

Dear Darrel,

Thank you very much for your detailed review of our manuscript. We gratefully acknowledge your suggestions and respond point-by-point. The changes can be tracked in the annotated manuscript enclosed to this response. Line numbers refer to the annotated manuscript.

#### GENERAL REMARKS

Responding to the comment by Grisa Močnik we also added a paragraph on the first appearance of the term “black carbon” to the section on historic definitions (see lines 364 – 374).

Responding to the comment by Olga Popovicheva, we changed the criterion of the specific surface area in Table 1 from “typically greater than  $10\text{m}^2\text{g}^{-1}$ ” to “typically larger than  $10\text{m}^2\text{g}^{-1}$  and may exceed  $100\text{m}^2\text{g}^{-1}$ ”.

Responding to the comment by Shuka Schwarz, we added a separate recommendation mixed particles on line 552, reading “Mixed particles containing a BC fraction should be termed BC-containing particle instead of BC particle or soot particle”.

#### SPECIFIC REPLIES

1. You stated: “The title implies a content of the paper that is not the actual focus of this manuscript. ... I would prefer that the word "interpretation" be changed to "Presentation" or "Reporting".

*Reply:* We agree and changed the title to “Recommendations for reporting "black carbon" measurements”.

2. You state: “... that a very important issue has been left out of this discussion, and that is related to impacts on health. Now that carbonaceous particles have been clearly identified as culprits in health problems, what property of these particles are most important? How should health researcher refer to the damaging particles? If only climate effects are being targeted in this paper, then this should be indicated in the title. Otherwise, health effects should be mentioned in the introduction and then further down when recommending terminology”.

*Reply:* We agree to the argument that we should explain how our recommendations may translate into the research area on particulate matter health effects. So we included the following paragraph in the introduction section (from line 87): “Furthermore, BC is a highly relevant topic with respect to research on adverse health effects of airborne particulate matter, much of which relies on air quality monitoring. An overview of current knowledge on the impacts of the atmospheric aerosol particle burden on human health is given in the recent integrated assessment of black carbon and tropospheric ozone by UNEP/WMO (2011). Since most epidemiological studies correlate particulate matter-related health impacts to aerosol (including BC) mass concentrations measured by air quality monitoring networks, the recommended terminology may also apply to research on particulate matter health effects.”

The recommendation for using soot reads now (line 543 ff): “*Soot is a useful qualitative description when referring to carbonaceous particles formed from incomplete combustion.*”

The term soot generally refers to the source mechanism of incomplete combustion of hydrocarbon fuels (Glassman and Yetter, 2008) rather than to a material property. It is widely used in research on the formation of carbonaceous particles in combustion processes, and on the emission of particulate matter from combustion sources as well as in the field of particulate matter-related health effects. Thus, terming particles emitted from a combustion source as soot particles is in agreement with the recommended terminology.”

However, any definition on which property of particulate matter is most relevant for hazardous health effects is far beyond the scope of this manuscript.

3. The SP2 uses the LII methodology, so referring to one technique as LII and the other SP-2 is confusing and needs to be rectified by clarifying the difference between the ensemble LII single particle LII.

*Reply:* Agreed; we clarified (line 272 ff) "More recent methods for measuring the mass concentration of light-absorbing carbonaceous aerosol by means of laser heating of light-absorbing aerosol particles and subsequent analysis of emitted radiation (Melton, 1984) have developed from applications in flame diagnostics to atmospheric observation. These techniques are implemented as laser-induced incandescence of an ensemble of particles (LII) (Snelling et al., 2005; Chan et al., 2011) or of single particles, e.g., the single-particle soot photometer (SP2)".

4. In Table 2, the common filter-based techniques are referred to by their common names, i.e. aethalometer, MAAP, PSAP and COSMOS. The same is true of the SP2. If the commercial instruments are being listed, than the PASS and PAX photoacoustic instruments need listing, as well as any other photoacoustic and LII devices.

*Reply:* Agreed; we added PASS to the list with adequate references but did not add the PAX modification because there is no reference available and the instrument measures extinction, not absorption. In general MAAP, PSAP, SP2, SP-AMS etc. are names based on the underlying method, and no commercial suppliers are listed in Table 2. So we decided to keep LII without specification of a certain commercial instrument; yet, the references point to the Artium Technology instruments. In general, only those methods and instruments are listed which are applicable to atmospheric measurements while methods developed for engine exhaust studies are excluded.

5. In Table 2, specifying calibration techniques should be mandatory for all techniques, even when none exist (this is never pointed out for filter based and TOA techniques, but should be).

*Reply:* We disagree in this point, because the manuscript focuses on reporting BC measurements, and not on instrument-specific issues. These topics are discussed in detail elsewhere (Baumgardner et al., 2012).

#### MINOR COMMENTS

Page 9489, line 19 - Where does the 0.95 number come from and why?

*Reply:* The number is a reference to the reply by Schwartz and Lewis (Schwartz and Lewis, 2012). We replaced the value by "almost unity"; see line 112.

Page 9491, Line 19 - I think that some of the TOA implementations have measured CH<sub>4</sub> instead of CO<sub>2</sub>.

*Reply:* Agreed; on line 170 ff we modified the sentence to: "The carbon contained in the analyzed aerosol sample is detected as CO<sub>2</sub> by non-dispersive infrared absorption or other CO<sub>2</sub> specific detection methods or as CH<sub>4</sub> by a flame-ionization detector".

Page 9492, line 14 "There is no overall agreed reference method for measurement of the aerosol light absorption coefficient, because all available methods suffer from cross-sensitivity to light-scattering particles and other potential measurement artifacts. However, photoacoustic spectroscopy is a candidate reference method for atmospheric observations and analytical applications...". This needs rewording since photoacoustic is not impacted by light scattering, as mentioned in the following sentence. Perhaps "...because many of the available...".

*Reply:* Done; see line 203.

Page 9495, line 12, Baumgardner, not Baumgartner.

*Reply:* Done; see line 296.

Section 4.2, rBC should be included.

*Reply:* Agreed; on line 447 we added “- Refractory black carbon (rBC): Carbonaceous fraction of particulate matter that is insoluble and vaporizes only at very high temperatures near 4000 K (Schwarz et al., 2010)”.

#### REFERENCES

Baumgardner, D., et al.: Soot reference materials for instrument calibration and intercomparisons: A workshop summary with recommendations, *Atmos. Meas. Tech.*, 5, 1869-1887, doi: 10.5194/amt-5-1869-2012, 2012.

Schwartz, S. E., and Lewis, E. R.: Interactive comment on “Are black carbon and soot the same?” by P. R. Buseck et al.: Disagreement on proposed nomenclature, *Atmos. Chem. Phys. Discuss.*, 12, C9099–C9109, 2012.

UNEP/WMO: Integrated Assessment of Black Carbon and Tropospheric Ozone, UNEP and WMO, Geneva, Switzerland, 285 pp., 2011.