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**Geoscientific
Model Development
Discussions**

# *Interactive comment on* "Incremental testing of the community multiscale air quality (CMAQ) modeling system version 4.7" *by* K. M. Foley et al.

**Anonymous Referee #2**

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Generally Comments This paper documents the updates made to the most recent released CMAQ model version 4.7 and evaluates the performance of the updated model with a limited set of observation data in the eastern United States. Although most of these updates were discussed in other publications individually, a comprehensive evaluation that includes all these changes was lacking. Thus, in this sense, the results presented in the paper are useful to user of CMAQ and air quality modeling community in general. However, the conclusion of the paper cannot be regarded as general since the West Coast States are not included in the analysis. The improvements of CMAQ v4.7 on the predicted PM concentrations are generally small and might be statistically insignificant.

Specific Comments 1. The paper reported that the modified $\gamma$N2O5 decreases the



bias in the simulated particulate nitrate concentrations in the eastern US in the winter. However, the absolute change in the nitrate concentrations is small due to relatively low nitrate concentrations in the eastern US in general. The evaluation of this new parameterization could have been extended to include West Coast States, such as California, where the nitrate concentrations during wintertime are more substantial.

2. Using the "previous increment" as a label (such as Figure 2) without clearly stating what increment is included leads to confusion. This makes it difficult for readers to replicate the results discussed in the paper. Since most of the users of CMAQ are likely not aware of these incremental changes not documented in this study, why not use the unmodified CMAQ as the basecase consistently throughout the text?

3. The paper claims that seasonal SOA pattern predicted by the updated SOA module in CMAQ 4.7 is "in better agreement than v4.6 with observational estimates of SOA" (line 4, p 1263). This sentence is not supported with statistics or time series. In addition, Figures 2 and 3 are comparing "CMAQ increment B" with "previous increments", which is not CMAQ v4.6, and cannot be used to support the claim. Similarly, "Updates to the SOA module also improve diurnal patterns. . ." (line 7, p 1263) is not well supported. Figure 3 shows a regional difference but it is insufficient to support the conclusion without comparing with observations.

4. Figure 7: Presumably, the reason that authors limit the scales in the difference plots (third column) to 0.75 $\mu$g m-3 is that there are some locations with much larger difference. What are the maximum differences and where are the locations where these maximum differences occur? Why there are significant decreases in the predicted concentrations in the southern part of Louisiana?

5. The in-line photolysis option is useful but it should be used with care. In general, using the in-line option tends to decrease in the surface photolysis rates but could leads to increased photolysis rates in higher elevations. It will be more informative for the authors to show vertical profiles of predicted actinic flux and photolysis rates to better

illustrate the effect of the in-line calculation. Some sort of evaluation of the accuracy of the in-line model in terms of both surface and vertical profile is also necessary.

6. The authors state that CMAQ v4.7 slightly improves the PM results in general. However, most of these differences are on the order of 0.1 $\mu$g m-3. So, are the CMAQ v4.7 model predictions statistically different from the previous version? Compensating errors in other model parameters, such as minimum vertical diffusivities, or meteorology inputs can easily lead to much larger differences and reverse the conclusion in this paper. It is not to say that these changes are not necessary but the authors should be careful in drawing their conclusion regarding whether the improvement in model science really leading to improvement in model predictions. In addition, as mentioned in comment 1, neglecting the West Coast is a significant omission and the results here are at most only apply to the East Coast.

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Interactive comment on Geosci. Model Dev. Discuss., 2, 1245, 2009.