

Comments:

This paper describes organic and elemental carbon concentration measured at one site using different sampling devices and flows and using different temperature protocols for analyzing TC, OC and EC. It tries to evaluate how well results are comparable, which is important as it is known that at least the used temperature protocol and used optical correction method have affect to the OC and EC concentrations. Also, different ways of correcting/uncorrecting gaseous artefact were studied.

The paper has clear structure and objective and it is worth of publishing after revision. Detailed comments are described below. In addition to these comments, clarify much more clearly, which results are new and not presented before. Occasionally, it was not clear whose results were presented. Also, check that same tense are mainly used when presented your results. Consider to retitle the subtitles in Results and discussion chapter, some of them were not informative if the names of the network are known.

Abstract:

Based on the suggested correction, modify the abstract.

Lines 23-30: OK

Lines 30-32: Why not compared without normalizing the concentrations? Check comment further below. Otherwise this kind of information belongs here.

Lines 32-36: this is not the objective of this paper and not actually studied here. The discussion of the sources of OC and EC is presented in lines 417-425 and are based on other studies. No proves for forest fires occurrence were presented although speculated. Anyway this is not the scope of this study, if I understood correctly. Remove.

Lines 38-41: these lines are more like a conclusions not belong into the abstract.

Introduction

Line 43. Modify the sentence to remove double parentheses e.g...carbonaceous aerosol, including elemental carbon (EC), often referred to black carbon (BC) and organic carbon (OC) make up a large fraction...

Line 43-44: reference needed

Lines 120-127, Objective:

- be more specific of how many sites are compared in this study (in line 120-121). Now I got the feeling that multiple sites were compared (line 125)
- remove the names of the networks or write them open

Sampling and Measurements

General comments: overall it is slightly difficult to remember the name of the different networks and the used protocols. I need to check them constantly. In the Results and discussion, use other subtitles than the name of the network vs other network.

Line 151-153: Modify the sentence by replacing “The IMPROVE measurements... to Results of/from the IMPROVE measurements

Lines 140-155: Add information if they are sampled at the same day as at the IMPROVE network and add sample amount into Table 1.

Line 155. I do not understand the reference of IMPROVE. Is it a book, paper or internet page? Specify.

Line 166: Re-locate the manufacture info of the quartz filters directly after quartz filters were mentioned.

Lines 163-170: Add information of the sample amount for Sunset-TOT and DRI-TOR and both into table 1.

Line 171-172 Use reference not internet pages for Sunset instrument. Add also, information of the manufactory, and country.

Line 176-178. This sentence is slightly confusing. Are you referring to results presented in Chow et al paper? Modify this sentence more clearly. Inform also what “small difference” means e.g. how much TC mass differs between IMPROVE_A TOR and Sunset-TOT/ DRI-TOR.

Line 179: the subtitle “the ECCC Canadian Aerosol Baseline Network” is slightly confusing as you used name of the CABM network later. Replace to CABM.

Lines 189-191. Add the amount of the filters.

Differences in Sampling and Analysis among Networks

Line 213: Modify the sentence so that network is added e.g. cyclones were used in IMPROVE and CABM networks whereas an impactor was used in CAPMoN network.

Line 215: bounce or bounce off. Check, which is correct?

Line 225: Re-order the list so that IMPROVE is before CAPMoN, as it was first introduced in the manuscript.

Lines 225-228: Specify how CAPMoN results (TC, OC, EC) are calculated especially when monthly mean values are presented. Did you use monthly mean value for vapor artifact or did you subtract vapor artifact for individual sample and then calculate the average.

Line 229: References needed after the statement “multiple studies”

NIST urban dust standard comparison (SRM 8785 & 1649a)

Remove the NIST and (SRM 8785 and 1649a) from the subtitle

This chapter need to be reorganized and clarified. I did not understand if the intercomparison is the same as the analysis of four replicates.

Reorganize:

Paragraph 1:

Start with the introduction of the urban dust sample (SRM 1649a) then describe how SRM 8785 is done and continue with the reference. After those, describe the intercomparison/analysis of four replicates.

Line 237: "OCEC measurements" is not right way to describe OC and EC analysis. Modify the sentence e.g. consistency between the ECT9 and the IMPROVE_A TOR analytical methods were assessed by measuring four replicates of

Line 239: replace IMPROVE_A to IMPROVE_A TOR

Line 240: replace "measuring" to analysing

Line 246-247: ECCC and DRI laboratory has not been presented. Could this information be added under the network presentation e.g. in line 151. Once sampled, filters were stored in freezer until they were ready to be analysed in the DRI laboratory in xx. Similarly the ECCC laboratory.

Paragraph 2: Show first the results based on Figure 2, where analyzed results were compared to the reported one. Change then the numbering of the figures, if Fig. 2 is presented before Fig. 1.

Paragraph 3: Compare TC, OC and EC results analyzed with ECT9 and IMPROVE_A TOR protocols. Were there any test solution that were analyzed during the intercomparison that could indicate the reason of discrepancy (instrumental, inhomogeneous sample etc) of TC between two different protocols and instruments?

Specify whether linear or orthogonal regressions were used in Fig 1. Orthogonal is better if either of the instrument is reference one (and concentrations are known).

Line 251:Use correct protocol name "IMPROVE_A TOR" and remove by DRI

Line 251: "compared well" does not inform if the concentration is the same. Modify the sentence.

Paragraph 4

Line 257: clarify what multiple SRM 1649a samples mean. Was it three samples as mentioned in line 266?

Line 267-269: EC to TC ratio of 0.425 measured with carbon isotopes should also compared to the value analyzed with ECT9 protocol. Now it has been compared only for reference value and result derived from the IMPROVE_A TOR protocol.

Line 261: refer that the method is presented in the Supplement material section. You can also consider to present the calculation (Eq 1) and text describing it in the Supplement material section.

Results and discussion

Add one paragraph where you have presented how you have compared different samples having different sampling times. If you compare weekly samples to 24h-samples collected every third day, have you calculated average of 2-3 samples and how you have weighted the sampling times to match to the weekly samples as well as possible or have you only compared monthly values. Also, inform if exactly same days

were sampled for IMPROVE and CAPMoN networks. Remind readers that Aug 16, 2006 – Oct 24, 2008 24h-sampling had different sampling times in IMPROVE network than after that.

After this, you can continue with PSAP measurement, but maybe without any subtitle, which is confusing as you have compared PSAP results here. If subtitle is needed, maybe something about “comparability”

PSAP measurement need to be explain under the Sampling and Measurements chapter.

Lines 272-276: Are these results and interpretation presented by Yang et al. or are they interpreted by the writers? Clarify.

Line 279-280: How have the correlation plot in Figure 3c done where weekly and every third day samples were compared? Are the third day samples averaged over 2-3 samples to cover the week samples or are they monthly averages? Clarify.

Vapor adsorption corrections

Line 284-286: Why monthly averaged results were presented and not daily? If I understood correctly, artifact correction was made for daily samples. I do understand that it is difficult to present data over long-time period, but clarify how the monthly averages have been calculated. Were artifact subtraction made individually for each sample, which were then averaged over month or calculated first monthly averages of OC and monthly average of gaseous OC and then subtracted. Specify here or in the beginning of the “Results and discussion” chapter.

Lines 285-286: Throughout the paper POC is discussed separately, although it is already included to OC. It is slightly confusing. If not presented/published before, I recommend that one section/paragraph is added where the contribution of POC (monthly averages) from TC for all protocols are presented and discussed. In addition, POC comparison between 24h TOT (Sunset-TOT) and TOR samples (IMPROVE_A TOR) and between DRI-TOR and IMPROVE_A TOR samples should be done. POC discussion, plots and statistics can be removed elsewhere in the Results and Discussion chapter.

Line 293-294: This sentence is quite loose if the readers have not information of the gaseous artefact of IMPROVE samples. Remove the information presented in lines 309-313 after the information of the CAPMoN samples (line 293). Explain to the readers what anchor IMPROVE sites are (Line 312). It may also be reasonable to remove the blank concentration discussion here after the gaseous artefact discussion.

Add field blank contribution for uncorrected OC values for all three networks. Now, only results of IMPROVE measurements were presented.

Line 296: add detection limit in the unit of $\mu\text{gC}/\text{cm}^2$ in parentheses

Line 299: Clarify, why vapor adsorption affects POC correction.

Line 302: remove information in the parentheses (red open circles)

Line 306: add reference after the sentence mentioned of POC to EC ratio. Correct also the mark EC/POC ratio as EC/POC already means a ratio of EC and POC. Discuss of the POC/EC using different protocols and their differences (shortly).

Figure 4: Rescale the y-axis for EC. Remove the POC plot as OC includes the POC.

Figure 5: In this plot, all data points (daily) can be easily presented instead of monthly (, if exactly the same days are sampled). Use daily data and add regression lines and equations for both data sets (DRI-TOR and Sunset-TOT). Use the same color for dots and line for DRI-TOR and another one for Sunset-TOT or color-coded the marks based on the time (or season) for DRI-TOR and Sunset-TOT. Use e.g. gray scale for Sunset-TOT and rainbow scale for DRI-TOR. If too messy, remove one of them to supplement (or make two plots). Also, specify why the linear regression should be go through the zero.

CAPMoN vs. IMPROVE measurements

Line 318: Instead of the used subtitle, could it be “comparison of daily sampling methods” or something which describes more illustratively what is compared, if the networks are not familiar for the readers.

Lines 319-321: The discussion of summer peak should be removed to the chapter Seasonality in Carbon.

Lines 321-326: the correlation coefficients have been presented in the table 2, do not repeat the values in the text. Concise these lines e.g. better correlations of TC, EC and OC were found between the protocols that use same POC correction method (DRI-TOR and IMPROVE_A TOR) than between Sunset-TOT, which use transmittance for POC correction and IMPROVE_A TOR (Table 2). Especially correlation of EC between Sunset-TOT and IMPROVE_A TOR was poor. Note, that Sunset-TOT and IMPROVE_A TOR had slightly different sampling time.

Figure 6: CAPMoN time series have been already presented in Fig 4. Remove this figure and plot correlation plot between IMPROVE and CAPMoN 24h-measurements (, if exactly the same days are sampled) instead of monthly mean. Color-code the marks based on season/time/or something else.

Lines 327-331 and Table 2: Clarify what kind of regression (linear, orthogonal) has been used. Prefer orthogonal. Clarify also, are the regression calculated from monthly mean values? Remove slopes, which are already presented in Table2. Explain why Regression 1 was used. Is it correct to force through the zero?

Lines 332-336: remove this paragraph to the new POC section.

CABM vs. IMPROVE measurements

Line 337: Change the subtitle e.g. Monthly comparison or something else

As CABM measurements does not subtract the gaseous artefact, the writers may consider to plot figures 6 and 7 with uncorrected data.

Figure 6: remove 6a-c to Supplement and delete 6d. Modify Fig 6a-c so that common x-axis is used to save space. Refer also to Figure 7 that should be presented against (x-axis) to CABM network that has the different sampling time compared to other networks.

Line 340-341: after “comparable” should be present correlation coefficient. The percentage shows the similarity of the concentrations. Also, if it is said that concentrations are higher, the writers should said where to compare “higher than”. Modify this sentence.

Lines 342-346: Again, I do not understand why both regressions are presented. Why fits are forced through the origin? I recommend to use only regression with intercept unless there is a clear reason for forcing through the zero. Again if comparative is used, there have to be the other party.

Lines 351-352: CABM network did not see any short-term variation as it has week-long sampling time. Anyway the Fig. S3 shows monthly mean values that is even longer time than week. Modify the sentence.

Line 353-359: POC discussion should be remove to its own section/paragraph. In line 356, Table 3 has not been presented yet. Why not use table 2? Remove the regression discussion with forced intercept

Comparison of the Normalized Time Series

I do not understand this chapter. Why the data should be normalized to Jan 2008 data? This can be removed or explained better the meaning of this chapter.

Seasonality in Carbon

Although this chapter if very interesting, it is not part of the objective. To stay with the objective, it would be interesting to see how the gaseous artefact correction varies between the season/temperature for DRI-TOR, Sunset-TOT and IMPROVE_A TOR. The writers can use the Sigmoid function if wanted but concentrate on the contribution of gaseous artefact. Also comparison of TC, OC and EC during different season between different networks is interesting. Is there any differences between different networks based on the season?

In the beginning of the Results and Discussion, the writers can present general overview of the results (yearly concentrations of TC, OC and EC). In addition, wind roses and footprints, if wanted, can be presented shortly here and put the plots in the Supplement.

Conclusions:

Based on the modification and comments, modify this chapter. In addition

Line 443-444: the filter face velocity does not affect for the field blank concentration. Now the readers may get wrong message. Modify. Add also information of the other field blanks e.g. field blanks accounted xx-xx% (xx-xx ugC/cm²) of the measured OC.

Lines 445-446: I am not sure if this statement was proved in this manuscript, although true. Modify this sentence e.g. Start with the information that CABM network did not correct gaseous artefact and its OC has xx% higher concentration than with two other networks that had the correction done.

Lines 446-448: I do not understand this statement or its purpose. Too long story and too much details (like values of r). Describe the contribution of POC of TC /OC.

Lines 451-452: SRM 8785 samples demonstrate the consistency of the different protocols not long-term carbon measurements. Correct.

Line 457: “North American harmonized carbonaceous concentration map” is new for me and may be to other readers. Clarify shortly

Supplement:

Line 69-70. Actually internal signal is used to correct slight variation during each analysis. TC, OC and EC concentrations are calculated based on the calibration value calculated from external calibration. Correct.

Line 79: There were no IMPROVE protocol. It was named to DRI-TOR and Sunset-TOT. Correct

Table S1: Use the protocols names you have chosen to use (Sunset-TOT and DRI-TOR). First column IMPROVE_A TOR, second column both Sunset-TOT and DRI-TOR and third column ECT9

FigureS1: protocol name IMPROVE has been used, although not mentioned in the manuscript. Either rename that or add to the manuscript that the temperature steps used in analyzing particulate carbon in CAPMoN network are called IMPROVE although different optical correction used.

Table S1 and Figure S1: Replace IMPROVE_A to IMPROVE_A TOR

Figure S3: Add information that results are monthly averages.