

Interactive comment on “Observations of PW activity in the MLT during SSW events using a chain of SuperDARN radars and SD-WACCM” by N. H. Stray et al.

Anonymous Referee #1

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General Comments

In this study by stray et al., the authors study the MLT planetary wave activity following SSW events from a network of SuperDARN radar measurements and simulations from specified dynamics WACCM. The authors show compelling evidence of enhanced PW activity (s1 and S2) in the MLT with a 3-day lag from stratospheric wind reversals at 50 km. The enhancement in PW activity is seen not only after strong SSW events with elevated stratopause events but also after smaller magnitude SSW events where the wind reversals might persist for only up to 4 days. The authors speculate that the enhancement in PW activity might be due to in-situ generation of PW in the MLT by

C234

either zonal asymmetry in GW drag or due to the development of baroclinic/barotropic instabilities.

Specific comments

1. Line 31-33 –This sentence is factually incorrect. There is no evidence that PW in the MLT initiate the descent of the elevated stratopause events. In fact the studies cited by the authors seem to indicate that the formation and descent of the elevated stratopause is gravity wave driven while the westward PW activity might be having some contribution.
2. Line 52. How do you define ‘strong’ events? It might be prudent to mention the WMO definition of major and minor SSW events. The strong event of 2012 studied in Chandran et al. 2013b is actually a minor SSW event.
3. Since the SuperDARN radars cover only 175o in longitudes it is not clear how this would affect the determination of especially wave 1 components keeping in mind that often during SSW events of a vortex displacement nature, the winds in one hemisphere might not even show a reversal. I think this might be biasing the amplitudes of the wave 1 components shown in the study. A more detailed discussion is warranted here.
- 4.SD- WACCM model output- What are the time steps in the model outputs used in this study? How does it affect determination of the S1 and S2 wave components?
- 5.Line 95- 110. The authors should mention that their definition of an SSW event differs from the traditional WMO definition of SSW events. While I do not have any issue with the authors definition of strong SSW events, to make a comparison with other studies which have followed the WMO definition it might be worthwhile to mention which of the seven events composited meet the WMO definition of a major SSW and which ones do not. Looking at table 1 in Chandran et al. 2014, I see only two events classified as SSW with ES events during the study period and 7 events classified as major SSWs during this period. A table might be in order here listing the authors classification of

C235

'strong' and 'weak' SSW events and SSWs with ES.

6. Line 115. Figure 2. Looking at figure 2, I see that the zonal mean winds do not show a reversal at 10 hPa for the composite of the 7 strong events. Again this is following on from the previous comments that the reader might not have the same definition of the authors on what constitutes a strong SSW event. Also the composite of the SSW ES events do now show the traditional image of an ES structure where we expect the ES to form around 80 km similar to the temperature structures seen in events such as 2006, 2009 SSW events or the composite of ES events shown in figure 5 of Chandran et al. 2013a. I suspect this is because of the author's choice of altitude difference to be 10 km. I am curious if the results show any difference if the authors select a subset of SSW events with an altitude difference of say 15 km instead.

7. Line 125 – 'A SSW' or 'an SSW'? later on the author's use 'an SSW'. Please be consistent.

8. Line 135-140. This is not very evident in the composite. Again I believe this might be because of the 10 km difference between altitudes selected by the authors to define an ES event.

9. Line 150- How many events out of the seven show the phase speed to be stronger westward and how many show weaker and eastward?

10. Line 172- When you mention that the amplitudes of S1 and S2 are similar, some important information is missing here. The authors need to mention out of the seven events, how many were vortex displacement and how many were vortex splitting events? If there were instances of both then I believe the analysis for figures 3 and 4 should also include separate panels for VD and VS events. I fear a strong vortex splitting event where the S2 component might be very strong biasing the composite result or vice versa.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 393, 2015.