Review: Nucleation and growth of sub-3nm particles in the polluted urban atmosphere of a megacity in China by Yu et al.

This article deals with observations of new particle formation and nano-particles in an urban atmosphere in China. The article is clearly written, the methods are explained in sufficient detail and the presented data is new and interesting for the scientific community. In places, the article could be shorter and more focused, as it struggles to combine a lot of detailed information and many different parameters.

The article fits to the scope of the journal and it presents a contribution to our understanding of the dynamics of the small particles in a megacity. Therefore I recommend it to be published after the following concerns/comments have been addressed.

General comments:

It does not make sense to report the size with 2 decimals (of nanometers). The sizing accuracy is not that good. I strongly advice for using 1.4nm instead of 1.38nm (and so on) everywhere in the article and figures (also J1.4 and not J1.38).

Chapter 2.2. rows 5-15. I agree that fluctuations in the total concentration that are faster than the scanning cycle can lead to a background concentration after the inversion. However, from your references, at least in the studies conducted in the boreal forest, there is often a clear scanning cycle also outside nucleation events indicating presence of sub-3nm particles or ions, which cannot be explained solely by fluctuations.

p. 18660, rows 11-19 and chapter 3.2. Have you thought about an effect due to chemical composition? It is well known that organic substances activate less readily in DEG (see e.g. Kangasluoma et al. 2014), so this could lower the detection efficiency at smallest sizes and therefore lead to the 'upside volcano' shape. Is there any evidence suggesting there was more organics involved in NPF on type B events? At least later you mention that in winter (when B-events were common) you got higher J with the same H2SO4…

Chapter 2.3. You could shorten the article by omitting the first part of this chapter (p. 18660 row 20 - 18661 row 11) and Fig. 4. It would be enough to say that due to high GRs, you chose to use GDE instead of appearace time method. I don't see that Fig. 4 produces a lot of new information to the reader.

Chapter 3.2 is very long, and would benefit from either shortening it or dividing it in parts.

Chapter 3.2-3.3: Have you ruled out that (self-) coagulation cannot cause the local maximum in the GRs?

Chapter 3.4: I think your explanation for the 'missing banana' is plausible. However, you should also look at the air mass trajectories, if this can explain the difference between type 1 and 2 events. For seeing continuous growth on a measurement site, you need to have nucleation taking place on a regional scale (not only locally).

You could comment in the conclusions how the emission control in summer was affecting your data (this is of general interest also outside nucleation experts).

Specific comments:

Introduction, p. 18654, row 26. I would say just ‘formation of clusters’ (instead of homogenous nucleation of thermodynamically stable clusters, which is an outdated view of the process), see also the articles about nucleation mechanism from the CLOUD experiments (Kirkby et al.,2011; Almeida et al. 2013; Schobesberger et al., 2013; Riccobono et al. 2014).

End of Introduction: The aims of your study are stated quite vaguely. I would consider using more concrete language, for instance: (1) provide new information about the initial steps on NPF in a polluted environment, (2) find possible limiting factors, which explain the seasonal and diurnal variation… But this is just a suggestion.

Methodology, p. 18657, row 6-9 complex sentence. What was actually moved?

The first sentence of chapter 2.2 is a bit complicated. Reformulate e.g. to: ‘a criterion -- was that the total particle concentration reading followed the supersaturation scanning cycle so that the highest concentrations were measured at lowest cut-off sizes.’

Conclusions, p. 18674, row 9: can occur → occurred

Check when to use definite/indefinite article and singular/plural forms throughout the article.