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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 #2

Received and published: 20 January 2015

General comments:

This is a well written study touching on some current and relevant issues related to the determination of mesopause temperature from ground-based measurements of the OH Meinel emissions. An extensive set of night-sky spectra measured with an astronomical spectrograph operated at the ESO in Chile and covering more than 20 OH bands is employed. The main aspects of the study are the vibrational level dependence of rotational and vibrational temperature. Nocturnal and seasonal variations in rotational temperature and vibrational population are also reported for the different vibrational levels. Most aspects of the study are not entirely new results, but the study is highly valuable for the scientific community, because a more extensive data covering more OH bands is used compared to earlier studies. I have no major objections to the publication

of this manuscript, but ask the authors to consider the comments listed below.

Specific comments:

Page 32980, line 16: '25 bands from OH(8-2) to OH(9-7)'

This is only a really minor point, but for the inexperienced reader this order will be difficult to understand. Perhaps the wavelength ranges of the two bands can be listed in parentheses?

Page 32980, line 21: 'show a clear trend in the change of the variability pattern.'

I'm not sure what the intended meaning of this phrase is. Can this be improved?

Page 32981, line 6: 'in situ' -> 'in-situ' ?

Page 32981, line 8: 'emission' -> 'emissions'

Page 32981, line 19: 'leads to temperatures of about 10000K'

This refers to vibrational temperature, which should be stated.

Page 32982, line 8: 'This implies possible real temperature gradients'

It's not clear what this implication aims at. What are the effects of 'real temperature gradients'?

Same sentence: also the following sub-sentence lacks context, I think.

Page 32984, line 19: 'is operated .. since' -> 'has been operated .. since' ?

Page 32984, line 20: 'We retrieved the archival data taken until March 2013.'

If the data was downloaded from a website, please provide that website. Also, does the data have a version number?

Page 32987, line 23: 'we only considered those observations where the temperature did not deviate by more than 3.5 25 SDs from the mean value for all considered OH

bands.'

It would be interesting to learn what fraction of the spectra left does not pass this filter. Also, although it is quite obvious, 'SD' should be spelled out.

Page 32988, line 1: 'The deviation from the mean values of an ideal distribution is only +13 min and -4 days, respectively.'

I find this statement potentially misleading. For the first value, only the time of the day is relevant, for the second number only the day of the year.

Page 32988, line 5: 'fraction .. were' -> 'fraction .. was'

Page 32988, line 19: 'by 32 min and 6 days'

See comment above.

Page 32991, line 4: 'First, the sky continuum was roughly determined by applying a median filter'

I don't quite understand how this median filter is specifically applied in this case. Can you briefly explain this?

Page 32991, line 8: 'Lines with critical continua should have been rejected'

Are they rejected or not?

Page 32992, line 8: 'The altitude distribution of the emission with a typical FWHM of 8 km is negligible, since the correction changes by less than 1% ..'

I don't really understand this statement. Does it mean that the correction changes by less than 1 % if the altitude profile is changed within plausible limits? It can certainly not mean that the maximum difference between I(0) and I(z) is less than 1 %, right? I also think the statement should be something like 'the effect of the altitude distribution of the emission on the correction is negligible' and not 'The altitude distribution .. is negligible'. The altitude variation is certainly not negligible.

Page 32992, line 15: please add '$\Delta \lambda / lambda$' before '$\approx 10^6$'

Page 32992, line 22: 'These profiles were then convolved with the transmission spectrum'

Were they really convolved? I think they just need to be multiplied by the transmission spectrum.

Page 32993: It would be good to mention the accuracy of the transmission correction.

Fig. 3: Please indicate what lines correspond to which v'.

Page 32995, line 24: 'The resulting correction was nearly 0 K .. and about +1 K'

Can you provide more accurate values for these corrections?

Same page, line 27: 'These are reasonable quantities'

Unclear what you mean by 'reasonable' here.

Page 32998, line 5: 'than reported by Beig (2003) referring to Perminov and Semenov (1992).'

What exactly do Perminov and Semenov suggest?

Page 32998, line 15: 'However'

This suggests a contradiction to the previous sentence, which is not the case. Suggest removing 'however'

Page 33000, line 10: ', the temperature decreases by 1.3 K on average.'

Suggest to state explicitly what the reference for the 1.3 K decrease is.

Page 3301, line 18: 'pecularities' -> 'peculiarities'

Page 33001, line 22: 'The process would be more efficient'

Not fully clear what 'process' refers to.

Page 33002, line 15: ‘which is caused by the O3 and O density-related collisional quenching efficiency’

Perhaps the paper by Savigny and Lednytskyy, GRL, 40, 5821 – 5825, 2013 should be cited here, because it’s the first paper showing the importance of O quenching in real data.

Page 33004, line 4: ‘(43%) .. (32%)’

Unclear what the percentages refer to. Please clarify.

Page 3304, line 16: ‘When only the vibrational levels 3 to 6 are considered, as shown in Fig. 7’

I think this should be a reference to Fig. 8, not 7?

Page 33005, line 3: ‘we can further constrain their origin’

‘Origin’ refers to ‘OH rotational and vibrational temperature’, which doesn’t make too much sense. Perhaps you mean the origin of variability in OH temperature?

Page 33008, line 4: ‘Figure 9 also indicates that structures in the variability pattern for T_rot and intensity appear to move from high emission layers ..’

Can you describe more precisely at what times, e.g. this is seen. I’m unable to see this in the intensity plot, and also in the temperature plot this effect is not very pronounced.

Page 33009, section 5.2.1: ‘Nocturnal variations’

How are nocturnal variations separated from a potential semi-annual contamination? This is probably simply the case, because your measurements are nearly equally distributed in local time and day of year. Perhaps this should be mentioned here.

Page 33010, line 16: ‘whichs’

Same sentence: suggest to mention that T_rot is averaged over all v’ here.

Page 33010, line 21: ‘The slope .. derived from all v’ tends to decrease through the entire night’

Looking at Fig. 11 leads me to the conclusion that the slope increases during the night.

Page 33030, line 25: ‘While the time-averaged absolute T_rot differ’

That’s the difference between odd and even v’, right? This should perhaps be mentioned at this point of the sentence already to avoid confusion.

Page 33012, line 15: ‘A LOWER slope of 1.0 K was found in spring’ and 2/3 lines below: ‘data of C&S (2007) for Mauna Kea ALSO indicate a STEEPER slope for spring’

This doesn’t seem to be consistent. Also in this paragraph: the difference between ‘spring’ in the NH and SH may lead to confusion.

Page 33013, line 1: ‘is in good agreement’

With what? Probably Takahashi and Gelinas?

Page 33017, line 26: ‘results of (Cosby and Slanger, 2007)’ -> ‘results of Cosby and Slanger (2007)’

Page 33030, Figure 2: The panels are barely legible on my printout. This Figure needs to cover an entire page, and even then the labels may not be legible. Please check.

Page 33030, Caption Fig. 2: ‘The displayed spectrum is the median’

How exactly is the median determined? Is the median determined for each pixel/wavelength bin separately? I think there are different ways to determine a ‘median spectrum’

Page 33032, caption, Fig. 4: Suggest to replace ‘lozenges’ by the commonly used ‘diamonds’

This comment also applies to Figs. 5, 7, 8, 11

Page 33034, Figure 6: What are typical errors for the individual temperature values shown in the two top panels? This can be mentioned in the caption.

Also, the labels in this figure may be too small.

Page 33037, Fig. 9: Labels perhaps too small?

Page 33038, Figure 10: closing brackets in legend wrong.

Page 33039, Caption Fig. 11, line 1: 'Change of T_rot with v' Delta T_rot /Delta v'

Something is wrong here? Perhaps just missing space after 'with v'? Same comment applies to caption of Fig. 15

Page 33040, Figure 10: closing brackets in legend wrong.

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