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Interactive comment on "Improvement of vertical and residual velocities in pressure or hybrid sigma-pressure coordinates in analysis data in the stratosphere" *by* I. Wohltmann and M. Rex

Anonymous Referee #2

Received and published: 6 November 2007

The calculation of appropriate vertical velocity fields to use in parcel trajectory or full CTM models is a long-standing issue. Some reasonable results have been obtained (in circumstances when the diabatic heating rate is known accurately) by using the diabatic vertical velocity in theta-coordinates. The authors of the present paper propose to use an approach that can be applied to more general vertical coordinates (e.g. pressure or sigma coordinates). Their procedure involves computing the vertical velocity from the thermodynamic equation (requiring an accurate knowledge of diabatic heating Q) and then following estimated Lagrangian trajectories for 24 hours to make an estimate of the (in this case) p-velocity. Results are compared with those obtained from the estimated "conventional" w that is consistent with the continuity equation and the horizontal winds

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(this should be equivalent I think to just using the w values given in the reanalysis fields).

1. The comparison of results obtained with conventional w and the authors' derived vertical velocity are somewhat problematic. The w obtained directly from reanalyses are (at least formally) meant to be instantaneous values, while diabatic heating rates in the model producing the analyses are likely updated only at infrequent intervals - so a diabatically-based vertical velocity is already effectively a time mean. In addition the use of the 24 hour trajectory to calculate the vertical velocity also involves some spatial smoothing. It is not surprising that using the standard (instantaneous, unsmoothed) w fields leads to poor results. It would be useful if the authors could at least comment on these issues, and ideally find some way of estimating how much improvement results from the effective time and space averaging that goes into their determination of the vertical velocity.

2. The authors show results only for trajectory calculations, but in the introduction they refer to the necessity of obtaining appropriate vertical velocity estimates for CTMs as well. Are the authors proposing to use their 24-hour Lagrangian estimates of the vertical velocity in Eulerian CTMs? Or do they propose some way to get back to appropriate Eulerian velocities?

3. On page 13407 the authors assert that "the vertical winds in the left panel would correspond to heating rates of several degrees per day after subtraction of the part of the wind caused by adiabatic movements." How do the authors know this? This should be elaborated.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 13401, 2007.

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