

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-461

Anonymous Referee #1

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Referee comment on "Eastward-propagating planetary waves in the polar middle atmosphere" by Liang Tang et al., Atmos. Chem. Phys. Discuss.,  
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This manuscript presents the global variations of eastward propagating planetary waves of wavenumber 1, 2, 3, and 4, and the environmental conditions in the polar middle atmosphere in 2019. The authors present that these wave modes exist when the background wind is westward. They found that mean flow instability in the upper stratosphere and upper mesosphere both contribute to the amplification of these waves. The results are significant and show potential of interesting findings. However, the manuscript is not presented well enough for me to understand the authors points for the following reasons.

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.

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.

I suggest the authors modify the manuscript, specifically polishing the language and do a better job explaining the figures.

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?

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

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.

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.

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.

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.

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.

Technical comments.

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

Line 45: 'The seasonal variations' to 'Seasonal variations'

Line 54: 'a maximum amplitude' to 'amplitudes'

Line 58: 'the W3' to 'W3'

Line 59: delete 'those of'

Line 62: citation format needs correction, 'the wave' to 'wave'

Line 67: 'confused' to 'indistinguishable', 'during the SSWs period' to 'during SSWs'

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

Line 71, Than the tropics?

Line 72, 'dominated' to 'modulated'

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

Line 81, It should be 'planetary waves' or 'planetary wave activities'

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

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

Line 109, 'proposed' to 'found'

Line 120, 'eastward propagation wave' to 'eastward propagating wave'

Line 127, 'In Section 2, ...',

Line 132, 'Section 3.3 compares and analyzes ..'

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

Line 144, 'amplitude of wave (not wavenumber)'

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)