

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## Comment on acp-2021-901

Anonymous Referee #2

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Referee comment on "Global simulations of monoterpene-derived peroxy radical fates and the distributions of highly oxygenated organic molecules (HOMs) and accretion products" by Ruochong Xu et al., Atmos. Chem. Phys. Discuss.,  
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### General Comments

In this study, autoxidation reactions and the resulting highly oxidized organic molecules (HOM) and accretion (ROOR) products derived from monoterpene oxidation were incorporated into the GEOS-Chem model, with wet and dry deposition and photolysis being sinks for HOMs and ROOR products. Sensitivity studies were conducted for a range of reaction rate constants and branching ratios taken from recent lab studies to explore the competition between MT-RO<sub>2</sub> isomerization and bimolecular reactions with RO<sub>2</sub>, HO<sub>2</sub>, NO, and NO<sub>3</sub>, and their impact on the fates of monoterpene-derived organic peroxy radicals (MT-RO<sub>2</sub>). Model predictions of MT-RO<sub>2</sub> fates or HOM concentrations are presented for annually averaged global distributions in the planetary boundary layer and vertical and diurnal profiles in the Southeast US and Amazon. When possible, the results are compared to results from field campaigns in an effort to constrain the input values used in the model.

I think this is an interesting and important study, and provides useful insights into the likely role of autoxidation in the atmospheric chemistry of monoterpenes and the potential contribution of HOM and ROOR products to secondary organic aerosol formation. It also points out the sorts of future studies that are needed to improve confidence in the model predictions, a valuable contribution. The work seems technically and scientifically sound, the sensitivity studies explore an appropriate set of conditions, and the discussion of the observed model trends is thorough and reasonable. The manuscript is also well written. I have no Specific Comments and only a few Technical Comments, and so think the manuscript can be published in ACP with only very minor edits.

### Specific Comments

None.

#### Technical Comments

- Line 52–53: I suggest defining SVOC, LVOC, and ELVOC.
- Line 97: "Hydrogen" should be "hydrogen".
- Line 124: Add link.
- Line 162: "Pinene" should be "pinene".
- Line 280: "Ozone" should be "Oxidant".
- Line 288: "contain" should be "containing".
- Line 289: Delete "atom".
- Line 442: "concentrations" should be "concentration".
- Lines 648–652: Something missing in the sentence. Perhaps Line 651 should read "...predicted by the model indicate a comprehensive...".