



# ***Interactive comment on “50 years of balloon-borne ozone profile measurements at Uccle, Belgium: short history, scientific relevance and achievements in understanding the vertical ozone distribution” by Roeland Van Malderen et al.***

## **Anonymous Referee #3**

Received and published: 4 April 2021

This manuscript provides a detailed overview of the ozonesonde measurements Uccle. This is one of the most important and longest records of profiles measured at a higher frequency (3/week) than nearly all other global ozonesondes sites. The manuscript covers the ozonesonde history, editing techniques applied to past data (homogenization) and includes data analysis of long-term tropospheric and stratospheric ozone. The fully homogenized data is used in the linear regression and well-documented LOUITS models to evaluate trends. Trends are evaluated and com-

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pared to MOZAIC/IAGOS commercial aircraft profiles. An additional interesting topic is the evaluation showing an increase in the frequency of tropopause fold events observed in the ozonesonde record. The manuscript also discusses and documents the changes in manufacturer sonde models used over the long record and operating procedures (changes were minimal making homogenization of long-term data much more straightforward). It also presents an important documentation of the homogenization method used for their long term records. The manuscript presents satellite comparisons/validations with the Uccle ozonesonde database, one of the most critical applications of ozonesonde data. This manuscript is a substantial contribution that shows the importance of 50 years of ozonesonde data records.

Scientific Question: Figures S6 shows an example of a tropopause fold event - a narrow high ozone layer at 600 hPa. I am not all that familiar with tropopause folds but have seen some examples showing massive ozone in broad layers near the tropopause. The RH is very low in the green line (very hard to see the RH scale in light green) which would indicate stratospheric source but wondering if anything else that shows this is a purely stratospheric ozone peak?

Technical Corrections/Suggestions: Line 43: First sentence states ozone is found mainly from surface to top of atmosphere (50km) which is true for all gases. Would be good to separate it out a little more and note that Ozone, O<sub>3</sub>, is a key trace gas in the Earth's atmosphere, where it is present in the troposphere but mainly resides in the lower to middle stratosphere (~90%).

Line 109: I would say something like "funding limitations or reductions" here rather than "financial problems"

Line 151: reduction by 100% may sound like the ozone signal is zero, which can be the case in very high SO<sub>2</sub> that exceeds ozone concentration. It would be more clear to state that – in particular, SO<sub>2</sub> reduces the ECC cell response on a 1:1 basis for every SO<sub>2</sub> molecule.

Line 170: Change “double soundings” to “dual soundings” so it matches with text in Figure 2.

Line 208: Change “From 1990” to “Since 1990”

Line 213: SECTION 4 Note: This section title is “Temporal evolution of vertical ozone concentrations at Uccle” but the section begins with “Total ozone trends from Dobson and Brewer”. Therefore, this section may be better titled as “Temporal evolution of total column and vertical ozone concentrations at Uccle”

Line 227: “. . .on the Uccle total ozone concentrations pops up.” to “. . .shows in the significant dips in Uccle total ozone.”

Line 231: “(e.g. the excess total ozone in 2010, the 2011 and 2016 low ozone anomalies).” to “(e.g. the excess total ozone in 2010, and the low ozone anomalies in 2011 and 2016).”

Line 351: Improve sentence to make clear if proxies were not used: “. . .,as there is no consensus on the used proxies to account for natural variability” which implies that proxies were used or change to “. . ., as there is no consensus in using proxies to account for natural variability.”

Line 368: Need more clarity here: “(since 1995, but the post-2000 trends have the same magnitude)” Is a flat trend (zero slope) meant for same magnitude. Also, wondering if post-2000 trends are shown in one of the graphs.

Line 621: Replace “. . .” is almost entirely compensated by the gain” with “. . .” has nearly fully recovered by the +2%/decade gain between 1997-2019”

Line 645: The most recent update by Stauffer shows the ozonesonde drop-off in TCO ranges from 3-7% was observed at 13 of 53 global stations (25%) 1/4 rather than 1/3.

Line 651: The drop-off was mentioned in line 645 – suggest removing “, as the total column ozone drop-off in a third of the ozonesonde stations (Stauffer et al., 655 2020)

made obvious”

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