**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Key aspects of stratospheric tracer modeling" *by* B. Bregman et al.

A. Stohl (Referee)

ast@nilu.no

Received and published: 29 June 2006

1   General

This paper compares the results for stratospheric tracers that were obtained using different setups of a tracer model (TM5). Investigated aspects are, for instance, the time resolution of the wind fields, the numerical advection scheme, and the effect of reducing the grid resolution in the polar regions, which is often done in order to ensure compliance with the CLF criterion and, thus, numerical stability. Although the paper is of a rather technical nature, it nevertheless is a valuable and interesting contribution to its field. The technical aspects discussed here are a matter of concern for all researchers

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developing atmospheric tracer models and I believe the paper will find its readership. The paper is generally well written but a few issues need to be addressed, as detailed below. I recommend the paper to be published in ACP after minor revisions.

2   Major points

What I find somewhat irritating is the fact that the age of air comparisons are made for the time resolution experiments, whereas the methane comparisons are made for the experiments on the model numerics. Why don't you discuss exactly the same (and all of them) model experiments for both methane and age of air calculations?

Pg 4379, line 19: The atmosphere does not really "deviate" from geostrophic balance in the tropics. Rather, the Coriolis force is so weak in the tropics that geostrophic balance is uneffective.

Figures: I think Figure 1 is not particularly useful and should be removed. Some of the figures are too small. In Figure 2, for instance, I cannot read anything on the printout.

I think there is an error in the Figure caption of Figure 7: In the figure, the red label says "no red. grid", the blue label says "red. grid", whereas the caption says "with (red dots) and without (blue dots) the reduced polar grid. Please clarify.

Pg 4394, line 9. You say that using interpolated winds (or 3-hourly instead of 6-hourly winds) introduces more variability and this yields reduced mixing. I think that effectively what happens is that you are using LESS VARIABLE winds by using winds with higher time resolution. The winds may be more variable in a Eulerian framework (i.e., at a fixed point) but they may be less variable in a Lagrangian framework (i.e., along a trajectory, the winds would change less), since the particles would follow more closely the real air motion and, thus, fulfil dynamical constraints more accurately. This results from wave motions being better described and, thus, aliasing being reduced. Using coarse time

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resolution leads to significant aliasing, especially for large horizontal resolution.

Regarding the automatic adjustment of computational time step to always fulfil the CFL criterion: What do you do very close to the pole, e.g., in the very last "row" of grid cells? These cells are extremely small, such that possibly exceedingly small time steps would be needed to ensure the CFL criterion to be fulfilled. I guess there is a limit to time step reduction even in your model version?

3   Minor points

Pg 4377, line 8: "wind fluxes or vectors": I guess you mean mass fluxes and wind vectors?

Pg 4387, first paragraph: Where were the vertical profiles taken? Please indicate the locations.

Figure 5 is not referenced after Figure 4, but only later on. Please change the order of the figures, such that they appear in the same order as they are first referenced in the text.

Figure 7: What exactly is shown here and where does the variability come from? Are these zonal averages?

Pg 4390, line 23: You say that differences extend to southwards of 70 degree (and to 60 degree) equivalent latitude, although the reduced grid is used only northward of 70 degree. Well, in one case you are using equivalent, in the other real latitude. Do differences also extend to 60 degree real latitude? I guess there are cases where 60 degree equivalent latitude corresponds to 70 degree real latitude.

Pg 4393, 2nd paragraph: The effect of the data assimilation (and dynamical inconsistencies caused by different assimilation cycles) was recently discussed also by:

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Stohl, A., O. Cooper, and P. James (2004): A cautionary note on the use of meteorological analysis data for quantifying atmospheric mixing. J. Atmos. Sci. 61, 1446-1453.

You are sometimes using both the words "instantaneous" and "constant" to say that you are using non-interpolated winds. Please choose one of them and use the same nomenclature throughout the manuscript. Otherwise, the reader is irritated whether it means the same or something different.

4   Language

Pg 4376, line 15: improve -> improves

Pg 4377, line 19: This results support -> These results support

Pg 4377, line 21: contrasts -> contrast

Pg 4379, line 2: analyses (ERA40) has been performed -> analyses (ERA40) have been produced

Pg 4381, line 24: addressing -> using

Pg 4382, line 4 and at other places: diagnose -> diagnostic

Pg 4382, line 27: by (Segers et al. 2002) -> by Segers et al (2002)

Pg 4383, line 20: criterium -> criterion

Pg 4383, line 26: has not be validated -> has not been validated

Pg 4384, line 2: where a CFL isolation occurs -> where a CFL criterion violation occurs

Pg 4386, line 9: demonstrated in previous model intercomparison -> demonstrated in a previous model intercomparison

Pg 4387, line 21: overestimates -> overestimate

Pg 4388, line 6: then -> than

Pg 4393, line 27: On the course of -> During the course of

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 4375, 2006.

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