Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-788-RC3, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Parameterized reactivity of hydroxy radical, ozone, nitrate radical and atmospheric oxidation capacity during summer at a suburban site between Beijing and Tianjin" *by* Yuan Yang et al.

Anonymous Referee #1

Received and published: 11 January 2020

The manuscript Parameterized reactivity of hydroxy radical, ozone, nitrate radical and atmospheric oxidation capacity during summer at a suburban site between Beijing and Tianjin by Yang et al. describes atmospheric reactivities towards OH, ozone and nitrate of several trace gases and their oxidation capacities from measurements of trace gases conducted during one-month of field campaign in Xiang he during summer 2018. The authors use an extensive dataset of concentrations of trace gases, including O3, NOx, NOy, SO2, CO and VOCs, with meteorological parameters and photolysis frequencies for calculating OH, O3 and NO3 reactivities as well as their atmospheric

oxidation capacities and describe the current air chemistry over the region during summertime when photochemistry is enhanced. I find the manuscript interesting in the way it addresses the air chemistry regime over a sensitive highly polluted region and suggests how to implement current environmental policies for improving the quality of air. I would have found the manuscript more accurate if OH/NO3 reactivities could be measured along with the trace gases during the campaign. Calculated reactivities need the associated uncertainty (from the measurements and from the reactions constants). Additionally, the parametrization used to determine the oxidation capacity needs better description and the associated uncertainty. Nevertheless, I find the manuscript suitable for the journal ACP and I recommend its publication after some changes will be considered.

General comment:

I suggest to include a short comment in the discussion of the results considering the missing reactivity fractions reported in highly polluted urban/suburban environments and studies in China, where available. This could possibly lead to different (more pessimistic or optimistic) scenarios than the one reported in the present study that is worth knowing to the reader. The manuscript is sometimes not very fluent either for the intensive use of acronyms or language phrasing, making the reading at times a bit complicated. I suggested some rephrasing but you might want to improve the fluency by making some concepts more concise and use a simplified nomenclature. I also suggest to revise the length of the abstract, of keywords used, number of figures and some parts of the discussion. You might also want to reconsider the title for a shorter one (for example, something like: parameterized atmospheric reactivity and oxidation capacity during summer . . .).

Specific comments:

p. 2 L 26 "that result" p. 2 L 27 "the air chemistry" instead of self-cleansing capacity p. 2 L 30 which network? Specify. Avoid references in the abstract as the personal

communication. p.2 L 35 use 48-99% p.2 L 36-40 try rephrasing with less acronyms p.2 L 40-43 give less details as the calculation is not yet explained p.2 L 43-47 Leave out this information p.3 L 47-49 Keep this information p.3 L 49-51 For conclusions p.3 L 52 suggested keywords: VOCs, atmospheric oxidants reactivity, atmospheric oxidizing capacity, North China Plain p.4 L 70 give an estimate p.4 L 72 remove a major part p.4 L 72 by reactions with atmospheric oxidants p.4 L 80 comparative reactivity method cit. Sinha et al., 2008 p.5 L 93 you can add the study of Helsinki (Praplan et al.) and of Seoul (Kim et al.) p.5 L 100 you can add the study done in the PO valley (Kaiser et al., 2015) and in India (Kumar et al., 2018) p.5 L 101 the range will change with the measurements done in India p.5 L 106 metric instead of matric, check also other parts of the manuscript p.6 L 112 You can cite the study of Mogensen et al. p.6 L 114 "as reported.." p.6 L 114 contribution from NOx p.6 L 117 Does this comparison point at the use of different fuels/vehicles used? p.6 L 123 due to NO3 elevated concentrations at night p.7 L 141 of the reactions for some alkenes. . . p.7 L 146 BERLIOZ and NOTOMO/ before write the type of environment and where then you can add in brackets the name of the campaign. p.7 L 151-152 remove sentence p.8 L 156 In this study, we calculated the OH, O3 and NO3 reactivities from VOCs measurements . . . p.8 L 158 we calculated the oxidation capacities of xx xx xx and estimated their relative contributions. p.8 L 175 detection limit instead of lowest detection limit, please modify also where else is mentioned. p.9 L 190 Please refer to Wang et al., (2014b) for more details about the techniques used. p.9 L 193 remove samples p.9 L 193 Is the GC system having 2 columns or columns were exchanged on different campaign periods? Please specify p.9 L 193 How was the sampling conducted? Which type of inlet was used? Was there any O3 scrubber used to measure alkenes? In general, are the VOC measurements and atmospheric events from this campaign described elsewhere? p.12 L 243 Please specify how close the sensors were to the measurement area. p.12 L 247 The nomenclature of radical reactivity where O3 is considered is incorrect. Please change this word where used in the text with "atmospheric oxidants reactivity" or something similar that can commonly include OH, NO3 and O3. p.12 L 248-253 Needs rephrasing. You

can express the same concept with one sentence, for example: atmospheric oxidants reactivity is a measure of the strength of reaction of trace gases to the three main atmospheric oxidants. . . You can cite the first studies that introduced this concept (check for Brune et al., or Kovacs and Brune) and remove the references not needed here. p.12 L 247&274 You can include a table with all rate coefficients used and respective references for these 2 sections p.16 L 331 Define OVOC p.16 L 335 I suggest to avoid the use of many acronyms when is not extremely needed, TVOC can be written as total VOC. There are many acronyms in the manuscript and the reader is sometimes lost. p.16 L 348 for secondary species p.16 L 351-352 remove lines p.23 L 503-505 You can shorten the discussion by removing from which are 3 etc.. p.25 L 543-555 Please make the concept more concise and present it in the methods part p.26 L 569 This is an interesting section. Can you implement the discussion by indicating the sources of the VOCs whose concentration could be limited and make some concrete examples for the region under study? p.30 L 644 what do you mean exactly by integral of the oxidation rate? This concept needs to be clarified. Can you (briefly) illustrate the 2 type of concepts of the oxidation rate results in the method section? Same for what you are illustrating in figures 10 &13. Also it is confusing using both approaches, you might want to make a table with the results from the 2 approaches and discuss the differences rather than discuss the two of them separately, it will make the discussion part also more clear. p.31 L 682-683 is overestimated Figures Fig 2. Move the legends of the panels out of the graphs. Add minor ticks on the left /right axes Fig. 3 where is NO2 in the right panel? Fig. 5 include a table clarifying which are the BVOC considered and OVOC considered Fig.10 Unsaturated VOC: there should be a larger contribution during daytime given by O3, why this is not the case? 13 figures are many. You might want to simplify the manuscript keeping only the most relevant ones in the main body and leave the others to the supplementary information (I suggest to keep 1, 2, 3, 4, (5 could be presented as a table instead of graphically), 6 or 7, 8& 9) Table 1& Table S1. Please readapt these tables to a table/ tables where: concentration, SD, reactivities, reaction coeffs, and refs are included. If the table is too big you can split it in two tables

(concentration, SD, reactivities) and reaction coefficients and references. The chemicals should be grouped according to the nomenclature used in the manuscript (BVOC, OVOC. . .etc) Supplementary material: Please include some explanations between the figures.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-788, 2019.