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Techniques
Discussions

Interactive comment on "Inversion of droplet aerosol analyzer data for long-term aerosol-cloud interaction measurements" *by* M. I. A. Berghof et al.

Anonymous Referee #3

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This well written paper presents a new technique for analysing data from the Droplet Aerosol Analyser (DAA) in a more systematic way than previously employed. It provides a detailed, step-by-step description of the different stages required to process the data, from the mathematics of the data inversion to the losses within the system. The paper also presents examples of the data analysis products from a field campaign. It will be a good reference paper for any future projects producing data from the DAA. There are a few minor comments/issues which I would like addressed before full publication in AMT.

Minor comments/issues

I feel the introduction is focusing too much on atmospheric processes and why there is a need for a DAA and not enough on why the data analysis products are required or why the inversion has been developed. The DAA already exists and has been described elsewhere. There is no need, in my opinion, to justify it here. For example, page 10271, paragraph 1, describes what a DMPS, OPC and fog monitor can do and the limitation with not being able to relate dry size to droplet size. Similarly with the discussion on the CVI. To my mind, this should be saying 'The DAA can provide a direct relationship between dry size and droplet size, unlike other instrumentation such as DMPS, OPC etc even when used in parallel. It has been shown to etc, etc, but the challenge has been in the processing of the data. '. Similarly with the details of the data from the Po valley and the DAA - DMPS closure study, this demonstrates the functionality of the DAA, which is already established, but not the need or advantage of the inversion, which is the main body (and title) of the manuscript. Do you get better statistics with the inversion? More data coverage? Is it simply more efficient? I think it would be better to cut down the introduction and make it much more focused.

Can the authors provide an estimate of the error associated with their assumption on page 10276 that the influence of multiply charged particles on the largest sizes can be neglected? I include a graph of some data I collected recently from a DMPS using the same assumption and no impactor, which clearly shows a breakdown in the assumption. This is important because a) it is most noticeable at low concentrations and; b) it is very noticeable when the distribution is bi-modal, such as that produced by cloud processing with a distinct Hoppel dip. Both a and b are highly likely to occur in the DAA as the dry, residual distribution may not be the same as the dry, pre-cloud distribution on which their assumption is based.

Can the authors state the basis (or errors associated with) the derivation of equations 1 and 2? i.e. the linear relation.

Section 3.3.4 are there losses in the dryer and are these accounted for?

Figure 3a (legend), please change dry particle diameter to dry (residual) particle diameter.

Figure 4c and page 10285. I have a slight issue with the definition of the 50% activation as it is potentially mis-leading. This relates back to my earlier comment about cloud processing. The DAA will measure a modified, residual, dry size distribution, which is not the same as the distribution the droplets formed on. Some of the smaller particles will have grown in size and been removed from the sub-100nm mode to the larger accumulation mode when dried. It might only be a small effect, but the data could be skewed to larger sizes. This needs commenting on.

Page 10286 and fig 5c. I am not convinced the analysis is rigorous enough to be so absolute and the emphasis of this section should be changed to focus on the application of the DAA products. For example, the opening sentence could be: 'Another application of the DAA data products is the estimation of the solute concentration within the cloud. This is achieved by etc, etc and assuming etc etc. A more rigorous approach would be to have HTDMA measurements'. Or similar. Then describe how to use the data and interpret figure 5c

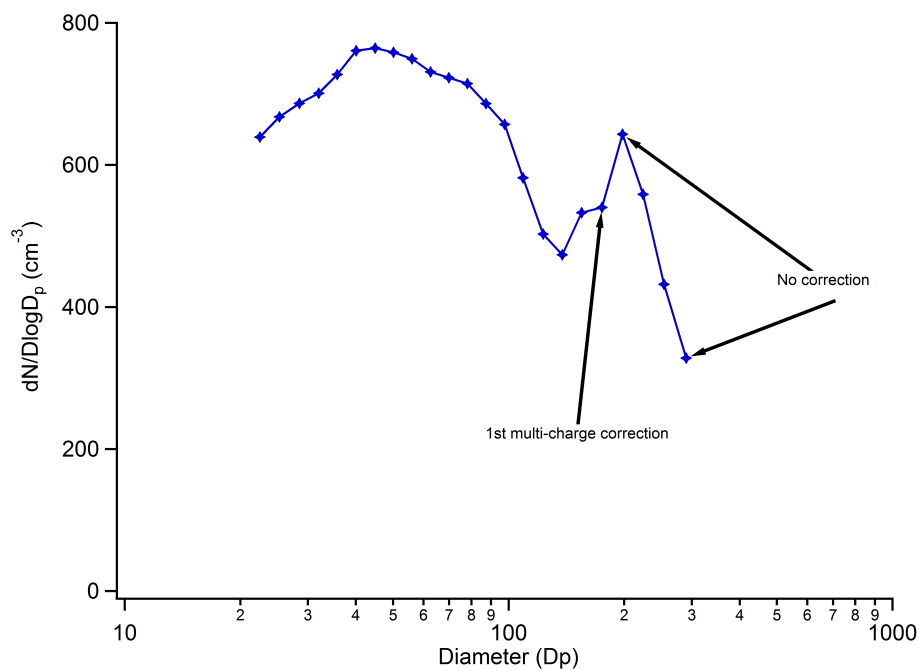Interactive comment on Atmos. Meas. Tech. Discuss., 6, 10269, 2013.

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Fig. 1.