

## ***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 #3**

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The manuscript presents results from measurements of new particle formation (NPF) in Beijing during Spring and Winter using high time resolution particle sizers. The characteristics of new particle formation at two adjacent sites were compared to assess the impacts of local traffic emissions on NPF. Traffic exhausts might emit primary particles or gas phase precursors that contribute significantly to secondary particle formation and hence traffic emissions play important roles in severe haze formation in megacities such as Beijing in China. While the topic is important in atmospheric chemistry and is of interest to the general readers of this journal, the manuscript in general is yet to be improved and several major issues need to be resolved before the manuscript can be publishable in the journal.

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Major comments:

1. The rationale of selecting plume events rather than regional events as examples must be clearly persuasive. Apparently, good “Banana shape” regional events were measured during the campaigns. Comparison of the differences of new particle formation between the two sites is of great interest. It will be clearer to see the impacts of traffic emissions on the new particle formation processes if those well-defined events were used as examples. For example, how particle number size distribution and particle composition might be affected by local emissions. The plume events are rather not well defined in terms of the formation rates and the growth rates which will need to be resolved in the next comment.

2. Particle formation rates and growth rates. First, the formation rate should be stick to J8 instead of new particle formation rate since particles in the range of 8-20 nm are rather too big to be called new particles. Also why a size range of 8-20nm is selected? Why is not 8-30 or 40 nm or others? The determination of the formation time (not the nucleation time) used in this paper seems to be objective and is of the authors’ preferences, profoundly affecting the formation rate calculations. The width of the size range also affects the determination of formation time which will need to be clarified. The formation rate of nanoparticles in a plume event is difficult to calculate and needs to use a more sophisticated method than the simple one used in this paper.

3. The classification of the nucleation events. It is very awkward to denote a nucleation event longer than 1 hour “a long term event”. It might sound better if “a long lasting event” or another name is adopted. Similarly, please change the notation of “a short term event” to another proper name. In addition, the two types of events are the well-known “regional events” and “plume events” in atmospheric aerosol sciences. It is not necessary to create new names for them.

4. Heterogeneity of NPF in Section 3.2. Quite a few “heterogeneity” were mentioned for NPF in both horizontal and vertical directions. It is really not that meaningful to

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emphasize the spatial inhomogeneity of particle formation because in the urban atmosphere, gas phase precursors are inhomogeneous and particle formation is also greatly constrained by local emissions and meteorological conditions.

5. Reasons for the reduced NPF and the enhanced NPF at the street site respectively in the springtime and in the wintertime. It is very interesting to figure out the reasons behind those observed phenomena. First, the authors need to confirm that particle formation is always reduced in the springtime and always enhanced in the springtime at the street site. That will exclude the possibility of dominant effects from the meteorological conditions e.g. differences in wind directions or mixing heights, temperature, humidities etc. Second, the authors need to present more other companion measurements of gas phase precursors and chemical composition of nanoparticles in order to elucidate the mechanisms of reduced or enhanced NPF at the street site. Without the information, the proposed explanation for the observed opposite effects on NPF during springtime and wintertime is only speculative.

Minor comments:

1. There are a lot of typos, ill-sentences all over the manuscript. It is recommended that the manuscript should be carefully edited prior to submission. Below are a few examples: L31, specie; L208, a several minutes; L254, didn't detail; L270, didn't detail description; L292, "were available currently", . . .

2. Rewrite all the figure captions clearly as those captions are hard to read and understand.

3. L225, a few more sentences might be needed to explain why NPF inside the street canyon was reduced.

4. L189, "estimating that the NPF possibly occurred in cleaner atmospheres over the region scale of  $\sim 120$  km", "suggesting that the NPF likely occurred in cleaner atmospheres over the region scale of  $\sim 140$  km in different NPF rates.", "The NPF was

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roughly estimated to occur in a semi-regional scale over  $\sim 50$  km". How do you know the scales of those events?

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