

The Baker et al. manuscript presents a comparison of gaseous and particulate organic carbon measurements and model predictions for the 2010 CalNex campaign. Simulation results from specific time periods and grid cells are analyzed to facilitate comparison with measurements. Overall, the manuscript represents an impressive effort to evaluate the CMAQ model's skill in predicting gaseous and particulate carbon (including primary vs. secondary and modern vs. fossil particulate organic carbon). The paper is technically sound and the results are an important contribution to understanding limitations and uncertainties in predicting particulate organic carbon, particularly the secondary fraction. It is well suited for ACP and is likely to serve as a good reference for other CalNex and CMAQ modeling studies. The presentation quality of the paper could be improved. There are: omissions of important/relevant literature, poorly organized sections, and many grammatical errors. Specific examples follow under the technical and editorial comments.

#### Technical:

The authors do not present sufficient evidence to support the assertion that reasonable predictions of VOCs and OH radical and underpredictions of SOC suggest error in parameterization of semi-volatile gasses. The sensitivity simulation in which the concentrations of lumped oxidation products are increased by a factor of 4 only addresses one of the many possible limitations/uncertainties in the CMAQ model approach. While the sensitivity study is instructive, its importance should not be overstated. A more comprehensive sensitivity analysis of other limitations/uncertainties (likely beyond the scope of this manuscript) would be required to make such a statement. The authors refer to other limitations briefly throughout the manuscript.

I am somewhat surprised that the authors did not further discuss the likely modeling implications of treating POA as non-volatile, particularly when comparing primary and secondary OC fractions. There have been several published studies suggesting that allowing evaporation and subsequent oxidation/partitioning of POA produces modeled primary to secondary OC ratios that are in better agreement with AMS measurements. I think this is a significant oversight/omission given the focus on underprediction of SOC. In the conclusions the authors do suggest this possibility, but it is not satisfactorily addressed in section 2.2.

How do the modeling results compare with those presented by Fast et al. (ACP, 2014), in which aerosol precursors over California were modeled during CalNex using WRF-Chem)?

#### Editorial:

Throughout the paper there are grammatical errors. It is recommended that the authors read carefully for such errors, some examples are noted below. It is suggested that the authors consider introducing the CMAQ model (2.2 Model Background) prior to discussing model application (2.1).

Abstract, line 6: “analysis indicate” should be “indicates” or “analyses”

Abstract, lines 10-12: why is only the SOC/OC fraction in Pasadena noted? The beginning of the sentence suggests that primary OC is underestimated at both sites.

Abstract, line 16: no other plural use of “SOC”

p. 161, lines 6-8: Awkward sentence. “Gas-to-particle condensation of VOC oxidation products” is the same as SOA formation. The link between organic nitrates (1/3 nighttime OA mass) and SOA concentrations greater than POA is not clear. Are the authors saying that because of this nighttime SOA source, total (24-hr average) SOA is greater than POA?

p. 161, line 14: Remove one “Bahreini et al.”

p. 161, line 24: Modeled and predictions not necessary.

p. 161, line 27: Does CMAQ predict SOC or SOA (which is then converted to SOC for comparison with measurements)?

p. 162, line 17: Remove one “global”

p. 163, line 8-9: Not clear what is meant by primary mass associated with carbon (non-carbon organic mass, NCOM)?

p. 163, line 13: Primary?

p. 163-164: Not clear how the SAPRC07 mechanism and aqueous phase chemistry mechanisms are linked (through SAPRC07?)

p. 167, line 20: Missing “study” or “analysis” after sensitivity

p. 168, line 1: Remove one “average”

p. 169, lines 12-17: Sentence starting with “At Bakersfield...” is confusing

p.171, line 22: Recommend removing the sentence starting with “The observed unexplained fraction...”. This is not well supported here. Further in the paragraph a similar statement is made (p. 172, line 8) that is better supported.

p. 172, line 19: Sentence starting with “The model underestimates...” is awkward.

p. 174, line 1: It is not entirely clear whether the authors are suggesting that underprediction of SOC is or isn't due to underprediction of oxidants. It is suggested that the authors consider reorganizing the paragraph. It is unexpected to read that the model overestimates OH radical after it is suggested that SOC could be underestimated due to underestimation of oxidants.

Figure 2: The authors may want to use green symbols for the contemporary carbon fraction so that it is clearer that it is the same as what is shown (just as a fraction)

Figure 4: Can the panels/text be enlarged?