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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieval of $O_2(^1\Sigma)$ and $O_2(^1\Delta)$ volume emission rates in the mesosphere and lower thermosphere using SCIAMACHY MLT limb scans" *by* Amirmahdi Zarboo et al.

Anonymous Referee #1

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In this paper, the SCIAMACHY MLT limb scans are used to retrieve both O2($1\sum$)$and O2(1\Delta)$ dayglow emissions. The altitudinal and latitudinal distributions and the seasonal variations of both emissions are given and compared in brief. The possible photochemical processes contributed to the distributions are discussed. The responses of both emissions to the SSW in 2009 are analyzed simply. These new data are beneficial to the expansion of O2($1\sum$)$and O2(1\Delta)$ dayglow emissions database, and for that I commend the authors. However, some minor comments below should be addressed.

1. Lines 10-12 on page 1. It is mentioned that

"O2($1\sum$)$shows secondary maxima during winter and spring, which are related to the downwelli$

2. Line 2 on page 2. It is better to add a reference for the sentence "has been a matter of dispute for some years".

3. Line 4 on page 5. It is better to add "based on O2($1\sum$)$emission" after" performed remote sensing measurements of upper atmosphere winds$

4. Line 20-21. "Daylight measurements by SCIAMACHY during the Envisat orbit begin with limb measurements of the twilit atmosphere (Bovensmann et al., 1999) which are located in the northern polar region (above 75°N)." I can not catch the meaning of this sentence.

5. Lines 27-28 on page 9. Figure 4a just shows emission intensities at some altitudes; especially the intensity at 83 km is not shown in this figure. How to draw the conclusion from Figure 4a that the largest SNR of the emission intensities for daytime O2($1\sum$)$are located around 83 - -99 km and the largest SNR are observed at the edges of the altitude range?$

6. Line 3 on page 10. "the largest SNRs at the lowest altitudes (Figure 4b),". Does the "lowest altitudes" means 54 km? If 54 km is the lowest altitude in the retrieval of O2(1Δ) emission intensity in this paper? Is the intensity below 54 km not significant or can it not be observed?

7. Line 4 on page 10. Similar to question 5, the intensity at 83 km is not given in Figure 4d.

8. It would be better to add a simple introduction about Figure 5 before that about Figure 6, for example in line 7 on page 10.

9. Line 10 on page 10. Figure 5b gives the altitude distributions above 50 km (maybe 54 km). And some profiles have not reached their maxima at the lowest altitude given in the figure. The altitude distributions of O2(1Δ) dayglow observed by the TIMED/SABER satellite often show its maximum around 50 km (usually lower than

50 km). The distributions of O2(1Δ) dagylow were given by Mlynczak et al. [2007, JGR, 112, D15306]. It is suggested to compare the altitude distributions of O2(1Δ) dayglow with that given by Mlynczak et al..

10. "around 80°N latitude" is mentioned in both lines 1 and 3 on page 12. Are both the VERs significant at only this latitude and not significant at other latitudes?

11. Lines 13-14 on page 14. "The altitudes of the peak values of O2(1$\sum$)$roughly follows the maximum intensity of solar radiance$". $This cannot be seen clearly f$

12. Lines 19-20 on page 14. The "maximal value" and "peak altitude" are derived from the profile between 85-100 km. Therefore, when the second peak does not appear or the second peak is not obvious, the derived maximal value must be the emission at 85 km and the peak altitude must be 85 km. In the situation, the peak altitude given here is not the altitude for a real peak. This means the peak values and peak altitudes at some latitudes or some time shown in Figure 8 are not for real peaks but for 85 km; however, they are for the real peaks when the second peaks are obvious. In fact, the lowest peak altitudes (85 km) occur not only in summer at high latitudes but also in the tropics in Figure 8d. It is better to solve this problem. At least, it should be explained in the paper in case some readers could think that all the maximum values and peak altitudes given in Figure 8 are for real second peaks.

13. Equation (6). Please give the altitude range.

14. Line 5 on Page 15. "hemispheric wintertimes" Please check if it should be "hemispheric summertimes".

15. Lines 2-3 on page 16. Please explain in brief why you suspect that these abrupt changes are related to a change in the altitude sequence of the satellite measurements during that time.

16. Lines 12-13 on page 18. The larger intensities could begin earlier (than three weeks later) as shown by Gao et al. [2011, JGR, 116, D19110]. You can compare the

results with those given in that paper.

17. Line 13 on page 18. It is better to add a citation for the sentence “as expected from enhanced mixing with oxygen-rich thermospheric air after the SSW”.

18. Line 14 on page 18. It is mentioned that “After the recovery phase, the O2(1Δ) signal is less prominent compared to O2(1$\sum$)$''. It is better if you can indicate the time when the recovery phase ended. In addition, it seem$ signal is less prominent compared to O2(1$\sum$)$after the recovery phase in Figure 10. However, th$ emission after the recovery phase is evidently weaker that that during the recovery phase; however it is still further stronger than the O2(1$\sum$)$emission after the recovery phase. So is the SNR.$

19. Line 2 on page 19. Similar to question 18.

20. Figure 5. Please revise the label in Figure 5.

21. Figure 6. Please explain in brief the blank regions in Figure 6 in the text.

22. Figure 7. Please revise the label (yy-Mmm) in Figure 7.

23. Figure 8. Please revise the labels (yy-Mmm and yy-mm-dd) in Figure 8. In addition, it is better to change the ranges of the color bars to show some characteristics described in the text more clearly; especially for Figure 8d, it is better to decrease the upper limit value of the color bar.

24. Labels in Figure 9. Add unit of “Altitude”. It is better to use O2(1$\sum$)$to replace O2(b) and use O2(1\Delta)$ to replace O2(a). It is better to use (photons cm-3 s-1) to replace [photons cm-3 s-1].

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2017-269/amt-2017-269-RC1-supplement.pdf