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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantification of black carbon mixing state from traffic: implications for aerosol optical properties" *by* M. D. Willis et al.

Anonymous Referee #1

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This paper explores the effect of mixing state on the bulk optical properties of a black carbon containing aerosol. This is potentially a very important sensitivity, as most models and instruments treat the mixing state of black carbon fairly homogeneously and the instrument and model used here (LS-SP-AMS and PartMC-MOSIAC) are fairly unique in their abilities to resolve this. While I wouldn't consider the end results to be overly dramatic and the significance is tempered by the lack of any top-down closure on the model outputs, it still represents a potentially useful exploration of the current state-of-the-art when it comes to resolving this on the process scale that will no doubt be built on in the future with other new instruments, so I would still consider this to be ACP material.

The paper is very well written overall and I do not have many specific comments to

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make, however I do have some reservations regarding style and regrettably, there is potentially a fundamental technical flaw. For what it is worth, I hope it does not prove to be too major an issue, but in the worst-case scenario, it could undermine the entire basis of this work.

General comments:

A potentially major technical issue relates to the fact that in the SP-AMS, it is not assured that the particle will completely vaporise. If the particle beam is wider than the laser beam (which given that soot particles are non-spherical, is a distinct possibility), then particles may pass through the 'tails' of the laser beam, which may mean that the particles absorb sufficient energy to vaporise the coating of the particle but not the core. This would occur if the peak temperature reached was between the boiling points of the coating of the core, which given this covers a temperature range of thousands of degrees, this is a distinct possibility. Furthermore, a report of this behaviour in diesel emission particles was presented at the most recent AMS users' meeting: http://cires1.colorado.edu/jimenez-group/UsrMtgs/UsersMtg16/JDASPAMSfocusing.pdf. In this paper, the reported population of particles that contained little or no rBC could be attributed to this incomplete vaporisation occurring. It could also give rise to the PMF result as well. The authors should see if they can discount this as a possibility, or failing this, add this possibility in as a caveat. In the worst case that the observation of the 'HOA rich' population turns out to be erroneous, what effect would this have on the paper?

Generally speaking, there is perhaps too much of a tendency to put things in the supplementary material. While this would be considered usual practice for a journal with a strict word or page limit, I feel that certain sections of the supplement would be better featured in the main article as they contain information very pertinent to the paper's conclusions. Personally, I would consider that sections 2, 3, 4 and 7 may be suitable for the main article.

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Specific comments:

Little detail on the PASS-3 operation is presented here. Why was the 405 nm channel used? How was it calibrated? Was any attempt to correct the scattering channel for truncation made?

Regarding the use of PMF, I would request that the authors include the graphs from the rejected solutions as well in the supplement, so as to justify their choice of solution.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 33555, 2015.

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