Atmos. Chem. Phys. Discuss., 9, S784–S786, 2009
www.atmos-chem-phys-discuss.net/9/S784/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of CLaMS, KASIMA and ECHAM5/MESSy1 simulations in the lower stratosphere using observations of Odin/SMR and ILAS/ILAS-II" *by* F. Khosrawi et al.

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Received and published: 13 March 2009

As a the co-author of Huck et al., 2006, as the main author of Tilmes et al. 2007,and as the author and co-author of various papers where tracer-tracer correlations were used to derive chemical ozone depletion in the polar vortex, I would like to comment on the comment of the anonymous Referee 1; I do not agree with the general statement: „These studies show that it is difficult to untangle the effects of chemistry and dynamics on the tracer-tracer correlation shape.". The review is not right in making this statement, considering conditions in an isolated polar vortex, as discussed especially in the first two specific comments of the review.

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Tracer-tracer correlations were applied successfully in the past to observations to derive vortex average chemical ozone depletion in an isolated the polar vortex. A comparison of ozone loss derived from ozonesonde observation using the vortex average approach in the Arctic polar vortex, and tracer-tracer correlations shows a good agreement (WMO 2006, Figure 4.13). In general, tracer-tracer correlations were shown to be a reliable tool to calculate chemical ozone depletion in various studies, for the Arctic and Antarctica based on in-situ and satellite observations. Also for Antarctica, Huck et al. (2007), have shown that a tight correlation exists between vortex average column ozone loss and chemical ozone loss deduced from tracer-tracer correlations. Further, a detailed discussion about the influence of mixing across the polar vortex can be found in Mueller et al., (2005) (who provide arguments that chemical ozone loss can only be underestimated and not overestimated by the tracer-tracer correlation method) .

With regard to CCMs, chemical ozone loss derived using tracer correlations was rather underestimated than overestimated (Tilmes et al, 2007). In this study, chemical ozone loss and polar processes were evaluated using the WACCM, the NCAR CCM. The reason for an underestimation of chemical ozone loss is a not sufficiently isolated polar vortex, a different temperature distribution compared to observations, and/or shortcomings in the chemical description in the model. The WACCM model simulation as used in Tilmes et al. (2007), shows a too cold Antarctic vortex core, but warmer temperature in the outer region of the core compared to meteorological analysis. Further, the edge of the polar vortex is not as sharp as derived from met. analyses and the homogeneous vortex core is smaller compared to analysis. Therefore ozone loss is comparable to measurements in the vortex core but underestimated (not overestimated) in the outer part of the vortex.

This is also described in Huck et al. (2007): „Therefore the integrated values represent the total amount of chemically destroyed ozone in the polar vortex. Mixing of air from outside to inside the vortex could potentially result in an underestimation of chemical ozone loss". But better references would be Lemmen et al., JGR, (2006) and Tilmes et

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al, (2007), as cited in the discussion paper. A new study by Tilmes et al, 2009 (JGR, in revision) also shows that the horizontal resolution matters. Using a model simulation with a horizontal resolution of 1.9x2.5 instead the resolution of 4x5 degrees employed by Tilmes et al. (2007), ozone depletion derived using tracer-tracer correlations improved due to the better simulated polar vortex edge.

Mueller, R., S. Tilmes, P. Konopka, J.-U. Grooß, and H.-J. Jost (2005), Impact of mixing and chemical change on ozone-tracer relations in the polar vortex, Atmos. Chem. Phys., 5, 3139-3151.

Tilmes S., Garcia R. R., Kinnison D. E., Gettelman A., Rasch P. J. (2009), Impact of Geo-engineered Aerosols on the Troposphere and Stratosphere, J. Geophys. Res., in revision.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 1977, 2009.