

Interactive comment on “Contrasting behaviors of the atmospheric CO₂ interannual variability during two types of El Niños” by Jun Wang et al.

Anonymous Referee #1

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Wang et al describe the different behaviour of CO₂ fluxes during the two types of El Nino event, the eastern Pacific (EP) and central pacific (CP) El Ninos. They use the atmospheric CO₂ growth rate and dynamic global vegetation models, and show differences for the two types of El Nino in the global CO₂ fluxes, as well as CO₂ fluxes separated regionally and by process. This is a relevant subject within the scope of ACP, the results will be useful and the paper is generally clearly written. I recommend the paper for publication after minor revision.

Detailed comments

Given the strong similarity of broad focus of this work with the recent Chylek et al paper, it might be worth adding a paragraph to the discussion that summarises the differences and similarities in approach and results e.g. exclusion of events that coincide with

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volcanic eruptions, identification of different events, inclusion of TRENDY and inversion results, focus on lag by Chylek, conclusions etc. Do you also see a difference in the lag? Is there anything from the TRENDY results that could shed light on the hypothesis from Chylek that the shorter time lag between the temperature rise and an increase in CO₂ emissions with CP El Ninos is influenced by fire response, while the longer time lag in EP El Ninos is dominated by vegetation response, noting although that the TRENDY models exclude or underestimate the effect of fire (maybe therefore there isn't anything you can add here, but at least worth thinking about)? Although there is a strong overlap of focus of this work with Chylek there are also significant differences, so I do believe that there is value in both studies.

Consider adding a figure (perhaps in the Supplement) with the CO₂ flux behaviour of separate El Nino events for EP and CP shown in comparison with the composite, to show how much the individual events vary from the composite.

page 2, line 36 - mention near the beginning of the sentence that you are considering the two types, e.g. "... evolutions of MLO CGR anomaly during the two El Nino types have three clear ..." otherwise it isn't clear until you get to the end of the long sentence.

page 2, line 44 - the sentence that begins "Regionally, significant anomalous ..." is long and you don't know which type of El Nino event this sentence refers to until the end. I suggest beginning the sentence something like "Regional analysis shows that during EP El Nino events significant anomalous ..." or some other way to mention EP at the start.

Page 5, line 111 - word "carefully" should be unnecessary

Page 7, line 154 - did the more recent version of LPX-Bern satisfy the minimum performance requirement?

Page 8, line 181 - say (broadly) what quantities you are calculating the anomalies in (e.g. in model results, observations)

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Page 9, line 198 - ".. with noticeable increases *in CO₂ growth rate* during ..."

page 9, line 210-212 - ".. and a similar regression analysis as done with the MLO CGR shows a sensitivity of 0.64 PgC yr⁻¹ K⁻¹" - Rather than describing it in this way, it would be clearer to say exactly what this is "and regression analysis of FTA with Nino3.4 shows a sensitivity of 0.64 PgC yr⁻¹ K⁻¹".

page 12, line 267 - how are you defining the MLO CGR peak here?

page 14, line 305 - "GPP anomalously increases ...etc" Can you check this sentence reflects the variations in Fig 4b? Would it be more accurate to say that there is a peak in GPP during austral fall (yr0), and is low from austral spring and winter (yr1)? Because austral summer spans from one year into the next, be more precise when you mention austral summer. Also be careful with the word increase (could be interpreted as talking about the trend) versus high values through this section.

page 16, line 349 - perhaps swap the order of figs S3 and S4 in the supplement, as S4 is always discussed before S3.

page 16, line 356-357 - "GPP is the dominant factor to FTA anomaly here" - I can see from Fig 4b that the GPP dominates globally at this time. Both GPP and TER look strongly anomalous in Feb-Aug, equator to 20N in Figs S3a and b, but the area of strongest flux is smaller for TER presumably therefore causing the dominance of GPP globally. If this is correct, maybe it is worth pointing out.

page 16, line 364 - "others" - other what? periods? regions? both?

page 17, line 378 - could mention the lag estimates from Chylek for CP and EP here.

page 18, line 402 - is there a better way to refer to this report? The url in the text did not work for me, as the new line added characters (403) to the hyperlink that shouldn't be in the url. Maybe use UNDP (2017) in the text, and remove the hyperlink from the url in the references.

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Fig 1 - the light red shaded area is difficult to see unless the size of the figure is increased on the screen - perhaps increase the size of the figure on the page. Other figures are also small in the printed copy and it is difficult to see some of their details.

Fig 1 or text - it should be known by most people, but it wouldn't hurt to include somewhere that high values of Nino3.4 correspond to El Nino (perhaps in the Fig 1 caption or on page 6 at line 140).

Minor editing is need to improve the English in some places.

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