

The authors present vertical (0-240 m) measurements of BC and its mixing state during summertime in urban areas in China, focusing on analysis and interpretation of four types of vertical profiles in the boundary layer. The discussion and conclusion could benefit from some quantitative analysis, e.g., the diurnal variation in the vertical profiles. This work is interesting and suitable for publication within the scope of ACP. Please see detailed comments below.

General Comments:

The authors can give more discussion on the significance of the work. In earlier studies, what had been left open, and what the present paper now to address? How their finding are relevant to atmospheric chemistry and radiative transfer? What the novel insights of their work are?

Specific comments:

(1) Abstract. Please indicate where the measurements are taken in the abstract and the date range of the measurements.

(2) SP2 data analysis: The minimum core size (from LII) and minimum total particle size (from scattering) differ, with the latter greater than the former. Have the authors filtered to account for any mismatch in the SP2 size for incandescence vs scattering, which can bias results? What are the limits on the D_p ? When calculating BC concentration calculation, have the authors considered the SP2 limitations?

(3) Page 5/Line 149-151: The authors are trying to add some discussions on the causes of BC coating growth during ozone pollution day. However, there is no sufficient evidence to support. The authors can support their explanation by previous studies, e.g. <https://doi.org/10.1021/acs.est.2c00090>.

(4) Page 6/Line 165-166: The author can give NO data rather than NO_x to demonstrate titration reaction.

(5) Page 6/Line 173-174: The author can discuss the emission sources of the measured BC based on MMD.

(6) Page 6/Line 175-176: O₃ decreased with increase height? I think that should be “O₃ increased with”.

(7) Page 7/Line 296-308: The measurement found higher O₃ and D_p/D_c in the residual layer. The authors can give more discussion on BC aging in the residual layer. How the finding is relevant to atmospheric chemistry and radiative transfer?

(8) Conclusions: The authors need to clear the novel insights of their work and the significance of their findings.