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Atmospheric Measurement Techniques Discussions

Interactive comment on "Predicting ambient aerosol thermal-optical reflectance (TOR) measurements from infrared spectra: extending the predictions to different years and different sites" *by* M. Reggente et al.

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1 Response to Referee 2 (Ref. amtd-8-C4407-2015)

The authors thank the anonymous referee for her/his constructive and useful comments. We have worked on the comments carefully and made all requested changes to the manuscript. Below, the comments from referee 2 are put in italic font, and our answers are in roman font. We have uploaded a revised version (as supplement mate-

rial) of the manuscript with the suggested changes marked in red (the changes marked in yellow refer to the changes suggested by the referee 1).

1.1 General Comments

GC-1: Overall, I found this work to be extremely well conducted for accurate predictions of EC concentrations via TOR as well as error. However, my one critique is that it not only builds on the previous study, but at some times depends on it. For example, for me to fully understand the development of the calibration model, I had to read the analysis using only the 2011 samples. This is not necessarily a detriment, and anyone interested in this method would naturally read both studies. This work did add new information which makes it stand alone, such as the added predictive error measurements.

Response: We are glad the referee found the article to be extremely well conducted. We agree with the referee that this work builds on the previous studies and sometimes depend on them. However, how the referee stated this is not necessarily a detriment. Indeed, one of the main goals of this work is to demonstrate that it is possible to reduce the operating costs of a large monitoring network, by using the calibration models produced in the previous works to predict the TOR OC and EC concentrations at different sites and years. Therefore, we found the binding with the previous works necessary.

GC-2: Two of the new 2013 urban sites, Korea and Fresno, required a separate calibration to improve EC ad OC predictions. I wonder if this implies the model approach is best suited, for now, with rural sites since there are fewer urban sites and the separate calibration curve was only applied to the newer, 2013 samples.

Response: We agree with the referee that with the calibration dataset used in this work (Calibration 2011 dataset), the models tend to be more accurate for rural sites because

the majority of the ambient samples used for calibration were collected at rural sites (76 % from six sites). However, we note that 1) the Calibration 2011 dataset contains samples collected at one urban site (Phoenix, Site IDs 3 and 3B), and 2) the model is able to predict the OC concentrations accurately for test samples collected in 2011 and 2013 at the Phoenix AZ site, and in 2013 at the urban sites Puget Sound (Seattle, WA) and Birmingham, AL. The Korea and Fresno sites require a new calibration model because the two sites may contain different types of urban sources, loadings, and chemical composition that are not well represented in the Calibration 2011 dataset. However, another solution is to include in the Calibration 2011 dataset samples collected at the Korean and Fresno sites (left panel in Fig. 1 below). The results of the new model show that including in the Calibration 2011 the samples collected at the Korean and Fresno sites, we can achieve accurate predictions of TOR OC values (right panel in Fig. 1 below, bias $= 0.07\,\mu g\,m^{-3}$, error $= 0.24\,\mu g\,m^{-3}$, normalized error $= 15\,\%$ and $R^2 = 0.93$) also in these two sites.

1.2 Specific Comments

Page 12441, line 13: It is stated that "which can be visualized" referring to the four classifications of 2013 samples. However, this is no reference to an image, only the appropriate results sections. I suggest using a different word or cite a figure.

Response: The authors thank the reviewer for pointing out this issue. We have changed the reference to the Figures: Figs. 5 and 11 (in the revised manuscript page 8 line 26 and page 9 line 1).

Page 12442, line 9: MDL is never defined. I actually did not know this acronym, which took away from the manuscripts flow.

Response: We have introduced the acronym in Section 2.5 (Model Evaluation): The

minimum detection limit (MDL) (in the revised manuscript page 9 lines 22-23).

1.3 Technical Comments

Page 12436, line 7: IMPROVE is never actually defined, other than the abstract.

Response: The IMPROVE acronym is defined in the Introduction: the Interagency Monitoring of PROtected Visual Environments network (IMPROVE, Hand et al., 2012; Malm et al., 1994) (in the revised manuscript page 3 lines 10-12).

Page 12437, lines 7 & 11: It was repeated that the same test set was used.

Response: Line 7 refers to **calibration set** and line 11 refers to **test set** (in the revised manuscript page 5 line 1 and line 5).

Page 12445, and elsewhere: Quite a few sentences began with "Figure 7 shows" or "Table 5 reports." This makes a few spots read like a report rather than a methods paper.

Response: We have changed in the revised manuscript the sentence that starts with Figure or Table:

- The comparison between predicted FT-IR OC and measured TOR OC for the datasets described in Sect. 2.1 is shown in Figure 2 (in the revised manuscript page 10 lines 13-14);
- The scatter plot and the performance metrics of the Test 2013 Addl without the samples collected at the two sites anticipated (and confirmed) to have high errors are shown in Fig. 6 (page 13 lines 7-9);
- The evaluation of predictions using a calibration model constructed from only the

Korea and Fresno sites is shown in Fig. 7 (in the revised manuscript page 13 lines 13-14);

- The results of the D^2_{M} against the absolute error for each sample (without any aggregation) are reported in Tab. 3 (page 13 lines 27-28);
- The comparison between predicted FT-IR EC and measured TOR EC for the datasets 10 described in Sect. 2.1 is shown in Fig. 8 (in the revised manuscript page 15 lines 9-10);
- The aggregated (per site) mean D^2_{M} against the mean absolute error for each dataset is shown in Fig. 11 (in the revised manuscript page 16 lines 18-19);
- The evaluation of predictions using a calibration model constructed from only the Korea and Fresno sites is shown in Fig. 13 (in the revised manuscript page 17 lines 4-5);
- The results of the D^2_{M} (and absolute error) for each sample (without any aggregation) are reported in Tab. 5 (in the revised manuscript page 17 lines 23-24);

This concludes our response to the referee. We would like to thank her/him again to have driven us to significantly improve this manuscript.

Please also note the supplement to this comment:
http://www.atmos-meas-tech-discuss.net/8/C4843/2016/amtd-8-C4843-2016-supplement.pdf

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 12433, 2015.

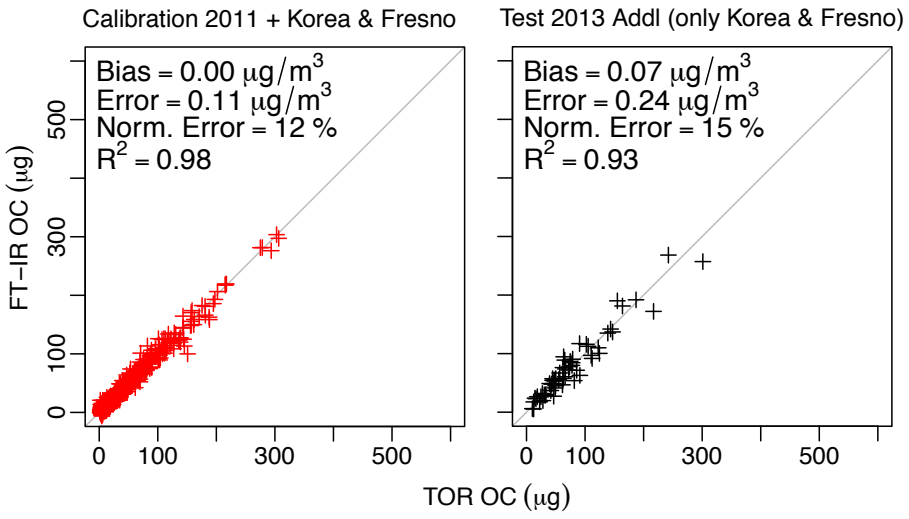

Fig. 1. Scatterplot and performance metrics between FT-IR OC and TOR OC of the Korea and Fresno sites (Site ID 10 and 11 respectively).