H., Heinze, C., Huntingford, C., Levis, S., Levy, P. E.,

Lomas, M., Poulter, B., Viovy, N., Zaehle, S., Zeng, N., Arneth, A., Bonan, G., Bopp, L., Canadell, J. G., Chevallier, F., Ciais, P., Ellis, R., Gloor, M., Peylin, P., Piao, S. L., Le Quéré, C., Smith, B., Zhu, Z., and Myneni, R.: Recent trends and drivers of regional sources and sinks of carbon dioxide, *Biogeosciences*, 12, 653-679, 2015.

- (4) Wang, J., Zeng, N., and Wang, M.: Interannual variability of the atmospheric CO<sub>2</sub> growth rate: roles of precipitation and temperature, *Biogeosciences*, 13, 2339-2352, 2016.

### **Technical Corrections:**

- 1) Line 16: It is not clear what CO<sub>2</sub> variability is being addressed. Perhaps, specify “The large interannual atmospheric CO<sub>2</sub> variability. . .”

Reply: Thanks very much. We have modified it accordingly.

- 2) Line 21: Same comment as above, “Mauna Loa atmospheric CO<sub>2</sub> concentration. . .”

Reply: Thanks very much. We have modified it.

- 3) Line 42: “. . .opposing to the cooler in. . .” would read better as “opposing the cooling in. . .”

Reply: Thanks very much. We have modified.

- 4) Line 68: for consistency and clarity, the variable “C<sub>fire</sub>” should have a written definition included like the other variables, such as “carbon flux from fire”.

Reply: Thanks. We have added the definition of “C<sub>fire</sub>” according to your suggestion in the context.

- 5) Line 73: “. . .involved in TRENDY project. . .” reads better as “involved in the TRENDY project. . .”

Reply: Thanks for your suggestion. We have modified.

6) Line 80: a comma is needed before “respectively”, “. . . 56 and 44% respectively”

Reply: Thanks very much. We have modified.

7) Line 101: “. . .in 2015-16 years” reads better as “. . .in years 2015-16”

Reply: Thanks very much. We have modified.

8) Line 104: “. . .El Niños in 1997-98 years and 2015-16 years. . .” reads better as “. . .El Niños in years 1997-98 and 2015-16. . .”

Reply: Thanks very much. We have modified.

9) Lines 119-120: Since more than one international project is listed, “. . .participated in the international carbon modelling project...” should read “...participated in international modelling projects. . .”

Reply: Thanks very much. We have modified.

10) Line 123: “The detailed descriptions on its model structure. . .” reads better as “A detailed description of its model structure. . .”

Reply: Thanks very much. We have modified accordingly.

11) Line 129: no space is needed before the comma after the reference in “. . .Anglia Climatic Research Unit et al., 2014) , NOAA’s. . .”

Reply: Thanks very much. We have modified accordingly.

12) Lines 149-150: Capitalize the expansion of the MACC acronym (e.g., “. . .Atmospheric Composition & Climate. . .”

Reply: Thanks very much. We have modified accordingly.

13) Line 168: Unit (K) is needed for temperature anomaly of 2.0

Reply: Thanks very much. We have modified accordingly.

14) Line 168: “El Niño event tends to. . .” reads better as “An El Niño event tends to. . .”

Reply: Thanks very much. We have modified accordingly.

15) Line 170: “growth rate” should be plural, “growth rates”

Reply: Thanks very much. We have modified accordingly.

16) Line 173: Remove extraneous period after Mount.

Reply: Thanks very much. We have modified accordingly.

17) Line 173: “...during 1982-83 El Niño event” reads better as “...during the 1982-83 El Niño event”

Reply: Thanks very much. We have modified accordingly.

18) Line 315: “...tropics, opposing to composite and. . .” reads better as “...tropics, as opposed to the composite and...”

Reply: Thanks very much. We have modified accordingly.

19) Line 325: “...anomalously higher, opposing to the cooler during...” reads better as “...anomalously higher, as opposed to the cooling during...”

Reply: Thanks very much. We have modified accordingly.

20) Line 331: “...more attentions have been paid on SIF..” reads better as “...more attention has been paid to SIF”

Reply: Thanks very much. We have modified accordingly.

21) Line 338: “...increased over America, Southern South America...”. The location needs to be better described. Perhaps change, “America” to “North America”.

Reply: Thanks very much. We have modified accordingly.

22) Line 339: “. . .but decreases” should be changed to past tense like the rest of the

sentence, “. . .but de- creased”

Reply: Thanks very much. We have modified accordingly.

23) Lines 340-341: “. . .anomalies were well corresponding to simulated. . .” reads better as “. . .anomalies corresponded well to simulated. . .”

Reply: Thanks very much. We have modified accordingly.

24) Line 344: “add a comma after “disturbances for FTA,”

Reply: Thanks very much. We have modified accordingly.

25) Line 346: “Globally” should be lowercase

Reply: Thanks very much. We have modified accordingly.

26) Line 390: “...El Niño episode, opposing to GPP...” reads better as “...El Niño episode, as opposed to GPP. . .”

Reply: Thanks very much. We have modified accordingly.

27) Line 393: The word “the” is not needed in the phrase “air temperature over the North America”

Reply: Thanks very much. We have modified accordingly.

28) Lines 395-396: “. . .higher, oppos- ing the cooler in. . .” reads better as “. . .higher, as opposed to the cooling in. . .”

Reply: Thanks very much. We have modified accordingly.

29) Line 400: “the” is needed in the phrase “. . .frequently happening in the tropics”

Reply: Thanks very much. We have modified accordingly.

30) Line 456: A period is needed after the reference for consistency

Reply: Thanks very much. We have modified accordingly.

31) Line 539: Randerson et al. reference does not follow alphabetical order. It should be moved before Schwalm in line 531.

Reply: Thanks very much. We have modified accordingly.

32) Line 583: “a It represents. . .” the word “It” is not needed

Reply: Thanks very much. We have modified accordingly.

33) Line 593: MLO should be defined in the caption like the other acronyms are

Reply: Thanks very much. We have modified accordingly.

34) Line 607: “And the arrows” reads better as “The arrows”

Reply: Thanks very much. We have modified accordingly.

35) Line 609: “And the purple” reads better as “The purple”

Reply: Thanks very much. We have modified accordingly.

36) Line 609: “denotes result” reads better as “denotes the result”

Reply: Thanks very much. We have modified accordingly.

37) Line 613: the lat/lon coordinates for extratropical NH and tropics should be defined in the caption so the reader doesn’t have to skim through the text when looking at the figure.

Reply: Thanks very much. We have modified accordingly.

38) Line 622: the lat/lon coordinates for extratropical NH and tropics should be defined in the caption so the reader doesn’t have to skim through the text when looking at the figure.

Reply: Thanks very much. We have modified accordingly.

39) Line 635: Figure 6 colorbar values are too small to read. Perhaps, include only 1 larger bar for each variable on the figure, rather than 3 small colorbars.

Reply: Thanks for your suggestions. We have tried our best to zoom in the colorbars. It looks better now.