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Geoscientific
Model Development
Discussions

Interactive comment on "Implementation of the chemistry module MECCA (v2.5) in the modal aerosol version of the Community Atmosphere Model component (v3.6.33) of the Community Earth System Model" *by* M. S. Long et al.

Anonymous Referee #2

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This manuscript describes an implementation of a detailed chemistry scheme (MECCA) within a climate model (CAM). Three aspects are discussed: (1) alignment of chemical species between the host model and embedded chemistry scheme; (2) testing performance of three numerical integration methods available within MECCA; (3) balancing the computational load of MECCA within CAM for parallel execution. The work seems to have been performed carefully and is presented clearly. My main concern is that there are insufficient new developments for publication.

Alignment of chemical species between a host model and an embedded chemistry

scheme (that was not designed specifically for the host model) is a task undertaken by many model developers and, in the opinion of this reviewer, does not justify publication.

Three Rosenbrock numerical integration methods (Ros-2, Ros-3 and RODAS3) were tested for computational efficiency and reproducibility of results. These solvers have been tested previously for a range of atmospheric chemistry problems (Sandu et al.,1997; Verwer et al., 1999) finding that all perform capably and that selection of one over another may depend upon the accuracy desired and the stiffness of the chemical problem. The results of this study are consistent with, but do not go beyond, results already published.

Figure 2 of the manuscript shows "the frequency distributions of average integration times (or waiting-time for completion of one chemistry timestep) for all grid cells varied among the solvers tested" and is the most interesting result presented. The distributions for Ros-3 and Ros-2 tail toward long integration times and there is discussion that this tail interferes with the load-balancing scheme and slows down model execution. The authors propose that improved load-balancing schemes could be developed by recognizing characteristics of the distribution of chemistry integration times. Such schemes would be valuable to the modeling community and their inclusion would improve this manuscript and merit publication.

Sandu, A.; Verwer, J.G.; Blom, J.G.; Spee, E.J.; Carmichael, G.R.; Potra, F.A. 1997. Benchmarking stiff ode solvers for atmospheric chemistry problems II: Rosenbrock solvers. Atmospheric Environment, 31:3459-3472. Doi:10.1016/S1352-2310(97)83212-8

Verwer, J.G.; Spee, E.J.; Blom, J.G.; Hundsdorfer, W. 1999. A Second-Order Rosenbrock Method Applied to Photochemical Dispersion Problems. SIAM Journal on Scientific Computing, 20:1456-1480. Doi:10.1137/S1064827597326651

Interactive comment on Geosci. Model Dev. Discuss., 5, 1483, 2012.