Geoscientific Instrumentation Methods and Data Systems Discussions

Geosci. Instrum. Method. Data Syst. Discuss., author comment AC1
https://doi.org/10.5194/gi-2021-3-AC1, 2021

Reply on RC2

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-AC1, 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 as follows:

- The calibration of the instruments in the lab has both offset and multiplication factor to account for the drift. This means that there is an inherent absorption/ scattering even in the absence of the absorber/ scatterer. Since CAPS and PAX are commercial instruments, such huge drifts are not expected. Can you explain if there any specific reason for the drift in the instrument calibration from the original factory specified ones?

The two reasons of drift in instrument calibration are as follows:1. due to the long-term operation of the instrument, its scattering background has deviated from the set value; 2. high concentration of absorbing gas and scattering particles was used to calibrate the instrument in this study, resulting in a correspondingly higher drift (~10%).

- CAPS-ALB and PAX, each is running at a single wavelength (530 nm/ 532 nm). One is using an LED and the other is using a laser. Another setup, IBBCEAS instrument uses a broadband source with a CCD array spectrometer. So, in the analysis of each instrument, corresponding spectral resolution must be taken into account, especially when using gas calibration with NO_2 etc. What is the strategy used in this study? This must be made clear and added to the manuscript.

The comment of the reviewer has been carefully considered and the related descriptions have been added to the revised manuscript. For a reasonable comparison in extinction coefficients of IBBCEAS and CAPS-ALB, the spectral resolution of two instruments needs to be synchronized. CAPS-ALB uses LED as the light source and 10-nm wide optical filter to define the measurement range, but its specific band range hasn't been found, here we presumed that to be 525-535 nm. Therefore, when calculating extinction coefficient of IBBCEAS from measured NO_2 concentration and its absorption cross section at the specific

wavelength, the average value of the NO_2 absorption cross section of Voigt et al. (2002) in the range of wavelength 525nm to 535nm was applied.

- Both laboratory calibration and field measurement campaign are done in this study. It will be beneficial to add one sentence or two in the abstract regarding the field campaign undertaken.

The comment of the reviewer has been carefully considered and the related descriptions have been added to the abstract: "In our recent field measurement carried out in the Gehu area of southwest Changzhou City".

- Please explain a little more about the IMPROVE model and provide relevant references.

This comment of the reviewer has been carefully considered and the related descriptions have been added to the text: "For comparison, the IMPROVE model was applied to identify aerosol light extinction contribution of major chemical components during field measurement. The IMPROVE model was established by analyzing the data from the long-term monitoring of aerosol mass concentration carried out in multi-site of the Inter-agency Monitoring of PROtected Visual Environments network in the United States. The IMPROVE model reconstructs extinction coefficient using the mass concentration of aerosol chemical components and their mass extinction efficiency, which has been used worldwide for estimating the aerosol extinction coefficient (Pitchford et al., 2007;Tao et al., 2014)".

5.The manuscript in general easy to read. However, it advised to have it corrected by a native speaker for proper English grammar and usage. Suggestions to correct some obvious text errors that I noticed are listed below:

a. The sentence in line 49 – 51 or page 2 has "technique" used three times. When you specify "spectroscopy" it is interpreted as a technique in itself. Just delete the word from the sentence.

b. Lines 83-84, page 3, "Spectroscopy (IBBCEAS) setup was used …" is used. You may use "Spectrometer (IBBCEAS) was used …" instead.

c. Line 152, page 6, "self-developed" was used. I guess the authors meant that they developed it instead of a commercial purchase. If it is so, it is better to use "developed in-house" or something similar.

d. Is it "PAX" or "PAS"? Page 9, line 217.

a-c. The corrections suggested by the reviewer were accepted and the corresponding sentences in the text have been revised.

d.Here "PAS" in the text refers to the photoacoustic spectrometer used by Arnott et al., not the Photoacoustic Extinctiometer (PAX).

Reference

Pitchford, M., Maim, W., Schichtel, B., Kumar, N., Lowenthal, D., and Hand, J.: Revised algorithm for estimating light extinction from IMPROVE particle speciation data, J. Air Waste Manag. Assoc., 57, 1326-1336, 10.3155/1047-3289.57.11.1326, 2007.

Tao, J., Zhang, L., Ho, K., Zhang, R., Lin, Z., Zhang, Z., Lin, M., Cao, J., Liu, S., and Wang, G.: Impact of $PM_{2.5}$ chemical compositions on aerosol light scattering in Guangzhou

— the largest megacity in South China, Atmos. Res., 135-136, 48-58, 10.1016/j.atmosres.2013.08.015, 2014.

Voigt, S., Orphal, J., and Burrows, J. P.: The temperature and pressure dependence of the absorption cross-sections of NO_2 in the 250-800 nm region measured by Fourier-transform spectroscopy, J. Phototech. Photobio. A, 149, 1-7, 10.1016/s1010-6030(01)00650-5, 2002.