

Interactive comment on “Inter-comparison of the Elemental and Organic Carbon Mass Measurements from Three North American National Long-term Monitoring Networks” by Tak W. Chan et al.

Anonymous Referee #1

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Review of “Inter-comparison of the elemental and organic carbon mass measurements from three North American national long-term monitoring networks” by Chan et al.

This paper summarizes collocated organic and elemental concentrations from three different types of analysis and sampling protocol. The results are useful in furthering our understanding of thermal optical analyses and resulting biases from sampling artifacts as well as temperature protocols. The paper is fairly well organized and written but could benefit from some clarification. I recommend publication after the authors address comments below.

C1

Line 1: The title, as well as some description in the text is somewhat misleading because it implies that large geographic scale comparisons are made when in fact the comparisons only exist at one site. Perhaps changing or including something regarding different analytical protocols would help clarify this point.

Line 23: Please state years.

Line 23-26: Again, similar to the title, point out that collocated samplers only exist at one site, so really what is being compared here are the impacts from different sampling and analytical protocols, not a large scale geographic comparison.

Line 29: More on this later, but I don't understand the value of the normalized comparison. The agreement depends on what you have normalized each time series to. Over what time periods where these comparisons made?

Line 35: Is there any evidence for linkages to forest fire emissions and increased vehicular emissions? Did the authors include analysis of these emissions or is this conjecture?

Line 36-37: This may be true depending on artifact corrections and how they are applied across a network.

Line 38: Again, extrapolating data and comparisons from one site to “regional to continental-scale-harmonized maps” hasn't been shown here and may not necessarily be true, especially given different sampling times and sources.

Line 23-41: I think it would be helpful if the abstract more closely reflected the comparison work rather than sources which was a rather minor part of the work and mostly based on previously published work (e.g., secondary aerosol formation in summer, smoke in summer, higher OC and EC in summer, etc.).

Line 52: OC can also absorb solar radiation.

Line 52,53,56,57: I would suggest using either BC or EC and keeping the same nomen-

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clature throughout the paper, unless the authors are actually referring to different measurements, then clarify and define.

Line 58: Include “impacts of” changing emissions since OC and EC measurements don’t directly determine emissions.

Line 61: The first sentence is unclear. Wouldn’t long term measurements just depend on making the same measurement over time and doesn’t really depend on a universal definition?

Line 67: The sentence starting with “BC is a generic term” would be a better starting sentence for this paragraph and the authors could remove the current first sentence.

Line 71: Replace “being” with “is”

Line 72: Include “as” after “EC is referred to”

Line 75: Can the authors clarify what they mean by “EC and BC resembled each other”?

Line 80: I am not sure what the authors mean by “direct measurement of carbon mass as part of gravimetric mass”?

Line 97: I’m not sure what is meant by “resulting EC method”?

Line 111: Can the authors provide a reference for the OC overestimation?

Line 120: The acronyms for the various networks should be spelled out at first usage.

Line 122: Again, this is somewhat misleading. Add that these collocated measurements occurred at one site.

Line 123: I might have missed this later, but what are the solutions for improving the compatibility?

Line 124: I am not sure the results from one site have been demonstrated to create a regional and continental scale harmonized carbon concentration data set.

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Line 138: What is meant by “regional-scale monitors”? Do the authors mean that many samplers operate across the United States?

Line 139: replace “understanding long-range transport” with “understanding long-term trends”.

Line 139-140: I suggest replacing the Malm 1989 reference with the Malm 1994 reference (Malm, W. C., J. F. Sisler, D. Huffman, R. A. Eldred, and T. A. Cahill (1994), Spatial and seasonal trends in particle concentration and optical extinction in the United States, *J. Geophys. Res.*, 99(D1), 1347-1370)

Line 143-144: The IMPROVE samplers typically sample midnight to midnight, was the sampler at Egbert running on a different schedule?

Line 148: Are the filters shipped cold?

Line 155: Spell out CAPMoN.

Line 159: Do the measurements include carbon at all of these sites as well?

Line 176: Also see Malm et al. (2001) for a discussion of sampling biases on OC and EC concentrations (Malm, W. C., B. A. Schichtel, and M. L. Pitchford (2011), Uncertainties in PM_{2.5} gravimetric and speciation measurements and what we can learn from them, *J. Air & Waste Manage. Assoc.*, 61, 1131-1149, doi:10.1080/10473289.2011.603998.)

Line 179: Spell ECCC- Also, please choose notation, either CABM or ECCC. Both are used interchangeably throughout the paper and it is confusing.

Line 184: replace “costal” with “coastal”

Line 207: replace “measurements is” with “measurements are”

Line 211: Include “an” between “uses” and “impactor”

Line 212: Replace “Impactor” with “Impactors”

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Line 218-222: See the Malm et al., 2011 paper mentioned earlier.

Line 228: Can the authors provide some references for the multiple studies?

Line 232: Change “introduce” to “introduces”

Line 236: I think you can remove “SRM 8785 & 1649a” from the section header.

Line 246: No correlations are given in Figure 1. Also include figure parts in the text and include OC.

Line 248-9: Need figure parts for Figure 2 in the text too (e.g., Figure 2(a)-(d) shows TC, EC, OC, and EC/TC, respectively)

Line 249-250: It is unclear what the authors mean by “Irrespective of data disparity”?

Line 270: I am not sure this is clear: Do the authors just resample the high resolution data for different averaging times? When they say different data sets do they mean the same measurement just with different averaging times? Wouldn't you expect these to compare well? Or do they compare EC to the PSAP measurement? The figures have units of Mm⁻¹, so it suggests that they either converted EC to absorption coefficient (if so, what absorption efficiency was used?). Please clarify, including figure caption 3 when “comparison of different sets of measurements” from (c) because it is misleading.

Line 255: Which EC/TC value was further verified? Also, replace “sample” with “samples”

Line 283: Over what time period?

Line 288: Can the authors comment on the offset (nonzero intercept) and what it implies in terms of sampling artifacts or biases?

Line 298: Yes, the POC correction directly influences EC concentrations. Can the authors comment on this vapor adsorption issue with respect to the PSAP weekly comparisons?

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Line 303: Add a period and start “An optical correction” as a new sentence.

Line 317: Include “monthly mean” before DRI-TOR CAPMon measurements and “comparable to the concentrations derived from the IMPROVE_A...”

Line 320: What are considered “good correlations”?

Line 351-352: Can the authors describe Figures 7a-c before 7d to keep them in order?

Line 355: At what level of significance?

Line 358: I am not convinced the normalized analysis is necessary and adds to the paper. The comparisons between samplers would change depending on what the data are normalized to (choose a different month or an annual mean for example). The comparisons already discussed are more useful because they show the true biases. The diurnal wind cycles on the timelines could be added to the earlier timelines if the authors want to include that analysis.

Line 393: I think elevated carbon concentrations in summer are better shown in Figure 6 given the averaging times.

Line 413: When are the concentration in the N and NW higher?

Line 414: Do the authors mean residential instead of residual?

Line 431: How appropriate is the comparison with ECT9 POC since this is a nonlinear relationship?

Line 447: Also include longer sampling time.

Line 452: What are typical measurement uncertainties? Are these greater?

Line 452: Note that others have performed similar comparisons across networks (CSN and IMPROVE) for continental scale integration. Biases for both OC and EC between networks were less than 10% (similar sampling and analytical procedures). Hand, J. L., B. A. Schichtel, M. Pitchford, W. C. Malm, and N. H. Frank (2012a), Seasonal composi-

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tion of remote and urban fine particulate matter in the United States, *J. Geophys. Res.*, 117, D05209, doi:10.1029/2011JD017122. Hand, J. L., B. A. Schichtel, W. C. Malm, and N. H. Frank (2013), Spatial and temporal trends in PM_{2.5} organic and elemental carbon across the United States, *Advances in Meteor.*, 2013, Article ID 367674.

Line 504: This link did not work, it needs to be updated: <http://vista.cira.colostate.edu/Improve/improve-data/>

Line 699: Table 1. Can the authors clarify: Is “IMPROVE” under CAPMoN consistent with lines 170-171 that lists IMPROVE-TOT for 2005-2007 and IMPROVE_TOR protocol? It is challenging to keep these different protocols straight and so careful attention to how they are referred to in the paper and the tables would help.

Line 702: Table 2: Similar comment, here it is referred to as “Sunset-TOT”. The number of significant digits included in this table seem unnecessary.

Line 710, 713: I don’t think these tables are necessary, see earlier comment.

Line 718: Figure 1: Again, please be consistent with ECCC and CABM

Line 725: Figure 2, Same comment as previous figure. What is ICP? Please relate x-axis labels to the caption description.

Line 732: Figure 3: See earlier comment- this comparisons is unclear.

Line 740: Figure 4: It would help to see the comparisons in (b) and (c) if the scales were reduced. Again, note the data description in the figures do not match the discussions or tables (e.g., “Sunset-TOT”)

Line 757: Figure 6: Please include location in this figure caption so it is clear that the three different networks are collocated at one site.

Line 766: Figure 7: Which “IMPROVE” are the comparisons made against? Please be clear in the caption to match the axis labels.

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Figures 8 and 9: Are unnecessary and do not lend to a better understanding of the comparisons.

Interactive comment on *Atmos. Meas. Tech. Discuss.*, doi:10.5194/amt-2019-104, 2019.

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