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Atmospheric Chemistry and Physics Discussions

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 #2

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General Comments:

In this work, Stray et al. studied the planetary wave (PW) variation in the mesosphere and lower thermosphere (MLT) during SSW events using both SuperDARN radar measurements and SD-WACCM simulations. Both observational and simulation results show evidence of PW (S1 and S2) enhancement in the MLT after polar-cap zonal wind reversal at 50km, and the correlation between the PW enhancement and the wind change at 50km was found to be statistically significant. Previous studies have showed that PW in the MLT during SSW could change significantly, though mainly using simulations and some satellite observations, and have focused on case studies.

The current study employed an observational network (SuperDARN) and examined events from 2000-2008, and demonstrated the value of ground-based observation networks in studying the MLT large-scale dynamics, in particular for studying the short term variability and establishing statistics.

Specific Comments:

1. Extraction of PW S1: The SuperDARN network used in this analysis covers a longitude range of 175 degrees (150W to 25E). I would think that this would cause uncertainty when deducing PW S1 using fitting method due to insufficient information, especially for stationary and slowly propagating S1 components. This is analogous to the difficulty/uncertainty involved in retrieving diurnal tides with night time only measurements. I would like to see this clarified and quantified in the paper and/or discussion.

2. Stratospheric polarcap wind: In this study, the authors decided to use the zonal wind at 50km as the "index wind" for the stratosphere, rather than the wind at 30km/10hPa as used traditionally in SSW literatures. The authors may want to briefly explain the rationale for this choice, and if/how the results would be affected if the 30km wind is used. And since 50km is to the top of MERRA, where there are less observations available for data assimilation, I wonder how reliable the wind there is compared with the 30km wind.

3. MLT PW during SSW: It is well known that Rossby waves can survive only in an eastward wind field, and indeed by comparing Figure 2a with Figure 4 the large wave amplitudes in the MLT coincide with eastward wind reversal (between 80-100km during SSW) in SD-WACCM simulations. So I wonder (i): what is the correlation between PWs and zonal wind at 95km? (ii): if the increase of MLT PWs is simply a result of favorable propagation conditions, namely eastward wind, in the MLT region? (i) would involve a straightforward correlation calculation, using zonal wind derived from SuperDARN, and the result will help shed light on (ii).

4. PW-wind correlation in model: What is the correlation between PW and strato-

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spheric polarcap wind in SD-WACCM simulations? Is it similar to that derived from SuperDARN/MERRA (0.4)?

5. Elevated stratopause (ES) in composite: Figure 2 is a composite based on 7 SSW ES events. One would expect that the ES to be found in the composite too. But this is not so clear in Figure 4b. Please clarify the ES structure in figure 4b.

6. Undisturbed winter conditions: in the paper (page 5 around line 110) the undisturbed winter condition was described as time periods when there is no polar cap wind reversal within 40 days prior to the target period. The 40-day time period sounds arbitrary, and I wonder if there is any physical significance to this time scale. For the 2000-2001 season, for example, there were a series of strong wave 1 and 2 events in December and January (with intervals of 10-20 days), so dynamically it was a very disturbed time period. So I am not sure if it is valid to characterize 29 January 2001 as under undisturbed winter conditions. It also seems problematic to use the wind reversal to demarcate winter conditions, since the polar vortex could be strongly disturbed between two warming events.

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