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Comment on acp-2022-99

Anonymous Referee #2

Referee comment on "Seasonal, interannual and decadal variability of tropospheric ozone in the North Atlantic: comparison of UM-UKCA and remote sensing observations for 2005–2018" by Maria R. Russo et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-99-RC2, 2022

Review of manuscript: **Seasonal, interannual and decal variability of Tropospheric Ozone in the North Atlantic: Comparison of UM-UKCA and remote sensing observations for 2005-2018** by **Russo et al.**

General comment:

This paper evaluates changes in North Atlantic O_3 (2005-2018) using satellite observations and a chemistry-climate model, with a detailed analysis of the drivers of variability in the model and how this differs from observations. The abstract and introduction introduce the importance of the topic very clearly. The methods are well explained, the use of satellite data to derive O_3 column in vertical layers provides a very useful tool for model evaluation. There is thorough and detailed analysis throughout the study. The scope of the manuscript is certainly relevant to this journal.

Specific comments are listed below. I would recommend the manuscript for publication after these minor issues are addressed.

Specific comments:

Abstract: The abstract introduces the intent of the paper, methodology and major findings very well, but would benefit from including quantitative results. e.g. model/observation bias, trend in model O_3 vs observations, variability attributed to lightning NOx/STT.

L103: Briefly expand on why the North Atlantic region is particularly important as well as the citation for more detail.

L131-134: Would benefit from clarifying exactly what the authors consider a "recent" trend. A number of studies, in particular TOAR assessments, have shown statistically significant increasing O_3 trends in the NH and in sites around the North Atlantic since the late 20th century (Gaudel et al., 2018, Tarasick et al. 2018). The authors rightly mention the uncertainties introduced by spatial and temporal inconsistency of these measurements but there is a broad consensus in the literature here.

L302-304: O3 burden compares well to the observed values, but given the large overestimate in tropical TCO, this must be the result of negative bias elsewhere in the model, and therefore not indicative of good model performance relevant to the current study. Supplementary Figure 4f also supports this.

Section 3.1: NOx emissions from soil and biomass burning also contribute to O_3 variability.

Section 4.1: More context from a modelling perspective would be very informative here. How does the UM-UKCA compare to other relatable modelling studies? Is the lack of an O3 trend a consistent problem across CCMs (if so why?) or is it just UM-UKCA?

Technical corrections:

L122: Jet stream?

Figure 3: If the shaded area is of no interest in all 4 panels perhaps remove it from the figure?

Figure 8. No label on y-axis.

Table 2. Unit. % change per year or over whole period?

Figure 9. The black boxes next to the shaded area don’t clearly highlight the area of interest. Changing the colour of boxes/shading could improve this so it’s easier to pick out the important regions.

Supplementary Figure 8. No label on y-axis.

References:

Gaudel, A., et al. 2018. Tropospheric Ozone Assessment Report: Present-day distribution and trends of tropospheric ozone relevant to climate and global atmospheric chemistry model evaluation.Elem Sci Anth, 6(1), p.39. DOI: 10.1525/elementa.291.

Tarasick, D., et al. 2019. Tropospheric Ozone Assessment Report: Tropospheric ozone from 1877 to 2016, observed levels, trends and uncertainties. *Elem Sci Anth*, 7(1), p.39. DOI : 10.1525/elementa.376.