

Author reply to Referee #5

Ground-based assessment of the bias and long-term stability of fourteen limb and occultation ozone profile data records

Hubert *et al.*, Atmos. Meas. Tech. Disc., 2015, 8, 6661-6757.

We are grateful for your kind words and for your effort to provide a valuable review. Our response to your questions, comments or suggestions can be found below, with different text formatting for **referee comments** and author replies.

The manuscript "Ground-based assessment of the bias and long-term stability of fourteen limb and occultation ozone profile data records" by Hubert et al. describes successful analyses that aim to characterize biases and drifts of long-term satellite ozone profile measurements. This is a long awaited and very important study since the community has started combining measurements from different satellite instruments for better temporal and spatial coverage, and the possibility of long-term trend assessments. Possible individual biases and drifts of the satellite instruments are important to know for these activities to be able to understand implications for uncertainties of determined trends. The manuscript presents a thorough comparison of satellite measurements with ground-based measurements from ozonesondes and lidars, and provides discussions about the implications of the detected drifts and biases on trend detection.

The manuscript is very well written, the language is clear, and grammar and style are great. The manuscript is well structured which facilitates the understanding of the discussed methodologies and results. There are only a few comments that I would like to see addressed. I therefore recommend the manuscript for publication after minor revisions.

Comments:

- The most substantial recommendation that I have is that the paper would benefit greatly from some shortening. At the moment it is very long which requires a lot of commitment from the reader to actually make it through. I understand that this is a study that required a lot of work and discussion of many details, but if the authors could shorten the text in some places it would be beneficial for the manuscript. In my opinion, especially the description of the different satellite instruments, and the ozonesonde and lidar descriptions can (and should) be shortened quite a bit. As the authors state, most of the information that is given here is already presented in Hassler et al. (2014), and therefore a lot of this information is redundant. Additionally, lots of the information in the text is nicely condensed in Table 3.

We will shorten the instrument description section parts, since most of the information is indeed already available in the literature or can be presented in a more condensed form.

- Throughout the manuscript: please check for the word "abundancies" (for example page 6664, line 21). This should be "abundances".

Ok, done.

- Page 6669, line 17-18: WOUDC is part of GAW, however, the community knows the database where ozonesonde measurements are stored as "WOUDC". I would therefore recommend to change this to avoid confusion.

Ok, done.

- Page 6684, line 18: the description "below the 5hPa level" could be confusing – does that mean higher or lower in the atmosphere?

To remove this potential cause of confusion we rephrased all occurrences in the paper to "altitudes below/above XX hPa".

- Page 6685, line 2: what is the reasoning for choosing 100kmh^{-1} for the wind?

This was taken as a rough estimate of horizontal wind speed in the stratosphere. Now explained in the manuscript.

- Page 6685, line 19-20: The phrase "The comparison results are somewhat sensitive to the shape of the smoothing function: : " is a little vague. Could you be more precise here?

We rephrased to "The comparison results, especially observed spreads, differ slightly when another shape of the smoothing function is chosen ...".

- Page 6703-6704, Section 5.2.11: Both vertical units ("km" and "hPa") are used here which makes it confusing to understand what the native units for MIPAS are.

Indeed, we changed this.

- Page 6717, line 17: The phrase "by more than about 1% or $1\% \text{decade}^{-1}$ " is unclear.

We rephrased to "... typically change, respectively, by less than 1%, 1% or 1% per decade".

- Page 6738-6740, Table 1 and Table 2: it is not entirely clear from the text why some stations are listed, although they are not included in the drift analysis. To avoid confusion, either make it clearer in the text what the stations, that are not used for the drift analysis, are used for, or removed them from the tables.

Tables 1 and 2 only include stations used in the analysis. All of them were used for the bias/comparison spread analyses in Sect. 5, while those marked in the last column were also used for the drift analysis in Sect. 4. This is now clarified in the table caption.

- Page 6750, Figure 5: The labeling in the individual graphs is too small (satellite name and covered time period). Please increase the font size for that. Additionally, it is not clear for the lower four rows if the pressure numbers are the labelling for the tick marks or if they are labels for the area between the tick marks. Please improve this.

Fig. 5 was optimized for viewing in the AMT layout on A4, not for the AMTD layout. The text labels are clear in the (larger) final manuscript. The position of the tick marks in each panel correspond to either the altitude labels (to the left on the page) or the pressure levels (to the right), depending on the native representation of the satellite record. Doing so shows makes it clear which vertical coordinate is the native coordinate. The same approach was used for Fig. 6 and 7.