General comments:

This manuscript describes OH and HO2 measurements in Shenzhen during Autumn 2018 and the skills of a photochemical box model to reproduce the observed radical levels when constrained with simultaneous observations of key reactants, to test the atmospheric photochemistry theory. The results showed that the model underestimated OH levels while it reproduced HO2 levels well. Missing recycling from HO2 to OH by species X was suggested, while the required levels of X were not very high (0.1 ppb). The atmospheric oxidation capacity was calculated on the observation basis and compared with the O3 formation rate. The results, though not including OH reactivity measurements, are worth to be added to those from numbers of previous field studies, for future diagnostics of missing processes in the model. Though the number of field studies in China has been increasing, the chemical conditions are very different among the studies and more field evidence is necessary. However, for this purpose, clarification is necessary at several points. First, uncertainty analysis needs to be provided for both observations and model simulations, particularly when the authors claim introduction of X to explain the model’s underestimation of the OH levels. Second, the authors cited values or results from previous studies for comparison but in-depth analysis/discussion across the studies were not provided in search for missing processes. The authors should specify the important characteristics of the conditions studied during this campaign and what is enabled with the observational results. Third, I am afraid that the major OH term of the atmospheric oxidation capacity is not very innovative; it is just the OH reactivity multiplied to the OH concentrations, i.e., OH loss rate, and thus it is very natural that it correlates with F(O3), i.e., the HO2/RO2 + NO rate, when the OH loss produces RO2/HO2 and the peroxy radicals undergo reactions with NO. Overall, I would suggest major revisions regarding the points above and the following specific comments.

Specific comments:
- Page 1, Line 26. Definition of the atmospheric oxidation capacity should be briefly mentioned in Abstract.
- Page 1, Line 26. x -> times character
- Page 2, Line 56. What are the important chemical conditions for this STORM campaign, in terms of differences from previous studies done in PRD, for example, city center/rural, NOx/BVOC levels, seasons etc.? From the inset map of Figure 1, I was not able to see if the site was in the city or in a rural region.
- Page 3, line 68. The coordinate should be 22.60 deg N and 113.97 deg E? (decimal points)
- Page 4, lines 89-96. Any literature to which the readers refer for further information of the specific FAGE instrument? Also, the uncertainty in OH and HO2 measurements should be quantified.
- Page 4, line 107. Did the author mean latest isoprene chemistry?
- Page 4, line 110. What are the "long-lived" species? Readers may think CO2 or CH4 as long-lived, which are not surely supposed in this context. I believe they are the modeled carbonyls/peroxides etc. But did they reach steady state within 2 days of integration? Did the authors assume a fast turnover time constant (dilution constant) for them? If so, any justification of the assumption?
- Page 8, Line 181. More discussion is preferred; what are the similarities and what are the differences to/from the previous studies in PRD?
- Page 8, Figure 3c and d. The fraction of the modeled OVOCs is fairly large. More explanation is needed what these species are and how their concentrations are justified.
- Page 8, line 188. Were the aerosol surface concentrations measured? Can the authors discuss maximum possible uptake coefficient from the surface concentrations?
- Page 8, line 193. It is worth mentioning where the study (Stevens et al. 1997) took place and add more information.
- Page 8, lines 193-194. I did not understand what the authors meant with the sentence "The comparison of the measured HO2/OH ratio...".
- Page 10, line 232. The unknown OH source NEEDS TO explain
- Page 10, lines 251-252. Species other than NO played a significant role to explain the model's OH underestimation
- Page 13, Line 301, Table 1. AOC includes all combination of pollutants i and oxidant j (j= OH, O3, NO3)? As the equation (1) does not include j, this in unclear.
- Page 14, Figure 7c. Why different units are used for the AOC and F(O3)? They can be both in ppb h-1 for example and should have close values.
- Page 14, Line 322. Why a fixed value (9x10^-12) is used for the rate constants of the RO2 + NO reactions? They should be variable in RACM depending of R and therefore these values should be used.
- Page 15, lines 351-352. Rewording is necessary.
- Page 16, line 362. What are the gradients here?
- Page 16, line 363. makes the quantification of F(O3) achieved – rewording is necessary.