

Interactive comment on “Comparison between CARIBIC aerosol samples analysed by accelerator-based methods and optical particle counter measurements” by B. G. Martinsson et al.

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The authors wish to thank the referees for constructive and useful comments.

Interactive comment on “Comparison between CARIBIC aerosol samples analysed by accelerator-based methods and optical particle counter measurements” by B. G. Martinsson et al.

Anonymous Referee #2 Received and published: 2 May 2014

GENERAL The work presents a performance analysis of an impactor system used in aircraft as part of the CARIBIC project. The CARIBIC is a very important research
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program for studying the atmospheric composition in large geographical areas. The impactor method analyzed here is useful for measuring the chemical composition of aerosols and will obviously be used a lot. The analysis is clearly presented and I can recommend its publication in AMT after minor modifications. I have two fairly general questions. In the paper a lot is discussed based on the bouncing of particles outside the impaction zone. I have used multistage impactors so that some well-known grease is spread on the impactor substrates before sampling, just to prevent bouncing. Why couldn't this be used in the present setup? Discuss this with a few lines.

A: On page 3261, line 8 the following will be added: Bounce-off can be counteracted by the use of a coating of the impaction surface. Pak et al. (1992) showed that a coating of Apeizon-L grease need to be more than 9 μm thick to obtain close to 100% impactor collection efficiency for solid particles, whereas silicon oil show more promising properties with rather high efficiency at 0.3 μm thickness. However, applying such a thickness would result in a factor of 2.5 thicker sampling substrate causing typically a factor 1.6 worse PIXE detection limits (if contamination in the coating process can be avoided). The effect on carbon detection can be expected to be much stronger, because the coating thickness variance will be added to that of the polyimide film which is low (Nguyen and Martinsson, 2007). Given the usually low UT/LMS aerosol concentrations and the short sampling time, minimum detections limits are very important. Therefore no coating of the impaction surface was used. This should not be seen as a general recommendation, but rather as an adaption to a special measurement situation with respect to required detection limits and properties of MT/UT/LMS particles.

The second is that you calculate the ratio C_v/C_m and discuss that a lot. Why wouldn't you calculate C_m/C_v ? That number would be directly the effective density and easy to interpret. Is there some fundamental reason for not presenting the results and discussion in that way? If not, I suggest considering presenting them so. But I leave that to the authors to decide since I know it would require a bit extra data processing.

B. We thank the referee for the open mind. The reason for using C_v/C_m was to separate

the issues for the reader. First we discuss causes for deviations, then problems with the two methods. After that we turn to the issue on whether the two measurements arrive at comparable results. It was the first author's hope that the distraction from the latter comparison would be less in the first part of the paper with the chosen method.

DETAILED COMMENTS P3259 L20 Give some more details of the polyamide film – manufacturer, type code or similar, so that people may possibly acquire the same material for analogical measurements.

The following was added at p3259, line 20: C. . . . , Proline-10, from Moxtek Inc., Orem, Utah, USA.

p3259, L21 Description of the impactor could be a bit more detailed. I checked Nguen et al. (2006) and found there are many nozzles and orifices with different flow rates. Which ones are used here?

D. The following was added with some reformulation of existing text at p3259, line 20: The sampling unit contains three kinds of nozzles. Here the nozzles connected to the 14 channels that were sequentially activated for sampling and subsequent PIXE/PESA analysis are used.

.P3263 L28-29. "The analyses of the aerosol samples are undertaken in high vacuum. This will cause losses of chemical compounds" At what pressure does the analysis take place? For how long time is the sample in this pressure? Give a few more examples of compounds that would be lost at that pressure.

The following was added on P3263, line 28: E. . . . of approximately 10-5 hPa. The samples remain at this pressure for 6 h, the duration of both analytical steps for a batch of 21 samples. The following was added on P3264, line 7: Among other common inorganic salts of the atmospheric aerosol, sodium chloride is stable during analysis, whereas ammonium nitrate will evaporate, if present.

P3266 L7 – 15. A lot of the readers of the paper are experimentalists like me. Potential

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vorticity is not a familiar concept. I understand it doesn't make sense to start explaining basic meteorology in an AMT paper but please write at least a reference to a paper where it is explained how these different ranges of PV can be associated to different layers.

The following was added on P3266 line 7: F. This tropopause is based on the strong gradient in potential vorticity (PV) in the tropopause region (Hoerling et al., 1991; Hoinka, 1997).

Section 3.1. How significant is nickel in the upper atmosphere? Can it come from anywhere but the inlet?

G. There is no known source of nickel to the aerosol in upper troposphere. In the stratosphere nickel is abundant when the influence from meteoritic material is strong. Still the concentrations are much smaller than the artifactual concentrations obtained in clouds.

Title of section 3.4 "Relation between OPC and IBA measurements" is a bit strange – most of the paper is discussing just this relationship.

H. Thank you. We change the title to "Apparent particle density"

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 3253, 2014.

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