

Interactive comment on “Aerosol Surface Area Concentration: a Governing Factor for New Particle Formation in Beijing” by R. Cai et al.

Summary:

This work elucidated the connections between aerosol Fuchs surface area and NPF events in polluted megacity. The simultaneous measurements of particle size distribution down to ~1 nm and gaseous sulfuric acid concentration were firstly conducted in Beijing. The manuscript fits well to the scope of ACP and presents valuable results. Thus I recommend it to be published after the minor comments.

Comments:

1. In the abstract (page 1, lines 15-16): It seems that this sentence is not complete. Please revise.
2. Line 25: “It appears that the abundance of gaseous precursors such as sulfuric acid in Beijing is high enough to have nucleation”, where does this conclusion come from? Do you mean that the measured sulfuric acid concentration is comparable with that in other places where NPF events were frequently observed? Please clarify. Have you considered other precursors?
3. Line 50-51: Please give a specific value/range.
4. Line 61: What do you mean transport? Do you indicate air mass origin, such as the air masses from the south direction are always associated with polluted situation in Beijing (Wehner et al., 2008; Wang et al., 2013a)?
5. Line 66-77: Gaseous sulfuric acid concentration was also measured in PRD, China (Wang et al., 2013b). Please add this reference.
6. Lines 179-180: See comments 4.
7. Lines 188-189: Please provide standard deviation.
8. Line 199: what do you mean NPF period, from 8:00-16:00?
9. Section 4.1: I would suggest to calculate the nucleation coefficients for the activation ($J_{1.5}=A [H_2SO_4]$) and kinetic ($J_{1.5}=K [H_2SO_4]^2$) nucleation mechanisms. This is very useful for the modeling study.
10. Line 233: For $A_{Fuchs} = 200 \mu m^2/cm^3$, could you also calculate the corresponding CS value?
11. Lines 301-302: I do not understand why the correlation is influenced by the nucleated particles. Do you mean the different particle number size distributions between nucleation and non-event days?

12. Section 4.2: It seems to me that you did not mention Figure 7 in the text. Please add one paragraph to explain it.
13. Line 316: 5 Conclusions
14. In Fig.1: Please use different colors to indicate non-event and undefined days.
15. In Figures 2 and 9: The unit of A_{Fuchs} should be $\mu\text{m}^2/\text{cm}^3$.
16. Please check the language and the plots, especially for the mistakes in the writing and symbols.

References

- Wang, Z. B., Hu, M., Wu, Z. J., Yue, D. L., He, L. Y., Huang, X. F., Liu, X. G., and Wiedensohler, A.: Long-term measurements of particle number size distributions and the relationships with air mass history and source apportionment in the summer of Beijing, *Atmos Chem Phys*, 13, 10159-10170, 10.5194/acp-13-10159-2013, 2013a.
- Wang, Z. B., Hu, M., Yue, D. L., He, L. Y., Huang, X. F., Yang, Q., Zheng, J., Zhang, R. Y., and Zhang, Y. H.: New particle formation in the presence of a strong biomass burning episode at a downwind rural site in PRD, China, *Tellus B*, 65, 19965, <http://dx.doi.org/10.3402/tellusb.v65i0.19965>, 2013b.
- Wehner, B., Birmili, W., Ditas, F., Wu, Z., Hu, M., Liu, X., Mao, J., Sugimoto, N., and Wiedensohler, A.: Relationships between submicrometer particulate air pollution and air mass history in Beijing, China, 2004-2006, *Atmos Chem Phys*, 8, 6155-6168, 2008.