

Interactive comment on “Rayleigh lidar observations of double stratopause structure over three different northern hemisphere stations” by V. Sivakumar et al.

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Sivakumar et al. 2006 ACP Review:

Paper: "Rayleigh lidar observations of double stratopause structure over three different northern hemisphere stations" by V. Sivakumar, H. Bencherif, A. Hauchecorne, P. Keckhut, D. N. Rao, S. Sharma, H. Chandra, A. Jayaraman, and P. B. Rao

General Comments: The paper contains a significant database of middle atmosphere temperature measurements and some potentially important findings. I feel that it needs more work on analysis and statistics to better support the findings before publication is warranted, as well as editing of English and correction of a number of smaller mistakes.

Specific Comments:

1. English grammar needs much editing. There are many grammar mistakes, with the introduction being the worst, some of which interfere with scientific understanding.
2. The authors postulate a GW cause for the double stratopause, but use a daily mean temperature profile for the statistics. So the number of hours that make up the mean relative to the wave period is quite important. The averaging time may vary greatly with season and latitude. The authors need to account for this in the statistics.
3. The mean values in Table 2 of NS, UDS, and LDS heights seem to contradict your claim that "The OHP observations demonstrate that NS is more frequently found at UDS than at LDS, whereas, the Gadanki observations show the opposite: NS is more frequent at LDS than at UDS." on line 23 on page 6939. Figure 3 also seems to show lower NS at OHP than Gadanki.
4. I am wondering if the definitions of NS, LDS, and UDS are themselves very scientifically useful. If the structures are thought to be caused by waves, the heights of the NS, LDS, and UDS will just depend on the phase of the perturbing wave relative to the time that the observations occur, which has no direct scientific relevance. Why not just fit the wave parameters directly and then look at the wave and mean structures separately? The 40 day dataset should certainly have sufficient time and height resolution for the planetary waves.
5. Figure 1: What is shown in Figure 1? When do the profiles come from? Are they simultaneous? Are these average profiles or profiles picked at random times? What is the time averaging? Why are the heights of the maxima important to be discussed in the text?
6. The authors mention a "quasi-continuous" data set. Does this include daytime and nighttime data? What percentage of the total time in the 40 days have data?
7. What are the criteria for deciding if a double or single stratopause is present? The

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profiles must always have some bumps due to noise or small waves. The 3 latitudes will have different gradients above and below the stratopause, so the relative effect of GW will also be different.

8. Section 4.1: More detail is needed on how $(T'/T_0)^2$ is calculated. What is the time averaging of the profiles used? How does this relate to the expected GW periods at each latitude?

9. This double stratopause reminds me of the double mesopause that showed up in nightly mean temperature profiles. When daytime measurements were included, the 24 hour mean showed primarily a mesopause with a single peak. The double structure at nighttime was largely a result of incomplete time sampling of the diurnal tide, with possibly a small dip due chemical heating at night. (States and Gardner, 2000; Chen et al., 2000) Subsequent work has treated the tidal perturbations and daily mean as largely separate issues. While tides are not very important at the stratopause, the GW and PW perturbations that are present may cause similar sampling issues.

Technical Corrections:

1. Table 1: The site names and latitudes are mixed up in the column headings..
2. Table 2: Please list the units for the values in the table.
3. I would suggest removing "different" from the title.
4. Too many acronyms in the abstract. People reading only the abstract should not need to learn a new acronym. Remove GW and PW and maybe try to rewrite so you do not need NS, UDS, and LDS in the abstract.
5. Figures 5 and 6: Please list the units for the contour plot.

References:

Chen, S., Z. Hu, M. A. White, H. Chen, D. A. Krueger, C. Y. She, Lidar observations of seasonal variation of diurnal mean temperature in the mesopause region over

Fort Collins, Colorado (41 °N, 105 °W), J. Geophys. Res., 105(D10), 12371-12380, 10.1029/2000JD900045, 2000.

States, R. J. and C. S. Gardner, Temperature structure of the mesopause region (80-105 km) at 40N latitude, J. Atmos. Sci., 57, 66-77, 2000.

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