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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol cloud activation in summer and winter at puy-de-Dôme high altitude site in France" *by* E. Asmi et al.

Anonymous Referee #2

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General comments

The manuscript "Aerosol cloud activation in summer and winter at puy-de-Dôme high altitude site in France" by E. Asmi et al. presents CCN and complementary measurements that were made during two campaigns at a high altitude site in France. The measurements are presented in a thorough way, and the analysis of the data and the results are described detailed and comprehensible. The overall structure of the manuscript is clear, however, some parts could be structured more clearly.
In my opinion, the paper is worth publishing when some minor changes are made, mainly concerning some of the structuring and some additional information on the drawn conclusions.

Specific comments

- p.23042 last paragraph / p. 23043 first paragraph: Maybe merge these two paragraphs, as the explanation for the connection between CCN number concentration and CDNC mentioned in the first is given in the second paragraph.
- p.23043, l.19: Maybe add some information on the measurement site
- p.23043/23044: Sections 2 and 2.1 give very similar information, I think it would be better to merge them in one section. (E.g. in line 26 (p.23043) one is waiting for more details about the campaigns, which is not given until section 2.1.)
- p.23046, l.16: Are the estimated CCNc supersaturations calculated by averaging both values?
- p.23046, l.20: How did you estimate the larger error?
- p.23047, l.24: Can you explain the large difference in R^2 for summer and winter experiments?
- p.23047, l.26: Maybe mention cut-off size for WAI and INT already here?
- p.23049, Section 2.2.1: aren′t the indices "*" and "2e" indicating the same – wouldn′t one indiced be enough?
- p.23049, Section 2.2.1, point 3.: I don′t understand the line $N^*_{i2e} + N_{i1e}$ – do you have the value of N_{i1e}? And if, how was it calculated? Or do you want to indicate that you use N_i, which is $N^*_{i2e} + N_{i1e}$? Maybe reformulate to make it clearer.

- p.23049, Section 2.2.1, point 5., last sentence: Do you assume that $Af_{2e}^{*} = Af_{1e}$ (and why?) or should that read Af_{1e}?
- p.23051, l.16: "Trajectories were started every three hours starting at 00:00 UTC time" – shouldn't this read either "every twenty-four hours" or "at different UTC times"?
- Section 3.1.: I find it sometimes confusing, which measurements refer to the summer and which to the winter campaign. Could be indicated/structured more clearly. (E.g. p.23052, l. 11: I assume this belongs to the summer measurements?)
- p.23053, l.4: How do you know that the influence came from biomass burning, from the NO_3 mass fractions?
- p.23053, l. 25: You conclude that not only size but also particle chemistry has a noticeable effect on the CCN activation, but you do not mention the size distribution here. Was it "normal" as during other times or different, why can you rule out influence from the size distribution?
- p.23054, l.7: "the continental aerosol at our site seems much more aged" – how do you conclude that, based on the hygroscopicity?
- p.23054, l.27: Why should the summer aerosol fit with the continental value, when you mention before that it is mainly influenced by marine air masses?
- p.23055, section 3.3: How do you get to the classification in this section, as you base many conclusions on that? Is it your own classification (and if, can you give more reasoning for it) or is it based on literature references? How representative do you think the classification is, how large would you estimate the variation of it?
- p.23055, l.13: Why is there a difference in the sized squares between summer and winter?

- p.23055, l.20: "to calculate averages" – averages of what?
- p.23056, l.5: How do you get κ values out of your sectoral data analysis?
- p.23056: Figure 7 and Figure 8 are mixed up (text describing Fig. 7 refers to Fig. 8 and vice versa)
- p.23056, l.12: Why should the organics in Northern Europe be less frequent or more aged?
- p.23058, l.26: How realistic is it to assume that all inorganic mass was in the form of Ammoniumsulphate, does your data indicate that?
- p.23060, l.10ff: Couldn't negative values also be an indicator that chosing $\kappa_{inorg} = 0.61$ is not an good option then? Did you vary κ_{inorg} to see how the negative values changed?
- p.23060, l. 25ff: Concerning the comparison of the two values for κ_{org}, can you explain the differences, which value do you think is more significant?
- p.23061, l.20: Could it also be that different, less hygroscopic organic components are present at smaller sizes?
- Section 3.6 /Conclusion p.23065, l. 26ff: The conclusions drawn on the CDNC and cloud SS are not mentioned that clearly in section 3.6 as they are in the conclusion section.
- Figure 1 and 2: There is very much information displayed, and the graphics are not very large. Is all this information needed in so much detail (or would it be possible to enlarge them)? Maybe also indicate the different measurement periods / air masses by vertical lines along the graph?

- Figure 4: “Dashed lines show the boundaries in within most of the data are centred.” – How did you calculate those lines? (Change to “in which” instead of “in within”)
- Figure 13: Through which parameter are the points connected on the x- and y-axis, were they taken at the same time?

Technical corrections:

- p.23042, l. 10/11: “Consequently, the efforts made in modelling the CCN initiating from ..” –Do you mean based on instead of initiating from?
- p.23043, l.1: “Upon the particle size and chemistry” – “Next to” instead of “upon”?
- p.23043, l.4f: “to which the aerosols can also affect” – remove “to”
- p.23043, l.13: “how the particle cloud activation properties” – Please change to “how do the particle..”
- p.23048, l. 18: “in a size range of 10 to 500 nm” – Please change to “in a size range from 10 to 500 nm”
- p.23048, l.26: "were" instead of "are"
- p.23049, l.18: Do you mean "N_i" instead of "N_i^*"?
- p.23054, l.2: “we can suggest that in our measurement site” – Please change to “at our measurement site”
- p.23054, l.11: “between the sites” – Please change to “between different sites”
- p.23058, l.18: “while” – do you mean “because”?

- p.23058, l.28: “remains to be the κ” – please change to “remains the κ”
- p.23059, l.7: The abbreviations LV-OOA and SV-OOA have not been introduced before
- p.23062, l.1: “In last part” – please change to “In the last part”
- p.23062, l.6: “swithing” – please change to “switching”
- p.23065, l. 11: “was good” –maybe change to more quantitative statement?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 23039, 2012.