

Interactive comment on “Stratospheric age of air computed with trajectories based on various 3-D-Var and 4-D-Var data sets” by M. P. Scheele et al.

M. P. Scheele et al.

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Answer to Referee 2, Andreas Stohl

We thank Andreas Stohl for his very useful comments.

Recent studies

We have included references to these in our revised text.

Mass conservation in CTM

The mass conservation indeed also affects the horizontal winds. We have added the sentence:

A CTM needs pre-processing to assure mass conservation. In the pre-processing for TM4 (Meijer et al.), the vertical velocity and the horizontal transport are directly derived

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from the model vorticity and divergence. To achieve mass conservation in time the horizontal transport is corrected.

Physical unbalances in 4D–Var

We added: Bregman et al. (2002) found that the 4D–Var analysis performed better than the 3D-Var in this aspect, but 4-D-Var analysis is not perfect either.

A 4D-Var experiment with a 1x1 grid

We have added a 4D-Var experiment on a 1 x 1 grid. It is added in Fig. 2 and in table 1. The relating text in the revised manuscript is: Decreasing the horizontal resolution from 1x1 to 2.5x2.5 has almost no effect, when applied to the 3D-Var data (Exp. 3 vs. 4). Decreasing the horizontal resolution from 1x1 to 2x3 for the 4D-Var data (Exp. 7 vs. 6) changes the value of F(50) from 16% to 12%, suggesting that some transport by small scale meteorological systems occurs in the 4D-Var data set.

Possible side effects of repeated use of one year

The annual jump will erroneously force cross-tropopause transport to some parcels that are close to the tropopause. To analyze this effect, we made a histogram, showing the per day transport through the tropopause from January 1 till December 31 at the first yearly jump. During the day around this jump the cross-tropopause transport is about three times as large as the running average. As the parcels that are involved are close to the tropopause, they would probably have passed the tropopause within short anyhow. Therefore it does not show in Fig. 3. As this discontinuity happens only once per year, the effect on the mean age is negligible.

Language

We have improved the language.

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