Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-308-AC2, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement of aerosol properties during wintertime in Beijing" *by* M. L. Zamora et al.

M. L. Zamora et al.

pengjianfeipku@gmail.com

Received and published: 6 August 2019

In this manuscript aerosol properties in Beijing in the wintertime were investigated by conducting a ïňĄeld measurement at an urban site of Beijing during January and February of 2015. The manuscript is well-organized and clearly written, and merits to be published in ACP. Line 18-19 of page 4: Please explain in more detail about how PBL is determined and give more evidence on "suppressed dilution of local pollutant (mixing layer depth of 1100 m compared to 2200 m, Fig. S1.)" (Line 10-11 of page 7)

Response: We thank the reviewer for this comment. We have modified the content as follows. "The PBL was determined by utilizing the National Oceanic and Atmospheric Administration's (NOAA) hybrid single-particle Lagrangian integrated trajectory (HYS-

PLIT) model. HYSPLIT identifies the mixing layer height, which we assumed to be the PBL, as the height at which the potential temperature is at least two degrees greater than the minimum potential temperature." "The hygroscopicity of the autumn aerosols (25 September) during the clean phase was much lower (0.2) than the hygroscopicity of the wintertime aerosols (0.35). This is likely due to the higher proportion of sulfate in PM during the winter (7% in the autumn, 16% in the winter) caused by the higher SO2 emission from residential heating in the winter and the lower PBL (1100 m compared to 2200 m, Fig. S1.), which suppressed the horizontal dilution of pollutants and thereby accelerated the sulfate formation (Wang et al., 2016). ."

Line 21-24 of page 7: "We show that the periodic cycles of haze episodes during the autumn and winter seasons in Beijing are closely linked to the meteorological conditions. During haze events, stagnant air masses typically develop under the calm or weak southerly wind, which traps the local pollutants." I do not think the conclusion is new.

Response: We thank the reviewer for pointing out this. We have revised the conclusions and implication part as follows. "We have elucidated the influence of meteorology, local emissions, and aerosol processes on severe haze events in Beijing during winter by conducting comprehensive aerosol properties measurements. We show that the periodic cycles of haze episodes during winter seasons in Beijing are also regulated by meteorological conditions. Formation of severe haze is comprised of two distinct processes of secondary aerosol formation, i.e., the nucleation that initially produces high concentrations of nanoparticles and the subsequent continuous growth from the nucleation mode particles to submicron particles. Our analysis of the aerosol chemical compositions suggests that organic aerosols are primarily responsible for producing the nucleation mode particles, while secondary organic aerosols and inorganic salts contribute jointly to the particle growth. The combination of the high aerosol nucleation potential and efficient subsequent growth over several days uniquely differentiates the severe PM2.5 episodes in Beijing from those typically observed in other regions world-

wide. The average effective density and kappa value of ambient particles are approximately 1.37 g cm-3 and 0.25 during the clean days, and 1.42 g cm-3 and 0.4 during the severe haze episodes, respectively. The higher effective density and kappa value during hazy days indicate the formation of secondary inorganic species during the continuous growth of nucleation mode particles. From the perspective of pollution control, it may be feasible to suppress the aerosol growth processes to reduce the PM2.5 levels in Beijing. Our results imply that the reductions in the emissions of the aerosol precursor gases, i.e., VOCs, NOX and SO2, are critical for remediation of the haze pollution in Beijing. Such a viewpoint of severe haze formation is critical for improving formulating effective regulatory policies by decision-makers at the central and local government levels."

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-308, 2019.