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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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General Comments: Hygroscopicity and volatility are the key properties of atmospheric aerosols that can significantly impact the climate directly by interacting with solar radiation and indirectly by affecting cloud microphysics. Hygroscopic aerosol components can uptake substantial water under sub-saturated conditions and thus can significantly change aerosol size distribution and promote both heterogeneous and aqueous-phase reactions. Severe haze event caused by high mass loading of aerosols is one of the most critical environmental issues faced by China. Although the underlying cause is still an area of active research, it is well recognized that ever-increasing economical expansion and demands for energy have led to tremendous emissions of primary air pollutants (e.g., VOCs, NOx, SO2) in China. Many mitigation measures have been

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proposed to reduce air pollutant emissions but their effectiveness still needs to be verified in practice. The “Victory Day Parade” event has provided the atmospheric scientists such an opportunity to examine the aerosol properties with/without those anthropogenic emissions. Therefore, this dataset by itself is a valuable contribution. The manuscript is well written and is certainly within the scope of ACP. The measurements techniques are well established and the methodology is generally sound. Overall, the research was well planned and carefully executed. I would recommend the manuscript for publication in ACP after the authors address the following comments.

Specific Comments:

1. L231: As the authors pointed out that “Air quality has a strong correlation with local wind direction in Beijing”, how did the authors manage to separate the effects of meteorological conditions from that of control measures?

2. L259 and L294: It is interesting to note that PM mass concentration decreased by a factor of ∼8 between polluted and clean periods while precursors only decreased by less than 50%. Please comment on this.

3. L311-314: The authors may also consider the possibility that during daytime strong vertical mixing can bring down air masses transported from long distance that were more aged. However, during nighttime thermal inversion would cap the ground level, where fresh primary emissions would dominate.

4. L319: How did “H2O2” form during nighttime? This is more likely due to N2O5 chemistry.

5. L324-330: “During NPF events, . . .condensation of VOCs”. Did the authors mean that these NPF events (Clean1 case) were caused by organic precursors? If these organics were less hygroscopic, why did kappa-mean increase? Was there any possibility that these 40 nm particles were due to primary emissions, such as automobile exhaust or cooking?

6. L377: “With the processes of. . .(i.e., SFmean increases).” Why did the aging, coagulation and growth processes cause decrease in particle volatility if the precursor gases were the same? This is more likely due to the formation of more oxidized oxygenated organic aerosols.

7. Figure 8: How was the linear fit calculated for each size? Did the authors try orthogonal distance regression (ORD), which I believe will generate more reasonable results especially for the 40 nm case?

Technical comments:

1. L138-147: remove period before semicolon;

2. L248: Particle mass concentration is denoted by “” throughout the manuscript, which, however, could be misleading, since “” is commonly used to represent density. Please replace “”with “m” or “mass” or something less misleading.

3. L376: dominated by sulfate and “organics” not "VOCs".

4. L459: change “corrected” to “correlated”.

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