Atmos. Chem. Phys. Discuss., 5, S4078–S4080, 2005
www.atmos-chem-phys.org/acpd/5/S4078/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #3

Received and published: 22 November 2005

Summary:

The authors identify the main numerical causes for unrealistic transport in GCMs and CTMs, and in a series of experiments with their CTM, go about to identify what the effects of individual perturbations to a "standard" model configuration are with respect to representations of ozone, methane and age of air. While model assessments of this kind are not new (the authors cite some examples), the work can serve as a guideline to model developers, telling them how certain common differences between models affect the results that these models produce. My feeling is that the range of results spanned by the different constellations of the model used here is actually smaller than the range spanned by different models used at a similar resolution. This indicates that

differences other than horizontal and vertical resolution and the height of the model lid also play an important role. Large differences have in the past arisen from different choices of vertical coordinate systems, advection schemes, methods to define vertical motion, to name a few. Ultimately, as the authors do, a reality check is necessary to define which simplifications are permitted.

On the whole, I think that although in parts the text is a little lengthy to read, the findings are interesting, and it is a more systematic treatise of the subject than I have found elsewhere. It therefore deserves publication in ACPD.

Minor comments:

p. 10221: Using GCM output may result in more benign transport characteristics than using analyses (as is most often done). With analyses, there are often problems with unbalanced fields, forced by observations, to which the Lin and Rood scheme may respond by creating spurious vertical motion. Did you try to repeat the analysis detailed here with meteorological analyses (e.g., from ECMWF) as driving fields?

p. 10222: Could you explain a bit more clearly how you define the age tracer? How do you specify its vertical distribution? How can age be "lost through surface deposition"?

p. 10223: It is worth mentioning that the Prather (1986) advection scheme achieves equal diffusivity, compared to other advection schemes used at higher resolution, by retaining and advecting information on higher-order moments. Hence it is not directly comparable to e.g. a semi-Lagrangian scheme. Of course the better performance of Prather (1986) comes at a higher computational cost.

p. 10226: Could you explain in a little more detail how you choose levels for a reduced vertical-resolution simulation? What does "conservation of vertical winds between the original levels" mean? Wouldn't it make more sense to find a way to conserve mass fluxes between the levels?

p. 10233: See above. It is not surprising that Searle et al (1998) achieve a good

ACPD

5, S4078–S4080, 2005

representation of the polar vortex at a lower resolution than other models not using Prather (1986).

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