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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigation on the abnormal quasi-two day wave activities during sudden stratospheric warming period of January 2006" *by* Sheng-Yang Gu et al.

Anonymous Referee #1

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Review of "Investigation on the abnormal quasi-two day wave activities during sudden stratospheric warming period of January 2006" by Gu et al. The paper investigated the impact of the SSW on QTDW at other hemisphere. The authors have carried out a number of analyses using satellite observations and reanalysis data to establish their conclusions. However, the findings do not illustrate any novelty in their characteristics. In this context it should be pointed out that earlier study by Gu et al. (2016c) already investigated on the SSW and QTDW (W2, W3) relationship using greater number of warming events including the present warming episode of 2006. Noting the listed issues the paper requires substantial revision before it could be considered for publication.

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Discussion paper

Major points 1) Characteristic features of the QTDW (W2 and W3) over both hemispheres during warming period as found from the present study are very similar with the past findings as expected. Explanation and interpretation related to the W2 and W3 components bear significant resemblance with the past study of Gu et al. (2016c).

2) The correlation analysis between zonal mean temperature (70N, 10 hPa) and zonal wind shown in Figure 9 looks very crude which does not entail any firm physical background, rather it is a chance occurrence. High anticorrelation is observed at several regions in the plot and cannot be considered as instability zones to excite QTDW. It is not clear why the interval is chosen from 1 Jan to 20 Feb when SSW activity is selected during 10-30 Jan for rest of the analyses.

3) The instability contours (Figures 7, 10, 11) do not suggest any evident link between the southern and northern hemispheres, rather southern hemispheric instabilities (to excite W3 and W2 QTDW near 40S and 20S, respectively) are found to be linked with highest instability southern polar mesosphere and stratosphere regions. Therefore from the present results it seems SSW has little to do with the summer hemisphere QTDW activity except coincidence and hence it requires substantiation.

4) Section 3.3: Fig. 14, Authors have mentioned that the present study could provide more realistic view of nonlinear interaction between SPW1 and W3 resulting generation of W2 QTDW as compared to the past study by Gu et al. (2016c). The present results (Figure 14) shows prominence of W3 in southern hemisphere and SPW1 in northern hemisphere indicating unlikely generation of W2 QTDW due to nonlinear interaction between SPW1 and W3 QTDW. Furthermore, nonlinear advection as shown in Figure 13 seems to be unreliable for identification of W2 generation as authors ruled out one such possibility in the text at winter polar region. Therefore using nonlinear advection to identify W2 QTDW generation looks incorrect in the present scenario.

5) Overall, the authors have pointed out stronger W2 and W3 QTDW in summer hemisphere in 2006 (SSW) in comparison with 2005 (no SSW), but it is not clear how the

disturbance propagates from winter to summer hemisphere. Therefore the authors are suggested to look into the latitudinal-temporal evolution of the dynamical parameters and attempt to link these two entities (SSW and QTDW in summer hemisphere) which could reduce present understanding gap and add significance to the present work since the past study by Gu et al. (2016c) already reported southern hemisphere QTDW enhancement through easterly wind strengthening during northern hemispheric SSW.

6) Figure 2, Instead of absolute temperature it is better to plot temperature deviation from mean wind.

7) Fig 7, 10, 11: Authors should describe how critical layers of W2 and W3 are calculated

8) Fig 12. It is not clear why EP flux divergence for W3 is plotted for the interval 23-30 Jan, whereas in all other cases it is 12-19 Jan for W3.

Other points 9) L29: Replace “provides stronger” by “strengthen”

10) L40: Replace “oscillation” by “significant variability”

11) L40: Replace “with a period. . ..” By “ with the period. . ..”

12) L45-46: “with different wavenumbers. . .. . .”. Please mention the wavenumbers

13) L-175: Correct “∼40N” to “40S”

14) L-214-215: Replace “in the mechanical study of the” by “in studying”

15) L-333: Correct “Their TIME-GCM simulations use” to “Their TIME-GCM simulations used”

16) L-355: Correct “may also exhibits” to “may also exhibit”

17) L-360-365: Both the links of data sources for NOGAPS-ALPHA and MLS-AURA are inaccessible. Please correct them.

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