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Reply on RC1

Jialuo Zhang et al.

Author comment on "Intercomparison of photoacoustic and cavity attenuated phase shift instruments: laboratory calibration and field measurements" by Jialuo Zhang et al., Geosci. Instrum. Method. Data Syst. Discuss., https://doi.org/10.5194/gi-2021-3-AC2, 2021

Dear reviewer and editor,

Many thanks for your time to review this article. After serious consideration of your comments and suggestions, the corresponding content has been modified and supplemented. On behalf of all authors of this article, I would like to furnish replies to the reviewer's comments are as follows:

- Line42: Need to describe the relation of optical properties, as "Extinction includes scattering and absorption".

The opinions of the reviewer have been accepted and related descriptions have been added to the text.

- Line66: What is shielding effects? How many correction factors we need? Describe the factors. Weather the"multiple scattering and shielding effects" happened in CRDS or CAPS?

The shielding effect is also called filter-loading effect, which means that as the load on the filter accumulates, the mutual shielding of the particles prevents part of the particles from being irradiated, resulting in a decrease in the measured light attenuation. The shielding effect was usually corrected by using the nonlinear relationship formula between the filter load and the light attenuation change(Weingartner et al., 2003;Arnott et al., 2005;Schmid et al., 2006;Virkkula et al., 2007;Collaud Coen et al., 2010).The multiple scattering and shielding effects are only happen in the filter-based methods, CRDS and CAPS are optical cavity spectroscopy methods, so such influence does not exist.

- Line79-84:The description is confusing. You use particles to calibrate extinction and scattering. What is the difference?

The particles used in this study are purely scattering particles with negligible absorption, that is, theoretically, their extinction coefficient and scattering coefficient are equal. Using the above relationship, the linear relationship between extinction coefficient and scattering coefficient can be established for reasonable correction.

- Line99: Is IBBCEAS used to measure NO_2 concentration? Not extinction? (Line 84: "(IBBCEAS) setup was used to measure extinction coefficient of NO_2", and Line 281-282: measured extinction coefficient of ----IBBCEAS).

As shown in the following formula, IBBCEAS can retrieve the NO_2 concentration. The relationship between the NO_2 concentration and the extinction coefficient of each wavelength was established through the NO_2 extinction cross-section, and which allows the wavelength conversion of the extinction coefficient.

- Line106: the heat was transferred to the receiving end of theinstrument or the wave?

The light-absorbing components were heated and quickly transfer the heat to the surrounding air, which generate pressure wave and be detected.

- Line101: Whatis the time resolution of IBBCEAS? What's the limit of detection and uncertainty in this time resolution?

As modified in the article, the time resolution of IBBCEAS was in 1 min. For IBBCEAS, the limit of deteciton in this resolution was 2.4 Mm^{-1} and the uncertainty was 16% mainly from the mirror -reflectivity measurement error.

- Line282: NO_2should be NO_2.The wavelength of CAPS-ALB was 530 nm, the wavelength of IBBCEAS was 355-380 nm, the cross-section of NO_2 was different in different wavelength range, which wavelength you used in comparison?

Modified was completed in the corresponding part of the article. The relationship between the NO_2 concentration and the extinction coefficient of each wavelength was established through the NO_2 extinction cross-section, and which allows the wavelength conversion of the extinction coefficient for the comparison with the extinciton coefficient of CAPS-ALB at the wavelength of 530 nm.

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