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Comment

## ***Interactive comment on “High spectral resolution ozone absorption cross-sections – Part 2: Temperature dependence” by A. Serdyuchenko et al.***

### **Anonymous Referee #1**

Received and published: 14 August 2013

The paper discusses the temperature dependence of a new set of high-resolution absorption cross sections for ozone covering a large spectral range from 213–1100 nm. It is the second paper of a group of two. This set of cross sections has great advantages over most of the available sets that are in use for many atmospheric remote sensing applications, as it is provided for a wide spectral range, at high resolution and because it has been measured at 11 temperatures covering the entire range of atmospheric relevant conditions. The new set is compared with the available sets in different spectral regions and the differences are quantified in detail. It is well known that the available ozone retrieval platforms (satellite and ground based) use different cross sections

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for the calculation of the ozone abundance in the atmosphere, which results in inherent differences in their ozone estimates, and affect the comparability of the ozone data provided by different platforms. The paper constitutes an important contribution towards the homogenization of the ozone data, and a comprehensive source of information enabling the users of the cross sections to assess the similarities and differences over the data sets already in use. There are parts of the paper that need clarifications and in some cases the discussion should be expanded to include the UV-B spectral range, where the main ground based instruments operate. The language is fine, but there is room for some further improvement. After addressing the following specific comments, I think that the paper should be accepted for publication in AMT.

Specific comments:

Abstract: The abstract should be expanded to include the highlights of the paper. In its present form it presents only the scope of the paper.

6615, 2: It would good to mention how much larger are the variations in the Huggins band (up to ...).

6615, 6-7: This sentence, on the Wulf band, does not discuss the temperature dependence as it was done for the previous bands. In addition, as it is written, one gets the impression that the NIR structure appears on the continuum of the visible. I guess the intention was to say something like “the continuum of the visible is extended in the NIR and on this extension the structure is superimposed”.

6615, 17: It would be good to mention the range of the BMD spectral region.

6615, 19: I am a bit confused with the use of the word “broadband”, here and in many other places in the paper. Usually “broadband” is used to denote the average, or the sum, of a radiation quantity that is calculated over a given spectral region, in contrast to values at single wavelengths. I guess that here “broadband” is used to denote a wide spectral range. Unless I am wrong in my interpretation, I would prefer to drop

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this word in sentences like “broadband low resolution”, or, a few lines later, “broadband high resolution” and “Broadband data sets”. The meaning would be the same without the word “broadband”.

6615, 22: “. . .optical densities.” of what?

6617, 5-9: It is not clear how the calibration was done, since the spectral regions do not overlap. Did the authors use a single wavelength in each case? (e.g., 335 nm for the 335-350 nm spectral region, and 780 nm for the 780-1100 nm spectral region). Here again the word “broadband is confusing”: One can interpret the statement as: the average of the absolute measurements over the region 310-335 nm.

6621, 16: This sentence puts emphasis on the satellite application of the cross sections. However, of equal scientific importance is the application of the cross sections to the ground based data. Therefore I suggest to refer also to the Dobson and Brewer spectrophotometers that operate in the UVB.

6622, 6: I wonder why the author have chosen to use a rectangular slit function for the convolution of the cross sections and not something more realistic, like a triangular or a trapezoid slit function.

6622, 13: Figure 5b is too busy, and it difficult to recognize easily the individual wavelengths. On the other hand, it is an important figure because it provides information on the accuracy of the temperature parameterization of the new cross sections at individual wavelengths used in Dobson and Brewer instruments. I suggest to consider including in the legend, next to each wavelength, the range of the deviations. For example the first Brewer wavelength would read: 306.45 (-1.4 - +1.2).

6622, 19: I do not see the reason for showing comparisons of the  $Co(\lambda)$  coefficient and not for cross sections derived from the full parameterization. I miss, also, some discussion on this Figure (particularly for the lower panel).

Moreover, it would be interesting to show a comparison between the BP and BDM,

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e.g., by inserting a third line in the lower panel of Figure 5.

6623, 1: The spectral range chosen for the comparisons (325–340 nm) is mainly relevant for satellite retrieval of ozone with the DOAS method. However, if these new cross sections are chosen to replace the BP cross sections in the ozone retrieval from ground based instruments, then it would be very important to discuss in section 3.3.2 the differences and shifts at wavelengths relevant for the Brewer and Dobson instruments.

6623, 22: The statements of this paragraph assume that the new set of coefficients is correct and the BMD and BP aren't. How this can be justified? What was the mean difference before applying the wavelength shift correction to the BP and BMD data?

6623, 26: I cannot fully understand the procedure followed for Fig. 6. It is stated that the scaling factors and shifts were calculated and then they were applied to the data. But one would expect that the remaining differences would be much smaller after applying the corrections and not only about half. The scaling factors range between 0.95 and 1.04 (roughly +/- 5%) and the differences are up to ~5%.

Could you please verify that all differences are positive?

It puzzles me how a point with scaling factor of 1 (practically of zero difference) can end with a 9% difference. I am referring to the BP (red symbol) at 243K.

Some symbols are missing: For example the Voigt symbol at 203 K is missing in the upper panel.

Some symbols are double: E.g., BMDexp at 218 K and 228 K.

The scaling factor is dimensionless, so please remove the % sign from the Y-axis of the upper panel.

Please change the fourth line of Fig. 6 caption: "... relative mean difference (other data minus new data), after applying corrections for shifts and scaling factors."

6625, 6: "Bass-Paur temperature parameterization must be used". What exactly you

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mean here? How you extrapolate the BMD data with the BP parameterization?

6627, 4: Please quantify the “good agreement”: (to within X%)

6627, 10: I guess that you are convinced that the new set of cross section is better! Therefore you should replace “is expected to provide” with “provides”.

Technical comments:

6614, 24: Delete “of”

6615, 19: “consequently” is probably a bad word choice. Try using “in turn” or “in addition”.

6615, 28: I suggest to replace “Broadband data sets” with “Cross section datasets”.

6616, 8: Add at the end of the sentence: “Hearn’s value at 253.65 nm”.

6616, 16: delete “and”

6616, 25: “absorption” instead of “absorptions”

6618, 25: Consider replacing “translates” with “applies”.

6622, 19: The comparisons refer to BP and DBM data, therefore, “several works” should be replaced.

6624, 31: Please add the year of the Orphal reference.

6625, 14: Consider replacing “falling” with “decreasing”.

6626, 21: I suggest to replace “broadband data sets” with “ozone cross section datasets”.

6626, 24: I suggest to replace “broadband data” with “data in an extended spectral region (213 – 1100 nm)”.

6627, 4: Delete “of” at the end of the line.

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6632: Table 2: I suggest rephrasing to: “Uncertainties associated with the absolute measurements of the ozone absorption cross-sections at 50 mbar . . .”

6633: Table 3: I suggest rephrasing to: “Integrated ozone cross-sections over different spectral bands, and . . .”

6634: Table 4: I suggest rephrasing to: “Comparison of some ozone cross-section datasets at low. . .”

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