Comments for the revised manuscript "Interpretable Machine Learning Quantifies Composition and Size Influences on Aerosol Spectral Absorption" by Wang et al.

The authors have addressed the majority of the previous review comments satisfactorily.

However, to further strengthen the manuscript's scientific depth and place its findings within the broader context of aerosol optics, I have a suggestion for a discussion point regarding the microphysical properties of aerosols, particularly black carbon (BC).

Discussion on Microphysical Properties (Morphology and Mixing State):
The manuscript convincingly demonstrates the importance of bulk properties like composition (BC, BrC, dust mass fractions) and size distribution parameters (e.g., Rfine) in controlling AAE. However, the optical properties of aerosols, especially light-absorbing ones like BC and BrC, are critically modulated by their microphysical characteristics, such as morphology (e.g., fractal vs. compact aggregates) and mixing state (e.g., coating thickness, uniformity, and the spatial distribution of inclusions).

Recent studies have highlighted that these microphysical properties introduce significant complexity that can influence AAE and subsequent radiative forcing estimates, sometimes in ways that are not fully captured by bulk properties alone. For instance:

Luo, J., Li, D., Wang, Y., Sun, D., Hou, W., Ren, J., Wu, H., Zhou, P., and Qiu, J.: Quantifying the effects of the microphysical properties of black carbon on the determination of brown carbon using measurements at multiple wavelengths, Atmos. Chem. Phys., 24, 427–448, https://doi.org/10.5194/acp-24-427-2024, 2024.

Luo, J., Hu, M., Luo, J., Li, C., Bi, M., Zhou, X., Geng, X., Wu, C., Li, K., and Wang, F.: Numerically quantifying the spectral dependence of the absorption enhancement of partially-coated black carbon with complex microphysical properties, Opt. Express, 32(26), 46982–46998, https://doi.org/10.1364/OE.545559, 2024.

Luo, J., Li, Z., Qiu, J., Zhang, Y., Fan, C., Li, L., Wu, H., Zhou, P., Li, K., Zhang, Q., et al.: The simulated source apportionment of light absorbing aerosols: Effects of microphysical properties of partially-coated black carbon, J. Geophys. Res.-Atmos., 128, e2022JD037291, https://doi.org/10.1029/2022JD037291, 2023.

Luo, J., Wang, W., Qiu, J., Zhang, Q., Li, C., Hou, W., Dong, X., and Hu, M.: Both non-uniform mixing states and coating structures are important for absorption enhancement and radiative effect of black carbon, Opt. Express, 33(10), 21719–21735, https://doi.org/10.1364/OE.552013, 2025.

Liu, C., Chung, C. E., Yin, Y., and Schnaiter, M.: The absorption Ångström exponent of black carbon: from numerical aspects, Atmos. Chem. Phys., 18, 6259–6273, https://doi.org/10.5194/acp-18-6259-2018, 2018.

Wang, Y., Zheng, Z., Sun, Y., Yao, Y., Ma, P. L., Zhang, A., and Li, W.: Improved representation of black carbon mixing structures suggests stronger direct radiative heating, One Earth, 8(5), https://doi.org/10.1016/j.oneear.2025.04.012, 2025.