Weather Clim. Dynam. Discuss., referee comment RC3
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Comment on wcd-2022-14

Anonymous Referee #3

Referee comment on "The tropical route of QBO teleconnections in a climate model" by Jorge L. García-Franco et al., Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2022-14-RC3, 2022

The paper analyses the QBO in 3 long preindustrial control experiments with different versions of the HadGEM climate models. The emphasis is on the equatorial teleconnections and the possible coupling to the ENSO. The results are compared to observations and reanalyses. The long model experiments make it possible to get more statistically significant results than in the much briefer observational records.

The paper is in general well written and the subject is interesting. However, many aspects of the methodology is not explained in enough details. I also find that the authors sometimes over-interpret the differences they find in the composites. I find that the paper needs some major improvements before it can be accepted for publication.

Specifc comments:

l110. I guess this description also is valid for the models and not just ERA5.

l130: I don't understand this weighting. Why is this important and how important is it? In particular the weighting with the number of days in each month cannot be important. The annual-mean composites seem to long-term means.

l135: I don't think I understand these counts. For example, in observations you have 62 QBOW Elnino months in a 40 years period while you have 376 months in 500 years for the model. But 62/40 is very different from 376/500. Does the model behave differently from observations or have I misunderstood something?

l140: More details should be given here. Is it individual years or months that are resampled? The time-scale of both the QBO and the ENSO are much longer and this should be reflected in the resampling procedure. If this is not done, the significance will be overestimated.

l165: The signal in the model seems weaker and more confined than in observations.

Figure 3: I would say that the signal is in general weaker in the model than in

observations and that there are considerable differences between model and observations.

l224: It is not correct that multiple linear regression assumes that the independent variables are orthogonal. But they cannot be linearly dependent.

Figure 6: The authors should briefly mention what the box plot shows: median, std. dev. etc.

l240-250: How is the statistical significance of the differences in Fig. 6 estimated? The spread seems very large.

l249: Christiansen et al. 2016 (doi:10.1002/2016GL070751) suggests that strong warm ENSO events change the phase of the QBO. Is there evidence for this in the model?

Table 1 Why are the errors smaller for the observations than for the model?

l250-255: I don't understand this paragraph. Why do you look at the pdfs? The K-S test tests if the pdfs are different, and not necessarily if the averages are different.

l260: Does this significance refer to the * in Fig. 7? There are very few *.

l268: They are very often opposite in sign. Can you say that the numerical values are different within the error-bars?

Figure 8: The hatching is hard to see.

l275: The plots in Fig. 8 seem very similar to me. Are you sure the difference of differences are statistically significant?

l370: What is the difference between the sentence 'When only ..' and the following sentence?