Geoscientific
Model Development
Discussions

Interactive comment on "Implementation and evaluation of an array of chemical solvers in a global chemical transport model" *by* P. Eller et al.

P. Eller et al.

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1   Responses to Review 3

- I agree with the second referee in main points of critics and recommend also a reorganization of the paper in separate sections for the technical implementation and the scientific evaluation. Especially, the evaluation part has to be clarified. The choice of the selected runs and observed differences in the performance of the solvers should be discussed more in detail.
  Addressed the issues from the second referee, clarified the evaluation section.

- Furthermore, the coupling between chemistry and the other processes have to be described for a better understanding of the whole algorithm as well as for a fair evaluation of the test results. Is the usual operator splitting approach applied

in GEOS-Chem? In this case, the authors should give more information about the choice of the step sizes, the influence of the used splitting sequence and the expected splitting error.

The accuracy results shown in the paper (when comparing several schemes) are for a chemistry-only simulation. GEOS-Chem indeed uses operator splitting. The splitting error depends on the splitting step, and also depends on the nature of individual processes. Estimating the splitting error is a difficult problem; adapting the time steps to control the splitting errors is even more difficult. To the best of our knowledge no large scale atmospheric transport has ever attempted to control splitting errors. Our point in this paper is that all chemical solvers tested deliver chemical solutions that are accurate within 2-3 digits. This paper makes no attempt to quantify the global temporal error of the GEOS-Chem model; the global error would include splitting error together with errors from individual processes. Rather, we make the point that a wide array of chemical solvers can be used to deliver similar accuracy; for the same levels of accuracy some solvers are more effective than others. Because solvers deliver similar accuracy they can be interchanged, without impacting the quality of the overall model solution. Besides computational speed, software engineering aspects can be an important factor in choosing the newer KPP array of solvers.

Interactive comment on Geosci. Model Dev. Discuss., 2, 185, 2009.

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