

Interactive comment on “Implications of Lagrangian transport for coupled chemistry-climate simulations” by A. Stenke et al.

Anonymous Referee #4

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General Comments: This paper discusses improvements to transport scheme used in the ECHAM4.L39(DLR)/CHEM (E39C) Chemistry Climate Model (CCM). This work presents for the first time a purely Lagrangian advection scheme for transport of trace species in a CCM. This work is a model evaluation study. The authors document the advection scheme and evaluate the performance of this scheme in the above-mentioned CCM. The simulation evaluated is consistent with a CCMval simulation as discussed in Eyring et al. 2006. The authors do a very nice job of documenting the improvements of the new CCM (E39C-A) relative to the previously published version (E39C). This type of model evaluation paper is not unique in the sense that the comparisons with observations are new, but it is important to document model improvements, especially since this model is used in international ozone assessments. I recommend this paper

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be published in ACPD.

Specific Comments: 1) Figure 1. Just showing EP Fluxes for E39C-A is not very insightful; the authors may want to also show the E39C version or include a figure from Hitchman and Huesmann [2007].

2) Figure 2. Can you say more on why E39C-A underestimates the wave forcing (v ; T). Is this related to insufficient forcing from below (i.e., tropospheric wave activity)?

3) Figures 3 and 4 show a dramatic improvement in the both the H₂O entering the stratosphere [cold point is warmer] and the evolution of the H₂O tape recorder. This latter improvement is related to the modal age-of-air, which brings me to the following question. Why didn't the authors show the age spectrum for both E39C and E39C-A (along with the mean-age and modal age) [Hall et al. 1999]? This type of analysis is very revealing and would compliment Figure 4 (tape recorder); Figure 5 [CH₄ at high polar latitude], and Figure 6 [CIY at high polar latitude].

4) The authors show that the total inorganic chlorine (CIY) is much improved in E39C-A (relative to E39C) and also show that E39C-A CIY is within the error bars of the observations for year 1992 [Figure 6]. However, CH₄ does not seem to agree with the UARS climatology in the SH polar region [Figure 5; E39C-A with UB]. Is this difference expected? Does it have something to do with how both CIY and CH₄ are forced at the upper lid? A statement in the conclusion section discussing the apparent inconsistency should be made.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 18727, 2008.

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