

**Thank you very much for addressing most of the reviewer's comments, the manuscript is greatly improved. After minor revisions regarding previous referee comments, I am happy to accept the manuscript for publication.**

**Referee #3** - Similarly, the abstract is very long-winded and makes it hard to understand the science question that the authors are trying to answer. I recommend revising the abstract to focus more on the big picture impact of this work rather than a list of detailed conclusions.

**Response:** The abstract has been revised based on the referee's comment.

**Review by Editor:** The track-changes file shows hardly any changes to the abstract, please address the reviewer's comment.

**Referee #3** - Line 149: Can you give quantitative descriptions for the reactivity scale?

**Response:** We reported the mathematical description of model parameters including reactivity scales and physicochemical parameters, and mathematical equations for stoichiometric coefficients in the recently published paper by Yu et al (Supporting Information of ACP, 2022). In this manuscript, same reactivity scale has been used, and the physicochemical parameters and mathematical equations for stoichiometric coefficients are extended to biogenic HCs at four major oxidation paths to simulate day and night SOA mass as seen in Sect. S7.

**Review by Editor:** Please provide a reference to Yu et al. around line 149.

**Referee #3** - Section 3.4 and Figure 1: I'm confused by which parts of the model mechanism uses MCM gas phase chemistry and which parts use SAPRC chemistry. Please clarify.

**Response:** Please find the response to comment 7. The model parameters and the predetermined mathematical equations for stoichiometric coefficients for lumping bins were derived by using the product predicted from the semi-explicit mechanisms for the atmospheric oxidation of biogenic HCs. The model parameter and the equations are integrated to the predicted hydrocarbon consumption from any gas mechanisms. In order to support SOA formation in complex ambient air, model parameters and equations for stoichiometric coefficients were integrated with SAPRAC07TC. The hydrocarbon consumption predicted with both semi-explicit mechanisms and SAPRAC07TC well accords with that observed in chamber studies.

**Review by Editor:** I would like to reiterate on referee #3's question. When was MCM used and when was SAPRC used? Please refer to any previously published work here when determination of mathematical equations for stoichiometric coefficients for lumping bins was performed for a previous study and please outline the exact methodology (incl. showing calculation results) when it was newly performed for this study.