Review of "The contribution of fires to $PM_{2.5}$ and population exposure in Pacific Asia" by Lu et al.

This study investigated the contribution of forest and vegetation fires to $PM_{2.5}$ and public health across Pacific Asia. The fire-specific $PM_{2.5}$ was effectively isolated from the monitoring data using the trajectory-fire interception method (TFIM) in combination with the random forest method. Based on the reliable and timely dataset, the geographical disparities in population exposure to both $PM_{2.5}$ and fire-specific $PM_{2.5}$ were estimated. The topic is novel, and the findings provide valuable insights for $PM_{2.5}$-related public health. Moreover, this manuscript is well-structured and readable. However, several issues need to be clarified before it can be considered for publication. Below are specific comments:

Specific Comments

1. I suggest changing the regional abbreviations to Southeast Asia (SEA), Northeast Asia (NEA), East Asia (EA) and Central Asia (CA), respectively. And these key regions should be marked in Figure 1.
2. To derive fire-specific $PM_{2.5}$ concentrations, a machine learning method was employed using aerosol variables, AOD, meteorological factors, land use, NDVI, and the GDP data. Ultimately, 15 of these variables were selected to fit $PM_{2.5}$ concentrations. In recent years, many Asian countries have implemented strict anthropogenic emissions reduction strategies to mitigate $PM_{2.5}$ pollution (see lines 322-330 for details). Anthropogenic emissions play crucial role in $PM_{2.5}$, but they are not incorporated into the machine learning model. While some variables, such as GDP and population, can indirectly reflect changes in anthropogenic emissions, the relationship needs to be further clarified. Therefore, the authors should briefly describe the machine learning method and variables used, even in the supporting information.
3. Section 3 Results: It is recommended that additional subheadings (e.g., 3.1, 3.2, 3.3, ...) be added to improve clarity. Furthermore, more attention should be given to key regions (EAS, EA, NA and CA) during wildfires. Regions with extremely sparse stations (Figure 1), such as Mongolia and the Tibetan Plateau, may be masked out due to the large uncertainties in

their results.

4. Figure 10 and 11: To my knowledge, the Health Impact Function (HIF) exhibits large uncertainty due to the relative risk (RR). Additionally, the Integrated Exposure-Response (IER) equation varies by region and population, resulting in a confidence interval in the estimated number of premature deaths. Although these key parameters are from Burrett et al. (2014) and Song et al. (2017) (please note that the citation of Song is missing in the reference list) in this study, they should still be explicitly provided.
5. Figure 12: The results related to vaper pressure deficit (VPD) appear somewhat disconnected from the main body of this manuscript.

Technical Corrections

1. Normally, references are sorted alphabetically rather than chronologically.
2. Line 230: “in this study” instead of “is this study”
3. Figure 8: Please add the unit.
4. The manuscript contains minor spelling and grammatical errors that should be corrected.