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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A review of the Match technique as applied to AASE-2/EASOE and SOLVE/THESEO 2000" *by* G. A. Morris et al.

S. Tilmes

Simone.Tilmes@t-online.de

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Ozone loss from ozone-trace gas correlations

Ozone loss from ozone-trace gas correlations is not the main focus of this paper; nonetheless some discussion of this issue appears in the introduction. The subject of this comment is the statement in the introduction that *"Plumb et al. (2000) show that even in the absence of chemical processes, conservative trace gas-ozone correlations will evolve due to continuous dynamical mixing processes."*

First, it should be noted that in the model studies discussed by Plumb et al. (2000) it is implicitly assumed that the same tracer-tracer relations hold inside and outside the polar vortex. Müller et al. (2001) have argued that this is *not* the case for the ozone-

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tracer correlation and that this fact has important consequences for the assessment of the impact of mixing across the vortex edge on ozone loss estimates. Namely, mixing-in of outside-vortex air into the polar vortex should lead to an *underestimate* rather than an overestimate (as argued by Plumb et al. (2000)) of the chemical ozone loss.

Second, Plumb et al. (2000) use the results of a *"simple conceptual model"* to discuss the temporal behaviour of a tracer-tracer relationship over the life-time of the polar vortex. These model results indicate that continuous mixing across the vortex edge may drastically alter tracer-tracer relationships across the vortex edge. However, a drastic change of the ozone-tracer relation due to mixing across the vortex edge is in contrast with the measurements of the ILAS instrument in the Arctic winter 1996-97. The temporal development of the O_3/N_2O relation in the ILAS data over January 1997 shows a rather constant relation (Fig. 7, in Tilmes et al., 2003). A change to lower ozone concentrations starts slowly in February and accelerates in late February and early March 1997. Such a behaviour is consistent with chemistry as the cause of the change and not mixing across the vortex edge (Tilmes et al., 2003).

Of course, the tracer-tracer method for determining ozone loss has its disadvantages and advantages as any other method. Nonetheless, the chemical ozone loss deduced using this method for the winters 1991-1992 and 1999/2000 (Tilmes et al., 2004) may be helpful as an independent value to be compared with the ozone loss estimates deduced here by Morris et al.. Note that the tracer-tracer method is independent of any model calculation of trajectories or decent rates.

References

1. R. Müller, U. Schmidt, A. Engel, D.S. McKenna, and M.H. Proffitt (2001) The O_3/N_2O relationship from balloon-borne observations as a measure of Arctic ozone loss in 1991-1992, *Q. J. R. Meteorol. Soc.*, **127**, 1389-1412.

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2. S. Tilmes, R. Müller, J.-U. Grooß, D.S. McKenna, J.M. Russell, and Y. Sasano (2003) Calculation of chemical ozone loss in the Arctic winter 1996-1997 using ozone-tracer correlations: Comparison of Improved Limb Atmospheric Spectrometer (ILAS) and Halogen Occultation Experiment (HALOE) results, *J. Geophys. Res.*, **108**, 4045, doi:10.1029/2002JD002213.

3. S. Tilmes, R. Müller, J.-U. Grooß, and J.M. Russell (2004) Ozone loss and chlorine activation in the Arctic winters 1991–2003 derived with the TRAC method, *Atmos. Chem. Phys. Diss*,4,2167-2238, 2004.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 4665, 2004.