

***Interactive comment on* “Formation of Nighttime Sulfuric Acid from the Ozonolysis of Alkenes in Beijing” by Yishuo Guo et al.**

Anonymous Referee #1

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This paper shows that, within the suite of measurements they present, the nighttime formation of SA is consistent with a simplified chemistry driven by alkene, ozone, and SO₂. Yet correlation does not constitute proof. Furthermore the procedures and details of the methodology (which may be correct) are either only sketched-out or are hard to follow (thus this reader did not have full confidence in the material.) Furthermore, the authors supply caveats (more than one time and even in the abstract!) that their analysis could be subject to revision/flawed. Providing a detailed, time-dependent simulation (even a box model) would bring their conclusion into the firmly believable realm. Below are some details and other points. Note the revisions are too strongly suggested as ‘major’: they are by no means damning and they should not be difficult to include or address. \

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1) Somewhat careless with precision, quoting a four significant figure k_{app} from a slope that has at most two significant figures. A minor detail of course, but attention to detail should be demonstrated in all aspects. A welcome detail here would be to present the uncertainties in the values of the fitted slopes. \

2) Overall sink was equated to the alkene O₃ SO₂ source but steady-state assumption was not fully discussed (not even sure what time period the data is averaged over?). Furthermore SO₃ to SA was not discussed. OH produced in alkene + O₃ reactions was not included: why not? A simple box model could include these and others such as HO₂ + NO for example. Then presenting box model simulations absent the alkene-ozone chemistry might really draw a distinct comparison. \

3) Is not sub-3 nm really sub-2.45 nm? \

4) The last figure purports to correlate sub-3 nm to measured SA and there is a linear relationship provided. Two problems: large error bars (what do they mean?) and there is a source of particles at zero SA (or zero alkene+ozone). The correlation may be due to the fact that the ordinate and abscissa are both dependent on the alkene-O₃ chemistry yet sub-3 nm particles at 'zero' chemistry destroys the happiness of the association between ordinate and abscissa. Another issue is the lack of discussion regarding any proposed theoretical relationship between SA and number of particles. \

5) The outliers are numerous in many of the plots in Fig. 2. How were they decided upon? In this vein it is not clear what data was included for each of the points in Fig. 4 for example. All data between 10pm and 4am?

6) "SIZE = CS*xyz" was included in many of the plots but a reference size was not easy to find.

7) " calibration coefficient " has no meaning by itself. Needs some context (an equation) and perhaps some comparisons. It can be argued that this quantity should have units

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of Hz Hz-1 attached to it also.

8) Why have PM2.5, visibility and CS all plotted in Fig. 2? Figure 2 would be cleaner if you pick one and plot the correlation between it and the others in the supplement....

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