

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

A. Stenke et al.

Received and published: 14 May 2009

We thank reviewer 4 for their comments which helped us to improve the paper. We note detailed replies to the comments below.

1. Figure 1: We have added an additional figure showing the EP fluxes and divergence for E39C. This should allow a better comparison of both model versions.
2. Figure 2: The wave forcing can be quantified in terms of the meridional heat flux at 100 hPa ($\overline{v'T'}$). For the NCEP data the heat flux values range between ≈ 4.5 to 11.5 mK/s. In E39C-A the simulated heat fluxes range between \approx to 10 mK/s, i.e. E39C-A agrees slightly better with NCEP than E39C. One possible reason for the underestimated wave forcing might be the coarse horizontal resolution of T30. Because of the coarse horizontal resolution smaller scale waves are not

S12186

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



represented in both model versions. Furthermore, the stratospheric temperature response to the wave forcing is underestimated in both model versions (i.e. the slope of the linear fits in Figure 2 is flatter than observed). We can only speculate about the reasons for this behaviour. As shown in the model intercomparisons of Austin et al. (2003) and Eyring et al. (2006) many CCMs have problems in their dynamical response to changes in planetary wave forcing, especially in the Southern Hemisphere, and it is not possible to identify any direct link between the model behavior and their resolution. In our case the 10 hPa model top might impact the simulated stratospheric responses to wave forcing, e.g. model deficiencies in the mean zonal wind near the model top might impact wave dissipation. We have added a short comment on this issue to the discussion of Fig. 2.

3. Age of air: As suggested by the reviewer we have calculated the age of air for both model versions and added a figure showing the age spectrum for 25 hPa and two geographical regions. The stratospheric air in E39C-A is older than in E39C. We agree with the reviewer that this additional figure complements the other diagnostics like the atmospheric tape recorder or the Cly profiles very well.
4. We think that the good agreement between E39C-A and the observations wrt Cly in the SH polar region for 1992 should not be overrated. The comparison is based on very limited observational data. In 2004/05 the model clearly underestimates the observations in polar regions, although the model results agree very well with observations for northern mid-latitudes (we have included a new figure showing the Cly time series in mid-lats). Furthermore, in Eyring et al. (2006) there are also some middle atmosphere models which show a good agreement with the Cly measurements in 1992, but overestimate the HALOE CH₄ in the SH polar region. This might suggest inconsistencies in the measurements. With respect to the different boundary conditions at the model top we do not expect a large impact.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

