Earth Syst. Sci. Data Discuss., referee comment RC1
https://doi.org/10.5194/essd-2021-39-RC1, 2021

Comment on essd-2021-39

Anonymous Referee #1

Referee comment on "Total column ozone measurements by the Dobson spectrophotometer at Belsk (Poland) for the period 1963–2019: homogenization and adjustment to the Brewer spectrophotometer" by Janusz W. Krzyścin et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-39-RC1, 2021

General comments:

The authors present one of the longest series of measurements of the total column of ozone globally. They also discuss the conditions and the procedures which ensure the high quality of the measurements. The scientific value of the presented dataset is high, and the manuscript is within the scope of the journal.

What I mainly miss, is a section wherein the authors would quantify the uncertainties of the final dataset. Uncertainty budget is of exceptional importance for anyone who would use the data. Thus, I strongly recommend that the authors should quantify the overall uncertainty and add the corresponding section.

A few more changes are also necessary prior to the publication of the manuscript. Specific comments are provided below.

Specific comments:

In the data files, or at least in an accompanying description file, please specify whether time is UTC or something else.

L7: please define that #84 is the serial number of the instrument.

L13: please add “which were” before “also performed”

L20: Please explain that #1 and #2 are the serial numbers of the instruments

L22: “TCO” instead of “TOC” like in the rest of the document. At the same line, the authors probably mean that “the number of ozone observations increased sharply” instead of “The ozone observations were triggered”.

L33: Delete “the”

L36: which ground-based network?

L42: Similar results to those reported by Redondas et al. (2014), have been also reported by Fragkos et al., (2015): K. Fragkos, A.F. Bais, D. Balis, C. Meleti & M. E. Koukouli (2015) The Effect of Three Different Absorption Cross-Sections and their Temperature Dependence on Total Ozone Measured by a Mid-Latitude Brewer Spectrophotometer, Atmosphere-Ocean, 53:1, 19-28, DOI: 10.1080/07055900.2013.847816

L47: In addition to Ball et al., the following study should be also cited:

Steinbrecht, W., Froidevaux, L., Fuller, R., Wang, R., Anderson, J., Roth, C., Bourassa, A., Degenstein, D., Damadeo, R., Zawodny, J., Frith, S., McPeters, R., Bhartia, P., Wild, J., Long, C., Davis, S., Rosenlof, K., Sofieva, V., Walker, K., Rahpoe, N., Rozanov, A., Weber, M., Laeng, A., von Clarmann, T., Stiller, G., Kramarova, N., Godin-Beekmann, S., Leblanc, T., Querel, R., Swart, D., Boyd, I., Hocke, K., Kämpfer, N., Maillard Barras, E., Moreira, L., Nedoluha, G., Vigouroux, C., Blumenstock, T., Schneider, M., García, O., Jones, N., Mahieu, E., Smale, D., Kotkamp, M., Robinson, J., Petropavlovskikh, I., Harris, N., Hassler, B., Hubert, D., and Tummon, F.: An update on ozone profile trends for the period 2000 to 2016, Atmos. Chem. Phys., 17, 10675–10690, https://doi.org/10.5194/acp-17-10675-2017, 2017.

L50: Please add references for the Arctic ozone depletion in 2020. For example:

Wohltmann, I., von der Gathen, P., Lehmann, R., Maturilli, M., Deckelmann, H., Manney, G. L., et al. (2020). Nearâ□□complete local reduction of Arctic stratospheric ozone by severe chemical loss in spring 2020. Geophysical Research Letters, 47, e2020GL089547. https://doi.org/10.1029/2020GL089547

Manney, G. L., Livesey, N. J., Santee, M. L., Froidevaux, L., Lambert, A., & Lawrence, Z. D., et al. (2020). Recordâ□□low Arctic stratospheric ozone in 2020: MLS observations of chemical processes and comparisons with previous extreme winters. *Geophysical Research Letters*, 47, e2020GL089063. https://doi.org/10.1029/2020GL089063

Inness, A., Chabrillat, S., Flemming, J., Huijnen, V., Langenrock, B., Nicolas, J., et al. (2020). Exceptionally low Arctic stratospheric ozone in spring 2020 as seen in the CAMS reanalysis. *Journal of Geophysical Research: Atmospheres*, 125, e2020JD033563. https://doi.org/10.1029/2020JD033563

L54: Delete "of the"

L55: Delete "including"

L65: "designed" instead of "deigned"

Figure 2 and lines 90 – 95:

First of all, the authors should explain how equations (1) and (2) were derived. Were all data shown in Figure 2 used to derive these equations?

Secondly, if the data shown in Figure 2 were used, then equation (2) has been calculated using a limited number of data points. Thus, I am not convinced that applying this relationship on future data would provide an accurate correction. Since data points for air mass above 4 are limited, and uncertainties in both the measurements of Dobson and MKII Brewer at such air masses are very large, I would recommend excluding data for air masses larger than 4 from the final, merged dataset.

Line 129: Please define R/N

Section 2.2: Adding a Table summarizing the campaigns (place, reference instrument, etc) would be useful.

L172: Add reference(s) for the Brewer reference instrument. For example: Fioletov, V. E., Kerr, J. B., McElroy, C. T., Wardle, D. I., Savastiouk, V., and Grajnar, T. S. (2005), The Brewer reference triad, Geophys. Res. Lett., 32, L20805, doi:10.1029/2005GL024244.

L180: “This … spectrophotometers”. Please rephrase. The meaning of this sentence is not clear.

Figure 7: Even after the correction for the effective temperature there seems to be a trend in the ratio between the measurements from the two instruments (i.e. differences are ~+1% in 2002 – 2004 and ~-1% in 2018 - 2020). The authors should add some relative discussion (are these differences within the uncertainty of the merged dataset?).

Section 2.3.3: Discussion about the effect of stray light can be also found in:

Moeini, O., Vaziri Zanjani, Z., McElroy, C. T., Tarasick, D. W., Evans, R. D., Petropavlovskikh, I., and Feng, K.-H.: The effect of instrumental stray light on Brewer and Dobson total ozone measurements, Atmos. Meas. Tech., 12, 327–343, https://doi.org/10.5194/amt-12-327-2019, 2019.

In this latter paper the authors show that at very large ozone slant paths (i.e., for very large air masses) the role of stray light becomes exceptionally significant. That makes the measurements of both instruments unreliable. As I did earlier, I recommend again removing measurements for air masses larger than 4 from the analysis, as the uncertainties are already very large, solely due to the effect of stray light.

Ideally, the authors should correct the measurements of both instruments for the effect of stray light, which of course is not a trivial task. Instead, they have scaled the measurements of Dobson to the measurements of the Brewer at large air masses. Assuming that the scaling is perfect, stray light still affects the measurements of the Brewer, and subsequently the ozone series. In any case, the authors should discuss, and try to quantify, the uncertainties related to the stray light effect.