Kumar et al.: **Correcting for filter-based aerosol light absorption biases at ARM's SGP site using Photoacoustic data and Machine Learning**, Atmos. Meas. Tech. Discuss. https://doi.org/10.5194/amt-2022-42, in review, 2022.

Review

General

The paper presents the use of a supervised ensemble Machine Learning (ML) algorithm for improving the constants in an algorithm used for calculating absorption coefficients from PSAP data and for calculating a new algorithm for the same purpose. The method interesting and useful since it can improve the accuracy of absorption meassurements. The paper is definitely worth publishing in AMT but I do have some suggestions and several questions that should be answered before that. They are all in the detailed comments and questions below.

Detailed comments and questions

L 45: Why not replace "Manufacturer's" with "Radiance Research"?

L66 - 79: You should also cite Müller et al. (AMT, 7, 4049–4070, https://doi.org/10.5194/amt-7-4049-2014, 2014) and note that it is based on much more rigorous theory of radiative transfer through the filter.

L72, Eq. (1): First, I suggest you don't present the equation in the introduction, it would be much more logical to present it in section" 2.2 Correction algorithms". However, where ever you present it, you should define exactly what you mean by B_{PSAP}. Is it the B_{PSAP} presented in Eq. (3) of Bond et al. (1999)? If it is, you should keep in mind that it already includes one loading-correction function f. In other words, what is your "uncorrected filter-based absorption" all over the paper? The RR 3wl PSAP firmware calculates automatically absorption coefficients corrected with the Bond et al. correction excluding the scattering correction. With user-defined constants. So is that what you think that is the "uncorrected B_{PSAP}"? If so, that is not quite correct. The uncorrected B_{abs} shoud be B_{PSAP} divided by the loading correction function f that the PSAP firmware uses. Explain in more detail. And further, if you really have used the B_{PSAP} calculated directly by the PSAP and assumed that it is the "uncorrected absorption" then you have to recalculate everything! I hope not. Recheck that!

L86-88: "Our findings show … ". I suggest you move this to the conclusions. These are all results of the whole study. In the intro you should present the goals and in the conclusions the main result.

Section 2.1 You should write something about the inlets, flows, cutoffs and size ranges for the different instruments. These are not just for fun, they are important info to try to evaluate the sources of the differences of the absorption coefficients from the different instruments.

In this section you should also tell, which filter material you used in the PSAP. That is important because the constants in the algorithms depend on the filter material.

L110-111: In this preprocessing, did you divide the B_{PSAP} with the f(Tr) that is automatically calculated by the instrument firmware?

L116-117: The AAE from the PASS data in Table A1 are somewhat suspicious. Especially the ones that have the wl 532 included. The fact that AAE(405-532) < -0 and AAE(532-781) > 2 suggest that B_{ABS}(532) is overestimated. Then this would have important implications to the factors presented in Table 2. Discuss this.

Further about Table A1. I strongly suggest you add more in formation in it. You have not presented anywhere the descriptive statistics (ave, std, some percentiles) of the aerosol optical properties during the campaign. That would be very important because it would show the range in which your results are applicable. Present B_{abs}, B_{sca}, SSA, AAE from the different instrument and algorithm combinations. Especially AAE is important, from the different algorithms. Peope use them for source apportionment. And in my opinion this table is important, it would deserve to be in the main text.

L271-275: So, this is not just an adjustment of the factors in Virkkula (2010). Do I understand right: the RFR has given as an output an equation that was used for calculating the absorption coefficients. If so, you should present the equation so that other people can use it also! What are the parameters the new function depends on?

L301-307: Please give the full functions so that other people can use and test them. What are the derived constants for wood burning and kerosene burning smoke?

Fig. A2a: You do have also EC concentration data! I suggest you use those data also, not just in this plot. Excluding the obvious outliers in the data shown in A2a, how do the the absorption coefficients with the different methods correlate with EC? From the linear regressions you would get mass absorption coefficients. What would be the derived MAC(λ)? Anything close to published ones? These info would not be just for fun, they would be an additional support for the values derived from the different algorithms.