

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-1010

Anonymous Referee #2

Referee comment on "Measurement report: On the difference in aerosol hygroscopicity between high and low relative humidity conditions in the North China Plain" by Jingnan Shi et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-1010-RC2>, 2022

The manuscript gives a report of aerosol hygroscopicity (HT-DMA) and composition (ACSM) measurements in the North China Plain. The authors examine data from two periods they identified based on ambient RH. They conclude that the observed difference in aerosol hygroscopicity between these two episodes was due to different chemical composition (specifically O:C ratio) of ambient aerosol particles.

The manuscript is generally written well and is fit for publication after the following issues are addressed.

Specific questions and comments

- HRH and LRH episodes and Figure 1. While the figure does give a (small and blurry) overview of the conditions during the measurement period, the actual numbers (and statistics) of the RH/T values for these periods should also be presented. Especially if these numbers are used to classify the measurement period into distinct episodes.
- Figure 1.
 - Please make the plot larger and use higher resolution. If this is a limitation of the preprint stage of publication, then that's understandable, but for the final publication it should be more readable.
 - Black line in κ plots – it's mentioned in the text what it is, but please add a label/description also to the figure itself or the caption.
- Page 8, line 220: "... mode were almost always observed for all sized particles ...". Please quantify "almost always". Also, Fig. 1 seems to argue against that statement as

the LH and MH modes are not continuous in time and have frequent gaps. As an example, LH mode for 100 nm particles during the HRH episode seems to be present (judging by the small plot) about 60% of the time.

- Figure 6: why was $N_{F_{MH}}$ omitted from the plots?
- Please include a description of and results from particle size distribution measurements mentioned in the manuscript (p. 13, after Eq. 5) and used to justify the use of 200 nm HT-DMA data.
- Figure 8:
 - What are the red points with error bars – averages over some range? Please describe.
 - The figure caption says the red line is a fit to data. Should it be "black line" instead?
 - How much did the ambient RH vary between individual data points on each plot? Looking at Figure 1, the RH had a fairly large diurnal variation. Also, one could almost group the individual data points and see several trends. If the data points were, for example, colored by the ambient RH, would distinct groups emerge?
- Page 14, line 385: "... RH ... was also quite high ...". Please quantify "quite high". Same comment for "... low RH conditions ..." on line 394 on the same page.

Minor comments

- Please check the use of underscore vs. dash throughout the manuscript. Examples include "*HT-DMA_measured*" and "*ACSM_derived*" on page 2.
- Page 3, line 68: what varies – aerosol or composition?
- Page 3, line 83: "... quite hygroscopicity ...". Please review language.
- Page 6, line 162: missing "r" in "*analyzer*".
- Page 9, line 229: sentence starting with "*Compared with ...*". Please review language and grammar. Currently it reads as if aerosols were somehow obtained and stored.
- Page 10, line 282: first sentence – please review language and grammar.
- Figure 5: suggest adding the meanings of the acronyms to the figure caption for easier reference.
- Page 11, line 291: Kuang et al. (2020) isn't on the references list.
- Beginning of section 4.3: Figure 6 is discussed, but not referenced.
- Eq. (5) on page 13: some of the text seems very small – were nested subscripts used by accident (from ϵ_{BC} onward)?
- Page 14, line 383: "... *moderately hygroscopic*". Please fix.
- Page 14, line 392: please review language and grammar.