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Atmospheric Chemistry and Physics Discussions

Interactive comment on "In-cloud measurements highlight the role of aerosol hygroscopicity in cloud droplet formation" *by* Olli Väisänen et al.

Anonymous Referee #2

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This paper analysis the influence of aerosol particle hygroscopicity on cloud droplet formation, based on field measurements. As pointed out by the authors, there are very few measurements dealing directly with this issue. The issue is at the same time relevant for aerosol-cloud-climate interactions as well as for the transport and lifetimes of air quality relevant pollutants and biogenic compounds in the aerosol. The measurements, data analysis and presentation are made with great care and the manuscript is very well written. It was a joy to read it! I thus recommend the manuscript for publication with minor revision.

Minor comments: p.1 line 19: "According to the kappa-Köhler simulations. . ..." It would be good to indicate if the simulation includes possible feedbacks on the supersaturation due to increased number of CCN at a given supersaturation or if the supersaturation is assumed constant. I would recommend that this is clarified also in other sections.

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Discussion paper

p.2 line 1: If “certain meteorological conditions” do not refer directly to peak supersaturation, but rather factors that governs the production of condensable water, like updraft, the ability of particles to activate to cloud drops also depends on the aerosol particle number concentration (influencing the critical supersaturation).

p.2 line 20: “spectrum” should be “spectra”.

p.7 line 27: Here the term “cloud-free” is used and the same term is used in the figure text for figure 1, but in the legend inside the figure the term “clear” is used. I would recommend that they are made consistent.

p.8 line 31 and top of page 9: It says that event #2 (with polluted air from north east) is characterized by small fraction less-hygroscopic particles and event #1 (with winds from west) has a high fraction less-hygroscopic particles (did I get it right?). Isn’t this the opposite compared to the general picture given in the figures S2-S4?

p.10 line 14-17: I do not know how to interpreat the sentence starting with “In our case,. . .”. Does it mean that a linear regression fits the data better than the power law fit? If so, could there be any reasons for that? For example that it is mainly the number fraction of less-hygroscopic particles that gives the variation in kappa? Related to this: in figure 2a a R2 value of -1.99 is given. Do you consider this real?

p.10 line 21: Can you quantify “considerable uncertainties”?

Section 3.5: Specify if the supersaturation is assumed constant or if feedbacks related to the water vapour sink from activated droplets is included.

Supplement: Be consistent in the naming of sectors between figure 1 (S1-S5) and table S2 (1-5). Maybe something like WS1-5 could be used, not to confuse with figure labels in the supplement?

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