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Comment on acp-2021-340

Anonymous Referee #2

Referee comment on "Atmospheric photooxidation and ozonolysis of Δ^3-carene and 3-caronaldehyde: rate constants and product yields" by Luisa Hantschke et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-340-RC2, 2021

The manuscript describes results from chamber experiments to study the atmospheric fate of an important biogenic VOC, namely D-3-carene and one of its oxidation products, 3-caronaldehyde. The methods described appear to be robust, the results well supported by the data and the manuscript is commendably well-written and concise. My main concerns are around the presentation and descriptions (captions and legends) of some of the plots. I strongly recommend publication in ACP once these fairly minor issues are resolved.

Fig 2 is missing legend information (what does the black line in the lower plot represent?) and potentially a dataset if we were really meant to see both O3 and CO time profiles.

On Fig 3, whilst a good match of experimental data to a yield of 0.65 is clear, the sensitivity of the system to this parameter is less clear. Could additional dashed lines be used to indicate yields of, for example 0.25, 0.45, 0.85 to illustrate just how sensitive was the experiment?

Fig 4 needs an improved caption. If I am interpreting it correctly, it need to state clearly that this plot was used to determine caronaldehyde yields from both (R1) and (R2).

I am a little confused by what is meant by "RO2" in Fig 5. Does this refer to the peroxyl radical derived from carene + OH + O2? If so, would the yields of both caronaldehyde and HO2 really be unity from the RO2 + RO2 channel? Could these yields be between 1 and 2? If "RO2" is meant to represent other peroxyl radicals present in the chamber then the caption does not make sense when referring to additional pathways.

One further point for clarification is regarding the rate coefficient determination for OH + D-3-carene, of k = (8.0 +/- 0.5) cm^3 s^{-1}. I understand that a complex model was used to

fit to experimentally determined decays of D-3-carene and presumably to time profiles of other species. The resulting value is reported as the mean from several runs, each reporting an "optimised value". Do the uncertainties quoted (the +/- 0.5) account for simply variability from one run to another (i.e. 0.5 is the standard error of the mean), or is there some extra uncertainty resulting from the optimisation process?

Minor points:

- Starting with abstract but also throughout - there should be space characters between units "cm3s-1" -> "cm3 s-1". Else it is easy to confuse units like m s-1 (metres per second) with ms-1 (permillisecond)
- Very minor point, but where % values are used there should be no space character, so "5 %" -> "5%" as % is part of the number itself, not a unit.
- There looks to me like a typo in the fourth Atkinson reference in the bibliography "O-x"