

Authors' Response to Reviewer #1's Comments

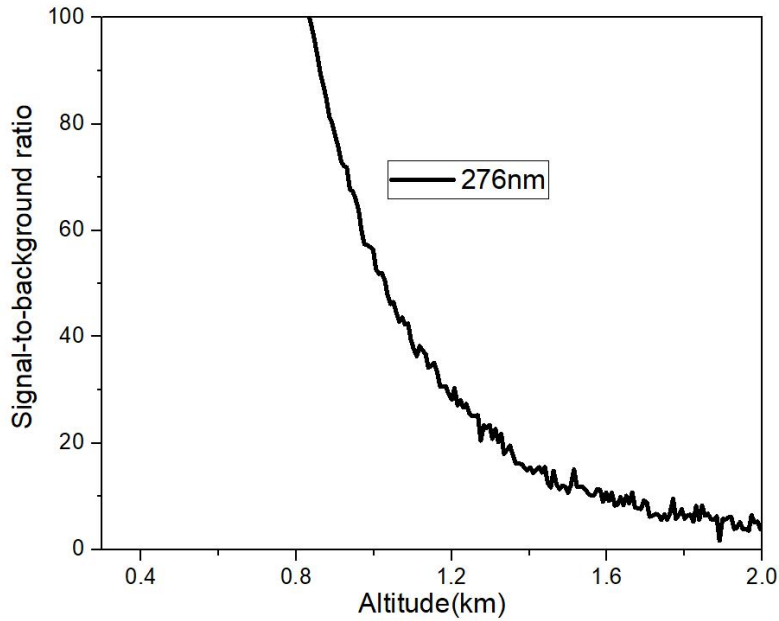
Dear Reviewer,

Thank you for your comments concerning our manuscript entitled “Tropospheric ozone sensing with a differential absorption lidar based on single CO₂ Raman cell” (MS NO: egusphere-2024-1853). Those comments are all valuable and very helpful for revising and improving our paper. We have studied the comments carefully and have made corrections which we hope will get your approval. Our point-to-point responses to the reviewer's comments are as following:

General comments:

1. “Considering the influences of aerosol interference and statistical error, a wavelength pair of 276 nm-287 nm is used for the altitude below 600 m and a wavelength pair of 287 nm-299 nm is used for the altitude above 600 m to invert ozone concentration.” Why do you choose 600 meters as the threshold value to analyze the ozone vertical characteristic? Please explain in detail.

Reply: Thanks for the comments. Table 1 lists the SF of the differential absorption wavelength pairs. Theoretically, the smaller the SF is, the smaller the influence of aerosol interference on ozone retrieval results. The SF of the differential absorption wavelength pair of 276.2 nm and 287.2 nm is nearly half of that of the 287.2 nm and 299.1 nm pair, indicating that $E_{a,B}$ of the wavelength pair of 276.2 nm and 287.2 nm is nearly half of that of the 287.2 nm and 299.1 nm. The detection of ozone at wavelengths of 276.2 nm and 287.2 nm is limited by the detection range of 276.2 nm. As shown in the figure, the signal-to-noise ratio of the 276nm signal is greater than 100 below 600m, which meets the detection requirements with sufficient signal-to-noise ratio. Above 800m, it quickly drops below 100. To accommodate different aerosol types and weather influences, and considering that aerosols are mainly distributed below a height of 600m, a height of 600m was adopted as the stitching height for the differential wavelength pair.



So it is only used in ozone retrieval under 600 m altitude. Above 600m, we adopted the wavelength pairs of 287.2 nm and 299.1 nm for ozone detection.

2. L330: It is suggested first to describe the shortcomings or problems still unresolved in this type LiDAR, and then expand to future work.

Reply: Thanks for the comments. “The bind zone of the ozone lidar is about 300 meters” has been supplemented.

3. References are few and old. Please add more recent related references.

Reply: Thanks for the comments. We have supplemented some references in the past six years, such as X. Chi et., 2018; X. Wang et al., 2021; M. Wang et al., 2023; Y. Qian et al., 2021.

Specific comments:

1. Line 27 “B. Koo et al.,2012” should be “B. Koo et al.,2012”. Please carefully check the format of cited references throughout the manuscript.

Reply: Thanks for the comments. line 27, "B. Koo et al., " has been amended as "B. Koo et.,". We have checked the format of cited references throughout the manuscript carefully.

2. Line 80: may not be correct. ‘i’ is not mentioned in the context. Thus ‘i’ should be changed to “on” or “off”.

Reply: Thanks for the comments. We have supplemented “i is on or off” on line 80

3. Line 95: “It is” should be “it is”.

Reply: Thanks for the comments. “It is” has been amended as “it is”. on line 102.

4. Line 108 “2” in “(e-20 cm2)” should be subscript. Please check the formats throughout the manuscript.

Reply: Thanks for the comments.

“(e-20 cm2)” has been amended as “(e⁻²⁰ cm²)” on line 108.

“(e-16 cm2)” has been amended as “(e⁻¹⁶ cm²)” on line 108.

5. Line 125: “According to (5)” should be “formula (5)”

Reply: Thanks for the comments. “According to (5)” has been amended as “According to formula (5)”.

6. Line 132: The font in Figure 2 is indistinct. It is suggested to redraw the picture.

Reply: Thanks for the comments. We have redrawn Figure 2.

7. Line 174: Figure 3 is small. It is suggested to adjust the size.

Reply: Thanks for the comments. We have redrawn Figure 3.

8. Line 215: “ In addition, The aerosol” should be “In addition, the aerosol”.

Reply: Thanks for the comments. “In addition, The aerosol” has been amended as “In addition, the aerosol”

9. Line 222: “relatively high concentration levels...” Please specify the concentration values or ranges.

Reply: Thanks for the comments. “ relatively higher concentration levels in the boundary layer. ” has been “ relatively higher concentration levels about from 0.3 km⁻¹ to 1 km⁻¹ in the boundary layer. ”

10. Line 230: There is a space between them and ‘aerosol’ and should be deleted.

Reply: Thanks for the comments.

11. Line 285: Figure 12 is a bit small and distorted and it is proposed to be redrawn.

Reply: Thanks for the comments. We have redrawn Figure 12.