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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simultaneous measurements of new particle formation in 1-second time resolution at a street site and a rooftop site" *by* Yujiao Zhu et al.

Anonymous Referee #4

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Review of "Simultaneous measurements of new particle formation in 1-second time resolution at a street site and a rooftop site" by Zhu et al. (acp-2016-1143)

This manuscript presents a field measurement of new particle formation (NPF) events in urban Beijing, China. The deployment of Fast Mobility Particle Sizers (FMPs) is unique and could deliver new insights into NPF, if interpreted properly. Overall, this manuscript describes interesting phenomena that NPF was enhanced in winter at a street site comparing to a close rooftop site, whereas NPF was less pronounced at the street site in spring. The explanation for these observation, unfortunately, is not well justified, and requires a major work over again. Here are my detailed comments,

Main comments, 1. Micro-meteorology could be a major player that explains the differ-

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ence between the street site and the rooftop site, which is not discussed at all in the current manuscript. Potentially, the loss of nanoparticles due to the surfaces along the street canyon is a factor too.

2. The inter-comparison between two FMPSs showed some differences, and the authors decided to use one FMPS as a reference and correct the number concentration of the other one. How did they decide which one is “the one” to trust? Nevertheless, number concentrations are used to calculate formation rates, growth rates, and condensation sink. This could lead to a major uncertainty in the discussion for nucleation mechanism.

3. The FMPSs were placed downstream of dryers, which indicates that the measured size distributions could be of from the atmospheric ones. This at least eliminates the role of relative humidity to a certain extent. Even for particles in the size ranges of 10-20 nm, the uptake of H2O is one of the major pathways for particle to grow.

4. The mixing ratio of SO2 was only measured at the rooftop site. How about CO? It might be possible to deduce a street SO2 simply by the mixing ratios of CO. The current assumption that concentrations of SO2 are identical at the two sites are not acceptable, and could lead to mis-interpretation.

5. The authors focused on the oxidation of biogenic organics when discussing the growth of >10 nm particles. In an urban environment such as Beijing, wouldn’t anthropogenic VOCs be more concentrated? Are there any measurements that point the authors to biogenic VOCs instead of anthropogenic ones? How will the interpretation

6. Throughout the manuscript, the authors are presenting J8, which is fine. However, particles bigger than 8 nm are larger enough that they don’t really reflect the nucleation mechanism, instead, a combination of nucleation and subsequent growth, especially growth mechanisms, might actually determines how many particles were measured.

Minor comments, 7. (Page 8), clearly define long-term NPN, short-term NPF, Class I

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NPF, and class II NPF.

8. (Page 10, Line 225), how about NO in the winter? Wouldn't NO be always higher in the street canyon?

9. (Page 13, Lines 280-287), the argument on H2SO4 is just speculation. Many factors determines H2SO4. Also, why is SO2 from on-road vehicles negligible comparing to the background?

10. (Page 15, the last paragraph), I am certainly not convinced by the discussion here. Different nucleation mechanisms probably explains NPF events in Beijing, Qingdao, and marginal seas of China. Again, J8 is not a good indicator for nucleation mechanisms. By definition, NMIoNP stand for "the net maximum increase of nucleation mode PNC". I don't see a clear connection between NMIoNP and J8. A cutoff of 8 cm-3 s-1 could be arbitrary. The correlation will not be bad if a cutoff of , say, 7 cm-3 s-1, was chosen.

11. In supplementary, coefficient of variation (CV) is defined, but try to define "25% minimum", especially what "minimum" stands for. Also, why 1 16.6 nm cutoff chosen in the following session?

12. Proofread the manuscript.

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