Response to reviews

February 19, 2021

1 Anonymous Referee #1

Overall Remarks

This is a comprehensive and well written paper on the long-term evolution of the Antarctic ozone hole using a number of measures. It is well suited for publication in ACP, and I have only a few minor suggestions.

We thank the reviewer for taking the time to review the paper.

If at all possible, it would be great to also include the 2020 ozone hole, which was rather on the large size again.

We appreciate the reviewers comment but, unfortunately, this won't be possible. The analysis reported on in the paper is based on the BS-filled database that extends from 1979 to 2019. Updating the database by just a single year is a significant amount of work that we are not currently resourced for. There will always be a desire to have 'just one more year added'.

Comments

line 4: "Antarctic" should be "Antarctica", or "the Antarctic"

Thanks for catching that. Now changed to 'Antarctica'.

line 28: replace "has led" by "should lead". Even in 2020, we are still far from "recovered".

Agreed. We have now changed this to 'is expected to lead'.

line 56: delete "a continuous body of"?

Agreed and replaced 'a continuous body of' with 'extant'.

line 91: The correlation between ozone mass deficit and EEASC is the same, no matter how you scale the axes. What you did, is obtain the axis scaling from a linear fit of EEASC to mass deficit. So: delete "selected", replace "maximizes ... between" by "is obtained from fitting", replace "deficit and EEASC" by "deficit to EEASC"

Very good point. Thanks and we have made the suggested changes.

lines 93, 94: Yes, it is really interesting that the data points scatter so much more after 2000, compared to before. Did Southern Hemisphere meteorology become much more variable? Does that have anything to do with the shift of climate patterns / jet streams in the Southern Hemisphere due to climate change and the ozone hole? You might want to add some text and cite a few references (e.g. recent ozone assessments)?

We have now added some text and citations to provide context for the observation of anomalously smaller AVP mean ozone mass deficit after 2000.

Figs. 1, 3, 4, 8: it might be useful to show / mention the correlation of the different time series with EEASC (overall correlation over the entire time series). Is there one measure that correlates best with EEASC? That might

Excellent idea and now done. Ozone hole area below 220 DU has the highest correlation against EEASC. Additional commentary has been added to each of those figures and to the conclusion of the paper to that effect.

Thank you again for the feedback.

2 Anonymous Referee #2

We thank reviewer #2 for taking the time to review the paper.

That is correct.

Whether or not the uncertainty estimates are correlated is more a function of the construction of the underlying TCO database rather than in how the uncertainties are incorporated into the net uncertainty on each metric. In calculating the net uncertainty on each metric we assume that the uncertainties are perfectly correlated in that they are *all* -1σ or *all* +1σ. We do this to create conservative (i.e. worst case) uncertainties. If we assume the uncertainties to be uncorrelated, then the resultant uncertainties on the metrics tend to be unrealistically small.

We have added text to the paper to better explain this choice of methodology.

Thanks for catching that. Now changed to 'Antarctica'.

No, the way we had it was correct, i.e. 'Interannual variability in Antarctic stratospheric dynamics...drives significant interannual variability in the severity of Antarctic ozone depletion. Has we used the word 'manifests' rather than 'manifest', then you would be correct, though we would then needed to have removed the parenthetical commas.

Yes, and we have now clarified that in the text.

Good point and now added.

Sure and fill colour opacity has been reduced from 50% to 35% in all four plots.