

***Interactive comment on “Using Empirical Orthogonal Teleconnections to evaluate interannual rainfall variability over China in the Met Office Unified Model Global Atmosphere 6.0 and Global Coupled 2.0 configurations” by Claudia Christine Stephan et al.***

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We thank the two reviewers for their helpful comments. In the following we list the changes and additions that we intend to make. We kindly ask the Editorial Office to let us know about the possibility to publish supplemental figures and to suggest the best way to do so.

Reviewer #1

This paper presents a very detailed description on the interannual rainfall variability over China in the Met Office model, using a relatively new technique. The whole paper is well organized and well written. I believe it can be published as is, although I have three minor comments just so the authors are aware.

1. The title seems too long. It may be shortened by eliminating some specific information.

We agree with this and will change the title to 'Interannual rainfall variability over China in the MetUM GA6 and GC2 configurations'

2. In addition to ENSO, the Indian Ocean Dipole (IOD) is another important interannual variability, which can have an impact on rainfall over China. It would be better to elaborate a bit on IOD where appropriate.

Our paper uses the results obtained in Stephan et al., 2017 as the basis for the model evaluation. Stephan et al., 2017 considered the IOD as a potential physical driver of precipitation variability but did not find evidence that the IOD was connected to any specific EOT pattern. We will add this information to this paper.

3. Nothing political and we all know this is a scientific paper. But, we would like to include Taiwan when we say "China".

We understand the reviewer's wish that Taiwan should be included. However, we have good scientific reasons why we cannot change this aspect of our analysis: the observational analysis by Stephan et al., 2017 did not include Taiwan and including Taiwan would change the EOT patterns.

Reviewer #2

This manuscript extends the observational analysis of Stephan et al. (2017a) using Empirical Orthogonal Teleconnections to examine interannual rainfall variability over China as produced by a model (both in atmosphere-only and coupled mode) at varying horizontal grid spacing. The authors conclude, based on their results, that coupling

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the atmosphere to the ocean produces improved interannual variability in precipitation over China, while changes in grid spacing show no consistent response. The metric for deciding this conclusion is the number of seasonal patterns produced by the model that have large-scale meteorological conditions matching the observations. Unfortunately, examining the effect of coupling the system for any individual season does not show a consistent response. Ultimately, the result that the precipitation variability is insensitive to horizontal resolution will help guide simulation choices for the future, making this work a useful contribution to the field. While I appreciate the authors' very thorough analysis, I found it difficult to follow the discussion of the figures at times owing to the small panel sizes and inconsistent layout of which models were presented (only those with statistically significant responses were shown forcing the selection of models to change from figure to figure, and from EOT pattern to EOT pattern). Perhaps since much of the discussion is based around how the model deviates from observations, difference plots would be more informative than plotting the mean and interannual variability (such as in Fig. 2). Maybe some of the other plots could be simplified somehow?

We understand that changing the layout between figures is not ideal. However, we calculated that creating figures with identical layout would require us to add 6 figures to our manuscript. This does not seem reasonable. If the Editorial Office allows it, then we would like to add a set of figures with a consistent layout as supplemental material. Similarly, we would like to leave Figure 2 as it is, but could offer to add the same figure as a difference plot as supplemental material. Showing absolute values in Figure 2 is more appropriate because the EOT analysis identifies patterns in areas of large mean precipitation and precipitation variability. These cannot be seen in difference plots.

I have a few other minor comments listed below. What grid spacing is the model tuning done for? Since the authors suggest C216 performs the best, it would be of interest to know whether this is because the parameterization constants have been optimized for this configuration or not. The tuning is normally done at a resolution of N96 and most parameterization constants do not change when changing the resolution. We

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will add this information to the manuscript with reference to the papers describing the parameter choices in the model.

Page 6, lines 23-24: Is the “drastic improvement” going from C96 to C216? Also, when it is mentioned the improvement is seen over the South China Sea, is this over ocean only? If so, why are the ocean points not shown in the corresponding figure? We admit that these sentences are not clear and do not convey useful information. We intend to delete them.

Page 15, line 15: the correlation coefficient is 0.44, “so ENSO explains only ~40% of the variance...” Typically explained variance is the square of the correlation coefficient. Can you explain how you compute the variance explained if not from the correlation coefficient here?

We thank the reviewer for catching this. We will replace ~40% with ~20%.

Page 13, line 14: “C96 and C512b (C512a) produce seven (eight), five (four) of [the observed patterns] associated with the observed mechanisms;” Figure 13 shows C512a produces six, not eight, of observed patterns. Also, C96 and C512b do not both produce seven of the observed patterns (as shown in Fig. 13). This line need to be clarified. Additionally, the sentence ends with a semi-colon as written, was there meant to be more there?

We thank the reviewer for pointing this out. One circle in Fig. 13 was also covered by another circle. We will replace Fig. 13 with the correct version and correct the numbers in the text. The paragraph is missing a sentence detailing the patterns that were produced in C216. This will be added as well.

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