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Interactive comment on "Enhanced hydrophobicity and volatility of submicron aerosols under severe emission control conditions in Beijing" *by* Yuying Wang et al.

Anonymous Referee #1

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Wang et al. presents their results of hygroscopicity and volatility measurements during and after the Victory Day parade period in China. Aerosol hygroscopicity describes the interaction of aerosols and water vapor, and Aerosol volatility reflect the mixing state of nonvolatile aerosol particles. In addition to their importance of climate effects, the variation of them indicates the change in primary emissions, particle aging process, and regional transport. This dataset provide us new insights into the haze formation mechanisms in Beijing. The paper is well written and organized. Overall, the manuscript is within the scope of ACP. The reviewer would recommend the manuscript for publication in ACP after some minor revisions.

Specific Comments: Line 61-64: The authors highlight the uncertainty of aerosol on cli-

mate. However, the author discuss the aerosol chemistry indicated from hygroscopicity and volatility throughout the paper. In fact, the pollution formation mechanism remain unclear in Beijing. Line 250-251: The authors define the 40 nm and 150 nm particles as fresh and pre-existing particles, respectively. The authors should address the validity of the definition. In fact, freshly emitted refractory particles (like BC) are primarily within the 150 nm to 240 nm diameter range (Levy et al., 2013). In contrast, it takes several hours for the growth of 40 nm even during NPF events. The reviewer suggests that the 40 nm particles are from local sources whereas the 150 nm particles are influenced by long-range transport and vertical mixing. Line 314-320: The reviewer highly suspects that the nitrate is responsible for the appearance of more hygroscopic mode in the 40 nm particles in the early morning. How can form H2O2 during the night? The presence of nitrate in Aitken mode particles is very difficult and the addition of nitrate was initially promoted by sulfate condensation (Ye et al., 2010). Line 372: The vehicles emit both gas and particle pollutants, regardless of emission control conditions. However, the NPF is favored when the concentration of pre-existing particles is lower due to emission control. Line 400-402: Do the authors think the emission of refractory particles at night is larger than at daytime? The increase of number fraction may be caused by the slower particle aging and weaker vertical mixing. Line 426-430: The authors should pay attention to the contradictory statements of $\sigma\kappa$-PDF "always" exceeds 0.08, . . ., the mean $\sigma\kappa$-PDF of 40-nm particles during the Clean1 period "is equal to" 0.08.

Technical comments: Line 325: The term of hydrophilic should be replaced by "hygroscopic", because hygroscopic growth do not take place at a high RH for many hydrophilic substance. Line 336: The condensation species are sulfate, nitrate, OA other than SO2, NOx, and VOCs.

Ye, X.N., Ma, Z., Hu, D.W., Yang, X., Chen, J.M., 2010. Size-resolved hygroscopicity of submicrometer urban aerosols in Shanghai during wintertime. Atmospheric Research 99, 353-364.