Atmos. Meas. Tech. Discuss.,
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Atmospheric Measurement Techniques Discussions

AMTD

Interactive comment

Interactive comment on "B3010: A Boosted TSI 3010 CPC for Airborne Studies" *by* David Picard et al.

Anonymous Referee #4

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This generally well-written paper describes a method to push the minimum detectable particle size down to 1.5 nm. The authors refer to this as "boosting" the performance; a term of which I am not so fond. The formerly available CPC TSI 3010 has been modified and is appropriate for aircraft use for reasons discussed in the text. The instrument would also remain useful in ambient studies. The instrument has been out of production for a number of years, and I am skeptical of the claims "widely available on the second-hand market"; from where? I cannot see any on eBay, for example. I consider revising this statement, but agree that there are many currently in use around the world.

Though modifying and enhancing the performance of old instrumentation is a worthwhile pursuit, it would have been extremely useful to have compared this instrument

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Discussion paper

directly across all main measurement metrics, with TSI's 3756, which measures down to 2.5nm. Figure 9 would have been very interesting with such a comparison.

Further to the other reviewer's comments (which I agree with), Fig.6 detection efficiency curves are not really pleasing at all. Why not increase the particle diameter to ensure that a DE of 1 is obtained?

Figure 10b shows a systematic error to my eye; the B3010 is always undercounting, not just above 1E4/cc. I would like to see this plot on a log-log axis, and again - does the B3010 agree with a 3025 for say PSL at 300nm? There we should be getting 1:1 agreement to within 5% at least. Commercial CPCs can agree to within 1-2%, and though it's useful to push the detection limit as low as possible, if the detection efficiency at larger diameters is not 100% then there's limited use for a modified CPC.

I think you should comment, or take measurements of, the rise-time. If you're using such a CPC in aircraft, the response time is important (arguably it is in any platform). To that end, mixing-type CPCs have faster time responses than saturator and laminar flow CPCs, and should the airmass change, how long for the B3010 to react to this? I believe this data should be presented (such as changes to a filtered air mass).

There should be a comparison of different particle types of the same "size". e.g. explicit response to silver particles, sodium chloride, PSL, etc. . . and not at the lower diameter. 100nm would be fine for this. Does the CPC respond the same way as a normal CPC? Figure 4 shows that the CPC never detects all particles, but. . . surely it must do at large enough diameters? I would like to see figure 4 expanded to 500nm for example.

Basically, there should be a more rigorous analysis of this CPC compared with commercially available CPCs, namely the 3756 as this detects down to 2.5nm, but it's unlike the authors have access to this, so a 3775/6 would also suffice.

Also, I am not sure the main advantage of "lower cost" is true, and really the main advantages of such an undertaking should be for the scientific merit. I think the conclusions need expansion and are generally lacking. You should report how well the B3010 agrees with other CPCs under “normal” conditions, and also how it compares at the smaller end. What is meant by “outlook of future CPCs should be simplicity”?

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-243, 2018.

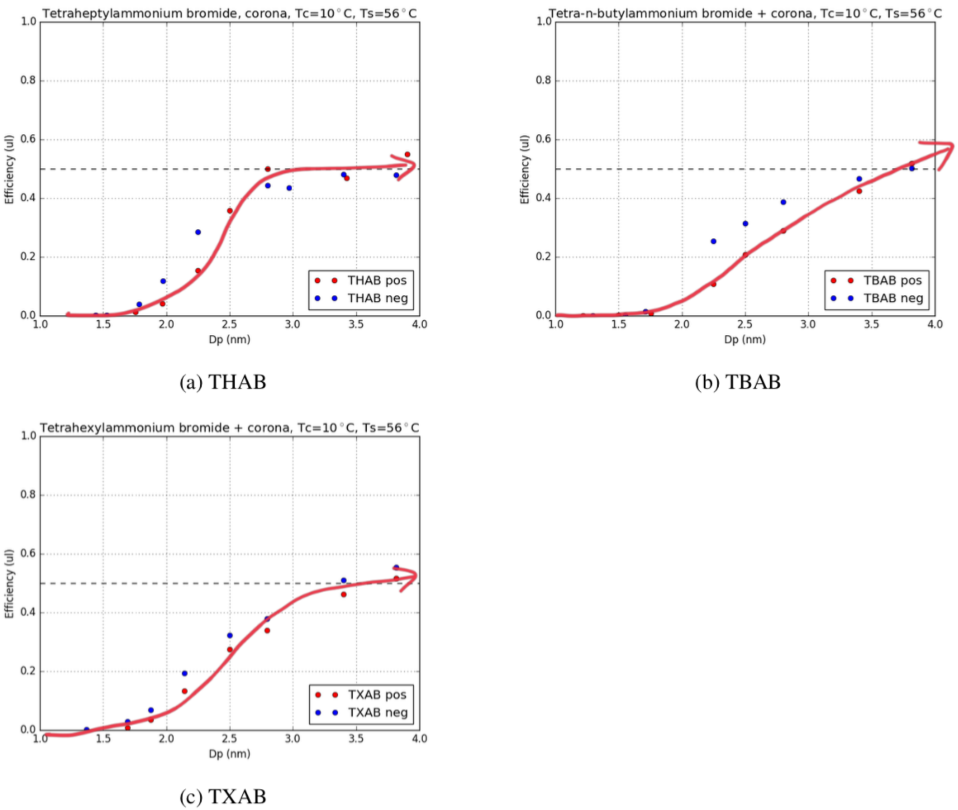

Figure 4. Efficiency curves measured for various laboratory-generated aerosols.

Fig. 1.