

Interactive comment on “On instrumental errors and related correction strategies of ozonesondes: possible effect on calculated ozone trends for the nearby sites Uccle and De Bilt” by R. Van Malderen et al.

Anonymous Referee #2

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This paper investigates tropospheric and stratospheric ozone trends based on the ozonesonde data record from nearby stations in Belgium, Uccle (1969-2014) and De Bilt (1992-2014). Each station has its own specific ozonesonde processing algorithms and these algorithms are compared to the WMO recommended O3S-DQA algorithm which was also used. The impact of the various ozonesonde processing steps including corrections for pump flow rate, box temperature measurement, background subtraction, ozone normalization, . . . , on the trends and the comparisons between the two stations are investigated.

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That there are, for certain time periods, rather significant differences in the conclusions which would be drawn from the trends from each station alone is somewhat sobering. Most of these differences, however, appear to be driven by the sonde types and corrections applied early in the sonde record. For Uccle this meant compensating for deficiencies in the Brewer Mast sondes, which require rather large corrections and definitely a total ozone normalization. For De Bilt there were significant ozone backgrounds measured in the first 5 years of that record, which lowered the overall ozone measured, leading to some rather strong and probably incorrect positive ozone trends. During this same period Uccle was still using Brewer Mast sondes and displayed a similar positive trend. Once the two sites settled down to using quite similar ECC sondes, without large backgrounds, although from different manufacturers, then the two records show quite a reasonable agreement.

The paper provides a lot of detail on all the different corrections employed, and Uccle employs an interesting yet unconventional method of combining the pump correction factor and total ozone normalization, but aside from that most other corrections are familiar to other ozonesonde investigators. The detailed discussion of the differences becomes at times difficult to follow and the point of such detailed discussion gets lost at times. This difficulty is compounded by the thin lines in the figures and the difficulty in separating the blue, black, gray, and purple lines. On some figures I just had to give up trying to follow the discussion. The colors were too hard to separate even when the figure is enlarged. The authors should consider attempts to shorten such discussions to the really important points.

The main criticism that the authors do not address is what should be made of the trends when the full data records are used? For De Bilt it is tempting to just ignore the 1992-1997 record since it is not that long. This cannot be done for Uccle which extends to 1969. Yet finally when Uccle and De Bilt are really compared, apples to apples, Fig. 10, they show a rather satisfying consistency between stations. What are the trends in the vertical ozone profile which would be inferred from only the Brewer Mast record,

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1969-1997? How does that compare to the trends shown 1969-2014 and 1997-2014? This would be much more interesting than comparing 1997-2014 and 1993-2014.

The authors may want to consider this comment, enhance the color fidelity in the figures, and the following specific suggestions/questions in preparing the final copy for publication.

1.5-8. What type of sonde is used at De Bilt? This should be mentioned here.

1.17. Fix, ... whole the vertical ...

2.1 Change to, ... throughout the whole lower atmosphere ...

2.29. I do not believe that this statement is true. Thorough calibration of every ozonesonde prior to flight may be needed, but resources and personnel are seldom available to complete a thorough calibration of each disposable instrument. Rather there are routine checks of the maximum and minimum to see that the range is appropriate. Temper this statement.

2.24. Since the conversion efficiency is the largest source of error the origin of the 3.6% should be stated.

7.7-9. If the deficit vanishes rapidly at pressures below 1000 hPa, why is a pressure dependent expression used at pressures below 100 hPa? That doesn't seem rapid. What is the composite of the conversion efficiency? The absorption efficiency has not been previously introduced. Basically these sentences do not tell the reader what was done and that should be changed to be explicit about how the conversion efficiency was adjusted.

7.12-13. Awkward, change to. ... Since at Uccle the recommended ... is only recently available, the value ... Replace "former and latter" with what they are to not confuse the reader.

10.1-2. Why this sentence now, after the earlier discussion about how the background

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current was dealt with. What is the reader to do with this conflicting information?

Section 2.2.2. Now I see that this is a description of the operational methods applied at Uccle, but hasn't all of this already been published and will it be used here? I question whether all this detail is necessary for this paper.

13.25-26. It should be stated that the curve showing only the corrections due to Eq. 4 is not shown, since there is no correction shown in the Uccle profile that reaches 4%, otherwise the reader, like me, is confused and wastes way too much time trying to figure it out.

14.5-15. The percentages quoted here are at times inconsistent with the figure. For example the relative difference at burst altitude is 2% not 4%. The relative differences are not clearly smallest at the ozone maximum, which the reader, since an ozone profile is not shown, has to guess at. Please make the text consistent with the figure shown! The discussion at 16.7-9 provides a more realistic statement of the differences of these profiles.

14.23-25. The Uccle ozone profile is not shown in Fig. 6, so the text should not make this claim. What is shown is a difference between the average operationally corrected profiles at Uccle, with, I assume, an average of the operationally corrected profiles between 1993 and 2014 at De Bilt. Insure the text and figures are consistent.

14.28-30. This statement is correct, but contradicts the statement just above which states that an Uccle ozone profile is shown. Correct these inconsistencies. Why is this statement, as the beginning of this new section, harking back to a figure which has already been discussed? Awkward. What is the operational De Bilt profile? Is this an average?

15.1 Two different types of ozonesondes where?

19.28. Than at De Bilt, ...

Table 1. Why are there two switch dates for sonde type at De Bilt, when there is only

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one switch between sondes? Compare to the column for Uccle in the same row, and to the row below showing the different radiosonde types.

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