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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Gas and aerosol carbon in California: comparison of measurements and model predictions in Pasadena and Bakersfield" *by* K. R. Baker et al.

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The authors present a detailed diagnostic evaluation of CMAQ model predictions for organic carbon during the CalNex study in California. Even after two decades of regional air quality model development, there still remains wide gaps between measurements and model predictions for gas and particle phase organic carbon. The manuscript nicely introduces the field of research and explains well the complexity of modeling organic aerosol. The manuscript is well written and figures and tables are nicely presented. The manuscript also places this work in the context of the state of science very well.

Overall, I wonder what is causing the day-to-day wide variations in carbon isotope at Pasadena. The model is not capturing this variation at all. Is this related to small-scale meteorological features, localized emission sources, grid spacing limitations? Clearly, more work is needed in the laboratory to parameterize SOA yields as a function of a wide range of precursors and aerosol compositions. The manuscript concluses that additional work is needed to characterize the volatility for ambient POA sources upon dilution and parameterize the unaccounted for IVOC (intermediate volatile) emissions.

I would recommend the manuscript for publication with only minor comments, as listed below.

Introduction

Pg 4. Line 15. "Given the direct relationship between precursor VOC and OH radical abundance and SOA formation,...." Can you rephase this statement as it is not clear which species directly relate to which species? SOA formation also depends on other oxidants, particle phase concentration and components, and other met variables such as temperature, relative humidity.

Methods

Pg 6. Line 15. Can the authors give more details on the nesting options used. For CMAQ, are the initial chemistry variables recycled from end of the last run or are they interpolated from the lower resolution parent model? For the high resolution WRF runs, do the initial conditions at each hour recycle from the last run (aerosol and cloud variables) or do they come from the regional WRF parent model and met analysis. Do the CMAQ met boundary conditions for the high resolution run come from the regional WRF model or from the high resolution WRF model. Is a spin-up time used to develop the clouds for the high resolution runs.

Pg 7. Line1. Change "was" to "were".

Pg 7. Line 9. Mobile emissions were generated from CARB. Can the authors expand

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a couple more lines and a reference as to how the mobile emissions were calculated, e.g. MOBILE, MOVES, traffic flow models?

Pg 8. Line 11. What version of SAPRC07 was used...detailed, toxics, condensed?

Pg 9, Line 2. I think fragmentation reactions should also be included as they produce the small carboxylic acids.

Pg 18. Line 4. Are there any ship or aircraft-based CO measurements to help validate upwind boundary conditions?

Reseults and Discussion

Pg 18, Line 5. Are there any results for total VOC reactivity? Stroud et al (2008) perfomred a comparison of total modeled and measured VOC OH reactivity to assess predictions of peroxy radical production rates.

Pg 20. Line 20. Should "exists" be changed to "does not exist" as the sentence states there is vegetation in the San Joaquin Valley.

Pg 21. Line 12. At Pasadena, I would think that SOA formation would be in the high NOx limit, so the SOA formation would be less dependent on HO2 than NOx.

Pg 22. Line 18. The recent study by Stroud et al (2014) also required an increase in unaccounted for SOA precursor emissions (IVOCs and SVOC) to compare to rapid SOA formation observed downwind of a major highway. Their simulations of POA also improved by considering POA evaporation to form reactive SVOC species.

Pg 23, Line 16. Water soluble organic aerosol can be useful to constrain sources.

Figure 1. What are the blue colored species above MGLY and GLY that have the same names? Can you put an explanation in caption?

Table S1a. Is residentual food cooking included in commerical food cooking? I would think they might be of similar magnitude.

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Figure S2. NO3-initiated isoprene oxidation could be a large source of semi-volatile production at night in an urban environment. Can any simple calculations be done based on predicted NO3 and SOA yields?

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