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Atmospheric Measurement Techniques Discussions

Interactive comment on "Particle Loss Calculator – a new software tool for the assessment of the performance of aerosol inlet systems" *by* S.-L. von der Weiden et al.

J. C. Wilson (Referee)

jwilson@du.edu

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The authors have presented a description of a Particle Loss Calculator (PLC) that facilitates the analysis of particle losses in sampling and transmission to instruments. The objective is to provide a tool to those utilizing sampling and transport systems while making aerosol measurements. The PLC permits users to quantitatively evaluate the losses of particles in sampling and transport systems. They also present experimental data acquired in lab measurements of particle penetration through various transport geometries which they then compare to the output of the PLC. The comparison is presented as a validation of the PLC.

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Interactive Discussion

Discussion Paper

In my opinion this manuscript is appropriate for publication in AMTD. The tool that is presented here will be of use to those designing sampling and transport systems. The review criteria for AMTD ask: “Does the manuscript represent a substantial contribution to scientific progress within the scope of Atmospheric Measurement Techniques (substantial new concepts, ideas, methods, or data)?” I am unaware of other compilations of the literature results that facilitate the calculation of end-to-end losses in a sampling system. Substantial new results concerning sampling and transport are not presented here, but the method presented will assist members of the aerosol community. (I have collaborated with one of the co-authors, but decided that the conflict of interest requirement, #5 in Reviewers Obligations, is met in this case and that this collaboration does not bias my judgment.)

The following comments are intended to aid the authors in improving the manuscript. 1) The introduction states that the PLC addresses conditions typical of ground based sampling. But this qualification is not specific enough. This might be dealt with by adding the qualification “through a constant-diameter tube” to the description of the sampling cases covered by the PLC (Intro and lines 16 and 17 of page 1117). This would help the user avoid the temptation of applying the PLC to other types of inlet geometries such as shrouded or diffusing inlets.

2) Although CFD calculations of particle loss are not the subject of this paper, the authors offer some opinions concerning the usefulness of such calculations. And they leave the reader with the impression that CFD calculations might in fact be superior to the relations used in the PLC. I suggest that those comments be dropped. In fact, CFD calculations of turbulent sampling or turbulent transport are often not reliable (Tian, L. and G. Ahmadi, 2007. Particle deposition in turbulent duct flows - comparisons of different model predictions. J. Aerosol Sci. 38:377-397.) But many of the relationships used in the PLC capture the impact of turbulence since they describe the results of experiments done with turbulent flows.

3) The text lists many relationships used to calculate losses and provides conditions

under which the relationships are valid. To help the user avoid misuse of the relationships, it might be helpful to tabulate the mechanisms treated with the range of validity for each one. (Or the software could issue a warning if the parameters entered are outside of the validated range.)

4) Many aerosol sampling and transport systems use flow splitters. Losses in flow splitters have been studied and are not mentioned: Gupta, R. and A. R. McFarland. 2001. Experimental study of aerosol deposition in flow splitters with turbulent flow, Aerosol Sci. Technol. 34: 216–226.

5) The claim that the reported measurements validate the accuracy of the PLC is not justified and should be dropped. (a) The accuracy of the PLC depends on the accuracy of the primary literature which is compiled in the PLC. Note that figure 5 shows calculations of loss that are outside of the error bars of the measurements, but the text claims consistency of the measurements and calculations. The text does not present a careful discussion of accuracy. The only possible discussion of accuracy would be to state the accuracies found in the primary literature describing the formulas that are used. The functionality of the PLC is demonstrated in some interesting cases and those results are informative, so I am not suggesting that the results be eliminated from the paper. (b) the ranges of variable values and geometries that have been tested are small compared to the ranges to which the PLC might be applied.

6) The authors might wish to address the accuracy of the calculations done in the PLC. As stated in 5) these comments would be based on the primary literature. Would the authors suggest that users apply corrections to measurements based upon on calculated losses in sampling and transport? (For example , would they recommend dividing measurements by the sampling efficiencies shown by green line in figure 7 in a case where the line described the performance of the transport system?) Or would the authors only recommend that the PLC be used to avoid large losses such as are presented in figure 6 for particles larger than 6 microns bu altering the design of the system? I recommend the second strategy over the first.

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