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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.

Anonymous Referee #1

Received and published: 11 March 2009

Eller et al. present the implementation of KPP numerical solvers into the CTM GEOS-Chem and compare it to the solver previously used in GEOS-Chem. The manuscript is well written, and I suggest to accept it in GMD after some minor modifications described below.

- Model description papers published in GMD should normally contain the model name and version number in the title. I suggest to revise the title accordingly.
- In the introduction, I suggest to mention that GEOS-Chem is a CTM (as opposed to a GCM).
- In the introduction, the authors claim that a finer model resolution leads to in-

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Interactive Discussion

Discussion Paper

creasingly stiff chemical systems. I do not think that this is true. As long as chemistry is calculated separately in each box of the model grid, it does not depend on the model resolution. Instead, it is the addition of more and more chemical reactions in recent models which increases the stiffness.

- On page 188, line 12, change “Kerkweg and Sander” to “Kerkweg et al.”
- If the authors agree to make the code available to the research community, I suggest to put the perl scripts as well as KPP-2.2 into the electronic supplement of this GMD paper.
- In Sect. 3.1, I do not understand how geos2kpp_parser.pl is able to distinguish between fixed and variable species. Is this determined by the letter A or I in the first column of globchem.dat? And why is the initial value apparently repeated four times in globchem.dat?
- In Sect. 3.3, it is shown that shuffle_user2kpp and shuffle_kpp2user map between the species numbering in GEOS-Chem and KPP. However, these subroutines do not map the numbering of chemical reactions. How does this mapping (between globchem.dat and globchem.eqn) work?
- Please define what “O_x” is.
- Please define what a “TES-trajectory” is.
- The calculation of the error ER_k is based on reference solutions obtained with the same solver. Thus, each solver has its own reference solution and the following analysis defines precision, not accuracy. If my understanding of the difference between precision and accuracy is correct, I suggest to change “Significant digits of accuracy (SDA)” to “Significant digits of precision (SDP)”.
- The numbers on the color bar in Fig. 2 overlap.

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Interactive Comment

- As mentioned in the text, Figs. 2a and 2b are visually identical. I agree. Therefore, I don't think it makes sense to show them both. Instead, I suggest to show one of them and then create another plot that shows the (absolute or relative) difference between them.

- Please show in all plots the physical unit. It seems that different units are used in Figs. 2 and 3.

- If I understand Fig. 4 correctly, each solver has been tested with different values of RTOL and ATOL. Can you indicate in the plot, which values were used? Also, why are there only 4 points for Rodas4 but 5 points for all others?

- I did not find the information to what species Fig. 4 refers to. Is it O_x?

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