

## ***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.***

**J. He et al.**

yzhang9@ncsu.edu

Received and published: 18 November 2015

Reply to Comments from Reviewer #1

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 air-

C2937

craft measurements, with generally better agreement for NO<sub>y</sub> 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 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.

Reply:

We thank the reviewer for the positive comments. We have addressed all the comments, please see below our point-by-point reply.

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.

Reply:

The suggested change has been made in the revised paper.

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

Reply:

A few references have been added in the Introduction section in the revised paper.

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 O<sub>3</sub> and related species using three different

C2938

photochemical mechanisms (CB4, CB05, SAPRC-99): comparisons with measurements during the 2004 ICARTT study, *Atmos. Chem. Phys.*, 10, 3001-3025.)

Reply:

The suggested discussions have been added along with the reference in the Introduction section in the revised paper.

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.).

Reply:

We have added the suggested references for this part in Section 3.3 in the revised paper.

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

Reply:

The observed SWCF and LWCF data are from Clouds and Earth's Radiant Energy Systems (CERES) Energy Balanced and Filled (EBAF). We have included this information in Sections 3.2 and 3.3 in the revised paper.

6. P14-15, L25 (P14)-L1 (P15): The statement "The overpredictions of the NH<sub>3</sub> concentrations result in the overpredictions of the NH<sub>4</sub><sup>+</sup> concentrations at the surface" is not necessary true. Please rewrite it. Regarding the bad performance of NH<sub>3</sub> and NO<sub>3</sub><sup>-</sup>, one of the reasons is because of partition of total (NH<sub>3</sub>+NH<sub>4</sub><sup>+</sup>) (and total (HNO<sub>3</sub>+NO<sub>3</sub><sup>-</sup>)) 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

C2939

air quality models with current thermodynamic equilibrium models to predict aerosol NO<sub>3</sub><sup>-</sup> *Journal of Geophysical Research*, 110, D07S13, doi:10.1029/2004JD004718.). Please add this discussion.

Reply:

We have added additional discussion along with the suggested reference for this part in Section 4.1.1.

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

Reply:

We have enlarged the plots in Figures 1, 4, and 7 (original Figure 9).

---

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

C2940