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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Stratospheric ozone loss in the Arctic winters between 2005 and 2013 derived with ACE-FTS measurements" *by* Debora Griffin et al.

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In this study, Griffin et al. estimate Arctic stratospheric ozone loss from ACE-FTS measurements using a range of different techniques. This is an important study addressing the consistency of ozone loss estimates using different techniques and their inherent assumptions. The paper is well written and merits publication in Atmos. Chem. Phys. after addressing of the following comments.

(I would like to apologize for my late review and have no other excuse than juggling with too many things at the same time.)



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General comments:

1) “artificial tracer”: The argument that mixing does not change the correlation between ozone and the artificial tracer (p4, l4) is only true if the correlation exhibits the same slopes inside and outside the polar vortex. If not, than mixing across the vortex edge can influence the correlation. On p7, l30 it is stated that this method provides a “mixing correction”. This is not immediately clear. As this is a critical point, I suggest to show the correlations inside and outside of the vortex.

2) Uncertainty of passive subtraction with ATLAS (p11, l8): Estimating the uncertainty by comparing ATLAS and ACE-FTS for January will almost certainly underestimate the true uncertainty, as the model was initialized in early January and run only for a relatively short period – uncertainties in model transport will accumulate until March, not captured here. While it is difficult to come up with a better uncertainty estimate, this needs to be at least acknowledged and discussed.

Specific comments and technical corrections:

P3, l13: “Polar Night Jet Oscillation Event”: I suggest either to give more information or drop the reference to the Polar Night Jet Oscillation Event. What is this and why is this relevant?

P4, l13: estimate differences between model and observations: The meaning of this sentence is not fully clear and should be rephrased accordingly.

P4, l20: “. . .and the passive subtraction method using only modelled ozone”: If the meaning here is “. . .and compare this to the modelled chemical ozone loss” better say so.

P7,l11: “high altitudes”: upper stratosphere and mesosphere?

P13, l11: “uncertainty 10-20%”: absolute or 10-20% of the ozone loss?

P13, l13: “that further confirmed the tracer/tracer correlation method to be inaccurate

for estimating Arctic ozone loss": This is a strong statement. Do you really want to say tracer/tracer methods are inaccurate for ozone loss estimates?

P14, l24: does this apply specifically to ACE-FTS retrievals of OCS and CCl3F ? If so it would be good to mention explicitly.

P16, l6: "The results of the artificial tracer technique should be uninfluenced by mixing": Again, it needs to be demonstrated that this is also true for mixing across the vortex edge.

P16, l9: "The passive subtraction methods may smooth out the year-to-year differences and model results in some years may compute some ozone loss even in the absence of ClOx chemistry": Why?? The meaning and basis for this statement is unclear.

P16, l22: "ozone loss has also been estimated using only the SLIMCAT ozone and passive ozone ("SLIMCAT only")": Again, I believe this is better expressed as "modeled ozone loss".

P18, l33: "passive subtraction methods using either ATLAS or SLIMCAT seem to have smaller computed uncertainties": As remarked above, I suspect that for these methods the uncertainties here are systematically underestimated.

P19, l4: "and might smooth out the year-to-year variability": again, any idea why the year-to-year variability may be "smoothed out"?

P19, l11: "For years with little to no ClOx activation the artificial tracer correlation technique might be the most reliable because it considers mixing and seems to compute a reasonably small ozone loss": This statement is problematic for two reasons: (a) one may argue that possible mixing across the vortex edge is better represented by the passive subtraction method that takes into account tracer gradients across the vortex edge at least in first order, and (b) the relatively good agreement between the passive subtraction method and modeled ozone loss ("SLIMCAT only") for this year (2010) indicates that according to our understanding of the processes involved there was potential

for substantial chemical loss.

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