Atmos. Chem. Phys. Discuss., 14, C11356–C11359, 2015
www.atmos-chem-phys-discuss.net/14/C11356/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "OH populations and temperatures from simultaneous spectroscopic observations of 25 bands" *by* S. Noll et al.

Anonymous Referee #1

Received and published: 20 January 2015

This is an excellent and exhaustive paper, and carries with it the bottom line that previous attempts to use the OH rotational distributions as an indication of mesospheric temperature are incorrect and should not be pursued. The actual causes of these distributions are complicated, and there is still much to be learned, but the approach of using the first few rotational levels of various OH bands to define a temperature is an over-simplification. The quality and spectral range of astronomical sky spectra is such that one may conclude that the typical ground-based experiment of using a single OH band to extract a Boltzmann distribution and then a local temperature is very misleading. Previously, there was uncertainty in data quality, so that the question of variation of rotational temperature with different vibrational levels was difficult to pin down. We now find that two distinct data sets reproduce rather well the dependence of "rotational tem-

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

perature" on vibrational level, and these findings should guide further research. Below are some typos, and further discussion.

32980/5 "as many OH bands as possible" is desirable.

32980/16 The given range presupposes that the reader understands the sequence of OH bands. "OH(8-2) to OH(9-7)" could imply that only v = 8 and 9 are investigated. It's much better to give the wavelength range, stating that this includes v = 2-9.

32980/19 "discrepancy" is not the right word here

32980/23 I don't think that you want to pursue the idea of "vibrational temperature". More on this below.

32981/6 "and satellites"

32981/14 Is v = 9 the ninth or the tenth vibrational level?

32981/(17-25) This section is murky, because of the introduction of vibrational temperature.

32982/9 "high-altitude layers"

32982/14 "uncertainties still present"

32983/23 I think "unusual plain" is better defined as "ordinary"

32984/12 delete "will"

32984/19 "has operated"

32985/10 "is necessary to apply"

32986/2 "in an adequate way"

32987/25 "for all OH bands considered"

32989/1 use wavelength range, not band range

ACPD

14, C11356–C11359, 2015

32989/3 “except for the 7-1 band”

32989/4 what is a median spectrum?

32987/7 many OH bands are in the optical range

32995/7 “to” here makes no sense, maybe a comma

32995/8 OH(2-0) is not a “neglected” band – it’s the only one you have for v’ = 2

32995/13 “required” instead of “necessary”

One needs a band table arranged by wavelength, to clarify how the bands appear in the nightglow.

32997/25 “of the Δy pattern observed”

32999/(21-27) another explanation could be that there are two distributions, v = 7-9 and v = 2-6.

33002/top It could be that OH is not a good choice at all for measuring mesospheric temperatures. As I understand it, temperatures determined from the O2(b-X) 0-1 band tend to be lower than any OH “temperature”, which suggests that we don’t understand the OH system well enough yet.

33003 I don’t understand the significance of a determination of Tvib. The initial v distribution is a consequence of the reaction dynamics of H + O3 $\rightarrow$ OH(v) + O2. The initial levels are v = 7-9, with a small amount of v = 6. Any lower v comes from relaxation, so what is observed is mainly related to altitude, i.e. the number of collisions and the radiative lifetime of OH(v). So it seems to me that a vibrational temperature has little meaning. The initial vibrational distribution has no population in v = 0-5 – so what then is the vibrational temperature? What would be useful is the total emission from each vibrational level. I think there’s enough data to compile that.

33004/25 “OH lines and bands considered”

ACPD

14, C11356–C11359, 2015

33008/28 “on”, not “in”

33012/23 “As for Trot”

33013/8 “We considered the (Trot(v’)) already discussed”

33017/18 “observed”, not “found”

33029/F1 what does “see legend” in the caption mean?

It strikes me that it would be useful to add the Cosby and Slanger data to Fig. 13. This would show how reproducible the structure of the “spectrum” is, and it would be interesting to compare their March/October data with the seasonal data in the figure, because the seasons are reversed between Mauna Kea and the VLT.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 32979, 2014.

ACPD

14, C11356–C11359, 2015