Atmospheric Chemistry and Physics Discussions

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# Comment on acp-2022-364

Anonymous Referee #2

Referee comment on "Water uptake and the gas-particle partitioning of nitrate aerosols" by Hoang Duong Do et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-364-RC2, 2022

Based on the HTDMA measurements and thermodynamic models (ISORROPIA-II and E-AIM) simulations, the author investigated water uptake and gas-particle partitioning of nitrates for inorganic and inorganic-organic aerosols, such as ammonium sulfate, ammonium nitrate, and glyoxal. More importantly, the author revised ISORROPIA-II and E-AIM simulation results to fit HTDMA measurements. However, the main analysis and conclusions were with fewer innovations and highlights. The discussion is too simplistic to draw conclusions. Some of the major comments are listed below.

- At the beginning of the paper, the author clearly proposed that the metastable mode in a thermodynamic model does not fully describe physical/chemical processes associated with water uptake and nitrate partitioning. Since many studies have used the metastable mode, what is the basis for their use? At the end of the paper, the author also claimed the metastable mode is more appropriate than the stable mode for most ambient condition simulations due to the deliquescent nature. Is the basis of your conclusion the same as the basis of previous studies? If it is the same, has this part of the work been done before?
- As the author explained, 250 nm diameter aerosols were investigated in HTDMA because 250 nm was the average size of SOA.Please explain whether this choice is reasonable in terms of particle size distribution. Also, whether the particles in the atmosphere that are not hygroscopic are more freshly emitted particles. So should it be more convincing to choose a smaller particle size for the experiment?
- The paper describes the measurement results and the results compared with the model. There are some improvements to the model, but there is no in-depth description of the reasons. Now that comprehensive measurements of aerosol hygroscopicity of different components are made, is there a comprehensive parameterization scheme that can really improve both models? What is the contribution of this improvement applied to real atmospheric samples?
- The results of the two models are always consistent. Can you summarize the differences between them?
- Innovations need to be emphasized.
- Ammonia and HNO3 are not included in the model input, but are present in the model output. In addition, ammonium nitrate decomposes into ammonia and nitric acid. How

to take this loss into account in the calculation process?