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Interactive comment on "Implementation issues in chemistry and transport models" *by* S. E. Strahan and B. C. Polansky

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Overall I found this paper a little bit too technical with some interesting new aspects which are worthwhile to be published. My main criticism relates to the following points (major revision points):

- lack of the comparison of the model results with in situ aircraft data
  Even if the authors compared their model results with the satellite data (mainly in terms of the PDFs or zonally averaged cross sections derived from HALOE or CLAES), the statements like "a realistic vortex edge" or the "subtropical transport barrier is reproduced" require the comparison with in situ data. The authors say nothing on the filamentary structure of these transport barriers and that the

comparison in terms of the PDFs derived from the coarse satellite observations do not cover these important properties of transport. So the statement (see abstract) that at 2 x 2.5 deg resolution, the CTM produces a vortex capable of isolating perturbed chemistry is probably not valid for a strongly disturbed vortex (e.g. by warmings) or during the vortex breakup when structures smaller than this resolution (filaments) are important for the chemistry Thus, by avoiding of the discussion of the small-scale structures and the of the comparison with high-resolution in-situ data, the authors give the wrong impression that the used CTM resolves all siginficant dynamical details in the lower stratosphere.

- numerical diffusion of the model
  In my opinion, the presented sensitivity studies with respect to the vertical (number of levels) and horizontal resolution mainly change the numerical diffusion of the model (as mentioned on some places in the manuscript). This numerical diffusion, even if the highest vertical or horizontal resolution is applied, is much larger than the physical diffusivity in the lower stratosphere (see Waugh 1997, JGR, Haynes and Anglade, 1997, JAS or Legras et al, 2005, ACP and references therein). So, most of the presented sensitivity studies with respect to the model resolution show the different influence of the numerical diffusivity on transport ! The question that arises for me is what is the best choice, or in other words, what is the necessary horizontal and vertical resolution of a (Eulerian) CTM in order to resolve the "most important" properties of transport. Whereas for the horizontal resolution some new and interesting answers are discussed in the manuscript, I miss this kind of "recommendation" for the vertical resolution (e.g. what is the best choice of the aspect ratio, i.e. of the ratio between the horizontal and vertical resolution ?)

Minor comments:

- the discussion of the GMI CTM is not necessary for understanding of the paper

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(everything "important" is based on the results of FVGCM and of GSFC CTM). So I found the use GMI CTM confusing.

- The subsection 3.1 is a part of introduction. I would recommend to shorten the original introduction and to include 3.1 into introduction
- please explain the terminus "large transients in the vertical velocities"
- in section 4 you explain the differences between the offline and online calculations (which, at first glance, are surprising) first as the result of faster photochemistry (page 10, second sentence) and then as a result of the averaged vertical velocities in the offline run. Here, I would recommend to change the order of the arguments (first dynamics then chemistry arguments)
- section 5.1, page 11, third sentence from the bottom "the levels in Reduced Vert are more closely spaced" sounds for me as a contradiction (here some additional explanation would be desirable)
- in summary, second par
  I recommend to explain the impact of the level spacing on the results in terms of the vertical (numerical) diffusivity that changes with the level spacing
- in summary, page 22, first par
  Normally, if the lid is moved from the mesosphere to the upper stratosphere the upper boundary condition has to be adjusted to the new lid. In some CTMs this is done by climatologies derived from satellite observations like HALOE. Here, an additional sentence on this topic would be desirable.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 10217, 2005.