Interactive comment on "Size-resolved and bulk activation properties of aerosols in the North China plain: the importance of aerosol size distribution in the prediction of CCN number concentration" by Z. Z. Deng et al.

Anonymous Referee #3

Received and published: 14 March 2011

In the full review and interactive discussion the referees and other interested members of the scientific community are asked to take into account all of the following aspects:

1. Does the paper address relevant scientific questions within the scope of ACP? Yes.

2. Does the paper present novel concepts, ideas, tools, or data? Yes.

3. Are substantial conclusions reached? A good conclusion is suggested.

Thanks for the comments. We rephrased the conclusion in the text.

4. Are the scientific methods and assumptions valid and clearly outlined?

(1) Please explain measurement places (roof of high building?) and methods.

More information of the measurements and the methods was added in the text. We input the following sentences in the text, "The instruments were equipped in the air-conditioned measurement container with a temperature around 20 ℃. The ambient aerosol sample is drawn in through a PM10 impactor inlet (16.67 L/min) at a height of 7 m above the ground level, and subsequently passes through a silica gel diffusion drier, maintaining a relative humidity (RH) below 30%."

(2) The explanation of the data analytical procedure is insufficient. Please describe the data analytical procedure in more detail.

We revised the sentences describing the data processing in the manuscript.

(3) The relationships between observation data and analytical results such as Table 2 and Figures 4, 5, 6 and 8 are not clear. Did the authors use average values of all data obtained from the observation sites?

Table 2 shows the statistical results of the measured CCN and CN concentrations. Figure 4 shows the probability of the inferred critical diameters. Figure 5 shows the time series of the activation ratio, for different particle sizes and supersaturations. Figure 8 shows the comparison of measured CCN number concentrations and the calculated ones.

Figure 6 is plotted using the average data to illustrate the activation curve during the campaign.

5. Are the results sufficient to support the interpretations and conclusions?

(1) The authors assume that the aerosol is chemically and morphologically externally mixed in some parts such as pages of 10 and 14. But Fig. 4 strongly suggests that the aerosol is considerably uniformly mixture with insoluble and hygroscopic materials because distribution of inferred critical dry diameters is comparatively narrow (Fig. 4).

The x-axis in Fig. 4 is in logarithm scale. Actually, the distributions of the inferred critical dry diameters at various supersaturations are not narrow. The inferred critical dry diameters are in the ranges of 190-280, 160-260, 95-180, 65-120 and 50-100 nm for supersaturations of 0.056, 0.083, 0.17, 0.35 and 0.7%, respectively. Also it's hard to tell the mixing state of aerosols from the range of the inferred critical dry diameters. The mixing state is discussed in section 4.2.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?
(1) It is not easy to understand the deriving method of (average) size-resolved activation ratio, calculated CCN concentration and some physical values and/or parameters.

We rephrased the description of the data processing and calculation.

(2) Please write Fig. 7 precisely and carefully.

Figure 7 illustrates the method for CCN Closure between bulk and size-resolved CCN measurement. This is described in section 4.3.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?
(1) The importance of aerosol size distribution in the prediction of CCN number concentration may not be a result to be able to say generally.

The conclusion of the importance of size of aerosol particles (aerosol size distribution) in the activation is obtained elsewhere (Dusek et al., 2006; McFiggans et al., 2006; Ervens et al., 2007; Pierce et al., 2007; Andreae and Rosenfeld, 2008). Similar results can be seen in our study as discussed in the text.

Andreae, M. O., and Rosenfeld, D.: Aerosol-cloud-precipitation interactions. Part 1. The nature and sources of cloud-active aerosols, Earth-Science Reviews, 89, 13-41, 2008.

Dusek, U., et al., 2006. Size matters more than chemistry for cloud nucleating ability of aerosol particles. Science 312, 1375 – 1378.

Ervens, B., et al.: Prediction of cloud condensation nucleus number concentration using measurements of aerosol size distributions and composition and light scattering enhancement due to humidity, J. Geophys. Res., 112, D10S32, doi:10.1029/2006JD007426, 2007.

McFiggans, G., Artaxo, P., Baltensperger, U., Coe, H., Facchini, M. C., Feingold, G., Fuzzi, S., Gysel, M., Laaksonen, A., Lohmann, U., Mentel, T. F., Murphy, D. M., O'Dowd, C. D., Snider, J. R., and Weingartner, E.: The effect of physical and chemical aerosol properties on warm cloud droplet activation, Atmos. Chem. Phys., 6, 2593-2649, 2006.

Pierce, J. R., Chen, K., and Adams, P. J.: Contribution of primary carbonaceous aerosol to cloud condensation nuclei: Processes and uncertainties evaluated with a global aerosol microphysics model, Atmos. Chem. Phys., 7, 5447-5466, 2007.

8. Does the title clearly reflect the contents of the paper?
(1) The title does not sufficiently reflect the contents of the paper.

We changed the title into "Size-resolved and Bulk Activation Properties of Aerosols in the North China Plain".

9. Does the abstract provide a concise and complete summary? OK

10. Is the overall presentation well structured and clear? The overall presentation is a little not well structured and clear. ?

The structure was revised, according to the comments of referee #1.

11. Is the language fluent and precise? Polish of English in sentences is better.

We improved the English usage in the revised manuscript according to the suggestions of the referees.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?
(1) It is better to explain the some parameters of Kelvin equation, Kohler equation and other equations in more detail.

References were added for Kelvin equation and Köhler equation.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?
(1) It is better to explain the some parameters of Kelvin equation, Kohler equation and other equations in more detail.

References were added for Kelvin equation and Köhler equation.

14. Are the number and quality of references appropriate?
(1) Please refer some papers for Kelvin equation, Kohler equation and other equations.

References were added for Kelvin equation and Köhler equation.

15. Is the amount and quality of supplementary material appropriate? ?