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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Some insights into the condensing vapors driving new particle growth to CCN sizes on the basis of hygroscopicity measurements" *by* Z. J. Wu et al.

Anonymous Referee #1

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Review on " Some insights into the condensing vapors driving new particle growth to CCN sizes on the basis of hygroscopicity measurements" by Z. J. Wu et al.

The authors present a case study on atmospheric new particle formation at a continental location, addressing the question of the composition of the condensing vapors in NPF growth indirectly through HTDMA and AMS measurements. While the paper discusses only three NPF events it provides an interesting view into the composition of the growth in NPF, which is still not very well characterized. I recommend the manuscript for publication after the following issues have been addressed.

My main concern is that the AMS data is underutilized. The paper seems to have a general mindset that only sulfuric acid and organics can contribute to the growth (e.g. page 8413, rows 1-2). Does the AMS data support this? What is the contribution of e.g. ammonium to the growth? For instance Zhang et al. (2004) combined AMS and SMPS in order to get an insight into chemistry of new particle formation and growth. I strongly recommend applying the Zhang et al. (2004) approach in your data set. This way you could compare the AMS and hygroscopicity implications on the composition.

Minor comments

page 8405, row 14 "Freshly formed particles are about several nanometers in diameter" Can you give more precise size, maybe with a reference? "About several nanometers" sound quite large for a freshly formed particle to me.

page 8405, row 27-29 Please clarify the last sentence.

page 8408 The methods for aerosol particle formation and growth rate analysis are not described at all. Please add a section in Chapter 3 on these.

page 8411, row 16-17 Please give a reference (or a detailed description) for the hygroscopic growth parameterization.

page 8412, row 1-2 Please include a short discussion on the accuracy of the H2SO4 estimate.

page 8412, row 19 "where [H2SO4]det is the median value from the measured sulfuric acid concentration" Do you mean the estimated H2SO4 or did you have direct measurements as well?

page 8413, row 13 Please indicate GR size range.

page 8415, row 7-8 "This was consistent with the variations in particle hygroscopic growth at RH= 90% above-mentioned." Please clarify this sentence.

page 8416, row 22-24 "At Melpitz, biological activities produced a lot of biogenic volatile

organic compounds (BVOCs) and lead to an organic-rich environment during summertime." Can you give a reference to support this statement?

page 8417, row 14-15 "The observation showed that sulfuric acid is a key species of atmospheric nucleation." In my opinion this has not been shown. For instance analysis similar to Sihto et al. (2006) could be used to back up this statement.

page 8417, row 16 "CC" should probably be CCN?

page 8417, row 26 "decline" do you mean increase?

page 8418, row 1-4 "Our results implied that the CCN production associated with atmospheric nucleation may be overestimated if assuming that new particles can serve as CCN in case they grow to a fixed particle size, which was used in some previous studies, especially for organic-rich environments." Please quantify the error of the fixed size approach in your case for a few typical threshold sizes. This would be valuable information for evaluating the uncertainty in other studies that did not have hygroscopicity measurements available.

page 8425, Table 1 Please include GR_obs for each size range.

page 8426, Fig. 1 There are so many parameters in this graph that it is getting difficult to read. Please

1. plot H2SO4 and N3-10 on logarithmic axis (see e.g. Sihto et al., 2006)

2. plot CS in its own panel

3. plot OA mass fraction in its own panel, or preferably prepare a new figure showing the AMS data for the study period (cf. Zhang et al., 2004)

page 8427, Fig. 2 ss=0.1% seems to be on the right axis. Please indicate if both ss=0.4% and ss=0.6% are on the left axis.

References

Sihto, S.-L., Kulmala, M., Kerminen, V.-M., Dal Maso, M., Petäjä, T., Riipinen, I., Korhonen, H., Arnold, F., Janson, R., Boy, M., Laaksonen, A. and Lehtinen, K. E. J.: Atmospheric sulphuric acid and aerosol formation: implications from atmospheric measurements for nucleation and early growth mechanisms, Atmos. Chem. Phys., 6(12), 4079–4091, doi:10.5194/acp-6-4079-2006, 2006.

Zhang, Q., Stanier, C. O., Canagaratna, M. R., Jayne, J. T., Worsnop, D. R., Pandis, S. N. and Jimenez, J. L.: Insights into the chemistry of new particle formation and growth events in Pittsburgh based on aerosol mass spectrometry, Environ. Sci. Technol., 38(18), 4797–4809, doi:10.1021/es035417u, 2004.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 8403, 2015.