Comment on acp-2022-680
Anonymous Referee #2

Referee comment on "Indicators of the ozone recovery for selected sites in the Northern Hemisphere mid-latitudes derived from various total column ozone datasets (1980–2020)" by Janusz Krzyścin, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-680-RC2, 2022

Referee comment on „Indicators of the ozone recovery for selected sites in the Northern Hemisphere mid-latitudes derived from various total column ozone datasets (1980-2020)“ by J. Krzyścin.

Overall remark

In this study the author proposes two new ozone recovery indices (ORI1 and ORI2) in order to evaluate the current status of ozone recovery related to changes in the amount of Ozone Depleting Substances (ODSs).

ORIs are computed for 16 stations located in the middle latitudes of the Northern Hemisphere. Four time series based on ground-based (Brewer/Dobson) and satellite (MOD V8.7) measurements and two reanalysis projects (MERRA-2 and MSR-2) are investigated. For each data set two different smoothing approaches are applied to both the original time series and the time series with natural variability removed (using a standard multiple linear regression). The uncertainties of the ORIs are estimated using bootstrapping.

Total ozone values from four key years (1980, 1988, 1997, and 2020) are used to calculate the indices, which are then compared to reference values obtained from the EESC loading.

From this comparison the following conclusions were drawn:
The author found a strong signal of slower ozone recovery for five stations (as expected from the decrease in EESC loading).

- For some stations an ongoing ozone decline was found.
- In general the results are quite consistent among the data records and do not depend on the smoothing approach or using the raw/non-proxy time series. However, in some cases ORIs and their significance can differ.

In my view the new indices provide a useful addition to the standard ozone trend analyses in order to assess the current stage of recovery.

The topic fits well into the scope of ACP and I recommend publication after having addressed my remarks.

**General comments**

The author uses ozone values that were averaged over the warm sub-period of the year (Apr-Sep), which is justified with (i) higher solar elevation (leading to more accurate observations) and (ii) higher UV indices (having detrimental biological effects). However, regarding long-term ozone changes, some seasonal dependence might be expected (see, e.g., Szelag et al., 2020 or Coldewey-Egbers et al., 2022). I think it is necessary to investigate and discuss the uncertainty of the ORIs associated with ozone values averaged over different periods of the year, e.g., annual mean, cold sub-period (Oct-Mar), or seasonal means (DJF, MAM, JJA, SON). I suggest to add a figure indicating this uncertainty.

Sec. 3: What is the impact of the Mt. Pinatubo eruption in 1991 and the extremely low ozone values in the following years on your results? Did you include these years in your analysis? Do all data records provide data during this time or do they have gaps?

Sec. 4: The discussion of Figures 3 and 4 should be expanded a bit. I suggest to elaborate on the apparent difference between the regions (Europe and North America / Japan) and on the agreement/differences between the data records (WOUDC/MOD/MERRA-2/MSR2).

Figs. 3 and 4: It might be helpful for the readers to somehow highlight those stations in the figures, which indicate a significant difference from EESC values.
Technical corrections

P1, L14: "obtained" □ "obtain"

P1, L35: "Earth surface" □ "Earth’s surface"

P1, L37: "Earth environment" □ "Earth’s environment"

P2, L51: "longitude/longitude" □ "latitude/longitude"

P2, L61: "NASA" □ "NOAA"

P3, L94: Please add also "Frith et al., 2014".

P5, Fig.2 caption: Which dataset is shown here? Ground-based? Please add the information in the caption.

P7, L207: "0%e" □ "0%"


References