

Interactive comment on “Contrasting terrestrial carbon cycle responses to the two strongest El Niño events: 1997–98 and 2015–16 El Niños” by Jun Wang et al.

Anonymous Referee #1

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General Comments:

This manuscript addresses the pertinent question of what terrestrial mechanisms and processes control inter-annual variability in atmospheric CO₂ growth rate during El Niño events, which is an area of research relevant to the scope of Earth System Dynamics. The title clearly reflects the research study and manuscript contents. The paper is a significant contribution to the field because there is large variability in carbon fluxes among models, especially during El Niño events, and it needs to be better understood. Through a multi-comparison study of model output, inversion studies and relevant datasets, this paper is a significant contribution to the study of earth system dy-

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namics bridging the gap in our understanding of land-atmosphere carbon flux response to climate variability. The literature review is comprehensive and clearly identifies the current state of the science. The manuscript contents are organized in a logical manner. The experiment is well designed and sufficient to answer the questions posed in the manuscript. The model results are presented with an analysis of the mechanisms driving them, and the conclusions drawn are consistent with the interpretation of the results. The tables and figures are clear, include relevant information for the study and are organized in a logical manner.

Specific 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. 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.

Technical Corrections:

1) Line 16: It is not clear what CO₂ variability is being addressed. Perhaps, specify “The large interannual atmospheric CO₂ variability. . .” 2) Line 21: Same comment as above, “Mauna Loa atmospheric CO₂ concentration. . .” 3) Line 42: “. . .opposing to the

cooler in..." would read better as "opposing the cooling in..." 4) Line 68: for consistency and clarity, the variable "Cfire" should have a written definition included like the other variables, such as "carbon flux from fire". 5) Line 73: "...involved in TRENDY project..." reads better as "involved in the TRENDY project..." 6) Line 80: a comma is needed before "respectively", "... 56 and 44% respectively" 7) Line 101: "...in 2015-16 years" reads better as "...in years 2015-16" 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..." 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..." 10) Line 123: "The detailed descriptions on its model structure..." reads better as "A detailed description of its model structure..." 11) Line 129: no space is needed before the comma after the reference in "...Anglia Climatic Research Unit et al., 2014) , NOAA's..." 12) Lines 149-150: Capitalize the expansion of the MACC acronym (e.g., "...Atmospheric Composition & Climate..." 13) Line 168: Unit (K) is needed for temperature anomaly of 2.0 14) Line 168: "El Niño event tends to..." reads better as "An El Niño event tends to..." 15) Line 170: "growth rate" should be plural, "growth rates" 16) Line 173: Remove extraneous period after Mount. 17) Line 173: "...during 1982-83 El Niño event" reads better as "...during the 1982-83 El Niño event" 18) Line 315: "...tropics, opposing to composite and..." reads better as "...tropics, as opposed to the composite and..." 19) Line 325: "...anomalously higher, opposing to the cooler during..." reads better as "...anomalously higher, as opposed to the cooling during..." 20) Line 331: "...more attentions have been paid on SIF..." reads better as "...more attention has been paid to SIF" 21) Line 338: "...increased over America, Southern South America...". The location needs to be better described. Perhaps change, "America" to "North America". 22) Line 339: "...but decreases" should be changed to past tense like the rest of the sentence, "...but decreased" 23) Lines 340-341: "...anomalies were well corresponding to simulated..." reads better as "...anomalies corresponded well to simulated..." 24) Line 344: "add a comma after "disturbances for FTA," 25) Line 346: "Globally" should be lowercase

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26) Line 390: "...El Niño episode, opposing to GPP..." reads better as "...El Niño episode, as opposed to GPP..." 27) Line 393: The word "the" is not needed in the phrase "air temperature over the North America" 28) Lines 395-396: "...higher, opposing the cooler in..." reads better as "...higher, as opposed to the cooling in..." 29) Line 400: "the" is needed in the phrase "...frequently happening in the tropics" 30) Line 456: A period is needed after the reference for consistency 31) Line 539: Randerson et al. reference does not follow alphabetical order. It should be moved before Schwalm in line 531. 32) Line 583: "a It represents..." the word "It" is not needed 33) Line 593: MLO should be defined in the caption like the other acronyms are 34) Line 607: "And the arrows" reads better as "The arrows" 35) Line 609: "And the purple" reads better as "The purple" 36) Line 609: "denotes result" reads better as "denotes the result" 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. 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. 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.

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