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Atmospheric Measurement Techniques Discussions

Interactive comment on "Application of an O-ring pinch device as a constant pressure inlet (CPI) for airborne sampling" *by* Sergej Molleker et al.

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General Reply: We thank the Referee #1 for carefully reading the manuscript and finding many valid mistakes and suggestions for improvements. All those specific comments will be addressed. As suggested, we will ask a native language speaker for proofreading the manuscript.

Specific comments: p2, l19: inner diameter x cross section (do not capitalize)

Changed.

p2, l19: please give city/country information for reference to a manufacturer of equipment, no quotation marks.

Changed to: . . .Dichtelemente arcus GmbH/Germany.

p2, l23: include proper reference to the manufacturer

Changed to: . . .rubber from the company Zhermack SpA/Italy. . .

p2, l26: . . .O-ring, i.e., the tube cross section. . . (include commas and "the"). Consider rephrasing.

Rephrased: The outer diameter of the pinch O-ring, i.e. the tube's cross section was chosen to be relatively large, as it enables higher relative shrinking of the O-ring's inner opening.

p2, l34: comma after "i.e."

Corrected.

p2, l35: ". . .not used for. . ." (d missing)

Corrected.

p2, l38: D_bore – "bore" not in italics

Changed, also for the same cases above.

p2, l45: include proper reference to the manufacturer of the pressure sensor

Changed to: CMR373-Model, Pfeiffer Vacuum GmbH/Germany

p2, l48: The research aircraft should be identified more consistently and clearly for readers outside the airborne science community (at least refer to the operating organizations of the respective platforms)

Changed to: . . .(DLR-HALO G550, AWI-Polar 6 (DC-3), Myasishchev M-55 "Geophysica", NASA DC-8, DLR-Dassault Falcon 20).

p3, l15: "meets" not "meet"

Corrected.

p3, l16: “particle” not “particles”

Correctted.

p3, sec 2 1st par: The discussion of particle losses is somewhat redundant to the next section where this is discussed in more detail. This paragraph motivating the use of visual inspection of the orifices could be shortened with reference to the next section. Consider moving this entire section after the discussion of transmission losses.

We have slightly reduced the length of this section. However, we consider it as part of the engineering process for finding a good pinching geometry and O-ring dimensions, and thus we would not include it in the methods and results section. The high particle losses of the first O-rings are given here as motivation for a better solution. The transmission efficiency at this point was measured with a different technique, namely by flash vaporization (AMS Instrument) and often more qualitatively, since losses were too high anyway. The description of this method would add even more to the particle losses section. Given that there were a few iterations of the mechanical design and O-rings, we don’t want to confuse the reader with different CPI versions and characterization techniques in the methods and results sections. For instance, an even softer silicon rubber material (shore hardness of 20) was tested.

p3, 2nd par: Is there any information on longer-term stability of the results – do the O-rings degrade after a number of pinching cycles such that the particle transmission might change? How reproducible are those results with a different batch of O-rings made of the same material?

Yes, this is a valid comment. Reviewer #2 has very similar questions and we comment on both remarks in Reply #2. We will also answer it in the revised manuscript.

p3, l43: “Supposedly” seems to be the wrong word here.

Changed to “Apparently”

p4, l8: include reference to manufacturer

Changed to: . . . referenced by a CPC (Model 5.403, GRIMM Aerosol Technik/Germany) . . .

p4, eq 1: erf should not be italicized

Corrected.

p4, l38: ...factor C, due to _the_ decrease. . . (missing “the”. Parenthesis not really needed, include into previous sentence)

Changed to: On the other hand, a decrease of inlet pressure enhances the effects of other factors such as the growing Cunningham slip correction factor C, and the increasing flow speed in order to keep the mass flow constant.

p5, l10: use roman font in formula subscripts “downstream” and “upstream”.

Corrected.

p5, l42: identify research aircraft more clearly - see comment above.

Changed as above.

p6, l2: “higher” -> “larger”

Corrected.

p6, sec 6: can the authors give an outlook to the performance of the CPI design for other particle measurements beyond aerosol mass spectrometry where the transmission characteristics of smaller particle sizes might be relevant?

We have added this to the summary: Furthermore, other particle counting instruments relying on constant pressure in their inlet or condensation cell, such as condensation particles counters (CPC, or cloud condensation nucleus counters, CCNC) can be equipped with the O-ring based CPI system. A CCN-200 (DMT, Longmont, CO, USA) was already deployed with the O-ring based CPI system (Andreae et al., 2018). How-

ever, it utilized a different O-ring with a controlled downstream pressure of about 200 hPa and an air flow of an order of magnitude higher. Therefore, this application requires a different study of the transmission efficiency.

Added to the summary: If used with a focus on even smaller particles sizes, in the nm size range, a high transmission efficiency is well maintained. This is attributed to the fact that impaction losses due to particles' smaller inertia are low, and diffusion losses are negligible due to the CPI's small internal volume and high flow rate.

Figure 1: Typo in "constant pressure inlet" Figure 7: the mixed use of color and line style is not very intuitive as only one parameter is varied here. Consider, e.g., using the same line style while labeling each line in the plot.

Corrected.

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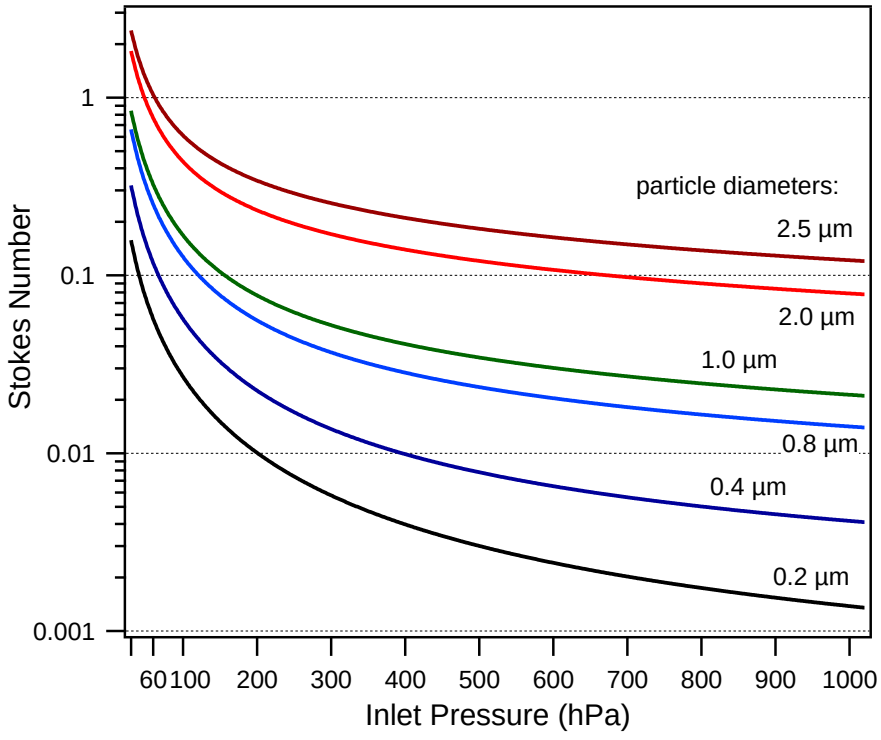

Fig. 1. Figure 7