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Reply on RC1

Liang Tang et al.

Author comment on "Eastward-propagating planetary waves in the polar middle atmosphere" by Liang Tang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-461-AC1, 2021

We thank the reviewers and editors for their constructive comments on our manuscript. The manuscript is revised thoroughly by considering all the comments. Besides, Figures 2, 4, 5, 6, 7, 9, 10, and 11 have been updated to make the results clearer. Besides, the language is polished by the Edit Springs English editing service. Our responses to every comment are listed below with blue.

Response to Anonymous Referee 1

1) There are too many grammar mistakes and some of the sentences are difficult to understand. I have list some of them in the detailed list. I did not list all the errors. The language need to be polished more.

The manuscript is polished by the Edit Springs English editing service before the resubmission, and more detailed descriptions are added in the revision.

2) The figures are not explained well. Especially Figures 4-7 and 9-11, the i and j figures need to be better explained. I have a hard time following the discussion of these figures.

More descriptions on the analysis results are added in the revision.

Specific comments:

Line 94-95, Further research by Palo et al. (2007). Also this sentence is confusing. Do you mean eastward Q2DW was produced by the nonlinear interaction?

The text is revised in the revision. A E2 Q2DW has been reported to be generated by nonlinear interactions in the MLT region. Nevertheless, the E2 Q2DW generated in the MLT

region is different from the E2 Q2DW in the polar stratosphere, which is discussed in this paper. This is made clear in the revision.

Line 113, This sentence is confusing. How can ‘propagation height’ be limited to high latitudes? Do you mean eastward waves are limited?

The text has been corrected as follows: "Lu et al. (2013) found that eastward planetary wave propagation is limited to the high latitudes in the winter hemisphere probably because the negative refractive indices equatorward of ~45°S result in evanescent wave characteristics."

Figure 1, please specify what the white areas represent, missing data, data too small, etc., either in the caption or the text. Without this information, I can not follow the discussion involved these figures.

White areas in Figure 1 represent small signals (corresponds to the right color bar). This is made clear in the revison.

Line 215-216, First, please describe what are showed in Figure 3. Second, please specify why these latitude bands are chosen for these waves. I assume that these are where the peaks are found in Figure 2, but please state it clearly in the paper.

Figure 3 shows the span of period for every planetary wave mode. And the latitudes and altitudes chosen in Figure 3 are where the corresponding wave peak. These two points are made clear in the revision.

Line 228-229, Please justify the statement ‘the PWs E1-E4 have similar phase speeds’ by, for instance, explaining how the phase speeds are calculated, and specifying what are values of the phase speeds.

The calculation of phase speed has been added in the revision. And the values of the phase speed are also clearly stated in the revision.

where is the phase speed; is the equatorial linear velocity; is the latitude; is the zonal wavenumber and is the wave period.

Line 230-232, Please explain more detailly what are shown in each figure of Figure 4. Specifically, what are ‘temperature structure’? From the context I can guess it’s the amplitude of the wave in temperature, but it should be clearly stated in the paper, instead of leaving it for the readers to figure out.

Temperature structure means the vertical and latitudinal distribution of the wave amplitude in temperature for the eastward waves. Every figure is stated more clearly in the revision.

Figures 4-8, and 9-11, Please explain what the filled colors in figures i and j are. Without this information, I can not follow the discussion associated with these figures.

Figures i and j are exhibited to show the propagation and amplification of every wave (below). The blue shaded region represent instability, and the red arrow represent EP flux. The green line represents critical layers. Regions enclosed by orange solid lines are characterized by the positive refractive index. More descriptions on the analysis results are added in the revision.

Technical comments.

Line 25-26: seasonal variations of the critical layers generated by the background wind

Revised in the revision.

Line 45: ‘The seasonal variations’ to ‘Seasonal variations’

Revised in the revision.

Line 54: ‘a maximum amplitude’ to ‘amplitudes’

Revised in the revision.

Line 58: ‘the W3’ to ‘W3’

Revised in the revision.

Line 59: delete ‘those of’

Revised in the revision.

Line 62: citation format needs correction, ‘the wave’ to ‘wave’

Revised in the revision.

Line 67: ‘confused’ to ‘indistinguishable’,’during the SSWs period’ to ‘during SSWs’

Revised in the revision.

Line 68-69: to ‘Then periods of W3, W4 and W2 vary between …., respectively

Revised in the revision.

Line 71, Than the tropics?

No. W2 can be observed in global satellite datasets, showing weaker amplitude than W3 and W4 in the NH and SH. This is stated more clearly in the revison.

Line 72, ‘dominated’ to ‘modulated’

Revised in the revision.

Line 76, ‘the SSWs period’ to ‘the SSWs’. Revise all the terms in the manuscript

Revised in the revision.

Line 81, It should be ‘planetary waves’ or ‘planetary wave activities’

Revised in the revision.

Line 82, change to ‘ with periods of nearly 2 and 4 days’

Revised in the revision.

Line 86-88, ‘In addition, planetary waves of …..have been found to have the same phase speeds as…’

Revised in the revision.

Line 109, ‘proposed’ to ‘found’

Revised in the revision.

Line 120, ‘eastward propagation wave’ to ‘eastward propagating wave’

Revised in the revision.

Line 127, ‘In Section 2, …’,

Revised in the revision.

Line 132, ‘Section 3.3 compares and analyzes ..’

Revised in the revision.

Line 136, Any reasons for choosing these windows (i.e.,10, 6, 4, 4 days)?

We chose analysis windows that are ~2-3 times as long as the wave periods without other specific reasons.

Line 144, ‘amplitude of wave (not wavenumber)’

Revised in the revision.

Line 170-176, These definitions of terms should be moved after Eq.2. Also when defining the terms of an equation with ‘where’, the first letter should not be capitalized, and it should not be a new paragraph (for example Line 182, 187)

Revised in the revision.

Please also note the supplement to this comment:
https://acp.copernicus.org/preprints/acp-2021-461/acp-2021-461-AC1-supplement.pdf