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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Oxidation processes in the Eastern Mediterranean atmosphere: Evidence from the Modelling of HO_x Measurements over Cyprus" *by* Chinmay Mallik et al.

Anonymous Referee #1

Received and published: 12 March 2018

General comments:

This manuscript describes the analysis of a measurement campaign in Cyprus with an emphasis on understanding the OH and HO2 measurements there. The measurement suite seems to be fairly complete and the model is well documented. The analysis is fairly thorough, the conclusions are justified, and the citations are appropriate. The manuscript meets ACP standards. I recommend that it be published with (very) minor revisions.

Before the authors get too concerned about 17% differences between the measured and modeled HO2, they need to assess what the model uncertainty is. I suspect that

it is about (15-30)% at the 1σ confidence level. When that uncertainty is combined with the measurement uncertainty, why do the authors think that this 17% difference is significant?

That being said, I commend the authors for their approach to searching for a cause of this difference, whether it is meaningful or not. Examining the trend in deviation between the measured and modeled HO2 with terpene concentration is a good approach to looking for possible causes.

Specific comments: Abstract, Line 25. "The model simulations for OH showed very good agreement with in-situ OH observations. Model simulations for HO2 also agreed fairly well with in-situ observations except when pinene levels exceeded 80 pptv." Please be more quantitative, such as agree to within uncertainties of . . . Section 2.2, page 6, line 39. By heating the water source to 80C, I am surprised that you do not get condensation in the downstream lines, which are probably at 25-35C.

Section 3.2. I would like to know what motivated the authors to want to see if simple chemistry with no NMHCs would replicate their measurements, since they and others have often shown that it cannot in environments where NMHCs are present.

Section 3.4. What would happen if the authors greatly increased the reaction rates of RO2 – R'O2 reactions to close to gas kinetic? Would it have the same effect as lowering the RO2+HO2 rate coefficient or the auto-oxidation rate?

Figure 8. In the second panel, is the secondary production really a few times 10-12 molecules cm-3 s-1? Is there a typo?

Page 17, line 31. You define the recycling efficiency as "the ratio of OH produced from secondary sources via reactions of HO2 with NO and O3 (R6-R7) to the OH produced from primary and secondary sources." But then you talk about recycling efficiencies in percent. Please use either the ratio or define the percentages. How is the recycling efficiency related to the more familiar chain length?

Technical corrections:

Abstract, line 25, and other places. In situ is Latin and therefore should not be hyphenated and should in italics.

Introduction, lines 5-10. You identify OH by its name, followed by its chemical formula, but do not do this for CO, CO2, NOx, SO2, HNO3, and H2SO4. I think you should be consistent and name all chemical species when you first introduce them.

Introduction, line 18. "its" refers to the subject of the main clause, which is "lifetime". You meant "its" to refer to "OH". I suggest rewriting as "Because OH reacts rapidly with . . .., its lifetime . . ."

Introduction, line 11. "upto" should be "up to".

Section 1.2, line 14. "Photochemical" should now be one word with no hyphen.

Section 1.2, line 18. ". . . still substantial having significant . . ."? Chose one or the other.

Section 2.1, page 5, line 1 (and other places). Directions such as "northwest" are one word and not hyphenated.

Page 9, line 17. "day to day" should be hyphenated when used as an adjective.

Page 10, line 5. The authors are pretty careful to distinguish between measured OH reactivity and calculated OH reactivity, and should do so on this line as well.

Page 10, line 11. "Suburban" is not hyphenated.

Page 11, line 42. Should be ". . ., which are sinks . . .".

Page 16, line 22. Should be "While, on average, the . . ."

Page 17, line 25. Would be better to use words: ". . . NO mostly less than 100 pptv. . .".

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