

Review for *Laboratory study of the collection efficiency of submicron aerosol particles by cloud droplets. Part II - Influence of electric charges* by Dépée et al. The paper presents an experimental of collection efficiency of submicron aerosol particles by cloud droplets under high humidity while testing different electric charge setups. This is a very interesting work with a very nice setup. I believe the paper fits well with ACP. My only issue is that the paper needs some organization clarification and rewriting of some parts to be suitable for publication.

General comments

You are citing your work part 1 before it has been published which is a bit problematic. I do not recommend using this (unless the editor disagrees) at least until it has been accepted. You have too much depended on it in this paper which makes it hard to understand can this paper stand by itself.

I had to read your other paper (part 1) to understand this paper, as you refer to it in almost every section. You need to provide more explanation (instead of sending us to part 1) and refer to reader to the part 1 only in case they would like to read something in more detail

I think a better organization of your experimental set up is required. As a reader, I had to jump back and forth to understand what you were referring to. Try to combine the different sections into your general set up description. You can also use fewer words to describe things as thermodynamic conditions. You can write this information in a 1-2 sentence. Also, you can add Fig 3 and 5 as part of the setup figure with sections of Fig A, Fig B. Please, and tell us what exactly we see on the figure and where, as it is not understood. For example, I do not understand where is the location of your piezoelectric injector? Does the aerosol pass the humidifier area? This means you increase their size due to the hygroscopic process, have you evaluated that aspect? Also, what is your aerosol size distribution, you mention sizes in the result (not the method) but do not show it. In the method part, you do not mention if the droplets stay stable or grow in your chamber since RH is 95%, you mention it later in the result. This led me to the last part you barely mention anything on uncertainties in the method later in the result you explain some of the differences you got by explaining them.

Overall, I think you should organize the paper better it feels like you are jumping between your experimental results and the model which make it's hard to follow

Specific comments

Abstract

In general, it is not recommended to use references in the abstract. Just keep it general and mention you will compare to literature or expand other works.

Introduction

Lines 37-38 the use of this example *developing cardiovascular disorder (Crouse et al., 2012)* is wrong, as the impact is not just cardiovascular, I recommend to keep it general - *They are also a key topic in human health where Aps increase the likelihood **impacting human health (morbidity and mortality) (new citations)**.*

Lines 40-41 you wrote *have been investigated extensively over the last decades* but you do not cite a single paper to show some of these papers.

Line 43 I suggest remove the word the (*the modeling*)

Lines 49 -50 can you change the sentence – this is very confusing - *leave the streamline that surrounds the falling droplet* maybe you can say that they are swept by the streamline of the droplets or something like that.

Line 51 change the word *motion*

Line 53 change the word *massive*

Line 54 use other words than *to go*

Lines 61-62 instead of writing *These effects prevail in a subsaturated air - as it is the case sometimes in clouds - and are discussed in Part I (Dépée et al., 2020)*. I would prefer to also see a description of them here which will make the reader life easier to understand the prices

Lines 68-71 I believe your example is not good, just state that AP is charged by natural atmosphere phenomenon e.g. lightning process, dust storm. The use of this example *particularly for nuclear safety issues when the APs removal by clouds result from the discharge of radioactive materials from a nuclear accident* is so low compared to all other phenomena, I do not recommend using it. Besides, I think you should mention that electroscavenging is more important for smaller particle sizes (<0.1 μm) than Brownian diffusion as found by the model work of Tinsley et al. (2001) and Ardon-Dryer (2015).

Lines 75-90 the entire paragraph is not clear, I recommend rewriting it, also provide the eq here since it is relevant for this paper.

Lines 91-106 will be nice to organize this and write this in a way that will flow better, I provide below small examples to improve this paragraph. Organizing all information in a table could help the reader to understand similarities and differences between previous works.

Lines 91-92 just say this instead *Several laboratory studies investigated the influence of the electric charges on CE* (citations)

Line 94 change *Beard (1974) do not*, to *Beard (1974) did not*

Ling change *Lai et al. (1978) have a polydispersed*, to *used a polydispersed*

Lines 111-113 please rewrite, even try to combine it with the previous sentence.

Lines 114- 124 I think is not relevant just add the comparison in the relevant parts in the paper.

Experimental Setup

Explain some of the measurement uncertainties, as you will mention later in the result but you do not mention anything in the method part.

How do you know the droplets reduced in size by 0.5% is it based on calculation or measurements?

What do you mean by Penetration tests?

I think your information in section 2.1 and Table 1 should be in the setup section as it describes the particles you used for the experiment.

Please describe the main Uncertainties that may impact your results in this paper

Lines 166 -169 you do not need this, this paper stand by itself, if you insist using the reference of part 1 at least explain how the set up here is different.

Line 185-186 instead of sending us to the paper just write in short here. Here you said RH was kept at 95% in the other paper as 71% so I am confused that's why you need to write it clearer here.

In Fig 6 you show different droplets sizes, how do you know these sizes how they were evaluated.
Line 241 – you cite Ardon-Dryer et al. (2015) but it is not your reference list

Lines 284-285 information of the duration of each experiment should have been provided in the experimental section
Line 285 - growth factor of what droplets or aerosol

Results and discussions

Line 308 - Extension of the Dépée et al. (2019) model,
Maybe this should be in your method parts and not as part of your result
Lines 312-313, unclear what do you mean?
Lines 316-317 hard to follow what belongs to what, which Eq 9? perhaps add them as an appendix

Line 324 and Table 2- where are these 4 AP sizes come from, in the method you presented other sizes. what do you mean wet AP, you mention it here for the first time?

Consider presenting Table 2 as a plot it is hard to see any connection between the variables.
Line 367 - what about the size or charge of the droplets was it kept constant? In the table, before you mention different charges, which one was used here

Line 346 - What do you mean have like signs

Line 349-350 – what do you mean this is not clear

Line 362-364 – seems like something as figure caption more than information on what presented in fig 8

Line 368 -370 this is not true, you write as if forces are equal, but we know they are not. Depending on the particle size

Lines 398-399 – rewrite the sentence add information about why it is important to do it

Line 415 no need for (*when color goes to blue*).

Lines 448-449, I disagree perhaps you have something in the model that has a bigger impact and it causes that uncertainties and disagreement with the measurements.

Lines 461-463 Unclear, these are also something you should talk about in the method part

Lines 468 – 470 – information that should be in the method also

Line 472-473 I think you should start this section with this, talk about the agreement up to 10^{-3} and then talk about the disagreement

Lines 478-492 you can calculate CE while changing AP sizes as suspected in the chamber their size might change, this way you could see if this can explain the differences you see

Conclusion

Your conclusion looks more like a discussion than a conclusion, I recommend organize it differently.

Reference

For forgot to put your 2019 paper

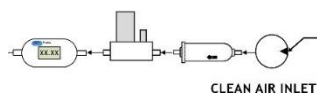
For your 2020 paper, you can at least write submitted and to where, since it is ACP it should have a DOI number

Comments on Figures

Figure 1.

I am not a big fan of Fig 1. It is too complex and confusing, too much information (AP and droplets size, flow charge, etc). Since you are describing, in general, the different mechanisms that impact the CE processes, I would prefer to see something more general as Fig 1. in Ardon-Dryer (2015).

Figure 2.




What is this part for:  and where is the piezoelectric injector it is not clear from the figure?

Figure 5 is very similar to a figure 5 you have in a paper in part 1 do you need it here.

Figure 9 what size of AP was used here?

Figure 10 - *The color code referrers to the droplet radius*, I believe you meant AP right not droplets

Appendix

I believe the numbers of the appendix should not continue you should give them new numbers as the appendix is a different part of the paper. Also, it would have been nice to see parts of the appendix as part of the paper when you explain your set up so we can understand in depth what you have done.

Reference used in this review

Ardon-Dryer, K., Huang, Y.-W., and Cziczo, D. J.: Laboratory studies of collection efficiency of sub-micrometer aerosol particles by cloud droplets on a single-droplet basis, *Atmos. Chem. Phys.*, 15, 9159–9171, <https://doi.org/10.5194/acp-15-9159-2015>, 2015.

Tinsley, B. A., Rohrbaugh, R., and Hei, M.: Electroscavenging in clouds with broad droplet size distributions and weak electrification, *Atmos. Res.*, 59, 115–135, 2001.