

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-912

Anonymous Referee #2

Referee comment on "Measurement report: Hygroscopic growth of ambient fine particles measured at five sites in China" by Lu Chen et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-912-RC1>, 2022

Review of "Hygroscopic growth of ambient fine particles measured at five sites of China" by Chen et al.

This study reports hygroscopic growth measurements at five sites in China, three in urban locations and two in suburban locations. Approximately one month of measurements was conducted at each site over the years of 2016 - 2020. The studies all took place between April and July, with the exception of the study in Guangzhou which occurred in November. The observations show the smaller particles at the urban sites are usually composed of externally-mixed modes of varying hygroscopicity compared to the larger particles as well as particles of all sizes at the suburban sites. The authors also characterize the observations diurnally, as a function of PM_{2.5}, in the presence of new particle formation and compared to chemical composition. Although numerous other HTDMA observations have been reported from China, I believe that this study is still of interest due to its greater spatial coverage and various analyses. The manuscript is well-written and the conclusions easy to follow. I recommend that the manuscript be accepted for publication provided that the authors address my scientific comments listed below, with the exception of the point about Sect 3.5 which would not be necessary for a Measurement Report but I am nevertheless interested in their explanation.

Scientific comments

Sect 2.2 - What was the residence time in the humidifying region? How often were calibrations conducted?

Can the authors comment on whether the pandemic and any ensuing lockdowns potentially affected their measurements in Shanghai and Xinzhou?

Sect 3.4 - could the fact that the GZ study occurred in November have affected these results: more rain, changing wind patterns, etc?

Sect 3.5 - I'm curious what the authors think about the source / composition of the 40 nm particles on non-NPF days

Sect 3.6 - Are the kappa values presented in this section for each Do represent all the fractions (NH, LH, MH)? Or is it for just one of the modes? Is it possible to calculate the kappa value for each of the different modes?

Line 365 - The authors state that the more hygroscopic mode accounts for only 20-40% of number fraction at urban sites. However, does this change significantly during NPF times?

Minor and Technical comments:

Title - consider changing to "measured at five sites in China"

Line 103 - should be "field campaign"

Eq (3) - consider inserting a multiplication symbol between GF and c

Line 215 - consider changing to "the aged particles"

Figure 5 - I understand that the current emphasis is on comparing the composition of each size particles over the five sites. However, have you considered making each site a panel with the sizes on the x-axis? This would make it easier to see how the hygroscopicity changes with size.

Line 293 - Consider spelling out NCP since you only use it 3 times

Figure 8 - What do the dots in panels b and d represent? It is not explained in the caption.

Line 345 - edit to "owing to the fact that"

Line 368 - edit to "aggregated PM2.5"

Lines 370-372 - I'm having trouble understanding this sentence. Are you trying to explain the spatial variability? Or attributing the observed differences to the spatial variability?
Please clarify

Line 489 - the reference for Liu et al., 2011 is repeated

General - Replace "accumulated particles" with "accumulation mode particles"