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8, C1887–C1889, 2015

Interactive Comment

Interactive comment on "CESM/CAM5 improvement and application: comparison and evaluation of updated CB05_GE and MOZART-4 gas-phase mechanisms and associated impacts on global air quality and climate" *by* J. He et al.

Anonymous Referee #1

Received and published: 5 September 2015

Comments: The subject is appropriate to GMD. This manuscript presents results of a comprehensive comparative evaluation using the CAM5-chem within the CESM with two most commonly-used gas-phase chemical mechanisms: CB05_GE and MOZART-4x. The results showed that the two CAM5-chem simulations with CB05_GE and MOZART-4x predict similar chemical profiles for major gases compared to the aircraft measurements, with generally better agreement for NOy profile by CB05_GE than MOZART-4x. They also found that the concentrations of SOA at four sites over continental US (CONUS) and organic carbon (OC) at the IMPROVE sites were well

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predicted by MOZART-4x but moderately underpredicted by CB05_GE. The results showed that the two simulations have similar cloud/radiative predictions, with slightly better performance of domain average cloud condensation nuclei (CCN) by CB05_GE, but slightly better agreement with observed CCN profile over Beijing by MOZART-4x. A lot of model evaluations have been done with tremendous observational data. Therefore I recommend clearly the acceptance for publication of this manuscript after minor revisions. Several editorial comments for improving the information content and presentation of the paper are listed as follows:

1. Abstract: Please use “continental US (CONUS)” instead of “CONUS” in the abstract.

2. P3, L10-15: please add some references for these statements.

3. P4, L12-15: Regarding the possible effects of different chemical mechanisms on the performance of CMAQ, please add discussions about the recent work for the CMAQ (such as Yu, Shaocai, R. Mathur, G. Sarwar, D. Kang, D. Tong, G. Pouliot, and J. Pleim, 2010. Eta-CMAQ air quality forecasts for O3 and related species using three different photochemical mechanisms (CB4, CB05, SAPRC-99): comparisons with measurements during the 2004 ICARTT study, Atmos. Chem. Phys., 10, 3001-3025.)

4. P12, L24-26: Please cite the definitions of MB, NMB, RMSE etc for some references (such as Yu, Shaocai, Brian Eder, Robin Dennis, Shao-hang Chu, Stephen Schwartz, 2006. New unbiased symmetric metrics for evaluation of air quality models. Atmospheric Science Letter, 7, 26-34.).

5. P13, L1: CERES doesn’t provide SWCF and LWCF. Please give more information about how to calculate them.

6. P14-15, L25 (P14)-L1 (P15): The statement “The overpredictions of the NH3 concentrations result in the overpredictions of the NH+4 concentrations at the surface” is not necessary true. Please rewrite it. Regarding the bad performance of NH3 and NO3-, one of the reasons is because of partition of total (NH3+NH4+) (and total

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(HNO3+NO3-)) between gas and aerosol phases as discussed by Yu et al. (Yu, Shaocai, Robin Dennis, Shawn Roselle Athanasios Nenes, John Walker, Brian Eder, Kenneth Schere, Jenise Swall, Wayne Robarge, 2005. An assessment of the ability of 3-D air quality models with current thermodynamic equilibrium models to predict aerosol NO3- Journal of Geophysical Research, 110, D07S13, doi:10.1029/2004JD004718.). Please add this discussion.

7. Regarding Figures 1, 4 and 9: They are too small to be seen clearly. Please enlarge them.

Interactive comment on Geosci. Model Dev. Discuss., 8, 7189, 2015.