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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Refining temperature measures in thermal/optical carbon analysis" *by* J. C. Chow et al.

Anonymous Referee #3

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Referee Comment to the manuscript submitted for publication in Atmospheric Chemistry and Physics (ACP):

MS-NR: acpd-2005-0142 Title: Refining temperature measures in thermal/optical carbon analysis Authors: J. Chow, J. Watson, L.-E. Chen, G. Paredes-Miranda, M.-C. Chang, D. Trimble, K. Fung, H. Zhang, and J. Yu

General comments:

The manuscript addresses to the problems of an exact particle sample temperature measurement during thermal OCEC analysis. OCEC separation in ambient particle samples is still a unresolved analytical problem of considerable importance with regard

to understanding and modelling direct and indirect radiative forcing, climatic implications or health impacts. The estimation of correct sample temperature is one of the most important aspects for reducing analytical uncertainties in thermal analysis. Methods and instruments using thermocouples cannot exclude temperature differences between thermocouple and sample position. Therefore the investigation of other procedures to calibrate temperature measurements in thermal OCEC analysis is highly desirable.

This manuscript deals with two DRI instrument models as well as the Sunset Lab analyser using TOR and TOT as charring correction procedure, but there are a lot of different methods without charring correction especially outside the USA. Exact temperature measurement during OC volatilisation / EC burning should be useful for all experimentalists involved in thermal carbon analysis. Methods including optical correction may be advancing, but the accuracy of them is not better a priori. During the Carbon Shoot Out Stage II (H. Puxbaum, not yet published) investigating remote samples from Mount Sonnblick (Alpes) three TOT methods were below the mean EC value, a TOR method near the mean value, and the Sunset Lab TOR method above the mean value. Between the lowest TOT and the Sunset TOR method a factor of three to four in the EC concentration could be found. This fact makes not very optimistic with regard to the comparability of the methods applied. Additionally the true EC value of the samples was still unknown and in principle every of the participants of this Round Robin Test could be right with his results.

The best method for OCEC separation and analysis should avoid charring by optimal conditions and not to correct for them by optical methods which might also bring uncertainties. Nevertheless, in every case an exact temperature measurement is necessary. The method suggested in this study seems to be suitable to improve the temperature control during OCEC analysis and therefore the submitted manuscript should be published.

Specific comment:

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In section 2.1 (page 4480, line 19/20) the statement on volatilisation of most OC below 550°C depends on the composition of the OC fraction. A lot of organic compounds like PAHs, MSA or higher dicarboxylic acids (e.g. succinic acid) evolve quantitatively under inert gas atmosphere at this temperature. In contrast small dicarboxylic acids, especially oxalic acid and their salts, resist the quantitative volatilisation up to 650°C. In some cases oxalic acid can contribute the main part of the OC fraction (these are cases showing high portions of solved OC fractions up to 40%) and so the statement on volatile OC below 550°C should be revised.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 4477, 2005.