Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-791-RC4, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Role of equatorial planetary and gravity waves in the 2015–16 quasi-biennial oscillation disruption" *by* Min-Jee Kang et al.

Anonymous Referee #4

Received and published: 18 September 2020

Review of "Role of equatorial planetary and gravity waves in the 2015–16 quasi-biennial oscillation disruption" by Kang et al.

Recommendation: accept after very minor revision

General comments

The authors investigated the relative contribution of each resolved wave and parameterized waves to the QBO disruption in 2015-2016. They have shown that MRG and westward IG weakened the QBO and then led to extratropical Rossby breaking at the QBO jet core at 40 hPa. They also investigated the roles of CGWs obtained from an offline CGW parameterization that author's group has developed and showed the im-

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portance of variable wave sources. There have been several studies to investigate the mechanism of the 2015-2016 QBO disruption. I think this paper is the most comprehensive study among them. I believe this paper is suitable for the publication in ACP. My recommendation is published after very minor revision. I have a few comments added below.

(1) MRG are confined to the range |k|<=20 and omega <0.75 cpd in the symmetric spectrum. I think zonal |k|<=20 is a little wide for the MRG. Presumably |k|<=$\sim$10 would be better. Westward IGWs should be included in this definition. How much do the results depend on the ranges of |k|? I guess the relative contribution of MRG, shown in Table 1 and Figure 4, would be changed. One good point to answer this concern is to mention the dominant zonal wavenumber ranges for the MRG to force the QBO. I guess 3 < k < 6, but am not sure. I would suggest authors at least to mention the dependence of |k| selection to the quantitative results.

(2) L216: "The required wave forcing term (REQ) is calculated as a residual by subtracting the advection terms from the zonal wind tendency in the TEM equation"

When calculating REQ, do the authors consider the first term on the left of Eq. (1), that is meridional advection term, which is normally very small near the equator? In my experiences, the meridional advection term has also some values off the equator even at $\sim$5 degrees, which cannot be sometimes negligible.

(3) L258: "although the magnitudes of the REQ and wave forcing (vertical advection) in ERA-I is generally stronger (weaker) than that in MERRA-2"

I guess one possible reason for this is the different values of w* between MERRA-2 and ERA-I. As you know, the representation of BDC is quite different quantitatively among reanalyses as the S-RIP project has indicated.

(4) I would suggest to refer the paper by Dunkerton (2016, GRL, https://doi.org/10.1002/2016GL070921). Dunkerton's paper, published just after

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the QBO disruption, discussed some presumable mechanisms, which would be now useful for the current study.

(5) Figure 4(c): The explanation lines of Rossby-Y & Rossby-Z are hard to see. Please expand the lines.

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