

Interactive comment on “Defining metrics of the Quasi-Biennial Oscillation in global climate models” by Verena Schenzinger et al.

Anonymous Referee #1

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The Quasi-Biennial Oscillation is one of the most important modes of variability in the atmosphere and it is to an increasing extent included in climate models and CCMs. The present paper defines a set of metrics for the QBO and compares these metrics for a set of models and reanalyses.

The subject is important and the paper is well written. However I have a couple of major considerations that the authors should consider before I can recommend that the paper is accepted.

Major comments:

1) I miss some motivations for the chosen metrics and the way they are defined.

For example, some metrics are defined from the Fourier filtered time-series while oth-

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ers seems to be defined from the raw zonal mean zonal wind. What would the difference be if the metrics were calculated from the real data without the Fourier filtering? Why are the mean period defined from calculating zero-crossings in the raw zonal mean zonal wind and not from the spectrum?

In many studies a filtering based on the leading principal components are used (e.g., Wallace 1993, JAS 50, 1751-1762) making it possible to obtain a well defined a phase-speed. This possibility is not even mentioned in the paper.

I also wonder why there is no metric related to the wave-forcing of the QBO included.

The metrics could also be somewhat more detailed described in the text. Even when the caption to Fig. 2 is included the definitions are very densely described. For example, how is the cut-off frequencies of the QBO in the spectrum around two years actually determined?

2) The second half of the paper deals with "model performance" and metrics calculated for the models are compared to those of observations. But there is almost no attempt to address the statistical uncertainty (in e.g. Table 3). Given the relatively few QBO events on record this is an important part of the analysis both for the comparisons in this paper and in general.

The monthly QBO data can because of the oscillatory nature not be modelled by simple processes such as white noise or AR1 models. Christiansen 2010 (JCLIM, 23, 3953-3966) demonstrates one way to overcome this with a Monte Carlo method.

Anyway, the authors should address this problem and provide uncertainty intervals for the numbers in the tables.

Minor comments:

Lines 11, 16: What is meant by "easterly/westerly shear zones"? Here it seems just to be the easterly/westerly phases the zonal mean wind.

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Fig. 3 and 5: Are the profiles in Fig. 3 for one single QBO event? And are the mean and standard deviations shown in Fig.5 then taken over all QBO events?

Perhaps more details about the models could be included in Table 1 regarding the parameterizations of the orographic/non-orographic gravity waves.

Table 2: Is "mth" in the unit for decent rates the same as "months"?

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-284, 2016.

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