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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Indicators of Antarctic ozone depletion: 1979 to 2019" *by* Greg E. Bodeker and Stefanie Kremser

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

Review of "Indicators of Antarctic ozone depletion: 1979 to 2019"
This is an extremely clear, well written manuscript on which I have only a small number of comments. The authors provide a clear update on Antarctic ozone depletion through a variety of established metrics, benefiting from recent advancements in the filling of the total column ozone database. My main comment relates to the handling and production of uncertainties (paragraph beginning L69). In my interpretation, you perturb the TCO field by adding/subtracting the gridded uncertainty values.

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Discussion paper

That is correct.

Let TCO values be x=x1,. . .xn, the corresponding uncertainty be σ=σ1,. . .σn, and α be a function for a metric, for example for a uniform area average α=1/n,. . .1/n n times. Your metric value for the three databases (added uncertainty, unperturbed, subtracted uncertainty) are then $\sum_n^i (x_i + \sigma_i)\alpha_i$, $\sum_n^i x_i\alpha_i$, and $\sum_n^i (x_i - \sigma_i)\alpha_i$. If I have understood correctly, the uncertainty for the metric is found by calculating the difference between the perturbed and unperturbed metric values found in the previous sentence. Therefore, you are estimating uncertainty as $\sum_n^i \sigma_i\alpha_i$. If I have understood the above correctly, I don't see why this uncertainty estimate is an appropriate one as it doesn't consider that gridded uncertainty estimates will be correlated.

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.

I am not aware of other uses of uncertainty estimation like this and given that a lot of figures and results from this manuscript rely on this method of uncertainty estimation I think there should be some explanation or references as to its efficacy.

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

Minor comments: L4: Antarctic → Antarctica

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

L44: I think there should be an ‘and’ between temperatures and drives.

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.

L91: Correlation is unchanged by the Y axes scale choices, so how was the Y axis scale chosen? Presumably to achieve the best fit between EEASC and ozone deficit pre 2000.

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

Fig2: I assumed that the dashed grey lines are the uncertainty of the max area values,but it isn’t mentioned.

Good point and now added.

Fig7: May I suggest that the opacity of the coloured shading be decreased for clarity?

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

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