Comment on egusphere-2022-256
Anonymous Referee #2

Referee comment on "Impact of water uptake and mixing state on submicron particles deposition in the human respiratory tract (HRT): Based on explicit hygroscopicity measurements at HRT-like conditions" by Ruiqi Man et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-256-RC2, 2022

In this work the authors describe measurement of the hygroscopic growth of externally mixed particles from the North China Plain. They use these data in conjunction with a lung deposition model to predict the effect of hygroscopic growth on deposition in the respiratory tract. The results show that in total, dose was reduced when hygroscopic growth effects were considered as the more numerous smaller particles, that deposit via diffusion mechanisms, deposited less effectively. Variations were seen across the size range, with smaller particles showing a reduced likelihood to deposit, while larger particles were more likely to deposit.

Overall, this paper goes some way towards showing the importance of considering hygroscopic growth, but the extent of new insights is limited. The effects are reported to be rather small so an improved sensitivity analysis and consideration of uncertainties is needed to validate and support the conclusions. Some specific points towards this are detailed below:

- Deposition fraction is on a particle number basis, and the conclusions connect the dose with the number of particles. The authors should considering reporting dose on a mass deposition basis, which will significantly increase the contributions of the larger particles on deposited dose.

- Does the lung deposition model change the density of the particles as they grow due to water uptake? A density of 1.5 g/cm3 is high for hygroscopic particles at >90% RH. I suggest a sensitivity analysis be performed to compare the difference in deposition for 1.0 and 1.5 g/cm3 particle distributions.
· How was the dry size of the particles determined in the hygroscopic growth measurements? Were any shape correction factors considered?

· How accurate is the RH measured in the HTDMA? How stable is the RH? At the high RH of these measurements, even fractions of a % of RH can lead to significant changes in the size of the particles and will introduce uncertainty in the results.

· On line 103, HH-TDMA is referred to – what does the second “H” stand for?

· Line 84 – a constant value of kappa with RH does not indicate an ideal solution. It indicates that the effective molar volume of the solute does not vary with RH.