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Reply on RC2

Zhaofeng Tan et al.

Author comment on "Atmospheric photo-oxidation of myrcene: OH reaction rate constant, gas-phase oxidation products and radical budgets" by Zhaofeng Tan et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-556-AC2, 2021

We thank the reviewer for his/her comments, which helped to improve the manuscript. Please find below our answers.

Comment: Page 6, line 170: While it does appear that a calibration error may be responsible for the discrepancy between the LIF and DOAS measurements of OH on 22 August given that the LIF and DOAS measurements agree during the 2013 measurements, the authors should comment on whether an unknown interference similar to that observed by Fuchs et al. (AMT, 9, 1431–1447, 2016) might be responsible for the discrepancy.

Answer: We added discussion in the end of the paragraph: "Interference could occur in OH measurements by the LIF instrument from alkene ozonolysis at exceptionally high concentrations of reactants (Fuchs et al., 2016). However, the ozone and myrcene concentrations used in this study were much lower compared to concentrations used in the characterization experiments in Fuchs et al. (2016). Therefore, it is not expected that similar interferences were significant for measurements in these experiments. Thus, the observed differences in the OH measurements of the LIF and DOAS instruments were most likely caused by calibration errors."

Comment: Page 14, lines 399 and 401: The authors should clarify the "?" reference referred to in this section.

Answer: Corrected.

Comment: Page 16, line 496 and Figure 10: The authors should clarify the adjustments made to the MyO2+HO2 reaction to bring the radical loss into balance with production with the actual factor used to (between 0.4 and 0.7) in the text and in the caption to Fig. 10, perhaps also including the uncorrected loss rates for comparison.

Answer: We revised the sentence: "The reaction rate constant of 2.1×10^{-11} cm^3s^{-1} suggested by Jenkin et al. (2019) would need to be reduced between a factor of 0.4 and 0.7 (0.9 to 1.6×10^{-11} cm^3s^{-1} (T = 298 K, Table 3) or the yield of radical products would need to be in the range of 0.3 and 0.6 to match the range of radical production.”

Figures 10 was updated to show the impact of the change in the reaction rate constant of the HO_2+MyO_2 reaction on the ROx destruction rate.

We revised the caption: “ROx primary production, P , (upper panels), termination L (middle panels) rates and their difference (lower panels). The rate constant of the reaction of MyO2 with HO2 was adjusted, to minimize the difference between radical production and destruction (see text for more explanation). The HO2 +RO2 (SAR) shows the additional radical loss if the unadjusted reaction rate constant is applied. In the bottom row, the lines show the difference between radical destruction and production (L − P) with adjusted rate constant of the reaction of MyO2 with HO2. Grey areas in the lower panels give the uncertainty of L − P .”

Comment: Pages 17-18, lines 528-530: The authors provide a sensitivity study to show the impact of additional MyO2 isomerization reactions on the production and loss of RO2 radicals in Figs. 11 and 12, producing one HOx radical for each isomerization reaction (line 529). How does the addition HOx production impact the OH and HO2 radical budgets in Figs.11 and 12? Does it improve the radical balance or make it worse?

Answer: We added in Line 529 to discuss the potential impact on the OH and HO_2 radical budget: “Because the yield of OH and HO_2 from potential isomerization and decomposition reactions of MyO_2 is not known, an upper limit of one OH and one HO_2 radical for each isomerization reaction is applied.” In Line 534 we added: “Similar as for the RO_2 loss rate, potential production of OH and HO_2 from MyO_2 isomerization reactions would overcompensate the imbalances in their production and destruction rates.”

Figures 11 and 12 are updated to show the maximum impact of OH and HO_2 production from isomerization reactions of MyO_2.

The captions are extended: “Upper limits for yields of OH and HO_2 radicals from MyO_2 isomerization reactions of one are assumed in the calculations of their production rates.”