

## ***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 1**

- 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.  
*The title is modified to contain the model name. The specific version number is mentioned in the introduction.*
- In the introduction, I suggest to mention that GEOS-Chem is a CTM (as opposed to a GCM).  
*The abstract mentions that GEOS-Chem is a global chemical transport model.*
- In the introduction, the authors claim that a finer model resolution leads to in-

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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.

*The line mentioning finer model resolution leads to increasingly stiff chemical systems has been removed.*

- On page 188, line 12, change “Kerkweg and Sander” to “Kerkweg et al.”

*This line has been modified.*

- 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.

*We have included a link to a webpage containing the latest version of the perl scripts: [http://people.cs.vt.edu/~asandu/Software/GC\\_ADJ/GC\\_ADJ.html](http://people.cs.vt.edu/~asandu/Software/GC_ADJ/GC_ADJ.html). KPP is available from: <http://people.cs.vt.edu/~asandu/Software/Kpp>.*

- 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?

*The letter A or I determines if it is fixed or variable. The initial value is repeated four times due to the four columns referring to the vol mix ratio in different locations (stratosphere, urban regions, etc). GEOS-Chem uses same values for all locations at the moment, so the same value is repeated four times.*

- 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?

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*The chemical reactions are mapped from the GEOS-Chem ordering to the KPP ordering using a reshuffling. This is described in section 3.3.*

- Please define what “Ox “ is.  
*Added the definition of Ox (O3 + O1D + O3P).*
- Please define what a “TES-trajectory” is.  
*Updated the paper with a better description of the TES trajectory.*
- The calculation of the error ERk 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)”.  
*Precision and accuracy refer to the same concept. SDA is used in previous papers so we want to keep it for continuity.*
- The numbers on the color bar in Fig. 2 overlap.  
*Created new graph which fixes this problem.*
- 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.  
*Added this graph to the paper in place of the SMVGEARII plot.*
- Please show in all plots the physical unit. It seems that different units are used in Figs. 2 and 3.  
*Updated the comments for these plots to include the unit information.*
- 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?

*Updated the comment for this plot to explain what tolerances were used and why Rodas4 has 4 points.*

- I did not find the information to what species Fig. 4 refers to. Is it Ox?  
*The Ox species is used to calculate the SDA. This is now better explained in section 4.*

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

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