

Interactive comment on “The influence of temperature calibration on the OC-EC results from a dual optics thermal carbon analyzer” by J. Pavlovic et al.

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Responses to Anonymous Referee #1

Referee #1: The paper addresses the temperature calibration issue for thermal-optical carbon analyzers and provides a first insight on the application of a temperature calibration device and its effects. Even though the experimental work is limited to one instrument and one type of aerosol it indicates the potential benefits of the implementation of temperature calibration in Quality Assurance and Quality Control procedures. Further, it provides the base for further research and discussion that can lead to im-

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provements in instrument and consequently study comparability. Finally, the paper introduces the temperature calibration procedure in an informative way, which is useful to other users willing to apply the method. Therefore I suggest the publication of the current work with minor revisions:

1. Referee #1: Page 3329, 2.4 Sample analysis: There were only TOT results considered for NIOSH5040 while TOR results were available. Could you explain why TOR results were excluded from the statistical analysis?

Author response: In the past NIOSH carbon results have been always TOT corrected and IMPROVE TOR corrected. Therefore, at first we included only NIOSH TOT and IMPROVE TOR results, since these are the 2 mostly applied methods and we wanted to see influence of temperature calibration on these two thermal-optical protocols. However, in this last version of the MS for the IMPROVE method we included both, TOT and TOR results, to be sure that results that we observed are consistent and that selection of optical correction is not reason for significant changes seen in the carbon results. In order to make this clear to the readers we now included new sentence in the MS (line 164-168): “IMPROVE carbon results have been usually TOR corrected. However, in this study for the IMPROVE protocol, both TOT and TOR results were used to evaluate the effect of the oven temperature calibration (TCAL) on the OC-EC fractionation and to be sure that results found are consistent and selection of optical correction is not a reason for possible changes found in the carbon results. For NIOSH 5040, only TOT results were considered since NIOSH carbon results have been always TOT corrected.”

2. Referee #1: Page 3331, lines 9 and 10: For clarification, _ 450 oC should be modified to _ 475 oC and _ 890 oC should be modified to 550 oC _ T _ 890 oC.

Author response: The comment is accepted and MS is corrected accordingly (line 206-207).

3. Referee #1: Page 3331, line 29: Temperatures indicated should be adjusted similarly

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to page 3331, lines 9 and 10.

Author response: The comment is accepted and MS is corrected accordingly (line 220).

4. Referee #1: Page 3332, line 30: Temperatures indicated should be adjusted similarly to page 3331, lines 9 and 10.

Author response: The comment is accepted and MS is corrected accordingly (line 221).

5. Referee #1: Page 3332, 3.2.1: The statistics show that EC and TC did not produce a statistical significant difference while OC showed a significant reduction of 12%. Nevertheless, this does not seem logical from a mass balance perspective. Maybe it could be further discussed? Is it explained by the fact that in principle the samples analyzed contained more EC than OC?

Author response: That effect is now better explained in the revised MS (lines 236-241): "Significant reduction of OC by 12% and no difference in EC and TC results are explained by the fact that average OC concentration in the samples analyzed by the IMPROVE protocol was two times lower than the average EC concentration in the same samples (Table 1). Therefore, different sample matrix with higher OC/TC ratio, and in particular higher semivolatile OC concentration (susceptible to pyrolysis, as discussed in section 3.3.1.) might result in significant increase of the EC concentration in addition to the decrease of the OC, while keeping TC values the same before and after the TCAL."

6. Referee #1: Page 3335, line 1: A range of percentage is given, 10-12%, while this is not the case in the rest of the text. Could you specify the separate values for TOT and TOR respectively?

Author response: MS is corrected accordingly (line 284-285).

7. Referee #1: Page 3336, line 12 and 18: It is not mentioned if the 16% increase of PyC is significant or not (probably not). While in page 3335 the respective percentage (10 to 12%) is mentioned to be significant.

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Author response: From the Table 5 the reviewer can see if the PyC change is statistically significant or not ($P < 0.05$). However, to make things more clear we now explained in the MS that PyC change seen in NIOSH protocol is not statistically significant (Line 318).

8. Referee #1: Figure 3: It would come handy if the sub-fraction periods could be illustrated. Maybe on the time axis?

Author response: That can be illustrated only for NIOSH temperature protocol where we have fixed and the same residence times before and after TCAL. However, for the IMPROVE protocol residence times are not fixed and vary and we have different sub-fraction periods before and after TCAL. If we illustrate that different sub-fraction periods in Figure 3 (that already has a lot of signals shown) the Figure might become confusing. Therefore, we decided to keep it in the present form.

9. Referee #1: Figure 3 (B): The transmittance signal seems to be higher after the TCAL at the end of the run. Could that indicate that the filter after analysis prior to TCAL could have some remaining EC? This may explain the 2% difference in TC before and after the TCAL (even though non-significant). It does not become clear in the graph, but the same may apply for the IMPROVE protocol.

Author response: Thank you for pointing this out. You helped us spot an error in Figure 3B, which is now corrected in the MS. Actually, the transmittance values at the beginning and throughout the whole run (for that sample) were about 10-15 % higher after TCAL (see updated Figure). So, the increase is not unique to the run end. Nor is this difference necessarily influencing the final OC-EC results because the char correction method measures $I = I_0$ which is independent of the absolute value of the starting transmittance (I_0). For the IMPROVE sample shown in Figure 3A the laser signal difference was less (~ 2%) and therefore difficult to see. In addition, the 0.98 ratio (2% difference in TC values from table 4, being referred to) is for TC (after TCAL)/ TC (before TCAL), not the opposite, and that means that we have slightly more TC before

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TCAL. The Figure 3B case is not the same for all samples analyzed and therefore, as reviewer already mentioned, statistical analysis showed that this difference (TC before and after TCAL) is not statistically different and hence not further discussed in the MS.

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