

Dear Editors and Reviewers:

Thank you very much for your careful review and constructive suggestions with regard to our manuscript “The contribution of fires to PM_{2.5} and population exposure in Asia Pacific” (Manuscript Number: egusphere-2025-598). Those comments are valuable and helpful for revising and improving our paper. We have studied these comments carefully and made changes in the manuscript according the reviewers’ comments. The responses to the reviewer’ comments are listed as follows.

Reviewer #1: This study explores the contributions of fires to air quality in Asia Pacific through isolating fire-specific PM_{2.5} using data-driven method. A comparative analysis of total PM_{2.5} and fire-specific PM_{2.5} variations, along with their effects on public health is conducted. The obvious decline in total PM_{2.5}, coupled with a gradual increase in the proportion of fire-specific PM_{2.5}, suggests that measures to reduce fires may be a crucial yet under-recognized option for improving air quality and preventing related premature deaths in the future. The authors also reveal differences in spatial distributions of total and fire-specific PM_{2.5}. Total PM_{2.5} is mainly concentrated in densely populated areas, while relatively high fire-specific PM_{2.5} disproportionately affect poor populations. These conclusions indicated that the contributions of fires to air quality and health impact are becoming increasingly significant and warrant more attention when developing air pollution standards and control measurements in Asia Pacific. Overall, this study is well-structured, clearly presented, and the results are meaningful. However, some issues still need to be addressed before it can be published:

Response: We would like to thank the reviewer for valuable and affirmative comments of our manuscript. The modifications based on the comments are listed as below.

1. Line 28, Line 34: The full names of abbreviations should be given when their first appearance. What do “VPD” and “PM” stand for?

Response: We feel sorry for the inconvenience for reading. “VPD” stands for vapor pressure deficit, while “PM” stands for “particulate matter”. We have added the full name of “VPD” and “PM” when their first appearance. Please check Line 17, 31 and 35 in the revised manuscript.

2. Figures: it is recommended to increase the resolution of the figures to enhance clarity and to enlarge the font sizes of annotations and icons within the figures.

Response: Thanks for the suggestion. We have re-plotted all the figures to increase the resolution and enlarge the font size of annotations and icons in the revised manuscript. Please check figures in the revised manuscript and supplementary information.

3. Figure 1: Authors conducted the analysis with several sub-regions in the study, like EA, CA, ESA and NA. However, there are no figures or descriptions indicating the specific areas of each sub-region. It is necessary to add a sub-figure in Figure 1 providing this information.

Response: Thanks for the suggestion. We have renewed Figure 1 by adding Figure 1(b) that indicates the specific areas of each sub region (EA, CA, ESA and NA). Please check Figure 1(b) in the revised manuscript.

4. Line 116-117: Please provide the references regarding the validation of the reliability of MODIS AOD, especially concerning the study regions in this manuscript.

Response: We feel sorry for not including the relevant references to support the viewpoint, and have added five references relating to the validation of the reliability of MODIS AOD concerning the study region or part of the region. Please see Line 136-137, 640-642, 670-673, 682-684 and 718-720 in the revised manuscript.

5. In 2.2 Method: There appears to be a lack of information regarding how the authors align the resolutions of the input and output datasets of machine learning method, considering that the resolutions of different datasets are quite distinct.

Response: We are appreciated with this comment. Although the resolutions of different datasets in the machine learning method are quite distinct, the target data are spatially and temporally dispersed points. Therefore, the construction of machine learning method is essentially point-to-point. The input and output datasets are matched based on their relative positions, meaning that the input data are temporally and spatially closet to the output data. We have added these descriptions regarding the issue of temporal and spatial matching among different datasets. Please check Line 170-174 of the revised manuscript.

6. Figure 4: The line colors in Figure 4 (c) and (d) are somewhat difficult to distinguish, especially since the colors for CA and EA are quite similar, and the two datasets are also close in value, making it hard to interpret. Besides, the figure caption should provide more information about each sub-figures to make the figure stand out of the texts.

Response: We appreciate the comment regarding Figure 4, and have adjusted the line colors in

Figure 4 (as well as in Figure 9, 12 and S1) to ensure that the lines are more distinguishable, especially for CA and EA. Besides, we have added detailed information in figure caption for each sub-figure. Please check Figure 4 and figure caption in the revised manuscript.

7. Line 294: GDP data are included in the machine learning method to estimate the counterfactual $PM_{2.5}$ that is absence of fire influence, however there is no any information describing the data source in the Section 2.

Response: We are sorry for the neglect. The GDP data are obtained from Wang and Sun (2023), measured in PPP 2005 international dollars. We have added the related description about the source of the GDP data and the reference in Line 167-168 and 758-759 of the revised manuscript.

8. Figure 7 and Figure 8: The original isolated fire-specific $PM_{2.5}$ appears to be corresponded to site data shown in Figure 7. However, it is unclear how the authors calculate the fire-specific $PM_{2.5}$ values in each area presented in Figure 8?

Response: We feel sorry for not expressing this issue clearly. The values for each region in Figure 8 are derived from the average values for sites within the region. We have clarified this issue in the caption of Figure 8 and Line 399-400 of the revised manuscript.

9. Line 395-396: “The number of annual premature deaths due to $PM_{2.5}$ ”, does “ $PM_{2.5}$ ” here mean fire-specific $PM_{2.5}$ or total $PM_{2.5}$?

Response: We appreciate the careful comment. The “ $PM_{2.5}$ ” refers to fire-specific $PM_{2.5}$ in the context. We have modified the expression in Line 458 of the revised manuscript accordingly.

10. Line 486-489: Authors should provide some evidence or references supporting the claim of decline in anthropogenic fire alongside increase in wildfires in Asia Pacific. If not, this statement should be omitted to maintain accuracy and credibility.

Response: Thanks for the rigorous comment. We have added relevant references to support the viewpoints discussed, and have rephrased the expressions to eliminate any unverified claims, enhancing the accuracy and credibility of the discussion. Please see Line 549-567 and the references in Line 691-696, 707-709 and 733-734 of the revised manuscript.

Best regards,

Authors