Submitted by Mazoyer et al
Title: Experimental study of the aerosol impact on fog microphysics
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Rev. A

Decision: major revisions and re-review

General:

This paper uses SIRTA measurements to study hygroscopicity of aerosols and its impact on fog formation, as well as CCN, and Nd and Na relationships. Overall, it uses extensive data set but quality of analysis needs to be improved before its acceptance. Based on previous version, which is very similar to this work was published, I expect that this paper should be prepared in a better way. After completing reading it, I had more questions than answers. Most of the figures do not really obtained properly, I had lots of questions with them.

I feel objectives were not clearly set up in the beginning because of this, I don't see this work is an accomplished work. What were the outcome of this work is not clear. This can be seen in discussion and conclusions sections.

Major issues:

The goal of this paper is not well defined and analysis has various issues, looking at figs one can see it easily. Overall, good data set but not accurate analysis is done. In discussion section, I don't see authors focusing on the uncertainties but stating more on how good is their results. In fact, various issues exist related to observations, and also as done in the analysis (see below).

Second parag in Discussion is not good one, people look at the fog droplet spectra and by definition droplets are above the 1 micron usually. What you did doesn't explain what is wrong with this. You also state in same parag that Nd was lower in your case…… why? Is this because you have measured drizzle but not fog droplets???? You need to show time series of Vis and summarize the results.

You need to state how did you average your obs and why? Then, how did you come up with your plots if they are acceptable?

On pag 15; last parag., your values are much lower compared to models, what this tells you? Either model doesn't do good job or your obs are not good.

LN11; median value ~3.8 micron??? why it is large?

In conclusions; you are saying winter time fog events???? How do I know? Why not provide T and Uh for each case?

Nd/Nact~ 0.25 to 0.67; in reality, Nact~Nd, why this comes out of this work? Your figures suggest that Nd>Nact (see above). What is going on here?

I will now start with figures:

Table 1; it is a good table summarizing sensors, needed.

Fig. 1 for 2 cases Nd about 127 and 46 cm-3, why these are selected and like to know in Table what is the fog droplet size range? Please provide min and FM100 values, additional to mean. Any drizzle formed on these cases? This can create lots of issues. I feel because of smaller Nd from fm100, for many cases, you likely have drizzle here. How did you eliminate drizzle?

Fig. 1 why large Nd diff between FM and WE over same size range? This shows serious issues for combining these two sensors, and derived parameters after combining them. Basically you cant combine them if both measuring fog particles because large diff exist. If not, explain to me why is that?

Fig. 2 FM100 versus WE plots; these correlations are useless, no correlation in fact. You need weighted averages and then use fits. How can you do a fit if 1000 points of data at the same location but 10 points in other place? This figure can't be acceptable for fits. Same after this figure discussion.

Fig. 3; What is the sampling rate/averaging time period of these data points? Do these points represent an event averages? Then you are comparing 2 different things, you cannot do this. Also, show some fog Nd versus Na from other works here. To me no relationship exists between Nd and Na.

Fig. 5; Show RHw here please. Also, SMPS decreases while Nd increases before 6 am, is this correct? Nccn and Nd should be correlated positively.

Fig. 6; This is not valid for real atmosphere because we don't see Sw >0.1%often. Then how can we trust these kappa values applicable to real conditions? How about model predictions?

Fig. 8; Again, what is the averaging length for these data points? To me no relationship can be seen.

Fig. 9; a) no relationship, b) obvious because you use same sensor for the data points, again, averaging conditions? C) no relationship.

Fig. 10; To me no relationship exists. Averaging scales? B) see above.

Fig. 11; Same reasoning, see above, averaging scales? Nact versus N* no relationship; why is that?

Fig. 12; are your data points are from CCN chamber measurements? How Nact is obtained from field observations of RHw? At SS=0.5% you have 3-4000 cm-3 ~ Nd, did you observe this during field project? How accurate SS in the field data? At SS=0.05%, basically no change in Nact? This is your final figure, and should do a better job to explain it, presently, not enough to be understood properly.

Fig. 13: How come CCN can be more than N*? What is the uncertainty in this figure's result? Basically N*~Nd, then CCN called like this because they are play a role in droplet formation. We should expect Nd getting close to CCN but not more than CCN? Please explain for your case.

Fig. 14; is this for dry aerosols or wet aerosols? Which sensor? SMPS? If dry aerosols, then why we expect to see change in SS. To me again there is no relationship.

Fig. 15/16; Same reasoning for plots above.

Overall, I see lots of issues with this work, with many claims but not clear accomplishment for the goals setup which need to be listed, and then responded, otherwise, I will not recommend his work for a possible publication.

Table 2; serious problems, if thick fog, then how can we see Nd less than 50 cm-3? What do you mean with thick? Like to see Vis time series to validate your results given in table. Problem in this work is that too much info but not focus on main objective.

Overall, this manuscript needs significant improvements.