

Interactive comment on “Diurnal variation of midlatitudinal NO₃ column abundance over Table Mountain Facility, California” by C. M. Chen et al.

Anonymous Referee #1

Received and published: 1 November 2010

The manuscript presents measurements of the NO₃ total column density using direct moonlight and an artificial light source on a horizontal path at surface level. Measurements were made during 40 nights in a period of 16 months and are compared with 1D and 3d model calculations. The manuscript provides new and interesting insight into tropospheric NO₃ chemistry, it is well written, the scientific conclusions are clearly stated and are well supported by the measurements. In summary I recommend publication after the authors had a chance to consider some suggestions for minor corrections as detailed below.

1) Page 20194, lines 20-26: The discussion of atmospheric NO₃ chemistry could be tidied up a bit: It probably would be good to mention up-front that the description deals with nighttime only (sentence in lines 4,5 of page 20194). Likewise, the statement that

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N₂O₅ thermal decay is a source for NO₃ holds for the troposphere just as well as for the upper stratosphere. In fact the equilibrium between NO₂, NO₃ and N₂O₅ could be mentioned.

2) Page 20195, lines 1 and 6ff: Heterogeneous reaction of N₂O₅ with water: Probably this is on surfaces of ice particles in the stratosphere and any moist surface in the troposphere?

3) Page 20196, lines 7ff: Measurements of free tropospheric NO₃ were also reported by: Platt et al., J. Geophys. Res. 86, 11965-11970, 1981 and: Penkett et al., Atmos. Environ. 41, 3465-3478. 2007.

4) Page 20196, line 12: The remark about NO₃ in the free trop. may also be informative to make in the abstract.

5) Page 20196, lines 20,21: What kind of ?input??

6) Page 20196, line 26: This statement belongs into section 2.1.

7) Page 20197, section 2.1: It might be of interest to the reader to have a little more precise information here: does ?two days before and after full moon? mean a period of 4 or five days? How many full moon periods did occur during the measurement period (16 or 17)? So measurements were actually made during e.g. 40 out of 80 possible nights?

8) Page 20197, section 2.2.1: Give spectral range of the instr. here.

9) Page 20198, section 2.2.1: Were the spectra co-added for 10-20 min.?

10) Page 20199, line 3: The total vertical O₄ column corresponds to a horizontal path at sea level of 4km (or to about 3 km for the column above 2000m) and more at slant views. Why is this negligible?

11) Page 20200, lines 5, 6: The authors state: ?The solar spectral features in the non diffuse spectra differed from those in the lunar spectra.? But what is required is that

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the diffuse solar spectra do not differ from the lunar spectra. This does not follow from the statement made.

12) Page 20200, line 21: What about saturation effects if the lines are not resolved??

13) Page 20203, line 13: Mean values of what?

14) Page 20205, line 9: Negligible daytime NO₃ values are not really visible in Fig. 3.

15) Page 20209, para. starting in line 19: Give more clear explanation of the boundary layer issue and "constructed" columns.

16) Page 20212, conclusion section: What are the consequences of this interesting finding for the oxidation capacity of the free troposphere and its NO_x contents?

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 20193, 2010.