

Cover letter

Dear Prof. Peter Haynes,

Thank you for your letter and for the reviewers' comments concerning our manuscript. Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our research. We have studied the comments carefully and made corrections which we hope meet with approval. The main corrections in the paper and the responses to the reviewer's comments are attached. We hope our revisions have well addressed every concern from our reviewers.

Yours,
Sincerely,

Jian Rao
raojian@nuist.edu.cn

Response to Editor

The referees all agree that your paper is close to being ready for publication. Referees 2 and 3 are requesting further minor changes. Please consider their comments carefully and also look at the whole paper carefully again to consider whether modest changes might improve clarity. I have made various comments below about the referee comments and about some other points in the paper.

[Response: Thank you for your positive comments. We considered the comments from you and referees 2 and 3.](#)

Please provided a revised version of the paper including responses to the referees' comments and to my own comments below. I hope that at the next stage I will be able to accept the paper for publication without further consultation with the referees, but this will depend on the changes that you have made and the clarity of your responses.

[Response: Thank you for your kindness.](#)

Response to Reviewer # 2

Referee 2: 'The only further point that the committee would like to discuss is that the figures in the text should be unified with those of ERA5. ERA5 should be prioritized because it is of higher quality than the NCEP/NCAR reanalysis in the tropics. Figures generated by the NCEP/NCAR reanalysis should be included in the supplement for reference purposes. Also, changing the data used for different elements without explanation may give the reader the impression that the figures in the paper are intentional.'

I think that 'the committee' should be interpreted as 'the referee'. The point being made here is that you use NCEP/NCAR for some purposes and ERA5 for others. This seems a valid point to me. Given that ERA5 has now been available for some time, why are you not using it for all quantities. If there is a concrete reason why you are not using it -- e.g. you have tried using ERA5 for some fields and the results you find are not as clear as when you use NCEP/NCAR then that should be mentioned explicitly. My recommendation is, following the referee comments, that you use ERA5 as the primary data source and that if you do not then you provide clear explanation for that.

Response: Thank you for the suggestion. We revised the manuscript with the ERA5 data replacing the NCEP/NCAR. The results based on the NCEP/NCAR are moved to the supplementary materials. Specific revisions are listed as follows.

- We changed the figures 1 and 6 with the ERA5 data and put the figures derived from NCEP/NCAR reanalysis into supplementary S17 and S21.
- Besides, we added the NCEP/NCAR version of Figure 5 as Figure S20. The figures of ERA5 and NCEP/NCAR reanalysis showed quite consistent results.
- We also changed the data description because we only use the ERA5 data in the paper this time. (L88-101)

Response to Reviewer # 3

Referee 3: I have a concern about descriptions of mechanisms and phenomena involved. The discussion is rather rambling, with many different things thrown into the stew. I recommend that this work should be published, but I feel that the authors need to try harder to streamline the discussion of physical mechanisms, to clarify and emphasize the primary processes that they think explain their result.'

Again I can understand why the referee has made this comment. You list 'main findings' in Section 7, but there are 7 main findings and several of them are quite complicated. Please consider whether your paper will be more effective if your choice of 'main findings' is more restricted and if those that you choose are genuinely robust and important.

Response: Thank you for the suggestion. We condensed the main findings this time Please refer to the last section (Page 16).

In considering the above I noted the following detailed points -- there may be others. Section 2: I found it quite difficult to find a definition of 'early summer' and how that affects your use of data. In the abstract you define early summer as June-July. Does that mean that you consider MJO indices etc ONLY in June-July. How is this implemented exactly -- for example if data is low-pass filtered in time then 'June-July' may be influenced by other months. Please be clear about your methods. The issue is slight confused by the fact that you say that the QBO phase is defined by fields in May-June.

Response: Thank you for the suggestion. We agree that the RMM index in June-July from Bureau of Meteorology Australia (BoM) indeed applied the band pass filter (20-100 day) to original data (OLR, U850 and U200) anomalies before applying a MV-EOF analysis. However, the projected timeseries of the MV-EOFs are not filtered and are raw data. The timeseries in June and July are not affected by other months.

We made several revisions this time as follows:

- “The raw Real-time Multivariate MJO (RMM) index (Wheeler and Hendon, 2004) is used to define the MJO phase.” (L101)
- “Note that the early summer is defined as June-July to focus on the influence of the QBO and MJO during the Meiyu period.” (Line 119-120).
- “The index in May-June (May–July means show similar results) is used to select the QBO phases...” (L113)

L309: 'and its modulation by the MJO' -- should this be 'and its modulation by the QBO'?

Response: Revised (L315).