Comment on acp-2021-413

Anonymous Referee #2

Referee comment on "Relating geostationary satellite measurements of aerosol optical depth (AOD) over East Asia to fine particulate matter (PM$_{2.5}$): insights from the KORUS-AQ aircraft campaign and GEOS-Chem model simulations" by Shixian Zhai et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-413-RC2, 2021

The manuscript investigated the physical relationships between AOD and PM2.5 over East Asia by using the model simulation and comprehensive observation. The results indicate that the aerosols over this region are largely contributed by the sulfate-nitrate-ammonium and organic aerosols within the PBL. Meanwhile, the dust in the free troposphere also has an important contribution to column AOD. The seasonality of AOD and PM2.5 has been specifically discussed. In general, this paper is well-written with a good logical connection. Thus, I recommend the manuscript for publication in Atmospheric Chemistry and Physics, after addressing the following comments.

Specific Comments:

- The current introduction section may be insufficient to demonstrate the significance of this paper. The authors need to clearly explain the limitation of previous studies and the advantage of this study.
- The analyses of this study are closely associated with the model simulation of GEOS-Chem, while the title only mentioned the observations. There are some disconnections between the title and the main text.
- Line 203, Page 8. The PBL varies significantly during the different periods. It is risky to define the 0-2 km as the PBL. The authors should give more justifications for this definition.
- The seasonality of AOD and PM2.5 and its association with PBLH have been discussed previously (e.g., Guo et al., 2017; Su et al., 2018). I suggest the authors acknowledge these works.

References:

Su, T., Li, Z. and Kahn, R., 2018. Relationships between the planetary boundary layer height and surface pollutants derived from lidar observations over China: regional pattern and influencing factors. Atmospheric Chemistry and Physics, 18(21), pp.15921-15935.

Guo, J., Xia, F., Zhang, Y., Liu, H., Li, J., Lou, M., He, J., Yan, Y., Wang, F., Min, M. and Zhai, P., 2017. Impact of diurnal variability and meteorological factors on the PM2. 5-AOD relationship: Implications for PM2. 5 remote sensing. Environmental Pollution, 221, pp.94-104.