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Discussions

Interactive comment on "Sources, seasonality, and trends of Southeast US aerosol: an integrated analysis of surface, aircraft, and satellite observations with the GEOS-Chem chemical transport model" *by* P. S. Kim et al.

Anonymous Referee #2

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This paper describes the aerosol characteristics as simulated by the GEOS-Chem model during the NASA SEAC4RS field campaign in 2013. The paper presents comparisons of the aerosol measurements acquired by the NASA DC-8 aircraft and compares the GEOS-Chem simulations with these measurements. Overall the paper provides a very good description of the GEOS-Chem simulations and these comparisons. However, there are a couple of major items the authors need to address before publication. I recommend the authors address these items before publication. Major 1. The discussion regarding AOD comparisons is confusing. Looking at Figure 10, it looks like

the model significantly underestimates AOD relative to MODIS. The MISR comparison looks better but the model still seems to underestimate AOD. The discussion seems to indicate that the GEOS-Chem AOD underestimate is consistent with the aerosol extinction estimate but Figure 9 does not seem to show the same underestimate in aerosol extinction as in AOD. What is the underestimate in extinction relative to both HSRL and the CRDS? Also, why not compare the GEOS-Chem model AOD with the AERONET measurements during the diurnal cycle in at least a few locations? If there is some question as to the ability of the model to represent AOD, it would be good to make some more detailed measurements of AOD with AERONET at various times of the day and a few locations. Also, the DC-8 also deployed the 4STAR instrument which measured column AOD at many wavelengths; this may help provide additional data for layer AOD comparisons. 2. There should be more discussion regarding ML heights related to the model. How does the GEOS-Chem derive ML heights? From Richardson number? Aerosol gradients? If the mechanism is different from the lidar measurements, one may expect to see differences depending on location and time of day. Why were the GEOS-Chem heights 30-50% too high before adjustment? What was done to the model to reduce this bias? Does this imply that the model requires external information to constrain the PBL height to satisfactorily estimate PM2.5? How would the GEOS-Chem results been different if these external measurements of PBL height not been available?

Minor 3. Abstract. . .why does the model require a missing oxidant? 4. Abstract. There are statements that say GEOS-chem reproduces observed column aerosol mass with 6%, extinction within 16%, and space-based AOD within 21%. Is GEOS-chem biased higher or lower than these other measurements? 5. Abstract. The abstract needs to mention the performance of GEOS-Chem related to PBL height and this impact on PM2.5. 6. Page 17659, Line 24. Should the Fischer et al., 2014 reference be 2015 instead? I would assume the Fischer reference should use SEAC4RS data. 7. Page 17659, line 29. Note that these are DC-8 flight tracks. It may be appropriate to note that these tracks also extend over other parts of the continental US as well as the Caribbean

Sea. 8. Page 17662, line 19. The Scarino reference is not listed in the references. 9. Page 17662, line 22. The Hair et al. reference does not indicate how the HSRL was used to derive ML heights. 10. Page 17667, line 29. Since the model requires buoyant injection of forest fire smoke, does this mean the model requires external information to determine the height at which the smoke has been injected?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 17651, 2015.

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