Related articles

Volume 6, issue 1 | Copyright

Model description paper | 22 Feb 2013

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

M. S. Long et al.

Received: 18 Apr 2012 – Discussion started: 12 Jun 2012 – Revised: 27 Nov 2012 – Accepted: 08 Jan 2013 – Published: 22 Feb 2013

Abstract. A coupled atmospheric chemistry and climate system model was developed using the modal aerosol version of the National Center for Atmospheric Research Community Atmosphere Model (modal-CAM; v3.6.33) and the Max Planck Institute for Chemistry's Module Efficiently Calculating the Chemistry of the Atmosphere (MECCA; v2.5) to provide enhanced resolution of multiphase processes, particularly those involving inorganic halogens, and associated impacts on atmospheric composition and climate. Three Rosenbrock solvers (Ros-2, Ros-3, RODAS-3) were tested in conjunction with the basic load-balancing options available to modal-CAM (1) to establish an optimal configuration of the implicitly-solved multiphase chemistry module that maximizes both computational speed and repeatability of Ros-2 and RODAS-3 results versus Ros-3, and (2) to identify potential implementation strategies for future versions of this and similar coupled systems. RODAS-3 was faster than Ros-2 and Ros-3 with good reproduction of Ros-3 results, while Ros-2 was both slower and substantially less reproducible relative to Ros-3 results. Modal-CAM with MECCA chemistry was a factor of 15 slower than modal-CAM using standard chemistry. MECCA chemistry integration times demonstrated a systematic frequency distribution for all three solvers, and revealed that the change in run-time performance was due to a change in the frequency distribution of chemical integration times; the peak frequency was similar for all solvers. This suggests that efficient chemistry-focused load-balancing schemes can be developed that rely on the parameters of this frequency distribution.

Download & links

- Article (PDF, 1510 KB)
- Companion paper
- Supplement (168 KB)

How to cite: Long, M. S., Keene, W. C., Easter, R., Sander, R., Kerkweg, A., Erickson, D., Liu, X., and Ghan, S.: 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, Geosci. Model Dev., 6, 255-262, https://doi.org/10.5194/gmd-6-255-2013, 2013.