Atmos. Chem. Phys. Discuss., 12, C9955–C9958, 2012
www.atmos-chem-phys-discuss.net/12/C9955/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Are black carbon and soot the same?" *by* P. R. Buseck et al.

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Received and published: 29 November 2012

We thank M. Gysel for his Comment. The suggested improvements to our Table 1 are appreciated and will be incorporated.

This comment and that from Anonymous Referee #2 present two contrasting approaches to the problem at hand. To some extent, they reflect the backgrounds of the respective scientists. One group, to which we belong, have determining the materials in the air as a primary goal, whereas the other group is more interested in the mass of something that absorbs a certain amount of radiation; the identities of those absorbing materials are secondary as long as the radiative effect is correctly quantified. Both goals have value, and ultimately there is of course the hope that both will be achieved.

The Comment also contrasts terminology based on materials vs. the analytical techniques used to measure those materials. The former is the basis of our paper.

With respect to our Reply to Kim Prather's Comment, Gysel wishes we had written a different paper: "The key question is not whether the carbon fragments are the "real building blocks" of the material under investigation, instead it is all about the question whether they can be uniquely attributed to a certain material (or material group) and how well the mass of this material can be quantified."

Our reply is twofold: a) attribution of a measurement to a particular source material requires knowledge of both the totality of constituent parts (the "building blocks") and how they are put together; b) the reviewer questions the ms. because it does not address his "key question" of quantification of the mass of "this material." We agree that quantifying the mass of aerosol particles is important, but that was not our goal.

The review suggests that rEC is a better term than rBC for the material measured by the SP2. This is another example of how difficult it is to insert the output of highly complex instrumental techniques into the simple quantitative concept of BC/EC. Classic examples are thermal/optical reflectance and transmittance (TOT/TOR) analyzers, which produce EC results unless they use sophisticated and substantial charring corrections with optical techniques to obtain the signal. Similar complications occur with the SP2 mentioned by the review, since refractory brown carbon (which also biases thermal EC measurements) would likely be seen by the SP2 since it is refractory and has moderate light absorption, but it is definitely not EC.

Regarding the two specific reviewer comments:

p. 24830, l. 21ff: "Volume mixing of soot" is defended because "homogeneously mixed spheres can in some cases outperform the assumption of spherical core-shell morphology."

Our point is that there is no chemical reality to the homogeneous mixing of carbon with associated materials in internally mixed aerosol particles. That an assumption of homogeneous mixing might outperform one based on core–shell particles is not persuasive because extensive TEM observations show that core–shell particles rarely, if

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ever, exist (Buseck, 2010; Adachi et al., 2010; Worringen et al., 2008). We believe that evaluating a chemically unreal configuration by comparison to a model that does not match physical observations is problematical and does not justify adopting an unreal model.

p. 24831, l.3ff: "'BC' never means 'light absorption', instead the measured light absorption coefficient is often used to infer the 'BC mass', i.e. the mass of the light absorbing matter. Above statement is just one example of several in this manuscript of the unclear distinction between measured quantity (absorption coefficient in this case) and mass of the matter of interest that is inferred from it."

The ms. says that BC absorbs light, not that BC means light absorption. Also, the review says our "statement is just one example of several in this manuscript of the unclear distinction between measured quantity (absorption coefficient in this case) and mass of the matter of interest that is inferred from it." The reviewer appears to want us to discuss the mass of "the matter of interest," but that is neither our goal nor what the ms. considers, so we are unsure what to make of this comment.

We will modify "The term should be restricted to light-absorbing refractory carbonaceous matter of uncertain character and should be used with a definition to explain what is meant, e.g., the total absorption resulting from ns-soot + organic carbon + other absorbing particle types." to "The term should be restricted to light-absorbing refractory carbonaceous matter of uncertain character whose measurements generally incorporate all absorption resulting from ns-soot + organic carbon + other absorbing particle types."

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 24821, 2012.