Review of „DLM estimates of long-term Ozone trends from Dobson and Brewer Umkehr profiles" by E. Maillard Barras et al.

The paper focuses on post-2000 ozone profile trend estimates using the Dynamical Linear Modeling (DLM) approach. The method is applied to Umkehr time series obtained from six collocated Dobson and Brewer spectrophotometers based in Arosa/Davos, Switzerland. One of the Dobson instruments (D051) has been homogenized based on two different approaches (the MCH homogenization based on comparisons with the 5 collocated Dobson and Brewer instruments and the NOAA homogenization developed by Petropavlovskikh et al., 2022) before trend estimation. In addition, the DLM approach is applied to the Aura/MLS satellite data record.

The post-2000 trends show similar features (e.g. an increase in ozone in the upper stratosphere) for most altitudes, although with inconsistencies in the level of significance. The authors attribute the differences to remaining inhomogeneities in the ground-based data records. For the lower stratosphere, no clear picture was found.

The paper fits well into the scope of ACP and I recommend publication after having addressed the comments (mostly minor) below.

Specific comments:

P1, L6: I would suggest to mention here the time period which is covered by D051.

P1, L14: What is meant with globally here?

P1, L19: "Moreover, a persistent negative trend is estimated in the middle and lower stratosphere with different…" → In the lower stratosphere the trend obtained from D051 is positive though non significant (Fig. 8a).

P2, L45: Do you mean the sensitivity with respect to the length of the fitting period and with respect to the start/end dates?

P3, L88: Could you please briefly mention, why exactly this specific instrument D051 was selected for homogenization?

P4, Sec.2.1: A table which indicates the periods during which the individual instruments at Arosa/Davos are measuring (and how often per week/month) could be helpful.

P5, L132 When the SZA is <u>increasing</u> from 60° to 90° the intensities should decrease.

P6, Figure 1: What is the difference between these two examples (blue/black curve)? The total ozone column, other atmospheric conditions,…?

P7, Subsection 2.3: I would suggest to remove the entire subsection (see the comment P18, LL386-390 for an explanation).

P8, Section 3: Think about subdividing Section 3 into three subsections (e.g., 3.1 MCH homogenization, 3.2 NOAA homogenization, and 3.3 Comparison of both homogenizations)

P8, L196: Could you provide a reference for this 2008 homogenization?

P8, L211: You state that the black frames in Fig. 2 indicate periods that can be attributed to technical issues, but Table 1 indicates that there was no technical issue in 2010; could you please clarify?

P9, Figure 2: In 2014 the comparison of D051 with the three Brewer instruments indicates a strong positive bias from 0-30km and a strong negative bias from 30-50km. Did you investigate this period in more detail?

P10, Table 1: What is the meaning of "RtoN" table? Last row: what is the start date for the homogenization "before 2018/05/01"?

P11, L261: I would suggest to write "The MCH homogenization approach" instead of "Our approach".

P12, Fig. 4: Is the MCH correction from 1956 to 1988 applied to D051 or to D015? I would suggest to briefly explain/mention the origin of the correction during that early period, because it was not discussed in the text.

P13, L293: A similar feature is seen in 2014; did you investigate this period in more detail?

P13, L298: Please add the panel of Fig. 5 you are referring to here.

P14, L306: The results, that you show, are for an inflection point of 1998.

P15, Fig.6: Please mention in the caption that the black curve belongs to PWLT and the blue to DLM.

P15, L328: Which D051 time series is used here? Uncorrected, MCH homogenized, or NOAA homogenized?

P15, L340: Maybe it is sufficient to define statistical significance (95% confidence level) only once, and then you don't have to mention "at the 95% confidence level" at every single occurrence.

P16, LL348-350: Do you mean here that MLR is more significantly impacted by outliers or boundary values than DLM? Could you provide a reference?

P16, Fig. 7 caption: Please add the info which Dobson Layers are shown. Moreover, I would suggest to add horizontal lines in the plots which delineate the different stratospheric sectors LS, MS, UpS.

P17, Fig. 8 a+b: Do the DLM trend results for D051 (MCH homogenized) and Brewer B040 change when you use the period 2004-2020? Just to make sure that it is consistent with the trend period used for MLS (panel c).

P17, LL366-368: "The lower stratospheric (LS, DL3&4, 14-24 km) trend estimates are non significantly negative before 1996 but significantly negative between 2008 and 2018 for the MCH homogenized data record and non significantly negative for the NOAA homogenized Dobson D051 record." → For DL 3 and DL 4 in Fig. 7a I cannot see the significant negative trend for MCH D051 between 2008 and 2018. Could you please doublecheck?

P17, L374: Please add that MLS trends are shown in panel c.

P18, L382: Please add that trends are significant only in DL6.

P18, LL386-390: The comparison with the trends derived from the Boulder and OHP time series is quite limited. In my view this paragraph could be either entirely deleted (since the main focus of this paper is the Arosa record) or a much more detailed comparison (including a plot showing the trends)

should be provided. However, for the comparison of trends from various locations the latitudinal and longitudinal variability of the altitude dependent trends should be kept in mind (Sofieva et al., 2021).

P18, LL402-403: To which plot do you refer to here? The agreement between the NOAA homogenized D051 and Aura MLS (Fig. 5) is quite good.

Technical issues:

* Check that all acronyms are defined, e.g., P2: M2GMI, MERRA2, SCIAMACHY, OMPS,…

* Sometimes the instrument numbers are written including the "B" or "D" (e.g. D051) and sometimes without that letter. I would suggest to use the notation including the letter consistently throughout the manuscript.

P2, L24: "(MP1, 1987)" → key "MP1" not found in list of references

P2, L29: "discrepencies" → "discrepancies"

P2, L37: "discrepencies" → "discrepancies"

P2, L43: remove blank before comma

P2, L50: "applied it on" → "applied it to"

P3, L56: "satellites data records" → "satellite data records"

P3, L63: "record" -> "records"

P4, L110: remove blank after "D051"

P5, L152: define acronym "Mk"

P6, Fig. 1 caption: "profiles in DU in functions of" → "profiles in DU as a function of"

P6, L153: "wavelenths" → "wavelengths"

P7, L187: remove parenthesis from "Waters et al., 2006"

P8, L204: do you mean "not flagged" here?

P9, Fig. 2 caption: "time serie are" → "time series are"

P11, L258: "homogenization remove" → "homogenization removes"

P11, L272: "both homogenizations differs" → "both homogenizations differ"

P12, L279: "both corrections of the N values looks" → "both corrections of the N values look"

P12, L282: "both homogenization" → "both homogenizations"

P14, L324: "30hPA" → "30hPa"

P16, L362: "informations" → "information"

P17, Fig. 8 caption: "post" → "Post"

P19, L421: “homog” → “homogenized”

P21, L504: “serie” → “series”

P21, L509: DOI missing

P22, L510: add blank after “S.M.”

P22, L537: “Mcclure” → “McClure”

P22, L542: “Deluisi” → “DeLuisi”

P24, L605: journal missing

References:

Sofieva, V. F., Szeląg, M., Tamminen, J., Kyrölä, E., Degenstein, D., Roth, C., Zawada, D., Rozanov, A., Arosio, C., Burrows, J. P., Weber, M., Laeng, A., Stiller, G. P., von Clarmann, T., Froidevaux, L., Livesey, N., van Roozendael, M., and Retscher, C.: Measurement report: regional trends of stratospheric ozone evaluated using the MErged GRIdded Dataset of Ozone Profiles (MEGRIDOP), Atmos. Chem. Phys., 21, 6707–6720, https://doi.org/10.5194/acp-21-6707-2021, 2021.