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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol hygroscopicity and CCN activity obtained from a combination analysis based on size-resolved CCN and aerosol chemical composition observations during the AC^{3}Exp13 campaign" *by* F. Zhang et al.

Anonymous Referee #1

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General comments: The paper "Aerosol hygroscopicity and CCN activity obtained from a combination analysis based on size-resolved CCN and aerosol chemical composition observations during the AC3Exp13 campaign" by F. Zhang, et al. 2014 provide a new data set in the southeast area of Beijing, China. The authors present useful observations on chemical composition, size distribution or mixing state of aerosol, and the results are consistent with the previous studies. However, the data analysis provides only qualitative explanation, which is known by previous studies. The paper titled "a combination analysis based on size-resolved CCN and aerosol chemical

composition observations", however authors did not clearly demonstrate the advantage of using size-resolved measurements. Authors may consider providing more analysis/discussion which separates aerosol size effect with its chemical composition effect by size-resolved measurements. In addition, the closure study shows that NPO test has a similar or may even better agreement between CCN_estimation and CCN_measurement than PO closure test. That is odd to reviewer. At lower SS, particles will active at larger size and it is supposed their chemical composition will be closer to ACSM measurement. Why lower correlation exhibited at lower SS?

Specific comments:

Page 6, Line 3-6: the field campaign was mainly conducted in June and July, 2013. However, the results are presents in different periods without clearly stating the criteria for selection. For example, figure 1 is for 07/07-07/21/2013, figure 3 is for 07/07-07/19/2013, and figure 9 is for 06/19-06/24/2013. Please clarify.

Page 6, Line 17: what is the inlet RH for CCN?

Page 7, Line 10: Need more information on BC analysis, because BC probably is the main source for externally mixed inactive CCN.

Page 7, Line 20: the criteria of clean day and pollution day is little weak. May consider include gas phase measurement and meteorology data, such as wind directions.

Page 8, line 2, page 12, section 4.1.1, and Table 1: It is expected that D_cut is larger than Da. But at SS=0.079% in table 1, Da_POL is larger than Dcut_POL. Why?

Page 11, line 11-14: it is not true. With MAF only, you can not characterize aerosols with homogeneous composition and a core-shell structure aerosols may has MAF = 1.

Page 12, Line 1-3: With increasing SS, the aerosol particle critical activation size changes too. With ACSM measurement, authors can only get bulk chemical composition and chemical composition varies with aerosol size. The conclusion maybe ture, but cannot draw from the differences of AR. In addition, Kuwata et al. paper was

published in 2007.

Page 12, section 4.1.2: the discussion here is not consistent with figure 1. In figure 1, the average AR at 0.109% is around 0.6 for POL and 0.8 for BK cases. The substantial portion of externally mixed CCN-inactive particles is around 20-40%, not 14-22%. The significant increase of MAF at POL case suggests that there is a large variability in mixing state at different size particles. What do authors mean by “a higher sensitivity of particle MAF dependence on SS”?

Page 14: Line 23: for particles at size range of 30-60 nm, kappa for polluted particles is high than clean aerosols. Why? Is clean case supposed to have more aged aerosols? Or does that mean the fresh biomass burning aerosol has higher kappa?

Figure 2, Is the data presented here are average of whole campaign? Please add error bar or uncertainty estimation.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 14889, 2014.