

# Respond to Reviewer and Editor

Dear reviewer and editor, thank you for your useful comments. We are very willing to revisit these outstanding comments on this version of revision. For the phrasing/grammatical issues, we will also check them with the language editor in the next step before the probably publishing to make sure that all our manuscript is OK.

We have carefully checked the comments, and replied to your comments point by point and included corresponding modifications. In the following text, your comments are marked in bold italics, our responses are in black, and the modifications in manuscript are shown in blue.

*I was a reviewer of the previous version of this manuscript. For the previous version, I liked the study but had some statistical and presentation concerns. In this version the authors have put in a lot of effort revising and have addressed my comments well. As with the previous version of this paper, journal copy-editing will be necessary to correct some phrasing/grammatical issues throughout but the paper is readable and the authors did a good job with this considering they are likely not native English speakers.*

*I have a few minor suggestions based on this revised version, but otherwise am happy for the manuscript to be published after these are taken care of. I would be happy to look at it again if the Editor would like, but I don't know that it would be necessary.*

Dear reviewer, thank you for your recognition and understanding. Your comments are very useful for improving our manuscript.

***1. Line 62: the wording here is awkward. I think the point the authors are trying to make here is that satellites can make observations globally (even if the coverage of products is not quite global). In that case I might change the last part of this sentence to “collect aerosol distribution information from space near-globally with spatial resolutions typically of the order of km”.***

Dear reviewer, thank you for your comments. Here, we want to express that comparing to ground-based sites such as AERONET, the observations from satellite are continuous in spatial scale. To avoid possible misunderstanding from readers, we have revised this sentence.

**Line 62-64:** Satellite observations are an irreplaceable approach because they can collect aerosol distribution information from space near-globally and greatly make up for the limitation of **the cover** in spatial scale, compared with ground-based observations.

***2. Lines 135-136: I am not sure what the sentence about bias and uncertainty refer to here. The AOD uncertainty in the mid-visible from AERONET is about 0.01. I wonder if the authors are talking about the difference between level 1.5 and level 2.0 AERONET direct Sun data? I don't think that is necessary – the rest of the text around there seems to be about the inversion product and not the direct Sun data – and it's best just to give the main level 2.0 direct Sun AOD uncertainty around 0.01.***

Dear reviewer, thank you for your comments. We have revised this part following your suggestions to improve our manuscript.

**Line 137:** The uncertainty of AOD calculation is reported as ~0.01.

**Line 138-143:** In addition, an extra site established at Wuhan University was also applied in this study (Jin et al. 2021)

to supplement the aerosol optical properties in CC area. This site is equipped with the same sun sky photometer as AERONET and calibrated annually using the China Meteorological Administration Aerosol Remote Sensing Network (CARSNET) (Che et al. 2009) to ensure the data quality. The AOD from Wuhan site was calculated from the direct sun measurement and other complex properties were retrieved from the sky irradiance under cloudless conditions (Smirnov et al. 2000), with the method of Dubovik and King (2000).

**3. Table 1: I think the rho header column is not aligned correctly here (mentioning in case the typesetters do not catch this).**

Dear reviewer, thanks for pointing out this mistake. We have checked and revised it.

**4. Figure 8: I don't think that three different significance levels need to be highlighted here (\*, \*\*, and \*\*\*). I would just pick one (maybe 0.05 for consistency with elsewhere) or report trend and uncertainty estimate (for all panels) instead so the reader can assess confidence. I would also delete the last sentence in the caption "It is noted..." since if there is no visually-apparent or statistically detectable change point I don't think it needs to be mentioned.**

Dear reviewer, thank you for your comments. I have revised this figure. Yes, as you pointing out, we should emphasize findings which are significant.

**5. Table 2: As in the Figure 8 comment, I'd just stick to one marker of significance and not three. If you're selecting as threshold as significant vs. not significant, I don't think it is meaningful to add extra subcategories, and it makes it harder to read at a glance.**

Dear reviewer, thank you for your comments. I have revised this table. Now, we use a uniform significance criterion that only trends passing the significance test ( $p < 0.05$ ) are shown in it.

**6. Line 632: It is ok to say that the aerosols are fairly stable, but I don't think it directly means it is anthropogenic. It may well be in this case if it's agricultural burning, but the wording implies that stability means anthropogenic, which is not the same thing. I would just say it's stable or maybe that it implies the burning is fairly stable.**

Dear reviewer, thank you for your comments. In this section, we focus more on showing the actual variability of aerosols than on explaining the causes of this variability. Of course, to avoid possible misunderstanding, we carefully checked this section and revised following your comments.

Line 628-629: In contrast, burning in spring and autumn in SEA did not lead to dramatic changes in relative AOD variability. This means that the aerosols in this region are dominated by the long-term and stable burning events.