

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2022-787

Anonymous Referee #1

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Referee comment on "Quantifying particle-to-particle heterogeneity in aerosol hygroscopicity" by Liang Yuan and Chunsheng Zhao, Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-787-RC1>, 2023

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This manuscript by Yuan et al. reports a new algorithm to quantifying the heterogeneity in aerosol hygroscopicity, by using the data from H-TDMA. Average per-particle species diversity  $D_p$ , the bulk population species diversity  $D_y$ , and their affine ratio  $\chi$  was calculated as three indices to describe aerosol heterogeneity. These data are valuable and the figures presented in the paper are good description of the research. Therefore, I would suggest publication after the following comments have been addressed.

Specific comments:

Line 28-29: "Considering that ambient aerosol particles in an aerosol population differ dramatically in chemical composition due to the complex sources and aging processes." The authors might find the following paper relevant findings from individual particle analysis by electron microscope and models. For example, recent studies focused on different kinds of mixing states such as *Journal of Geophysical Research: Atmospheres* 2022, 127, (5), e2021JD036055; *Atmos. Chem. Phys.* **2021**, 21, (23), 17727-17741; *Environmental Science & Technology* **2021**, 55, (24), 16339-16346."

Line 43: may change from "black carbon (BC)-containing" to "black carbon-containing (BC-containing)"

Line 48: "most literature is" should use plural form

Line 50: "we propose" -> "we proposed"

Line 59: "propose" should be "proposed"

Line 52: "will describe" should be "described"

Line 53: "will be" should be "was"

Line 54: "are discussed" should be "were discussed"

Line 55: "comes" should be "came"

Line 81: why the font of "TDMA<sub>fit</sub>" is different?

Line 139: "ageing" is different with other "aging" in your article, here should be unified

Line 154: "ranges 1 to 2" should be added "from"

Line 155-156: "it is 1 when ... while 2 when ...", the grammar here is strange. May add "the" or "be" behind "while"

Figure 2: Does blue represent the LH or grey represent the LH? Need explanations here.

Line 186: why chose 110 nm aerosol? Need reasons here.

Line 190: why is  $\chi$  high at night? Here needs more explanations.

Line 217: remove "will"

Figure 6 (a) and (d) need a legend

Line 230: "Aitken mode" Why capitalize here?