

Review R2

The manuscript describes an intercomparison of several instruments for measuring particle mass from the output of a Mini-CAST generator. The comparison includes both offline and online instruments based on various measurement principles. The results from the instruments are compared against offline gravimetric determination of the particle mass from a filter deposition. An offline OC/TC analysis is also performed to support the analysis of the results. The Mini-CAST is run with varying amounts of oxidation air flow to achieve different levels of organic content, total mass, and different particle size distributions. A potential complication here is that all the parameters are changed together, which can complicate the analysis, but the authors make convincing arguments for the dependence of the measurement results on the changing parameters. The different methods show good agreement, to approximately 10% from the reference values, with the caveats that PPS requires a size dependent correction and with MA300, different wavelengths correlate with the total particle mass, depending on the OC/TC ratio.

I believe the topic is suitable for the journal and would be of interest to its readers. The measurements and the analysis are described thoroughly, and support the conclusions mostly, but there are a few unclear points I would ask the authors to address. I have also listed a few stylistic or typographical points at the end.

line 182: Any comments on why the PPS correctly estimates the largest particles from Mini-CAST, if the size distribution from the engines, which were used in the calibration, is mostly smaller particles (according to the geometric mean at line 119)?

The PPS measures leakage current based on the electrical charge of an entire particle size distribution. Its calibration was performed using aerosols generated by a diesel engine, which were variable in concentration but stable in terms of median diameter—monomodal distributions centered at 48 nm with a geometric standard deviation of 1.78. In our study, the aerosol characteristics are more variable, including parameters such as the OC/TC ratio and the shape of the size distribution, which ranges from monomodal to strongly bimodal. We observe that as the median diameter of the distribution decreases, the OC/TC ratio increases significantly. For instance, even with a median diameter close to 48 nm, OC/TC ratios can already reach high levels, around 40%. However, no information is available regarding the OC/TC ratio under the PPS calibration conditions. A high organic fraction may alter the morphology of the aggregates, and consequently the surface electrical charging, which is the basis of the PPS measurement principle.

We changed this sentence to “the PPS mass calibration constant was established essentially on automobile emissions with a relatively limited range of size distribution in numbers”

We also added uncertainty on this figure to consider all experimental uncertainties.

figure 6 (right): I don't quite understand the bottom axis here. Should it not match the last column of table 1? For example, the point marked 1.2 has a median diameter of roughly 60 nm in table 1, but in the figure it looks to be less than 50 nm. The point marked 1.25 also appears to be out of place in the figure. It's “median diameter” in the figure is closer to the mode 1 diameter from table 1, to my eye. The axis title is also unclear.

Indeed, there was an update that was not made in the version submitted, and we took that into account. Thank you, it has been corrected in the article project.

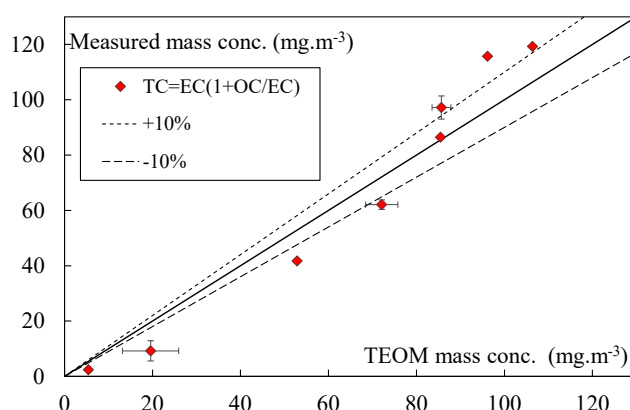
line 189: The statement that the concentration ratio of PPS/gravimetric is independent of the median diameter may be a little misleading, since the diameter is very close to each other in this range of oxidant flow rate. That is, based on the table 1 data, unless the figure 6 data is correct and I have misunderstood something here.

Indeed, we discussed this point in your first comment. We think we have answered, and we also believe it must be limited to the air range mentioned. The sentence has been updated to:

“The raw PPS measurement becomes reliable for soot generated with an oxidation air flowrate in the limited range of 1.3 to 1.5 L/min, where the mass concentration ratio between the PPS and the TEOM reference method remains nearly constant and close to 1, regardless of the measured median diameter.”

line 238: Did you try to evaluate the MA300 data from the different wavelength channels together? For example, could you try to estimate the total mass from the BC and BrC fractions together, with less dependence on the OC/TC ratio?

Indeed, the purpose of using multiple wavelengths is to access more detailed information about the composition of carbonaceous particles. It is known that the 880-nanometer wavelength corresponds to a maximum response from the so-called black carbon fraction, and it is also known that the presence of BrC—representing a significant organic fraction—can be detected at the 375-nanometer wavelength. We could not exploit the ultraviolet results to account for BrC. However, by correcting the results obtained in the infrared—thus corresponding a priori only to the black carbon portion—using the formula $TC = EC \times (1 + OC/EC)$, we obtain a diagram like the one shown below. The proposed correction, through the consideration of the OC/EC ratio, indeed allows for a correction of the mass concentration referred to as black carbon. But the limit here is that the correction is based on an thermooptical measurement technique.



Minor comments:

line 45: Although it becomes clear from context later, it is unclear here, what instrument the sentence “and considered as the reference measurement” refers to.

Indeed, in the revised version and based on the comments of R1 and R3, we have evaluated the mass concentration downstream the diluter with different instruments and finally considered the TEOM as the reference instrument. The manuscript is revised as:

“The mass concentration evaluated by the online devices (MA300, PPS Pegasor, and SMPS) and the offline direct gravimetric measurement were studied as a function of the reference mass concentration evaluated by the TEOM. The evaluation of the OC/TC ratio done from the filters, and the size distributions of the produced soot particles are also necessary for the interpretation of the instrument responses.”

line 47: you should mention the OC/TC measurement done from the filters here. Right now, it sounds like SMPS could do that as well.

Indeed, the sentence has been clarified.

figure 5: I would suggest changing the legend entry for “Improve A” to “OC/TC analysis” or mentioning the protocol also in the figure caption.

Indeed, the figure caption has been modified.

figure 7 (left): there seems to be a typo in the bottom axis title.

Thank you, it has been corrected.