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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison of VLT/X-shooter OH and O_2 rotational temperatures with consideration of TIMED/SABER emission and temperature profiles" *by* S. Noll et al.

Anonymous Referee #1

Received and published: 1 December 2015

1. This is a very well written manuscript based on a thorough analysis of echelle spectra (taken with X-shooter spectrograph at the Very Large Telescope at Cerro Paranal in Chile) combined with volume emission and temperature profiles obtained by the SABER radiometer on the TIMED satellite.

2. The X-shooter spectra are used to calculate rotational temperatures (Trot) from the O2b(0-1) and O2a(0-0) emission bands in addition to 25 different OH emission bands. The temperatures so derived must be corrected for the different emission heights of these bands. SABER VER profiles of O2a(0-0) and OH were used to correct the derived temperatures with an assumed linear altitude (upper vibrational level) v'-

dependence of the different OH bands. A simple Gaussian profile based on published values was used to correct the rotational temperatures derived from the O2b(0-1) band.

3. Since the radiative lifetimes of the upper levels of the two O2 bands are known to be relatively long, the derived (Trot) are not significantly affected by non-LTE contributions. On the other hand values of (Trot) derived from OH bands, particularly those arising from higher v' levels, are known to be susceptible to non-LTE effects.

4. Trot values derived from the two O2 bands showed excellent agreement with the SABER-related temperatures, whereas the temperatures derived from the OH bands showed a significant v'-dependence (in addition to an odd-even effect) which exceeded 10 K in the case of v'=8.

5. Correcting for the different altitude profiles of the O2 and OH bands, the authors quantify the non-LTE contributions to the OH Trot as a function of the upper vibrational level v' for a range of published molecular parameters.

6. A nocturnal trend in non-LTE contributions to OH Trot was also identified, which could be explained by the nocturnal behaviour of the OH emission layer.

7. The assumptions used in the calculations, the criteria applied at each stage and the significance of the results are clearly explained.

8. The manuscript is very well referenced and easily deserves to be published with only very minor textual corrections.

Very minor textual corrections

Page 30794, line 27: suggest "The variations revealed may be important ... " instead of "The found variations can be critical ...".

Page 30795, line 16: suggest "collisions may be too infrequent ... " instead of "collisions can be too rare ... ".

Page 30795, line 19: The use of the word "(lower)" in this sentence could be confusing

for readers. Consider omitting it?

Page 30804, line 2: suggest "The choice is not critical ..." instead of "The choice is uncritical ...".

Page 30810, line 14: suggest "The SABER OH profiles cannot be used directly ..." instead of "The SABER OH profiles cannot directly be used ...".

Page 30816, line 1: suggest "either." instead of "too.".

Page 30821, line 2: suggest " ... are shown in Fig. 13." instead of " ... are provided by Fig. 13.".

Page 30823, line 7: suggest " ... than their actual values." instead of " ... than their amount".

Figure 7 caption; suggest " ... mean after midnight as a function of ... " instead of " ... mean of second night half as a function of ... ".

Figure 8; use the same colour for "O2a(0-0) ref." as in Figure 9 to be consistent.

Figure 9 (legend); why use "[" as the closing bracket, e.g. in "[18h, 21h["? Same question for the other entries in the legend; also same question concerning Figure 10, 15 and 16?

Figure 15, (last line of legend); omit the word "be" in " ... very likely be smaller than 2K.".

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 30793, 2015.